S0717 REVB
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W.W. Hansen Experimental Physics Laboratory
STANFORD UNIVERSITY
STANFORD, CA 94305 – 4085

Gravity Probe B Relativity Mission

TCAD User's Manual

Lasp-2.0

S0717 Rev. B

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Approvals

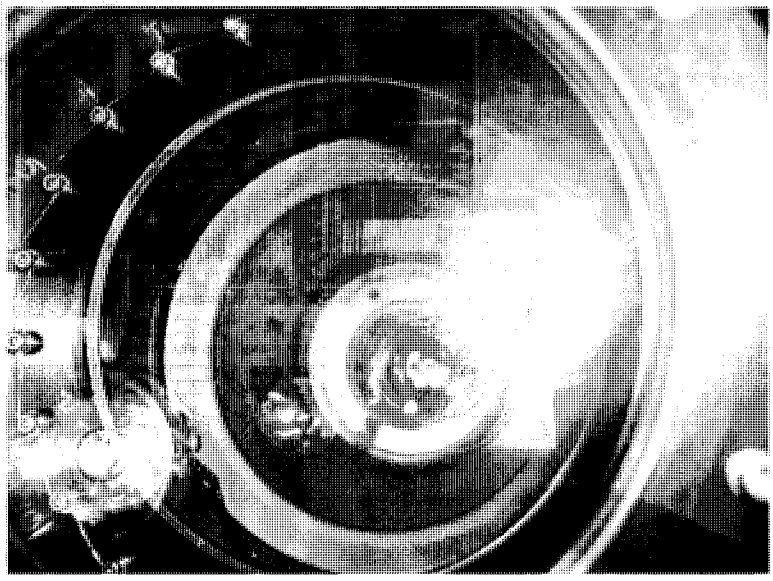
NAME	SIGNATURE	DATE
Samantha Patterson *Software Engineer*	Samantha Patterson	10-1-3
Jennifer Spencer *Data Processing Lead*		10 Oct. 2003
Ron Sharbaugh *S/W Manager*	Ron Sharbaugh	10/1/03
Marcie Smith *MOC Project Manager*	Marcie Smith	10 Oct 03
Kelly Burlingham *Software Quality Engineer*	O. Kelly Burlingham	10/3/03

T. Langenstein 9.7.03

Tom Langenstein, ITAR Assessment Performed, ITAR Control Req'd? _ Yes X No

T C A D

USER GUIDE



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History

REV	DATE	AUTHOR	COMMENTS
	Initial Release	Sap	initial version v1.7 (Not an SDOC)
-	05/27/03	Sap	Updated features for 1.8; made into SDOC
A	07/29/03	Sap	Updated features for 1.9
B	09/17/03	Sap	Changed 3.4, 3.7, 3.8

Introduction

About this manual

This manual details the user interface of TCAD (Telemetry Checking Analysis and Display) version lasp-2.0 as implemented for the Gravity Probe B mission.

Conventions

Plain Times	The body of information in this guide
Bold Times	Important information and section headers
Plain Mono	Output from the Unix command line
Bold Mono	User-issued commands at Unix prompt
Italicized Times	Examples, Figures, and Diagrams
Underlined Times	Menu items.

Abbreviations and Acronyms

EU	Engineering Units
DBRO	DataBase Read-Out
MRO	Memory Read-Out
DN	Data Numbers – meaning uncalibrated "raw" data
GP-B	Gravity Probe B
IDL	Integrated Data Language
IDL Window	The Unix terminal window from which TCAD was started
TCAD	Telemetry Checking Analysis and Display

50117 Rev B
Sept. 17, 2003

Chapter 1: Getting Started

1.1 Requirements

The user must have a valid login on the science or MOC network and be a member of the group *users* and the group *sybase*. Enter "groups" at the UNIX prompt to see if you are a member of each. The Sybase database server *science* must be up and running.

1.2 Logging in

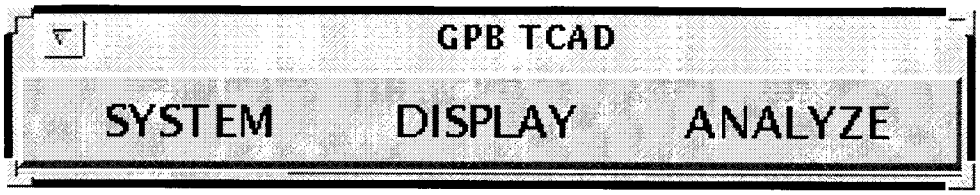
TCAD does not require a specific login; the user need only log in to the science server or one of its clients. To do so, the user should follow standard Unix login procedure. Enter username and password at the proper prompts. Once logged into the Unix system, the user should enter **tcad** at the Unix command line. The following output should appear in the terminal window:

```
IDL Version 5.4 (sunos sparc). (c) 2000, Research Systems, Inc.
Installation number: 103338-1.
Licensed for use by: Stanford University

% Compiled module: NEW_DT.
% Compiled module: DT_ADD_SECS.
% Compiled module: DT_DIF.
% Compiled module: CLOCK_TO_DT.
% Compiled module: DT_TO_STRING.
% Compiled module: STRING_TO_DT.
% Compiled module: CURRENT_DT.
% Compiled module: NEW_SCT.
% Compiled module: SCT_ADD_TICKS.
% Compiled module: SCT_DIF.
% Compiled module: DT_TO_SCT.
% Compiled module: SCT_TO_DT.
% Compiled module: DB_CONNECT.
% Compiled module: DB_DISCONNECT.
% Compiled module: DB_SELECT_PACKETS.
% Compiled module: DB_GET_PACKETS.
% Compiled module: DB_SELECT_EVENTS.
% Compiled module: DB_GET_EVENTS.
% Compiled module: DB_SELECT_SCTIME.
% Compiled module: DB_GET_SCTIME.
% Compiled module: DB_SELECT_TMDISCRETE.
% Compiled module: DB_GET_TMDISCRETE.
% Compiled module: DB_SELECT_TMANALOG.
% Compiled module: DB_GET_TMANALOG.
% Compiled module: DB_SELECT_TMAVERAGE.
% Compiled module: DB_GET_TMAVERAGE.
% Compiled module: DB_GET_TMINFO.
% Compiled module: DB_GET_SUBSYSTEMS.
% Compiled module: DB_GET_NAMES.
% Compiled module: DB_GET_MNEMONIC.
% Compiled module: DB_GET_TMDECOM.
% Compiled module: DB_GET_TMAVGID.
% Compiled module: DB_GET_CALIBRATION.
% Compiled module: DB_GET_STATES.
% Compiled module: DB_GET_LIMITS.
% Compiled module: TCAD_MAIN_EVENT.
```

```
% Compiled module: TCAD_MAIN.
% Compiled module: TCAD_INPUT_TIMES__CYCLELIST.
% Compiled module: TCAD_INPUT_TIMES__DRAW.
% Compiled module: TCAD_INPUT_TIMES__GET.
% Compiled module: TCAD_ITEMS_LIST__DRAW.
% Compiled module: TCAD_ITEMS_LIST__GET_SUBSYSTEM.
% Compiled module: TCAD_ITEMS_LIST__DISPLAY_ITEMS.
% Compiled module: TCAD_ITEMS_LIST__GET_ITEM.
% Compiled module: TCAD_SELECTION_LIST__DRAW.
% Compiled module: TCAD_SELECTION_LIST__ADD_SELECTED_ITEM.
% Compiled module: TCAD_SELECTION_LIST__ADD_ITEM.
% Compiled module: TCAD_SELECTION_LIST__UPDATE.
% Compiled module: TCAD_SELECTION_LIST__REMOVE_ITEM.
% Compiled module: TCAD_SELECTION_LIST__REMOVE_ALL.
% Compiled module: TCAD_TIME_STRING__PARSE_DATE_TIME.
% Compiled module: TCAD_TIME_STRING__PARSE_DELTA_TIME.
% Compiled module: TCAD_TIME_STRING__PARSE_TIME.
% Compiled module: TCAD_VALUE__FETCH_ALL.
% Compiled module: TCAD_VALUE__DELETE_ALL.
% Compiled module: TCAD_PLOT__SET_XWINDOWS.
% Compiled module: TCAD_PLOT__SET_POSTSCRIPT.
% Compiled module: TCAD_PLOT__PRINT.
% Compiled module: TCAD_PLOT__DRAW_COMMON.
% Compiled module: TCAD_PLOT__DRAW_DISCRETE.
% Compiled module: TCAD_PLOT__DRAW_ANALOG.
% Compiled module: TCAD_PLOT__CONTROL.
% Compiled module: TCAD_PLOT__DRAW_MOUSEOVER.
% Compiled module: TCAD_PLOT__DRAW_SINGLEPLOT.
% Compiled module: TCAD_PLOT__DRAW_MULTIPLOT.
% Compiled module: TCAD_PLOT__RESIZE.
% Compiled module: TCAD_PLOT__RETRIEVE_ENG.
% Compiled module: TCAD_PLOT__INIT_DATA.
% Compiled module: TCAD_PLOT__DIMENSION_PLOTS.
% Compiled module: TCAD_PLOT__MAKE_COLORS.
% Compiled module: TCAD_PLOT__DRAW_PAGE.
% Compiled module: TCAD_PLOT__PREPARE_PRINT_EVENT.
% Compiled module: TCAD_PLOT__PREPARE_PRINT.
% Compiled module: TCAD_PLOT__SETUP_EVENT.
% Compiled module: TCAD_PLOT__SETUP.
% Compiled module: TCAD_TABLE__CREATE.
% Compiled module: TCAD_TABLE__PREPARE_PRINT_EVENT.
% Compiled module: TCAD_TABLE__PREPARE_PRINT.
% Compiled module: TCAD_TABLE__SETUP_EVENT.
% Compiled module: TCAD_TABLE__SETUP.
% Compiled module: TCAD_DISPLAY_EVENT.
% Compiled module: TCAD_DISPLAY.
% Compiled module: TCAD_DISPLAY__TIMETYPE_EVENT.
% Compiled module: TCAD_DISPLAY__TIMETYPE.
% Compiled module: TCAD_DISPLAY__RESTORE_EVENT.
% Compiled module: TCAD_DISPLAY__RESTORE.
% Compiled module: TCAD_DISPLAY__SAVE_EVENT.
% Compiled module: TCAD_DISPLAY__SAVE.
% Compiled module: TCAD_INITIAL_PRINTER.
% Compiled module: TCAD_TMINFO_EVENT.
% Compiled module: TCAD_TMINFO.
% Compiled module: RSTRPOS.
% Compiled module: REVERSE.
% Compiled module: XMANAGER.
```

Then the main TCAD menu *(Dia 1.1)* should appear on the user's Unix desktop.



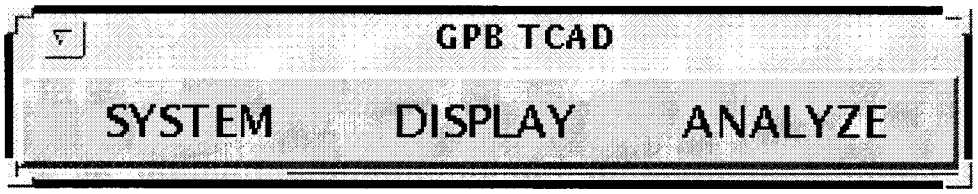
(Diagram 1.1)

1.3 Using TCAD

TCAD is governed predominantly by means of a mouse-driven user interface, although Version 2.0 adds some selected hotkeys in the Display Data screen. Error messages, status messages, and debugging information appear in the IDL window. To use TCAD in a batch mode, see the description of TCAD's auto plot functions detailed in section 9.

Chapter 2: The Main Menu

When TCAD is initiated from the Unix command line, the following window appears.



(Diagram 2.1: TCAD Main Window)

The SYSTEM menu contains functions that affect the entire operation of this instance of TCAD. The DISPLAY menu contains static display routines to retrieve data from the database. The ANALYZE menu contains custom routines which fetch data from the database, perform analysis on the data, then provide results to the user. The ANALYZE menu is runtime configurable. By placing IDL programs in the directory */apps/supported/lasp-2.0/src/tcad/analyze,* the system administrator may add tools to TCAD without altering the existing code.

2.1 SYSTEM menu overview

The SYSTEM menu contains functions that affect the entire operation of this instance of TCAD. At this time, the SYSTEM menu contains only the QUIT option. Selecting QUIT quits the TCAD application.

2.2 DISPLAY menu overview

The DISPLAY menu contains static display routines to retrieve data from the database. Display TM Data allows the user to select metrics for display and view them graphically or as text file. TM Information allows the user to select a mnemonic from a sub-system and display the information about the monitor such as calibration coefficients and limits.

2.3 ANALYZE menu overview

This menu contains customized add-on tools for analyzing data.

