Visualization Cookbook Using Gsharp

Acknowledgment

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[1] International Association for the Exchange of Students for Technical Experience.

[2] UK AVS+UNIRAS User Group website is www.uauug.org.uk.

Contents

1 Introduction 1
1.1 Conventions Used 1
2 Drawing a Graph 2
2.1 Creating a 2D Graph 2
2.1.1 Specifying a Viewport 2
2.1.2 Selecting a Graph Type 4
2.1.3 Setting the Data Values 7
2.1.4 Labelling the Axes 10
2.1.5 Writing a Title 18
2.2 Creating a 3D Graph 22
2.2.1 Specifying a Viewport 22
2.2.2 Selecting a Graph Type 24
2.2.3 Setting Data Values 27
3 Displaying Temperature Inside a Room 30
3.1 Choosing the Best Graph 30
3.1.1 2D Contour for z=1 33
3.1.2 2D Contour for z=2 46
3.1.3 2D Contour for z=3 48
3.1.4 2D Contour for z=4 49
3.1.5 2D Contour for z=5 50
3.1.6 2D Contour for z=6 51
3.1.7 2D Contour for z=7 52
3.1.8 2D Contour for z=8 53
3.1.9 2D Contour for z=9 54
3.1.10 2D Contour for z=10 55
3.1.11 2D Contour in 3D Style 57
4 Visualizing Behaviour of a Superconductor 71
4.1 Choosing the Best Graph 73
4.1.1 Scatter Graph for 02-07-33,Sep-07.txt 74
4.1.2 Scatter Graph for 01-23-29,Sep-07.txt 80
4.1.3 Scatter Graph for 00-39-33,Sep-07.txt 81
4.1.4 Scatter Graph for 20-00-22,Sep-06.txt 82
4.1.5 Scatter Graph for 20-45-45,Sep-06.txt 83
4.1.6 Scatter Graph for 21-33-38,Sep-06.txt 84
4.1.7 Scatter Graph for 22-19-18,Sep-06.txt 85
4.1.8 Scatter Graph for 23-06-59,Sep-06.txt 86
4.1.9 Scatter Graph for 23-54-13,Sep-06.txt 87
4.1.10 Scatter Graph for phi-90.txt 88
4.1.11 3D Scatter Graph 93
5 Showing Percentiles of a Value Over 10 Days 96
5.1 Choosing the Best Graph 96
5.1.1 2D Scatter Graph 97
5.1.2 2D Bar Graph 106
5.1.3 2D Area Graph 112
5.1.4 Box Plot 117

6 Viewing Percentage of Longitude and Latitude Points 126
6.1 Choosing the Best Graph 127
6.1.1 2D Scatter Graph for t1 128
6.1.2 2D Scatter Graph for t2 138
6.1.3 3D Scatter Graph for t1 and t2 139
6.1.4 3D Irregular Bar Graph for t1 and t2 141
6.1.5 3D Irregular Grid for t1 and t2 144
6.1.6 Visualizing scores.dat on the same axes as uk.dat 146
Appendix A: Gsharp Window 151
Appendix B: File Block.dat 154
Appendix C: Superconductor Files 160
Appendix D: File percs.dat 162
Appendix E: File scores.dat 164

Figures

Figure II-1: Creating a Viewport for 2D Graphs 2
Figure II-2: Defining a Viewport for 2D Graphs 3
Figure II-3: Selecting Graph Type 4
Figure II-4: Graph Editor 5
Figure II-5: Selecting Graph Type for 2D Graphs 6
Figure II-6: Graph Editor for 2D Graphs 7
Figure II-7: Setting a Y Value for 2D Graphs 8
Figure II-8: An Example of a 2D Line Graph 9
Figure II-9: X-Axis 10
Figure II-10: Axis Editor 11
Figure II-11: Writing Text for an X-Axis 12
Figure II-12: An Example of Labelling an X-Axis 13
Figure II-13: Y-Axis 14
Figure II-14: Axis Editor 15
Figure II-15: Setting Text for Y-Axis 16
Figure II-16: An Example of Labelling a Y-Axis 17
Figure II-17: Selecting Viewport to Write a Title for 2D Graphs 18
Figure II-18: Creating a Title for 2D Graphs 19
Figure II-19: Writing a Title for 2D Graphs 20
Figure II-20: An Example of a Title for 2D Graphs 21
Figure II-21: Creating a Viewport for 3D Graphs 22
Figure II-22: Defining a Viewport for 3D Graphs 23
Figure II-23: Selecting Graph Type 24
Figure II-24: Graph Editor 25
Figure II-25: Selecting 3D Line Graph 26
Figure II-26: Graph Editor for 3D Graphs 27
Figure II-27: Setting Values for 3D Graphs 28
Figure II-28: An Example of a 3D Line Graph 29
Figure III-1: Opening a File 31
Figure III-2: Result of Opening block.dat 32
Figure III-3: Writing Commands in Command Line 33
Figure III-4: Setting Values for 2D Contour 35
Figure III-5: Result of 2D Contour for z=1 36
Figure III-6: Editing the Domain 37
Figure III-7: Changing the Classes Value 38
Figure III-8: Class Editor 39
Figure III-9: Changing Classes Dataset 40
Figure III-10: Result After Changing Colour Classes 41
Figure III-11: Editing the Legend 42
Figure III-12: Editing Entry Height 43
Figure III-13: Enable the Legend 44
Figure III-14: Result With a Legend 45
Figure III-15: Editing Graph 46
Figure III-16: Result of 2D Contour for z=2 47
Figure III-17: Result of 2D Contour for z=3 48
Figure III-18: Result of 2D Contour for z=4 49

Figure III-19: Result of 2D Contour for z=5 50
Figure III-20: Result of 2D Contour for z=6 51
Figure III-21: Result of 2D Contour for z=7 52
Figure III-22: Result of 2D Contour for z=8 53
Figure III-23: Result of 2D Contour for z=9 54
Figure III-24: Result of 2D Contour for z=10 55
Figure III-25: Creating Domain 58
Figure III-26: Result of Creating Domain 59
Figure III-27: Editing X Limits 60
Figure III-28: Editing Y Limits 61
Figure III-29: Editing Projections 62
Figure III-30: Editing Style 63
Figure III-31: Result of 1st Domain 64
Figure III-32: Editing Viewport 65
Figure III-33: Editing Values in 3D Workbox 66
Figure III-34: Result of 1st Block 67
Figure III-35: Result When Visualizing the Dataset in 3D way 68
Figure III-36: Result of 3D Block With Legend 69
Figure IV-1: Importing Files 74
Figure IV-2: Setting Data Values for Scatter 75
Figure IV-3: Setting Markers 76
Figure IV-4: Result of 02-07-33,Sep-07.txt File 77
Figure IV-5: Labelling the X-Axis 78
Figure IV-6: Labelling the Y-Axis 79
Figure IV-7: Result of 01-23-29,Sep-07.txt File 80
Figure IV-8: Result of 00-39-33,Sep-07.txt File 81
Figure IV-9: Result of 20-00-22,Sep-06.txt File 82
Figure IV-10: Result of 20-45-45,Sep-06.txt File 83
Figure IV-11: Result of 21-33-38,Sep-06.txt File 84
Figure IV-12: Result of 22-19-18,Sep-06.txt File 85
Figure IV-13: Result of 23-06-59,Sep-06.txt File 86
Figure IV-14: Result of 23-54-13,Sep-06.txt File 87
Figure IV-15: Result of phi-90.txt File 88
Figure IV-16: Editing a Legend 89
Figure IV-17: Setting Entry Height 90
Figure IV-18: Enable the Legend 91
Figure IV-19: Result of a Legend 92
Figure IV-20: Result of 3D Scatter for 02-07-33,Sep-07.txt File 94
Figure IV-21: Final Graph of 3D Scatter 95
Figure V-1: Importing File 97
Figure V-2: Setting Data Values 98
Figure V-3: Result for Variable p3 99
Figure V-4: Final Result of Scatter Graph 100
Figure V-5: Editing Legend 101
Figure V-6: Setting Entry Height 102
Figure V-7: Enable Legend 103
Figure V-8: Graph With Legend 104
Figure V-9: Labelling the Y-Axis 105

Figure V-10: Result for Variable p97 107
Figure V-11: Final Result of Bar Graph 108
Figure V-12: Labelling the Y-Axis 109
Figure V-13: Labelling the X-Axis 110
Figure V-14: Graph with Legend 111
Figure V-15: Result for variable p97 112
Figure V-16: Result Area 113
Figure V-17: Labelling the Y-Axis 114
Figure V-18: Labelling the X-Axis 115
Figure V-19: Graph with Legend 116
Figure V-20: Graph Editor 117
Figure V-21: Chart 118
Figure V-22: Bar Ends 119
Figure V-23: Maximum and Minimum Values 120
Figure V-24: Color 121
Figure V-25: Lower and Upper Quartiles 122
Figure V-26: Mean Values 123
Figure V-27: Labelling the Y-Axis 124
Figure V-28: Labelling the X-Axis 125
Figure VI-1: Importing File 127
Figure VI-2: Setting Data Values 128
Figure VI-3: Final Graph for Variable t1 129
Figure VI-4: Editing the Legend 130
Figure VI-5: Setting Entry Height 131
Figure VI-6: Enable the Legend 132
Figure VI-7: Result With Legend 133
Figure VI-8: Axis Editor 134
Figure VI-9: Setting Text for the Y-Axis 135
Figure VI-10: Result of the Y-Axis 136
Figure VI-11: Result of the X-Axis 137
Figure VI-12: Result of Percentage Value t2 138
Figure VI-13: 3D Scatter Graph for t1 139
Figure VI-14: 3D Scatter Graph for t1 and t2 140
Figure VI-15: Bar Frame Color 141
Figure VI-16: 3D Irregular Bar for t1 142
Figure VI-17: 3D Irregular Bar for t1 and t2 143
Figure VI-18: 3D Irregular Grid for t1 144
Figure VI-19: 3D Irregular Grid for t2 145
Figure VI-20: UK Area Graph 146
Figure VI-21: Grid Cells 147
Figure VI-22: Area Graph for uk.dat and 3D Irregular Grid for scores.dat 148
Figure VI-23: Selecting Viewport 149
Figure VI-24: Result of Rotating the Graph 150
Figure A-1: Gsharp Window 151
Figure A-2: Icons Descriptions 153
Figure B-1: First 40 Lines of the File 154
Figure B-2: Last 40 Lines of the File 155
Figure B-3: Data Editor Containing Values of Block.dat 156

Figure B-4: Selecting Data Manager 157
Figure B-5: Selecting Block 158
Figure B-6: Selecting Editor for Block 159
Figure C-1: First 25 Lines and 3rd, 4th and 5th Column 160
Figure C-2: Last 25 Lines and 3rd, 4th and 5th Column 161
Figure D-1: First Four Columns of percs.dat File 162
Figure D-2: Last Four Columns of percs.dat File 163
Figure E-1: First 25 Lines of File scores.dat 164
Figure E-2: Last 25 Lines of scores.dat File 165

1 Introduction

Gsharp[3] is an application for data presentation, which allows the users to design graphs interactively and display their data in 2D and 3D graphs. Gsharp is a modular application with powerful interactive graphing and easy layout.

- This cookbook aims to explain to the users how Gsharp works and how the presentations through this application, are structured.
- There are examples of how a graph is drawn in Chapter 2. The examples used will show the user how to produce a data presentation with Gsharp.
- Chapters 3, 4, 5, and 6 contain four example datasets; and describe step-by-step how to visualize them respectively.

This cookbook is written for users:

- Who are new to using Gsharp.
- Who want to visualize data using Gsharp.

It is not intended to be a tutorial on Gsharp.

1.1 Conventions Used

- Underlined text denotes the title of a dialogue window.
- *Italic* text is used to signify the name of a file or a command or a button, which can be selected.
- The figures in Chapter 2 are preceded by the Roman numerals II, figures in Chapter 3 are preceded by III and so on.
- All files used or created are stored in the current working directory.

[3] http://www.avs.com/

2 Drawing a Graph

2.1 Creating a 2D Graph

2.1.1 Specifying a Viewport

- Select *Viewport…* from the *Create* drop-down menu (Figure II.1).

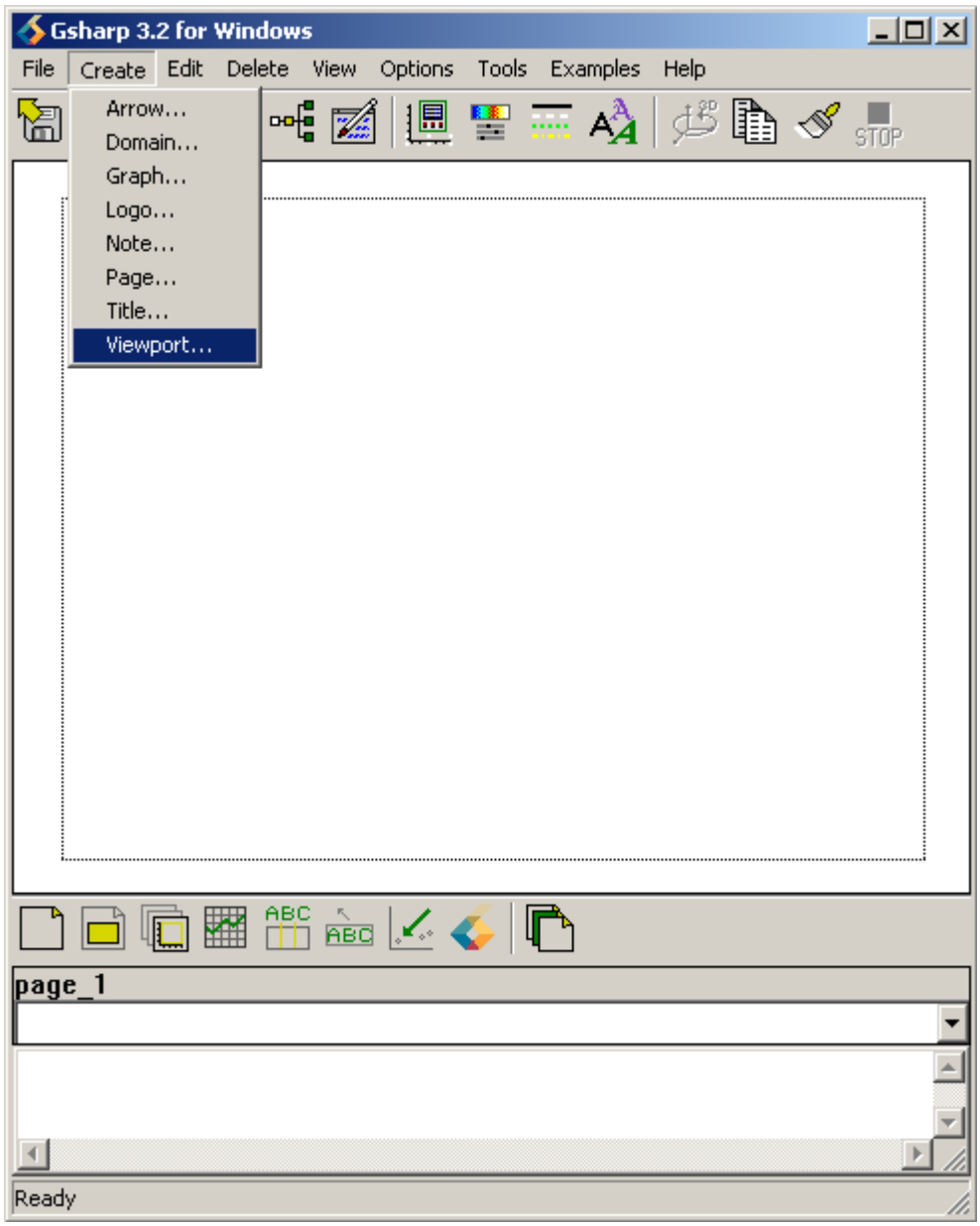


Figure II-1: Creating a Viewport for 2D Graphs

- Use the left mouse button to draw a rectangle on the Canvas[4] area (Figure II-2).

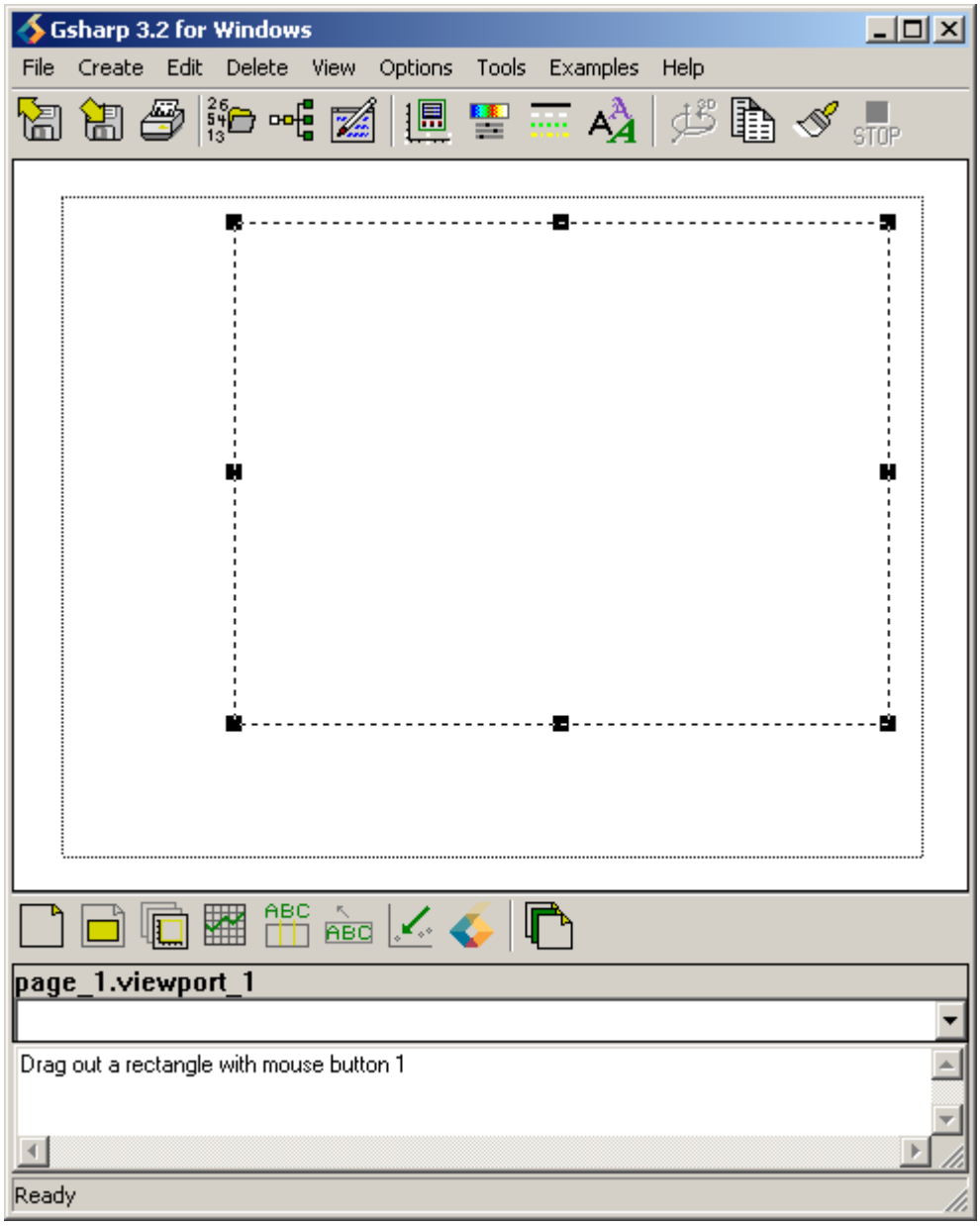


Figure II-2: Defining a Viewport for 2D Graphs

[4] Refer to Appendix A, Figure A-1, for descriptions of what the canvas is.

2.1.2 Selecting a Graph Type

- Select *Graph…* from the *Create* drop-down menu (Figure II-3).

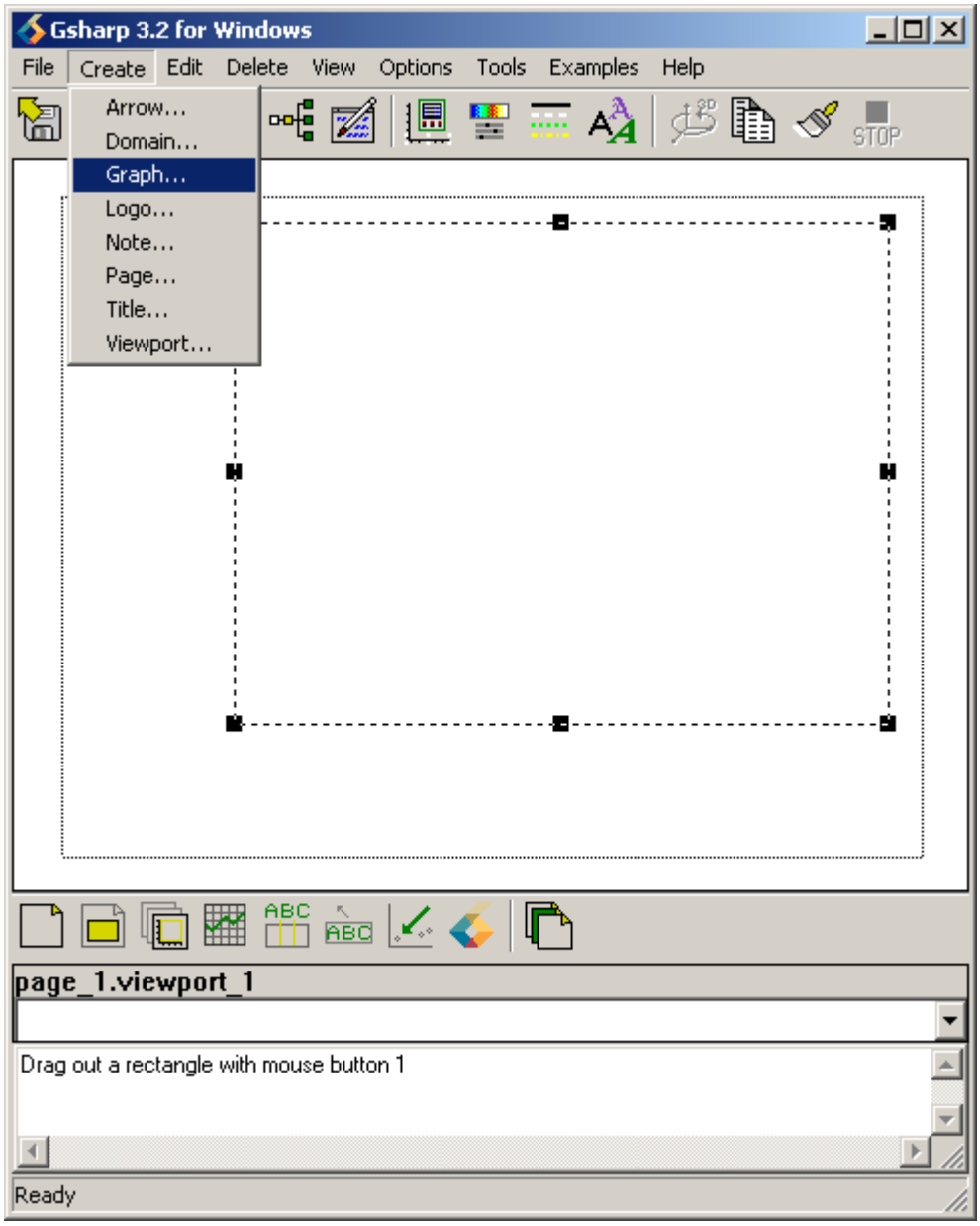


Figure II-3: Selecting Graph Type

- The Graph Editor appears (Figure II-4).

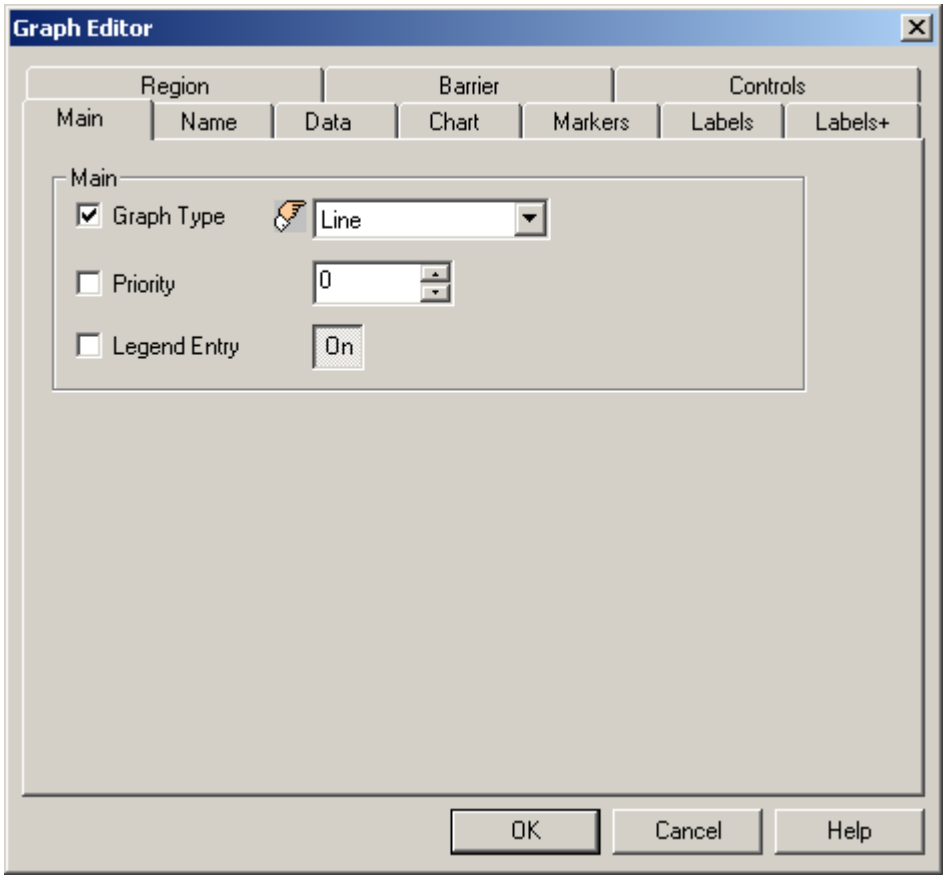


Figure II-4: Graph Editor

- Under *Main* of the Graph Editor, select *Line* from the *Graph Type* drop-down menu (Figure II-5).

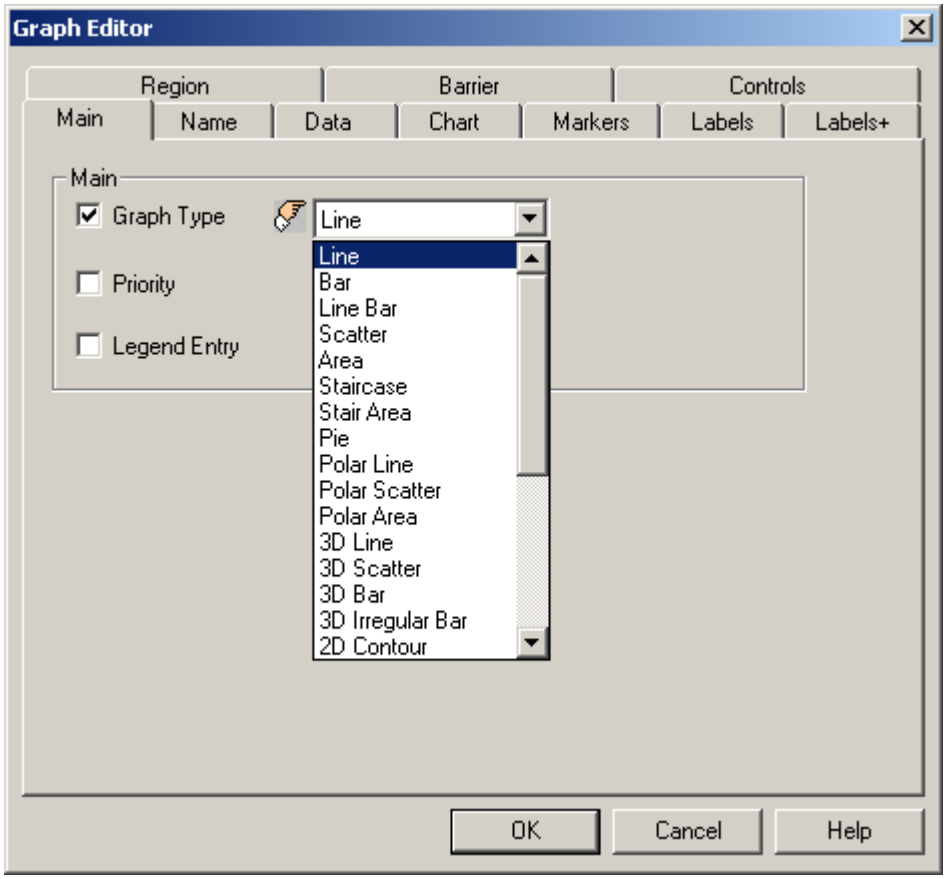


Figure II-5: Selecting Graph Type for 2D Graphs

2.1.3 Setting the Data Values

- Select *Data* to set a value for Y Data. The [5] in the example is next to the *Y* so a value is to be set. (Figure II-6).

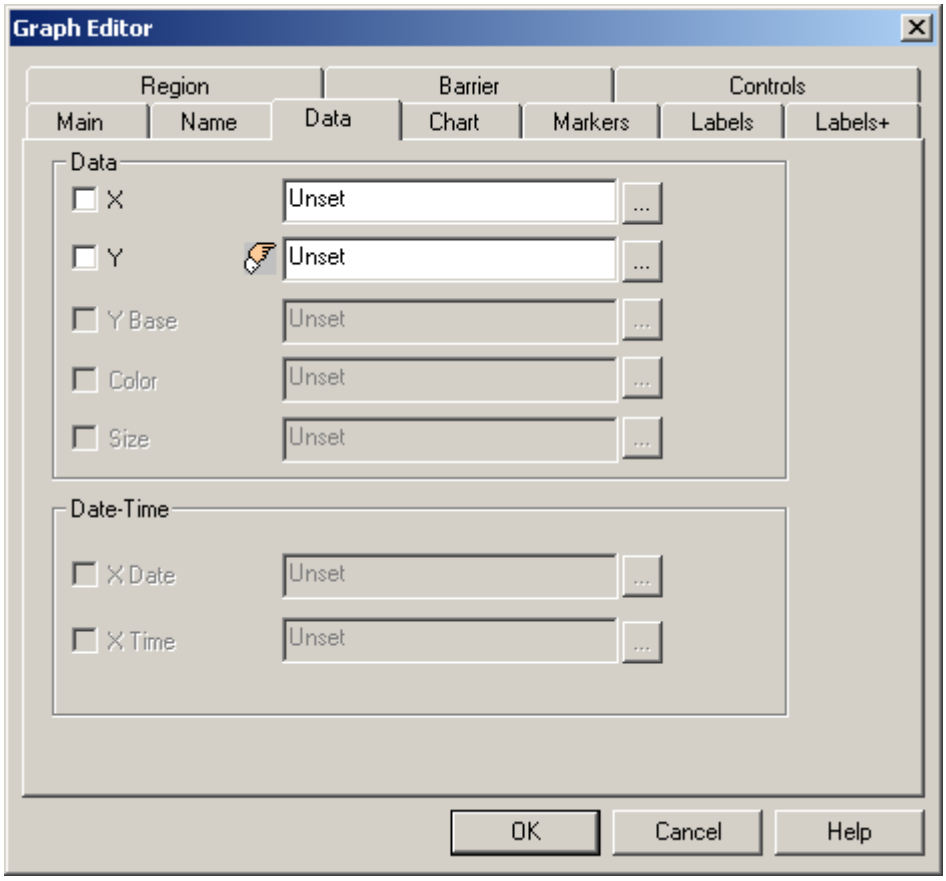


Figure II-6: Graph Editor for 2D Graphs

[5] The next to some data resources signifies that a value is to be set.

- Next to the in the box, there is the word "Unset" (Figure II-6). In the example, the value[6] log(-10:10) is entered. The X values are set automatically[7] (Figure II-7).

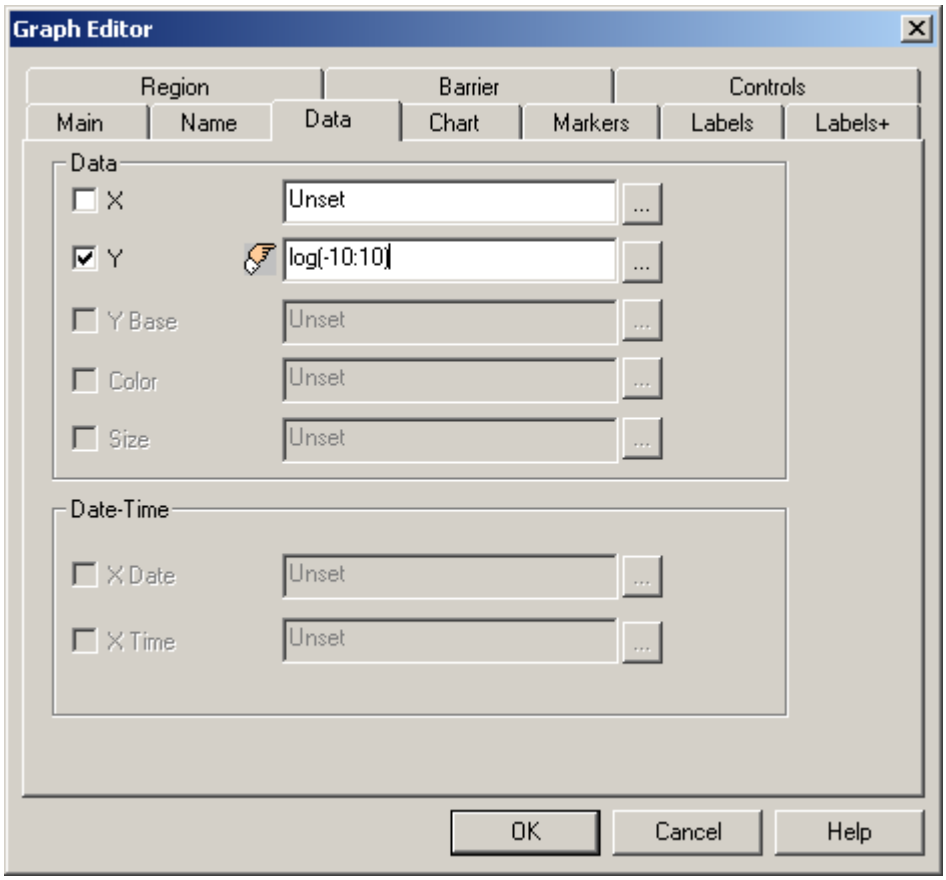


Figure II-7: Setting a Y Value for 2D Graphs

- Select *OK* and a line is drawn according to the entered values (Figure II-8).

[6] (-10:10) is shorthand for –10, -9, -8, …, 10

[7] In the example, X takes a value when Y values are true. Since log(-10) to log(0) are undefined, no values are set for X. So for log(1), X will take the value of 12 because the previous values are undefined.

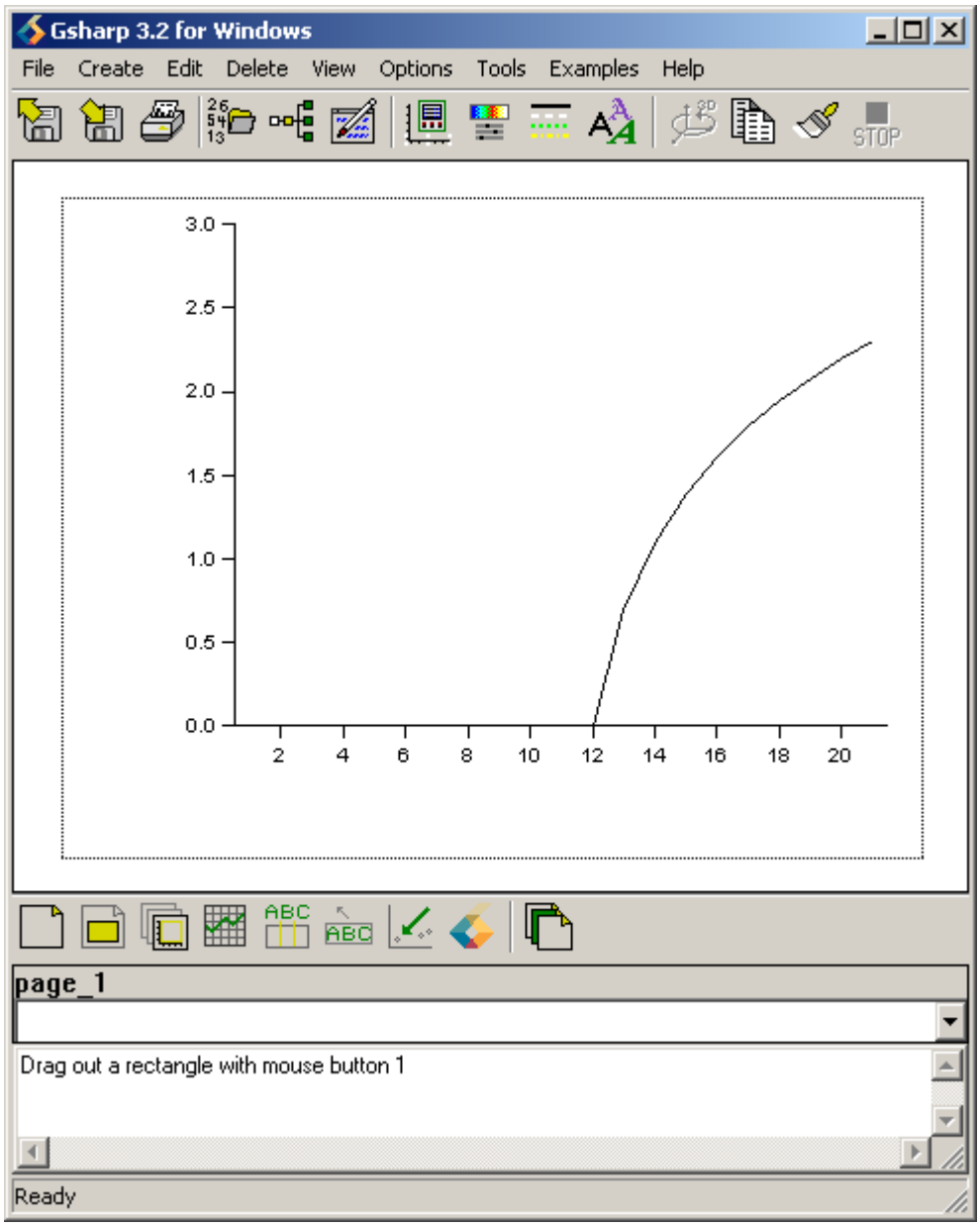


Figure II-8: An Example of a 2D Line Graph

2.1.4 Labelling the Axes

- Double click with the left mouse button on the x-axis (Figure II-9) so that Axis Editor appears (Figure II-10).

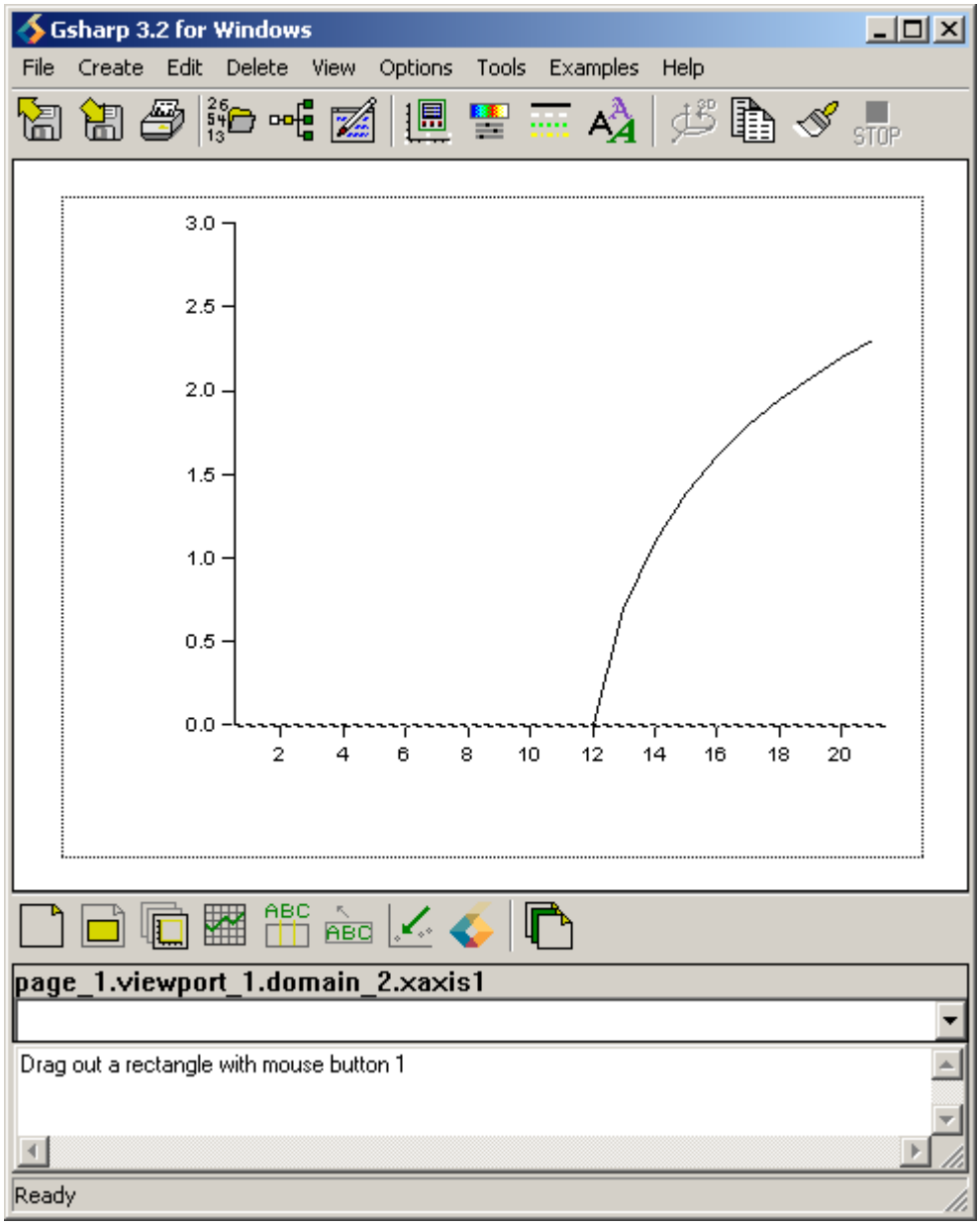


Figure II-9: X-Axis

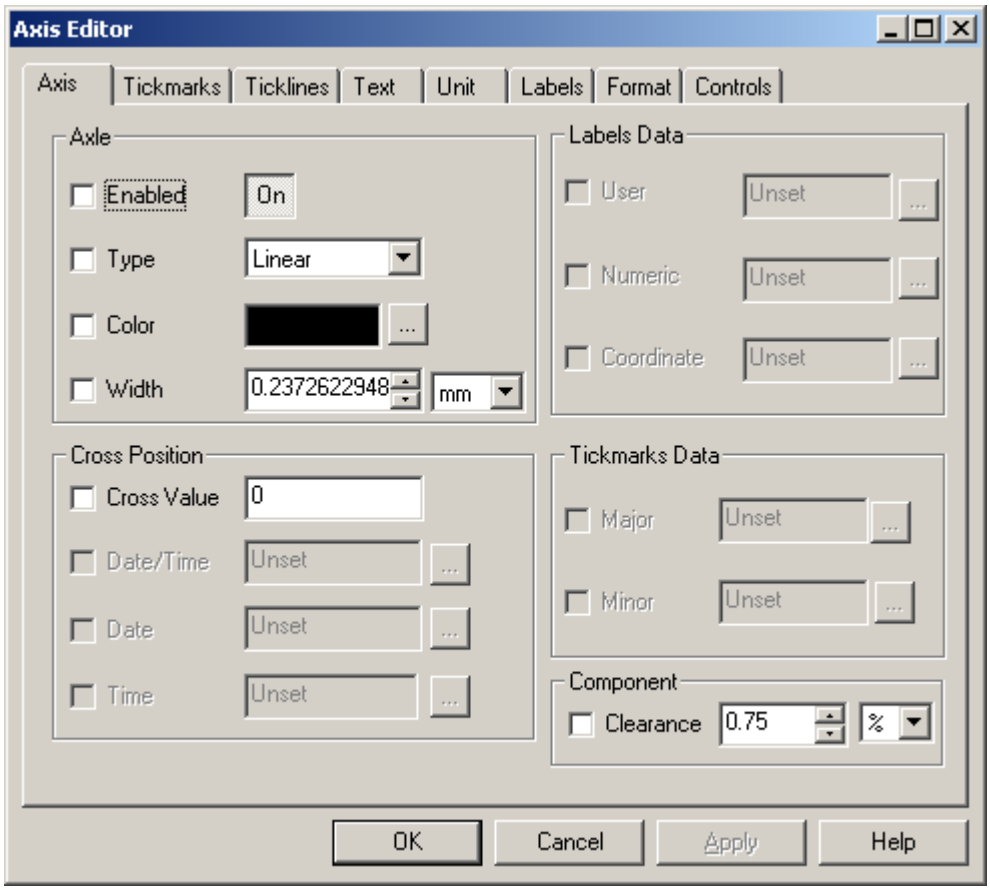


Figure II-10: Axis Editor

- Select *Text* and enter in the box next to *Text*, X-AXIS, and set the *Height* to 5 (Figure II-11).

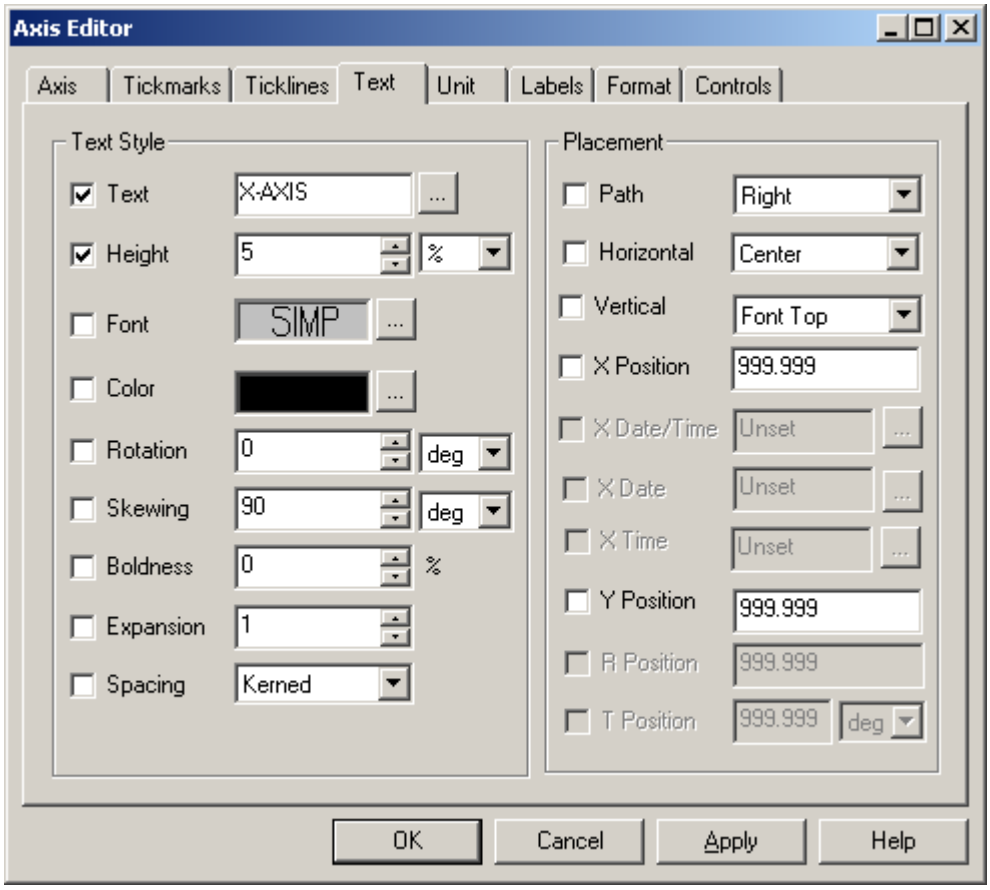


Figure II-11: Writing Text for an X-Axis

- Select OK and the result will be (Figure II-12).

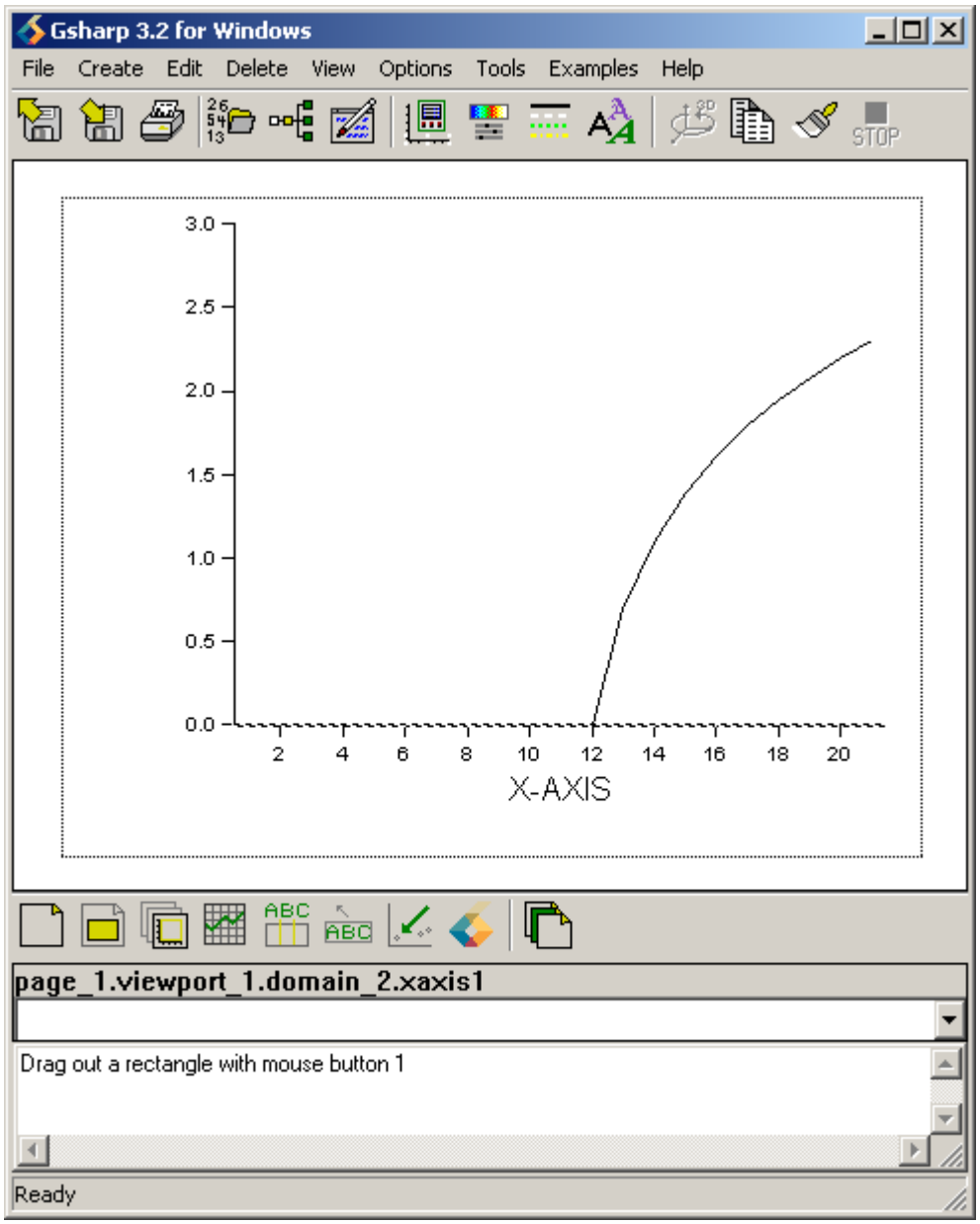


Figure II-12: An Example of Labelling an X-Axis

- Double click with the left mouse button on the y-axis (Figure II-13) so that the Axis Editor appears (Figure II-14).

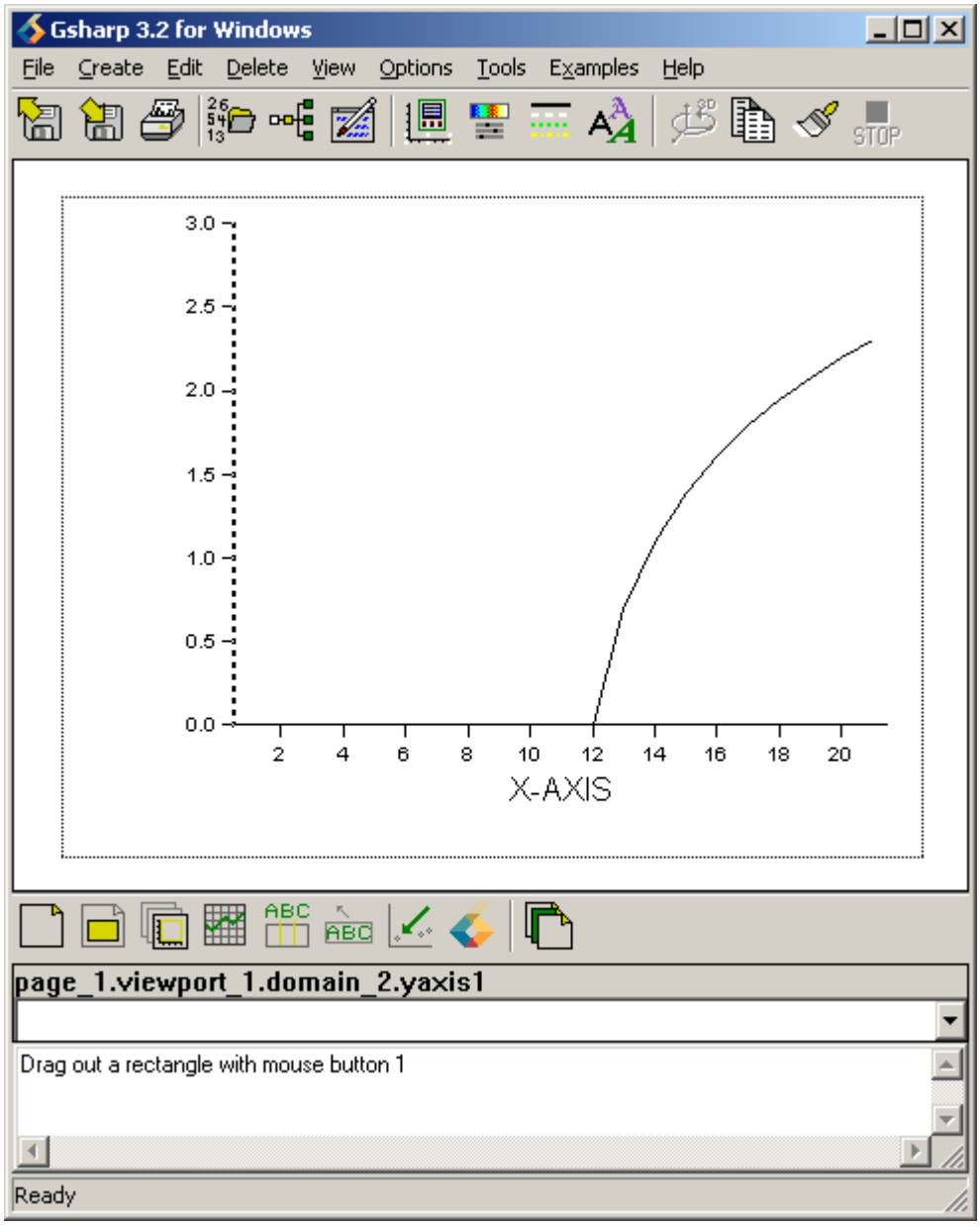


Figure II-13: Y-Axis

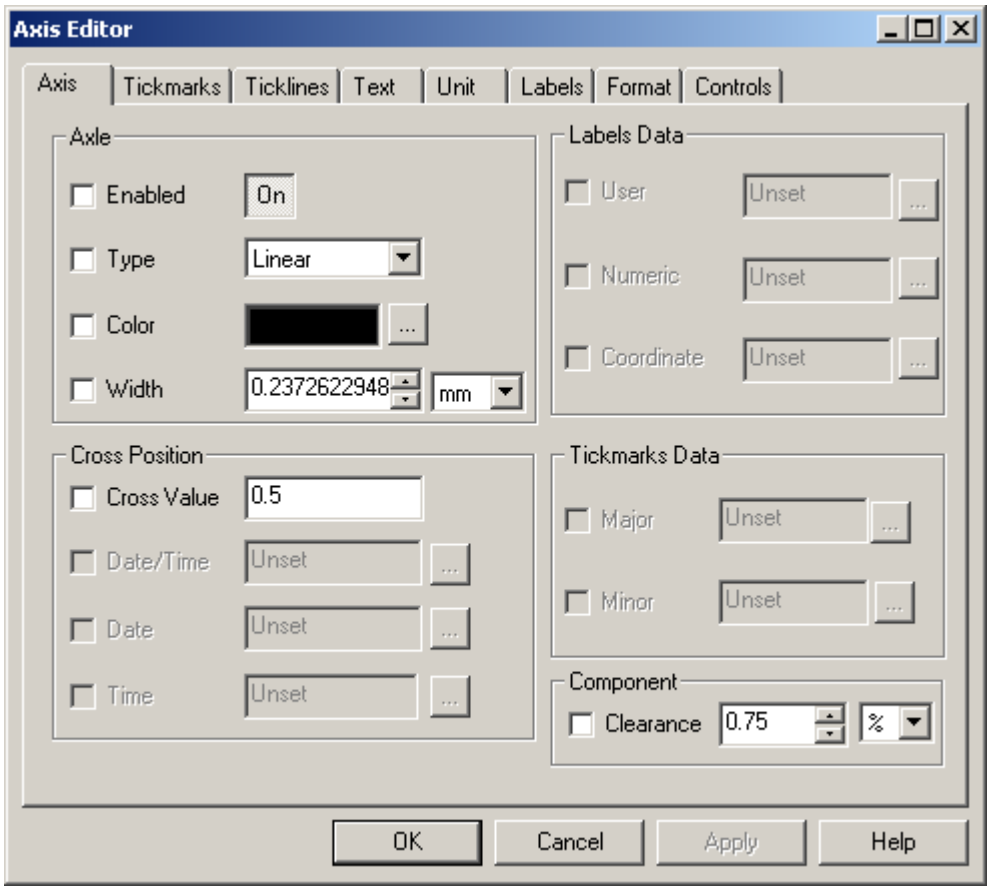


Figure II-14: Axis Editor

- Select *Text* and next to the box of *Text* enter Y-AXIS. Also set *Height* to 5 (Figure II-15).

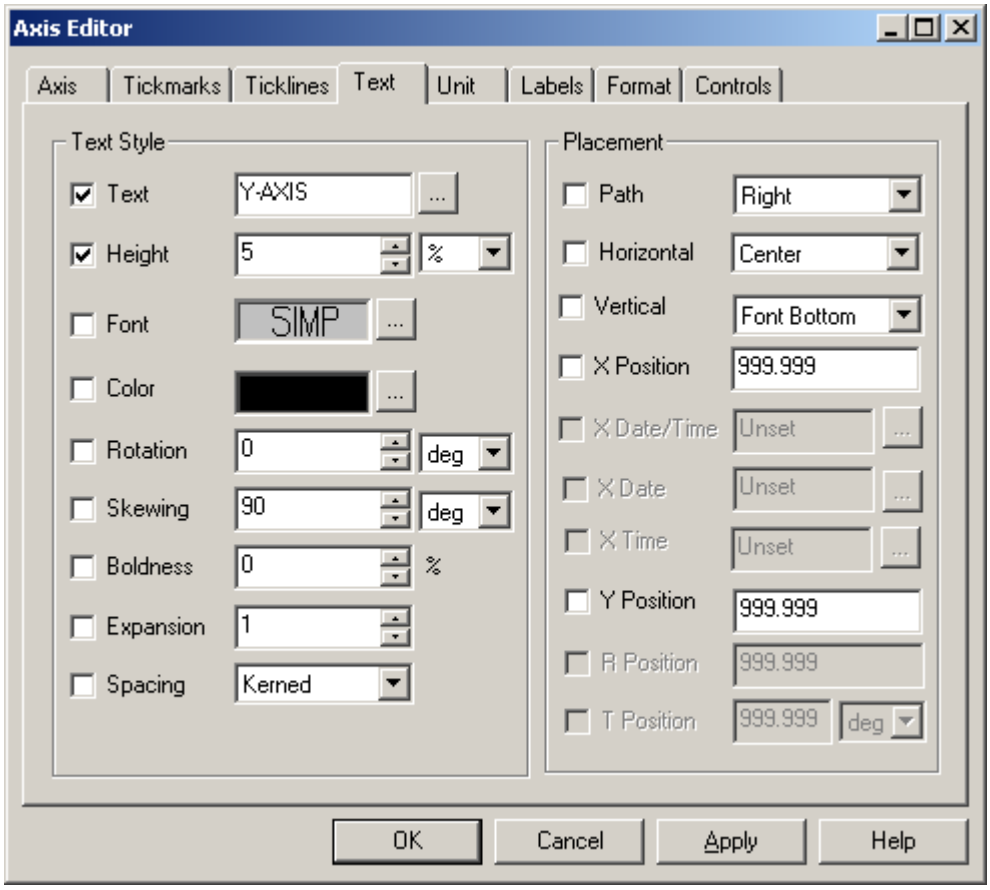


Figure II-15: Setting Text for Y-Axis

- Select *OK* and the result will be (Figure II-16).

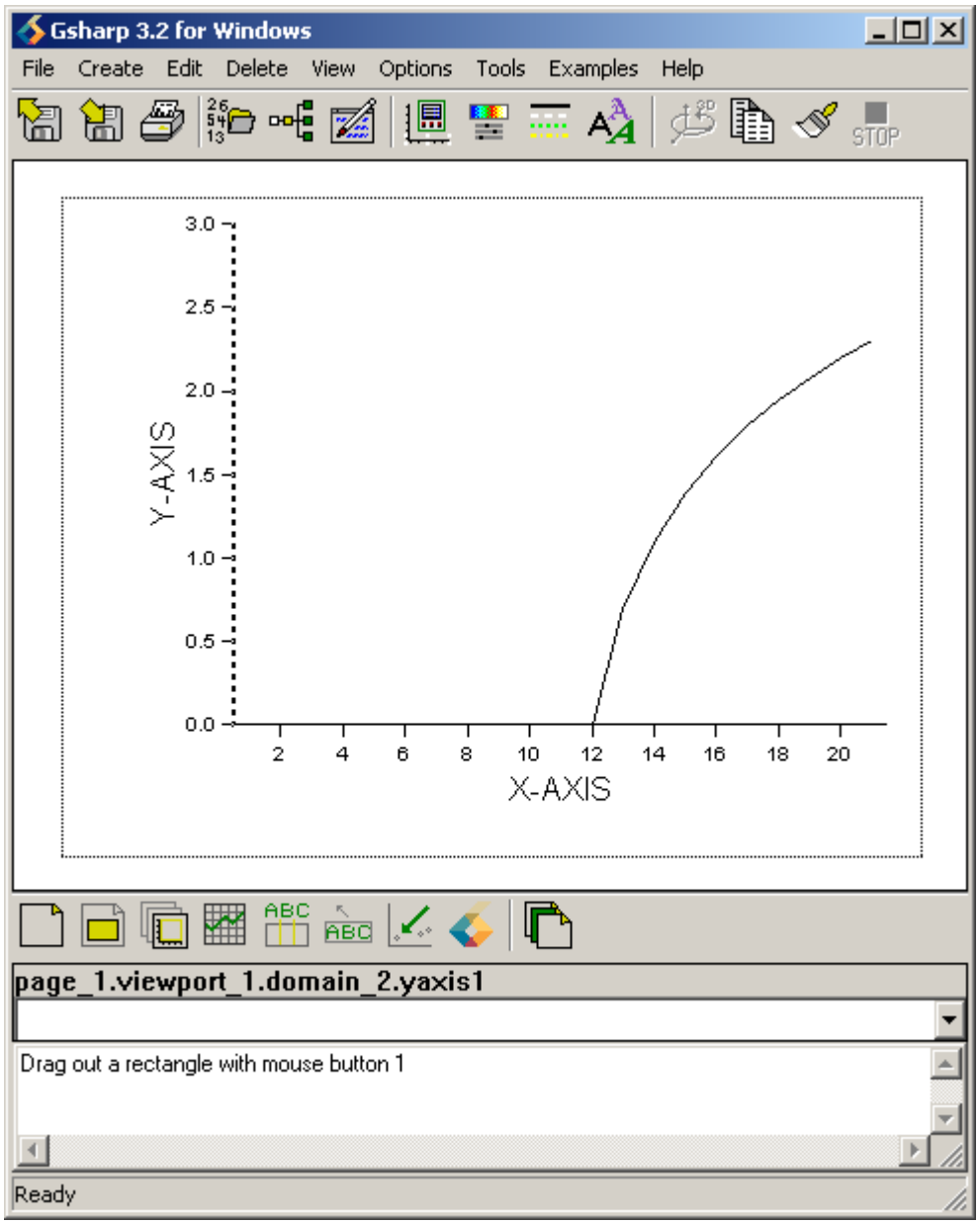


Figure II-16: An Example of Labelling a Y-Axis

2.1.5 Writing a Title

- Select the viewport by clicking with the left mouse button in the graph (Figure II-17, Section 2.1.1).

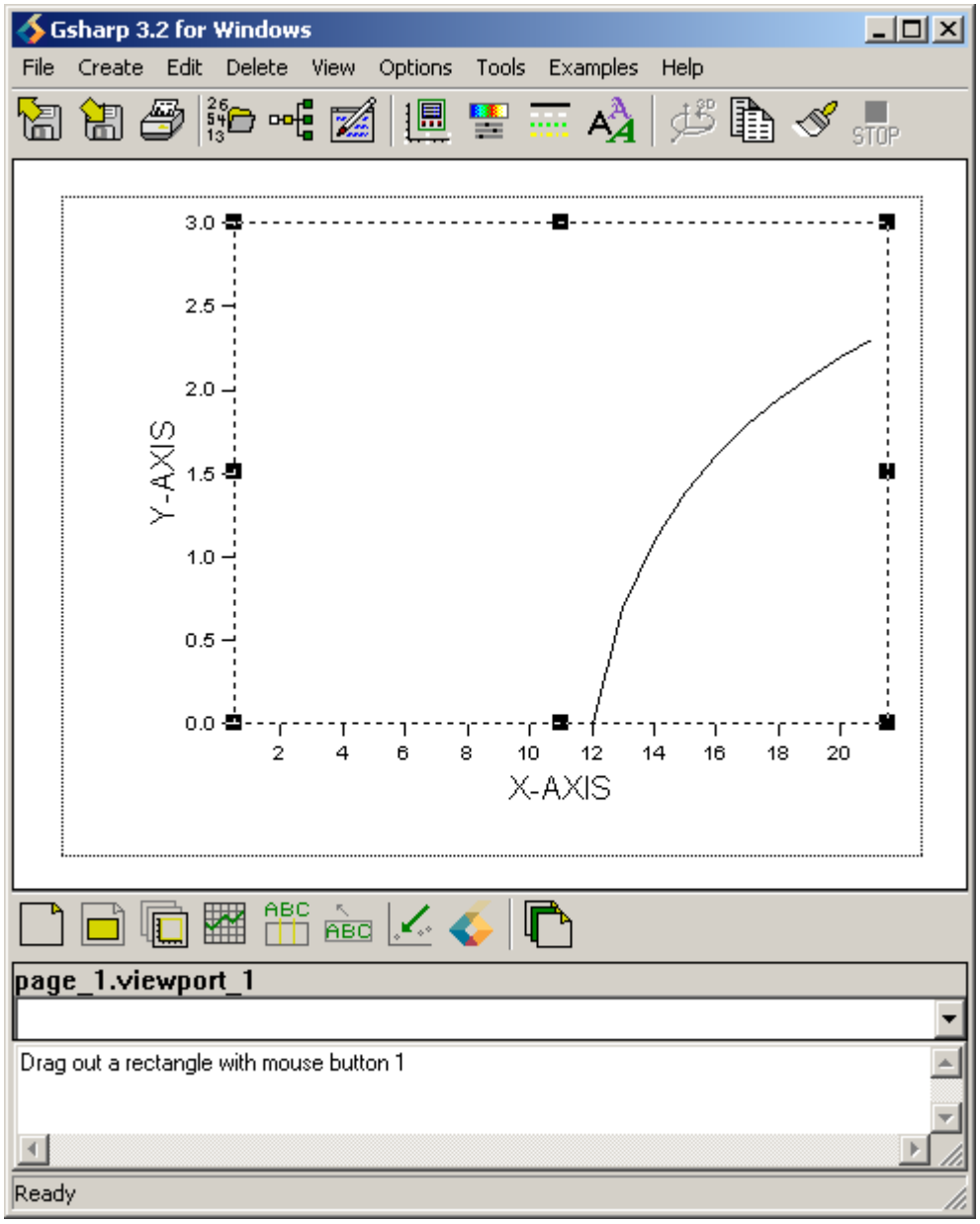


Figure II-17: Selecting Viewport to Write a Title for 2D Graphs

- Select *Title…* from the *Create* drop-down menu (Figure II-18).

