WesternGeco

PROCESSING REPORT

for the

HGP2002A
MARINE SEISMIC SURVEY
GIPPSLAND BASIN

PERMIT: VIC/P45

CONTRACT NO: 68000734 / 68000744

for

bhpbilliton

BHP Billiton Petroleum Pty Ltd
(ABN 97 006 918 832)
BOURKE PLACE
600 BOURKE STREET
MELBOURNE, 3000
VICTORIA

By

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December 2002
Project Number: J2642

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1. INTRODUCTION

This report details the data processing of the HGP2002A 3D Marine Seismic Survey carried out by WesternGeco (WG). The project was conducted in the Gippsland Basin, offshore Victoria under the contract numbers 68000734 (service order 3300014089) / 68000744 (service order 3300014089) for BHP Billiton Petroleum. (BHPBP).

The project consisted of 43,250 kilometres of prime data and 13,157 kilometres of infill data over 132 sail lines of prime and infill data and 1 line of 2D well tie data in permit VIC/P45 (**Figure 1**).

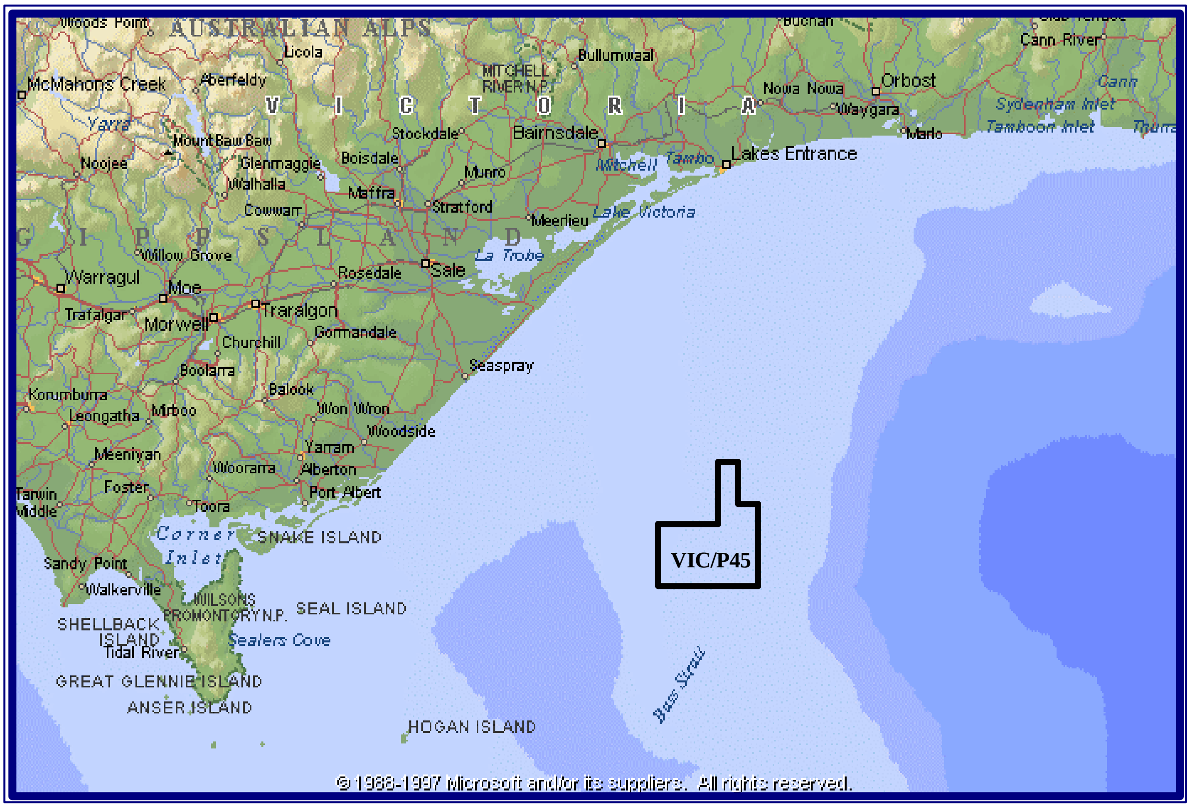
Data was recorded by the WesternGeco vessel M/V Geco Beta from August 2002 to September 2002. The data processing was conducted between August 2002 and March 2003.

The project was co-coordinated from the Melbourne Processing Centre. Data processing was carried out both onboard the Geco Beta and at the Melbourne Processing Centre. Computing facilities in Perth, Western Australia were linked to the Melbourne geophysical staff using Frame Relay Technology with a burst capacity of 256 Kbit/sec. This enabled all of the main processing to be performed on the WesternGeco's IBM SP2, Dell cluster, Sun E6000 and Sun E10, 000 supercomputers, using WesternGeco's Omega® Seismic Processing system software.

Tests were performed to determine processing parameters between March 2002 and February 2003.

The project was co-ordinated for BHPBP by Mr. Mark Stanley. The processing team at WesternGeco was managed by Mr. Mike Hartley.

Figure 1: Locality Map



Project Aims and Objectives

BHPBP's geophysical requirements for this project were as follows:

1. Definition and focus of deeper section.
2. Imaging with Pre Stack Time Migration (PSTM)
3. The processing of data through a fast-track processing flow for fast turnaround to satisfy constraints imposed by drilling schedules.
4. Lateral continuity within shallow high velocity channels.
5. High density velocity field generation to be used for depth conversion
6. AVO consistent processing.

The following archive datasets were also produced:

- **Fast Track Processing:**
  - F-K Demultiple 3D CMP Gathers
  - Fast track stack
  - Fast track post stack migration
  - Bin center coordinate information
  - Fast track velocity field
- **Production Processing:**
  - Radon Demultiple Interpolated 3D CMP Gathers
  - PSTM 3D CMP Gathers
  - Final PSTM Stacks – Raw, Filtered / Scaled
  - Angle Stacks
  - High Density Velocity Analyses
  - Velocity Data (text)

2. ACQUISITION SUMMARY

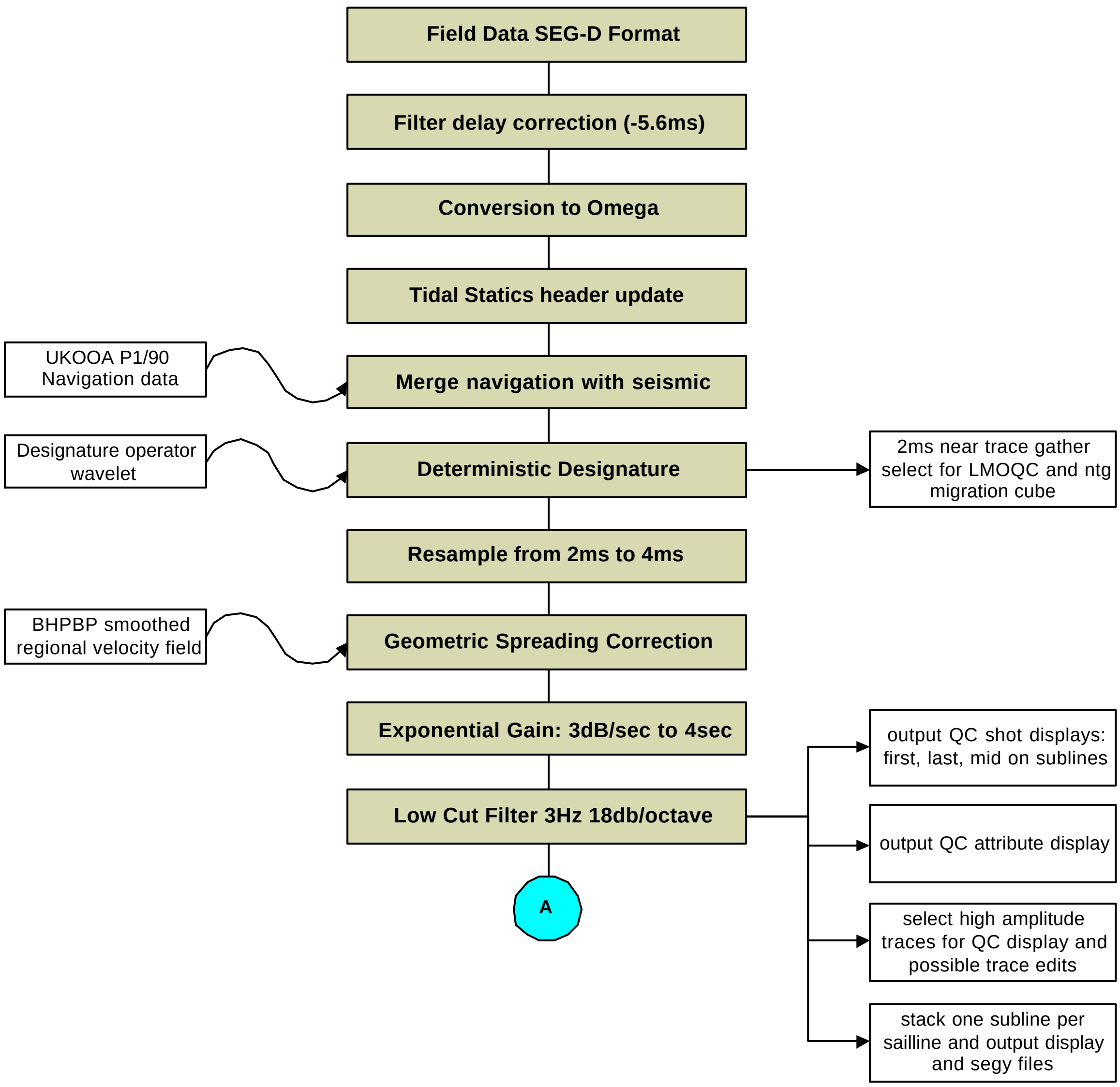
The HGP2002A 3D Gippsland Basin field data was collected from August 2002 to September 2002 by WesternGeco using the *M/V Geco Beta* with a conventional towed streamer technique. The following parameters were utilized for data collection:

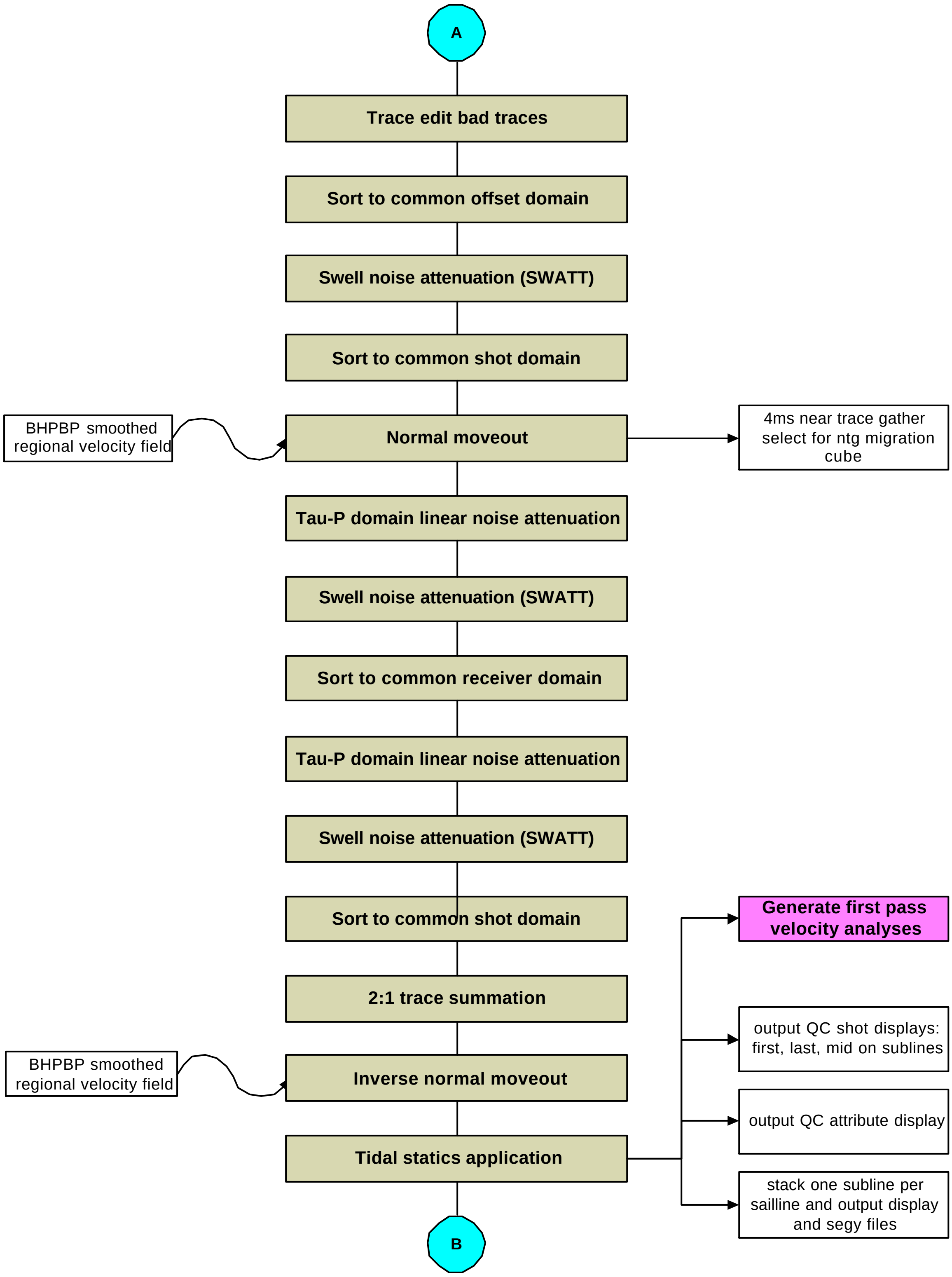
General	
▪ Client	BHP Billiton Petroleum Pty Ltd
▪ Vessel(s)	Geco Beta
▪ Job Number	9227
▪ Client Contract Number	68000734
▪ Location	Vic/P45, offshore Gippsland Basin
▪ Type of Survey (2D or	3D
▪ Area or Total km	996 square kms
▪ Average Line Length	30.0 km (full fold)
▪ Heading	198° / 018°
▪ Estimated Start Date	AUG 2002
▪ Estimated Duration	10 weeks
Streamers	
▪ Type:	Nessie 4 Sections/Nessie 3 Bubbles
▪ Length	4600m
▪ Number of streamers	8
▪ Streamer separation	100 metres
▪ Number of Groups/strmr	368
▪ Depth	8m (+/- 1 m)
▪ Group length	14.86 metres
▪ Group Interval	12.5 metres
▪ Streamer tracking	Sonardyne SIPS 1 acoustics & DigiCourse 5011 compass units
Energy Source	
▪ Source Type	Bolt Airgun Array
▪ Number of Sources	2
▪ Source separation	50 metres
▪ Total Volume	3542 cu in
▪ Operation Pressure	2000 psi
▪ Source Depth	7 metres
▪ Shotpoint Interval per shot	18.75 metres (37.5m per CMP line)
▪ No. of subarrays / source	3

▪ Subarray separation	8 metres
▪ No. of airguns / subarray	8/9
▪ Gun timing specification	+/-1 ms
▪ Alternative firing sources	yes
▪ Source control system	Trisor
▪ Gun Delay	0
Instrumentation	
▪ Recording System:	Triacq 2.0
▪ Recording Format	SEG-D Rev 2 8015
▪ Low Cut Filter	3Hz (18dB/oct)
▪ High Cut Filter	180Hz (72dB/oct)
▪ Recording system delay	0
▪ Recording media	IBM3590 cartridge
▪ Filter type	N3
▪ Filter type	N3
▪ Dual record / Tape copies	yes
▪ Sample Interval	2 ms
▪ Record Length	6144 ms
Navigation Systems	
▪ Primary	TRINAV GPS
▪ Secondary	Multifix 3
Data Sampling	
▪ Nominal Fold	62

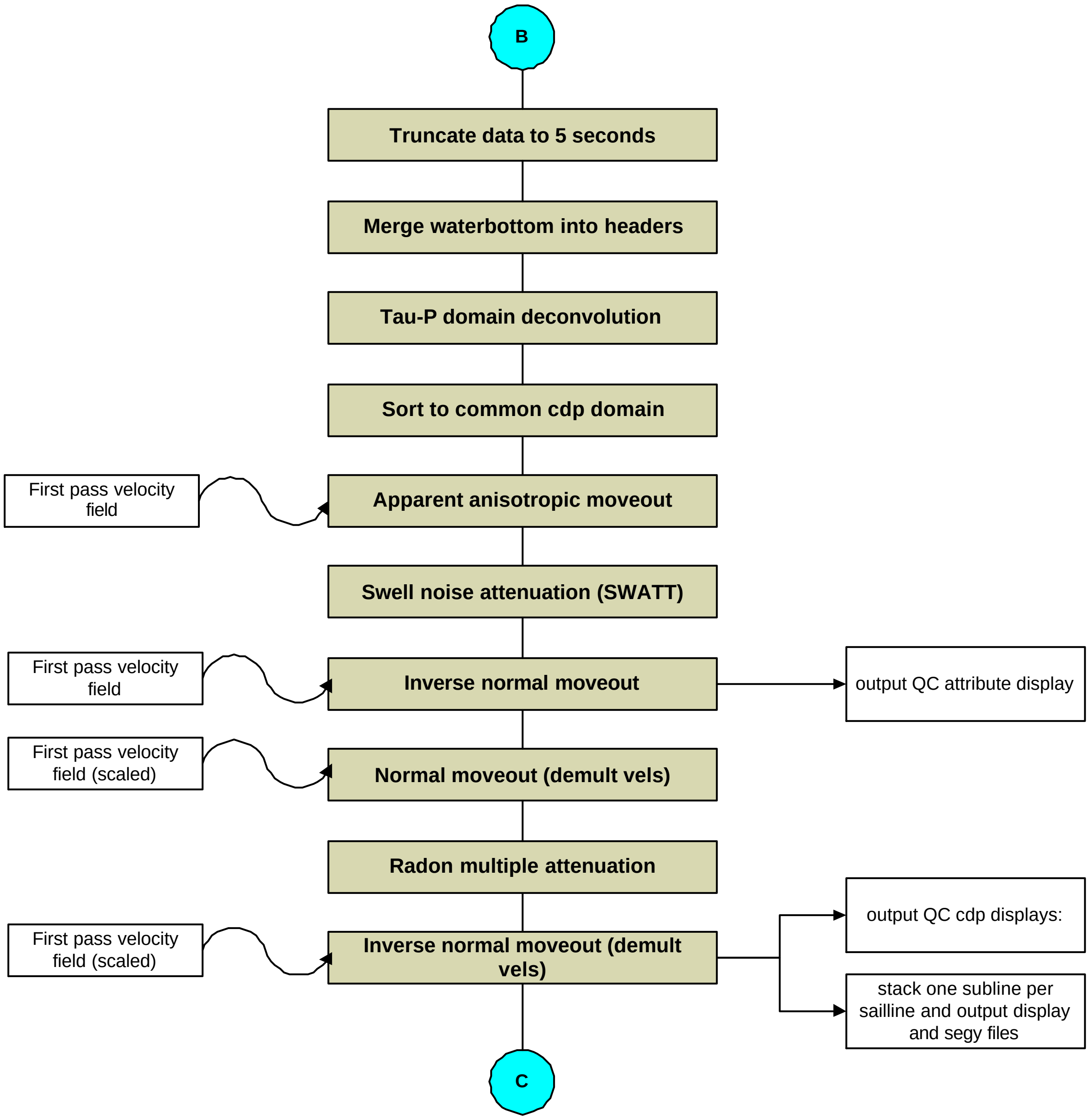
3. DATA PROCESSING SUMMARY

Figure 2: Production Processing Flow Diagram

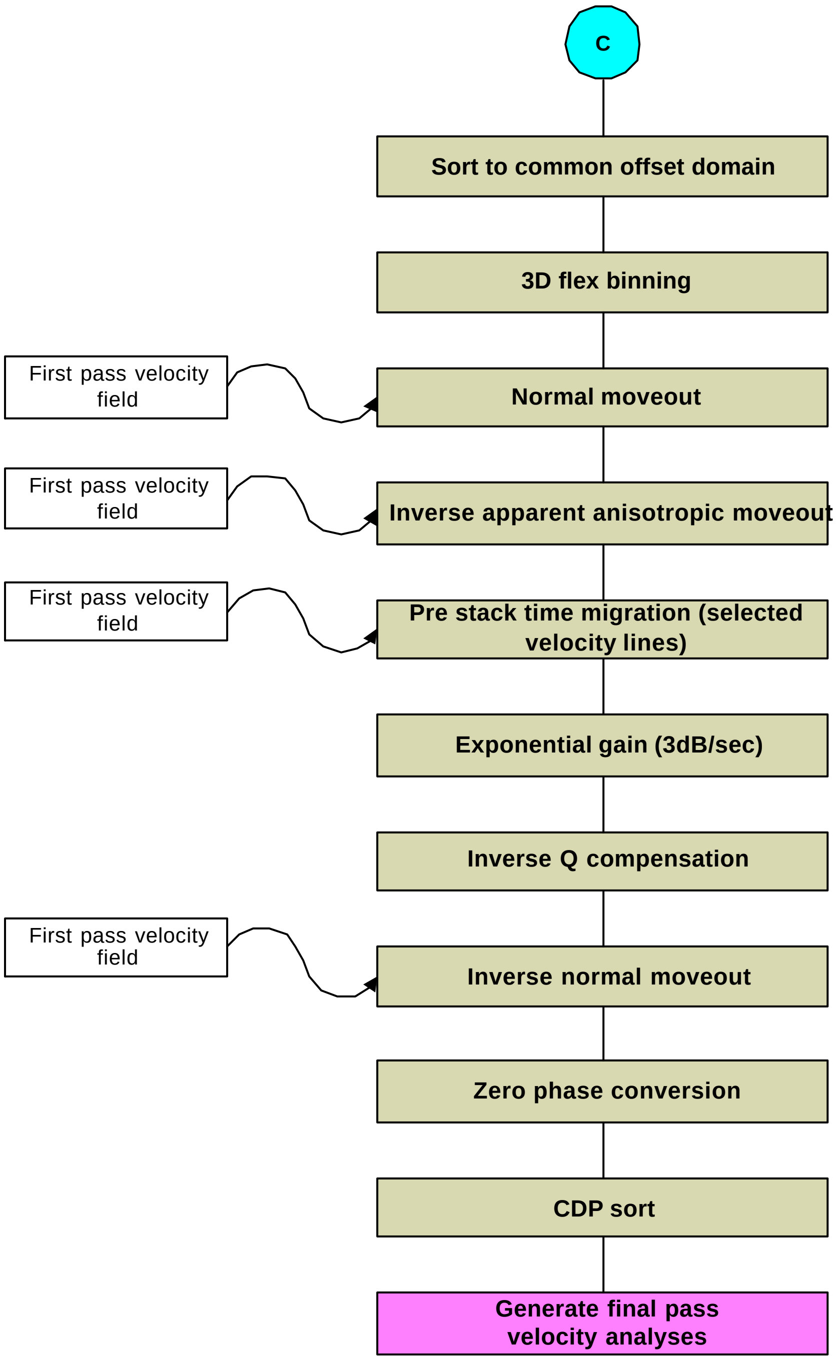



A
Trace edit bad traces
Sort to common offset domain
Swell noise attenuation (SWATT)
Sort to common shot domain
BHPBP smoothed regional velocity field
Normal moveout
4ms near trace gather select for ntg migration cube
Tau-P domain linear noise attenuation
Swell noise attenuation (SWATT)
Sort to common receiver domain
Tau-P domain linear noise attenuation
Swell noise attenuation (SWATT)
Sort to common shot domain
Generate first pass velocity analyses
2:1 trace summation
output QC shot displays: first, last, mid on sublines
BHPBP smoothed regional velocity field
Inverse normal moveout
output QC attribute display
Tidal statics application
stack one subline per sailline and output display and segy files
B

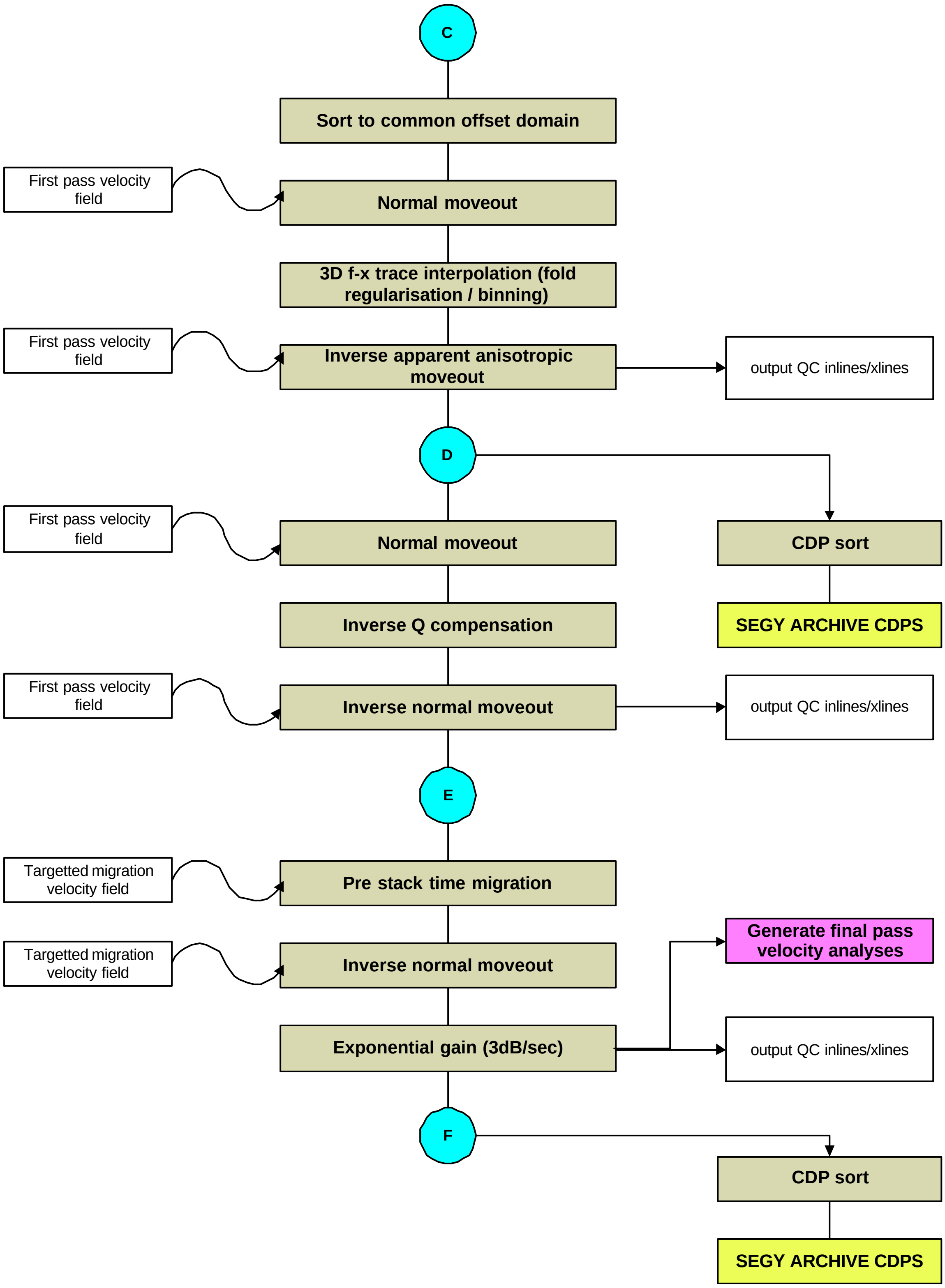
PRODUCTION FLOW



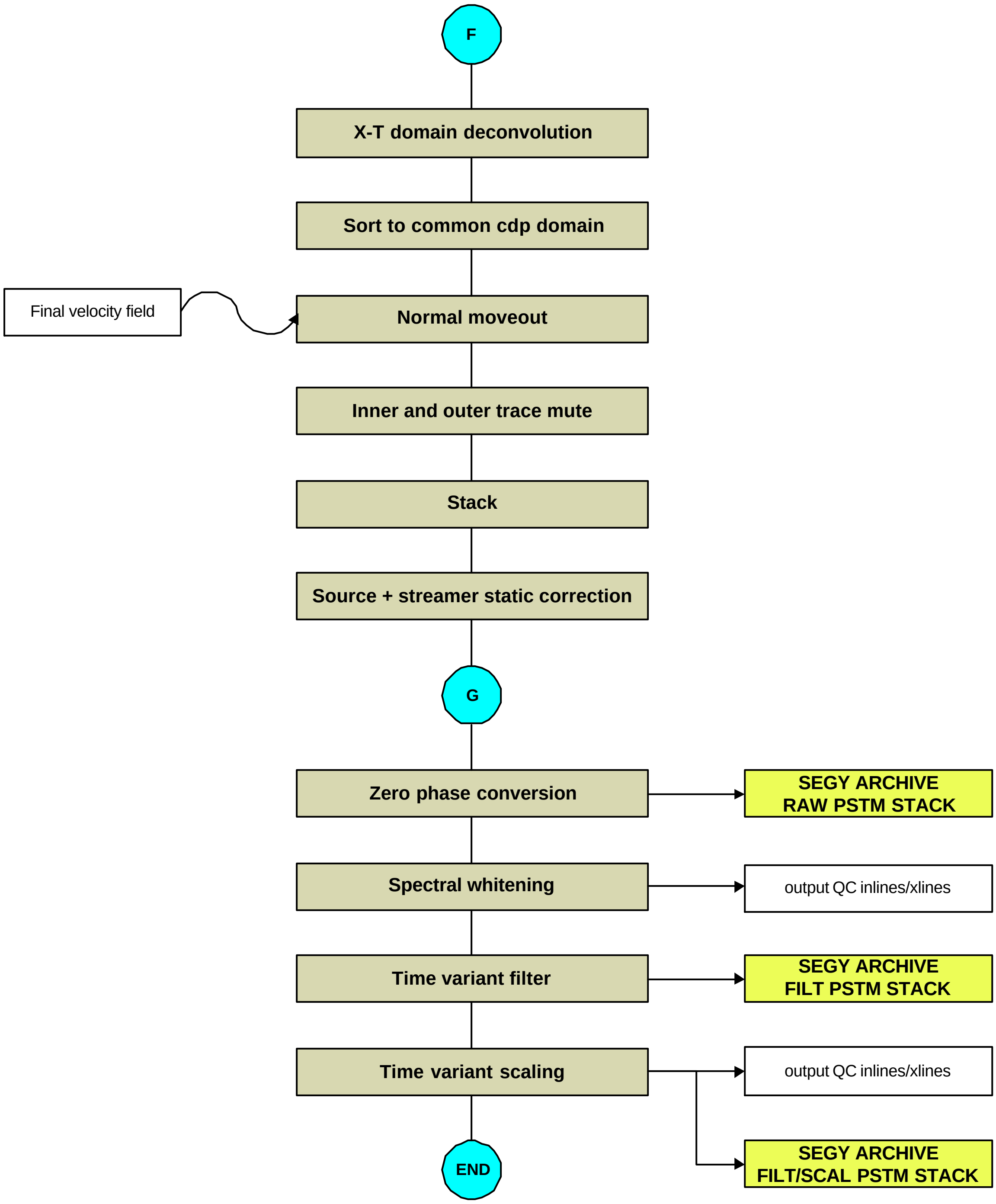
TARGETED MIGRATION VELOCITY FLOW



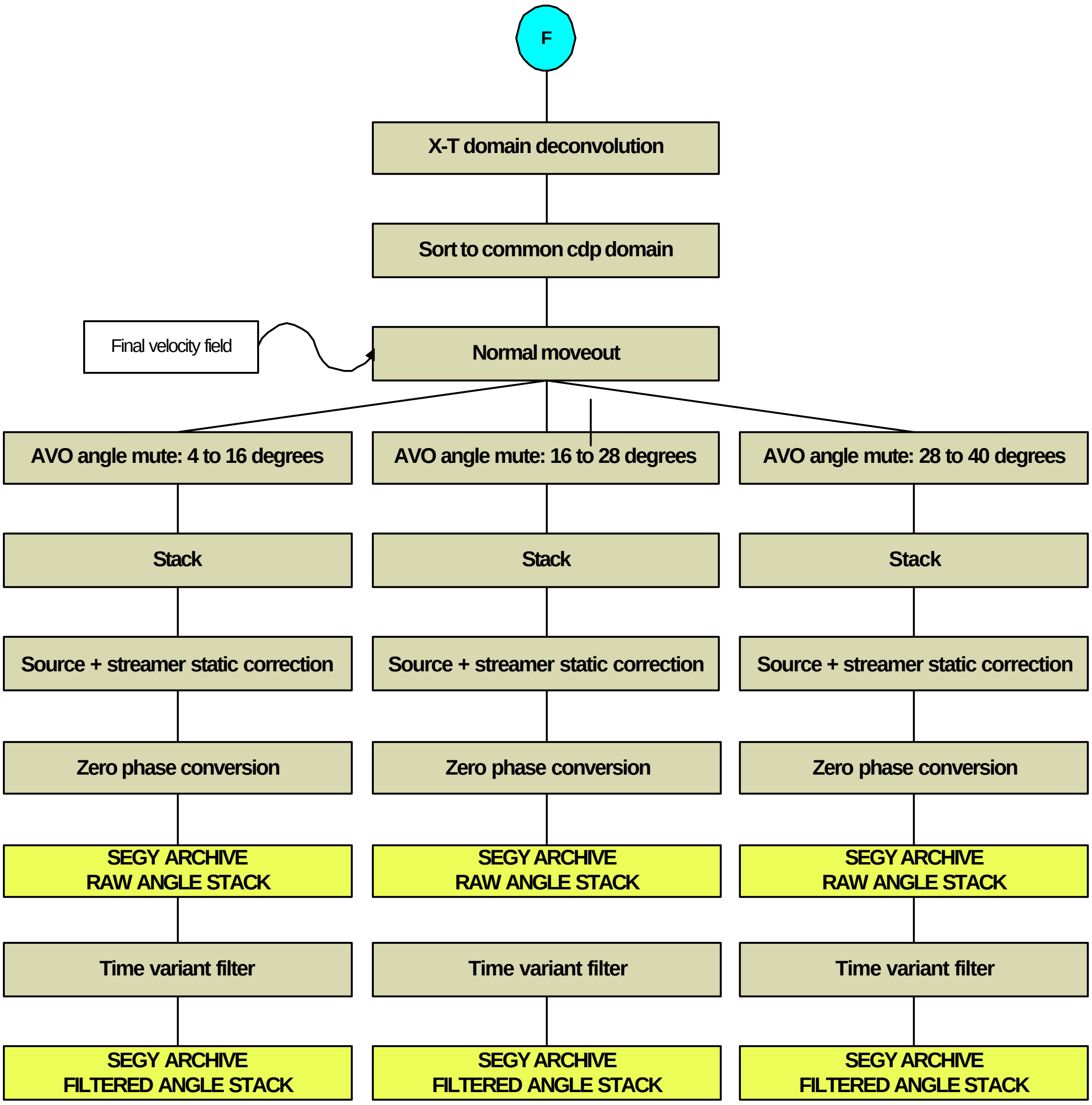
PRODUCTION FLOW



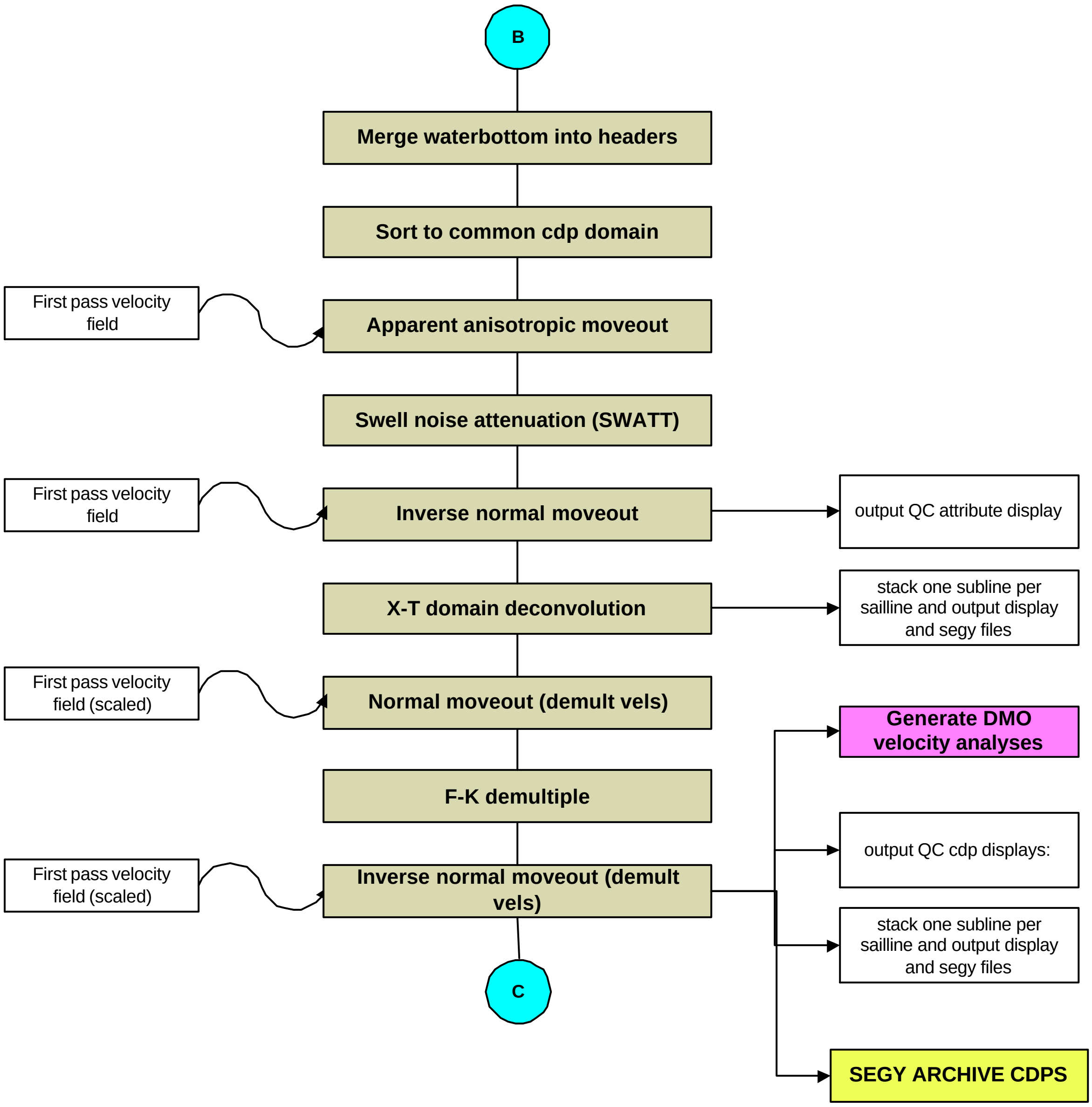
PRODUCTION FLOW



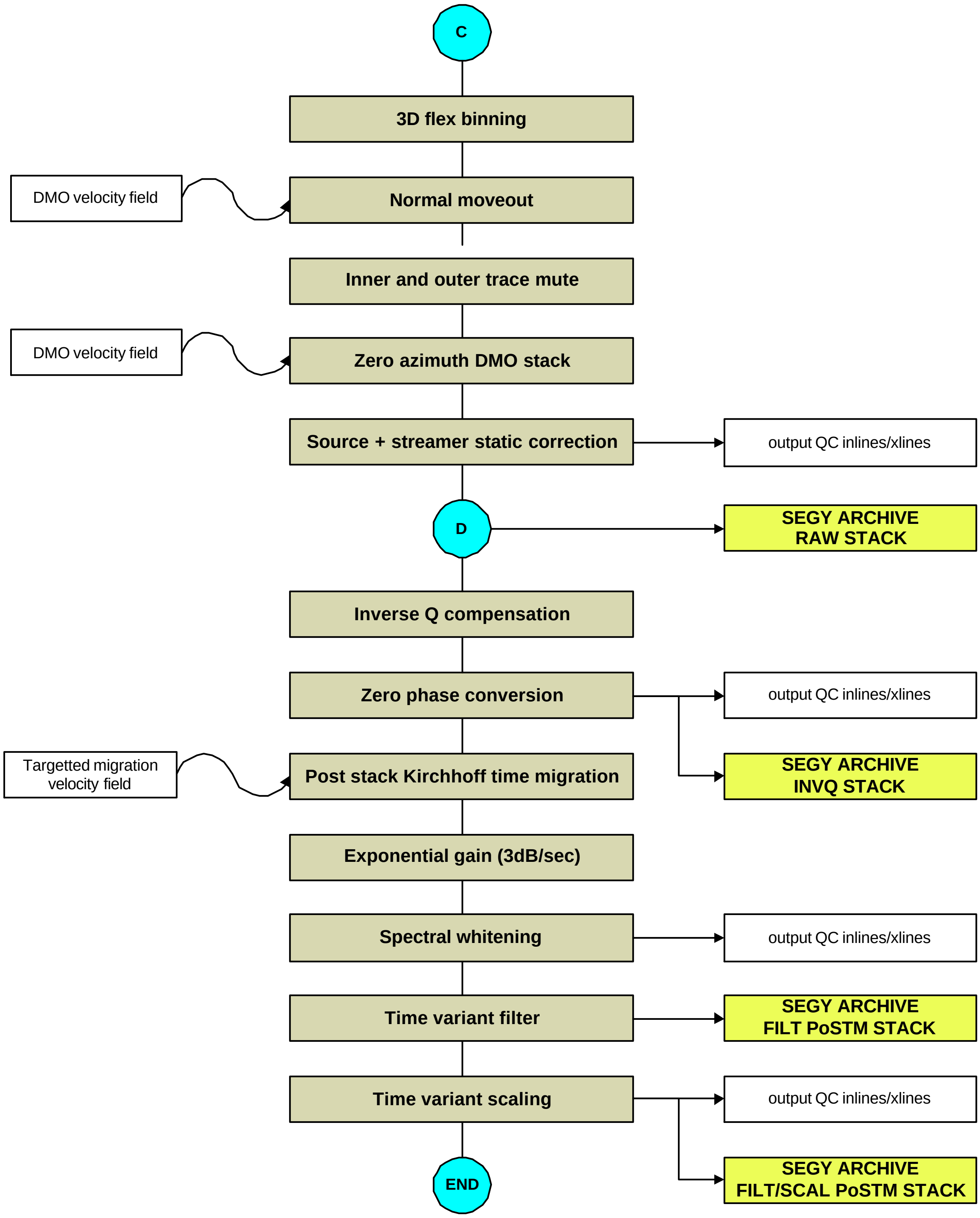
PRODUCTION FLOW: ANGLE STACKS



FAST TRACK FLOW



FAST TRACK FLOW



4. PERSONNEL AND EQUIPMENT

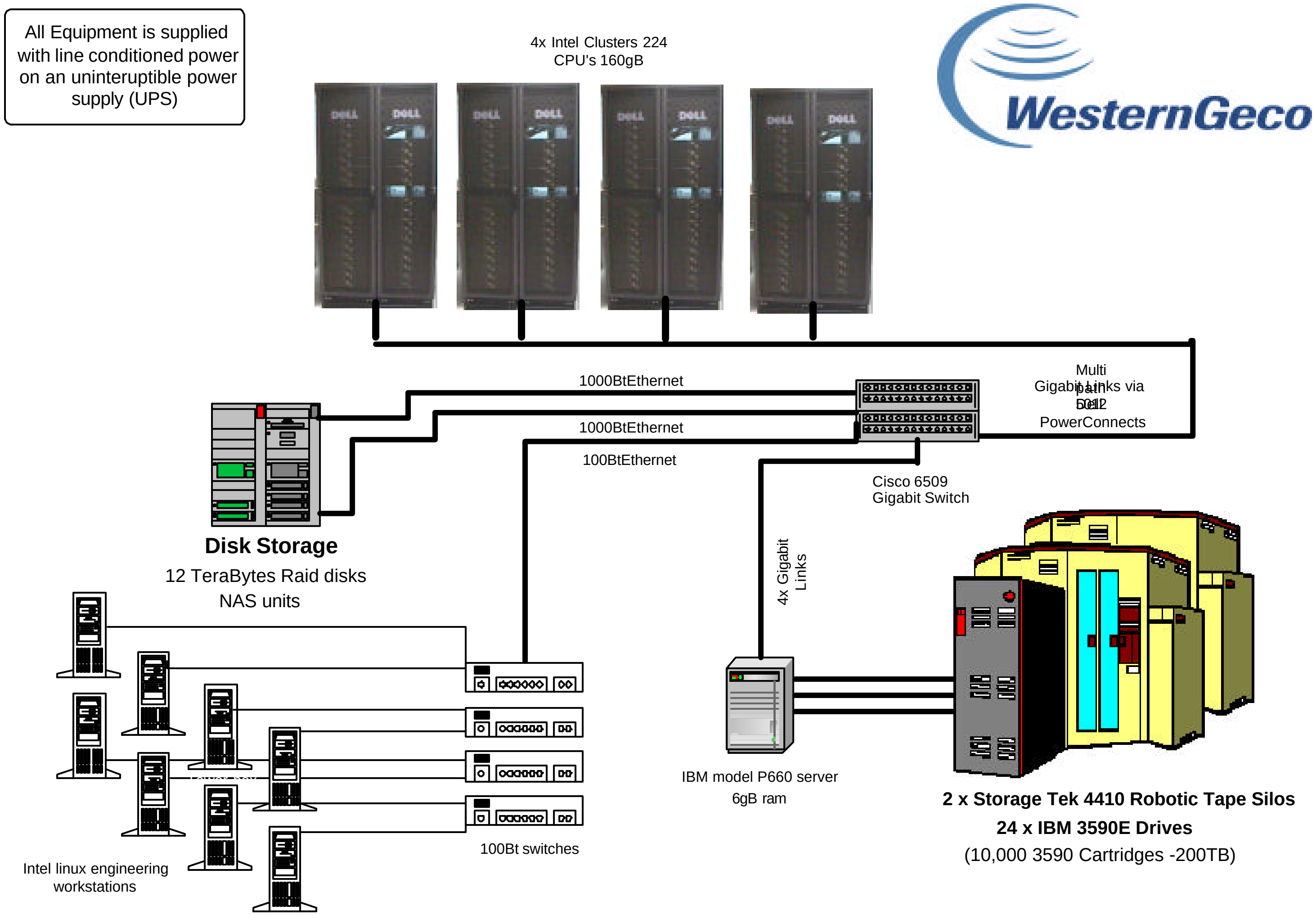
4.1. GEOPHYSICAL STAFFING AND ORGANISATION

