

# **Log Processing Cookbook:**

***A guide to processing ODP conventional logs with Geoframe***



Any opinions, findings, and conclusions or recommendations expressed in this document are those of the author(s) and do not necessarily reflect the views of the National Science Foundation, Joint Oceanographic Institutions, Inc., or ODP member countries.

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## I Introduction

The purpose of shore-based log processing is to provide scientists with a comprehensive quality-controlled downhole log data set. This data set can then be used for comparison and integration with core and seismic data from each ODP leg: for example the Sagan in-house software is used to put cores and logs on the same depth scale, and IESX software is used to analyze seismic sections and generate synthetic seismograms from the logs. Shore-based log processing comprises:

- Depth adjustments to remove depth offsets between data from different logging runs
- Corrections specific to certain tools and logs
- Documentation for the logs, with an assessment of log quality
- Conversion of the data to a widely accessible format (ASCII for the conventional logs, GIF for the FMS images and summary diagrams)
- Assembling the data for inclusion in the ODP Logging Services on-line and tape databases.

Log analysts at ODP Logging Services carry out the processing, mostly using Schlumberger GeoQuest's "GeoFrame" software package. Conventional log data (natural gamma radioactivity, resistivity, density, porosity, sonic velocity, magnetic susceptibility logs) are transmitted via internet connection from the ship, processed, and returned to the ship, usually within a few days of logging. Processing of other log data (FMS images, GHMT magnetic polarities, etc.) is generally done after the cruise.

## II Preparing for Log Processing

### A Setting up the Geoframe Project

1. Start GeoFrame from the Geonet window – the Project Manager window will appear.
2. Press the ‘Project Management’ tab, and press ‘Create a new project’.
3. Enter a project name and password (set the password to be the same as the project name).
4. After a few minutes, the ‘Edit Project Parameters’ window will appear (below).
  - a. Set the Display Units to Metric, and edit them according to Table 1 (below). Save the Display Units as ‘ODP’.

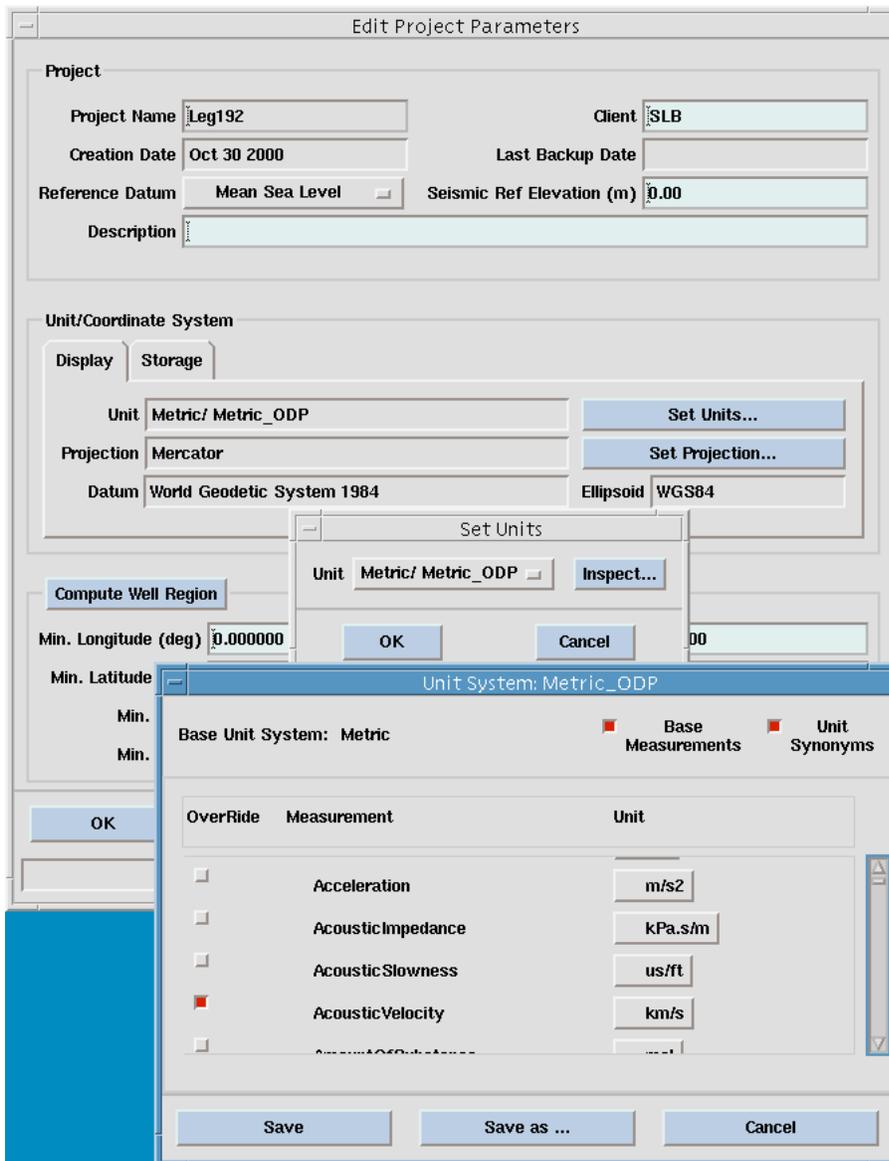


Table 1. Changing units from their default settings

<b>Property</b>	<b>Unit</b>	<b>Log curve</b>
Acoustic Velocity	km/sec	VELP, VELS
Count Rate	cps	GR
Force	lbf	TENS, DF
Magnetic Field Strength	Oe	FX, FY, FZ
Porosity	%	APLC
Short Length	Inches (in)	STOF
Velocity (for LWD ROP)	m/hr	ROP*

b. Press Set Projection, then press Create. Choose the World Geodetic System 1984 as the datum, and WGS84 as the ellipsoid. Choose Mercator projection. For ODP log processing, the projection settings don't matter, except that it is not possible to leave the settings blank (the projection is important when working with seismic lines and basemaps in IESX). Press OK.

5. The Storage Settings window will appear. Choose /data/spaceman/gf\_data (or whichever disk is available on the local system). The Geoframe administrator will have to set up a disk if none appear in the top list. The project is now set up, and you are connected to it.

6. Start the Application Manager. From there, open the Process Manager and the Data Manager.

## B Setting up the Unix directory

Create a directory in /data/spaceman/gf\_data/STANDARD\_proc for each leg, for example 'Leg192'. Within that directory, create two directories for each hole, for example '1186A' and '1186A\_datfiles'. Most files will be placed within that directory. Then create the "lgp\_templates" sub-directory for the plot files. E.g.:

```
/data/spaceman/gf_data/STANDARD_proc/  
  Leg192/  
    1186A/  
      lgp_templates/  
      dlis_files/  
    1186A_datfiles/
```

## C Obtaining the DLIS files

1. DLIS by direct ftp from the ship.

The DLIS files sent from the ship arrive in the /users/brg0/transfer/JR2lamont directory: copy them to the 'dlis\_files' directory. In the case where the DLIS files are on the Schlumberger CD, they can be loaded into GeoFrame directly from the CD.

2. DLIS files by satellite transfer (old method).

Jim Murray is in charge of the Satellite PC in the Borehole computer room. He will set it up so it is ready to receive data from the ship, and also put the processed data on it so the ship can pick it up. He moves the incoming DLIS files from the PC to /users/brg0/logguest/to\_ideo/[date]

3. DLIS files from the Schlumberger CD.

Files from the Schlumberger CD can be loaded directly into GeoFrame from the CD-ROM drive.

Proprietary vs. Reduced DLIS files.

The proprietary DLIS files contain all the log curves and parameters recorded during logging. Only the main log curves are required for processing and output for the online database.

## D Putting unrecognized logs into the Geoframe catalog

Geoframe does not automatically recognize logs with names that are not in the catalog (for example the GHMT logs MAGB, RMGS, etc). It will load them in with the name 'unknown' and a message saying 'not in catalog', and you can work with them, but you will not be able to save them as DLIS output at the end of processing.

So, you must add these logs to the catalog using the Catalog Editor.

1. Start the Catalog Editor from the Data Manager / Tools menu, or from the file menu in the General Data Manager.
2. Press 'Add', and fill out the fields for the following logs (all will have Customer availability):

<b>Name</b>	<b>Description</b>	<b>Measurement</b>
MAGB	GHMT Magnetic Induction	MagneticFluxDensity
MAGC	GHMT Conductivity	Dimensionless
MAGS	GHMT Magnetic Susceptibility	Dimensionless
RMGS	GHMT Magnetic Susceptibility (high range)	Dimensionless
NMST	GHMT NMRS Temperature	Temperature
NMSV	GHMT NMRS Voltage	Electric Potential
SXRT	GHMT SUMS Differential Temperature	Temperature
SURT	GHMT SUMS Receiver Coil Temperature	Temperature

## E Setting up the plotter

In the Process Manager, select 'Hardcopy Setup' module from the Utility directory. Set up the following:

Spoolers:

Spooler Name            pds\_spooler  
Script File             bin/pdsprint

Servers:

Server Name            pds\_server  
Host Name              local  
Access method         local

Printers:

Printer Name            OYO-GS612E  
Server Name            pds\_server  
Device Name            V80  
Script File             bin/pdsprint  
Paper Width            12"  
Resolution             200 dpi  
File Type               PDS  
Color Mode              monochrome

## **F The Geoframe Xterm – checking files and the system**

Open a ‘Geoframe X-term’ window directly from the Geonet menu. Some Geoframe programs are available from this window:

1. DLISU can be used to check the contents of the DLIS file. Navigate to the directory of interest, then:

```
spaceman> DLISU
```

```
DLISU> a i=1234A.dlis          (assign input = )
```

```
DLISU> display static file
```

```
DLISU> display frame summary
```

```
DLISU> list                    (lists a summary of the contents of DLIS file)
```

```
DLISU> exit
```

2. LIS\_to\_DLIS. For converting LIS-formatted log data files to DLIS format. Note that DLISU and LIS\_to\_DLIS will also run from regular terminal windows.

2. gf\_users – this command will list the projects and users currently active on the system

3. gf\_accounts – lists all the geoframe projects in the oracle database

4. space\_check system/manager – lists the space taken up in the oracle tablespaces by each project.

