EnSight User Manual

for Version 7.3

Table of Contents

Computational Engineering International, Inc.
2166 N. Salem Street, Suite 101, Apex, NC 27502
USA • 919-363-0883 • 919-363-0833 FAX
http://www.ceintl.com

EN-UM Revision History

EN-UM:5.2-1	October 1994
EN-UM:5.2.2-1	January 1995
EN-UM:5.5-1	September 1995
EN-UM:5.5.1-1	December 1995
EN-UM:5.5.2-1	February 1996
EN-UM:6.0-1	June 1997
EN-UM:6.0-2	August 1997
EN-UM:6.0-3	October 1997
EN-UM:6.0-4	October 1997
EN-UM:6.1-1	March 1998
EN-UM:6.2-1	September 1998
EN-UM:6.2.1-1	November 1998
EN-UM:7.0-1	December 1999
EN-UM:7.1-1	April 2000
EN-UM:7.3-1	March 2001

This document has been reviewed and approved in accordance with Computational Engineering International, Inc. Documentation Review and Approval Procedures.

This document should be used only for Version 7.2 and greater of the EnSight program.

CEI's World Wide Web addresses:
http://www.ceintl.com
or
http://www.ensight.com

Restricted Rights Legend

Table of Contents

4 Variables

5 GUI Overview

6 Main Menu

7 Features

8 Modes

9 Transformation Control

10 Preference File Formats

11 EnSight Data Formats

12 Utility Programs

1 Overview

EnSight (for Engineering inSight) provides engineers and scientists with an easy-to-use graphics postprocessing package. EnSight supplies powerful, easy-to-use tools through a user-friendly interface.

The purpose of this chapter is to give you an overview of the EnSight system and its documentation. Because of the power and flexibility of EnSight, the synergy between features provides a great many visualization techniques.

The Overview topics discussed are:

Part Concepts

EnSight processing begins with your model. Usually the elements of your model are grouped into parts. *Within EnSight, nearly all information is associated with parts, and nearly all actions are applied to parts*.

Geometry

A part consists of *nodes* and *elements* (elements are sets of nodes connected in a particular geometric shape). Each node, which is shared by its adjoining elements, is defined by its coordinate-location in the model frame of reference.

Variable Values

EnSight-compatible data files provide variable values either at each part's nodes, element centers, or both. When needed (or requested) EnSight will find any variable's value at any point on or within an element by utilizing the element's shape function.

Part Attributes

Within EnSight, you can specify additional information about each part. These *part attributes* tell EnSight how to display each part and how the part responds to

EnSight controls and display options. Part attributes include:

Category	Includes attributes that control....
General Attributes	Visibility Susceptibility to Auxiliary Clipping Reference frame Response to changes in time (frozen or active) Symmetry options
Color By Attributes	Coloration (constant or by a palette associated with a variable)
Node, Element, and Line Attributes	Node visibility Node type (dot, cross, or sphere) Node size (constant or variable) Node detail (for spheres) Element-line visibility Element-line width Element-line style (solid, dotted, or dot-dash) Element representation on client (full, border, 3D border/2D full, feature angle, or not loaded) Element-size shrink-factor
Surface Attributes	Shaded Surface susceptibility Surface shading (flat, Gouraud, smooth) Fill density (for transparency) Lighting (diffuse, shininess, and highlight intensity)
Displacement Attributes	Displacement variable Displacement scaling factor
Labeling Attributes	Node, element, and part label visibility

Part Operations

Parts can be copied to show, for example, the same part colored by a different variable. Model parts can be split along an arbitrary plane or any quadric surface, and merged with other model parts. The geometry of parts can be simplified by creating a new part by extracting a simpler representation of an existing part.

Part Representation

Parts can be represented with simpler geometry, both to enhance visualization performance and for special effects. Representation modes include:

Full mode, which represents all the part's elements in the graphics window.

Border mode, which represents 3D elements with their 2D external faces.

Feature angle mode, which represents with 1D elements the "significant" edges of the part (you control what is "significant")

(see Section 3.3, Part Editing, and Section 8.4, Part Mode)

Data Types

EnSight supports a number of common data formats as well as interfaces to various simulation packages. There are four different means to get your data into EnSight.

Type 1 - Direct (built-in) Readers - Are accessed by choosing the desired format in the Data Reader dialog. These include common data formats as well as a number of readers for commercial software.

Type 2 - User-Defined readers - A library of routines is provided with EnSight to allow users to create their own custom interfaces. Like Type 1, User-Defined Readers have the advantage of not requiring a separate data translation step and thus reduce user effort and disk storage requirements. A number of User-Defined Readers are provided with EnSight; complete documentation and dummy routines may be found in the directory $ENSIGHT7_HOME/user_defined_src/readers.

Type 3 - Stand - Alone Translators - May be written by the user to convert data into EnSight format files. A complete description of EnSight formats may be found in Chapter 2 of the EnSight Online User Manual. Several translators are provided with EnSight. These are found in the directory $ENSIGHT7_HOME/translators. Translators must first be compiled before they may be used. Some require links to libraries provided by the vendor of the program in question. See the README files found in each translator's directory.

Type 4 - EnSight Format - A growing number of software suppliers support the EnSight format directly, i.e. an option is provided in their products to output data in the EnSight format.

The table that follows summarizes all of the data formats and software packages for which an interface of Type 1-4 exists. As this information changes frequently, please consult your EnSight support representative should you have any questions. If your format or program is not listed here, there is the possibility that an interface does indeed exist. Contact EnSight support for assistance. Should you create a User-Defined Reader or Stand - Alone Translator and wish to allow its distribution with EnSight, please send an email to this effect to ensight_support@ceintl.com.

Data Format / Program	Type	Comments
ABAQUS	1	Direct reader for binary or ascii .fil files
ACUSOLVE	2	Contact vendor for details
ADINA	3	Use I-DEAS neutral files and translators
ANSYS	1	Direct reader for binary .rst, .rth, .rmq, .rfl files
CASE (EnSight6/EnSight Gold)	1	Native EnSight formats, EnSight6 Case and EnSight Gold Case
CFD++	4	Exports EnSight Case format
CFD-ACE	2	Contact vendor for DTF reader
CFD-FASTRAN	2	Contact vendor for DTF reader
CFDESIGN	2	Uses Tecplot files and reader
CFF	2	User reader for Common File Format (WIND code)
CFX4	2	User reader
CFX5	4	Code exports EnSight Case format
CFX-TASCflow	3	Converts TASCflow output to EnSight format
CGNS	3	User reader
COBALT	2	User reader (obtain from www.cobaltcfd.com)
CRAFT	4	Exports EnSight Case format
CRUNCH	4	Exports EnSight Case format

Data Format / Program	Type	Comments
CTH	4	Exports EnSight format
ENSIGHT (EnSight 5)	1	Original EnSight format (unstructured)
ESTET	1	Direct reader for the EDF code ESTET
EXODUS II	2	User reader
FAST Unstructured	1	Direct reader for NASA FAST unstructured format
FEFLOW	3	Contact vendor for details
FENSAP	4	Contact vendor for details
FIDAP	1	Direct reader for FIDAP neutral (FDNEUT) files
FINE/Aero	1, 2	Use PLOT3D or CGNS files/reader
FINE/Turbo	1, 2	Use PLOT3D or CGNS files/reader
FIRE	4	Code exports EnSight format
FLOW-3D	2	User reader for FLOW-3D results (flsgrf) files
FLUENT (particle files)	3	Converts Fluent particle file to EnSight format
FLUENT	4	Code exports EnSight Casefile format
GASP	4	Exports EnSight Case format
GUST	4	Exports EnSight Case format
HDF	2	Contact CEI for reader
I-DEAS	3	Translator for I-DEAS FEA neutral file
KIVA	2, 3	Conversion routines to export EnSight format, contact CEI for info
LS-DYNA	2	User reader for d3plot files
MAYA ESC	4	Contact vendor for details
MOVIE.BYU	1	Direct reader for MOVIE.BYU format files
MPGS 4.1	1	Direct reader for MPGS, EnSight's predecessor
MSC.DYTRAN	2	User reader for MSC/Dytran archive (.arc) files
MSC.NASTRAN	2	User reader for binary OP2 files
N3S	1	Direct reader for the EDF code N3S
PATRAN	3	Converts PATRAN neutral files to MOVIE.BYU format
PHOENICS	1	Use PLOT3D file/reader
PLOT3D	1	Direct reader for PLOT3D and FAST structured formats
POLY-3D	3	Contact vendor for details
POLYFLOW	1	Read as FIDAP neutral file, FDNEUT
POWERFLOW	3	Contact EXA for information on interfaces available
PXI	2	User reader for Parallel Exodus Interface format
RAD THERM	4	Contact vendor for details
SCRYU	2	User reader
SILO	2,3	Reads various formats supported by SILO API
SPHINX	4	Code exports EnSight format
STAR-CD (Version 3.0.5 and up)	4	Code exports EnSight Casefile format (including particle data)
STL	2	User reader for STL geometry files
TECPLOT	2	User reader for TECPLOT structured and unstructured formats
VECTIS	2, 3	Contact vendor, Ricardo, for information

Geometry EnSight reads unstructured geometric data grouped by parts. Data can be 2D or 3D.

Analysis Results EnSight reads scalar and vector variable values associated with each node of the geometry. The loading of variable values is optional, and variables can be unloaded to free memory.

Measured Data EnSight can read measured or computed particles (referred to as discrete particles in EnSight). Particles can have the same variables as the model geometry, or their own variables. Particles can be displayed as points, crosses, or spheres whose size can vary according to a variable value. Sphere smoothness is also controllable. Discrete particles can be time dependent with the geometry, or time dependent with a steady geometry.

(See EnSight Gold Measured/Particle File Format, in Section 11.1)

Cases EnSight provides the capability to read and manipulate up to eight datasets or models at a time. Each new "Case" is handled by its own Server process while the Client appropriately deals with merged variables, solution times, etc. This option allows both the recombination of models partitioned for parallel analysis and a number of comparative operations.

Graphical Environment

Parts are visualized in a main Graphics Window. You can create additional viewports and adjust their size to your needs. Each viewport has its own transformations (global, local, look-at, look-from, and Z-clip locations). Part visibility is also controllable in each viewport.

A separate "Show Selected Part(s)" window helps in identifying parts.

Hidden Lines and Shaded Surfaces You can choose to shade surfaces and/or hide hidden lines for realistic views of you model. Visible element edges can be overlaid on shaded solid images.

Clipping In addition to user-control of the front and back clipping planes of your workspace, you can cutaway parts or portions of parts along any plane using Auxiliary Clipping. Individual parts can be made immune to the effect, enabling you to look at parts inside of other parts.

Annotations EnSight can display text-strings, lines, arrows, logos, entity labels, and color-map legends. Text annotations (which may include variables) can be made to automatically update for time-dependent data.

Image Output Screen images can be saved from within EnSight. Conversion to popular formats is under user control as the image is saved.

Perspective You have your choice of a perspective view or an orthogonal view. The latter is useful for comparing the position of parts and positioning EnSight tools.

Background Color You can specify a constant or blended color background for the main Graphics Window and independently for any Viewports displayed in the Graphics Window.

Transformations

The standard transformations of rotate, translate, and scale are available, as well as positioning of the Look-At and Look-From points. An automatic zoom control is available. The transformation-state (the specific view in the Graphics Window and Viewports) can be saved for later recall and use. Transformations can be performed with precision in a dialog, or interactively with the mouse. For the latter case, you can choose to represent the parts with bounding-boxes all the time or only while they are moving. Transformations can individually be reset by type.

(see Chapter 9, Transformation Control)

Frames

Transformations actually apply to frames—the parts attached to the frames transform right along with their frame. You can create new frames and transform them like parts (in a dialog or with the mouse), and change to which frame a part is attached. You control whether and how frames are displayed, enabling you to use them as rulers. Frames can have rectangular, cylindrical, or spherical coordinates.

Frames, and therefore all parts attached to them, can be "periodic". Rotational or translational periodicity (as well as mirror symmetry) attributes are under user control allowing, for example, an entire pie to be built from one slice of the pie.

(see Section 8.6, Frame Mode and Section 9.2, Frame Transform)

Coloration

Parts can be colored according to the value of a variable. This "fringes" feature works for both lines and surfaces. The coloration of each part is an attribute of that part.

Variable Palettes

You control the value-color correspondence with a *palette*. A palette's scale can be linear, logarithmic, or exponential. Palettes can have a continuous range of colors, or color bands. Off-the-scale parts or portions of parts can be made invisible.

(see Section 4.2, Variable Summary & Palette)

Created Parts

In addition to the *model parts* defined in the dataset, you can (and usually will) define additional *created parts* based on both the geometry *and* variable-values of existing *parent-parts.* Model parts and most kinds of created parts can be used as parent parts. Created parts have their own part attributes, including the *creation attributes* that define them, but *remain dependent upon their parent-parts.* A created part *automatically regenerates* if any of its parent-parts are changed in a way that will affect its representation.

Clips

A clip is a plane, line, box, quadric surface (cylinder, sphere, cone, etc.), or revolution surface passing through specified parent-parts. The plane clip can either be limited to a specific area (finite), or clip infinitely through the model. A line clip is finite and other clips are infinite in nature. You control the location of the various clips with an interactive Tool or appropriate parameter or coefficient input.

A clip line has query points along the line (you control how many).

A clip plane will either be a true clip through the model, or can be made to be a grid where the grid density is under your control.

Clip surfaces can be animated as well as manipulated interactively.

In most cases you will create a clip which is the intersection of the clip tool and the parent parts. You can also choose to cut the parent parts into half spaces.

(see Section 7.5, Clip Create/Update)

Contours

Contours are created by specifying which parts are to be contoured, and which function palette to be used to specify the contour-level values.

(see Section 7.2, Contour Create/Update)

Developed Surfaces

Developed Surfaces can be created from cylindrical, spherical, conical, or revolution clip surfaces. You control the seam location and projection method that will flatten the surface.

(see Section 7.9, Developed Surface Create/Update)

Elevated Surfaces Elevated Surfaces can be displayed using a scalar variable to elevate the displayed surface of specified parts. The elevated surface can have side walls.

(see Section 7.7, Elevated Surface Create/Update)

Isosurfaces Isosurfaces can be created using a scalar, vector component, vector magnitude, or coordinate. Isosurfaces can be manipulated interactively or animated by incrementing the isovalue.

(see Section 7.3, Isosurface Create/Update)

Particle Traces Particle traces—both streamlines (steady state) and pathlines (transient)—trace the path of a massless particle in a vector field. You control which parts the particle trace will be computed through, the duration of the trace, which vector variable to use during the integration, and the integration time-step limits. Like other parts, the resulting particle trace part has nodes at which *all* of the variables are known, and thus it can be colored by a different variable than the one used to create it. Components of the vector field can be eliminated by the user to force the trace to, for example, lie in a plane. The particle trace can either be displayed as a line, or a ribbon or square tube showing the rotational components of the flow field. Streamlines can be computed upstream, downstream, or both.

Particle traces originate from *emitters*, which you create. An emitter can be a point, rake, net, or can be the nodes of a part. Each emitter has a particle trace emit time specified which you set, and a re-emit time (if the data case is transient) can also be specified. Point, rake, and net emitters can be interactively positioned with the mouse. For streamlines, the particle trace continues to update as the emitter tool is positioned interactively by the user.

(see Section 7.4, Particle Trace Create/Update)

Profiles Profile plots can be created by scalar, vector component, or vector magnitude. You control the orientation of the resulting profile plot.

(see Section 7.8, Profile Create/Update)

Subsets A subset Part can contain node and element ranges of any model Part.

(see Section 7.16, Subset Parts Create/Update)

Vector Arrows Vector arrows show the direction and magnitude of a vector field. Vector arrows originate from element vertices, element nodes (including mid-side nodes), or from element centers. You specify which parts are to have arrows and which vector variable to use for the arrows, as well as a scale factor. You can eliminate components of the vector, and can also filter the arrows to eliminate high, low, low/high, or banded vector arrow magnitudes. The vector arrows can be either straight, or curved and can have arrow heads. The arrow heads are either proportional to the arrow or can be of fixed size.

(see Section 7.6, Vector Arrow Create/Update)

Tensor Glyphs Tensor glyphs show the direction of the principal eigenvectors. You specify which eigenvectors you wish to view and how you wish to view compression and tension.

(see Section 7.17, Tensor Glyph Parts Create/Update)

Vortex Cores Vortex cores show the center of swirling flow in a flow field.

(see Section 7.18, Vortex Core Create/Update)

Shock Surfaces/ Regions Shock surfaces or regions show the location and extent of shock waves in a 3D flow field.

(see Section 7.19, Shock Surface/Region Create/Update)

Separation/Attachment Lines Separation and attachment lines show where flow abruptly leaves or returns to the 2D surface in 3D fields.

(see Section 7.20, Separation/Attachment Lines Create/Update)

Queries

In addition to visualizing information, you can make numerical queries.

You can query on information for a node, point, element, or a part.

You can query on information for a data set (such as size, no. of elements, etc.)

You can query scalar and vector information for a point or node over time.

You can query scalar and vector information along a line. The line can either be a defined line in space, or a logical line composed of multiple 1D elements for a part (for example query of a variable on a particle trace).

You can query to find the spatial or temporal mean as well as the min/max information for a variable.

Where applicable, query information can be in the form of a Fast Fourier Transform (FFT).

Plotting The plotter plots X vs. Y curves. The user controls line style, axis control, line thickness and color. All query operations that result in multiple value output in EnSight can be sent to the plotter for display. The user can control which curves to plot. Multiple curve plots are possible. All plotable query information can be saved to a disk file for use with more sophisticated plotting packages.

(see Section 7.11, Query/Plot and Section 7.12, Interactive Probe Query)

Variable Creation New information can be computed resulting in a constant, a scalar, or a vector. EnSight includes useful built-in functions for computing new variables:

Area	Case Map
Coefficient	Complex from real and imaginary
Complex Argument	Complex Conjugate
Complex Imaginary	Complex Modulus
Complex Transient Response	Complex Real
Curl	Density
Density, Normalized	Density, Stagnation
Density, Normalized Stagnation	Density, Log of Normalized
Divergence	Element to Node
Energy, Total	Energy, Kinetic
Enthalpy	Enthalpy, Normalized
Enthalpy, Stagnation	Enthalpy, Normalized Stagnation
Entropy	Flow

Flow Rate	Fluid Shear Stress
Fluid Shear Stress Max	Force
Gradient	Gradient Approximation
Gradient Tensor	Gradient Tensor Approximation
Helicity Density	Relicity, Relative
Helicity, Relative Filtered	Integral, Line
Integral, Surface	Integral, Volume
Length	Mach Number
Make Vector	Mass Flux Average
Max	Min
Moment	Momentum
Node to Element	Normal
Normal Constraints	Normalize Vector
Offset Variable	Pressure
Pressure Coefficient	Pressure, Dynamic
Pressure, Normalized	Pressure, Log of Normalized
Pressure, Pitot	Pressure, Pitot Ratio
Pressure, Stagnation	Pressure, Normalized Stagnation
Pressure, Stagnation Coefficient	Pressure, Total
Rectangular to Cylindrical Vector	Shock Plot3d
Spatial Mean	Speed
Sonic Speed	Stream Function
Swirl	Temperature
Temperature, Normalized	Temperature, Stagnation
Temperature, Normalized Stagnation	Temperature, Log of Normalized
Temporal Mean	Tensor Component
Tensor Determinate	Tensor Eigenvalue
Tensor Eigenvector	Tensor Make
Tensor Tresca	Tensor Von Mises
Velocity	Volume
Vorticity	

A calculator and built-in math functions also are useful for creating variables. Any created variable is available throughout EnSight, and is automatically recomputed if the user changes the current time (in case of transient data).

(see Section 4.3, Variable Creation)

Another feature of EnSight facilitates the creation of boundary layer variables.

(see Section 7.21, Boundary Layer Variables Create/Update)

Transient Data

EnSight handles transient (time dependent) data, including changing connectivity for the geometry. You can easily change between time steps via the user interface. All parts that are created are updated to reflect the current display time (you can override this feature for individual parts). You can change to a defined time step, or change to a time between two defined steps (EnSight will linearly interpolate between steps), though the “continuous” option is only available for cases without transient geometry.

Animation

You can animate your model in three ways: particle trace animation, flipbook animation, and keyframe animation.

Particle Trace Particle trace animation sends “tracers” down already created particle traces.

Animation You control the color, line type, speed and length of the animated traces.

If transient data is being animated at the same time, animated traces will automatically synchronize to the transient data time, unless you specifically indicate otherwise.

Flipbook Animation Flipbook animation is simpler to do than keyframe animation, while allowing three common types of animation:

Sequential presentation of transient data
Mode shapes based on a displacement variable
EnSight created parts with an animation delta that recreates the part at a new location (i.e., moving isosurfaces and Clip surfaces).

You can specify the display speed, and can step page-by-page through the animation in either direction. You can load some, or all the desired data. If you later load more data, you can choose to keep the already loaded data. With transient data, you can create pages between defined time steps, with EnSight linearly interpolating the data.

Flipbooks can be created in two formats: a) Object animation where new objects are created for each time step. The user can then manipulate the model during animation play back or b) Image animation where a bitmap of the Main View image is created and stored off for each animation page.

(see Section 7.14, Flipbook Animation)

Keyframe Animation Keyframe animation performs linearly interpolated transformations between specified key frames to create animation frames. Command language can be executed at key frames to script your animation. Some minimal editing is possible by deleting back to defined key frames. Animation key frames can be saved and restored from disk. Animation can be done on transient data and can automatically synchronize with simultaneous flipbook animation and particle trace animation.

Keyframe animation can be recorded to disk files using a format of your choice.

(see Section 7.15, Keyframe Animation)

Implementation

Interface EnSight uses the OSF/Motif graphical user interface conventions for the Unix version and Win32 conventions under the Windows xx operating system. Many aspects of the interface can be customized.

Client-Server EnSight is a *distributed application*—it runs as separate processes that communicate with each other via a TCP/IP or similar connection. The *Server* performs most CPU-intensive and data-handling functions, while the *Client* performs the graphics-display and user-interface functions. The Client and Server can run together on one host workstation in a “stand-alone” installation or on two host systems with each hardware system performing the functions it does best. When more than one case is loaded the Client communicates with multiple Server processes.

A special server-of-servers (SOS) can be used in place of a normal server if you have partitioned data. This SOS acts like a normal server to the client, but starts and deals with multiple servers, each of which handle their portion of the dataset. This provides significant parallel advantage for large datasets.

(see Section 11.8, Server-of-Server Casefile Format)

Command Language Each action performed with the graphical user interface has a corresponding EnSight command. A session file is always being saved to aid in recovery from a mistake or a program crash. The command language is human-readable and can easily be modified. Command files can be played all the way through, or you can choose to stop the file and step through it line-by-line.

Context Files You can define a “context” and apply it to similar datasets.

Graphics Hardware Many graphics functions of EnSight are performed by your workstation’s graphics hardware. EnSight version 7 uses the OpenGL graphic libraries and is available on a multitude of hardware platforms.

Solid image lighting can be done either in hardware, or in software. The software option does not recalculate the lighting changes due to transformations (hence, the light source seems to move with the model). While this is less realistic, it can greatly increase performance and decrease memory requirements.

Parallel Computation EnSight supports shared-memory parallel computation via POSIX threads on a variety of platforms. As of this writing, threads are supported on IRIX 6.5, HP-UX 11.0, OSF1 V4.0, and Linux 2.2 operating systems. Additional support may be added in the near future. Threads are used to accelerate the computation of streamlines, clips, isosurfaces, and other compute-intensive operations. (See How To Setup for Parallel Computation for details on using.)

Macros You can define macros tied to mouse buttons or keyboard keys to automate actions you frequently perform.

Saving and Archiving You can save the entire current status of EnSight for later use, and can save other entities as well (including the geometry of created parts for use by your analysis software).

(see Section 2.5, Archive Files)

Documentation

The printed EnSight documentation consists of the Getting Started manual.

The on-line EnSight documentation consists of the EnSight User Manual and the many How To documents.

User Manual The EnSight User Manual is organized as follows:

User Manual Table of Contents

Chapter 1 - Overview

Chapter 2 - Input/Output. This chapter describes the reading of model data (with internal or user-defined readers), command files, archive files, context files, scenario files, and various other input and output operations.

Chapter 3 - Parts. This chapter describes the various types of Parts, selection, identification, and editing of Parts, and various Part operations,

Chapter 4 - Variables. This chapter describes the selection and activation of variables, color palettes, and the creation of new variables.

Chapter 5 - GUI Overview. This chapter describes the EnSight Graphic User Interface.

Chapter 6 - Main Menu. This chapter describes the features and functions available through the buttons and pull-down sub menus of the Main Menu of the GUI.

Chapter 7 - Features. This chapter describes the features and functions available through the Icon buttons of the Feature Icon Bar of the GUI.

Chapter 8 - Modes. This chapter describes the features and functions available through the Icon Buttons of the Mode Icon Bar in the six different Modes.

Chapter 9 - Transformation Control. This chapter describes the Global transformation of all Frames and Parts, the transformation of selected Frames and Parts as well as selected Frames alone, the transformation of the various Tools, and the adjustment of the Z-Clip planes and the Look At and Look From Points.

Chapter 10 - Preference File Formats. This chapter describes the format of various preference files which the uses can affect.

Chapter 11 - EnSight Data Formats. This chapter describes in detail the format of the various EnSight data formats.

Chapter 12 - Utility Programs. This chapter describes a number of unsupported utility programs distributed with EnSight.

User Manual Index

Cross References in the User Manual will appear similar to:

(see Chapter __ or **(**see Section __

Clicking on these Cross References will automatically take you to the referenced Chapter or Section.

How To...

The various How To documents available on-line provide detailed instructions which explain how to perform various operations within EnSight such as creating an isosurface or reading in data.

Ordering

To order copies of EnSight documentation, contact CEI by telephone at the numbers listed below or via the internet:

Email: ensight_mkt@ceintl.com

Newsletter

CEI periodically publishes an EnSight newsletter, called the EnSight Post. If you would like to receive the newsletter, send Email to:

Email: post_editor@ceintl.com.

Contacting CEI

EnSight was created to make your work easier and more productive. If you have any questions about or problems using EnSight, or have suggestions for improvements, please contact CEI support:

Phone: (800) 551-4448 (USA)
(919) 363-0883 (Outside-USA)
Fax: (919) 363-0833

Email: ensight_support@ceintl.com

2 Input/Output

This chapter provides information on data input and output for EnSight.

2.1 Internal Readers provides a brief description of the data formats that can be read into EnSight using direct readers. It then describes how each format's data can be loaded into EnSight. Suggestions on minimizing memory usage is also noted.

2.2 User Defined Readers describes how the user defined reader API can be used to read data into EnSight.

2.3 Other External Data Sources describes other ways in which model data can be prepared to be read into EnSight.

2.4 Command Files provides a description of the files that can be saved for operations such as automatic restarting, macro generation, archiving, hardcopy output, etc.

2.5 Archive Files describes options for saving and restoring the entire current state of the program.

2.6 Context Files describes the options for saving and restoring context files.

2.7 Scenario Files describes the options for saving scenario files that can be displayed in the EnLiten program.

2.8 Saving Geometry and Results Within EnSight describes how to save model data, from any format which can be read into EnSight, as EnSight gold casefile format.

2.9 Saving and Restoring View States describes options for saving and restoring given view orientations.

2.10 Saving and Printing Graphic Images describes options for saving and printing graphic images.

2.11 Saving and Loading XY Plot Data describes options for saving and loading xy plot data.

2.12 Saving and Restoring Animation Frames describes options for saving and restoring flipbook and keyframe animation frames.

2.13 Saving Query Text Information describes options for saving query information to a text file.

2.14 Saving Your EnSight Environment describes options for saving various environment settings which affect EnSight.

2.15 Parallel Rendering Setup describes how to setup EnSight for parallel rendering.

Note: *Formats for EnSight related files are described in chapters 10 and 11. Formats for the various Analysis codes are not described herein.*

2.1 Internal Readers

Included in this section:

Dataset Format Basics

EnSight is designed to be an engineering postprocessor, yet its many features can be used in other areas as well. Its native data is defined as general finite elements or curvilinear structured data. EnSight has been used to visualize and animate results from simulations of diesel combustion, cardiovascular flow, petroleum reservoir migration, pollution dispersion, meteorological flow, and from many other disciplines. EnSight has two native data formats (EnSight5 and EnSight6) which are defined so that they can be easily interfaced to your analysis code.

(see Chapter 11, EnSight Data Formats)

EnSight reads node and element definitions from the geometry file and groups elements into an entity called a *Part*. A Part is simply a group of nodes and elements (the Part can contain different element types) which all behave the same way within EnSight and share common display attributes (such as color, line width, etc.).

EnSight allows you to read multiple datasets and work with them individually in the same active session. Each data set comprises a new “Case” and is handled by its own Server process.

EnSight also supports data formats for popular engineering simulation codes and generally used data formats.

Formats Used For Both Computational Fluid Dynamics and Structural Mechanics

- The **EnSight6** and **EnSight Gold** format supports the following files:

Case	Defines all of the variables, time steps, etc. that completely describe the files which will be used for an EnSight Case.
Geometry	Defines all geometric model Parts in terms of groups of finite elements, or ijk blocks.
Variable	A file for each variable, which contains either scalar or vector information for every node defined in the geometry file (per_node) or for elements of various parts (per_element).
Measure/Particle	Defines discrete Particles in space directly from a simulation or measured information from an experiment. The measured information can be used to compare actual versus simulated results.

- The **EnSight5** format supports the following files:

Geometry	Defines all geometric model Parts in terms of groups of finite elements.
Result	Defines variable names such as Stress, Strain, and Velocity, and indicates what files these are tied to. It also, defines time information if you have a transient data case. This file is optional (and is unnecessary if your geometry is static and you have no results data).
Variable	A file for each variable, which contains either scalar or vector information for every node defined in the geometry file.
Measured/Particle	Defines discrete Particles in space directly from a simulation or measured information from an experiment. The measured information can be used to compare actual versus simulated results.

- **MPGS4** is composed of the following files:

Geometry	Defines all geometric model Parts in a general n-sided polygon format.
Result	Utilizes the EnSight results file format. This file is optional.
Variable	A file for each variable, which contains either scalar or vector information for every node defined in the geometry file.
Measured/Particle	Utilizes the EnSight5 measured/Particle file.

Formats Generally Used For Computational Fluid Dynamics

- **ESTET** contains the geometry and results information in one file. This is the native binary data format for the ESTET simulation code. The EnSight5 measured/Particle file can also be used in conjunction with these.
- **FIDAP Neutral** contains the geometry and results in one file. This file is

produced by a separate procedure defined in the FIDAP documentation. If the data is time dependent this information is also defined here. The EnSight5 measured/Particle file can also be used in conjunction with these.

- **N3S** is native to the N3S simulation code and is composed of the files:

Geometry	Defines the geometry.
Result	Contains all result information describing variables and the scalar and vector information. This file is required.
Measure/Particle	Utilizes the EnSight5 measured/Particle files.

- **PLOT3D** is composed of the following files:

Geometry	Defines the geometry. This is known as a GRID file in PLOT3D and FAST. This file is a structured file format with FAST enhancements.
Result	Utilizes a modified EnSight results file format. This file is optional.
Variable	This file is a solution file (Q-file) defined in PLOT3D or a function file as defined by FAST. The modified EnSight results file provides access to multiple solution files that are produced by time dependent simulations.
Measured/Particle	Utilizes the EnSight5 measured/Particle files.

- **FAST UNSTRUCTURED** is composed of the following files:

Geometry	Defines the geometry as unstructured triangles and/or tetrahedrons. It is the FAST unstructured single block grid file.
Result	Utilizes a modified EnSight results file format. This file is optional.
Variable	This file is a solution file (Q-file) defined in PLOT3D or a function file as defined by FAST, with I equal to the number of points and J=K=1. The modified EnSight results file provides access to multiple solution files that are produced by time dependent simulations.
Measured/Particle	Utilizes the EnSight5 measured/Particle files.

Formats Generally Used For Structural Mechanics

- **ABAQUS** can produce a .fil file which contains the geometry and results requested. EnSight can read this file in either ASCII or binary format. EnSight will read the commonly used nodal and element based results contained in this file.
- **ANSYS RESULTS** contains the geometry and results in one file. The

files are defined as .rst, .rth, rfl, and .rmg files in the ANSYS documentation (EnSight 5.5 supports only the .rst file). If the data is time dependent this information is also defined here. The EnSight5 measured/ Particle file can also be used in conjunction with these.

- **Movie.BYU** is composed of the following files:

Geometry	Defines all geometric model Parts in a general n-sided polygon format.
Result	Utilizes the EnSight results file format. This file is optional.
Variable	A file for each variable, which contains either scalar or vector information for every node defined in the geometry file.
Measured/Particle	Utilizes the EnSight5 measured/Particle files.

Data files are never altered by EnSight. They are used only for reading the dataset information. EnSight can produce a set of files in its native format to save geometric information that may have been read from another format or created through the postprocessing techniques. Section 2.8, Saving Geometry and Results Within EnSight

Reading and Loading Data Basics

Reading and then Loading Data into EnSight is a two step process. First, files are specified through the File Selection Dialog and then read by EnSight to the Server. Data from the files is then loaded to the Client using the Data Part Loader dialog. All Parts or a subset of those available on the Server may be loaded to the Client. You should try to reduce the amount of information that is being processed in order to minimize required memory. Here are some suggestions:

- When writing out data from your analysis software, consider what information will actually be required for postprocessing. Any filtering operation you can do at this step greatly reduces the amount of time it takes to perform the postprocessing.
- Load to the Client only those Parts that you need. For example, if you were postprocessing the air flow around an aircraft you would normally not need to see the flow field itself, but you would like to see the aircraft surface and Parts created based on the flow field (which remains available on the Server).
- For each Part you do load to the Client, a *representation* must be chosen. This visual representation can be made very simple (through the use of the Feature Angle option), or can be made complex (by showing all of the surface elements). The more you can reduce the visual representation, the faster the graphics processing will occur on the Client (see Node, Element, and Line Attributes in (see Section 3.3, Part Editing).
- If you have multiple variables in your result file, activate only those variables you want to work with. When you finish using a variable, consider deactivating it to free up memory and thereby speed processing (see Section 4.1, Variable Selection and Activation).

- When dealing with transient data in an EnSight flipbook, consider loading initially only a sampling of the available time steps—you can always load the in-between steps later if you find something interesting.

Troubleshooting Loading Data

Problem	Probable Causes	Solutions
Data loads slowly	Loading more Parts than needed	For some models, especially external fluid flow cases, there is a flow field Part which does not need to be visualized. Try eliminating the loading of this Part.
	Too many elements	Make sure the default element representation for Model Parts is set to 3D Border/2D Full before loading the data. In some cases it is helpful to set the representation to Feature Angle before loading.
	Client is swapping because it does not have enough memory to hold all the Parts specified.	Try loading fewer Parts or installing more memory to handle the dataset size.
	Server is swapping because it does not have enough memory to hold all of the Parts contained in the dataset.	Install more memory in your Server host system, reduce the number of variables activated, or somehow reduce the geometry’s size. (If you can get the data in, you can cut away any area not now needed. What is left can then be saved as a geometric entity and that new dataset used for future postprocessing.)
Error reading data	Incorrect path or filename	Reenter the correct information
	Incorrect file permissions	Change the permissions of the relevant directories and files to be readable by you.
	Temporary file space is full	Temporary files are written to the default temporary directory or the directory specified by the environment variable TMPDIR for both the Client and Server. Check file space by using the command “df” and remove unnecessary files from the temporary directory or other full file systems.
	Format of the data is incorrect	Recheck the data against the data format definition.
EnSight format scalar (or vector) data loads, but appears incorrect. Often range of values off by some orders or magnitude.	Scalar (or vector) information not formatted properly in data file	Format the file according to examples listed under EnSight Variable Files in Section 2.5
	Extra white space appended to one or more of the records	Check for and remove any extra white space appended to each record

EnSight Case Reader

EnSight6 and EnSight Gold input data consists of the following files:

- Case file (required)
- Geometry file (required)
- Variable files (optional)
- Measured/Particle files (optional)
  - Measured/Particle geometry files
  - Measured/Particle variable files

The Case file is a small ASCII file which defines geometry and variable files and names, as well as time information. The Case file points to all other files which pertain to the model. The geometry file is a general finite-element format describing nodes and Parts, each Part being a collection of elements, and/or structured curvilinear ijk blocks. Measured/Particle files contain data about discrete Particles in space from the simulation code or information directly from actual experimental tests.

EnSight data is based on Parts. The Parts defined in the data are always available on the Server. However, all Parts do not have to be loaded to the Client for display. Large flow fields for CFD problems, for example, are needed for computation by the Server, but do not generally need to be seen graphically.

EnSight data can have changing geometry, in which case the changing geometry file names are contained in the Case file.

File Selection dialog

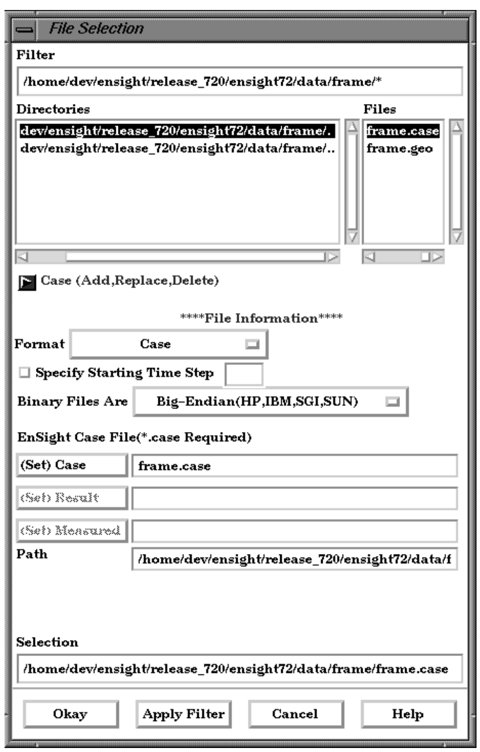


Figure 2-1
File Selection dialog for EnSight6 data

The File Selection dialog is used to specify which files you wish to read.
`Access: Main Menu > File > Data (Reader)...`

Filter

This field specifies the directory name that your data files reside in. Enter a /* at the end of the name to list all of the files and directories contained there. To filter to a smaller file list you can be more specific by entering Parts of the file names, such as /my* which will list all files and directories starting with "my". If you only enter a /, then only the directories found will be listed. To apply the Filter, click the Apply Filter button and the Directories and Files lists will be updated and the directory will be listed in the Selection field below as the current selection.

Directories

Selection of directories available to use in the current directory. Single click to place the directory string in the Filter field. Double click to use the directory as the filter (same effect as clicking once and then clicking Apply Filter button), the Directories and Files lists will be updated and the directory will be listed in the Selection field below as the current selection. The sliding controls to the right and bottom of the list let you view all available directories.

Files

Single click to select a file. This will insert the file name after the directory listed in the Selection field. This list contains all unfiltered files that are in the filter directory.

Case

Add...

Specify an additional case. Additional data can be read into another connected Server.

Replace...

Specify a new case to replace an existing case.

Delete

Delete an existing case. Case 1 cannot be deleted, but it can be replaced.

Format

Specifies the Format of the dataset. To read EnSight6 or EnSight Gold data, use the Case format.

Specify Starting Time Step

Specify starting time step. If not specified, EnSight will load the last step.

Binary Files Are

If the file is binary, sets the byte order to:
Big-Endian - byte order used for HP, IBM, SGI, SUN, NEC, and IEEE Cray.
Little-Endian - byte order used for Intel and alpha based machines.
Native to Server Machine - sets the byte order to the same as the server machine.

(Set) Geometry

Model file name for file containing at least the geometry. Clicking this button inserts the file name shown in the Selection field and inserts the path information into the Path field. File name can alternatively be typed into field.

(Set) Result

Result file name corresponding to the geometry file. For most data formats this file is optional. Clicking button inserts file name shown in Selection field and also inserts path information into Path field. File name can alternatively be typed into field.

(Set)Measured

Name of a measured file. This is an optional file. Clicking button inserts file name shown in Selection field and also inserts path information into Path field. File name can alternatively be typed into field.

Path

Path to dataset location is inserted by clicking (Set) buttons or may be entered. If blank, files are read from the Server's current working directory. Can use the tilde character (~)

to specify home directory on the Server host system.

Selection File or directory selected. Click the appropriate (Set) button to use information in this field.

Okay Click to read the files specified in the (Set) fields and close the File Selection dialog.

Apply Filter Click to apply the string in the Filter field.
Cancel Click to close the File Selection dialog without reading the files specified in the (Set) fields.

(see How To Read EnSight6 Data)

Loading Parts from EnSight6 or EnSight Gold Data

Data Part Loader dialog for Unstructured EnSight6 or EnSight Gold Data

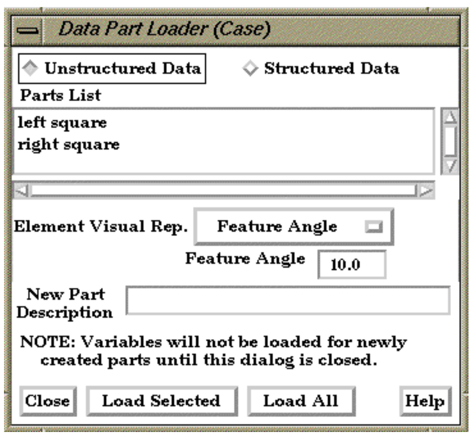


Figure 2-2
Data Part Loader dialog for EnSight6 or EnSight Gold Unstructured Data

You use the Data Part Loader dialog to control which Parts will be loaded to the Server (and made available on) the EnSight Client. It will automatically open after you have read in data and clicked Okay in the File Selection dialog.
`Access: Main Menu > File > Data (Part Loader)...`

Unstructured Data This toggle indicates that the Part(s) listed in the Part List is(are) unstructured.

Parts List Lists all unstructured EnSight6 format Parts in the data files which may be loaded to the Server (and subsequently to the Client). An EnSight6 or EnSight Gold data file can have unstructured, structured, or both types of Parts.

Element Visual Rep. Parts are defined on the server as a collection of 1, 2, and 3D elements. EnSight can show you all of the faces and edges of all of these elements, but this is usually a little overwhelming, thus EnSight offers several different *Visual Representations* to simplify the view in the graphics window. Note that the Visual Representation only applies to the

EnSight client—it has no affect on the data for the EnSight server.

Figure 2-3
Element Visual Representation pulldown

3D Border, 2D Full — In this mode, you will see all 1D and 2D elements, but only the outside surfaces of 3D elements.

Border — In Border mode all 1D elements will be shown. Only the unique (non-shared) edges of 2D elements and the unique (non-shared) faces of 3D elements will be shown.

Feature Angle — When EnSight is asked to display a Part in this mode it first calculates the 3D Border, 2D Full representation to create a list of 1D and 2D elements. Next it looks at the angle between neighboring 2D elements. If the angle is above the Angle value specified the shared edge between the two elements is removed. Only 1D elements remain on the EnSight client after this operation.

Bounding Box — All Part elements are replaced with a bounding box surrounding the Cartesian extent of the elements of the Part.

Full — In Full Representation mode all 1D and 2D elements will be shown. In addition, all faces of all 3D elements will be shown.

Non Visual — This specifies that the loaded Part will not be visible in the Graphics Window because it is only loaded on the Server. Visibility can be turned on again later by changing the representation.

Load Selected — Loads Parts selected in Parts List to EnSight Server. The Parts are subsequently loaded to the EnSight Client using the specified Visual Representation. If Non Visual is specified, the selected Parts will be loaded to the Server, but not to the Client.

Load All — Loads all Parts in Parts List to EnSight Server. The Parts are subsequently loaded to the EnSight Client using the specified Visual Representation. If Non Visual is specified, the selected Parts will be loaded to the Server, but not to the Client.

Data Part Loader dialog for Structured EnSight6 or EnSight Gold data

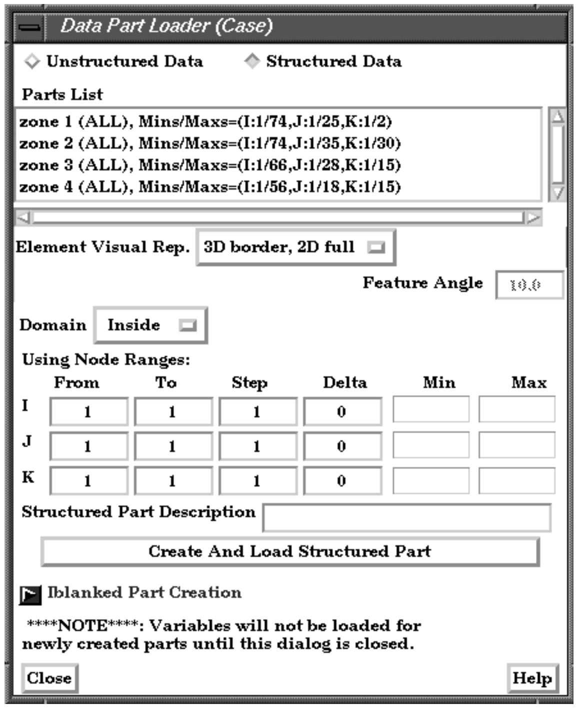


Figure 2-4

Data Part Loader dialog for EnSight6 or EnSight Gold Structured Data

You use the Data Part Loader dialog to control which structured Parts will be loaded to the EnSight Server (and subsequently to the EnSight Client). It will automatically open after you have read in data and clicked Okay in the File Selection dialog.

`Access: Main Menu > File > Data (Part Loader)...`

Structured Data This toggle indicates that the Part data listed is structured.

Parts List Lists all structured Parts on Server which may be loaded to the EnSight Server (and subsequently to the EnSight Client). When one part is highlighted in this list, the Domain and Node Range fields are updated accordingly.

Element Visual Rep. Parts are defined on the server as a collection of 1, 2, and 3D elements. EnSight can show you all of the faces and edges of all of these elements, but this is usually a little overwhelming, thus EnSight offers several different *Visual Representations* to simplify the view in the graphics window. Note that the Visual Representation only applies to the EnSight client—it has no affect on the data for the EnSight server.

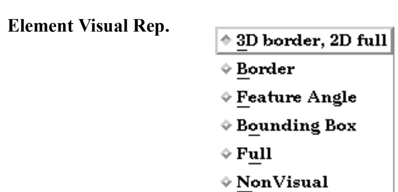


Figure 2-5

Element Visual Representation pulldown

3D Border, 2D Full In this mode, you will see all 1D and 2D elements, but only the outside surfaces of 3D elements.

Border In Border mode all 1D elements will be shown. Only the unique (non-shared) edges of 2D elements will be shown, and only unique (non-shared) faces of 3D elements will be shown.

Feature Angle
: When EnSight is asked to display a Part in this mode it first calculates the 3D Border, 2D Full representation to create a list of 1D and 2D elements. Next it looks at the angle between neighboring 2D elements. If the angle is above the Angle value specified the shared edge between the two elements is removed. Only 1D elements remain on the EnSight client after this operation.

Bounding Box
: All Part elements are replaced with a bounding box surrounding the Cartesian extent of the elements of the Part.

Full
: In Full Representation mode all 1D and 2D elements will be shown. In addition, all faces of all 3D elements will be shown.

Non Visual
: This specifies that the loaded Part will not be visible in the Graphics Window because it is already loaded on the EnSight Server. Visibility can be turned on again later by changing the representation.

Domain
: Specifies the general iblanking option to use when creating a structured Part. If the model does not have iblanking, InSide will be specified by default.

Inside	Iblank value = 1 region
Outside	Iblank value = 0 region
All	Ignore iblanking and accept all nodes

Using Node Ranges:

From IJK
: Specifies the beginning I,J,K values to use when extracting the structured Part, or a portion of it. Must be >= Min value.

To IJK
: Specifies the ending I,J,K values to use when extracting the structured Part, or a portion of it. Must be <= Max value.

Valid values for the From and To fields can be positive, zero, or negative. Positive numbers are the natural 1 through Max values. Zero is a special way to indicate the max surface of a given direction. Negative values indicate surfaces back from the max, so -1 would be the next to last surface, -2 the next to next to last surface etc. There are therefore two ways to indicate any of the range values; the positive number from the min towards the max, or the zero or negative number from the max toward the min. The zero/negative method is provided for ease of use because of varying max values per part.

```
   1, 2, 3,... --->                 <--- ...-3, -2 ,-1, 0
   |---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
 min                                                  max
(always 1)                                     (varies per zone)
```

Step IJK
: Specifies the step increment through I,J,K. A Step value of 1 extracts all original data. A Step value of 2 extracts every other node, etc.

Delta IJK
: Specifies the delta to use when creating more than one surface from the same ijk part. Only one of the directions may be non-zero. *Note that an unstructured part is the result of any non-zero delta values.*

Min IJK
: Minimum I,J,K values for Part chosen

Max IJK
: Maximum I,J,K values for Part chosen

Part Description
: Text field into which you can enter a description for the Part

Create And Load Part
: Extracts the data from the data files and creates a Part on the Server (and on the Client unless NonVisual has been specified for Representation) based on all information specified in the dialog.

If only one part is highlighted, the values shown in the From and To fields(as well as the

Min and Max fields) are the actual values for the selected part. Using the From and To fields you can control whether an EnSight part will be created using the entire ijk ranges or some subset of them. The Step field allows you to sample at a more coarse resolution. And the Delta field allows for multiple "surfaces" in a given part (like blade rows of a jet engine). Please note that use of a non-zero delta produces an unstructured part instead of a structured one.

If more than one Part is highlighted, the values shown in the From and To fields are the combined bounding maximums of the selected parts. The same basic functionality described for a single part selection applies for multiple part selection, with one part being created for each selected part in the dialog. If the specified ranges for the multiple selection exceed the bounds of a given part, they are modified for that part so that its bounds are not exceeded.

Iblanked Part Creation section of Structured Part Loader dialog

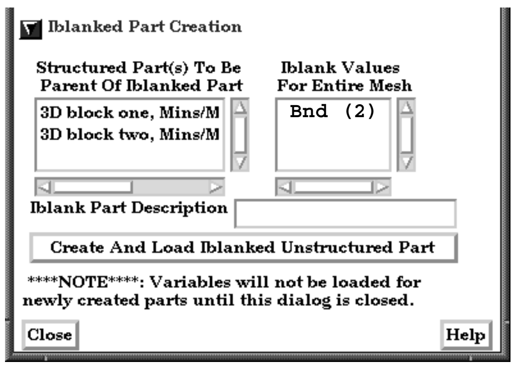


Figure 2-6

Iblanked Part Creation Section of EnSight6 or EnSight Gold Structured Part Loader dialog

You use this portion of the Part Loader dialog to further extract iblanked regions from structured parts which were created either as inside, outside, or all portions of the model.

Structured Part(s) To Be Parent of Iblanked Part — Lists all structured parts that have been created thus far in the dialog above.

Iblank Values For Entire Mesh — Lists all possible iblank values found in the model. This is a global list and may not apply to all parts.

Iblank Part description — Text field into which you can enter a description for the iblanked part.

Create And Load Iblanked Unstructured Part — Extracts a new iblanked part from an existing structured part. This new part will actually be an unstructured part.

(see How To Read EnSight6 Data)

EnSight5 Reader

EnSight5 input data consists of the following files:

- Geometry file (required)
- Result file (optional)
- Variable files (optional)
- Measured Particle Files (optional)

  - Measured/Particle geometry files
  - Measured/Particle results files
  - Measured/Particle variable files

The geometry file is a general finite-element format describing nodes and Parts, each Part being a collection of elements. The result file is a small file allowing the user to name variables and provide time information. The result file points to variable files which contain the scalar or vector information for each node. Measured/Particle files contain data about discrete Particles in space from the simulation code or information directly from actual experimental tests.

EnSight5 data is based on Parts. The Parts defined in the data are always available on the Server. However, all Parts do not have to be loaded to the Client for display. Large flow fields for CFD problems, for example, are needed for computation by the Server, but do not generally need to be seen graphically.

EnSight5 data can have changing geometry, in which case the changing geometry file names are contained in the results file. However, it is still necessary to specify an initial geometry file name.

File Selection dialog

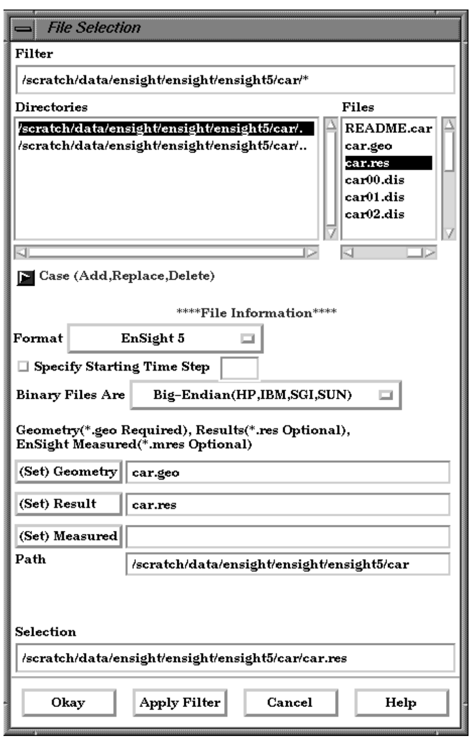


Figure 2-7
File Selection dialog for EnSight5 data

The File Selection dialog is used to specify which files you wish to read.
`Access: Main Menu > File > Data (Reader)...`

Filter — This field specifies the directory name that your data files reside in. Enter a /* at the end of the name to list all of the files and directories contained there. To filter to a smaller file list you can be more specific by entering Parts of the file names, such as /my* which will list all files and directories starting with "my". If you only enter a /, then only the directories found will be listed. To apply the Filter, click the Apply Filter button and the Directories and Files lists will be updated and the directory will be listed in the Selection field below as the current selection.

Directories — Selection of directories available to use in the current directory. Single click to place the directory string in the Filter field. Double click to use the directory as the filter (same effect as clicking once and then clicking Apply Filter button), the Directories and Files lists will be updated and the directory will be listed in the Selection field below as the current selection. The sliding controls to the right and bottom of list let you view all available directories.

Files — Single click to select a file.This will insert the file name after the directory listed in the Selection field. This list contains all unfiltered files that are in the filter directory.

Case

Add... — Specify an additional case. Additional data can be read into another connected Server.

Replace... — Specify a new case to replace an existing case.

Delete — Delete an existing case. Case 1 cannot be deleted, but it can be replaced.

Format — Specifies the Format of the dataset. To read EnSight6 or EnSight Gold data, use the Case format.

Specify Starting Time Step — Specify starting time step. If not specified, EnSight will load the last step.

Binary Files Are — If the file is binary, sets the byte order to:
Big-Endian - byte order used for HP, IBM, SGI, SUN, NEC, and IEEE Cray.
Little-Endian - byte order used for Intel and alpha based machines.
Native to Server Machine - sets the byte order to the same as the server machine.

(Set) Geometry — Model geometry file name. Clicking button inserts file name shown in Selection field and inserts path information into Path field. File name can alternatively be typed into field.

(Set) Result — Result file name corresponding to the geometry file. For most data formats this file is optional. Clicking button inserts file name shown in Selection field and also inserts path information into Path field. File name can alternatively be typed into field.

(Set)Measured — Name of a measured file. This is an optional file. Clicking button inserts file name shown in Selection field and also inserts path information into Path field. File name can alternatively be typed into field.

Path — Path to dataset location is inserted by clicking (Set) buttons or may be entered. If blank, files are read from the Server's current working directory. Can use the tilde character (~) to specify home directory on the Server host system.

Selection — File or directory selected. Click the appropriate (Set) button to use information in this field.

Okay Click to read the files specified in the (Set) fields and close the File Selection dialog.

Apply Filter Click to apply the string in the Filter field.

Cancel Click to close the File Selection dialog without reading the files specified in the (Set) fields.

(see How To Read EnSight5 Data)

Loading Parts from EnSight5 data

Data Part Loader dialog

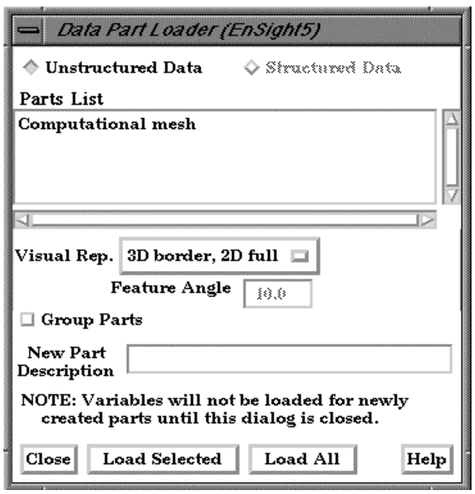


Figure 2-8
Data Part Loader dialog for EnSight5 data

You use the Data Part Loader dialog to control which Parts will be loaded to the EnSight Server (and subsequently, to the Client). It will automatically open after you have read in data and clicked Okay in the File Selection dialog.
`Access: Main Menu > File > Data (Part Loader)...`

Unstructured Data This toggle indicates that Part data is unstructured. It must be on for EnSight5 format.

Structured Data This toggle is not available for EnSight5 data.

Parts List Lists all Parts in the data files which may be loaded to the EnSight Server (and subsequently, to the Client).

Element Visual Rep. Parts are defined on the server as a collection of 1, 2, and 3D elements. EnSight can show you all of the faces and edges of all of these elements, but this is usually a little overwhelming, thus EnSight offers several different *Visual Representations* to simplify the view in the graphics window. Note that the Visual Representation only applies to the

EnSight client—it has no affect on the data for the EnSight server.

Figure 2-9

Element Visual Representation pulldown

3D Border, 2D Full — In this mode, you will see all 1D and 2D elements, but only the outside surfaces of 3D elements.

Border — In Border mode all 1D elements will be shown. Only the unique (non-shared) edges of 2D elements will be shown, and only unique (non-shared) faces of 3D elements will be shown.

Feature Angle — When EnSight is asked to display a Part in this mode it first calculates the 3D Border, 2D Full representation to create with a list of 1D and 2D elements. Next it looks at the angle between neighboring 2D elements. If the angle is above the Angle value specified the shared edge between the two elements is removed. Only 1D elements remain on the EnSight client after this operation.

Bounding Box — All Part elements are replaced with a bounding box surrounding the Cartesian extent of the elements of the Part.

Full — In Full Representation mode all 1D and 2D elements will be shown. In addition, all faces of all 3D elements will be shown.

Non Visual — This specifies that the loaded Part will not be visible in the Graphics Window because it is only loaded on the EnSight Server. Visibility can be turned on again later by changing the representation.

Load Selected — Loads Parts selected in Parts List to EnSight Server. The Parts are subsequently loaded to the EnSight Client using the specified Visual Representation. If Non Visual is specified, the selected Parts will be loaded to the Server, but not to the Client.

Load All — Loads all Parts in Parts List to EnSight Server. The Parts are subsequently loaded to the EnSight Client using the specified Visual Representation. If Non Visual is specified, the selected Parts will be loaded to the Server, but not to the Client.

(see How To Read EnSight5 Data)

ABAQUS Reader

ABAQUS input data consists of the following files:

- Geometry/Results file (required). This file (the ABAQUS .fil file) contains both the geometry and any requested results. It can be either ASCII or binary.
- EnSight5 Measured/Particle Files (optional). The measured .res file

references the measured geometry and variable files.

EnSight will read ASCII or binary .fil files directly. Geometry and commonly used results contained in the file will be read.

The element sets in the .fil file will be used for creating parts.

(see How To Read ABAQUS Data)

ANSYS RESULTS Reader

ANSYS input data consists of the following files:

- Geometry and Results file (required). The ANSYS .rst file (or similar results files such as .rfl, .rmq, .rth) contains geometry and results and should be entered in the geometry field of the Data dialog.
- EnSight5 Measured/Particle Files (optional). The measured .res file references the measured geometry and variable files.

EnSight allows you to read the geometry and results data directly from an ANSYS results data file. Not all element types possible in ANSYS can be converted to EnSight format. However, EnSight will handle most practical cases just fine.

Note that certain variables may read slower than others. Displacement, acceleration, and velocity vector variables, as well as nodal solution scalars (pressure, temperature, etc.), read in quickly because they are provided at the nodes directly. Stress and strain variables, on the other hand, can be quite time consuming to read because the process involves:

1. getting the element nodal values,
2. if necessary, computing principal stresses (or strains),
3. if necessary, applying equivalent stress (or strain) and/or stress (or strain) intensity equations,
4. if shell elements, using one side or the other (user selectable),
5. averaging the values at shared nodes, and,
6. if higher order elements, averaging to get mid-side node values.

ANSYS data is based on Parts. The Parts defined in the data are always read on the Server. These Parts, however, do not all have to be loaded to the Client for display.

(see How To Read ANSYS Data)

ESTET Reader

ESTET input data consists of one file that contains all geometry and results information. The ESTET data is a structured grid. The data file is binary.

When reading this data into EnSight, you extract Parts from the mesh interactively based on indices assigned to the nodes in the data. Currently, three domains are possible for extracting Parts: inside, outside, and symmetry plane. As you extract Parts, you can limit the domains according to ranges in I, J and K.

The data can be in rectangular, cylindrical, or curvilinear coordinates. EnSight will interpret and convert properly for any of these types.

Once the desired geometry has been extracted as Parts, you are presented with a list of the results variables contained in the file. There is no way to automatically determine which of the results variables are actually vector components, so you are given the opportunity to build the vectors from the variables. The descriptions usually make this a straightforward process. All variables not used as components to vectors are assumed to be scalar variables.

ESTET Vector Builder and Data Part Loader dialogs

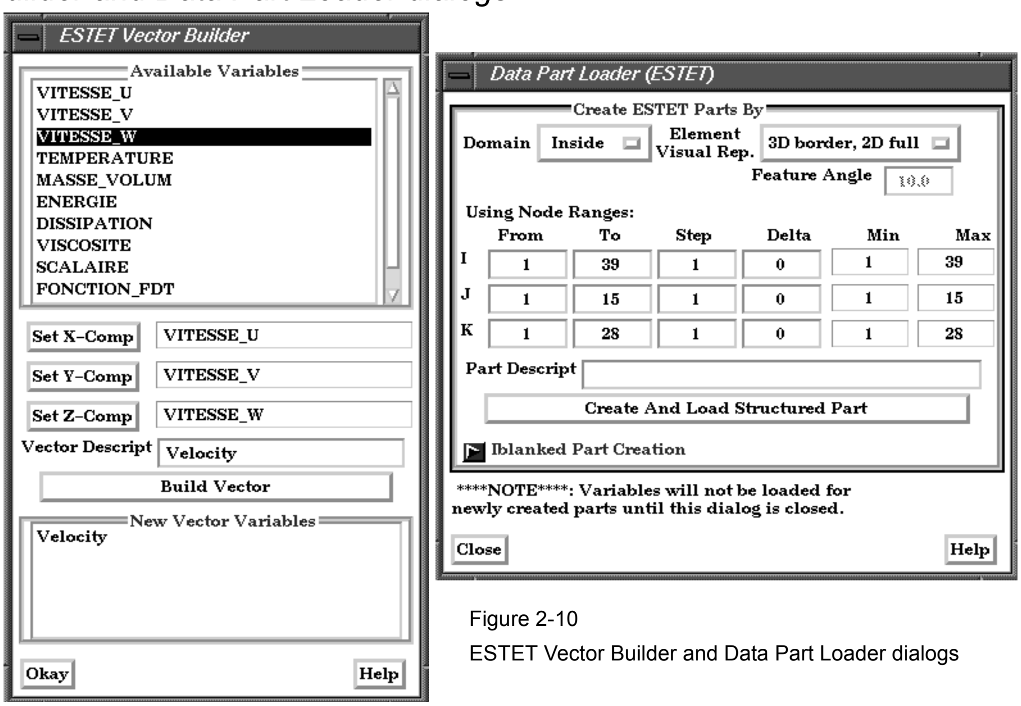


Figure 2-10
ESTET Vector Builder and Data Part Loader dialogs

You use the File Selection dialog to read ESTET data files, the ESTET Vector Builder dialog to build vector variables from scalar components for an ESTET dataset, and the Data Part Loader dialog to extract Parts from an ESTET dataset. The latter two dialogs open in sequence automatically after you click Okay in the File Selection dialog.

`Access: Main Menu > File > Data (Reader)…> ESTET`

Create ESTET Parts By

Domain — Select domain to extract Part.

Inside — Create a structured Part that contains elements whose nodes are flagged as being “inside”.

Outside — Create a structured Part that contains elements whose nodes are flagged as “outside”.

All — Create a structured Part that contains all elements because node iblanking is ignored.

Using Node Ranges: Specification of node range when creating a Part. Values must be between Min and Max.

From IJK — Specifies the beginning I,J,K values to use when extracting the structured Part, or a portion of it.

To IJK — Specifies the ending I,J,K values to use when extracting the structured Part, or a portion of it.

Valid values for the From and To fields can be positive, zero, or negative. Positive numbers are the natural 1 through Max values. Zero is a special way to indicate the max surface of a given direction. Negative values indicate surfaces back from the max, so -1 would be the next to last surface, -2 the next to next to last surface etc. There are therefore two ways to indicate any of the range values; the positive number from the min towards the max, or the zero or negative number from the max toward the min.

```
   1, 2, 3,... --->                <--- ...-3, -2 ,-1, 0
   |---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
 min                                                    max
(always 1)                                       (varies per zone)
```

Step IJK — Specifies the step increment through I,J,K. A Step value of 1 extracts all original data. A Step value of 2 extracts every other node, etc.

Delta IJK — Specifies the delta to use when creating more than one surface from the same ijk part. Only one of the directions may be non-zero. *Note that an unstructured part is the result of any non-zero delta values.*

Min IJK — Minimum I,J,K values for zone chosen
Max IJK — Maximum I,J,K values for zone chosen

Part Descrip — Set the name of the Part. If empty, EnSight will assign a name.

Create Part — Click to create a Part according to the range, step by, and delta specifications. Using the From and To fields you can control whether an EnSight part will be created using the entire ijk ranges or some subset of them. The Step field allows you to sample at a more coarse resolution. And the Delta field allows for multiple “surfaces” in a given zone (like blade rows of a jet engine). *Please note that use of a non-zero delta produces an unstructured part instead of a structured one.*

Available Variables — Selection to specify a variable to use for the next Set...Comp action.

Set X-Comp — Click to set the current selection to be the X component of the vector to build.
Set Y-Comp — Click to set the current selection to be the Y component of the vector to build.
Set Z-Comp — Click to set the current selection to be the Z component of the vector to build.

Vector Descript — Set the name of the vector variable.

Build Vector — Click to define the vector variable.

New Vector Variables — List of vector variables that have been defined.

Okay — Click Okay to load the variable information.

WARNING: You should build all the vectors you are going to use before clicking Okay, because you cannot return to this dialog. If you fail at this point to make all of the vectors desired, it is possible to do so later using the Make Vector function (see Section 4.3, Variable Creation)

Iblanked Part Creation section of Data Part Loader (ESTET) dialog

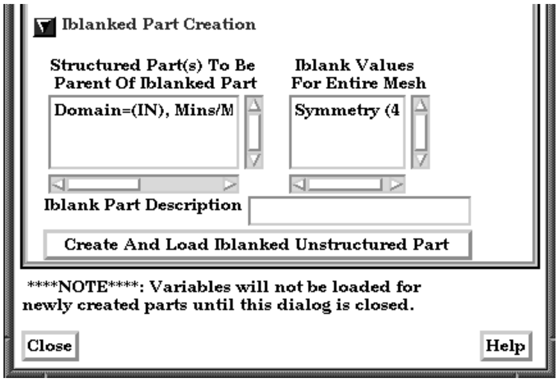


Figure 2-11
Iblanked Part Creation Section of Data Part Loader (ESTET) dialog

You use this portion of the Part Loader dialog to further extract iblanked regions from structured parts which were created either as inside, outside, or all portions of the model.

Structured Part(s) To Be Parent of Iblanked Part — Lists all structured parts that have been created thus far in the dialog above.

Iblank Values For Entire Mesh — Lists all possible iblank values found in the model. This is a global list and may not apply to all parts.

Iblank Part description — Text field into which you can enter a description for the iblanked part.

Create And Load Iblanked Unstructured Part — Extracts a new iblanked part from an existing structured part. This new part will actually be an unstructured part.

(see How To Read ESTET Data)

FAST UNSTRUCTURED Reader

FAST UNSTRUCTURED input data consists of the following files:

- Geometry file (required) This is the FAST UNSTRUCTURED single zone grid file.
- Modified Result file (optional)
- Variable files (optional) These are either a PLOT3D solution file (Q-file) or FAST function file with I = number of points and J=K=1.
- EnSight5 Measured/Particle Files (optional). The measured .res file references the measured geometry and variable files.

FAST UNSTRUCTURED is a format containing triangle and/or tetrahedron elements. The triangles have tags indicating a grouping for specific purposes. EnSight will read the unstructured single zone grid format for this data type, placing all tetrahedral elements into the first Part, and the various triangle element groupings into their own Parts.

The modified EnSight results file allows results to be read from PLOT3D-like Q-files or FAST-like function files. They can be time dependent.

FAST UNSTRUCTURED data can have changing geometry. When this is the case, the changing geometry file names are contained in the results file. However, it is still necessary to specify an initial geometry file name.

(see How To Read FAST Unstructured Data)

FIDAP NEUTRAL Reader

A FIDAP Neutral file contains all of the necessary geometry and result information for use with EnSight.

FIDAP data is based on Parts. The Parts defined in the data are always read on the Server. They do not, however, all have to be loaded to the Client for display. Large flow fields for CFD problems, for example, are needed for computation by the Server, but do not generally need to be seen graphically.

EnSight5 Measured/Particle Files can also be read with a FIDAP model. The measured .res file references the measured geometry and variable files.

(see How To Read FIDAP Neutral Data)

FLUENT UNIVERSAL Reader

FLUENT input data files consist of the following:

- Universal file (required)
- EnSight5 format Results file (optional)
- EnSight5 Measured/Particle Files (optional).

The FLUENT Universal file contains all of the necessary geometry and result information for use with EnSight for a steady-state case. If the case is transient, EnSight needs a Universal file for each time step of the analysis and a modified version of the EnSight results file.

FLUENT data is based on Parts. The Parts defined in the data are always read on the Server. They do not, however, all have to be loaded to the Client for display. Large flow fields for CFD problems, for example, are needed for computation by the Server, but do not generally need to be seen graphically.

EnSight5 Measured/Particle Files can also be read with a FLUENT model. The measured .res file references the measured geometry and variable files.

(see How To Read FLUENT Universal Data)

Movie.BYU Reader

Movie.BYU input data consists of the following files:

- Geometry file (required)
- Results file (optional)
- Variable files (optional)
- EnSight5 Measured/Particle Files (optional). The measured .res file references the measured geometry and variable files.

Movie.BYU has a general n-sided polygon data format. In translating this format to the element-based EnSight data format, not all elements possible in the Movie.BYU format can be converted to EnSight format. However, for most practical cases there are no problems.

Movie.BYU datasets can be read directly by EnSight. Additionally, an external translator, “movieto5”, is provided if you wish to convert the actual data files to EnSight format.

In order to read Movie.BYU data result files into EnSight, you must create a results file of the same format as EnSight. The external translator, “mpgs4to5,” can be used to generate a results file if you do not want to create your own using a text editor.

Movie.BYU data is based on Parts. The Parts defined in the data are always read on the Server. They do not, however, all have to be loaded to the Client for display.

Movie.BYU data can have changing geometry. When this is the case, the changing geometry file names are contained in the results file. However, it is still necessary to specify an initial geometry file name.

(see How To Read MOVIE.BYU Data)

MPGS 4.1 Reader

MPGS4 data files consist of the following:

- Geometry file (required)
- EnSight format Results file (optional)
- Variable files (optional)
- EnSight5 Measured/Particle Files (optional). The measured .res file references the measured geometry and variable files.

MPGS4.x uses a general n-sided polygon, n-faced polyhedral data format. In going from this format to the specific element data format of EnSight, you encounter the problem associated with translating from a general format to a specific format. Not all elements possible in MPGS4.x can be converted to EnSight format. However, there will not be a problem in most situations.

MPGS4.x models of modest size can be read directly into EnSight. Size can become an issue since the amount of memory needed to do the conversion in EnSight to the internal data format in a reasonable length of time can become excessive for large models. An external translator, “mpgs4to5”, is provided for the larger models. You should also consider using the external translator to convert MPGS4.x data to EnSight data if you need to continue loading the same dataset, as this will perform the data conversion one time while reading it into EnSight will continue to take resources each time the data is read. Converting it from MPGS4.x to EnSight format also has the advantage of taking less disk space as the EnSight format is more compact.

In order to read MPGS4.x results directly into EnSight, you must create a results file of the same format as EnSight. The external translator, “mpgs4to5,” can be used to generate a results file if you do not want to create your own using an editor.

MPGS4.x data is based on Parts. The Parts defined in the data are always read on the Server. They do not, however, all have to be loaded to the Client for display. Large flow fields for CFD problems, for example, are needed for computation on the Server, but do not generally need to be seen graphically.

MPGS4.x data can have changing geometry. When this is the case, the changing geometry file names are contained in the results file. However, it is still necessary to specify an initial geometry file name.

(see How To Read MPGS Data)

N3S Reader

N3S input data consists of the following files:

- Geometry file (required)
- Results file (required)
- EnSight5 Measured/Particle Files (optional). The measured .res file references the measured geometry and variable files.

N3S is a data format developed by Electricité de France (EDF) consisting of a geometry file and a results file. For this data format, both files are always required. Versions 3.0 and 3.1 are both supported.

When reading N3S data into EnSight, you extract Parts from the mesh interactively based on different color numbers or boundary conditions. The available color numbers and boundary conditions for the model are presented.

N3S Part Creator dialog

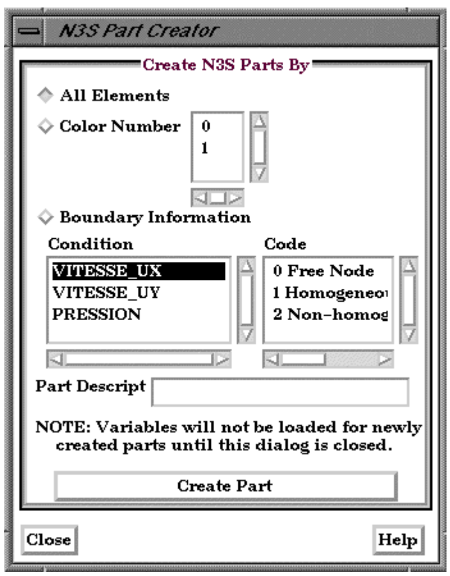


Figure 2-12
N3S Part Creator dialog

You use the File Selection dialog to read in N3S dataset files. You use the N3S Part Creator dialog to extract Parts from a N3S dataset.

`Access: Main Menu > File > Data (Reader)...> N3S`

Create N3S Parts By

All Elements — Selection to create a Part using all of the elements available within the data file.

Color Number — Selection to create a Part according to the color number associated with each element.

Boundary Information — Selection to create a Part according to specified conditions and codes.

Condition — Select boundary condition to use for Part creation.

Code — Select Code to use for boundary condition.

Part Descript — Specify name for Part.

Create Part — Click to create a Part. The Part is listed in the main Parts list of the Parts & Frames dialog and is displayed in the Main View window.

(see How To Read N3S Data)

PLOT3D Reader

PLOT3D is a commonly used structured data format and input data consists of the following files:

- Geometry file. This is a required file. (Structured GRID file with FAST enhancements)
- Modified EnSight Results file (optional). A standard plot3d Q-file can be read in the results field in place of a modified EnSight Results file.
- Variable files, which are solution (PLOT3D) or function (FAST) files (optional)
- EnSight5 Measured/Particle Files (optional). The measured .res file references the measured geometry and variable files.

When reading PLOT3D files into EnSight, you extract Parts from the mesh based on a domain, a list of zones, and/or indices assigned to the nodes in the data. Currently, three domains are possible for extracting structured Parts: (a) inside, (b) outside, or (c) all. These options are dependent on what the file format is from the parameters defined in the previous paragraph. For instance, when using single zone, non-iblanked data the domain is fixed at “Inside” and the one zone listed in the zones list is selected. As you extract Parts from a single zone file, however, it is possible to limit the domains according to ranges in I, J, and K.

Once the desired structured Parts have been extracted from the geometry, further iblanking options can be used to extract unstructured parts, such as for boundaries. When the Data Reader (PLOT3D) dismissed, the user is presented with a list of the result variables available from the result file

To successfully read PLOT3D data, the following information must be known about the data:

1. format - ASCII, C binary, or Fortran binary
2. whether single or multizone
3. dimension - 3D, 2D, or 1D
4. whether iblanked or not
5. precision - single or double

EnSight attempts to determine these five settings automatically from the grid file. The settings that were determined (for the first four) are shown in the Part Builder dialog, where you can override them manually if needed.

The precision setting is not reflected in the dialog, but is echoed in the Server shell window. The q (or function) file precision will by default be set the same as that of the grid file. In the rare case where the automatic detection is wrong for the grid file or the precision is different for the q (or function) file than for the grid file, commands can be entered into the Command dialog to manually set the precision.

test:	`plot3d_grid_single`	to read grid file as single precision
test:	`plot3d_grid_double`	to read grid file as double precision
test:	`plot3d_qr_single`	to read q (or function) file as single precision
test:	`plot3d_qr_double`	to read q (or function) file as double precision

PLOT3D Part Loader dialog

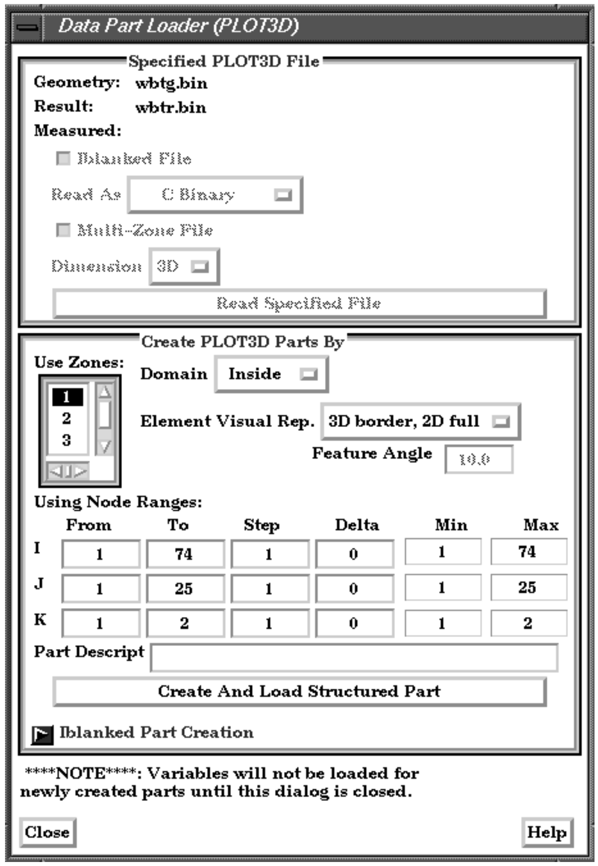


Figure 2-13
Part Data Loader (PLOT3D)

You use the Part Data Loader (PLOT3D) dialog to read a specified PLOT3D file and to extract parts out of the PLOT3D geometry.

`Access: Main Menu > File > Data (Reader)... > PLOT3D`

Geometry Specifies name of file which geometry data will be read.

Result Specifies name of file which result data will be read.

Measured Specifies name of file which measured/discrete data will be read.

IBlanked File Toggle Turn on if geometry field has iblanking.

Read As Specifies file type. Choices are:
ASCII
C Binary (Note: Files may not be portable across hardware platforms).
FORTRAN Binary (Note: Files may not be portable across hardware platforms).

Multi-Zone File Toggle Turn on if dataset contains multiple zones. If Multi-zoned and you are not doing a "between boundary" domain option (see below), a part can span several zones (see Use Zone list below).

Dimension Specifies the dimension of the dataset. Options are 1D, 2D, or 3D. If multi-zone, the dimension of the problem is forced to be 3D.

Read Specified File — Click to initiate the reading process.

Use Zones — List of Zones defined in the data that can be used to create Parts. If there are multiple zones you can select one or more of them.

Domain — Select the domain to create a structured Part from. Options are:

Inside Create structured Part from grid points flagged with Iblanking = 1
Outside Create structured Part from grid points flagged with Iblanking = 0.
All Create part from all grid points (ignores Iblanking).

Using Node Ranges

From IJK — Specifies the beginning I,J,K values to use when extracting the structured Part, or a portion of it.

To IJK — Specifies the ending I,J,K values to use when extracting the structured Part, or a portion of it.

Valid values for the From and To fields can be positive, zero, or negative. Positive numbers are the natural 1 through Max values. Zero is a special way to indicate the max surface of a given direction. Negative values indicate surfaces back from the max, so -1 would be the next to last surface, -2 the next to next to last surface etc. There are therefore two ways to indicate any of the range values; the positive number from the min towards the max, or the zero or negative number from the max toward the min. The zero/negative method is provided for ease of use because of varying max values per part.

```
    1, 2, 3,... --->              <--- ...-3, -2 ,-1, 0
    |---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
  min                                              max
(always 1)                               (varies per zone)
```

Step IJK — Specifies the step increment through I,J,K. A Step value of 1 extracts all original data. A Step value of 2 extracts every other node, etc.

Delta IJK — Specifies the delta to use when creating more than one surface from the same ijk part. Only one of the directions may be non-zero. Note that an unstructured part is the result of any non-zero delta values.

Min IJK — Minimum I,J,K values for Part chosen
Max IJK — Maximum I,J,K values for Part chosen

Part Descrip — Specify name of Part you wish to create.

Create Part — Click to create a Part.

If only one part is highlighted, the values shown in the From and To fields(as well as the Min and Max fields) are the actual values for the selected part. Using the From and To fields you can control whether an EnSight part will be created using the entire ijk ranges or some subset of them. The Step field allows you to sample at a more coarse resolution. And the Delta field allows for multiple “surfaces” in a given part (like blade rows of a jet engine). Please note that use of a non-zero delta produces an unstructured part instead of a structured one.

If more than one Part is highlighted, the values shown in the From and To fields are the combined bounding maximums of the selected parts. The same basic functionality described for a single part selection applies for multiple part selection, with one part being created for each selected part in the dialog. If the specified ranges for the multiple selection exceed the bounds of a given part, they are modified for that part so that its bounds are not exceeded.

Iblanked Part Creation section of Data Part Loader (PLOT3D) dialog

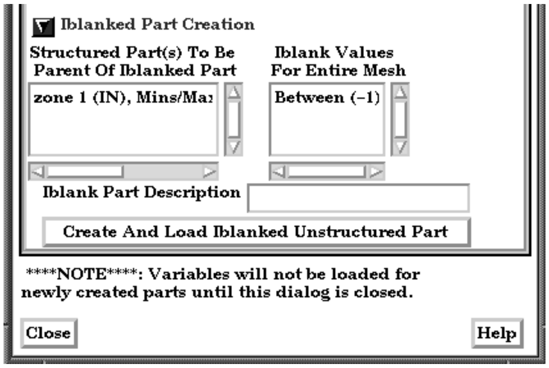


Figure 2-14
Iblanked Part Creation Section of Data Part Loader (PLOT3D) dialog

You use this portion of the Part Loader dialog to further extract iblanked regions from structured parts which were created either as inside, outside, or all portions of the model.

Structured Part(s) To Be Parent of Iblanked Part Lists all structured parts that have been created thus far in the dialog above.

Iblank Values For Entire Mesh Lists all possible iblank values found in the model. This is a global list and may not apply to all parts.

Iblank Part description Text field into which you can enter a description for the iblanked part.

Create And Load Iblanked Unstructured Part Extracts a new iblanked part from an existing structured part. This new part will actually be an unstructured part.

(see How To Read PLOT3D Data)

2.2 User Defined Readers

A user defined reader capability is included in EnSight which allows otherwise unsupported structured or unstructured data to be read. In other words, the user can create their own data readers. Each user defined reader utilizes a dynamic shared library produced by the user. Once produced, these readers show up in the list of data formats in the Data Reader Dialog just like an internal readers.

The readers are produced by creating the routines of an API. Two versions of the userd defined API are available starting with EnSight version 7.2. The 1.0 API (which has been available since EnSight version 6) was designed to be friendly to those producing it, but requires more manipulation internally by EnSight and accordingly requires more memory and processing time. The 2.0 API is considerably more efficient, and was designed with that in mind. It requires that all data be provided on a part basis, and as such lends itself closely to the EnSight Gold type format. A few of the advantages of the new 2.0 API are:

- Considerably more memory efficient
- Considerably faster
- Tensor variables are supported
- Complex variables are supported
- Geometry and variables can be provided on different time lines
- If boundary representation is available, provides for its use instead of having EnSight compute it.

The process for creating and using a user-defined reader is explained in detail in the README files on the installation CD or in your installation directory.

On the CD: /CDROM/ensight73/user_defined_src/readers

In installation
directory: $ENSIGHT7_HOME/user_defined_src/readers

Therein you will also find a detailed description of each routine in the API and the order in which the routines are called by EnSight. In the subdirectories at the same location as the README’s, you will find source code for a number of sample and working readers. These are often helpful examples when producing your own reader.

The actual working user defined readers included in the EnSight distribution may vary, but typically would include such formats as:

CFF	PXI	SCRYU
CFX4	FLOW-3D	SILO
Cobalt	LS-DYNA	STL
MSC/Dytran	NASTRAN	TECPLOT
EXODUS II	OP2	VECTIS

2.3 Other External Data Sources

External Translators

Translators supplied with the EnSight application enable you to use data files from many popular engineering packages. These translators are found in the translators directory on the EnSight distribution CD. A README file is supplied for each translator to help you understand the operation of each Particular translator. These translators are not supported by CEI, but are supplied at no-cost and as source files, where possible, to allow user modification and porting.

Exported from Analysis Codes

Several Analysis codes can export data in EnSight file formats. Examples of these include Fluent, STAR-CD, CFX and others.

2.4 Command Files

Command files contain EnSight command language as ASCII text that can be examined and even edited. They can be saved starting at any point and ending at any point during an EnSight session. They can be replayed at any point in an EnSight session. However, *some command sequences require a certain state to exist*, such as connection to the Server, the data read, or a Part created with a Particular Part number.

There are a multitude of applications for command files in EnSight. They include such things as being able to play back an entire EnSight session, easily returning to a standard orientation, connecting to a specific host, creating Particle traces, setting up a keyframe animation, etc. Anything that you will want to be able to repeatedly do is a candidate for a command file. Further, if it is a task that you frequently do, you can turn the command file into a macro (see To Use Macros below).

Documenting Bugs

Command files are one of the best ways of documenting any bugs found in the EnSight system. Hopefully that is a rare occasion, but if it occurs, a command file provided to CEI will greatly facilitate the correction of the bug.

Nested Command Files

Command files can be nested, which means that if you have a command file that does a specific operation, you can play that command file from any other command file, as long as any prerequisite requirements are completed. This is done by adding the command `play: <filename>` in the command file.

Default Command File

EnSight is always saving a command file referred to as the *default command file* (unless the you have turned off this feature with a Client command line option). This command file can be saved (and renamed) when exiting EnSight, as described later in this section. The default command file is primarily intended to be a crash recovery aid. If something unforeseen were to prematurely end your EnSight session, you can recover to the last successfully completed command by restarting EnSight and running the default command file. Saving the Default Command File for EnSight Session

Command dialog

Figure 2-15
Command dialog

You use the Command dialog to control the execution of EnSight command language. The

language can be entered by hand, or as is most often the case, played from a file. This dialog also controls the recording of command files as well as Macro path definition.
`Access: Main Menu > File > Command...`

Command History	Displays most recent command language executed (or recorded). Can click on an entry which will bring entry to the Command Entry field.
Command Entry	Command language entry. Enter command and press RETURN. During file playback, next command to be executed is shown here. Any command preceded by a # is a comment line.
Record	Select to start play file recording. Will be prompted for file name. Can simultaneously record and play files. When engaged, all actions in EnSight are recorded to the specified file.
Record Part Selection By	Select the method by which parts will be recorded in the command language - either by Number (default) or by Name.
Play	Select to start playing a command file. You must provide the command language file name. Command play continues as long as there are commands in file, mouse is not in Main View window, an interrupt: command has not been processed, or the Interrupt button has not been pressed.
Interrupt	Interrupt playback of the command file.
Step	Step though commands of play file. File playback must be stopped. Each click will execute next command shown in Command Entry field.
Skip	Skip over the playing command file's next command (shown in Command Entry box).
Continue	Continue playing interrupted command file.
Delay Between Commands	Set the delay between commands in seconds when playing a command file.
Delay Refresh	When enabled, will cause the EnSight graphics window to refresh only after the playfile processing has completed or has been interrupted by the user.
Reload Macros	Causes the Macro definitions to be reread from the site preferences directory and from the user's .ensight directory.

Troubleshooting Command Files

This section describes some common errors when running commands. If an error is encountered while playing back a command file you can possibly retype the command or continue without the command.

Problem	Probable Causes	Solutions
Error in command category	Incorrect spelling in the command category	Check and fix spelling
Command does not exist	Incorrect spelling in the command	Check and fix spelling
Error in parameter	Incorrect integer, float, range, or string value parameter	Fix spelling or enter a legal value
Commands do not seem to play	Mouse cursor in the graphics window	Move the mouse cursor out of the Main View window
	Command file was interrupted by an error or an interrupt command	Click continue in the Command dialog

(see How To Record and Play Command Files)

Saving the Default Command File for EnSight Session

EnSight is always saving a command file referred to as the *default command file* (unless the you have turned off this feature with a Client command line option). This default command file receives a default name starting with "ensigAAA" and is written to your /usr/tmp directory (unless you set your TMPDIR environment variable). This command file can be saved (and renamed) when exiting EnSight. If you do not save this temporary file in the manner explained below, it will be deleted automatically for you when you Quit EnSight.

Quit Confirmation dialog

Figure 2-16
Quit Confirmation dialog

You use the Quit Confirmation dialog to save either or both the default command file and an archive file before exiting the program.
`Access: Main Menu > File > Quit...`

Save Command Backup File To: Toggle-on to save the default command file. Can also specify a new name for the command file. (see Section 2.4, Command Files for more information on using command files.)

Save Full Backup Toggle-on and specify a name to create a Full Backup file.

Yes Click to save the indicated files and terminate the program.

(see How To Record and Play Command Files)

2.5 Archive Files

Saving and Restoring a Full backup

The current state of the EnSight Client and Server host systems may be saved to files. An EnSight session may then be restored to this saved state after restarting at a later time. A Full Backup consists of the following files. First, a small archive information file is created containing the location and name of the Client & Server files that will be described next. Second, a file is created on the Client host system containing the entire state of the Client. Third, a file is created on each Server containing the entire state of that Server. You have control over the name and location of the first file, but only the directories for the other files.

Restoring EnSight to a previously saved state will leave the system in exactly the state EnSight was in at the time of the backup. For a restore to be successful, it is important that EnSight be in a “clean” state. This means that no data can be read in before performing a restore. During a restore, any auto connections to the Server(s) will be made for you. If manual connections were originally used, you will need to once again make them during the restore. (If more than one case was present when the archive was saved, then connection to all the Servers is necessary).

An alternative to a Full Backup is to record a command file up to the state the user wishes to restore at a later date, and then simply replaying the command file. However, this requires execution of the entire command file to get to the restart point. A Full Backup returns you right to the restart point without having to recompute any previous actions.

A Full Backup restores very quickly. If you have very large datasets that take a significant time to read, consider reading them and then immediately writing a Full Backup file. Then, use the Full Backup file for subsequent session instead of reading the data.

Save Full Backup Archive dialog

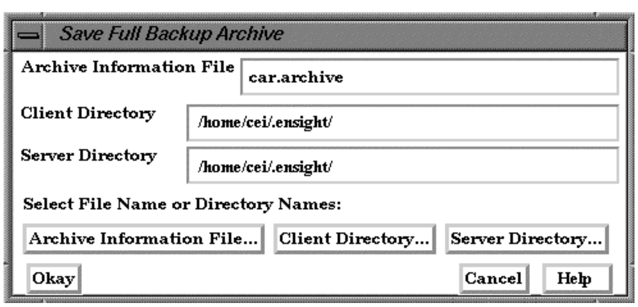


Figure 2-17
Save Full Backup Archive dialog

You use the Save Full Backup Archive dialog to control the files necessary to perform a full archive on EnSight.
`Access: Main Menu > File > Backup > Save Full Backup...`

Archive Information File Specifies name of Full Backup control file.

Client Directory Specifies the directory for the Client archive file.

Server Directory	Specifies the directory for the Server archive file.
Archive information File...	Click to display the file selection dialog for specifying the Archive Information File.
Client Directory...	Click to display the file selection dialog for specifying the Client Directory.
Server Directory...	Click to display the file selection dialog for specifying the Server Directory (for the selected case if there is more than one). Choose a common path if there is more than one.
Okay	Click to perform the full backup.

NOTE: This command is written to the command file, but is preceded with a # (the comment character). To make the archive command occur when you play the command file back, uncomment the #.

(see How To Save and Restore an Archive)

File Selection for Restarting from an Archive

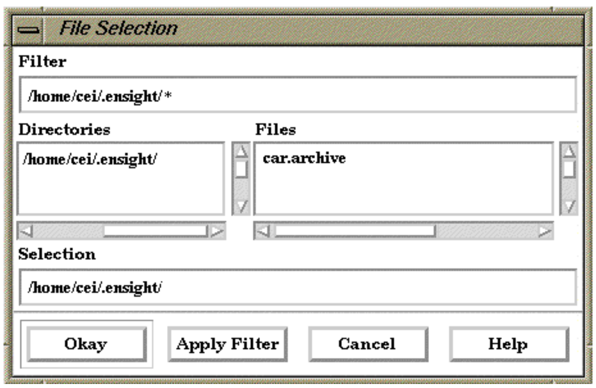


Figure 2-18
File Selection for Restarting from an Archive

You use the Restore Full Archive Backup dialog to read and restore a previously stored archive file.

`Access: Main Menu > File > Backup > Restore Full...`

Troubleshooting Full Backup

Problem	Probable Causes	Solutions
Error message indicating that all dialogs must be dismissed	When saving and restoring archives, all EnSight dialogs, except for the Client GUI, must be dismissed to free up any temporary tables that are in use. Temporary tables are not written to the archive files.	Dismiss all the Motif dialogs except the main Client GUI.
Backup fails for any reason	Ran out of disk space on the Client or Server host system	Check the file system you are writing to, on both the Server and the Client host systems, with the command “df” then remove any unnecessary files to free up disk space.
	Directory specified is not writeable	Change permissions of destination directory or specify alternate location.

2.6 Context Files

EnSight context files can be used to duplicate the current EnSight state with a different, but similar, dataset. The context file works best if the dataset it is being applied to contains the same variable names and parts, but can also be used when this is not the case.

Input and output of context files is described below as well as in How To Save or Restore a Context File and under Save and Restore of Section 6.1, File Menu Functions

Saving a Context File

To save the current context, simply entered the desired file name in the dialog under:

```
Access:  File > Save > Context...
```

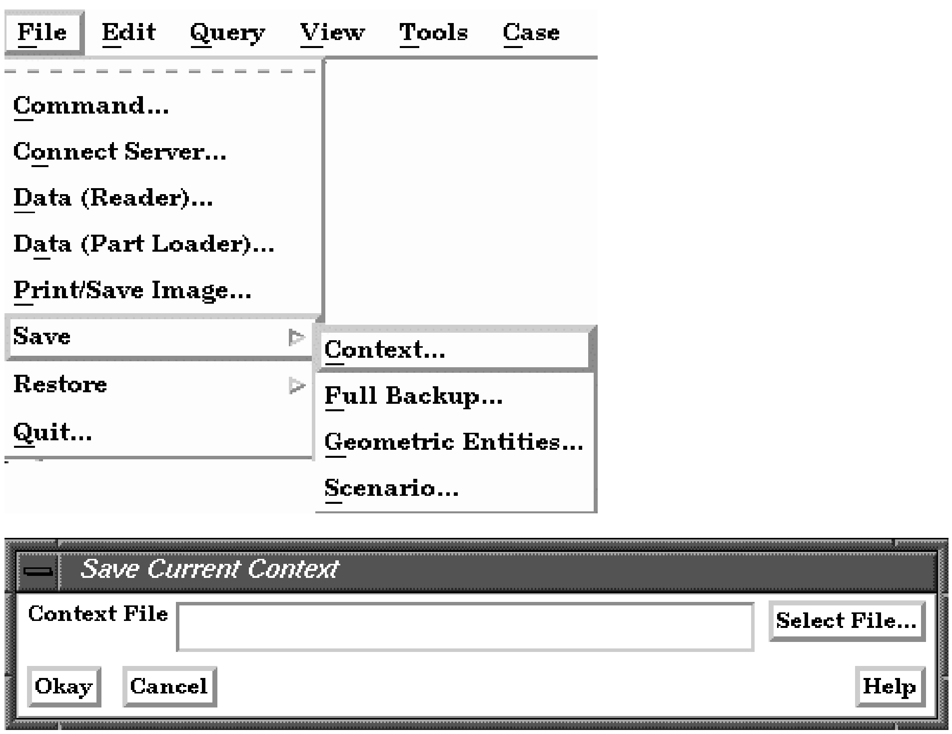
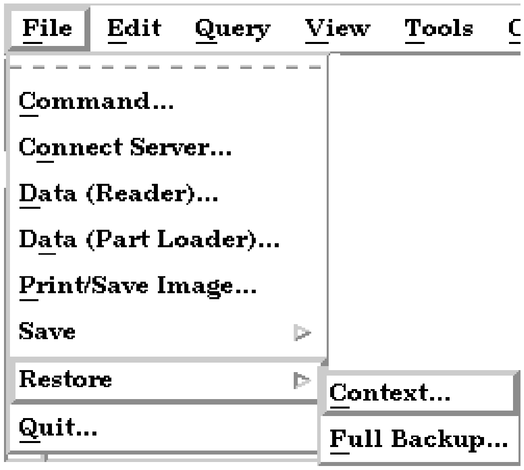


Figure 2-19
Saving a Context File

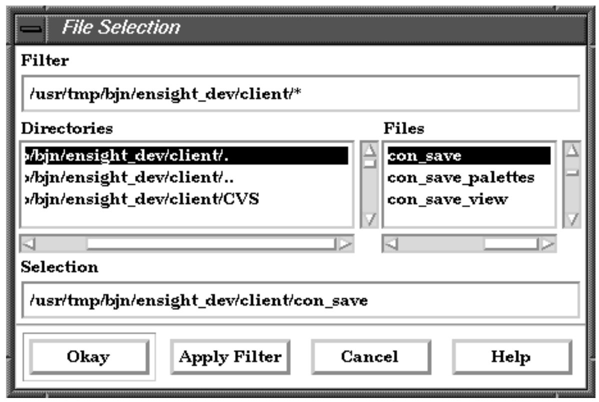
Restoring a Context

When restoring a context you can either read the new dataset and build the new parts and then restore the context file, or you can read the new dataset, close the part builder without building any parts and restore the context file (whereupon the context file will build the same parts as existed when it was saved). The way you decide to do this depends upon whether the same parts exist in the new dataset.

If the same parts do not exist, you would typically read the new dataset and build the desired parts in the normal way. Then:



select the context file saved in an earlier session and restore it. Either or both of the next dialogs may appear if they are needed to resolve part or variable name differences. As you can see, you can map these as needed.



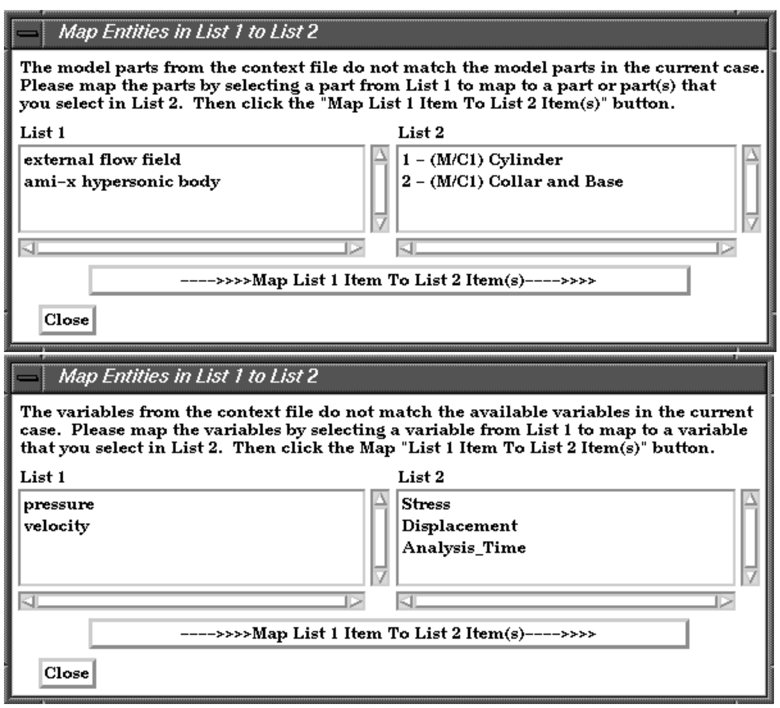


Figure 2-20
Restoring a Context

Flipbook animations are not restored using the context file because it is unknown at the time the context file is created what state existed when the flipbook was saved.

Context files use EnSight's command language and other state files (such as palette, view, and keyframe animation)

2.7 Scenario Files

Scenario files are used by CEI's EnLiten product which is capable of viewing all geometry (such as parts, annotation, plots, etc.) that EnSight can display, including flipbook, keyframe, and particle trace animations.

A "scenario" defines all visible entities you wish to view with EnLiten and includes any saved views and notes that you want to make available to the EnLiten user.

When you create a scenario, the following may be saved: (a) EnLiten file containing geometric display information, saved views, and attached nodes. (b) A palette file for each visible variable legend. (c) A JPEG image file (not used by EnLiten). (d) A scenario description file (not used by EnLiten). (e) A EnSight context file (not used by EnLiten).

When saving a scenario, either the scenario file itself can be saved, or the scenario project - which includes all of the files in the previous paragraph.

EnLiten is a geometry viewer only. As such it is not capable of creating or modifying any new/existing information such as variables or parts, or of changing timesteps.

Since EnLiten is only a geometry viewer, only keyframe transformation information is stored when saving a scenario file, i.e., no transient data keyframing is possible (consider loading a flipbook instead)

.

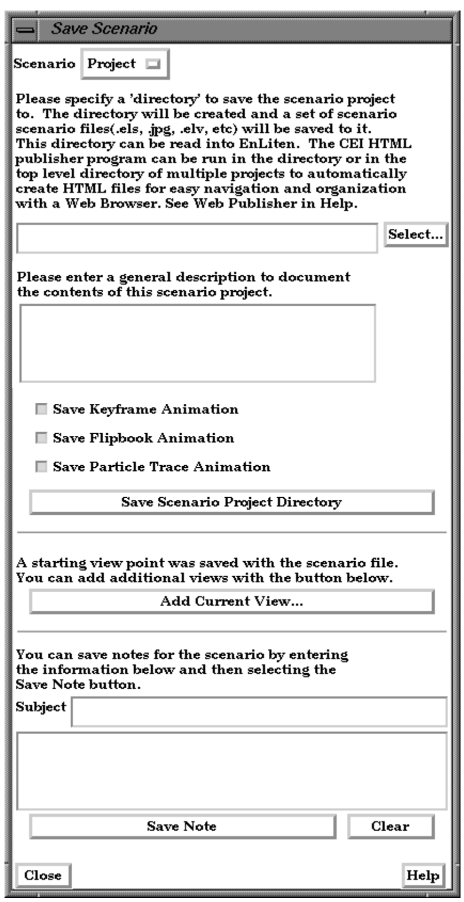


Figure 2-21
Save Scenario Dialog

You use the Save Scenario dialog to control the options of the scenario files to be saved in EnSight for display in EnLiten.
`Access: Main Menu > File > Save > Scenario...`

Scenario	*Project* - will save the scenario file plus files mentioned on the previous page. *File* - will save only the scenario file.
Scenario Directory/ File	Specifies the directory or file to which the scenario information will be written.
General Description	Specifies the general description which will be used when a html page is generated for the scenario.
Save Keyframe Animation Toggle	Select to have any currently defined keyframe animation sequence saved to the scenario.
Save Flipbook Animation Toggle	Select to have any currently defined flipbook animation saved to the scenario.
Save Particle Trace Animation Toggle	Select to have any currently defined particle trace animation saved to the scenario.
Save Scenario	Click to actually save the scenario.
Add Current View...	After the scenario has been saved you may save additional views by setting the desired view in EnSight, then selecting this button You will be asked to name the view in a resulting pop-up dialog.
Save Note	After the scenario has been saved you may write notes regarding the scenario by entering a Subject line and typing in the notes input area. When satisfied, select this button.

(see How To Save Scenario)

2.8 Saving Geometry and Results Within EnSight

Saving Geometric Entities

Sometimes you may wish to output geometric information from EnSight to be included in a different analysis code, or be part of a HTML based presentation.

EnSight allows you to save the geometric information in Case(EnSight6), VRML, or Case(EnSight Gold) (if you have a Gold license) formats. If you choose to save the geometric information in one of the EnSight Case formats, the files will be written on the Server in either ASCII or binary format. You may also choose to save multiple time steps. The Case file is also created. The geometry, as well as all of the active variables will be saved to files. This feature is limited to saving the following Part types: Model, 2D-Clips, Elevated Surfaces, Developed Surfaces, and Isosurfaces.

The other choice, which is to save the information in a VRML formatted file will allow you to save all of the visible Parts in their current visual state except for Parts which have limit fringes set to transparent. The VRML file will be saved on the Client.

Save Geometric Entities dialog

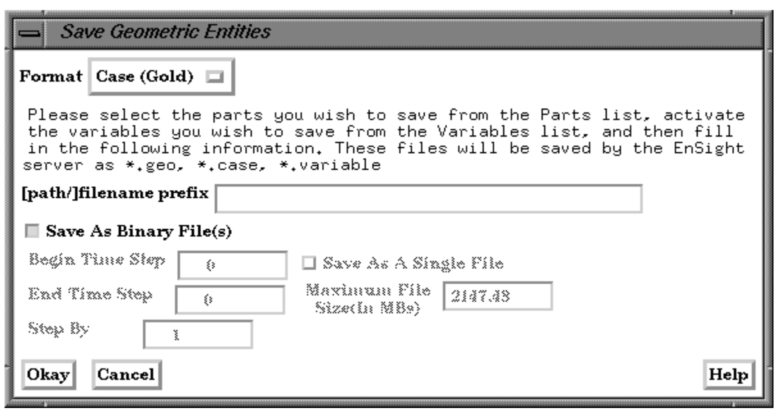


Figure 2-22
Save Geometric Entities dialog

The Save Geometric Entities dialog is used to save Selected Model, 2D-Clip, Isosurface, Elevated Surface, and Developed Surface Parts as EnSight6 files. Thus modified model Parts and certain classes of created Parts can become model Parts of a new dataset. All geometric and variable information is saved for all indicated time steps in either EnSight6 ASCII or binary format.
`Access: Main Menu > File > Save > Save Geometric Entities...`

Format — Specify the desired format: Case(EnSight6), Case(EnSight Gold) or VRML.

[path]/filename prefix — Specify path and filename prefix name for the saved files. The saved geometry file will be named filename.geo, the result file will be filename.res, and the active variables will be filename.variablename. The VRML file will be filename.wrl.

Save As Binary File(s) — Save as Binary File(s) specifies whether to save the data in EnSight6 ASCII (button toggled off - default) or binary (button toggled on) format.

Begin Time Step Begin Time Step field specifies the initial time step for which information will be saved for all selected Parts and activated variables.

End Time Step End Time Step field specifies the final time step for which information will be saved for all selected Parts and activated variables.

Step By Step By field specifies the time step increment for which information will be saved for all selected Parts and activated variables starting with Begin Time Step and finishing with End Time Step. The Step By value MUST be an integer.

Save as a Single File Toggle on to have a single file per variable - containing all values for all time steps for that variable. The default is to have a file per variable per time step.

Maximum file Size For Single File option, can specify the maximum file size. Continuation files are created if the file size would exceed this maximum.

Troubleshooting Saving Geometric Entities

Problem	Probable Causes	Solutions
A Part was not saved	User attempted to save an unsupported Part type.	Select only Model, Isosurface, 2D-Clip, and Elevated Surface Parts.
Variable(s) not saved	The variable was not activated or the variable was a constant.	Activate all scalar and vector variables you want saved.
Error saving	File prefix indicates a directory that is not writable or disk is out of space.	Re-specify a writable directory and valid prefix name. Remove unneeded files.

(see How To Save Geometric Entities)

2.9 Saving and Restoring View States

EnSight's viewports provide a great deal of flexibility in how objects are displayed in the Graphics Window. Given the complicated transformations that can be performed, it is imperative that users be able to save and restore accumulated viewport transforms.

View saving and restoring is accessed from the Transformations dialog.

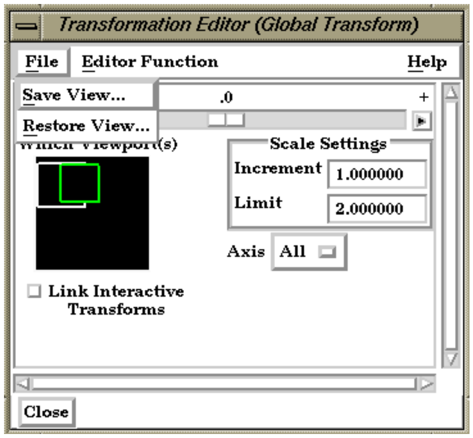


Figure 2-23
View Saving and Restoring in Transformation Dialog

```
Access: Desktop > Transformation Edit... > File
```

When either the Save View... or Restore View... selection is made, the user is presented with the typical File Selection dialog from which the save or restore can be accomplished.

(see also How To Save and Restore Viewing Parameters)

2.10 Saving and Printing Graphic Images

EnSight enables you to save an image of the Main View to a disk file or send it directly to a printer. The choice of save file formats depends on the implementation, but in all cases it is possible to obtain formats compatible with printers and plotters. Currently Apple PICT, PCL, PostScript, SGI RGB, JPEG, and TARGA formats are available.

EnSight also enables you to save images of an animation to disk files. These files can then be converted and printed or recorded to video equipment (see Section 7.15, Keyframe Animation).

Print/Save Image dialog

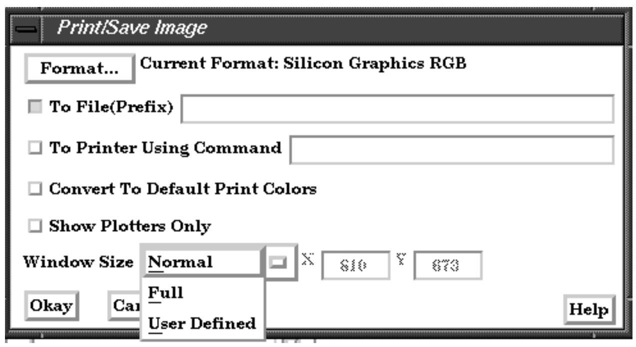


Figure 2-24
Print/Save Image dialog

You use the Print/Save Image dialog to specify the format and destination of an image to save. The destination can be a disk file or a printer. You also access the Image Format Options dialog for the various types from this dialog.
`Access: Main Menu > File > Print/Save Image...`

Format... — Click to select image format. (See next figure)

To File Toggle/Field — The image will be saved to this disk file name if toggle is on. This is a filename prefix. An appropriate suffix, according to the file format chosen, will be added.

To Printer Using Command Toggle/Field — The command to send a file to the printer if toggle is on

Convert to default print colors — Clicking this toggle on will convert all black to white and all white to black but will leave all other colors as they are.

Show Plotters Only — Clicking this toggle will cause the graphics window to only display plotters.

Window Size — Specifies the size of the Graphics Window and the resulting image size.

Normal — Creates a window which is the size of the current Graphics Window.

Full — Creates a window which is the size of the full screen.

User Defined — Creates a window which is specified in terms of its width and height in the X and Y fields.

Format... .

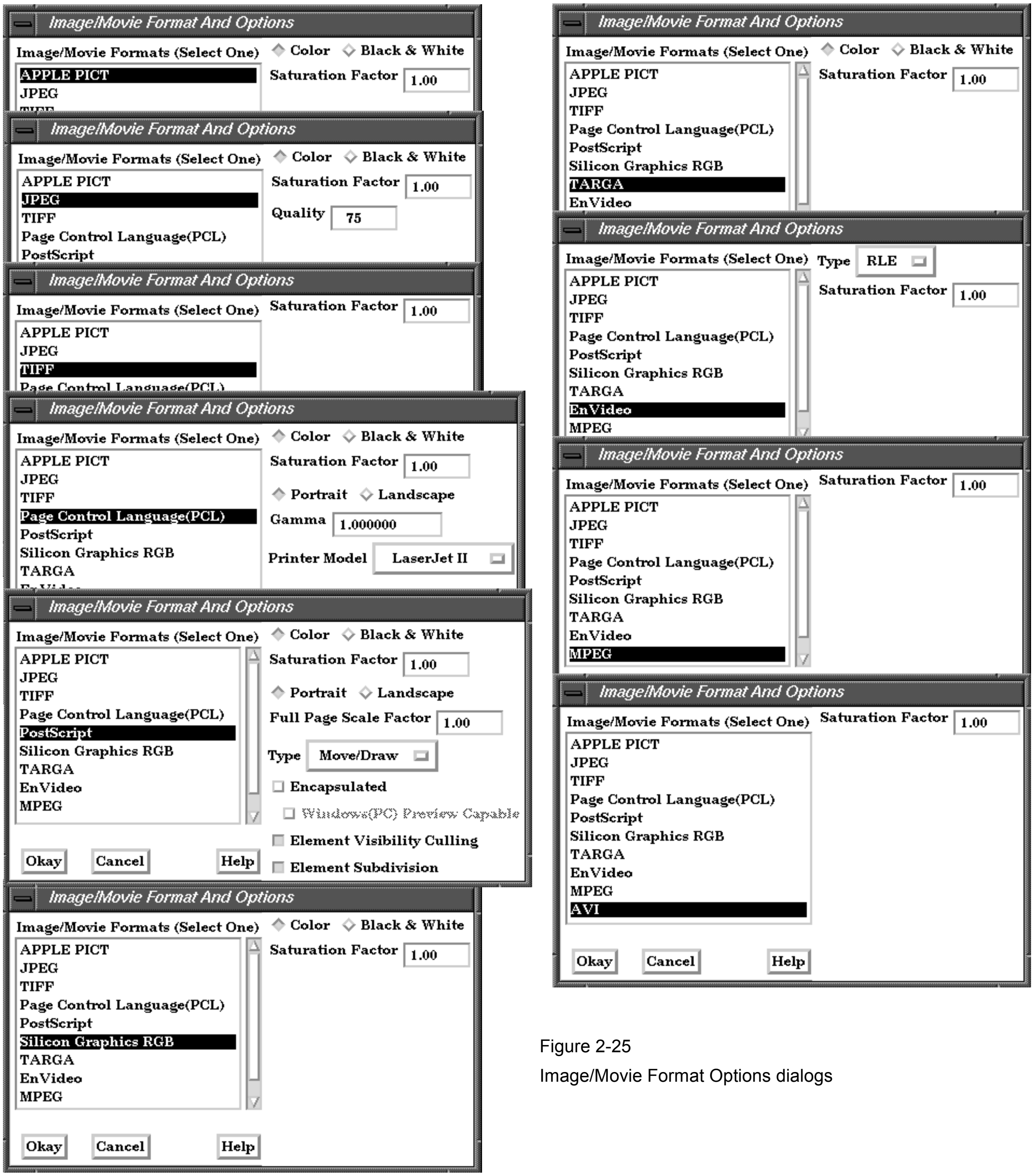


Figure 2-25
Image/Movie Format Options dialogs

Color/Black & White *(Several formats)*: Color versus Black and White toggle.

Saturation Factor *(all formats)*: At a value of 1.0, no change to the image. At lower values, a proportionate amount of white is added to each pixel. At a value of 0.0, the image would be all white.

Quality (JPEG)	Specifies trade-off between fidelity & compression. 100 max fidelity; 0 max compression.
Portrait/Landscape (PCL, Postscript)	Page Orientation for printing.
Gamma (PCL)	Gamma correction factor.
Full Page Scale Factor (Postscript)	The percentage of full page scaling to do. This is according to Orientation as well. Values are from 0.0 to 1.0.
Printer Model (PCL)	The destination PCL printer model.
Type (Postscript)	Type of Postscript output: Move/Draw (vector) or Image Pixels. If type is Image Pixels, shaded 3D objects will be output as pixels while overlay graphics (annotation text, plots, color legends) will be output Move/Draw for higher print quality.
Type (EnVideo)	Type of EnVideo output: Run Length Encoded or Jpeg.
Encapsulated Toggle (Postscript)	Generate Encapsulated PostScript (EPS) for importing into other applications. (The graphic typically will appear as a gray box in the importing application on all systems unless the Windows(PC) Preview Capable toggle is also On).
Windows(PC) Preview Capable Toggle	Create an Encapsulated PostScript (EPS) file which also has a preview image for use in Windows® applications. (The graphic will still appear as a gray box in the importing application on Macintosh systems).
Element Visibility Culling Toggle (Postscript)	Hidden geometry will be removed from the output stream if toggle is on. Valid for Move/Draw output only. On by default.
Element Subdivision (Postscript)	Subdivide output primitives (lines and polygons) if toggle is on. Although the output file will be larger, the color distribution will be far superior.Valid for Move/Draw output only. On by default.

Troubleshooting Saving an Image

Problem	Probable Causes	Solutions
Image has blotches or ghosts of other windows in it	A viewport or menu was popped in front of the Main Graphics Window as the image was being saved.	Do not perform any window manager functions until image is finished recording to disk file.
Error while saving image file	Directory or file specified is not writable	Rename the file or change the permissions.
	Ran out of disk space	Check the file system you are writing to with the "df" command then remove any unnecessary files to free up disk space.
	Image format not selected	Select an image format before saving.
Image looks bad when printed	Original on-screen image has low resolution	Make the graphics window as large as possible before saving the image to increase the number of RGB pixels used on the display.
	Image has been dithered during processing	Do not enlarge or reduce the image until it is in your word processor.
	Non-integral ratio of printer resolution to image resolution at final size	The image is a pixel-map image. For best results, the number of printer-dots per image-dot should be an integer. For example, if the original image resolution is 72 dpi, reduced to 48% the final-size resolution is 72/.48 = 150 dpi. On a 600 dpi printer, each image pixel is exactly 4 printer-dots on a side.
Move/Draw PostScript output doesn't look correct.	Primitives in Move/Draw PostScript output sometimes suffer from sorting problems. (This will be fixed in a subsequent release.)	Use Image Pixel type instead of Move/Draw.

(see How To Print/Save an Image)

2.11 Saving and Loading XY Plot Data

The xy data used for curves in EnSight's plotter can be saved to a file for future re-loading into EnSight or for use in other plotting packages.

The process is described below as well as in Section 7.11, Query/Plot

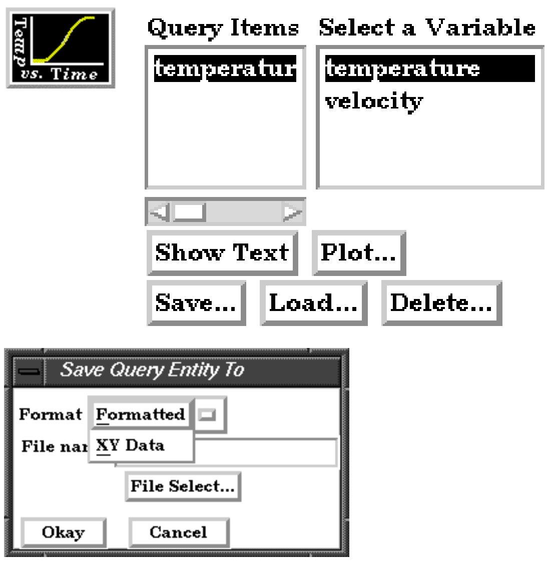


Figure 2-26
Saving or Loading XY Plot Data

`Access: Desktop > Query/Plot Feature`

Once the desired query item (curve) is selected in the list, the user can perform a Save operation by:

Save... Click this button in the Quick Interaction area of the Query/Plot feature to save the plotter curve data.

Format Select the Format of the data to save.
Formatted is a table suitable for printing. (see Section 2.13, Saving Query Text Information)
XY Data is the xy file format described in Section 11.10, XY Plot Data Format, which is suitable for re-loading into EnSight.

File Name Enter the desired filename for the xy data file, or click *File Select...* to be presented with the typical File Section dialog from which to perform the operation.

Load... Click this button in the Quick Interaction area of the Query/Plot feature to load a previously saved xy data file (see Section 11.10, XY Plot Data Format) into EnSight. You will then be presented with the typical File Selection dialog from which to select the file.

2.12 Saving and Restoring Animation Frames

Both Flipbook and Keyframe Animation processes have save and restore capability. These are best described in the chapters devoted specifically to these features.

For Flipbook Animations, see Section 7.14, Flipbook Animation and How To Create a Flipbook Animation.

For Keyrame Animations, see Section 7.15, Keyframe Animation and How To Create a Keyframe Animation.

2.13 Saving Query Text Information

The data used for curves in EnSight's plotter and any other information from a query or otherwise which is presented in the EnSight Message Window can be saved to a file suitable for printing.

