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**GENPLOT: An Interactive Program  
for Display and Analysis of Data**

**USERS MANUAL**

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## 1. Introduction

GENLPLOT is an interactive program written in FORTRAN and running under VAX/VMS that enables technicians, scientists, engineers, and other users to quickly and accurately examine and analyze data. The current version utilizes the GRAPAC4 plot package<sup>1</sup>, reads a standard input file or permits direct data entry, and is optimized for use with data stored in MDS<sup>2</sup> databases. This program has been the principal interactive data analysis tool used on the Tara Tandem Mirror Experiment<sup>3</sup> and on the Constance II Mirror Experiment. The program is menu driven with options selected on command lines distinguished by various prompts. Subsequent changes and additions to the program will be indicated by a version number greater than that appearing in the welcome message of the example in section 2.1, and will be documented in the appropriate menu(s).

## 2. Getting Started

The DCL verb GENL is defined; all of its qualifiers and parameters are optional. Tara defaults appear in parentheses in the following list of qualifiers.

/S=	Shot number ( -1)
/D=	Device type ( RETRO)
/N=	Namelist file name ( GENLNML) {filetype must be NML}
/HCD=	Device type for hardcopy ( QMS)
/HCP=	Port /queue for hardcopy ( P4)
/ALTDB=	Alternate Data base logical name (TARA\$)

The parameter is:

P1 Signal name

The namelist file GENLNML will be used if it exists and no signal name is given or a logical name translation of the qualifier exists. Otherwise, a prompt requests a signal name input.

Most directly, GENLPLOT is run by specifying the shot number as a qualifier and the signal name as a parameter e.g.

```
$ GENL/S=16140 CC_DIAM_BS2P
```

or the default namelist file (see section 3.2.12 entitled Saving the Kit in a Namelist File) and the current shot number (the default value) may be used. If no namelist file exists then the user will be prompted for a signal name.

```
$GENL
```

Optionally, a shot number qualifier may be specified

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\$GENL/S=16140

and/or the device type.

\$GENL/S=16140/D=VT125

Other qualifiers specify the hardcopy port/queue, hardcopy device type, the name of an alternate database, or the name of a namelist file. It should be remembered that the graphics output can be customized by use of logical names defined in GRAPAC4. For example, GP4\$*hcdevtyp*, GP4\$*hcportid*, GP4\$*devtyp*, GP4\$*hcdevtyp\_CHSC*, etc. The definition of any of these logical names will override the verb defaults.

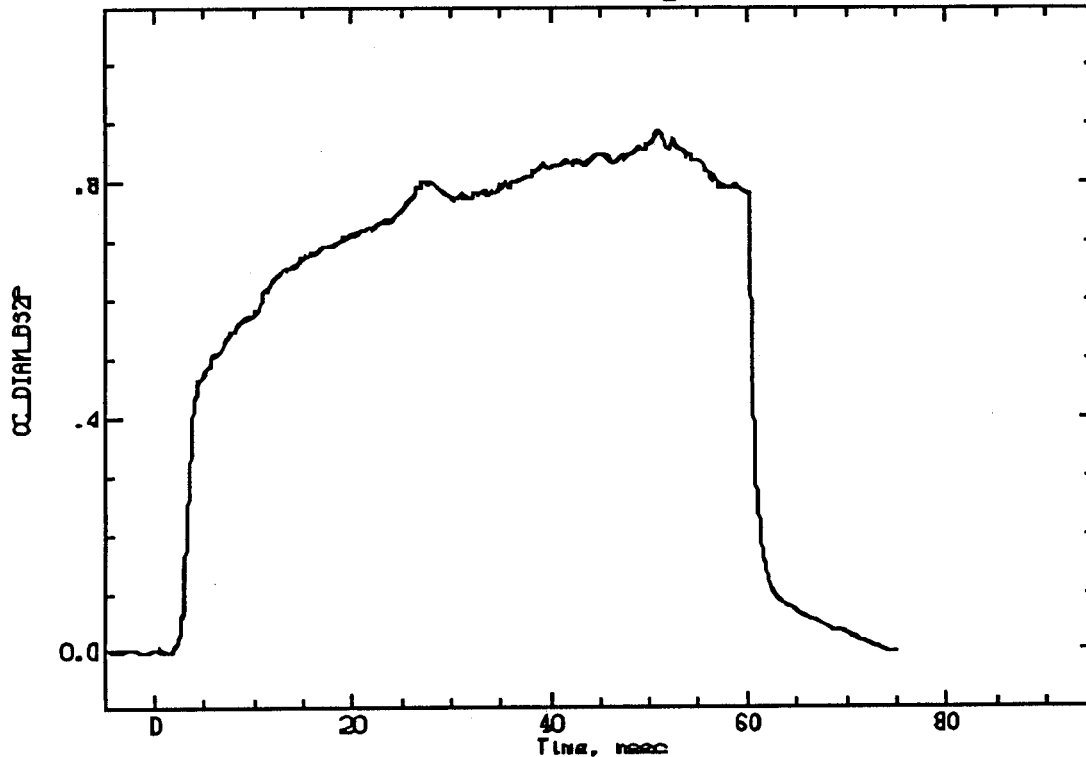
## 2.1. Sample Session

The following sample session illustrates a typical usage of GENLPLOT by plotting shot 16140, the signal CC\_DIAM\_BS2P using the GRAPAC4 MAC driver which assumes the VersaTerm-PRO<sup>4</sup> Tektronix terminal emulation on the Apple® Macintosh™.

```
$GENL/S=16140/D=MAC CC_DIAM_BS2P
```

```
Welcome to GENLPLOT version 2.525
```

```
Shot 16140 1-Aug-1987 14:10
```



```
Graf> ?
```

Typing a ? at the Graf> prompt will bring up the graphic options menu, like this:

```
Graf> List of additional options:
```

```
COPY Make a hardcopy
H     Make a hardcopy
LAS   Make a hardcopy
R     Replot to the terminal
V     Value (of crosshair position in user coordinates)
```

```
Graf><CR>
```

This menu allows the user to make a hardcopy of the plot just viewed, replot the graph to the terminal, or find the value of a specific point on the plot in user coordinates using a crosshair cursor. Hitting <CR> (carriage return) at the Graf> prompt will bring up the first page of the main menu. To exit

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GENLPLOT enter EX or EXIT (at any prompt). Note that a response not recognized at one prompt level is passed up to the next higher prompt level.

```
GENLPLOT Options:      16140  CC_DIAM_BS2P      3200
A      Average and variance within a shot ( A#)
C      Change shot number ( C###, C# ##, CA, CA ##)
D      Dataname (new signal, same shot) ( D#)
EX     Exit
F      Fourier transform ( F#)
G      Gain and offset (lin, exp, log, or pwr) ( G#)
J      Join two signals to form a third
K      Kit of signals ( KS, KS#)
L      List signals ( LS, LP, LT)
M      Multi signal plot ( M###)
N      New shot and signal ( N#)
P      Plot a signal ( P#, P#/#)
R      Reread (same signal, same shot) ( R#)
S      Signal, change parameters of ( S#, SA)
T      Time axis (abscissa), change parameters of
V      Voice-print ( V#)
W      World-view, multishot, plot
X      auto/cross correlation ( X#, X#, #)
Y      change "Y" axis (ordinate) parameters ( Y###, YA ###)
Z      Zero, subtract baseline ( Z#)
#      signal select (# = 1,...,40)
at any prompt: ? display current menu; CTRL Z terminate input
Genl (Menu page 1/2)><CR>
```

This menu is the first page (of two) of the main menu; note the current shot number, signal name, and number of data points of the current signal are listed on the first line. To see the next page of the main menu the user must hit the <CR> key. The second page of the main menu follows:

```

ER      Erase screen
HC      Change the hardcopy port/queue and device type
SP      spawn a process at DCL command level ( DCL, $ verb)
TB      change scale and offset of the "time" base
TC      change "time" base to a different abscissa type ( TS)
CDB     Change data base
DCS     Define a composit signal
DEV     enter new interactive device type
FIT     Fit a curve (lin, exp, pwr, or nor) ( FIT#)
FIX     Fix current signal in the kit
OGR     Overall Graph Reduction
PCL     execute PCL
RID     Read In Data
SAV     Save the kit in a namelist file
SUM     average signals over many shots ( SUM###)
WOD     Write Out Data ( WOD#)
GLOB    change global settings of CHSC and LCUTLN
MAIL    execute MAIL
MENU    toggle MENU display off/on
NOTE    use the Notepad ( NOTE msg)
OMIT    change point omission parameter
SMTH    Smooth current signal
RNML    Reset the kit from a namelist file
Gen1 ( Menu page 2/2)>EXIT
$

```

A carriage return at the Gen1 ( Menu page 2/2)> prompt will plot the current signal (autoscaled). Entering the P option at this juncture will perform the same task at either page of the main menu, although the signal will not necessarily be autoscaled. Type EXIT or EX to leave GENPLOT.



### 3. Plot Options

Once in GENLPLOT there are four basic types of options available to the user. First there are the System Options such as exiting, reading in data, and changing the hardcopy device. Then there are the Data Set Options such as listing all the signals in the shot, changing the shot number or selecting a new signal name. A third type of option is the Display Options which allow the user to manipulate the plot in such ways as changing axis parameters. The last set of options are the algorithmic functions which perform various mathematics on the data such as FFTs, autocorrelations, and curve fitting. In the main menu all of the options are alphabetized, in the following sections they will be grouped according to type. The menu gives a brief explanation of each command, sometimes followed by acceptable formats listed parenthetically. Three pound signs, ###, indicates that a list (n1-n2,n3,n4-n5...) is acceptable as input to the indicated command. In a list a range of numbers is indicated by a hyphen with individual numbers separated by commas, e.g. [1-3,5] means 1,2,3,5. Two pound signs represent a shot number, and one pound sign represents the number of a signal in the kit. Note that a response not recognized at one prompt level is passed up to the next higher prompt level; also case is ignored. Typing CTRL Z (by holding down the control key and typing Z) will terminate input at any prompt and return to the main menu.

In the examples that follow it should be assumed that the display of the two page main menu has been "turned off" via the toggling MENU command (see section 3.1.8 Toggling the Menu Display Off and On).

#### 3.1. System Options

System options are those which allow the user to control the execution of GENLPLOT in response to the prompt, Gen1>.

ER	Erase screen
EX	Exit
HC	Change the hardcopy port/queue and device type
SP	spawn a process at DCL command level ( DCL, \$ verb)
DEV	enter new interactive device type
PCL	execute PCL
MAIL	execute MAIL
MENU	toggle MENU display off/on
NOTE	use the Notepad ( NOTE msg)
?	display current menu

##### 3.1.1. Erasing the Screen

Typing ER at the Gen1> prompt will erase the screen.

### 3.1.2. Exiting GENLPLOT

Typing **EX** or **EXIT** at any prompt will terminate the current GENLPLOT session. The following example demonstrates how statistics, including elapsed actual and CPU time of the GENLPLOT session being exited are displayed.

```
Gen1> EX
ELAPSED:0 00:01:09.66 CPU: 0:00:04.77 BUFIO: 68 DIRIO: 57 FAULTS: 681
$
```

### 3.1.3. Changing the Hardcopy Queue and the Device Type

Typing **HC** at the **Gen1>** prompt enables the user to change the current hardcopy queue and device type. In order to switch to a printer other than the default printer the user must know the name of the print queue and the type of printing device located at that queue. In this example **P8** is the name of the new print queue and **QMSIGV** is the type of printing device.

```
Gen1> HC
Enter HCPORTID> P8
Enter HCDEVTYP> QMSIGV
Gen1>
```

### 3.1.4. Spawning a Process at DCL Command Level

To spawn a subprocess at the DCL command level from inside of a GENLPLOT session the user can type **SP** and execute as many DCL commands as desired before logging back out as in this example

```
Gen1> SP
$ SHOW TIME
      8-JUN-1987 13:25:19
$ LOGOUT
Gen1>
```

Or a DCL command preceded by a **\$** may be entered on one line as in the following example, after which control is automatically returned to the GENLPLOT level.

```
Gen1> $ DIR TARA$ROOT:[AML]

Directory TARA$ROOT:[AML]

ALLLIB.OLB;1      AUTL.OLB;9      BEV.OLB;2      GLSUB.OLB;1
GP4.OLB;1        TAP.OLB;2      TAPSHR.EXE;15  TPU.VT200KEYS;3
TPUSECINI.200;4  TPUSECINI.VT100;1  TPUSECINI.VT200;1  UCB.OLB;1
VECSHR.EXE;2

Total of 13 files.
Gen1>
```

Similarly, the command `DCL` prompts for one `DCL` command and then returns to GENLPLOT.

```
Gen1> DCL
DCL Command> SHOW LOGICAL AML$
"AML$" = "TARA$ROOT:[AML]" (LNM$SYSTEM_TABLE)
Gen1>
```

### 3.1.5. Changing the Terminal Device Type

If the `/D` qualifier was not used to initiate GENLPLOT (see section 2. Getting Started) or was used in error so that the terminal device type is different from the terminal being used, then the user has the ability to change the terminal device type using the `DEV` command. The following example illustrates how to change to the `GO235` device type which corresponds to GraphOn model 235 terminals.

```
Gen1> DEV
Enter DEVTYP> GO235
Gen1>
```

### 3.1.6. Executing PCL

Typing `PCL` at the `Gen1>` prompt gives the user access to `PCL`, the plot control facility of `MDS`

### 3.1.7. Execute VMS Mail

Typing `MAIL` at the `Gen1>` prompt allows the user to use the `VMS Mail` facility without exiting the GENLPLOT session.

```
Gen1> MAIL

MAIL> EXIT
Gen1>
```

### 3.1.8. Toggling the Main Menu Display Off and On

The `MENU` command gives the user the option of toggling on or off the display of the two page main menu. Note that there is no response from GENLPLOT for the `MENU` command. For all of the examples demonstrated in this manual the menu display has been toggled off.

### 3.1.9. Using the Notepad

Typing `NOTE` at the `Genl>` prompt will activate the Notepad facility to append messages on a notepad file kept in `SYSS$LOGIN:GENLNOTES.TXT`; on the first use of `NOTE` in a GENLPLOT session the date and time are written on the notepad. The note pad is available to the GENLPLOT user for making or adding to an ongoing file of miscellaneous notes. The `NOTE` facility has its own menu and prompt. The `.EDIT` command from the `NOTE` menu will bring the EDT editor for editing the `NOTE` file (remember new notes are appended to the end of the file). Typing `NOTE` and `<CR>` will invoke the `NOTE` menu as in this example the first time and just the `>` prompt subsequently.

```
Genl> NOTE
      Note pad options:

msg      Text to be entered on the notepad
          except
.EDIT    EDIT the notepad file
.EXIT    Terminate note taking
.HELP    Display this list
.QUIT    Terminate note taking
.        Terminate note taking
?        Display this list
```

```
>.QUIT
Genl>
```

The `NOTE` menu directs the user on how to enter text to be added to the notepad, edit the notepad file, exit the notepad facility, ask for help on using the notepad facility, and display the `NOTE` menu. To add a line of text to the `NOTE` file, the user may enter `NOTE` followed by the line of text as in the following example.

```
Genl> NOTE a simple line of text
Genl>
```

The message "a simple line of text" will have been added to the notepad.

### 3.1.10. Terminating Input

Typing `CTRL Z` (by holding down the control key and typing `Z`) will terminate input at any prompt and return to main menu.

### 3.1.11. Displaying Menus

Typing `?` at any prompt will display that menu

### 3.2. Data Set Options

After plotting an initial set of data the user may want to see more without having to quit GENLPLOT and starting over. There are six different ways of accessing new data sets. In the first page of the main menu there are three. The user could change the shot number and keep the signal the same (C option), change the signal and keep the same shot number (D option), or change the shot number and the signal (N option). Assembling a set of data signals or 'building a kit' is done most often by using the Dataname option. After adding signals or at any time the user may display all the signals with the kit option. There are four different types of signals, regular, fixed, composit, and arrayed. Signal names are made up of letters, numbers and underscores. In the case of arrayed signals part of the signal name is a list of numbers enclosed in square brackets (see section 3. for a description of list format).

C	Change shot number ( C###, C# ##, CA, CA ##)
D	Dataname (new signal, same shot) ( D#)
K	Kit of signals ( KS, KS#)
L	List signals ( LS, LP, LT)
N	New shot and signal ( N#)
R	Reread (same signal, same shot) ( R#)
#	signal select (# = 1, ..., 40)
CDB	Change data base
DCS	Define a composit signal
FIX	Fix current signal in the kit
RID	Read In Data
SAV	Save the kit in a namelist file
WOD	Write Out Data ( WOD#)
RNML	Reset the kit from a namelist file

#### 3.2.1. Changing the Shot Number

The c command, entered at the Gen1> prompt enables the user to add a signal to the kit using the same signal the one that is currently selected, from a user-specified shot number. The C### command, where ### represents a list of signals, changes the shot number of a list of signals, C# ## changes a specific signal and CA changes all the signals in the kit. The C command works on regular and arrayed signal types. The following example illustrates some of these possibilities.

```
Gen1> K
 1 16140      CC_DIAM_BS2P          3200      -0.100000      1.10000
Gen1> C
Enter new shot number: 16141
Gen1> K
 1 16140      CC_DIAM_BS2P          3200      -0.100000      1.10000
 2 16141      *CC_DIAM_BS2P        3200      -0.100000      1.10000
Gen1>
```

```
Genl> K
  1 16140    CC_DIAM_BS2P      3200      -0.100000      1.10000
  2 16141    CC_NL_BS2P       4001      -0.100000     -0.100000
  3 16142    *CC_PPD_4        8000      -0.100000     -0.100000
```

```
Genl> C1-3
Enter new shot number: 16143
```

```
CC_DIAM_BS2P
CC_NL_BS2P
CC_PPD_4
```

```
Genl> K
  1 16143    CC_DIAM_BS2P      3200      -0.100000      1.10000
  2 16143    CC_NL_BS2P       4001      -0.100000     -0.100000
  3 16143    *CC_PPD_4        8000      -0.100000     -0.100000
```

```
Genl> C1 16144
```

```
Genl> K
  1 16144    *CC_DIAM_BS2P      3200      -0.100000      1.10000
  2 16143    CC_NL_BS2P       4001      -0.100000     -0.100000
  3 16143    CC_PPD_4        8000      -0.100000     -0.100000
```

```
Genl> CA 16146
```

```
CC_DIAM_BS2P
CC_NL_BS2P
CC_PPD_4
```

```
Genl> K
  1 16146    *CC_DIAM_BS2P      3200      -0.100000      1.10000
  2 16146    CC_NL_BS2P       4001      -0.100000     -0.100000
  3 16146    CC_PPD_4        8000      -0.100000     -0.100000
```

```
Genl>
```

### 3.2.2. Asking for a New Signal from the Same Shot

Typing D at the Genl> prompt allows the user to add a new signal to the kit from the shot data that is currently selected (see section 3.2.7 Selecting a signal to work with). Typing D#, where # represents the number of a signal already in the kit, at the Genl> prompt allows the user to change the indicated signal to a new signal name or an arrayed signal name. An arrayed signal may be read in by entering an arrayed signal: string[list], where list is a list of numbers, e.g. CC\_PPD\_[1-4,7]. The D command also allows the user to delete a signal from the kit even if they are fixed (see section 3.2.10 Fixing the Current Signal in the Kit). To delete a signal, enter a <CR> at the Enter new signal name: prompt. The following example illustrates all three situations.

