

SciGraphica

Tutorial Manual - Tutorials 1 and 2

Version 0.8.0

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Tutorial Manual - Tutorials 1 and 2

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Tutorial 1: My First Plot

1.1 Introduction

This tutorial will show how to input a simple set of data into a worksheet named **MyData**, create a 2D plot named **MyFirstPlot**, input the worksheet data into the 2D plot and finally visualize the data by autoscaling the graph.

1.2 My First Worksheet

Although there are much more elaborate ways to input data into SciGraphica, let us start with some "Hello World" like stuff.

Start SciGraphica by the command **sga** (e.g., from some shell window). The program's main window will appear on the screen (Figure 1).

For the first, we do not care about the menu or the button bar, we first try what we can do with the worksheet icon named **Data1** which is contained within the tabbed panel. The icon text is highlighted so that by typing some text the name of the worksheet can be changed. Let us change the worksheet's name to **MyData**.

Now, by double-clicking the worksheet icon a worksheet window is opened. Into one column of the worksheet, numbers can be input by just typing the number and pressing the **enter** button. By doing so, the number is shown in the cell and the cursor jumps into the cell below. To go on, just type in the numbers as shown in Figure 2.

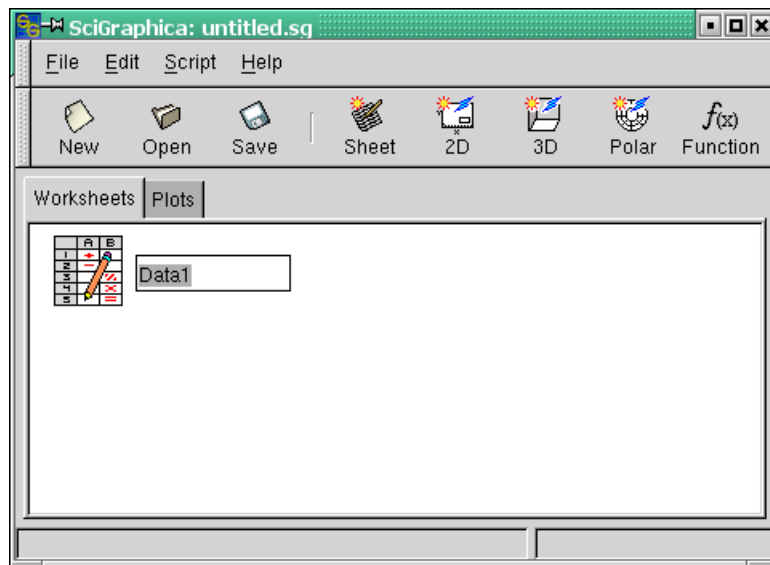


Figure 1: SciGraphica's main window just after program start.

	A	B	C	D
0	1.000	1.000		
1	2.000	2.000		
2	3.000	4.000		
3	4.000	8.000		
4	5.000	16.000		
5	6.000	16.000		
6	7.000	8.000		
7	8.000	4.000		
8	9.000	2.000		
9	10.000	1.000		
10				

Figure 2: Worksheet **MyData** after some numbers have been input into the cells.

1.3 Plotting My Data

After having input the data into the worksheet **MyData**, the next step is to activate the **Plots** panel in the main window by clicking the **Plots** tab. To create your first plot, just click the **2D** button in the button bar (Figure 3). Do not worry that you have only created an icon. First of all, rename the highlighted name of the plot icon - by default named **Plot1** - into **MyFirstPlot**.

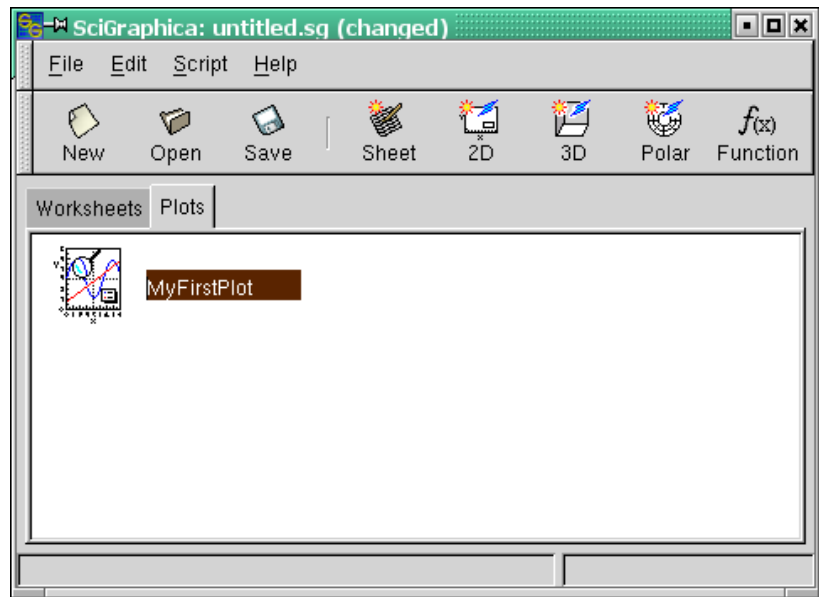


Figure 3: Creation of a 2D plot icon named **MyFirstPlot**

Now double-click the plot icon. A plot window named **MyFirstPlot** opens (Figure 4). Just ignore the button bar on top of the window as well as the toolbar on the left hand - we will return to that later.

Instead your attention should be caught by the small grey button of quadratic shape at the upper left corner of the graph page. The button shows just a number **1**. The meaning of this number will be explained in detail in tutorial 3.

At the moment, the plot does not seem to have anything to do with the worksheet data you typed in. To change this, double-click the small grey button named **1** in the upper left left.

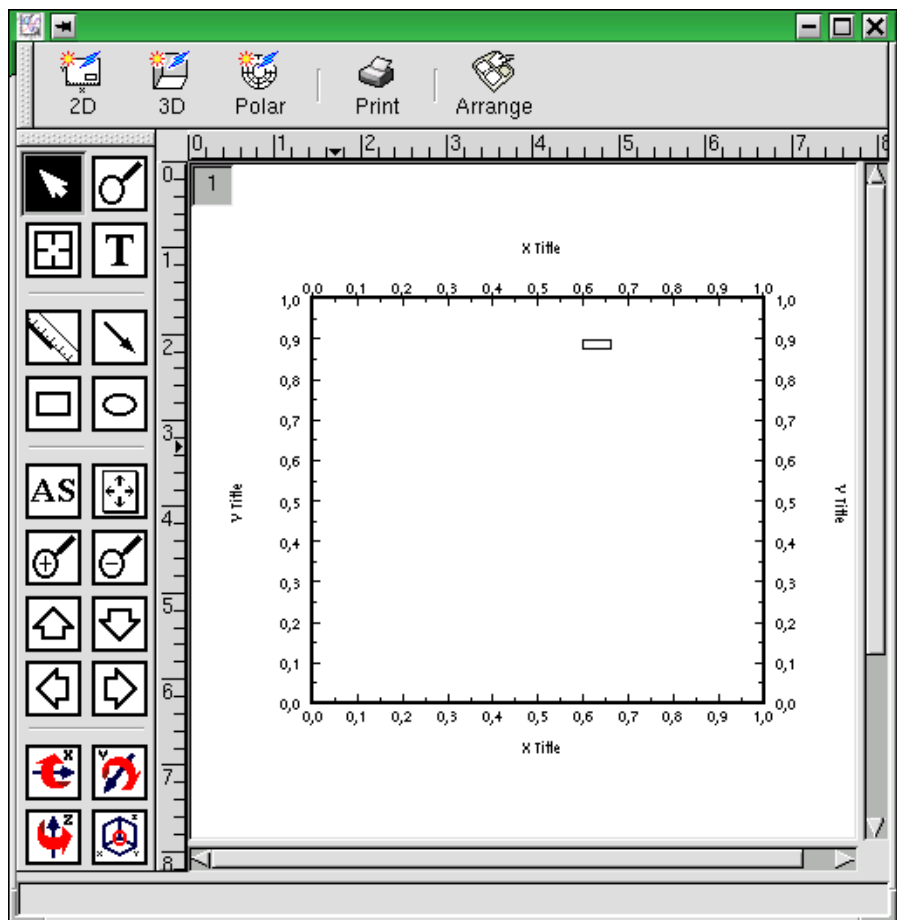


Figure 4: The plot window of **MyFirstPlot**

Having double-clicked the small button in the upper left corner of the graph page, the **Layer Control** dialog shown in Figure 5 opens.