From Query/Plot Save... Formatted

One place this can occur is in the Query/Plot Quick Interaction area as described below as well as in Section 7.11, Query/Plot

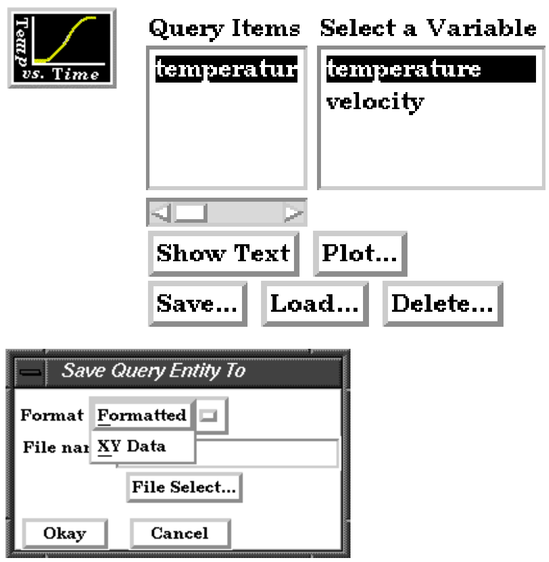


Figure 2-27
Saving or Loading XY Plot Data

`Access: Desktop > Query/Plot Feature`

Once the desired query item (curve) is selected in the list, the user can perform a Save operation by:

Save... — Click this button in the Quick Interaction area of the Query/Plot feature to save the plotter curve data.

Format — Select the Format of the data to save.
Formatted is a table suitable for printing.
XY Data is the xy file format described in Section 11.10, XY Plot Data Format, which is suitable for re-loading into EnSight.

File Name — Enter the desired filename for the xy data file, or click *File Select...* to be presented with the typical File Section dialog from which to perform the operation.

From Query/Plot Show Text

Show Text... — Click this button to see the plotter curve information presented in the EnSight Message Window.

From EnSight Message Window

A file suitable for printing can be saved from any operation which places its information into the EnSight Message Window, such as Show Information queries and the Query/Plot Show Text... button described previously.

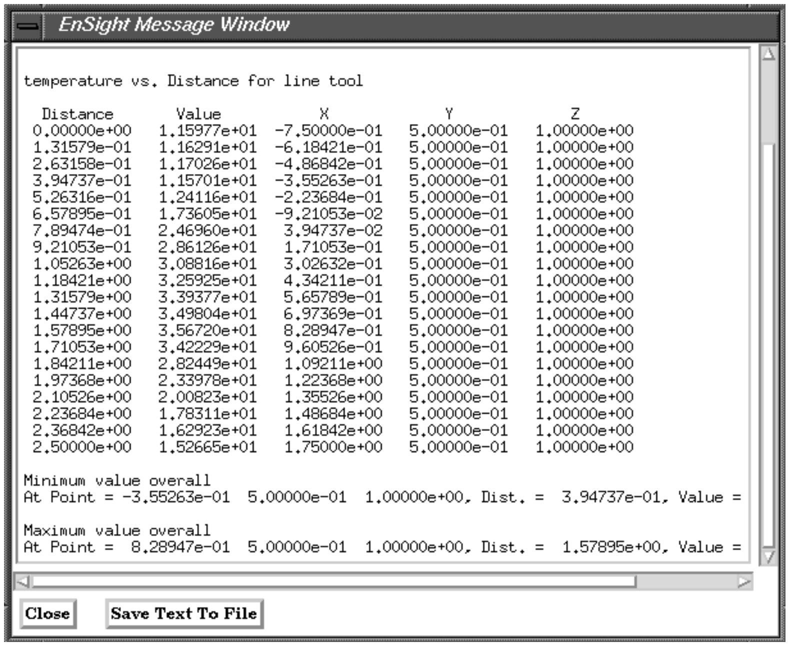


Figure 2-28
EnSight Message Window with Save Text To File Button

Save Text To File Brings up the typical File Selection dialog from which the information can be saved in the file of your choice.

2.14 Saving Your EnSight Environment

Every user has different postprocessing needs and personal preferences for how the EnSight windows should be positioned and sized. EnSight allows you to save dialog expandable section settings, and dialog size and position information to a file called “ensight7.winpos.default”. EnSight looks for this file at start up (in the current Client directory and if not there in the .ensight7 directory of the user’s home directory) and will bring the user interface dialogs up according to your saved settings (if the file is found).

Almost all major dialog windows are saved in the:

ensight7.winpos.default_XRESxYRES

file (where XRES and YRES are the resolution of the monitor when the preferences were saved). The only exception are minor prompt dialogs. There are also some dialogs for which you cannot save the size (such as the Tool Positions dialog).

The ensight7.winpos.default file also contains the size and location for all of the windows containing graphics.

A number of other settings, such as mouse and keyboard buttons and Icon Bar settings can also be saved to a user preferences file.

(see Preferences... in Section 6.2, Edit Menu Functions and How to Save GUI Settings)

2.15 Parallel Rendering Setup

EnSight Gold now supports general parallel rendering for increased performance and display resolution. This section describes the default behavior of EnSight as well as the command-line parameters necessary to customize the parallel rendering capabilities. With hardware rendering these features are only supported on SGI hardware at this time. Using software rendering (ensight7 -X) these features are supported on all platforms for which CEI support pthreads.

Configuration

Main window

When run on a multi-pipe X server (monster pipe), EnSight will auto-configure to use all available pipes to accelerate rendering in the main EnSight GUI window. There is a command-line option (-prsw <config>) to specify an alternate parallel configuration. If you are on a multi-pipe server and would like to run with only one pipe, "-prsw none" will turn off parallel rendering for the main window. It is also possible to run EnSight on multiple graphics pipes which run under separate X servers. In this case it will be necessary to create a configuration file with the following format:

```
PRSw 1.0
<n> <p0> <p1> ... <p(n-1)>
```

where:
<n> = number of worker pipes (excluding main EnSight display)
<pi> = an X display (i.e. b21:0.2)

Example:

```
PRSw 1.0
7 :0.1 :0.2 :0.3 :4.0 :4.1 :4.2 :4.3
```

In the example above, there are two X servers (:0 and :4) which each manage four graphics pipes. Note that the configuration file should not include the pipe on which you are running. The configuration file specifies ADDITIONAL pipes that you would like to use. Also note that EnSight does not take care of resource allocation. You must have display access to any pipe that you hope to use for the parallel rendering (usually means logging in at a console).

For parallel rendering in batch, the configuration file has the same format. In this case the named displays are not really opened; only the number of pipes matters.

Parallel software rendering is available on some platforms when EnSight is run with the "-X" option. The same configuration file format may be used in this case, although the displays themselves are not actually opened. For convenience, if the configuration file is not found and "<config>" is a number, this number will be interpreted as the number of parallel rendering workers. For example:

```
ensight7 -X -batch -prsw 3 -p <cmdfile>
```

will run a batch session with 4 worker threads performing parallel rendering.

Detached windows

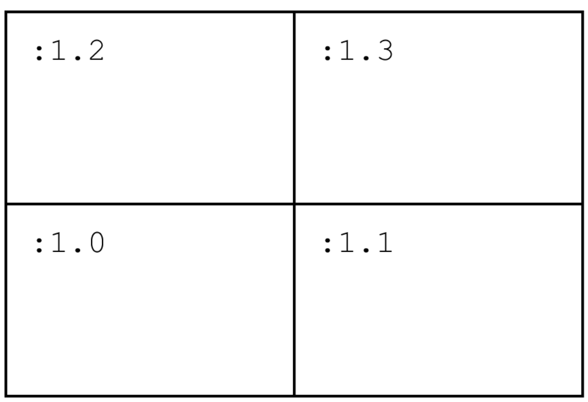
The parallel renderer also supports rendering to detached displays (external to the EnSight GUI). Use the option “-prsd2 <config>” to specify the layout of the display. The display config file format is:

```
PRSd 1.0
<w> <h>                 : width/height of the complete display
<numpipes>              : number of logical displays
<xdisplay> <w> <h> <xo> <yo> <lxo> <lyo> [eye]
                        : parameters for each pipe. The xdisplay
                        : is of the format :2.0, etc. Width &
                        : height describe the subset of the total
                        : display rendered by this pipe. The x
                        : and y origin give the offset of this
                        : display in the global display. The
                        : "local" x and y origin give the offset
                        : of this window on the given display.
                        : This is often needed for passive stereo.
                        : [eye] is an optional parameter (L or R)
                        : to specify an eye for passive stereo
```

(repeat above line for numpipes)

Example 1

In this example there is one Xserver with four screens. For best operation the GUI should be displayed on a separate pipe.

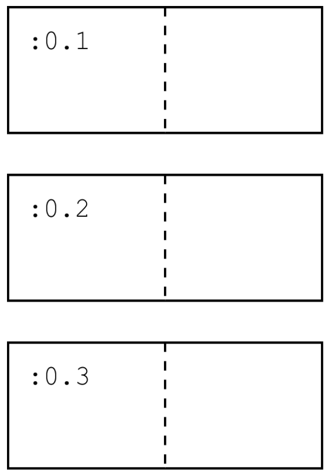



```
PRSd 1.0
2560 2048
4
:1.0 1280 1024    0    0    0    0
:1.1 1280 1024 1280    0    0    0
:1.2 1280 1024    0 1024    0    0
:1.3 1280 1024 1280 1024    0    0
```

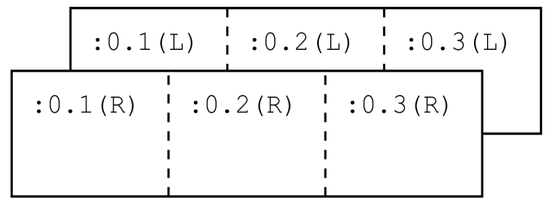
Example 2

In this example there is a single X server managing three pipes. Each pipe has two output channels which are sent to overlapping projectors with polarized filters for passive stereo.

Pipes:



Display:




```
PRSd 1.0
3024 1008
6
:0.1 1008 1008    0    0    0    0 L
:0.1 1008 1008    0    0 1008    0 R
:0.2 1008 1008 1008    0    0    0 L
:0.2 1008 1008 1008    0 1008    0 R
:0.3 1008 1008 2016    0    0    0 L
:0.3 1008 1008 2016    0 1008    0 R
```

Note that the ‘L/R’ parameters are NOT necessary when using traditional quad-buffered stereo to drive the polarized projectors. In this case a simple mono configuration file is sufficient, and the “test: prsstereo2” command (see below), or use of the F12 key, will toggle between mono and stereo display.

Example 3

Note that it is fairly easy to test large displays on smaller systems. The passive stereo display might be tested with:

```
PRSd 1.0
768 256
6
:0.0 256 256   0   0   0   0 L
:0.0 256 256   0   0   0 256 R
:0.0 256 256 256   0 256   0 L
:0.0 256 256 256   0 256 256 R
:0.0 256 256 512   0 512   0 L
:0.0 256 256 512   0 512 256 R
```

The above configuration file simulates the six-pipe passive stereo example on a single-pipe machine, with each display represented by a 256x256 window.

Example 4

It is possible to combine the monster and powerwall rendering capabilities if you have enough pipes. The way to do this is to generate a PRSw file (as in the above section) with one line per display. For example, to use 8 pipes for the 4-panel powerwall configuration of Example 1, you might have a worker file such as:

:1.2 :2.2	:1.3 :2.3
:1.0 :2.0	:1.1 :2.1

```
PRSw 1.0
1 :2.0
1 :2.1
1 :2.2
1 :2.3
```

The lines of this file correspond one-to-one to the lines in the display file. The name of the detached display worker file is specified with the "-prsw2" command-line parameter.

Notes

1. Currently auto-configuration of monster mode occurs for all displays accessed by the parallel renderer. This may cause problems when you do not specify a worker file and your powerwall pipes are all managed by one X server. You need to use "-prsw2 none" in order to specify that no workers should be created for the powerwall.

2. Stereo mode and full-screen mode work as usual in the main GUI window. In stereo mode the pipes get split into left-eye/right-eye groups (only in the case of single-pipe mode does one pipe render both eyes). When configured to use a detached display, the main GUI window will always be monoscopic. Pressing the F12 key for stereo will only affect the detached display.

3. Annotation and plot mode work as usual for monster-mode. Detached displays are only updated when in part mode. The effects of plot mode and annotation mode are not visible until part mode is selected.

Options

Several parallel rendering options can be set either through the command dialog or through command-line options to the ensight7 or ensight7.client commands.

test: prssort [first|last] — Select a sorting method. Currently both sort-first and sort-last are supported. Sort-first tiles the screen into rectangular regions, one for each pipe. Sort-last partitions the geometry to the multiple pipes, and composites the result. The command line arguments, `-sort_first` or `-sort_last` can also be used to invoke the desired sorting method.

test: prstile — Toggle the display of tiles (if using sort-first). This is useful to monitor the load-balancing between the pipes.

test: prsbalance — Toggle load balancing for sort-first. Without load-balancing performance may vary greatly depending on the viewing parameters.

test: prsbbox — When using the detached displays it may be desirable to render only boxes in the main window. This command will toggle the feature. The command-line option "-bbox" will turn this feature on initially.

test: prsstereo2 — Toggle stereo on the detached display (when started with -prsd2). Note that this is only necessary for quad-buffered stereo. If you are using a passive stereo config file the display is always in stereo. Note: the command-line option "-prsd2stereo" will turn this feature on initially, or pressing the F12 key (while the mouse is in the main graphics window) will turn on stereo for the detached display.

3 Parts

The *Part* is the fundamental visualization entity in EnSight. Virtually every postprocessing task you perform will involve a Part, thus it is vital to understand how Parts work.

A Part is a collection of nodes and elements that are grouped together and share the same attributes. When you start EnSight, you either read directly or interactively extract Parts from the data files. Parts which come from the original dataset are referred to as model Parts. Other Parts created within EnSight, are referred to as created (or dependent) Parts.

In this chapter you will learn how to create derived Parts and how to modify the attributes of all Part types.

Section 3.1, Part Overview is ***extremely important***. It defines how Parts work together to form other Parts and explains the dependencies which may exist between model Parts and created Parts. Failure to understand the concept of Parts as explained in this section will limit your ability to use EnSight. Please study this section carefully.

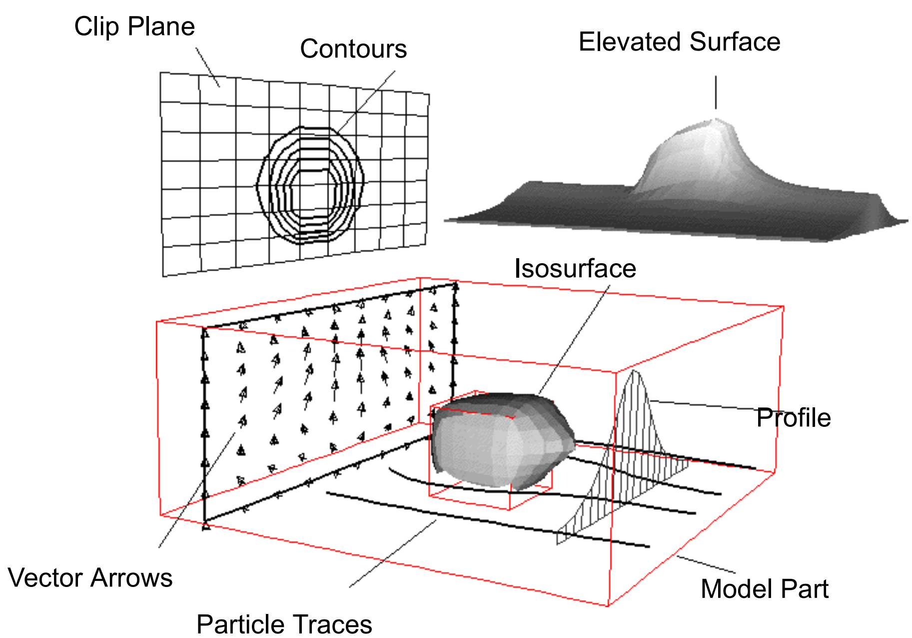


Figure 3-1
Various EnSight Part Types

Included in this Chapter are:

3.1 Part Overview

In EnSight, a Part is simply a collection of nodes and elements which are grouped together, will be manipulated together, and which share the same attributes. This section defines Parts and how they are related. It gives you an overview of the Part types and Part attributes that are available within EnSight.

Parts that are defined or extracted from your dataset are referred to as *model* Parts. Parts that are created within EnSight are referred to as *created* (or *dependent)* Parts. The types of Parts that you create depends on what features within EnSight you choose to utilize. Any created Part is derived from Parts that already exist, which is why the created Parts are sometimes called dependent Parts—they depend on the Parts from which they were created. The Parts that are used to create a dependent Part are referred to as *parent* Parts. Any time that a parent Part changes, its dependent Parts must also change. A parent Part will change when you change its attributes, or modify the current time in the case of transient data.

The Main Parts List contains all Parts that have been read in from your results data or created within EnSight. Displayed are a Part ID Number, a Part symbol, a case number, and a Part description. Table 3-1 lists all of the different types of Parts and their associated symbols. The figure below of the Parts List shows a number of different Part types.

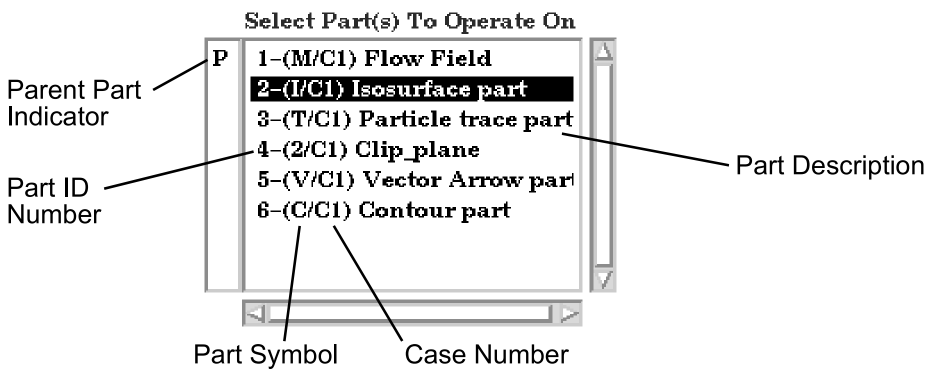


Figure 3-2
Main Parts List

Note that in the illustration above the Isosurface Part is selected and that there is a “P” in the left column next to the Computational mesh (model) Part. This indicates that the Computational mesh Part is the parent Part of the isosurface Part. All parent Parts of a created Part will be so noted if that individual created Part is highlighted in the Main Parts List.

Reassign Parent

Parent Parts of any created Part can be changed by first selecting the created Part in the Feature Detail Editor, then selecting a new parent Part in the Main Parts List, and finally by clicking the Update Parent button in the Feature Detail Editor.

Table 3–1 Part Types, Symbols, and Descriptions

Part Type	Symbol	Description
Clip	(2)	A surface or line resulting from a clip of other Parts using the line, plane, or quadric tools
Contour	(C)	Lines of constant value on 2D elements
Developed Surface	(D)	A planar surface derived by unrolling a surface of revolution (i.e., the unrolling of a cylinder clip Part produced by the cylinder quadric tool)
Elevated Surface	(E)	Surface created by elevating elements by a variable
Isosurface	(I)	Surface of constant value through 3D elements of other Parts
Model Part	(M)	A Part that originated from the dataset
Particle Trace	(T)	Path of a massless Particle through a vector field
Profile	(P)	Plot of a variable along a line (Similar to a 2D elevated surface)
Separation/ Attachment Line	(L)	Line where flow separation or attachment is occurring
Shock Surface/ Region	(K)	Surface or region where shock is occurring
Subset	(S)	Valid node and/or element label range(s) from model Part(s)
Tensor Glyph	(G)	Glyph showing direction of first, second, and third eigenvectors of a tensor field.
Vector Arrow	(V)	Arrows showing direction and magnitude of vector field
Vortex Core	(X)	Line representing center of a flow vortex

Part Creation

Part creation occurs on either the server or the client. Since the data that is available on the client and server are different, it is useful to understand where Parts are created and where the data structures are stored. By understanding this, you will understand why some Parts can be created with certain parent Parts and others cannot. This information can be gained by examining the following table.

Table 3–2 Part Creation and Data Location

Part Type	Where Created	Data on Server	Data on Client
Clip	Server	Yes	Depending on Part attributes
Contour	Client	No	Yes
Developed Surface	Server	Yes	Depending on Part Attributes
Discrete Particle	Not Applicable	Yes	Depending on Part attributes
Elevated Surface	Server	Yes	Depending on Part attributes
Isosurface	Server	Yes	Depending on Part attributes
Model	Not Applicable	Yes	Depending on Part attributes
Particle Trace	Server	No	Yes
Profile	Client	No	Yes

Part Type	Where Created	Data on Server	Data on Client
Separation/ Attachment Line	Server	Yes	Depending on Part attributes
Shock Surface/ Region	Server	Yes	Depending on Part attributes
Subset	Server	Yes	Depending on Part attributes
Tensor Glyph	Client	No	Yes
Vector Arrow	Client. Server if necessary.	Maybe	Yes
Vortex Core	Server	Yes	Depending on Part attributes

(see Introduction to Part Creation)

Part Attributes

Each type of created Part has a unique set of attributes that are used to accomplish its creation, the *Creation Attributes*. Model Parts (symbol: M) and discrete Particle Parts (symbol: D) typically do not have creation attributes because they are not created—they are read or extracted from the dataset. The one exception to this is model parts originating from block structured datasets. These parts contain the I,J,K and step attributes used to create the part.

All Parts have a set of *Display Attributes* that are used in visualizing the Part in the Graphics Window. These can be modified using the Feature Detail Editor or by utilizing the Part Mode Icons (See Section 8.4). The Feature Detail Editor for each Part type will show you attributes grouped together under turndown sections. They deal with such things as color, line width, symmetry operations, etc. Display attributes do not control how the Part is created, only how it appears or how it behaves in the Graphics Window.

Table 3–3 Display Attribute Sections

Section:	Includes controls for...
General Attributes (see Section 3.3 Part Editing)	Visibility in Graphics Window and individual Viewports
	Symmetry options
	Susceptibility to Auxiliary Clipping
	Reference frame
	Response to changes in time (frozen or active)
	Coloration (constant or by a palette associated with a variable)
	Shaded Surface and Hidden Line display
	Surface shading (flat, Gouraud, smooth)
	Opaqueness and Fill density
	Lighting (diffuse, shininess, and highlight intensity)

Section:	Includes controls for...
Node, Element, and Line Attributes (see Section 3.3, Part Editing)	General Visibility: Node, Line, and Element
	Label Visibility: Node and Element
	Node Representation: Node type (dot, cross, or sphere), Node Scale, Node Detail (for spheres), and Node size (constant or variable)
	Line Representation: Line Width and Line style (solid, dotted, or dot-dash)
	Element representation on client (full, border, 3D border/2D full, feature angle, or non visual), Element-size, Shrink-Factor, and Element Angle
Displacement Attributes	Displacement variable
(see Section 3.3, Part Editing)	Displacement scaling factor

3.2 Part Selection and Identification

In the process of creating a Part you will need to be able to select the parent Part(s) from the Main Parts List. You will also find that it is possible to either read or create so many Parts within EnSight that you become confused as to the identity of each Part. This section describes Part selection and identification

Selecting Parts

Items in all Parts Lists are selected using standard Motif/Win32 methods:

To:	Do This:	Details
Select an item	Select (or single-click)	Place the mouse pointer over the item and click the left mouse button. The item is highlighted to reflect the "selected" state.
Extend a contiguous selection	Select-drag	Place the mouse pointer over the first item. Click and hold the left mouse button as you drag over the remaining items to be selected. Only contiguous items may be selected in this fashion.
Extend a (possibly long) contiguous selection	Shift-click	Select the first item. Place the mouse pointer over the last item in the list to be selected. Press the shift key and click the left mouse button. This action will extend a selection to include all those items sequentially listed between the first selection and this one.
Extend a non-contiguous selection	Control-click	Place the mouse pointer over the item. Press the control key and click the left mouse button. This action will extend a selection by adding the new item, but not those in-between any previously selected items.
De-select an item	Control-click	Place the mouse pointer over the selected item. Press the control key and click the left mouse button. This action will de-select the item.
Open the Quick Interaction Area for a Part	Double-click	Place the mouse pointer over the item and click the left mouse button twice in rapid succession.

(see How To Select Parts)

Identifying Parts

There are two quick ways to identify one or more Parts that have been selected in the Main Parts List. You can identify them in the Graphics Window by toggling visibility on/off while in Part Mode or you can select View > Show Selected Parts... from the Main Menu to show only the selected Part(s) in the pop-up Selected Part(s) Window.

3.3 Part Editing

In EnSight, new Parts can be created and edited in the Quick Interaction Area Editor or in the Feature Detail Editor specific to each type of Part. This process is described in Sections 7.2 to 7.9. For editing, the Quick Interaction Area provides access to the most common attributes; the Feature Detail Editor allow modification of all attributes.

Whereas each individual change made in the Quick interaction Area Editor is applied to the Part immediately, the Feature Detail Editor allows you to make a number of changes to various attributes and then apply them all at one time. This is done by toggling off View > Immediate Modification in the Feature Detail Editor. The default behavior is to immediately apply a change when you press Return.

The Feature Detail Editor for Parts is opened from the Main Menu (or by double clicking on a Part creation Icon in the Main GUI Feature Icon Bar).

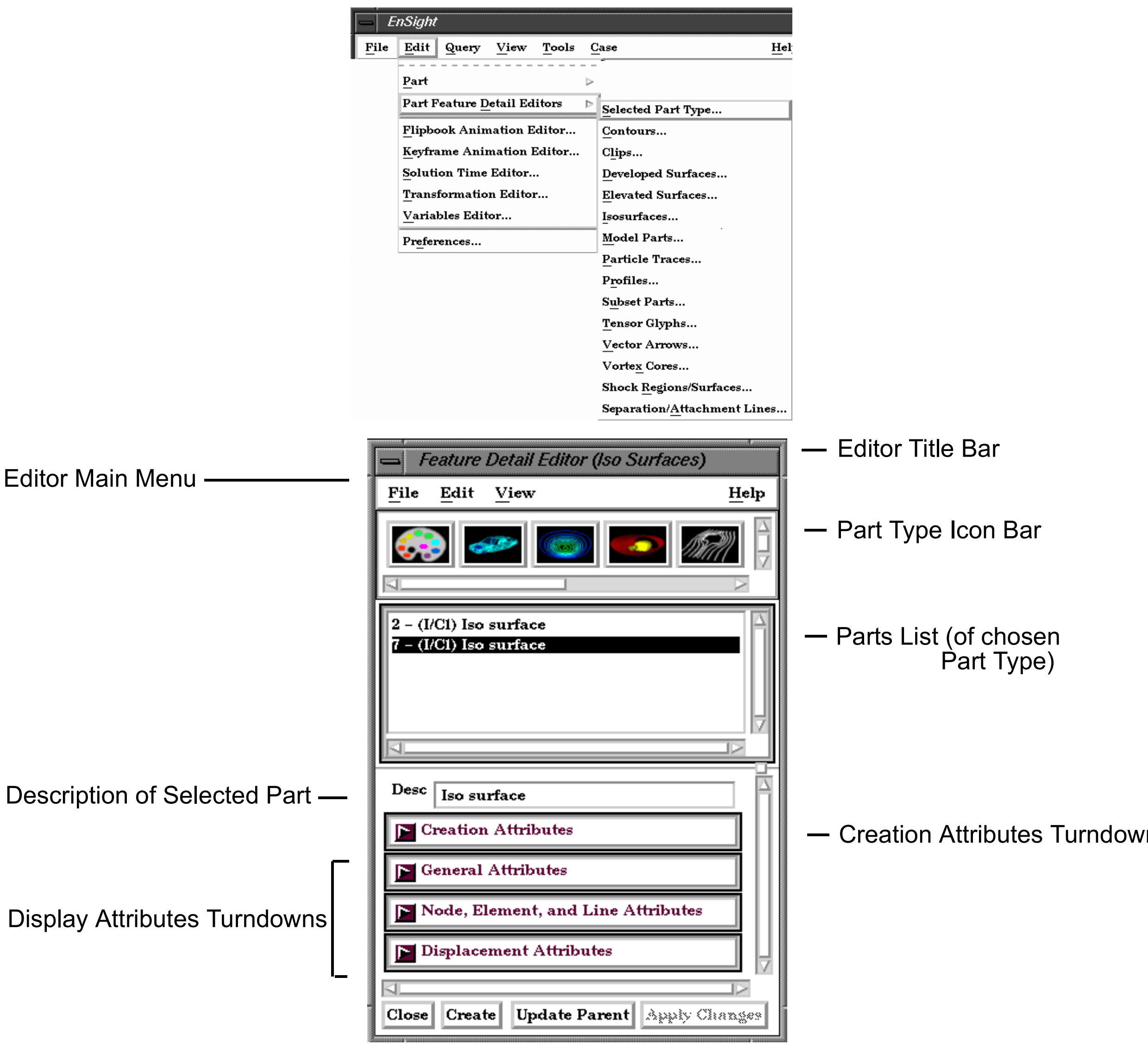


Figure 3-3
Feature Detail Editor (Isosurfaces)

Feature Detail Editor Main Menu

File — Not applicable when Feature Detail Editor is used for Parts - only applicable for Variables.

Edit — Opens a pull down menu.

Figure 3-4
Feature Detail Editor Edit pull-down menu

Select All — Selects all Parts in Feature Detail Editor Parts List. (see Section 3.4, Part Operations)

Copy — Makes a copy of all selected Parts. (see Section 3.4, Part Operations), also (see How To Copy a Part)

Delete — Deletes selected Parts. (see Section 3.4, Part Operations), also (see How To Delete a Part)

Group... — Groups the selected parts into a new part and removes the original parts from the list.

Ungroup — Extracts the original parts out of a group and removes the group part.

Immediate Modification Toggle — Toggles on/off the immediate modification of Parts when individual changes are made to Attributes within the Feature Detail Editor. Default is on. By toggling off, you can make several changes within the Feature Detail Editor and then apply them all at one time by clicking the Apply Changes button.

View — Opens a pull-down menu.

Figure 3-5
Feature Detail Editor View pull-down menu

Show Selected Part(s) Toggle — Opens the Selected Part(s) Window in which only Parts selected in the Feature Detail Editor's Parts List are visible.

Part Type Icon Bar

The Feature Detail Editor is initially opened from EnSight's Main Menu (or by double clicking a Part creation icon in the Feature Icon Bar) and the Feature Detail Editor's Parts List contains all Parts of the type named in the Editor's Title Bar. The type of Parts in the Feature Detail Editor's Parts List may be changed by clicking on the appropriate icon in the Feature Detail Editor's Part Type Icon Bar. The figure below shows the choices available.

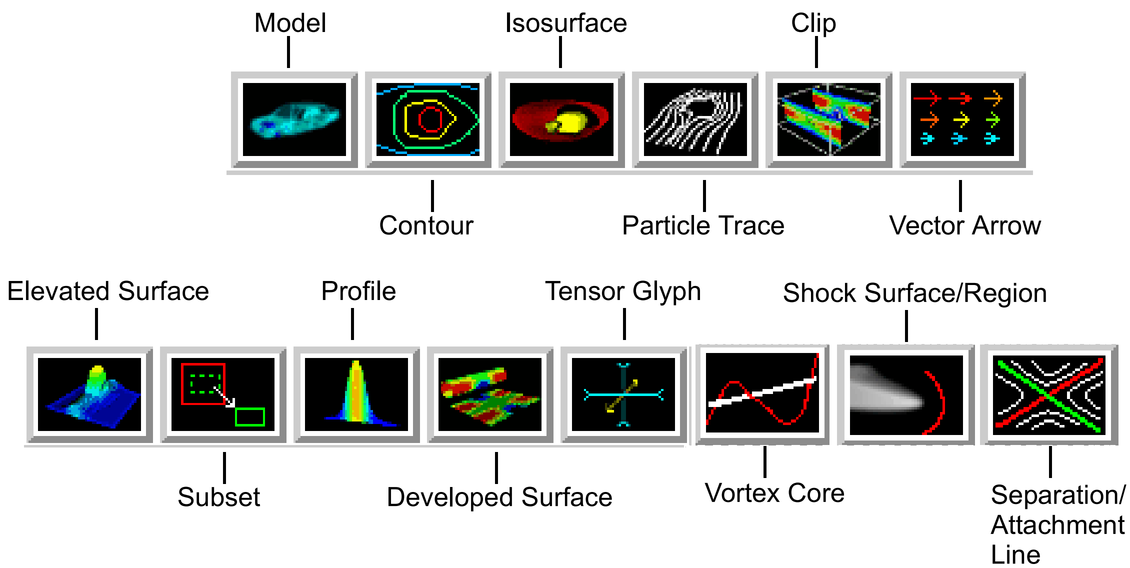


Figure 3-6
Feature Detail Editor Part Type Selection Icons

There is a Color Icon in the Feature Detail Editor's Part Type Icon Bar which, if clicked will open the Feature Detail Editor for Variables.

See Section 4.1 Variable Selection and Activation for further discussion.

Creation Attributes

Creation Attributes are "specific" attributes used to create (or modify) model and created Parts.

Model Parts

Creation Attributes for updating the I,J,K node range attributes of the selected block structured Model Parts with proper updating of all dependent parts and variables. The Creation Attributes area is inactive for unstructured Model Parts.
Access: Main Menu > Edit > Part Feature Detail Editors > Model Parts

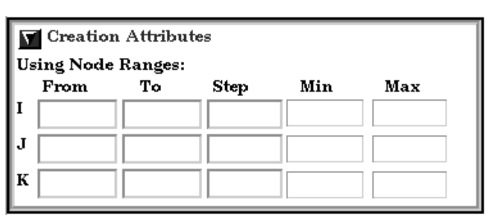


Figure 3-7
Feature Detail Editor (Model) Creation Attributes Area

Using Node Ranges

IJK From These fields specify the desired minimum interval value in the respective IJK

component direction of the Model Part.
IJK To These fields specify the desired maximum interval value in the respective IJK component direction of the Model Part.

IJK Step These fields specify the desired interval stride value in the respective IJK component direction of the Model part.

IJK Min These fields verify the minimum interval limit in the respective IJK component direction of the Model part.

IJK Max These fields verify the maximum interval limit in the respective IJK component direction of the Model part.

(see How To Create IJK Clips)

Created Parts

See the appropriate Section in Chapter 7 for a description of the Creation Attributes section.

- (see Section 7.2, Contour Create/Update)
- (see Section 7.3, Isosurface Create/Update)
- (see Section 7.4, Particle Trace Create/Update)
- (see Section 7.5, Clip Create/Update)
- (see Section 7.6, Vector Arrow Create/Update)
- (see Section 7.7, Elevated Surface Create/Update)
- (see Section 7.8, Profile Create/Update)
- (see Section 7.9, Developed Surface Create/Update)
- (see Section 7.16, Subset Parts Create/Update)
- (see Section 7.17, Tensor Glyph Parts Create/Update)
- **(see Section 7.18, Vortex Core Create/Update)**
- **(see Section 7.19, Shock Surface/Region Create/Update)**
- **(see Section 7.20, Separation/Attachment Lines Create/Update)**

General Attributes

General Attributes are "general" in that: (a) all Parts have them, and (b) they can't be neatly categorized into any other attribute type. Like all Part attributes, they are set individually for each Part.
Access: Main Menu > Edit > Part Feature Detail Editors > General Attributes

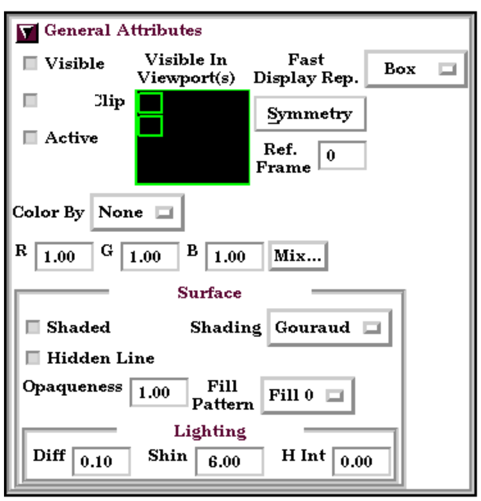


Figure 3-8
Feature Detail Editor General Attributes Area

Visible Toggle

Toggles-on/off whether Part is visible on a global basis (in the Graphics Window or in all viewports). (Performs the same function as the Visibility Toggle in the Parts Mode Icon Bar). Default is ON.

Visible In Viewports This small window allows you to control the visibility of the selected Part(s) on a per Viewport basis. Each visible viewport is shown. A green outline around a Viewport indicates that the selected Part(s) will be visible in this Viewport, while a red outline indicates that the selected Part(s) will not be visible. Change the visibility (red to green, green to red) by selecting a viewport with the mouse.

Fast Display Rep. This button opens a pop-up menu button for the selection of the fast display representation used to display a part on the client. This attribute helps the display of complex data sets. The part's fast display representation displays according to whether the Fast Display Mode (located in the View Menu or on the desktop) is on or off and on the state of the Static Fast Display button located under Edit > Preferences..., Performance. For instance, when the Fast Display Mode is Off (default) the part displays according to its specified Element Representation. When on, the parts are displayed by the fast display representation. The fast display representation will only be used while performing transformations, unless the Static Fast Display option has been selected. The part detail representations are:

Box a bounding (Cartesian extent) box of all part elements (default).
Off display according to specified Element Representation.
Points point cloud representation of the part.

(see How To Set Global Viewing)

Symmetry This button opens a pull-down menu which allows you to toggle-on/off the display of a mirror image of Parts (which are selected in the Feature Detail Editor's Parts List) in each of the seven other quadrants of the Part's local frame. It also allows you to turn on or off the original (non-symmetric) part representation. It performs the same function as the Symmetry Pull-down Icon in the Part Mode Icon Bar. You can mirror the Part to more than one quadrant. If the Part occupies more than one quadrant, each portion of the Part mirrors independently. Symmetry enables you to reduce the size of your analysis problem while still visualizing the "whole thing." Symmetry affects only the displayed image, not the data, so you cannot query the image or use the image as a parent Part. However, you can create the same effect by creating dependent Parts with the same symmetry attributes as the parent Part. Symmetry works as if the local frame is Rectangular, even if it is cylindrical or spherical. The images are displayed with the same attributes as the Part. For each toggle, the Part is displayed as follows. The default for all toggle buttons is OFF, except for the original representation - which is ON.

Mirror X	quadrant on the other side of the YZ plane.
Mirror Y	quadrant on the other side of the XZ plane.
Mirror Z	quadrant on the other side of the XY plane.
Mirror XY	diagonally opposite quadrant on the same side of the XY plane.
Mirror XZ	diagonally opposite quadrant on the same side of the XZ plane.
Mirror YZ	diagonally opposite quadrant on the same side of the YZ plane.
Mirror XYZ	quadrant diagonally opposite through the origin.
Original	the original part location.

(see How To Set Symmetry)

Aux Clip Toggle Toggles-on/off whether Part(s) selected in the Part List of the Feature Detail Editor will be affected by the Auxiliary Clipping Plane feature, which enables you to make invisible that portion of each Part on the negative side of the current position of the Plane Tool. Performs the same function as the Part Mode: Auxiliary Clipping Toggle Icon. A Part with its Aux Clip attribute toggled-off will not be cut away. Default is

ON. (see Auxiliary Clipping in Section 6.4, View Menu Functions).

Active Toggle

Toggles-on/off whether or not display of the Part automatically updates as the solution time changes. When visualizing transient data, you may wish to "freeze" a Part in time while other Parts continue to update. For example, you can create two identical vector-arrow Parts, toggle-off Active for one of them, change the time step of the display, and see how the vector arrows change from one time step to the other. Only the EnSight client Part is frozen, the EnSight server Part is kept current. Default is ON.

Ref. Frame

This field specifies which frame the Part is assigned to. Default is the frame of the Part's parent Part (Frame 0 for original model Parts). Enter a different frame number in the field to change the assignment. Changing a Part's frame causes the Part to be drawn in the new coordinate frame. Once assigned to a different frame, the Part will transform with that frame. The choice of frame does not affect variable values. The interpolated value of a variable at point 0,0,0 in Frame 0 is the same as at point 0,0,0 in Frame 1, even though the points may appear at different locations in the Main View Window.
(see Section 8.6, Frame Mode)

Color By

This button opens a pop-up menu for the selection of the variable color palette by which you wish to color the selected Part(s). Coloring a Part with a palette does not normally affect graphics performance while in line drawing mode, but Shaded Surface mode performance can become considerably slower. If you do not color by a palette (Color By > None), the Part will be displayed according to the color specified in the R, G, B fields. If you want to color Parts by palettes and want Shaded Surface mode, consider using the Static Lighting option (see Static Lighting in Section 6.4, View Menu Functions).

R G B

These fields allow you to specify a solid color for the selected Part(s) (applicable only if Color By is None). Enter a numerical value from 0 to 1 for each component color (Red, Green, and Blue).

Mix...

Opens the Color Selector dialog for the selection of a solid color for the selected Part(s) (applicable only if Color By is None). (see Section 7.1, Color)

Surface

Shaded Surface Toggle

Toggles on/off surface shading for individual Parts. When global Shaded Surface has been toggled on for the Graphics Window display (from Main Menu > View > Shaded Surface or via the Global Shaded Surface Toggle in the View Mode Icon Bar), individual Parts can be forced to stay in line drawing mode using this toggle. Default is ON. (see Section 6.4, View Menu Functions)

Hidden Line Toggle

Toggles on/off hidden line representation for individual Parts. When global *Hidden Line* has been toggled on for the Graphics Window display (from Main Menu > View > Hidden Line or via the Global Hidden Line Toggle in the View Mode Icon Bar), individual Parts can be forced not to appear as Hidden Line representation using this toggle. (To have lines hidden behind surfaces, Parts must have surfaces, i.e. 2D elements) Default is ON. (see Section 6.4, View Menu Functions)

Shading

Opens a pop-up menu for selection of appearance of Part surface when Shaded Surface is on. Normally the mode is set to Gouraud, meaning that the color and shading will interpolate across the polygon in a linear scheme. You can also set the shading type to Flat, meaning that each polygon will get one color and shade, or Smooth which means that the surface normals will be averaged to the neighboring elements producing a "smooth" surface appearance.Not valid for all Part types. Options are:

Flat	Color and shading same for entire element
Gouraud	Color and shading varies linearly across element
Smooth	Normals averaged with neighboring elements to simulate smooth surfaces

Opaqueness

This field specifies the opaqueness of the selected Part(s). A value of 1.0 indicates that the Part is fully opaque, while a value of 0.0 indicates that it is fully transparent. Setting this attribute to a value other than 1.0 can seriously affect the graphics performance.

Fill Pattern

Opens a pop-up menu for selection of a fill pattern which can provide pseudo-transparency for shaded surfaces. Default is Fill 0 which uses no pattern (produces a solid surface), while Fill patterns 1 through 3 produce a EnSight defined fill pattern.

Lighting

Diff

This field specifies diffusion (minimum brightness or amount of light that a Part reflects). (Some applications refer to this as *ambient* light.) The Part will reflect no light if value is 0.0. If value is 1.0, no lighting effects will be imposed and the Part will reflect all light and be shown at full color intensity at every point. To change, enter a value from 0 to 1.

Shin

This field specifies shininess.You can think of the shininess factor in terms of how smooth the surface is. The larger the shininess factor, the smoother the object. A value of 0 corresponds to a dull finish and a value of 100 corresponds to a highly shiny finish. To change, enter a value from 0 to 100.

H Int

This field specifies highlight intensity (the amount of white light contained in the color of the Part which is reflected back to the observer). Highlighting gives the Part a more realistic appearance and reveals the shine of the surface. To change, enter a value from 0 to 1 with larger values representing more white light. Will have no effect if Shin parameter is zero.
(see How To Set Attributes)

Troubleshooting Surface Attributes and Lighting

Problem	Probable Causes	Solutions
Part not in Shaded Surface mode	Global Toggle not on, or if on, Shaded Surface is turned off for the Part in the Feature Detail Editor	Turn on Shaded Surface toggle from View menu of Main Menu or turn and make sure Shaded Surface is turned on for the Part in the Feature Detail Editor.
	Part contains only 1D elements	No Solution
Part appears not to have any lighting.	Diffuse light intensity too high	Lower the Diff value.

Node, Element, and Line Attributes

Each Part's Node, Element, and Line attributes control the representation of the Part on the client, and how nodes, elements, and lines are displayed.

Access: Main Menu > Edit > Part Feature Detail Editors > Node, Element, and Line Attributes

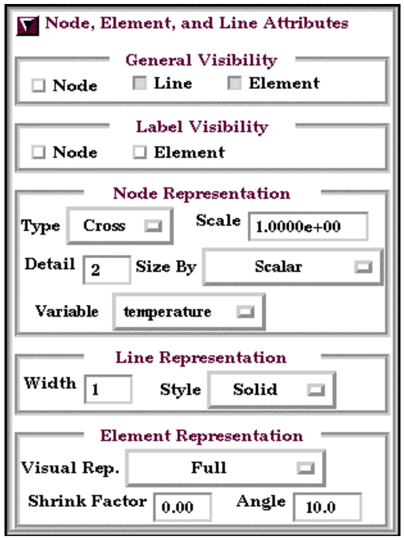


Figure 3-9
Feature Detail Editor Node, Element, and Line Attributes Area

General Visibility

Node Toggle — Toggles-on/off display of Part's nodes whenever the Part is visible. Default is OFF.

Line Toggle — Toggles-on/off display of line (1D) elements in the client-representation whenever the Part is visible. Default is ON.

Element Toggle — Toggles-on/off display of 2D elements in the client-representation whenever the Part is visible. Note that 3D elements are always represented as 2D elements on the client. Default is ON.

Label Visibility

Node Toggle — Toggles-on/off display of Part's node labels (if they exist) whenever the Part is visible. Only model Parts may have node labels. Default is OFF.

Element Toggle — Toggles-on/off display of Part's element labels (if they exist) whenever the Part is displayed in Full visual representation. Only model Parts may have element labels, and. Default is OFF.

Node Representation

Type — Opens a pop-up menu for the selection of symbol to use when displaying the Part's nodes. Default is Dot. Options are:
Dot to display nodes as one-pixel dots.
Cross to display nodes as three-dimensional crosses whose size you specify.
Sphere to display the nodes as spheres whose size and detail you specify.

Scale
This field is used to specify scaling factor for size of node symbol. Values between 0 and 1 reduce the size, factors greater than one enlarge the size. Not applicable when node-symbol Type is Dot. Default is 1.0.

Detail
This field is used to specify how round to draw the spheres when the node-symbol type is Sphere. Ranges from 2 to 10, with 10 being the most detailed (e.g., roundest spheres). Higher values take longer to draw, slowing performance. Default is 2.

Size By
Opens a pop-up menu for the selection of variable-type to use to size each node-symbol. For options other than Constant, the node-symbol size will vary depending on the value of the selected variable at the node. Not applicable when node-symbol Type is Dot. Default is Constant. Options are:
Constant sizes node using the Scale factor value.
Scalar sizes node using a scalar variable.
Vector Mag sizes node using magnitude of a vector variable.
Vector X-Comp sizes node using magnitude of X-component of a vector variable.
Vector Y-Comp sizes node using magnitude of Y-component of a vector variable.
Vector Z-Comp sizes node using magnitude of Z-component of a vector variable.

Variable
Selection of variable to use to size the nodes. Activated variables of the appropriate Size By type are listed. Not applicable when node-symbol Type is Dot or Size By is Constant.

Line Representation

Width
Specification of width (in pixels) of line elements and edges of 2D elements whenever they are visible. Range is from 1 to 20. Default is 1. Line widths other than 1 are not available on all hardware. This performs the same function as the Part Line Width Pulldown Icon in Part Mode.

Style
Selection of style of line when lines are visible. Default is Solid. Options are:
Solid
Dotted
Dot-Dash

Element Representation

Visual Rep.
Selection of representation of Part's elements on the client. Saves memory and time to download.
3D border, 2D full represents the Part's 3D elements in Border representation, the Part's 1 and 2D elements in Full representation. The result is the outside surfaces of the Part are displayed along with all bar elements.
Border represents the Part's 3D elements with 2D elements corresponding to unshared element faces, the Part's 2D elements with 1D elements corresponding to the unshared edges, and the Part's 1D elements as 1D elements. The result is the outside faces and edges of the Part's elements.
Feature Angle first runs the 3D border, 2D full representation to get a list of 1 and 2D elements. The 1D elements and all non-shared 2D edges will be shown, but only the shared edges above the Angle value will be shown. The result consists of 1D elements visualizing the sharp edges of the Part.
Bounding Box represents all Part elements as a bounding box surrounding the Cartesian extent of the elements of the Part.
Full represents all faces of the Part's 3D elements, and all the 1 and 2D elements.
Non Visual means the Part exists on the server, but is not loaded on the client. Not Loaded Parts may be used as parent Parts, but do not exist on the client.

Shrink Factor
: Specification of scaling factor by which to shrink every element toward its centroid. Enter the fraction to shrink by in range from 0 to 1. Default is 0.0 for no shrinkage.

Angle
: Specification of lower limit for not displaying shared edges in Feature Angle Representation. Value is in degrees.

(see How To Set Attributes and How To Display Labels)

Troubleshooting Node, Element and Line Attributes

Problem	Probable Causes	Solutions
After changing to Feature Angle representation, the Part is not shown.	Angle value is to large	Set Angle to smaller value.

Displacement Attributes

Displacement Attributes specify how to displace the Part nodes based on a vector variable. Each node of the Part is displaced by a distance and direction corresponding to the value of a vector variable at the node. The new coordinate is equal to the old coordinate plus the vector times the specified Factor, or:

$C_{new} = C_{orig} + \text{Factor} * \text{Vector},$

where C_{new} is the new coordinate location, C_{orig} is the coordinate location as defined in the data files, Factor is a scale factor, and Vector is the displacement vector.

You can greatly exaggerate the displacement vector by specifying a large Factor value. Though you can use any vector variable for displacements, it certainly makes the most sense to use a variable calculated for this purpose. Note that the variable value represents the *displacement* from the original location, not the *coordinates* of the new location.

Access: Main Menu > Edit > Part Feature Detail Editors > Displacement Attributes

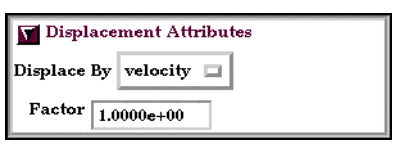


Figure 3-10
Feature Detail Editor Displacement Attributes Area

Displace by
: Opens a pop-up menu for selection of vector variable to use for displacement (or None for no displacement). Variable must be a vector and be activated.

Factor
: This field is used to specify a scale factor for the displacement vector. New coordinates are calculated as: $C_{new} = C_{orig} + \text{Factor*Vector}$, where C_{new} is the new coordinate location, C_{orig} is the original coordinate location as defined in the data file, Factor is a scale factor, and Vector is the displacement vector. Note that a value of 1.0 will give you “true” displacements.
(see How To Display Displacements)

Troubleshooting Displacement Attributes

Problem	Probable Causes	Solutions
Displacement not visible	Displace By attribute set to None for Part that is not displacing.	Set the Displace By attribute
	Factor value too small.	Specify a larger Factor.

Create Clicking this button creates a new Part using attributes currently selected/specified in the Feature Detail Editor. This performs the same function as the Create button in the Quick Interaction Area Editor for each type of created Part. Clicking Create updates the Graphics Window and adds the new Part to the Main Parts List and to the Parts List in the Feature Detail Editor for this type of Part. Not applicable for model Parts or discrete Particles.

(see Introduction to Part Creation)

Update Parent Clicking this button assigns the Part which is currently selected in the Main Parts List as the new parent Part of the created Part(s) which is(are) currently selected in the Feature Detail Editor's Parts List.

Apply Changes Clicking this button applies all changes that have been made within the Feature Detail Editor all at once if Immediate Modification has been toggled off above in the Feature Detail Editor's Edit pull-down menu. If Creation attributes have been changed, the Part will be regenerated.

3.4 Part Operations

This section will describe the Part operations accessible through “Edit > Part” in the Main Menu and “Edit” in the Feature Detail Editor Menu. These include *Select All, Select, Delete*, *Assign to Single or Multiple Viewports, Group, Ungroup*, *Copy*, *Cut*, *Extract*, and *Merge*.

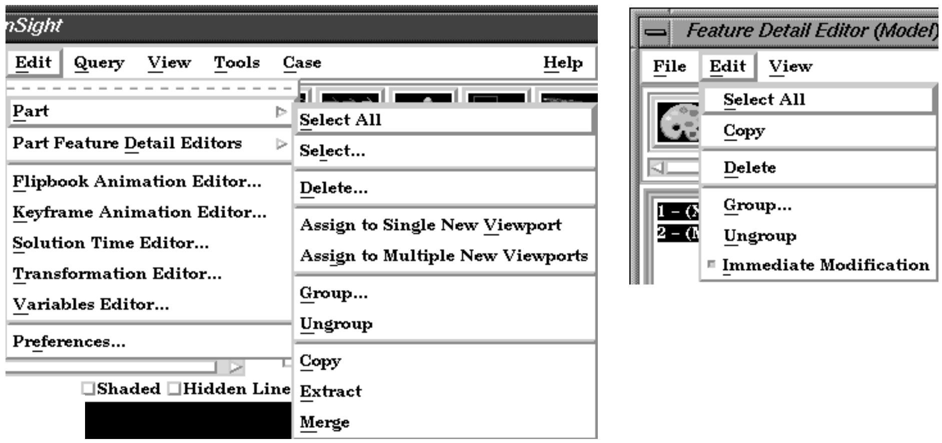


Figure 3-11
Part Operation Selection Menus

Select All

Choosing this from the Main Menu > Edit >Part pull-down, selects all Parts in the Main Parts List. Choosing this from the Edit pull-down in the Feature Detail Editor Menu selects all Parts in the Feature Detail Editor Parts List.
Access: Main Menu > Edit > Part > Select All
Feature Detail Editor Menu > Edit > Select All

(see How to Select Parts)

Select ...

Choosing this from the Main Menu > Edit >Part pull-down, opens the Select Part(s) By Keyword dialog.

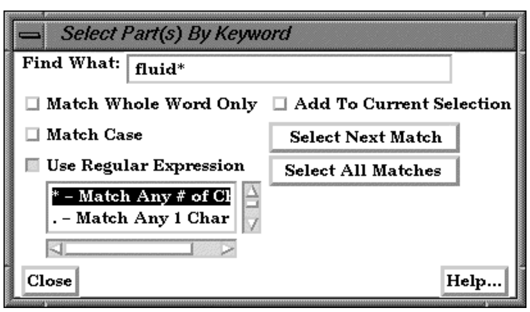


Figure 3-12
Select Part(s) By Keyword dialog

Find What

This field is used to specify the keyword or regular expression to compare (match) against Part names.

Match Whole Word Only Toggle

When on, the entire Part name must match the keyword or regular expression.
When off, a Part name will be selected if only a substring of the Part name matches.

Match Case Toggle

When on, the comparison is case sensitive. When off, case is ignored.

Use Regular Expression Toggle
When on, special characters in the keyword will be used to define a regular expression. When off, any special characters will be treated as a regular character during comparison.

Special Character Selection List
Contains a list of special characters available to create a regular expression. Selecting an item from the list will insert the special character into the "Find What" text field at the cursor location.

*	Match any number of characters in the part name
.	Match any one character in the part name
~	Match part names that do not match the specified search criteria.
|	Separates multiple search keywords or regular expressions. (extra spaces are not allowed around "|")

Examples: Find What: abc*xyz Match Whole Word Only: On
Select any Part who's name starts with "abc" and ends with "xyz"

Find What: tom|jerry Match Whole Word Only: OFF
Select all Part s who's names contain the string "tom" and/or the string "jerry"

Add to Current Selection Toggle
When on, any matching Part names will be added to the list of Part names currently selected. When off, only the matching Part names will be selected.

Select Next Match
Selects the next Part name which matches the keyword or regular expression.

Select All Matches
Selects all Part names which match the keyword or regular expression.

Delete…
If chosen from the Main Menu > Edit > Part pull-down, deletes all selected Parts in the Main Parts List after you have confirmed in a pop-up dialog that you wish to do so. If chosen from the Edit pull-down in the Feature Detail Editor Menu, deletes all selected Parts in the Feature Detail Editor Parts List after you have confirmed in a pop-up dialog that you wish to do so. If model Parts are deleted, they are no longer available for the current session. Parts dependent upon selected Parts will also be deleted or modified
Access: Main Menu > Edit > Part > Delete...
Feature Detail Editor Menu > Edit > Delete...

(see How to Delete a Part)

Assign to Single New Viewport
Creates a new viewport and assigns all of the selected parts to the new viewport. The new viewport will be 2D if all of the selected parts are 2D and lie on the same plane.

Assign to Multiple New Viewports
Creates a new viewport for each of the selected parts. Each new viewport will show one part only. If the part is 2D, the viewport will be 2D. Further, if the part assigned to the new viewport is a XYZ or IJK clip or an isosurface, annotation will be created in the lower left corner of the viewport indicating the value of the clip or iso.

Group/Ungroup
The group operation is used to collect any number of parts into a set which can be modified and utilized as one entity. The operation is non-destructive and reversible, and is used solely as a convenience to the user in order to organize a large number of parts.

Any attribute modification to a grouped part affects each of the parts in the group. Similarly, if a grouped part is used as a parent part, each part in the group is used as a parent in the creation process.

When group is selected, the dialog shown in the figure below will appear. A part name must be input in order to complete the grouping operation.

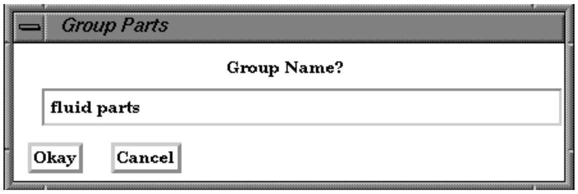


Figure 3-13
Group Parts Dialog

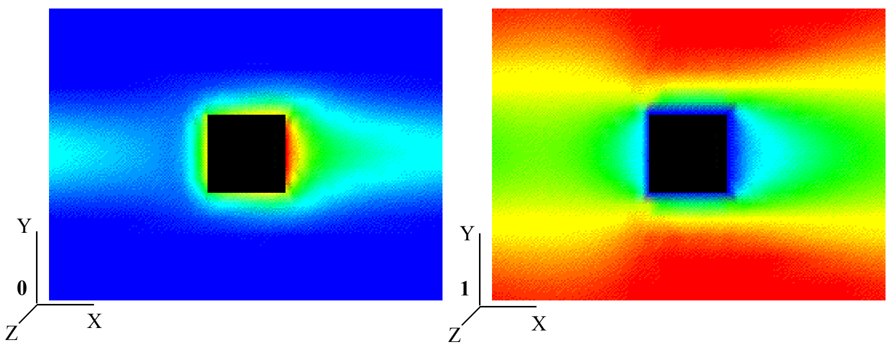
Only parts of the same type and case can be grouped together. Further, groups can not contain other part groups.

(see How To Group Parts)

Copy

If chosen from the Main Menu > Edit > Part pull-down, makes a copy of selected Part(s) in the Main Parts List. If chosen from the Edit pull-down in the Feature Detail Editor Menu, makes a copy of selected Part(s) in the Feature Detail Editor Parts List.

The Copy operation creates a dependent copy of another (original) Part. The Copy is created on the Client and its existence is not known to the EnSight Server process. A Copy shares geometric data and variable data with the original Part. (This type of Part is sometimes called a "shallow copy".)



Original Clip Part - colored by temperature

Copy of Clip Part, assigned to new Frame, translated to right, and colored by velocity at the same time step

Figure 3-14
Part Copy Example

relationships

The relationship between a Model Part and a Copy made from a Model Part will be one of original and copy. That is, the Model Part will not be a Parent to the Copy as it is to a Created Part such as a clip.

The relationship between a Created Part and a copy made from it will also be one of original and copy since the Copy will initially regard as its Parent the same Part that the original Created Part regards as its Parent. The Parent of individual Created Parts can of course be reassigned (using the Update Parent button at the bottom of the Feature Detail Editor) but the Parent of a Created Part Copy can Not be reassigned.

A copy can be used as a Parent Part for Parts created since the create operation will operate on the original Part.

attributes — The initial attributes assigned to a Copy are the same as those of the original Part at the time of copying. All attributes for the Copy except Element Representation (3D border, 2D full, border, Feature Angle, etc.) can be changed. The Element Representation of a Copy cannot be changed independently; a change in Element Representation of the original changes the copy as well.

description — The description of the new Copy will be the same as the original Part with the suffix "-COPY" added (of course, you can change this description in the Desc field in the Feature Detail Editor).

copies of copies — You can make multiple copies from a Model or Created Part, but you can Not make copies of copies.

frame assignment — A new frame is automatically created for each newly created Copy and the Copy is assigned to the new frame so that it can easily be moved with a local transformation. The location of the original Part and the Copy will initially coincide as well. Like all Parts, Copies of Parts can be reassigned to different frames in the General Attributes Section of the Feature Detail Editor (for that type of Part).

usefulness — One of the most useful purposes for copies is a separation allowing for the side-by-side display of different attributes (shown in Figure 3-11). Since all attributes except Element Representation can be different, the original and the copy can be displaying different variables, different displacements, etc.

(see How To Copy a Part)

Extract — Extracts selected Part(s) into a new, true Part, *using the Part representation in effect at the time* (full, border, or feature). If more than one Part is selected, then they are joined into a single Part. If more than one Part is selected when extract is invoked, then all will have their extracted geometry joined into a single new Part. The new Part is assigned to Frame 0.

The Extract option is closely tied to Element Representation. It creates a new Part using the geometry of the current representation (what you see is what you get). Extracted Parts which are in Full Representation are actual copies of the original, but extracted Parts which are in Border Representation are only the shell or boundary of the original. Extract is often used with the Save Geometric Entities feature to save extracted Parts (and not the originals) into a smaller set of data. It is also used to create hollow Parts from solid Parts to be able to look inside a solid Part after cutting it open with the Cut feature.

(see How To Extract Part Representations)

Merge — If more than one Part is selected, the Merge operation creates a new model Part on the Server host that is a combination of all selected. If only one Part is selected when Merge is invoked, then a new Part is created on the Server host that is identical but fully independent from the original Part (Note that this type of "copy" does not have the restriction on Element Representation that Part Copy does, - *all* Attributes can be reassigned - but it requires considerably more memory because it does not share the geometry with the original but now has its own copy of the geometry). The merge operation creates a new Part. The new Part is assigned the default Display Attributes and is also assigned to Frame 0.

(see How To Merge Parts)

4 Variables

Included in this chapter:

General Description

Variables are numerical values provided by your analysis software or created within EnSight. Variables can be dependent on part-geometry (for example, the area of a part), and a part's geometry can be dependent on its parent part's variable values (for example, an isosurface).

Variable Types

There are four types of variables: *tensor, vector*, *scalar*, and *constant*. Scalars and vectors can be real or complex. Symmetric tensors are defined by six values, while asymmetric tensors are defined by nine values. Vectors, such as displacement and velocity, have three values (the components of the vector) if real, or six values if complex. Scalars, such as temperature or pressure, have a single value if real, or two values if complex. Constants have a single value for the model, such as analysis time or volume. All four types can change over time for transient models.

Activation

Before using a variable, it must be loaded by EnSight, a process called activation. EnSight normally activates variables as they are needed. Section 4.1 describes how to select, activate, and deactivate variables to make efficient use of your system memory.
(see Section 4.1, Variable Selection and Activation)

Creation

In addition to using the variables given by your analysis software, EnSight can create additional variables based on any existing variables and geometric properties of parts. EnSight provides more than fifty functions (and more are being added for the next minor release) to make this process simpler.(see Section 4.3, Variable Creation)

Color Palettes

Very often you will wish to color a part according to the values of a variable. EnSight associates colors to values using a *color palette*. You have control over the number of value-levels of the palette and the type of scale, as well as control over colors and method of color gradation. You also use function palettes to specify a set of levels for a variable, such as when creating contours.
(see Section 4.2, Variable Summary & Palette)

Queries

You can make numerical queries about variables and geometric characteristics of Server-based parts. These queries can be at points, nodes, elements, parts, along lines, and along 1D parts. If you have transient data, you can query at one time step or over a range of time steps, looking at actual variable values or a Fast Fourier Transform (FFT) of the values. (see Section 6.3, Query Menu Functions)

Plotting

Once you have queried a variable, you can plot the result.

(see Section 8.5, Plot Mode)

From More than One Case Variables can come from more than one case. If more than one case has a variable with the same name, this will be treated as one variable. If a variable is applicable to one case but not another, it will not be applied to the non-applicable case(s).

Parts When variables are activated or created, all parts except Particle Trace parts are updated to reflect the new variable state. Particle Trace parts will always show variables which are activated after the part's creation as zero values.

Location Variables can be defined at the vertices, at the element centers, or undefined.

4.1 Variable Selection and Activation

All available variables, both those read in and those created within EnSight, are shown in the Feature Detail Editor (Variables), whether they have been activated or not. In addition, a variable list is included in each function requiring a variable. In this case, only the appropriate variable types are shown.

Feature Detail Editor (Variables)

Double clicking on the Color Icon in the Feature Icon Bar opens the Feature Detail Editor (Variables).

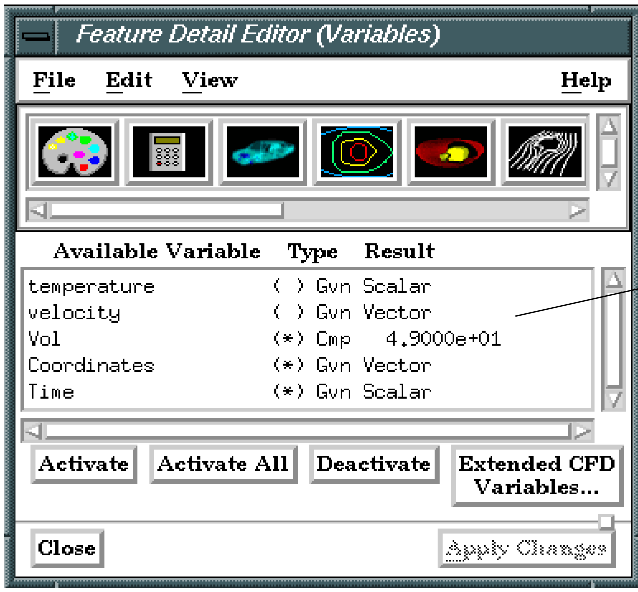


Figure 4-1
Feature Detail Editor (Variables)

Feature Detail Editor Variables List

This list shows all variables currently available, both those read from data and those you have created within EnSight. Each row provides information about a variable.

Available Variable

The description or name of the variable.

( ) or (*)

Activation status. An asterisk indicates that the variable has been activated.

Type

Type of the variable:

Gvn Scalar:	real scalars read from the dataset (Given).
Cmp Scalar:	real scalars created within EnSight (Computed).
Gvn Complex Scalar:	complex scalars read from the dataset (Given).
Cmp Complex Scalar:	complex scalars created within EnSight (Computed).
Gvn Vector:	real vectors read from the dataset (Given).
Cmp Vector:	complex vectors created within EnSight (Computed).
Gvn Complex Vector:	complex vectors read from the dataset (Given).
Cmp Complex Vector:	complex vectors created within EnSight (Computed).
Gvn Tensor:	real tensors read from the dataset (Given).
Cmp Tensor:	real tensors created within EnSight (Computed).
Gvn #:	constants read from the dataset (Given).
Cmp #:	constants created within EnSight (Computed).

Result — Current value of a constant variable (is blank for other types of variables). Changing the current solution time will update the value in this column to the value for the new time.

Activate — Clicking this button activates the variable(s) selected in the Feature Detail Editor Variables List. Activation of a variable loads its values into the memory of the EnSight Server host system. The EnSight Server then passes the necessary data to the Client. One way you can control EnSight's memory usage is to only activate the variables you want to use. Once activated, a variable becomes available in the Main Variables List and, as is described in Section 4.2, EnSight creates a default color palette for the variable.

Activate All — Clicking this button activates all variables listed in the Feature Detail Editor Variables List, regardless of which are selected.

Deactivate — Clicking this button deactivates the variable(s) selected in the Feature Detail Editor Variables List. Deactivating a variable frees up some memory on both the Client and the Server. You can activate and deactivate variables as often as you like. For example, you could activate one variable to color a part, deactivate that variable, then activate a different variable to re-color the part. Of course, if you have enough memory and a small enough model, you can simply activate all the variables and leave them activated.

Extended CFD Variables... — Opens the Extended CFD Variable Settings dialog. If your data defines variables or constants for density, Total Energy per unit volume, and momentum (or velocity), it is possible to show new variables defined by these basic variables in the Main Variables List of the GUI by utilizing the capabilities of this dialog. (See Preferences... in Section 6.2, Edit Menu Functions).

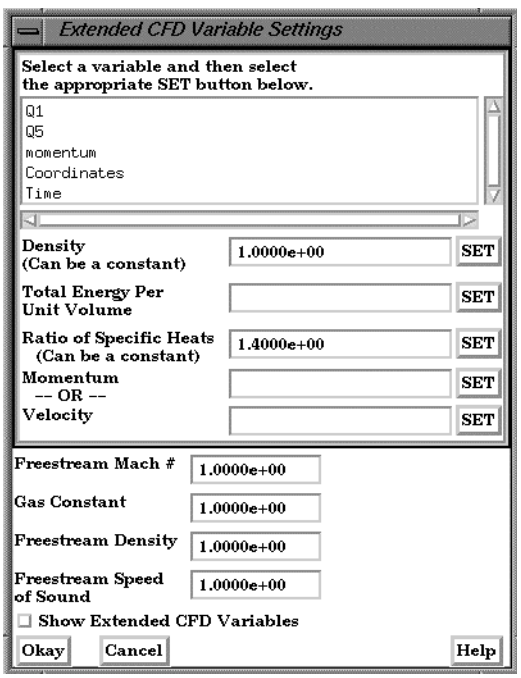


Figure 4-2
Extended CFD Variable Settings Dialog

WARNING If you deactivate a created variable or any of the variables used to define it, both the values and the definition of the created variable are deleted. If you deactivate a variable used to create a part's geometry, the part will be deleted. If you deactivate a variable who's color palette has been used to color a part, the part's appearance will change.

(see How To Activate Variables)

4.2 Variable Summary & Palette

You can visualize information about a model by representing variable values with colors, often called fringes. Fringes are an extremely effective way to visualize variable variations and levels. A variable color palette associates (or maps) variable values to colors. Palettes are also used in the creation of contours. The number of contour levels is based on the number of palette color levels, and the contour values are based on the palette level values.

EnSight uses a variable's color palette to convert numbers to colors, while you, the viewer, use them in the opposite manner—to associate a visible color with a number. If you wish, EnSight can display a color-value legend in the Main View window.

Default Palettes

At least one color palette—the Coordinate color palette—always exists, even if your model has no variables. In addition, EnSight creates a color palette for each real scalar and vector variable that you activate, giving the color palette the same name as the variable. If the variable is a vector variable, the default color palette uses the vector's magnitude. Tensor variables have no palette.

Default color palettes have five color levels. Ranging from low to high, the colors are blue, cyan, green, yellow, and red (the spectral order). The numerical values mapped to these five levels are determined by first finding the value-range for the variable at the current time step when the variable is activated. The value for the lowest level is set to the minimum value. The value for the highest level is set to the maximum value. The three middle levels are spaced evenly between the lowest and highest values. For datasets with only one time step, the scheme just described works well because the variable's value range is not changing over time. However, if you have transient data, the range could vary widely at different times and since the default was based on one time step, it may not be appropriate for other time steps. EnSight can show you a histogram of the variable values over time to assist you in setting a palette for transient cases.

Value Levels

A color palette can have up to 21 levels at which the variable value is specified. Each color palette level's value must be between the value at the adjoining levels, with higher levels having higher variable-values. Between levels, you select whether the scale is linear (the default), quadratic (2^x), or logarithmic ($\log_{10}$). Also, you can have EnSight use one of these scales to automatically assign values to a range of levels.

Sometimes you may wish to only visualize areas whose palette-variable values are in a limited range. You can choose to visualize other areas with a different, uniform color, or to make those areas invisible.

Management

The Feature Detail Editor (Variables) enables you to manage your color palettes. You can copy, save to a file, and restore from a file existing palettes

Clicking the Variable Summary and Palette turndown button opens that dialog within the Feature Detail Editor (Variables) dialog.

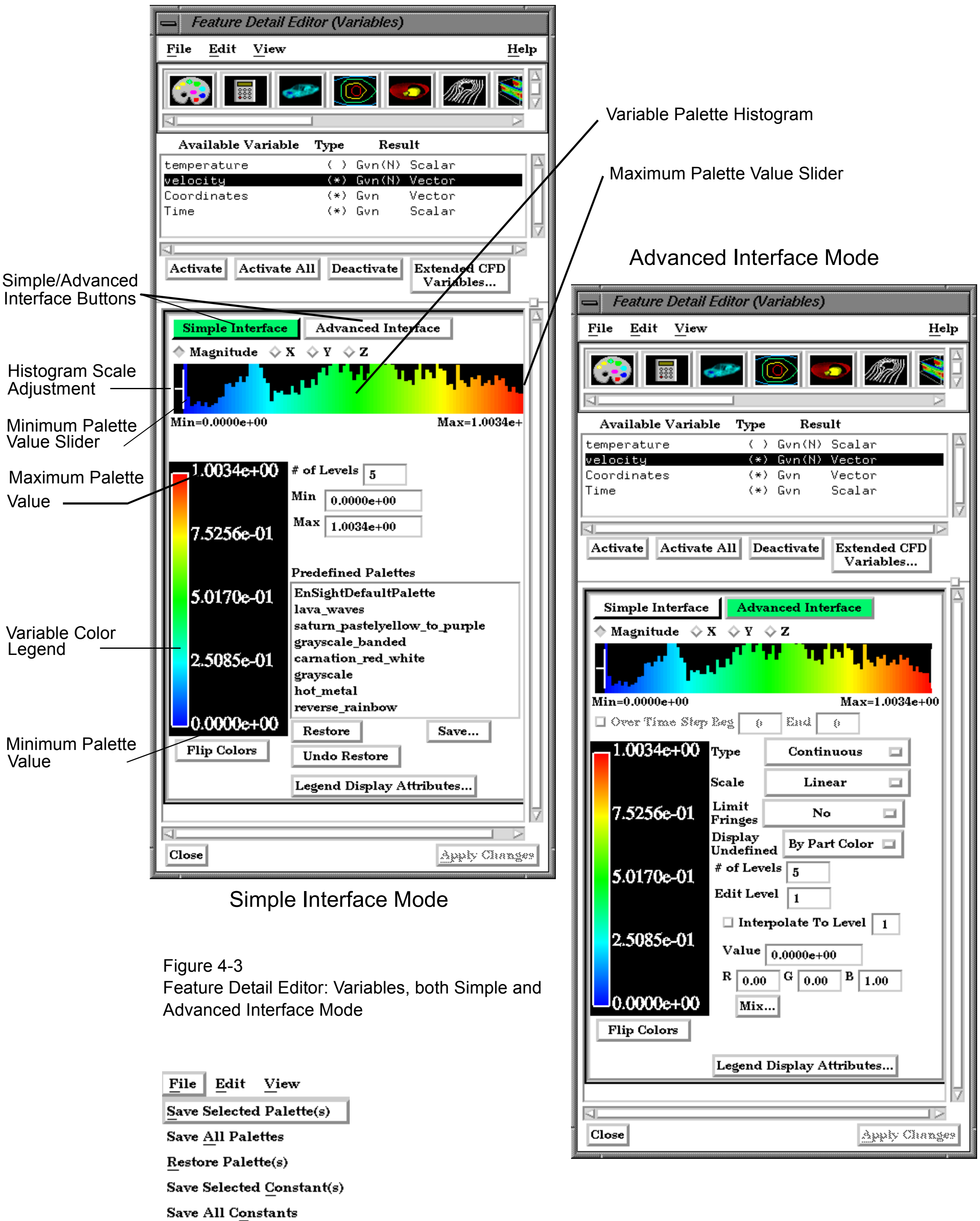


Figure 4-3
Feature Detail Editor: Variables, both Simple and Advanced Interface Mode

File Menu Clicking this button opens a pull-down menu with the following options:

Save Selected Palette(s) Opens the file selection dialog for the specification of a filename in which to save the selected color palette(s).

Save All Palettes… Opens the file selection dialog for the specification of a filename in which to save all color palette(s).

Restore Palette(s) Opens the file selection dialog for the specification of a filename from which to restore previously saved color palettes.

Save Selected Constant(s) Opens the file selection dialog for the specification of a filename in which to save the selected constant values.

Save All Constant(s) Opens the file selection dialog for the specification of a filename in which to save all constant values.

Edit Menu Clicking this button opens a pulldown menu with the following choice:

Select All Clicking this selects all variables in the Feature Detail Editor Available Variables List.

Immediate Modification Toggle Default is On. While on, any modification made in the Editor is immediately implemented by EnSight. For large problems, this may be impractical. In such instances, click this toggle off, make all desired modifications, and then implement then all at once by clicking the Apply Changes button at the bottom of the Editor dialog.

Simple/Advanced Interface Buttons which allow the user to choose between a simple or advanced mode for this dialog. The advanced interface is shown in the figure. The simple interface is a small subset of the advanced.

Variable Palette Histogram This histogram shows the relative number of nodes at which the value of the selected variable is within the range represented by a particular color band. The two vertical white slider bars are used to interactively set the minimum and maximum variable values to be used in the variable's color palette and these will show up in the Legend both within the turndown area and within the Graphics Window. The small horizontal white line on the left hand side can be used to interactively adjust the vertical scale of the histogram.

Over Time Step Toggle & Beg, End Fields Toggles on/off the automatic assignment of values to palette levels using the palette-variable's value range over multiple time steps which are specified in the Beg and End fields to the right of the toggle. This function is only available when you are using transient data. All other attributes of the color palette (including the number of levels, colors, type, etc.) are not changed.

Magnitude, X,Y,Z, Toggles For vector variables, this controls which histogram and color palette will be displayed and edited. By default, the vector magnitude is used, however, the X, Y, and Z components of the vector are also available.

Type This button opens a pop-up menu for the selection of the desired type of color gradation. Both the legend in the turn-down area and the legend in the Graphics Window (if visible) are affected. Options are:

Continuous displays graduated color variation across or along each element interpolating the color across each element based on the value of the variable at the nodes.

Banded displays discrete color values for each value range, but interpolates the location demarcation line within an element.

Constant displays each element with one color for the entire element rather than interpolating the color across the element using values at the nodes. The color of the first node encountered is used.

Scale This button opens a pop-up dialog for the selection of the desired type of scale for the value-separation of levels and color gradation. The options are:

Linear scale divisions, where the value-separation of levels is uniform and values map linearly to the colors.

Quadratic scale divisions, where the value-separations of levels are not equal, but instead are based on the second order of the variable (value2). Level-values always increasing upwards. For example, for five levels with a low-level value of 0 and a high-level value of 16, the linear scale would be 0, 4, 8, 12, 16 while the quadratic scale would be 0, 1, 4, 9, 16.

Logarithmic scale divisions, where the value-separations of levels are not equal, but instead are based on the base–10 logarithm of the variable value (log10). Level-values always increasing upwards. For example, for five levels with a low-level value of 1 and a high-level value of 10000, the linear scale would be 1, 2500, 5000, 7500, 10000 while the logarithmic scale would be 1, 10, 100, 1000, 10000.

Limit Fringes This button allows you to select how you wish to display elements with node values above and below the range of the palette scale values. This option only works for hidden surface mode. Options are:

No limit on values. Values above and below are colored with color of the corresponding end of the range (no interpolation).

By Model Color option colors values outside the function range with the current part- color (the color of the part when its Color By Palette attribute is None).

By Invisible option does not display elements whose node values are all above or below the value-range of the palette.

Display Undefined If the variable is not defined, the element cannot be colored according to the color palette. In this case, the element will be colored by the Part Color, or the element will become invisible.

# of Levels This field specifies the number of value-levels for the variable color palette, which are shown beside the Legend color bar. The number of levels is independent of the Type and Scale, and can range from 2 to 21 with the default being 5.

Min For the Simple Interface, this field is used to specify the variable value for the bottom level.

Max For the Simple Interface, this field is used to specify the variable value for the top level.

Edit Level Selection of the level you wish to edit, selected with stepper buttons, by entering a value in the field, or by clicking the mouse pointer on the desired level in the Variable Color Legend area. Levels start at 1 and count up from lower end. You can change the variable-value and color assigned to any level. Also, you can have EnSight interpolate value-levels and colors over a range of levels.

Interpolate to Level Toggle and Field	If this option is toggled-on while you are specifying a value (or color), the value (or color) of EnSight adjusts the values (or colors) of intermediate levels between the current level and the specified Interpolate To Level according the specified Scale type.
Value	This field specifies the variable value for the current palette level.
R G B Fields	These fields are used to specify the color to use for the current palette level.
Mix...	Clicking this button opens the Color Selector dialog which provides an alternative to the RGB fields for the specification of the color to use for the current palette level. (see Section 7.1, Color)
Predefined Palettes	For the Simple Interface only, shows a list of all predefined color palettes.
Restore	For the Simple Interface only. Restores the palette selected in the Predefined Palettes list.
Save...	For the Simple Interface only. Will bring up a file dialog to allow saving of the currently defined color palette.
Undo Restore	For the Simple Interface only. Will set the color palette definition back to what existed before the previous Restore.
Flip Colors	Reverses colors in the palette.
Legend Display Attributes ...	Clicking this button opens a pop-up message which reminds you that additional options for the modification of Legend display attributes may be found in the Annot Mode Icon Bar. (See How To Create Color Legends, How To Edit Color Palettes)

4.3 Variable Creation

You can create additional variables based on existing data. Typical mathematical operations, as well as many special built-in functions, enable you to produce simple or complex equations for new variables. Some built-in functions enable you to use values based on the geometric characteristics of parts. Created variables are available for any process, just like given variables. If you have transient data, a time change will recompute the created variable values.

Often an analysis program produces a set of basic results from which other results can be derived. For example, if a computational fluid dynamics analysis gives you density, momentum and total energy, you can derive pressure, velocity, temperature, mach number, etc. EnSight provides many of these common functions for you, or you can enter the equation(s) and build your own.

As another example, suppose you would like to normalize a given scalar or vector variable according to its maximum value, or according to the value at a particular node. Variable creation enables you to easily accomplish such a task. The more familiar you become with this feature, the more uses you will discover.

EnSight allows variables to be defined at vertices (nodes) or element centers. If a new variable is created from a combination of nodal and element based variables, such a new variable will always be element based.

Building Expressions

The Feature Detail Editor (Variables) dialog Variable Creation turn-down section provides function selection lists, calculator buttons, and feedback guidance to aid you in building the working expression (or equation) for a new variable. You can use three types of values in an expression: constants, scalars, and vectors.

Constants

A *constant* in a variable expression can be a…	for example…
• number	3.56
• constant variable from the Active Variables list	Analysis_Time
• scalar variable at a particular node/element (component and node/element number in brackets)	temperature[25]
• vector variable component at a particular node /element (component and node/element number in brackets)	velocity[Z][25]
• coordinate component at a particular node/element (component and node/element number in brackets)	coordinate[X][25]
• any of the previous three at a particular time step	temperature{15}[25]
• (time step in braces right after the variable name)	velocity{15}[Z][25] coordinate{15}[X][25]
• Math function	COS(1.5708)
• General function that produces a constant	AREA(plist)

Scalars

A *scalar* in a variable expression can be a…	for example…
• Scalar variable from the Active Variables list	pressure
• vector variable component (component in brackets)	velocity[Z]
• coordinate component (component in brackets)	coordinate[Y]
• any of the previous three at a particular time step (time step in braces right after the variable name)	pressure{29} velocity{29}[Z] coordinate{29}[Y]
• General function that produces a scalar	Divergence(plist,velocity)

Vectors	A *vector* in a variable expression can be a…	for example…
	• vector variable from the Active Variables list	velocity
	• coordinate name from the Active Variables list	coordinate
	• any of the previous two at a particular time step (time step in braces right after the variable name)	velocity{9} coordinate{9}
	• General function that produces a vector	Vorticity(plist,velocity)

Examples of Expressions and How To Build Them

The following are some example variable expressions, and how they can be built. These examples assume Analysis_Time, pressure, density, and velocity are all given variables.

Expression	*Discussion and How To Build It*
-13.5/3.5	A true constant since it does not change over time. To build it, type on the keyboard or click on the Variable Creation dialog calculator buttons `-13.5/3.5`
Analysis_Time/60.0	A simple example of modifying a given constant variable. If Analysis_Time is in seconds, this expression would give you the value in minutes. To build it, select *Analysis_Time* from the Active variable list and then type or click `/60.0`.
velocity*density	This expression is momentum, which is a vector. To build it, select *velocity* from the Active Variables list, type or click *, then select *density* from the Active Variable list.
SQRT(pressure[73] * 2.5)+ velocity[X][73]	This says, take the pressure at node (or element if pressure is an element center based variable) number 73, multiply it by 2.5, take the square root of the product, and then add to that the x-component of velocity at node (or element) number 73. To build it, select *SQRT* from the Math function list, select *pressure* from the Active Variables list, type `[73]*2.5)+`, select *velocity* from the Active Variable list, then type `[X][73]`.
pressure{19}	This is a scalar, the value of pressure at time step 19. It does not change with time. To build it, select pressure from the Active Variables list, then type `{19}`.
MAX(plist,pressure)	MAX is one of the built-in General functions. This expression calculates the maximum pressure value for all the nodes of the selected parts. To build it, type or click (, select *MAX* from the General function list and follow the interactive instructions that appear in the Feedback area of this dialog (in this case, to select the parts, click Okay, and select *pressure* from the Active Variable list).
(pressure /pressure_max)^2	This scalar is essentially the normalized pressure, squared. To build it, first build the preceding MAX(plist,pressure) expression and name it "pressure_max". Then to build this expression, select *pressure* from the Active Variables list, type or click `/`, select *pressure_max* from the Active Variables list, then type or click `)^2`.

Notice in the last example how a complex equation can be broken down into several smaller expressions, just as in a programming language. Simply assign a variable to the intermediate expression and include that variable name in later expressions. In fact, this is a necessary step in many cases since EnSight can compute only one variable at a time. It is not valid to use a variable name for the new variable which is used in the expression. For example, it is not valid to create an expression such as:

temperature = temperature + 100.

Clicking the Calculator Icon opens the Feature Detail Editor (Calculator) dialog.

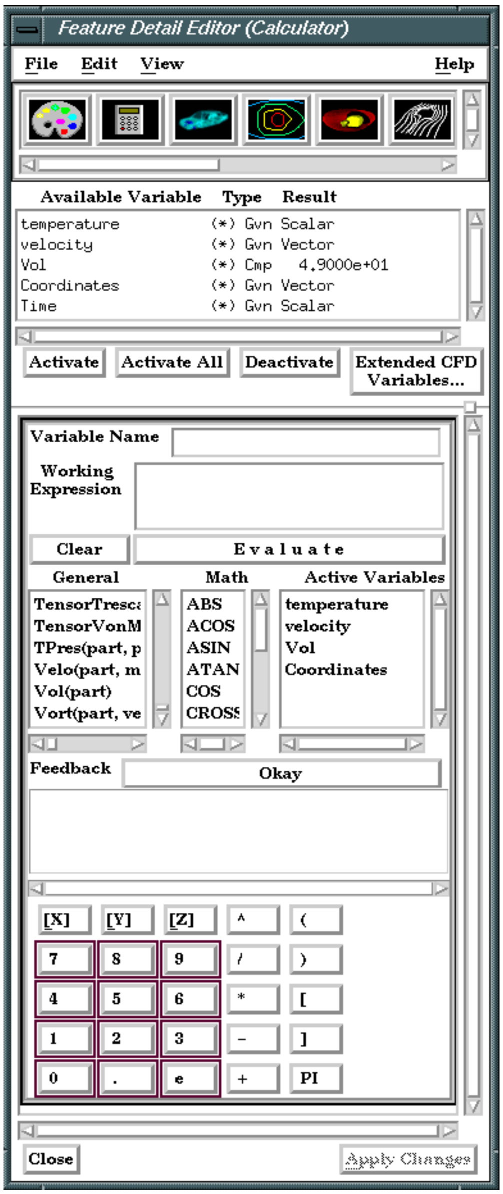


Figure 4-4
Feature Detail Editor (Calculator) dialog

Variable Name — This field is used to specify the name for the variable being created. Built-in general functions will provide a default, but they can be modified here. Variable names must not start with a numeric digit and must not contain any of the following reserved characters:

(	[	{	+	@	!	*	$
)	]	}	–	space	#	^	/

Working Expression — The expression or equation for the new variable is presented in this area. Interaction with the expression takes place here, either directly by typing in values and variable names, etc., or indirectly by selecting built-in functions and clicking calculator buttons.

Clear — Clicking this button clears the Variable name field, Working Expression area, Feedback area, and deselects any built-in function.

Evaluate — Clicking this button produces the new variable defined in the working expression area. Until you click this button, nothing is really created. The selection commands specify to which parts the new variable should be applied.

General — Scroll this list of built-in functions provided for your convenience. Click on a function to insert it into your Working Expression. For some functions, the Feedback Window provides interactive instructions.

Area — *Area* (any part(s)) Computes a constant variable whose value is the area of the selected parts. If a part is composed of 3D elements, the area is of the border representation of the part. The area of 1D elements is zero.

Case Map — *CaseMap*(2D or 3D part(s), case to map from, scalar or vector)

Finds the specified scalar or vector variable values for the specified part(s) from the indicated case.

Coefficient — *Coeff* (any 1D or 2D part(s), scalar, component)

Computes a constant variable whose value is a coefficient Cx , Cy, or Cz such that

$$C_x = \int_S f n_x dS \qquad C_y = \int_S f n_y dS \qquad C_z = \int_S f n_z dS$$

where f = any scalar variable

S = 1D or 2D domain

n_x = x component of normal

n_y = y component of normal

n_z = z component of normal

Specify [X], [Y], or [Z] to get the corresponding coefficient.

Note: *Normal for a 1D part will be parallel to the plane of the plane tool.*

Complex — *Cmplx*(any part(s), real portion, complex portion, frequency)

Creates a complex scalar or vector from two scalar or vector variables. The frequency is optional and is used only for reference.

Z = A + Bi

Complex Argument — *CmplxArg*(any part(s), complex scalar or vector)

Computes the Argument of a complex scalar or vector. The resulting scalar is given in degrees and will be in the range -180 and 180 degrees.

Arg = atan(Vi/Vr)

Complex Conjugate

CmplxConj(any part(s), complex scalar or vector)

Computes the Conjugate of a complex scalar of vector. Returns a complex scalar or vector where:

Nr = Vr
Ni = -Vi

Complex Imaginary

ComplexImaginary(any part(s), complex scalar or vector)

Extracts the imaginary portion of a complex scalar or vector into a real scalar or vector.

N = Vi

Complex Modulus

ComplexModulus(any part(s), complex scalar or vector)

Returns a real scalar/vector which is the modulus of the given scalar/vector

N = SQRT(Vr*Vr + Vi*Vi)

Complex Transient Response

CmplxTransientResponse(any part(s), complex scalar or vector, angle (degrees))

Returns a real scalar which is the real transient response:

Re(Vt) = Re(Vc)Cos(phi) - Im(Vc)Sin(phi)

which is a function of the transient phase angle "phi" defined by:
phi = 2 Pi f t
where
t = the harmonic response time parameter
f = frequency of the complex variable "Vc"
and the complex field "Vc", defined as:
Vc = Vc(x,y,z) = Re(Vc) + i Im(Vc)
where
Vc = the complex variable field
Re(Vc) = the Real portion of Vc
Im(Vc) = the imaginary portion of Vc
i = Sqrt(-1)

Note, the transient complex function, was a composition of Vc and Euler's relation, namely:

Vt = Vt(x,y,z,t) = Re(Vt) + i Im(Vt) = Vc * e^(i phi)

where:
e^(i phi) = Cos(phi) + i Sin(phi)

The real portion Re(Vt), is as designated above:

Note: this function is only good for harmonic variations, thus fields with a defined frequency!

Ensight allows phi to vary between 0 and 360 degrees.

Complex Real

ComplexReal(any part(s), complex scalar or vector)

Extracts the real portion of a complex scalar or vector into a real scalar or vector

N = Vr

Curl

Curl (any part(s), vector)

Computes a vector variable which is the curl of the input vector

$$Curl_f = \bar{\nabla} \times \dot{f} = \left(\frac{\partial f_3}{\partial y} - \frac{\partial f_2}{\partial z}\right)\hat{i} + \left(\frac{\partial f_1}{\partial z} - \frac{\partial f_3}{\partial x}\right)\hat{j} + \left(\frac{\partial f_2}{\partial x} - \frac{\partial f_1}{\partial y}\right)\hat{k}$$

Density

Density(any part(s), pressure, temperature, gas constant).

Computes a scalar variable which is the density ρ, defined as:

$$\rho = \frac{p}{TR}$$

where: p = pressure
T = temperature
R = gas constant

Normalized **Density**

DensityNorm (any part(s), density, freestream density)

Computes a scalar variable which is the Normalized Density ρ_n defined as:

$$\rho_n = \rho / \rho_i$$

where: ρ = density
ρ_i = freestream density

Log of Normalized **Density**

DensityLogNorm (any part(s), density, freestream density)

Computes a scalar variable which is the natural log of Normalized Density defined as:

$$ln \rho_n = ln(\rho / \rho_i)$$

where: ρ = density
ρ_i = freestream density

Stagnation **Density**

DensityStag (any part(s), density, total energy, velocity, ratio of specific heats) Computes a scalar variable which is the Stagnation Density ρ_o defined as:

$$\rho_o = \rho\left(1 + \left(\frac{\gamma - 1}{2}\right)M^2\right)^{(1/(\gamma - 1))}$$

where: ρ = density
γ = ratio of specific heats
M = mach number

Normalized Stagnation **Density**

DensityNormStag (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound, freestream velocity magnitude)

Computes a scalar variable which is the Normalized Stagnation Density ρ_{on} defined as:

$$\rho_{on} = \rho_o / \rho_{oi}$$

where: ρ_o = stagnation density
where: ρ_{oi} = freestream stagnation density

Divergence *Div* (any 2D or 3D part(s), vector)

Computes a scalar variable whose value is the divergence defined as:

$$Div = \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z}$$

where u, v, w = velocity components in x,y,z directions.

Element to Node *ElemToNode* (any part(s), element based variable).

Averages an element based variable to produce a node based variable.

Energy:

Total **Energy** *EnergyT* (any part(s), density, pressure, velocity, ratio of specific heats).

Computes a scalar variable of total energy per unit volume

$$e = \rho\left(e_i + \frac{V^2}{2}\right) \quad \text{Total Energy}$$

$$e_i = e_0 - \frac{V^2}{2} \quad \text{Internal Energy}$$

$$e_0 = \frac{e}{\rho} \quad \text{Stagnation Energy}$$

where:

$$\rho = density$$

$$V = Velocity$$

Or based on gamma, pressure and velocity:

$$e = \frac{p}{(\gamma - 1)} + \rho\frac{V^2}{2}$$

Kinetic **Energy** *KinEn* (any part(s), velocity, density)

Computes a scalar variable whose value is the kinetic energy E_k defined as:

$$E_k = \frac{1}{2}\rho V^2$$

where ρ = density (variable or constant)
V = Velocity variable

Enthalpy *Enthalpy* (any part(s), density, total energy, velocity, ratio of specific heats)

Computes a scalar variable which is Enthalpy h defined as:

$$h = \gamma\left(\frac{E}{\rho} - \frac{V^2}{2}\right)$$

where: E = total energy per unit volume
ρ = density
V = velocity magnitude
γ = ratio of specific heats

Normalized **Enthalpy** *EnthalpyNorm* (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound)

Computes a scalar variable which is Normalized Enthalpy h_n defined as:

$$h_n = h / h_i$$

where: h = enthalpy
h_i = freestream enthalpy

Stagnation **Enthalpy**

EnthalpyStag (any part(s), density, total energy, velocity, ratio of specific heats) Computes a scalar variable which is Stagnation Enthalpy h_o defined as:

$$h_o = h + \frac{V^2}{2}$$

where: h = enthalpy
V = velocity magnitude

Normalized Stagnation **Enthalpy**

EnthalpyNormStag (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound, freestream velocity magnitude)
Computes a scalar variable which is Normalized Stagnation Enthalpy h_{on} defined as:

$$h_{on} = h_o / h_{oi}$$

where: h_o = stagnation enthalpy
h_{oi} = freestream stagnation enthalpy

Entropy

Entropy (any part(s), density, total energy, velocity, ratio of specific heats, gas constant, freestream density, freestream speed of sound)
Computes a scalar variable which is Entropy s defined as:

$$s = ln\left(\frac{\frac{p}{p_i}}{\left(\frac{\rho}{\rho_i}\right)^{\gamma}}\right)\left(\frac{R}{\gamma - 1}\right)$$

where: R = gas constant
ρ = density
ρ_i = freestream density
p = pressure
p_i = freestream pressure = $(\rho_i c_i^2)/\gamma$
c_i = velocity magnitude
γ = ratio of specific heats

Flow

Flow (any 1D or 2D part(s), velocity).
Computes a constant variable whose value is the flow Q_c defined as:

$$Q_c = \int_S V_n dS$$

where V_n = Velocity value normal to the surface
S = 1D or 2D domain

Note: Normal for a 1D part will be parallel to the plane of the plane tool

Flow Rate

FlowRate (any 1D or 2D part(s), velocity).
Computes a scalar variable Q defined as:

$$Q = V \cdot N$$

where V = Velocity
N = Surface Normal

Fluid Shear *FluidShear*(2D part(s), velocity gradient, viscosity)

Computes a scalar variable tau whose value is defined as:

$$\text{tau} = \mu\frac{\partial V}{\partial n} \qquad \text{where tau = shear stress}$$

μ = dynamic viscosity

$\frac{\partial V}{\partial n}$ = Velocity gradient in direction of surface normal

Hints: To compute fluid shear stress:

1. Use gradient function on velocity to obtain “Velocity Grad” variable in the 3D part(s) of interest.
2. Use clip option (through the 3D part(s) used in 1.) to obtain a surfaceon which you wish to see the fluid shear stress.
3. Compute Fluid Shear variable (on the 2D clip surface of 2.)

Fluid Shear Stress Max *FluidShearMax* (3D part(s), velocity, density, turbulent kinetic energy, turbulent dissipation, laminar viscosity)

Computes a scalar variable Σ defined as:

$$\Sigma = F/A = (u_t + u_l)E \qquad \text{where } F = \textit{force}$$

A = *unit area*

u_t = *turbulent (eddy) viscosity*

u_l = *laminar viscosity (treated as a constant)*

E = *local strain*

The turbulent viscosity u_t is defined as:

$$u_t = \frac{\rho 0.09\kappa^2}{\varepsilon} \qquad \text{where } \rho = \textit{density}$$

κ = *turbulent kinetic energy*

ε = *turbulent dissipation*

A measure of local strain *E* (i.e. local elongation in 3 directions) is given by

$$E = \sqrt{(2tr(D \cdot D))} \qquad \text{where}$$

$$2tr(D \cdot D) = 2((d_{11})^2 + (d_{22})^2 + (d_{33})^2) + ((d_{12})^2 + (d_{13})^2 + (d_{23})^2)$$

given the *Euclidean norm* defined by

$$tr(D \cdot D) = (d_{11})^2 + (d_{22})^2 + (d_{33})^2 + \frac{1}{2}((d_{12})^2 + (d_{13})^2 + (d_{23})^2) \quad ;$$

and the rate of deformation tensor *dij* defined by

$$D = [d_{ij}] = \frac{1}{2}\begin{bmatrix} 2d_{11} & d_{12} & d_{13} \\ d_{21} & 2d_{22} & d_{23} \\ d_{31} & d_{32} & 2d_{33} \end{bmatrix}$$

with $d_{11} = {}^1u/{}^1x$

$d_{22} = {}^1v/{}^1y$

$d_{33} = {}^1w/{}^1z$

$d_{12} = {}^1u/{}^1y + {}^1v/{}^1x = d_{21}$

$d_{13} = {}^1u/{}^1z + {}^1w/{}^1x = d_{31}$

$d_{23} = {}^1v/{}^1z + {}^1w/{}^1y = d_{32}$

given the strain tensor e_{ij} defined by $e_{ij} = \frac{1}{2}d_{ij}$

Force *Force*(2D part(s), pressure)

Computes a vector variable whose value is the force F defined as:

$$F = pA$$

where p = pressure (a scalar variable)
A = unit area

Note: The force acts in the surface normal direction.

Gradient *Grad* (any part(s), scalar or vector)

Computes a vector variable whose value is the gradient $GRAD_f$ defined as:

$$GRAD_f = \frac{\partial f}{\partial x}\hat{i} + \frac{\partial f}{\partial y}\hat{j} + \frac{\partial f}{\partial z}\hat{k}$$

where f = any scalar variable (or the magnitude of the specified vector)
x, y, z = coordinate directions
i, j, k = unit vectors in coordinate directions

Gradient Approximation *GradApprox* (any part(s), scalar or vector)

Same as Gradient, except all elements are first subdivided into triangles (for 2D) or tetrahedrons (for 3D) and a closed-form solution is done on the subdivided element's nodal values (only applicable for per node variables). This is basically a quicker, linear approximation of the regular gradient.

Gradient Tensor *GradTensor* (2D or 3D part(s), vector)

Computes a tensor variable whose value is the gradient $GRAD_F$ defined as:

$$GRAD_F = \frac{\partial F}{\partial x}\hat{i} + \frac{\partial F}{\partial y}\hat{j} + \frac{\partial F}{\partial z}\hat{k}$$

where F = any vector variable
x, y, z = coordinate directions
i, j, k = unit vectors in coordinate directions

Gradient Tensor Approximation *GradTensorApprox* (any part(s), vector)

Same as Gradient Tensor, except all elements are first subdivided into triangles (for 2D) or tetrahedrons (for 3D) and a closed-form solution is done on the subdivided element's nodal values (only applicable for per node variables). This is basically a quicker, linear approximation of the regular gradient tensor.

Helicity:

Helicity Density *HelicityDensity*(any part(s), velocity)

Computes a scalar variable H_d whose value is:

$$H_d = V \bullet \Omega$$

where: V = Velocity
Ω = Vorticity

Relative **Helicity** *HelicityRelative*(any part(s), velocity)

Computes a scalar variable H_r whose value is:

$$H_r = cos\ \phi = \frac{V \bullet \Omega}{|V||\Omega|}$$

where: ϕ = the angle between the velocity vector and the vorticity vector.

Filtered Relative **Helicity**

HelicityRelFilter(any part(s), velocity, freestream velocity magnitude).

Computes a scalar variable H_{rf} whose value is:

$$H_{rf} = H_r \quad \text{, if } |H_d| \geq filter$$

or $$H_{rf} = 0 \quad \text{, if } |H_d| < filter$$

where H_r = relative helicity (as described above)

H_d = helicity density (as described above)

$filter = 0.1(V_\infty)^2$

Iblanking Values *IblankingValues* (any structured iblanked part(s))

Computes a scalar variable whose value is the iblanking flag of selected parts.

Integrals:

Line **Integral** *IntegralLine* (1D part(s), scalar or (vector component or magnitude))

Computes a constant variable whose value is the integral of the input variable over the length of the specified 1D part(s).

Surface **Integral** *IntegralSurface* (2D part(s), scalar or (vector component or magnitude))

Computes a constant variable whose value is the integral of the input variable over the surface of the specified 2D part(s).

Volume **Integral** *IntegralVolume* (3D part(s), scalar or (vector component or magnitude))

Computes a constant variable whose value is the integral of the input variable over the volume of the specified 3D part(s).

Length *Length* (any 1D part(s))

Computes a constant variable whose value is the length of selected parts. While any part can be specified, it will only return a nonzero length if the part has 1D elements.

Line Integral See Line Integral under **Integrals**.

Mach Number *Mach* (any part(s), density, total energy, velocity, ratio of specific heats)

Computes a scalar variable whose value is the Mach number M defined as:

$$M = \frac{u}{\sqrt{\frac{\gamma p}{\rho}}} = \frac{u}{c}$$

where m = momentum

ρ = density

u = speed, computed from velocity input.

γ = ratio of specific heats (1.4 for air)

p = pressure (see *Pressure* below)

c = speed of sound

See Total Energy in this section for a description.

Make Vector *MakeVect* (any part(s), scalar, scalar, scalar or zero)

Computes a vector variable formed from scalar variables. First scalar becomes the X component of the vector, second scalar becomes the Y component, and the third scalar becomes the Z component. A zero can be specified for the third scalar, creating a 2D vector.

Mass-Flux Average *MassFluxAvg* (any part(s), scalar, velocity, density)
Computes a constant variable whose value is the mass flux average b_{avg} defined as:

$$bavg = \frac{\int_A \rho b (V \bullet N) dA}{\int_A \rho (V \bullet N) dA} = \frac{MassFluxOfScalar}{MassFlux} = \frac{Flow(plist, b\rho V)}{Flow(plist, \rho V)}$$

where b = any scalar variable, i.e. pressure, mach, a vector component, etc.
ρ = density (constant or scalar) variable
V = velocity (vector) variable
dA = area of some 2D domain
N = unit vector normal to dA

Max *Max* (any part(s), scalar or vector, component)
Computes a constant variable whose value is the maximum value of the scalar (or vector component) in the parts selected. The component is not requested if a scalar is selected.

Min *Min* (any part(s), scalar or vector, component)
Computes a constant variable whose value is the minimum value of the scalar (or vector component) in the parts selected.

Moment *MomentBasedOnCurrentCursorToolLocation* (any part(s), vector, component).
Computes a constant variable whose value is the *x*, *y*, or *z* component of Moment M.

$$M_x = \Sigma(F_y d_z - F_z d_y)$$

$$M_y = \Sigma(F_z d_x - F_x d_z)$$

$$M_z = \Sigma(F_x d_y - F_y d_x)$$

where F_i = force vector component in direction *i* of vector *F*(x,y,z)
= (Fx,Fy,Fz)
d_i = signed moment arm (the perpendicular distance from the line of action of the vector component F_i to the moment axis (or cursor tool position)).

Momentum *Momentum*(any part(s), velocity, density).
Computes a scalar variable *m*, which is:

$$m = \rho V$$

where ρ = density
V = velocity

Node to Element *NodeToElem* (any part(s), node based variable).
Averages a node based variable to produce an element based variable.

Normal *Normal* (2D part(s))
Computes a vector variable which is the normal to the surface at each node.

Normal Constraints

NormC (2D or 3D part(s), pressure, velocity, viscosity)

Computes a constant variable whose value is the Normal Constraints *NC* defined as:

$$NC = \int_S \left(-p + \mu \frac{\partial V}{\partial n}\hat{n}\right) dS$$

where p = pressure
V = velocity
μ = dynamic viscosity
n = direction of normal
S = border of a 2D or 3D domain

Normalize Vector

NormVect (any part(s), vector)

Computes a vector variable whose value is a unit vector U of the given vector V.

$$U = \frac{V(V_x, V_y, V_z)}{\|V\|}$$

where: V = vector variable field

$$\|V\| = \sqrt{V_x^2 + V_y^2 + V_z^2}$$

Offset Variable

OffsetVar(2D or 3D part(s))

Computes a scalar (or vector) variable defined as the offset value into the field of that variable that exists in the normal direction from the boundary of the part.

Pressure

Pres (any part(s), density, total energy, velocity, ratio of specific heats)

Computes a scalar variable whose value is the pressure p defined as:

$$p = (\gamma - 1)\rho\left(\frac{E}{\rho} - \frac{1}{2}V^2\right)$$

where: m = momentum
E = total energy per unit volume
ρ = density
V = velocity = m/ρ
γ = ratio of specific heats (1.4 for air)

Pressure Coefficient

PresCoef (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound, freestream velocity magnitude)

Computes a scalar variable which is Pressure Coefficient C_P defined as:

$$C_P = \frac{p - p_i}{\frac{\rho_i V_i}{2}}$$

where: p = pressure
p_i = freestream pressure
ρ_i = freestream density
V_i = freestream velocity magnitude

Dynamic **Pressure**

PresDynam (any part(s), density, velocity)

Computes a scalar variable which is Dynamic Pressure q defined as:

$$q = \frac{\rho V^2}{2}$$

where: ρ = density
V = velocity magnitude

See also: Kinetic Energy

Normalized **Pressure**

PresNorm (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound)

Computes a scalar variable which is Normalized Pressure p_n defined as:

$$p_n = p/p_i$$

where: p_i = freestream pressure = $1/\gamma$

γ = ratio of specific heats

p = pressure

Log of Normalized **Pressure**

PresLogNorm (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound)

Computes a scalar variable which is the natural log of Normalized Pressure defined as: $ln p_n = ln(p/p_i)$

where: p_i = freestream pressure = $1/\gamma$

γ =ratio of specific heats

p = pressure

Stagnation **Pressure**

PresStag (any part(s), density, total energy, velocity, ratio of specific heats)

Computes a scalar variable which is the Stagnation Pressure p_o defined as:

$$p_o = p\left(1 + \left(\frac{\gamma - 1}{2}\right)M^2\right)^{(\gamma/(\gamma - 1))}$$

where: p = pressure

γ = ratio of specific heats

M = mach number

Normalized Stagnation **Pressure**

PresNormStag (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound, freestream velocity magnitude)

Computes a scalar variable which is Normalized Stagnation Pressure p_{on}

defined as: $p_{on} = p_o/p_{oi}$

where: p_o = stagnation pressure

p_{oi} = freestream stagnation pressure

Stagnation **Pressure** Coefficient

PresStagCoef (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound, freestream velocity magnitude)

Computes a scalar variable which is Stagnation Pressure Coefficient C_{p_o}

defined as: $C_{p_o} = (p_o - p_i)/\left(\frac{\rho_i V^2}{2}\right)$

where: p_o = stagnation pressure

p_i = freestream pressure = $1/\gamma$

γ = ratio of specific heats

ρ_i = freestream density

V = velocity magnitude

Pitot **Pressure**

PresPitot (any part(s), density, total energy, velocity, ratio of specific heats)
Computes a scalar variable which is Pitot Pressure p_p defined as:

$$p_p = sp$$

$$s = \frac{\frac{\gamma+1}{2}\left(\frac{V^2}{\gamma(\gamma-1)\left(\frac{E}{\rho}-\frac{V^2}{2}\right)}\right)^{(\gamma/(\gamma-1))}}{\left(\left(\left(\frac{2\gamma}{\gamma+1}\right)\left(\frac{V^2}{\gamma(\gamma-1)\left(\frac{E}{\rho}-\frac{V^2}{2}\right)}\right)\right)-\left(\frac{\gamma-1}{\gamma+1}\right)\right)^{(1/(\gamma-1))}}$$

where γ = ratio of specific heats
E = total energy per unit volume
ρ = density
V = velocity magnitude
p = pressure

Note: For mach numbers less than 1.0, the Pitot Pressure is the same as the Stagnation Pressure. For mach numbers greater than or equal to 1.0, the Pitot Pressure is equivalent to the Stagnation Pressure behind a normal shock.

Pitot **Pressure** Ratio

PresPitotRatio (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound)
Computes a scalar variable which is Pitot Pressure Ratio p_{pr} defined as:

$$p_{pr} = s(\gamma-1)\left(E-\frac{\rho V^2}{2}\right)$$

where s = (defined above in Pitot Pressure)
γ = ratio of specific heats
E = total energy per unit volume
ρ = density
V = velocity magnitude

Total **Pressure**

PresT (any part(s), pressure, velocity, density)
Computes a scalar variable whose value is the total pressure p_t defined as:

$$p_t = p + \rho\left(\frac{V^2}{2}\right)$$

where ρ = density
V = velocity
p = pressure

Rectangular To Cylindrical Vector

RectToCyl (any part(s), vector)
Produces a vector variable with cylindrical components according to frame 0. (Intended for calculation purposes)
x = radial component, y = tangential (theta) component, z = z component

Shock Plot3d *ShockPlot3d*(2D or 3D part(s), density, total energy, velocity, ratio of specific heats).
computes a scalar variable *ShockPlot3d*, whose value is:

$$ShockPlot3d = \frac{V}{c} \bullet \frac{grad(p)}{|grad(p)|}$$

where V = velocity
c = speed of sound
p = pressure
grad(p) = gradient of pressure

Spatial Mean *SpaMean* (any part(s), scalar or vector, component)
Computes a constant variable whose value is the mean value of a scalar (or vector component) at the current time. This value can change with time. The component is not requested if a scalar variable is used.

Speed *Speed* (any part(s), velocity)
Computes a scalar variable whose value is the Speed defined as:

$$Speed = \sqrt{u^2 + v^2 + w^2}$$

where: *u,v,w* = velocity components in the x,y,z directions.

Sonic **Speed** *SonicSpeed*(any part(s), density, total energy, velocity, ratio of specific heats).
Computes a scalar variable c, whose value is:

$$c = \sqrt{\frac{\gamma p}{\rho}}$$

where γ = ratio of specific heats
ρ = density
p = pressure

Stream Function *Stream Function* (any 2D part(s), velocity, density)
Computes a scalar variable whose value is the Stream Function Ψ defined as:

$$\psi = -vdx + udy$$

where: *u,v* = velocity components in X, Y directions

Surface Integral See Surface Integral under **Integrals**.

Computes a constant variable whose value is the integral of the input variable over the surface of the specified 2D part(s).

Swirl *Swirl*(any part(s), density, velocity).
Computes a scalar variable *Swirl*, whose value is:

$$Swirl = \frac{\Omega \bullet V}{\rho V^2}$$

where: Ω = vorticity
ρ = density
V = velocity

Temperature *Temperature* (any part(s), density, total energy, velocity, ratio of specific heats, gas constant)

Computes a scalar variable whose value is the temperature T defined as:

$$T = \frac{\gamma - 1}{R}\left(\frac{E}{\rho} - \frac{1}{2}V^2\right)$$

where:
m = momentum
E = total energy per unit volume
ρ = density
V = velocity = m/ρ
γ = ratio of specific heats (1.4 for air)
R = gas constant

Normalized **Temperature** *TemperNorm* (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound, gas constant)

Computes a scalar variable which is Normalized Temperature T_n defined as:

$$T_n = \frac{T}{T_i}$$

where:
T = temperature
T_i = freestream temperature

Log of Normalized **Temperature** *TemperLogNorm* (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound, gas constant)

Computes a scalar variable which is the natural log of Normalized Temperature

defined as: $\ln T_n = \ln(T / T_i)$

where:
T = temperature
T_i = freestream temperature

Stagnation **Temperature** *TemperStag* (any part(s), density, total energy, velocity, ratio of specific heats, gas constant)

Computes a scalar variable which is the Stagnation Pressure T_o

defined as: $T_o = T\left(1 + \left(\frac{\gamma - 1}{2}\right)M^2\right)$

where:
T = temperature
γ = ratio of specific heats
M = mach number

Normalized Stagnation **Temperature** *TemperNormStag* (any part(s), density, total energy, velocity, ratio of specific heats, freestream density, freestream speed of sound, freestream velocity magnitude, gas constant)

Computes a scalar variable which is Normalized Stagnation Temperature T_{on}

defined as: $T_{on} = T_o / T_{oi}$

where:
T_o = stagnation temperature
T_{oi} = freestream stagnation temperature

Temporal Mean *TempMean* (any part(s), scalar or vector, time1, time2)

Computes a scalar or vector variable, depending on which type was selected, whose value is the mean value at each node of a scalar or vector variable over the interval from time1 to time2. Thus, the resultant scalar or vector is independent of time.

Tensor:

Tensor Component

Tensor-Component(any part(s), tensor, row, col)
Creates a scalar variable which is the specified row and column of a tensor variable.

S = Tij

i = given row (1 to 3)
j = given column (1 to 3)

Tensor Determinate

Tensor-Determinant(any part(s), Tensor or 3 Principals or 6 Tensor Components)
Computes the determinate of a tensor variable. The tensor may be specified as either a tensor, three principal values or six tensor components. If the three tensor components are given they must be given in the order:
T11, T22, T33, T12, T13,T23.

Tensor Eigenvalue

Tensor-Eigenvalue(any part(s), tensor, number)
Computes the number (1-3) eigenvalue of the given tensor. The first eigenvalue is always the largest, while the third eigenvalue is always the smallest.

Tensor Eigenvector

Tensor-Eigenvector(any part(s), tensor, number)
Computes the number (1-3) eigenvector of the given tensor.

Tensor Make

Tensor-Make(any part(s), T11, T22, T33, T12, T13, T23)
Create a tensor from six scalars.

Tensor Tresca

Tensor-Tresca(any part(s), Tensor or 3 Principals or 6 Tensor Components)
Computes Tresca stress/strain from a tensor variable. The tensor may be specified as either a tensor, three principal values or six tensor components. If the three tensor components are given they must be given in the order:
T11, T22, T33, T12, T13, T23.

Tensor Von Mises

TensorVonMises(any part(s), Tensor or 3 Principals or 6 Tensor Components)
Computes Von Mises stress/strain from a tensor variable. The tensor may be specified as either a tensor, three principal values or six tensor components. If the three tensor components are given they must be given in the order:
T11, T22, T33, T12, T13, T23.

Velocity

Velo (any part(s), momentum, density)
Computes a vector variable whose value is the velocity V defined as:

$$V = \frac{m}{\rho}$$

where ρ = density
m = momentum

Volume

Vol (3D part(s))
Computes a constant variable whose value is the volume of 3D parts.

Volume Integral

See Volume Integral under **Integrals**.

Vorticity

Vort (any 2D or 3D part(s), velocity)
Computes a vector variable with components ζ_x , ζ_y , ζ_z defined as:

$$\zeta_x = \frac{\partial w}{\partial y} - \frac{\partial v}{\partial z} \qquad \zeta_y = \frac{\partial u}{\partial z} - \frac{\partial w}{\partial x} \qquad \zeta_z = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}$$

where u, v, w = velocity components in the X, Y, Z directions.

Math

Math functions use the syntax: function (value *or expression*). All angle arguments are in radians. When you select a math function from the list, the function name and the opening "(" appears in the Working Expression for you. However, after defining the argument(s) for the function, you have to manually provide a closing ")". The Math functions include:

SIN(radian value) sine = constant
COS(radian value) cosine = constant
TAN(radian value) tangent = constant
ASIN(radian value) arcsine = constant
ACOS(radian value) arccosine = constant
ATAN(radian value) arctangent = constant
*LOG(*value*)* ln = constant
SQRT(value) square root = constant
ABS(value) absolute value = constant
RMS(vector) root-mean-square (magnitude) = scalar
CROSS(vector, vector) cross product = vector
DOT(vector, vector) dot product = scalar
*EXP(*value*)* e^{value} = constant
*LOG10(*value*)* $\log_{10}$ = constant

Active Variables

Selection list of all variables which are active and therefore available for use in Expressions. You activate variables in the Feature Detail Editor Variables List.

Feedback

This area displays interactive guidance when you select a General function, including detailed instructions concerning the function's arguments.

Okay

Click this button when so prompted by the Feedback instructions. It basically signals the completion of various intermediate tasks for general functions.

Calculator

This on-screen calculator can usually be used in place of typing on your keyboard.

Button	Function
0 to 9	number digits
.	decimal
e	e for exponential notation
+	plus operator
–	minus operator
*	multiplication operator
/	division operator
^	exponentiation operator
PI	value for ¼
(	opening parentheses. For function arguments and general grouping
)	closing parentheses. For function arguments and general grouping
[	opening brackets. For components and node/element numbers
]	closing brackets. For components and node/element numbers
[X]	X component
[Y]	Y component
[Z]	Z component

(see How To Create New Variables)

5 GUI Overview

The Graphical User Interface for EnSight 7 has undergone a number of improvements. These changes are not revolutionary in nature as compared to the EnSight 6 interface, but are refinements intended to increase, even more, the ease of use of EnSight. For example, the need for scrolling has been greatly reduced, tool toggles are on the desktop, and some of the advanced modes are off by default. Our experience has shown that current users of EnSight 6 have no difficulty in running EnSight 7. The interface has been designed to allow the user to access most commonly needed capabilities at the desktop level.

The purpose of this Chapter is to provide a brief overview of the EnSight 7 GUI.