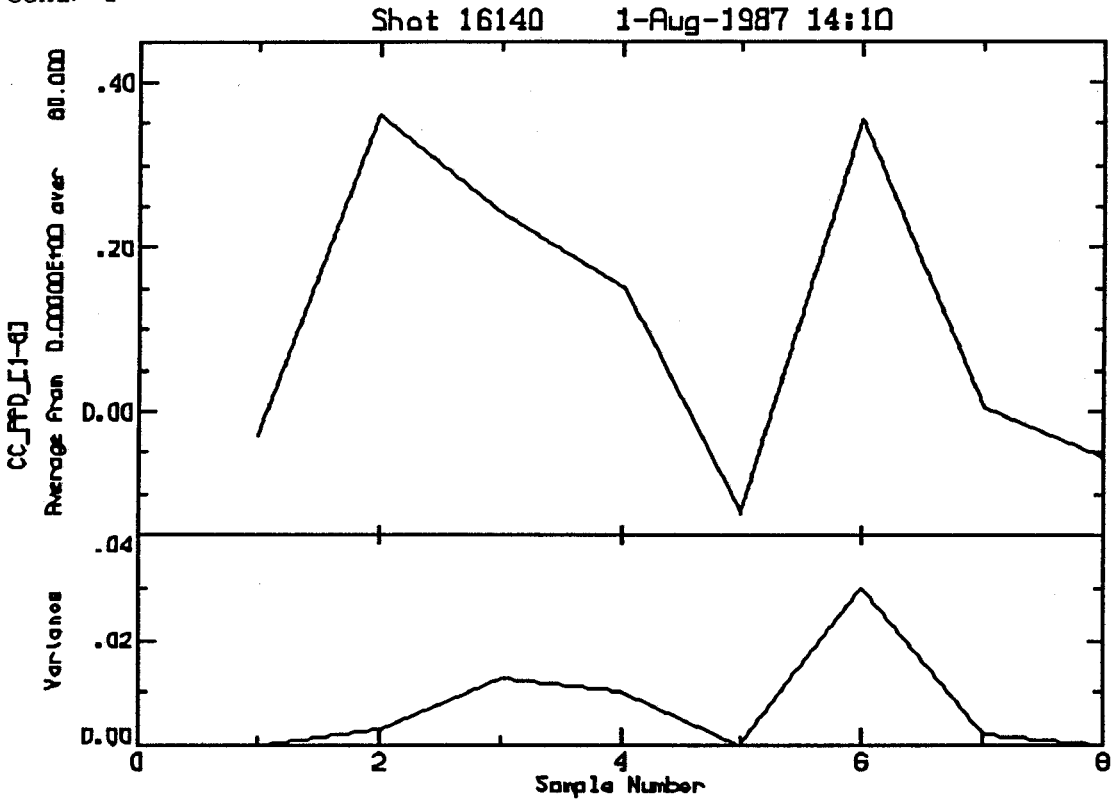
```
Genl> K
  1 16140    CC_DIAM_BS2P      3200      -0.100000      1.10000
Genl> D
Enter new signal name: CC_PPD_4
Genl> K
  1 16140    CC_DIAM_BS2P      3200      -0.100000      1.10000
  2 16140    *CC_PPD_4        8000      0.000000E+00  0.000000E+00
Genl> D1
Enter new signal name: CC_NL_BS2P
Genl> K
  1 16140    *CC_NL_BS2P       4001      -0.100000     -0.100000
  2 16140    *CC_PPD_4        8000      0.000000E+00  0.000000E+00
```

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```

Genl> D2
Enter new signal name:<CR>
Genl> K
  1 16140      *CC_NL_BS2P                4001          -0.100000    -0.100000
Genl> D
Enter new signal name: CC_PPD_[1-8]
Enter name for abscissa variable><CR>
Enter abscissa values (later)? [y/N]><CR>
Enter start time and delta> 0,80,1
Zero each signal? [y/N]><CR>
Gain and offset for each signal? [y/N]><CR>
Genl> K
  1 16140      CC_DIAM_BS2P                3200          -0.100000     1.10000
  2 16140  A *CC_PPD_[1-8]                8   S&V  0.000000E+00 0.000000E+00 N
Genl> P

```



```

Graf> <CR>
Genl>

```

### 3.2.3. Listing the Contents of the Kit

Typing **K** at the `Gen1>` prompt will generate a list of the contents of the kit. The GENLPLOT kit is the set of different shots and their different signals that have been opened for display and numerical manipulation in the current GENLPLOT session. Listing the contents of the kit shows what has been opened so far. The information displayed by the kit listing includes the following: first is the signal number which is used for selecting a signal to work with (see section 3.2.7); next is the shot number for the signal; then the signal title; followed by the number of data points in the signal; and finally the signal axis interval parameters (if these two numbers are equal autoscaling is used).

```

1 16140      CC_DIAM_BS2P          3200      -0.100000      1.10000
2 16141      CC_DIAM_BS2P          3200      -0.150000      -0.150000
3 16140 F    CC_NL_BS2P           4001         0.000000E+00  0.000000E+00
4 16140 C    1+3                  3200      -1.000000E+13  1.100000E+14
5 16141 A *CC_PPD_[1-8]           8      S&V      0.000000E+00  0.000000E+00 N
Gen1>

```

↑1

↑2

↑3

Additional parameters may appear at three places 1,2,3 indicating at 1 signal types, F for fixed, C for composited, A for arrayed signals and no parameter indicates a regular signal (see section 3.2 for a description of signal types). At 2 signal plot class: blank, signal; S&V, signal and variance; HS, histogrammed signal; and HS&V, histogrammed signal with variance. And at 3 abscissa type: blank, time; N, sample number; F, frequency; S, shot number; O, other. In order to display a more detailed list of parameters for a signal the user can use the **KS** or **KS#** command which produce a listing like the following.

```

Gen1> KS 1
Signal parameters: Current signal number 1 Shot 16140 1-Aug-1987 14:10

```

```

Signal: CC_DIAM_BS2P
vs.: Time, msec
CC_DIAM_BS2P
CC_DIAM_BS2P_TM
Number of sample points is          3200
Sample point increment is           1
Time, msec axis parameters:
  WA      WB      IW NW LW      WFT      DWLT      WSC      WREF
-5.00    95.0      0  4  5    -20.0    20.0      1.0E-03  0.0E+00
Signal axis parameters:
  SA      SB      IS NS LS      SFT      DSLT
-0.100    1.10      0  4  3    -0.400    0.400
Gen1>

```

The signal and time axis parameters that appear in this listing are described in appendices A.1 and B.1 respectively.



### 3.2.4. Listing the Signals in the Shot

Typing **L** at the **Gen1>** prompt will bring up the **TDB command>** prompt and hitting carriage return will produce a list of all the signals available for the current shot number. Typing **LS** at the **Gen1>** prompt will list all the raw data signals, **LP** will list the processed data signals, and **LT** will list all the transforms. Wild card characters in a search list are also possible, e.g.

```
Gen1> L
TDB Command> DIR *CC_PPD_*
Directory of shot      16141

LEVEL: T  Transforms
CC_PPD_1_B           CC_PPD_2_B           CC_PPD_3_B
CC_PPD_4_B           CC_PPD_5_B           CC_PPD_6_B
CC_PPD_7_B           CC_PPD_8_B           CC_PPD_I_1
CC_PPD_I_1_TM       CC_PPD_I_2           CC_PPD_I_2_TM
CC_PPD_I_3           CC_PPD_I_3_TM       CC_PPD_I_4
CC_PPD_I_4_TM       CC_PPD_I_5           CC_PPD_I_5_TM
CC_PPD_I_6           CC_PPD_I_6_TM       CC_PPD_I_7
CC_PPD_I_7_TM       CC_PPD_I_8           CC_PPD_I_8_TM
CC_PPD_N_1           CC_PPD_N_1_TM       CC_PPD_N_2
CC_PPD_N_2_TM       CC_PPD_N_3           CC_PPD_N_3_TM
CC_PPD_N_4           CC_PPD_N_4_TM       CC_PPD_N_5
CC_PPD_N_5_TM       CC_PPD_N_6           CC_PPD_N_6_TM
CC_PPD_N_7           CC_PPD_N_7_TM       CC_PPD_N_8
CC_PPD_N_8_TM
Total of 40 records

LEVEL: S  Raw Data
CC_PPD_1             CC_PPD_1_TM         CC_PPD_2
CC_PPD_2_TM         CC_PPD_3             CC_PPD_3_TM
CC_PPD_4             CC_PPD_4_TM         CC_PPD_5
CC_PPD_5_TM         CC_PPD_6             CC_PPD_6_TM
CC_PPD_7             CC_PPD_7_TM         CC_PPD_8
CC_PPD_8_TM
Total of 16 records
Grand Total of 56 records
Gen1>
```

See the TDB directory command in MDS; in fact any TDB command may be executed.

### 3.2.5. Getting a New Shot and Signal

Typing N#, where # is the number of a signal that is either currently in the kit or is new, at the Gen1> prompt will allow the user to open a new shot and signal. The N command works for regular and arrayed signals. If the signal number is omitted the first available signal number is used.

```
Gen1> K
 1 16140 *CC_NL_BS2P          4001          -1.000000E+13  1.100000E+14
 2 16141   CC_DIAM_BS2P       3200           -0.100000      -0.100000
 3 16142   CC_DIAM_BS2P       3200           -0.100000      -0.100000
 4 16143   CC_DIAM_BS2P       3200           -0.100000      -0.100000
Gen1> N5
Enter new shot number: 16144
Enter new signal name: CC_PPD_4
Gen1> K
 1 16140   CC_NL_BS2P          4001          -1.000000E+13  1.100000E+14
 2 16141   CC_DIAM_BS2P       3200           -0.100000      -0.100000
 3 16142   CC_DIAM_BS2P       3200           -0.100000      -0.100000
 4 16143   CC_DIAM_BS2P       3200           -0.100000      -0.100000
 5 16144 *CC_PPD_4            8000            0.000000E+00  0.000000E+00
Gen1>
```

### 3.2.6. Rereading the Same Signal and Same Shot.

Typing R#, where # is the number of a signal in the kit, at the Gen1> prompt will allow the user to reread the same signal and shot and to reset the averaging, gain and offset, and zeroing options in order to recover the original signal.

### 3.2.7. Selecting a Signal to Work With

Typing the number of the desired signal at the Gen1> prompt selects that signal to work with. Displaying the kit (see section 3.2.3) will show what number each signal is. For example if the kit is displayed the current signal is indicated by an asterisk. Changing the current signal to shot 16142, signal CC\_NL\_BS2P is accomplished by entering a 3 at the Gen1> prompt since that is the number of that signal in the kit. If the contents of the kit is listed again, the current signal is indicated by the asterisk, this time in front of signal number 3.

```
Gen1> K
 1 16140   CC_DIAM_BS2P       3200           -0.100000      1.10000
 2 16141   CC_DIAM_BS2P       3200           -0.100000      1.10000
 3 16142   CC_NL_BS2P         4001            0.000000E+00  0.000000E+00
 4 16143 *CC_PPD_4            8000            0.000000E+00  0.000000E+00
Gen1> 3
Gen1> K
 1 16140   CC_DIAM_BS2P       3200           -0.100000      1.10000
 2 16141   CC_DIAM_BS2P       3200           -0.100000      1.10000
 3 16142 *CC_NL_BS2P         4001            0.000000E+00  0.000000E+00
 4 16143   CC_PPD_4          8000            0.000000E+00  0.000000E+00
Gen1>
```

### 3.2.8. Changing the Data Base

Typing **CDB** at the **Gen1>** prompt allows the user to change MDS data bases and access signals stored, for example, in a private MDS database. In the following example the current database is changed from **TARA\$** to **TS\$** and back again. Note how the current database is indicated after a **CDB** command is issued.

```
Gen1> CDB
Current database is TARA$

Enter new database> TS$
Gen1> CDB
Current database is TS$

Enter new database> TARA$
Gen1>
```

### 3.2.9. Defining a Composit Signal

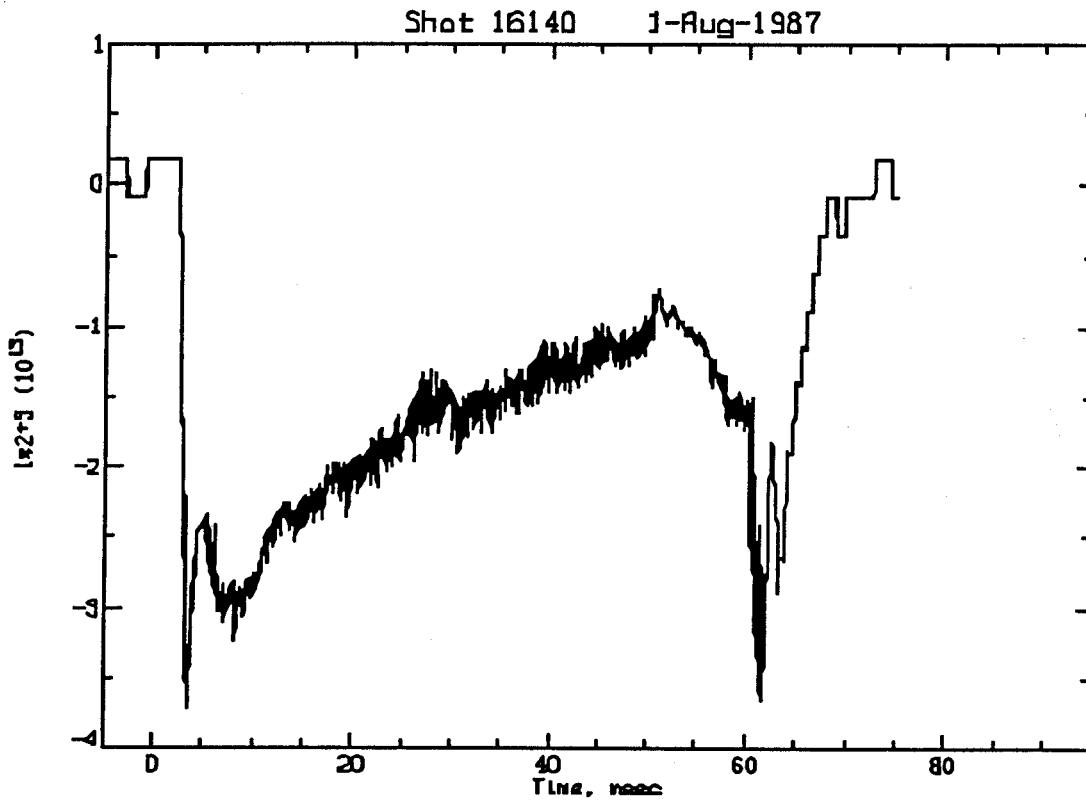
Typing a **DCS** at the **Gen1>** prompt allows the user to construct a composit signal from regular signals. The following table lists the possible unary and binary operations and a description of each. It should be noted that when entering formulas for constructing composit signals the operations are case specific and no spaces are allowed in between characters.

<u>Unary</u>		<u>Binary</u>	
-	=negation	+	=addition
/	=inversion	-	=subtraction
d	="time"derivative	*	=multiplication
r	=square root	/	=division
s	=integration	d	=derivative, ds1/ds2
		S	=integral, ∫s1ds2

```
Gen1> DCS
In Composit Signal Formulae:

Operations for joining signals:
Unary :   -   /   d   r   S
Binary:  +   -   *   /   d   S
Scan binary operations left to right within groups
Groups defined by balanced ()s
Single unary operation on right in each group

Enter formula for composit signal: 1*2+3
1*2+3
Enter alternate signal title><CR>
Enter panel text><CR>
Gen1> P
```



### 3.2.10. Fixing the Current Signal in the Kit

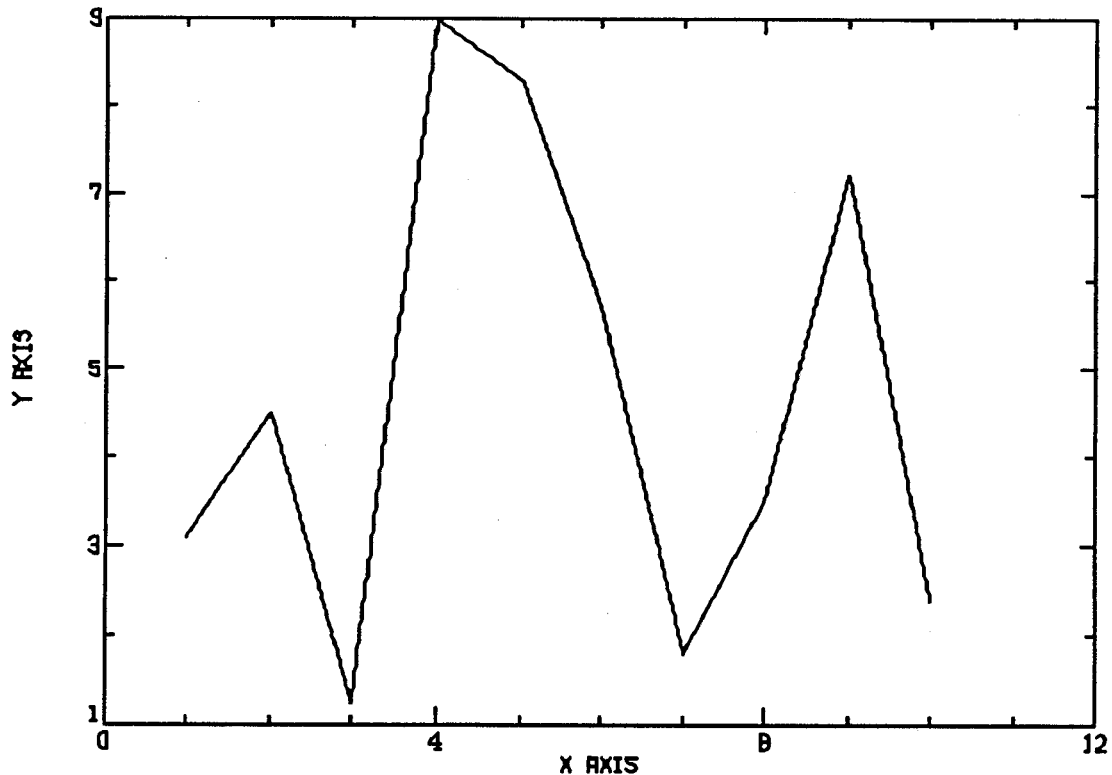
Typing `FIX` at the `Gen1>` prompt allows the user to fix the current signal in the kit, that is to make the signal permanent and unaffected by change commands. A fixed signal may only be deleted by the `D` option (see section 3.2.2 Asking for a New Signal from the Same Shot).

### 3.2.11. Reading in Data

Typing `RID` at the `Gen1>` prompt allows the user to read in data. This function is used to read any file created by the `WOD` command (in section 3.2.13 Writing Out Data), or by another program in the correct format (see below), or to allow direct data entry by the user. The following example demonstrates both possibilities.

```
Gen1> RID
Enter data set filename or <CR> for direct data entry> QUICK.WOD
Gen1>
```

```
Gen1> RID
Enter data set filename or <CR> for direct data entry><CR>
How many data points? > 10
Signal Title > Y AXIS
Abscissa Title > X AXIS
with variances? [y/N]><CR>
Abscissa/ordinate pair ( 1) > 1,3.1
Abscissa/ordinate pair ( 2) > 2,4.5
Abscissa/ordinate pair ( 3) > 3,1.25
Abscissa/ordinate pair ( 4) > 4,9.0
Abscissa/ordinate pair ( 5) > 5,8.3
Abscissa/ordinate pair ( 6) > 6,5.7
Abscissa/ordinate pair ( 7) > 7,1.8
Abscissa/ordinate pair ( 8) > 8,3.5
Abscissa/ordinate pair ( 9) > 9,7.2
Abscissa/ordinate pair (10) > 10,2.4
Gen1> P
```



```
Graf>
Gen1>
```

The following is a listing of quick.wod file illustrating the file format required by the RID command. The first seven lines are optional. The KST parameter (signal plot class) is described in appendix A.6. The data lines are abscissa value, ordinate (signal) value, and optionally the variance of the ordinate.

```

$ type quick.wod
AXTXT
PNTXT
DATESTR Shot 16140      1-Aug-1987 14:10
SIGTITL CC_DIAM_BS2P
TTITL Time, msec
NPTS      41
KST       0
 5.0000    , 0.47506
 5.0250    , 0.47499
 5.0500    , 0.47492
 5.0750    , 0.47685
 5.1000    , 0.47878
 5.1250    , 0.47871
 5.1500    , 0.47864
 5.1750    , 0.47857
 5.2000    , 0.47850
 5.2250    , 0.48043
 5.2500    , 0.48236
 5.2750    , 0.48429
 5.3000    , 0.48222
 5.3250    , 0.48415
 5.3500    , 0.48408
 5.3750    , 0.48601
 5.4000    , 0.48594
 5.4250    , 0.48387
 5.4500    , 0.48380
 5.4750    , 0.48373
 5.5000    , 0.48566
 5.5250    , 0.48559
 5.5500    , 0.48752
 5.5750    , 0.48946
 5.6000    , 0.49139
 5.6250    , 0.49132
 5.6500    , 0.49325
 5.6750    , 0.49518
 5.7000    , 0.49711
 5.7250    , 0.49904
 5.7500    , 0.49897
 5.7750    , 0.49890
 5.8000    , 0.49883
 5.8250    , 0.50476
 5.8500    , 0.50469
 5.8750    , 0.50462
 5.9000    , 0.50455
 5.9250    , 0.50648
 5.9500    , 0.50641
 5.9750    , 0.50634
 6.0000    , 0.50627
$

```

### 3.2.12. Saving the Kit in a Namelist File

Typing `SAV` at the `Gen1>` prompt allows the user to save the kit in a namelist file to easily recreate the GENPLOT run later on. The `'.NML'` is not required when naming the file since it is the default. A `<CR>` will use the default name `GENLNML.NML`.