The dialog is divided in two parts. The left hand part shows a tree view of the graph's structure. We will examine this in full detail in tutorial 2. For the moment, we just click the Add button in the right hand part of the dialog. A new dialog - named **Add dataset** - opens (Figure 6).

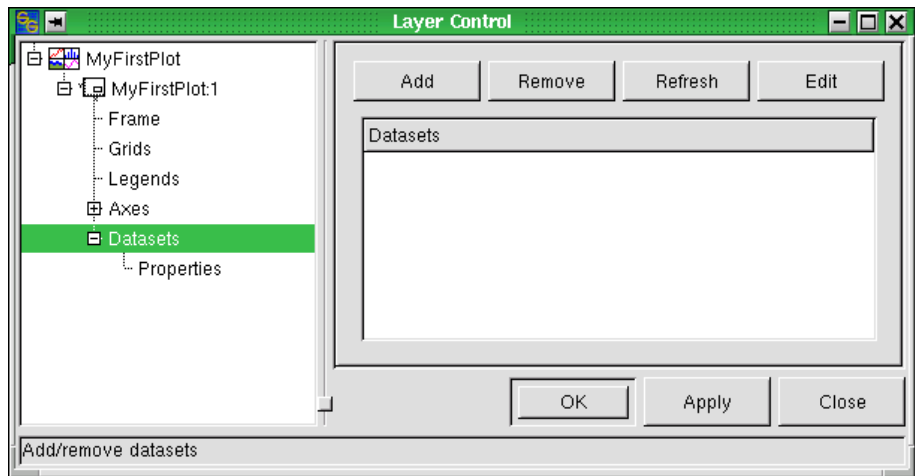


Figure 5: The **Datasets** section of the **Layer Control** dialog.

The **Get data from** dropdown list shows the item **Worksheet**, the **Select Worksheet** contains **MyData** - so there is nothing to change for us at the moment. The dropdown list **Dataset Style** lets you choose the style in which your data will be plotted. As we want to change this, we click the down arrow on the right of the style symbol and choose the line + symbol style as shown in Figure 6. Next, by clicking we highlight the **A** entry in the **Columns** box and click the arrow button pointing towards the **x** textbox. The **A** entry will now appear in the **x** textbox, whereas it has disappeared in the **Columns** box. We repeat the procedure for the **B** entry in the **Columns** box which is moved to the **y** textbox.

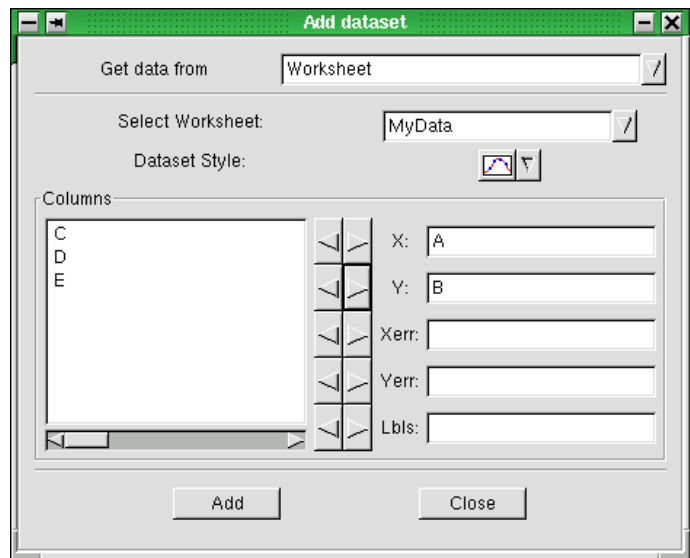



Figure 6: The **Add dataset** dialog

Clicking the **Add** button, we leave the **Add dataset** dialog and return to the **Datasets** section of the **Layer Control** dialog. Clicking the **Apply** button, the data of the **MyData** worksheet are added to the graph.

But what's that? There are no data visible in **MyFirstPlot**! Do not worry - we will fix this within the next second.

Taking a look at the graph's x and y axis scaling, there is a discrepancy between the range of values that we have typed into our MyData worksheet and the default scaling of the graph layout. To fix this, just click the **AS** button in the toolbar (see Figure 7).

Congratulations! You have plotted your first set of data using SciGraphica.

In tutorial 2, all the details of formatting **MyFirstPlot** will be shown. Therefore, you should save your first SciGraphica project. To do so, click the  button. Type **tutorial1.sg** in the **File** textbox of the **Save Project** dialog.

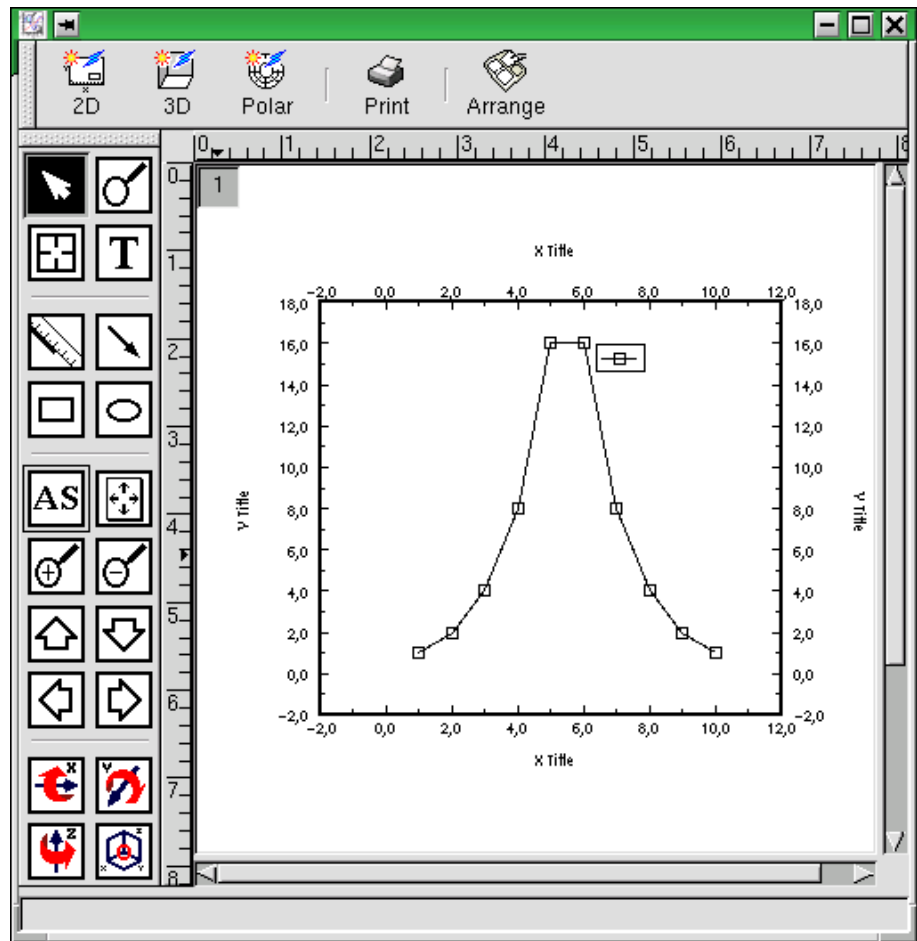



Figure 7: Dataset **MyData** plotted by SciGraphica

Tutorial 2: Formatting the Graph

2.1 Introduction

In this rather comprehensive tutorial, we will go through some of the formatting options that SciGraphica offers to the user. We will perform such operations as resizing the graph, providing some background color, adding grids, adding a text to the legend, change shape and color of the data symbols - just to mention a few.

Because the Layer Control is very well-structured and self-explaining, you are invited to try those options that will not be touched in this tutorial. Nevertheless, at the end of this tutorial, you will have taken a look at all the dialogs that SciGraphica offers in order to format graphs.

To begin, you will open the SciGraphica project that you have created in the first tutorial: click the  button to open the **Tutorial11.sg** file. Then, double-click the graph icon named MyFirstPlot in the plot panel.

In order to ensure optimal access to the different sections of the Layer Control dialog, it is advisable to drag the window containing the plot to the upper right corner and the Layer Control dialog to the upper left corner of the screen.

