Section Contents

U300.010 Introduction and General Features

DAMM is a Display, Analysis and Manipulation Module which is configured to be used on DECstations, SPARCstations, ans VAXstations. DAMM provides the features to be found in VAXPAK programs DAM, SAM, TDX and XAM. Some general features are listed below.

Display features .....

(1)....Works with DECstations, SPARCstations & VAXstations running windows.

(2)....Displays 1-D data from HIS- or SPK-files.

(3)....Displays 2-D data from HIS-files.

(4)....Hardcopy available via screen-copy to LN03, LN03 ScriptPrinter

(5)....A dialog record may be saved on a Log-file.

(6)....Supports Free-Form (Banana) gate construction.

(7)....Provides for total number of counts within a Banana.

(8)....Supports X- & Y-projections of Bananas (saved on DAMQ8Q.SPK).

(9)....Provides for peak sum, centroid and fwhm.

(10)...Provides for spectrum analysis (fitting - see SEC# U300.400).

General features .....

(1)....Reads 1-D histograms from either HIS-, SPK-files.

(2)....Extracts GATES (on parameters 1 or 2) from 2-D histograms.

(3)....Supports general projections of Bananas on arbitrary axis.

(4)....Forms linear combinations, gain-shifts etc. of 1-D histograms.

(5)....Forms linear combinations, gain-shifts etc. of 2-D histograms.

(6)....Does linear gain and intercept transformations by rebinning.

(7)....Does crunches (sums a specified number of channels together).

(8)....Lists and plots 1-D histograms on the line printer.

(9)....Shows directory (ID'S) contained in HIS-, SPK- & BAN-files.

(10)...Shows count-sums for all ID's in SPK- or HIS-files.

(continued on next page)

Program operation .....

The program is controlled by a set of commands (alphabetic directives) and associated data-lists (numbers): I call these command-lists. Input is free-form. Command and list-element delimiters are BLANK , ( ) /

U300.020 GETTING STARTED

The steps given below outline how I would do it. Of course, you can do it any way that you choose or not at all.

(1)....Log onto the workstayion, Xterminal, etc. in the usual manner.

(2)....Open a window and move it to the lower left corner of screen.

```
(3)....Type:  damm                ;to start program on any host
                                  ;where the path to the executable
                                  ;has been defined in your
                                  ;.cshrc, .login or login.com files
                                  ;otherwise,

       Type:  /usr/hhirf/damm     ;to start on a HHIRF DECstation

       Type   /home/upak/damm     ;to start on a HHIRF SPARCstation

(4)....Type:  H                   ;for HELP directory
(5)....Type:  H  ITEM             ;for help on directory ITEM
(6)....Type:  H  FIG              ;for screen configurations
```

(7)....Try a few FIG commands to get a feel for how they work.

(8)....Note the fact that the display required for entering fitting information (like peak positions, etc) is via the DS & DSX commands rather than the general display commands D & DX.

(9)....Learn to use the HELP facility. That will usually be more up-to-date than this document.

(10)...Filenames have been made case-sensitive for the UNIX version. Where default extensions apply, upper case is assumed for VMS and lower case is assumed for UNIX. Acceptable standard extensions now include .spk, .SPK, .his, .HIS, .ban, .BAN, .cmd & .CMD. Note: If the his-file extension is lower/upper case then the drr-file extension must be lower/upper case. Also note:

```
/usr/users/directory/subdirectory/filename   ;is an acceptable form but

        ../directory/subdirectory/filename   ;is NOT! (at least for now)
```

U300.030 Commands for Assigning Input/Output Files

```
IN   FIL.EXT    - Open N-file (EXT = SPK or HIS)
OU   FIL.EXT    - Open O-file (EXT = SPK or HIS) - OUTPUT for SPK only
OU   FIL.SPK,NEW- Create and open O-file (SPK-file for output)
QF   FIL.EXT    - Open Q-file (EXT = SPK or HIS) - for display only
RF   FIL.EXT    - Open R-file (EXT = SPK or HIS) - for display only
SF   FIL.EXT    - Open S-file (EXT = SPK or HIS) - for display only
BAN  FIL        - Open FIL.BAN for store, recall, proj, etc
BAN  FIL,NEW    - Create & open FIL.BAN for store, recall, etc
                - (See below for how to specify variable FILENAMES)
CLO  F          - Closes F-file (where F = N, O, P, Q, R, S or BAN)
DFIL            - Displays data files currently open

CMD  FIL        - Open and process commands from FIL.CMD
CMD  FIL.EXT    - Open and process commands from FIL.EXT

LON/LOF         - Turn Log-output (to LU7) ON/OFF (default = OFF)
```

Explanation of variables in FILENAMES .....

One symbol (integer variable) may be incorporated in a FILENAME specification as the following examples illustrate:

Example-1 .....

```
SYM=3
OU FIL"SYM".SPK  ;Opens FIL3.SPK
```

Example-2 .....

```
I=0
LOOP 3
I=I+1
IN FIL"I".SPK    ;Opens (in succession) FIL1.SPK, FIL2.SPK, FIL3.SPK
.
ENDLOOP
```

U300.040 Commands Related to Loop-Execution & Symbol-Definition

```
SYM = EXPRESSION - Define symbol (SYM) up to 100 symbols supported
                 - symbols: UIND CIND ULOC CLOC FIX NONE FITS ALL and
                 - COLR GREY DOTS LIVE BAN  M N O P Q R S are reserved
                 - expression syntax is same as in CHIL
                 - no imbedded blanks are allowed in expressions
                 - symbols may contain up to 4 characters (5-8 ignored)

DSYM             - Displays list of currently defined sumbols & values

LOOP N           - Starts LOOP (executed N-times) N=SYM or CONST
CMD  ....        - Nesting supported
CMD  ....        - # lines between 1st LOOP & matching ENDL = 100
ENDL             - Defines end-of-loop
                 - KILL (entered before END) kills LOOP
                 - Ctrl/C    - aborts loop-in-progress
                 - opening of CMD-file within a LOOP not allowed
```

(continued on next page)

LOOP suspension - the WO command

A command WO [means the same thing as WOA or WHOA - i.e the opposite of GIDDUP (my preferred spellings)] has been implemented to work within LOOPs. Whenever the WO command is encountered (within a LOOP only, otherwise it's illegal), the message:

Type [RETURN] to CONTINUE--->

will appear on the screen. This gives you an opportunity to look at the display etc. before it gets wiped out. When you are finished looking, press the [RETURN] key and it will continue.

U300.050 Log File - damm.log

The VMS version of DAMM always creates a new version of DAMM.LOG while the UNIX version creates a new damm.log or appends to an old version of damm.log if it exists. If you enter the command LON, almost all dialog to and from the host will be logged, otherwise, only certain "print commands" will produce output to the log-file or device. You may turn the log ON/OFF by entering LON/LOF.

U300.060 Comments on Hard Copy

As I have defined the default the color mapping, it is best to set up the Workstation to Print Screen in the negative image mode. If you are printing on something like a LN03 ScriptPrinter, anything you chose to print will be scaled to fit on one page. If you are using an LN03, it may come out on multiple pages (and you may miss some) unless you choose a "Portion of Screen" that it likes.

U300.070 File ID-directories and Count-Sums

```
DIR  KF   Displays a list of all ID's in file-KF, where
          KF   left blank says input-file
          KF = N     denotes   input-file
          KF = O     denotes  output-file
          KF = Q     denotes       Q-file
          KF = R     denotes       R-file
          KF = S     denotes       S-file
          KF = BAN   denotes     BAN-file

LDIR KF   Logs a list of all ID's in file-KF on DAMM.LOG

DDIR KF   Displays ID's & # of non-zero channels for SPK-files
DDIR KF   Displays ID-directory in detail        for HIS-files
          Also logs on DAMM.LOG if LON

DSUM KF   Displays count-sums of all ID's on file-KF
          Also logs on DAMM.LOG if LON
```

U300.090 Cursor Tracking Problems With Xterminals

The software-generated full-window cursor displayed by DAMM when in the "1-key cursor mode" requires a lot of real-time response from the host computer for live tracking of the mouse. This works fine when the host is a local workstation but does not work well for Xterminals hosted by a busy VAX. The following commands are intended to alleviate this problem. Type:

```
CURT LIVE  ;for full-window cursor which tracks mouse "live" (default)

CURT X     ;for new cursor display only for mouse-click or key-press
           ;(works better for Xterminals hosted by busy VAX, etc.)
```

Execute the desired CURT command and then FIG to make it take effect.

U300.100 Changes in Cursor-Mode Commands

I have eliminated the destinction between upper and lower case in all cursor-mode commands. The Shift- and Caps-lock keys have no effect. In order to do this and retain meaningful command names, it was neccessary to use two keys for certain commands. These commands (UP, UX, UW, UL, UH, UO, and UB) are defined below:

```
P/UP   Add/Delete peak to Library (pos specified by cursor)
X/UX   Fix/Free  peak position (for displayed peak nearest to cursor)
W/UW   Fix/Free  peak width    (for displayed peak nearest to cursor)
L/UL   Fix/Free  Lo-Side ASYM  (for displayed peak nearest to cursor)
H/UH   Fix/Free  Hi-Side ASYM  (for displayed peak nearest to cursor)
O/UO   Turn peak  ON/OFF       (for displayed peak nearest to cursor)
B/UB   Add/Delete background point at cursor position
```

Read UP as Unset Peak, for example. As usual, no carriage return is used. There are also a few other changes in commands. These are listed below:

```
LF-ARROW    Set expand-region lo-limit
RT-ARROW    Set expand-region hi-limit
DN-ARROW    Pan DOWN - move picture so cursor-chan at right-screen
UP-ARROW    Pan UP   - move picture so cursor-chan at  left-screen
/           Display XCUR, YCUR, channel# & energy
```

U300.110 Mouse Button Customizing

The Mouse Buttons can be used in place of some key-strokes while in the 1-key cursor-mode. Different button definitions are provided for the three different types of displays (namely: the displays resulting from the commands D, DD & DS). The following customizing commands are supported:

```
BUD  L,M,R  ;Defines Left,Middle,Right buttons for cursor in  D-window
BUDD L,M,R  ;Defines Left,Middle,Right buttons for cursor in DD-window
BUDS L,M,R  ;defines Left,Middle,Right buttons for cursor in DS-window
BUD  L,H,S  ;Example (cursor in 1-D)   L-butt sets sum-reg lo-limit,
            ;M-butt sets sum-reg hi-limit,  R-butt requests S-sum
BUDD A,T,Z  ;Example (cursor in 2-D)   L-butt adds banana points,
            ;M-butt totalizes enclosed counts,  R-butt zots banana
```