WESTERNGECO (ONBOARD PROCESSING)		
Peter Carver	OBP Shift Leader	Parameter testing. Production Processing Data quality control
Maris Steele	OBP Geophysicist	Production Processing Data quality control
Pham Quoc Hung	OBP Shift Leader	Parameter testing. Production Processing Data quality control
Phil McBride	OBP Geophysicist	Production Processing Data quality control
WESTERNGECO (MELBOURNE CENTRE)		
Michael Hartley	Data Processing Manager Melbourne	Allocation of resources in the Melbourne Data Processing Centre. Parameter testing. Overall project management. Contract administration.
Swee Leng Ng	Area Geophysicist Asia Pacific Region	Advisor on geophysical elements.
Ian Moore	Area Geophysicist Asia Pacific Region	Advisor on geophysical elements.
Paul Bellofiore	Senior Geophysicist	Parameter testing Velocity picking Data quality control

BHP Billiton Petroleum		
John Thornton		Project Co-Ordination Parameter Testing and Evaluation, Technical and Quality Control
Mark Stanley		Parameter Testing and Evaluation, Technical and Quality Control

4.2. EQUIPMENT

Figure 3: Computer Equipment Configuration (Perth)



4.3. PERTH AND ENVIRONS – WIDE AREA NETWORK

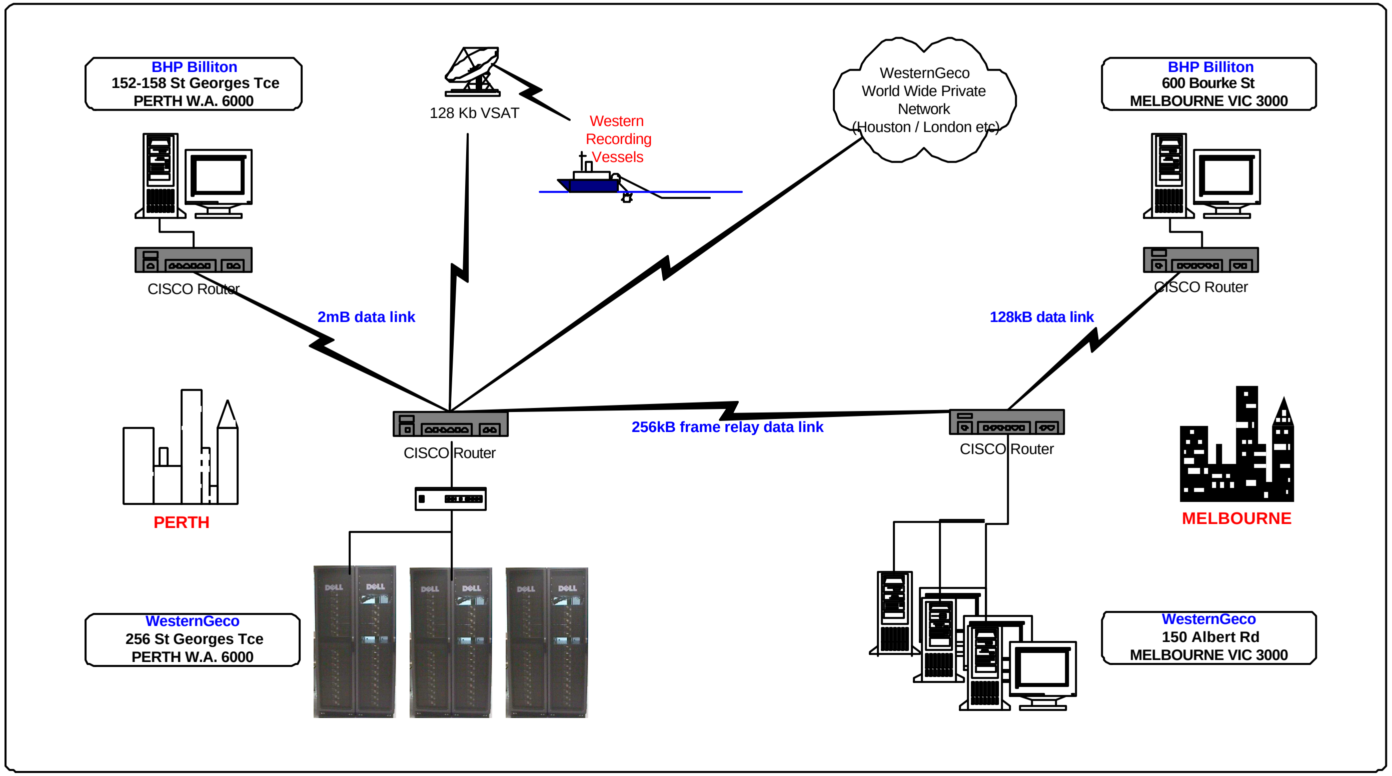
WesternGeco

Data Processing System Schematic

Distributed Computing System

Fourth Quarter 2002

All Wide Area Networks use secure, private lines



5. PRODUCTION PROCESSING SEQUENCE

Details of the processing flow, in the order that they were applied, are described below.

5.1. POLARITY

Recording polarity was maintained throughout the processing sequence.

5.2. REFORMAT SEGD TO OMEGA

The basic function of the tape transcription process was to reformat field tape data to WG Omega format. The demultiplexed data, in SEG-D format, was converted to WG Omega format. Full word, 32 bit floating point data at hydrophone amplitude was maintained.

5.3. FILTER DELAY CORRECTION

A –5.6ms bulk shift was applied to correct for the recording instrument filter delay. The filter delay was due to acquisition using Nessie 3 bubbles with a Nessie 4 streamer.

5.4. FIELD DATA EDITS

Records and traces flagged as bad in the Observer's logs were edited from the processing sequence.

5.5. TIDAL STATICS

Tidal static corrections were stored in trace headers but not applied. Application of tidal statics was delayed until later in the processing sequence (after static qc).

5.6. NAVIGATION MERGE

True x and y co-ordinates of the source and receiver locations supplied by UKOOA P1/90 datasets were merged with seismic data based on shotpoint number.

5.7. GRID DEFINITION

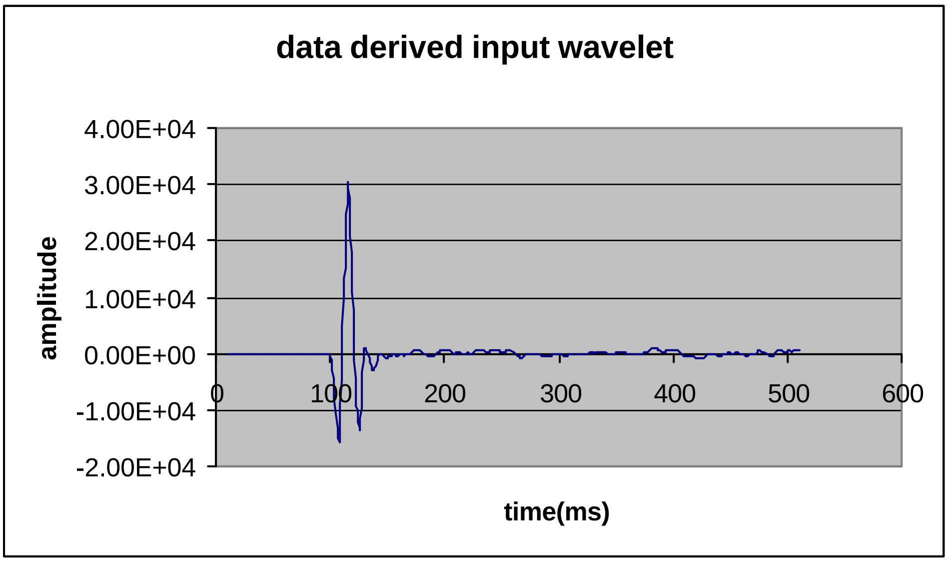
Data was gridded onto the following master grid.

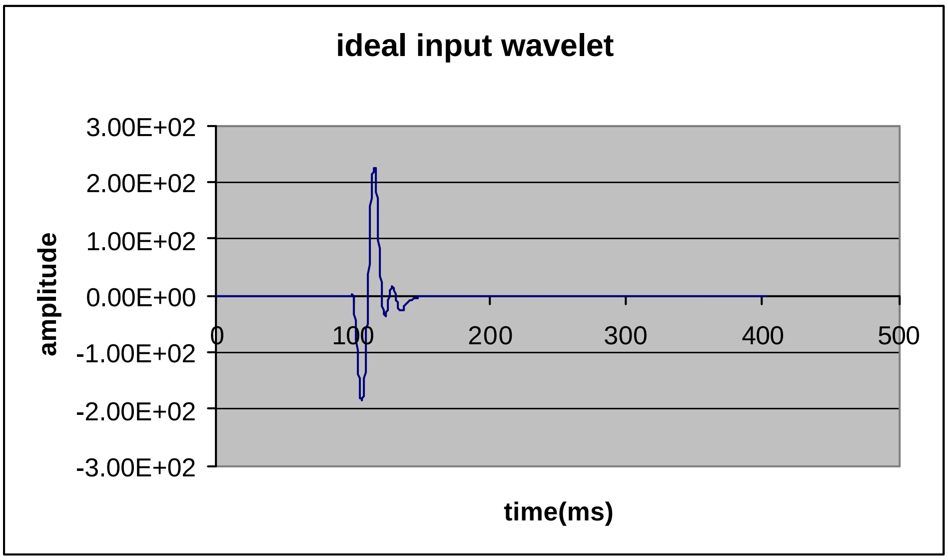
Primary ordinals (crosslines):	800 - 4650	
Secondary ordinals (inlines):	950 - 2380	
MG1:	X = 631129.0832	Y = 5727961.8305
MG2:	X = 616257.6403	Y = 5682192.2357
MG3:	X = 597128.8127	Y = 5739009.1881
MG4:	X = 582257.3699	Y = 5693239.5932

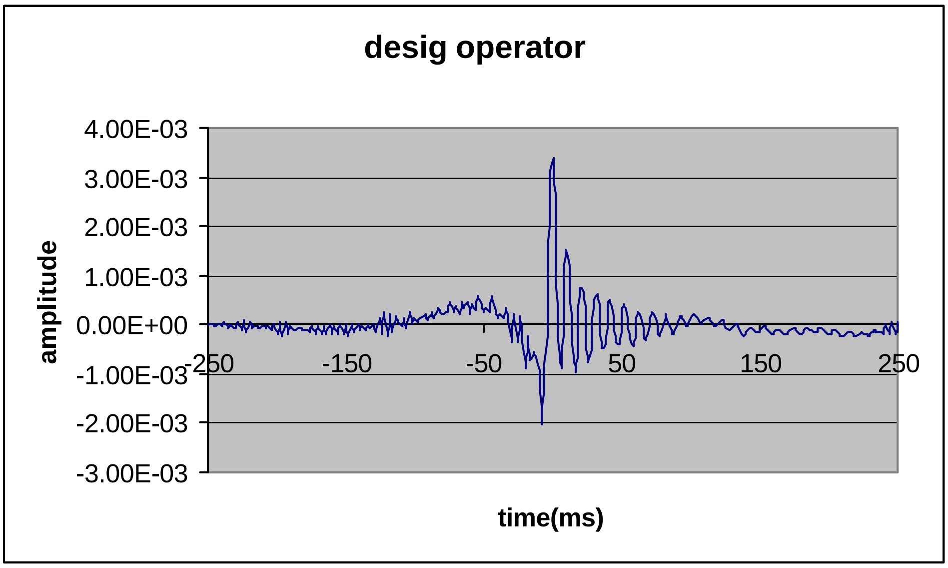
5.8. WAVELET DESIGNATURE

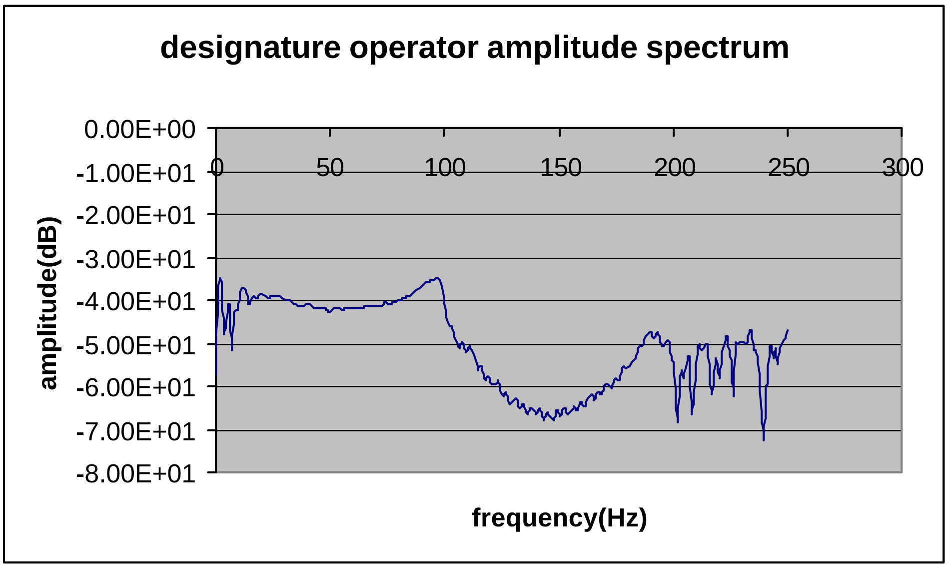
An “ideal” minimum phase wavelet was generated from a minimum phase filtered spike trace using a 20Hz(8dB/oct) - 75Hz(30dB/oct) band pass filter. A data derived wavelet was then shaped to this "ideal" wavelet to produce a deterministic designature operator. The data derived wavelet was generated by flattening a rugose waterbottom near trace gather, then trim mean filtering and stacking the flattened data. The operator was generated onboard at the commencement of acquisition, and was applied to the data at a 2ms sample rate.

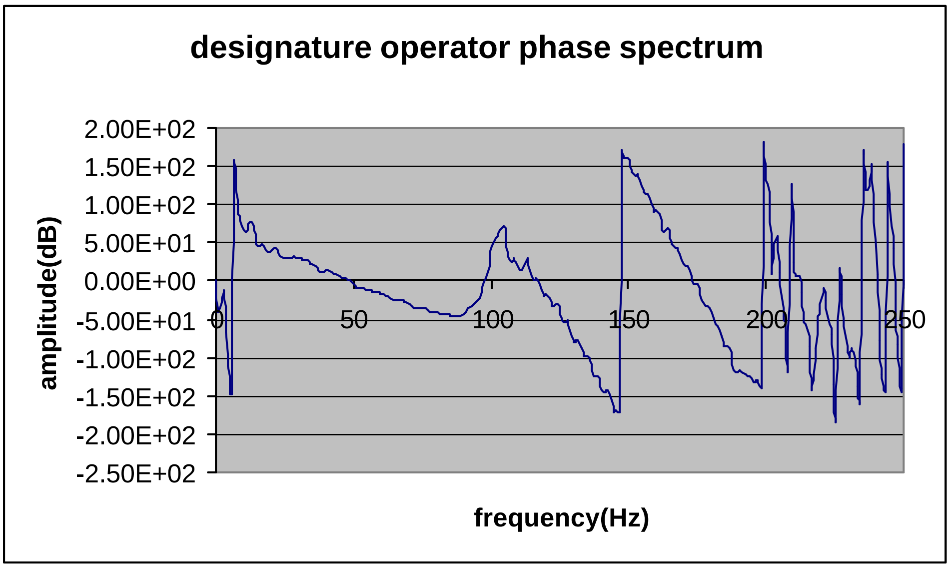
The following displays illustrate the input, desired output and designature operator wavelet characteristics:






desig operator
amplitude
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
-1.00E-03
-2.00E-03
-3.00E-03
-250
-150
-50
50
150
250
time(ms)


designature operator amplitude spectrum
amplitude(dB)
0.00E+00
-1.00E+01
-2.00E+01
-3.00E+01
-4.00E+01
-5.00E+01
-6.00E+01
-7.00E+01
-8.00E+01
0
50
100
150
200
250
300
frequency(Hz)


designature operator phase spectrum
amplitude(dB)
2.00E+02
1.50E+02
1.00E+02
5.00E+01
0.00E+00
-5.00E+01
-1.00E+02
-1.50E+02
-2.00E+02
-2.50E+02
0
50
100
150
200
250
frequency(Hz)

5.9. NEAR TRACE CUBE: DATA CAPTURE

All near offsets falling within the range 450-500m were captured at this stage in the processing sequence and used to generate a high resolution (2ms s.r.) migrated stack volume for use in hazard identification. Linear moveout qc was also performed at this stage. Inline interval was 25m and crossline interval was 12.5m for the near trace cube.

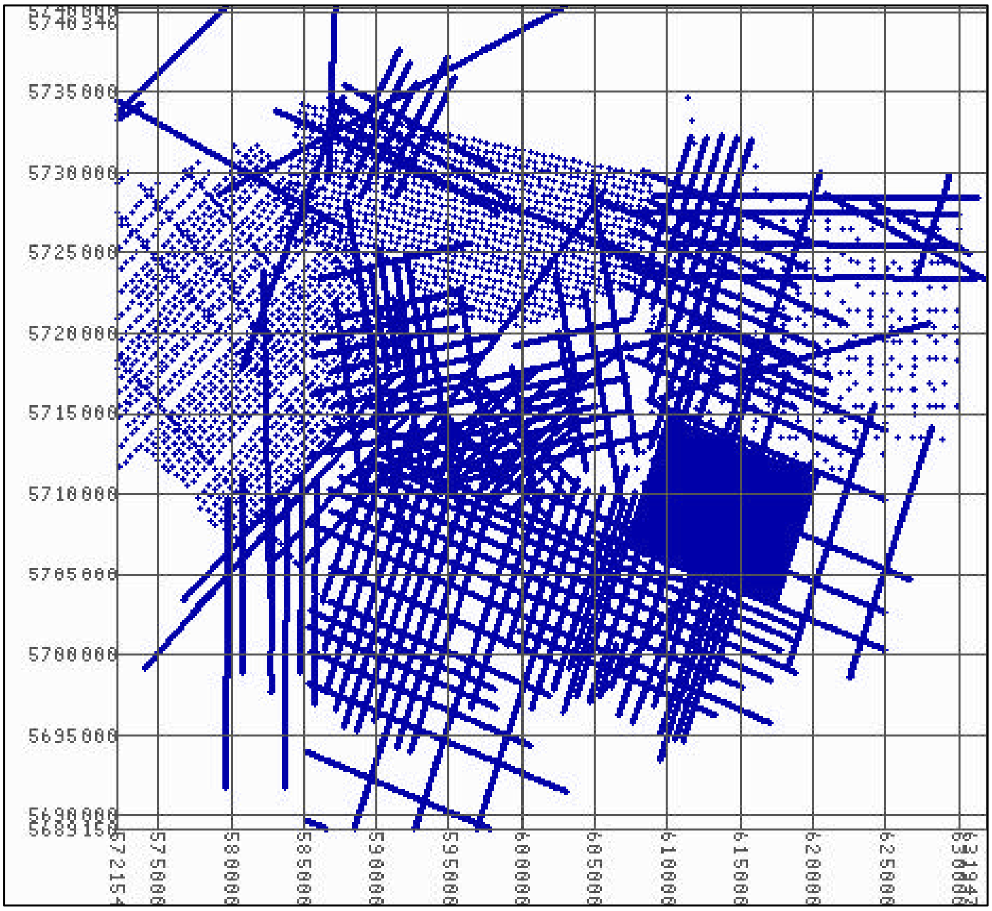
5.10. RESAMPLE

The data was resampled from 2 ms to 4 ms. A zero phase anti-alias filter with a high cut of 93.75 Hz (3/4 Nyquist) with a slope of 36 dB/oct was applied prior to resample.

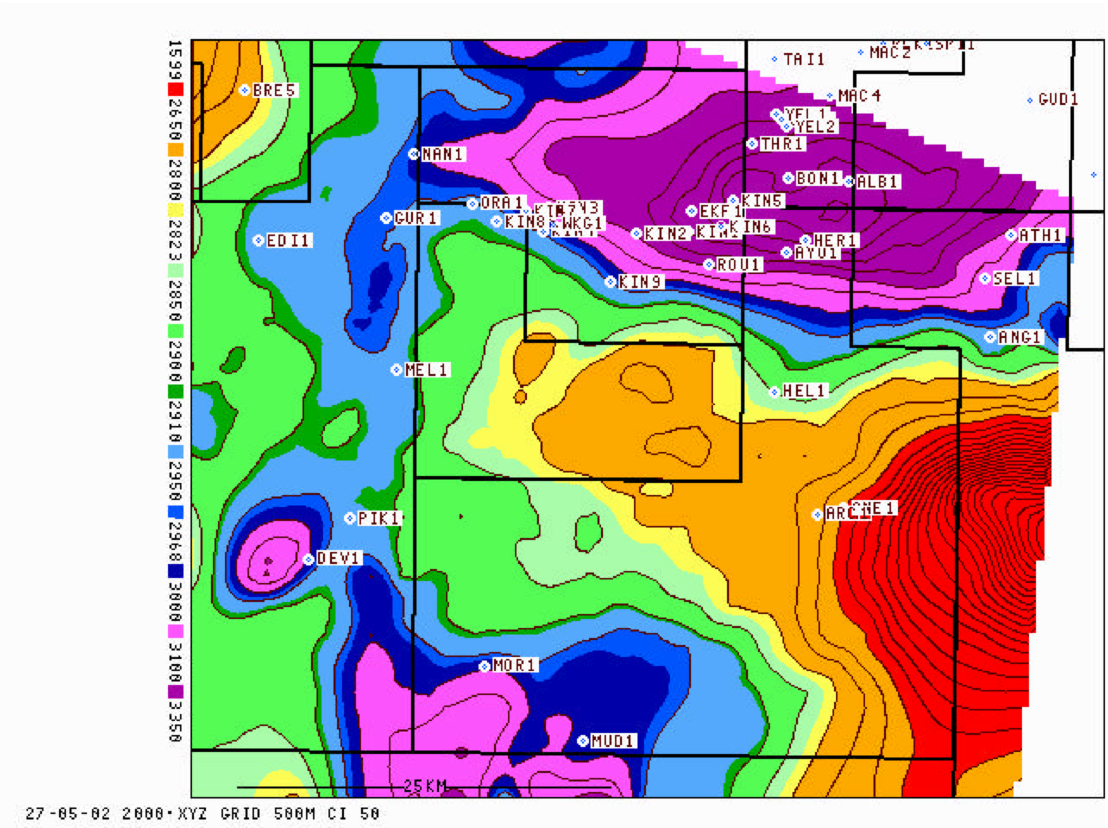
5.11. AMPLITUDE RECOVERY

To correct for spherical spreading, the inverse of the amplitude decay factor (A) was applied to the data where $A = 1/(T^*(V^2))$, where T = 2 way time and V = RMS velocity. Regional velocities supplied by BHPBilliton were used for this correction. The velocity field was smoothed using the smoothing regime defined below:

Regional velocity field: control points



Regional velocity field: 2000ms timeslice



Vel smoothing:	time(ms)	radius(m)	decay rate
	4	100	0.5
	3500	100	0.5
	4000	500	0.5
	4500	2500	0.001
	5000	6500	0.0001
	6200	10000	0.0001

An exponential gain of 3dB per second from 0 seconds to 4 seconds was also applied.

5.12. LOW CUT FILTER

A low cut filter of 3 Hz (18dB/oct) was applied to attenuate the low frequency bias from the data.

5.13. DATA INTEGRITY QC.

A QC attribute plot representing amplitudes for every shot and trace recorded was used to identify bad traces (RMS trace strength versus shotpoint/trace number plot).
First and last shots on each sub surface line were selected and output for display.
A Selected sub-surface line from each sailline (rotating gun/cable combinations) was processed through to stack, and output to display and to a segy dataset for transmission to BHPBP.

5.14. FIELD DATA EDITS

Records and traces identified as having anomalous amplitudes from the data integrity QC step were edited from further processing.

5.15. SORT

Data was sorted from common shot to common offset domain for subsequent swell noise attenuation processing.

5.16. SWELL NOISE ATTENUATION (SWATT)

Noise attenuation was achieved by applying SWATT in multiple domains, the first application being in the offset domain. SWATT removes anomalous amplitudes within a user specified frequency band. Anomalous amplitudes are defined as amplitudes that exceed a maximum deviation from the median amplitude within a window.

Frequency Bands	2-10Hz
Band increment	2Hz
Analysis window length	1000ms
Window overlap	20%
Window start	Offset dependent, relative to wbtime
Threshold	400% from 0-6144ms

5.17. SORT

Data was sorted from common offset to common shot domain for subsequent processing.

5.18. NORMAL MOVEOUT

Normal moveout corrections were applied using the BHPBilliton supplied regional velocity field described in step 5.11.

5.19. TAU-P DOMAIN LINEAR NOISE ATTENUATION

Direct arrival energy and dipping noise was removed in the Tau-P domain using a high resolution radon transform. The following parameters were utilized:

Linear moveout range	-500ms to 4500ms
Number of P traces	500 at 10ms increments
Shallow blend zone	From wbtime+300ms to wbtime+400ms
Maximum moveout for signal	1000ms (time invariant)

5.20. SWELL NOISE ATTENUATION (SWATT)

A second pass of SWATT was applied in the shot domain (on NMO corrected data) as follows:

Frequency Bands	2-10Hz		
Band increment	2Hz		
Analysis window length	1000ms		
Window overlap	20%		
Window start	Offset dependent, relative to wbtime		
Threshold	400% from 0-6144ms		
Analysis Zone	Wbtime(ms)	Offset(m)	Window(ms)
	100	175.0	0-6144
		4762.5	1500-6144
	500	175.0	300-6144
		4762.5	1800-6144
	1000	175.0	700-6144
		4762.5	2200-6144

5.21. SORT

Data was sorted from common shot to common receiver domain for subsequent processing.

5.22. TAU-P DOMAIN LINEAR NOISE ATTENUATION

Direct arrival energy and dipping noise was removed in the Tau-P domain using a high resolution radon transform. The following parameters were utilized:

Linear moveout range	-500ms to 4500ms
Number of P traces	500 at 10ms increments
Shallow blend zone	From wbtime+300ms to wbtime+400ms
Maximum moveout for signal	1000ms (time invariant)

Note: for selected infill and restart lines shot gather repeating at line ends and within data holes is required at this stage to avoid low fold edge effects resulting from receiver domain tau-p domain linear noise attenuation.

5.23. SWELL NOISE ATTENUATION (SWATT)

A third pass of SWATT was applied in the receiver domain (on NMO corrected data) as follows:

Frequency Bands	2-10Hz		
Band increment	2Hz		
Analysis window length	1000ms		
Window overlap	20%		
Window start	Offset dependent, relative to wbtime		
Threshold	400% from 0-6144ms		
Analysis Zone	Wbtime(ms)	Offset(m)	Window(ms)
	100	175.0	0-6144
		4762.5	1500-6144
	500	175.0	300-6144
		4762.5	1800-6144
	1000	175.0	700-6144
		4762.5	2200-6144

5.24. SORT

Data was sorted from common receiver to common shot domain for subsequent processing.

5.25. TRACE SUM

A 2:1 trace sum was carried out on shot gathers. The number of channels per shot was reduced from 368 to 184 on summation. Nominal CMP fold after trace summation is 62.

5.26. INVERSE NORMAL MOVEOUT

Inverse normal moveout corrections were applied using the BHPBilliton supplied regional velocity field described in step 5.11.

5.27. TIDAL STATICS APPLICATION

The tidal statics stored in trace headers in step 5.5. were applied to the data.

5.28. DATA INTEGRITY QC.

A QC attribute plot representing amplitudes for every shot and trace recorded was used to identify bad traces (RMS trace strength versus shotpoint/trace number plot). QC attribute displays were generated for every line, as acquisition of a significant percentage of data was acquired in marginal conditions and careful manual qc of attribute displays was required.

First and last shots on each sub surface line were selected and output for display.
A Selected sub-surface line from each sailline (rotating gun/cable combinations) was processed through to stack, and output to display and to a segy dataset for transmission to BHPBP.

5.29. VELOCITY ANALYSES.

Velocity analyses were run on a 1000m x 800m grid using the following parameters. All velocity analysis were performed with WesternGeco's Interactive Velocity Processing (IVP). The regional velocities described in step 5.11. were used as the central function.

Mild F-K demultiple	Using 90% of regional function as per step 5.11.
Number of MVF panels	13
Panel separation	3%
Stack traces per MVF	15
IVP displays	Gathers, MVF's, semblances, stacks, horizons
Horizon information	8 interpreted horizons provided by BHPBP

The first pass velocities were picked by WesternGeco and qc'd by BHPBP.

At this stage of the processing sequence the processing flow diverged into production and fast track streams to enable early delivery of an interpretable fast track stack cube. The fast track flow utilized X-T domain deconvolution in place of Tau-P domain deconvolution, F-K demultiple in place of radon demultiple, and post stack migration in place of pre stack migration. The fast track flow is detailed in steps 5.69 To 5.98

PRODUCTION FLOW:

5.30. DATA LENGTH TRUNCATION

The processing data length was reduced from 6144ms to 5000ms for further processing.

5.31. WATERBOTTOM INTERPRETATION TRACE HEADER MERGE

Revised waterbottom times were loaded into trace headers Waterbottom values are smoothed, P1/90 navigation values above 200ms (using an 800m diameter smoothing function). Values below 200ms are derived from digitizing water bottom profiles on NMO corrected near trace gathers. The final waterbottom interpretation was provided by BHPBP.

5.32. TAU-P DOMAIN DECONVOLUTION

Tau-P domain gapped deconvolution targeting the water bottom multiple was applied to remove reverberations from the data. The following parameters were utilized.

Forward transform	-500ms to 2000ms moveout at far offset
Number of P traces	368
Removable AGC	200ms for deconvolution operator design
Decon Windows	1 window from 0-4000ms
Decon Gap Length	Autocorrelation multiple period minus 30ms
Decon Active Operator Length	Autocorrelation multiple period plus 30ms
Application	From 0-5000ms

5.33. SORT

Data was sorted from common shot to common cdp domain for subsequent processing.

5.34. APPARENT ANISOTROPIC MOVEOUT

Extended moveout corrections were applied using the first pass velocity field.

5.35. SWELL NOISE ATTENUATION (SWATT)

A fourth pass of SWATT was applied in the cmp domain (on AAMO corrected data) as follows:

Frequency Bands	2-10Hz		
Band increment	2Hz		
Analysis window length	1000ms		
Window overlap	20%		
Window start	Offset dependent, relative to wbtime		
Threshold	400% from 0-5000ms		
Analysis Zone	Wbtime(ms)	Offset(m)	Window(ms)
	100	175.0	0-5000
		4762.5	1500-5000
	500	175.0	300-5000
		4762.5	1800-5000
	1000	175.0	700-5000
		4762.5	2200-5000

5.36. INVERSE NORMAL MOVEOUT

Normal moveout corrections were removed using the first pass velocity field. Extended order moveout terms from anisotropic moveout application remain on the data.

5.37. DATA INTEGRITY QC.

A QC attribute plot representing amplitudes for every shot and trace recorded was used to identify bad traces (RMS trace strength versus shotpoint/trace number plot). QC attribute displays were generated for every line, as acquisition of a significant percentage of data was acquired in marginal conditions and careful manual qc of attribute displays was required.

5.38. NORMAL MOVEOUT

Normal moveout corrections were applied using the first pass velocity field scaled by the following time variant scaling factors.

Time (ms)	Velocity Scaling (%)
0	96
500	96
1000	94
2000	92
6144	90

5.39. MULTIPLE ATTENUATION

Multiple attenuation was applied using a combination of F-K demultiple and a high resolution radon transform parabolic demultiple as follows:

Roll along interleaved F-K demultiple

interleaving	3 CDPs. Overlap 1 CDP
Removable AGC	120ms windows
Application zone	Wbtime-40ms to 600ms
Taper zone	400ms (100%) to 600ms (0%)

Parabolic Radon demultiple

Transform type	parabolic
Removable AGC	120ms windows
Application zone	400ms to 5000ms
Taper zone	400ms (0%) to 600ms (100%)
Noise modeling blend zone	(Wbtime x 2)-100ms. Blend taper 50ms
Moveout range	-2000ms to 3500ms at maximum offset
Number of P traces	501 at 10ms increments
Multiple definition	Parabolas > 50ms moveout at max offset

Note: for selected infill and restart lines cdp gather repeating at line ends and within data holes is required at this stage to avoid low fold edge effects resulting from cdp domain radon parabolic noise attenuation.

5.40. INVERSE NORMAL MOVEOUT

Normal moveout corrections were removed using the first pass scaled velocity field as described in step 5.38.

5.41. DATA INTEGRITY QC.

Selected CDPs on each sailline were output for display.

A Selected sub-surface line from each sailline (rotating gun/cable combinations) was processed through to stack, and output to display and to a segy dataset for transmission to BHPBP.

5.42. SORT

Data was sorted from common cdp to common offset domain for subsequent processing.

5.43. TARGETED MIGRATION VELOCITY ANALYSIS

Data processed through this stage is used only for targeted migration velocity analyses. To expedite the generation of the velocity field, input common offset sorted data was flexibinned instead of being processed through full 3D f-x trace interpolation. This had negligible effect on the quality of the velocity analyses, and enabled velocity picking to be performed at an earlier stage. Kirchhoff pre stack time migration was then run on designated velocity lines at an 800m interval. Second pass velocities were subsequently run on targeted PSTM (pre-stack time migration) CDP sorted gathers. The PSTM algorithm accounts for geometric spreading and anisotropic moveout (AAMO) so both were backed off prior to running targeted PSTM. A time variant pre filter was also applied to the data to reduce the possibility of migration aliasing. Processing applied after PSTM but before velocity generation included exponential gain (3dB/sec to 4 seconds), inverse Q compensation (as in step 5.49) minimum to zero phase conversion (as in step 5.64), and polarity reversal.

Time variant pre-filter for PSTM

Time (ms)	Frequency (Hz)	Slope (dB/oct)
0	90	72
1000	80	72
2000	70	72
3000	60	72
4000	50	72
5000	40	72

Kirchhoff migration parameters for targeted PSTM

Velocity lines	1008, 1024 to 2328 incr 32; 1432, 1852	
Input Vel smoothing	Time (ms)	Radius (m)
	0	1000
	1000	1000
	3000	2000
	5000	4000
Input Vel percentage	Time (ms)	Percentage
	0	100
	5000	100
Implementation	Curved ray algorithm	
Half aperture	3000 m	
Dip limits	45 degrees	

Velocity analyses were run on a 1000m x 800m grid using the following parameters. All velocity analysis were performed with WesternGeco's Interactive Velocity Processing (IVP). The first pass velocities described in step 5.29. were used as the central function.

Number of MVF panels	13
Panel separation	3%
Stack traces per MVF	15
IVP displays	Gathers, MVF's, semblances, stacks, horizons
Horizon information	8 interpreted horizons provided by BHPBP

The targeted PSTM velocities were picked by WesternGeco and qc'd by BHPBP.

5.44. NORMAL MOVEOUT

Normal moveout corrections were applied using the first pass velocity field.

5.45. 3D F-X DOMAIN TRACE INTERPOLATION

Prestack regularization using full 3D f-x domain sinc interpolation was applied. Interpolation was run in the common offset domain, and one trace per offset per bin was output, resulting in a nominal CDP fold of 62. Grid cells with missing traces have traces interpolated, and those with redundant traces (more than one trace in a cell) have non-optimum traces deleted until the trace count in the cell is one. The following parameters were used for production.

Interpolation type	3D f-x domain sinc interpolation
Maximum interp distance	21 traces in primary and secondary directions
Dip scans	21 from –1.0 to +1.0 ms/tr
Grid size	Inline spacing: 25.0m Crossline spacing: 12.5m

5.46. INVERSE APPARENT ANISOTROPIC MOVEOUT

Extended moveout corrections were removed using the first pass velocity field in preparation for subsequent pre stack time migration.

5.47. DATA INTEGRITY QC.

Selected inlines and crosslines from each offset volume were output for display.

5.48. NORMAL MOVEOUT

Normal moveout corrections were applied using the first pass velocity field.

5.49. INVERSE Q COMPENSATION

A Q filter correction was applied to compensate for earth attenuation using the following parameters.

Q value	110 (constant)
Reference frequency	750Hz
Application mode	Phase only
Timing	Q estimation windows tied to water bottom

5.50. INVERSE NORMAL MOVEOUT

Normal moveout corrections were removed using the first pass velocity field.

5.51. DATA INTEGRITY QC.

Selected inlines and crosslines from each offset volume were output for display.

5.52. PRE STACK TIME MIGRATION

The PSTM program accounts for geometric spreading, which was consequently removed before running production PSTM. A time variant pre filter was also applied to the data to reduce the possibility of migration aliasing. The following parameters were utilized.

Time variant pre-filter for PSTM

Time (ms)	Frequency (Hz)	Slope (dB/oct)
0	95	72
1000	85	72
2000	75	72
3000	65	72
4000	55	72
5000	45	72

Kirchhoff migration parameters

<table>
<tr><td rowspan="5">Input Vel smoothing</td><td>Time (ms)</td><td>Radius (m)</td></tr>
<tr><td>0</td><td>1000</td></tr>
<tr><td>1000</td><td>1000</td></tr>
<tr><td>3000</td><td>2000</td></tr>
<tr><td>5000</td><td>4000</td></tr>
<tr><td rowspan="3">Input Vel percentage</td><td>Time (ms)</td><td>Percentage</td></tr>
<tr><td>0</td><td>100</td></tr>
<tr><td>5000</td><td>100</td></tr>
<tr><td>Implementation</td><td colspan="2">Curved ray algorithm</td></tr>
<tr><td>Half aperture</td><td colspan="2">4000 m</td></tr>
<tr><td>Dip limits</td><td colspan="2">60 degrees</td></tr>
</table>

5.53. INVERSE NORMAL MOVEOUT

Normal moveout corrections (applied as part of the PSTM process) were removed using the targeted migration velocity field.

