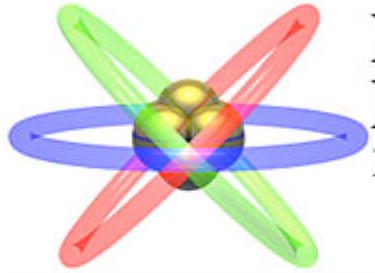


ReviewPlus
Data Visualization Software

User Manual

Introduction To ReviewPlus

ReviewPlus is a general-purpose plotting tool, capable of displaying interactive 2D and 3D graphs of raw, analyzed, and simulation data. It can mix and couple 2D and 3D plots in one display, providing a rapid means of examining 3D data. ***ReviewPlus*** displays data retrieved from PTDATA and MDSplus systems, and can make use of the Internet to display data from any fusion research site with an MDSplus data server. In addition, ***ReviewPlus*** supports User Written IDL Data Procedures and Post Draw IDL Procedures, making it a powerful and versatile visualization tool.

About This User Manual

This User Manual was written for new users of ***ReviewPlus***. It will explain the functions found in the program and will get you started using the program to plot signal and point data. The manual can help you learn a few of the more advanced plotting techniques available with ***ReviewPlus*** and may also serve as a quick reference for ***ReviewPlus*** functions, once you've mastered the program. The User Manual assumes you have a good understanding of physics, engineering, and the data signals generated by fusion research facilities. Attempting to explain the nature of the data signals, and how to develop more meaningful data through analysis of those signals, is beyond the scope of this manual.

Document Conventions

While using this User Manual, you will see that certain words or phrases are represented in different fonts or typefaces. Different words are represented in the same style to indicate that they belong to a specific category.

The types of categories that are represented this way include:

- ***Application***
  - Example: Start ***ReviewPlus***.
- **Application Window**
  - Example: This opens the **ReviewPlus Setup** dialog.
- **Menu>Command**
  - Example: Use **Edit>Set Signals** to enter signal expressions.
- **GUI text**
  - Example: Enter shots under **LIST OF SHOTS TO PLOT**.
- `user input text`
  - Example: In the List of Shots field, type `104276`.
- `computer output text`
  - Example: The command will return `kill -ReviewPlus: not a valid command switch`
- `filename`
  - Example: Open the example file `review_example.revplus`.
- [keyboard entry]
  - Example: Type your name, then press [Enter].
- [key]+[combination]
  - Example: Press [Ctrl]+[Alt]+[Del] to log in.
- *User Manual Section*
  - Example: For more information on signals, refer to *Defining Signals and Retrieving Data*.

Mouse Definitions

The following is a description of the actions needed to accomplish certain mouse related tasks. Remember, **Mouse** refers to the actual input device you move with your hand, and **Cursor** refers to the mouse pointer that moves about on your display screen as you move the Mouse.

- **Click**: Click the left mouse button once on an item or button and then release it.
- **Double-click**: Click the left mouse button twice rapidly and then release it.
- **Right-click**: Click the right mouse button and release it.
- **Select**: Click the left mouse button on the item and then release it.
- **Drag**: Click and hold the left mouse button and then move the mouse.
- **Drop**: Move the mouse cursor so that it hovers over an item on the screen; click and hold the left mouse button, then move the mouse so that the item being moved appears to cover or hover over the target item on the screen; release the mouse button.
- **Scroll**: Use the scrollbar found at the side or bottom of a list window to move within the list.

Quick-Start Guide To ReviewPlus

This Quick-Start Guide assumes that ***ReviewPlus*** has been installed on your system and that you're already familiar with most of the terms used. It also assumes you know how to navigate within your system and find ***ReviewPlus***, how to start and quit the program, and how to open and save files.

Plotting a Signal

Start ***ReviewPlus***. The application window that opens on your screen is referred to hereafter as the '**main display window**'. This window displays the plots generated by ***ReviewPlus***. The application menu bar holds four menu command lists: **File**, **Edit**, **Transform**, and **Help**.

Click **Edit>Set Signals**. This launches the **ReviewPlus Setup** dialog.

The table found in this dialog is used to enter signal expressions for plotting and will be your main interface into ***ReviewPlus***. Move your cursor to the first open cell in the **Z Data Signal** column and left-click, making the cell active. A cell must always be active in order to accept a signal name.

Type the signal name `IP` (for Plasma Current) and press [Enter] on the keyboard. Then, click the **Apply** button near the bottom of the **Setup** dialog. ***ReviewPlus*** plots the signal in a plot box in the **main display window**.

For more information on signals, see *Defining Signals and Retrieving Data*.

Selecting a Shot Number

Note that if there are no shot numbers entered in ***ReviewPlus***, the signal data displayed is always from the most recently completed shot (and this shot will change during experiment operations). To retrieve signal data for a particular shot, type the shot number (for example, `104276`) in the **Default Shot** field near the bottom of the **main display window** and click **Update**. The **Setup** dialog also contains controls for entering shot numbers.

For more information on shot numbers, see *Defining Shot Numbers*.

Modifying a Plot

Click **Select** near the top of the **main display window**. Now, click and select the IP signal trace in the plot box. Once the signal trace is selected, the **Transform** menu commands are enabled. Click **Transform>Derivative** to see an example of a transform in action. In this case, the time derivative of IP is shown in the next plot. Now, click the **Mouse Mode** - **Zoom**, and then move the cursor into the plot window, click and hold the left mouse button and drag the cursor sideways for a short distance within the plot. When you release the mouse button, the plot changes to mirror the range of data you 'selected' while dragging the mouse. Now, click the right mouse button within the plot to reveal a list of commands that can be performed on the signal or the plot. Choose the **Set Appearance** command, and then click the **COLOR** drop-down list in the **Set Appearance** dialog and choose **blue**. This action changes the color of the selected signal trace and legend.

These are some simple examples of what you can do with ***ReviewPlus***. For more information on modifying signals and plots, see *Interacting with Plots* and *Customizing the Appearance of Plots*.

ReviewPlus also features a REVIEW mode command line interface, the ability to invoke user written data procedures and post draw procedures, and the ability to retrieve data from MDSplus servers at remote facilities. For more information on these capabilities, see *Advanced Plotting Techniques* and the *Tutorials*.

Help is always available in ***ReviewPlus*** by selecting the menu command **Help>Getting Started**, or **Help>Printing**.

Tour of the User Interface

The Main Display Window

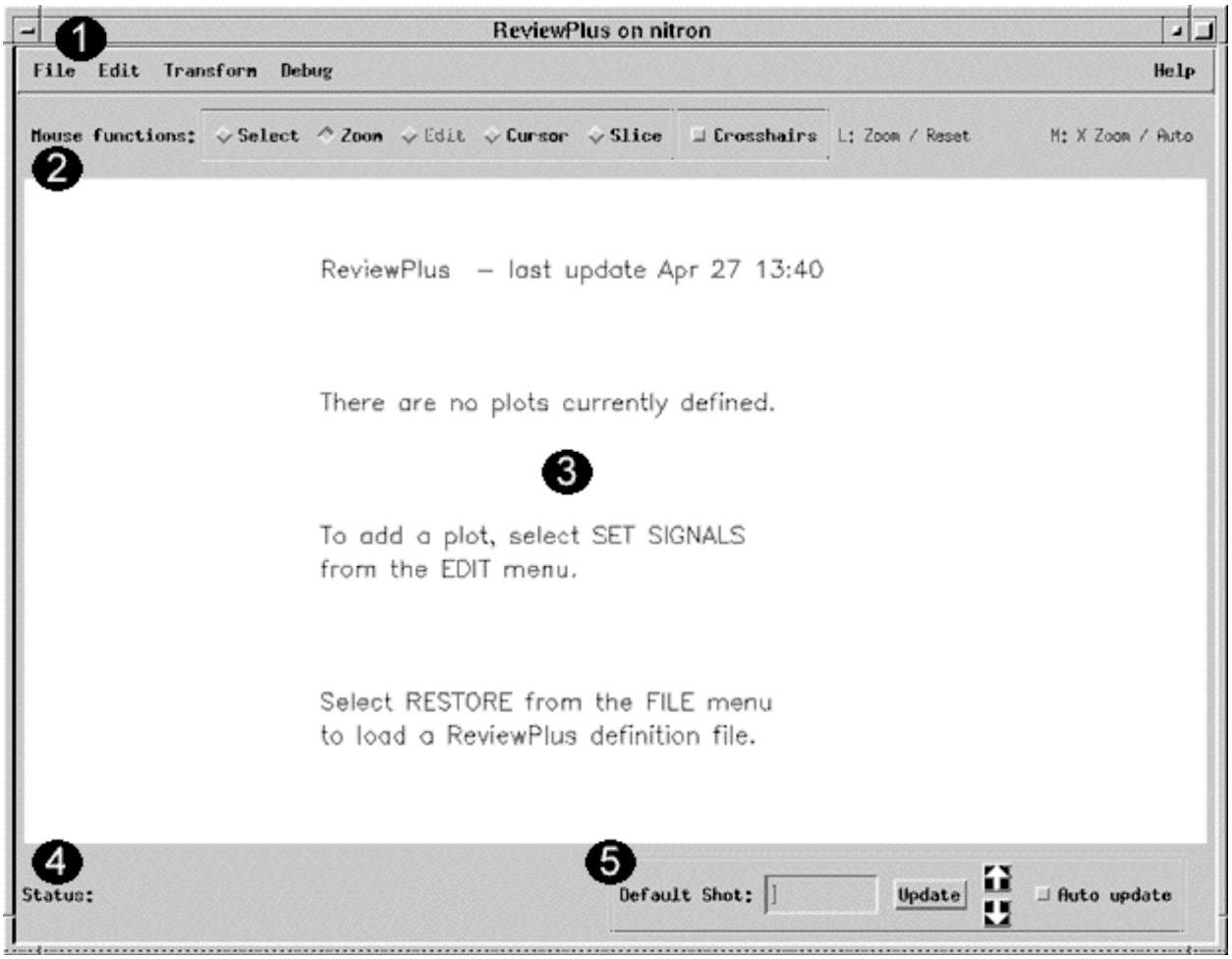


*Figure 1: Main Display Window – Launched by starting **ReviewPlus***

1. The four major menus of commands are available here: **File**, **Edit**, **Transform**, and **Help**.
2. Mouse functionality can be selected and changed using the **Mouse Mode** controls.
3. All of the plots created by ***ReviewPlus*** will be displayed here, along with their axis units, legends, and other annotations.
4. The **Status** area displays messages when the program is performing certain functions.
5. The **Default Shot** area provides an easy way to enter shot numbers and to monitor the most recent shots.

* Clicking the **Right Mouse Button** in a plot window reveals a list of commonly used commands.

The Plot Display Window

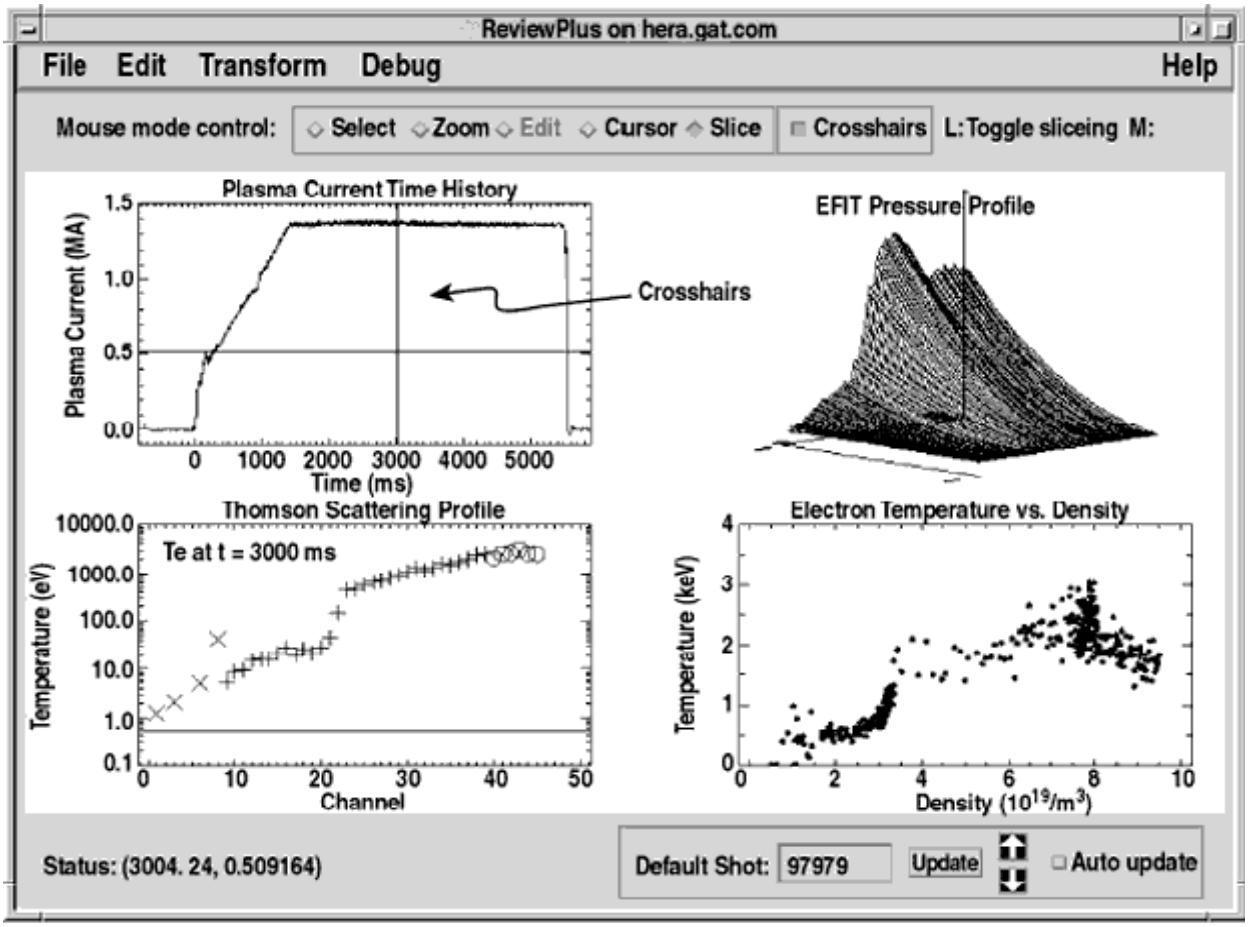


Figure 2: Plot Display Window

There are 4 **plot boxes** displayed above each containing one data trace that use various plot types and signal symbols. The naming conventions are described below and refer to the lower-left plot box:

- The **Plot Title** is "Thomson Scattering Profile"
- The **Legend** is "Te at t = 3000 ms"
- The **X axis scale** is "Channel"
- The **Z axis scale** is "Temperature (eV)"

Controls for these parameters are available using **Edit>Set Appearance**. See *Customizing the Appearance of Plots* for more information.

The Restore a ReviewPlus File Dialog

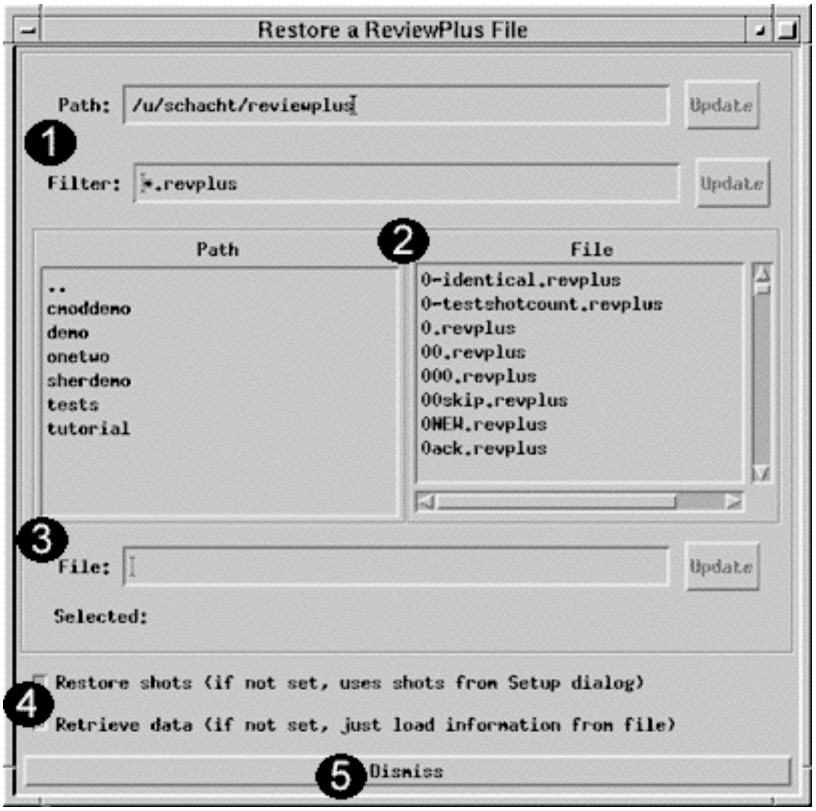


*Figure 3: Restore a **ReviewPlus** File Dialog - Launched with* **File>Restore**

1. Use **Path** and **Filter** at the top to type directory and file names and filter files.
2. Use the **Path** and **File** windows to interactively navigate within the file system.
3. Use **File** to type a specific file pathname.
4. Use **Restore Shots** and **Retrieve Data** to determine how ***ReviewPlus*** loads saved data.
5. **Dismiss** closes the dialog.

The Print Dialog

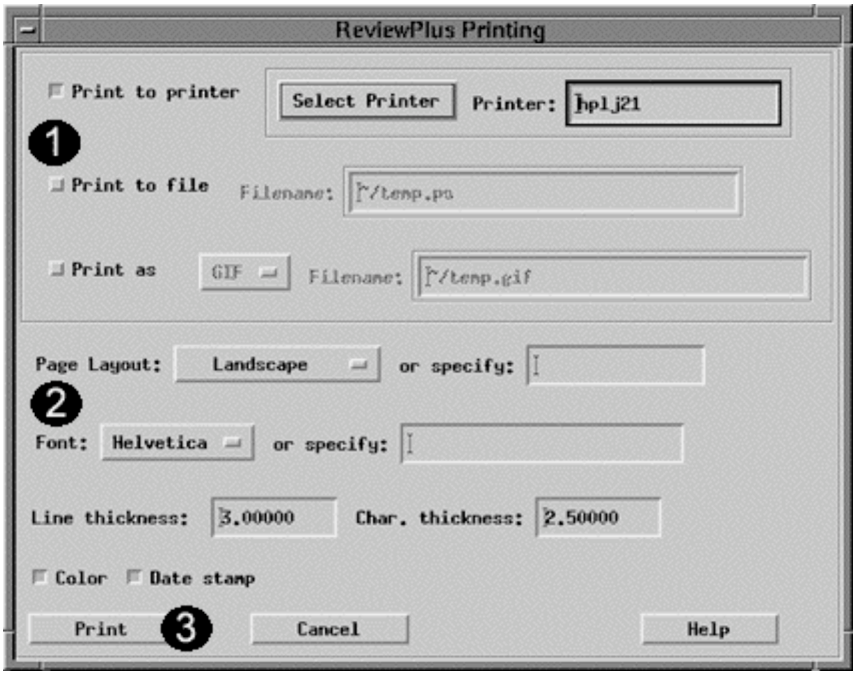


Figure 4: Printing Dialog - Launched with **File>Print Setup**

1. Use the upper controls to determine where and how your plots are printed.
2. Use the lower controls to specify properties for your print jobs.
3. **Print** or **Cancel** your job or get **Help** printing with the click of a button.