```
Gen1> SAV
Enter name of namelist save file> SAV.NML
Gen1>
```

### 3.2.13. Writing Out Data

Typing `WOD` at the `Gen1>` prompt allows the user to write out data to the screen and/or to a file. Data saved in a file can later be read in using the `RID` command described in section 3.2.10 Reading in data. Typing a `?` at the `WOD>` prompt will display the `WOD` menu which allows the user to reenter time and array bounds, write output to a file, continue printing the data on the screen, or quit `WOD`. The data are displayed a screen full at a time.

```
Gen1> WOD
```

```
1 16140 CC_DIAM_BS2P 3200
Enter time bounds (and skip increment): Ts,Te[,iskp]> 5,10
```

400	5.0000	0.47506
401	5.0250	0.47499
402	5.0500	0.47492
403	5.0750	0.47685
404	5.1000	0.47878
405	5.1250	0.47871
406	5.1500	0.47864
407	5.1750	0.47857
408	5.2000	0.47850
409	5.2250	0.48043
410	5.2500	0.48236
411	5.2750	0.48429
412	5.3000	0.48222
413	5.3250	0.48415
414	5.3500	0.48408
415	5.3750	0.48601
416	5.4000	0.48594
417	5.4250	0.48387
418	5.4500	0.48380
419	5.4750	0.48373
420	5.5000	0.48566
421	5.5250	0.48559
422	5.5500	0.48752

```
WOD> ?
```

```
WOD> List of additional options:
```

```
Q    Quit
R    Reenter time/array bounds
W    Write output to a file (QUICK.WOD)
      (this file may be reread by using RID)
<CR> continue printing
```

```
WOD> W
```

```
Enter file name (default QUICK.WOD)><CR>  
WOD><CR>  
Gen1>
```

This example will display the data between 5 and 10 msec; if a <CR> is typed for time limits, array bounds are asked for and if none entered the entire signal is displayed.

### 3.2.14. Resetting the Kit from a Namelist File

Typing **RNML** at the Gen1> prompt allows the user to reset the kit from a namelist file (like that created previously using SAV). Any existing kit is replaced since this is not an additive process. To save a kit in a namelist file refer to section 3.2.12 Saving the kit in a namelist file. The default file type is '.NML' and does not necessarily have to be included in the filename.

```
Gen1> RNML  
Enter namelist filename> SAV.NML  
Gen1>
```



### 3.3. Display Options

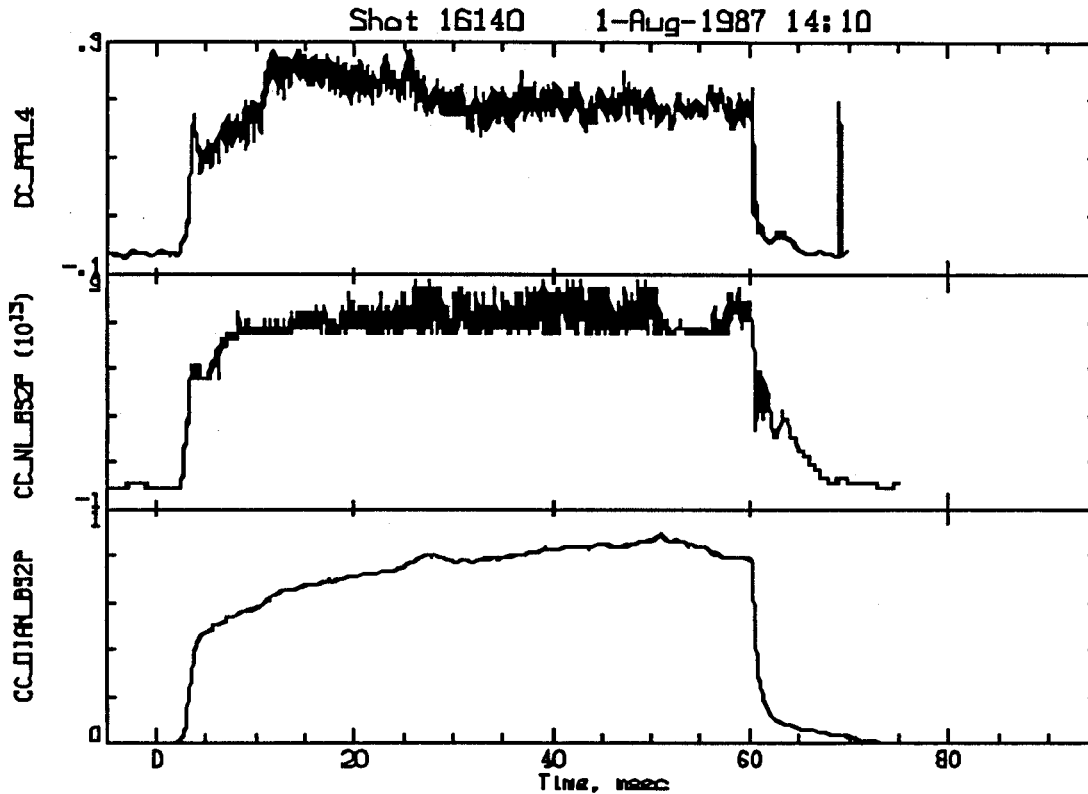
There are several alternatives to plotting a signal versus time. For example a multisignal plot will display any number of signals at a time just as a World-view plot will display several shots at a time. Also available to the user is voice-print plotting and the ability to set gain and offset or change axis parameters.

M	Multi signal plot ( M###)
P	Plot a signal ( P#, P#/#)
S	Signal axis, change parameters of ( S#, SA)
T	Time axis (abscissa), change parameters of
V	Voice-print ( V#)
W	World-view, multishot, plot
Y	change "Y" axis (ordinate) parameters ( Y###, YA ###)
TB	change scale and offset of the "time" base
TC	change "time" base to a different type ( TS)
OGR	Overall Graph Reduction
GLOB	change global settings of CHSC and LCUTLN
OMIT	change point omission parameter
SMTH	Smooth current signal

### 3.3.1. Multi Signal Plot

The user may want to plot several signals in the kit all on one plot. The multi-signal plot facility is available for this purpose. The M command will display all current signals in the kit numbered in the order in which they were opened. The user must then indicate which signals are to appear on the plot using their signal number. Alternatively, the user may simply enter the command M###, where ### represents a list of signals (see section 3.1 Plot Options). After the plot is displayed the M command brings up its own menu allowing the user to make a hardcopy of the plot, replot it to the terminal, rotate the plot, and quit the M menu.

```
Gen1> M
 1 16140    CC_DIAM_BS2P      3200      0.000000E+00 0.000000E+00
 2 16140    CC_NL_BS2P       4001      0.000000E+00 0.000000E+00
 3 16140    CC_PPD_4         8000      0.000000E+00 0.000000E+00
Enter list of signal numbers> 1,2,3
```

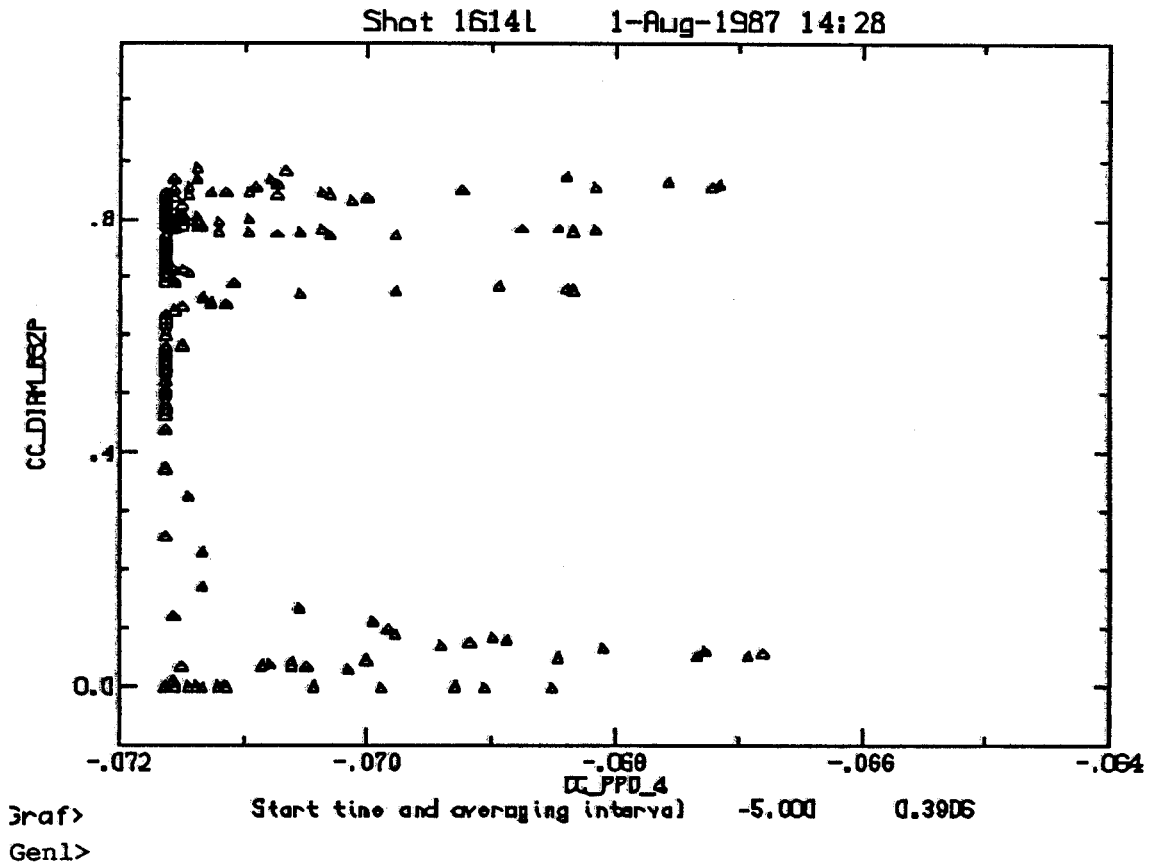


```
M> List of additional options:
COPY Make a hardcopy
H     Make a hardcopy
LAS  Make a hardcopy
Q     Quit this menu
R     Replot to the terminal
ROT  Negate graph rotation flag
M><CR>
Gen1>
```

### 3.3.2. Plot a Signal

To plot the current signal, enter P as in the sample session in section 2.1. P# can also be used to plot a specific signal. To plot one signal against another use the command P#/# where each # stands for a different signal number. In the following example the user has plotted signal 1 against signal 2.

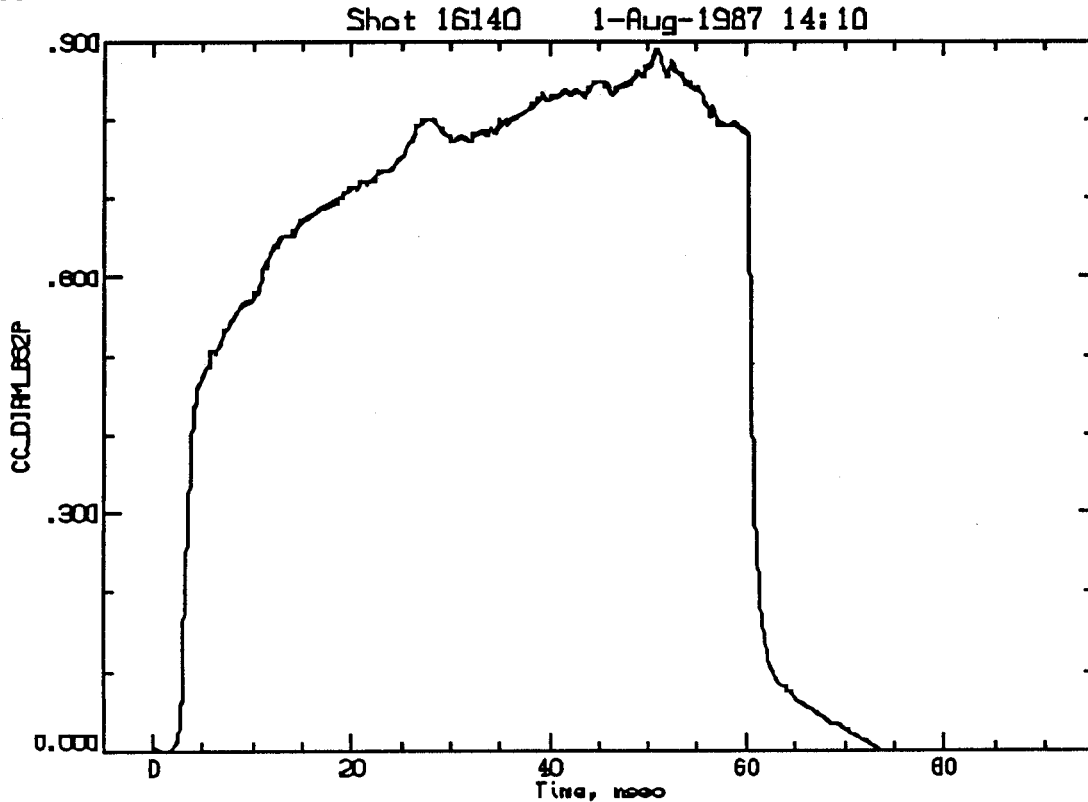
```
Gen1> K
  1 16140    CC_DIAM_BS2P          3200      -0.100000      1.10000
  2 16141    *CC_PPD_4            8000       0.000000E+00  0.000000E+00
Gen1> P1/2
Enter Y to connect points><CR>
```



### 3.3.3. Signal Axis

Typing `s` at the `Gen1>` prompt allows the user to change all of the signal axis parameters. See appendix A.1 Signal Axis Parameters and appendix B.1 Abscissa Axis Parameters for a description of each of the axis parameters. See appendix C. Making a Text String in GP4 for a description on how to construct text strings for such things as the signal and abscissa titles.

```
Gen1> s
Signal parameters: Current signal number 1 Shot 16140 1-Aug-1987 14:10
Signal: CC_DIAM_BS2P
vs.: Time, msec
CC_DIAM_BS2P
CC_DIAM_BS2P_TM
Number of sample points is 3200
Sample point increment is 1
Time, msec axis parameters:
WA WB IW NW LW WFT DWLT WSC WREF
-5.00 95.0 0 4 5 -20.0 20.0 1.0E-03 0.0E+00
Signal axis parameters:
SA SB IS NS LS SFT DSLT
-0.100 1.10 0 4 3 -0.400 0.400
Automatic autoscale [y/N]<CR>
Enter axis parameters: SA,SB,IS,NS,LS[,sft,dslt]> 0.0,0.9,0,9,3
Enter sample increment> 1
CC_DIAM_BS2P
Alternate signal title<CR>
Alternate panel title<CR>
Time, msec
Alternate abscissa title<CR>
Shot 16140 1-Aug-1987 14:10
Alternate graph title<CR>
Gen1> P
```



```
Graf>.<CR>
Gen1>
```

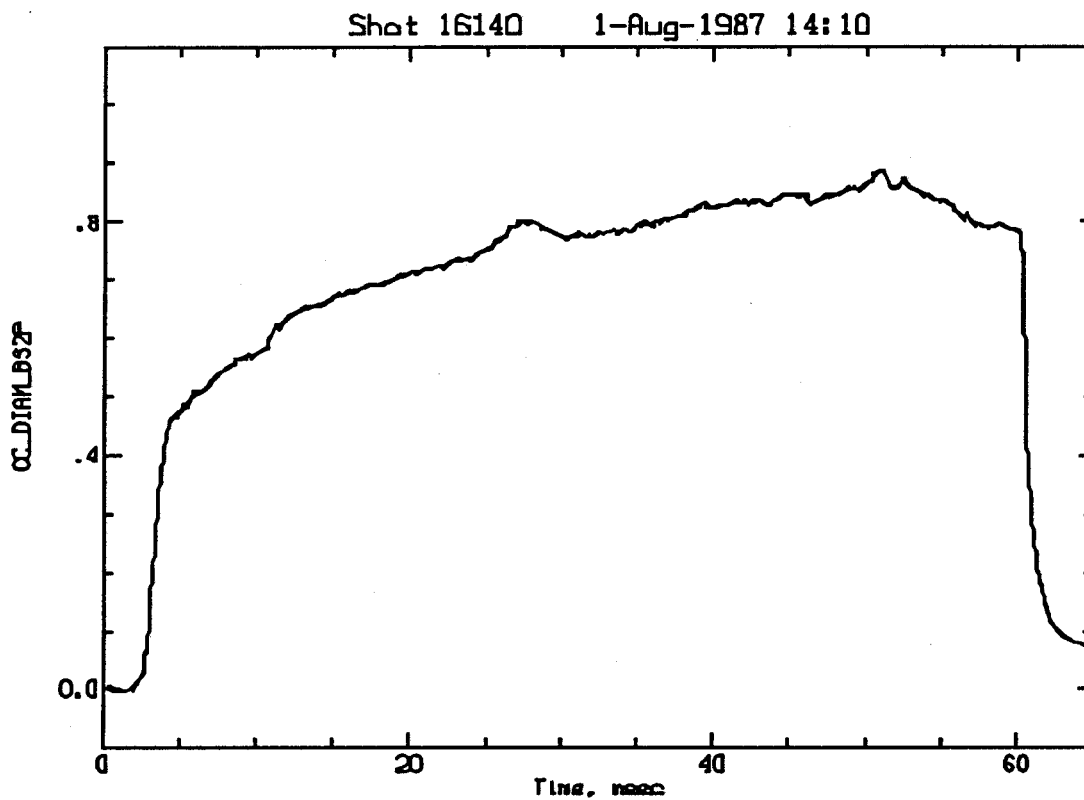
### 3.3.4. Time (Abscissa) Axis

Typing **T** at the **Gen1>** prompt allows the user to change all the time (abscissa) axis parameters. See appendix B.1 Abscissa Axis Parameters, for a description of each of the parameters prompted for by the **T** command.