2.2 Moving and Resizing the Graph


Before we go through the details of the Layer Control Dialog, let's spend a second with the possibilities of moving and resizing a graph just by using the mouse.



To do so, click on the lower x axis. The graph is now highlighted by a frame decorated with squares. Dragging one of the squares by the mouse will resize the graph in the same way that you may know from some graphics program package.

To move the graph to a new position, click on the x axis again. While holding the mouse button down, you can move the graph to a new position by dragging it with the mouse.

2.3 The Layer Control Dialog

Page Properties

Double-clicking the  button in the upper left corner of the graph page opens the Layer Control dialog. You already had first contact with it in tutorial 1 when you added the data to the empty graph template (see Figure 5 on page 5).

Now, we take a closer look at the dialog. Its left part is organized like a tree. Its branches can be expanded and collapsed by clicking on the  or  symbol.

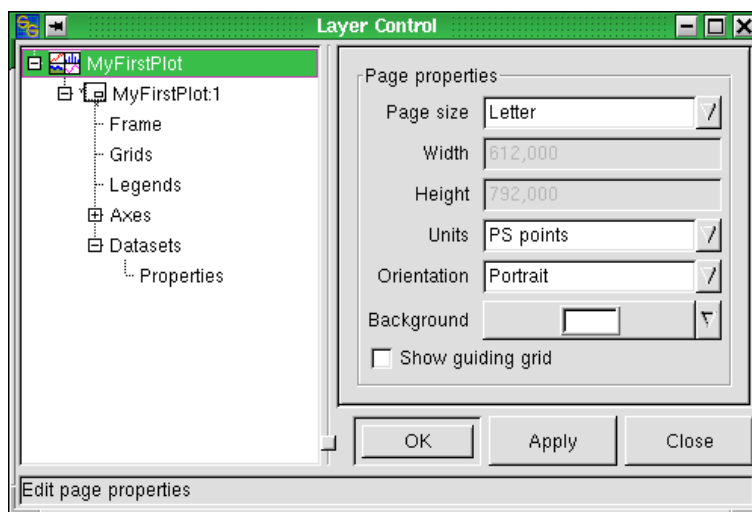


Figure 8: The Layer Control Dialog

The root of the tree (which is highlighted in Figure 8) is labeled **MyFirstPlot** - which is the name of the graph. It branches to **MyFirstPlot:1** which denotes the first layer of the graph. This structure will become clearer in tutorial 3. The items covered by **MyFirstPlot:1** are **Frame, Grids, Legends, Axes** and **Datasets**.

The right part shows the dialog itself. It contains the settings that can be made in the context of the item selected from the tree.

As for **MyFirstPlot**, the settings determine the layout of the graph page, like page size, orientation etc. Just to try something, click the dropdown arrow right of the **Background** list box. Choose one of the colors from the palette and click the **Apply** button. The background color of the plot window immediately changes to the color of your choice.

For the following steps, please set the background color back to white (default).

Click on the **Show guiding grid** checkbox so that it shows a checkmark, then click apply. Now, the background of the graph shows a grid which can be used as a guide when moving and resizing a graph (see Figure 9).

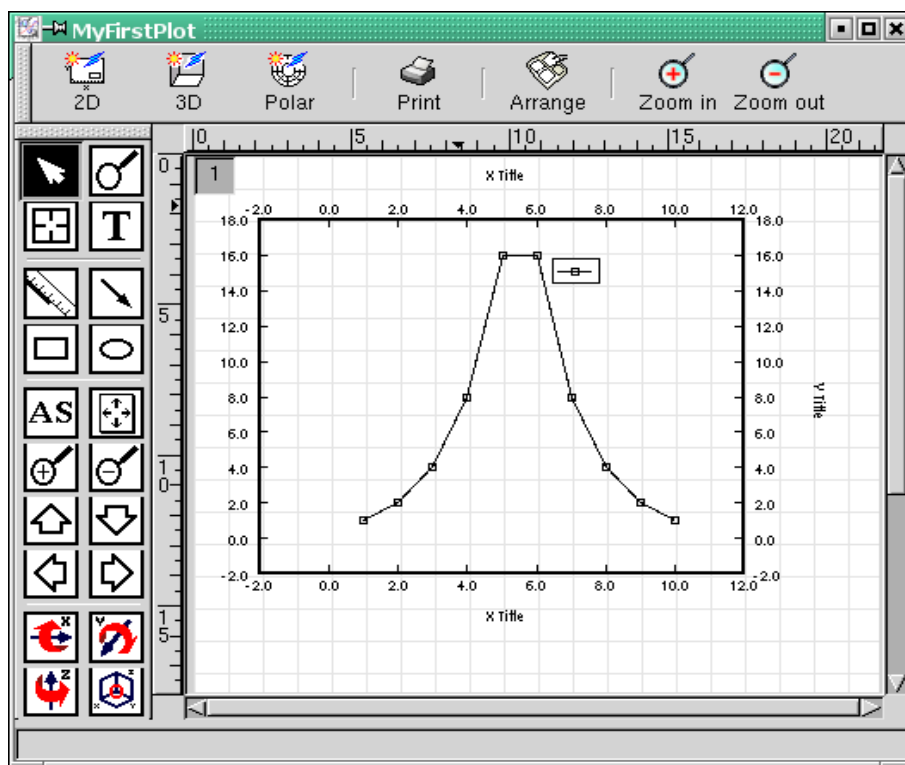


Figure 9: Guiding grid in the background of the graph page.

General Layer Properties

After having adjusted the graph page properties, the next step is the formatting of the graph itself. Click on the **MyFirstPlot:1** entry in the tree. The dialog changes to show the items in Figure 10. It allows to change position and size of the graph by precise numbers instead of dragging by mouse.

Let us input some new numbers. The numbers that have to be input represent a fraction of the page size (not percentage, as labeled in the dialog; e.g. width = 1.0 will be 100 percent of the page size). Just take the numbers as shown in Figure 11 and press the **Apply** button. Position and size of MyFirstPlot should have changed according to the new settings.

As a last thing, we will change the background color of the graph. To do so, first uncheck the **transparent** checkbox. Then click the dropdown arrow of the **Background** list box. Choose some color (See Figure 12) from the palette which appears and then press the **Apply** button.

The graph should now look like in Figure 13.

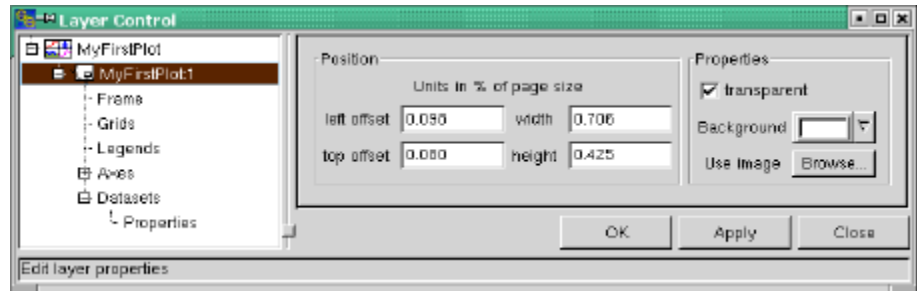


Figure 10: Graph position and size

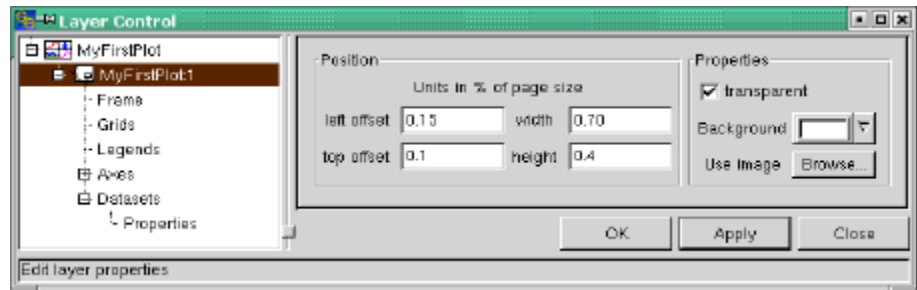


Figure 11: Changing position and size of MyFirstPlot...