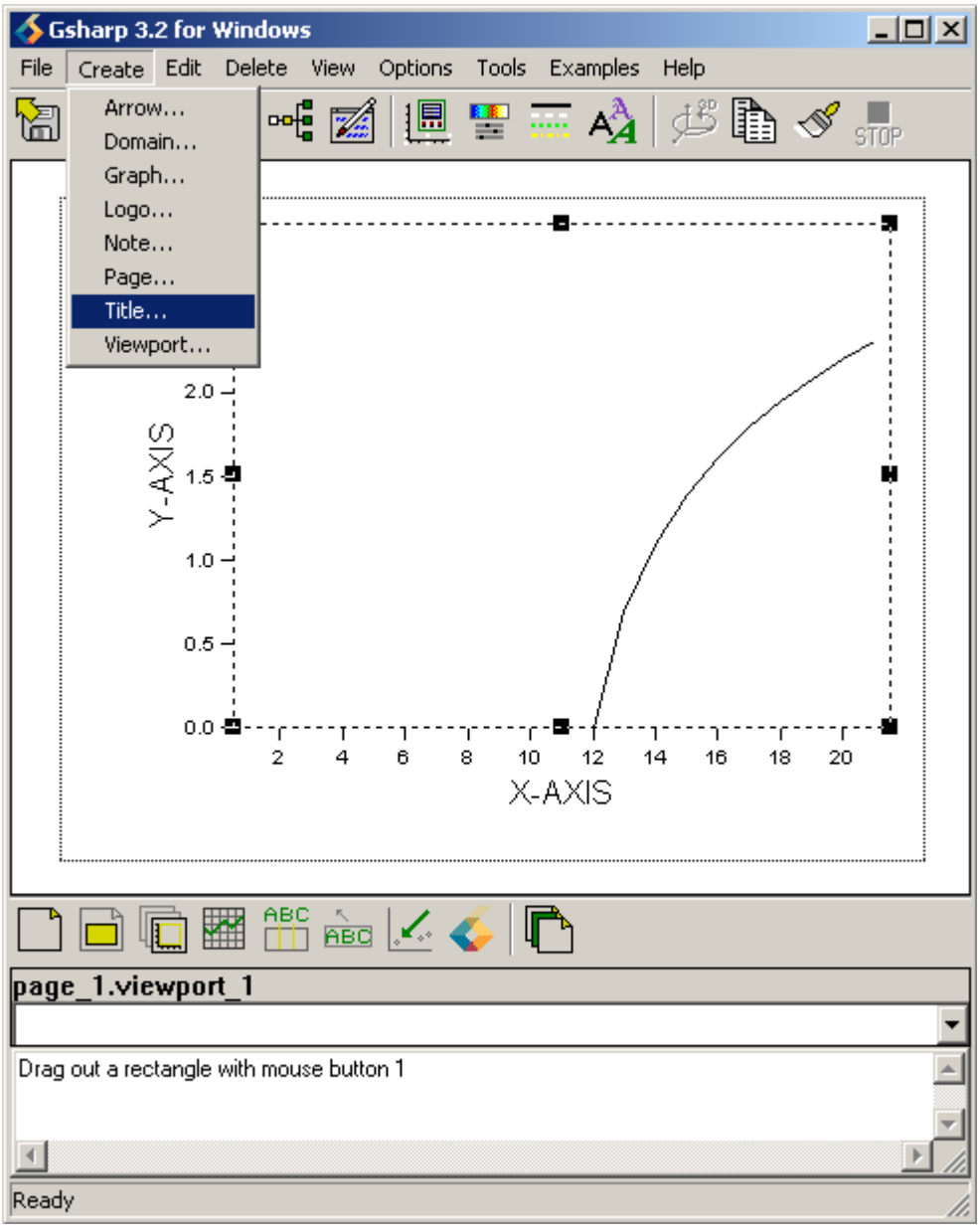


Figure II-18: Creating a Title for 2D Graphs

- The Title Editor appears and next to *Text* a name is written for the title. For this example log(-10:10) is written. Next set *Height* to 10 (Figure II-19).

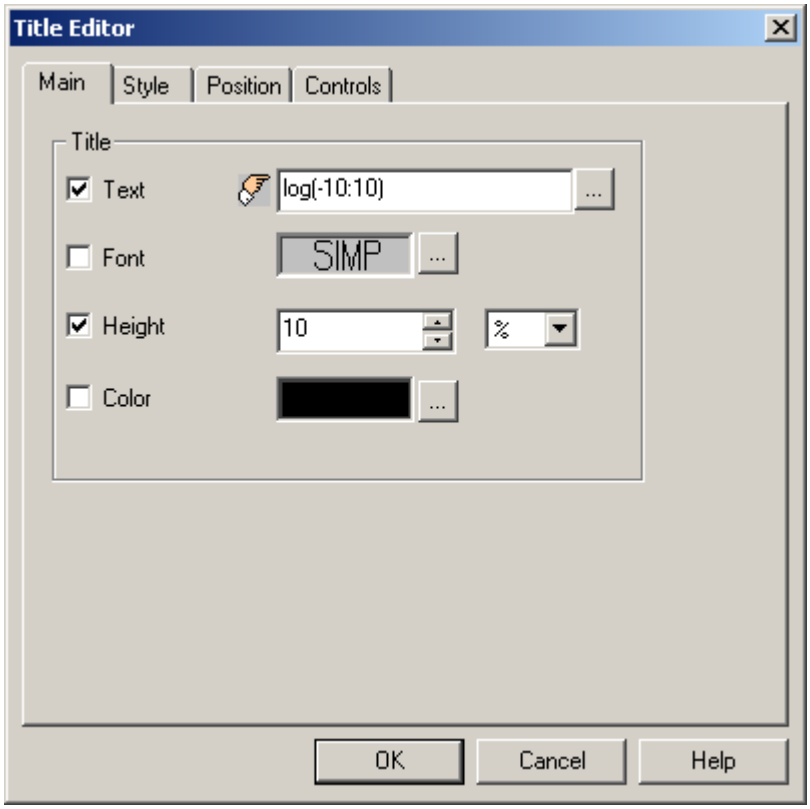


Figure II-19: Writing a Title for 2D Graphs

- Select *OK* and the title is written above the graph[8] (Figure II-20)

[8] If necessary, drag the title with the left mouse button to position it.

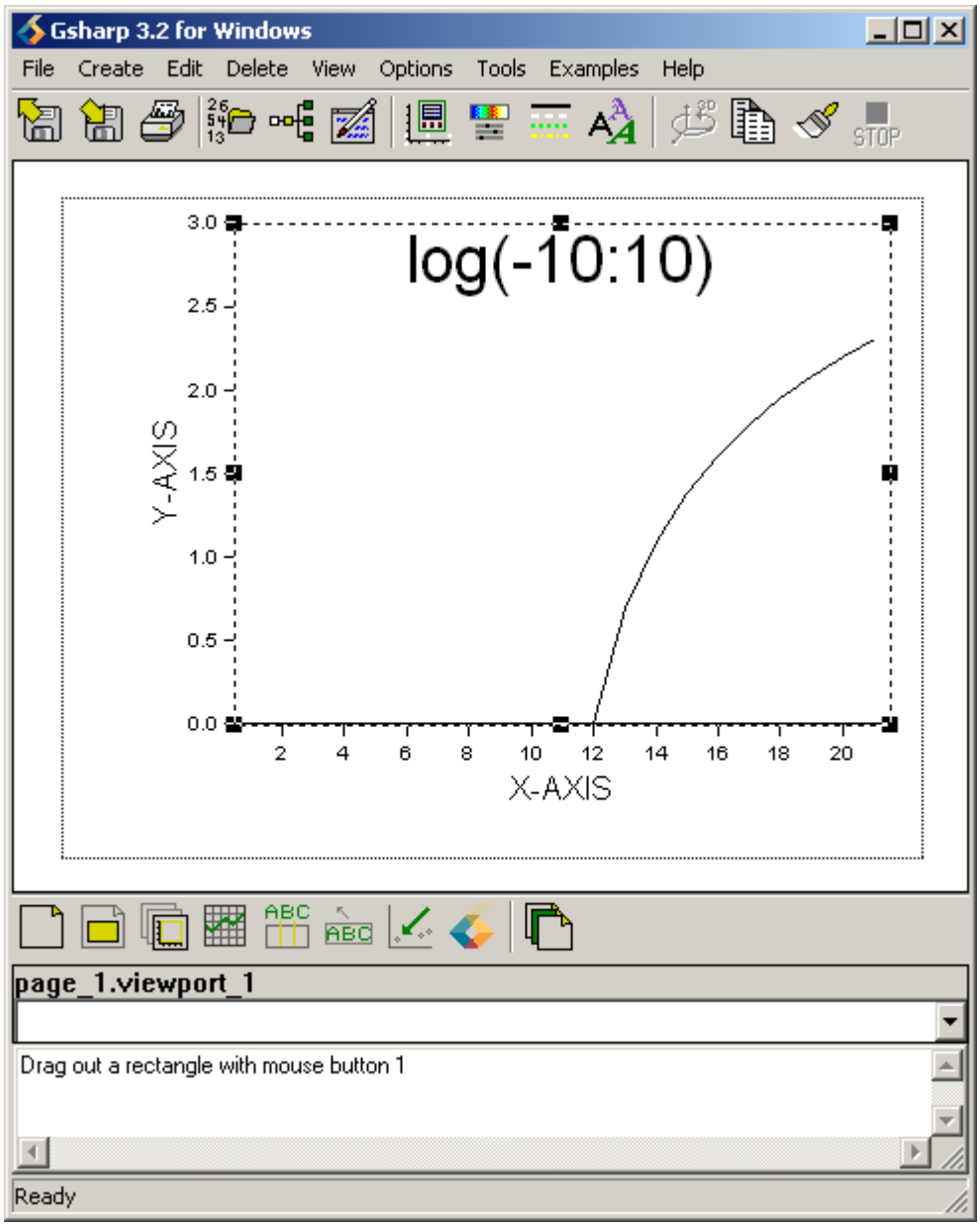


Figure II-20: An Example of a Title for 2D Graphs

2.2 Creating a 3D Graph

2.2.1 Specifying a Viewport

- Select *Viewport…* from the *Create* drop-down menu (Figure II-21).

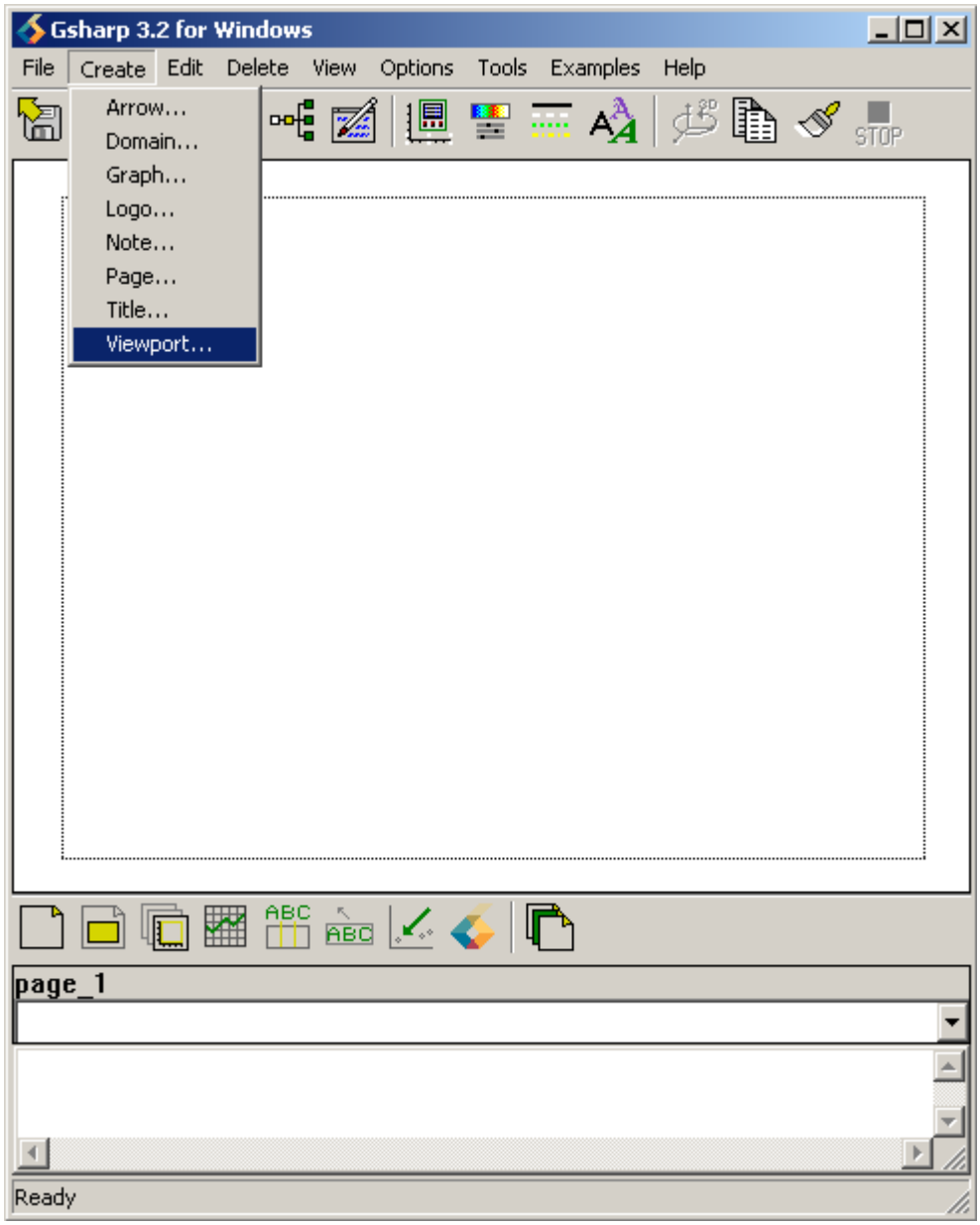


Figure II-21: Creating a Viewport for 3D Graphs

- Use the left mouse button to draw a rectangle on the Canvas[9] area (Figure II-22).

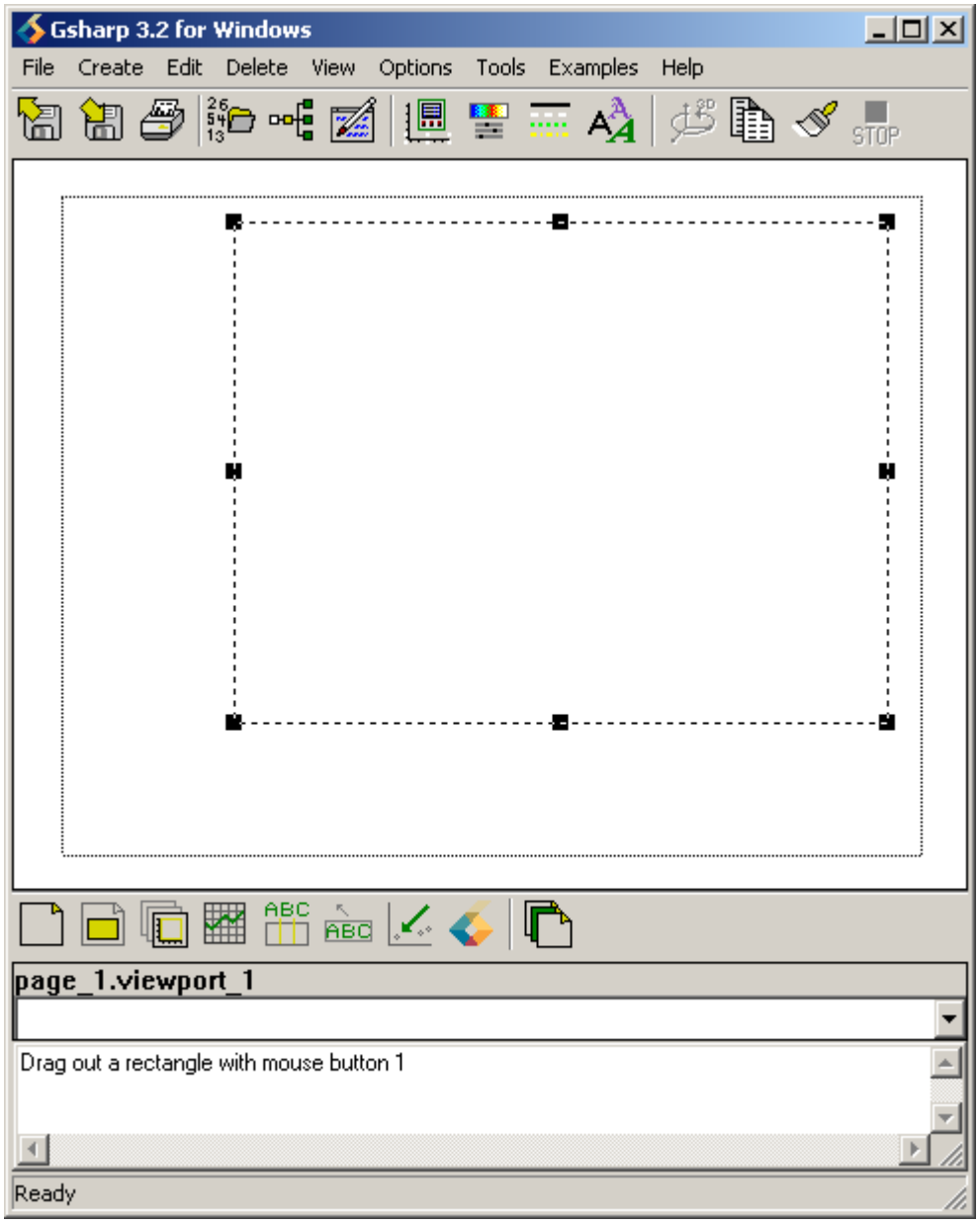


Figure II-22: Defining a Viewport for 3D Graphs

[9] Refer to Appendix A, Figure A-1, for descriptions of what the canvas is.

2.2.2 Selecting a Graph Type

- Select *Graph…* from the *Create* drop-down menu (Figure II-23) so that the Graph Editor appears (Figure II-24).

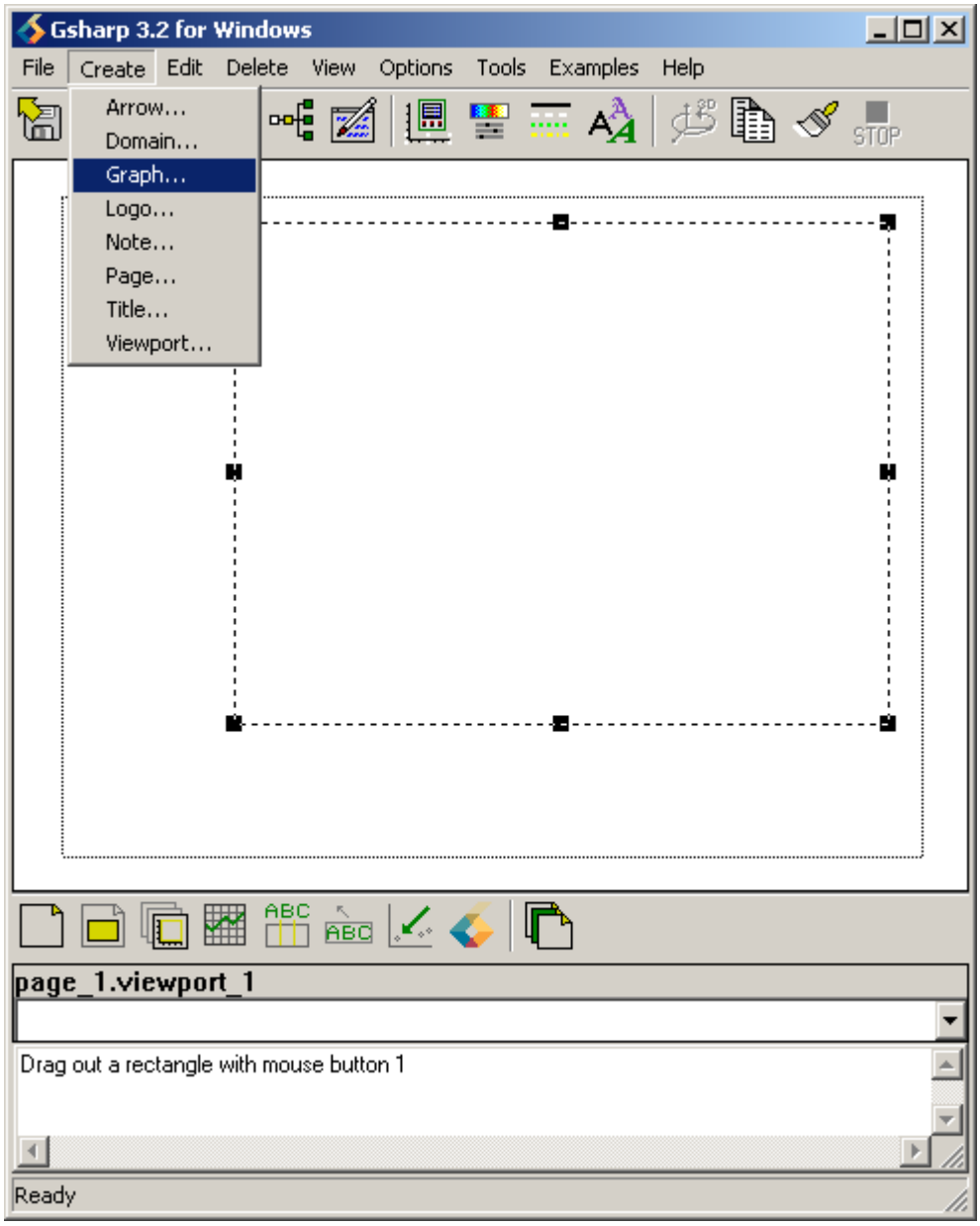


Figure II-23: Selecting Graph Type

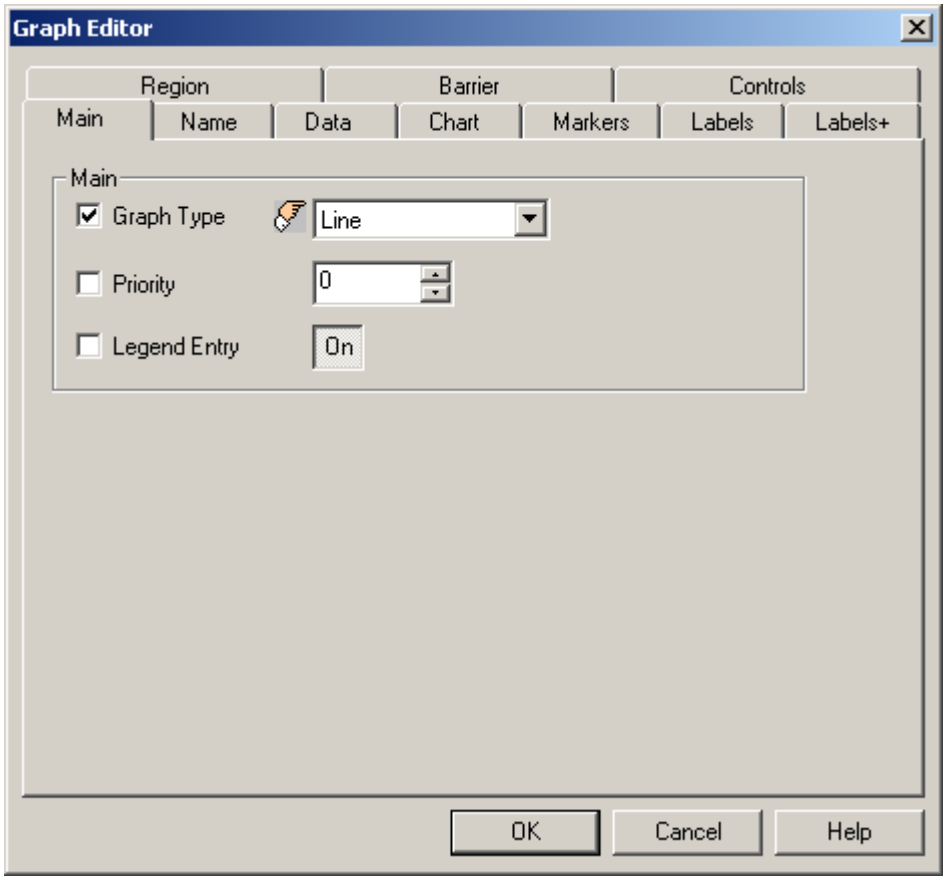


Figure II-24: Graph Editor

- Under *Main* of the Graph Editor, select *3D Line* from the *Graph Type* drop-down menu. (Figure II-25).

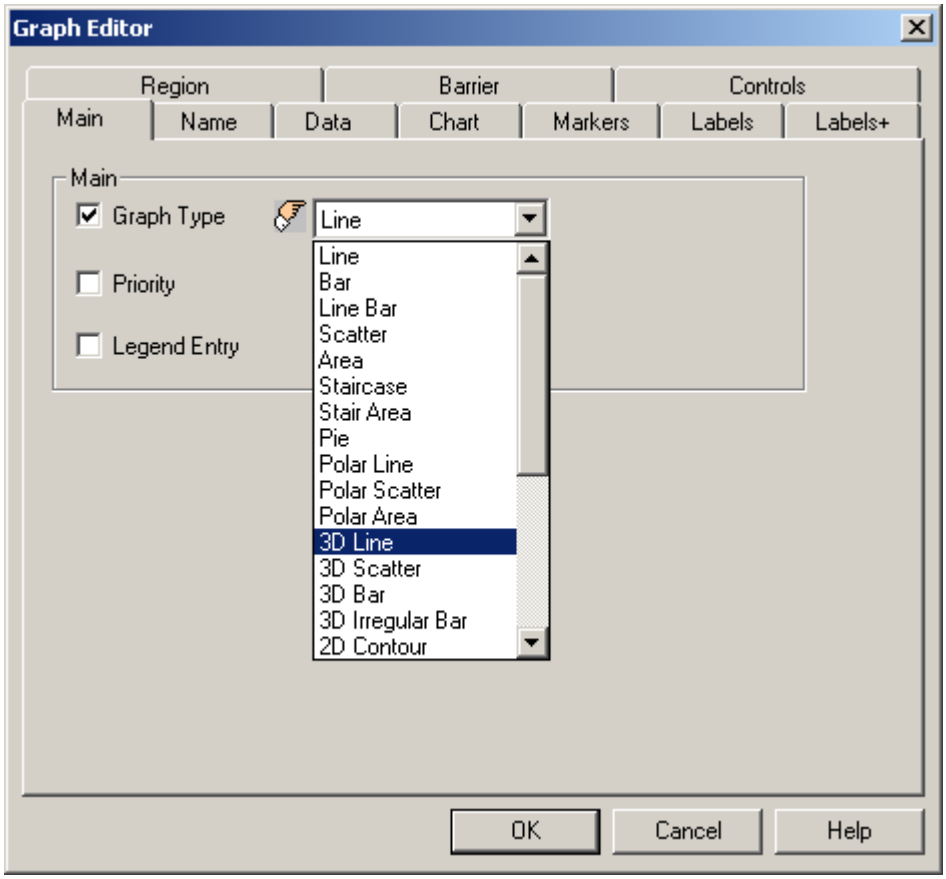


Figure II-25: Selecting 3D Line Graph

2.2.3 Setting Data Values

- Select *Data* to set a value for *X*, *Y* and *Z* values. The [10] in the example is next to the X, Y and Z values so values are to be entered (Figure II-26).

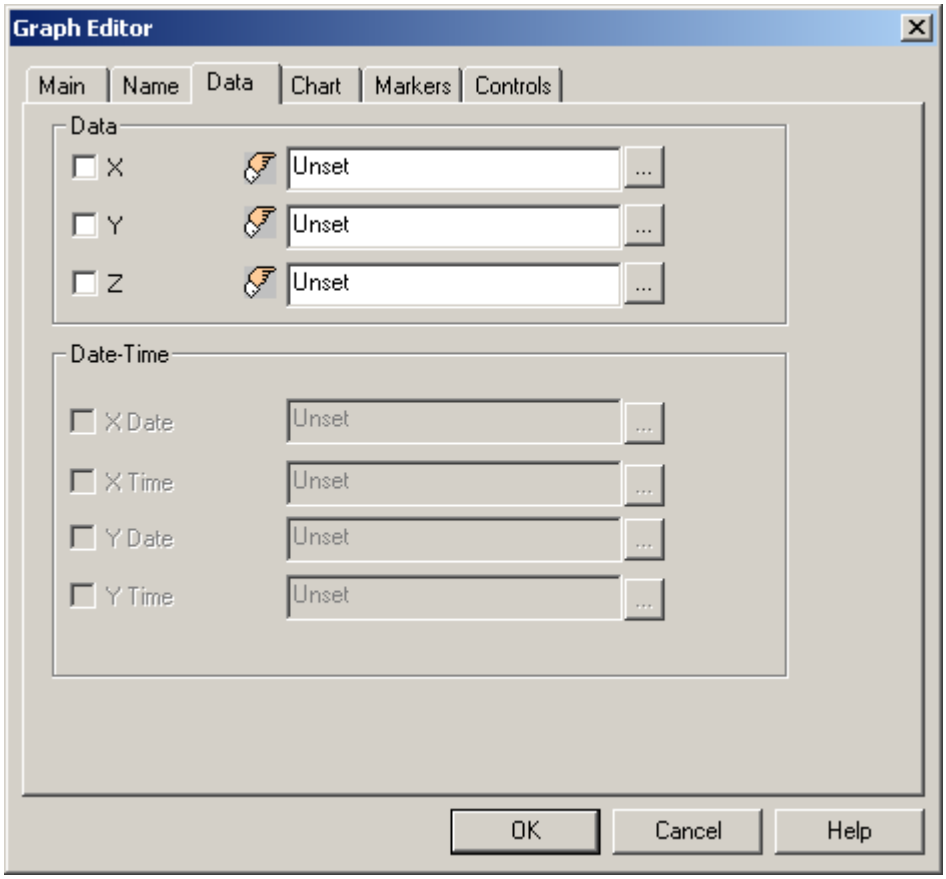


Figure II-26: Graph Editor for 3D Graphs

- Next to the in the boxes, there is the word "Unset" (Figure II-26). Here a value is entered for the 3D line graph. In this example the values[11] (1:10) for X, 1/(1:10) for Y, and (-10:10) for Z are entered (Figure II-27).

[10] The next to some data resources signifies that a value is to be set for those resources.

[11] (1:10) is shorthand for 1,2,3, …,10; 1/(1:10) is shorthand to 1/1,1/2,1/3, …,1/10; and (-10,10) is shorthand to –10,-9,-8, …,10.

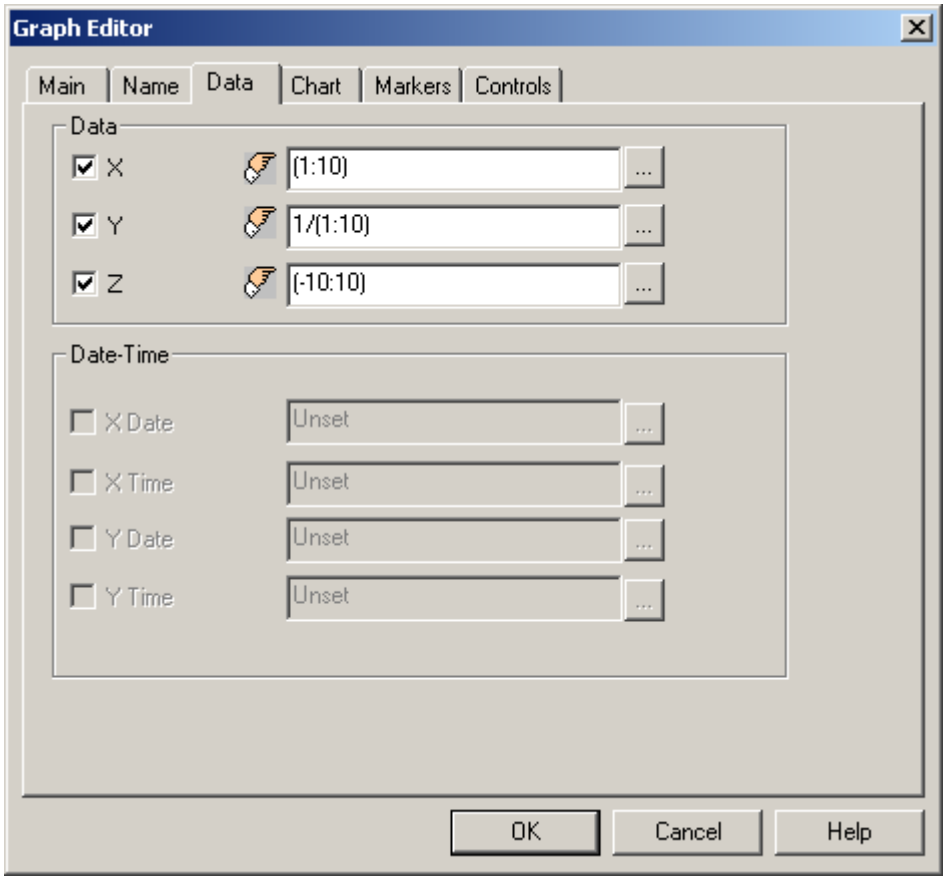


Figure II-27: Setting Values for 3D Graphs

- Select *OK* and a 3D line graph is drawn according to the entered values (Figure II-28).

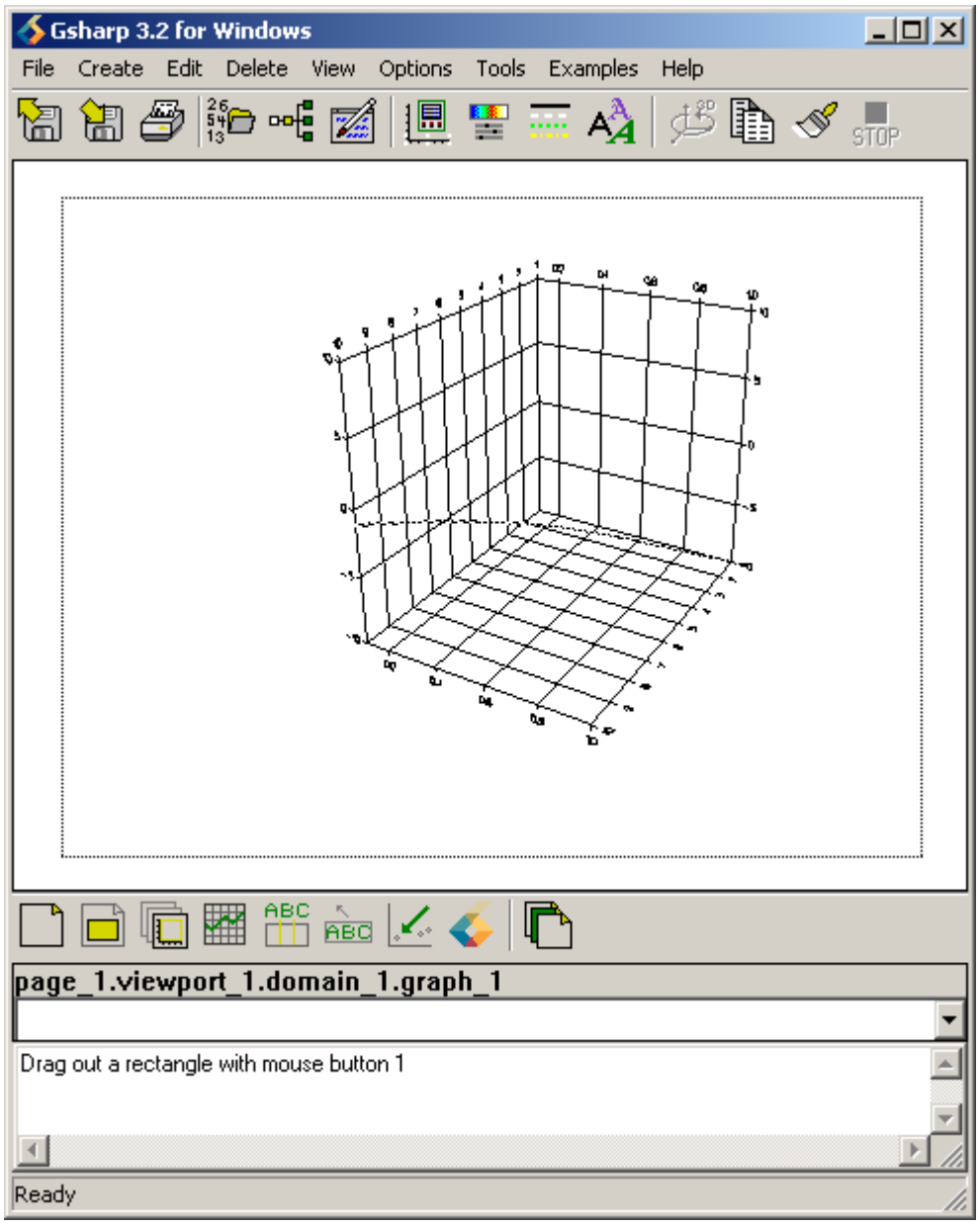


Figure II-28: An Example of a 3D Line Graph

3 Displaying Temperature Inside a Room

This chapter describes how the temperature flows inside a room.

The values given are x, y, z and t from a data file called block.dat[12]. t is the value for the temperature at locations given by coordinates x, y and z. The task is to visualize the distribution of temperature in the room. For example, if in the centre of the room the colour of the temperature is blue then this part of the room is cold. The data is irregular (the location of each point is given explicitly) and the coordinates are located on a regular grid (the points are arranged in planes perpendicular to the coordinate axes).

3.1 Choosing the Best Graph

Notice that there is no functionality within GSharp menus/data manager to automatically create a 3D block or a variable such as unique x. This means there is no tag or a button that sets automatically variables or creating a 3D block.

[12] Courtesy of John Stringer, AVS UK. Refer to Appendix B, Figures B-1 and B-2 for descriptions of the file.

- Select *Open…* from the *File* drop-down menu. Import block.dat file into Gsharp (Figure III-1).

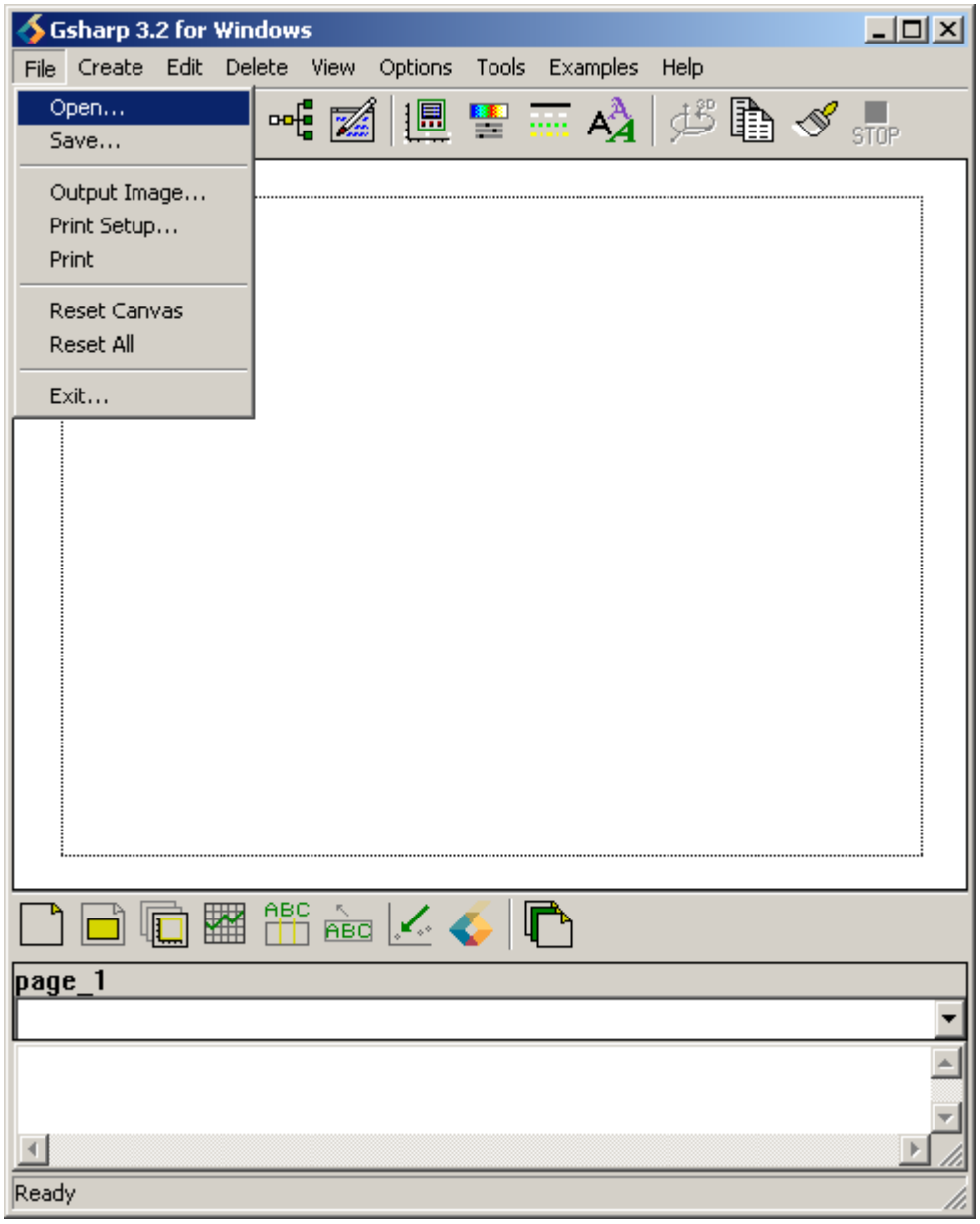


Figure III-1: Opening a File

- The result will be (Figure III-2).

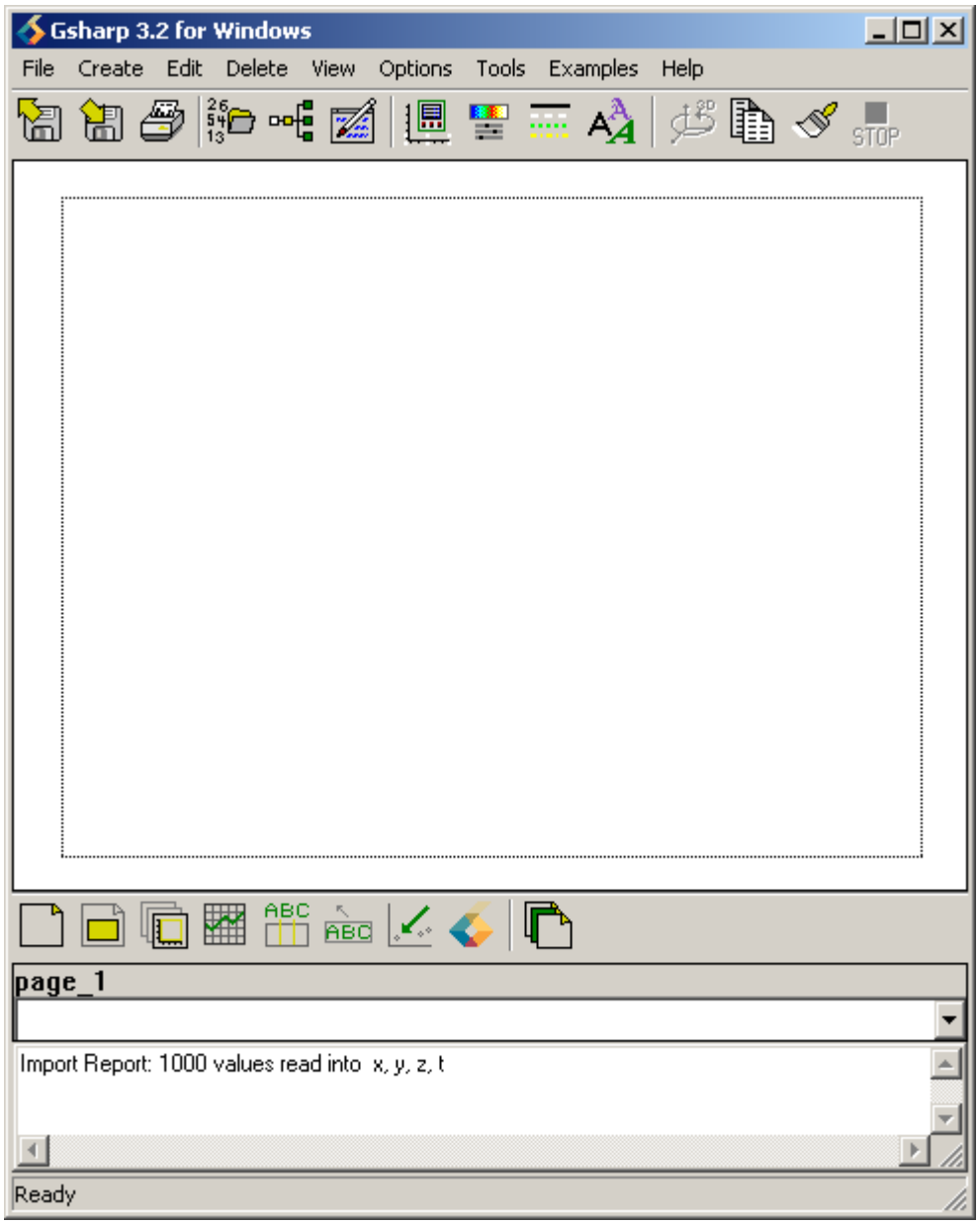


Figure III-2: Result of Opening block.dat

3.1.1 2D Contour for z=1

The task is to visualize all values of Z (10 values) within the block.dat file. To do that a 3D block is to be created using 2D contours of each slice (Z values) of the block.

- Type *BlockX = unique(x)*; in command line[13] (Figure III-3)[14].

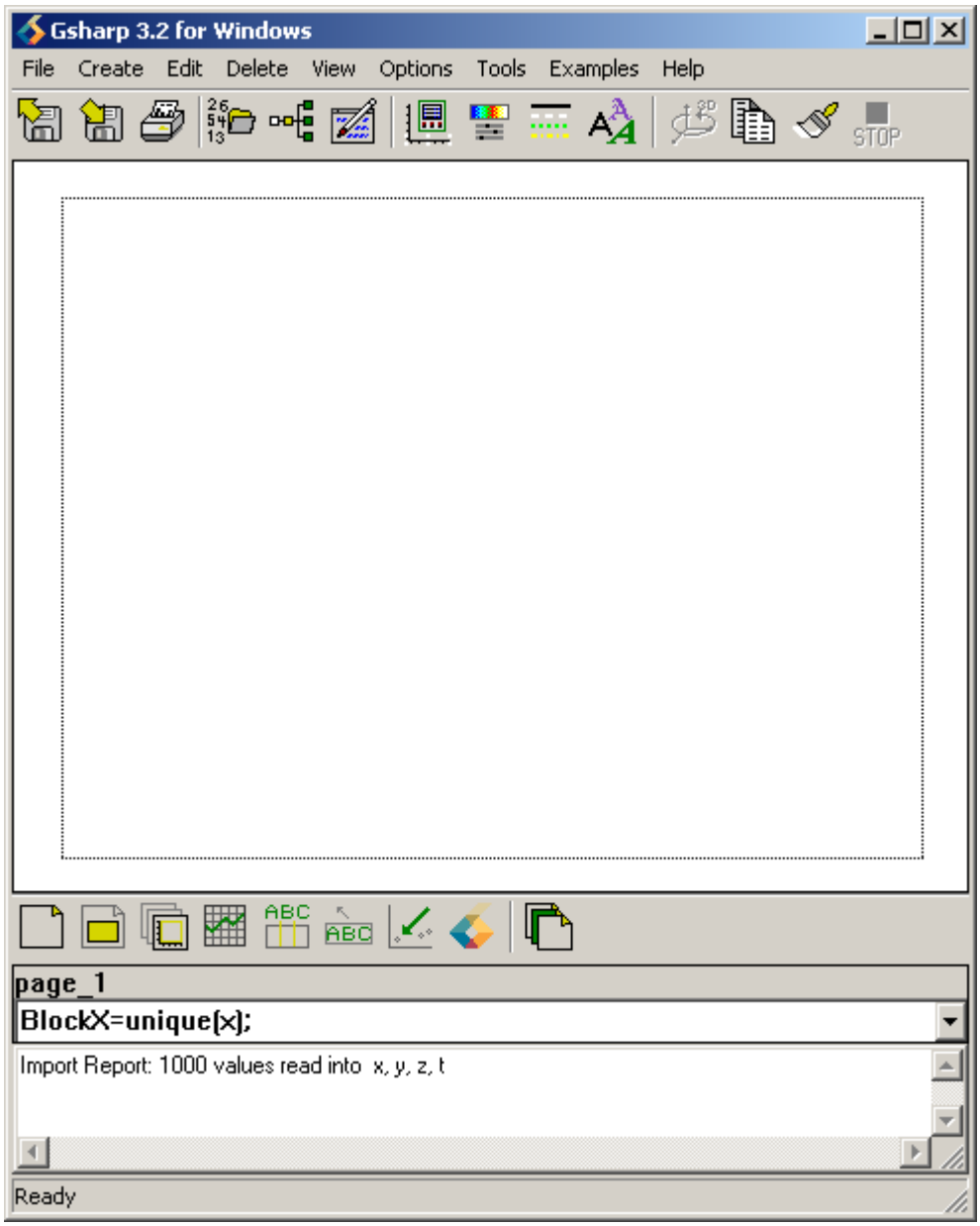


Figure III-3: Writing Commands in Command Line

- Press enter so that the command is processed.

[13] Refer to Appendix A, Figure A-1, for descriptions of what the command line is.
[14] This command is entered in order to get the unique values (not the repeated) of x.

- Type *BlockY=unique(y)*; in command line (Figure III-3) and press enter[15].
- Type *BlockZ=unique(z)*; in command line (Figure III-3) and press enter[16].
- Type *Block=reshape(t,size(BlockX),size(BlockY),size(BlockZ))*; in command line (Figure III-3) and press enter[17].
- Type *Classes=range(t, 10)* and press enter (Figure III-3)[18].
- Select *Viewport…* from the *Create* drop-down menu (Section 2.1.1).
- Select *Graph…* from the *Create* drop-down menu (Section 2.1.2).
- Select *2D Contour* for *Graph Type* (Section 2.1.2)[19].

[15] This command is entered in order to get the unique values (not the repeated) of y.
[16] This command is entered in order to get the unique values (not the repeated) of z.
[17] This command is entered in order to get a new block of 10 (BlockX) by 10 (BlockY) by 10 (BlockZ) with range t.
[18] This command is entered in order to get 10 different classes of colour for the t value.
[19] Refer to Appendix B, Figure B-3 to see how the dataset is managed and if the dataset is set correctly in the Data Editor.

- In *Data,* set *X* to be BlockX, *Y* to be BlockY and *Color Grid* to be Block[,,1] (Figure III-4)[20].

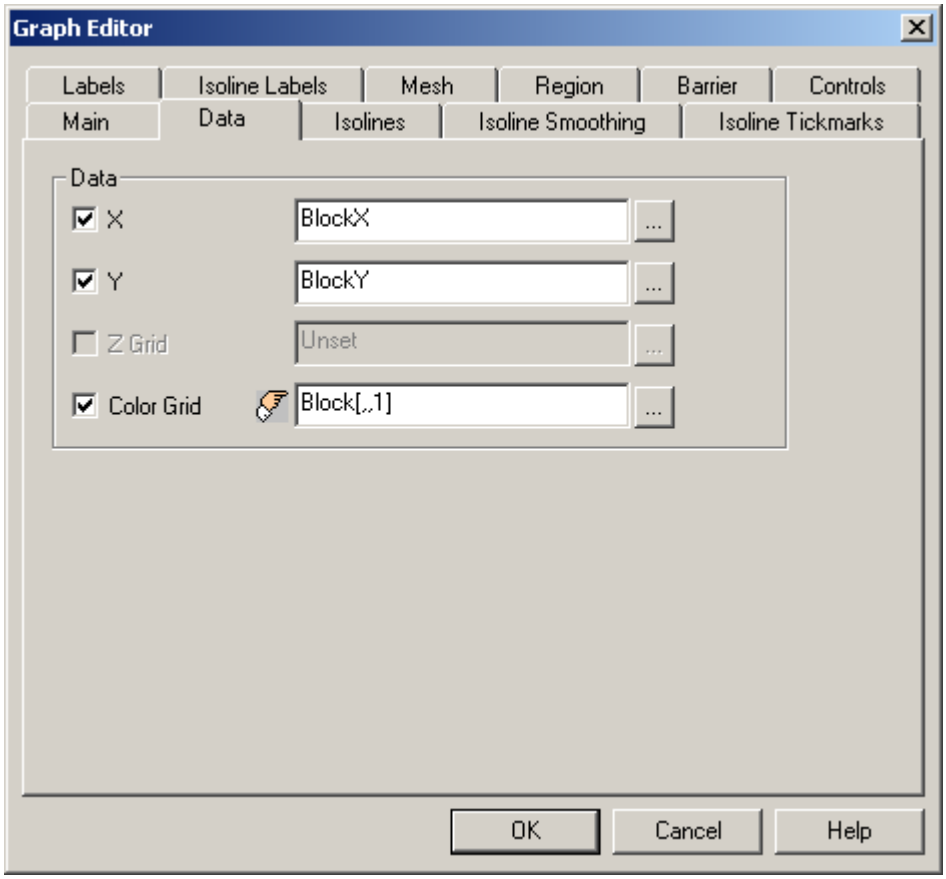


Figure III-4: Setting Values for 2D Contour

- Select *OK* and the result will be (Figure III-5).

[20] That means the plane is set to z=1.

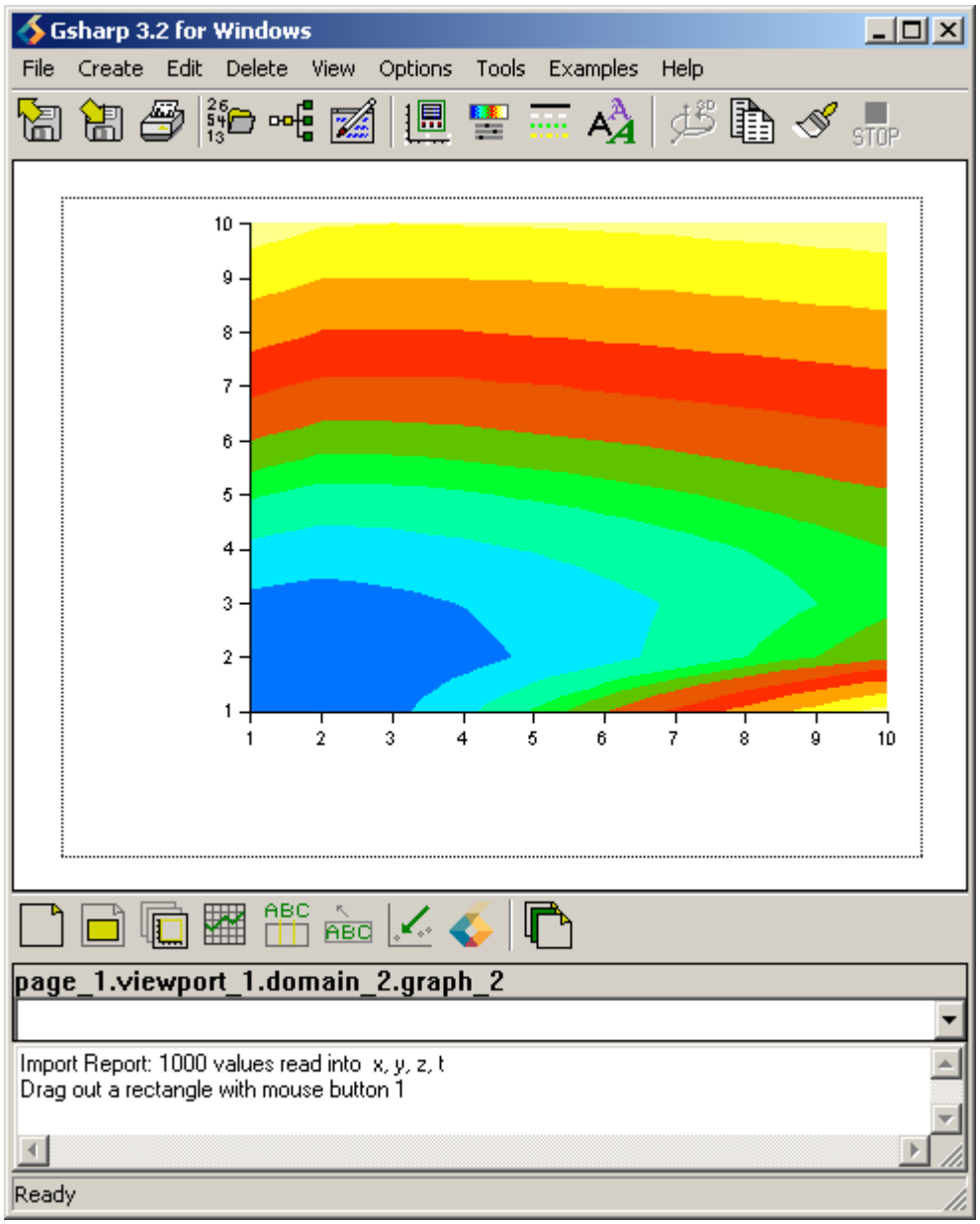


Figure III-5: Result of 2D Contour for z=1

- Select *Domain…* from the *Edit* drop-down menu (Figure III-6).

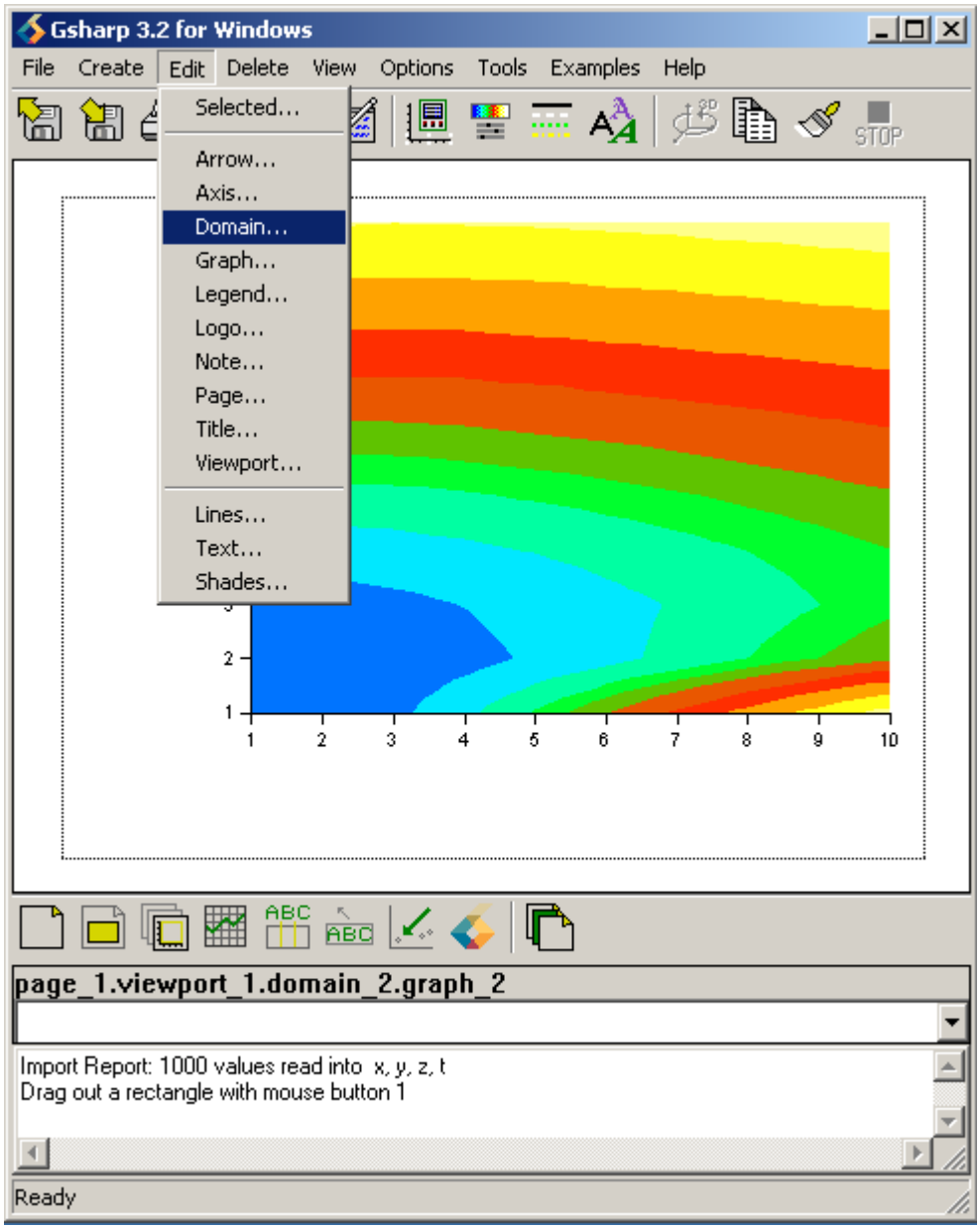


Figure III-6: Editing the Domain

- In the Domain Editor select *Classes* and set *Num Values* to 10 (Figure III-7)[21].

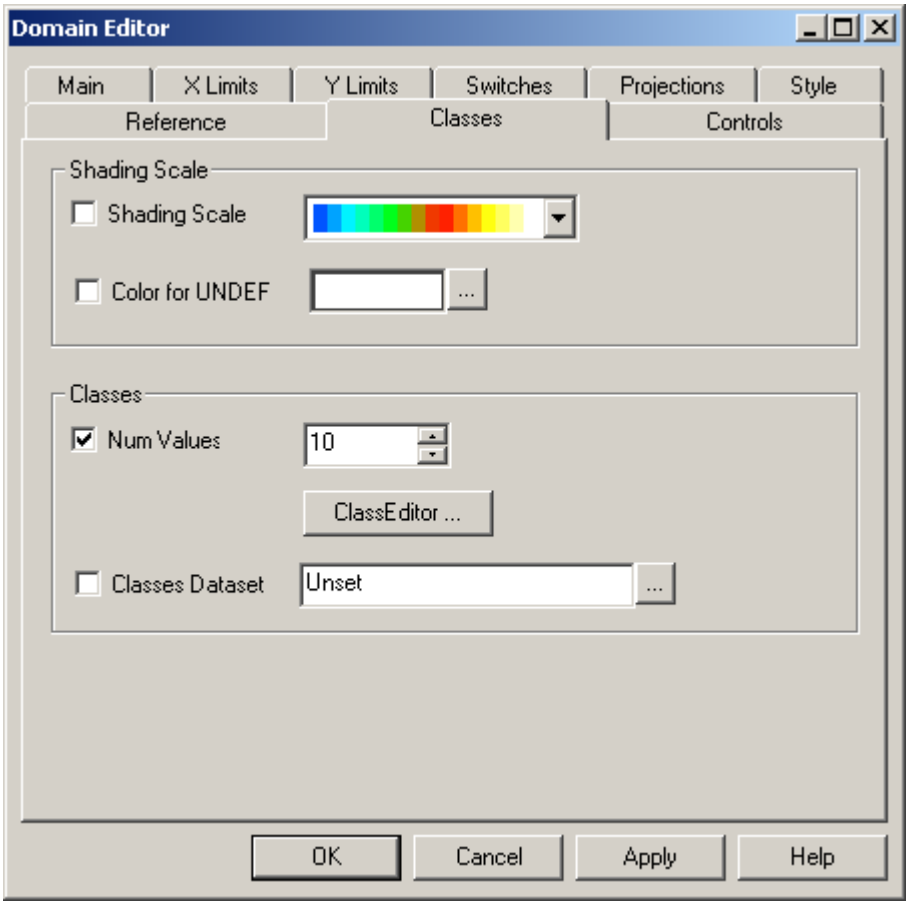


Figure III-7: Changing the Classes Value

- Select *ClassEditor*..., (Figure III-7) and the Class Editor appears (Figure III-8).

[21] This gives 10 different colours to the graph.

- Set *Mode* to Min/Max[22], the *Type* to Limits[23], *Minimum* to 3[24] and *Maximum* to 11.1[25] (Figure III-8).

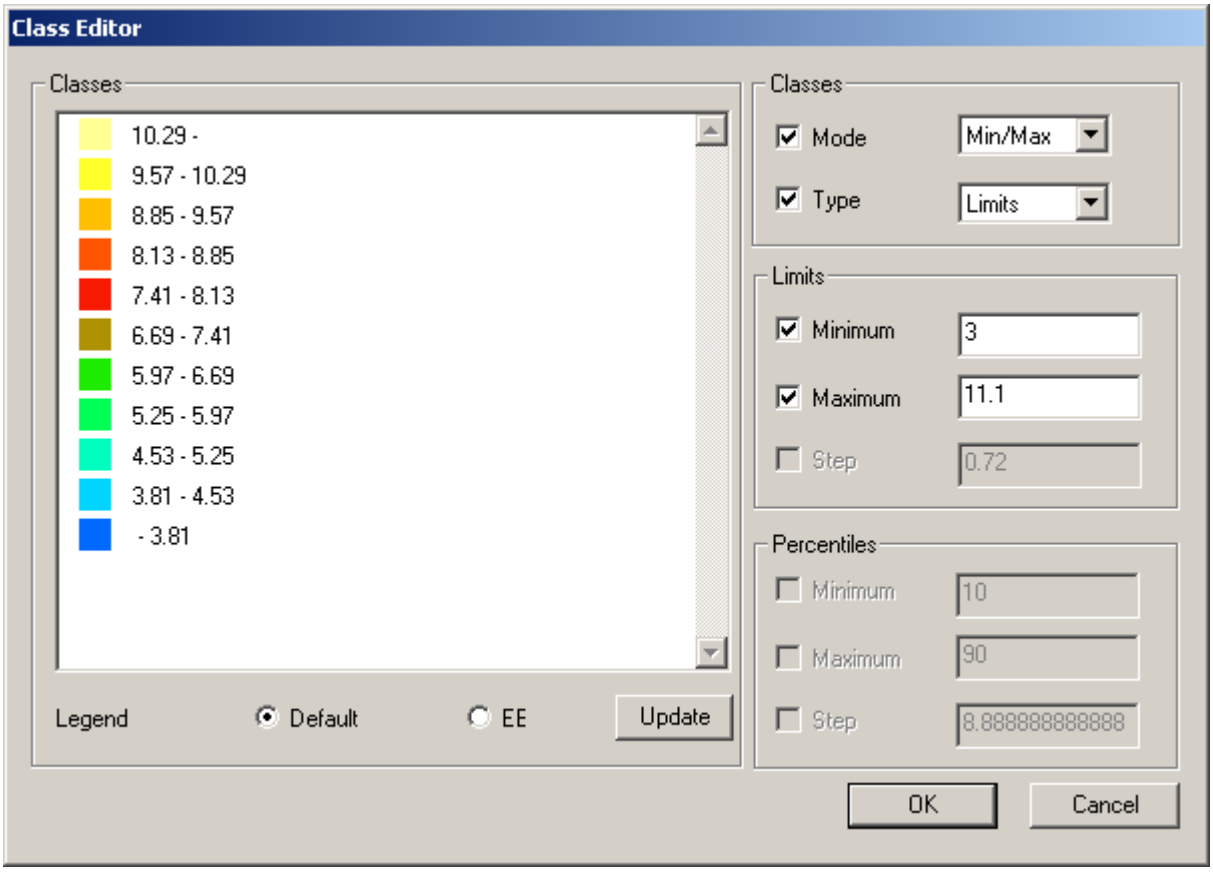


Figure III-8: Class Editor

- Select *OK* and return to Domain Editor (Figure III-9).

[22] To set minimum and maximum values to the colours.

[23] There are two options here, percentiles and limits. Limits are to be set because the temperature is between 3 and 11.1 values. Other values are not needed.

[24] 3 is the minimum value of t in the file.

[25] 11.1 is the maximum value of t in the file.

- In the Domain Editor set *Classes Dataset* to Classes (Figure III-9).

