

Gnplt 2 Documentation

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Introduction

Purpose

Gnplt2 is the updated version of Gnplt. Gnplt is a tool for displaying antenna data, and calculating gain curves to calibrate the antennas with. Gnplt2 is capable of all that Gnplt is capable of, and is in fact very similar, but there are a couple of new features.

Gnplt2 uses Gndat to parse log files. The information from Gndat can, after a log has been read, be plotted in a number of ways. When Gndat is parsing the file, a control file (with extension .rxg) is required. Gnplt2 also uses some information from these control files, and Gnplt2's different tools can update the file as well.

Plots can also be printed.

Definitions

The control file is crucial for both Gnplt2 and Gndat. The control file is an ascii based file with extension ".rxg". It contains a number of data about the antenna, which the log file is recorded by. In this document, the control file is defined as the original file, and the working file is defined as the control file Gnplt2 is currently using.

User Guide

The File Menu

The file menu contains different options regarding the actual file reading, I/O settings, printing and exiting Gnplt2.

Opening a log file

To open a log file, press "New Log". Gnplt2 then calls Gndat, which first reads the log, and then produces a temporary output file. Gnplt2 then parses this temporary output file. A status bar under the plot shows the progress. If the control file(s) matched the data in the log, the reading will be successful, and the user will now have a number of plot options to choose from. Note that before a log is read, almost all of the menus in the program are faded out.

It is also possible open log files from the command prompt with Gnplt2. If Gnplt2 is opened with the command:

gnplt2 -log your_log_file.log

Gnplt2 will then automatically open the specified log file upon starting up.

Printing

To print what is currently plotted, select Print Plot on the File Menu. A new window with some print options will be displayed. Users of logpl2 may notice it is the exact same print feature.

In the print window, the user can select if the plot should be sent to a file, printer or display. If the plot is sent to a file, a filename has to be specified as well. If Python Imaging Library (PIL) is installed, the user may select any of the various file formats. If not, the only available format is Post Script. Also note that the Post Script output is the only output that preserves everything in the plot. The other outputs are similar, but not exact copies (e.g. fonts are not preserved).

If instead printer output is selected, the user must specify a printer, or the output will be sent to the computers default printer. Since the plots can be resized in any way the user chooses, the height vs. width ratio may not always fit the printer papers. Therefore, the user can select to resize the plot to a specified height/width ratio. By default, the ratio is US letter. Note that only the ratio is important, not the actual numbers.

If display is selected, a new window will pop up, showing what the plot would look like if it was printed to a file or printer.

I/O Settings

In the I/O settings, the user can change where Gnplt2 (and thus Gndat) should look for control files, where to look for log files, and where to save the temporary Gndat output file. Note that the temporary Gndat output file is automatically deleted, just make sure the user has write permissions in that directory. By default it is */tmp/gndat_output.PID*, where PID is the process' process id.

Exit

To exit Gnplt2, use the exit option on the file menu, or shut it down like any other program (depending on the shell). If any working files were updated, Gnplt2 will ask the user to save the updates to the original control files. If not, the working files will be discarded.

The Simulation Menu

In Gnplt2 it is possible to simulate data for TCal(Jy) to verify the operation of the program, opacity simulation is not yet supported. The data can then be used in the same way as it came from a log file, with the difference that the RXG file can't be updated. When you read in some data, the Simulation Menu item will allow opening the simulation dialogue box.

When the simulation dialogue box is open, only simulation data is used. The simulation will be based on the frequencies, polarization and sources available in the log file.

In the simulation window it is possible to choose between generate data for Elevation or Altaz gain curves. By default the gain is plotted, but if chosen the

TCal(K) can be plotted. The degree and coefficients of the gain curve used for calculating TCal(Jy) can be chosen. The DPFU can also be changed. Default values for gain curve polynomial and DPFU is fetched from the RXG file. It is possible to normalize your polynomial in the window by pressing the "Normalize polynomial"-button. This will automatically update the entry fields with the correct coefficients. Select for which polarization, source and frequency the data should be generated for.

It is also possible to adjust the TCal(K) table used for generating the data. This window will show the values in use for data generation. The initial values are from the working file. To change these values either load a new TCal(K) file or save, edit in a text editor and load file. You can also re-get the values from the working file.