```
Gen1> T
Change Time, msec
```

TA	TB	IT	NT	LT	TFT	DTLT
-5.00	95.0	0	4	5	-20.0	20.0

```
Enter axis parameters: TA,TB,IT,NT,LT[,tft,dlt]> 0.0,65.0,0,4,5,-20.,20.
Gen1> P
```

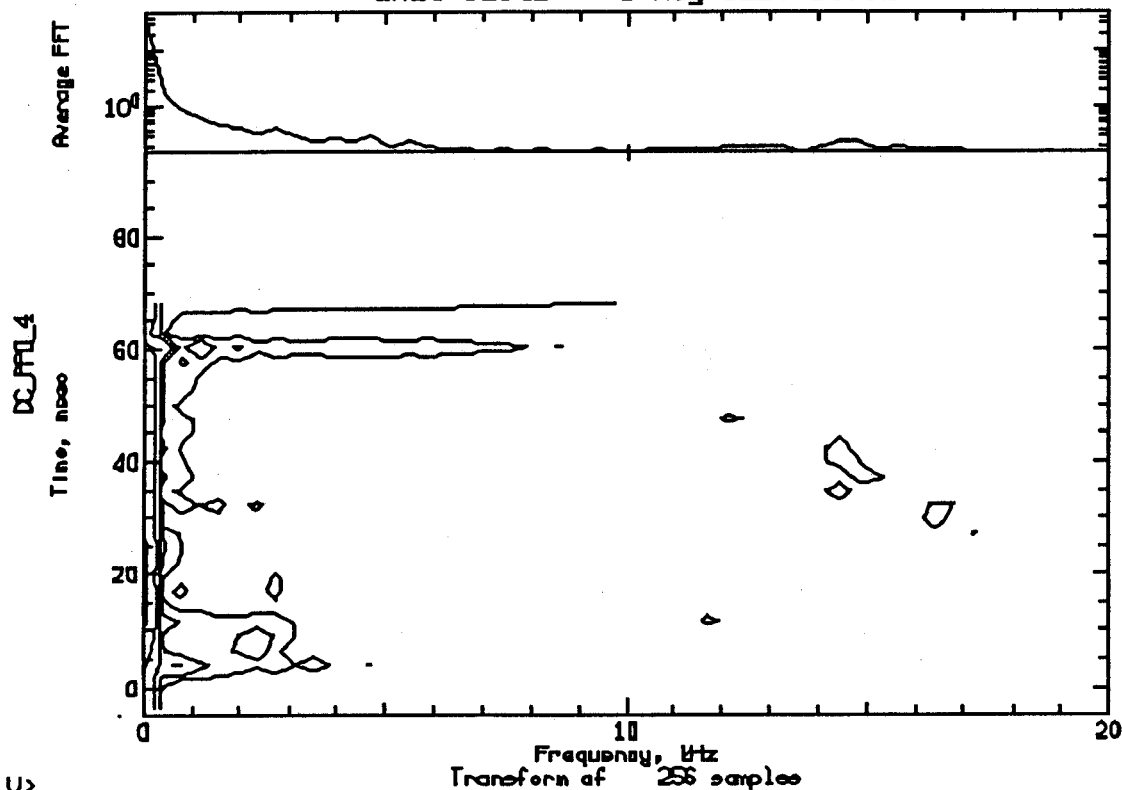


### 3.3.5. Voice Print

Typing `v` at the `Gen1>` prompt allows the user to generate a voice print plot of a signal; a contour plot of time lapsed FFT's. After the voice print is plotted a menu is displayed allowing the user to change the Average FFT axis parameters, modify contour levels, make a hardcopy, quit the voice print facility, replot to the terminal, change the signal and time axis, and toggle the between the time and frequency displays.

```

Non-kit signal? [y/N]><CR>
Enter number of points per FFT [<CR> = 256]
i.e. 32,64,128,256,512,1024,2048,4096,or 8192 ><CR>
Enter how many times to smooth [<CR> = 0]><CR>
Enter number of first isopleth [<CR> = 5]><CR>
  1   2   3   4   5   6   7   8   9
.0001,.0003,.001,.003,.01,.03,.1,.3,.8><CR>
          Shot 16140      1-Aug-1987 14:10
    
```

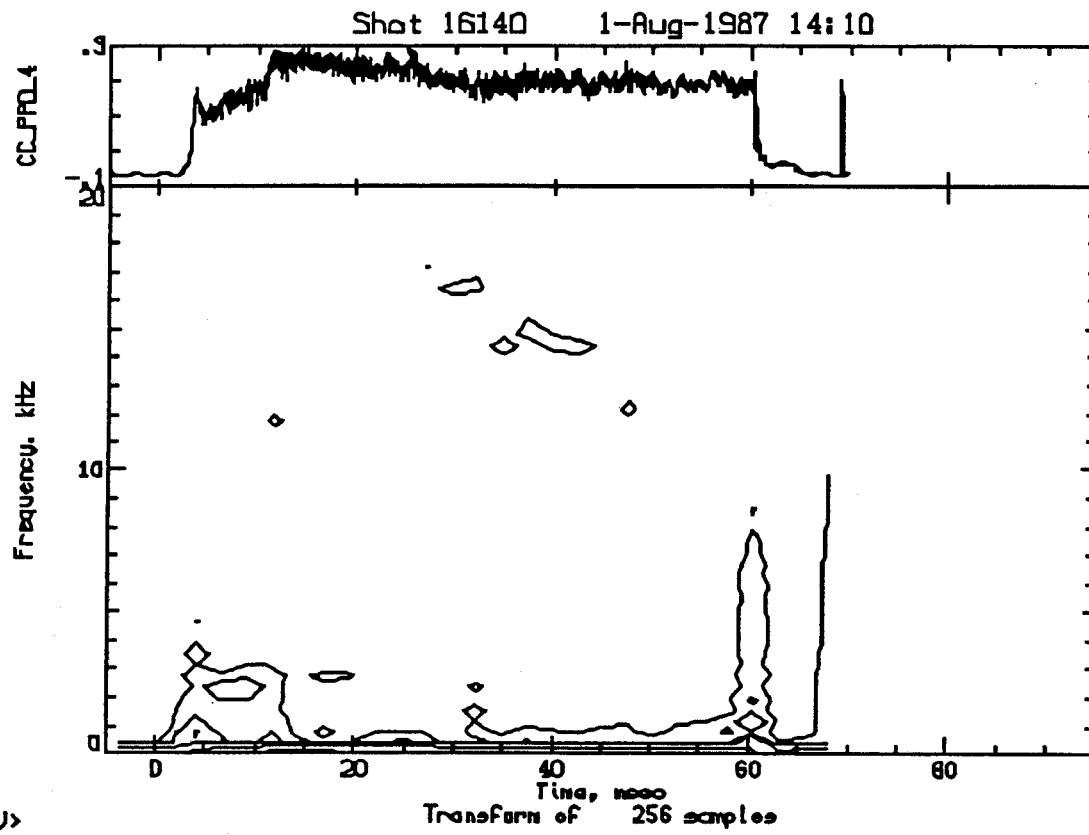


U> G

V> List of interactive options:

- A change Average FFT axis
- CL modify Contour Levels
- COPY make a hardCOPY
- F change Frequency axis
- H make a Hardcopy
- LAS make a hardcopy
- Q Quit
- R Replot to the terminal
- S change Signal axis
- T change Time axis
- TTF Toggle Time-Frequency displays

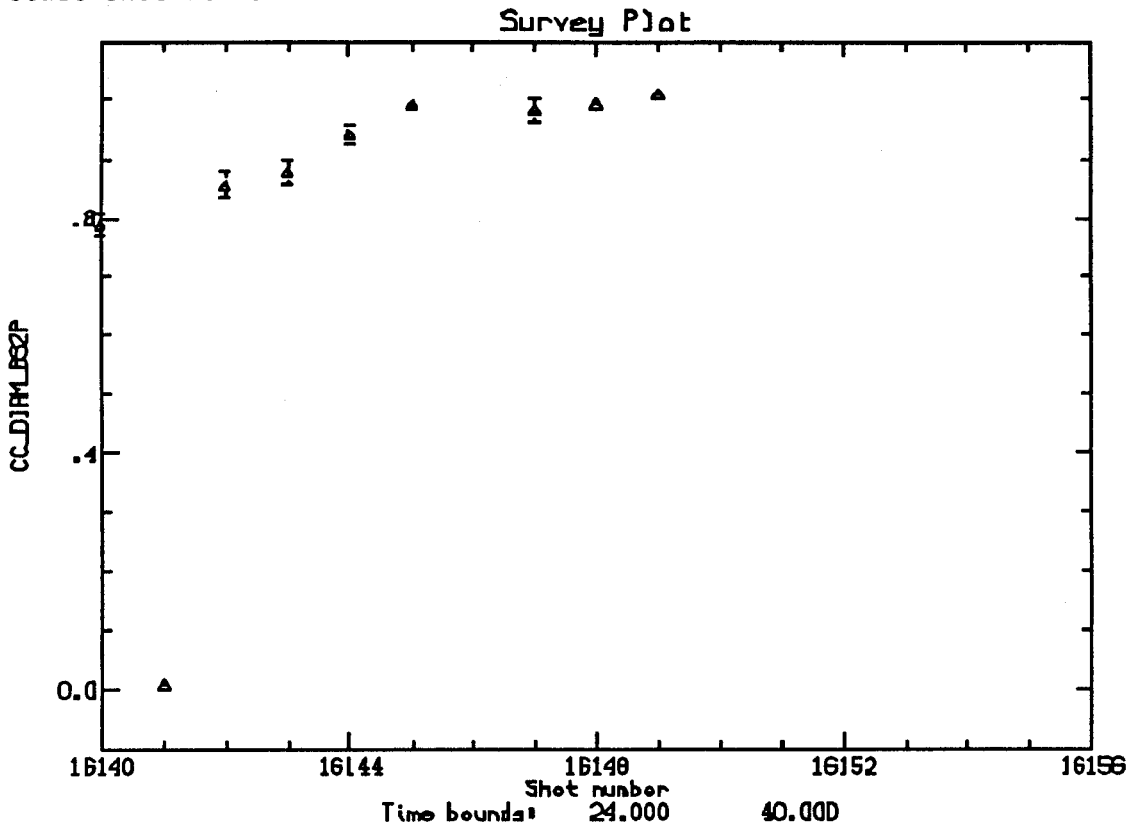
V>TTF



### 3.3.6. World-view

Typing a w at the Gen1> prompt allows the user to create a multi-shot plot, to survey or to scan data over many shots possibly plotting one against another and to select among display options as the signal is plotted. Note that in world-view if fluctuation amplitude is selected to start then there is an additional option to suppress baseline trends from the variance estimates.

```
Gen1> W
  1 16140 *CC_DIAM_BS2P          3200          -0.100000          1.10000
WORLD parameters
Enter signal number for ordinate> 1
Enter time bounds for averaging ordinate> 24,40
Signal display flag:
  Average                <CR> or 0
  Fluctuation Amplitude  T or 1
  Standard Deviation     S or 2
Enter flag><CR>
Enter signal number for abscissa or return to use shot number><CR>
Enter list of shot numbers> 16140-16145,16147,16148-16149
Enter Z to input abscissa value for each shot><CR>
Start shot 16140
Start shot 16141
Start shot 16142
Start shot 16143
Start shot 16144
Start shot 16145
Start shot 16147
Start shot 16148
Start shot 16149
```



W> ?



Typing a ? or a <CR> at the W> prompt after the plot has been drawn will bring up a menu instructing the user on how to perform various manipulations on the world plot. For example the abscissa parameters can be changed, shots can be added to the data set, error bars can be toggled on and off. The user can make a hardcopy, change the title of the graph, initialize parameters, negate shot numbering on each point, change the ordinate axis parameters, replot the graph to the terminal, reread the data, enter a new list of shot numbers, store results as a signal in the kit, swap signals, display a table of parameters and write output to a quick.dmp file (not compatible with RID format described in section 3.2.11).

```

W> List of additional options:
A   Abscissa, change parameters of
    ( new data: AD; display flag: AF; time bounds: AT;
      axis parameters: AS; new title: ATIT)
ASHT Add SHoT numbers to current list
B   Bars, choose error bars or not
COPY Make a hardcopy
GTIT Change graph title
H   Make a hardcopy
I   Initialize (all parameters)
LAS  Make a hardcopy
N   Negate shot numbering on each point
O   Ordinate, change parameters of ( OD, OF, OT, OS)
    ( new data: OD; display flag: OF; time bounds: OT;
      axis parameters: OS; new title: OTIT)
Q   Quit this menu
R   Replot to the terminal
RD  Reread the data from all the shots
S   Shot numbers, new list of (and make plot)
STOR Store results as a signal
SWAP Interchange signals
T   Table of parameters, display
W   Write output to a file (QUICK.DMP)
W><CR>
Genl>

```

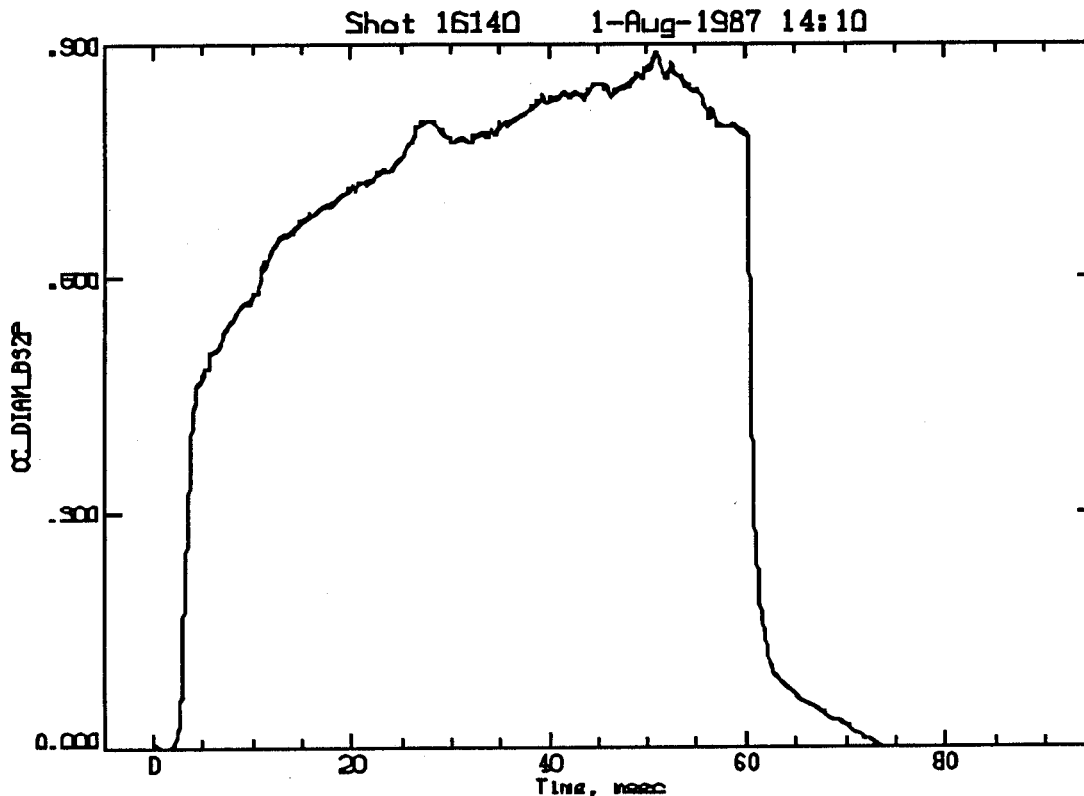
At this point if worldplot is reentered the data are still there and may be replotted with the R option or otherwise manipulated.

### 3.3.7. Changing "Y" Axis Parameters

Typing a Y at the Gen1> prompt allows the user to change "Y" axis parameters. The Y command is similar to but abbreviated S command (see section 3.3.4 Signal Axis). A list of all of the signal parameters and their descriptions is in Appendix A Signal Attributes.

```
Gen1> Y
Signal parameters: Current signal number 2 Shot 16140 1-Aug-1987 14:10

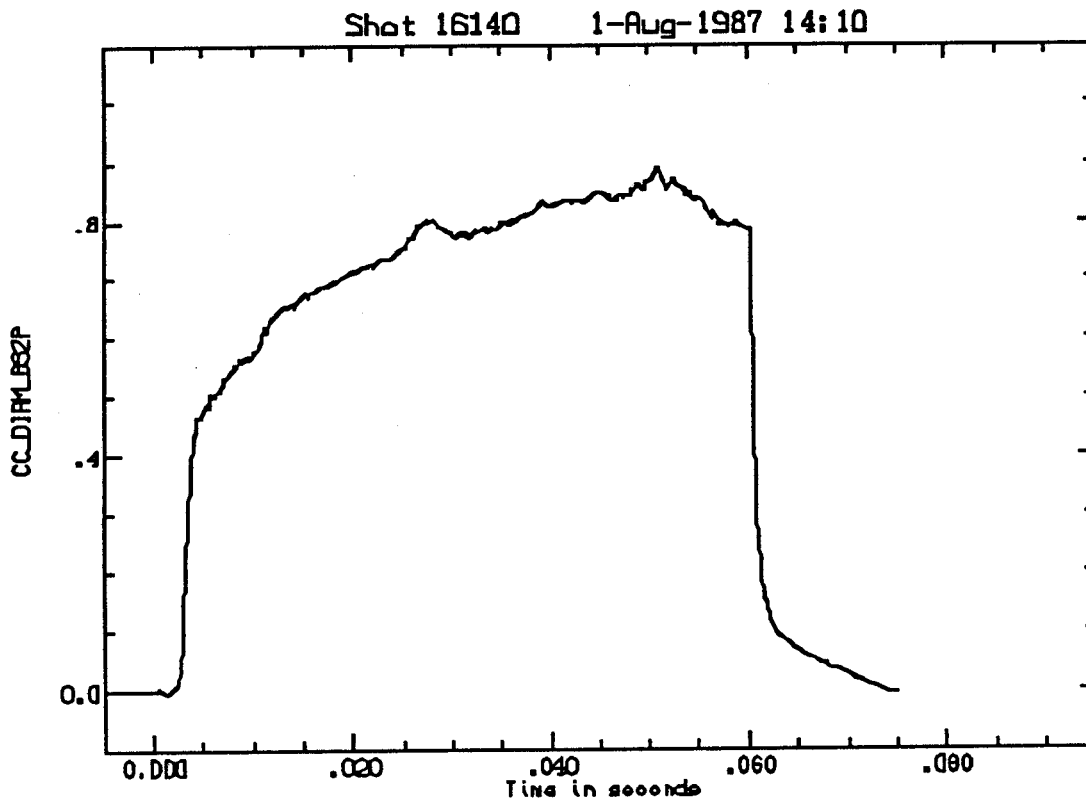
Signal: CC_DIAM_BS2P
vs.: Time, msec
CC_DIAM_BS2P
CC_DIAM_BS2P_TM
Number of sample points is 3200
Sample point increment is 1
Time, msec axis parameters:
WA WB IW NW LW WFT DWLT WSC WREF
-5.00 95.0 0 4 5 -20.0 20.0 1.0E-03 0.0E+00
Signal axis parameters:
SA SB IS NS LS SFT DSLT
-0.100 -0.100 0 4 3 -0.400 0.400
Automatic autoscale [y/N]> <CR>
Enter axis parameters: SA,SB,IS,NS,LS[,sft,dslt]> 0.0,0.9,0,4,3,0,0
Gen1> p
```



### 3.3.8. Changing Scale and Offset of the "Time" Base

Typing a TB at the Gen1> prompt allows the user to change the scale and offset of the time base. So if, for example, the user wishes to change the time axis to be in seconds instead of milliseconds the offset would be zero and the scale would be 1000.

```
Gen1> TB
Choose abscissa type
 1 Time, msec
 2 Sample Number
 3 Frequency, kHz
 4 Shot Number
 5 Special
Choice = 1
Change Time, msec
Enter scale and reference (scaled)> 1000,0
New abscissa label> Time in seconds
Gen1> P
```



Graf>

**CAUTION:** A value of one thousand works immediately but will be wrong when new signals are read in since time data is stored in seconds. A more correct way of changing from msec to seconds would be to use a scale of 1 and then reread in the signal.

### 3.3.9. Changing the "Time" Base to a Different Type

Typing TC at the Gen1> prompt allows the user to change the time base to a different type. TC changes the "time" base to sample number by default. To change it to another type, like frequency for example, the TC command must be issued again whereupon a menu will prompt for the desired type. The TS command does the same thing.