The Setup Dialog

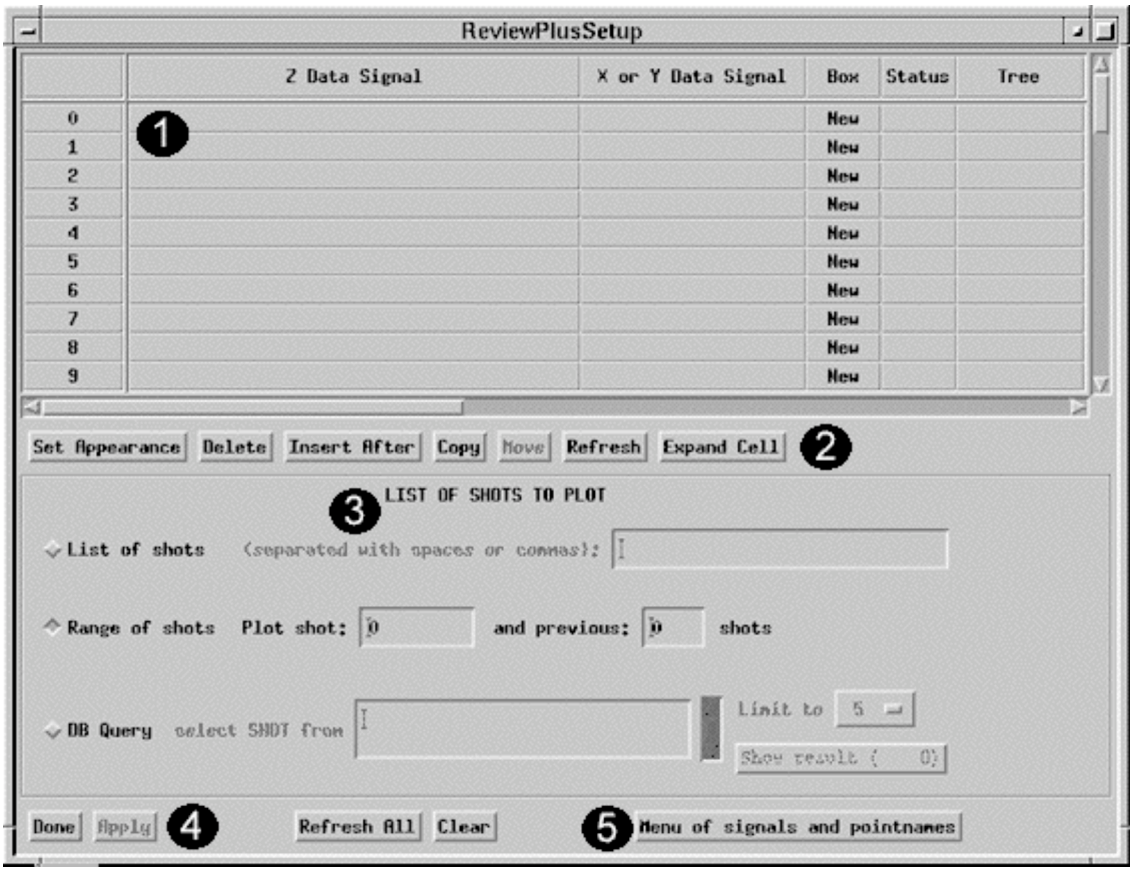


Figure 5: Setup Dialog - Launched with **Edit>Set Signals**

1. Use the **Signal Table** to enter signal expressions and other modifiers for retrieving signal data and displaying plots.
2. Modify the signal table list using the controls below the table.
3. Use the controls in **LIST OF SHOTS TO PLOT** to create lists or ranges of shots or query a relational database for shots based on their global properties.
4. Apply changes to your plots, refresh the signal data, or clear the table using the buttons at the bottom of the dialog.
5. Open the **Menu of signals and pointnames** (also referred to as the **Signal Menu**).

The ReviewPlus Signal Menu

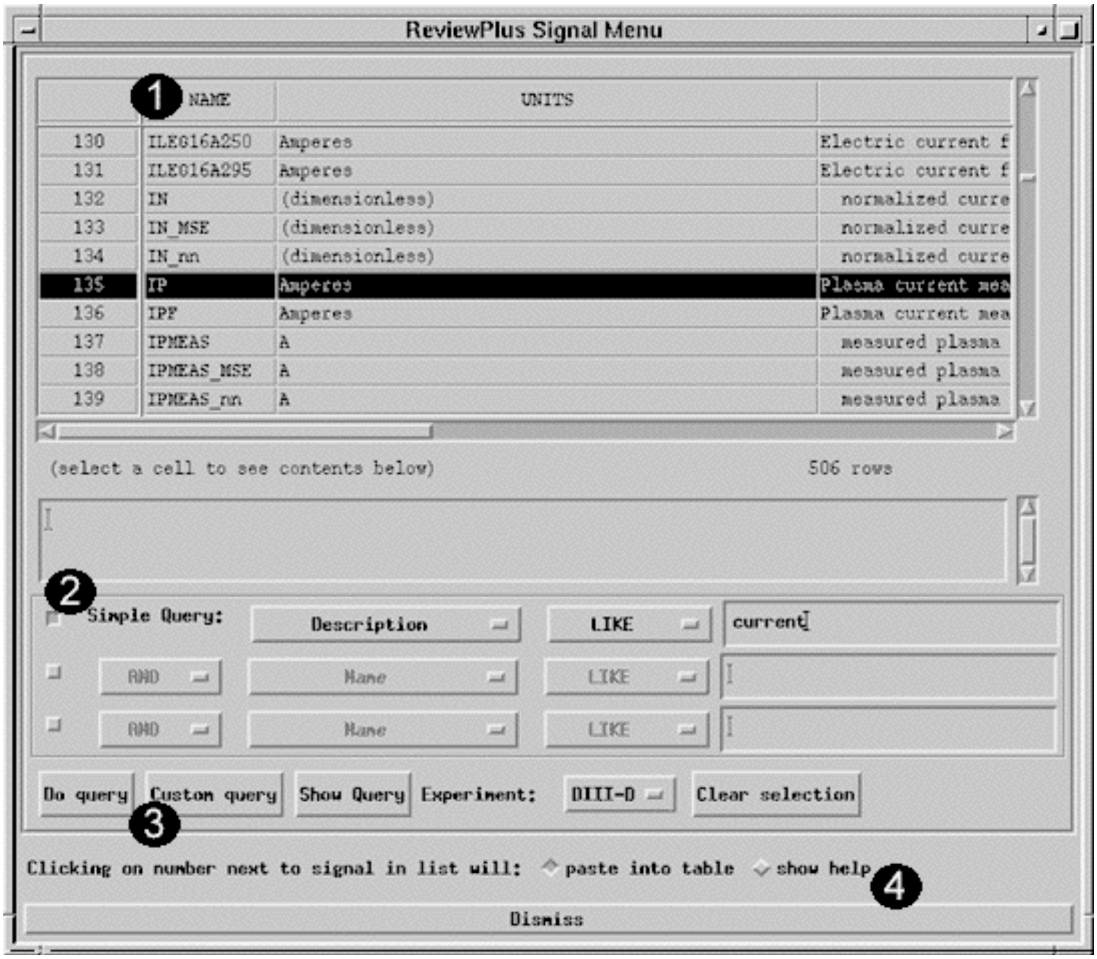


Figure 6: ***ReviewPlus*** *Signal Menu - Launched with* **Edit>Set Signals>Menu of signals and pointnames** *(button)*

1. Use this dialog to choose from a list of signals and pointnames.
2. Query the database for a list of use signals matching your criteria (if your system supports this feature).
3. Create a **Custom Query** to peruse the database.
4. Get help with a particular signal or pointname.

The Set Appearance Dialog

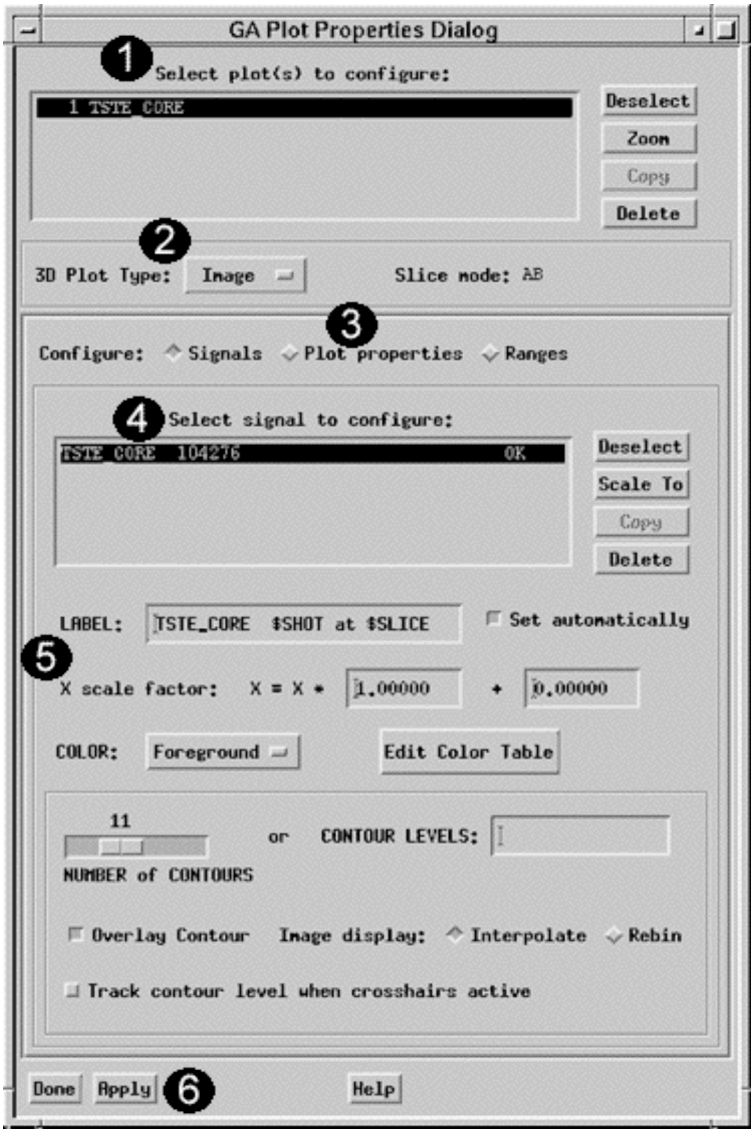


Figure 7: Set Appearance Dialog - Launched with **Edit>Set Appearance** *or* **RMB>Set Appearance***

Use these controls to:

1. Select a specific plot.
2. Change the plot type.
3. Configure a plot's properties.
4. Select a specific signal within a plot.
5. Alter a plot's appearance.
6. Apply the current settings and get help.

***RMB** = Right Mouse Button

The Preferences Dialog

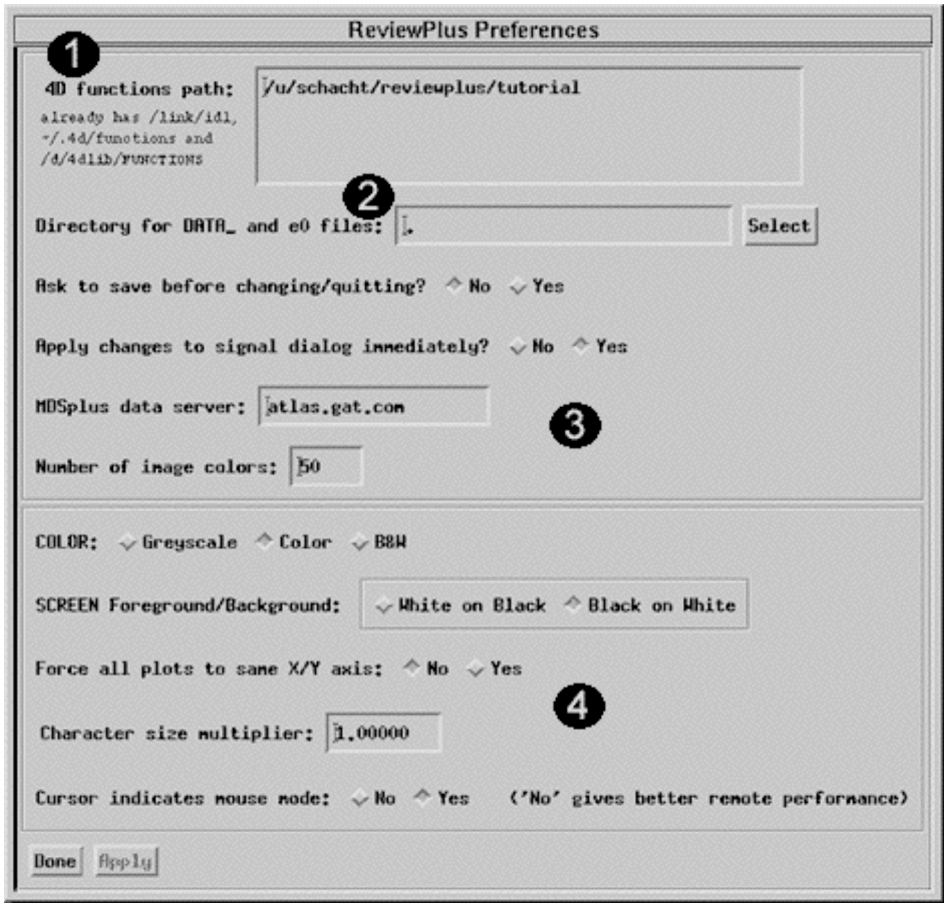


Figure 8: Preferences Dialog - Launched with **Edit>Preferences**

Use the **ReviewPlus Preferences** dialog to:

1. Set the search paths for User Written Data Procedures and Post Draw Procedures.
2. Set the path for legacy data files.
3. Set program defaults.
4. Set display defaults.

Defining Signals and Retrieving Data

As stated in the *Introduction*, ***ReviewPlus*** is a general-purpose plotting tool, capable of displaying interactive 2D and 3D graphs of raw, analyzed, and simulation data. There are two main identifiers of the data displayed by ***ReviewPlus***: the shot and the signal. The shot number refers to a specific fusion experiment from which data will be retrieved. The signal refers to the specific data retrieved from that experiment. This section details how ***ReviewPlus*** handles signals and signal data.

Signal Expressions

Signal data is retrieved from the PTDATA or MDSplus data storage systems at your facility. Signal data can also be retrieved over the Internet from remote MDSplus data servers. A signal 'expression' is a description of the specific signal data (along with any modifiers) that is entered in ***ReviewPlus*** and used to retrieve and display data. Signal expressions can take a variety of forms.

A signal expression can refer to:

- 2D signals plotted against their natural dimension, such as temperature versus time
- 3D signals plotted versus both or either natural dimension, such as temperature versus time and position
- data combinations, such as `ABS(IP)` or `PTOT*PTAUE`
- user-written IDL data procedures

When a signal is plotted against its natural dimension, the dependent data (the data being measured) is plotted along the Z axis, and the independent parameter (such as time) is plotted along the X axis. All signals plotted by ***ReviewPlus*** are assumed to have a Z axis parameter and are plotted versus the X axis by default.

2D or 3D signals are plotted with the dependent data again on the Z axis, and the independent parameters are plotted on the X and Y axes. X always refers to the first dimension of the signal and Y (if used) refers to the second dimension. Please note that ***ReviewPlus*** does NOT make the assumption that the X dimension is always time. Profiles are stored in MDSplus in many different ways, such that their first dimension will not, in general, be time. This is in contrast to 2D data from the DIII-D PTDATA system, which nearly always has time as its lone dimension.

Data combinations are mathematical combinations of signals. In an expression like:

```
WMHD / (PINJ + POH - WDOT)
```

the four signals in the expression may be on different timebases. In order to perform a mathematical operation using the signals, ***ReviewPlus*** uses this method for determining a common timebase:

- ***ReviewPlus*** determines the greatest lower bound and the least upper bound of the individual signals' timebases:

  tmin = MAX(MIN(t0), MIN(t1), MIN(t2),...)
  and
  tmax = MIN(MAX(t0), MAX(t1), MAX(t2),...)

- It then takes the maximum number of samples of the individual signals' timebases (call this "nt")
- It constructs a new timebase from tmin to tmax in nt equal steps
- It then interpolates all the individual signals onto this new timebase and evaluates the mathematical formula using IDL's expression evaluator (the EXECUTE() function)

It is, therefore, important that all the signals in the data combination have the same physical dimension (usually time or position). Since ***ReviewPlus*** uses IDL's expression evaluator, any valid IDL math operation is allowed, subject to the rules of IDL programming.

For more information, see the IDL Manuals. User-written IDL data procedures are described in *Advanced Plotting Techniques* and *Tutorial 3*.

Evaluating a Signal Expression

All signal expressions ultimately refer to data signals from PTDATA or MDSplus, or from IDL functions. Unless you specifically indicate that the expression is from MDSplus, ***ReviewPlus*** uses the following algorithm to determine the ultimate location of the data requested (Figure 9).

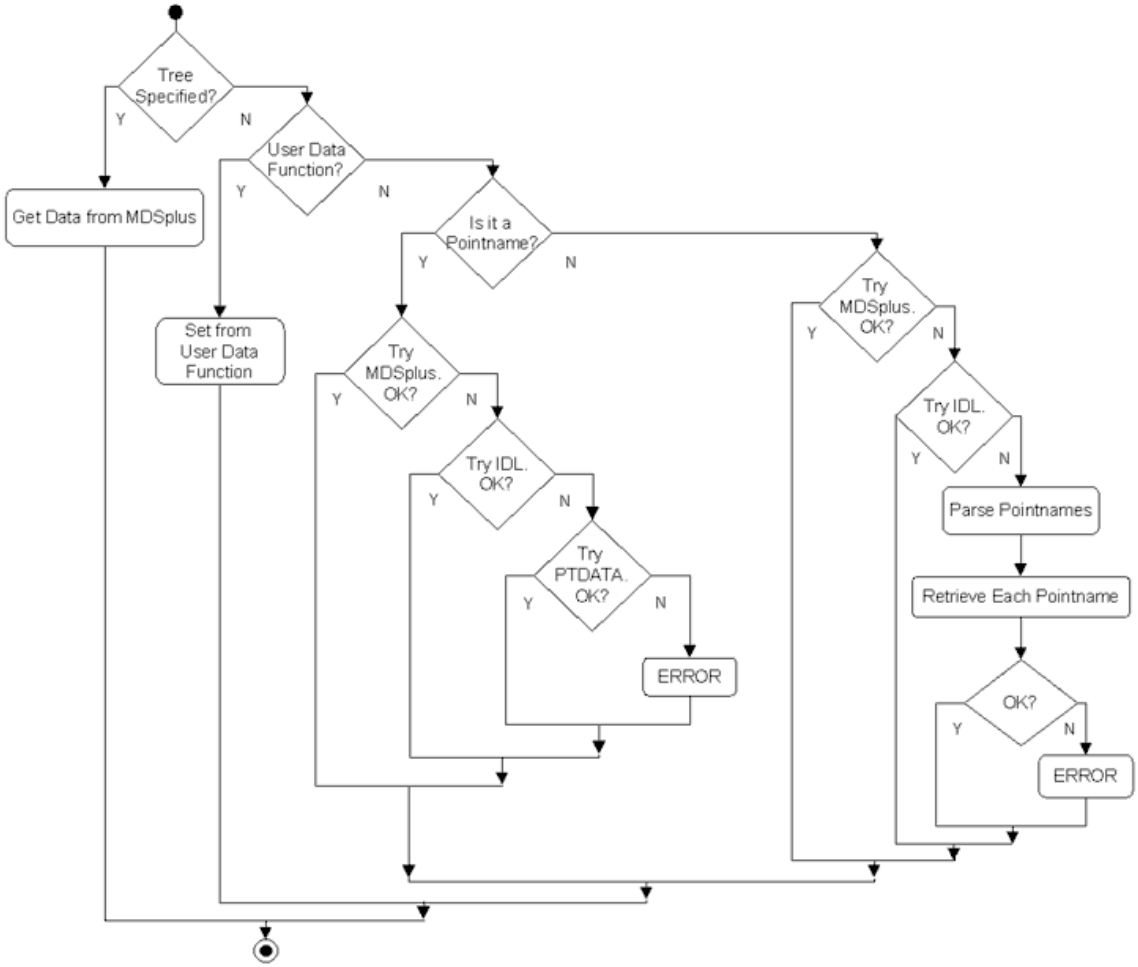


Figure 9: Algorithm

Entering a Signal Expression in ReviewPlus

Signal expressions are entered in ***ReviewPlus*** by selecting the menu command **Edit>Set Signals**, clicking in a cell in the **Z Data Signal** column of the **ReviewPlus Signal** table and typing the expression, then pressing [Enter].

The **Status** column of the **Signal** table will display an **OK** if the data has been retrieved successfully and will be blank if the data has not yet been retrieved. The word **ERROR** will be displayed if there is a problem retrieving signal data or plotting an expression. When it appears, click on the word **ERROR** for more information about the problem.

The ReviewPlus Signal Table

The **ReviewPlus Signal** table can be used to build lists of signal expressions for storage and later retrieval. By typing signal expressions and pressing [Enter], you can enter expressions in the table just as in a spreadsheet. Once a list is built, it can be saved using the menu command **File>Save As**. (See *File Operations* for more information.)

Signal expressions can be manipulated within the **Signal** table using the buttons below the table.

- To alter the appearance of a signal plot, use the **Set Appearance** button. (See *Interacting with Plots* and *Customizing the Appearance of Plots* for more information.)
- To delete a signal expression from the table, use the **Delete** button.
- To create an empty row below the row where the cursor is placed, use **Insert**.
- To copy the signal expression in a row where the cursor is placed to a new row just below it, use **Copy**.
- To move a signal expression from one row to another, use the **Move** button.
- To re-retrieve the data for a signal expression from its source and re-plot it, use **Refresh**.
- The **Expand Cell** button is used when text overruns a cell. When this button is clicked, a dialog is displayed that contains the entire text of the cell inhabited by the cursor. If the text in the cell is editable, then the text in the dialog is also editable.