5.54. EXPONENTIAL GAIN

An exponential gain of 3dB per second to a maximum time of 4 seconds below the water bottom time was applied to the data.

5.55. THIRD PASS VELOCITY ANALYSES.

Processing applied after PSTM but before velocity generation (for velocity analyses only) included minimum to zero phase conversion (as in step 5.64), and polarity reversal. Velocity analyses were run on a 500m x 500m grid using the following parameters.
All velocity analysis were performed with WesternGeco's Interactive Velocity Processing (IVP). The targeted migration velocities described in step 5.43. were used as the central function.

Number of MVF panels	13
Panel separation	1.5%
Stack traces per MVF	15
IVP displays	Gathers, MVF's, semblances, stacks, horizons
Horizon information	18 interpreted horizons provided by BHPBP

The final pass of velocities were picked by WesternGeco and BHPBP. Final qc was performed by BHPBP.

5.56. X-T DOMAIN DECONVOLUTION

X-T domain gapped deconvolution targeting the water bottom multiple was applied to remove any remaining reverberations from the data. The following parameters were utilized.

Sample rate	subsampled to 2ms for decon analysis
Removable AGC	120ms for deconvolution operator design
Decon Windows	2 windows; 2000ms length, 25% overlap
Trace averaging	21 trace mix on acorrs prior to oper design
Decon Gap Length	Autocorrelation multiple period minus 30ms
Decon Active Operator Length	Autocorrelation multiple period plus 30ms
White noise	2%
Application	From 0-5000ms

5.57. SORT

Data was sorted from common offset to common cdp domain for subsequent processing.

5.58. NORMAL MOVEOUT

Normal moveout corrections were applied using the final velocity field.

5.59. PRE-STACK MUTE

The mute pattern was designed as follows and applied based on a waterbottom time.

Outer Trace Mute		
Water Bottom (ms)	**Offset (m)**	**Time (ms)**
100	350	115
	351	350
	670	650
	1350	1400
	2850	3150
	4420	4000
2100	350	615
	351	850
	670	1650
	1350	2400
	2850	4150
	4420	5000

Inner Trace Mute		
Water Bottom (ms)	**Offset (m)**	**Time (ms)**
100	195	1365
	880	2200
	920	5000
2100	195	2365
	880	4200
	920	5000

5.60. STACK

NMO corrected, scaled and muted data was stacked to produce final raw migrated stacks.

Nominal fold:	62
Normalisation:	1/N

5.61. SOURCE AND STREAMER DEPTH CORRECTION

A bulk static shift was applied to correct for gun depth and streamer depth.

Bulk Static:	+10 ms

5.62. DISPLAY MUTE

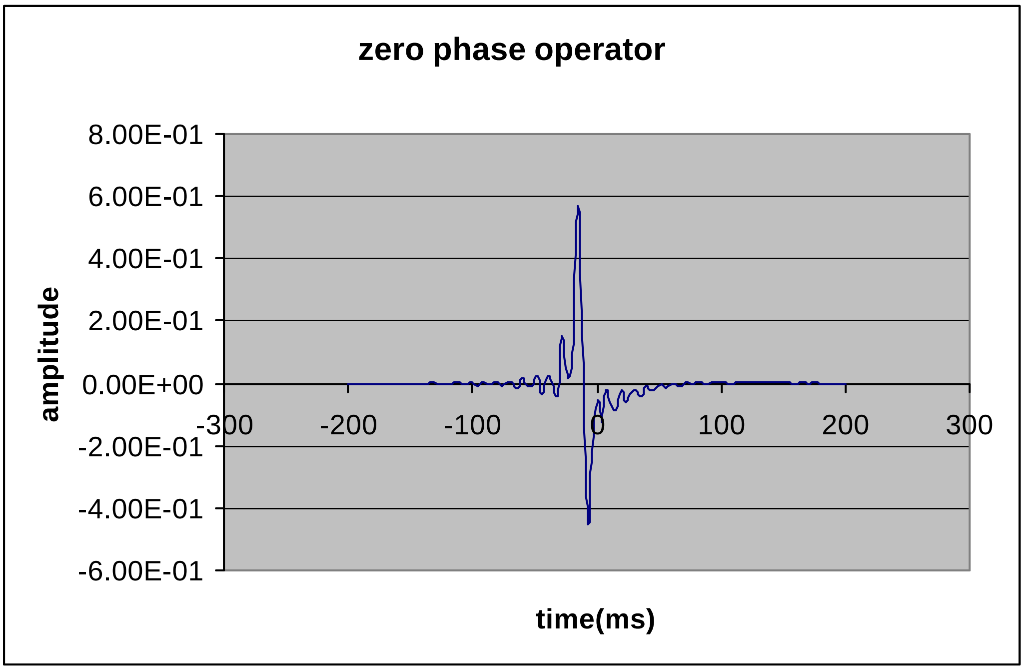
Surgical mute was applied to the stack data in order to clean up lead in and tail sections of lines. A waterbottom mute was also applied. Muting of the waterbottom utilized a delay time of 40ms and a taper of 20ms.

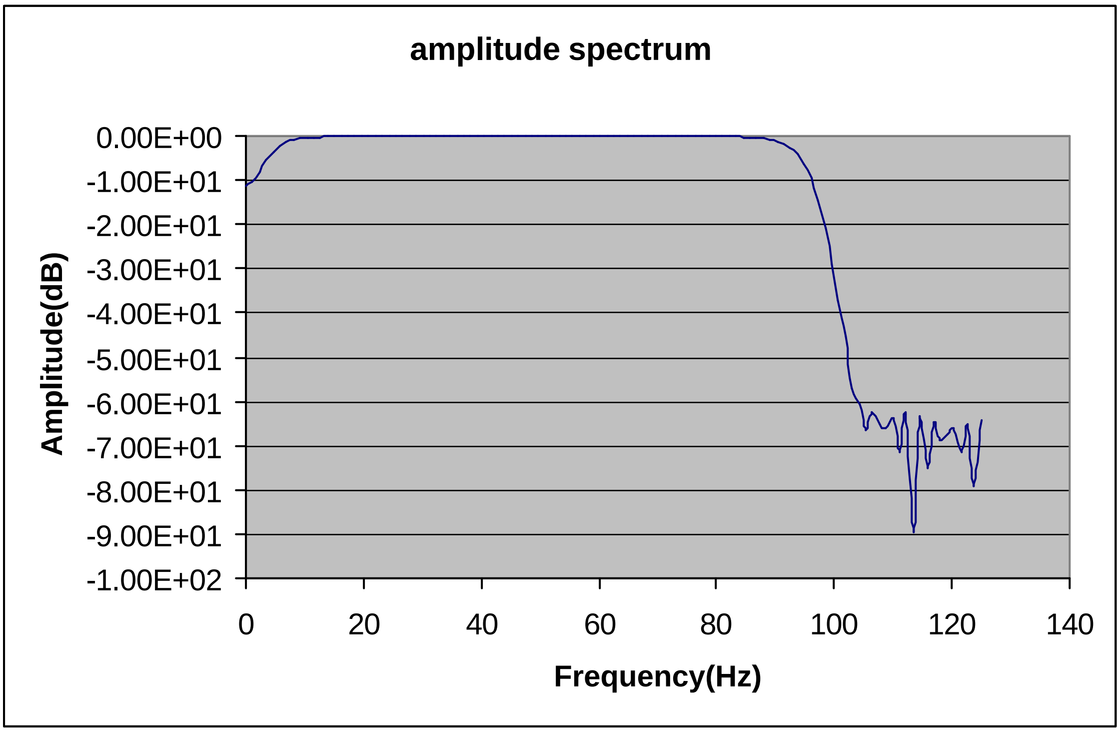
5.63. DATA INTEGRITY QC.

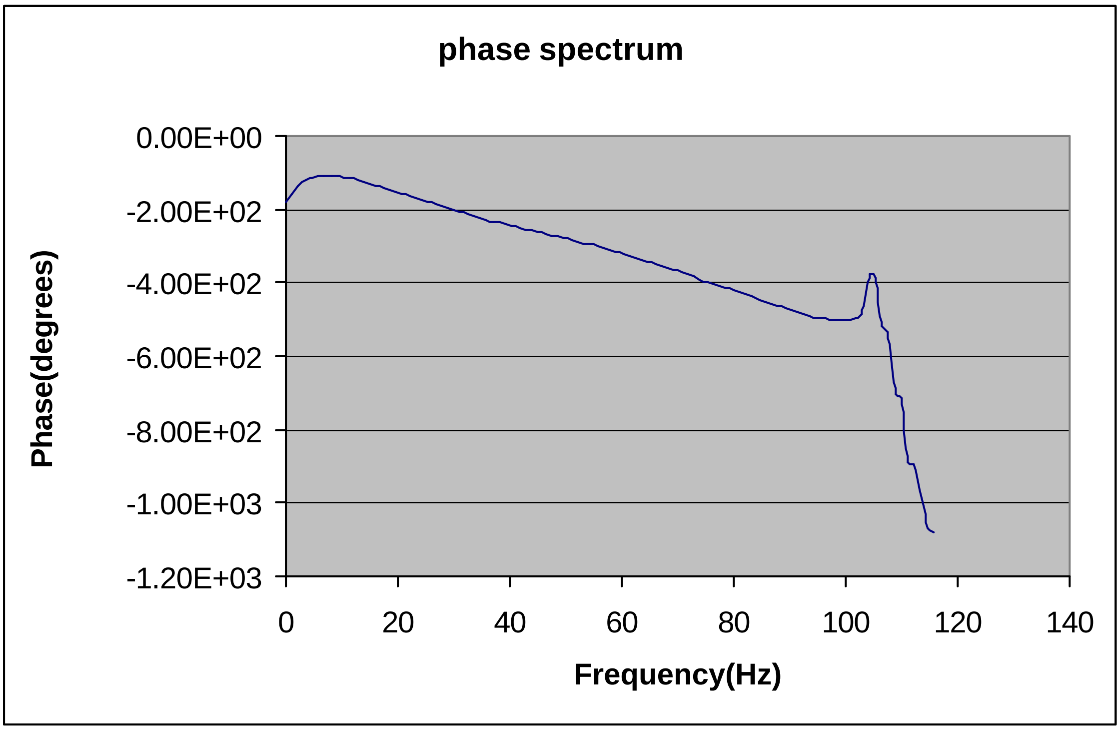
Selected inlines, crosslines and timeslices from the stack volume were output for display.

5.64. ZERO PHASE CONVERSION

The desired output for the data was a zero phase wavelet. To achieve this, an operator was designed to convert the ideal minimum phase wavelet described in section 5.8 from minimum to zero phase. The ideal minimum phase wavelet was resampled to 4ms before the conversion process. The output shaping operator was then used to convert the data to zero phase.







5.65. SPECTRAL WHITENING

Spectral whitening was applied to the data over 7 frequency bands and 7 time windows as follows. All frequency windows were waterbottom time dependent. Data was time shifted prior to spectral whitening (based on waterbottom time) such that after shifting the data the water bottom event was at a constant 100ms. The time shift was reversed after spectral whitening application.

T(ms)	Wndw	Freq (Hz)	Amp (dB)	Freq (Hz)	Amp (dB)	Freq (Hz)	Amp (dB)	Freq (Hz)	Amp (dB)
400	1	4	0.001	11	1.0	19	1.0	28	0.001
1200	1	4	0.001	10	1.0	17	1.0	25	0.001
2000	1	4	0.001	9	1.0	15	1.0	22	0.001
2800	1	4	0.001	8	1.0	13	1.0	19	0.001
3600	1	4	0.001	7	1.0	11	1.0	16	0.001
4400	1	4	0.001	6	1.0	9	1.0	13	0.001
5000	1	4	0.001	5	1.0	7	1.0	10	0.001
400	2	11	0.001	19	1.0	28	1.0	38	0.001
1200	2	10	0.001	17	1.0	25	1.0	34	0.001
2000	2	9	0.001	15	1.0	22	1.0	30	0.001
2800	2	8	0.001	13	1.0	19	1.0	26	0.001
3600	2	7	0.001	11	1.0	16	1.0	22	0.001
4400	2	6	0.001	9	1.0	13	1.0	18	0.001
5000	2	5	0.001	7	1.0	10	1.0	14	0.001
400	3	19	0.001	28	1.0	38	1.0	49	0.001
1200	3	17	0.001	25	1.0	34	1.0	44	0.001
2000	3	15	0.001	22	1.0	30	1.0	39	0.001
2800	3	13	0.001	19	1.0	26	1.0	34	0.001
3600	3	11	0.001	16	1.0	22	1.0	29	0.001
4400	3	9	0.001	13	1.0	18	1.0	24	0.001
5000	3	7	0.001	10	1.0	14	1.0	19	0.001
400	4	28	0.001	38	1.0	49	1.0	61	0.001
1200	4	25	0.001	34	1.0	44	1.0	55	0.001
2000	4	22	0.001	30	1.0	39	1.0	49	0.001
2800	4	19	0.001	26	1.0	34	1.0	43	0.001
3600	4	16	0.001	22	1.0	29	1.0	37	0.001
4400	4	13	0.001	18	1.0	24	1.0	31	0.001
5000	4	10	0.001	14	1.0	19	1.0	25	0.001
400	5	38	0.001	49	1.0	61	1.0	74	0.001
1200	5	34	0.001	44	1.0	55	1.0	67	0.001
2000	5	30	0.001	39	1.0	49	1.0	60	0.001
2800	5	26	0.001	34	1.0	43	1.0	53	0.001
3600	5	22	0.001	29	1.0	37	1.0	46	0.001
4400	5	18	0.001	24	1.0	31	1.0	39	0.001
5000	5	14	0.001	19	1.0	25	1.0	32	0.001
400	6	49	0.001	61	1.0	74	1.0	88	0.001
1200	6	44	0.001	55	1.0	67	1.0	80	0.001
2000	6	39	0.001	49	1.0	60	1.0	72	0.001
2800	6	34	0.001	43	1.0	53	1.0	64	0.001

3600	6	29	0.001	37	1.0	46	1.0	56	0.001
4400	6	24	0.001	31	1.0	39	1.0	48	0.001
5000	6	19	0.001	25	1.0	32	1.0	40	0.001
400	7	61	0.001	74	1.0	88	1.0	103	0.001
1200	7	55	0.001	67	1.0	80	1.0	94	0.001
2000	7	49	0.001	60	1.0	72	1.0	85	0.001
2800	7	43	0.001	53	1.0	64	1.0	76	0.001
3600	7	37	0.001	46	1.0	56	1.0	67	0.001
4400	7	31	0.001	39	1.0	48	1.0	58	0.001
5000	7	25	0.001	32	1.0	40	1.0	49	0.001

5.66. DATA INTEGRITY QC.

Selected inlines, crosslines and timeslices from the stack volume were output for display.

5.67. TIME VARIANT FILTER

The following zero phase time variant, waterbottom time dependent filter was applied. Data was time shifted prior to filtering (based on waterbottom time) such that after shifting the data the water bottom event was at a constant 100ms. The time shift was reversed after filter application.

Time(ms)	Low Cut(Hz)	Slope dB/oct)	High Cut(Hz)	Slope dB/oct)
0	12	36	80	72
1000	10	36	72	72
2000	9	36	64	72
3000	8	36	50	72
4000	7	36	35	72
5000	6	36	20	72

5.68. TIME VARIANT SCALING

The following waterbottom time dependent dual window AGC was applied. Data was time shifted prior to scaling (based on waterbottom time) such that after shifting the data the water bottom event was at a constant 100ms. The time shift was reversed after scalar application.

Window (ms)	Contribution
400	30%
2000	70%

Time variant scaling was the final processing step for production data. The steps below detail the fast track processing flow outlined at step 5.29.

ANGLE STACK FLOW: (continuation from step 5.58)

5.69. AVO ANGLE MUTE

AVO incidence angle mute patterns for angle ranges of 4-16 degrees, 16-28 degrees and 28-40 degrees were generated and cdp gathers output. The velocity used for angle mute generation was a spatially and temporally smoothed version of the final stacking velocity. Smoothing was performed as follows:

Spatial Vel smoothing	Time (ms)	Radius (m)
	0	1000
	1000	1000
	3000	2000
	5000	4000
Temporal Vel smoothing	200ms temporal running average	

5.70. ANGLE STACK

NMO corrected, scaled and angle muted data was stacked to produce final raw migrated angle stacks (three stack cubes generated).

Nominal fold:	62
Normalisation:	1/N

5.71. SOURCE AND STREAMER DEPTH CORRECTION

A bulk static shift was applied to correct for gun depth and streamer depth.

Bulk Static:	+10 ms

5.72. DISPLAY MUTE

Surgical mute was applied to the stack data in order to clean up lead in and tail sections of lines. A waterbottom mute was also applied. Muting of the waterbottom utilized a delay time of 40ms and a taper of 20ms.

5.73. DATA INTEGRITY QC.

Selected inlines, crosslines and timeslices from the stack volume were output for display.

5.74. ZERO PHASE CONVERSION

The desired output for the data was a zero phase wavelet. To achieve this, an operator was designed to convert the ideal minimum phase wavelet described in section 5.8 from minimum to zero phase. The ideal minimum phase wavelet was resampled to 4ms before the conversion process. The output shaping operator was then used to convert the data to zero phase.

FAST TRACK FLOW: (continuation from step 5.29)

5.75. WATERBOTTOM INTERPRETATION TRACE HEADER MERGE

Revised waterbottom times were loaded into trace headers Waterbottom values are smoothed, P1/90 navigation values above 200ms (using an 800m diameter smoothing function). Values below 200ms are derived from digitizing water bottom profiles on NMO corrected near trace gathers. The final waterbottom interpretation was provided by BHPBP.

5.76. SORT

Data was sorted from common shot to common cdp domain for subsequent processing.

5.77. APPARENT ANISOTROPIC MOVEOUT

Extended moveout corrections were applied using the first pass velocity field.

5.78. SWELL NOISE ATTENUATION (SWATT)

A fourth pass of SWATT was applied in the cmp domain (on AAMO corrected data) as follows:

Frequency Bands	2-10Hz		
Band increment	2Hz		
Analysis window length	1000ms		
Window overlap	20%		
Window start	Offset dependent, relative to wbtime		
Threshold	400% from 0-6144ms		
Analysis Zone	Wbtime(ms)	Offset(m)	Window(ms)
	100	175.0	0-6144
		4762.5	1500-6144
	500	175.0	300-6144
		4762.5	1800-6144
	1000	175.0	700-6144
		4762.5	2200-6144

5.79. INVERSE NORMAL MOVEOUT

Normal moveout corrections were removed using the first pass velocity field. Extended order moveout terms from anisotropic moveout application remain on the data.

5.80. DATA INTEGRITY QC.

A QC attribute plot representing amplitudes for every shot and trace recorded was used to identify bad traces (RMS trace strength versus shotpoint/trace number plot). QC attribute displays were generated for every line, as acquisition of a significant percentage of data was acquired in marginal conditions and careful manual qc of attribute displays was required.

5.81. X-T DOMAIN DECONVOLUTION

X-T domain gapped deconvolution targeting the water bottom multiple was applied to remove reverberations from the data. The following parameters were utilized.

Removable AGC	120ms for deconvolution operator design
Decon Windows	2 windows; 2000ms length, 25% overlap
Decon Gap Length	Autocorrelation multiple period minus 40ms
Decon Active Operator Length	Autocorrelation multiple period plus 80ms
White noise	0.1%
Application	From 0-6144ms

5.82. DATA INTEGRITY QC.

A Selected sub-surface line from each sailline (rotating gun/cable combinations) was processed through to stack, and output to display and to a segy dataset for transmission to BHPBP.

5.83. NORMAL MOVEOUT

Normal moveout corrections were applied using the first pass velocity field scaled by the following time variant scaling factors.

Time (ms)	Velocity Scaling (%)
0	100
200	100
300	96
500	94

1000	92
2000	90
3000	88
6144	88

5.84. F-K MULTIPLE ATTENUATION

Multiple attenuation was applied using an F-K demultiple algorithm as follows.

Dip range	Passing zero and negative dips
interleaving	3 CDPs.
Removable AGC	120ms windows
Application zone	Wbtime+100ms to 6144ms
Taper zone	Wbtime+100ms (0%) to wbtime+120ms(100%)

5.85. INVERSE NORMAL MOVEOUT

Normal moveout corrections were removed using the first pass scaled velocity field as described in step 5.77.

5.86. DATA INTEGRITY QC.

Selected CDPs on each sailline were output for display.

A Selected sub-surface line from each sailline (rotating gun/cable combinations) was processed through to stack, and output to display and to a segy dataset for transmission to BHPBP.

5.87. DMO VELOCITY ANALYSES.

Velocity lines were processed through zero azimuth dip moveout prior to DMO velocity analyses. Velocity analyses were then run on a 1000m x 800m grid using the following parameters. All velocity analysis were performed with WesternGeco's Interactive Velocity Processing (IVP). The first pass velocities described in step 5.29 were used as the central function.

Number of MVF panels	13
Panel separation	3%
Stack traces per MVF	15
IVP displays	Gathers, MVF's, semblances, stacks, horizons
Horizon information	8 interpreted horizons provided by BHPBP

The velocities were picked by WesternGeco and BHPBP. Final qc was performed by BHPBP.

5.88. 3D BINNING

Nominal bin size was 25.0 m (spacing between adjacent inlines) x 12.5 m (cmp spacing in the crossline direction). Duplicated trace offsets within a particular cell were discarded (i.e. the trace with its perpendicular offset nearest to the cell centre was retained). A rectangular bin was used in the flex binning process to maintain the nominal 62 fold multiplicity.

The following offset varying bin expansion was used:

Offset (m)	Crossline Bin Size (m)	Inline Bin Size (m)
257	12.5	75
4832	12.5	150

5.89. NORMAL MOVEOUT

Normal moveout corrections were applied using the DMO velocity field.

5.90. PRE-STACK MUTE

The mute pattern was designed as follows and applied based on a waterbottom time.

Outer Trace Mute		
Water Bottom (ms)	**Offset (m)**	**Time (ms)**
100	500	115
	501	350
	820	650
	1650	1400
	3150	3150
	4720	4000
2100	500	615
	501	850
	820	1650
	1650	2400
	3150	4150
	4720	5000
Inner Trace Mute		
Water Bottom (ms)	**Offset (m)**	**Time (ms)**
100	195	1000
	1180	2200
	1220	6144
2100	195	2000
	1180	4200
	1220	6144

5.91. DMO STACK

NMO corrected, scaled and muted data was zero azimuth DMO stacked to produce a fast track raw stack volume. Zero azimuth DMO is a mode of application in which the aperture segment joining source and detector is rotated so that it coincides with the inline direction. It should generally be used only when azimuths are within a 10 degree range of the inline direction, but was considered adequate for the fast track data cube.

Mode	Zero azimuth DMO
Nominal fold:	62
Maximum dip:	80 degrees

5.92. DATA INTEGRITY QC.

Selected inlines, crosslines and timeslices from the stack volume were output for display.

5.93. SOURCE AND STREAMER DEPTH CORRECTION

A bulk static shift was applied to correct for gun depth and streamer depth.

Bulk Static:	+10 ms

5.94. DISPLAY MUTE

Surgical mute was applied to the stack data in order to clean up lead in and tail sections of lines. A waterbottom mute was also applied. Muting of the waterbottom utilized a delay time of 40ms and a taper of 20ms.

5.95. INVERSE Q COMPENSATION

A Q filter correction was applied to compensate for earth attenuation using the following parameters. Data was time shifted prior to Q application (based on waterbottom time) such that after shifting the data the water bottom event was at a constant 50ms. The time shift was reversed after Q application.

Q value	110 (constant)
Reference frequency	750Hz
Application mode	Phase only
Timing	Q estimation windows tied to water bottom

5.96. ZERO PHASE CONVERSION

The desired output for the data was a zero phase wavelet. To achieve this, an operator was designed to convert the ideal minimum phase wavelet from minimum to zero phase. This shaping operator was then used to convert the data. See section 5.64 for details of the zero phase conversion operator.

5.97. POST STACK TIME MIGRATION

Kirchhoff post stack time migration accounts for geometric spreading, which was consequently removed before running the migration. A time variant pre filter was also applied to the data to reduce the possibility of migration aliasing. As a targeted migration velocity field from the production flow was available at this stage of the project, it was used to migrate the fast track data. The following parameters were utilized.

Time variant pre-filter for PSTM

Time (ms)	Frequency (Hz)	Slope (dB/oct)
0	90	72
1000	80	72
2000	70	72
3000	60	72
4000	50	72
5000	40	72

Kirchhoff migration parameters

<table>
<tr><td rowspan="5">Input Vel smoothing</td><td>Time (ms)</td><td>Radius (m)</td></tr>
<tr><td>0</td><td>1000</td></tr>
<tr><td>1000</td><td>1000</td></tr>
<tr><td>3000</td><td>2000</td></tr>
<tr><td>5000</td><td>4000</td></tr>
<tr><td rowspan="3">Input Vel percentage</td><td>Time (ms)</td><td>Percentage</td></tr>
<tr><td>0</td><td>100</td></tr>
<tr><td>5000</td><td>100</td></tr>
<tr><td>Implementation</td><td colspan="2">Curved ray algorithm</td></tr>
<tr><td>Half aperture</td><td colspan="2">4000 m</td></tr>
<tr><td>Dip limits</td><td colspan="2">60 degrees</td></tr>
</table>

5.98. EXPONENTIAL GAIN

An exponential gain of 3dB per second to a maximum time of 4 seconds below the water bottom time was applied to the data.

5.99. DATA INTEGRITY QC.

Selected inlines, crosslines and timeslices from the migrated stack volume were output for display.

5.100.SPECTRAL WHITENING

Spectral whitening was applied to the data over 7 frequency bands and 7 time windows as follows. All frequency windows were waterbottom time dependent. Data was time shifted prior to spectral whitening (based on waterbottom time) such that after shifting the data the water bottom event was at a constant 100ms. The time shift was reversed after spectral whitening application.

T(ms)	Wndw	Freq (Hz)	Amp (dB)	Freq (Hz)	Amp (dB)	Freq (Hz)	Amp (dB)	Freq (Hz)	Amp (dB)
400	1	4	0.001	11	1.0	19	1.0	28	0.001
1200	1	4	0.001	10	1.0	17	1.0	25	0.001
2000	1	4	0.001	9	1.0	15	1.0	22	0.001
2800	1	4	0.001	8	1.0	13	1.0	19	0.001
3600	1	4	0.001	7	1.0	11	1.0	16	0.001
4400	1	4	0.001	6	1.0	9	1.0	13	0.001
5000	1	4	0.001	5	1.0	7	1.0	10	0.001
400	2	11	0.001	19	1.0	28	1.0	38	0.001
1200	2	10	0.001	17	1.0	25	1.0	34	0.001
2000	2	9	0.001	15	1.0	22	1.0	30	0.001
2800	2	8	0.001	13	1.0	19	1.0	26	0.001
3600	2	7	0.001	11	1.0	16	1.0	22	0.001
4400	2	6	0.001	9	1.0	13	1.0	18	0.001
5000	2	5	0.001	7	1.0	10	1.0	14	0.001
400	3	19	0.001	28	1.0	38	1.0	49	0.001
1200	3	17	0.001	25	1.0	34	1.0	44	0.001
2000	3	15	0.001	22	1.0	30	1.0	39	0.001
2800	3	13	0.001	19	1.0	26	1.0	34	0.001
3600	3	11	0.001	16	1.0	22	1.0	29	0.001
4400	3	9	0.001	13	1.0	18	1.0	24	0.001
5000	3	7	0.001	10	1.0	14	1.0	19	0.001
400	4	28	0.001	38	1.0	49	1.0	61	0.001
1200	4	25	0.001	34	1.0	44	1.0	55	0.001
2000	4	22	0.001	30	1.0	39	1.0	49	0.001
2800	4	19	0.001	26	1.0	34	1.0	43	0.001
3600	4	16	0.001	22	1.0	29	1.0	37	0.001
4400	4	13	0.001	18	1.0	24	1.0	31	0.001
5000	4	10	0.001	14	1.0	19	1.0	25	0.001
400	5	38	0.001	49	1.0	61	1.0	74	0.001
1200	5	34	0.001	44	1.0	55	1.0	67	0.001
2000	5	30	0.001	39	1.0	49	1.0	60	0.001
2800	5	26	0.001	34	1.0	43	1.0	53	0.001
3600	5	22	0.001	29	1.0	37	1.0	46	0.001
4400	5	18	0.001	24	1.0	31	1.0	39	0.001
5000	5	14	0.001	19	1.0	25	1.0	32	0.001

400	6	49	0.001	61	1.0	74	1.0	88	0.001
1200	6	44	0.001	55	1.0	67	1.0	80	0.001
2000	6	39	0.001	49	1.0	60	1.0	72	0.001
2800	6	34	0.001	43	1.0	53	1.0	64	0.001
3600	6	29	0.001	37	1.0	46	1.0	56	0.001
4400	6	24	0.001	31	1.0	39	1.0	48	0.001
5000	6	19	0.001	25	1.0	32	1.0	40	0.001
400	7	61	0.001	74	1.0	88	1.0	103	0.001
1200	7	55	0.001	67	1.0	80	1.0	94	0.001
2000	7	49	0.001	60	1.0	72	1.0	85	0.001
2800	7	43	0.001	53	1.0	64	1.0	76	0.001
3600	7	37	0.001	46	1.0	56	1.0	67	0.001
4400	7	31	0.001	39	1.0	48	1.0	58	0.001
5000	7	25	0.001	32	1.0	40	1.0	49	0.001

5.101.DATA INTEGRITY QC.

Selected inlines, crosslines and timeslices from the stack volume were selected and output for display.

5.102.TIME VARIANT FILTER

The following zero phase time variant, waterbottom time dependent filter was applied. Data was time shifted prior to filtering (based on waterbottom time) such that after shifting the data the water bottom event was at a constant 100ms. The time shift was reversed after filter application.

Time(ms)	Low Cut(Hz)	Slope dB/oct)	High Cut(Hz)	Slope dB/oct)
0	12	36	80	72
1000	10	36	72	72
2000	9	36	64	72
3000	8	36	50	72
4000	7	36	35	72
5000	6	36	20	72

5.103.TIME VARIANT SCALING

The following waterbottom time dependent dual window AGC was applied. Data was time shifted prior to scaling (based on waterbottom time) such that after shifting the data the water bottom event was at a constant 100ms. The time shift was reversed after scalar application.

Window (ms)	Contribution
400	30%
2000	70%

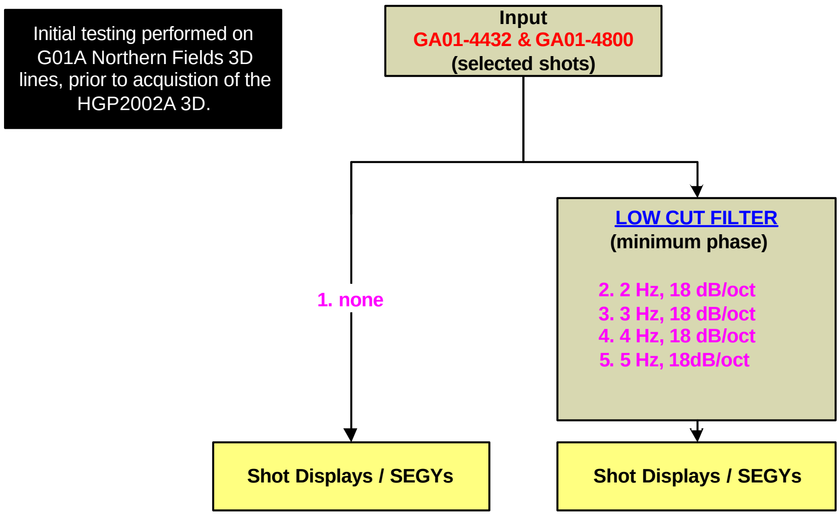
5.104.DATA INTEGRITY QC.

Selected inlines, crosslines and timeslices from the stack volume were selected and output for display.

6. PARAMETER TESTING

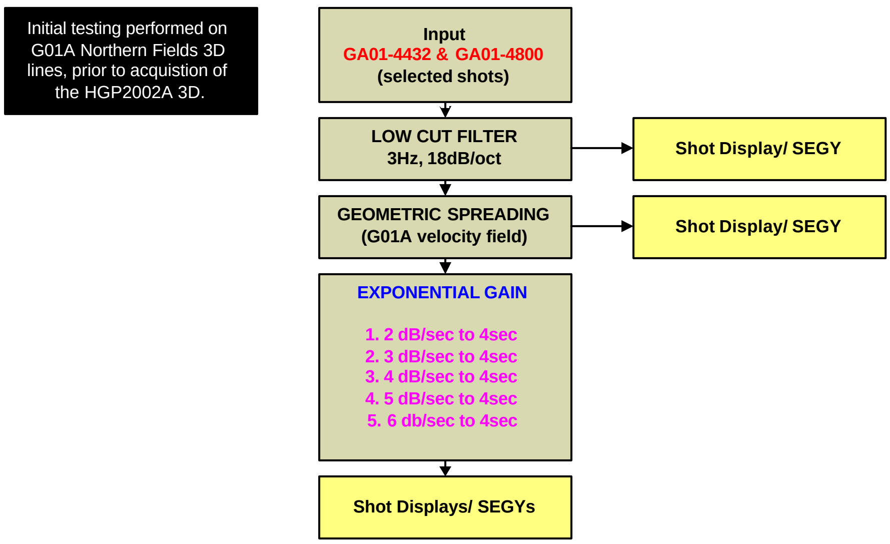
The majority of testing for this project was performed on G01A Northern Margins data at the initial stages as acquisition of the HGP2002A 3D had not yet commenced. Test flow for many of the processes tested were repeated on HGP2002A data when it became available.

6.1. LOW CUT FILTER



A low cut filter of 3Hz (18dB/octave) was chosen to be applied for production.

6.2. AMPLITUDE CORRECTION

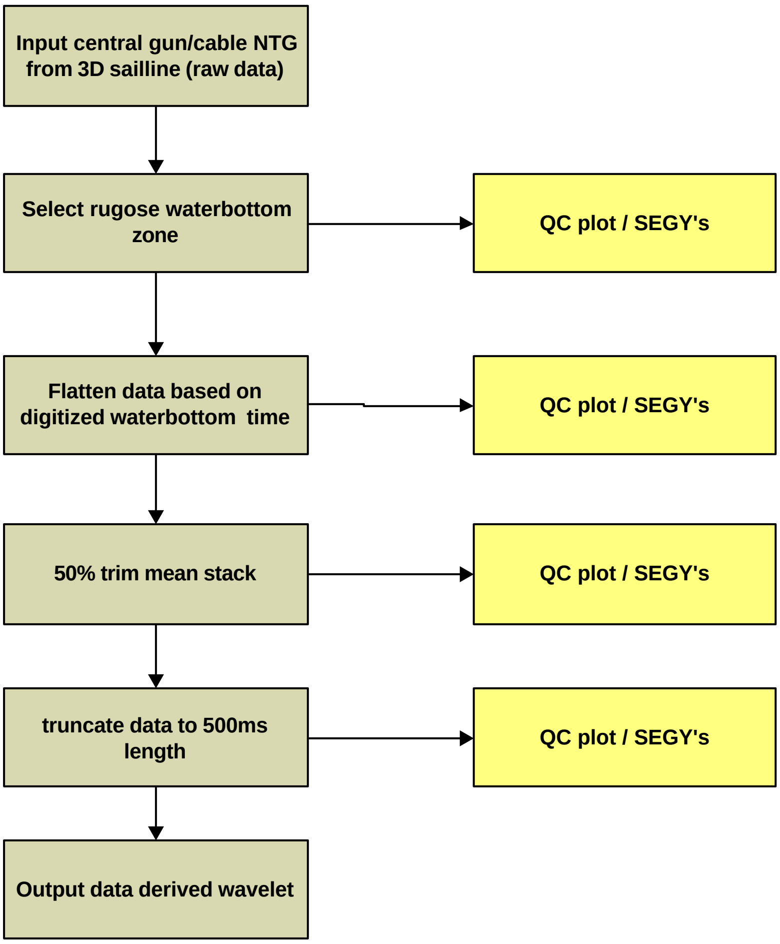


A 3dB/second exponential gain held constant after 6 seconds was selected for production.

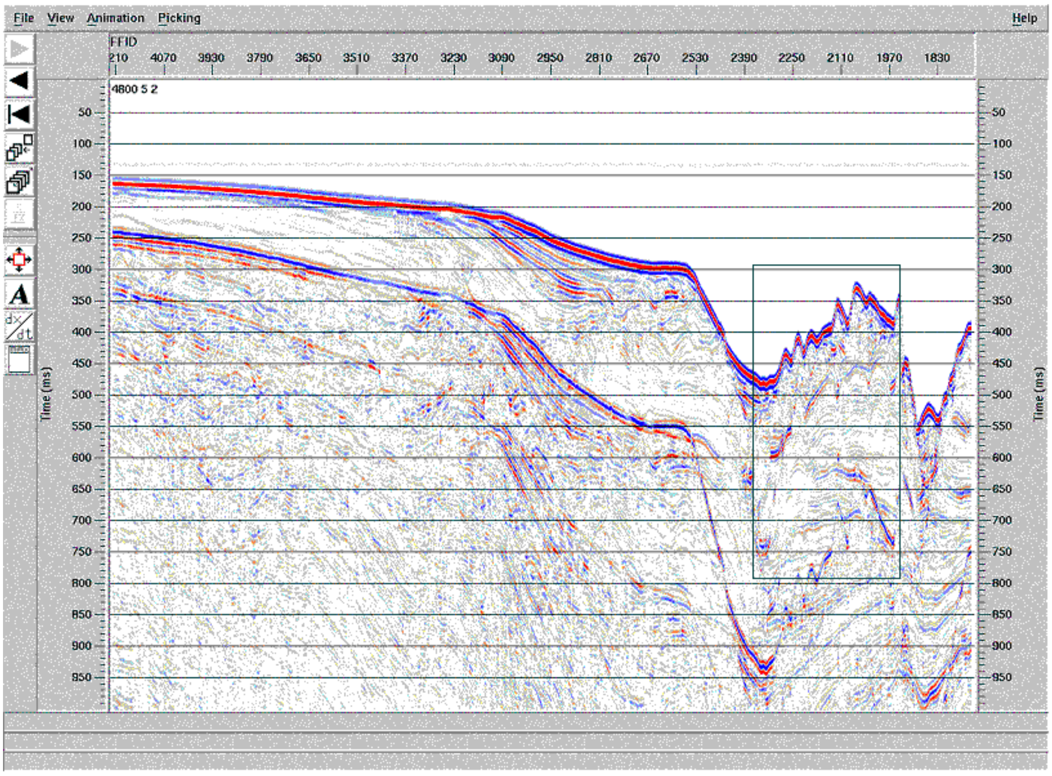
6.3. DETERMINISTIC WAVELET DESIGNATURE

The approach preferred by BHPBP for deriving a deterministic designature operator involved shaping an ideal minimum phase wavelet to a data derived signature wavelet. The data derived wavelet was generated by selecting a near trace gather exhibiting a rugose water bottom and highly variable water depths, applying a static correction to the data such that the water bottom was flat, and trim mean stacking the stack traces into a single trace. Due to the variable water depths, geologic events were destructively interfered with during stack, and only the embedded source wavelet (including ghosts and bubble) remained. Initial testing for this step was performed on Northern Margins data.

