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1 Introduction

Seismic processing was carried out in order to QC the seismic data acquired by the vessel ***Polar Duke*** on behalf of **Santos**. The survey was conducted in the Bass Strait, offshore Gippsland (State of Victoria) in Australia. This comprised the VIC/RL3 block. Acquisition was implemented using a source array of 3500 cu in. volume and a single streamer with 168 primary and 12 auxiliary channels.

The survey commenced recording on the 5th January 2003, and was completed on the 10th January 2003. A total of 25 sequences and approximately 194 km of full fold seismic data were acquired. Raw and Brute 2D Stacks were processed for all of these lines. On board processing maintained an average processing throughout of 32 kilometres per day of 2D, 4000ms record length, 56 fold data.

The data quality was generally very good throughout the survey, with extraneous noise coming primarily from swell. Seismic reflections were easily visible throughout the sections and sharply defined. Multiple energy was also readily apparent. Brute stack processing included an offset weighted stack. The weather conditions were generally good during the survey. A variable degree of swell noise was visible on most of the raw stack sections.

The deliverables for this project were paper copies of QC plots including Raw Stacks, Brute Stacks, Near Trace Displays and RMS plots. 8mm Exabyte tape copies of raw stacks and brute stacks were made in SEG-Y format. Velocities were saved as ASCII files, which were then UNIX tarred to Exabyte tape as well as copied to floppy disk at the end of the survey.

The ProMAX system was a stand-alone machine, with a single operator and two 3590 tape drives. The system performed well throughout the survey with no system or processing problems. Field tape copies were generated in SEG-D format on 3590 tapes, using the ProMAX tape copying utility.

Although the ProMAX was not set up as an on-line system, it was still possible to process every sequence through to brute stack, and produce all the necessary QC plots at a fast enough rate to keep close behind the data acquisition. The two 3590 tape drives proved to be adequate for both tape copying and data loading operations.

The ProMAX system and QC processing consultants were provided by Exploration Partners International Ltd of Mannez Alderney, Channel Islands, UK. Eurotech Computer Services Ltd of Cranleigh, Surrey, UK, set up the computer system and Landmark Graphics Corporation Ltd installed the ProMAX software.

2 Acquisition Parameters

Recording Instruments

Recording System	:	Syntrak
Source controller	:	Syntron GCS-90
Recording format	:	3590 SEG-D 8058 Rev 1
Record length	:	4000 ms
Sample rate	:	2 ms
Low cut filter	:	3Hz – 12dB/Oct
High cut filter	:	206Hz - 276 dB/oct
Channel set 1	:	168 Seismic channels
Channel set 2	:	12 Auxiliary channels

Streamers

Streamer type	:	Syntron
Number of streamers	:	1
Active length	:	2100 m
Number of groups	:	168
Group interval	:	12.5 m
Near trace	:	168
Streamer depth	:	7.0 m +/- 1m
Near trace offset from source	:	75 m

Source

Array type	:	Airgun
Total volume	:	3500 cu in
Air pressure	:	2000 psi
Gun depth	:	5.0 m +/- 0.5 m
Number of sub arrays	:	4
Shotpoint interval	:	18.75 m

Navigation

Primary Navigation	:	Fugro MRDGPS: Starfix+ Dual frequency
Secondary Navigation	:	Fugro MRDGPS Inmarsat Direct Injection

3 Personnel and ProMAX QC System

EPI Consultant Processing Geophysicists

5th January 2003 to 10th January 2003: Adam Gebarski

Onboard Processing Hardware

Machines	:	*1 SUN Ultra 60 (2xUltraSPARC-II 450MHz)*
Memory	:	*1024 Mb*
Monitor	:	*Iiyama*
Hard Disk Drives	:	*70 GB*
Tape Drives	:	*2 x 3590 IBM tape drives*
	:	*2 x 8mm, Exabytes, Artecon*
CD Drives	:	*1 x DVD*
Plotters	:	*1 OYO GS-624 thermal plotter (24 inch)*

Software

ProMAX 2D	:	Version 1998.6
IBM Operating System	:	UNIX (SunOS Rel. 5.6)

Data loading was accomplished entirely via 3590 copy tapes. There was no on-line connection of the ProMAX to the data acquisition system.

As there was no on-line SEGD tape copying, the ProMAX system had to be used for all the Tape Copying operations. Copy tapes were generated in SEG-D format on 3590 tapes using the ProMAX tape copy utility. Copy tapes were used for data loading and seismic processing for verification of original as well as copy tapes.

4 Raw Stack Processing Sequences:

SEG-D Input From Tape
Reformat to ProMAX internal format — Read 168 channels + 12 auxiliary channels. Input 10000ms
↓
Resample / Desample — From 2 to 4 ms. Hi-Fi antialias filter applied in module
↓ ——→ **Auxiliary Channel QC** — On screen QC. All auxiliary channels
↓ ——→ **Near Trace Display** — On screen QC. Ch 168
Pick WBT
↓ ——→ **<u>HARDCOPY (with direct arrival RMS)</u>**

Marine Trace Decimation — 2:1 trace summation after differential NMO
2D Marine Geometry — Spreadsheet / Database preparation
Bulk Shift Static — 0ms for instrument filter delay
↓ ——→ **RMS Shot Analysis** — Shot RMS, Av. RMS for channels 32-52
↓ Shallow RMS window 30-130ms
↓ Conversion factor from µV to µbar=50
↓ ——→ **<u>STACK HEADERS & PLOT</u>**
↓ ——→ **Raw Shots Display** — Every 4 km, 4000 ms, 168 channels
↓ ——→ **<u>ON SCREEN QC DISPLAY</u>**

Trace / Shot Kill — Edits based on Observer's Logs
Band-pass Filter
Type of filter specification — Ormsby band-pass
Details of filter — Minimum Phase, 4-8-90-120 Hz
True Amplitude Recovery
Apply dB/sec corrections — Spherical Div. 1 dB/sec from water bottom to 4000ms
Maximum application time — 4000 ms
↓ ——→ **Velocity Analysis** — Every 4 km, Semblance, Gathers, Function Stack
↓ ——→ **<u>ASCII FILE</u>**

Normal Move-out Correction
↓ ——→ **NMO Corrected Gathers** — Every 4 km, 4000 ms
↓ ——→ **<u>ON SCREEN QC DISPLAY</u>**

NMO Stretch Mute — Top mute picked from CDP gathers and tied to WBT
CDP / Ensemble Stack
METHOD for trace summing — Mean
Root power scalar for stack normalisation — 0.5
Gun and Cable Static — + 9 ms
Display Stack ——→ **Raw Stack** — 4000 ms. Unfiltered, Unscaled.
——→ **<u>SEG-Y TAPE</u>**
——→ **<u>HARDCOPY PLOT</u>** + Shot RMS values

5 Brute Stack Processing Sequences:

SEG-D Input From Tape
Reformat to ProMAX internal format | Read 168 channels + 12 auxiliary channels. Input 6000ms
↓

Resample / Desample		From 2 to 4 ms. Hi-Fi antialias filter applied in module	
Spike to Median Ratio editor		Automatic spike / Noise Burst edit. Used only when needed.	
Marine Trace Decimation		2:1 trace summation after differential NMO	
2D Marine Geometry		Spreadsheet / Database preparation	
Bulk Shift Static		0ms for instrument filter delay	
Trace / Shot Kill		Edits based on Observer's Logs	
Band-pass Filter			
Type of filter specification		Ormsby band-pass	
Details of filter		Minimum Phase, 4-8-90-120 Hz	
True Amplitude Recovery			
Apply dB/sec corrections		Spherical Div. 1 dB/sec from water bottom to 4000ms	
Maximum application time		4000 ms	
Pre-deconvolution First Break Mute		Picked from CDP gathers + tied to Water Bottom Times	
Spiking / Predictive Deconvolution			
TYPE of deconvolution		Minimum phase predictive	
Decon operator length		240 ms	
Operator prediction distance		32 ms	
Operator white noise level		0.1 %	
Design gate		Single gate & tied to WBT	
Band-pass Filter			
Type of filter specification		Ormsby band-pass	
Details of filter		Minimum Phase, 4-8-90-120 Hz	
↓	——→ **Velocity Analysis**	Every 4 km, Semblance, Gathers, Function Stack	
↓		——→ **<u>ASCII FILE</u>**	
Normal Move-out Correction			
↓	——→ **NMO Corrected Gathers**	Every 4 km, 4000 ms	
↓		——→ **<u>ON SCREEN QC DISPLAY</u>**	
NMO Stretch Mute		Top mute picked from CDP gathers and tied to WBT	
Inner Trace Mute		Bottom Mute picked from CDP gathers and tied to WBT	
CDP / Ensemble Stack			
METHOD for trace summing		Weighted. Weight factor = sqrt(offset)	
Gun and Cable Static		+ 9 ms	
Display Stack	——→ **Brute Stack**	4000 ms. Unfiltered. Unscaled.	
		——→ **<u>SEG-Y TAPE</u>**	
		——→ **<u>HARDCOPY PLOT</u>**	4000ms, 1000ms op AGC

6 Start of Line RMS Noise Analysis (Appendix C)

Using the start of line noise record, channel RMS values were computed for all 324 channels.