Buttons can't be set to / or ; - set to ? or : instead

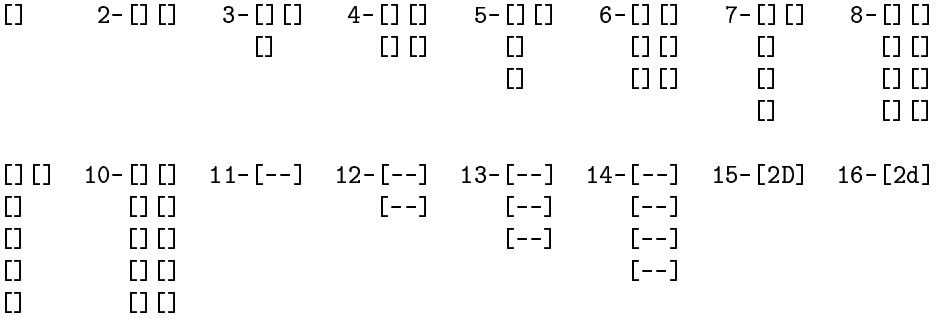
U300.120 Screen Setup and Color Mapping

Screen configuration (placement of graphics windows on the screen) and color (or black & white) mapping is discussed in more detail in SEC# U300.550, U300.560 and U300.570 (if you have a B&W monitor, you will probably want to change the color mapping). Here we give the usual list of commands and a brief description of each.

COMMANDS RELATED TO SCREEN SETUP & COLOR MAPPING .....

```
FIGI           ;Set  screen configuration library to default
FIGF FILNAM    ;Read screen configuration library from FILNAM
FIG  N         ;Set current screen configuration to type-N

WIN  ID        ;Set subsequent displays to be in window-ID (dflt=1)

AXON ID        ;Enable  the drawing of axis for  window-ID (dflt)
AXOF ID        ;Disable the drawing of axis for  window-ID

CMAP           ;Set color map to default  ("takes" after next FIG)
CMAP FILNAM    ;Set color map from FILNAM ("takes" after next FIG)
REVV           ;Reverse all color specs   ("takes" after next FIG)

DLNS N         ;Set # disp-lines = N - for HELP, DDIR & DSUM

CURT LIVE      ;Set full-wind cursor to track mouse LIVE (default)
CURT X         ;New full-wind cursor generated via mouse-click or key
               ;The CURT command takes effect only after next FIG

SSI            ;Set screen to initial - erase all graphic windows
```

Program damm has, by default, 16 pre-defined screen connfigurations available. Each is referenced (via the FIG command) by an ID-number. A list of the ID-numbers along with the associated configuration is given below. Try a few FIGs and observe the results or if you really want to get serious, see SEC# U300.550. In particular, if you have an Xterminal with less than 1024 x 860 pixels, you will probably need to modify the configuration table as described in SEC# U300.550.



U300.130 Display Delay (hangup problems)

Some display devices (X-terminals for example) may require a delay between successive displays. If your device "hangs up" or produces "incomplete displays" when executing LOOPS, you might try increasing the appropriate delay. A range of 10 to 20000 miliseconds is accepted.

```
DLAF MS        ;Set FIG-delay     to MS   milliseconds (default=1000)
DLAF           ;Set FIG-delay     to 1000 milliseconds
DLAD MS        ;Set Display-delay to MS   milliseconds (default=500)
DLAD           ;Set Display-delay to 500  milliseconds
```

U300.150 Commands Related to 1-D Display

```
FIG  NF        ;Choose screen config-NF. See SEC# U300.120 & U300.550
               ;for screen configuration and color mapping commands
WIN  NW        ;Set subsequent displays to be in window-NW

LIN/LOG        ;Set display to linear/log  (default is linear)

PLON/PLOF      ;Turn peak logging ON/OFF (dflt OFF) see SEC# U300.155

ST /OV         ;Set to disp mult hist stacked/overlayed (dflt = OV)

CAL  A,B,C     ;Define energy calibration (E=A+B*Chan+C*Chan**2)

COL  I,J,K...  ;Defines color sequence for display
               ;For I,J.. = 1     2   3     4    5    6       7
               ;       COL= white,red,green,blue,yellow,magenta,cyan
GWID WID       ;Define cursor-mode sum-region width (channels)

DNOR LO,HI     ;Normalize displayed data to count-sum of chans LO,HI

DL   LO,HI     ;Set display limits (min,max chan#)

DMM  LO,HI     ;Set display limits (min,max counts)
               ;LO or HI = X  says use MIN or MAX data value

D    IDLST     ;Display histogram ID's contained in IDLST

DX   IDLST     ;Display IDLST (range defined by expand-region)
               ;IDLST format is   KF C ID, C ID.. KF C ID, C ID..
               ;C is an OPTIONAL floating-point norm-coeff (DFLT=1.0)
               ;KF = M,N,O,P,Q,R,S (default is N) and denotes:
               ;MEM-BUF, IN-FIL, OU-FIL, PROJ-FIL, Q-FIL, R-FIL, S-FIL
               ;If IDLST omitted, uses previously defined IDLST

SUML LO,HI     ;Define sum region for SUM command below
SUM  IDLST     ;Sum counts (LO,HI) (IDLST same as D except C illegal)

C              ;Enter cursor-mode

SSI            ;Set screen to initial - erase graphic windows
```

(continued on next page)

U300.150 Commands Related to 1-D Display (continued)

1-KEY CURSOR COMMANDS FOR 1-D DISPLAY .....

```
<-- (LF-ARROW) ;Set expand-region lo-limit
--> (RT-ARROW) ;Set expand-region hi-limit

V              ;Make marker display visible/invisible (toggles)
E              ;Expand display

M              ;Turn marker display ON
K              ;Turn marker display OFF (K is for kill)

UP-ARROW       ;Pan up   - move picture so cursor-chan at  left-screen
DN-ARROW       ;Pan down - move picture so cursor-chan at right-screen
               ;(you must be expanded to execute pan)

L              ;Set sum-region lo-limit
H              ;Set sum-region hi-limit
G              ;Set sum-region limits (LO=XCUR, HI=XCUR+WID-1)

S              ;Display sum, centroid, fwhm (2.354*sigma) of sum region
               ;DATA(LO),DATA(HI) defines BGD for NETS

A              ;Display sum, centroid, fwhm (2.354*sigma) of sum region
               ;YCUR(LO),YCUR(HI) defines BGD for NETS

C              ;Draw peak-marker and display chan#  at cursor pos
P              ;Draw peak-marker and display energy at cursor pos

/ or ?         ;Display XCUR, YCUR, channel# & energy
'              ;Same as ? except forces logging (see SEC# U300.155)

Q              ;Quit cursor-mode (return to normal-mode)
```

See SEC# U300.110 or Type: h mous for use of Mouse Buttons.

U300.155 Peak Finding/Logging

The following commands control peak finding.

```
FIND BIAS,IFWHM     ;Turn peak-find ON  (see definitions below)
FIND                ;Turn peak-find ON  (with defaults - see below)
NOFI                ;Turn peak-find OFF (default is OFF)
```

BIAS...is the number of standard deviations above background that a peak channel must be in order to be considered as part of a peak. Useful values of BIAS are in the range 3 to 10. The default value is 5.0.

IFWHM..is the approximate full-width at half-max (in channels) of peaks in the region of interest. This value is not very critical but should be within a factor of 2 or so of the correct value. The default value is 5.

All peaks found within the display region will be marked & labeled with the associated energy-calibration value (default is the same as channel number). Peak labels are integers (no decimals - to minimize screen space used) so if you want labels to be in units of keV, for example, you must enter CAL such that E(keV) is a whole number.

See SEC# U300.430 for how peak-finding is used in fitting operations.

Logging "found" and "marked" peaks on damm.log

Peaks which either found via the FIND command above or marked via the 1-key command (/ or ? or ;) may be logged on damm.log. The following commands (independent of LON/LOF) turns said logging ON and OFF.

```
PLON           ;Turns peak logging (to damm.log) ON
PLOF           ;Turns peak logging (to damm.log) OFF (default)
```

For found peaks, damm.log may be read (skipping prog, date & time) as:

```
       READ(LU,10)IFLG,ID,CH,HEFT,(FILNAM(I),I=1,16)
    10 (29X,A4,I10,2F10.0,2X,16A4)
```

Where: IFLG = 'PEAK' for found peak log entry
ID = Spectrum ID number
CH = Peak location in channels
HEFT = Peak heftiness
FILNAM = First 64 characters of spk- or his-filename

For marked peaks, damm.log may be read (skipping prog, date & time) as:

```
       READ(LU,10)IFLG,ID,CH,ENER,(FILNAM(I),I=1,16)
    10 (29X,A4,I10,2F10.0,2X,16A4)
```

Where: IFLG = 'MARK' for marked peak log entry
ID = Spectrum ID number
CH = Peak location in channels
ENER = Peak "energy" from calibration constants
FILNAM = First 64 characters of spk- or his-filename

U300.160 Commands Related to 2-D Display

```
FIG   NF       ;Choose screen config-NF. See SEC# U300.120 & U300.550
               ;for screen configuration and color mapping commands

WIN   NW       ;Set subsequent displays to be in window-NW

ZLEV  N        ;Set # of color/grey-scale intensity levels to N
ZLEV           ;Set # of color/grey-scale intensity levels to 10 (dflt)

GRAS  I,J,K..  ;Set grey-scale values (range 0-100) & ZLEV (# entries)
               ;Must do after first FIG  ("takes" after next FIG)

ZINT  COLR     ;Set 2-D intensity mapping to Color (default)
ZINT  GREY     ;Set 2-D intensity mapping to Grey-scale
ZINT  DOTS     ;Set 2-D intensity mapping to Dot-matrix (3x3 or 5x5)

ZSON/ZSOF      ;Z-scale ON/OFF - displays cnts vs colors legend (dflt)

ZLIN/ZLOG      ;Set 2-D display to linear/log (default is log)

XC    LO,HI    ;Set min & max X-channel numbers for display
YC    LO,HI    ;Set min & max Y-channel numbers for display

ZMM   LO,HI    ;Set min & max counts/channel    for display & count-sum
ZMM   LO       ;Sets min & searches for max (semi-autoscale)
ZMM            ;Searches for min & max      (full-autoscale)

DD       ID    ;Display 2-D histogram ID from IN-file
DD    KF,ID    ;Display 2-D histogram ID from KF-file

DDX      ID    ;Display 2-D histogram ID from IN-file (expand region)
DDX   KF,ID    ;Display 2-D histogram ID from KF-file (expand region)
               ;Where KF = N,O,Q,R,S (default is N) and denotes:
               ;IN-FIL, OU-FIL, Q-FIL, R-FIL, S-FIL
               ;ID (and KF) omitted says use previously defined spec

DDID           ;Shows ID-number & Filename for current 2-D display

ZBL            ;Zero in-core BAN-library

LBL            ;List in-core BAN-ID numbers

C              ;Enter cursor-mode

SSI            ;Set screen to initial - erase graphic windows
```