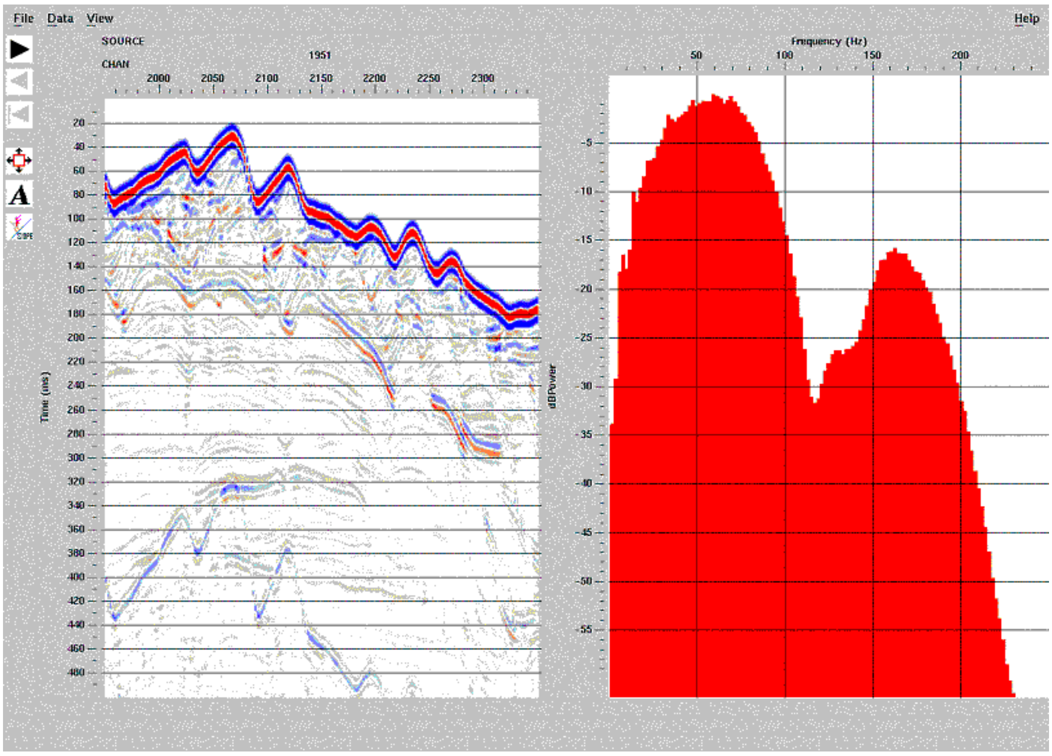
Data derived wavelet generation: processing flow



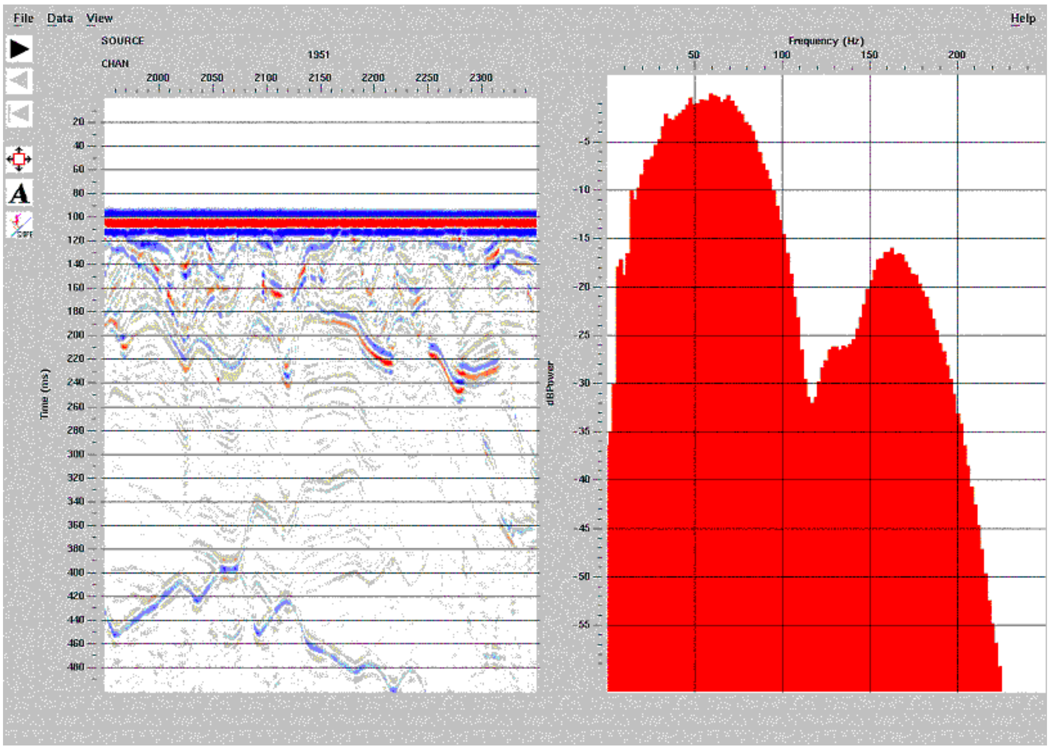
Data derived wavelet generation: select rugose waterbottom zone



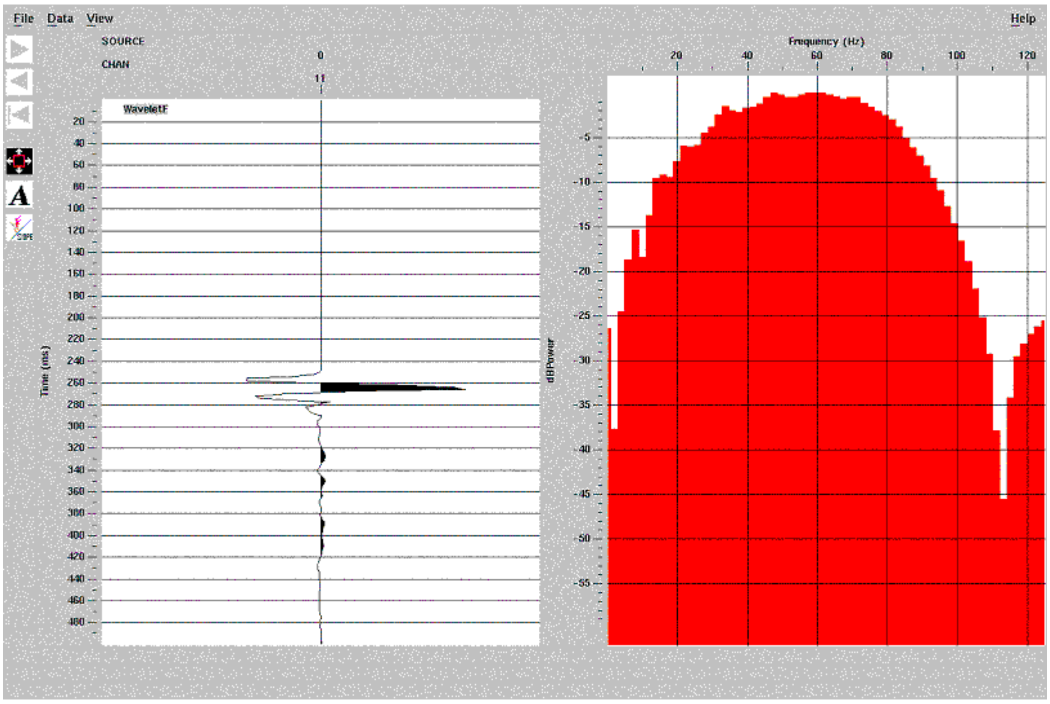
Data derived wavelet generation: select rugose waterbottom zone: amplitude spectrum



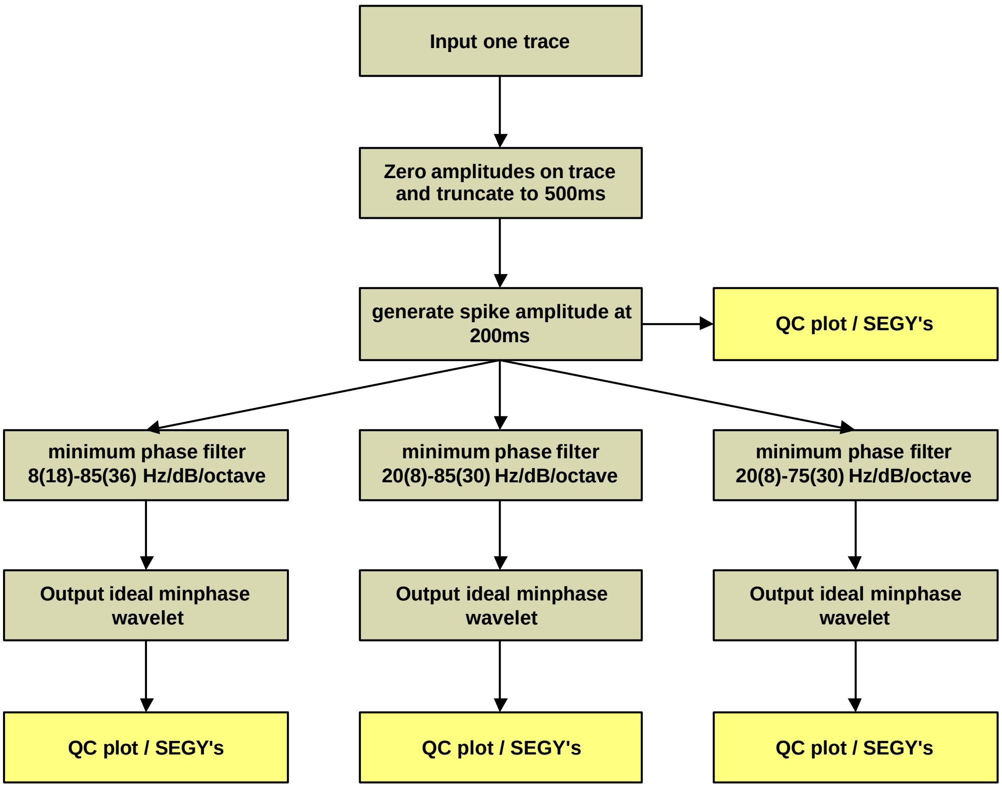
Data derived wavelet generation: flatten data at waterbottom: amplitude spectrum



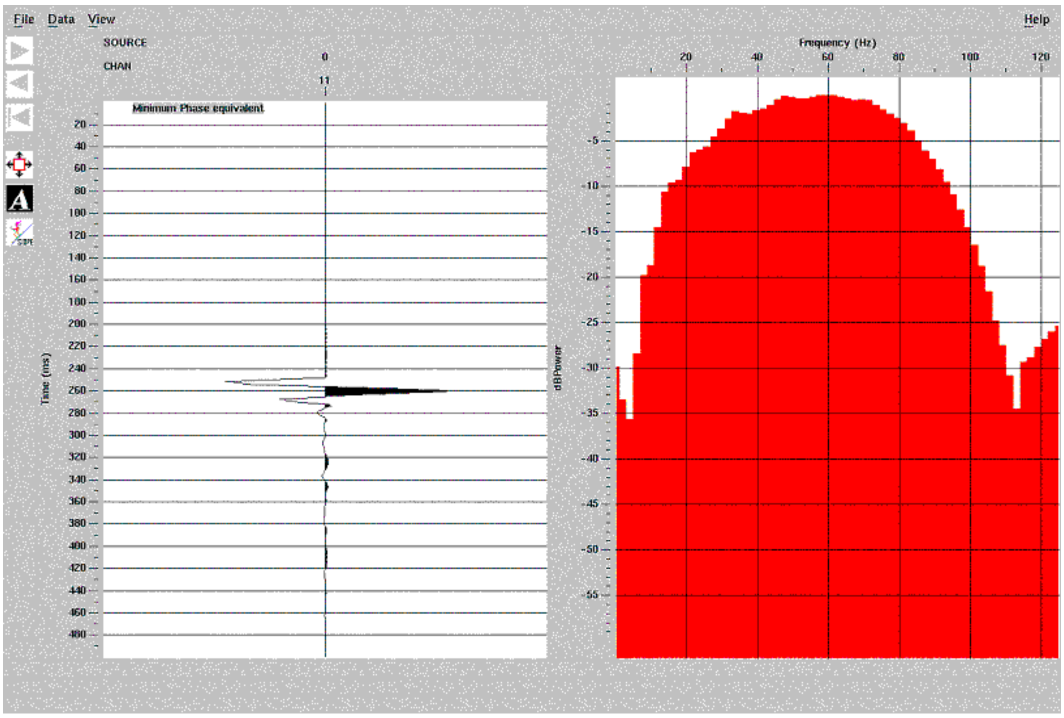
Data derived wavelet generation: wavelet after 50% trim mean stack: amplitude spectrum



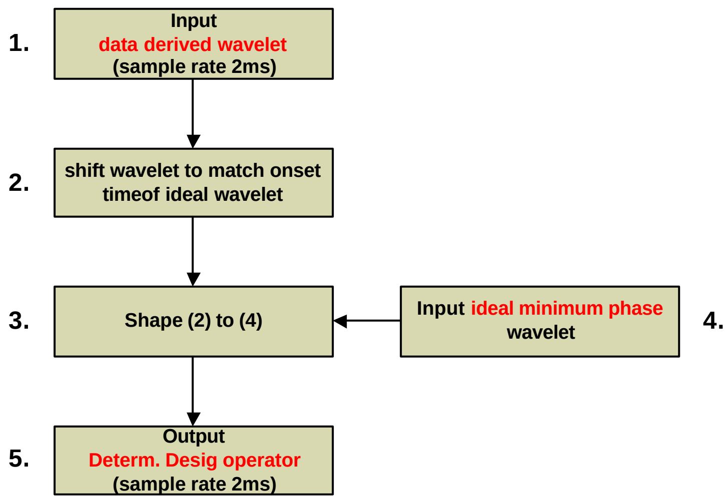
An ‘ideal’ minimum phase wavelet was generated from a mimimum phase filtered spike trace using a minimum phase bandpass filter. Various filter bandwidths were tested to best match the amplitude spectrum of the data derived wavelet.



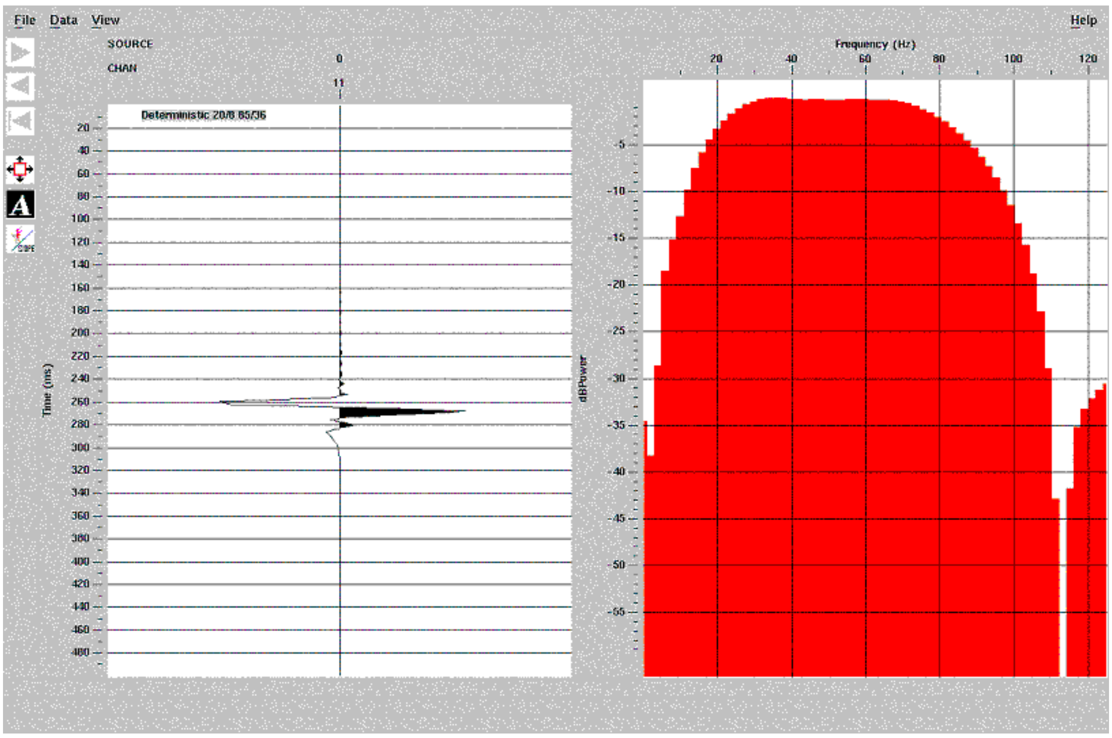
Ideal minimum phase wavelet generation: 20(8)-85(30) Hz/dB/octave: amplitude spectrum



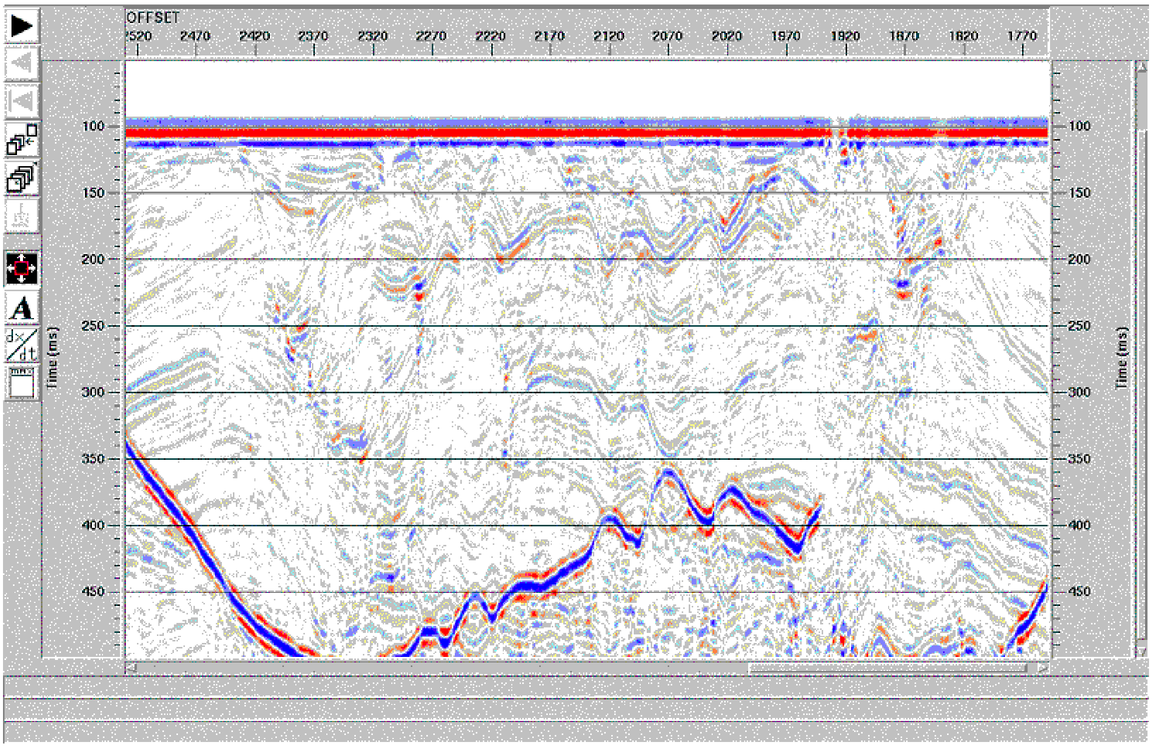
A deterministic designature operator was derived by shaping the data derived wavelet to the ideal minimum phase wavelet:



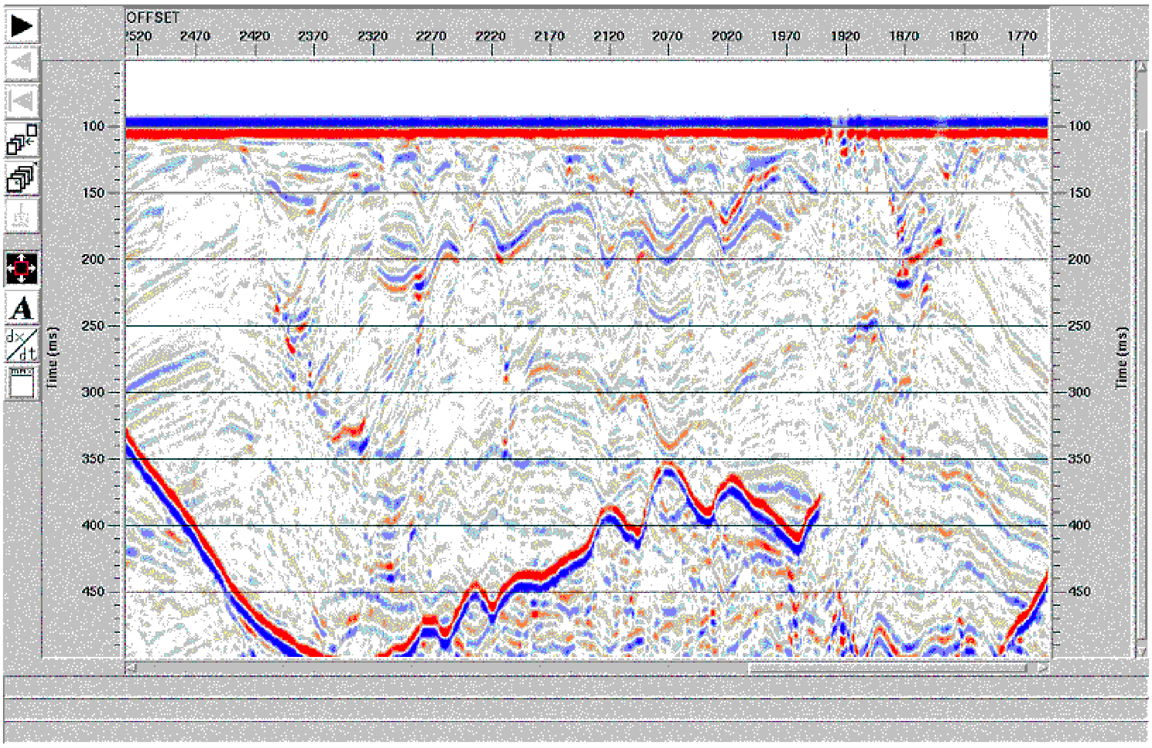
Shaping operator: 20(8)-85(30) Hz/dB/octave: amplitude spectrum



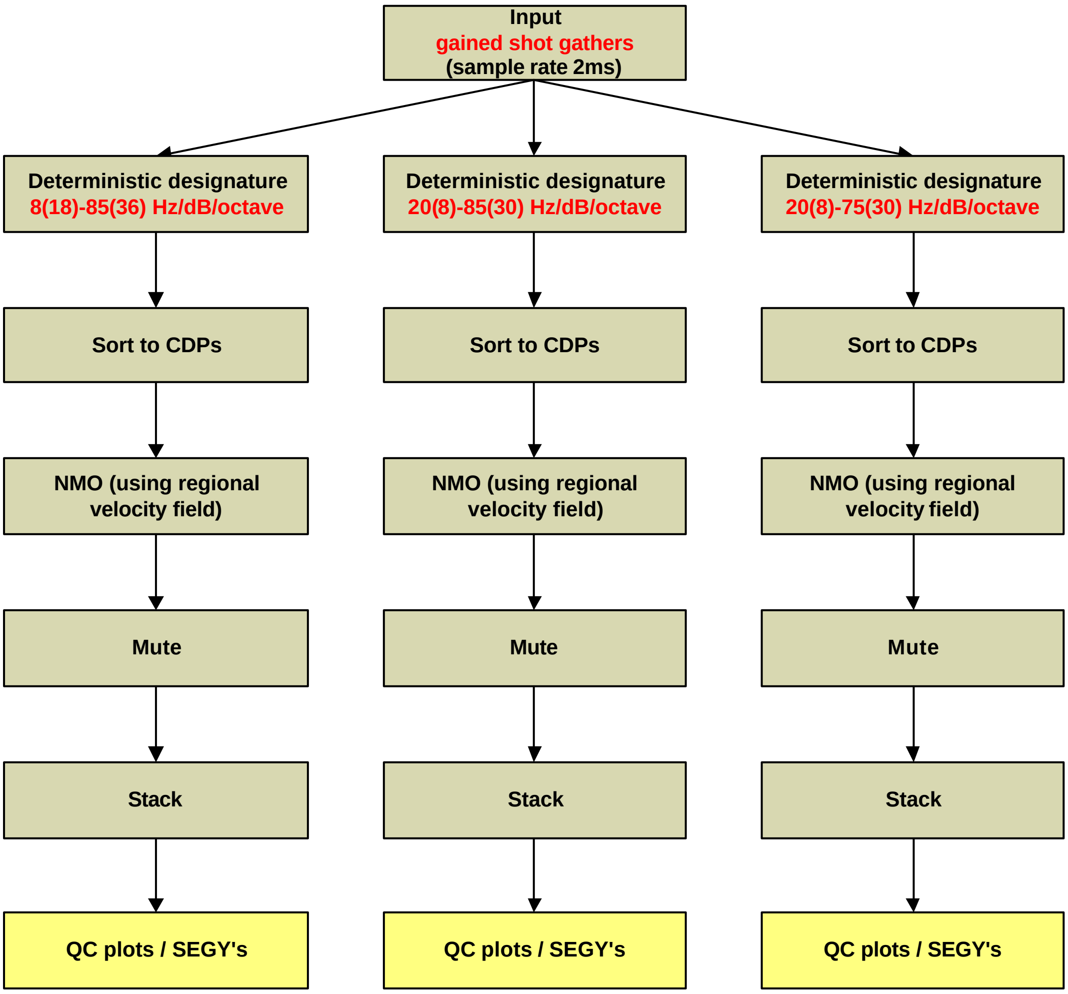
Near trace gather: flattened waterbottom before deterministic designature application.



Near trace gather: flattened waterbottom after deterministic designature application.



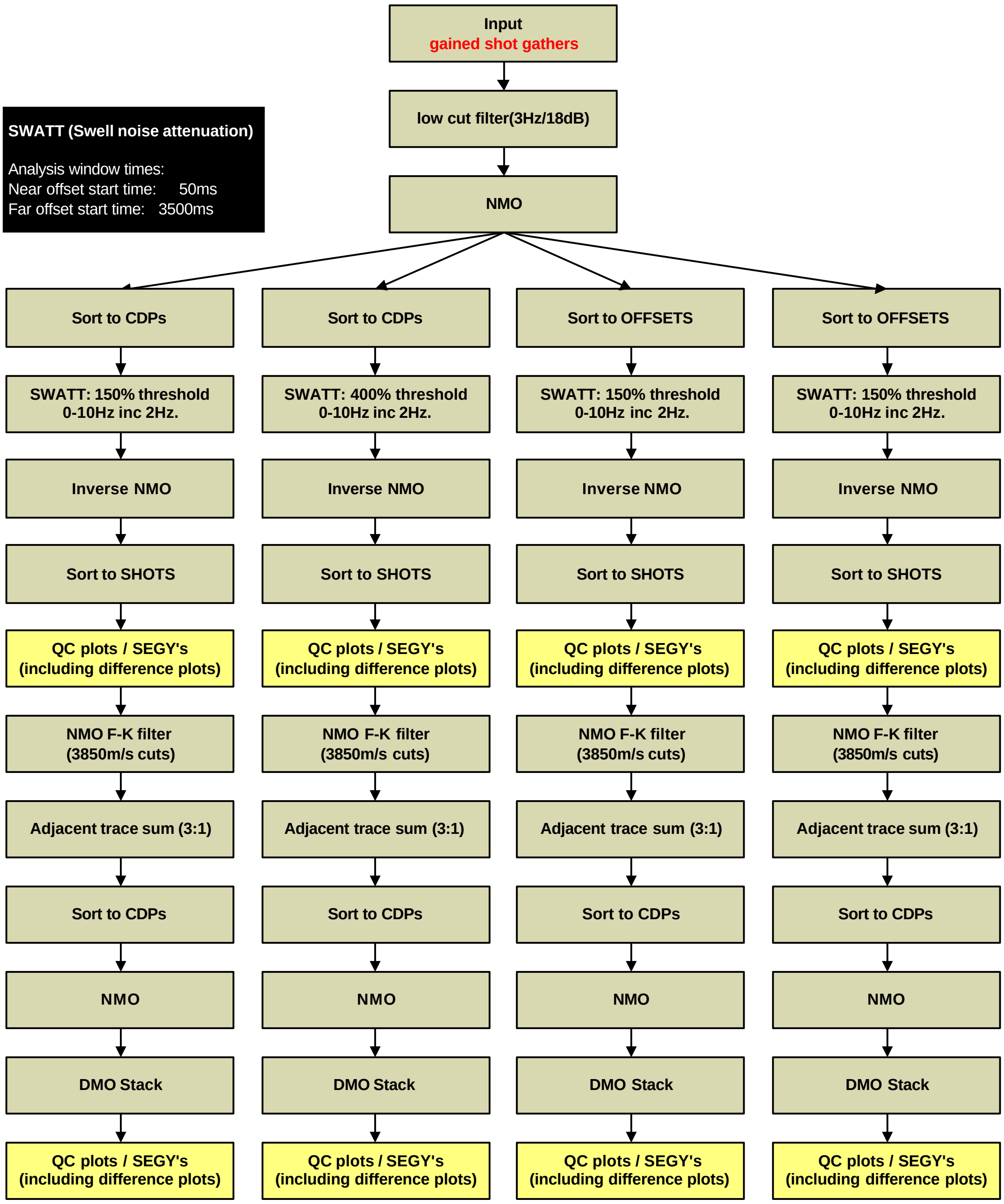
Stack sections before and after deterministic designature were generated for the testlines:



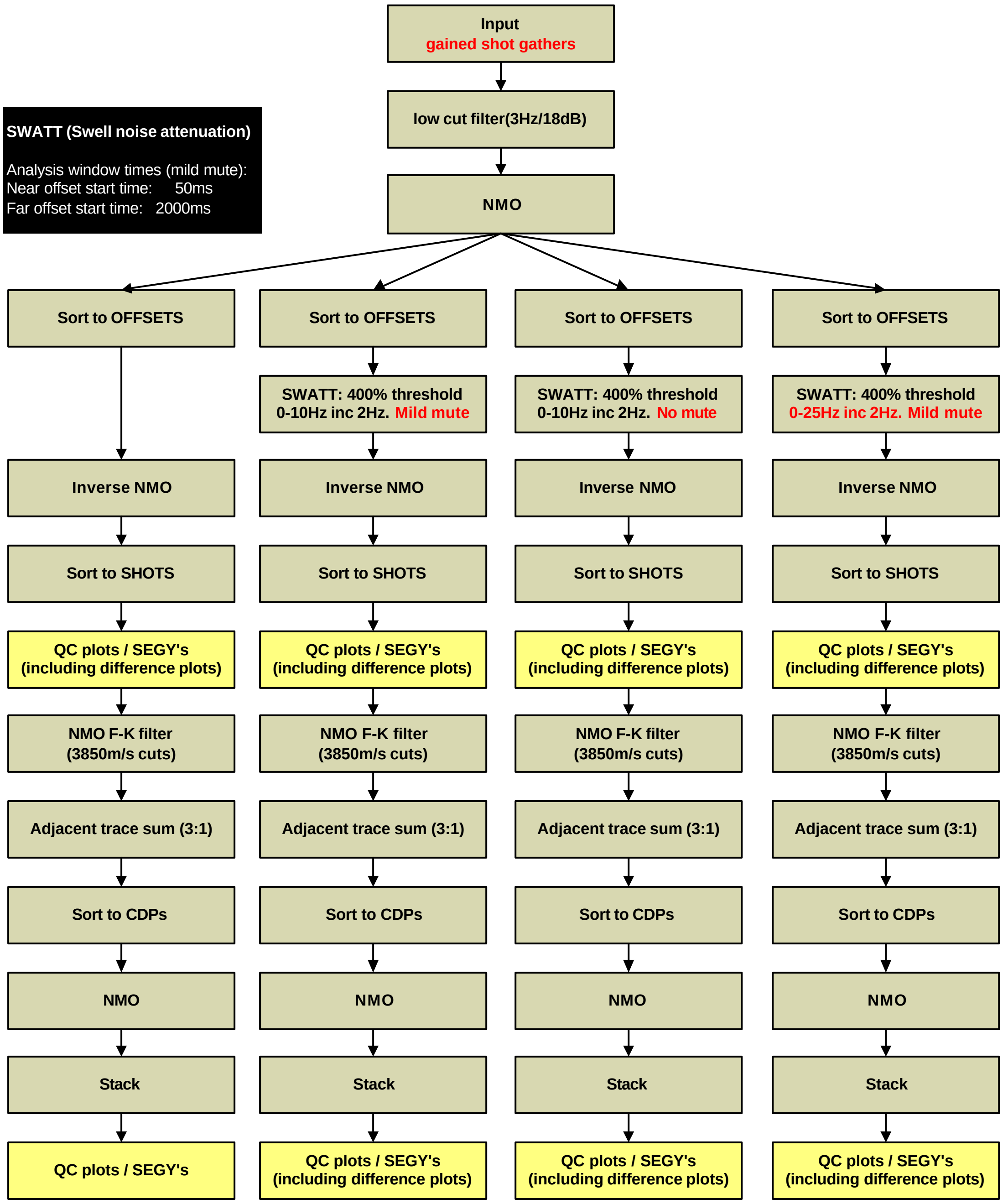
Application of deterministic designature was effective in removing the embedded source signature, with good removal of the ghosted events evident on stacks and near trace gathers prior to deterministic designature. Shaping the input wavelet to a minimum phase, 20(8)-85(30) Hz/dB/octave wavelet gave the best results on the G01A test data, however when tested on the HGP2002A data shaping to a minimum phase, 20(8)-75(30) Hz/dB/octave wavelet was preferable due to the different cable depth (7m instead of 8m). Shaping to this ideal wavelet was chosen for production.

6.4. SWELL NOISE ATTENUATION (SWATT)

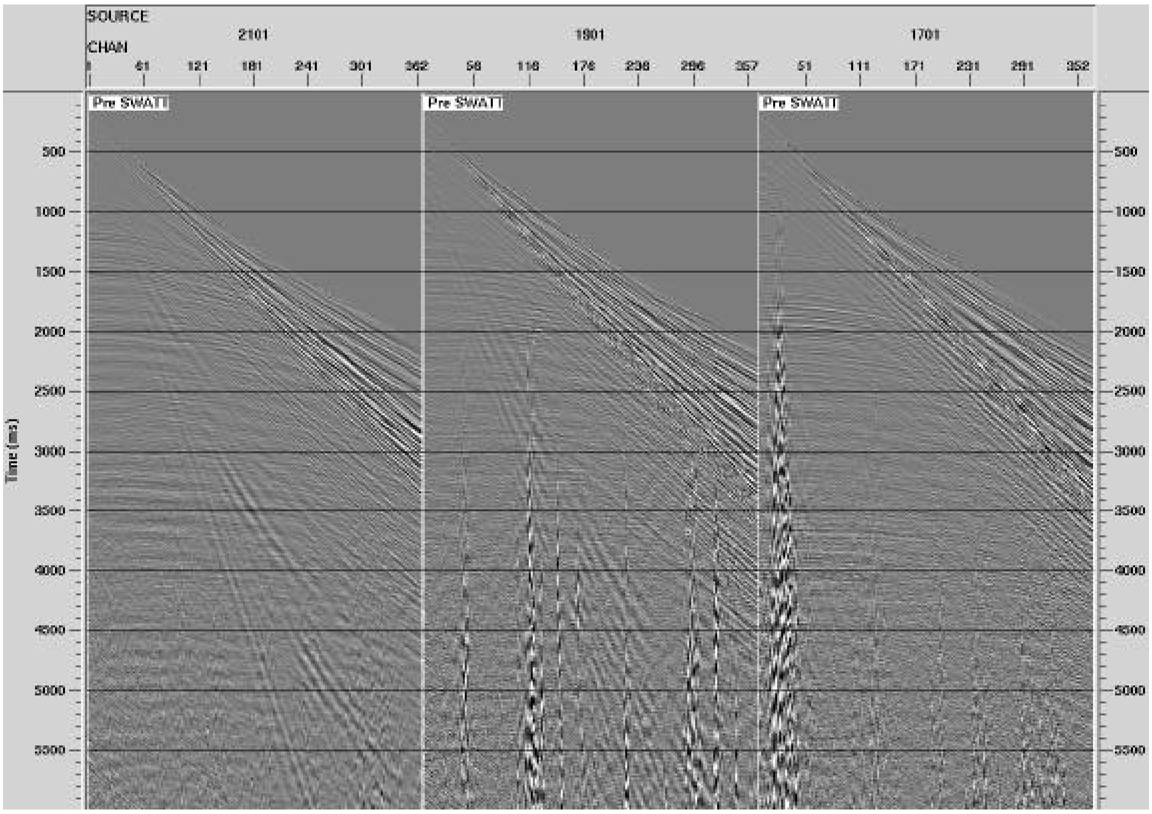
Initial tests were performed on Northern Margins data prior to acquisition of HGP2002A data. Various noise attenuation threshold values from 150% to 400% were tested (a threshold value of 400% results in attenuation of amplitudes greater than 4 times the window).
Final parameter selection was verified on HGP2002A data during the initial stages of acquisition.



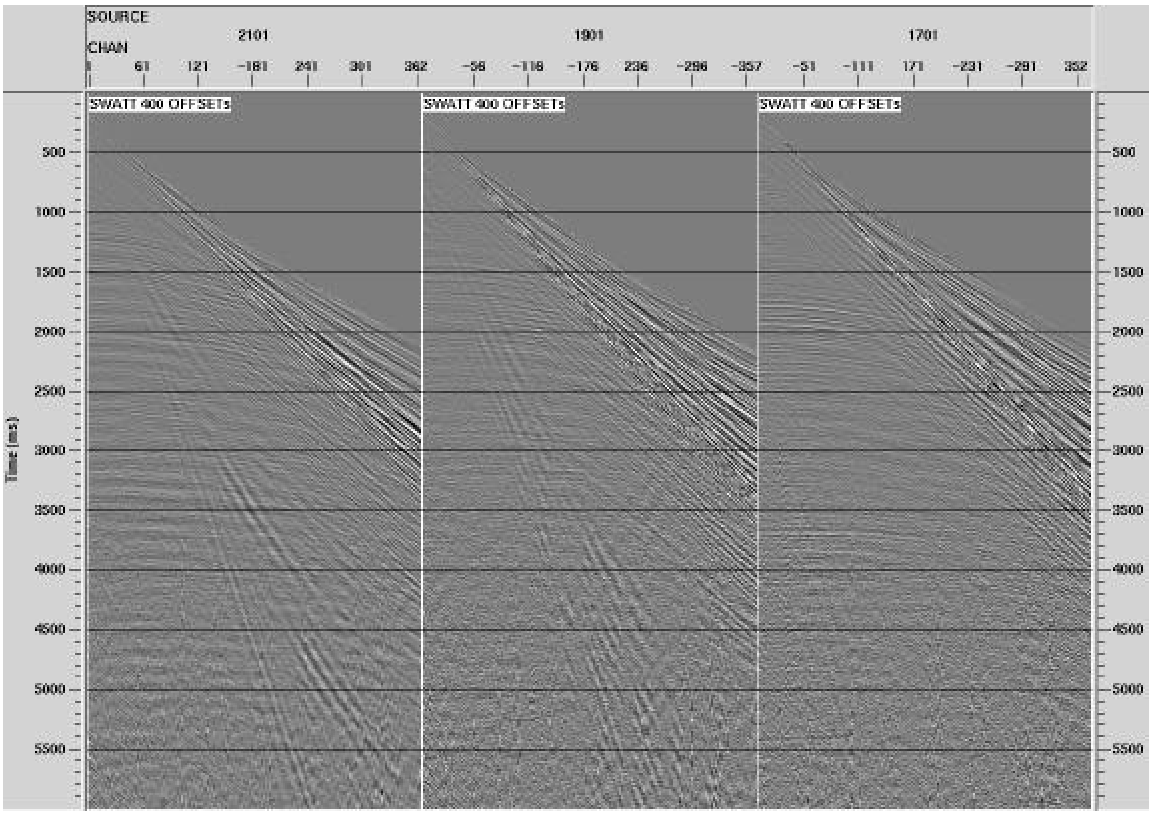
A wider analysis window (shallow window start times) was tested as a significant amount of noise was evident at far offsets in the mute zone. These tests were performed on data sorted to common offset order. A wider frequency band (0-25Hz incrementing by 2 Hz) was also tested.



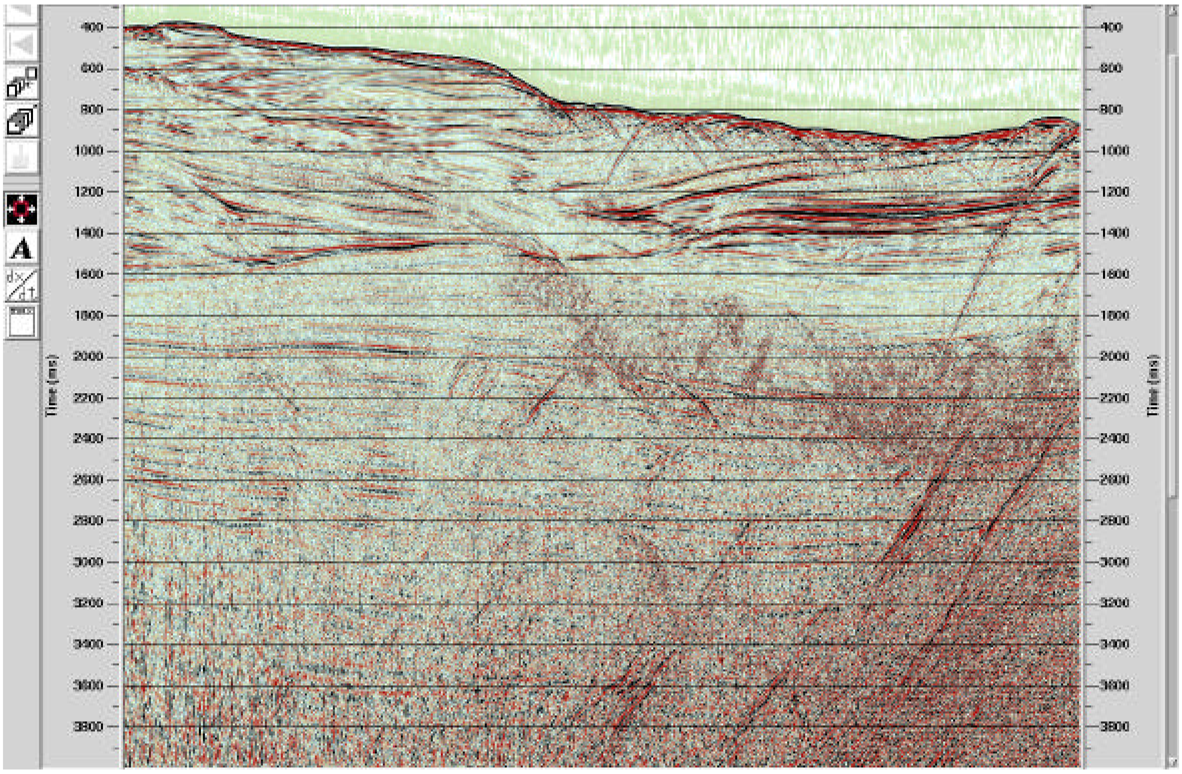
shot records: before SWATT application



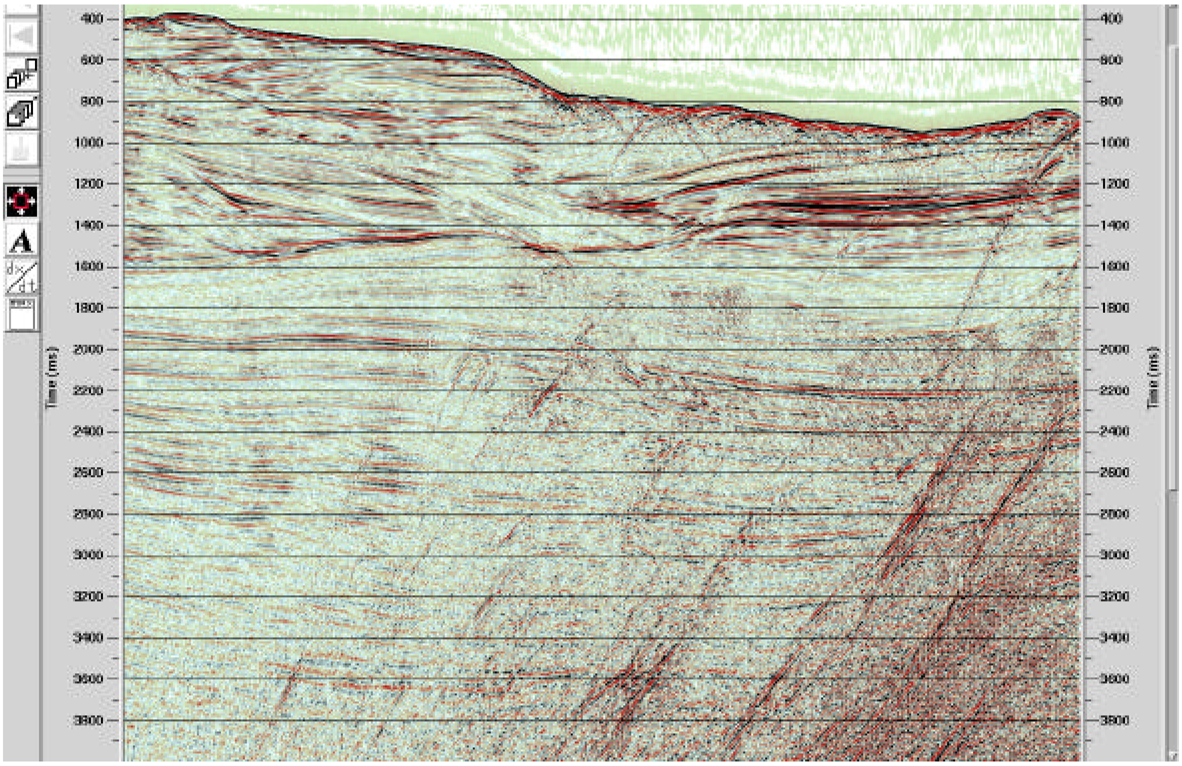
Shot records: after SWATT application in offset domain – 400% threshold, 0-10Hz inc 2Hz.