The data was not re-sampled, and no filter was applied. The RMS values for each individual channel were computed using a gate of 500-4000ms to look at the ambient noise levels.

The plots were analysed in conjunction with the colour RMS displays to check for dead or noisy channels, and these were then crosschecked with the edits in the Observer's logs.

These RMS values also gave a good indication as to the amount of swell noise at the start of each line, and the results could be analysed as soon as the first tape was available.

The average ambient noise from this unfiltered RMS analysis was normally around 2-5 µbar on the noise record, and similar values were observed on the shot records. A 3-6-100-120Hz filter was applied to the data before prior to this RMS analysis.

A scaling factor of 50 was used to convert from millivolts to microbars, and hardcopy plots were included in each of the line files.

7 Auxiliary Channel QC (Appendix D)

All 12 auxiliary channels were input from tape during the SEGD tape loading procedure. The auxiliary channels were then separated from the data channels and stored in a separate data file, which could have been used for on screen analysis.

Unfortunately not all the gun hydrophone channels were connected during this survey. Auxiliary channels -1 (Gun 1-1), -2 (Gun 2-1), -5 (Gun 3-1) and -6 (Gun 4-1) were good, and were quality controlled on screen using colour amplitude displays, to monitor gun volumes and pressures. Gun performance was also monitored using a direct arrival RMS QC on the near trace displays. Appendix D shows the example of drop in pressure/volume due to the gun air leak.

8 Near Trace Displays (Appendix E)

Near traces were displayed on screen routinely at the end of each line. This proved to be useful in quickly determining any possible errors with acquisition. They revealed gun volume changes, bad records, internal time break problems and any auto-fires not reported by the recording system.

In addition to looking at the entire near trace display, an averaged direct arrival RMS was computed over the 12 nearest traces. An RMS window of 12-30ms was used after the 12 near traces were LMO corrected. The direct arrival RMS was plotted along the top of all the near trace displays. Variations in source volume and pressure were visible on the direct arrival graph, but the amplitude of the direct arrival was often variable due to vessel speed, feather angle and cable jerk. This display was really only useful when used in conjunction with the gun hydrophone channels to QC any undetected source anomalies.

RMS amplitude and dominant frequency statistics were also calculated for the direct arrival. These were viewed on screen whenever further investigations were required.

The near traces also provided a good indication of the geological conditions including strength of the water bottom multiples, remnant multiple interference and reflection data.

Hardcopy plots of the near trace displays were made for all lines. Plots were generated using a high level of gain, which helped to show up any amplitude variations in the direct arrival, and also assisted in the assessment of the level of swell noise whenever the weather condition deteriorated.

9 Shot vs Channel Colour RMS Displays for 168 channels (Appendix F)

RMS and trace statistics were calculated for every shot and all 168 channels. A shallow analysis window of 3500-4000 ms was used, and RMS values were computed for both unfiltered and filtered data. The band-pass filter was a 4-8-90-120 Hz Ormsby.

Colour RMS amplitude displays were made for all 168 channels for the entire line. These display were used as channel QC, and also to identify noise trends as the line progressed. For example swell noise deterioration, water currents or external seismic interference. In each case the affected shot point range was listed in the comments section in the Observer's Log. Only shots that were significantly affected were listed as bad shots.

In addition to the RMS computations further trace statistics included:

Trace amplitude	*- Average trace energy.*
Spikiness	*- Ratio of max magnitude sample to trace signal amplitude.*
Dominant Frequency	*- Based on a count of zero crossings within signal window.*
Frequency Deviation	*- Based on statistical scatter of frequency estimates.*
Amplitude Decay	*- Estimated late trace energy decay rate (in dB/sec).*

These statistics were averaged within the ProMAX database for the source, CDP and channel domains, where they could be viewed in the various different domains using the ProMAX database display tools.

In addition to a colour plot being generated for all shots for every sequence, a sequence-by-sequence RMS display was also generated. This involved extracting 200 shots from each sequence, and then displaying the colour RMS side by side. These displays enabled a direct comparison of bad traces and noise conditions from sequence to sequence.

All filtered colour RMS displays were saved to disk as GIF image files, and these were Unix tarred to Exabyte tape. The images were included in the data shipments and a final copy tape was generated at the end of the survey.

10 Shot RMS

Shot RMS values were calculated by averaging the RMS values for the central 21 channels (after 2:1 summation) from the streamer. RMS values were calculated using a fixed shallow window at 30-130 ms to look at ambient noise. The central 21 channels were chosen to avoid contamination by the direct arrival and any shallow water bottom events.

Ambient noise RMS values were also calculated using 3 different filters. A band-pass filter of 3-6-70-90 Hz was used to look at ambient noise levels within the signal bandwidth, and a 6-9 Hz high cut filter was used to look at the amplitude of the lower frequency swell noise. A further low cut filter of 50-70 Hz was used to look at ambient noise levels at the high frequency end of the spectrum. The ambient noise remained around 3-6 µbar.

This shallow window RMS provided a good estimation of the background ambient noise levels for each line. Increases in swell noise could be clearly identified on the ambient noise RMS plots above the raw stack, which also had a more spiky appearance whenever the swell noise picked up.

Noise levels in microbars provided a good statistical means of confirming the amount of swell noise interference visible on both the raw shot records and stack. One of the main advantages of using these RMS values to assess the swell noise, was that they could be processed during the SEGD tape loading operation if necessary, and were therefore available well before the raw stack could be processed.

A scaling factor of 50 was used to convert from millivolts to microbars. This is the conversion factor used for the recording system, which has a sensitivity of 20 Volts per Bar.

Noise (6-70Hz), Noise (<6Hz), Noise (>70Hz), Signal (6-70Hz) and signal to noise ratio RMS graphs were plotted above all Raw stacks, so any noise contamination on the stack could be verified statistically on the RMS plots. All CDP averaged RMS values were written into the SEGY brute stack headers as a backup.

11 Raw Shot Displays

Shot records were filtered to the signal bandwidth and balanced with a true amplitude gain recovery. Shot records were displayed at 3 km intervals for each line. Hardcopy displays were produced when necessary, and individual records were examined on screen if there was felt to be a problem with acquisition, or to investigate the source of anomalous seismic energy. This was useful in confirming the start of any seismic interference or for confirming auto-fires, which could be identified on the near trace displays.

The raw shot displays were used to estimate the amplitude and amount of swell noise on the raw shot records, prior to further processing. Consistently noisy channels were also identified on the raw shot displays, and any edited channels on the observer's logs were verified.

12 Velocity Analysis (Appendix G)

Velocities were picked at regular 4 km intervals along every line, using one of the ProMAX's on screen interactive velocity picking utilities.

The ProMAX velocity-picking module included a semblance display; CDP super gather, which could have NMO applied instantly, a series of Function Stack Panels and an interval velocity graph. To improve the signal to noise ratio super-gathers were formed by combining 5 adjacent CDP gathers, and these CDP's also made up the Stack panels.

A regional velocity function was used as the central guide function for the stack panels. A total of 11 stack panels were processed using a +/- 10% velocity variation.