(continued on next page)

U300.160 Commands Related to 2-D Display (continued)

1-KEY CURSOR COMMANDS FOR 2-D DISPLAY .....

```
<-- (LF-ARROW) ;Set expand-region lo-left- limit
--> (RT-ARROW) ;Set expand-region hi-right-limit

V      ;Make expand markers visible/invisible (toggles)

E      ;Expand

1      ;Move display such that cursor is at lo-left
2      ;Move display such that cursor is at hi-left
3      ;Move display such that cursor is at hi-right
4      ;Move display such that cursor is at lo-right

Z      ;Zero  (open) active X,Y-list
A      ;Add point to active X,Y-list
D      ;Dele nearest point in active X,Y-list
M      ;Move nearest point in active X,Y-list to cursor pos
I      ;Insert a point in active X,Y-list at cursor position

L      ;List active X,Y-list (on VDT)
B      ;Draw active BAN & BAN's in in-core library
G      ;Prompt for ID & read into in-core BAN-library
O      ;Open nearest in-core BAN for modification
S      ;Prompt for ID & store in in-core library & on disk
R      ;Store  nearest BAN with original ID
F      ;Remove nearest BAN from in-core library & erase
K      ;Delete nearest BAN from in-core library and disk
T      ;Totalize counts in nearest BAN (active or not)
P      ;Totalize and & save X- & Y-projections on DAMQ8Q.SPK

/ or ? ;Display/(log if PLON)  X,Y-coordinates of cursor
'      ;Like ? but forces log (see X,Y-log format below)

Q      ;Quit cursor-mode (return to normal-mode)
```

See SEC# U300.110 or Type: h mous for use of Mouse Buttons.

X,Y-log format- damm.log may be read (skipping prog, date & time) as:

```
       READ(LU,10)IFLG,ID,X,Y,(FILNAM(I),I=1,16)
    10 (29X,A4,I10,2F10.0,2X,16A4)

Where: IFLG   = 'MAR2' for 2-D position mark entry
       ID     = Histogram ID number
       X      = X-position in channels
       Y      = Y-position in channels
       FILNAM = First 64 characters of spk- or his-filename
```

U300.170 Special XY-Line Display

DECstation damm provides for the display of one or more lists of concatenated vectors (lines) onto any of the FIGed windows. In order to use this feature, a ASCII file must be created of the following form:

```
XYDATA  ID  XLEN  YLEN
X Y
X Y
. .
. .
XYDATA  ID  XLEN  YLEN
X Y
X Y
. .
END-OF-FILE     Where:
```

XYDATA is the ASCII string "xydata" in upper or lower case (XYDA is enough).

ID.....is an integer ID-number by which the X,Y data set which follows will be referenced.

XLEN...is the X-length basis for the following X-values (optional).

YLEN...is the Y-length basis for the following y-values (optional).

X......is a floating# (used as chan# for 1D & 2D displays).
(X is decoded via E-format & can contain up to 12 characters)

Y......is a floating# (used as chan# for 2D and count for 1D displays).
(Y is decoded via E-format & can contain up to 12 characters)

If XLEN and YLEN are entered and "histogram lengths" are provided by the displayed histograms, the X,Y data will be appropriately scaled to match the histogram data contained in the window in which it is drawn. "Histogram lengths" are provided by all his-file directories and by spk-file entries which are copied from his-files. If either of these "length entries" are missing, no scaling will be done. For 1D displays, no attempt is made to scale Y.

(continued on next page)

U300.170 Special XY-Line Display (continued)

List of commands

```
XYF  filename     ;Opens XY-file and reads in all data

XYI               ;Displays XY IDs which have been read in

XYD  I J K L ...  ;Displays XY data for IDs (I J K L ..) into active
                  ;window (default = window 1 or set by WIN command)

XYP  I J K L ...  ;Same as XYD except that XY-points are shown in
                  ;addition to the connecting vectors

                  ;XYD or XYP with no ID-list uses previous ID-list

XYC  KOL          ;Specifies the "color" for subsequent XY displays
                  ;Legal values of KOL are:

                  ;WHIT - white      - CMAP entry 34
                  ;RED  - red        - CMAP entry 35
                  ;GREE - green      - CMAP entry 36
                  ;BLUE - blue       - CMAP entry 37
                  ;RG   - red-green  - CMAP entry 38
                  ;RB   - red-blue   - CMAP entry 39
                  ;GB   - green-blue - CMAP entry 40
```

Note: Displays are done in "complement mode" so that displaying the same ID a second time will erase it, displaying a third time will show it, etc.

Current Limits

```
Maximum number of IDs        in a file = 2048
Maximum number of XY entries in a file = 256,000
Maximum number of XY points  in a set  = 500
```

These limits are rather arbitrary, and can easily be changed.

Comments

(1)....The XY display feature is for display only. The XY data file is not another data type on a par with HIS-file or SPK-file data. It cannot be analysed, summed, or combined with other data, etc.

(2)....If the XY data extend beyond the range of the display, it is allowed to spill over into the "scale label" regions. It is easy enough to prevent this but I am not sure if it would be more desirable.

(3)....An ID label is drawn near to the XY-point which is "nearest" to the center of the window. If multiple XY-lines are displayed, there may be some confusion in identification. I will think about trying to minimize this.

(4)....All commands and specifications are case insensitive.

U300.175 Label Generation and Annotation

damm provides a simple method for labeling and annotating graphical displays. The following features are provided:

(1)....Normal text labels may be generated either interactively or by the usual processing of command files.

(2)....The Label Generating Commands (LA7, LA8, LA9) described below are used to generate up to three blocks of "label text".

(3)....Each of the three "label blocks" can contain up to 10 lines of text with each line containing up to 76 characters (80 - 4 command characters).

(4)....Each damm window supports up to 3 independent, active (relocatable) label blocks.

(5)....By "locking" labels already displayed and re-defining label blocks, you can display as many labels as you like.

(6)....Labels are positioned within graphics windows using the 1-key Label Display Commands described below.

(7)....Label Pointer Commands, defined below, may be used to make close associations between labels and specific graphic features.

Note: LA7, LA8, LA9 label specifiers are used in order to make the association with the label display keys (7,8,9) easier.

Label Generating Commands ----------

```
LA7  text   ;Adds line of "text" to LA7 label
LA8  text   ;Adds line of "text" to LA8 label
LA9  text   ;Adds line of "text" to LA9 label

LAZ7        ;Deletes all lines of   LA7 label
LAZ8        ;Deletes all lines of   LA8 label
LAZ9        ;Deleted all lines of   LA9 label

LAL         ;Displays current labels - LA7, LA8, LA9

LAC  KOL    ;Specifies label color for subsequent displays
            ;Legal values of KOL are:

            ;WHIT - white      - CMAP entry 34
            ;RED  - red        - CMAP entry 35
            ;GREE - green      - CMAP entry 36
            ;BLUE - blue       - CMAP entry 37
            ;RG   - red-green  - CMAP entry 38
            ;RB   - red-blue   - CMAP entry 39
            ;GB   - green-blue - CMAP entry 40
```

(see next page for label display commands)

U300.175 Label Generation and Annotation (continued)

Label Display Commands (1-key cursor-mode) ----------

Key	Action
7	Displays LA7 at cursor location (complement mode)
8	Displays LA8 at cursor location (complement mode)
9	Displays LA9 at cursor location (complement mode)
0	Locks previously displayed labels against subsequent change (i.e. all labels displayed in a given window will be fixed) (enables the drawing of additional labels)

It goes like this:

(1)....The first strike of say key-7 displays LA7 with the upper-left corner of an unclosed box at the cursor location.

(2)....The next strike of key-7 will erase the LA7 label and the box.

(3)....The next strike of key-7 will display LA7 in any new cursor location. Etc, etc. and the same for key-8 and -9.

(4)....Finally, key-0 will close any open boxes and lock in all current labels within a given window. Additional labels are now enabled.

Label Pointer Commands (1-key cursor-mode) ----------

The following 1-key commands provide for the interactive drawing of concatenated straight-line segments. The idea is to provide a method of associating a block of text with a very specific region in a display. The following 1-key commands are used to draw and modify such lines.

Key	Action
=	Adds a vector point to current list and draws point or line
-	Deletes last vector point in current list and erases line
;	Locks current vector list against subsequent change and enables new list

Comments:

(1)....Each window supports an independent active vector list.

(2)....The active vector-list associated with any window can contain a maximum of 20 points.