Stack: before SWATT application (on line HGP2002A-1088 sequence 011)



Stack: after production SWATT application (on line HGP2002A-1088 sequence 011)

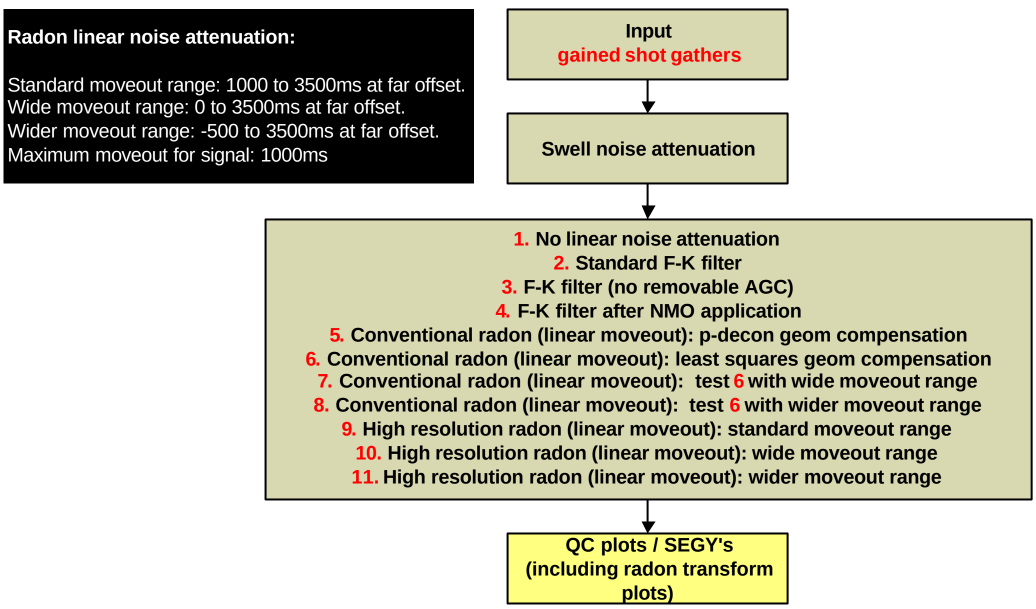


SWATT testing showed that application of the process in multiple domains was beneficial, as the randomness of the noise was different in different domains (eg – noise which had coherent patterns in the shot domain appeared random in the CDP and offset domains and was therefore targeted by SWATT). As production processing involved sorting the data into common shot, receiver, offset and CDP domains at various stages of the processing sequence, it was decided to apply SWATT in each of the domains, resulting in four passes of SWATT application. The following parameters were chosen for production processing in each of the four passes of SWATT:

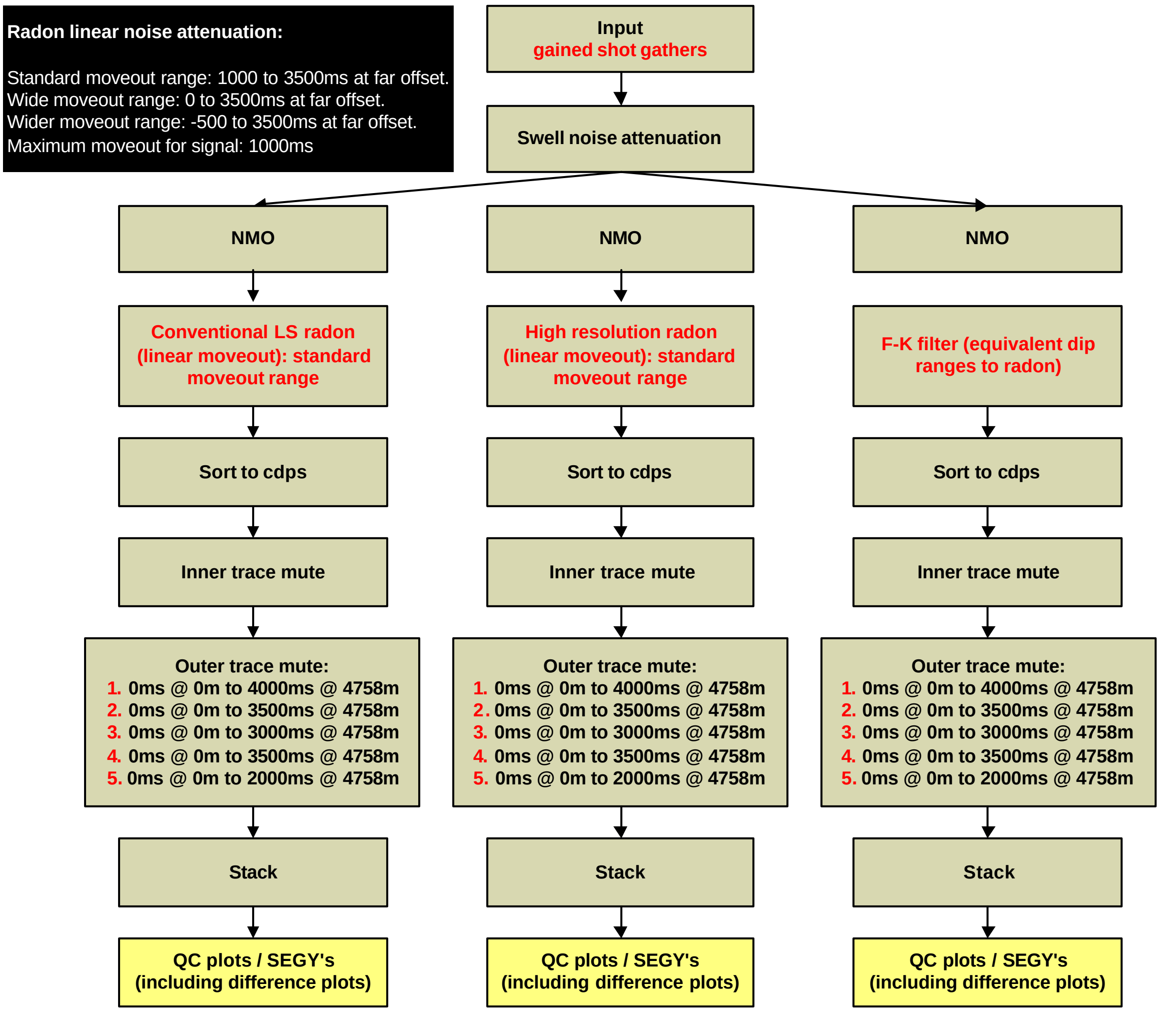
Frequency Bands	2-10Hz inc 2Hz		
Analysis window length	1000ms		
Window overlap	20%		
Window start	Offset dependent, relative to wbtime		
Threshold	400% from 0-6144ms		
Analysis Zone	Wbtime(ms)	Offset(m)	Window(ms)
	100	175.0	0-6144
		4762.5	1500-6144
	500	175.0	300-6144
		4762.5	1800-6144
	1000	175.0	700-6144
		4762.5	2200-6144

6.5. LINEAR NOISE ATTENUATION

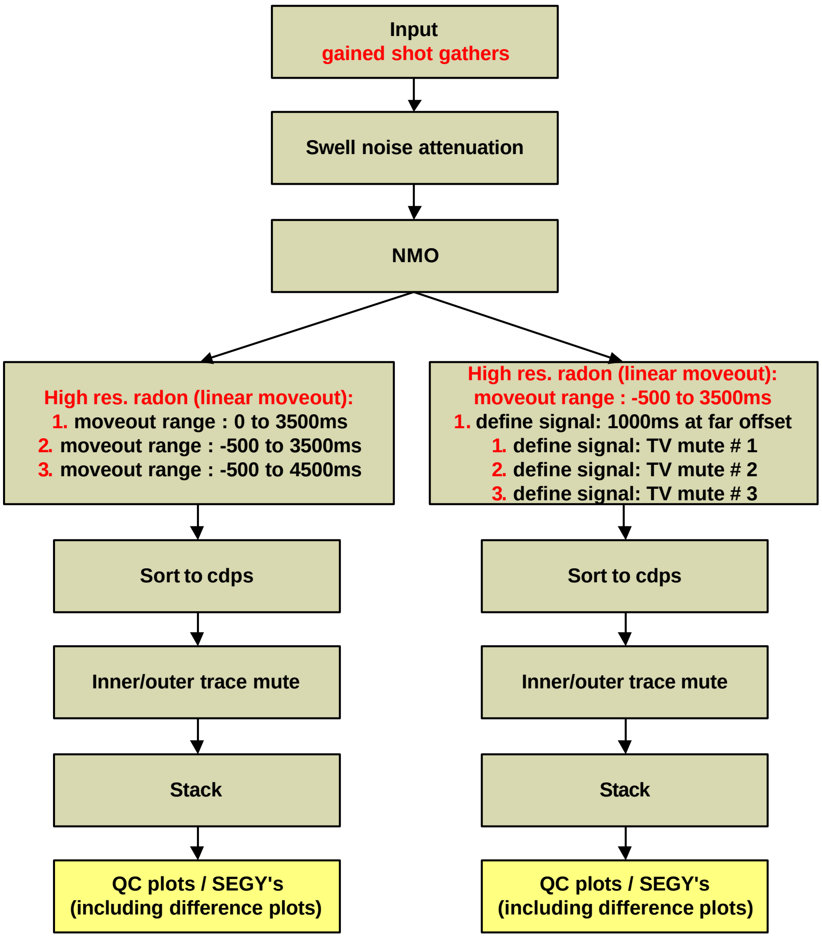
Initial testing of linear noise attenuation methods comprised comparisons of different noise attenuation methods on shot gathers. High resolution radon linear noise attenuation was the preferred choice for coherent noise removal, so testing concentrated on optimizing the application of this process. High resolution radon noise attenuation was compared to standard F-K filter (using comparable dip filter ranges), F-K filter after normal moveout application, conventional radon linear noise attenuation using P-decon (transforms performed in time domain) and least squares (transform performed in frequency domain) geometry compensation methods. Various moveout ranges for modeling signal and noise were also tested.



Results of the initial tests showed that conventional (least squares) radon and high resolution radon results were similar in terms of noise removal, however both radons (and to a lesser extent the F-K filter tests) degraded the far trace reflections compared to the conventional (p-decon) radon. The high resolution radon handled edge effects better than other methods, and application of NMO prior to noise attenuation gave superior results in the shallow section.
Following the initial tests, it was believed that high resolution radon results could be improved with better parameterisation, and further stack comparisons of high resolution radon and F-K filter (both with removable NMO) were run. Stacks were muted with various mute patterns to assess the effectiveness of the noise attenuation on stack data.



Results from the stack tests were similar to those seen on the shot records in that all stack sections suffered some shallow degradation, and that obvious edge effects stacked into the sections at wide mutes on the high resolution tests. At this stage it was thought that modelling negative dips in the high resolution radon moveout range (as in the earlier wider moveout range tests) would better remove the edge effects evident on stack tests. Further high resolution radon tests investigating the moveout range defined as signal were also run. Previous tests had defined signal as all dips within the range 0-1000ms at far offset. Time variant specification of signal moveout range was tested to ascertain whether noise attenuation could be improved in this way.



Radon linear noise attenuation:

Mute # 1:

time(ms)	max moveout for signal(m)
15.3	3140
40.1	2980
59.9	2600
69.7	2270
233.0	1730
332.0	1520
455.7	1260
638.8	1080
6128.7	1060

Radon linear noise attenuation:

Mute # 2:

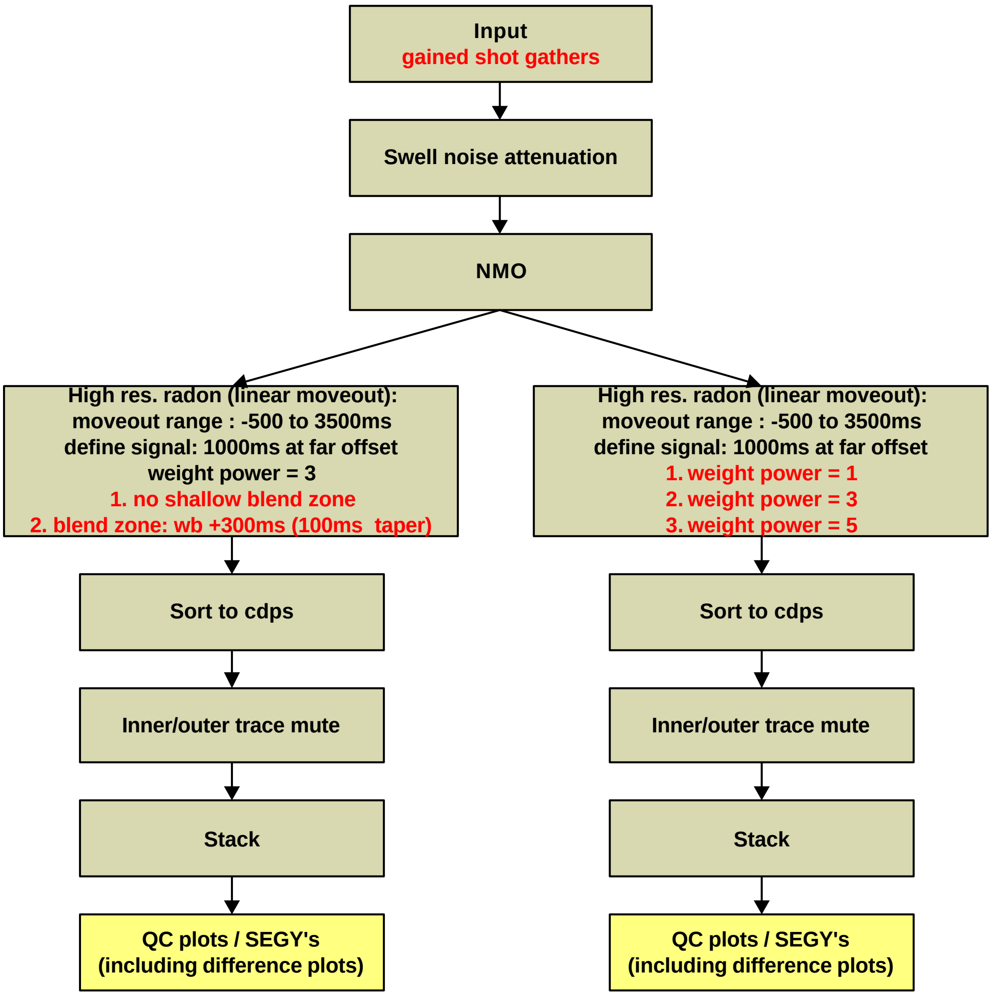
time(ms)	max moveout for signal(m)
0.0	3000
29.5	2680
50.9	2430
81.4	2200
130.2	2020
191.2	1810
294.9	1560
404.7	1350
523.6	1200
743.2	1070
1026.9	1000
6114.5	1000

Radon linear noise attenuation:

Mute # 3.

time(ms)	max moveout for signal(m)
0.0	3110
69.0	2280
255.0	1730
352.0	1490
487.0	1310
808.0	1000
6144.0	1000

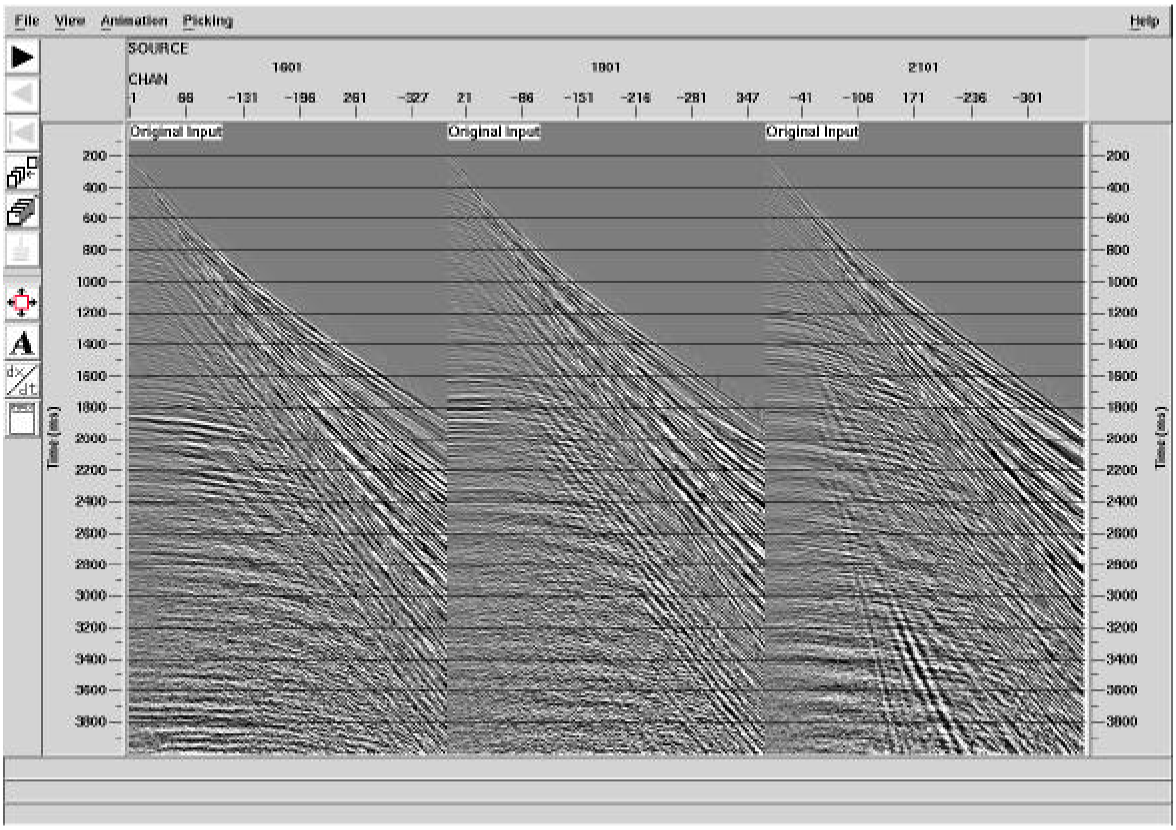
Results of the high resolution radon stack tests showed that a wider moveout range for the radon transform reduced the edge effects evident in earlier tests, with a moveout range of –500ms to 4000ms at far offset (510 P traces) being the most effective. The constant maximum moveout for definition of the signal (1000ms at far offset) was the preferred choice from the signal definition tests. At this stage high resolution radon linear noise attenuation was giving superior noise attenuation results to conventional radon and F-K filter methods. Final testing to optimise radon transform parameterisation involved tests on weight power, shallow blend zone, and multiple passes of linear noise attenuation (in the shot and receiver domains). Weight power tests were performed as the high resolution transform is controlled by weights - weights should be high for those parts of the transform domain where energy belongs, and low everywhere else. Larger weight powers will sharpen the power function (focus the dipping event to a single point in tau-p space) and smaller weight powers will flatten the power function. A weight power of 1 is similar to a conventional (least squares) radon transform.



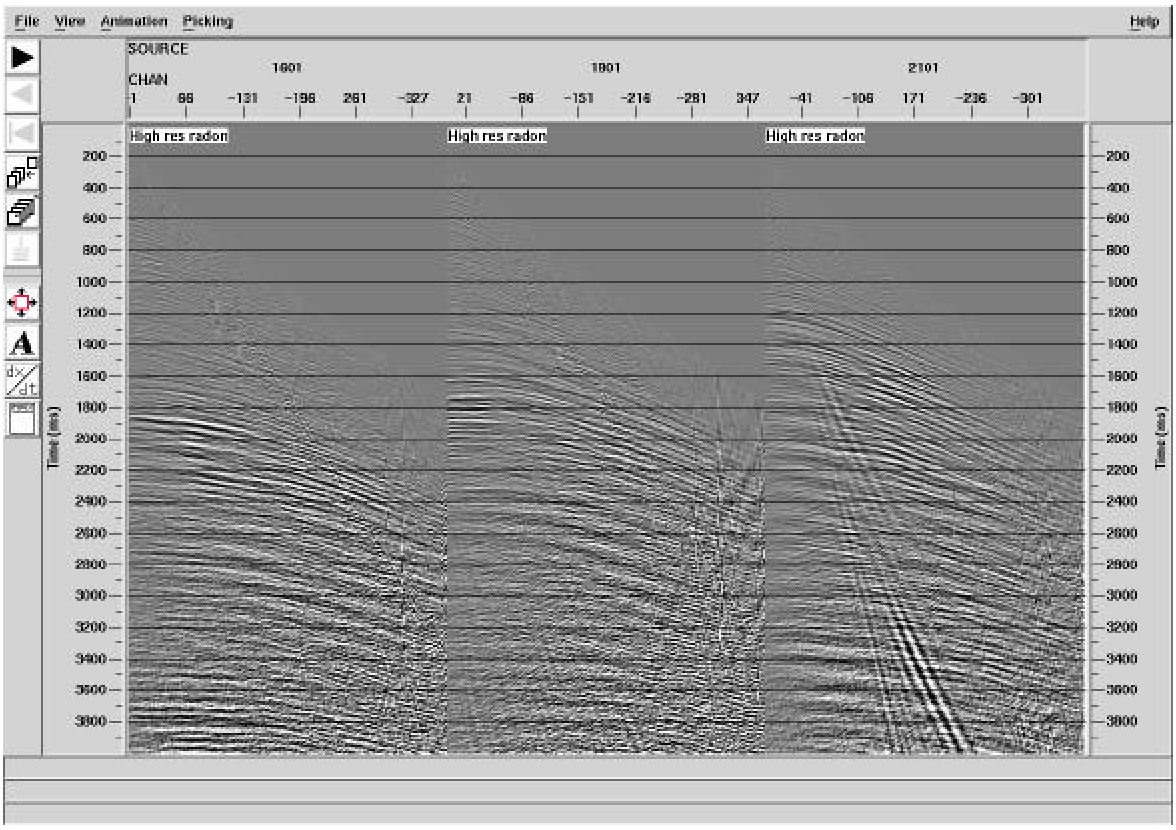
Following assessment of the final suite of tests and revision of previous tests, high resolution radon linear noise attenuation was chosen for production processing. The following parameters were utilized (note that the process was applied in both the shot and receiver domains as tests showed this method was the most effective in removing linear noise).

Application domain	Shot domain **and** receiver domain
Linear moveout range	-500ms to 4500ms
Number of P traces	500 at 10ms increments
Minimum moveout for signal	0ms (at far offset, time invariant)
Maximum moveout for signal	1000ms (at far offset, time invariant)
Weight power	3
Shallow blend zone	From wbtime+300ms to wbtime+400ms

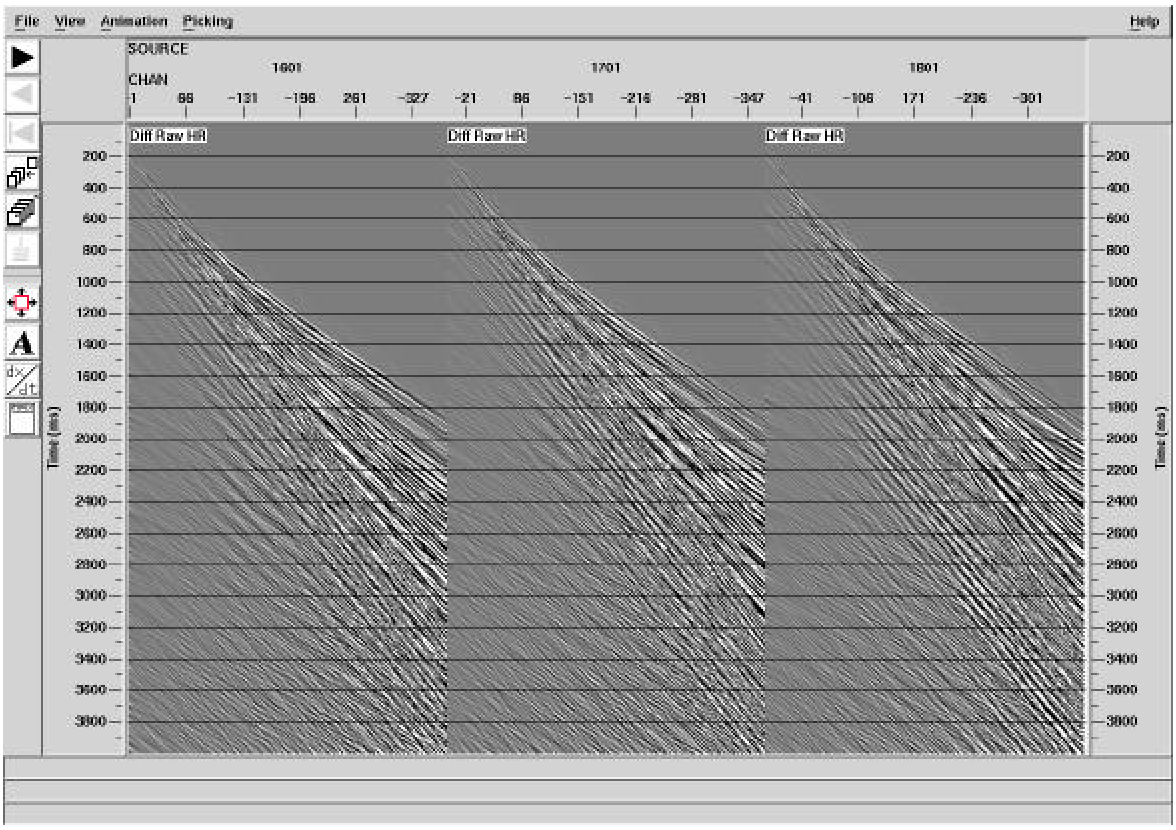
Shot gathers: before high resolution radon linear noise attenuation



Shot gathers: after high resolution radon linear noise attenuation

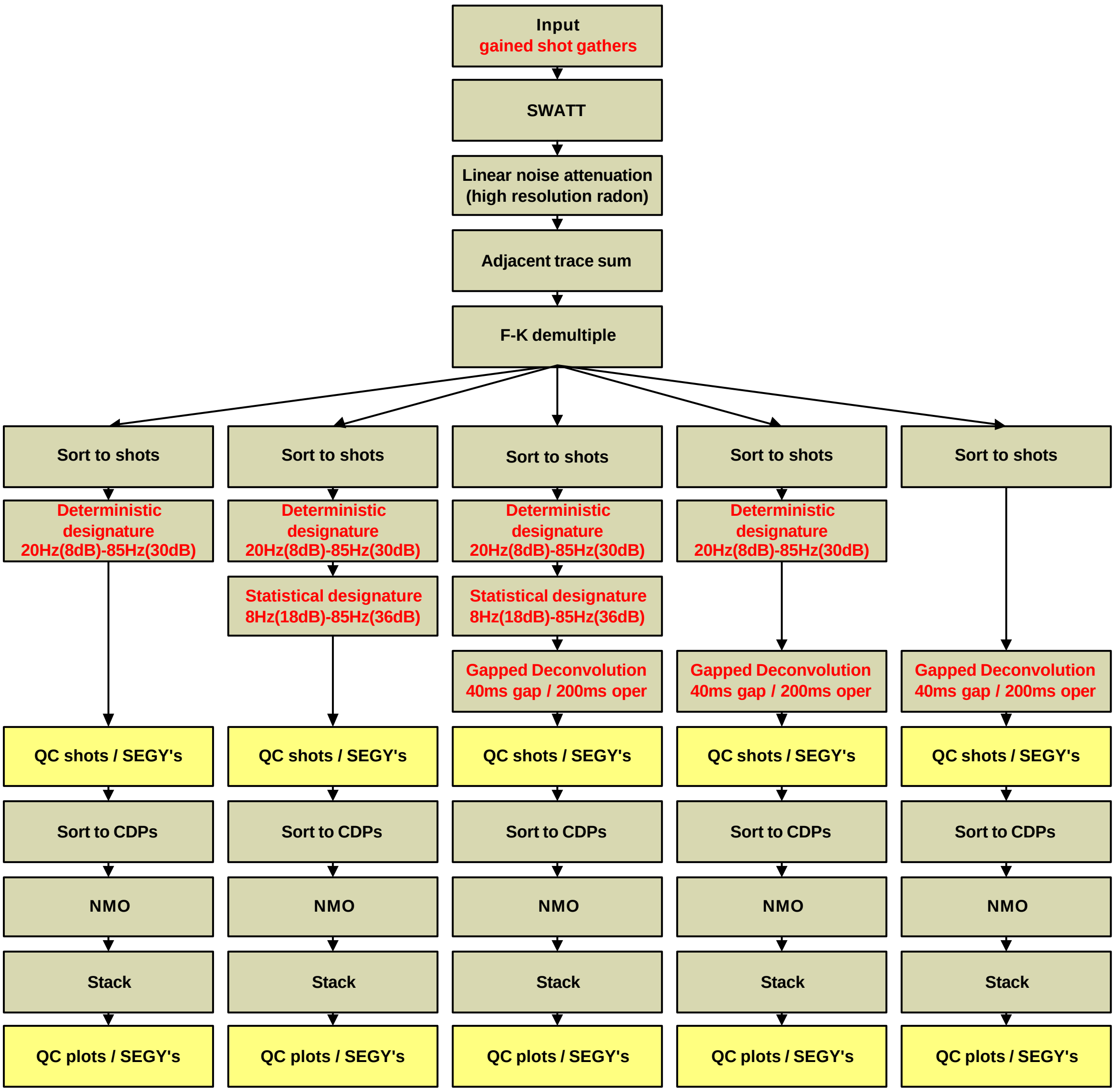


Shot gathers: difference plot: input vs high resolution radon linear noise attenuation

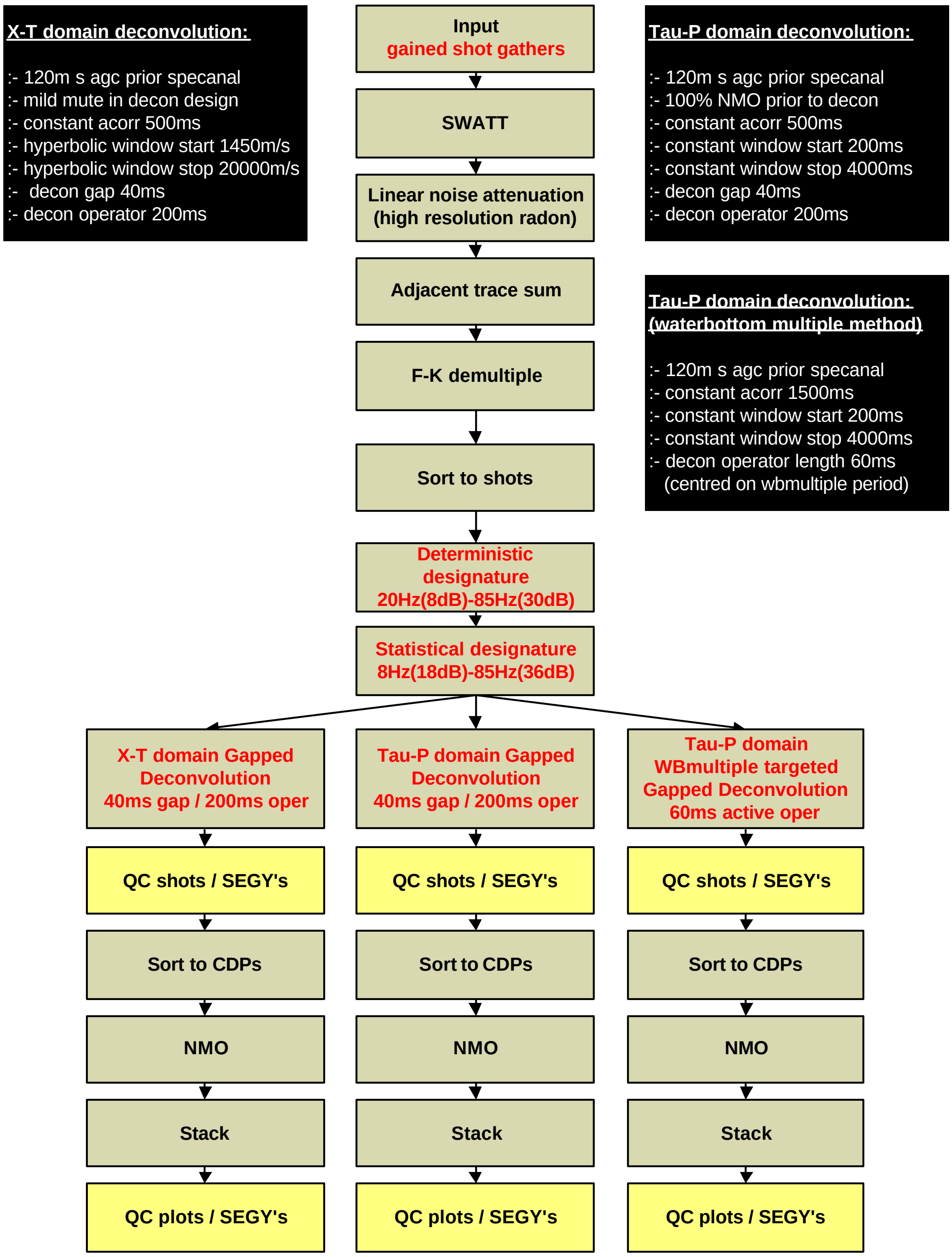


6.6. TAU-P DOMAIN DECONVOLUTION

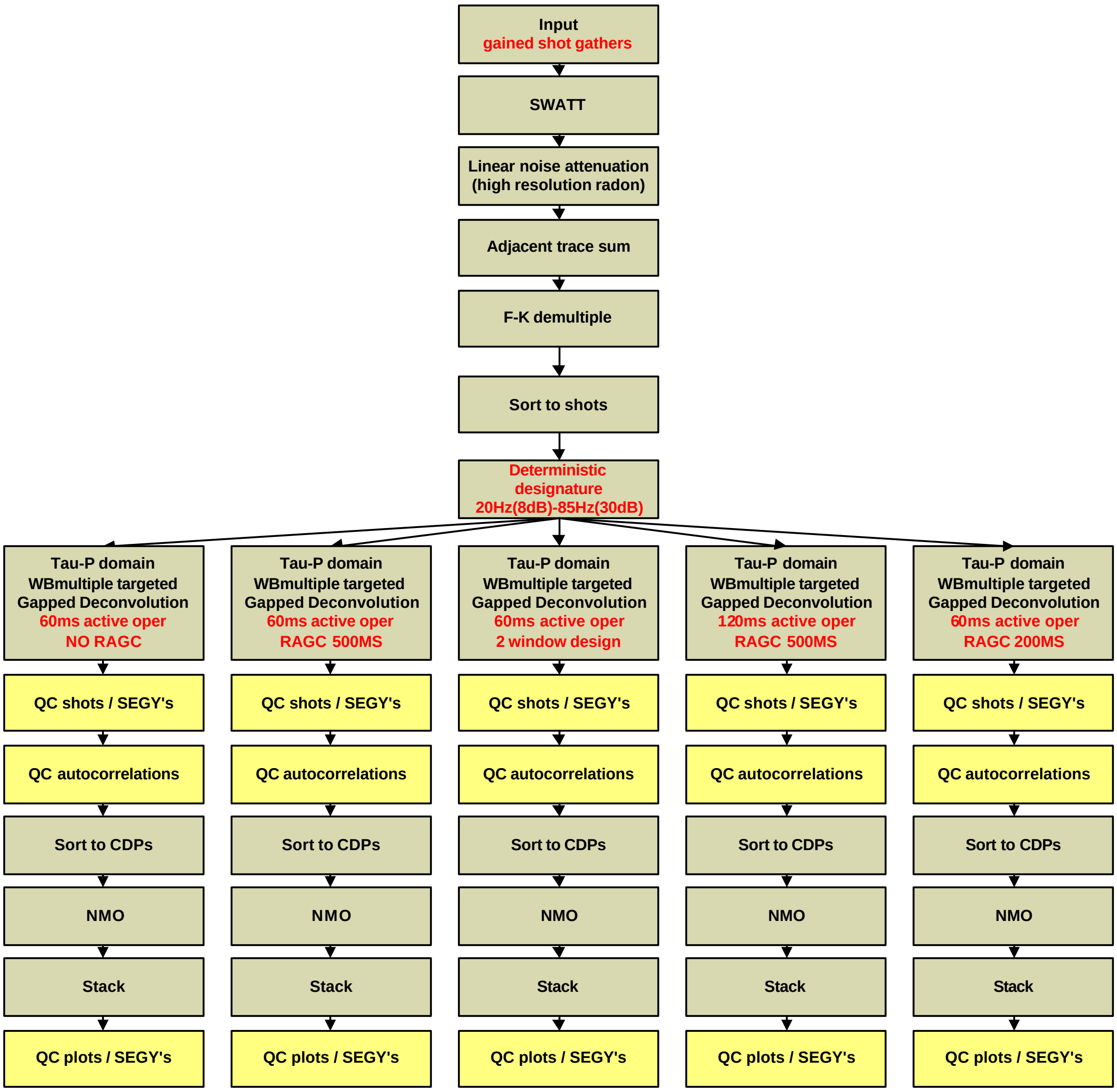
Initial deconvolution tests were performed on Northern Margins line 29, and consisted of a comparison of different deconvolution methods, including deterministic designature, statistical designature and gapped deconvolution.



following the initial tests deconvolution in the tau-p domain was compared to deconvolution in the x-t domain. A water bottom multiple targeted Tau-P domain deconvolution was also tested. This method calculates the water bottom multiple period in tau-p space and centres the active part of the decon operator on the multiple period time. Autocorrelations before and after deconvolution were generated for all tests.



The waterbottom multiple targeted Tau-P domain deconvolution results were encouraging, and in general were superior to other deconvolution methods in reducing reverberations in the test data. The deterministic designature tested earlier had already been selected for production, and statistical designature was not tested further as no further wavelet shaping was thought necessary, so subsequent tests concentrated on optimising Tau-P domain waterbottom multiple targeted deconvolution.

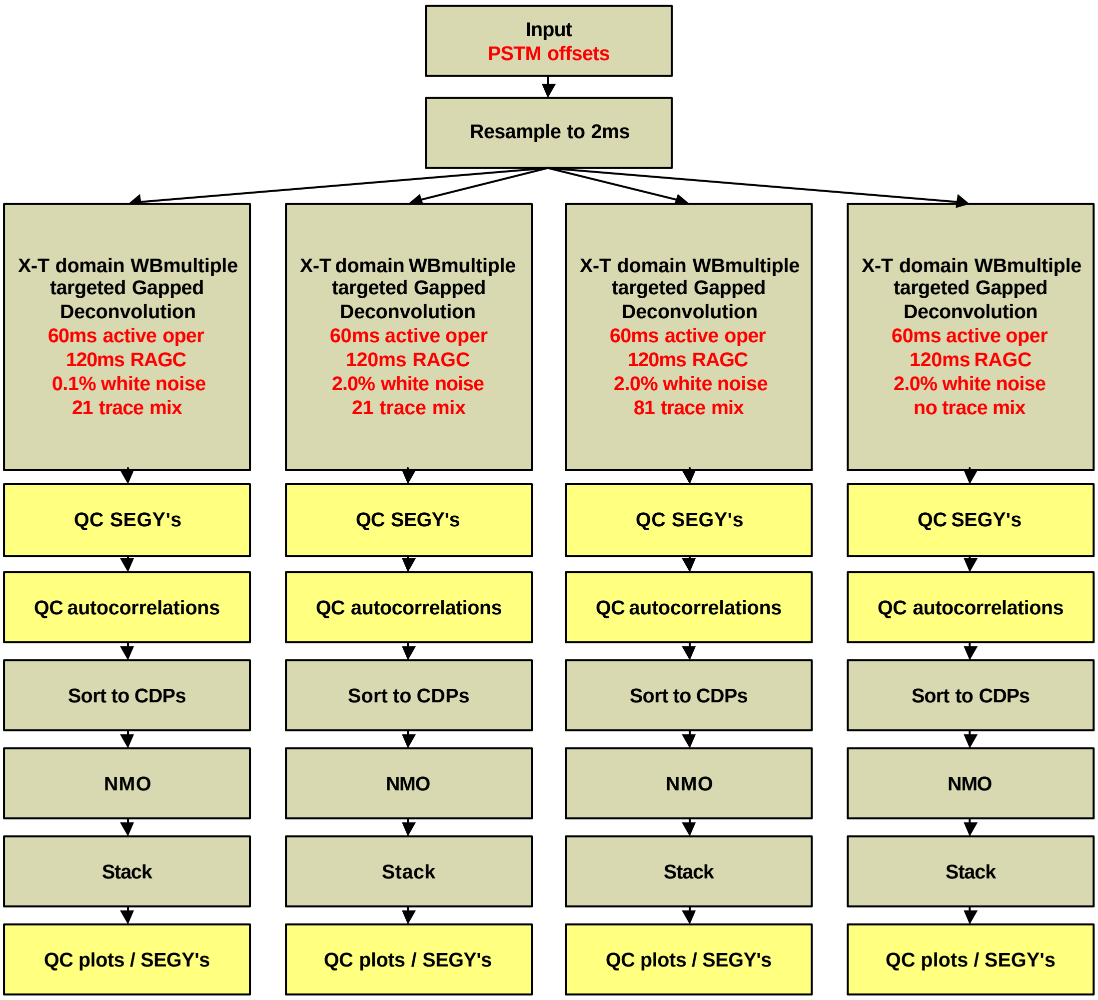


Subsequent to the previous suite of tests, the following deconvolution was selected for production processing.