To speed up the on screen velocity picking procedure the velocity analysis displays were pre-computed. When primary velocities were clearly defined they were normally picked off the semblance display, and normal move-out was applied to the gather to check that the events were lining up well. Velocities could also be picked off the Function stacks whenever the velocities were poorly defined on the Semblance display.

Velocities were generally poorly defined, with multiple energy being dominant just below water bottom. For final velocity analysis an FK de-multiple or Radon demultiple filter may be required in order to pick reliable velocities. Unfortunately the increased run times required for the radon filter, meant that it was not a practical option for normal QC processing.

Velocity functions were output to ASCII file for every line, and then put on 8mm Exabyte tapes as well as floppy disk for data shipments.

13 CDP Gather Displays

These displays were essentially used to verify the velocity picking. On screen displays and sometimes hardcopy plots were made of NMO corrected gathers with an NMO stretch mute applied. The gathers were displayed at 4 km intervals. When swell noise levels were high they also provided a good indication as to whether the swell noise would stack out or not. They were also useful for identifying consistently spiking traces.

All mutes and time gates were picked interactively on screen using CDP gathers sorted into water bottom time order. By picking all the mutes and time gates in this manner it was possible to tie them all to water bottom depth, and therefore make the gates and mutes extremely accurate. As all the gates were tied to water bottom depth, this in turn speeded up the picking of mutes considerably and enabled the mutes and gates to be carried over from one line to the next. All gates were carefully quality controlled on screen before running the stack processing flows.

14 Raw and Brute Stack Processing (Appendix H)

The main objective of onboard QC processing is to stack each line with minimal processing to enable a thorough QC of the data onboard.

Normally, the general aim of the QC processing is not to attenuate noise but to show the data as it is recorded, or how it would be presented to a shore or vessel based processing centre. This means that band-pass filtering is normally confined to the anti-alias filter prior to re-sampling to 4ms, and a wide band-pass filter at the signal bandwidth after deconvolution to clean up the high frequency noise introduced by the deconvolution operator. It is also important to avoid using an AGC as this tends to soften and hide background noise, so raw stacks were always plotted out without any AGC scaling.

For all lines a basic raw stack with minimal processing, and a brute stack with deconvolution and some de-multiple attenuation were processed. The raw stack was essentially used for QC purposes only and the brute stack was used more to look at the geological structure.

The SEG-D data was input from 3590 copy tapes, re-sampled to 4ms and output to hard disk as 16 bit data. An anti-alias filter was applied internally within the ProMAX resample module to prevent aliasing of frequencies above 125 Hz.

Minimum Phase Predictive Deconvolution and True Amplitude Recovery tests were carried out on the first sequence, and the parameters for the entire survey were set up at this time. Deconvolution parameters were picked off CDP gathers, with corresponding autocorrelations plotted along the bottom of the display. Analysis of the results indicated that an operator length of 240ms and gap of 32ms would provide a good average for the entire survey. Due to the length of the lines, further more detailed testing will reveal more optimal spatially variable de-convolution parameters. The deconvolution gates were picked from the CDP gathers and tied to water bottom times, the start of the gate being approximately 20ms below the water bottom and the end of the gate being close to the bottom of the record. Deconvolution was only used for the brute stack processing, and no deconvolution was applied to the raw stack.

True Amplitude Recovery tests indicated that the data was better balanced when the dB/sec amplitude recovery started at the water bottom, rather than at T0. The optimal parameters were Spherical Divergence correction followed by a 1dB/sec correction tied to the water bottom time. These parameters resulted in a reasonably well-balanced stack, however as the water depth became shallower the amplitudes of the deeper data often dropped off significantly. For QC purposes the True Amplitude of the stacked data was preferred, but for interpretation purposes a post-stack AGC would be very beneficial to suppress the high amplitude events near the water bottom and bring up the amplitudes of the weaker events at depth.

As for the band-pass filter, it was decided to leave this as open as possible for QC purposes. For this reason little testing was carried out apart from some initial spectral analyses, and the band-pass filter was set at 4-8-90-120 Hz.

Spectral Analysis of the data revealed that this filter would not affect the data in any way, and would remove only a minimal amount of swell noise contamination. A filter was applied prior to TAR and deconvolution to clean up any high amplitude low frequencies, and then again after deconvolution to remove any noise that might be introduced by the deconvolution process itself.

Noisy and dead traces were killed, as well as bad shots noted in the Observer's Logs. The brute stack was run after QC had been completed and the data had been thoroughly analysed. Any additional shots with time-break errors, gun problems and any new noisy traces were edited from the brute stacks.

Full details of all the processing flows and parameters are listed in section 4 of this report.

An un-scaled, unfiltered raw stack was plotted out on board of the vessel for every line. A fairly high level of gain was sometimes applied to the raw stack plot to boost up the amplitudes of the deep data, but this had the adverse effect of over scaling the water bottom and near surface events. Trace equalisation was occasionally added to the plotting routine to improve the brute stack plots. Shot ambient noise RMS values were plotted above the raw stack, as already discussed in the shot RMS part of this report. The raw stack plot was intended solely for QC purposes.

In addition to the un-scaled raw stack plot generated for every sequence, a brute stack was plotted out with an AGC operator of 1000ms, to look at the geological structures along the line.

All shot points with misfires, spread errors or timing errors over 1.0 millisecond were killed. In addition to this all dead or noisy channels were eliminated from the stack.

The CDP to station tie used for brute stacks in this prospect was

$$\text{Station} = \text{first SP} + 57 + ((\text{CDP}-168)/1.5).$$

The shot point number was then recalculated to be an integer. The results of all stacked sections were discussed with the onboard Santos representative. A processing log was maintained throughout the survey with notes concerning noise problems and data quality (Appendix A).

All raw stacks and brute stacks were backed on 8mm Exabyte tapes in SEGY format, and shipped to the client office at the end of the survey. The SEGY headers include the shot point numbers, CDP numbers and complete listing of the acquisition and data processing parameters. The water bottom times and CDP averaged RMS values are also included in the SEGY trace headers for convenience.

15 Additional QC Displays (Appendix I)

Spectral analysis displays were generated for several lines to evaluate the power and frequency content of the data.

FK plots and FT displays were also occasionally displayed, but the spectral analysis displays were found to be more useful for analysing the frequency range of both noise and data.

16 Tape Copying

As there were insufficient 3590 tape-drives available on the Syntrak recording system, it was necessary to use the ProMAX system to generate copy tapes. Tape copies were generated by the ProMAX system in SEG-D format on 3590 tapes.

17 Summary

Many potential problems were analysed using ProMAX including checking bad field tapes or whether a tape had closed properly; checking shot records for noise bursts, swell noise or auto-fires; confirming bad or noisy channels, etc. It was also useful for investigating data problems whilst acquisition was still in progress.

Although the ProMAX was not an online system, it still managed to carry out a full and thorough QC of every sequence. Tape loading was a time consuming procedure, but the benefits were that every single field tape could be independently verified and checked. In addition to this, any errors in the Observer's Logs such as incorrect file numbers or incomprehensible logs were detected, and corrected.

Data quality was good in this area but swell noise was the major concern. Multiple energy was also apparent on all lines. Factors affecting data quality included the following:

- ✓ Ship noise
- ✓ Spikes / noisy channels
- ✓ Geological noise
- ✓ Swell noise

<u>Ship noise</u> - Although the centre of source to centre of first group was 75m, ship noise was visible on the noise records. Spectral analysis and FK analysis of this noise revealed what was thought to be propeller noise with 5Hz harmonics, within the 10-70Hz frequency range. FK analysis revealed that the move-out of this noise was approximately 1500m/s. As would be expected for ship noise, the strength of these frequencies was strongest on the near offset traces and minimal at the far offsets.

<u>Spikes / noisy channels</u> - Most of the time all 168 channels were good. The spiking/noisy channel was dealt with by editing in processing and later in acquisition by replacing streamer sections.

<u>Geological noise</u> - Water bottom multiples were apparent on the shot records as well as the stack sections.

Diffractions were often visible and were probably caused by the prodigious faulting and not uniform water bottom apparent in many of the sections.