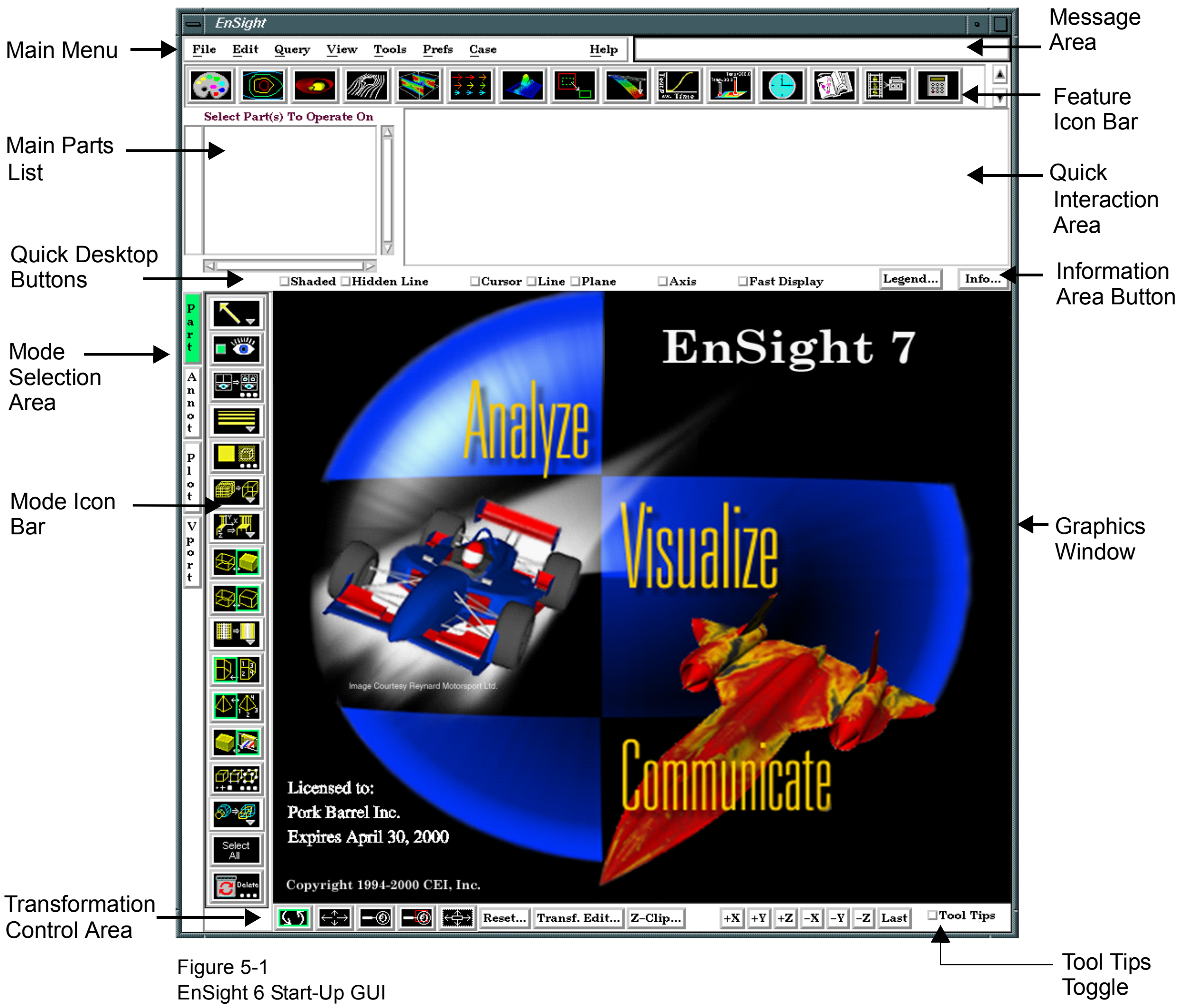


Figure 5-1
EnSight 6 Start-Up GUI

When EnSight first comes up, the Graphical User Interface should appear approximately as shown. The different sections of the GUI are used for specific purposes.

Main Menu

In addition to providing access to high-level features such as Command File Creation/Editing/Reading, Results Data Reading, File Printing, Saving/Restoring a session, and Quitting, the Main Menu provides access to often-used postprocessing features such as editing, querying variable data, part appearance adjustment, and tool visibility.

Chapter 6 contains a complete description of each section of the Main Menu.
(see Chapter 6, Main Menu)

Main Parts List

The Main Parts List contains the descriptions of all parts that have been read in from your results data (model parts) or created within EnSight (created parts). Displayed are a part number, a part symbol, a case number, and a part description.

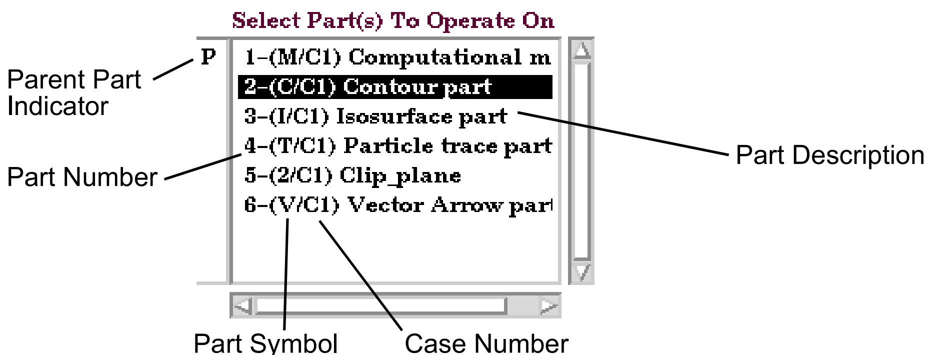


Figure 5-2
Main Parts List

You will find sub-sets of this Main Parts List in the Feature Detail Editor for each type of part. For example, the Feature Detail Editor (Isosurface) will contain a parts list of only isosurface parts.

For a complete description of the Main Parts List as well as a detailed discussion about Part selection, editing, and operations thereon:
(see Section 3.1, Part Overview)

Feature Icon Bar

This Icon Bar provides rapid access to color assignment, new part creation, part displacement, 2D plot creation, data querying, time step control, flipbook animation and keyframe animation. Clicking once on an icon opens its associated editor in the Quick Interaction Area.

Double clicking on the Color icon will open the Feature Detail Editor for Variables. Double clicking on a new part creation Icon (contours, isosurfaces, particle traces, clips, vector arrows, elevated surfaces, profiles, developed surfaces) will open the Feature Detail Editor for that type of created part.

Chapter 7 contains a detailed explanation of the features in the Quick Interaction Area which are available through each of the Icons.
(see Chapter 7, Features)

Mode Selection Area

The Mode Selection Area contains four to six buttons which allow you to choose which of the “Modes” you wish to work in. The Mode selected will not only determine which icons you see in the Mode Icon Bar but also the way in which you work within the Graphics Window, The six possible Modes are:

- **View Mode** for the specification of how you wish to “view” parts and their labels. *By default this mode is not displayed. The most common uses of this mode are on the desktop. If needed, this mode can be turned on under Edit > Preferences... Graphical User Interface - View Mode Allowed.*

- **Annot Mode** for the addition and editing of annotation lines, text, and logos to the Graphics window as well as the editing of Variable legends
- **VPort Mode** for the creation and control of additional viewports within the Graphics Window
- **Part Mode** for the specification of attributes for specific parts
- **Plot Mode** for the creation and specification of attributes for 2D Variable plots
- **Frame Mode** for the creation and specification of attributes for additional frames of reference within EnSight. *By default this mode is not displayed. If needed, this mode can be turned on under Edit > Preferences... Graphical User Interface - Frame Mode Allowed.*

Chapter 8 contains a detailed explanation of the features available and the differences between the six modes.
(see Chapter 8, Modes)

Mode Icon Bar

The vast majority of editing features available in EnSight are divided into six different groups and are accessible through the Mode Icon Bar. The set of Icons you see at any time are determined by which Mode has been selected in the Mode Selection Area.

The various Mode Icon Bars can be customized by the user:

See Preferences... in Section 6.2, Edit Menu Functions)

Chapter 8 contains a detailed explanation of the features available and the differences between the six modes.
(see Chapter 8, Modes)

Transformation Area

This area determines how you will transform Parts within the Graphics Window and also provides quick access to the Transformations Editor for precise control of transformations. Buttons have been added which allow for quick viewing down any of the major axes.

Chapter 9 contains a detailed description of the features in the Transformation Area.
(see Chapter 9, Transformation Control)

Message Area

This area provides feedback on what EnSight is doing. If you are using Transient data, this area will indicate which time step is currently in use.

Information Area Button

This button will bring up a dialog which will display any output that EnSight generates. When no new information is in the area, the button will be the typical interface color. When new information has been placed in the area, the button will be green in color. If warning information has been placed in the area, it will be yellow in color. If error information has been placed in the area, it will be red in color.

Quick Interaction Area	This area provides quick access to the features associated with each of the Icons in the Feature Icon Bar. Chapter 7 contains a detailed explanation of the features in the Quick Interaction Area which are available through each of the Icons. (see Chapter 7, Features)
Quick Desktop Buttons	This area contains some very commonly used toggles, such as the shading and tools.
Graphics Window	This area shows the model using the current display attributes. You perform all interactive transformations in the Graphics Window.
Tool Tips Toggle	This toggles on/off the Tool Tips (balloon help) for most icons. This option is useful for new users, but it is on the Desktop so experienced users can easily turn it off. (It's state is a part of the user's preferences - so it is remembered from session to session.)

GUI Conventions

The EnSight graphical user interface (GUI) uses the OSF/Motif toolkit for menus, dialogs, buttons, and other interface components. This section provides Motif specific information, as well as a quick introduction to some of the features of EnSight interface components.

Motif Window Manager

The Motif Window Manager (mwm) is commonly used on workstations supporting Motif. Its use is recommended with EnSight. Although not required, the following values for mwm resources are strongly recommended:

```
Mwm*focusAutoRaise: false
Mwm*keyboardFocusPolicy: pointer
```

Without the first setting, windows may raise automatically when the mouse is moved into a window (which is very distracting). The second setting causes windows to be active (accept input) when the cursor is in the window, even if the window is partially obscured or has not been selected. These and other mwm resources are set in the appropriate X session resource file. See a local X Windows expert if you don't know where this file resides. See the references at the end of this chapter for more information on Motif, mwm, and X Windows.

NOTE: The resources above prefixed with Mwm are specific to the Motif Window Manager. If you are using a different window manager consult your Systems Administrator for the equivalent settings. For instance, EnSight has been tested and performs as described herein on the 4Dwm and CDE window managers.

Interface Components

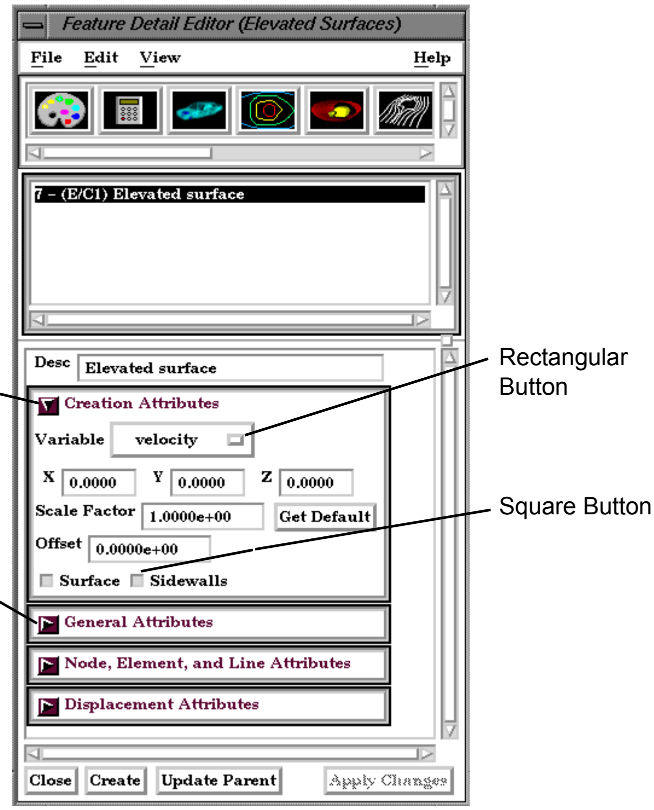
The EnSight GUI uses menus and dialogs that utilize and expand upon established OSF/Motif conventions. This section provides some general information on the operation of EnSight dialogs, menus, lists, buttons, and text fields.

Dialogs

A dialog is a window that groups interface components based on function. Dialogs are typically opened by making selections from a menu. Menu selections that open dialogs always end with "...". Most EnSight dialogs can be opened and closed independently. In order to optimize scarce workstation screen real estate, you should close dialogs that are not in use.

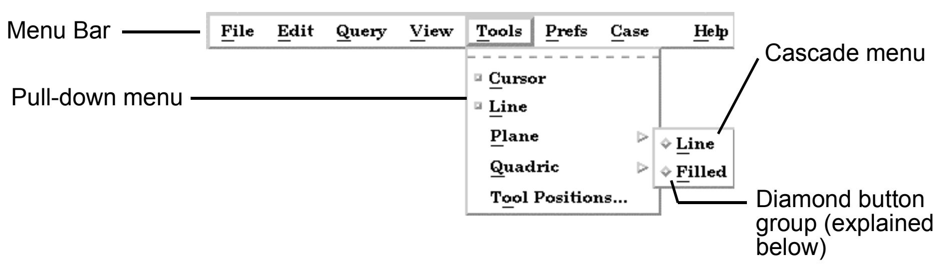
Dialogs typically consist of buttons, menus, lists, and areas to type in. Many EnSight dialogs also have expandable sections that let you hide parts of the interface that you use infrequently. Each expandable section consists of an indicator button, a section title, and the contents of the section. The indicator button and the section title are always visible. If the section is open, the contents are visible as well.

The indicator button is a toggle switch for opening and closing the section. A down pointing arrow button indicates an open section. Clicking the arrow will close the section. A right pointing arrow indicates a closed section. Clicking the arrow will open the section. These indicators are referred to as turndown buttons.



Menus

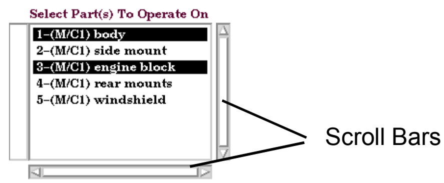
The EnSight documentation uses the following terms to describe various types of menus.



Menu Bar	A horizontal strip across the top of some dialogs listing menu titles.
Pull-down menu	A pull-down menu is one accessed directly from a menu bar.
Cascade menu or submenu	A submenu is accessed from another menu selection. Submenu selections are indicated by a right-pointing arrow.
Pop-up menu	A pop-up menu is accessed by pressing the associated rectangular button. The current selection from the menu always appears as the button title. (An example is the rectangular button labeled “PRESSURE” beside the word Variable shown above in the Feature Detail Editor.)

Lists

EnSight provides access to the list of Model and Created Parts as well as Original and Created Variables through the Main Parts List and the Main Variables List as well as the sub-lists available in the various Feature Detail Editors. These lists are presented as scrollable sections. Various mechanisms are used to select items from a list for further action:



Select (or single-click)	Place the mouse cursor over the item and click the left mouse button. The item is highlighted to reflect the "selected" state.
Select-drag	Place the mouse cursor over the first item. Click and hold the left mouse button as you drag over the remaining items to be selected. Only contiguous items may be selected in this fashion.
Shift-click	Place the mouse cursor over the item. Depress the shift key and click the left mouse button. This action will extend a selection to include all those items sequentially listed between the previous selection and this one.
Control-click	Place the mouse cursor over the item. Depress the control key and click the left mouse button. This action will extend a selection by adding the new item, but not those in-between. Use this mechanism to build a non-contiguous selection.
Double-click	Place the mouse cursor over the item and click the left mouse button twice in rapid succession.

Buttons

EnSight uses the following kinds of buttons:

Rectangular	Place the mouse cursor in the button area and click the left mouse button. Rectangular buttons typically access the function described in the label. If the label is followed by "..." then the button opens another dialog. (Example shown above.)
Arrow	Place the mouse cursor in the button area and click the left mouse button. Arrow buttons typically have an associated text field. Clicking the button increments or decrements the text field value. (Example shown above.)
Diamond	Place the mouse cursor in the button area and click the left mouse button. Diamond buttons (also called radio buttons) are toggles that select an item from a mutually exclusive list. Exactly one diamond button of a group can be on at any given time. (Example shown above.)

Square — Place the mouse cursor in the button area and click the left mouse button. Square buttons are toggles that access the function indicated by the label (Example shown above.).

Text Fields

EnSight utilizes three types of text fields:

Information Text Fields — These text fields are used to report information and cannot be edited by the user. Information text fields are surrounded with a single pixel border.

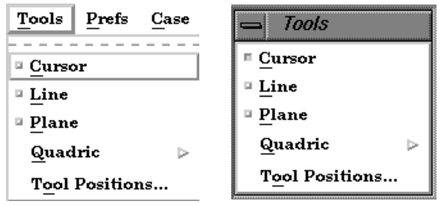
Editable Text Fields — Place the mouse cursor in the text field and click to insert a blinking insertion cursor. Several techniques are available to accelerate text editing. Select a single word by double-clicking or the entire string by triple-clicking. Selected text is replaced by subsequent typing. The left and right arrow keys (on most systems) will move the insertion cursor. EnSight does not recognize the change in the text field until you press Return.

Where appropriate, EnSight recognizes the following shortcut specifications for UNIX directories:

`~/`	Expands to your home directory
`~username/`	Expands to the home directory of `username`
`./`	Expands to the current working directory
`../`	Expands to the parent directory of the current working directory

Tear-Off Menus

If your window system allows it, the EnSight user interface supports "tear-off" menus. Judicious use of tear-off menus can provide custom, rapid access to frequently used functions. To use tear-off menus:



Select (or single-click)	Place the mouse cursor over a pulldown menu button, then click and release the left mouse button. This operation will open the pulldown menu.
Tear off	Move the mouse cursor to the dotted lines on the menu, and again click and release the left mouse button. This will "tear off" the pulldown into a separate window which can be placed anywhere on the screen.
Closing a tear-off	A tear-off menu can be closed by selecting Close from the tear-off window's frame menu which is accessed clicking on the button in the upper left of the dialog frame.
Dialog Control	The window manager will normally allow you to control some basic functions (Restore, Move, Raise, Lower, Close) by clicking-holding the right mouse button on a dialog or window border.

References

The following books provide more information on various aspects of OSF/Motif, X Windows and the Motif Window Manager.

Kobara, Shiz, Visual Design with OSF/Motif, Addison-Wesley Publishing Co., Reading, MA, 1991.

Berlage, Thomas, OSF/Motif: Concepts and Programming, Addison-Wesley Publishing Co., Wokingham, England, 1991.

Heller, Dan, Motif Programming Manual (for OSF/Motif Version 1.1), X Window System, Vol. 6, O'Reilly & Associates, Inc., 1991.

Open Software Foundation, OSF/Motif Programmer's Guide, Revision 1.2, and OSF/Motif Programmer's Reference Revision 1.2, P T R Prentice-Hall, Inc., Englewood Cliffs, NJ, 1993.

Quercia, Valerie and O'Reilly, Tim, "Appendix C: The OSF/Motif Window Manager," in X Window System User's Guide (Volume Three) O'Reilly & Associates, Inc., Sebastopol, CA, 1990.

6 Main Menu

This chapter describes the functions available from the Main Menu.

Figure 6-1
EnSight Main Menu

Section 6.1, File Menu Functions

Section 6.2, Edit Menu Functions

Section 6.3, Query Menu Functions

Section 6.4, View Menu Functions

Section 6.5, Tools Menu Functions

Section 6.6, Case Menu Functions

Section 6.7, Help Menu Functions

6.1 File Menu Functions

Clicking the File button in the Main Menu opens a pull-down menu which provides access to capabilities which enable you to record and play command files, connect the EnSight Client process to an EnSight Server process, read data into the EnSight Server, load parts, print and save images, save and restore an archive file, and quit from EnSight.

File Pull-down Menu

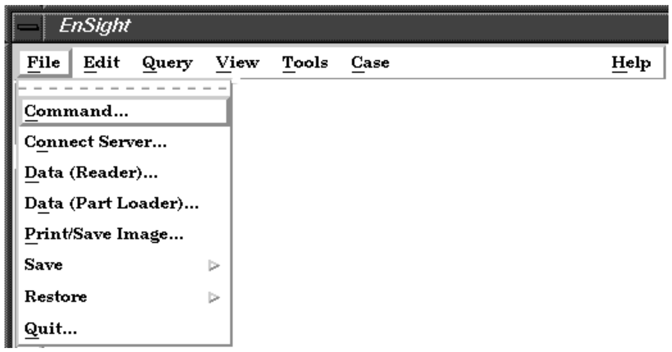


Figure 6-2
File pull-down menu

Command

Opens the Command dialog which is used to record and play Command Files
Access: Main Menu > Command...

(see Section 2.4, Command Files and How To Record and Play Command Files)

Connect Server

Opens the Connect Server dialog which is used to perform an Auto or Manual connection from the EnSight Client process to an EnSight Server process.
Access: Main Menu > Connect...

For a complete description of the Connection process:

(see How To Connect Automatically)

Data (Reader)

Opens the File Selection dialog which is used to specify files you wish to read into EnSight.
Access: Main Menu > Data (Reader)...

(see Reading and Loading Data Basics, in Section 2.1 and How To Read Data)

Data (Part Loader)

Opens the Data Part Loader dialog which is used to load parts into EnSight.
Access: Main Menu > Data (Part Loader)...

(see Reading and Loading Data Basics, in Section 2.1 and How To Read Data)

Print/Save Image

Opens the Print/Save Image dialog which is used to print or save images from EnSight.
Access: Main Menu > Print/Save Image...

(see Section 2.10, Saving and Printing Graphic Images and How To Print/Save an Image)

Save Opens a pull-down menu which allows you to choose between the following Save options: Context, Full Backup or Geometric Entities.
Access: Main Menu > File > Save

Context... Opens the Save Current Context dialog where you can specify the name of a context file to be created. This file saves information needed to reproduce the same basic imagery on a different set of data.
Access: Main Menu > File > Save > Context...

(See How To Save or Restore a Context File)

Full Backup Opens the Save Full Backup Archive dialog which is used to save an entire session as an Archive file which can later be used to restore EnSight to the same condition present when the Archive file was made.
Access: Main Menu > File > Save > Full Backup

(see Section 2.5, Archive Files and How To Save and Restore an Archive)

Geometric Entities Opens the Save Geometric Entities Dialog which is used to save geometric information from EnSight, either EnSight Gold or VRML format.
Access: Main Menu > File > Save > Geometric Entities

(see Section 2.8, Saving Geometry and Results Within EnSight and How To Save Geometric Entities)

Scenario... Opens the Save Scenario dialog where you can create a scenario file which can be viewed by CEI's EnLiten product. EnLiten can display any scene created with EnSight and can be run standalone or be embedded in Microsoft applications.
Access: Main Menu > File > Save > Scenario...

(See How To Save Scenario)

Restore Opens a pull-down menu which allows you to choose between the following Restore options: Context or Full Backup. stored archive file.
Access: Main Menu > File > Restore

Context... Opens the File Selection dialog where you can specify the name of a context file to be applied. First read in your data, then restore the context. This will do its best to create the same basic imagery (as that when the context file was saved) to your current model.
Access: Main Menu > File > Restore > Context...

(See How To Save or Restore a Context File)

Full Backup Opens the Save Full Backup Archive dialog which is used to save an entire session as an Archive file which can later be used to restore EnSight to the same condition present when the Archive file was made.
Access: Main Menu > File > Restore > Full Backup

(see Section 2.5, Archive Files and How To Save and Restore an Archive)

Quit Opens the Quit Confirmation dialog which allows you to save a command file or/and an archive file before exiting EnSight.
Access: Main Menu > Quit...

(see Section 2.5, Archive Files)

6.2 Edit Menu Functions

Clicking the Edit button in the Main Menu opens a pull-down menu which provides access to the following features:

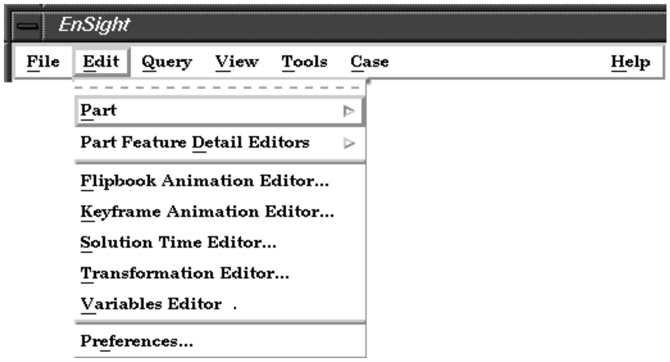


Figure 6-3
Edit pull-down menu

Part

Opens a pull-down menu which allows you to choose between the following part operations:

- Select All (see Section 3.4, Part Operations and How To Select Parts)
- Select ... (see Section 3.4, Part Operations and How To Select Parts)
- Delete (see Section 3.4, Part Operations and How To Delete a Part)
- Assign to Single New viewport (see Section 3.4, Part Operations)
- Assign to Multiple New viewports (see Section 3.4, Part Operations)
- Copy (see Section 3.4, Part Operations and How To Copy a Part)
- Group & Ungroup (see Section 3.4, Part Operations and How To Group Parts)
- Extract (see Section 3.4, Part Operations and How To Extract Part Representations)
- Merge (see Section 3.4, Part Operations and How To Merge Parts)

Access: Main Menu > Edit > Part

Part Feature Detail Editors

Opens a pull-down menu which allows you to choose between the following options to open the Feature Detail Editor:

- Selected Part Type (see Section 3.1, Part Overview and Introduction to Part Creation)
- Contours (see Section 3.3, Part Editing, Section 7.2, Contour Create/Update, and How To Create Contours)
- Clips (see Section 3.3, Part Editing, Section 7.5, Clip Create/Update, How To Create Line Clips, How To Create Plane Clips, How To Create Quadric Clips, and How To Create IJK Clips)
- Developed Surfaces (see Section 3.3, Part Editing, Section 7.9, Developed Surface Create/Update, and How to Create Developed Surfaces)
- Elevated Surfaces (see Section 3.3, Part Editing, Section 7.7, Elevated

Surface Create/Update, and How to Create Elevated Surfaces)

- Isosurfaces (see Section 3.3, Part Editing, Section 7.3, Isosurface Create/Update, and How to Create Isosurfaces)
- Model Parts (see Section 3.3, Part Editing and Introduction to Part Creation)
- Particle Traces (see Section 3.3, Part Editing, Section 7.4, Particle Trace Create/Update, and How to Create Particle Traces)
- Profiles (see Section 3.3, Part Editing, Section 7.8, Profile Create/Update, and How to Create Profile Plots)
- Subset Parts (see Section 3.3, Part Editing, Section 7.16, Subset Parts Create/Update, and How to Create Subset Parts)
- Tensor glyphs (see Section 3.3, Part Editing, Section 7.17, Tensor Glyph Parts Create/Update, and How to Create Tensor Glyphs)
- Vector Arrows (see Section 3.3, Part Editing, Section 7.6, Vector Arrow Create/Update, and How to Create Vector Arrows)
- Vortex Cores (see Section 3.3, Part Editing, Section 7.18, Vortex Core Create/Update, and How To Extract Vortex Cores)
- Shock Regions/Surfaces (see Section 3.3, Part Editing, Section 7.19, Shock Surface/Region Create/Update, and How To Extract Shock Surfaces)
- Separation/Attachment Lines (see Section 3.3, Part Editing, Section 7.20, Separation/Attachment Lines Create/Update, and How To Extract Separation/Attachment Lines)

Access: Main Menu > Edit > Part Feature Detail Editors...

Flipbook Animation Editor

Opens the Flipbook Animation editor in the Quick Interaction Area which is used to create, save, and restore Flipbook Animation sequences.
Access: Main Menu > Edit > Flipbook Animation Editor...
(see Section 7.14, Flipbook Animation and How To Create a Flipbook Animation)

Keyframe Animation Editor

Opens the Keyframe Animation editor in the Quick Interaction Area which is used to create, save, and restore Keyframe Animation sequences.
Access: Main Menu > Edit > Keyframe Animation Editor...
(see Section 7.15, Keyframe Animation and How To Create a Keyframe Animation)

Solution Time Editor

Opens the Solution Time Editor in the Quick Interaction Area which is used to specify the currently displayed time step in a transient dataset.
Access: Main Menu > Edit > Solution Time Editor...
(see Section 7.13, Solution Time and How To Animate Transient Data)

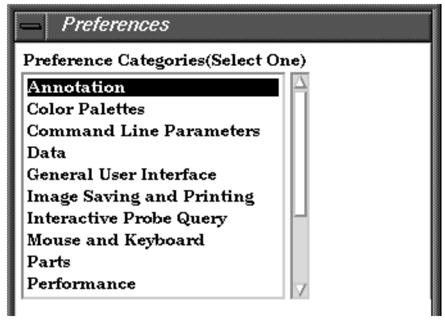
Transformation Editor

Opens the Transformation Editor dialog which is used to precisely position parts, frames, and tools in the Graphics Window and to Save and Restore Views.
Access: Main Menu > Edit > Transformation Editor...
(see Chapter 9, Transformation Control)

Variables Editor

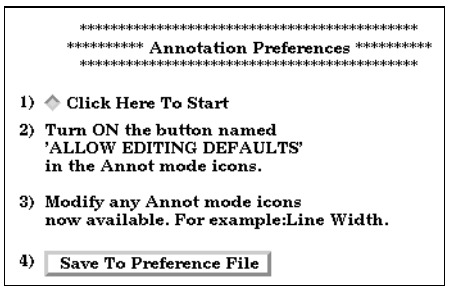
Opens the Feature Detail Editor (Variables) dialog which is used to obtain information about variables, change the information, and to create new variables.
Access: Main Menu > Edit > Variables Editor...
(see Chapter 4, Variables)

Preferences... Opens the Preferences dialog which is used to set or modify preference values for the various categories within EnSight.



In this area you can set default attributes and preferences which will be used for the current EnSight session. You may also save any of these to the preference file(s) so that they will be the defaults for future invocations of EnSight. Each of the preference categories will now be explained.

Annotation Preferences

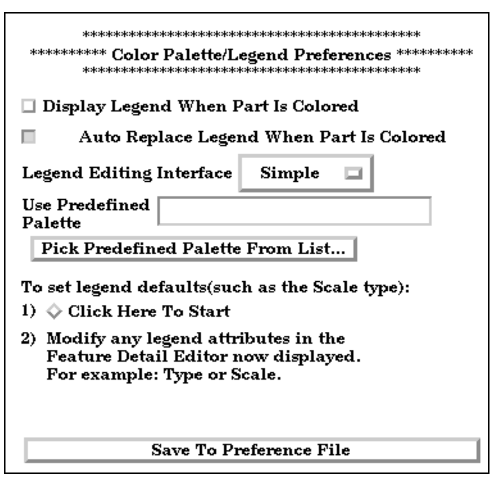


Click Here To Start Will place you in Annotation mode in EnSight with no annotations selected (default mode). You must do step 2) so that you are allowed to edit annotation defaults. You can then change any annotation attributes desired and they will become the defaults for the session.

Save To Preference File Will write the current annotation preferences to the preference file for future EnSight sessions.

(see How To Set Annotation Preferences:)

Color Palettes Preferences



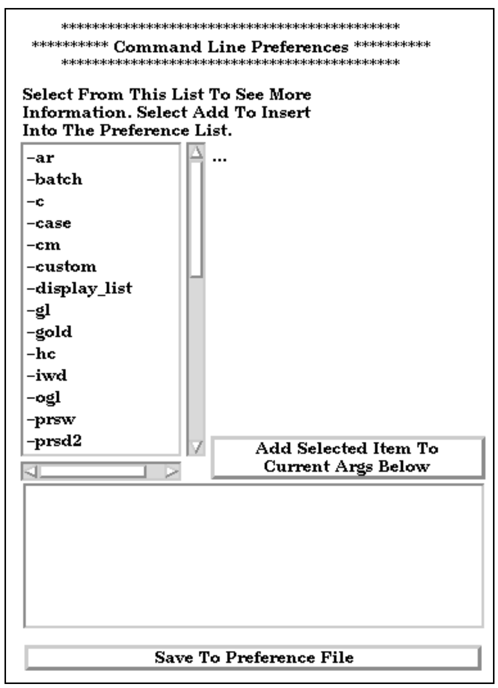
Display Legend When Part is Colored	Will cause the legend to automatically appear when you color a part by a variable.
Auto Replace Legend When Part is Colored	Will cause legends to be automatically replaced when the current legend is no longer in use (i.e. no parts are colored by the variable) and a new variable is in use.
Legend Editing Interface	Can be EnSight's *Simple* or *Advanced* interface.
Use Predefined Palette	Allows you to enter a predefined palette name if you have predefined color palettes.
Pick Predefined Palette From List...	Allows you to pick from your predefined palette list.

Legend Defaults:

Click Here To Start	Will allow you to modify legend default attributes.
Save To Preference File	Will write the current legend and palette preferences to the preference file for future EnSight sessions.

(see How To Set Color Palette Defaults:)

Command Line Parameter Preferences

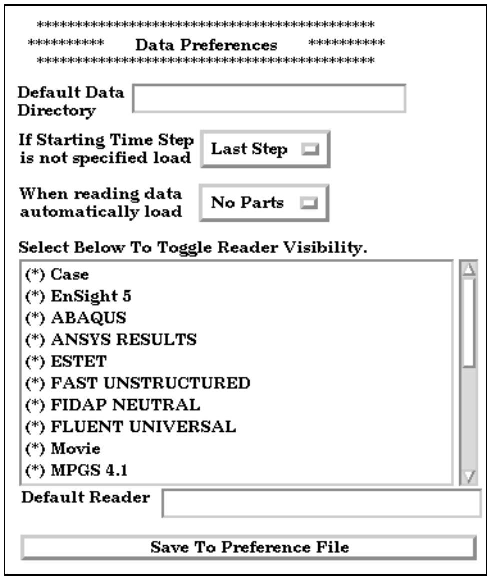


By selecting arguments from the list and hitting:

Add Selected Item To Current Args Below	You can build customized command line preferences.
Save To Preference File	Will save the command line preferences to the preference file for future invocations of EnSight.

(see How To Set Command Line Preferences:)

Data Preferences



Default Data Directory — Will allow you to specify a default directory for data files.

If Starting Time Step is not specified load — Can be set so that the default starting time step for transient data can be either *Last Step* or *First Step*.

When reading data automatically load — Allows you to have EnSight automatically load *All Parts, First Part, Last Part,* or *No Parts* at startup. If *No Parts* is specified, the Part Loader dialog will be presented to the user at startup.

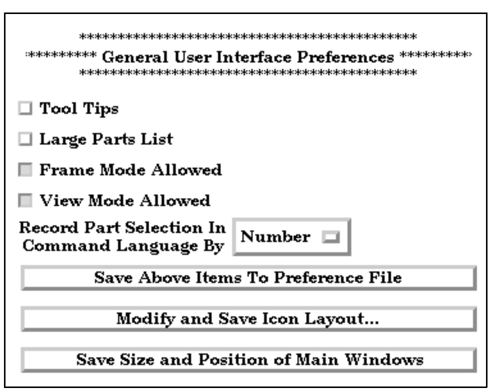
Select Below To Toggle Reader Visibility — Allows you to specify which data formats will appear in the "Format" pull-down of the Data Reader dialog.

Default Reader — Allows you to specify the default data reader format.

Save To Preference File — Will save the data preferences to the preference file for future invocations of EnSight.

(see How To Set Data Preferences:)

General User Interface Preferences



Tool Tips — Will cause pop-up help information to appear when the mouse is placed over certain icons while running EnSight.

Large Parts List — Will cause a separate, larger parts list dialog (which can be expanded) to be used in place of the normal parts list.

Frame Mode Allowed — Will display Frame as a managed mode.

View Mode Allowed — Will display View Mode as a managed mode.

Record Part Selection in Command Language By — Allows you to specify whether the part selections recorded in command language will be by part *Name* or by part *Number*.

Save Above Items To Preference File — Will save the preferences above to the preference file for future invocations of EnSight.

Modify and Save Icon Layout.... — Opens the Icon Bar Preferences dialog

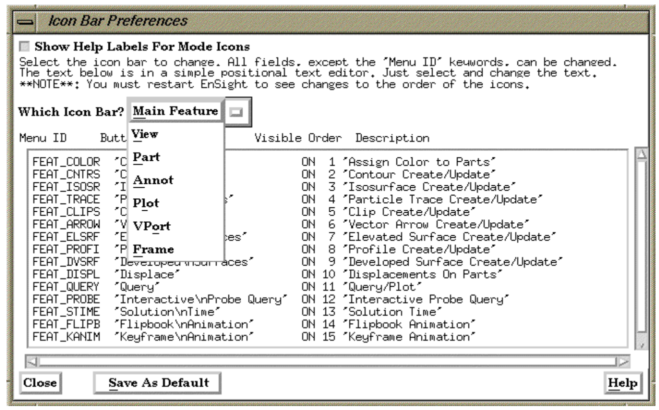


Figure 6-4
Icon Bar Preferences

Show Help Labels For Mode Icons — When toggled on, the Icon name will appear beneath each icon in the Mode Icon Bar. You can customize the EnSight GUI by specifying which icons appear and their order in the Feature and Mode Icon Bars. Do **NOT** modify the Menu ID for any function. The other fields for each function may be edited within the dialog. Customization options are:

Button Name — Describes the function of the icon which would be displayed if EnSight was started with no icons (command line function). Further, this is the name which will appear below the each Mode Icon when Show Help Labels For Mode Icons is toggled on.

Visible — Determines the visibility of a feature icon. Must be either ON or OFF.

Order — Determines the order in which the icons appear. A value of 1 will cause the icon to appear leftmost in the Main Feature Icon Bar and uppermost in the Mode Icon Bars.

Description

The text description of the button which will be displayed in the Message Area when the icon is selected. You must click the Save As Default button to save any changes you have made. The Button Name and Order, if modified, will not take effect until you restart EnSight. Changes to Visibility, Description, and Show Help Labels however, will be implemented immediately upon clicking the Save as Default button (and will control these options in future EnSight sessions as well).

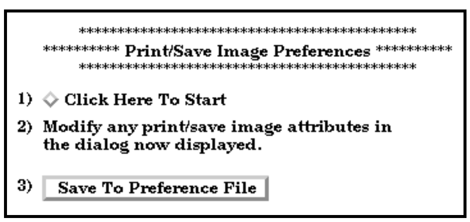
When EnSight is started, the icon preferences are initially read from the `$ENSIGHT7_HOME/site_preferences` directory and are then overwritten by any information in the user's preferences directory.
(see How To Customize Icon Bars)

Save Size and Position of Main Windows

Will record the location and size of the main GUI, and all dialogs that have been opened during the session or are currently open and will make those locations and sizes the default for future sessions of EnSight. Be aware also that if you had a turn-down section open in a dialog (such as General Attributes in the Feature Detail Editor dialog) when you closed it earlier in the session or at the time you choose Save Window Positions, this will be recorded as well and opening that dialog in future sessions will also open that turn-down section within the dialog.
(see How To Save GUI Settings)

(see How To Set General User Interface Preferences:)

Image Saving and Printing Preferences



Click Here To Start

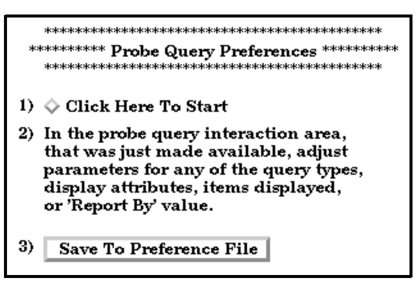
Will allow you to modify default attributes for image saving and printing.

Save To Preference File

Will write the current print/save preferences to the preference file for future EnSight sessions.

(see How To Set Image Saving and Printing Preferences:)

Interactive Probe Query Preferences

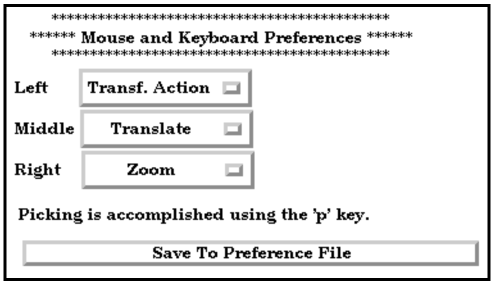


Click Here To Start — Will allow you to modify default attributes for interactive probe queries.

Save To Preference File — Will write the current interactive probe query preferences to the preference file for future EnSight sessions.

(see How To Set Interactive Probe Query Preferences:)

Mouse and Keyboard Preferences



Here you can specify the actions of the three mouse buttons. Select the option you wish to assign to each button. The options are as follows:

Transf. Action — When this option is chosen (it is the default for the left button), depressing the button and moving the mouse will perform the transformation (rotate, translate, zoom) currently selected in the Transformation Control Area on the model.

Rotate — When this option is chosen, depressing the button and moving the mouse will perform a rotate transformation on the model.

Translate — When this option is chosen, depressing the button and moving the mouse will perform a translate transformation on the model.

Zoom — When this option is chosen, depressing the button and moving the mouse will perform a zoom transformation on the model.

Pick — When this option is chosen, depressing the button will perform a pick operation. If Pick has not been assigned to one of the mouse buttons, the “p” key is used to perform the operation. (see Pick Pull-down Icon in Section 8.4, Part Mode)

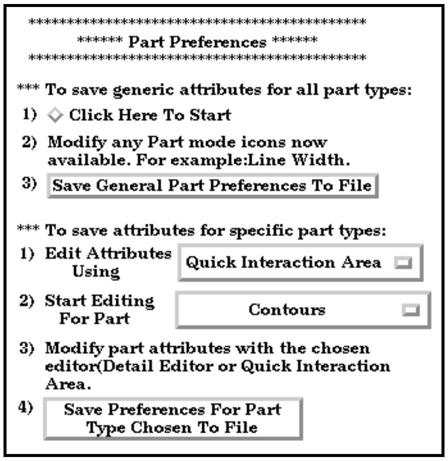
Nothing — When this option is chosen, no function is mapped to the mouse button.

Note: One of the Mouse buttons must be assigned to Transf. Action. Macros cannot be assigned to a mouse key which has a function assigned to it. (see How To Customize Mouse Button Actions)

Save To Preference File — Will write the current mouse and keyboard preferences to the preference file for future EnSight sessions.

(see How To Set Mouse and Keyboard Preferences:)

Parts



Generic Attributes:

Click Here To Start — Will allow you to modify default visual part attributes which apply to all part types.

Save General Part Preferences To File — Will write the current generic part preferences to the preference file for future EnSight sessions.

Attributes For Specific Part Types:

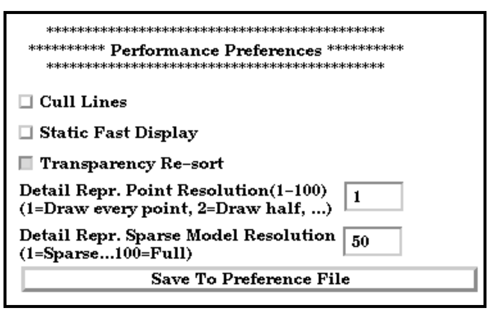
Edit Attributes Using — Allows you to specify which area to use for default attribute modification - the *Quick Interaction Area* or the *Detail Editor Dialog*.

Start Editing For Part — Allows the user to specify the part type for which default attributes will be modified.

Save Preferences For Part Type Chosen To File — Will write the current specific part type preferences to the preference file for future EnSight sessions.

(see How To Set Part Preferences:)

Performance Preferences



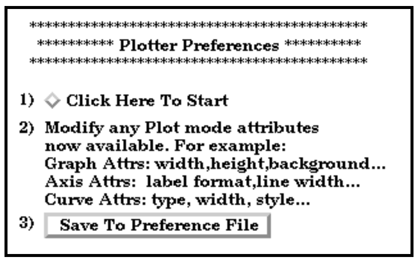
Cull Lines — Will only draw shared lines between polygons once.

Static Fast Display — Will cause the fast representation to always be displayed. If this is off (the default), fast display will only be active during a transformation.

Transparency Re-sort	Causes polygons to be resorted with each transformation - so the image is always correct. If not on, the polygons will not be resorted while the mouse is down during transformations, but will be resorted when the mouse is released.
Detail Repr. Point Resolution	Allows specification of fraction of nodes to display in Fast Display, point representation. (The default is "1", indicating all nodes, "2" would be every other node, "3" every third node, etc.)
Detail Repr. Sparse Model Resolution	Allows specification of the percentage of the model geometry that will be displayed.
Save To Preference File	Will write the current performance preferences to the preference file for future EnSight sessions.

(see How To Set Performance Preferences:)

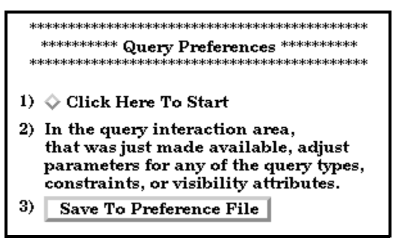
Plotter Preferences



Click Here To Start	Will allow you to modify defaults for the various plotter graph, axis, and curve attributes.
Save To Preference File	Will write the current plotter preferences to the preference file for future EnSight sessions.

(see How To Set Plotter Preferences:)

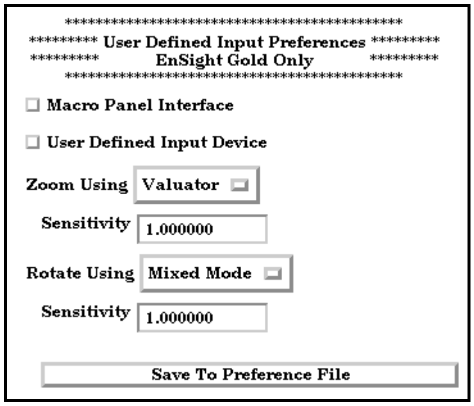
Query Preferences



Click Here To Start	Will allow you to modify defaults for the various query attributes.
Save To Preference File	Will write the current query preferences to the preference file for future EnSight sessions.

(see How To Set Query Preferences:)

User Defined Input Preferences



This area provides access to user defined input devices. The input devices include a Macro Panel Interface (a grid of commands that displays in the Main Graphics window and executes EnSight command files upon selection), and/or a User Defined Input Device (a virtual input device designed for - but not limited to - use with VR environments such as an Immersadesk)

Macro Panel Interface — Toggles on/off the user defined macro panel (defined in your `~/.ensight7/macros/hum.define` file) to the Main Graphics window. (An example hum.define file is located at `$ENSIGHT7_HOME/client/site_preferences/macros/hum.define` on your client system.).

User Defined Input Device — Toggles on/off the User Defined Input Device that is linked via a runtime library. (Steps outlining the implementation of this library and input device are found in the file:

`$ENSIGHT7_HOME/client/user_defined_input/README`

on your client system.).

Zoom Using — Opens a pull-down menu for selection of the type of input device used for zoom transformations. The type of devices are:

- *Valuator* — a device that returns a value (like a virtual joystick).
- *Position* — a device that returns delta movement in the Z direction (like a wand).

Sensitivity — Specifies a positive scalar value that adjusts the Sensitivity of the type of zoom input device selected in Zoom Using (i.e. values < 1 are slower, and values > 1 are faster).

Rotate Using — Opens a pull-down menu for selection of the type of input device used to record rotation transformations.

- *Mixed Mode* — A device that returns virtual angle values where the Z rotations correspond to (literal) movement of the input device about its local Z (or roll) axis; and where the X and Y rotations correspond to translational movements of the input device with respect to its local X and Y axes.

Direct Mode — A device that returns virtual angle values that correspond to (literal) rotational movements of the input device about its local X, Y, and Z axes.

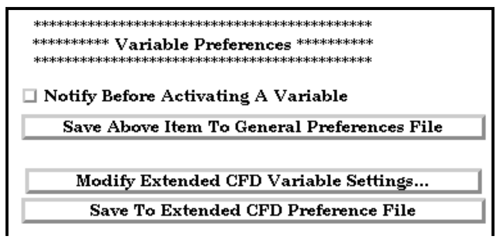
Sensitivity — Specifies a positive scalar value that adjusts the Sensitivity of the type of rotation input device selected in Rotate Using (i.e. values < 1 are slower, and values > 1 are faster).

(see How To Enable User Defined Input Devices)

Save To Preference File — Will write the current user defined input preferences to the preference file for future EnSight sessions.

(see How To Set User Defined Input Preferences:)

Variables Preferences



Notify Before Activating A Variable — Will cause you to be notified before a variable, which was going to be automatically activated, is actually activated.

Save Above Item To General Preferences File — Will write the variable notification preference to the preference file for future EnSight sessions.

Modify Extended CFD Variable Settings... — Opens the Extended CFD Variable Settings dialog. If your data defines variables or constants for density, total energy, per unit volume, and momentum (or velocity), it is possible to show new variables defined by these basic variables in the Main Variables List of the GUI by utilizing the capabilities of this dialog.

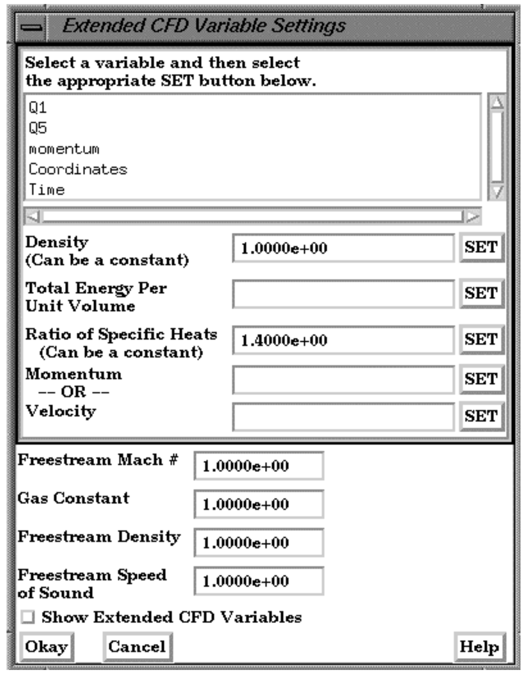


Figure 6-5
Extended CFD Variable Settings Dialog

Density
: Permits the selection of the density variable from the list (click SET after selection) or the specification of a constant value in the field provided.

Total Energy Per Unit Volume
: Permits the selection of the energy variable from the list. Click SET after selection.

Ratio of Specific Heats
: Permits the selection of the ratio of specific heats variable from the list (click SET after selection) or the specification of a constant value in the field provided.

Momentum or Velocity
: Permits the selection of the momentum or velocity variable from the list. Click SET after selection.

Freestream Mach #
: Permits the specification of the freestream mach number in the field provided.

Gas Constant
: Permits the specification of the gas constant in the field provided.

Freestream Density
: Permits the specification of the freestream density value in the field provided.

Freestream Speed of Sound
: Permits the specification of the freestream speed of sound value in the field provided.

Show Extended
: When selected, all of the variables that can be derived from the information entered will be

CFD Variables
: Shown in the Main Variables List of the GUI. (will not take effect until the Okay button is clicked.

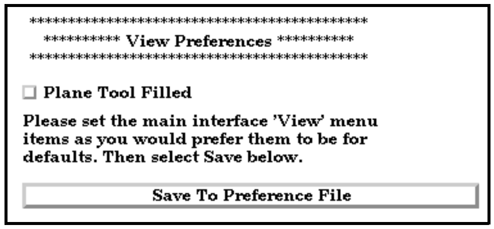
Okay — Clicking this button applies the changes made in the dialog.

(See How To Create New Variables)

Save To Extended CFD Preference File — Will write the current extended CFD preferences to the extended CFD preference file for future EnSight sessions.

(see How To Set Variable Preferences:)

View Preferences



Plane Tool Filled — Will cause the plane tool to be a filled transparent surface. If it is off, the plane tool will be in line drawing mode. You can save this default to the preference file.

Save To Preference File — Will write the current view preferences to the preference file for future EnSight sessions.

(see How To Set View Preferences:)

6.3 Query Menu Functions

Clicking the Query button in the Main Menu opens a pull-down menu which provides access to the following features:

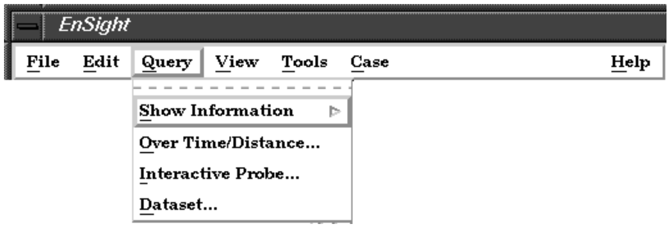


Figure 6-6
Query pull-down menu

EnSight provides several ways to examine information about variable values. You can, of course, visualize variable values with fringes, contours, vector arrows, profiles, isosurfaces, etc. Only parts with data residing on the Server host system may be queried. Thus, parts that reside exclusively on the Client host system (i.e. contours, particle traces, profiles, vector arrows) may NOT be queried.

(see Table 3–2 Part Creation and Data Location)

Show Information

Opens the following pull-down menu:

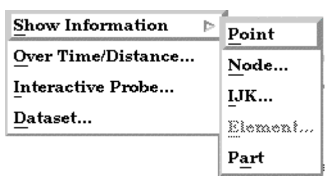


Figure 6-7
Show Information pull-down menu

Access: Main Menu > Query > Show Information

(see How To Get Point, Node, Element and Part Information)

Point

Provides the following information in the Status History Area about a Point inside of the selected Part(s) who's position you have specified with the cursor tool:

x,y,z coordinates, Frame assignment of Point, the Part that the Point is found in, the closest Node to the Point, and the specified Variable value at the Point

Access: Main Menu > Query > Show Information > Point

(see How To Get Point, Node, Element and Part Information and How To Use the Cursor (Point) Tool)

Node

Opens the Query Prompt dialog which is used to specify Node ID number.

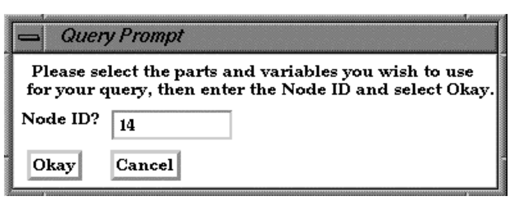


Figure 6-8
Query Prompt dialog

When Okay button is pressed, the following information about the specified Node is shown in the Status History Area:

x,y,z coordinates, Frame assignment of Node, the Part that the Node is found in, and the specified Variable value at the Node

Access: Main Menu > Query > Show Information > Node...

(see How To Get Point, Node, Element and Part Information)

IJK

Opens the Query Prompt dialog which is used to specify IJK values.

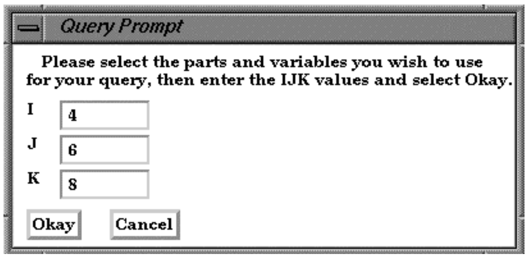


Figure 6-9
Query Prompt for IJK Values

When Okay button is pressed, the following information about the Node specified by the IJK values is shown in the Status History Area:

Node ID, Part in which the Node is located, x,y,z coordinates of the Node, Frame assignment of the Node, and the specified Variable value at the Node.

Access: Main Menu > Query > Show Information > IJK...

(see How To Get Point, Node, Element and Part Information)

Element

Opens the Query Prompt for Element ID.

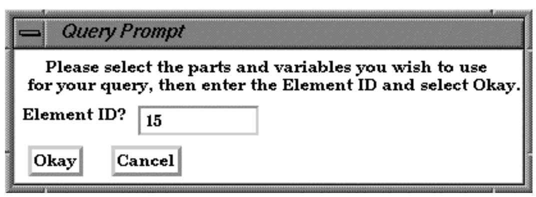


Figure 6-10
Query Prompt for Element ID

When Okay button is pressed, the following information about the Element is shown in the Status History Area:

Part in which Element is located, Type of Element, IJK bounds (if a structured mesh), Number of Nodes, Node ID numbers, information on neighboring Elements, and the specified Variable value at the Element.

Access: Main Menu > Query > Show Information > Element...

(see How To Get Point, Node, Element and Part Information)

Part

Causes the following information about the Part to be shown in the Status History Area:

Part type (structured or unstructured), number of Nodes in Part, minimum and maximum x,y,z coordinates, Element type, and the number of Elements.

Access: Main Menu > Query > Show Information > Part

(see How To Get Point, Node, Element and Part Information)

Over Time/Distance

Opens the Query/Plot Editor in the Quick Interaction Area which is used to obtain information about variables and to create plots of the information.

Access: Main Menu > Query > Over Time/Distance...

(see Section 7.11, Query/Plot, How To Query over Time, How To Query Over Distance)

Interactive Probe

Opens the Interactive Probe Query Editor in the Quick Interaction Area which is used to obtain information interactively about variables.
Access: Main Menu > Query > Interactive Probe...
(see Section 7.12, Interactive Probe Query and How To Probe Interactively)

Dataset

Opens the Query Dataset dialog which is used to obtain information about datasets for the selected case.

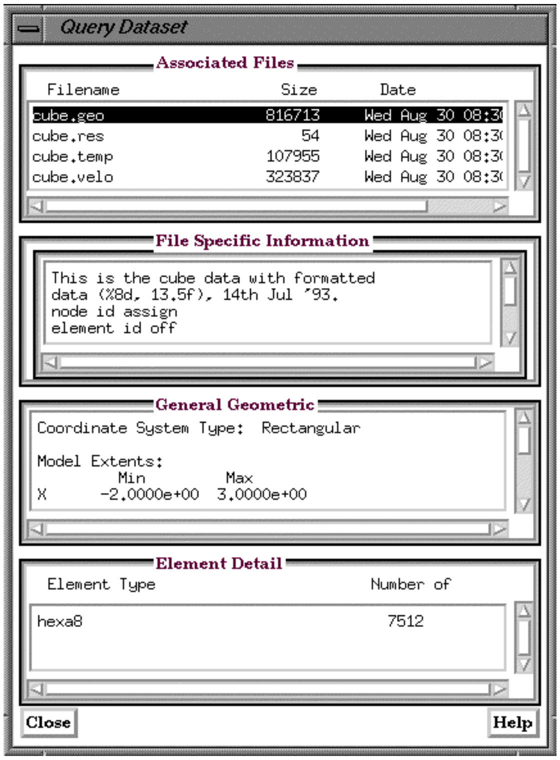


Figure 6-11
Query Dataset dialog

For the specified file, specific, general and detail information is provided.
Access: Main Menu > Query > Dataset...
(see Section 7.11, Query/Plot and How To Query Datasets)

6.4 View Menu Functions

Clicking the View button in the Main Menu opens a pull-down menu which provides access to the following features:

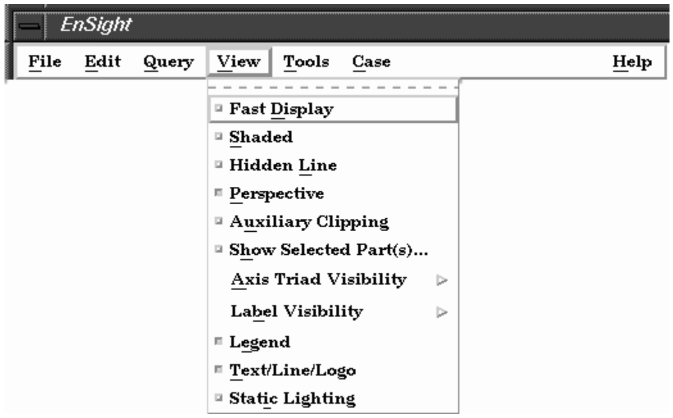


Figure 6-12
View pull-down menu

Fast Display

Toggles the Fast Display mode.
Access: Main Menu > View > Fast Display

Fast Display in this pull-down is the same as the one located on the Desktop.

By default, EnSight displays all of the lines and elements for each part every time the Main View window redraws. If you have very large models (or if you have slow graphics hardware), each redraw can take significant time. As a result, interactive transformations become jerky and lag behind the motion of the mouse. Ironically, the slower the graphics performance, the harder it is to perform precise interactive transformations. To avoid this problem, you can tell EnSight to show a lesser detailed part representation, i.e, a bounding box surrounding each Part, or the Part as a point cloud. You can select to show the detail representation all the time, or only while you are performing transformations. This obviously displays much less information, but may be sufficient if you want to rotate a very large model.

A lesser detail display is also useful when experimenting with keyframe-animation rates. Using lesser detail, the display rate can be adjusted to approximate the video rate, thus you can see how your scene will transform on the video tape

The default setting is off, indicating that all lines and elements of all visible parts will be redrawn. When on, the redraw will show only the part's Fast Display Representation (by default a box). The fast display representation is only used while transformations are being performed. The fast display representation will be continuously displayed if the Static Fast Display option is turned on in:
Main Menu > Prefs > Graphics Window > Static Fast Display.

Shaded Toggle

Toggles the *Global* Shaded mode for parts on and off. (The Shaded Toggle in the View Mode Icon Bar performs the same action.) EnSight by default displays parts in line mode. Shaded mode displays parts in a more realistic manner by making hidden surfaces invisible while shading visible surfaces according to specified lighting parameters. Parts in Shaded mode require more time to redraw than when in line mode, so you may wish to first set up the Graphics Window as you want it, then turn on Shaded to see the final result.

Access: EnSight dialog > View > Shaded
or View Mode Icon Bar: Shaded Toggle
or Desktop > Shaded

(see Section 8.1, View Mode and How To Set Drawing Style)

Troubleshooting Hidden Surfaces and Shading

Problem	Probable Causes	Solutions
Main View shows line drawing after turning on Shaded.	Shaded is toggled off for each individual part.	Toggle Shaded on for individual parts with the Shaded Icon in Part Mode or in the Feature Detail Editor dialog.
	There are no surfaces to shade—all parts have only lines.	If parts are currently in Feature Angle representation, change the representation. If model only has lines, you can not display shaded images.
	The element visibility attributes has been toggled off for the part(s).	Toggle the element visibility on for individual parts in the Feature Detail Editor dialog.

Hidden Line Toggle

Toggles the global Hidden Line display for all parts on/off. (The Hidden Line Toggle icon in the View Mode Icon Bar performs the same action.) This simplifies a line drawing display by making hidden lines - lines behind surfaces - invisible while continuing to display other lines. Hidden Line can be combined with Shaded to display both surfaces and the edges of the visible surface elements. Hidden Line can be toggled on/off for individual parts by using the Hidden Line Toggle icon in the Part Mode Icon Bar.

To have lines hidden behind surfaces, you must have surfaces (2D elements). If the representation of the in-front parts consists of 1D elements, the display is the same whether or not you have Hidden Lines mode toggled-on. During interactive transformations, the display reverts to displaying all lines. When you release the mouse button, the Main View display automatically resumes Hidden Line mode. The Hidden line option will not be active during playback of flipbook animations.

Access: Main Menu > View > Hidden Line
or View Mode Icon Bar: Hidden Line Toggle

(see Section 8.1, View Mode and How To Set Drawing Style)

Hidden Line Overlay dialog

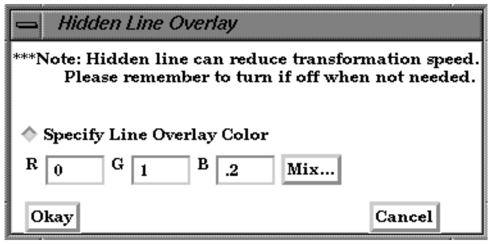


Figure 6-13
Hidden Line Overlay dialog

If you combine Shaded mode with Hidden Line mode, the lines overlay the surfaces. The Hidden Line Overlay dialog will pop-up on the screen if the Shaded option is currently on and you then turn the Hidden Line option on. From this dialog you specify a color for the displayed lines (you do not want to use the same color as the surfaces since they then will be indistinguishable from the surfaces). The default is the part-color of each part, which may be appropriate if the surfaces are colored by a color palette instead of their part-color.

Specify Overlay — Toggle-on if you want to specify an overlay color. If off, the overlay line color will be the same as the part color.

R, G, B — The red, green, and blue components of the hidden line overlay. These fields will not be accessible unless the Specify Overlay option is on.

Mix... — Click to interactively specify the constant color used for the hidden line overlay using the Color Selector dialog.
(see Section 7.1, Color and How To Change Color)

Okay — Click to accept the hidden line overlay color options.

Perspective (Global)Toggle — Toggles the view within each of the viewports within the Graphics Window between a perspective view (the default) and an orthographic projection. *Perspective* is what gives you the sense of depth when viewing a three dimensional scene on a two dimensional surface. Objects that are far away look smaller and parallel lines seem to meet at infinity. *Orthographic projection* removes the sense of depth in a scene. Lines that are parallel will never meet and objects of the same size all appear the same no matter how far away they are from you. Orthographic projection mode often helps when you are positioning the Cursor, Line, and Plane tools using multiple viewports. This is the Global toggle. Each viewport also has a Perspective Toggle.
Access: Main Menu > View > Perspective

(see Section 8.3, VPort Mode and see How To Set Global Viewing)

Auxiliary Clipping Global Toggle — Toggles the Auxiliary Clipping feature on/off. (Default is Off). The Auxiliary Clipping Global Toggle icon in the View Mode Icon Bar performs the same action. Like a Z-Clip plane, Auxiliary Clipping cuts-away a portion of the model. When Auxiliary Clipping is On, Parts (or portions of Parts) located on the back (negative-Z) side of the Plane Tool are removed. Parts whose Clip attribute you have toggled off (in the General Attributes section of the Feature Detail Editor dialog or with the Auxiliary Clipping Toggle Icon in the Part Mode Icon Bar) remain unaffected.

Auxiliary Clipping is interactive—the view updates in real time as you move the Plane Tool around
(see Section 6.5, Tools Menu Functions and How To Use the Plane Tool).

Unlike a Z-Clip plane, Auxiliary Clipping applies only to the parts you specify, and the plane can be located anywhere with any orientation though it is always infinite in extent (see Section 9.5, Z-Clip and How To Set Z Clipping).

Auxiliary Clipping is helpful, for example, with internal flow problems since you can "peel" off the outside parts and look inside. This capability is also often useful in animation.

The position of the Plane Tool and the status of Auxiliary Clipping is the same for all displayed viewports.

Do not confuse Auxiliary Clipping with a 2D-Clip plane, which is a created part whose geometry lies in a plane cutting through its parent parts or with the Part operation of cutting a part.
(see Section 3.4, Part Operations, How to Create Plane Clips, and How To Cut a Part).

Troubleshooting Auxiliary Clipping

Problem	Probable Causes	Solutions
The Plane Tool does not appear to clip anything	The Auxiliary Clipping toggle is off for all parts.	Turn the Auxiliary Clipping toggle on for individual parts in the Feature Detail Editor (Model) dialog General Attributes section.
	The Plane Tool is not intersecting the model	Change the position of the Plane Tool.
The Main View window shows nothing other than the Plane Tool after Clipping is toggled-on.	All of the part(s) is(are) on the back side of the Plane Tool and is(are) thus clipped	Change the position of the Plane Tool.

Axis Triad Visibility — Opens the pull-down menu which allows you to toggle on/off the visibility of the Global axis triad and the axis triads for all Frames.

Frame Toggle — Toggles on/off (default is On) the display of all coordinate Frame axis triads. (The All Frame Axis Triad Visibility Toggle icon in the Frame Mode Icon Bar performs the same function.)The visibility of individual coordinate Frame axes can be selectively turned on/off by clicking on the Frame's axis triad and then clicking on the Frame Axis Triad Visibility Toggle in the Frame Mode Icon Bar.
Access: Main Menu > View > Axis Visibility > Axis - Local
(see Section 8.6, Frame Mode)

Global Toggle — Toggles on/off (default is Off) the display of the global coordinate frame axis. (The Global Axis Visibility Toggle icon in the Frame Mode Icon Bar performs the same function.)The global coordinate frame axis triad represents the Look-At Point.
Access: Main Menu > View > Axis Visibility > Axis - Global
(see Section 8.1, View Mode)

Label Visibility — Opens the pull-down menu which allows you to toggle on/off the visibility of labels for Elements or Nodes.

Element Labeling Toggle

Toggles on/off (default is Off) the global visibility of labels (if they are available in the dataset) for elements in all parts. (The Element Label Toggle in the View Mode Icon Bar performs the same function.) Visibility of element labels for individual parts can be controlled in the Node, Element, and Line Attributes section of the Feature Detail Editor (Model).
Access: Main Menu > View > Label Visibility > Element Labeling
(see Section 8.1, View Mode)

Node Labeling Toggle

Toggles on/off (default is off) the global visibility of labels (if they are available in the dataset) for nodes in all parts. (The Node Label Toggle in the View Mode Icon Bar performs the same function). Visibility of node labels for individual parts can be controlled in the Node, Element, and Line Attributes section of the Feature Detail Editor (Model).
Access:Main Menu > View > Label Visibility > Node Labeling
(see Section 8.1, View Mode)

Legend Toggle

Toggles on/off (default is on) the global visibility of all legends. (the Legend Visibility Toggle Icon in the Annotation Mode Icon Bar performs the same function). Visibility of individual legends can be controlled by using the Show Legend button above the Feature Icon Bar. Clicking the Show Legend button will make visible only those legends for variables which are selected in the Variables List, and then only if Legend Visibility is toggled on. If a Legend has been made visible by selecting a variable and then clicking the Show Legend button, deselecting the variable and clicking the Show Legend button again will turn visibility off for that individual legend.
Access: Main Menu > View > Legend
(see Section 4.2, Variable Summary & Palette, Section 8.2, Annot Mode and How To Create Color Legends.

Text/Line/Logo Toggle

Toggles on/off global visibility for text strings and lines which have been created and logos which have been imported. (The Text/Line/Logo Visibility Icon in the Annotation Mode Icon Bar performs the same function). Visibility of individual Text strings, Lines, or Logos can be controlled by selecting the item while in Annotation Mode and clicking the Visibility Toggle in the Annotation Mode Icon Bar. While in Annot Mode, you will notice that the item does not disappear, but turns transparent. Such items will not appear in the Graphics Window in any Mode except Annotation Mode, and then only if global visibility has been turned on.
Access: Main Menu > View > Text/Line/Logo
(see Section 8.2, Annot Mode, How To Create Lines and Arrows, How To Create Text Annotation, and How To Load Custom Logos.

Static Lighting

Toggles on/off whether the light source moves as the model transforms, or instead remains stationary. Static lighting only affects shaded surfaces (i.e., Hidden Surfaces mode is toggled-on).When the Static Lighting option is *off* (the default), the light source remains fixed as you transform the model. Your graphics hardware performs the lighting calculations *each time the Graphics Window redraws*.

When the Static Lighting option is on, the light source moves with the model (it is the lighting *of the model* that remains “static”). EnSight performs the lighting equations *once*. This can greatly improve graphics performance, especially when color fringes are on in which case the performance boost may be as much as a factor of five. Also, memory requirements are somewhat less with Static Lighting, an important point to remember if you are loading flipbook animation pages as objects. However, keep in mind that this performance improvement comes at the cost of realism since the display’s lighting does not update when the scene moves.
Access: Main Menu > View > Static Lighting

6.5 Tools Menu Functions

The Cursor, Line, Plane, and Quadric (cylinder, sphere, cone, and revolution) Tools in EnSight are used for a variety of tasks, such as: positioning of clipping planes and lines, query operations, particle trace emitters, etc. Collectively these tools are referred to as Positioning Tools. Clicking the Tools button in the Main Menu opens a pull-down menu which provides access to these features:

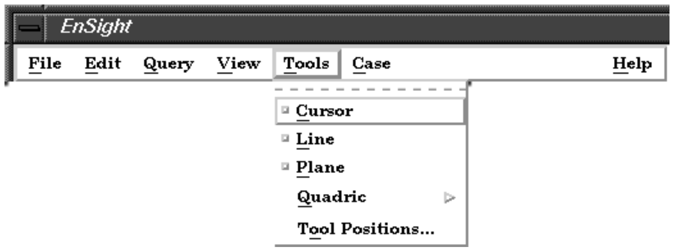


Figure 6-14
Tools pull-down menu

Cursor Tool Toggle

Makes the Cursor Tool visible/invisible in the Graphics Window. The Cursor Tool appears as a three-dimensional cross colored red, green, and blue. The red axis of the cross corresponds to the X axis direction for the currently selected Frame, while green matches the Y and blue matches up with the Z. The Cursor Tool is initially located at the Look-At point and may be repositioned interactively in the Graphics Window by selecting and dragging it or by selecting Pick Cursor Location from the Pick Pull-down Icon menu in the Part Mode Icon Bar. Alternatively, you can reposition it precisely by specifying coordinates in the Transformation Editor dialog (described in Tool Positions... Cursor Mode below).

Access: Main Menu > Tools > Cursor
or Desktop > Cursor
(see Section 8.4, Part Mode and How to Use the Cursor (Point) Tool)

Line Tool Toggle

Makes the Line Tool visible/invisible in the Graphics Window. The Line Tool appears as a white line with a cross at the center point. The Line Tool is initially centered about the Look-At point and sized so that it fills approximately 10% of the default view. You can change its length and orientation interactively in the Graphics Window by selecting one of its end points. You can reposition it interactively in the Graphics Window by selecting its center and dragging it or by selecting Pick Line Location from the Pick Pulldown Icon menu in the Part Mode Icon Bar. Alternatively, you can reposition it precisely by specifying coordinates in the Transformation Editor dialog (described in Tool Positions... Line Mode below).

Access: Main Menu > Tools > Line
or Desktop > Line
(see Section 8.4, Part Mode and How to Use the Line Tool)

Plane Tool

Makes the Plane Tool visible/invisible in the Graphics Window. (*Note: Its appearance (line or filled) is controlled under Main Menu > Prefs > Tools*)

Access: Main Menu > Tools > Plane
or Desktop > Plane

The Plane Tool is shown with an X, Y, Z axis system, is initially centered about the Look-At point, and lies in the X-Y plane. You can reposition it interactively in the Graphics Window by selecting its center point in the Graphics Window and dragging it or by selecting Pick Plane Location from the Pick Pull-down Icon menu in the Part Mode Icon Bar. Alternatively, you can reposition it precisely by specifying coordinates in the

Transformation Editor dialog (described in Tool Positions... Plane Mode below). You can change its orientation interactively in the Graphics Window by selecting the X, Y, or Z letters at the ends of the axes. You can resize the Plane Tool interactively in the Graphics Window by selecting the corner or the plane between the ends of the X and Y axes. (see Section 8.4, Part Mode and How to Use the Plane Tool)

Quadric

Opens a pull-down menu which allows you to choose one of the Quadric Tools and make it visible.
Access: Main Menu > Tools > Quadric

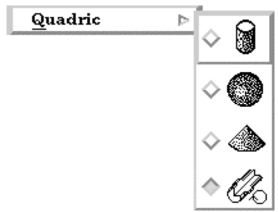


Figure 6-15
Quadric Tool pull-down menu

Cylinder Tool Toggle

Makes the Cylinder Tool visible/invisible in the Graphics Window. The Cylinder Tool appears as thick direction line with center point and a circle around the line at the mid and two end points. Thinner projection lines run parallel to the direction line through the three circles outlining the surface of the cylinder. The Cylinder Tool is initially centered about the Look-At point with the direction line pointing in the X direction. You can change its length and orientation interactively in the Graphics Window by selecting one of its end points. You can change its diameter by selecting the circle about the mid point. You can reposition it interactively in the Graphics Window by selecting its center or alternatively, you can reposition it precisely by specifying coordinates in the Transformation Editor dialog (described in Tool Positions... Quadric below).
Access: Main Menu > Tools > Quadric
(see How to Use the Cylinder Tool)

Sphere Tool Toggle

Makes the Sphere Tool visible/invisible in the Graphics Window. The Sphere Tool appears as thick direction line with several circles outlining the sphere. The Sphere Tool is initially centered about the Look-At point with the direction line pointing in the X direction. You can change its radius and orientation interactively in the Graphics Window by selecting one of the thick direction line end points. You can reposition it interactively in the Graphics Window by selecting its center or alternatively, you can reposition it precisely by specifying coordinates in the Transformation Editor dialog (described in Tool Positions... Quadric below).
Access:Main Menu > Tools > Quadric
(see How to Use the Sphere Tool)

Cone Tool Toggle

Makes the Cone Tool visible/invisible in the Graphics Window. The Cone Tool appears as thick direction line with a circle at the end point. Thinner projection lines run from the beginning point to the circle at the end point outlining the surface of the cone. The Cone Tool is initially centered about the Look-At point with the direction line pointing in the X direction. You can change its length and orientation interactively in the Graphics Window by selecting one of the thick direction line end points. You can change its diameter by selecting the largest circle about the end point. You can reposition it interactively in the Graphics Window by selecting its center or alternatively, you can reposition it precisely by specifying coordinates in the Transformation Editor dialog (described in Tool Positions... Quadric below).
Access: Main Menu > Tools > Quadric
(see How to Use the Cone Tool)

Revolution Tool Toggle

Makes the Surface of Revolution Tool visible/invisible in the Graphics Window. The Revolution Tool appears as thick direction line with several circles outlining each user defined point along the tool. Thinner projection lines run through the circles to outline the revolution surface. The Revolution Tool is initially centered about the Look-At point with the direction line pointing in the X direction. You can change its length and orientation interactively in the Graphics Window by selecting one of the thick direction line end points. You can reposition it interactively in the Graphics Window by selecting its center or alternatively, you can reposition it precisely by specifying coordinates in the Transformation Editor dialog (described in Tool Positions... Quadric below).

Access: Main Menu > Tools > Quadric

(see How to Use the Surface of Revolution Tool)

Tool Positions...

Opens the Transformation Editor dialog which allows you to precisely position the various tools within the Graphics Window in reference to the selected Frame.

Access: Main Menu > Tools > Tool Positions...

Cursor Tool

Clicking on Editor Function in the Transformation Editor dialog and then selecting Tools > Cursor from the pull-down menu configures the dialog as shown below.

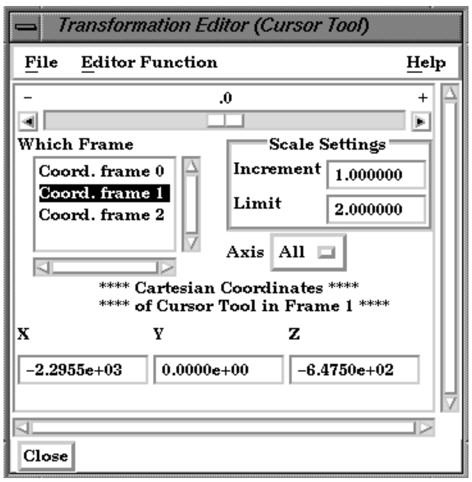


Figure 6-16
Transformation Editor (Cursor)

The Transformation Editor dialog provides three methods for the precise positioning of the Cursor Tool. First, the Cursor Tool may be positioned within the Graphics Window by entering coordinates in the X, Y, and Z fields. Pressing return causes the Cursor Tool to relocate to the specified coordinates in the selected Frame (or, if more than one Frame is selected, for Frame 0).

It is also possible to reposition the Cursor Tool from its present coordinate position by specific increments. The Axis Button allows you to choose the axis of translation (X, Y, Z, or All). The Slider Bar at Top allows you to quickly choose the increment by which to move the position of the Cursor Tool. Dragging the slider in the negative (left) or positive (right) directions and then releasing it will cause the X, Y, and Z coordinate fields to increment as specified and the Cursor Tool to relocate to the new coordinates. The number specified in the Limit field of the Scale Settings area determines the negative (-) and positive (+) range of the slider. If the Limit is set to 1.0 as shown, then the numerical range of the slider bar will be -1 to +1.

Alternatively, you can specify an increment for translation in the Increment field of the Scale Settings area. Pressing return while the mouse pointer is in the Increment field will cause the Cursor Tool to translate along the specified axis (or all axes) by the increment specified.

Access: Transformation Editor > Editor Function > Tools > Cursor

(see How to Use the Cursor (Point) Tool)

Line Tool

Clicking on Editor Function in the Transformation Editor dialog and then selecting Tools > Line from the pull-down menu configures the dialog as shown below.

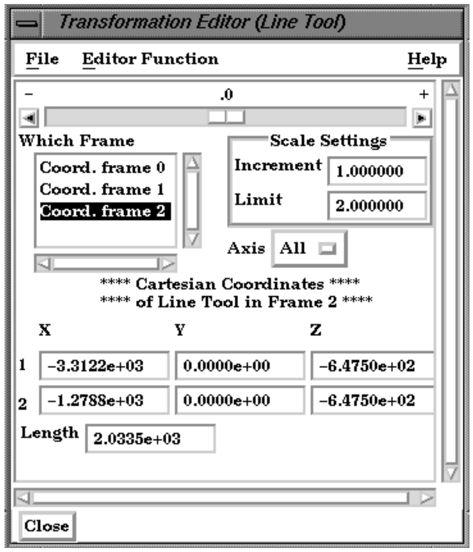


Figure 6-17
Transformation Editor (Line Tool)

The Transformation Editor dialog provides three methods for the precise positioning of the Line Tool. First, the Line Tool may be positioned within the Graphics Window by entering coordinates for the two endpoints in the X, Y, and Z fields. Pressing return causes the Line Tool to relocate to the specified coordinates in the selected Frame (or if more than one Frame is selected, in Frame 0).

It is also possible to reposition the Line Tool from its present coordinate position by specific increments. The Axis Button allows you to choose the axis of translation for the center of the line (X, Y, Z, or All). The Slider Bar at Top allows you to quickly choose the increment by which to move the position of the center point of the Line Tool. Dragging the slider in the negative (left) or positive (right) directions and then releasing it will cause the X, Y, and Z coordinate fields to increment as specified and the Line Tool to relocate to the new coordinates. The number specified in the Limit field of the Scale Settings area determines the negative (-) and positive (+) range of the slider. If the Limit is set to 1.0 as shown, then the numerical range of the slider bar will be -1 to +1.

Alternatively, you can specify an increment for translation in the Increment field of the Scale Settings area. Pressing return while the mouse pointer is in the Increment field will cause the center point of the Line Tool to translate along the specified axis (or all axes) by the increment specified.

Access: Transformation Editor > Editor Function > Tools > Line

(see How to Use the Line Tool)

Plane Tool

Clicking on Editor Function in the Transformation Editor dialog and then selecting Tools > Plane from the pull-down menu configures the dialog as shown below.

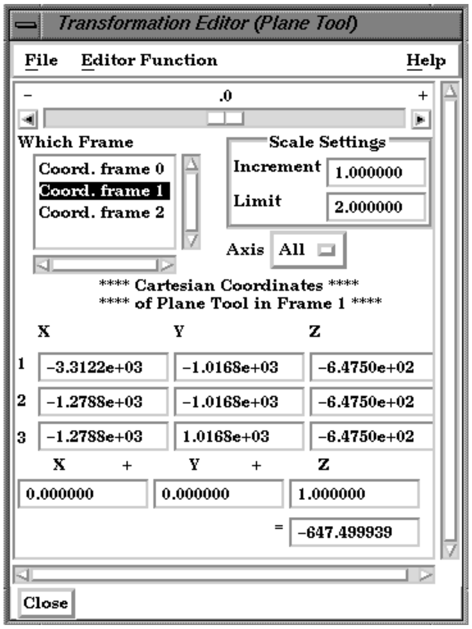


Figure 6-18
Transformation Editor (Plane Tool)

The Transformation Editor dialog provides four methods for the precise positioning of the Plane Tool. First, the Plane Tool may be positioned within the Graphics Window by entering coordinates for the three corners of the plane in the X, Y, and Z fields. Corner 1 is defined as the -X, -Y corner of the plane, Corner 2 is defined as the +X, -Y corner of the plane, and Corner 3 is defined as the +X, +Y corner of the plane. Pressing return causes the Line Tool to relocate to the specified coordinates in the selected Frame (or if more than one Frame is selected, in Frame 0).

You can also position the Plane Tool by entering a plane equation in the form $A_x + B_y + C_z = D$ in the X+Y+Z fields and then pressing Return. The coefficients of the plane equation are in reference to the selected Frame (or if more than one Frame is selected, to Frame 0).

As with the Cursor and Line Tools, it is possible to reposition the Plane Tool from its present coordinate position by specific increments. The Axis Button allows you to choose the axis of translation (X, Y, Z, or All) for the origin of the Plane Tool (intersection of the axes). The Slider Bar at Top allows you to quickly choose the increment by which to move the position of the origin. Dragging the slider in the negative (left) or positive (right) directions and then releasing it will cause the X, Y, and Z coordinate fields to increment as specified and the origin of the Plane Tool to relocate to the new coordinates. The number specified in the Limit field of the Scale Settings area determines the negative (-) and positive (+) range of the slider. If the Limit is set to 1.0 as shown, then the numerical range of the slider bar will be -1 to +1.

Alternatively, you can specify an increment for translation in the Increment field of the Scale Settings area. Pressing return while the mouse pointer is in the Increment field will cause the center of the Plane Tool to translate along the specified axis (or all axes) by the increment specified.

Access: Transformation Editor > Editor Function > Tools > Plane

(see How to Use the Plane Tool)

Cylinder or Sphere Tools

Clicking on Editor Function in the Transformation Editor dialog and then selecting Tools and then Cylinder or Sphere from the pull-down menu configures the dialog as shown below.

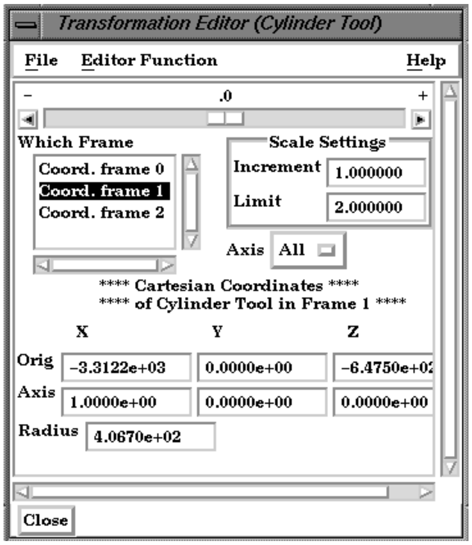


Figure 6-19
Transformation Editor (Cylinder Tool) or (Sphere Tool)

The Transformation Editor dialog enables you to precisely control the coordinates of the Cylinder or Sphere Tool origin (center point of the thick direction line) by specifying them in the Orig. X, Y, and Z fields. You control the direction vector for the Cylinder or Sphere Tool direction axes by specifying the coordinates in the Axis X, Y, and Z fields of the selected Frame (or if more than one Frame is selected, in Frame 0). The Radius of each tool may be specified in the Radius Field.

It is possible to reposition the Cylinder or Sphere Tool origins by specific increments. The Axis Button allows you to choose the axis of translation (X, Y, Z, or All) for the origin of the tool. The Slider Bar at Top allows you to quickly choose the increment by which to move the position of the origin. Dragging the slider it in the negative (left) or positive (right) directions and then releasing it will cause the X, Y, and Z coordinate fields to increment as specified and the origin of the Cylinder or Sphere Tool to relocate to the new coordinates. The number specified in the Limit field of the Scale Settings area determines the negative (-) and positive (+) range of the slider. If the Limit is set to 1.0 as shown, then the numerical range of the slider bar will be -1 to +1.

Alternatively, you can specify an increment for translation in the Increment field of the Scale Settings area. Pressing return while the mouse pointer is in the Increment field will cause the origin of the Cylinder or Sphere Tool to translate along the specified axis (or all axes) by the increment specified.

Access: Transformation Editor > Editor Function > Tools > Cylinder or Sphere

(see How To Use the Cylinder Tool and How To use the Sphere Tool)

Cone Tool

Clicking on Editor Function in the Transformation Editor dialog and then selecting Tools and then Cone from the pull-down menus configures the dialog as shown below.

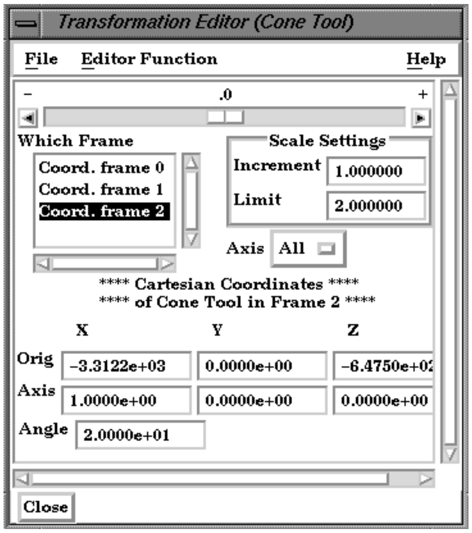


Figure 6-20
Transformation Editor (Cone Tool)

The Transformation Editor dialog enables you to precisely control the coordinates of the Cone Tool origin (center point of the thick direction line) by specifying them in the Orig. X, Y, and Z fields. You control the direction vector for the Cone Tool direction axis by specifying the coordinates in the Axis X, Y, and Z fields for the selected Frame (or if more than one Frame is selected, in Frame 0). The Angle of the tool may be specified in the Angle Field.

It is possible to reposition the Cone Tool origin by specific increments. The Axis Button allows you to choose the axis of translation (X, Y, Z, or All) for the origin of the tool. The Slider Bar at Top allows you to quickly choose the increment by which to move the position of the origin. Dragging the slider in the negative (left) or positive (right) directions and then releasing it will cause the X, Y, and Z coordinate fields to increment as specified and the origin of the Cone Tool to relocate to the new coordinates. The number specified in the Limit field of the Scale Settings area determines the negative (-) and positive (+) range of the slider. If the Limit is set to 1.0 as shown, then the numerical range of the slider bar will be -1 to +1.

Alternatively, you can specify an increment for translation in the Increment field of the Scale Settings area. Pressing return while the mouse pointer is in the Increment field will cause the center of the Cone Tool to translate along the specified axis (or all axes) by the increment specified.

Access: Transformation Editor > Editor Function > Tools > Cone

(see How to Use the Cone Tool)

Revolution Tool

Clicking on Editor Function in the Transformation Editor dialog and then selecting Tools and then Revolution from the pull-down menu configures the dialog as shown below.

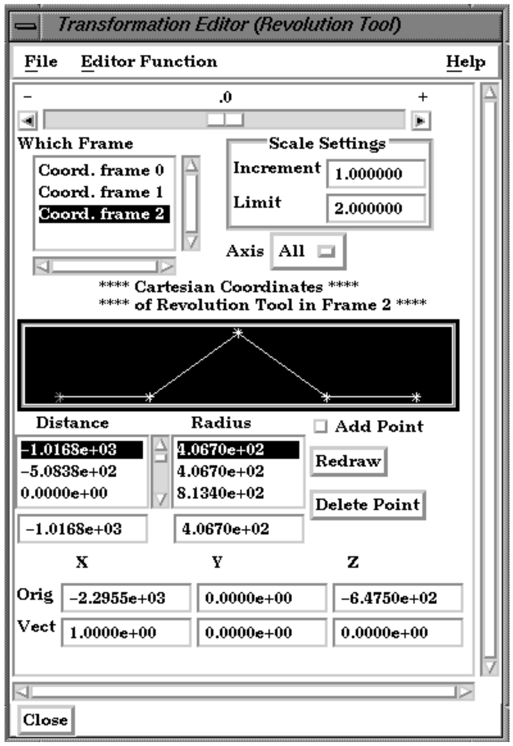


Figure 6-21
Transformation Editor (Revolution Tool)

For the Revolution Tool, you not only control the origin and direction vector, but the number of points and positions that are revolved about the axis.The desired coordinates of the Revolution Tool origin (center point of the thick direction line) are specified in the Orig. X, Y, and Z fields. The direction vector for the Revolution Tool direction axis is specified by entering the desired coordinates in the Vect X, Y, and Z fields for the selected Frame (or if more than one Frame is selected, in Frame 0).

Additional points may be added to the Revolution Tool by clicking on the Add Point(s) toggle and then clicking at the desired location in the schematic for the tool. There is no need to be overly precise in its placement since its location can be modified. Once you have added all of the new points you wish, the Add Point(s) toggle should be turned off. A point may be deleted by selecting it in the schematic area and then clicking the Delete button.

The position of any point may be modified interactively within the Revolution Tool schematic window, Simply click on and drag the point to the desired location. The precise location of any point may be specified by selecting the point in the schematic with the mouse and then entering the desired Distance (from the Revolution Tool origin) or Radius (from the axis) for the point in the text entry fields beneath the Distance and Radius Lists. Pressing return will enter the new value in the list above for the selected point.

It is possible to reposition the Revolution Tool origin by specific increments. The Axis Button allows you to choose the axis of translation (X, Y, Z, or All) for the origin of the tool. The Slider Bar at Top allows you to quickly choose the increment by which to move the position of the origin. Dragging the slider in the negative (left) or positive (right) directions and then releasing it will cause the X, Y, and Z coordinate fields to increment as specified and the origin of the Revolution Tool to relocate to the new coordinates. The number specified in the Limit field of the Scale Settings area determines the negative (-) and positive (+) range of the slider. If the Limit is set to 1.0 as shown, then the numerical range of the slider bar will be -1 to +1.

Alternatively, you can specify an increment for translation in the Increment field of the Scale Settings area. Pressing return while the mouse pointer is in the Increment field will cause the center of the Revolution Tool to translate along the specified axis (or all axes) by the increment specified.

Redraw

This button will cause the Revolution Tool schematic window to re-center to the currently defined points of the tool.

Access: Transformation Editor > Editor Function > Tools > Revolution

(see How to Use the Surface of Revolution Tool)

6.6 Case Menu Functions

EnSight allows you to work concurrently with up to eight different sets of results data (computational or experimental). Each set of results data is read in as a "Case".

Clicking the Case button in the Main Menu opens a pull-down menu which provides access to the following features:

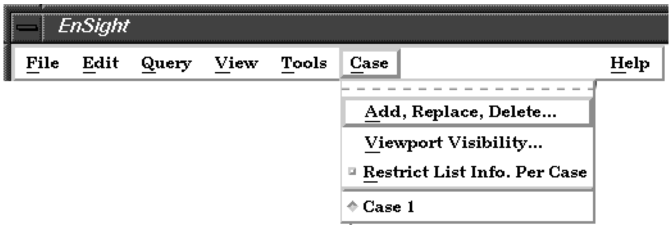


Figure 6-22
Case pull-down menu

Add, Replace, Delete... Opens the File Selection dialog.

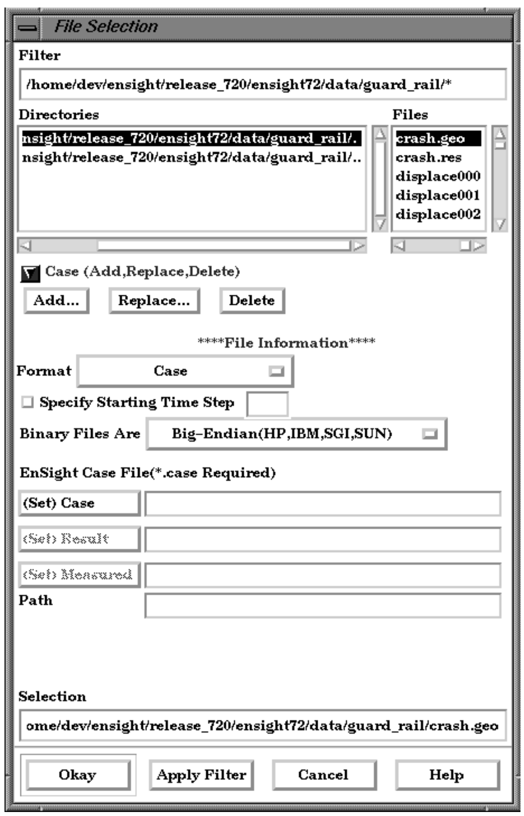


Figure 6-23
File Selection Dialog to Add, Replace or Delete a Case

Case Turndown Button

Add... Opens a small dialog which allows you to specify a name for the new Case. This name will appear in the list of active Cases at the bottom of the Main Menu: Case pull-down menu as shown in Figure 6-24 above. Adding a Case actually starts a new EnSight Server and connects it to the EnSight Client. You then read and load data files for the new Case and the data will be added to the data already present in the EnSight Client.

Replace... Replacing a Case causes all parts and variables associated with the active Case to be deleted. The Server will be restarted and assigned the new Case name. Clicking the Replace... button opens a small dialog which allows you to specify a name for the Case you wish to use to replace the Case currently selected in the Main Menu: Case pull-down menu as shown in Figure 6-24 above. You then read and load data for the new Case.

Delete Deleting a Case causes all parts and variables associated with the Case to be deleted and terminates the Server associated with the Case. Clicking the Delete button opens a Warning Dialog which asks you to confirm that you wish to delete the Case currently selected in the Main Menu: Case pull-down menu as shown in Figure 6-24 above.
(see How To Load Multiple Datasets (Cases))

Viewport Visibility... Opens the Case Visible In Which Viewport dialog which allows you to specify in which Viewports (including the Main Graphics Window) you wish to make the parts associated with the currently selected Case visible. Parts associated with the selected Case will be visible in the viewports outlined in green and invisible in those outlined in red. Visibility for specific Parts can of course be toggled on/off using the Part Visibility Icon in the Part Mode Icon Bar.
(see Part Visibility Toggle Icon in Section 8.4, Part Mode)

Restric List Info. Per Case Toggle Toggling this menu selection on will restrict all lists displayed in EnSight (such as the Parts and variables Lists) to show only information pertaining to the Case currently selected in the Main Menu: Case pull-down menu as shown in Figure 6-24 above.

Finally, at the bottom of the pull-down menu you will find a list of active Cases, The toggle buttons allow the selection of only one Case at a time. In figure 6-24 above, Case 1 is the currently selected Case. The current selected Case is the one which will be affected by the Data Reader, Querys, and many other operations.

6.7 Help Menu Functions

Clicking the Help button in the Main Menu opens a pull-down menu which provides access to the following features:

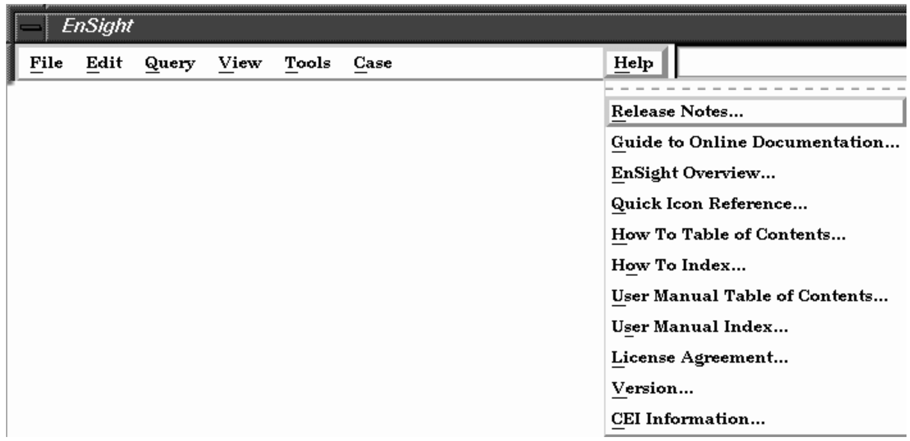


Figure 6-24
Help pull-down menu

Release Notes... Provides an overview of changes made since the last EnSight release.

Guide to Online Documentation... Provides a guide to the use of the On-Line Documentation.

EnSight Overview... Provides an overview of EnSight.

Quick Icon Reference... Provides a quick reference guide to all EnSight GUI icons, many of which have links to appropriate How To documents

How To Table of Contents... Opens up On-Line Documentation to the Table of Contents for the How To section.

How To Index... Opens up On-Line Documentation to the Index for the How To section.

User Manual Table of Contents... Opens up On-Line Documentation to the Table of Contents for the User Manual.

User Manual Index... Opens up On-Line Documentation to the Index for the User Manual.

License Agreement... Opens up On-Line Documentation to the text of the EnSight End User License Agreement and the EnSight Support and Maintenance Service Agreement.

Version... Opens up the Version Information dialog which states the version number of the EnSight software currently running.

CEI Information... Opens up the CEI Information display which gives full CEI contact information.

7 Features

This chapter describes the functions available through the Feature Icon Bar.

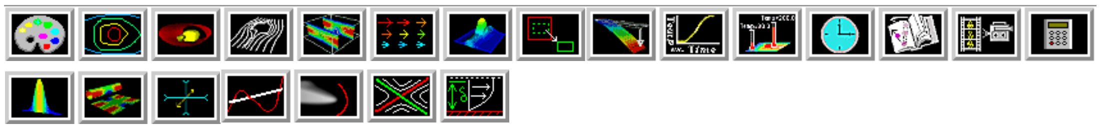


Figure 7-1
EnSight Feature Icon Bar

7.1 Color

Clicking once on the Color Icon opens the Color Editor in the Quick Interaction Area which allows you to assign color to the individual Part(s) which has(have) been selected in the Parts List. If no Parts are selected, modifications will affect the default Part color and all Parts subsequently loaded or created will be assigned the new default color.

Figure 7-2
Color Icon

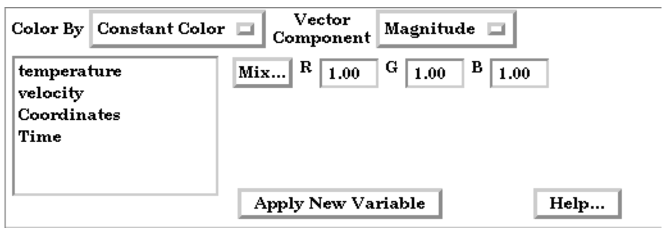


Figure 7-3
Quick Interaction Area - Color Editor - Constant Color

Color By

Opens a pull-down menu which allows you to choose whether to color the selected Part(s) by a Constant Color or by the Variable selected in the Variables List.

Constant Color

The selected Part(s) may be assigned a constant color in two ways. First, the color may be assigned by entering red, green, and blue numerical values (0.0 to 1.0) in the R,G,B fields of the Quick Interaction Area and then pressing the return key.

Mix...

Second, you can click on the Mix... button and the Color Selector dialog will open.

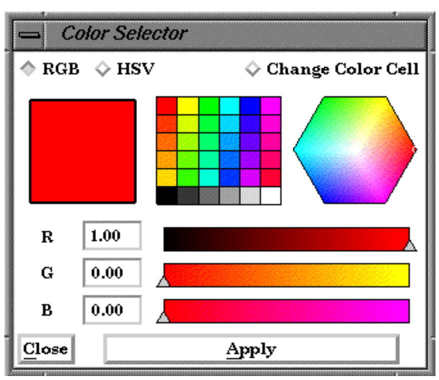


Figure 7-4
Color Selector dialog

You can choose whether you wish to use the RGB color scheme or HSV. A color may be chosen in one of four ways. First, a color may be chosen from one of the color cells (small squares of constant color). Second, you can grab the small circle in the color assignment hexagon and interactively pick the desired color. Third, you can pick a color by entering numerical values (0.0 to 1.0) in the numerical (RGB or HSV) fields and then pressing return key. Finally, you can interactively choose a color by using the slider bars to the right of the numerical (RGB or HSV) fields which adjust the values therein (the color in the slider bars indicates the effect that modifying the color components will have on the final color).

It is possible to assign to the Color Cells area a color that you have specified in one of the other three ways by clicking the Change Color Cell and then clicking on the cell to which you wish to assign the currently defined color (as shown in the large rectangle to the left). This reassignment will be retained for use in subsequent EnSight sessions.

Regardless of which method you use to define a color, it will not be applied to the selected Part(s) unless and until you click the Apply button.

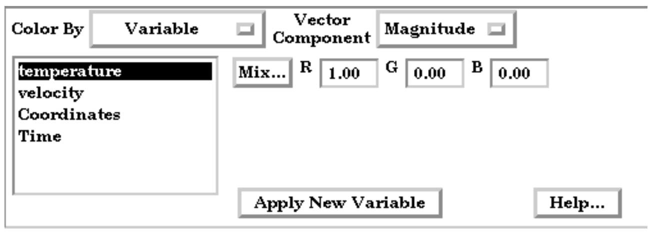


Figure 7-5
Quick Interaction Area - Color Editor - Variable

Variable

Alternatively, the Part(s) may be colored by a variable selected in the Variables List instead of by one constant color. The color palette for each Variable associates a color with each value of the variable and these colors are used to color the selected Part(s).

Vector Component

If you are coloring by a vector variable, this opens a pull-down menu which allows you to choose whether you wish to color using the magnitude or a component of the vector.

Magnitude

Color by the vector magnitude.

X

Color by the vector's X component.

Y

Color by the vector's Y component.

Z

Color by the vector's Z component.

Apply New Variable

Changes the color palette used to color the selected Part(s) to that of the variable currently chosen in the Variables List. If more than one variable is selected, then the color palette of the first selected variable will be used.

Feature Detail Editor (Variables)

Double clicking on the Color Icon will open the Feature Detail Editor (Variables) dialog.

(see Section 4.1, Variable Selection and Activation, Section 4.2, Variable Summary & Palette, and How To Edit Color Palettes)

7.2 Contour Create/Update

Contours are lines that trace out constant values of a variable across the surface(s) of selected Part(s), just like contour lines on a topographical map.

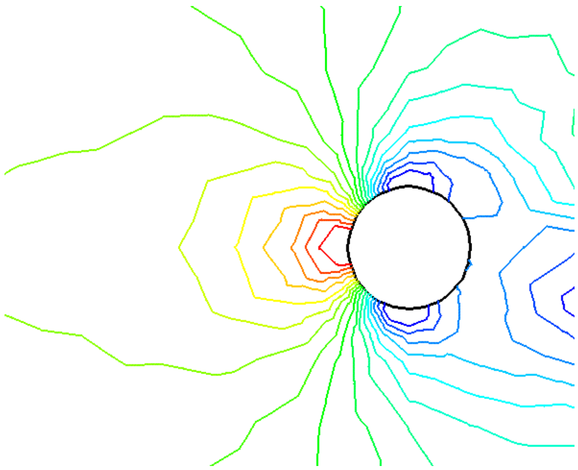


Figure 7-6
Pressure Contours in a Flow Field around a Circular Obstruction

The variable must be a node-based scalar, but can, of course, be a function of a vector variable (i.e., the magnitude or a component). A Contour Part can consist of one contour line, or a set of lines corresponding to the value-levels of the variable palette. A Contour Part has its own attributes independent of those Parts used to create it (the parent Part(s)).

Contours are drawn across the faces of parent Part elements (one-dimensional elements are ignored). At each node along the edges of any one element face, the contour's variable has a value. If the range of these values includes the contour's value-level, the contour line crosses the face. EnSight draws the contour by dividing the face into triangles each having the face's centroid as one vertex. For each triangle the contour crosses, it will cross only two sides. EnSight interpolates to find the point on each of those two sides where the variable value equals the contour value-level, then creates a bar element to connect the two points. Note that a contour line can bend while crossing an element face.

Because Contour Parts are created on the EnSight Client, the Representation attribute of the parent Part(s) greatly affects the result. Representations that reduce Part elements to one-dimensional representations (Border applied to two-dimensional Parts and Feature Angle), or do not download the Part (Not Loaded), will eliminate those Part elements from the Contour creation process. On the other hand, Full representation of three-dimensional elements will create contour lines across hidden surfaces. Usually, you will want the Representation selection to be 3D Border, 2D Full.

Contour Parts are created on the Client, and so cannot be queried or used in creating new variables. However, Contours can be used as parent Parts for Profiles and Vector Arrows.

If you change the value-levels in the Feature Detail Editor (Variables) Summary and Palette section, the Contour automatically regenerates using the new value-levels.

Use care when simultaneously displaying contours based on different function palettes so that you do not become confused as to which contours are which. Coloring them differently and adding an on-screen legend can help.

Clicking once on the Contour Create/Update Icon opens the Contour Editor in the Quick Interaction Area which is used to both create and update (make changes to) contour Parts.

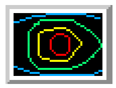


Figure 7-7
Contour Create/Update Icon

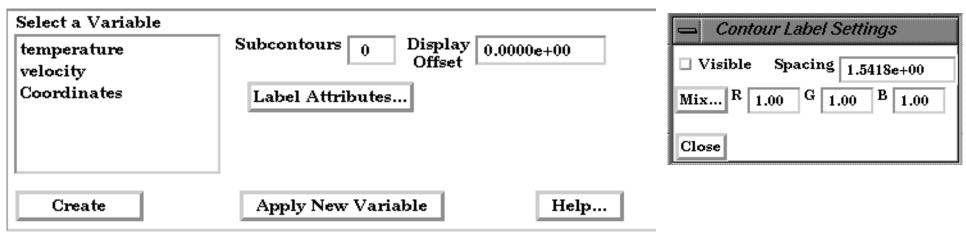


Figure 7-8
Quick Interaction Area - Contour Editor

Subcontours — This field allows you to specify the number of sub-contours you wish to be drawn at evenly spaced value-levels between the value-levels defined in the Variable Feature Detail Editor Summary and Palette section. Leaving this field 0 will produce exactly the number of contour lines for which value levels are specified in the Feature Detail Editor (Variables) Summary and Palette.

Display Offset — This field specifies the distance away from a surface to display the contours (so that potential Z-buffer conflicts can be overcome). A positive distance value moves the contour away from the surface in the direction of the surface normal.

Labels

Visible Toggle — Toggles on/off the visibility of number labels for contour lines.

Spacing — Determines the spacing between labels.

Mix... — Opens the Color Selector dialog for the assignment of a color to labels.

R,G,B — Allows the specification of red, green, and blue values for the assignment of a color to labels.

Create — Creates a Contour Part using the selected Part(s) in the Parts List and the color palette associated with the Variable currently selected in the Main Variables List.

Apply New Variable — Will change the Contour Part to show contours based on the color palette associated with the Variable currently selected in the Variables List.

Vector Component — If the selected Variable is a vector, this option allows you to choose between the vector magnitude or the X, Y, or Z component.

Feature Detail Editor (Contours) — Double clicking on the Contour Create/Update Icon opens the Feature Detail Editor (Contours), the Creation Attributes Section of which provides access to the same functions available in the Quick Interaction Area. For a detailed discussion of the remaining Feature Detail Editor turn-down sections (which are the same for all Part types):

(see Section 3.3, Part Editing and How to Create Contours)

Troubleshooting Contours

Problem	Probable Causes	Solutions
No contours created.	Variable values on element faces are outside range of palette function value-levels.	Adjust palette function using the Feature Detail Editor (Variables) Summary and Palette section.
	Parent Parts do not contain any 2D elements.	Re-specify Parent Part list.
	Parent Parts do not contain the specified Variable.	Recreate the Variable for the selected Parent Part(s).
Too many contours.	Palette has too many function levels.	Change the number of levels for the palette using the Feature Detail Editor (Variables) Summary and Palette.
	Specified too many sub-contours.	Lower the sub-contour attribute.
Too few contours.	The palette levels do not adequately cover the function value range for the Parent Parts.	Modify the palette using the Feature Detail Editor (Variables) Summary and Palette.
	Sub-contour attribute set to 0.	Modify the Sub-contour attribute.
Contour Part created but (empty)	Parent Part is in Feature Angle representation.	Change Parent Part to 3D border, 2D full representation.
Contours are fine at first, but later go away.	Parent Parts representation changed to Feature Angle, or Not Loaded.	The contours are created from the Part representation on the EnSight client. Modifying the representation affects the Contour Parts.

7.3 Isosurface Create/Update

Isosurfaces are surfaces that follow a constant value of a variable through three-dimensional elements. Hence, isosurfaces are to three-dimensional elements what contour lines are to two-dimensional elements.

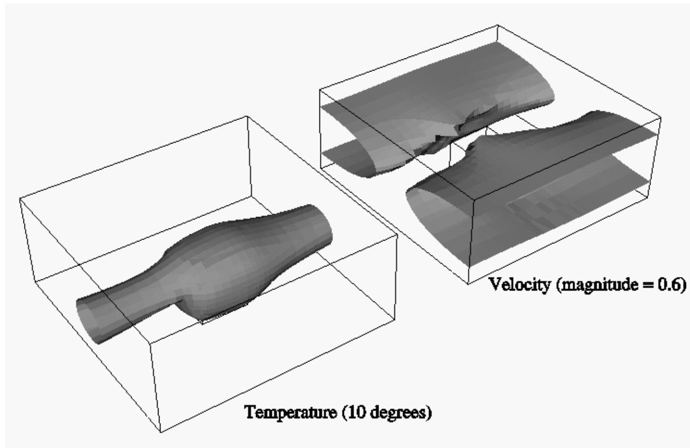


Figure 7-9

An isosurface may be based on a vector variable (magnitude or components), or a scalar variable.

At each node of a three-dimensional element, the isosurface's variable has a value. If the range of these values includes the isosurface's isovalue, the isosurface cuts through the element. EnSight draws the isosurface through that element by first determining which edges the isosurface crosses, and then interpolating to find the point on each of those edges corresponding to the isovalue. EnSight connects these points with triangle elements passing through the parent Part elements. If the Parent Part(s) contain two-dimensional elements, a line is created across the elements - just like a contour.

All the triangle elements created inside all the three-dimensional elements of all the parent Part(s) together with all the lines created across the two-dimensional elements of all the Parent Part(s) constitute the isosurface. One-dimensional elements of the parent Part(s) are ignored. Because isosurfaces are generated by the server, the Representation of the parent Part(s) is not important.

You can interactively manipulate the value of an isosurface with a slider allowing you to scan through the min/max range of a variable. This scanning can also be done automatically. The isosurface will change shape as the value is changed.

If you are using animation, you can specify an Animation Delta value by which the isovalue is incremented for each animation frame or page. The isosurface is automatically updated to appear as if it had been newly created at the new location and time.

Clicking once on the Isosurface Create/Update Icon opens the Isosurface Editor in the Quick Interaction Area which is used to both create and update (make changes to) isosurface Parts.

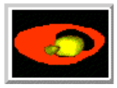


Figure 7-10
Isosurface Create/Update Icon

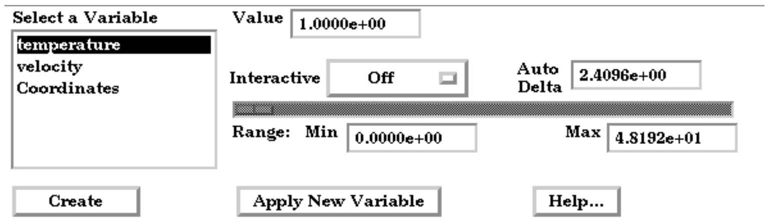


Figure 7-11
Quick Interaction Area - Isosurface Editor

Value — Specification of numerical isovalue of the isosurface. To avoid an empty Part, this value must be in the range of the Variable within the Parent Parts. You can find this range using the Variables dialog or by showing the Legend for the Variable. For vector-variable-based isosurfaces, the vector magnitude is used.

Interactive — Opens pull-down menu for selection of type of interactive manipulation of the isosurface value. Options are:

- Off — Interactive isosurfaces are turned off.
- Manual — Value of the isosurface(s) selected are manipulated via the slider bar and the isosurface is interactively updated in the Graphics Window to the new value.
- Auto — Value of the isosurface is incremented by the Auto Delta value from the minimum range value to the maximum value when the cursor is moved into the Main View. When reaching the maximum it starts again from the minimum.
- Auto Cycle — Value of the isosurface is incremented by the Auto Increment value from the minimum range value to the maximum value. When reaching the maximum it decrements back to the minimum.

Auto Delta — Specification of the increment for the Auto and Auto Cycle options to use when modifying the value between the minimum and maximum values.

Range Min — Specification of the minimum isosurface value for the range used with the “Manual” slider bar and the “Auto” and “Auto Cycle” options.

Range Max — Specification of the maximum isosurface value for the range used with the “Manual” slider and the “Auto” and “Auto Cycle” options.

Create — Creates an isosurface Part at the value specified for the variable selected in the Variables List and from the Part(s) selected in the Parts List.

Apply New Variable — Will recreate the isosurface Part at the value specified for the variable currently selected in the Variables List.

Feature Detail Editor (Isosurfaces)

Double clicking on the Isosurface Create/Update Icon opens the Feature Detail Editor (Isosurfaces), the Creation Attributes Section of which provides access to additional features for isosurface creation and modification:

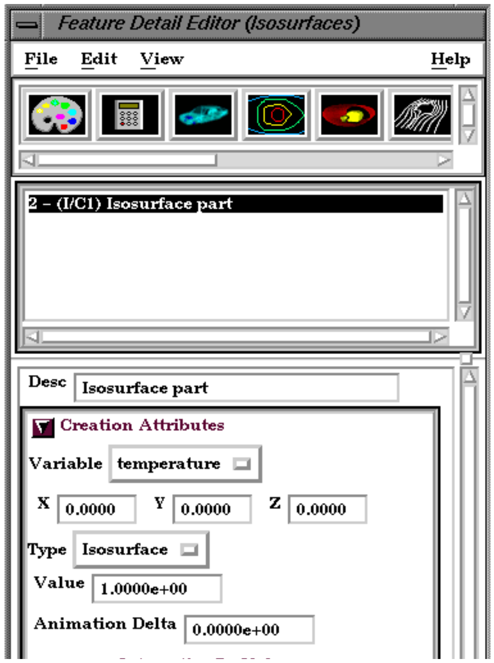


Figure 7-12
Feature Detail Editor (Isosurfaces) Creation Attributes Area

Variable

Opens a pop-up menu for the selection of an active Variable to use to calculate the isosurface.

X Y Z

These fields specify the vector- component coefficients. When the three fields are set to 0.0000, the vector magnitude is used for the isosurface calculation. Otherwise, the sum of: ($Vector_x$ * X)+($Vector_y$ *Y) + ($Vector_z$*Z) is used as the isosurface value.

Type

Isosurface

Specification that an Isosurface type part created from the specified Variable and selected parts will have the isovalue of Value for all its elements.

Value

Specification of the numerical isovalue of the Isosurface Part(s) selected in the Feature Detail Editor's Parts List (or if none is selected, of the isosurface you are about to Create).

Figure 7-13
Feature Detail Editor (Isovolume) Creation Attributes Area

Isovolume

Specification that an Isovolume type part created from the specified Variable and selected parts will consist of elements with isovalues constrained to either below a Min, above a Max, or within the specified interval of Min and Max.

Constraint

Specification restricting the element isovalues of the Isovolume Part to an interval. The Constraint options are:

Low all elements of the Isovolume Part have isovalues below the specified Min value.

Band all elements of the Isovolume Part have isovalues within the specified Min and Max interval values.

High all elements of the Isovolume Part have isovalues above the specified Max value.

Min — Specification of the minimum isovalue limit for the Isovolume Part.
Max — Specification of the maximum isovalue limit for the Isovolume Part.

Animation Delta — This field specifies the incremental change in isovalue for each frame or page of animation It can be negative.

(see Section 7.14, Flipbook Animation and Section 7.15, Keyframe Animation)

Create — (At the bottom of the Feature Detail Editor) Creates an Isosurface Part at the value specified for the variable selected in the Variable pop-up menu of the Creation Attributes section and from the Part(s) selected in the Main Parts List.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

For a detailed discussion of the remaining Feature Detail Editor turn-down sections (which are the same for all Parts):

(see Section 3.3, Part Editing and How To Create Isosurfaces

7.4 Particle Trace Create/Update

A *Particle trace* visualizes a vector field by displaying the path that a massless Particle would follow if placed in that field. At each point on the Particle trace, the direction of the trace is parallel to the vector field at that point and time.

A *streamline* is a Particle trace in a steady-state vector field, while a *pathline* is a Particle trace in a time-varying vector field. Particle traces can be lines or "ribbons" (that additionally visualize the rotation of the vector field around the path of the trace).

EnSight is capable of computing a pathline through a model with changing coordinates and/or changing connectivity. The variable values are assumed to behave linearly between the known timesteps.

Particle Trace Parts have their own attributes, so you can, for example, trace a flow field using the velocity variable, and then color the resulting trace using the temperature variable.

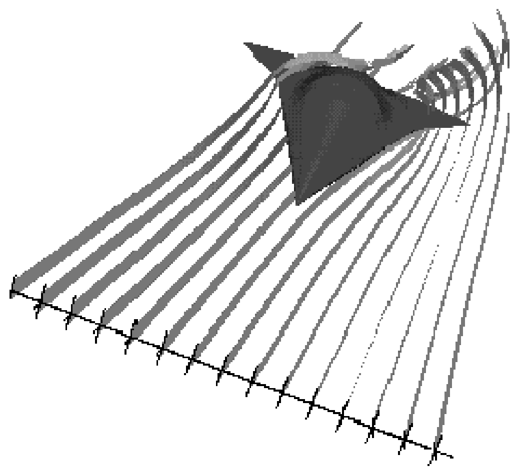


Figure 7-14
Particle Trace Illustration

Emitters

A Particle Trace Part consists of one or more Particle traces originating from points on one or more *emitters*. Each emitter is capable of emitting a Particle starting at a specified time and continuing to emit Particles at given intervals. When pathlines are generated with emitters emitting at multiple time intervals and these traces are then animated, *streaklines* are displayed.

Emitters consist of single points, points along a line, points forming a grid in a plane, or points corresponding to the nodes of a Part. You can define emitters using the Cursor tool, the Line tool, the Plane tool, or a Part.

Emitters can be created using the cursor, line, and plane tools, using existing Part nodes, or can be created in a surface restricted mode where the mouse can be used to project points, rakes or nets directly onto the displayed surfaces of the model.

Pathlines, of course, must be drawn forward in time, but streamlines can be drawn forward in time, backward in time, or both. Each Particle trace terminates when either (1) the Particle trace moves outside the space in which the vector field is defined, (2) a user-specified time limit is reached, (3) the massless Particle becomes stationary in a place where the vector field is zero, or (4) the last transient-data time step is reached. (4 applies only to pathlines)

A Particle trace can pass through any point inside an element of the parent Part(s). The vector field at any point is calculated from the shape function of the containing element. Emitter points located outside the elements are ignored when creating Particle traces.

Surface-Restricted Traces

A surface-restricted Particle trace is constrained to the surface of the selected Part(s) by using only the tangential component of the velocity. The velocity values for this type of trace can be the velocity at the surface (if nonzero) or at some user specified offset into the velocity field.

Interactive Traces

A Particle trace can be updated interactively by entering interactive mode and moving the tool used to create the emitter. When a trace is selected and interactive emitter is turned on, the tool will appear at the location of the emitter. The user then manipulates the tool interactively in the Graphics Window or using the transformations dialog. (This option is not available for surface-restricted Particle traces or traces emitted from a Part).