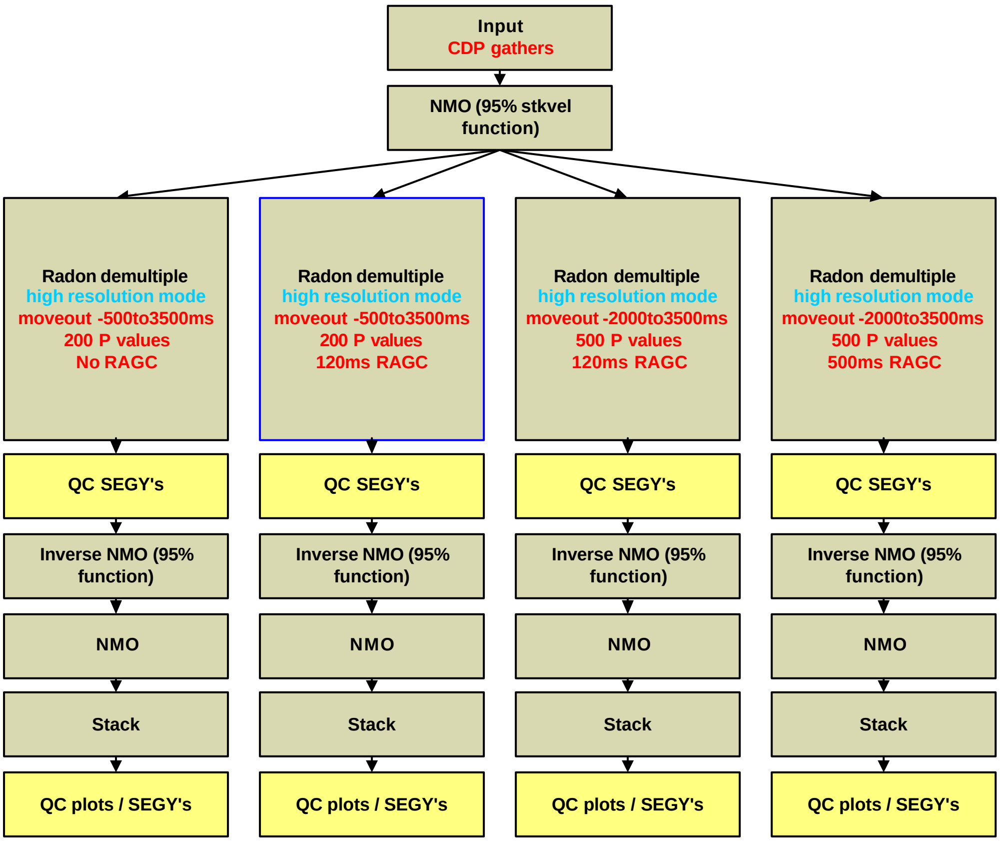
Forward transform	-500ms to 2000ms moveout at far offset
Number of P traces	368
Removable AGC	200ms for deconvolution operator design
Decon Windows	1 window from 0-4000ms
Decon Active Operator Length	60ms centred on 1st order wbmultiple time
Application	From 0-5000ms

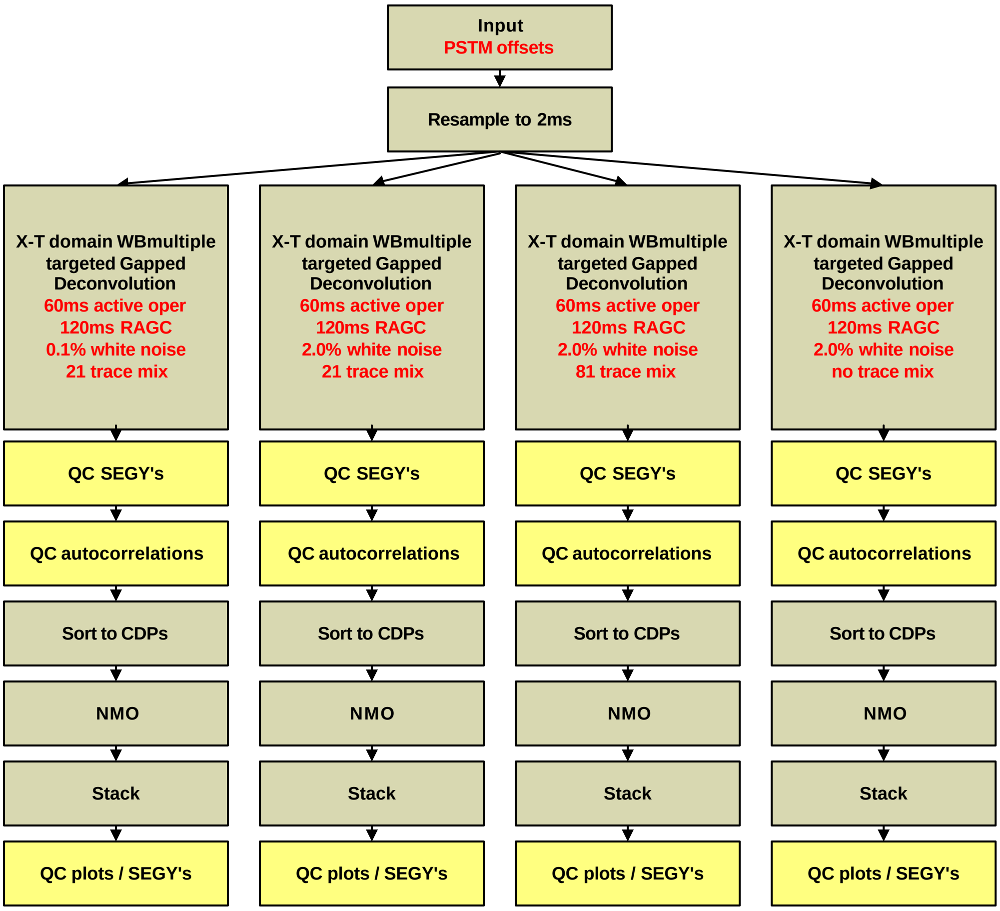
6.7. DEMULTIPLE

Initial testing of multiple attenuation methods comprised comparisons of different multiple attenuation methods on cdp gathers. High resolution radon parabolic noise attenuation was the preferred choice for multiple removal, so testing concentrated on optimizing the application of this process. High resolution radon multiple attenuation was compared to standard F-K demultiple, and conventional radon multiple attenuation using least squares (transform performed in frequency domain) and P-decon (transform performed in xt domain) geometry compensation methods. Various moveout ranges for modeling signal and noise were also tested.



Initial tests showed that high resolution radon demultiple produced better results when using a wider moveout range (-500ms to 3500ms), and in general was more effective than conventional radon demultiple. F-K demultiple was in general better than other methods in the shallow section on test data. Further testing concentrated on parameterisation of the high resolution radon, and on percentage adjustment of the velocity field prior to demultiple.


Input
CDP gathers
NMO (95% stkvel function)
Radon demultiple
high resolution mode
moveout -500to3500ms
200 P values
No RAGC
Radon demultiple
high resolution mode
moveout -500to3500ms
200 P values
120ms RAGC
Radon demultiple
high resolution mode
moveout -2000to3500ms
500 P values
120ms RAGC
Radon demultiple
high resolution mode
moveout -2000to3500ms
500 P values
500ms RAGC
QC SEGY's
Inverse NMO (95% function)
NMO
Stack
QC plots / SEGY's


Input
PSTM offsets
Resample to 2ms
X-T domain WBmultiple targeted Gapped Deconvolution
60ms active oper
120ms RAGC
0.1% white noise
21 trace mix
X-T domain WBmultiple targeted Gapped Deconvolution
60ms active oper
120ms RAGC
2.0% white noise
21 trace mix
X-T domain WBmultiple targeted Gapped Deconvolution
60ms active oper
120ms RAGC
2.0% white noise
81 trace mix
X-T domain WBmultiple targeted Gapped Deconvolution
60ms active oper
120ms RAGC
2.0% white noise
no trace mix
QC SEGY's
QC autocorrelations
Sort to CDPs
NMO
Stack
QC plots / SEGY's

Testing showed that a time variant percentage velocity adjustment (from 96% at 0ms to 90% at 6000ms) was the optimum choice on testline data. The 120ms removable gain prior to radon demultiple also produced better results than a larger gain window or no removable gain at all. Expanding the moveout range (to –2000ms to 3500ms) for the radon transform reduced edge effects and was more effective in modelling moveout ranges present on cdp gathers after normal moveout with the scaled velocity field. A number of other tests related to parameterisation of the high resolution radon demultiple were run in an effort to optimise the process before final parameter selection. F-K demultiple still resulted in better demultiple in the shallow section, due mainly to the fact that parabolas on cdp gathers could not be modelled accurately by the high resolution radon on low fold data. As a result final testing included blending of data processed through F-K demultiple from 0-600ms and radon demultiple from 400ms to 6000ms. This method proved effective in preserving shallow events (while still removing multiples) so was chosen for production processing.

The final radon demultiple parameters are outlined below.

Normal moveout corrections (adjustment to stacking velocity field)

Time (ms)	Velocity Scaling (%)
0	96
500	96
1000	94
2000	92
6144	90

Roll along interleaved F-K demultiple

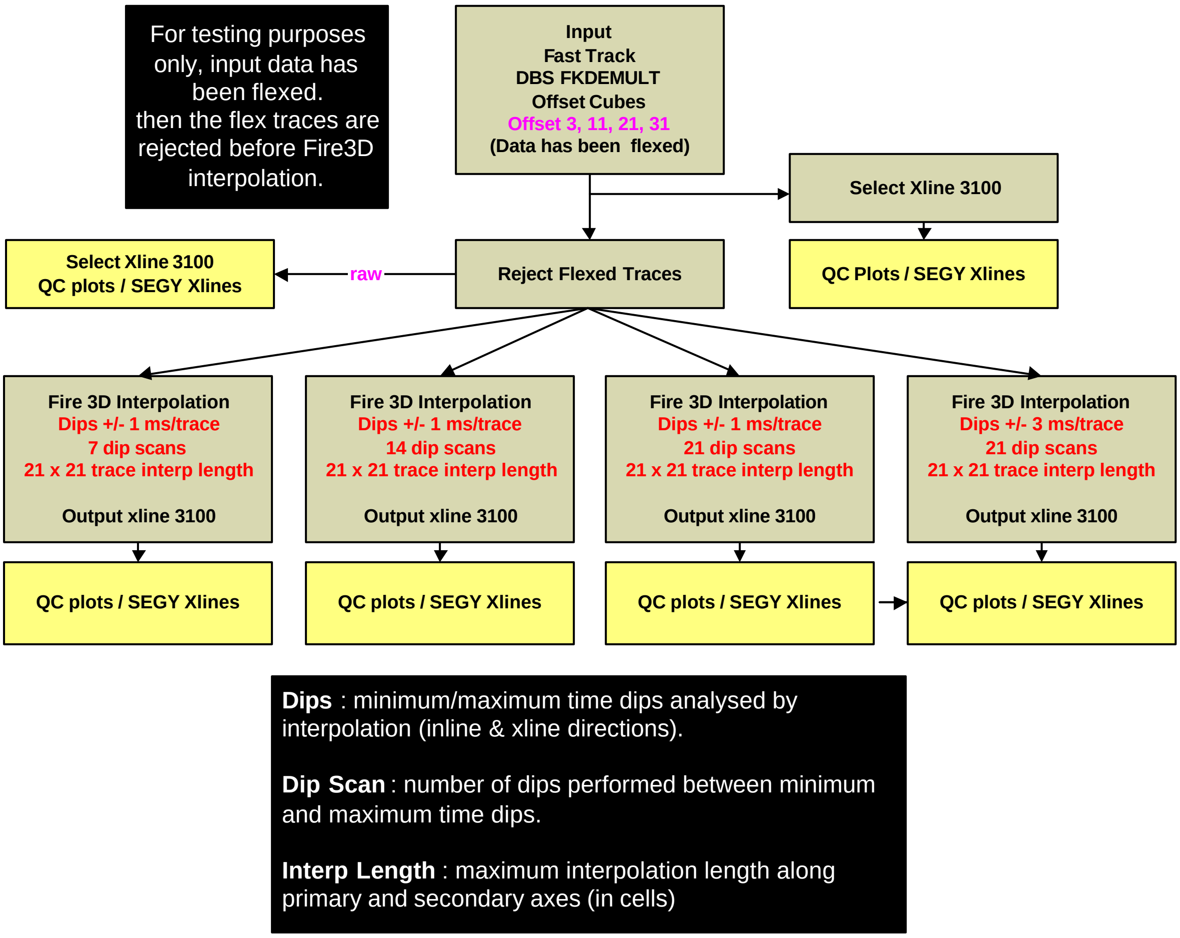
interleaving	3 CDPs. Overlap 1 CDP
Removable AGC	120ms windows
Application zone	Wbtime-40ms to 600ms
Taper zone	400ms (100%) to 600ms (0%)

Parabolic Radon demultiple

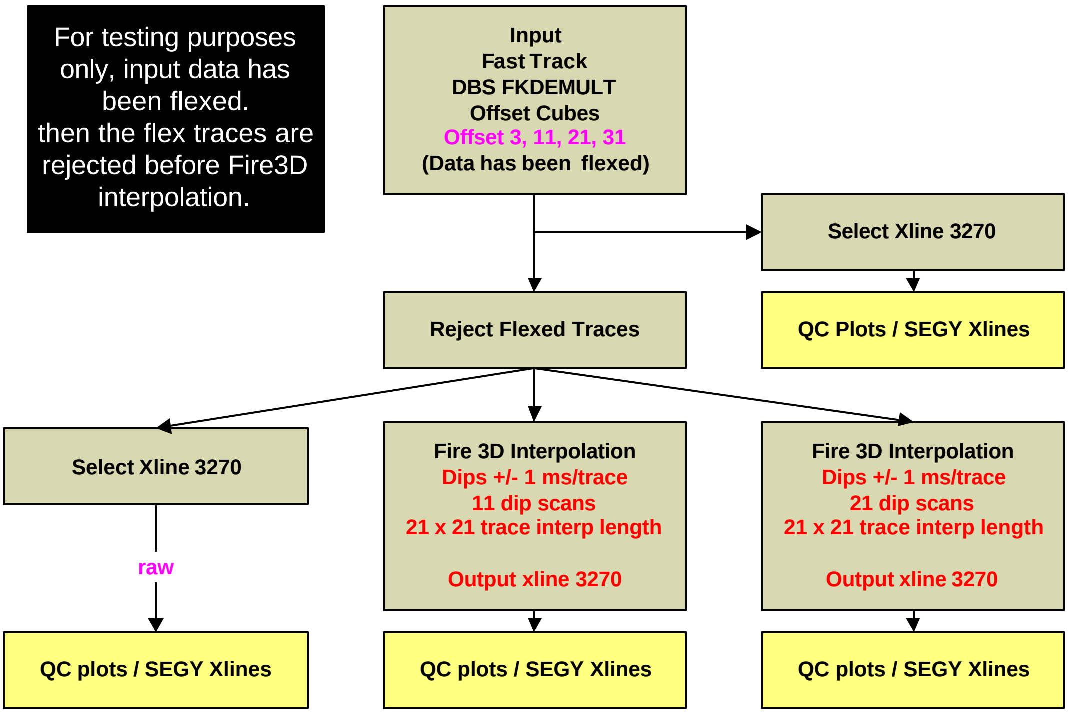
Transform type	parabolic
Removable AGC	120ms windows
Application zone	400ms to 5000ms
Taper zone	400ms (0%) to 600ms (100%)
Noise modeling blend	(Wbtime x 2)-100ms. Blend taper 50ms
Moveout range	-2000ms to 3500ms at maximum offset
Number of P traces	501 at 10ms increments
Multiple definition	Parabolas > 50ms moveout at max offset

6.8. 3D INTERPOLATION

Interpolation tests were performed on four offset cubes centred around crossline 3100. This crossline exhibited data holes due to missing traces, and was in an area of localised steeply dipping geology where interpolation could be effectively assessed. For testing purposes the offsets were first flexed, then had their flexed traces zeroed so that data holes were obvious on pre interpolation tests. Interpolation testing investigated the effect of dip search limits, dip analysis increment and sinc interpolation operator width on interpolation results.



Test results showed that a 21 trace interpolation length and dip limits of +/-1ms/trace resulted in the best interpolation result. Expanding the dip range to +/-3ms/trace resulted in some spurious interpolation results so this option was rejected. The tests above were repeated for crossline 3270 to verify the parameter selection in a different area



Dips : minimum/maximum time dips analysed by interpolation (inline & xline directions).

Dip Scan : number of dips performed between minimum and maximum time dips.

Interp Length : maximum interpolation length along primary and secondary axes (in cells)

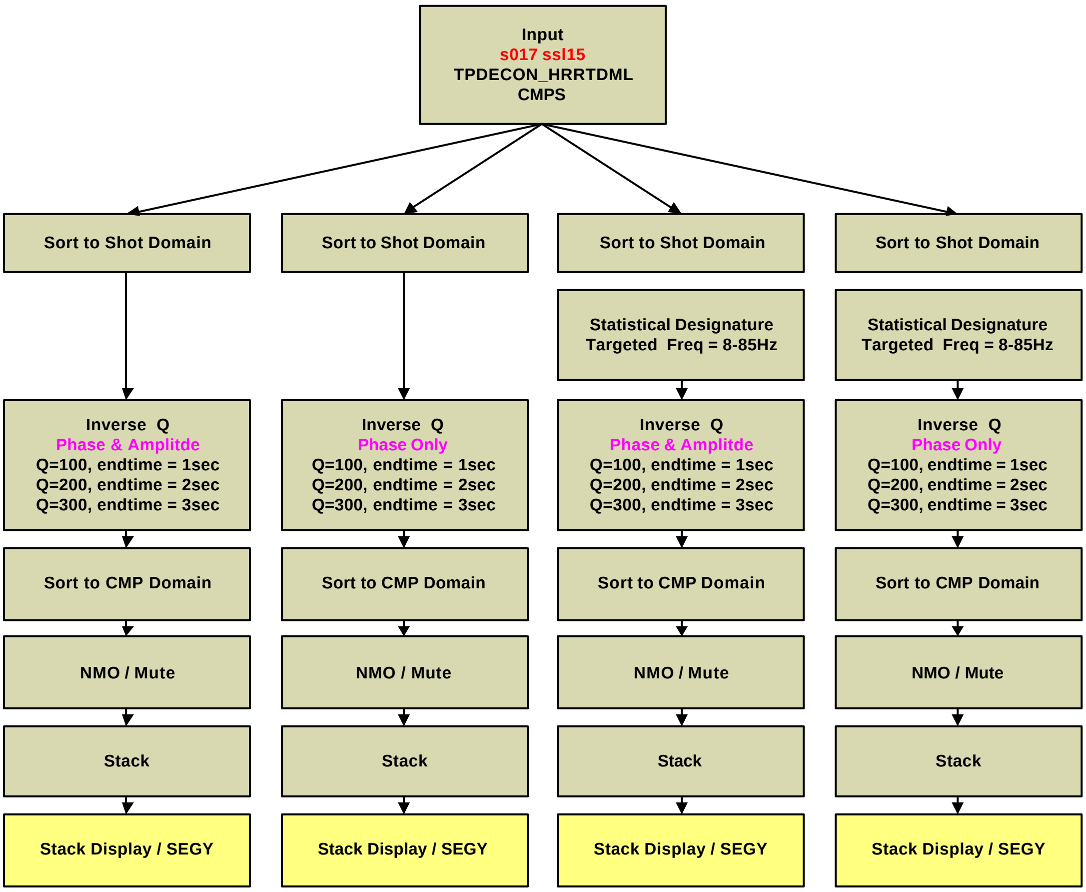
The following parameters were chosen for production.

.

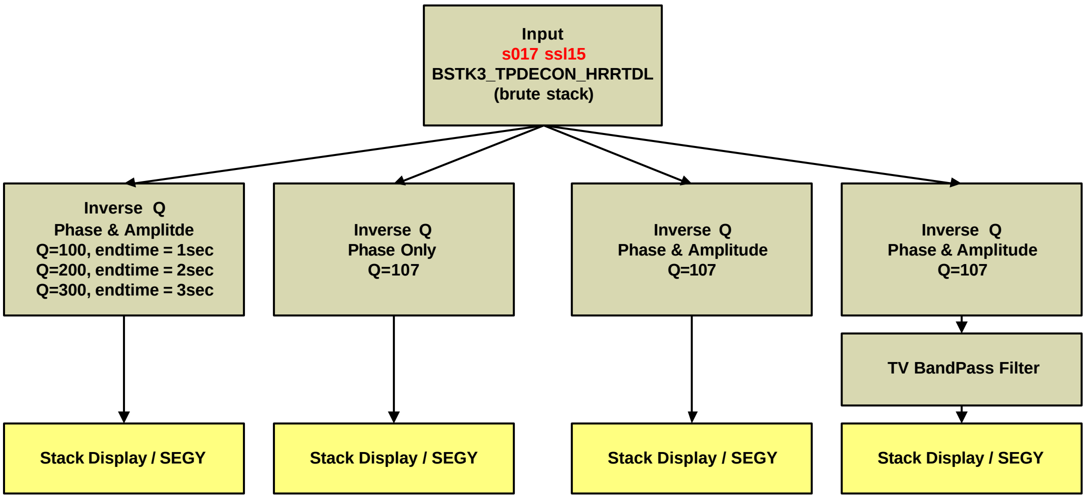
Interpolation type	3D f-x domain sinc interpolation
Sinc interpolation length	21 traces in primary and secondary directions
Dip scans	21 from –1.0 to +1.0 ms/tr
Grid size	Inline spacing: 25.0m Crossline spacing: 12.5m

6.9. INVERSE Q FILTER

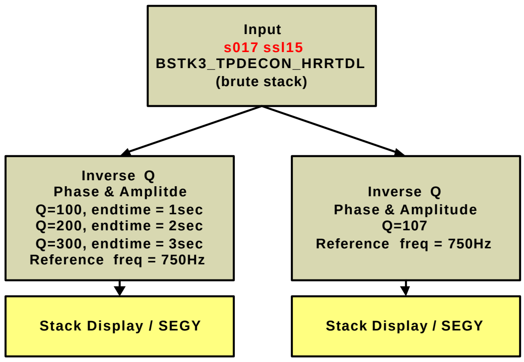
Initial testing of inverse Q filter was performed on production demultiple gathers. Testing consisted of various Q factors applied in a phase only, and phase plus amplitude manner.



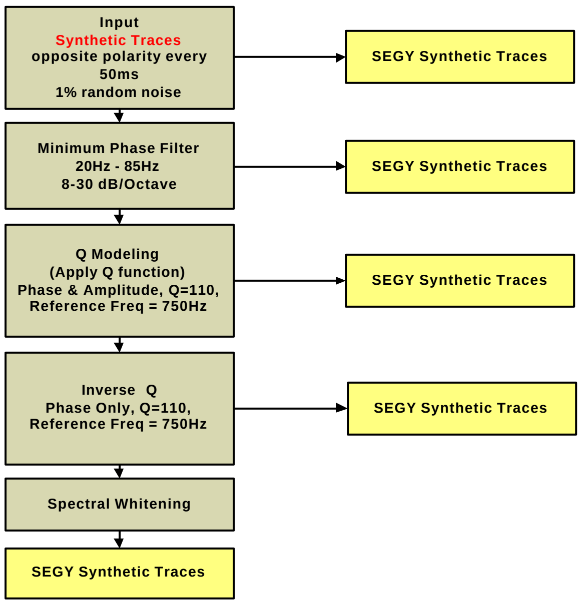
As inverse Q filter was applied post stack on the fast track dataset, testing was carried out on stack data. A Q value of 107 was included in the testflow as this factor had been previously used in the survey area.



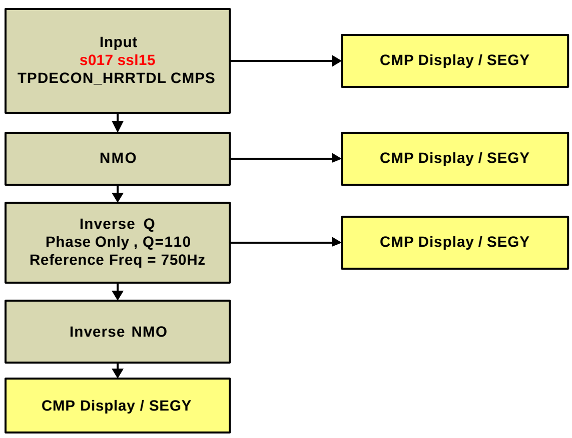
A reference frequency of 750Hz (center frequency for the seismic band) was tested in an attempt to match the Q phase and amplitude response of BHPBP's Promax Q filter (the reference frequency has a significant effect on phase). The reference frequency value was derived from benchmark testing on a synthetic model, and was the value required to achieve the correct output timing.



Q filter tests using a reference frequency of 750Hz were also run on synthetic traces.

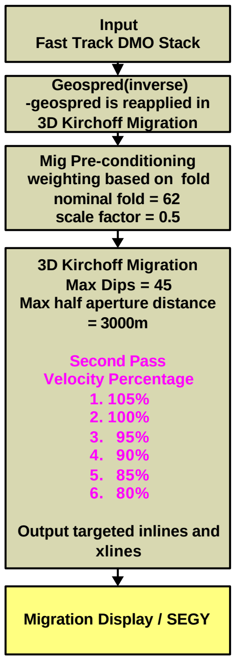


Final Q filter parameters (Q=110, phase only correction, reference frequency=750Hz) were applied to gathers to verify the choice of parameters on production data.



6.10. PRE STACK TIME MIGRATION

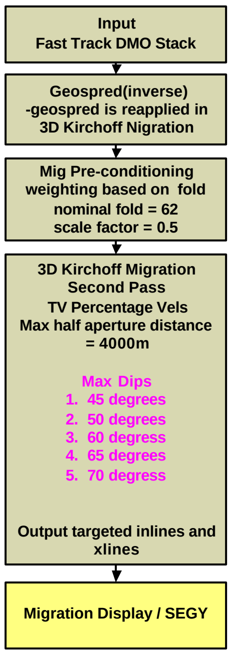
Initial tests were performed on fast track stack data and were run for parameterisation of the fast track (post stack) Kirchhoff migration. Migrations using varying percentages of the smoothed 3D stacking velocity field were run, using 45 degree maximum dips and a 3km half aperture.



The following percentage changes was selected for further testing:

time	Vel %
0ms	100%
2000ms	100%
3000ms	95%
4000ms	90%
6000ms	90%

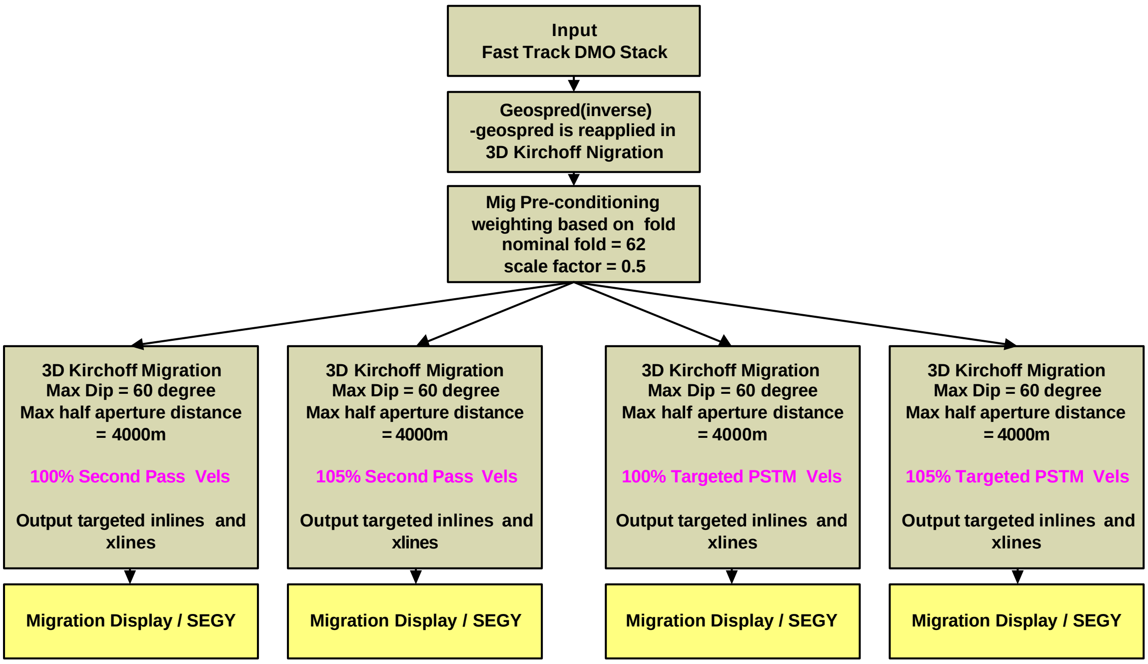
A time variant scaling function was chosen from the initial tests (see inset), and the fast track migration was run at 45 degree maximum dips and a 3km half aperture. The next phase of testing was performed on both post stack data and pre stack offsets (pre stack time migration). In both cases test sublines were target 3D Kirchhoff migrated using maximum migration dips from 45 degrees to 70 degrees and a 4km half aperture.



TV vel percentage

time	Vel %
0ms	100%
2000ms	100%
3000ms	95%
4000ms	90%
6000ms	90%

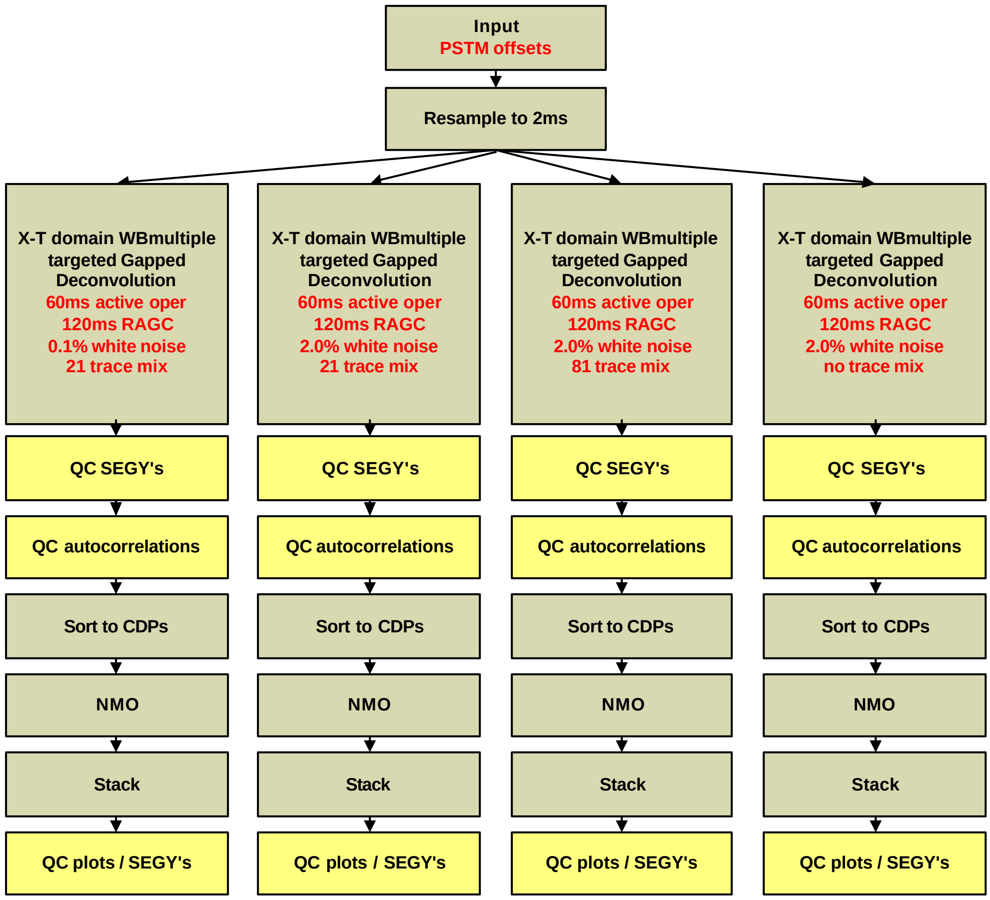
Results of these tests showed that steep dips were better migrated by increasing the maximum dip angle from 45 degrees to 60 degrees. Subsequent tests performed pre stack and post stack on targeted testlines revisited the migration velocity tests, but used 60 degree dips and a 4km half aperture as standard.



Subsequent to the velocity scaling for migration tests, 100% of the targeted migration smoothed 3D velocity field was selected for production. A decision was made to remigrate the fast track volume using the final pre stack time migration parameters as dip imaging was improved with the revised parameters. See sections 5.52 and 5.91 for final production (pre stack) and fast track (post stack) migration parameters.

6.11. X-T DOMAIN DECONVOLUTION

A final pass of deconvolution was tested on HGP2002A 3D pre stack time migrated data prior to final stack. The aim of the testing was to remove any residual reverberations by applying deconvolution in the common offset domain. Tests were again designed around waterbottom targeted style deconvolution, and included variation of decon design windows, trace mixing of spectral analyses, and white noise percentages. The active operator lengths (60ms) described in the test flow are centred on the period of the water bottom multiple within a trace autocorrelation, such that the gap length is equivalent to the acorr multiple period minus 30ms, and the active operator length is equivalent to the acorr multiple period plus 30ms.

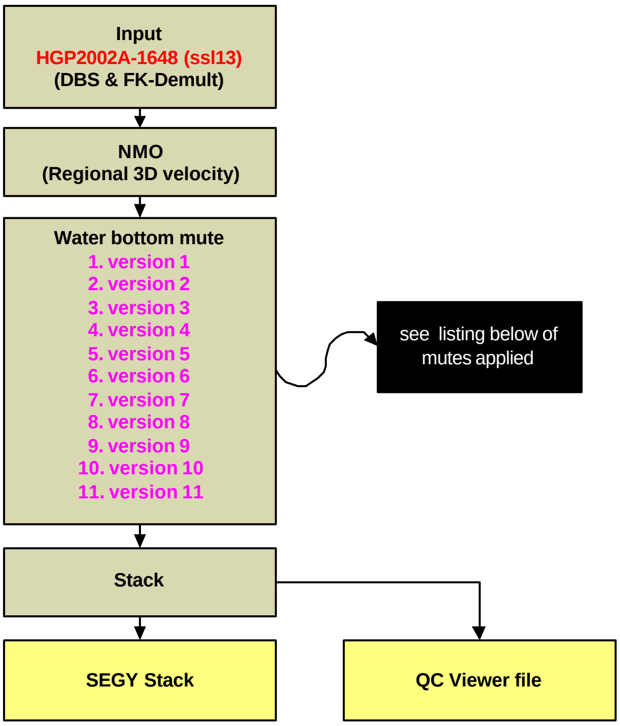


Subsequent to the previous suite of tests, the following deconvolution was selected for production.

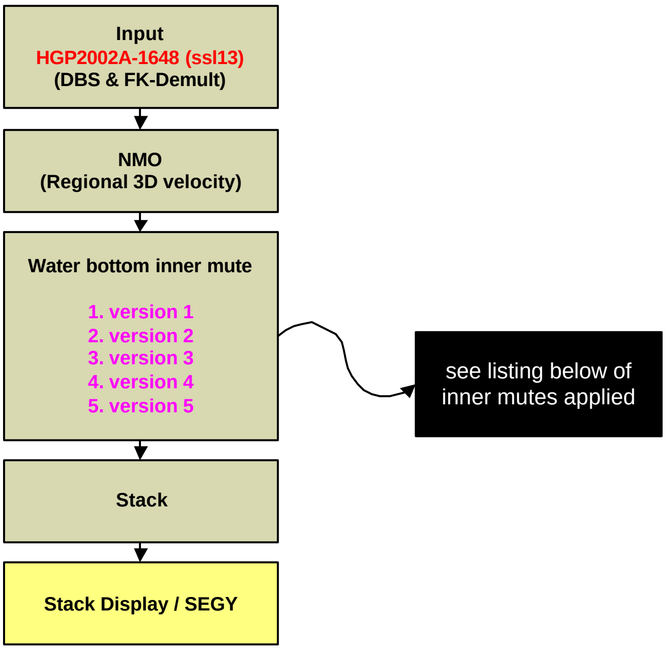
Sample rate	subsampled to 2ms for decon analysis
Removable AGC	120ms for deconvolution operator design
Decon Windows	2 windows; 2000ms length, 25% overlap
Trace averaging	21 trace mix on acorrs prior to oper design
Decon Active Operator Length	60ms centred on 1st order wbmultiple time
White noise	2%
Application	From 0-5000ms

6.12. PRE STACK MUTE

The following inner and outer trace mute tests were run:



Water bottom outer mute	wb time (ms)	offset + time pairs (m + ms)					
version 1	100	450+115	451+350	820+650	1650+1400	3150+3150	4720+4000
	2100	450+615	451+850	820+1650	1650+2400	3150+3500	4720+5000
version 2	100	600+115	601+350	970+650	1800+1400	3300+3150	4870+4000
	2100	600+615	601+850	970+1650	1800+2400	3300+3500	4870+5000
version 3	100	750+115	751+350	1120+650	1950+1400	3450+3150	5020+4000
	2100	750+615	751+850	1120+1650	1950+2400	3450+3500	5020+5000
version 4	100	900+115	901+350	1270+650	2100+1400	3600+3150	5170+4000
	2100	900+615	901+850	1270+1650	2100+2400	3600+3500	5170+5000
version 5	100	1050+115	1051+350	1420+650	2250+1400	3750+3150	5320+4000
	2100	1050+615	1051+850	1420+1650	2250+2400	3750+3500	5320+5000
version 6	100	1200+115	1201+350	1570+650	2400+1400	3900+3150	5470+4000
	2100	1200+615	1201+850	1570+1650	2400+2400	3900+3500	5470+5000
version 7	100	300+115	301+350	670+650	1500+1400	3000+3150	4570+4000
	2100	300+615	301+850	670+1650	1500+2400	3000+3500	4570+5000
version 8	100	150+115	151+350	520+650	1350+1400	2850+3150	4420+4000
	2100	150+615	151+850	520+1650	1350+2400	2850+3500	4420+5000
version 9	100	0+115	1+350	370+650	1200+1400	2700+3150	4270+4000
	2100	0+615	1+850	370+1650	1200+2400	2700+3500	4270+5000
version 10	100	0+115	0+350	220+650	1050+1400	2550+3150	4120+4000
	2100	0+615	0+850	220+1650	1050+2400	2550+3500	4120+5000
version 11	100	0+115	0+350	70+650	900+1400	2400+3150	3970+4000
	2100	0+615	0+850	70+1650	900+2400	2400+3500	3970+5000
inner mute	100	195+1000	1180+2200	1220+6144			
	2100	195+2000	1180+4200	1220+6144			

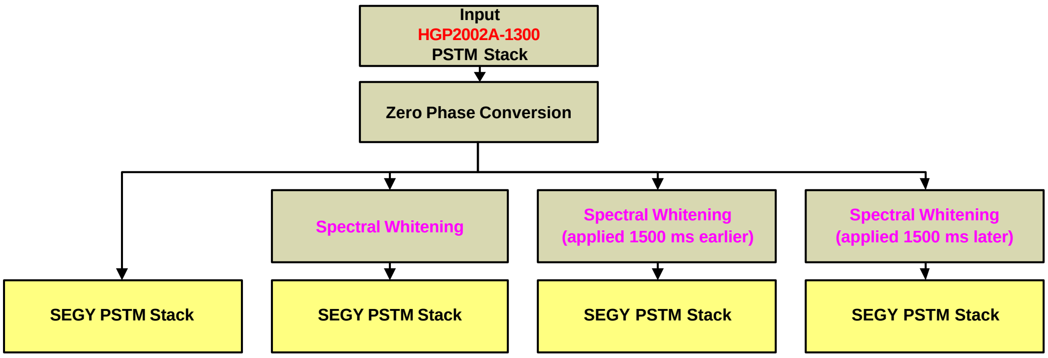


Water bottom inner mute	wb time (ms)	offset + time pairs (m + ms)					
version 1	100	195+1000	1180+2200	1220+6144			
	2100	195+2000	1180+4200	1220+6144			
version 2	100	45+1000	1030+2200	1070+6144			
	2100	45+2000	1030+4200	1070+6144			
version 3	100	0+1127	880+2200	920+6144			
	2100	0+2127	880+4200	920+6144			
version 4	100	345+1000	1330+2200	1370+6144			
	2100	345+2000	1330+4200	1370+6144			
version 5	100	495+1000	1480+2200	1520+6144			
	2100	495+2000	1480+4200	1520+6144			
front mute	100	500+115	501+350	820+650	1650+1400	3150+3150	4720+4000
	2100	500+615	501+850	820+1650	1650+2400	3150+3500	4720+5000

Mute tests were originally run on fast track cmp gathers. The selected inner and outer mute functions for fast track data are detailed in section 5.84. Mute tests were rerun on production pre-stack time migrated cdp gathers to verify the validity of the mutes after PreSTM. Adjustments were made to both the inner and outer mutes as a result of these tests (see section 5.59 for production mute details).