Additionally, the buttons at the bottom of the **ReviewPlus Setup** dialog can also affect the signal expressions and plots.

- The **Done** button applies the current settings in the **Setup** dialog to all plots, and then dismisses the dialog.
- The **Apply** button applies the current settings in the **Setup** dialog to all plots.
    - Note: If you type an entry into a new row, you need to use the **Apply** button. If there is already an entry in that row that has been retrieved once (if there is an entry in the status column) and you make a change and move the cursor out of the cell, the change will be applied immediately. If you don't want the changes applied immediately, you can change this setting using **Edit>Preferences**. (The general rule is if the **Apply** button is lit, you should use it.)
- The **Refresh All** button retrieves the data for all signal expressions and shots currently entered in ***ReviewPlus*** and re-plots them. The menu command **Edit>Refresh All Signals** also re-retrieves the signal data for all plots currently displayed by ***ReviewPlus***.
- The **Clear** button removes all signal expressions from the **Signal** table and clears the **main display window**. You can also select the menu command **Edit>Clear All Settings** to achieve the same effect.
- The **Menu of Signals and Pointnames** is described at the end of this section.

Plotting One Signal vs. Another

One signal can be plotted versus another by entering the second signal expression in the **X or Y Data Signal** column of the **Signal** table. There must be a signal expression in the **Z Data Signal** column of the **Signal** table for this feature to work.

Here's how ***ReviewPlus*** handles the case where the Z signal and the X/Y signal have dimensions of different sizes. This algorithm depends on whether the Z signal is a 2D signal (data versus one other dimension) or a 3D signal (data versus two other dimensions).

For a 2D signal (ZvsX), ***ReviewPlus*** interpolates the X expression onto the Z expression's natural dimension. The Z and X signals must therefore have commensurate dimensions. For example, if the Z signal is `WMHD`, whose natural dimension is time, the X signal must also have a natural dimension of time. So, it is legal to plot `WMHD` versus `IP`, since both signals are individually measured versus time.

For a 3D signal, the signal specified under **X or Y Data Signal** in the **Signal** table must correspond to one of the two dimensions of the **Z Data Signal** expression. This means that it must have the same number of elements as one of the 2 dimensions. For example, if the Z signal is a 1000 x 300 matrix, the X/Y signal must be a vector with either 1000 or 300 elements. If the X/Y signal has 1000 elements, ***ReviewPlus*** assumes that it is to be used as the X dimension of the signal; whereas, if the X/Y signal has 300 elements, it is assumed to be the Y dimension of the signal. No interpolation is allowed, so the X/Y signal must be directly commensurate with the Z signal.

Overplotting Signals

When only one signal expression is entered in the **Signal** table, and the signal data is retrieved for multiple shot numbers, ***ReviewPlus*** will display the resultant signal traces in a single plot box. In general, each **Signal** table row entry will have one data trace plotted for each shot, so one row may have multiple traces associated with it.

When signal expressions are entered on separate rows of the **Signal** table, they can be overplotted (displayed in one plot box) by altering the setting in the **Box** column of the **Signal** table. By default, each signal expression entered in the **Signal** table has the value in the **Box** column set to **New**, meaning they will be plotted in '**New**' or separate plot boxes. When you click in the **Box** cell and remove the setting, the signal is overplotted on the closest signal above it in the **Signal** table. Many signals can be overplotted this way, but be aware that ***ReviewPlus*** will overplot signals that do not share common units of measure for their axes.

Customizing Signal Data Retrieval

The **ReviewPlus Signal** table can be used to customize the retrieval of signal data by defining settings in the columns described below.

- **Server**

  Signal data can be retrieved from different MDSplus servers at locations around the world, provided that access to the data has been made available via the Internet. You can view remote data by entering the MDSplus server IP address (for example, `atlas.gat.com` for General Atomics) in the **Server** column. Remember that other MDSplus data servers may use different naming conventions for their shots and signals.

  See *Defining Shot Numbers* and *Tutorial 1* for more information.

- **Tree**

  If you are familiar with MDSplus, and would like ***ReviewPlus*** to retrieve your signal expression directly from an MDSplus tree, enter the tree name in the column marked **Tree**. If

you do not specify an MDSplus tree, ***ReviewPlus*** uses the algorithm shown in Figure 9 to determine how to evaluate your signal expression.

- **tmin and tmax**

  The **tmin** and **tmax** columns of the **Signal** table allow you to enter `minimum` and `maximum` time ranges and retrieve only a subset of data for a signal. The `tmax` entry must be greater than the `tmin` entry for these settings to be applied. You can also set ranges for individual signals and plots using **Configure: Ranges** in the **Set Appearance** dialog.

  For more information on setting ranges, see *Configuring Plot Ranges*.

- **ICAL**

  When dealing with the PTDATA system, the default value for the **ICAL** column is set to **1**. If you change it to a different value, the data you request comes back in a different form:

ICAL	Data Units returned
`0`	digitizer counts
`1`	physics units (default, most often used)
`2`	volts input to the digitizer
`3`	voltage at the integrator output
`4`	returns the integrated signal in v-sec
`10-14`	same as 0-4 except for the baseline algorithm
`20`	returns data in the original integer format as provided by PTDATA

  Note that the **ICAL** value only applies to signals retrieved from PTDATA. It is ignored for any other signal.

- **Units of Measure**

  The units of measure of a plotted signal trace are displayed in the **Z units**, **X units**, and **Y units** column of the **Signal** table. Note that ***ReviewPlus*** treats axis units of measure as labels only, and it associates the axes of signals in separate plots that share a common unit of measure.

  Signals whose axes share units of measure, but whose units refer to different qualities, can be separated by assigning an arbitrary unit of measure to the axis of one of the signals. This capability serves to differentiate units of measure into "physical units" (those that refer to real-world signal measurement units) and "logical units" (those used by ***ReviewPlus*** to associate separate plot axes for functions like **Crosshairs** and **Slicing**). By default, the logical units are the physical units, but you can override this when necessary by changing the logical unit label using the **Set X Units** or **Set Y Units** columns of the **Signal** table.

  For example, if two signals have "m" (meters) as their Y-axis physical units of measure, but one signal measures major radius and the other measures minor radius, the logical Y units of the second signal can be arbitrarily changed using **Set Y Units** to keep ***ReviewPlus*** from linking the two axes during plotting. Be aware that

changing logical units of measure using **Set X Units** or **Set Y Units** will not transform the signal trace itself (for example, entering cm for a signal whose physical units are m will not multiply the data by 100).

See *Units of Measure - In Depth* and *Tutorial 2* for examples of this process.

- **Post Draw Procedures**

ReviewPlus allows Post Draw Procedures to be performed on signal data prior to plotting. A Post Draw Procedure is a user written IDL procedure that modifies retrieved signal data and plots it in the **main display window**. The procedures are stored on the user's system, and are called by entering the procedure name in the **Post Draw Procedure** column in the **Signal** table.

See *Advanced Plotting Techniques* and *Tutorial 3* for more information.

The Signal Menu

If your site maintains a signal documentation scheme in a relational database, ***ReviewPlus*** can use it to present a menu of available signals. This menu can be accessed using the **Menu of signals and pointnames** button in the **Setup** dialog. You can select a signal from the menu and enter it in the **Signal** table by clicking inside a cell in the **Z Data Signal** column in the **Signal** table, which makes the cell active, and then clicking on a signal number in the **Signal Menu**. This loads the signal in the **Signal** table. When you click the **Apply** button at the bottom of the **Setup** dialog, the signal plot appears in the **main display window**.

The **Signal Menu** has columns for the **Units of Measure**, a short description of the signal, where the signal resides in the data system, etcetera. (Note that the **Units of Measure** may not always be strictly correct, refer to the data.) Clicking on a column heading will sort the table by the contents of that column.

The **Signal Menu** also contains a simple query constructor to filter the list of signals. Choose the names of columns and operators from drop-down lists to specify values to filter the list. The **Show Query** button displays the query being sent to the relational database. **Custom Query** allows display to all columns in the table and provides a window in which to type an SQL query.

There is a button near the bottom of the **Signal Menu** that can provide help on a particular signal. Click the button, and then click on a **signal name** in the list. This activates your web browser and opens a web page that displays documentation on the selected signal.

Defining Shot Numbers

As stated earlier, a shot number refers to a specific experiment from which data will be retrieved, and a signal refers to the specific data retrieved from that experiment. This section describes how shot numbers are used in ***ReviewPlus***.

Entering Shot Numbers in ReviewPlus

There are three main areas used to enter shot numbers in ***ReviewPlus***:

- **Default Shot** text field at the bottom of the **main display window**
- **Setup** dialog under the sentence "**LIST OF SHOTS TO PLOT**"
- **Signal** table in the column labeled "**Shot**"

Note that in any of these places, if the field where the shot number should be entered is left blank, its value is assumed to be zero.

The Simplest Way to Enter Shot Numbers

The easiest way to retrieve and plot data for one shot is to enter the shot number into the **Default Shot** text field at the bottom of the main window. If no other shot information is explicitly entered into the **Setup** dialog, this will then mean that all data is retrieved and plotted for that shot only.

ReviewPlus can do much more than this, however. It is possible to plot your signals for multiple shots. You can plot signals for multiple shots, and select certain signals to plot for only one shot. It is also possible to use the current shot for your experiment, or shot numbers relative to it. This additional complexity is explained below.

The Shot Number Algorithm

The following algorithm describes how the three areas in which to enter shot numbers are used to determine the shot(s) for which to retrieve data.

For each row in the table, the first question to answer is whether to use the shots entered in the **Shot List** section of the **Setup** dialog (identified by the label **LIST OF SHOTS TO PLOT**), or whether to use one specific shot number for that row (and only that row). This is determined by the value in the column **Use List?** for the row in question.

If **Use List?** is set to **Yes**, the signal is retrieved and plotted for all the shots listed in the **Shot List** part of the dialog. If **Use List?** is set to **No**, ***ReviewPlus*** will use the shot number entered in the column **Shot** instead.

In most cases, it is sufficient to leave **Use List?** set to **Yes** for all rows, and then just use the **Shot List** part of the **Setup** dialog to control the shot numbers. However, if you want to plot one or more of your signals for a specific shot regardless of what shots are in the **Shot List**, then enter that shot number into the **Signal** table under the column **Shot** (which automatically changes the value under **Use List?** to **No**). Clicking on the cell in the column **Use List?** allows you to easily toggle between using the shot list and the specific shot in the **Shot** column for a given row.

The other question to answer in order to determine which shot numbers are used is whether or not there are any "relative shot numbers" *anywhere* in the **Setup** dialog, either in the **Shot List** section, or in the **Shot** column of the **Signal** table. (Note that the latter's value only matters for a row if the

value of **Use List?** for that row is **No**.) A relative shot number is a number less than or equal to zero. Recall that a blank field is equivalent to zero for shot numbers.

If a shot number less than or equal to zero appears anywhere in the **Setup Dialog**, this value is added to the value appearing in the **Default Shot** field at the bottom of the main dialog. To make this concrete, assume that the following is true:

- the number 104276 is entered into the **Default Shot** field on the main dialog window, and
- one row in the **Signal** table has 0 entered under the **Shot** column and **Use List?** is set to **No**

For this row, then, the value 0 is added to the default shot 104276, so that the data is retrieved for shot number 104276. If -5 is entered in the **Shot** column, then the shot number that is used is 104271.

The same applies if 0 or -5 is entered into the **Shot List** part of the **Setup** dialog and **Use List?** is set to **Yes**.

The Simplest Way to Enter Shot Numbers - Revisited

Having discussed the whole algorithm for determining shot numbers, it should hopefully be clear why, in a fresh ***ReviewPlus*** session, entering a shot number only in the **Default Shot** field on the main window retrieves data for that shot. In the **Signal** table, all of the rows would have their **Use List?** value equal to **Yes**, meaning that the shot numbers are determined by the shot list. Since no entries explicitly have been made in the shot list section, the blank field is interpreted as shot 0. This means to add 0 to the value in the **Default Shot** field on the main window.

Plotting One Signal for Multiple Shots

There are two ways to see the data for one signal from multiple shots. The first way is to enter multiple shots into the **Shot List** part of the **Setup** dialog (under **List of Shots to Plot** as described in the previous section). For each row of the **Signal** table (whose **Use List?** value is **Yes**) you will then get one data trace per shot number appearing in the plot box. In this case, there is no way to display the traces for each shot in a separate plot box. They are always manipulated as a unit.

To display the same signal expression for different shots in different plot boxes, make multiple entries of the signal in the **Z Data Signal** column, then type separate shot numbers for each row in the **Shot** column. Recall that when you type an entry in the **Shot** column, ***ReviewPlus*** automatically sets the **Use List?** value to **No**.

List of Shots to Plot

As stated earlier, when one signal expression is entered in the **Signal** table, and data is retrieved for multiple shot numbers, ***ReviewPlus*** will display the resultant signal traces in a single plot box. In general, each **Signal** table row entry will have one data trace plotted for each shot, so one row may have multiple traces associated with it.

Use the menu command **Edit>Set Signals** to open the **ReviewPlus Setup** dialog. There are 3 easy ways to enter shot numbers using this dialog.

You can:

- create a list of shots to plot
- specify a range of shots

- construct an SQL query that will return a list of shots that adhere to parameters you supply

Near the middle of the **ReviewPlus Setup** dialog is the sentence "**LIST OF SHOTS TO PLOT**" below which are controls used to enter shot numbers. To enter a single shot number, click the radio button marked **List of shots**, and type the shot number into the text field. Then, click the **Apply** button near the bottom left side of the dialog.

Multiple shots can be entered using the same method. Type the shot numbers (separated by spaces or commas) into the text field to the right of **List of shots**, and then click **Apply**. ***ReviewPlus*** will plot one signal expression from multiple shot numbers onto a single plot in the **main display window**, overlaying the signal traces, and supplying different colors for each trace.

A range of shots can be plotted using the radio button in the **Setup** dialog. After clicking the **Range of shots** radio button, enter the baseline shot number in the text field, and then choose how many previous shots to plot by entering the number in the '**and previous**' text field.

You can also specify a list of shots to plot via SQL query. The **DB Query** radio button provides the opportunity to construct relational database queries and return lists of shots that adhere to the supplied parameters.

Note that retrieving shot numbers via database query only works if that capability has been built into the system at your location. ***ReviewPlus*** expects to find tables indexed by shot number in a relational database that it can access. Typically, these tables would contain scalar parameters summarizing shots from the experiment at your site (e.g., maximum plasma current, maximum stored energy, etc.). ***ReviewPlus*** can query this summary information to determine a list of shots to use for retrieving and plotting data.

ReviewPlus constructs an SQL query to generate the list of shots as follows:

Select SHOT from [...]

where [...] is a valid SQL clause completing the statement.

For example, to generate a list of shots where the maximum plasma current was at least 1.2 MA, enter the following text into the text field:

```
SUMMARIES where IP>1.2e6
```

ReviewPlus adds "**Select SHOT from**" to the beginning of this string, to produce the query:

Select SHOT from SUMMARIES where IP>1.2e6

This example works for the General Atomics DIII-D relational database, which contains a table called "SUMMARIES" that stores scalar highlights of the shot data from MDSplus and PTDATA. One of these highlights is the column "IP," defined to be the maximum plasma current for each shot.

Since a query could return many thousands of shots, there is a limit imposed on the number of shots plotted in ***ReviewPlus***. This limit is adjustable using the drop-down list next to the query field. Choose a limit of **5, 10, 25, 50, 100, 200, 300, 400, or 500** shots. The default value for this field is **5**. To see the shots returned, click the button **Show result [N]**, where **[N]** is the number of shots returned.

Unique Shot Numbers and the Shot Column

You can define a specific shot number for an individual signal expression by entering the shot number in the **Shot** column of the **Signal** table. It is possible to create separate plots of the same signal, taken from

different shots, by making multiple entries of the signal expression in the **Z Data Signal** column, and then typing separate shot numbers for each entry in the **Shot** column. When you type an entry in the **Shot** column, ***ReviewPlus*** automatically sets the **Use List?** value to **No**. You can toggle between shots by clicking on the setting in the **Use List?** column of the **Signal** table provided the shot numbers are entered correctly in the **Shot** column and in one of the other areas in ***ReviewPlus***.

More on Relative Shot Numbers: Blank, Zero and Negative Shots

Recall that anywhere a field specifying a shot number is left blank, the value is interpreted as zero. Shot numbers less than or equal to zero are referred to as "relative" shot numbers. The meaning of these shot numbers, that is, what they are taken relative to, depends on where they appear.

As described in *The Shot Number Algorithm*, if a relative shot number appears *anywhere* in the **Setup** dialog, either in the **Signal** table or the **List of Shots to Plot**, the number is added to the "default shot" - the value in the **Default Shot** field on the main window.

If the default shot is itself blank or zero, then the current experimental shot is used. (At GA, this would be the current DIII-D shot.) If the default shot is negative, its value is added to the current experimental shot. Entering -1 as the default shot would then give the previous shot, for example.

This makes it easy to follow the experiments over the course of a day. Just leave the default shot equal to zero, and use shot 0 somewhere within your shot list in the **Setup** dialog. That shot will then always reflect the current experimental shot number.

Just to confuse things, suppose that -1 is entered in the shot list, and -1 is also entered as the default shot. In this case, the shot that will be used is *two* less than the current shot. This is because the -1 in the shot list means "subtract one from the default shot," while having the default shot equal to -1 means "subtract one from the current shot." The result is the current shot -1 -1 = current shot -2.

Automatic Updating

If your facility supports MDSplus events, you can have ***ReviewPlus*** automatically refresh your data and graphs when the shot number changes and new data becomes available. To do this, check the box labeled **Auto Update** next to the **Default Shot** field on the **main application window**.

Note that this feature is not very efficient (***MDSplus Scope*** users will especially be concerned about this). This is because when an event is heard and the shot number has changed, ***ReviewPlus*** attempts to retrieve all the specified signals at once. At DIII-D, it is not setup to distinguish different events signifying the availability of different datasets. If ***ReviewPlus*** is unable to retrieve some of its signals after the first event, it will try those again when it hears its next event. This continues until all the signals specified in the **Signal** table have been retrieved for the current shot, or until the current shot changes (at which point the process begins over again).

The ***MDSplus Scope*** is able to update individual plots as soon as the data for those plots becomes available. This is because separate events for each dataset are declared, and are known to the user community. At DIII-D, signal-specific events are available, but the user community currently has no easy way of learning them all. The plan for DIII-D and ***ReviewPlus*** is to use the relational database to keep track of what events belong with what signals, so the application is automatically configured to update itself if the user desires.
MDSplus Scope users take note: When this feature is added, an extra column in the **Signal** table will be added as well so that you can input the event names manually. Stay tuned for more information.

Creating and Restoring Shot and Signal Lists

Lists of shots and signals can be stored in `*.revplus` files. You can selectively control the data imported when a `*.revplus` file is opened using the **Restore shots** and **Retrieve data** checkboxes in the **Restore** dialog.

See *Restoring Shot and Signal Lists* for more information.

Interacting With Plots

As stated in the *Introduction*, ***ReviewPlus*** is a general-purpose plotting tool, capable of displaying interactive 2D and 3D plots of raw, analyzed, and simulation data. This section looks at how those plots are generated.

Defining the ReviewPlus Coordinate System

- 2D data is considered as a function of one variable, Z(X).
- 3D data is considered as a function of two variables, Z(X,Y).

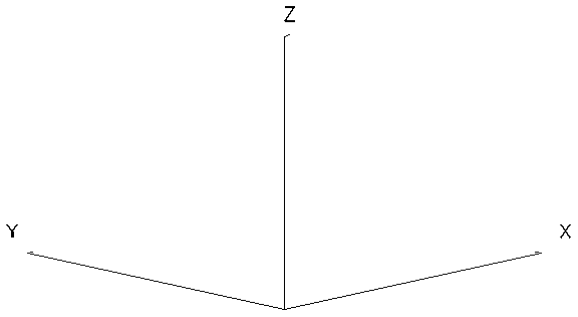


Figure 10: ***ReviewPlus*** *Coordinate System*

- X always refers to the first dimension of the signal, determined by how the data is stored in MDSplus or PTDATA.
- Y refers to its second dimension, if the signal is 3D. If the signal is 2D, Y is unused.
- Z always refers to the dependent data (the measured or calculated parameter).

Defining 2D Plots

When plotting 2D data versus time, for example IP from PTDATA, Z = IP and X = time. ***ReviewPlus*** shows the plot in the X-Z plane as a 2D image.

Here, it is displayed as a 3D image to make the point that the Y dimension is unused.