<u>Swell Noise</u> – Was the major cause of noise and affected most of the sequences. This low frequency noise was peaking up to 5-15µbars on the most sequences.

18 Conclusion

The ProMAX system proved to be extremely reliable and performed extremely well. There was not a single system crash or hardware malfunction that could have resulted in loss of processed data on the hard disk.

The survey averaged approximately 32 km per day. Data processing also averaged approximately 32 km per day. The ProMAX system was more than capable of keeping pace with these acquisition rates, and as a result it was possible to thoroughly QC and stack every line.

19 APPENDICES

APPENDIX A

PROMAX PROCESSING LOG

Seq	Line	Dir	Date	First SP	Last SP	FFID	CDP's Processed	Noise Record RMS	SOL FK Analysis	SOL Spectral Analysis	Tape Copy	SEG-D Input	2D Geom S/Shheet	Near Trace	Plot Near Traces	2:1 Sum / Geom Assign	Near Trc WBT Pick	Database Fill WBT	WBT to Trc Headers	480 Chan Col RMS	Aux QC	Delete Raw Shots	Pick Decon / Mute Gates	Velocity Analysis	RMS for Stack	Pick NMO Mute	Raw Stack	Brute Stack + Decon	Plot Raw Stack + RMS	Merge Stacks	Plot Brute Stack	Delete Geom Shots	Stack to Archive	Vel to ASCII	Archive / Delete Line	Segy Stack to Tape	Shipment date	Notes
001	GS02-19-001	180	5/01	1422	937	1422-937	1-812	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.** Very strong multiples on entire line.
002	GS02-01-002	000	5/01	1001	1486	1001-1486	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
003	GS02-21-003	180	6/01	1422	937	1422-937	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
004	GS02-03-004	60	6/01	1001	1486	1001-1486	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**

005	GS02-23-005	180	6/01	1422	937	1422-937	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	GOOD.
006	GS02-05-006	001	6/01	1001	1486	1001-1486	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	GOOD.
007	GS02-25-007	180	6/01	1422	937	1422-937	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	GOOD.
008	GS02-07-008	000	6/01	1001	1486	1001-1486	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	GOOD.
009	GS02-29-009	180	6/01	1421	937	1421-937	1-810	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	GOOD.
010	GS02-09-010	000	6/01	1001	1486	1001-1486	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	GOOD.
011	GS02-31-011	180	6/01	1421	937	1421-937	1-810	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	GOOD.

012	GS02-11-012	360	7/01	1001	1486	1001-1486	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
013	GS02-33-013	180	7/01	1421	937	1421-937	1-810	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
014	GS02-13-014	359	7/01	1001	1486	1001-1486	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
015	GS02-35-015	-	7/01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10 Jan. 2003	**NTBP** d/t gun airleak.
016	GS02-35-016	180	7/01	1421	937	1421-937	1-810	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
017	GS02-15-017	000	7/01	1001	1486	1001-1486	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
018	GS02-37-018	180	7/01	1421	937	1421-937	1-810	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
019	GS02-17-019	000	7/01	1001	1486	1001-1486	1-812	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**

020	GS02-39-020	180	8/01	1421	937	1421-937	1-810	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
021	GS02-10-021	298	8-01	1413	937	1421-937	1-798	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
022	GS02-02-022	90	8/01	1001	1552	1001-1552	1-911	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**GOOD.**
023	GS02-08-023	269	8/01	1486	937	1486-937	1-908	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**FAIR-MARGINAL.**
024	GS02-06-024	270	10/01	1486	937	1486-937	1-908	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**FAIR-MARGINAL.**
025	GS02-04-025	090	10/01	1001	1552	1001-1552	1-911	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	10 Jan. 2003	**FAIR.**

APPENDIX B

DATA SHIPMENTS

Appendix B - List of Deliverable Products

The following data shipment was sent on 10th January 2003.

1. Paper Displays for Gippsland Basin GS02 Survey (Sequences 001-025):
Start of line RMS noise, Near Trace displays, Raw Stacks and Brute Stacks.

2. 1 x 8mm tape containing SEGY format Raw Stacks for Gippsland Basin GS02 Survey.
Seq. 001-025 (SEGY files 1-024)

3. 1 x 8mm tape containing SEGY format Brute Stacks for Gippsland Basin GS02 Survey.
Seq. 001-025 (SEGY files 1-024)

4. 1 x 8mm tape for seq. 001-025 of Gippsland Basin GS02 Survey containing:
Velocities (ASCII files, UNIX tar –cvf format).
Colour RMS, Start of Line RMS Noise (GIF files, UNIX tar –cvf format).

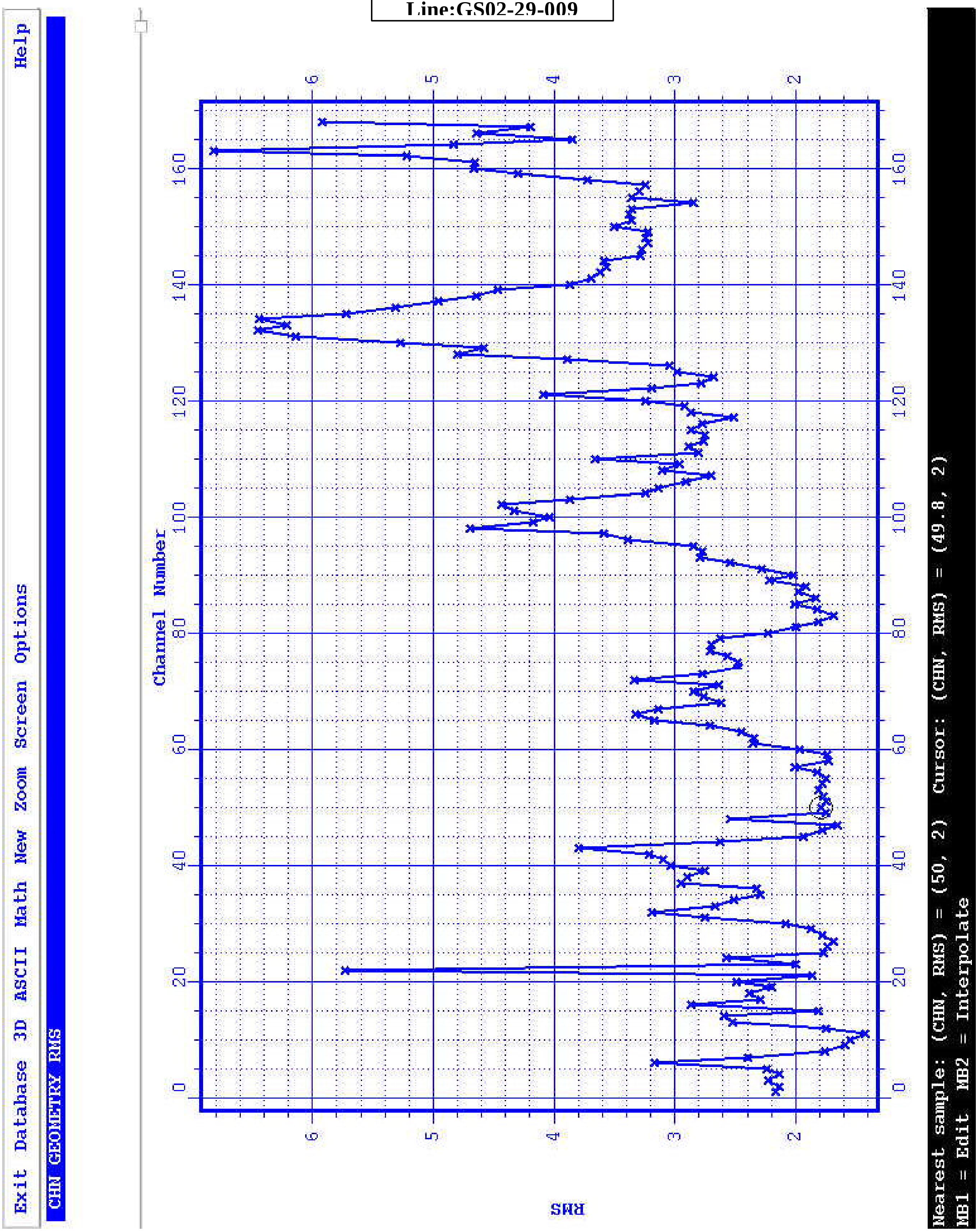
5. 1 x 8mm tape for seq. 001-025 of Gippsland Basin GS02 Survey containing:
Master flows, Stacks, Near Traces, Shot vs. Chan RMS
(ProMAX archive format).

