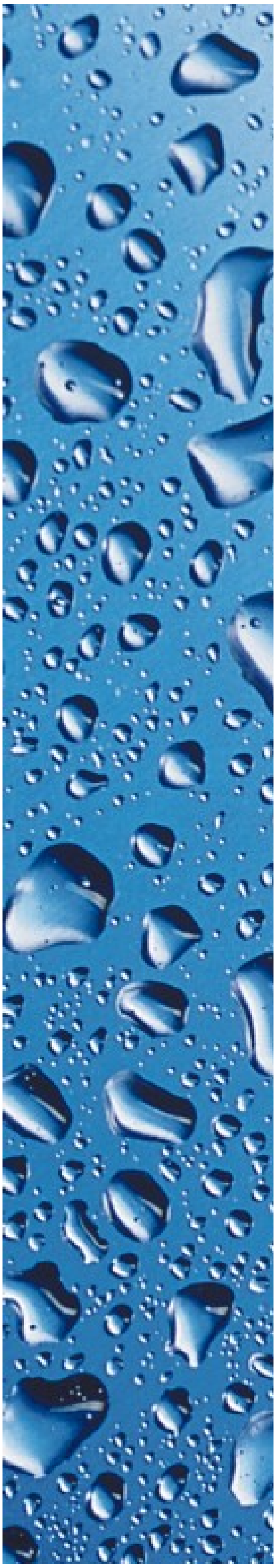

University of Svalbard

Vsp Data Processing Report

Zero Offset VSP – DH4

Contents

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VSP DATA PROCESSING REPORT

University of Svalbard

Zero Offset VSP, Adventdalen DH4

This report describes the Zero Offset VSP data acquisition and processing of the well DH4, Adventdalen at Svalbard.

CONTENTS

COMMENTS ON ACQUISITION

The data was acquired by Read Well Services, with the acquisition taking place on the 5th and 6th of February 2010. The data was acquired utilizing a GSP acquisition system, with a single gimballed ESR receiver. The nominal receiver spacing was 5 m. The survey was acquired between 600m – 100m MD(RKB). The seismic source employed was dynamite of 0.5kg in a snow/tundra environment. The record length was 6 seconds. Further details can be found in the section Field Report.

The well deviation was only one meter in 1000m, so the well was treated as vertical. There were a number of test shots at the deepest levels, and these were omitted from processing. Except for the test shots at the deepest levels, only one shot a level was performed. For a complete listing of the levels acquired for the Zero Offset VSP, see the stack include file.

The frequency content of the data for the total field is fair, and improves significantly after the separation of the upgoing from the downgoing wavefield. The frequency content of the total wavefield and the upgoing wavefield are shown in the FZ and FK displays.

EDITING, STACKING AND TIMING OF DATA

The raw records consisted of three field recorded SEGY files of correlated data, one for each orthogonal component. Timing was carried out on the positive peak. The vertical component of the geophone data was displayed at large scale and each component edited.

Data in each level was aligned by maximizing the cross-correlation inside a window after first break: the data was resampled to 1/4 ms for this purpose. The geophone data was then stacked using a median algorithm. Since each level only were recorded with one level, this was just a one-trace stack. A summary of the traces included in the stacks at each level, the system delays and residual alignment delays is contained in the stack report

A total of 143 levels were recorded over the survey interval. Since many of the shots were test shots where the signals were only noise, we ended up with one recording for each level in the range between 600m – 100m and 5m separation. This gave 101 levels for the check shot report and VSP processing.

COMMENTS ON THE DATA QUALITY

The recorded total wavefield has relatively high S/N ratio with fair frequency content. However, presence of monochromatic noise and a very strong event at about 0.4s below first arrival reduces the data quality.

CHECK SHOT COMPUTATIONS

Using the first arrival values picked above, and information on survey geometry, the check shot report was produced. Because of significant variations in interval velocities, the first arrivals were smoothed by a 5 points regressive filter. Details of the computations and results are included in the check shot report.

VSP PROCESSING SEQUENCE WITH CLARIFICATION OF KEY PROCESSES

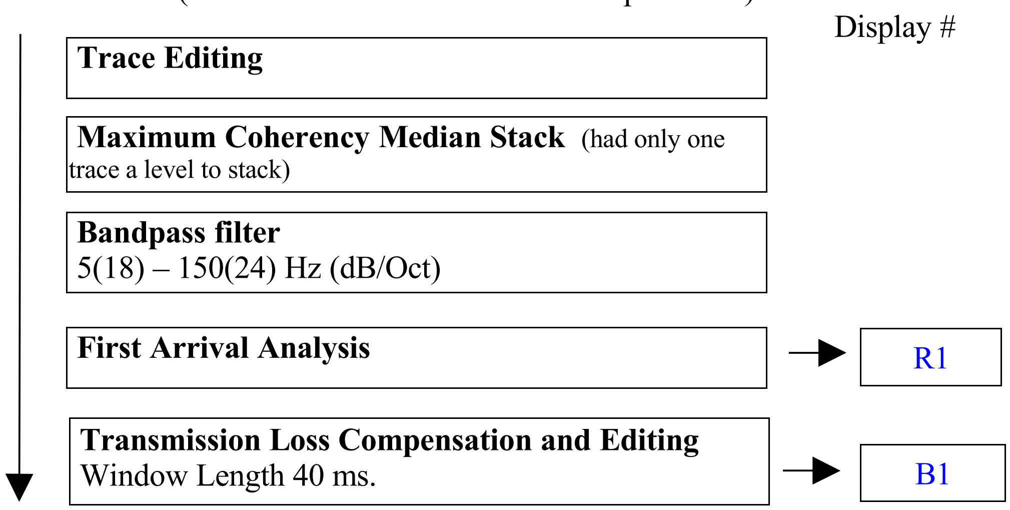
Data in the interval from 600m – 100m MD(RKB) was used in the Zero Offset VSP processing.

Figure 2 is an outline of the pre stack processing sequence up to transmission loss compensation.

TRANSMISSION LOSS COMPENSATION
Energy loss of the direct arrival is compensated for by normalizing the data in a window from -10 to 30 ms relative to the first arrival. A single scalar is applied to each trace to force the RMS amplitude in this window to unity.

SPHERICAL DIVERGENCE COMPENSATION
The loss of energy due to spherical divergence is compensated for by applying the scalar Si to sample i, where Si = (Ti / T0) ** X and Ti is the time of sample i, T0 being the first arrival time, and X a data dependent parameter in the range from 1.0 to 1.5, 1.4 in this case.

Figure 2: VSP Processing Sequence
(Raw data to transmission loss compensation)



P-WAVEFIELD SEPARATION

The separation of upgoing and downgoing wavefields was performed in seven steps.

Step 1: Separation of total wavefield into smooth downgoing P-wavefield and a 1st residual wavefield by applying 25 point median filter. (Display group B2A.)

Step 2: Separation of 1st residual into smooth upgoing wavefield and 2nd residual by applying 25 point median filter. (Display group B2B, panel A.)

Step 3: Separation of 2nd residual into residual downgoing wavefield and 3rd residual by applying 17 points dip adaptive median filter. (Display group B2B, panel C.)

Step 4: Separation of 3rd residual into residual upgoing wavefield and 4th residual by applying 13 points dip adaptive median filter. (Display group B2B, panel E.)

Step 5: Generate a raw downgoing by subtracting smooth upgoing wavefield and residual down- and up-going wavefield from total wavefield. (Display group B2B, panel G.)

Step 6: Final downgoing P-wavefield is extracted from the raw downgoing with 11 points median filter. (Display group B2B, panel H.)

Step 7: Raw upgoing wavefield: Subtract final downgoing wavefield and residual down- and up-going wavefield from total wavefield. (Display group B2B, panel J.)

NOISE REJECTION
In order to improve the quality of the upgoing wavefield, a spike removal median filter was applied prior to deconvolution. A 7 points median filter with replacement factor 4 was applied. Filtering with replacement factor *c* means that the output sample will only be replaced with the median if it is less than 1/*c* of the median value or greater than *c* times the median value. (Display group B2B, panel K.)

VSP DECONVOLUTION
Deterministic deconvolution was applied to this data set, using operators derived from the final downgoing wavefield directly after the first arrival, and applied to the corresponding trace in the upgoing wavefield. In order to get a consistent result, the first 16 traces were omitted from deconvolution, leaving 85 traces. As can be clearly seen on B2B panel K, the offsets these traces represents are somewhat out of phase with the others, and in tests gave a degraded result of the deconvolution. The design window was 1200 ms and operator length 1250 ms. The desired output was specified as a Butterworth filter designed in the frequency domain as 6(18) - 90(24) Hz (dB/Oct) with a zero phase wavelet. For a detailed description of this process see appendix; `Deconvolution during VSP processing`

WAVEFIELD TRANSPOSITION
This process moves data from the deconvolved upgoing wavefield, which lies directly under the first break line, to the ‘near trace’ of the output. The length of the time window on each trace is defined as the FTB difference between the neighboring traces. The algorithm used is described in more detail in appendix ‘Derivation of Transposed Display’

CORRIDOR STACKS
Two types of corridor stacks are presented in this report. The main corridor stack is an average stack of the final upgoing wavefield within a corridor area defined by:

- Front mute 10 ms after the FTB on all traces.
- Tail mute 100 ms after the FTB on traces 1-75.
- No tail mute on traces 76-85.

The second corridor stack was produced by an average stack of traces 2-8 of the transposed wavefield. More details can be found on the sidelabels of the display groups in section 2.

Fig. 2: VSP Processing Sequence
(Final upgoing wavefield, post separation processing)

Noise rejection: Apply a 7 points spike removal filter with replacement factor 4 to the raw upgoing wavefield.	
Spherical divergence compensation: (T/T0**1.4.	→ Display group B3 Panel A
VSP deconvolution: Design window: 1200 ms Operator length: 1250 ms Desired output: 6(18)-90(24) Hz(dB/Oct) Zero phase wavelet	→ Display group B3 Panel B
Noise rejection: 5 points median filter	
Bandpass filter: 6(18)-90(72) Hz(dB/Oct) Zero Phase	→ Display group B3 Panel C
Corridor stack: Corridor stack from transposed wavefield.	→ Display group B3 Panel D - F

VSP TEST PROCESSING

VSP DECONVOLUTION

The operator is computed from the final downgoing wavefield. The design window was defined as 1200 by inspecting the multiple energy. The low cut (6 Hz) in the Butterworth filter that is defined as desired output is taken from the FZ- and FK-plots (see enclosures). Different high-cuts were tested (30, 40, 50, 60, 70, 80 and 90 Hz). These tests together with the FK plot conclude that a 90 Hz high cut gives the optimum VSP result.

