SciGraphica

Tutorial Manual - Tutorial 3

Version 0.8.0

Tutorial Manual - Tutorial 3

Contents

Preface

Tutorial 3: Multilayer Plots..3

3.1 Introduction..3
3.2 Importing ASCII data..3
3.3 Plotting the data...4
Amplitude and acceleration in one diagram?..5
Creating Layer No. 2..6
Applying some Styling...8
Completing the Graph..9

Tutorial 3: Multilayer Plots

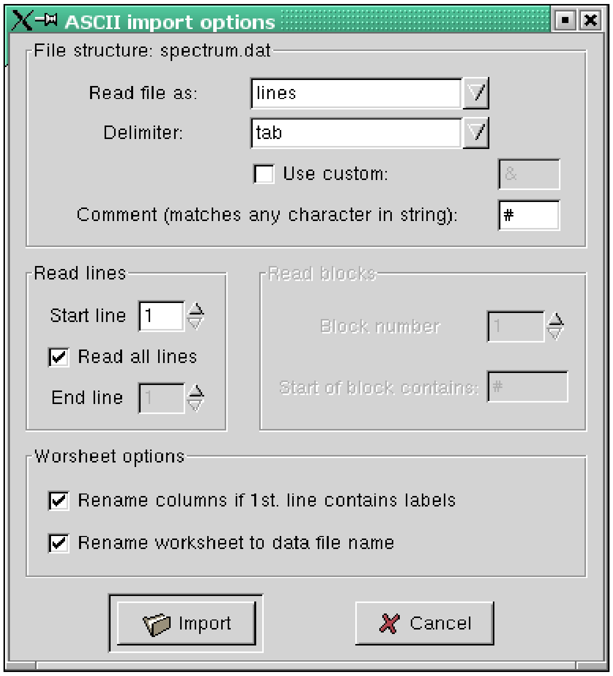
3.1 Introduction

In this tutorial, we will import some real life ASCII data from a file named "spectrum.dat" containing sonic spectra into a SciGraphica worksheet. These data will then be plotted using SciGraphica's multilayer capabilities. Most of the steps taken to produce the graphs build on tutorial 2, so refer to it if a question concerning one of the dialogs should arise.

3.2 Importing ASCII data

To get started, run SciGraphica by typing **sga** in some terminal window or click the button (i.e. “create new project”) in the button bar of the main window.

Then double-click the **Data1** icon in the **Worksheets** canvas to open the worksheet. Take a closer look at the worksheet: the upper left worksheet cell (i.e. cell A0) is highlighted by default. This is important because SciGraphica takes the highlighted cell as the upper left corner of the array of numbers that is imported from the ASCII file. To import the file "spectrum.dat", click the cell using the right mouse button. From the appearing pop-up menu, choose “file --> import”. Use the file open dialog to import the spectrum.dat file that came along with this tutorial.



ASCII import options

File structure: spectrum.dat

Read file as: lines

Delimiter: tab

☐ Use custom: &

Comment (matches any character in string): #

Read lines

Start line 1

☑ Read all lines

End line 1

Read blocks

Block number 1

Start of block contains: #

Worsheet options

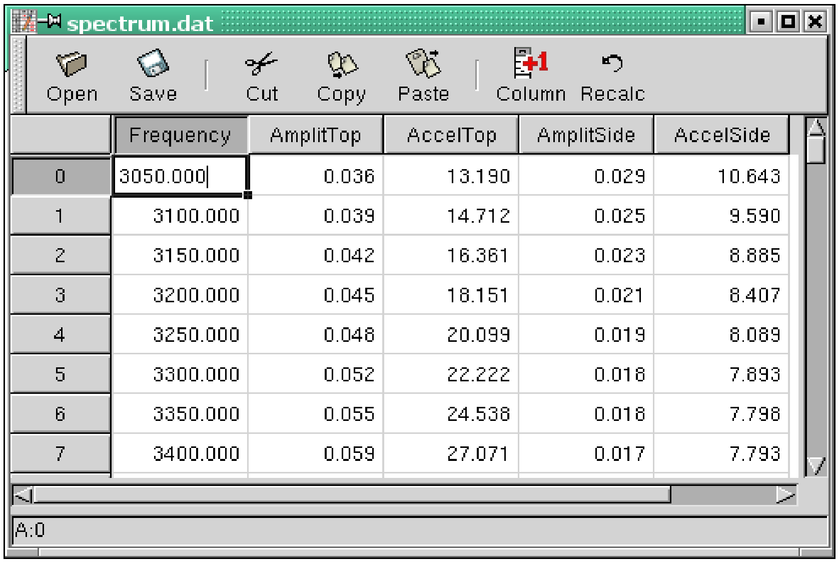
☑ Rename columns if 1st. line contains labels

☑ Rename worksheet to data file name

Figure 1: *The ASCII import options dialog.*

Upon clicking the **OK** button of the **file open** dialog, the dialog shown in Figure 1 opens. The dialog is divided into four frames. The **File structure** frame contains some general settings concerning the data structure of the file. In our case, we leave the **Read file as** dropdown list untouched. From the **Delimiter** dropdown list, we choose “tab” as delimiter because the “spectrum.dat” file was generated with tabs as delimiters between the numbers of a line.