During the simulation session the program protects the RXG file from unwanted updates. When you close the simulation window the simulated data will be erased and the log file reread and it is possible to use the program as usual.

The Edit Menu

In the edit menu, the user finds a number of different options to select or delete specific data depending on a number of attributes. Note that all options have the same priority, so if a certain frequency is added, and then deleted when the user deleted all points with bad gain compression, that point will be deleted. Vice versa applies as well.

Selecting sources

A log file may contain any number of sources. In the select sources menu, the different sources will appear as drop down boxes. The drop down boxes are filled with the different observations (the time is showed) for each of the sources. The user can then delete any individual observation, or delete/select all observations for any source.

Selecting polarization and frequency

In the Edit menu, the user will find the two submenus; Left Polarization and Right Polarization. In those menus the user can select the following: All left/right, no left/right, left and right, or any individual frequency. Note that it is the selected frequencies (shown by check buttons) that indicate the selection. So if for instance, only the data that is left polarized with frequency 4120Hz that is selected in both of the menus, then this is the only data that will be shown. If the user suspects that some data isn't being displayed, it may be a good idea to check this menu because when the program automatically sorts the data, it uses this menu to tell the user what was sorted out.

The shortcuts to plot different data is also sorted under right and left polarization. Please note that the tools (for any data) is available when only when one single polarization is being plotted.

Resetting the plot

To undelete all data, click Undelete All Points in Log. It will be as if the log was just read. To undelete all points in the current selection (i.e the points that are filled red on the plot), click Undelete All For This Selection, or simply press s.

Deleting data with bad Gain Compression

Under the edit menu, there is a quick way to delete all data with bad values for the Gain Compression. These data often contain other nonsensical data. When clicking Delete Points with bad GC (Gain Compression), a box will appear where the user can specify the interval for the GC to keep. All other data will be deleted. The default values are $0.95 < GC < 1.05$.

Deleting data with erroneous temperature data

If a datapoint with a system temperature minus receiver temperature minus the temperature spill over less than zero ($T_{\text{system}} - T_{\text{receiver}} - T_{\text{spill}} < 0$), some calculations cannot be performed. Therefore, it might be a good idea to remove these points. To do this, there is a shortcut on the edit menu. Note that this is probably an indication that the receiver temperature isn't correct. This action should never be performed before the receiver temperature has been estimated.

Delete points outside of the plot boundaries

If a dataset is plotted, and then plot boundaries are changed so that some points won't be included, these points will appear on the border of the plot. A quick way to delete these points, is to use the Delete Points Outside of Plot shortcut on the edit menu.

Replotting

To replot the current plot, click replot on the edit menu, or simply press r on the keyboard. This will replot the selected dataset. If something has been updated, this will be included.

Shortcuts

Oftentimes, the same type of data with the same polarization is to be plotted. There are therefore a number of quick shortcuts to do this. The available shortcuts are Gain vs. Elevation, TCal vs Frequency and Tsys-Tspill vs Airmass. The first and the last of the shortcuts are organized identically. The user first selects the polarization, then the specific frequency (or all, or all from a specific source). The TCal vs. Frequency is organized by band instead of frequency. Each band corresponds to a certain rxg file. There can be one or more bands for each log, depending on the number of rxg files.

The Items Menu

There are two ways to select data to plot. One way is using the shortcuts under the Edit-menu. The other way is to first select the x item under the menu X-Axis and then selecting the y item under the menu Y-Axis. The items in the X-axis menu are (if they all exist in the log file): Time, Elevation, Frequency, Azimuth and Airmass. The Y-axis menu isn't hardwired like the X-axis menu, but is still sorted. It is divided into the sections non ONOFF data (which is as the name implies not ONOFF data. It might for instance be weather data), Assumed items, Calculated data, X-axis items, and all other items that appear in the log file that have numerical values.

At the end of the Y-axis menu, the user can also find a menu for opacity corrections. The opacity correction is applied by band, and all the bands are found automatically. If opacity corrections for this band were used when calculating the gain curve in the corresponding rxg file, opacity corrections for

that band will by default be turned on. The user can select for each band if opacity corrections should be applied for gain and tcal or for them individually. Note that it doesn't make much sense using it for one item, but not for the other.

The Source and Frequencies menus – Highlighting

Highlighting sources

Under the sources menu, all the different sources of the log will appear. To highlight (fill the circles) specific sources in the plot, the user can just select the specific source in the menu. To deselect all sources, simply click "Deselect All Sources."