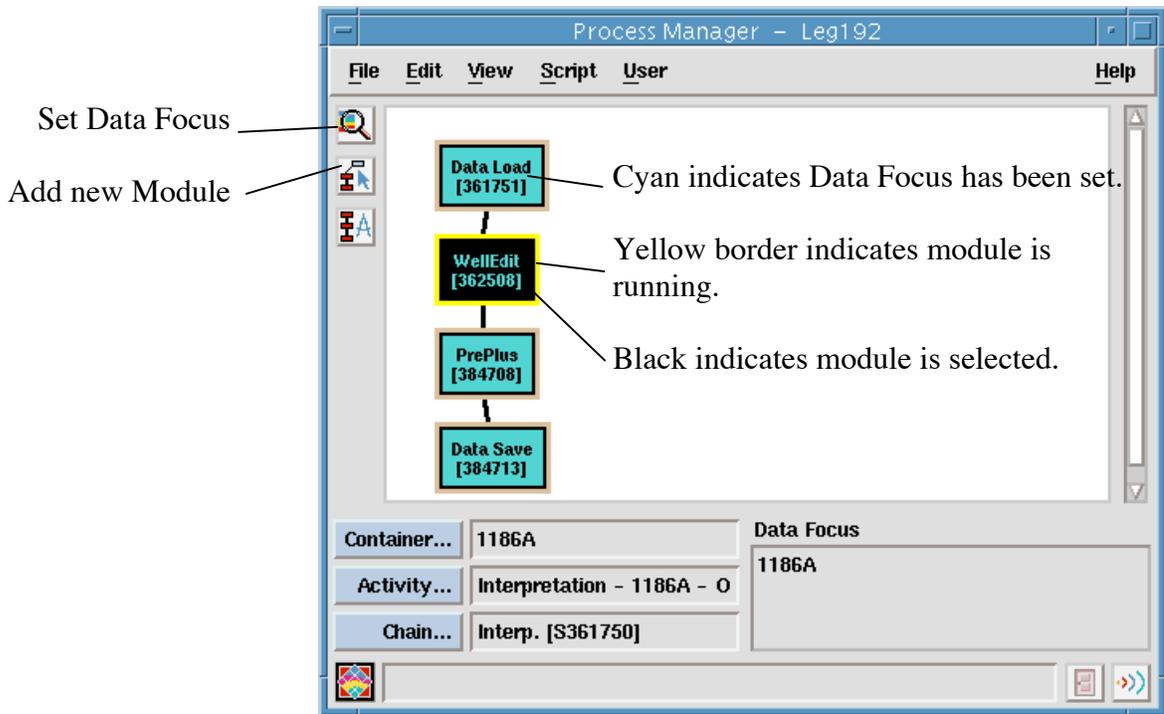
### III ODP log processing

#### A Process Manager

Use the Process Manager to set up the four Modules that are used in the processing. The Add New Module icon will bring up a window from which the modules can be chosen.

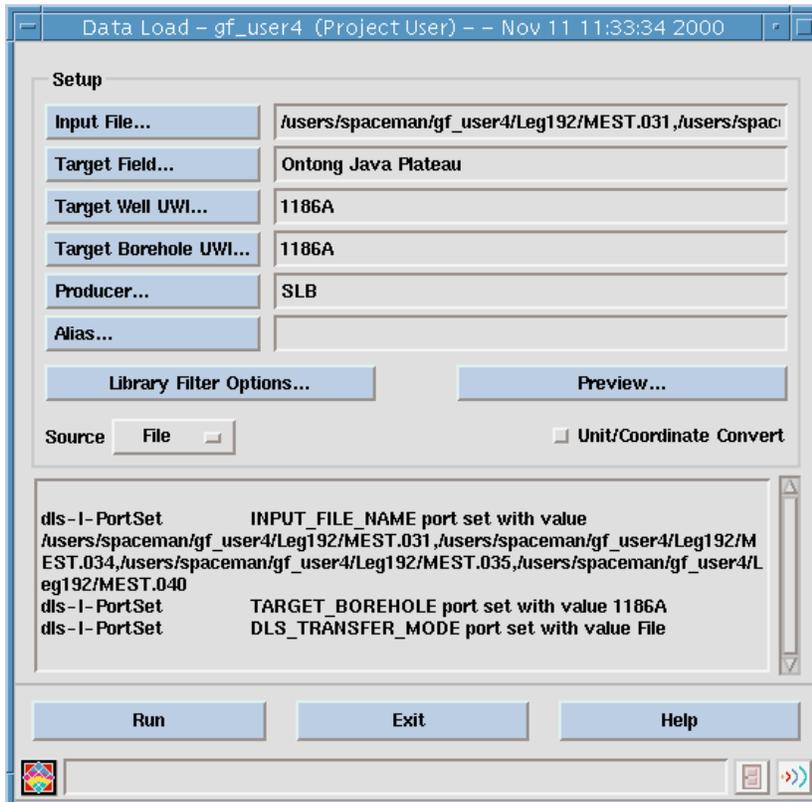
- Data Load is in Utilities/Import-Export
- WellEdit is in Geology
- PrePlus is in Petrophysics (used for NGT processing and occasionally some other corrections)
- Data Save is in Utilities/Import-Export

After running Data Load, set the Data Focus of each module to be the Borehole (e.g. 1186A).



## B Data Load

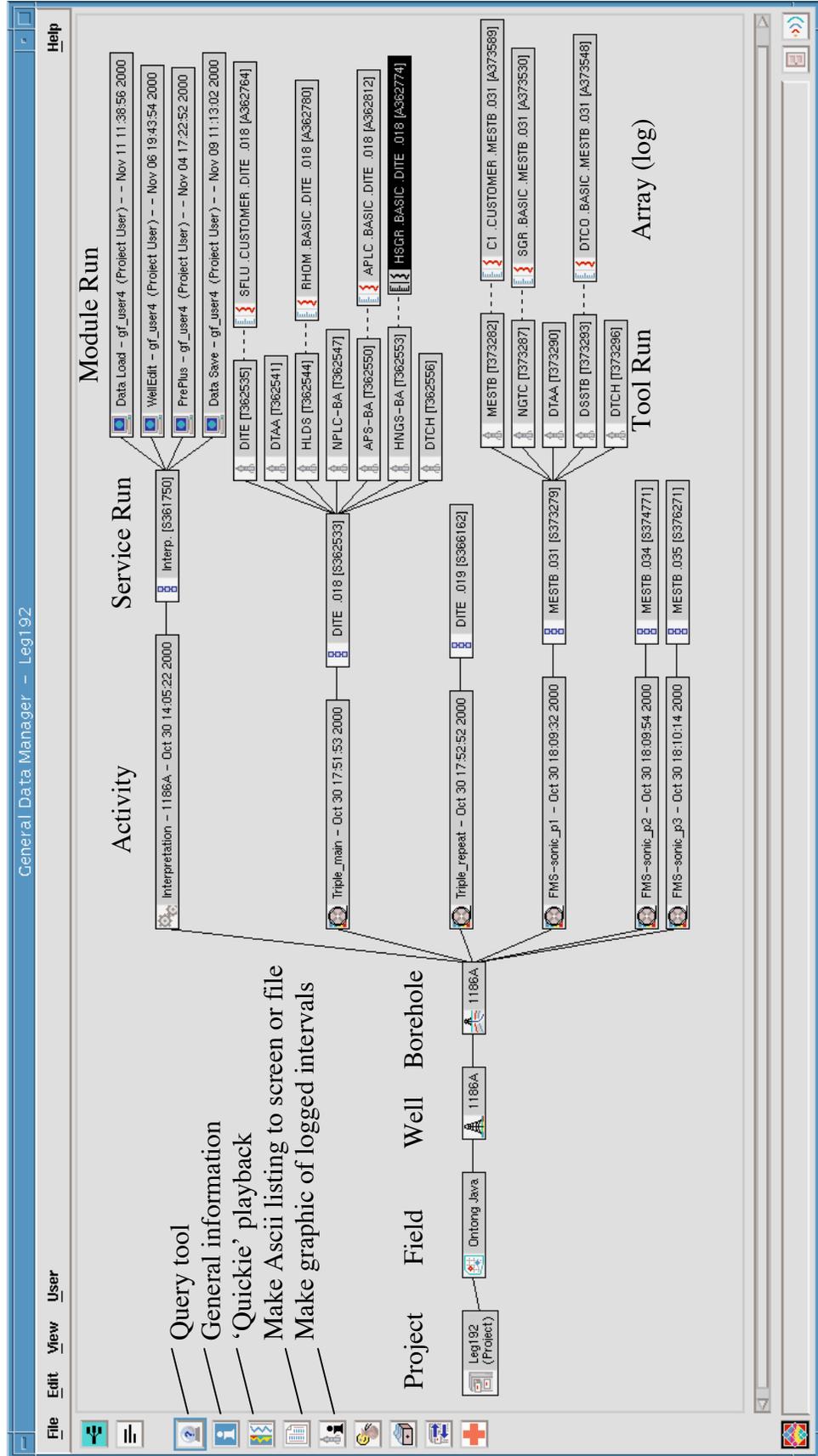
Use the Data Load module to load the DLIS files directly into Geoframe. How you fill out the fields in the module depends on what is already set up in the Data Manager. If this is the first hole of the Leg and Project, a field will not yet be set up: leave the Field, Well, and Borehole blank, they will be taken from the DLIS headers. If there is already a Field set up, choose that one, but leave the Well and Borehole blank.



It is possible to load in all the DLIS files at once in Data Load, but it is best not to. This is because if the Schlumberger field engineer has given slightly different information in the headers of the different DLIS files (this happens), this can lead to two or more sets of the Fields, Wells, or Boreholes in the Data Manager, when you actually want a single hole. Load the FMS DLIS files first (they can have more extensive header information). Then load the others filling out the Field, Well, and Borehole in the Data Load module.

Then go to the General Data Manager window (see below), and change the names of the Field, Well, and Borehole to be of the form Ontong-Java, 1186A, 1186A. Do this by double clicking on the Field, Well, or Borehole rectangle, and changing the Name and UWI fields. Similarly, re-name the 'Loaded\_Data' activity to, for example, 'Triple\_main\_load' and so on. Also rename the "Interpretation" activity by adding the hole number (e.g. "Interpretation – 1257A"), so that it can be distinguished from the other Interpretations in the Process Manager

After loading the data, the General Data Manager should look something like this:



## C Data Manager

The Data Manager is used to view and organize all the log data. Logs, parameters, boreholes, etc are generically known as ‘Data Items’

The hierarchy of Data Items in Geoframe goes something like this:

<b>Project</b>	<b>Field</b>	<b>Well</b>	<b>Borehole</b>	<b>Activity</b>	<b>Service Run</b>	<b>Tool Run / Module Run</b>
Leg 181	SW Pacific	1123B	1123B	Data Load	Tool String	Tool / Module

The Tool Run contains the arrays (logs) (e.g. SGR, POTA, etc) collected by an individual logging tool (e.g. NGT). The Module Run contains the arrays (logs) that are output by a particular module (e.g. the BorEID module outputs FMS4.EID).