6.13. POST STACK SPECTRAL WHITENING

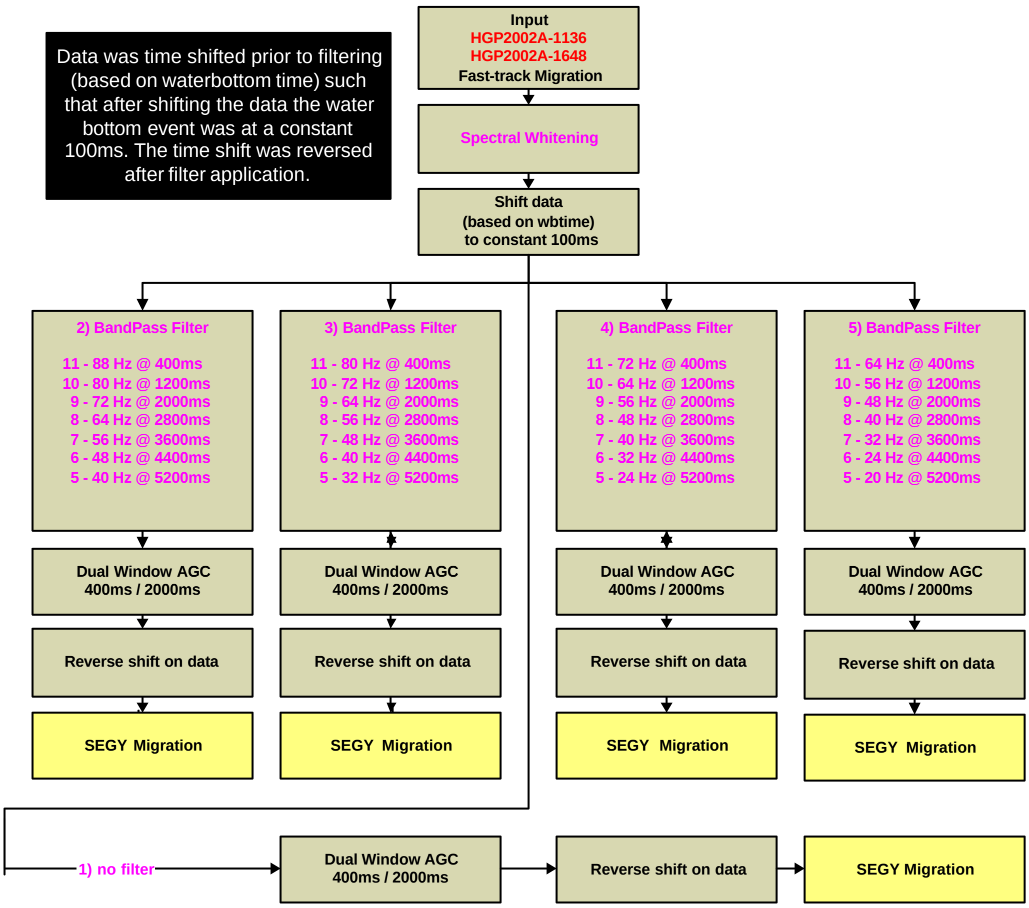
Seven band spectral whitening (see section 5.65 for frequency/time windows) was tested on fast track stack data. A 'standard' spectral whitened stack was compared to stacks where spectral whitening time windows were adjusted up by 1500ms (resulting in an overall lower frequency section) and adjusted down by 1500ms (resulting in an overall higher frequency section).



Subsequent to testing the spectral whitening outlined in section 5.65 was selected for production.

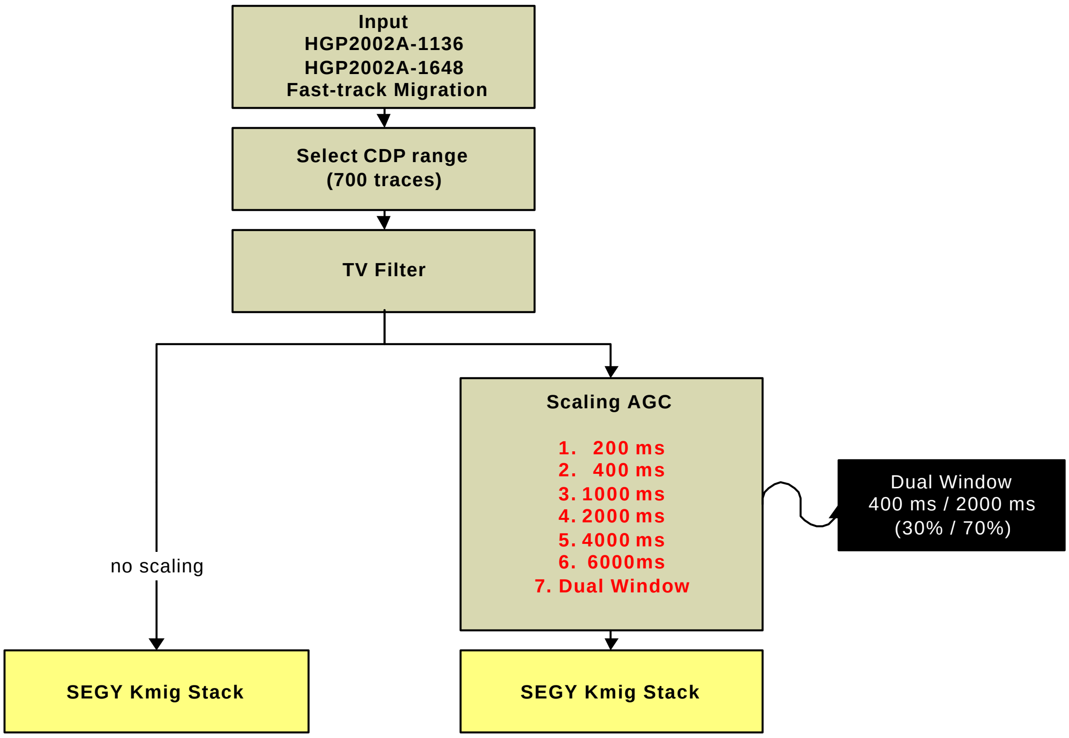
6.14. POST STACK FILTER

The following filter panel tests were run on fast track migrated stack data.



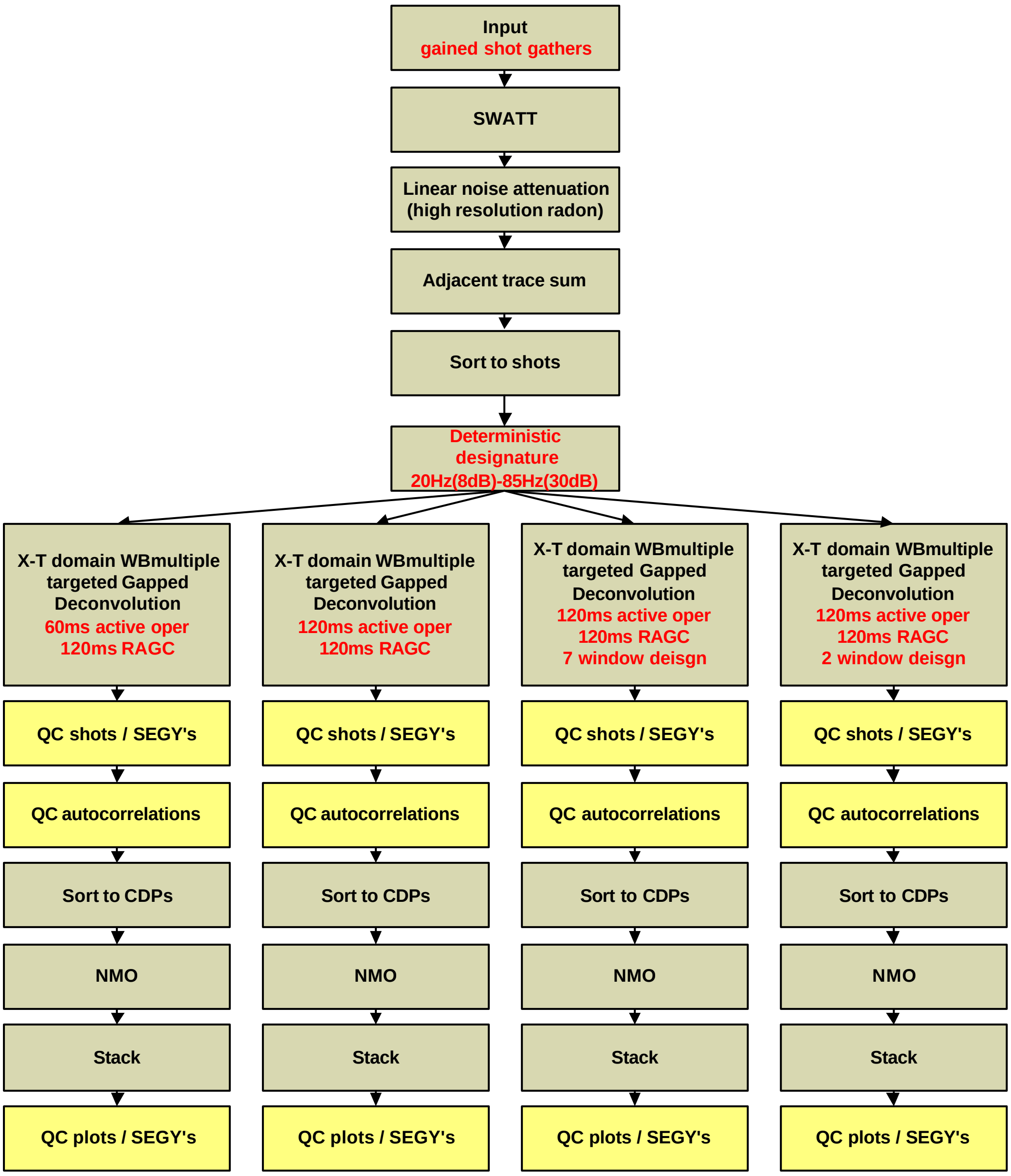
6.15. POST STACK SCALING

The following scaling tests were run on fast track migrated stack data.



6.16. FAST TRACK FLOW: X-T DOMAIN DECONVOLUTION

To enable timely delivery of the fast track cube, X-T domain deconvolution was selected for the fast track processing flow. As the waterbottom multiple targeted tau-p domain deconvolution had produced the best results in earlier testing, tests concentrated on this method.

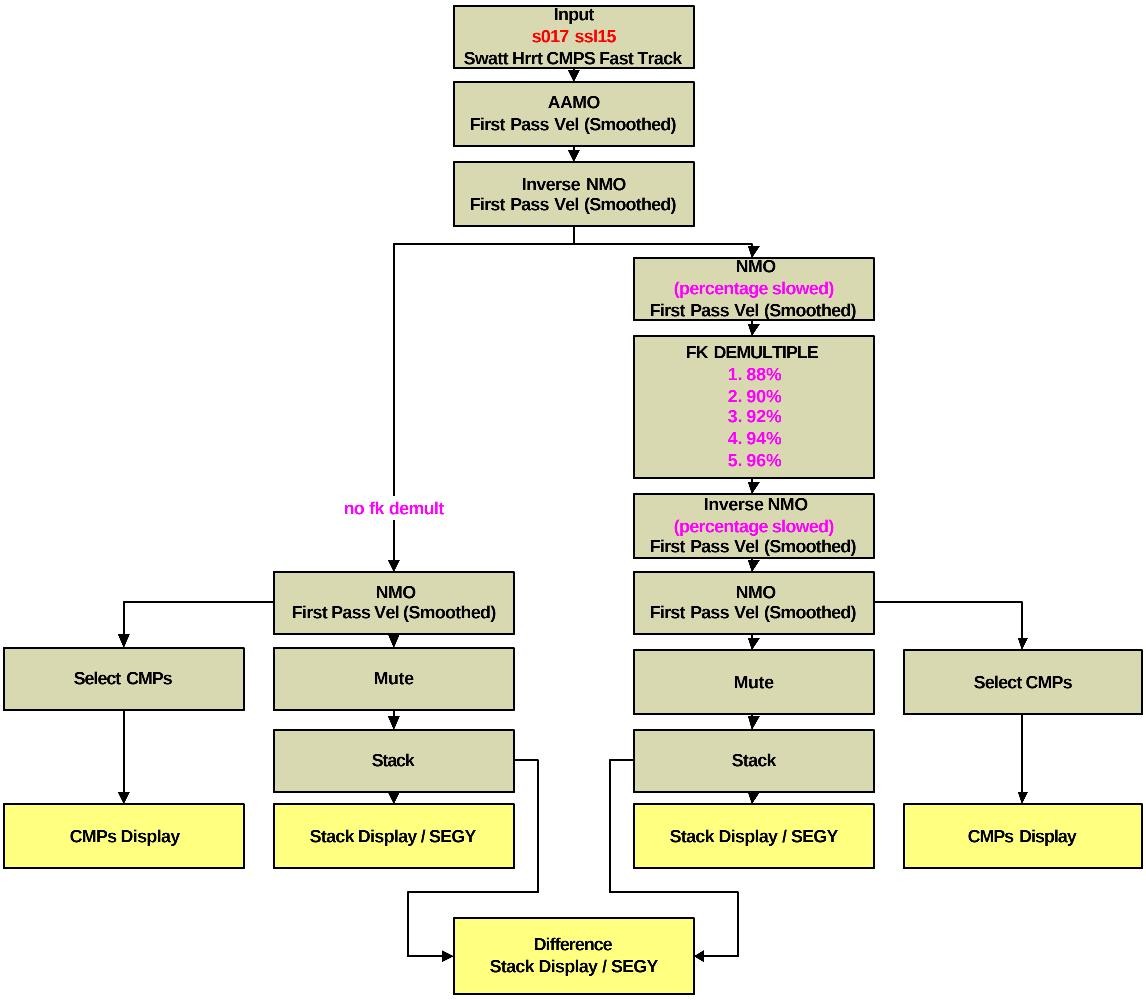


Subsequent to the previous suite of tests, the following deconvolution was selected for production.

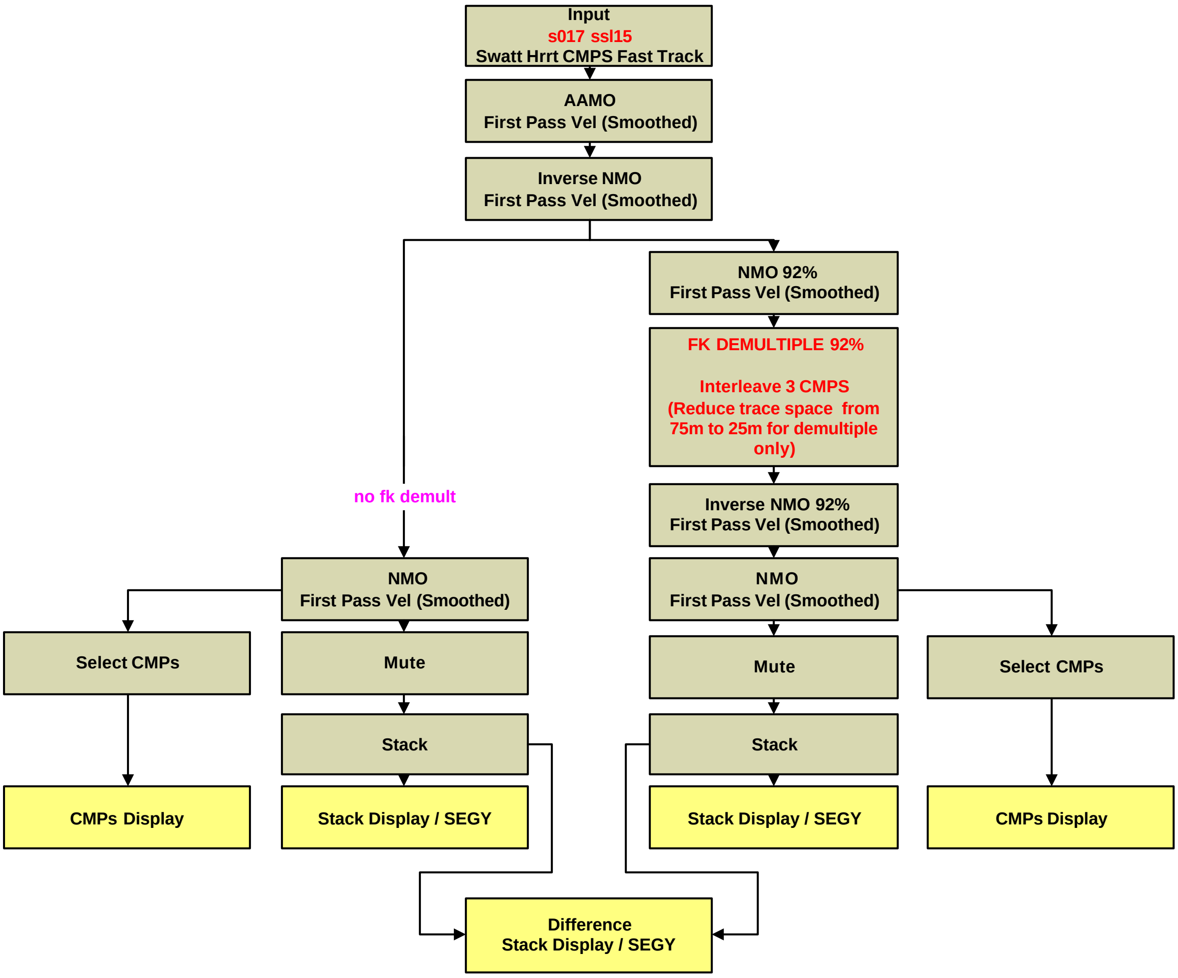
Removable AGC	120ms for deconvolution operator design
Decon Windows	2 windows; 2000ms length, 25% overlap
Decon Active Operator Length	120ms (start 40ms above wbmultiple time)
White noise	0.1%
Application	From 0-6144ms

6.17. FAST TRACK FLOW: F-K DEMULTIPLE

F-K demultiple was applied to fast track data. Initial tests were carried out on cdp gathers with linear noise attenuation applied. Tests consisted of applying normal moveout with various velocity scaling factors prior to F-K demultiple application. Extended moveout (AAMO) was applied to gathers prior to F-K demultiple. QC products included difference stacks (between demultiple and pre-demultiple data) to quantify the amount of multiple removed in each test.



From the initial tests a time variant velocity scaling function to be applied prior to F-K demultiple was selected. Subsequent tests were run to assess the effectiveness of cdp gather interleaving prior to F-K demultiple. Interleaving of three cdp gathers (with a reduction in cmp gather trace spacing from 75m to 25m) was compared to stack and gather data with no interleaving.



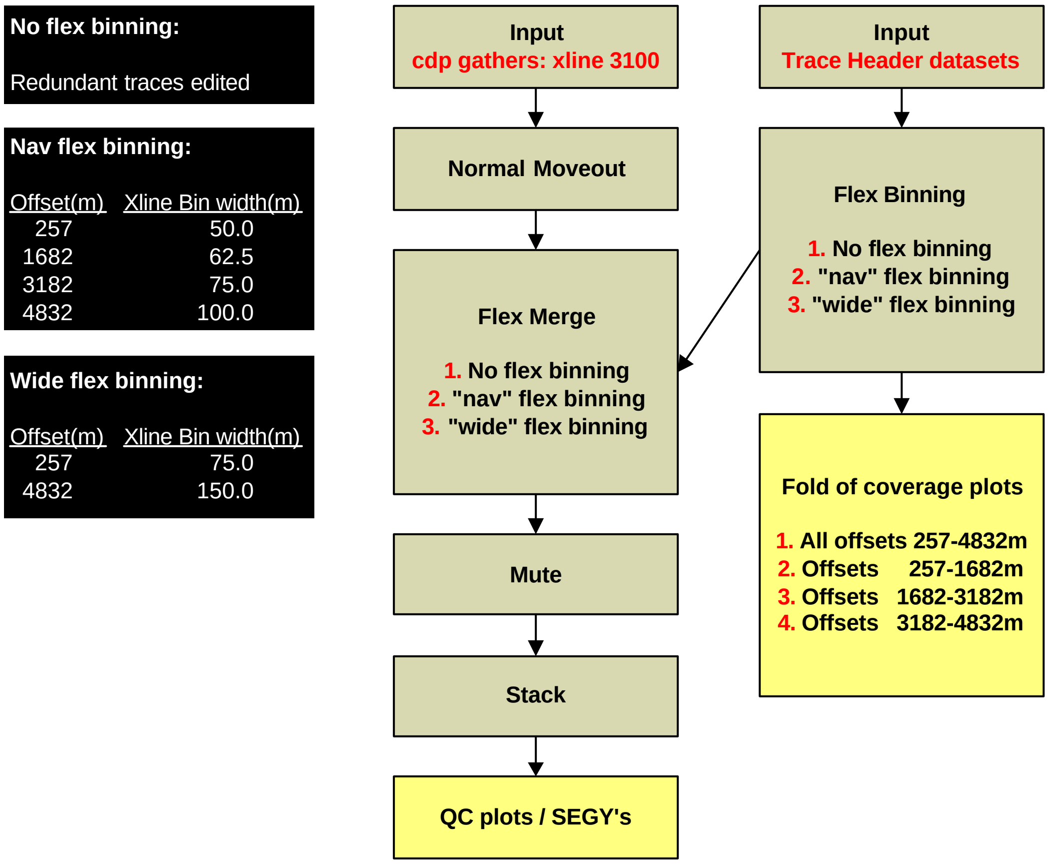
Subsequent to testing the following parameters were chosen for fast track data multiple attenuation.

Time (ms)	Velocity Scaling (%)
0	100
200	100
300	96
500	94
1000	92
2000	90
3000	88
6144	88

Dip range	Passing zero and negative dips
interleaving	3 CDPs.
Removable AGC	120ms windows
Application zone	Wbtime+100ms to 6144ms
Taper zone	Wbtime+100ms (0%) to wbtime+120ms(100%)

6.18. FAST TRACK FLOW: FLEX BINNING

Two flex schemes were tested for binning of fast track data; a standard flex scheme based on the acquisition binning parameters, and one based on a wider binning design. Flex plots before and after both flex schemes were generated for complete offset ranges and for one third cable offset groups. Xline stacks were generated to verify binning on the seismic data.

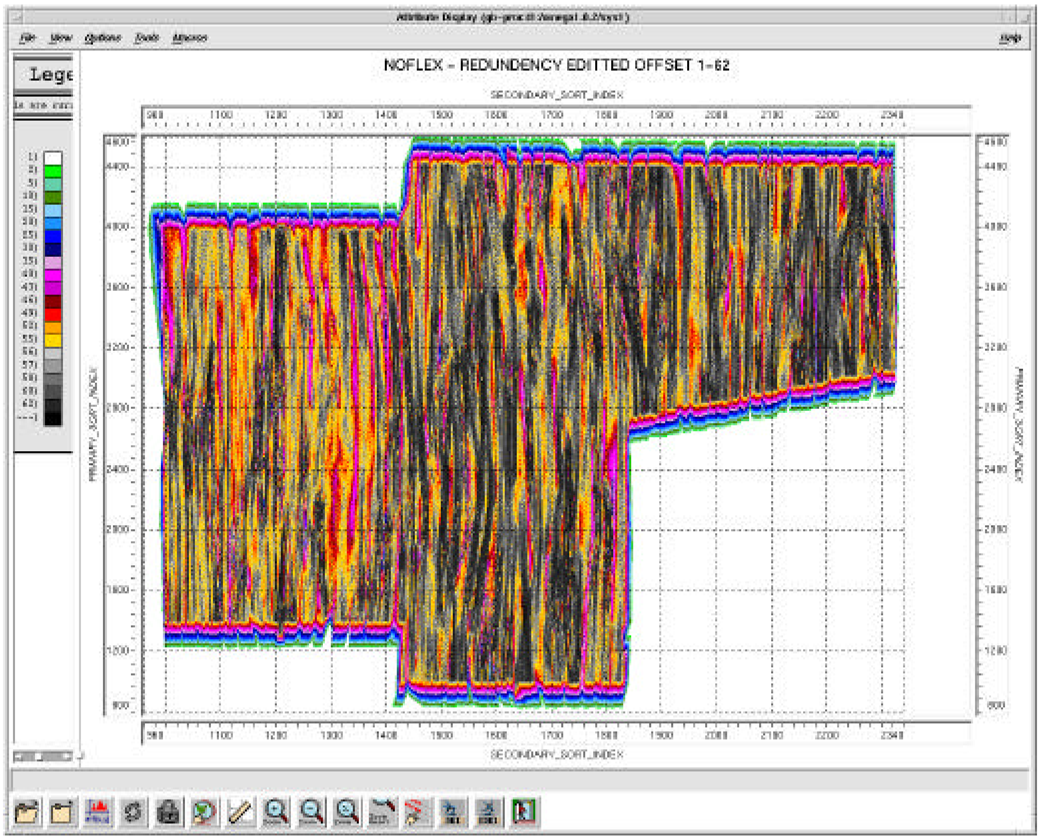


Following flex testing the wide flex binning scheme was selected for the fast track production flow.

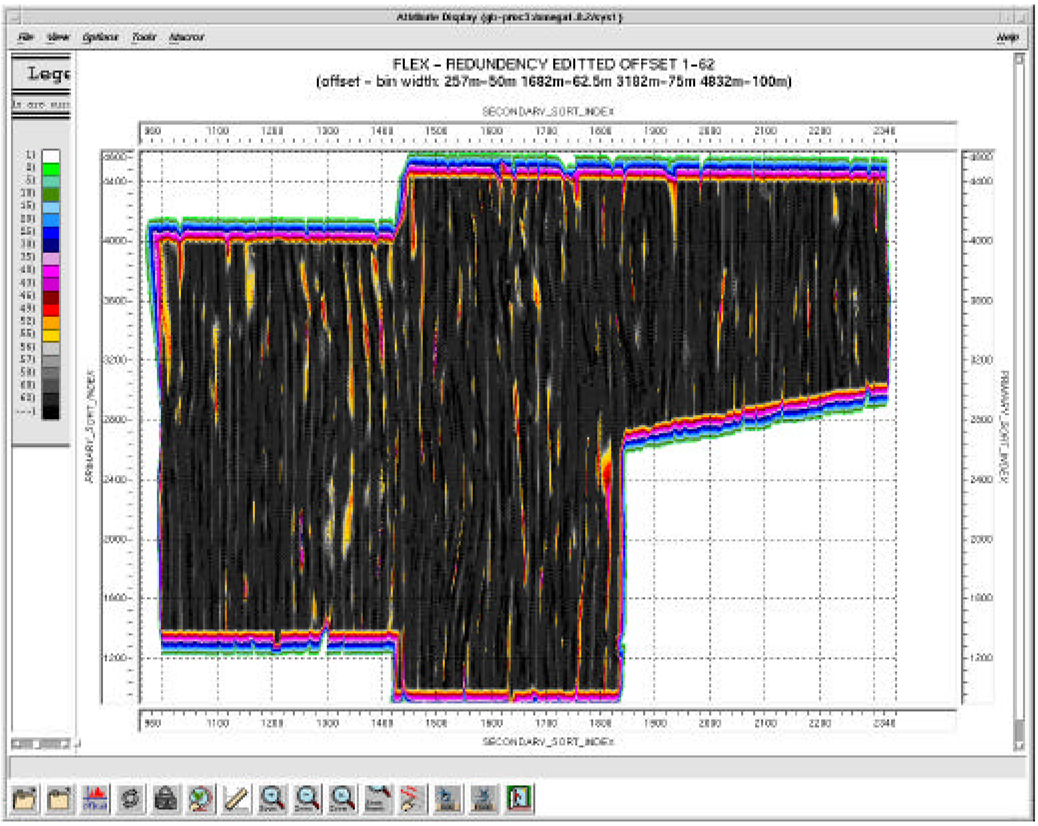
Offset (m)	Crossline Bin Size (m)	Inline Bin Size (m)
257	12.5	75
4832	12.5	150

The following flex qc plots illustrate the full offset flex coverage before and after flex binning.

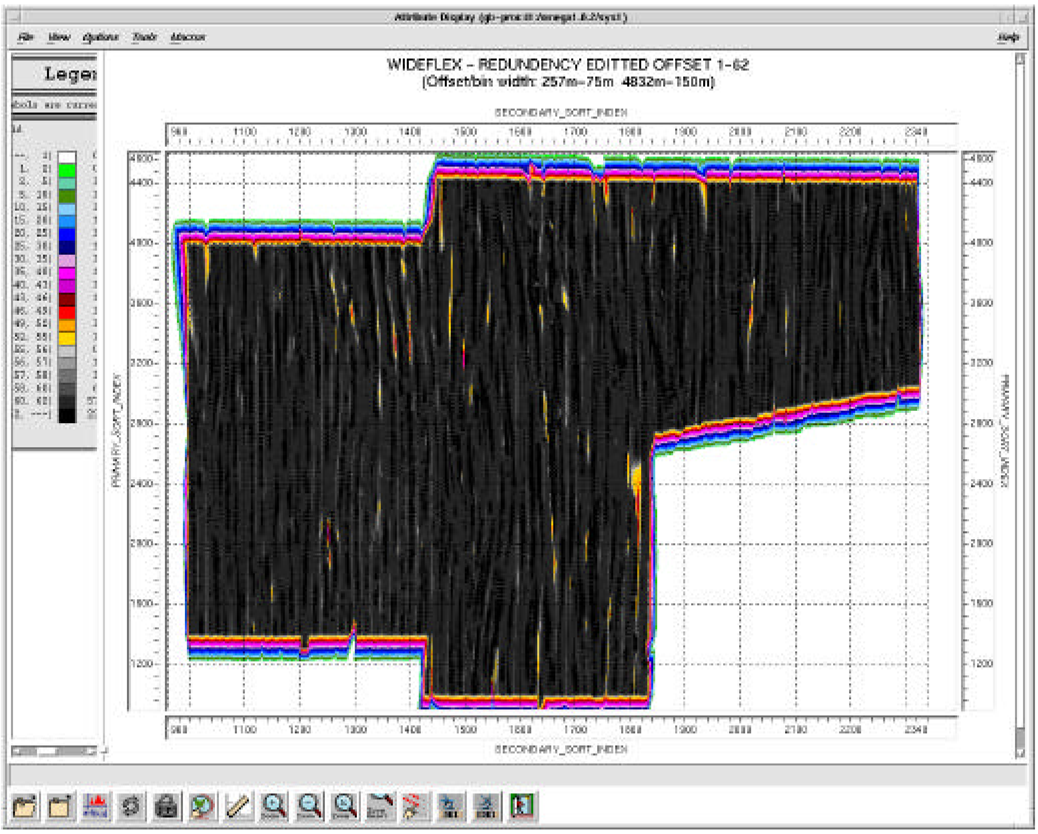
Flex plot: No flex (redundancy edited offsets 1-62)



Flex plot: Nav flex (offset bin width 50m (at 257m) to 100m (at 4832m)



Flex plot: Nav flex (offset bin width 75m (at 257m) to 150m (at 4832m)



7. CONCLUSIONS

The following factors were considered important in contributing to the quality of the final product:

1. Velocity Interpretation

Water bottom times across the survey area are variable (from approximately 150ms to more than 1000ms) and in some areas coming off the continental shelf the water bottom profile is extremely rugose. Consequently rapid lateral velocity variations were observed, and great care was required when interpreting velocities through these areas. Additional velocity analyses were run where the existing analysis interval was insufficient to adequately map the lateral velocity changes. The final pass of velocity analyses were run on a 500m grid which also aided accurate interpretation of the velocity field

2. Radon Demultiple

The choice of a high resolution radon demultiple technique for multiple attenuation was an important factor in the quality of the final data volume. Simple water bottom multiples, and a persistent water bottom pegleg multiple which appears as soon as the velocity flattens off at the base of the high velocity channel were the main targets of demultiple, and the selection of high resolution radon demultiple along with the chosen deconvolution were instrumental in removing these spurious events.

3. Space Variant Parameterisation

To maintain consistent data quality over areas of variable water depth, many processes were applied in a space variant, water depth dependent manner. Amplitude corrections (geometric spreading and exponential gains), residual statics analysis windows (on datuming lines), inner and outer trace mutes and post stack filtering and scaling were all applied space variantly.

4. Swell Noise Attenuation

The use of swell noise attenuation in four separate domains (shot, receiver, offset, cdp) was critical in removal of anomalous amplitudes prior to multichannel processes. SWATT removed significant low frequency noise and enabled data with high levels of recorded noise to be processed normally.

5. Deconvolution

The water bottom targeted method of deconvolution (in both the Tau-P domain and X-T domain) was most effective in removing the severe waterbottom pegleg multiples discussed previously. The majority of this noise was removed by the Tau-P domain deconvolution (in the shot domain), and the post PreSTM trace averaged, common offset domain X-T deconvolution contributed in multiple removal by identifying the reverberations in a different (ie – common offset) domain.

8. APPENDICES

8.1. LINE SUMMARY

#	Line	SEQ	Line Name	DIR (deg)	FSP	LSP
1	1008	P001	GP02_1008P001	18	2984	1144
2	1216	P002	GP02_1216P002	198	1266	3102
3	1024	P003	GP02_1024P003	18	2984	1144
4	1232	P004	GP02_1232P004	198	1266	3102
5	1040	P005	GP02_1040P005	18	2983	1144
6	1248	P006	GP02_1248P006	198	1266	3102
7	1056	P007	GP02_1056P007	18	2983	1144
8	1264	P008	GP02_1264P008	198	1266	3101
9	1072	P009	GP02_1072P009	18	2982	1144
10	1280	P010	GP02_1280P010	198	1266	3101
11	1088	P011	GP02_1088P011	18	2626	1143
12	1296	P012	GP02_1296P012	198	2300	3101
13	1104	P013	GP02_1104P013	18	2982	1143
14	1296	A014	GP02_1296A014	198	1363	2309
15	1120	P015	GP02_1120P015	18	2981	1143
16	1312	P016	GP02_1312P016	198	1266	3100
17	1136	P017	GP02_1136P017	18	2981	1143
18	1328	P018	GP02_1328P018	198	1266	3100
19	1152	P019	GP02_1152P019	18	2981	1143
20	1344	P020	GP02_1344P020	198	1266	3100
21	1168	P021	GP02_1168P021	18	2980	1143
22	1360	P022	GP02_1360P022	198	1266	3099
23	1088	A023	GP02_1088A023	18	2982	1143
24	1376	P024	GP02_1376P024	198	1266	3099
25	1184	P025	GP02_1184P025	18	2980	1143
26	1392	P026	GP02_1392P026	198	1266	3098
27	1200	P027	GP02_1200P027	18	2980	1143
28	1408	P028	GP02_1408P028	198	1266	3098
29	1200	J029	GP02_1200J029	18	2980	1143
30	1424	P030	GP02_1424P030	198	1266	3098
31	1200	K031	GP02_1200K031	18	2900	1143
32	1424	J032	GP02_1424J032	198	1266	3098
33	1088	J033	GP02_1088J033	18	2400	1143
34	1440	P034	GP02_1440P034	198	1001	3097
35	1680	P035	GP02_1680P035	18	3266	878
36	1584	P036	GP02_1584P036	198	1001	3391
37	1696	P037	GP02_1696P037	18	3265	878
38	1600	P038	GP02_1600P038	198	1001	2800
39	1664	P039	GP02_1664P039	18	3000	878

40	1456	P040	GP02_1456P040	198	1001	1710
41	1808	P041	GP02_1808P041	18	3262	878
42	1456	A042	GP02_1456A042	198	1001	3395
43	1792	P043	GP02_1792P043	18	3263	878
44	1616	P044	GP02_1616P044	198	1001	3390
45	1776	P045	GP02_1776P045	18	3263	878
46	1568	P046	GP02_1568P046	198	1001	3392
47	1712	P047	GP02_1712P047	18	3265	878
48	1552	P048	GP02_1552P048	198	1001	3392
49	1728	P049	GP02_1728P049	18	3264	878
50	1536	P050	GP02_1536P050	198	1001	3392
51	1664	A051	GP02_1664A051	18	3266	2991
52	1680	A052	GP02_1680A052	18	2612	2174
53	1600	A053	GP02_1600A053	198	2470	3391
54	1744	P054	GP02_1744P054	18	3264	878
55	1520	P055	GP02_1520P055	198	1001	3393
56	1760	P056	GP02_1760P056	18	3263	878
57	1472	P057	GP02_1472P057	198	1001	3394
58	1824	P058	GP02_1824P058	18	3262	878
59	1488	P059	GP02_1488P059	198	1001	3394
60	1776	J060	GP02_1776J060	18	3263	878
61	1520	J061	GP02_1520J061	198	1001	3393
62	1120	A062	GP02_1120A062	18	2981	1143
63	1296	B063	GP02_1296B063	198	1266	1900
64	1488	J064	GP02_1488J064	198	1001	3394
65	1760	J065	GP02_1760J065	18	3263	878
66	1504	P066	GP02_1504P066	198	1001	3393
67	1760	K067	GP02_1760K067	18	650	78
68	1520	K068	GP02_1520K068	198	1001	3085
69	1648	P069	GP02_1648P069	18	3266	878
70	1522	A070	GP02_1552A070	198	1001	1219
71	1824	A071	GP02_1824A071	18	1141	1067
72	1632	P072	GP02_1632P072	198	1001	3390
73	1632	J073	GP02_1632J073	18	3267	878
74	1536	J074	GP02_1536J074	198	1500	2500
75	1632	A075	GP02_1632A075	198	2916	3124
76	1664	J076	GP02_1664J076	18	2920	878
77	1488	K077	GP02_1488K077	198	2220	3394
78	1952	P078	GP02_1952P078	18	3258	2094
79	2128	P079	GP02_2128P079	198	2292	3376
80	2032	P080	GP02_2032P080	18	3256	2128
81	2208	P081	GP02_2208P081	198	2326	3374
82	1840	P082	GP02_1840P082	18	3261	2047

83	2288	P083	GP02_2288P083	198	2360	3372
84	1936	P084	GP02_1936P084	18	3259	2087
85	2112	P085	GP02_2112P085	198	2285	3377
86	2144	P086	GP02_2144P086	198	2299	3376
87	2016	P087	GP02_2016P087	18	3256	2121
88	2224	P088	GP02_2224P088	198	2224	3374
89	1856	P089	GP02_1856P089	18	3261	2053
90	2240	P090	GP02_2240P090	198	2340	3373
91	2048	P091	GP02_2048P091	18	3256	2135
92	2304	P092	GP02_2304P092	198	2367	3372
93	1968	P093	GP02_1968P093	18	3258	2101
94	2160	P094	GP02_2160P094	198	2306	3376
95	1872	P095	GP02_1872P095	18	3260	2060
96	2256	P096	GP02_2256P096	198	2346	3373
97	2000	P097	GP02_2000P097	18	3257	2115
98	1872	J098	GP02_1872J098	18	3260	2060
99	2192	P099	GP02_2192P099	198	2319	3375
100	1920	P100	GP02_1920P100	18	3259	2081
101	2160	J101	GP02_2160J101	198	2306	3376
102	1968	J102	GP02_1968J102	18	3258	2101
103	2256	J103	GP02_2256J103	198	2346	3373
104	2000	J104	GP02_2000J104	18	3257	2115
105	2176	P105	GP02_2176P105	198	2312	3375
106	1888	P106	GP02_1888P106	18	3260	2067
107	2272	P107	GP02_2272P107	198	2353	3373
108	1904	P108	GP02_1904P108	18	3259	2074
109	2096	P109	GP02_2096P109	198	2278	3377
110	1984	P110	GP02_1984P110	18	3257	2108
111	2256	K111	GP02_2256K111	198	2346	3373
112	1904	J112	GP02_1904J112	18	3259	2074
113	2256	L113	GP02_2256L113	198	2346	3373
114	1568	J114	GP02_1568J114	198	1330	2820
115	1776	K115	GP02_1776K115	18	2350	2010
116	2320	P116	GP02_2320P116	198	2373	3128
117	1888	J117	GP02_1888J117	18	3215	2310
118	2160	K118	GP02_2160K118	198	2306	3285
119	2064	P119	GP02_2064P119	18	3255	2142
120	2320	J120	GP02_2320J120	198	2630	3371
121	2000	K121	GP02_2000K121	18	3257	2115
122	2080	P122	GP02_2080P122	198	2272	3378
123	2080	J123	GP02_2080J123	18	3255	2149
124	2320	K124	GP02_2320K124	198	2373	3371
125	2080	K125	GP02_2080K125	18	3200	2365

126	2272	J126	GP02_2272J126	198	2353	2720
127	2080	L127	GP02_2080L127	18	2375	2149
128	**2336**	**T128**	**GP02_2336T128**	**109**	**1001**	**2925**
129	1408	J129	GP02_1408J129	198	2030	3081
130	1728	J130	GP02_1728J130	18	3033	2630
131	1728	K131	GP02_1728K131	18	2020	1105
132	1536	K132	GP02_1536K132	198	1310	3300
133	1984	J133	GP02_1984J133	18	3177	2615