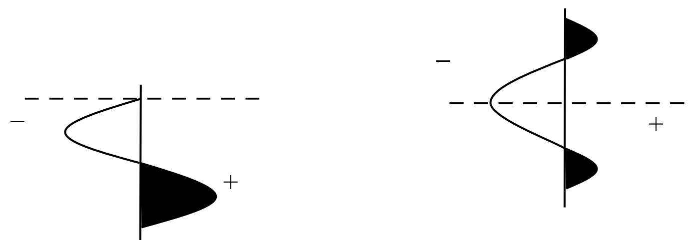
NOISE REJECTION MEDIAN FILTER.

Different median filters (3, 5 and 7 points) were tested on the deconvolved upgoing wavefield. These filters will enhance and smooth all events that are horizontal in two way travel time and suppress all other events. The longer the filters are and the more an event dips, the more the event will be suppressed. By subtracting the enhanced deconvolved upgoing wavefield from the raw deconvolved wavefield a residual-residual wavefield is produced. This wavefield will contain the events that have been suppressed in the median filtering, like dipping events, reflections from fault planes, converted shear waves etc. A 5 point median filter was chosen for the enhancement of the upgoing wavefield and a 7 point median filter for the residual-residual display.

POLARITY CONVENTIONS

Normal Polarity, Minimum Phase
is equal to SEG positive polarity defined as: An increase in acoustic impedance with depth is represented by a white trough and negative number on tape, see figure (A) below.

Normal Polarity, Zero Phase
is equal to SEG negative polarity defined as: An increase in acoustic impedance with depth is represented by a white central trough and negative number on tape, see figure (B) below.



(A) Normal Polarity, MPH (B) Normal Polarity, ZPH

Normal polarity, minimum phase (A); normal polarity, zero phase (B).

FIRST ARRIVAL PICKING

1. INTRODUCTION

The two methods commonly employed to pick first arrival times from VSP data are ‘trough-to-trough’ and ‘break-to-break’ measurements. The terms trough and break refer to the part of the waveform on the near field monitor trace and the vertical component geophone trace which are picked. Both these methods have their supporters in oil companies, and both are justified by theoretical and practical considerations. The decision about which to use rests with the client, and will generally be based on company policy in this matter, the method used in nearby wells, and to some extent data quality. The software in use at READ Well Services allows both methods to be used.

Section 3 outlines the theoretical problems about choice of first arrival picking method. It concludes that trough-to-trough measurements will probably give the best 'tie' between the VSP and surface seismic data sets, due to the inescapable dispersive and absorptive nature of the earth. From a practical viewpoint alone, trough to trough picking is preferable for the following reasons:

1. The trough pick can be made with much greater accuracy, the timing of a local minimum being virtually indisputable.

2. In the presence of noise, the trough pick is more easily recognizable. Though the presence of noise can alter the timing of a trough pick, this can usually be overcome by using an envelope function.

2.0 STANDARD PROCESSING SEQUENCE FOR FIRST ARRIVAL ESTIMATION

2.1 Editing

The near field monitor traces and z-component geophone traces are read from field tape, displayed at a large scale, and edited. Traces are edited because of:

- Electrical noise contamination (50 / 60 Hz)
- High frequency noise bursts
- S / N ratio low
- Poor clamping

However it is important to preserve enough data to produce a good stack. The median stacking routine is particularly robust in the presence of noise bursts. A level can be completely removed after FTB picking (as it is nearly always possible to estimate the FTB), so that the bad trace does not affect adjacent levels during wavefield separation

2.2 Near Field Monitor timing

There is a small, potentially variable time delay from the start of data on tape and the seismic energy being released from the source. This is measured by recording a near field monitor trace simultaneously with the geophone data. This, in the marine case, is a hydrophone kept at a fixed distance from the airgun. The near field hydrophone is timed by a semi-automatic algorithm.

2.3 Stack of geophone data

Each geophone trace is sub-sample shifted by the value of the corresponding monitor time. The geophone data is now sorted into common level gathers. Optionally, the traces can be aligned by a cross-correlation and sub-sample shift technique. The data is then stacked in common level gathers, using the normal average stack or optionally a median algorithm.

2.4 Timing of geophone traces

This process is done semi-interactively, using a blown up view of the first arrival region. After picking is complete, there is optionally an automatic alignment process, which can correct the first breaks by cross-correlation of each trace with a pilot trace, or by numerical smoothing of the arrival times.

2.5 Use of first break information

The first break times are transferred to the check shot software for use in producing the check shot report and calibration of the sonic log. The times are also transferred to the trace headers of the x- and y- geophone components, for use in further processing of three component data.

3.0 BREAK-TO-BREAK vs. TROUGH-TO-TROUGH: THEORY

First consider the ideal seismic source: A true impulse with a flat amplitude spectrum and a zero or linear phase spectrum. The first break and the first trough are the same thing. This source is of course impossible to produce, but a source with a very short rise time (e.g. dynamite has a relatively flat amplitude spectrum from 5 - 200 Hz.) approaches the ideal. The travel time of the center of this impulse characterizes the group velocity of the medium. With an airgun or watergun source, the leading peak of the main energy is also of relatively short duration.

Due to the absorptive and dispersive properties of the earth, it is observed in most wells that the time between first break and first trough increases with depth. The first trough, however, still retains its meaning as a travel time characteristic of the group velocity of the medium. The first break, however, will characterize the arrival of the various phase velocities. The position of the first break in time will depend on the amplitude and gain downhole. Higher frequencies will be detectable with higher gain. In the presence of broad band noise, detectability becomes a yet more complex problem.

‘Minimum phase’ interpretation of surface seismic data deals essentially with breaks, though velocity analysis deals essentially with peaks and troughs (though at much lower resolution). The timing of identifiable events on the surface seismic will thus be a break measurement. The 'tie' between the VSP and the surface seismic will depend on both data sets having the same temporal bandwidth. This can be arranged by using the same deconvolution and bandpass filter parameters on the VSP as were used on the surface seismic. If the surface seismic is 'zero phase', this will often mean, in the marine case, that some sort of phase correction process has been run on the data. A similar process can be applied to the VSP data set.

One important use of check shot data is the calibration of sonic logs. The sonic log is recorded with a single ultra-sonic sound pulse (ca. 25 kHz.), and the transit time measured by the signal crossing a detection threshold. The threshold varies according to the signal-to-noise conditions at the receiver, and although some adjustment is made, the 'pick' is neither first break nor first trough. The single frequency means there will be no dispersion, and there is relatively little absorption over the short travel path. The well geophone data includes a possibly dispersive and certainly absorptive effect better estimated by the trough-to-trough method and not removed by picking break-to- break. Thus by calibrating the sonic log with trough-to-trough picked check shot values, the synthetic seismogram will have included in it the effects of dispersion and absorption. This will then tie well with the surface seismic data.

Sonic derived interval velocities are often used for quite detailed formation analysis, and in these cases it is wise to investigate the way in which the sonic log has been calibrated.

DECONVOLUTION DURING VSP PROCESSING

1.0 SOURCE SIGNATURE DECONVOLUTION

In some situations it may be necessary to perform source signature deconvolution on the data set before stack. This occurs when there is significant variation in the source signature from shot to shot, caused by large variations in gun depth, variation in the pressure of the air supplied to the gun, or with sources consisting of several guns, failure of the synchronization system. In these situations, the geophone traces will be potentially dissimilar, and cannot be stacked without severe loss of signal quality.

Source signature deconvolution is performed by designing a filter which shapes each near field hydrophone signal into a suitable standard output wavelet (e.g. a bandlimited spike), and applying this filter to the corresponding geophone trace.

Another technique, which can be applied to cases where the source signature varies, but is still essentially minimum phase, is a predictive deconvolution using a window from the geophone trace alone.

Software for performing both these types of deconvolution is in available at RWS.

It should be noted that the near field hydrophone data is usually not of the same quality as the geophone data. The severe operating environment requires an instrument built for robustness rather than high fidelity. The signal is also dominated by high frequencies which do not penetrate the earth to the geophones. Hence it is recommended to employ a gun flotation system, good air supply, and a reliable gun control system to ensure a repeatable source signature. Then the source signature may be removed from the data together with downgoing multiples during the VSP deconvolution process.