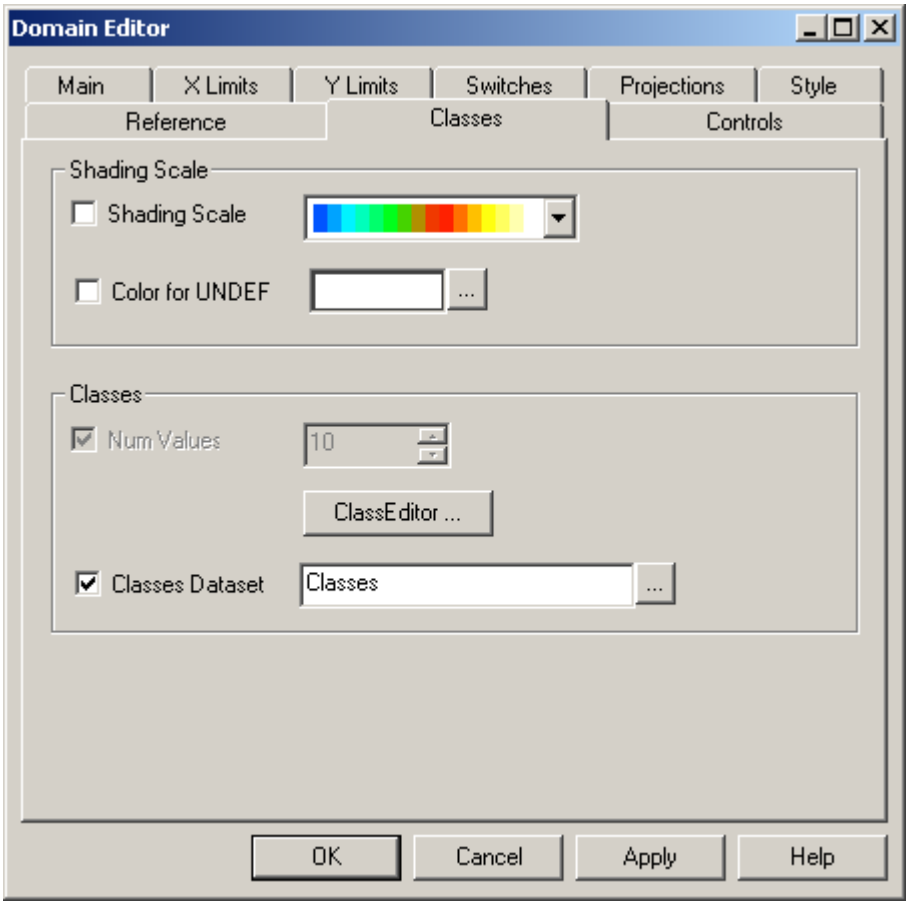


Figure III-9: Changing Classes Dataset

- Select *OK* and the result will be (Figure III-10).

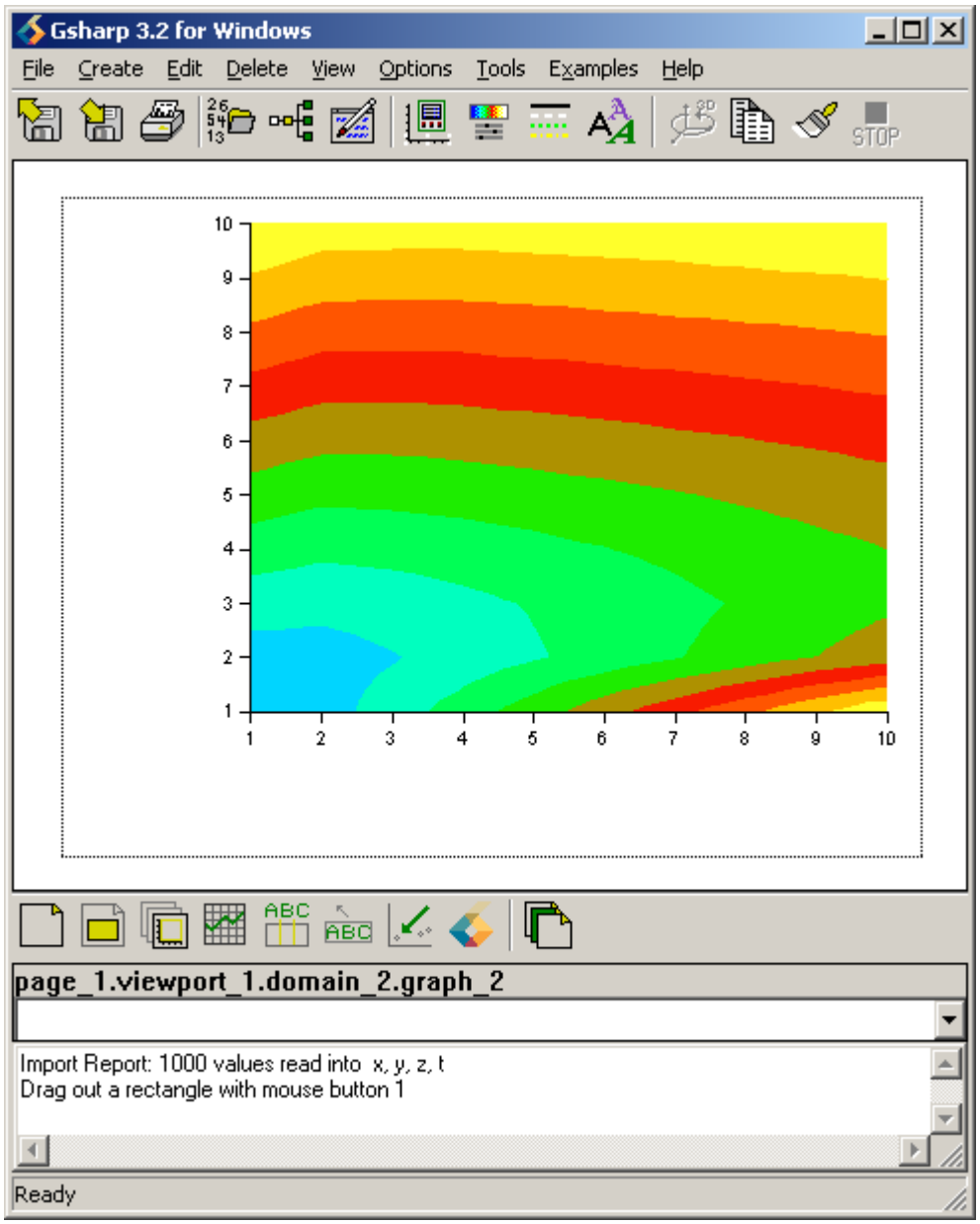


Figure III-10: Result After Changing Colour Classes

- Select *Legend*... from the Edit drop-down menu (Figure III-11).

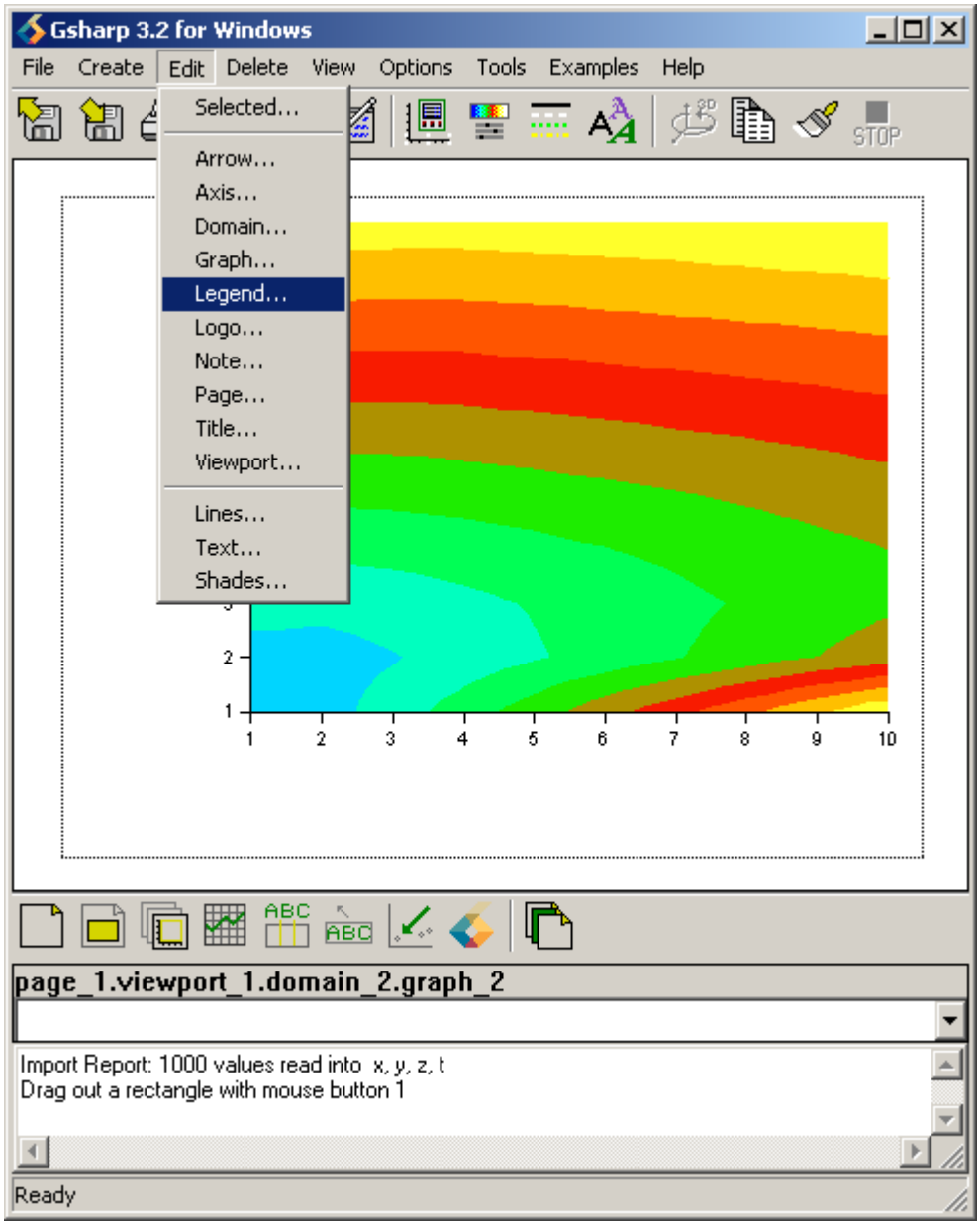


Figure III-11: Editing the Legend

- In the Legend Editor select *Text* and set *Entry Height* to be 7 (Figure III-12)[26].

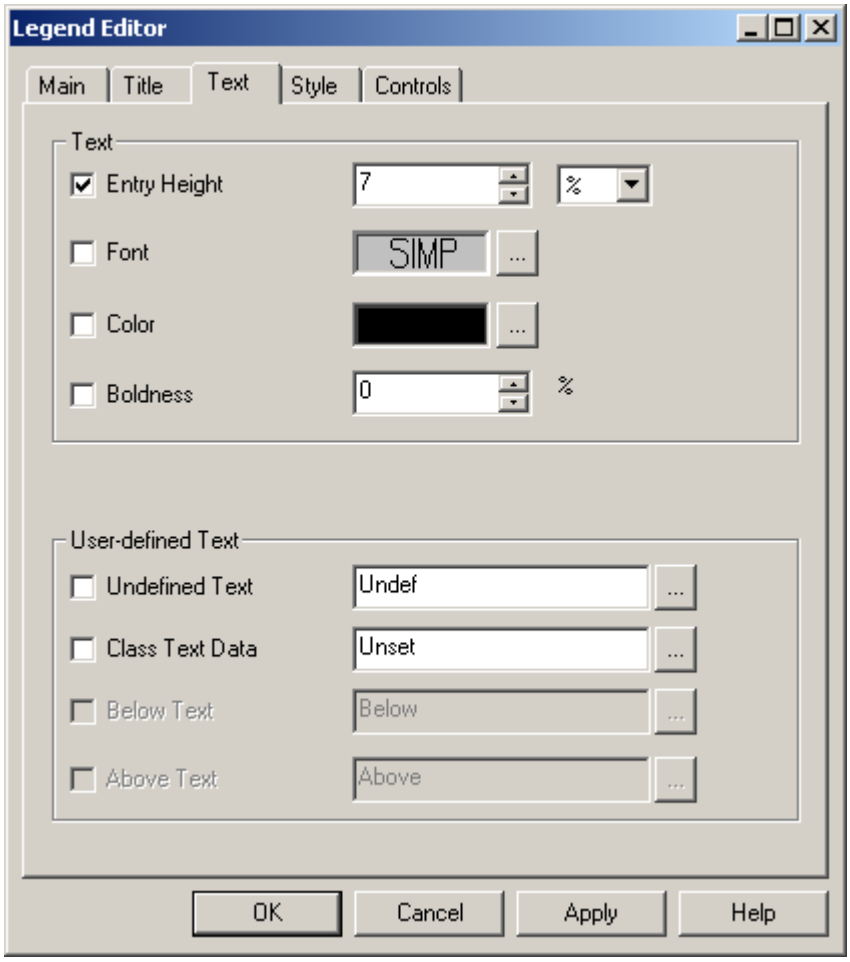


Figure III-12: Editing Entry Height

- Select *Controls* (Figure III-13).

[26] The legend is more readable when setting *Entry Height* to 7 than other values.

- Set *Enabled* to On (Figure III-13).

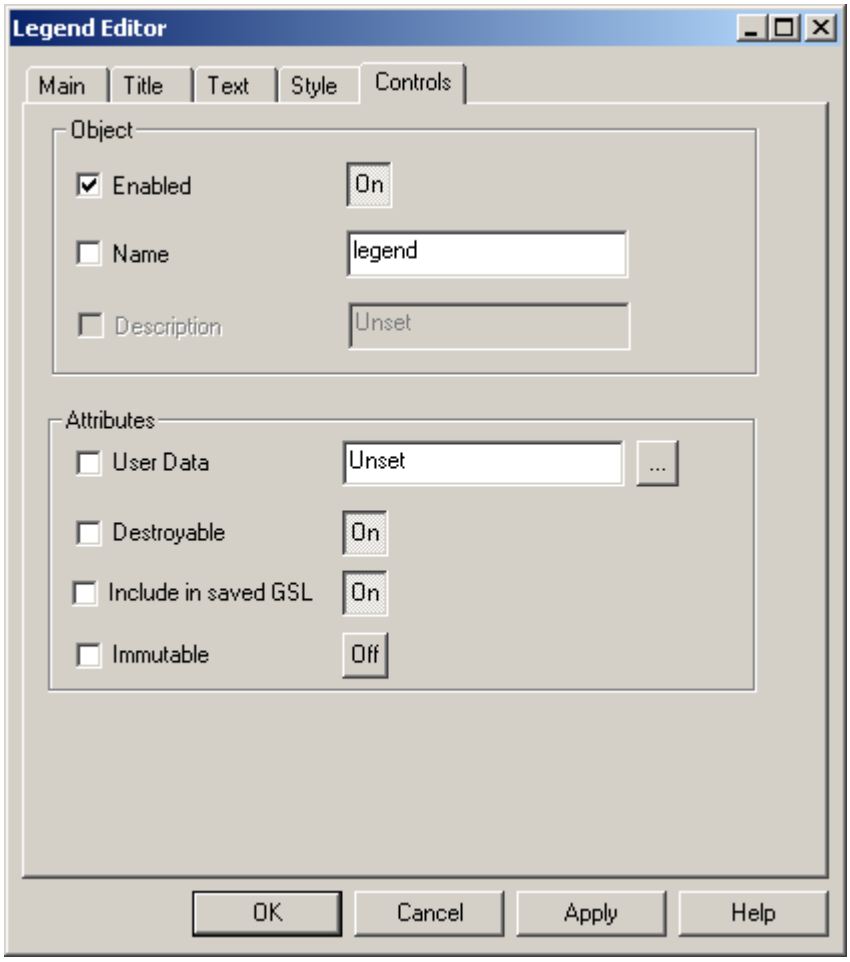


Figure III-13: Enable the Legend

- Select *OK* and the result will be (Figure III-14).

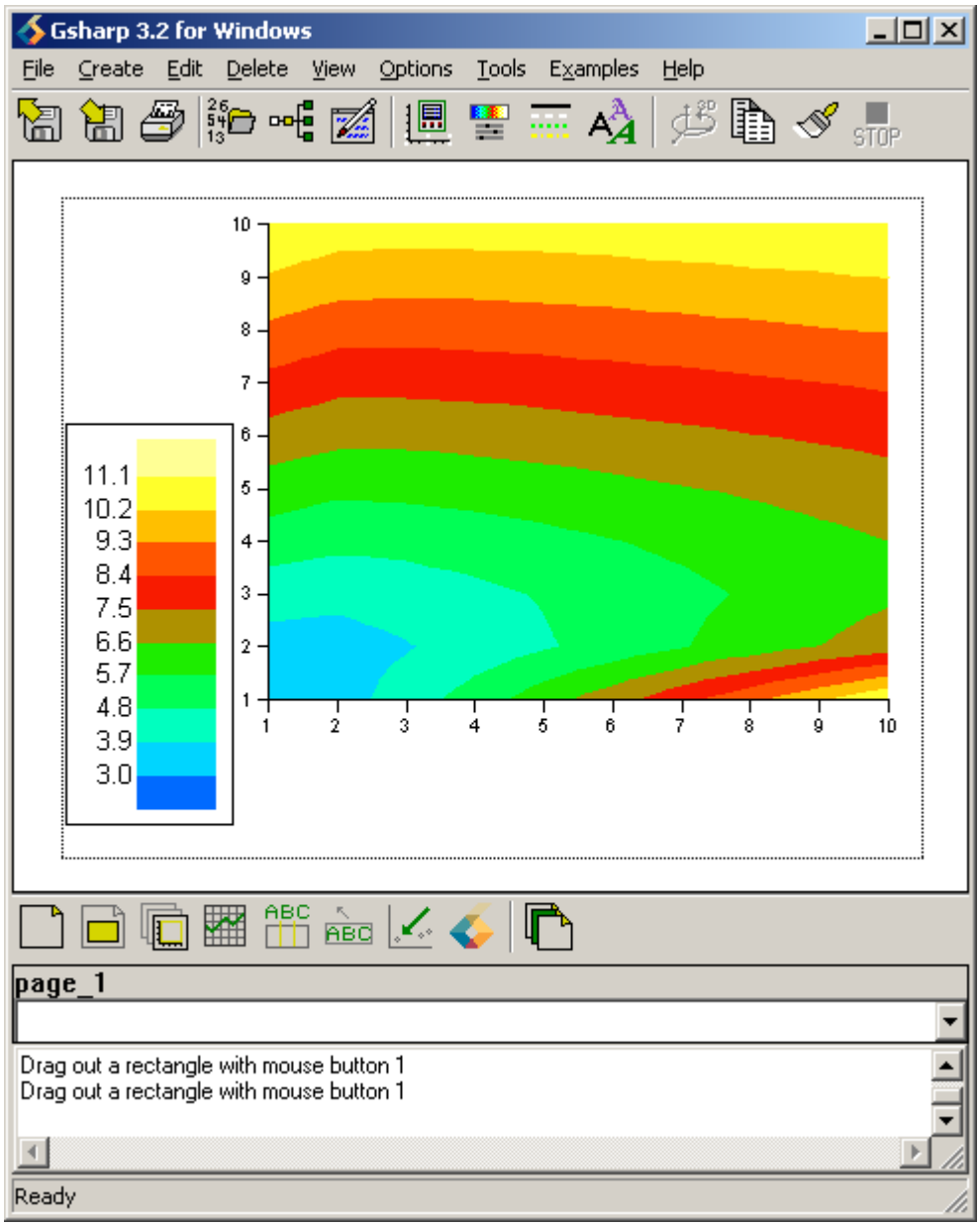


Figure III-14: Result With a Legend

This result (Figure III-14) is the plane of z=1. The Legend[27] shows the value of the corresponding colour in the graph in each x, y dimension.

[27] The Legend will require positioning to provide a result similar to Figure III-14.

3.1.2 2D Contour for z=2

- Select *Graph…* from the *Edit* drop-down menu (Figure III-15).

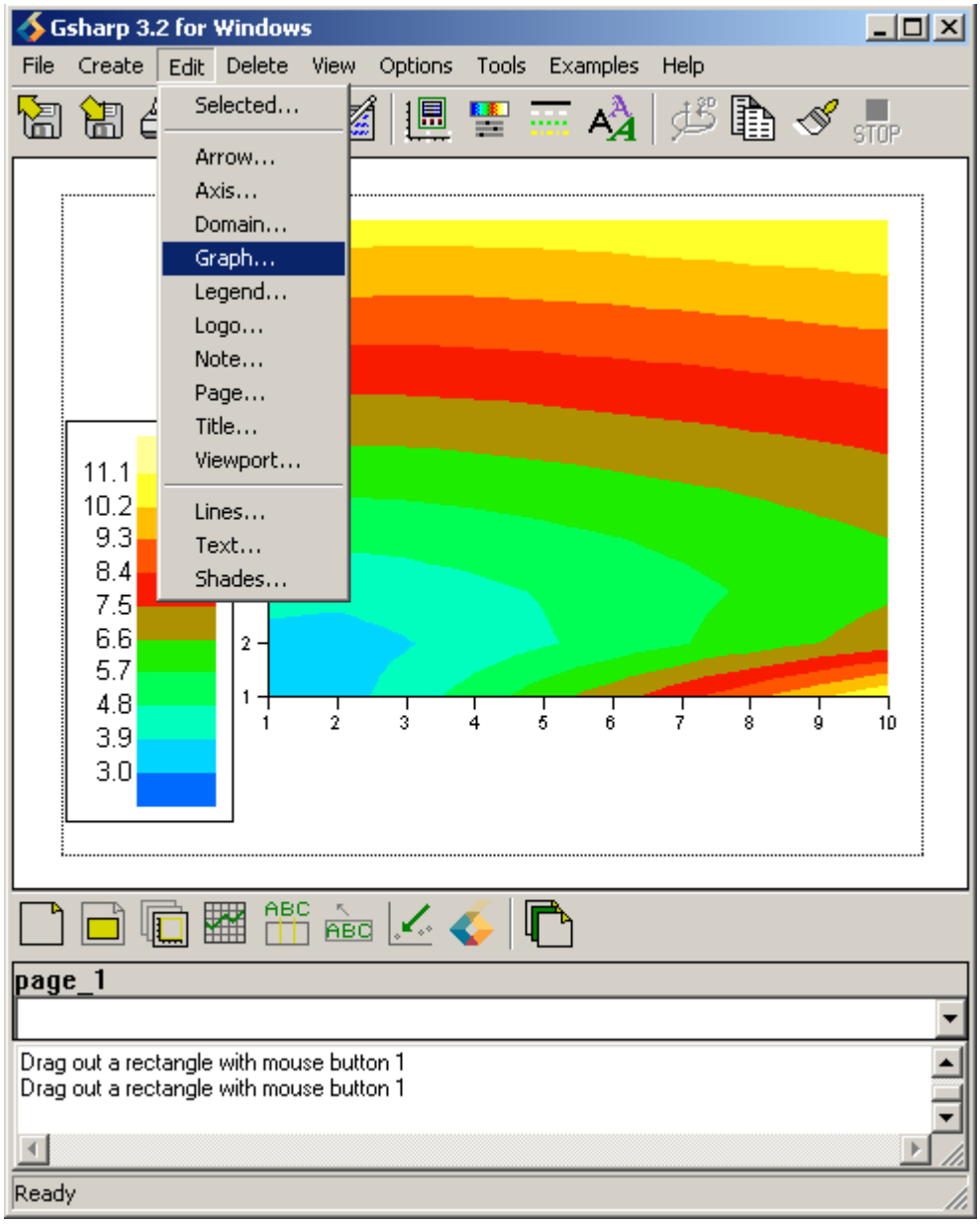


Figure III-15: Editing Graph

- In Data of Graph Editor set *Color Grid* to be Block[,,2] (Section 3.1.1, Figure III-4).
- Select *OK* and the result will be (Figure III-16).

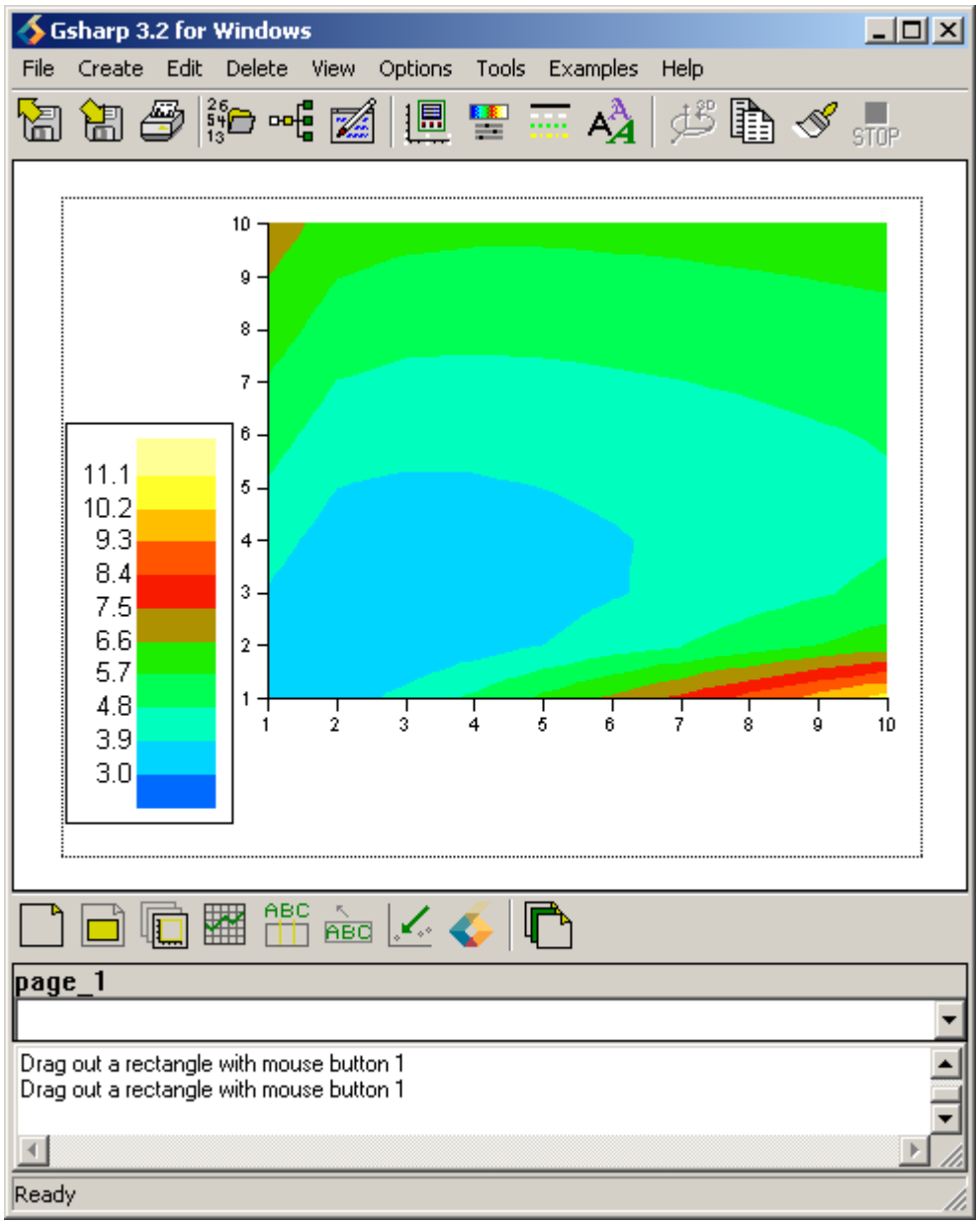


Figure III-16: Result of 2D Contour for z=2

This result (Figure III-16) is the plane of z=2.

3.1.3 2D Contour for z=3

- Select *Graph…* from the Edit drop-down menu (Section 3.1.2, Figure III-15).
- In *Data* of Graph Editor set *Color Grid* to be Block[,,3] (Section 3.1.1, Figure III-4).
- Select *OK* and the result will be (Figure III-17).

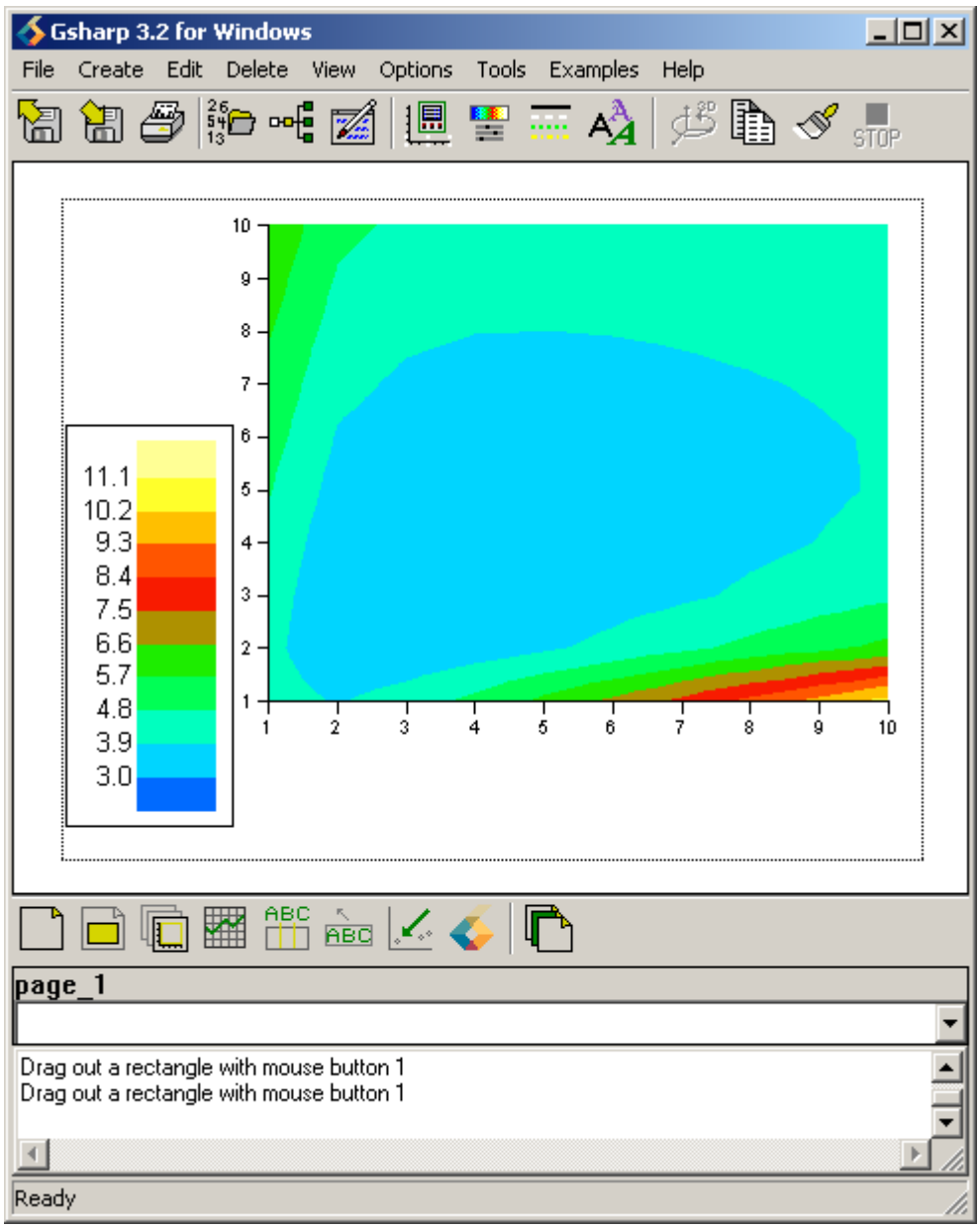


Figure III-17: Result of 2D Contour for z=3

This graph (Figure III-17) is the plane of z=3.

3.1.4 2D Contour for z=4

- Select *Graph…* from the Edit drop-down menu (Section 3.1.2, Figure III-15).
- In *Data* of Graph Editor set *Color Grid* to be Block[,,4] (Section 3.1.1, Figure III-4).
- Select *OK* and the result will be (Figure III-18).

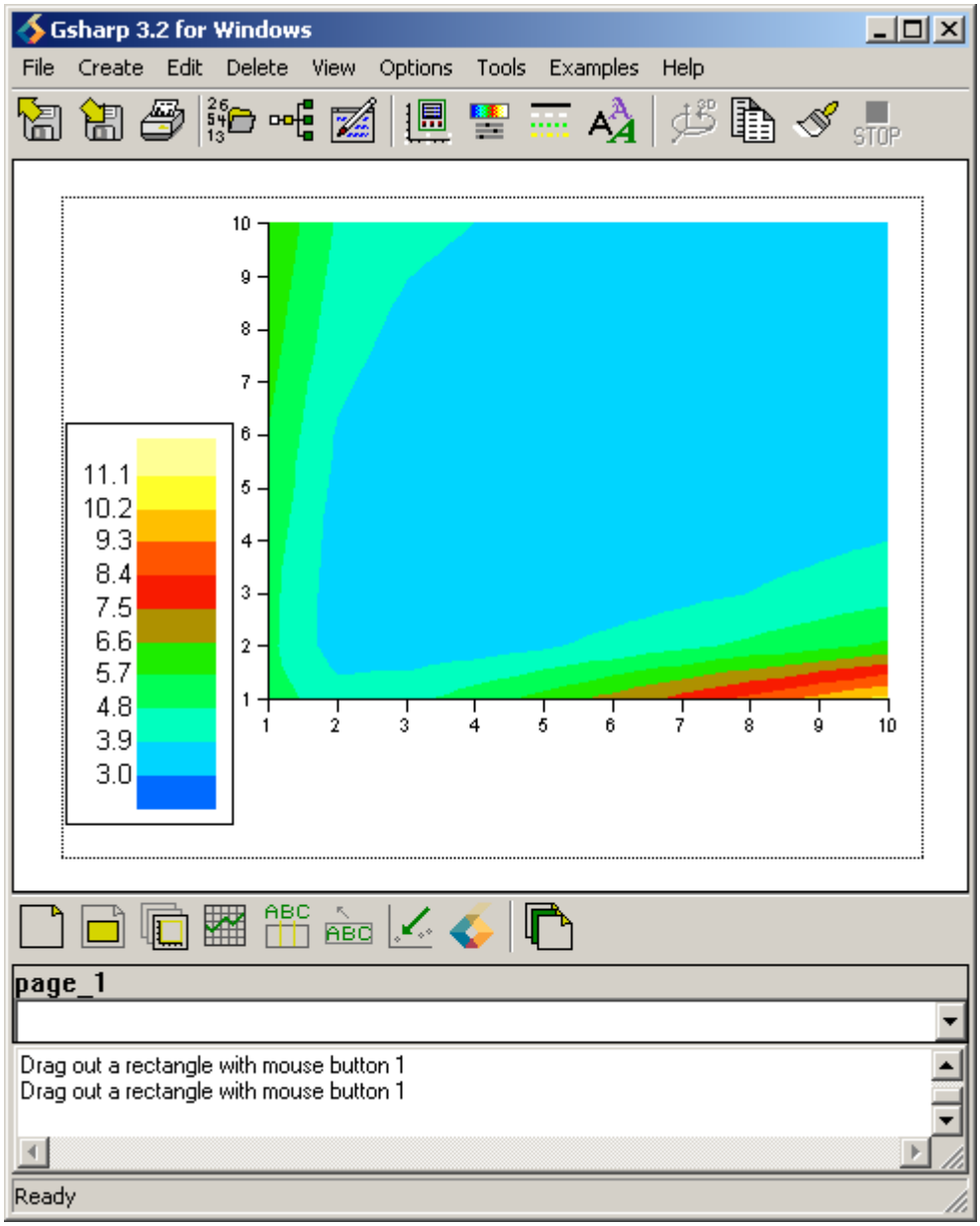


Figure III-18: Result of 2D Contour for z=4

This graph (Figure III-18) is the plane of z=4.

3.1.5 2D Contour for z=5

- Select *Graph…* from the Edit drop-down menu (Section 3.1.2, Figure III-15).
- In *Data* of Graph Editor set *Color Grid* to be Block[,,5] (Section 3.1.1, Figure III-4).
- Select *OK* and the result will be (Figure III-19).

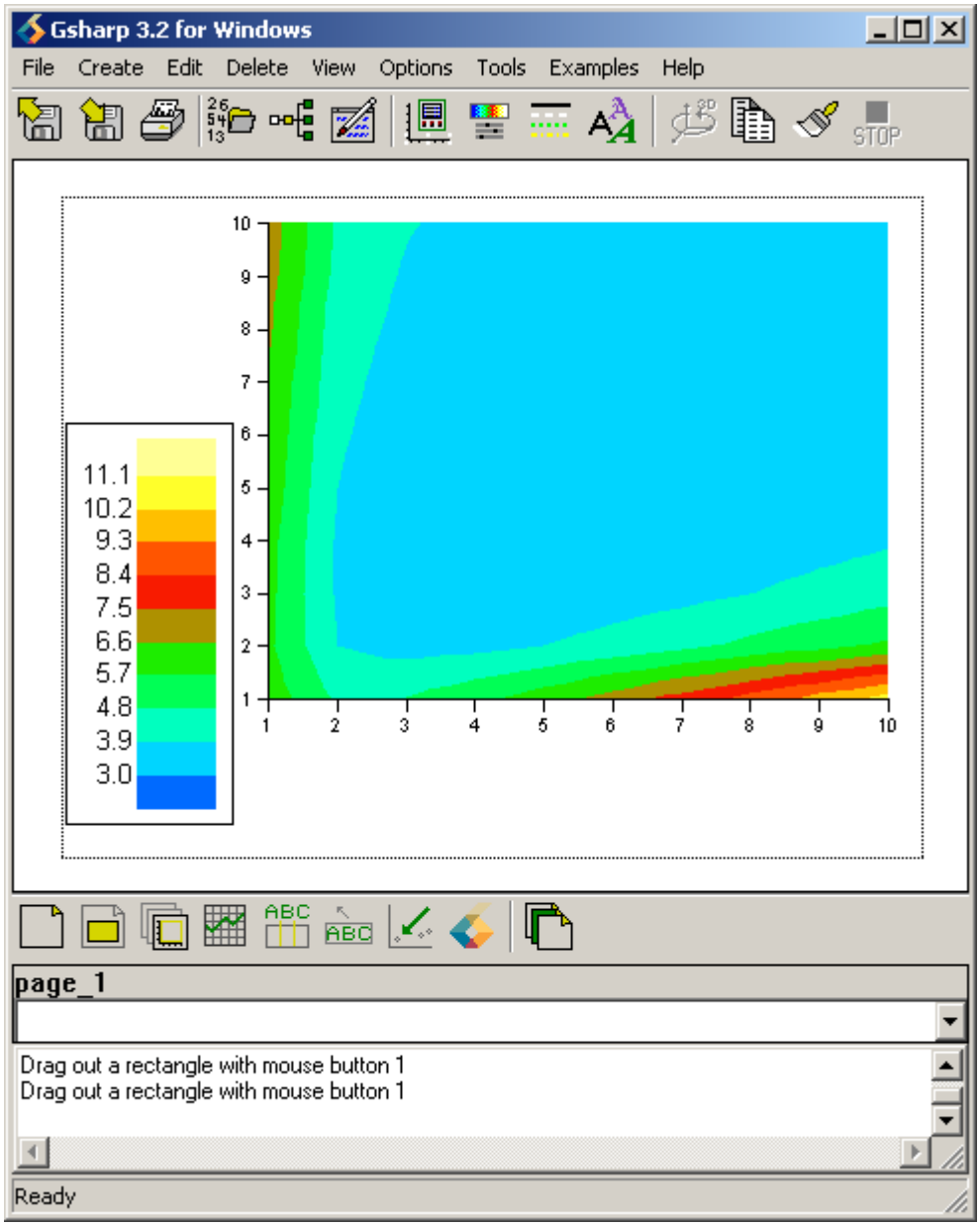


Figure III-19: Result of 2D Contour for z=5

This graph (Figure III-19) is the plane of z=5.

3.1.6 2D Contour for z=6

- Select *Graph…* from the Edit drop-down menu (Section 3.1.2, Figure III-15).
- In *Data* of Graph Editor set *Color Grid* to be Block[,,6] (Section 3.1.1, Figure III-4).
- Select *OK* and the result will be (Figure III-20).

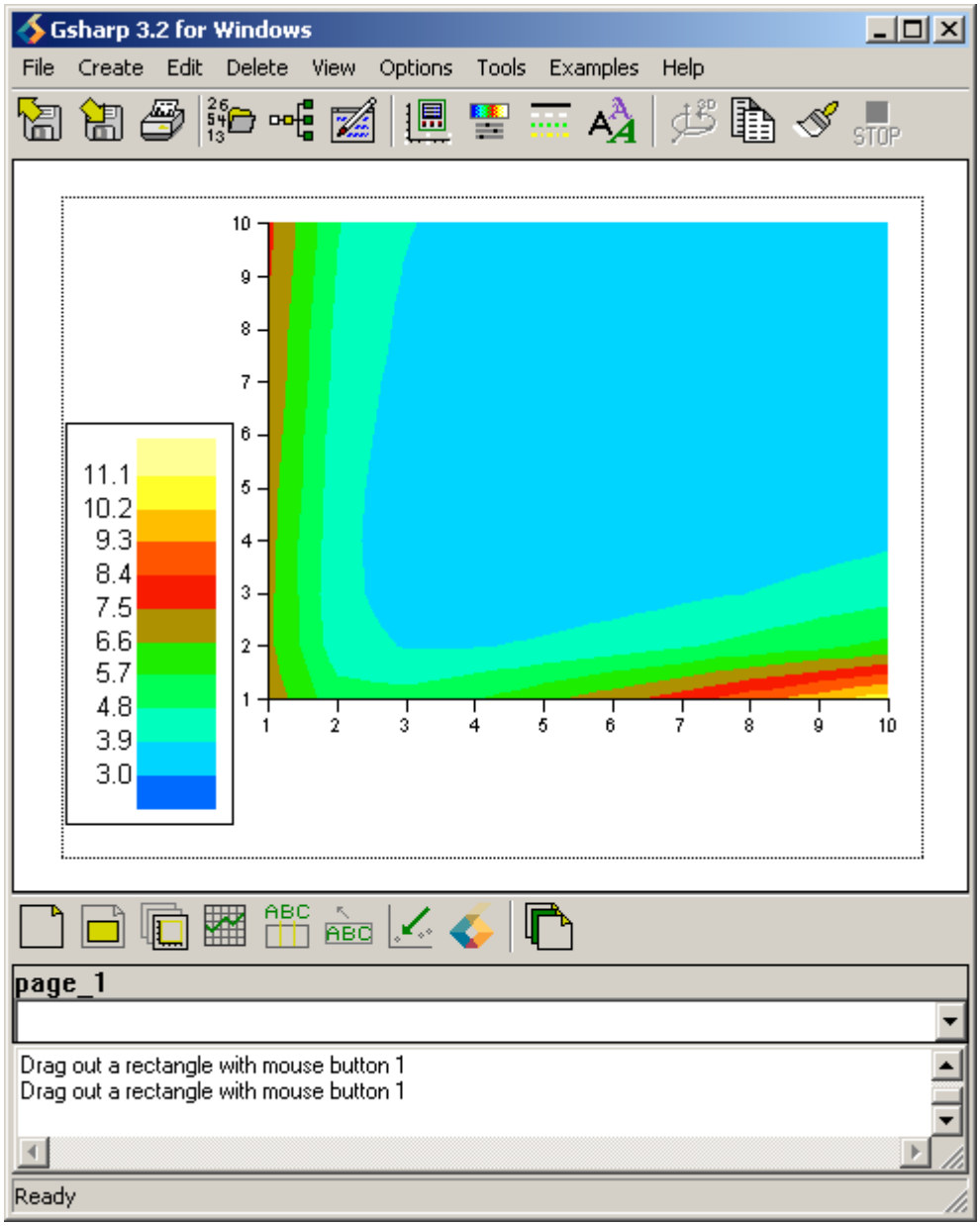


Figure III-20: Result of 2D Contour for z=6

This graph (Figure III-20) is the plane of z=6.

3.1.7 2D Contour for z=7

- Select *Graph…* from the Edit drop-down menu (Section 3.1.2, Figure III-15).
- In *Data* of Graph Editor set *Color Grid* to be Block[,,7] (Section 3.1.1, Figure III-4).
- Select *OK* and the result will be (Figure III-21).

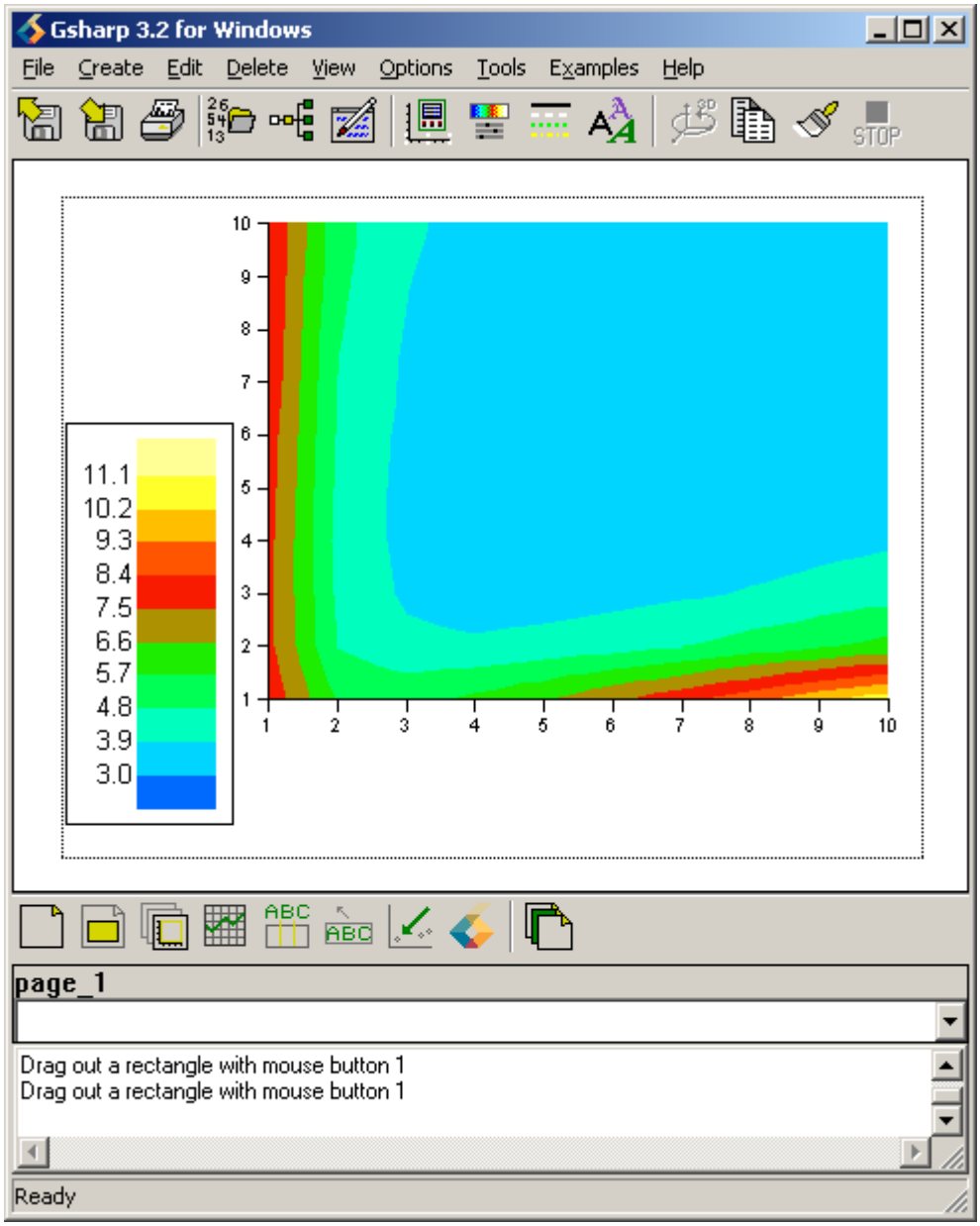


Figure III-21: Result of 2D Contour for z=7

This graph (Figure III-21) is the plane of z=7.

3.1.8 2D Contour for z=8

- Select *Graph…* from the Edit drop-down menu (Section 3.1.2, Figure III-15).
- In *Data* of Graph Editor set *Color Grid* to be Block[,,8] (Section 3.1.1, Figure III-4).
- Select *OK* and the result will be (Figure III-22).

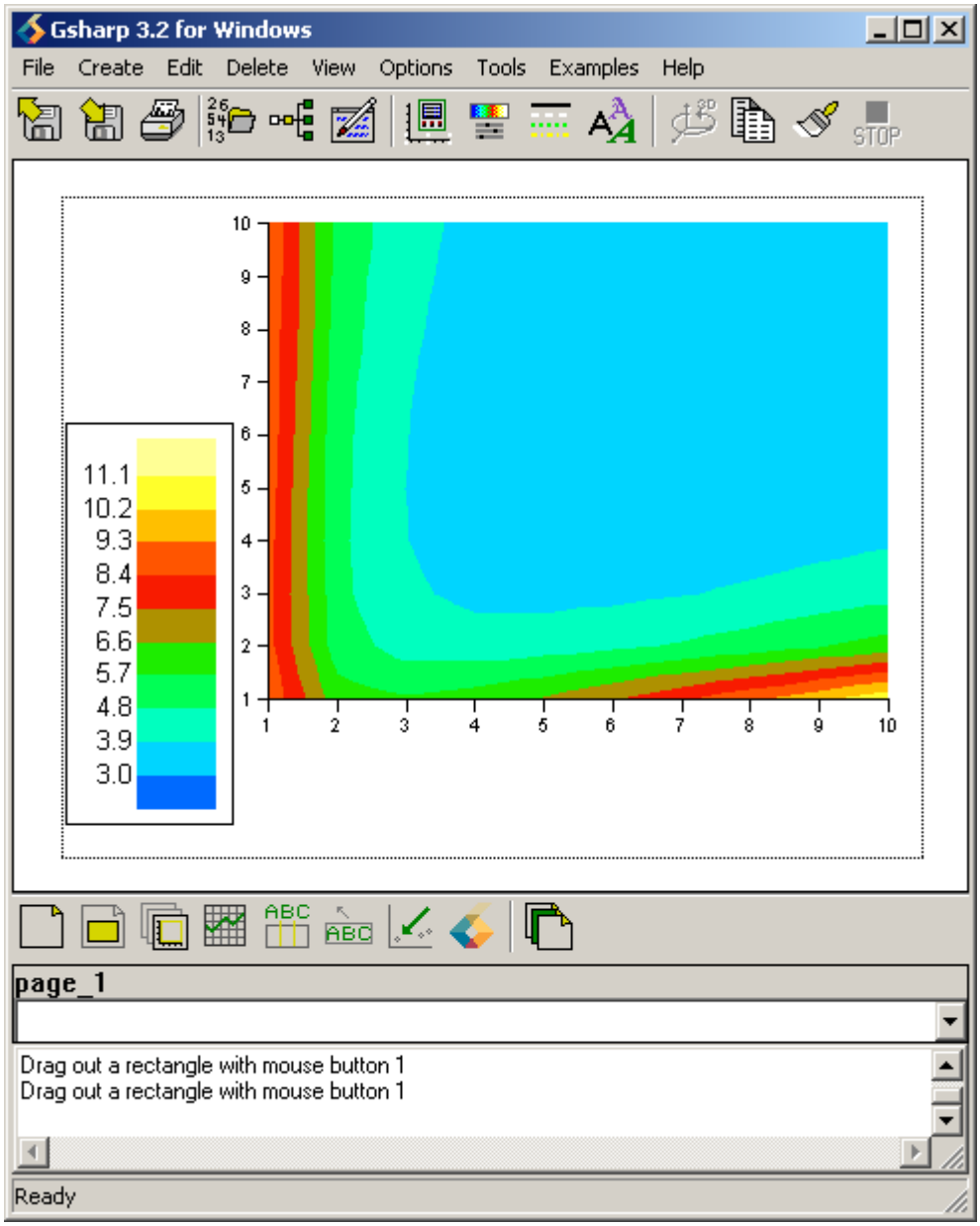


Figure III-22: Result of 2D Contour for z=8

This graph (Figure III-22) is the plane of z=8.

3.1.9 2D Contour for z=9

- Select *Graph…* from the Edit drop-down menu (Section 3.1.2, Figure III-15).
- In Data of Graph Editor set *Color Grid* to be Block[,,9] (Section 3.1.1, Figure III-4).
- Select *OK* and the result will be (Figure III-23).

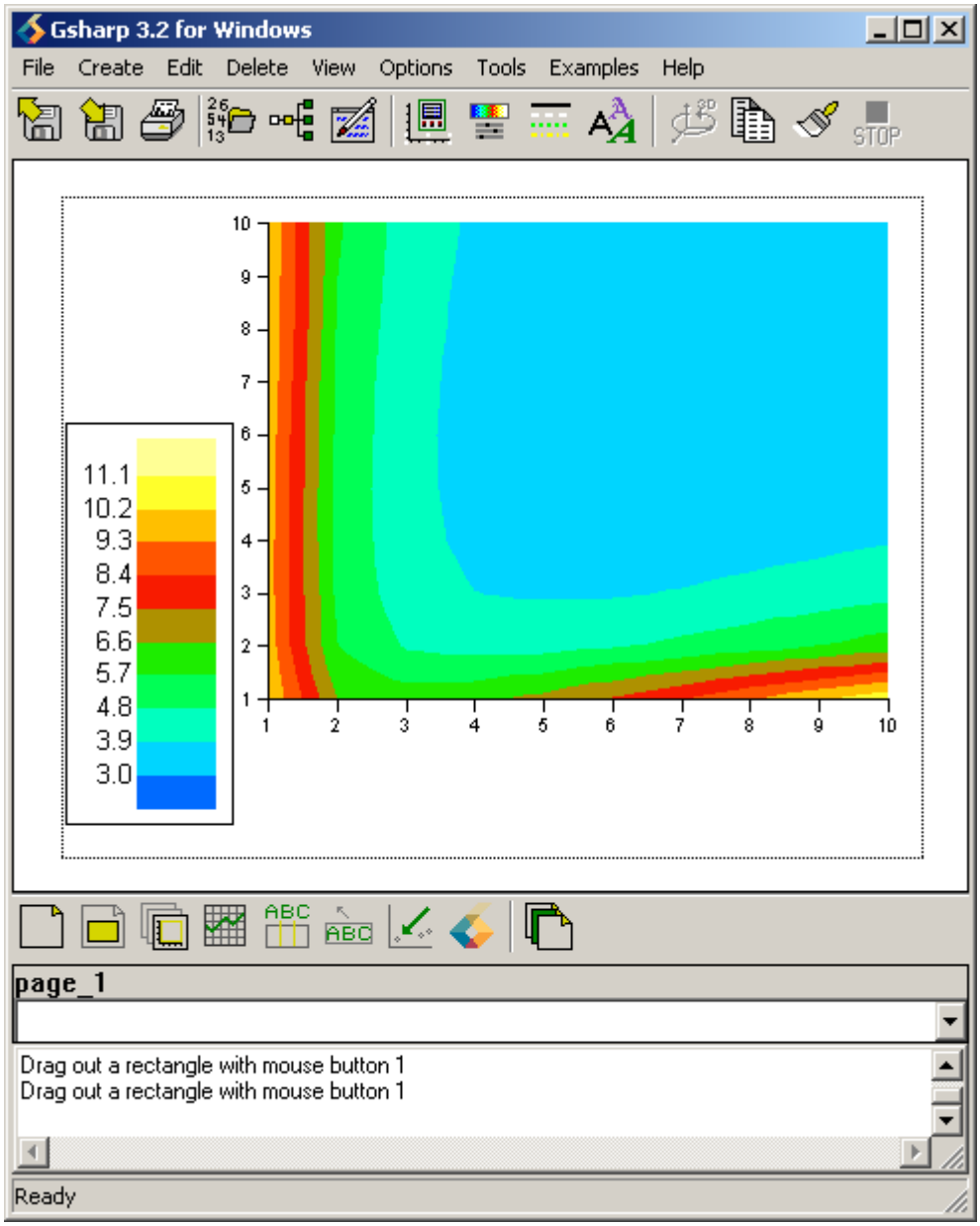


Figure III-23: Result of 2D Contour for z=9

This graph (Figure III-23) is the plane of z=9.

3.1.10 2D Contour for z=10

- Select *Graph…* from the Edit drop-down menu Section (3.1.2, Figure III-15).
- In Data of Graph Editor set *Color Grid* to be Block[,,10] (Section 3.1.1, Figure III-4).
- Select *OK* and the result will be (Figure III-24).

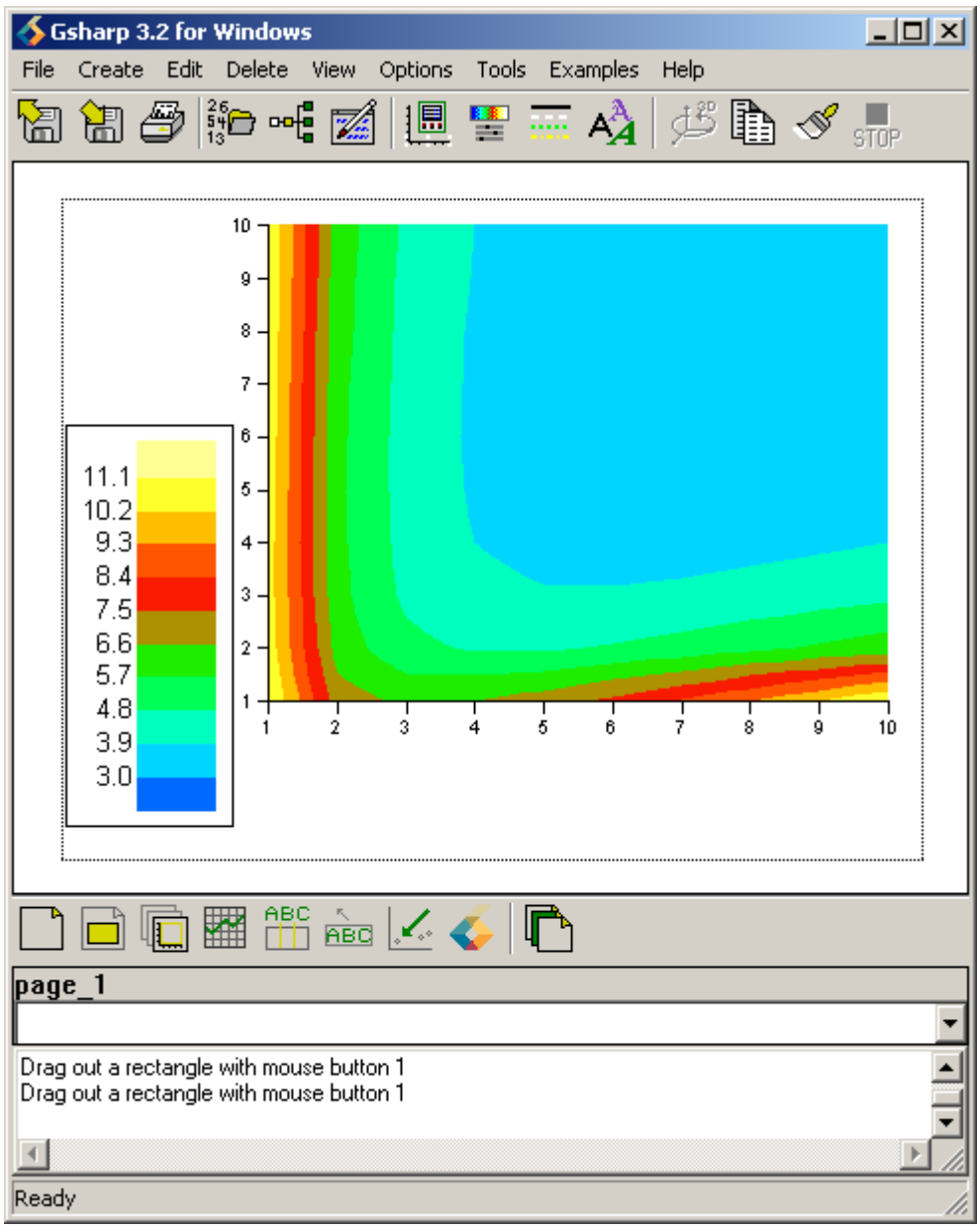


Figure III-24: Result of 2D Contour for z=10

This graph (Figure III-24) is the plane of z=10.

The conclusion from those 10 graphs is that they give a very good visualization as each plane shows the different temperatures in the room. The blue colour represents the coldest temperature in the room and the yellow colour the hottest temperature in the room.

3.1.11 2D Contour in 3D Style

A graph will be drawn to show the previous 2D graphs in a 3D style, i.e. the 10 planes combined into a 3D graph.

1. Select *Open…* from the *File* drop-down menu. Import block.dat (Section 3.1, Figure III-1).
2. Type *BlockX=unique(x)*; in command line[28] (Figure III-3)[29] and press enter so that the command will be processed.
3. Type *BlockY=unique(y)*; in command line (Figure III-3)[30] and press enter.
4. Type *BlockZ=unique(z)*; in command line (Figure III-3)[31] and press enter.
5. Type *Block=reshape(t,size(BlockX),size(BlockY),size(BlockZ))*; in command line (Figure III-3) and press enter[32].
6. Type *Classes=range(t,10)* and press enter (Figure III-3)[33].
7. Select *Viewport…* from the *Create* drop-down menu (Section 2.1.1).

[28] Refer to Appendix A, Figure A-1, for descriptions of what the command line is.
[29] This command is entered in order to get the unique values (not the repeated) of x.
[30] This command is entered in order to get the unique values (not the repeated) of y.
[31] This command is entered in order to get the unique values (not the repeated) of z.
[32] The *reshape* command is entered in order to get a new block of 10 (BlockX) by 10 (BlockY) by 10 (BlockZ) with range t.
[33] The *range* command arranges the colours according to the t value.

8. Select *Domain…* from the *Create* drop-down menu (Figure III-25).

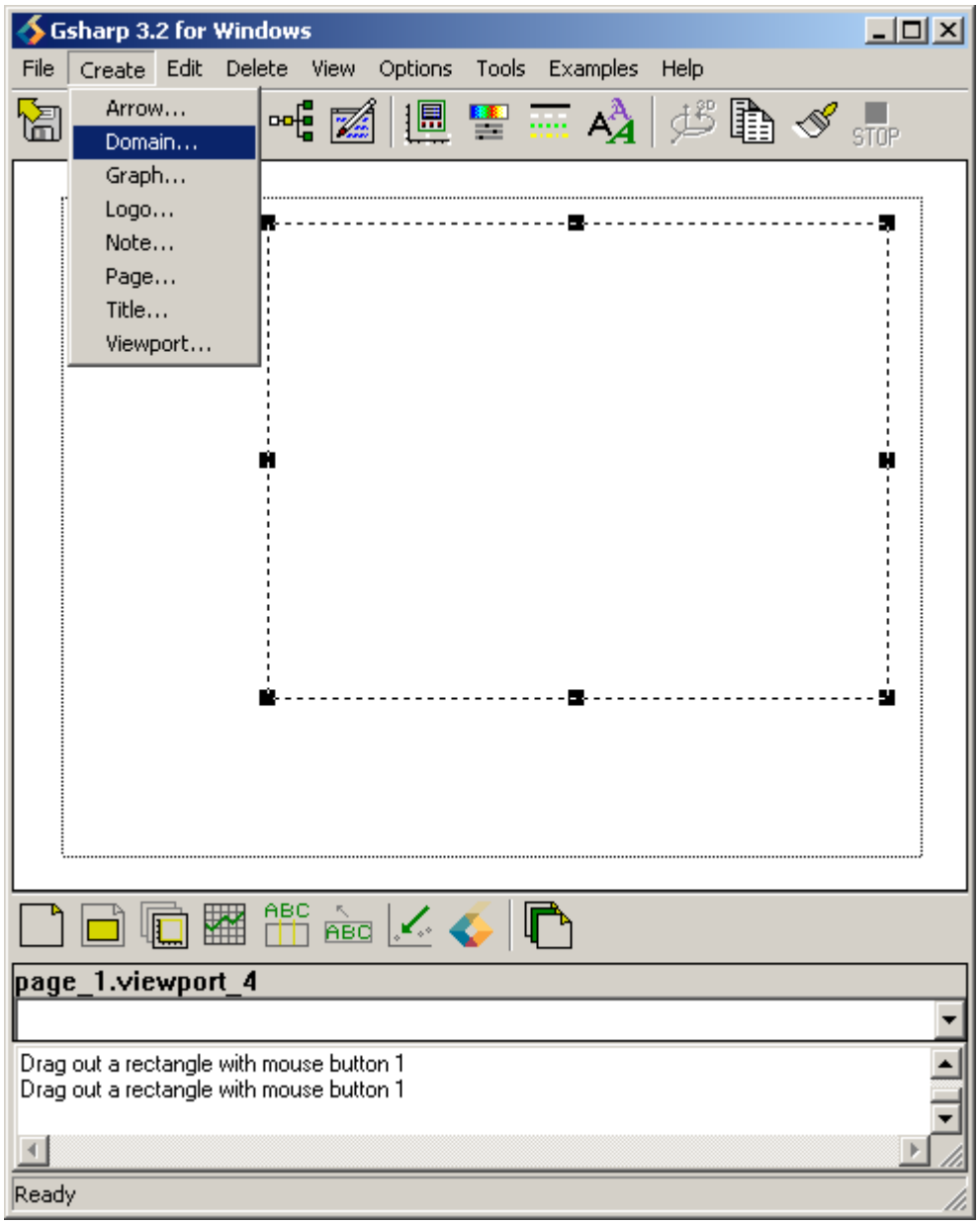


Figure III-25: Creating Domain

9. Select *OK* and the result will be (Figure III-26).

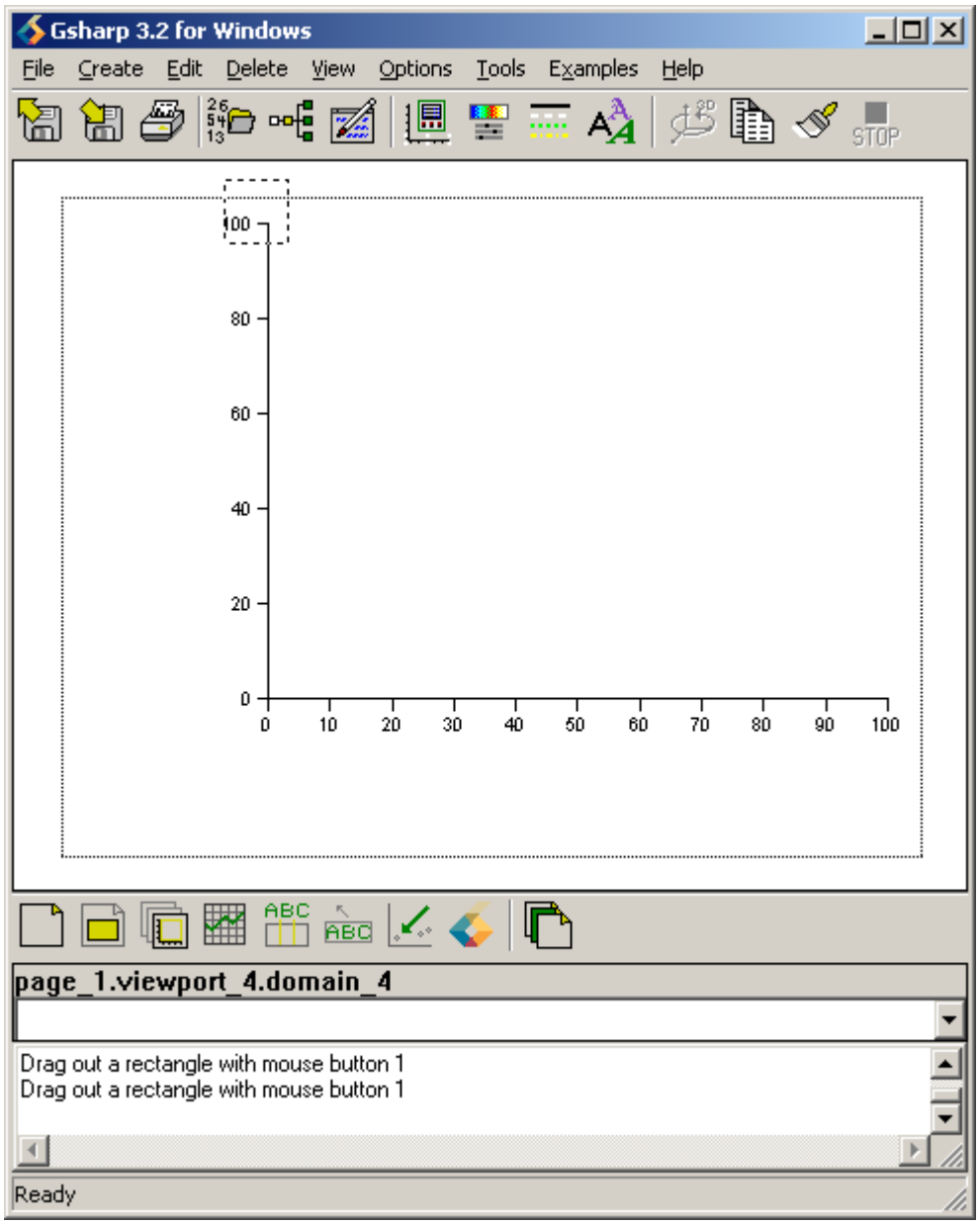


Figure III-26: Result of Creating Domain

10. Select *Domain…* from the *Edit* drop-down menu (Section 3.1.1, Figure III-6).

11. In the Domain Editor select *X Limits* and set *X Minimum* to 1 and *X Maximum* to 10 (Figure III-27)[34].

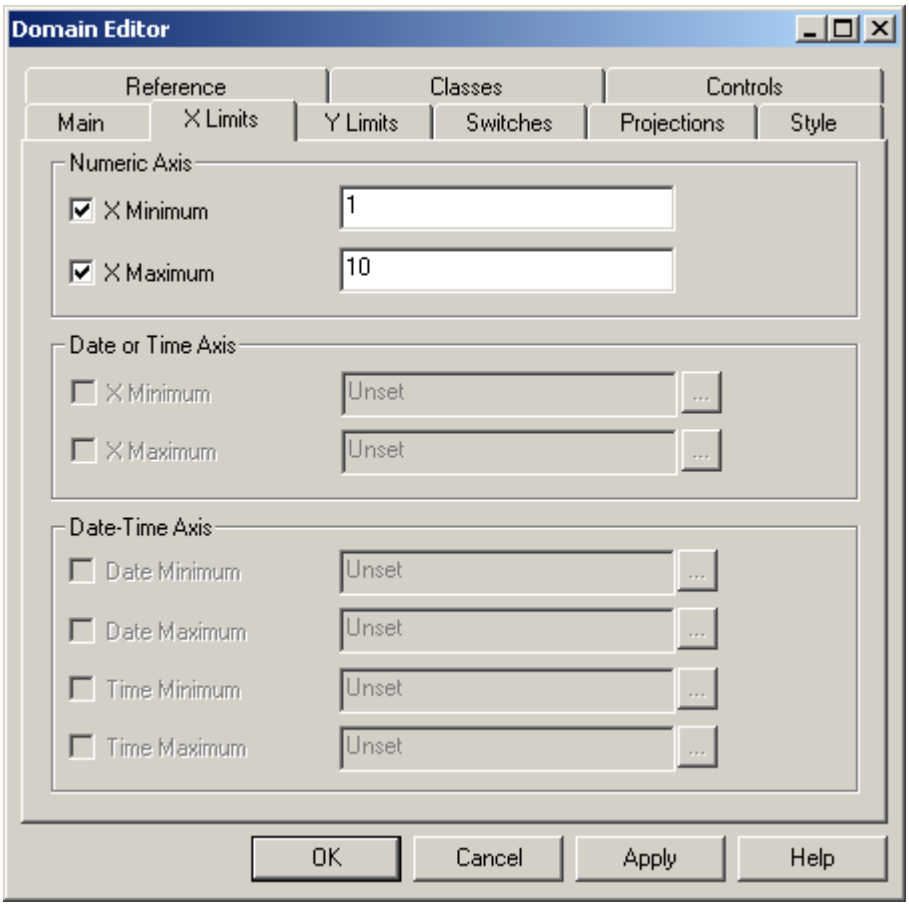


Figure III-27: Editing X Limits

12. Select *Y Limits* (Figure III-28).

[34] To give the correct limits to the x-axis.