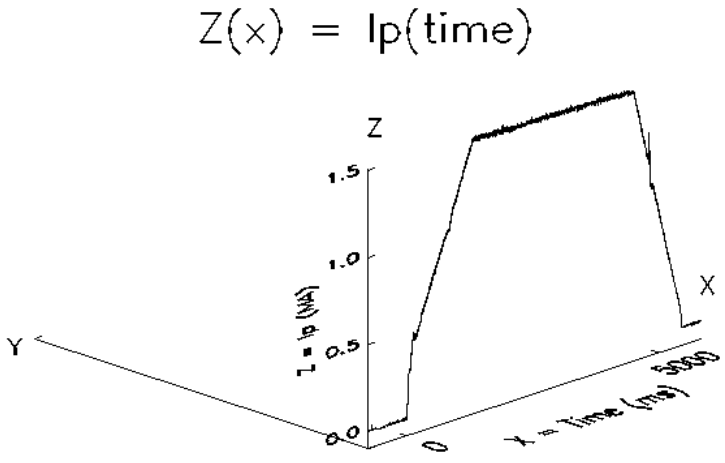


Figure 11: Plot IP versus time

When plotting 2D data that is measured versus some parameter other than time, the plot is also shown in the X-Z plane.

For example, suppose that the data below represents Te from the old single pulse Thomson Scattering system at the DIII-D facility. This system measured Te at one time only but at many positions in the plasma. Here, Z = Te and X = elevation (or "z" to be confusing). ***ReviewPlus*** would display this as follows (remember that it shows only the X-Z plane - the 3D image is shown here for instructional purposes only):

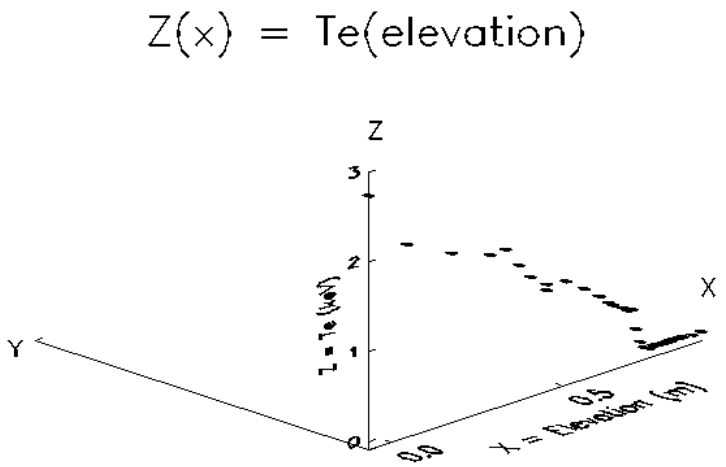


Figure 12: Plot of Te from single pulse system versus elevation

Defining 3D Plots

There are five types of 3D plots displayed by ***ReviewPlus***:

1. **Surface**
2. **Image**
3. **Contour**
4. **ZvsX**
5. **ZvsY**

- **Surface**, **Image**, and **Contour** plots show the data as a function of both of their dimensions.
- The **ZvsX** and **ZvsY** plot types show the data as a function of one of their dimensions, calculated for a fixed value of the other dimension.

You can access the **3D Plot Type** settings using **Edit>Set Appearance**, or with the **RMB>Set Appearance** command.

The example below shows Te from the core system of the modern Thomson Scattering diagnostic at the DIII-D facility: this is the signal TSTE_CORE. (The data have been smoothed to make it easier to see the profile.) TSTE_CORE is stored in MDSplus with time as its first dimension and elevation as its second dimension, so here Z(X,Y) = Te(time, elevation).

Plotted as a **Surface**, ***ReviewPlus*** would show:

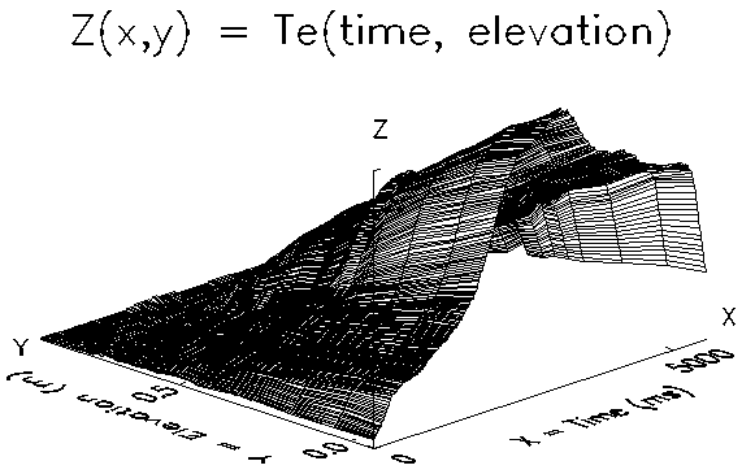


Figure 13: Surface plot of Thomson Te (time, elevation)

Defining 3D Plot Slices

3D data can also be "Sliced" to show Z as:

- a function of X for a fixed value Y = y0 (Plot Type **ZvsX**)
- a function of Y for a fixed value X = x0 (Plot Type **ZvsY**)

For the TSTE_CORE plot in Figure 13, the **X units** are ms and the **Y units** are m. **ZvsX** and **ZvsY** plots of TSTE_CORE for sample values Y = y0 and X = x0, respectively, are shown in Figure 14.

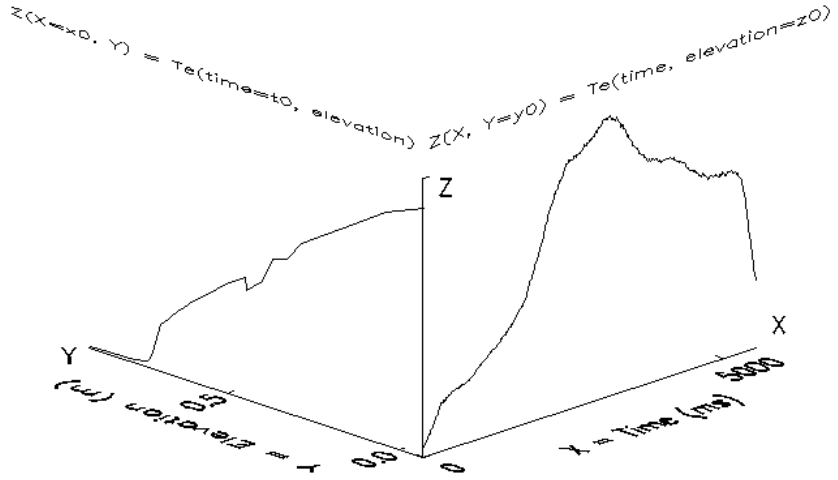


Figure 14: ZvsX and ZvsY "Slice" plots of TSTE_CORE

Of course, ***ReviewPlus*** does not display the plots projected in 3 dimensions. Instead, it shows the plots as you would expect - see Figure 15.

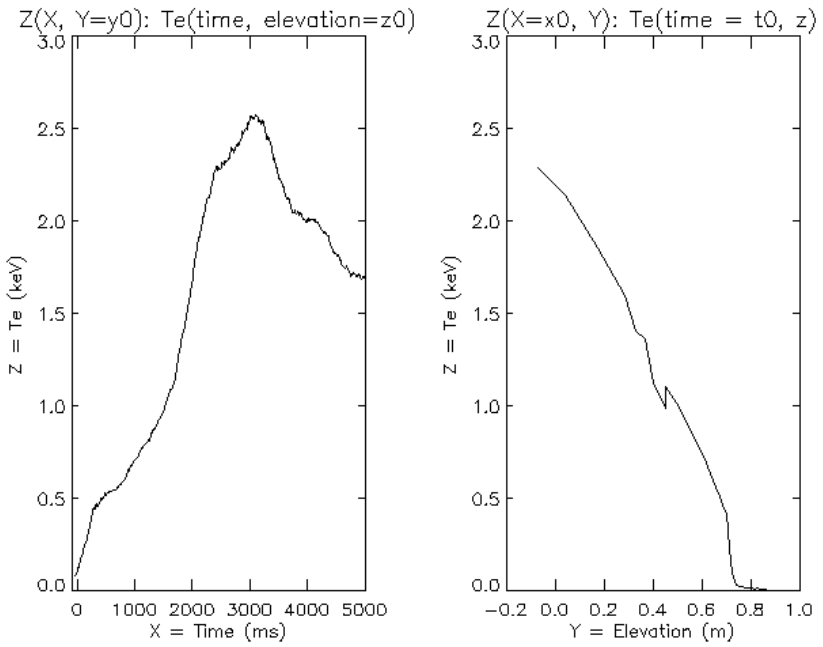


*Figure 15: ZvsX and ZvsY "Slice" plots of TSTE_CORE as shown by **ReviewPlus***

The q profile from EFIT, signal name QPSI, is an example of a profile stored in MDSplus whose X dimension is not time; instead X = normalized psi and Y = time.

A surface plot of QPSI is shown in Figure 16.

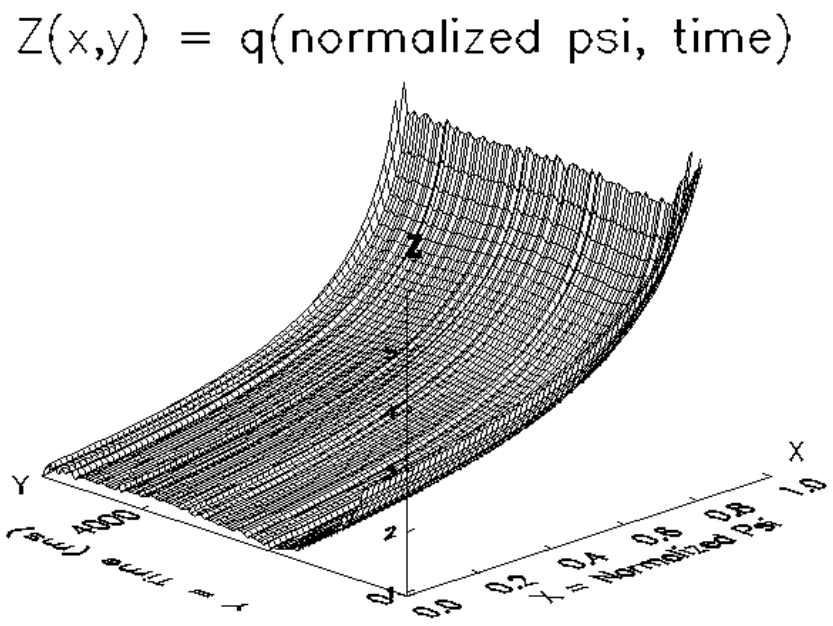


Figure 16: Surface plot of EFIT q(normalized psi, time)

The **ZvsX** and **ZvsY** slices of QPSI, as they are actually displayed by ***ReviewPlus***, are shown in Figure 17.

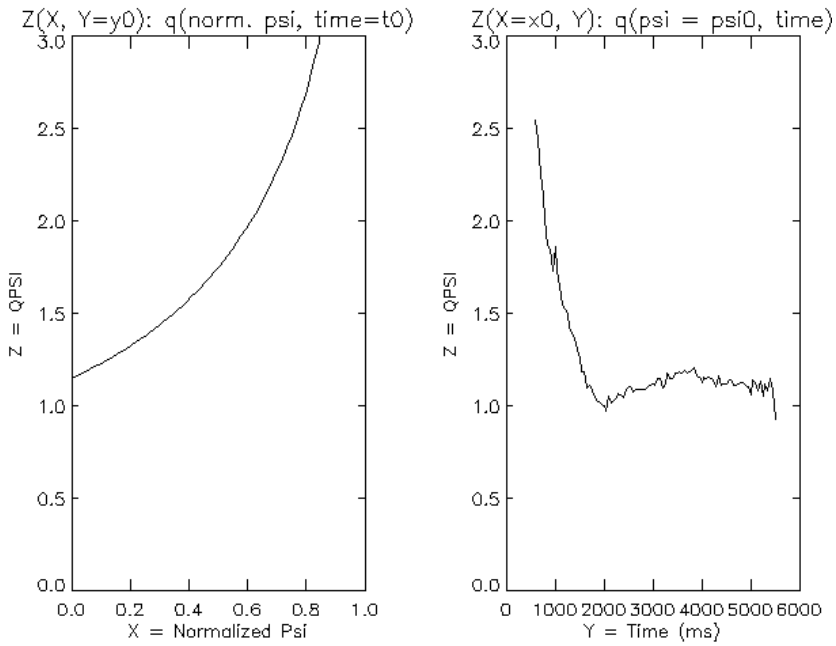


Figure 17: ZvsX and ZvsY "Slice" plots of QPSI

Defining 3D Plot Types

You can determine the type of plot used for displaying 3D data by selecting the menu command **Edit>Set Appearance**, and then selecting a **3D Plot Type**. The default setting for a plot type is **ZvsX**. If you set up a signal in ***ReviewPlus*** and notice that the **3D Plot Type** drop-down list has been disabled, it means that the signal data is two dimensional and can be shown as **ZvsX** only.

Open ***ReviewPlus*** on your system and restore the example file `example_plot_types.revplus`.

The file restores 5 different views of the Electron Temperature Profile TSTE_CORE:

1. 3D **Surface** plot
2. 3D **Contour** plot
3. 3D **Image** plot
4. **ZvsX** plot
5. **ZvsY** plot

The first three plots in this display show the entire 3D data set at once. The last two plots show slices of the data set.

Click in the fourth plot (**ZvsX**) and then select the menu command **Edit>Set Appearance**. Near the bottom of the **Set Appearance** dialog is the **Y Slice** control. Use this slider to change the position of the slice on the Y axis of the 3D plot. Notice how the profile changes for each different position on the plot. For finer control of the slice position on the Y axis, you can type a font into the text field next to the slider.

You can also change the look of the profile trace in the **ZvsX** plot by placing symbols along the signal trace. Use the **SYMBOL** drop-down list to choose a symbol type. You can alter the properties of the symbols using the **Symbol features** controls: **fill**, **size**, and **fraction**. You can also alter the signal trace using the **LINE** drop-down list to choose another line style, or to remove the line altogether. Press **Apply** to commit your changes to the plot, or press **Done** to commit your changes and dismiss the **Set Appearance** dialog.

Changing the **Line**, **Symbol**, and **Slice** characteristics for the **ZvsY** plot are the same as for the **ZvsX** plot, except that the slider now controls the slice position on the X axis and you can type a value in the text field to specify where to slice on the X axis.

The **Surface** plot type (the upper plot in the example) displays a 3D map of the signal, with datapoints connected by surfaces. When selected, the **Set Appearance** dialog contains controls for rotating the **Surface** plot along the Z and X axes. You can display the 'upper half' of the plot bounding box by filling the **SHOW BOX** checkbox. There are four **Surface** plot styles to choose from: **Shaded**, **Mesh**, **Horizontal**, and **Lego**. For more information on these styles, consult the IDL Reference Guide for the functions 'SURFACE' and 'SHADE_SURF'.

The **Contour** plot type displays contours of constant Z value projected on the X-Y plane (like a topographical map). The **Set Appearance** controls for this plot allow you to choose the number of contours using the slider, or you can enter your own contour levels by typing an IDL expression for the Z axis values to use. For example, a specific set of values can be entered as [1,2,3,4]. Or, you can use IDL function. For example, entering `10XFINDGEN(21)/20` will show 21 evenly spaced contours from Z = 0 to Z = 10. When **Crosshairs** (described later) are active, you can have them track the contours by placing a check in the box near the bottom of the dialog.

For more information, see the 'Contour' topic in the IDL Reference Guide.

The **Image** plot type displays a 2D 'false color' representation of the data on the X and Y axis. Data variations on the Z axis are represented by changes in the intensity or color of the image, giving the plot its 3rd dimension. The **Set Appearance** controls for this plot type allow you to **Overlay Contours** over the **Image** plot by placing a checkmark in the supplied box. This also activates controls for the **number of contours** and **contour levels**. You can switch between **Interpolated** and **Rebinned Image** displays using the radio buttons. (In most cases, you can use the **Interpolate** method on these commands.)

See the IDL Reference Guide topics 'TV' and 'CONGRID' for more information.

Mouse Modes

ReviewPlus provides interactive signal plotting. There are different ways to interact with the plots, one of which is the **Mouse Modes**.

Mouse Mode settings can be found on the ***ReviewPlus*** **main display window**, just above the main display area. Each of the different settings is described below. A short summary of what the left and middle mouse buttons do in each mode can be found to the right of the **Mouse Mode** radio buttons in the **main display window**.

Select mode allows data or plot selection and panning. When in the **Select** mode, a dataset can be selected by clicking the left mouse button in the plot, near the target dataset (the dataset then becomes highlighted). Also, an entire plot can be selected by clicking just outside the plot border. The selected dataset can be dragged (by clicking the left mouse button on the selected dataset and holding the button down, then moving the mouse) and dropped (the left mouse button is released) into another plot window. If the dataset is dropped outside of all plot windows, it is deleted (after a confirmation message is okayed). If the left mouse button is released in the same plot window from which the data was selected, the plot is panned and its ranges are adjusted. A single click of the middle mouse button within a plot window resets the plot to its original ranges.

Zoom mode allows zooming from many plots in the **main display window** to a single plot, and vice versa. When viewing many plots, clicking outside a single plot window while in **Zoom** mode fills the entire display with the plot. Clicking outside the plot again returns you to the 'many plots' view. **Zoom** mode also

allows zooming within a single plot window. While the cursor is within a plot window, you can use click-and-drag to draw a box identifying a particular region to examine. When the mouse button is released, the range of the plot is adjusted to display the identical region. While zoomed, a single click of the left mouse button within the plot window returns the plot to its preset ranges; and a single click of the middle mouse button while zoomed autoscales the plot. These two methods differ only when explicit ranges have been set for a plot.

Cursor mode allows you to mark a reference point by clicking the left or middle mouse button in a plot window. A crosshair is kept at the reference point with Z/X lines for the left mouse button and X only for the middle button. The coordinates shown in the **Status** area are for the cursor's current position relative to the last crosshair reference point shown in red; older crosshairs are shown in blue. To clear reference points, simply left-click outside the plot.

Slice mode allows you to interactively slice a 2D or 3D plot and view the results of the slice in another plot. The rules for determining which plots have their slices changed are based on the units of measure of their axes. More about slicing is explained in *Slicing 3D Plot Data*.

Crosshairs turns on and off cursor tracking. **Crosshairs** may be combined with any other **Mouse Mode**.

If **Crosshairs** is on, and if no dataset has been selected in a plot window, then the readout in the **Status** area (near the bottom left corner of the ***ReviewPlus* main display window**) shows the location of the cursor in data coordinates. If a dataset is selected, the cursor always traces the selected data. (For example, when the cursor is at any X/Y coordinate, the **Status** readout will also show the **Z** value from the selected data trace at that X/Y location.) When in **Cursor Mode** (above), the readout in the **Status** area shows the difference between the cursor and the reference point.

If there are multiple plots in the main display window, **Crosshair**(**s**) are shown in every plot window reflecting the same readout (when appropriate). See the following discussions on *Displaying Ganged Crosshairs* and *Slicing 3D Plot Data*.

Right Mouse Button (RMB) Commands

Right Mouse Button commands (also referred to in this manual as **RMB** commands) are launched by right clicking inside a plot. This action selects the plot and the **RMB** command is executed on the data in that plot (unless otherwise noted).

This is a description of each **RMB** command:

- **Autoscale**: This command automatically displays the entire set of data in the plot box and sets the ranges just beyond the extent of the data.
- **Autoscale Z**: This command automatically sets the range of the Z axis just beyond the extent of the available Z axis data, within the range already set for the X or Y data.
- **Autoscale All**: This command applies **Autoscale** to all plots.
- **Autoscale All Z**: This command applies **Autoscale Z** to all plots.
- **All Same Scale**: This command automatically sets the range of all other plots to the range of the active plot (that which the mouse cursor was over when the command was issued).

- **All Same X/Y Scale**: This command automatically sets the range of the X and Y axes of all plots to that of the active plot.

- **All Same X/Y Auto Z**: This command automatically sets the scale of the X and Y axes of all plots to that of the selected plot, then issues an **Autoscale Z** command to all plots.

- **All Same Z Scale**: This command automatically sets the scale of the Z axis of all plots to that of the selected plot.

- **Scale to Data**: Sets the range of the plot to the minimum/maximum value of the selected signal (assuming one has been selected in **Select** mode).

- **Ranges Dialog**: Opens the **GA Plot Properties** dialog with the **Ranges** radio button enabled. Changes made in the dialog affect the selected plot.

- **Reset Scales**: Resets the scales of a plot to the values in the **Ranges** dialog. If there are no values set in the **Ranges** dialog, this command **Autoscales** the plot.