Integration Method

EnSight creates Particle traces by integrating the vector field variable over time using a Fourth Order Runge-Kutta method and utilizing a time varying integration step. The integration step is lengthened or shortened depending on the flow field, but you can control the minimum number of integration steps performed in any element as well as other time step controls.

Normally, EnSight will perform the integration using all of the components of the vector. However, it is possible to restrict the integration to a plane by specifying which components of the vector to use. Typical uses of this feature would be to restrict the Particle traces to a clip plane. Surface-restricted Particle traces provide even greater flexibility in restricting a trace to planes or other surfaces.

Line-type Particle traces consist of bar elements. Ribbons consist of 4-noded quad elements and originate with their end-edge parallel to the Z-axis of the global frame. Then, at each integration step, the leading edge is rotated around the current direction of the path by the same amount the vector field has rotated around the path since the previous time step. Ribbons are not available for surface-restricted Particle traces.

Particle Trace Parts are created on the server, so the Representation-type of the parent Parts has no effect. The algorithm that creates Particle traces initially sets up a cross-referencing map of adjoining elements. Hence, the first Particle trace takes longer to generate than subsequent traces.

If you calculate pathlines, consider calculating as many as possible at a time, since the process can be very time consuming (most of the time is taken in reading time step information). However, the data for the Trace Part is sent to and stored on the Client, Thus, you cannot label or make queries about Particle Trace Parts. Instead, label or make queries about the Particle Trace’s parent Part(s). Line-type Particle Traces can be parent Parts for Profiles. You can animate the motion of the massless Particles along their Particle traces.

Transient Data

By default the emission point is always set to emit the Particles at the current time step. This can be a problem if you have a transient dataset with the current time set at the last time step available. If you compute pathlines from this location, the default emission time will be at the current time (last time step), thus no pathlines will be generated. To solve this problem you will need to either change the current time, or change the Start Time of the emitter.

The process of creating a Particle trace is always to specify an emission point (location and time), specify the Part(s) to trace the Particle through and specify which vector variable to integrate. There are quick ways of doing this process which assume that the correct defaults are set, or there are more deliberate ways which give you more control. Particle trace Parts carry only one set of attributes for all of the traces in the Part, thus it is not possible, for example, to trace some of the emission points forward in time and others backward in time.

Particle trace Parts are different from all other created Parts in that when the parent Parts change (such as at a time step change), the Particle trace Part does not change. This is due to the fact that the Particle trace has been created at a specified time (the emission time), making the Part independent of time (after the trace has been created).

Regular Particle traces can only be computed through a set of parent Parts consisting of model Parts. Surface-restricted Particle traces can be created on model Parts, clip Parts, elevated surface Parts, and developed surface Parts.

If your dataset contains 3D elements, the Particles for regular traces will be traced through 3D element fields only. Surface-restricted traces would have to be used to trace along 2D elements of such a data set.

Clicking once on the Particle Trace Create/Update Icon opens the Particle Trace Editor in the Quick Interaction Area which is used to both create and update (make changes to) Particle trace Parts.

Figure 7-15
Particle Trace Create/Update Icon

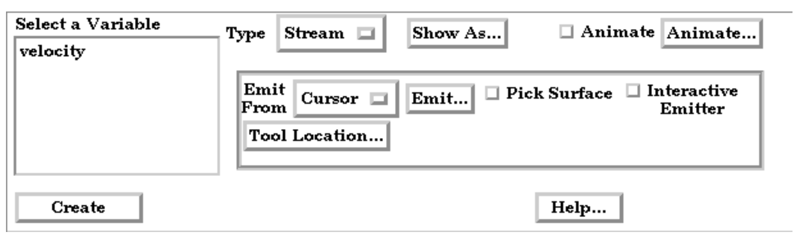


Figure 7-16
Quick Interaction Area - Particle Trace Editor

Type — Opens a pull-down menu for specification of whether Particle trace calculation uses steady-state data (streamlines) or transient data (pathlines).

Stream — Traces a massless Particle in a steady-sate vector field (for steady-state data or the current time-step of transient data).

Path — Traces a massless Particle through a time-varying vector field *and so is only available with transient results data*. On certain systems, this selection can consume significant quantities of CPU time to calculate the resulting Particle trace.

Show As — Opens a dialog for specification of trace representation.

Line — Depicts the trace as a line.

Ribbon — Depicts trace as if it were a ribbon. The ribbon width is a specified fixed value, while the twisting is determined by the rotation of the flow about the path of the trace at any particular point on the trace.

Square Tubes

Depicts trace as if it were a square tube. The tube width is a specified fixed value, while the twisting is determined by the rotation of the flow about the path of the trace at any particular point on the trace.

Animate Toggle

Toggles on/off the animation of the motion of the Particles along the traces. In addition to creating Particle traces based on vector variables, EnSight can also animate the motion of the Particles along the Particle traces. To distinguish them from discrete Particles, we call Particles moving along Particle traces "tracers."

At any instant, each tracer consists of a portion of a Particle trace displayed with attributes you specify separately from the attributes of the Particle trace. EnSight animates each tracer by updating which portion of the Particle trace is currently displayed. Tracers move whenever the mouse cursor is inside the Graphics Window. You specify the length of each tracer as a time value, so the tracer's length varies dynamically as it moves down the Particle trace (faster moving tracers are longer). This option can add tremendously to the understanding of the flow field since relative speed can be determined.

EnSight provides control over how the tracer looks and acts. You can animate one, some, or all of the Particle traces you have created, but they are all animated in the one way you specify. To help you get started, at the click of a button EnSight will suggest time-specification values based on the Particle traces you have selected to animate. You can specify the line width of the tracer, and choose to color it with a constant color or the same calculated color used to color the Particle trace. You can also display a spherical "head" on the leading-end of the tracer, and dynamically size the head according to any active variable.

You control the speed of the motion and have the option to display multiple tracers on the same Particle trace separated by a time interval. Hence, you can choose to view rapid-fire pulses, slow moving "noodles," or something in between. For steady-state Particle traces (streamlines), "time" is the integration time with the emitters located at time zero. For transient Particle traces (pathlines), you have the option to synchronize the animation time to the solution time. The choice of whether a Particle trace is a streamline or a pathline is made when you create the Particle trace.

You do not have to animate the entire Particle trace. You can specify where you want the animation to start with a time value corresponding to a distance down the Particle trace from the emitter, and where you want the animation to stop with a time value corresponding to a distance farther down the Particle trace.

Tracers on all animated Particle traces are synchronized. If you combine Particle trace animation with flipbook animation or keyframe animation, the animation time values are automatically synchronized if you toggle-on Sync To Transient in the Trace Animation Settings dialog.

Animate...

Opens the Trace Animation Settings dialog

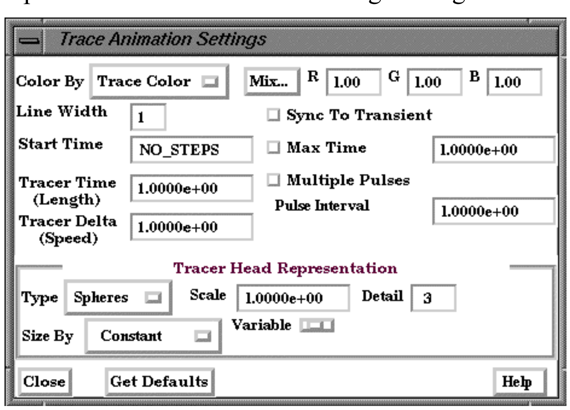


Figure 7-17
Trace Animation Settings dialog

Color By	Opens a pull-down menu for selection of method by which to color the tracers.
Constant	Displays tracers in the constant color specified in this dialog.
Mix…	Opens the Color Selector dialog (See Figure 7-4 Color Selector dialog).
R,G,B	Fields allow specification of constant color.
Trace Color	Displays tracers in the same color as the Particle Trace Part from which they originate.
Line Width	Specification of displayed width (in pixels) of tracers. Note: Line Width specification may not be available on some workstation platforms.
Start Time	Specification of how far down each Particle trace to begin displaying tracers. A Particle trace is made up of line segments. Each segment that makes up a Particle trace has an associated time value. The start time indicates where on the Particle trace the tracers will begin animation.
Tracer Time (Length)	Specification of length of tracers which varies as the tracer speed varies along the Particle trace. The Particle Time Length parameter scales the length of all tracers at all times.
Tracer Delta (Speed)	Specification of how fast tracers move. Longer times result in faster moving tracers. This parameter is not applicable when using Sync To Transient and displaying transient data through flipbook or keyframe animation.
Sync to Transient Toggle	Toggles on/off synchronization of tracer position to solution time of transient data. When toggled-on and transient data is in use, each tracer is displayed with its leading-end at the correct location along the Particle trace for the current solution time. Traces only move forward in time so cycling through transient data is not applicable here.
Max Time Toggle	Toggles on/off maximum lifetime for all tracers. If toggled-off, tracers continue to end of Particle trace. If toggled-on, each tracer stops after moving down the Particle trace for a distance corresponding to the specified Max Time (or until one of the other conditions that stop a tracer occurs).
Max Time	Field specifies lifetime of all tracers when Set Max Time is toggled-on.
Multiple Pulses Toggle	Toggles on/off multiple emission of tracers. When toggled-off, a single tracer for each Particle trace appears at the specified Start Time. When toggled-on, additional tracers appear after each specified Pulse Interval. Not applicable to pathlines.
Pulse Interval	Field specifies time delay between tracers. Not applicable when Multiple Pulses is toggled-off.

Tracer Head Representation

Type	Opens a pull-down menu for selection of type of head for each tracer.
None	Specifies that no head will appear.
Spheres	Specifies that a sphere will appear on the leading end of the tracer.
Scale	Specification of scaling factor for head size. Values between 0 and 1 reduce the size, factors greater than one enlarge the size. Not applicable when Head Type is None.
Detail	Specification of detail-level of head in range from 2 to 10, with 10 being the most detailed (e.g., rounder spheres because more polygons are used to create spheres). Higher values take longer to draw, slowing performance. Not applicable when Head Type is None.

Size By — Opens a pull-down menu for the selection of variable-type to use to size each tracer's head. If you select a variable, the head size is determined by multiplying the Scale factor times the variable value, which will vary depending on the location of the tracer. Not applicable when Head Type is None.

Constant	Sizes head using just the Scale factor value.
Scalar	Sizes head using a scalar variable.
Vector Mag	Sizes head using magnitude a vector variable.
Vector X	Sizes head using X-component of a vector variable.
Vector Y	Sizes head using Y-component of a vector variable.
Vector Z	Sizes head using Z-component of a vector variable.

Variable — Selection of variable to use to size the tracer heads. Not applicable when Type is None or Size By is Constant.

Get Defaults — Click to set time-value specifications in this dialog to values suggested by EnSight based upon the characteristics of the selected Particle traces.

See Also: How To Animate Particle Traces

Troubleshooting Animated Particle Traces

Problem	Probable Causes	Solutions
No motion. Can't see any tracers.	No Particle traces selected to animate.	Select the traces you wish to animate in the list at the top of the Animated Trace Setup dialog.
	Tracers colored same as Particle traces and have same line width.	Change Color By or Line Width.
	Animate Traces not toggled-on.	Toggle Animate on in the Quick Interaction Area.
	Cursor not in Graphics Window.	Use the mouse to move the cursor into the Main View.
	Start Time > maximum Particle trace time for all traces selected.	Change settings in the Trace Animation Settings dialog.
	Delta Time (Speed) set too high.	Change settings in the Trace Animation Settings dialog.
	Particle Time (Length) set too small.	Change settings in the Trace Animation Settings dialog.
Motion too fast.	Delta Time (Speed) set too high.	Change settings in the Trace Animation Settings dialog.
Can't get multiple pulses at same time.	Pulse interval too high.	Decrease to have pulses start closer together.
Have one big tracer, no pulses.	Pulse interval too small, pulses start right after each other with no separation.	Increase the interval.

Quick Interaction Area Particle Trace Editor, continued,

Emit From — Opens a pull-down menu for the specification of the emitter type.

Cursor — Creates Particle trace beginning from the position of the Cursor tool.

Line — Creates Particle traces beginning from the position of the Line tool.

\# Points — This field specifies the number of evenly spaced traces you want to emit from the Line tool.

Plane — Create Particle traces beginning from the position of the Plane tool.

\# Points — These fields specify the number of traces you want to emit from the Plane tool in the X and Y axes of the tool.

Part — Creates particle traces beginning from each node of the Part specified by the Part ID Number field.

Part ID Number — This field specifies the Part you wish to use as an emitter for the creation of a particle trace. The Part ID Number for a Part is found in the Main Parts List.
(see Section 3.1, Part Overview)

Emit... — Opens the Emission Detail Attributes dialog.

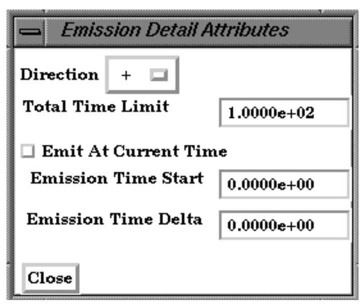


Figure 7-18
Emission Detail Attributes dialog

Direction — Trace the Particle in positive time, meaning to trace with the vector field, or trace the Particle in negative time, meaning to trace the Particle upstream. Option only applies to streamlines. Pathlines must be traced in + time.

(+) — Positive time option traces Particle(s) forward in time. (This is the only option for pathlines.)

(–) — Negative time option traces Particle(s) backward in time.

(+/–) — Positive/Negative time option traces Particle(s) both forward and backward in time.

Total Time Limit — This field specifies the maximum length of time the Particle trace may continue (it may terminate sooner for other reasons). For vector fields with recirculation zones, this can be important to keep from integrating a trace indefinitely.

Emission Time Start — This field specifies the simulation time at which to begin Particle emission. Enter value between beginning and ending time available.

Time Delta — This field specifies the time interval between emissions of Particles from the emitters. If “0”, only one set of emissions will occur at start time

Pick Surface Toggle — Toggles on/off the feature which allows you to place the trace emitter at a point on a surface directly below the mouse pointer by clicking the left mouse button.

Interactive Emitter — Toggles on/off interactive Particle tracing. Manipulation of the Cursor, Line or Plane tool will cause the Particle trace to be recreated at the new location and updated in the Graphics Window. When manipulation of the tool stops, the Particle trace and any Parts that are dependent on it will be updated. (Only available for non-surface-restricted streamlines).

Tool Location... — Opens Transformations Editor dialog which allows you to precisely position the Cursor, Line or Plane tool.

Create — Creates a Particle trace Part using the selected Part(s) in the Main Parts List and the vector Variable selected in the Main Variables List.

Feature Detail Editor (Traces)

Double clicking on the Particle Trace Create/Update Icon opens the Feature Detail Editor for Particle Traces, the Creation Attributes Section of which provides access to additional functions for trace creation and modification:

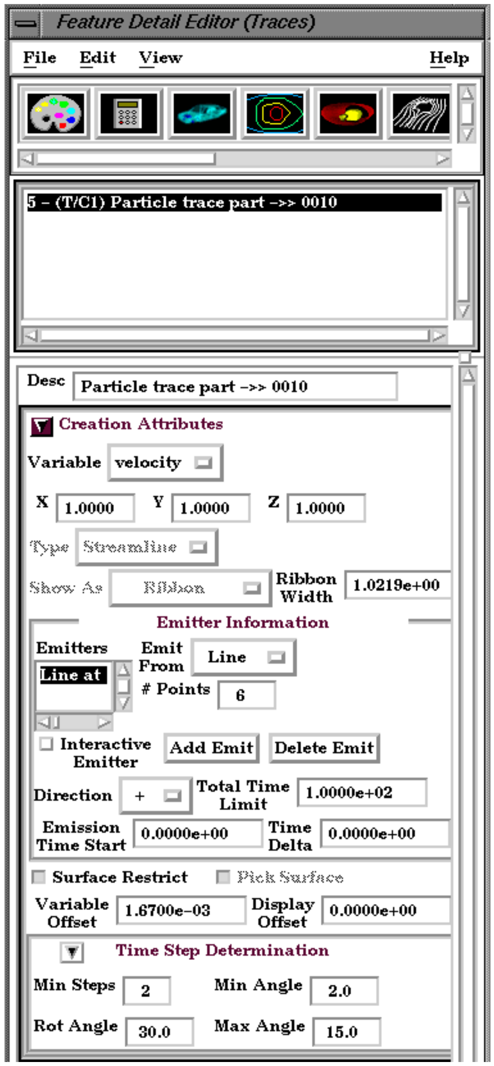


Figure 7-19
Feature Detail Editor (Traces)

Variable

Opens a pop-up menu for the selection of an active variable to use to calculate the trace.

X Y Z

These fields specify the fraction of each vector component to be used in the calculation. Specify 1 to use the full value of the vector component. Specify 0 to ignore the corresponding vector component (and thus confine the motion of the Particle to a plane perpendicular to that axis). Values between 0 and 1 diminish the contribution of the corresponding component, while values greater than 1 exaggerate them.

Type

Opens a pull-down menu for specification of whether Particle trace calculation uses steady-state data to produce a Streamline or transient data to produce a Pathline.

Stream

Traces a massless Particle in a steady-sate vector field (for steady-state data or the current time-step of transient data).

Path

Traces a massless Particle through a time-varying vector field *and so is only available with transient results data*. On certain systems, this selection can consume significant quantities of CPU time to calculate the resulting Particle trace.

Show As	Opens a dialog for specification of trace representation.
Line	Depicts the trace as a line.
Ribbon	Depicts trace as if it were a ribbon. The ribbon width is a specified fixed value, while the twisting is determined by the rotation of the flow about the path of the trace at any particular point on the trace.
Ribbon Width	This field only applys when Ribbon representation is chosen. Larger values in this field produce wider ribbons.
Emitter Information	
Emitters List	This section shows a list of all emitters created for the currently selected Particle Trace Part.
Emit From	Opens a pull-down menu for the specification of the emitter type.
Cursor	Creates Particle trace beginning from the position of the Cursor tool.
Line	Creates Particle traces beginning from the position of the Line tool.
# Points	This field specifies the number of traces you want to emit from the Line tool.
Plane	Create Particle traces beginning from the position of the Plane tool.
# Points	These fields specify the number of traces you want to emit from the Plane tool in the X and Y axes of the tool.
Part	Creates particle traces beginning from each node of the Part specified by the Part ID Number field.
Part ID Number	This field specifies the Part you wish to use as an emitter for the creation of a particle trace. The Part ID Number for a Part is found in the Main Parts List. (see Section 3.1, Part Overview)
Density	If 1.0, will emit from each node of the part. Lass than 1.0 values indicate a subset of nodes to be used, randomly placed, as emitters.
Interactive Emitter	Toggles on/off interactive Particle tracing. Manipulation of the emitter currently selected in the Emitters List will cause the Particle trace to be recreated at the new location and updated in the Graphics Window. When manipulation of the tool stops, the Particle trace and any Parts that are dependent on it will be updated. (Only available for non-surface-restricted streamlines) (Emitters created by picking a surface or from a Part can not be made interactive).
Add Emit	Adds an emitter of the type specified by Emit From to the currently selected Particle Trace Part.
Delete Emit	Deletes the emitter selected in the Emitters List from the selected Particle Trace Part.
Direction	Trace the Particle in positive time, meaning to trace with the vector field, or trace the Particle in negative time, meaning to trace the Particle upstream. Option only applies to streamlines. Pathlines must be traced in + time.
(+)	Positive time option traces Particle(s) forward in time. (This is the only option for time-dependent datasets.)
(–)	Negative time option traces Particle(s) backward in time.
(+/–)	Positive/Negative time option traces Particle(s) both forward and backward in time.

Total Time Limit	This field specifies the maximum length of time the Particle trace may continue (it may terminate sooner for other reasons).
Emission Time Start	This field specifies the solution time at which to begin Particle emission. Enter value between beginning and ending time available.
Time Delta	This field specifies the time interval between emissions of Particles from the emitters. If “0”, only one set of emissions will occur at start time
Surface-Restrict Toggle	Toggles on/off surface restricted feature for streamlines. The streamline will be constrained to stay on the surface of the selected Part(s) by using only the tangential component of velocity. Be sure to use the Pick Surface feature in locating the emitter for a surface restricted particle trace to ensure that the emitter is located on the surface of a Part.
Pick Surface Toggle	Toggles on/off the feature which allows you to place the trace emitter at a point on a surface directly below the mouse pointer by clicking the left mouse button. This option is forced on if the Surface Restricted Toggle is on.
Variable Offset	This field specifies the distance into the flow field at which velocity (and other variables) are to be sampled for the surface restricted trace(s). If velocity values are present at the surface, this offset can be set to zero.
Display Offset	This field specifies the distance away from the surface to display the surface restricted trace(s). This is provided so z buffer conflicts between surfaces and trace lines can be overcome. A positive distance moves the trace away from the surface in the direction of the surface normal, while a negative distance moves the trace in the opposite direction.
Time Step Determination	Opens a turn-down area for the specification of time-step parameters.
Min Steps	This field is used to specify the minimum number of integration steps to perform in each element.
Min Angle	If angle between two successive line segments of the Particle trace is less than this value EnSight will double the integration step.
Max Angle	If angle between two successive line segments of the Particle trace is greater than this value EnSight will half the integration step.
Rot Angle	If the dot product between successive rotation vectors of the Particle trace is greater than COS(Rot Angle), the integration step is halved.
Create	(At the bottom of the Feature Detail Editor) Creates the Particle trace Part in the Graphics Window as specified.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How to Create Particle Traces)

Troubleshooting Particle Traces

Problem	Probable Causes	Solutions
Particle Trace Part is empty.	Velocity is zero.	Change time steps or change location of emitters.
	Emitter points are outside of flow field.	Change location for emitter points.
	Dataset is 3D and parent Parts are 2D, or dataset is 2D and parent Parts are not planar.	Change parent Parts.
	The created variable selected does not exist for the parent Part(s)	Recreate the variable for the parent Part(s) selected
Streamline is OK, but pathline is empty.	Creating pathline with the emitter emitting at the last time step.	Modify emitter time for the emitter groups.
Particle trace terminates prematurely	Velocity has gone to zero.	None
	Particle has been traced out of the flow field.	None
	Stopping point is at the boundary between two Parts.	Change the parent Parts for the Particle trace to include neighbor Part.
	Particle getting lost and EnSight's search algorithm failing.	Call CEI hotline support.
	Total Time Limit reached.	Change Total Time Limit.
Particle trace exists, then is removed after deleting Parts.	The parent Part for the Particle trace was deleted.	None
Particle trace creation requested, but Particles don't come back.	Requested a large number of Particle traces and/or doing pathlines in large transient dataset.	Be patient.
	Particles are stuck in a recirculation area.	Process will finish when Total Time Limit is reached. Consider terminating job and starting over with a smaller Total Time Limit.
Interactive tracing is slow.	The size of the model and density of the mesh will affect the performance of an interactive trace.	If you can, run on a faster, larger memory workstation. Also, limit if possible the area of interest by cutting the mesh into pieces with the Cut & Split Part editing operation.
Interactive trace does not enter the next Part	Interactive tracing is only done through the Part the emitter resides in.	When you let go of the emitter the full trace will be shown
Surface restricted Particle trace does not appear	Zero velocity at chosen variable offset	Select a Variable offset distance that will give nonzero velocity
	Display offset causing trace to be on opposite side of a surface (hidden surface on)	Change sign of the Display offset
	Emitter does not lie on the surface of selected Parts	Create emitters that lie on the surface

7.5 Clip Create/Update

A Clip is a straight line (a Clip Line), a plane (a Clip Plane), a quadric surface (cylinder, sphere, etc.), a constant x, y, or z plane, a box, or an i, j, or k plane that passes through selected model Parts (or already created Clips, Isosurface, or Developed Surface Parts). EnSight calculates the values of variables at the nodes of the Clip. Clips can be parent Parts. For example, you can create a Clip Line passing through a vector field, then create vector arrows originating from the nodes of the Clip Line. Clips are created on the server, and so are not affected by the selected Representation(s) of the parent Part(s). If you activate or create variables after creating a Clip, the Clip automatically updates to include them.

You specify the location, orientation, and size of the Clip numerically in the Transformations Editor dialog, or interactively using the Line, Plane, or Quadric surface tool. If you wish, EnSight will automatically extend the size of a Clip Plane to include all the elements of the parent Part(s) that intersect the plane.

For a Clip Line, which is composed of bar elements, you specify how many evenly spaced nodes are along the line. For a grid-type Clip Plane, which is composed of rectangular elements, you specify the number of nodes in each dimension, resulting in an evenly spaced grid of nodes across the plane.

If you request a mesh-type Clip Plane, an xyz clip, or any of the quadric surfaces, EnSight finds the intersection of the specified plane or surface with the selected parent Part(s) and creates elements of various dimensions, sizes, and shapes that together form a cross-section of the parent Part(s). In this cross-section, three-dimensional parent Part elements result in two-dimensional Clip Plane elements, and two-dimensional parent Part elements result in one-dimensional Clip Plane elements. Note that two-dimensional parent Part elements that are coplanar with the cross-section are not included since they do not intersect the plane.

For each Clip node on or inside an element of the selected parent Part(s), EnSight calculates the value of each variable by interpolating from the variable's values at the surrounding nodes of the parent Part(s).

You can interactively manipulate the location of a clip Part by toggling on the Interactive Tool button. When this toggle is on, the tool used to create the clip Part will appear in the Graphics Window. Manipulation of this tool will cause the clip Part to be recreated at the new location. This feature allows you to interactively sweep a plane across your model or manipulate the size and location of the cylinder, sphere, or cone.

You can animate a Clip by specifying an Animation Delta vector that moves the Clip to a new location for each frame or page of the animation. The Clip updates to appear as if it had been newly created at the new location and time.

For structured Parts, you can sweep through the Part with any of the i, j, or k planes.

An XYZ Box Clip will create a subset part which is either inside or outside the specified x,y,z boundaries. The boundaries can be infinite.

Clicking once on the Clip Create/Update Icon opens the Clip Editor in the Quick interaction Area which is used to both create and update clip Parts.

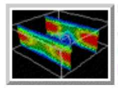


Figure 7-20
Clip Create/Update Icon

Use Tool

IJK The IJK clip tool is used with structured mesh results.

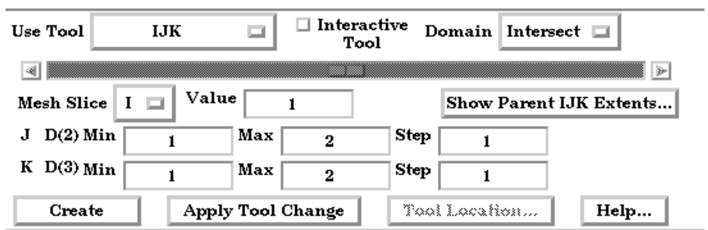


Figure 7-21
Quick Interaction Area - Clip Editor - IJK tool

Interactive Tool — Toggles on/off interactive movement and updating of a clip Part. When manipulation of the tool stops, the clip Part and any Parts that are dependent on it will be updated.

Tool Location... — Opens the Transformation Editor dialog to permit precise positioning of the Plane Tool. (see Tool Positions... Plane Tool in Section 6.5, Tools Menu Functions and How To Use the Plane Tool)

Slider Bar — For IJK clips, the slider bar is used to increment / decrement the Mesh Slice Value between its Minimum and Maximum value.

Mesh Slice — Opens a pull-down menu for selecting which of the IJK dimensions you wish to allow to change. You will then specify Min, Max and Step limits for the two remaining “fixed” dimensions.

Value — This field specifies the coordinate desired for the dimension selected in Mesh Slice

Show Parent IJK Part Extents — Will show the second and third dimension Min and Max extents as defined for the clip parent Part.

IJK D(2)Min — This field specifies the minimum value for the second fixed dimension.

IJK D(2)Max — This field specifies the maximum value for the second fixed dimension.

IJK D(2) Step — This field specifies the step size through the second fixed dimension.

IJK D(3)Min — This field specifies the minimum value for the third fixed dimension.

IJK D(3)Max — This field specifies the maximum value for the third fixed dimension.

IJK D(3) Step — This field specifies the step size through the third fixed dimension.

Apply Tool Change — Recreates the Clip Part selected in the Main Parts List at the current position of and of the type specified by Use Tool.

Create — Creates the Clip Part in the Graphics Window as specified.

Feature Detail Editor (Clips) - IJK

Double Clicking on the Clip Create/Update Icon brings up the Feature Detail Editor, the Creation attributes section of which offers the same features for the IJK tool as the Quick Interaction Area Editor.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How To Create IJK Clips)

Use Tool

XYZ The XYZ tool is used to create a planar Part at a constant Cartesian component value that is referenced according to the local frame of the part.

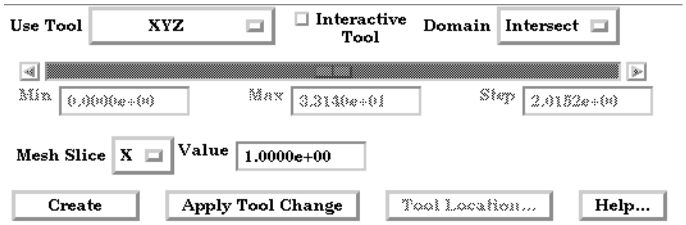


Figure 7-22
Quick Interaction Area - Clip Editor - XYZ Tool

Interactive Tool — Toggles on/off interactive movement of the XYZ component tool via the slider bar within the interval defined by the Min, Max, and Step values. Movement of the slider bar causes the Clip Part to be recreated at the new position. When the slider bar is released, the Part and any dependent Parts update.

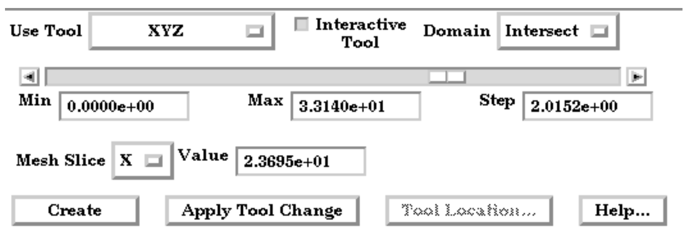


Figure 7-23
Quick Interaction Area - Clip Editor - XYZ Tool - Interactive

Min — Specification of the minimum interval value of the interactive XYZ clip.

Max — Specification of the maximum interval value of the interactive XYZ clip.

Step — Specification of the interval step of the interactive XYZ clip.

Mesh Slice — Opens a pulldown menu for selecting which of the XYZ components you wish to clip, i.e. the X, the Y, or the Z component.

Value — This field specifies the coordinate desired for the Mesh Slice component.

Apply Tool Change — Recreates the Clip Part selected in the Main Parts List at the current position of and of the type specified by Use Tool.

Create — Creates the Clip Part in the Graphics Window as specified.

Feature Detail Editor (Clips) - XYZ

Double Clicking on the Clip Create/Update Icon brings up the Feature Detail Editor (Clips), the Creation attributes section of which offers access to the same interactive clip parameters as found in the Quick Interaction Area Editor, along with additional animation delta control of clips using the XYZ tool.

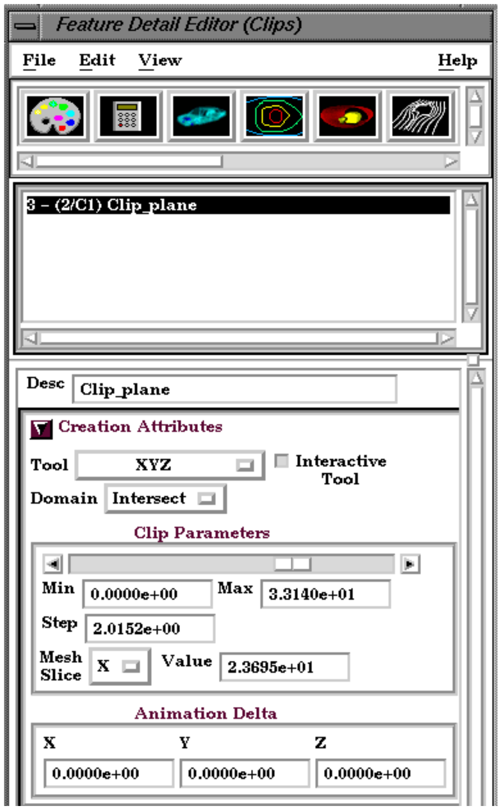


Figure 7-24
Quick Interaction Area - Clip Editor - XYZ Tool - Creation Attributes

Animation Delta

These X,Y,Z fields specify the incremental change in position of the clip for each page of Flipbook or frame of Keyframe animation.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How To Create XYZ Clips)

Use Tool

Line The Line tool is used to create a clip line.

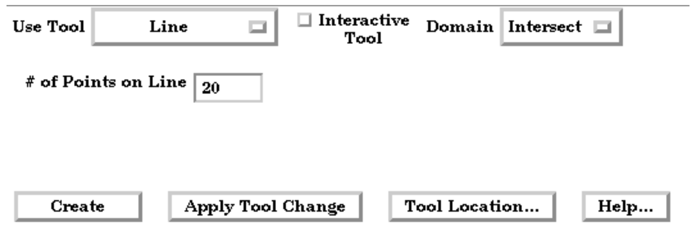


Figure 7-25
Quick Interaction Area - Clip Editor - Line Tool

# of Points on Line Specification of number of evenly spaced points on the line at which to create a node.

Interactive Tool Toggles on/off interactive movement and updating of a clip Part. When toggled on, the line tool used to create the 2D clip line will appear in the Graphics Window. Movement of the tool will cause the Clip Part to be recreated at the new position. When manipulation of the tool stops, the clip Part and any Parts that are dependent on it will be updated. During movement, the Tool itself will not be visible, so as not to obscure the Line Clip Part. The Tool will reappear when the mouse button is released.

Tool Location... Opens the Transformation Editor dialog to permit precise positioning of the Line Tool within the Graphics Window. (see Tool Positions... Line Tool in Section 6.5, Tools Menu Functions and How To Use the Line Tool)

Apply Tool Change Recreates the Clip Part selected in the Main Parts List at the current position of and of the type specified by Use Tool.

Create Creates the Clip Part in the Graphics Window as specified.

Feature Detail Editor (Clips) - Line

Double Clicking on the Clip Create/Update Icon brings up the Feature Detail Editor (Clips), the Creation attributes section of which offers access to additional features for the creation and modification of clips using the Line tool.

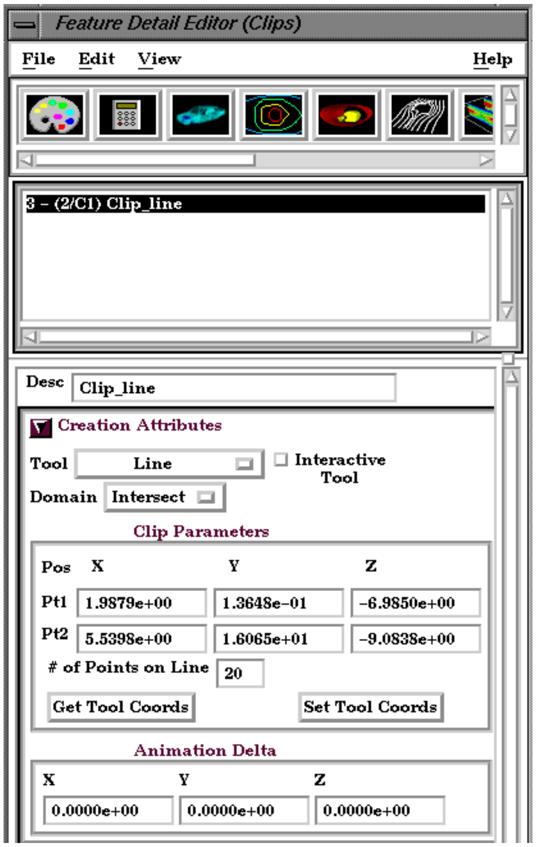


Figure 7-26
Feature Detail Editor (Clips) - Line Tool Creation Attributes

Clip Parameters

Pos of Pt1
Pos of Pt2

Specification of XYZ endpoint-coordinates of Line Clip. The position of a Line Clip Part, if selected in the Feature Detail Editor's Parts List, can be changed by entering values in the numeric fields and then pressing Return.

Set Tool Coords

The position of the Line Clip tool can be changed by entering values in the numeric fields and then pressing Set Tool Coords.

Get Tool Coords

The values in the numeric fields (and the position of a Line Clip Part, if selected in the Feature Detail Editor's Parts List) can be updated after moving the Line tool interactively in the Graphics Window by clicking Get Tool Coords. If a Line Clip Part is selected in the Feature Detail Editor Parts List, it will be repositioned to the new coordinates after clicking Get Tool Coords. Coordinates are always in the original model frame (Frame 0).

Animation Delta

These X,Y,Z fields specify the incremental change in position of the clip for each page of Flipbook or frame of Keyframe animation.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How To Create Line Clips)

Use Tool

Plane The Plane Tool is used to create a Plane Clip.

Domain

Intersect will create the cross section of the selected parts where they intersect the plane tool.

Inside will cut the parent parts and create a new part consisting of the portion on the positive z side of the plane tool.

Outside will cut the parent parts and create a new part consisting of the portion on the negative z side of the plane tool.

In/Out will cut the parent parts and create two new parts - namely an *Inside* and *Outside* part.

Plane Type

Mesh Will create a Plane Clip showing the cross section of the parent Part.

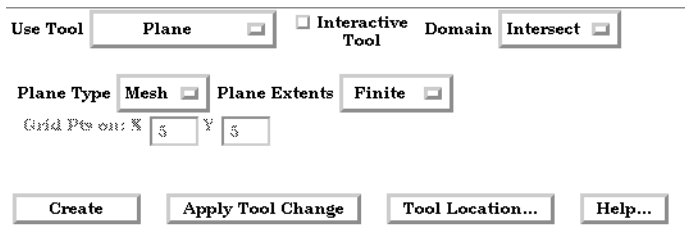


Figure 7-27
Quick Interaction Area - Clip Editor - Plane Tool - Mesh Type

Plane Extents Opens a pull down menu for selection of the extent of the Plane Clip.
Finite limits the Plane Clip to the area specified by the Plane Tool corner coordinates.
Infinite extends the Plane Clip to include the intersection of the plane with all elements of the selected model Parts.

Grid Will create a Plane Clip by discrete point sampling.

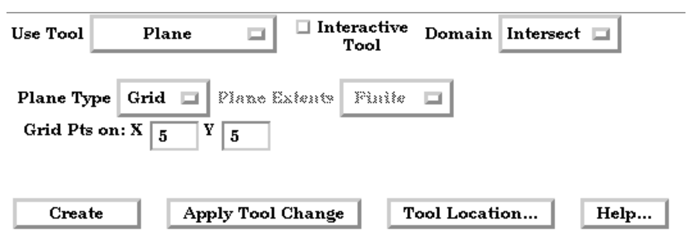


Figure 7-28
Quick Interaction Area - Clip Editor - Plane Tool - Grid Type

Grid Pts on:XY These fields specify the number of points on each edge of a Plane Clip at which to create nodes. Additional nodes are located in the interior of the plane to form an evenly spaced grid. The values must be positive integers. Applicable only to grid-type Plane Clips. Grid Pts in X correspond to the x-direction on the Plane tool, while the number of Grid Pts in Y correspond to the y-direction of the Plane tool.

Apply Tool Change Recreates the Clip Part selected in the Main Parts List at the current position of and of the type specified by Use Tool.

Interactive Tool Toggles on/off interactive movement and updating of the clip Part. When toggled on, the Plane Tool used to create the clip Part will appear in the Graphics Window. Movement of the Plane Tool will cause the Plane Clip to be recreated at the new position. When manipulation of the tool stops, the clip Part and any Parts that are dependent on it will be updated. During movement, the Tool itself will not be visible, so as not to obscure the Line Clip Part. The Tool will reappear when the mouse button is released.

Tool Location... Opens the Transformation Editor dialog to permit precise positioning of the Plane Tool. (see Section 6.5, Tools Menu Functions and How To Use the Plane Tool)

Create Creates the Clip Part in the Graphics Window as specified.

Feature Detail Editor (Clips) - Plane

Double Clicking on the Clip Create/Update Icon brings up the Feature Detail Editor (Clips), the Creation attributes section of which offers access to additional features for the creation and modification of clips using the Plane tool.

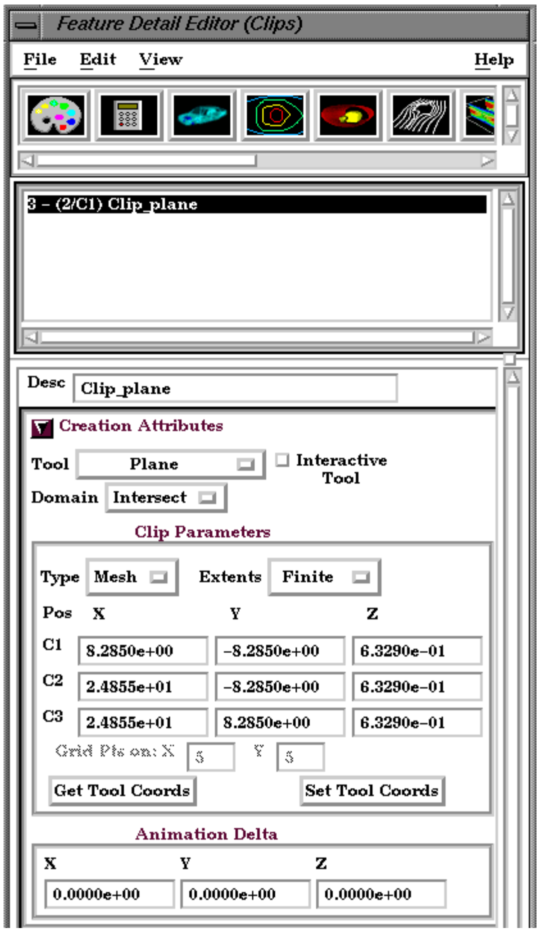


Figure 7-29
Feature Detail Editor (Clips) - Plane Tool Creation Attributes

Clip Parameters

Pos of C1
Pos of C2
Pos of C3

Specification of the location, orientation, and size of the Plane Clip using the coordinates (in the Parts reference frame) of three corner points, as follows:

Corner 1 is corner located in negative-X negative-Y quadrant
Corner 2 is corner located in positive-X negative-Y quadrant
Corner 3 is corner located in positive-X positive-Y quadrant

Set Tool Coords Will reposition the Plane Tool to the position specified in C1, C2, and C3.

Get Tool Coords — Will update the C1, C2, and C3 fields to reflect the current position of the Plane Tool.

Animation Delta — These X,Y,Z fields specify the incremental change in position of the clip for each page of Flipbook or frame of Keyframe animation.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How To Create Plane Clips)

Use Tool

Cylinder, Sphere, Cone These Tools are used to create a quadric clip surface

Domain

Intersect will create the cross section of the selected parts where they intersect the quadric tool.

Inside will cut the parent parts and create a new part consisting of the portion on the inside of the quadric tool.

Outside will cut the parent parts and create a new part consisting of the portion on the outside of the quadric tool.

In/Out will cut the parent parts and create two new parts - namely an *Inside* and *Outside* part.

.

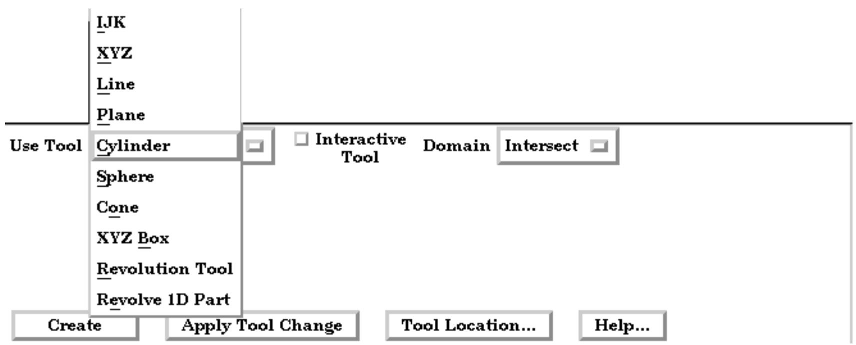


Figure 7-30
Quick Interaction Area - Clip Editor - Cylinder, Sphere, & Cone Tools

Interactive Tool — Toggles on/off interactive movement and updating of a clip Part. When toggled on, the Quadric Tool used to create the Clip Part will appear in the Graphics Window at the location of the Clip Part. Movement of the Quadric Tool will cause the Clip Part to be recreated at the new position. When manipulation of the tool stops, the Clip Part and any Parts that are dependent on it will be updated. During movement, the Tool itself will not be visible, so as not to obscure the Line Clip Part. The Tool will reappear when the mouse button is released.

Tool Location... — Opens the Transformation Editor dialog to permit precise positioning of Quadric Tools. (see Section 6.5, Tools Menu Functions and How To Use the Cylinder Tool, How To Use the Sphere Tool, and How To Use the Cone Tool)

Apply Tool Change — Recreates the Clip Part selected in the Main Parts List at the current position of and of the type specified by Use Tool.

Create — Creates the Clip Part in the Graphics Window as specified.

Feature Detail Editor (Clips) Quadric Tool

Double Clicking on the Clip Create/Update Icon brings up the Feature Detail Editor (Clips), the Creation attributes section of which offers access to additional features for the creation and modification of clips using the Quadric tools.

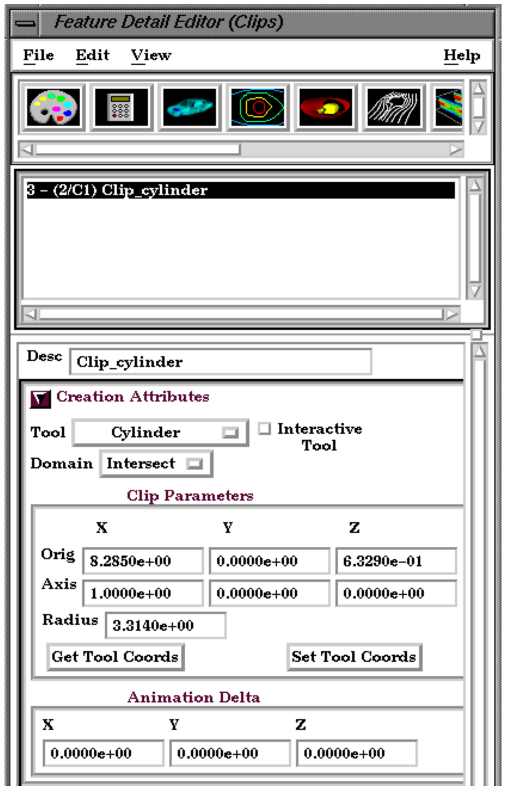


Figure 7-31
Feature Detail Editor (Clips) - Quadric Tool Creation Attributes

Clip Parameters

Cylinder

Orig XYZ — Specification of the origin (the center point) of the Cylindrical Clip.

Axis — Specification of the axis direction of the Cylindrical Clip.

Radius — Specification of the radius of the Cylindrical Clip.

Sphere

Orig — Specification of the origin (the center point) of the Spherical Clip.

Axis — Specification of the axis direction of the Spherical Clip.

Radius — Specification of the radius of the Spherical Clip.

Cone

Orig — Specification of the origin (the center point) of the Conical Clip.

Axis — Specification of the axis direction of the Conical Clip.

Angle — Specification of the angle of the Conical Clip.

Set Tool Coords — Will reposition the Quadric Tool to the position specified in the Clip Parameter fields.

Get Tool Coords — Will update the Clip Parameter fields to reflect the current position of the Quadric Tool.

Animation Delta — These X,Y,Z fields specify the incremental change in position of the clip for each page of Flipbook or frame of Keyframe animation.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How To Create Quadric Clips)

Use Tool

XYZ Box — This Clipping Tool extracts all elements that are entirely inside of a specified box, or its complement

Domain

Inside will extract the elements of the parent parts that lie entirely within the box.
Outside will extract the elements of the parent parts that do not lie entirely within the box.
In/Out will create two new parts - namely the *Inside* and *Outside* parts.

.

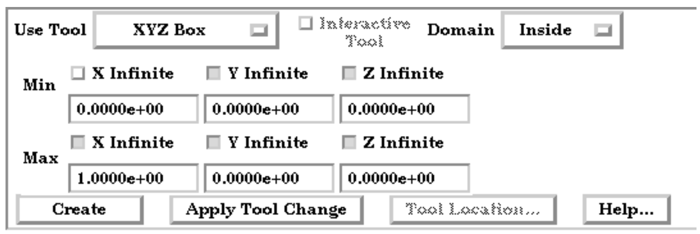


Figure 7-32
Quick Interaction Area - Clip Editor - Cylinder, Sphere, & Cone Tools

Infinite — The Min and Max bounding for x, y, and z can be set to infinity (or negative infinity in the case of Min).

Min — Specify the minimum box coordinates for x, y, and z (used only when respective Infinity toggles are off).

Max — Specify the maximum box coordinates for x, y, and z (used only when respective Infinity toggles are off).

Apply Tool Change — Recreates the Clip Part selected in the Main Parts List at the current position of and of the type specified by Use Tool.

Create — Creates the Clip Part in the Graphics Window as specified.

Feature Detail Editor (Clips) - XYZ Box — Double Clicking on the Clip Create/Update Icon brings up the Feature Detail Editor, the Creation attributes section of which offers the same features for the XYZ Box tool as the Quick Interaction Area Editor.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How To Create XYZ Box Clips)

Use Tool

Revolution Tool This clipping Tool is used to create custom clip surfaces which are defined by revolving a set of lines about a defined axis.

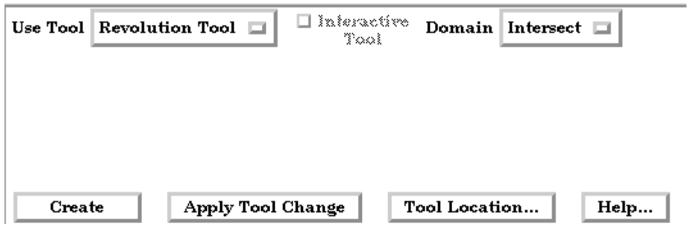


Figure 7-33
Quick Interaction Area - Clip Editor - Revolution Tool

Interactive Tool Not applicable for the revolution clip.

Tool Location... Opens the Transformation Editor dialog to permit precise location of the revolution tool within the Graphics Window. It is here where you also can control the number and positioning of the set of lines which make up the tool. (see Section 6.5, Tools Menu Functions and How To Use the Surface of Revolution Tool)

Apply Tool Change Recreates the Clip Part selected in the Main Parts List at the current position of and of the type specified by Use Tool.

Create Creates the Clip Part in the Graphics Window as specified.

Feature Detail Editor (Clips) - Revolution Tool Double Clicking on the Clip Create/Update Icon brings up the Feature Detail Editor (Clips), the Creation attributes section of which offers access to additional features for the creation and modification of clips using the Revolution tool.

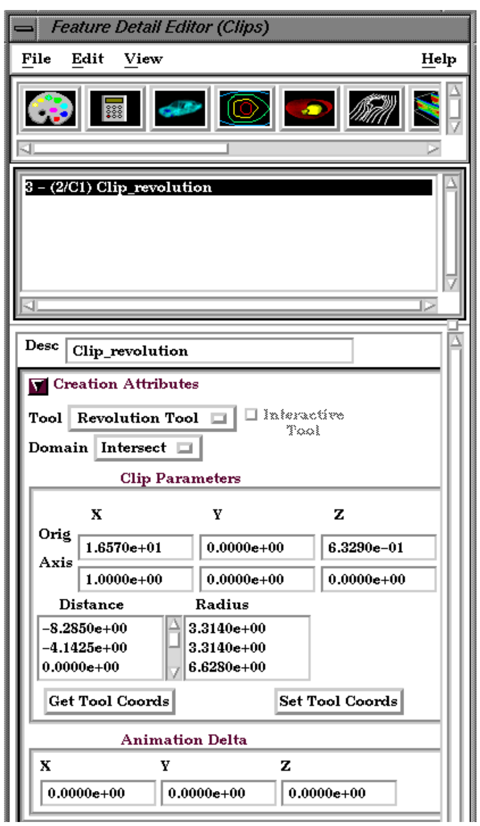


Figure 7-34
Feature Detail Editor (Clips) - Revolution Tool Creation Attributes

Revolution Tool Clip Parameters

Orig	These fields specify the XYZ coordinates of the origin (center point) of the Revolution Clip.
Axis	These fields specify the XYZ coordinates of the axis direction of the Revolution Clip.
Distance/Radius	These lists specify the distance (from the origin) and radius for each point that defines the Revolution Clip. The points can Not be edited within this dialog. You must edit the Revolution Tool in the Transformations dialog.
Set Tool Coords	Will reposition the Revolution Tool to the position specified in the Clip Parameter fields.
Get Tool Coords	Will update the Clip Parameter fields to reflect the current position of the Revolution Tool.
Animation Delta	These X,Y,Z fields specify the incremental change in position of the clip for each page of Flipbook or frame of Keyframe animation.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see Section 6.5, Tools Menu Functions and How To Use the Surface of Revolution Tool)

Use Tool

Revolve 1D Part This option will create a clip surface by revolving a line, defined by a Part, about an axis.

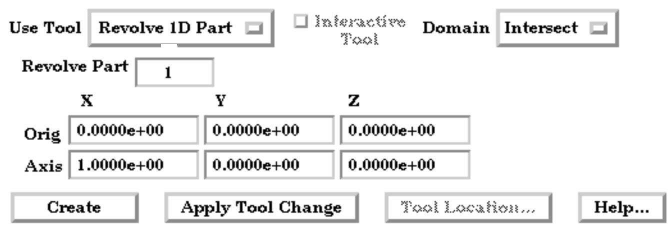


Figure 7-35
Quick Interaction Area - Revolve 1D Part Clip Editor

Revolve Part — This field specifies the Part number which will be revolved. The Part must contain only bar elements and must have only two free ends (i.e., there must be only one "logical" line contained in the Part).

Orig — These fields specify the XYZ coordinates of the axis line origin point.

Axis — These fields specify the direction vector of the axis line. The "line" contained in the Part specified by number in Revolve Part will be revolved about this axis to create the clip surface Part.

Apply Tool Change — Recreates the Clip Part selected in the Main Parts List at the current position of and of the type specified by Use Tool.

Create — Creates the Clip Part in the Graphics Window as specified.

General Quadric
Feature Detail Editor (Clips)

Double Clicking on the Clip Create/Update Icon brings up the Feature Detail Editor (Clips), the Creation attributes section of which offers access to offers access to one type of clip creation which is not available in the Quick Interaction area. It is possible to create a 3D Quadric clip using the General Quadric option by directly specifying the coefficients of a general quadric equation.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

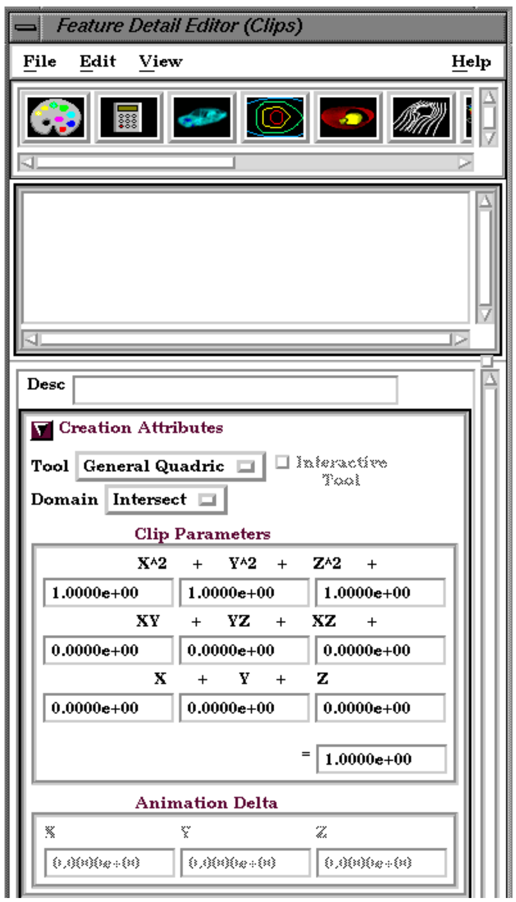


Figure 7-36
Feature Detail Editor (Clips) - Revolve 1D Part Creation Attributes

10 coefficient values

These coefficient values represent the general equation of a Quadric surface. They can be changed by modifying the values. No tool exists corresponding to this equation.

$$AX^2+BY^2+CZ^2+DXY+EYZ+FXZ+GX+HY+IZ=J$$

Animation Delta

Not available for General Quadric Clips.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

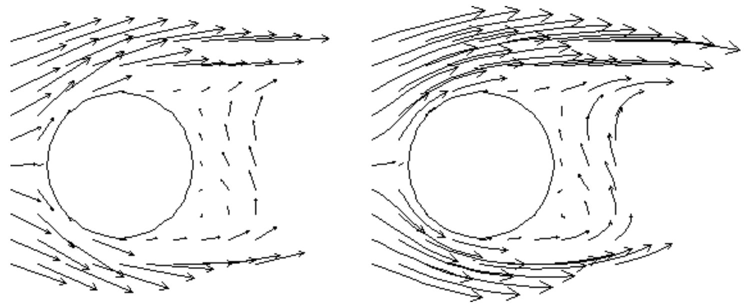
Troubleshooting Clips

Problem	Probable Causes	Solutions
Clip does not move during animation	Animation deltas are not set, or are too small.	Change the animation delta values.
Clip results in an empty Part.	Clip was taken outside of the model.	Change the clip Tool location.

7.6 Vector Arrow Create/Update

Vector Arrows visualize the magnitude and direction of a vector variable at discrete points (at nodes, element vertices, or at the center of elements).

Other features can visualize magnitude, but Vector Arrows also show direction.



Vector arrow Parts are dependent Parts known only to the client. They cannot be used as a parent Part for other Part types and cannot be used in queries. As dependent Parts, they are updated anytime the parent Part and/or the creation vector variable changes (unless the general attribute Active flag is off).

Vector arrows can be filtered according to low and/or high threshold values.

Vector arrows can emanate from the available nodes of the parent Part(s), the available element vertex nodes of the parent Part(s), or the available element centers of the parent Part(s) which pass through the filter successfully. The nodes and elements available in the parent Part are based on the visual Representation of the Part. Thus, for a border Representation of a Part, only the border elements and associated nodes are candidates.

Vector arrows can have straight shafts representing the vector at the originating location, or be the segment of a streamline emanating from the originating location (curved). Straight vector arrows are displayed relatively quickly, while curved vector arrows can be time consuming.

Different tip styles, sizes, and colors can be used to enhance vector arrow display.

Clicking once on the Vector Arrow Create/Update Icon opens the Vector Arrow Editor section of the Quick interaction Area which is used to both create and update (make changes to) vector arrow Parts.

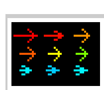


Figure 7-37
Vector Arrow Create/Update Icon

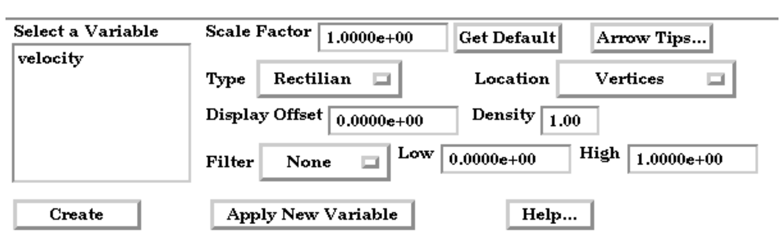


Figure 7-38
Quick Interaction Area - Vector Arrow Editor

Scale Factor / Time

When Type is “Rectilian”, this field specifies a scale factor to apply to the vector values before displaying them. Scaling is usually necessary to control the visual length of the vector arrows since the vector values may not relate well to the geometric dimensions. Can be negative, causing the vector arrows to reverse direction.

When Type is “Rect. Fixed”, this field specifies the length of the arrows in units of the model coordinate system. Can be negative, causing the vector arrows to reverse direction.

When Type is “Curved”, this field specifies the duration time for streamlines forming the shaft of curved vector arrows. Is an indication of the length of the curved vector arrow.

Get Default

Sets Scale or Time Factor value to a computed reasonable value based on the vector variable values and the geometry.

Arrow Tips...

Opens the Vector Arrow Tip Settings dialog.

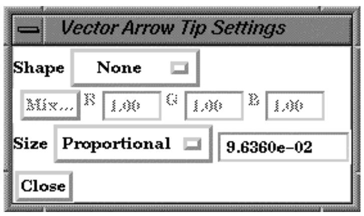


Figure 7-39
Vector Arrow Tip Settings dialog

Shape

Opens a pop-up menu to select tip shape.
None option displays arrows as lines without tips.
Normal arrows have two short line tips, similar to the way many people draw arrows by hand. The tip will lie in the X–Y, X–Z, or Y–Z plane depending on the relative magnitudes of the X, Y, and Z components of each individual vector. Suggested for 2D problems.
Triangles arrows have a tip composed of two intersecting triangles in the two dominant planes. Good for both 2D and 3D fields.
Tipped arrows display the tip of the arrow in any user specified color. Good for both 2D and 3D fields. The color may be specified in the RGB fields or chosen from the Color Selector dialog which is opened by pressing the Mix... button

Size

Opens a pop-up menu for selecting tip size.
Fixed sized arrows have tips for which the length is specified in the data entry field to the right of the pop-up menu button. Units are in the model coordinate system.
Proportional sized arrow tips change proportionally to the change in the magnitude of the vector arrows.

Type

Opens a pop-up menu for selection of shaft-type of vector arrows. Options are:
Rectilian arrows have straight shafts. The arrow points in the direction of the vector at the originating location. The length of the arrow shaft is determined by multiplying the vector magnitude by the scale factor.
Rect. Fixed arrows have straight shafts. The arrow points in the direction of the vector at the originating location. The length of the arrow shaft is determined by the scale factor. It is independent of the vector variable.
Curved arrows have curved shafts. The arrow is actually a streamline emanating from the originating location. It represents the path that a massless Particle would follow if the flow field was steady state. For this option, the “Scale Factor” changes to “Time”. Time is the amount of time the streamline is allowed to take and is an indication of how long the arrow will be.
Hint: Since curved arrows can take a significant amount of time(depending on the number of originating locations), the setting of a proper “Time” value is

critical. The best way to do this is to first do a single Particle trace at a representative location with the estimated “Time” value as the Max Time. A quick iteration or two on the value here could save considerable time for the curved vector arrow computation.

Location

Opens a pop-up dialog for the selection of root-location of arrow shafts. The options are:

Node arrows originate from each node of the parent Part(s).
Note: Discrete Particles Parts must use Node option.

Vertices arrows originate only from those nodes at the vertices of each element of the parent Part(s) (i.e., arrows are not displayed at free nodes or mid-side nodes).

Element Center arrows originate from the geometric center of each element of the parent Part(s).

Display Offset

This field specifies the distance away from a surface to display the vector arrows (so that potential Z-buffer conflicts can be overcome). A positive distance value moves the vector arrows away from the surface in the direction of the surface normal.

Density

The fraction of the parent’s nodes/elements which will show a vector arrow. A value of 1.0 will result in a vector arrow at each node/element, while a value of 0.0 will result in no arrows. If between these two values, the arrows will be distributed randomly at the specified density.

Filter

Selection of pattern for filtering Vector Arrows according to magnitude. Options are:

None displays all the vector arrows. No filtering done.

Low displays only those arrows with magnitude above that specified in the Low field. Filters low values out.

Band displays only those arrows with magnitude below that specified in the Low field and above that specified in the High field. Filters the band out.

High displays only those arrows with magnitude below that specified in the High field. Filters the high values out.

Low_High displays only those arrows with magnitude between that specified in the Low field and that specified in the High field. Filters out low and high values.

Apply New Variable

Changes the vector Variable used to create the Vector Arrows to that currently selected in the Variables List.

Feature Detail Editor (Vector Arrows)

Double clicking on the Vector Arrow Create/Update Icon opens the Feature Detail Editor for Vector Arrows, the Creation Attributes Section of which provides access to the functions available in the Quick Interaction Area plus two more:

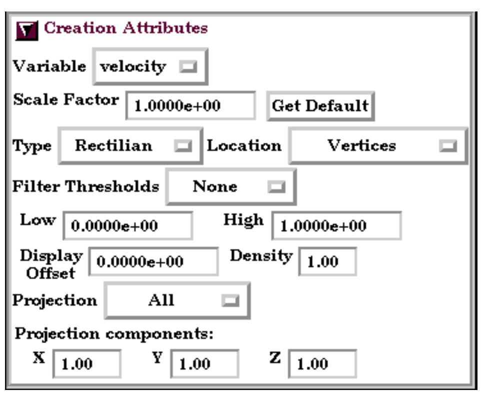


Figure 7-40
Feature Detail Editor (Vector Arrows)

Projection

Opens a pop-up menu to allow selection of which vector components to include when calculating both the direction and magnitude of the vector arrows. The vector components at the originating point are always first multiplied by the Projection Components (see below). Then one of the following options is applied:

All, to display a vector arrow composed of the Projection-Component-modified X, Y, and Z components.
Normal, to display a vector which is the projection of the All vector in the direction of the normal at the originating location.
Tangential, to display a vector which is the projection of the All vector into the tangential plane at the originating location.
Component, to display both the Normal and the Tangential vectors

The *All, Normal*, and *Tangential* options produce a single vector per location, while the *Component* option produces two vectors per location. If selection is not applicable to a Particular element, that element's vector arrow uses the *All* projection.

Projection Components X Y Z These fields specify a scaling factor for each coordinate component of each vector arrow used in calculating both the magnitude and direction of the vector arrow. Specify 1 to use the full value of a component. Specify 0 to ignore the corresponding vector component (and thus confine all the vector arrows to planes perpendicular to that axis). Values between 0 and 1 diminish the contribution of the corresponding component, while values greater than 1 exaggerate them. Negative values reverse the direction of the component. Always applied before the Projection options above.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How to Create Vector Arrows)

Troubleshooting Vector Arrows

Problem	Probable Causes	Solutions
Vector arrows do not match up with their originating locations on one or more of the parent Parts.	Displacements are on for some of the parent Parts, but not others. Or the parent Parts have been assigned to different coordinate frames	Create separate vector arrow Parts for the parents that will be displaced (or assigned to different frame) and the ones that will not be displaced (or assigned to different frames).
You are displaying several different vector arrow Parts at once and can't tell which is which.	Just too much similar information in the same area.	Use different attributes for the different vector arrow Parts, or better yet, display the conflicting vector arrow Parts on separate Part copies which have been moved apart.
You are trying to display vector arrows on a Discrete Particle Part, but can't get them to show up	Arrow Location set to Vertices (the default).	Set the Arrow Location to Nodes.
	No vector data provided for the Discrete Particle dataset, thus values all set to zero when read into EnSight.	Provide vector data for the particles. Specify in the Measured results file. See Section 3.7.

7.7 Elevated Surface Create/Update

Elevated Surfaces visualize the value of a variable by creating a surface projected away from the 2D elements of the parent Part. It is easiest to describe this feature if you think of a planar Part as the parent Part. Now warp this surface up out of plane proportionally to the value of a variable. The resultant surface is an Elevated Surface. Elevated surfaces are to surfaces what Profiles are to lines. While planar surfaces are perhaps the most useful parent Parts to use, parents do not have to be planar. Model Parts containing 2D elements, Clip Planes, Isosurfaces, and even other elevated surfaces are all valid parent Parts.

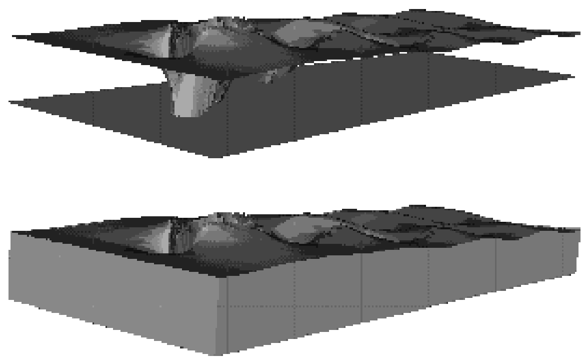


Figure 7-41
Elevated Surface example, with and without Sidewalls

The parent Part is not actually changed, a new surface is created. As this new surface is “raised”, projection (Sidewall) elements can be created stretching from the parent to the elevated surface around the boundary of the surfaces if desired. Just the surface, just the sidewalls, or both can be created.

The projection from a node on the parent Part will be in the direction of the normal at the node. If the node is shared by multiple elements, the average normal is used.

The projected distance from a parent Part’s node to the corresponding elevated surface node is calculated by adding to the variable’s value an Offset value, then multiplying the sum by a Scaling value. Adding the Offset enables you to shift the zero location of the plane. An Offset performs a “shift”, but does not change the “shape” of the resulting elevated surface. The Scaling factor changes the distance between parent and elevated surface, a “stretching” effect. EnSight will provide default values for both factors based on the variable’s values at the parent Part’s nodes.

Clicking once on the Elevated Surface Create/Update Icon opens the Elevated Surface Editor in the Quick Interaction Area which is used to both create and update (make changes to) elevated surface Parts.

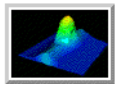


Figure 7-42
Elevated Surface Create/Update Icon

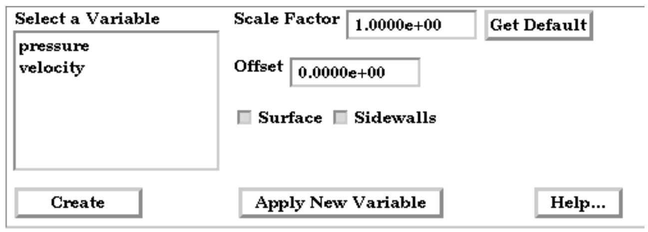


Figure 7-43
Quick Interaction Area - Elevated Surface Editor

Scale Factor

This field specifies the scaling for magnitude of distance between the parent Part node and the corresponding elevated surface node. The Factor is multiplied times the value of the variable. Values larger than one increase the size and values smaller than one decease the size. A negative value will have the effect of switching the direction of the projected surface.

Get Default

Click to set Scale Factor and Offset values to the calculated defaults based on the variable values for the parent Part.

Offset

Value specified is added to the variable values before the Scale Factor is applied to change the magnitude of projected distance. Default offset is magnitude of most-negative projection distance (will cause the surface to be projected positively). Has the effect of shifting the surface plot, but does not change the surface plot shape.

Surface Toggle

Toggles on/off the creation of the actual elevated surface. The sidewalls alone will be created if this toggle is off.

Sidewalls Toggle

Toggles on/off the creation of the sidewalls of the Elevated Surface. Elements will stretch from the parent Part to the Elevated surface around the boundary of the surfaces. The Elevated Surface alone will be created if this toggle is off.

Apply New Variable

Changes the variable the Elevated Surface Part is based on to that currently selected in the Variables List.

Feature Detail Editor (Elevated Surfaces)

Double clicking on the Elevated Surfaces Create/Update Icon opens the Feature Detail Editor for Elevated Surfaces, the Creation Attributes Section of which provides access to all of the functions available in the Quick Interaction Area plus one more:

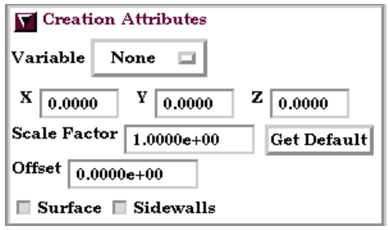


Figure 7-44
Feature Detail Editor (Elevated Surfaces)

X Y Z

For vector-based or coordinate-based elevated surfaces, specify vector components used in creating the elevated surface. Not applicable to scalar-type elevated surfaces. Are according to the reference frame of the Elevated Surface-Part. Letters labeling dialog data entry fields depend on type of the reference frame (Rectangular, Spherical, or Cylindrical). If all components are 0.0, the vector or coordinate magnitude will be used.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How to Create Elevated Surfaces)

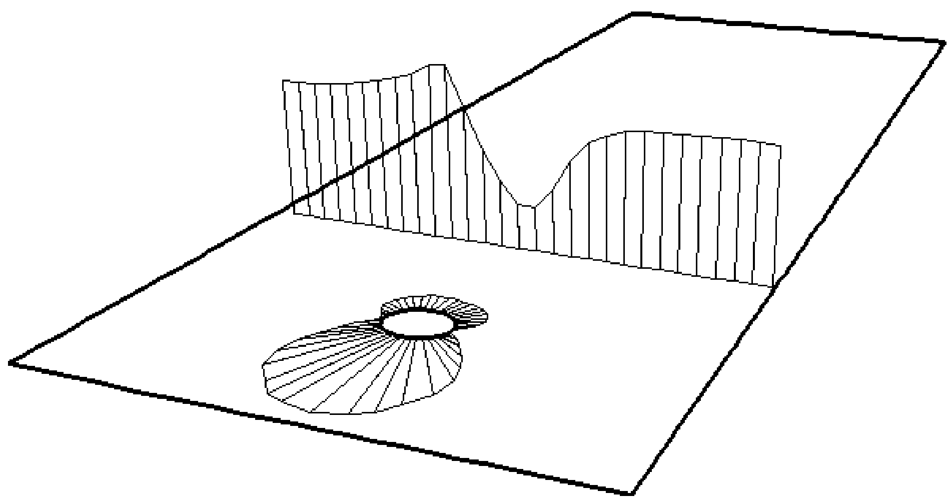
Troubleshooting Elevated Surfaces

Problem	Probable Causes	Solutions
The entire Elevated Surface is not projected in the direction you want.		Change the sign of the scale factor.
You have a non-planar parent Part and the elevated surface seems to have strange intersecting elements.	Sidewall elements are not appropriate	Turn off sidewall toggle.
	Scale factor too large.	Lower the Scale Factor.
The Elevated Surface projection appears to be “confused” at various locations.	Inconsistently ordered elements, such that the normals are not “consistent”	Modify element ordering to be consistent, if possible.

7.8 Profile Create/Update

Profiles visualize values of a variable along a line with a plot projecting away from the line. Projectors are parallel to a plane, but not necessarily in a plane. Hence, Profile can follow the line.

You can scale and offset projectors. The positive direction is set with the center point of the Plane Tool (away from center point is positive). Consider a base-line (not necessarily straight) along which the value of a variable is known. Moving along this base-line, you can “plot” the value of the variable on an “axis” whose origin moves along the base-line and whose orientation varies so that it is always both perpendicular to the base-line and parallel to a specified *plane* (but not necessarily parallel to a *line*, enabling the plot-line to follow the curve of the base-line in one dimension). A surface joining the base-line to the plot-line is called a *profile.*



The parent Part of a Profile-Part can be a 2D-Clip Line, a Contour, a Particle Trace, or a model Part consisting of a chain of bar elements. From each node of the parent Part, EnSight draws a “projector” whose length is proportional to the value of the variable at the node, and whose orientation makes it (1) parallel to a specified plane, (2) pointing in a direction corresponding to the sign of the variable’s value at the node (with the negative-direction determined by the location of a specified point), and (3) perpendicular to the base-line elements adjoining the node, or, if the base-line bends at the node, oriented so that its projection into the plane defined by the base-line elements will bisect the angle formed by the base-line elements. The outer-end of each projector is connected to those of its neighbors, forming a series of four-sided polygons and hence a surface.

The appearance of the profile depends greatly on the position of the specified sign-direction point (From Point) and the orientation of the specified plane, which you can specify numerically or with the Plane tool. EnSight calculates the projectors using the vector cross-product of the specified-plane’s normal (the Z-axis) and each parent Part element, thus you should orient the plane so that its normal is not parallel to the parent Part elements.

The projector length is calculated by adding to the variable's value an Offset value, then multiplying the sum by a Scaling value. Adding the Offset enables you to shift the zero location of the projectors, which might be useful if you wanted to make all the projectors have the same sign. An offset performs a "shift", but does not change the "shape" of the resulting profile. The Scaling factor changes the displayed size of the profile, a "stretching" type of action.   EnSight will provide default values for both factors based on the variable's values at the parent Part's nodes.

Clicking once on the Profile Create/Update Icon opens the Profile Editor the Quick Interaction Area which is used to both create and update (make changes to) profile Parts.

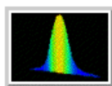


Figure 7-45
Profile Create/Update Icon

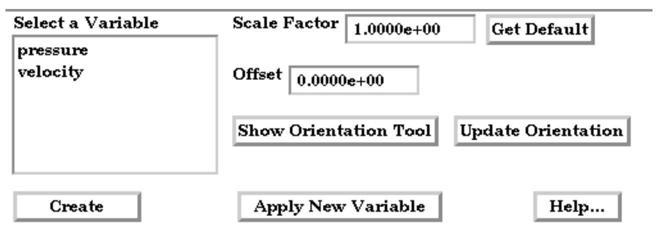


Figure 7-46
Quick Interaction Area - Profile Editor

Scale Factor — This field specifies the scaling for magnitude of the projector. The Scale Factor is multiplied times the value of the variable. Values larger than one increase the size and values smaller than one decrease the size.

Offset — The value specified in this field is added to the variable values before the Scale Factor is applied to change the magnitude of projectors. Default offset is magnitude of most-negative projector (making them all positive). Has the effect of shifting the plot, but does not change the plot shape.

Get Default — Click to set Scale Factor and Offset values to the calculated defaults based on the variable values for the parent Part.

Show Orientation Tool — Causes the Plane Tool to become visible in the Graphics Window at the location specified

Update Orientation — Recreates the Profile Part at the current location and orientation of the Plane Tool.

Apply New Variable — Changes the variable the Profile Part is based on to that currently selected in the Variables List.

Feature Detail Editor (Profiles)

Double clicking on the Profile Create/Update Icon opens the Feature Detail Editor for Profiles, the Creation Attributes Section of which provides access to additional functions for the creation and modification of Profiles:

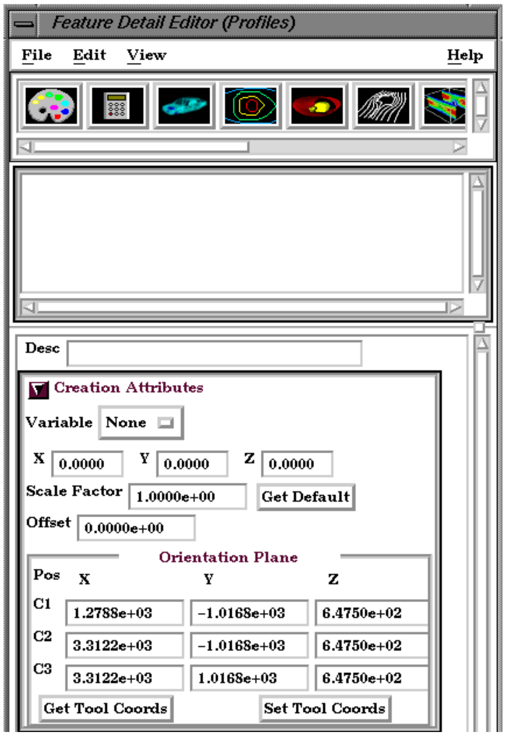


Figure 7-47
Feature Detail Editor (Profiles)

X Y Z

These fields specify the vector components used in creating the Part for vector based or coordinate-based Profiles. These fields are not applicable to Scalar-based Profiles. When all fields are zero, the magnitude of the Variable value is used. If a value other than zero is entered into a field, the sum of $(Vector_X*X)+(Vector_Y*Y)+(Vector_Z*Z)$ is used as the variable value.

Orientation Plane
Pos of C1
Pos of C2
Pos of C3

Specification of the location, orientation, and size of the Plane Clip using the coordinates (in the Parts reference frame) of three corner points, as follows:
Corner 1 is corner located in negative-X negative-Y quadrant
Corner 2 is corner located in positive-X negative-Y quadrant
Corner 3 is corner located in positive-X positive-Y quadrant

Set Tool Coords

Will reposition the Plane Tool to the position specified in C1, C2, and C3.

Get Tool Coords

Will update the C1, C2, and C3 fields to reflect the current position of the Plane Tool.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How To Create Profile Plots)

Troubleshooting Profiles

Problem	Probable Causes	Solutions
The entire profile is not projected the direction you want.	The Plane is not oriented correctly.	Turn on the Plane tool so you can see its orientation. The projectors will be parallel to this plane, so adjust its orientation.
	The From Point is not in a good location	Turn on the Plane tool so you can see the location of the center of the plane. Positive projectors will go away from this point, negative towards.
Portions of the profile appear to be projected in the wrong direction.	The From Point is not in a good location.	Turn on the Plane tool so you can see the location of the center of the plane. Positive projectors will go away from this point, negative towards.
	The normal to the Plane is parallel to some of the elements of the parent Part.	Turn on the Plane tool so you can see its orientation. Try to make sure the Z axis of the Plane tool does not lie parallel to any portions of the parent Part.
	The Parent Part does not contain elements which are consistently ordered	None

7.9 Developed Surface Create/Update

A Developed Surface is generated by treating any 2D Part (or parent Part) as a surface of revolution, and mapping specific curvilinear coordinates of the revolved surface into a planar representation.

A Developed Surface derives its name from the implied process that defines a developable surface. A surface is considered “developable” if it can be unrolled onto a plane without distortion. Although every 2D Part in EnSight is not by definition a developable surface, each 2D Part can nevertheless be developed into a planar surface which is distorted according to the type of developed projection specified. For example, a Cylinder Clip Part is by definition a developable surface, because it can be developed into planar surface without distortion. Whereas, a Sphere Clip Part is not a developable surface, because it can not be developed into a planar surface without distortion.

Parent Parts

Only 2D Parts are developed. Also, only one Part is developed at a time. While all 2D Parts qualify as candidate parent Parts, only 2D Parts of revolution are developed coherently. The current developed surface algorithm treats all parent Parts as surfaces of revolution that are developed according to a local origin and axis of revolution. These attributes are either inherited from the parent Part, or must be specified according to the parent Part.

A developed surface permanently inherits the local origin and axis of revolution information from any parent Part created via the cylinder, cone, sphere, or revolution Clip tools. Whereas, surfaces developed from non-Clip Parts require this information to be specified via the Orig. and Axis fields in the Attributes (Developed Surfaces) dialog. The latter case is the only time the values in these fields are used. Although default values are provided, it is up to you to make sure that valid values are specified. In the former case, the Orig and Axis fields only provide convenient feedback of the selected Clip Part. Note that developed surfaces resulting from parent Parts of revolution created via the general quadric Clip tool do not inherit the local origin and axis of revolution attributes from the General Quadric Clip parent; rather, these attributes must be specified.

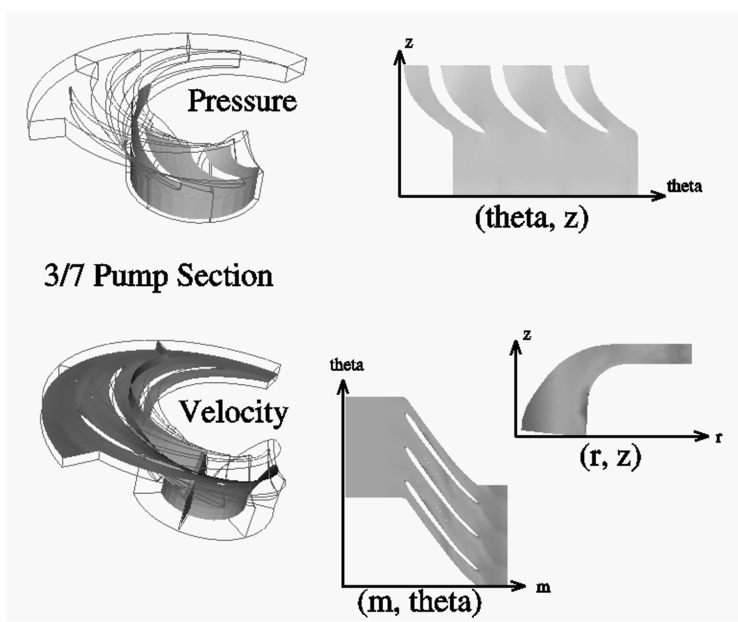


Figure 7-48 Developed Surface Examples

Developed Projections A parent Part is developed by specifying one of three curvilinear mappings called *developed projections*; namely, an (r,z), (θ,z), or (m,θ) projection. The curvilinear coordinates r, θ, z, and m stand for the respective radius, θ, z, and meridian (or longitude) directional components which are defined relative to the local origin and axis of revolution of the parent Part. The meridian component is defined as m = SQRT($r^2 + z^2$).

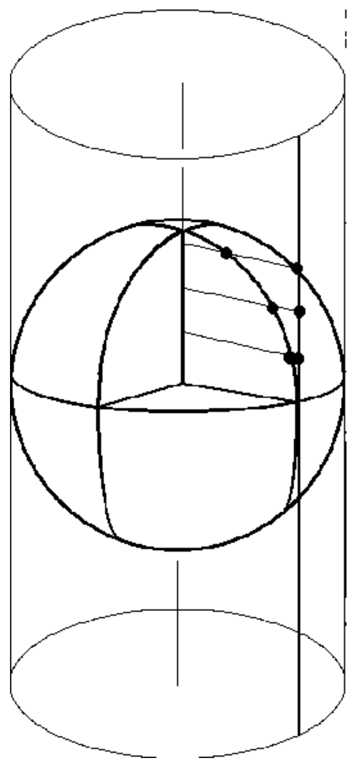


Figure 7-49
Developed Equiareal Projection

Essentially, each topological projection first surrounds the parent Part of revolution with a virtual cylinder of constant radius. The curvilinear coordinates of the parent Part are then projected along the normals of (and thus onto) the virtual cylinder. Finally, the virtual cylinder is slit along a straight line, or generator, and unwrapped into a plane. This process yields an *equiareal,* or *area preserving*, mapping which means that the area of any enclosed curve on the surface of the parent Part is equal to the area enclosed by the image of the enclosed curve on the developed plane. Although equiareal mappings provide reduced shape distortion, they do suffer from angular distortions of local scale.

Vector fields of the parent Part (for all three developed projections) are developed such that a vector's angle to its surface normal is preserved. For example, a vector normal to the parent surface remains normal when developed onto the planar surface.

Seam Line A surface of revolution is developed about its axis, starting at its "seam" line (or zero meridian) where the surface is to be slit. Surface points along the seam are duplicated on both ends of the developed Part. The seam line is specified via a vector that is perpendicular to and originates from the axis of revolution, and which points toward the seam which is located on the surface at a constant value. This vector can be specified either manually or interactively. Interactive seam line display and manipulation is provided via a slider in the Attributes (Developed Surfaces) dialog.

Clicking once on the Developed Surface Create/Update Icon opens the Developed Surface Editor in the Quick Interaction Area which is used to both create and update (make changes to) developed surface Parts.

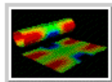


Figure 7-50
Developed Surface Create/Update Icon

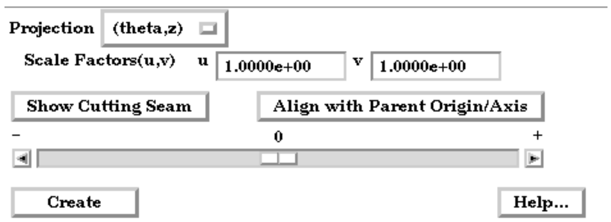


Figure 7-51
Quick Interaction Area - Developed Surface Editor

Projection

Opens a pop-up dialog for the specification of which type of (u,v) projection, or mapping, you wish to use for developing a surface of revolution; where u,v denotes curvilinear components of the parent Part that are mapped into the xy-plane of reference Frame 0. The options are:

(r,z)	denotes the radial and z-directional components of the revolved surface
(theta,z)	denotes the theta and z-directional components of the revolved surface.
(m,theta)	denotes the meridian and theta components of the revolved surface. The meridian component is the curvilinear component along a revolved surface that runs in the direction of its axis of revolution (e.g. the meridonal and z-directional components along a right cylinder are coincident, and for a sphere the meridian is the longitude).

Scale Factors (u,v)

These fields specify the scaling factors which will be applied to the u and v projections.

Show Cutting Seam

Click this button to display the current seam line location about the circumference of the revolved surface. The seam line is manipulated interactively via the Slider Bar.

Align with Parent Origin/Axis

Retrieves the Origin and Axis information from the Parent Part. Must be done if Parent Part is a quadric clip.

Feature Detail Editor (Developed Surfaces

Double clicking on the Developed Surface Create/Update Icon opens the Feature Detail Editor for Developed Surfaces, the Creation Attributes Section of which provides access to all of the functions available in the Quick Interaction Area plus several more:

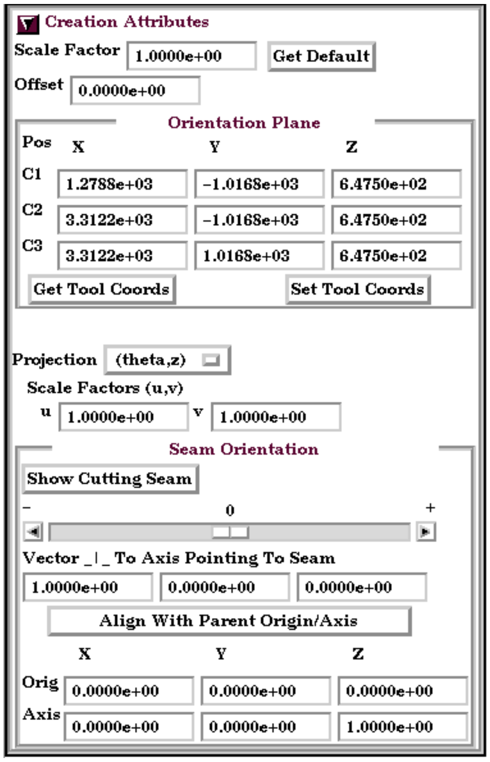


Figure 7-52
Feature Detail Editor (Developed Surfaces)

Vector _|_ To Axis Pointing To Seam

These fields allow you to precisely specify the position of the Cutting Seam Line by specifying the direction of the vector perpendicular to the axis of revolution which points in the direction of the seam line.

Orig X Y Z

These fields specify a point on the axis of revolution.

Axis X Y Z

These fields specify a vector, which when used with the Axis Origin defines the axis of revolution.

The Feature Detail Editor also allows you to make changes in batch; that is, to make several changes to the menus and fields which do not effect the Graphics Window until you click in the Apply Changes button. It is sometimes quicker (with respect to CPU time) to make several changes at once rather than one at a time as in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

(see How To Create Developed (Unrolled) Surfaces)

Troubleshooting Developed Surfaces

Problem	Probable Causes	Solutions
Error message is encountered while creating a Developed Surface Part.	Parent Part is invalid.	Only 2D Parts can be developed.
Developed Surface is created, but is either not visible, Partially visible, or obstructed by other Parts which may be other developed Parts	Since all Developed Surfaces are projected about the origin on the xy-plane of the reference frame of the parent Part, they may map outside the viewport, intersect other Parts, or pile up on each other.	Set the Developed Surface to be viewed in its own viewport and initialize the viewport. Use different u/v scaling. Assign the developed Part to its own local reference frame and transform it accordingly.
Developed Surface Part is a line.	Wrong Projection type was specified.	Select a different Projection.
Developed Surface Part does not update to new Orig and/or Axis values.	The Orig and Axis values can not be specified if the Parent Part is created from either a cylinder, sphere, cone, or revolution quadric clip. These values can only be specified if the 2D parent Part is not a quadric clipped surface.	Since values entered for this condition are not used, click the Get Parent Part Defaults button to update the fields based on the selected parent Part in the Parts & Frames list.

7.10 Displacements On Parts

Each node of a Part is displaced by a distance and direction corresponding to the value of a vector variable at the node. The new coordinate is equal to the old coordinate plus the vector times the specified Factor, or:

$C_{new} = C_{orig} + Factor * Vector$,

where C_{new} is the new coordinate location, C_{orig} is the coordinate location as defined in the data files, Factor is a scale factor, and Vector is the displacement vector.

You can greatly exaggerate the displacement vector by specifying a large Factor value. Though you can use any vector variable for displacements, it certainly makes the most sense to use a variable calculated for this purpose. Note that the variable value represents the *displacement* from the original location, not the *coordinates* of the new location.

Clicking once on the Displacements On Parts Icon opens the Displacements Editor in the Quick Interaction Area which is used to specify how you wish to displace Part nodes based on a vector variable.

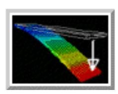


Figure 7-53
Displacements On Parts Icon

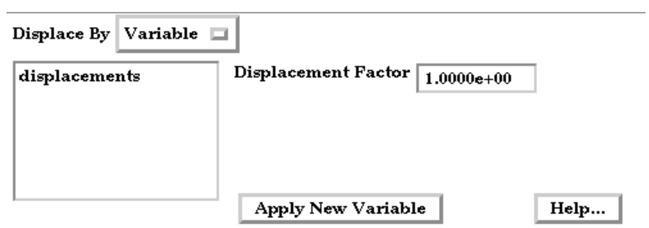


Figure 7-54
Quick Interaction Area - Displacements Editor

Displace by — This button allows selection of either None for no displacement or Variable (that selected in the Variables List) to use for displacement. The selected Variable must be a node-based vector and must be defined on the Parent Parts.

Displacement Factor — This field specifies a scale factor for the displacement vector. New coordinates are calculated as: $C_{new} = C_{orig} + Factor*Vector$, where C_{new} is the new coordinate location, C_{orig} is the original coordinate location as defined in the data file, Factor is a scale factor, and Vector is the displacement vector. Note that a value of 1.0 will give you “true” displacements.

Apply New Variable — Changes the variable the Displacements are based upon to that currently selected in the Variables List.

Feature Detail Editor (Model)	Double clicking on the Displacement on Parts Icon opens the Feature Detail Editor for Model Parts, the Displacements Attributes turndown area of which provides access to the same functions available in the Quick Interaction Area.

(see Section 3.3, Part Editing for a detailed discussion of the other features available in the Feature Detail Editor (Model)),

(see How To Display Displacements)

Troubleshooting Displacement Attributes

Problem	Probable Causes	Solutions
Displacement not visible	Displace By set to None for Part that is not displacing.	Set Displace By to Variable
	Displacement Factor value too small.	Specify a larger Displacement Factor.

7.11 Query/Plot

EnSight provides several ways to examine information about variable values. You can, of course, visualize variable values with fringes, contours, vector arrows, profiles, isosurfaces, etc. This section describes how to query variables *quantitatively* at points, over distance, and over time (if you have transient data).

Query Over Distance

EnSight can query over distance for the following information:

- variable values inside Parts at evenly spaced points along a straight line
- variable values inside Parts at the nodes of a different 1D Part

Query Over Time

EnSight can query over time for the following information:

- minimum and maximum variable values for Parts
- variable values at any number of sample times at any point inside of a Part or at any labeled node or element.

Over-time queries can report actual variable values, or Fast Fourier Transform (FFT) spectral values at the positive FFT frequencies.

Query Candidates

Only Parts with data residing on the Server host system may be queried. Thus, Parts that reside exclusively on the Client host system (i.e. contours, particle traces, profiles, vector arrows) may NOT be queried.

(see Section 3.1, Part Overview)

Clicking once on the Query/Plot Icon opens the Query/Plot Editor in the Quick Interaction Area which is used to query about the selected Variable on the selected Part and, if you wish, assign a query entity to a plotter.

Figure 7-55
Query/Plot Icon

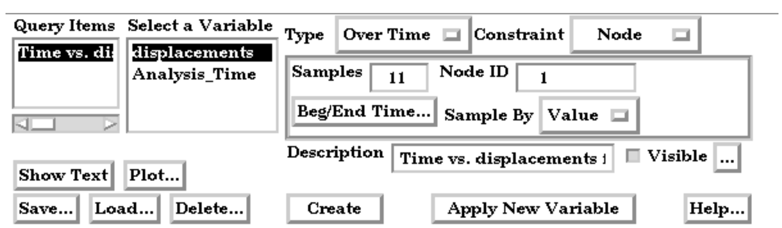


Figure 7-56
Quick Interaction Area - Query/Plot Editor

Type

Opens a pop-up menu for the selection of the type of query you wish to make. Choices are:

Distance to query along a line using the Line Tool or 1D Part at the current time step. Outputs for the selected variable a plot list entity of variable value versus distance.

Over Time to query variable values or FFTs over a specified range of time steps. Outputs for the selected variable a plot list entity of variable-value versus time or FFT frequency versus FFT spectral values.

External indicates that the selected query entity was not generated within EnSight. (see Load)

Constraint — Opens a pop-up dialog for the selection, when the Type is Over Time, of the spatial domain of the query. Choices are:
Node to query the variable values or (FFTs) at the node specified by Node ID
Element to query the variable values or (FFTs) at the element specified by Element ID
IJK to query the variable values or (FFTs) at a specified IJK node (only applicable if the selected Part is a structured Part)
Point to query the variable values or (FFTs) at the current Cursor Tool location
Min to query for the minimum variable value at each time step
Max to query for the maximum variable value at each time step

Choices when the Type is Distance are:
Line Tool to query the variable values at evenly spaced steps of the Line Tool
1D Part to query the variable values at the ends of the bar elements of a Part

Samples — For queries over Distance using the Line Tool, this field specifies the number of equally spaced points to query along the line. For queries Over Time, it specifies how many evenly timed moments over the specified range of time steps at which to query (if left blank, you get a sample point at each time step). If you specify more or fewer sample points than the number of time steps, EnSight linearly interpolates between the adjoining time steps. If query is an FFT sampling, the number of frequencies output will be less than or equal to the number of sample points.

Node ID — This field specifies a node ID when querying Over Time at a node.

Element ID — This field specifies an element ID when querying Over Time at an element.

Beg/End Time ... — Opens up the Solution Time Editor in the Quick Interaction Area. Here you can specify the start and end times for queries Over Time.
(see Section 7.13, Solution Time)

Sample By — Opens a pop-up menu for specification of how to report values for Over Time queries. Options are:
Value reports values versus time.
FFT reports FFT spectral values versus FFT positive frequencies.

Show Text — This button will display the results of the selected query in the Status History Area.

Plot... — Opens the Plot Query Entity To dialog which allows you to assign a query to a new or existing Plotter.

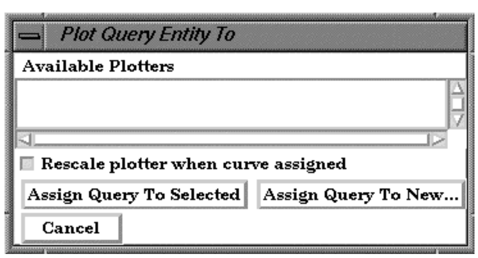


Figure 7-57
Plot Query Entity To dialog

Available Plotters — Shows a list of currently defined Plotters.

Rescale plotter when curve assigned — If the Assign Query to Selected option is used, this option when enabled will rescale the axis of the Plotter to show all queries that are assigned to it.

Assign Query to Selected — Will display the query in the Plotters selected in the Available Plotters list

Assign Query to New ... — Opens the New Plotter Name dialog. Clicking Okay creates a new Plotter and displays the query in the new Plotter.

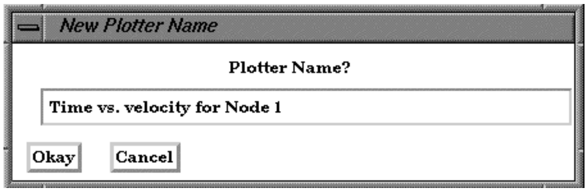


Figure 7-58
New Plotter Name dialog

Query/Plot Editor - Quick Interaction Area continued...

Description — This text field is used to enter a description for the Query entity.

Visible — Toggles the visibility of the marker showing the location for the query. For distance queries, a sphere marker will be shown indicating the beginning location for the query.

... — Opens the Query Display Attributes dialog for the specification of the display attributes of the query marker.

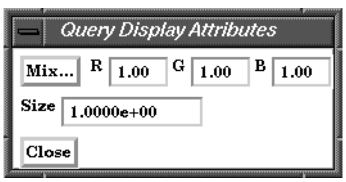


Figure 7-59
Query Display Attributes dialog

Mix... — Opens the Color Selector to specify the color of the marker.

RGB — The red, green, and blue color for the marker.

Size — The size of the sphere marker. The value is a scale factor. Values larger than 1.0 will scale the marker up, while values less than 1.0 (but greater than 0.0) will scale the marker down.

Apply New Variable — This button causes the plot to be recomputed using the variable currently selected in the Variables List.

Save... — Opens the Save Entity Query To dialog for the specification of the format, and file name in which you wish to save the query entity.

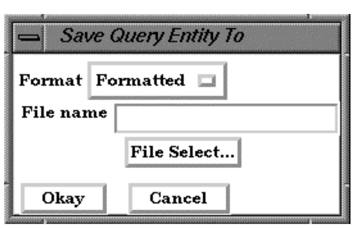


Figure 7-60
Save Query Entity To dialog

Format — Opens a pop-up menu to allow specification of the format. Choices are:

Formatted — Outputs the query information to the specified file in the same format as the Show Text button.

XY Data — Outputs the query information in a generic format which could be used to export the information to a different plotting system.

File Name — This field is used to specify the file name in which you wish to save the query entity.

File Select — Opens up the File Selection dialog for specifying the File Name as an alternative to entering it manually in the File Name field.

Load — Opens the File Selection dialog for the specification of an externally generated file from which to read query data (which could then be plotted). This is especially useful in bringing experimentally derived information into EnSight.

7.12 Interactive Probe Query

EnSight enables you to obtain scalar, vector, or coordinate information for the model at a point directly under the mouse pointer, at the location of the cursor tool, or at particular node, element, ijk, or xyz locations. The information is normally displayed in the Interactive Probe Query section of the Quick Interaction Area, but it can also be displayed in the Graphics Window. The performance of Interactive Query operations is dependent on the refresh time of the Graphics Window. Interactive query values are not echoed to EnSight command language files.

Clicking once on the Interactive Probe Query Icon opens the Interactive Probe Query Editor in the Quick Interaction Area which is used to specify parameters for querying interactively.

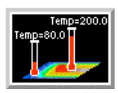


Figure 7-61
Interactive Probe Query Icon

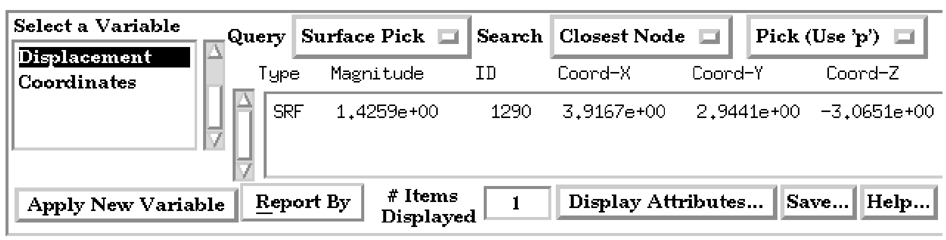


Figure 7-62
Quick Interaction Area - Interactive Probe Query Editor

Query

Selection of whether interactive query is on, or which method to use to indicate input.

Surface Pick will query the location under the mouse in the Main View. The query will be performed when the “p” keyboard key is pressed (when “Pick Use ‘p’ ” is on) or whenever the mouse moves to a new location in the Main View (when “Continuous” is on).

Cursor will query the location indicated by the Cursor Tool in the Main View. The query will be performed when the “p” keyboard key is pressed (when “Pick Use ‘p’ ” is on) or whenever the Cursor Tool moves to a new location in the Main View (when “Continuous” is on.

Node will query the node as specified in the “Node ID” field.

IJK will query the IJK node as specified in the “I J K” fields.

Element will query the element as specified in the “Element ID” field.

XYZ will query the x, y, z location as specified in the “x y z” fields.

None indicates that interactive query is off.

Search

Selects the location for the query.

Exact indicates that the query will occur at the location of the mouse.

Closest Node indicates that the query will “snap” to the node closest to the mouse.

Pick (Use ‘p’)

When the Action is Surface Pick or Cursor, controls whether the query will occur on a keyboard ‘p’ key press (when on) or will occur continuously - tracking the mouse location.

Apply New Variable — Changes the variable which query results are returned for to that currently chosen in the Variables List.

Report By — Selects the information which will be displayed for the vector Variables during the query. Options are:
X-component will display the x component of the coordinate or vector.
Y-component will display the y component of the coordinate or vector.
Z-component will display the z component of the coordinate or vector.
Magnitude will display the magnitude of the vector.

 # Items Displayed — Sets the number of query locations that are kept in memory and displayed to the user.

Display Attributes... — Opens the Interactive Probe Query Display dialog.

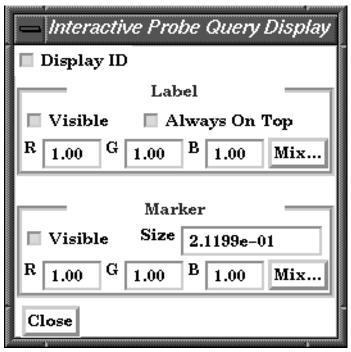


Figure 7-63
Interactive Probe Query Display dialog

Display ID Toggle — When toggled on, if an ID is appropriate for the type of search, will display the ID in the query table and in the label on the model.

Label

Visible Toggle — When toggled on, query information will be displayed in the Graphics Window

Always on Top — When on, query information in the Graphics Window will not be hidden from view behind other geometry.

RGB — These fields specify color values for the Labels.

Mix — Opens the Color Selector dialog (see Section 7.1, Color)

Marker

Visible — When on, query location markers will be displayed in the Graphics Window.

Size — The size of the markers.

RGB — These fields specify color values for the markers.

Mix — Opens the Color Selector dialog (see Section 7.1, Color)

7.13 Solution Time

Many analyses contain time dependent information, such as automobile crash simulations and unsteady flow problems. The presence of time-dependent data is indicated to EnSight through an EnSight result file, case file, or is determined directly from the data files of other formats. EnSight has the capability of displaying the model and results at any time provided for in the data. Linear interpolation between given time steps is possible as long as the geometry does not have changing connectivity over time.

EnSight keeps track of which variables and Parts have been created so that if you change time steps, variables and Parts will update appropriately. For example, assume you have created a clip plane through the combustion chamber of an engine. From this clip plane you have created two constant variables Min Temperature and Max Temperature and are displaying them in the Main View. Now change time steps. First, the geometry updates to a new crank angle position. Second, the clip plane will automatically be recalculated to fit the new geometry. Third, the Min and Max values displayed in the Graphics Window are recalculated and updated. This is all performed automatically by EnSight after you change the current time value.

It is important to distinguish between time step and solution time. An example will best illustrate this concept.

Consider a model with data for 5 different times:

Time Step	Solution Time
0	1.0125
1	11.025
2	11.50
3	13.00
4	21.333

Note that the time steps coincide with the number of transient data files and are integers. The solution time at each time step comes from the analysis, and does not have to be at uniform intervals. The solution time can be in any units needed, but must be consistent with the solution files. That is, if a velocity file was in terms of meters per second, then the solution time must be in terms of seconds. Hence it is not possible, for example, to have the solution time reported in degrees crank angle for a combustion case unless the corresponding solution files were also in terms of crank angle (otherwise velocity would be reported in the meaningless units of meters-per-degree-crank-angle).

The Solution time must *always* be increasing in time. Failure to follow this rule will result in an error.

A special Solution Time dialog gives you control over time and relates time step to solution time. You can force the time information to conform to the actual time data given at the steps, or you can allow interpolation to occur between time steps. You must be aware of the implications of such an interpolation and choose the method that is appropriate.

Also, you can see the ranges of time dependent data available and the current time that is set for the Main View. You can change time steps by either entering a new time to view, or using the Solution Time slider bar.

The Solution Time Dialog shows a composite timeline of all timesets from all cases. For any case, a number of different timesets can exist. Each timeset can be attached to multiple variables and/or geometry. This makes it possible to, for example, have one variable defined at t = 1.0, 2.0, 3.5 and another variable defined at t = 1.5, 2.0, 4.0. For each timeline, controls exist to specify how EnSight should interpolate the variables when time is set to a value not defined for a given timeset.

There are other places within EnSight where time information is requested. These include, traces, emitters, animated traces, flip book transient data, key frame animation transient data, and Query/Plot. Each of these use the specified Beg/End values. For functions which do not explicitly specify the time step the current display time (as defined in the Solution Time Dialog) is used.

Clicking once on the Solution Time Icon opens the Solution Time Editor in the Quick Interaction Area which is used to specify time information.

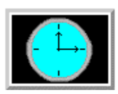


Figure 7-64
Solution Time Icon

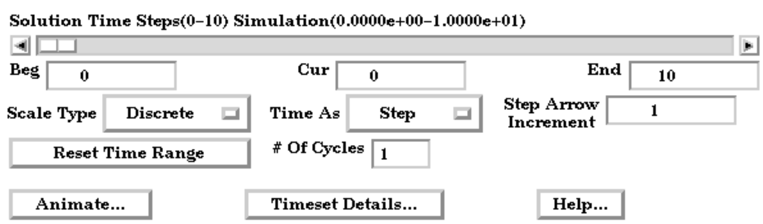


Figure 7-65
Quick Interaction Area - Solution Time Editor

The range of both Time Steps and Simulation Time is shown at the top of the Editor.

Beg — Value for Beginning Time Step or Simulation Time depending on setting for Time As.

Cur — Value for Current Time Step or Simulation Time depending on setting for Time As. The slider bar can be used to select a value for the Current Time Step field.

End — Value for Ending Time Step or Simulation Time depending on setting for Time As.

Scale Type — Opens a pop-up menu to specify use of existing time steps, or allow EnSight to linearly interpolate to show any time step. Choices are:

Discrete Can only change time to defined steps.

Continuous Can change time to any time, including times between steps. Only available if do not have changing geometry connectivity transient case.

Time As — Opens pop-up menu to specify whether to use and display:

Steps which will be an integer showing time as step data. Will show NOSTEP if in Continuous mode and current time is not at a given time step. Current time will automatically change to keep within range Begin/End range. The default beginning and ending simulation times correspond to the first and last time steps specified in the results.

Simulation Time which will be a real number showing true simulation time.
Current time will automatically change to keep within the Begin/End range. The default beginning and ending simulation times correspond to the first and last times specified in the results.

Reset Time Range — Will reset the Begin/End Time values to the minimum/maximum possible. Useful if you have specified your own Begin/End time values.

Step Arrow Increment — Species the incremental time which will be applied to the current time each time the slider stepper buttons are used.

Animate Over Time... — Opens the Flipbook Animation Editor.
(see Section 7.14, Flipbook Animation)

# of Cycles — For cyclic transient analysis, the solution is often computed for one cycle only. It is often desirable to be able to visualize more than one cycle. This is possible only if the first and last timesteps contain the same information. By default, EnSight assumes one cycle.

Timeset Details... — will open the Timeset Details dialog.

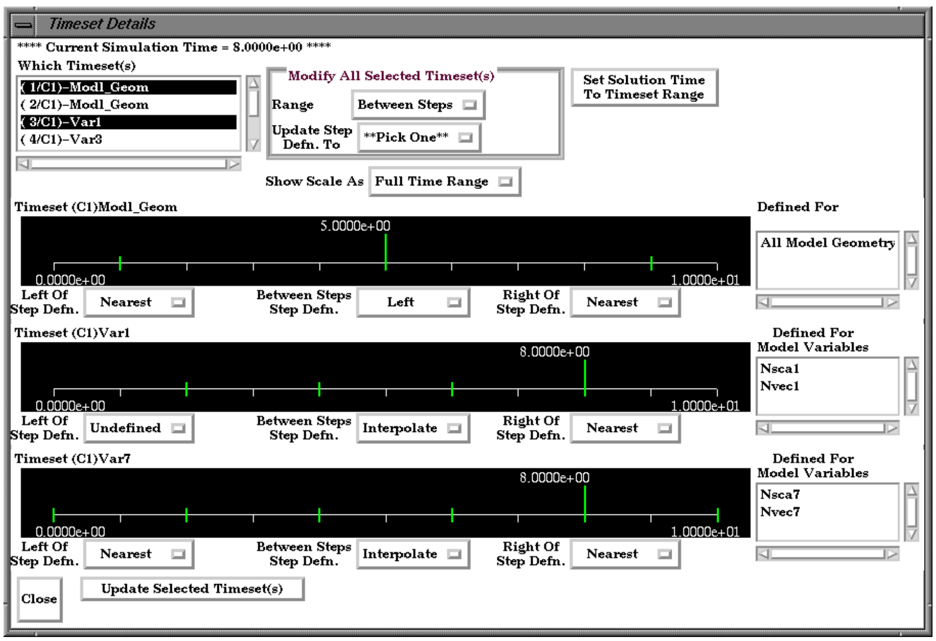


Figure 7-66
Timeset Details Dialog

Which Timeset(s) — Selects the timesets to be viewed.

Modify All Selected Timeset(s) — Allows modification of all selected timesets.

Range which time range to modify.
Update Step Defn. To Choose how to modify the selected Timeset's Range.

Set Solution Time To Timeset Range — Will set the Solution Time Beg. and End. time values to correspond to the selected timeset.

Show Scale As — "Full Time Range" will show the Timeset's values in relation to the full composite timeline. "Timeset's Range" will adjust the beginning and ending boundaries of the graphic timeset to correspond to the begin and end values for the timeset. The change will not take effect until the "Update Selected Timeset(s)" button is pressed.

Defined For	Lists all of the variables and/or geometry attached to the Timeset.
Left/Right of Step Defn.	When the Current time is less than the Timeset's minimum time, the attached variables will use the Nearest values or become Undefined.
Between Steps Step Defn.	When the Current time is between the Timeset's minimum and maximum time values, but not defined, the attached variables will use the Right/ Left, Interpolate, or Nearest values, or become Undefined.
Update Selected Timeset(s)	Must be selected in order to update any changed Timeset.

7.14 Flipbook Animation

There are three common animation techniques which are easily accomplished with Flipbook Animation. They are:

- animation of transient data, which can be any combination of scalar/vector variables, geometry, and discrete Particles
- animation of mode shapes based on a mode-shape displacement variable
- animation of a Part moving or changing value during animation, such as sweeping a 2D-Clip Plane or changing the value of an isosurface.

You can combine any of these techniques with the animation of Particle traces discussed in the previous Section 7.4.

The concept of a flipbook is similar to the stick figures you have probably seen in books where each page contains a picture. When you flip through the pages quickly you get the sense of motion. Flipbook animation stores a series of "pages" in Client memory which are then rapidly played back to create the illusion of motion. Pages can be loaded as *graphic images*, which may playback faster; or as *graphic objects*, which can be transformed after creating the flipbook, even while the flipbook is running.

For animation to be of interest, something must change from page to page. For *transient-data* flipbooks, you must have visualized something about the model that changes over time. For *mode-shape* flipbooks, you need to have set the displacement attributes of the Parts for which you want to see mode shapes (see Section 7.10 Displacement On Parts). For *created-data* flipbooks, you need to have used the Start/Stop utility or specified Animation delta values for the Parts.

The number of pages in the flipbook determines the length and smoothness of the animation. You directly or indirectly specify how many pages to create. While the Server performs the calculations, the Client stores the flipbook pages in memory. Just how many pages you can store depends on the amount of memory installed on your Client workstation. Your choice to load graphic images or graphic objects affects memory requirements, but the complexity of the model and the size of the Graphics Window determine which will use less memory in any particular situation.

You can control which original model Parts and created Parts will be updated for each time increment as the user chooses. This feature takes all dependencies into account. For example if an elevated surface was created from a 2D clip plane, the clip plane would be updated first and then the elevated surface based on the new clip. The ability to choose which Parts are or are not updated allows before and after type comparisons of a Part.

After creating the flipbook, options for displaying it include: running all or only a portion of it, adjusting the display speed, running under manual control or automatically, and running from the beginning or cycling back-and-forth between the two ends.

It is important to know that objects in the flipbook cannot be edited. If you wish to change something in the flipbook, you must reload it. If you decide to regenerate a flipbook (after changing something), you can choose to discard all the old pages, or keep any old page with the same page number as a new page.

This is very useful when you first load every tenth frame then decide to load them all. EnSight will not have to reload every tenth frame that already exists. When you are done with a flipbook, remember to click Delete All Pages. This will free up memory for other uses.

Flipbook vs. Keyframe While you can implement any flipbook animation technique with keyframe animation (described in the next section), flipbook animation has three advantages. First, graphic-object-type flipbooks allow you to transform the model interactively to see from many viewpoints. Second, graphic-image-type flipbooks can be saved to a file and later replayed without having to have the dataset loaded, or even being connected to the Server. Third, the speed of display can be more interactive because the flipbook is in memory and can be flipped through automatically or stepped through manually.

Flipbook animation has a few disadvantages. First, you cannot change any Part attributes, except visibility and material properties, without regenerating the flipbook. Second, each page is stored in Client memory, which limits the number of pages and hence the duration of the animation.

Transient Data Transient-data flipbooks have pages that correspond to particular solution times; i.e. step or simulation. You specify at which time value to start and stop the animation, and the time increment between each page. The time increment can be more than one solution-time value; this is useful in finding a range of interest or for a coarse review of the results. The increment can be a fraction, in which case the data for a page is interpolated from the two adjoining solution-time values.

Mode Shapes Mode-shape flipbooks are used to show primary modes of vibration for a structure. This is done by using a per node displacement, enabling the Part to vibrate. While you can use any vector variable for a displacement, to see actual mode shapes you need to have a Results-file vector variable corresponding to each mode shape you wish to visualize. Note that you can create copies of Parts and simultaneously display them with different mode-shape variables, or one at its original state and the other with displacement for comparison.

The first page of a mode-shape flipbook shows the full displacement (as it is normally shown in the Graphics Window). The last page shows the full displacement in the opposite direction. The in-between pages show intermediate displacements in proportion to the cosine of the elapsed-time of the animation.

Created Data Created-data flipbooks animate the motion of 2D-Clips and Isosurfaces according to their animation attributes. This animation allows you to show clipping planes sweeping through a model or to show a range of Isosurface values. The first page shows the Part’s location as it appears in the normal Graphics Window. On each subsequent page, each 2D-Clip is regenerated at the new location found by adding the animation-delta displacement to the 2D-Clip’s location on the previous page. Also, each Isosurface is regenerated with a new iso-value found by adding the animation-delta increment to the iso-value of the previous page.

Linear Load Linear-loaded flipbooks are used to animate a displacement field of a part by linearly interpolating the displacement field from its zero to its maximum value. The variable by which the part is colored also updates according to the linearly displaced values. Like Mode Shapes, this utilizes a per node displacement. The function can be applied to any static vector variable.

Clicking once on the Flipbook Animation Icon opens the Flipbook Animation Editor in the Quick Interaction Area.

Figure 7-67
Flipbook Animation Icon

Figure 7-68
Quick Interaction Area - Flipbook Animation Editor

Load Type — Opens a pop-up menu for the selection of type of flipbook animation to load. Options are:
Transient animates changes in data information resulting from changes in the transient data. For example, changes in coloration resulting from changes in variable values, or changes in displacement of Parts. See discussion in the introduction section.
Mode Shapes animates the mode shape resulting from a displacement variable. See discussion in the introduction of this section.
Create Data animates Parts having nonzero animation-delta values or which have been recorded with the Start/Stop utility. See discussion in the introduction of this section.

Load As — Opens a pop-up menu for the selection of whether to load flipbook pages as Graphic Images or Graphic Objects.
Graphic Objects flipbooks enable you to transform objects after creating the flipbook. Playback performance depends on the complexity of the model.
Graphic Images flipbooks may be saved for later recall, but they cannot be transformed, nor can the window be resized. Playback performance depends on the Graphics Window size.
Linear Load animates the Displacement (vector) variable of a part by linearly interpolating the displacement field from its zero to its maximum value. The Color variables of the part also update according to the linearly displaced values.

Adjust Beg/End Time... — Opens the Solution Time Editor in the Quick Interaction Area. To return to the Flipbook Animation Editor from the Solution Time Editor, click on Animate Over Time... (When loading Transient data, the flipbook will start and stop at the Beg/End values specified in the Solution Time Editor.
(see Section 7.13, Solution Time)

Increment Time By — In this field you specify the increment of each transient-data flipbook page which corresponds to the range type specified in the Solution Time Editor,

Note: *If you enter a Begin, End, or Increment value not corresponding exactly to a Step or Simulation time value, EnSight will interpolate the values, affecting the appearance of each page.*

Record Interactive Iso/Clip — Allows you to define the change (isovalue change or clip plane movement) in an isosurface or clip plane which will take place during the Flipbook load. Only isosurfaces and clip planes which are modified in interactive mode are tracked.

Start - Stop — Start and stop the recording of interactive movement of isosurfaces or clip planes. Any interactive isosurface or clip plane modified between the Start and Stop will be modified during the flipbook load.

Run Type — Opens a pop-up menu for selection of how the loaded flipbook will play
Auto makes flipbook play continuously when mouse cursor is inside Graphics Window.
Step activates Page and Time fields and stepper buttons for manual page control.
Off deactivates animation.

Modify Run... — Opens the Auto Run Settings dialog.

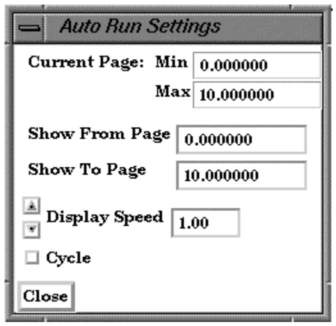


Figure 7-69
Auto Run Settings dialog

You use the Flipbook Run Settings dialog to change the number of pages displayed, the running speed, and whether or not the flipbook playback repeats from the beginning or cycles playing forward and backward.

Current Page Min/Max — These fields display the minimum and maximum flipbook-page numbers currently loaded.