2.0 VSP DECONVOLUTION

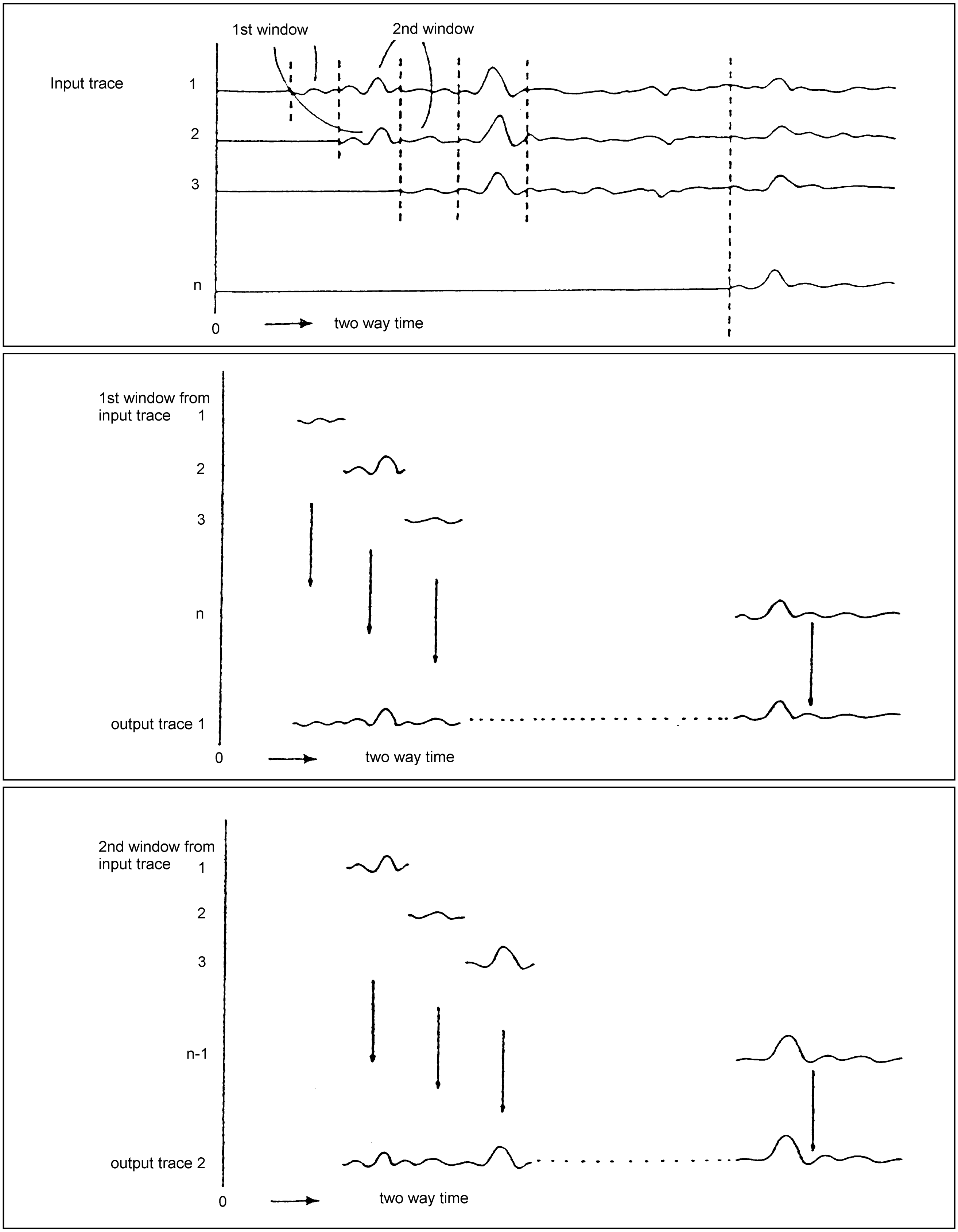
In order to remove the downgoing multiple response and source signature from the upgoing wavefield, there are two main options available:

Deterministic deconvolution: This is applicable to zero offset, vertical incidence, and with less accuracy to offset geometry's. The assumption is that measured upgoing wavefield is the convolution of the reflection series beneath the geophone with the downgoing wavefield measured at the geophone. Thus if we design a filter which collapses the measured downgoing wavefield to a bandlimited spike, applying the filter to the measured upgoing wavefield will produce the bandlimited reflection coefficient series beneath the geophone. The window input to the Wiener filter will be chosen to include significant multiples. In the case of offset geometry's, the main assumption made above is invalid, as the downgoing energy has a different ray-path to the upgoing at a given receiver. However, as many of the multiples are in fact short period and generated in the near surface region, where the ray paths are not significantly different, applying deterministic deconvolution with a short input window may prove effective.

An alternative is predictive deconvolution. This process, while effective on surface seismic data, is for VSP inferior to the deterministic method described above. This is because no assumptions are made in the deterministic method about the nature of the source or the reflectors. In predictive deconvolution, the assumptions made are that the reflection series is white, and that the source signature is minimum phase. The method is applicable to situations where the up- and downgoing ray paths differ significantly, and may be used in combination with a deterministic approach.

Software to perform both these types of deconvolution, together with a sophisticated wavelet analysis package, is available at RWS. The software is sufficiently flexible to allow deconvolution operators to be designed, processed independently and stored for use as required in either other stages of the VSP processing, or on other data sets. RWS has experience in the reprocessing of surface seismic data employing VSP derived deconvolution operators.

Derivation of Transposed Display



CALCULATION OF DIP FROM VSP DATA

Vertical Wells: Source at Well Head

1. INTRODUCTION

The angle of dip can be calculated from the hyperbolic curvature of primary reflections observed on the VSP deconvolved upgoing wavefield. In calculating dip, as described below, two assumptions are made:
1. The dipping reflector is a planar, uniform surface.
2. The velocity of the material above the reflector can be regarded as constant.

2. DERIVATION OF EQUATIONS

Figure 1 shows reflections from a dipping interface received at two geophone positions, G_1 and G_2 in a vertical well. An image point is constructed such that
SO = OI and SR = RI

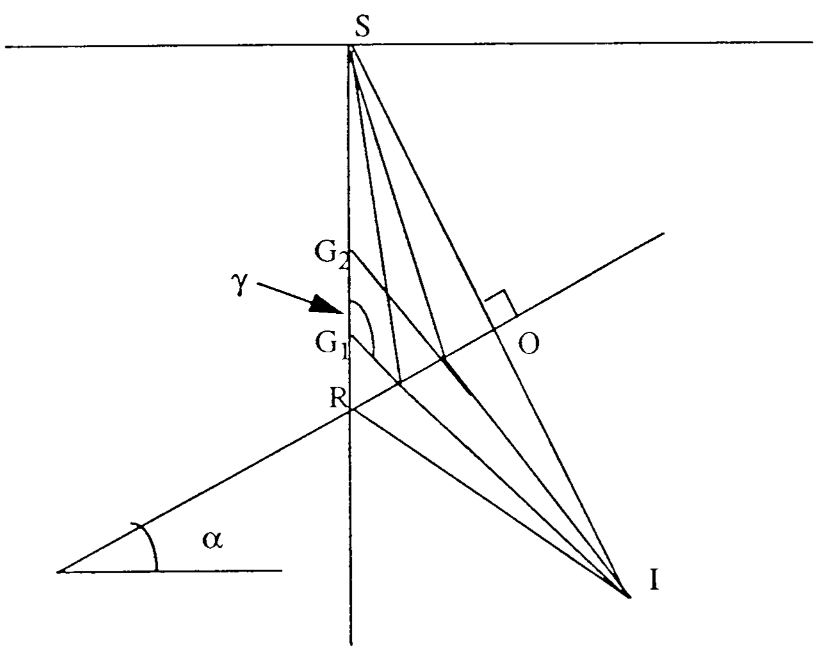


Figure 1: S = Source, I = Image, α = Angle of dip, G_1 = Geophone 1, G_2 = Geophone 2

t_1 is the one-way first arrival time at G_1 (i.e. direct arrival from S to G_1)

t_2 is the one-way first arrival time at G_2.

t_3 is the arrival time of the reflection from the dipping interface at G_1

t_4 is the arrival time of the reflection from the dipping interface at G_2

t_5 is the travel time over the distance SI

Using the cosine rule in triangle G_1G_2I we find:

Equation 1: $$\cos\gamma = \frac{t_3^2 + (t_1 - t_2)^2 - t_4^2}{2t_3(t_1 - t_2)}$$

Hence the angle may be calculated.

Using the cosine rule in the triangle SG_1I, we find:

Equation 2: $$t_5^2 = t_1^2 + t_3^2 - 2t_1t_3\cos\gamma$$

Hence t_5 may be calculated

Using the sine rule in triangle SG_1I gives:

Equation 3: $$\frac{t_3}{\sin\alpha} = \frac{t_5}{\sin\gamma}$$

therefor angle of dip:

$$\alpha = \sin^{-1}\left(\frac{t_3\sin\gamma}{t_5}\right)$$

Changes of dip, as characterized by changes in ΔT from trace to trace on an event on the deconvolved upgoing wavefield, can be assessed if dip is increasing ‘up-dip’; however, if dip is decreasing ‘up-dip’ then the event in question will disappear from the data.

3. METHOD OF CALCULATION

To calculate the dip of any primary reflection observed on VSP data we therefore require t_1, t_2 , t_3 and t_4. These values can be obtained from a combination of the check shot report and deconvolved upgoing wavefield display as follows:

> Given a dipping Primary reflection observed on the deconvolved upgoing wavefield, then choose a pair of geophone traces to be used in the dip calculation.
>
> We would advise that the estimate be made using data as close as possible to the time-depth curve as the ΔT due to dip is at its greatest for any given geophone spacing when the geophone is closest to the reflector in question.
>
> t_1 : the one-way first arrival time at the deeper of the chosen geophone positions can be obtained from the check shot report (t_c at relevant depth). Alternatively, if the check shot report is not available, the equivalent two-way time can be measured from the deconvolved upgoing wavefield display (time at time-depth curve on relevant trace) and halved; this method is less accurate.
>
> t_2 :the one-way first arrival time at the shallower of the chosen geophone positions (t_c, at relevant depth, on check shot report)
>
> t_3 :the time of the arrival of the reflection from the dipping horizon in question at the deeper of the chosen geophone positions. This can be obtained from the deconvolved upgoing wavefield by measuring the two-way time, on the deeper, to the reflection being examined, and subtracting the one-way first arrival time at the same geophone (i.e. t_1)
>
> Similarly,
>
> t_4 :can be obtained from the deconvolved upgoing wavefield by measuring the two-way time to the reflection being examined, on the shallower of the chosen geophone traces, and substituting t_2.

By subtracting these values (t_1, t_2, t_3 and t_4) in equations 1-3 the angle of dip (α) can be calculated. Note that azimuth of dip cannot be calculated from this data.

It is suggested that dip should be calculated for a number of geophone pairs to give an indication of the scatter on the dip estimate.