13. Set *Y Minimum* to 1 and *Y Maximum* to 10 (Figure III-28).

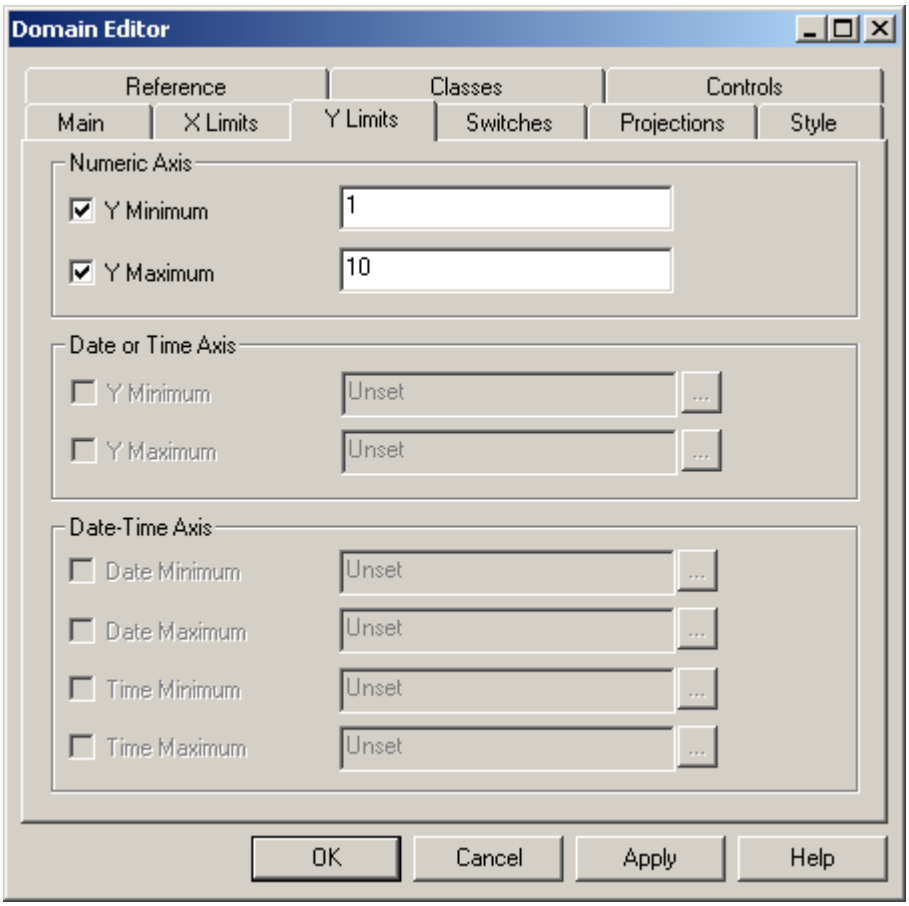


Figure III-28: Editing Y Limits

14. Select *Projections* (Figure III-29).

15. Set *3D Plane* to On[35], *Location* to Inside and *Level* to 0 (Figure III-29)[36].

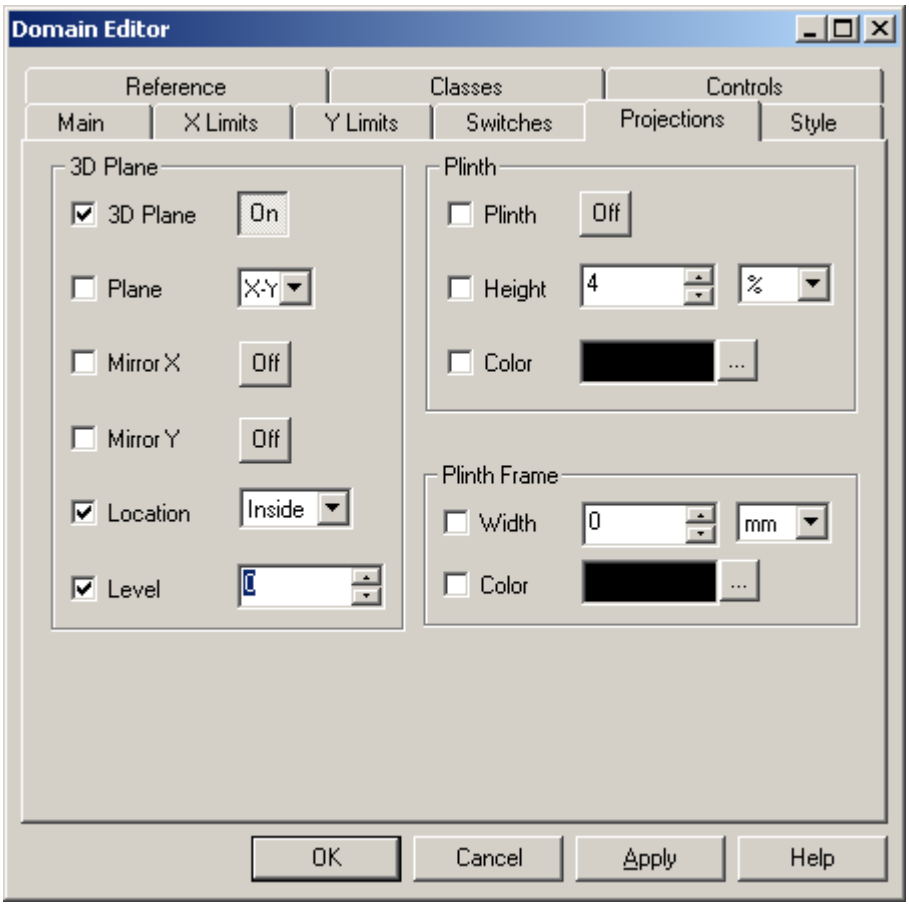


Figure III-29: Editing Projections

16. Select *Style* (Figure III-30).

[35] This will draw the domain in a 3D way.
[36] This will set the location of the domain inside the viewport.

17. Set *X Data Type* to Continuous[37] (Figure III-30).

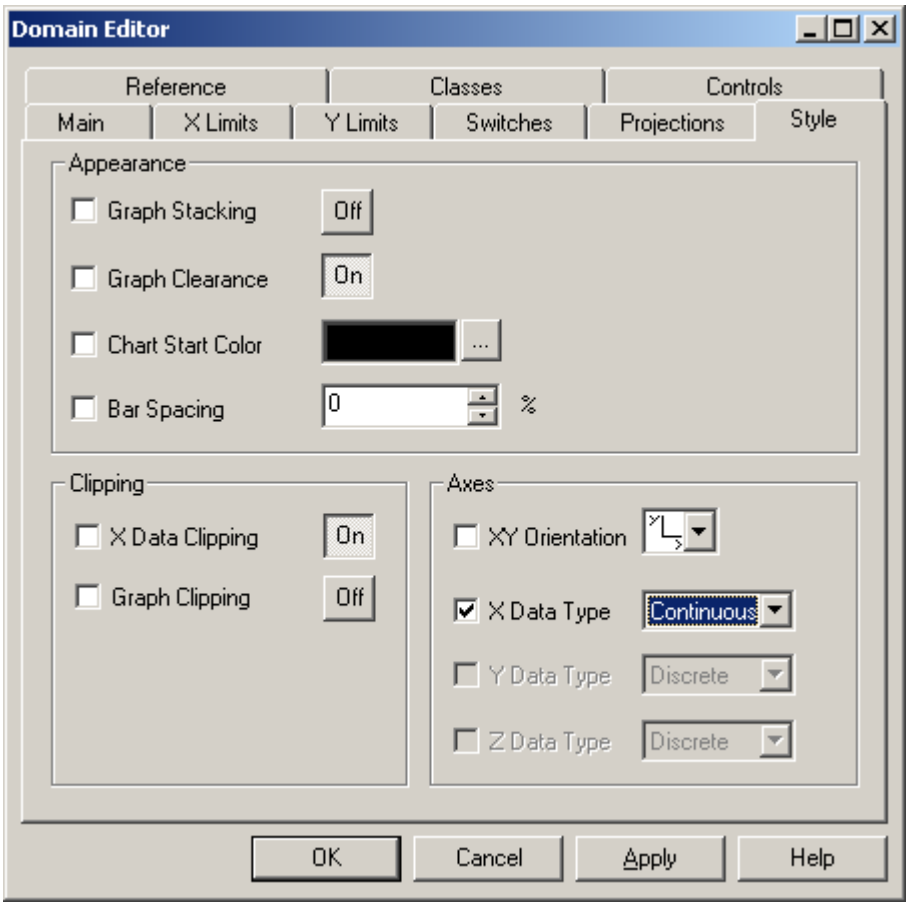


Figure III-30: Editing Style

18. Select *Classes* and set *Num Values* to 10 (Section 3.1.1, Figure III-7).
19. Select *ClassEditor…* and the Class Editor appear. Here set *Mode* to Min/Max,[38] the *Type* to Limits,[39] *Minimum* to 3 and *Maximum* to 11.1 (Section 3.1.1, Figure III-8).
20. Select *OK* and then set *Classes Dataset* to Classes (Section 3.1.1, Figure III-9).

[37] This will make sure that the values will be correctly set to the axis.

[38] To set minimum and maximum values to the colours.

[39] There are two options here, percentiles and limits. Limits are to be set because the temperature is between 3 and 11.1 values. Other values are not needed.

21. Select *OK* and the result will be (Figure III-31).

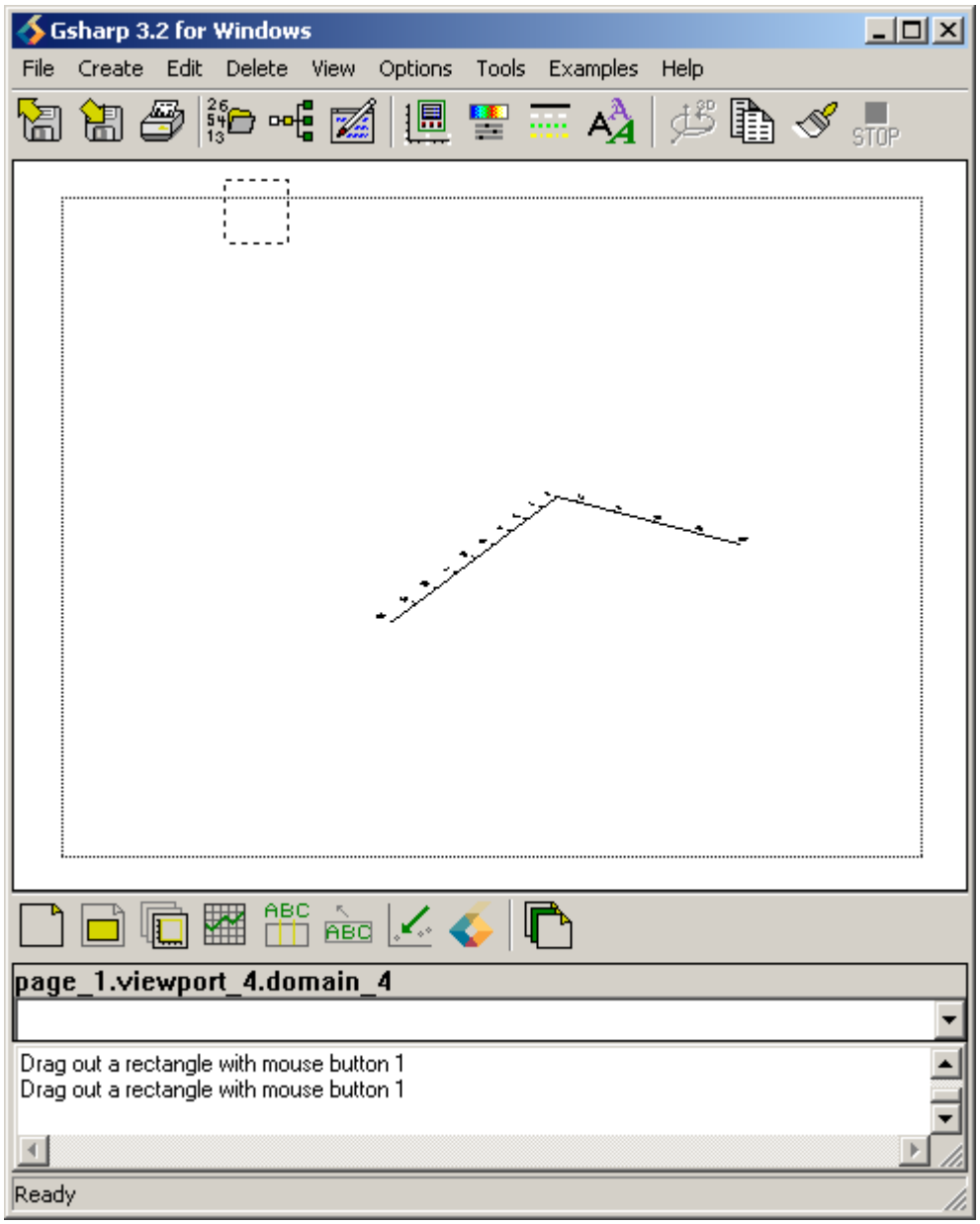


Figure III-31: Result of 1st Domain

22. Select *Viewport…* from the *Edit* drop-down menu (Figure III-32).

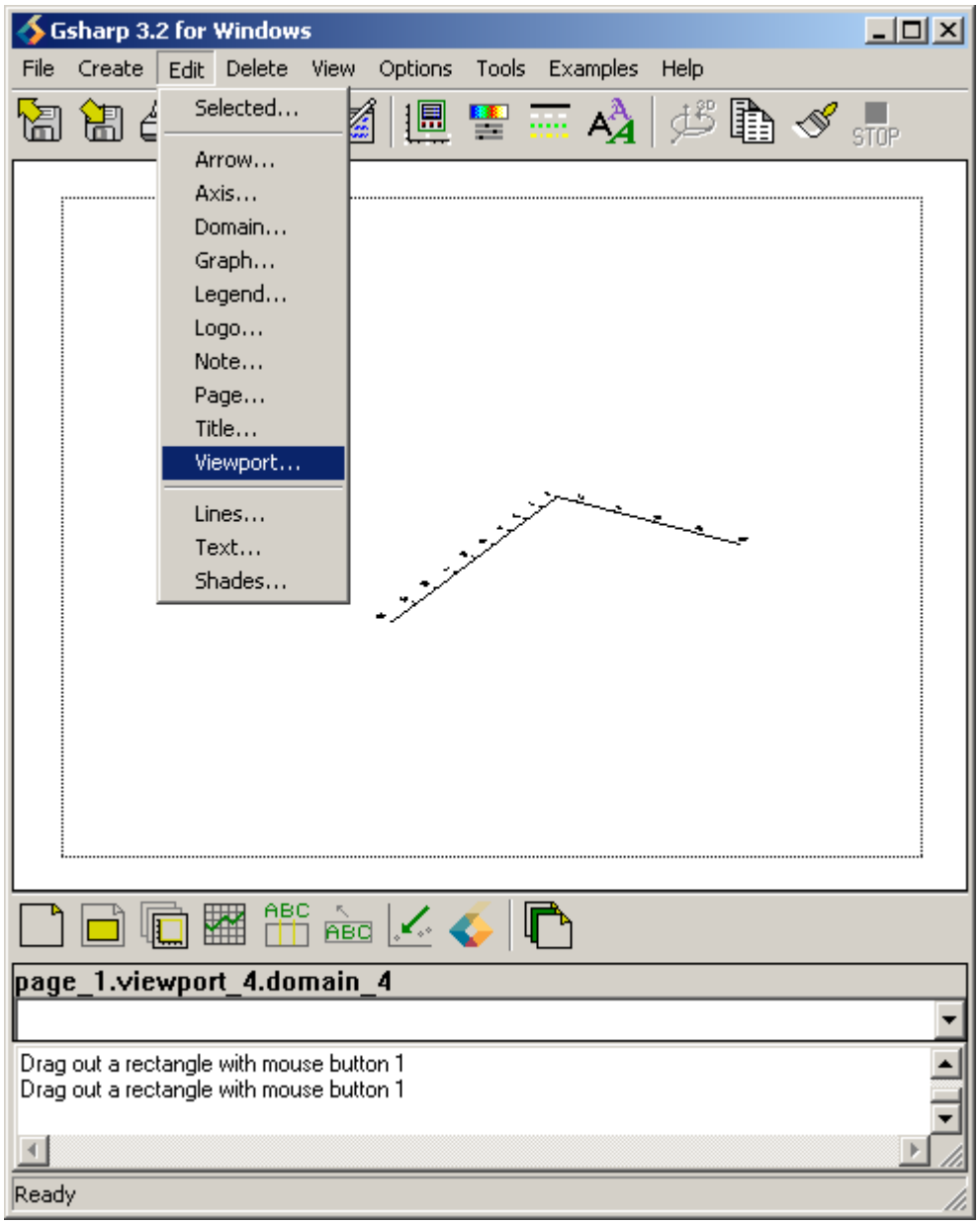


Figure III-32: Editing Viewport

23. In Viewport Editor select *3D Workbox*. Set *Angle in XY Plane* to 245, *Elevation Plane* to 10.292 and *Distance Factor* to 10 (Figure III-33)[40].

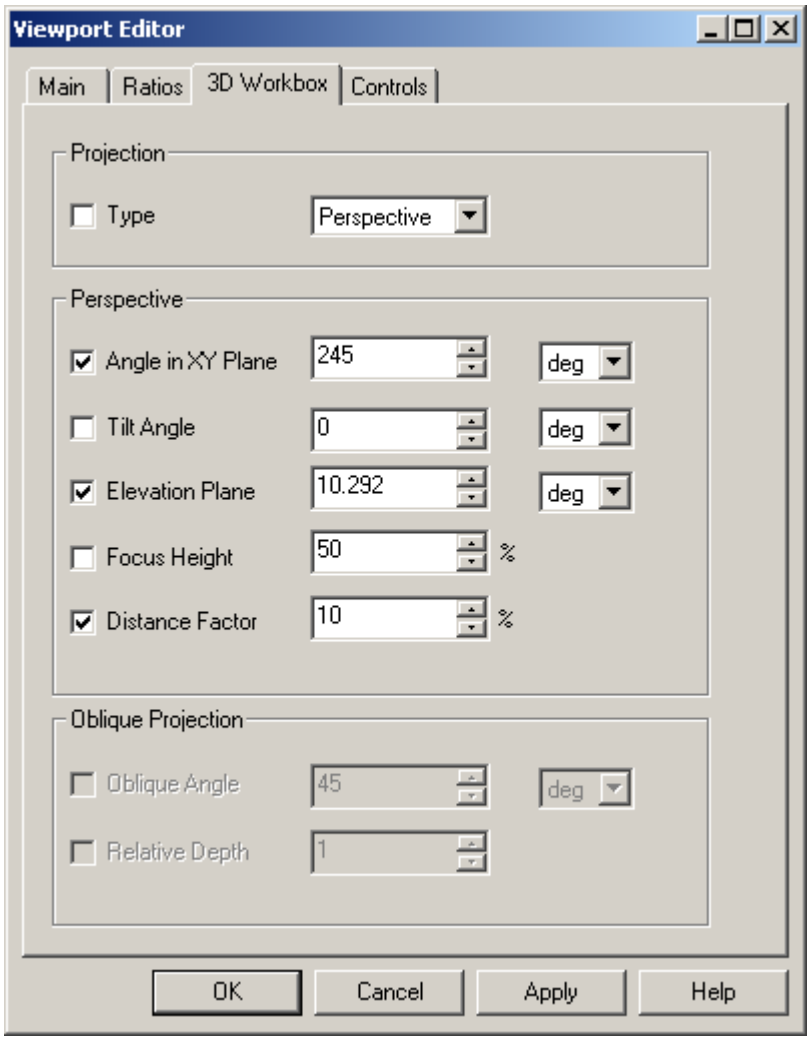


Figure III-33: Editing Values in 3D Workbox

24. Select *OK*.

[40] All these values are selected to give a better view to the graph.

25. Select *Graph…* from the *Create* drop-down menu (Section 2.1.2).
26. Select *2D Contour* for *Graph Type* (Section 2.1.2).
27. In *Data* set BlockX for *X*, BlockY for *Y* and Block[,,1] for *Color Grid* (Section 3.1.1, Figure III-4).
28. Select *OK* and the result will be (Figure III-34).

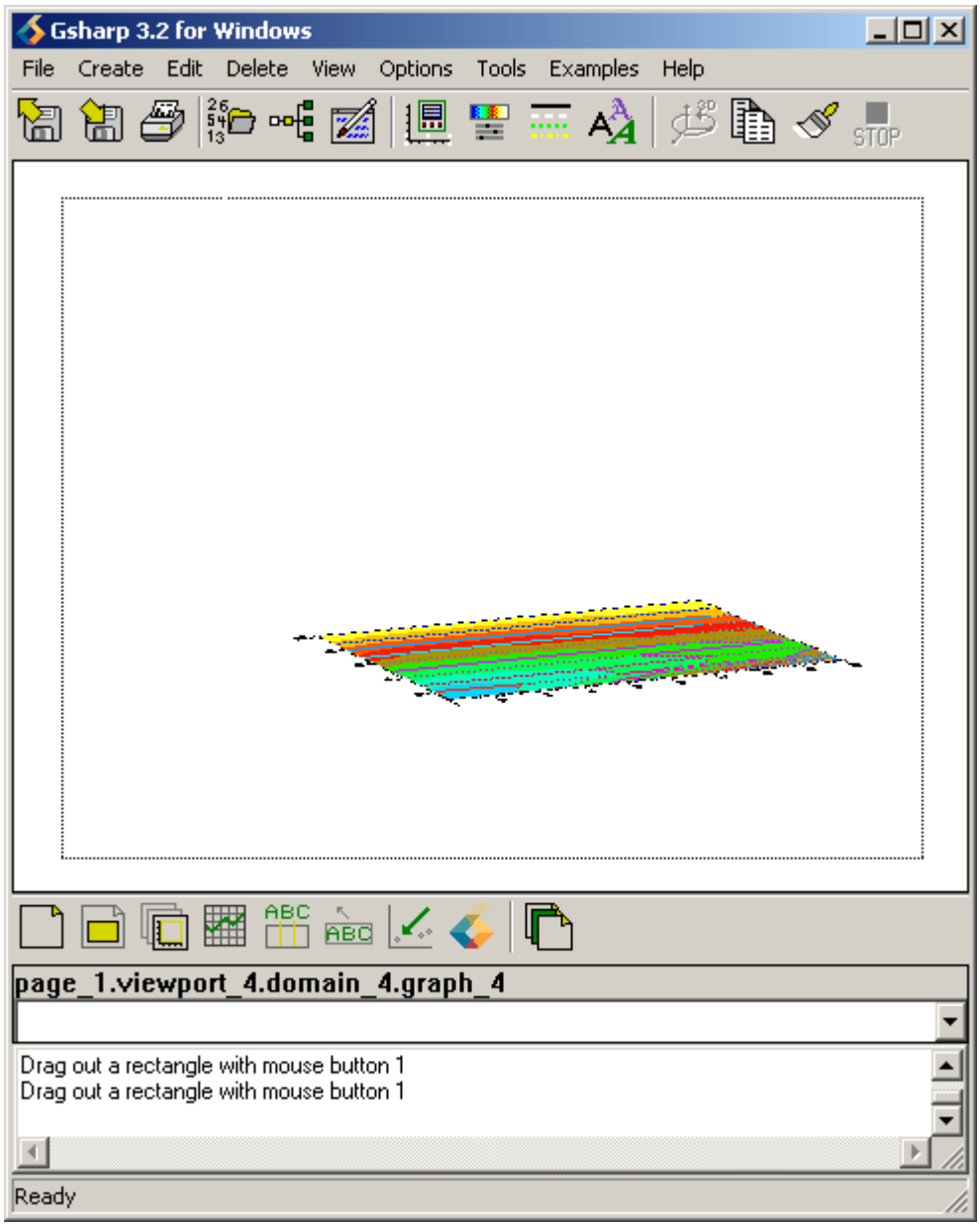


Figure III-34: Result of 1st Block

- To produce the remaining graphs in a 3D style, repeat steps 8[41] – 21 followed by steps 25 - 28 for each graph, i.e. the second graph for the 2nd Block, the third graph for the 3rd Block, …, the tenth graph for the 10th Block. Use the following settings while creating those graphs:
  - In *Projections* of Domain Editor, set *Level* for the 2nd Block to 0.1111111, for the 3rd Block to 0.2222222, for the 4th Block to 0.3333333 and so on.
  - In *Data* of Graph Editor, set *Color Grid* for the 2nd Block to Block[,,2], for the 3rd Block to Block[,,3], for the 4th Block to Block[,,4] and so on.
- The final result will be Figure III-35.

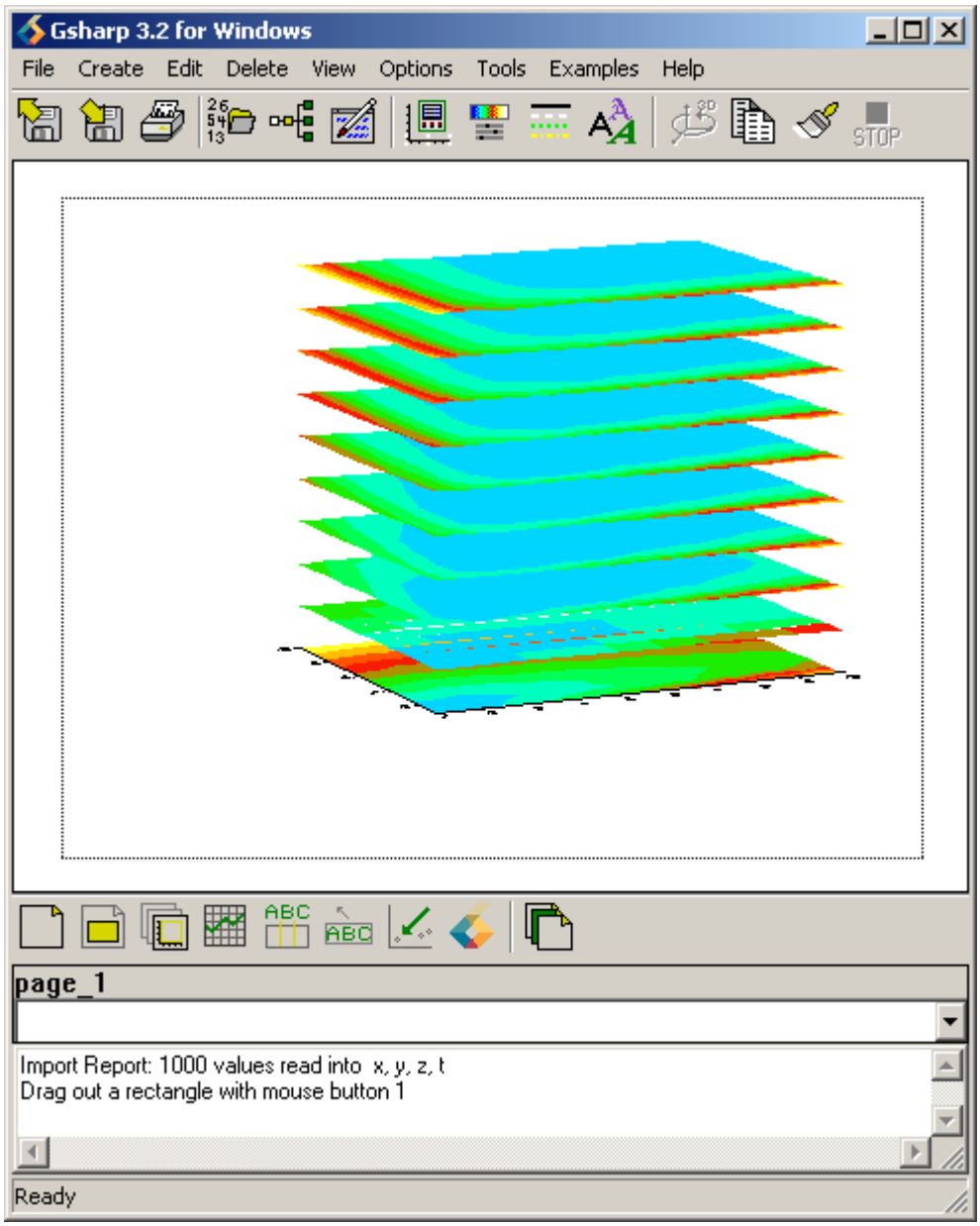


Figure III-35: Result When Visualizing the Dataset in 3D way

[41] The viewport must be selected before repeating step 8.

- Select *Legend…* from the Edit drop-down menu (Figure III-11).
- In the Legend Editor select *Text* and set *Entry Height* to be 7 (Figure III-12).
- Select *Controls* and set *Enabled* to On (Figure III-13).
- Select *OK* and the result will be (Figure III-36).

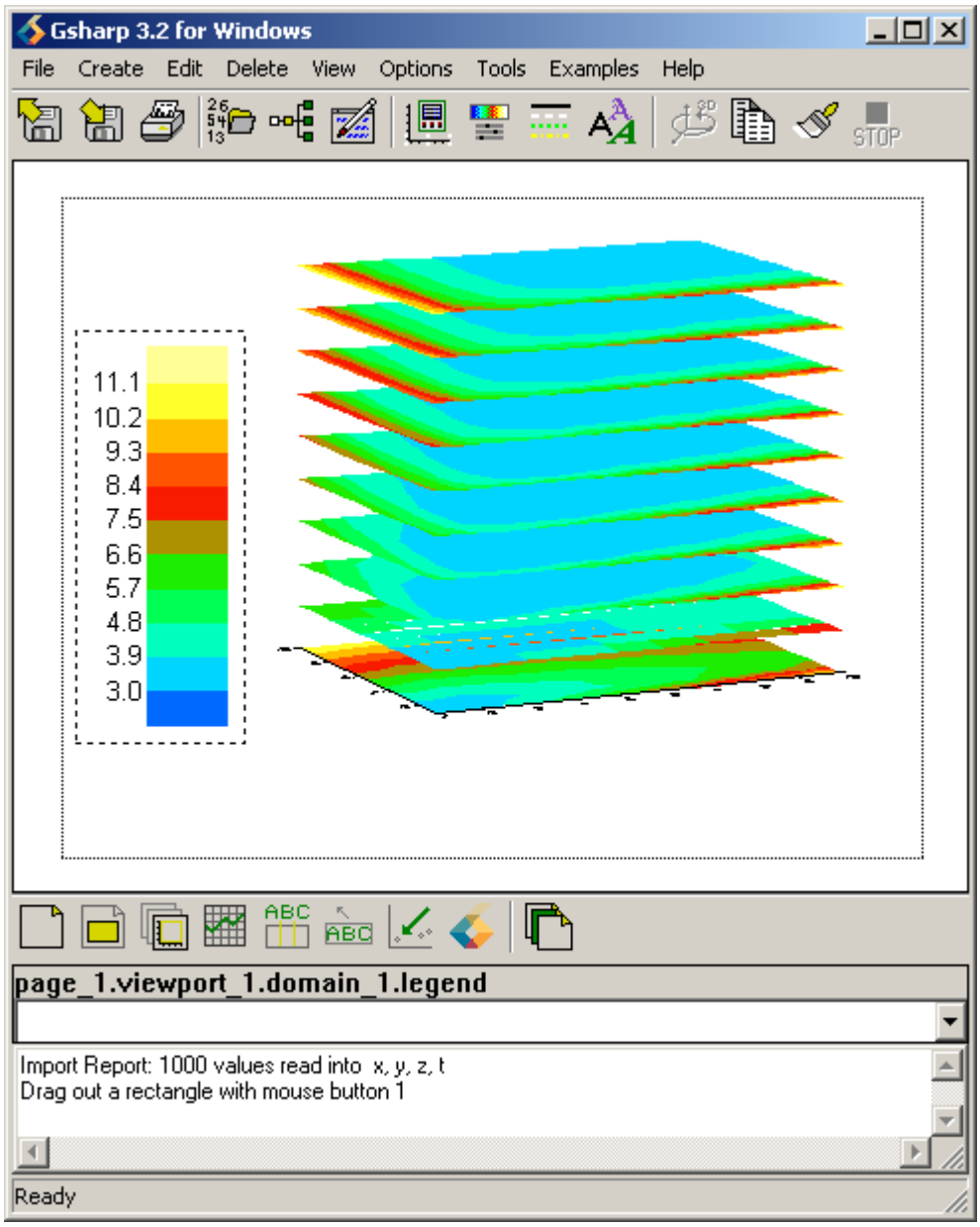


Figure III-36: Result of 3D Block With Legend

Figure III-36 shows the temperature of the room. Each plane represents the room height (z). The Figure illustrates a method for visualizing 2D graphs in a 3D style. The Legend shows the temperature for each graph, where the blue colour represents the coldest temperature and the light yellow the hottest temperature.

4 Visualizing Behaviour of a Superconductor

This chapter describes the visualization of the behaviour of a superconductor. The visualization shows the critical current, the angle and the temperature.

The task is to visualize the behaviour of the superconductor in each point of critical current (Jc), against each angle (phi, theta).

The values given are T(Kelvin), B(Tesla), Theta, Phi, Jc(A/m2), dv/di criterion, Smoothed Jc, Actual Theta and actual phi (the values needed for the task are Theta, Phi, and Jc(A/m2)) from 10 files[42] which are:

- 02-07-33,Sep-07.txt contains the following variables:
  1. T1 represents T(Kelvin) that is the temperature values.
  2. T2 represents B(Tesla) that is magnetic field values.
  3. Theta that is angle values.
  4. phi that is angle values.
  5. T3 represents Jc(A/m2) that is the maximum current values.
  6. T4 represents dv/di criterion.
  7. T5 represents Smoothed Jc.
  8. T6 represents Actual Theta.
  9. T7 represents actual phi.
- 01-23-29,Sep-07.txt

02-07-33,Sep-07.txt is imported first. The variables, in the files that follow, will not have the same name of the file in Gsharp. The same will happen with the names of this file against the next file and so on.

1. T8 represents T(Kelvin).
2. T9 represents B(Tesla) that is magnetic field values.
3. T10 represents Theta that is angle values.
4. T11 represents phi that is angle values
5. T12 represents Jc(A/m2) that is the maximum current values.
6. T13 represents dv/di criterion.
7. T14 represents Smoothed Jc.
8. T15 represents Actual Theta.
9. T16 represents actual phi.

[42] Courtesy of John Durrell, University of Cambridge. Refer to Appendix C, Figures C-1 and C-2 for description of the file.

- 00-39-33,Sep-07.txt
- 20-00-22,Sep-06.txt
- 20-45-45,Sep-06.txt
- 21-33-38,Sep-06.txt
- 22-19-18,Sep-06.txt
- 23-06-59,Sep-06.txt
- 23-54-13,Sep-06.txt
- phi-90.txt

4.1 Choosing the Best Graph

The data will be visualized in 2D. A scatter graph will best show the pattern of the visualization.

Each of the 10 data files will be imported individually.

- Define a viewport (Section 2.1.1).

4.1.1 Scatter Graph for 02-07-33,Sep-07.txt

- Select *Open…* from the *File* drop-down menu to import a file (Figure IV-1).

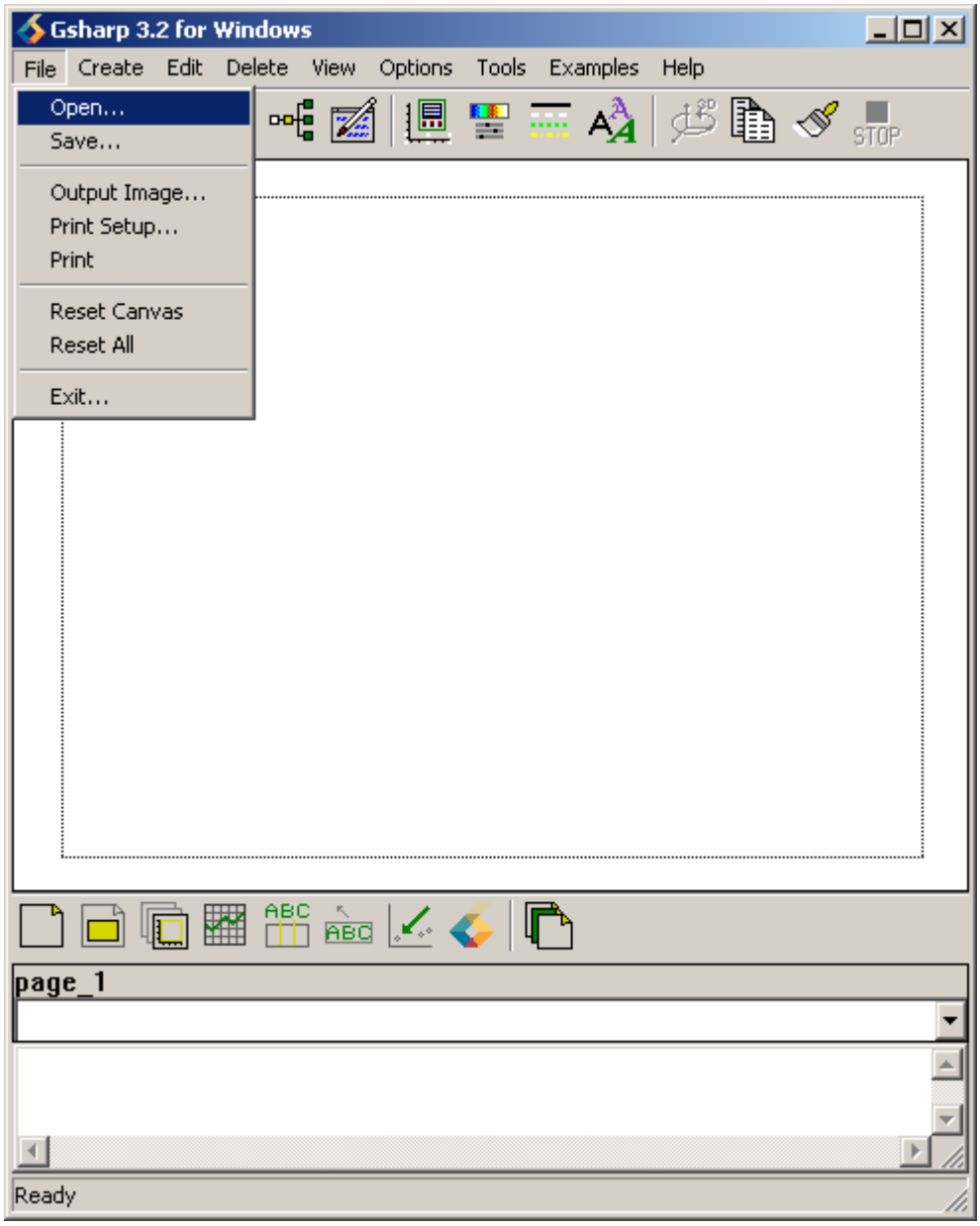


Figure IV-1: Importing Files

- Select *Graph…* from the *Create* drop-down menu (Section 2.1.2, Figure II-3).

- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be Theta, *Y* to be T3 (Figure IV-2).

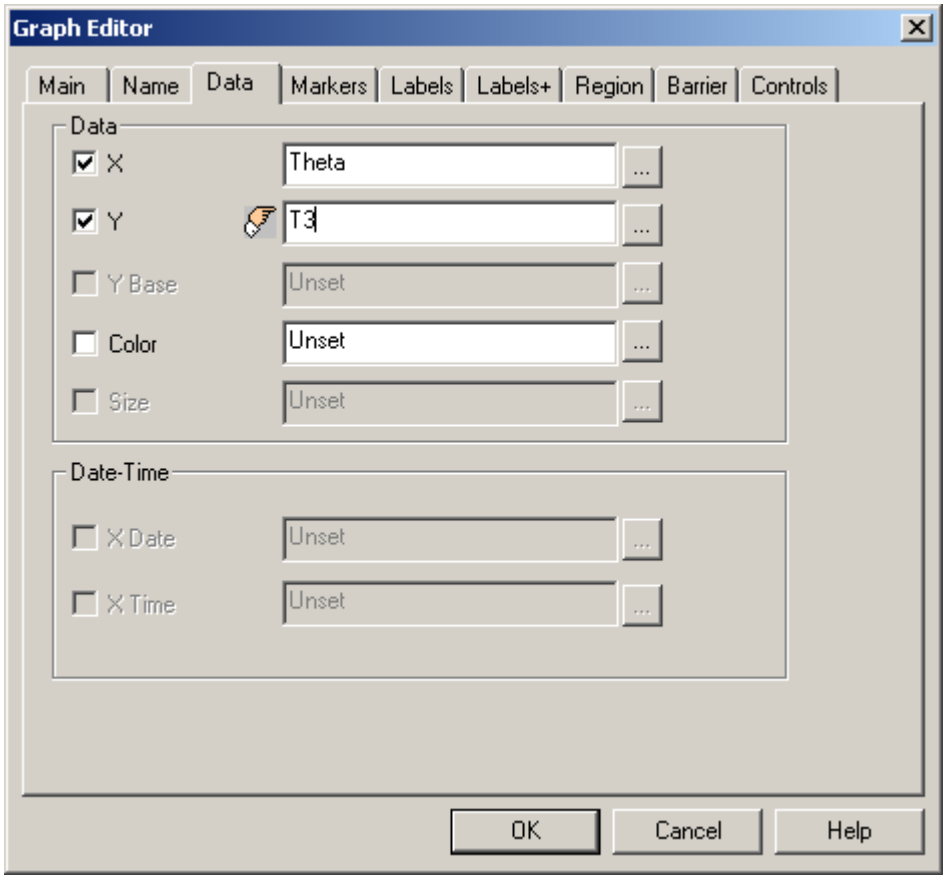


Figure IV-2: Setting Data Values for Scatter

- Select *Markers* and set *Symbol* to ○ and *Color* to Blue (Figure IV-3).

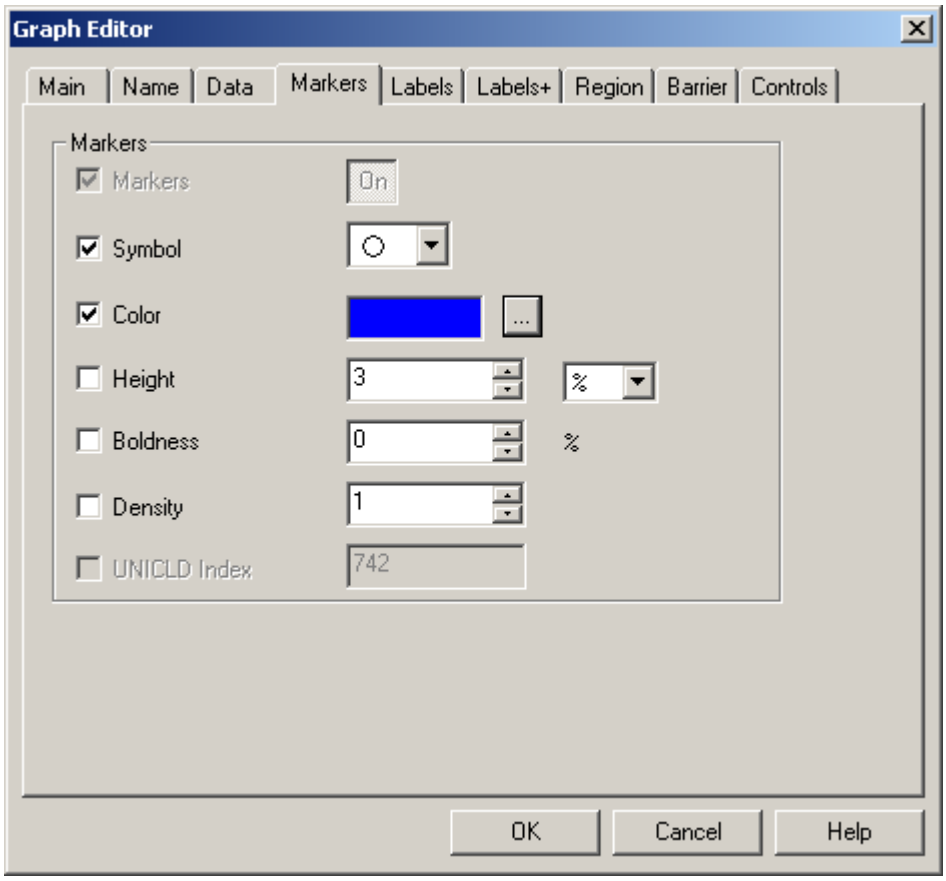


Figure IV-3: Setting Markers

- Select *OK* and the result will be (Figure IV-4).

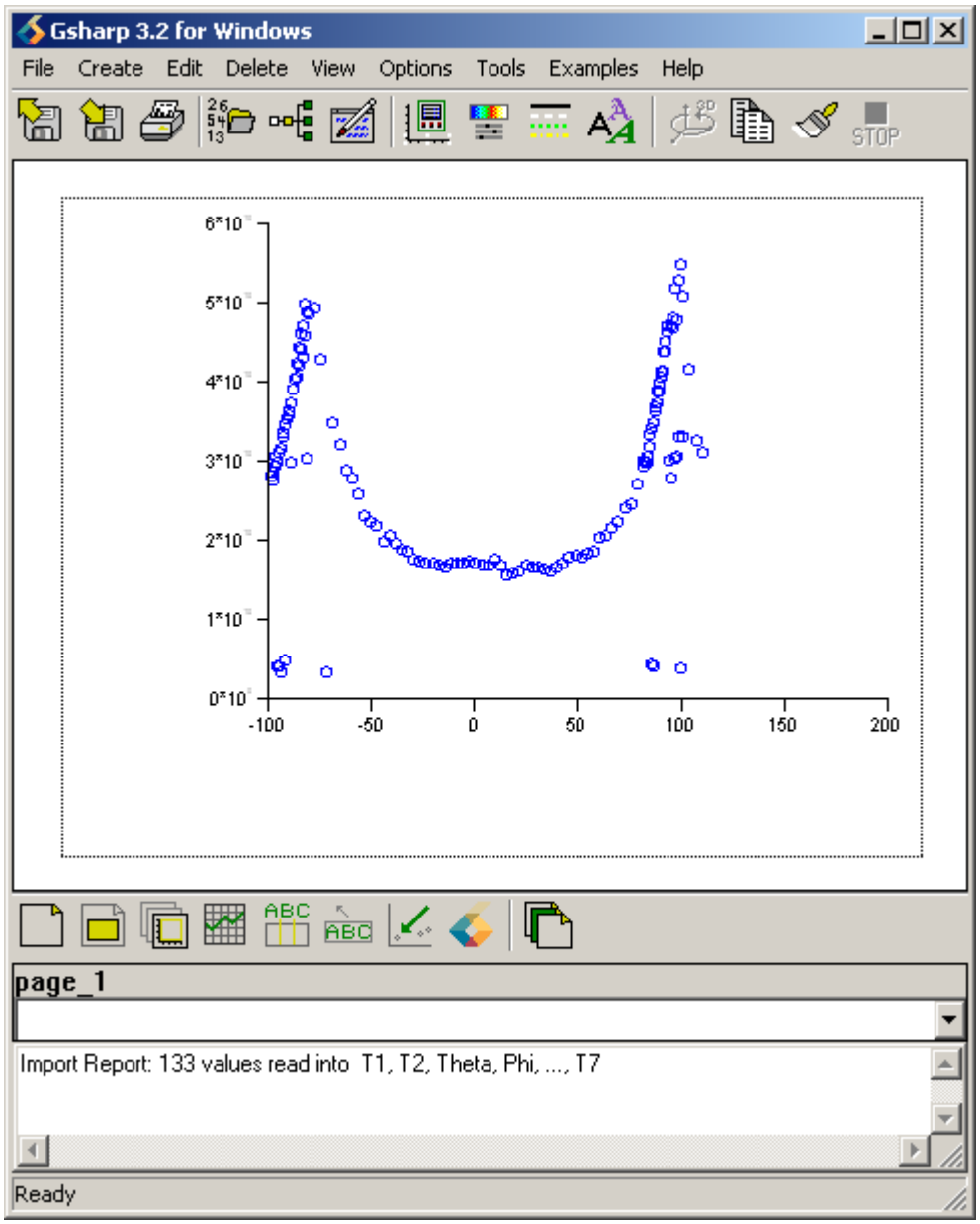


Figure IV-4: Result of 02-07-33,Sep-07.txt File

- Double click with the left mouse button on the x-axis (Section 2.1.4, Figure II-9) so that Axis Editor appears (Section 2.14, Figure II-10).
- Select *Text* and enter in the box next to *Text*, Theta, and set the *Height* to 5 (Section 2.1.4, Figure II-11).
- Select OK and the result will be (Figure IV-5).

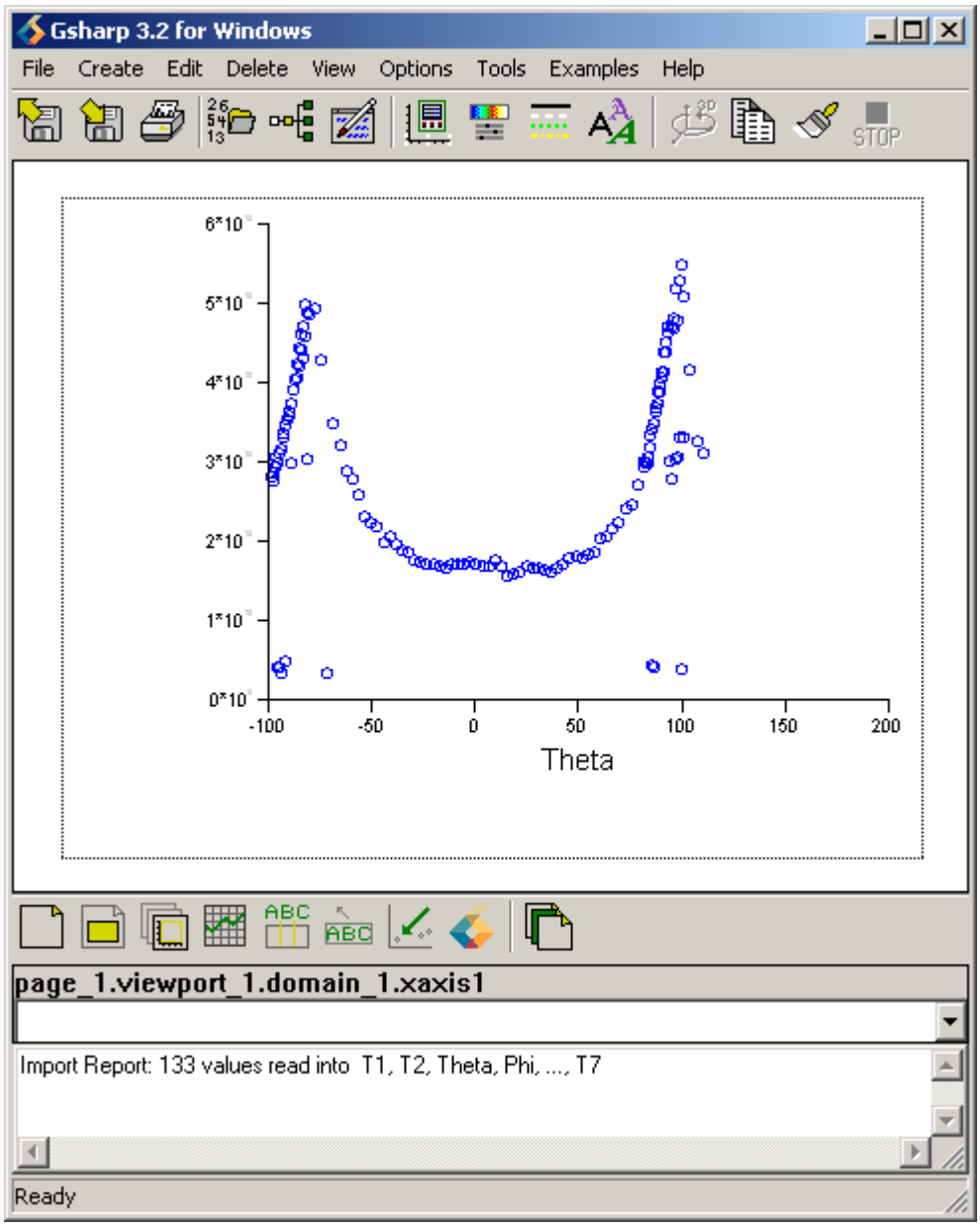


Figure IV-5: Labelling the X-Axis

- Double click with the left mouse button on the y-axis (Section 2.1.4, Figure II-13) so that Axis Editor appears (Section 2.14, Figure II-14).
- Select *Text* and enter in the box next to *Text*, Jc (A/m2), and set the *Height* to 5 (Section 2.1.4, Figure II-15).
- Select *OK* and the result will be (Figure IV-6).

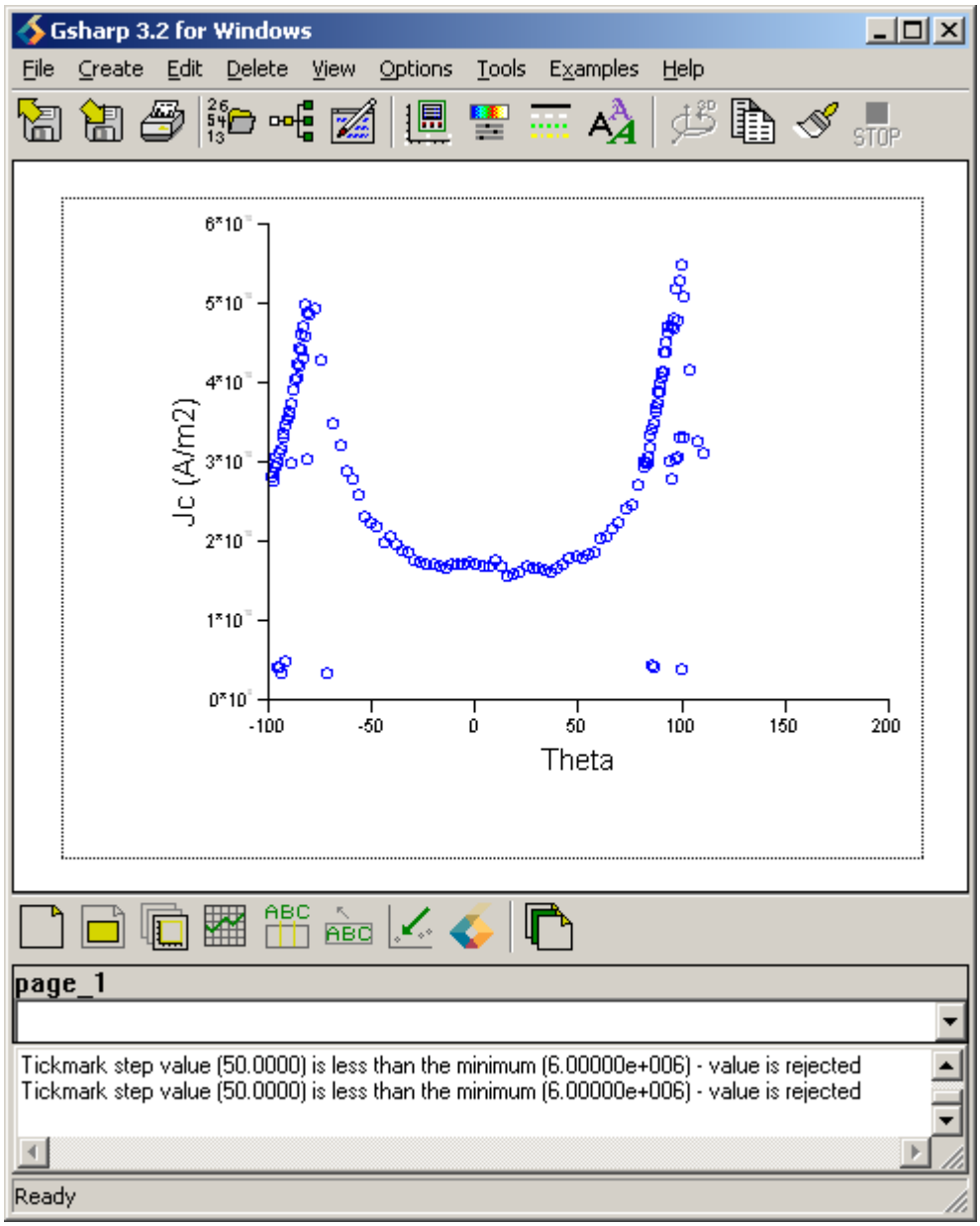


Figure IV-6: Labelling the Y-Axis

4.1.2 Scatter Graph for 01-23-29,Sep-07.txt

- Select *Open…* from the *File* drop-down menu to import the 01-23-29,Sep-07.txt file (Section 4.1.1, Figure IV-1).
- Select the previous graph[43].
- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be T10, *Y* to be T12 (Section 4.1.1, Figure IV-2).
- Select *Markers* and set *Symbol* to ☆ and *Color* to Green (Section 4.1.1, Figure IV-3).
- Select *OK* and the result will be (Figure IV-7).

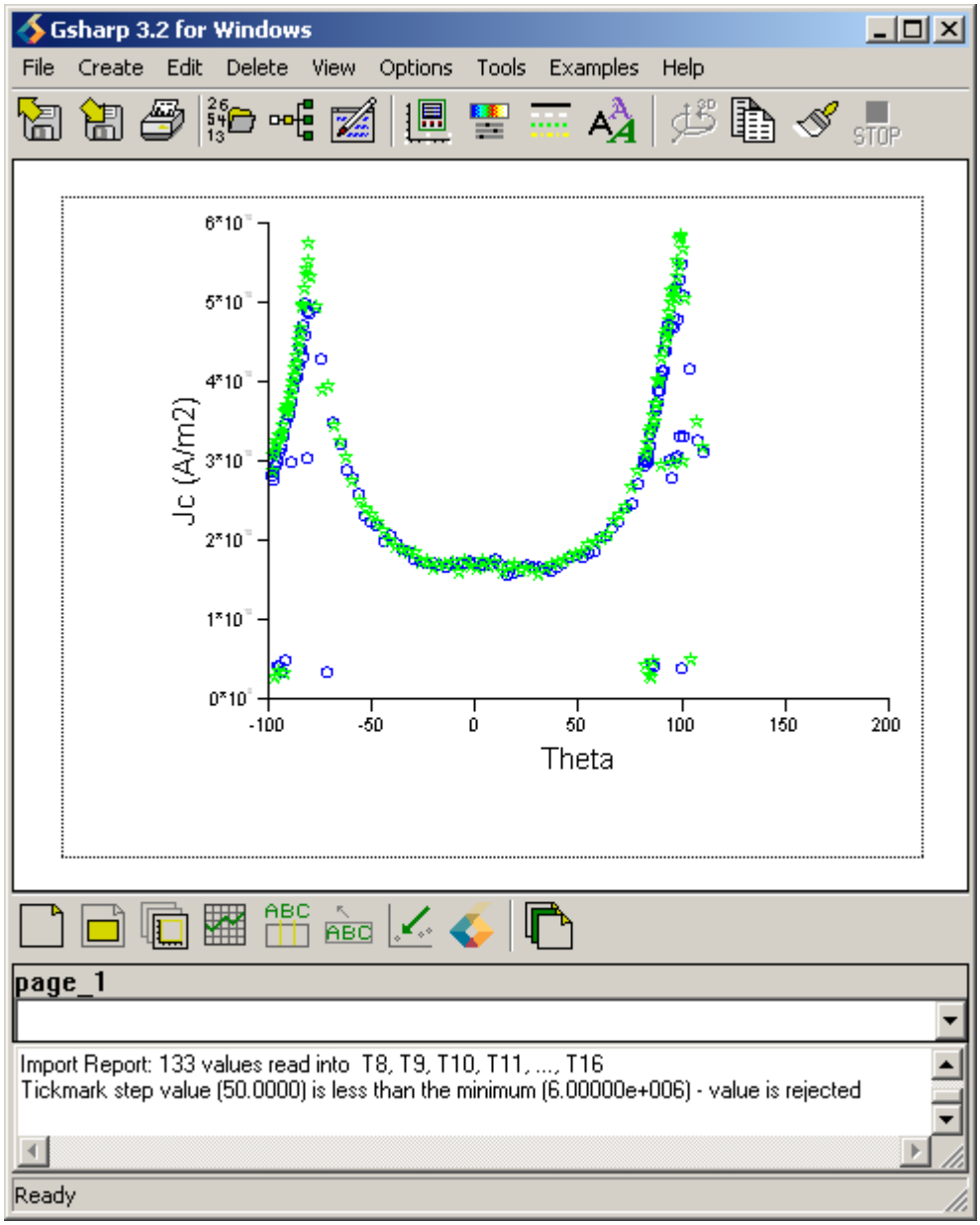


Figure IV-7: Result of 01-23-29,Sep-07.txt File

[43] This graph is must be selected in order to visualize the next graph. This must be done for all of the graphs.

4.1.3 Scatter Graph for 00-39-33,Sep-07.txt

- Select *Open…* from the *File* drop-down menu to import the 00-39-33,Sep-07.txt file (Section 4.1.1, Figure IV-1).
- Select the previous graph
- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be T19, *Y* to be T21 (Section 4.1.1, Figure IV-2).
- Select *Markers* and set *Symbol* to ✣ and *Color* to Red (Section 4.1.1, Figure IV-3).
- Select *OK* and the result will be (Figure IV-8).

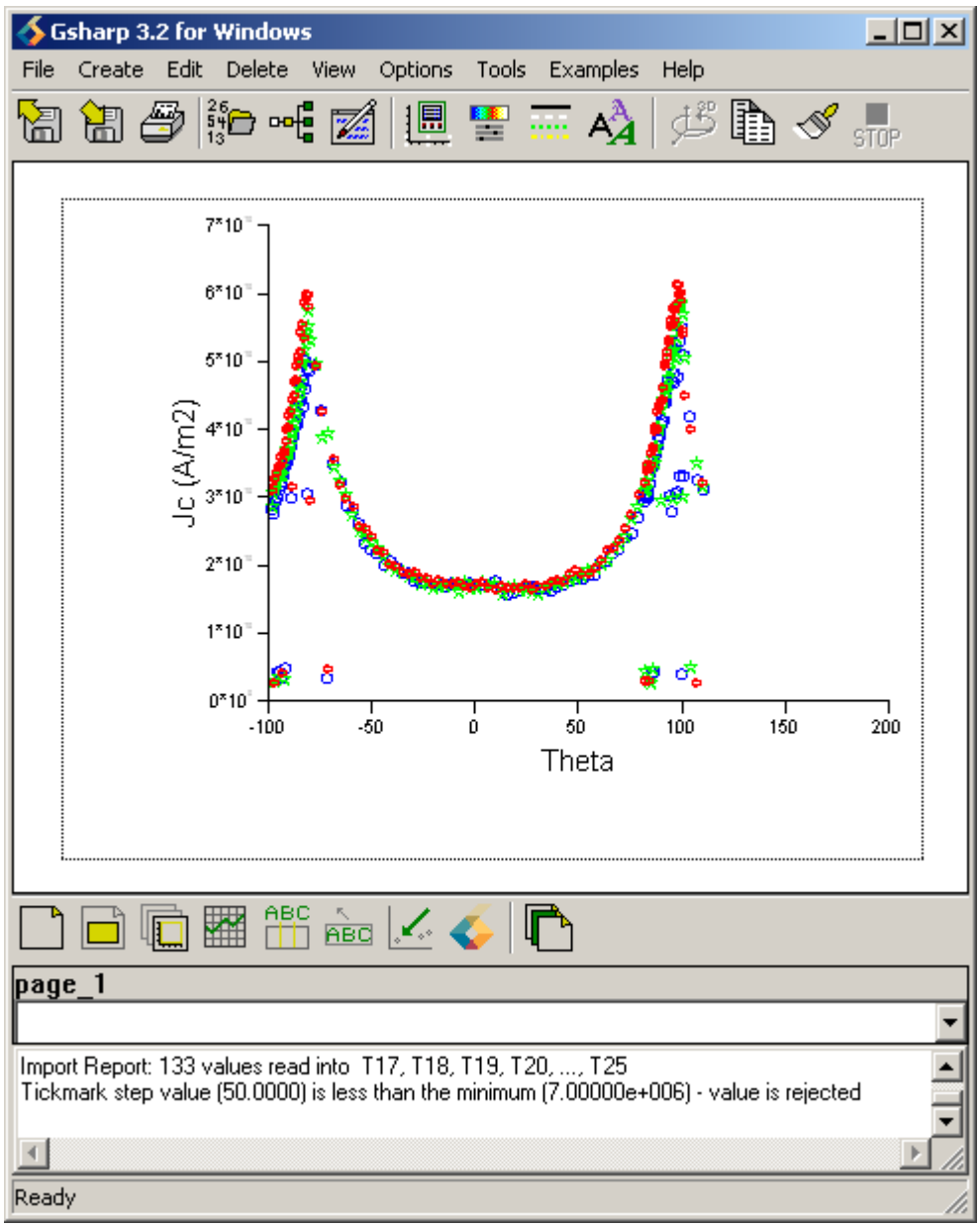


Figure IV-8: Result of 00-39-33,Sep-07.txt File

4.1.4 Scatter Graph for 20-00-22,Sep-06.txt

- Select *Open…* from the *File* drop-down menu to import the 20-00-22,Sep-06.txt file (Section 4.1.1, Figure IV-1).
- Select the previous graph
- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be T28, *Y* to be T30 (Section 4.1.1, Figure IV-2).
- Select *Markers* and set *Symbol* to ▸ and *Color* to Turquoise (Section 4.1.1, Figure IV-3).
- Select *OK* and the result will be (Figure IV-9).