- **Reset All Scales**: Resets the scales of all plots to their default settings. If no values are set in the **Ranges** dialog, this command **Autoscales** all plots.

- **Refresh Display**: Redraws all the plots. This is useful in case your X-Windows backing store fails (your display does not automatically refresh after being exposed).

- **Set Appearance**: This is the same as performing the **Edit/Set Appearances** command for a particular plot.

- **Refresh Signal**: Retrieves the signal data of a single plot from its source. The usual rules for determining the shot number applies, so if you are using the most recent shot, and that shot has changed, you will get data for the most recent shot.

Resizing the Main Display Window

It is possible to resize the plotting window by moving the cursor over any part of the window border, left clicking and dragging the window border. The menu command **Edit>Reset window size** will reset the window size to the default value in case the window cannot be resized manually.

Setting Common Plot Ranges

ReviewPlus allows users to set plots to the same X or Y range, either manually using the **RMB** command, or automatically as a preference (see **Edit>Preferences**). ***ReviewPlus*** groups plots together based on the units of the X and Y dimensions. All plots in the same group have their ranges set the same in either of the above situations.

To illustrate how this feature works, please start ***ReviewPlus*** and load the example fill: `3dexample.revplus`.

This example file makes 6 plots:

1. **ZvsX**: IP vs. time in ms
2. **ZvsX**: TSTE_CORE vs. time in ms at elevation z0

3. **Image**: QPSI vs. normalized psi and time in ms
4. **ZvsX**: QPSI vs. normalized psi at t0
5. **ZvsY**: QPSI vs. time in ms at psi0
6. **ZvsX**: WMHD vs. time in ms

If you do not have the preference **Force all plots to the same X/Y axis** set, please set it now (by choosing **Edit>Preferences**) so that you may follow along with the example. You should see the following display:

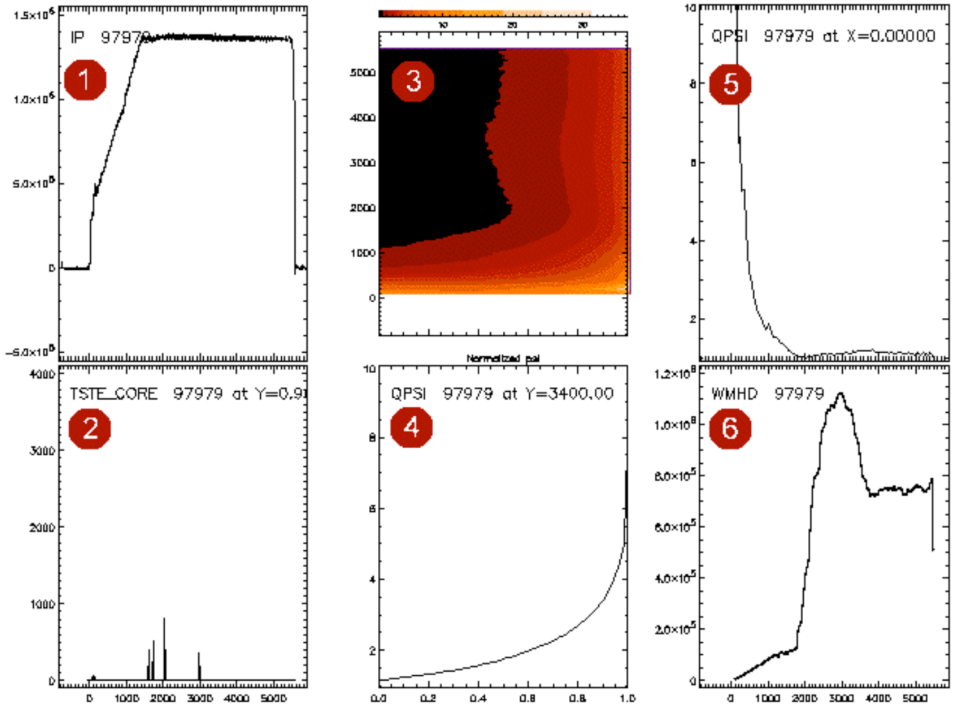


*Figure 18: **ReviewPlus** file* `3dexample.revplus`

Notice that plots 1, 2, 5, and 6 all have the same horizontal scale: this is because all 4 plots have time in ms as their horizontal axis (either X or Y). The Y axis of plot 3 has units of ms as well, so its range is the same as the X axis range of plots 1, 2, 5, and 6.

Make sure the mouse is in **Zoom** mode and move to plot 1. Press and hold the middle mouse button while dragging over a small horizontal distance. This makes plot 1 the active plot and will set the ranges of all other plots with the same units (2, 3, 5, and 6) to the same range. You should see something like what is shown in Figure 19 (depending on what range you actually set when you moved the mouse).

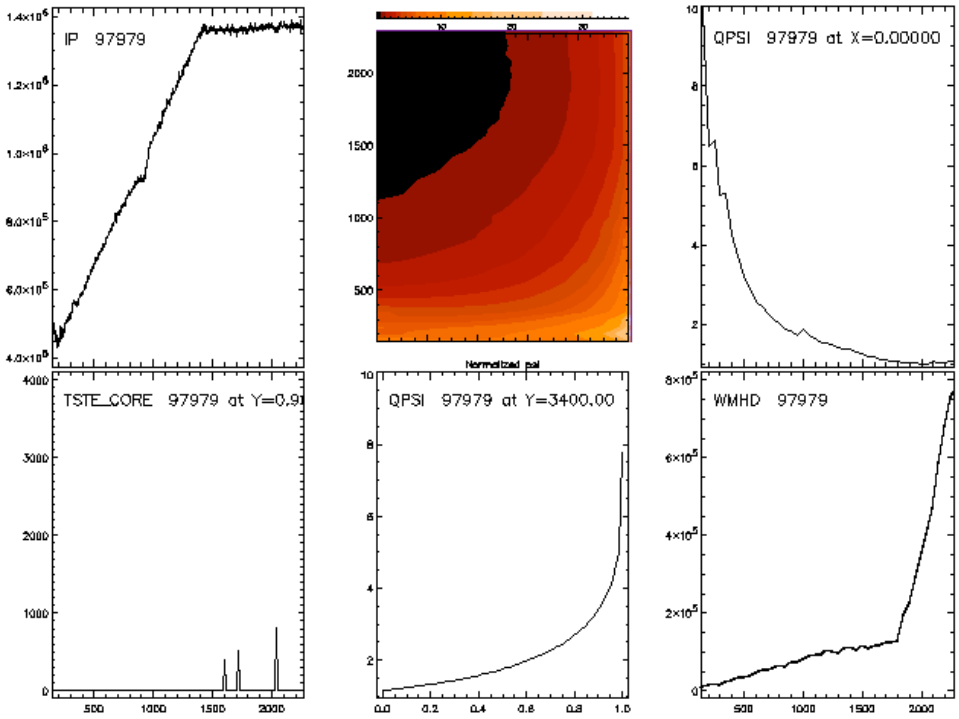


Figure 19: Same plots, after zooming in plot 1

Plot 4 is not affected as it does not have a displayed axis with units = ms. If you move to plot 4 and perform the same type of zoom operation, the ranges of both plots 3 and 4 are adjusted - since plot 3 also has an axis with units "normalized psi." All other plots are not affected.

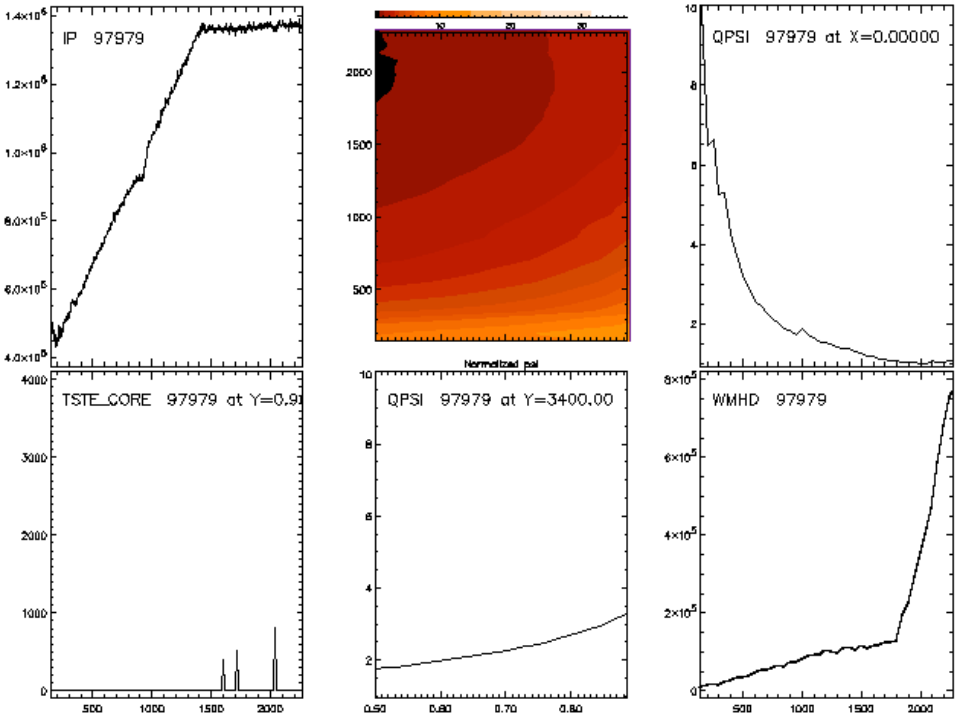


Figure 20: Same plots, after zooming in plot 4

If you **Zoom** inside of plot 3, then all the plots will be affected, as the units of the axes of all plots are the same as at least one of the axes in plot 3.

Having the preference **Force all plots to same X/Y axis** enabled is equivalent to adjusting the range of one plot, and then using the **RMB>All Same X/Y Scale** command. If you do not have the preference set, then any time you use the **All Same X/Y Scale** or **All Same X/Y, Auto Z** commands, the behavior of the plot ranges will be the same as described above.

Displaying Ganged Crosshairs

When the **Mouse Mode** - **Crosshairs** is turned on, ***ReviewPlus*** will draw horizontal and vertical lines at the data coordinates in the plot in which the cursor resides. The data coordinates corresponding to the cursor location are displayed in the lower left **Status** area of the **main display window**. In a 2D plot, these coordinates are (x0,z0) for a **ZvsX** plot, or (y0,z0) for a **ZvsY** plot. In a 3D plot, these coordinates will be (x0,y0) if there is no data object selected, or (x0,y0,z0) if there is. z0 is the value of the selected data object at coordinates (x0,y0).

ReviewPlus will also draw a horizontal line at Z = z0 in all other 2D plots regardless of their units. In any plot, 2D or 3D, whose X or Y units are the same as the X units of the active plot, a line perpendicular to the axis will be drawn at X = x0 or Y = x0, accordingly. A similar situation holds for any plot whose X or Y units match the Y units of the active plot - a perpendicular line is drawn at X = y0 or Y = y0.

Once again, refer to ***ReviewPlus*** and the example file `3dexample.revplus` to see this in action. Turn **Crosshairs** on and move into plot 1. The location of the mouse cursor is shown as an arrow in Figure 21. In plots 2, 3, 5, and 6 you should see lines at the time corresponding to the cursor location. In plot 3, since time is the Y axis, the line is horizontal; in all the other plots, the lines are vertical. This is shown in Figure 21.

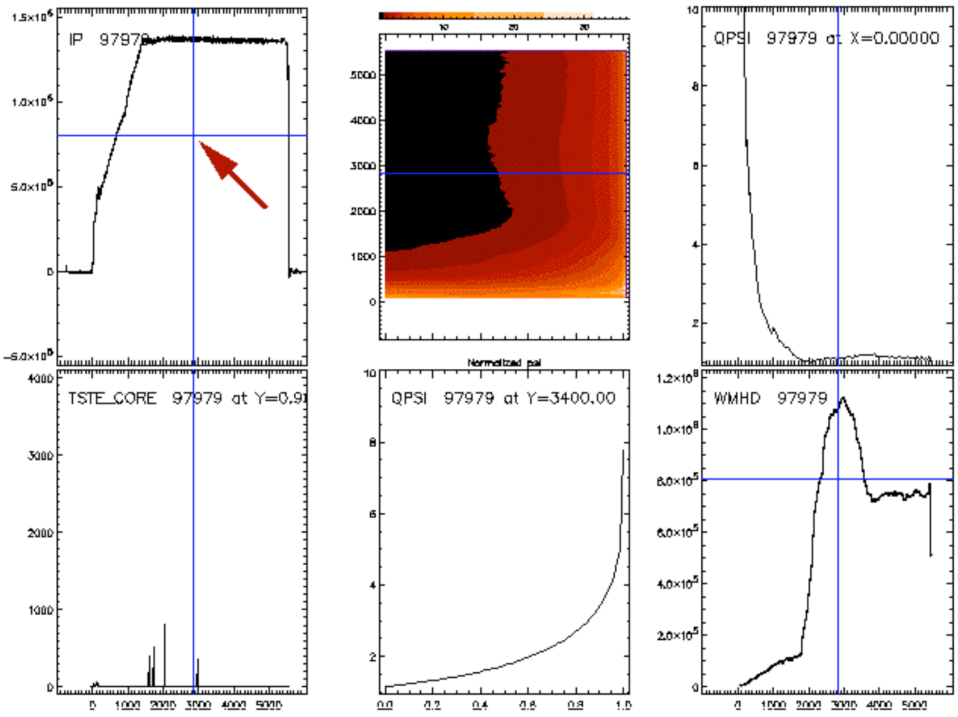


Figure 21: ***Crosshairs*** *shown plots when the mouse is in plot 1*

Notice in Figure 21 that the Z value corresponding to the cursor location in plot 1 is about $8x10^5$. Plot 6 is the only other plot that has this value in its Z range, so it is the only other plot that has the horizontal crosshair line.

If you move the cursor into plot 3, then there will be crosshairs displayed in all plots, as shown in Figure 22.

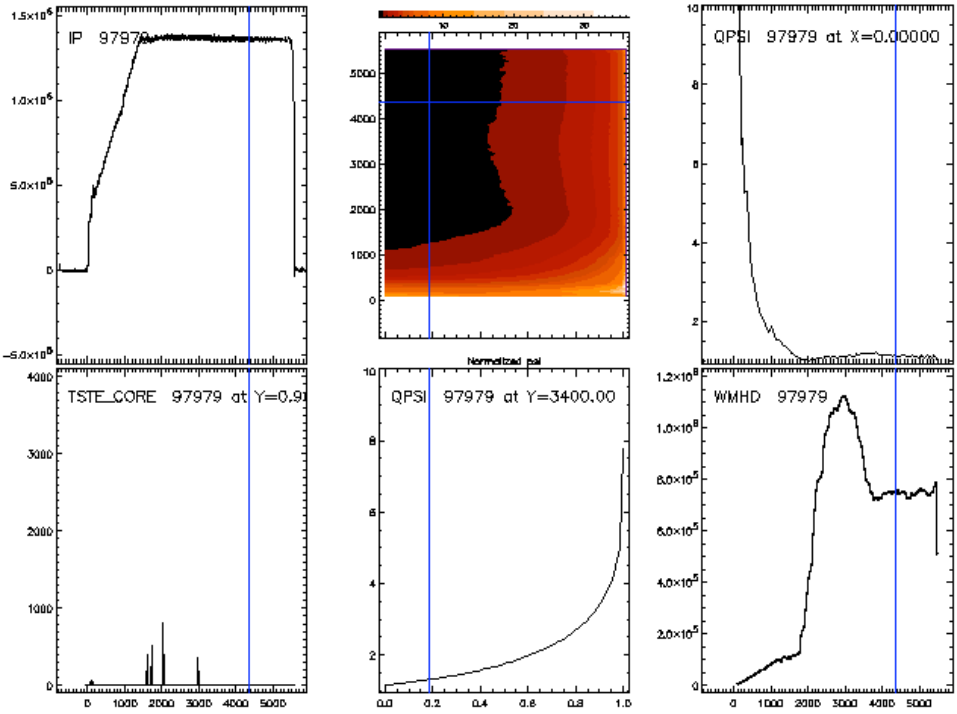


Figure 22: ***Crosshairs*** *shown on plots when the mouse is in plot 3*

Slicing 3D Plot Data

As explained earlier, for 3D data, the plots **ZvsX** and **ZvsY** show slices of the dataset at a "slice value" Y = y0 and X = x0, respectively. In the **Mouse Mode** - **Slice**, the slice values of plots can be changed interactively by moving the cursor in any plot.

The rules for determining which plots have their slices changed are also based on the units of the axes. Assume that the active plot, that is the plot in which the cursor is being moved, is a **ZvsX** plot (can be 2D or 3D data). Let Xu be the units of the X axis of the active plot. In any other 3D slice plot (**ZvsX** or **ZvsY**) where the units of the axis not plotted equal Xu, the slice value is changed. Note that in a slice plot the units of the axis not plotted are just the units of the slice value.

The same holds if the active plot is **ZvsY**: any other slice plots, where the units of the slice value match Yu, have their slice values changed. If the active plot is a 3D plot (a **Surface**, **Image**, or **Contour**), the units of the slice values of all other slice plots are compared to both Xu and Yu, the units of its X and Y axes. If there are any matches, the slice values are adjusted.

With the ***ReviewPlus*** example file `3dexample.revplus`, set the **Mouse Mode** to **Slice**. Move the cursor into plot 1 (IP vs. time) and turn slice mode on by pressing the left mouse button. Move to a different time value and notice that plot 4, which shows q vs. psi for a fixed time t = t0, changes to show the profile at the time corresponding to the cursor location in plot 1.

An example is shown in Figure 23.

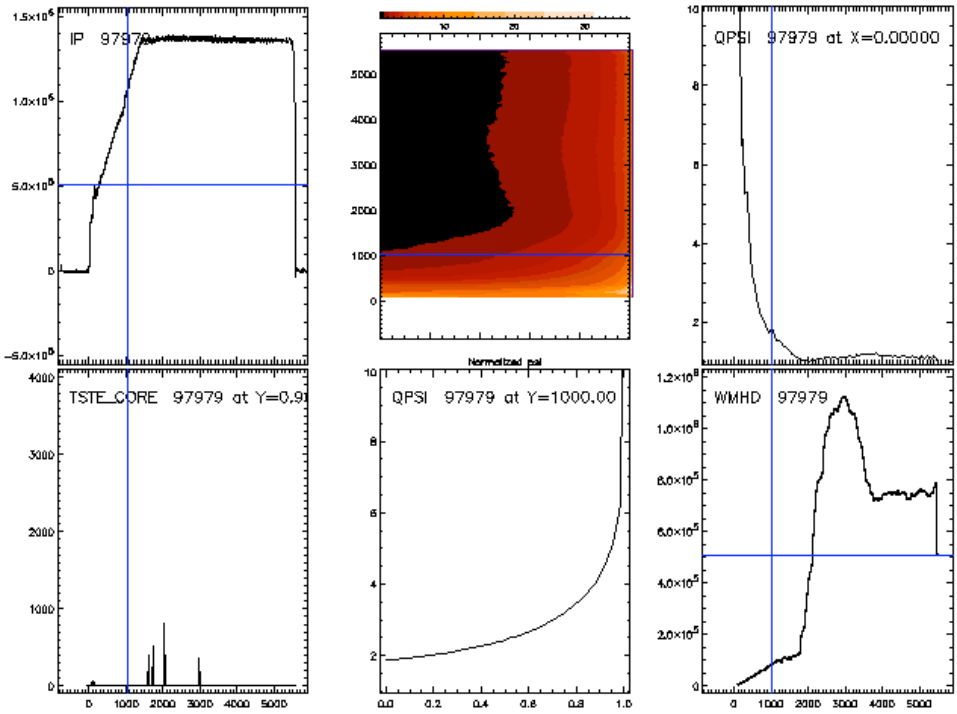


Figure 23: Slicing plot 4 by moving in plot 1. Plot 4 shows q vs. normalized psi at t = 1000ms, the location of the crosshairs in plot 1.

If you move the cursor in plot 4, then only plot 5 has its slice value adjusted. This is because plot 5 is the only slice plot whose slice value has the units "normalized psi."

Figure 24 shows the cursor sitting at normalized psi = 0.8 in plot 4 and the time history of q(norm. psi = 0.8) in plot 5.