If the beds are not plane dipping then shorter segments of the reflector have to be used to determine the dip at any point, with an increasing likelihood of error. Alternatively, the ΔT can be smoothed by hand to give an ‘average’ dip estimate.

```
FOLDERS AND FILES ON THIS CD-ROM
********************************************************************************


VSPZO_REPORTS_2010-02-12/               Folder with main reports.

   PDF FORMAT:
   VSP_AND_VELOCITY_REPORT.PDF          Main processing report.
   VSP_FIELD_ACQUISITION_REPORT.PDF     Field report.



VSPZO_RAW_2010-02-12/                   Folder with raw VSP data. SEGY files.

   PDF/ASCII FORMAT:
   VSPZO_RAW_2010-02-12_INF.PDF/ASC     SEGY-file listing with file description.

   SEGY FORMAT:
   VSPZO_RAW_#.SEGY, #=1,2,3...         SEGY files (4 byte IBM floating point).



VSPZO_COMPUTED_2010-02-12/              Folder w/ computed VSP data. SEGY files.

   PDF/ASCII FORMAT:
   VSPZO_COMPUTED_STKLIST_*.PDF/ASC     Stack report.
   VSPZO_COMP.._2010-02-12_INF.PDF/ASC  SEGY-file listing with file description.

   SEGY FORMAT:
   VSPZO_COMPUTED_#.SEGY, #=1,2,3...    SEGY files (4 byte IBM floating point).

   LAS FORMAT:
   VSPZO_COMPUTED_VSPCS.LAS             Corridor stacks from VSP.



VSPZO_VELOCITY_LOGS_2010-02-12/         Folder with time-depth velocity data.

   PDF/ASCII FORMAT:
   TZV_DEPTH_CHECKSHOT.PDF/ASC          Check shot report.
   TZV_DEPTH_GEOMETRY.PDF/ASC           Geometry report.
   TZV_TIME_CHECKSHOT.ASC               Vertical time-depth pairs from VSP.
   TZV_DEPTH_WELLDEV.PDF/ASC            Wellpath deviation.



Acrobat/
   Folder with the Acrobat Reader software for both Windows and Unix platforms
   (see below).



README.PDF/TXT
   Listing of files and folders on this CD-ROM.



index/
   Folder with indexing information for the Acrobat Reader. Makes it possible
   to use advanced search within the PDF documents included on this CD-ROM.
```

index.pdx
Files that belongs to the Acrobat Reader indexing.

read.ico and autorun.inf
READ icon for display on the Windows platform, and autoplay information file that automatically starts the Acrobat Reader software and loads the main report file (VSP_AND_VELOCITY_REPORT.PDF) when the CDROM is inserted on the Windows platform.

This CD-ROM includes the Acrobat Reader software for the Windows platform.

More details on how to install the Acrobat Reader software is found in the Acrobat folder.

On the Windows platform the Acrobat Reader will start automatically and load the READ Well Services Processing Report.

VSP Processing Displays

University of Svalbard

DH4, Zero Offset VSP

Contents:

READ WELL SERVICES
P.O. BOX 193, N-1378 NESBRU NORWAY
TEL. (+47) 66851800 FAX. (+47) 66851870

UNIS
WELL : DH4

Zero Offset VSP

FIELD PARAMETERS

FIELD :	Adventdalen
COUNTRY :	Svalbard/Norway
LOCATION :	78 12 13.49 N NORTH 15 49 38.39 E EAST

LOGGING PARAMETERS

LOG DEPTHS MEASURED FROM :	KB 8.1 M. ABOVE MSL
TOTAL TRAVEL TIME DATUM :	MSL
DEPTH OF SEABED :	---
LOGGING COMPANY :	---
WELL SEISMIC COMPANY :	READ Well Services
DATE PROCESSED :	24 May 2010

ACQUISITION PARAMETERS

SURVEY DATE :	5 Feb 2010
SOURCE TYPE :	Dynamite
SOURCE DEPTH :	0.0 M.
SOURCE OFFSET :	155.2 M. 67.6 DEG.
GUN PRESSURE :	P.S.I.
SOURCE MONITOR TYPE :	Spike Geophone
SOURCE MONITOR OFFSET :	80.7 M.
GEOPHONE TYPE :	SINGLE ESR
RECORDING EQUIPMENT :	NA
SAMPLE INTERVAL :	1.0 MS.
RECORD LENGTH :	4.0 S.
LOG REFERENCE :	8.1 M. ABOVE MSL
SEISMIC REFERENCE :	MSL
WATER DEPTH :	0.0 M.

NORMAL POLARITY, MINIMUM PHASE :
IS EQUAL TO SEG POSITIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE TROUGH AND A NEGATIVE NUMBER ON TAPE"
NORMAL POLARITY, ZERO PHASE:
IS EQUAL TO SEG NEGATIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE CENTRAL TROUGH AND A NEGATIVE NUMBER ON TAPE"

READ WELL SERVICES
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University of Svalbard
WELL : DH4

Zero Offset VSP

DISPLAY NO. :R1

Raw Stack

All Components

POLARITY : NORMAL
TIME SCALE : 20 cm/s
HORIZONTAL SCL 1: 4000 Measured Depth

PROCESSING PARAMETERS

1. Editing of geophone data.
2. System delay compensation from near field hydrophones.
3. Correction for geometry static (4.03 ms).
4. Maximum coherence median stack.
5. Bandpass filter: 5(18) - 150(24) Hz(dB/Oct) Zero phase.
6. First break analysis.

›
-------> Panel A : Vertical (Z) Component total wavefield raw stack.
-------> Panel B : H1 Component total wavefield raw stack.
-------> Panel C : H2 Component total wavefield raw stack.
›
DISPLAYS AT ONE-WAY TIME

NORMAL POLARITY, MINIMUM PHASE :
IS EQUAL TO SEG POSITIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE TROUGH AND A NEGATIVE NUMBER ON TAPE"
NORMAL POLARITY, ZERO PHASE:
IS EQUAL TO SEG NEGATIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE CENTRAL TROUGH AND A NEGATIVE NUMBER ON TAPE"

WELL : DH4. DISPLAY NO. : R1. Panel : A. Page : 1 of 1

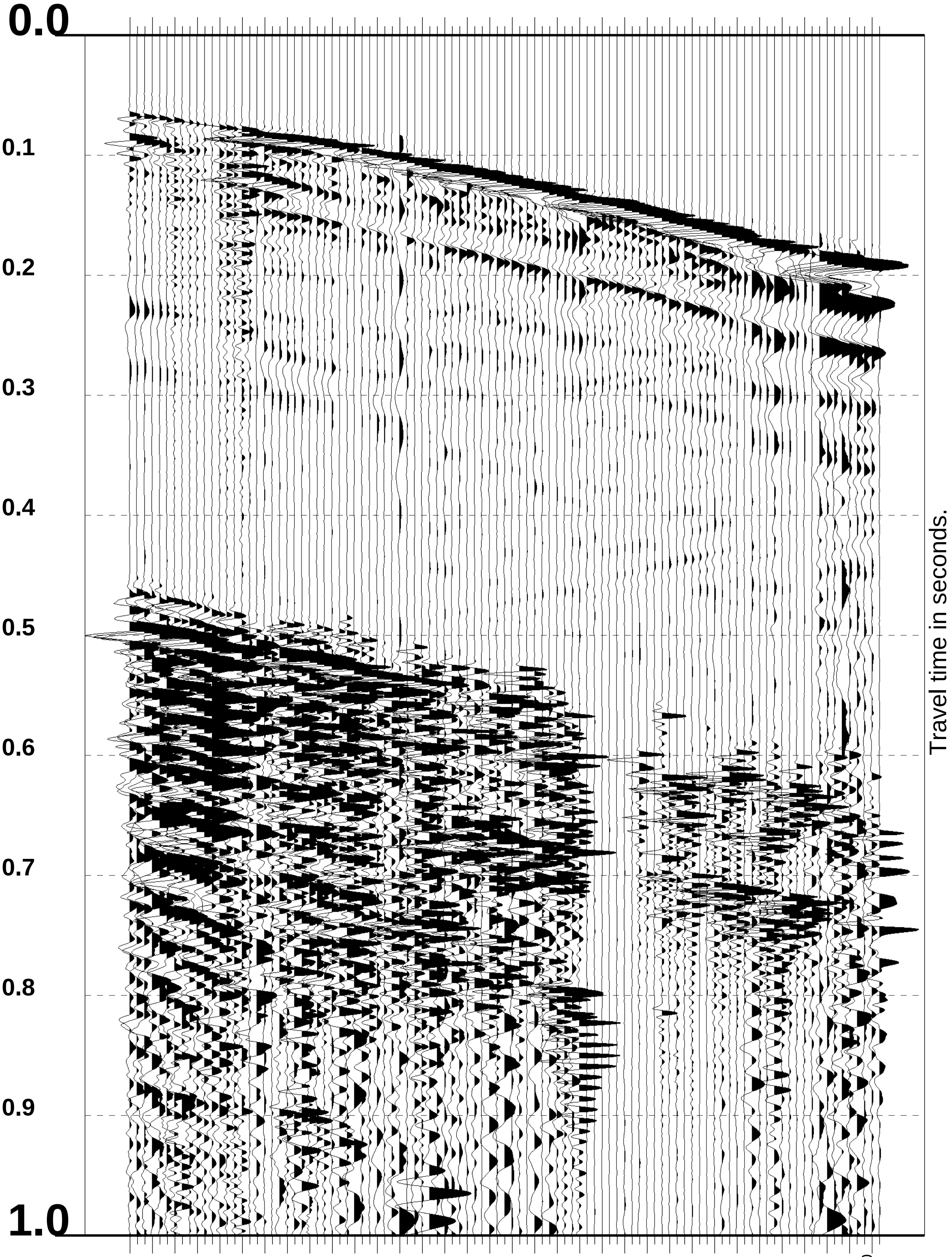
Raw Stack
Vertical Z Component OWT

Normal polarity.
Trace scaling.
Swing 12.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 20 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB	LEVEL NO.
66.120	100.00	100.00	1
68.210	115.00	115.00	4
70.970	130.00	130.00	7
73.770	145.00	145.00	10
76.390	160.00	160.00	13
78.690	175.00	175.00	16
83.710	190.00	190.00	19
86.389	205.00	205.00	22
88.330	220.00	220.00	25
91.900	235.00	235.00	28
95.723	250.00	250.00	31
99.510	265.00	265.00	34
102.96	280.00	280.00	37
107.65	295.00	295.00	40
111.72	310.00	310.00	43
114.66	325.00	325.00	46
119.15	340.00	340.00	49
123.14	355.00	355.00	52
126.94	370.00	370.00	55
131.56	385.00	385.00	58
136.15	400.00	400.00	61
139.06	415.00	415.00	64
143.84	430.00	430.00	67
148.81	445.00	445.00	70
154.12	460.00	460.00	73
158.97	475.00	475.00	76
163.57	490.00	490.00	79
169.00	505.00	505.00	82
173.69	520.00	520.00	85
177.49	535.00	535.00	88
181.02	550.00	550.00	91
185.74	565.00	565.00	94
189.08	580.00	580.00	97
191.92	595.00	595.00	100