```
Gen1> TC
Change CC_DIAM_BS2P to sample number
```

```
Gen1> TC
Transform sample number to ?
```

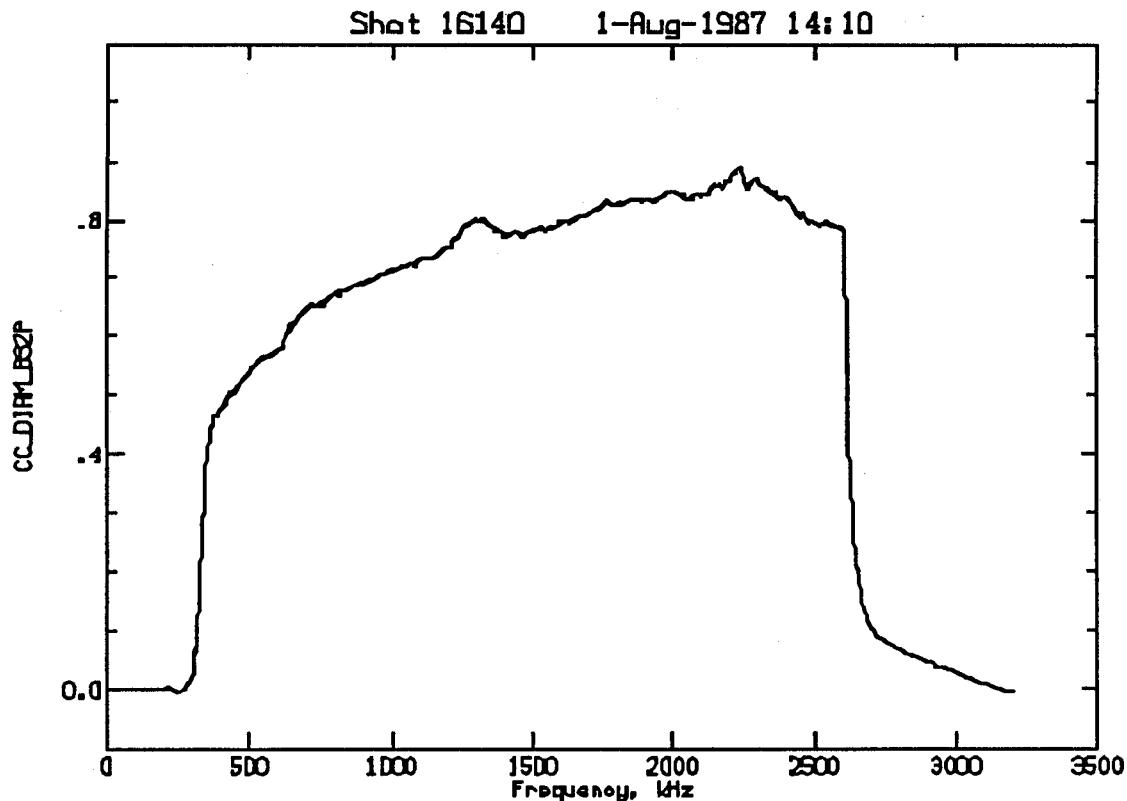
- 1 Time, msec
- 2 Sample Number
- 3 Frequency, kHz
- 4 Shot Number
- 5 Special

```
Choice = 3
```

```
Change to Frequency, kHz
```

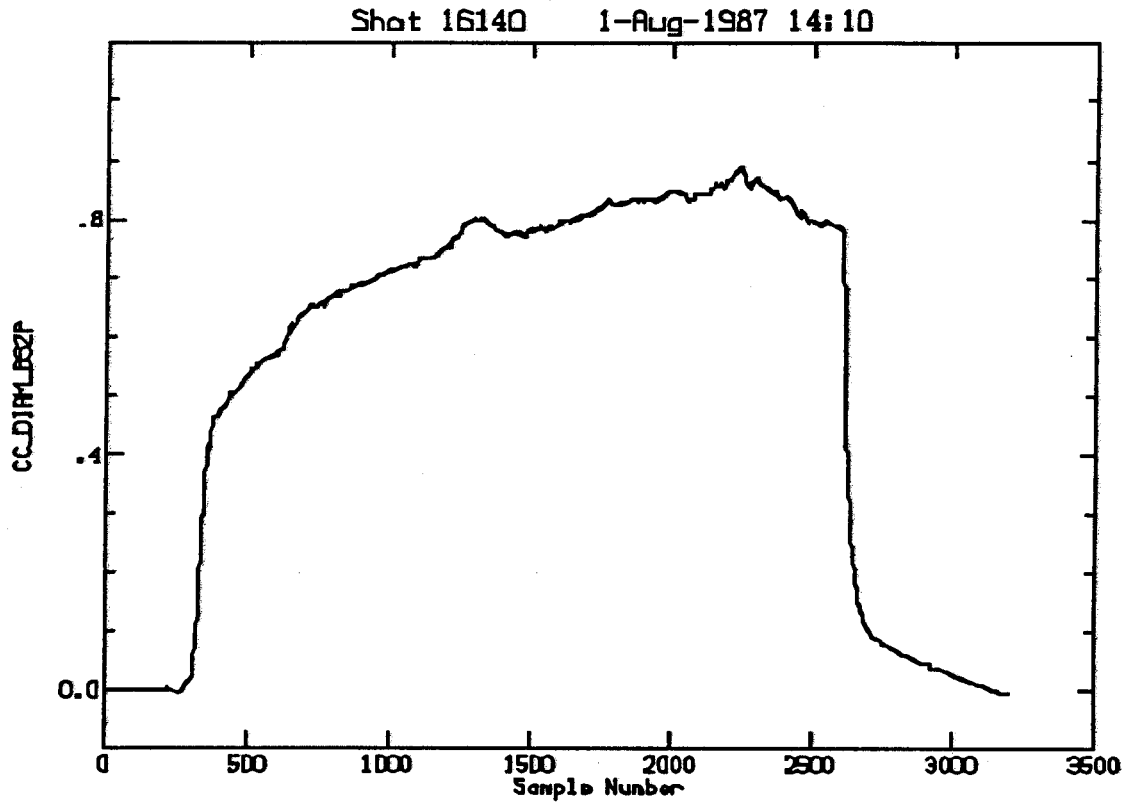
```
Enter parameters DEL, A0 for  $A = DEL * n + A0 > 1.0, 0$ 
```

```
Gen1> P
```



```
Graf>
```

```
Genl> TS  
Change CC_DIAM_BS2P to sample number  
Genl> P
```



Graf>

### 3.3.10. Overall Graph Reduction

Typing **OGR** at the `Gen1>` prompt allows the user to perform an overall graph reduction. In conjunction with **GLOB** (see section 3.3.11 Changing Global Settings) the hardcopy displays can be optimized for illustration style output.

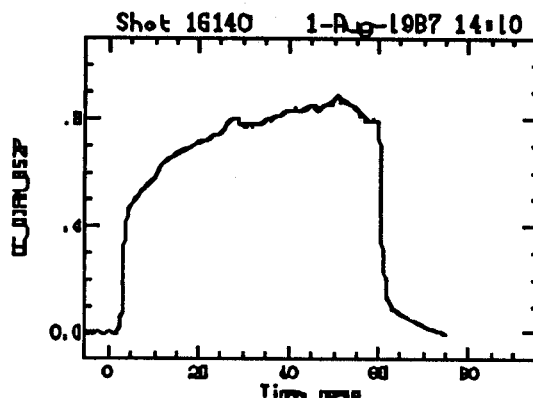
### 3.3.11. Changing Global Settings

Typing **GLOB** at the `Gen1>` prompt allows the user to change the two global parameters **CHSC** (character height scale divisor) and **LCUTLN** (turn off page stamp on all hardcopy). Changing the **CHSC** parameter may be useful for making the text on the plots more legible. If either of these affects is desired for hardcopy output only then the logical names `GP4$devtyp_CHSC` and `GP4$devtyp_LCUTLN` can be redefined before running GENLPLOT. For example

```
$ DEFINE GP4$QMSIGV_CHSC 36
$ DEFINE GP4$QMSIGV_LCUTLN FALSE
```

The following example illustrates the combined effect of performing an overall graph reduction (see above) and changing the character height scale divisor from its default of 56 to 36.

```
Gen1> OGR
Enter overall reduction fraction> .5
Gen1> GLOB
Enter new character height scale divisor ( 56)> 36
Turn off page stamp on all hardcopy? [y/N]>
<CR>
Gen1> P
```



```
Graf><CR>
Gen1>
```

### 3.3.12. Changing the Point Omission Parameter

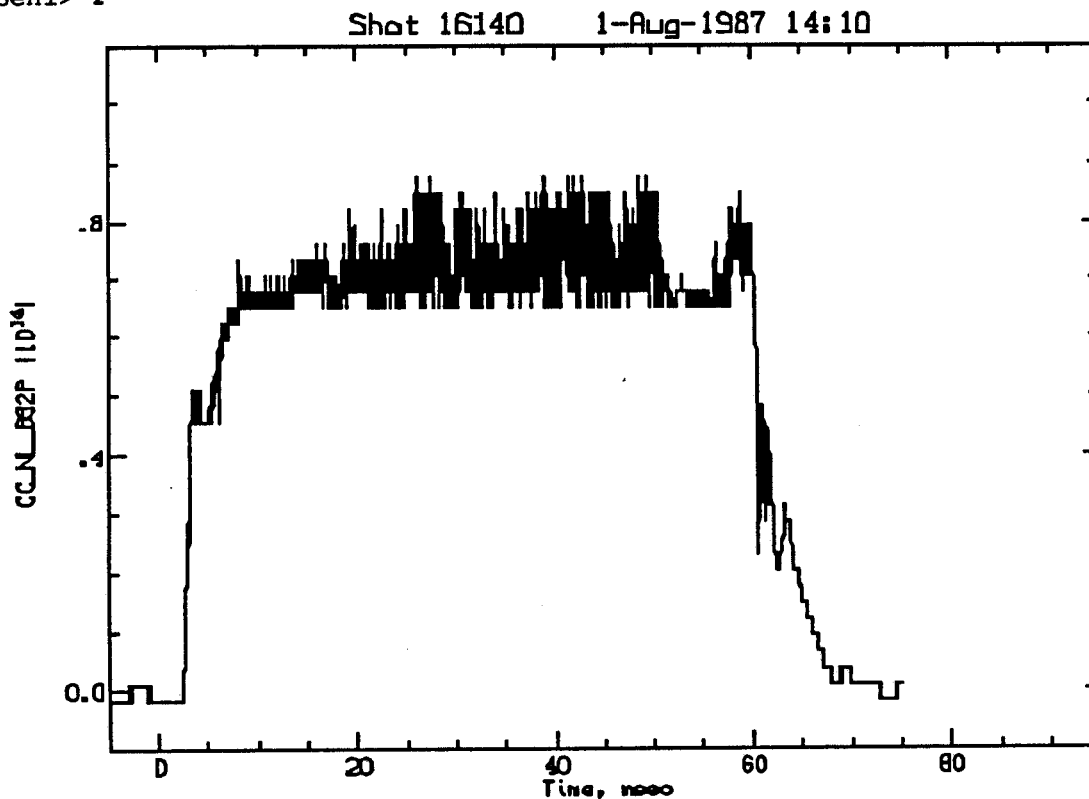
Typing **OMIT** at the **Gen1>** prompt allows the user to change the point omission parameter which sets the minimum number of pixels for deviation from a straight line. The default value for the point omission parameter is 2; a value of zero forces every point to be plotted.

```
Gen1> OMIT
Enter point omission scale in pixels> 0
Gen1>
```

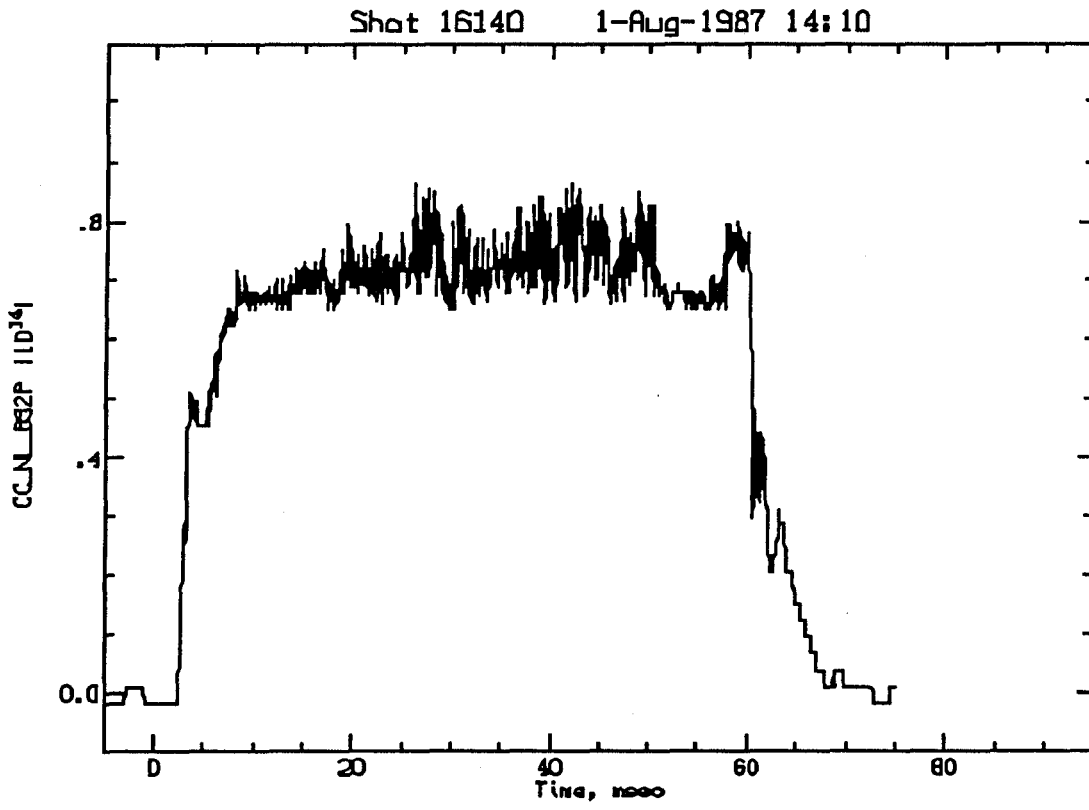
### 3.3.13. Smoothing the Current Signal

Enter **SMTH** at the **Gen1>** prompt allows the user to smooth the current signal using the three point smoothing algorithm. Smoothing is applied immediately to the current signal and successive calls result in greater smoothing i.e. 3,5,7,... point smoothing. There is no automatic labeling to indicate that a signal has been smoothed. The following example illustrates a curve that has been smoothed once.

```
Gen1> P
```



```
Graf> SMTH
Gen1> P
```





### 3.4. Algorithmic Functions

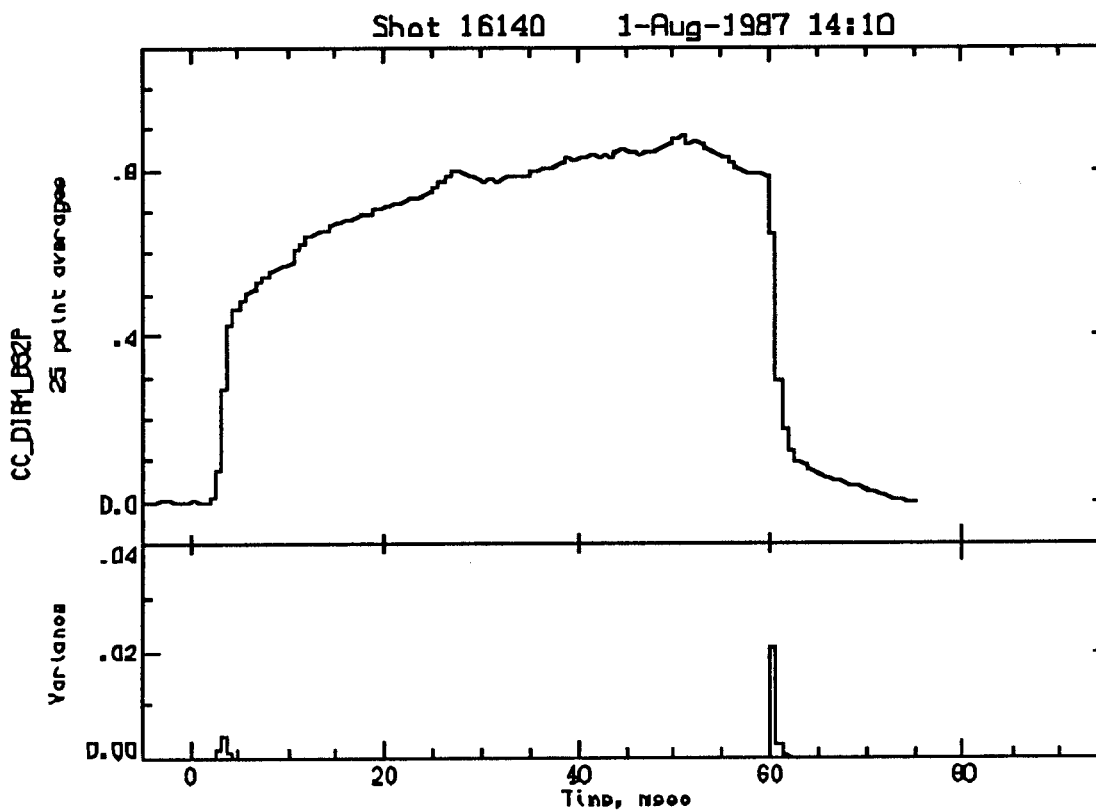
The ability to perform specific numerical analyses on the raw data is an option available to GENPLOT users. This section outlines command designed to perform standard functions on the data in the user's kit. Note that the commands A,G, and Z are defined both immediately and for new signals.

A	Average and variance within a shot ( A#)
F	Fourier transform ( F#)
G	Gain and offset (lin, exp, log, or pwr) ( G#)
J	Join two signals to form a third
X	auto/cross correlation ( X#, X#, #)
Z	Zero, subtract baseline ( Z#)
FIT	Fit a curve (lin, exp, pwr, or nor) ( FIT#)
SUM	average signals over many shots ( SUM###)

#### 3.4.1. Average and Variance

Entering the letter A at the Gen1> prompt allows the user to calculate the average and variance of the current signal (the command A#, where # is the number of a signal in the kit, is used for a specific signal) and for any subsequent signals. For example:

```
Gen1> A
Enter number of points to average over (<CR> to enter times)> 25,40
To plot:
Average                A    or -1
Average and Variance   <CR> or 0
Fluctuation Amplitude  T    or 1
Standard Deviation     S    or 2
Enter flag><CR>
Gen1> P
```



### 3.4.2. Fourier Transform

Typing an `F` at the `Gen1>` prompt allows the user to perform a Fast Fourier Transform (FFT) on the current signal (using the command `F#`, where `#` is the number of a signal in the kit, allows the user to perform the transform on a specific signal). The FFT menu allows the user to change the parameters of the amplitude and frequency, make a hardcopy, initialize, change leakage reduction, write output to a file and change phase parameters. The power spectral estimate from the FFT in GENLPLOT is

$$\frac{1}{0.875} \left( \frac{2 \Delta t}{N} \right) |X_k|^2$$

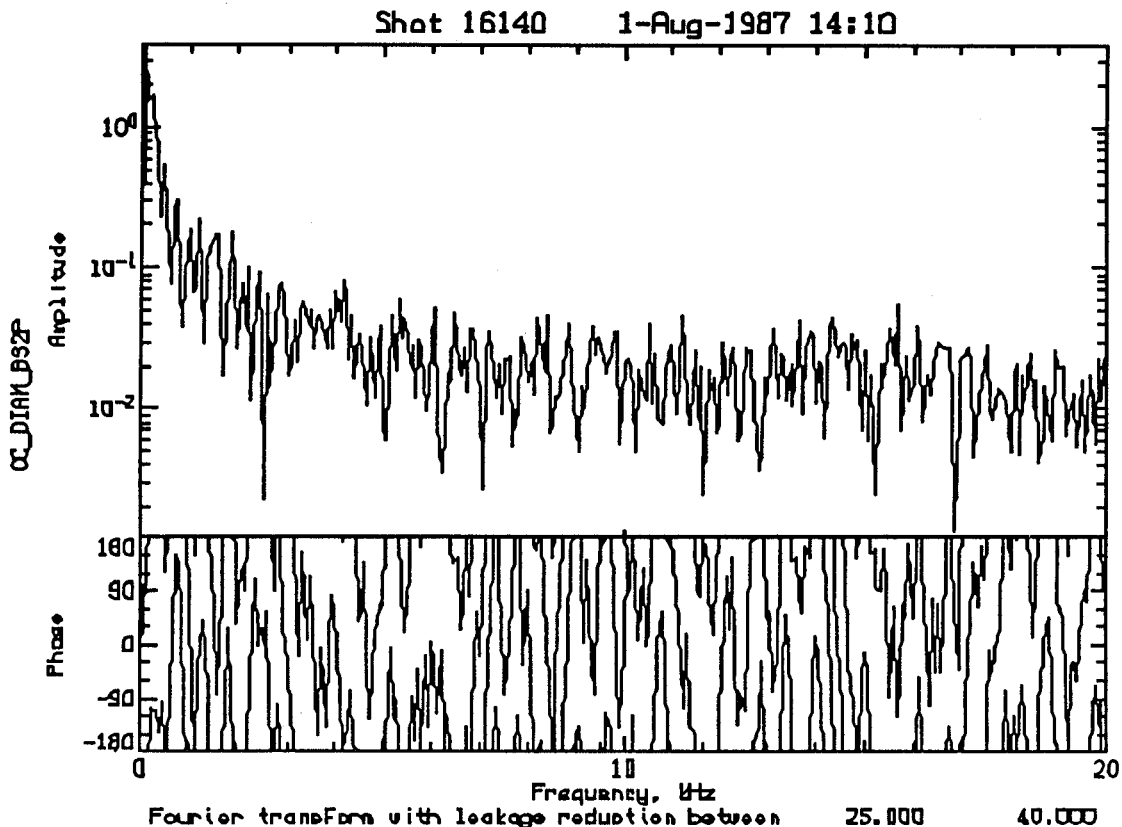
with  $\Delta t$  sampling period  
 $N$  number of samples  
 $X_k$  same units as input signal

which is

$$= \frac{1}{0.875} \left( \frac{2 (\Delta t)^2}{T} \right) |X_k|^2$$

where  $\Delta t$  sampling period  
 $T$  total time for transform