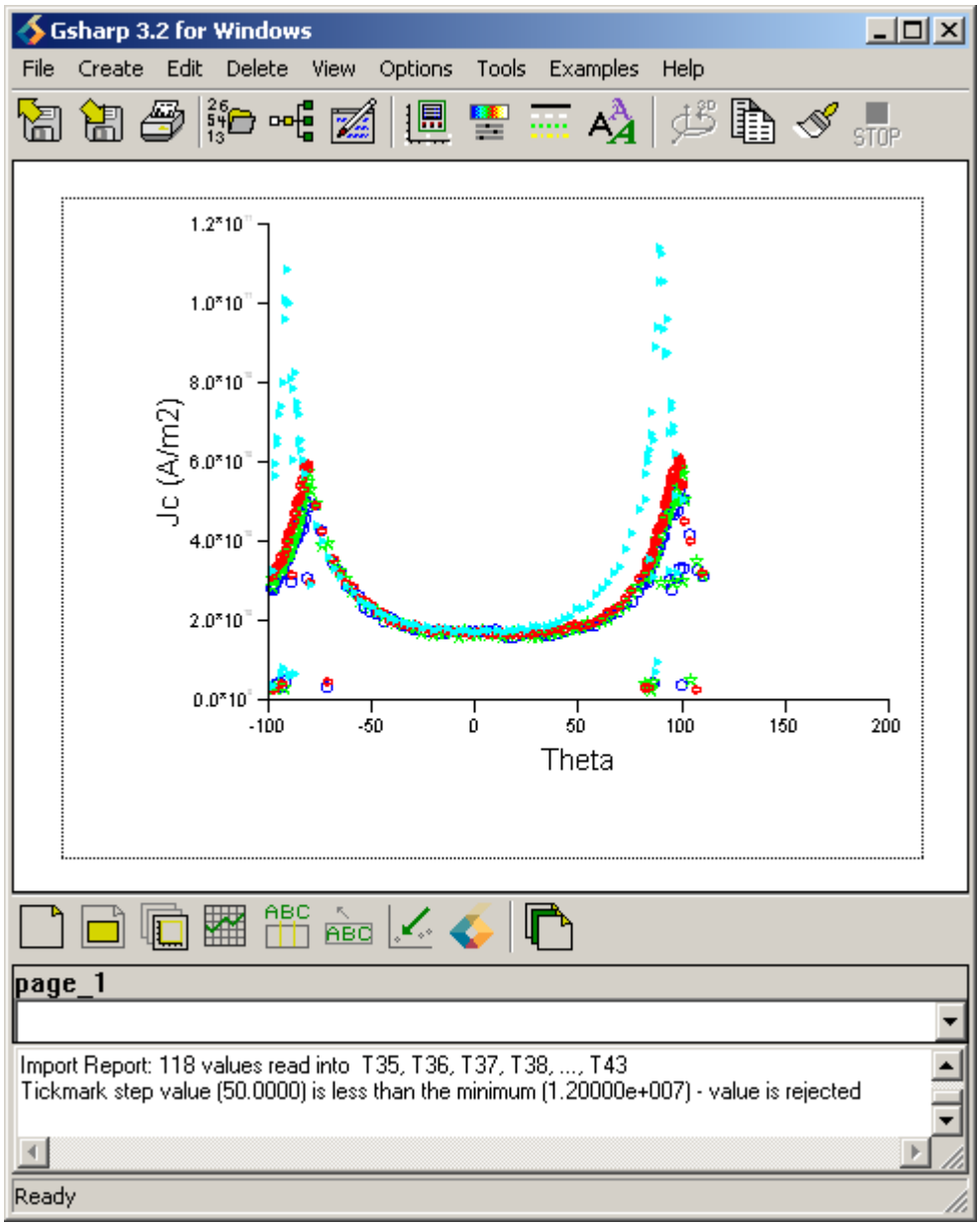


Figure IV-9: Result of 20-00-22,Sep-06.txt File

4.1.5 Scatter Graph for 20-45-45,Sep-06.txt

- Select *Open…* from the *File* drop-down menu to import the 20-45-45,Sep-06.txt file (Section 4.1.1, Figure IV-1).
- Select the previous graph
- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be T37, *Y* to be T39 (Section 4.1.1, Figure IV-2).
- Select *Markers* and set *Symbol* to △ and *Color* to Orange (Section 4.1.1, Figure IV-3).
- Select *OK* and the result will be (Figure IV-10).

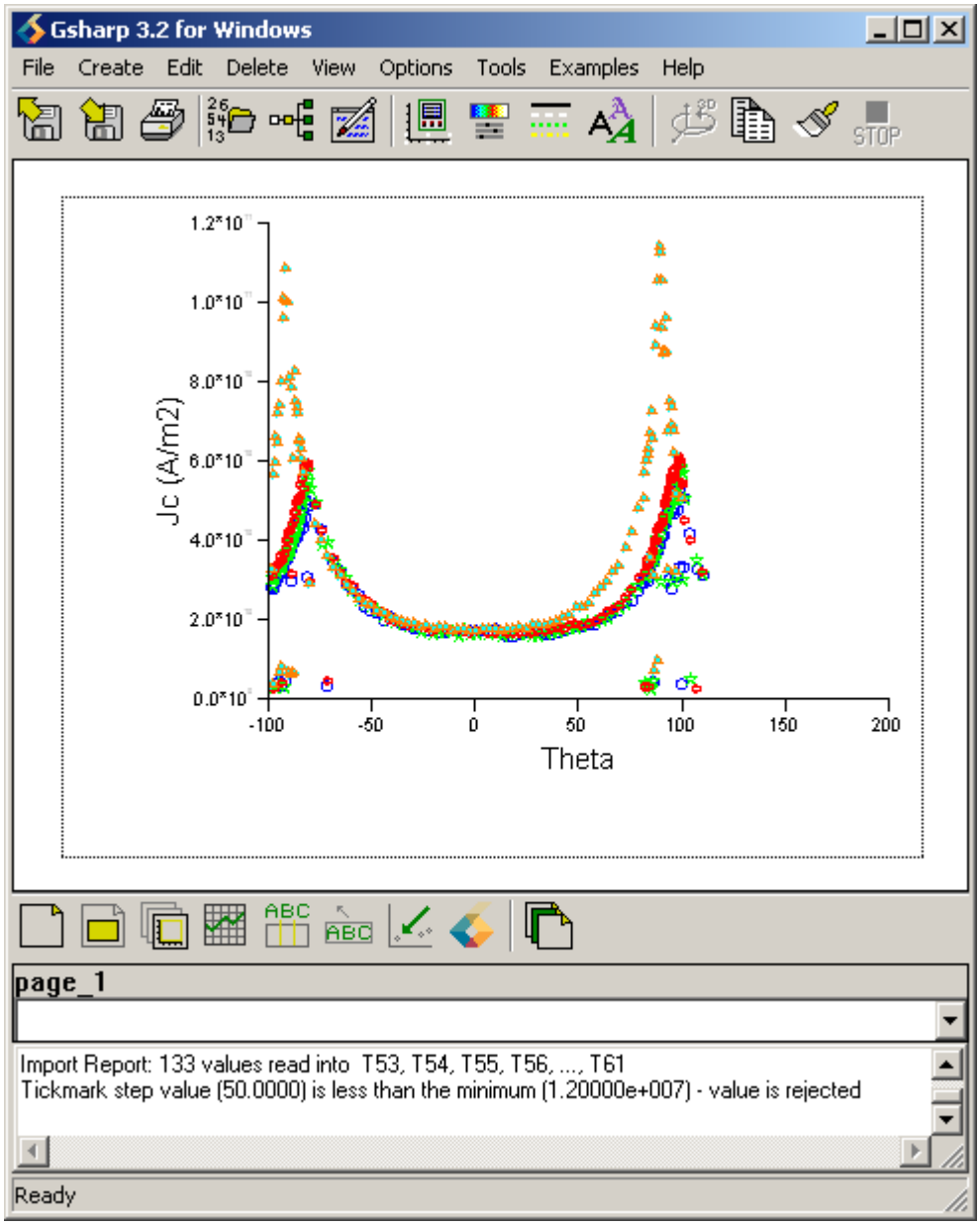


Figure IV-10: Result of 20-45-45,Sep-06.txt File

4.1.6 Scatter Graph for 21-33-38,Sep-06.txt

- Select *Open…* from the *File* drop-down menu to import the 21-33-38,Sept-06.txt file (Section 4.1.1, Figure IV-1).
- Select the previous graph
- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be T46, *Y* to be T48 (Section 4.1.1, Figure IV-2).
- Select *Markers* and set *Symbol* to and *Color* to Yellow (Section 4.1.1, Figure IV-3).
- Select *OK* and the result will be (Figure IV-11).

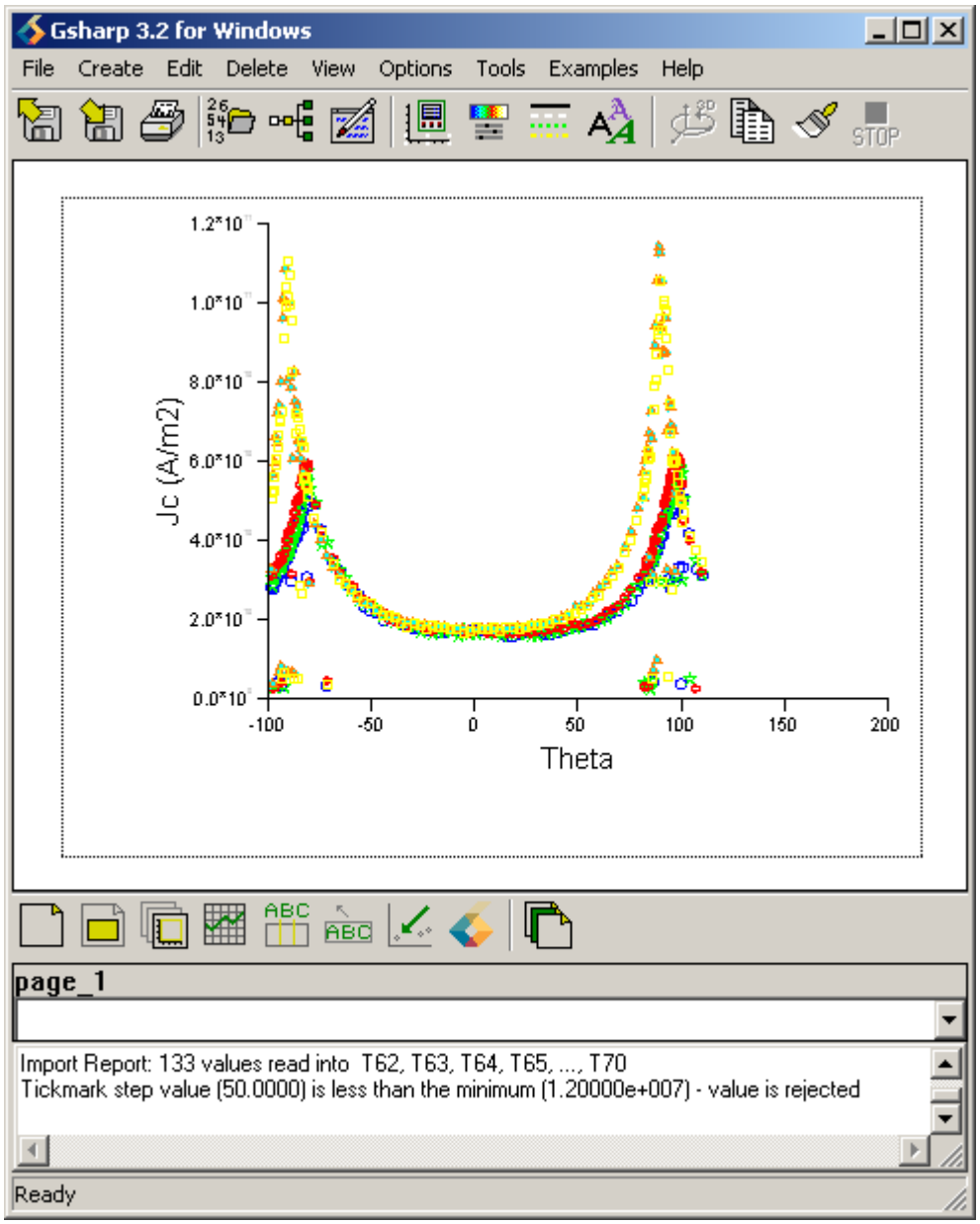


Figure IV-11: Result of 21-33-38,Sep-06.txt File

4.1.7 Scatter Graph for 22-19-18,Sep-06.txt

- Select *Open…* from the *File* drop-down menu to import the 22-19-18,Sep-06.txt file (Section 4.1.1, Figure IV-1).
- Select the previous graph
- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be T55, *Y* to be T57 (Section 4.1.1, Figure IV-2).
- Select *Markers* and set *Symbol* to and *Color* to Purple (Section 4.1.1, Figure IV-3).
- Select *OK* and the result will be (Figure IV-12).

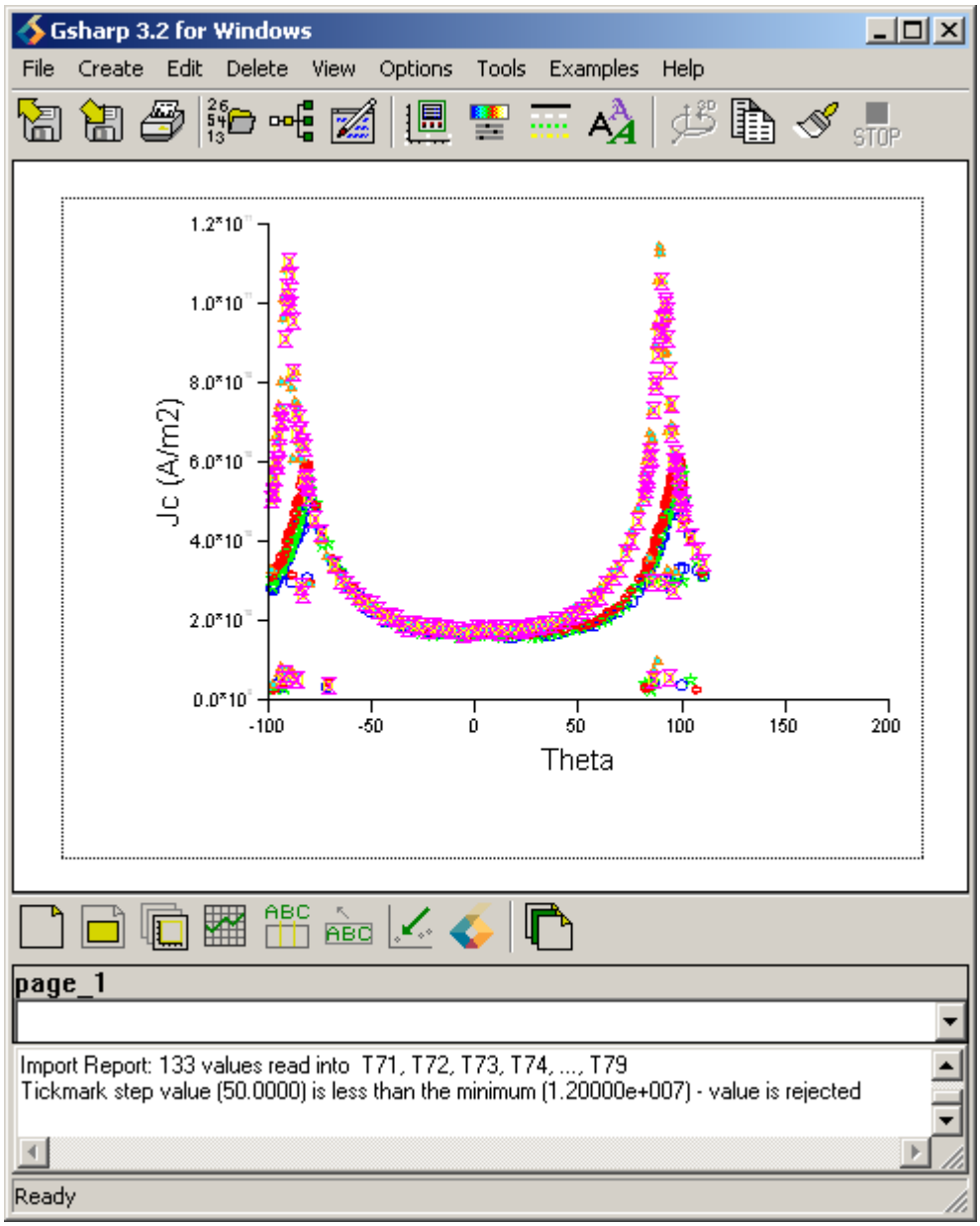


Figure IV-12: Result of 22-19-18,Sep-06.txt File

4.1.8 Scatter Graph for 23-06-59,Sep-06.txt

- Select *Open…* from the *File* drop-down menu to import the 23-06-59,Sep-06.txt file (Section 4.1.1, Figure IV-1).
- Select the previous graph
- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be T64, *Y* to be T66 (Section 4.1.1, Figure IV-2).
- Select *Markers* and set *Symbol* to and *Color* to Brown (Section 4.1.1, Figure IV-3).
- Select *OK* and the result will be (Figure IV-13).

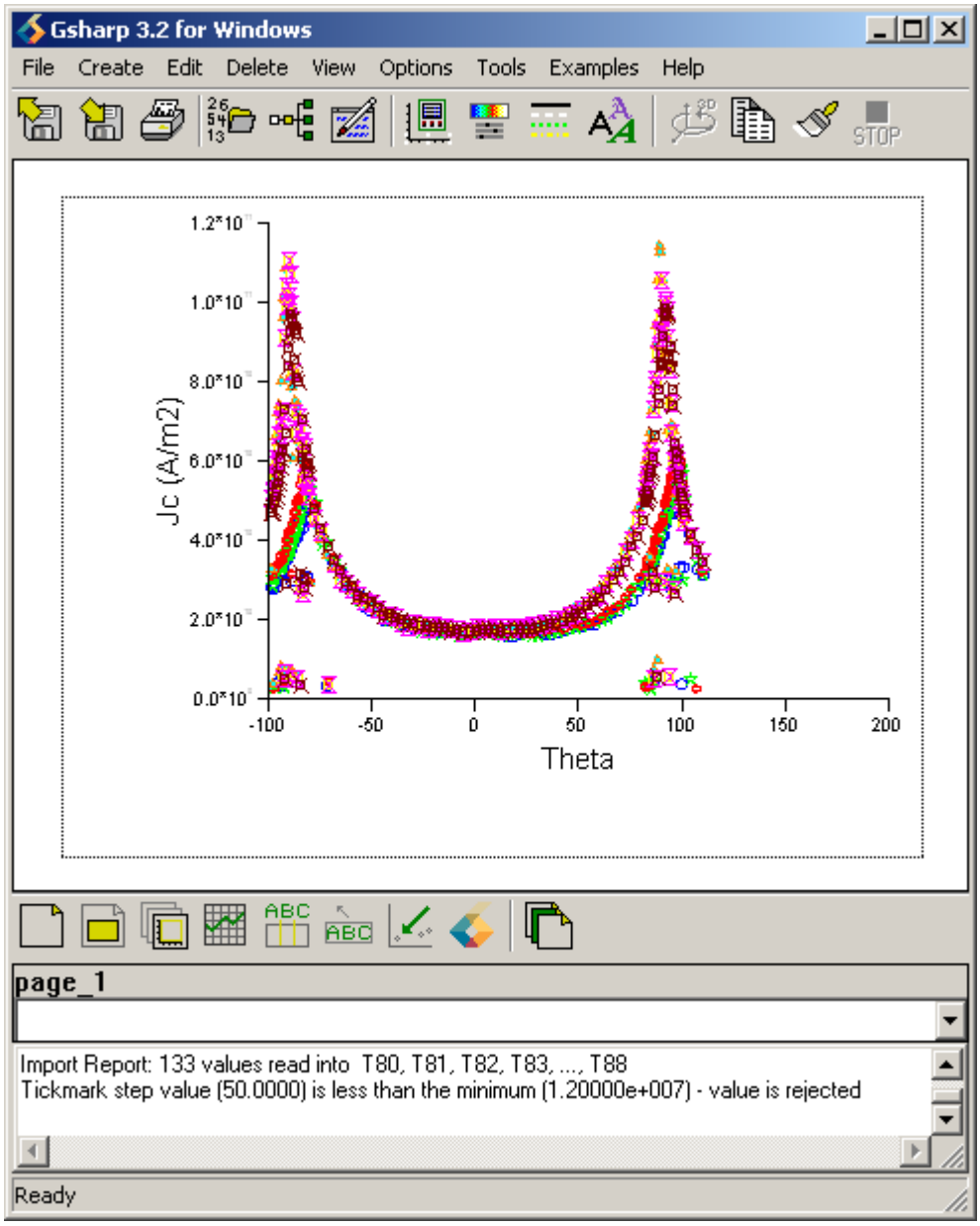


Figure IV-13: Result of 23-06-59,Sep-06.txt File

4.1.9 Scatter Graph for 23-54-13,Sep-06.txt

- Select *Open…* from the *File* drop-down menu to import the 23-54-13,Sep-06.txt file (Section 4.1.1, Figure IV-1).
- Select the previous graph
- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be T73, *Y* to be T75 (Section 4.1.1, Figure IV-2).
- Select *Markers* and set *Symbol* to and *Color* to Dark Green (Section 4.1.1, Figure IV-3).
- Select *OK* and the result will be (Figure IV-14).

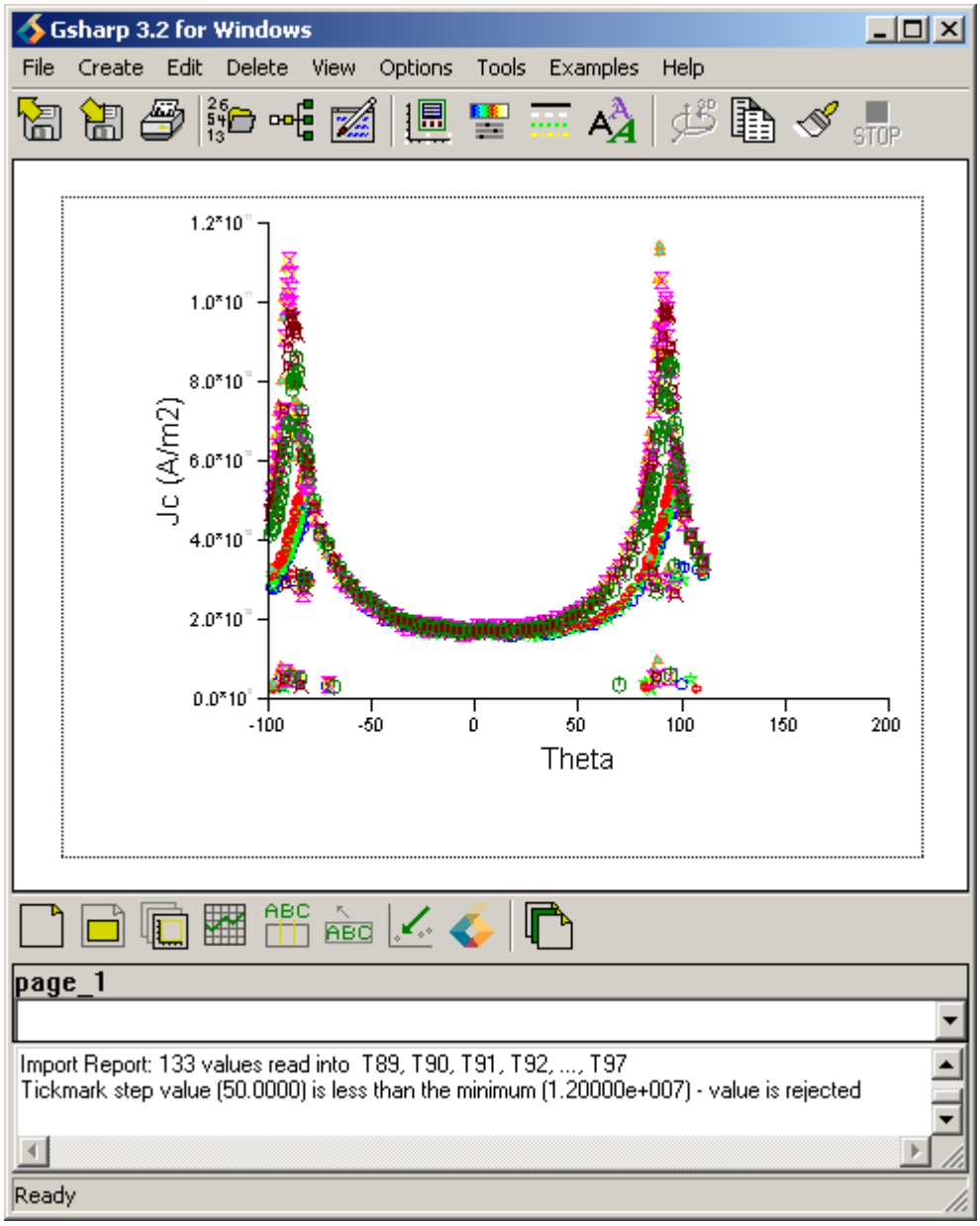


Figure IV-14: Result of 23-54-13,Sep-06.txt File

4.1.10 Scatter Graph for phi-90.txt

- Select *Open…* from the *File* drop-down menu to import the phi-90.txt file (Section 4.1.1, Figure IV-1).
- Select the previous graph
- In Graph Editor select Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
- In *Data* set *X* to be T82, *Y* to be T84 (Section 4.1.1, Figure IV-2).
- Select *Markers* and set *Symbol* to × and *Color* to Dark Blue (Section 4.1.1, Figure IV-3).
- Select *OK* and the result will be (Figure IV-15).

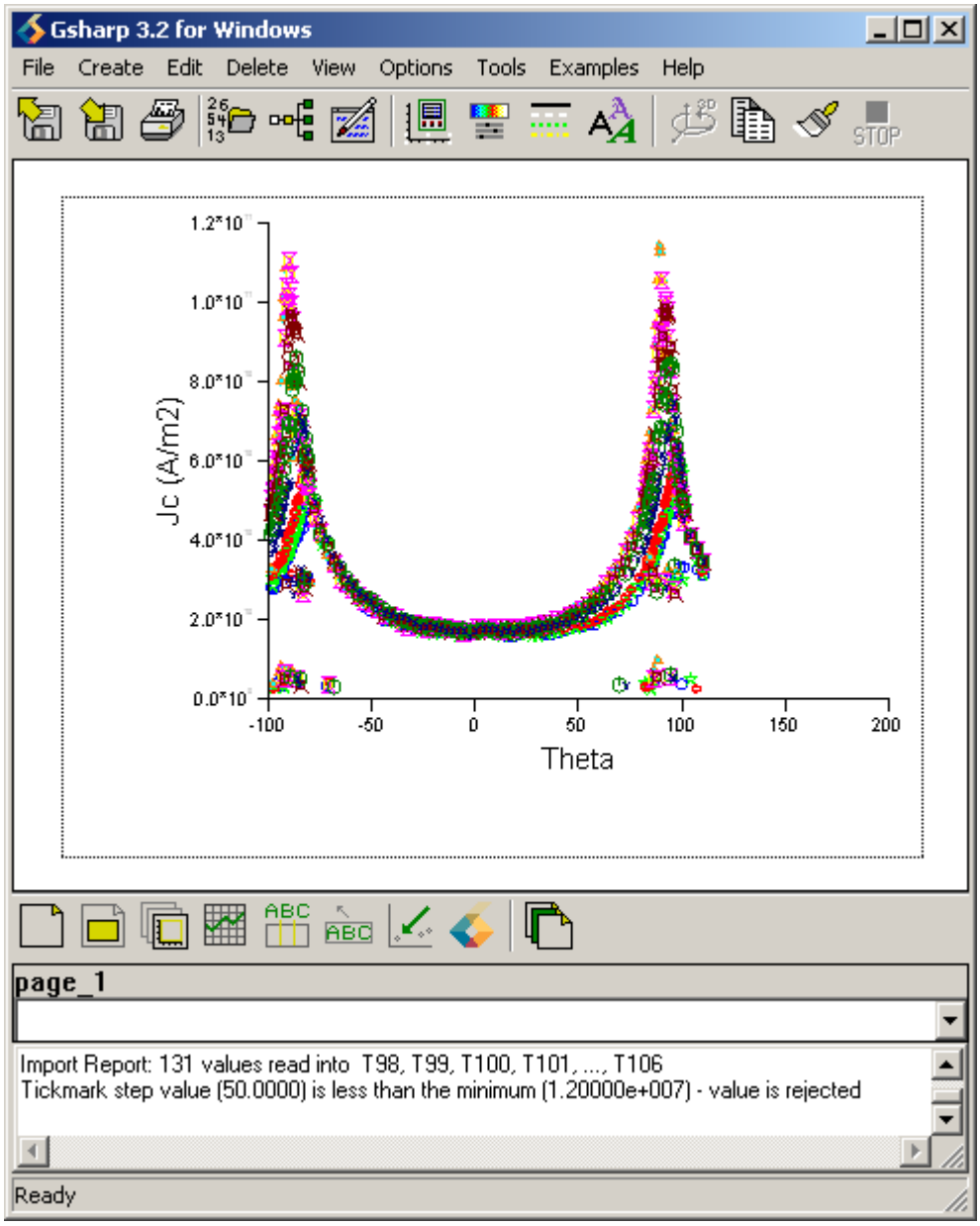


Figure IV-15: Result of phi-90.txt File

- Select *Legend…* from the *Edit* drop-down menu (Figure IV-16).

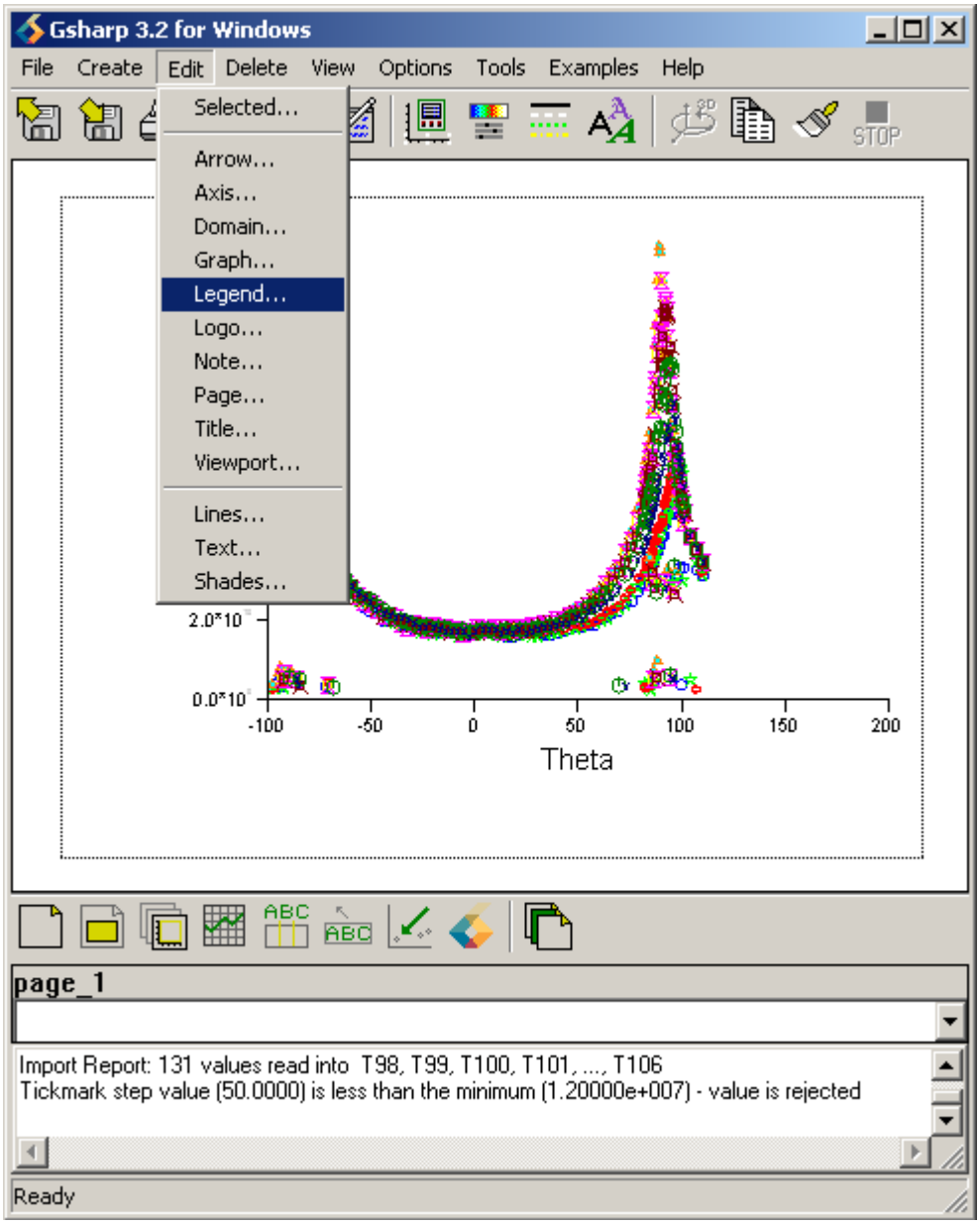


Figure IV-16: Editing a Legend

- In Legend Editor set *Entry Height* to be 6 (Figure IV-17).

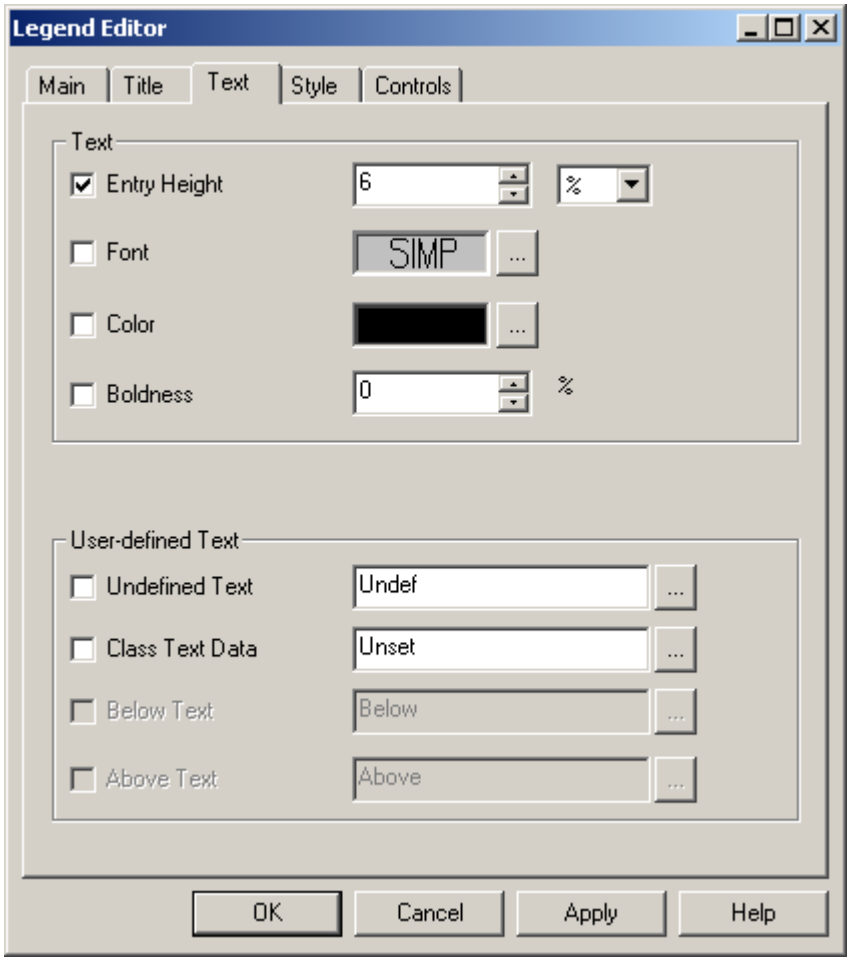


Figure IV-17: Setting Entry Height

- Select *Controls* and set *Enabled* to On (Figure IV-18).

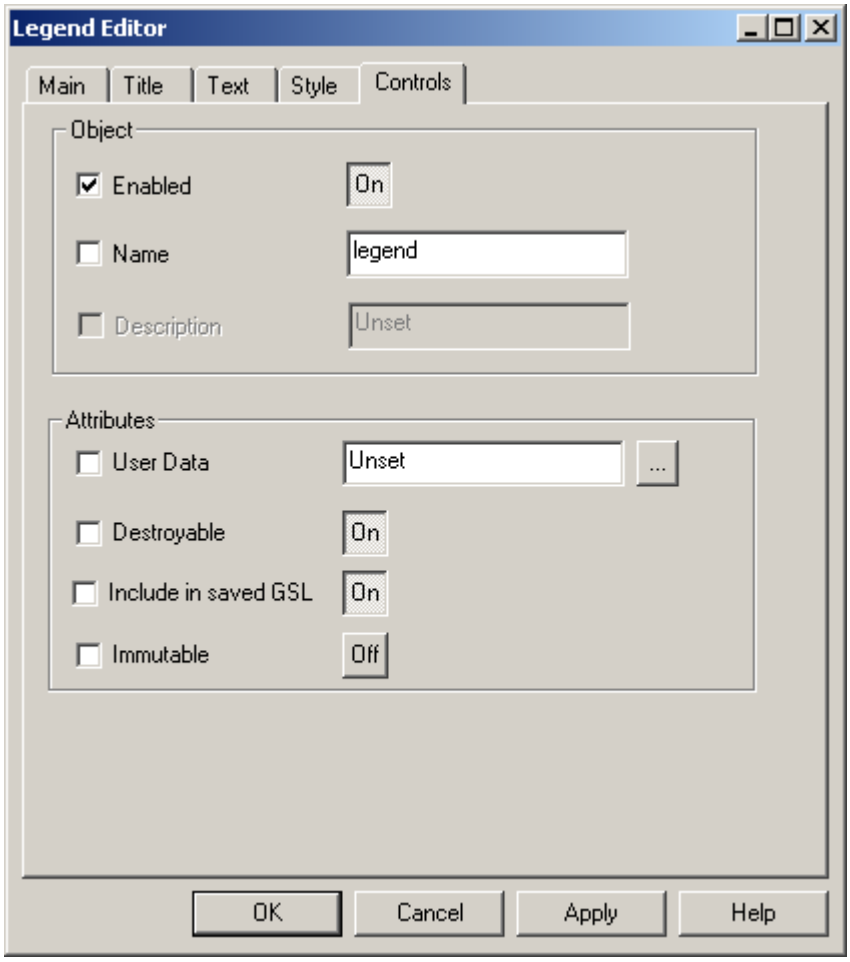


Figure IV-18: Enable the Legend

- Select *OK* and the result will be (Figure IV-19).

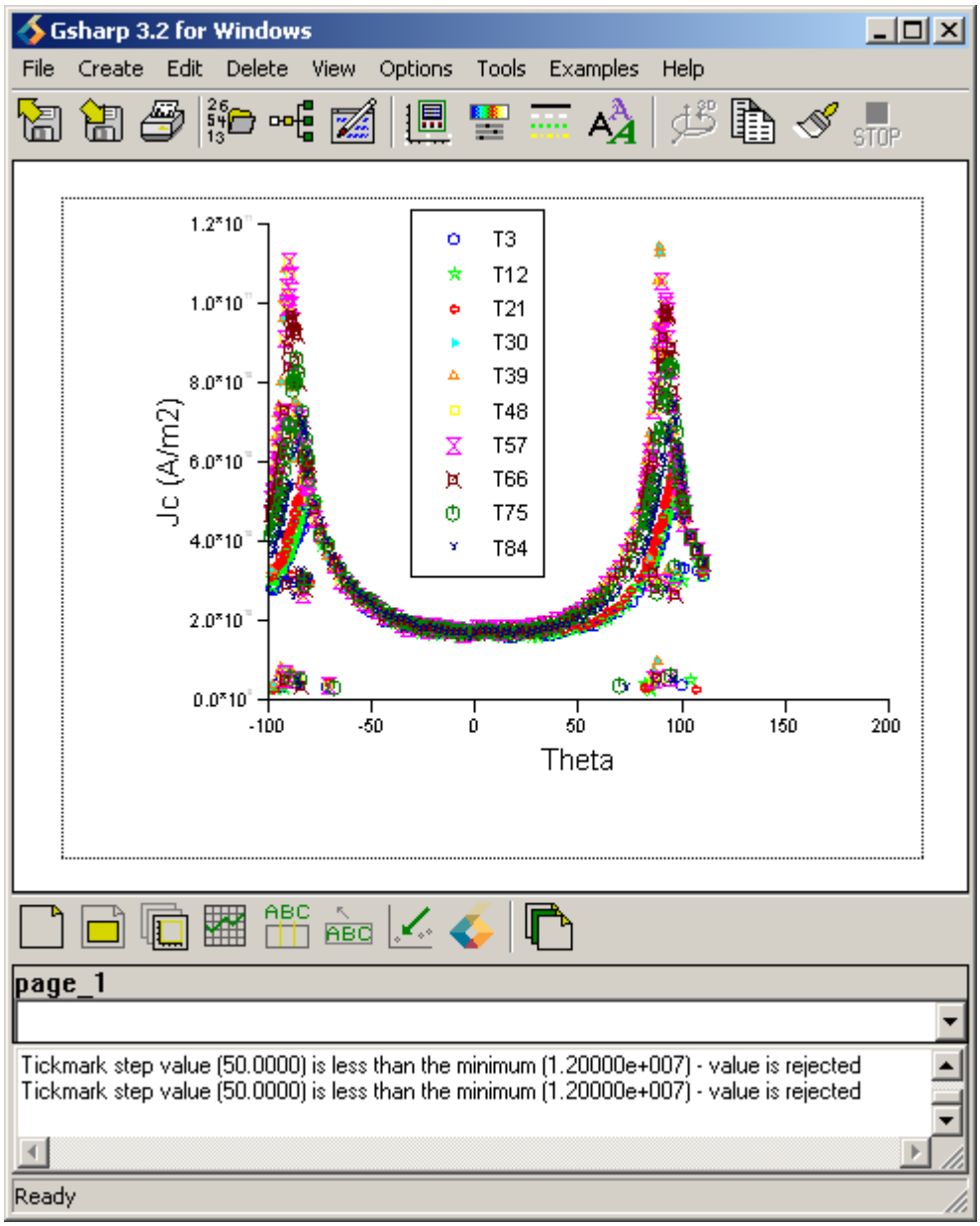


Figure IV-19: Result of a Legend

4.1.11 3D Scatter Graph

A 3D scatter graph will be drawn so that the previous 10 scatter graphs will be visualized in 3D style.

1. Select *Open…* from the *File* drop-down menu to import the 02-07-33,Sep-07.txt (Section 4.1.1, Figure IV-1).
2. In Graph Editor select 3D Scatter for *Graph Type* (Section 2.1.2, Figure II-5).
3. Select *Data* and set *X* to be Theta, *Y* to be T3 and *Z* to be Phi (Section 2.2.3 Figure II-28).
4. Select *Markers*, set *Color* to Blue (Section 4.1.1 Figure IV-3).
5. Select *OK* and the result will be (Figure IV-20).

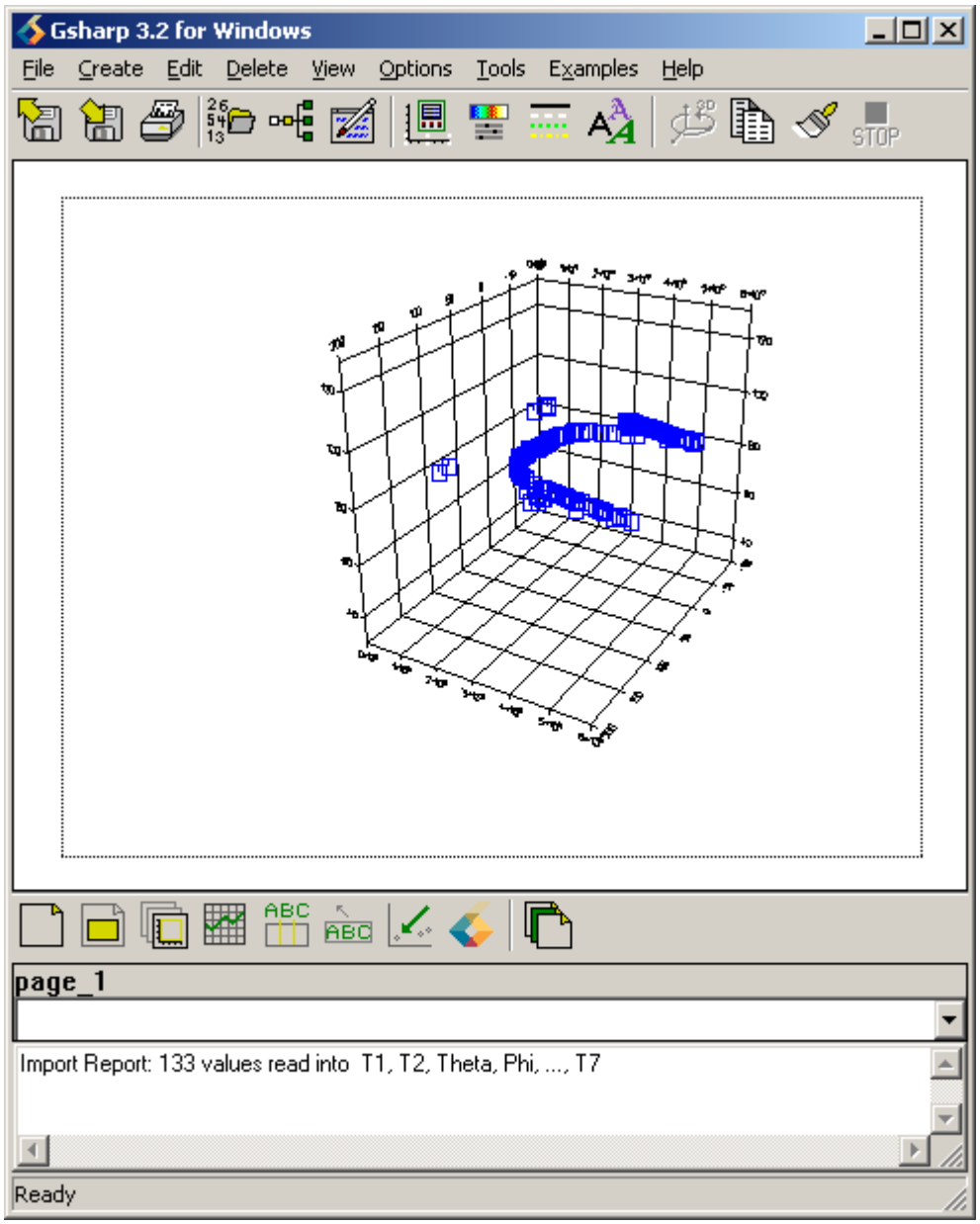


Figure IV-20: Result of 3D Scatter for 02-07-33,Sep-07.txt File

- Repeat steps 1-5 in Section 4.1.11 using the data files and colour settings listed in Sections 4.1.1 to 4.1.10 inclusive. The values for X, Y and Z for each graph should correspond to the Theta, Jc(A/m2) and phi values in the data files[44] (Section 4). The final result will be (Figure IV-21).

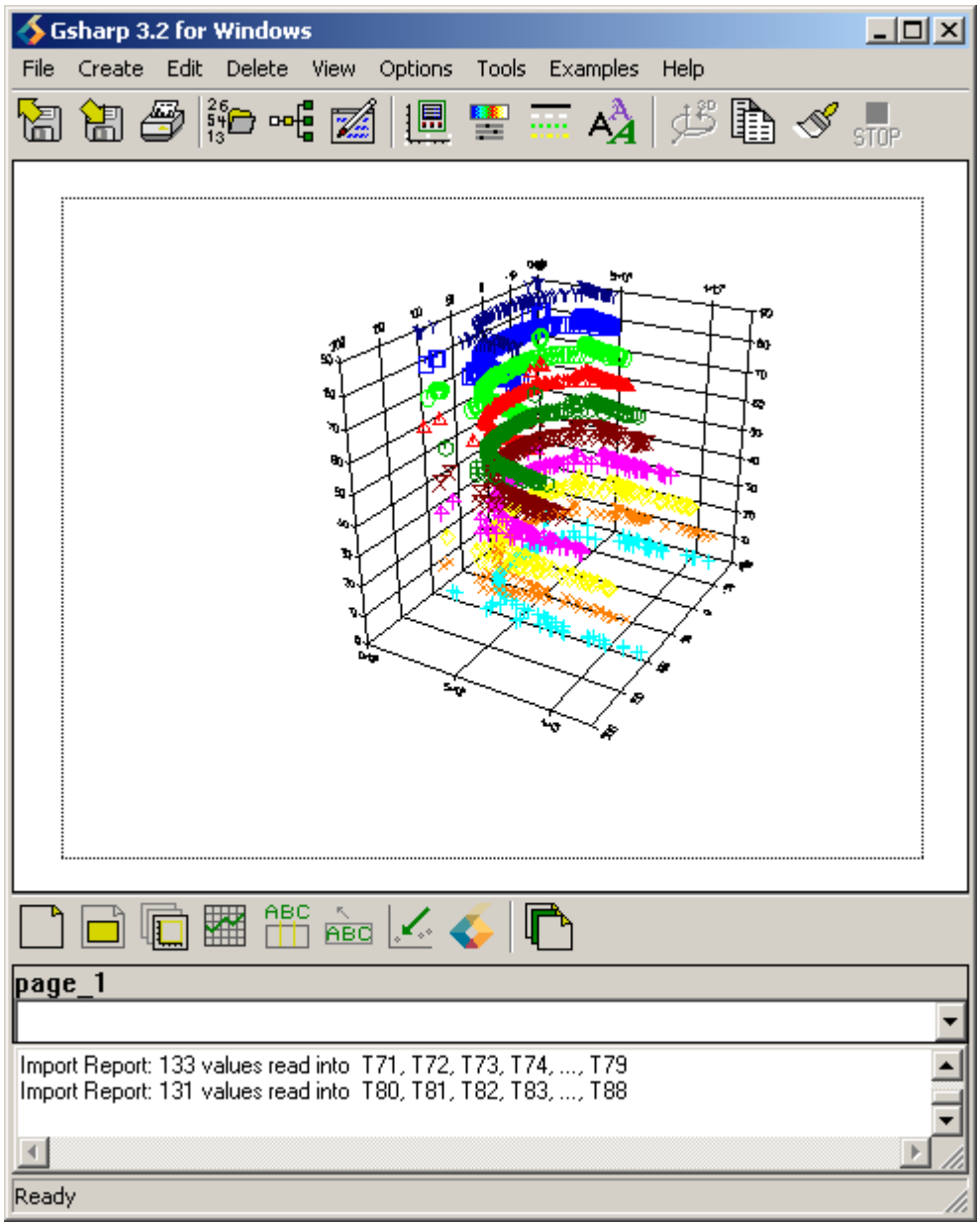


Figure IV-21: Final Graph of 3D Scatter

[44] For example in 01-23-29,Sep-07.txt file the values to be entered are T10 (Theta) for *X*, T12 (Jc(A/m2)) for *Y*, and T11 (phi) for *Z*. The colour of the graph will be green.

5 Showing Percentiles of a Value Over 10 Days

In this chapter percentiles over a period of 10 days are visualized. The file percs.dat[45] contains 10 values (p3, p5, p10, p25, p50, p75, p90, p95, p97, x). Each value of p contains percentile data for each day x (24 May 2002 to 02 June 2002).

The task is to visualize how the percentiles vary through the 10 days.

5.1 Choosing the Best Graph

First the data will be visualized in 2D. A scatter graph will best show the pattern of the visualization.

[45] Courtesy of John Stringer, AVS UK. Refer to Appendix D, Figures D-1 and D-2, for descriptions of the file.

5.1.1 2D Scatter Graph

1. Import percs.dat file by selecting *Open…* from the *File* drop-down menu (Figure V-1).

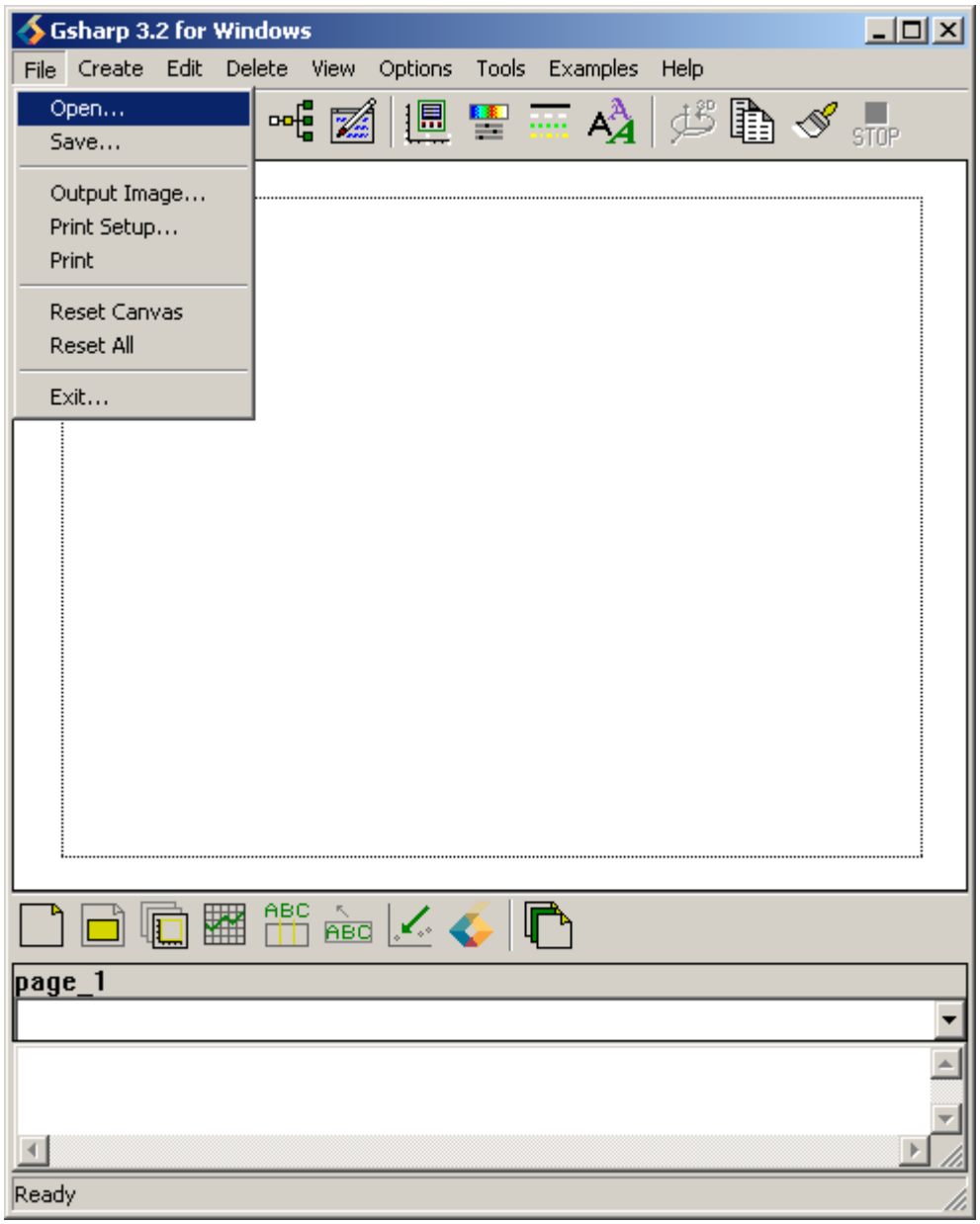


Figure V-1: Importing File

2. Define a viewport (Section 2.1.1).
3. Select *Graph…* from the *Create* drop-down menu (Section 2.1.2, Figure II-3).

4. In Graph Editor select *Scatter* for *Graph Type* (Section 2.1.2, Figure II-5).
5. Select *Data* and set *X* to x and *Y* to p3 (Figure V-2).

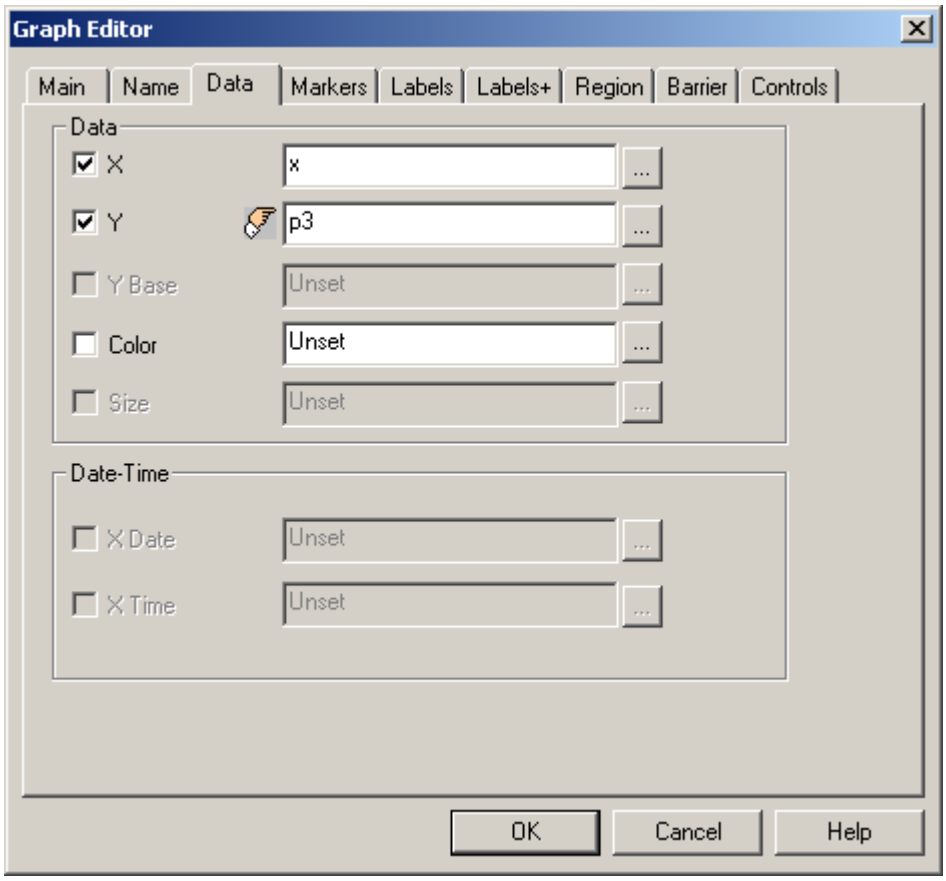


Figure V-2: Setting Data Values

6. Select *OK* and the result will be (Figure V-3)[46].

[46] To remove *June*, double click on the *x-axis*, the Axis Editor will appear. Select *Labels,* select *Level 2* and the Level 2 Labels window will appear, set *Enabled* to *Off*. Select *OK* on the Level 2 Labels window and select *OK* on the Axis Editor. *June* will now be removed from the x-axis. To remove *2002* from the x-axis repeat the steps above but select *Level 3* instead.

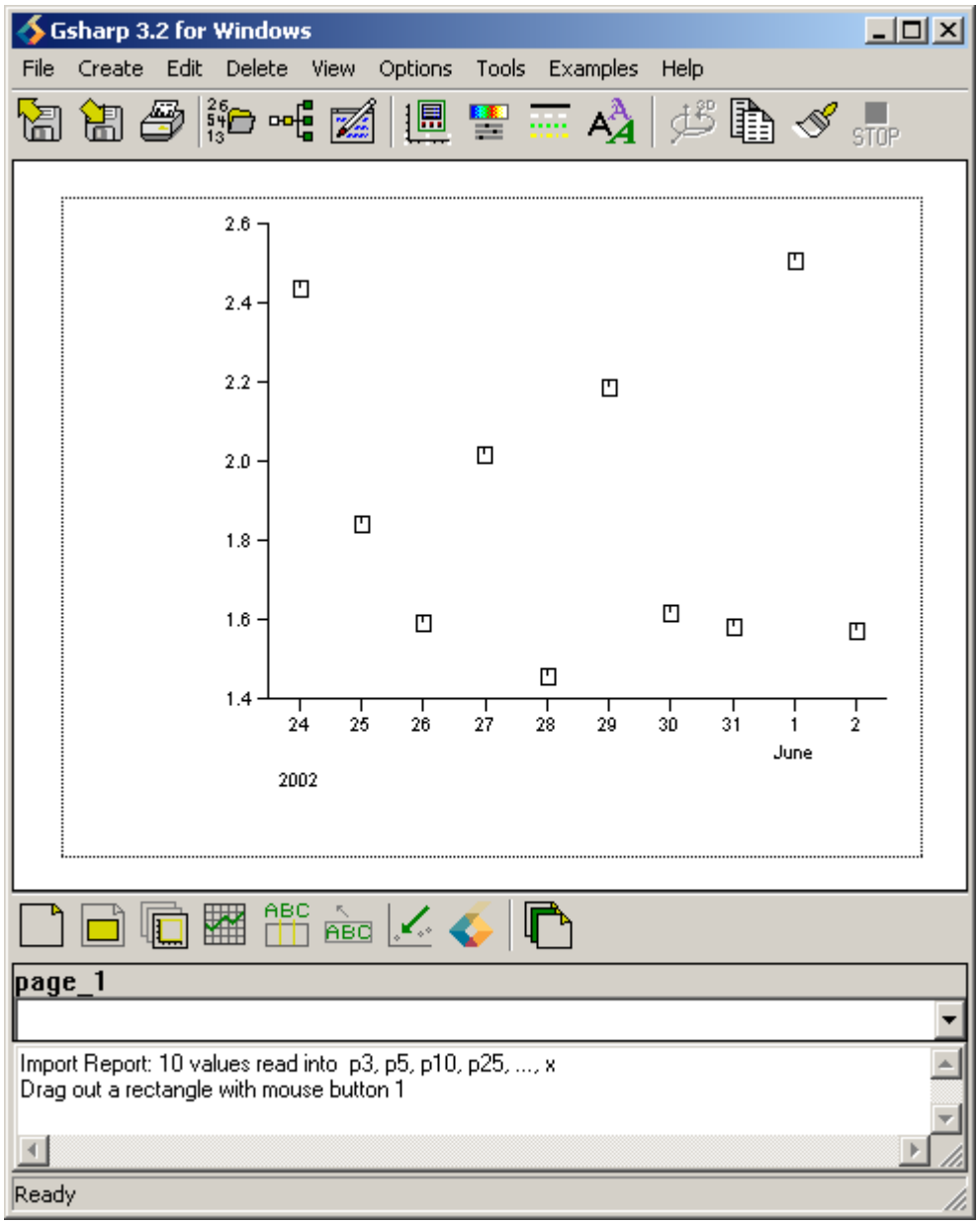


Figure V-3: Result for Variable p3

7. Repeat steps 3 to 6[47] but change *Y*[48] to p5 for the second graph, *Y* to p10 for the third graph until *Y* to p97 for ninth graph. The result will be (Figure V-4).

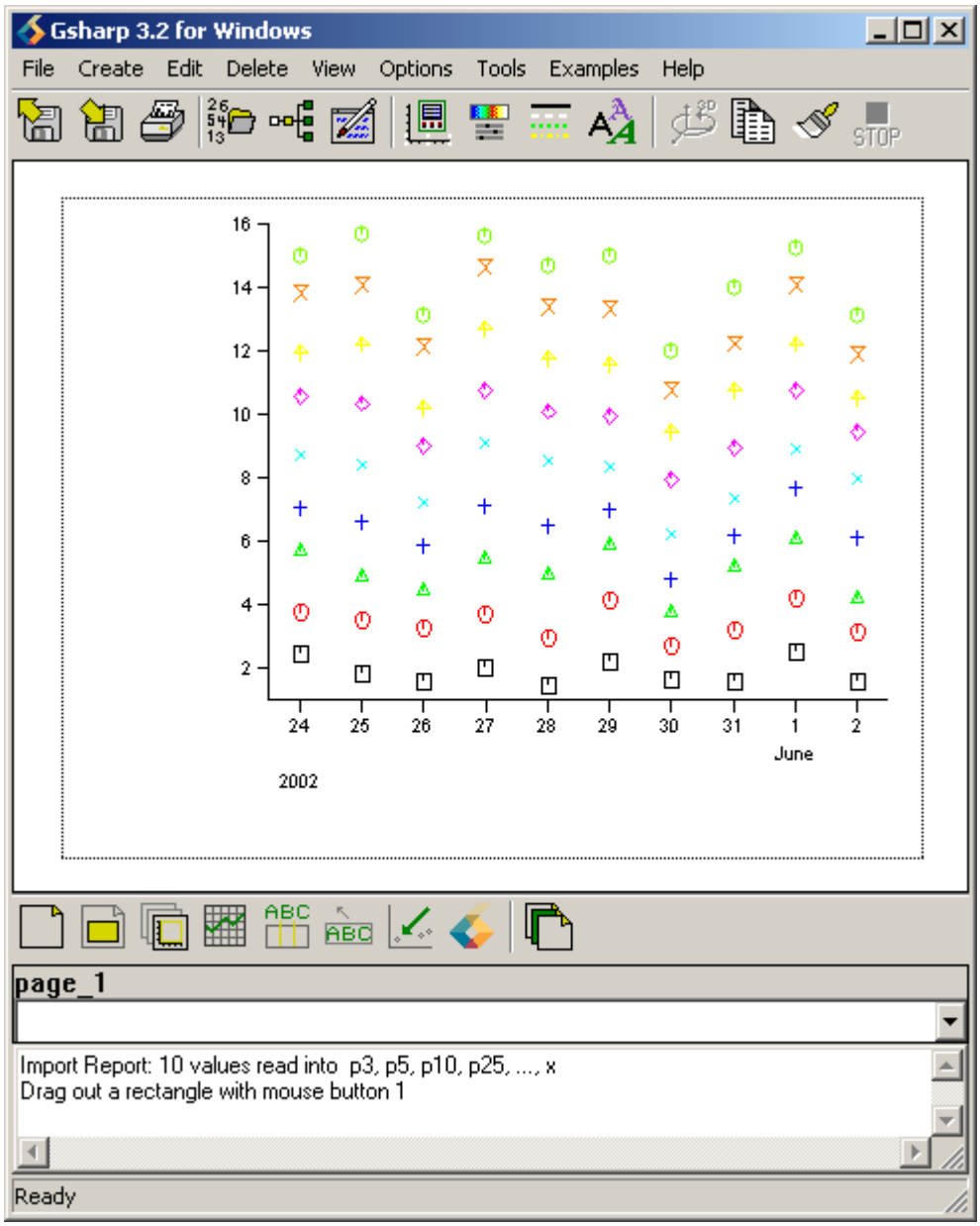


Figure V-4: Final Result of Scatter Graph

[47] The previous graph must be selected before repeating steps 3-6.

[48] The value of Y is determined by the column headings in the percs.dat file. For example, the value of Y for the second graph corresponds to the value of the second column heading in the percs.dat file (Appendix D, Figures D-1 and D-2).