6. 1 x floppy disk for seq. 001-025 of Gippsland Basin GS02 Survey containing:
Velocity files (ASCII format).

APPENDIX C

START OF LINE NOISE RECORD RMS ANALYSIS

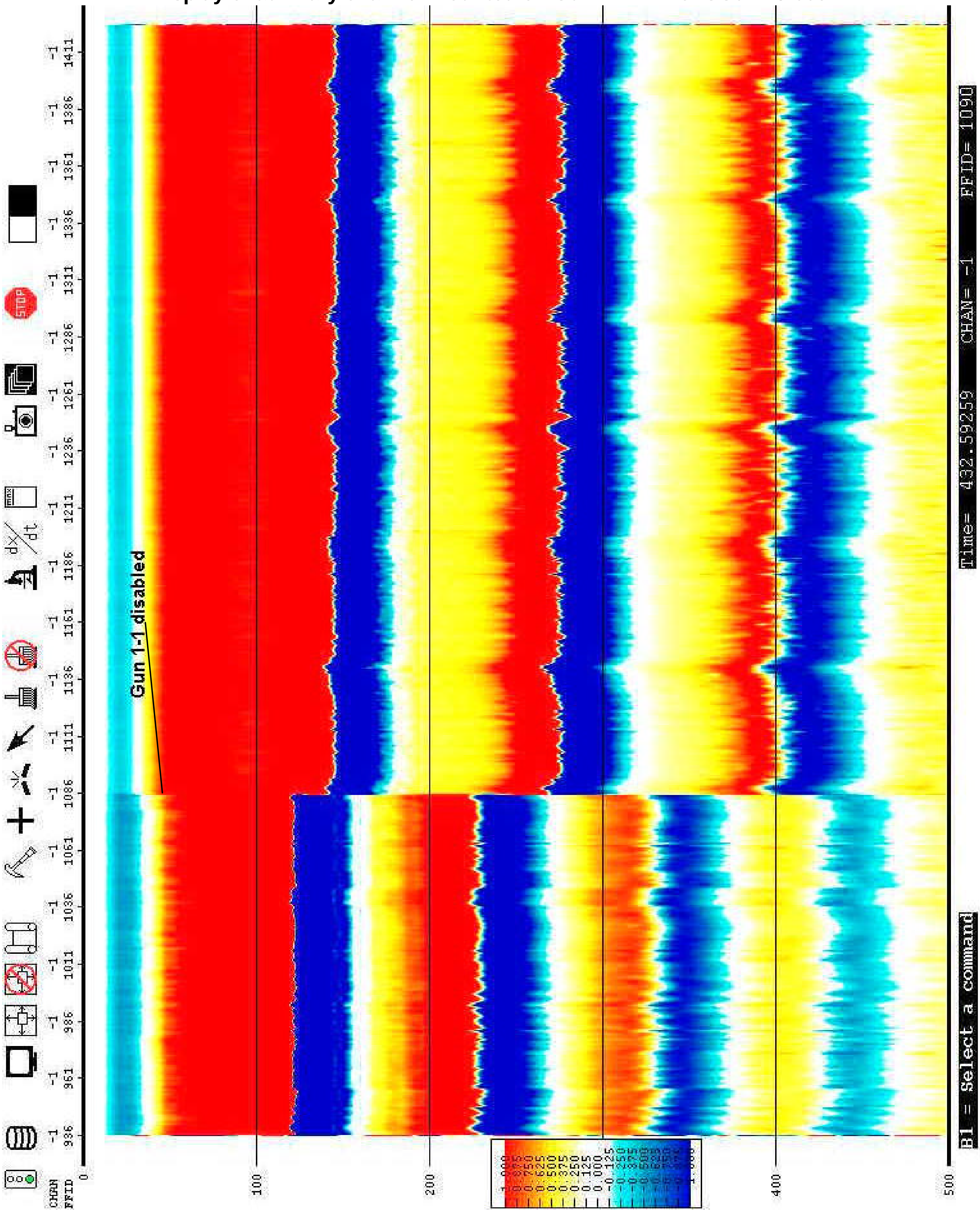
Line:GS02-29-009



APPENDIX D

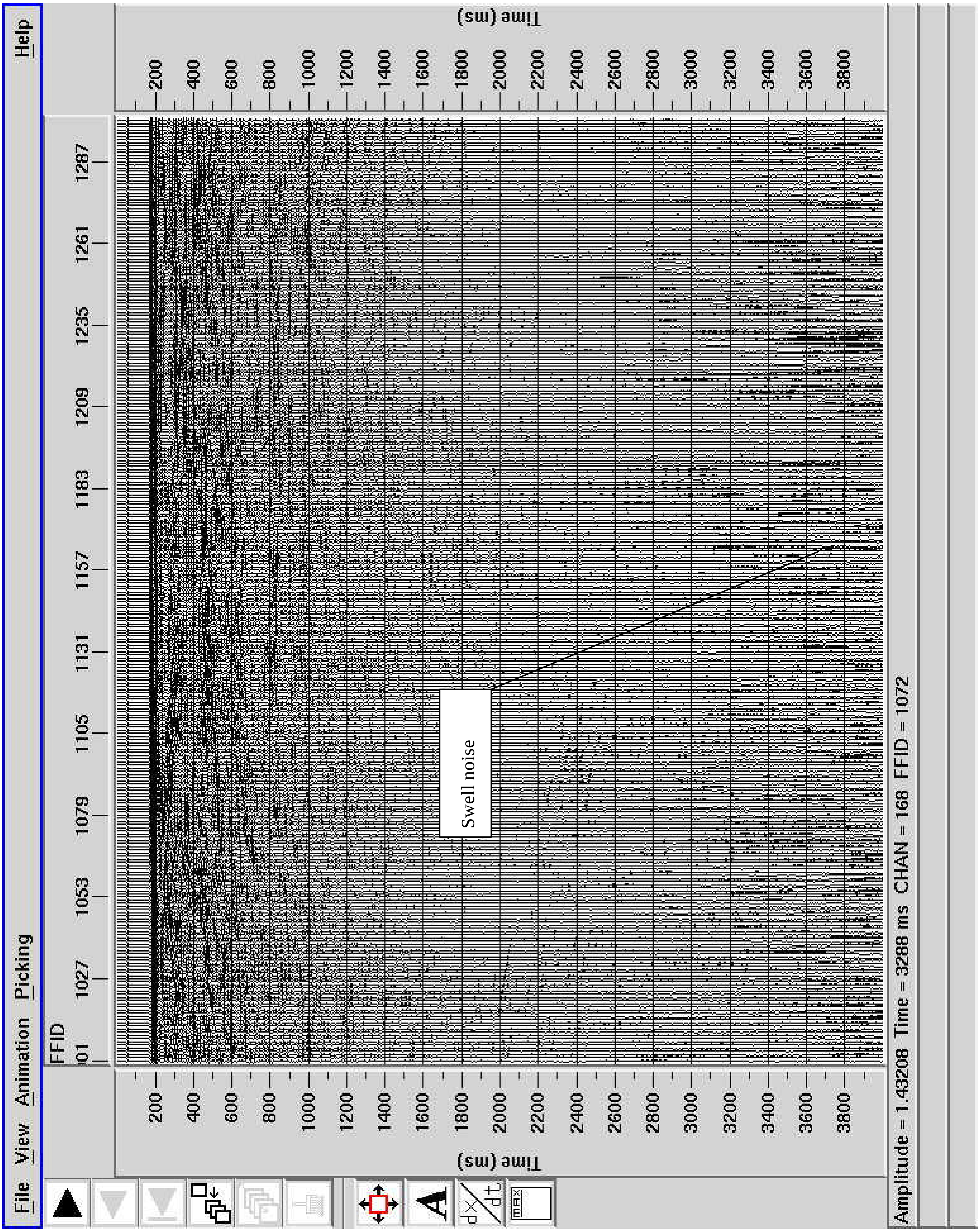