We also leave the **Read lines** frame untouched because we want to read the entire file from the first to the last line. Nevertheless it is helpful to keep in mind that SciGraphica is able to read only a defined part of a file if the user wants to do so.



spectrum.dat

	Frequency	AmplitTop	AccelTop	AmplitSide	AccelSide
0	3050.000	0.036	13.190	0.029	10.643
1	3100.000	0.039	14.712	0.025	9.590
2	3150.000	0.042	16.361	0.023	8.885
3	3200.000	0.045	18.151	0.021	8.407
4	3250.000	0.048	20.099	0.019	8.089
5	3300.000	0.052	22.222	0.018	7.893
6	3350.000	0.055	24.538	0.018	7.798
7	3400.000	0.059	27.071	0.017	7.793

A:0

Figure 2: *Worksheet **Data1** after import of the spectrum.dat file. Note that the worksheet is renamed to the filename and that the columns have new labels.*

In the Worksheet options frame, we check both entries because we want to have the columns renamed according to the first line of the ASCII file and because we want to have the worksheet renamed to the data file name.

Clicking the **`Import`** button reads the contents of the file and puts them as numbers into the worksheet cells.

3.3 Plotting the data

Before we start to plot the data now contained in the worksheet, let me explain their nature in short. The data are real life data taken from vibration measurements. The **`AmplitTop`** and **`AmplitSide`** columns represent frequency dependent vibration amplitudes from the top and the side of the measured structure, the **`AccelTop`** and the **`AccelSide`** columns the respective accelerations.

This tutorial's idea about how to visualize these data is to plot the data from the top and the side into two graphs on one page. The graphs are aligned such that they are identical in size, one graph above the other. The upper graph should contain the data taken from the top of the structure, the lower graph shows the data taken from one side. Each single graph is intended to contain the amplitude as well as the acceleration.

The latter is not as simple as it seems at a first glance. Maybe you take a look at the data. The accelerations reach values up to roughly 4000, whereas the maximum values for the amplitudes range from about 3 to 4. A simple graph containing both amplitude and acceleration would consequently look like in Figure 3. Due to the scaling which complies with the acceleration, the amplitude is only visible as a straight line.

As this is not the way to produce such a graph, we have to look for a different way to make it happen. Happily, SciGraphica provides everything needed to process such a task. The following sections provide a step by step guide how to set up such a graph.