WELL : DH4. DISPLAY NO. : R1. Panel : B. Page : 1 of 1

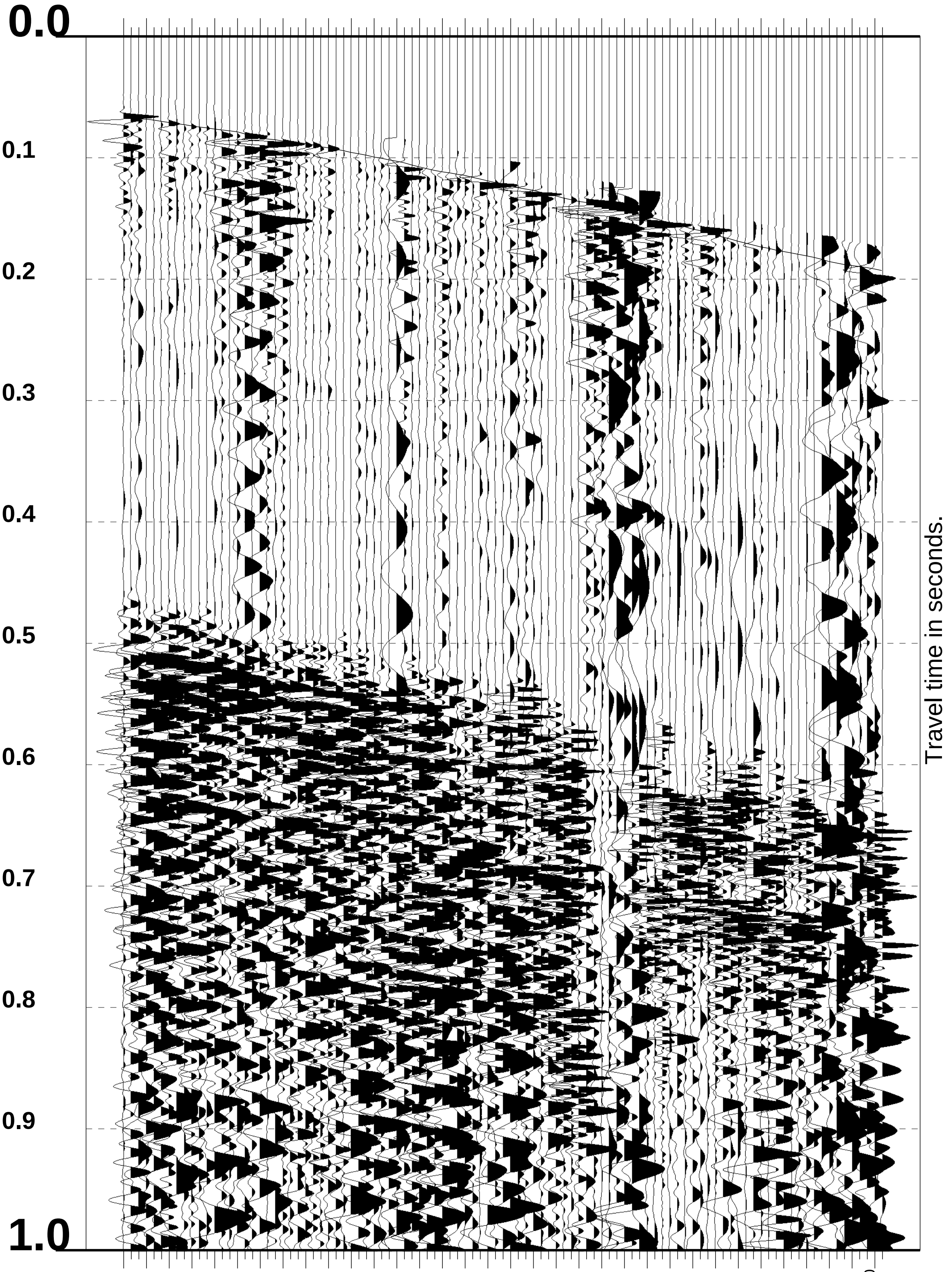
Raw Stack
H1 Component OWT

Normal polarity.
Trace scaling.
Swing 10.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 20 cm/s

LEVEL NO.	FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
1	66.120	100.00	100.00
4	68.210	115.00	115.00
7	70.970	130.00	130.00
10	73.770	145.00	145.00
13	76.390	160.00	160.00
16	78.690	175.00	175.00
19	83.710	190.00	190.00
22	86.389	205.00	205.00
25	88.330	220.00	220.00
28	91.900	235.00	235.00
31	95.723	250.00	250.00
34	99.510	265.00	265.00
37	102.96	280.00	280.00
40	107.65	295.00	295.00
43	111.72	310.00	310.00
46	114.66	325.00	325.00
49	119.15	340.00	340.00
52	123.14	355.00	355.00
55	126.94	370.00	370.00
58	131.56	385.00	385.00
61	136.15	400.00	400.00
64	139.06	415.00	415.00
67	143.84	430.00	430.00
70	148.81	445.00	445.00
73	154.12	460.00	460.00
76	158.97	475.00	475.00
79	163.57	490.00	490.00
82	169.00	505.00	505.00
85	173.69	520.00	520.00
88	177.49	535.00	535.00
91	181.02	550.00	550.00
94	185.74	565.00	565.00
97	189.08	580.00	580.00
100	191.92	595.00	595.00



DISPLAYED: 24 May 2010

WELL : DH4. DISPLAY NO. : R1. Panel : C. Page : 1 of 1

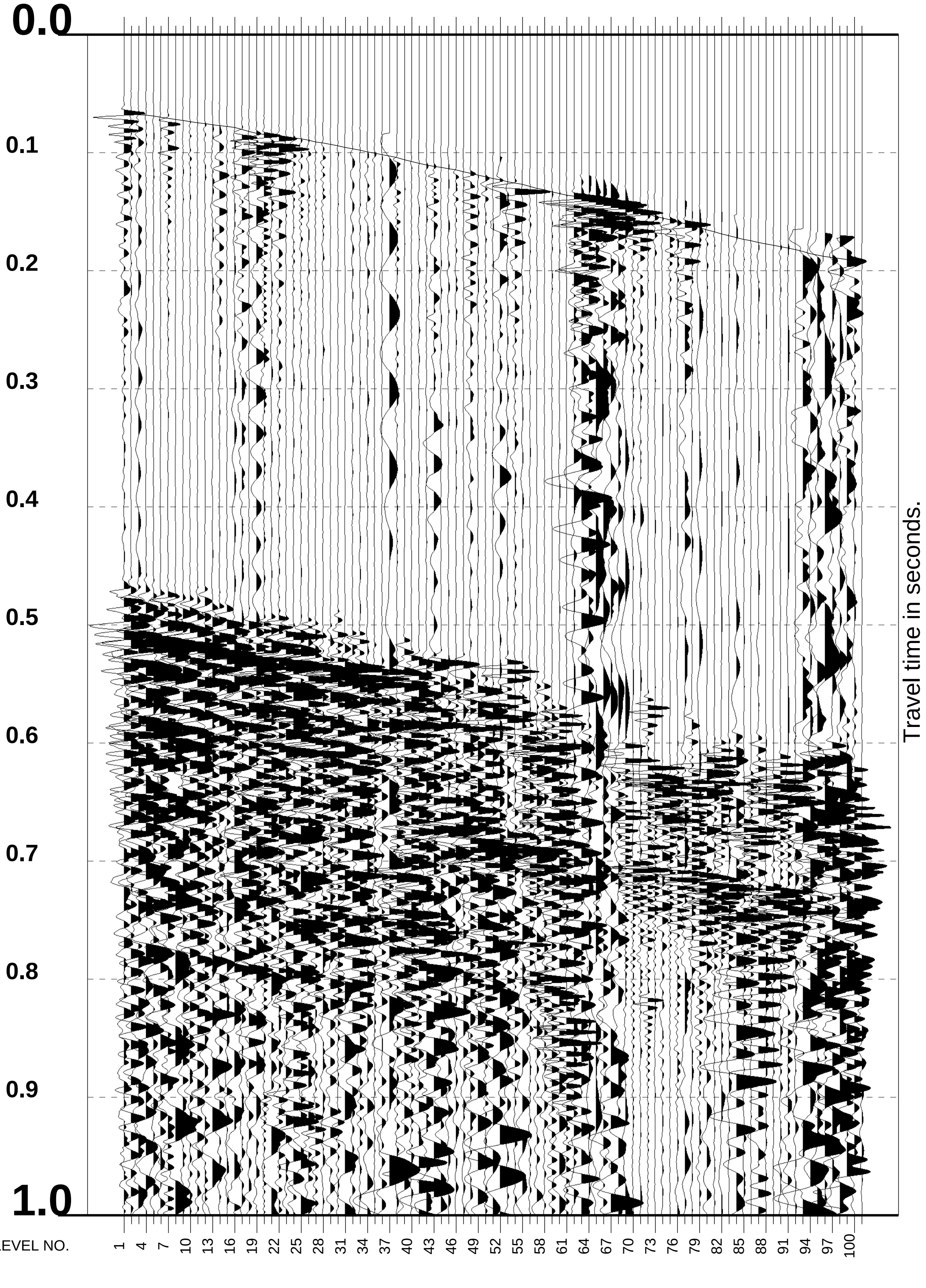
Raw Stack
H2 Component OWT

Normal polarity.
Trace scaling.
Swing 10.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 20 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
66.120	100.00	100.00
68.210	115.00	115.00
70.970	130.00	130.00
73.770	145.00	145.00
76.390	160.00	160.00
78.690	175.00	175.00
83.710	190.00	190.00
86.389	205.00	205.00
88.330	220.00	220.00
91.900	235.00	235.00
95.723	250.00	250.00
99.510	265.00	265.00
102.96	280.00	280.00
107.65	295.00	295.00
111.72	310.00	310.00
114.66	325.00	325.00
119.15	340.00	340.00
123.14	355.00	355.00
126.94	370.00	370.00
131.56	385.00	385.00
136.15	400.00	400.00
139.06	415.00	415.00
143.84	430.00	430.00
148.81	445.00	445.00
154.12	460.00	460.00
158.97	475.00	475.00
163.57	490.00	490.00
169.00	505.00	505.00
173.69	520.00	520.00
177.49	535.00	535.00
181.02	550.00	550.00
185.74	565.00	565.00
189.08	580.00	580.00
191.92	595.00	595.00