```
Gen1> F
Fourier Transform of CC_DIAM_BS2P
Time limits> 25,40
```



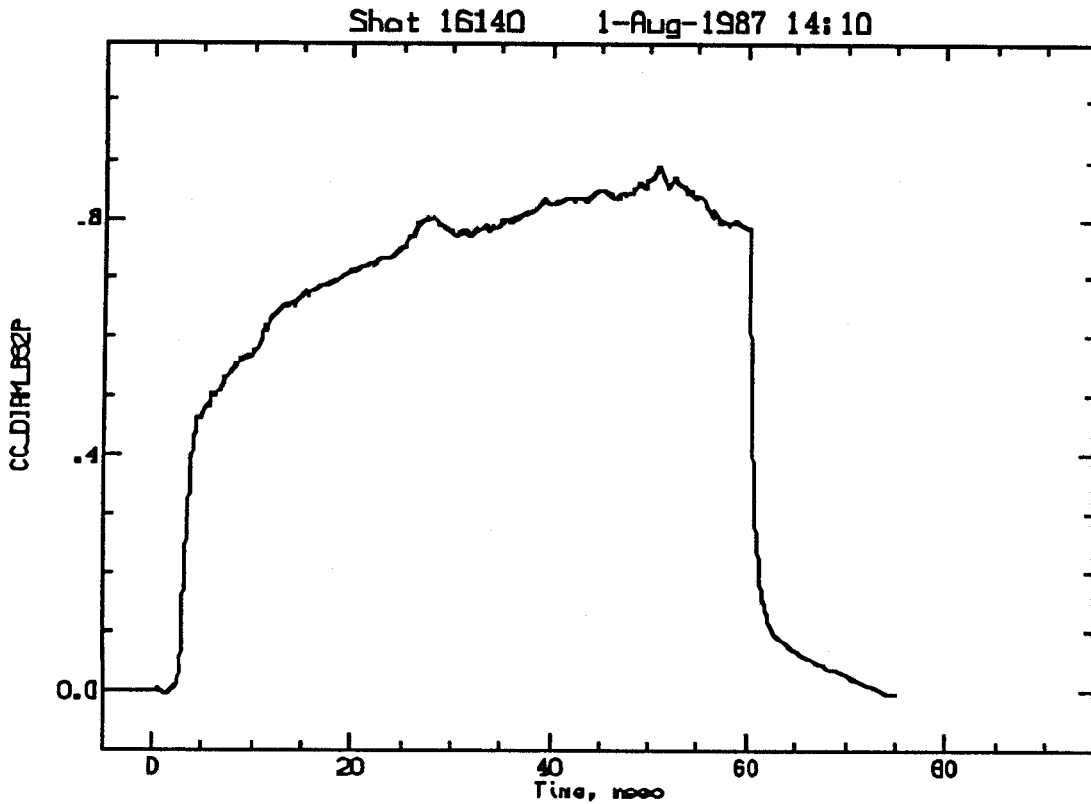
FFT> List of additional options:

- A Amplitude, change parameters of
- F Frequency, change parameters of
- H Make a hardcopy
- I Initialize (change time limits, retransform, and plot)
- L Leakage reduction, change (cosine taper)
- Q Quit this menu
- R Replot
- W Write output to a file
- COPY Make a hardcopy
- LAS Make a hardcopy
- PH Phase, change parameters of

FFT>

### 3.4.3. Gain and Offset

Typing G#, where # is the number of a signal in the kit, at the Gen1> prompt enables the user to change gain and offset parameters for the signal and any subsequent signals. In the following example the original signal is displayed. Then, using the G command, an exponential transformation is performed on the signal.



Graf>

Gen1> G1

Signal parameters: Current signal number 1 Shot 16140 1-Aug-1987 14:10

Signal: CC\_DIAM\_BS2P

vs.: Time, msec

CC\_DIAM\_BS2P

CC\_DIAM\_BS2P\_TM

Number of sample points is 3200

Sample point increment is 1

Time, msec axis parameters:

WA	WB	IW	NW	LW	WFT	DWLT	WSC	WREF
-5.00	95.0	0	4	5	-20.0	20.0	1.0E-03	0.0E+00

Signal axis parameters:

SA	SB	IS	NS	LS	SFT	DSL
-0.100	1.10	0	4	3	-0.400	0.400

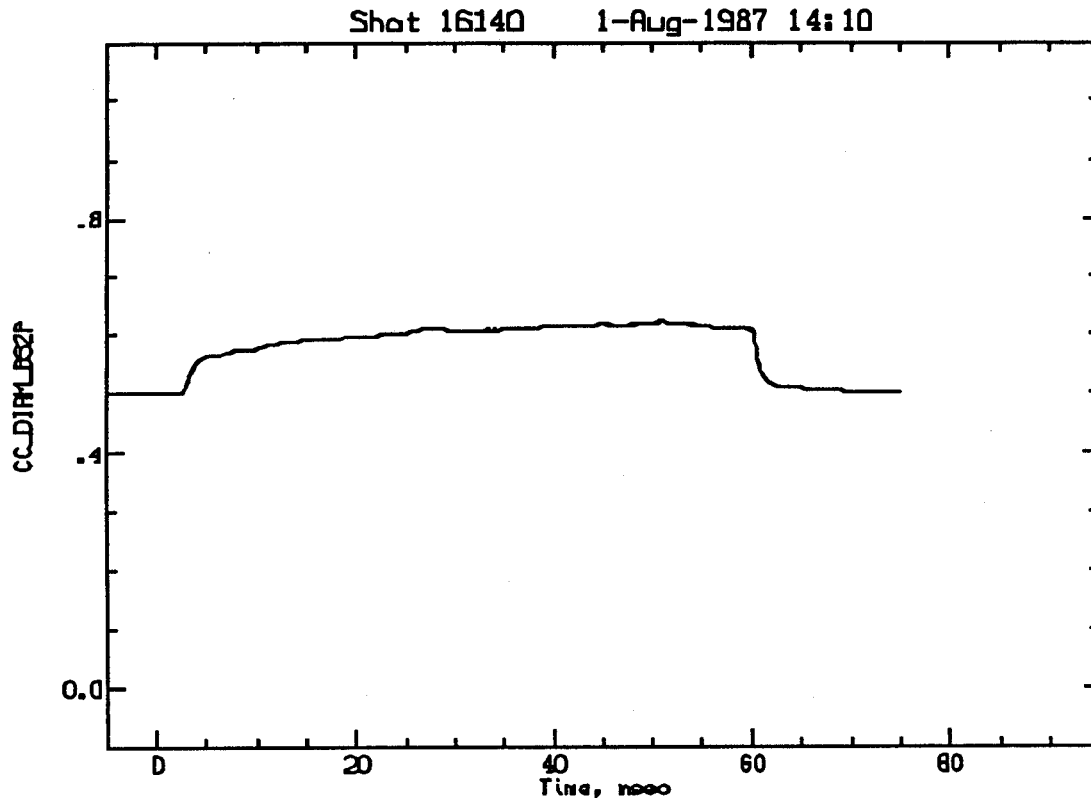
GAI OFF transformation of CC\_DIAM\_BS2P

Exponential	$S = B * EXP(A*S)$	flag -1
Linear	$S = B + A*S$	flag 0
Logarithmic	$S = ALOG(B + A*S)$	flag +1
Power law	$S = A*(S^B)$	flag +2

Enter transformation flag: -1

Enter A and B: .25,.5

Gen1> P



Graf>

Gen1>

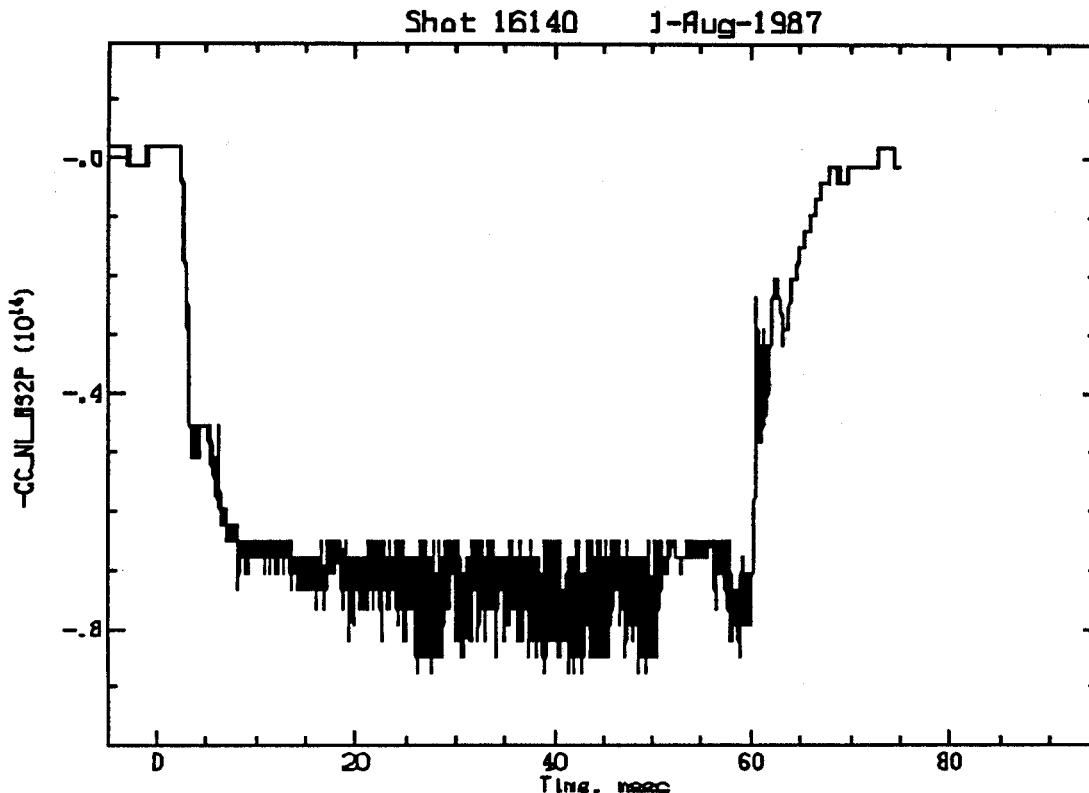
### 3.4.4. Joining Two signals to Form a Third

Typing a **J** at the `Gen1>` prompt allows the user to perform either a unary operation (see section 3.2.9 for a description of all operations) on a signal to form another signal or join two signals from the kit to form a third. The signal that is created will be a fixed signal. Naturally, the user must have at least two signals in the kit to do a binary operation (see section 3.2.2 for adding a signal to the kit). This following example demonstrates first a unary signal operation followed by a binary operation. A description of the possible operations for joining signals goes as follows:

```
Gen1> J
 1 16140    CC_DIAM_BS2P          3200      -0.100000    1.10000
 2 16140    *CC_NL_BS2P          4001      0.000000E+00 0.000000E+00
```

Operations for joining signals:

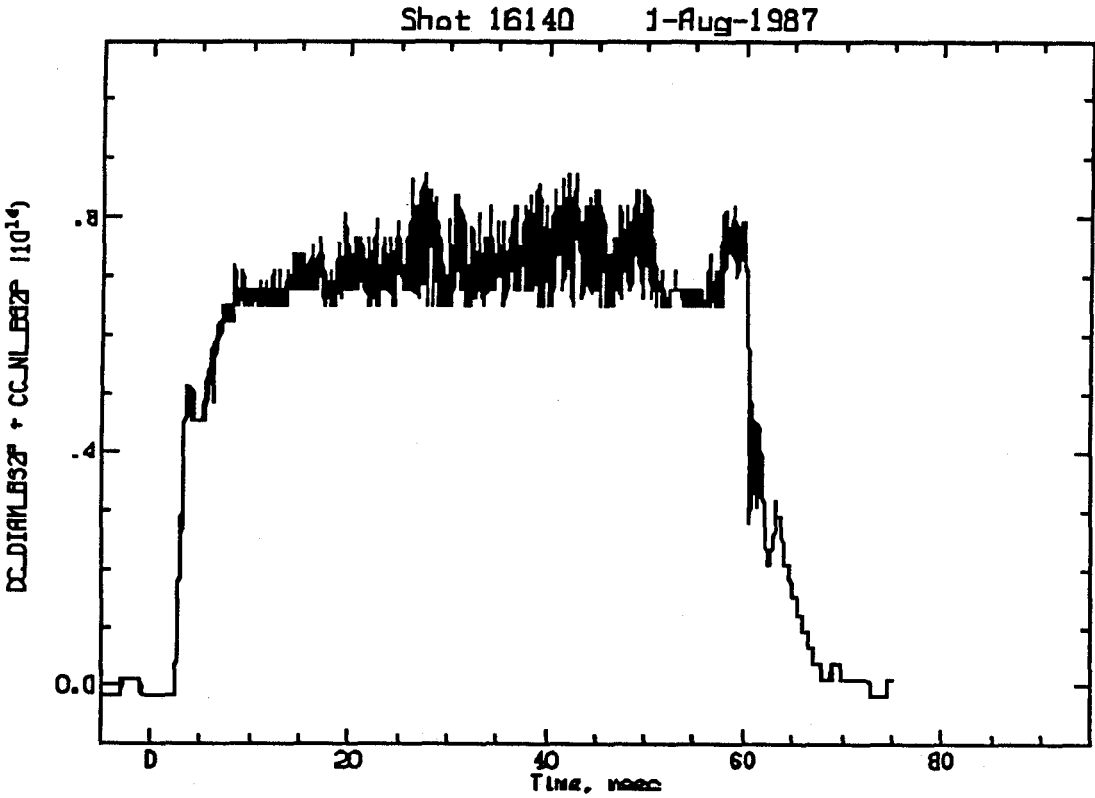
```
Unary : - / d r S
Binary: + - * / d S
S3 = [S1] operation S2
Number of first signal (<CR> for unary operation)<CR>
Operation> -
Number of second signal> 2
Number of third, output, signal> 3
-CC_NL_BS2P
Alternate signal title<CR>
Gen1> P
```



The next example illustrates how to join two signals with a binary operation to form a third signal.

```
Gen1> J
 1 16140    CC_DIAM_BS2P          3200      -0.100000    1.10000
 2 16140    CC_NL_BS2P          4001      0.000000E+00 0.000000E+00
 3 16140    F *-CC_NL_BS2P      4001      -1.000000E+14 2.000000E+13
```

```
Operations for joining signals:  
Unary : - / d r S  
Binary: + - * / d S  
S3 = [S1] operation S2  
Number of first signal (<CR> for unary operation)> 1  
Operation> +  
Number of second signal> 2  
Number of third, output, signal> 4  
CC DIAM_BS2P + CC_NL_BS2P  
Alternate signal title<CR>  
Genl> p
```

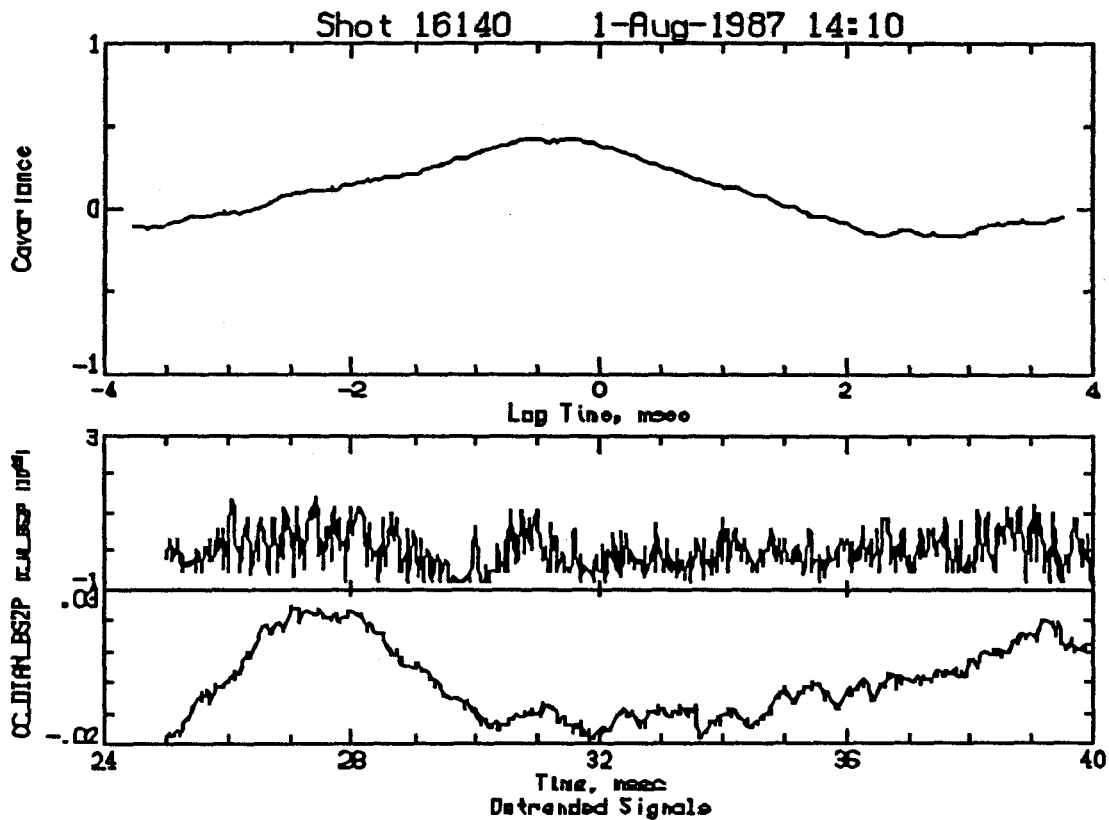


### 3.4.5. Auto/cross Correlation

Typing an X at the Gen1> prompt enables the user to perform an auto/cross-correlation on any two signals or just an autocorrelation on one signal. Alternatively, the command X#, where # is the number of a signal in the kit, will perform the autocorrelation on the desired signal. The following example illustrates the use of the auto/cross correlation function.

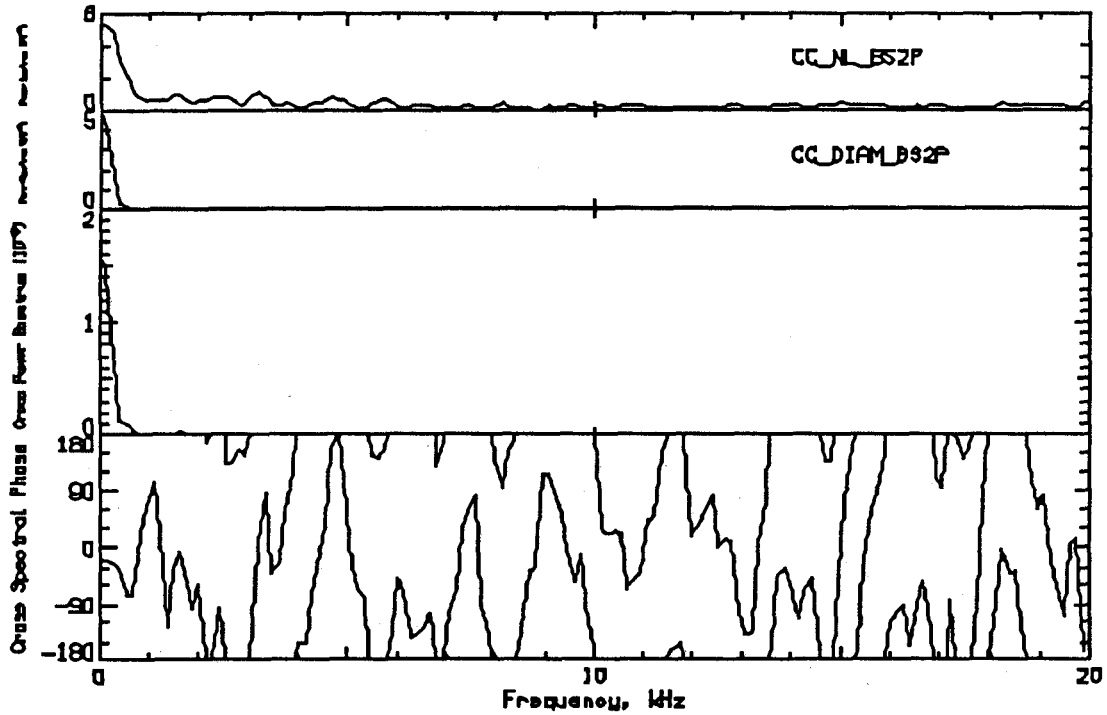
```
Gen1> X
 1 16140 *CC_DIAM_BS2P          3200          -0.100000    1.10000
 2 16140  CC_NL_BS2P           4001          -1.000000E+13 1.100000E+14
 3 16140 F -CC_NL_BS2P         4001          -1.000000E+14 2.000000E+13
 4 16140 F  CC_DIAM_BS2P + CC_NL_BS 3200          -1.000000E+13 1.100000E+14
```