U300.200 Command Syntax - General Definitions

```
B1   - Memory Buffer-1
B2   - Memory Buffer-2
ID   - The  ID-number of histogram to be read
NUID - Next ID-number to be assigned to output histogram
LO   - A first-channel-number (usually of a Gate)
HI   - A last- channel-number (usually of a Gate)
FAC  - A multiplication factor
```

Meaning of the individual command-characters .....

```
I    - Input  or read
O    - Output or write
A    - Add or accumulate
S    - Shift (gain shift)
GX   - Gate on X-parameter (i.e. parameter # 1)
GY   - Gate on Y-parameter (i.e. parameter # 2)
1    - Buffer-1
2    - Buffer-2
M    - Multiply
C    - Crunch
D    - Divide
```

U300.210 Commands for Setup (no immediate action)

```
NUID IV    - Set next ID to be used to IV

IDST N     - Set ID-step to be used in implied I/O loops
             (remains active until changed - default=1)

CRUN IVAL  - Sets standard crunch value to IVAL

GASP XI1,XI2,XF1,XF2,NCF - Standard gain shift specification

SIDA       - Says treat 16-bit HIS-file data as signed
USDA       - Says treat 16-bit HIS-file data as un-signed (default)
```

U300.220 Commands for Input/Output of 1-D Histograms

```
I    ID            Input to B1
IS   ID            Input to B1, gain shift B1
IA   ID,FAC        Input to B1, B2=B2+FAC*B1
ISA  ID,FAC        Input to B1, shift  B1, B2=B2+FAC*B1
IO   ID            Input to B1, output B1
ISO  ID            Input to B1, shift  B1, output B1
IO   IDA,IDB       Input to B1, output B1     (for ID=IDA,IDB)
ISO  IDA,IDB       Input to B1, shift, output (for ID=IDA,IDB)
O1                 Output B1
O2                 Output B2
```

U300.230 Commands for Gating 2-D Histograms

```
GY   ID,LO,HI      Y-gate to B1
GYS  ID,LO,HI      Y-gate to B1, shift  B1
GYO  ID,LO,HI      Y-gate to B1, output B1
GYO  IDA,IDB,LO,HI Y-gate to B1,         output B1 (for ID=IDA,IDB)
GYSO ID,LO,HI      Y-gate to B1, shift & output B1
GYSO IDA,IDB,LO,HI Y-gate to B1, shift & output B1 (for ID=IDA,IDB)
GYA  ID,LO,HI,FAC  Y-gate to B1, B2=B2+FAC*B1
GYSA ID,LO,HI,FAC  Y-gate to B1, shift B1, B2=B2+FAC*B1

GX   ID,LO,HI      X-gate to B1
GXS  ID,LO,HI      X-gate to B1, shift  B1
GXO  ID,LO,HI      X-gate to B1, output B1
GXO  IDA,IDB,LO,HI X-gate to B1,         output B1 (for ID=IDA,IDB)
GXSO ID,LO,HI      X-gate to B1, shift & output B1
GXSO IDA,IDB,LO,HI X-gate to B1, shift & output B1 (for ID=IDA,IDB)
GXA  ID,LO,HI,FAC  X-gate to B1, B2=B2+FAC*B1
GXSA ID,LO,HI,FAC  X-gate to B1, shift B1, B2=B2+FAC*B1
O1                 Output B1
O2                 Output B2
```

U300.240 Commands for General 2-D Projections

```
PJ   ID,BID,DEGR               PROJ TO B1
PJS  ID,BID,DEGR               Proj to B1, shift  B1
PJO  ID,BID,DEGR               Proj to B1, output B1
PJO  IDA,IDB,BIDA,BIDB,DEGR -  Proj to B1, output B1
                               (outer loop on BID, inner loop on ID)
PJSO ID,BID,DEGR               Proj to B1, shift & output B1
PJSO IDA,IDB,BIDA,BIDB,DEGR -  Proj, shift, output
                               (outer loop on BID, inner loop on ID)
PJA  ID,BID,DEGR,FAC           Proj to B1, B2=B2+FAC*B1
PJSA ID,BID,DEGR,FAC           Proj to B1, shift B1, B2=B2+FAC*B1

PJAL                           Project all bananas in currently open
                               BAN-file for HIS-files, ID's & DEGR'S
                               contained therin
O1                             Output B1
O2                             Output B2
```

ID denotes histogram ID, BID denotes Banana ID

(DEGR = Projection-axis angle in degrees)

U300.250 Commands for Operations on Buffer-1 & Buffer-2

```
M1  XM             Multiply B1 by XM
M2  XM             Multiply B2 by XM
C1  ICRUN          Crunch B1  by ICRUN (standard crunch unchanged)
C2  ICRUN          Crunch B2  by ICRUN (standard crunch unchanged)
S1                 Shift  B1  by standard GASP
S2                 Shift  B2  by standard GASP
S1  XI1,XI2,XF1,XF2,NCF - Shift B1 as specified
                          (standard GASP unchanged)
S2  XI1,XI2,XF1,XF2,NCF - Shift B2 as specified
                          (standard GASP unchanged)
Z1                 Zero B1
Z2                 Zero B2
A12  FAC           B2=B2+FAC*B1
A21  FAC           B1=B1+FAC*B2
SWAP               Swap B1 & B2
M2D1 FAC           B2=(FAC*B2)/B1
O1                 Output B1
O2                 Output B2
```

U300.260 Commands which Show Data, Count-Sums etc (from Bufs-1 & -2)

```
PR1                Print   Buffer-1
PR2                Print   Buffer-2

D1   LO,HI         Display Buffer-1 (channels LO thru HI)
D2   LO,HI         Display Buffer-2 (channels LO thru HI)

SUM1 LO,HI         Display sum of counts LO-thru-HI of B1
SUM2 LO,HI         Display sum of counts LO-thru-HI of B2

COMP NCH           Compare first NCH-channels of B1 & B2
                   (gives # counts and # mis-matches)

GEN  ID,KO,KX,NCH  Generate test spectrum in B1 (NCH channels)
                   Channel contents = KO+KX*(channel#+1)
```

U300.270 Commands which Modify Buffer Contents

```
SET1 ICN,YV        Set channel ICN of B1 to YV
SET2 ICN,YV        Set channel ICN of B2 to YV
SET1 LO,HI,YV      Set channels LO-thru-HI of B1 to YV
SET2 LO,HI,YV      Set channels LO-thru-HI of B2 to YV
SET1 LO,HI,YA,YB   Set channels LO-thru-HI of B1 to YA-thru-YB
SET2 LO,HI,YA,YB   Set channels LO-thru-HI of B2 to YA-thru-YB
ADD1 ICN,YV        Add YV to channel ICN of B1
ADD2 ICN,YV        Add YV to channel ICN of B2
ADD1 LO,HI,YV      Add YV to channels LO-thru-HI of B1
ADD2 LO,HI,YV      Add YV to channels LO-thru-HI of B2
ADD1 LO,HI,YA,YB   Add YA-thru-YB to channels LO-thru-HI of B1
ADD2 LO,HI,YA,YB   Add YA-thru-YB to channels LO-thru-HI of B2
                   (i.e. a strait line)
```

U300.280 Commands Related to Printer Plots

```
SKRZ              Set to skip repeated-zeros for printer plots
PLRZ              Set to plot repeated-zeros for printer plots

PLG  ID,LO,HI,NCYC      - Input to B1 & LOG plot
PLN  ID,LO,HI,NCFS      - Input to B1 & LIN plot
PLG  IDA,IDB,LO,HI,NCYC - Input to B1 & LOG plot (for ID=IDA,IDB)
PLN  IDA,IDB,LO,HI,NCFS - Input to B1 & LIN plot (for ID=IDA,IBD)

PLG1 LO,HI,NCYC    Log    Printer-plot of Buffer-1
PLG2 LO,HI,NCYC    Log    Printer-plot of Buffer-2
PLN1 LO,HI,NCFS    Linear Printer-plot of Buffer-1
PLN2 LO,HI,NCYC    Linear Printer-plot of Buffer-2

(NCFS = # of counts full-scale for LIN plots)
(NCYC = # of cycles            for LOG plots)
```

U300.290 Discussion of Gain-Shifts and Compressions

Gain shifts are specified by five parameters - XI1, XI2, XF1, XF2 and NCF. XI1 and XI2 represent two locations (in channel-# units) in the initial 1-D histogram and XF1 and XF2 represent corresponding locations in the final histogram (i.e. after the transformation). That is:

```
      XF=A+B*XI
where,
      B=(XF2-XF1)/(XI2-XI1)
and
      A=XF1-B*XI1
```

NCF gives the number of channels in the histogram after the transformation. If NCF=0, the final #-of-channels is determined by the initial #-of-channels NCI and the transformation specified. If NCF=-1 the final #-of-channels is set equal to NCI. Counts are redistributed into the final set of channels (bins) by assuming a uniform distribution of counts in the initial bins. Data shifted below channel-#-0 and above channel-#-NCF-1 are lost and gone forever.

Gain-shifts are always "in place"
CRUN IVAL (i.e. standard crunch) does it at "input time"
Data is kept internally as floating - is converted to fixed on output
All output from DAMM is 32 bits/channel

U300.300 Manipulation of HIS-files (Copy, Add, Gain-Shift, etc)

DAMM can copy, add (or subtract) and gain-shift 1-D or 2-D histograms from an input HIS-file to an output HIS-file.

(1)....All operations are from an INPUT-file and INPUT-ID (IDI) to an OUTPUT-file and OUTPUT-ID (IDO).

(2)....For HCOP and HADD operations, the output histogram must have the same dimensions and ranges as the input histogram.

(3)....For SHIF (gain-shift) and SHAD (gain-shift & add) operations, the dimensions of the output histogram need not match the input.

(4)....The number of bits-per-channel (16 or 32) need not be the same for input and output.

(5)....Gain-shifts are accomplished by converting the data to floating point, rebinning (with count fractionation) and finally converting back to integer.

(6)....Fractional copies and adds are also done in floating point.

(7)....Final conversion from floating point to integer involves the addition of a random number whose range is 0.0 to 1.0. This procedure results in slight differences in the total number of counts for the input and output histograms.

Use CHIL to create output DRR-file and allocate HIS-file as usual.

```
HOU  FIL.HIS            - Opens HIS-file for output

SNEG OFF                - Turn OFF reset of neg 16bit out data (default)
SNEG IV                 - Says set negative 16-bit output data to IV
                        - (you MUST use SIDA mode for this to work!!)

GSX  XI1,XI2 XF1,XF2    - Defines   X-gain-shift (described below)
GSY  YI1,YI2 YF1,YF2    - Defines   Y-gain-shift (described below)

GSXOF                   - Turns X-gain-shift OFF (GSX turns it ON)
GSYOF                   - Turns Y-gain-shift OFF (GSY turns it ON)

HSTA                    - Shows files open & gain-shift data

HCOP IDI,IDO <,F>       - Copies F*IDI (input) to IDO (output)
                          (If F is not entered, F=1)

HADD IDI,IDO <,FI><,FO> - Adds FI*IDI to FO*IDO
                          (If FI is not entered, FI=1)
                          (If FO is not entered, FO=1)
                          (If FO is entered, FI must be entered)
```

(continued on next page)

U300.300 Manipulation of HIS-files (continued)

```
HDIV IDI,IDO <,FI>      - Divides FI*IDI by IDO & saves in IDO

SHIF IDI,IDO <,FI>      - Gain-shifts IDI & stores in IDO
SHAD IDI,IDO <,FI><,FO> - Gain-shifts IDI & adds   to IDO

HSET IDO,IV             - Sets IDO on output-file to IV
HZOT IDO                - Sets IDO on output-file to 0
```

X- and Y-Gain-shifts

X-gain-shifts are specified by the parameters - XI1, XI2, XF1 & XF2.
Y-gain-shifts are specified by the parameters - YI1, YI2, YF1 & YF2.