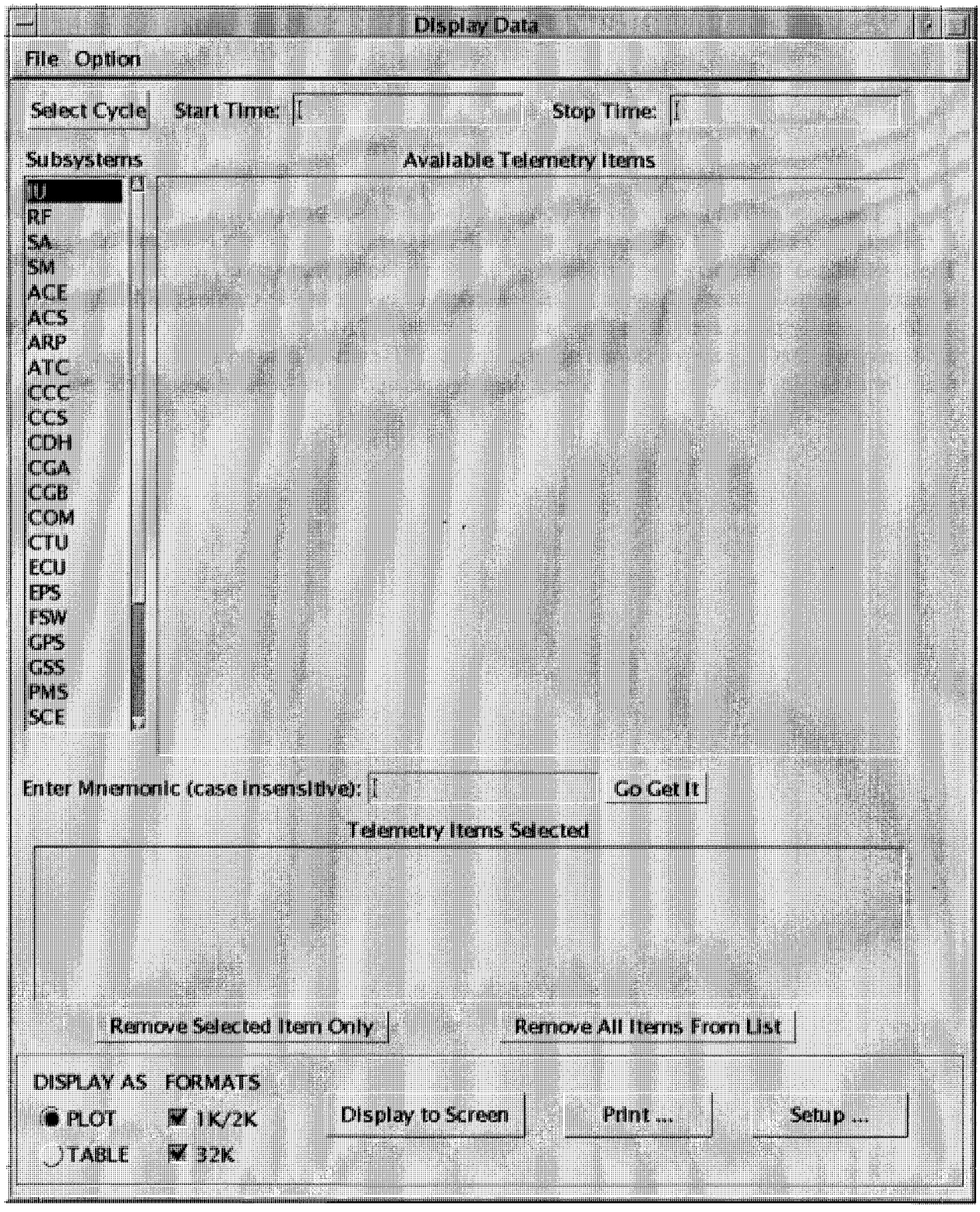
- snapread reads snapshot data
- tcad_dbroget allows the user to extract DBROs (Database Read Outs; APID 300) from a time range.
- tcad_eventget does the same for its respective packets.
- tcad_formatrpt
- tcad_mroget
- tcad_ssget

Other scripts may be added to this menu throughout the course of the GP-B mission.

Chapter 3: Display TM Data

3.1 Overview

The Display TM Data window is, by far, the most used part of the TCAD system. With it, the user may select time ranges from any cycle and display mnemonics from any subsystem. These selections may query large amounts of data from the science server, so the user should take some care to request only what is really needed, as unreasonable queries from multiple users could potentially place a strain on the system resources. TCAD will not filter a user's query and tell him or her that he perhaps should not request 10,000 hours of data on 15 mnemonics at a time, for example. Each area of the screen components and menu items is detailed below.



(Diagram 3.1 the Display TM Data window)

3.1.1 Cycle, Start, and Stop times

Across the top of the TCAD window are the three primary user inputs.

- Select Cycle Calls a listbox routine identical to selecting 'Cycle Select' from the menu.
- Start Time The beginning time range the user wishes to select.
- Stop Time The end of the time range the user has selected.

The Cycle number is an integer value assigned by the database administrator to a particular set of data that makes it unique from all other sets of data in the database. Typically, negative numbers will be used to express pre-launch sets of data and positive numbers will be used to express post-launch sets of data. After launch, a new cycle number should only be generated in the event of an on-board clock reset.
Cycle number information can also be selected from the Option menu (see section 3.3.1)

Start Time must be entered either in the format of YYYY/DOY-HH:MM:SS.ms *(ex:* ***2001/317-15:34:27)*** or entered as the actual VTCW spacecraft time in 10^{ths} of a second *(ex:* ***359460120)*** This time represents the number of 10^{ths} seconds elapsed since January 1^{st}, 2000 at 12PM.

Stop Time may be entered in the same absolute format as Start Time, or it may be entered as a relative time in hours *(e.g. +10 or +2.5)*

3.1.2 Subsystem and Available Telemetry Items

To display data, the user must first select it from the database. This is accomplished via the Subsystem and Available Telemetry Items frames inside the Display TM Data window. The Available Telemetry Items frame is a child of Subsystem. When a subsystem is selected, the subsystem's list of telemetry items is displayed in the Available Telemetry Items frame. Single-clicking an item in the Available Telemetry Items frame selects it as an item to view and copies the mnemonic to the Telemetry Items Selected frame. No data is loaded from the database until either the Print or Display button is selected.

3.1.3 Telemetry Items Selected

This frame displays all telemetry items selected by the user to be displayed. The user may remove a single item from the list by single-clicking it, then pressing the Remove Selected Item Only button, or the user my remove all current selections by pressing the Remove All Items From List button.

3.1.4 Display As

Once the user has selected a cycle, time range, and mnemonics to view, they may choose to display the data either as a plot or as a table. This is determined by the Plot and Table (respectively) radio buttons in the Display As frame. Plot will display the selected data

graphically. Table will display the data in a tab-delimited format in a text editor. A user can save the data to a file if desired.

Additional display options may be configured via the Setup button (This button performs the same function as the Display Options menu item in the Option menu. (See sections 3.5 and 3.6 for more detail)

When everything is ready, the user may chose to either display the data to the screen or print it to a printer or file by clicking either the Print... or Display to Screen button. (See sections 3.7 and 3.8 for more detail)

3.1.5 1K/2K and 32K Data Formats

Different data rates may be selected by marking one or both of the 1K/2K and 32K checkboxes listed under the Formats frame. See sections 3.7 (The Plot Window) and 3.8 (The Table Window) for details on the presentation of this data in each mode.

3.1.6 Enter Mnemonic

This function allows the user to search all of the mnemonics for instances of their chosen search string. If 4 or fewer mnemonics are found, they will appear directly below the textbox under Telemetry Items Selected. If more than 4 mnemonics are found that match the user's query, the program returns another sub-window (see Fig. 3.2). Selecting an item from this sub-window and pressing OK will add the chosen mnemonic to the main list of Telemetry Items Selected. If no matches are found, an error window warns the user that this is the case. The search is not case-sensitive, and it automatically queries using a wildcard before and after the user's entry (i.e. "FA" will be searched as "*FA*"). User wildcards are also accepted - use *'s.

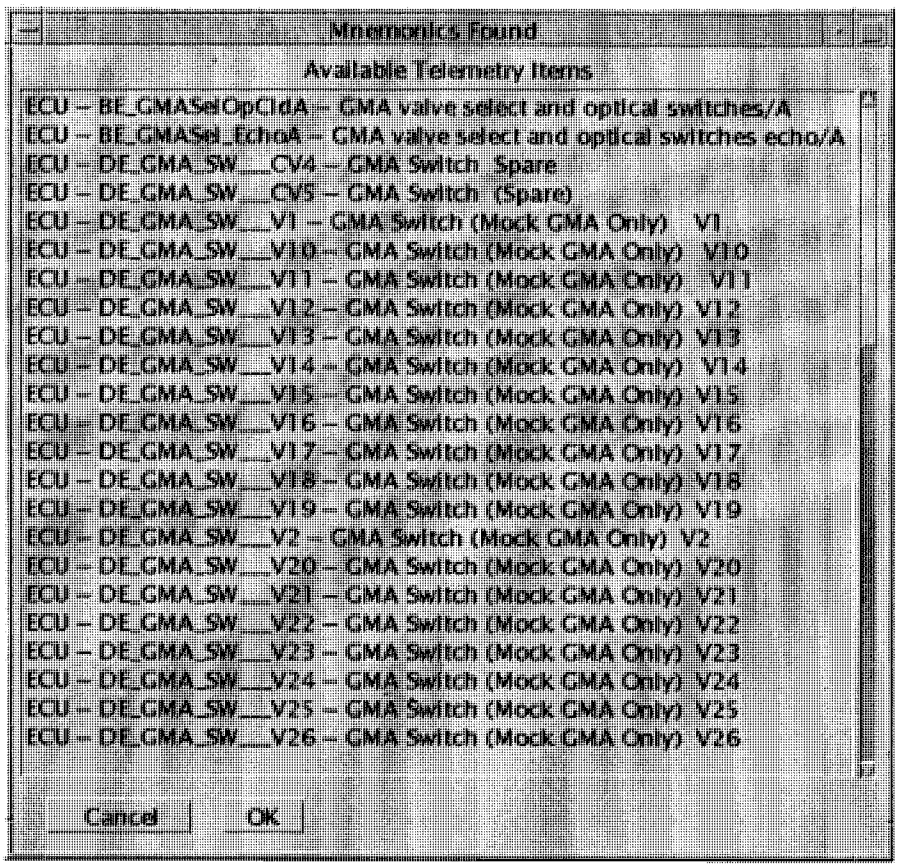


Fig. 3.2 Subwindow shown after searching for "gma"

3.1.7 Keyboard Hotkeys

For convenience, several hotkeys have been defined to make navigation of this window quicker. They are:

CTRL-N	Same function as New in the file menu, this tool clears the current settings.
CTRL-O	Open a configuration file.
CTRL-W	Write out a configuration file.
CTRL-P	Print the selected mnemonics.
CTRL-D	Display the selected mnemonics.
CTRL-U	Undo the last addition/removal from mnemonic list.
CTRL-Q	Quit the Display Data screen.

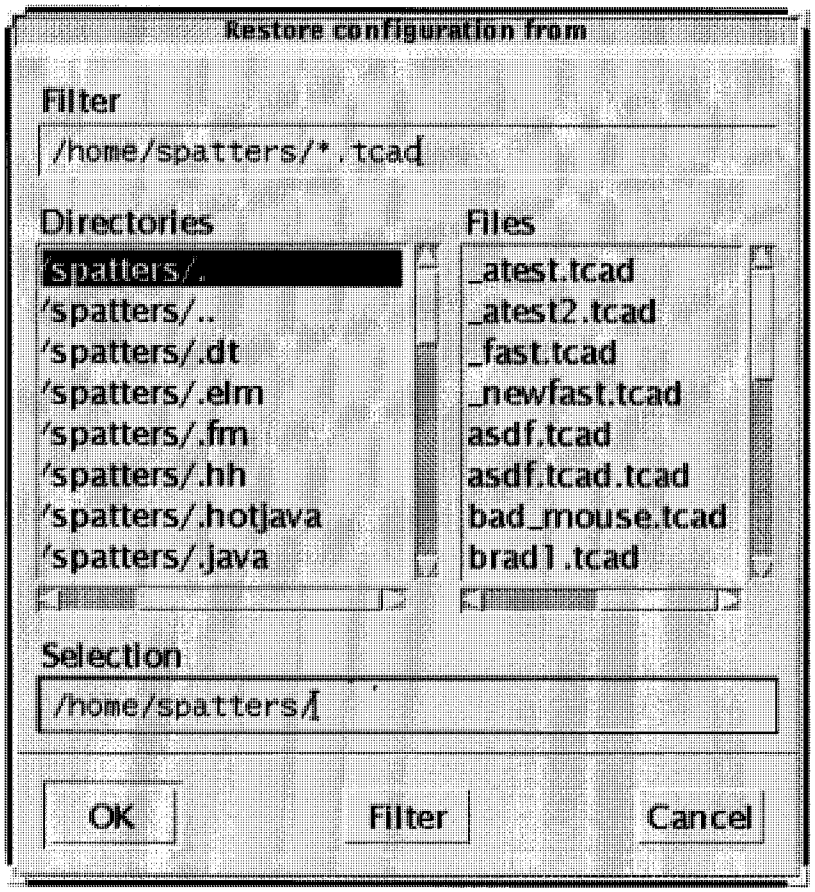
3.2 The File Menu

3.2.1 Clear Configuration

This item clears all user inputs in the Display TM Data window.

3.2.2 Restore Configuration

When this menu item is selected, the following dialog box is displayed

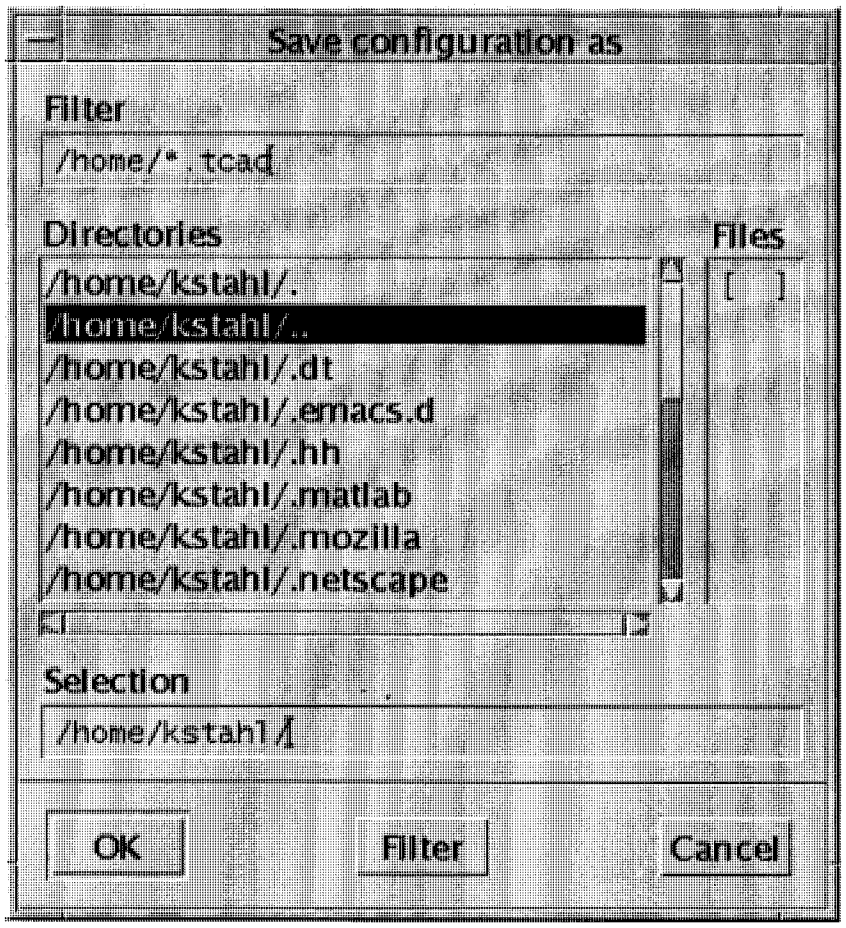


(Diagram 3.2 the Restore dialog)

The path is defaulted to the user's home directory. All files containing a '.tcad' extension are displayed in the list box. The user may select any of the TCAD configuration files and restore a previously saved selection set. Clicking OK will make the stored configuration replace all current settings in the Display TM Data screen, including the start and stop times. Cancel will return to the screen with no changes. In the event of a badly named or corrupt file, the user will be warned that the file is invalid and no changes to their current selections will be made. Stored configurations can be used to display the data in the same way every day or as a placeholder to show interesting data to another user at a later time.