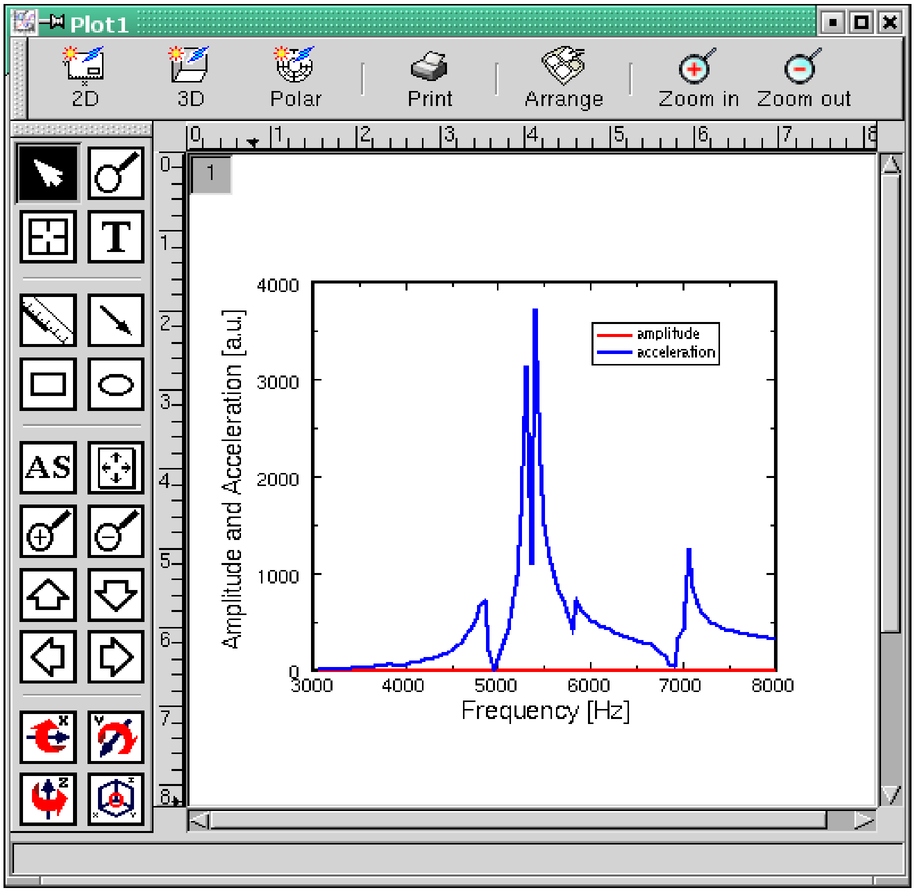


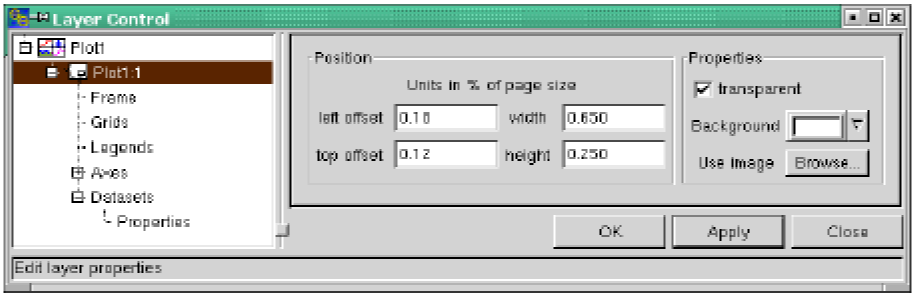
Figure 3: *If you plot amplitude and acceleration into one graph, the result is obviously not very enlightening...*

Amplitude and acceleration in one diagram?

The idea how to plot amplitude and acceleration into one diagram is to combine the graph of two layers which then appear as one diagram. We will do this by creating two graphs with identical position and size.

First, we create a graph which just contains the **`AmplitTop`** data. We double-click the **`Plot1`** icon in the **`Plots`** canvas of the SciGraphica main window. The graph page containing a plot template opens. By double-clicking the 1 button in the upper left corner of the plot page, the **`Layer Control`** dialog opens. As we have explored this dialog in full detail in tutorial 2, we will now only touch those items that are of concern for our present task.

Again, it is advisable to place the graph window to the upper right corner of the screen and the **`Layer Control`** dialog to the upper left corner.



Position

Units in % of page size

left offset 0.18 width 0.650

top offset 0.12 height 0.250

Properties

☑ transparent

Background

Use image Browse...