AUXILIARY CHANNELS DISPLAY

Display of auxiliary channel mounted on Gun 1-1. Line: GS02-23-005



APPENDIX E

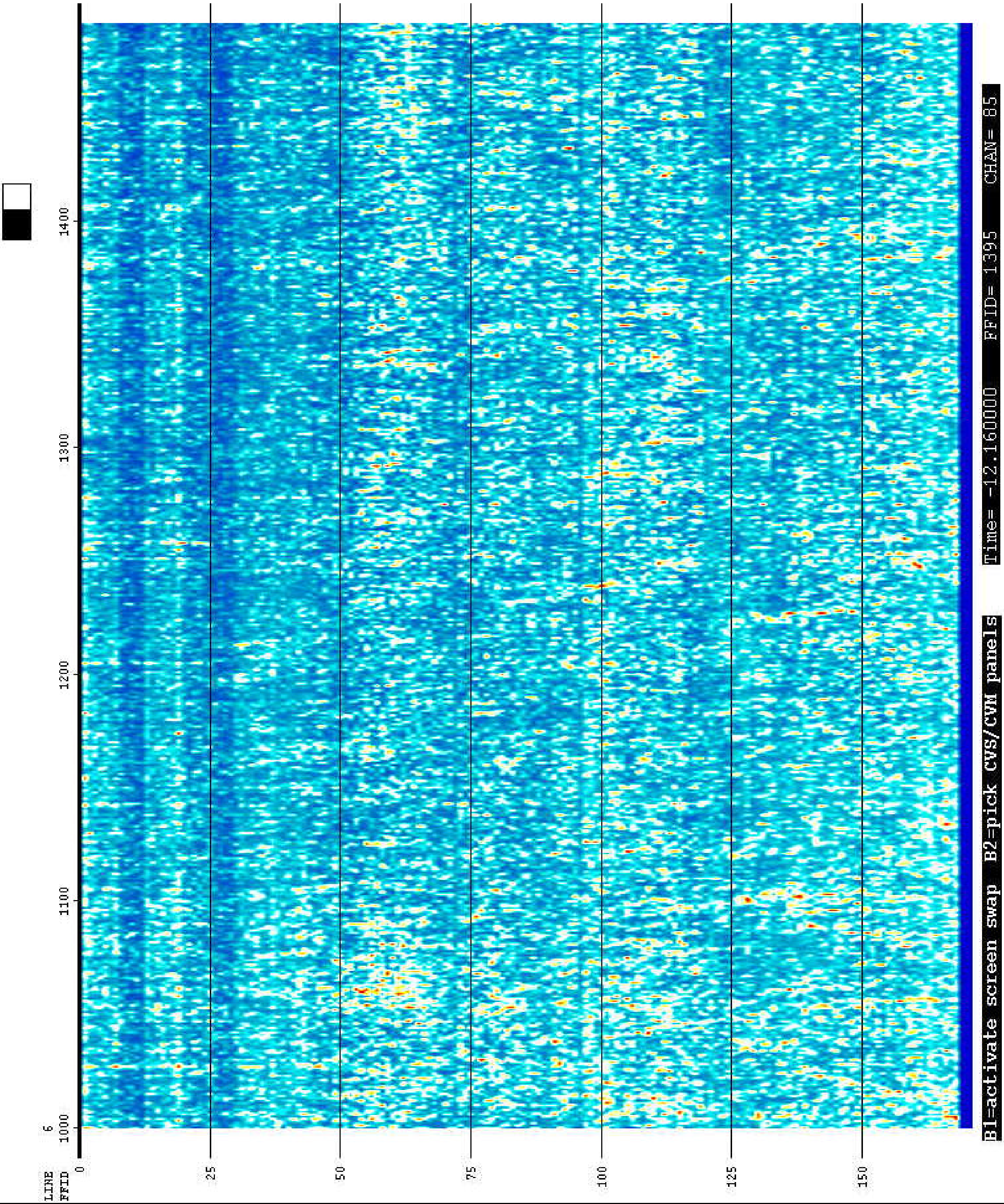
NEAR TRACE DISPLAY


File View Animation Picking Help
FFID
Time (ms)
Swell noise
Amplitude = 1.43208 Time = 3288 ms CHAN = 168 FFID = 1072