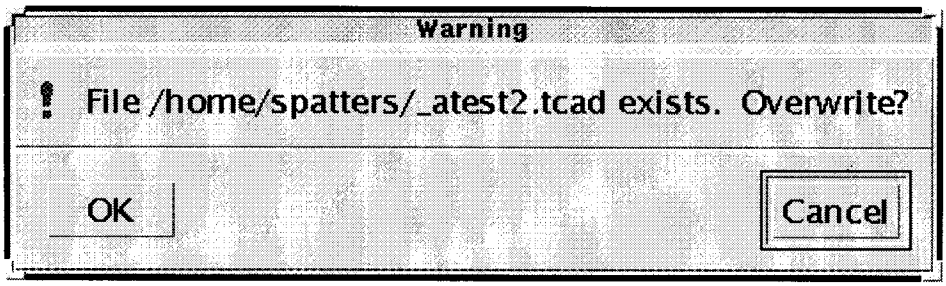
3.2.3 Save Configuration

Selecting the Save option from the file menu will display the following dialog.



(Diagram 3.3 the Save dialog)

The user should enter a valid Unix file name in the textbox provided. The save function will now warn the user if they are about to overwrite an existing file via the following dialog:



The default path for save files is the user's home directory. The '.tcad' extension will be added to a file if it does not exist.

For Example: Entering ***Example1*** *will create a file named Example1.tcad in the user's home directory.*

The user may issue paths relative to their home directory using the / character.

For Example: ***/configs/Example2*** *will create a file named 'Example2.tcad' in the user's configs directory.*

Please note that files written to a subdirectory will only be written if the directory exists and the user has write privileges to the directory. Any failure to write the file will be reported to the user when the OK button is clicked. Cancel will abort from this screen without saving the configuration file.

3.2.4 Print

This menu item sends the current data selections to the printer or a file. See section 3.4 for more details.

3.2.5 Close

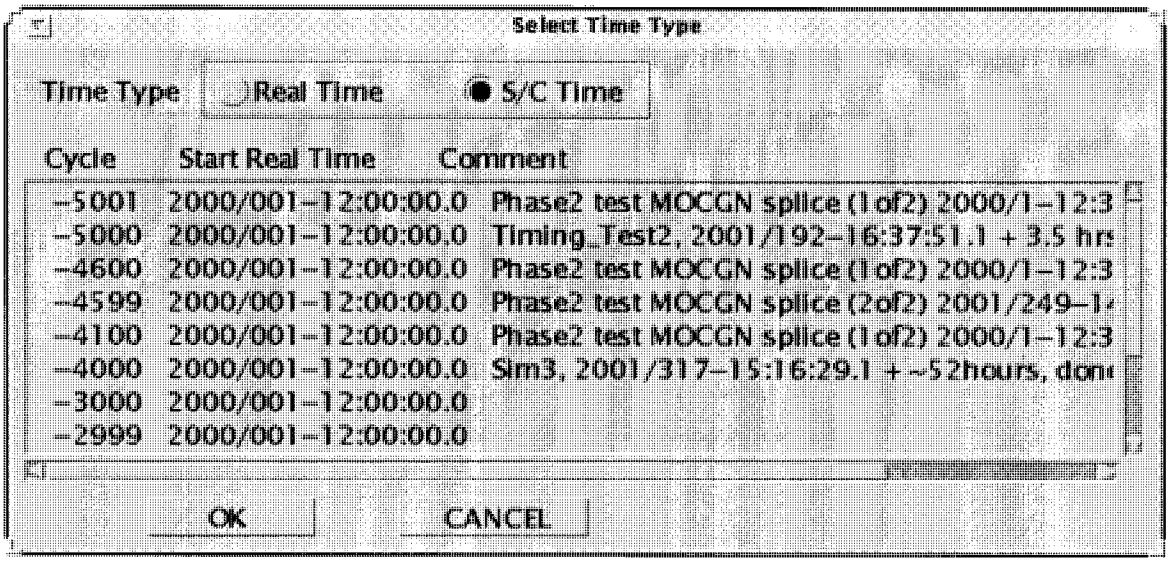
Closes the Display TM Data window.

3.3 The Option Menu

This menu contains items related to displaying data and customizing the user interface.

3.3.1 Cycle Select

The Cycle Select menu item serves the same purpose as the drop-down listbox. When Cycle Select is selected from this menu, the following dialog screen is displayed:



(Diagram 3.4: Cycle Select dialog)

Information about the cycle is displayed along with the cycle number. If Real Time is selected instead of S/C time, the largest numeric value of cycle number is assumed when the data is submitted to the Print and Display functions. This screen is also accessible by clicking the button labeled 'Select Cycle' in the TCAD display data routine.

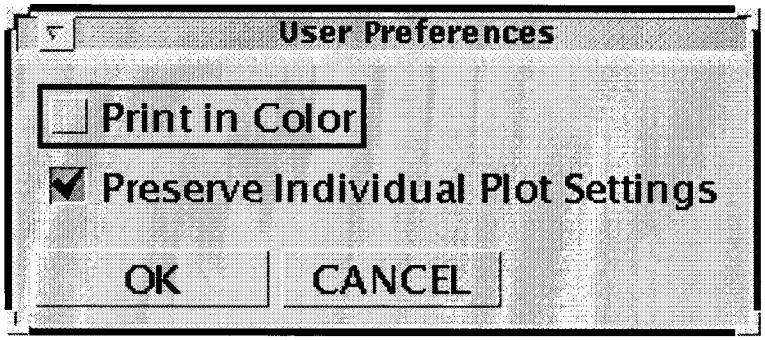
3.3.2 Display Options

This menu item has the same functionality as the Setup button on the screen. If in Plot mode, the Plot Setup window is displayed. If in Table mode, Table Setup is displayed. See sections 3.5 and 3.6 for a detailed description of these dialog windows.

3.3.3 Preferences

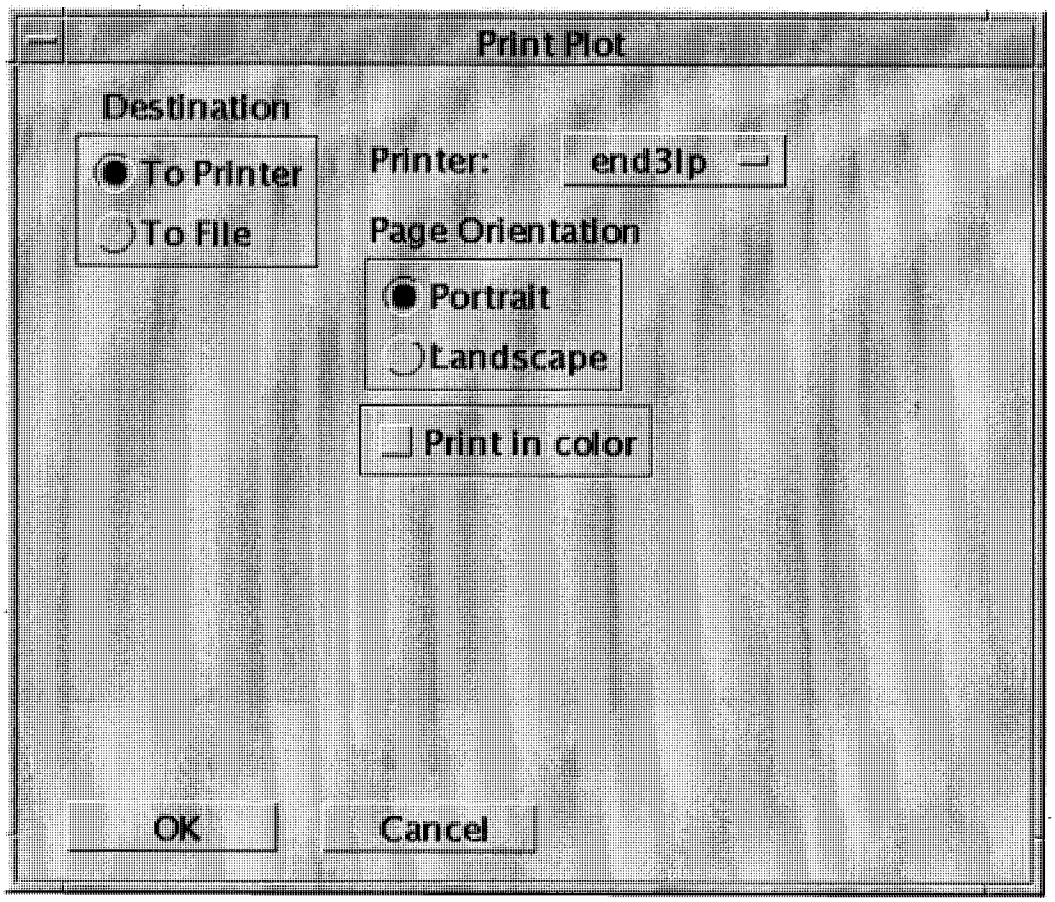
At this time, the only user preferences defined are those that affect plot output. The 'Print in Color' option allows color printing (See section 3.4 for more information on using a color printer). The 'Preserve Individual Plot Settings' option will preserve plot adjustments made in the right-click menu such as Y-Axis scaling, Function Overplots, and Plot color/symbol settings. It will not preserve zooms made with the rubber-band zoom tool.

Unchecking Preserve Plot Settings will immediately revert settings to the default when the OK button is clicked. Preserved plot settings will be saved to configuration files and will be used by the auto_plot program.



3.4 Print...

The print setup dialog allows the user to pick an output device for the selected data set. Print for plotting and print for table are identical except for the file format that will be output. Print setup in Plot mode allows the user to generate a PostScript copy of the plots whereas table printing allows the user to output an ASCII file. Below is an example of the Print Setup window for printing a plot:



(Diagram 3.5: The Print Setup dialog)

When Print to File is selected, the print window reveals an additional set of fields (see Fig. 3.6). A dropdown box that specifies the output file type, the file name, and a checkbox for 'Push to Web'. JPG, PNG, PICT, TIFF, BMP, and Postscript (EPS) file types are now supported (note that the extensions will be capitalized when saving). The file name is relative to your $HOME path. I.E.: If you echo $HOME at the command-line and it says '/home/science', the files you generate will appear in this directory. The extension name (in capitals) is appended onto whatever text you type for a filename with a '.'. If 'Push to Web' is checked, the file will be pushed to the web and will be available in https://gpbops.stanford.edu:/reports/tcad. Please remember that this is a shared web space and choose file names carefully as they WILL over-write existing files by the same

name without prompting you. All users can write to this web space from the science server; users cannot write to the web server (at present) from moc-server. Ssh to science and run TCAD from there if you need to push a plot to the web.

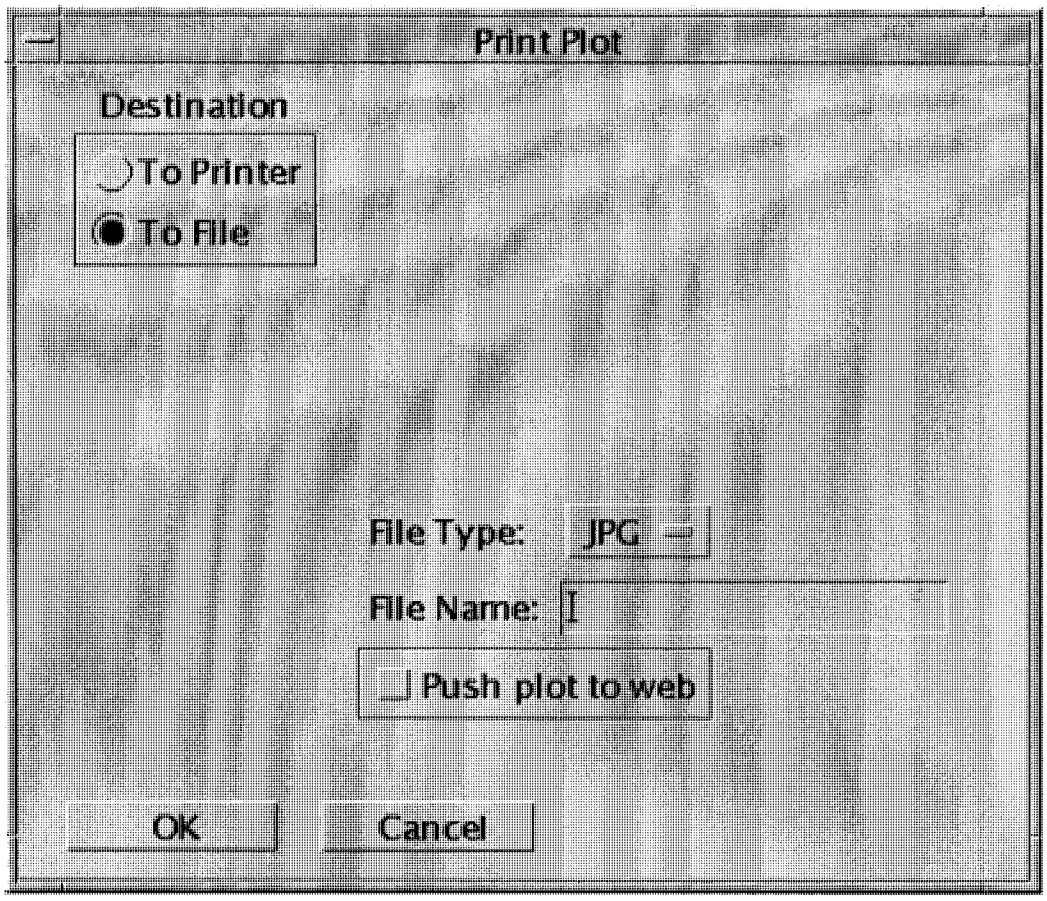
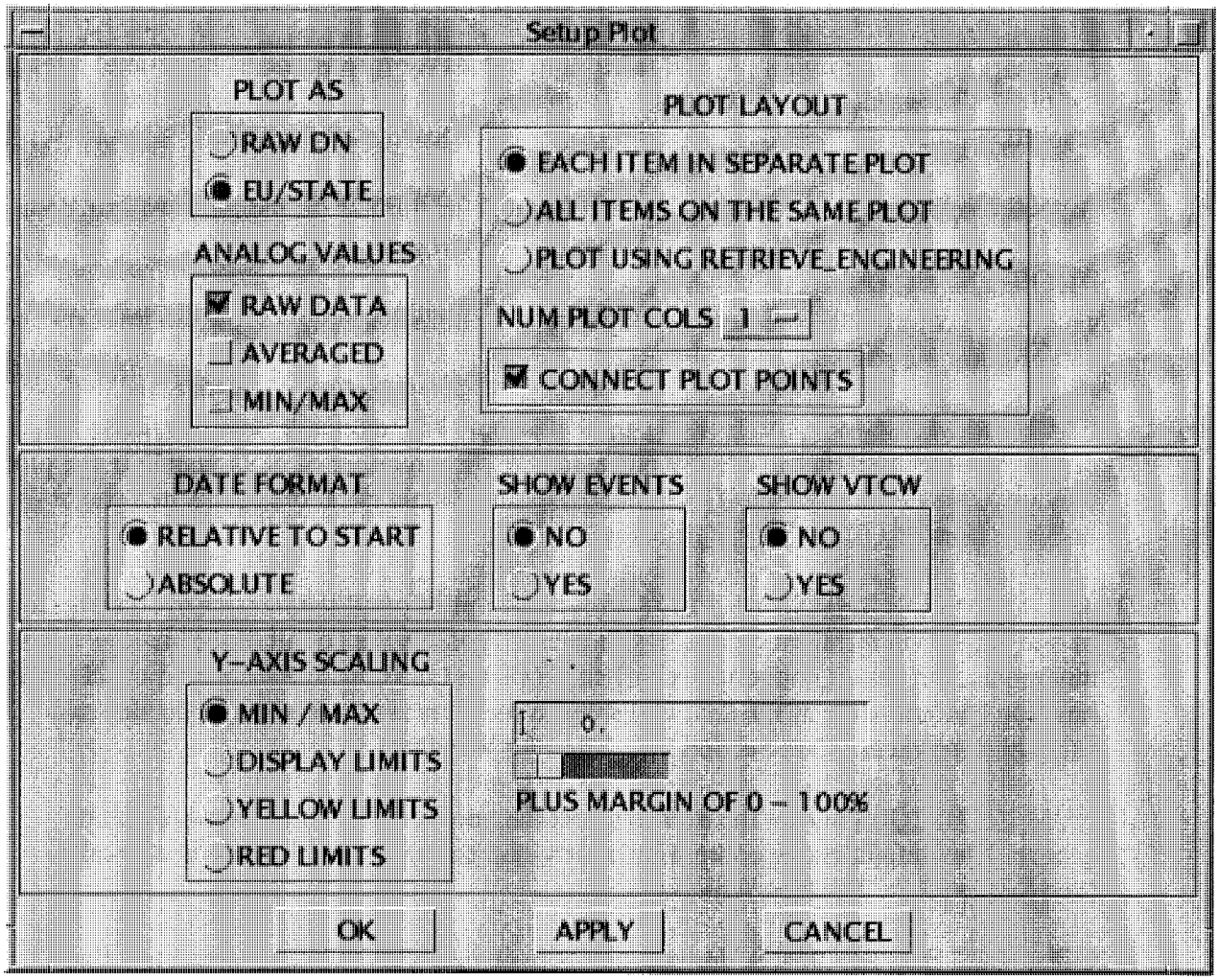