For an X-gain-shift, XI1 and XI2 represent two locations (in channel # units) in the initial spectrum and XF1 and XF2 represent corresponding locations in the final spectrum (i.e. after transformation). that is:

```
         XF=A+B*XI
where:   B=(XF2-XF1)/(XI2-XI1)
and      A=XF1-B*XI1
```

The "final" # of channels is determined by the "initial" # of channels and the transformation specified. Counts are redistributed into the final set of channels (bins) by assuming a uniform distribution of counts in the initial bins. Data shifted out of the range of the final histogram are lost and gone forever!

The rules and procedures are identical for Y-gain-shifts.

COMMENTS

(1)....If gain-shift specifications are not given (or turned off), bin-widths will be the same for output and input.

(2)....Any data which does not fall within the ranges of the output histogram will be lost (without comment).

(3)....Data will be properly positioned in the output histogram even if the ranges of the input and output are different. That is, data will appear in that region of the output histogram which overlaps the gain-shifted input histogram.

U300.350 Bananas - Definition, Rules, Construction & Display

Free-form-gates (or Banana-gates - Bananas for short) are 2-D regions of arbitrary shape which are specified by a list of X,Y-points (channel-# coordinates). Each Banana on a given BAN-file is stored and recalled by means of an identification number (ID #). Attempts to store two Bananas with the same ID will be rejected. The rules for Bananas are listed below:

(1) Banana coordinates nust be given in CLOCKWISE order.
(2) The Banana is formed by connecting X,Y-points with strait lines.
(3) The last point is connected to the first by the program.
(4) No line segment of the Banana should intersect another.
(5) A maximum of 63 points may be specified for any one Banana.
(6) A maximim of 880 Bananas may be stored on a given BAN-file.

Bananas may be displayed in two different forms (OPEN and CLOSED).

A CLOSED Banana is one which has just been recalled from or stored on a BAN-file (i.e. there is an exact image on disk). There may be up to 20 CLOSED Bananas displayed at once. You can do the following things with a CLOSED Banana:

GET	-	recall from disk (prompted for ID)	by typing G
OPEN	-	for modification (change to OPEN)	by typing O
FORGET	-	delete from display	by typing F
KILL	-	delete from display and BAN-file	by typing K
TOTALIZE	-	counts contained within Banana	by typing T
PROJECT	-	(X & Y) and save on DAMQ8Q.SPK	by typing P

An OPEN Banana is one which is open for creation or modification. If the Banana is being newly created there will be no corresponding image or partial image on a BAN-file. Only one such Banana can exist at a given time. You can do the following things with a OPEN Banana:

ADD	-	X,Y-point at cursor position	by typing A
INSERT	-	X,Y-point at cursor position	by typing I
MOVE	-	nearest X,Y-point to cursor position	by typing M
SAVE	-	on BAN-file (prompted for ID)	by typing S
REPLACE	-	on BAN-file (with old ID)	by typing R
ZERO	-	all X,Y-points	by typing Z
TOTALIZE	-	counts contained within Banana	by typing T
PROJECT	-	(X & Y) and save on DAMQ8Q.SPK	by typing P

All Banana references are made in cursor mode. ADD, INSERT, MOVE, SAVE, REPLACE and ZERO refer only to the OPEN Banana. Other references (except for GET) are made by moving the cursor such that it is closer to some point on the Banana of interest than it is to any point on any other Banana.

ALL BANANAS MUST BE CONSTRUCTED IN CLOCKWISE ORDER

U300.360 Bananas - Projections

Projections via the PJ-command

Data which fall within and on the boundries of a Banana are projected onto the X-axis of a coordinate system which is rotated through an angle DEGR with respect to the systen in which data channel-# (0,0) falls at the origin and the first and second indices of the histogram array define the X- and Y-axis, respectively. Channel-# XP in the projected histogram is calculated from channel-# X,Y in the 2-D histogram by an expression of the following form:

```
XP=A+COS(DEGR)*X+SIN(DEGR)*Y
```

where,

A=0.0	For DEGR = 0 - 90
A=-COS(DEGR)*XMAX	For DEGR = 90 - 180
A=-COS(DEGR)*XMAX-SIN(DEGR)*YMAX	For DEGR = 180 - 270
A=-SIN(DEGR)*YMAX	For DEGR = 270 - 360

XMAX and YMAX are the "dimensions" of the 2-D histogram. The effect of this transformation is to make all channel numbers in the projected histogram positive.

NOTE: The "length" of the projected histogram may be as large as SQRT(XMAX**2+YMAX**2).

Projections via the P-command

Each time DAMM is executed it will create a new version of the file DAMQ8Q.SPK for the storage of projections. The file is only created if projrctions are actually made.

When you project a Banana, both X- and Y-projections are stored on DAMQ8Q.SPK under the ID-numbers displayed. These 1-D histograms may be displayed (or otherwise used) in the normal manner for a SPK-file. Use the P-qualifier to display spectra from DAMQ8Q.SPK without explicitally opening it. For example, to display ID numbers 1,3,5 from DAMQ8Q.SPK, type:

```
D P 1,3,5
```

U300.400 FITTING - Introduction & General Features

You specify how fitting is to be carried out by supplying a number of Fit Specification Data Sets which may be given in any order. Many of these have default values (see SEC# U300.450). After the fitting process is specified, one or more Fit Requests are entered. Subsequently, some or all of the Fit Specifications may be changed and more Fit Requests entered etc. etc.

GENERAL FEATURES

(1)....Fit specifications may be entered interactively or read from a file or a combination of the two methods may be used.

(2)....Peak and background intensities are determined in a weighted linear least-squares fit while peak positions, widths, and asymmetry parameters are determined by a non-linear least-squares search (either Gradient search or Gauss method - See SEC#s U300.490 and U300.500).

(3)....Peak positions may be typed in or selected interactively or found automatically.

(4)....Spectra are fitted one section at a time and can be no more than 512 channels in length.

(5)....In the gradient search mode (FIT command), each section may contain a total of 16 peaks and background terms. That is, the number of linear coefficients to be determined in the linear least squares fit (# of peaks plus # of background terms) may not exceed 16. In the Gauss mode, only 5 peaks are allowed and asymmetry is not supported.

(6)....Initial values of peak positions, widths and asymmetry parameters must be specified by the user. Different values of width and asymmetry may be assigned to each peak or all peaks may be assigned the same values.

(7)....The FWHM for peaks in a section may vary independently, conditionally, or be held fixed. All peaks in a section may be forced to have the same width or fixed relative widths.

(8)....Peak positions may be adjusted or held fixed.

(9)....Peaks may be gaussian or asymmetric (see SEC# U300.480 & U300.540

(10)...The background may be specified (by up to 50 X,Y-points) or be determined in the fit. If determined in the fit, the background takes the form, Y = A + B*X + C*X*X + D*X*X*X + ... with the number of terms in the power series specified by the user.

(11)...The output includes the Fit Specification Data, peak positions, widths, energies, areas and uncertainties (in percent) as well as a printer plot of the fit on a 0.5 to 5 cycle plot.

U300.410 Commands for 1-key (cursor mode)

One-Key cursor commands (valid following a DS or DSX command)

Type: C - To enter cursor-mode

P/UP Add/Delete peak to Library (pos specified by cursor)

M/M Move nearest displayed peak to cusor pos (FW, ASYM unchanged)

X/UX Fix/Free peak position (for displayed peak nearest to cursor)

W/UW Fix/Free peak width (for displayed peak nearest to cursor)

L/UL Fix/Free Lo-Side ASYM (for displayed peak nearest to cursor)

H/UH Fix/Free Hi-Side ASYM (for displayed peak nearest to cursor)

O/UO Turn peak ON/OFF (for displayed peak nearest to cursor)

B/UB Add/Delete background point at cursor position

<-- Set Expand Region Lo-Limit

--> Set Expand Region Hi-Limit

[Set Fit Region Lo-Limit

] Set Fit Region Hi-Limit

/ or ? Display chan#, cursor Y-value, chan contents

S Disp sum, cent & fwhm of Fit-Reg - DAT([),DAT(]) defines BGD

A Disp sum, cent & fwhm of Fit-Reg - CUR([),CUR(]) defines BGD

Q Return from cursor control routine

E Expand display (region defined by <-- -->)

See SEC# U300.110 or Type: h mous for use of Mouse Buttons.

U300.420 Setup Commands

Commands for entry of peak, background & skip-regions ----------

```
PZOT                    - Zero the Peak Library
PK     X,W,ASLO,ASHI    - List of complete peak specifications

BZOT                    - Delete Fixed Background array
BACK   X1,Y1 X2,Y2 ..   - X,Y-points for fixed background

SKIP                    - Without List turns SKIP OFF
SKIP   I1,I2 J1,J2 ..   - Up to 4 regions to omit from Fit
```

Commands for defining FWHM, ASYM, WLIM, ALIM, NBC, WOOD, ECAL -------------

```
FW     FWA,FWB,FWC      - Coefficients for standard width function
WLIM   FWLO,FWHI        - Variation limit factors for peak widths

ASYM   ASLO,ASHI        - Standard Lo-Side and Hi-Side asymmetries
ALIM   FALO,FAHI        - Variation limit factors for peak asymmetries

NBC    NBC              - Number of power series terms in variable BGD
WOOD   ON/OFF           - Turn Woods-Saxon BGD term ON/OFF (default OFF)
                        - ON creates an additional background component
                        - with a Woods-Saxon "jog" under each peak which
                        - is porportional to the peak intensity.

ECAL   ECO,ECA,ECB      - Coefficients for standard energy calibration
```

Commands for control of non-linear parameter variation ----------

```
DPX    XSTEP,DXMAX      - Initial step size and limit for peak pos
DEL    DEL,DELFAC,NDEL  - Initial step size, step size multiplier and
                        - number of DEL-values to use

VB                      - Use Variable Background (the default)
FB                      - Use Fixed Background if available

VX     KVAR             - Kind of variation for peak positions
VW     KVAR             - Kind of variation for peak widths
VALO   KVAR             - Kind of variation for Lo-Side asymmetries
VAHI   KVAR             - Kind of variation for Hi-Side asymmetries

       KVAR = UIND      - says vary Unconditionally, Independently
            = CIND      - says vary   Conditionally, Independently
            = ULOC      - says vary Unconditionally, Locked
            = CLOC      - says vary   Conditionally, Locked
            = FIX       - says keep Fixed - this the default assignmemt
```

Conditional says hold Fixed if peak so specified.