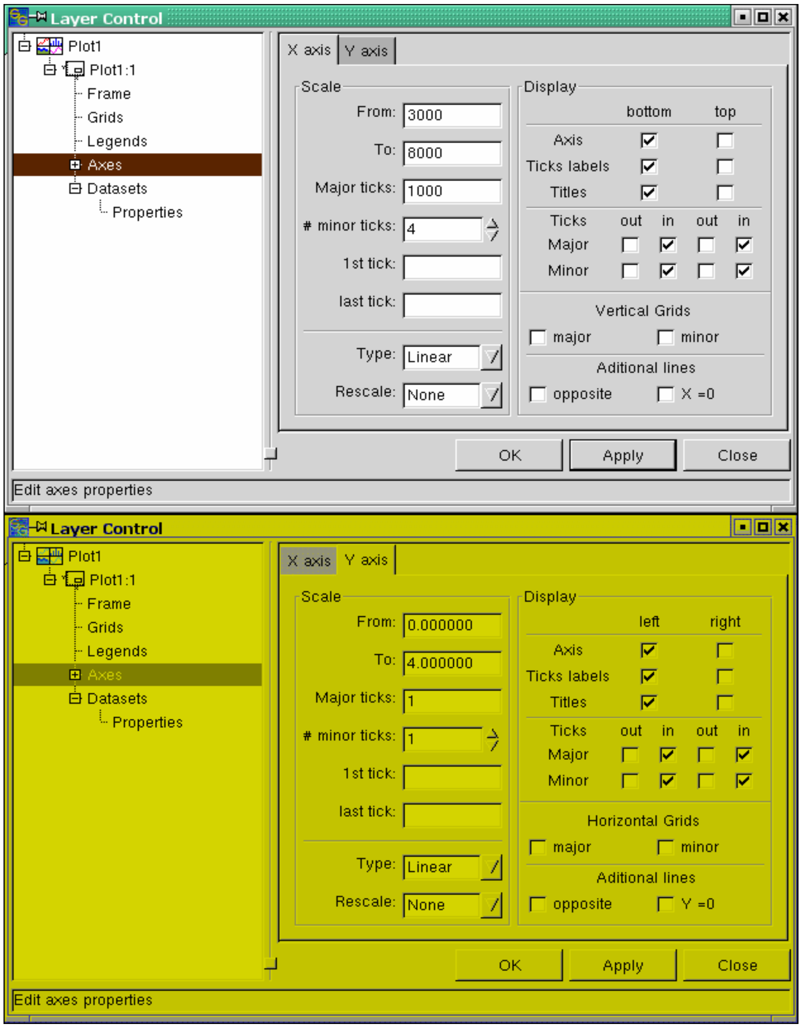
Edit layer properties

Figure 4: *Position and size data for the first graph layer.*

Click the **`Plot1:1`** entry in the dialog tree on the left. Into the **`Position`** frame, input the numbers as shown in Figure 4. Now click on the **`Datasets`** entry in the dialog tree. Add the **`Frequency`** column as the x column and the **`AmplitTop`** column as the y column. If you are not shure how to do that, please refer to tutorial 1, Figures 5 and 6.

Next, choose the **`Axes`** dialog to input the axis scaling. The settings can be taken from Figure 5. Clicking the **`Apply`** button shows the measured frequency response. At the moment, the data are visualized as a scattered graph which looks rather ugly - we will care about that later. At the moment, we focus on the display settings.

As you can see from Figure 5, the **`Axis`**, **`Ticks labels`** and **`Titles`** checkboxes for the top x as well as for the right y axis have been set to unchecked. This is because we want to use only the bottom x and the left y axis for representation of the amplitude data. If you make your settings accordingly and click the **`Apply`** button, your graph should now look like in Figure 6 (see page 6).



X axis

Scale

From: 3000

To: 8000

Major ticks: 1000

minor ticks: 4

1st tick:

last tick:

Type: Linear

Rescale: None

Display

	bottom	top
Axis	☑	□
Ticks labels	☑	□
Titles	☑	□

Ticks	out	in	out	in
Major	□	☑	□	☑
Minor	□	☑	□	☑

Vertical Grids

□ major □ minor

Aditional lines

□ opposite □ X =0

Edit axes properties

Y axis

Scale

From: 0.000000

To: 4.000000

Major ticks: 1

minor ticks: 1

1st tick:

last tick:

Type: Linear

Rescale: None

Display

	left	right
Axis	☑	□
Ticks labels	☑	□
Titles	☑	□

Ticks	out	in	out	in
Major	□	☑	□	☑
Minor	□	☑	□	☑

Horizontal Grids

□ major □ minor

Aditional lines

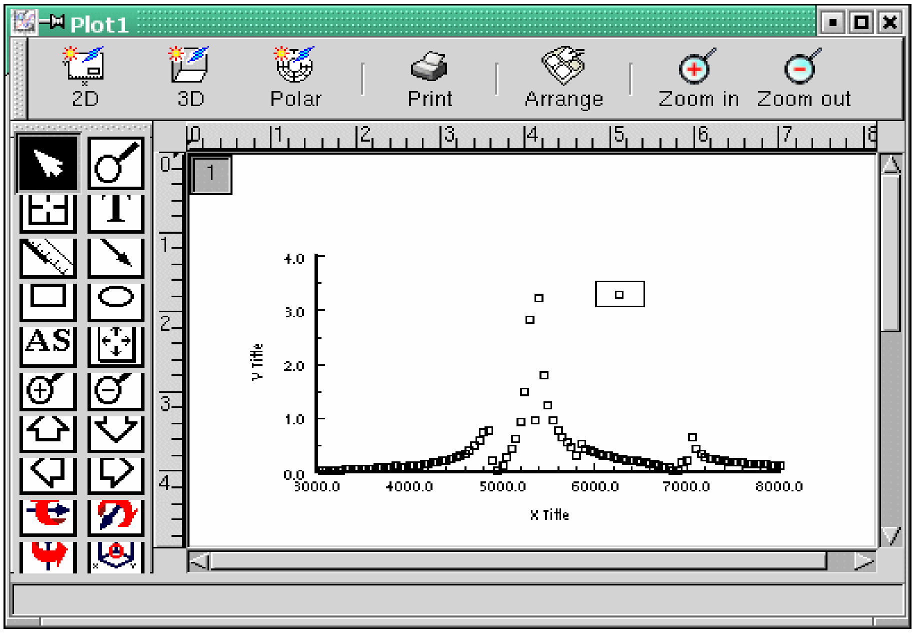
□ opposite □ Y =0

Edit axes properties

Figure 5: **`Axes`** *dialog settings for the first graph layer.*

***Figure 6**:*

Visualization of the graph showing the amplitude data after applying the settings from Figure 5. Note that the right and the top axis have been switched off.