To navigate around in the General Data Manager, two main tools are useful:

- The menu under MB3 (the right mouse button). Use ‘Expand by’ to prevent getting hundreds of needless data items on screen, as is possible when you just do ‘Expand’. Use ‘list arrays’ to list arrays (i.e. logs).
- The ‘Query Tool’ (it’s the crystal ball icon in the left margin of the window). It’s the best way to find the locations of useful arrays (logs) such as FMS4, \*SGR, P1AZ, etc. Select the data item under which you want to search (e.g. the Borehole; it will appear black when you click on it). Then in the query tool window, find all ‘Arrays’ with ‘Code’ (then enter the code, like SGR). Wildcards (\*) are acceptable.

Double clicking on any Data Item will bring up a window where the attributes of the Data Item can be examined and edited. Double clicking on an array will produce a sketch of the log data, a scrollable list of the data values, and the names and modifiers of the log.

## D WellEdit

Well Edit is the main module used to perform the processing steps, to visualize the logs, and to plot them. On starting Well Edit, an initial window pops up where you must enter the depth range and a template file. Default and generic ODP template files can be found in /users/spaceman/gf\_user4/geoframe402\_sun/sun/lgp\_templates. Use ODP\_SGR\_initial.lgp, or whichever template is appropriate. You get to select from a number of default: two sets of settings are appropriate (there is flexibility for more).

1. select 'code' only. The most recent version of the log curve will be placed in the track.
2. select 'code', 'curve set', 'copy number', 'modifiers', 'code', 'modifiers', and 'Oracle ID number'. Use this when saving the template file. Then when you come to re-open it, the log curves will appear just as you saved them.

Then press 'run' to start Well Edit.

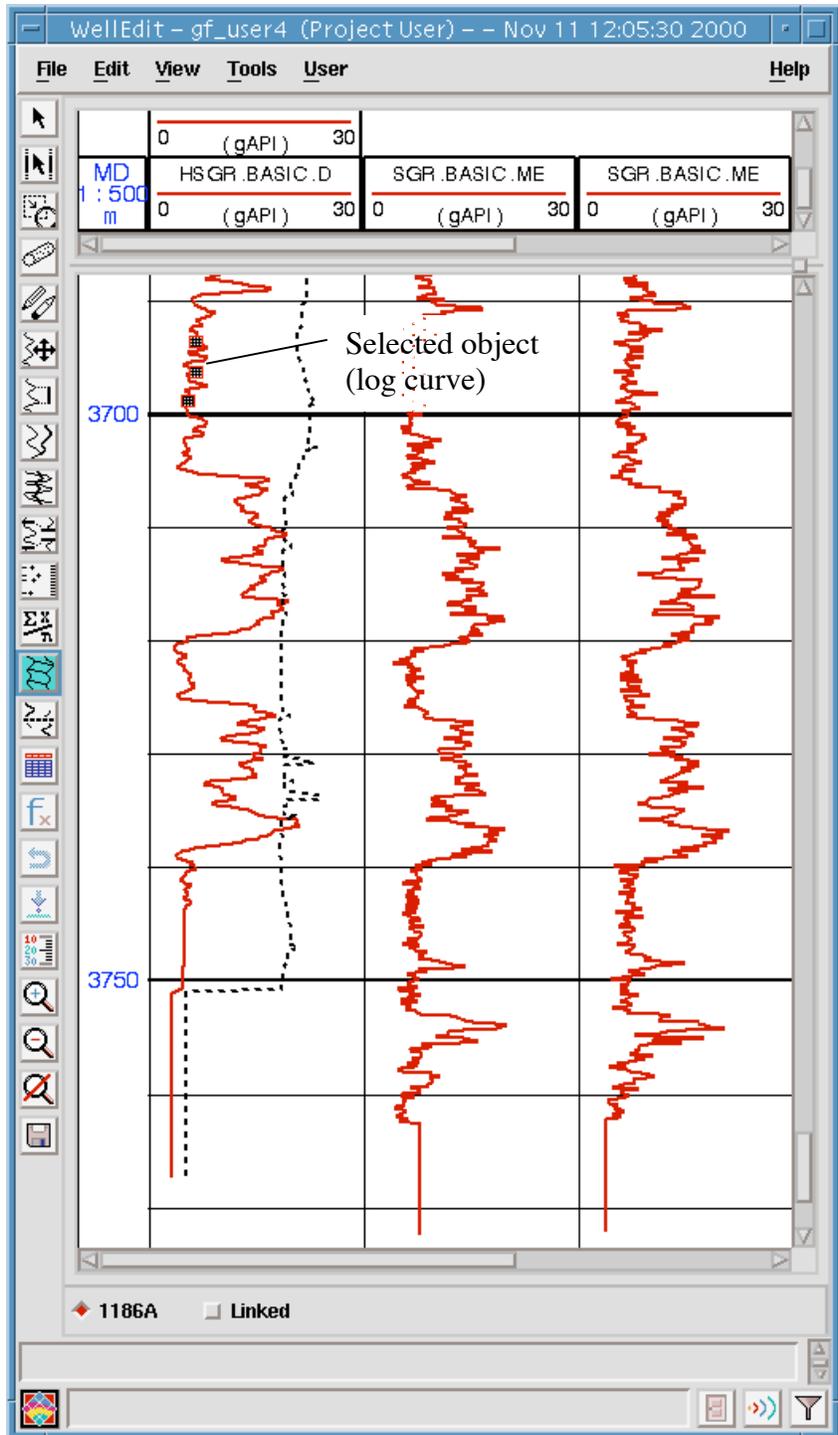
Within Well Edit you can add tracks ('add track' under the Edit menu), and, with a track selected using the track selector icon, add objects ('add object' under the Edit menu). Objects include log curves, FMS4 images, gridlines, depth numbers, etc.

Several utilities are available for manipulating data within Well Edit, including Depth Match (described in the next section), data functioning, and block depth shift (used to move the logs to a sea floor reference).

Once the logs are presented to your satisfaction, the template can be saved (File menu, 'Save Presentation As' (always remember the 'As'!)). Save it in the lgp\_templates directory in the hole directory you set up earlier (e.g. /data/spaceman/gf\_data/STANDARD\_proc/Leg188/1166B/lgp\_templates)

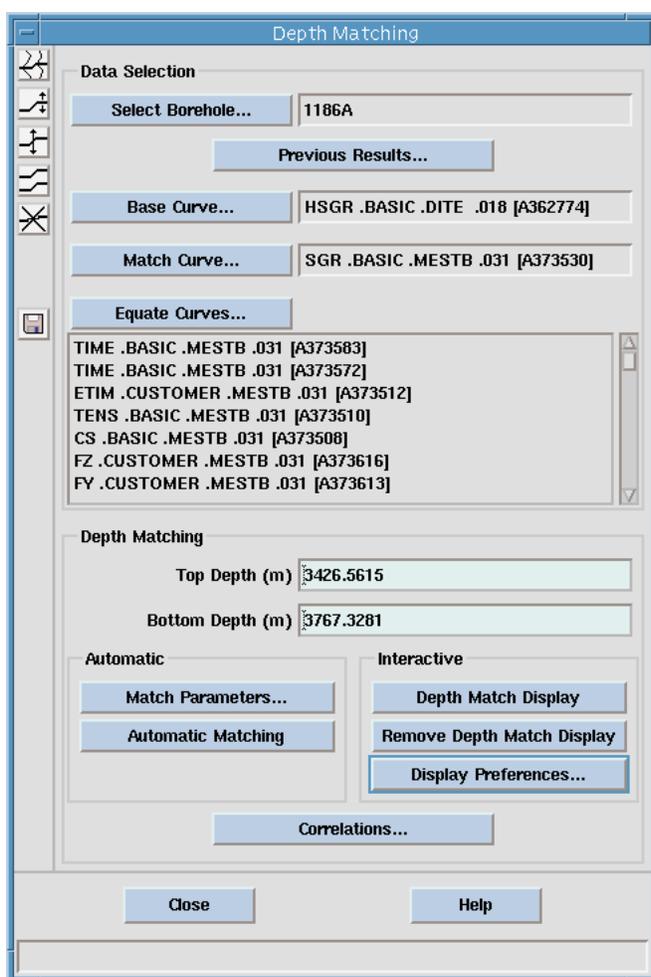
Print the plot to the OYO plotter using 'Print' from the file menu. From the same Print window, save the plot file in PDS format to the lgp\_templates directory. Include caliper (LCAL, C1), cable speed (CS) and head tension (DF) in the initial plot – they are valuable quality control indicators.

- Object select
- Track Select
- Edit log curve
- Block shift log curve
- Depth Match
- Data functioning
- Undo last edit action
- Undo all edit actions
- Change scale
- Save log curve



## E Depth Match (WellEdit)

Small depth discrepancies occur between successive logging runs. In order to bring all runs onto a common depth scale, a natural gamma tool (HNGS, NGT, or SGT) is run on all toolstrings, and the total gamma logs (ECGR or HSGR) have their depths adjusted so they match together. Other logs (for example, caliper logs, SFLU resistivity logs) may be used if the gamma ray logs lack matchable features. A 'reference run' must be chosen to which the others will be matched. The reference run is usually the longest run, and that which goes to the seafloor, and is typically the Triple Combo main run. Check that there are no sudden changes in tool speed in the reference run (evidenced by the CS cable speed log and the DF/TENS tool weight logs). Note that if the hole has been logged before, perhaps on a previous leg, you should use the reference log from the previous logging. The procedure for depth matching log curves is as follows:



1. Select a curve, and press the Depth Match icon to bring up the depth match window.

2. Select a Base curve (from the reference run) and a Match curve

3. Select the Equate curves. The depth adjustments derived for the Base curve are applied to the equate curves. Choose curves in the 'same service run', then press 'Query and Add'.