Fig. 3.6 Print-to-File Window

3.5 Plot Setup

The Plot Setup dialog allows the user to customize the appearance of their plotted data. Depicted below, this window contains several groupings of display controls. These are detailed in the following sections.



(Diagram 3.6: The Plot Setup dialog)

3.5.1 PLOT AS

The radio buttons RAW DN and EU/STATE allow the user to select either the raw data received from the instruments, or calibrated data displayed in Engineering Units or States. The default is EU/STATE. TCAD will display raw DNs for monitors that have no calibration or state information as imported from the MSS database.

3.5.2 ANALOG VALUES

The Analog Values sub-frame allows the user to select additional pieces of stored information from the database about the analog values chosen to plot. These items may be displayed concurrently.

RAW DATA is the only option selected by default and represents the full resolution data for each time reference.

AVERAGED data represents any stored averages for this mnemonic for the entire cycle in the TM Average table. Data is only averaged and archived in the TMaverage table in flight after a few weeks at full resolution.

MIN/MAX plots the minimum and maximum values for this metric as horizontal lines on the plot. These values are also queried from the TMaverage table; not from the full-resolution data.

A good rule of thumb is to use the default settings for this sub-frame for pre-flight data.

3.5.3 PLOT LAYOUT

This frame controls the physical display of plots within the plot window, both for display and printing purposes.

EACH ITEM IN SEPARATE PLOT indicates that each telemetry item should be displayed in its own plot inside the plot window. The number of plots visible in the plot window is determined by PLOTS PER PAGE and cannot exceed 12 plots in a single display. (See PLOTS PER PAGE below)

ALL ITEMS ON THE SAME PLOT will display plots of all the metrics overlaid on top of one another in different colors. If the telemetry items are not all of the same mnemonic, the data is converted relative to 1000 and the units are displayed in scientific notation. Mouse-over of the data will snap-to the nearest mnemonic and display and exact measurement. (See Section 3.7: The Plot Window)

NUM PLOT COLS allows the user to select the number of columns in which plots appear. The default is one column, in which case the plots appear stacked vertically. (See Section 3.7: The Plot Window)

CONNECT PLOT POINTS draws a line between the data points, generating a line graph. When disabled, data is displayed as points in a scatter graph.

3.5.4 DATE FORMAT

Displays the data axis labels either as relative to the start time *(IE: +1hr, +2hrs, +3hrs)* or as an absolute time *(2001/317-15:00:00.0, 2001/317-16:00:00.0)*. The default is relative.

3.5.5 SHOW EVENTS

Displays events overlaid on the plotted data when set to YES. Default is NO.

3.5.6 SHOW VTCW

If set to NO, time is displayed in the date format *(2001/317-15:34:26.0)* when set to YES, time is displayed as a long integer representing the number of deci-seconds elapsed since January 1, 2000 at 12PM. *(EX: 5360871203), the Vehicle Time Clock Word.*

3.5.7 Y-AXIS SCALING

Options in this frame define how the data is displayed inside the plot. The default setting, MIN/MAX, scales the plot values such that the data will fill the vertical space of the plot

area. (Datasets which have no variance in the values for the given time range and discrete data will not be scaled.

DISPLAY LIMITS scales the data within the plot to display it relative to the minimum and maximum possible values for this telemetry item.

YELLOW LIMITS displays the data relative to the Yellow Out-Of-Spec limits set in the limits data for this telemetry item. The limits are displayed in the plot as horizontal yellow lines.

RED LIMITS displays the data relative to the Red Out-Of-Spec limits set in the limits data for this telemetry item. The limits are displayed in the plot as red horizontal lines. When this view is selected, both red and yellow limits are plotted over the data as horizontal lines.

3.5.8 PLUS MARGIN

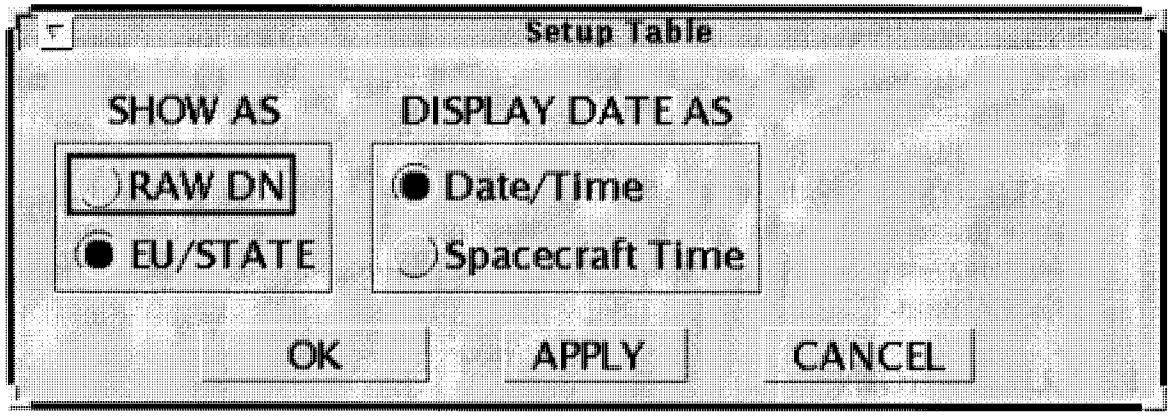
Often, if data is displayed on the minimum or maximum of the plot display, the output becomes unreadable when the plot is printed. Plus Margin uses the range of the data and adds the user-selected percentage as a buffer to the outsides of the Y-axis.

3.5.9 OK, Apply, and Cancel Buttons

This group of buttons saves or discards the changes to the current settings. OK commits the changes and exits the screen. Apply commits the changes and re-displays the plot window but leaves the Plot Setup window active. Cancel exits this window, discarding any alterations the user made in this dialog.

3.6 Table Setup

When table mode is selected, the following dialog is displayed instead of the Plot Setup dialog:



(Diagram 3.7: The Table Setup dialog)

3.6.1 SHOW AS

The user may chose to display data either as raw data or as Engineering Units and States by selecting one of the radio buttons. The default is Engineering Units and States. If the data is an analog value and has no calibration, the raw data number will be displayed instead Table data will be displayed in a tab-delimited form, either in a text editor or as a printed item. (See section 3.8 for more details)

3.6.2 Display Date As

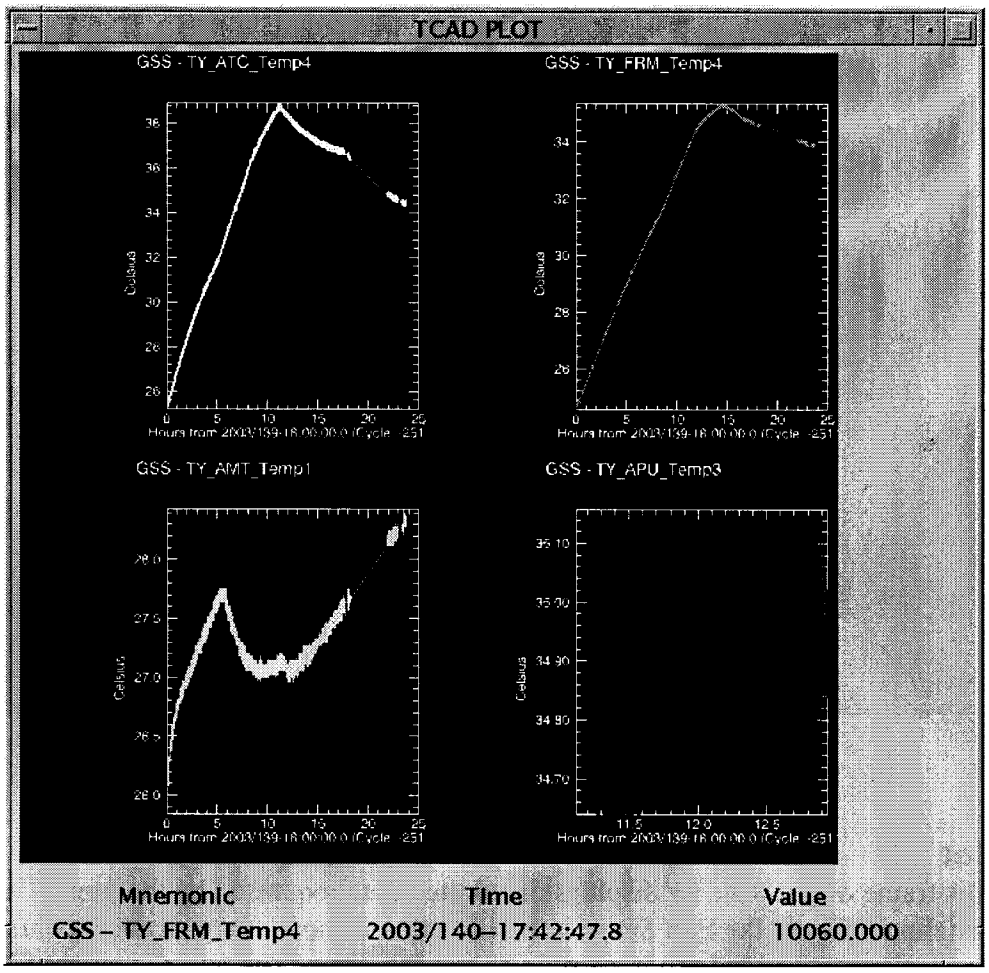
The user can select whether data in the output file displays the text date and time or the VTCW time.

3.6.3 OK, Apply, and Cancel Buttons

This group of buttons saves or discards the changes to the current settings. OK commits the changes and exits the screen. Apply commits the changes and re-displays the table window but leaves the Table Setup window active. Cancel exits this window, discarding any alterations the user made in this dialog.

3.7 The Plot Window

When data is sent to a plot, a window similar to the following is displayed. The layout of this screen is highly variable, depending on the mnemonics selected by the user, the options requested in the Plot Setup screen, etc. The user may also elect to resize this window by clicking and dragging a corner of the window. The plots will be enlarged or reduced to fill the available display area of the new window.



(Diagram 3.8: The Plot Window)

3.7.1 Legend

This window is only displayed when the plot configuration is set to display all mnemonics in a single window (see Fig. 3.9). When displayed, the Legend frame displays the name of each mnemonic in the color it will be displayed on the screen. If the user has defined a linestyle and symbol setting, these too will be displayed in the legend. The legend is a static fixed object in the screen. It will scale on the y-axis with the

window but cannot be altered by the user. The legend will appear only in plot-all-plots to a single plot mode.