Creating Layer No. 2

Now, click on the graph by the right mouse button. From the pop-up menu, choose “Layer --> New Layer --> 2D”.

First, you will notice that there is a new plot template on the plot page. Also, you will notice that there is a new grey button 2 in addition to the 1 button. These two buttons represent the layers on which each of the two graphs is plotted.

For those who are not familiar with the layer concept: a layer is like a transparency on which a single graph is plotted. If you have, e.g., two graphs, each on its own transparency, you can visualize a combined graph by laying transparency 2 on top of transparency 1. You will then see both graphs simultaneously.

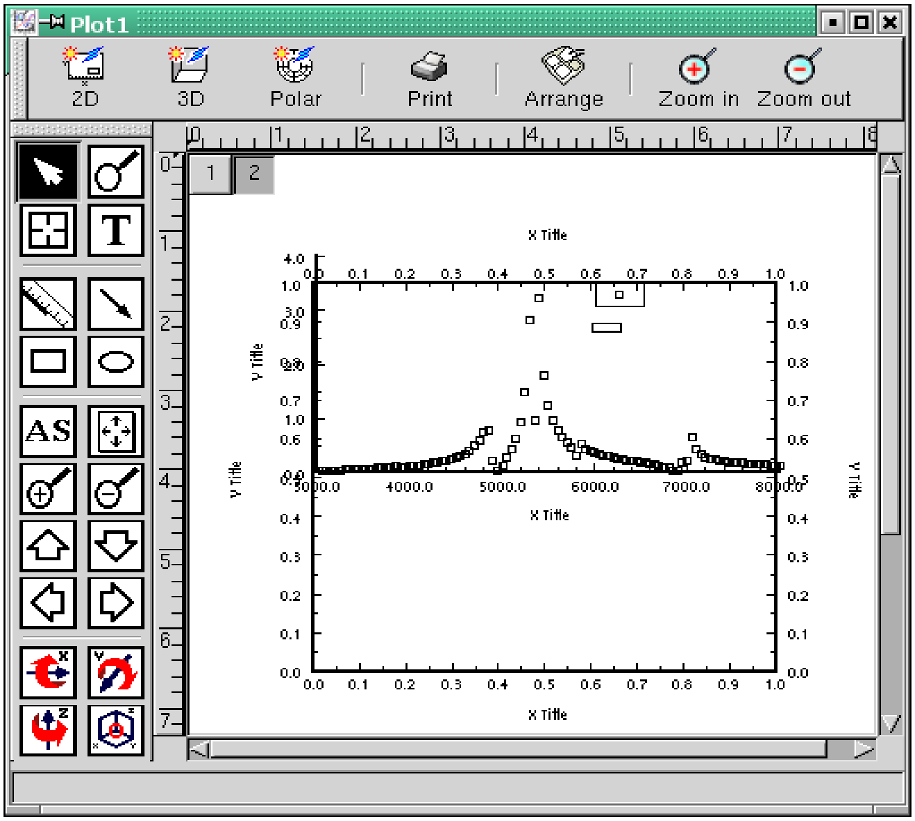
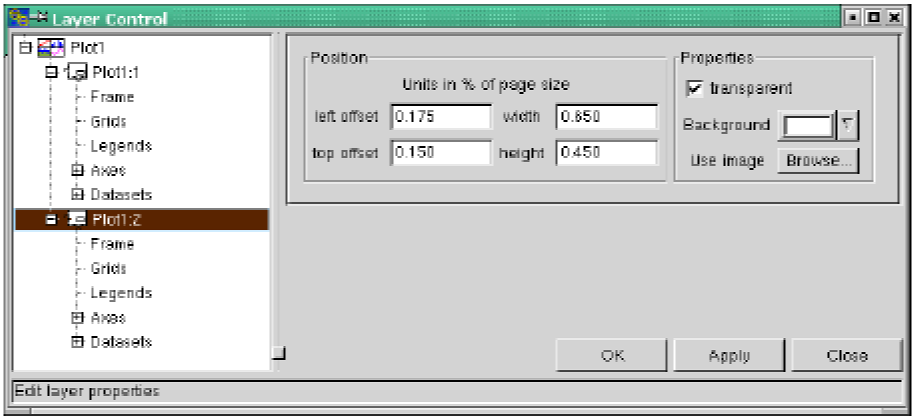


***Figure 7**: The graph after creating layer No. 2.*

We will now align the graph in layer 2 such that its position and size are identical with the layer 1 graph. To do so, we open the Layer Control dialog again (e.g. by double-clicking the 2 button). First, notice the change in the tree structure. Layer number two is represented by a branch of its own, denoted **`Plot1:2`**. The “:2” stands for layer two. If you now expand the branches of layers 1 and 2, you see that their structure is identical (see

Figure 8).

