GNUPLOT for XSPECT[a]

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Gnuplot:

Gnuplot is a command line plotting program for the generation of two and three dimensional plots that runs on all major operating systems (Linux, Windows, Mac OS, ..). It is well suited for generation of data plots using script applications such as Tcl/Tk.

Installation:

The official website for gnuplot is;

http://www.gnuplot.info/

The link for the Gallery of demos goes to a page with numerous command scripts that illustrate the diverse capability of the software. Use the Download link to obtain the current major version from SourceForge. Windows installer files (i.e. gp*.exe) can be obtained for both 32 and 64 bit systems. The gnuplot manual, gnuplot.pdf, can also be downloaded from SourceForge. The lab modules have been most recently validated using version 5.0.5 but a more recent release should be OK.

The Windows installer file, gp*.exe, will install the application in the 'Program Files' folder and will associate certain extensions with the gnuplot application. During installation, you will be asked to select certain installations options;

- Select the Windows terminal.
  - This will create an environmental variable that can be changed later.
- Select the path addition.
  - This will add the path to the gnuplot bin directory to the system path variable.
- Otherwise leave the default selections for file extensions.

Many Unix/Linux and Mac OS systems will have gnuplot already installed. If not, it is typically downloaded as source code from the above site and made on the user's system.

After installation on a Windows system, look in the gnuplot folder in the 'programs' section of the 'start menu'. 'gnuplot documention' is a pdf book for gnuplot that documents the behavior of all commands. Similar information is in the 'gnuplot Help' application in a windows help format. To verify the installation, execute 'gnuplot 5.?' from

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the start menu. A command window should open. In response to the gnuplot> prompt, enter the simple command:

Gnuplot> plot sin(x)

A second window should open with a plot of the sine function.

Plotting datafiles:

format of datafiles:

Data files should be in columns with space or tab delineation. Comment lines can be included by using the # character at the beginning of the line. For example, *datafile* may contain:

```
# Data description
1       1       1
2       4       8
3       9       27
4       16      64
```

plot command:

Use the plot command to plot the data ,

plot "datafile" using 1:3

where 1:3 refers to the x,y data being taken from columns 1 and 3. Many other useful options can be added to the plot command lines. For example,

plot "datafile" using 1:3 w l

plots the data with lines.

Styling the plot:

A variety of commands are available to put labels on the axis, titles on the graph, or legends on the curves. For example,

set xlabel "millimeter"

See the help files for the available options under set. A need often encountered is to put labels on the legend for the plot. This is done with the plot command as:

plot "datafile" using 1:3 title "mydata"

Adding another curve:

After the initial plot use,

replot "datafile" using 1:2

can be used to add another curve to the same graph.

Changing plot ranges:

To change the range of values on the axis, commands such as

set xrange [10:80]
set yrange [0:200]

can be used. Then the replot command with no arguments can be used to to refresh the screen.

Saving plots:

Version 5.? of the windows terminal, wxt, provides for saving a plot as an png graphic file, *.png. Start gnuplot 5.? and change the working directory using the ChDir icon on the toolbar to that where there is a datafile such as that from "TCL for XSPECT". For example:

cd 'C:\XIRL_Rad-Img_xspect3.5_Examples'

Then plot the data using a command such as

plot "TEMP_lab01.txt" w l title "lab01"

Note the use of the quotes required by gnuplot. Then, using the toolbar at the top, export the file to a pdf file. The plot window size and aspect can be changed and will be saved as seen in the pdf file. These pdf files can be easily imported to microsoft office documents. Alternatively, the plot can be saved to the Windows clipboard and pasted in documents.

Command files:

For the standard Windows gnuplot installation (Vers 5.0), text files with a 'gpl' extension, *.gpl, with be executed with the wgnuplot.exe file in the gnuplot installation bin directory. In the directory where the above 'datafile' is located, create a new text document and open it with notepad. Write the following,

 # Simple gnuplot example
plot "TEMP_lab01.txt" w l title "lab01"
pause -1 "To continue, use the return key"
exit

Comments can be added to these files by placing a # character at the beginning of the comment line.

Save the file with a .gpl extension such as Lab01_Intro_A.gpl Executing this file should open a window with the plot. Later, we will create plot commands and execute them directly using tcl commands.

Graphic files:

Gnuplot support a large number of output formats that can generate image files with graphic content. For the .gpl file created above, add the following content before the exit command,

set terminal png size 500,500 font "Times New Roman, 14"
set output "temp-gpl.png"
plot "TEMP_lab01.txt" w l title "lab01" smooth csplines
pause -1 " To continue, use the return key "
exit

When executed, the added commands will generate the png file and gnuplot will exit after the second command. In this example, several plot properties have been adjusted,

- The plot size is set to 500 x 500 pixels
- The font is set to Times New Roman
- The curve has been smoothed with a cubic spline operation.

To access the full font set, the following environmental variable should be set in the windows OS,

GDFONTPATH C:\WINDOWS\FONTS

Further information:

The gnuplot documention provided as a pdf file, gnuplot.pdf, provides the most complete information on available commands. The windows help application is also a useful source of information. The gnuplot homepage has a page with links to tutorials and learning material;

http://www.gnuplot.info/

An interesting blog from a physicist that has numerous examples can be read at

http://www.gnuplotting.org/