READ WELL SERVICES
P.O. BOX 193, N-1378 NESBRU NORWAY
TEL. (+47) 66851800 FAX. (+47) 66851870

University of Svalbard
WELL : DH4

Zero Offset VSP

DISPLAY NO. :B1

True Amplitude Stack

All Components

POLARITY : NORMAL
TIME SCALE : 20 cm/s
HORIZONTAL SCL 1: 4000 Measured Depth

PROCESSING PARAMETERS

1. Editing of geophone data.
2. System delay compensation from near field hydrophones.
3. Correction for geometry static (4.03 ms).
4. Maximum coherence median stack.
5. Bandpass filter: 5(18) - 150(24) Hz(dB/Oct) Zero phase.
6. First break analysis.
7. Repair of trace at 280m MDRKB
8. Transmission loss compensation : -10 to 30 ms window
9. Spherical divergence compensation (T/T0) ** 1.4

›
-------> Panel A : Z Component true amplitude stack
-------> Panel B : H1 Component true amplitude stack
-------> Panel C : H2 Component true amplitude stack
›
DISPLAYED AT ONE-WAY TIME

NORMAL POLARITY, MINIMUM PHASE :
IS EQUAL TO SEG POSITIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE TROUGH AND A NEGATIVE NUMBER ON TAPE"
NORMAL POLARITY, ZERO PHASE:
IS EQUAL TO SEG NEGATIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE CENTRAL TROUGH AND A NEGATIVE NUMBER ON TAPE"

WELL : DH4. DISPLAY NO. : B1. Panel : A. Page : 1 of 1

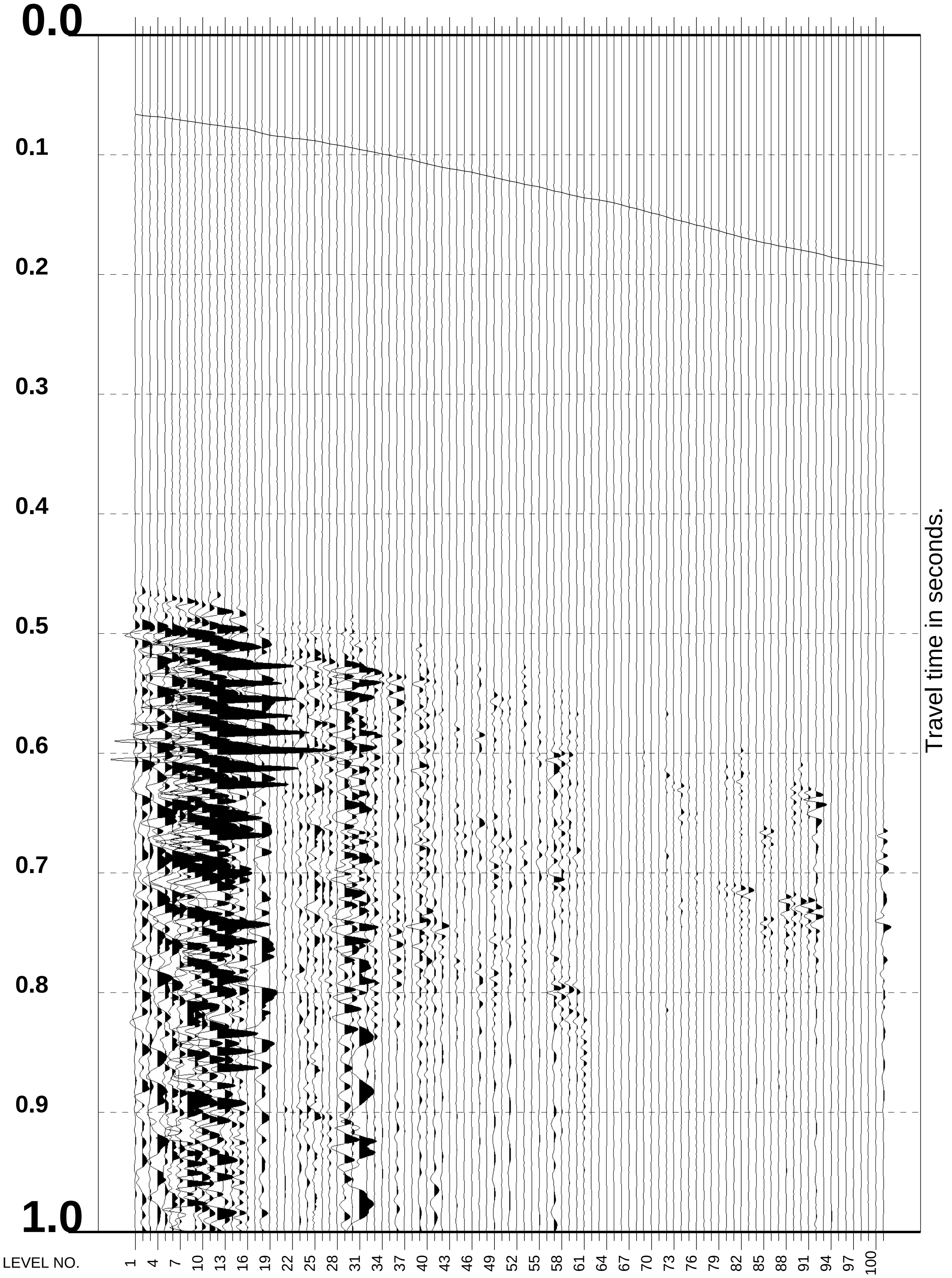
True Amplitude Stack
Z Component

Normal polarity.
RMS global scaling.
Swing 10.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 20 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
66.120	100.00	100.00
68.210	115.00	115.00
70.970	130.00	130.00
73.770	145.00	145.00
76.390	160.00	160.00
78.690	175.00	175.00
83.710	190.00	190.00
86.389	205.00	205.00
88.330	220.00	220.00
91.900	235.00	235.00
95.723	250.00	250.00
99.510	265.00	265.00
103.07	280.00	280.00
107.65	295.00	295.00
111.72	310.00	310.00
114.66	325.00	325.00
119.15	340.00	340.00
123.14	355.00	355.00
126.94	370.00	370.00
131.56	385.00	385.00
136.15	400.00	400.00
139.06	415.00	415.00
143.84	430.00	430.00
148.81	445.00	445.00
154.12	460.00	460.00
158.97	475.00	475.00
163.57	490.00	490.00
169.00	505.00	505.00
173.69	520.00	520.00
177.49	535.00	535.00
181.02	550.00	550.00
185.74	565.00	565.00
189.08	580.00	580.00
191.92	595.00	595.00



DISPLAYED: 24 May 2010

WELL : DH4. DISPLAY NO. : B1. Panel : B. Page : 1 of 1

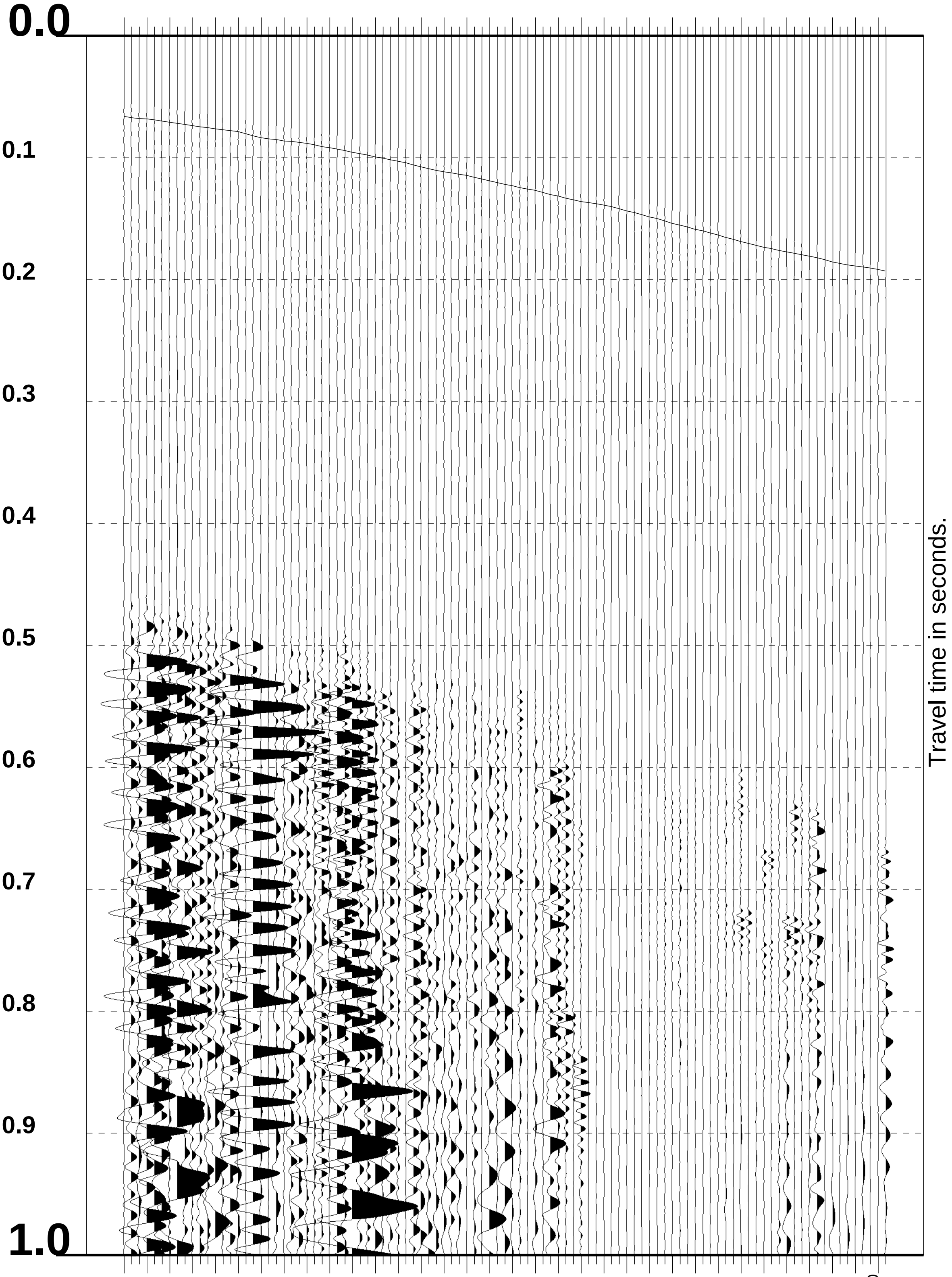
True Amplitude Stack
H1 Component

Normal polarity.
RMS global scaling.
Swing 10.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 20 cm/s