Now, copy the position data that have been entered into the **Plot:1** dialog shown in Figure 4 (see page 5) to layer two (this is done using the **Plot:2** dialog shown in Figure 8). If you now click the **Apply** button, the two graphs have exactly the same position and size. Only the scaling of the left and the bottom axis looks a bit strange.


Layer Control

Plot1
- Plot1:1
  - Frame
  - Grids
  - Legends
  - Axes
  - Datasets
- Plot1:2
  - Frame
  - Grids
  - Legends
  - Axes
  - Datasets

Position

Units in % of page size

left offset 0.175 width 0.850

top offset 0.150 height 0.450

Properties

☑ transparent

Background

Use image Browse...

OK Apply Close

Edit layer properties

Figure 8: *Adjusting position and size of layer 2.*

We fix this by activating the **Axes** dialog of layer 2. Here, we uncheck the **Axis**, **Ticks labels** and **Titles** checkboxes for the bottom x axis as well as for the left y axis (cf. Figure 5, page 5). The axis scaling is set from 3000 to 8000, **Mayor Ticks** 1000, **# minor ticks** 4 (same as for layer 1 - see Figure 5). We also uncheck **Ticks labels** and **Titles** for the top x axis, because the x axis scaling is the same as for the bottom axis of the layer 1 graph.

For the right y axis, we set the scaling from 0 to 4000, **Mayor Ticks** 1000, **# minor ticks** 1. Now, click the **Datasets** entry for layer 2 in the dialog tree. Add the **AccelTop** dataset of the **spectrum.dat** worksheet to the layer 2 graph.

If you have not forgotten to click the **Apply** button every time you changed the entries of a dialog, your graph should now look like in Figure 9. This result is still somewhat ugly because both datasets use the same symbol so that they can hardly be discerned.

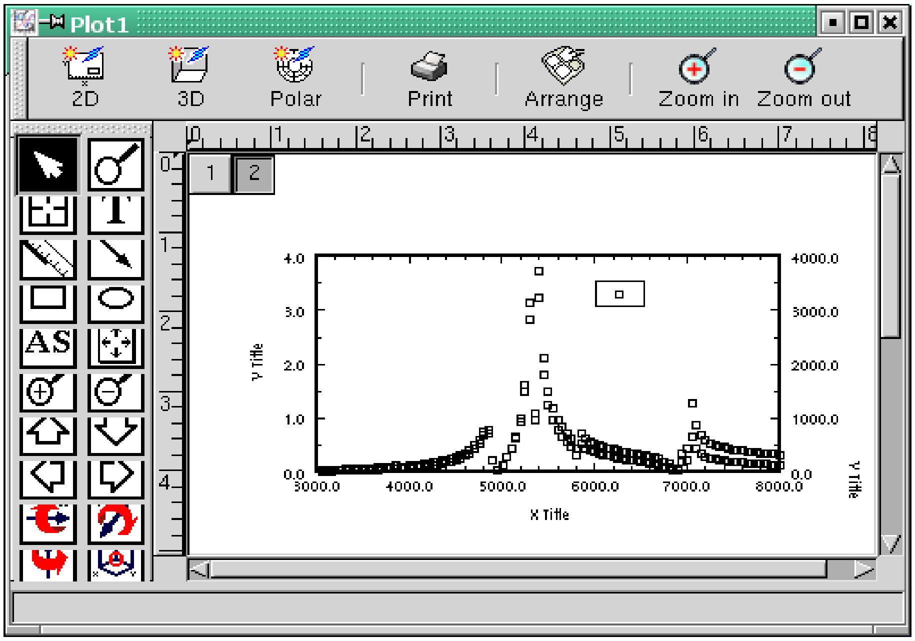


Figure 9: *The two-layer plot after size adjustment of layer 2.*

A better idea would be to represent the two datasets with lines of different color. And as the legends coincide, it would be advisable to drag one of them to a different position. But first line and color...