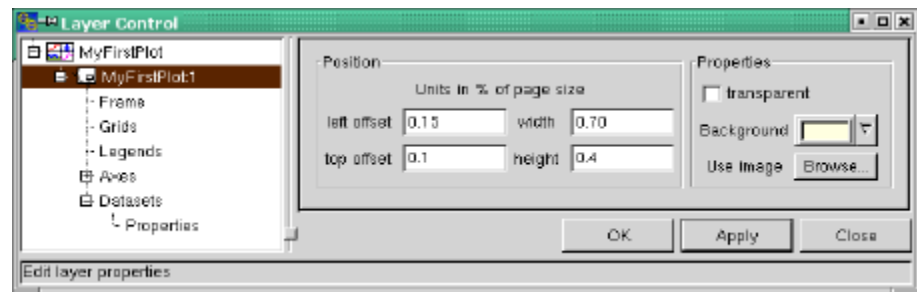


Figure 12: Changing the graph's background color...

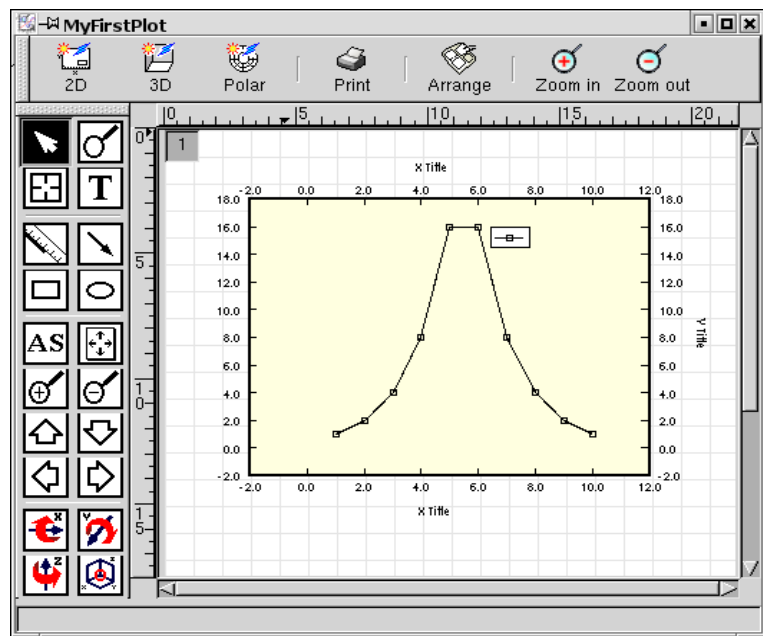


Figure 13: Appearance of MyFirstPlot after changing position, size and background color.

Changing the Axis („Frame“) Layout

Now that position, size and background color of the graph are defined, we choose the next entry in the dialog tree which is named **Frame** (see Fig. 14). With this dialog, one can change thickness and color of the frame of axes that surrounds our graph **MyFirstPlot**.

As an example, we change the color of the axis frame to dark blue (**Color** dropdown list box). Because these are self-explaining features, just play around with them. Remember that changes are invoked only if you press the **Apply** button. Because these settings are of no further concern for our tour through SciGraphica, please set them back to: thickness = 2.0, ticks length = 8, color = black, before proceeding.

SciGraphica also enables us to change the axis position. What does that mean? To find that out, just set the four sliders to a value of 0.5 and then press the Apply button. Your graph should now look like in Figure 15.

While this kind of presentation has its advantages in certain cases, it is not so helpful for the next steps. So please change these settings according to Figure 14.

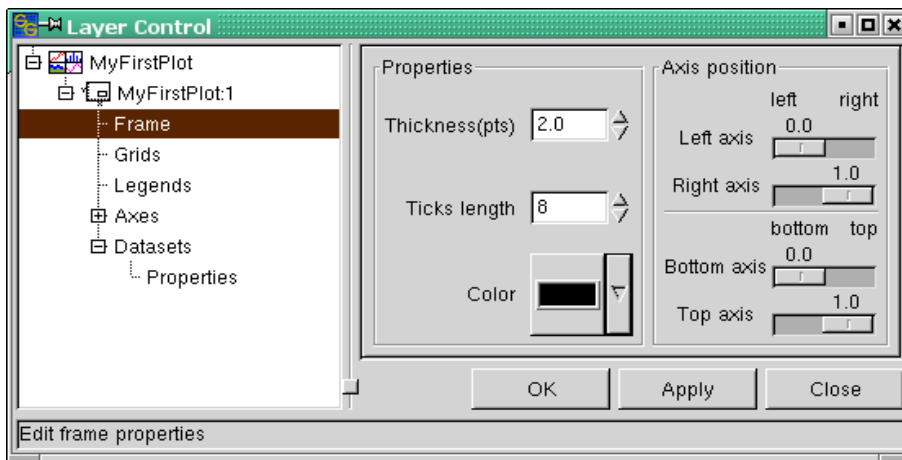


Figure 14: The **Frame** dialog.

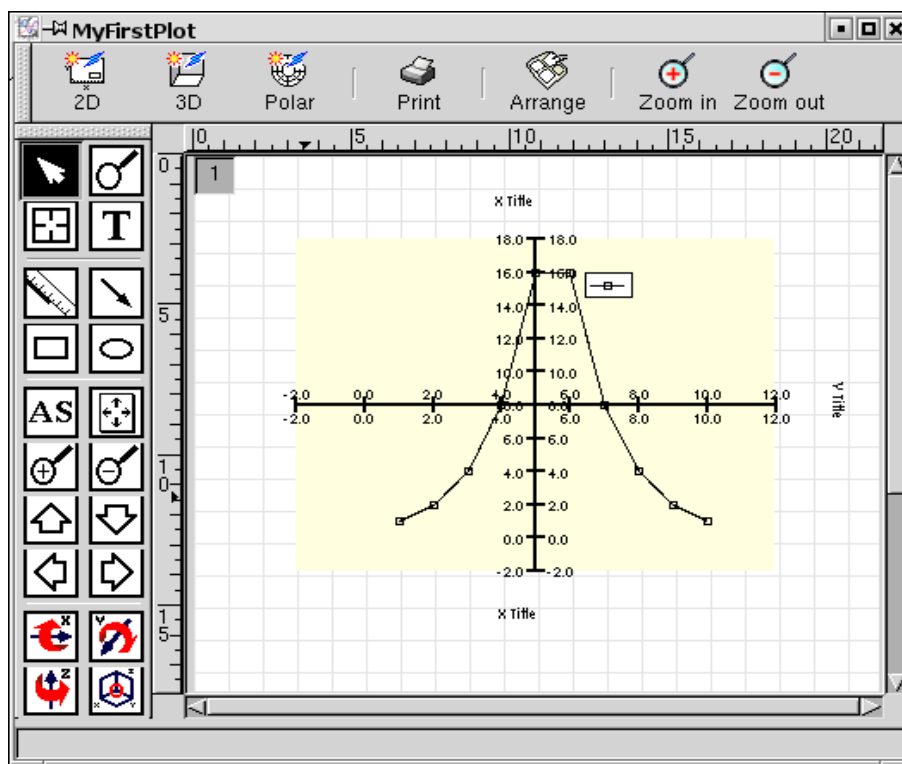


Figure 15: Graph **MyFirstPlot** with a cross of axes...

Adding Grids

With the help of the **Grids** dialog we can switch on grids. As you may see, we have now a tabbed dialog - one for the x axis and one for the y axis. To see the effect of grids, we choose the settings according to Figure 16. After having pressed the **Apply** button, we do the same settings for the y axis (just click the y axis tab and repeat the procedure).

You will end up with a plot like in Figure 17.

Some of you may wonder where the minor grids (those showing a dotted line) are. Please be patient. They will appear as soon we will have applied some manual scaling to the graph.