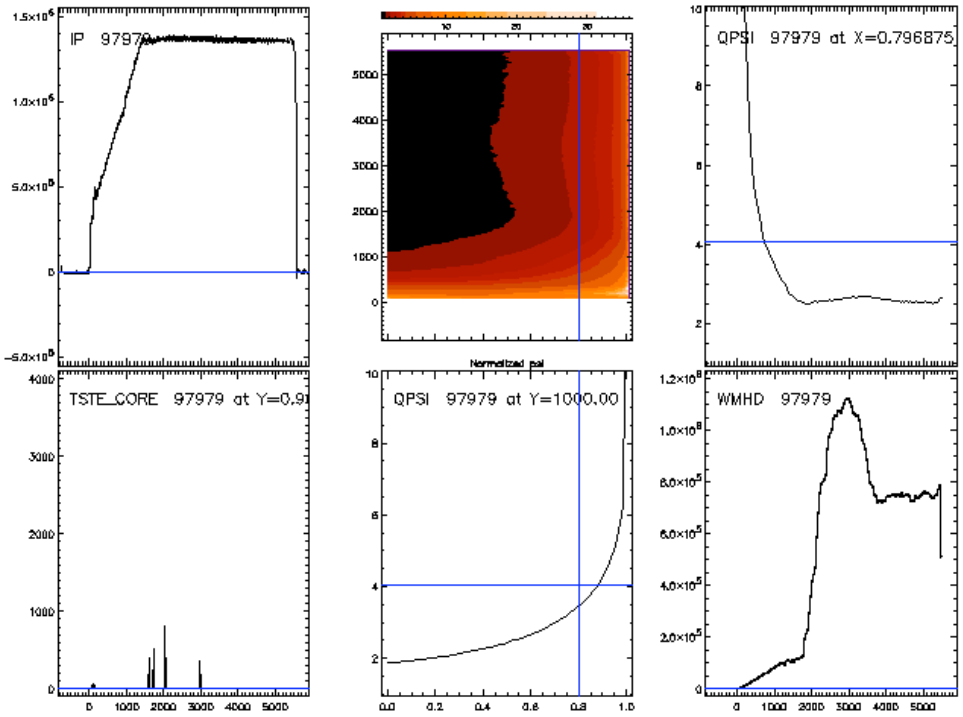


Figure 24: Slicing plot 5 by moving in plot 4.

Note that plot 2, which shows Te(t, z = z0), was not affected by moving in plot 4, as their units are not commensurate. However, moving in plot 2 will affect plot 4, since the units of the slice value of plot 4, and the units of the X axis in plot 2, are both time in ms.

Units of Measure - In Depth

ReviewPlus bases its behavior for setting ranges, ganging crosshairs, and slicing data on the logical units of measure of the data signals. These are displayed (in read-only cells) in the **Signal** table. Sometimes an ambiguous situation arises with the units. For example, TSTE_CORE from the Thomson Scattering system is Te(time, elevation), where elevation is measured in meters. The composite ion temperature profile from CERQuick analysis, CERQTI is Ti (time, radius), where radius is also measured in meters. Clearly, while the physical units of their spatial dimensions are the same, it is not desirable to show them on the same scale, or to slice one based on the other.

It is also possible for a signal to be stored without units. In this case, the signal will not interact with any other signal: no other signal will be set to its axis range, and no other signal will be sliced based on it. It may be, however, that the user wants the signal without units to interact with other signals.

ReviewPlus allows the user to change the character string it uses to identify the logical units of the X and Y (if present) axes. This is done by entering a string in the columns **set X units** and **set Y units** in the **Signal** table. If there is a non-blank string in one or both of these columns for a given signal, ***ReviewPlus*** will use the string(s) as the X (and Y) logical units instead of the units stored with the signal.

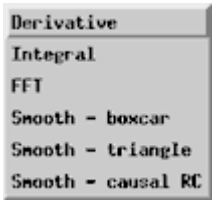
NOTE THAT CHANGING THE UNITS DOES NOT TRANSFORM THE SIGNAL! If a signal is stored with X = time in ms and Y = normalized psi, and you enter the string `ms` in the column **set Y units**, you will not cause the signal to be transposed. Instead, ***ReviewPlus*** will think that the units of Y are ms as well, resulting in some very confusing behavior when it tries to set ranges or slice data. The value of the logical units string is not relevant, only whether the string matches the logical units of other signals matters.

To see this in action, load the example ***ReviewPlus*** file `ts_cer_example.revplus`. The file shows TSTE_CORE and CERFTI in their default behavior - both have Y logical units = m. If you have the preference **Force all plots to the same X/Y axis** set, then any range change in one plot will set the range of the other plot as well, so that you will not be able to see both profiles simultaneously (unless you expand the range to cover 0 to 2.5 m). To fix this, go to the **Signal** table and enter `Z(m)` in the **set Y units** column for the CERFTI profile. After doing **Autoscale all** (using the **RMB** command), you should be able to see both profiles simultaneously. The value of the string entered in the **set Y units** column does not matter - it only has to be different than the Y units of TSTE_CORE. You could enter `gizmos` instead and see the same behavior. ***ReviewPlus*** will remember these settings if you save the file and return to it later.

CAUTION! ***ReviewPlus*** will remember the units setting if you change the signal. Using the above example, if you change the signal CERFTI to TSTE_CORE (for example, in preparation to display an image plot of Te and a slice plot), the logical units of the second TSTE_CORE will still be Z(m) (or gizmos if you entered it). You will need to erase the value in the **set Y units** column for ***ReviewPlus*** to behave as expected.

Transforming Signals

Signal traces can be transformed in a variety of ways. A signal must first be selected before it can be transformed. Use either the **Mouse Mode** - **Select** and then click the signal trace, or use the menu command **Edit>Set Appearance**, and select the signal from the **Select signal to configure** window. Then, click the menu command **Transform** and choose a specific transformation to apply to your selected signal trace.



You can transform a signal using:

- **Derivative**: This command takes the derivative of the selected signal trace.
- **Integral**: This command will integrate the selected signal trace.
- **FFT**: This command implements a Fast Fourier Transform on the selected signal trace.
- **Smooth - boxcar**: This transformation individually averages all signal trace datapoints within a set range from each point.
- **Smooth - triangle**: This transformation averages each datapoint with those near it, using a linear falloff function as the sampled points get farther away from the averaged point.
- **Smooth - causal RC**: This transformation averages each datapoint with those near but only preceding it in time, using an exponential falloff function as the sampled points get farther away from the averaged point.

Customizing the Appearance of Plots

You can further customize the way ***ReviewPlus*** displays plots and signals by selecting **Edit>Set Appearance** and using:

- **Configure: Signals**
- **Configure: Plot Properties**
- **Configure: Ranges**

You can access the **Configure Ranges** dialog either through **Edit>Set Appearance**, or through the **RMB>Ranges** command.

Configuring Signal Appearance

To configure the properties of a particular signal, first select **Edit>Set Appearance**, then click **Configure: Signals** (if not already selected). Select the signal by clicking the signal name in the **Select signal to configure** window.

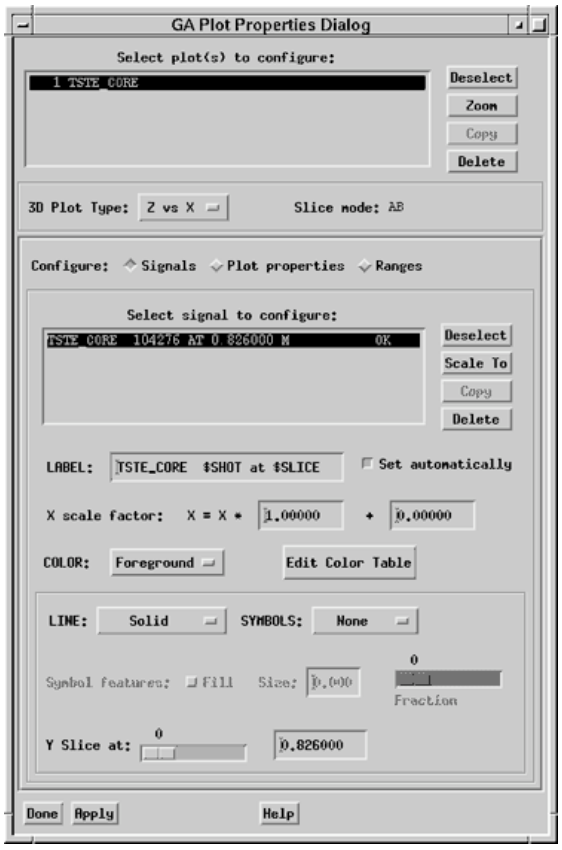


Figure 25: Plot Properties Dialog – Configure signal properties

Once the signal is selected, the controls to the right of the selection window become enabled. You can **Deselect** the signal, **Scale** the plot to the range of the signal data, **Copy** the signal, or **Delete** it from the current display.

There are three main configuration controls in this dialog:

- **Label**: ***ReviewPlus*** allows you to custom-label each signal in your setup list using the **Label** command on the **Set Appearance** dialog. ***ReviewPlus*** will (by default) automatically label signals if the **Set automatically** checkbox is filled. If you add `$SHOT` and/or `$SLICE` to your custom label, ***ReviewPlus*** automatically adds the shot number and/or slice value to the label as direct text replacements for these two entries wherever they appear in your label.

- **X scale factor**: You can scale the X dimension of a signal by adjusting the values of the **X scale factor** fields. This actually performs a simple transformation on the signal. Below is the equation used for this scaling:

  X = X * `[a]` **+** `[b]`

  where `[a]` and `[b]` are values you supply. By default, ***ReviewPlus*** sets [a] = 1 and [b] = 0.

  See *Tutorial 1* for an example.

- **COLOR**: ***ReviewPlus*** gives you control over the colors used to display your plots. The **COLOR** drop-down list provides an easy method of changing the color of a signal trace and its legend and can also change the color of 3D plot types. Simply click the signal you want to modify in the **Select signal to configure** window, and then choose a color from the drop-down list.

  - **Edit Color Table**: use the button next to the **COLOR** drop-down list to change the available colors and gradients in the color table that are used for the **Surface** and **Image** plot types.

  See the IDL documentation for more information on setting and using the color table.

Configuring Plot Properties

To configure the properties of a particular plot, first select the plot in the **Edit>Set Appearance** dialog by clicking the plot title in the **Select plot(s) to configure** window, and then click the **Configure: Plot Properties** radio button.

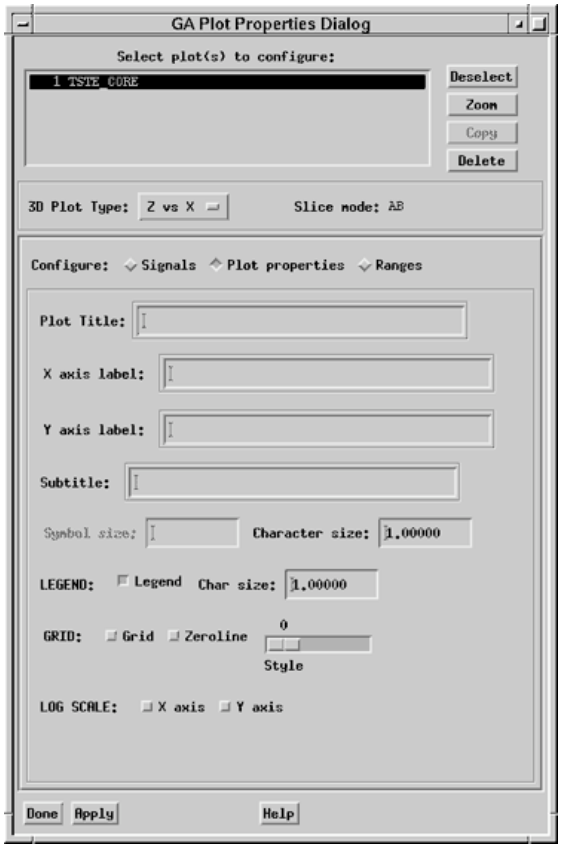


Figure 26: Plot Properties Dialog – Configure plot properties

Once the plot is selected, the controls to the right of the selection window become enabled. You can **Deselect** the plot, **Zoom** the plot so that it inhabits the entire main display window, or **Delete** it from the current display.

Customizing Plot Labels

There are a variety of controls that allow you to customize the labels and titles applied to the plot:

- **Plot title**: This control provides you with the ability to place a text title above a plot in the ***ReviewPlus* main display window**.
- **X axis label**: This allows you to provide a text label for the X axis of a plot.
- **Y axis label**: This allows you to provide a text label for the Y axis of a plot.
- **Subtitle**: This control provides you with the ability to place a text title below a plot in the ***ReviewPlus* main display window**.
- **Character size**: This control adjusts the size of the symbols used for your titles and labels.
- **Legend**: This checkbox toggles the list of signals in a plot window.
- **Char size**: This control adjusts the size of alphanumeric characters used in a plot window.

Customizing Plot Scales

There are also controls that allow you to configure the appearance of the plot scales:

- **GRID**:

- **Grid**: This checkbox toggles a graphical grid in the plot window.
- **Zeroline**: This checkbox toggles a line at X = 0 in the plot window.
- **Style**: This slider allows you to change the style of the grid lines and zerolines.

- **LOG SCALE**:
  - **X axis**: Implements a logarithmic scale on the X axis of the plot.
  - **Y axis**: Implements a logarithmic scale on the Y axis of the plot.

Configuring Plot Ranges

To configure the ranges of a particular plot, first select **Edit>Set Appearance**, click on the plot you want to configure in the **Select plot(s) to configure** window, and then click **Configure: Ranges**. An alternate way of opening the dialog is by clicking in the plot you want to configure and using the **RMB>Ranges** command.

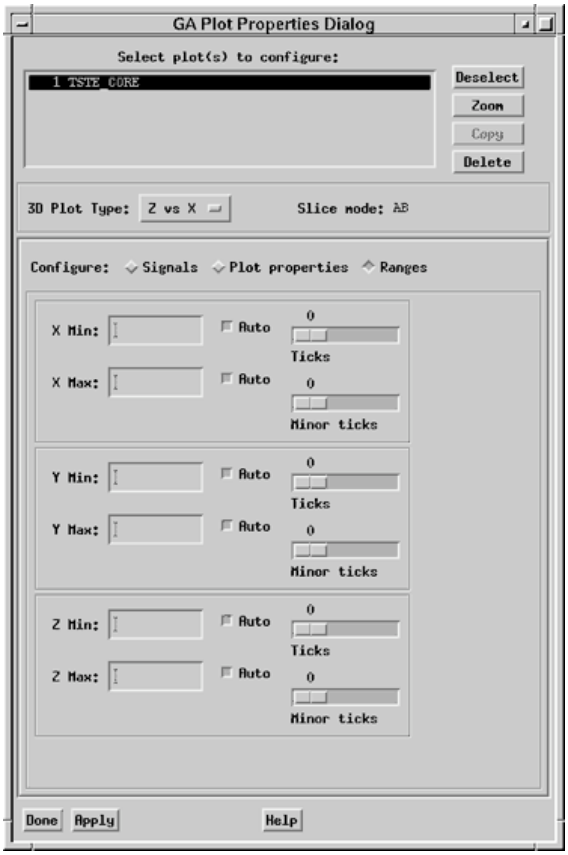


Figure 27: Plot Properties Dialog – Configure range properties

You can specify particular ranges for each axis scale of a plot using these controls. Note that setting these ranges can also affect other plots if you have enabled the **Force All Plots to Same X/Y Axis** preference and the plots share a common axis. You can enter minimum and maximum numerical ranges for the **X**, **Y**, and **Z** axes of your plot(s) and control the number of major and minor ticks in the scale using the sliders to the right. Make certain that your maximum range for a given axis is greater than your minimum range.

Changing the Plot Grid

You can use the **Edit>Change Plot Grid** menu command to modify the way multiple plots are displayed on the screen.

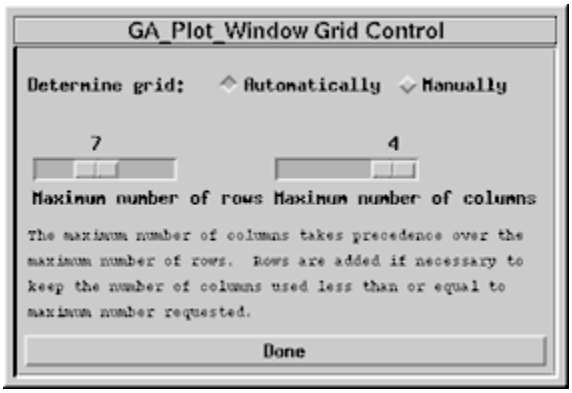


Figure 28: Plot Window Grid Control

ReviewPlus can automatically determine how many rows and columns of plots it displays, or you can manually set the number of rows and columns. Click the **Automatically** or **Manually** radio button to set your preference. If you choose **Manually**, use the sliders to control the maximum number of rows and columns. Click **Done** when you're satisfied with the settings.

Customizing ReviewPlus Preferences

Setting ***ReviewPlus*** **Preferences** allows you to define file paths that the program uses, control functionality within the entire program, and control how the ***ReviewPlus*** **main display window** appears. Use the menu command **Edit>Preferences** to launch the **Preferences** dialog.

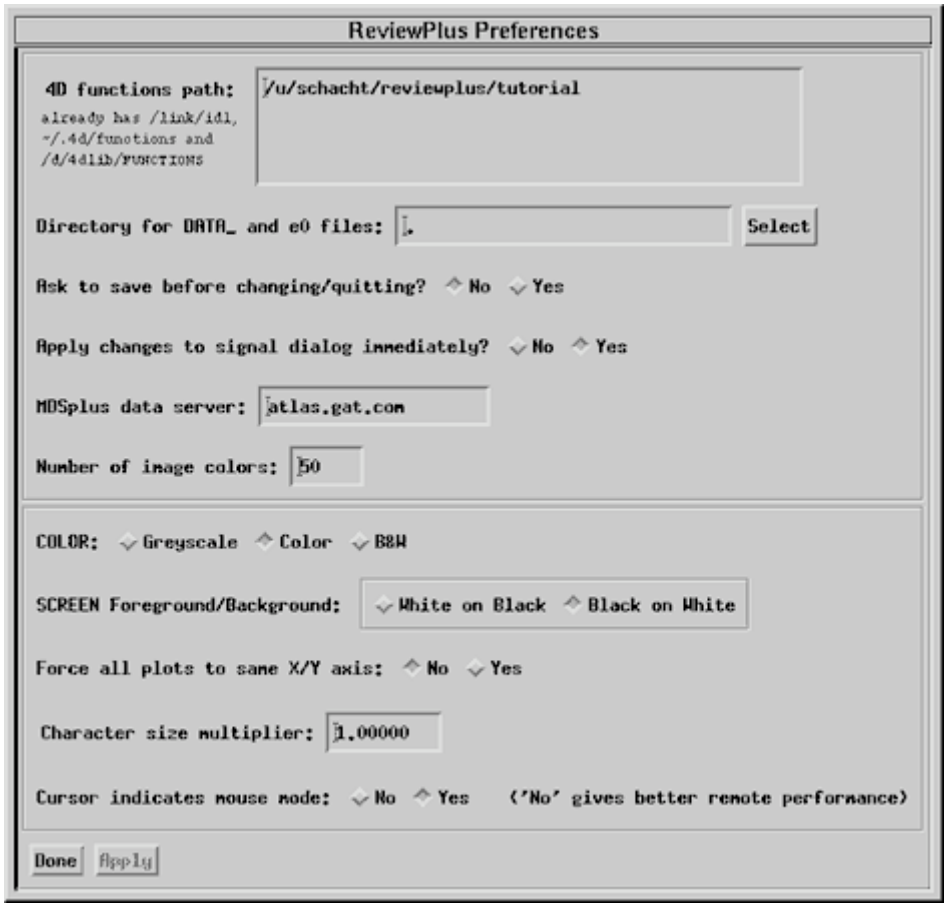


Figure 29: ***ReviewPlus*** *Preferences Dialog*

Setting Environment Search Paths

- **4D functions path**: ***ReviewPlus*** can accept IDL procedures you construct as signal expressions for plotting “user written data procedures.” ***ReviewPlus*** must be able to find these procedures in its search path in order to use them. In the example above, the directories **/link/idl, ~/.4d/functions** and **/d/4dlib/functions** are already a part of the search path. You can add directories to the search path by typing IDL paths (colon delimited) into the text field at the top of the **Preferences** dialog.

- **Directory for DATA_ and e0 files**: This points to a local directory for holding legacy data files from ***REVIEW*** and the "summard" code.

- **MDSplus data server**: This **text field** contains the IP address of the default MDSplus data server from which ***ReviewPlus*** retrieves shot and signal data. You can change the default MDSplus server by typing a new IP address into this field.

Customizing Program Functionality

- **Ask to save before changing/quitting?**: Selecting **Yes** causes ***ReviewPlus*** to generate a popup dialog box whenever you clear your **main display window** or quit the program; the popup dialog asks you to save your current signal configuration and display. Selecting **No** causes these commands to execute immediately, without confirmation.