T128 GP02_2336T128 is a 2D tie-line

8.2. ARCHIVE PRODUCTS

Item Number	Media | Format	Data Description
Onboard Brute Stack		
Q00735	3590B tar SEGY	Tar of SEGY brute stacks: bstk1 & bstk2
Q00736	3590B tar SEGY	Tar of SEGY brute stacks: bstk3 & bstk4
Near Trace Gather Cube		
Q50081	3590E SEGY	Raw NTG Migration @ **2ms** (Lines 1001-1851) – 1 of 2
Q50082	3590E SEGY	Raw NTG Migration @ **2ms** (Lines 1852-2328) – 2 of 2
Q50085	3590E SEGY	Raw NTG Migration @ **4ms** (Lines 1001-2328)
Fast Track DMO Stack		
Q50079	3590E SEGY	Raw DMO Stack (Lines 1001-1945) – 1 of 2
Q50080	3590E SEGY	Raw DMO Stack (Lines 1946-2328) – 2 of 2
Fast Track Migration		
Q50083	3590E SEGY	Filtered Migration (Lines 1001-1945) – 1 of 2
Q50084	3590E SEGY	Filtered Migration (Lines 1946-2328) – 2 of 2
Q50077	3590E SEGY	Filtered & Scaled Migration (Lines 1001-1945) – 1 of 2
Q50078	3590E SEGY	Filtered & Scaled Migration (Lines 1946-2328) – 2 of 2
Q50086	3590E SEGY	Filtered & Scaled **60 Degree** Migration (Lines 1001-1945)
Q50087	3590E SEGY	Filtered & Scaled **60 Degree** Migration (Lines 1946-2328)
Fast Track Migration (noise analysis test cube)		
Q50273	3590E SEGY	Filtered & Scaled Migration (Lines 1001-1200) – 1 of 1
Q50276	3590E SEGY	Filtered Stack (Lines 1001-1200) – 1 of 1
Q50277	3590E SEGY	Filtered Migration (Lines 1001-1200) – 1 of 1
Final Production Migration (Raw)		
Q50258	3590E SEGY	Raw PSTM Stack (Lines 1001-2232) – 1 of 2
Q50259	3590E SEGY	Raw PSTM Stack (Lines 2233-2328) – 2 of 2
Q50255	3590E SEGY	Raw PSTM Stack with Spectral Wht. (Lines 1001-2233)
Q50256	3590E SEGY	Raw PSTM Stack with Spectral Wht. (Lines 2234-2328)
SEQ128 2D line 2336		
Q50274	3590E SEGY	Raw; Raw (specwhit); Filtscal PSTM Stacks (subline 8)
Government Copies		
Q00872	3590B SEGY	Raw PSTM Stack (Lines 1001-1567) – 1 of 3
Q00873	3590B SEGY	Raw PSTM Stack (Lines 1568-2230) – 2 of 3

Q00876	3590B SEGY	Raw PSTM Stack (Lines 2231-2328) – 3 of 3
Government copy: SEQ128 2D line 2336		
Q00890	3590B SEGY	Raw; Raw (specwhit); Filtscal PSTM Stacks (subline 8)
INPEX Copy: SEQ128 2D line 2336		
DL0352	DLT SEGY	Raw PSTM Stack (Lines 1001-1550) – 1 of 3
DL0353	DLT SEG Y	Raw PSTM Stack (Lines 1551-2100) – 2 of 3
DL0354	DLT SEGY	Raw PSTM Stack (Lines 2101-2328) – 3 of 3
Inpex copy: SEQ128 2D line 2336		
DL0365	DLT SEGY	Raw; Raw (specwhit); Filtscal PSTM Stacks (subline 8)
Final Production Migration (Filtered & Scaled)		
Q50253	3590E SEGY	Filtered & Scaled PSTM Stack (Lines 1001-2233) – 1 of 2
Q50254	3590E SEGY	Filtered & Scaled PSTM Stack (Lines 2234-2328) – 2 of 2
Government Copies		
Q00870	3590B SEGY	Filtered & Scaled PSTM Stack (Lines 1001-1567) – 1 of 3
Q00871	3590B SEGY	Filtered & Scaled PSTM Stack (Lines 1568-2230) – 2 of 3
Q00877	3590B SEGY	Filtered & Scaled PSTM Stack (Lines 2231-2328) – 3 of 3
INPEX Copies		
DL0343	DLT SEGY	Filtered & Scaled PSTM Stack (Lines 1001-1550) – 1 of 3
DL0344	DLT SEGY	Filtered & Scaled PSTM Stack (Lines 1551-2100) – 2 of 3
DL0345	DLT SEGY	Filtered & Scaled PSTM Stack (Lines 2101-2328) – 3 of 3
Final PSTM Angle Stack (Raw)		
Q50262	3590E SEGY	PSTM Angle Stack 4 to 16° (Lines 1001-2232) – 1 of 2
Q50263	3590E SEGY	PSTM Angle Stack 4 to 16° (Lines 2233-2328) – 2 of 2
Q50266	3590E SEGY	PSTM Angle Stack 16 to 28° (Lines 1001-2232) – 1 of 2
Q50267	3590E SEGY	PSTM Angle Stack 16 to 28° (Lines 2233-2328) – 2 of 2
Q50270	3590E SEGY	PSTM Angle Stack 28 to 40° (Lines 1001-2232) – 1 of 2
Q50271	3590E SEGY	PSTM Angle Stack 28 to 40° (Lines 2233-2328) – 2 of 2
Final PSTM Angle Stack : 4 to 16 degrees (Filtered)		
Q50260	3590E SEGY	Filtered PSTM Angle Stack (Lines 1001-2232) – 1 of 2
Q50261	3590E SEGY	Filtered PSTM Angle Stack (Lines 2233-2328) – 2 of 2
Angle stacks: SEQ128 2D line 2336		
Q50275	3590E SEGY	Raw + Filtered PSTM Angle tacks (sublines 8,12)
INPEX Copies		
DL0355	DLT SEGY	Filtered PSTM Angle Stack (Lines 1001-1550) – 1 of 3
DL0356	DLT SEGY	Filtered PSTM Angle Stack (Lines 1551-2100) – 2 of 3

DL0357	DLT SEGY	Filtered PSTM Angle Stack (Lines 2101-2328) – 3 of 3
Inpex copy: Angle stacks: SEQ128 2D line 2336		
DL0342	DLT SEGY	Raw + Filtered PSTM Angle tacks (sublines 8,12)
Final PSTM Angle Stack : 16 to 28 degrees (Filtered)		
Q50264	3590E SEGY	Filtered PSTM Angle Stack (Lines 1001-2232) – 1 of 2
Q50265	3590E SEGY	Filtered PSTM Angle Stack (Lines 2233-2328) – 2 of 2
INPEX Copies		
DL0358	DLT SEGY	Filtered PSTM Angle Stack (Lines 1001-1550) – 1 of 3
DL0359	DLT SEGY	Filtered PSTM Angle Stack (Lines 1551-2100) – 2 of 3
DL0360	DLT SEGY	Filtered PSTM Angle Stack (Lines 2101-2328) – 3 of 3
Final PSTM Angle Stack : 28 to 40 degrees (Filtered)		
Q50268	3590E SEGY	Filtered PSTM Angle Stack (Lines 1001-2232) – 1 of 2
Q50269	3590E SEGY	Filtered PSTM Angle Stack (Lines 2233-2328) – 2 of 2
INPEX Copies		
DL0361	DLT SEGY	Filtered PSTM Angle Stack (Lines 1001-1550) – 1 of 3
DL0362	DLT SEGY	Filtered PSTM Angle Stack (Lines 1551-2100) – 2 of 3
DL0363	DLT SEGY	Filtered PSTM Angle Stack (Lines 2101-2328) – 3 of 3
Velocity Fields (ASCII) | Bin Centre (AGD84) | Processed Tape Listing (endpoints)		
WG2250	CD-R | WG Format	Targeted Migration Velocities (raw & smoothed)
WG2250	CD-R | Esso Format	Targeted Migration Velocities (raw & smoothed)
WG2250	CD-R | WG Format	Final PSTM Velocities
WG2250	CD-R | Esso Format	Final PSTM Velocities
WG2250	CD-R | P6/98	Bin Centre Coordinates
WG2250	CD-R | ASCII	Processed Tape List Endpoints
WG2251	CD-R | WG Format	High Density Velocities (25m x 25m Grid)
WG2252	CD-R | Esso Format	High Density Velocities (25m x 25m Grid)
INPEX Copies		
WG2253	CD-R | WG Format	Final PSTM Velocities
WG2253	CD-R | WG Format	Targeted Migration Velocities (raw)
WG2253	CD-R | WG Format	High Density Velocities (25m x 25m Grid)
WG2254	CD-R | P6/98	Bin Centre Coordinates
WG2254	CD-R | ASCII	Processed Tape List Endpoints
Government Copies		
WG2255	CD-R | WG Format	Final PSTM Velocities
WG2256	CD-R | P6/98	Bin Centre Coordinates (Copy 1)

WG2256	CD-R | P6/98	Processed Tape List Endpoints (Copy 1)
WG2257	CD-R | ASCII	Bin Centre Coordinates (Copy 2)
WG2257	CD-R | ASCII	Processed Tape List Endpoints (Copy 2)
Noise Analysis Tests		
WG2258	CD-R | various	Noise Analysis Tests (gifs, excel files & ASCII)
Data Processing Report		
WG2260	CD-R | pdf	Data Processing Report (Copy 1)
WG2261	CD-R | pdf	Data Processing Report (Copy 2)
	Hardcopy	Data Processing Report
INPEX Copies		
WG2262	CD-R | pdf	Data Processing Report
Government Copies		
WG2263	CD-R | pdf	Data Processing Report (Copy 1)
WG2264	CD-R | pdf	Data Processing Report (Copy 2)
High Density Velocity Semblances (50m x 50m Grid) 5 tapes		
DL0337	DLT | Tar SEGY	Velocity Semblances (Lines 1000-1274 inc 2)
DL0338	DLT | Tar SEGY	Velocity Semblances (Lines 1276-1532 inc 2)
DL0339	DLT | Tar SEGY	Velocity Semblances (Lines 1534-1766 inc 2)
DL0340	DLT | Tar SEGY	Velocity Semblances (Lines 1768-2100 inc 2)
DL0341	DLT | Tar SEGY	Velocity Semblances (Lines 2102-2328 inc 2) **§**
Fast Track 3D CMP Gathers (every 2nd CMP and 2nd trace)		**17 tapes**
Q50120	3590E SEGY	Fast Track CMP Gathers (Lines 1001-1075)
Q50121	3590E SEGY	Fast Track CMP Gathers (Lines 1076-1150)
Q50122	3590E SEGY	Fast Track CMP Gathers (Lines 1151-1225)
Q50123	3590E SEGY	Fast Track CMP Gathers (Lines 1226-1300)
Q50124	3590E SEGY	Fast Track CMP Gathers (Lines 1301-1376)
Q50125	3590E SEGY	Fast Track CMP Gathers (Lines 1377-1449)
Q50126	3590E SEGY	Fast Track CMP Gathers (Lines 1450-1507)
Q50127	3590E SEGY	Fast Track CMP Gathers (Lines 1508-1565)
Q50128	3590E SEGY	Fast Track CMP Gathers (Lines 1566-1622)
Q50129	3590E SEGY	Fast Track CMP Gathers (Lines 1623-1680)
Q50130	3590E SEGY	Fast Track CMP Gathers (Lines 1681-1738)
Q50131	3590E SEGY	Fast Track CMP Gathers (Lines 1739-1796)
Q50133	3590E SEGY	Fast Track CMP Gathers (Lines 1797-1877)

Q50134	3590E SEGY	Fast Track CMP Gathers (Lines 1878-1995)
Q50135	3590E SEGY	Fast Track CMP Gathers (Lines 1996-2119)
Q50136	3590E SEGY	Fast Track CMP Gathers (Lines 2120-2248)
Q50137	3590E SEGY	Fast Track CMP Gathers (Lines 2249-2328) §
Interpolated 3D CMP Gathers		**67 tapes**
Q50252	3590E SEGY	Interpolated CMP Gathers (Lines 1001-1019)
Q50097	3590E SEGY	Interpolated CMP Gathers (Lines 1020-1039)
Q50098	3590E SEGY	Interpolated CMP Gathers (Lines 1040-1059)
Q50099	3590E SEGY	Interpolated CMP Gathers (Lines 1060-1079)
Q50100	3590E SEGY	Interpolated CMP Gathers (Lines 1080-1099)
Q50101	3590E SEGY	Interpolated CMP Gathers (Lines 1100-1119)
Q50102	3590E SEGY	Interpolated CMP Gathers (Lines 1120-1139)
Q50103	3590E SEGY	Interpolated CMP Gathers (Lines 1140-1159)
Q50104	3590E SEGY	Interpolated CMP Gathers (Lines 1160-1179)
Q50105	3590E SEGY	Interpolated CMP Gathers (Lines 1180-1199)
Q50106	3590E SEGY	Interpolated CMP Gathers (Lines 1200-1219)
Q50107	3590E SEGY	Interpolated CMP Gathers (Lines 1220-1239)
Q50108	3590E SEGY	Interpolated CMP Gathers (Lines 1240-1259)
Q50109	3590E SEGY	Interpolated CMP Gathers (Lines 1260-1279)
Q50110	3590E SEGY	Interpolated CMP Gathers (Lines 1280-1299)
Q50111	3590E SEGY	Interpolated CMP Gathers (Lines 1300-1319)
Q50112	3590E SEGY	Interpolated CMP Gathers (Lines 1320-1339)
Q50113	3590E SEGY	Interpolated CMP Gathers (Lines 1340-1359)
Q50114	3590E SEGY	Interpolated CMP Gathers (Lines 1360-1379)
Q50115	3590E SEGY	Interpolated CMP Gathers (Lines 1380-1399)
Q50116	3590E SEGY	Interpolated CMP Gathers (Lines 1400-1419)
Q50117	3590E SEGY	Interpolated CMP Gathers (Lines 1420-1429)
Q50089	3590E SEGY	Interpolated CMP Gathers (Lines 1430-1438)
Q50118	3590E SEGY	Interpolated CMP Gathers (Lines 1439-1454)
Q50119	3590E SEGY	Interpolated CMP Gathers (Lines 1455-1470)
Q50139	3590E SEGY	Interpolated CMP Gathers (Lines 1471-1485)
Q50140	3590E SEGY	Interpolated CMP Gathers (Lines 1486-1500)
Q50141	3590E SEGY	Interpolated CMP Gathers (Lines 1501-1516)
Q50142	3590E SEGY	Interpolated CMP Gathers (Lines 1517-1531)

Q50143	3590E SEGY	Interpolated CMP Gathers (Lines 1532-1546)
Q50144	3590E SEGY	Interpolated CMP Gathers (Lines 1547-1562)
Q50145	3590E SEGY	Interpolated CMP Gathers (Lines 1563-1577)
Q50146	3590E SEGY	Interpolated CMP Gathers (Lines 1578-1592)
Q50147	3590E SEGY	Interpolated CMP Gathers (Lines 1593-1608)
Q50148	3590E SEGY	Interpolated CMP Gathers (Lines 1609-1623)
Q50149	3590E SEGY	Interpolated CMP Gathers (Lines 1624-1638)
Q50180	3590E SEGY	Interpolated CMP Gathers (Lines 1639-1653)
Q50181	3590E SEGY	Interpolated CMP Gathers (Lines 1654-1669)
Q50152	3590E SEGY	Interpolated CMP Gathers (Lines 1670-1684)
Q50153	3590E SEGY	Interpolated CMP Gathers (Lines 1685-1700)
Q50154	3590E SEGY	Interpolated CMP Gathers (Lines 1701-1715)
Q50155	3590E SEGY	Interpolated CMP Gathers (Lines 1716-1731)
Q50156	3590E SEGY	Interpolated CMP Gathers (Lines 1732-1746)
Q50157	3590E SEGY	Interpolated CMP Gathers (Lines 1747-1761)
Q50158	3590E SEGY	Interpolated CMP Gathers (Lines 1762-1777)
Q50159	3590E SEGY	Interpolated CMP Gathers (Lines 1778-1792)
Q50160	3590E SEGY	Interpolated CMP Gathers (Lines 1793-1807)
Q50161	3590E SEGY	Interpolated CMP Gathers (Lines 1808-1823)
Q50162	3590E SEGY	Interpolated CMP Gathers (Lines 1824-1838)
Q50163	3590E SEGY	Interpolated CMP Gathers (Lines 1839-1857)
Q50088	3590E SEGY	Interpolated CMP Gathers (Lines 1858-1875)
Q50164	3590E SEGY	Interpolated CMP Gathers (Lines 1876-1906)
Q50165	3590E SEGY	Interpolated CMP Gathers (Lines 1907-1937)
Q50166	3590E SEGY	Interpolated CMP Gathers (Lines 1938-1968)
Q50167	3590E SEGY	Interpolated CMP Gathers (Lines 1969-2000)
Q50168	3590E SEGY	Interpolated CMP Gathers (Lines 2001-2033)
Q50169	3590E SEGY	Interpolated CMP Gathers (Lines 2034-2065)
Q50170	3590E SEGY	Interpolated CMP Gathers (Lines 2066-2083)
Q50090	3590E SEGY	Interpolated CMP Gathers (Lines 2084-2099)
Q50171	3590E SEGY	Interpolated CMP Gathers (Lines 2100-2132)
Q50172	3590E SEGY	Interpolated CMP Gathers (Lines 2133-2166)
Q50173	3590E SEGY	Interpolated CMP Gathers (Lines 2167-2201)
Q50174	3590E SEGY	Interpolated CMP Gathers (Lines 2202-2234)

Q50175	3590E SEGY	Interpolated CMP Gathers (Lines 2235-2270)
Q50176	3590E SEGY	Interpolated CMP Gathers (Lines 2271-2306)
Q50177	3590E SEGY	Interpolated CMP Gathers (Lines 2307-2336)
Q50178	3590E SEGY	Interpolated CMP Gathers (Lines 2337-2343) §
PSTM 3D CMP Gathers		**65 tapes**
Q50272	3590E SEGY	PSTM CMP Gathers (Lines 1001-1019)
Q50187	3590E SEGY	PSTM CMP Gathers (Lines 1020-1039)
Q50188	3590E SEGY	PSTM CMP Gathers (Lines 1040-1059)
Q50189	3590E SEGY	PSTM CMP Gathers (Lines 1060-1079)
Q50190	3590E SEGY	PSTM CMP Gathers (Lines 1080-1099)
Q50191	3590E SEGY	PSTM CMP Gathers (Lines 1100-1119)
Q50192	3590E SEGY	PSTM CMP Gathers (Lines 1120-1139)
Q50193	3590E SEGY	PSTM CMP Gathers (Lines 1140-1159)
Q50194	3590E SEGY	PSTM CMP Gathers (Lines 1160-1179)
Q50195	3590E SEGY	PSTM CMP Gathers (Lines 1180-1199)
Q50196	3590E SEGY	PSTM CMP Gathers (Lines 1200-1219)
Q50197	3590E SEGY	PSTM CMP Gathers (Lines 1220-1239)
Q50198	3590E SEGY	PSTM CMP Gathers (Lines 1240-1259)
Q50199	3590E SEGY	PSTM CMP Gathers (Lines 1260-1279)
Q50200	3590E SEGY	PSTM CMP Gathers (Lines 1280-1299)
Q50201	3590E SEGY	PSTM CMP Gathers (Lines 1300-1319)
Q50202	3590E SEGY	PSTM CMP Gathers (Lines 1320-1339)
Q50203	3590E SEGY	PSTM CMP Gathers (Lines 1340-1359)
Q50204	3590E SEGY	PSTM CMP Gathers (Lines 1360-1379)
Q50205	3590E SEGY	PSTM CMP Gathers (Lines 1380-1399)
Q50206	3590E SEGY	PSTM CMP Gathers (Lines 1400-1419)
Q50207	3590E SEGY	PSTM CMP Gathers (Lines 1420-1435)
Q50208	3590E SEGY	PSTM CMP Gathers (Lines 14361451)
Q50209	3590E SEGY	PSTM CMP Gathers (Lines 1452-1467)
Q50210	3590E SEGY	PSTM CMP Gathers (Lines 1468-1482)
Q50211	3590E SEGY	PSTM CMP Gathers (Lines 1483-1497)
Q50212	3590E SEGY	PSTM CMP Gathers (Lines 1498-1513)
Q50213	3590E SEGY	PSTM CMP Gathers (Lines 1514-1528)
Q50214	3590E SEGY	PSTM CMP Gathers (Lines 1529-1543)

Q50215	3590E SEGY	PSTM CMP Gathers (Lines 1544-1559)
Q50216	3590E SEGY	PSTM CMP Gathers (Lines 1560-1574)
Q50217	3590E SEGY	PSTM CMP Gathers (Lines 1575-1589)
Q50218	3590E SEGY	PSTM CMP Gathers (Lines 1590-1605)
Q50219	3590E SEGY	PSTM CMP Gathers (Lines 1606-1620)
Q50220	3590E SEGY	PSTM CMP Gathers (Lines 1621-1635)
Q50221	3590E SEGY	PSTM CMP Gathers (Lines 1636-1650)
Q50222	3590E SEGY	PSTM CMP Gathers (Lines 1651-1666)
Q50223	3590E SEGY	PSTM CMP Gathers (Lines 1667-1681)
Q50224	3590E SEGY	PSTM CMP Gathers (Lines 1682-1697)
Q50225	3590E SEGY	PSTM CMP Gathers (Lines 1698-1712)
Q50226	3590E SEGY	PSTM CMP Gathers (Lines 1713-1728)
Q50227	3590E SEGY	PSTM CMP Gathers (Lines 1729-1743)
Q50228	3590E SEGY	PSTM CMP Gathers (Lines 1744-1758)
Q50229	3590E SEGY	PSTM CMP Gathers (Lines 1759-1774)
Q50230	3590E SEGY	PSTM CMP Gathers (Lines 1775-1789)
Q50231	3590E SEGY	PSTM CMP Gathers (Lines 1790-1804)
Q50232	3590E SEGY	PSTM CMP Gathers (Lines 1805-1820)
Q50233	3590E SEGY	PSTM CMP Gathers (Lines 1821-1835)
Q50234	3590E SEGY	PSTM CMP Gathers (Lines 1836-1851)
Q50235	3590E SEGY	PSTM CMP Gathers (Lines 1852-1870)
Q50236	3590E SEGY	PSTM CMP Gathers (Lines 1871-1895)
Q50237	3590E SEGY	PSTM CMP Gathers (Lines 1896-1925)
Q50238	3590E SEGY	PSTM CMP Gathers (Lines 1926-1955)
Q50239	3590E SEGY	PSTM CMP Gathers (Lines 1956-1985)
Q50240	3590E SEGY	PSTM CMP Gathers (Lines 1986-2016)
Q50241	3590E SEGY	PSTM CMP Gathers (Lines 2017-2047)
Q50242	3590E SEGY	PSTM CMP Gathers (Lines 2048-2078)
Q50243	3590E SEGY	PSTM CMP Gathers (Lines 2079-2110)
Q50244	3590E SEGY	PSTM CMP Gathers (Lines 2111-2142)
Q50245	3590E SEGY	PSTM CMP Gathers (Lines 2143-2175)
Q50246	3590E SEGY	PSTM CMP Gathers (Lines 2176-2208)
Q50247	3590E SEGY	PSTM CMP Gathers (Lines 2209-2242)
Q50248	3590E SEGY	PSTM CMP Gathers (Lines 2243-2277)

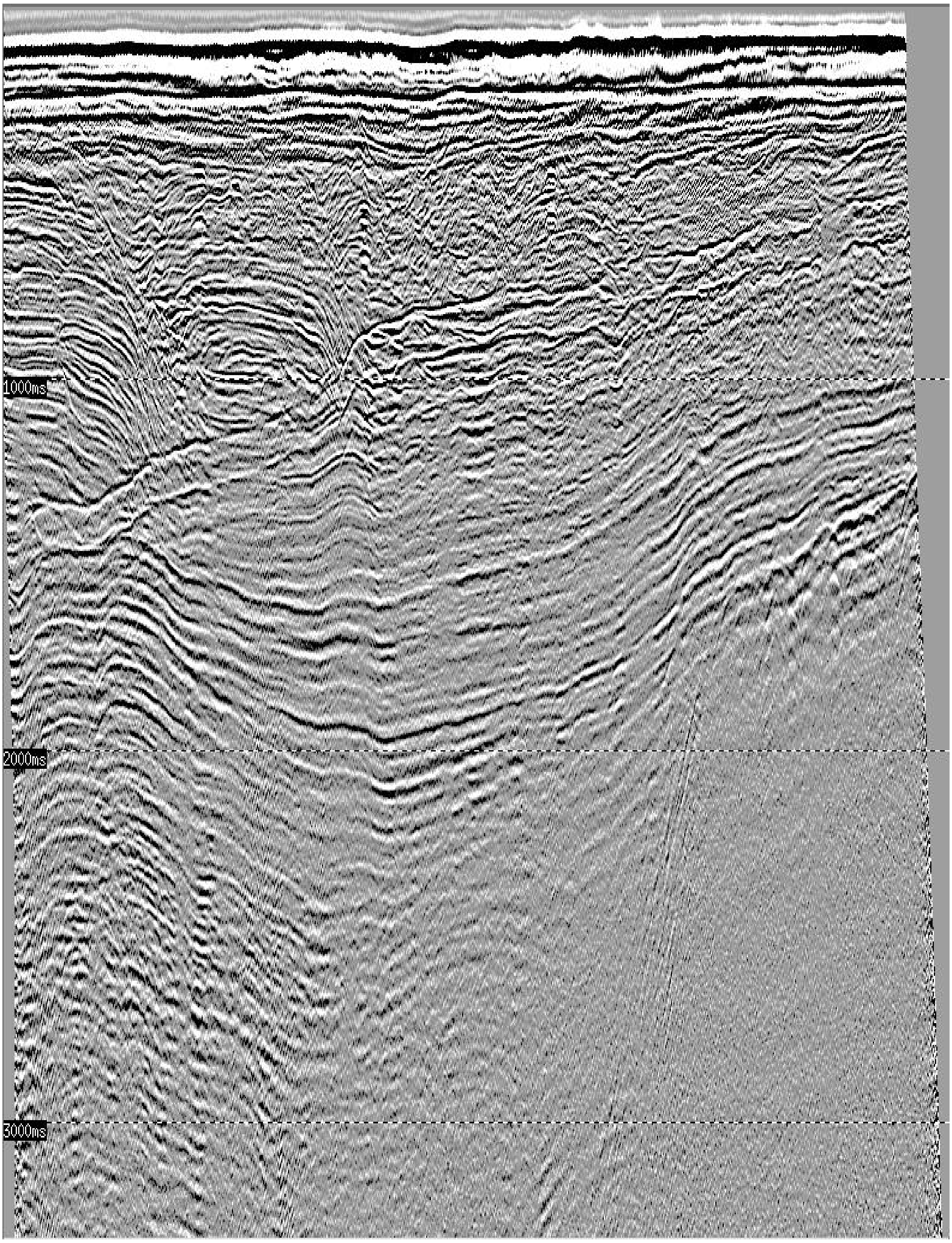
Q50249	3590E SEGY	PSTM CMP Gathers (Lines 2278-2313)
Q50250	3590E SEGY	PSTM CMP Gathers (Lines 2314-2328) **§**

8.3. PROCESSING SCHEDULE

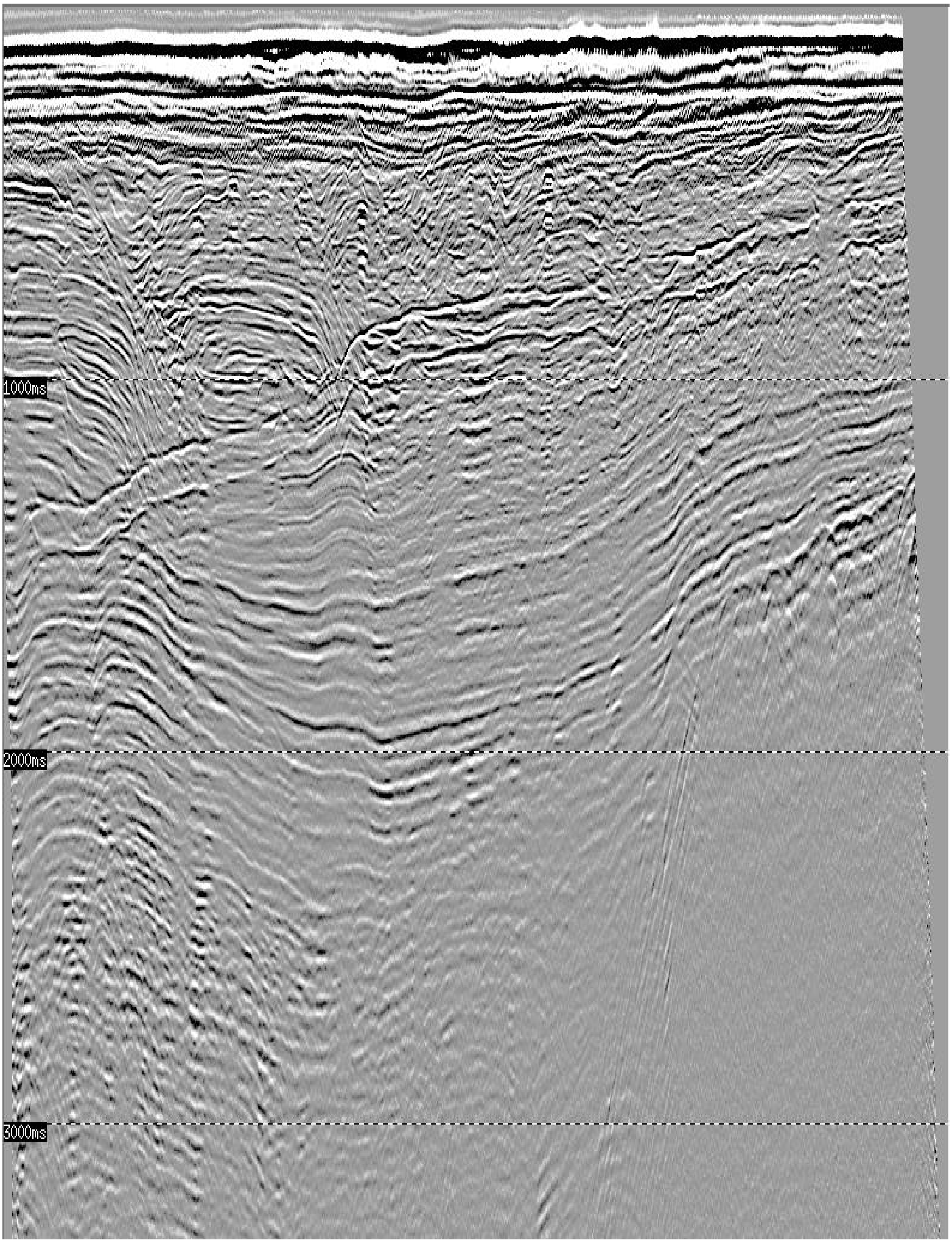
ENCLOSURES

8.4. ENCLOSURES

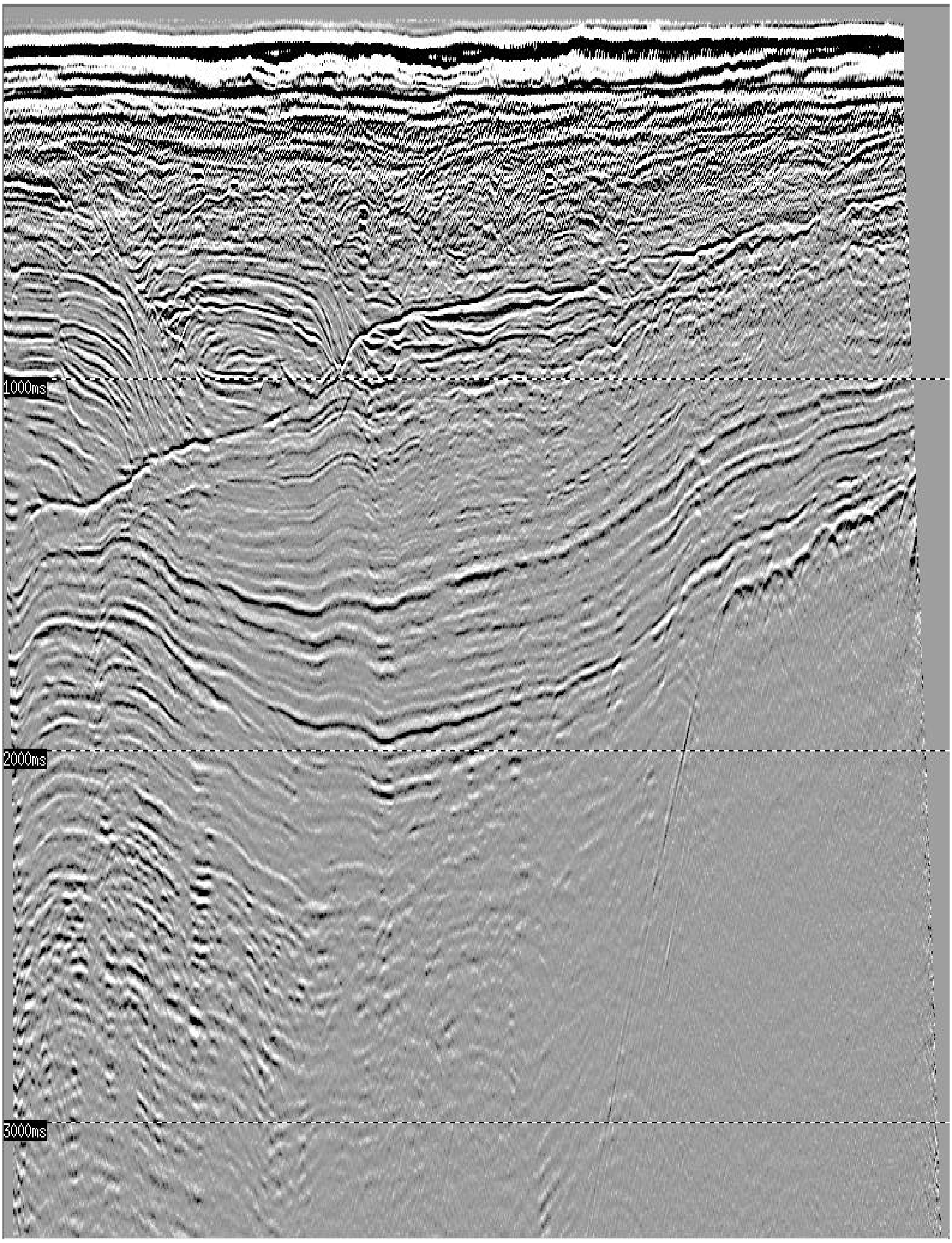
Sequence 069 (line 1760): stack after navmerge/offset domain SWATT.



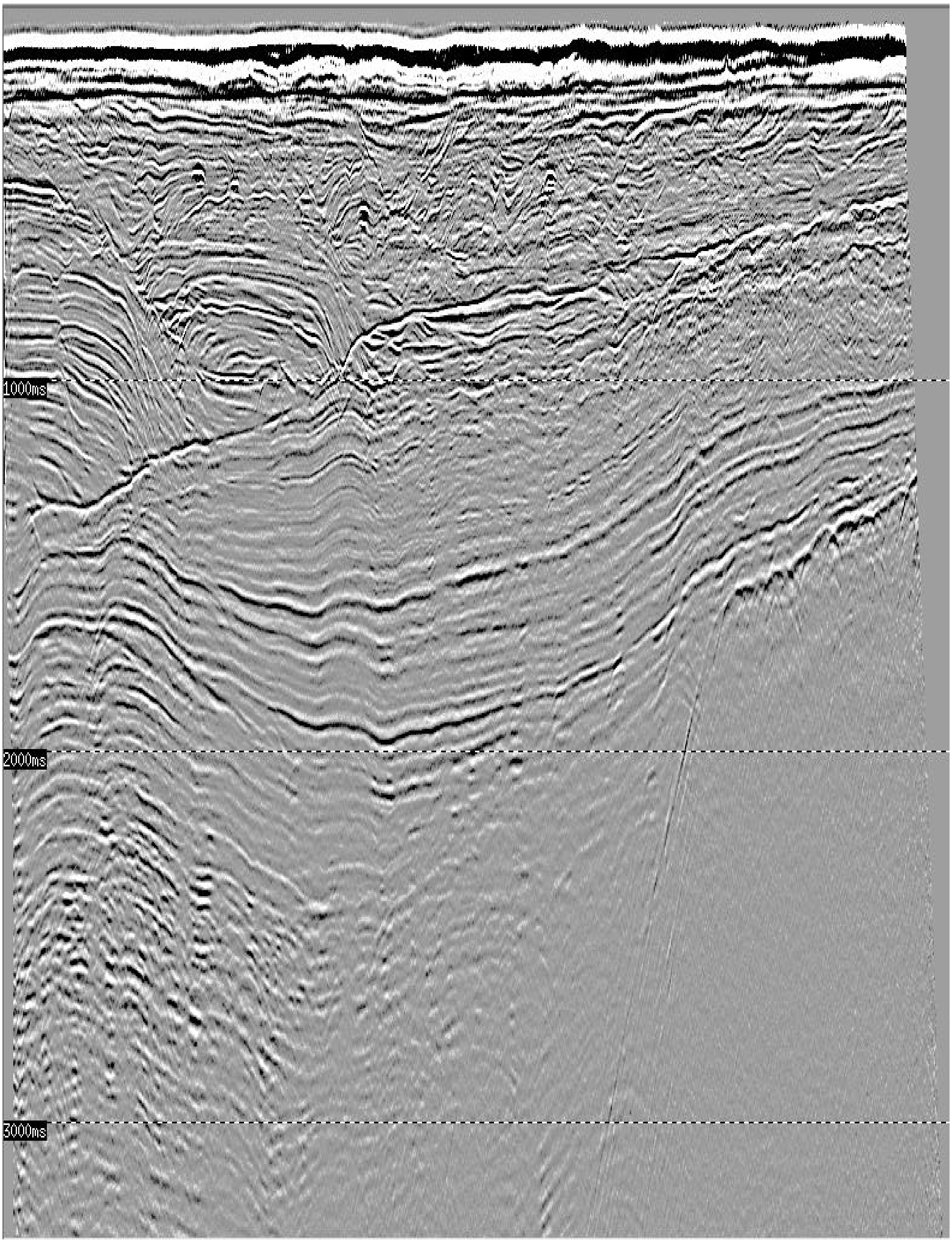
Sequence 069 (line 1760): stack after linear noise attenuation.



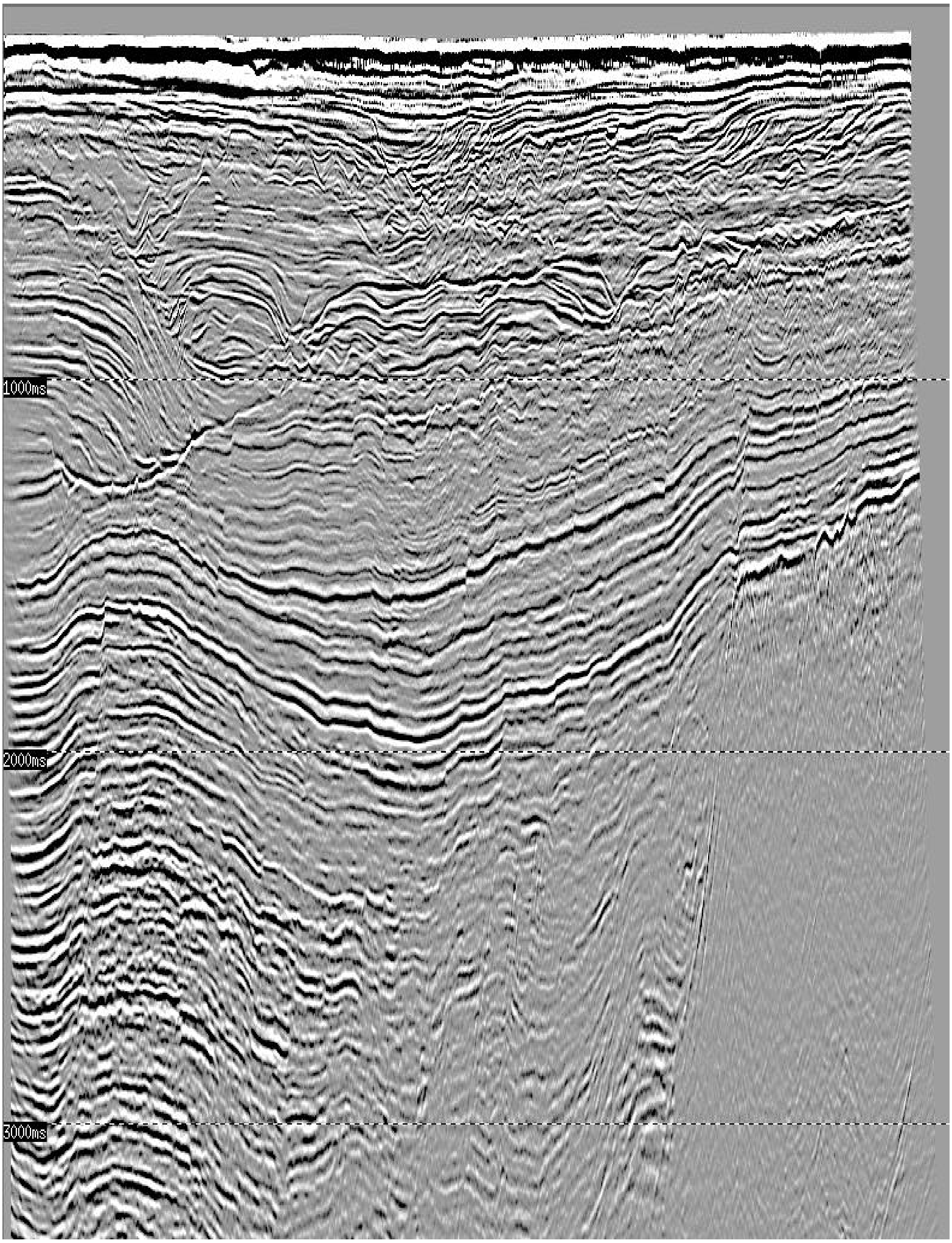
Sequence 069 (line 1760): stack after Tau-P domain deconvolution.



Sequence 069 (line 1760): stack after radon demultiple.



Sequence 069 (line 1760): stack after PreSTM + final X-T domain deconvolution.



Sequence 069 (line 1760): stack after post stack spectral whitening + zero phase conversion.