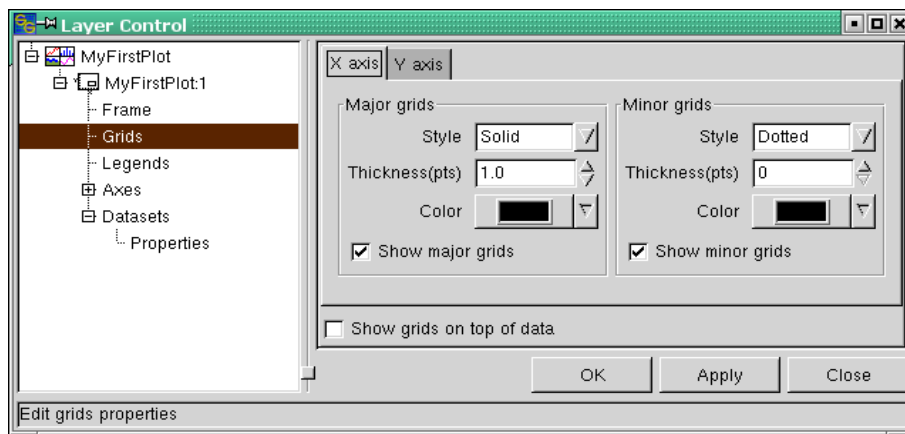


Figure 16: The Grid dialog

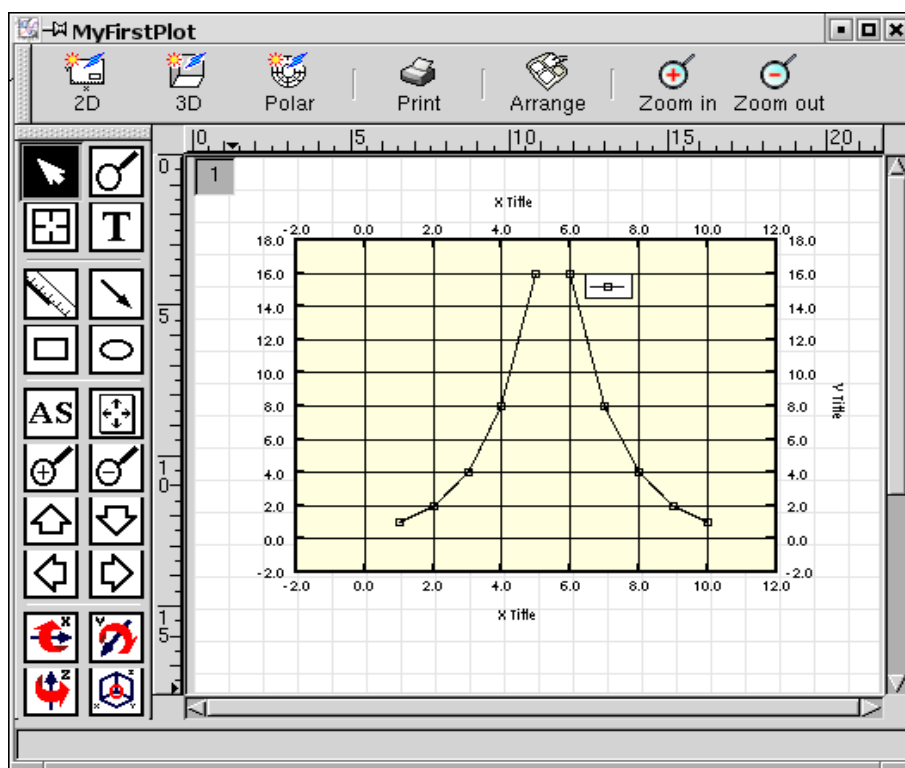


Figure 17: MyFirstPlot after adding grids.

Legends

If it makes sense to have a legend in your graph that denotes the different datasets that have been plotted into one graph plane, then you can make some general settings for the legends in the **Legends** dialog which is shown on the right hand (see Figure 18).

Please keep in mind that it is this dialog where you switch legends on and off!

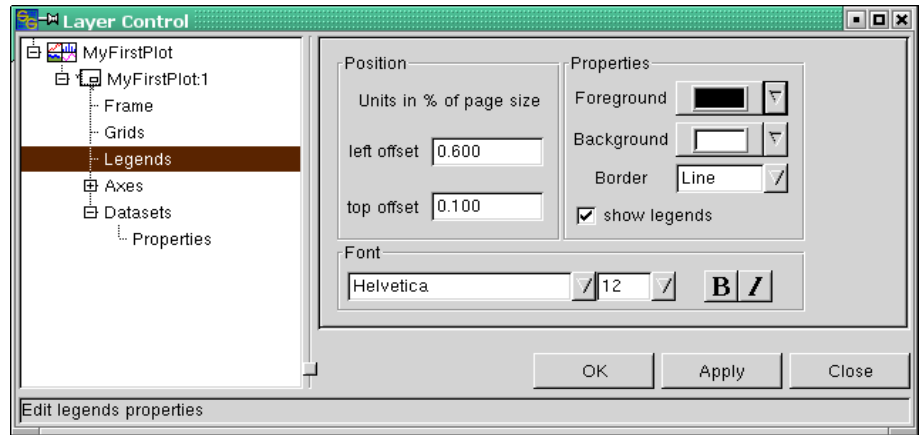


Figure 18: The **Legends** dialog.

Axes Settings

When we set up the basic graph in tutorial 1 (see page 6), we applied autoscaling to the graph in order to visualize the data. While this is appropriate in order to get a first overview, it may be advisable for presentation purposes to enhance the clarity of the graph's message by applying manual scaling.

This can be achieved by help of the **Axes** dialog (Figure 19). As in the case of the **Grids** dialog, this one is also structured as a tabbed dialog. By clicking the **Axes** entry in the tree, the **X axis** tab appears. The dialog itself is divided into two frames. One contains the scale settings for x axis. It lets you also choose whether the axis type is linear, logarithmic etc. (see the **Type** dropdown list) The other frame contains checkboxes which allow to switch axes, tick labels, titles and ticks on and off.

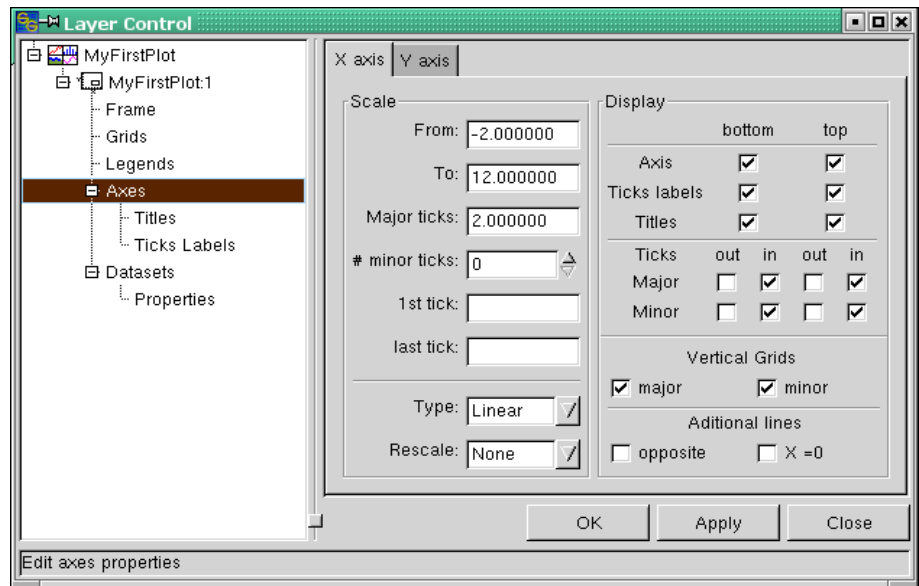


Figure 19: The **Axes** dialog

Now let us apply these possibilities to MyFirstPlot. Into the **From** textbox (denoting x_{min}), type 0.0, into the **To** textbox (i.e. x_{max}) type 10.0, the **Major Ticks** entry may be left untouched (see Figure 19). The number of minor ticks is set from zero to 3 (see the **# minor ticks** textbox). If you now press the **Apply** button, the x axis ranges from 0.0 to 10.0, and - oops! - the minor grid has appeared! This means: the appearance of a minor grid depends on what number of minor ticks you have defined in the **Axes** dialog.

The next step is the decoration of the graph with “ticks and titles”. At the moment, it looks somewhat “overcrowded” with tick labels also on the top x and the right y axis. To change this, we uncheck the top ticks labels and the top titles (see the respective checkboxes in the **Display** frame - Figure 20).

Now click on the **Y axis** tab and input 0.0 into the **From** textbox, 20.0 into the **To** textbox, and 4.0 into the **Major ticks** textbox. For the **# minor ticks** we choose a value of 3. After having pressed the Apply button, the minor ticks related to the y axis have also appeared.

Last, we switch off the ticks and titles for the right y axis. You find the respective checkboxes in the **Display** frame. Now click the Apply button, and the graph looks a lot clearer (See Figure 21).