- **Apply changes to signal dialog immediately?**: Selecting **Yes** forces ***ReviewPlus*** to perform changes to signals immediately, without confirmation. When working in the **ReviewPlus Signal** table, if you type an entry into a new row, you need to use the **Apply** button at the bottom of the dialog. If there is already an entry in that row that has been retrieved once (if there is an entry in the **Status** column) and you make a change and move the cursor out of the cell, the change will be applied immediately. If you don't want changes applied immediately, change this preference to **No**. This way you can edit >1 row quickly.

- **Force all plots to same X/Y axis**: Choosing **Yes** means that ***ReviewPlus*** signals are displayed with their common parameters (if any) falling on the same axes (either X or Y). Choosing **No** means that the plots will display in their default manner. For more information, see *Setting Common Plot Ranges*.

- **Cursor indicates mouse mode**: Choosing **Yes** causes ***ReviewPlus*** to alter the appearance of the cursor, depending on the **Mouse Mode** setting (found near the top of the **main display window**). Choosing **No** leaves the cursor the same for all **Mouse Modes** and gives better performance to ***ReviewPlus*** for remote users.

Customizing the Main Display Window Appearance

- **Number of image colors**: This setting limits the total number of colors displayed by ***ReviewPlus***. The new setting only takes effect after quitting and restarting the program.

- **COLOR**: These three radio buttons control the appearance of the main display window. You can choose to display in **Greyscale**, **Color**, or **BW** (black and white).

- **SCREEN Foreground/Background**: These two radio buttons control the foreground and background colors used in the **main display window**. You may choose **White on Black** (white foreground images over a black background) or **Black on White** (black foreground images over a white background - the default setting).

- **Character size multiplier**: You can adjust the size of alphanumeric characters in the main display window by changing the value in this field.

- **Done**: Applies the current settings and dismisses the **Preferences** dialog.

- **Apply**: Applies the current settings.

File Operations

This section describes how to use the **File>** operations in ***ReviewPlus*** to save and restore your work.

Saving Files

The **File>Save** command allows you to save the displayed shot and signal configuration as a `*.revplus` file. The command opens a standard save dialog box, prompting you to type a name for the file and save it in your directory of choice. If the display configuration has already been saved to disk, **File>Save** will automatically write the current configuration to disk, using the previously saved filename and directory. The **File>Save As** command also allows you to save the displayed shot and signal configuration as a `*.revplus` file. The command opens a standard save dialog box, prompting you to type a name for the file and save it in your directory of choice.

Restoring and Opening Files

The **File>Restore** command imports a previously saved shot and signal configuration. Depending on content of the file and the settings of the **Restore shots** and **Retrieve data** checkboxes, **File>Restore** may import only shots or signals and may not retrieve signal data until you choose to do so.

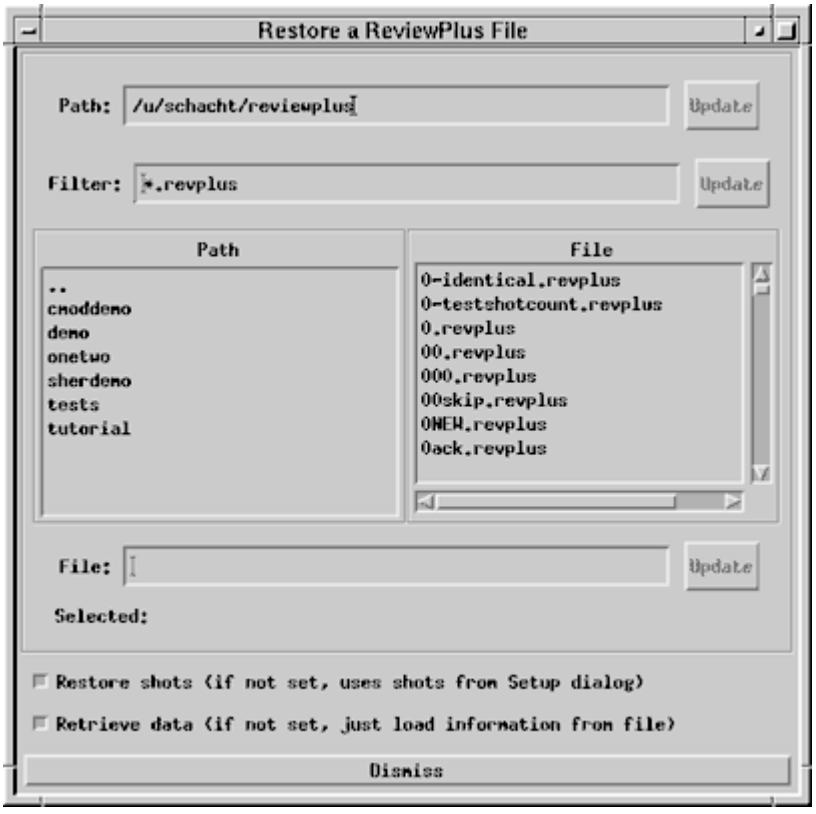


*Figure 30: Restore a **ReviewPlus** File Dialog*

File>Restore Operations

Here is a description of the commands in the **Restore a ReviewPlus File** dialog:

- **Path (text field)**: You can type the full pathname to a directory containing `*.revplus` files in this text field. Click **Update** or press [Enter] after you're done typing.

- **Filter**: You can use this text field to filter files during your search. Simply enter a wildcard character and the proper file extension (usually `*.revplus`) to show only those files in the current directory with that extension. Click **Update** after you're done typing.

- **Path (display area)**: This display area shows the listing of directories within the current working directory and can be used to interactively navigate within the directory structure.

- **File (display area)**: This displays the listing of filtered files within the current directory. Only files with names that contain the text shown in the **Filter** field will be listed. You can click on a file in the list to have ***ReviewPlus*** automatically restore it.

- **File (text field)**: This displays the full pathname of the file you select, or you can type any file name here. Click **Update** after you're done typing.

- **Selected**: This display shows the path to the last file you selected.

- **Restore shots**: If this box is checked, the shot numbers previously saved in the `*.revplus` file are loaded into ***ReviewPlus***. When left unchecked, ***ReviewPlus*** will not load shot numbers from the file and will retrieve signal data for the shot numbers you have currently entered in ***ReviewPlus***.

  See *Restoring Shot and Signal Lists* for more information.

- **Retrieve data**: If this box is checked, ***ReviewPlus*** will load the signal list from the stored file and will retrieve the signal data from the server and display the signal plots. If left unchecked, ***ReviewPlus*** will only load the signal list and will display the **ReviewPlus Setup** dialog.

  See *Restoring Shot and Signal Lists* for more information.

- **Hide**: Pressing this button dismisses the **Restore a ReviewPlus File** dialog.

Restoring Shot and Signal Lists

Lists of shots and signals can be stored in `*.revplus` files. You can selectively control the data imported when a `*.revplus` file is opened using the **Restore shots** and **Retrieve data** checkboxes in the **Restore** dialog. Use the menu command **File>Restore**, and then use the **Restore** dialog to browse to your `*.revplus` file. Upon opening the file:

- if the **Restore Shots** checkbox is filled, ***ReviewPlus*** loads the shot list from the file into the **Setup** dialog.

- if the **Restore Shots** checkbox is empty, ***ReviewPlus*** refrains from loading saved shot numbers, instead retrieving the saved signals for the shots already entered in the **Setup** dialog.

- if the **Retrieve Data** checkbox is filled, ***ReviewPlus*** loads the signal list from the file into the **Signal** table, and retrieves and plots the signal data.

- if the **Retrieve Data** checkbox is empty, ***ReviewPlus*** loads the signal list from the file into the **Signal** table, but does not retrieve or plot the signal data.

Assuming you have two favorite lists, one for shots and one for signals, you can restore the `*.revplus` file that contains only shot numbers, and then, with the **Restore Shots** checkbox empty, restore the file that contains only signals. Now, both of your lists have been loaded into ***ReviewPlus***, and the program proceeds to retrieve and plot your data. If you wish to make adjustments to your lists before retrieving data, remove the check from the **Retrieve Data** checkbox before restoring your signal list.

Importing Files from Other Programs

You can use ***ReviewPlus*** to open plot definition files from other programs, such as ***REVIEW***, ***4D***, and ***Scope***. You can import a `*.rev`, `*.pts`, or `*.dat` file using the **Restore** dialog.

Restoring Example Files

The **File>Restore Examples** command opens the **Restore a ReviewPlus File** dialog and displays the directory that contains the example files referred to in this User Manual, provided the example files were placed there by your system administrator when ***ReviewPlus*** was installed. The directory may also contain other files placed there by the system administrator.

Print Operations

To print from ***ReviewPlus***, select **File>Print**. The program then prints a graphic of the **plot boxes** in the **main display window** to your default printer. The **Print Setup** command displays a dialog that allows you to choose your printer, alter your print settings, or even print to a file.

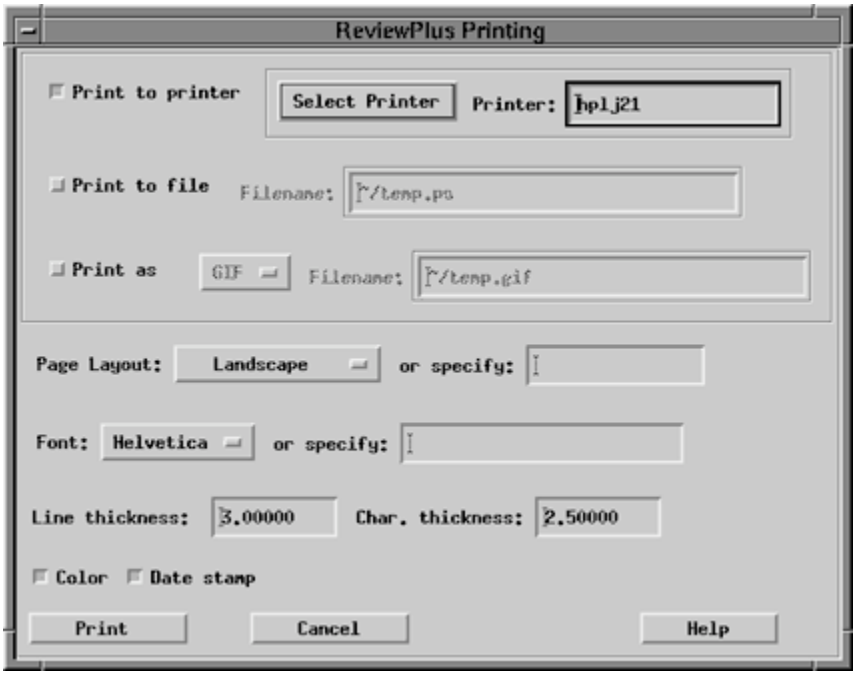


*Figure 31: **ReviewPlus** Printing Dialog*

Printer Controls

Print to printer: With this box checked, ***ReviewPlus*** will print to the selected printer.

Select Printer: Pressing this button shows a list of locations and printers available for you to use. Selecting a printer from this list will cause the printer name to show up in the **Printer** text field directly to the right of the **Select Printer** button. You can also type the name of a specific printer in the **Printer** field. Each site administrator can configure the list of printers as they choose.

Print Output File Controls

These controls allow you to select how ***ReviewPlus*** prints your file. You may also choose to have ***ReviewPlus*** create print or graphic files instead of printing to your default printer.

- **Print to file**: Place a check in this box if you want to print to a file. Type the path and name of the target file in the **Filename** text field to the right of the **Print to file** checkbox.

- **Print as**: You may use this checkbox to make ***ReviewPlus*** print the current display to either a GIF or a PICT graphic file. Type the path and file name of the target file into the **Filename** text field to the right of the **Print as** checkbox.

NOTE: You can print to a printer, a print file, and as a graphic file simultaneously by checking the box for each print type.

- **Color**: Place a check into this box to print your files in color. If you prefer monochrome, remove the check mark from this box.

- **Date Stamp**: Place a check in this box to date stamp your print files. The date is printed in the bottom right of the page. Remove the check mark from this box if you prefer no date stamp.

Print Appearance Controls

- **Page Layout**: You may choose the type of page layout for your print file using this drop-down list. The choices are **Landscape**, **IDL Portrait**, **Full Portrait**, or **Centered Square**, or you may specify your own layout using the **"or specify"** text field to the right of the **Page Layout** drop-down list. Try the command to see examples of the page layout styles.

  See the IDL Reference Manual for more information on the Postscript device.

- **Font**: You can use this drop-down list to choose the font style for your print files. The choices are **Helvetica**, **Courier**, **Hershey**, **AvantGarde**, **Schoolbook**, or **Times**. You may also specify your own font by typing its name into the **"or specify"** text field to the right of the **Font** drop-down list.

- **Line thickness**: You can use the default line thickness of **3.0** in your plots, or you can change the thickness by typing a new value into the **text field**. This feature is often useful when making viewgraphs.

- **Char. Thickness**: You can use the default character thickness value of **2.5** for your plots, or you can change the character thickness by typing a new value into the **text field**.

Print Dialog Buttons

- **Print**: Executes the print job.

- **Cancel**: Exits the **ReviewPlus Printing** dialog without executing the print job.

- **Help**: Provides you with help printing your files from ***ReviewPlus***.

Advanced Plotting Techniques

REVIEW Command Mode

ReviewPlus has a Command Line Mode that can be used to configure the program, using syntax from the old ***REVIEW*** code. Command line recall works in this dialog, and you can select any command in the **History** window shown below the command line. Select the menu command **Edit>REVIEW Command Mode**, type your command in the field provided, and click **Done**.

Figure 32: ReviewPlus - REVIEW mode Dialog

The following commands are currently supported:

Command	Abbreviation	Brief Description	Differences from *REVIEW*
ADD	AD	Add pointnames or shots for plotting to list	None
ALL	AL	Apply remaining commands on line to all pointnames	Only works for XMI, XMA, YMI, YMA, PO for now
ANALYSIS	AN	Analysis mode: for smoothing, etc. Supported analysis commands: • Smooth (triangle) • Derivative • Integral (e.g., AN SM 10/D)	No need to enter EDIT mode. Use ANALYSIS CLEAR to reset analysis.
AVERAGE	AV	Smooth (e.g., AV 10)	Must specify smoothing width; there is no settable default yet
BOX	BO	0 = plot in same box as plot above else = plot in new box	No need to enter EDIT mode
CLEAR	CL	Clear list of shots (CL S) or pointnames (CL P)	None
CURVE	CU	Set index of curve for analysis and editing	No need to enter EDIT mode. 1st signal is CURVE 0.

DELETE	DE	Remove pointnames or shots from plotting list	"DELETE pointname" and "DELETE index" both work for deleting pointnames
MOVE	MO	Move currently selected curve to index	Select curve with CURVE, not GET
NEXT	NE	Increment current CURVE index	None
PLOT	PL	Refresh plot	Cannot specify "PLOT pointname" or "PLOT index" yet
POINT	PO	Change the pointname for the current CURVE index	No need to enter EDIT mode
REMOVE	REM	Delete the last pointname in the list	None
SHOT	SH	Change the current default shot	None
WIPE	WI	Same as CLEAR POINTNAMES	None
XMIN XMAX	XMI XMA	Set the X range	Only affects ALL plots if use ALL, or if "All Same X/Y" is set in preferences
YMIN YMAX	YMI YMA	Set the Y range	None

REVIEW commands and features that can be added:

- **PLOT pointname** will add the pointname to the list and blow up the plot so that it fills the window.
- **PLOT index** will blow up the plot for the index so that it fills the window (like clicking outside a plot in **Zoom** mode).
- **ALL** command will be supported for **ANALYSIS**.
- Ability to set **ICAL**, **TMIN**, and **TMAX** from the command line will be added and will work with the **ALL** command.
- **READ** command will either be able to import ***REVIEW*** files or read ***ReviewPlus*** files.
- If **READ** reads ***ReviewPlus*** files, then **WRITE** will save a ***ReviewPlus*** file.

REVIEW features that will **NOT** be supported:

- **SCALE** and **OFFSET**

These can be accomplished by simply entering the data combination as the pointname. For example, to scale the electron temperature from Thomson Scattering by .001 (convert to keV), just enter:

```
AD TSTE_CORE*.001,PL
```

These values are read when importing ***REVIEW*** files and converted to the data combination.

User Written Data Procedures and Post Draw Procedures

You can plot data in ***ReviewPlus*** generated by IDL software programs you write. These programs are called User Written Data Procedures. If you write a program that follows the appropriate calling procedures, it can generate virtually any kind of data, and ***ReviewPlus*** can visualize it just as if it had come from an MDSplus or PTDATA server. To plot the data from the Procedure, enter the procedure name as a signal expression surrounded by backticks (`` `procedure` ``) in the **Z Data Signal** column or the **XorY Data Signal** column of the **Signal** table. User Written Data Procedures can't be used as part of data combinations in signal expressions.

Using a User Written Data Procedure as a signal expression called from the **Z Data Signal** column requires that the procedure return data to ***ReviewPlus*** in a specific way.

The procedure (with the filename `FOO.pro` for this example) must be written in the following form for 2D data (ZvsX):

```
pro FOO, shot, x, z, error
```

where	`shot`	(input)	is the shot number
	`x`	(output)	is the x data (usually time but can be anything)
	`z`	(output)	is the z data
	`error`	(output)	is an error code indicating to ***ReviewPlus*** the success or failure of the procedure (0 = success, anything else = failure)

This is the form the procedure must follow for 3D data (ZvsX and Y):

```
pro FOO, shot, x, y, z, error
```

where	`shot`	(input)	is the shot number
	`x`	(output)	is the x data
	`y`	(output)	is the y data
	`z`	(output)	is the z data
	`error`	(output)	is an error code indicating to ***ReviewPlus*** the success or failure of the procedure (0 = success, anything else = failure)

There are other optional keywords that can be used to pass arguments to the procedure `FOO` and return the units for the data and dimensions.

To call the User Written Data Procedure `FOO.pro` from within ***ReviewPlus***, type the following in the **Z Data Signal** column in the **ReviewPlus Signal** table:

```
`FOO`
```

The name of the procedure *must be delimited by backticks* in order for ***ReviewPlus*** to recognize the requested signal as coming from an IDL procedure.

You can also use IDL to write Post Draw Procedures that manipulate data retrieved from MDSplus or PTDATA servers, prior to plotting. The procedure is called by entering its name in the **Post Draw Procedure** column of the **Signal** table. This feature gives you greater control over the processing of

signal data and its display, but it won't change any of the data retrieved from the servers. You can overplot anything else that you want to on top of the data and also add annotations. Note that if you do any overplotting or add annotations to the plot using a Post Draw Procedure, you cannot manipulate those items using the interactive plotting techniques in ***ReviewPlus*** (for example, you can't select an overplotted line using the **Mouse Mode** - **Select**). The Post Draw Procedure exists outside the ability of ***ReviewPlus*** to enact changes on its resultant data. However, you can use the same Post Draw Procedure with many data traces.

In both cases, you can write and store these procedures locally, provided the path to the procedures is part of the **4D functions path** in your **ReviewPlus Preferences**. Type the new path to your IDL procedures in the **4D functions path** field, then click **Apply**. The path to any other procedures that your IDL procedure depends on must also be part of the **4D functions path**.

When you use IDL procedures called by ***ReviewPlus***, you're running programs outside of ***ReviewPlus***. Always follow good programming practices, and remember that a malformed program can act unexpectedly, crash ***ReviewPlus***, or otherwise misbehave. If you use these features of ***ReviewPlus***, you are responsible for the outcome.

For information on programming IDL procedures, see the IDL Reference documentation.

ReviewPlus Tutorials

Tutorial 1 - Shifting Timebases and Plotting Signals from More than One Server

In this tutorial, you will create a plot that compares signals from three different Tokamak reactors.

The plot will consist of the Plasma Current signals from:

- The DIII-D Facility at General Atomics in San Diego, California, USA;
- The Alcator C-Mod Facility at the Massachusetts Institute of Technology in Cambridge, Massachusetts, USA;
- The JET Facility at the Culham Science Centre in Abingdon, Oxfordshire, UK.

The first step is to get the signals from the three machines into separate plots in ***ReviewPlus***. This is accomplished using the **Edit>Set Signals** command, which launches the **ReviewPlus Setup** dialog. The first signal will come from the DIII-D Facility at General Atomics, assumed for this tutorial to be the default MDSplus server. Click in the first cell in the **Z Data Signal** column and type the signal name for Plasma Current, `IP`, and press [Return] or [Enter] on your keyboard.

Next, you will retrieve the Plasma Current signal from the Alcator C-Mod Facility at MIT. Click in the second cell of the **Z Data Signal** column and type `\MAGNETICS::IP,` then press [Return]. You will need to specify the **Tree** name for the data stored in MDSplus at MIT; type `MAGNETICS` in this column and press [Return]. Then, you need to identify the MDSplus server at MIT by typing its IP address into the **Server** column: `cmoda.psfc.mit.edu`.