LEVEL NO.	FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
1	66.120	100.00	100.00
4	68.210	115.00	115.00
7	70.970	130.00	130.00
10	73.770	145.00	145.00
13	76.390	160.00	160.00
16	78.690	175.00	175.00
19	83.710	190.00	190.00
22	86.389	205.00	205.00
25	88.330	220.00	220.00
28	91.900	235.00	235.00
31	95.723	250.00	250.00
34	99.510	265.00	265.00
37	103.07	280.00	280.00
40	107.65	295.00	295.00
43	111.72	310.00	310.00
46	114.66	325.00	325.00
49	119.15	340.00	340.00
52	123.14	355.00	355.00
55	126.94	370.00	370.00
58	131.56	385.00	385.00
61	136.15	400.00	400.00
64	139.06	415.00	415.00
67	143.84	430.00	430.00
70	148.81	445.00	445.00
73	154.12	460.00	460.00
76	158.97	475.00	475.00
79	163.57	490.00	490.00
82	169.00	505.00	505.00
85	173.69	520.00	520.00
88	177.49	535.00	535.00
91	181.02	550.00	550.00
94	185.74	565.00	565.00
97	189.08	580.00	580.00
100	191.92	595.00	595.00



DISPLAYED: 24 May 2010

WELL : DH4. DISPLAY NO. : B1. Panel : C. Page : 1 of 1

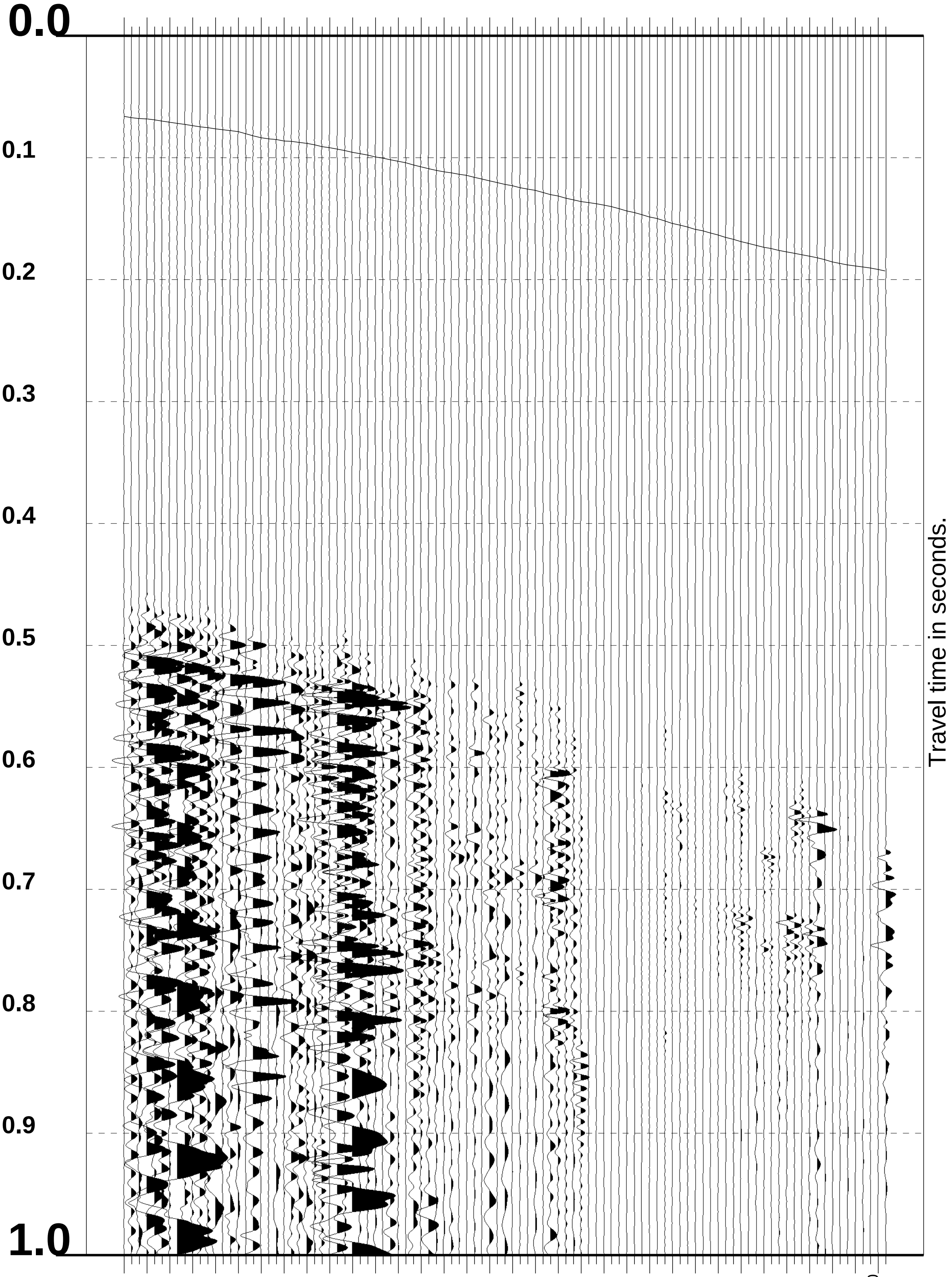
True Amplitude Stack
H2 Component

Normal polarity.
RMS global scaling.
Swing 10.0

Horizontal scale 1: 4000 Measured Depth

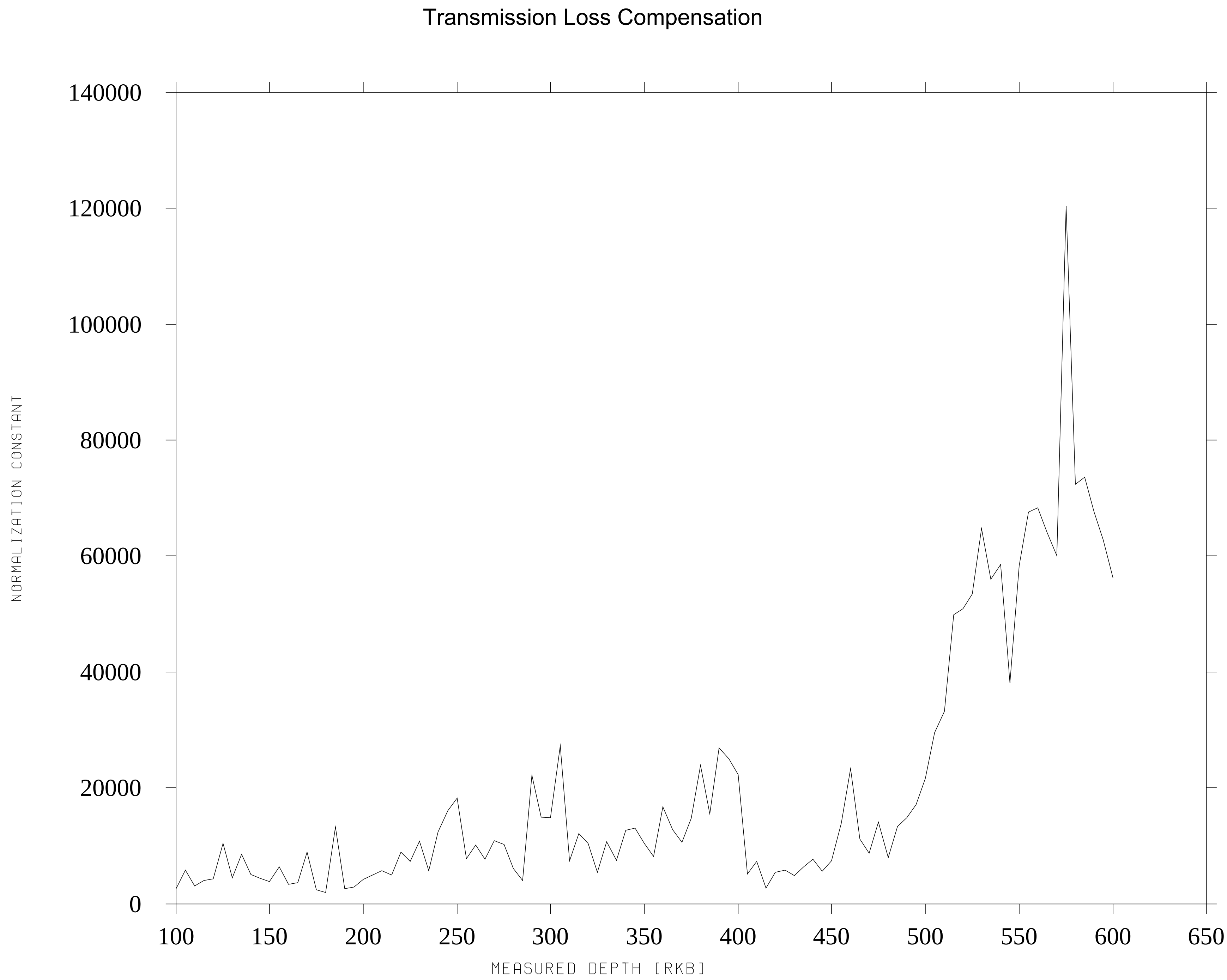
Vertical scale 20 cm/s

FIRST TIME BREAK (MS)	66.120	68.210	70.970	73.770	76.390	78.690	83.710	86.389	88.330	91.900	95.723	99.510	103.07	107.65	111.72	114.66	119.15	123.14	126.94	131.56	136.15	139.06	143.84	148.81	154.12	158.97	163.57	169.00	173.69	177.49	181.02	185.74	189.08	191.92
MEASURED DEPTH (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00
TVD (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00