```
Auto/Cross Correlation
Select signal(s)> 1,2
Time limits> 25,40
```



XCOR: <CR> for second page<CR>

Shot 16140 1-Aug-1987 14:10



Cross correlation between 25.000 40.000

XCOR><CR>

XCOR> List of additional options:

- A Amplitude, change parameters of ( A1, A2)
- F Frequency, change parameters of
- H Make a hardcopy
- I Initialize (all parameters)
- Q Quit this menu
- R Replot to the terminal
- S% Signal limits, change ( S1, S2)
- T Time limits, change
- W Write output to a file (QUICK.XCR)
- COPY Make a hardcopy
- LAS Make a hardcopy
- PH Phase, change parameters of
- RET Retransform
- STOR Store analysis as a signal
- TAX Time, change parameters of
- TLAX Time lag, change parameters of

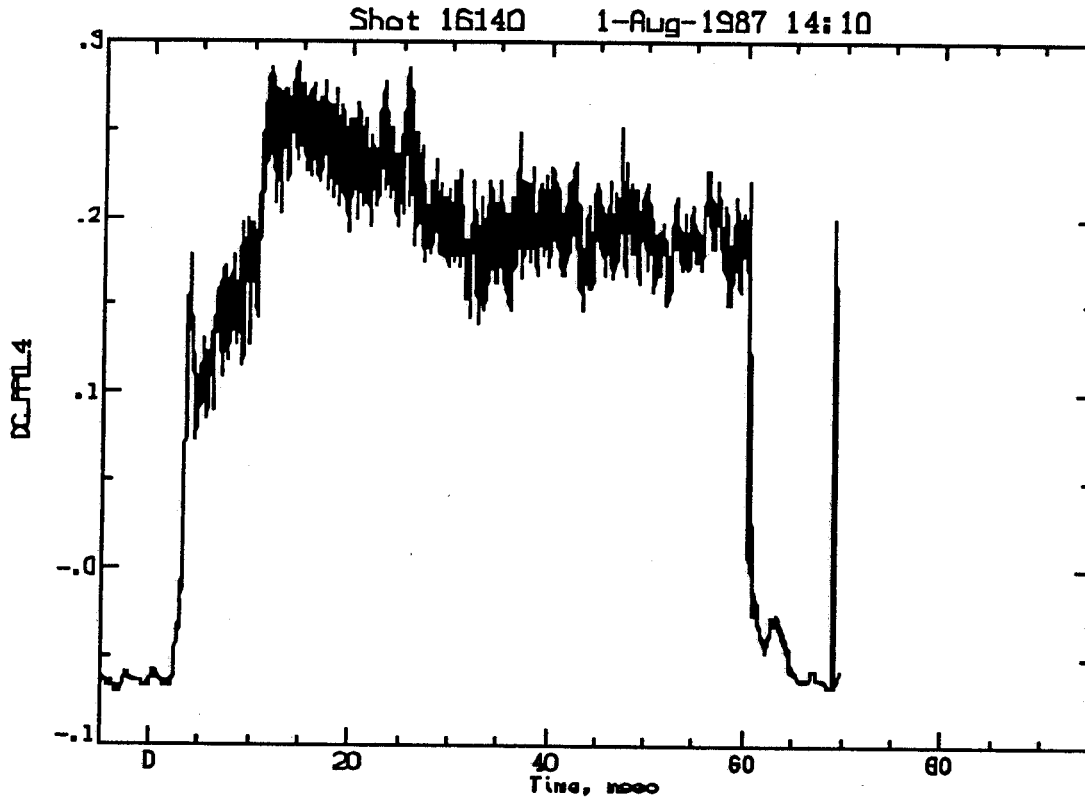
XCOR><CR>



### 3.4.6. Zeroing or Subtracting a Baseline

Typing a `z` or a `z#`, where `#` is the number of a signal in the kit, at the `Gen1>` prompt allows the user to zero or subtract a baseline from the signal and from any subsequent signals. The zeroing facility allows the user to specify a reference level or reference line (given in time bounds) over which to compute a baseline to subtract.

Gen1> P



Gen1> Z

Signal parameters: Current signal number 1 Shot 16140 1-Aug-1987 14:10

Signal: CC\_PPD\_4

vs.: Time, msec

CC\_PPD\_4

CC\_PPD\_4\_TM

Number of sample points is 8000

Sample point increment is 1

Time, msec axis parameters:

WA	WB	IW	NW	LW	WFT	DWLT	WSC	WREF
-15.0	85.0	0	4	5	-20.0	20.0	1.0E-03	0.0E+00

Signal axis parameters:

SA	SB	IS	NS	LS	SFT	DSL
-0.300	0.200	0	2	6	-0.400	0.100

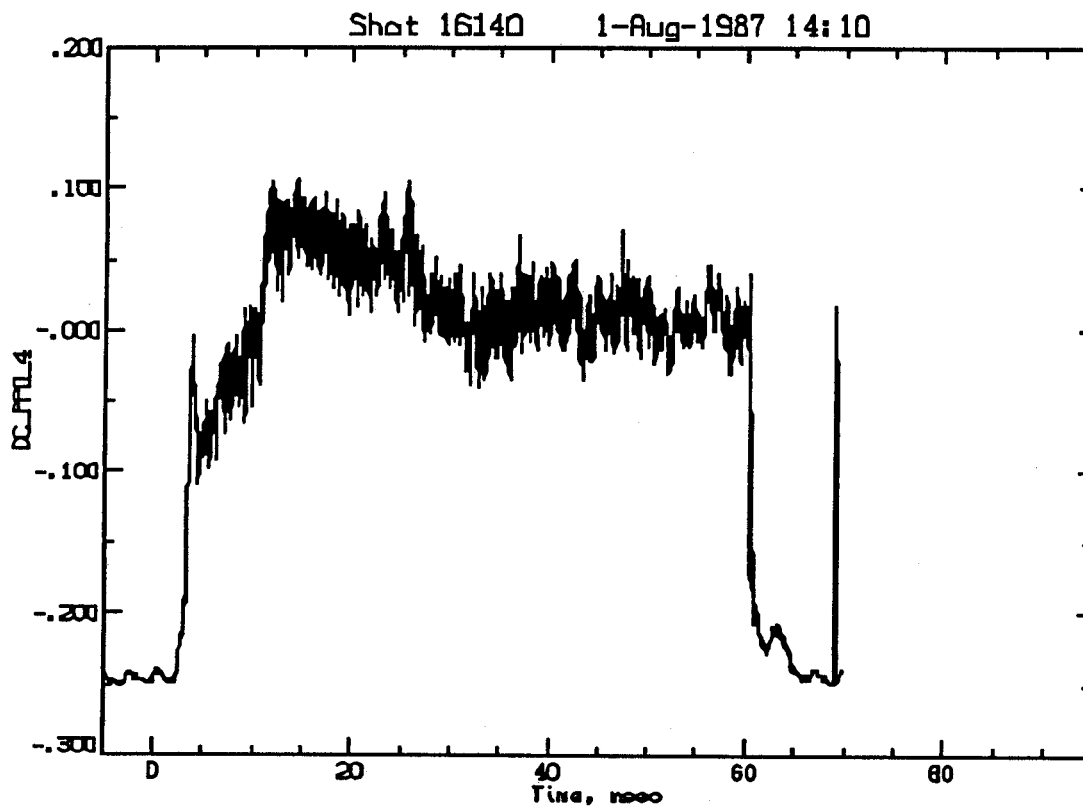
Reference level time limits 0.000E+00 40.0

Autoscale ON

Select zeroing option (-1=no zeroing; 0=reference level; 1=reference line)>1

Enter time bounds for [split] reference line (T0,T1[,T2,T3])>-5.,0.,65.,70.

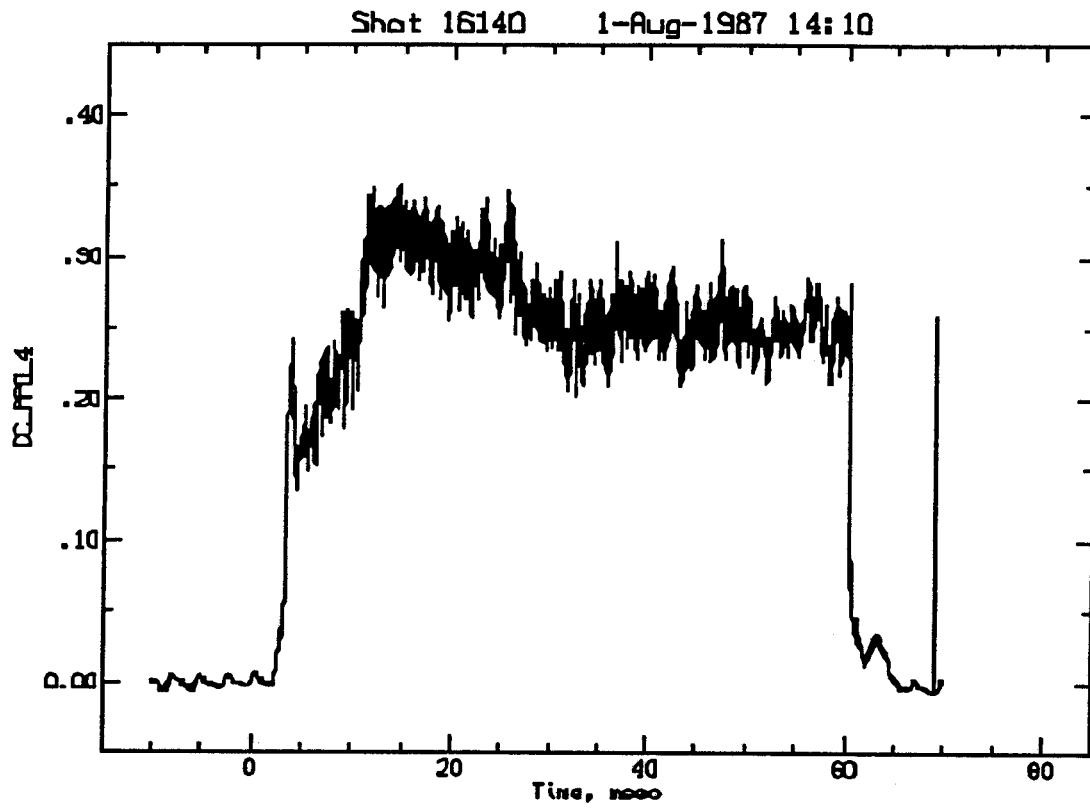
Gen1> P



```

Genl> z
Signal parameters: Current signal number 1 Shot 16140 1-Aug-1987
14:10

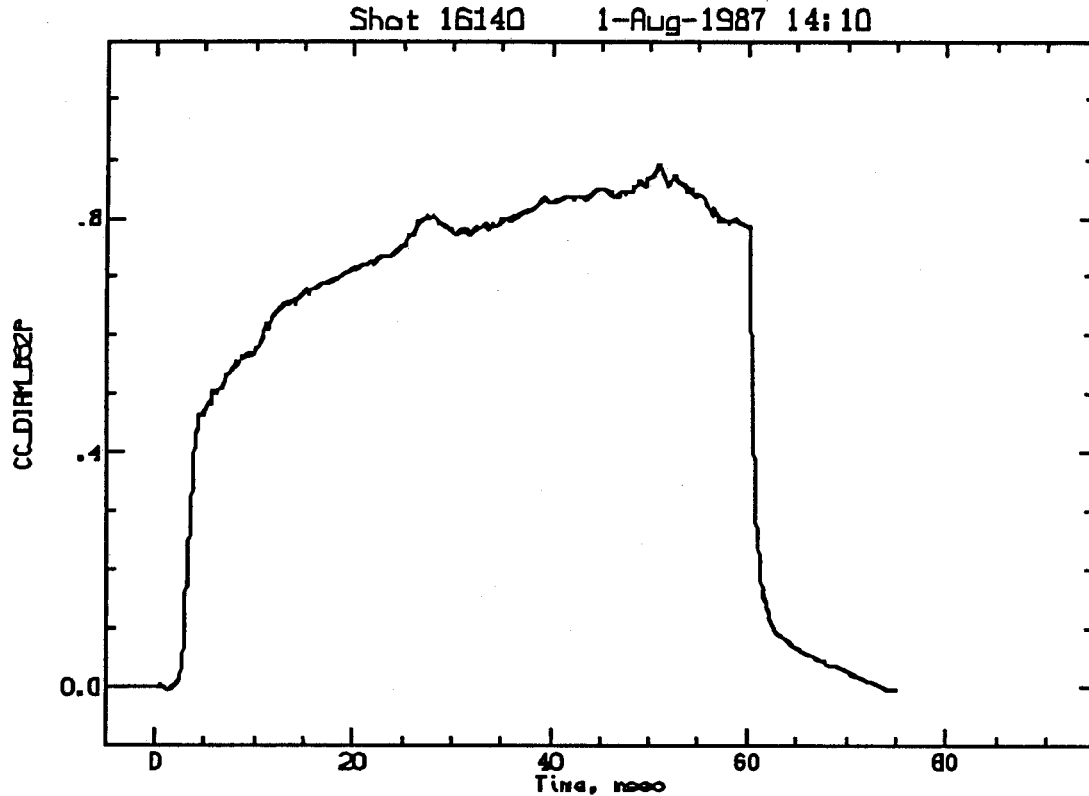
Signal: CC_PPD_4
vs.: Time, msec
CC_PPD_4
CC_PPD_4_TM
Number of sample points is 8000
Sample point increment is 1
Time, msec axis parameters:
WA WB IW NW LW WFT DWLT WSC WREF
-15.0 85.0 0 4 5 -20.0 20.0 1.0E-03 0.0E+00
Signal axis parameters:
SA SB IS NS LS SFT DSLT
-0.100 0.300 0 2 5 -0.200 0.100
Select zeroing option (-1=no zeroing; 0=reference level; 1=reference line)>1
Autoscale ON
Enter time bounds for [split] reference line (T0,T1[,T2,T3])>-5.,0.,65.,70.
Genl> P
    
```



### 3.4.7. Curve fitting

Typing `FIT` at the `Gen1>` prompt allows the user to fit a function to the current signal in the kit (using the command `FIT#`, where `#` is the number of a signal in the kit, allows the user to perform the transform on a specific signal). The functions available for fitting are linear exponential, power, or normal.

`Gen1> FIT`



Fit: Select L and R points>

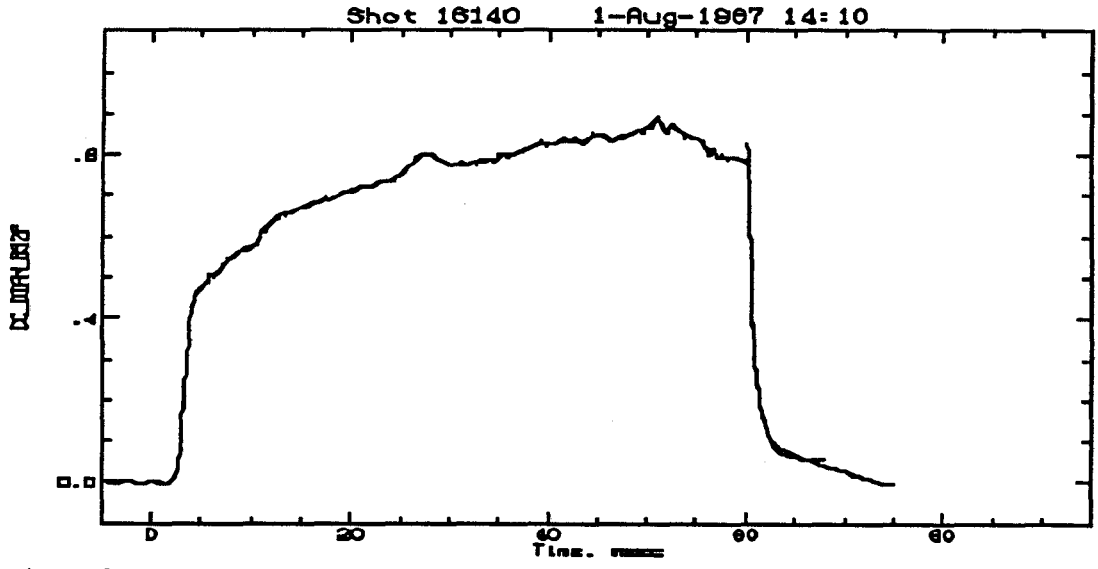
After entering the command a plot of the signal will be displayed with a prompt asking for L (left) and R (right) values. Hit the carriage return and a crosshair cursor will appear. Position the crosshair cursor over the first value of the desired interval on the curve and type an L. Do the same for the last desired value of the interval and type an R.

Enter type of fit: 0,lin; 1,exp; 2,pwr; 3,nor> 1

Choose the fit (exp, linear, power) desired. A plot similar to the following example will be displayed.

```

Y(X) = A3*EXP(A2*(X-A1)) + A5      X > A1
      = A3 + A4*(X-A1) + A5      X < A1
Iterations = 8      CHISQA = 7.33452E-05
A(1) = 60.638      0.85167
A(2) = -1.0161     1.8459      0.88411
A(3) = 0.91370     0.59000
A(4) = -0.87934    1.6753
A(5) = 5.7966E-02  0.59220E-02
    
```



Fit> ?

Fit> List of additional options:

- COPY Make a hardcopy
- H Make a hardcopy
- LAS Make a hardcopy
- NOTE Write fit info to notepad.
- R Replot to the terminal

Fit><CR>

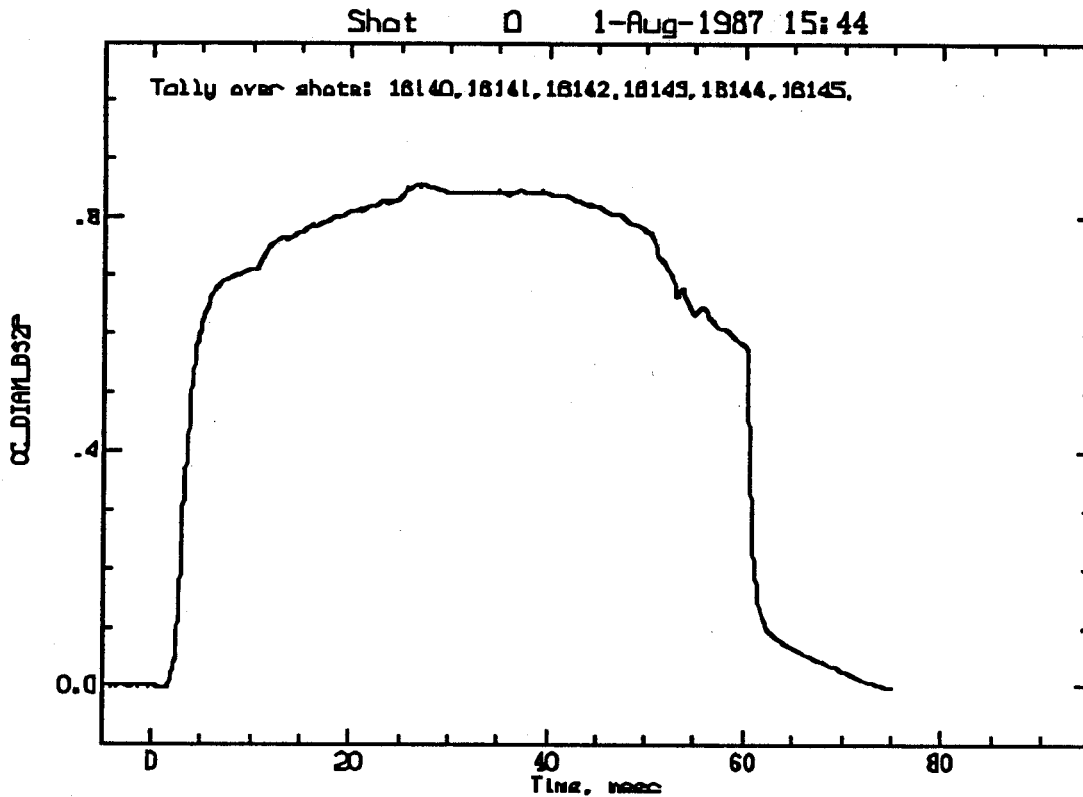
Genl>

### 3.4.8. Averaging Signals Over Many Shots

Typing SUM, or SUM###, where ### is a list of signal numbers, at the Gen1> prompt allows the user to average signals over many shots. The resulting signal is a fixed signal.