Show From Page Show To Page — These interactive fields specify the starting and ending flipbook pages to show when running flipbook.

Display Speed — This field specifies the playback-speed factor. Varies from 1.0 (full speed of your hardware) to 0.0 (stopped). Change by entering a value or clicking the stepper buttons.

Cycle Toggle — Toggles-on/off whether, during automatic playback, to replay from the beginning (toggled-off) or alternate playing forward and backward (toggled-on).

Regen. All Pages Toggle — Toggles-on/off whether to regenerate already created flipbook pages. When toggled-on, all existing pages are overwritten. When toggled-off, existing pages are not replaced by new pages having the same time value, and, if loading transient data, new pages can be interleaved according to their solution-time value.

Load — Clicking this button starts the loading flipbook pages and opens a pop-up dialog which reports the progress of the load and then closes to signal load is complete. If you cancel the load, the pages already created during the load remain in memory.

Record... Opens the Save Flipbook Pages To dialog where you specify the type and name of the file in which you wish to save the flipbook animation pages you have created.

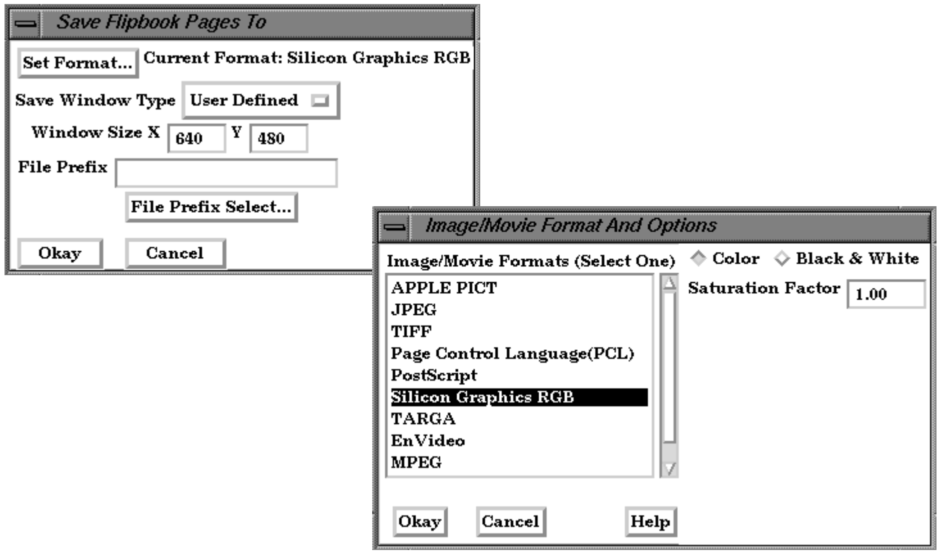


Figure 7-70
Save Flipbook Pages To dialog

Set Format... Brings up the Image/Movie Format and Options dialog. The flipbook will be recorded using the selected format. (see Section 2.10, Saving and Printing Graphic Images and How to Print/Save an Image)

Save Window Type When "Normal", will save images of the same size as the Main View. When "User Defined", will allow a specified width and height.

File Prefix The location and filename prefix for the recorded images. The appropriate suffix will be added automatically.

Delete... Opens a pop-up warning dialog which asks you if you really wish to delete all loaded pages. Click Okay to delete all loaded flipbook pages and free the memory for other use.

Troubleshooting Flipbook Animation

Problem	Probable Causes	Solutions
No motion	No pages are loaded.	Load flipbook pages.
	All pages are the same visually.	In order to see motion there must be a difference between one page and the next. Reload with differing Part attributes, such as coloring by a variable, using displacements, etc.
	Run Type set to Step or Off	Select Run Type to be Auto
	Are in Auto mode but mouse cursor not in Graphics Window.	Flipbook only runs when the mouse cursor is in the graphics window.
Speed too fast	Display Speed is set too fast.	Change speed.
Speed too slow	Display Speed is set too slow.	Change speed.
	Hardware bottleneck (computer simply isn't sufficiently powerful)	Reduce the number of pages.Load pages as graphic images.
Speed erratic	Virtual memory is swapping pages to and from disk storage.	Only load the no.of pages that fit into the workstation's main memory.
Mode Shape(s) not visible	Wrong Load Type setting	Change Load Type to Mode Shapes and reload.
	Displacement attributes are incorrect.	Change Displace by and Factor attributes for the Part to animate.
2D Clip plane(s) not moving	Wrong Load Type setting	Change Load Type to Mode Shapes and reload.
	Plane was not moved interactively between Start and Stop.	
Isosurface(s) not moving	Wrong Load Type setting	Change Load Type to Mode Shapes and reload.
	Isosurface was not moved interactively between Start and Stop.	
Transient data ignored	Wrong Load type	
	Solution time step specifications are incorrect.	Change Load Type to Transient and set Solution time values according to available time steps.
Pages lost	Show From or Show To pages are not at ends of flipbook.	
	Old pages are being regenerated.	Toggle-off Regen. All Pages
	Delete All Pages is clicked.	Recover using the session command file.
Transformations do not work	Flipbook pages are loaded as graphic images.	Reload flipbook pages as Graphic Objects

7.15 Keyframe Animation

Since its initial release in 1987, EnSight has been used extensively for animation, due to its easy-to-use keyframe animator, ability to handle transient data, and ability to communicate with common animation controllers. This mechanism allows you to create your own movie sequence to present your results more easily. There seems to be two mind sets when it comes to animation. The first group of people believe animation to be totally trivial—something that can be completely finished in an hour or two by anyone. The other group of people seem to believe that animation is something that takes many days, if not weeks to finish and requires an “animation expert” to get done. Well, neither of these ideas are correct. While animation is not trivial, it is also not overly complicated. Most animation produced by EnSight is setup during a day, and recorded the same day or during the night to be complete by the next morning. Engineers create and record their own animations. The majority of the time involved takes place in the recording of the frames to the recording device. EnSight is intended to be used by end users—this includes the animation module. We do acknowledge, however, that there is a difference between animation, and animation done well. The latter comes with time and experience.

EnSight uses a modified keyframe technique. This technique enables the user to define what the scene should look like at certain times called Keyframe. Each keyframe can be different from a previous keyframe by using any combination of rotate, translate, scale, zoom, look-at, or look-from operations. A given keyframe can also be the same as the previous frame (the purpose of which will be explained shortly). The keyframe technique only works on transformations, and is not used for other items related to what the scene looks like (i.e., when to turn on Parts, do isosurfaces, shading changes, etc.). EnSight actually keeps track of the transformation commands performed between keyframes and linearly interpolates these commands when creating frames between the keyframes. These in-between frames are referred to as subframes. A reset command will not be allowed during keyframe animation because it cannot be interpolated.

Each keyframe includes the following information: (1) a set of transformation matrix values, specifying each local frame, the global frame, the Look-At and Look-From Points, and the position of the Plane Tool; (2) the value of all isosurfaces and position of all clip Parts using the plane tool; (3) the specific keyframe attributes; and (4) the transformation commands and isosurface values to get the scene and clip Parts to the next keyframe.

When running keyframe animation, EnSight performs the following actions for each keyframe: (1) any command language commands associated with the keyframe are executed, (2) the specified number of subframes are displayed in sequence, interpolating among them the *resultant* of the transformations *you performed* to get to the next keyframe, which are *not* necessarily the most direct transformations to get to the next keyframe.

What is meant by the *resultant* of your transformations? Consider, for example, if you create a keyframe, rotate the model 360 and create another keyframe, when you run the animation the model will rotate 360, not stay still. But if you create a keyframe, rotate the model one way 360, rotate it back the other way 360 and then create an keyframe; when you run the animation the model will not move because the *resultant of your transformations* produced no rotation.   If you had created a keyframe between the two transformations, then both rotations would have been seen. The various types of transformations are performed simultaneously.

To begin the process of creating an animation sequence, first define the scene you desire for the first keyframe. This includes having all the Parts you want shown, having the attributes you wish for these Parts, orienting as desired, etc. Then, turn on keyframe animation and create this scene as your first keyframe. You can then proceed to modify the orientation of the model and create your other keyframes.

If you make mistakes during the keyframe definition, click Delete Keyframe ... and enter the number of the last keyframe you were satisfied with. Then, proceed to define the subsequent keyframes again. As soon as you have at least two keyframes defined, you may play back the animation to see what it looks like. To do this, select the Run Animation button in the Quick Interaction Area. The animation process generally proceeds with some keyframe definitions, running what you have so far after some of those definitions, once in a while a delete back to operation, more keyframe definitions, etc., until you are satisfied with the entire animation sequence. You then set up the recording device information and set the process in motion to produce a video.

Note, that when playing back the animation, you do not have to always play the entire sequence. Run From, and To frame capability is provided. You also can abort an animation run by entering the “a” key in the graphics window.

In order to get the length of animation you want on video, you will need to adjust the number of sub-frames between keyframes in the Keyframe Speed/Actions dialog. The total number of frames displayed during animation is the sum of the keyframes plus the sum of the subframes. The NTSC broadcasting standard calls for 30 frames displayed per second. On most workstations, it is unlikely that EnSight will be able to display this rapidly during playback on the workstation. So it can be difficult to get a feel for how fast the animation will be once recorded. The speed of the playback on the workstation is related both to its graphics capability and the complexity of the scene, so reducing the complexity will speed things up. Accordingly, you might consider options like making all but a representative Part invisible, use the feature angle option to reduce the visual complexity of the Parts, and/or use the dynamic/static box drawing modes.

Anything that is currently on will be on during the animation. That is, if contours, vector arrows, Particle traces, shaded surfaces, flipbook animation, animated traces, etc. are on, they will be on during animation. If any Parts have an animation delta set or are dependent on a Part that has the delta set then they will be regenerated and change through the animation. This enables you to do any of the flipbook animation techniques within keyframe animation for recording purposes, including the use of transient data (See Flipbook Animation). The advantage for doing flipbook techniques within keyframe animation is that they can be recorded and the amount of memory used is smaller because the whole flipbook is not loaded into memory. This enables the recording of long sequences of changing information that would not be able to be shown fully with flipbook animation because of memory limits of the workstation. Short sequences that you have already loaded into the flipbook can also be used by making sure that the Flipbook Run toggle is on before running keyframe animation.

If dealing with transient data, you should set up the keyframes for display of the model first, play it back, edit, etc. Then, after you are satisfied with the model presentation, you can start dealing with displaying the transient data on the model. You should be careful in doing movement of the model while transient data is being displayed. It can be confusing to have the transient data changing at the same time that the model in the scene is moving. When dealing with transient data, we normally introduce the problem first with some keyframes, then run the transient data without any transformations by defining two successive identical keyframes. Between these two identical keyframes, we animate the transient data using one of the several methods available.

We have attempted to create the animation module to be able to run in a set-up-walk-away mode to create video. In order to do this, you can issue command language lines at each keyframe. For example, if you had a case where you wanted to first show off some of the model, and then turn on fringes to show results, you could issue a "view: fringes on" command at the keyframe. It is also possible to play a command language file using this option. Care should be taken to *not* issue an `anim_keyframe: run` command as Part of this command language (which would cause an infinite loop).

When saving images to disk files, be aware that image files can take a great deal of disk space. The file system that you are writing images to should be monitored during the animation run to make sure it doesn't run out of space.

Clicking once on the Keyframe Animation Icon opens the Keyframe Animation Editor in the Quick Interaction Area.

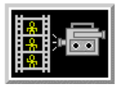


Figure 7-71
Keyframe Animation Icon

Figure 7-72
Quick Interaction Area - Keyframe Animation Editor

Keyframing Toggle — Toggles-on/off Keyframe animation feature. WARNING: If you toggle-off Keyframing, all the keyframes previously created will be lost (see Save... below).

Create Keyframe — Click this button to create a keyframe. If Keyframing toggle is not turned on then creating the first keyframe will turn it on automatically. Keyframes are automatically numbered in sequence of their creation. As each keyframe is created, a message appears in the Status History Area.

Delete Keyframe… — Opens the Delete Keyframes pop-up dialog which allows you to specify the number of the last keyframe you wish to retain and then delete all keyframes back to that frame. The keyframe whose number you specify is not deleted. To delete all keyframes enter 0 at the prompt.

Run Animation — Click to run the keyframe animation. If you click Run more than once, the animation will play for the corresponding number of times. To abort the run, press the “a” key in the Graphics Window.

Run From
Run To — These fields specify the numbers of the keyframe to start from and the keyframe to run to when Run button is pressed. Must be integer numbers of already created keyframes. Default is Run From 1 and Run To number of keyframes you have created.

Set Speed/Actions... — Opens the Keyframe Speed(Subframes)/Actions(Commands) dialog.

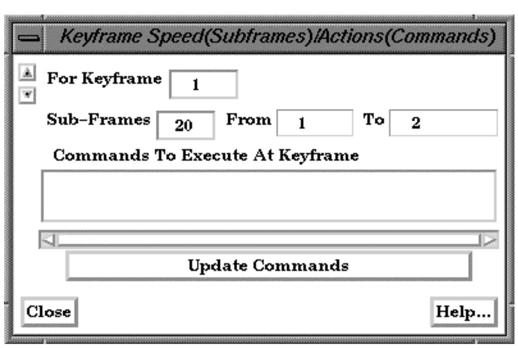


Figure 7-73
Keyframe Speed(Subframes)/Actions(Commands) dialog

For Keyframe This field and the stepper buttons are used to select which keyframe to edit.

Sub-Frames From To The Sub-Frames field specifies the number of subframes between that keyframe specified in the “From” field and that specified in the “To” field. More subframes make the transformations to the next keyframe smoother and slower.

Commands to Execute at Keyframe This command text area is used to specify up to five commands to execute before displaying the keyframe referenced in the For Keyframe field. You may use any command except commands corresponding to nonpermitted actions, such as loading another dataset. Also, there is no point in using `view_transf` commands that transform frames, change the Look At and Look From points, or move the Plane Tool since the next thing EnSight does is update the Graphics Window to match the transformation matrix information stored as Part of the keyframe. You may use `anim_keyframe` commands, for example, to toggle-on using transient data, but you should not use the `anim_keyframe: run` command since then the animation will enter an infinite loop. Commands frequently used here would be `view:` and `annotation:` commands. You may also play a command file, so there is really no limit as to how many commands you can execute. The `shell:` command is a special command to issue a UNIX command.

Update Commands This button will accept the commands entered above.

Viewing Window... Opens the Keyframe Viewing Window dialog.

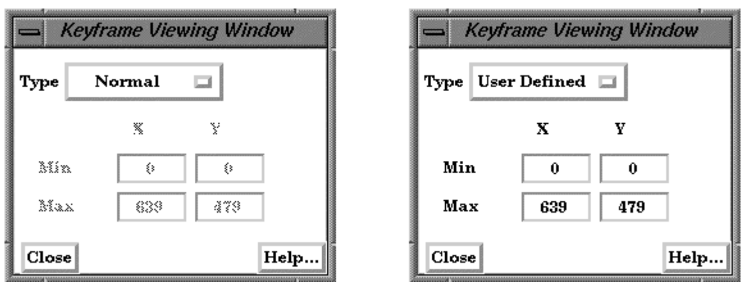


Figure 7-74
Keyframe Viewing Window dialog

Type Selection of image type, including standard video formats. Options are:
Normal type is appropriate for display in the Graphics Window.
Full type is appropriate for a full-screen graphics window.
NTSC type is NTSC window size.
PAL type is PAL window size.
User Defined type enables you to specify the screen dimensions (see below).

Min X Y
Max X Y In Type: User Defined, these fields allow you to specify the pixel dimensions for user-defined type of screen. Allowed values for X are 0 to 1279 and for Y from 0 to 1023. Bottom left corner is 0,0. EnSight assumes a horizontal-to-vertical aspect ratio of 5-to-4. Other aspect ratios will distort the images.

Record... Opens the Keyframe Animation Recorder dialog.

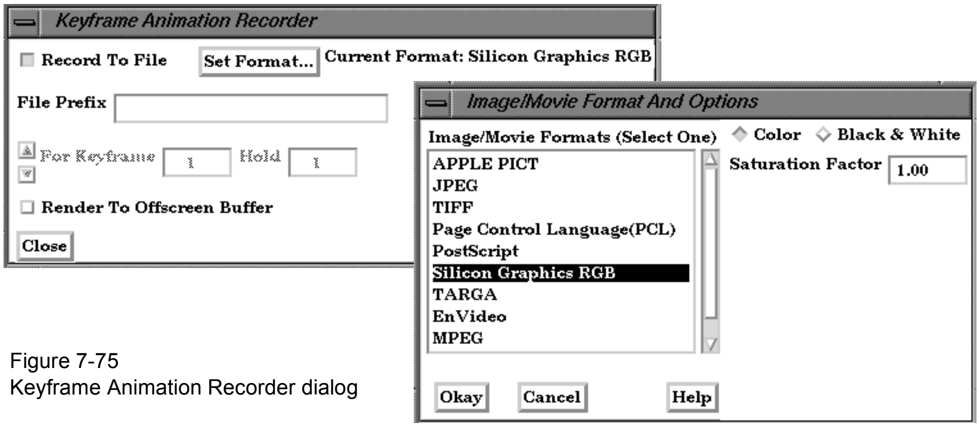


Figure 7-75
Keyframe Animation Recorder dialog

Record To File: When on, will record the keyframe animation images to the specified filename(s).

Set Format...: Brings up the Image/Movie Format and Options dialog. The flipbook will be recorded using the selected format. (see Section 2.10, Saving and Printing Graphic Images and How to Print/Save an Image)

Render to Offscreen Buffer: On some SGI models it is possible to render the keyframe animation in the "background", thus freeing the workstation for other tasks.

For Keyframe: This field and the stepper buttons are used to select the number of frames to Hold. Each Hold will record the indicated number of frames to the Record To device.

Hold: This field specifies the number of frames to hold.

Note: It is ignored in on-screen viewing.

File Prefix: Specification of filename prefix to use when saving frames to a disk file. Each frame is saved in a different file according to the File Numbering. The prefix can also have a directory path before it, such as /usr/tmp/prefix.

File Numbering: Opens a pop-up menu for the selection of file numbering method. Choices are:

Frame Code File names will contain the keyframe and sub-frame numbers as indicated under File Prefix.

Sequential File names will be numbered from 1 sequentially upwards throughout the animation.

Transient Data Sync... Opens the Keyframe Transient Data Synchronization dialog.

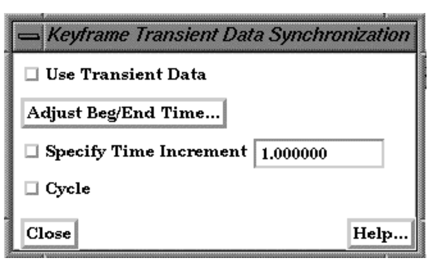


Figure 7-76
Keyframe Transient Data Synchronization dialog

Use Transient Data Toggle: Toggles-on/off synchronization of keyframe animation to transient data. If toggled-on, each animation frame (keyframe or subframe) will cause the next transient-data time to be swapped in. You can interpolate between whole time steps with the Specify Increment attribute (see below).

Adjust Beg/ End Time...	Opens the Solution Time dialog to allow modification of the ranges. (see Section 7.13, Solution Time)
Specify Time Increment Toggle / Field	Toggle-on/off to indicate that you want to specify how to step through the transient data, or that you want EnSight to calculate how to do this. For example, for a Step time, entering 1 indicates that you want EnSight to step by 1 with no interpolation. To cause frames to be interpolated between actual time steps then enter a fractional value, such as 0.5 to interpolate half way between or 0.25 to interpolate at each 1/4. Enter a value greater than 1 to skip over transient times, such as using 10 to jump by tens.
Cycle Toggle	Toggles-on/off cycling through transient data during playback of keyframe animation. Toggling-on cycling will cause the transient data to be played from beginning to end and then end to beginning depending on how many keyframes and subframes you have specified.
Save…	Opens the File Selection dialog to allow you to save the specifications of the current keyframe into a file. This saves only the keyframe specifications, not the animation images or Part information. If you perform a Full Backup, the keyframe specifications are saved as Part of the Backup.
Restore…	Opens the File Selection dialog to allow you to restore keyframe specifications from a file. This restores only the keyframe specifications; you must also load Part data and set the Part attributes.
Use Interactive Iso/Clip	Turn on to animate clip and isosurface parts which were interactively modified during the keyframe animation.

(see How To Create a Keyframe Animation)

Troubleshooting Keyframe Animation

Problem	Probable Causes	Solutions
Graphics Window flashes at start of animation run.	New graphics window is opened to display the animation.	Hardware specific. Does not affect frames sent to recorder.
Colors seem to bleed when I play the recorded tape back.	The color display from tape has a tendency to bleed colors that are pure, such as full intensity red, green, or blue.	Don't use them. If you want a red object don't use full intensity, and mix in some other components. For example you may want to try RGB =.9 .1 .1.
Lines "crawl" across the screen when I play the recorded tape back.	Lines are only 1 pixel wide which would cause crawling on video tape.	Use a line width greater than 1.
During playback the action of the video starts as soon as the picture comes up and it's hard to recognize what is happening that quickly and then it goes away.	When creating a video it is best to have the model come up with a hold of 3 seconds or more before starting the animation. The animation should run for a reasonable length of time and then it should hold for 3 or more seconds again at the end. On complex models the hold may need to be as much as 10.	Holding a video at the beginning and the end and showing enough frames in-between will allow your audiences eyes to adjust and increase comprehension of the video. Adding annotation strings and pointers to point out areas of interest also helps. Also, showing the whole model with a hold and then zooming way in on the area of interest will help comprehension.
Video is too fast when played back from a recorded tape, but it looked fine on the monitor.	Video formats play back at rates that are normally faster than the workstation hardware can. For example, NTSC plays back at 30 frames per second which can be impossible for the workstation to match on a fairly complex model.	Increase the number of frames recorded by adding more subframes or by possibly having your video recording device record more than one frame when EnSight tells it to record.
Transformation of my object on the recorded tape is not smooth.	Not enough subframes.	Adding more subframes will cause more finely interpolated scene between keyframes. For instance the model should probably not rotate more than 3 degrees between frames being recorded.
Model is being clipped away as the animation proceeds.	Running into the Z-Clip plane or the regular plane tool with Clipping on.	Make sure the Z-Clip planes and the plane tool are far enough away from the model for the whole animation sequence. NOTE: The distance between the Z-Clip planes could affect the clarity of the image. The Z-Clip should be kept as close to the model and as close to each other as possible for better results.

7.16 Subset Parts Create/Update

EnSight enables you to create and modify Subset Parts from ranges of node and/or element labels of model parts. The Subset Parts feature allows you to isolate contiguous and/or non-contiguous regions of large data sets, and apply the full-range of feature applications and inspection provided by EnSight.

Subset Parts can only be created from parts that have node and/or element labels. Therefore, Subset Parts can not be created from any Created Parts, because the only parts that can have node and element labels are Model Parts such as parts built from file data, Merged Model Parts, or Computational Mesh Model Parts (parts created via the periodic computational symmetry Frame attribute). Model Parts that do not have given or assigned node and/or element labels can not be used to create Subset Parts.

Subset Parts are created and reside on the server. They are Created Parts that provide proper updating of all dependent parts and variables.

Subset Parts are created and modified by specifying parent parts, as well as their node and/or element labels. Node and/or element labels can be displayed and filtered interactively according to global View Mode and local Part Mode attributes.

Clicking once on the Subset Parts Create/Update Icon open the Subset Parts Editor in the Quick Interaction Area which is used to both create and update Subset Parts.

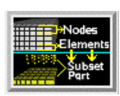


Figure 7-77
Subset Parts Create/Update Icon

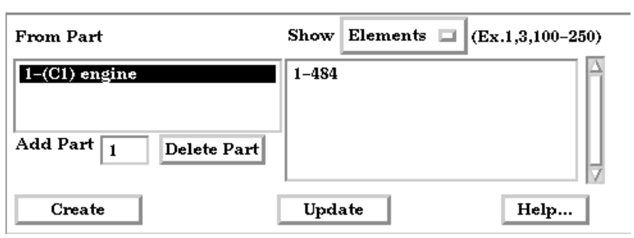


Figure 7-78
Quick Interaction Area - Subset Parts Editor

From Part — List reflecting the parent parts that have been added to the list. Selecting a part in this list displays any corresponding element or node range specifications in the Show List.

Show — Opens a pull-down menu for selecting which type of part entity you wish to include (or have included) in your Subset Part. The Show options are:
Elements show any specified element label ranges
Nodes show any specified node label ranges

Show List This field specifies the label ranges of Elements and/or Nodes wanted for the Subset Part that correspond to the selected part in the From Part list. The Elements or Nodes are specified as a range as the example indicates, i.e. (Ex. 1,3,8,9,100-250).

Add This field specifies the GUI part number you wish to add to the From Part list.

Delete This button deletes any selected entries in the From Part list along with any corresponding element or node range specifications in the Show List.

Update Part Recreates the Subset Parts selected in the Main Parts List according to the selections in the From Part List and the Show List.

Feature Detail Editor (Subset Parts) Double Clicking on the Subset Parts Create/Update Icon brings up the Feature Detail Editor (Subset Parts), the Creation Attributes of which offers the same features for the Subset Parts as the Quick Interaction Area Editor.

(see Section 3.3, Part Editing for a detailed discussion of the remaining Feature Detail Editor turn-down sections which are the same for all Parts),

7.17 Tensor Glyph Parts Create/Update

Tensor glyphs visualize the direction and tension/compression of the eigenvectors at discrete points (at nodes or at element centers) for a given tensor variable.

Tensor glyph Parts are dependent Parts known only to the client. They cannot be used as a parent Part for other Part types and cannot be used in queries. As dependent Parts, they are updated anytime the parent Part and/or the creation tensor variable changes (unless the general attribute Active flag is off).

Tensor glyphs can be filtered to show just the tensile or compressive eigenvectors. Further, the visibility for each of the eigenvectors (Major, Middle, and Minor) can be controlled.

Tensor glyphs will appear for each of the nodes/elements for the Parent part's visual Representation. Thus, for a border Representation of a Part, only the border nodes/elements will be candidates for a tensor glyph.

The tensile and compressive eigenvectors can be visualized by modifying the tensile/compressive component's line width and color.

Clicking once on the Tensor Glyph Create/Update Icon opens the Tensor Glyph Editor section of the Quick Interaction Area which is used to both create and update (make changes to) tensor glyph Parts.

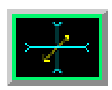


Figure 7-79
Tensor Glyph Parts Create/Update Icon

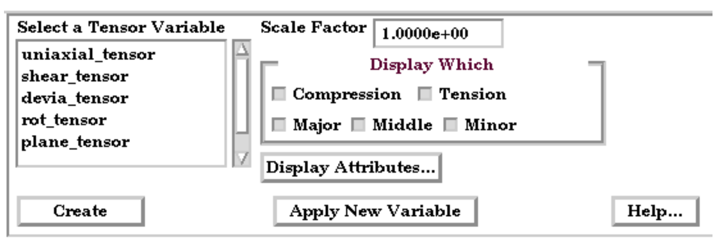


Figure 7-80
Quick Interaction Area - Tensor Glyph Parts Editor

Scale Factor The size of the tensor glyph.

Display Which Controls which eigenvectors will be displayed

Compression	Show the eigenvectors that are in compression
Tension	Show the eigenvectors that are in tension
Major	Show the major eigenvector
Middle	Show the middle eigenvector
Minor	Show the minor eigenvector

Display Attributes Opens the Tensor Display Attributes dialog.

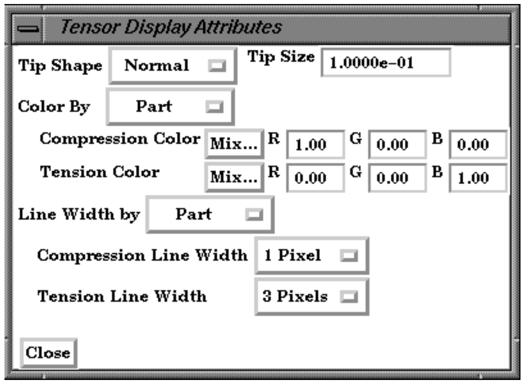


Figure 7-81
Tensor Display Attributes Dialog

Tip Shape Opens a pop-up menu to select the tip shape

None	Displays eigenvectors as lines with no tips.
Normal	Displays “classical” tips.
Triangles	Displays triangle tips.

Tip Size Controls the size of the tips.

Color By The tensor glyphs can be colored according to the part color, or have a separate color for compression and tension.

Compression Color	Specify the compressive color
Tension Color	Specify the tensile color

Line Width By The tensor glyphs can use the part line width, or have a separate line width for compression and tension.

Compression Line Width	Specify the compressive line width
Tension Line Width	Specify the tensile line width

Apply New Variable Changes the tensor Variable used to create the Tensor Glyphs to that currently selected in the “Select a Tensor Variable” list.

Feature Detail Editor (Tensor Glyph) Double clicking on the Tensor Glyph Create/Update Icon opens the Feature Detail Editor for Tensor Glyphs, the Creation Attributes Section of which provides access to the same functions available in the Quick Interaction Area. For a detailed discussion of the remaining Feature Detail Editor turn-down sections (which are the same for all Part types)

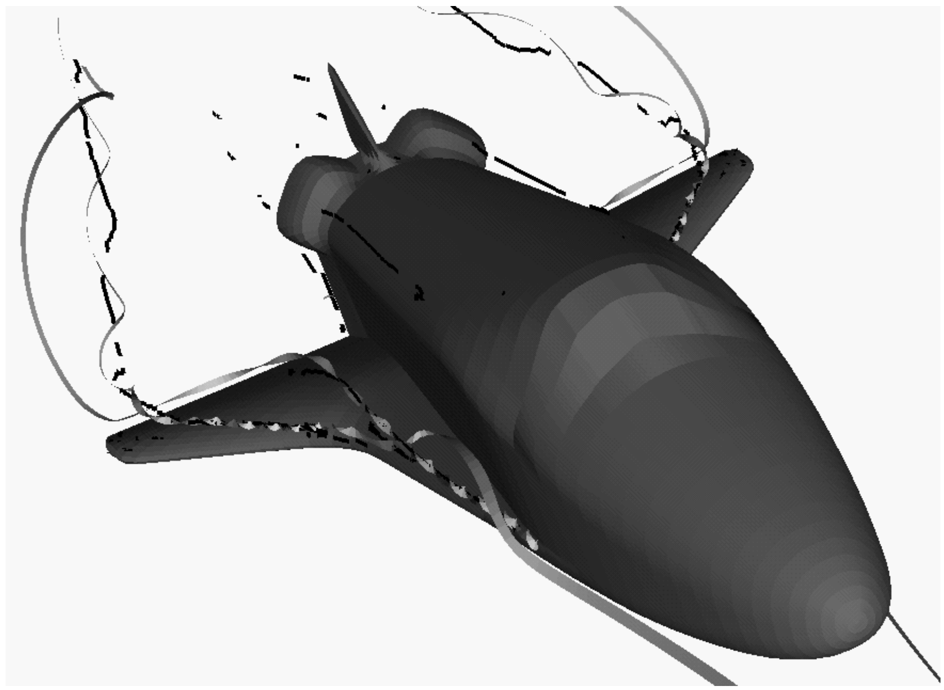
(see Section 3.3, Part Editing and How to Create Tensor Glyphs)

Troubleshooting Tensor Glyphs

Problem	Probable Causes	Solutions
No tensor glyphs created	No real eigenvectors exist.	None
	Scale Factor too small.	Increase Scale Factor.
	Parent parts have non-visual attributes.	Re-specify parent parts or modify parent part's Element Representation.
	Parent parts do not contain selected tensor variable.	Re-specify parent parts.
Too many glyphs	Parent parts have too many points at which tensor glyphs are to be displayed.	Consider using a grid clip as the parent part.

7.18 Vortex Core Create/Update

Vortex cores help visualize the centers of swirling flow in a flow field. EnSight creates vortex core segments from the velocity gradient tensor of 3D flow field part(s). Core segments can then be used as emitters for ribbon traces to help visualize the strength and nature of the vortices.



Velocity Gradient Tensor

EnSight automatically pre-computes the velocity gradient tensor for all 3D model parts prior to creating the vortex cores. Since this variable is automatically created, all subsequent 3D model parts created will also have this tensor computed.

Note: The velocity gradient tensor variable will continue to be created and updated for all 3D model parts until it is deactivated.

This tensor variable behaves like any other created tensor variable, and may be deactivated via the Feature Detail Editor (Variables) dialog.

Thresholding

Core segments may be filtered out according to the settings of a threshold variable, value, and relational operator (see Access below for details). Most active variables can be used as threshold variables. Thresholding was implemented to help the user filter-out, or view portions of the core segments according to variable values.

When vortex core parts are Created/Updated, the vorticity magnitude scalar variable “`fx_vortcore_streng`” is created to help you threshold unwanted core segments according to these scalar values.

Due to the difference in algorithms, some segments produced may not be vortex cores (see Caveats). Thus, the need for a filtering mechanism that filters out segments according to different variables arose and has been provided via thresholding options.

Algorithms

Currently, vortex cores are calculated according to two algorithms based on techniques outlined by Sujudi, Haimes, and Kenwright (see References below). Both techniques are linear and nodal. That is, they are based on decomposing finite elements into tetrahedrons and then solving closed-form equations to determine the velocity gradient tensor values at the nodes. Also, any variable with values at element centers are first averaged to element nodes before processing.

The eigen-analysis algorithm uses classification of eigen-values and vectors to determine whether the vortex core intersects any faces of the decomposed tetrahedron. The vorticity based algorithm utilizes the fact of alignment of the vorticity and velocity vectors to determine core intersection points.

References

Please refer to the following references for more detailed explanations of pertinent concepts and algorithms.

D. Banks, B. Singer, “Vortex Tubes in Turbulent Flows: Identification, Representation, Reconstruction”, IEEE Visualization ‘94, 1994

D. Sujudi, R. Haimes, “Identification of Swirling Flow in 3-D Vector Fields”, AIAA-95-1715, Jun. 1995

D. Kenwright, R. Haimes, “Vortex Identification - Applications in Aerodynamics”, IEEE Visualization ‘97, 1997

M. Roth, R. Peikert, “A Higher-Order Method For Finding Vortex Core Lines”, IEEE Visualization ‘98, 1998

R. Haimes and D. Kenwright, On the Velocity Gradient Tensor and Fluid Feature Extraction”, AIAA-99-3288, Jan. 1999

R. Peikert, M. Roth, “The ‘Parallel Vectors’ Operator - a vector field visualization primitive”, IEEE Visualization ‘99, 1999

D. Kenwright, T. Sandstrom, GEL, NASA Ames Research Center, 1999

R. Haimes, D. Kenwright, The Fluid Extraction Toll Kit, Massachusetts Institute of Technology, 2000

R. Haimes, K. Jordan, “A Tractable Approach to Understanding the Results from Large-Scale 3D Transient Simulations”, AIAA-2000-0918, Jan. 2001

Caveats

Due to the linear implementation of both the eigen-analysis and vorticity algorithms, they both have problems finding cores of curved vorticities. In addition, testing has shown that both algorithms usually fail to predict vortex core segments in regions of weak vorticies.

Since the eigen-analysis method finds patterns of swirling flow, it can also locate swirling flow features that are not vortices (especially in the formation of boundary layers). These non-vortex core type segments can be filtered out via thresholding (see Thresholding). In addition, the eigen-analysis algorithm may produce incorrect results when the flow is under more than one vortex, and has a tendency to produce core locations displaced from the actual vortex core.

The vorticity based method does not seem to exhibit the problem of producing core segments due to boundary layer formations, because the stress components of the velocity gradient tensor have been removed in the formation of the vorticity vector. Thus, the vorticity method seems to produce longer and more contiguous cores - in most cases; and therefore, the reason for including both algorithms.

Access

Clicking once on the Boundary Layer Variable Create/Update Icon opens the Boundary Layer Variables Editor in the Quick Interaction Area which is used to both create and update (make changes to) the boundary layer variables.

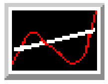


Figure 7-82
Vortex Core Create/Update Icon

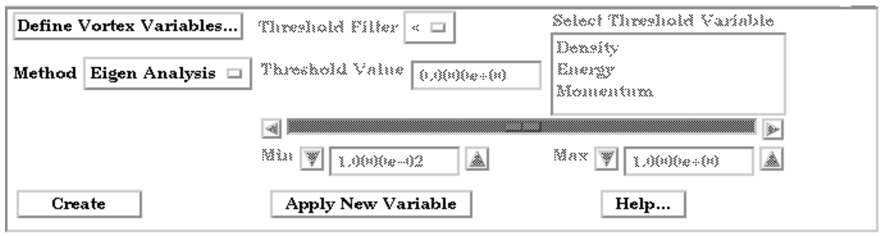


Figure 7-83
Quick Interaction Area - Vortex Core Editor (before Create)

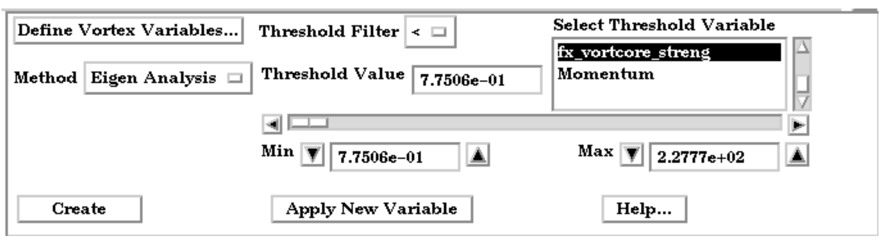
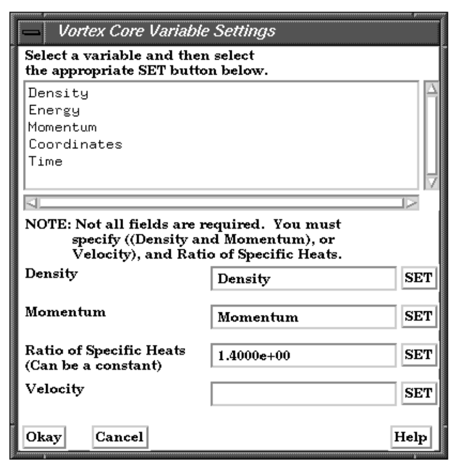


Figure 7-83
Quick Interaction Area - Vortex Core Editor (after Create)

Define Vortex Variables

Opens the Vortex Core Variable Settings dialog which allows the user to identify and set the dependent variables used in computing the vortex cores. This dialog has a list of current accessible variables from which to choose. Immediately below is a list of dependent variables with corresponding text field and SET button. The variable name in the list is tied to a dependent variable below by first highlighting a listed variable, and then clicking the corresponding dependent variables's SET button, which inserts the listed variable into its corresponding text field.



All text fields are required, except you may specify either Density and Momentum (which permits velocity to be computed on the fly), or just Velocity. A default constant value is supplied for the Ratio of Specific Heats which may be changed or specified by a scalar variable name.

Clicking Okay activates all specified dependent variables and closes the dialog.

Method	Opens a pop-up dialog for the specification of which type of method to use to compute the vortex cores in the 3D field. These options are: *Eigen Analysis* - Scheme that uses eigen-analysis on the Velocity gradient tensor to compute the vortex core segments. (See Algorithms above). *Vorticity* - Scheme that uses the vorticity vector from the anti-symmetric portions of the velocity gradient tensor to compute the vortex core segments. (See Algorithms above).
Threshold Filter	Relational operators used to filter out vortex core segments. < Filter out any core segments less than the Threshold Value (default). > Filter out any core segments greater than the Threshold Value.
Threshold Value	The value at which to filter the vortex core segments.
Select Threshold Variable List	A list of possible variables that you may use to help filter out vortex core segments. This list includes the vorticity magnitude scalar variable (named `fx_vortcore_streng`) which gets created when you Create/Update a vortex core part.
Threshold Slider Bar	Used to change the Threshold Value in increments dependent on the Min and Max settings. The stepper button on the left (and right) of the slide bar is used to decrement (and increment) the Threshold value. *Min* - The minimum value of the Threshold Variable. The stepper button on the left (and right) side of the Min text filed is used to decrease (and increase) the order of magnitude, or the exponent, of the min value. *Max* - The maximum value of the Threshold Variable. The stepper button on the left (and right) side of the Max text field is used to decrease (and increase) the order of magnitude, or the exponent, of the Max value.
Create	Creates vortex cores that correspond to the selected 3D field in the part list, based on the respective settings.
Apply New Variable	Applies the threshold settings to the vortex core segments based on the threshold variable that is highlighted in the Select Threshold Variable list.

Troubleshooting Vortex Cores

Problem	Probable Causes	Solutions
Error creating vortex cores	Non-3D part selected in part list	Highlight 3D part
Undefined (colored by part color) regions on vortex cores	Vortex core line segment node was not mapped within a corresponding 3D field element	Make sure corresponding 3D field part is defined.

7.19 Shock Surface/Region Create/Update

The Shock Surface/Region feature helps visualize shock waves in a 3D flow field. Shock waves are characterized by an abrupt increase in density, energy, and pressure gradients, as well as a simultaneous sudden decrease in the velocity gradient.

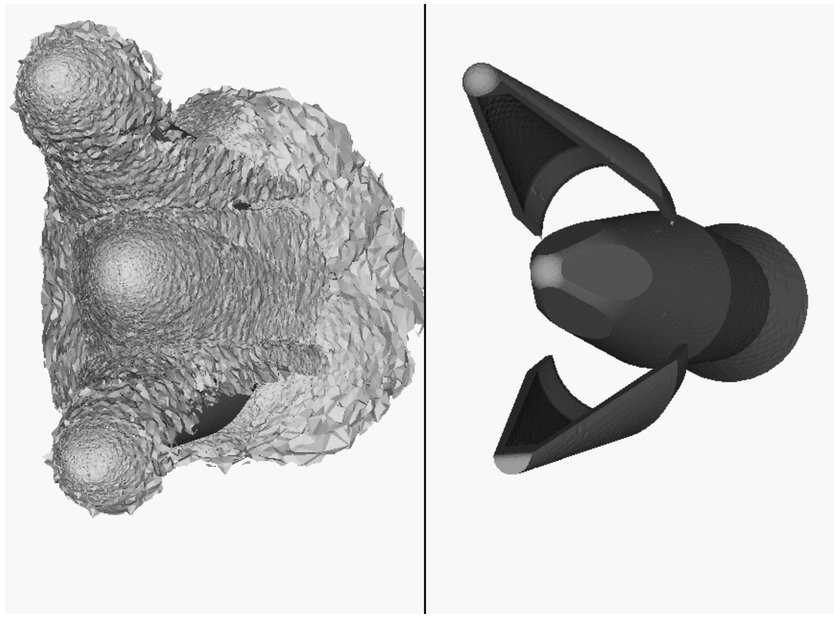


Figure 7-84
Shock Surface (Data Courtesy of Craft Technology)

EnSight creates candidate shock surfaces in 3D (trans/super-sonic) flow fields using a creation scalar variable (i.e. density, pressure) along with the velocity vector (see Algorithms below).

Thresholding

Due to the nature of the shock algorithms, other surfaces with similar characteristics may be produced besides shock surfaces, i.e. expansion regions, etc. Therefore, a filtering mechanism is necessary to help filter out these non-shock regions.

Shock surfaces may be filtered out according to the settings of a threshold variable, value, and relational operator (see Access below for details). Most active variables can be used as threshold variables, but gradients of the density and energy related scalar variables in the streamwise direction seem to work best.

When Shock parts are created via the Surface method, the scalar "`SHK_*`" variable (where * is the appended name of the variable, i.e. `SHK_Density`) is created to help threshold unwanted areas according to these scalar values. When Shock parts are created via the Region method, the scalar "`SHK_Threshold`" variable is created to help threshold respective unwanted areas.

Currently, these `SHK_*` variables consist of the gradient of an appropriate creation variable (i.e. `SHK_Density`, `SHK_Pressure`, etc.) in the streamwise direction. For the Region method, the creation variable is always pressure.

EnSight tries to compute a reasonable default threshold value each time one of these threshold variables is applied. By default this value is half of one exponential order less than the maximum value of the threshold variable on the shock part. This seems to produce a reasonable starting surface for the user to threshold. By default, the smaller the threshold value, the larger the part.

The default threshold variable for non “SHK_” variables is the minimum of the specified variable on the shock part.

The default Min/Max slider values try to bound the default threshold value by appropriate orders of magnitude. Min/Max slider values floor/ceil the min/max values of the threshold variable of the shock part when these ranges are exceeded (see Threshold Slider Bar below).

Algorithms

Shock parts are calculated according to two algorithms, or methods. The first algorithm (referred to by EnSight as the Surface method) is based on the work of Pagendarm et. al., and the second algorithm (referred to by EnSight as the Region method) is based on the work by Haimes et. al. (See References below.)

The Surface method utilizes the maximal gradient of a quantity like density or pressure in the streamwise direction. This yields a surface that requires thresholding to distinguish significant portions of the shock patterns from weak numerical artefacts.

The Region method utilizes flow physics to define shocks in steady state and transient solutions. The steady state equation is based on developing a scalar field based on combining the mach vector with the normalized pressure gradient field. The transient solution combines this term with appropriate correction terms. The Region method produces iso-shock surfaces that form regions that bound the shock wave.

Note: Both methods use dependent variables (See Define Shock Variables below). If some of the dependent variables do not exist and are required, they will be temporarily calculated based on other defined dependent variables (as defined in Section 4.3, Variable Creation). The user has the responsibility to ensure these variables have consistent units.

Both techniques have been implemented in a linear and nodal fashion. That is, their gradient calculations are based on decomposing finite elements into tetrahedrons to approximate the gradient values at the nodes. Also, any variables with values at element centers are averaged to element nodes before processing.

Other Notes

Pre-filtering flow field elements by Mach Number.

The Surface Method allows the user to filter-out any flow field elements less than a specified mach number, by issuing the following command via the command line processor (See Section 2.4, Command Files):

```
test: shock_mach_prefilter #
```

Where # is the corresponding mach-number value (>=0.0) by which to filter. (Zero is the default value - which means this option is turned-off until activated by a value > 0.0.) Ideally this mach-number value would be 1; and thus, would eliminate any subsonic regions from being processed via the Surface method’s algorithm. In some transonic cases, this has doubled the efficiency of the algorithm by eliminating the calculation of the second derivative on many elements. Unfortunately, other cases have been observed (especially noticed in regions with normal shack waves) where this option (due to the grid resolution and/or the numerical dissipation inherent in the shock algorithm - see 1999 reference by D. Lovely and R. Haimes) has eliminated some valid shock regions. Although care is taken to provide an appropriate stencil of elements for the gradient calculations of values adjacent to these areas, it appears this value may need to be < 1 to prevent these shock regions from being eliminated. This option is therefore provided at the discretion and expertise of the user. This option only takes effect when issued prior to a create or an update in shock method.

Post-filtering shock part elements by Mach Number.

Both methods allow the user to filter-out (prior to thresholding) any shock part elements less than a specified mach number, by issuing the following command via the command line processor (see Section 2.4, Command Files):

```
test: shock_mach_postfilter #
```

Where # is the corresponding mach-number value (>=0.0) by which to filter. (Zero is the default value - which means this option is turned-off until activated by a value > 0.0.) Ideally this mach number value would be 1; and thus, would eliminate any subsonic regions from being displayed as part of the shock surface. Unfortunately, some cases have been observed (especially noticed in regions with normal shock waves) where this options (due to the grid resolution and/or the numerical dissipation inherent in the shock algorithm - see 1999 reference by D. Lovely and R. Haimes) has eliminated some valid shock regions. This option is therefore provided at the discretion and expertise of the user. This option only takes effect when issued prior to a create or an update in shock method.

Moving Shock.

Both methods compute the stationary shock based on the user specified parameters. The Region Method has the capability of applying a correction term to represent moving shocks in transient cases. This capability is toggled ON/OFF by issuing the following command via the command line processor (see Section 2.4, Command Files).

```
test: toggle_moving_shock
```

Issuing the command a second time will toggle this option off. This option is provided at the discretion and expertise of the user. This option only takes effect when issued prior to a create or an update in shock method.

References

Please refer to the following references for more detailed explanations of pertinent concepts and algorithms.

H.G. Pagendarm, B. Seitz, S.I. Choudhry, "Visualization of Shock Waves in Hypersonic CFD Solutions", DLR, 1996

D. Lovely, R. Haimes, "Shock Detection from Computational Fluid Dynamics Results", AIAA-99-3285, 1999

R. Haimes and D. Kenwright, "On the Velocity Gradient Tensor and Fluid Feature Extraction", AIAA-99-3288, Jan. 1999

D. Kenwright, T. Sandstrom, GEL, NASA Ames Research Center, 1999

R. Haimes, D. Kenwright, The Fluid Extraction Tool Kit,
Massachusetts Institute of Technology, 2000

R. Haimes, K. Jordan, "A Tractable Approach to Understanding the Results from Large-Scale 3D Transient Simulations", AIAA-2000-0918, Jan. 2001

Access

Clicking once on the Shock Surface/Region Create/Update Icon opens the Shock Editor in the Quick Interaction Area which is used to both create and update (make changes to) the shock part.

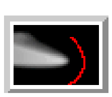
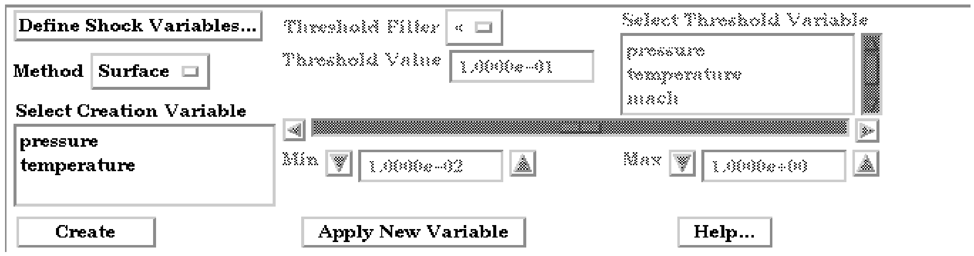


Figure 7-85
Shock Surfaces/Regions Create/Update Icon



Quick Interaction Area - Shock Surfaces/Regions Editor (before Create)

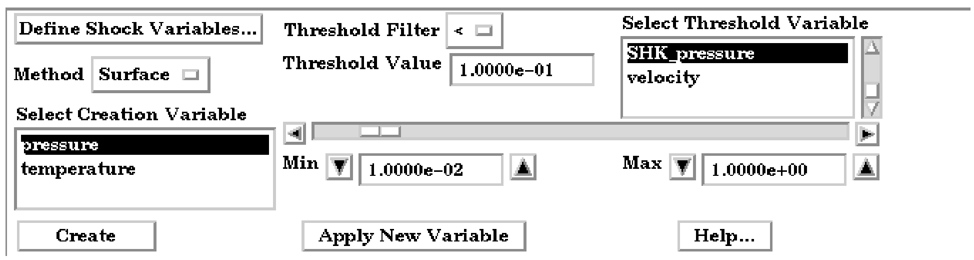
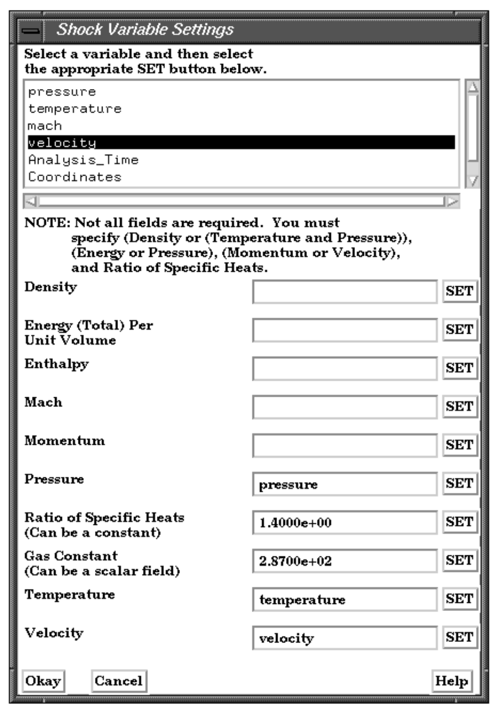


Figure 7-86
Quick Interaction Area - Shock Surfaces/Regions Editor (after Create)

Define Shock Variables...

Opens the Shock Variable Settings dialog which allows the user to identify and set the dependent variables used in computing the shock parts. This dialog has a list of current accessible variables from which to choose. Immediately below is a list of dependent variables with corresponding text field and SET button. The variable name in the list is tied to a dependent variable below by first highlighting a the listed variable, and then clicking the corresponding dependent variable's SET button, which inserts the listed variable into its corresponding text field.



Not all text fields are required. Although you must specify either Density or Pressure, Temperature, and Gas Constant; either Energy or Pressure; either Velocity or Momentum; and the Ratio of Specific Heats. A default constant value is supplied for the Ratio of Specific Heats and the Gas Constant which may be changed or specified by a scalar variable name.

Clicking Okay activates all specified dependent variables and closes the dialog.

Method	Opens a pop-up dialog for the specification of which type of method, to use to compute the vortex cores in the 3D field. These options are: *Surface* - Scheme that uses maximal density or pressure gradients in the streamwise direction to locate candidate shock surfaces. (See Algorithms above). *Region* - Scheme that uses flow physics based on the mach vector coupled with pressure gradient to locate candidate shock regions. (See Algorithms above.)
Select Creation Variable	A list of variables used to create the shock surface via Surface method. These variable are specified via those SET in the Define Shock Variables list above. *Note: This list is not used for the Region method. The Region method only uses pressure as the creation variable.*
Threshold Filter	Relational operators used to filter out shock areas. < Filter out any areas less than the Threshold Value (default). > Filter out any areas greater than the Threshold Value.
Threshold Value	The value at which to filter the shock areas.
Select Threshold Variable List	A list of possible variables that you may use to help filter out unwanted areas. This list includes the shock threshold variables "`SHK_*`" which gets created when you Create/Update a shock part.
Threshold Slider Bar	Used to change the Threshold Value in increments dependent on the Min and Max settings. The stepper button on the left (and right) of the slide bar is used to decrement (and increment) the Threshold value. *Min* - The minimum value of the Threshold Variable. The stepper button on the left (and right) side of the Min text field is used to decrease (and increase) the order of magnitude, or the exponent, of the Min value. *Max* - The maximum value of the Threshold Variable. The stepper button on the left (and right) side of the Max text field is used to decrease (and increase) the order of magnitude, or the exponent, of the Max value.
Create	Creates shock parts that correspond to the selected 3D field in the part list, based on the respective settings.
Apply New Variable	Applies the threshold settings to shock surfaces based on the threshold variable that is highlighted in the Select Threshold Variable list.

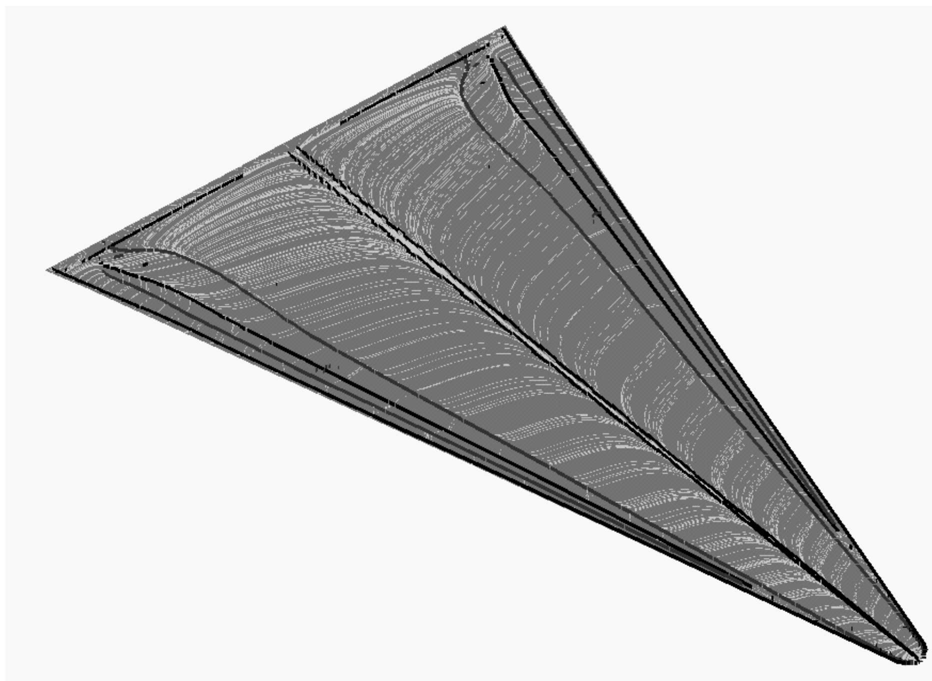
Troubleshooting Shock Surfaces/Regions

Problem	Probable Causes	Solutions
Error creating shock part	Non-3D part selected in part list	Highlight 3D flow field part
No shock part created	Flow field part subsonic	No shock in subsonic regions
	Shock dependent variables defined with incorrect units, i.e. since Region method uses density and mach, if file variables are pressure, temperature, and velocity, then density (and thus mach) is dependent on gas constant. By default this value is 287 (Nm/KgK)	Make sure dependent variables have correct units. i.e. gas constant may need to be 1716(ft-lb/slugDegR), or some other value rather than the default
No to little shock part created	Threshold value too large for < operation	Decrease threshold value

7.20 Separation/Attachment Lines Create/Update

Separation and Attachment Lines exist on 2D surfaces and help visualize areas where flow abruptly leaves or returns to the 2D surface in 3D flow fields. These lines are topologically significant curves on the 2D surface where flow converges and then separates (separation lines) from the surface into the 3D flow field, and where flow diverges and then attaches (attachment lines) to the surface from the 3D flow field.

These line segments can be used as emitters for ribbon traces to help visualize flow interaction from the 2D surface into the 3D field, or displayed along with surface-restricted traces to help visualize the topology of the 2D surface.



EnSight creates separation and attachment lines as two distinct parts so that each may be assigned their own attributes. Although both are updated computationally when changes are made to either one via the quick interaction area.

Separation/Attachment lines can be created on any 2D part, whether it is a boundary surface or internal surface to a 3D flow field. These lines can also be created on 3D flow field parts. However, computation of the separation/attachment lines is restricted to only the boundary surfaces of the 3D flow field.

Velocity Gradient Tensor

Ensight creates separation and attachment lines from the velocity gradient tensor of the 3D flow field part. EnSight automatically pre-computes the velocity gradient tensor for all 3D model parts prior to creating the separation and attachment lines. These values are then mapped to any corresponding 2D model part, or inherited by any created part.

Since this variable is automatically created, all subsequent 3D model parts created will also have this tensor variable computed.

Note: The velocity gradient tensor variable will continue to be created and updated for all 3D model parts until it is deactivated.

This tensor variable behaves like any other created tensor variable, and may be deactivated via the Feature Detail Editor (Variables) dialog.

Thresholding

Separation/Attachment lines may be filtered out according to the settings of a threshold variable, value, and relational operator (see Access below for details). Most active variables can be used as threshold variables. Thresholding was implemented to help the user to filter-out, or view portions of the line segments according to variable values.

When separation and attachment line parts are Created/Updated, the scalar variable "`fx_sep_att_strength`" is created to help you threshold unwanted core segments according to these scalar values.

Note: This scalar variable is currently set to the vorticity magnitude scalar, until a better thresholding variable can be identified.

Since it has been observed that the current implementation of this algorithm may produce additional lines that are not separation or attachment lines, the need for a filtering mechanism that filters out segments according to different variables arose and had been provided via thresholding options.

Algorithms

Currently, separation and attachment lines are calculated according to the phase-plane algorithm presented by Kenwright (see References below). This algorithm detects both closed and open separation. Closed separation lines originate and terminate at critical points. Whereas open separation lines do not need to start or end at critical points.

This technique is linear and nodal. That is, 2D elements are decomposed into triangles, and then closed-form equations are solved to determine the velocity gradient tensor values for eigen-analysis at the nodes. Also, any variables with values at element centers are averaged to element nodes before processing.

References

Please refer to the following references for more detailed explanations of pertinent concepts and algorithms.

J. Helman, L. Hesselink
"Visualizing Vector Field Topology in Fluid Flows",
IEEE CG&A, May 1991

D. Kenwright, "Automatic Detection of Open and Closed Separation and Attachment Lines", IEEE Visualization '98, 1998, pp. 151-158

R. Haimes and D. Kenwright, "On the Velocity Gradient Tensor and Fluid Feature Extraction", AIAA-99-3288, Jan. 1999, pp. 315-324

S. Kenwright, C. Henze, C. Levit, "Feature Extraction of Separations and Attachment Liens", IEEE TVCG, Apr.-Jun. 1999, pp. 135-144

R. Peikert, M. Roth, "The 'Parallel Vectors' Operator - a vector field visualization primitive", IEEE Visualization ' 99, 1999

D. Kenwright, T. Sandstrom, GEL, NASA Ames Research Center, 1999

R. Haimes, D. Kenwright, The Fluid Extraction Tool Kit,
Massachusetts Institute of Technology, 2000

Access

Clicking once on the Separation and Attachment Lines Create/Update Icon opens the Separation and Attachment Lines Editor in the Quick Interaction Area which is used to both create and update (make changes to) the separation and attachment line parts.

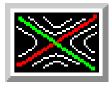
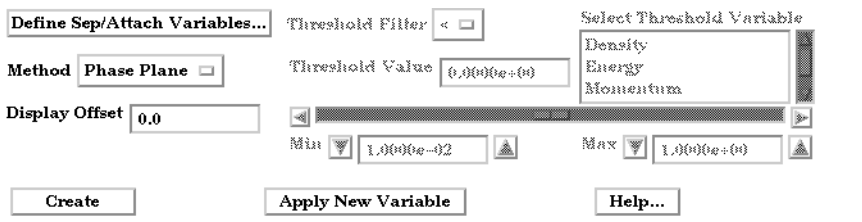


Figure 7-87
Separation/Attachment Lines Create/Update Icon



Quick Interaction Area - Separation/Attachment Lines Editor (before Create)

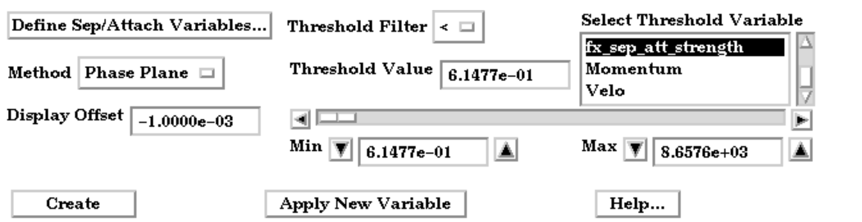
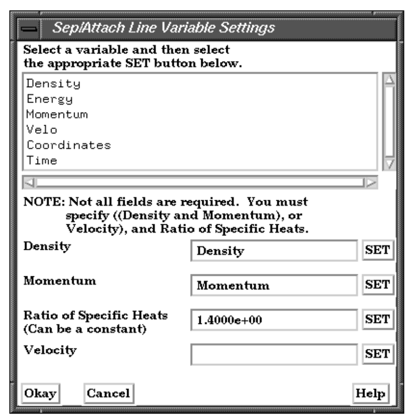


Figure 7-88
Quick Interaction Area - Separation/Attachment Lines Editor (after Create)

Define Sep/Attach Variables...

Opens the Sep/Attach Line Variable Settings dialog which allows the user to identify and set the dependent variables used in computing separation and attachment lines. This dialog has a list of current accessible variables from which to choose. Immediately below is a list of dependent variables with corresponding text field and SET button. The variable name in the list is tied to a dependent variable below by first highlighting a listed variable, and then clicking the corresponding dependent variable's SET button, which inserts the listed variable into it's corresponding text field.



All text fields are required, except you may specify either Density and Momentum (which permits velocity to be computed on the fly), or just Velocity. A default constant value is supplied for the Ratio of Specific Heats which can be changed or specified by a scalar variable name.

Clicking Okay activates all specified dependent variables and closes the dialog.

Method	Opens a pop-up dialog for the specification of which type of method, to use to compute the separation and attachment lines on the 2D surface. These options are: *Phase Plane* - Scheme that uses eigen-analysis on the velocity gradient tensor along with phase plane analysis to compute the separation and attachment line segments (see Algorithms).
Display Offset	Model coordinate value used to display the lines in a normal direction from the surface.
Threshold Filter	Relational operators used to filter out line segments. < Filter out any line segments less than the Threshold Value (default). > Filter out any line segments greater than the Threshold Value.
Threshold Value	The value at which to filter the line segments.
Select Threshold Variable List	A list of possible variables that you may use to help filter out line segments. This list includes the vorticity magnitude scalar variable (named fx_sep_att_strength) which gets created when you Create/Update a separation and attachment part.
Threshold Slider Bar	Used to change the Threshold Value in increments dependent on the Min and Max settings. The stepper button on the left (and right) of the slide bar is used to decrement (and increment) the Threshold value. *Min* - The minimum value of the Threshold Variable. The stepper button on the left (and right) side of the Min text filed is used to decrease (and increase) the order of magnitude, or the exponent, of the min value. *Max* - The maximum value of the Threshold Variable. The stepper button on the left (and right) side of the Max text field is used to decrease (and increase) the order of magnitude, or the exponent, of the Max value.
Create	Creates separation and attachment lines that correspond to the selected 2D part in the part list, based on the respective settings.
Apply New Variable	Applies the threshold settings to the separation and attachment line segments based on the threshold variable that is highlighted in the Select Threshold Variable list.

Troubleshooting Separation/Attachment Lines

Problem	Probable Causes	Solutions
Error creating separation and attachment lines	Invalid part selected in part list	Highlight 2D or 3D part
Undefined (colored by part color) regions on sep/attach lines	Sep/Attach line segment node was not mapped within a corresponding 3D field element	Make sure corresponding 3D field part is defined.

7.21 Boundary Layer Variables Create/Update

EnSight creates the following Boundary Layer Variables simultaneously on a 2D boundary part directly from velocity information of its corresponding 3D flow field part. Their corresponding variable names are included in all appropriate EnSight variable lists, i.e. Color Parts variable list, etc.

Variable Name	Description	Symbol
(N) bl_thickness	Boundary layer thickness	δ
(N) bl_disp_thickness	Displacement thickness	$\delta*$
(N) bl_momen_thickness	Momentum thickness	Θ
(N) bl_shape_parameter	Shape parameter	H
(N) bl_skin_friction_Cf	Skin friction coefficient	C_f

Only nodal (values per node) variables are created. Any dependent elemental variables (values per element) are averaged to nodal variables before processing. (See Definitions below.)

Whether these variables are mapped onto the 2D boundary part, or used in conjunction with other EnSight features (such as Elevated Surfaces of the boundary layer thickness off the 2D boundary part, Vortex Cores, Separation and Attachment Lines, Shock, etc.), these variables help provide valuable insight into the formation and location of possible boundary layers.

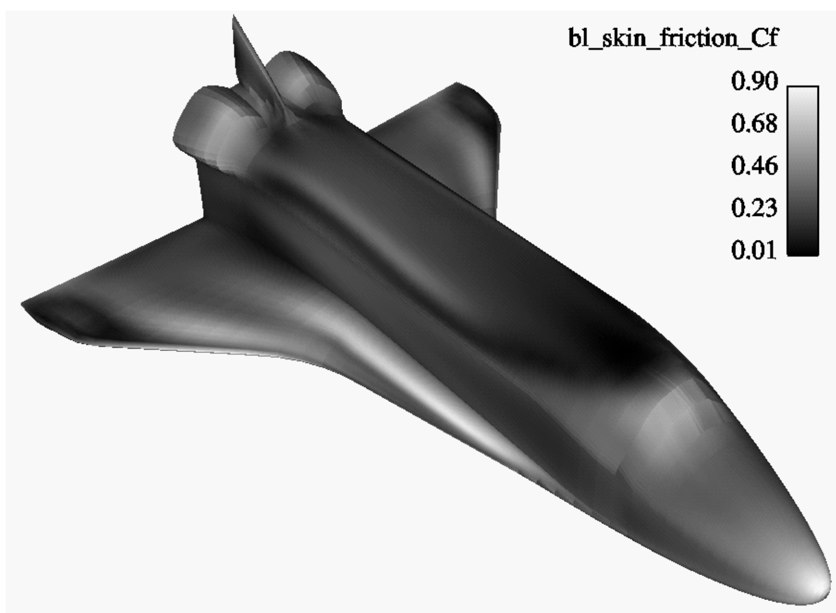


Figure 7-89
Skin Friction Coefficient

Boundary Layer

A boundary layer is a relatively thin region that confines viscous diffusion near the surface of a flow field, where the velocity gradient in the normal direction to the surface goes through an abrupt change. Although multiple boundary layers may be considered (especially in areas of flow separation), our current implementation provides boundary layer parameters based on the former concept. In these thin regions, the thickness of the boundary layer typically increases in the downstream direction, and the velocity parallel to the surface is much larger than the velocity normal to the surface.

Boundary Surfaces Boundary parts are typically 2D surface part(s) that correspond to a 3D field. These surfaces may either be boundary parts defined directly from the data file, or created parts (i.e. 2D IJK sweeps of a structured part, or an isosurface of zero velocity of either an unstructured or structured part).

Velocity-Magnitude Gradient Vector Changes of the velocity in the normal direction from the surface into the 3D flow field are utilized to determine the boundary layer. EnSight automatically creates a velocity-magnitude gradient vector for all 3D model parts prior to creating the boundary layer variables. These gradient values are then mapped to all corresponding 2D model parts, and inherited by all created parts.

Note: The velocity-magnitude gradient vector variable will continue to be created for all 3D model parts until it is deactivated.

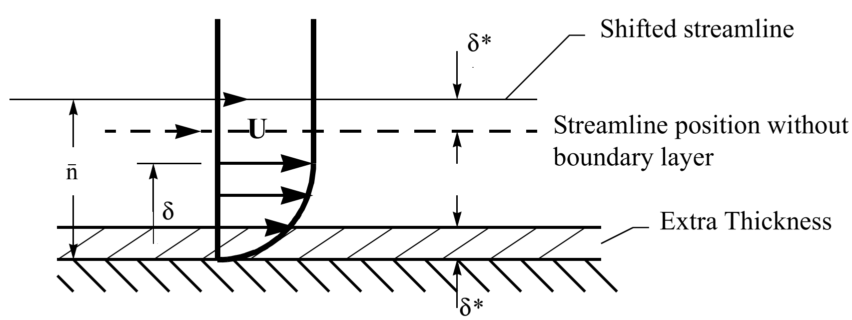
This vector variable behaves like any other created variable, and may be deactivated via the Feature Editor (Variables) dialog.

Definitions

Boundary Layer Thickness

$$\delta = \bar{n}\big|_{u/U = 0.995}$$

The distance normal from the surface to where u/U = 0.995,
where: u = magnitude of the velocity at a given location in the boundary layer,
U = magnitude of the velocity just outside the boundary layer.



Displacement Thickness

$$\delta^* = \frac{1}{U}\int_0^{\delta}(U-u)\,dn$$

Provides a measure for the effect of the boundary layer on the “outside” flow. The boundary layer causes a displacement of the streamlines around the body.

Momentum Thickness

$$\Theta = \frac{1}{U^2}\int_0^{\delta}(U-u)u\,dn$$

Relates to the loss of momentum in the air in the boundary layer.

Shape Parameter

δ^*/Θ

Used to characterize boundary layer flows, especially to indicate potential for separation.

This parameter increases as a separation point is approached, and varies rapidly near a separation point.

Note: Separation has not been observed for $H < 1.8$, and definitely has been observed for $H = 2.6$; therefore, separation is considered in some analytical methods to occur in turbulent boundary layers for $H = 2.0$.

In a Blasius Laminar layer (i.e. flat plate boundary layer growth with zero pressure gradient), $H = 2.605$. Turbulent boundary layer, $H \sim= 1.4$ to 1.5, with extreme variations $\sim= 1.2$ to 2.5.

Skin Friction Coefficient

$$C_f = \frac{\tau_w}{0.5\rho_\infty(V_\infty)^2}$$

where: $\tau_w = \mu\left(\frac{\partial u}{\partial n}\right)_{n=0}$ = fluid shear stress at the wall.

μ = molecular viscosity of the fluid.

May be spatially and/or temporarily varying quantity (usually a constant).

n = distance normal to the wall.

ρ_∞ = freestream density

V_∞ = freestream velocity magnitude.

This is a non-dimensionalized measure of the fluid shear stress at the surface. An important aspects of the Skin Friction Coefficient is:

$C_f = 0$, indicates boundary layer separation.

Other Notes:

Factor Determining Velocity at Boundary-Layer Thickness (δ)

The factor (default = 0.995) which determines the velocity magnitude (u) at the boundary-layer thickness (δ) with respect to the velocity magnitude (U) just outside the boundary layer (i.e. δ is the distance normal to the surface at which $u = 0.995U$), may be changed by issuing the following command via the command line processor (see Section 2.4, Command Files):

```
test: blt_factor #
```

where # is the corresponding factor (> 0.).

References

Please refer to the following texts for more detailed explanations.

P.M. Gerhart, R.J. Gross, & J.I. Hochstein, Fundamentals of Fluid Mechanics, 2nd Ed., (Addison-Wesley: New York, 1992),

C.A.J. Fletcher, Computational Techniques for Fluid Dyanmics, Vol. 2, 2nd Ed., (Springer: New York, 1997)

Access

Clicking once on the Boundary Layer Variable Create/Update Icon opens the Boundary Layer Variables Editor in the Quick Interaction Area, which is used to both create and update (make changes to) the boundary layer variables.

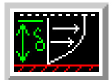


Figure 7-90
Boundary Layer Variables Create/Update Icon

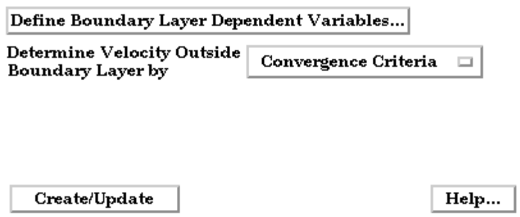


Figure 7-91
Quick Interaction Area - Boundary Layer Variables Editor

Define Boundary Layer Dependent Variables...

Opens the Boundary Layer Variable Settings dialog which allows the user to identify and set the dependent variables used in computing the boundary layer variables (see Definitions above). This dialog has a list of current accessible variables to choose from. Immediately below is a list of dependent variables with corresponding text field and SET button. The variable name in the list is tied to a dependent variable below by first highlighting a the listed variable, and then clicking the corresponding dependent variable's SET button, which inserts the listed variable into its corresponding text field.

All text fields are required, except you may specify either Density and Momentum (which permits velocity to be computed on the fly), or Velocity. Default constant values are provided which may be changed by editing the text field.

Clicking Okay activates all specified dependent variables and closes the dialog.

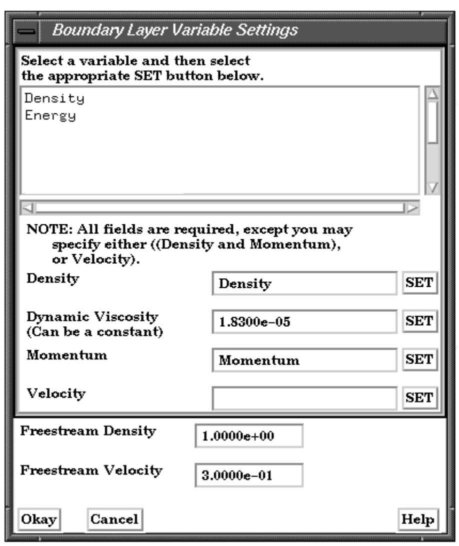


Figure 7-92
Boundary Layer Variable Settings Dialog

Determine Velocity Outside Boundary Layer By

Opens a pop-up dialog for the specification of which type of method to determine the constant velocity just outside the boundary layer (U) (see Definitions above). The following options determine (U) at each node of the surface in the direction normal from the surface into the 3D field by:

Convergence Criteria - monitoring the velocity profile until either the velocity magnitude goes constant or its gradient goes to zero.

Distance From Surface - specifying the Normal Distance from the surface into the field at which to extract the velocity and assign as U. Then monitor the velocity profile from the surface into the field until U is obtained.

Normal Distance - Text field that contains the distance normal from the surface into the 3D field at which to extract the velocity for U.

Velocity Magnitude - specifying the Velocity Magnitude to assign as U. Then monitor the velocity profile from the surface into the field until U is obtained.

Velocity Magnitude - Text field that contains the specified velocity magnitude to assign as U.

Troubleshooting Boundary Layer Variables

Problem	Probable Causes	Solutions
Error creating boundary layer variables.	Non-2D part selected in part list.	Highlight 2D part.
Undefined (colored by part color) regions on boundary surface.	2D boundary surface node was not mapped to corresponding 3D field boundary node.	Make sure corresponding 3D field part is defined.

8 Modes

This chapter describes the six different Modes through which you can work in the Graphics Window. The “active” Mode determines both the configuration and what functions are available through the Mode Icon Bar.

Figure 8-1
Mode Choices

Section 8.1, View Mode describes the layout of the Mode Icon Bar and the functions available when **View** is the active Mode. *By default, this mode is not available unless it has been enabled under Edit > Preferences... General User Interface - View Mode Allowed.*

Section 8.2, Annot Mode describes the layout of the Mode Icon Bar and the functions available when **Annot** is the active Mode.

Section 8.3, VPort Mode describes the layout of the Mode Icon Bar and the functions available when **VPort** is the active Mode.

Section 8.4, Part Mode describes the layout of the Mode Icon Bar and the functions available when **Part** is the active Mode.

Section 8.5, Plot Mode describes the layout of the Mode Icon Bar and the functions available when **Plot** is the active Mode.

Section 8.6, Frame Mode describes the layout of the Mode Icon Bar and the functions available when **Frame** is the active Mode. *By default, this mode is not available unless it has been enabled under Edit > Preferences... General User Interface - Frame Mode Allowed*

8.1 View Mode

View Mode is used to adjust the appearance of Parts in the Graphics Window, the visibility and appearance of Labels, to adjust Auxiliary Clipping status, and to toggle visibility of the Global Axis triad. *By default, this mode is not available unless it has been enabled under Edit > Preferences... General User Interface - View Mode Allowed, as all of the attributes under this mode are available either on the Desktop or from the Main Menu > View pulldown.*

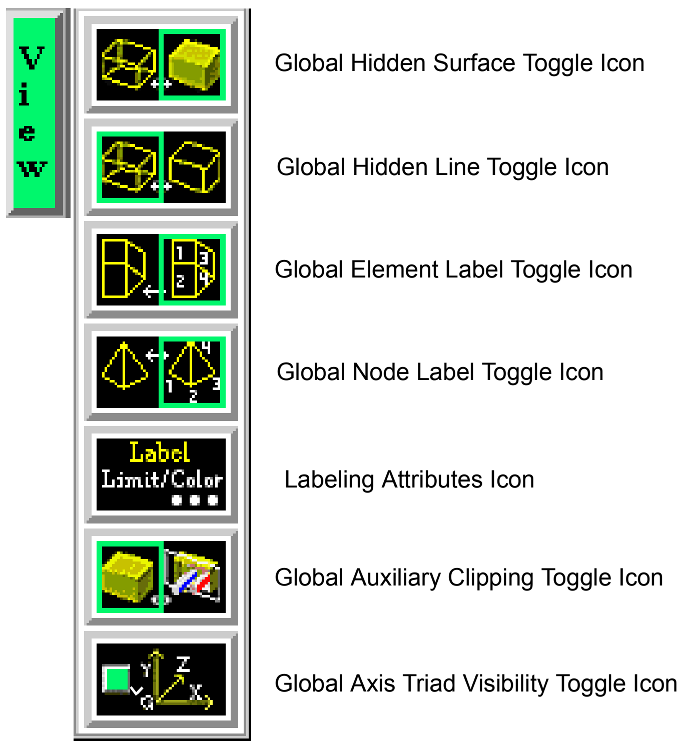


Figure 8-2
Mode Selection Area - View Selected

Global Shaded Toggle Icon

Toggles on/off global Shaded (default is off) which displays all Parts in a more realistic manner by making hidden surfaces invisible while shading visible surfaces according to specified lighting parameters. Performs the same function as Main Menu > View > Shaded toggle button and the Desktop > Shaded button.

Figure 8-3
View Mode - Shaded Toggle Icon

When toggled-off, all visible Parts are shown as line drawings. Shaded may be turned off for individual Parts using the Shaded toggle in the Parts Mode Icon Bar or the Feature Detail Editor for each type of Part. It can also be turned off for a Particular viewport in the Viewport Special Attributes Icon under VPort Mode.

Shaded require more time to redraw than a line-mode display (the default), so you may wish to first set up the Graphics Window as you want it, then turn on Shaded to see the final result. It is possible to improve graphics performance when Shaded is on by also toggling on Static Lighting (Main Menu > View > Static Lighting). To shade surfaces, a Part's representation on the Client must include surfaces - (2D elements). Any 1D elements of Parts displayed with Shaded on will continue to be drawn as lines. Lighting parameters for brightness and reflectivity are specified independently in the Feature Detail Editor for each type of Part.

Access: View Mode Icon Bar: Shaded Toggle Icon
or: EnSight dialog > View > Shaded
or: Desktop > Shaded

(see Section 6.4, View Menu Functions and How To Set Drawing Style)

Troubleshooting Hidden Surfaces

Problem	Probable Causes	Solutions
Graphics Window shows line drawing after toggling on Shaded.	Shaded is toggled off for some or all individual Parts.	Toggle Shaded on for individual Parts with the Shaded Icon in Part Mode or in the Feature Detail Editor dialog.
	There are no surfaces to shade—all Parts have only lines.	If Parts are currently in Feature Angle representation, change the representation. If model only has lines, you can not display shaded images.
	Element Visibility has been toggled off for some or all Parts.	Toggle Element Visibility on for individual Parts in the Feature Detail Editor dialog.

Global Hidden Line Toggle Icon

Toggles on/off global Hidden Line (default is off) which simplifies a line-drawing display by making hidden lines—lines behind surfaces—invisible while continuing to display other lines. Performs the same function as Main Menu > View > Hidden Line Toggle and the Desktop > Hidden Line button.

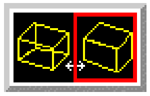


Figure 8-4
View Mode - Global Hidden Line Toggle Icon

Hidden Line can be combined with Shaded to display both shaded surfaces and the edges of the visible surface elements. Hidden Line applies to all Parts displayed in the Graphics Window but it can be toggled-on/off for individual Parts using the Feature Detail Editor or the Part Mode: Hidden Line Toggle button.

To have lines hidden behind surfaces, you must have surfaces (2D elements). If the representation of the in-front Parts consists of 1D elements, the display is the same whether or not you have Hidden Lines mode toggled-on.

During interactive transformations, the display reverts to displaying all lines. When you release the mouse button, the Main View display automatically resumes Hidden Line mode (assuming it is toggled on at that time).

The Hidden line option will not be active during playback of flipbook objects animations.

Hidden Line Overlay

If you toggle Hidden Line on while Shaded is already on, the lines overlay the surfaces. EnSight will prompt you to specify a color for the displayed lines (you do not want to use the same color as the surfaces since they then will be indistinguishable from the surfaces). The default is the Part-color of each Part, which may be appropriate if the surfaces are colored by a color palette instead of their Part-color.

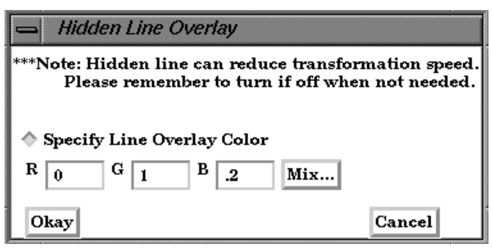


Figure 6-5
Hidden Line Overlay dialog

Specify Line Overlay Toggle

Toggle-on if you want to specify an overlay color. If off, the overlay line color will be the same as the Part color.

R, G, B

The red, green, and blue components of the hidden line overlay. These fields will not be accessible unless the Specify Overlay option is on.

Mix...

Click to interactively specify the constant color used for the hidden line overlay using the Color Selector dialog. (see Section 7.1, Color and How To Change Color)

Access: View Mode Icon Bar: Global Hidden Line Toggle Icon
or: Main Menu > View > Hidden Line
or: Desktop > Hidden Line

(See How To Set Attributes)

Global Element Label Toggle Icon

Toggles on/off the global visibility (default is on) of element labels (if they are available in the data set) for all Parts. Performs the same function as Main Menu > View > Label Visibility > Element Labeling.

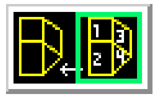


Figure 8-6
View Mode - Global Element Label Toggle Icon

Visibility of element labels for individual Parts can be controlled in the Node, Element, and Line Attributes section of the Feature Detail Editor (Model) or using the Element Label Toggle under Part Mode.

Access:‘ View Mode : Global Element Label Icon
or: Main Menu > View > Label Visibility > Element Labeling

Global Node Label Toggle Icon

Toggles on/off the global visibility (default is on) of node labels (if they are available in the data set) for all Parts. Performs the same function as Main Menu > View > Label Visibility > Node Labeling.

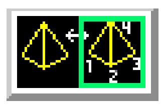


Figure 8-7
View Mode - Global Node Label Toggle Icon

Visibility of node labels for individual Parts can be controlled in the Node, Element, and Line Attributes section of the Feature Detail Editor (Model) or using the Node Label Toggle under Part Mode.

Access: View Mode : Global Node Label Icon
or: Main Menu > View > Label Visibility > Node Labeling

Label Attributes Icon

Opens the Node/Element Labeling Attributes dialog.

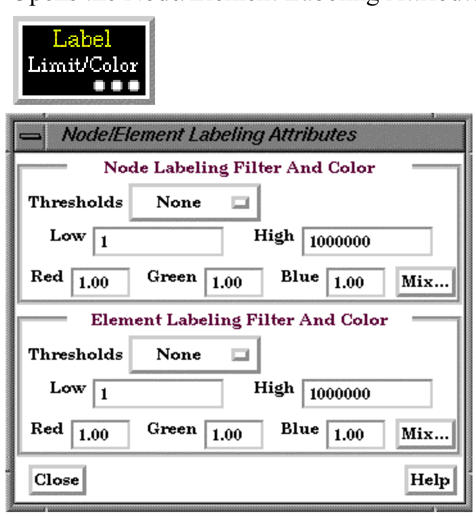


Figure 8-8
View Mode - Labeling Attributes Icon and Node/Element Labeling Attributes dialog

It is often useful to limit the visibility of node and element labels to a subset of those available in order to identify areas of interest. Coloring the labels can also make identification easier. The Node/Element Labeling Attributes dialog is used for these two purposes.

Node Labeling Filters and Color

Thresholds — Selection of pattern for filtering node labels according to the label number. Options are:
- *None* displays all the node labels. (No filtering done)
- *Low* displays only the node numbers that are above Low. (Filters low numbers out)
- *High* displays only the node numbers that are below High. (Filters high numbers out)
- *Band* displays only the node numbers that are below Low and above High. (Filters the band out)
- *Low_High* displays only the node numbers between Low and High. (Filters the low and high node numbers out)

Low — This field specifies the lowest node number you wish to display.

High — This field specifies the highest node number you wish to display.

R G B — These fields may be used to specify node label color by RGB values between 0 and 1.

Mix… — Opens the Color Selector dialog. (see Section 7.1, Color)

Element Labeling Filters and Color

Thresholds — Selection of pattern for filtering element labels according to the label number. Options are:
- *None* displays all the element labels. (No filtering done)
- *Low* displays only the element numbers that are above Low. (Filters low numbers out)
- *High* displays only the element numbers that are below High. (Filters high numbers out)
- *Band* displays only the element numbers that are below Low and above High. (Filters the band out)
- *Low_High* displays only the element numbers between Low and High. (Filters the low and high node numbers out)

Low — This field specifies the lowest element number you wish to display.

High — This field specifies the highest element number you wish to display.

R G B — These fields may be used to specify element label color by RGB values between 0 and 1.

Mix… — Opens the Color Selector dialog. (see Section 7.1, Color)

Access: View Mode : Labeling Attributes Icon
or: Main Menu > View > Label Visibility > Labeling Attributes...

Global Auxiliary Clipping Toggle Icon — Toggles the global Auxiliary Clipping feature on/off (Default is off). Performs the same function as Main Menu > View > Auxiliary Clipping.

Figure 8-9
View Mode - Global Auxiliary Clipping Toggle Icon

Like a Z-Clip plane, Auxiliary Clipping cuts-away a portion of the model. Unless Auxiliary Clipping (Aux. Clip) has been toggled off for specific Parts in the Feature Detail Editor dialog General Attributes section or with the Auxiliary Clipping Toggle Icon in the Part Mode Icon Bar, Parts (or portions of Parts) located on the back (negative-Z) side of the Plane Tool are removed. Individual Parts whose Aux Clip attribute you have toggled off remain unaffected.

Auxiliary Clipping is helpful, for example, with internal flow problems since you can "peel" off the outside Parts and look inside. This capability is also often useful in animation.

Auxiliary Clipping is interactive—the view updates in real time as you move the Plane Tool around. Unlike a Z-Clip plane, Auxiliary Clipping applies only to the Parts you specify, and the plane can be located anywhere with any orientation though it is always infinite in extent. The position of the Plane Tool and the status of Auxiliary Clipping is the same for all displayed viewports.

Do not confuse Auxiliary Clipping with a 2D-Clip plane, which is a created Part whose geometry lies in a plane cutting through its parent Parts or with the Part-operation of cutting a Part.

Access: View Mode : Global Auxiliary Clipping Toggle Icon
or: Main Menu > View > Label Visibility > Auxiliary Clipping

(see Section 6.5, Tools Menu Functions and How To Use the Plane Tool)

Troubleshooting Auxiliary Clipping

Problem	Probable Causes	Solutions
The Plane Tool does not appear to clip anything	The Aux Clip toggle is off for each individual Part.	Turn the Aux Clip toggle on for individual Parts in the Feature Detail Editor (Model) General Attributes section.
	The Plane Tool is not intersecting the model	Change the position of the Plane Tool.
The Graphics Window shows nothing other than the Plane Tool after Clipping is toggled-on.	All of the Part(s) is(are) on the back side of the Plane Tool and is(are) thus clipped	Change the position of the Plane Tool.

Global Axis Triad Visibility Toggle Icon

Toggles on/off the visibility (default is off) of the Global Axis triad. Performs the same function as Main Menu > View > Axis Visibility > Axis - Global.

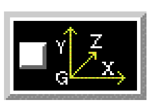


Figure 8-10
View Mode - Global Axis Triad Visibility Toggle Icon

The Global Axis triad shows the point and axes around which Global rotations occur.

Access: View Mode : Global Axis Triad Visibility Toggle Icon
or: Main Menu > View > Axis Triad Visibility > Global

8.2 Annot Mode

Annot (Annotation) Mode is used to create and edit text strings, lines, and import logos into the Graphics Window., and to adjust their visibility, size, color. and position. It is also used to adjust the type, size, format, and position of legends.

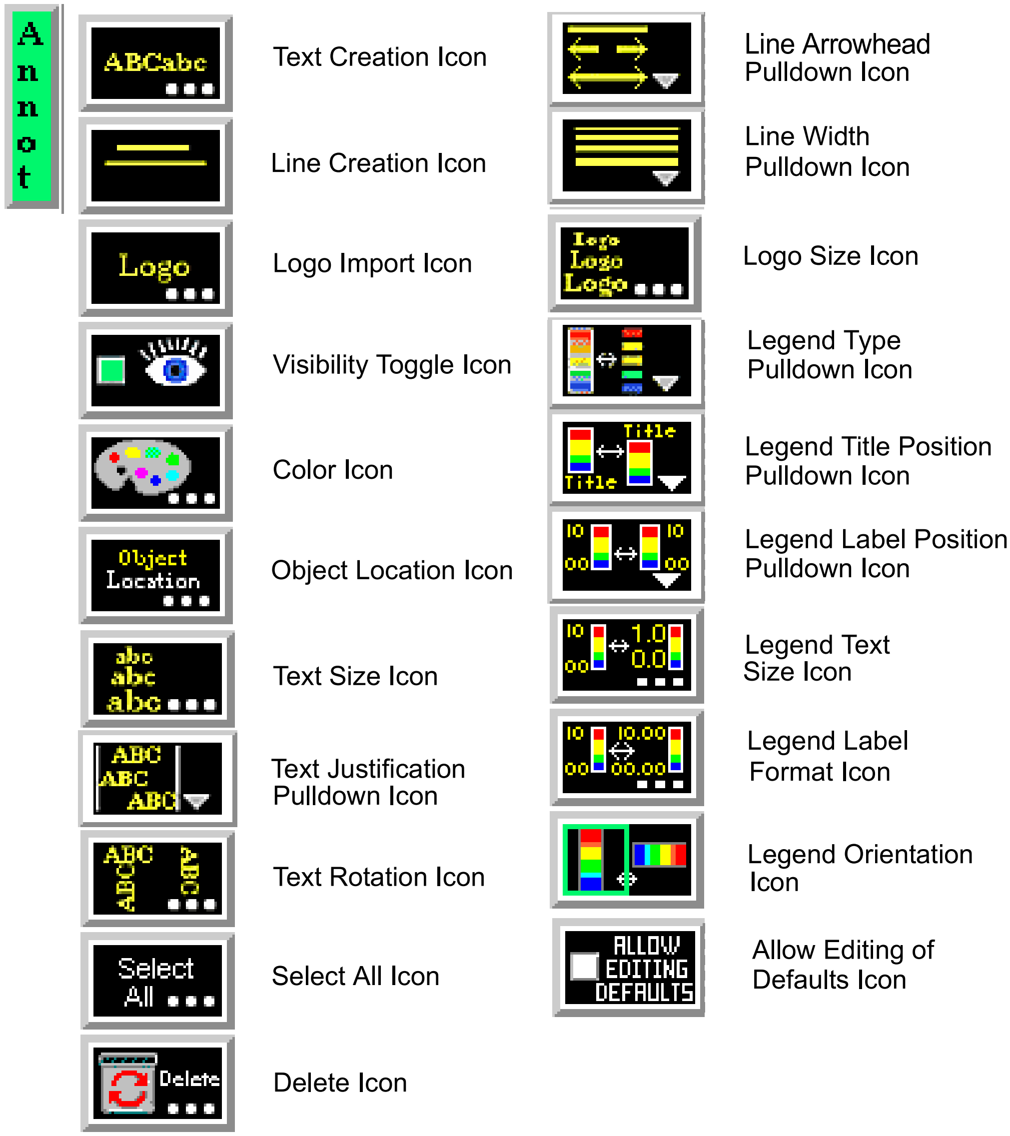


Figure 8-11
Mode Selection Area - Annot Selected

When in Annot Mode, you are always modifying the objects selected in the Graphics Window. Selected Annotation objects are outlined in the “selection color”, while unselected objects are outlined in a white color. To select an object, click the mouse over it. To select multiple objects, hold the Control key down while clicking on the objects.

All annotation objects are positioned in the main Graphics Window; they are not tied to specific viewports.

Text Creation Icon Opens the Text Annotation Creation dialog.

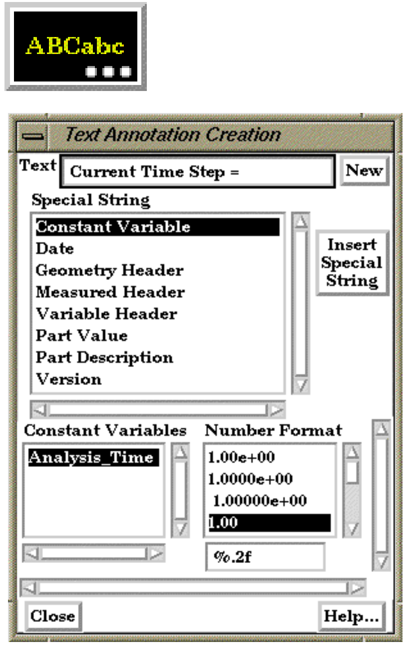


Figure 8-12
Annot Mode - Text Creation Icon and Text Annotation Creation dialog

Text strings may be created and inserted into the Graphics Window using the Text Annotation Creation dialog.

Text — This field specifies the desired text string.

New — Clicking this button inserts the text in the Text field into the Graphics Window.

Special String — Menu of eight different special strings used to insert information contained in results data set or within EnSight into text string.

Insert Special String — Inserts selected Special String into Text field at position of cursor. Choices are:

Constant Variable inserts the value of the constant variable selected and displays it in the selected format

Date inserts the Day of Week, Month, Date, Time, Year

Geometry Header inserts either the first or second header lines of the geometry file

Measured Header inserts the header line of the measured results file

Variable Header inserts the header line of the selected variable data file

Part Value inserts the pertinent value for the single Part selected in a Parts List which pops up within the Text Annotation Creation dialog (This option currently works only for Isosurface Parts and XYZ or IJK Clip Planes and will insert the Isosurface Creation Value or clip plane location.)

Part Description inserts the description of the Part selected in a Parts List which pops up within the Text Annotation Creation dialog

Version inserts the EnSight version number

Access: Annot Mode : Text Creation Icon

Line Creation Icon

Creates a new line in the Graphics Window.

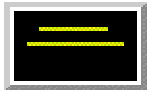


Figure 8-13
Annot Mode - Line Creation Icon

This line may be interactively repositioned and its length adjusted within the Graphics Window using the mouse cursor or these actions may be precisely done using the Object Location Icon.

Access: Annot Mode : Line Creation Icon

Logo Import Icon

Clicking the Logo Import Icon opens the File Selection dialog for the specification of the file name containing the desired logo. Files must be in xpm format (and cannot use color names -colors must be hex numbers).

Figure 8-14
Annot Mode - Logo Import Icon

Access: Annot Mode : Logo Import Icon

Visibility Toggle

Toggles on/off the visibility of selected text strings, lines, logos, and legends.

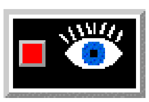


Figure 8-15
Annot Mode - Visibility Toggle Icon

This toggle affects only the individual text, line, or logo Annotation object(s) that is(are) currently selected in the Graphics Window. Toggling visibility off for an object will cause it to be “grayed-out” while in Annot Mode. These “grayed-out” objects will not be visible in the Graphics Window in any of the other five Modes.

Be aware that selecting a legend in the Graphics Window and then clicking the Annot Mode : Visibility Toggle will cause it to disappear (instead of become “grayed-out”) and that clicking the Toggle again will NOT cause it to reappear. To make a legend visible once again in the Graphics Window you must select the desired variable in the Main Variables List and then click the Show Legend button just below the List.

Access: Annot Mode : Visibility Toggle

Color Icon

Opens the Color Selector dialog for the specification of the color you wish to assign to the selected text strings, lines, logos, or legends (text and color bar border).

Figure 8-16
Annot Mode - Color Icon

Access: Annot Mode : Color Icon

(see Section 7.1, Color)

Location Attributes Icon

Opens the Annotation Item Location dialog for the specification (in X and Y coordinates) of the desired location for selected Annotation objects.

Figure 8-17
Annot Mode - Location Attributes Icon

This method of positioning an Annotation object in the Graphics Window is an alternative to interactively positioning it with the mouse cursor and can be more precise.

Access: Annot Mode : Location Attributes Icon

Text Justification Pulldown Icon

Opens a pull-down menu for the selection of the desired justification of the selected text string(s). This icon will only be visible in the Annot Mode Icon Bar if a Text String has been selected.

Figure 8-18
Annot Mode - Text Justification Icon and resulting pull-down menu

Access: Annot Mode : Text Justification Icon

Text Size Icon

Opens the Annotation Text Size/Rotation dialog for the specification of desired size of selected text string(s) in the Graphics Window. Values specified should range from 1 to 100. This icon will only be visible in the Annot Mode Icon Bar if a Text String has been selected.

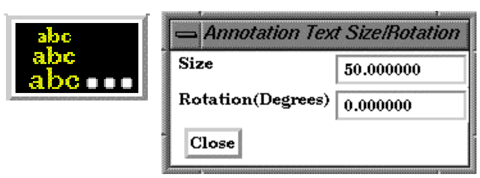


Figure 8-19
Annot Mode - Text Size Icon and Annotation Text Size/Rotation dialog

Access: Annot Mode : Text Size Icon

Text Rotation Icon

Opens the Annotation Text Size/Rotation dialog (above) for the specification of desired orientation of selected text string(s) in the Graphics Window. This icon will only be visible in the Annot Mode Icon Bar if a Text String has been selected. The rotation is specified in degrees and is applied in the counter clockwise direction about the justification point.

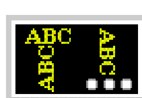


Figure 8-20
Annot Mode - Text Rotation Icon

Access: Annot Mode : Text Rotation Icon

Line Arrowhead Pulldown Icon

Opens a pulldown menu for the placement of arrows on selected line objects. This icon will only be visible in the Annot Mode Icon Bar if a line has been selected.

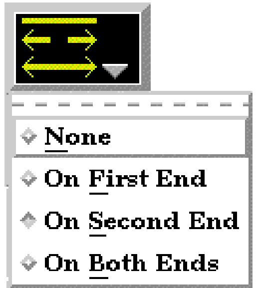


Figure 8-21
Annot Mode - Line Arrowhead Pulldown Icon

Access: Annot Mode : Line Arrowhead Pull-down Icon

Line Width Pulldown Icon

Opens a pulldown menu for the specification of the desired width of the selected line objects. This icon will only be visible in the Annot Mode Icon Bar if a line has been selected.

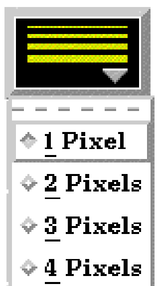


Figure 8-22
Annot Mode - Line Width Pulldown Icon

Access: Annot Mode : Line Width Pull-down Icon

Logo Size Icon

Opens the Annotation Logo Scaling dialog for the specification of the desired scaling of selected logos. This icon will only be visible in the Annot Mode Icon Bar if a logo has been selected. A scale factor of 1.0 keeps the logo in its original defined size, while values less than 1.0 make it smaller and greater than 1.0 make it larger.

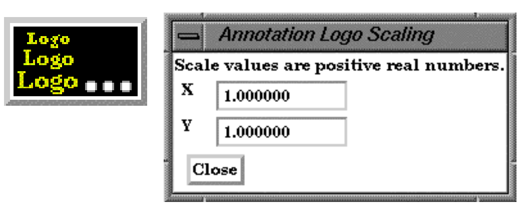


Figure 8-23
Annot Mode - Logo Size Icon and Annotation Logo Scaling dialog

Access: Annot Mode : Logo Size Icon

Legend Type Pulldown Icon

Opens a pull-down menu for the specification of the desired display type for selected legends. Continuous will display a color interpolated bar, Discrete will display only colors at specific levels. This icon will only be visible in the Annot Mode Icon Bar if a legend has been selected.

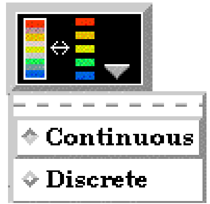


Figure 8-24
Annot Mode - Legend Type Pulldown Icon

Access: Annot Mode : Legend Type Pull-down Icon

Legend Title Position Pulldown Icon

Opens a pull-down menu for the specification of the desired visibility and placement of the title for selected legends. This icon will only be visible in the Annot Mode Icon Bar if a legend has been selected.

Figure 8-25
Annot Mode - Legend Title Position Pulldown Icon

Access: Annot Mode : Legend Title Pull-down Icon

Legend Label Position Pulldown Icon

Opens a pull-down menu for the specification of the desired visibility and placement of value labels for selected legends.This icon will only be visible in the Annot Mode Icon Bar if a legend has been selected.

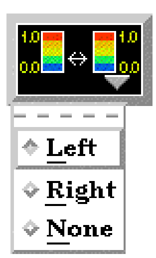


Figure 8-26
Annot Mode - Legend Label Position Pulldown Icon

Access: Annot Mode : Legend Label Pull-down Icon

Legend Text Size Icon Opens the Text Size Prompt dialog for the specification of the desired font size for the text of selected legends. Values specified should range from 1 to 100. This icon will only be visible in the Annot Mode Icon Bar if a legend has been selected.

Figure 8-27
Annot Mode - Legend Text Size Icon and dialog

Access: Annot Mode : Legend Text Size Icon

Legend Text Format Icon Opens the Text Size Prompt dialog for the specification of the desired font size for the text of selected legends. Values specified should range from 1 to 100. This icon will only be visible in the Annot Mode Icon Bar if a legend has been selected.

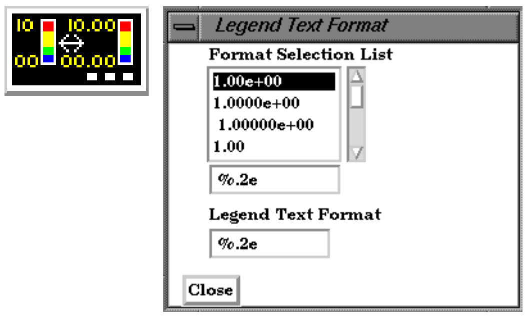


Figure 8-28
Annot Mode - Legend Label Format Icon and dialog

Any legal C language *printf* format string is permitted. The Selection List shows how the value of 1.0 will appear using the selected format.

Access: Annot Mode : Legend Label Format Icon

Legend Orientation Icon Toggles between a vertical legend and a horizontal legend.

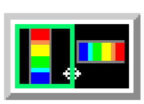


Figure 8-29
Annot Mode - Legend Orientation Icon

Select All...

Brings up the Annotation Selection Options Dialog which allows selection of the various annotation types.

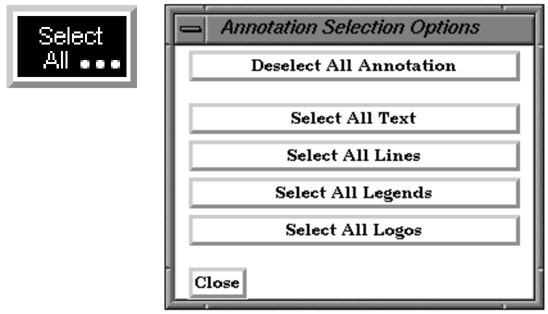


Figure 8-30
Annot Mode - Select All... Icon and Annotation Selection Options Dialog

Delete Icon

Deletes selected text, line or logo Annotation object(s).

Figure 8-31
Annot Mode - Delete Icon

You cannot delete legends using the Delete Icon. Once a legend for a specific variable has been made visible using the Show Legend button, it can be made non-visible using either the Annot : Visibility Toggle or the Annot: Global Legend Visibility Toggle Icon.

Access: Annot Mode : Delete Icon

Allow Editing Defaults

If on, all annotation icons are shown, so defaults can be edited without having to have an object selected. Otherwise, only those icons which are applicable to the current selection are displayed.

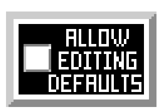


Figure 8-32
Annot Mode - Allow Editing Defaults

Legend...

Clicking the Legend... button (located on the Desktop) will allow the user to control which legends are visible.

8.3 VPort Mode

VPort Mode is used to create, adjust the attributes of, and delete viewports.

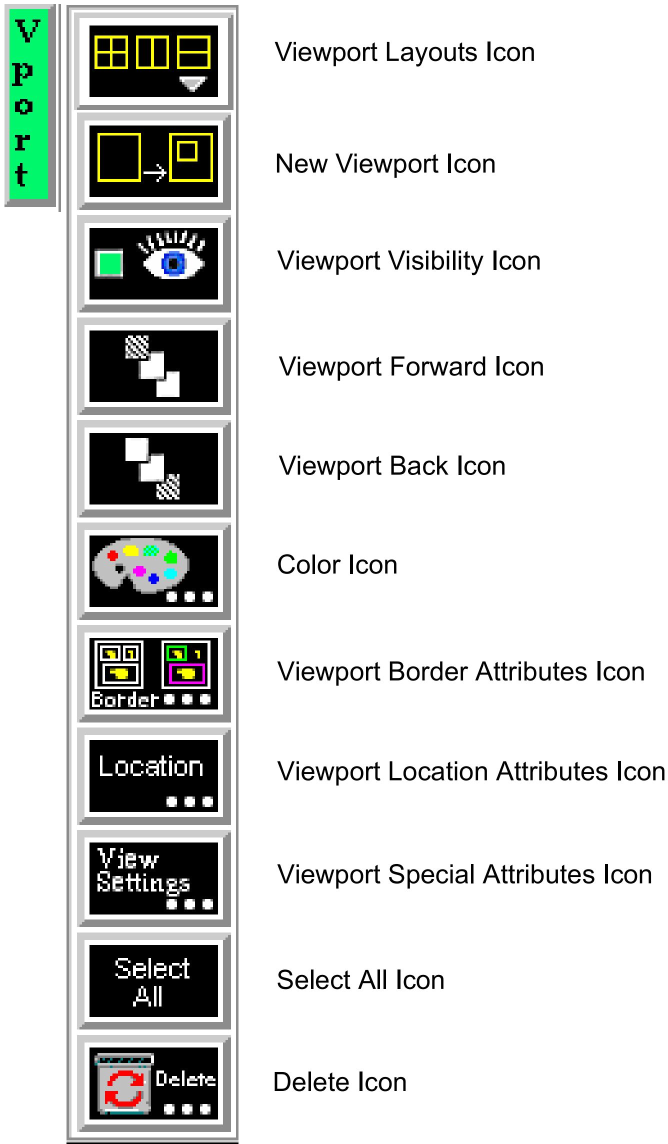


Figure 8-33
Mode Selection Area - VPort Selected

The default EnSight configuration shows one view of your model in the “main” Graphics Window. This “initial viewport”, which covers the Graphics Window. cannot be removed and is always used to clear (erase) the Graphics Window prior to a redraw. Using the VPort Mode, you can create up to fifteen additional viewports that will overlay the Graphics Window. These viewports can be interactively resized and relocated within the Graphics Window using the mouse and the visibility of each Part can be controlled on a per viewport basis. Transformations, and Z-clip location settings can also be made independently in each viewport.

When in VPort Mode, you are always modifying the viewports selected in the Graphics Window. Selected viewports are outlined in the “selection color”, while unselected objects are outlined in a white color. To select a viewport, click the mouse over it. To select multiple viewports, hold the Control key down while clicking on them.

Multiple viewports are helpful in showing the same object from multiple views, showing different axes in each viewport, showing the same parts with different attributes, etc.

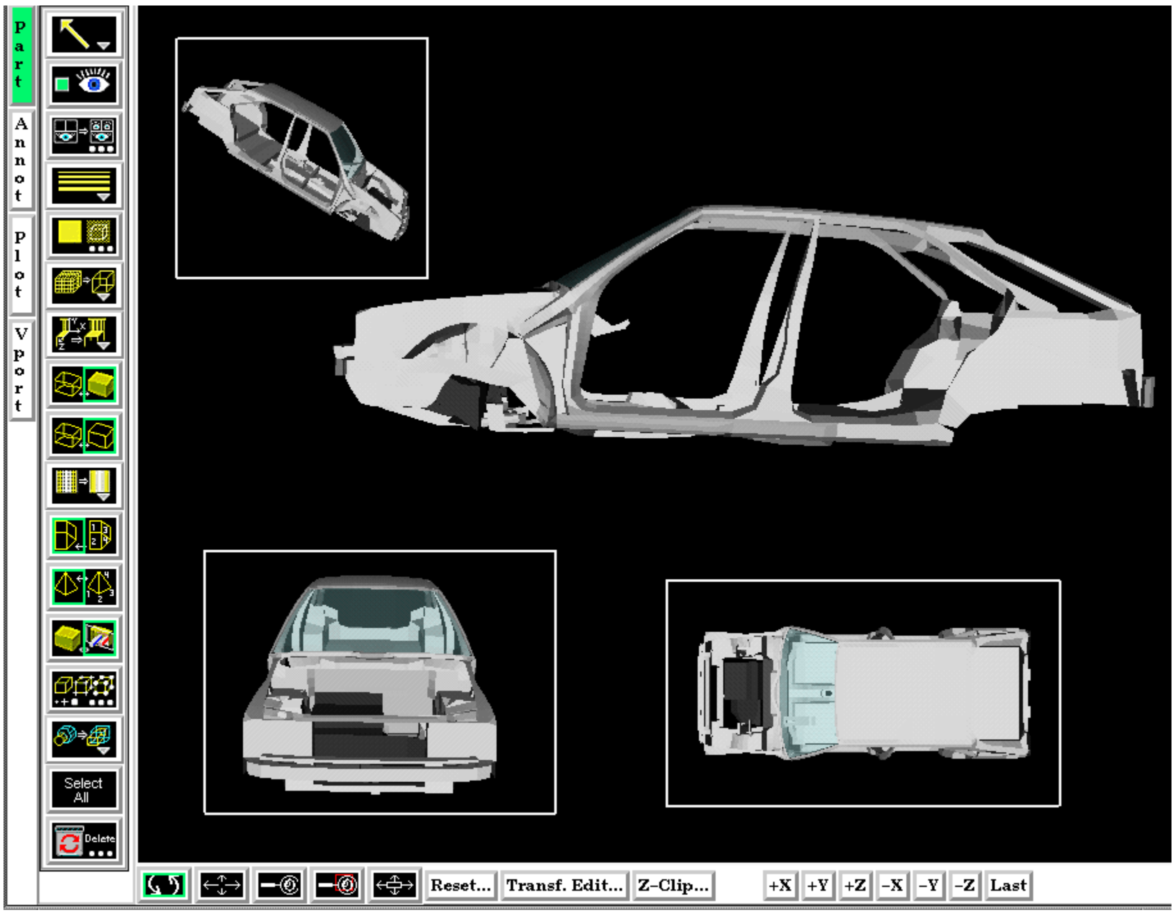
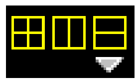


Figure 8-34
Viewport Example

Viewport Layouts Icon This icon opens a pull-down menu of icons which indicate standard viewport layouts.



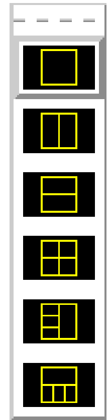


Figure 8-35
Viewport Mode - Viewport Layouts Icon and Menu

Access: Vport Mode : Viewport Layouts Icon

New Viewport Icon Clicking this button creates a new Viewport within (and on top of) the “main” Graphics Window. The location and size of the viewport can be modified interactively in the Graphics Window by a) clicking and dragging within the viewport to move it of b) clicking and dragging the edge or corner to resize it. More precise modifications may be performed using the Location ... Icon.

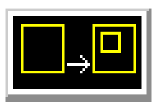


Figure 8-36
VPort Mode - New Viewport Icon

Access: VPort Mode : New Viewport Icon

Viewport Visibility Toggle Icon Determines the visibility of the selected viewport(s). The border of a viewport which, in the VPort Mode, has its visibility toggled off will still be visible in the VPort Mode only - and then as a dotted rather than a solid line.

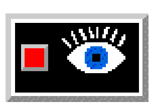


Figure 8-37
VPort Mode - Viewport Visibility Toggle Icon

Access: VPort Mode : Viewport Visibility Toggle Icon

Viewport Forward Icon Clicking this button moves the selected viewport(s) “forward” in the Graphics Window to occlude any viewports which it (they) may overlap. Viewport 0 cannot be “popped”.

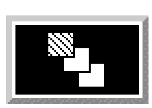


Figure 8-38
VPort Mode -Viewport Forward Icon

Access: VPort Mode : Viewport Forward Icon

Viewport Back Icon Clicking this button moves the selected viewport(s) "back" in the Graphics Window to be occluded by any viewports which may overlap it (them). Viewport 0 cannot be "pushed".

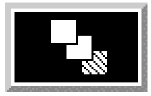


Figure 8-39
VPort Mode - Viewport Back Icon

Access: VPort Mode : Viewport Back Icon

Color Icon Opens the Viewport Background Color Attributes dialog for the specification of the color you wish to assign to the background of the selected viewport(s).

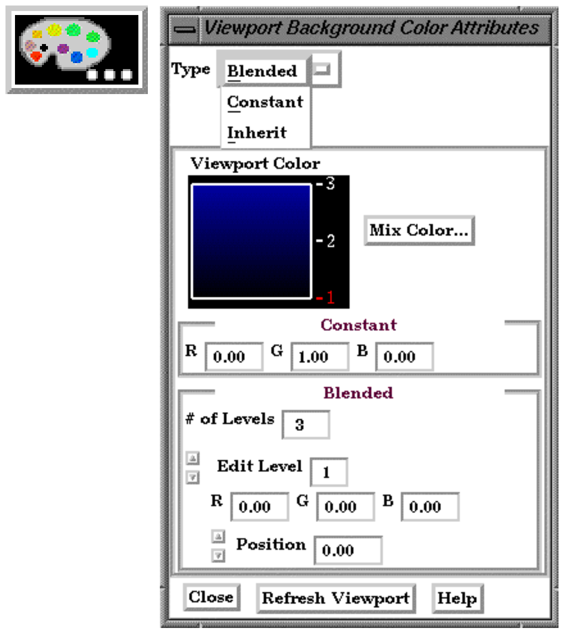


Figure 8-40
VPort Mode - Color Icon

Type Opens a pull-down menu for the specification of the type of background you wish to assign to a viewport.

Blended Allows you to specify a background comprised of 2 to 5 blended colors.

# of Levels This field specifies the number of levels (from 2 to 5) at which a color will be specified. The default is 2.

Edit Level This field specifies which of the levels you wish to edit. You may select the desired level using the stepper buttons, by entering a value in the field, or interactively by clicking on its number on the right side of the Viewport Color window.

Position This field specifies the vertical position of the edit level as a fraction (from 0 to 1) of the vertical height of the Viewport Color window, where 0.0 is at the bottom and 1.0 is at the top. You may adjust a level to the desired position using the stepper buttons, by entering a value in the field, or interactively by selecting and dragging a level's number on the right side of the Viewport Color window. The position of any level can not be below the position of the next lower level.

Constant — Allows you to specify a constant color using the RGB fields or the Color Selector dialog which is accessed by clicking the Mix Color... button.

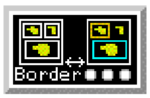
Inherit — Causes the viewport to display the same background color attributes as the main Graphics Window. Only applicable for created viewports, not the main Graphics Window.

Mix Color... — Opens the Color Selector dialog. (see Section 7.1, Color)

Refresh Viewport — Will redraw the selected viewport(s) with the defined viewport background settings.

Access: VPort Mode : Color Icon

Viewport Border Attributes Icon — Opens the Viewport Border Attributes dialog for the specification of a constant color for the border of the selected viewports. Be aware that the color assigned will only be visible in the other five Modes, not in VPort mode.



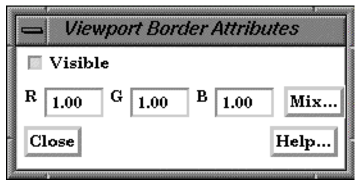


Figure 8-41
VPort Mode - Viewport Border Attributes Icon and Viewport Border Attributes dialog

Visible Toggle — Toggles on/off visibility of a viewport's border in the other five Modes. The border of each viewport will always be visible in VPort Mode.

RGB — These fields specify the RGB values for the color you wish to assign.

Mix... — Opens the Color Selector dialog. See Section 7.1 Color

Access: VPort Mode : Viewport Border Attributes Icon

Viewport Location Attributes Icon — Opens the Viewport Location Attributes dialog for the specification of the desired location in the main Graphics Window for the selected viewports. This dialog provides a more precise alternative to moving and resizing the viewports interactively.

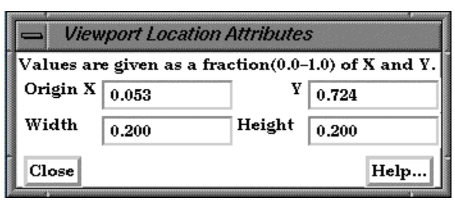


Figure 8-42
VPort Mode - Viewport Location Attributes Icon and Viewport Location Attributes dialog

Origin X Y — These fields specify the location for the X and Y coordinates of the selected viewport's origin (lower left corner) in the main Graphics Window. Values range from 0.0 to 1.0.

Width, Height — These fields specify the width and height of a selected viewport in X and Y coordinates from the viewport's origin. Values range from 0.0 to 1.0.

Access: VPort Mode : Viewport Location Attributes Icon

Viewport Special Attributes Icon

Opens the Viewport Special Attributes dialog for the specification of whether the global settings for Perspective versus Orthographic display, hidden surface display, and hidden line display will apply in the selected viewport(s). In addition, a viewport can be designated as 2D, in which case only planar 2D parts can be displayed in the viewport.

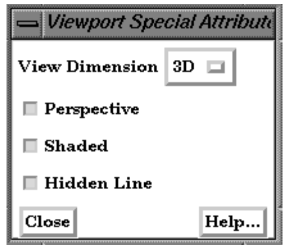


Figure 8-43
VPort Mode - Viewport Special Attributes Icon and Viewport Special Attributes dialog

Access: VPort Mode : Viewport Special Attributes Icon

Select All

Selects all of the currently defined viewports.

Figure 8-44
Vport Mode - Select All Icon

Delete Icon

Deletes individual, selected viewports. (You cannot delete viewport 0).

Figure 8-45
VPort Mode - Delete Icon

Access: VPort Mode : Delete Icon

8.4 Part Mode

Part Mode is used to adjust a number of attributes for individual Parts and to specify the desired type of Pick operation.