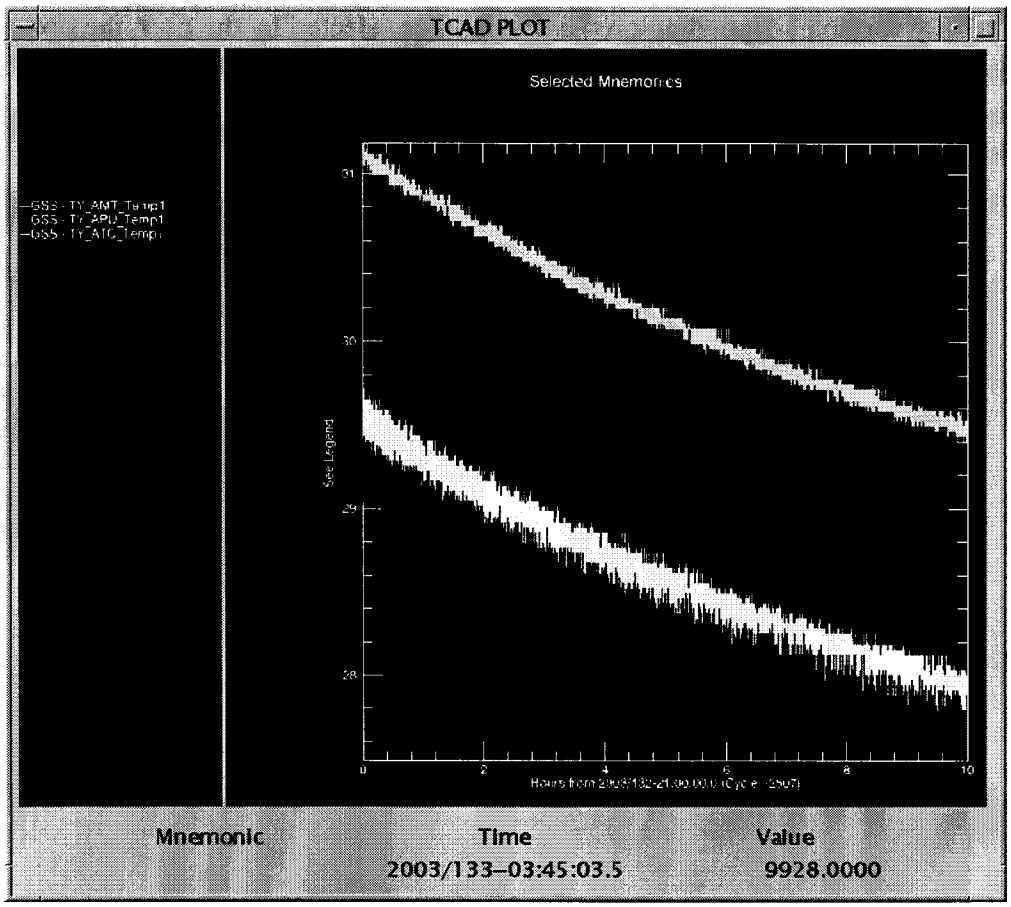


Fig. 3.9 Plot with Legend

3.7.2 Plot

This frame of the window displays the plotted data requested by the user. The Plots Per Column setting in the Plot Setup screen determines how many physical columns across are displayed. The default is a single-column display. The latest version of TCAD allows the user to plot as many mnemonics as they can read on a single page. The practical limit is about twelve plots on a page unless you are operating in single-plot mode. Plotting many mnemonics at once will result in longer load times from the database.

3.7.3 Display Bar

'Display Bar' refers to the three fields at the bottom of the plot window: Mnemonic, Time, and Value. When the user moves the mouse cursor over a plot in multi-plot mode, the time index, data value, and mnemonic are displayed.

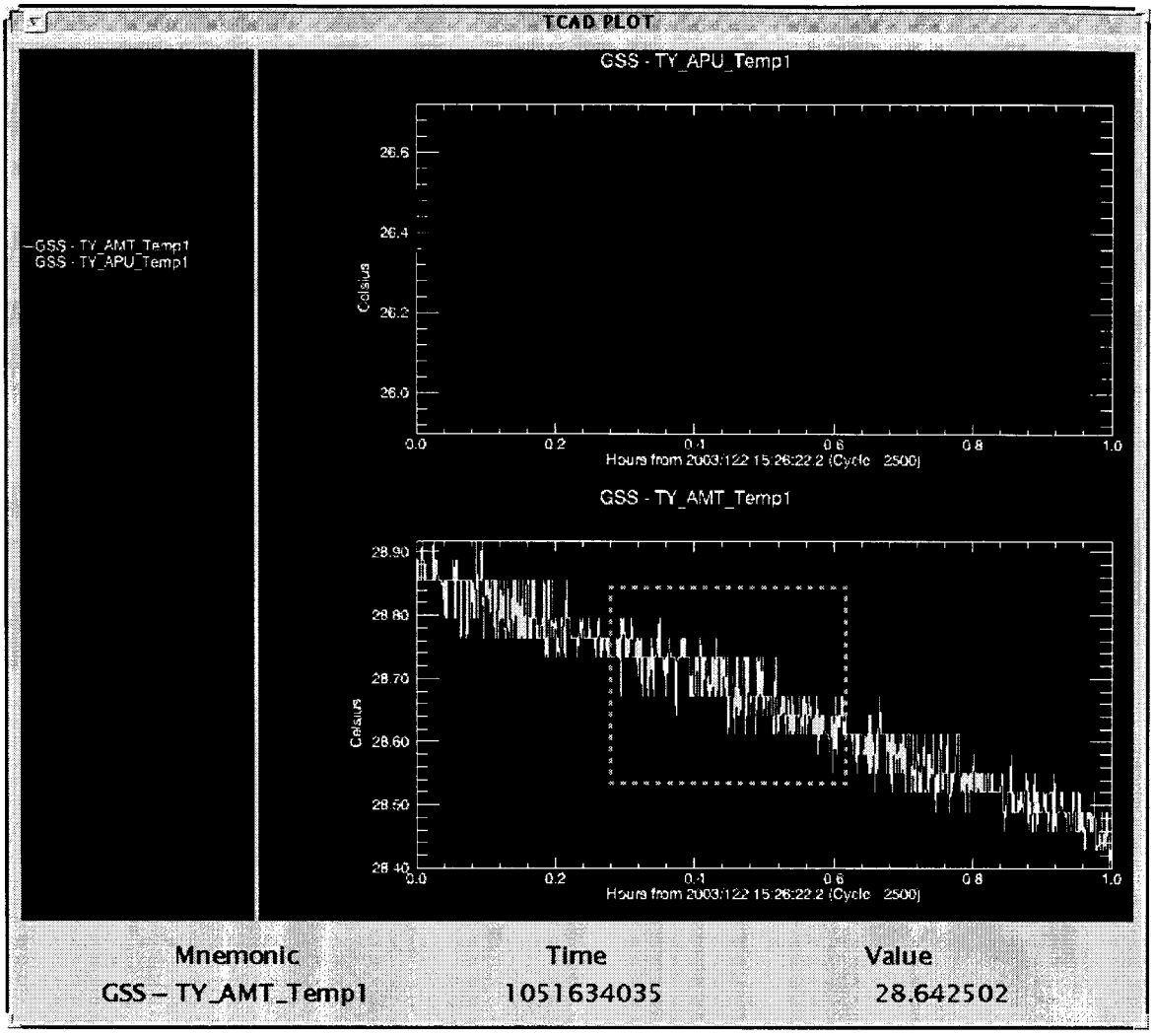
In 'ALL ITEMS ON THE SAME PLOT'' mode, the behavior is slightly different. All plots are overlaid in a single display. The program scans the plotted data to determine which mnemonic has a value closest to the Y position of the mouse within the window, then displays the name of that mnemonic, the time index, and the exact measurement for that mnemonic at that time.

3.7.4 1K/2K and 32K data

On the display screen, there are checkboxes to display 1K/2K and 32K data. When only one of these data types is selected or there is only one data type for the given mnemonic, the data display behaves normally. When both data sets are present, the 1K/2K data is overlaid on the 32K data in a different color. Mouse-over will reflect the values of the 32K data.

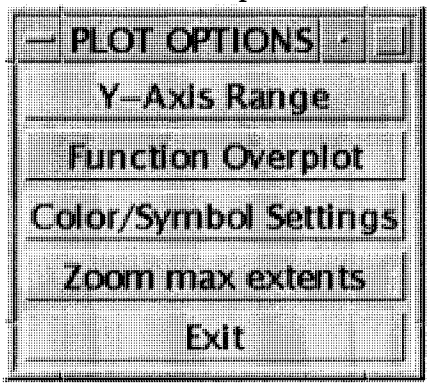
3.7.5 Rubber-band Zoom Tool

Left-clicking in a plot will activate the rubber-band zoom tool. A dotted red area will be created on the screen by mouse movement. A second left-click defines the opposite corner of the zoom rectangle. This section of the plot is then expanded to fill the plot area. TCAD now supports one level of undo for this function. The right-click menu will show the option to undo the last zoom.



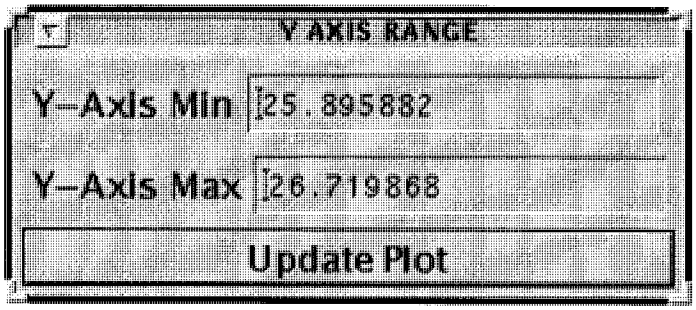
3.7.5 The Right-click Menu

Right-clicking on a plot activates a menu of additional options which may be performed to refine this particular plot. Each of the options will be explained in detail below.



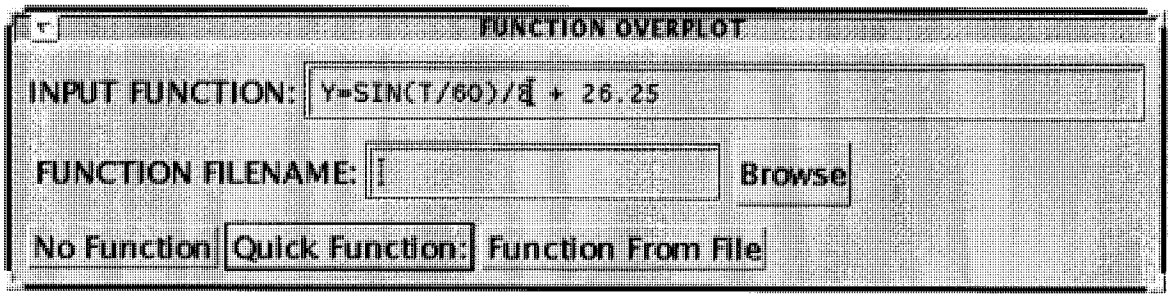
Y-Axis Range

This feature allows the user to manually specify an exact data range to view in their plot. When initialized, this window contains the extrema points of the displayed data.



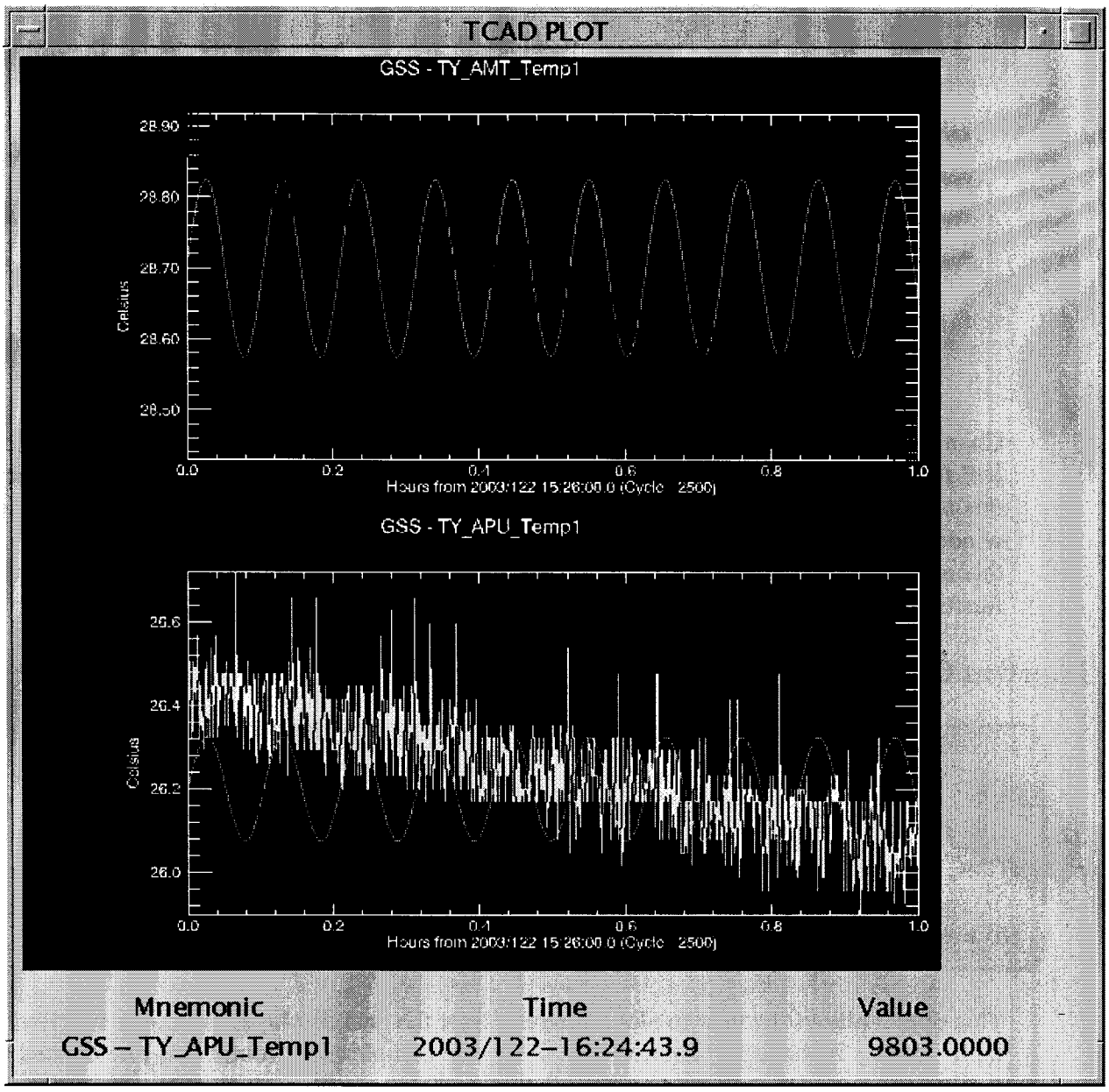
Changing the min and max values to 26.0 and 26.5 for example and clicking 'update plot' will focus in on the Y range of data requested as in the following screen shot. Note that this option is intended for use one plot at a time and will not be applied to all plots on the window. Except when the user has selected to print all mnemonics to a single plot. In this mode, all plots are scaled because they exist in the same relative window. Limits and function overplots are also scaled to match their parent plot.