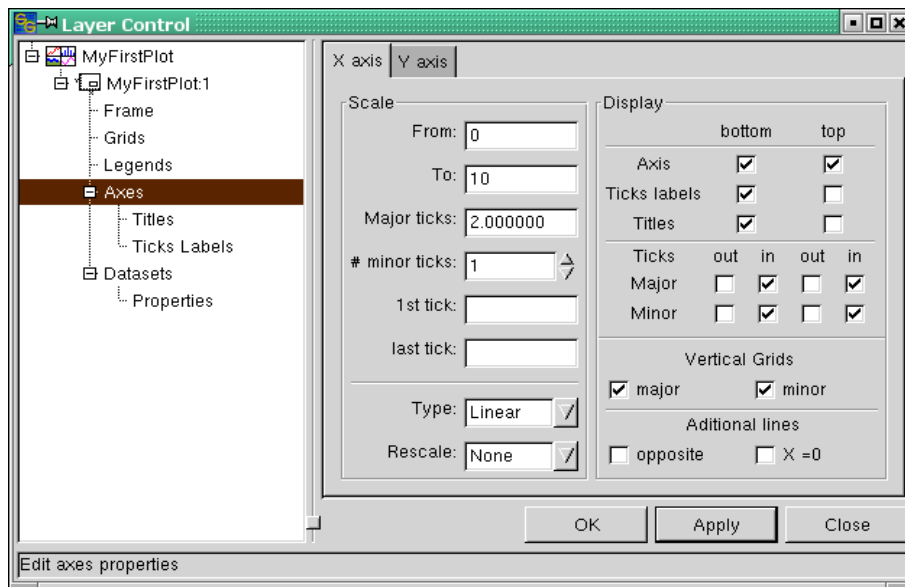


Figure 20: Axis settings as described in the text...

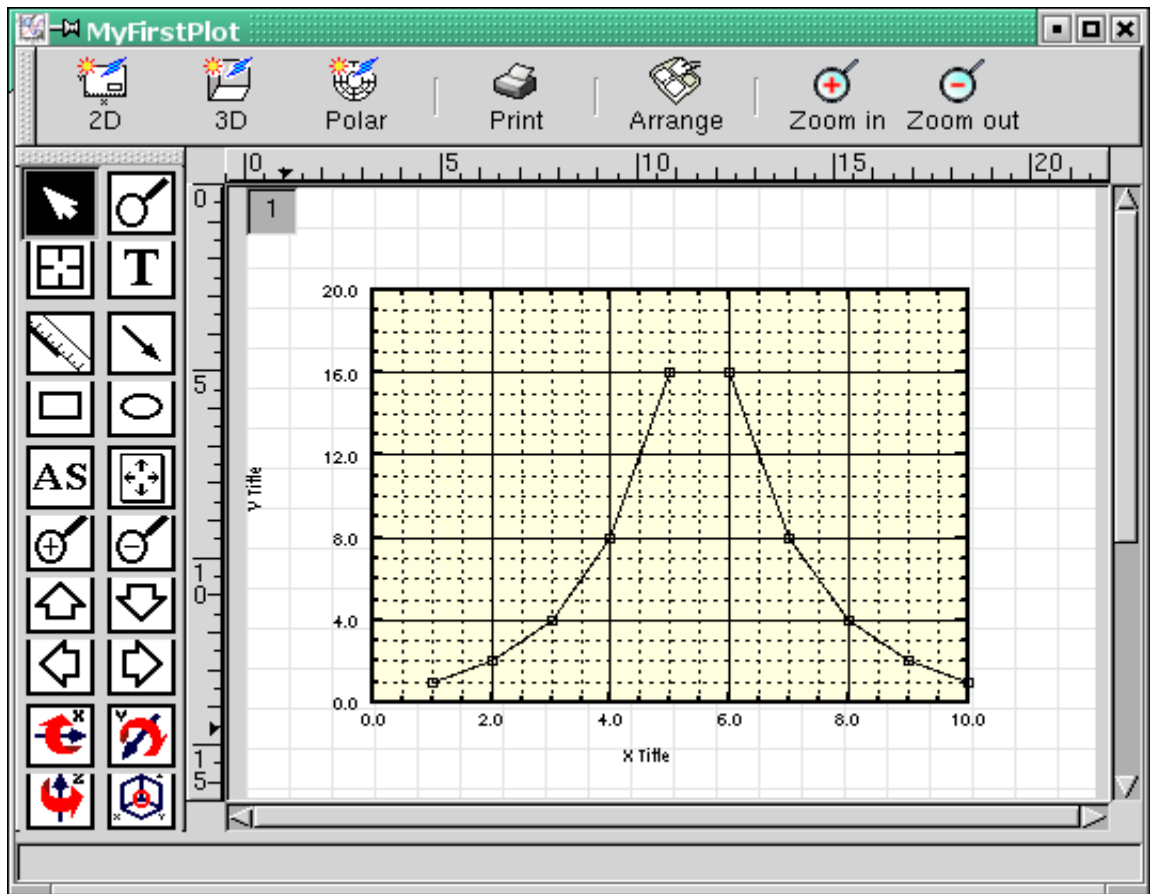


Figure 21: Graph MyFirstPlot after switching off ticks and titles on the top and the right axis. The axes scaling as well as the gridding have been redefined for better clarity.

Axis Titles

Although MyFirstPlot has gained a lot of clarity compared to its first appearance on the screen, we are not completely content. "X Title" and "Y Title" are not so much helpful, and having a trailing zero after the decimal point seems to be a little bit exaggerated.

We can tackle this by the next two dialogs which branch from the **Axes** entry in the dialog tree. The first of them, the **Titles** dialog, provides some means for formatting the axis titles. With the help of the **Position** frame, you can adjust the position of the label. You also can rotate the label by some angle different from 90°. Figure 22 has already some entries in the respective textboxes which provide a good position for the label. Another possibility of positioning the labels exists in dragging them by mouse into

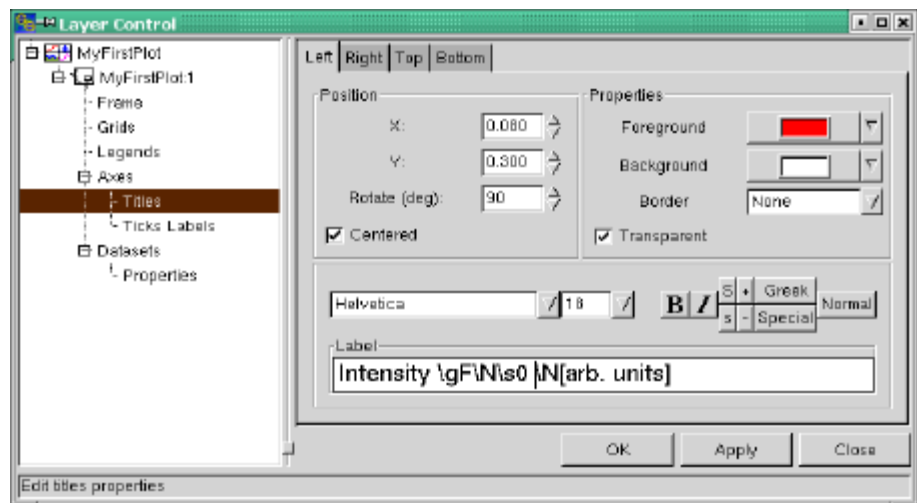


Figure 22: Settings of the **Titles** dialog (**Left** tab).

the wanted position.

By use of the **Properties** frame we can, e.g., change the text color of the label. As you can see from Figure 22, the color has been already changed to red. This is because we want to make the color of the y axis title correspond with the color of the graph data which we will change to red later on.

In the last frame we can change text font and size. According to the settings in Figure 22 we choose Helvetica 18 point.

But what's that! Hieroglyphs?! "**Intensity Φ_0 [arb. units]**" does not seem to make so much sense. Let me explain this. SciGraphica provides some means to make use of special characters, superscripts and subscripts and the like as well as basic formatting (bold, italic) for axis titles, tick labels etc. The way this is done is to use tags which switch these features on and off. The "**g**" tag switches on greek letters. Thus, **\gF** is equivalent to the greek letter Φ . To switch back to the normal font, one uses the "**N**" tag. The "**s**" tag switches subscript on, the "**S**" tag stands for Super-script.

You can just type these tags into the **Label** textbox. The other way is to click on one of the buttons to enter the respective tag into the textbox. Just play around with it to find out which tag each of the buttons represents. If you are through, click the **Apply** button.