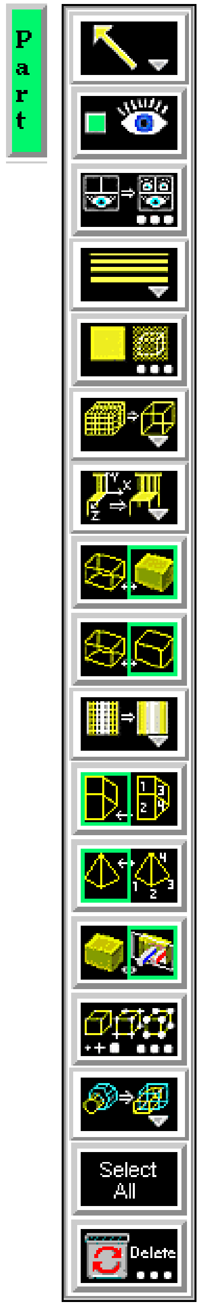


Figure 8-46
Mode Selection Area - Part Selected

For a complete discussion about Parts:

(see Chapter 3, Parts)

Pick Pull-down Icon

Opens a pull-down menu for the specification of the desired type of Pick operation. The actual Pick operation is normally assigned to the "P" key on the keyboard, unless it has been reassigned under Main Menu: Edit > Preferences... Mouse and Keyboard...

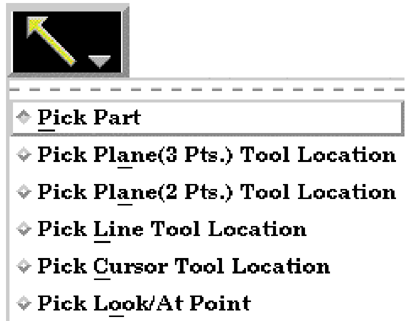


Figure 8-47
Part Mode - Pick Pulldown Icon

Pick Part

When the Pick operation is performed (by default, pressing the "P" key), the Part directly under the mouse cursor is selected. To select multiple Parts, hold down the Control Key during the Pick operation. It is usually helpful to open and use the Selected Parts Window while Picking Parts. This is done from Main Menu: View > Show Selected Part(s)...

Pick Plane (3 Pts) Tool Location

When the Pick operation is performed (by default, pressing the "P" key), the Plane Tool will be positioned at the Picked points. Three points must be Picked to position the Plane Tool.

Pick Plane (2 Pts) Tool Location

When the Pick operation is performed (by default, pressing the "P" key), the view in the graphics window will change to an orthographic view. At this point, you can click and drag the mouse to define a line. The Plane Tool will be positioned parallel to your current viewing angle through the defined line. Consider using this option together with the F5, F6, F7, and F8 keys which will transform the view to a standard orientation.

(see Section 9.1, Global Transform)

Pick Line Tool Location

When the Pick operation is performed (by default, pressing the "P" key), the ends of the Line Tool will be centered on a plane defined by the Picked points. Two points must be Picked to position the Line Tool.

Pick Cursor Tool Location

When the Pick operation is performed (by default, pressing the "P" key), the Cursor Tool will be positioned at the Picked point.

Pick Look At Point

When the Pick operation is performed (by default, pressing the "P" key), the Look At Point is positioned at the Picked point. The Look From Point is also adjusted to preserve the distance (between the two Points) and vector that existed prior to the Pick operation.

(see Section 9.6, Look At/Look From)

Access: Part Mode : Pick Pull-down Icon

Part Visibility Toggle Icon

Determines the global (in all viewports and in all Modes) visibility of the selected Part(s).

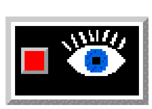
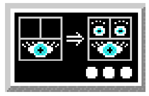


Figure 8-48
Part Mode - Part Visibility Toggle Icon

Access: Part Mode : Part Visibility Toggle Icon

Part Visibility in Viewport Icon

Opens the “Part Visible in Which Viewport?” dialog. If the global visibility of a Part is on, this dialog can be used to selectively turn on/off visibility of the selected Part(s) in different viewports simply by clicking on a viewport’s border symbol within the dialog’s small window. The selected Part(s) will be visible in the viewports outlined in green and invisible in those outlined in red.



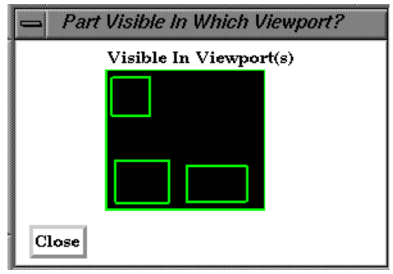


Figure 8-49
Part Mode - Part Visibility in Viewport Icon

Access: Part Mode : Part Visibility in Viewport Icon

Part Line Width Pulldown Icon

Opens a pulldown menu for the specification of the desired display width for Part lines. Performs the same function as the Line Representation Width field in the Node, Element, and Line Attributes section of the Feature Detail Editor (Model).

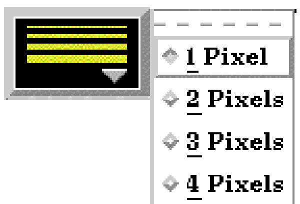
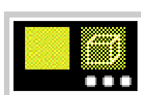


Figure 8-50
Part Mode - Part Line Width Pulldown Icon

Access: Part Mode : Part Line Width Pull-down Icon

Transparency Attributes Icon

Opens the Part Transparency Modification dialog.



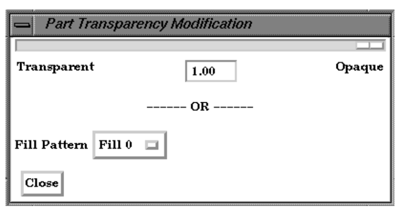


Figure 8-51
Part Mode - Transparency Attributes Icon and Part Transparency Modification dialog

The degree of Opaqueness for the selected Parts when Hidden Surface is on for the Part(s) may be adjusted by typing in a value from 0.0 to 1.0 in the field or by using the slider bar. A value of 0.0 will render the selected Part(s) completely transparent whereas the default value of 1.0 renders them completely opaque. This field performs the same function as the Opaqueness field in the General Attributes section of the Feature Detail Editor (Model).

Fill Pattern

Opens a pull-down menu to specify that a fill pattern be used to provide pseudo-transparency for Hidden Surface shaded Part surfaces. The Default is Fill 0 which uses no pattern (produces a solid surface), while Fill patterns 1 through 3 produce an EnSight defined fill pattern. Performs the same function as the Fill Pattern pulldown menu in the General Attributes section of the Feature Detail Editor (Model). Fill Pattern and Transparency should not be used together.

Access: Part Mode : Transparency Attributes Icon

Element Visual Representation Pulldown Icon

Opens a pulldown menu for the specification of the desired representation for elements of the selected Part(s). Performs the same function as the Element Representation Visual Rep. pulldown menu in the Node, Element, and Line Attributes section of the Feature Detail Editor (Model).

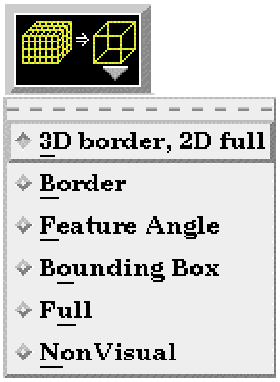


Figure 8-52
Part Mode - Element Representation Pulldown Icon

(see Element Representation in Section 3.3, Part Editing)

Access: Part Mode : Element Representation Pull-down Icon

Symmetry Pulldown Icon

Opens a pulldown menu which allows you to toggle-on/off the display of a mirror image of the selected Part(s) in each of the seven other quadrants of the Part's local frame. This performs the same function as the Symmetry menu in the General Attributes section of the Feature Detail Editor (Model).

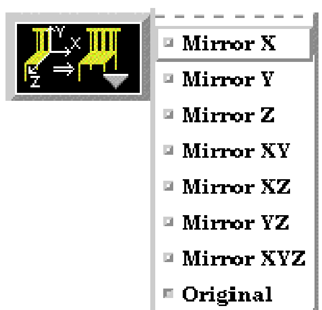


Figure 8-53
Part Mode - Symmetry Pulldown Icon

You can mirror the Part to more than one quadrant. If the Part occupies more than one quadrant, each portion of the Part mirrors independently. Symmetry enables you to reduce the size of your analysis problem while still visualizing the "whole thing." Symmetry affects only the displayed image, not the data, so you cannot query the image or use the image as a parent Part. However, you can create the same effect by creating dependent Parts with the same symmetry attributes as the parent Part. Symmetry works as if the local frame is Rectangular, even if it is cylindrical or spherical. The images are displayed with the same attributes as the Part. For each toggle, the Part is displayed as follows. The default for all toggle buttons is OFF, except for the original representation - which is ON.

Mirror X	quadrant on the other side of the YZ plane.
Mirror Y	quadrant on the other side of the XZ plane.
Mirror Z	quadrant on the other side of the XY plane.
Mirror XY	diagonally opposite quadrant on the same side of the XY plane.
Mirror XZ	diagonally opposite quadrant on the same side of the XZ plane.
Mirror YZ	diagonally opposite quadrant on the same side of the YZ plane.
Mirror XYZ	quadrant diagonally opposite through the origin.
Original	

Access: Part Mode : Symmetry Pull-down Icon

Part Shaded Toggle Icon

Toggles on/off Shaded display of surfaces for the selected Part(s) assuming that Global Shaded has been toggled ON in the Main Menu > View > Shaded. Performs the same function as the Shaded Toggle in the General Attributes section of the Feature Detail Editor (Model). Default for all Parts is ON.

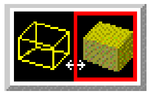


Figure 8-54
Part Mode - Part Shaded Toggle Icon

Access: Part Mode : Part Shaded Toggle Icon

Part Hidden Line Toggle Icon

Toggles on/off hidden line display of surfaces for the selected Part(s) assuming that the Global Hidden Line has been toggled ON in the Main Menu > View > Hidden Line. Performs the same function as the Hidden Line Toggle in the General Attributes section of the Feature Detail Editor (Model). Default for all Parts is ON.

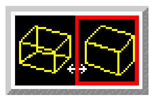


Figure 8-55
Part Mode - Part Hidden Line Toggle Icon

Access: Part Mode : Part Hidden Line Toggle Icon

Shading Type Pull-down Icon

Opens a pull-down menu for the selection of appearance of the surface of the selected Part(s) when Hidden Surface is ON.

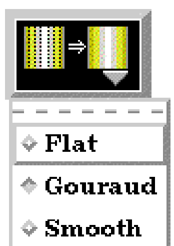


Figure 8-56
Part Mode - Shading Type Pulldown Icon

Normally the mode is set to Gouraud, meaning that the color and shading will interpolate across the polygon in a linear scheme. You can also set the shading type to Flat, meaning that each polygon will get one color and shade, or Smooth which means that the surface normals will be averaged to the neighboring elements producing a “smooth” surface appearance. Not valid for all Part types. Options are:

Flat Color and shading same for entire element
Gouraud Color and shading varies linearly across element
Smooth Normals averaged with neighboring elements to simulate smooth surfaces

Access: Part Mode : Shading Pull-down Icon

Element Label Toggle Icon

Toggles on/off the visibility of the element labels (assuming the result file contains them) for the selected Part(s). The Global Element Label Toggle (View Mode) must be on in order to see any element labels. Performs the same function as the Label Visibility Element toggle in the Node, Element, and Line Attributes section of the Feature Detail Editor (Model). Default is OFF.

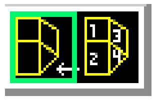


Figure 8-57
Part Mode - Element Label Toggle Icon

Access: Part Mode : Element Label Toggle Icon

Node Label Toggle Icon

Toggles on/off the visibility of the node labels (assuming the result file contains them) for the selected Part(s). The Global Node Label Toggle (View Mode) must be on in order to see any element labels. Performs the same function as the Label Visibility Node toggle in the Node, Element, and Line Attributes section of the Feature Detail Editor (Model). Default is OFF.

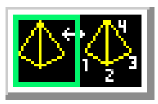


Figure 8-58
Part Mode - Node Label Toggle Icon

Access: Part Mode : Node Label Toggle Icon

Part Auxiliary Clipping Toggle Icon

Toggles on/off whether the selected Part(s) will be affected by the Auxiliary Clipping Plane feature. Performs the same function as the Aux Clip toggle in the General Attributes section of the Feature Detail Editor (Model). Default is ON.
Note: The Global Auxiliary Clipping Toggle (in the View Mode Icon Bar) must be on in order for any Parts to be affected by the Aux Clip Plane.

Figure 8-59
Part Mode - Part Auxiliary Clipping Toggle Icon

Access: Part Mode : Part Auxiliary Clipping Toggle Icon

Node Representation Icon

Opens the Part Node Representation dialog. Performs the same function as the Node Representation area in the Node, Element, and Line Attributes section of the Feature Detail Editor (Model).

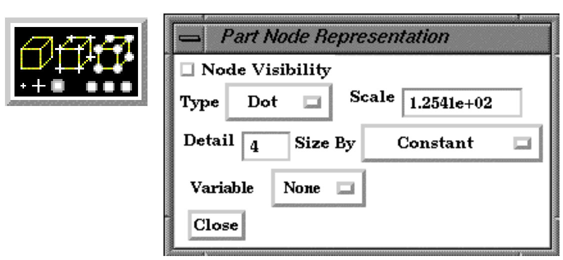


Figure 8-60
Part Mode - Node Representation Icon and Part Node Representation dialog

Node Visibility Toggle Toggles-on/off display of Part's nodes whenever the Part is visible. Default is OFF.

Type Opens a pop-up menu for the selection of symbol to use when displaying the Part's nodes.

Default is Dot. Options are:
Dot to display nodes as one-pixel dots.
Cross to display nodes as three-dimensional crosses whose size you specify.
Sphere to display the nodes as spheres whose size and detail you specify.

Scale

This field is used to specify scaling factor for size of node symbol. If Size By is Constant, this field will specify the size of the marker in model coordinates. If Size By is set to a variable, this field will be multiplied by the variable value. Not applicable when node-symbol Type is Dot.

Detail

This field is used to specify how round to draw the spheres when the node-symbol type is Sphere. Ranges from 2 to 10, with 10 being the most detailed (e.g., roundest spheres). Higher values take longer to draw, slowing performance. Default is 2.

Size By

Opens a pop-up menu for the selection of variable-type to use to size each node-symbol. For options other than Constant, the node-symbol size will vary depending on the value of the selected variable at the node. Not applicable when node-symbol Type is Dot. Default is Constant. Options are:
Constant sizes node using the Scale factor value.
Scalar sizes node using a scalar variable.
Vector Mag sizes node using magnitude of a vector variable.
Vector X-Comp sizes node using magnitude of X-component of a vector variable.
Vector Y-Comp sizes node using magnitude of Y-component of a vector variable.
Vector Z-Comp sizes node using magnitude of Z-component of a vector variable.

Variable

Selection of variable to use to size the nodes. Activated variables of the appropriate Size By type are listed. Not applicable when node-symbol Type is Dot or Size By is Constant.

Access: Part Mode : Node Representation Icon

Fast Display Toggle Icon

Opens a pull-down menu for the specification of the desired fast display representation in which a Part is displayed. The Part fast display representation corresponds to whether the view Fast Display Mode (located in the View Menu or as a View Mode icon) is on. The Fast Display pull-down icon performs the same function as the Fast Display pop-up menu button in the General Attributes section of the Feature Detail Editor (of all parts).

Figure 8-61
Part Mode - Detail Representation Pulldown Icon

Box causes selected Part(s) to be represented by a bounding box of the Cartesian extent of all Part elements (default).
Elements causes selected Part(s) to be represented according to specified Element Representation.
Points causes selected Part(s) to be represented by a point cloud

(see General Attributes in Section 3.3, Part Editing, How To Set Global Viewing))

Access: Part Mode : Detail Representation Pull-down Icon

Select All Selects all parts.

Figure 8-62
Part Mode - Select All Icon

Delete Deletes the selected parts.

Figure 8-63
Part Mode - Delete Icon

8.5 Plot Mode

Plot Mode is used to adjust the attributes of 2D plotters and curves that you have created. Most often, you will create plotters using the Query/Plot Editor in the Quick Interaction Area, but you can create a new "empty" plotter using the Create New Plotter Icon and then assign a title and data to its axes using the Query/Plot Editor in the Quick Interaction Area.

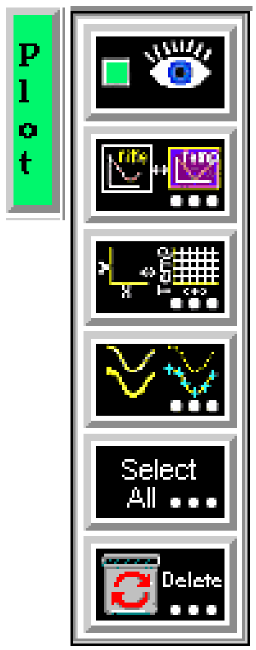


Figure 8-64
Mode Selection Area - Plot Selected

The plotting capability is limited to simple x versus y data. Most often this data is in the form variable value versus Time or Distance.

Plotter Visibility Toggle Icon — Determines the visibility of the selected plotters. The plotters for which visibility has been toggled off will appear grayed-out in Plot Mode.

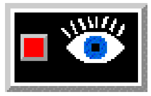


Figure 8-65
Plot Mode - Plotter Visibility Toggle Icon

Access: Plot Mode : Plotter Visibility Toggle Icon

Plotter Attributes Icon — Opens the Plotter Specific Attributes dialog for the specification of attributes for Title, background, legend, border and position of the selected plotters.

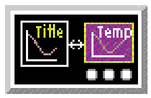
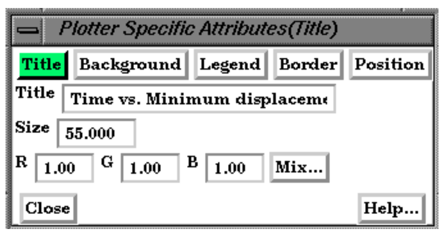


Figure 8-66
Plot Mode - Plotter Attributes Icon and Plotter Specific Attributes dialog

Title



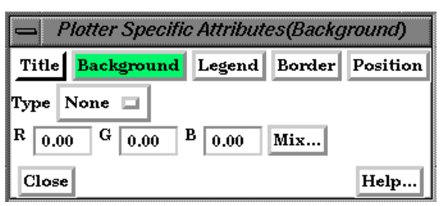
Clicking the Title button causes the dialog to configure itself for Plotter Title editing.

Title — This field allows you to edit the existing plotter title.

Size — This field allows you to specify the title text size.

RGB Mix... — Color for the Title text may be specified using either the RBG fields or the Color Selector dialog which is opened by clicking the Mix... button.

Background

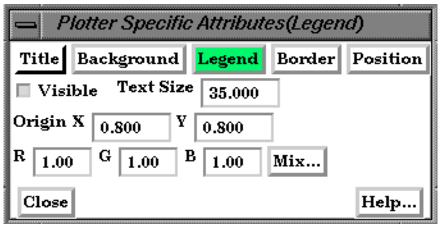


Clicking the Background Button causes the dialog to configure itself for Plotter Background editing.

Type — Opens a pop-up menu for the specification of plotter background color. Choices are:
None no background (the color of the Graphics Window or the viewport underneath will show through the Plotter)
Solid allows a solid color to be specified for the Plotter Background

RGB Mix... — Color for the Plotter background may be specified using either the RBG fields or the Color Selector dialog which is opened by clicking the Mix... button.

Legend



Clicking the Legend Button causes the dialog to configure itself for Plotter Legend editing. The legend shows a line of the appropriate color, width, and marker next to the name of the curve plotted using this line style.

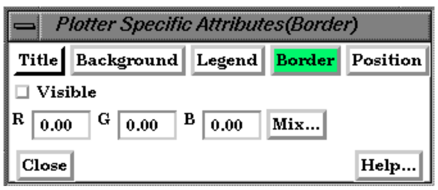
Visible Toggle — Toggles on/off the visibility of the legend for the selected Plotters.

Text Size — This field specifies the desired size of the Legend text.

Origin X Y — These fields specify the location of the Legend within a Plotter's border. Values range from 0.0 to 1.0 and resulting distances are measured from the Border origin (lower left corner). These fields provide an alternative to interactively positioning the plotter Legend.

RGB Mix... — Color for the Legend text may be specified using either the RBG fields or the Color Selector dialog which is opened by clicking the Mix... button.

Border



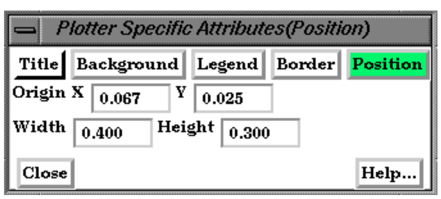
Clicking the Border Button causes the dialog to configure itself for Plotter Border editing.

Visible Toggle — Toggles on/off the visibility in the other five Modes of the Border for the selected Plotters.

RGB Mix... — Color for the plotter border may be specified using either the RBG fields or the Color Selector dialog which is opened by clicking the Mix... button. Note that the border color is not shown while the plotter is selected - while selected the border is shown in green.

(see Section 7.1, Color)

Position



Clicking the Position Button causes the dialog to configure itself for Plotter Position editing.

Origin X Y — These fields specify the location of the selected Plotter within the Graphics Window. Values range from 0.0 to 1.0 and resulting distances are measured from the Graphics Window origin (lower left corner). These fields provide an alternative to interactively positioning the plotter which is done simply by clicking within the Plotter and dragging it to the desired position.

Width, Height — These fields specify the width and height of the Plotter. Resulting distances are measured from the Border origin (lower left corner). These fields provide an alternative to interactively resizing the plotter which is done simply by clicking on a side or corner and dragging.

Access: Plot Mode : Plotter Attributes Icon

Axis Attributes Icon — Opens the Axis Specific Attributes dialog for the specification of attributes for axes of the selected Plotters.

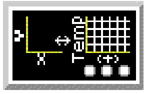
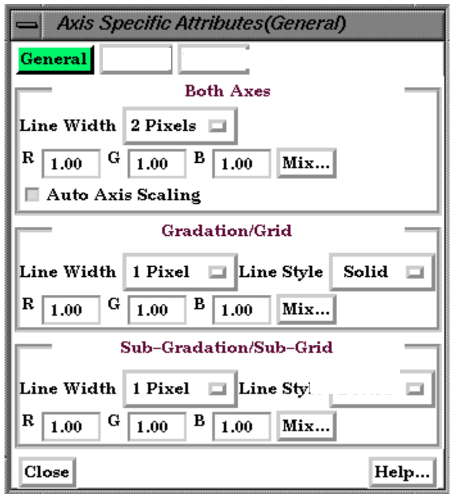


Figure 8-67
Plot Mode - Axis Attributes Icon and Axis Specific Attributes dialog

General



Clicking the General button causes the dialog to configure itself for General Plotter Axis editing.

Both Axes

Line Width — Opens a pop-up menu for the specification of the desired line width (1 to 4 Pixels) for Plotter axes.

RGB Mix... — Color for the axes may be specified using either the RBG fields or the Color Selector dialog which is opened by clicking the Mix... button

Auto Axis Scaling Toggle — When toggled on, the axis range and number of divisions will be scaled to make nice “round” numbers.

Gradation/Grid

Line Width — Opens a pop-up menu for the specification of the desired width (1-4 Pixels) for Gradation Lines or Ticks.

Line Style — Opens a pop-up menu for the specification of the style of line (Solid, Dotted, or Dashed) desired for gradations. (The lines are normally not visible and so this specification is only valid if Grad Type has been selected to Grid in the X-Axis and/or Y-Axis configuration of the Axis Specific Attributes dialog.)

RGB Mix... — Color for the Gradation Lines or Ticks may be specified using either the RBG fields or the Color Selector dialog which is opened by clicking the Mix... button.

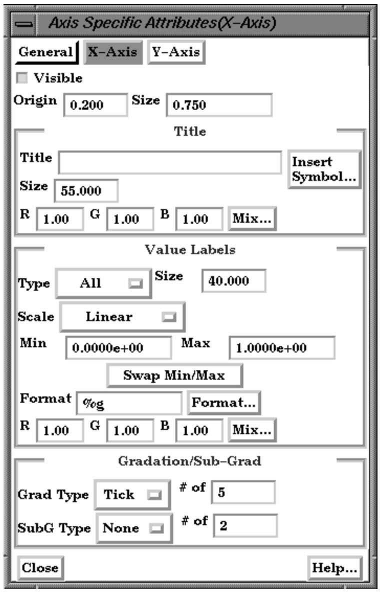
Sub-Gradation/Sub-Grid

Line Width — Opens a pop-up menu for the specification of the desired line width (1-4 Pixels) for Sub-Gradation Lines or Ticks (those between the Gradation Lines or Ticks).

Line Style — Opens a pop-up menu for the specification of the style of line (Solid, Dotted, or Dashed) desired for sub-gradations. (The lines are normally not visible and so this specification is only valid if SubG Type has been selected to Grid in the X-Axis and/or Y-Axis configuration of the Axis Specific Attributes dialog.)

RGB Mix... — Color for the Sub-Gradation Lines or Ticks may be specified using either the RBG fields or the Color Selector dialog which is opened by clicking the Mix... button.

X-Axis or Y-Axis



Clicking the X-Axis or Y-Axis button causes the dialog to configure itself for editing of Attributes specific to either the X or the Y Axis. If X-Axis ha s been clicked - all actions within the dialog will affect the X-Axis attributes only. Likewise for Y-Axis.

Visible Toggle — Toggles on/off the visibility of the X (or Y) Axis line.

Origin — This field specifies the location of the X (or Y) Axis origin. Values range from 0.0 to 1.0 and resulting distances are measured from the left side (or bottom) of the Plotter.

Size — This field specifies the length of the X (or Y) Axis line. Values range from 0.0 to 1.0 and resulting distances are measured from the X (or Y) Axis Origin.

Title

Title — This field allows you to edit the existing X (or Y) Axis title.

Size — This field allows you to specify the title text size.

RGB Mix... — Color for the Title text may be specified using either the RBG fields or the Color Selector dialog which is opened by clicking the Mix... button.

Value Labels

Type — Opens a pop-up menu for selection of desired number (None, All, or Beg/End) of X (or Y) Axis labels.

Size — This field allows you to specify the size of X (or Y) Axis labels.

Scale — This field allows you to specify a linear or log10 scale for the Axis.

Min — This field contains the minimum value of the X (or Y) Axis. If Auto Axis Scaling is on, it is only an approximation to the value which will be used.

Max — This field contains the maximum value of the X (or Y) Axis. If Auto Axis Scaling is on, it is only an approximation to the value which will be used.

Format — This field specifies the format used to display the X (or Y) Axis. Any C language *printf* format is valid in this field.

Format... — This button will open the Format dialog which allows you to select a pre-defined format.

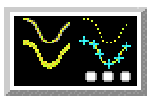
Gradation/Sub-Grad

Grad Type
of
Opens a pop-up menu for selection of desired marker (None, Grid, or Tick) for major gradations. # of field specifies the number of major gradations you wish along the X (or Y) Axis. If Auto Axis Scaling is on, it is only an approximation to the value which will be used.

SubG Type
of
Opens a pop-up menu for selection of desired marker (None, Grid, or Tick) for sub gradations (between the major gradations. # of field specifies the number of sub gradations you wish between each major gradation along the X (or Y) Axis.

Access: Plot Mode : Axis Attributes Icon

Curve Attributes Icon Opens the Curve Specific Attributes dialog for the specification of attributes for an individual curve which has been selected in a Plotter. A curve is selected by clicking the mouse cursor on top of the curve. The selected curve will be drawn by a wider line than is normally used to display the curve.



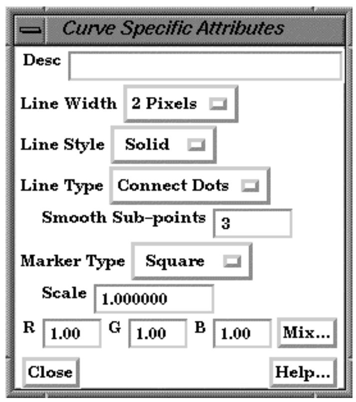


Figure 8-68
Plot Mode - Curve Attributes Icon and Curve Specific Attributes dialog

Desc. This field initially contains the Legend description of the selected Curve which was assigned to it when the Curve was created.

Line Width Opens a pop-up menu for the specification of the desired line width (1-4 Pixels) for the selected Curve.

Line Style Opens a pop-up menu for the specification of the style of line (Solid, Dotted, or Dashed) desired for the selected Curve.

Line Type Opens a pop-up menu for the specification of the type of line desired for the selected Curve. Options are:
None No lines will be drawn between points
Connect Dot Lines will be drawn between the points
Smooth A piecewise spline will connect the points

Smooth Sub-points This field specifies the number of sub-points to use between data points in drawing the curve when Smooth Line Type is selected.

Marker Type Opens a pop-up menu for the specification of the desired type of data point marker (None, Dot, Circle, Triangle, Square) on the curve.

Scale This field specifies the size of the data point markers for the selected curve.

RGB Mix... Color for the selected Curve may be specified using either the RBG fields or the Color Selector dialog which is opened by clicking the Mix... button

Access: Plot Mode : Curve Attributes Icon

Select All... Brings up the Plot Selection Option Dialog which allows selection of all curves or all plotters.

Figure 8-69
Plot Mode - Select All... Icon and Plot Selection Options Dialog

Delete Icon Deletes the selected Plotters.

Figure 8-70
Plot Mode - Delete Icon

Access: Plot Mode : Delete Icon

8.6 Frame Mode

As EnSight reads in model Parts, they are all initially assigned to the same “Frame” of reference: Frame 0. Frame 0 corresponds to the model coordinate system (defined when the model was created). Using the Frame Mode, you can create additional frames, reassign Parts to different Frames, and specify various attributes of the Frames.

Transformations you make in View or Parts Mode (rotations, translations, etc.) are performed globally; all Frames, Parts, and Tools are transformed with respect to the Global Axis origin and orientation. Frame Mode, on the other hand, allows you to perform transformations only on selected Parts. This is useful if you wish, for example, to create an animation with Parts moving in different directions (such as a door or hood opening to reveal Parts within) or to move Part copies away from each other in order to color the Parts by different variables (in fact, if you make a copy of a Part, a new Frame is automatically created and the Part copy is assigned to it).

In Frame Mode, transformations are always about the selected Frame’s definition, that is, its origin position (with respect to Frame 0) and the orientation of its axes (with respect to Frame 0). Since this is the case, the Frame’s orientation must be adjusted (if necessary) before any transformations are applied. If transformations are applied first, and the Frame’s definition adjusted at a later time, the transformations will likely cause unexpected results (since the transformations originally performed were about a different axis definition than that about which transformations performed after the Frames definition changed occur).

A Part can be assigned to only one Frame at a time. The Part will always be transformed by the Frame’s transformation. A Part is not affected by a Frame’s definition (other than transformations will be in reference to the definition). A Part’s mirror symmetry operation (which can be thought of as a scaling transformation) is always about the Frame to which the Part is assigned.

The Tools (Cursor, Line, Plane, etc.) are always shown in reference to the selected Frame and are thus also transformed by the selected Frame’s transformations.

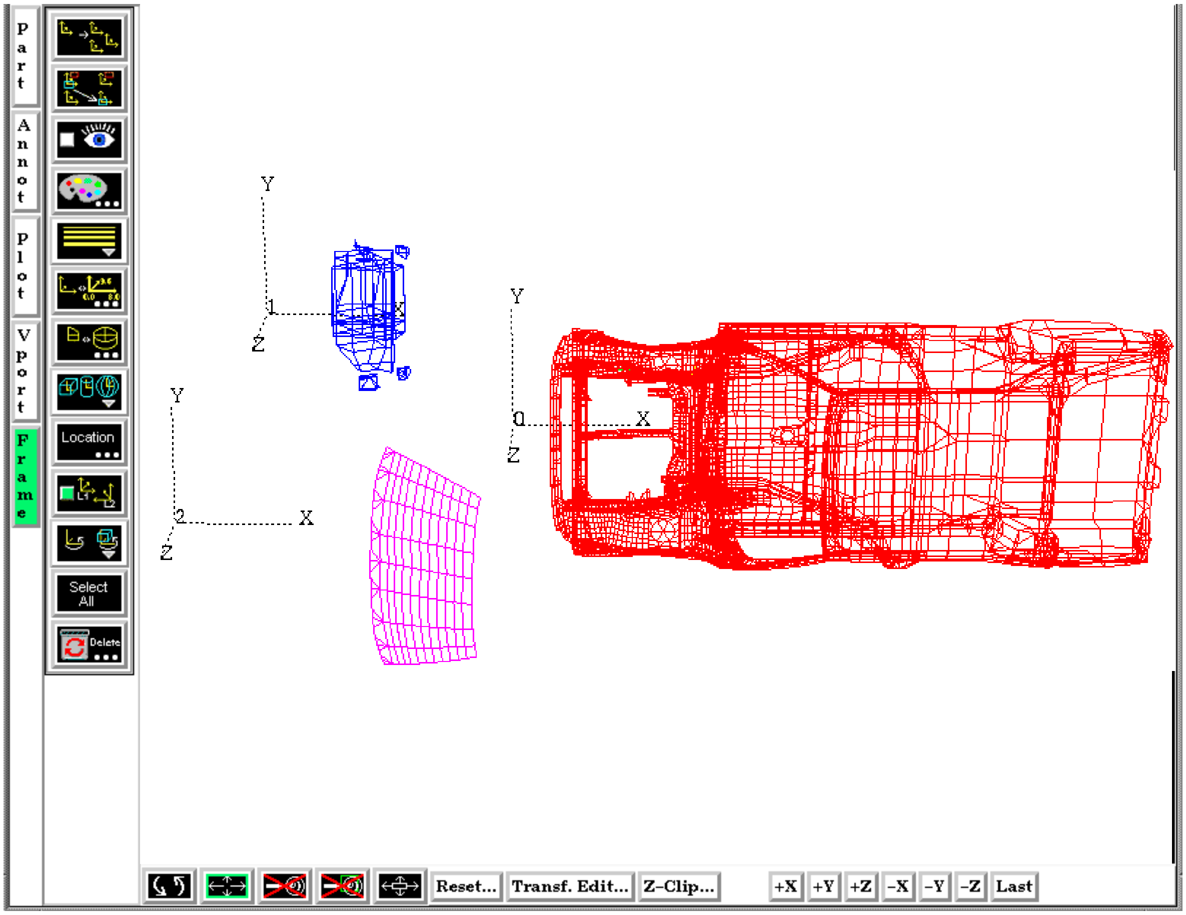
There are two transformation alternatives in Frame Mode: Frame Transform (the default) and Frame Definition. As pointed out earlier, a frame should first be defined (if necessary) before it is transformed.

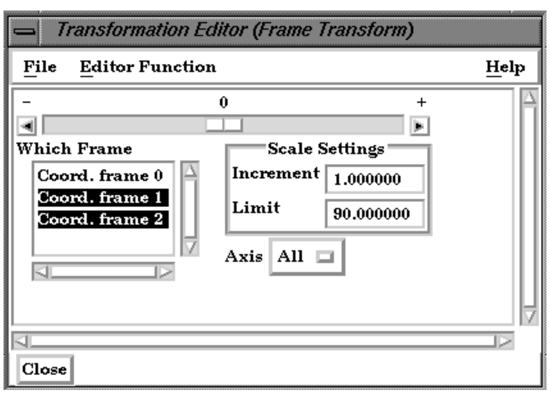
In Frame Mode the axis triads for all Frames will be visible in the Graphics Window. Invisible Frames will be shown with a dotted frame axis. Selected Frames are shown in green. A Frame may be selected by clicking on its axis triad or by selecting its description from the Frame List in the Transformation Editor dialog (which is opened by clicking the Transf Edit... button in the Transformation Control Area).

By default, Frame mode is not available unless it has been enabled under Edit > Preferences... General User Interface - Frame Mode Allowed.

For further discussion concerning the transformation of Frames:

(see Section 9.2, Frame Transform and Section 9.3, Frame Definition)





Three Frames exist in this example.

Figure 8-71
Frame Mode - Frame Example

When Frame Mode is selected, the Mode Icon Bar appears as follows.:

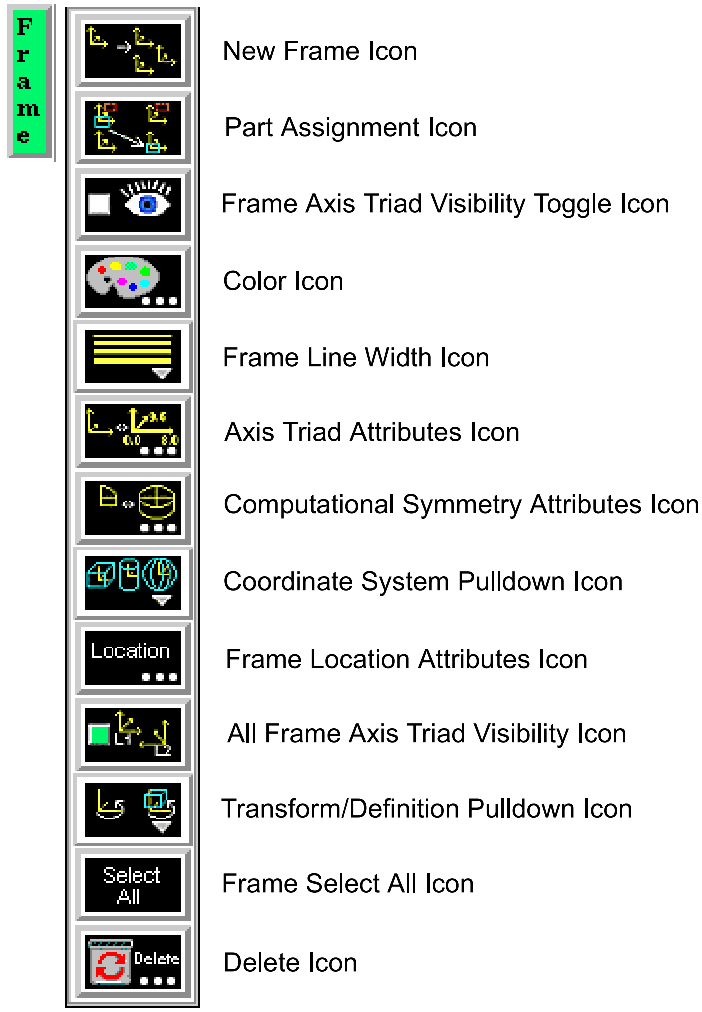


Figure 8-72
Mode Selection Area - Frame Selected

New Frame Icon

Creates a new Frame to which you can assign Parts. Be aware that each time you make a copy of a Part EnSight creates a new Frame and assigns the copy to the new Frame. If Parts are selected in the Main Parts List, the new Frame's origin will be positioned at the center of the selected Parts.

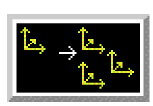


Figure 8-73
Frame Mode - Create New Frame Icon

Access: Frame Mode : Create New Frame Icon

Part Assignment Icon

Clicking this icon reassigns Part(s) selected in the Main Parts List to the currently selected Frame. (An alternative method for reassigning Parts is to edit the Ref. Frame field in the General Attributes section of the Feature Detail Editor.)

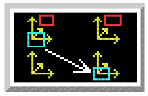


Figure 8-74
Frame Mode - Part Assignment Icon

Access: Frame Mode : Part Assignment Icon

Frame Axis Triad Visibility Toggle Icon

Determines the visibility of the axis triad(s) of selected Frame(s). Invisible Frames are drawn in dotted lines while in Frame Mode. Default is Off.

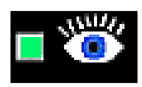


Figure 8-75
Frame Mode - Frame Axis Triad Visibility Toggle Icon

Access: Frame Mode : Frame Axis Triad Visibility Toggle Icon

Color Icon

Opens the Color Selector dialog for the specification of the color you wish to assign to a selected Frame's axis triad A selected Frame will always be shown in the selection color while in Frame Mode.

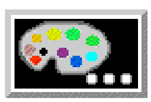


Figure 8-76
Frame Mode - Color Icon

Access: Frame Mode : Color Icon

Frame Line Width Pulldown Icon

Opens a pulldown menu for the specification of the width for Frame axis triad lines for the selected Frame(s).

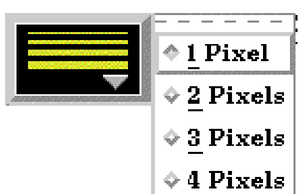


Figure 8-77
Frame Mode - Frame Line Width Pulldown Icon

Access: Frame Mode : Frame Line Width Icon

Axis Triad Attributes Icon

Opens the Frame Axis Attributes dialog for the specification of axis triad line length and labels for the selected Frame(s).

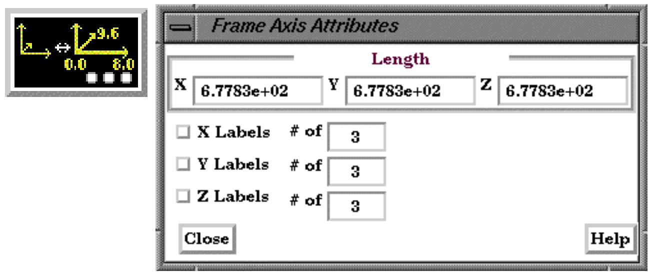


Figure 8-78
Frame Mode - Axis Triad Attributes Icon

X Y Z

These fields allow you to specify the desired length, in model coordinates, of each of the three axes of the selected Frame's axis triad.

X Y Z Labels Toggles

Toggles on/off the display of Labels on the respective line of a selected Frame's axis triad. Labels show distance along each axis.

X Y Z # of

These fields specify the number of Labels which will appear on the respective axis.

Access: Frame Mode : Axis Triad Attributes Icon

Computational Symmetry Attributes Icon

Opens the Frame Computational Symmetry Attributes dialog for the specification of the type of periodic conditions which will be applied to all assigned Parts of the selected Frame.

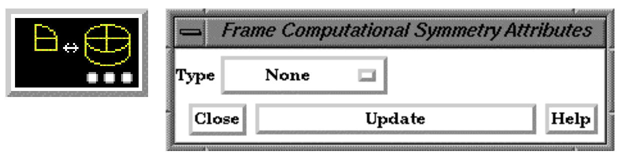


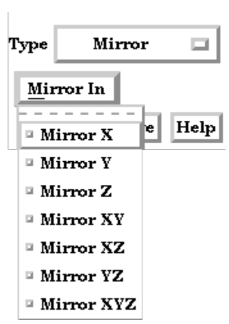
Figure 8-79
Frame Mode - Computational Symmetry Attributes Icon

(see How To Set Symmetry)

Type

Opens a pop-up menu for the selection of whether you wish the selected Frame to have no periodicity (None as shown above) or to be mirror, rotational, or translational periodic.

Mirror

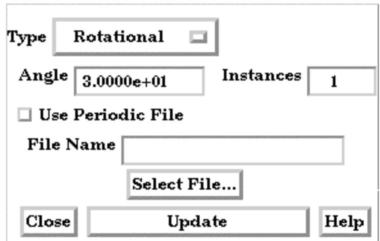


Mirror In

Specification of the type of mirror periodicity.

Mirror X	face-sharing quadrant on other side of the Y-Z plane
Mirror Y	face-sharing quadrant on other side of the X-Z plane
Mirror Z	face-sharing quadrant on other side of the X-Y plane
Mirror XY	diagonally opposite quadrant on same side of the X-Y plane
Mirror XZ	diagonally opposite quadrant on same side of the X-Z plane
Mirror YZ	diagonally opposite quadrant on same side of the Y-Z plane
Mirror XYZ	quadrant diagonally opposite through origin

Rotational



Angle — This field specifies the rotational angle (in degrees) about the selected Frame's z-axis for rotational periodicity.

Instances — This field specifies the number of periodic instances for rotational periodicity.

Use Periodic — If toggled On, the periodic match file specified in File Name is used for rotational symmetry.

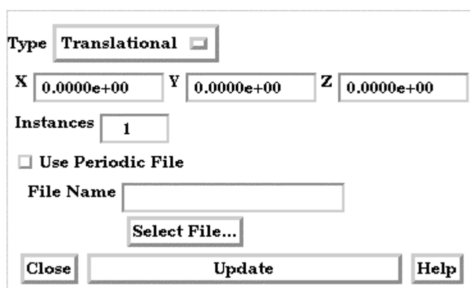
File Name — This field specifies the name of the periodic match file you wish to use.

Select File... — Opens the File Selection dialog for the selection of a periodic match file.

(see Section 11.9, Periodic Matchfile Format)

Update — Changes made in the dialog will not be applied until this button is clicked.

Translational



X Y Z — These fields specify the translational offset in reference to the selected Frame's orientation.

Instances — This field specifies the number of periodic instances for translational periodicity.

Use Periodic — If toggled On, the periodic match file specified in File Name is used for translational symmetry.

File Name — This field specifies the name of the periodic match file you wish to use.

Select File... — Opens the File Selection dialog for the selection of a periodic match file.

(see Section 11.9, Periodic Matchfile Format)

Update — Changes made in the dialog will not be applied until this button is clicked.

Access: Frame Mode : Computational Symmetry Attributes Icon

Coordinate System Pull-down Icon

Opens a pulldown menu for the selection of the type of coordinate system (rectangular, cylindrical, spherical) you wish to use for a selected Frame. All three are defined in reference to Frame 0, which is rectangular. Note that each frame's orientation vectors (which describe its orientation to Frame 0) are rectangular (as is their on-screen representation) no matter what the frame's coordinate system type. However, functions that access the frame will behave different depending on the frame's coordinate system type.

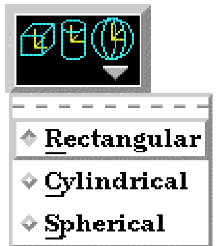
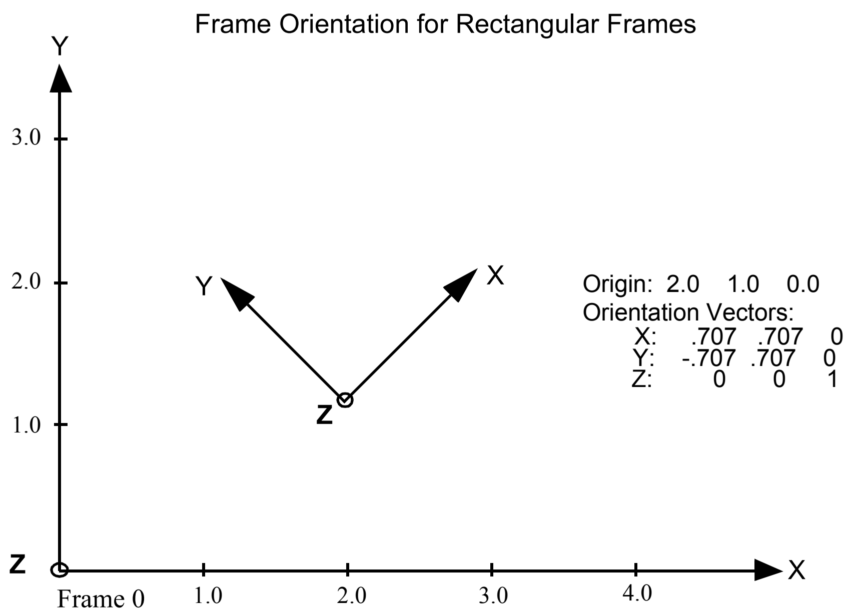


Figure 8-80
Frame Mode - Coordinate System Pulldown Icon

Rectangular

The Figure below shows a rectangular frame. The origin is in reference to the Frame 0 origin, while the orientation is in reference to Frame 0's orientation.

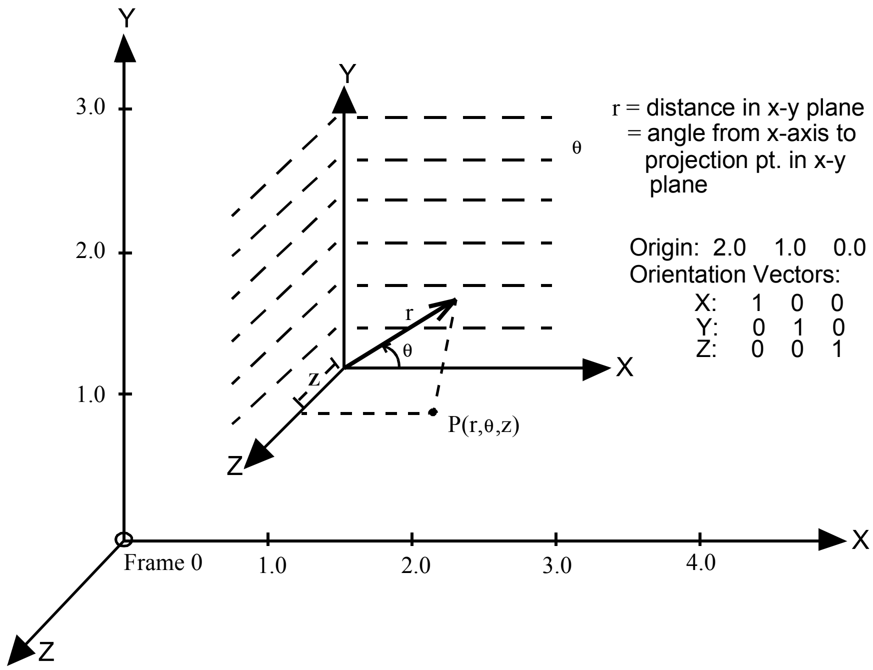


Cylindrical

The figure below shows a cylindrical frame. The origin is in reference to the Frame 0 origin, while the orientation is in reference to Frame 0's orientation. Any function which accesses a cylindrical frame will do so in cylindrical coordinates:

r The distance from the origin to projection point in the X–Y plane.
Θ The angle from the X-axis to the projection point in the X–Y plane.
Z The Z-coordinate

Frame Orientation and Coordinate System Key for Cylindrical Frames

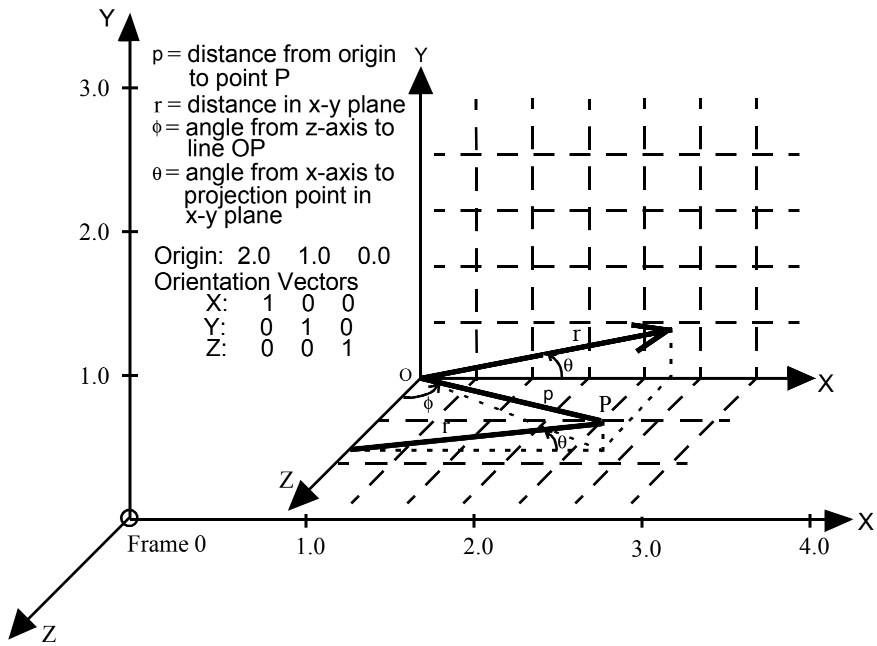


Spherical

The figure below shows a spherical frame. The origin is in reference to the Frame 0 origin, while the orientation is in reference to Frame 0's orientation. Any function which accesses a spherical frame will do so in spherical coordinates:

- ρ The distance from the origin to the point in question.
- Φ The angle measured from the Z-axis towards the projection point in the X–Z plane.
- Θ The angle from the X-axis to the projection point in the X–Y plane.

Frame Orientation and Coordinate System Key for Spherical Frames



Access: Frame Mode : Coordinate System Pull-down Icon

Frame Location

Opens the Transformations Editor dialog to permit precise definition of the selected Frame(s).

Figure 8-81
Frame Mode - Frame Location Attributes Icon

(see Section 9.2, Frame Transform)

Access: Frame Mode : Frame Location Attributes Icon

All Frame Axis Triad Visibility Toggle Icon

Determines the visibility of the axis triads of all Frame(s). Default is On.

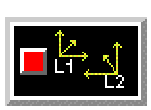


Figure 8-82
Frame Mode - All Frame Axis Triad Visibility Toggle Icon

Access: Frame Mode : All Frame Axis Triad Visibility Toggle Icon

Transform/Definition Pulldown Icon

Opens a pop-up menu for selection of desired method of Frame transformation.

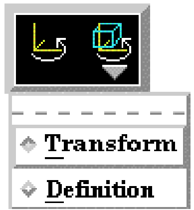


Figure 8-83
Frame Mode - Transform/Definition Pulldown Icon

Transform - Transformations will cause the Parts assigned to the selected Frame(s) to be transformed as well as the selected Frame's axis triad. Translations will move the Frames' axis triad(s) and the assigned Parts. Rotations of Parts will take place about the selected Frame(s) axis origin.

Definition - User interaction in the Graphics Window or Transformation Editor will modify the selected Frame(s) origin location and/or axis orientation.

Access: Frame Mode : Transform/Definition Pull-down Icon

(see Section 9.2, Frame Transform and Section 9.3, Frame Definition)

Select All

Selects all frames.

Figure 8-84
Frame Mode - Select All Icon

Delete Icon

Deletes the selected Frame(s).

Figure 8-85
Frame Mode - Delete Icon

Access: Frame Mode : Delete Icon

9 Transformation Control

Included in this chapter:

General Description

An essential feature of postprocessing is the reorientation of the visualized model in order to see it from a number of different vantage points. Basic transformations include *rotating* (about an axis or axis origin point), *translating* (up, down, left, right), and *zooming* (moving the model toward or away from you). When EnSight reads in a geometry file, it assigns all model parts to the same Frame of reference: Frame 0. Frame 0 corresponds to the model coordinate system (defined when the model was created).

Using the Frame Mode, it is possible to create additional frames and reassign parts to them. In fact, when you copy a part, a new Frame is automatically created and the part copy is assigned to the new Frame. (See Section 8.6 Frame Mode for further discussion).

Just after all parts of your model have been read in, EnSight centers the model in the Graphics Window by placing the geometric center of the model at the *Look At Point* which is always located in the center of the Graphics Window. Initially - before any Global translations are made -the origin for the *Global Axis* is located at the Look At Point.

There are seven Editor Functions available within the Transformation Editor, Global Transform, Frame, Tools, Z-Clip, Look At/Look From, Copy Transformation State, and Paste Transformation State. (The Transformation Editor dialog is opened by clicking the Transf Edit... button)

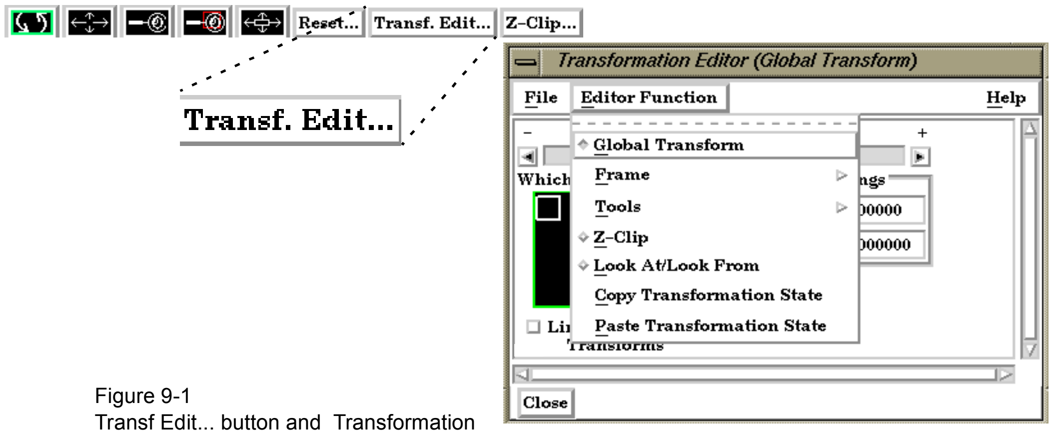


Figure 9-1
Transf Edit... button and Transformation Editor dialog

Transformations performed within the Editor affect the selected viewports and/or frames. The transforms from one viewport can be copied to another by selecting the viewport to be copied, selecting *Copy Transformation State*, selecting the viewport(s) to be modified, and selecting *Paste Transformation State*.

File button Pull-down Menu

File > Save View — This opens the Save View dialog which allows you to save in a file the view (orientation) of the model you have created in the Graphics Window and any Viewports by selecting Save View and then entering the name of the file.

File > Restore View — Opens the Restore View dialog which allows you to specify the name of a file in which you previously stored a view. Clicking Okay in this dialog restores the view only in the selected Viewports.

9.1 Global Transform

Transformations you make while in Part or View Modes (rotations, translations, zoom, scale) are performed globally. Global transformations affect the *entire* model as a unit and move all Frames, parts, and *visible* tools relative to the Global Axis. You can make the Global Axis triad (which pinpoints the Global Axis Origin) visible by selecting Axis Visibility > Axis - Global from View in the Main Menu or by clicking the Global Axis Visibility Toggle Icon in the View Mode icon bar.

Figure 9-2
Global Axis Visibility Toggle Icon and Global Axis triad

You can also show the global frame orientation by toggling it on from Desktop > Axis.

Most Global transformations you will make will be done interactively. Interactive Transformations normally affect only the single, selected viewport (the one which the mouse pointer is in when you click the left mouse button). The exception to this is if when you toggle on *Link Interactive Transforms*, causing the selected viewports in the Transformation Editor dialog to all transform together. You choose the type of transformation you wish to perform from among the Transformation Control Icons.

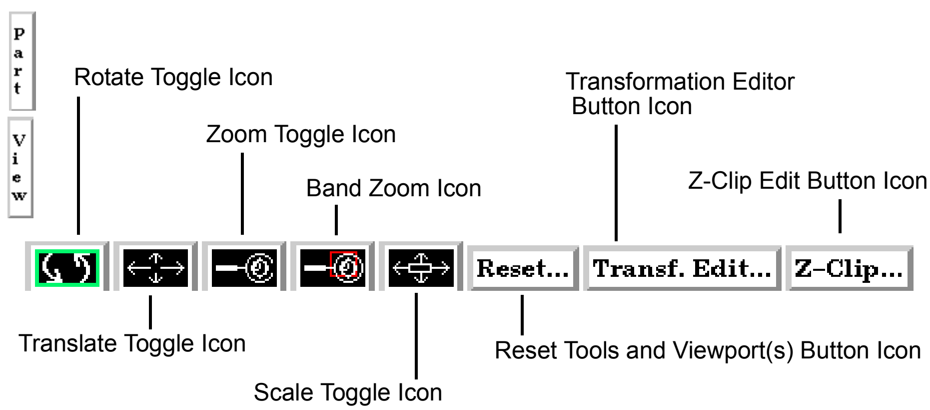


Figure 9-3
Transformation Control Area in View or Part Mode

Rotate Toggle

Interactive Rotation

When this toggle is on, clicking the left mouse button and dragging horizontally will rotate the scene (including any tools that are visible) about the Global Y axis.

Clicking the left mouse button and dragging vertically will rotate the scene (including any tools that are visible) about the Global X axis.

Holding the Control Key down and then clicking the left mouse button and dragging will rotate the scene (including any tools that are visible) about the Global Z Axis.

Rotation Using Function Keys

Pressing the F1, F2, or F3 function keys will rotate the scene 45 degrees about the X, Y, or Z axis respectively. Holding the Control Key down while pressing these keys will rotate the scene by -45 degrees. The mouse must be located in the graphics window for these keys to work.

Precise Rotation

When the Transformation Editor is open under Global Transform and the Rotate toggle is selected, the dialog will be configured to permit precise Rotation.

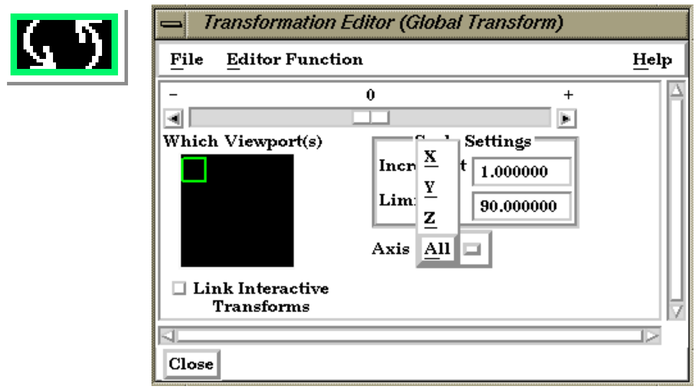


Figure 9-4
Transformation Editor for Exact Global Rotation

You may rotate the entire scene (including any tools that are visible) precisely about the X, Y, Z, or All axes by:

- entering the desired rotation in (+ or -) degrees in the Increment field and pressing Return,
- clicking the stepper buttons at each end of the slider bar (each click will rotate the model by the number of degrees specified in the Increment field), or
- dragging the slider in the positive or negative direction to the desired number of degrees you wish to rotate the model (the Limit Field specifies the maximum number of degrees of rotation performed when the slider is pulled to either end of the slider bar).

Translate Toggle

Interactive Translation

When this toggle is on, you can transform objects interactively in the Global X-Y plane (or by holding down the Control key, in Z). Clicking the left mouse button and dragging will translate the scene (including any tools that are visible) up, down, left or right (or forward or backward).

Precise Translation

When the Transformation Editor is open under Global Transform and the Translate toggle is selected, the dialog will be configured to permit precise Translation.

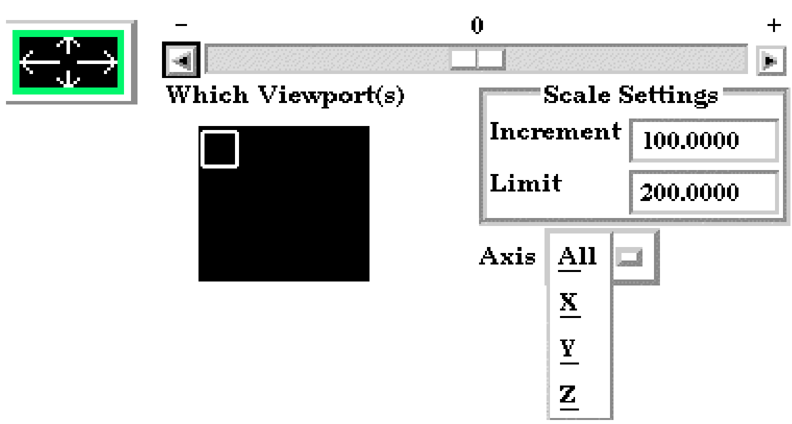


Figure 9-5
Transformation Editor for Exact Global Translation

You may translate the entire scene (including any tools that are visible) precisely along the X, Y, Z, or All axes by:

entering the desired translation in (+ or -) model coordinate units in the Increment field and pressing Return,

clicking the stepper buttons at each end of the slider bar (each click will translate the model by the number of model coordinate units specified in the Increment field), or

dragging the slider in the positive or negative direction to the desired number of model coordinate units you wish to translate the model and then releasing the slider (the Limit Field specifies the maximum number of model coordinate units that the model is translated when the slider is pulled to either end of the slider bar).

Zoom Toggle

Interactive Zooming

A Zoom transform is really an adjustment of the Look From Point, which you might also think of as the Camera Position. When this toggle is on, clicking and dragging to the left or down will zoom-in, that is it will move the Look From Point closer to the Look At Point. Clicking and dragging to the right or up will zoom-out, that is it will move the Look From Point farther away from the Look At Point. If you hold down the Control key while interactively zooming, you will “pan”, i.e. move both the Look At and Look From Points in the direction of the mouse movement.

(see Section 9.6, Look At/Look From)

As you Zoom in or out, be aware that you may clip the model with the Front or Back Z-Clip planes since they move in relationship to the Look From Point, always maintaining the distance from the Look From Point specified in the Transformation Editor dialog: Editor Function > Z-Clip.

(see Section 9.5, Z-Clip)

Precise Zooming

When the Transformation Editor is open under Global Transform and the Zoom toggle is selected, the dialog will be configured to permit precise Zoom.

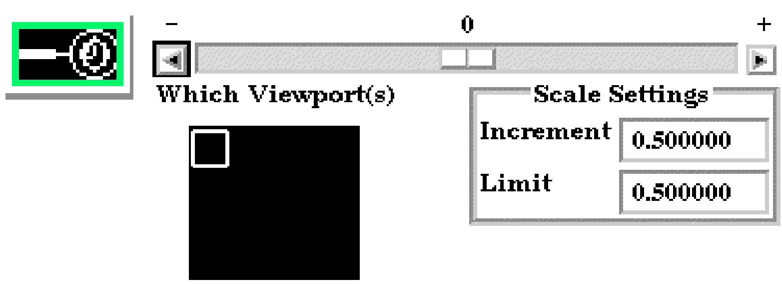


Figure 9-6
Transformation Editor for Exact Global Zoom

You may precisely adjust the position of the Look From Point (with respect to the Look At Point) by:

entering in the Increment Field the desired modification (+ or -) in the distance between the two Points (a value of .5 will increase the distance to be equal to 1.5 the current distance, a value of 1.0 will double the current distance),

clicking the stepper buttons at each end of the slider bar (each click will increase or decrease the distance between the two Points by the factor specified in the Increment field), or

dragging the slider in the positive or negative direction to the desired modification factor and then releasing the slider (the Limit Field specifies the maximum modification factor for the distance between the two Points when the slider is pulled to either end of the slider bar).

Band Zoom Button

When you click this button, the Zoom Toggle Icon will actually become highlighted, but EnSight will be ready to perform a Band Zoom operation. You specify the area of interest by clicking and dragging the white rectangle (rubber band) around the area you wish to zoom in on. Immediately after you perform the Band Zoom operation however, EnSight will switch to the regular Zoom Transformation. So, each time you click on the Band Zoom button, EnSight allows you to perform one Band Zoom operation and subsequent clicking/dragging actions you make in the Graphics Window perform regular Zoom transformations.

Band Zoom combines the functionality of a zoom-in transform as described above with a panning operation. The effect of performing a Band Zoom is that the area of interest that you specify will be centered in and will fill the selected viewport. EnSight adjusts the Look At Point to be in the center of the area you specified. Since the position of the Global Axis Origin is defined relative to the Look At Point (distance from it in X, Y, X coordinates), the position of the Global Axis Origin is also changed and any future global rotations you perform will be about the Global Axis Origin in its new position.

The Transformation Editor is inactive for the Band Zoom Operation.

Scale Toggle

Interactive modifications to scale are not permitted. When the Transformation Editor is open under Global Transform and the Scale toggle is selected, the dialog will be configured to permit precise adjustments to the scale of the scene.

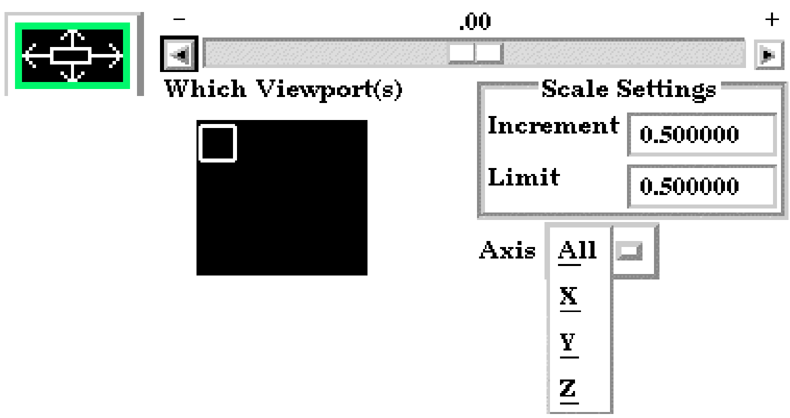


Figure 9-7
Transformation Editor for Exact Global Scaling

You may precisely rescale the scene in the X, Y, Z, or All axes by:

entering in the Increment Field the desired rescale factor and pressing Return (A value of .5 will reduce the scale of the scene in the chosen axis by half. A value of 2 will double the scale in the chosen axis. *Be aware that entering a negative number will invert the model coordinates in the chosen axis.*),

clicking the stepper buttons at each end of the slider bar (Clicking the left stepper button will apply 1/Increment value to the scale. Clicking the right stepper button will apply the entire Increment value to the scale), or

dragging the slider in the positive or negative direction to the desired scale factor and then releasing the slider. (Dragging the slider to the leftmost position will apply 1/Limit value to the scale. Dragging the slider to the rightmost position will apply the entire Limit value to the scale.)

Reset Tools & Viewports Button — Clicking the Reset Tools and Viewport(s) button in the Transformation Control Area will open the Reset Tools and Viewport(s) dialog

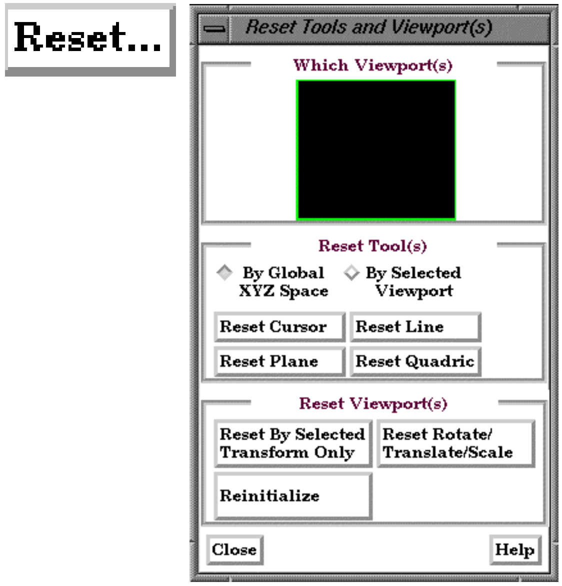


Figure 9-8
Reset Tools and Viewport(s) dialog

By Global XYZ Space Toggle — When enabled, clicking a Reset button will cause the Cursor, Line, Plane, or Quadric Tool to reset to its initial default position.

By Selected Viewport Toggle — When enabled, clicking a Reset button will cause the Cursor, Line, Plane, or Quadric Tool to be repositioned in the center of the geometry for the selected viewport.

Reset Cursor — Clicking this button will cause the Cursor Tool to reset according to the “By” toggle.

Reset Line — Clicking this button will cause the Line Tool to reset according to the “By” toggle.

Reset Plane — Clicking this button will cause the Plane Tool to reset according to the “By” toggle.

Reset Quadric — Clicking this button will cause the currently selected Quadric Tool to reset according to the “By” toggle.

Reset By Selected Transform Only — Clicking this button will cause the transformation selected in the Transformation Control Area to reset for the viewports selected in the dialog’s Viewport(s) area.

Reset Rotate/ Translate/Scale — Clicking this button will cause the rotate, translate, and scale transformations to reset for the viewports selected in the dialog’s Viewport(s) area.

Reinitialize — Clicking this button will cause the viewports selected in the dialog’s Viewport(s) area to reset and recenter on the Parts which are visible in the Viewport(s).

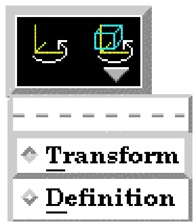
Reset using Function Keys — Pressing the F5 button will change the scene in the current viewport to the standard “right side” view. Similarly, pressing F6 will show a “top” view and F7 a “front” view. Pressing F8 will restore the view to the one which existed before F5, F6, or F7 were pressed. If the Control Key is pressed at the same time as F5, F6, or F7, then the current view will be stored to the selected button.

Z-Clip Edit Button — Clicking this button will open the Transformation Editor dialog for precise Z-Clip editing. For further discussion:

(see Section 9.5, Z-Clip)

9.2 Frame Transform

When Frame Transform has been chosen from the Transform/Definition button Pulldown menu or from the Editor Function menu in the Transformation Editor dialog, transformations you make will affect the selected Frame(s) and the Parts assigned to them.



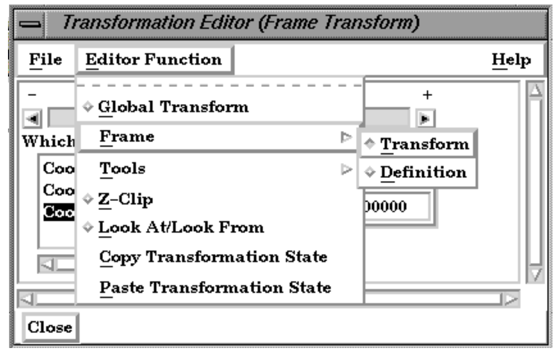


Figure 9-9
Two ways to choose Frame Transform

Note: *Before any transformations are performed on a Frame, its definition should be modified (if necessary) as described later in this section. Transformations always occur about a Frame's origin and orientation. Failure to define the proper position and orientation of the Frame will result in unexpected transform behavior.*

You choose the type of transformation you wish to perform from among the Transformation Control Icons. Note that under Frame Transform, you cannot perform the zoom operation.

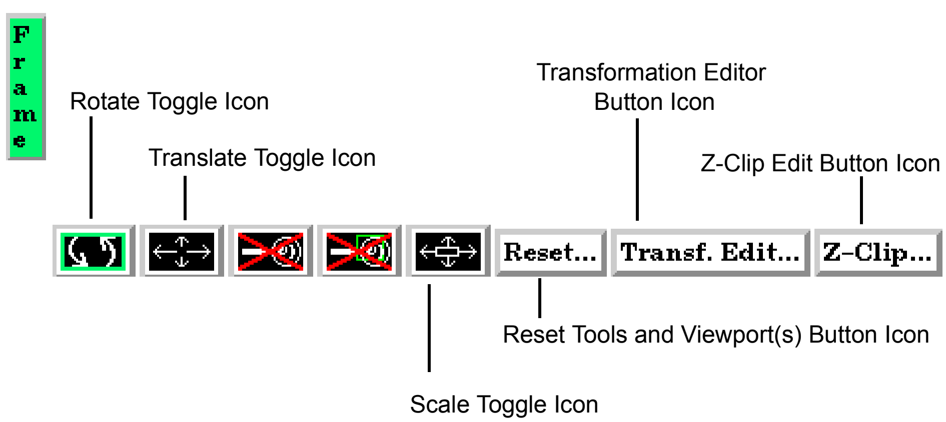


Figure 9-10
Transformation Control Area in Frame Mode under Frame Transform

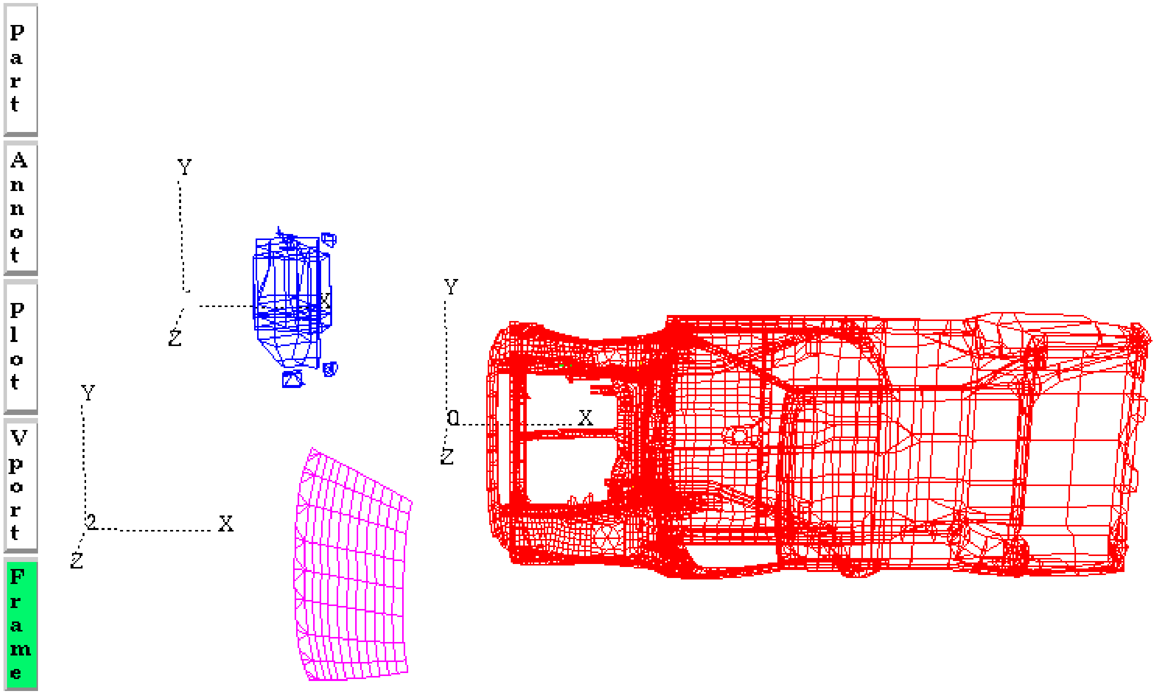


Figure 9-11
Frame axis triads for Frame 0, Frame 1, and Frame 2

Rotate Toggle

Interactive Rotation — When this toggle is on, clicking the left mouse button and dragging causes the selected Frame(s) and all Parts assigned to the Frame(s) to rotate about the Origins of each Frame Axis. Holding down the Control key while dragging will rotate the selected Frame(s) and all assigned Parts about a Z axis perpendicular to the screen.

Precise Rotation — When the Transformation Editor is open under Frame Transform and the Rotate toggle is selected, the dialog will be configured to permit precise Rotation.

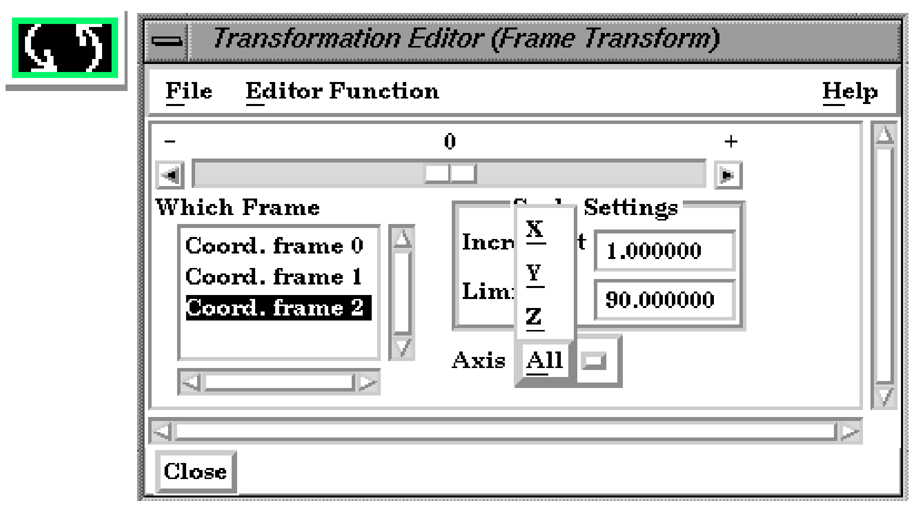


Figure 9-12
Transformation Editor for Precise Rotation under Frame Transform

You may rotate the selected Frame(s) and assigned Part(s) precisely about the X, Y, Z, or All axes, as the orientation of the axes were defined when the Frame was first created by:

entering the desired rotation in (+ or -) degrees in the Increment field and pressing Return,

clicking the stepper buttons at each end of the slider bar (each click will rotate the selected Frame(s) and assigned Part(s) by the number of degrees specified in the Increment field), or

dragging the slider in the positive or negative direction to the desired number of degrees you wish to rotate the selected Frame(s) and assigned Part(s) (the Limit Field specifies the maximum number of degrees of rotation performed when the slider is pulled to either end of the slider bar).

Translate Toggle

Interactive Translation

When this toggle is on, you can transform objects interactively in the X-Y plane (or by holding down the Control key, in Z). Clicking the left mouse button and dragging will translate the selected Frame(s) and all assigned Part(s) up, down, left or right (or forward or backward) within the selected viewport.

Precise Translation

When the Transformation Editor is open under Frame Transform and the Translate toggle is selected, the dialog will be configured to permit precise Translation.

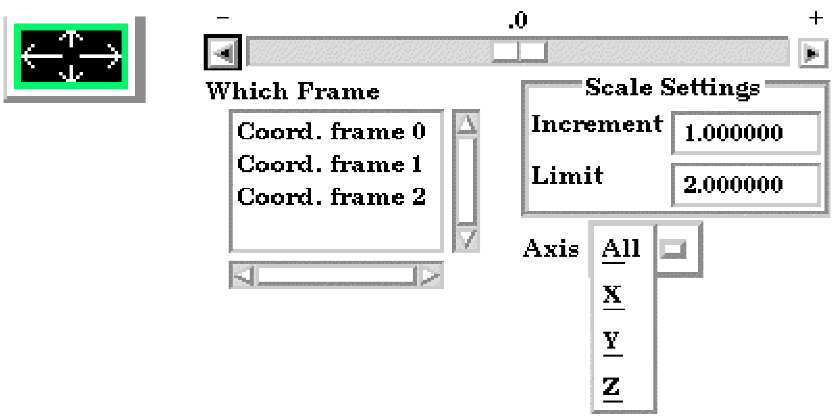


Figure 9-13
Transformation Editor for Precise Translation under Frame Transform

You may translate the selected Frame(s) and all Parts assigned to them precisely along the X, Y, Z, or All axes by:

entering the desired translation in (+ or -) model coordinate units in the Increment field and pressing Return,

clicking the stepper buttons at each end of the slider bar (each click will translate the selected Frame(s) and assigned Part(s) by the number of model coordinate units specified in the Increment field), or

dragging the slider in the positive or negative direction to the desired number of model coordinate units you wish to translate the selected Frame(s) and assigned Part(s) and then releasing the slider (the Limit Field specifies the maximum number of model coordinate units that the model is translated when the slider is pulled to either end of the slider bar).

Scale Toggle

When the Transformation Editor is open under Frame Transform and the Scale toggle is selected, the dialog will be configured to permit precise scale.

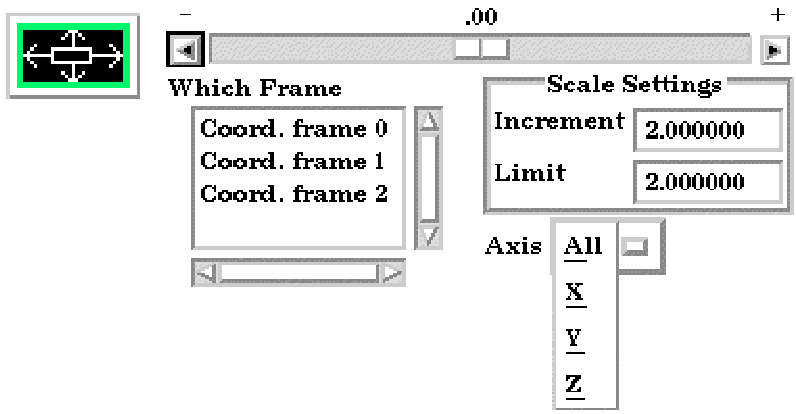


Figure 9-14
Transformation Editor for Exact Scaling under Frame Transform

You may precisely rescale the selected Frame(s) and assigned Part(s) in the X, Y, Z, or All axes by:

entering in the Increment Field the desired rescale factor and pressing Return (A value of .5 will reduce the scale of the selected Frame(s) and assigned Part(s) in the chosen axis by half. A value of 2 will double the scale in the chosen axis. *Be aware that entering a negative number will invert the model coordinates in the chosen axis.*),

clicking the stepper buttons at each end of the slider bar (Clicking the left stepper button will apply 1/Increment value to the scale. Clicking the right stepper button will apply the entire Increment value to the scale), or

dragging the slider in the positive or negative direction to the desired scale factor and then releasing the slider. (Dragging the slider to the leftmost position will apply 1/Limit value to the scale. Dragging the slider to the rightmost position will apply the entire Limit value to the scale.)

Reset Tools & Viewports Button

Clicking the Reset Tools and Viewport(s) button in the Transformation Control Area will open the Reset Tools and Viewport(s) dialog

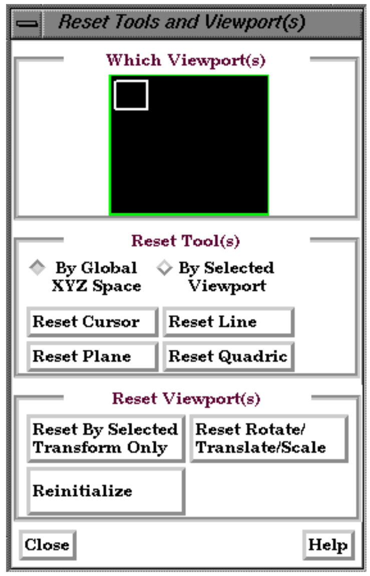


Figure 9-15
Reset Tools and Viewport(s) dialog

Reset Cursor — Clicking this button will cause the Cursor Tool to reset to its default position

Reset Line — Clicking this button will cause the Line Tool to reset to its default position

Reset Plane — Clicking this button will cause the Plane Tool to reset to its default position

Reset Quadric — Clicking this button will cause the currently selected Quadric Tool to reset to its default position

Reset By Selected Transform Only — Clicking this button will cause the transformation selected in the Transformation Control Area to reset for the viewports selected in the dialog's Viewport(s) area. Under Frame Transform, will reset the transformation associated with the selected Frame(s).

Reset Rotate/ Translate/Scale — Clicking this button will cause the rotate, translate, and scale transformations to reset for the viewports selected in the dialog's Viewport(s) area. Under Frame Transform, will reset the transformation associated with the selected Frame(s).

Reinitialize — Clicking this button will cause the viewports selected in the dialog's Viewport(s) area to reset and recenter on the Parts which are visible in the Viewport(s).

Z-Clip Edit Button

Clicking this button will open the Transformation Editor dialog for Z-Clip editing. If the Transformation Editor is already open, it will be reconfigured for Z-Clip editing. For further discussion:

(see Section 9.5, Z-Clip)

9.3 Frame Definition

When Frame Definition has been chosen from the Transform/Definition button Pulldown menu or from the Editor Function menu in the Transformation Editor dialog, then actions you make will affect only the definition (origin and orientation) of the selected Frame(s). Frame 0's definition however, can not be changed.

Figure 9-16
Two ways to choose Frame Definition

A Frame's definition should be adjusted before it is transformed under Frame Transform (as described in the previous pages). Transformations under Frame Transform are always about the Frame's origin and orientation. Failure to define the proper origin position and orientation of a Frame will result in unexpected transformation behavior.

You choose the type of transformation you wish to perform (rotate or translate) from the Transformation Control Icons. Note that you cannot perform zoom, scale, or reset operations under Frame Definition.

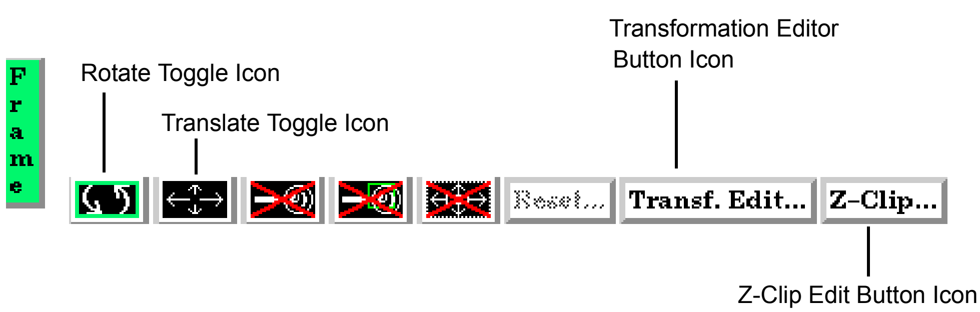


Figure 9-17
Transformation Control Area in Frame Mode under Frame Definition

Rotate Toggle

Interactive Modification of Orientation

When this toggle is on, clicking the left mouse button and dragging modifies the orientation of the selected Frame(s). Clicking on the end of the X axis will limit the rotation to be about the Y axis. Similarly, clicking on the end of the Y axis will limit the rotation to be about the X axis.

Precise Modification of Orientation

When the Transformation Editor is opened under Frame Definition and the Rotate toggle is selected, the dialog will be configured to permit precise rotation (modification of the orientation) of the selected Frame(s).

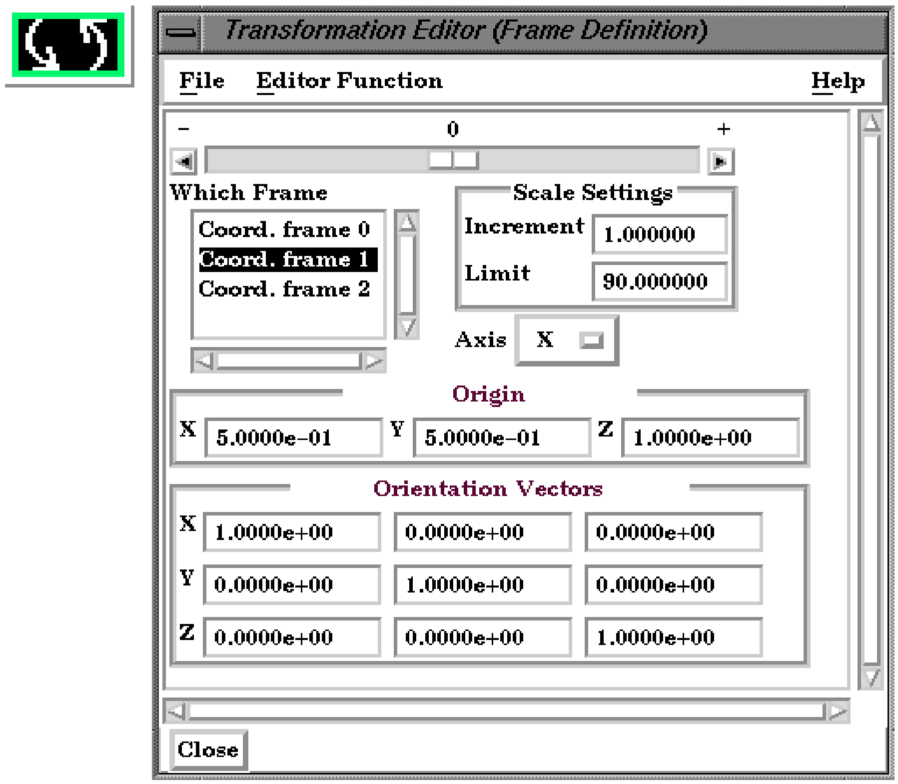


Figure 9-18
Transformation Editor for Exact Rotation for Selected Frame(s) Only

You may rotate the selected Frame(s) precisely about their X, Y, Z, or All axes by:

entering the desired rotation in (+ or -) degrees in the Increment field and pressing Return,

clicking the stepper buttons at each end of the slider bar (each click will rotate the selected Frame(s) by the number of degrees specified in the Increment field), or

dragging the slider in the positive or negative direction to the desired number of degrees you wish to rotate the selected Frame(s) (the Limit Field specifies the maximum number of degrees of rotation performed when the slider is pulled to either end of the slider bar).

Origin XYZ
Orientation XYZ

You may precisely position both the origin and the axis of a selected Frame by entering in the desired coordinates in the Origin and Orientation Vector X Y Z fields and then pressing Return. These fields can be used regardless of whether the Rotate or the Translate toggle is selected.

Translate Toggle

Interactive Translation of Origin Position

When this toggle is on, clicking the left mouse button and dragging will translate the selected Frame(s) (other than Frame 0) up, down, left, or right within the viewport. Holding down the Control key while dragging will translate the selected Frame(s) forward or backward.

Precise Translation of Origin Position

When the Transformation Editor is open under Frame Definition and the Translate toggle is selected, the dialog will be configured to permit precise Translation (modification of the origin position) of the selected Frame(s).

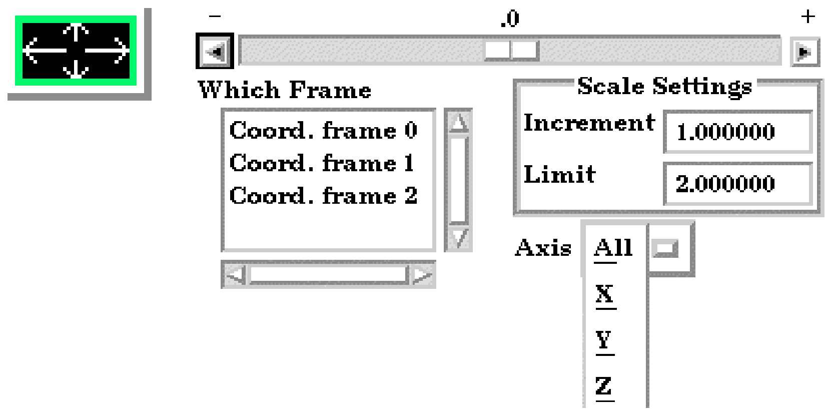


Figure 9-19
Transformation Editor for

You may translate the selected Frame(s) precisely along the X, Y, Z, or All axes by:

entering the desired translation in (+ or -) model coordinate units in the Increment field and pressing Return,

clicking the stepper buttons at each end of the slider bar (each click will translate the selected Frame(s) by the number of model coordinate units specified in the Increment field), or

dragging the slider in the positive or negative direction to the desired number of model coordinate units you wish to translate the selected Frame(s) and then releasing the slider (the Limit Field specifies the maximum number of model coordinate units that the Frame is translated when the slider is pulled to either end of the slider bar).

Z-Clip Edit Button

Clicking this button will open the Transformation Editor dialog for Z-Clip editing. If the Transformation Editor is already open, it will be reconfigured for Z-Clip editing. For further discussion:

(see Section 9.5, Z-Clip)

9.4 Tool Transform

Transformation of the Cursor, Line, Plane, and Quadric (cylinder, sphere, cone, and revolution) Tools is covered in depth in Chapter 6.

(see *Tool Positions* in Section 6.5, Tools Menu Functions)

9.5 Z-Clip

EnSight displays the scene in a three-dimensional, rectangular workspace that has finite boundaries on all sides. Even if you rotate the model, you are always looking into the workspace from the front side. The top-to-bottom and side-to-side boundaries of the workspace are analogous to looking out a real window—the window frame limits your view. In addition, since the memory of your computer is finite, your workspace also has limits in the front-and-back direction.

The front boundary is the *Front Clipping Plane* (or the *Near Plane*) and the rear boundary is the *Back Clipping Plane* (or the *Far Plane*). Only the portion of the scene *between* these two planes is visible—the rest of the model (if any) is *clipped* and therefore invisible. By convention, the front-to-back direction of the workspace is the Z direction. Hence, the front and back clipping planes are together called the *Z-Clip Planes*. Note that the Z-direction in the workspace is always in-and-out of the screen and is completely independent of the Z-direction of the model Frame (Frame 0).

Z-Clip Positions

The position of the Z-Clip planes is specified in terms of their *distance from the Look From Point* in the distance units implied by the model-geometry data. By default, the planes automatically move as the model moves.

Initially, EnSight positions the Z-Clip Planes based on the dimensions of the model parts read to the Client, with some extra space for you to perform transformations. You can reposition the planes when doing so becomes necessary or desirable.

Each viewport has its own independently adjustable set of Z-Clip Planes.

Using Z-Clip Planes

You can use Z-Clip planes to *deliberately* clip-away portions of the model you are not interested in, or which are getting in the way of what is of interest. For example, you can clip-away both a front-portion and a back-portion of a model to reduce the number of node and element labels displayed. *Z-Clip Planes and* EnSight uses your workstation's graphics hardware to perform all graphics

Hidden Surfaces

manipulations, including the display of solid surfaces. The appearance of a solid model is created by *not* displaying *hidden surfaces*—surfaces hidden behind nearer surfaces. The algorithm used by the graphics hardware to do this task— *Z-buffering*—is a simple algorithm which compares Z-values to calculate which surfaces are closest to you and thus visible. Z-buffering is normally performed in integer arithmetic, and on most graphics systems is confined to 24 bits of resolution. Hence, the coordinates in Z must be mapped into this 24-bit space. To achieve the maximum resolution possible in the 24 bits available, the graphics hardware maps the Z-distance between the Front and Back Clipping Planes into the 24 bits available. Hence, the larger the distance between the Z-Clip Planes, the lower the Z resolution, which can affect image quality for solid images. If you see problems with your solid images, move the front and back clipping planes in as close as possible.

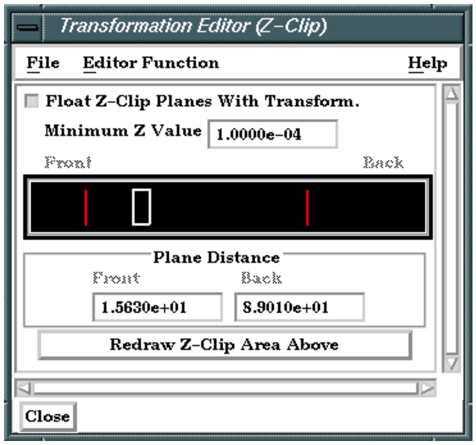


Figure 9-20
Transformation Editor for Z-Clip Plane Positions

The Transformation Editor (Z-Clip) is used to adjust the distances of the Front and Back Clipping Planes from the Look-From Point.

Float Z Clip Planes With Transform
When on, will automatically adjust the front and back Z-Clip planes away from the model.

Minimum Z Value
Minimum distance the Front Clipping Plane is allowed to float to from the Look From Point (model coordinates). Used only if Float Z Clip Planes with Transform toggle is on.

Z-Clip Area Display
Displays position of Z-Clip planes relative to model-part Z-range (shown as a rectangle) and allows interactive positioning (by clicking and dragging) of the Z-Clip planes. If lines are inside model rectangle, that part of model is clipped from the display. Values update in data fields as you move sliders. Active viewports of the Main View update automatically as you move sliders.

Plane Distance

Front
Distance of the Front Clipping Plane from Look From Point in model coordinates. Precisely specify by typing in desired distance and pressing Return. Not used if the Float Z Clip Planes With Transform toggle is on.

Back
Distance of the Back Clipping Plane from the Look From Point in model coordinates. Precisely specify by typing in desired distance and pressing Return. Not used if the Float Z Clip Planes With Transform toggle is on.

Redraw
The Plane Position Display does not automatically update if you perform transformations in the active viewport. Click this button to update the Plane Position Display.

Troubleshooting Z-Clip Planes

Problem	Probable Causes	Solutions
Main View is empty	No parts located between Front and Back Z-Clip Planes.	Adjust Z-Clip plane locations
Model degenerates to irregular polygons or the front Z-Clip line is locked in the model extent box	You have moved the front Z-Clip plane too close to (or on) the Look From Point.	Move the front Z-Clip plane away from the Look From Point.

9.6 Look At/Look From

Using the Transformation Editor with Editor Function > Look At/Look From chosen, you can reposition the point from which you are observing the model (the Look From Point) and the point at which you are looking (the Look At Point). Both the Look-From and Look-At points are specified in the coordinates of the Model Frame (Frame 0).

Initially, the Look At Point is at the geometric center of the initial model parts read by the EnSight Client. The Look From Point is on the positive Z-axis at a distance appropriate to display the model in the Main View window.

If you increased only the X position of the Look From Point, in the Graphics Window (or selected Viewport), it would appear that the model had rotated about the Global Y axis. In fact, the model has not rotated at all, which is shown by the visible Global Axis triad in the figure below. What has happened is that you are now viewing the model from a position farther to the right than previously.

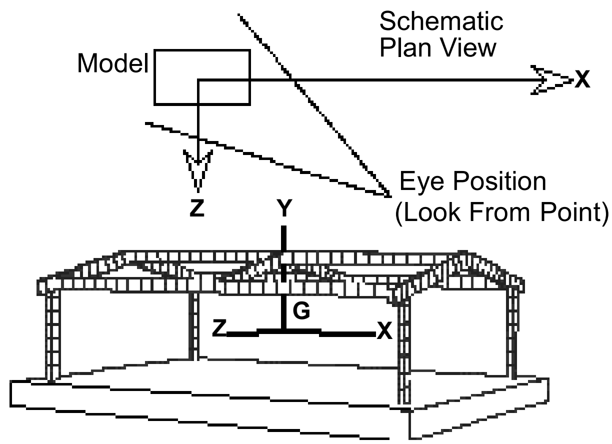


Figure 9-21
Image showing view of model from negative X axis towards positive X axis

If the Y and Z coordinates of the Look From point were made to be the same as those of the Look At point, but the X coordinate of Look From point was specified as a much smaller value than that of the Look At point, it would appear in the Graphics Window (or selected Viewport) that the model had rotated 90 degrees about the Global Y axis. As before, the model has actually not rotated at all, which is shown by the visible Global Axis triad in the figure below. What has happened is that you are now viewing the model from a position on the negative Global X axis looking in the positive X direction.

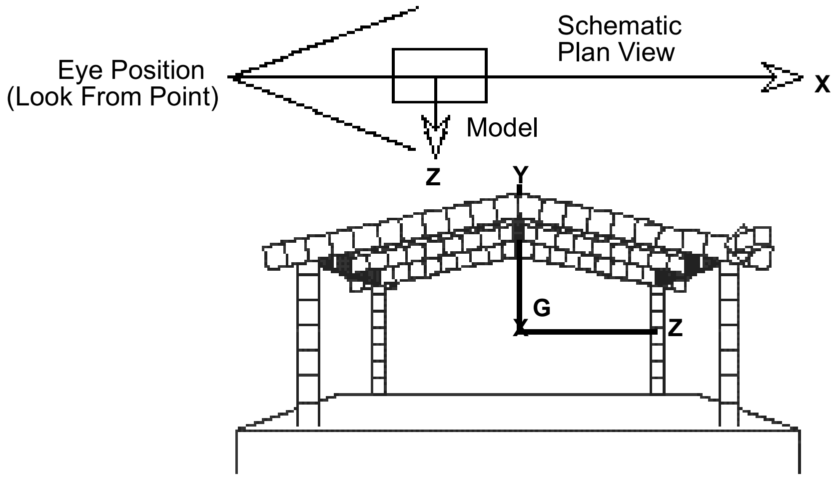


Figure 9-22
Image showing view of model from negative X axis towards positive X axis

The position of the Look-At and Look-From points can be interactively or precisely specified using the Transformation Editor dialog with Editor Function > Look At/Look From.

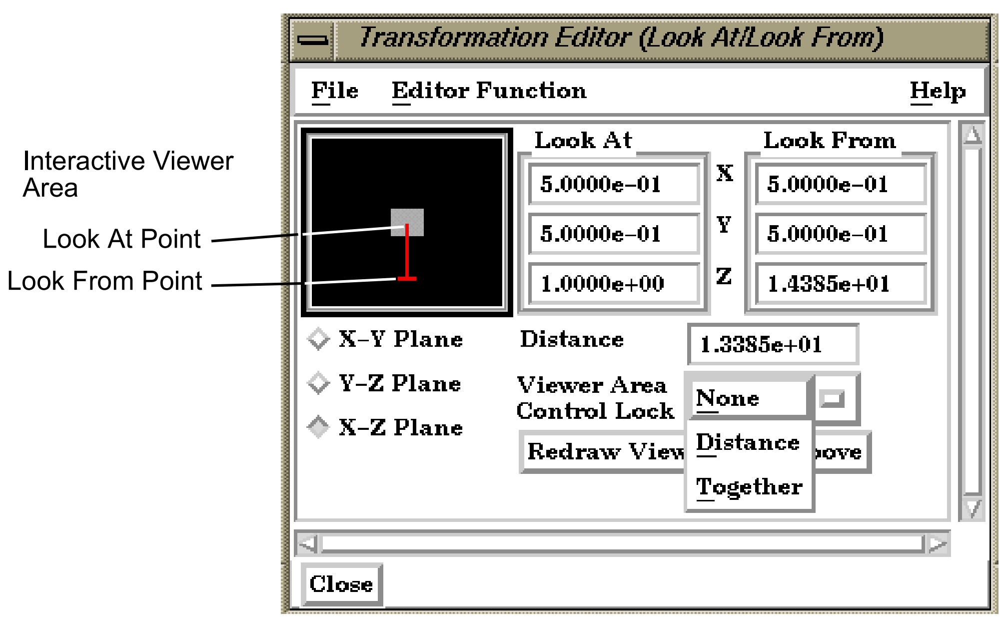


Figure 9-23
Transformation Editor for Look At/Look From

Interactive The position of the Look At and Look From Points may be positioned interactively in the Interactive Viewer Area by grabbing the Look At or Look From Point and dragging it to the desired location. These interactive modifications can be made in the X-Z Plane, the X-Y Plane, or the Y-Z Plane, depending upon which of the three toggles are selected. The Graphics Window as well as the Look At and Look From coordinate fields updates as you drag either Point to a new location.

Precise The position of the Look At and Look From Points may be positioned precisely by specifying the desired coordinate values in the X Y Z fields and pressing Return.

Distance The distance in model coordinates may be precisely specified by entering the desired value in this field and pressing Return.

Viewer Area Control Lock Opens a pop-up menu for the selection of how interactive actions taken in the Viewer Area will be limited. Choices are:
None No locks are applied
Distance The distance between the two Points is locked
Together The distance and direction vector between the two Points is locked

Redraw Viewer Area Above This button redraws the Viewer Area. This button should be clicked after a transformation is performed in the selected viewport while this dialog is active.

9.7 Copy/Paste Transformation State

This transformation option can be used to apply the transformation state of one viewport to other viewports. Useful if you want multiple viewports to have the model oriented the same, and you did not link the viewports for transformations before applying any transformations.

The use of this option consists of:

1. Selecting the viewport (one only) containing the transformation state desired.
2. Selecting *Copy Transformation State* in the Transformation Editor dialog.
3. Selecting the one or more viewports to receive this transformation state.
4. Selecting *Paste Transformation State* in the Transformation Editor dialog.

10 Preference File Formats

This chapter provides information about the various file formats associated with different preference options within EnSight.

Section 10.1, Window Position File Format describes the format of the file which contains your saved window positions and sizes.

Section 10.2, Connection Information File Format describes the format of the file which contains your auto-connection information.

Section 10.3, Palette File Formats describes the format of the color selector palette, saved function palettes, and the default false color function palette.

Section 10.4, Default Part Colors File Format describes the file format for the default colors for parts.

Section 10.5, Data Reader Preferences File Format describes the format for the data reader preferences file.

Section 10.6, MPEG Parameters File describes the format of the MPEG parameters file.

Section 10.7, Parallel Rendering Configuration File points to the location where the format of the parallel rendering configuration file is described.

10.1 Window Position File Format

To save a window position file, click Edit >Preferences... from the Main Menu and select the "General User Interface" option. Then select the Save Size and Position of Main Windows button. When you select this button, the current position of major dialog windows is saved to the `ensight7.winpos.default.XRESxYRES` file. In general, this file contains dialog position and size information, along with information about the states of the expandable sections of dialogs.

This file is normally saved to and read from the .ensight7 directory of the users home directory. If the file is in the Client working directory it will be read from and saved to that directory instead.

Only major dialogs are affected; the miscellaneous pop-up dialogs are not specified. You do not have to include every dialog and every section listed. EnSight will process the ones provided.

Window File Format

The format of the EnSight window position file is as follows:

- Line 1: Font Size

  Integer specifying font size for dialog labels.

- Lines 2 to N: Dialog Title, Size, & Location

  `String: [IntegerXInteger+]Integer+Integer` specifying
  Dialog title: Width x Height + Xloc + Yloc. The dialog title of each window can be shortened using the * as a meta character. For example, the string title Transformation Editor: 0+815 can be shortened to *Transform*: 0+815. Be careful that your abbreviated name does not match any other names, or the position of all those names will be changed.

- Line N+1: List Separator String

  Character string `–Section Expansion Information–` to separate dialog size and location information from section-open information.

- Lines N+2 to End: Section Expansion Toggles

  `Dialog->Section[->Section]: open|closed` character strings indicating whether corresponding dialog section is open or closed.

The following is an example window position file:

```
fontsize: 13
EnSight: 910x984+369+31
Transformation Editor: 390x381+180+368
Command: 300x0+0+682
Connect Server: 137+0
Query Dataset: 0+0
```

10.2 Connection Information File Format

EnSight saves a file on the Client host system, called `ensight.connect.default` whenever you connect the Server via the auto connect feature. The next time you start EnSight, it will read this file and display your previous connection information. This file is normally saved to and read from the .ensight7 directory of the users home directory. But, any local file will override this location process.

The complete ASCII text file contains the following Server and/or plotter system information.

```
server
machine SERVER_SYSTEM_ID
executable [SERVER_EXE_PATH/]ensight.server
directory SERVER_WORKING_DIRECTORY
login_id SERVER_LOGIN_ID
```

Each line of the file consists of a descriptive keyword that is usually followed by an appropriate system variable. The system variables are shown above with generic abbreviations in capital letters.

Keyword	Description
`server`	Denotes that following keywords and variables pertain to how the program `ensight7.server` is started via an automatic connection.
`machine`	The id or hostname of the system where the program is executed. This defaults to your Client host system hostname.
`executable`	The complete path to the executable program. This defaults to executing ensight7.server (which must be in your defined UNIX search path). This path is normally defined in your .login or .cshrc file in your home directory (for C shell users).
`directory`	The directory that you wish the Server to execute from on the Server host system. You may want to specify the directory that contains your data files on the Server host system. This defaults to your home directory on the (Server or plotter) host system for a distributed connection. It defaults to the Client's working directory when in standalone mode.
`login_id`	Your alternate login id on the Server host system. This defaults to your Client host system login id. (This option is only applicable to distributed connections).

10.3 Palette File Formats

The following palette formats are discussed in this section:

Color Selector Palette File Format

Function Palette File Format

Predefined Function Palette

Default False Color Map File Format

Color Selector Palette File Format

This file defines the colors that are used with the EnSight Color Selector. If EnSight does not find a definition file it uses a default palette. If, however, it does find a file (the file must be called ensight.colpal.default and be located in the .ensight7 directory of the users home directory) at start-up it will read your colors and show them in the Color Selector.

The format of the ensight.colpal.default file is as follows:

- Line 1: “Version 6.0” (Note, this need not match EnSight’s version number.)
- Line 2 through Line 37

  Three integers, one for each color (red, green, blue), ranging from

  0 (no intensity) to 255 (full intensity).

Function Palette File Format

A function palette file is saved using the Function Editor when you save (one or more) function color palettes. The following is an example function palette file:

```
palette ‘velocity’
variable_type vector
variable ‘velocity’
type continuous
limit_fringes no
scale linear
number_of_levels 5
colors
0.000000 0.000000 1.000000
0.000000 1.000000 1.000000
0.000000 1.000000 0.000000
1.000000 1.000000 0.000000
1.000000 0.000000 0.000000
values
0.100341
0.301022
0.501704
0.702385
0.903067
```

Many lines of the file consists of a descriptive keyword followed by an appropriate value. In other areas the keyword is used to start a block of information. The values are all free format real or integer numbers or string constants. The palette name must have single quotes around each name. The string keywords and constant values must match exactly.

Keyword	Description
`palette`	Name of the palette when one name is present. Name of the subpalette when two names are present (ex. palette ‘velocity’’xcomp’)
`variable`	Name of the variable used with the palette.
`variable_type`	Type of the variable, scalar or vector.
`type`	Type of the palette, continuous or banded.
`limit_fringes`	Indicates if the palette is set up for limiting fringe. If it is, the options are `by_Part` or `by_invisible`.
`scale`	Indicates whether the palette scale is linear, logarithmic, or quadratic.
number_of_levels	Indicates the number of levels defined for the palette.
colors	Indicates the start of a block of RGB triplets, 1 triplet per line. There will be the same number of lines as there are levels.
values	Indicates the start of a block of level values. There will be the same number of values as there are levels.

Predefined Function Palette

When EnSight starts, it looks for user defined function color palettes located under `$ENSIGHT7_HOME/site_preferences/palettes` and in the `.ensight7/palettes` directory found in the user’s home directory. These files must be named `palette_name.cpal`, where the palette_name is the name of the color palette in the Simple Interface area of the function dialog.

The format of the `.cpal` file is as follows:

- Line 1: The string “`number_of_levels x`”, where x is an integer.
- Line 2: The string “`colors`”
- Line 3 through x + 2: Three float values in range 0.0 to 1.0, indicating red, green, and blue color components.

An example color palette file:

```
number_of_levels 5
colors
.008 0. 0.
.5 0. 0.
1. 0. 0.
1. 1. 0.
1. 0. 1.
```

Default False Color Map File Format

This file defines the default false-color map color range that is assigned by EnSight to each palette when variables are activated. If EnSight does not find a definition file, it uses an internal default list. If, however, EnSight does find a file (the file must be called `ensight.false_color.default` and be located in the `.ensight7` directory of the user's home directory or be located in `$ENSIGHT7_HOME/site_preferences`) at start-up, EnSight will read your colors as the default palette colors.

The format of the `ensight.false_color.default` file is as follows:

- Line 1: "Version 6.0" (Note, this need not match EnSight's version number.)
- Line 2: One integer, the number default false color map colors
- Line 3 on: three floats (each ranging between 0. and 1.), the (red, green, blue) color triplet of each color, each listed on separate lines.

An example default file can be found in:

`$ENSIGHT7_HOME/site_preferences/ensight.false_color.default`

on your client system.

The following is an example default false color map file with 5 colors; blue, cyan, green, yellow, and red:

```
Version 6.0
5
0. 0. 1.
0. 1. 1.
0. 1. 0.
1. 1. 0.
1. 0. 0.
```

10.4 Default Part Colors File Format

This file defines default Constant Colors that are assigned (and cycled through) by EnSight when parts are built. If EnSight does not find a definition file it uses an internal default list. If, however, EnSight does find a file (the file must be called `ensight.part.colors.default` and be located in the `.ensight7` directory of the user's home directory or be located in `$ENSIGHT7_HOME/site_preferences`) at start-up, EnSight will read your colors as the default Constant Colors.

The format of the `ensight.part.colors.default` file is as follows:

- Line 1: "Version 6.0" (Note, this need not match EnSight's version number.)
- Line 2: One integer, the number of default part colors
- Line 3 on: three floats (each ranging between 0. and 1.), the (red, green, blue) color triplet of each color, each listed on separate lines.

An example default file can be found in:

```
$ENSIGHT7_HOME/site_preferences/ensight.part.colors.default
```

on your client system.

The following is an example default part colors file with 6 colors (blue, cyan, green, yellow, red, and magenta):

```
Version 6.0
6
0. 0. 1.
0. 1. 1.
0. 1. 0.
1. 1. 0.
1. 0. 0.
1. 0. 1.
```

10.5 Data Reader Preferences File Format

This is an optional file that will be created when the user saves preferences under Main Menu > Edit > Preferences... Data. It can contain two basic things: 1) the reader name desired to be the default Format in the Data Reader dialog, and/or 2) any reader names that the user does NOT want to appear in the Format list. The default data Format will be "Case" unless this file exists and overrides it. Also, by default, all readers (both internal and User-Defined) will appear in the list of available reader Formats unless specifically set to be removed in this file. The file must be called `ensight_reader_prefs.def` and be located in the `.ensight7` directory of the user's home directory or be located in `$ENSIGHT7_HOME/site_preferences`.

The format of the `ensight_readers_prefs.def` file is as follows:

- Line 1: "Version 7.1" (Note, this need not match EnSight's version number.)
- Line 2: "select *readername*" Where *readername* is the name of the reader that will be used as the default
- Line 3 on: "remove *readername*" Where *readername* is the name of a reader that will NOT be shown in the data reader Format list.

The following is an example data reader preferences file which sets EnSight 5 as the default Format, and causes the Movie, MPGS 4.1, and the SCRYU readers to NOT be available in the list.

```
Version 7.1
select Ensight 5
remove Movie
remove MPGS 4.1
remove SCRYU
```

10.6 MPEG Parameters File

This file sets the parameters used by the MPEG Encoder. MPEG is a lossy video compression standard. As such, there are trade-offs to be made regarding the degree of compression vs. image quality. The MPEG Encoder utilizes a parameters file to set numerous options that affect quality, compression, and other attributes. Three sample parameter files can be found in:

`$ENSIGHT7_HOME/site_preferenses/`

These files roughly correspond to:

high quality/low compression (`cei_mpeg_hi_q.param`)
medium quality/medium compression (`cei_mpeg_med_q.param`)
and low quality/high compression (`cei_mpeg_lo_q.param`).

The format of the parameters file is documented in the PostScript document:

`$ENSIGHT7_HOME/doc/mpeg/mpeg_encode_doc.ps`

The Encoder will read the parameters from `~/.ensight7/cei_mpeg.param` if it exists, otherwise it will use `$ENSIGHT7_HOME/site_preferences/cei_mpeg.param` which is a link to `cei_mpeg_hi_q.param`; thus high quality/low compression is the default.

Note: This is the opposite of the EnSight 6.1 default

Please see the file:

`$ENSIGHT7_HOME/doc/mpeg/README.mpeg`

for further information.

10.7 Parallel Rendering Configuration File

The format of the configuration file for parallel rendering is described in detail in Section 2.15, Parallel Rendering Setup and in How To Setup For Parallel Rendering

11 EnSight Data Formats

This section describes the format for all readable and writable files in EnSight which you may need access to. The formats described are only for those files that are specific to EnSight. We do not describe data formats not developed by CEI (for example, data formats for various analysis codes). For information about these formats, consult the applicable creator.

Note: *If you are using this documentation to produce your own data translator, please make sure that you follow the instructions exactly as specified. In many cases, EnSight reads data in blocks to improve performance. If the format is not followed, the calculations of how much to read for a block will be thrown off. EnSight does little in the way of error checking data files when they are read. In this respect, EnSight sacrifices robustness for performance.*

As an aid to developing translators, a C library is provided that supports input and output of the native EnSight data format in both ASCII and binary versions.

Section 11.1, EnSight Gold Casefile Format describes in detail the EnSight Gold case, geometry, and variable file formats.

Section 11.2, EnSight6 Casefile Format describes in detail the EnSight6 case, geometry, and variable file formats.

Section 11.3, EnSight5 Format describes in detail the EnSight5 geometry and variable file formats.

Section 11.4, FAST UNSTRUCTURED Results File Format describes the “executive” .res file that can be used with FAST unstructured solution and function files.

Section 11.5, FLUENT UNIVERSAL Results File Format describes the “executive” .res file that can be used with FLUENT Universal files for transient models.

Section 11.6, Movie.BYU Results File Format describes the “executive” .res file that can be used with Movie.BYU files.

Section 11.7, PLOT3D Results File Format describes the “executive” .res file that can be used with PLOT3D solution and function files.

Section 11.8, Server-of-Server Casefile Format describes the format of the casefile used with the server-of-server capability of EnSight.

Section 11.9, Periodic Matchfile Format describes the format of the file which can be used to explicitly specify which nodes match from one periodic instance to the next.

Section 11.10, XY Plot Data Format describes the format of the file containing XY plot data.

11.1 EnSight Gold Casefile Format

Include in this section:

EnSight Gold General Description

EnSight Gold data consists of the following files:

- Case (required) (points to all other needed files including model geometry, variables, and possibly measured geometry and variables)

EnSight makes no assumptions regarding the physical significance of the scalar, vector, 2nd order symmetric tensor, and complex variables. These files can be from any discipline. For example, the scalar file can include such things as pressure, temperature, and stress. The vector file can be velocity, displacement, or any other vector data, etc.

In addition, EnSight Gold format handles "undefined" as well as "partial" variable values. (See appropriate subsections later in this chapter for details.)

All variable results for EnSight Gold format are contained in disk files—one variable per file. Additionally, if there are multiple time steps, there must either be a set of disk files for each time step (transient multiple-file format), or all time steps of a particular variable or geometry in one disk file each (transient single-file format).

Sources of EnSight Gold format data include the following:

- Data that can be translated to conform to the EnSight Gold data format (including being written from EnSight itself using the Save Geometric Entities option under File->Save)
- Data that originates from one of the translators supplied with the EnSight application

The EnSight Gold format supports an unstructured defined element set as shown in the figure on the following page. Unstructured data must be defined in this element set. Elements that do not conform to this set must either be subdivided or discarded.

The EnSight Gold format also supports the same structured block data format as EnSight6, which is very similar to the PLOT3D format.

A given EnSight Gold model may have either unstructured data, structured data, or a mixture of both.

This format is somewhat similar to the EnSight6 format, but differs enough to allow for more efficient reading of the data. It is intended for **3D, binary, big** data models.

Note: While an ASCII format is available, it is not intended for use with large models and is in fact subject to limitations such as integer lengths of 10 digits. Use the binary format if your model will exceed 10 digits for node or element numbers or labels.

Starting with version 7, EnSight writes out all model and variable files in EnSight Gold format. Thus, it can be read by all version 7 EnSight licenses (i.e. standard, gold, and custom licenses).