Unconditional says vary regardless of peak specifications.

Independent says given parameter-types are varied independently.

Locked says given parameter-types (width for example) are varied together
(multiplied by the same factor) in the non-linear search.

U300.430 Display of Data, Fits and Printer-plots

Commands for general display control ----------

```
FIG    N           - Select screen configuration number-N
WIN    N           - Select window-N for subsequent displays
LIN/LOG            - Set graphic display to LIN (default) or LOG
DMM    YMIN,YMAX   - Set display-range (YMIN & YMAX)
DL     ILO,IHI     - Set display-range (channel# limits)
DS     ID          - Display spectrum# ID (range defined by DL)
DS     ID,ILO,IHI  - Display spectrum# ID (DL values replaced)
                     (MAX value of IHI-ILO = 4095)
DSX    ID          - Display Data defined by Expand Region
C                  - Enters 1-key cursor-mode
```

Commands related to display of FITS ----------

```
MON/MOF            - Peak Markers ON/OFF for DF (default = ON)
DFI                - Set to display (DF ) DATA,FIT,BGD (default)
DPK                - Set to display (DF ) DATA,FIT,PEAKS,BGD
DPPB               - Set to display (DF ) DATA,FIT,(PEAKS+BGD),BGD
DF                 - Display Fit (channel-limits given by Fit-range)
DF     ILO,IHI     - Display Fit (channel-limits given by ILO,IHI)
DC     NPK         - Display Calculated peak #  NPK+ RESIDUAL

PRP    XLO,XHI     - Display peaks from Library in range XLO thru XHI
PRP                - Display all peaks from Library
PRB                - Display all fixed Bgd-points
FSTAT              - Display current fit-parameters
DR                 - List results of last Fit on VDT (terminal)
```

Commands related to printer-plots of results ----------

```
KPPL   NONE        - Says do no printer plots
KPPL   FITS        - Says plot FITS only (the default)
KPPL   ALL         - Says plot FITS, COMPONENTS and RESIDUALS

PR                 - Print and Plot results of last Fit on printer
```

Commands related to peak-finding ----------

```
FIND  BIAS,FWHM    - Enables  peak-finding (see SEC# U300.155)
FIND               - Enables  peak-finding with (BIAS=5, FWHM=5)
NOFI               - Disables peak-finding
```

If FIND is enabled (see SEC# U300.155 for general details), DAMM will do a peak find within the display region each time a DS (or DSX) command is given. An attempt will then be made to add the newly found peaks to the internal peak library. If a newly found peak is closer than 0.5*FWHM channels to an existing library peak, it will not be added. Finally, all library peaks will be marked on the display in the usual manner. No distinction is made between "found peaks" and "manually entered peaks".

U300.440 FIT Execution Commands

Commands for FIT execution ----------

```
FIT    ID,ILO,IHI  - Fit Request - (non-linear gradient search)
GFIT   ID,ILO,IHI  - Fit request - (gaussian method)
RFIT   ID,ILO,IHI  - Resume FIT/GFIT start with Parms from last Fit
LFIT   ID,ILO,IHI  - Linear Fit - no non-linear search
                   - (Fit-range specified by ILO,IHI)
FIT    ID X        - Fit Range specified by cursors (Fit Region)
GFIT   ID X        - Fit Range specified by cursors (Fit Region)
RFIT   ID X        - Fit Range specified by cursors (Fit Region)
LFIT   ID X        - Fit Range specified by cursors (Fit Region)

Ctrl/C             - Terminates Fit-in-prograss
```

U300.450 FIT Parameters - Saving, Setting, Default

Commands which save FIT parameters in memory library ----------

```
SAV    I,J  - Save all Parms from peaks I thru J of last Fit in PK-LIB
SAX    I,J  - Save X-Parms   for  peaks I thru J of last Fit
SAW    I,J  - Save W-Parms   for  peaks I thru J of last Fit
SAL    I,J  - Save ASL-Parms for  peaks I thru J of last Fit
SAH    I,J  - Save ASH-Parms for  peaks I thru J of last Fit
(If I,J ommitted, indicated Parms from ALL peaks are saved)
```

Commands which set FIT parameters ----------

```
SET- X1,X2          - Set STD WIDTH and ASYM for peaks in range X1-X2
                      values (defined by FWA, FWB, FWC, ASLO, ASHI)

SETW X1,X2          - Set WIDTH for peaks in range X1-X2 to STD value
SETW X1,X2,WA,WB,WC - Set WIDTH for peaks in range X1-X2 to value
                      defined by WA,WB,WC (FWA,FWB,FWC unchanged)

SETL X1,X2          - Set ASLO  for peaks in range X1-X2 to STD value
SETL X1,X2,ASLOT    - Set ASLO=ASLOT for peaks in range X1-X2

SETH X1,X2          - Set ASHI  for peaks in range X1-X2 to STD value
SETH X1,X2,ASHIT    - Set ASHI=ASHIT for peaks in range X1-X2

(If X1,X2,.. omitted, indicated Parms for ALL peaks are set)
```

List of default FIT parameters ----------

```
DEL   = 0.05    FWLO = 0.5      VX   = CIND    NBC  = 2
DELFAC=0.25     FWHI = 2.0      VW   = CLOC    WOOD = OFF
NDEL  = 1       FALO = 0.5      VALO = FIX     KPPL = FITS
XSTEP = 0.5     FAHI = 2.0      VAHI = FIX
DXMAX = 5.0     ASLO = 0.0
                ASHI = 0.0
```

U300.460 Commands to Control Relative Peak-intensities

The following commands may be used to fix the intensity of two or more peaks relative to each other within a section being fitted:

```
RELI  X,R   Sets relative intensity of library-peak nearest chan-X to be R
RELI  ZOT   Deletes all relative intensity entries
RELI  OFF   Disables relative intensity control but saves previous entries
RELI  ON    Enables  relative intensity control (default)
```

NOTE: RELI specifications must be entered AFTER the associated peak library entries are completed. RELI has no effect unless there two or more peaks with specified relative intensities within the region being fitting. R may be in any units however there is an 8 character limit on the number entered! Peak-areas will be in the same ratios as the relative intensities specified ONLY if width & asymmetry parameters are the same for each peak.

U300.470 FIT Specification Details

PK Data Set - Complete Peak Specifications

The PK Data Set accomodates a full specification of the characteristics of each individual peak. Up to 100 peaks may be included in the list. Each peak is specified by the following parameters.

X.....Gives the initial peak position in channels.

W.....Specifies the initial peak FWHM in channels. If not entered, FWHM is set to the value specified by FWA, FWB & FWC.

ASLO...Specifies the Lo-Side asymmetry parameter.

ASHI...Specifies the Hi-Side asymmetry parameter.

Other Specifications

EC0,ECA,ECB...Defines the spectrum energy calibration (not required for fitting) through the relation;

E = EC0 + ECA*(CHAN #) + ECB*(CHAN #)**2

FWA,FWB,FWC...Defines the peak WIDTH as a function of channel number through the relation;

FWHM(CHANNELS)=FWA+FWB*SQRT(CHAN #)+FWC*(CHAN #)

ASLO,ASHI...Are the initial values of the Lo-Side and Hi-Side asymmetry parameters. If this specification is used, the initial values will be the same for all peaks.

FWLO...Is the minimum fraction of the initially specified value by which any peak width may be reduced.

FWHI...Is the maximum fraction of the initially specified value by which any peak width may be increased.

(continued on next page)

U300.470 FIT Specification Details (continued)

FALO...Is the minimum fraction of the initially specified value by which any peak asymmetry parameter may be reduced.

FAHI...Is the maximum fraction of the initially specified value by which any peak asymmetry parameter may be increased.

DEL....Specifies the fraction by which the peak width and the peak asymmetry parameters are to be changed in each step of the non-linear search. For example,

(NEW WIDTH) = (OLD WIDTH)*(1.0+-DEL)

DELFAC-Is a factor by which the current value of DEL is multiplied in order to obtain a new (smaller) value. Typically one starts with a fairly large value of DEL (say 0.02 to 0.05) and subsequently makes one or more reductions in order to achieve a greater convergence speed.

NDEL...Is the number of DEL-values to be used

XSTEP..Is the maximum amount (in channels) that a peak may be moved in any one step in the non-linear search for the best fit. XSTEP is reduced at the same time and by the same factor (DELFAC) that DEL is reduced.

DXMAX..Is the maximum number of channels (either + or -) that any peak is allowed to be moved from its original position.

SKIP...Defines up to four regions within the Fit Range which are to be ignored in doing the fit.

KPPL=..NONE says do no printer plots.

KPPL=..FITS says plot the FIT (experimental and calculated spectrum on the same graph).

KPPL=..ALL says plot the FIT (as in KPPL...=FITS) and in addition, plot each component (calculated peak) together with the corresponding "residual component". What do you mean by residual component, you ask. When plotting the Ith peak we calculate the Ith residual component by subtracting any background (specified or calculated) as well as all calculated peaks other than the Ith from the experimental spectrum.

NBC....Denotes the number of background components to be included in the power series. NBC=2 Says use the form Y=A+B*X and NBC=4 says use Y=A + B*X + C*X*X + D*X*X*X. The number of peaks in a section plus NBC must not exceed 16.