Function Overplot



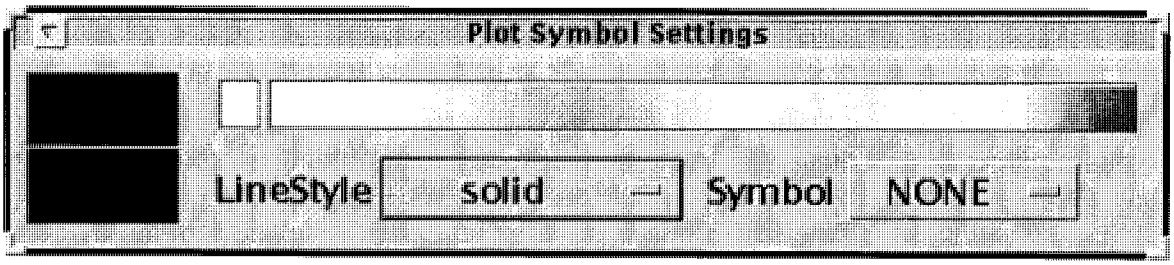
This option allows the user to plot a function over the data displayed. A quick function is input directly in the input function box, or a more complex IDL routine may be created as a .PRO file and loaded in the Function Filename field.

In the quick function mode, Y represents the data points to display and T represents time where 0 is the beginning of the data range (not mission time = 0). The unit of measurement in this function is seconds. The function above would plot the following display:



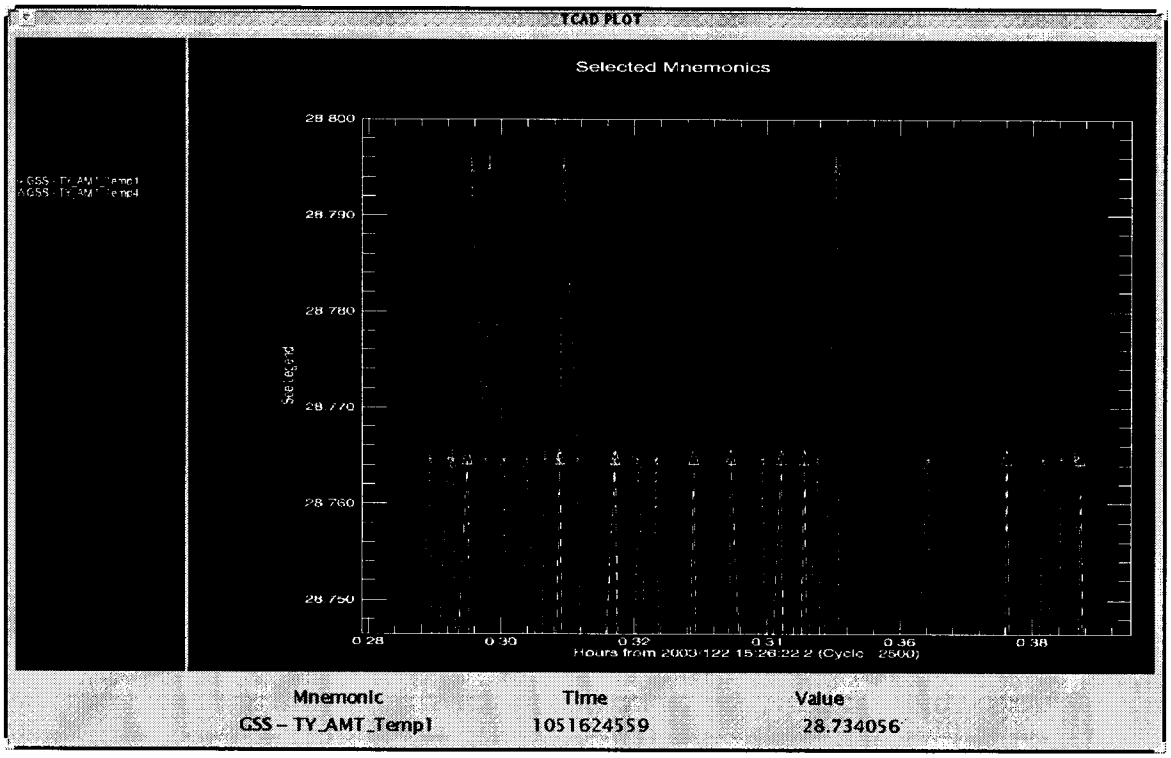
Overplot functions are always displayed in orange and their color, like the limits, cannot be changed.

Color/Symbol Settings



This option allows users to alter the display of this plot. Clicking in the colorbar will change the color of the plot. The linestyle dropdown provides several options to chose from including a "do not connect plot points" option. The symbol dropdown similarly has several options. Symbols are displayed at actual data points only.

The plot symbol settings can become particularly useful when plotting multiple items to a single plot. For example, the user might chose a dotted-line and * symbols for one mnemonic and dashed-lines and triangles for another and produce a display similar to the following:



Zoom max extents

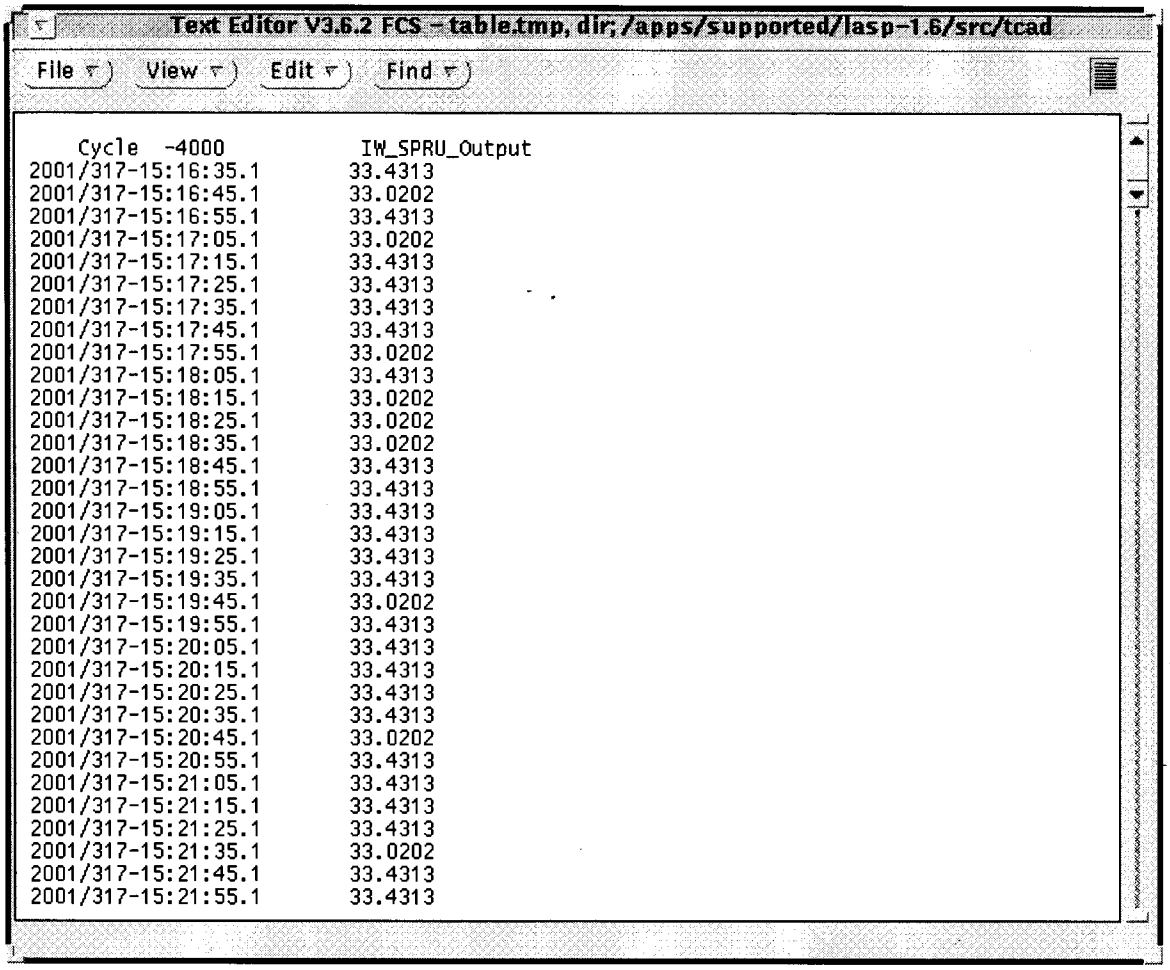
This option returns the plot window to its original dimensions after zooming. If there has been no zooming since it was first displayed, the image will not change.

Exit

This button closes the right-click menu. The right click menu is also automatically terminated when the plot window is destroyed.

3.8 The Table Window

When data are displayed to a table, a window similar to the following is displayed. Time and data measurement are displayed on the same line. Column headings denote the cycle and mnemonic selected. The user may use the controls in textedit normally, however this file is write protected and may not be modified. (See the Unix man page on textedit for more information. '**man textedit**' from the Unix prompt.) However, the user may perform a 'save as' and make modifications, if desired. The resulting data is a tab-delimited file. The column headings are displayed only once at the top of the file.



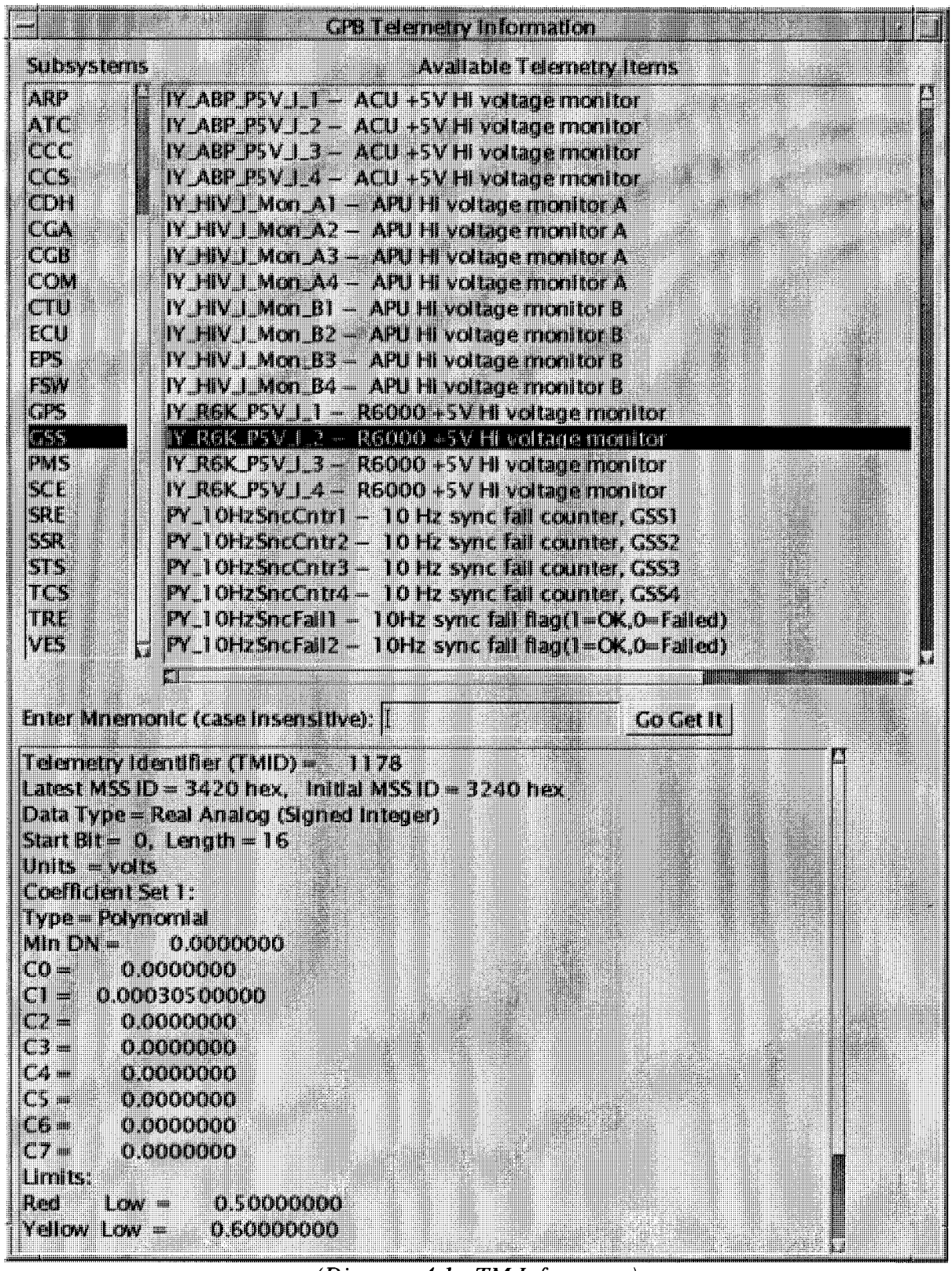
Cycle -4000	IW_SPRU_Output
2001/317-15:16:35.1	33.4313
2001/317-15:16:45.1	33.0202
2001/317-15:16:55.1	33.4313
2001/317-15:17:05.1	33.0202
2001/317-15:17:15.1	33.4313
2001/317-15:17:25.1	33.4313
2001/317-15:17:35.1	33.4313
2001/317-15:17:45.1	33.4313
2001/317-15:17:55.1	33.0202
2001/317-15:18:05.1	33.4313
2001/317-15:18:15.1	33.0202
2001/317-15:18:25.1	33.0202
2001/317-15:18:35.1	33.0202
2001/317-15:18:45.1	33.4313
2001/317-15:18:55.1	33.4313
2001/317-15:19:05.1	33.4313
2001/317-15:19:15.1	33.4313
2001/317-15:19:25.1	33.4313
2001/317-15:19:35.1	33.4313
2001/317-15:19:45.1	33.0202
2001/317-15:19:55.1	33.4313
2001/317-15:20:05.1	33.4313
2001/317-15:20:15.1	33.4313
2001/317-15:20:25.1	33.4313
2001/317-15:20:35.1	33.4313
2001/317-15:20:45.1	33.0202
2001/317-15:20:55.1	33.4313
2001/317-15:21:05.1	33.4313
2001/317-15:21:15.1	33.4313
2001/317-15:21:25.1	33.4313
2001/317-15:21:35.1	33.0202
2001/317-15:21:45.1	33.4313
2001/317-15:21:55.1	33.4313

(Diagram 3.9: The Table Window)

On the 'Display' screen there are checkboxes for 1K/2K and 32K data. When only 1K/2K or 32K data is selected for a given mnemonic, or only one type of data is applicable to a given

mnemonic, table output behaves normally. If both data types are present for the selected mnemonic, two columns will appear for the given mnemonic. The first one (reading left to right) will be the 32K data and the second column will be the 1K/2K data.