8. Select *Legend*... from the *Edit* drop-down menu (Figure V-5).

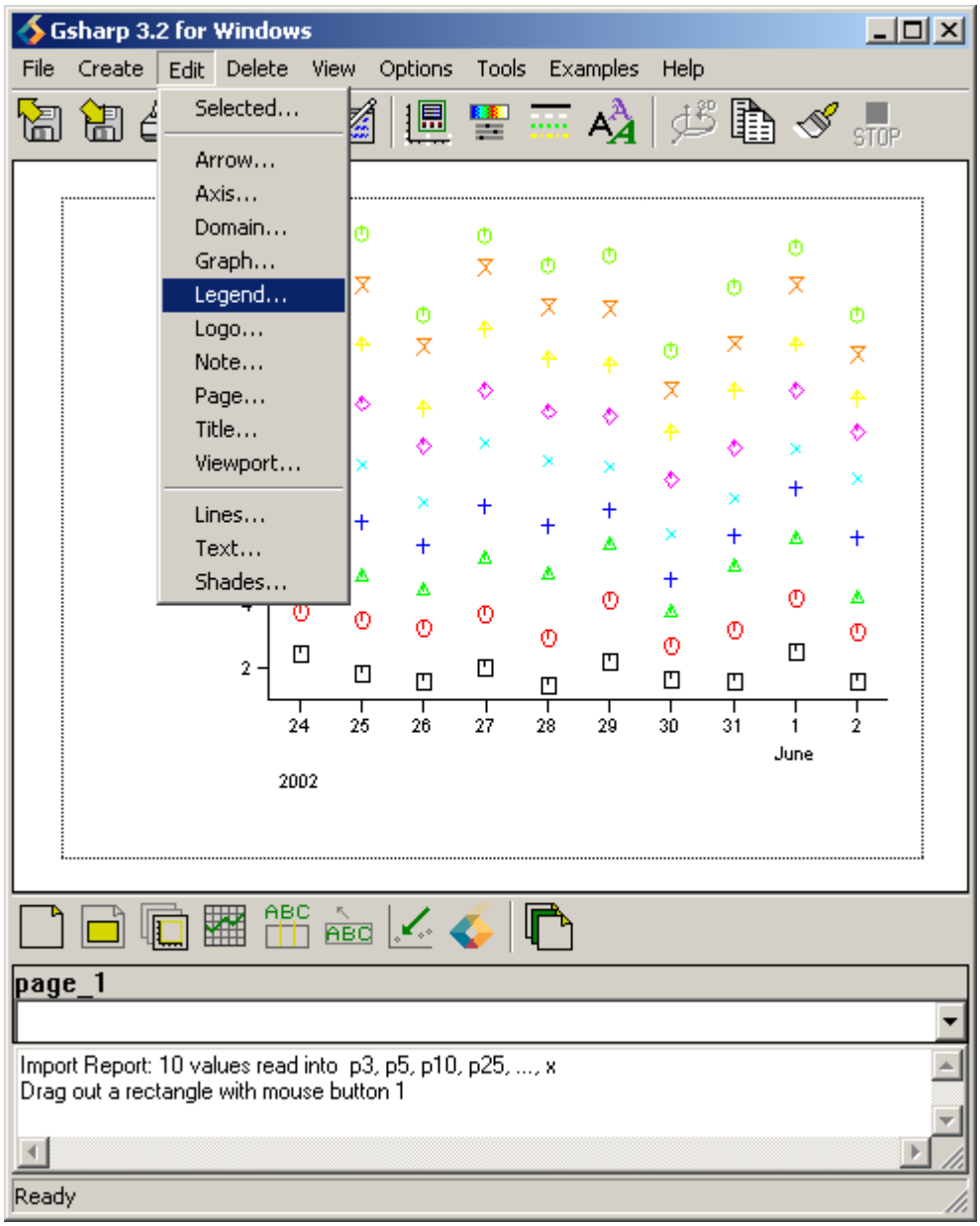


Figure V-5: Editing Legend

9. In the Legend Editor select *Text* and set *Entry Height* to 6 (Figure V-6).

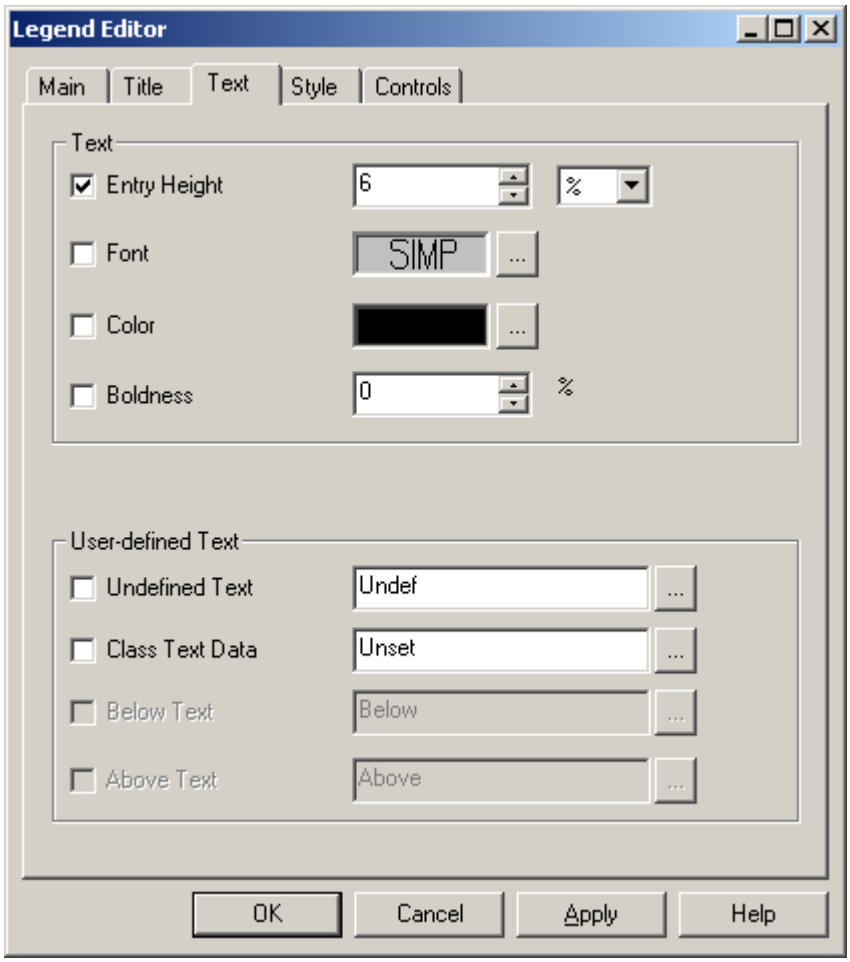


Figure V-6: Setting Entry Height

10. Select *Controls* and set *Enabled* to On (Figure V-7).

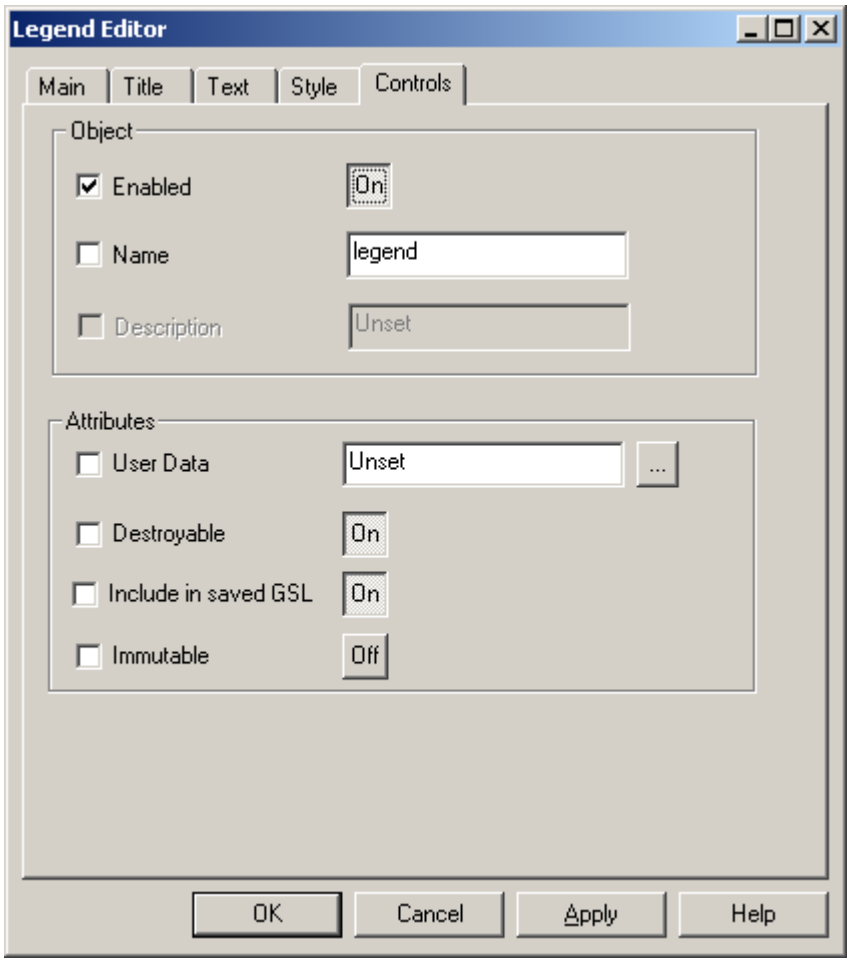


Figure V-7: Enable Legend

11. Select *OK* and the result will be (Figure V-8).

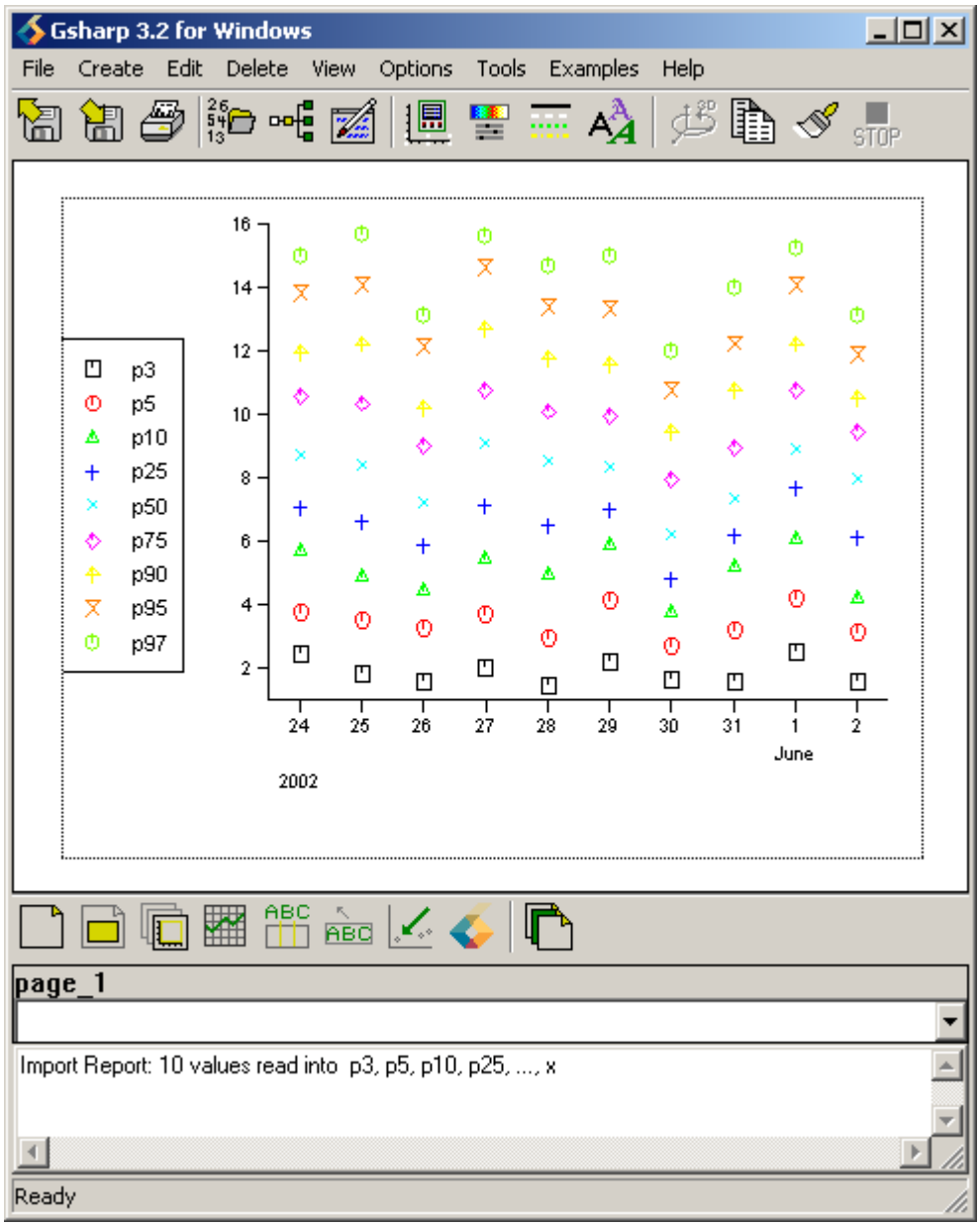


Figure V-8: Graph With Legend

12. Double click with the left mouse button on the y-axis (Section 2.1.4, Figure II-13) so that the Axis Editor appears (Section 2.1.4, Figure II-14).
13. Select *Text* and next to the box of *Text* enter Percentiles. Also set *Height* to 5 (Section 2.1.4, Figure II-15).
14. Select *OK* and the result will be (Figure V-9).

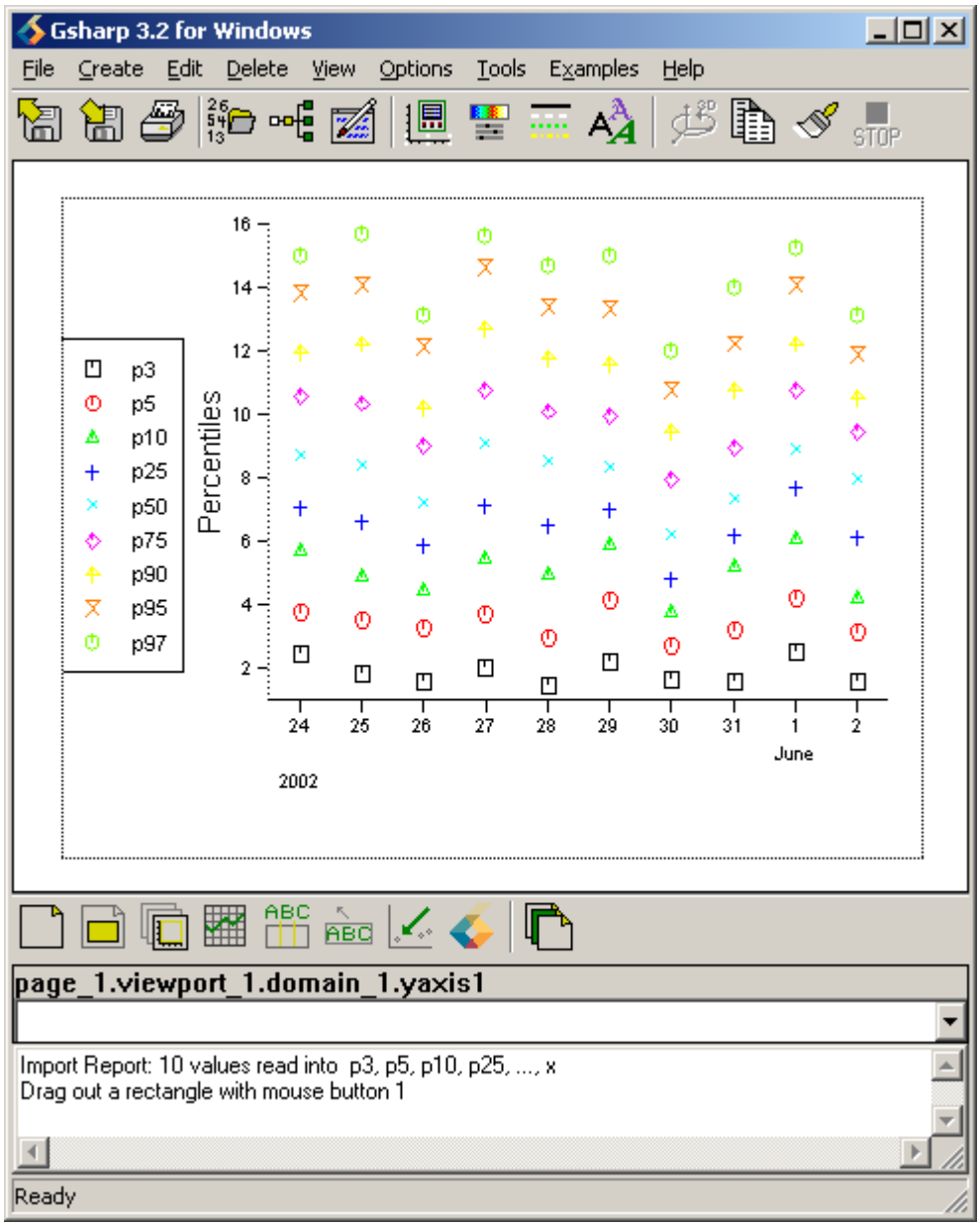


Figure V-9: Labelling the Y-Axis

The graph above shows percentiles over a period of ten days. The symbols show the values of the percentiles (p3, p5, p10, p25, p50, p75, p90, p95, p97) on each day, from 24 May 2002 to 2 June 2002.

5.1.2 2D Bar Graph

The dataset will be visualized using a bar graph so a clearer image of the percentiles over the time period can be obtained.

1. Import percs.dat file by selecting *Open…* from the *File* drop-down menu (Figure V-1).
2. Define a viewport (Section 2.1.1).
3. In Graph Editor select *Bar* for *Graph Type* (Section 2.1.2, Figure II-5).
4. Select *Data* and set *X* to x and *Y* to p97 (Section 5.1.1, Figure V-2).
5. Select OK and the graph will be (Figure V-10).

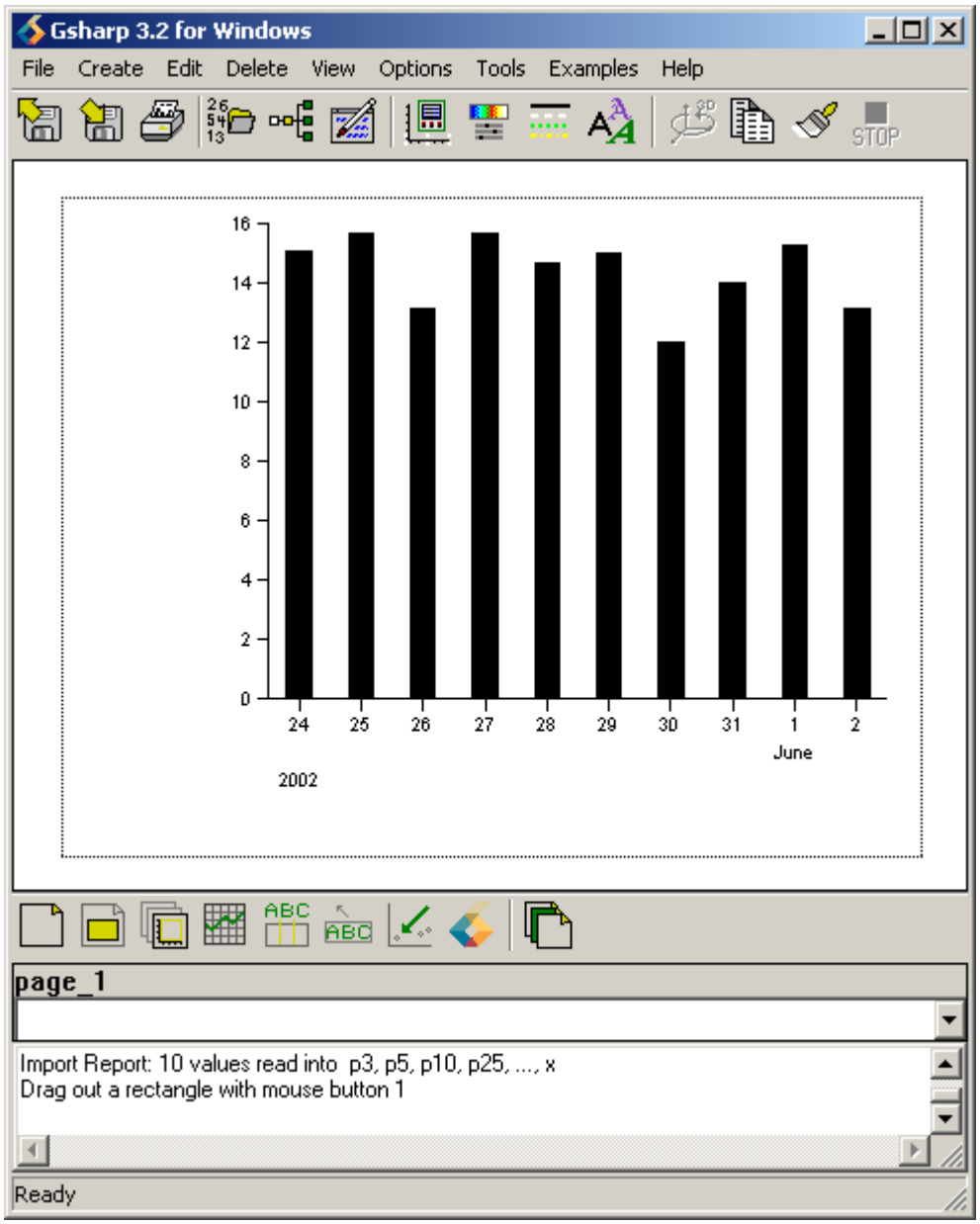


Figure V-10: Result for Variable p97

6. Repeat steps 3 to 5[49] but change *Y*[50] to p95 for the second graph, *Y* to p90 for the third graph until *Y* to p3 for ninth graph. The result will be (Figure V-11).

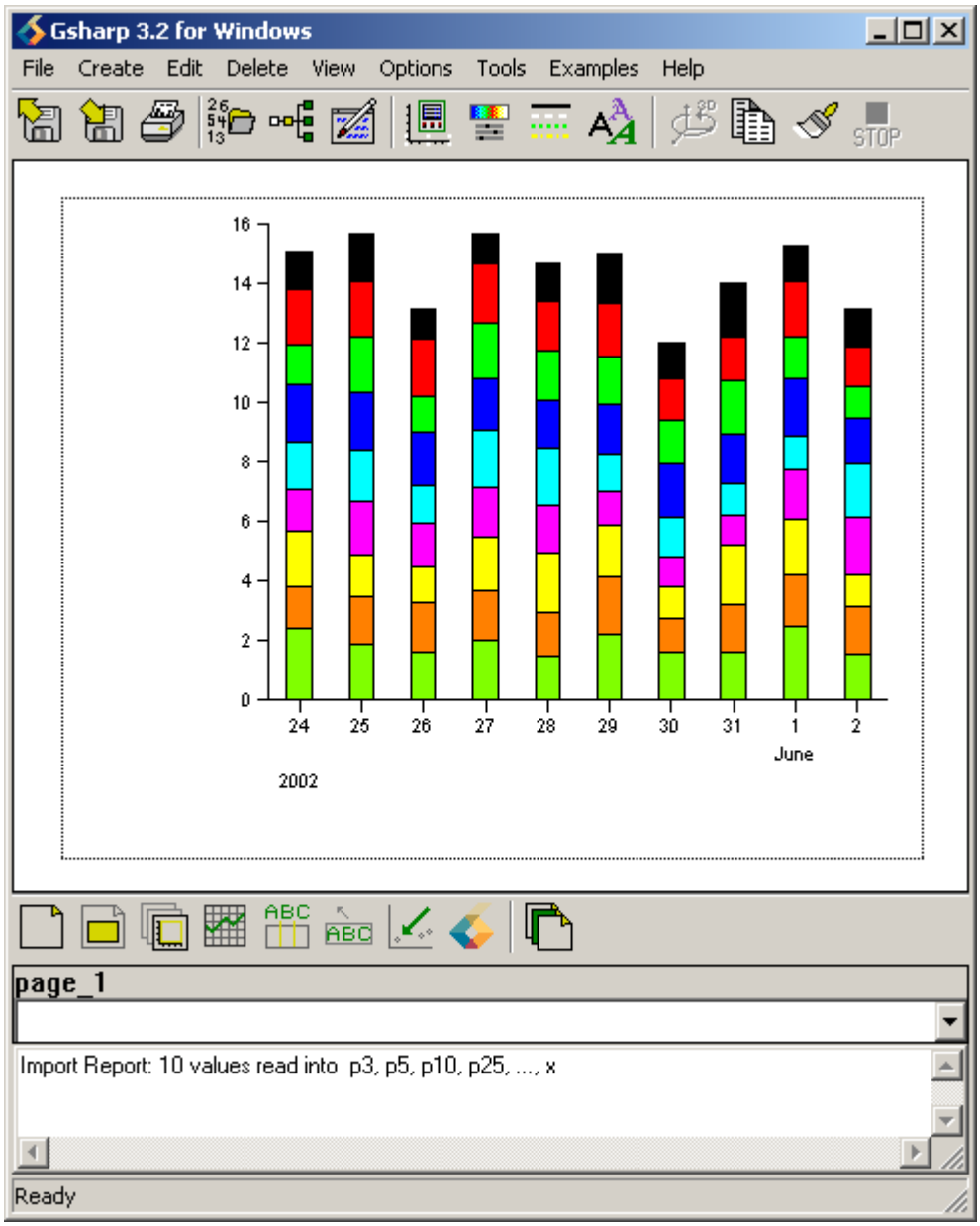


Figure V-11: Final Result of Bar Graph

[49] The previous graph must be selected before repeating steps 3-5.

[50] The value of Y is determined by the column headings in the percs.dat file (Appendix D, Figures D-1 and D-2).

7. Double click with the left mouse button on the y-axis (Section 2.1.4, Figure II-13) so that the Axis Editor appears (Section 2.1.4, Figure II-14).
8. Select *Text* and next to the box of *Text* enter Percentiles. Also set *Height* to 5 (Section 2.1.4, Figure II-15).
9. Select *OK* and the result will be (Figure V-12).

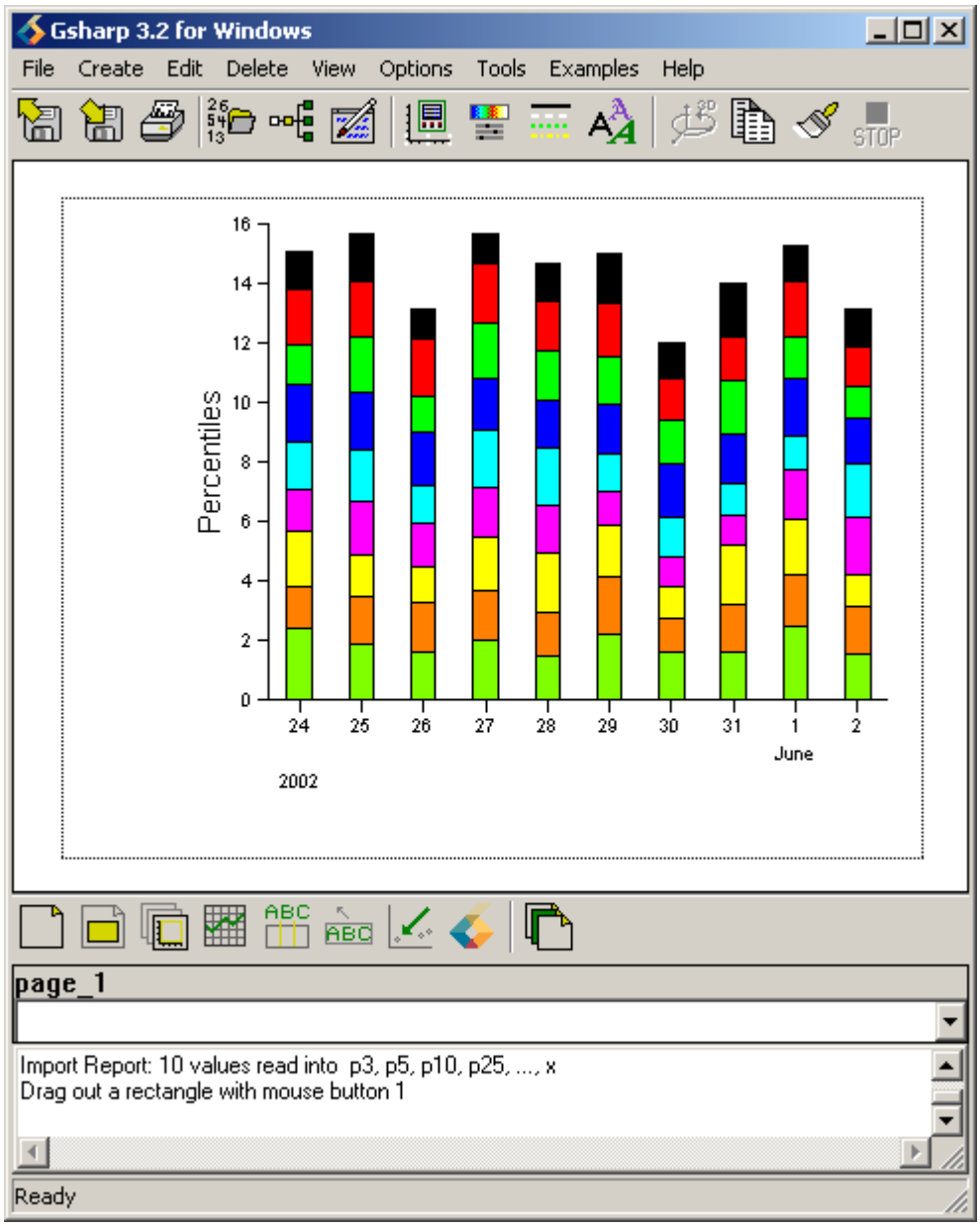


Figure V-12: Labelling the Y-Axis

10. Double click with the left mouse button on the x-axis (Section 2.1.4, Figure II-13) so that the Axis Editor appears (Section 2.1.4, Figure II-14).
11. Select *Text* and next to the box of *Text* enter Date. Also set *Height* to 5 (Section 2.1.4, Figure II-15).
12. Select *OK* and the result will be (Figure V-13).

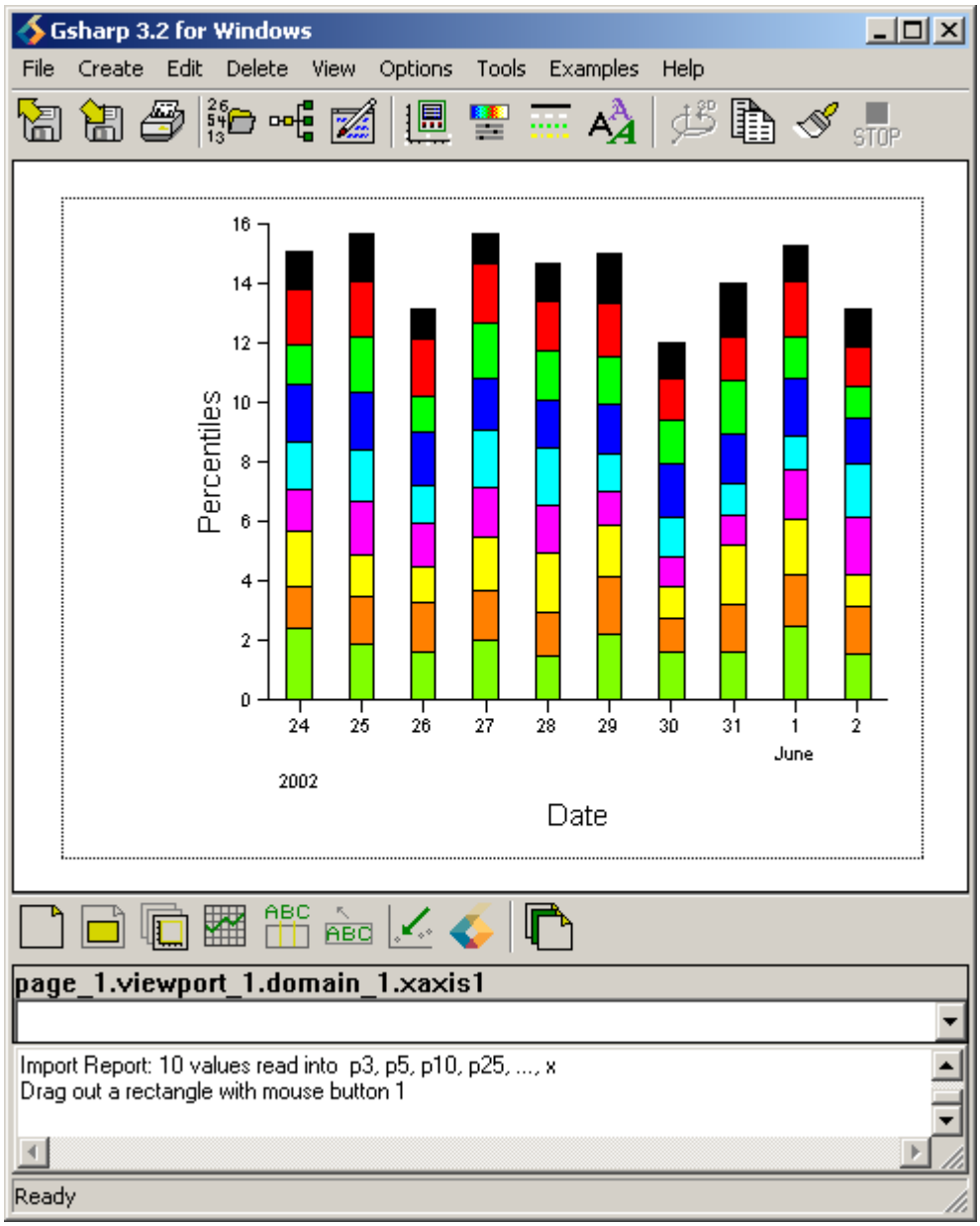


Figure V-13: Labelling the X-Axis

13. Select *Legend…* from the *Edit* drop-down menu (Section 5.1.1, Figure V-5).
14. In the Legend Editor select *Text* and set *Entry Height* to 6 (Section 5.1.1, Figure V-6).
15. Select *Controls* and set *Enabled* to On (Section 5.1.1, Figure V-7).
16. Select *OK* and the graph will be (Figure V-14).

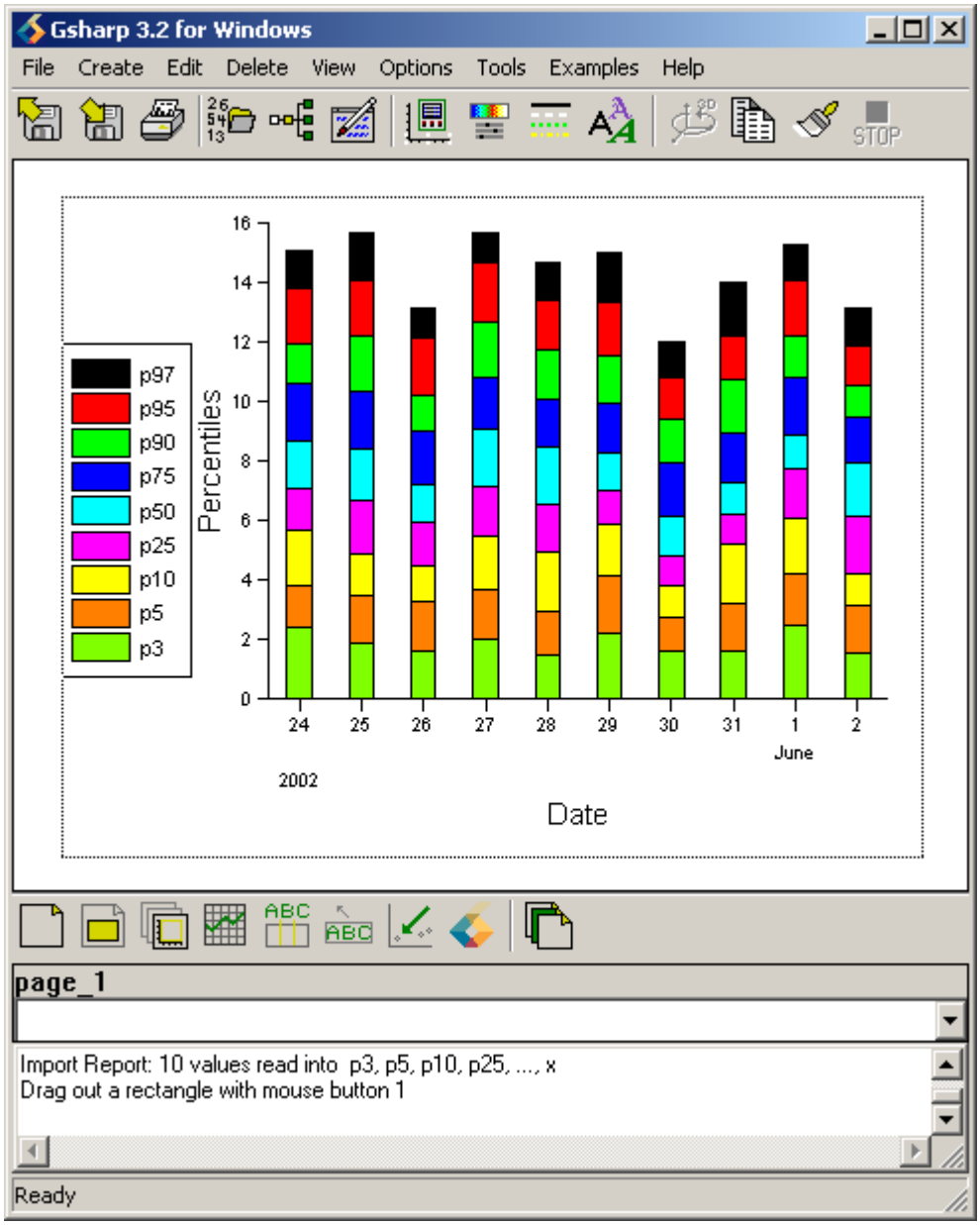


Figure V-14: Graph with Legend

This graph shows the percentiles for each day in a bar chart. Each percentile is represented by a different colour so the percentile change can be compared between dates.

5.1.3 2D Area Graph

The dataset will be visualized displaying the percentiles using a 2D Area graph.

1. Import percs.dat file by selecting *Open…* from the *File* drop-down menu (Figure V-1).
2. Define a viewport (Section 2.1.1).
3. In Graph Editor select *Area* for *Graph Type* (Section 2.1.2, Figure II-5).
4. Select *Data* and set *X* to x and *Y* to p97 (Section 5.1.1, Figure V-2).
5. Select OK and the graph will be (Figure V-15).

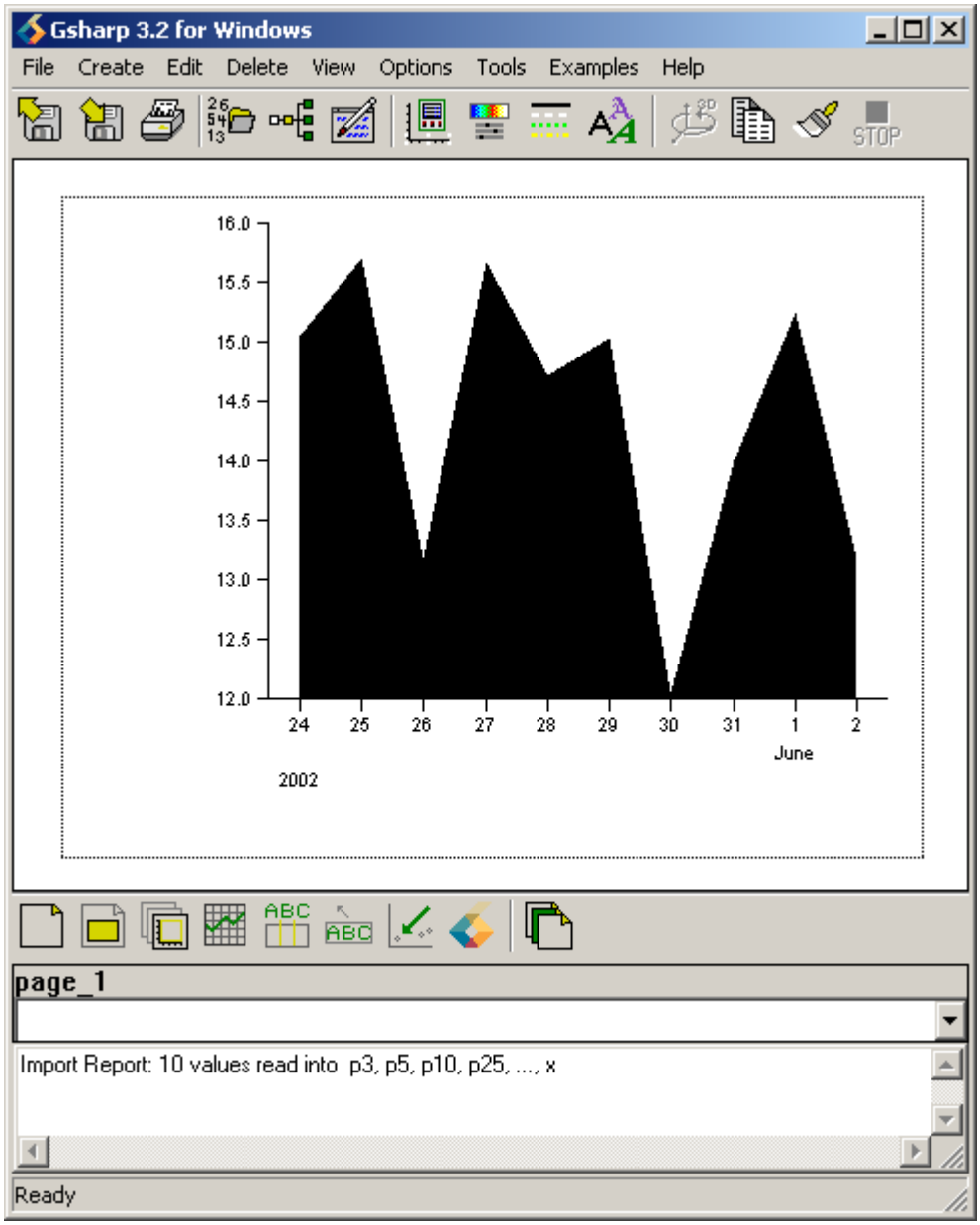


Figure V-15: Result for variable p97

6. Repeat steps 3 to 5[51] but change *Y*[52] to p95 for the second graph, *Y* to p90 for the third graph until *Y* to p3 for ninth graph. The result will be (Figure V-16).

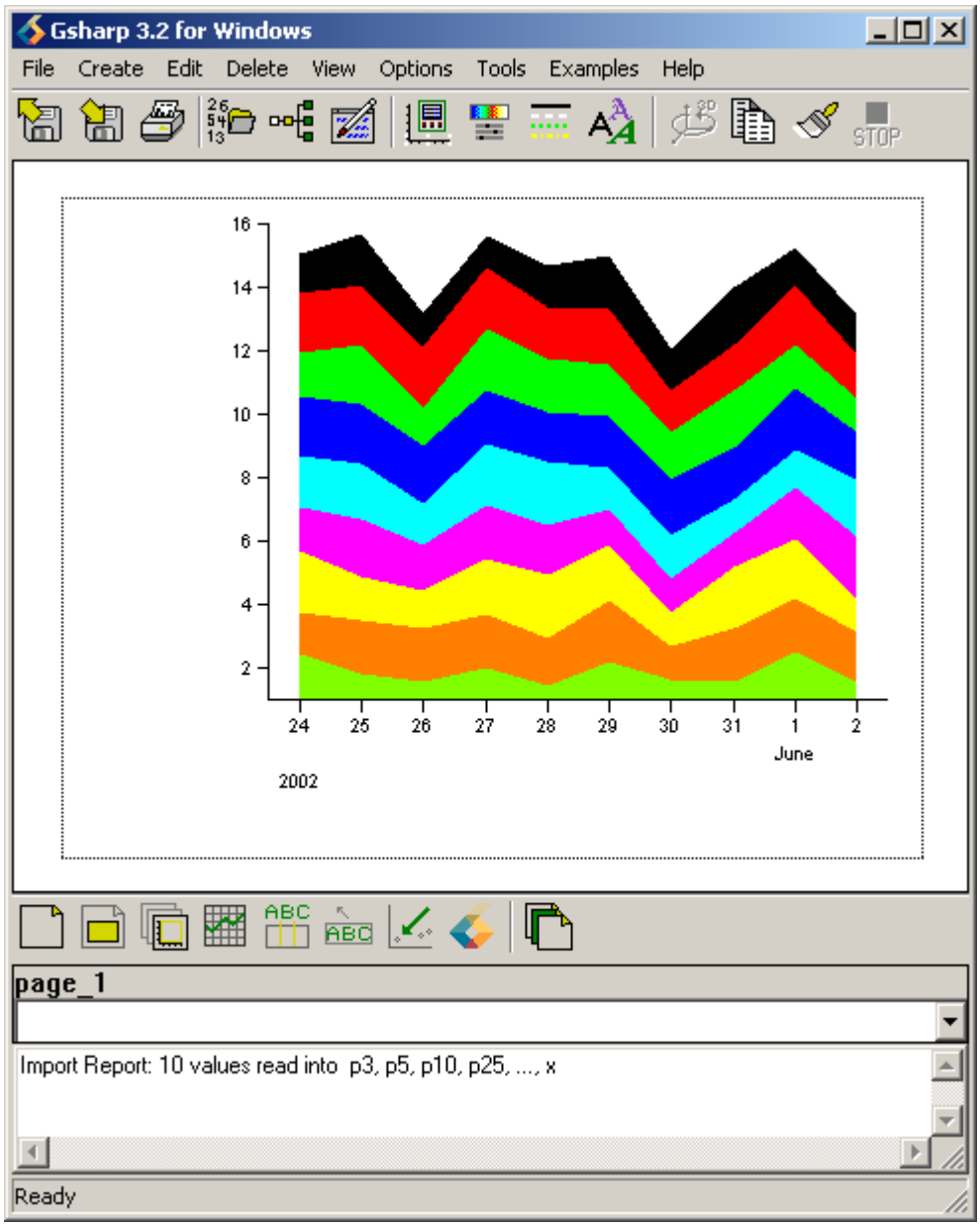


Figure V-16: Result Area

[51] The previous graph must be selected before repeating steps 3-5.

[52] The value of Y is determined by the column headings in the percs.dat file (Appendix D, Figures D-1 and D-2).

7. Double click with the left mouse button on the y-axis (Section 2.1.4, Figure II-13) so that the Axis Editor appears (Section 2.1.4, Figure II-14).
8. Select *Text* and next to the box of *Text* enter Percentiles. Also set *Height* to 5 (Section 2.1.4, Figure II-15).
9. Select *OK* and the result will be (Figure V-17).

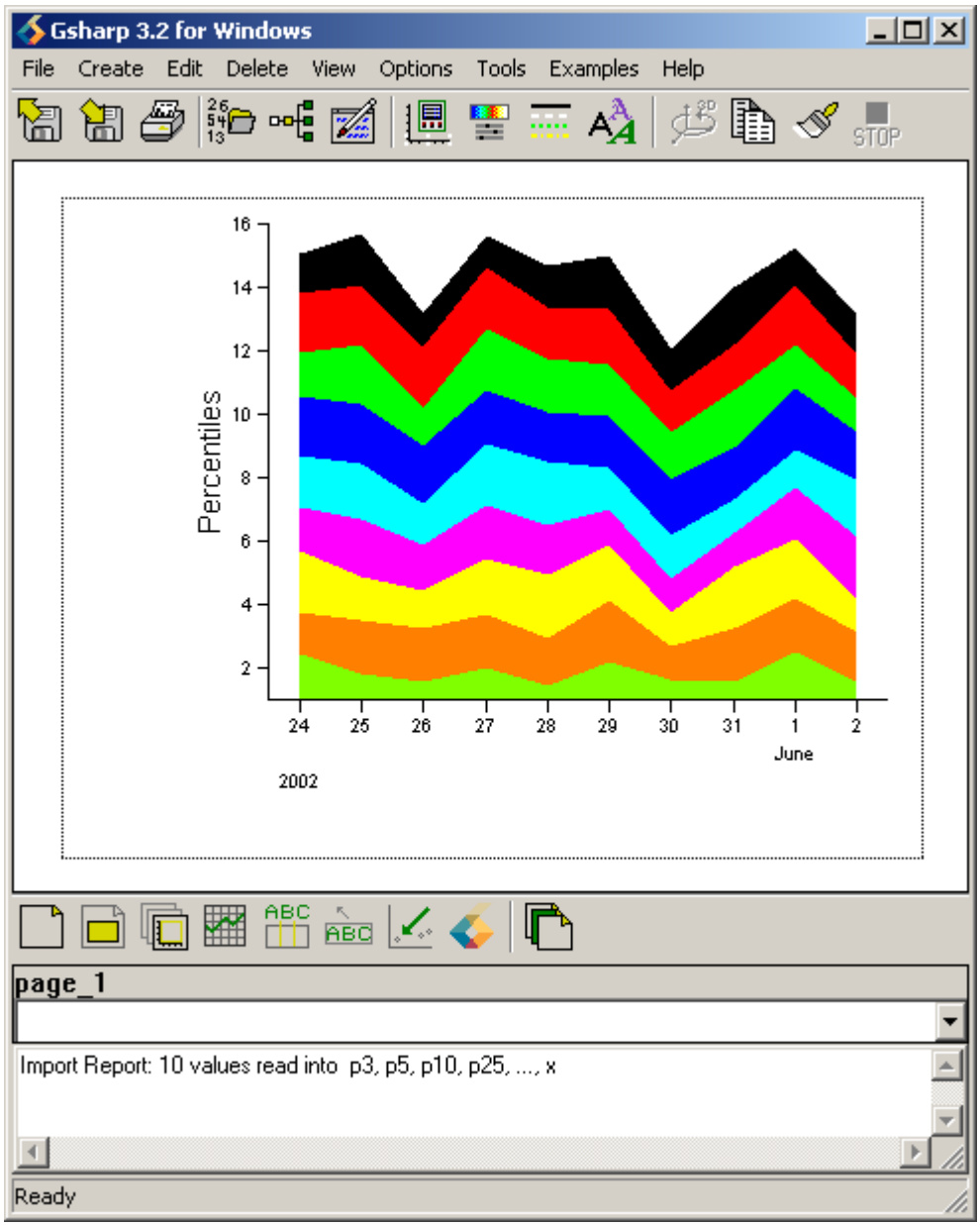


Figure V-17: Labelling the Y-Axis

10. Double click with the left mouse button on the x-axis (Section 2.1.4, Figure II-13) so that the Axis Editor appears (Section 2.1.4, Figure II-14).
11. Select *Text* and next to the box of *Text* enter Date. Also set *Height* to 5 (Section 2.1.4, Figure II-15).
12. Select *OK* and the result will be (Figure V-18).

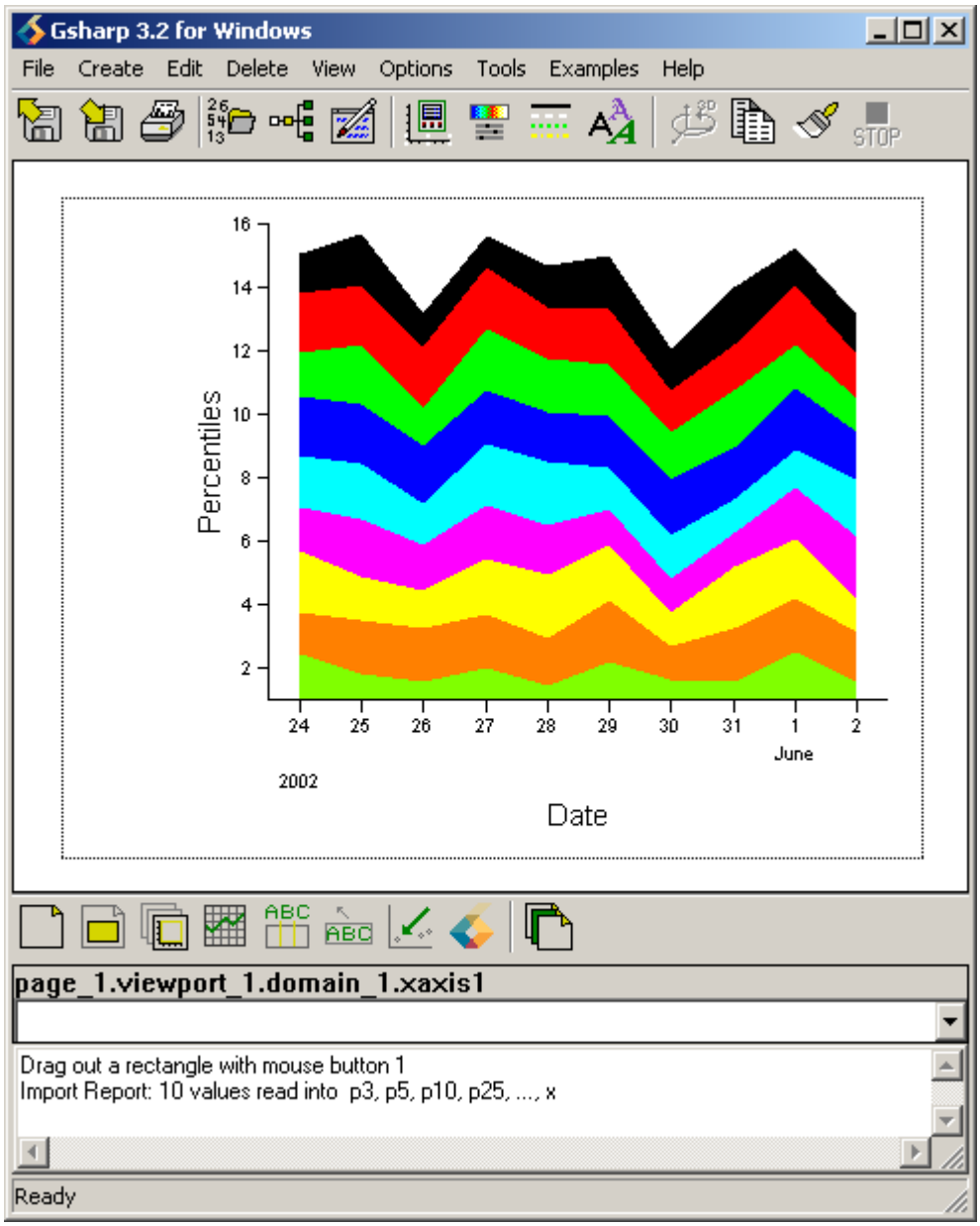


Figure V-18: Labelling the X-Axis

13. Select *Legend…* from the *Edit* drop-down menu (Section 5.1.1, Figure V-5).
14. In the Legend Editor select *Text* and set *Entry Height* to 6 (Section 5.1.1, Figure V-6).
15. Select *Controls* and set *Enabled* to On (Section 5.1.1, Figure V-7).
16. Select *OK* and the graph will be (Figure V-19).

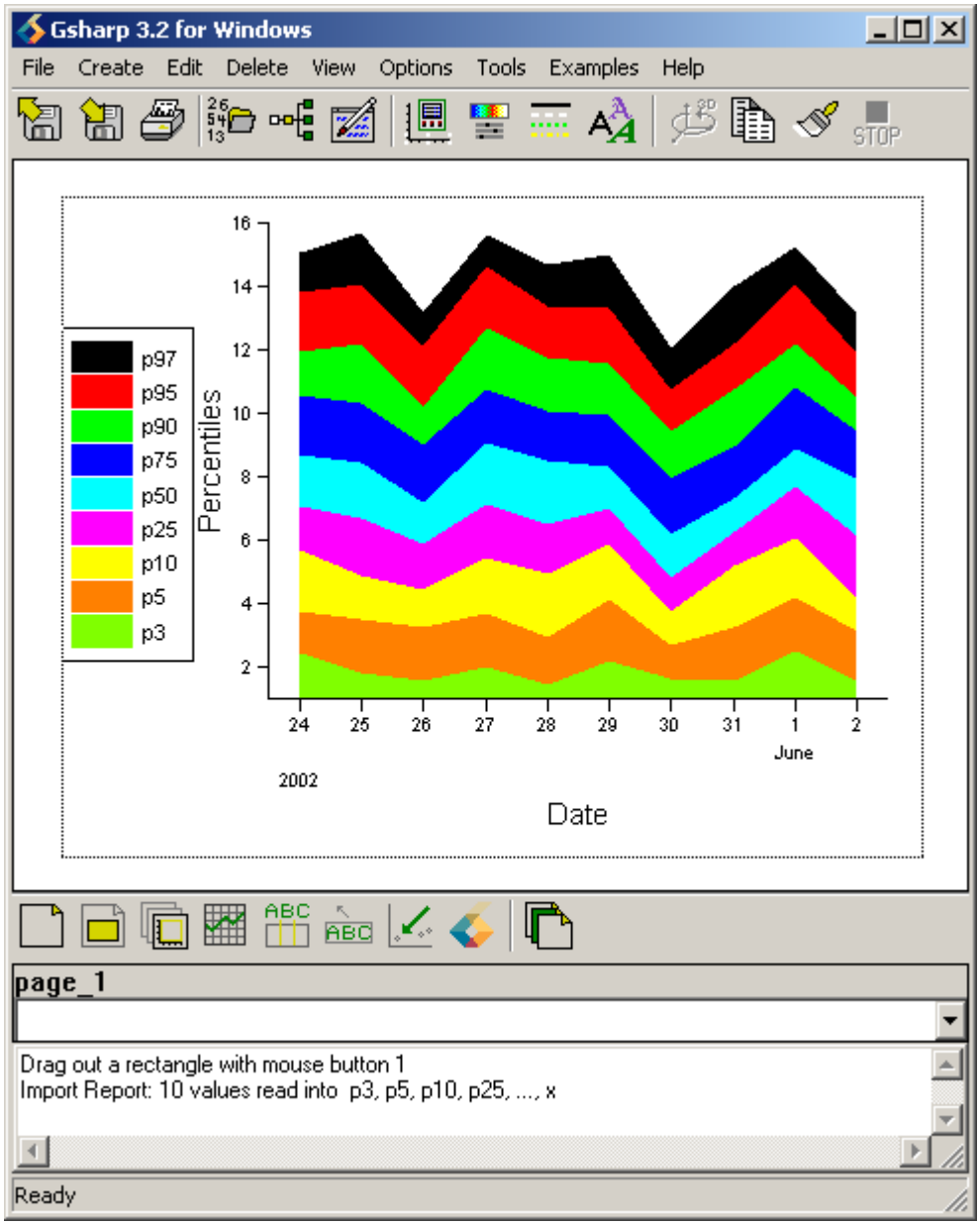


Figure V-19: Graph with Legend

5.1.4 Box Plot

The dataset will be visualized showing the percentiles as a box plot.

1. Import percs.dat file by selecting *Open…* from the *File* drop-down menu (Figure V-1).
2. Define a viewport (Section 2.1.1).
3. In Graph Editor select *Line Bar* for *Graph Type* (Section 2.1.2, Figure II-5).
4. Select *Data* and set *X* to x, *Y* to p97 and *Y Base* to p3 (Figure V-20).

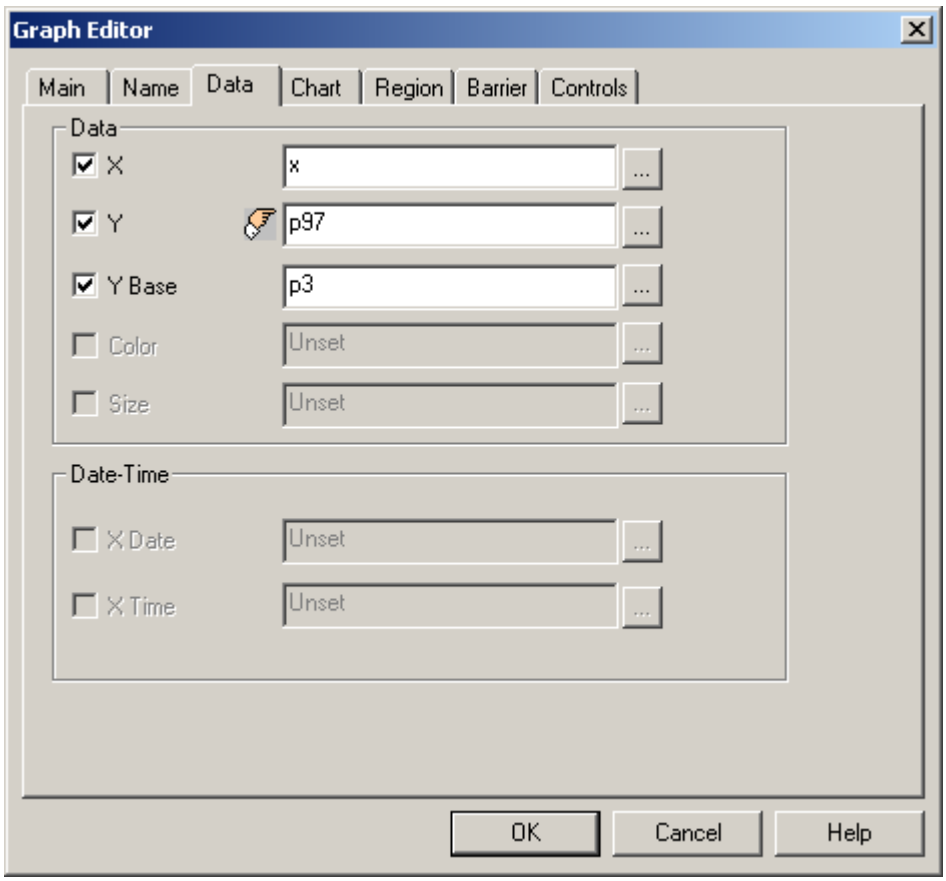


Figure V-20: Graph Editor

5. Select *Chart* from the Graph Editor (Figure V-21).

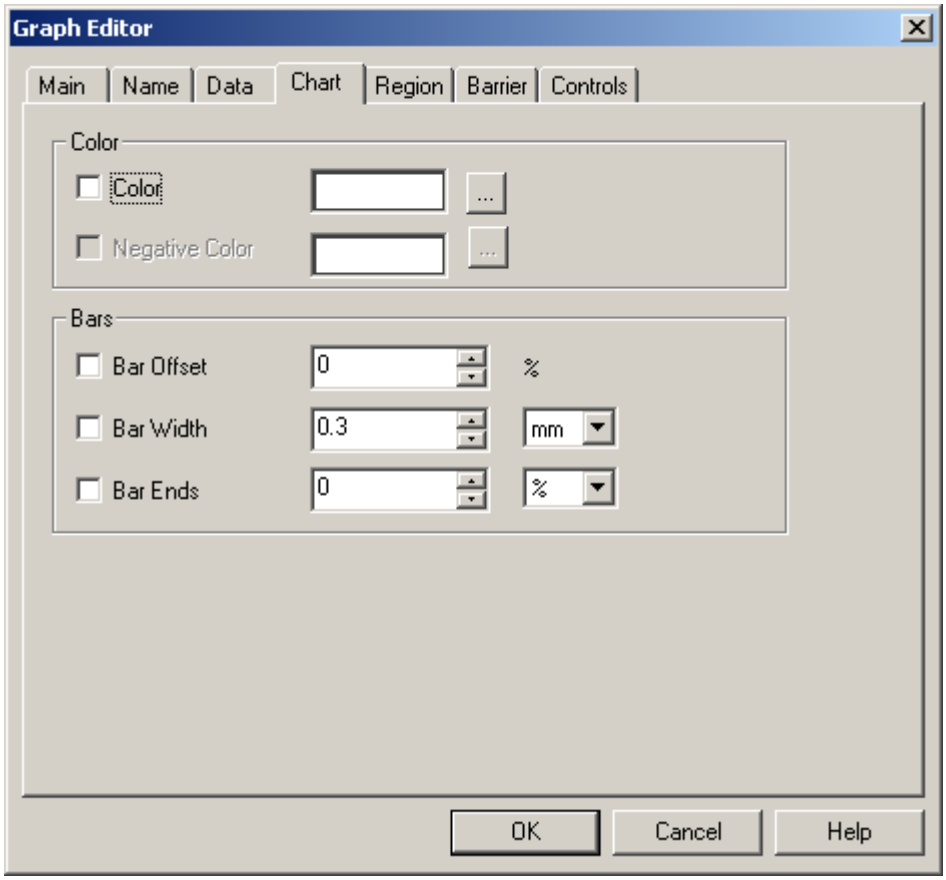


Figure V-21: Chart

6. Set *Bar Ends* to be 4 (Figure V-22).

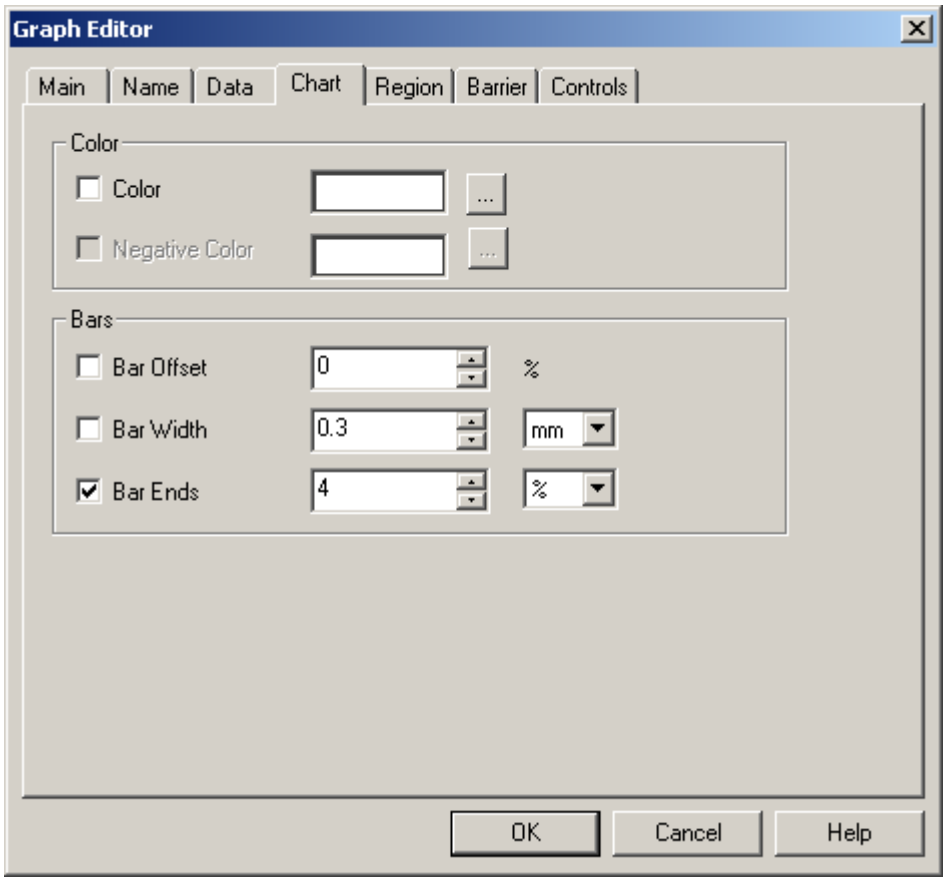


Figure V-22: Bar Ends

7. Select *OK* and the result will be (Figure V-23).

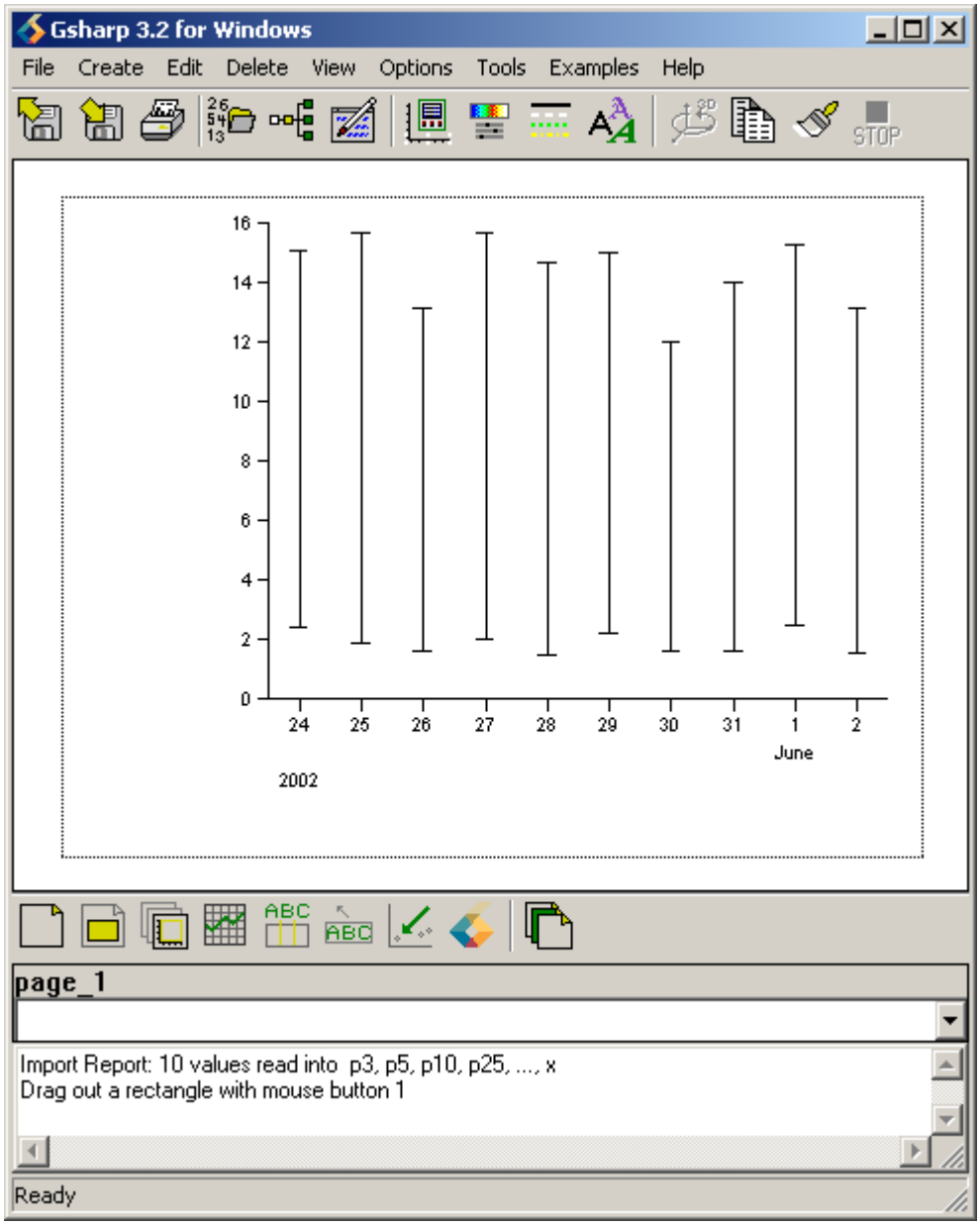


Figure V-23: Maximum and Minimum Values

8. In Graph Editor select *Bar* for *Graph Type* (Section 2.1.2, Figure II-5).
9. Select *Data* and set *X* to x, *Y* to p75 and *Y Base* to p25 (Figure V-20).
10. Select Chart and set *Color* to White (Figure V-24).