Applying some Styling

With the **Properties** dialog in the **Datasets** branch of each layer, you can change color, line style and the symbol to your choice. Let me suggest to use the red line, 1.5 point thick, no symbol for layer 1 and the blue line, 1.5 point thick, no symbol for layer 2. For the details of these settings, refer to tutorial 2. Maybe you want to apply the appropriate legend. If so, then input “Amplitude” into the Legend textbox for layer 1 and “Acceleration” into that for layer 2.

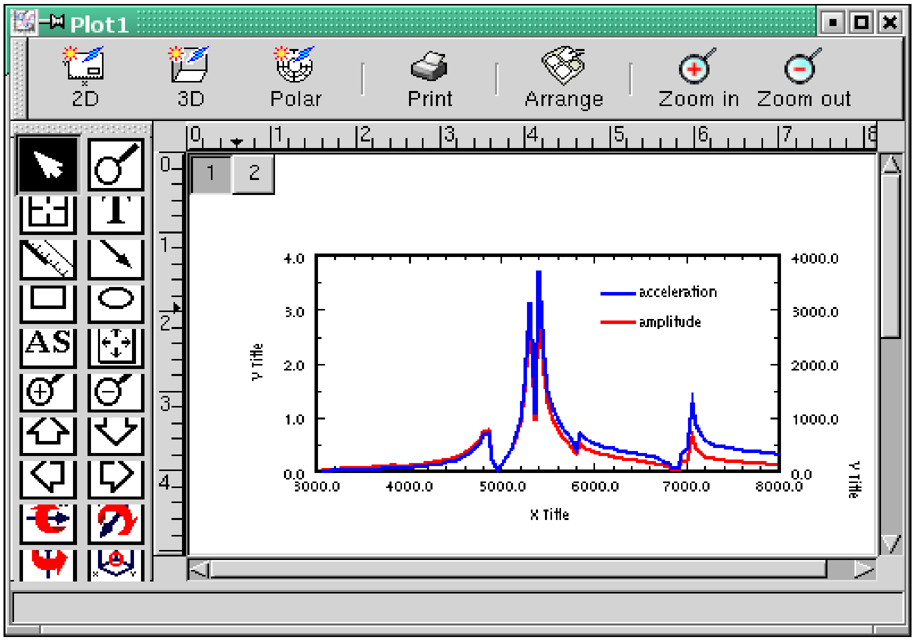


***Figure 10**: The graph after setting color and line style.*

After application of these settings, the graph should look like shown in Figure 10. Sorry? Ah, the frames around the legends! I have switched them off using the **Legends** dialogs of both layers.

Now we got legends - so far, so good. But who knows which axis and scaling belongs to which graph?

The best way to visualize this is to color the axis, ticks and titles themselves. Then we do not need the legends any more.

So we switch the legends off (**Legends** dialogs) and then turn to the **Frame** dialog of layer 1. In the **Properties** frame, we choose the red color from the **Color** dropdown list. If you click the **Apply** button, the bottom and the left axis will turn to red. But also the ticks are now colored in red!

Next, we choose the **Titles** dialog of the **Axes** branch (still layer 1). In the **Properties** frame, we set the **Foreground** to red. We input “amplitude [a.u.]” into the textbox of the **Label** frame.

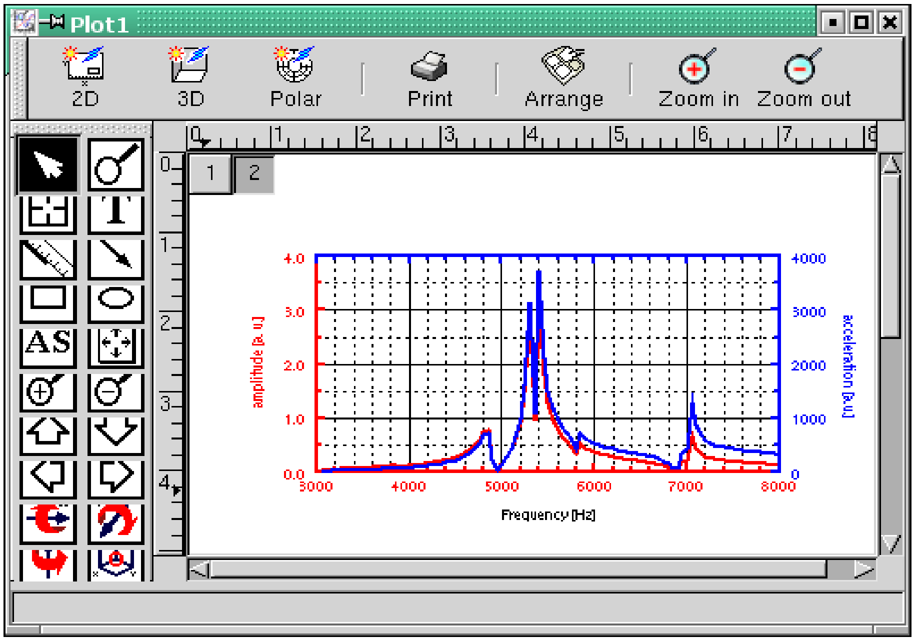


***Figure 11:** Setting text labels and axis colors...*

We repeat this procedure for layer 2, this time using the blue color. And after having switched the grids on (only for layer 1), the graph has gained a lot of clarity (see Figure 11).