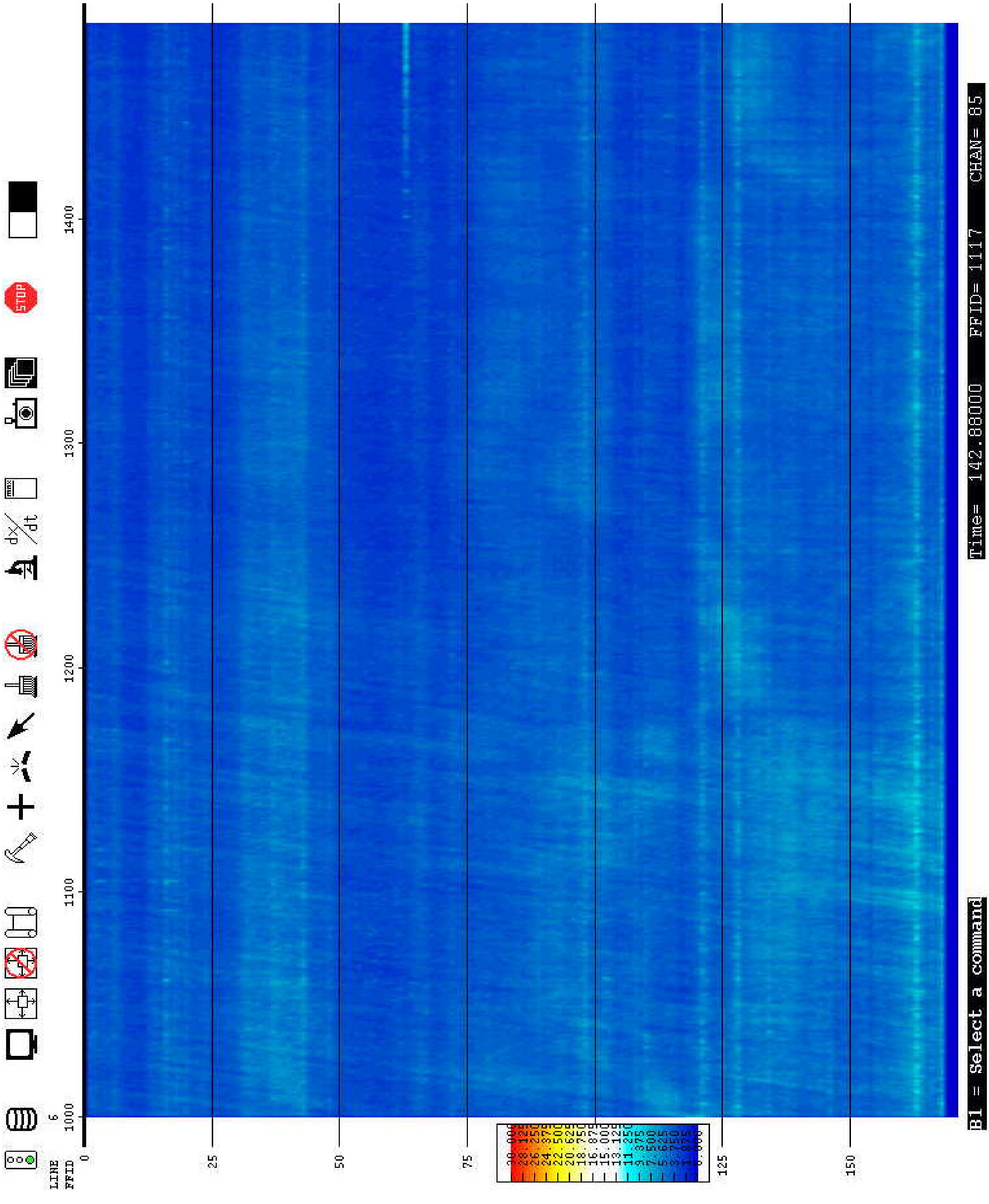
APPENDIX F

SHOT vs. CHANNEL COLOUR RMS

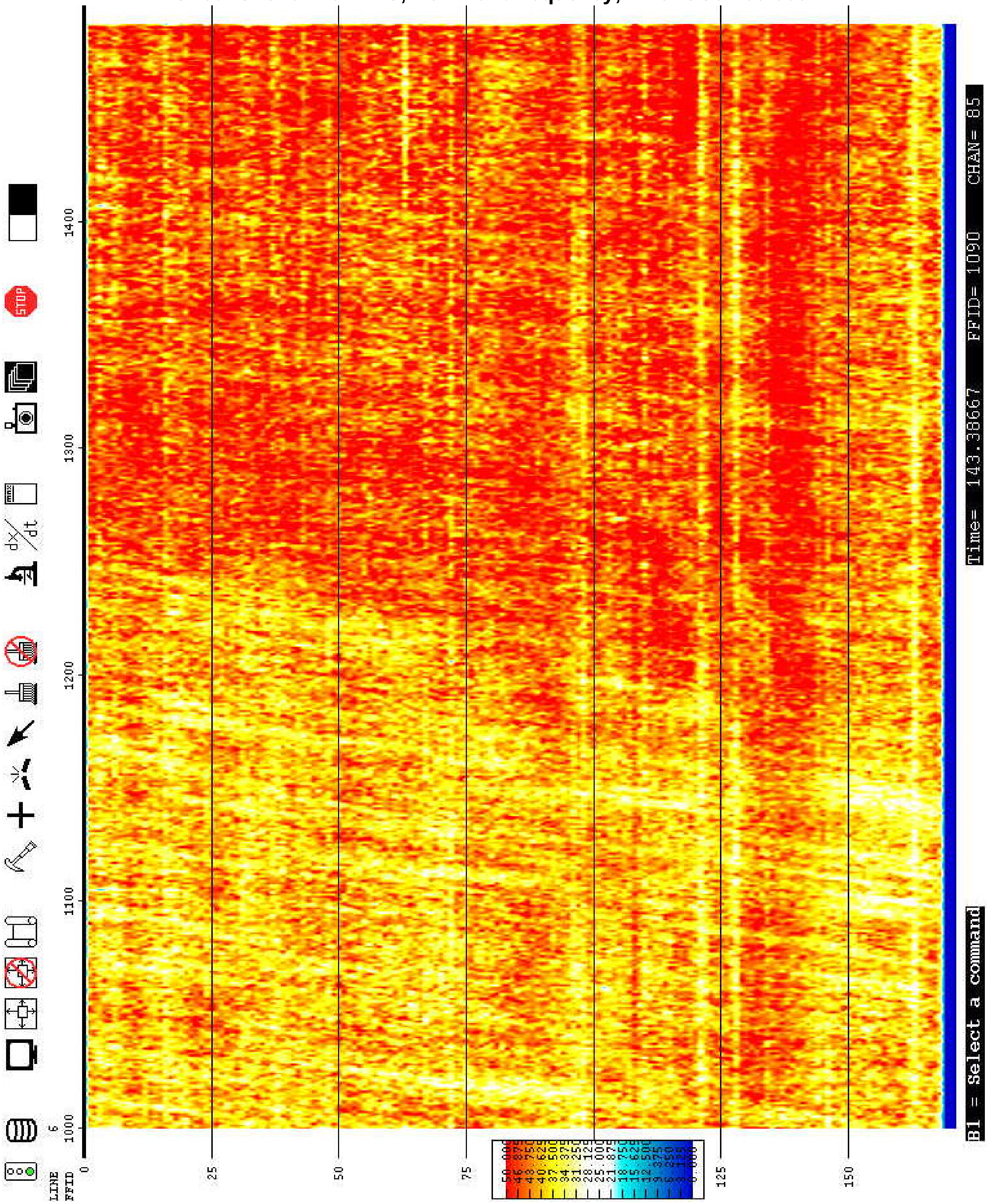
Shot vs. Channel RMS, No filter applied; Line: GS02-05-006



Shot vs. Channel RMS, Ormsby band-ass filter 4-8-90-120 Hz applied; Line: GS02-05-006



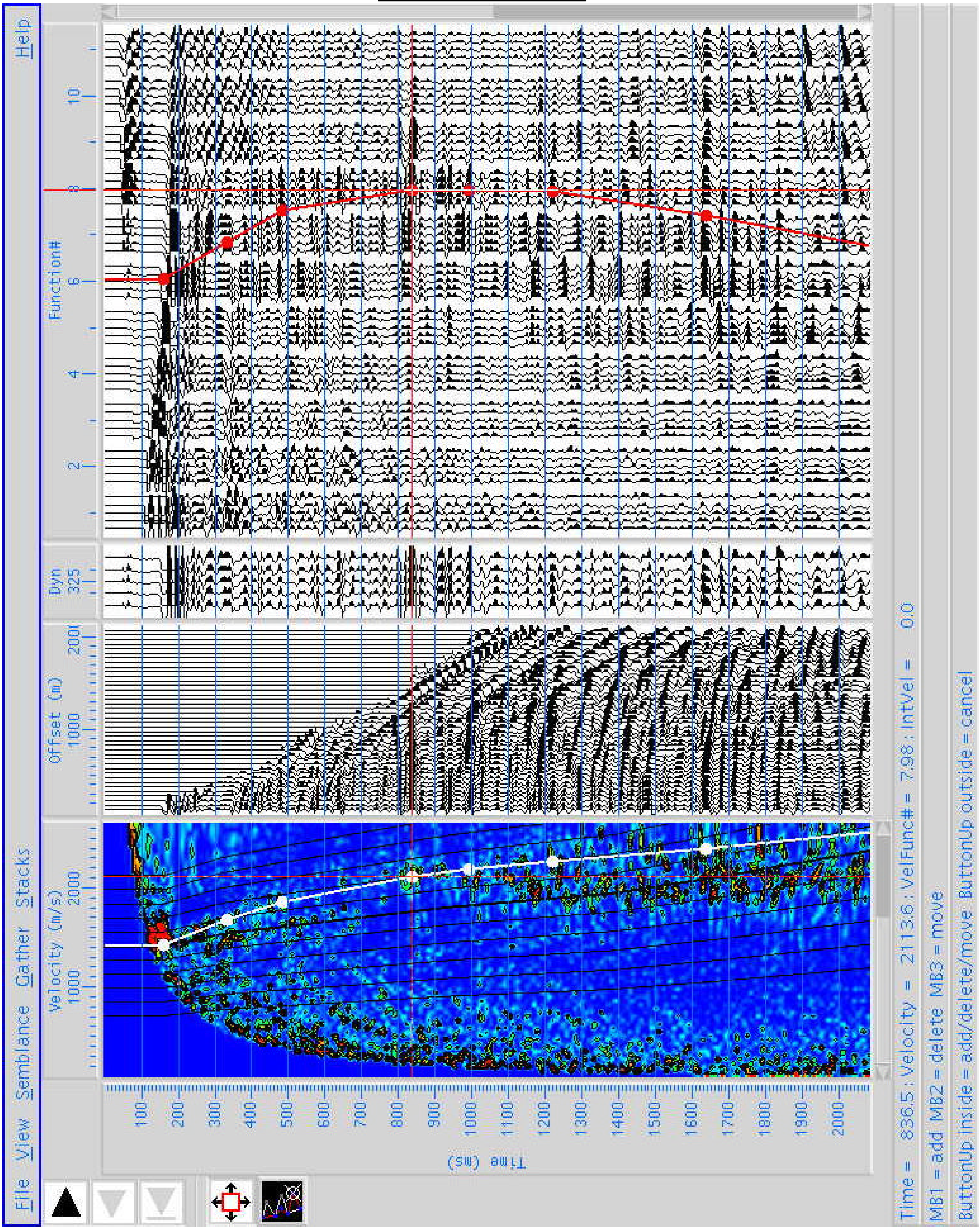
Shot vs. Channel RMS, Dominant frequency; Line: GS02-05-006