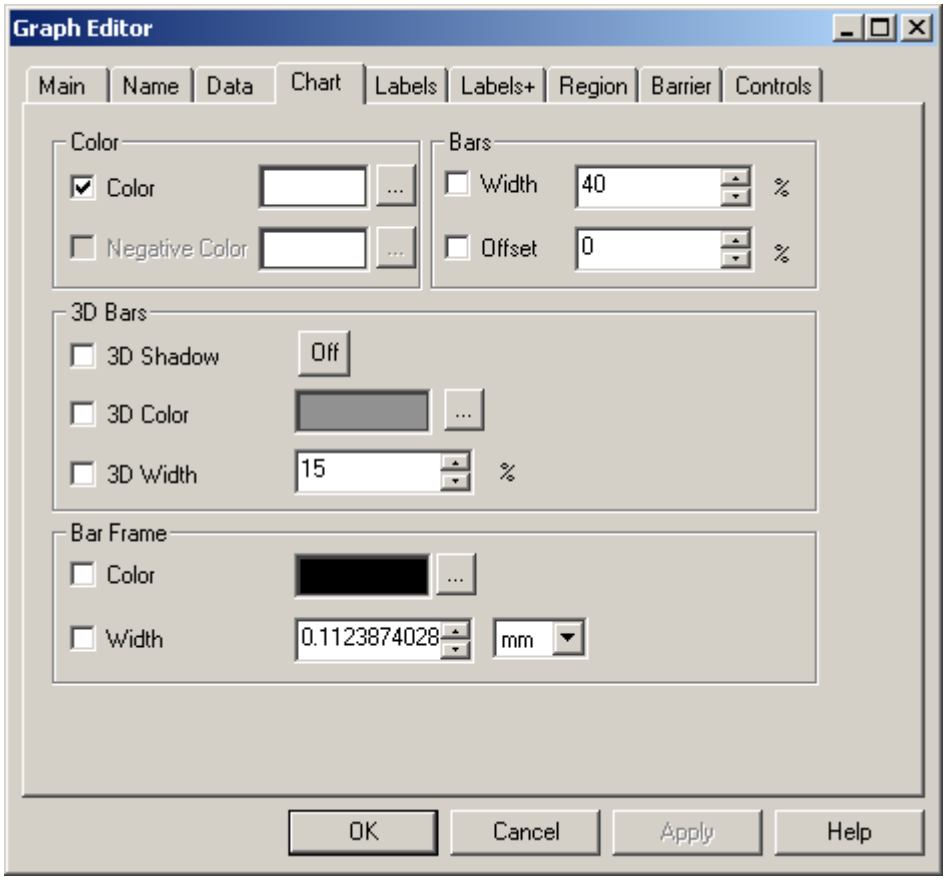


Figure V-24: Color

11. Select *OK* and the graph will be (Figure V-25).

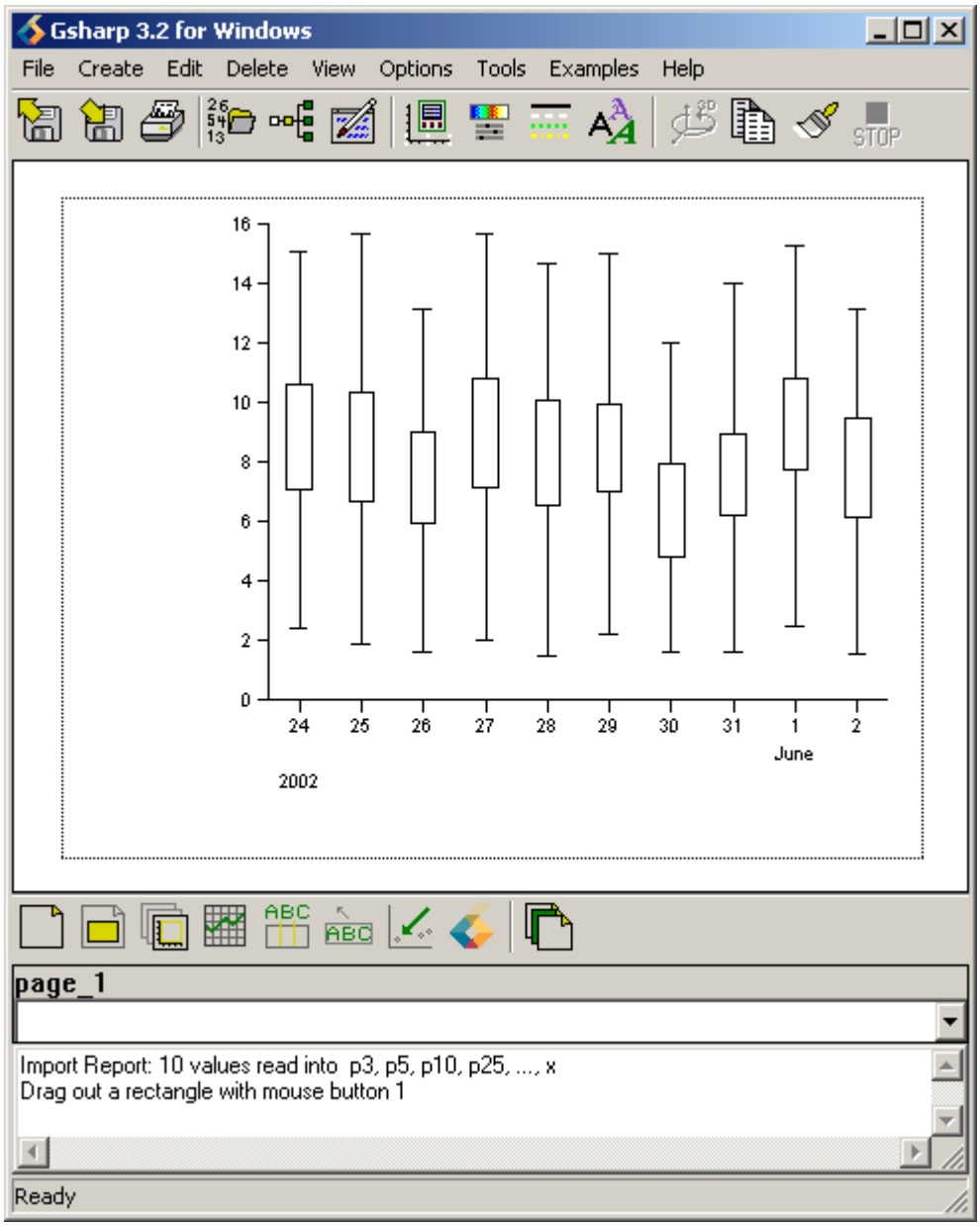


Figure V-25: Lower and Upper Quartiles

12. In Graph Editor select *Line Bar* for *Graph Type* (Section 2.1.2, Figure II-5).
13. Select *Data* and set *X* to x, *Y* to p50 and *Y Base* to p50 (Figure V-20).
14. Select *Chart* from the Graph Editor, set *Bar Ends* to be 4 (Figure V-21).
15. Set *Color* to Black (Figure V-24).
16. Select *OK* and the graph will be (Figure V-26).

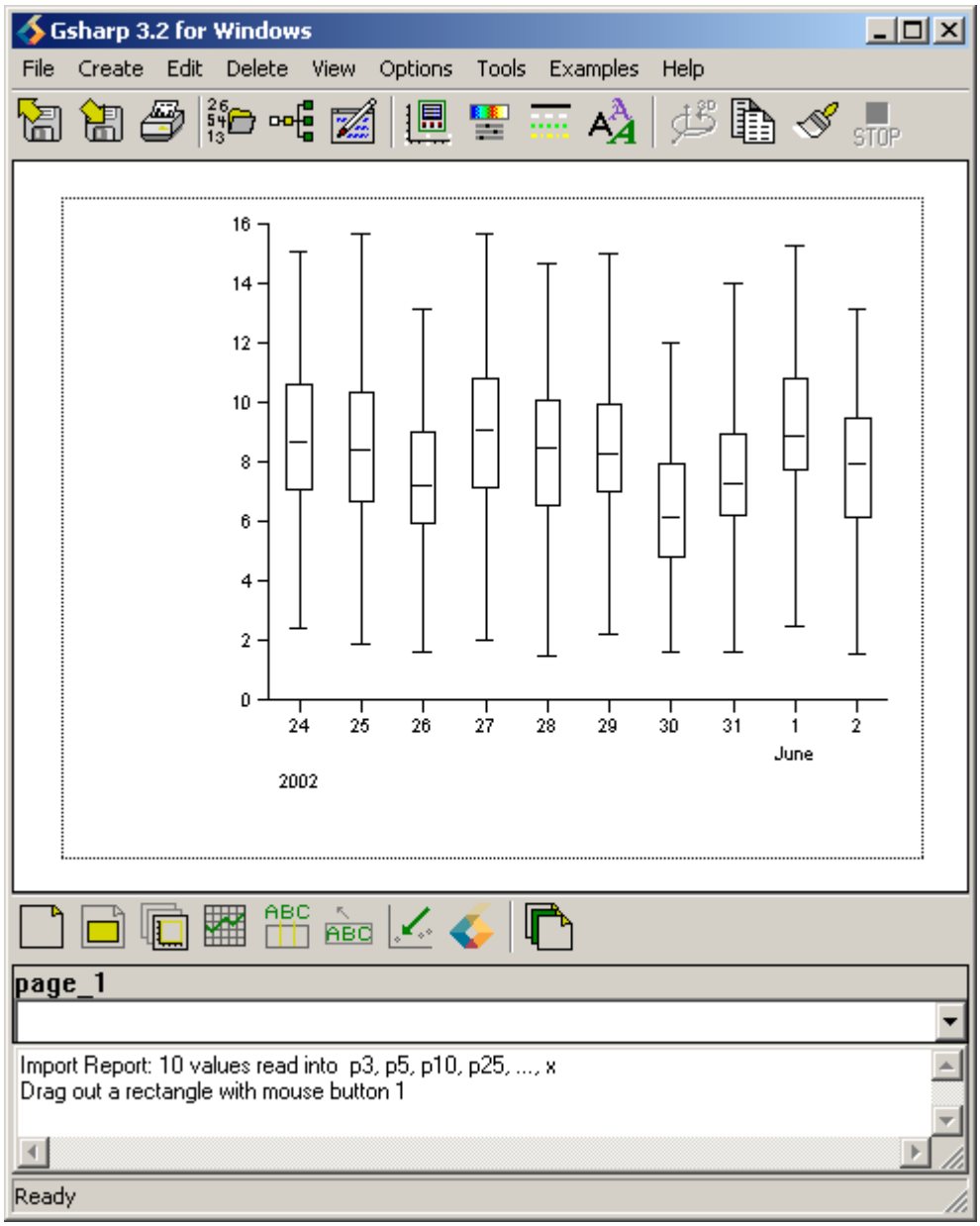


Figure V-26: Mean Values

17. Double click with the left mouse button on the y-axis (Section 2.1.4, Figure II-13) so that the Axis Editor appears (Section 2.1.4, Figure II-14).
18. Select *Text* and next to the box of *Text* enter Percentiles. Also set *Height* to 5 (Section 2.1.4, Figure II-15).
19. Select *OK* and the result will be (Figure V-27).

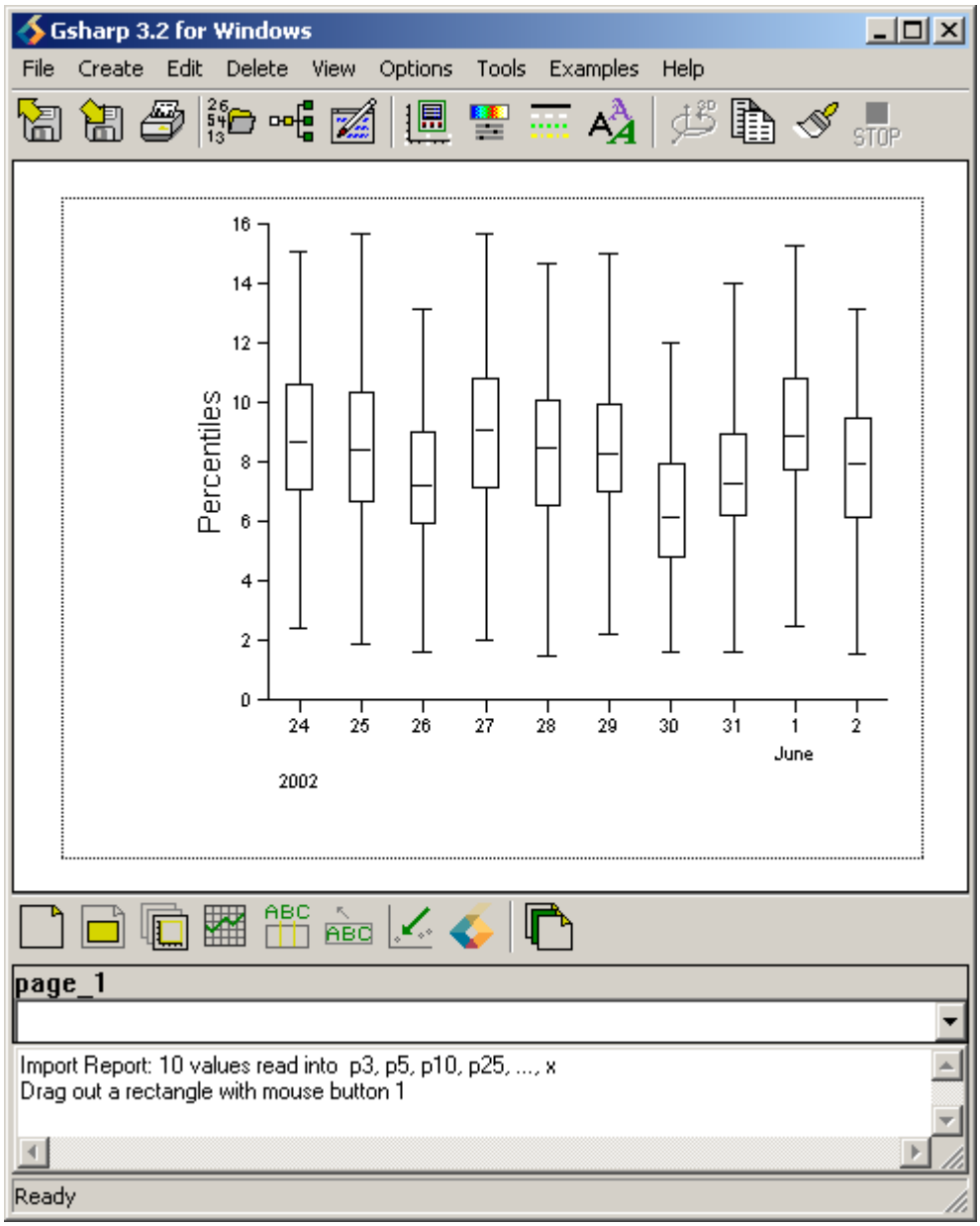


Figure V-27: Labelling the Y-Axis

20. Double click with the left mouse button on the x-axis (Section 2.1.4, Figure II-13) so that the Axis Editor appears (Section 2.1.4, Figure II-14).
21. Select *Text* and next to the box of *Text* enter Date. Also set *Height* to 5 (Section 2.1.4, Figure II-15).
22. Select *OK* and the result will be (Figure V-28).

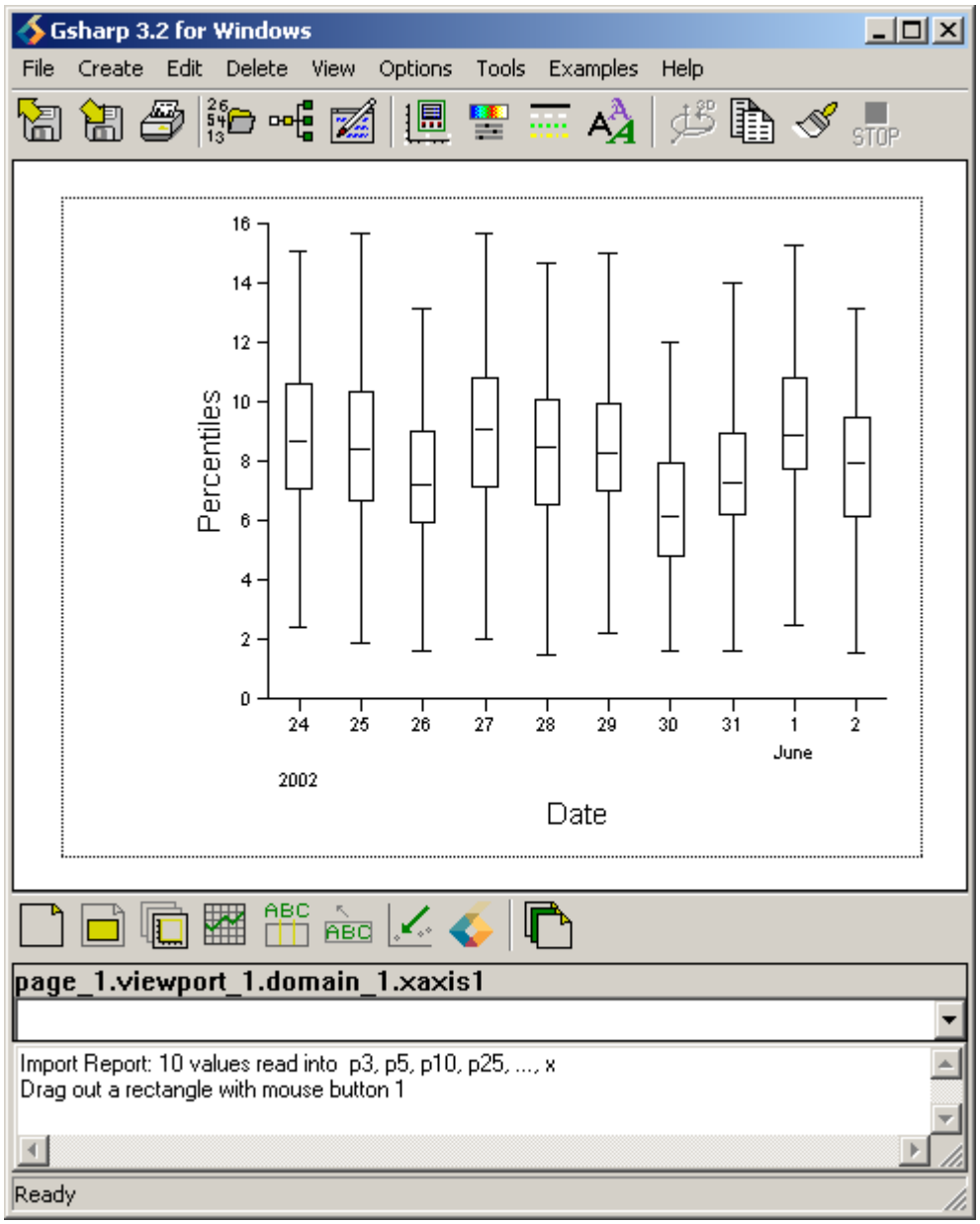


Figure V-28: Labelling the X-Axis

6 Viewing Percentage of Longitude and Latitude Points

In this chapter the task is to visualize the various percentages in each point of longitude and latitude over the UK.

The file scores.dat[53] contains four variables, which are x, y, t1 and t2. x represents the latitude over UK, y represents the longitude over UK and t1, t2 are the percentage values for each point.

[53] Courtesy of John Stringer, AVS UK. Refer to Appendix E, Figures E-1 and E-2, for descriptions of the file.

6.1 Choosing the Best Graph

1. Select *Open…* from the *File* drop-down menu to import a file (Figure VI-1).

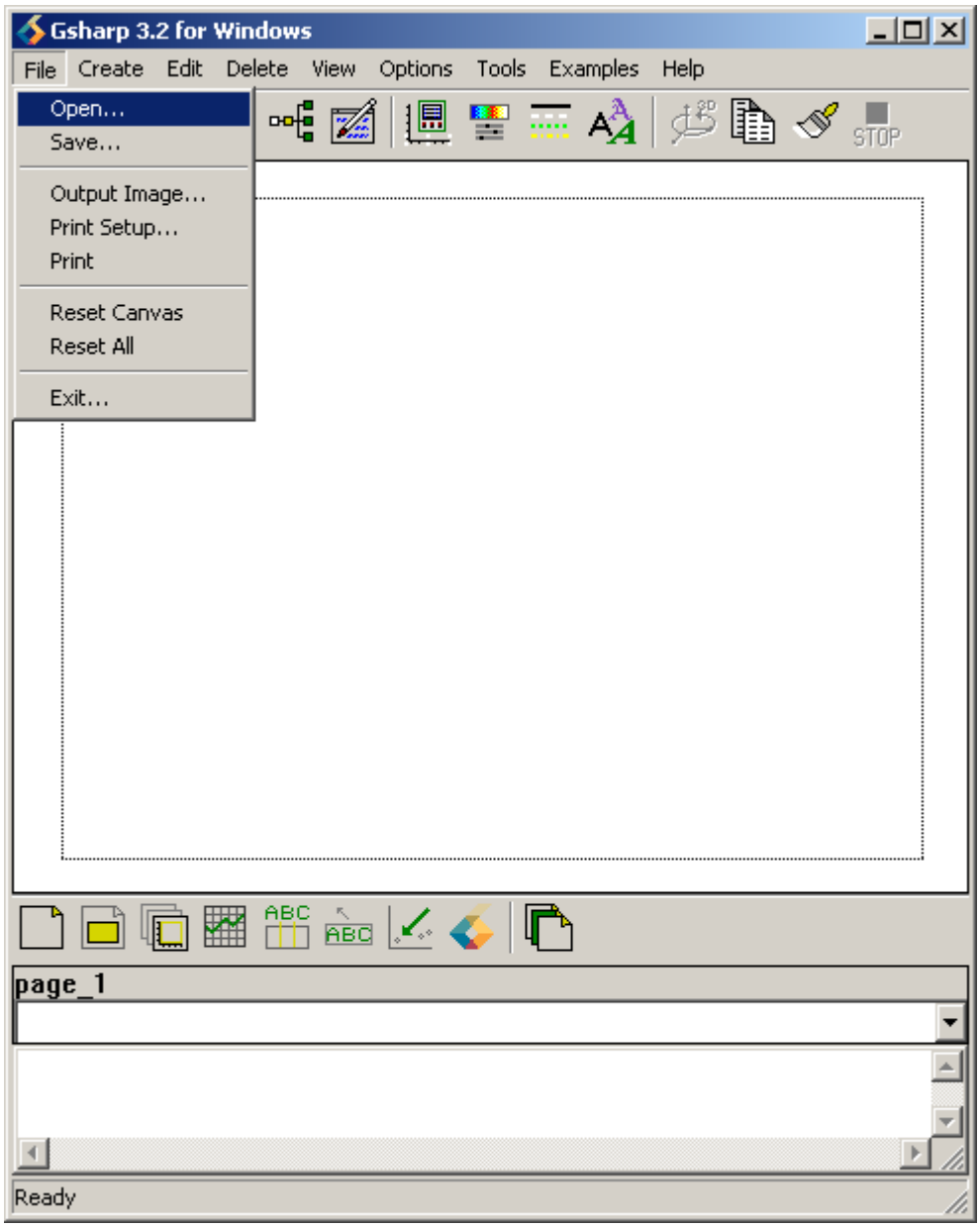


Figure VI-1: Importing File

2. Define a viewport (Section 2.1.1).
3. Select *Graph…* from the *Create* drop-down menu (Section 2.1.2, Figure II-3).

6.1.1 2D Scatter Graph for t1

In this section, 2 scatter graphs will be visualized - one for each percentage values (one graph for t1 and one for t2). This will show the pattern of the final graph.

4. In Graph Editor select *Scatter* for *Graph Type* (Section 2.1.2, Figure II-5).
5. Select *Data* and set *X* to x, *Y* to y and *Color* to t1 (Figure VI-2).

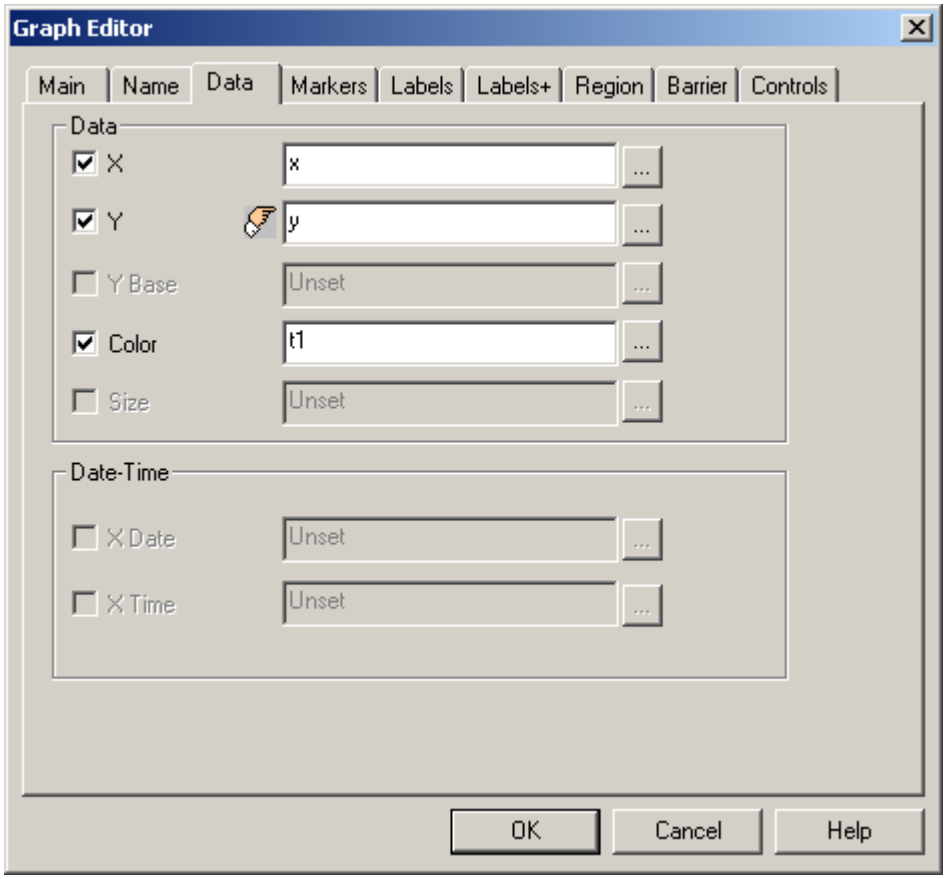


Figure VI-2: Setting Data Values

6. Select *OK* and the result will be (Figure VI-3).

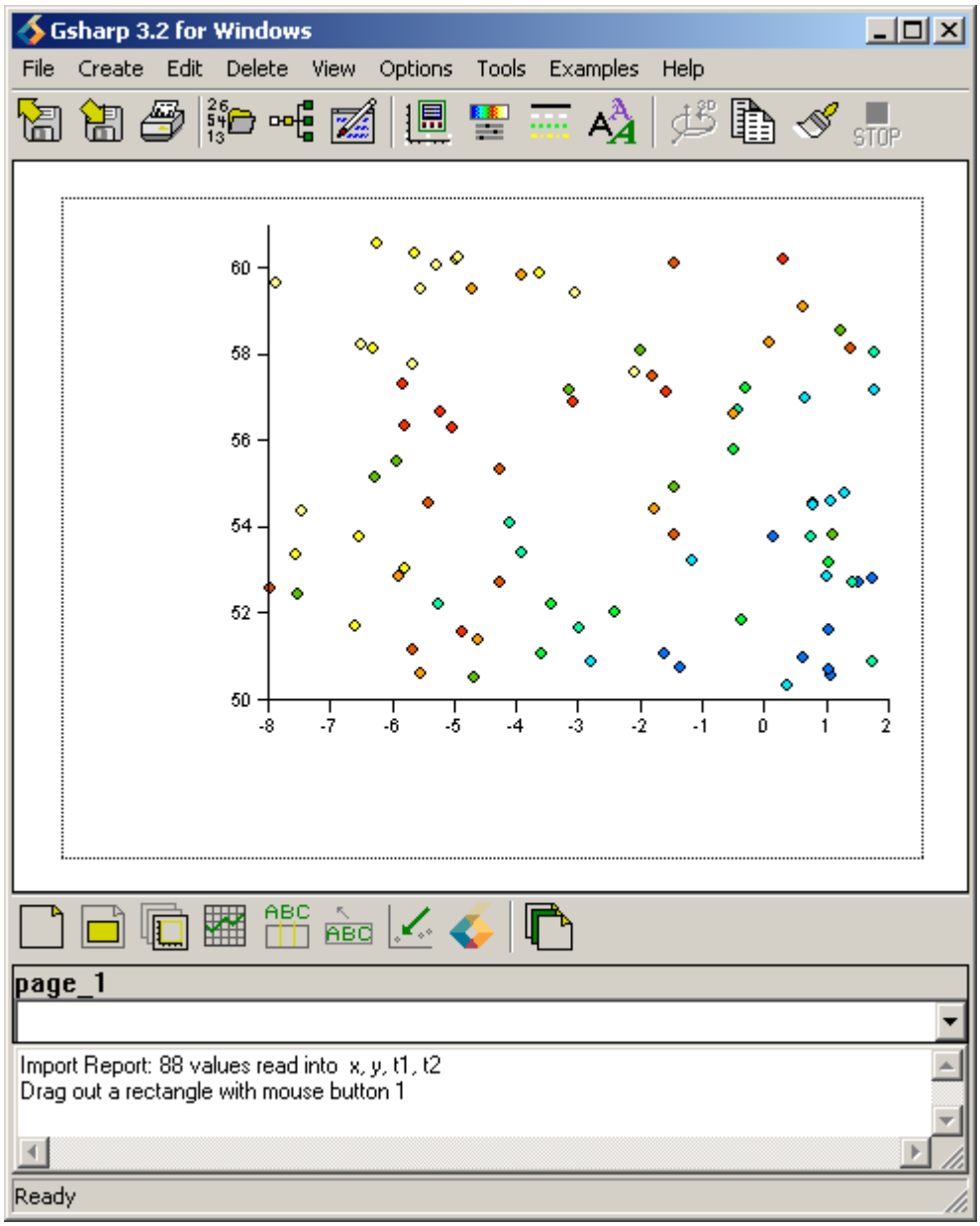


Figure VI-3: Final Graph for Variable t1

7. Select *Legend*... from the *Edit* drop-down menu (Figure VI-4).

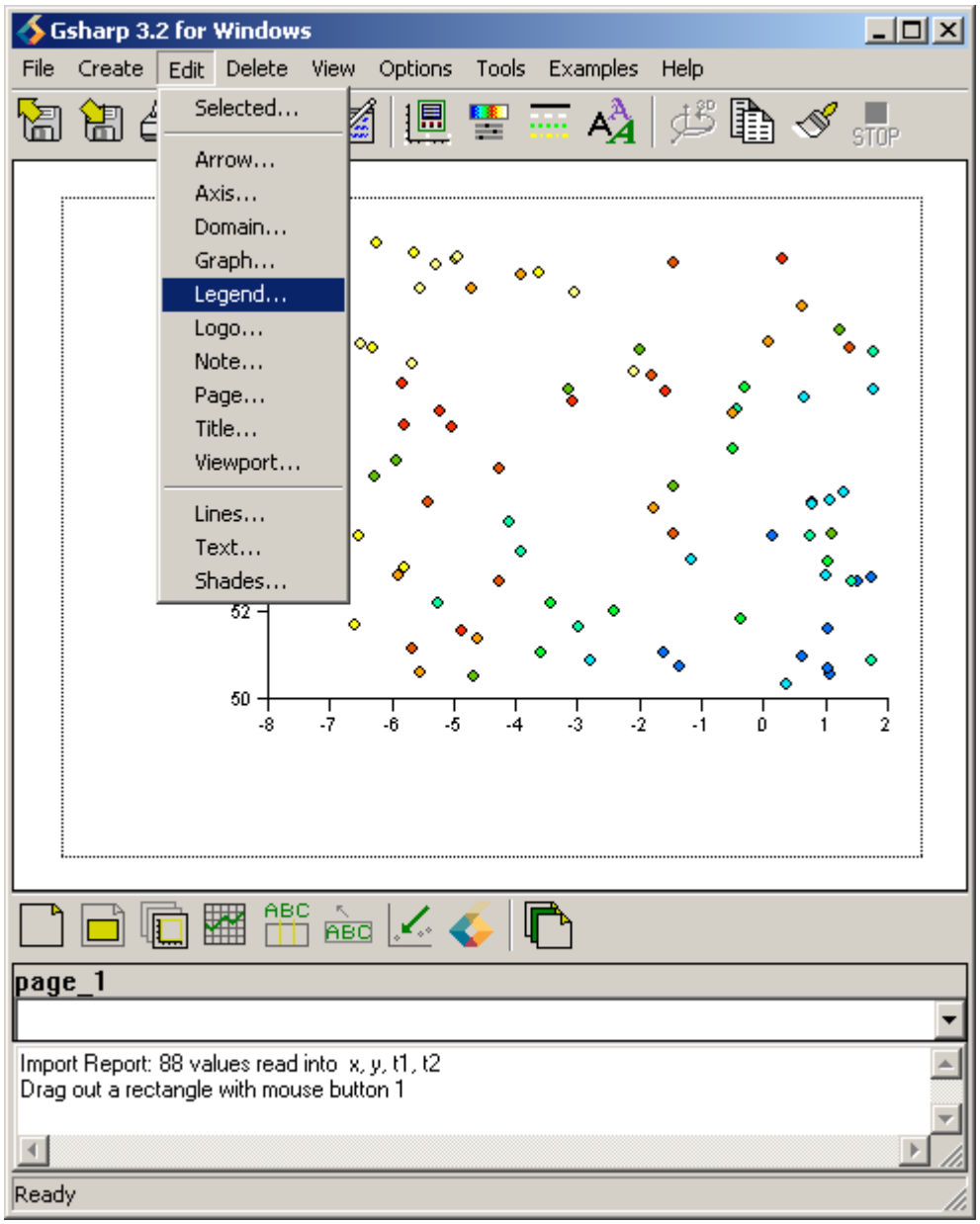


Figure VI-4: Editing the Legend

8. In the Legend Editor select *Text* and set *Entry Height* to 6 (Figure VI-5).

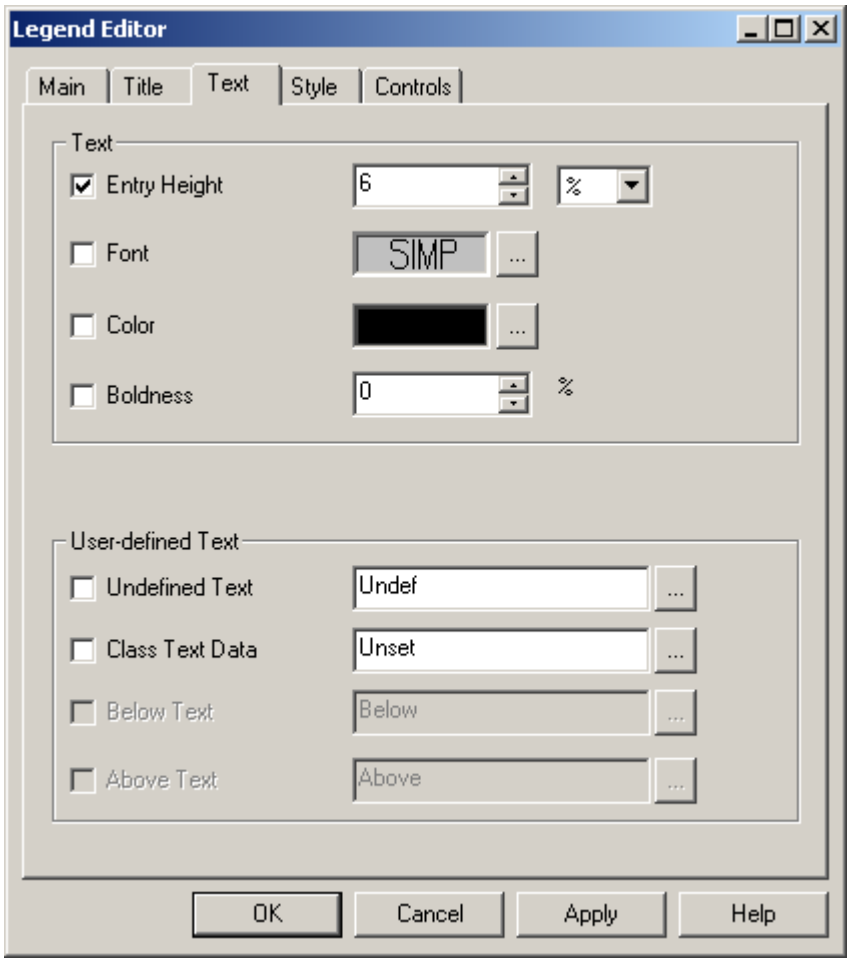


Figure VI-5: Setting Entry Height

9. Select *Controls* and set *Enabled* to On (Figure VI-6).

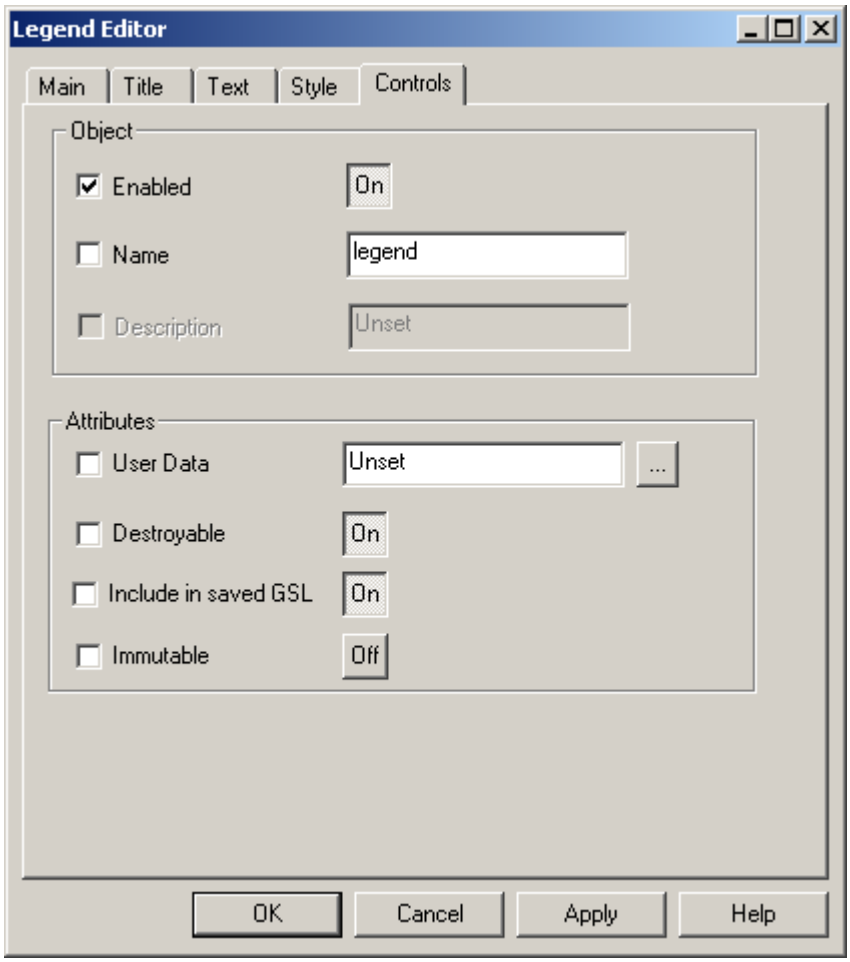


Figure VI-6: Enable the Legend

10. Select *OK* and the result will be (Figure VI-7).

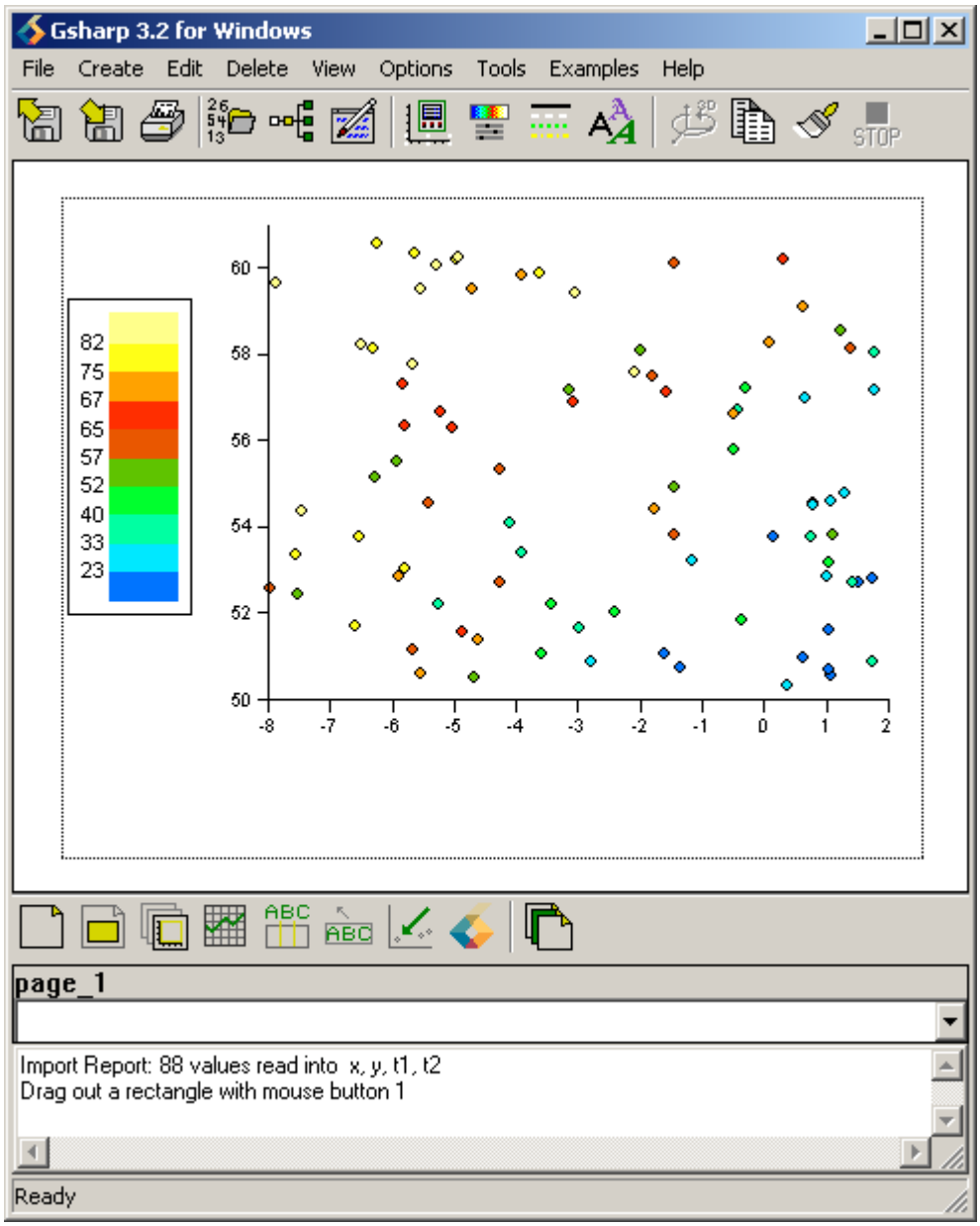


Figure VI-7: Result With Legend

11. Double click on the y-axis and the Axis Editor will appear (Figure VI-8).

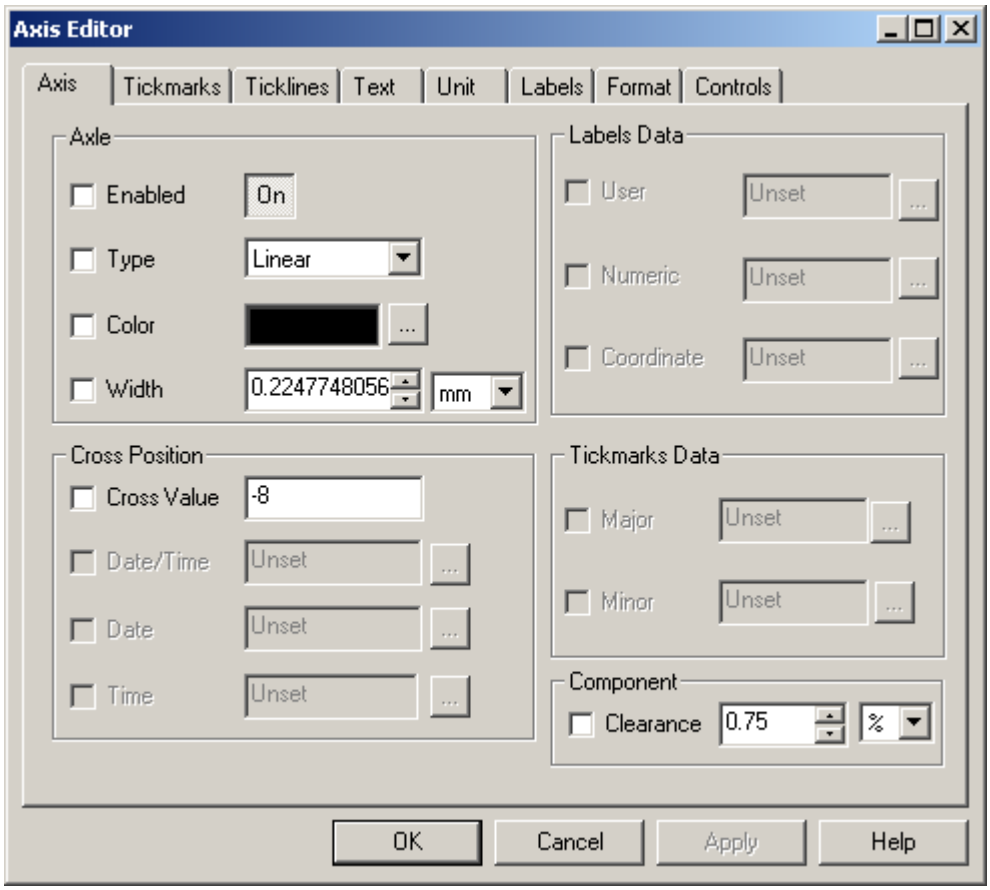


Figure VI-8: Axis Editor

12. In the Axis Editor select *Text* and set *Text* to Latitude and *Height* to 5 (Figure VI-9).

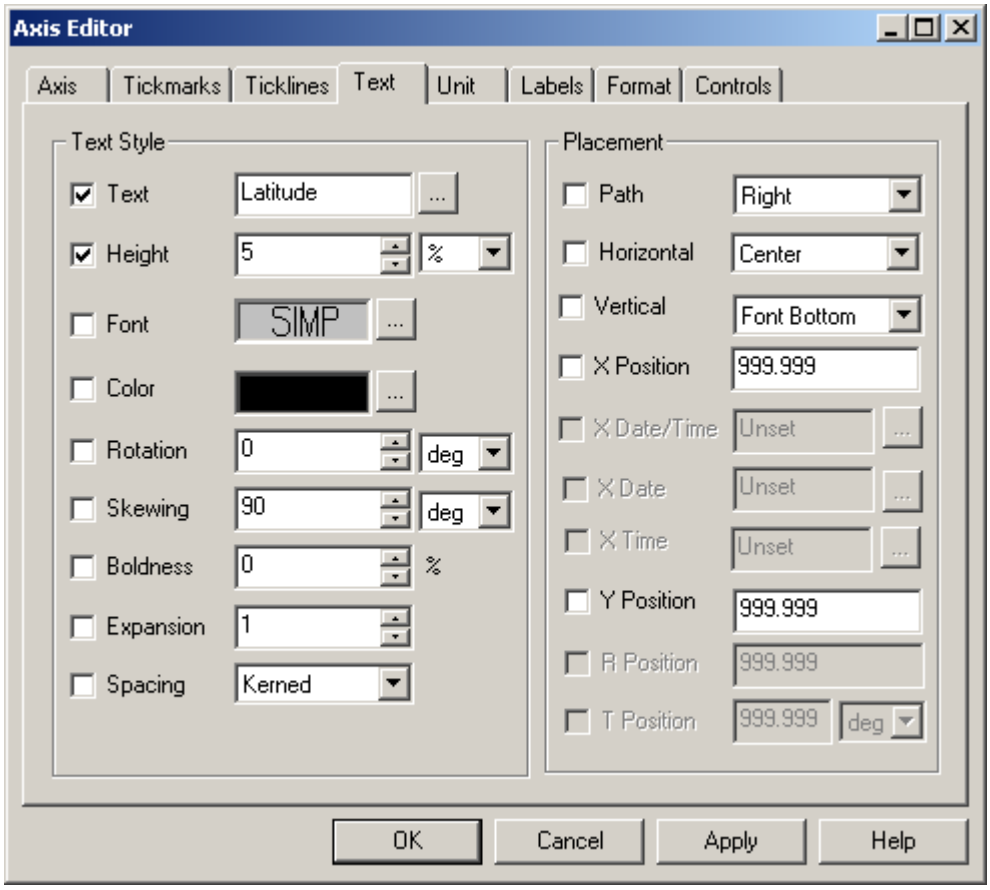


Figure VI-9: Setting Text for the Y-Axis

13. Select *OK* and the result will be (Figure VI-10).

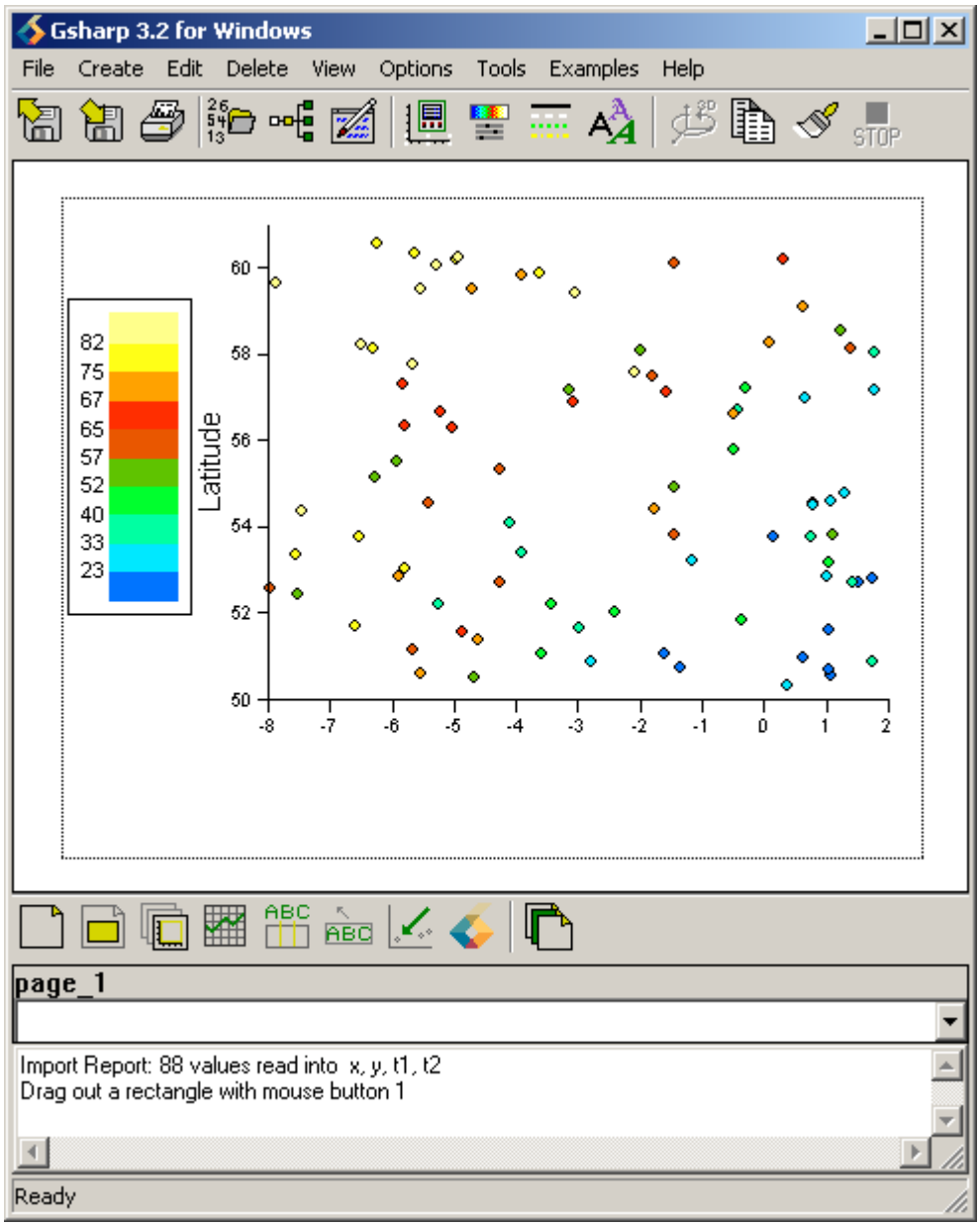


Figure VI-10: Result of the Y-Axis

14. Repeat steps 11-13 for the x-axis. The only thing to be changed is to set *Text* to Longitude. Select *OK* and the result will be (Figure VI-11).

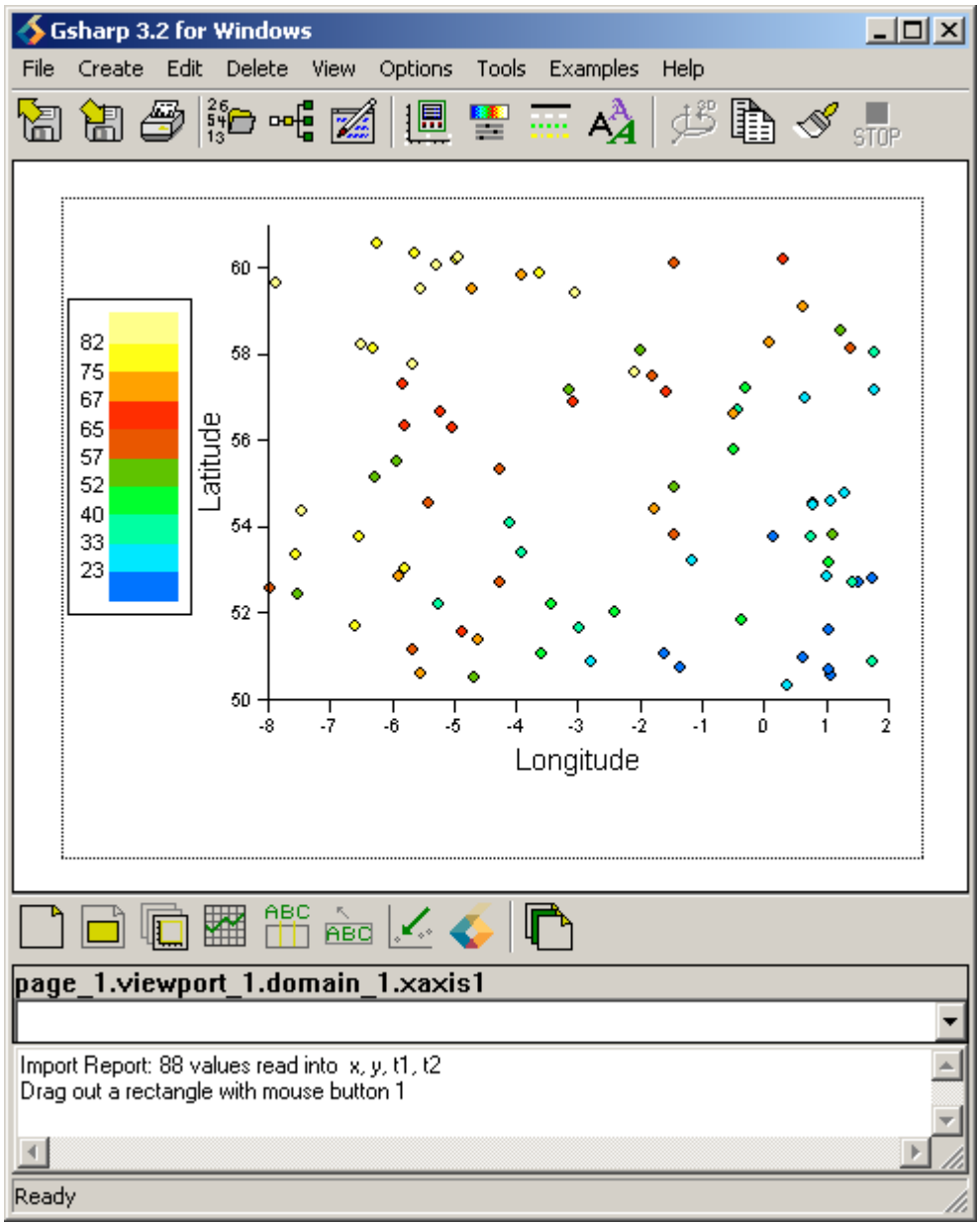


Figure VI-11: Result of the X-Axis

6.1.2 2D Scatter Graph for t2

This section contains the second 2D scatter graph which is going to show the visualization of the t2 percentage value.

1. Change page by selecting this icon in the icon toolbar[54].
2. Repeat steps 1-14 from Sections 6.1 and 6.1.1 but when setting data values set *Colour* to t2. The result will be (Figure VI-12).

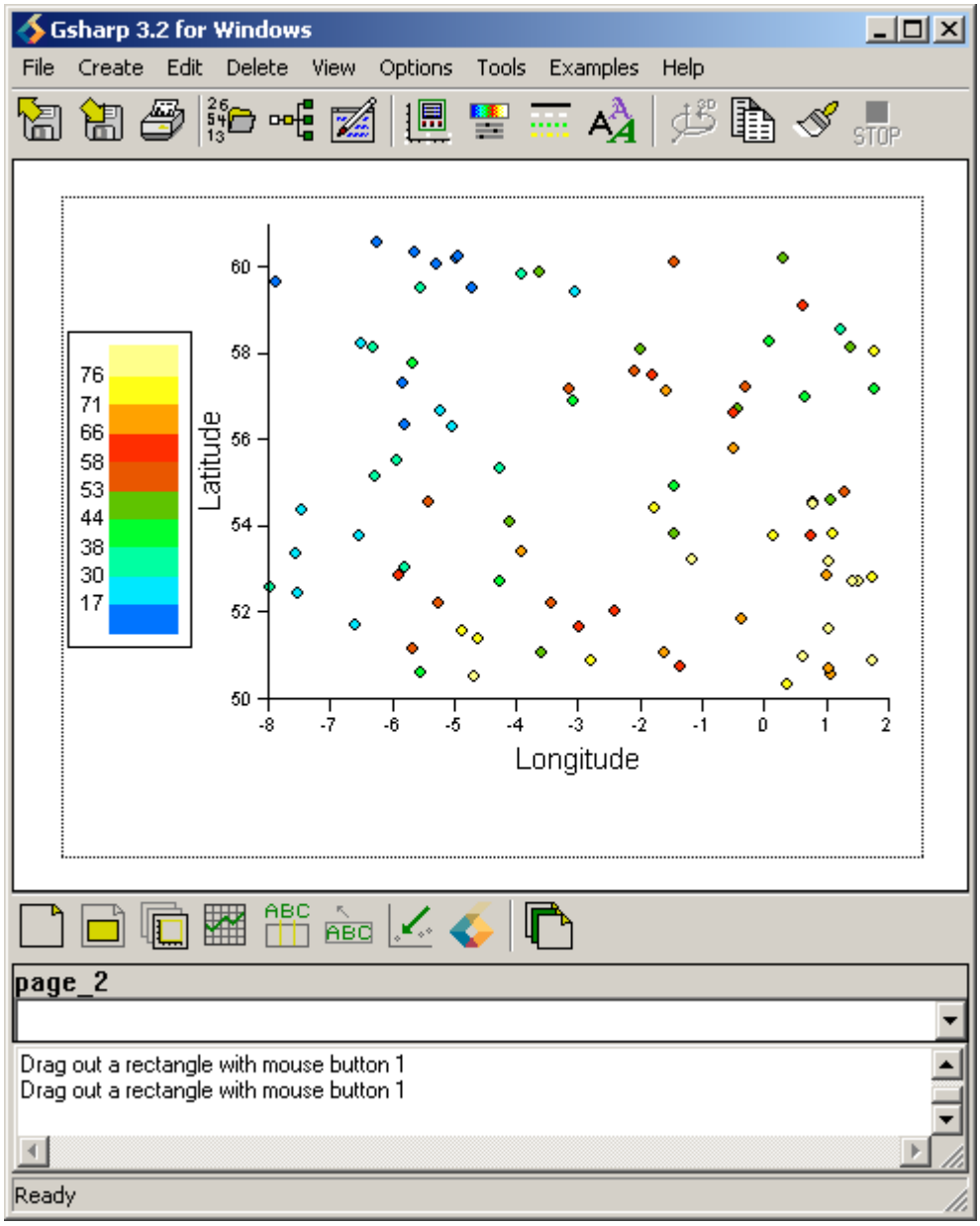


Figure VI-12: Result of Percentage Value t2

[54] Refer to Appendix A, Figure A-1 for where the icon toolbar is and Figure A-2 for a description of the icon.

6.1.3 3D Scatter Graph for t1 and t2

This section shows how to produce a 3D graph displaying both the t1 and t2 datasets.

1. Select *Open…* from the *File* drop-down menu to import the scores.dat file (Section 6.1, Figure VI-1).
2. Define a viewport (Section 2.1.1).
3. Select *Graph…* from the *Create* drop-down menu (Section 2.1.2, Figure II-3).
4. In Graph Editor select *3D Scatter* for *Graph Type* (Section 2.1.2, Figure II-5).
5. Select *Data* and set *X* to x, Y to y and *Color* to t1 (Section 6.1.1, Figure VI-2).
6. Select *Markers* and set *Symbol* to ■ and *Color* to Red (Section 4.1.1, Figure IV-3).
7. Select *OK* and the result will be (Figure VI-13).

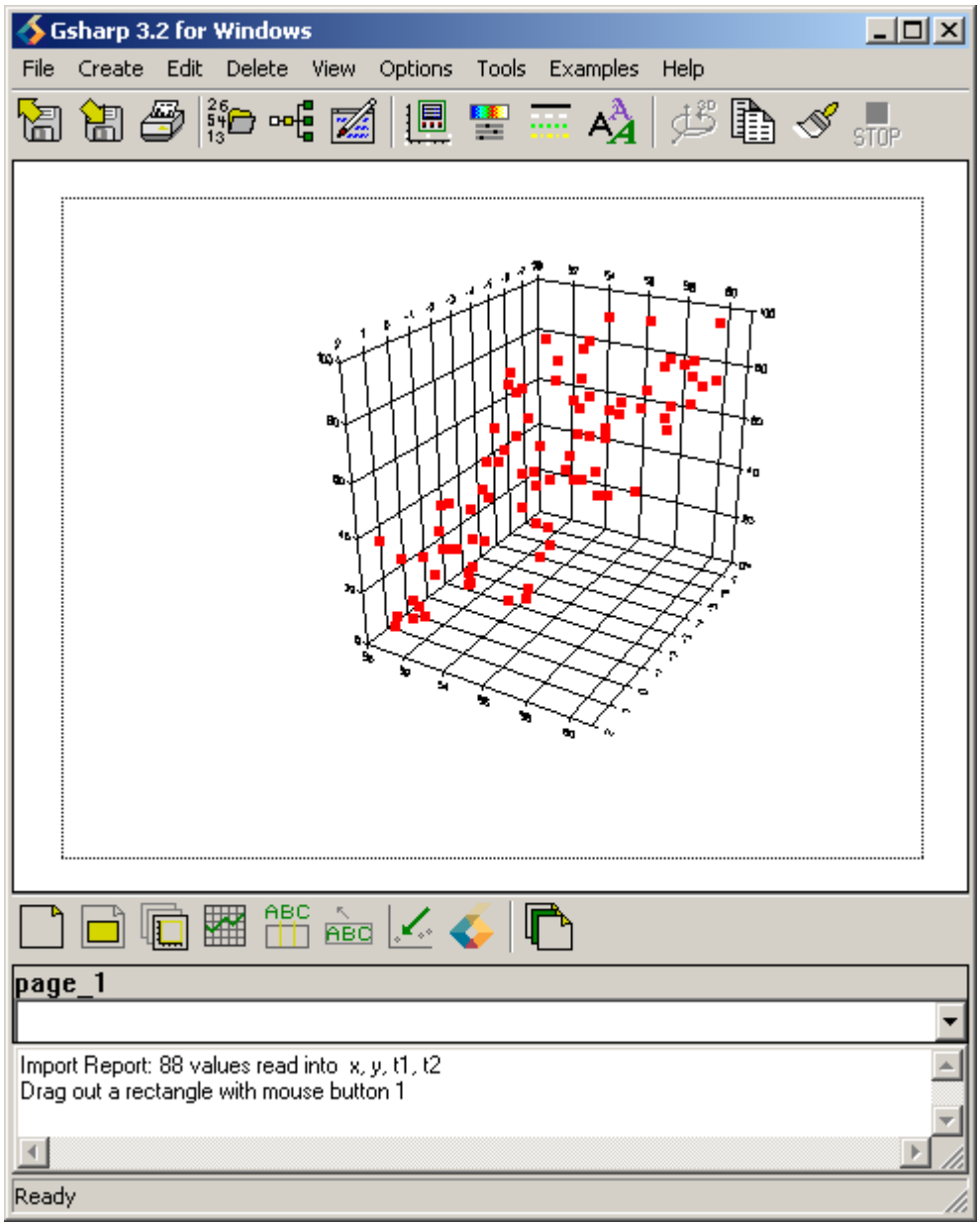


Figure VI-13: 3D Scatter Graph for t1

8. Repeat steps 3-7[55], but when setting data values set *Colour* to t2 and select *Markers* and set *Color* to Blue. The result will be (Figure VI-14).

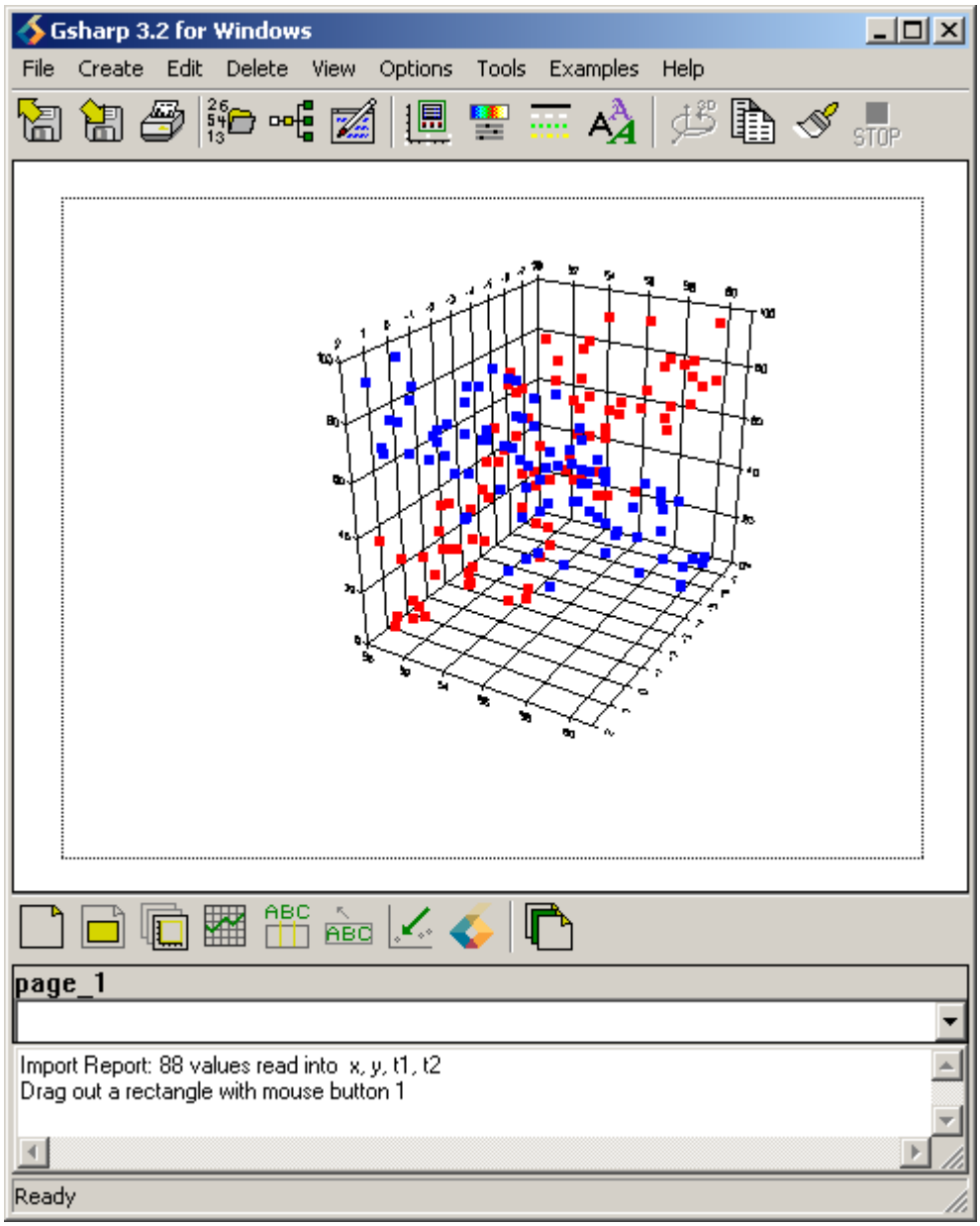


Figure VI-14: 3D Scatter Graph for t1 and t2

[55] The previous graph must be selected before repeating steps 3-7.