Click the **Bottom** tab to switch to the bottom axis dialog. Enter "Frequency

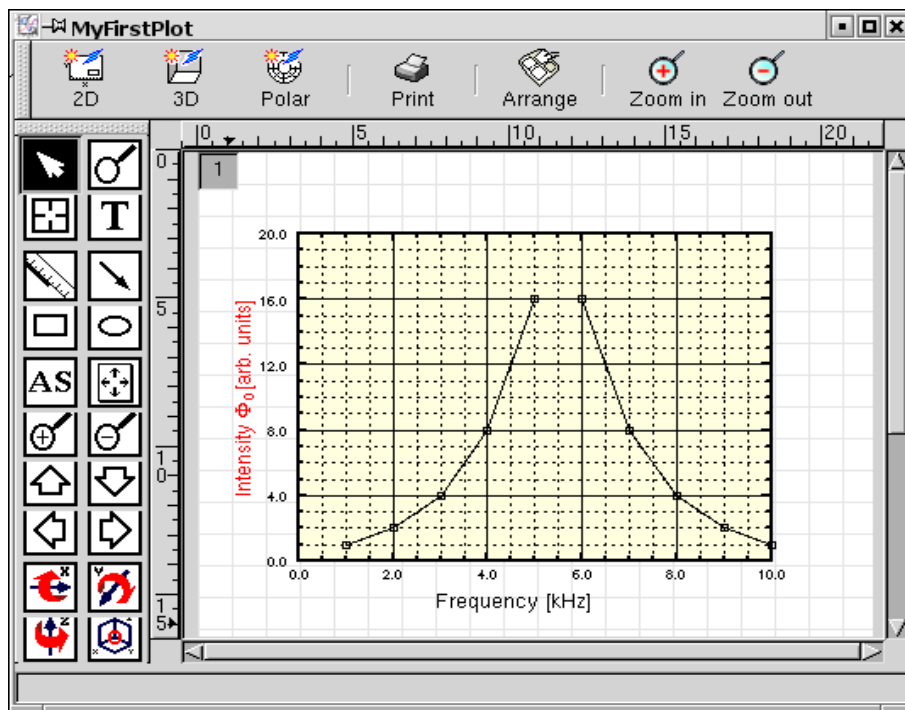


Figure 23: MyFirstPlot after renaming the titles of the bottom x and the left y axis. The color of the y axis title has been set to red in order to match the line and symbol color of the data (which will be set later).

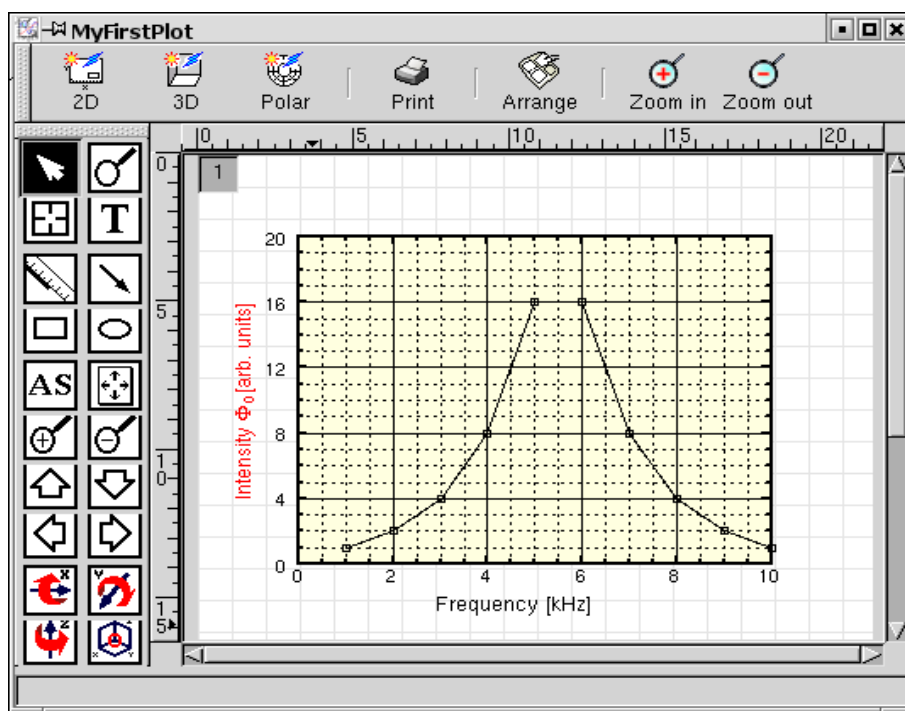


Figure 24: MyFirstPlot after tick label formatting.

[kHz]" into the **Label** textbox and adjust font and size to Helvetica 18 point. Click the Apply button. The graph should now look like Figure 23.

Formatting Tick Labels

After having changed the size of the axis titles, we also want to change the tick label size. This is done within the **Ticks Labels** dialog (see Figure 25).

By means of the **style** dropdown list, you can choose whether your tick labels have numeric values according to the axis scaling or text labels contained in some column of a worksheet. From the **Format** dropdown list, you can select the format of the numbers (decimal, scientific, ...). The **Precision** spinbutton lets you set the number of digits following the decimal point. In the case of MyFirstPlot, it makes no sense to have digits after the point, so we set **Precision** to zero.

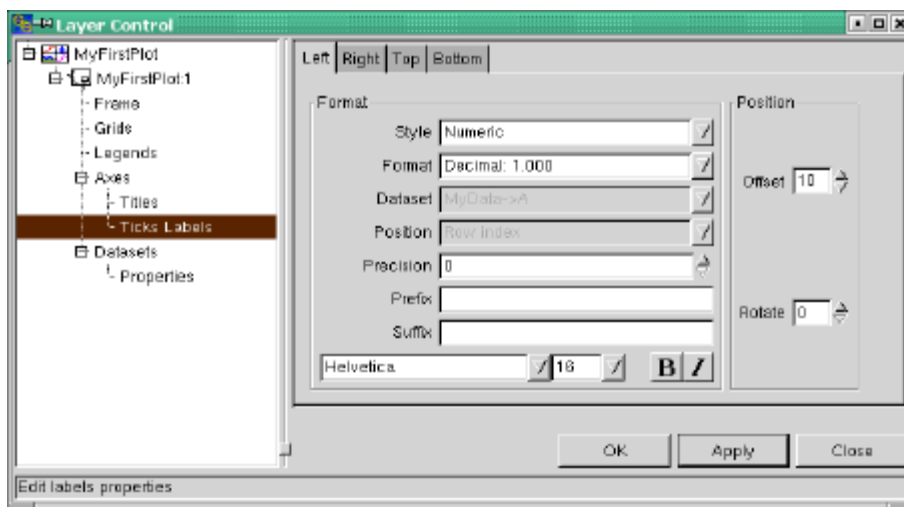


Figure 25: Formatting the tick labels...

The **Prefix** and **Suffix** textboxes let you define leading and trailing symbols for your tick labels. For example, if you define the greek letter π as a suffix for the x axis, you will get 0π , 2π , 4π , ... as tick labels.

We leave this blank, but we choose Helvetica 16 point as the font size for the tick labels.

Using the **Offset** spinbutton within the **Position** frame, it is possible to change the distance by which the tick labels are offset from the respective axis. Also, we can rotate the labels by some angle other than zero degree by choosing an appropriate value from the **Rotate** spinbutton.

To finish label formatting, we click the **Bottom** tab of the dialog to set the font size to 16 point and the precision for the bottom x axis to zero. Then click the **Apply** button. The result is shown in Figure 24.

Dataset Properties

Still up and awake? O.k., then let's deal with the last dialog we have not touched yet. As you remember, we have already encountered the Datasets dialog in tutorial1. So we skip it here and turn directly to the dataset **Properties** dialog.