Supported EnSight Gold Elements

The elements that are supported by the EnSight Gold format are:

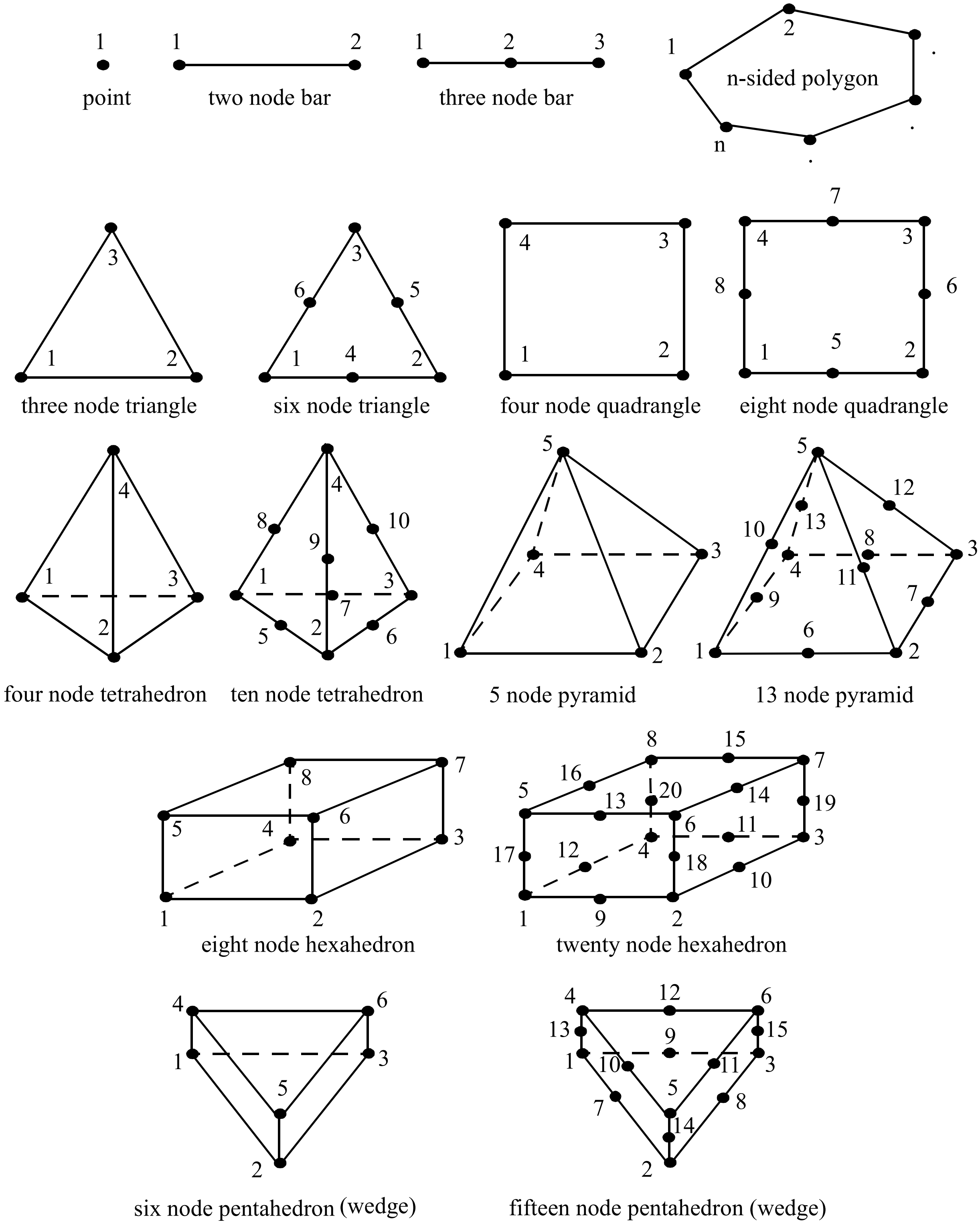


Figure 2-1
Supported EnSight Gold Elements

EnSight Gold Geometry File Format

The EnSight Gold format is part based for both unstructured and structured data. There is no global coordinate array that each part references, but instead - each part contains its own local coordinate array. Thus, the node numbers in element connectivities refer to the coordinate array index, not a node id or label. *This is different than the EnSight6 format!*

The EnSight Gold format consists of keywords followed by information. The following items are important when working with EnSight Gold geometry files:

1. Node ids are optional. In this format they are strictly labels and are not used in the connectivity definition. The element connectivities are based on the local implied node number of the coordinate array in each part, which is sequential starting at one. If you let EnSight assign node IDs, this implied internal numbering is used. If node IDs are set to off, they are numbered internally, however, you will not be able to display or query on them. If you have node IDs given in your data, you can have EnSight ignore them by specifying “node id ignore.” Using this option may reduce some of the memory taken up by the Client and Server, but display and query on the nodes will not be available.
2. Element ids are optional. If you specify element IDs, or you let EnSight assign them, you can show them on the screen. If they are set to off, you will not be able to show or query on them. If you have element IDs given in your data you can have EnSight ignore them by specifying “element id ignore.” Using this option will reduce some of the memory taken up by the Client and Server. This may or may not be a significant amount, and remember that display and query on the elements will not be available.
3. Model extents can be defined in the file so EnSight will not have to determine these while reading in data. If they are not included, EnSight will compute them, but will not actually do so until a dataset query is performed the first time.
4. The format of integers and real numbers **must be followed** (See the Geometry Example below).
5. ASCII Integers are written out using the following integer format:

   From C: `10d` format
   From FORTRAN: `i10` format

   Note: this size of integer format places a limitation on the number of nodes and the node and element labels that can make up a model. Use the binary format for large models!

   ASCII Real numbers are written out using the following floating-point format:

   From C: `12.5e` format
   From FORTRAN: `e12.5` format

   The number of integers or reals per line must also be followed!
6. By default, a Part is processed to show the outside boundaries. This representation is loaded to the Client host system when the geometry file is read (unless other attributes have been set on the workstation, such as feature angle).

7. Coordinates for unstructured data must be defined within each part. This is normally done before any elements are defined within a part, but does not have to be. The different elements can be defined in any order (that is, you can define a hexa8 before a bar2).

8. Parts which contain n-sided polygon elements may not contain other element types. They can however contain several different n-sided sections.

9. A Part containing structured data cannot contain any unstructured element types or more than one block. **Each structured Part is limited to a single block.** A structured block is indicated by following the Part description line with a ‘block’ line. The various options include:

block	(default is curvilinear)
block rectilinear	(uses i,j,k delta vectors)
block uniform	(uses i,j,k delta values)
block iblanked	
block rectilinear iblanked	
block uniform iblanked	

An “iblanked” block must contain an additional integer array of values at each node, traditionally called the iblank array. Valid iblank values for the EnSight Gold format are:

0	for nodes which are exterior to the model, sometimes called blanked-out nodes
1	for nodes which are interior to the model, thus in the free stream and to be used
<0 or >1	for any kind of boundary nodes

In EnSight’s structured Part building dialog, the iblank option selected will control which portion of the structured block is “created”. Thus, from the same structured block, the interior flow field part as well as a symmetry boundary part could be “created”.

Note: By default EnSight does not do any “partial” cell iblank processing. Namely, only complete cells containing no “exterior” nodes are created. It is possible to obtain partial cell processing by issuing the “test:partial_cells_on” command in the Command Dialog before reading the file.

Generic Format

Usage Notes:

In general a `part` can contain several different `element type`s. There are two exceptions to this rule. Parts containing `nsided` polygons cannot contain any other element type, and `block` parts can contain one and only one block.

`element type` can be any of:

point	bar2	bar3
tria3	tria6	quad4
quad8	nsided	tetra4
tetra10	pyramid5	pyramid13
penta6	penta15	hexa8
hexa20		

# = a part number
nn = total number of nodes in a part
ne = number of elements of a given type
np = number of nodes per element for a given element type
id_* = node or element id number
x_* = x component
y_* = y component
z_* = z component
e*_* = node number for an element
ib_* = iblanking value

[ ] contain optional portions
< > contain choices
` indicates the beginning of an unformatted sequential FORTRAN binary write
' indicates the end of an unformatted sequential FORTRAN binary write

C Binary form:

```
C Binary
description line 1                                           80 chars
description line 2                                           80 chars
node id <off/given/assign/ignore>                            80 chars
element id <off/given/assign/ignore>                         80 chars
[extents                                                     80 chars
xmin xmax ymin ymax zmin zmax]                                6 floats
part                                                         80 chars
#                                                             1 int
description line                                             80 chars
coordinates                                                  80 chars
nn                                                            1 int
[id_n1 id_n2 ... id_nn]                                      nn ints
x_n1 x_n2 ... x_nn                                           nn floats
y_n1 y_n2 ... y_nn                                           nn floats
z_n1 z_n2 ... z_nn                                           nn floats
element type                                                 80 chars
ne                                                            1 int
[id_n1 id_n2 ... id_ne]                                      ne ints
e1_n1 e1_n2 ... e1_np
e2_n1 e2_n2 ... e2_np
 .
 .
ne_n1 ne_n2 ... ne_np                                        ne*np ints
element type                                                 80 chars
 .
 .
part                                                         80 chars
 .
 .
part                                                         80 chars
#                                                             1 int
description line                                             80 chars
block [iblanked]                                             80 chars
i j k                        # mm = i*j*k                     3 ints
x_m1 x_m2 ... x_mm                                           mm floats
y_m1 y_m2 ... y_mm                                           mm floats
z_m1 z_m2 ... z_mm                                           mm floats
[ib_m1 ib_m2 ... ib_mm]                                      mm ints
part                                                         80 chars
#                                                             1 int
description line                                             80 chars
block rectilinear [iblanked]                                 80 chars
i j k                        # mm = i*j*k                     3 ints
x_1 x_2 ... x_i                                              i floats
y_1 y_2 ... y_j                                              j floats
z_1 z_2 ... z_k                                              k floats
[ib_m1 ib_m2 ... ib_mm]                                      mm ints
part                                                         80 chars
#                                                             1 int
description line                                             80 chars
block uniform [iblanked]                                     80 chars
i j k                        # mm = i*j*k                     3 ints
x_origin y_origin z_origin                                    3 floats
x_delta y_delta z_delta                                       3 floats
[ib_m1 ib_m2 ... ib_mm]                                      mm ints
```

Fortran Binary form:

```
'Fortran Binary'
'description line 1'                                        80 chars
'description line 2'                                        80 chars
'node id <off/given/assign/ignore>'                         80 chars
'element id <off/given/assign/ignore>'                      80 chars
['extents'                                                  80 chars
'xmin xmax ymin ymax zmin zmax']                             6 floats
'part'                                                      80 chars
'#'                                                          1 int
'description line'                                          80 chars
'coordinates'                                               80 chars
'nn'                                                         1 int
['id_n1 id_n2 ... id_nn']                                   nn ints
'x_n1 x_n2 ... x_nn'                                        nn floats
'y_n1 y_n2 ... y_nn'                                        nn floats
'z_n1 z_n2 ... z_nn'                                        nn floats
'element type'                                              80 chars
'ne'                                                         1 int
['id_n1 id_n2 ... id_ne']                                   ne ints
'e1_n1 e1_n2 ... e1_np
 e2_n1 e2_n2 ... e2_np
 .
 .
 ne_n1 ne_n2 ... ne_np'                                     ne*np ints
'element type'                                              80 chars
 .
 .
'part'                                                      80 chars
 .
 .
'part'                                                      80 chars
'#'                                                          1 int
'description line'                                          80 chars
'block [iblanked]'                                          80 chars
'i j k'                      # mm = i*j*k                    3 ints
'x_m1 x_m2 ... x_mm'                                        mm floats
'y_m1 y_m2 ... y_mm'                                        mm floats
'z_m1 z_m2 ... z_mm'                                        mm floats
['ib_m1 ib_m2 ... ib_mm']                                   mm ints
'part'                                                      80 chars
'#'                                                          1 int
'description line'                                          80 chars
'block rectilinear [iblanked]'                              80 chars
'i j k'                      # mm = i*j*k                    3 ints
'x_1 x_2 ... x_i'                                           i floats
'y_1 y_2 ... y_j'                                           j floats
'z_1 z_2 ... z_k'                                           k floats
['ib_m1 ib_m2 ... ib_mm']                                   mm ints
'part'                                                      80 chars
'#'                                                          1 int
'description line'                                          80 chars
'block uniform [iblanked]'                                  80 chars
'i j k'                      # mm = i*j*k                    3 ints
'x_origin y_origin z_origin                                  3 floats
 x_delta y_delta z_delta'                                    3 floats
['ib_m1 ib_m2 ... ib_mm']                                   mm ints
```

ASCII form:

```
description line 1                                        A (max of 79 typ)
description line 2                                        A
node id <off/given/assign/ignore>                         A
element id <off/given/assign/ignore>                      A
[extents                                                  A
xmin xmax                                                 2E12.5
ymin ymax                                                 2E12.5
zmin zmax]                                                2E12.5
part                                                      A
#                                                         I10
description line                                          A
coordinates                                               A
nn                                                        I10
[id_n1                                                    I10    1/line (nn)
 id_n2
  .
  .
 id_nn]
x_n1                                                      E12.5  1/line (nn)
x_n2
 .
 .
x_nn
y_n1                                                      E12.5  1/line (nn)
y_n2
 .
 .
y_nn
z_n1                                                      E12.5  1/line (nn)
z_n2
 .
 .
z_nn
element type                                              A
ne                                                        I10
[id_n1                                                    I10    1/line (ne)
 id_n2
  .
  .
 id_ne]
e1_n1 e1_n2 ... e1_np                                     I10    np/line
e2_n1 e2_n2 ... e2_np                                 (ne lines)
 .
 .
ne_n1 ne_n2 ... ne_np
element type                                              A
 .
 .
part                                                      A
 .
 .
part                                                      A
#                                                         I10
description line                                          A
block [iblanked]                                          A
i j k                        # mm = i*j*k                 3I10
x_m1                                                      E12.5  1/line (mm)
x_m2
 .
```

```
 .
x_mm
y_m1                                                          E12.5  1/line (mm)
y_m2
 .
 .
y_mm
z_m1                                                          E12.5  1/line (mm)
z_m2
 .
 .
z_mm
[ib_m1                                                        I10    1/line (mm)
 ib_m2
  .
  .
 ib_mm]
part                                                          A
#                                                             I10
description line                                              A
block rectilinear [iblanked]                                  A
i j k                      # mm = i*j*k                       3I10
x_1                                                           E12.5  1/line (i)
x_2
 .
 .
x_i
y_1                                                           E12.5  1/line (j)
y_2
 .
 .
y_j
z_1                                                           E12.5  1/line (k)
z_2
 .
 .
z_k
[ib_m1                                                        I10    1/line (mm)
 ib_m2
  .
  .
 ib_mm]
part                                                          A
#                                                             I10
description line                                              A
block uniform [iblanked]                                      A
i j k                      # mm = i*j*k                       3I10
x_origin                                                      E12/5
y_origin                                                      E12/5
z_origin                                                      E12/5
x_delta                                                       E12.5
y_delta                                                       E12.5
z_delta                                                       E12.5
[ib_m1                                                        I10    1/line (mm)
 ib_m2
  .
  .
 ib_mm]
```

Notes:

- If `node id` is `given` or `ignore`, the [id] section must be there for each part.
- If `element id` is `given` or `ignore`, the [id] section must be there for each `element type` of each part
- If `iblanked` is there, the [ib] section must be there for the block.
- x, y, and z coordinates are mandatory, even if a 2D problem.
- If `block rectilinear`, then the x, y, z coordinates change to the x, y, and z delta vectors.
- If `block uniform`, then the x, y, z coordinates change to the x, y, z coordinates of the origin and the x, y, and z delta values.
- Ids are just labels, the coordinate (or element) order is implied.
- Element blocks for `nsided` elements contain an additional section - **the number of nodes in each element**. See below

C Binary form of element block, if nsided:

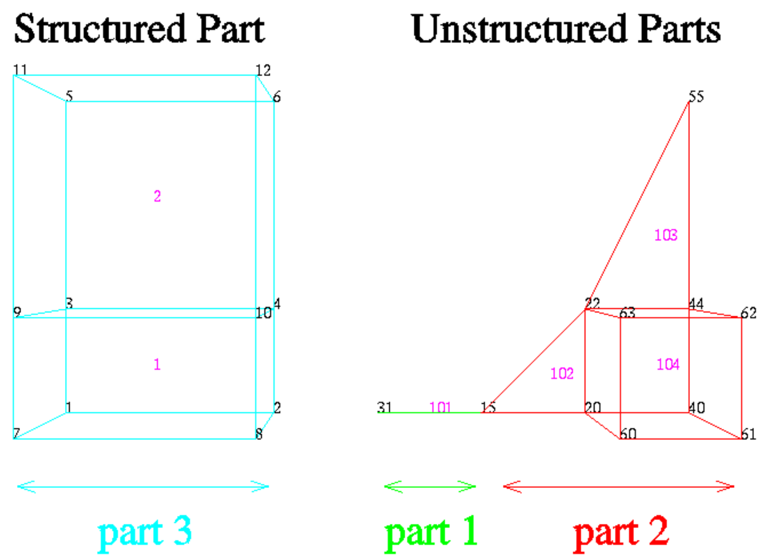
```
nsided                                                       80 chars
ne                                                            1 int
[id_n1 id_n2 ... id_ne]                                      ne ints
np1 np2 ... npne          This data is needed                ne ints
e1_n1 e1_n2 ... e1_np1
e2_n1 e2_n2 ... e2_np2
 .
 .
ne_n1 ne_n2 ... ne_npne                           np1+np2+...+npne ints
```

Fortran Binary form of element block, if nsided:

```
'nsided'                                                     80 chars
'ne'                                                          1 int
['id_n1 id_n2 ... id_ne']                                    ne ints
'np1 np2 ... npne'        This data is needed                ne ints
'e1_n1 e1_n2 ... e1_np1
 e2_n1 e2_n2 ... e2_np2
 .
 .
 ne_n1 ne_n2 ... ne_npne'                         np1+np2+...+npne ints
```

Ascii form of element block, if nsided:

```
nsided                                                       A
ne                                                           I10
[id_n1                                                       I10    1/line (ne)
 id_n2
  .
 id_ne]
np1                       This data is needed                I10    1/line (ne)
np2                        .
  .                        .
npne                       .
e1_n1 e1_n2 ... e1_np1                                       I10    np*/line
e2_n1 e2_n2 ... e2_np2                                    (ne lines)
 .
ne_n1 ne_n2 ... ne_npne
```



EnSight Gold Geometry File Example

The following is an example of an ASCII EnSight Gold geometry file: This is the same example model as given in the EnSight6 geometry file section (only in Gold format) with 11 defined unstructured nodes from which 2 unstructured parts are defined, and a 2x3x2 structured part as depicted in the above diagram.

Note: *The example file below (*`engold.geo`*) and all example variable files in the gold section (also prefixed with* `engold`*) may be found under your EnSight installation directory (path:* `$ENSIGHT7_HOME/data/user_manual`*).*

Note: *The appended "#" comment lines are for your reference only, and are not valid format lines within a geometry file as appended below.* ***Do NOT put these # comments in your file!!!***

```
This is the 1st description line of the EnSight Gold geometry example
This is the 2nd description line of the EnSight Gold geometry example
node id given
element id given
extents
 0.00000e+00 2.00000e+00
 0.00000e+00 2.00000e+00
 0.00000e+00 2.00000e+00
part
         1
2D uns-elements (description line for part 1)
coordinates
        10                # nn               Do NOT put these # comments in your file!!
        15                # node ids
        20
        40
        22
        44
        55
        60
        61
        62
        63
 4.00000e+00              # x components
 5.00000e+00
 6.00000e+00
```

```
 5.00000e+00
 6.00000e+00
 6.00000e+00
 5.00000e+00
 6.00000e+00
 6.00000e+00
 5.00000e+00
 0.00000e+00                # y components
 0.00000e+00
 0.00000e+00
 1.00000e+00
 1.00000e+00
 3.00000e+00
 0.00000e+00
 0.00000e+00
 1.00000e+00
 1.00000e+00
 0.00000e+00                # z components
 0.00000e+00
 0.00000e+00
 0.00000e+00
 0.00000e+00
 0.00000e+00
 2.00000e+00
 2.00000e+00
 2.00000e+00
 2.00000e+00
tria3                       # element type
         2                  # ne
       102                  # element ids
       103
         1         2         4
         4         5         6
hexa8
         1
       104
         2         3         5         4       7       8       9      10
part
         2
1D uns-elements (description line for part 2)
coordinates
         2
        15
        31
 4.00000e+00
 3.00000e+00
 0.00000e+00
 0.00000e+00
 0.00000e+00
 0.00000e+00
bar2
         1
       101
         2         1
part
         3
3D struct-part (description line fro part 3)
block iblanked
         2         3         2
 0.00000e+00                # i components
 2.00000e+00
 0.00000e+00
 2.00000e+00
 0.00000e+00
 2.00000e+00
 0.00000e+00
 2.00000e+00
```

```
0.00000e+00
2.00000e+00
0.00000e+00
2.00000e+00
0.00000e+00                # j components
0.00000e+00
1.00000e+00
1.00000e+00
3.00000e+00
3.00000e+00
0.00000e+00
0.00000e+00
1.00000e+00
1.00000e+00
3.00000e+00
3.00000e+00
0.00000e+00                # k components
0.00000e+00
0.00000e+00
0.00000e+00
0.00000e+00
0.00000e+00
2.00000e+00
2.00000e+00
2.00000e+00
2.00000e+00
2.00000e+00
2.00000e+00
        1                  # iblanking
        1
        1
        1
        1
        1
        1
        1
        1
        1
        1
        1
```

EnSight Gold Case File Format

The Case file is an ASCII free format file that contains all the file and name information for accessing model (and measured) geometry, variable, and time information. It is comprised of five sections (`FORMAT, GEOMETRY, VARIABLE, TIME, FILE`) as described below:

Notes:

All lines in the Case file are limited to 79 characters.

The titles of each section must be in all capital letters.

Anything preceded by a "#" denotes a comment and is ignored. Comments may append information lines or be placed on their own lines.

Information following ":" may be separated by white spaces or tabs.

Specifications encased in "[]" are optional, as indicated.

Format Section

This is a required section which specifies the type of data to be read.

Usage:

```
FORMAT
type:    ensight gold
```

Geometry Section

This is a required section which specifies the geometry information for the model (as well as measured geometry if present, and periodic match file (see Section 11.9, Periodic Matchfile Format) if present).

Usage:

```
GEOMETRY
model:       [ts]   [fs]        filename     [change_coords_only]
measured:    [ts]   [fs]        filename     [change_coords_only]
match:                          filename
```

where: `ts` = time set number as specified in TIME section. This is optional.
`fs` = corresponding file set number as specified in FILE section below.
`filename` = The filename of the appropriate file.
-> Model or measured filenames for a static geometry case, and match filenames will not contain "*" wildcards.
-> Model or measured filenames for a changing geometry case will contain "*" wildcards.
`change_coords_only` = The option to indicate that the changing geometry (as indicated by wildcards in the filename) is coords only. Otherwise, changing geometry connectivity will be assumed.

Variable Section

This is an optional section which specifies the files and names of the variables. Constant variable values can also be set in this section.

Usage:

```
VARIABLE
constant per case:            [ts]          description  const_value(s)
scalar per node:              [ts]  [fs]    description  filename
vector per node:              [ts]  [fs]    description  filename
tensor symm per node:         [ts]  [fs]    description  filename
scalar per element:           [ts]  [fs]    description  filename
vector per element:           [ts]  [fs]    description  filename
tensor symm per element:      [ts]  [fs]    description  filename
scalar per measured node:     [ts]  [fs]    description  filename
vector per measured node:     [ts]  [fs]    description  filename
complex scalar per node:      [ts]  [fs]    description  Re_fn    Im_fn    freq
complex vector per node:      [ts]  [fs]    description  Re_fn    Im_fn    freq
```

```
complex scalar per element:     [ts] [fs] description Re_fn    Im_fn    freq
complex vector per element:     [ts] [fs] description Re_fn    Im_fn    freq
```

where:

`ts`	=	The corresponding time set number (or index) as specified in TIME section below. This is only required for transient constants and variables.
`fs`	=	The corresponding file set number (or index) as specified in FILE section below.
`description`	=	The variable (GUI) name (ex. Pressure, Velocity, etc.)
`const_value(s)`	=	The constant value. If constants change over time, then `ns` (see TIME section below) constant values of `ts`.
`filename`	=	The filename of the variable file. Note: only transient filenames contain "*" wildcards.
`Re_fn`	=	The filename for the file containing the real values of the complex variable.
`Im_fn`	=	The filename for the file containing the imaginary values of the complex variable.
`freq`	=	The corresponding harmonic frequency of the complex variable. For complex variables where harmonic frequency is undefined, simply use the text string: UNDEFINED.

Note: *As many variable description lines as needed may be used.*

Note: *The variable description is limited to 19 characters in the current release. Variable names must not start with a numeric digit and must not contain any of the following reserved characters:*

(	[	+	@	!	*	$
)	]	-	space	#	^	/

Time Section

This is an optional section for steady state cases, but is required for transient cases. It contains time set information. Shown below is information for one time set. Multiple time sets (up to 16) may be specified for measured data as shown in Case File Example 3 below.

Usage:

```
TIME
time set:              ts  [description]
number of steps:       ns
filename start number: fs
filename increment:    fi
time values:           time_1  time_2  .... time_ns
```

or

```
TIME
time set:              ts  [description]
number of steps:       ns
filename numbers:      fn
time values:           time_1  time_2  .... time_ns
```

where: `ts` = timeset number. This is the number referenced in the GEOMETRY and VARIABLE sections.

`description` = optional timeset description which will be shown in user interface.

`ns` = number of transient steps

`fs` = the number to replace the "*" wildcards in the filenames, for the first step

`fi` = the increment to fs for subsequent steps
`time` = the actual time values for each step, each of which must be separated by a white space and which may continue on the next line if needed
`fn` = a list of numbers or indices, to replace the "*" wildcards in the filenames.

File Section

This section is optional for expressing a transient case with single-file formats. This section contains single-file set information. This information specifies the number of time steps in each file of each *data entity*, i.e. each geometry and each variable (model and/or measured). Each data entity's corresponding file set might have multiple *continuation* files due to system file size limit, i.e. ~2 GB for 32-bit and ~4 TB for 64-bit architectures. Each file set corresponds to one and only one time set, but a time set may be referenced by many file sets. The following information may be specified in each file set. For file sets where all of the time set data exceeds the maximum file size limit of the system, both `filename index` and `number of steps` are repeated within the file set definition for each continuation file required. Otherwise `filename index` may be omitted if there is only one file. File set information is shown in Case File Example 4 below.

Usage:

```
FILE
file set:           fs
filename index:     fi  # Note: only used when data continues in other files
number of steps:    ns
```

where: `fs` = file set number. This is the number referenced in the GEOMETRY and VARIABLE sections above.
`ns` = number of transient steps
`fi` = file index number in the file name (replaces "*" in the filenames)

Case File Example 1

The following is a minimal EnSight Gold case file for a steady state model with some results.

Note: this (`engold.case`*) file, as well as all of its referenced geometry and variable files (along with a couple of command files) can be found under your installation directory (path:* `$ENSIGHT7_HOME/data/user_manual`*). The EnSight Gold Geometry File Example and the Variable File Examples are the contents of these files.*

```
FORMAT
type:  ensight gold

GEOMETRY
model:  engold.geo

VARIABLE
constant per case:            Cden   .8

scalar per element:           Esca   engold.Esca
scalar per node:              Nsca   engold.Nsca

vector per element:           Evec   engold.Evec
vector per node:              Nvec   engold.Nvec

tensor symm per element:      Eten   engold.Eten
tensor symm per node:         Nten   engold.Nten

complex scalar per element:   Ecmp   engold.Ecmp_rengold.Ecmp_i2.
complex scalar per node:      Ncmp   engold.Ncmp_rengold.Ncmp_i4.
```

Case File Example 2

The following is a Case file for a transient model. The connectivity of the geometry is also changing.

```
FORMAT
type:  ensight gold

GEOMETRY
model:                 1                        exgold2.geo**

VARIABLE
scalar per node:       1     Stress             exgold2.scl**
vector per node:       1     Displacement       exgold2.dis**

TIME
time set:                    1
number of steps:             3
filename start number:       0
filename increment:          1
time values:       1.0   2.0   3.0
```

The following files would be needed for Example 2:

```
exgold2.geo00        exgold2.scl00        exgold2.dis00
exgold2.geo01        exgold2.scl01        exgold2.dis01
exgold2.geo02        exgold2.scl02        exgold2.dis02
```

Case File Example 3

The following is a Case file for a transient model with measured data.

This example has pressure given per element.

```
FORMAT
type:  ensight gold


GEOMETRY
model:                 1                  exgold3.geo*
measured:              2                  exgold3.mgeo**


VARIABLE
constant per case:                        Gamma       1.4
constant per case:                  1     Density     .9 .9 .7 .6 .6
scalar per element                  1     Pressure          exgold3.pre*
vector per node:                    1     Velocity          exgold3.vel*
scalar per measured node:           2     Temperature       exgold3.mtem**
vector per measured node:           2     Velocity          exgold3.mvel**

TIME
time set:                     1
number of steps:              5
filename start number:        1
filename increment:           2
time values:                  .1 .2 .3          # This example shows that time
                              .4 .5             # values can be on multiple lines
time set:                     2
number of steps:              6
filename start number:        0
filename increment:           2
time values:
.05 .15 .25 .34 .45 .55
```

The following files would be needed for Example 3:

```
exgold3.geo1          exgold3.pre1          exgold3.vel1
exgold3.geo3          exgold3.pre3          exgold3.vel3
exgold3.geo5          exgold3.pre5          exgold3.vel5
exgold3.geo7          exgold3.pre7          exgold3.vel7
exgold3.geo9          exgold3.pre9          exgold3.vel9

exgold3.mgeo00        exgold3.mtem00        exgold3.mvel00
exgold3.mgeo02        exgold3.mtem02        exgold3.mvel02
exgold3.mgeo04        exgold3.mtem04        exgold3.mvel04
exgold3.mgeo06        exgold3.mtem06        exgold3.mvel06
exgold3.mgeo08        exgold3.mtem08        exgold3.mvel08
exgold3.mgeo10        exgold3.mtem10        exgold3.mvel10
```

Case File Example 4

The following is Case File Example 3 expressed in transient single-file formats.

In this example, the transient data for the measured velocity data entity happens to be greater than the maximum file size limit. Therefore, the first four time steps fit and are contained in the first file, and the last two time steps are 'continued' in a second file.

```
FORMAT
type: ensight gold

GEOMETRY
model:                  1     exgold4.geo  1
measured:               2     exgold4.mgeo 2

VARIABLE
constant per case:                        Density          .5
scalar per element:           1     1     Pressure         exgold4.pre
vector per node:              1     1     Velocity         exgold4.vel
scalar per measured node:     2     2     Temperature      exgold4.mtem
vector per measured node:     2     3     Velocity         exgold4.mvel*

TIME
time set:               1     Model
number of steps:        5
time values:            .1 .2 .3 .4 .5

time set:               2     Measured
number of steps:        6
time values:            .05 .15 .25 .34 .45 .55

FILE
file set:               1
number of steps:        5

file set:               2
number of steps:        6

file set:               3
filename index:         1
number of steps:        4
filename index:         2
number of steps:        2
```

The following files would be needed for Example 4:

```
exgold4.geo      exgold4.pre      exgold4.vel
exgold4.mgeoe    exgold4.mtem     exgold4.mvel1
                                  exgold4.mvel2
```

Contents of Transient Single Files

Each file contains transient data that corresponds to the specified number of time steps. The data for each time step sequentially corresponds to the simulation time values `(time values)` found listed in the `TIME` section. In transient single-file format, the data for each time step essentially corresponds to a standard EnSight gold geometry or variable file (model or measured) as expressed in multiple file format. The data for each time step is enclosed between two *wrapper* records, i.e. preceded by a `BEGIN TIME STEP` record and followed by an `END TIME STEP` record. Time step data is not split between files. If there is not enough room to append the data from a time step to the file without exceeding the maximum file limit of a particular system, then a continuation file must be created for the time step data and any subsequent time step. Any type of user comments may be included before and/or after each transient step wrapper.

Note 1: If transient single file format is used, EnSight expects all files of a dataset to be specified in transient single file format. Thus, even static files must be enclosed between a `BEGIN TIME STEP` *and an* `END TIME STEP` *wrapper.*

1. *Note 2: For binary geometry files, the first* `BEGIN TIME STEP` *wrapper must follow the <C Binary/Fortran Binary> line. Both* `BEGIN TIME STEP` *and* `END TIME STEP` *wrappers are written according to type (1) in binary. Namely: This is a write of 80 characters to the file:*

   in C:
   ```
   char buffer[80];
   strcpy(buffer,"BEGIN TIME STEP");
   fwrite(buffer,sizeof(char),80,file_ptr);
   ```

   in FORTRAN:
   ```
   character*80 buffer
   buffer = "BEGIN TIME STEP"
   ```

Note 3: Efficient reading of each file (especially binary) is facilitated by appending each file with a ***file index****. A file index contains appropriate information to access the file byte positions of each time step in the file. (EnSight automatically appends a file index to each file when exporting in transient single file format.) If used, the file index must follow the last* `END TIME STEP` *wrapper in each file.*

File Index Usage:

ASCII	Binary	Item	Description
"%20d\n"	sizeof(int)	n	Total number of data time steps in the file.
"%20d\n"	sizeof(long)	fb_1	File byte loc for contents of 1^{st} time step*
"%20d\n"	sizeof(long)	fb_2	File byte loc for contents of 2^{nd} time step*
. . .	. . .	. . .	. . .
"%20d\n"	sizeof(long)	fb_n	File byte loc for contents of n^{th} time step*
"%20d\n"	sizeof(int)	flag	Miscellaneous flag (= 0 for now)
"%20d\n"	sizeof(long)	fb of item n	File byte loc for Item n above
"%s\n"	sizeof(char)*80	"FILE_INDEX"	File index keyword

* *Each file byte location is the first byte that follows the* `BEGIN TIME STEP` *record.*

Shown below are the contents of each of the above files, using the data files from Case File Example 3 for reference (without FILE_INDEX for simplicity).

Contents of file `exgold4.geo_1`:

BEGIN TIME STEP
Contents of file `exgold3.geo1`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.geo3`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.geo5`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.geo7`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.geo9`
END TIME STEP

Contents of file `exgold4.pre_1`:

BEGIN TIME STEP
Contents of file `exgold3.pre1`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.pre3`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.pre5`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.pre7`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.pre9`
END TIME STEP

Contents of file `exgold4.vel_1`:

BEGIN TIME STEP
Contents of file `exgold3.vel1`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.vel3`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.vel5`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.vel7`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.vel9`
END TIME STEP

Contents of file `exgold4.mgeo_1`:

BEGIN TIME STEP
Contents of file `exgold3.mgeo00`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mgeo02`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mgeo04`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mgeo06`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mgeo08`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mgeo10`
END TIME STEP

Contents of file `exgold4.mtem_1:`

BEGIN TIME STEP
Contents of file `exgold3.mtem00`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mtem02`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mtem04`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mtem06`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mtem08`
END TIME STEP

BEGIN TIME STEP
Contents of file `exgold3.mtem10`
END TIME STEP

Contents of file `exgold4.mvel1_1:`

BEGIN TIME STEP
Contents of file `exgold3.mvel00`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mvel02`
END TIME STEP
BEGIN TIME STEP
Contents of file `exgold3.mvel04`
END TIME STEP
BEGIN TIME STEP
Contents of file exgold3.mvel06
END TIME STEP

Contents of file `exgold4.mvel2_1:`

Comments can precede the beginning wrapper here.

BEGIN TIME STEP
Contents of file `exgold3.mvel08`
END TIME STEP

Comments can go between time step wrappers here.

BEGIN TIME STEP
Contents of file `exgold3.mvel10`
END TIME STEP

Comments can follow the ending time step wrapper.

EnSight Gold Wild Card Name Specification

If multiple time steps are involved, the file names must conform to the EnSight wild-card specification. This specification is as follows:

- File names must include numbers that are in ascending order from beginning to end.
- Numbers in the files names must be zero filled if there is more than one significant digit.
- Numbers can be anywhere in the file name.
- When the file name is specified in the EnSight case file, you must replace the numbers in the file with an asterisk(*). The number of asterisks specified is the number of significant digits. The asterisk must occupy the same place as the numbers in the file names.

EnSight Gold Variable File Format

EnSight Gold variable files can either be per_node or per_element. They cannot be both. However, an EnSight model can have some variables which are per_node and others which are per_element.

EnSight Gold Per_Node Variable File Format

EnSight Gold variable files for per_node variables contain values for each unstructured node and for each structured node. First comes a single description line. Second comes a part line. Third comes a line containing the part number. Fourth comes a 'coordinates' line or a 'block' line. If a 'coordinates' line, the value for each unstructured node of the part follows. If it is a scalar file, there is one value per node, while for vector files there are three values per node (output in the same component order as the coordinates, namely, all x components, then all y components, then all z components). If it is a 'block' line, the value(s) for each structured node follows. The values for each node of the structured block are output in the same IJK order as the coordinates. (The number of nodes in the part are obtained from the corresponding EnSight Gold geometry file.)

C Binary form:

SCALAR FILE:

```
description line 1                                          80 chars
part                                                        80 chars
#                                                            1 int
coordinates                                                 80 chars
s_n1 s_n2 ... s_nn                                          nn floats
part                                                        80 chars
 .
 .
part                                                        80 chars
#                                                            1 int
block                    # mm = i*j*k                       80 chars
s_m1 s_m2 ... s_mm                                          mm floats
```

VECTOR FILE:

```
description line 1                                          80 chars
part                                                        80 chars
#                                                            1 int
coordinates                                                 80 chars
vx_n1 vx_n2 ... vx_nn                                       nn floats
vy_n1 vy_n2 ... vy_nn                                       nn floats
vz_n1 vz_n2 ... vz_nn                                       nn floats
part                                                        80 chars
 .
 .
part                                                        80 chars
#                                                            1 int
block                    # mm = i*j*k                       80 chars
vx_m1 vx_m2 ... vx_mm                                       mm floats
vy_m1 vy_m2 ... vy_mm                                       mm floats
vz_m1 vz_m2 ... vz_mm                                       mm floats
```

TENSOR FILE:

```
description line 1                                          80 chars
part                                                        80 chars
#                                                            1 int
coordinates                                                 80 chars
v11_n1 v11_n2 ... v11_nn                                    nn floats
v22_n1 v22_n2 ... v22_nn                                    nn floats
v33_n1 v33_n2 ... v33_nn                                    nn floats
v12_n1 v12_n2 ... v12_nn                                    nn floats
v13_n1 v13_n2 ... v13_nn                                    nn floats
v23_n1 v23_n2 ... v23_nn                                    nn floats
part                                                        80 chars
 .
 .
part                                                        80 chars
#                                                            1 int
block                    # mm = i*j*k                       80 chars
v11_m1 v11_m2 ... v11_mm                                    mm floats
```

```
v22_m1 v22_m2 ... v22_mm                              mm floats
v33_m1 v33_m2 ... v33_mm                              mm floats
v12_m1 v12_m2 ... v12_mm                              mm floats
v13_m1 v13_m2 ... v13_mm                              mm floats
v23_m1 v23_m2 ... v23_mm                              mm floats
```

TENSOR9 FILE:

```
description line 1                                    80 chars
part                                                  80 chars
#                                                      1 int
coordinates                                           80 chars
v11_n1 v11_n2 ... v11_nn                              nn floats
v12_n1 v12_n2 ... v12_nn                              nn floats
v13_n1 v13_n2 ... v13_nn                              nn floats
v21_n1 v21_n2 ... v21_nn                              nn floats
v22_n1 v22_n2 ... v22_nn                              nn floats
v23_n1 v23_n2 ... v23_nn                              nn floats
v31_n1 v31_n2 ... v31_nn                              nn floats
v32_n1 v32_n2 ... v32_nn                              nn floats
v33_n1 v33_n2 ... v33_nn                              nn floats
part                                                  80 chars
 .
 .
part                                                  80 chars
#                                                      1 int
block                   # mm = i*j*k                  80 chars
v11_m1 v11_m2 ... v11_mm                              mm floats
v12_m1 v12_m2 ... v12_mm                              mm floats
v13_m1 v13_m2 ... v13_mm                              mm floats
v21_m1 v21_m2 ... v21_mm                              mm floats
v22_m1 v22_m2 ... v22_mm                              mm floats
v23_m1 v23_m2 ... v23_mm                              mm floats
v21_m1 v21_m2 ... v21_mm                              mm floats
v22_m1 v22_m2 ... v22_mm                              mm floats
v23_m1 v23_m2 ... v23_mm                              mm floats
```

COMPLEX SCALAR FILES (Real and/or Imaginary):

```
description line 1                                    80 chars
part                                                  80 chars
#                                                      1 int
coordinates                                           80 chars
s_n1 s_n2 ... s_nn                                    nn floats
part                                                  80 chars
 .
 .
part                                                  80 chars
#                                                      1 int
block                   # mm = i*j*k                  80 chars
s_m1 s_m2 ... s_mm                                    mm floats
```

COMPLEX VECTOR FILES (Real and/or Imaginary):

```
description line 1                                    80 chars
part                                                  80 chars
#                                                      1 int
coordinates                                           80 chars
vx_n1 vx_n2 ... vx_nn                                 nn floats
vy_n1 vy_n2 ... vy_nn                                 nn floats
```

```
vz_n1 vz_n2 ... vz_nn                                       nn floats
part                                                        80 chars
 .
 .
part                                                        80 chars
#                                                            1 int
block                   # mm = i*j*k                        80 chars
vx_m1 vx_m2 ... vx_mm                                       mm floats
vy_m1 vy_m2 ... vy_mm                                       mm floats
vz_m1 vz_m2 ... vz_mm                                       mm floats
```

Fortran Binary form:

SCALAR FILE:

```
'description line 1'                                        80 chars
'part'                                                      80 chars
'#'                                                          1 int
'coordinates'                                               80 chars
's_n1 s_n2 ... s_nn'                                        nn floats
'part'                                                      80 chars
 .
 .
'part'                                                      80 chars
'#'                                                          1 int
'block'                   # mm = i*j*k                      80 chars
's_m1 s_m2 ... s_mm'                                        mm floats
```

VECTOR FILE:

```
'description line 1'                                        80 chars
'part'                                                      80 chars
'#'                                                          1 int
'coordinates'                                               80 chars
'vx_n1 vx_n2 ... vx_nn'                                     nn floats
'vy_n1 vy_n2 ... vy_nn'                                     nn floats
'vz_n1 vz_n2 ... vz_nn'                                     nn floats
'part'                                                      80 chars
 .
 .
'part'                                                      80 chars
'#'                                                          1 int
'block'                   # mm = i*j*k                      80 chars
'vx_m1 vx_m2 ... vx_mm'                                     mm floats
'vy_m1 vy_m2 ... vy_mm'                                     mm floats
'vz_m1 vz_m2 ... vz_mm'                                     mm floats
```

TENSOR FILE:

```
'description line 1'                                        80 chars
'part'                                                      80 chars
'#'                                                          1 int
'coordinates'                                               80 chars
'v11_n1 v11_n2 ... v11_nn'                                  nn floats
'v22_n1 v22_n2 ... v22_nn'                                  nn floats
'v33_n1 v33_n2 ... v33_nn'                                  nn floats
'v12_n1 v12_n2 ... v12_nn'                                  nn floats
```

```
'v13_n1 v13_n2 ... v13_nn'                                  nn floats
'v23_n1 v23_n2 ... v23_nn'                                  nn floats
'part'                                                      80 chars
 .
 .
'part'                                                      80 chars
'#'                                                          1 int
'block'                  # mm = i*j*k                       80 chars
'v11_m1 v11_m2 ... v11_mm'                                  mm floats
'v22_m1 v22_m2 ... v22_mm'                                  mm floats
'v33_m1 v33_m2 ... v33_mm'                                  mm floats
'v12_m1 v12_m2 ... v12_mm'                                  mm floats
'v13_m1 v13_m2 ... v13_mm'                                  mm floats
'v23_m1 v23_m2 ... v23_mm'                                  mm floats
```

TENSOR9 FILE:

```
'description line 1'                                        80 chars
'part'                                                      80 chars
'#'                                                          1 int
'coordinates'                                               80 chars
'v11_n1 v11_n2 ... v11_nn'                                  nn floats
'v12_n1 v12_n2 ... v12_nn'                                  nn floats
'v13_n1 v13_n2 ... v13_nn'                                  nn floats
'v21_n1 v21_n2 ... v21_nn'                                  nn floats
'v22_n1 v22_n2 ... v22_nn'                                  nn floats
'v23_n1 v23_n2 ... v23_nn'                                  nn floats
'v31_n1 v31_n2 ... v31_nn'                                  nn floats
'v32_n1 v32_n2 ... v32_nn'                                  nn floats
'v33_n1 v33_n2 ... v33_nn'                                  nn floats
'part'                                                      80 chars
 .
 .
'part'                                                      80 chars
'#'                                                          1 int
'block'                  # mm = i*j*k                       80 chars
'v11_m1 v11_m2 ... v11_mm'                                  mm floats
'v12_m1 v12_m2 ... v12_mm'                                  mm floats
'v13_m1 v13_m2 ... v13_mm'                                  mm floats
'v21_m1 v21_m2 ... v21_mm'                                  mm floats
'v22_m1 v22_m2 ... v22_mm'                                  mm floats
'v23_m1 v23_m2 ... v23_mm'                                  mm floats
'v31_m1 v31_m2 ... v31_mm'                                  mm floats
'v32_m1 v32_m2 ... v32_mm'                                  mm floats
'v33_m1 v33_m2 ... v33_mm'                                  mm floats
```

COMPLEX SCALAR FILES (Real and/or Imaginary):

```
'description line 1'                                        80 chars
'part'                                                      80 chars
'#'                                                          1 int
'coordinates'                                               80 chars
's_n1 s_n2 ... s_nn'                                        nn floats
'part'                                                      80 chars
 .
 .
'part'                                                      80 chars
'#'                                                          1 int
'block'                  # mm = i*j*k                       80 chars
's_m1 s_m2 ... s_mm'                                        mm floats
```

COMPLEX VECTOR FILES (Real and/or Imaginary):

```
'description line 1'                                    80 chars
'part'                                                  80 chars
'#'                                                      1 int
'coordinates'                                           80 chars
'vx_n1 vx_n2 ... vx_nn'                                 nn floats
'vy_n1 vy_n2 ... vy_nn'                                 nn floats
'vz_n1 vz_n2 ... vz_nn'                                 nn floats
'part'                                                  80 chars
 .
 .
'part'                                                  80 chars
'#'                                                      1 int
'block'                   # mm = i*j*k                  80 chars
'vx_m1 vx_m2 ... vx_mm'                                 mm floats
'vy_m1 vy_m2 ... vy_mm'                                 mm floats
'vz_m1 vz_m2 ... vz_mm'                                 mm floats
```

ASCII form:

SCALAR FILE:

```
description line 1                                      A (max of 79 typ)
part                                                    A
#                                                       I10
coordinates                                             A
s_n1                                                    E12.5  1/line (nn)
s_n2
 .
 .
s_nn
part                                                    A
 .
 .
part                                                    A
#                                                       I10
block                      # mm = i*j*k                 A
s_m1                                                    E12.5  1/line (mm)
s_m2
 .
 .
s_mm
```

VECTOR FILE:

```
description line 1                                      A (max of 79 typ)
part                                                    A
#                                                       I10
coordinates                                             A
vx_n1                                                   E12.5  1/line (nn)
vx_n2
 .
 .
vx_nn
```

```
vy_n1                                          E12.5  1/line (nn)
vy_n2
 .
 .
vy_nn
vz_n1                                          E12.5  1/line (nn)
vz_n2
 .
 .
vz_nn
part                                           A
 .
 .
part                                           A
#                                              I10
block                  # mm = i*j*k            A
vx_m1                                          E12.5  1/line (mm)
vx_m2
 .
 .
vx_mm
vy_m1                                          E12.5  1/line (mm)
vy_m2
 .
 .
vy_mm
vz_m1                                          E12.5  1/line (mm)
vz_m2
 .
 .
vz_mm
```

TENSOR FILE:

```
description line 1                             A (max of 79 typ)
part                                           A
#                                              I10
coordinates                                    A
v11_n1                                         E12.5  1/line (nn)
v11_n2
 .
 .
v11_nn
v22_n1                                         E12.5  1/line (nn)
v22_n2
 .
 .
v22_nn
v33_n1                                         E12.5  1/line (nn)
v33_n2
 .
 .
v33_nn
v12_n1                                         E12.5  1/line (nn)
v12_n2
 .
 .
v12_nn
v13_n1                                         E12.5  1/line (nn)
v13_n2
 .
```

```
 .
v13_nn
v23_n1                                        E12.5  1/line (nn)
v23_n2
 .
 .
v23_nn
part                                          A
 .
 .
part                                          A
#                                             I10
block                   # mm = i*j*k          A
v11_m1                                        E12.5  1/line (mm)
v11_m2
 .
 .
v11_mm
v22_m1                                        E12.5  1/line (mm)
v22_m2
 .
 .
v22_mm
v33_m1                                        E12.5  1/line (mm)
v33_m2
 .
 .
v33_mm
v12_m1                                        E12.5  1/line (mm)
v12_m2
 .
 .
v12_mm
v13_m1                                        E12.5  1/line (mm)
v13_m2
 .
 .
v13_mm
v23_m1                                        E12.5  1/line (mm)
v23_m2
 .
 .
v23_mm
```

TENSOR9 FILE:

```
description line 1                            A (max of 79 typ)
part                                          A
#                                             I10
coordinates                                   A
v11_n1                                        E12.5  1/line (nn)
v11_n2
 .
 .
v11_nn
v12_n1                                        E12.5  1/line (nn)
v12_n2
 .
 .
v12_nn
v13_n1                                        E12.5  1/line (nn)
```

```
v13_n2
 .
 .
v13_nn
v21_n1                                          E12.5  1/line (nn)
v21_n2
 .
 .
v21_nn
v22_n1                                          E12.5  1/line (nn)
v22_n2
 .
 .
v22_nn
v23_n1                                          E12.5  1/line (nn)
v23_n2
 .
 .
v23_nn
v31_n1                                          E12.5  1/line (nn)
v31_n2
 .
 .
v31_nn
v32_n1                                          E12.5  1/line (nn)
v32_n2
 .
 .
v32_nn
v33_n1                                          E12.5  1/line (nn)
v33_n2
 .
 .
v33_nn
part                                            A
 .
 .
part                                            A
#                                               I10
block                    # mm = i*j*k           A
v11_m1                                          E12.5  1/line (mm)
v11_m2
 .
 .
v11_mm
v12_m1                                          E12.5  1/line (mm)
v12_m2
 .
 .
v12_mm
v13_m1                                          E12.5  1/line (mm)
v13_m2
 .
 .
v13_mm
v21_m1                                          E12.5  1/line (mm)
v21_m2
 .
 .
v21_mm
v22_m1                                          E12.5  1/line (mm)
```

```
v22_m2
 .
 .
v22_mm
v23_m1                                                E12.5  1/line (mm)
v23_m2
 .
 .
v23_mm
v31_m1                                                E12.5  1/line (mm)
v31_m2
 .
 .
v31_mm
v32_m1                                                E12.5  1/line (mm)
v32_m2
 .
 .
v32_mm
v33_m1                                                E12.5  1/line (mm)
v33_m2
 .
 .
v33_mm
```

COMPLEX SCALAR FILES (Real and/or Imaginary):

```
description line 1                                    A (max of 79 typ)
part                                                  A
#                                                     I10
coordinates                                           A
s_n1                                                  E12.5  1/line (nn)
s_n2
 .
 .
s_nn
part                                                  A
 .
 .
part                                                  A
#                                                     I10
block                      # mm = i*j*k               A
s_m1                                                  E12.5  1/line (mm)
s_m2
 .
 .
s_mm
```

COMPLEX VECTOR FILES (Real and/or Imaginary):

```
description line 1                                    A (max of 79 typ)
part                                                  A
#                                                     I10
coordinates                                           A
vx_n1                                                 E12.5  1/line (nn)
vx_n2
 .
 .
```

```
vx_nn
vy_n1                                                  E12.5  1/line (nn)
vy_n2
 .
 .
vy_nn
vz_n1                                                  E12.5  1/line (nn)
vz_n2
 .
 .
vz_nn
part                                                   A
 .
 .
part                                                   A
#                                                      I10
block                        # mm = i*j*k              A
vx_m1                                                  E12.5  1/line (mm)
vx_m2
 .
 .
vx_mm
vy_m1                                                  E12.5  1/line (mm)
vy_m2
 .
 .
vy_mm
vz_m1                                                  E12.5  1/line (mm)
vz_m2
 .
 .
vz_mm
```

The following variable file examples reflect scalar, vector, tensor, and complex variable values *per node* for the previously defined EnSight6 Gold Geometry File Example with 11 defined unstructured nodes and a 2x3x2 structured Part (Part number 3). The values are summarized in the following table.

Note: *These are the same values as listed in the EnSight6 per_node variable file section. Subsequently, the following example files contain the same data as the example files given in the EnSight6 section - only they are listed in gold format. (No asymmetric tensor example data given)*

	Node Index	Node Id	Scalar Value	Vector Values	Tensor (2nd order symm.) Values	ComplexScalar Real Value	Imaginary Value
Unstructured							
	1	15	(1.)	(1.1, 1.2, 1.3)	(1.1, 1.2, 1.3, 1.4, 1.5, 1.6)	(1.1)	(1.2)
	2	31	(2.)	(2.1, 2.2, 2.3)	(2.1, 2.2, 2.3, 2.4, 2.5, 2.6)	(2.1)	(2.2)
	3	20	(3.)	(3.1, 3.2, 3.3)	(3.1, 3.2, 3.3, 3.4, 3.5, 3.6)	(3.1)	(3.2)
	4	40	(4.)	(4.1, 4.2, 4.3)	(4.1, 4.2, 4.3, 4.4, 4.5, 4.6)	(4.1)	(4.2)
	5	22	(5.)	(5.1, 5.2, 5.3)	(5.1, 5.2, 5.3, 5.4, 5.5, 5.6)	(5.1)	(5.2)
	6	44	(6.)	(6.1, 6.2, 6.3)	(6.1, 6.2, 6.3, 6.4, 6.5, 6.6)	(6.1)	(6.2)
	7	55	(7.)	(7.1, 7.2, 7.3)	(7.1, 7.2, 7.3, 7.4, 7.5, 7.6)	(7.1)	(7.2)
	8	60	(8.)	(8.1, 8.2, 8.3)	(8.1, 8.2, 8.3, 8.4, 8.5, 8.60	(8.1)	(8.2)
	9	61	(9.)	(9.1, 9.2, 9.3)	(9.1, 9.2, 9.3, 9.4, 9.5, 9.6)	(9.1)	(9.2)
	10	62	(10.)	(10.1,10.2,10.3)	(10.1,10.2,10.3,10.4,10.5,10.6)	(10.1)	(10.2)
	11	63	(11.)	(11.1,11.2,11.3)	(11.1,11.2,11.3,11.4,11.5,11.6)	(11.1)	(11.2)
Structured							
	1	1	(1.)	(1.1, 1.2, 1.3)	(1.1, 1.2, 1.3, 1.4, 1.5, 1.6)	(1.1)	(1.2)
	2	2	(2.)	(2.1, 2.2, 2.3)	(2.1, 2.2, 2.3, 2.4, 2.5, 2.6)	(2.1)	(2.2)
	3	3	(3.)	(3.1, 3.2, 3.3)	(3.1, 3.2, 3.3, 3.4, 3.5, 3.6)	(3.1)	(3.2)
	4	4	(4.)	(4.1, 4.2, 4.3)	(4.1, 4.2, 4.3, 4.4, 4.5, 4.6)	(4.1)	(4.2)
	5	5	(5.)	(5.1, 5.2, 5.3)	(5.1, 5.2, 5.3, 5.4, 5.5, 5.6)	(5.1)	(5.2)
	6	6	(6.)	(6.1, 6.2, 6.3)	(6.1, 6.2, 6.3, 6.4, 6.5, 6.6)	(6.1)	(6.2)
	7	7	(7.)	(7.1, 7.2, 7.3)	(7.1, 7.2, 7.3, 7.4, 7.5, 7.6)	(7.1)	(7.2)
	8	8	(8.)	(8.1, 8.2, 8.3)	(8.1, 8.2, 8.3, 8.4, 8.5, 8.6)	(8.1)	(8.2)
	9	9	(9.)	(9.1, 9.2, 9.3)	(9.1, 9.2, 9.3, 9.4, 9.5, 9.6)	(9.1)	(9.2)
	10	10	(10.)	(10.1,10.2,10.3)	(10.1,10.2,10.3,10.4,10.5,10.6)	(10.1)	(10.2)
	11	11	(11.)	(11.1,11.2,11.3)	(11.1,11.2,11.3,11.4,11.5,11.6)	(11.1)	(11.2)
	12	12	(12.)	(12.1,12.2,12.3)	(12.1,12.2,12.3,12.4,12.5,12.6)	(12.1)	(12.2)

Per_node (Scalar) Variable Example 1: This shows an ASCII scalar file (`engold.Nsca`) for the gold geometry example.

```
Per_node scalar values for the EnSight Gold geometry example
part
         1
coordinates
 1.00000E+00
 3.00000E+00
 4.00000E+00
 5.00000E+00
 6.00000E+00
 7.00000E+00
 8.00000E+00
 9.00000E+00
 1.00000E+01
 1.10000E+01
part
         2
coordinates
 1.00000E+00
 2.00000E+00
```

```
part
         3
block
 1.00000E+00
 2.00000E+00
 3.00000E+00
 4.00000E+00
 5.00000E+00
 6.00000E+00
 7.00000E+00
 8.00000E+00
 9.00000E+00
 1.00000E+01
 1.10000E+01
 1.20000E+01
```

Per_node (Vector) Variable Example 2: This example shows an ASCII vector file (`engold.Nvec`) for the gold geometry example.

```
Per_node vector values for the EnSight Gold geometry example
part
         1
coordinates
 1.10000E+00
 3.10000E+00
 4.10000E+00
 5.10000E+00
 6.10000E+00
 7.10000E+00
 8.10000E+00
 9.10000E+00
 1.01000E+01
 1.11000E+01
 1.20000E+00
 3.20000E+00
 4.20000E+00
 5.20000E+00
 6.20000E+00
 7.20000E+00
 8.20000E+00
 9.20000E+00
 1.02000E+01
 1.12000E+01
 1.30000E+00
 3.30000E+00
 4.30000E+00
 5.30000E+00
 6.30000E+00
 7.30000E+00
 8.30000E+00
 9.30000E+00
 1.03000E+01
 1.13000E+01
part
         2
coordinates
 1.10000E+00
 2.10000E+00
 1.20000E+00
 2.20000E+00
 1.30000E+00
 2.30000E+00
part
         3
block
 1.10000E+00
```

```
 2.10000E+00
 3.10000E+00
 4.10000E+00
 5.10000E+00
 6.10000E+00
 7.10000E+00
 8.10000E+00
 9.10000E+00
 1.01000E+01
 1.11000E+01
 1.21000E+01
 1.20000E+00
 2.20000E+00
 3.20000E+00
 4.20000E+00
 5.20000E+00
 6.20000E+00
 7.20000E+00
 8.20000E+00
 9.20000E+00
 1.02000E+01
 1.12000E+01
 1.22000E+01
 1.30000E+00
 2.30000E+00
 3.30000E+00
 4.30000E+00
 5.30000E+00
 6.30000E+00
 7.30000E+00
 8.30000E+00
 9.30000E+00
 1.03000E+01
 1.13000E+01
 1.23000E+01
```

Per_node (Tensor) Variable Example 3: This example shows an ASCII 2nd order symmetric tensor file (`engold.Nten`) for the gold geometry example.

```
Per_node symmetric tensor values for the EnSight Gold geometry example
part
         1
coordinates
 1.10000E+00
 3.10000E+00
 4.10000E+00
 5.10000E+00
 6.10000E+00
 7.10000E+00
 8.10000E+00
 9.10000E+00
 1.01000E+01
 1.11000E+01
 1.20000E+00
 3.20000E+00
 4.20000E+00
 5.20000E+00
 6.20000E+00
 7.20000E+00
 8.20000E+00
 9.20000E+00
 1.02000E+01
 1.12000E+01
 1.30000E+00
 3.30000E+00
 4.30000E+00
```

```
 5.30000E+00
 6.30000E+00
 7.30000E+00
 8.30000E+00
 9.30000E+00
 1.03000E+01
 1.13000E+01
 1.40000E+00
 3.40000E+00
 4.40000E+00
 5.40000E+00
 6.40000E+00
 7.40000E+00
 8.40000E+00
 9.40000E+00
 1.04000E+01
 1.14000E+01
 1.50000E+00
 3.50000E+00
 4.50000E+00
 5.50000E+00
 6.50000E+00
 7.50000E+00
 8.50000E+00
 9.50000E+00
 1.05000E+01
 1.15000E+01
 1.60000E+00
 3.60000E+00
 4.60000E+00
 5.60000E+00
 6.60000E+00
 7.60000E+00
 8.60000E+00
 9.60000E+00
 1.06000E+01
 1.16000E+01
part
         2
coordinates
 1.10000E+00
 2.10000E+00
 1.20000E+00
 2.20000E+00
 1.30000E+00
 2.30000E+00
 1.40000E+00
 2.40000E+00
 1.50000E+00
 2.50000E+00
 1.60000E+00
 2.60000E+00
part
         3
block
 1.10000E+00
 2.10000E+00
 3.10000E+00
 4.10000E+00
 5.10000E+00
 6.10000E+00
 7.10000E+00
 8.10000E+00
 9.10000E+00
 1.01000E+01
 1.11000E+01
 1.21000E+01
```

```
1.20000E+00
2.20000E+00
3.20000E+00
4.20000E+00
5.20000E+00
6.20000E+00
7.20000E+00
8.20000E+00
9.20000E+00
1.02000E+01
1.12000E+01
1.22000E+01
1.30000E+00
2.30000E+00
3.30000E+00
4.30000E+00
5.30000E+00
6.30000E+00
7.30000E+00
8.30000E+00
9.30000E+00
1.03000E+01
1.13000E+01
1.23000E+01
1.40000E+00
2.40000E+00
3.40000E+00
4.40000E+00
5.40000E+00
6.40000E+00
7.40000E+00
8.40000E+00
9.40000E+00
1.04000E+01
1.14000E+01
1.24000E+01
1.50000E+00
2.50000E+00
3.50000E+00
4.50000E+00
5.50000E+00
6.50000E+00
7.50000E+00
8.50000E+00
9.50000E+00
1.05000E+01
1.15000E+01
1.25000E+01
1.60000E+00
2.60000E+00
3.60000E+00
4.60000E+00
5.60000E+00
6.60000E+00
7.60000E+00
8.60000E+00
9.60000E+00
1.06000E+01
1.16000E+01
1.26000E+01
```

Per_node (Complex) Variable Example 4: This example shows ASCII complex real (`engold.Ncmp_r`) and imaginary (`engold.Ncmp_i`) *scalar* files for the gold geometry example. (The same methodology would apply for complex real and imaginary *vector* files.)

Real scalar File:

```
Per_node complex real scalar values for the EnSight Gold geometry example
part
         1
coordinates
 1.10000E+00
 3.10000E+00
 4.10000E+00
 5.10000E+00
 6.10000E+00
 7.10000E+00
 8.10000E+00
 9.10000E+00
 1.01000E+01
 1.11000E+01
part
         2
coordinates
 1.10000E+00
 2.10000E+00
part
         3
block
 1.10000E+00
 2.10000E+00
 3.10000E+00
 4.10000E+00
 5.10000E+00
 6.10000E+00
 7.10000E+00
 8.10000E+00
 9.10000E+00
 1.01000E+01
 1.11000E+01
 1.21000E+01
```

Imaginary scalar File:

```
Per_node complex imaginary scalar values for the EnSight Gold geometry example
part
         1
coordinates
 1.20000E+00
 3.20000E+00
 4.20000E+00
 5.20000E+00
 6.20000E+00
 7.20000E+00
 8.20000E+00
 9.20000E+00
 1.02000E+01
 1.12000E+01
part
         2
coordinates
 1.20000E+00
 2.20000E+00
part
         3
block
```

```
 1.20000E+00
 2.20000E+00
 3.20000E+00
 4.20000E+00
 5.20000E+00
 6.20000E+00
 7.20000E+00
 8.20000E+00
 9.20000E+00
 1.02000E+01
 1.12000E+01
 1.22000E+01
```

EnSight Gold Per_Element Variable File Format

EnSight Gold variable files for per_element variables contain values for each element of designated types of designated Parts. First comes a single description line. Second comes a Part line. Third comes a line containing the part number. Fourth comes an element type line and then comes the value for each element of that type and part. If it is a scalar variable, there is one value per element, while for vector variables there are three values per element. (The number of elements of the given type are obtained from the corresponding EnSight Gold geometry file.)

C Binary form:

SCALAR FILE:

```
description line 1                                          80 chars
part                                                        80 chars
#                                                            1 int
element type                                                80 chars
s_e1 s_e2 ... s_ne                                          ne floats
element type                                                80 chars
 .
 .
part                                                        80 chars
 .
 .
part                                                        80 chars
#                                                            1 int
block                    # mm = (i-1)*(j-1)*(k-1)           80 chars
s_m1 s_m2 ... s_mm                                          mm floats
```

VECTOR FILE:

```
description line 1                                          80 chars
part                                                        80 chars
#                                                            1 int
element type                                                80 chars
vx_e1 vx_e2 ... vx_ne                                       ne floats
vy_e1 vy_e2 ... vy_ne                                       ne floats
vz_e1 vz_e2 ... vz_ne                                       ne floats
element type                                                80 chars
 .
 .
```

```
part                                                        80 chars
 .
 .
part                                                        80 chars
#                                                            1 int
block                    # mm = (i-1)*(j-1)*(k-1)           80 chars
vx_m1 vx_m2 ... vx_mm                                       mm floats
vy_m1 vy_m2 ... vy_mm                                       mm floats
vz_m1 vz_m2 ... vz_mm                                       mm floats
```

TENSOR FILE:

```
description line 1                                          80 chars
part                                                        80 chars
#                                                            1 int
element type                                                80 chars
v11_e1 v11_e2 ... v11_ne                                    ne floats
v22_e1 v22_e2 ... v22_ne                                    ne floats
v33_e1 v33_e2 ... v33_ne                                    ne floats
v12_e1 v12_e2 ... v12_ne                                    ne floats
v13_e1 v13_e2 ... v13_ne                                    ne floats
v23_e1 v23_e2 ... v23_ne                                    ne floats
element type                                                80 chars
 .
 .
part                                                        80 chars
 .
 .
part                                                        80 chars
#                                                            1 int
block                    # mm = (i-1)*(j-1)*(k-1)           80 chars
v11_m1 v11_m2 ... v11_mm                                    mm floats
v22_m1 v22_m2 ... v22_mm                                    mm floats
v33_m1 v33_m2 ... v33_mm                                    mm floats
v12_m1 v12_m2 ... v12_mm                                    mm floats
v13_m1 v13_m2 ... v13_mm                                    mm floats
v23_m1 v23_m2 ... v23_mm                                    mm floats
```

TENSOR9 FILE:

```
description line 1                                          80 chars
part                                                        80 chars
#                                                            1 int
element type                                                80 chars
v11_e1 v11_e2 ... v11_ne                                    ne floats
v12_e1 v12_e2 ... v12_ne                                    ne floats
v13_e1 v13_e2 ... v13_ne                                    ne floats
v21_e1 v21_e2 ... v21_ne                                    ne floats
v22_e1 v22_e2 ... v22_ne                                    ne floats
v23_e1 v23_e2 ... v23_ne                                    ne floats
v31_e1 v31_e2 ... v31_ne                                    ne floats
v32_e1 v32_e2 ... v32_ne                                    ne floats
v33_e1 v33_e2 ... v33_ne                                    ne floats
element type                                                80 chars
 .
 .
part                                                        80 chars
 .
 .
```

```
part                                                      80 chars
#                                                          1 int
block                    # mm = (i-1)*(j-1)*(k-1)         80 chars
v11_m1 v11_m2 ... v11_mm                                  mm floats
v12_m1 v12_m2 ... v12_mm                                  mm floats
v13_m1 v13_m2 ... v13_mm                                  mm floats
v21_m1 v21_m2 ... v21_mm                                  mm floats
v22_m1 v22_m2 ... v22_mm                                  mm floats
v23_m1 v23_m2 ... v23_mm                                  mm floats
v31_m1 v31_m2 ... v31_mm                                  mm floats
v32_m1 v32_m2 ... v32_mm                                  mm floats
v33_m1 v33_m2 ... v33_mm                                  mm floats
```

COMPLEX SCALAR FILES (Real and/or Imaginary):

```
description line 1                                        80 chars
part                                                      80 chars
#                                                          1 int
element type                                              80 chars
s_e1 s_e2 ... s_ne                                        ne floats
element type                                              80 chars
 .
 .
part                                                      80 chars
 .
 .
part                                                      80 chars
#                                                          1 int
block                    # mm = (i-1)*(j-1)*(k-1)         80 chars
s_m1 s_m2 ... s_mm                                        mm floats
```

COMPLEX VECTOR FILES (Real and/or Imaginary):

```
description line 1                                        80 chars
part                                                      80 chars
#                                                          1 int
element type                                              80 chars
vx_e1 vx_e2 ... vx_ne                                     ne floats
vy_e1 vy_e2 ... vy_ne                                     ne floats
vz_e1 vz_e2 ... vz_ne                                     ne floats
element type                                              80 chars
 .
 .
part                                                      80 chars
 .
 .
part                                                      80 chars
#                                                          1 int
block                    # mm = (i-1)*(j-1)*(k-1)         80 chars
vx_m1 vx_m2 ... vx_mm                                     mm floats
vy_m1 vy_m2 ... vy_mm                                     mm floats
vz_m1 vz_m2 ... vz_mm                                     mm floats
```

Fortran Binary form:

SCALAR FILE:

```
'description line 1'                                      80 chars
'part'                                                    80 chars
```

```
'#'                                                      1 int
'element type'                                          80 chars
's_e1 s_e2 ... s_ne'                                    ne floats
'element type'                                          80 chars
 .
 .
'part'                                                  80 chars
 .
 .
'part'                                                  80 chars
'#'                                                      1 int
'block'                # mm = (i-1)*(j-1)*(k-1)         80 chars
's_m1 s_m2 ... s_mm'                                    mm floats
```

VECTOR FILE:

```
'description line 1'                                    80 chars
'part'                                                  80 chars
'#'                                                      1 int
'element type'                                          80 chars
'vx_e1 vx_e2 ... vx_ne'                                 ne floats
'vy_e1 vy_e2 ... vy_ne'                                 ne floats
'vz_e1 vz_e2 ... vz_ne'                                 ne floats
'element type'                                          80 chars
 .
 .
'part'                                                  80 chars
 .
 .
'part'                                                  80 chars
'#'                                                      1 int
'block'                # mm = (i-1)*(j-1)*(k-1)         80 chars
'vx_m1 vx_m2 ... vx_mm'                                 mm floats
'vy_m1 vy_m2 ... vy_mm'                                 mm floats
'vz_m1 vz_m2 ... vz_mm'                                 mm floats
```

TENSOR FILE:

```
'description line 1'                                    80 chars
'part'                                                  80 chars
'#'                                                      1 int
'element type'                                          80 chars
'v11_e1 v11_e2 ... v11_ne'                              ne floats
'v22_e1 v22_e2 ... v22_ne'                              ne floats
'v33_e1 v33_e2 ... v33_ne'                              ne floats
'v12_e1 v12_e2 ... v12_ne'                              ne floats
'v13_e1 v13_e2 ... v13_ne'                              ne floats
'v23_e1 v23_e2 ... v23_ne'                              ne floats
'element type'                                          80 chars
 .
 .
'part'                                                  80 chars
 .
 .
'part'                                                  80 chars
'#'                                                      1 int
'block'                # mm = (i-1)*(j-1)*(k-1)         80 chars
'v11_m1 v11_m2 ... v11_mm'                              mm floats
'v22_m1 v22_m2 ... v22_mm'                              mm floats
```

```
'v33_m1 v33_m2 ... v33_mm'                              mm floats
'v12_m1 v12_m2 ... v12_mm'                              mm floats
'v13_m1 v13_m2 ... v13_mm'                              mm floats
'v23_m1 v23_m2 ... v23_mm'                              mm floats
```

TENSOR9 FILE:

```
'description line 1'                                    80 chars
'part'                                                  80 chars
'#'                                                      1 int
'element type'                                          80 chars
'v11_e1 v11_e2 ... v11_ne'                              ne floats
'v12_e1 v12_e2 ... v12_ne'                              ne floats
'v13_e1 v13_e2 ... v13_ne'                              ne floats
'v21_e1 v21_e2 ... v21_ne'                              ne floats
'v22_e1 v22_e2 ... v22_ne'                              ne floats
'v23_e1 v23_e2 ... v23_ne'                              ne floats
'v31_e1 v31_e2 ... v31_ne'                              ne floats
'v32_e1 v32_e2 ... v32_ne'                              ne floats
'v33_e1 v33_e2 ... v33_ne'                              ne floats
'element type'                                          80 chars
 .
 .
'part'                                                  80 chars
 .
 .
'part'                                                  80 chars
'#'                                                      1 int
'block'              # mm = (i-1)*(j-1)*(k-1)           80 chars
'v11_m1 v11_m2 ... v11_mm'                              mm floats
'v12_m1 v12_m2 ... v12_mm'                              mm floats
'v13_m1 v13_m2 ... v13_mm'                              mm floats
'v21_m1 v21_m2 ... v21_mm'                              mm floats
'v22_m1 v22_m2 ... v22_mm'                              mm floats
'v23_m1 v23_m2 ... v23_mm'                              mm floats
'v31_m1 v31_m2 ... v31_mm'                              mm floats
'v32_m1 v32_m2 ... v32_mm'                              mm floats
'v33_m1 v33_m2 ... v33_mm'                              mm floats
```

COMPLEX SCALAR FILES (Real and/or Imaginary):

```
'description line 1'                                    80 chars
'part'                                                  80 chars
'#'                                                      1 int
'element type'                                          80 chars
's_e1 s_e2 ... s_ne'                                    ne floats
'element type'                                          80 chars
 .
 .
'part'                                                  80 chars
 .
 .
'part'                                                  80 chars
'#'                                                      1 int
'block'              # mm = (i-1)*(j-1)*(k-1)           80 chars
's_m1 s_m2 ... s_mm'                                    mm floats
```

COMPLEX VECTOR FILES (Real and/or Imaginary):

```
'description line 1'                                   80 chars
'part'                                                 80 chars
'#'                                                     1 int
'element type'                                         80 chars
'vx_e1 vx_e2 ... vx_ne'                                ne floats
'vy_e1 vy_e2 ... vy_ne'                                ne floats
'vz_e1 vz_e2 ... vz_ne'                                ne floats
'element type'                                         80 chars
 .
 .
'part'                                                 80 chars
 .
 .
'part'                                                 80 chars
'#'                                                     1 int
'block'                 # mm = (i-1)*(j-1)*(k-1)       80 chars
'vx_m1 vx_m2 ... vx_mm'                                mm floats
'vy_m1 vy_m2 ... vy_mm'                                mm floats
'vz_m1 vz_m2 ... vz_mm'                                mm floats
```

ASCII form:

SCALAR FILE:

```
description line 1                                     A (max of 80 typ)
part                                                   A
#                                                      I10
element type                                           A
s_e1                                                   12.5  1/line (ne)
s_e2
 .
 .
s_ne
element type                                           A
 .
 .
part                                                   A
 .
 .
part                                                   A
#                                                      I10
block                   # mm = (i-1)*(j-1)*(k-1)       A
s_m1                                                   E12.5  1/line (mm)
s_m2
 .
 .
s_mm
```

VECTOR FILE:

```
description line 1                                     A (max of 80 typ)
part                                                   A
#                                                      I10
element type                                           A
vx_e1                                                  E12.5  1/line (ne)
vx_e2
 .
```

```
 .
vx_ne
vy_e1                                                    E12.5  1/line (ne)
vy_e2
 .
 .
vy_ne
vz_e1                                                    E12.5  1/line (ne)
vz_e2
 .
 .
vz_ne
element type                                             A
 .
 .
part                                                     A
 .
 .
part                                                     A
#                                                        I10
block                    # mm = (i-1)*(j-1)*(k-1)        A
vx_m1                                                    E12.5  1/line (mm)
vx_m2
 .
 .
vx_mm
vy_m1                                                    E12.5  1/line (mm)
vy_m2
 .
 .
vy_mm
vz_m1                                                    E12.5  1/line (mm)
vz_m2
 .
 .
vz_mm
```

TENSOR FILE:

```
description line 1                                       A (max of 80 typ)
part                                                     A
#                                                        I10
element type                                             A
v11_e1                                                   E12.5  1/line (ne)
v11_e2
 .
 .
v11_ne
v22_e1                                                   E12.5  1/line (ne)
v22_e2
 .
 .
v22_ne
v33_e1                                                   E12.5  1/line (ne)
v33_e2
 .
 .
v33_ne
v12_e1                                                   E12.5  1/line (ne)
v12_e2
 .
```

```
 .
v12_ne
v13_e1                                                        E12.5  1/line (ne)
v13_e2
 .
 .
v13_ne
v23_e1                                                        E12.5  1/line (ne)
v23_e2
 .
 .
v23_ne
element type                                                  A
 .
 .
part                                                          A
 .
 .
part                                                          A
#                                                             I10
block                    # mm = (i-1)*(j-1)*(k-1)             A
v11_m1                                                        E12.5  1/line (mm)
v11_m2
 .
 .
v11_mm
v22_m1                                                        E12.5  1/line (mm)
v22_m2
 .
 .
v22_mm
v33_m1                                                        E12.5  1/line (mm)
v33_m2
 .
 .
v33_mm
v12_m1                                                        E12.5  1/line (mm)
v12_m2
 .
 .
v12_mm
v13_m1                                                        E12.5  1/line (mm)
v13_m2
 .
 .
v13_mm
v23_m1                                                        E12.5  1/line (mm)
v23_m2
 .
 .
v23_mm
```

TENSOR9 FILE:

```
description line 1                                            A (max of 80 typ)
part                                                          A
#                                                             I10
element type                                                  A
v11_e1                                                        E12.5  1/line (ne)
v11_e2
 .
```

```
 .
v11_ne
v12_e1                                                E12.5  1/line (ne)
v12_e2
 .
 .
v12_ne
v13_e1                                                E12.5  1/line (ne)
v13_e2
 .
 .
v13_ne
v21_e1                                                E12.5  1/line (ne)
v21_e2
 .
 .
v21_ne
v22_e1                                                E12.5  1/line (ne)
v22_e2
 .
 .
v22_ne
v23_e1                                                E12.5  1/line (ne)
v23_e2
 .
 .
v23_ne
v31_e1                                                E12.5  1/line (ne)
v31_e2
 .
 .
v31_ne
v32_e1                                                E12.5  1/line (ne)
v32_e2
 .
 .
v32_ne
v33_e1                                                E12.5  1/line (ne)
v33_e2
 .
 .
v33_ne
element type                                          A
 .
 .
part                                                  A
 .
 .
part                                                  A
#                                                     I10
block                  # mm = (i-1)*(j-1)*(k-1)       A
v11_m1                                                E12.5  1/line (mm)
v11_m2
 .
 .
v11_mm
v12_m1                                                E12.5  1/line (mm)
v12_m2
 .
 .
v12_mm
```

```
v13_m1                                              E12.5  1/line (mm)
v13_m2
 .
 .
v13_mm
v21_m1                                              E12.5  1/line (mm)
v21_m2
 .
 .
v21_mm
v22_m1                                              E12.5  1/line (mm)
v22_m2
 .
 .
v22_mm
v23_m1                                              E12.5  1/line (mm)
v23_m2
 .
 .
v23_mm
v31_m1                                              E12.5  1/line (mm)
v31_m2
 .
 .
v31_mm
v32_m1                                              E12.5  1/line (mm)
v32_m2
 .
 .
v32_mm
v33_m1                                              E12.5  1/line (mm)
v33_m2
 .
 .
v33_mm
```

COMPLEX SCALAR FILES (Real and/or Imaginary):

```
description line 1                                  A (max of 80 typ)
part                                                A
#                                                   I10
element type                                        A
s_e1                                                12.5  1/line (ne)
s_e2
 .
 .
s_ne
element type                                        A
 .
 .
part                                                A
 .
 .
part                                                A
#                                                   I10
block                # mm = (i-1)*(j-1)*(k-1)       A
s_m1                                                E12.5  1/line (mm)
s_m2
 .
```

```
 .
s_mm
```

COMPLEX VECTOR FILES (Real and/or Imaginary):

```
description line 1                                      A (max of 80 typ)
part                                                    A
#                                                       I10
element type                                            A
vx_e1                                                   E12.5  1/line (ne)
vx_e2
 .
 .
vx_ne
vy_e1                                                   E12.5  1/line (ne)
vy_e2
 .
 .
vy_ne
vz_e1                                                   E12.5  1/line (ne)
vz_e2
 .
 .
vz_ne
element type                                            A
 .
 .
part                                                    A
 .
 .
part                                                    A
#                                                       I10
block                    # mm = (i-1)*(j-1)*(k-1)       A
vx_m1                                                   E12.5  1/line (mm)
vx_m2
 .
 .
vx_mm
vy_m1                                                   E12.5  1/line (mm)
vy_m2
 .
 .
vy_mm
vz_m1                                                   E12.5  1/line (mm)
vz_m2
 .
 .
vz_mm
```

The following variable file examples reflect scalar, vector, tensor, and complex variable values *per element* for the previously defined EnSight Gold Geometry File Example with 11 defined unstructured nodes and a 2x3x2 structured Part (Part number 3). The values are summarized in the following table

Note: *These are the same values as listed in the EnSight6 per_element variable file section. Subsequently, the following example files contain the same data as the example files in the EnSight6 section - only they are listed in gold format.. (No asymmetric tensor example data given)*

	Element Index	Element Id	Scalar Value	Vector Values	Tensor (2nd order symm.) Values	Complex Scalar Real Value	Complex Scalar Imaginary Value
Unstructured							
bar2							
	1	101	(1.)	(1.1, 1.2, 1.3)	(1.1, 1.2, 1.3, 1.4, 1.5, 1.6)	(1.1)	(1.2)
tria3							
	1	102	(2.)	(2.1, 2.2, 2.3)	(2.1, 2.2, 2.3, 2.4, 2.5, 2.6)	(2.1)	(2.2)
	2	103	(3.)	(3.1, 3.2, 3.3)	(3.1, 3.2, 3.3, 3.4, 3.5, 3.6)	(3.1)	(3.2)
hexa8							
	1	104	(4.)	(4.1, 4.2, 4.3)	(4.1, 4.2, 4.3, 4.4, 4.5, 4.6)	(4.1)	(4.2)
Structured							
block	1	1	(5.)	(5.1, 5.2, 5.3)	(5.1, 5.2, 5.3, 5.4, 5.5, 5.6)	(5.1)	(5.2)

Per_element (Scalar) Variable Example 1: This example shows an ASCII scalar file (`engold.Esca`) for the gold geometry example.

```
Per_elem scalar values for the EnSight Gold geometry example
part
         1
tria3
 2.00000E+00
 3.00000E+00
hexa8
 4.00000E+00
part
         2
bar2
 1.00000E+00
part
         3
block
 5.00000E+00
 6.00000E+00
```

Per_element (Vector) Variable Example 2: This example shows an ASCII vector file (`engold.Evec`) for the gold geometry example.

```
Per_elem vector values for the EnSight Gold geometry example
part
         1
tria3
 2.10000E+00
 3.10000E+00
 2.20000E+00
 3.20000E+00
```

```
 2.30000E+00
 3.30000E+00
hexa8
 4.10000E+00
 4.20000E+00
 4.30000E+00
part
         2
bar2
 1.10000E+00
 1.20000E+00
 1.30000E+00
part
         3
block
 5.10000E+00
 6.10000E+00
 5.20000E+00
 6.20000E+00
 5.30000E+00
 6.30000E+00
```

Per_element (Tensor) Variable Example3: This example shows an ASCII 2nd order symmetric tensor file (`engold.Eten`) for the gold geometry example.

```
Per_elem symmetric tensor values for the EnSight Gold geometry example
part
         1
tria3
 2.10000E+00
 3.10000E+00
 2.20000E+00
 3.20000E+00
 2.30000E+00
 3.30000E+00
 2.40000E+00
 3.40000E+00
 2.50000E+00
 3.50000E+00
 2.60000E+00
 3.60000E+00
hexa8
 4.10000E+00
 4.20000E+00
 4.30000E+00
 4.40000E+00
 4.50000E+00
 4.60000E+00
part
         2
bar2
 1.10000E+00
 1.20000E+00
 1.30000E+00
 1.40000E+00
 1.50000E+00
 1.60000E+00
part
         3
block
```

```
 5.10000E+00
 6.10000E+00
 5.20000E+00
 6.20000E+00
 5.30000E+00
 6.30000E+00
 5.40000E+00
 6.40000E+00
 5.50000E+00
 6.50000E+00
 5.60000E+00
 6.60000E+00
```

Per_element (Complex) Variable Example 4: This example shows ASCII complex real (`engold.Ecmp_r`) and imaginary (`engold.Ecmp_i`) *scalar* files for the gold geometry example. (The same methodology would apply for complex real and imaginary *vector* files.)

Real scalar File:

```
Per_elem complex real scalar values for the EnSight Gold geometry example
part
         1
tria3
 2.10000E+00
 3.10000E+00
hexa8
 4.10000E+00
part
         2
bar2
 1.10000E+00
part
         3
block
 5.10000E+00
 6.10000E+00
```

Imaginary scalar File:

```
Per_elem complex imaginary scalar values for the EnSight Gold geometry example
part
         1
tria3
 2.20000E+00
 3.20000E+00
hexa8
 4.20000E+00
part
         2
bar2
 1.20000E+00
part
         3
block
 5.20000E+00
 6.20000E+00
```

EnSight Gold Undefined Variable Values Format

Undefined variable values are allowed in EnSight Gold scalar, vector, tensor and complex variable file formats. Undefined values are specified on a "per section" basis (i.e. `coordinates, element_type`, or `block`) in each EnSight Gold variable file. EnSight first parses any undefined keyword "undef" that may follow the sectional keyword (i.e. `coordinates undef`, `element_type undef`, or `block undef`) on its line. This indicates that the next floating point value is the undefined value used in that section. EnSight reads this undefined value, reads all subsequent variable values for that section; and then converts any undefined (file section) values to an internal undefined value recognized computationally by EnSight (Note: the internal, or computational, undefined value can be changed by the user via the "`test: change_undef_value`" command **before any data is read**.)

The following per_node and per_element ASCII scalar files contain examples of undefined values. For your comparison, these two files are the files `engold.Nsca` and `engold.Esca` written with some undefined values specified. Note that the undefined values per section need not be the same value; rather, it may be any value - usually outside the interval range of the variable. *The same methodology applies to vector, tensor, and complex files*.

C Binary form: (Per_node)

SCALAR FILE:

```
description line 1                                          80 chars
part                                                        80 chars
#                                                            1 int
coordinates undef                                           80 chars
undef_value                                                  1  float
s_n1 s_n2 ... s_nn                                          nn floats
part                                                        80 chars
 .
 .
part                                                        80 chars
#                                                            1 int
block undef                  # mm = i*j*k                   80 chars
undef_value                                                  1 float
s_m1 s_m2 ... s_mm                                          mm floats
```

Fortran Binary form: (Per_node)

SCALAR FILE:

```
'description line 1'                                        80 chars
'part'                                                      80 chars
'#'                                                          1 int
'coordinates undef'                                         80 chars
'undef_value'                                                1 float
's_n1 s_n2 ... s_nn'                                        nn floats
'part'                                                      80 chars
 .
 .
'part'                                                      80 chars
'#'                                                          1 int
```

```
'block undef'              # mm = i*j*k           80 chars
'undef_value'                                      1 float
's_m1 s_m2 ... s_mm'                              mm floats
```

ASCII form: (Per_node)

SCALAR FILE:

```
description line 1                                A (max of 79 typ)
part                                              A
#                                                 I10
coordinates undef                                 A
undef_value                                       E12.5
s_n1                                              E12.5  1/line (nn)
s_n2
 .
 .
s_nn
part                                              A
 .
 .
part                                              A
#                                                 I10
block undef                # mm = i*j*k           A
undef_value                                       E12.5
s_m1                                              E12.5  1/line (mm)
s_m2
 .
 .
s_mm
```

Undefined per_node (Scalar) Variable Example: This example shows undefined data in an ASCII scalar file (`engold.Nsca_u`) for the gold geometry example.

```
Per_node undefined scalar values for the EnSight Gold geometry example
part
         1
coordinates undef
-1.00000E+04
-1.00000E+04
 3.00000E+00
 4.00000E+00
 5.00000E+00
 6.00000E+00
 7.00000E+00
 8.00000E+00
 9.00000E+00
 1.00000E+01
 1.10000E+01
part
         2
coordinates
 1.00000E+00
 2.00000E+00
part
         3
block undef
-1.23450E-10
 1.00000E+00
 2.00000E+00
```

```
 3.00000E+00
 4.00000E+00
 5.00000E+00
-1.23450E-10
 7.00000E+00
 8.00000E+00
 9.00000E+00
 1.00000E+01
 1.10000E+01
 1.20000E+01
```

C Binary form: (Per_element)

SCALAR FILE:

```
description line 1                                         80 chars
part                                                       80 chars
#                                                           1 int
element type undef                                         80 chars
undef_value                                                 1 float
s_e1 s_e2 ... s_ne                                         ne floats
element type undef                                         80 chars
undef_value                                                 1 float
.
 .
part                                                       80 chars
 .
 .
part                                                       80 chars
#                                                           1 int
block undef                  # mm = (i-1)*(j-1)*(k-1)      80 chars
undef_value                                                 1 float
s_m1 s_m2 ... s_mm                                         mm floats
```

Fortran Binary form: (Per_element)

SCALAR FILE:

```
'description line 1'                                       80 chars
'part'                                                     80 chars
'#'                                                         1 int
'element type undef'                                       80 chars
'undef_value'                                               1 float
's_e1 s_e2 ... s_ne'                                       ne floats
'element type undef'                                       80 chars
'undef_value'                                               1 float
.
 .
'part'                                                     80 chars
 .
 .
'part'                                                     80 chars
'#'                                                         1 int
'block undef'                 # mm = (i-1)*(j-1)*(k-1)     80 chars
'undef_value'                                               1 float
```

```
's_m1 s_m2 ... s_mm'                                        mm floats
```

ASCII form: (Per_element)

SCALAR FILE:

```
description line 1                                          A (max of 80 typ)
part                                                        A
#                                                           I10
element type undef                                          A
undef_value                                                 E12.5
s_e1                                                        E12.5  1/line (ne)
s_e2
 .
 .
s_ne
element type undef                                          A
undef_value                                                 E12.5
 .
 .
part                                                        A
 .
 .
part                                                        A
#                                                           I10
block undef                 # mm = (i-1)*(j-1)*(k-1)        A
undef_value                                                 E12.5
s_m1                                                        E12.5  1/line (mm)
s_m2
 .
 .
s_mm
```

Undefined per_element (Scalar) Variable Example: This example shows undefined data in an ASCII scalar file (`engold.Esca_u`) for the gold geometry example.

```
Per_elem undefined scalar values for the EnSight Gold geometry example
part
         1
tria3 undef
-1.00000E+02
 2.00000E+00
-1.00000E+02
hexa8
 4.00000E+00
part
         2
bar2
 1.00000E+00
part
         3
block undef
-1.23450E-10
-1.23450E-10
6.00000E+00
```

EnSight Gold Partial Variable Values Format

Partial variable values are allowed in EnSight Gold scalar, vector, tensor and complex variable file formats. Partial values are specified on a "per section" basis (i.e. `coordinates, element_type`, or `block`) in each EnSight Gold variable file. EnSight first parses any partial keyword "`partial`" that may follow the sectional keyword (i.e. `coordinates partial`, `element_type partial`, or `block partial`) on its line. This indicates that the next integer value is the number of partial values defined in that section. EnSight reads the number of defined partial values, next reads this number of integer partial indicies, and finally reads all corresponding partial variable values for that section. Afterwords, any variable value not specified in the list of partial indices is assigned the internal "undefined" (see previous section) value. Values interpolated between time steps must be defined for both time steps; otherwise, they are undefined.

The following per_node and per_element ASCII scalar files contain examples of partial values. For your comparison, these two files are the files `engold.Nsca` and `engold.Esca` written with some partial values specified. The same methodology applies to vector, tensor, and complex files.

C Binary form: (Per_node)

SCALAR FILE:

```
description line 1                                            80 chars
part                                                          80 chars
#                                                              1 int
coordinates partial                                           80 chars
nn                                                             1 int
i_n1 i_n2 ... i_nn                                            nn  ints
s_n1 s_n2 ... s_nn                                            nn floats
part                                                          80 chars
 .
 .
part                                                          80 chars
#                                                              1 int
block partial                   # mm = i*j*k                  80 chars
mm                                                             1 int
i_m1 i_m2 ... i_mm                                            mm  ints
s_m1 s_m2 ... s_mm                                            mm floats
```

Fortran Binary form: (Per_node)

SCALAR FILE:

```
'description line 1'                                          80 chars
'part'                                                        80 chars
'#'                                                            1 int
'coordinates partial'                                         80 chars
'nn'                                                           1 int
'i_n1 i_n2 ... i_nn'                                          nn ints
's_n1 s_n2 ... s_nn'                                          nn floats
'part'                                                        80 chars
 .
```

```
 .
'part'                                                    80 chars
'#'                                                        1 int
'block partial'                  # mm = i*j*k             80 chars
'mm'                                                       1 int
'i_m1 i_m2  ...  i_mm'                                    mm ints
's_m1 s_m2 ... s_mm'                                      mm floats
```

ASCII form: (Per_node)

SCALAR FILE:

```
description line 1                                        A (max of 79 typ)
part                                                      A
#                                                         I10
coordinates partial                                       A
nn                                                        I10
i_n1                                                      I10  1/line (nn)
i_n2
 .
 .
i_nn
s_n1                                                      E12.5  1/line (nn)
s_n2
 .
 .
s_nn
part                                                      A
 .
 .
part                                                      A
#                                                         I10
block partial                     # mm = i*j*k            A
mm                                                        I10
i_m1                                                      I10  1/line (mm)
i_m2
 .
 .
i_mm
s_m1                                                      E12.5  1/line (mm)
s_m2
 .
 .
s_mm
```

Partial per_node (Scalar) Variable Example: This example shows partial data in an ASCII scalar file (engold.Nsca_p) for the gold geometry example.

```
Per_node partial scalar values for the EnSight Gold geometry example
part
         1
coordinates partial
         9
         2
         3
         4
         5
         6
         7
         8
```

```
         9
        10
 3.00000E+00
 4.00000E+00
 5.00000E+00
 6.00000E+00
 7.00000E+00
 8.00000E+00
 9.00000E+00
 1.00000E+01
 1.10000E+01
part
         2
coordinates
 1.00000E+00
 2.00000E+00
part
         3
block
 1.00000E+00
 2.00000E+00
 3.00000E+00
 4.00000E+00
 5.00000E+00
 6.00000E+00
 7.00000E+00
 8.00000E+00
 9.00000E+00
 1.00000E+01
 1.10000E+01
 1.20000E+01
```

C Binary form: (Per_element)

SCALAR FILE:

```
description line 1                                          80 chars
part                                                        80 chars
#                                                            1 int
element type partial                                        80 chars
ne                                                           1 int
i_n1 i_n2 ... i_ne                                          ne ints
s_e1 s_e2 ... s_ne                                          ne floats
element type partial                                        80 chars
ne                                                           1 int
i_n1 i_n2 ... i_ne                                          ne ints
 .
 .
part                                                        80 chars
 .
 .
part                                                        80 chars
#                                                            1 int
block partial                # me= (i-1)*(j-1)*(k-1)        80 chars
me                                                           1 int
i_m1 i_m2 ... i_me                                          me ints
s_m1 s_m2 ... s_me                                          me floats
```

Fortran Binary form: (Per_element)

SCALAR FILE:

```
'description line 1'                                  80 chars
'part'                                                80 chars
'#'                                                    1 int
'element type partial'                                80 chars
'ne'                                                   1 int
'i_n1 i_n2 ... i_ne'                                  ne ints
's_e1 s_e2 ... s_ne'                                  ne floats
'element type partial'                                80 chars
'ne'                                                   1 int
'i_n1 i_n2 ... i_ne'                                  ne ints
  .
  .
'part'                                                80 chars
  .
 .
'part'                                                80 chars
'#'                                                    1 int
'block partial'            # me = (i-1)*(j-1)*(k-1)   80 chars
'me'                                                   1 int
'i_m1 i_m2 ... i_me'                                  me ints
's_m1 s_m2 ... s_me'                                  me floats
```

ASCII form: (Per_element)

SCALAR FILE:

```
description line 1                                    A (max of 80 typ)
part                                                  A
#                                                     I10
element type partial                                  A
ne                                                    I10
i_n1                                                  I10  1/line  (ne)
i_n2
 .
 .
i_ne
s_e1                                                  E12.5  1/line (ne)
s_e2
 .
 .
s_ne
element type partial                                  A
ne                                                    I10
i_n1                                                  I10  1/line  (ne)
i_n2
 .
 .
i_ne
 .
 .
part                                                  A
 .
 .
part                                                  A
```

```
#                                               I10
block partial          # me = (i-1)*(j-1)*(k-1)  A
me                                              I10
i_m1                                            I10  1/line  (me)
i_m2
 .
 .
i_me
s_m1                                            E12.5  1/line (me)
s_m2
 .
 .
s_me
```

Partial per_element (Scalar) Variable Example: This example shows partial data in an ASCII scalar file (`engold.Esca_p`) for the gold geometry example.

```
Per_elem partial scalar values for the EnSight Gold geometry example
part
         1
tria3 partial
         1
         1
 2.00000E+00
hexa8
 4.00000E+00
part
         2
bar2
 1.00000E+00
part
         3
block partial
         1
         2
 6.00000E+00
```

EnSight Gold Measured/Particle File Format

The format of a Measured/Particle geometry file is as follows:

- Line 1

  This line is a description line.

- Line 2

  Indicates that this file contains particle coordinates. The words "`particle coordinates`" should be entered on this line without the quotes.

- Line 3

  Specifies the number of Particles.

- Line 4 through the end of the file.

  Each line contains the ID and the X, Y, and Z coordinates of each Particle. The format of this line is "integer real real real" written out in the following format:

  From C: `%8d%12.5e%12.5e%12.5e` format

From FORTRAN: `i8, 3e12.5` format

A generic measured/Particle geometry file is as follows:

```
A description line
particle coordinates
#_of_Particles
id xcoord ycoord zcoord
id xcoord ycoord zcoord
id xcoord ycoord zcoord
 .
 .
 .
```

Measured Geometry Example

The following illustrates a measured/Particle file with seven points:

```
This is a simple measured geometry file
particle coordinates
       7
     101 0.00000E+00 0.00000E+00 0.00000E+00
     102 1.00000E+00 0.00000E+00 0.00000E+00
     103 1.00000E+00 1.00000E+00 0.00000E+00
     104 0.00000E+00 1.00000E+00 0.00000E+00
     205 5.00000E-01 0.00000E+00 2.00000E+00
     206 5.00000E-01 1.00000E+00 2.00000E+00
     307 0.00000E+00 0.00000E+00-1.50000E+00
```

Measured Variable Files

Measured variable files are the same as **EnSight6 case** per_node variable files. *Please note that they are NOT the same as the EnSight gold per_node variable files.*

11.2 EnSight6 Casefile Format

Included in this section:

EnSight6 General Description

EnSight6 data consists of the following files:

- Case (required) (points to all other needed files including model geometry, variables, and possibly measured geometry and variables)

EnSight6 supports constant result values as well as scalar, vector, 2nd order symmetric tensor, and complex variable fields.

EnSight makes no assumptions regarding the physical significance of the variable values in the files. These files can be from any discipline. For example, the scalar file can include such things as pressure, temperature, and stress. The vector file can be velocity, displacement, or any other vector data. And so on.

All variable results for EnSight6 are contained in disk files—one variable per file. Additionally, if there are multiple time steps, there must either be a set of disk files for each time step (transient multiple-file format), or all time steps of a particular variable or geometry in one disk file (transient single-file format). Thus, all EnSight6 transient geometry and variable files can be expressed in either multiple file format or single file format.

Sources of EnSight6 data include the following:

- Data that can be translated to conform to the EnSight6 data format
- Data that originates from one of the translators supplied with the EnSight application

The EnSight6 format supports an unstructured defined element set as shown in the figure on the following page. Unstructured data must be defined in this element set. Elements that do not conform to this set must either be subdivided or discarded. The EnSight6 format also supports a structured block data format which is very similar to the PLOT3D format. A given EnSight6 model may have either unstructured data, structured data, or a mixture of both.

Supported EnSight Elements

The elements that are supported by the EnSight6 format are:

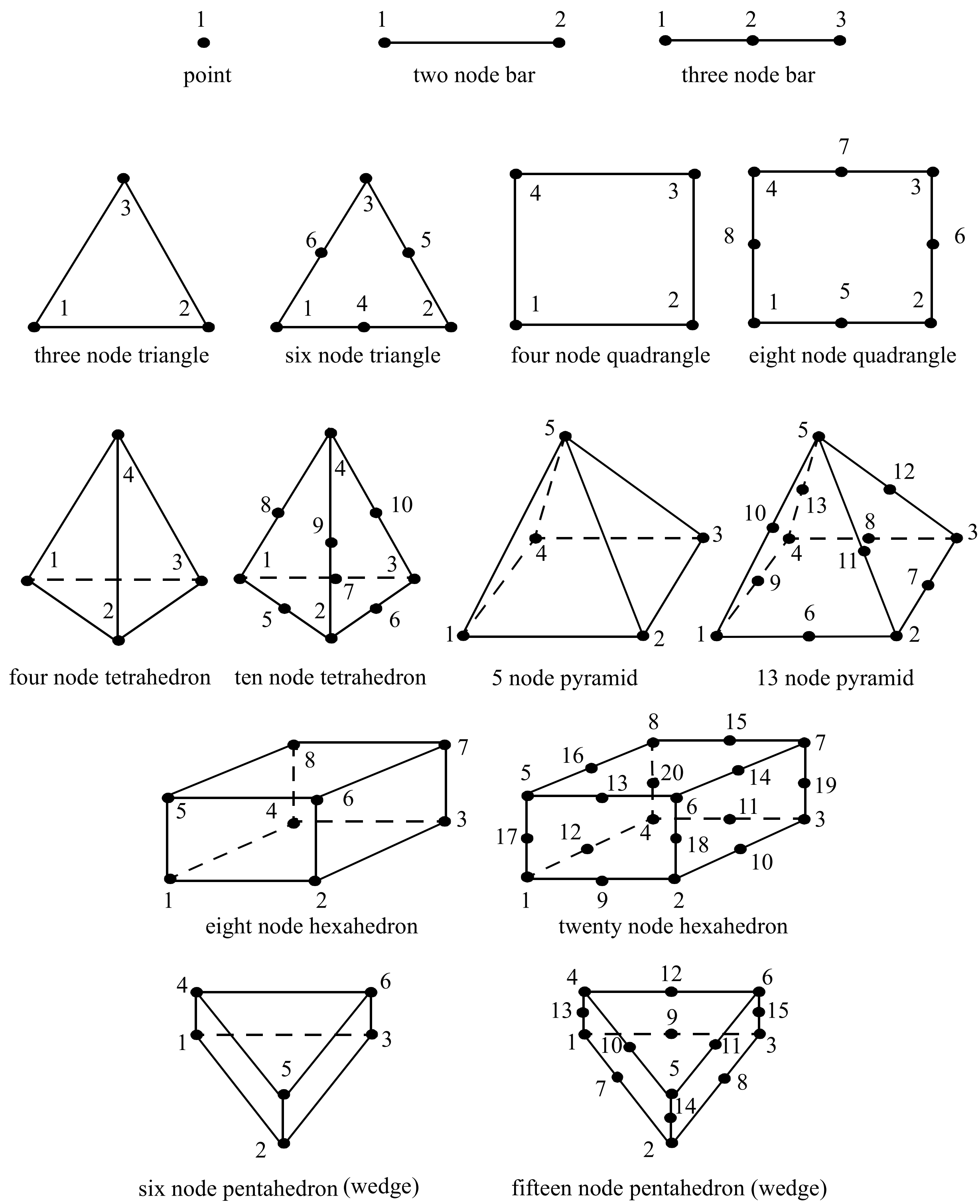


Figure 2-2
Supported EnSight6 Elements

EnSight6 Geometry File Format

The EnSight6 format consists of keywords followed by information. The following seven items are important when working with EnSight6 geometry files:

1. You do not have to assign node IDs. If you do, the element connectivities are based on the node numbers. If you let EnSight assign the node IDs, the nodes are considered to be sequential starting at node 1, and element connectivity is done accordingly. If node IDs are set to off, they are numbered internally; however, you will not be able to display or query on them. If you have node IDs in your data, you can have EnSight ignore them by specifying "node id ignore." Using this option may reduce some of the memory taken up by the Client and Server, but display and query on the nodes will not be available.
2. You do not need to specify element IDs. If you specify element IDs, or you let EnSight assign them, you can show them on the screen. If they are set to off, you will not be able to show or query on them. If you have element IDs in your data you can have EnSight ignore them by specifying "element id ignore." Using this option will reduce some of the memory taken up by the Client and Server. This may or may not be a significant amount, and remember that display and query on the elements will not be available.
3. The format of integers and real numbers **must be followed** (See the Geometry Example below).
4. Integers are written out using the following integer format:

   From C: `8d` format
   From FORTRAN: `i8` format

   Real numbers are written out using the following floating-point format:

   From C: `12.5e` format
   From FORTRAN: `e12.5` format

   The number of integers or reals per line must also be followed!
5. By default, a Part is processed to show the outside boundaries. This representation is loaded to the Client host system when the geometry file is read (unless other attributes have been set on the workstation, such as feature angle).
6. Coordinates for unstructured data must be defined before any Parts can be defined. The different elements can be defined in any order (that is, you can define a hexa8 before a bar2).
7. A Part containing structured data cannot contain any unstructured element types or more than one block. **Each structured Part is limited to a single block.** A structured block is indicated by following the Part description line with either the "block" line or the "block iblanked" line. An "iblanked" block must contain an additional integer array of values at each node, traditionally called the iblank array. Valid iblank values for the EnSight format are:

   0 for nodes which are exterior to the model, sometimes called blanked-out nodes
   1 for nodes which are interior to the model, thus in the free stream and to be used
   <0 or >1 for any kind of boundary nodes

In EnSight's structured Part building dialog, the iblank option selected will control which portion of the structured block is "created". Thus, from the same structured block, the interior flow field part as well as a symmetry boundary part could be "created".

Note: By default EnSight does not do any "partial" cell iblank processing. Namely, only complete cells containing no "exterior" nodes are created. It is possible to obtain partial cell processing by issuing the "test:partial_cells_on" command in the Command Dialog before reading the file.

Generic Format

Not all of the lines included in the following generic example file are necessary:

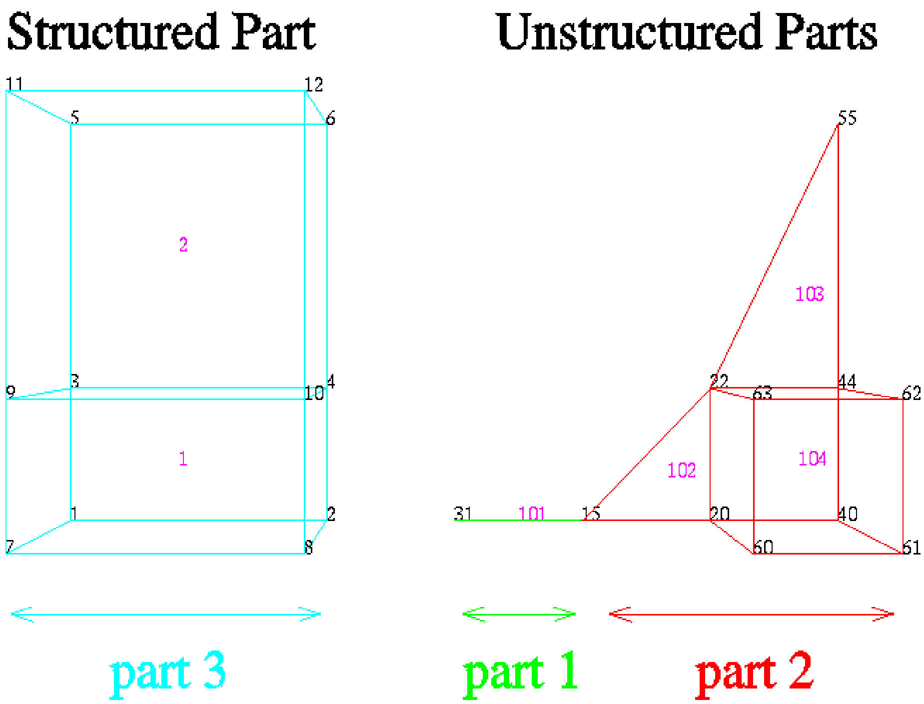
```
description line 1                              |
description line 2                              |
node id <off/given/assign/ignore>               |  All geometry files must
element id <off/given/assign/ignore>            |  contain these first six lines
coordinates                                     |
# of unstructured nodes                         |
id x y z
id x y z
id x y z
.
.
.
part #
description line
point
number of points
id nd
id nd
id nd
.
.
.
bar2
number of bar2's
id nd nd
id nd nd
id nd nd
.
.
.
bar3
number of bar3's
id nd nd nd
id nd nd nd
id nd nd nd
.
.
.
tria3
number of three node triangles
id nd nd nd
id nd nd nd
id nd nd nd
.
.
```

```
.
tria6
number of six node triangles
id nd nd nd nd nd nd
.
.
.
quad4
number of quad 4's
id nd nd nd nd
id nd nd nd nd
id nd nd nd nd
id nd nd nd nd
.
.
.
quad8
number of quad 8's
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
.
.
.
tetra4
number of 4 node tetrahedrons
id nd nd nd nd
id nd nd nd nd
id nd nd nd nd
id nd nd nd nd
.
.
.
tetra10
number of 10 node tetrahedrons
id nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd
.
.
.
pyramid5
number of 5 node pyramids
id nd nd nd nd nd
id nd nd nd nd nd
id nd nd nd nd nd
id nd nd nd nd nd
.
.
.
pyramid13
number of 13 node pyramids
id nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd
.
.
.
```

```
hexa8
number of 8 node hexahedrons
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
.
.
.
hexa20
number of 20 node hexahedrons
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
.
.
.
penta6
number of 6 node pentahedrons
id nd nd nd nd nd nd
id nd nd nd nd nd nd
id nd nd nd nd nd nd
id nd nd nd nd nd nd
id nd nd nd nd nd nd
.
.
.
penta15
number of 15 node pentahedrons
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
.
.
.

part #
description line
block                                  #mm=i*j*k
i j k
x_m1 x_m2 x_m3 ..... x_mm              (6/line)
y_m1 y_m2 y_m3 ..... y_mm               "
z_m1 z_m2 z_m3 ..... z_mm               "

part #
description line
block     iblanked                     #mm=i*j*k
i j k
x_m1 x_m2 x_m3 ..... x_mm              (6/line)
y_m1 y_m2 y_m3 ..... y_mm               "
z_m1 z_m2 z_m3 ..... z_mm               "
ib_m1 ib_m2 ib_m3 .... ib_mm           (10/line)
```



EnSight6 Geometry File Example

The following is an example of an ASCII EnSight6 geometry file with 11 defined unstructured nodes from which 2 unstructured parts are defined, and a 2x3x2 structured part as depicted in the above diagram. (See Case File Example 1 for reference to this file.)

```
This is the 1st description line of the EnSight6 geometry example
This is the 2nd description line of the EnSight6 geometry example
node id given
element id given
coordinates
        11
        15 4.00000e+00 0.00000e+00 0.00000e+00
        31 3.00000e+00 0.00000e+00 0.00000e+00
        20 5.00000e+00 0.00000e+00 0.00000e+00
        40 6.00000e+00 0.00000e+00 0.00000e+00
        22 5.00000e+00 1.00000e+00 0.00000e+00
        44 6.00000e+00 1.00000e+00 0.00000e+00
        55 6.00000e+00 3.00000e+00 0.00000e+00
        60 5.00000e+00 0.00000e+00 2.00000e+00
        61 6.00000e+00 0.00000e+00 2.00000e+00
        62 6.00000e+00 1.00000e+00 2.00000e+00
        63 5.00000e+00 1.00000e+00 2.00000e+00
part 1
2D uns-elements  (description line for part 1)
tria3
         2
       102       15       20       22
       103       22       44       55
hexa8
         1
       104       20       40       44       22       60       61       62       63
part 2
1D uns-elements  (description line for part 2)
bar2
         1
       101      31       15
part 3
```

```
3D struct-part  (description line for part 3)
block iblanked
       2       3       2
 0.00000e+00 2.00000e+00 0.00000e+00 2.00000e+00 0.00000e+00 2.00000e+00
 0.00000e+00 2.00000e+00 0.00000e+00 2.00000e+00 0.00000e+00 2.00000e+00
 0.00000e+00 0.00000e+00 1.00000e+00 1.00000e+00 3.00000e+00 3.00000e+00
 0.00000e+00 0.00000e+00 1.00000e+00 1.00000e+00 3.00000e+00 3.00000e+00
 0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
 2.00000e+00 2.00000e+00 2.00000e+00 2.00000e+00 2.00000e+00 2.00000e+00
       1       1       1       1       1       1       1       1       1       1
       1       1
```

EnSight6 Case File Format

The Case file is an ASCII free format file that contains all the file and name information for accessing model (and measured) geometry, variable, and time information. It is comprised of five sections (`FORMAT, GEOMETRY, VARIABLE, TIME, FILE`) as described below:

Notes: *All lines in the Case file are limited to 79 characters.*

The titles of each section must be in all capital letters.

Anything preceded by a "#" denotes a comment and is ignored. Comments may append information lines or be placed on their own lines.

Information following ":" may be separated by white spaces or tabs.

Specifications encased in "[]" are optional, as indicated.

Format Section This is a required section which specifies the type of data to be read.

Usage:

```
FORMAT
type:     ensight
```

Geometry Section This is a required section which specifies the geometry information for the model (as well as measured geometry if present, and periodic match file (see Section 11.9, Periodic Matchfile Format) if present).

Usage:

```
GEOMETRY
model:      [ts]   [fs]         filename     [change_coords_only]
measured:   [ts]   [fs]         filename     [change_coords_only]
match:                          filename
```

where: `ts` = time set number as specified in TIME section. This is optional.
`fs` = corresponding file set number as specified in FILE section below.
`filename` = The filename of the appropriate file.
-> Model or measured filenames for a static geometry case, and match filenames will not contain "*" wildcards.
-> Model or measured filenames for a changing geometry case will contain "*" wildcards.
`change_coords_only` = The option to indicate that the changing geometry (as indicated by wildcards in the filename) is coords only. Otherwise, changing geometry connectivity will be assumed.

Variable Section This is an optional section which specifies the files and names of the variables.

Constant variable values can also be set in this section.

Usage:

```
VARIABLE
constant per case:             [ts]        description  const_value(s)
scalar per node:               [ts]  [fs]   description  filename
vector per node:               [ts]  [fs]   description  filename
tensor symm per node:          [ts]  [fs]   description  filename
scalar per element:            [ts]  [fs]   description  filename
vector per element:            [ts]  [fs]   description  filename
tensor symm per element:       [ts]  [fs]   description  filename
scalar per measured node:      [ts]  [fs]   description  filename
vector per measured node:      [ts]  [fs]   description  filename
complex scalar per node:       [ts]  [fs]   description  Re_fn    Im_fn    freq
complex vector per node:       [ts]  [fs]   description  Re_fn    Im_fn    freq

complex scalar per element:      [ts]  [fs] description  Re_fn    Im_fn    freq
complex vector per element:      [ts]  [fs] description  Re_fn    Im_fn    freq
```

where:

`ts`	=	The corresponding time set number (or index) as specified in TIME section below. This is only required for transient constants and variables.
`fs`	=	The corresponding file set number (or index) as specified in FILE section below.
`description`	=	The variable (GUI) name (ex. Pressure, Velocity, etc.)
`const_value(s)`	=	The constant value. If constants change over time, then `ns` (see TIME section below) constant values of `ts`.
`filename`	=	The filename of the variable file. Note: only transient filenames contain "*" wildcards.
`Re_fn`	=	The filename for the file containing the real values of the complex variable.
`Im_fn`	=	The filename for the file containing the imaginary values of the complex variable.
`freq`	=	The corresponding harmonic frequency of the complex variable. For complex variables where harmonic frequency is undefined, simply use the text string: UNDEFINED.

Note: *As many variable description lines as needed may be used.*

Note: *The variable description is limited to 19 characters in the current release. Variable names must not start with a numeric digit and must not contain any of the following reserved characters:*

(	[	+	@	!	*	$
)	]	-	space	#	^	/

Time Section

This is an optional section for steady state cases, but is required for transient cases. It contains time set information. Shown below is information for one time set. Multiple time sets (up to 16) may be specified for measured data as shown in Case File Example 3 below.

Usage:

```
TIME
time set:              ts   [description]
number of steps:       ns
filename start number: fs
filename increment:    fi
time values:           time_1  time_2  .... time_ns
```

or

```
TIME
time set:            ts  [description]
number of steps:     ns
filename numbers:    fn
time values:         time_1  time_2  .... time_ns
```

where: `ts` = timeset number. This is the number referenced in the GEOMETRY and VARIABLE sections.
`description` = optional timeset description which will be shown in user interface.
`ns` = number of transient steps
`fs` = the number to replace the "*" wildcards in the filenames, for the first step
`fi` = the increment to fs for subsequent steps
`time` = the actual time values for each step, each of which must be separated by a white space and which may continue on the next line if needed
`fn` = a list of numbers or indices, to replace the "*" wildcards in the filenames.

File Section

This section is optional for expressing a transient case with single-file formats. This section contains single-file set information. This information specifies the number of time steps in each file of each *data entity*, i.e. each geometry and each variable (model and/or measured). Each data entity's corresponding file set might have multiple *continuation* files due to system file size limit, i.e. ~2 GB for 32-bit and ~4 TB for 64-bit architectures. Each file set corresponds to one and only one time set, but a time set may be referenced by many file sets. The following information may be specified in each file set. For file sets where all of the time set data exceeds the maximum file size limit of the system, both `filename index` and `number of steps` are repeated within the file set definition for each continuation file required. Otherwise `filename index` may be omitted if there is only one file. File set information is shown in Case File Example 4 below.

Usage:

```
FILE
file set:            fs
filename index:      fi  # Note: only used when data continues in other files
number of steps:     ns
```

where: `fs` = file set number. This is the number referenced in the GEOMETRY and VARIABLE sections above.
`ns` = number of transient steps
`fi` = file index number in the file name (replaces "*" in the filenames)

Case File Example 1

The following is a minimal EnSight6 case file for a steady state model with some results.

Note: this (`en6.case`*) file, as well as all of its referenced geometry and variable files (along with a couple of command files) can be found under your installation directory (path:* `$ENSIGHT7_HOME/data/user_manual`*). The EnSight6 Geometry File Example and the Variable File Examples are the contents of these files.*

```
FORMAT
type:  ensight

GEOMETRY
model:  en6.geo

VARIABLE
constant per case:           Cden   .8

scalar per element:          Esca   en6.Esca
scalar per node:             Nsca   en6.Nsca
```

```
vector per element:           Evec   en6.Evec
vector per node:              Nvec   en6.Nvec

tensor symm per element:      Eten   en6.Eten
tensor symm per node:         Nten   en6.Nten

complex scalar per element:   Ecmp   en6.Ecmp_r  en6.Ecmp_i   2.
complex scalar per node:      Ncmp   en6.Ncmp_r  en6.Ncmp_i   4.
```

Case File Example 2

The following is a Case file for a transient model. The connectivity of the geometry is also changing.

```
FORMAT
type:  ensight

GEOMETRY
model:                  1                       example2.geo**

VARIABLE
scalar per node:        1     Stress            example2.scl**
vector per node:        1     Displacement      example2.dis**

TIME
time set:                     1
number of steps:              3
filename start number:        0
filename increment:           1
time values:      1.0    2.0    3.0
```

The following files would be needed for Example 2:

```
example2.geo00        example2.scl00        example2.dis00
example2.geo01        example2.scl01        example2.dis01
example2.geo02        example2.scl02        example2.dis02
```

Case File Example 3

The following is a Case file for a transient model with measured data.

This example has pressure given per element.

```
FORMAT
type:  ensight


GEOMETRY
model:                  1                 example3.geo*
measured:               2                 example3.mgeo**


VARIABLE
constant per case:                        Gamma        1.4
constant per case:                  1     Density      .9 .9 .7 .6 .6
scalar per element                  1     Pressure           example3.pre*
vector per node:                    1     Velocity           example3.vel*
scalar per measured node:           2     Temperature        example3.mtem**
vector per measured node:           2     Velocity           example3.mvel**

TIME
time set:                     1
number of steps:              5
filename start number:        1
filename increment:           2
time values:                  .1 .2 .3          # This example shows that time
```

```
                                .4 .5             # values can be on multiple lines
time set:                       2
number of steps:                6
filename start number:          0
filename increment:             2
time values:
.05 .15 .25 .34 .45 .55
```

The following files would be needed for Example 3:

```
example3.geo1        example3.pre1        example3.vel1
example3.geo3        example3.pre3        example3.vel3
example3.geo5        example3.pre5        example3.vel5
example3.geo7        example3.pre7        example3.vel7
example3.geo9        example3.pre9        example3.vel9

example3.mgeo00      example3.mtem00      example3.mvel00
example3.mgeo02      example3.mtem02      example3.mvel02
example3.mgeo04      example3.mtem04      example3.mvel04
example3.mgeo06      example3.mtem06      example3.mvel06
example3.mgeo08      example3.mtem08      example3.mvel08
example3.mgeo10      example3.mtem10      example3.mvel10
```

Case File Example 4

The following is Case File Example 3 expressed in transient single-file formats.