APPENDIX G

VELOCITY ANALYSIS

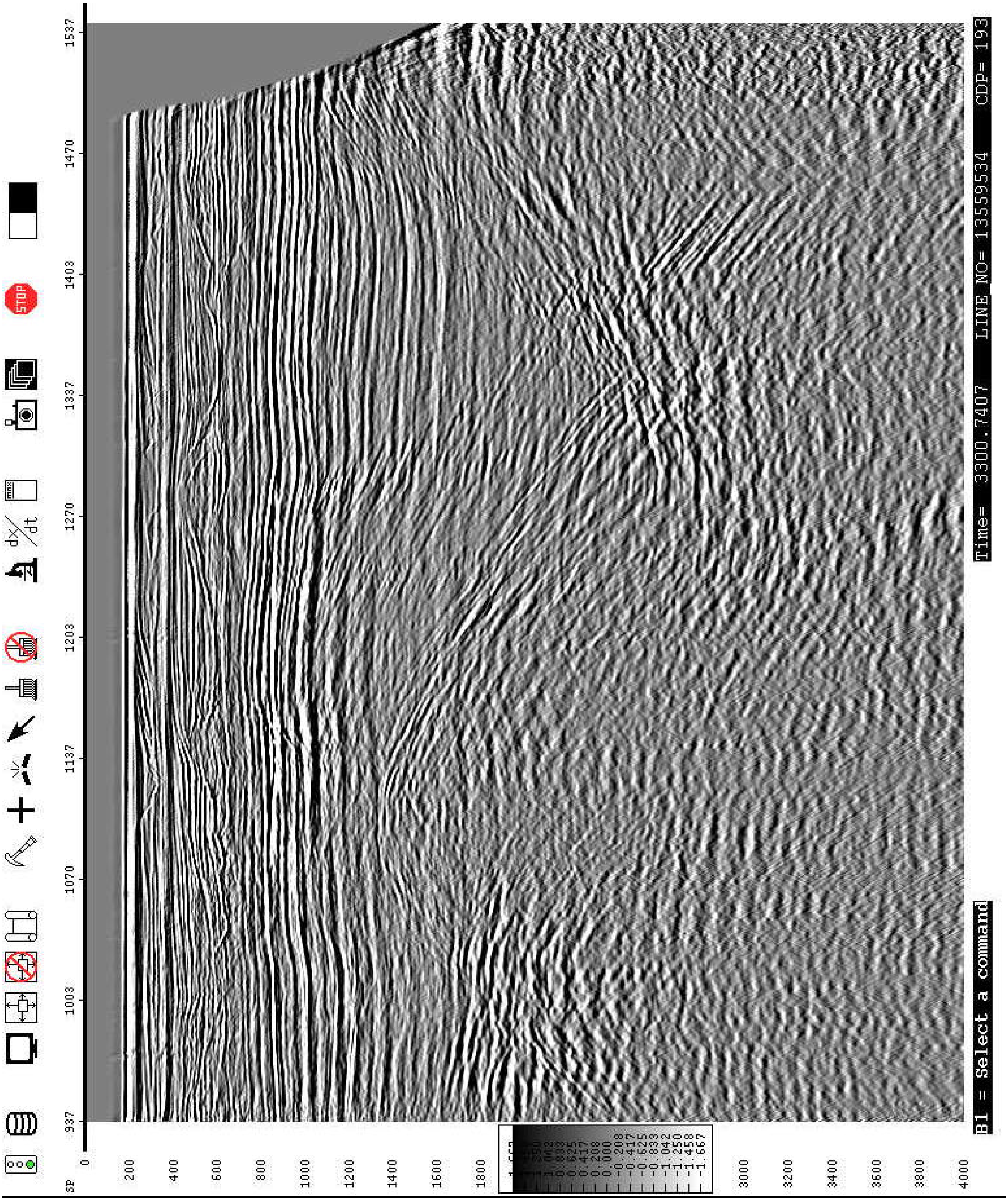
Line GS02-21-003



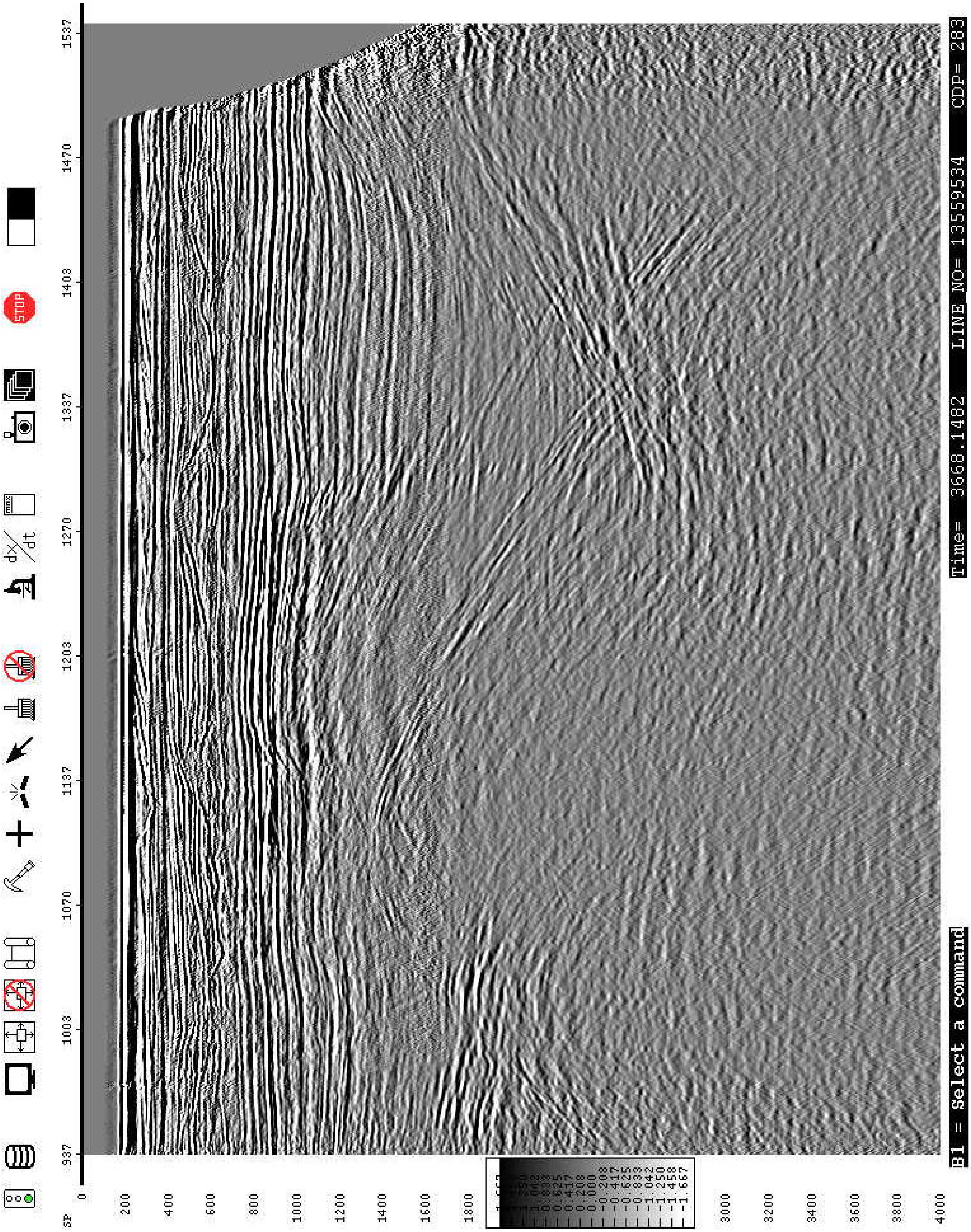
APPENDIX H

STACKS

Raw stack: Ormsby band-ass 4-8-90-120 Hz filter applied; Line: GS02-06-024



Brute stack: Ormsby band-pass filter, inside trace mute and predictive deconvolution applied; Line: GS02-06-024



APPENDIX I

SPECTRAL ANALYSIS

Line GS02-23-005