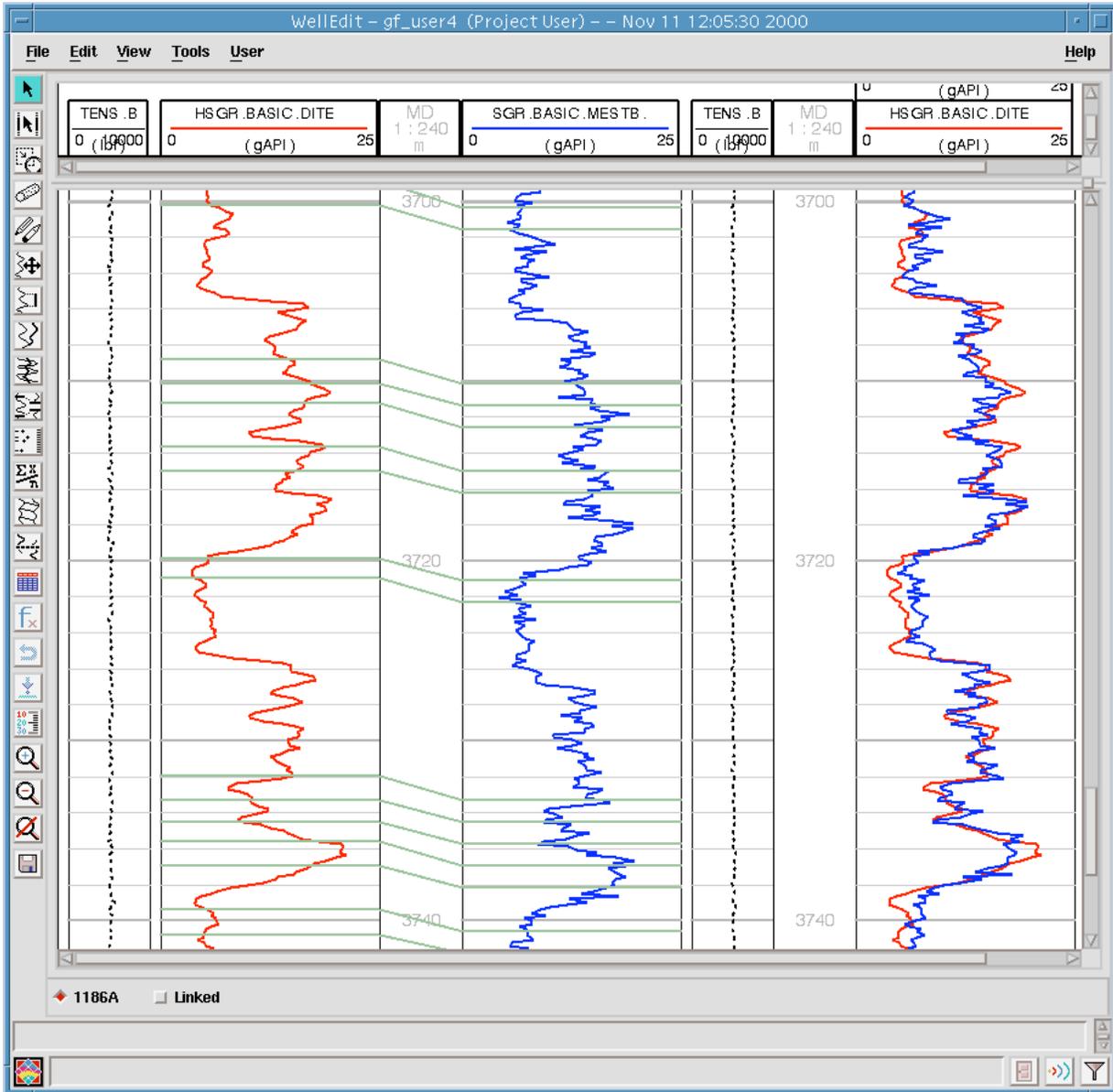
4. Press Depth Match Display (do not use the automatic matching options):

- set the scales for the gamma logs to be the same. Start with 1:240 for the vertical scale.
- add and edit the matches using the tool icons at the top left of the Depth Matching window. Continue until the patterns in the two curves are well matched. Avoid sudden changes in offset. Add other logs (e.g. caliper, SFLU) to the display to see if the matches you are making apply equally well to other logs.

5. Press the Save icon. Change modifier to, e.g., 'DM\_FMS\_p1', and 'Group X' also to 'DM\_FMS\_p1'. You need to do this so as to be able to distinguish curves of the same type from each other later. The saving process takes a minute or two, for some reason.

6. Exit Depth Match, re-enter it to match new curves.

7. Print out the depth matched gamma ray logs on the OYO plotter. Include the caliper logs. Also save the plot as a PDS file in the lgp\_templates directory.



Note that sometimes the tool becomes stuck or the cable speed changes. Depth matching here is more difficult; the match using gamma ray logs may not be the same as the match between, say resistivity and sonic slowness logs. For this reason, the reference log should be as free as possible from sudden changes in cable speed and head tension.

## F Shift to Sea floor (WellEdit)

Initially, the logs are on depth scales referenced to the rig floor (metres below rig floor, mbrf). The sea floor appears in the natural gamma log as a step to lower background values in the water column above the sea floor. We shift the reference to sea floor (metres below sea floor, mbsf) by subtracting natural gamma seafloor depth (mbrf) from all the log depths. This is done in Well Edit:

- Display the natural gamma curve at the seafloor and choose the sea floor depth near the base of the step decrease in that log, using the driller's seafloor depth as a guide. Sometimes the natural gamma logs do not cross the sea floor. In this case, generally, the driller's sea floor depth is used.
- Select the HSGR/SGR curve in WellEdit, and press the Block Depth Shift icon.
- Enter the vertical shift in the Depth Shift window (a negative number). Press Update and then Close.
- Press the 'Save' icon. Press 'Propagate To', then 'Add Curves', and set the array code to '\*'; set the Data Focus to the Activity 'Triple\_main' (or whichever is the reference run), set the curve to '\*', and press 'Add.' Check that all the required curves are present in the list. In the case of Depth Matched data, select 'Add curves in Same Container', then press 'Query and Add'
- Change the Modifier to 'DSH\_Triple\_main.'
- Press OK. The process of saving the shifted curves can take a minute.
- N.B. Remember to change the activity name from WellEdit to 'DSH\_Triple\_main' in the General Data Manager. If you don't, the depth shifted curves from the next toolstring will end up in the same activity.
- Repeat for the other passes.

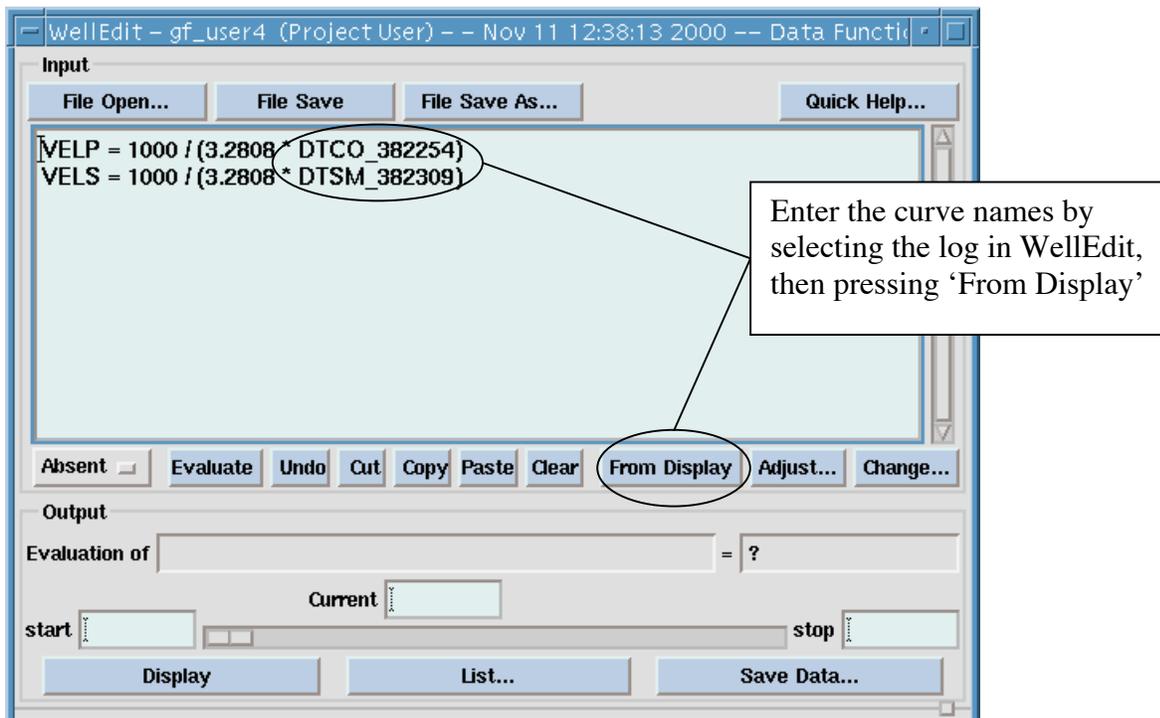
### Tips

If the seafloor is not clear, display the component gamma logs (K, Th, U). Trust the K more than U. Also compare the driller's depth to the base of the pipe to the log depth to the base of the pipe, to see if the difference is similar to the difference at seafloor.

## G Convert Sonic Slowness to Velocity (Well Edit)

The sonic slownesses from the DSI tool have to be checked to see if they are giving reasonable values, repeat between runs, or contain anomalous spikes or runs of bad data. To do this, plot all the slowness data in Well Edit (P and S wave slowness in one track; one track for each pass). It should be evident which pass gives the best/longest data – use this one in the Final DIT plot. If two passes that overlap but contain unique data, they can be spliced (see Appendix B).

Then the P and S wave sonic slownesses (DTCO and DTSM usually) can be converted to velocities ( $\mu\text{sec}/\text{ft}$  to  $\text{km}/\text{sec}$ ). This is done using the Data Functioning tool of Well Edit, which brings up the window below:



1. Type in the formula to convert  $\mu\text{sec}/\text{ft}$  to  $\text{km}/\text{sec}$  (use  $304.8/\text{DTCO}$  instead of the formula in the figure above).
2. Select the slowness log in Well Edit and press 'From Display' to make the log name appear in the formula.
3. Press Evaluate.
4. Press 'Save Data', and change the name modifier to reflect the pass number.
5. Change the name of the activity in the General Data Manager to be, for example, Velocities\_p1. Check the quality (or lack of quality) of the velocity log in Well Edit.