Highlighting frequencies

Different frequencies can be highlighted just as different sources. All different sources appear as radio buttons under the menu.

The Tools menu

The different options displayed under the Tools menu depends on which data that is being plotted. First of all, no tools are available if the plotted data has mixed polarization. Furthermore, the plotted data can only be covered by one rxg file. That is, only one band at a time may be plotted in order to get access to the tools. The reason for that is to avoid any confusion when updating the rxg file.

Gain vs. Elevation Tools

When the plotted data is gain vs. elevation with a homogenous polarization, a number of tools will appear under the Tools menu.

The first tool is "Gain Curve From Working File." This tool plots the gain elevation polynomial from the rxg file.

The other tools are different ways to fit a new gain curve. The different (three) options are fitting to a new polynomial, fitting to a new DPFU but keeping the gain curve, or scaling the tcal table (and keeping the same polynomial) to fit the data.

To save the updates (the last update made, since they are all redundant), the user can click "Update Working File". That will write the updates to the working file, and reread the data.

To show the fit statistics, click "Show statistics." The statistics will appear different depending on the last tool used.

The last item on the menu is "Add Virtual Point." That brings up a dialog box where a y-value, x-value and weight can be specified. A fictitious point will appear on those coordinates with the specified weight. The reason to use this is if the user thinks that some data is missing somewhere, and the polynomial fit is behaving strangely.

Tcal(K) vs. Frequency Tools

To gain access to the tcal vs frequency tools, the user should plot TCal(K) vs. Frequency, for one band and one polarization.

The first option on the menu is “Plot TCal(K) Curve from Working File,” which plots the TCal Frequency table in the rxg file.

When fitting a new table to the data, the user can select to either fit to the average TCal(K) value at every frequency or at every median value by simply selecting either fit to average or fit to median.

To save the new table, press “Update Working File.”

Tsys-Tspill vs. Airmass Tools

When plotting Tsys-Tspill vs Airmass of one polarization, these tools are available under the Tools menu. The different tools aim to decide the Trec (temperature from the receiver).

The first option on the menu is “Mark Trec from the working file,” which displays the Trec on the y axis.

When clicking “Fit to Trec”, gnplt2 will perform an exponential fit to the data. The Trec is where the airmass intercepts the y-axis. The fit depends on the temperature on the atmosphere, so a dialog box to specify this appears when the user clicks “Fit to data.” The default value is 273K.

In the same dialog box, it is possible to specify the time length for each interval that is fitted. For each interval, a trec is fitted, if the fit is successful (converges).

The final Trec is the mean value of all fitted Trec. To remove any of the values, click the circles, indicating the values and then press “recalculate trec.” The mean value is then recalculated with the remaining Trec values.

TCal Ratio Tools

When plotting TCal Ratio (on any axis, versus anything), an option to plot a line for Tcal Ration = 1 appears. If the Tcal table is correct, the data should be distributed around the plotted line.

The Scaling Menu

There are three alternatives as how the scaling of the plots work. The different methods are autoscaling with or without deleted points and manual scaling. Note that when replotting, the selected scaling mode will be used.

Autoscaling with deleted points

If this mode is selected, the boundaries of the plot will be set to the maximum and minimum values of the current data set, taking deleted points into consideration.

Autoscaling without deleted points

If this mode is selected, the boundaries of the plot will be set to the maximum and minimum values of the current data set, excluding all the deleted points.

Manual scaling

When clicking manual scale, a dialog box will appear so that the user can manually set the plot boundaries.

Plot Options Menu

Under the plot options menu, there are different options to display how the data is displayed.

For old displays, it might be difficult to differentiate between different colors. That is why there is an option to display deleted points as either red filled circles (default value), or as crosses.

The user can also specify if the data should have a letter by the circle of each data point to specify the source. The different options are: symbol, letter or symbol and letter.

It is also possible to not display deleted points at all. This is a very useful feature when a lot of data, deleted and non-deleted, is being plotted.

New Features in Gnplt2

There are numerous differences between gnplt and gnplt2, even though the overall appearance is very similar.

Most of the improvements are in the code, which the user might not notice. Some are more noticeable, like the heavily improved file parsing. It is now possible to read much bigger log files, much faster. A status bar is added to indicate the progress of the file parsing.