Chapter 4: TM Information



(Diagram 4.1: TM Info screen)

The TM Info screen allows the user to select a monitor from a subsystem and display all of its configuration properties.

The Subsystem and Available Telemetry Items frames behave as they do in the Display TM Data window (Section 3.1.2). Selecting a Subsystem displays all telemetry items for that subsystem in the Available Telemetry Items frame. Selecting a telemetry item displays its information in the output frame.

Chapter 5: Analyze Menu Add-On Programs

5.1 SnapRead

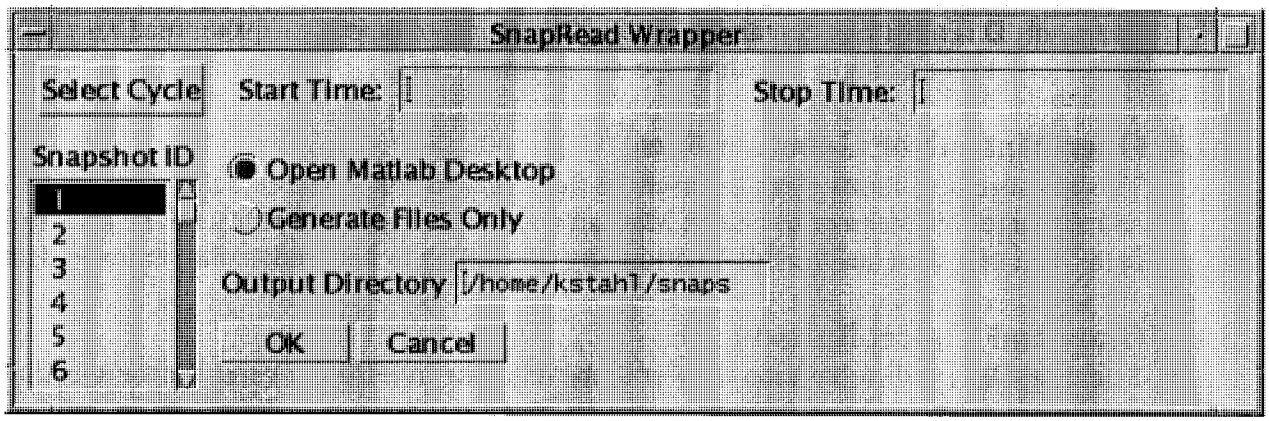


Fig. 5.1 Snapread window

5.1.1 Select Cycle, Start and Stop Times

Across the top of the TCAD window are the three primary user inputs.

- Cycle: A dropdown list of all the cycle numbers in the GPB-L0 database.
- Start Time: The beginning time range the user wishes to select.
- Stop Time: The end of the time range the user has selected.

The Cycle number is an integer value assigned by the database administrator to a particular set of data that makes it unique from all other sets of data in the database. Typically, negative numbers will be used to express pre-launch sets of data and positive numbers will be used to express post-launch sets of data. After launch, a new cycle number should only be generated in the event of an on-board clock reset.
Cycle number information can also be selected from the Option menu (see section 3.3.1)

Start Time must be entered either in the format of YYYY/DOY-HH:MM:SS.ms *(ex: **2001/317-15:34:27**)* or entered as the actual VTCW spacecraft time in 10^{ths} of a second *(ex: **359460120**)* This time represents the number of 10^{ths} seconds elapsed since January 1st, 2000 at 12PM.

Stop Time may be entered in the same absolute format as Start Time, or it may be entered as a relative time in hours *(ie: +10 or +2.5)*

5.1.2 Display Options

Output may be sent to any combination of the following: Displayed to the screen, output to a printer, or written to a file. Display to screen will display the queried data in textedit, similar to outputting to a table from the Display TM Data window. A valid Unix filename must be supplied by the user. No file extension is added. The data will be written in a plain ASCII format in a location relative to the user's home directory. This process spawns a MatLab job and the output is directed to MatLab arrays.

5.1.3 Snapshot ID selection

Snapshot ID is a list box containing all existing snapshot types. Snapshot read may only be performed for a single snapshot type at this time.

5.1.4 Open MatLab or Generate Files

This set of radio buttons gives the user the flexibility to either generate the snapshot files and return to this menu or to launch MatLab and run the snapread utility on the selected data. The user then has the full functionality of MatLab to manipulate the retrieved data.

5.1.5 Okay and Cancel Buttons

Selecting Okay will submit the request to the database to retrieve events for the specified time range. Cancel aborts from this screen without retrieving data from Sybase.

5.2 DBRO_Get

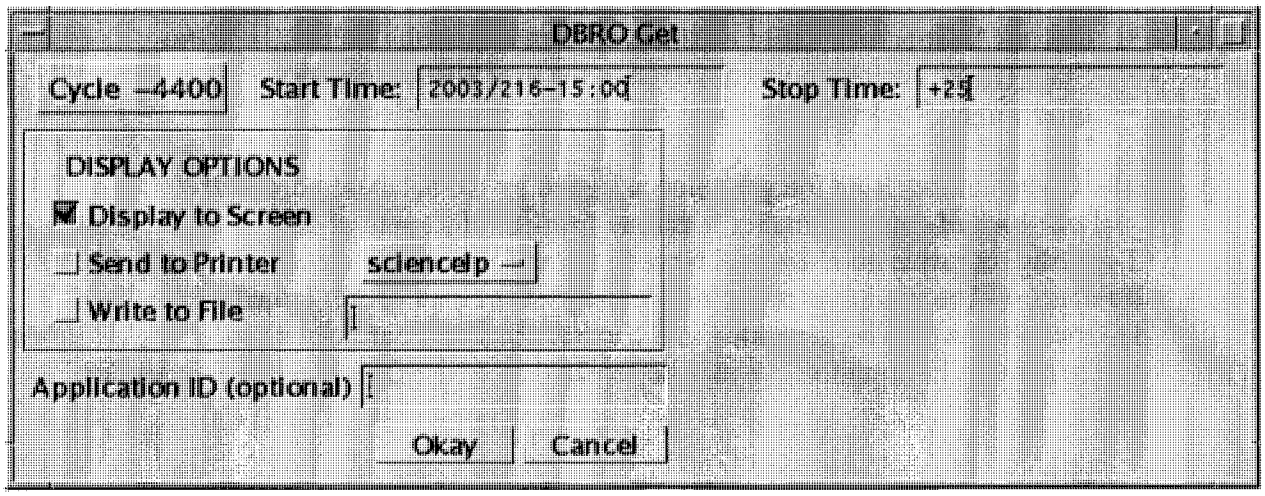


Fig. 5.2 DBRO_Get window

5.2.1 Select Cycle, Start and Stop Times

Across the top of the TCAD window are the three primary user inputs.

- Cycle: A dropdown list of all the cycle numbers in the GPB-L0 database.
- Start Time: The beginning time range the user wishes to select.
- Stop Time: The end of the time range the user has selected.

The Cycle number is an integer value assigned by the database administrator to a particular set of data that makes it unique from all other sets of data in the database. Typically, negative numbers will be used to express pre-launch sets of data and positive numbers will be used to express post-launch sets of data. After launch, a new cycle number should only be generated in the event of an on-board clock reset.
Cycle number information can also be selected from the Option menu (see section 3.3.1)

Start Time must be entered either in the format of YYYY/DOY-HH:MM:SS.ms *(ex: **2001/317-15:34:27**)* or entered as the actual VTCW spacecraft time in 10^{ths} of a second *(ex: **359460120**)* This time represents the number of 10^{ths} seconds elapsed since January 1st, 2000 at 12PM.

Stop Time may be entered in the same absolute format as Start Time, or it may be entered as a relative time in hours *(ie: +10 or +2.5)*

5.2.2 Display Options

Output may be sent to any combination of the following: Displayed to the screen, output to a printer, or written to a file. Display to screen will display the queried data in textedit, similar to outputting to a table from the Display TM Data window. By default, DROget generates a directory in the OFILE directory in a user's home directory. In this directory it outputs several files, named uniquely by cycle. The .int file is the file displayed by TCAD. The user may make a more convenient copy of this file using the 'output to file' option. The name must be a valid Unix filename. No file extension is added. Unless specified by the user, this file will be created in their home directory.

5.2.3 Application ID

In this textbox, users can enter any valid Application ID number to make the DBROget routine more specific.

5.2.4 Output file

The '.int' file generated by DBROget is a tab-delimited text file which shows both the raw and real value for the mnemonic. It is important to note that the timestamp in this file is Vehicle time, not ground time. The columns in this file are detailed below.

- **Timestamp:** The spacecraft time at which this sample was taken.
- **Application:** The name of the application issuing the command.
- **Mnemonic:** The sampled mnemonic.
- **Raw Value:** The raw value of the readout in hex.
- **Real Value:** The interpreted value of the mnemonic.

5.2.5 Okay and Cancel Buttons

Selecting Okay will submit the request to the database to retrieve DBROs for the specified time range. Cancel aborts from this screen without retrieving data from Sybase.

5.3 Event Get

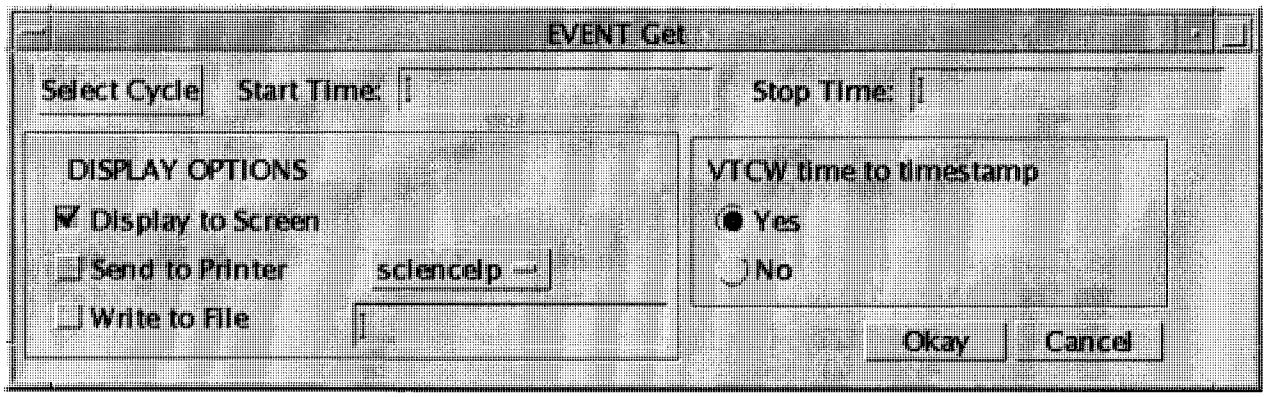


Fig. 5.3 Event_Get window

5.3.1 Select Cycle, Start and Stop Times

Across the top of the TCAD window are the three primary user inputs.

- Cycle: A dropdown list of all the cycle numbers in the GPB-L0 database.
- Start Time: The beginning time range the user wishes to select.
- Stop Time: The end of the time range the user has selected.

The Cycle number is an integer value assigned by the database administrator to a particular set of data that makes it unique from all other sets of data in the database. Typically, negative numbers will be used to express pre-launch sets of data and positive numbers will be used to express post-launch sets of data. After launch, a new cycle number should only be generated in the event of an on-board clock reset.
Cycle number information can also be selected from the Option menu (see section 3.3.1)

Start Time must be entered either in the format of YYYY/DOY-HH:MM:SS.ms *(ex: **2001/317-15:34:27**)* or entered as the actual VTCW spacecraft time in 10^{ths} of a second *(ex: **359460120**)* This time represents the number of 10^{ths} seconds elapsed since January 1st, 2000 at 12PM.

Stop Time may be entered in the same absolute format as Start Time, or it may be entered as a relative time in hours *(ie: +10 or +2.5)*

5.3.2 Display Options

Output may be sent to any combination of the following: Displayed to the screen, output to a printer, or written to a file. Display to screen will display the queried data in textedit, similar to outputting to a table from the Display TM Data window. By default, Event get

generates a directory in the OFILE directory in a user's home directory. In this directory it outputs a file named uniquely by cycle. The .event file is the file displayed by TCAD. The user may make a more convenient copy of this file using the 'output to file' option. The name must be a valid Unix filename. No file extension is added. Unless specified by the user, this file will be created in their home directory.

5.3.3 Output file

The .event file generated by Event get is a tab-delimited text file which shows both the raw and real value for the mnemonic. It is important to note that the timestamp in this file is Vehicle time, not ground time. The columns in this file are detailed below.

- **Timestamp:** The spacecraft time at which this sample was taken.
- **Cycle:** The cycle number this event was stored under.
- **VTCW:** The spacecraft time when the event was stored.
- **Application Number:** An integer that references the application.
- **Application Name:** The name of the application that sent the command.
- **Event Number:** An integer that references the event.
- **Event Name:** The name of the event.

A final note on events: When multiple events have the same VTCW storage time, they are sorted by *application number* and *event number*, not the order in which the were processed.

5.3.4 VTCW time to timestamp

The VTCW will be output with the data instead of a text YYYY/DOY-HH:MM:SS.ms time string.

5.3.5 Okay and Cancel Buttons

Selecting Okay will submit the request to the database to retrieve events for the specified time range. Cancel aborts from this screen without retrieving data from Sybase.

5.4 Format RPT

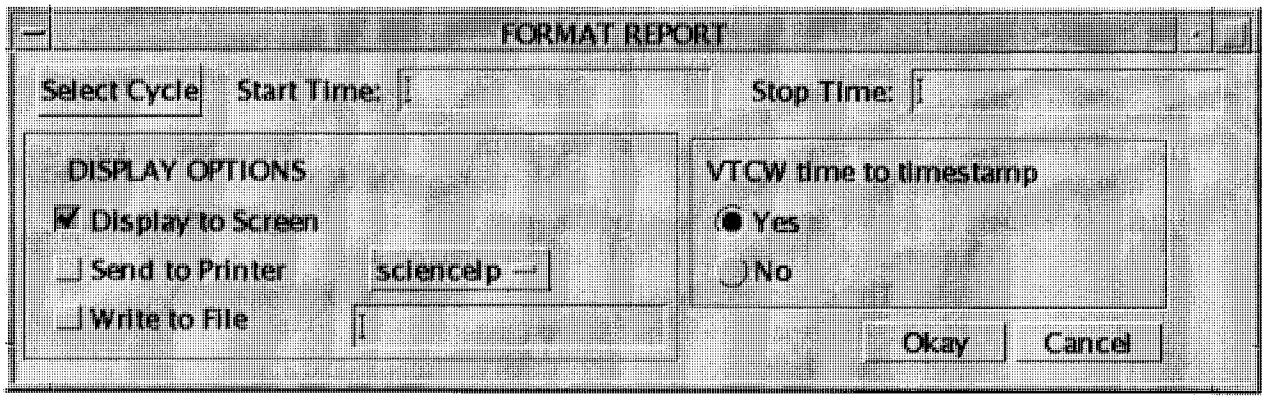


Fig. 5.4 Format_RPT window

5.4.1 Select Cycle, Start and Stop Times

Across the top of the TCAD window are the three primary user inputs.