Where the LSS or SDT sonic tool has been used, the velocities can be calculated from the sonic travel times (TT1-4 or LTT1-4). The data have to be downloaded from Geoframe using Data Save. Then run the in-house program 'dtlss3.f' to discard bad data and calculate the new velocity log. Re-load the data back into Geoframe with Ascii Load.

## **H PrePlus**

Pre Plus is a powerful module used to correct the NGT logs for borehole diameter and the density of the drilling fluid. Since the NGT is no longer used in ODP, we do not go into the details of the Pre Plus module here. Pre Plus can be used to make borehole size, temperature, and other corrections to many tools and log types.

Comparison of the all the HNGS and NGT runs is a good idea, to test repeatability. Total gamma usually repeats quite well, but Thorium and especially Uranium can be way different. Take a look.

## I Data presentation and Log Plots

After the Depth Matching, Depth Shifting, and Velocity calculation have been made, the General Data Manager should look something like this:

**Activity**

- Interpretation - 1186A - Oct 30 14:05:22 2000
  - Interp. [S361750]
    - Data Load - gf\_user4 (Project User) - - Nov 11 14:50:23 2000
    - WellEdit - gf\_user4 (Project User) - - Nov 11 12:38:13 2000
    - PrePlus - gf\_user4 (Project User) - - Nov 04 17:22:52 2000
    - Data Save - gf\_user4 (Project User) - - Nov 11 14:50:28 2000
- Triple\_main - Oct 30 17:51:53 2000
  - DITE .018 [S362533]
    - HNGS-BA [T362553]
      - HSGR .BASIC .DITE .018 [A362774]
  - Triple\_repeat - Oct 30 17:52:52 2000
    - DITE .019 [S366162]
      - HNGS-BA [T366181]
        - HSGR .BASIC .DITE .019 [A366402]
    - FMS-sonic\_p1 - Oct 30 18:09:32 2000
      - MESTB .031 [S373279]
        - NGTC [T373287]
          - SGR .BASIC .MESTB .031 [A373530]
      - FMS-sonic\_p2 - Oct 30 18:09:54 2000
        - MESTB .034 [S374771]
          - NGTC [T374778]
            - SGR .BASIC .MESTB .034 [A375025]
        - FMS-sonic\_p3 - Oct 30 18:10:14 2000
          - MESTB .035 [S376271]
            - NGTC [T376278]
              - SGR .BASIC .MESTB .035 [A376521]

**Borehole** 1186A

**Depth Matched**

    - DM\_FMS-sonic.p1 - Oct 31 11:17:09 2000
      - SGR .DM\_FMS-sonic.p1 [A380104]
    - DM\_FMS-sonic.p2 - Oct 31 11:30:06 2000
      - SGR .DM\_FMS-sonic.p2 [A380646]
    - DM\_FMS-sonic.p3 - Oct 31 11:37:55 2000
      - SGR .DM\_FMS-sonic.p3 [A380944]

**Depth Shifted to seafloor**

    - DSH\_Triple\_repeat - Oct 31 11:54:32 2000
      - HSGR .DSH\_Triple\_repeat [A381265]
    - DSH\_Triple\_main - Oct 31 12:09:00 2000
      - HSGR .DSH\_Triple\_main [A381836]
    - DSH\_FMS-sonic.p1 - Oct 31 12:15:34 2000
      - SGR .DSH\_FMS-sonic.p1 [A382078]
    - DSH\_FMS-sonic.p3 - Oct 31 12:28:30 2000
      - SGR .DSH\_FMS-sonic.p3 [A382670]
    - DSH\_FMS-sonic.p2 - Oct 31 12:36:22 2000
      - SGR .DSH\_FMS-sonic.p2 [A382975]

**P and S wave velocities calculated using the Data Functioning tool**

    - Velocities\_p1 - Oct 31 15:48:15 2000
      - VELP .DF [A383973]
      - VELS .DF [A383979]
    - Velocities\_p2 - Oct 31 16:04:13 2000
      - VELP .DF [A384017]
      - VELS .DF [A384023]
    - Velocities\_p3 - Oct 31 16:07:04 2000
      - VELP .DF [A384033]
      - VELS .DF [A384039]

Raw data

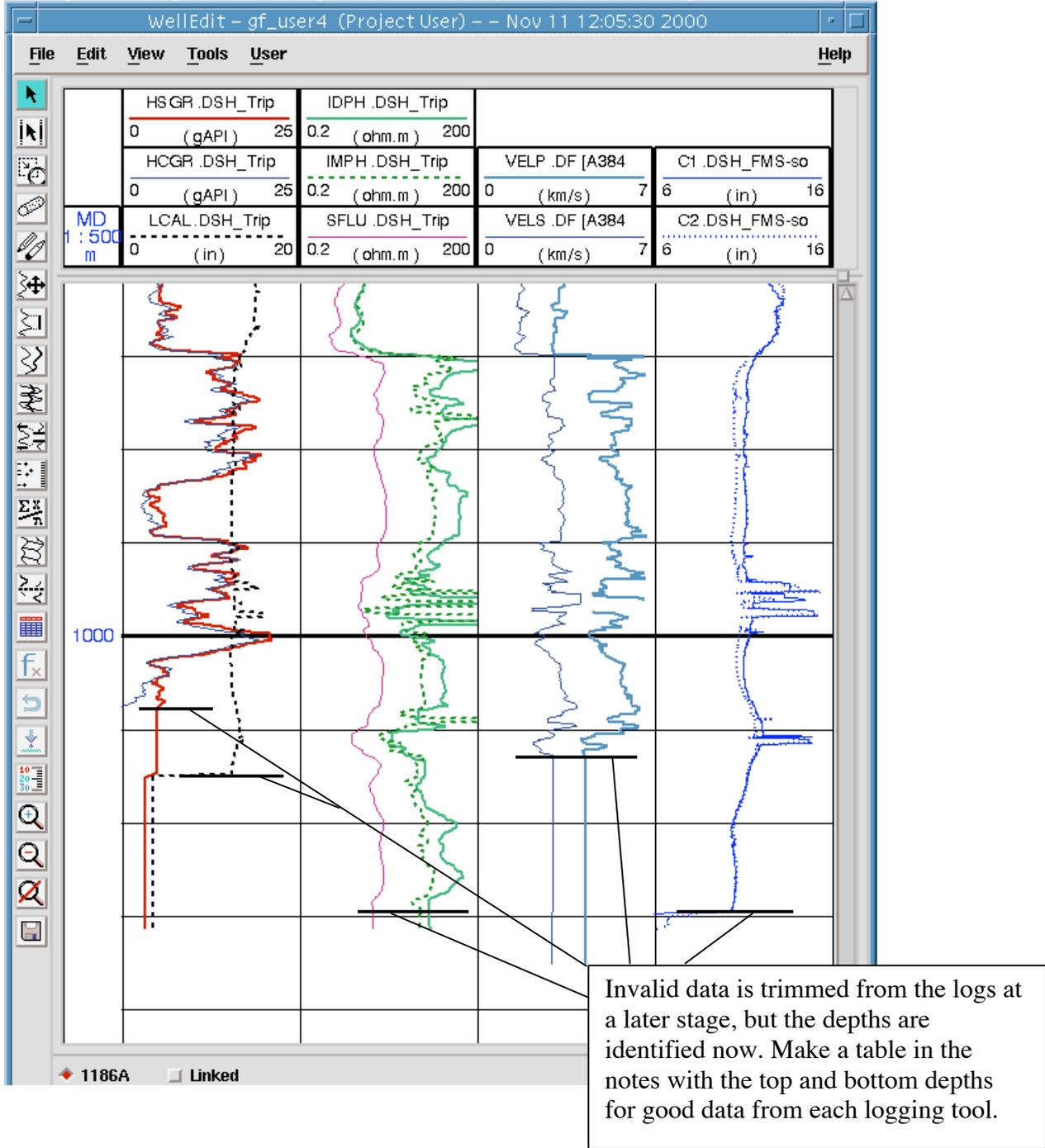
Each log has a 'modifier' that identifies which pass and which processing step it belongs to.

The processing step, toolstring, and pass number are identified in the activity name.