The third Plasma Current signal will come from the JET (Joint European Torus) Facility at the Culham Science Centre. Click in the third cell of the **Z Data Signal** table and type `JET("PPF/MAGN/IPLA",_shot)`, then press [Return]. Note that this signal name is actually an MDSplus function which runs on the JET data server and that the shot number is being passed as an MDSplus variable. For this signal you don't have to specify a tree, but you still need to specify the JET server; type `mdsplus.jet.efda.org` in the **Server** column and press [Return].

Now that the list of signals is built, you need to specify shot numbers for the signals.

For the DIII-D signal (**row 0** in the **ReviewPlus Signal** table) simply type the shot number (`104276` for this tutorial) in the **List of shots** field in the bottom half of the dialog.

(Note: If the General Atomics server is not your default server, you can still import the signal by typing `atlas.gat.com` in the first cell in the **Server** column of the **ReviewPlus Signal** table. Then, type the shot number in the column labeled **shot**. The setting in the **Use List?** column automatically changes to **No** when you enter the shot number. Click **Apply** to see the resulting plot.)

For the Alcator C-Mod signal, type the shot number (`960116024`) directly into the **Signal** table in the **shot** column.

Type the JET shot number (`40573`) directly into the table in the **shot** column.

Finally, click **Apply** at the bottom of the **ReviewPlus Setup** dialog to plot the signals.

Now, the three Plasma Current traces are displayed in three different plots in the **main display window**. Here, you may notice that the DIII-D signal timebase is in milliseconds, but the MIT and JET signal timebases are in seconds. Additionally, at JET, plasma breakdown occurs at 40 seconds, but breakdown for the other two Tokamaks occurs at 0 seconds. So, you will need to modify the signals in order to view them all in one plot on the same axis.

First, change the colors of the second and third signal traces to make viewing the plots easier. Move your cursor into the second plot window, right-click, and choose **Set Appearance** from the **RMB** command menu. Use the **COLOR** drop-down list to change the plot color to **Red**, then click **Done**. Do the same for the third plot window, but change the color of the JET plot to **blue**.

Now, you need to reset the scale of the GA signal to seconds. Right-click in the first plot window and select **Set Appearance**. Use the **X scale factor** control to make the adjustment. Set the command to read:

X = X * `.001` **+** `0`

(change the first text field to `.001`), then press **Apply**. This operation scales the data but doesn't reset the scale of the plot window. Move your cursor over the GA signal plot, right-click, and select **Autoscale**. You can see that all three signals are now plotted versus time in seconds.

Now you can put all three signals in the same plot. Return to the **ReviewPlus Setup** dialog and left- click in the **Box** column on the second and third rows. This overplots the signals, creating a single plot with three signal traces of different colors. You can see that the GA and MIT signals are lined up, but that the JET signal is shifted by 40 seconds. To shift the JET signal, go back to the **GA Plot Properties** (**Set Appearance**) dialog and click on the JET signal in the **Select signal to configure** display area. In this case, you want to subtract 40 seconds from the JET signal timebase, so you would type `-40` into the second text field in the **X scale factor** command area. The equation should read:

X = X * `1.0` **+** `-40`

Press **Apply**. The main display window shows all three signals compared to each other.

If the sign of the plasma current isn't important, you can take the absolute value of the MIT and JET Plasma Currents by putting the MDSplus function `ABS()` around the **Z Data Signal** expressions. For example, the MIT **Z Data Signal** expression becomes `ABS(\MAGNETICS::IP)`, and the JET **Z Data Signal** expression becomes `ABS(JET("PPF/MAGN/IPLA",_shot))`.

With the absolute value of the signal data plotted, all three plasma current traces appear positive on the graph.

Notice that when you change the **Z Data Signal** expression, ***ReviewPlus*** immediately refreshes the data from the server. If you would rather ***ReviewPlus*** waited until you made the changes, go to **ReviewPlus Preferences** and set **Apply changes to signal immediately** to **No**.

Tutorial 2 - Slicing Data and Changing Units of Measure

*For the purposes of this tutorial, please go to the **Edit>Preferences** dialog and set **Force all plots to same X/Y axis** to **Yes**.*

In this tutorial, you will learn to slice 3D data and to change the units of measure of a signal trace.

To start, type shot number `104276` into the **Default Shot** field in the ***ReviewPlus* main display window**.

(This assumes that the General Atomics MDSplus server is your default server. If this is not the case, you can still retrieve data for this shot by typing `atlas.gat.com` into the **Server** column of the **ReviewPlus Signal** table.)

Next, you will plot three different views of the Electron Temperature Profile for this shot. Choose **Edit>Set Signals**, click in **Row 0** of the **Z Data Signal** column and type `TSTE_CORE`, and then press [Return]. Now, click twice on the **Copy** button (near the bottom of the table) to enter the signal into **Row 1** and **Row 2** of the table. Click **Apply**.

The **main display window** shows three identical time histories of the Electron Temperature Profile at a given position. Notice that there is only one set of time tick marks for the X axis because all of the plots are on the same X scale.

Now you can change your display to show three different views of the same data. Use the **Edit>Set Appearance** command and click on the first plot under **Select plot(s) to configure**. Use the **3D Plot Type** drop-down list and select the **Image** plot type and click **Apply**. Next, click on the third plot under **Select plot(s) to configure** and change the **3D Plot Type** to **ZvsY**. Finally, use the **LINE** drop-down list to change the signal trace line in the plot to **None**, and then use the **SYMBOLS** drop-down list and pick circles to represent the plot data. Click **Apply**.

The three plots shown in the **main display window** now contain different views of the data. The first shows the **Image** plot, the second shows the time history at a given position, and the third shows the profile versus position at a given time. The two lower plots are displaying data slices of the full 3D profile, shown in the first plot. You may also notice that the top two plots share a common X axis (time), but that the third plot is on its own since it was changed to the **ZvsY** plot type (and thus shows temperature vs. position).

Now, turn on the **Mouse Mode** - **Crosshairs** and place your cursor in the **Image** plot. Try moving your cursor from left to right in the plot, holding it steady from top to bottom. As you do this, you're pointing to different times in the plot, and the crosshair in the temperature time history below moves with you, but the cursor in the bottom plot (profile at a given time) stays constant. If you move your cursor up and down (in time) in the first plot window, the crosshairs in the bottom plot moves but the crosshairs middle one stays constant.

Now, click on the **Mouse Mode** - **Slice** and click in the **Image** plot to enable the function. This time, as you move the cursor (in time) from left to right in the **Image** plot, the time for which the profile is plotted changes. As you move the cursor up and down (setting a different position), the position for which the time history is plotted changes.

If you move your cursor down into the temperature profile plot and move along the trace, you only change the position at which the time history is plotted. If you move your cursor into the time history plot and move along the trace, you only change the time at which the profile is plotted. (This type of plotting relationship applies to any signal, not just TSTE_CORE.)

Next, you will add another signal into the mix. Go back to the **ReviewPlus Setup** dialog, highlight **Row 1** in the table and click the **Insert After** button. This moves the contents of **Row 2** down to Row 3, and **Row 2** is now blank. Type `IP` and click **Apply**. (Again, this assumes that `atlas.gat.com` is your default server.) ***ReviewPlus*** now displays four plots. The first three are versus time (and share X tick marks) and the last is the temperature profile at a given time slice.

Move your cursor into the Plasma Current plot and move it around a bit. You may notice that the crosshair follows your movement in the other two time history plots, and the time slice for which the profile is plotted in the bottom graph changes simultaneously. This behavior demonstrates that any signal with ms as its unit of measure can be used to slice the Electron Temperature Profile because it also has ms as its X axis unit of measure.

Go back to the **ReviewPlus Signal** table and change `IP` to `CERQTI` (Ion Temperature Profile). Press [Return] and ***ReviewPlus*** will apply the changes.

Note that the Electron Temperature Profile is measured versus elevation in the plasma in meters, whereas the Ion Temperature Profile is measured versus major radius, also in meters. Both signals have m as their units of measure, which creates an ambiguity.

Next, go to **Edit>Set Appearance**, choose **CERQTI** from **Select plot(s) to configure**, and change the **3D Plot Type** from **ZvsX** to **ZvsY**. ***ReviewPlus*** places the Electron & Ion Temperature Profiles on the same axis since they have the same logical units of measure (meters). Note that the X axis range for the two plots is determined by the electron temperature range, which runs from approximately 0 to 0.8 meters. This range does not span the major radius range of the ion temperature profile, and thus its plot box appears blank. This happens because the units of measure of both signals axes are meters, but since the axes are actually physically different, they can't both be displayed on the same range at the same time. This problem is exacerbated by forcing all plots to the same X axis in the **ReviewPlus Preferences**, set at the beginning of this tutorial.

The answer to this problem lies in understanding that ***ReviewPlus*** uses logical units of measure only as text labels for the axes of plots, and ***ReviewPlus*** considers axes the same if they have the same text labels. The solution for this situation is to change the label of the units of measure of the Y axis of the CERQTI signal, separating the TSTE_CORE meters (elevation) from the CERQTI meters (major radial).

Return to the **ReviewPlus Setup** dialog. Scroll the **Signal** table to the right. Near the end of the table you will find that the **Z units** for all four signals are labeled `eV` (electron volts), the **X units** column contains `ms` (milliseconds), and the **Y units** column contains `m` (meters). Since the CERQTI "meters" and the TSTE_CORE "meters" aren't identical physical units of measure, you can type a new label into **Row 2** of the **Set Y Units** column of the **Signal** table and re-label the **Y units** of the `CERQTI` signal. Since ***ReviewPlus*** only looks for a text string as a label for logical units of measure, you can type anything you like, such as `gizmos`.

When `gizmos` are used for the **Y units**, plots one and two appear on the same axis (since they share an X axis label – "ms"), and plots three and four can both be seen together since they are now plotted on separately labeled axes. All of the plots still share the same X axis (ms), so if you go into **Slice** mode and move in time in either the **Image** plot or the time history of Te plot, you still change the time slice at which the profiles are plotted. However, since the Ti profile now has a different Y axis label than the Te plots, moving the crosshairs in the Ti plot from one radius to another does not change the position for which the Te time history is plotted.

Tutorial 3 - User Written Data Procedures and Post Draw Procedures

This tutorial will show you how to use IDL programming procedures in ***ReviewPlus***, called from either the **Z Data Signal** column or the **Post Draw Procedure** column in the **ReviewPlus Signal** table.

User Written Data Procedures

User Written Data Procedures can be called from the **Z Data Signal** column or from the **XorY Data Signal** column, but they can't be used in data combinations for signal expressions.

Using a User Written Data Procedure as a signal expression called from the **Z Data Signal** column requires that the procedure return data to ***ReviewPlus*** in a specific way, as described in *Advanced Plotting Techniques*.

You can use the example tutorial file `example_user_data.pro` to see an IDL procedure in action and to gain more understanding of how IDL procedures are constructed. If you use this file and enter its name in the **Z Data Signal** column of the **Signal** table, ***ReviewPlus*** will display a plot containing a line with random noise. You are encouraged to open the file in an editor to see the IDL code that was used to generate the data and pass it back to ***ReviewPlus***.

Post Draw Procedures

In order to use the Post Draw Procedure, you should have a basic understanding of "GA_SIGNAL" objects. When you type in the name of a **Post Draw Procedure**, ***ReviewPlus*** will pass the retrieved data (referred to by the signal expression in that row) to the procedure. ***ReviewPlus*** sends the data as an array of GA_SIGNAL objects (one per data trace that's associated with the row). The Post Draw Procedure uses the objects to get the data values for each of the traces. Refer to the example Post Draw Procedure file `example_linefit.pro` for the syntax on how to do this. This procedure, when used with the example file above, will perform a linear regression on the noisy line, overplot the fit, and add annotations to the graph indicating the results of the fit. This demonstrates the ability to process data retrieved by ***ReviewPlus***, as well as add annotations and data to the plots. Again, please look at the IDL procedure for details on how this was done.

Using a Post Draw Procedure, you can perform any manipulation on the data that you desire, but you cannot affect the data that is stored on the servers (you can do anything with it, but you can't do anything to it). You can overplot anything else that you want to on top of the data and also add annotations. Again, see the included file for examples of the kinds of things you can do.

Note that if you do any overplotting or add any annotations to the graph, you cannot manipulate those items using the interactive plotting techniques in ***ReviewPlus*** (for example, you can't **Select** an overplotted line using the **Mouse Mode** - **Select**). The Post Draw Procedure exists outside the ability of the ***ReviewPlus*** system to enact changes on its resultant data. However, you can use User Written Data Procedures or Post Draw Procedures with a completely different data trace.

Example Files

You can use the two tutorial example files together to see the IDL procedures in action. Make sure that the path to the files `example_user_data.pro` and `example_linefit.pro` is part of the ***ReviewPlus*** search path by using **Edit>Preferences**, and typing the path into the **4D functions path** dialog, then clicking **Apply**.

Then, use the **Edit>Set Signals** command to call the **ReviewPlus Setup** dialog.

Type:

```
`example_user_data`
```

(note the backticks) into the **Z Data Signal** column, and press [Return]. Click **Apply**. The **main display window** now shows a plot of the data generated by the IDL procedure.

Next, scroll the **ReviewPlus Signal** table all the way to the right, type `example_linefit` into the **Post Draw Procedure** column, and then press [Return]. Click **Apply**. The **main display window** now shows the original IDL generated data, with a line showing the fit from the Post Draw Procedure running through the data trace.

See the IDL Reference documentation for more on the subject of IDL procedures.

Glossary

Autoscale

This command automatically displays the entire set of data in the plot box and sets the ranges just beyond the extent of the data.

Box

Signals can be overplotted by clicking in the **Box** column of the **ReviewPlus Signal** table.

Contour

The **Contour** plot type displays contours of constant Z value projected on the X-Y plane (like a topographical map).

Default Shot

The **Default Shot** area (in the bottom of the main display window) provides an easy way to enter shot numbers and to monitor the most recent shots. When a shot number is entered in the **Default Shot** field, ***ReviewPlus*** uses that shot number as its default throughout the program.

GUI

Graphical User Interface: Modern computer programs use a system of displaying and accepting information that includes windows that appear on the computer screen and a pointer or cursor controlled by a computer mouse device. This combination is commonly referred to as a GUI, or "gooey" interface.

ICAL

When dealing with the PTDATA system, the default value for the **ICAL** column of the **ReviewPlus Signal** table is set to 1. If you change it to a different value, the data you request comes back in a different form.

Image

The **Image** plot type displays a 2D 'photographic' representation of the data on the X and Y axis. Data variations on the Z axis are represented by changes in the intensity or color of the image, giving the plot its 3rd dimension.

Main Display Window

The application window that opens on your screen when you start ***ReviewPlus*** is referred to as the **main display window**. This window displays the plots generated by ***ReviewPlus***.

MDSplus

MDSplus is a relatively new data repository system (like a database) for shot and signal data generated by the fusion experiments and viewed by ***ReviewPlus***.

Menu>Command

Most computer programs that include a GUI (windowing interface) have a row of options just below the top title bar of the window. Clicking on one of these options with the mouse will reveal a list of commands that can be performed by moving the mouse cursor over the command name and left-clicking.

Menu of Signals and Pointnames

If your site maintains a signal documentation scheme in a relational database, ***ReviewPlus*** can use it to present a menu of available signals. This menu can be accessed using the **Menu of signals and pointnames** button in the **Edit>Set Signals** dialog.

Mouse Mode

- **Select**

  Select mode allows data or plot selection and panning.

- **Zoom**

  Zoom mode allows switching from the many plots view in the main display window to a single plot, and vice versa. It also allows zooming within a single plot window to examine a subset of data in finer detail.

- **Cursor**

  Cursor mode allows you to mark a reference point by clicking the left or middle mouse button in a plot window. A crosshair is kept at the reference point, with Z/X lines for the left mouse button, and X only for the middle button. The coordinates shown in the **Status** area are for the cursor's current position relative to the last crosshair reference point.

- **Slice**

  Slice mode allows you to interactively slice a 2D or 3D plot and view the results of the slice in another plot. The rules for determining which plots have their slices changed are based on the units of measure of their axes.

- **Crosshair(s)**

  Crosshairs mode toggles the cursor tracking. Crosshairs may be combined with any other Mouse Mode.

Overplot

Multiple signal traces can be displayed in one plot box and overlayed upon each other, much like multiple lines co-existing in the same graph.

Plot Box

One of the graphs appearing in the main dislay window.

Plot Grid

The number of plot boxes appearing in the main display window at the same time.

Post Draw Procedures

A Post Draw Procedure is a user written IDL procedure that modifies retrieved signal data and plots it in the main display window.

PTDATA

PTDATA is an older data repository system (like a database) for shot and signal data generated by the fusion experiments and viewed by ReviewPlus.

Range

The numerical span that signal data inhabits.

Restore

To open a saved file in ***ReviewPlus*** and load the information stored in the file into ***ReviewPlus***.

Retrieve

To use the shot and signal data settings in ***ReviewPlus*** to access data from MDSplus, PTDATA, or other storage devices and return it to ***ReviewPlus*** to be plotted.

ReviewPlus

ReviewPlus is a general-purpose plotting tool, capable of displaying interactive 2D and 3D graphs of raw, analyzed, and simulation data. It can mix and couple 2D and 3D plots in one display, providing a rapid means of examining 3D data. ***ReviewPlus*** displays data retrieved from PTDATA and MDSplus systems and can make use of the Internet to display data from any fusion research site with an MDSplus data server. In addition, ***ReviewPlus*** supports User Written IDL Data Procedures, and Post Draw IDL Procedures, making it a powerful and versatile visualization tool.

RMB>Command

A list of commands accessed by clicking the right mouse button within the plot area of the main display window.

Scale

Adjusting the visible range of a signal by either altering the signal data or by adjusting the view of the plot box.

Server

Signal data can be retrieved from different MDSplus servers locally using the MDSplus data server setting in the **ReviewPlus Preferences**, or from locations around the world provided that access to the data has been made available via the Internet. You can view remote data by entering the MDSplus server IP address in the **Server** column of the **ReviewPlus Signal** table.

Signal Table

The **ReviewPlus Signal** table can be used to build lists of signal expressions for storage and later retrieval. By typing signal expressions and pressing [Enter], you can enter expressions in the table just as in a spreadsheet. Signal expressions can be manipulated within the **Signal** table using the buttons below the table.

Signal (or signal expression)

The signal refers to the specific data retrieved from a fusion experiment. A signal expression is a description of the specific signal data (along with any modifiers) that is entered in ***ReviewPlus*** and used to retrieve and display data.

Shot (or shot number)

The shot number refers to a specific fusion experiment from which data will be retrieved.

Status

This column in the **ReviewPlus Signal** table displays the retrieval status of a particular signal expression.

Status:

The **Status** area (found in the lower left corner of the main display window) displays messages when the program is performing certain functions.

Surface

The **Surface** plot type displays a 3D map of the signal with datapoints connected by surfaces.

Tmax

The tmin and tmax columns of the **ReviewPlus Signal** table allow you to enter minimum and maximum time ranges and retrieve only a subset of data for a signal. The **tmax** entry must be greater than the **tmin** entry for these settings to be applied.

Tmin

See **tmax** (above).

Transform (or Transformation)

Use the menu command **Transform** to perform mathematical operations on signal data and display the results in a plot window.

Tree

If you are familiar with MDSplus and would like ***ReviewPlus*** to retrieve your signal expression directly from an MDSplus tree, enter the tree name in the column marked **Tree** in the **ReviewPlus Signal** table.

Units of Measure

The units of measure of a plotted signal trace are displayed in the **Z units**, **X units**, and **Y units** column of the **ReviewPlus Signal** table. Note that ***ReviewPlus*** treats axis units of measure as labels only and it associates the axes of signals in separate plots that share a common unit of measure. These labels can be changed to disassociate signals that share common units of measure but that refer to differing qualities by using the **Set X Units** and **Set Y Units** columns of the **ReviewPlus Signal** table.

User Written IDL Procedures

You can plot data in ***ReviewPlus*** generated by IDL software programs you write, called User Written Data Procedures, and ***ReviewPlus*** can visualize it just as if it had come from an MDSplus or PTDATA server. User Written Data Procedures can't be used as part of data combinations in signal expressions.

XorY Data Signal

One signal can be plotted versus another by entering the second signal expression in the **X** or **Y Data Signal** column of the **Signal** table. There must be a signal expression in the **Z Data Signal** column of the **Signal** table for this feature to work. (Also see **Z DataSignal**, below.)

Z Data Signal

Signal expressions are entered in ***ReviewPlus*** by selecting the menu command **Edit>Set Signals**, clicking in a cell in the **Z Data Signal** column of the **ReviewPlus Signal** table and typing the expression, then pressing [Enter].

ZvsX and ZvsY

The **ZvsX** and **ZvsY** plot types show the data as a function of one of their dimensions, calculated for a fixed value of the other dimension.

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