(continued on next page)

U300.470 FIT Specification Details (continued)

WOOD...ON/OFF says turn Woods-Saxon background term ON/OFF. The default is OFF. If WOOD is ON, an additional background component is included which has a Woods-Saxon type "jog" under each peak which is porportional to the peak intensity. The jog form is given by:

```
Y    =  1.0/(1.0+EXP(ARG))    ;where
ARG  =  4.714*(X0-X)/FWHM     ;and
X0=peak-position, X=channel-of-interest, and FWHM=peak-FWHM.
```

The use of such a background form could be helpful in the analysis of weak peaks which are located on the low-energy side of strong peaks. You will have to be the judge.

U300.480 Discussion of Peak Shapes

The most general peak shape allowed is given by

```
YL=EXP(-(X-X0)**2/(A**2*(1+ASLO*(X0-X)/A)
YH=EXP(-(X-X0)**2/(A**2*(1+ASHI*(X-X0)/A)
```

Where A is the gaussian Half-Width at 1/e max and YL and YH describe the curve on the Lo- and Hi-Sides, respectively. If all asymmetry parameters are held to zero, the shape is gaussian. The ASLO/ASHI parameters broaden the Lo/Hi sides of the peak and result in an expodential fall-off (like EXP(-(X0-X)/(A*ASLO)) for example) As you move far away from the peak maximum (i.e. channel X0). To get some idea of what size asymmetry parameters to use see Fig 1.

U300.490 Gradient-search Method (FIT request)

Each time the program encounters a Fit Request, it searches the complete Library and includes in the Fit all peaks which are ON and whose positions lie within the Range of Fit (i.e. between ILO and IHI).

GENERAL PROCEDURE FOR THE NON-LINEAR SEARCH

(1)....The initial values of all parameters which are to vary in a non-linear way are set to the initial values specified by the user.

(2)....Each individual parameter is changed (both increased and decreased) by an amount determined by DEL or XSTEP in order to establish a "direction" (increase or decrease) for each parameter.

(3)....All parameters are changed in the direction determined in step (2) and in step sizes determined by DEL and XSTEP until the Quality of Fit is no longer improved.

(4)....Steps (2) and (3) are repeated until no improvment in the Fit can be made

(5)....DEL and XSTEP are multiplied by DELFAC and steps (2) and (3) are repeated until no improvment in the Fit can be made.

(6)....Step (5) is repeated (NDEL-1) times.

U300.500 Gaussian Method (GFIT request)

The GFIT (Gauss-method) fit request initiates an alternate non-linear procedure. Commands are:

GFIT ID,ILO,IHI
or
GFIT ID X

This command initiates a nonlinear least-squares search by Gauss' method as modified by Marquardt. (See, for example, P.R. Bevington's book, "Data Reduction and Error Analysis for the Physical Sciences", p. 235 ff. The routines used in GFIT are not Bevington's, but are those of M.J. Saltmarsh from the SEL 840-A program PKFT.)

The search continues until chi-squared per degree of freedom (QFN) has changed by less than 0.0001 or until 25 iterations have occurred. The search may be resumed by the RFIT command. The iteration number and QFN appear on the right side of the screen.

The printer output from GFIT includes absolute error estimates for the peak positions, widths, and areas which are derived from the correlation matrix of the fit. The percentage error in the area is printed in the column labeled PCE.

The DAMM commands VW ULOC or VW CLOC (the default option) ae interpreted to mean that the widths of the peaks are to be the same and vary together. Widths may be varied independently by VW UIND or VW CIND. Individual widths or positions may be frozen or released by the standard cursor commands of DAMM. If one or more widths are to be kept fixed while others are varied, the command VW CIND or VW CLOC should be given; if UIND or ULOC is given, the instruction to fix is ignored.

If GFIT is chosen, the program attempts to estimate the width of the tallest peak for its initial guess of width. If unsuccessful it reverts to the standard DAMM procedure of using whatever was stored from the last previous FW, SETW commands (or the default option, which is FW = 5).

At present The GFIT request is limited to fitting a sum of up to 5 Gaussian peaks with a linear background. The parameters ASLO and ASHI for asymmetric peaks are ignored.

U300.510 Estimated Uncertainties in Peak Areas

Estimated uncertainties should always be viewed with considerable skepticism, especially when non-linerar as well as linear fitting processes are involved, as it is here. The uncertainties in the peak areas estimated by both the FIT and GFIT procedures are rather "standard" and involve CHISQ (of the overall fit) as well the diagonal element of the inverse matrix corresponding to the peak intensity in question. This inverse matrix is found in the standard linear least-squares fitting process. See a book like "Bevington" or Cziffra et. al. UCRL-8523, 1958 for a real discussion of this subject. I have used:

D(J) = SQRT(AINV(J,J)*QFN) where;

D(J) = the estimated uncertainty in the J-th fit parameter B(J)
(there is a B(J) for each peak-area(J))

QFN = CHISQ/(#data-points - #adjustable-parameters)

AINV(J,J) = the J-th diagonal element of the inverse matrix found in the linear least-squares fitting process.

PCE(J) = 100*D(J)/B(J) = percent uncertainty in J-th peak-area.

U300.520 Reading Fit Results from damm.log

The table of fit-results recorded on damm.log, as a result of a PR command, includes flags of the form LAB$ to facillitate the location and decoding of relevant data by other programs. Formats associated with the different line-labels are listed below.

Label	Format
TIT$	(1X,15X,2I6,6X,20A4)
DEL$	(1X,2F10.0,I10,6F10.0)
SKP$	(1X,8I10)
CAL$	(1X,8F10.0,I10)
VAR$	(1X,6(6X,A4),I10)
FIT$	(1X,5F10.0,3F8.0,4F7.0,I5,I7)
GFI$	(1X,5F10.0,3F8.0,4F7.0,I5,I7)
BGD$	(1X,2F10.2)
QFN	(1X,6X,F10.0,11X,F10.0)

Alternatively, one may make use of the routines contained in the internally documented demonstration program samred. The source of this program is in /usr/users/milner/Ddamm/samred.f.

U300.530 Common Problems

(1)....If you define the standard FWHM (via command: FW FWA,FWB,FWC) or standard asymmetry parameters (via command: ASYM ASLO,ASHI), this does not re-define such parameters for previously defined peaks. You must use SETW to do this (see SEC# U300.450).

U300.540 Peak Shape vs Asymmetry (Log plot)

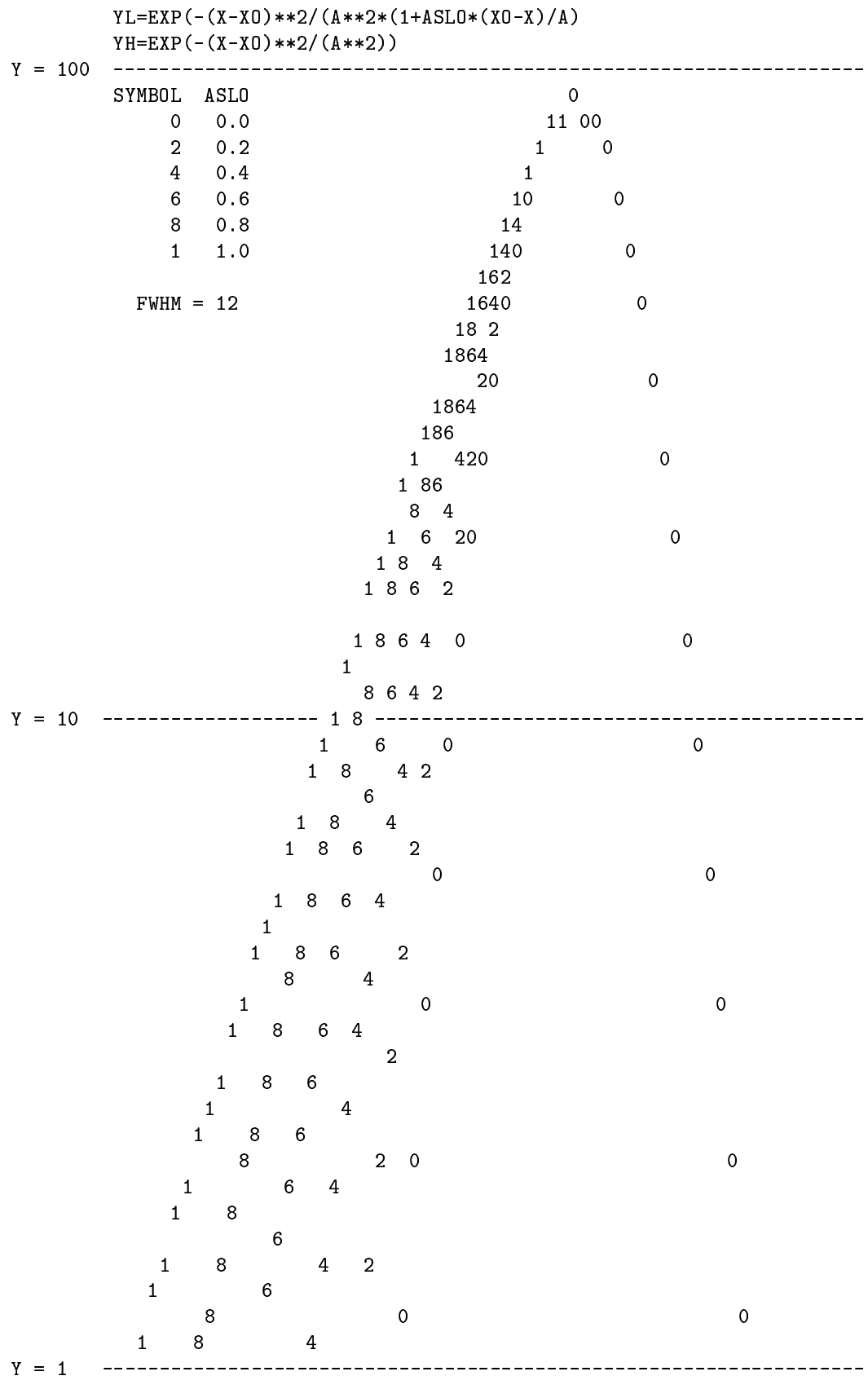


Figure 1

U300.550 Screen Configurations

The sizes and locations of display windows are controlled by one or more of the commands - FIG, FIGF or FIGI.

FIG ID - Sets the number and size of display windows to that specified by configuration number ID. A given configuration ID number may specify up to 20 display windows. The default configuration library contains ID-numbers 1 thru 16. Type: H FIG for a display indicating the default sceen configurations or just Type: FIG 1, FIG 2 ... FIG 16 and see what you get.