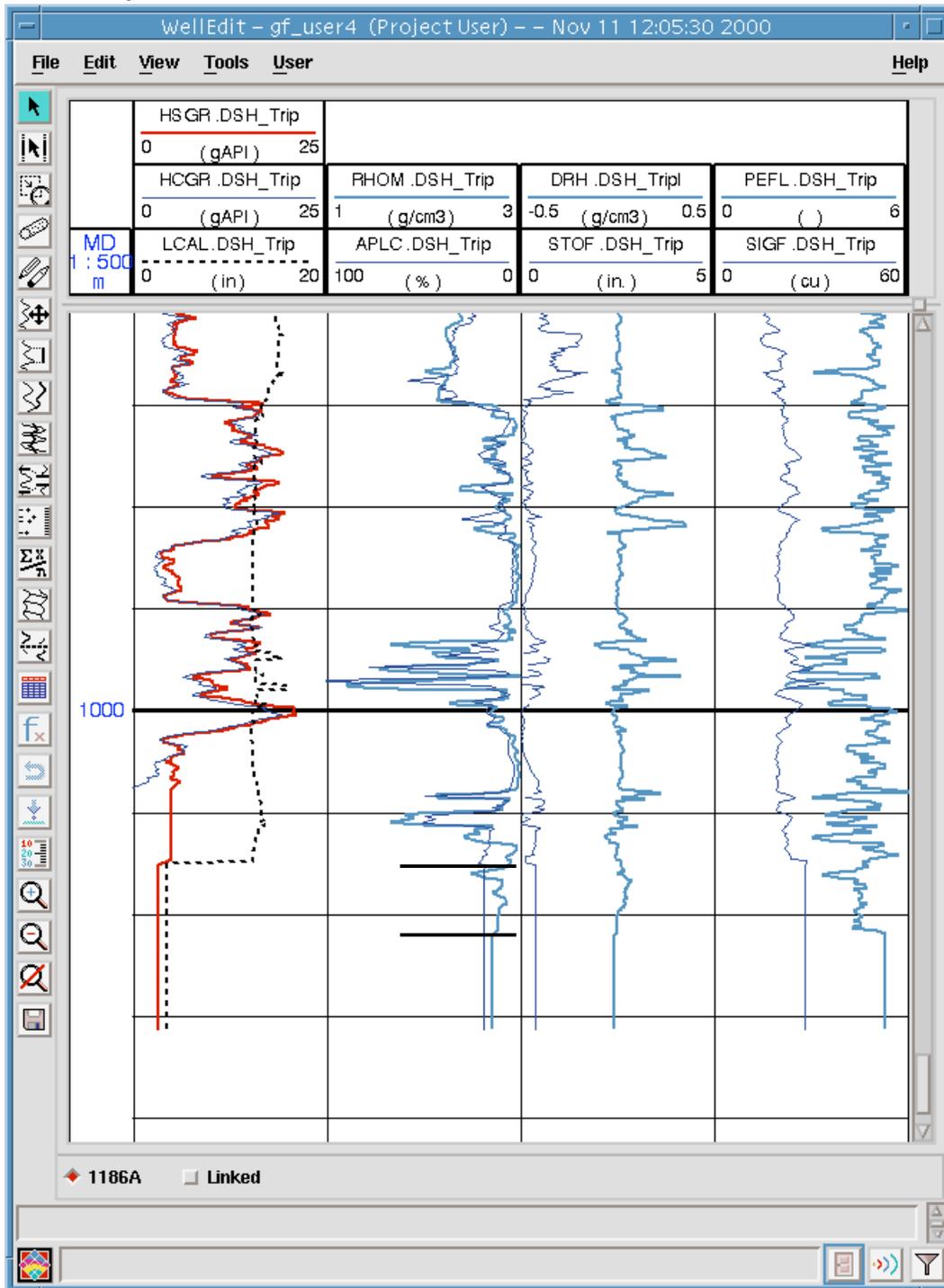
## Log Plots

The log plots are one of the output products of the processing. Usually there will be 3 plots, each at 1:500 scale: Resistivity-Sonic-FMS caliper ('DIT'), Density-Porosity ('HLDS'), and spectral natural gamma ray ('HNGS'). See also Appendix A for a listing of the logs that go in these final plots. They should be saved as lgp templates, PDS files, and plotted on the OYO plotter.

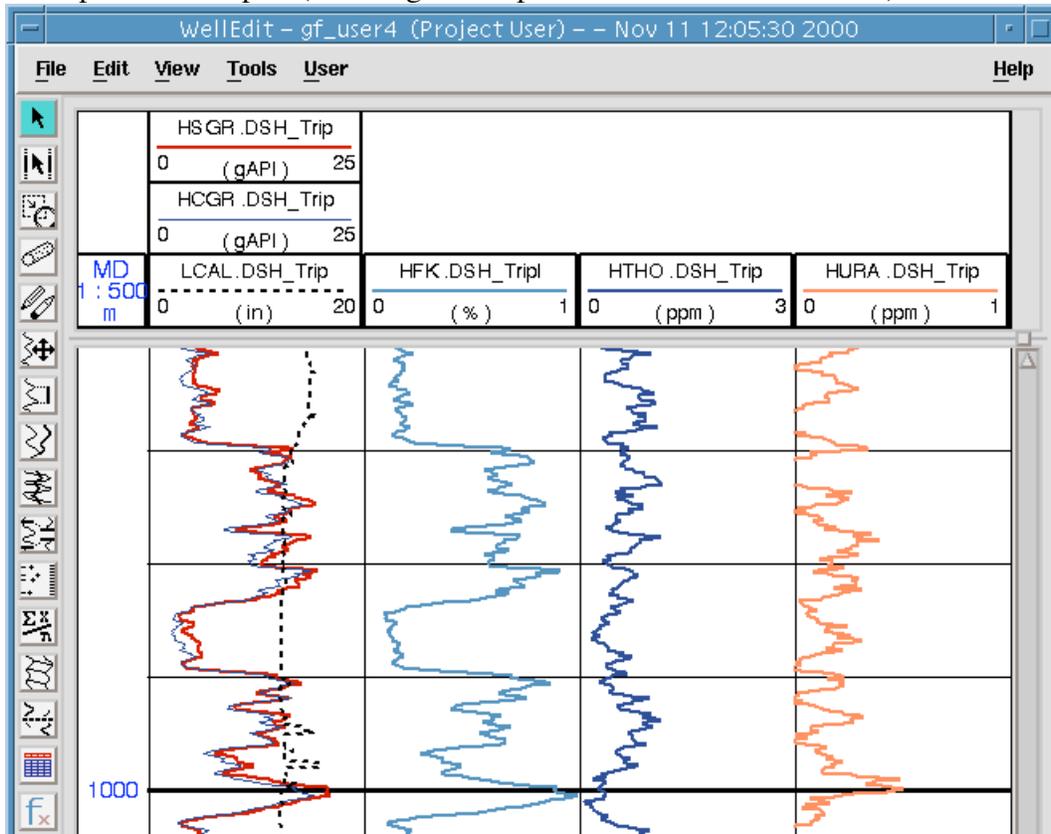
Example 'DIT' plot (Natural gamma, resistivity, sonic, FMS calipers)



Example 'HLDS' plot (natural gamma; density and porosity, density correction and standoff; PEF and  $\Sigma_f$ )



### Example 'HNCS' plot (natural gamma; potassium; thorium; uranium)



#### To Save the LGP template

Choose 'Save As' from the file menu in WellEdit. Navigate to the lgp\_templates directory of the borehole you are working on, and give the file a sensible name. Select 'code', 'curve set', 'copy number', 'modifiers', 'code', 'modifiers', and 'Oracle ID number'. Then when you come to re-open it, the log curves will appear just as you saved them.

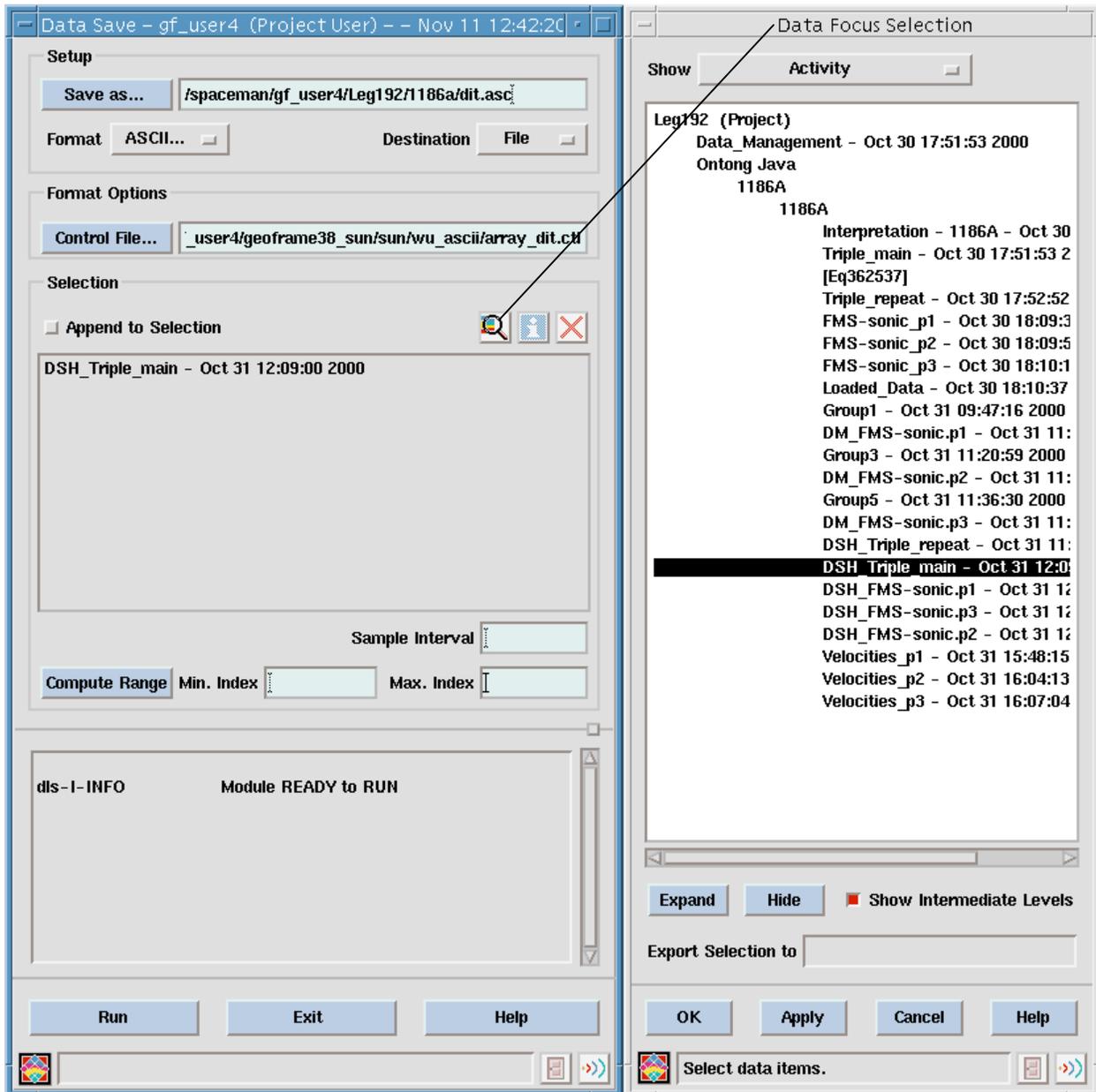
#### To plot on the OYO plotter

Choose 'Print' from the file menu. Also save the plot as a PDS file at this stage. You might have to enter the plotter information (see Section B, 'Setting up the Plotter').

## IV Saving and distributing data

### A ASCII Data Save

Log data are saved to Ascii files using the Data Save module (below). The Geoframe installation on Spaceman has been set up with templates for saving the various ODP Ascii files (\*.asc) (/users/spaceman/gf\_user4/geoframe402\_sun/wu\_ascii/\*.ctl). In a second step, a Unix script is run to put the standard ODP-BRG headers at the top of the files, to trim the invalid data from the top and bottom, and to remove all space characters from the file (\*.dat).