In this example, the transient data for the measured velocity data entity happens to be greater than the maximum file size limit. Therefore, the first four time steps fit and are contained in the first file, and the last two time steps are 'continued' in a second file.

```
FORMAT
type: ensight

GEOMETRY
model:                  1     example4.geo 1
measured:               2     example4.mgeo2

VARIABLE
constant per case:                          Density          .5
scalar per element:           1     1       Pressure         example4.pre
vector per node:              1     1       Velocity         example4.vel
scalar per measured node:     2     2       Temperature      example4.mtem
vector per measured node:     2     3       Velocity         example4.mvel*

TIME
time set:               1     Model
number of steps:        5
time values:            .1 .2 .3 .4 .5

time set:               2     Measured
number of steps:        6
time values:            .05 .15 .25 .34 .45 .55

FILE
file set:               1
number of steps:        5

file set:               2
```

```
number of steps:        6

file set:               3
filename index:         1
number of steps:        4
filename index:         2
number of steps:        2
```

The following files would be needed for Example 4:

```
example4.geo     example4.pre     example4.vel
example4.mgeoe   xample4.mtem     example4.mvel1
                                  example4.mvel2
```

Contents of Transient Single Files

Each file contains transient data that corresponds to the specified number of time steps. The data for each time step sequentially corresponds to the simulation time values (`time values`) found listed in the `TIME` section. In transient single-file format, the data for each time step essentially corresponds to a standard EnSight6 geometry or variable file (model or measured) as expressed in multiple file format. The data for each time step is enclosed between two *wrapper* records, i.e. preceded by a `BEGIN TIME STEP` record and followed by an `END TIME STEP` record. Time step data is not split between files. If there is not enough room to append the data from a time step to the file without exceeding the maximum file limit of a particular system, then a continuation file must be created for the time step data and any subsequent time step. Any type of user comments may be included before and/or after each transient step wrapper.

Note 1: If transient single file format is used, EnSight expects all files of a dataset to be specified in transient single file format. Thus, even static files must be enclosed between a `BEGIN TIME STEP` *and an* `END TIME STEP` *wrapper.*

Note 2: For binary geometry files, the first `BEGIN TIME STEP` *wrapper must follow the <C Binary/Fortran Binary> line. Both* `BEGIN TIME STEP` *and* `END TIME STEP` *wrappers are written according to type (1) in binary.* *(see Writing EnSight6 Binary Files, in Section 11.2)*

*Note 3: Efficient reading of each file (especially binary) is facilitated by appending each file with a **file index**. A file index contains appropriate information to access the file byte positions of each time step in the file. (EnSight automatically appends a file index to each file when exporting in transient single file format.) If used, the file index must follow the last* `END TIME STEP` *wrapper in each file.*

File Index Usage:

ASCII	Binary	Item	Description
"%20d\n"	sizeof(int)	n	Total number of data time steps in the file.
"%20d\n"	sizeof(long)	fb_1	File byte loc for contents of 1st time step*
"%20d\n"	sizeof(long)	fb_2	File byte loc for contents of 2nd time step*
. . .	. . .	. . .	. . .
"%20d\n"	sizeof(long)	fb_n	File byte loc for contents of nth time step*
"%20d\n"	sizeof(int)	flag	Miscellaneous flag (= 0 for now)
"%20d\n"	sizeof(long)	fb of item n	File byte loc for Item n above
"%s\n"	sizeof(char)*80	"FILE_INDEX"	File index keyword

* *Each file byte location is the first byte that follows the* `BEGIN TIME STEP` *record.*

Shown below are the contents of each of the above files, using the data files from Case

File Example 3 for reference (without FILE_INDEX for simplicity).

Contents of file `example4.geo_1`:

BEGIN TIME STEP
Contents of file `example3.geo1`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.geo3`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.geo5`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.geo7`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.geo9`
END TIME STEP

Contents of file `example4.pre_1`:

BEGIN TIME STEP
Contents of file `example3.pre1`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.pre3`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.pre5`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.pre7`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.pre9`
END TIME STEP

Contents of file `example4.vel_1`:

BEGIN TIME STEP
Contents of file `example3.vel1`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.vel3`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.vel5`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.vel7`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.vel9`
END TIME STEP

Contents of file `example4.mgeo_1`:

BEGIN TIME STEP
Contents of file `example3.mgeo00`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mgeo02`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mgeo04`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mgeo06`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mgeo08`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mgeo10`
END TIME STEP

Contents of file `example4.mtem_1`:

BEGIN TIME STEP
Contents of file `example3.mtem00`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mtem02`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mtem04`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mtem06`

END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mtem08`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mtem10`
END TIME STEP

Contents of file `example4.mvel1_1:`

BEGIN TIME STEP
Contents of file `example3.mvel00`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mvel02`
END TIME STEP
BEGIN TIME STEP
Contents of file `example3.mvel04`
END TIME STEP
BEGIN TIME STEP
Contents of file example3.mvel06
END TIME STEP

Contents of file `example4.mvel2_1:`

Comments can precede the beginning wrapper here.

BEGIN TIME STEP
Contents of file `example3.mvel08`
END TIME STEP

Comments can go between time step wrappers here.

BEGIN TIME STEP
Contents of file `example3.mvel10`
END TIME STEP

Comments can follow the ending time step wrapper.

EnSight6 Wild Card Name Specification

For transient data, if multiple time files are involved, the file names must conform to the EnSight wild-card specification. This specification is as follows:

- File names must include numbers that are in ascending order from beginning to end.
- Numbers in the files names must be zero filled if there is more than one significant digit.
- Numbers can be anywhere in the file name.
- When the file name is specified in the EnSight result file, you must replace the numbers in the file with an asterisk(*). The number of asterisks specified is the number of significant digits. The asterisk must occupy the same place as the numbers in the file names.

EnSight6 Variable File Format

EnSight6 variable files can either be per_node or per_element. They cannot be both. However, an EnSight model can have some variables which are per_node and other variables which are per_element.

EnSight6 Per_Node Variable File Format

EnSight6 variable files for per_node variables contain any values for each unstructured node followed by any values for each structured node.

First comes a single description line.

Second comes any unstructured node value. The number of values per node depends on the type of field. An unstructured scalar field has one, a vector field has three (order: x,y,z), a 2nd order symmetric tensor field has 6 (order: 11, 22, 33, 12, 13, 23), and a 2nd order asymmetric tensor field has 9 values per node (order: 11, 12, 13, 21, 22, 23, 31, 32, 33). An unstructured complex variable in EnSight6 consists of two scalar or vector fields (one real and one imaginary), with scalar and vector values written to their separate files respectively.

Third comes any structured data information, starting with a part # line, followed by a line containing the "block", and then lines containing the values for each structured node which are output in the same IJK component order as the coordinates. Briefly, a structured scalar is the same as an unstructured scalar, one value per node. A structured vector is written one value per node per component, thus three sequential scalar field blocks. Likewise for a structured 2nd order symmetric tensor, written as six sequential scalar field blocks, and a 2nd order tensor, written as nine sequential scalar field blocks. The same methodology applies for a complex variable only with the real and imaginary fields written to separate structured scalar or vector files.

The values **must be written** in the following floating point format (**6 per line** as shown in the examples below):

From C: `12.5e` format

From FORTRAN: `e12.5` format

The format of a per_node variable file is as follows:

- Line 1

  This line is a description line.

- Line 2 through the end of the file contains the values at each node in the model.

A generic example for *per_node* variables:

```
One description line for the entire file
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+**
part #
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
part #
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+**
```

The following variable file examples reflect scalar, vector, tensor, and complex variable values *per node* for the previously defined EnSight6 Geometry File Example with 11 defined unstructured nodes and a 2x3x2 structured Part (Part number 3). The values are summarized in the following table.

	Node Index	Node Id	Scalar Value	Vector Values	Tensor (2nd order symm.) Values	ComplexScalar Real Value	Imaginary Value
Unstructured							
	1	15	(1.)	(1.1, 1.2, 1.3)	(1.1, 1.2, 1.3, 1.4, 1.5, 1.6)	(1.1)	(1.2)
	2	31	(2.)	(2.1, 2.2, 2.3)	(2.1, 2.2, 2.3, 2.4, 2.5, 2.6)	(2.1)	(2.2)
	3	20	(3.)	(3.1, 3.2, 3.3)	(3.1, 3.2, 3.3, 3.4, 3.5, 3.6)	(3.1)	(3.2)
	4	40	(4.)	(4.1, 4.2, 4.3)	(4.1, 4.2, 4.3, 4.4, 4.5, 4.6)	(4.1)	(4.2)
	5	22	(5.)	(5.1, 5.2, 5.3)	(5.1, 5.2, 5.3, 5.4, 5.5, 5.6)	(5.1)	(5.2)
	6	44	(6.)	(6.1, 6.2, 6.3)	(6.1, 6.2, 6.3, 6.4, 6.5, 6.6)	(6.1)	(6.2)
	7	55	(7.)	(7.1, 7.2, 7.3)	(7.1, 7.2, 7.3, 7.4, 7.5, 7.6)	(7.1)	(7.2)
	8	60	(8.)	(8.1, 8.2, 8.3)	(8.1, 8.2, 8.3, 8.4, 8.5, 8.60	(8.1)	(8.2)
	9	61	(9.)	(9.1, 9.2, 9.3)	(9.1, 9.2, 9.3, 9.4, 9.5, 9.6)	(9.1)	(9.2)
	10	62	(10.)	(10.1,10.2,10.3)	(10.1,10.2,10.3,10.4,10.5,10.6)	(10.1)	(10.2)
	11	63	(11.)	(11.1,11.2,11.3)	(11.1,11.2,11.3,11.4,11.5,11.6)	(11.1)	(11.2)
Structured							
	1	1	(1.)	(1.1, 1.2, 1.3)	(1.1, 1.2, 1.3, 1.4, 1.5, 1.6)	(1.1)	(1.2)
	2	2	(2.)	(2.1, 2.2, 2.3)	(2.1, 2.2, 2.3, 2.4, 2.5, 2.6)	(2.1)	(2.2)
	3	3	(3.)	(3.1, 3.2, 3.3)	(3.1, 3.2, 3.3, 3.4, 3.5, 3.6)	(3.1)	(3.2)
	4	4	(4.)	(4.1, 4.2, 4.3)	(4.1, 4.2, 4.3, 4.4, 4.5, 4.6)	(4.1)	(4.2)
	5	5	(5.)	(5.1, 5.2, 5.3)	(5.1, 5.2, 5.3, 5.4, 5.5, 5.6)	(5.1)	(5.2)
	6	6	(6.)	(6.1, 6.2, 6.3)	(6.1, 6.2, 6.3, 6.4, 6.5, 6.6)	(6.1)	(6.2)
	7	7	(7.)	(7.1, 7.2, 7.3)	(7.1, 7.2, 7.3, 7.4, 7.5, 7.6)	(7.1)	(7.2)
	8	8	(8.)	(8.1, 8.2, 8.3)	(8.1, 8.2, 8.3, 8.4, 8.5, 8.6)	(8.1)	(8.2)
	9	9	(9.)	(9.1, 9.2, 9.3)	(9.1, 9.2, 9.3, 9.4, 9.5, 9.6)	(9.1)	(9.2)
	10	10	(10.)	(10.1,10.2,10.3)	(10.1,10.2,10.3,10.4,10.5,10.6)	(10.1)	(10.2)
	11	11	(11.)	(11.1,11.2,11.3)	(11.1,11.2,11.3,11.4,11.5,11.6)	(11.1)	(11.2)
	12	12	(12.)	(12.1,12.2,12.3)	(12.1,12.2,12.3,12.4,12.5,12.6)	(12.1)	(12.2)

Per_node (Scalar) Variable Example 1 This example shows ASCII scalar file (`en6.Nsca`) for the geometry example.

```
Per_node scalar values for the EnSight6 geometry example
 1.00000E+00 2.00000E+00 3.00000E+00 4.00000E+00 5.00000E+00 6.00000E+00
 7.00000E+00 8.00000E+00 9.00000E+00 1.00000E+01 1.10000E+01
part 3
block
 1.00000E+00 2.00000E+00 3.00000E+00 4.00000E+00 5.00000E+00 6.00000E+00
 7.00000E+00 8.00000E+00 9.00000E+00 1.00000E+01 1.10000E+01 1.20000E+01
```

Per_node (Vector) Variable Example 2 This example shows ASCII vector file (`en6.Nvec`) for the geometry example.

```
Per_node vector values for the EnSight6 geometry example
 1.10000E+00 1.20000E+00 1.30000E+00 2.10000E+00 2.20000E+00 2.30000E+00
 3.10000E+00 3.20000E+00 3.30000E+00 4.10000E+00 4.20000E+00 4.30000E+00
 5.10000E+00 5.20000E+00 5.30000E+00 6.10000E+00 6.20000E+00 6.30000E+00
 7.10000E+00 7.20000E+00 7.30000E+00 8.10000E+00 8.20000E+00 8.30000E+00
 9.10000E+00 9.20000E+00 9.30000E+00 1.01000E+01 1.02000E+01 1.03000E+01
 1.11000E+01 1.12000E+01 1.13000E+01
part 3
block
 1.10000E+00 2.10000E+00 3.10000E+00 4.10000E+00 5.10000E+00 6.10000E+00
 7.10000E+00 8.10000E+00 9.10000E+00 1.01000E_01 1.11000E+01 1.21000E+01
 1.20000E+00 2.20000E+00 3.20000E+00 4.20000E+00 5.20000E+00 6.20000E+00
 7.20000E+00 8.20000E+00 9.20000E+00 1.02000E+01 1.12000E+01 1.22000E+01
 1.30000E+00 2.30000E+00 3.30000E+00 4.30000E+00 5.30000E+00 6.30000E+00
 7.30000E+00 8.30000E+00 9.30000E+00 1.03000E+01 1.13000E+01 1.23000E+01
```

Per_node (Tensor) Variable Example 3 This example shows an ASCII 2nd order symmetric tensor file (`en6.Nten`) for the geometry example.

```
Per_node symmetric tensor values for the EnSight6 geometry example
 1.10000E+00 1.20000E+00 1.30000E+00 1.40000E+00 1.50000E+00 1.60000E+00
 2.10000E+00 2.20000E+00 2.30000E+00 2.40000E+00 2.50000E+00 2.60000E+00
 3.10000E+00 3.20000E+00 3.30000E+00 3.40000E+00 3.50000E+00 3.60000E+00
 4.10000E+00 4.20000E+00 4.30000E+00 4.40000E+00 4.50000E+00 4.60000E+00
 5.10000E+00 5.20000E+00 5.30000E+00 5.40000E+00 5.50000E+00 5.60000E+00
 6.10000E+00 6.20000E+00 6.30000E+00 6.40000E+00 6.50000E+00 6.60000E+00
 7.10000E+00 7.20000E+00 7.30000E+00 7.40000E+00 7.50000E+00 7.60000E+00
 8.10000E+00 8.20000E+00 8.30000E+00 8.40000E+00 8.50000E+00 8.60000E+00
 9.10000E+00 9.20000E+00 9.30000E+00 9.40000E+00 9.50000E+00 9.60000E+00
 1.01000E+01 1.02000E+01 1.03000E+01 1.04000E+01 1.05000E+01 1.06000E+01
 1.11000E+01 1.12000E+01 1.13000E+01 1.14000E+01 1.15000E+01 1.16000E+01
part 3
block
 1.10000E+00 2.10000E+00 3.10000E+00 4.10000E+00 5.10000E+00 6.10000E+00
 7.10000E+00 8.10000E+00 9.10000E+00 1.01000E+01 1.11000E+01 1.21000E+01
 1.20000E+00 2.20000E+00 3.20000E+00 4.20000E+00 5.20000E+00 6.20000E+00
 7.20000E+00 8.20000E+00 9.20000E+00 1.02000E+01 1.12000E+01 1.22000E+01
 1.30000E+00 2.30000E+00 3.30000E+00 4.30000E+00 5.30000E+00 6.30000E+00
 7.30000E+00 8.30000E+00 9.30000E+00 1.03000E+01 1.13000E+01 1.23000E+01
 1.40000E+00 2.40000E+00 3.40000E+00 4.40000E+00 5.40000E+00 6.40000E+00
 7.40000E+00 8.40000E+00 9.40000E+00 1.04000E+01 1.14000E+01 1.24000E+01
 1.50000E+00 2.50000E+00 3.50000E+00 4.50000E+00 5.50000E+00 6.50000E+00
 7.50000E+00 8.50000E+00 9.50000E+00 1.05000E+01 1.15000E+01 1.25000E+01
 1.60000E+00 2.60000E+00 3.60000E+00 4.60000E+00 5.60000E+00 6.60000E+00
 7.60000E+00 8.60000E+00 9.60000E+00 1.06000E+01 1.16000E+01 1.26000E+01
```

Per_node (Complex) Variable Example 4 This example shows the ASCII complex real (`en6.Ncmp_r`) and imaginary (`en6.Ncmp_i`) *scalar* files for the geometry example. (The same methodology would apply for complex real and imaginary *vector* files.)

Real scalar File:

```
Per_node complex real scalar values for the EnSight6 geometry example
 1.10000E+00 2.10000E+00 3.10000E+00 4.10000E+00 5.10000E+00 6.10000E+00
 7.10000E+00 8.10000E+00 9.10000E+00 1.01000E+01 1.11000E+01
 part 3
 block
 1.10000E+00 2.10000E+00 3.10000E+00 4.10000E+00 5.10000E+00 6.10000E+00
 7.10000E+00 8.10000E+00 9.10000E+00 1.01000E+01 1.11000E+01 1.21000E+00
```

Imaginary scalar File:

```
Per_node complex imaginary scalar values for the EnSight6 geometry example
 1.20000E+00 2.20000E+00 3.20000E+00 4.20000E+00 5.20000E+00 6.20000E+00
 7.20000E+00 8.20000E+00 9.20000E+00 1.02000E+01 1.12000E+01
 part 3
 block
 1.20000E+00 2.20000E+00 3.20000E+00 4.20000E+00 5.20000E+00 6.20000E+00
 7.20000E+00 8.20000E+00 9.20000E+00 1.02000E+01 1.12000E+01 1.22000E+00
```

EnSight6 Per_Element Variable File Format

EnSight variable files for per_element variables contain values for each element of designated types of designated Parts. First comes a single description line. Second comes a Part line. Third comes an element type line and fourth comes the value for each element of that type and part. If it is a scalar variable, there is one value per element, while for vector variables there are three values per element. (The number of elements of the given type are obtained from the corresponding EnSight6 geometry file.)

The values must be written in the following floating point format (6 per line as shown in the examples below):

From C: `12.5e` format

From FORTRAN: `e12.5` format

The format of a per_element variable file is as follows:

- Line 1 This line is a description line.
- Line 2 Part line, with part number corresponding to the geometry file.
- Line 3 Element type line (example: tria3, hexa8, ...)
- Line 4 Repeats until next element type line, part line, or end of file is reached. Lists values for each element of this part and type.

A generic example for *per_element* variables:

```
One description line for the entire file
part  #
element type
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+**
part  #
block
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+**
```

The following variable file examples reflect scalar, vector, tensor, and complex variable values *per element* for the previously defined EnSight6 Geometry File Example with 11 defined unstructured nodes and a 2x3x2 structured Part (Part number 3). The values are summarized in the following table.

		Element Index	Element Id	Scalar Value	Vector Values	Tensor (2nd order symm.) Values	Complex Scalar Real Value	Complex Scalar Imaginary Value
Unstructured								
	bar2							
		1	101	(1.)	(1.1, 1.2, 1.3)	(1.1, 1.2, 1.3, 1.4, 1.5, 1.6)	(1.1)	(1.2)
	tria3							
		1	102	(2.)	(2.1, 2.2, 2.3)	(2.1, 2.2, 2.3, 2.4, 2.5, 2.6)	(2.1)	(2.2)
		2	103	(3.)	(3.1, 3.2, 3.3)	(3.1, 3.2, 3.3, 3.4, 3.5, 3.6)	(3.1)	(3.2)
	hexa8							
		1	104	(4.)	(4.1, 4.2, 4.3)	(4.1, 4.2, 4.3, 4.4, 4.5, 4.6)	(4.1)	(4.2)
Structured								
	block	1	1	(5.)	(5.1, 5.2, 5.3)	(5.1, 5.2, 5.3, 5.4, 5.5, 5.6)	(5.1)	(5.2)

Per_element (Scalar) Variable Example 1 This example shows an ASCII scalar file (`en6.Esca`) for the geometry example.

```
Per_elem scalar values for the EnSight6 geometry example
part 1
tria3
 2.00000E+00 3.00000E+00
hexa8
 4.00000E+00
part 2
bar2
 1.00000E+00
part 3
block
 5.00000E+00 6.00000E+00
```

Per_element (Vector) Variable Example 2 This example shows an ASCII vector file (`en6.Evec`) for the geometry example.

```
Per_elem vector values for the EnSight6 geometry example
part 1
tria3
 2.10000E+00 2.20000E+00 2.30000E+00 3.10000E+00 3.20000E+00 3.30000E+00
hexa8
 4.10000E+00 4.20000E+00 4.30000E+00
part 2
bar2
 1.10000E+00 1.20000E+00 1.30000E+00
part 3
block
 5.10000E+00 6.10000E+00
 5.20000E+00 6.20000E+00
 5.30000E+00 6.30000E+00
```

Per_element (Tensor) Variable Example 3 This example shows the ASCII 2nd order symmetric tensor file (`en6.Eten`) for the geometry example.

```
Per_elem symmetric tensor values for the EnSight6 geometry example
part 1
tria3
 2.10000E+00 2.20000E+00 2.30000E+00 2.40000E+00 2.50000E+00 2.60000E+00
 3.10000E+00 3.20000E+00 3.30000E+00 3.40000E+00 3.50000E+00 3.60000E+00
hexa8
 4.10000E+00 4.20000E+00 4.30000E+00 4.40000E+00 4.50000E+00 4.60000E+00
part 2
bar2
 1.10000E+00 1.20000E+00 1.30000E+00 1.40000E+00 1.50000E+00 1.60000E+00
part 3
block
 5.10000E+00 6.10000E+00
 5.20000E+00 6.20000E+00
 5.30000E+00 6.30000E+00
 5.40000E+00 6.40000E+00
 5.50000E+00 6.50000E+00
 5.60000E+00 6.60000E+00
```

Per_element (Complex) Variable Example 4 This example shows the ASCII complex real (`en6.Ecmp_r`) and imaginary (`en6.Ecmp_i`) *scalar* files for the geometry example. (The same methodology would apply for complex real and imaginary *vector* files).

Real scalar File:

```
Per_elem complex real scalar values for the EnSight6 geometry example
part 1
tria3
 2.10000E+00 3.10000E+00
hexa8
 4.10000E+00
part 2
bar2
 1.10000E+00
part 3
block
 5.10000E+00 6.10000E+00
```

Imaginary scalar File:

```
Per_elem complex imaginary scalar values for the EnSight6 geometry example
part 1
tria3
 2.20000E+00 3.20000E+00
hexa8
 4.20000E+00
part 2
bar2
 1.20000E+00
part 3
block
 5.20000E+00 6.20000E+00
```

EnSight6 Measured/Particle File Format

The format of a Measured/Particle geometry file is as follows:

- Line 1

  This line is a description line.

- Line 2

  Indicates that this file contains particle coordinates. The words "`particle coordinates`" should be entered on this line without the quotes.

- Line 3

  Specifies the number of Particles.

- Line 4 through the end of the file.

  Each line contains the ID and the X, Y, and Z coordinates of each Particle. The format of this line is "integer real real real" written out in the following format:

  From C: `%8d%12.5e%12.5e%12.5e` format

  From FORTRAN: `i8, 3e12.5` format

A generic measured/Particle geometry file is as follows:

```
A description line
particle coordinates
#_of_Particles
id xcoord ycoord zcoord
id xcoord ycoord zcoord
id xcoord ycoord zcoord
 .
 .
 .
```

Measured Geometry Example

The following illustrates a measured/Particle file with seven points:

```
This is a simple measured geometry file
particle coordinates
       7
     101 0.00000E+00 0.00000E+00 0.00000E+00
     102 1.00000E+00 0.00000E+00 0.00000E+00
     103 1.00000E+00 1.00000E+00 0.00000E+00
     104 0.00000E+00 1.00000E+00 0.00000E+00
     205 5.00000E-01 0.00000E+00 2.00000E+00
     206 5.00000E-01 1.00000E+00 2.00000E+00
     307 0.00000E+00 0.00000E+00-1.50000E+00
```

Measured Variable Files

Measured variable files use the same format as EnSight6 per_node variable files.

Writing EnSight6 Binary Files

This section describes the EnSight6 binary files. This format is used to increase the speed of reading data into EnSight.

For binary files, there is a header that designates the type of binary file. This header is: “C Binary” or “Fortran Binary.” This must be the first thing in the geometry file only. The format for the file is then essentially the same format as the ASCII format, with the following exceptions:

> The ASCII format puts the node and element ids on the same “line” as the corresponding coordinates. The BINARY format writes all node id’s then all coordinates.
>
> The ASCII format puts all element id’s of a type within a Part on the same “line” as the corresponding connectivity. The BINARY format writes all the element ids for that type, then all the corresponding connectivities of the elements.
>
> FORTRAN binary files should be created as sequential access unformatted files.

In all the descriptions of binary files that follow, the number on the left end of the line corresponds to the type of write of that line, according to the following code:

1. This is a write of 80 characters to the file:

   C example:
   ```
   char buffer[80];
   strcpy(buffer,"C Binary");
   fwrite(buffer,sizeof(char),80,file_ptr);
   ```

   FORTRAN:
   ```
   character*80   buffer
   buffer = "Fortran Binary"
   write(10) buffer
   ```

2. This is a write of a single integer:

   C example: `fwrite(&num_nodes,sizeof(int),1,file_ptr);`

   FORTRAN: `write(10) num_nodes`

3. This is a write of an integer array:

   C example: `fwrite(node_ids,sizeof(int),num_nodes,file_ptr);`

   FORTRAN: `write(10) (node_ids(i),i=1,num_nodes)`

4. This is a write of a float array:

   C example: `fwrite(coords,sizeof(float),3*num_nodes,file_ptr);`

   FORTRAN: `write(10) ((coords(i,j),i=1,3),j=1,num_nodes)`

(NOTE: Coords is a single precision array, double precision will not work!)

EnSight6 Binary Geometry

An EnSight binary geometry file contains information in the following order:

(1) <C Binary/Fortran Binary>
(1) description line 1
(1) description line 2
(1) node id <given/off/assign/ignore>
(1) element id <given/off/assign/ignore>
(1) coordinates
(2) #_of_points
(3) [point_ids]
(4) coordinate_array
(1) part #
(1) description line
(1) element_type
(2) #_of_element_type
(3) [element_ids] for the element_type
(3) connectivities for the element_type
(1) element_type
(2) #_of_element_type
(3) [element_ids] for the element_type
(3) connectivities for the element_type
:
(1) part #
(1) description line
(1) element_type
(2) #_of_element_type
(3) [element_ids] for the element_type
(3) connectivities for the element_type
(1) element_type
(2) #_of_element_type
(3) [element_ids] for the element_type
(3) connectivities for the element_type
(1) part #
(1) description line
(1) block [iblanked]
(3) i j k
(4) all i coords, all j coords, all k coords
(3) [iblanking]
:

Per_node Binary Scalar

An EnSight6 binary scalar file contains information in the following order:

(1) description line
(4) scalar_array for unstructured nodes
(1) part #
(1) block
(4) scalar_array for part's structured nodes

Per_node Binary Vector

An EnSight6 binary vector file contains information in the following order:

(1) description line
(4) vector_array for unstructured nodes
(1) part #

(1) block
(4) vector_array for part's structured nodes

Per_node Binary Tensor An EnSight6 binary tensor file contains information in the following order:

(1) description line
(4) tensor_array for unstructured nodes
(1) part #
(1) block
(4) tensor_array for part's structured nodes

Per_node Binary Complex An EnSight6 binary complex real and imaginary *scalar* files contain information in the following order: (The same methodology applies for the complex real and imaginary vector files.)

Real scalar file:

(1) description line
(4) real scalar_array for unstructured nodes
(1) part #
(1) block
(4) real scalar_array for part's structured nodes

Imaginary scalar file:

(1) description line
(4) imaginary scalar_array for unstructured nodes
(1) part #
(1) block
(4) imaginary scalar_array for part's structured nodes

Per_element Binary Scalar An EnSight6 binary scalar file contains information in the following order:

(1) description line
(1) part #
(1) element type (tria3, quad4, ...)
(4) scalar_array for elements of part and type

Per_element Binary Vector An EnSight6 binary vector file contains information in the following order:

(1) description line
(1) part #
(1) element type (tria3, quad4, ...)
(4) vector_array for elements of part and type

Per_element Binary Tensor An EnSight6 binary tensor file contains information in the following order:

(1) description line
(1) part #
(1) element type (tria3, quad4, ...)
(4) tensor_array for unstructured elements of part and type
(1) part #
(1) block
(4) tensor_array for structured elements of part and type

Per_element Binary Complex EnSight6 binary complex real and imaginary *scalar* files contain information in the following order: (The same methodology applies for the complex real and imaginary vector files.)

Real scalar file:

(1) description line
(1) part #
(1) element type (tria3, quad4, ...)
(4) real scalar_array for unstructured elements of part and type
(1) part #
(1) block
(4) real scalar_array for structured elements of part and type

Imaginary scalar file:

(1) description line
(1) part #
(1) element type (tria3, quad4, ...)
(4) imaginary scalar_array for unstructured elements of part and type
(1) part #
(1) block
(4) imaginary scalar_array for structured elements of part and type

Binary Measured Geometry An EnSight6 binary measured/particle geometry file contains information in the following order:

(1) <C Binary/Fortran Binary>
(1) description line 1
(1) particle coordinates
(2) #_of_points
(3) point_ids
(4) coordinate_array

Binary Measured Variable Files EnSight6 binary measured/discrete particle scalar and vector files follow the same binary formats as EnSight6 model per-node scalar and vector files.

11.3 EnSight5 Format

Included in this section:

EnSight5 General Description

Note: The EnSight6 format replaces and includes all aspects of the older EnSight5 format. This description is included for completeness but use of the EnSight6 format with EnSight 6.x and later versions is encouraged!

EnSight5 data consists of the following files:

- Geometry (required)
- Results (optional) (points to other variable files and possibly to changing geometry files)
- Measured (optional) (points to measured geometry and variable files)

The results file contains information concerning scalar and vector variables. EnSight makes no assumptions regarding the physical significance of the scalar and vector variables. These files can be from any discipline. For example, the scalar file can include such things as pressure, temperature, and stress. The vector file can be velocity, displacement, or any other vector data.

All variable results for EnSight5 are contained in disk files—one variable per file. Additionally, if there are multiple time steps, there must be a set of disk files for each time step.

Sources of EnSight5 data include the following:

- Data that can be translated to conform to the EnSight5 data format
- Data that originates from one of the translators supplied with the EnSight application

The EnSight5 format supports a defined element set as shown below. The data must be defined in this element set. Elements that do not conform to this set must either be subdivided or discarded.

Supported EnSight5 Elements

The elements that are supported by the EnSight5 format are:

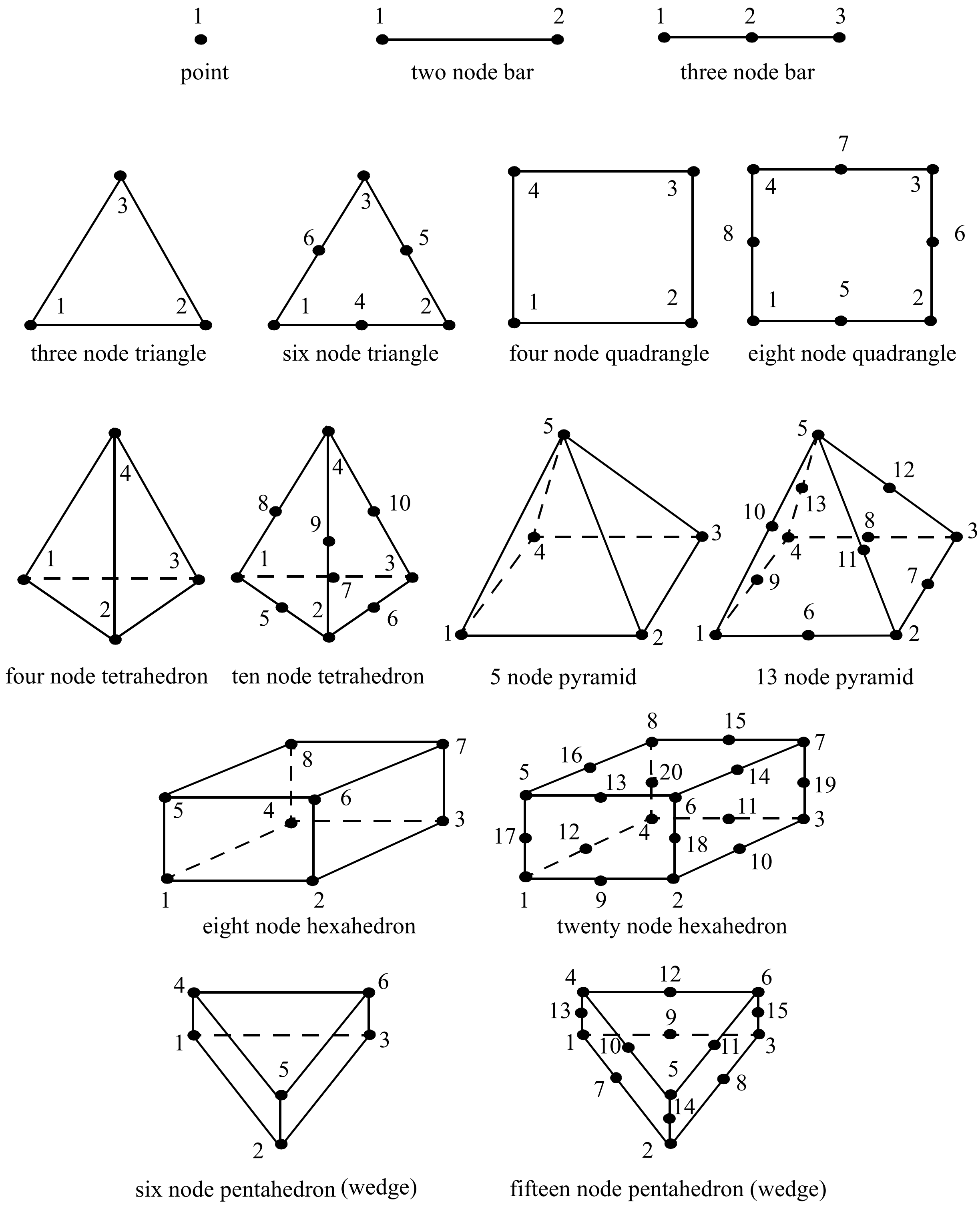


Figure 2-3
Supported EnSight5 Elements

EnSight5 Geometry File Format

The EnSight5 format consists of keywords followed by information. The following items are important to remember when working with EnSight5 geometry files:

1. You do not have to assign node IDs. If you do, the element connectivities are based on the node numbers. If you let EnSight assign the node IDs, the nodes are considered to be sequential starting at node 1, and element connectivity is done accordingly. If node IDs are set to off, they are numbered internally; however, you will not be able to display or query on them. If you have node IDs in your data, you can have EnSight ignore them by specifying "node id ignore." Using this option may reduce some of the memory taken up by the Client and Server, but remember that display and query on the nodes will not be available.
2. You do not need to specify element IDs. If you specify element IDs, or you let EnSight assign them, you can show them on the screen. If they are set to off, you will not be able to show or query on them. If you have element IDs in your data you can have EnSight ignore them by specifying "element id ignore." Using this option will reduce some of the memory taken up by the Client and Server. This may or may not be a significant amount, and remember that display and query on the elements will not be available.
3. The format of integers and real numbers **must be followed** (See the Geometry Example below).
4. Integers are written out using the following integer format:

From C:	`8d` format
From FORTRAN:	`i8` format

   Real numbers are written out using the following floating-point format:

From C:	`12.5e` format
From FORTRAN:	`e12.5` format

   The number of integers or reals per line must also be followed!
5. By default, a Part is processed to show the outside boundaries. This representation is loaded to the Client host system when the geometry file is read (unless other attributes have been set on the workstation, such as feature angle).
6. Coordinates must be defined before any Parts can be defined. The different elements can be defined in any order (that is, you can define a hexa8 before a bar2).

Generic Format

Not all of the lines included in the following generic example file are necessary:

```
description line 1
description line 2
node id <off/given/assign/ignore>
element id <off/given/assign/ignore>
coordinates
# of points
id x y z
id x y z
```

```
id x y z
.
.
.
part #
description line
point
number of points
id nd nd
id nd nd
id nd nd
.
.
.
bar2
number of bar2's
id nd nd
id nd nd
id nd nd
.
.
.
bar3
number of bar3's
id nd nd nd
id nd nd nd
id nd nd nd
.
.
.
tria3
number of three node triangles
id nd nd nd
id nd nd nd
id nd nd nd
.
.
.
tria6
number of six node triangles
id nd nd nd nd nd nd
.
.
.
quad4
number of quad 4's
id nd nd nd nd
id nd nd nd nd
id nd nd nd nd
id nd nd nd nd
.
.
.
quad8
number of quad 8's
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
.
.
```

```
.
tetra4
number of 4 node tetrahedrons
id nd nd nd nd
id nd nd nd nd
id nd nd nd nd
id nd nd nd nd
.
.
.
tetra10
number of 10 node tetrahedrons
id nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd
.
.
.
pyramid5
number of 5 node pyramids
id nd nd nd nd nd
id nd nd nd nd nd
id nd nd nd nd nd
id nd nd nd nd nd
.
.
.
pyramid13
number of 13 node pyramids
id nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd
.
.
.
hexa8
number of 8 node hexahedrons
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd
.
.
.
hexa20
number of 20 node hexahedrons
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
.
.
.
penta6
number of 6 node pentahedrons
id nd nd nd nd nd nd
id nd nd nd nd nd nd
id nd nd nd nd nd nd
```

```
id nd nd nd nd nd nd
id nd nd nd nd nd nd
.
.
.
penta15
number of 15 node pentahedrons
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
id nd nd nd nd nd nd nd nd nd nd nd nd nd nd nd
.
.
.
```

EnSight5 Geometry Example

The following is an example of an EnSight geometry file:

```
this is an example problem
this is the second description line
node id given
element id given
coordinates
      10
       5 1.00000e+00 0.00000e+00 0.00000e+00
     100 0.00000e+00 1.00000e+00 0.00000e+00
     200 0.00000e+00 0.00000e+00 1.00000e+00
      40 1.00000e+00 1.00000e+00 0.00000e+00
      22 1.00000e+00 0.00000e+00 1.00000e+00
    1000 2.00000e+00 0.00000e+00 0.00000e+00
      55 0.00000e+00 2.00000e+00 0.00000e+00
      44 0.00000e+00 0.00000e+00 2.00000e+00
     202 2.00000e+00 2.00000e+00 0.00000e+00
     101 2.00000e+00 0.00000e+00 2.00000e+00
part 1
This is Part 1, a pretty strange Part
tria3
       2
     101     100     200      40
     201     101       5    1000
tetra4
       1
     102     100     202     101    1000
part 2
This is Part 2, it’s pretty strange also
bar2
       1
     103     101    1000
```

EnSight5 Result File Format

The Result file is an ASCII free format file that contains variable and time step information that pertains to a Particular geometry file. The following information is included in this file:

- Number of scalar variables
- Number of vector variables
- Number of time steps
- Starting file number extension and skip-by value
- Flag that specifies whether there is changing geometry
- Names of the files that contain the values of scalar and vector variables
- The names of the geometry files that will be used for the changing geometry.

The format of the EnSight5 result file is as follows:

- Line 1

  Contains the number of scalar variables, the number of vector variables and a geometry-changing flag. (If the geometry-changing flag is 0, the geometry of the model does not change over time. If it is 1, then there is connectivity changing geometry. If it is 2, then there is coordinate only changing geometry.)

- Line 2

  Indicates the number of time steps that are available.

- Line 3

  Lists the time that is associated with each time step. There must be the same number of values as are indicated in Line 2. This “line” can actually span several lines in the file. You do not have to have one very long line.

- Line 4

  Specified only if more than one time step is indicated in Line 2. The two values on this line indicate the file extension value for the first time step and the offset between files. If the values on this line are 0 5, the first time step available has a subscript of 0, the second time step available has a subscript of 5, the third time step has a subscript of 10, and so on.

- Line 5

  Contains the names of the geometry files that will be used for changing geometry. This line exists only if the flag on Line 1 is set to 1 or 2. The geometry file name must follow the EnSight5 wild card specification.

- Line 6 through Line [5+N] where N is the number of scalar variables specified in Line 1.

  List **BOTH** the file names **AND** variable description that correspond to each scalar variable. There must be a file name for each scalar variable that is specified in Line 1.

If there is more than one time step, the file name must follow the EnSight5 wild card specification. See Note below.

- Lines that follow the scalar variable files.

  List the file names that correspond to each vector variable. There must be a file name for each vector variable that is specified in Line 1. If there is more than one time step, the file name must follow the EnSight5 wild card specification. See Note below.

Note *The variable description is limited to 19 characters in the current release. Variable names must not start with a numeric digit and must not contain any of the following reserved characters:*

(	[	+	@	!	*	$	:
)	]	-	space	#	^	/	?

The generic format of a result file is as follows:

```
#_of_scalars #_of_vectors geom_chang_flag
#_of_timesteps
time1 time2 time3 .....
start_file_# skip_by_value
geometry_file_name.geo**
scalar0_file_name**   description (19 characters max)
scalar1_file_name**   description
.
.
.
vector0_file_name**   description (19 characters max)
vector1_file_name**   description
.
```

EnSight5 Result File Example 1

The following example illustrates a result file specified for a non-changing geometry file with only one time step:

```
2 1 0
1
0.0
exone.scl0 pressure
exone.scl1 temperature
exone.dis0 velocity
```

EnSight5 Result File Example 2

This example illustrates a result file that specifies a connectivity changing geometry that has multiple time steps.

```
1 2 1
4
1.0 2.0 2.5 5.0
0 1
extwo.geom**
pres.scl** pressure
vel.dis** velocity
grad.dis** gradient
```

The following files would be needed for example 2:

```
extwo.geom00 pres.scl00 vel.dis00 grad.dis00
extwo.geom01 pres.scl01 vel.dis01 grad.dis01
extwo.geom02 pres.scl02 vel.dis02 grad.dis02
extwo.geom03 pres.scl03 vel.dis03 grad.dis03
```

EnSight5 Wild Card Name Specification

If multiple time steps are involved, the file names must conform to the EnSight5 wild-card specification. This specification is as follows:

- File names must include numbers that are in ascending order from beginning to end.
- Numbers in the files names must be zero filled if there is more than one significant digit.
- Numbers can be anywhere in the file name.
- When the file name is specified in the EnSight5 result file, you must replace the numbers in the file with an asterisk(*). The number of asterisks specified is the number of significant digits. The asterisk must occupy the same place as the numbers in the file names.

EnSight5 Variable File Format

Variables files have one description line followed by a value for each node. For a scalar file there is one value per node, while for vector files there are three values per node.

The values **must be written** in the following floating point format (**6 per line** as shown in the examples below):

From C: `12.5e` format

From FORTRAN: `e12.5` format

The format of a variables file is as follows:

- Line 1

  This line is a description line.

- Line 2 through the end of the file contains the values at each node in the model. A generic example:

```
A description line
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
 *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+** *.*****E+**
```

EnSight5 Variable File Example 1

This example shows a scalar file for a geometry with seven defined nodes.

```
These are the pressure values for a 7 node geometry
 1.00000E+00 2.00000E+00 3.00000E+00 4.00000E+00 5.00000E+00 6.00000E+00
 7.00000E+00
```

EnSight5 Variable File Example 2

This example shows the vector file for a geometry with seven defined nodes.

```
These are the velocity values for a 7 node geometry
 1.00000E+00 1.00000E+00 1.00000E+00 2.00000E+00 2.00000E+00 2.00000E+00
 3.00000E+00 3.00000E+00 3.00000E+00 4.00000E+00 4.00000E+00 4.00000E+00
 5.00000E+00 5.00000E+00 5.00000E+00 6.00000E+00 6.00000E+00 6.00000E+00
 7.00000E+00 7.00000E+00 7.00000E+00
```

EnSight5 Measured/Particle File Format

This file allows you to define Particle locations, sizes, etc. to display with the geometry. Typical uses are fuel droplets for combustion analysis or data derived from experiments on prototypes.

The measured/Particle files consist of the following:

- Measured/Particle geometry file (referenced by the measured results file)
- Measured/Particle results file (the filename which is put into the Data Reader's "(Set) Measured" field)
- Measured/Particle variables file (referenced by the measured results file)

The format of the EnSight5 Measured/Particle geometry file is described below.

Note that there is only one description line and there *must* be an ID for each measured point.

Note also that the number of Particles can be different in each of the geometry file (if you have transient data), however, the number of values in each of the corresponding variable files must coincide, and the IDs of the Particles must be consistent in order to track the Particles at intermediate times or locations.

The format of an EnSight5 Measured/Particle geometry file is as follows:

- Line 1

  This line is a description line.

- Line 2

  Indicates that this file contains Particle coordinates. The words "particle coordinates" should be entered on this line without the quotes.

- Line 3

  Specifies the number of Particles.

- Line 4 through the end of the file.

  Each line contains the ID and the X, Y, and Z coordinates of each Particle. The format of this line is "integer real real real" written out in the following format:

  From C: `%8d%12.5e%12.5e%12.5e` format

  From FORTRAN: `i8, 3e12.5` format

A generic measured/Particle geometry file is as follows:

```
A description line
particle coordinates
#_of_Particles
id xcoord ycoord zcoord
id xcoord ycoord zcoord
id xcoord ycoord zcoord
 .
 .
 .
```

EnSight5 Measured Geometry/Particle File Example

The following illustrates an EnSight5 Measured Geometry/Particle file with seven points:

```
This is a simple ensight5 measured geometry/particle file
particle coordinates
       7
     101 0.00000E+00 0.00000E+00 0.00000E+00
     102 1.00000E+00 0.00000E+00 0.00000E+00
     103 1.00000E+00 1.00000E+00 0.00000E+00
     104 0.00000E+00 1.00000E+00 0.00000E+00
     205 5.00000E-01 0.00000E+00 2.00000E+00
     206 5.00000E-01 1.00000E+00 2.00000E+00
     307 0.00000E+00 0.00000E+00-1.50000E+00
```

EnSight5 Measured/ Particle File Format

The format of the EnSight5 Measured/Particle results file is as follows:

- Line 1

  Contains the number of scalar variables, the number of vector variables, and a measured geometry changing flag. If the measured geometry changing flag is 0, only one time step is indicated.

- Line 2

  Indicates the number of available time steps.

- Line 3

  Lists the time that is associated with each time step. The time step information does not have to coincide with the model time step information. This “line” can actually span several lines in the file. You do not have to have one very long line.

- Line 4

  Specified only if Line 2 specifies more than one time step. The line contains two values; the first value indicates the file extension value for the first time step, and the second value indicates the offset between files. If this line contains the values 0 and 5, the first time step has a subscript of 0, the second of 5, the third of 10, and so on.

- Line 5

  Contains the name of the measured geometry file. If there is more than one time step, the file name must follow the EnSight wild card specification.

- Line 6 through Line [5+N] where N is the number of scalar variables specified in Line 1.

  List the file names that correspond to each scalar variable. There must be a file name for each scalar variable that is specified in Line 1. If there is more than one time step, the file name must follow the EnSight wild card specification.

- Lines that follow the scalar variable files.

  List the names of the files that correspond to each vector variable. There must be a file name for each vector variable that is specified in Line 1. If there is more than one time step, the file name must follow the EnSight wild card specification.

A generic EnSight5 Measured/Particle results file is as follows:

```
#_of_scalars #_of_vectors geom_chang_flag
#_of_timesteps
time1 time2 time3 .....
start_file_# skip_by_value
measured_geom_file_name**
scalar0_file_name**   description
scalar1_file_name**   description
.
.
.
vector0_file_name**   description
vector1_file_name**   description
.
.
.
```

Measured/Particle Results File Example 1

This example illustrates an EnSight5 Measured/Particle result file that specifies a non-changing geometry with only one time step:

```
2 1 0
1
0.0
exone.geom
exone.scl0 pressure
exone.scl1 temperature
exone.dis0 velocity
```

Measured/Particle Results File Example 2

This example illustrates an EnSight5 Measured/Particle result file that specifies a changing geometry with multiple time steps:

```
1 2 1
4
1.0 2.0 2.5 5.0
0 1
extwo.geom**
pres.scl** pressure
vel.dis** velocity
grad.dis** gradient
```

The following files are needed for Example 2:

```
extwo.geom00pres.scl00vel.dis00       grad.dis00
extwo.geom01pres.scl01vel.dis01       grad.dis01
extwo.geom02pres.scl02vel.dis02       grad.dis02
extwo.geom03pres.scl03vel.dis03       grad.dis03
```

Measured /Particle Results Variable files

The EnSight5 Measured/Particle variable files referred to in the measured Results file follow the same format as EnSight5 Variable files. The number of values in each of these variable files must correspond properly to the number of Particles in the corresponding measured geometry files.

Writing EnSight5 Binary Files

This section describes the EnSight5 binary files. This format is used to increase the speed of reading data into EnSight. A utility exists for converting EnSight5 ASCII files to EnSight5 binary files—it is called asciitobin5 and is found on the release tape under ensight/server/utilities/asciitobin5.

For binary files, there is a header that designates the type of binary file. This header is: "C Binary" or "Fortran Binary." This must be the first thing in the file. The format for the file is then essentially the same format as the ASCII format, with the following exceptions:

> The ASCII format puts the node and element ids on the same "line" as the corresponding coordinates. The BINARY format writes all node id's then all coordinates.
>
> The ASCII format puts all element id's of a type within a Part on the same "line" as the corresponding connectivity. The BINARY format writes all the element ids for that type, then all the corresponding connectivities of the elements.

In all the descriptions of binary files that follow, the number on the left end of the line corresponds to the type of write of that line, according to the following code:

1. This is a write of 80 characters to the file:

   C example:
   ```
   char buffer[80];
   strcpy(buffer,"C Binary");
   fwrite(buffer,sizeof(char),80,file_ptr);
   ```

   FORTRAN:
   ```
   character*80   buffer
   buffer = "Fortran Binary"
   write(10) buffer
   ```

2. This is a write of a single integer:

   C example: `fwrite(&num_nodes,sizeof(int),1,file_ptr);`

   FORTRAN: `write(10) num_nodes`

3. This is a write of an integer array:

   C example: `fwrite(node_ids,sizeof(int),num_nodes,file_ptr);`

   FORTRAN: `write(10) (node_ids(i),i=1,num_nodes)`

4. This is a write of a float array:

   C example: `fwrite(coords,sizeof(float),3*num_nodes,file_ptr);`

   FORTRAN: `write(10) ((coords(i,j),i=1,3),j=1,num_nodes)`

(Note: Coords is a single precision array, double precision will not work!)

EnSight5 Binary Geometry File Format

An EnSight5 binary geometry file contains information in the following order:

(1) <C Binary/Fortran Binary>
(1) description line 1
(1) description line 2
(1) node id <given/off/assign/ignore>
(1) element id <given/off/assign/ignore>
(1) coordinates
(2) #_of_points
(3) [point_ids]
(4) coordinate_array
(1) part #
(1) description line
(1) element_type
(2) #_of_element_type
(3) [element_ids] for the element_type
(3) connectivities for the element_type
(1) element_type
(2) #_of_element_type
(3) [element_ids] for the element_type
(3) connectivities for the element_type
.
.
.
(1) part #
(1) description line
(1) element_type
(2) #_of_element_type
(3) [element_ids] for the element_type
(3) connectivities for the element_type
(1) element_type
(2) #_of_element_type
(3) [element_ids] for the element_type
(3) connectivities for the element_type
.
.
.

Binary Scalar

An EnSight5 binary scalar file contains information in the following order:

(1) description line
(4) scalar_array

Binary Vector

An EnSight5 binary vector file contains information in the following order:

(1) description line
(4) vector_array

Binary Measured

An EnSight5 binary measured/Particle geometry file contains information in the following order:

(1) <C Binary/Fortran Binary>
(1) description line 1
(1) particle coordinates
(2) #_of_points
(3) point_ids
(4) coordinate_array

11.4 FAST UNSTRUCTURED Results File Format

FAST UNSTRUCTURED input data consists of the following:

- Geometry file (required) (GRID file).
- Results file (optional).
- EnSight5 Measured/Particle Files (optional). The measured .res file references the measured geometry and variable files.

FAST UNSTRUCTURED data files can be read as:

Workstation: ASCII, C Binary, or FORTRAN binary

Cray: ASCII, C Binary, or COS-Blocked FORTRAN binary

Due to the different number of representations on a Cray Research vector system and workstations, binary files created on a Cray Research vector system can *not* be read on the workstation, and visa versa.

EnSight reads the geometry (grid files) directly. However, an EnSight-like results file is needed in order to read the results unless a “standard” Q-file is provided in its place. See FAST UNSTRUCTURED Result File below.

FAST UNSTRUCTURED Geometry file notes

Only the single zone format can be read into EnSight. Any tetrahedral elements will be placed into the first “domain” Part. Triangular elements are placed into Parts based on their “tag” value.

The FAST UNSTRUCTURED solution file or function file formats can be used for variable results. The I J K values need to be I=Number of points and J=K=1. This does require the use of a modified EnSight results file as explained below.

Node and element numbers are assigned sequentially allowing for queries to be made within EnSight. Tetrahedron elements will be assigned before triangular elements.

FAST UNSTRUCTURED Result file format

The FAST UNSTRUCTURED result file was defined by CEI and is very similar to the EnSight results file and contains information needed to relate variable names to variable files, step information, etc. There is a slight variation from the normal EnSight results file because of the differences between the solution (Q file) and function files. The difference lies on the lines which relate variable filenames to a description. These lines have the following format:

```
<filename> <type> <number(s)> <description>
```

See FAST UNSTRUCTURED Result File below for the definition of each.

The following information is included in a FAST UNSTRUCTURED result file:

- Number of scalar variables
- Number of vector variables
- Number of time steps

- Starting file number extension and skip-by value
- Flag that specifies whether there is changing geometry.
- Names of the files that contain the values of scalar and vector variables. An indication as to the type of the file being used for the variable, which variable in the file and the name given to that variable.
- The names of the geometry files that will be used for the changing geometry.

Generic FAST UNSTRUCTURED Result File Format

The format of the Result file is as follows:

- Line 1

  Contains the number of scalar variables, the number of vector variables and a geometry changing flag. If the geometry changing flag is 0, the geometry of the model does not change over time. If the flag is 1, the geometry can change connectivity. If the flag is 2, only coordinates can change.

- Line 2

  Indicates the number of time steps that are available. If this number is positive, then line 3 information must be present. If this number is negative, then Line 3 information must not be present and the times will be read from the solution file. Thus, one must have a solution file in one of the lines from Line 6 on.

- Line 3

  Lists the time that is associated with each time step. There must be the same number of values as are indicated in Line 2. This “line” can actually span several lines in the file. Specify only if Line 2 value is positive.

- Line 4

  Specified only if more than one time step is indicated in Line 2. The two values on this line indicate the file extension value for the first time step and the offset between files. If the values on this line are 0 5, the first time step available has a subscript of 0, the second time step available has a subscript of 5, the third time step has a subscript of 10, and so on.

- Line 5

  This line exists only if the changing geometry flag on Line 1 has been set to 1 or 2. Line contains name of the FAST UNSTRUCTURED grid file. The file name must follow the EnSight wild card specification.

- Line 6 through Line [5+N] where N is the number of scalar variables specified in Line 1.

  List the file names that correspond to each scalar variable. There must be a file name for each scalar variable that is specified in Line 1. If there is more than one time step, the file name must follow the EnSight wild card specification.

  These lines also contain the type of file being used, solution or function, and the location of the variable value in the file. The contents are:

```
<filename> <type> <number> <description>
```

where filename is the name of solution file or function file containing the variable; type is “S” for solution file, or “F” for function file; numberis which variable in the file to use (specify just one number); and `description` is the Description of the variable.

The solution file (“s”) is the traditional .q file in which normally the first variable is density, the second through fourth variables are the components of momentum, and the fifth variable is total energy.

- Lines that follow the scalar variable files.

  List the file names that correspond to each vector variable. There must be a file name for each vector variable that is specified in Line 0. If there is more than one time step, the file name must follow the EnSight wild card specification.

  These lines also contain the type of file being used, solution or function, and the location(s) of the variable values in the file. The contents are:

```
<filename> <type> <numbers> <description>
```

  where filename is the name of solution file or function file containing the variable; type is “S” for solution file, or “F” for function file; numbersare which variables in the file to use (specify just three numbers); and description is the Description of the variable.

The generic format of the result file is as follows:

```
#_of_scalars #_of_vectors geom_chng_flag
#_of_timesteps
time1 time2 time3 .....
start_file_# skip_by_value
geometry_file_name.geo**
scalar0_file_name** type # description
scalar1_file_name** type # description
.
.
.
vector0_file_name** type # # # description
vector1_file_name** type # # # description
.
.
.
```

FAST UNSTRUCTURED Example This example illustrates a result file that specifies a non-changing geometry with only one time step.

```
3 2 0
1
0.0
block.sol S 1 Density
block.sol S 5 Total_Energy
block.scl F 1 Temperature
block.var F 1 2 3 Displacement
block.sol S 2 3 4 Momentum
```

Thus, this model will get two scalars from the solution file (block.sol). The first is Density in the first location in the file and the next is Total energy in the fifth location in the solution file. It will also get a Temperature scalar from the first location in the function file (block.scl).

It will get a Displacement vector from the function file called block.var. The three components of this vector are in the 1st, 2nd, and 3rd locations in the file. Finally, a Momentum vector will be obtained from the 2nd, 3rd, and 4th locations of the solution file.

Example 2 is somewhat similar, except that it is transient, with coordinate changing geometry. Note also that the times will come from the solution file.

```
3 2 2
-10
0 1
block***.grid
block***.sol S 1 Density
block***.sol S 5 Total_Energy
block***.scl F 1 Temperature
block***.var F 1 2 3 Displacement
block***.sol S 2 3 4 Momentum
```

11.5 FLUENT UNIVERSAL Results File Format

This section describes the FLUENT results file format and provides an example of this file. For transient cases, you *must* supply this result file. For static models this file is not required. The FLUENT result file is a slightly modified EnSight5 results file and provides a way to describe multiple time-step FLUENT Universal files to EnSight.

When using multiple FLUENT files with this result file definition, you *must* make sure that the files contain the same defined variables. In other words, any variable that exists in one must exist in all.

The Result file is an ASCII free format file that contains time step and universal file information for each available time step. The following information is included in this file:

- Number of time steps
- Simulation Time Values
- Starting file number extension and skip-by value
- Name of the universal file with EnSight wild card specification.

The format of the Result file is as follows:

- Line 1

  Indicates the number of time steps that are available.

- Line 2

  Lists the time that is associated with each time step. There must be the same number of values as are indicated in Line 1. This “line” can actually span several lines in the file. You do not have to have one very long line.

- Line 3

  Specified only if more than one time step is indicated in Line 1. The two values on this line indicate the file extension value for the first time step and the offset between files. If the values on this line are 0 5, the first time step available has a subscript of 0, the second time step available has a subscript of 5, the third time step has a subscript of 10, and so on.

- Line 4

  Contains the names of the universal file that will be used for the changing time step information. The universal file name must follow the EnSight5 wild card specification.

The generic format of the result file is as follows:

```
#_of_timesteps
time1 time2 time3 .....
start_file_# skip_by_value
universal_file_name***
```

FLUENT Example

This example illustrates a FLUENT result file

```
4
1.0 2.0 3.0 4.0
0 1
extwo**.uni
```

The following FLUENT universal files will need to exist for the result file:

```
extwo00.uni
extwo01.uni
extwo02.uni
extwo03.uni
```

11.6 Movie.BYU Results File Format

For transient cases, you must supply an EnSight result file. The result file for the Movie.BYU case is exactly the same as for EnSight5 (it is repeated below for your ease).

The Result file is an ASCII free format file that contains variable and time step information that pertains to a Particular geometry file. The following information is included in this file:

- Number of scalar variables
- Number of vector variables
- Number of time steps
- Starting file number extension and skip-by value
- Flag that specifies whether there is changing geometry
- Names of the files that contain the values of scalar and vector variables
- The names of the geometry files that will be used for the changing geometry.

The format of the Movie.BYU (EnSight5) result file is as follows:

- Line 1

  Contains the number of scalar variables, the number of vector variables and a geometry-changing flag. (If the geometry-changing flag is 0, the geometry of the model does not change over time. If it is 1, then there is connectivity changing geometry. If it is 2, then there is coordinate only changing geometry.)

- Line 2

  Indicates the number of time steps that are available.

- Line 3

  Lists the time that is associated with each time step. There must be the same number of values as are indicated in Line 2. This “line” can actually span several lines in the file. You do not have to have one very long line.

- Line 4

  Specified only if more than one time step is indicated in Line 2. The two values on this line indicate the file extension value for the first time step and the offset between files. If the values on this line are 0 5, the first time step available has a subscript of 0, the second time step available has a subscript of 5, the third time step has a subscript of 10, and so on.

- Line 5

  Contains the names of the geometry files that will be used for changing geometry. This line exists only if the flag on Line 1 is set to 1 or 2. The geometry file name must follow the EnSight5 wild card specification.

- Line 6 through Line [5+N] where N is the number of scalar variables specified in Line 1.

List **BOTH** the file names **AND** variable description that correspond to each scalar variable. There must be a file name for each scalar variable that is specified in Line 1.

If there is more than one time step, the file name must follow the EnSight5 wild card specification. See Note below.

- Lines that follow the scalar variable files.

  List the file names that correspond to each vector variable. There must be a file name for each vector variable that is specified in Line 1. If there is more than one time step, the file name must follow the EnSight5 wild card specification. See Note below.

Note *The variable description is limited to 19 characters in the current release. Variable names must not start with a numeric digit and must not contain any of the following reserved characters:*

(	[	+	@	!	*	$	:
)	]	-	space	#	^	/	?

The generic format of a result file is as follows:

```
#_of_scalars #_of_vectors geom_chang_flag
#_of_timesteps
time1 time2 time3 .....
start_file_# skip_by_value
geometry_file_name.geo**
scalar0_file_name**   description (19 characters max)
scalar1_file_name**   description
.
.
.
vector0_file_name**   description (19 characters max)
vector1_file_name**   description
.
```

Movie.BYU Result File Example 1

The following example illustrates a result file specified for a non-changing geometry file with only one time step:

```
2 1 0
1
0.0
exone.scl0 pressure
exone.scl1 temperature
exone.dis0 velocity
```

Movie.BYU Result File Example 2

This example illustrates a result file that specifies a connectivity changing geometry that has multiple time steps.

```
1 2 1
4
1.0 2.0 2.5 5.0
0 1
extwo.geom**
pres.scl** pressure
vel.dis** velocity
grad.dis** gradient
```

The following files would be needed for example 2:

```
extwo.geom00 pres.scl00 vel.dis00 grad.dis00
extwo.geom01 pres.scl01 vel.dis01 grad.dis01
extwo.geom02 pres.scl02 vel.dis02 grad.dis02
extwo.geom03 pres.scl03 vel.dis03 grad.dis03
```

11.7 PLOT3D Results File Format

PLOT3D input data consists of the following:

- Geometry file (required) (GRID file).
- Results file (optional).
- EnSight5 Measured/Particle Files (optional). The measured .res file references the measured geometry and variable files.

PLOT3D data files can be read as:

Workstation: ASCII, C Binary, or FORTRAN binary

Cray: ASCII, C Binary, or COS-Blocked FORTRAN binary

(see PLOT3D Reader, in Section 2.1)

Due to the different number of representations on a Cray Research vector system and workstations, binary files created on a Cray Research vector system can *not* be read on the workstation, and visa versa.

EnSight attempts to ensure that the format of the file being read matches the format you have selected in the Data Reader dialog. However, if you specify that the file is C binary, and it is really FORTRAN binary, this will not be detected and erroneous values will be loaded.

EnSight reads the geometry (xyz files) directly. However, an EnSight-like results file (described below) is needed in order to read the results, unless a “standard” Q-file is provided in its place.

PLOT3D Geometry file notes

The following information is required in order to read PLOT3D files correctly:

1. whether there is Iblanking information in the file
2. whether files are in ASCII, C Binary, or FORTRAN binary
3. whether the file is “Single Zone” or Multi-Zoned”
4. whether the model is 1D, 2D, or 3D in nature.

Iblanking can be one of the following:

0 = Outside (Blanked Out)

1 = Inside

2 = Interior boundaries

<0 = zone that neighbors

If single zone with Iblanking, you can build EnSight Parts from the inside portions, blanked-out portions, or internal boundary portions. If single zone, you can also specify I, J, K limiting ranges for Parts to be created.

If Multi-zoned with Iblanking, you can additionally build Parts that are the boundary between two zones. (For boundary you must specify exactly two zones.)

If Multi-zoned and not using the “between boundary” option, a Part can span several zones.

If Multi-zoned, the dimension of the problem is forced to be 3D.

There can be nodes in different zones which have the same coordinates. No attempt has been made to merge these. Thus, on shared zone boundaries, there will likely be nodes on top of nodes. One negative effect of this is that node labels will be on top of each other.

Currently EnSight only prints out the global conditions in the solution file, fsmach, alpha, re, and time. It does not do anything else with them.

Node and element numbers are assigned in a sequential manner. Queries can be made on these node and element numbers or on nodes by I, J, and K.

PLOT3D Result file format

The PLOT3D result file was defined by CEI and is very similar to the EnSight results file and contains information needed to relate variable names to variable files, step information, etc. There is a slight variation from the normal EnSight results file because of the differences between the solution (Q file) and function files. The difference lies on the lines which relate variable filenames to a description. These lines have the following format:

```
<filename> <type> <number(s)> <description>
```

See PLOT3D Result File below for the definition of each.

The following information is included in a PLOT3D result file:

- Number of scalar variables
- Number of vector variables
- Number of time steps
- Starting file number extension and skip-by value
- Flag that specifies whether there is changing geometry.
- Names of the files that contain the values of scalar and vector variables. An indication as to the type of the file being used for the variable, which variable in the file and the name given to that variable.
- The names of the geometry files that will be used for the changing geometry.

Generic PLOT3D Result File Format

The format of the Result file is as follows:

- Line 1

  Contains the number of scalar variables, the number of vector variables and a geometry changing flag. If the geometry changing flag is 0, the geometry of the model does not change over time. Only the coordinates can change for a PLOT3D file at present time.

- Line 2

  Indicates the number of time steps that are available.

- Line 3

  Lists the time that is associated with each time step. There must be the same number of values as are indicated in Line 2. This “line” can actually span several lines in the file.

- Line 4

  Specified only if more than one time step is indicated in Line 2. The two values on this line indicate the file extension value for the first time step and the offset between files. If the values on this line are 0 5, the first time step available has a subscript of 0, the second time step available has a subscript of 5, the third time step has a subscript of 10, and so on.

- Line 5

  This line exists only if the changing geometry flag on Line 1 has been set to 1. Line contains name of the PLOT3D xyz file. The file name must follow the EnSight wild card specification.

- Line 6 through Line [5+N] where N is the number of scalar variables specified in Line 1.

  List the file names that correspond to each scalar variable. There must be a file name for each scalar variable that is specified in Line 1. If there is more than one time step, the file name must follow the EnSight wild card specification.

  These lines also contain the type of file being used, solution or function, and the location of the variable value in the file. The contents are:

  ```
  <filename> <type> <number> <description>
  ```

  where filename is the name of solution file or function file containing the variable; type is “S” for solution file, or “F” for function file; numberis which variable in the file to use (specify just one number); and description is the Description of the variable.

  The solution file (“s”) is the traditional .q file in which normally the first variable is density, the second through fourth variables are the components of momentum, and the fifth variable is total energy.

- Lines that follow the scalar variable files.

  List the file names that correspond to each vector variable. There must be a file name for each vector variable that is specified in Line 1. If there is more than one time step, the file name must follow the EnSight wild card specification.

  These lines also contain the type of file being used, solution or function, and the location(s) of the variable values in the file. The contents are:

  ```
  <filename> <type> <numbers> <description>
  ```

  where filename is the name of solution file or function file containing the variable; type is “S” for solution file, or “F” for function file; numbersare which variables in the file to use (specify just three numbers); and description is the Description of the variable.

The generic format of the result file is as follows:

```
#_of_scalars #_of_vectors geom_chng_flag
#_of_timesteps
time1 time2 time3 .....
start_file_# skip_by_value
geometry_file_name.geo**
scalar0_file_name** type # description
scalar1_file_name** type # description
.
.
.
vector0_file_name** type # # # description
vector1_file_name** type # # # description
.
.
.
```

PLOT3D Example

This example illustrates a result file that specifies a non-changing geometry with only one time step.

```
3 2 0
1
0.0
block.sol S 1 Density
block.sol S 5 Total_Energy
block.scl F 1 Temperature
block.var F 1 2 3 Displacement
block.sol S 2 3 4 Momentum
```

Thus, this model will get two scalars from the solution file (block.sol). The first is Density in the first location in the file and the next is Total energy in the fifth location in the solution file. It will also get a Temperature scalar from the first location in the function file (block.scl).

It will get a Displacement vector from the function file called block.var. The three components of this vector are in the 1st, 2nd, and 3rd locations in the file. Finally, a Momentum vector will be obtained from the 2nd, 3rd, and 4th locations of the solution file.

Vectors can be 1D, 2D, or 3D. For a vector, always provide three numbers, but a zero will indicate that a component is empty, thus:

```
block.var F 1 0 3 XZ_Displacement
```

would be a 2D vector variable with components only in the X–Z plane.

If the above example was transient, with 3 time steps, it would appear as:

```
3 2 0
3
0.0 1.5 4.0
1 1
block.sol** S 1 Density
block.sol** S 5 Total_Energy
block.scl** F 1 Temperature
block.var** F 1 2 3 Displacement
block.sol** S 2 3 4 Momentum
```

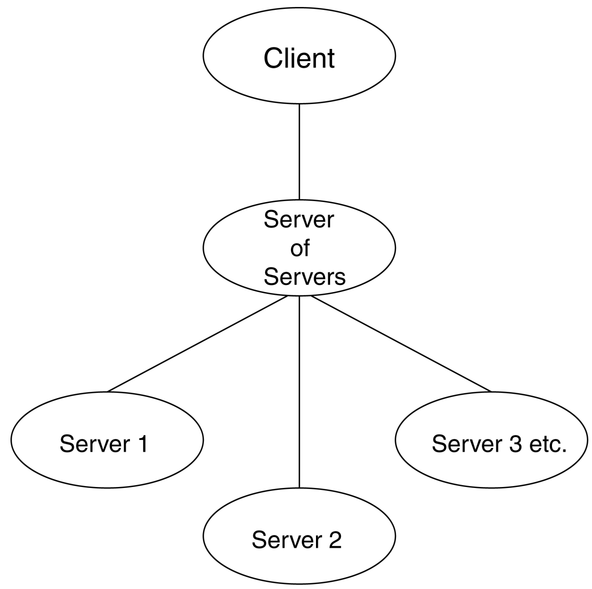
The files needed would then be:

```
block.sol01       block.scl01       block.var01
block.sol02       block.scl02       block.var02
block.sol03       block.scl03       block.var03
```

Note: A "standard" Q-file can be substituted for PLOT3D result file format if desired. A "standard" Q-file has 5 variable components (First is density, then the three components of momentum, and last is energy).

11.8 Server-of-Server Casefile Format

EnSight7 (with gold license key) has the capability of dealing with partitioned data in an efficient distributed manner by utilizing what we call a server-of-servers (SOS for short). An SOS server resides between a normal client and a number of normal servers. Thus, it appears as a normal server to the client, and as a normal client to the various normal servers.



This arrangement allows for distributed parallel processing of the various portions of a model, and has been shown to scale quite well.

Please recognize that your data must be partitioned in some manner (hopefully in a way that will be reasonably load balanced) in order for this approach to be useful.

(Included in the EnSight distribution is an unsupported utility that will take most EnSight Gold binary datasets and partition it for you. The source for this utility (called "chopper") can be found in the `$ENSIGHT7_HOME/ensight73/unsupported/partitioner` *directory.*)

Note: If you do your own partitioning of data into EnSight6 or EnSight Gold format, please be aware that each part must be in each partition - but, any given part can be "empty" in any given partition. (All that is required for an empty part is the "part" line, the part number, and the "description" line.)

You should place each partitioned portion of the model on the machine that will compute that portion. Each partitioned portion is actually a self contained set of EnSight data files, which could typically be read by a normal client - server session of EnSight. For example, if it were EnSight gold format, there will be a casefile and associated gold geometry and variable results file(s). On the machine where the EnSight SOS will be run, you will need to place the sos casefile. This is a simple ascii file which informs the SOS about pertinent information need to run a server on each of the machines that will compute the various portions.

The format for this file is as follows: (Note that [ ] indicates optional information, and a blank line or a line with # in the first column are comments.)

FORMAT (Required)
type: master_server *datatype* (Required)

where: *datatype* is required and is one of the formats of EnSight's internal readers.

gold	ensight6	ensight5	plot3d	fidap
n3s	estet	mpgs4	movie	ansys
abaqus	fastunst	fluent		

or it can be any other string to use the user-defined format.
Note: the user-defined format declared to the SOS will be used by all servers.

If *datatype* is blank, it will default to EnSight6 data type.

SERVERS (Required)
number of servers: *num* (Required)

where: *num* is the number of servers that will be started and run concurrently.

#Server 1 (Comment only)
machine id: *mid* (Required)

where: *mid* is the machine id of the server.

executable: /.../ensight7.server (Required, must use full path)
[directory: *wd*] (Optional)

where: *wd* is the working directory from which ensight7.server will be run

[login id: *id*] (Optional)

where: *id* is the login id. Only needed if if is different on this machine.

[data_path: /.../*dd*] (Optional)

where: *dd* is the data where the data resides. Full path must be provided if you use this line.

casefile: *yourfile.case* (Required, but depending on format, may vary as to whether it is a casefile, geometry file, neutral file, universal file, etc.)
[resfile: *yourfile.res*] (Depends on format as to whether required or not)
[measfile: *yourfile.mea*] (Depends on format as to whether required or not)
#Server 2 (Comment only)

--- Repeat pertinent lines for as many servers as declared to be in this file ---

Example

This example deals with a EnSight Gold dataset that has been partitioned into 3 portions, each running on a different machine. The machines are named joe, sally, and bill. The executables for all machines are located in similar locations, but the data is not. Note that the optional data_path line is used on two of the servers, but not the third.

FORMAT
type: master_server gold

SERVERS
number of servers: 3

#Server 1
machine id: joe
executable: /usr/local/bin/ensight73/bin/ensight7.server
data_path: /usr/people/john/data
casefile: portion_1.case

#Server 2
machine id: sally
executable: /usr/local/bin/ensight73/bin/ensight7.server
data_path: /scratch/sally/john/data
casefile: portion_2.case

#Server 3
machine id: bill
executable: /usr/local/bin/ensight73/bin/ensight7.server
casefile: /scratch/temp/john/portion_3.case

If we name this example sos casefile - “all.sos”, and we run it on yet another machine - one named george, you would want the data distributed as follows:

On george: all.sos

On joe (in /usr/people/john/data): portion_1.case, and all files referenced by it.

On sally (in /scratch/sally/john/data): portion_2.case, and all files referenced by it.

On bill (in /scratch/temp/john): portion_3.case, and all file referenced by it.

By starting EnSight with the -sos command line option (which will autoconnect using ensight7.sos instead of ensight7.server), or by manually running ensight7.sos in place of ensight7.server, and providing all.sos as the casefile to read in the Data Reader dialog - EnSight will actually start three servers and compute the respective portions on them in parallel.

Additional Note: The initial EnSight SOS provided with release 7.2 does not yet support all EnSight features. The basics of reading and creating parts, coloring by variables, clips, isosurfaces and cuts are provided. Most query, plotting, and other features are not. If you try to use a not-yet-implemented feature, you will receive a message that it isn’t supported or the desired action will simply not occur. In a future release of EnSight, all features should be supported.

11.9 Periodic Matchfile Format

This is an optional file which can be used in conjunction with models which have rotational or translational computational symmetry (or periodic boundary conditions). It is invoked in the GEOMETRY section of the EnSight casefile, using the “match: filename” line. (see Section , EnSight6 Case File Format).

When a model piece is created with periodic boundary conditions, there is usually a built-in correspondence between two faces of the model piece. If you transform a copy of the model piece properly, face 1 of the copy will be at the same location as face 2 of the original piece. It is desirable to know the corresponding nodes between face 1 and face 2 so border elements will not be produced at the matching faces. This correspondence of nodes can be provided in a periodic match file as indicated below. (Please note that if a periodic match file is not provided, by default EnSight will attempt to determine this correspondence using a float hashing scheme. This scheme has been shown to work quite well, but may not catch all duplicates. The user has some control over the “capture” accuracy of the hashing through the use of the command: “test: float_hash_digits”. If this command is issued from the command dialog, the user can change the number of digits, in a normalized scheme, to consider in the float hashing. The lower the number of digits, the larger the “capture” distance, and thus the higher the number of digits, the smaller the capture distance. The default is 4, with practical limits between 2 and 7 or 8 in most cases.)

The transformation type and delta value are contained in the file. The periodic match file is an ASCII free format file. For unstructured data, it can be thought of as a series of node pairs, where a node pair is the node number of face 1 and its corresponding node number on face 2. For structured blocks, all that is needed is an indication of whether the i, j, or k planes contain the periodic face. The min plane of this “direction” will be treated as face 1, and the max plane will be treated as face 2.

The file format is as follows:

rotate / translate	The first line is either rotate or translate
theta / dx dy dz	The second line contains rotation angle in degrees or the three translational delta values.
np	If any unstructured pairs, the third line contains the number of these pairs (np).
n_{11} n_{21}	And the node ids of each pair follow. (The first
n_{12} n_{22}	subscript indicates face, the second is pair.)
. .	
. .	
. .	
n_{1np} n_{2np}	
blocks b_{min} b_{max} i/j/k	Last in the file comes as many of these “blocks” lines as needed. b_{min} and b_{max} are a range of block numbers. For a single block, b_{min} and b_{max} would be the same. Only one of i, j, or k can be specified for a given block.

Simple unstructured rotational example:

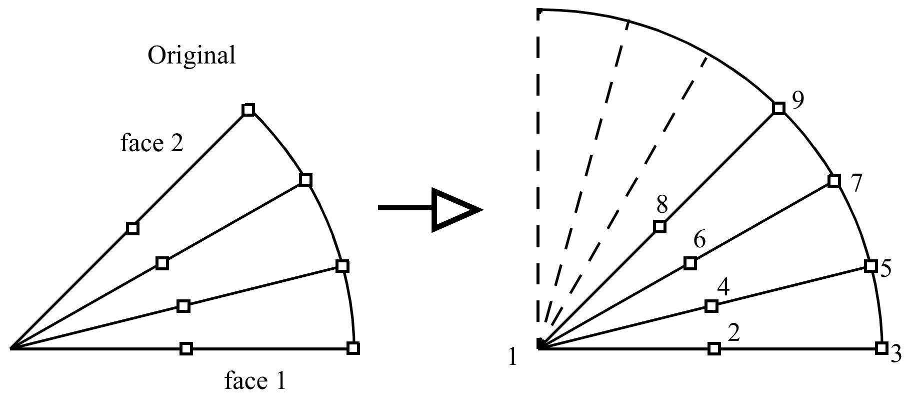


Figure 2-4
Model Duplication by rotational symmetry

The periodic match file for a rotation of this model about point 1 would be:

```
rotate
45.0
3
1 1
2 8
3 9
```

Thus, face 1 of this model is made up of nodes 1, 2, and 3 and face 2 of this model is made up of nodes 1, 8, and 9. So there are 3 node pairs to define, with node 1 corresponding to node 1 after a copy is rotated, node 2 corresponding to node 8, and node 3 corresponding to node 9.

Simple structured translational model:

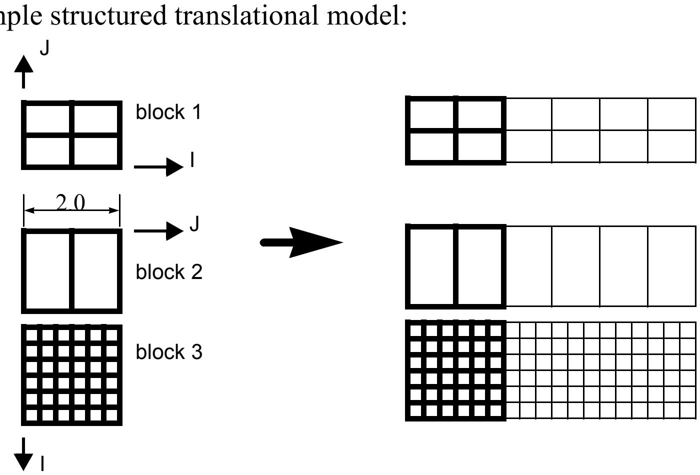


Figure 2-5
Model Duplication by translational symmetry
of structured blocks (3 instances)

```
translate
2.0 0.0 0.0
blocks 1 1 i
blocks 2 3 j
```

Since block 1 is oriented differently than blocks 2 and 3 in terms of ijk space, two "blocks" lines were needed in the match file.

Special Notes / Limitations:

1. This match file format requires that the unstructured node ids of the model be unique. This is only an issue with EnSight Gold unstructured format, since it is possible with that format to have non-unique node ids.

2. The model instance (which will be duplicated periodically) must have more than one element of thickness in the direction of the duplication. If it has only one element of thickness, intermediate instances will have all faces removed. If you have this unusual circumstance, you will need to turn off the shared border removal process, as explained in note 3.

3. The shared border removal process can be turned off, thereby saving some memory and processing time, by issuing the "test: rem_shared_bord_off" command in the command dialog. The effect of turning it off will be that border elements will be left between each periodic instance on future periodic updates.

4. The matching and hashing processes actually occur together. Thus, matching information does not have to be specified for all portions of a model. If no matching information is specified for a given node, the hashing process is used. By the same token, if matching information is provided, it is used explicitly as specified - even if it is has been specified incorrectly.

11.10XY Plot Data Format

This file is saved using the Save section of the Query Entity dialog. The file can contain one or more curves. The following is an example XY Data file:

Line	Contents of Line
1	2
2	Distance vs. Temperature for Line Tool
3	Distance
4	Temperature
5	1
6	5
7	0.0 4.4
8	1.0 5.8
9	2.0 3.6
10	3.0 4.6
11	4.0 4.8
12	Distance vs. Pressure for Line Tool
13	Distance
14	Pressure
15	2
16	4
17	0.00 1.2
18	0.02 1.1
19	0.04 1.15
20	0.06 1.22
21	3
22	1.10 1.30
23	1.12 1.28
24	1.14 1.25

Line 1 contains the (integer) number of curves in the file.

Line 2 contains the name of the curve.

Line 3 contains the name of the X-Axis.

Line 4 contains the name of the Y-Axis.

Line 5 contains the number of curve segments in this curve.

Line 6 contains the number of points in the curve segment.

Lines 7-11 contain the X-Y information.

Line 12 contains the name of the second curve.

Line 13 contains the name of the X-Axis

Line 14 contains the name of the Y-Axis

Line 15 contains the number of curve segments in this curve. (For the second curve, the first segment contains 4 points, the second 3 points.)

12 Utility Programs

This chapter describes the utility programs that accompany EnSight. The Server utility programs are located in `ENSIGHT7_HOME/server_utilities` and the Client utility programs are located in `ENSIGHT7_HOME/client_utilities` on the EnSight release tape or CD.

Utility programs are supplied on an "as is" basis and are unsupported. CEI will, however, try to assist in problem resolution.

Each utility program is presented below and accompanied with a brief overview that describes the function of the utility.

Section 12.1, EnSight5 Programs

Section 12.2, MPGS4 Programs

Section 12.3, Movie.BYU Programs

Section 12.4, Keyboard Macro Maker (macromake)

Section 12.5, Web Publisher/Project Management (scenario_html_publisher)

12.1 EnSight5 Programs

EnSight5 ASCII-to-Binary File Converter (asciitobin5)

The *asciitobin5* program runs on a Server host system to read ASCII EnSight 5.x files and convert them to C binary format files, which read much faster than ASCII files. Use this utility to facilitate the reading of large data files, especially when these files are read repeatedly.

EnSight Data Translation Library

The EnSight interface library ("libeio") provides a C API for reading and writing both the ASCII and the binary versions of the EnSight 5 format for geometry and results data. You can use it to simplify the process of writing translators or output modules for the EnSight format, as well as utilities that operate on the format.

Before using this library, you should be reasonably familiar with the EnSight 5 format described in section 2.5 of the EnSight User Manual.

The library (C source) can be found in the $ENSIGHT7_HOME/translators/libeio directory in your EnSight distribution. A translator for the unstructured "FAST" format that makes use of libeio can be found in $ENSIGHT7_HOME/translators/unf.

EnSight provides both ASCII and binary versions of its native data format. There are really only two reasons to use the ASCII format: if you need to actually look at the files or if you need to move a dataset to a computer system with a different binary format for numbers. Always use the binary format if possible. Not only does the I/O occur much faster, but the files will be smaller and will load into EnSight much faster as well.

You specify ASCII or binary output via the `SetFileType()` call. By default, output is set to binary.

Building the library

This library has been compiled and tested (to a limited extent) on the following systems:

SGI IRIX 4.0.5
SGI IRIX 5.3
HPUX 9.0.5
Solaris 2.3

1. Edit the Makefile for your system (as shipped, it is configured for IRIX).

2. To build the library, type "make". If you are porting the library to a new platform or operating system release, you may have to make some minor modifications to the Makefile and/or the source code.

3. To build executables that call routines in the library either include "`.../libeio.a`" in your final link command or add the "`-leio`" option to the link command (which assumes the linker knows where to find the library).

Warnings

The following caveats apply to this initial release of libeio:

1. Error checking is a little skimpy at this point. It needs to be improved, especially for the input routines. In general, the input routines assume that a correctly formatted EnSight file is being read.

2. The input routines will only handle C binary files – not Fortran!

Hints When reading EnSight format files into EnSight, you have the option of whether to load all parts, all but the first part, or the first part only. You can sometimes take advantage of this and save loading time as well as memory on the EnSight Client if you can load all but the first part. In many 3D applications (particularly CFD) one part can contain all 3D elements of the computational domain. Other parts typically contain boundary or shell elements. Since you don't really need to look at a graphical representation of the computational domain (if you have a boundary representation), you can avoid its initial load and display on the Client by having the 3D computational domain part as the first part in the EnSight geometry file and using the "all but the first part" load option in EnSight.

Output Routines

```
void SetFileType(int type)
```

`SetFileType()` sets the output type for subsequent calls to I/O routines. The type parameter is either `ASCII` or `BINARY` (as defined in eio.h). NOTE: the `ReadGeometry()` and `ReadParticleGeometry()` input routines will reset the type based on the type of the file last read.

The output routines are divided into two types: those that operate on the EnSight-based data structures (defined in eio.h) and those that accept raw arrays for output. The first four routines operate on the defined data structures:

```
int WriteGeometry(char *filename,Geometry *geo)
int WriteParticleGeometry(char *filename,ParticleGeometry *geo);
int WriteScalar(char *filename,Scalar *scl)
int WriteVector(char *filename,Vector *vec)
```

These routines take a completed structure for the corresponding item and write it to the file specified by "`filename`". See the definitions for `Geometry`, `ParticleGeometry`, `Scalar`, and `Vector` in `eio.h` for more info.

The remaining routines accept raw arrays for output.

```
int WriteGeoHeader(char *filename,char *des1,char *des2,int nodeid,int elemid)
```

`WriteGeoHeader()` begins the process of geometry file output. The `des1` and `des2` parameters are description lines for the model. The `nodeid` and `elemid` parameters should be set to one of the defined constants (e.g. `ID_OFF` or `ID_ASSIGN`) in eio.h. `WriteGeoHeader()` should be followed by `WriteGeoCoords()`.

```
int WriteParticleGeoHeader(char *filename, char *des)
```

`WriteParticleGeoHeader()` begins the process of particle geometry file output. Although particle files have two description lines in the header, the second one is ALWAYS "particle coordinates". `WriteParticleGeoHeader()` should be followed by a call to `WriteGeoCoords()`. Note that particle files must always have coordinate IDs!

```
void WriteGeoCoords(int partcoords, int num, int *id, float *coords)
```

`WriteGeoCoords()` appends coordinates to the geometry file opened by the previous call to `WriteGeoHeader()`. If the `nodeid` parameter to WriteGeoHeader() was either `ID_GIVEN` or `ID_IGNORE` then the `id` pointer must point to a list of num integers. The `coords` parameter must point to a list of 3*num floats in order X1,Y1,Z1,X2,Y2,Z2,...,Xn,Yn,Zn. `WriteGeoCoords()` should be followed by a call to

WriteGeoPart().

WriteGeoCoords() is also used to output particle coordinates (e.g. following a call to WriteParticleGeoHeader()). Be sure to set the partcoords parameter to True when writing particle coordinates!

```
void WriteGeoPart(char *line)
```

WriteGeoPart() begins the process of part definition. A part header will be output to the file opened in the previous call to WriteGeoHeader(). WriteGeoPart() must be followed by one or more calls to WriteGeoElem().

```
void WriteGeoElem(int elemtype, int num, int *id, int *nd)
```

WriteGeoElem() outputs a set of elements of the same type to the current part (as defined by the most recent call to WriteGeoPart()). The elemtype parameter must be one of the types defined in eio.h (e.g. HEXA8 or QUAD4). num is the number of elements to output. If the elemid parameter to WriteGeoHeader() was either ID_GIVEN or ID_IGNORE then the id pointer must point to a list of num integers containing element ID numbers. The nd pointer points to a list of N*num integers, where N is the number of nodes in the particular type of element (e.g. 8 for a HEXA8 type). Node ordering is defined section 3.8.

You can call WriteGeoElem() as many times as you like between calls to WriteGeoPart() to define different element sets belonging to a particular part.

```
int WriteRawScalar(char *filename, char *descrip, char *varname, int num, float
                   *data)
```

WriteRawScalar() writes a scalar variable to the file named filename. The varname parameter will be saved and used in a subsequent call to WriteResults(). num is the number of values. data is a pointer to num floating point values. The values must be ordered the same as the coordinates in the corresponding geometry file.

```
int WriteRawVector(char *filename, char *descrip, char *varname, int num, float
                   *data)
```

WriteRawVector() writes a vector variable to the file named filename. The varname parameter will be saved and used in a subsequent call to WriteResults(). num is the number of values. data is a pointer to 3*num floating point values. The values must be ordered the same as the coordinates in the corresponding geometry file.

```
int WriteResults(char *filename, Result *rp)
```

WriteResults() will output an EnSight "results" file describing a complete geometry plus results dataset. rp points to a Result structure (defined in eio.h) containing the desired information.

Input Routines

The input routines read a particular type of EnSight file and load the contents to a structure defined in eio.h.

```
Geometry *ReadGeometry(char *filename)
```

The `ReadGeometry()` routine reads a complete geometry file and returns the various components in the Geometry structure. It returns `NULL` on error. `ReadGeometry()` will automatically determine if the file is ASCII or binary and will set the type for subsequent reads.

```
ParticleGeometry *ReadParticleGeometry(char *filename)
```

The `ReadParticleGeometry()` routine reads a complete particle geometry file and returns the various components in the `ParticleGeometry` structure. It returns `NULL` on error. `ReadParticleGeometry()` will automatically determine if the file is ASCII or binary and will set the type for subsequent reads.

```
Scalar *ReadScalar(char *filename, int num)
```

`ReadScalar()` will read a scalar file and return a pointer to a `Scalar` structure (or `NULL` on error). `num` must equal the number of values to read. `ReadScalar()` will assume the file type (ASCII or binary) is the same as that determined in `ReadGeometry()` (but you can override with a call to `SetFileType()`).

```
Vector *ReadVector(char *filename, int num)
```

`ReadVector()` will read a vector file and return a pointer to a `Vector` structure (or `NULL` on error). `num` must equal the number of values (nodes) to read, *i.e.* there should be 3*`num` floats in the file. `ReadVector()` will assume the file type (ASCII or binary) is the same as that determined in `ReadGeometry()` (but you can override with a call to `SetFileType()`).

```
Result *ReadResults(char *filename)
```

`ReadResults()` will read an EnSight results file and return the information in an allocated `Result` structure.

12.2 MPGS4 Programs

MPGS4 ASCII-to-Binary File Converter (asciitobin4)

The *asciitobin4* program runs on a Server host system to read ASCII MPGS 4 data files and convert them to binary files, which read much faster than ASCII files. Use this utility to facilitate the reading of large data files, especially when these files are read repeatedly. See also *asciitobin5* above.

MPGS4 File Concatenater-Transformer

The programs under the `cat_transform4` directory run on a Server host system and perform various concatenation and transformation operations on MPGS 4 dataset files. For example, the following two utility programs are included in this directory:

cat_mpgs concatenates two or more MPGS 4 data files.

tform_mpgs translates and rotates MPGS 4 data files.

MPGS4 Geometry File Debug Filter (filter4)

The *filter4* program runs on a Server host system to read an MPGS 4 geometry file (either ASCII or binary). After reading the file, you can perform queries to aid in debugging connectivity information. You are prompted for a solid number, after which *filter4* will print all known information for that solid. If *filter4* cannot read the data, there is probably a problem with the data formatting.

MPGS4 Min-Max Scalar Finder (minmaxs4)

The *minmaxs4* program runs on a Server host system to scan a set of MPGS 4 (multiple time step) *scalar* files, and print the minimum and maximum scalar information. See also *minmaxv4* below.

MPGS4 Min-Max Vector Finder (minmaxv4)

The *minmaxv4* program runs on a Server host system to scan a set of MPGS 4 (multiple time step) *vector* files, and print the minimum and maximum vector information. See also *minmaxs4* above.

MPGS4 Structured Mesh Generator (structmesh4)

The *structmesh4* program runs on a Server host system, and creates an MPGS 4 geometry file that contains a 3D (cube) structured mesh.

12.3 Movie.BYU Programs

Movie.BYU File Polygon Reducer (reducemovie)

The *reducemovie* program runs on a Server host system to read Movie.BYU geometry, and output a geometry file with shared face information removed. This program is especially useful when dealing with geometry files that were created from FEM solid elements.

Depending on how smart a FEM translator is, the faces shared between two solid elements might be described twice in the geometry file. If *reducemovie* finds two faces (polygons in the Movie.BYU file) that share the same node numbers, both polygons are removed because they are both interior faces and should not be visible to the observer (unless the geometry is clipped open using the Z-clipping planes).

Running a FEM geometry that has been created using solid elements through this filtering program can reduce the number of polygons in the model dramatically, thus speeding postprocessing.

12.4 Keyboard Macro Maker (macromake)

The *macromake* program runs on the Client host system and assigns a keyboard key to a prerecorded EnSight command file (or files). The macro key code and command file name(s) are updated in the `macro.define` file, which stores your macro definitions.

The command file(s) can contain any sequence of valid EnSight commands that will execute each time the macro key is pressed while running EnSight. You can assign one command file to a *repeatable* macro key—the contents of the command file plays as long as the macro key is depressed. Macros are currently limited to single key definitions.

See: How To Define and Use Macros.

12.5 Web Publisher/Project Management (scenario_html_publisher)

The '*scenario_html_publisher'* program runs on the client host system. It provides a way to generate HTML files that describe EnSight scenario projects and can be used with a web browser to ease access to the information contained there. The publisher program will create an HTML file with links to project description, EnLiten scenario, image, EnVideo movie, MPEG movie, and EnSight restart files. The web browser reads the main HTML file for the project directory or set of directories. The user can then select the links to view further information contained throughout the project which might start up helper applications EnVideo, EnLiten, and EnSight. In the case of EnSight the context file will be read to restore EnSight to the point that you saved the scenario project. This arrangement does not require you to have a web server handle the pages. The user can have there own little area that can be accessed with the web browser by providing it with a URL of `file:/home/users/joe/projects/shuttle1.htm`. The user, of course, would provide the true path to the starting HTML file produced by the '*scenario_html_publisher*' program. The user can also collaborate with their colleagues by pointing them to this '`file:`' URL if they have access to the same directory or they can work with their local Web Master to put copy the directory structure into the location served by a local web server. This area could then be accessed by colleagues around the world with their browser. The area may be a password protected area or it could be wide open to the world to view the exciting images, movies, and information that it contains. Work with your Web Master to protect the area as you see fit. To use the publisher please read the header of the '*scenario_html_publisher*' script. It can be found in the installation directory for EnSight under scenario_tools/unix. The '*scenario_html_publisher*' program is currently only available for Unix but the pages that it produces are readable by any web browser on any type of computer.

Index

A

B

C

D

E

H

I

J

K

L

M

Q

U

V

W

X

Z

EnSight ® Version 7 End User License Agreement

UNLESS A SEPARATE LICENSE OR TRIAL AGREEMENT DOCUMENT EXISTS BETWEEN THE LICENSEE AND CEI OR AN AUTHORIZED CEI DISTRIBUTOR, THE TERMS AND CONDITIONS OF THIS AGREEMENT SHALL GOVERN YOUR USE OF VERSION 7 OF THE EnSight SOFTWARE. READ THIS LICENSE CAREFULLY BEFORE USING THE EnSight SOFTWARE. BY USING THE EnSight SOFTWARE YOU AGREE TO BE BOUND BY THIS AGREEMENT. IF YOU DO NOT ACCEPT OR AGREE TO BE BOUND BY THE TERMS OF THIS AGREEMENT, PROMPTLY RETURN THE EnSight SOFTWARE UNUSED WITHIN THIRTY (30) DAYS OF PURCHASE FOR A REFUND.

1. LICENSE GRANT. The Licensee is hereby granted by Computational Engineering International, Inc. ("CEI") a single, non-transferable and non-exclusive license to use the EnSight Software under the terms and conditions set forth below, in binary form only, and at the major release level indicated on the media used to deliver the licensed EnSight Software.

2. DEFINITIONS.

   "Ancillary Software" includes translators, user defined data readers, tools, or other software which may from time to time be delivered with, but separate from, the "EnSight Software".

   "End User" means one individual running an EnSight process.

   "EnSight Purchase Agreement" means the document provided by Licensee to CEI which describes the type of installation Licensee is authorized to make.

   "EnSight Documentation" means manuals, release or installation notes related to the EnSight Software, including electronic versions thereof.

   "EnSight Software" means the Client and Server Software of the CEI computer programs standard EnSight or EnSight Gold, the EnSight Documentation, the Third-Party Libraries (if licensed through CEI), and any backups or other copies.

   "Maximum Seats" means the maximum authorized number of End Users who may simultaneously use the licensed copy of the EnSight Software as identified in the EnSight Purchase Agreement.

   "Major Release Level" means all versions of the EnSight Software which are denoted by the same integer number to the left of the first decimal point in the specification of the release. For example, all versions denoted as EnSight 7.x are regarded as the same Major Release Level.

3. USAGE LIMITATIONS. Licensee acknowledges that the EnSight Software is proprietary and shall remain the property of CEI. This License is not a sale. Title to and ownership of the EnSight Software and any copies thereof, any patents, trademarks or copyrights incorporated therein and to the CEI Proprietary information shall at all times remain with CEI. No rights to rent, loan, transfer, relicense, distribute, or otherwise assign any or all of Licensee's rights in the EnSight Software are granted. All rights not specifically granted to Licensee by this license shall remain in CEI. CEI may include features in the EnSight Software which prevent unlicensed use or use after license expiration. The license granted herein does not include provision of support and maintenance service or future releases or versions of the EnSight Software.

4. INSTALLATION. EnSight may be installed and used by the Licensee only in the manner indicated in the EnSight Purchase Agreement. End User may use EnSight only at his immediate workplace, unless otherwise authorized by CEI. Subject to request of and approval by CEI, Licensee may permanently or temporarily change the systems and /or networks upon which Licensee is authorized to use the EnSight Software. In either case, such change may result in additional charges to the Licensee. Licensee may duplicate the EnSight Software for backup, archiving, or security, provided that each copy includes all of the copyright or proprietary notices of the original. Licensee shall not clone, reverse assemble, or reverse compile any part of the EnSight Software or adopt any part of the EnSight Software as its own. CEI reserves the right to charge an upgrade fee for future Major Release versions of the EnSight Software.

5. PATENTS AND COPYRIGHTS. EnSight is copyrighted under the laws of the United States and international treaty provisions. Notwithstanding the copyright, the EnSight Software contains trade secrets and proprietary information of CEI. Licensee acknowledges that CEI owns these copyrights and has the following exclusive rights with regard to the EnSight Software: to reproduce it; to adapt, transform or rearrange it; to prepare derivative works from it; and to control its distribution. Licensee agrees not to act in contravention of any of CEI's intellectual property rights.

6. EnSight DOCUMENTATION. Licensee may use the EnSight Documentation only in support of its use of the licensed EnSight Software and may print or duplicate the Documentation (except any marked as proprietary), but only for its internal use and provided that each copy includes all of the copyright or related notices of the original. CEI will provide one (1) printed copy of the EnSight "Getting Started" document with each license purchased by Licensee for the EnSight Software. Additional printed copies of the "Getting Started" document and copies of the on-line EnSight Documentation may be purchased from CEI.

7. WARRANTY; DISCLAIMER. CEI warrants that for a period of thirty (30) days after delivery of the EnSight Software, it will substantially conform in all material respects to the specifications set forth in CEI's published EnSight Documentation. If the EnSight Software does not meet this requirement, and Licensee notifies CEI within thirty (30) days after delivery, CEI will, at its option, repair or replace the effected EnSight Software. This warranty excludes problems caused by acts of Licensee, unauthorized use of or causes external to the EnSight Software, and items which would be covered under Support and Maintenance service. CEI specifically does not warrant, guarantee, or make any representations regarding the use, or the results of the use, of the EnSight Software or Documentation in terms of correctness, accuracy, reliability, currentness, or otherwise. The entire risk as to the result produced by and the performance of the EnSight Software is assumed by the End User. CEI does not warrant that the execution of the EnSight Software will be uninterrupted or error free.

   THE ANCILLARY SOFTWARE IS PROVIDED AND HEREBY ACCEPTED BY THE LICENSEE ON AN "AS IS" BASIS WITHOUT WARRANTY OF ANY KIND. THE ABOVE WARRANTIES ARE CEI'S ONLY WARRANTIES AND ARE IN LIEU OF ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND THE ABOVE REMEDIES ARE THE EXCLUSIVE REMEDIES FOR ANY BREACH OF WARRANTY. NO ORAL OR WRITTEN INFORMATION OR ADVICE GIVEN BY CEI OR ITS EMPLOYEES SHALL CREATE A WARRANTY OR IN ANY WAY INCREASE THE SCOPE OF THIS WARRANTY, AND LICENSEE MAY NOT RELY ON SUCH INFORMATION OR ADVICE. LICENSEE'S SOLE REMEDY AND CEI'S SOLE OBLIGATION SHALL BE GOVERNED BY THIS AGREEMENT. LICENSEE EXPRESSLY AGREES THAT IN NO EVENT SHALL CEI BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, OR SPECIAL DAMAGES ARISING FROM THE BREACH OF WARRANTY, NEGLIGENCE, OR ANY OTHER LEGAL THEORY, WHETHER IN TORT OR CONTRACT, EVEN IF CEI HAS BEEN APPRISED OF THE LIKELIHOOD OF SUCH DAMAGES OCCURRING, INCLUDING WITHOUT LIMITATION DAMAGES FROM INTERRUPTION OF BUSINESS, LOSS OF PROFITS OR BUSINESS OPPORTUNITIES, LOSS OF USE

   OF SOFTWARE, LOSS OF DATA, COST OF RECREATING DATA, COST OF CAPITAL, COST OF ANY SUBSTITUTE PRODUCTS, OR LOSSES CAUSED BY DELAY. FURTHER, CEI SHALL NOT BE RESPONSIBLE FOR ANY DAMAGES OR EXPENSES RESULTING FROM ALTERATION OR UNAUTHORIZED USE OF THE EnSight SOFTWARE OR FROM THE UNINTENDED AND UNFORESEEN RESULTS OBTAINED BY LICENSEE AND RESULTING FROM SUCH USE. IN ANY EVENT, CEI'S MAXIMUM LIABILITY UNDER ANY LICENSE OR OTHERWISE FOR ANY REASON SHALL NOT EXCEED THE TOTAL AMOUNT PAID BY LICENSEE FOR THE CEI EnSight SOFTWARE, EXCLUSIVE OF ANY SUPPORT AND MAINTENANCE FEES PAID. THE EXISTENCE OF MORE THAN ONE CLAIM WILL NOT ENLARGE OR EXTEND THE LIMIT.

8. THIRD-PARTY RIGHTS AND LICENSE. If Third-Party owned graphics libraries are sublicensed to Licensee by CEI, it will be so noted in the EnSight Purchase Agreement. All terms related to the EnSight Software, including and without limitation, terms related to limitation of remedies and restrictions on use, apply to the Third-Party Software.

9. LICENSE MANAGER SOFTWARE. If Licensee is authorized to install and use License Manager Software to enable the EnSight Software to execute on multiple computer systems on a network, it will be so noted in the EnSight Purchase Agreement. All terms related to the EnSight Software, including and without limitation, terms related to limitation of remedies and restrictions on use, apply to the License Manager Software. Licensees authorized to use License Manager Software may install multiple redundant license servers on the same network subnet node. Installation of multiple redundant license servers on different subnet nodes requires Licensee to submit a written request to CEI, stating that the use of multiple servers will not enable more than the maximum seats of the software to be used. Furthermore, Licensee agrees to submit License Manager log files upon request to CEI for verification. Use of EnSight on a network is restricted to one geographic location, unless otherwise authorized by CEI.

10. U. S. GOVERNMENT RESTRICTED RIGHTS. If the Licensee is the USA Department of Defense ("DOD"), the licensed EnSight Software is subject to "Restricted Rights" as that term is defined in the DOD Supplement to the Federal Acquisition Regulations ("DFARS") section 252.227-7013(c). If the Licensee is any unit or agency of the U.S. Government other than the DOD, the Government's rights in the EnSight Software will be defined in paragraph 52.227-19(c)(2) of the Federal Acquisition Regulations ("FAR"). Use, duplication, reproduction, or disclosure by the U.S. Government is subject to such restrictions. Contractor/ Manufacturer is: Computational Engineering International, Inc., 2166 N. Salem Street, Suite 101, Apex, NC 27502, USA.

11. INVOICES; PAYMENT; TAXES. Licensee agrees to pay the License Fee(s) owed for this Software License as shown on a separate Invoice(s) from

CEI. All Payments will be in U. S. Dollars. Payment is due within thirty (30) days after the date of each Invoice. Payment is considered made when good funds are received by CEI. To those Licensees leasing an EnSight Software License, future Invoices for the EnSight Software Lease Fee will be issued yearly in the month prior to that in which the initial payment of the EnSight Software Lease Fee was made to CEI. Licensees located in the State of North Carolina, USA are responsible for payment to CEI of all applicable State and Local sales taxes. Licensees located in any State other than North Carolina in the USA are directly responsible for payment of all State and Local sales taxes applicable at their location. Licensees located in any Country other than the USA are directly responsible for payment of all import and sales taxes to the responsible government(s) at their location.

12. SEVERABILITY. If any provision of this Agreement shall be held by a court of competent jurisdiction to be contrary to law or not enforceable, the remaining provisions of this Agreement shall remain in full force and effect.

13. EXPORT. This License and the rights granted hereunder are subject to compliance by Licensee with all laws, regulations, orders, or other regulations relative to export or redistribution of Licensed Software that may now or in the future be imposed by the government of the United States or any agency thereof or of any other country into which licensed EnSight Software may be transported and any act of noncompliance shall immediately terminate this License. If the Licensee imports the licensed copy of the EnSight Software into a country in which CEI has an authorized Distributor, then if the License was purchased the Licensee shall pay to CEI a Penalty Fee equal to one half the cost of the original Purchased License Fee.

14. TERM. If a License for the EnSight Software was purchased by Licensee, then this license is valid upon the date of initial payment of the Purchase License Fee to CEI by Licensee and shall continue until an event of Termination. If a License for the EnSight Software was leased by Licensee, then this license is valid for twelve (12) months from the date of initial payment of the Lease License Fee to CEI by Licensee and shall renew for subsequent twelve (12) month periods from the date Licensee pays the amounts indicated on each yearly invoice, according to Section11, unless an event of Termination occurs.

15. TERMINATION. This Software License Agreement shall terminate upon occurrence of any of the following events: (i) the failure of Licensee to observe or perform any of the material covenants, terms, and conditions of this Agreement where such nonperformance is not fully remedied by Licensee within thirty (30) days after written notice by CEI; (ii) any breach of Sections 3, 4, 6, 7, 8, 9, or 10 hereof (effective immediately); (iii) the filing of a petition for Licensee's bankruptcy, whether voluntary or involuntary, or an assignment of Licensee's assets made for the benefit of creditors, or the appointment of a trustee or receiver to take charge of the business of Licensee for any reason, or Licensee's becoming insolvent or voluntarily or involuntarily being dissolved; or (iv) the use of a license purchased at an academic discount for purposes other than teaching or academic research. Termination of this Agreement under Section 15 shall be in addition to, and not a waiver of, any remedy at law or in equity. Notwithstanding the foregoing, the provisions of Sections 4, 6, 7, 8, 9, and 10 shall survive the termination of this agreement. Upon termination of this Software License Agreement, Licensee shall promptly cease to use and shall return to CEI all copies of the EnSight Software, the Ancillary Software, and EnSight Documentation.

16. GENERAL. Licensee may not assign or transfer its rights or obligations under this Agreement without the prior written consent of CEI. The parties agree that this Agreement shall be governed and construed by the laws of the State of North Carolina, USA, and that no conflict-of-laws provision shall be invoked to permit the laws of any other state or jurisdiction. Any legal action must be filed within one (1) year after the cause for such action arises with the court of jurisdiction in the State of North Carolina, USA. All preprinted additional or different terms on any purchase order forms or other documents received from Licensee are deemed deleted and Licensee agrees that such terms shall be void even if the Licensee's documentation indicates the terms therein take precedence over other documents. This Software License Agreement, together with the most recent EnSight Purchase Agreement delivered to CEI by Licensee, constitutes the entire agreement of the parties and supersedes any prior understandings relating to the subject matter, and may be amended or supplemented only in a written agreement signed by both an officer of CEI and the Licensee.

17. RESTRICTION ON USE OF TrackdAPI SOFTWARE, developed and owned by VRCO Inc., an Illinois corporation, with principal place of business at 330 S. Wells Street, Suite 1200, Chicago, IL 60606; here after referred to as "VRCO". Licensee is prohibited from the distribution, transfer, modification, or alteration of the TrackdAPI software and associated written materials and/or documentation ("TrackdAPI Software") and shall abide by the following:

I. PROPRIETARY RIGHTS. Licensee agrees that its use of TrackdAPI Software is a license only and VRCO owns all right, title, and interest in the TrackdAPI Software including any patents, trademarks, trade names, inventions, copyrights, know-how and trade secrets relating to the design, manufacture, operation or service of the TrackdAPI Software. Nothing in this agreement should be construed as transferring any aspects of such rights to Licensee or any third party.

II. WARRANTY DISCLAIMER. THE LICENSED TrackdAPI Software IS PROVIDED “AS IS” WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LICENSED TrackdAPI Software IS ON THE LICENSEE.

III. LIMITATION OF LIABILITY. IN NO EVENT SHALL VRCO BE LIABLE FOR COSTS OF PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES OR FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, OR INDIRECT DAMAGES OR LOST PROFITS ARISING OUT OF THIS AGREEMENT OR USE OF THE TrackdAPI Software, HOWEVER CAUSED, ON ANY THEORY OF LIABILITY, AND EVEN IF VRCO HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. LICENSEE AGREES VRCO’S LIABILITY ARISING OUT OF CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT OR WARRANTY SHALL NOT EXCEED ANY AMOUNTS PAID BY LICENSEE FOR THE TrackdAPI Software IDENTIFIED ABOVE.

EnSight® Version 7 Support and Maintenance Service Agreement

UNLESS A SEPARATE AGREEMENT FOR SUPPORT AND MAINTENANCE SERVICES EXISTS BETWEEN THE LICENSEE AND CEI OR AN AUTHORIZED CEI DISTRIBUTOR, THE TERMS AND CONDITIONS OF THIS AGREEMENT SHALL GOVERN CEI'S PROVISION OF AND LICENSEE'S USE OF AND PAYMENT FOR SUCH SERVICES.

1. GENERAL. The EnSight Software Licensee and Computational Engineering International, Inc., ("CEI") agree that the following terms and conditions apply to the provision of Software Support and Maintenance Service.
2. DEFINITIONS.
   "Ancillary Software" includes translators, user defined data readers, tools, or other software which may from time to time be delivered with, but separate from, the "EnSight Software".

   "EnSight Purchase Agreement" means the document provided by Licensee to CEI which describes the type of installation Licensee is authorized to make.

   "EnSight Documentation" means manuals, release or installation notes related to the EnSight Software including electronic versions thereof.

   "EnSight Software" means the Client and Server Software of the CEI computer programs standard EnSight or EnSight Gold, the EnSight Documentation, the Third-Party Libraries (if licensed through CEI, as called out on Schedule A), and any backup or copies thereof.

   "Major Release Level" means all versions of the EnSight Software which are denoted by the same integer number to the left of the first decimal point in the specification of the release.
3. SOFTWARE SUPPORT SERVICE. During the term of this Agreement CEI will provide technical support as described below to the EnSight Software Licensee in its use of the EnSight Software, provided that Licensee has an active License to use the EnSight Software from CEI. CEI will provide telephone consultation on problems encountered in using the EnSight Software during the Prime Time period defined as Monday through Friday, from 8:00 AM to 5:00 PM, USA Eastern Standard Time or Eastern Daylight Time, excluding U. S. Holidays. Licensee is limited to five (5) hours per month of telephone consultation. Alternatively, support requests can be made to CEI via FAX or Electronic mail.

   EnSight U.S. Support Telephone Number:(800) 551-4448
   Outside U.S. Support Telephone Number:(919) 363-0883
   EnSight Support FAX Number: (919) 363-0833
   EnSight Support Email address: ensight_support@ceintl.com
4. SOFTWARE MAINTENANCE SERVICE. During the term of this Agreement CEI will maintain the EnSight Software provided that Licensee has an active License to use the EnSight Software from CEI. CEI will distribute to Licensee one copy of new minor releases of the major release listed on the media used to deliver the EnSight Software including EnSight Documentation as they become available, subject to the terms and conditions of this Agreement. CEI may modify the terms, conditions, and prices for services applicable to future major releases.
5. EXCLUDED SOFTWARE. NO SUPPORT OR MAINTENANCE SERVICE FOR THE ANCILLARY SOFTWARE IS OFFERED OR PROVIDED BY THIS AGREEMENT.
6. LICENSEE AGREEMENTS FOR SOFTWARE SUPPORT AND SOFTWARE MAINTENANCE. In order to permit CEI to supply the Software Support and Software Maintenance specified above:

   (i). If third party graphic libraries accompanied the EnSight Software delivered to Licensee, as noted in the EnSight Purchase Agreement, and such third party issues a new version of such library software which CEI incorporates into the Software, then Licensee must comply with any additional licensing or fee requirements imposed by such third party.

   (ii). If Licensee is authorized to use License Manager Software, as noted in the EnSight Purchase Agreement, and the third party owning such software issues a new version which CEI then provides to Licensee, then Licensee must comply with any additional licensing or fee requirements imposed by such third party.

   (iii). Licensee agrees to install minor releases, fixes, circumventions, and corrective code to the EnSight Software in a reasonable time after receipt thereof.

   (iv). Licensee agrees to be responsible for the installation and administration of the EnSight Software.

   (v). Upon request by CEI, Licensee will provide the name, address, telephone and FAX number, and Email address (if available) of the Licensee's contact individual for communicating problems and solutions.
7. FEES. If Licensee is Leasing an EnSight Software License, then the cost of the Software Support and Maintenance Service is included in the annual EnSight Software License Lease Fee.

   If Licensee has Purchased an EnSight Software license, then there is no separate fee for Software Support and Maintenance Service for a period of twelve (12) months from the date of the initial payment of the EnSight Software License Purchase Fee to CEI. Licensee agrees to subsequently pay the annual EnSight Software Support and Maintenance Service Fee(s) for subsequent twelve (12) month periods at the then current rates when invoiced. If an additional yearly charge for Support and Maintenance Service for third-party graphics libraries of license manager software accompanying the EnSight Software is required, Licensee agrees to pay the additional charges at the same time and at the then current rates.

Licensees located in any State other than North Carolina in the USA are directly responsible for payment of all State and Local taxes applicable at their location for this Service. Licensees located in any Country other than the U.S. are directly responsible for payment of all taxes to the government(s) at their location for this Service.

8. LIMITATION OF REMEDY AND DISCLAIMER. CEI WILL USE ITS DILIGENT EFFORTS TO PROVIDE THE SUPPORT AND MAINTENANCE SERVICES SPECIFIED HEREIN. CEI MAKES NO OTHER WARRANTY OF ANY KIND OR NATURE WITH REGARD TO THE SERVICES TO BE PERFORMED BY CEI UNDER THE TERMS OF THIS AGREEMENT AND ANY IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY, ARE HEREBY DISCLAIMED. THE REMEDIES SET FORTH IN THIS AGREEMENT ARE LICENSEE'S EXCLUSIVE REMEDIES FOR ANY BREACH OF THE TERMS OF THIS AGREEMENT. CEI WILL NOT BE LIABLE IN ANY EVENT FOR LOSS OF OR DAMAGE TO REVENUES, PROFITS, OTHER ECONOMIC LOSS OR GOODWILL OR OTHER CONSEQUENTIAL, SPECIAL, INCIDENTAL OR INDIRECT DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE PERFORMANCE OF ITS OBLIGATIONS HEREUNDER, INCLUDING ANY LIABILITY FOR NEGLIGENCE WITH RESPECT TO SERVICE PROVIDED UNDER THIS AGREEMENT EVEN IF CEI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN ANY AND ALL CASES, CEI'S MAXIMUM LIABILITY IN CONNECTION WITH OR ARISING OUT OF THIS AGREEMENT SHALL NOT EXCEED THE EQUIVALENT OF ONE (1) YEAR OF CHARGES FOR THE RELEVANT SERVICE. THE EXISTENCE OF MORE THAN ONE CLAIM WILL NOT ENLARGE OR EXTEND THE LIMIT.

9. INVOICES AND PAYMENT. To those Licensees who have purchased an EnSight Software License, future Invoices for the EnSight Software Support and Maintenance Fee(s) will be issued yearly in the month prior to that in which the initial payment of the EnSight Software License Purchase Fee was made to CEI. Invoices shall be due and payable within thirty (30) days of date of invoice. All payments will be in U. S. Dollars.

   Payment of invoice is considered made when good funds are received by CEI.

10. OBSOLETE PRODUCTS. CEI will continue to provide Software Support Service for the release prior to the most current release for a period of twelve (12) months after the release date of the most current release. At that time, the previous release is designated as Obsolete and Software Support Service for the Obsolete release shall thereafter be discontinued.

11. TERM. The Term of this Agreement shall be from the date payment from Licensee is first received by CEI for the EnSight Software License Purchase Fee or the EnSight Software License Lease Fee, whichever is applicable, until an event of Termination.

12. TERMINATION. EnSight Software Support and Software Maintenance Service hereunder may be terminated as follows: (A) by Licensee or CEI to be effective during or after the first year of such Service upon giving ninety (90) days written notice; (B) by CEI with respect to Obsolete Products; (C) by CEI immediately and without notice, with respect to the EnSight Software, the license for which has expired or been terminated; (D) by CEI after ten (10) days subsequent to providing notice to Licensee upon either (i) nonpayment by Licensee of any Invoiced amount due under this Agreement or the EnSight End User License Agreement; or (ii) nonperformance by Licensee of any other material term or condition of this Agreement.

13. ASSIGNMENTS. The Licensee may not assign or transfer its rights or obligations under this Agreement, in whole or in part, without the written consent of CEI.

14. APPLICABLE LAW. The parties agree that this Agreement shall be governed and construed by the laws of the State of North Carolina, USA, and that no conflict-of-laws provision shall be invoked to permit the laws of any other state or jurisdiction. Any legal action must be filed within one (1) year after the cause for such action arises with the court of jurisdiction in the State of North Carolina, USA.

15. GENERAL. The terms and conditions stated in this Agreement constitute the complete and exclusive statement of the Agreement between Licensee and CEI and supersede all prior oral and written statements of any kind whatsoever made by either party or their representatives.

    All preprinted additional or different terms on any purchase order forms or other documents received from Licensee are deemed deleted and Licensee agrees that such terms shall be void even if the Licensee's documentation indicates the terms therein take precedence over other documents.

    Any waivers of or amendments to the terms and conditions of this Agreement, to be effective, must be in writing and signed by an officer of CEI and Licensee.

    CEI Address:

    Computational Engineering International, Incorporated
    2166 N. Salem Street, Suite 101, Apex, North Carolina
    27502
    USA