FIGF FILENAME - Requests that a new configuration library be read from a file named FILENAME. The file /usr/hhirf/fig.dat (or the file /home/upak/fig.dat) which contains the default configuration is listed on the next next two pages. The **** in col-1 of the table denote comment lines and are ignored in processing.

```
****DEFAULT SCREEN-CONFIGURATION TABLE
****-------------------------------------------------
****FIG-ID   X0(PIX)   Y0(PIX)    W(PIX)    H(PIX)
         1        30        84       540       480
****
         2         0        39       480       480
         2       495        39       480       480
****
         3        30       369       540       300
         3        30        39       540       300
         3       585        39       390       390
****
         4         0       369       480       300
         4         0        39       480       300
         4       495       369       480       300
         4       495        39       480       300
****
         5        30       489       480       195
         5        30       264       480       195
         5        30        39       480       195
         5       525        39       435       435
****
         6         0       489       480       195
         6         0       264       480       195
         6         0        39       480       195
         6       495       489       480       195
         6       495       264       480       195
         6       495        39       480       195
****
         7        30       534       480       135
         7        30       369       480       135
         7        30       204       480       135
         7        30        39       480       135
         7       525        39       435       435
```

(continued on next page)

****DEFAULT SCREEN-CONFIGURATION TABLE (continued)

****FIG-ID	X0(PIX)	Y0(PIX)	W(PIX)	H(PIX)
8	0	534	480	135
8	0	369	480	135
8	0	204	480	135
8	0	39	480	135
8	495	534	480	135
8	495	369	480	135
8	495	204	480	135
8	495	39	480	135
****				
9	30	579	480	105
9	30	444	480	105
9	30	309	480	105
9	30	174	480	105
9	30	39	480	105
9	525	39	435	435
****				
10	0	579	480	105
10	0	444	480	105
10	0	309	480	105
10	0	174	480	105
10	0	39	480	105
10	495	579	480	105
10	495	444	480	105
10	495	309	480	105
10	495	174	480	105
10	495	39	480	105
****				
11	0	39	960	525
****				
12	0	354	960	270
12	0	54	960	270
****				
13	0	489	960	195
13	0	264	960	195
13	0	39	960	195
****				
14	0	549	960	135
14	0	384	960	135
14	0	219	960	135
14	0	54	960	135
****				
15	240	39	750	750
****				
16	0	39	645	645

FIG-ID = Configuration ID number to be associated with window.
X0(PIX) = X-coordinate of upper left corner of window in pixels.
Y0(PIX) = Y-coordinate of upper left corner of window in pixels.
W(PIX) = Width of window in pixels.
H(PIX) = Height of window in pixels.

FIGI   Restores the configuration library to the default state.

U300.560 Graphic Screen Color Mapping

The colors (or grey scale) is controlled by means of a color map which has 40 entries that specify (red, green, blue) intensities in the range 0-65535. The default table contained in /usr/hhirf/cmap.dat or in /home/upak/cmap.dat is listed below:

```
    RED  GREEN   BLUE   ;ENTRY# - NORMAL USE ------------------------------

      0      0      0  ;01 - BLACK
  65535  65535  65535  ;02 - 1-D DISPLAY - COL(1) - FIT DATA
  65535      0      0  ;03 - 1-D DISPLAY - COL(2)
      0  65535      0  ;04 - 1-D DISPLAY - COL(3) - FIT CALC
      0      0  65535  ;05 - 1-D DISPLAY - COL(4)
  65535  65535      0  ;06 - 1-D DISPLAY - COL(5) - FIT BACK
  65535      0  65535  ;07 - 1-D DISPLAY - COL(6)
      0  65535  65535  ;08 - 1-D DISPLAY - COL(7)
  65535  65535      0  ;09 - 1-D DISPLAY - COL(8)
  65535  65535      0  ;10 - NOT USED FOR NOW
      0      0  32767  ;11 - 2-D COLOR DISPLAY
      0      0  65535  ;12 - 2-D COLOR DISPLAY
  32767      0  32767  ;13 - 2-D COLOR DISPLAY
  65535      0  65535  ;14 - 2-D COLOR DISPLAY
  32767      0      0  ;15 - 2-D COLOR DISPLAY
  65535      0      0  ;16 - 2-D COLOR DISPLAY
  32767  32767      0  ;17 - 2-D COLOR DISPLAY
  65535  65535      0  ;18 - 2-D COLOR DISPLAY
  32767  32767  32757  ;19 - 2-D COLOR DISPLAY
  65535  65535  65535  ;20 - 2-D COLOR DISPLAY
  15000  15000  15000  ;21 - 2-D GREY-SCALE DISPLAY
  20600  20600  20600  ;22 - 2-D GREY-SCALE DISPLAY
  26200  26200  26200  ;23 - 2-D GREY-SCALE DISPLAY
  31800  31800  31800  ;24 - 2-D GREY-SCALE DISPLAY
  37400  37400  37400  ;25 - 2-D GREY-SCALE DISPLAY
  43000  43000  43000  ;26 - 2-D GREY-SCALE DISPLAY
  48600  48600  48600  ;27 - 2-D GREY-SCALE DISPLAY
  54200  54200  54200  ;28 - 2-D GREY-SCALE DISPLAY
  59800  59800  59800  ;29 - 2-D GREY-SCALE DISPLAY
  65535  65535  65535  ;30 - 2-D GREY-SCALE DISPLAY
  32767  32767  32767  ;31 - NOT USED FOR NOW
  32767  65535  65535  ;32 - NOT USED FOR NOW
  65535      0      0  ;33 - NOT USED FOR NOW
  65535  65535  65535  ;34 - GCOR(1)
  65535      0      0  ;35 - GCOR(2), SAM PK MARK,  FIT VAR MARK
      0  65535      0  ;36 - GCOR(3), 1-D PK LAB, 2-D BAN & EX-MARK
      0      0  65535  ;37 - GCOR(4), 1-D REG MARK, FIT VAR MARK
  65535  65535      0  ;38 - GCOR(5), CURSOR
  65535      0  65535  ;39 - GCOR(6)
      0  65535  65535  ;40 - GCOR(7)
```

Different color mapping is accomplished by the CMAP command as shown below:

```
CMAP FILENAME  ;Processes a file FILENAME of the structure shown above
               ;and maps as  specified  therein.  The new mapping only
               ;takes place subsequent to the next FIG command.
```

U300.570 Graphic Screen Black & White Mapping

When using black & white monitors, the table /usr/hhirf/bmap.dat, (or /home/upak/bmap.dat) listed below, may be more useful. If you are using the REVV mode, then table /usr/hhirf/bmapr.dat or /home/upak/bmapr.dat, not listed here, should be used as a template. You will probably need to make other adjustments in order to achieve semi-satisfactory results. Note: that table entries are labeled with their uses.

```
   RED  GREEN   BLUE   ;ENTRY# - NORMAL USE -----------------------------

     0      0      0  ;01 - BLACK
 65535  65535  65535  ;02 - 1-D DISPLAY - COL(1) - FIT DATA
 65535  65535  65535  ;03 - 1-D DISPLAY - COL(2)
 65535  65535  65535  ;04 - 1-D DISPLAY - COL(3) - FIT CALC
 65535  65535  65535  ;05 - 1-D DISPLAY - COL(4)
 65535  65535  65535  ;06 - 1-D DISPLAY - COL(5) - FIT BACK
 65535  65535  65535  ;07 - 1-D DISPLAY - COL(6)
 65535  65535  65535  ;08 - 1-D DISPLAY - COL(7)
 65535  65535  65535  ;09 - 1-D DISPLAY - COL(8)
 65535  65535  65535  ;10 - NOT USED FOR NOW
     0      0  32767  ;11 - 2-D COLOR DISPLAY
     0      0  65535  ;12 - 2-D COLOR DISPLAY
 32767      0  32767  ;13 - 2-D COLOR DISPLAY
 65535      0  65535  ;14 - 2-D COLOR DISPLAY
 32767      0      0  ;15 - 2-D COLOR DISPLAY
 65535      0      0  ;16 - 2-D COLOR DISPLAY
 32767  32767      0  ;17 - 2-D COLOR DISPLAY
 65535  65535      0  ;18 - 2-D COLOR DISPLAY
 32767  32767  32757  ;19 - 2-D COLOR DISPLAY
 65535  65535  65535  ;20 - 2-D COLOR DISPLAY
 15000  15000  15000  ;21 - 2-D GREY-SCALE DISPLAY
 20600  20600  20600  ;22 - 2-D GREY-SCALE DISPLAY
 26200  26200  26200  ;23 - 2-D GREY-SCALE DISPLAY
 31800  31800  31800  ;24 - 2-D GREY-SCALE DISPLAY
 37400  37400  37400  ;25 - 2-D GREY-SCALE DISPLAY
 43000  43000  43000  ;26 - 2-D GREY-SCALE DISPLAY
 48600  48600  48600  ;27 - 2-D GREY-SCALE DISPLAY
 54200  54200  54200  ;28 - 2-D GREY-SCALE DISPLAY
 59800  59800  59800  ;29 - 2-D GREY-SCALE DISPLAY
 65535  65535  65535  ;30 - 2-D GREY-SCALE DISPLAY
 32767  32767  32767  ;31 - NOT USED FOR NOW
 32767  65535  65535  ;32 - NOT USED FOR NOW
 65535      0      0  ;33 - NOT USED FOR NOW
 65535  65535  65535  ;34 - GCOR(1)
 45000  45000  45000  ;35 - GCOR(2), FIT PK MARK,  FIT VAR MARK
 65535  65535  65535  ;36 - GCOR(3), 1-D PK LAB, 2-D BAN & EX-MARK
 65535  65535  65535  ;37 - GCOR(4), 1-D REG MARK, FIT VAR MARK
 65535  65535  65535  ;38 - GCOR(5), CURSOR
 65535  65535  65535  ;39 - GCOR(6)
 65535  65535  65535  ;40 - GCOR(7)
```

U300.600 Implementation

The SUNPAK or UPAK tape that you receive will contain all of the files that I have on the SPARCstation (or DECstation), whether you want them or not - it is just a lot easier for me to do that.

Please read the SUNPAK or UPAK document, supplied in hardcopy form with the tape, for a discussion of file organization, implementation of run-time help-files, etc.

Good Luck,
W. T. Milner