```
Gen1> SUM
Enter list of signal numbers> 1
Enter list of shot numbers> 16140-16145
Start signal: CC_DIAM_BS2P
```

```
Start shot 16140
Start shot 16141
Start shot 16142
Start shot 16143
Start shot 16144
Start shot 16145
Gen1> P
```



## Appendix A. Signal Attributes

There is a specific order of events that occurs when a signal is opened from the data base. First the signal data is read from the data base, then the time array is read in. If any of the following actions are defined to occur they do so in the following order: time is modified, gain and offset are applied, zeroing is applied, and finally averaging is applied. Each signal has associated with it many attributes which are stored in the kit and saved with namelist files including the name of the time signal.

### A.1. Signal Axis Parameters

The following seven signal attributes are determined when autoscaling is in effect. If the user wishes to change any of the values of these attributes (see section 3.3.4 Signal Axis or section 3.3.8 Changing "Y" axis parameters) only the first three attributes must be specifically defined for a logarithmically scaled plot. Redefining attributes for a linearly scaled plot requires that either five or seven of the attributes must be explicitly defined.

- SA = BEGINNING SIGNAL AXIS VALUE
- SB = LAST SIGNAL AXIS VALUE
- IS = SCALE FLAG, 0=LINEAR, 1=LOGARITHMIC.
- NS = TOTAL NUMBER OF MINOR INTERVALS ( A MULTIPLE OF LS) FOR LINEARLY SCALED PLOTS, UNLESS SFT AND DSLT ARE DEFINED, IN WHICH CASE NS = NUMBER OF MINOR INTERVALS PER MAJOR INTERVAL.
- LS = NUMBER OF LABELED INTERVALS (MAJOR INTERVALS)
- SFT = VALUE OF THE FIRST TIC MARK (OPTIONAL FOR LINEARLY SCALED PLOTS)
- DSLT = DELTA VALUE BETWEEN TICS (OPTIONAL FOR LINEARLY SCALED PLOTS)

### A.2. Zeroing Parameters

- ZFL = ZEROING FLAG
- T0, T1, T2, T3 DEFINE THE ONE OR TWO TIME INTERVALS USED IN ZEROING.

### A.3. Gain and Offset Parameters

- G = GAIN (if 0.0 gain and offset is turned off)
- O = OFFSET
- IK = TYPE OF TRANSFORMATION

### A.4. Averaging Parameters

NAV = AVERAGING FLAG  
     -1 USE DT AND TS  
     0 NONE  
     0 NUMBER OF POINTS FOR AVERAGING)  
 TS = START TIME FOR AVERAGING  
 DT = DELTA TIME FOR AVERAGING

LFLUC = SIGNAL DISPLAY FLAG  
     -1 AVERAGE  
     0 AVERAGE AND VARIANCE  
     1 FLUCTUATION INTERVAL (STDEV / AVG)  
     2 STANDARD DEVIATION

AVTXT = AVERAGING TEXT IN PANEL

### A.5. Reading Parameters

LREAD = READ IN SIGNAL  
     1 YES  
     0 NO

LABSC = READ IN ABSCISSA  
     1 YES  
     0 NO

LRABSC = ACCEPT ABSCISSAE KEYBOARD ENTRIES  
     1 YES  
     0 NO

### A.6. General Signal Parameters

LSIGNL = NUMBER OF SIGNALS IN KIT.

SIGNAME = SIGNAL VARIABLE NAME

SIGTITL = LABEL FOR SIGNAL (ORDINANT) AXIS

TNAME = NAME OF ABSCISSA VARIABLE

TTITL = ABSCISSA AXIS LABEL

DATESTR = DEFAULT PLOT TITLE CONTAINING SHOT NUMBER, DATE, AND TIME.

JFORMULA = THE FORMULA FROM DCS COMMAND (see section 3.2.9 Defining a composit signal).

NINC = SKIP INCREMENT FOR DATA POINTS.

IAS = AUTOSCALE FLAG  
     0 NORMAL  
     1 AUTOSCALE



IST           = SIGNAL TYPE FLAG  
               -2     COMPOSIT  
               -1     FIXED  
               0     REGULAR  
               1     ARRAYED

PNTXT        = OPTIONAL PANEL LABEL

IERR         = SIGNAL ERROR  
               -1     UNKNOWN SIGNAL  
               0     OK  
               1     READ ERROR

DBNAM        = DATA BASE NAME

ITFLG        = ABSCISSA FLAG  
               1     TIME  
               2     SAMPLE NUMBER  
               3     FREQUENCY  
               4     SHOT NUMBER  
               5     OTHER

KST           = SIGNAL PLOT CLASS ( ns=NSAMPL)  
               Flag Ntim Ndat Nvar  
               0   ns    ns   0  
               1   ns    ns   ns  
               2   ns+1 ns   0  
               3   ns+1 ns   ns

## Appendix B. Abscissa Attributes

### B.1. Abscissa Axis Parameters

The following seven abscissa attributes are determined when autoscaling is in effect. If the user wishes to change any of the values of these attributes (see section 3.3.5 Time (Abscissa) Axis ) only the first three attributes must be specifically defined for a logarithmically scaled plot. Redefining attributes for a linearly scaled plot requires that either five or seven of the attributes must be explicitly defined.

- TA = BEGINNING TIME AXIS VALUE
- TB = LAST TIME AXIS VALUE
- IT = SCALE FLAG, 0=LINEAR, 1=LOGARITHMIC.
- NT = TOTAL NUMBER OF MINOR INTERVALS (A MULTIPLE OF LS) FOR LINEARLY SCALED PLOTS, UNLESS TFT AND DTLT ARE DEFINED, IN WHICH CASE NT = NUMBER OF MINOR INTERVALS PER MAJOR INTERVAL.
- LT = NUMBER OF LABELED INTERVALS (MAJOR INTERVALS)
- TFT = VALUE OF THE FIRST TIC MARK (OPTIONAL FOR LINEARLY SCALED PLOTS)
- DTLT = DELTA VALUE BETWEEN TICS (OPTIONAL FOR LINEARLY SCALED PLOTS)

### B.2. Abscissa Types

There are 5 types of abscissae: Time, sample number, frequency, shot number, and other. The default names and units are:

Time, msec  
 Sample Number  
 Frequency, kHz  
 Shot Number  
 Special

Remember that the time is stored in the database in seconds and frequency in Hertz.

## Appendix C. Making a Text String in GP4

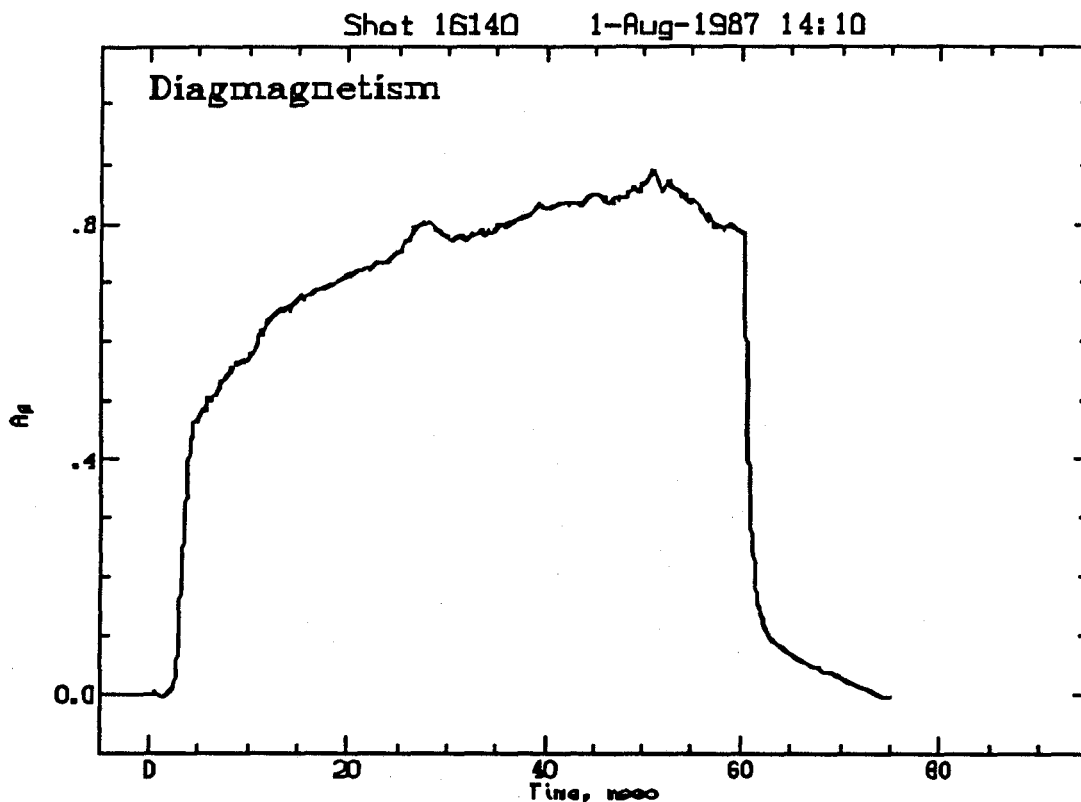
The control sequences are used for both in stream commands and to reference the special centered characters. In general the commands are parameter setting within a string. The backslash character "\" is used as a delimiter to permit entering the following control sequences:

Control Sequence	Function
\#	plot special character number # in text string
\bs	backspace
\lf	line feed
\nl	new line (\cr\lf)
\vt	vertical tab
\pl	previous line (\cr\vt)
\cr	carriage return
\sup	superscript mode
\no	normal line mode (default)
\sub	subscript mode
\mag#	magnification of default by factor # e.g. \mag 0.5\ \mag 1.0\ \mag 2.0\ # should contain an explicit decimal point.
\reg	regular font (default)
\pri	principal fonts
\ind	indexical fonts
\cx	complex characters (default)
\dx	duplex characters
\car	cartographic fonts
\la	latin font
\gr	greek font

Note that \\ will be interpreted as an actual backslash. Case is ignored in the commands. For more information see the GRAPAC4 manual. For example the user can change the signal axis label (see section 3.3.3 Signal Axis) to the following:

```
Alternate signal title> A\gr\sub\b
Alternate panel title> \pri\mag1.5\Diagmagnetism
```

And the plot will look like this:



The following tables of fonts are those available to the user.

Characters Available in Subroutine SYMBOL  
Complex, Regular, Latin and Greek Fonts

.	0	15	12	0	6	0	54	P	10	'	10	p	112	.	128	134	100	0	178	132	1202	'	224	11	240						
o	1	o	17	1	18	A	15	Q	61	a	97	q	114	o	129	o	145	+	181	1	177	A	149	Q	209	α	205	o	241		
Δ	2	▲	13	"	3	B	18	R	12	b	108	r	114	Δ	130	▲	148	"	182	2	178	B	156	P	210	β	228	p	242		
+	8	+	16	#	8	3	21	C	17	S	69	c	99	9	115	+	181	+	187	£	198	3	179	H	145	Σ	211	η	227	σ	244
X	4	□	21	¢	11	4	22	D	18	T	14	d	108	t	118	X	132	□	148	¢	184	4	180	Δ	135	T	212	δ	228	κ	244
◇	5	▼	21	×	17	5	23	E	18	U	65	e	102	U	117	◇	133	▼	148	×	185	5	181	E	147	U	213	ε	229	U	245
+	8	■	22	§	18	6	24	F	18	V	15	f	102	v	118	+	134	■	150	§	188	6	182	Φ	138	V	214	φ	230	/	248
X	7	●	20	'	10	7	25	G	11	W	67	g	108	w	114	X	185	●	151	'	197	7	180	Γ	149	Π	215	γ	231	ω	247
Z	8	▲	24	(	45	8	26	H	12	X	15	h	104	x	120	Z	138	▲	152	(	198	8	184	X	200	Ξ	218	χ	232	ξ	248
Y	8	—	25	)	41	9	27	I	18	Y	69	i	105	y	121	Y	187	—	194	)	198	9	185	I	201	Ψ	217	ι	233	ψ	249
X	10	.	26	#	42	:	38	J	14	Z	10	j	108	z	122	X	139	.	134	×	170	→	188	202	Z	219	ζ	234	ζ	230	
κ	11	.	27	+	40	:	38	K	15	[	61	k	107	{	128	κ	189	.	135	±	171	↑	187	K	203	[	219	κ	235	{	251
X	12	.	28	,	44	<	40	L	18	\	12	l	108		134	X	140	.	138	κ	172	≤	188	Λ	204	√	220	λ	236		252
	14	.	29	-	45	=	41	M	17	]	69	m	108	}	125		141	.	137	≠	178	≠	189	M	205	]	221	μ	237	}	253
κ	14	.	30	.	46	>	42	N	18	^	14	n	110	~	128	κ	142	.	138	.	174	≥	190	N	206	^	222	ν	238	°	254
-	15	.	31	/	47	?	48	O	18	_	65	o	111	■	127	-	149	.	139	/	175	+	181	O	207	_	229	o	240	┌	255

Note: Integer Equivalents > 127 are Greek  
INTEG 0 thru 31 are special centered symbols

Characters Available in Subroutine SYMBOL  
Complex, Principal, Latin and Greek Fonts

33	0	6	34	P	35	-	36	p	118	180	O	178	±	179	Π	206	'	204	π	240	
!	34	1	6	A	35	Q	36	a	119	←	181	1	177	A	185	⊙	209	α	215	ϕ	241
	34	2	6	B	35	R	36	b	124		182	2	178	B	184	P	210	β	216	ρ	242
⊙	35	3	6	C	36	S	37	c	125	#	183	3	179	H	186	Σ	211	γ	217	σ	243
\$	36	4	6	D	37	T	38	d	126	∩	184	4	180	Δ	188	T	212	δ	218	τ	244
∞	37	5	6	E	38	U	39	e	127	∓	185	5	181	E	187	I	213	ε	219	υ	245
∇	38	6	6	F	39	V	40	f	128	⊗	186	6	182	Φ	189	°	214	φ	220	⋆	246
	38	7	6	G	40	W	41	g	129		187	7	183	Γ	189	Ω	215	γ	221	ω	247
(	39	8	6	H	41	X	42	h	130	}	188	8	184	X	200	⊚	216	χ	222	ξ	248
)	40	9	6	I	42	Y	43	i	131		189	9	185	I	201	Ψ	217	ι	223	ψ	249
*	41	:	6	J	43	Z	44	j	132		190	→	186	⊙	202	Z	218	⊙	204	ζ	250
+	42	:	6	K	44	[	45	k	133		191	↑	187	K	203		219	κ	225	ϕ	251
,	43	<	6	L	45	√	46	l	134	∩	192	'	188	Δ	204	∓	220	λ	226	∥	252
-	44	=	6	M	46	]	47	m	135	∩	193	∈	189	M	205		221	μ	227	Ξ	253
.	45	>	6	N	47	=	48	n	136	'	194	"	190	N	206		222	ν	228	~	254
/	46	?	6	O	48	÷	49	o	137	∩	195	↓	191	O	207	'	223	ο	229		255

Note: Integer Equivalences > 127 are Greek

Characters Available in Subroutine SYMBOL  
Duplex, Principal, Latin and Greek Fonts

33	0	6	34	P	35	-	36	p	118	180	O	178	±	179	Π	206	'	204	π	240	
!	34	1	6	A	35	Q	36	a	119	←	181	1	177	A	185	⊙	209	α	215	ϕ	241
	34	2	6	B	35	R	36	b	124		182	2	178	B	184	P	210	β	216	ρ	242
⊙	35	3	6	C	36	S	37	c	125	#	183	3	179	H	186	Σ	211	γ	217	σ	243
\$	36	4	6	D	37	T	38	d	126	∩	184	4	180	Δ	188	T	212	δ	218	τ	244
∞	37	5	6	E	38	U	39	e	127	∓	185	5	181	E	187	I	213	ε	219	υ	245
∇	38	6	6	F	39	V	40	f	128	⊗	186	6	182	Φ	189	°	214	φ	220	⋆	246
	38	7	6	G	40	W	41	g	129		187	7	183	Γ	189	Ω	215	γ	221	ω	247
(	39	8	6	H	41	X	42	h	130	}	188	8	184	X	200	⊚	216	χ	222	ξ	248
)	40	9	6	I	42	Y	43	i	131		189	9	185	I	201	Ψ	217	ι	223	ψ	249
*	41	:	6	J	43	Z	44	j	132		190	→	186	⊙	202	Z	218	⊙	204	ζ	250
+	42	:	6	K	44	[	45	k	133		191	↑	187	K	203		219	κ	225	ϕ	251
,	43	<	6	L	45	√	46	l	134	∩	192	'	188	Δ	204	∓	220	λ	226	∥	252
-	44	=	6	M	46	]	47	m	135	∩	193	∈	189	M	205		221	μ	227	Ξ	253
.	45	>	6	N	47	=	48	n	136	'	194	"	190	N	206		222	ν	228	~	254
/	46	?	6	O	48	÷	49	o	137	∩	195	↓	191	O	207	'	223	ο	229		255

Note: Integer Equivalences > 127 are Greek

Characters Available in Subroutine SYMBOL  
Complex, Indexical, Latin and Greek Fonts

23	D 43	∞ 24	P 33	' 22	p 113	123	0 178	± 122	Π 202	' 224	π 240	
!	33	1 46	A 25	Q 21	a 27	q 112	← 121	1 177	A 122	⊙ 203	α 206	∅ 241
24	2 50	B 22	R 23	b 28	r 114	122	2 179	B 124	P 223	β 208	ρ 242	
∂ 26	3 51	C 27	S 24	c 29	s 115	# 125	3 178	H 125	Σ 211	γ 207	σ 243	
\$ 28	4 22	D 28	T 25	d 30	t 116	∩ 126	4 180	Δ 126	T 212	δ 209	τ 244	
∇ 29	5 23	E 29	U 26	e 31	u 117	∓ 127	5 181	E 127	T 213	ε 210	υ 245	
30	7 25	G 31	W 27	g 32	w 118	⊕ 128	6 182	Φ 128	S 214	φ 211	∞ 246	
( 31	8 26	H 32	X 28	h 33	x 119	129	7 183	Γ 129	Ω 215	γ 212	ω 247	
) 41	9 27	I 33	Y 29	i 34	y 120	130	8 184	X 130	Ξ 216	χ 213	ξ 248	
*	32	: 28	J 34	Z 30	j 35	Z 121	131	9 185	I 211	ψ 214	∫ 249	
+ 42	; 29	K 35	[ 31	k 36	≡ 122	132	170	→ 186	⊗ 212	ζ 215	§ 250	
,	34	< 30	L 36	√ 32	l 37	/ 124	133	↑ 187	K 213	η 216	κ 251	
- 43	= 31	M 37	] 32	∏ 20	≧ 123	∞ 172	134	Δ 204	∫ 214	λ 217	∥ 252	
.	44	> 32	N 38	≡ 33	∏ 21	× 125	135	ε 188	E 124	M 216	∞ 253	
/ 47	? 33	O 39	÷ 34	∅ 211	127	∩ 173	136	+ 189	∅ 217	∞ 218	∞ 254	

Note: Integer Equivalence > 127 are Greek

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<sup>4</sup>VersaTerm-PRO is a registered trademark of Ablebeck Software.

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