- Cycle: A dropdown list of all the cycle numbers in the GPB-L0 database.
- Start Time: The beginning time range the user wishes to select.
- Stop Time: The end of the time range the user has selected.

The Cycle number is an integer value assigned by the database administrator to a particular set of data that makes it unique from all other sets of data in the database. Typically, negative numbers will be used to express pre-launch sets of data and positive numbers will be used to express post-launch sets of data. After launch, a new cycle number should only be generated in the event of an on-board clock reset.
Cycle number information can also be selected from the Option menu (see section 3.3.1)

Start Time must be entered either in the format of YYYY/DOY-HH:MM:SS.ms *(ex: **2001/317-15:34:27**)* or entered as the actual VTCW spacecraft time in 10^{ths} of a second *(ex: **359460120**)* This time represents the number of 10^{ths} seconds elapsed since January 1st, 2000 at 12PM.

Stop Time may be entered in the same absolute format as Start Time, or it may be entered as a relative time in hours *(ie: +10 or +2.5)*

5.4.2 Display Options

Output may be sent to any combination of the following: Displayed to the screen, output to a printer, or written to a file. Display to screen will display the queried data in textedit, similar to outputting to a table from the Display TM Data window. Sending output to printer will print the reports created, and writing to file will write the display of the terminal window to a file in the user's home directory.

5.4.3 VTCW time to timestamp

The VTCW will be output with the data instead of a text YYYY/DOY-HH:MM:SS.ms time string.

5.4.4 Output files

By default, Format_RPT generates a directory in the user's home directory named TIMEFMT. In this directory it outputs files named uniquely by cycle (for instance: TIMEFMT.-4400.2003216150000-2003216160000.32k) These files have extensions describing the content of the report, e.g. an extension of '.32k' designates 32k data. The data can be viewed in a text editor by double-clicking them.

5.5 MRO Get

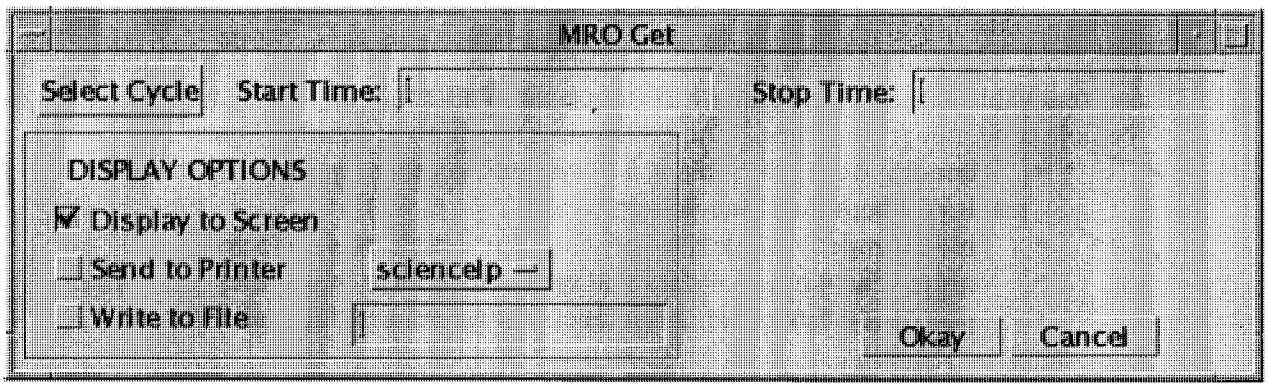


Fig 5.5 MRO_Get window

5.5.1 Select Cycle, Start and Stop Times

Across the top of the TCAD window are the three primary user inputs.

- Cycle: A dropdown list of all the cycle numbers in the GPB-L0 database.
- Start Time: The beginning time range the user wishes to select.
- Stop Time: The end of the time range the user has selected.

The Cycle number is an integer value assigned by the database administrator to a particular set of data that makes it unique from all other sets of data in the database. Typically, negative numbers will be used to express pre-launch sets of data and positive numbers will be used to express post-launch sets of data. After launch, a new cycle number should only be generated in the event of an on-board clock reset.
Cycle number information can also be selected from the Option menu (see section 3.3.1)

Start Time must be entered either in the format of YYYY/DOY-HH:MM:SS.ms *(ex: **2001/317-15:34:27**)* or entered as the actual VTCW spacecraft time in 10^{ths} of a second *(ex: **359460120**)* This time represents the number of 10^{ths} seconds elapsed since January 1st, 2000 at 12PM.

Stop Time may be entered in the same absolute format as Start Time, or it may be entered as a relative time in hours *(ie: +10 or +2.5)*

5.5.2 Display Options

Output may be sent to any combination of the following: Displayed to the screen, output to a printer, or written to a file. Display to screen will display the queried data in textedit, similar to outputting to a table from the Display TM Data window. When outputting to a file, a valid Unix filename must be supplied by the user. No file extension is added. By default, MRO get generates a directory in the OFILE directory in a user's home directory. In this directory it outputs a file named uniquely by cycle. The .dri file is the file displayed by TCAD. The user may make a more convenient copy of this file using the 'output to file' option. The name must be a valid Unix filename. No file extension is added. Unless specified by the user, this file will be created in their home directory.

5.5.3 Output file

The .dri file generated by MRO get is a tab-delimited text file which shows both the raw and real value for the mnemonic. It is important to note that the timestamp in this file is Vehicle time, not ground time. The columns in this file are detailed below.

- **Memory Address:** This is a 4-byte hex number representing the address in memory where the value was collected.
- **Tme Stamp:** Vehicle time of when the sample was collected.
- **Value:** The 4 bytes of data that were collected at this address and time.
- **Application Number:** An integer that references the application.

5.5.4 Okay and Cancel Buttons

Selecting Okay will submit the request to the database to retrieve events for the specified time range. Cancel aborts from this screen without retrieving data from Sybase.

5.6 SSget

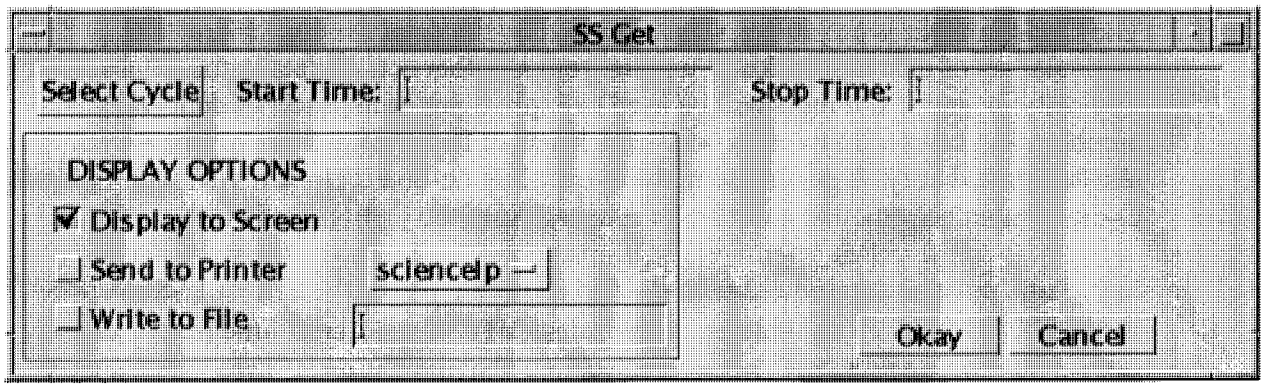


Fig. 5.6 SSget window

5.6.1 Select Cycle, Start and Stop Times

Across the top of the TCAD window are the three primary user inputs.

- Cycle: A dropdown list of all the cycle numbers in the GPB-L0 database.
- Start Time: The beginning time range the user wishes to select.
- Stop Time: The end of the time range the user has selected.

The Cycle number is an integer value assigned by the database administrator to a particular set of data that makes it unique from all other sets of data in the database. Typically, negative numbers will be used to express pre-launch sets of data and positive numbers will be used to express post-launch sets of data. After launch, a new cycle number should only be generated in the event of an on-board clock reset.
Cycle number information can also be selected from the Option menu (see section 3.3.1)

Start Time must be entered either in the format of YYYY/DOY-HH:MM:SS.ms *(ex: **2001/317-15:34:27**)* or entered as the actual VTCW spacecraft time in 10^{ths} of a second *(ex: **359460120**)* This time represents the number of 10^{ths} seconds elapsed since January 1st, 2000 at 12PM.

Stop Time may be entered in the same absolute format as Start Time, or it may be entered as a relative time in hours *(ie: +10 or +2.5)*

5.6.2 Display Options

Output may be sent to any combination of the following: Displayed to the screen, output to a printer, or written to a file. Display to screen will display the queried data in textedit, similar to outputting to a table from the Display TM Data window. When outputting to a file, a valid Unix filename must be supplied by the user. No file extension is added. By default, SSget generates a directory SS in the OFILE directory in a user's home directory. In this directory it outputs two files, one character/hex dump and the other binary, named uniquely by cycle. The '.ssasc' file is the file displayed by TCAD, the other .ssbin file is available for programs that can read binary input. The user may make a more convenient copy of this file using the 'output to file' option. The name must be a valid Unix filename. No file extension is added. Unless specified by the user, this file will be created in their home directory.

5.6.3 Output file

The .ssasc and .ssbin files generated by SSget is a file which shows header information plus a hex dump (or binary dump for .ssbin) of each snapshot in the time range requested. It is important to note that the timestamp in this file is Vehicle time, not ground time. The columns in this file are detailed below.

- **Cycle:** The cycle number this event was stored under.
- **VTCW:** The spacecraft time when the snapshot was stored.
- **f_0:** The f_0 clock counter for this snapshot.
- **Snapshot ID:** The ID of this snapshot

- **Decimation:** Please see S0401 for more details on this value
- **Channel:** Please see S0401 for more details on this value
- **Axis:** Please see S0401 for more details on this value
- **Indx:** Please see S0401 for more details on this value
- **GSS_Spare:** Please see S0401 for more details on this value
- **Length:** Please see S0401 for more details on this value
- **Data:** The actual bytes of data that were collected and make up this snapshot.

5.6.4 Okay and Cancel Buttons

Selecting Okay will submit the request to the database to retrieve events for the specified time range. Cancel aborts from this screen without retrieving data from Sybase.

5.7 Time Converter

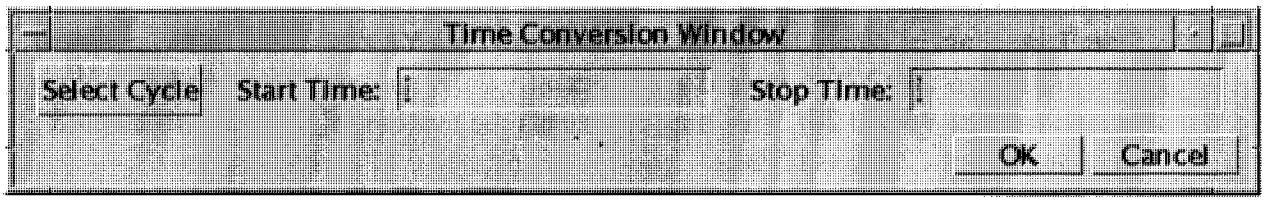


Fig. 5.7 Time Converter Window

5.7.1 Select Cycle, Start and Stop Times

Across the top of the TCAD window are the three primary user inputs.

- Cycle: A dropdown list of all the cycle numbers in the GPB-L0 database.
- Start Time: The beginning time range the user wishes to select.
- Stop Time: The end of the time range the user has selected.

The Cycle number is an integer value assigned by the database administrator to a particular set of data that makes it unique from all other sets of data in the database. Typically, negative numbers will be used to express pre-launch sets of data and positive numbers will be used to express post-launch sets of data. After launch, a new cycle number should only be generated in the event of an on-board clock reset.
Cycle number information can also be selected from the Option menu (see section 3.3.1)

Start Time must be entered either in the format of YYYY/DOY-HH:MM:SS.ms *(ex: **2001/317-15:34:27**)* or entered as the actual VTCW spacecraft time in 10^{ths} of a second *(ex: **359460120**)* This time represents the number of 10^{ths} seconds elapsed since January 1st, 2000 at 12PM.

Stop Time may be entered in the same absolute format as Start Time, or it may be entered as a relative time in hours *(ie: +10 or +2.5)*

5.7.2 Ok and Cancel

Pressing Ok will return a window in which the start and stop times are both shown with the YYYY/DOY-HH:MM:SS format next to their corresponding VTCW spacecraft times. Pressing Cancel will exit the window.

Chapter 6: Command-line Tools

6.1 The auto-plot command-line tool

Auto_plot is a command-line function that uses the TCAD saved configuration files to generate plots from the command line. The command-line syntax is as follows:

Auto_plot <cycle> <start_time> <end_time> <file1> <..> <fileN>

The start and end times used on the command line may use any syntax allowed by the user interface (see Section 3.1.1 for details) however, text times should be enclosed in single-quote marks to prevent the Unix shell from attempting to interpret them. The files may be any valid *.tcad configuration files. If no path is provided, the default path of the user's home directory is assumed. The '.tcad' extension is implicit and may be entered by the user but will be automatically appended if it is not present. The output generated by this routine is sent directly to the default printer the user selected in TCAD. This program requires no interaction with the user beyond the command-line arguments to start it and may therefore easily be scripted into another program or run from a cron job or .procmail script.

Chapter 7: TroubleShooting

Startup Problems:

The command **showserver** may be issued at the Unix command line (on the science server only) to verify that the science server is running. If the user has started TCAD and sees the following message in the IDL window (The Unix command-window TCAD was started from), the science server, network connection has failed or the user's account is not configured correctly.

% XMANAGER: Caught unexpected error from client application. Message follows...
% CALL_EXTERNAL: Error loading sharable executable.
Symbol: db_connect, File =
/apps/supported/lasp/src/db/db_routines.so
ld.so.1: /apps/licensed/idl-5.4/idl_5.4/bin/bin.solaris2.spa
rc/idl: fatal: libct.so: open failed: No such file or directory
% Execution halted at: DB_CONNECT 56

In all cases, either the network administrator or the database administrator should be contacted.