- In the Data Save module, set the format to Ascii, and a drop-down menu should list the Save Templates (array\_dit.ctl, array\_hlds.ctl, etc). Choose the top one and work down the list, as appropriate for the tool strings used in the hole. The control file will appear in the Control File box.
- Press 'Save As', navigate to the Hole directory, and set the filename to be of the form 'ditm.asc' (i.e. with the tool first, the pass second). The naming convention is that the tool name is followed by a letter or number indicating the pass, e.g. m for Main, 1 for Pass 1, u for Upper Pass, etc.
- Set 'Destination' to 'File'
- Press the Data Focus icon and navigate down so that all Activities in the Borehole are displayed (see figure below). Select the Activity containing the relevant data (e.g. DSH\_Triple\_main for ditm.asc), and press Apply. Include the velocity data with the DSI slownesses. For the processed NGT curves, you have to select the appropriate Module Run of the Pre-Plus module in the Interpretation Chain (see the DLIS Save figure).
- Leave the Sample Interval and Compute Range blank, except for the GPIT and FMS caliper file, where you have to set the sample interval to 0.1524 m.
- Press Run.
- Repeat for all other tools on all passes of the toolstrings.

Once all the \*.asc files have been created, they must have the bad data trimmed from the top and bottom, spaces replaced with tabs, and header information added. This process is carried out using the scripts util-triple, util-sonic, etc. These files have to be edited to add the relevant depths and hole names and thus provide a record of the top and bottom depths for each tool pass. The script util-makedat, called for each tool pass, does the actual file manipulation.

Example .asc file: apsm.asc

DEPTH	APLC	STOF	SIGF	AFEC	ANEC			
m	%	in.	cu	cps	cps			
1031.3281		19.0747		0.3750		27.8646	712.0000	3188.0000
1031.1757		18.8732		0.3750		27.8629	712.0000	3188.0000
1031.0233		18.6749		0.3750		27.8611	712.0000	3188.0000

Example .dat file: 1186A\_apsm.dat

```

HOLE: 1186A
LEG: 192
TOP: 679.1317
BOTTOM: 1014.8689
DEPTH  APLC    STOF    SIGF    AFEC    ANEC
679.1317      53.1794 0.9211 23.2430 435.4286      2483.0000
679.2841      53.1794 0.9211 23.2430 432.0000      2517.1428
679.4365      53.1794 0.9211 23.2430 461.0000      2441.0000

```

Example utility files for producing the .dat files:

### util-triple

```
#!/bin/csh

# Shell Script to re-format ascii output from GeoFrame
echo 'Re-formatting ascii output from GeoFrame'
echo
set hole = 1186A
set leg = 192
echo 'Leg '$leg' Hole '$hole
echo

# _____
# DIT file

set infile = ditm.asc
set outfile = 1186A_ditm.dat
set top = 679
set bottom = 1030
echo $outfile
util-makedat $infile $outfile $top $bottom $hole $leg

# _____
# HLDS file

set infile = hldsm.asc
set outfile = 1186A_hldsm.dat
set top = 679
set bottom = 1021.5
echo $outfile
util-makedat $infile $outfile $top $bottom $hole $leg
[etc]
```

### util-makedat

```
#!/bin/csh

# Script to do the re-format of the Geoframe ascii output.
# Called from util-triple, etc, like this:
# util-makedat $infile $outfile $top $bottom $hole $leg

awk 'NR == 1' $1 > tmp.header
awk '($1 <= '$4' && $1 >= '$3)'' $1 | sed 's/ //g' | sed 's/ $//g' | sort -n > tmp.bogus
tail -1 tmp.bogus | awk '{print $1}' > tmp.bottom
head -1 tmp.bogus | awk '{print $1}' > tmp.top

printf '%s\t%s\n' "HOLE:" $5 > $2
printf '%s\t%s\n' "LEG:" $6 >> $2
printf '%s\t' "TOP:" >> $2; cat tmp.top >> $2
printf '%s\t' "BOTTOM:" >> $2; cat tmp.bottom >> $2
sed 's/ //g' tmp.header >> $2
cat tmp.bogus >> $2
```

Once all the \*.dat files are made, list the top lines of each to a file and print it for the processing notes folder:

```
> head *.dat > datfiles
> enscrip -2r datfiles
```

Then copy the \*.dat files to the directory parallel to the working directory, e.g. 1186A\_datfiles.

The final working directory should look something like this:

```
12 spaceman:gf_user4> pwd
/users/spaceman/gf_user4/Leg192/1186a
13 spaceman:gf_user4> ls -R
.:
1186a_proc.dlis  ditm.asc          gpit2.dat         hngsr.dat         ngt2.asc
apsm-hr.asc     ditm.dat          gpit3.asc         lgp_templates     ngt2.dat
apsm-hr.dat     ditr.asc          gpit3.dat         misc-ditm.asc     ngt3.asc
apsm.asc        ditr.dat          hldsm-hr.asc     misc-ditm.dat     ngt3.dat
apsm.dat        dlis_files        hldsm-hr.dat     misc-ditr.asc     tmp.bogus
cali-fms1.asc   dsil.asc          hldsm.asc         misc-ditr.dat     tmp.bottom
cali-fms1.dat   dsil.dat          hldsm.dat         misc-fms1.asc     tmp.header
cali-fms2.asc   dsi2.asc          hldsr-hr.asc     misc-fms1.dat     tmp.top
cali-fms2.dat   dsi2.dat          hldsr-hr.dat     misc-fms2.asc     util-makedat
cali-fms3.asc   dsi3.asc          hldsr.asc         misc-fms2.dat     util-sgr
cali-fms3.dat   dsi3.dat          hldsr.dat         misc-fms3.asc     util-sonic
cali-hldsm.asc  gpit1.asc         hngsm.asc         misc-fms3.dat     util-sonic-old
cali-hldsm.dat  gpit1.dat         hngsm.dat         ngt1.asc          util-triple
                  gpit2.asc         hngsr.asc         ngt1.dat          util-triple-rep

./lgp_templates:
DIT.dsl        HLDS.lgp          INITIAL_sgr.dsl   SGR_seafloor.lgp  Sonic2.dsl
DIT.lgp        HNGS.dsl          INITIAL_sgr.lgp   Sonic1.dsl         Sonic2.lgp
HLDS.dsl       HNGS.lgp          SGR_seafloor.dsl  Sonic1.lgp
HLDS.pds
```



Procedure for saving in DLIS format:

1. Select DLIS, File/Tape, and the output path and filename.
2. Select 'producer' for availability.
3. Leave the default blocksize.
4. Use the data focus icon to select the data items to save:
  - a. Expand from the field level down through the well and borehole to get a list of the *activities* within the borehole.
  - b. For the triple combo, select (for example) the DSH\_triple\_main activity, and press Apply. The activity will appear in the box, and the file number (the logical file number) will update automatically.
  - c. Sometimes you need to select individual arrays, for example where NGT arrays have been reprocessed:
    - i. Select the Pre-Plus *Module Run*. Press Apply (in the data focus window).
    - ii. Toggle the 'append to selection' option.
    - iii. Using MB3, list the *arrays* within the DSH activity. Select all but the NGT arrays (you can drag select, and use the control key to deselect). Press Apply.
    - iv. Select the Activity containing the P and S wave velocities. Press Apply.
5. Set the file type to Result.
6. Set the file ID to Triple\_main, GHMT\_p1, etc.
7. Set the snap option to 'off'.
8. You don't need to Compute Range.
9. Press Apply. NB none of the above settings are applied until you do this.
10. Return to step 4 and select the next set of data items to be saved. Each pass will have a separate logical file.

## C Archive locations

The processed data in Ascii format are maintained in several locations:

- Where they were processed (/data/spaceman/gf\_data/STANDARD\_proc)
- In the Ascii database on Cristina Broglia's Mac.
- In the online database, /data/web\_brg0/WWW\_BRG/online2
- On CD-ROM.

The DLIS processed data are maintained in the archive:

- /data/web\_brg0/WWW\_BRG/archive/ODP\_data\_proc/standard
- On 4mm DAT tape.

## D Writing the Processing Notes

See document template in Appendix C.

In the DSDP processing notes, written after ODP processing was finished, we have introduced a table with the logging tool strings and depth ranges, which should be continued in future IODP log processing. For example:

Tool string	Pass	Top depth (mbsf)	Bottom depth (mbsf)	Bit depth (mbsf)	Notes
1. DIT/LSS/GR/MCD	Main	150	536	171	
2. FDC/CNL/GR	Main	0	530	172	Reference
	Repeat	441.5	492		

## E Data transfer to the ship

Put the processed and zipped Ascii files to be sent to the ship in the outgoing directory (/users/brg0/transfer/lamont2JR/Leg/Hole). Let the Logging Staff Scientist onboard the ship know the data have been processed and are ready to be picked up. The data will be picked up by the Logging Staff Scientist.

## Appendicies

### Appendix A. Log curves in Final Logplots

Wireline

#### Template #1: Resistivity-Spectral Gamma Ray-Sonic-FMS Calipers

Track 1: Spectral Gamma ray: HSGR (or SGR), HCGR (or CGR), API units

Track 2: Resistivity: IDPH, IMPH, SFLU (ohmm), linear or logarithmic

Track 3: Sonic: compressional velocity (Long and short-spacing, km/s)

Or

Track 3: Sonic: compressional and shear velocity (km/s)

Track 4: FMS calipers (in)

#### Template #2: Resistivity- Spectral Gamma Ray-Sonic-HLDT caliper

Track 1: Spectral Gamma ray: HSGR (or SGR), HCGR (or CGR), API units, HLDT caliper (in)

Track 2: Resistivity: IDPH, IMPH, SFLU (ohmm), linear or logarithmic

Track 3: Sonic: compressional velocity (Long and short-spacing, km/s)

Track 4: Spectral Gamma Ray: HTHO (or THOR) and HURA (or URAN, both ppm), HFK (or POTA, wt %)

#### Template #3: Spectral Gamma Ray-Density-Porosity-HLDT Caliper

Track 1: Spectral Gamma ray: HSGR (or SGR), HCGR (or CGR), API units, HLDT caliper (in)

Track 2: Bulk Density (g/cm<sup>3</sup>), Porosity (%)

Track 3: Density Correction (g/cm<sup>3</sup>), Standoff (in)

Track 4: Capture cross section (capture units), Photoelectric Effect (barns/e<sup>-</sup>)

#### Template #4: Spectral Gamma Ray

Track 1: Spectral Gamma ray: HSGR (or SGR), HCGR (or CGR), API units, HLDT caliper (in)

Track 2: HFK (or POTA, wt %)

Track 3: HTHO (or THOR, ppm)

Track 4: HURA (or URAN, ppm)

NOTE: if you choose template #2, there is no need for template #4.