Some of you who like perfect graphs may ask “Why aren't the x axes and ticks black? They are valid for both graphs and should not be colored!”

There are two answers. One is to generate four layers for a graph like the one in Figure 11. After having gone through the same procedure as described above, you would be able to color the four axes independently. The second answer is that SciGraphica develops at a very fast pace. Not every feature that one might think of has been realized yet. Nevertheless I hope that I could show you the power of at least the 2D graphics capabilities. And be shure - more things are to come soon!

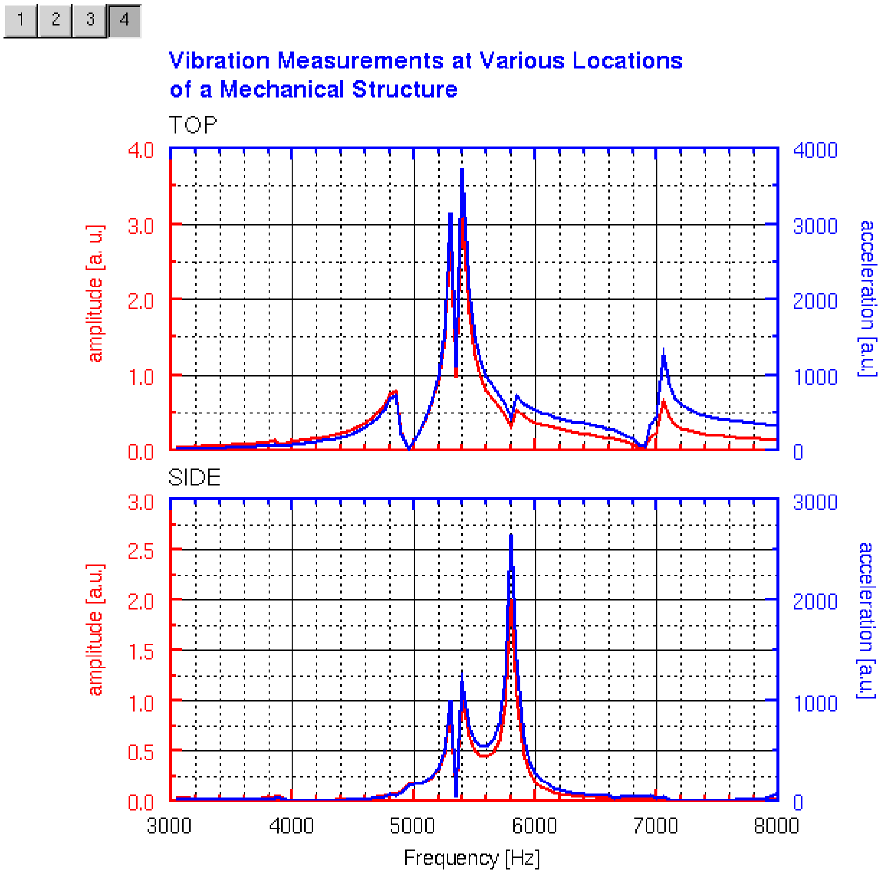


Figure 12: *The final result of this tutorial. The four columns are plotted in two graphs, each of which consists of two layers.*

Completing the Graph

Let us conclude this tutorial with Figure 12. This graphics has been generated by adding a third and a forth layer to the graph shown in Figure 11. The bottom axis ticks and title of layer 1 (upper graph) have been switched off. Due to the fact that both graphs show the same size as well as the same x scaling, it is sufficient to have x axis ticks and title only for the lower graph. The grids serve as a guide to the eye.

Layers 3 and 4 exhibit obviously the same size as layers 1 and 2. The only parameter that is different is the top offset of these two layers.

The graph in Figure 12 is left as an exercise to you. After having made the first two layers, it should not be too difficult to generate also the second graph. Having finished your work, you may save it as “tutorial3.sg”

You still don't have enough? Well, then we will meet at tutorial 4. There, you will learn how to do some calculations with the columns of a worksheet.