6.1.4 3D Irregular Bar Graph for t1 and t2

Continuing from Section 6.1.3, this section shows how to produce a 3D Irregular Bar graph displaying both the t1 and t2 datasets on the same set of axes as the 3D Scatter Graph.

1. Select *Graph…*[56] from the *Create* drop-down menu (Section 2.1.2, Figure II-3).
2. In Graph Editor select 3D Irregular Bar for *Graph Type* (Section 2.1.2, Figure II-5).
3. Select *Data* and set *X* to x, *Y* to y and *Color* to t1 (Section 6.1.1, Figure VI-2).
4. Select *Chart* from the Graph Editor and set *Bar Frame Color* to Red (Figure VI-15).

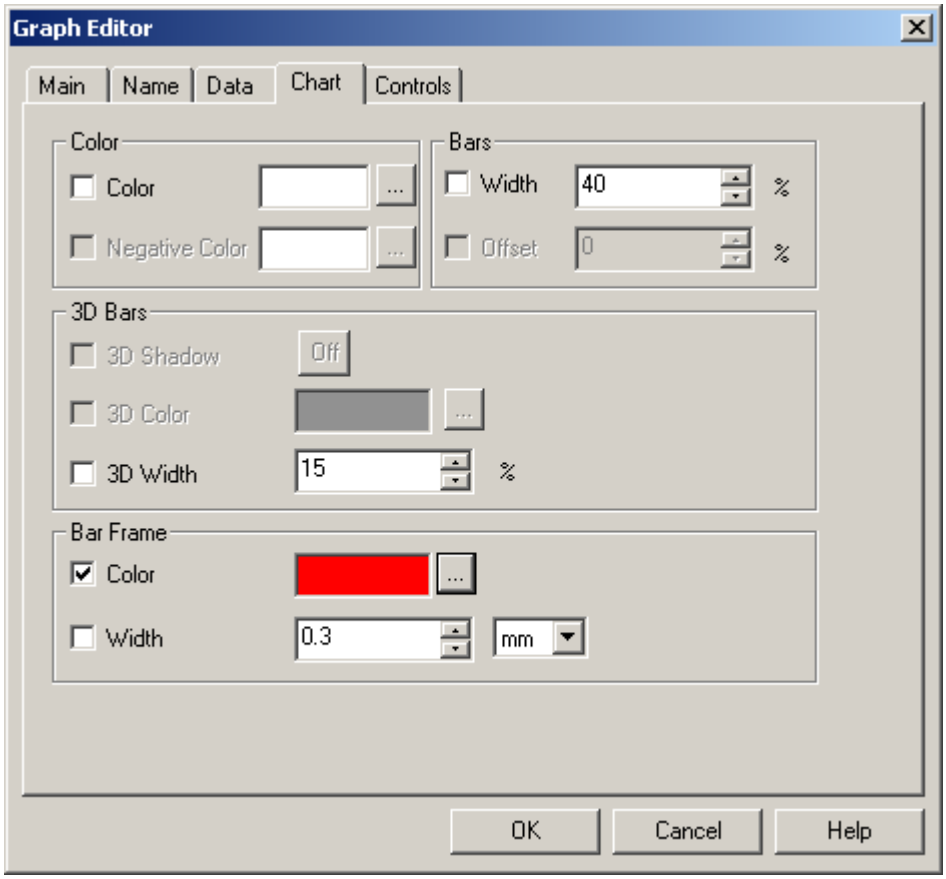


Figure VI-15: Bar Frame Color

5. Select *OK* and the result will be (Figure VI-16).

[56] The previous graph must be selected

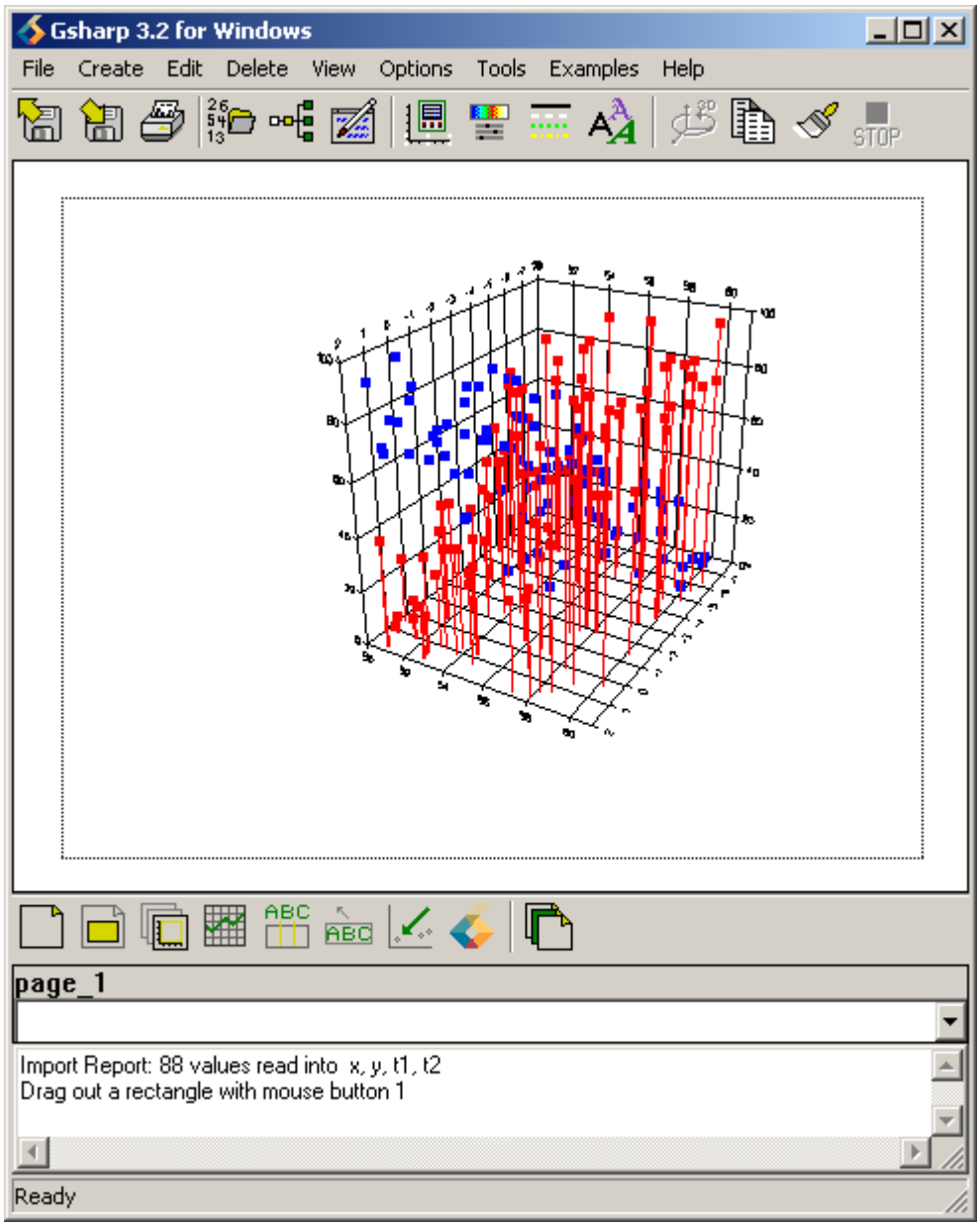


Figure VI-16: 3D Irregular Bar for t1

6. Repeat steps 1-5[57], but when setting data values set *Colour* to t2 and set *Bar Frame Color* to Blue. The result will be (Figure VI-17).

[57] The previous graph must be selected before repeating steps 1-5.

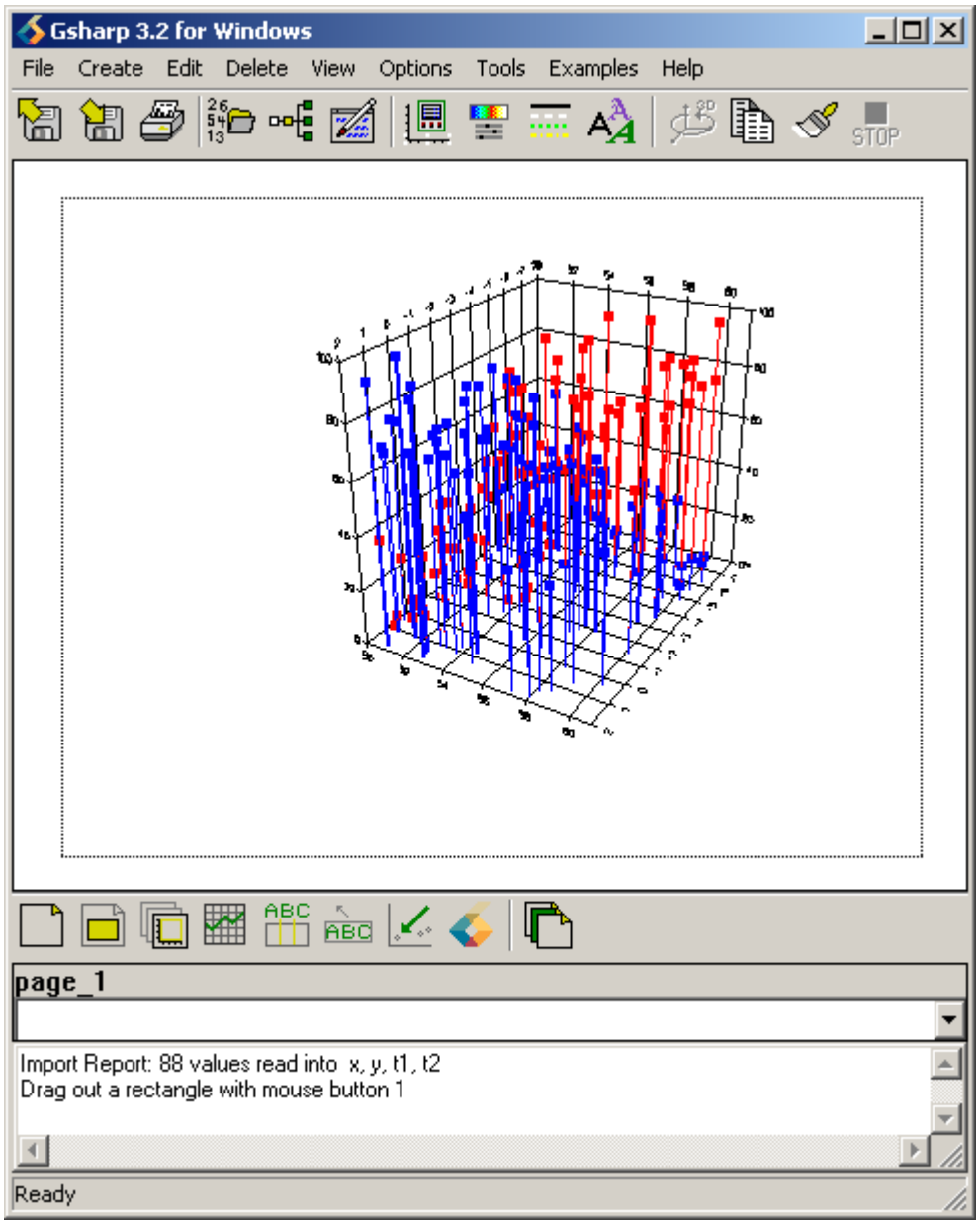


Figure VI-17: 3D Irregular Bar for t1 and t2

6.1.5 3D Irregular Grid for t1 and t2

This section shows how to produce a 3D Irregular Grid for both the t1 and t2 datasets.

1. Select *Open…* from the *File* drop-down menu to import the scores.dat file (Section 6.1, Figure VI-1).
2. Define a viewport (Section 2.1.1).
3. Select *Graph…* from the *Create* drop-down menu (Section 2.1.2, Figure II-3).
4. In Graph Editor select 3D Irregular Grid for *Graph Type* (Section 2.1.2, Figure II-5).
5. Select *Data* and set *X* to x, *Y* to y and *Z* to t1 (Section 6.1.1, Figure VI-2).
6. Select *OK* and the result will be (Figure VI-18).

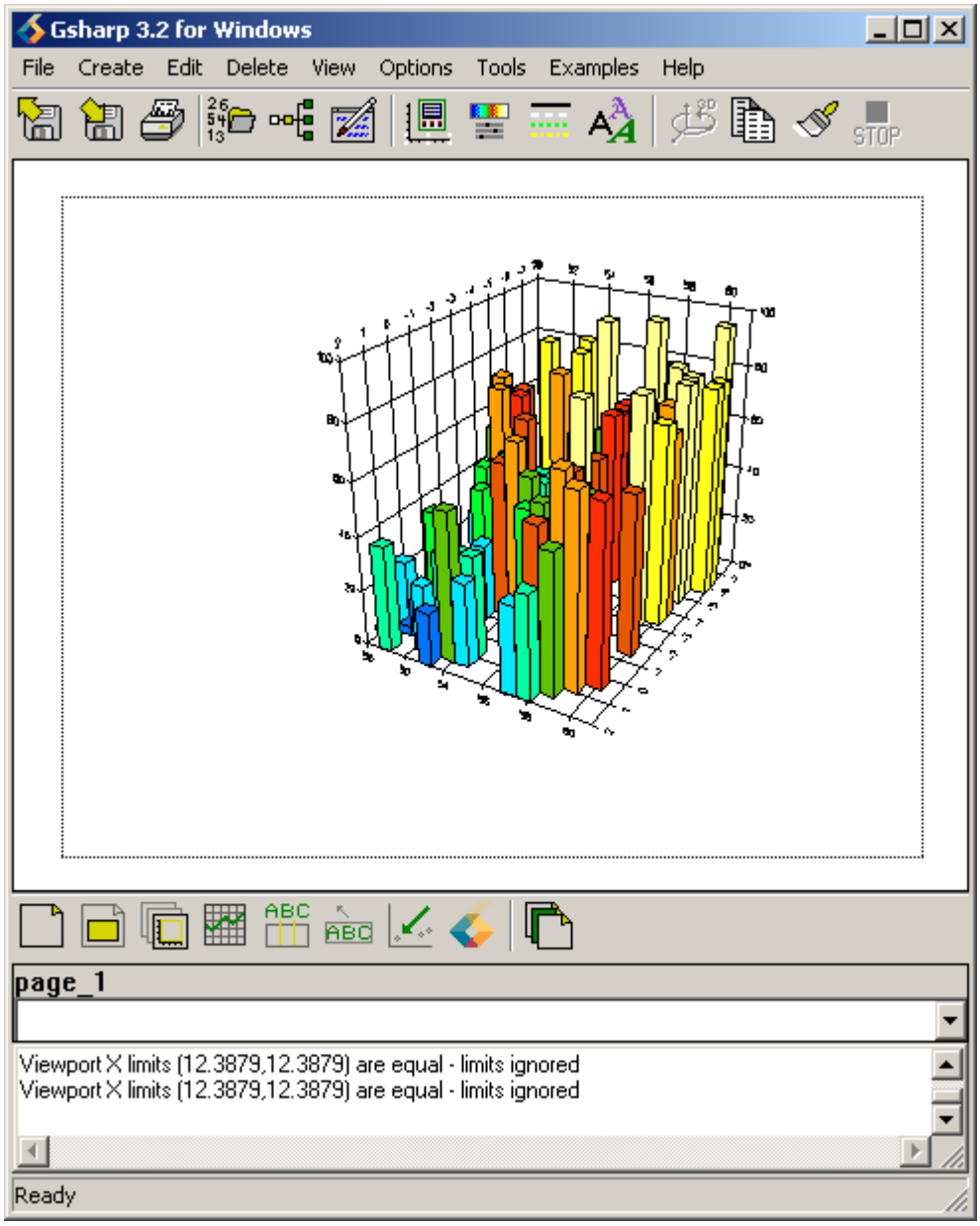


Figure VI-18: 3D Irregular Grid for t1

7. Repeat steps 1-6, but when setting data values set *Y* to t2. The result will be (Figure VI-19).

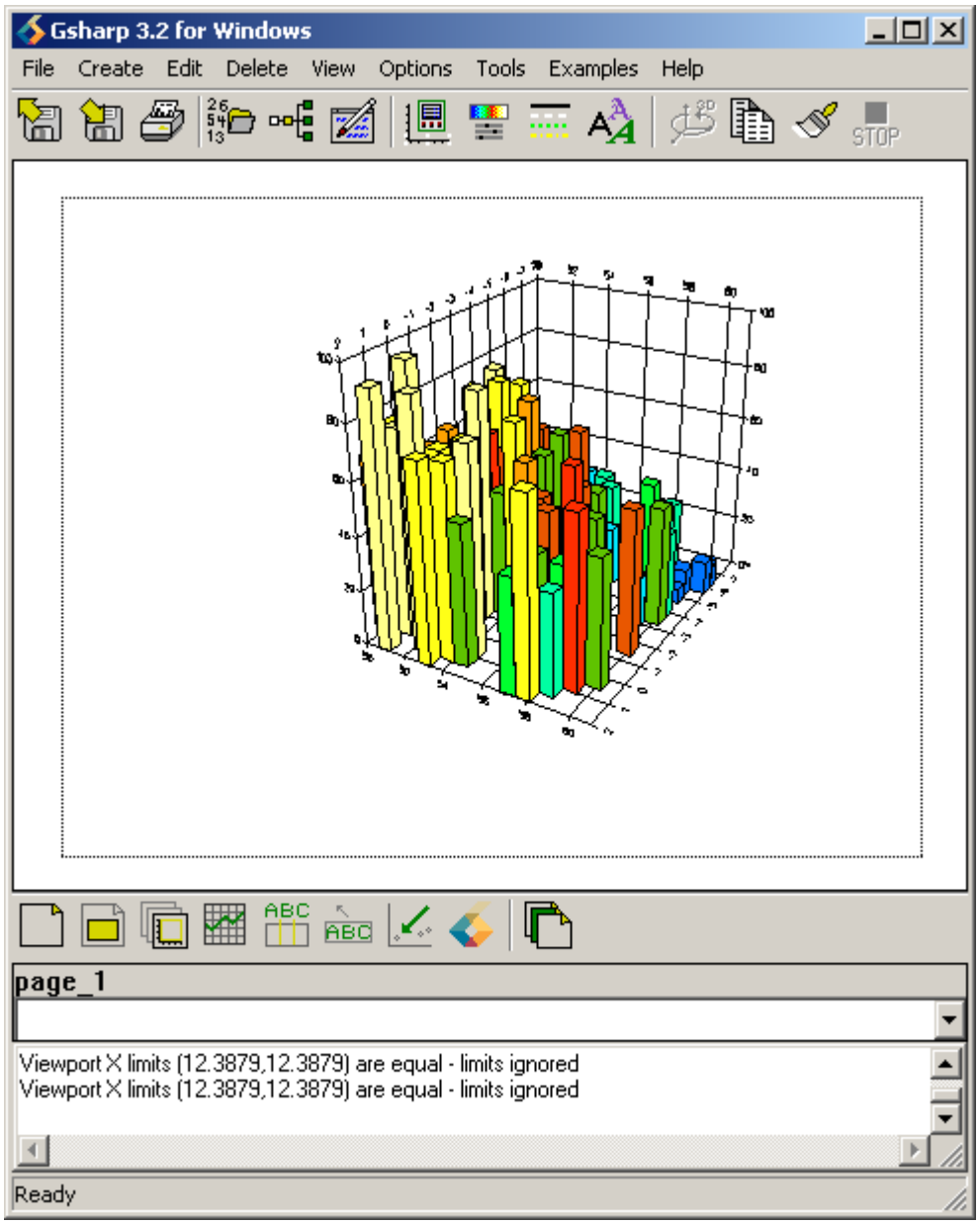


Figure VI-19: 3D Irregular Grid for t2

6.1.6 Visualizing scores.dat on the same axes as uk.dat

This section shows how to visualize scores.dat using 3D Irregular Grid to show the percentage of longitude and latitude points with an Area graph of the UK on the same axes.

1. Select *Open…* from the *File* drop-down menu to import the uk.dat file (Section 6.1, Figure VI-1).
2. Define a viewport (Section 2.1.1).
3. Select *Graph…* from the *Create* drop-down menu (Section 2.1.2, Figure II-3).
4. In Graph Editor select Area for *Graph Type* (Section 2.1.2, Figure II-5).
5. Select *Data* and set *X* to Long and *Y* to Lat (Section 6.1.1, Figure VI-2).
6. Select *OK* and the result will be (Figure VI-20).

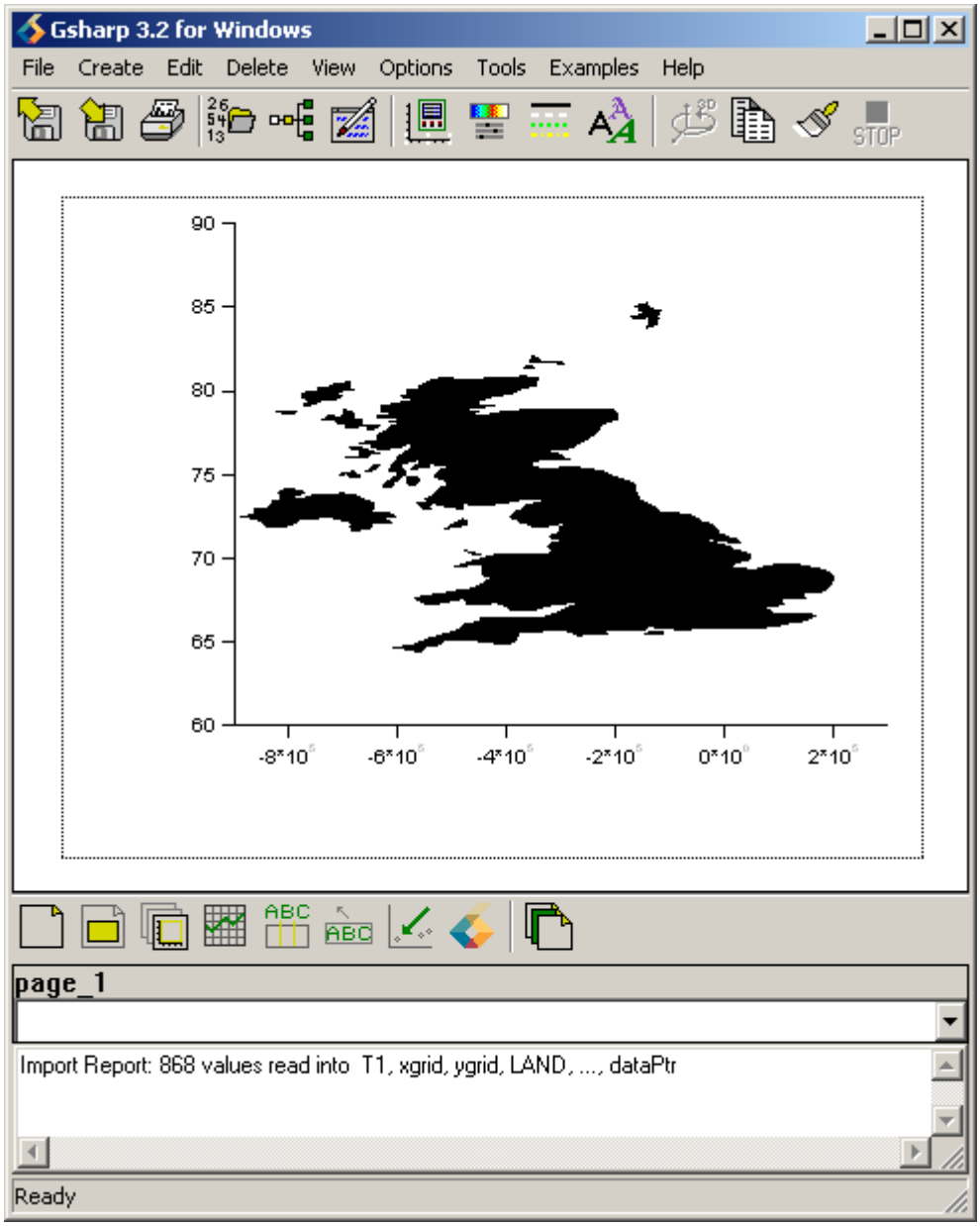


Figure VI-20: UK Area Graph

7. Select *Open…* from the *File* drop-down menu to import the scores.dat file (Section 6.1, Figure VI-1).
8. Select *Graph…*[58] from the *Create* drop-down menu (Section 2.1.2, Figure II-3).
9. In Graph Editor select 3D Irregular Grid for *Graph Type* (Section 2.1.2, Figure II-5).
10. Select *Data* and set *X* to x, *Y* to y and *Z* to t1 (Section 6.1.1, Figure VI-2).
11. Select *Grid Cells* from Graph Editor and set *Num X Cells* to 30, *Num Y Cells* to 30 and *Width* to 0 (Figure VI-21).

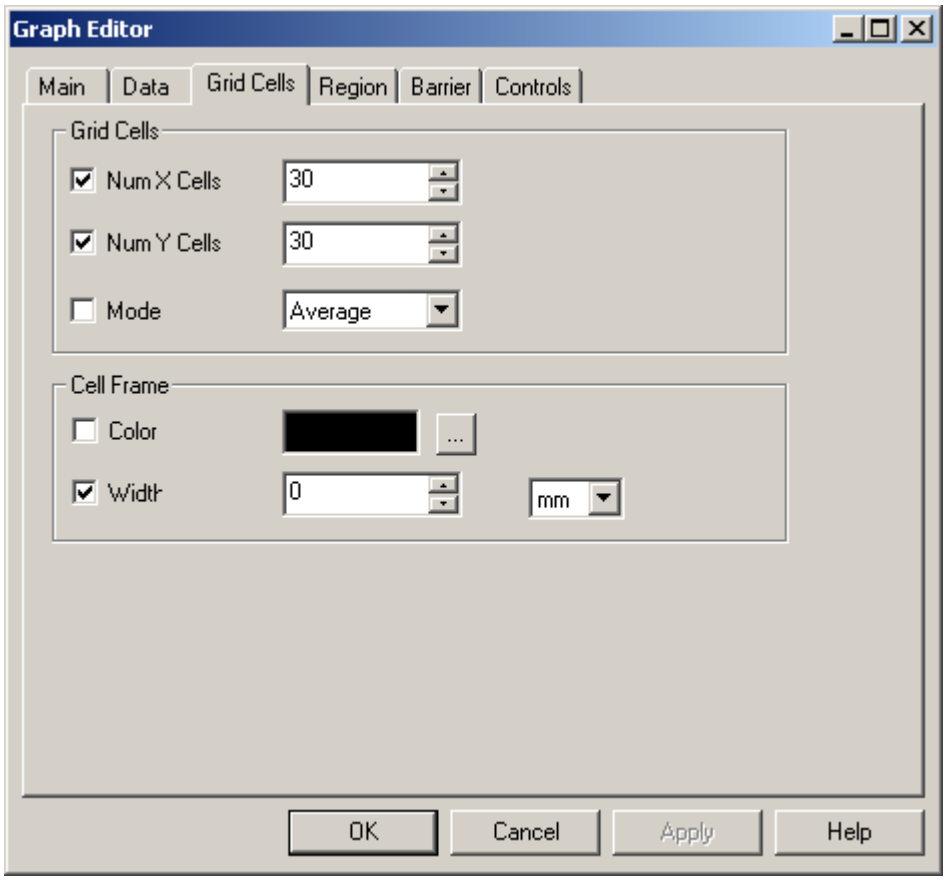


Figure VI-21: Grid Cells

12. Select *OK* and the result will be (Figure VI-22).

[58] The viewport must be selected.

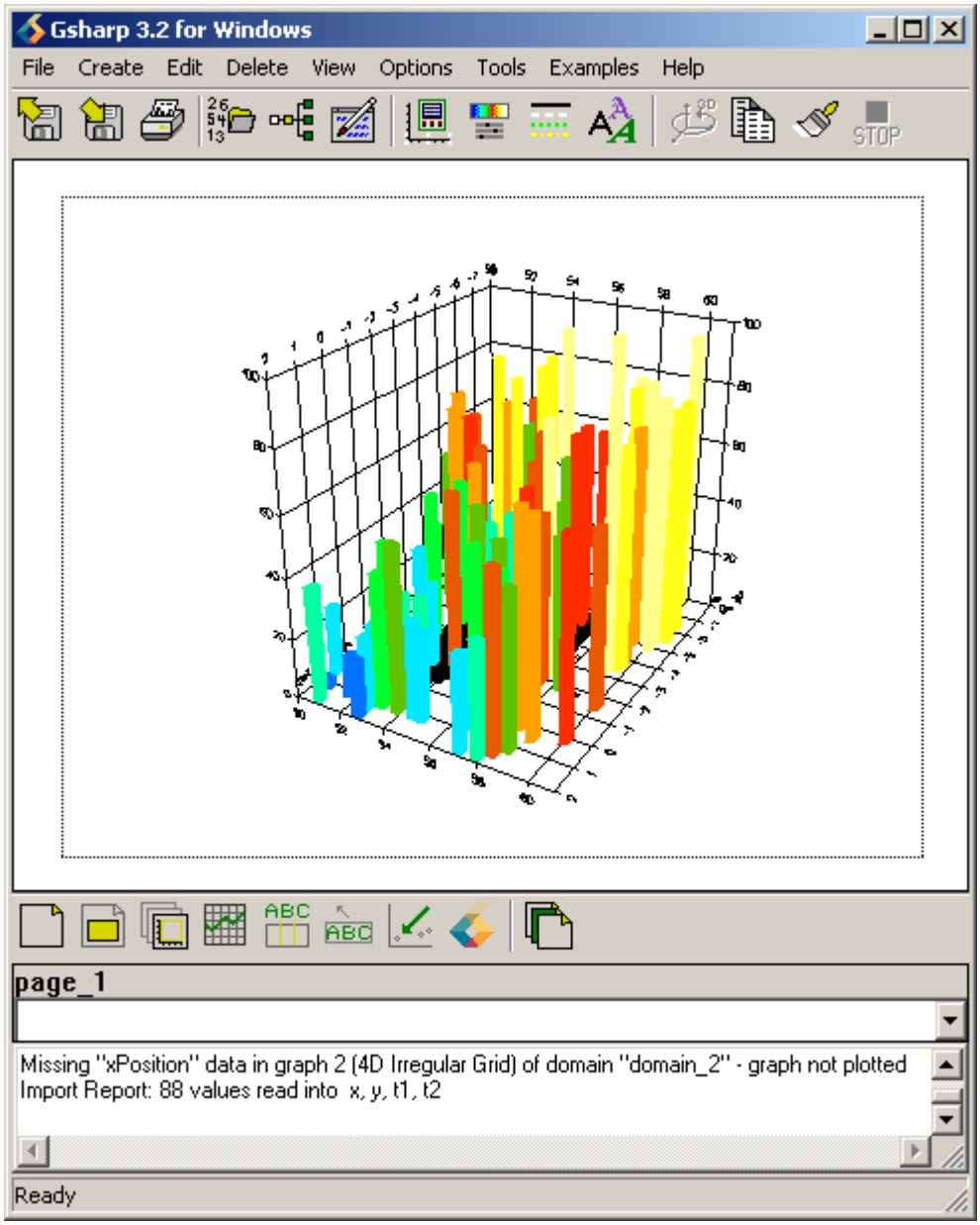


Figure VI-22: Area Graph for uk.dat and 3D Irregular Grid for scores.dat

13. Select the Viewport (Figure VI-23).

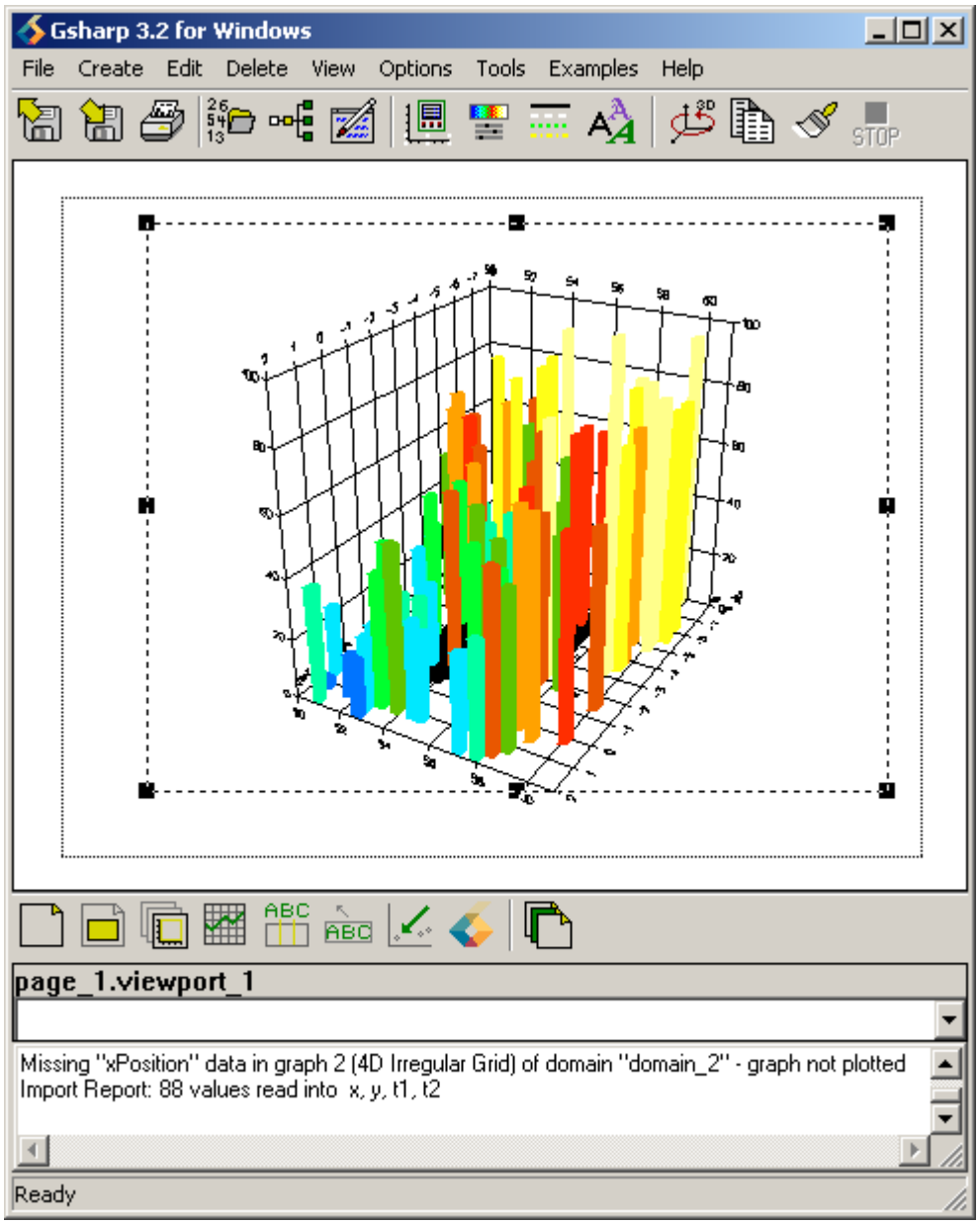


Figure VI-23: Selecting Viewport

14. Select the button from the icon toolbar[59] and use the left mouse button to drag the graph to produce a better view of the graph. The result will be (Figure VI-24).

[59] Refer to Appendix A, Figure A-1, for where the icon toolbar is; and Figure A-2 for a description of the icon.

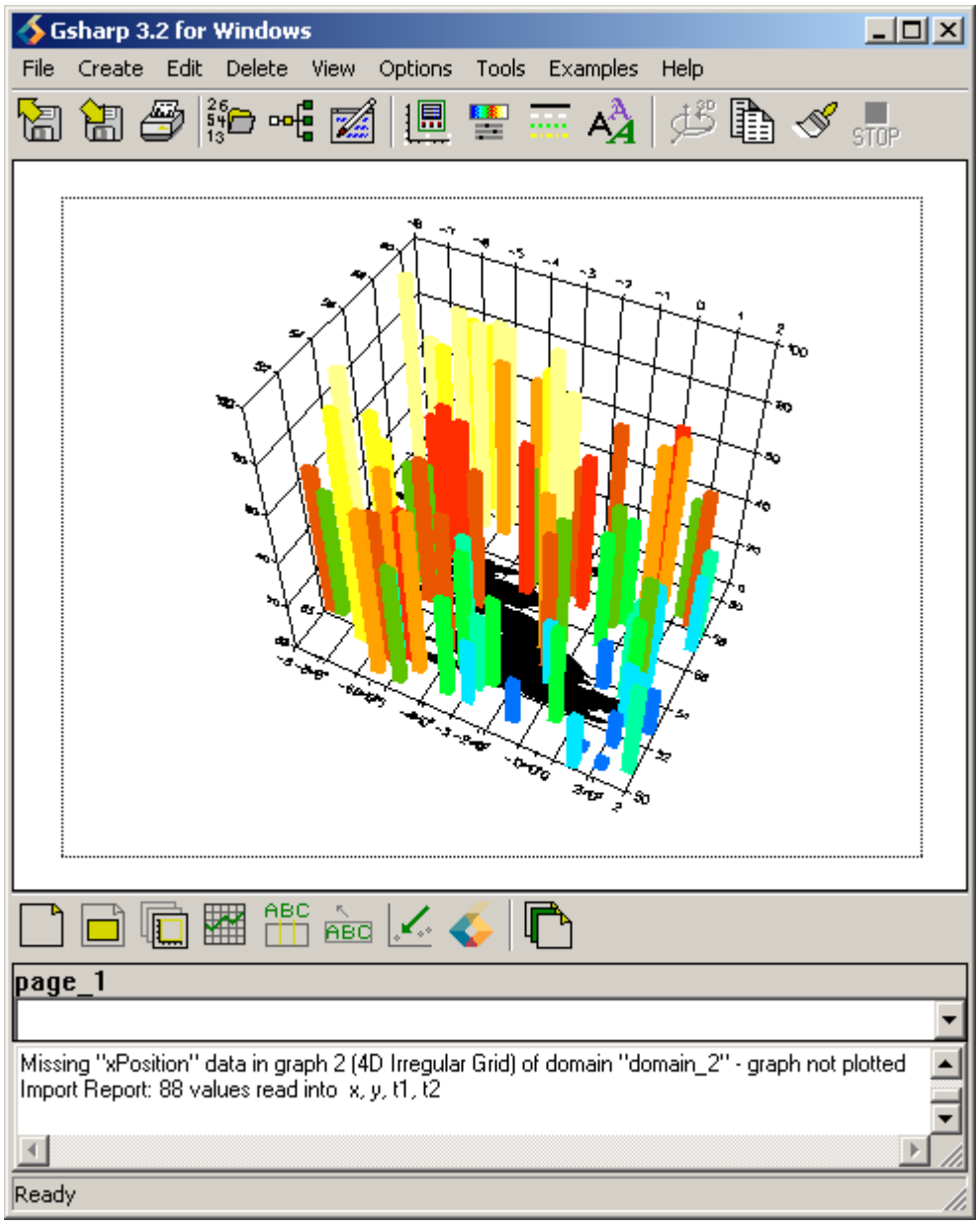


Figure VI-24: Result of Rotating the Graph

Appendix A: Gsharp Window

Figure A-1 shows the Gsharp window.

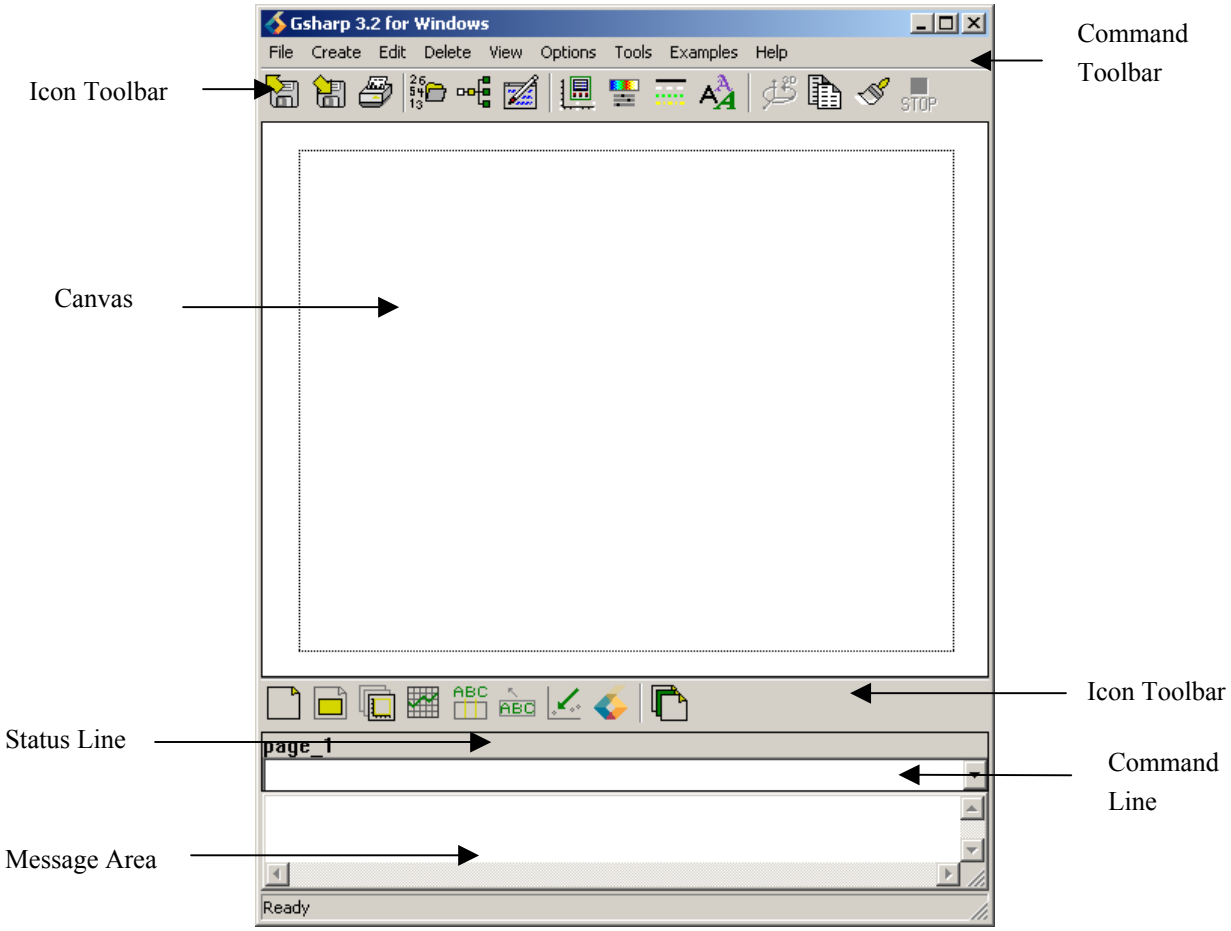


Figure A-1: Gsharp Window

Figure A-2 shows the icons of Gsharp and description of each icon.

Icon	Description
	Open
	Save
	Print
	Data Manager
	Hierarchy Browser
	Script Builder
	Object Editor
	Shade Editor
	Line Editor
	Text Editor
	Rotate
	Copy Clipboard
	Repaint
	Stop

Icon	Description
	Page
	Viewport
	Domain
	Graph
	Title
	Note
	Arrow
	Logo
	Select

Figure A-2: Icons Descriptions

Appendix B: File Block.dat

Figure B-1 shows the description of the first 41 lines of the block.dat file. The first line contains the title.

```
x   y   z   t
1   1   1   3
2   1   1   3.5
3   1   1   4.33333333333333
4   1   1   5.25
5   1   1   6.2
6   1   1   7.16666666666667
7   1   1   8.14285714285714
8   1   1   9.125
9   1   1   10.1111111111111
10  1   1   11.1
1   2   1   3.5
2   2   1   3.5
3   2   1   3.83333333333333
4   2   1   4.25
5   2   1   4.7
6   2   1   5.16666666666667
7   2   1   5.64285714285714
8   2   1   6.125
9   2   1   6.61111111111111
10  2   1   7.1
1   3   1   4.33333333333333
2   3   1   4.16666666666667
3   3   1   4.33333333333333
4   3   1   4.58333333333333
5   3   1   4.86666666666667
6   3   1   5.16666666666667
7   3   1   5.47619047619048
8   3   1   5.79166666666667
9   3   1   6.11111111111111
10  3   1   6.43333333333333
1   4   1   5.25
2   4   1   5
3   4   1   5.08333333333333
4   4   1   5.25
5   4   1   5.45
6   4   1   5.66666666666667
7   4   1   5.89285714285714
8   4   1   6.125
9   4   1   6.36111111111111
              ...
              ...
```

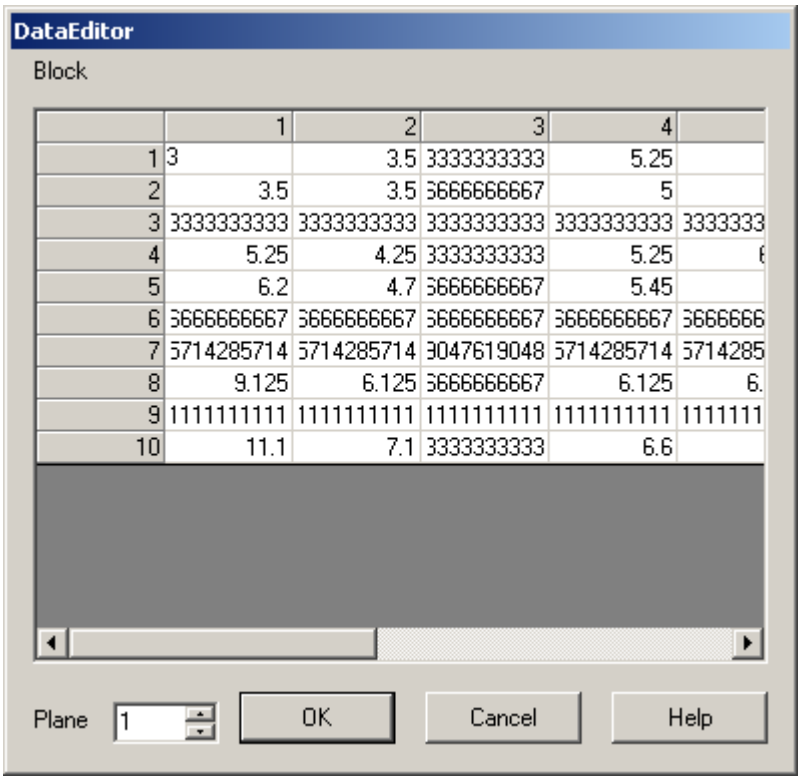
Figure B-1: First 40 Lines of the File

Figure B-2 shows the description of the last lines of the block.dat file

```
                    ...
                    ...
1   7   10  10.8428571428571
2   7   10  5.98571428571429
3   7   10  4.46190476190476
4   7   10  3.77142857142857
5   7   10  3.41428571428571
6   7   10  3.22380952380952
7   7   10  3.12857142857143
8   7   10  3.09285714285714
9   7   10  3.0968253968254
10  7   10  3.12857142857143
1   8   10  10.925
2   8   10  6.05
3   8   10  4.50833333333333
4   8   10  3.8
5   8   10  3.425
6   8   10  3.21666666666667
7   8   10  3.10357142857143
8   8   10  3.05
9   8   10  3.03611111111111
10  8   10  3.05
1   9   10  11.0111111111111
2   9   10  6.12222222222222
3   9   10  4.56666666666667
4   9   10  3.84444444444444
5   9   10  3.45555555555556
6   9   10  3.23333333333333
7   9   10  3.10634920634921
8   9   10  3.03888888888889
9   9   10  3.01111111111111
10  9   10  3.01111111111111
1   10  10  11.1
2   10  10  6.2
3   10  10  4.63333333333333
4   10  10  3.9
5   10  10  3.5
6   10  10  3.26666666666667
7   10  10  3.12857142857143
8   10  10  3.05
9   10  10  3.01111111111111
10  10  10  3
```

Figure B-2: Last 40 Lines of the File

Figure B-3 shows Data Editor



	1	2	3	4	
1	3	3.5	3333333333	5.25	
2	3.5	3.5	3666666667	5	
3	3333333333	3333333333	3333333333	3333333333	3333333
4	5.25	4.25	3333333333	5.25	6
5	6.2	4.7	3666666667	5.45	
6	3666666667	3666666667	3666666667	3666666667	3666666
7	3714285714	3714285714	3047619048	3714285714	3714285
8	9.125	6.125	3666666667	6.125	6.
9	1111111111	1111111111	1111111111	1111111111	1111111
10	11.1	7.1	3333333333	6.6	

Figure B-3: Data Editor Containing Values of Block.dat

To see the dataset of other planes, for example plane z=2, click on the upper arrow (Figure B-3). The horizontal grey cells (1,2…10) are the y values and the vertical grey cells are the x values (1,2…10).

To use the Data Editor follow steps 1 –3 overleaf.

1. Select *Data Manager* from the *Tools* drop-down menu (Figure B-4).

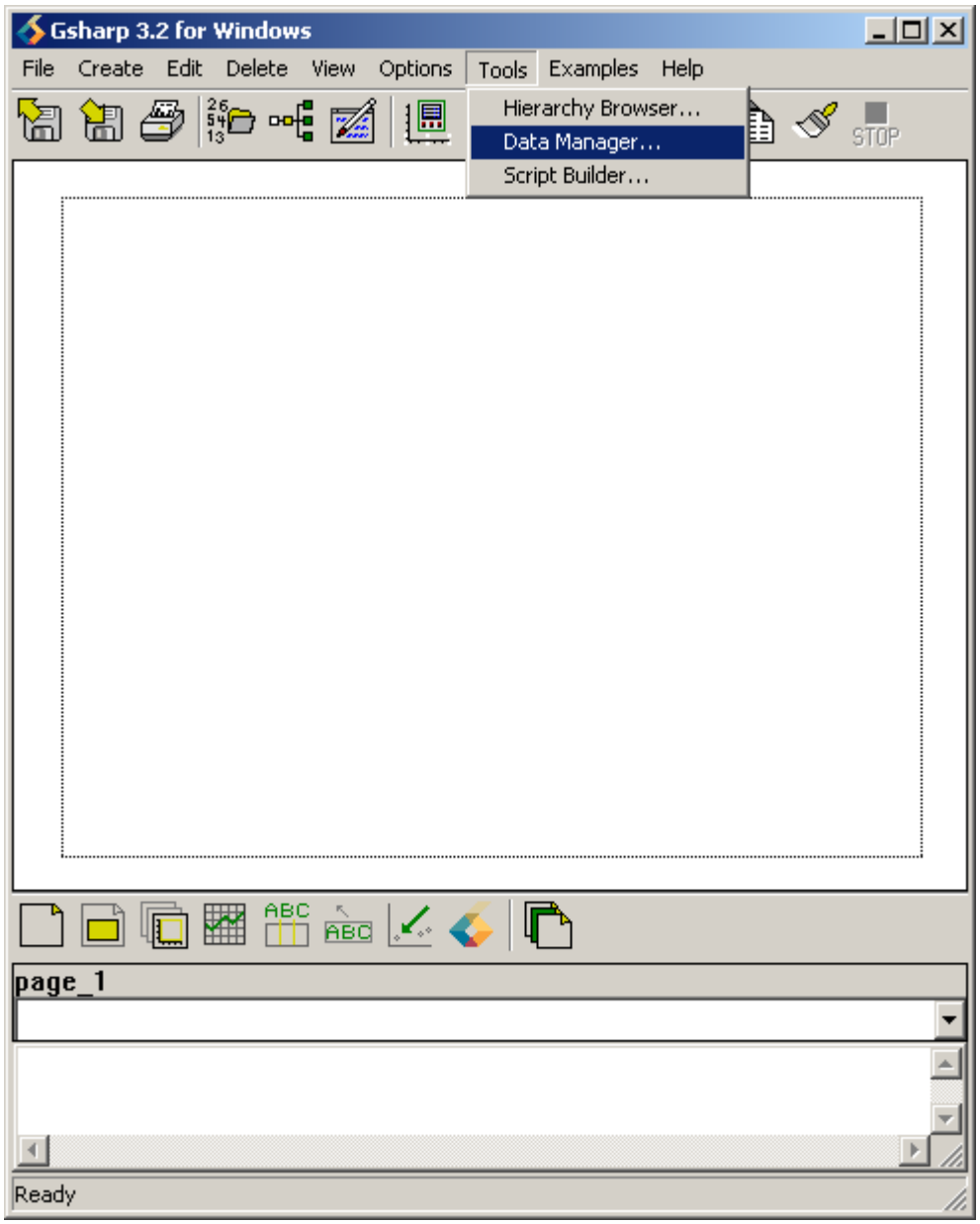


Figure B-4: Selecting Data Manager

2. Select *Block* in the Data Manager by clicking once with the left mouse button on it (Figure B-5).

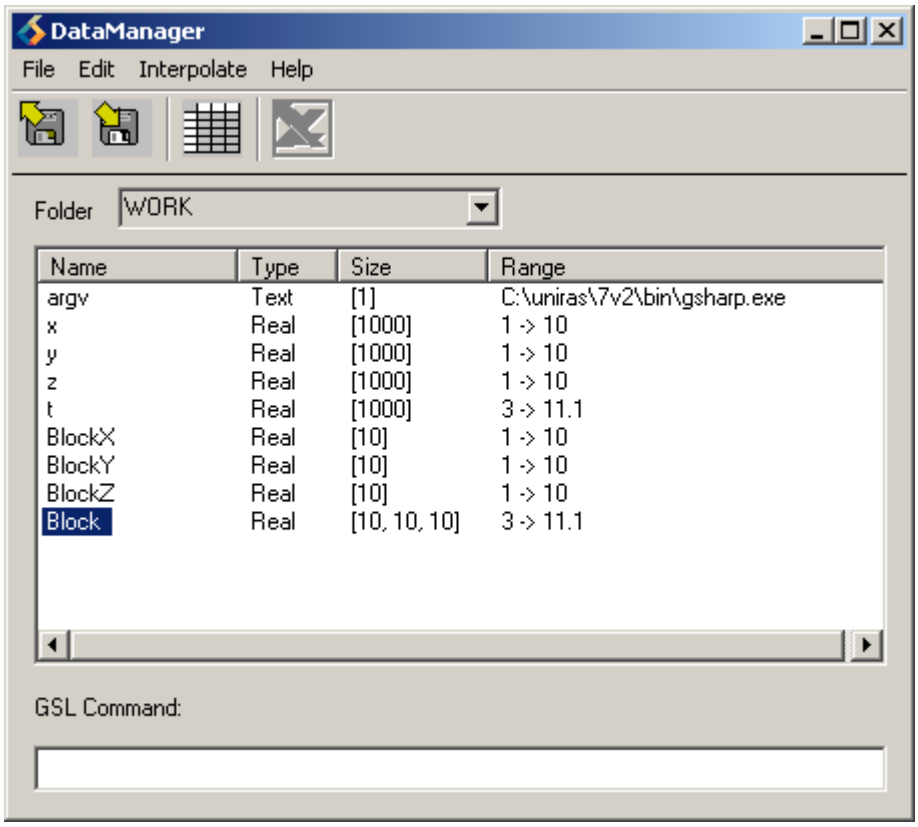


Figure B-5: Selecting Block

3. Select *Editor…* from the *Edit* drop-down menu (Figure B-6).

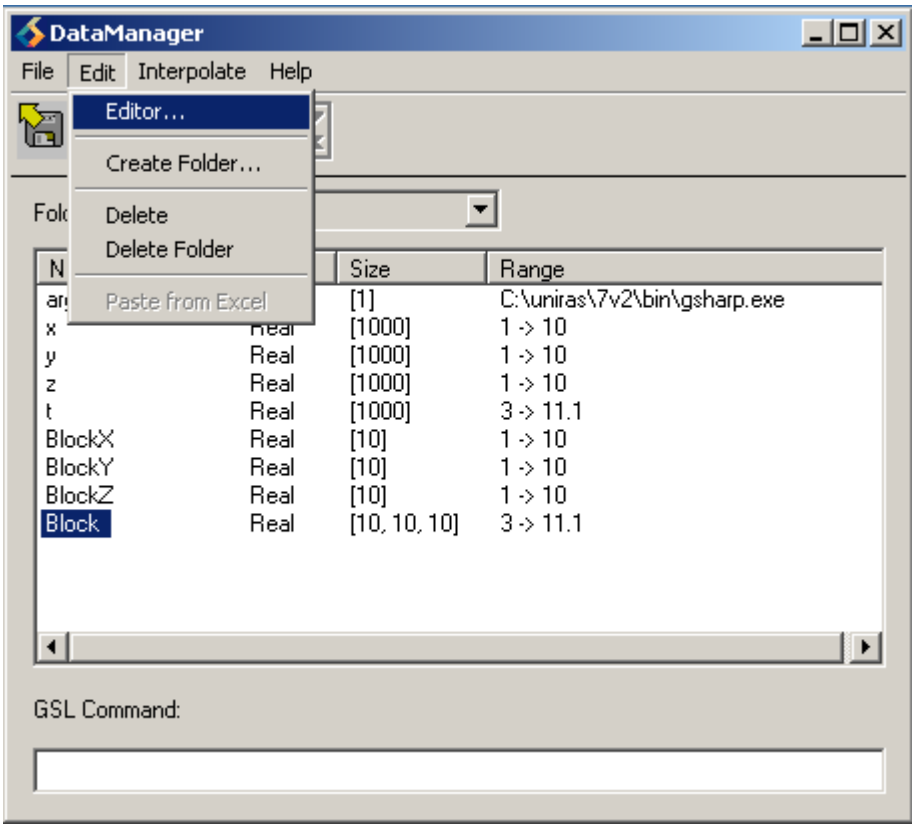


Figure B-6: Selecting Editor for Block

Appendix C: Superconductor Files

These are the first 25 lines and 3rd, 4th and 5th column of 00-39-33,Sep-07.txt file. The first line contains header information.

```
Theta        Phi                Jc (A/m2)
1.10000000E+2     6.00000000E+1     3.22356347E+10
1.07000000E+2     6.00000000E+1     2.72672295E+9
1.04000000E+2     6.00000000E+1     3.99047557E+10
1.01000000E+2     6.00000000E+1     4.49788889E+10
1.00500000E+2     6.00000000E+1     5.47276568E+10
1.00000000E+2     6.00000000E+1     5.40836973E+10
9.95000000E+1     6.00000000E+1     5.89814061E+10
9.90000000E+1     6.00000000E+1     6.01080968E+10
9.85000000E+1     6.00000000E+1     6.00190000E+10
9.80000000E+1     6.00000000E+1     6.13340059E+10
9.75000000E+1     6.00000000E+1     6.14041306E+10
9.70000000E+1     6.00000000E+1     5.84813843E+10
9.65000000E+1     6.00000000E+1     5.60704645E+10
9.60000000E+1     6.00000000E+1     5.76031000E+10
9.55000000E+1     6.00000000E+1     5.77612824E+10
9.50000000E+1     6.00000000E+1     5.55248723E+10
9.45000000E+1     6.00000000E+1     5.59663788E+10
9.40000000E+1     6.00000000E+1     5.52096211E+10
9.35000000E+1     6.00000000E+1     5.28042857E+10
9.30000000E+1     6.00000000E+1     5.30446316E+10
9.25000000E+1     6.00000000E+1     5.13812061E+10
9.20000000E+1     6.00000000E+1     5.05760806E+10
9.15000000E+1     6.00000000E+1     4.96483687E+10
9.10000000E+1     6.00000000E+1     4.92829048E+10
9.05000000E+1     6.00000000E+1     4.45706370E+10
                        ...
                        ...
```

Figure C-1: First 25 Lines and 3rd, 4th and 5th Column

These are the last 25 lines and 3rd, 4th and 5th column of 00-39-33,Sep-07.txt file.

```
                                    . . .
                                    . . .
-8.65000000E+1    6.00000000E+1     4.95293759E+10
-8.70000000E+1    6.00000000E+1     4.72481049E+10
-8.75000000E+1    6.00000000E+1     4.70969448E+10
-8.80000000E+1    6.00000000E+1     4.51317600E+10
-8.85000000E+1    6.00000000E+1     4.43541698E+10
-8.90000000E+1    6.00000000E+1     3.14603254E+10
-8.95000000E+1    6.00000000E+1     4.25624647E+10
-9.00000000E+1    6.00000000E+1     4.27740195E+10
-9.05000000E+1    6.00000000E+1     4.20171477E+10
-9.10000000E+1    6.00000000E+1     4.02391475E+10
-9.15000000E+1    6.00000000E+1     4.00687173E+10
-9.20000000E+1    6.00000000E+1     3.81946048E+10
-9.25000000E+1    6.00000000E+1     3.66846151E+10
-9.30000000E+1    6.00000000E+1     3.68072364E+10
-9.35000000E+1    6.00000000E+1     3.53120000E+10
-9.40000000E+1    6.00000000E+1     4.22324515E+9
-9.45000000E+1    6.00000000E+1     3.59350042E+10
-9.50000000E+1    6.00000000E+1     3.48161520E+10
-9.55000000E+1    6.00000000E+1     3.43704468E+10
-9.60000000E+1    6.00000000E+1     3.37127385E+10
-9.65000000E+1    6.00000000E+1     3.36291080E+10
-9.70000000E+1    6.00000000E+1     3.26614471E+10
-9.75000000E+1    6.00000000E+1     2.81305867E+9
-9.80000000E+1    6.00000000E+1     3.20563254E+10
-9.85000000E+1    6.00000000E+1     3.10477712E+10
```

Figure C-2: Last 25 Lines and 3rd, 4th and 5th Column

Appendix D: File percs.dat

This figure shows the first four columns of the file perc.dat.

```
p3                p5                p10               p25
2.43675231933594  3.77732753753662  5.70948028564453  7.10166454315186
1.84078788757324  3.50401306152344  4.90051651000977  6.66944313049316
1.59338760375977  3.26341724395752  4.47679138183594  5.91360950469971
2.01849555969238  3.69032096862793  5.4636344909668   7.16080856323242
1.45458221435547  2.97425365447998  4.92519378662109  6.528639793396     ...
2.1877498626709   4.14098739624023  5.86970901489258  7.02697563171387
1.61725997924805  2.7100076675415   3.77587890625     4.81455326080322
1.58316993713379  3.23186683654785  5.22469711303711  6.23193359375
2.5045166015625   4.22495174407959  6.05863189697266  7.71629619598389
1.57023429870605  3.10932159423828  4.17752456665039  6.12541389465332
```

Figure D-1: First Four Columns of percs.dat File

This figure shows the last four columns of the file perc.dat.

```
        p90               p95               p97               x
        11.9674530029297  13.8349866867065  15.0559692382813  24-MAY-2002
        12.1997451782227  14.1032314300537  15.705602645874   25-MAY-2002
        10.2283935546875  12.1270723342896  13.1783790588379  26-MAY-2002
        12.7075729370117  14.6593627929688  15.6653079986572  27-MAY-2002
...     11.7831573486328  13.3862447738647  14.7151870727539  28-MAY-2002
        11.5595169067383  13.3478031158447  15.0407543182373  29-MAY-2002
        9.43350219726563  10.7913370132446  12.0494499206543  30-MAY-2002
        10.7643661499023  12.1877174377441  13.9972248077393  31-MAY-2002
        12.2233734130859  14.0631742477417  15.2575836181641  01-JUN-2002
        10.5418472290039  11.9082317352295  13.1667995452881  02-JUN-2002
```

Figure D-2: Last Four Columns of percs.dat File

Appendix E: File scores.dat

This is the first 25 lines of scores.dat file. The first line contains the title.

```
x                   y                 t1                t2
-5.90733313200349   55.5266956331216  51.7027875726873  33.5983972549438
-1.46225439109685   60.1075656571411  59.7741234519265  54.222677230835
1.06086531013739    50.5573746640111  1.54237955266779  68.2734390894572
-6.52290783287663   53.7736891078093  81.0779072154652  26.507391611735
1.39636514483277    58.1416396545574  59.4995085976341  49.2445370356242
-3.90857078830641   53.399280273421   37.1455126675693  70.76717821757
-0.425759868677005  56.7069040250462  34.8837006308816  50.8982877731323
0.612751125563591   59.0741435867967  71.115478515625   64.1433537801107
-7.54941335136959   53.3659391575675  80.8876491893421  26.6496082941691
-7.45483522166569   54.3848920580858  90.9967269897461  28.9188365936279
1.76506208042906    58.0115493110898  38.6923290599476  72.2880900700887
-6.29041610035802   58.1423005793913  81.1032229336825  32.5832506815592
-4.09463699135927   54.0793719275425  40.0948371887207  51.3035198847453
-5.89688668770987   52.8292986966335  69.7386328957298  64.4605299631755
-0.501863008875034  56.6057926935282  73.2044154080478  61.3572340011597
0.614618229101325   50.9885721937462  3.13098421963778  76.3990224202474
-5.62816381104153   60.333998505248   79.3884731639515  12.7326389948527
-7.8670169986558    59.6548016416709  93.7991423173384  0.0240942637125627
-1.44299521810512   53.7911476914996  58.7413375160911  47.9315659205119
1.30055472679396    54.7825247743313  29.7147424871271  53.0532341003418
-4.60749299110398   51.3576631252399  70.4393667741255  73.2497911453247
-5.01972144568254   56.2966120562123  66.9868490045721  22.1736570994059
1.51318981318877    52.7016588590886  14.3460641340776  89.8317238489787
-1.16398460094388   53.2083848452312  28.7966142134233  84.9824091593425
                                      ...
                                      ...
```

Figure E-1: First 25 Lines of File scores.dat

These are the last 25 lines of the scores.dat file.

```
                                        ...
                                        ...
0.785943649723777   54.543493682082   43.055605801669   65.9791768391927
-5.53630231698503   50.6206404227305  70.9149901650169  40.7115360895793
-1.44253777773838   54.9021623373483  56.403318231756   40.3092047373454
1.77126086417434    57.1827292331836  32.9838079972701  42.9769099553426
0.0881323735311526  58.2463403163274  70.6714130748402  38.0455792744954
0.801879378418334   54.5162737469982  33.0352197126909  88.7063086827596
1.07256271380129    54.5973234677876  32.6649773337624  51.9302031199137
-4.27527925863501   52.7014961698987  60.776478507302   42.6509122848511
-5.78678359208971   53.0409776688321  78.4202769886364  35.9273096720378
-4.67377516669353   50.5214813614912  52.0707324634899  75.6735544204712
-4.70108155593289   59.4874758098667  74.7530524513938  16.2260672251383
-3.43235669548972   52.2048467454551  51.2239563681863  53.0950765609741
0.148551844012218   53.7646598577703  21.6022685657848  74.6390164693197
-5.54948406796143   59.5125401131845  86.3400653492321  35.0198488235474
-5.21755973654081   56.6720173618887  65.169319152832   16.8963413238525
-6.28241556169883   55.1617634440445  53.1987557844682  34.4737908045451
-5.65108250696721   57.7622993041005  99.1254133744673  38.3359731038411
-2.08335571844168   57.5520133580903  84.9288007562811  54.1882257461548
-1.76741379330406   54.4077498892657  67.5235075517134  74.489528020223
0.299833908157098   60.20826009761    66.5677091425115  47.8629013697306
-6.50423679749929   58.2139651675388  83.0511460737748  24.0640780131022
1.03086095628601    53.1882418899077  44.5077483437278  76.7415107091268
1.75861123770619    52.7883823653756  19.7151204889471  73.486421585083
-3.13933346627778   57.1508828242622  53.5556033741344  57.3330462773641
-1.7895389702262    57.4623817825341  57.230674050071   60.5098546346029
```

Figure E-2: Last 25 Lines of scores.dat File