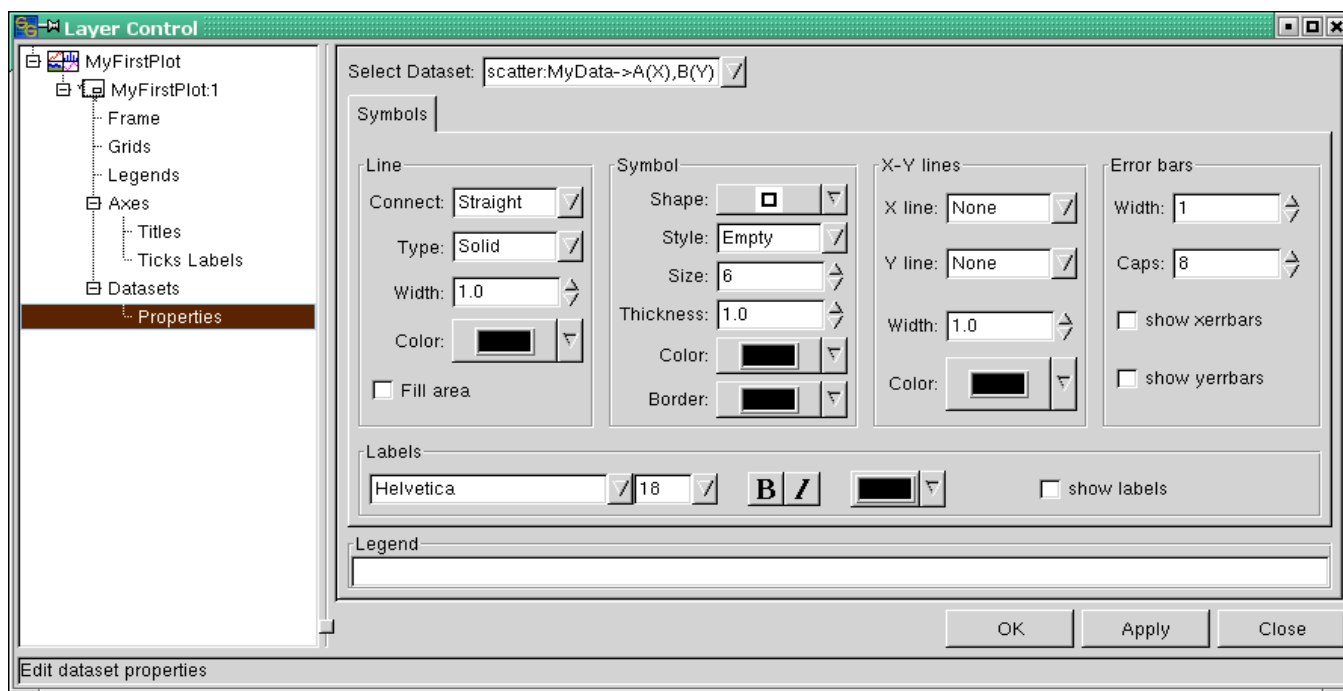


Figure 26: The (dataset) **Properties** dialog showing the initial settings for **MyFirstPlot**.

Here, you can set all the properties concerning the lines respectively the symbols which represent a certain data trace.

Let us begin with the **Line** frame. The **Connect** dropdown list lets you choose the way in which your data are connected. As we have chosen the “line + symbol” representation of our data (see page 5 and Figure 6), the default connection is “Straight”. Because our dataset consists of only a few data, this looks not very elegant. So we choose “Spline” as the connection method.

The line type (see **Type** dropdown list: solid, dot, dash-dot etc.) is not changed. The linewidth, 1.0 by default, is set to 1.5. As the line color, we choose the red color from the **Color** dropdown list.

In the **Symbol** frame, we choose a circle “o” as our favorite symbol from the **Shape** dropdown list. The style is set to “Filled” (**Style** dropdown list). Via the **Size** spinbutton, we choose a value of 10 for the symbol size. Last, the fill color as well as the border color for the symbol are set to red (**Color** and **Border** dropdown list). To make the effects visible, we click the **Apply** button.

Done! To round off the result of our formatting efforts, we add some header to the graph of MyFirstPlot. To do so, click the **T** button in the toolbar. Then after having moved the mouse pointer slightly above the upper left corner of the graph, click on the graph page. A dialog opens asking “Enter text here” (Figure 27). Let us type in “My First SciGraphica Plot” and set the font size to 22 point. Maybe you want to choose some text color other than black? After having input the text, click the **OK** button. As you see, the text is placed just where you clicked the plot page. The position is not the way you like it? Just drag it - oops! Before trying to drag the text to the intended position, be sure that you first click the **☐** button. The buttons in the toolbar act like radio buttons and remain active as long as you do not select something else. Oh - you have already tried to drag with the **T** button active and now have this ugly “Enter text here” label on your plot? Just click the **☐** button, then click the label so that it is highlighted, then hit the “delete” key on your keyboard.

Maybe the result of all the formatting is not the way you like it. But now that you are a SciGraphica formatting expert, you are invited to go through all that stuff once more and do it your way...

Hope we will meet at tutorial No. 3 which will show you how to import ASCII data and how to set up multilayer graphs.

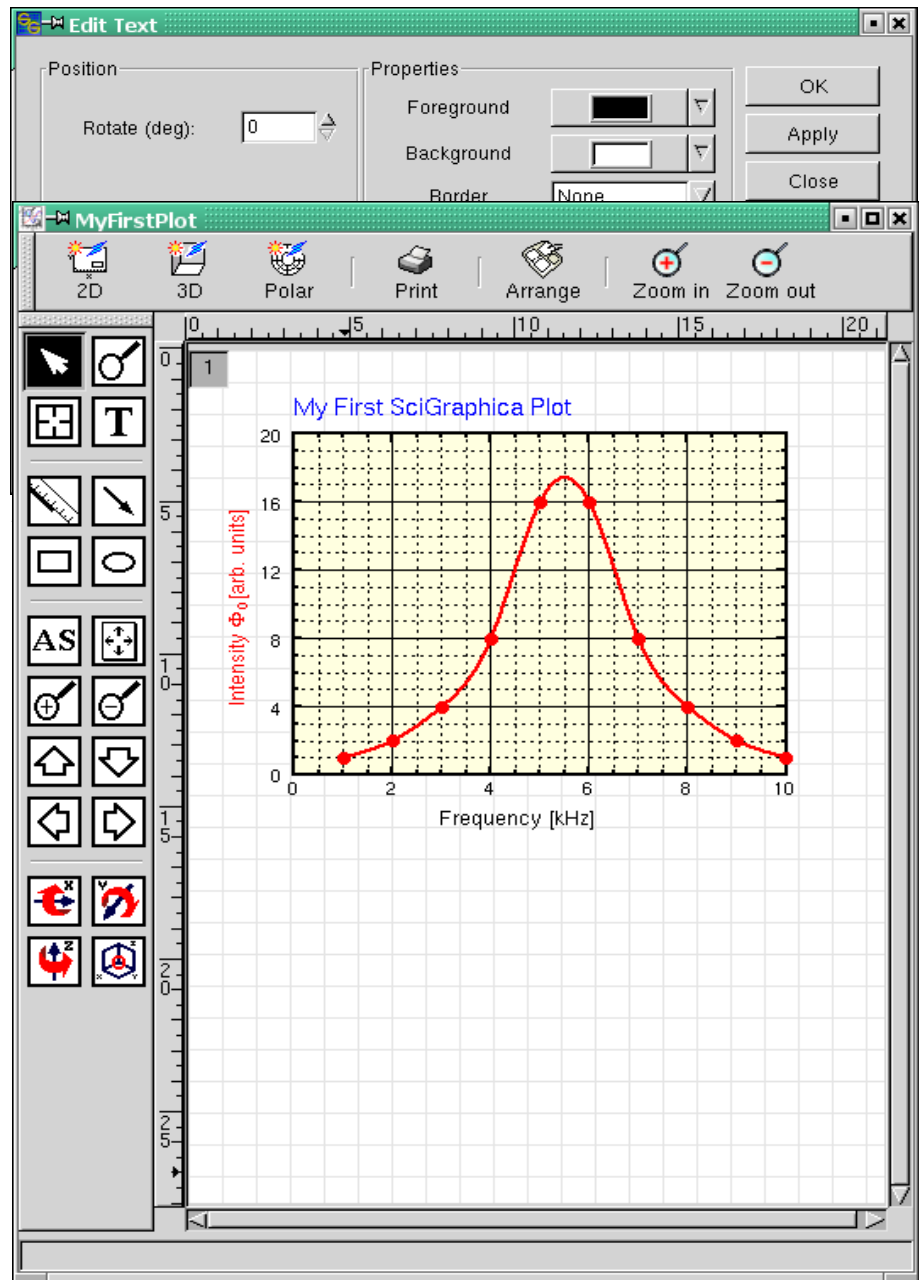


Figure 28: The final result!