LWD

#### Template #1: Penetration Rate-Gamma Ray-Resistivity-Spectral Gamma Ray

Track 1: Gamma ray: GR (API units), ROP (f/hr)

Track 2: Resistivity: ATR and PSR (ohmm), linear or logarithmic

Track 3: Spectral Gamma Ray (SGR and CGR, API units)

Track 4: Spectral Gamma Ray: THOR and URAN (ppm), POTA (wt %)

Template #2: Penetration Rate-Spectral Gamma Ray-Resistivity

Track 1: Spectral Gamma ray: GR (API units), ROP (f/hr)

Track 2: Resistivity: ATR and PSR (ohmm), linear or logarithmic

Track 3: Spectral Gamma ray POTA (wt %)

Track 4: Spectral Gamma Ray: THOR and URAN (ppm)

Template #3: Spectral Gamma Ray-Density-Porosity- Caliper

Track 1: Spectral Gamma ray: SGR and CGR), API units, caliper (in)

Track 2: Bulk Density (g/cm<sup>3</sup>), Porosity (%)

Track 3: Density Correction (g/cm<sup>3</sup>), Photoelectric Effect (barns/e<sup>-</sup>)

Track 4: Spectral Gamma Ray: THOR and URAN (ppm), POTA (wt %)

## Appendix B. How to splice curves in Well Edit

### Description:

This example will describe the case where you want to splice two arrays with the same code from different service runs, for example, two sp curves from a shallow and a deep log run.

### Solution:

After starting WellEdit, click on the Splice Multiple Log Curves Simultaneously icon, the twelfth icon from the top. This brings up the Splice Mode window. Select the borehole containing the curves you wish to splice. Next, Select the Activities which contain the arrays you wish to splice. In this case, it is not necessary to Customize Splice Groups. Each activity will be given a Group Name which is the same as the activity name and the Group Focus will be set to that activity.

Next, click the Use Common Codes button. This will show the arrays which are common to all the Groups (or Activities) which have been selected. The Display Log Curve will have the code of one of the arrays available to be spliced. You can change this by highlighting a different array and typing in the code for the Display Log Curve. The Display Log Curve input will determine which curves will be displayed.

Next, click Splice Display. This will bring up a WellEdit window that shows each array with the common code in an individual log track, with an output track to the right which shows the spliced curve. You may need to expand or scroll this window to see all tracks. The Splice icons are those four icons back in the Splice Mode window, so position this window where you can use those icons and still see the Splice Display window.

The next step is to put in the splice point(s) by clicking on the top icon in Splice Mode, then moving to the WellEdit window and clicking on the log at the splice point. A green line will appear across all log tracks. To remove a splice point, click on the second icon then click on the green line. To select the log interval to be spliced, click on the third icon, then click on the desired track anywhere above the green line. Then click on a different track below the green line. The output window will now show the spliced version of the log. Continue putting in splice points and selecting the log intervals. When finished splicing, click on the save icon in the WellEdit window to save the spliced log.

GeoQuest Customer Support Knowledge Base, 12/21/98

## Appendix C. Standard processing notes document template.

**ODP logging contractor:** LDEO-BRG

**Hole:**

**Leg:**

**Location:**

**Latitude:** ° ' "

**Longitude:** ° ' "

**Logging date:**

**Bottom felt:** mbrf (used for depth shift to sea floor)

**Total penetration:** mbsf

**Total core recovered:** m ( %)

### Logging Runs

Logging string 1:

Logging string 2:

Logging string 3:

Text explaining notable events in the logging operations, ship heave conditions, and whether the wireline heave compensator was used.

### Bottom-hole Assembly/Pipe/Casing

The following bottom-hole assembly/pipe/casing depths are as they appear on the logs after differential depth shift (see "Depth shift" section) and depth shift to the sea floor. As such, there might be a discrepancy with the original depths given by the drillers onboard. Possible reasons for depth discrepancies are ship heave, use of wireline heave compensator, and drill string and/or wireline stretch.

DIT/APS/HLDT/HNGS: Bottom-hole assembly at mbsf

FMS/DSI/GPIT/SGT: Bottom-hole assembly at mbsf.

### Processing

**Depth shift:** The original logs were depth matched to the HNGS/NGT from the ..... run and were then shifted to the sea floor (-m). The sea floor depth is determined by the step in gamma ray values at the sediment-water interface. In this case it is the same as the "bottom felt" depth given by the drillers (see above).

Depth matching is typically done in the following way. One log is chosen as reference (base) log (usually the total gamma ray log from the run with the greatest vertical extent), and then the features in the equivalent logs from the other runs are matched to it in turn. This matching is performed automatically, and the result checked and adjusted as necessary. The depth adjustments that were required to bring the match log in line with the base log are then applied to all the other logs from the same tool string.

**Gamma-ray processing:** The HNGS and SGT data were corrected for hole size during the recording.

**Acoustic data processing:** Because of the extremely noisy character of the sonic logs, no processing has been performed at this stage.

**Acoustic data processing:** The array sonic tool was operated in two modes: linear array mode, with the 8-receivers providing full waveform analysis (compressional and shear) and standard depth-derived borehole compensated mode, including long-spacing (8-10-10-12') and short-spacing (3-5-5-7') logs. The sonic logs have been processed to eliminate some of the noise and cycle skipping experienced during the recording. Using two sets of the four transit time measurements and proper depth justification, four independent measurements over a -2ft interval centered on the depth of interest are determined, each based on the difference between a pair of transmitters and receivers. The program discards any transit time that is negative or falls outside a range of meaningful values selected by the processor.

**High-resolution data:** Bulk density and neutron porosity data were recorded at a sampling rate of 2.54 and 5.08 cm, respectively. SGT gamma ray data were sampled every 5.08 cm. The enhanced bulk density curve is the result of Schlumberger enhanced processing technique performed on the MAXIS system onboard. While in normal processing short-spacing data is smoothed to match the long-spacing one, in enhanced processing this is reversed. In a situation where there is good contact between the HLDT/HLDS pad and the borehole wall (low-density correction) the results are improved, because the short spacing has better vertical resolution.

### Quality Control

null value=-999.25. This value may replace invalid log values or results.

During the processing, quality control of the data is mainly performed by cross-correlation of all logging data. Large (>12") and/or irregular borehole affects most recordings, particularly those that require eccentricization (APS, HLDT/HLDS) and a good contact with the borehole wall. Hole deviation can also affect the data negatively; the FMS, for example, is not designed to be run in holes deviated more than 10 degrees, as the tool weight might cause the caliper to close.

Data recorded through bottom-hole assembly should be used qualitatively only because of the attenuation on the incoming signal.

Hole diameter was recorded by the hydraulic caliper on the HLDT/HLDS tool (CALI/LCAL) and on the FMS string (C1 and C2).

Additional information about the logs can be found in the "Explanatory Notes" and Site Chapter, ODP IR volume ..... For further questions about the logs, please contact:

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## **Appendix D. DSI Shear Sonic information**

In STC processing of dipole waveforms, a coherence peak corresponding to the dispersive flexural mode occurs at a slowness near that of the frequency of peak excitation after filtering. The estimate is therefore biased slower than the true shear, and must be corrected. The bias depends on the time signature of the source excitation, the filter characteristics, the borehole size and shear slowness. In slow formations, the correction is less than 10%, and usually much less. In fast formations, where the dispersion of the flexural mode is greater, a large correction is required only in large (>17 in.) boreholes. In a fast formation with a moderate hole size (<12 in.), very little or no bias is found.

### **DTSM: Delta-T Shear**

This channel is the shear slowness (Dt) used in the Poisson's ratio computation. It is derived either from the dipole mode shear slowness (DT1 or DT2 channel) or from the P & S mode shear slowness (DT4S channel). The parameter DTSS determines which channel is used.

### **DTCO: Delta-T Compressional**

This channel is the compressional slowness (Dt) used in the Poisson's ratio computation. It is derived either from the DFMD mode compressional slowness (DT5 channel) or from the P & S mode compressional slowness (DT4P channel). The parameter DTCS determines which channel is used.

### **DTSS: Shear Delta-T Source for DTSM Channel**

This parameter determines which shear slowness measurement channel is used to drive the DTSM channel used for the Poisson's ratio computation. UPPER\_DIPOLE or LOWER\_DIPOLE means the DT1 or DT2 channel, the dipole mode shear measurement, will be used for the DTSM channel. PS\_SHEAR means DT4S, the P & S mode shear, is used for DTSM. If selected option's shear channels is unavailable, DTSM assumes the absent value (i.e., -999.25) as does Poisson's ratio.

### **DTCS: Compressional Delta-T Source for DTCO Channel**

This parameter determines which compressional slowness measurement channel is used to drive the DTCO channel used for the Poisson's ratio computation. FMD means the DT5 channel, the DFMD mode compressional measurement, will be replicated in the DTCO channel. PS\_COMP means DT4P, the P & S mode compressional, is used for DTCO. If the selected option's compressional channel is unavailable, DTCO assumes the absent value (i.e., -999.25) as does Poisson's ratio.

### **DTn: Delta-T Shear (n = 1, 2)**

This channel is the bias-corrected (and borehole-compensated if LPMn = DDBHC) dipole shear slowness. This slowness represents an average over a formation interval equal to the length of the active receiver array (roughly equivalent to vertical resolution).

DTnR: Delta-T Shear, Receiver Array (n = 1, 2)

This channel is the final receiver array dipole shear slowness derived by the labeling from the STC results. This slowness represents an average over a formation interval equal to the length of the active receiver array (roughly equivalent to vertical resolution).

## **Appendix E. HNGS processing (internal to the tool)**

Kerry,

The curves you mention (MSGR and PSGR) are simply curve error limits using Statistical Uncertainty in Standard Gammaray (SSGR). In other words:

$$\text{MSGR} = \text{HSGR} - \text{SSGR}$$

$$\text{PSGR} = \text{HSGR} + \text{SSGR}$$

where HSGR is HNGS Standard Gammaray.

The calculation of Statistical Uncertainty is another story. The computations and algorithms of HNGS are explained in IPLS Training Manual. Basically in order to improve precision the processing algorithm uses non-linear Marguardt least squares fit using five different spectral standards (thorium, uranium, potassium, borehole potassium and tool background) to analyze the measurement. From these results the environmental effects are removed and the elemental yields are computed. These results are finally alpha filtered to improve statistical precision.

I hope this helps,

Hannu