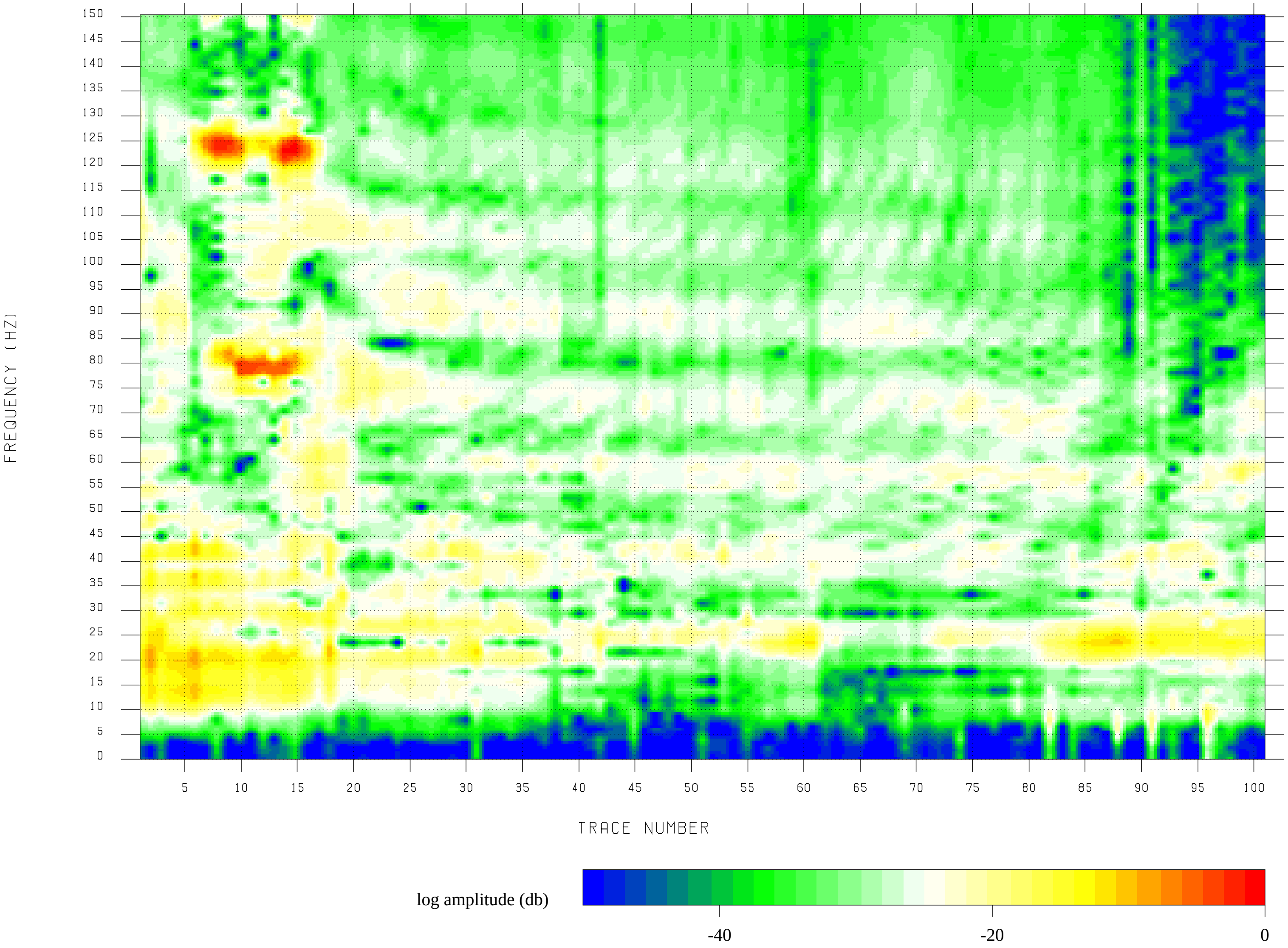


LEVEL NO.	1	4	7	10	13	16	19	22	25	28	31	34	37	40	43	46	49	52	55	58	61	64	67	70	73	76	79	82	85	88	91	94	97	100

DISPLAYED: 24 May 2010


Transmission Loss Compensation
NORMALIZATION CONSTANT
0
20000
40000
60000
80000
100000
120000
140000
100
150
200
250
300
350
400
450
500
550
600
650
MEASURED DEPTH [RKB]

F1. FZ Plot of aligned Vert. Stack, 0-0.4 s.



READ WELL SERVICES
P.O. BOX 193, N-1378 NESBRU NORWAY
TEL. (+47) 66851800 FAX. (+47) 66851870

University of Svalbard
WELL : DH4

Zero Offset VSP

DISPLAY NO. :B2A

Separation of Smooth Dng. P
and 1st Residual

POLARITY : NORMAL
TIME SCALE : 40 cm/s
HORIZONTAL SCL 1: 4000 Measured Depth

PROCESSING PARAMETERS

1. Editing of geophone data.
2. System delay compensation from near field hydrophones.
3. Correction for geometry static (3.72 ms).
4. Maximum coherence median stack.
5. Bandpass filter: 5(18) - 150(24) Hz(dB/Oct) Zero phase.
6. First break analysis.
7. Repair of trace at 280m MDRKB
8. Transmission loss compensation : -10 to 30 ms window
9. Alignment of direct-P arrival at 100 ms.
10. Spherical divergence compensation: (T/T0) ** 1.4.
11. Bandpass filter: 6(18) - 90(72) Hz(dB/Oct) Zero Phase.

-------> Panel A : Total Wavefield.
FIRST ARRIVALS ALIGNED AT 100 MS.

›

10. Separation into smooth down P and 1st residual: 25 pts median.
11. Spherical divergence compensation: (T/T0) ** 1.4.
12. Bandpass filter: 6(18) - 90(72) Hz(dB/Oct) Zero Phase.

-------> Panel B : Smooth Downgoing P. Extracted from total wavef.
FIRST ARRIVALS ALIGNED AT 100 MS.
-------> Panel C : 1st Residual.
FIRST ARRIVALS ALIGNED AT 100 MS.

›

11. 1st residual shifted: OWT, P-P VSP NMO correction.
12. Spherical divergence compensation: (T/T0) ** 1.4.
13. Bandpass filter: 6(18) - 90(72) Hz(dB/Oct) Zero Phase.

-------> Panel D : 1st Residual.
DISPLAYED AT TWO-WAY P-TIME

NORMAL POLARITY, MINIMUM PHASE :
IS EQUAL TO SEG POSITIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE TROUGH AND A NEGATIVE NUMBER ON TAPE"
NORMAL POLARITY, ZERO PHASE:
IS EQUAL TO SEG NEGATIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE CENTRAL TROUGH AND A NEGATIVE NUMBER ON TAPE"

WELL : DH4. DISPLAY NO. : B2A. Panel : A. Page : 1 of 1

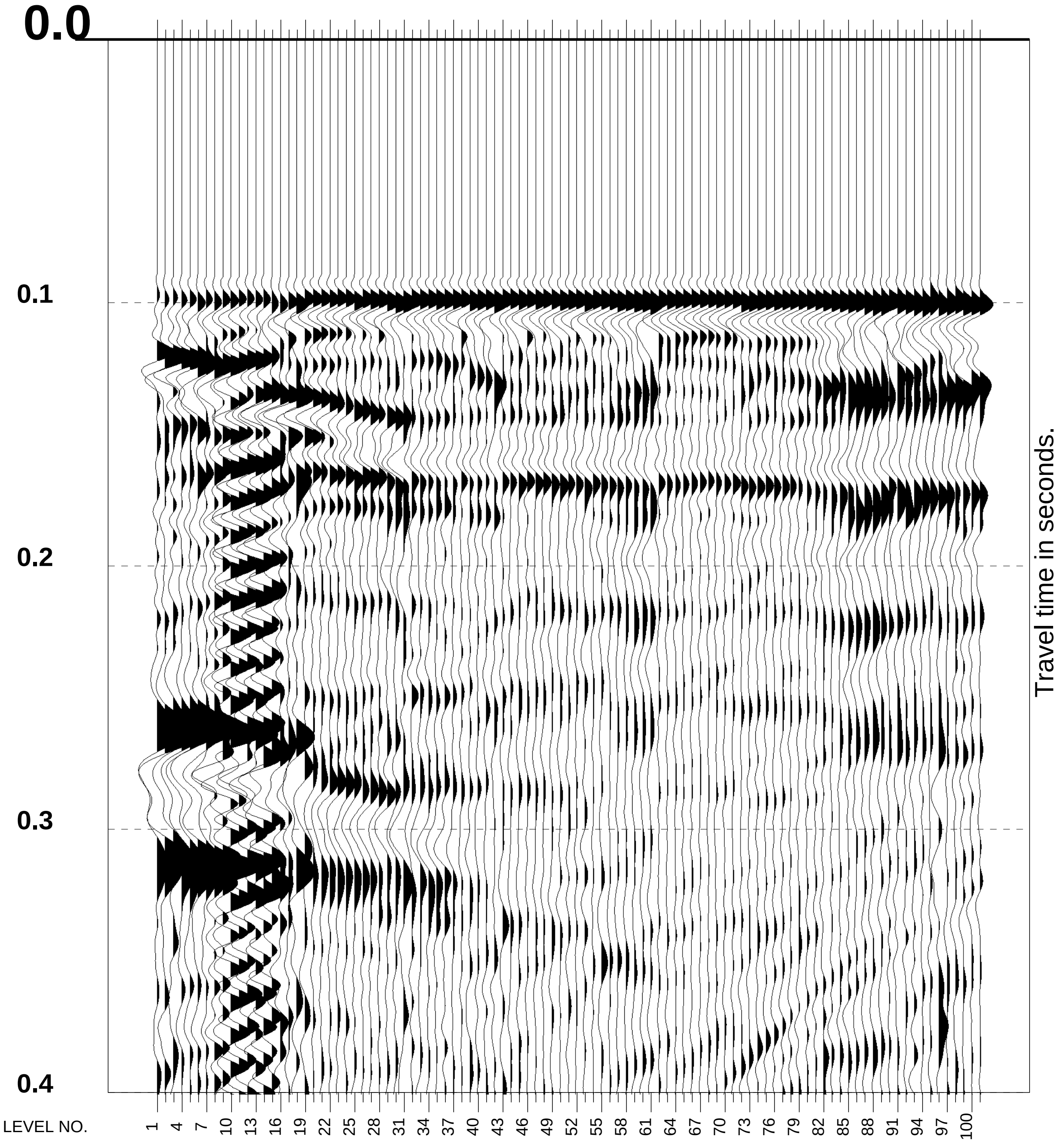
Total Wavefield

Normal polarity.
RMS global scaling.
Swing 12.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	66.120	68.210	70.970	73.770	76.390	78.690	83.710	86.389	88.330	91.900	95.723	99.510	103.07	107.65	111.72	114.66	119.15	123.14	126.94	131.56	136.15	139.06	143.84	148.81	154.12	158.97	163.57	169.00	173.69	177.49	181.02	185.74	189.08	191.92
MEASURED DEPTH (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00
TVD (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00



WELL : DH4. DISPLAY NO. : B2A. Panel : B. Page : 1 of 1

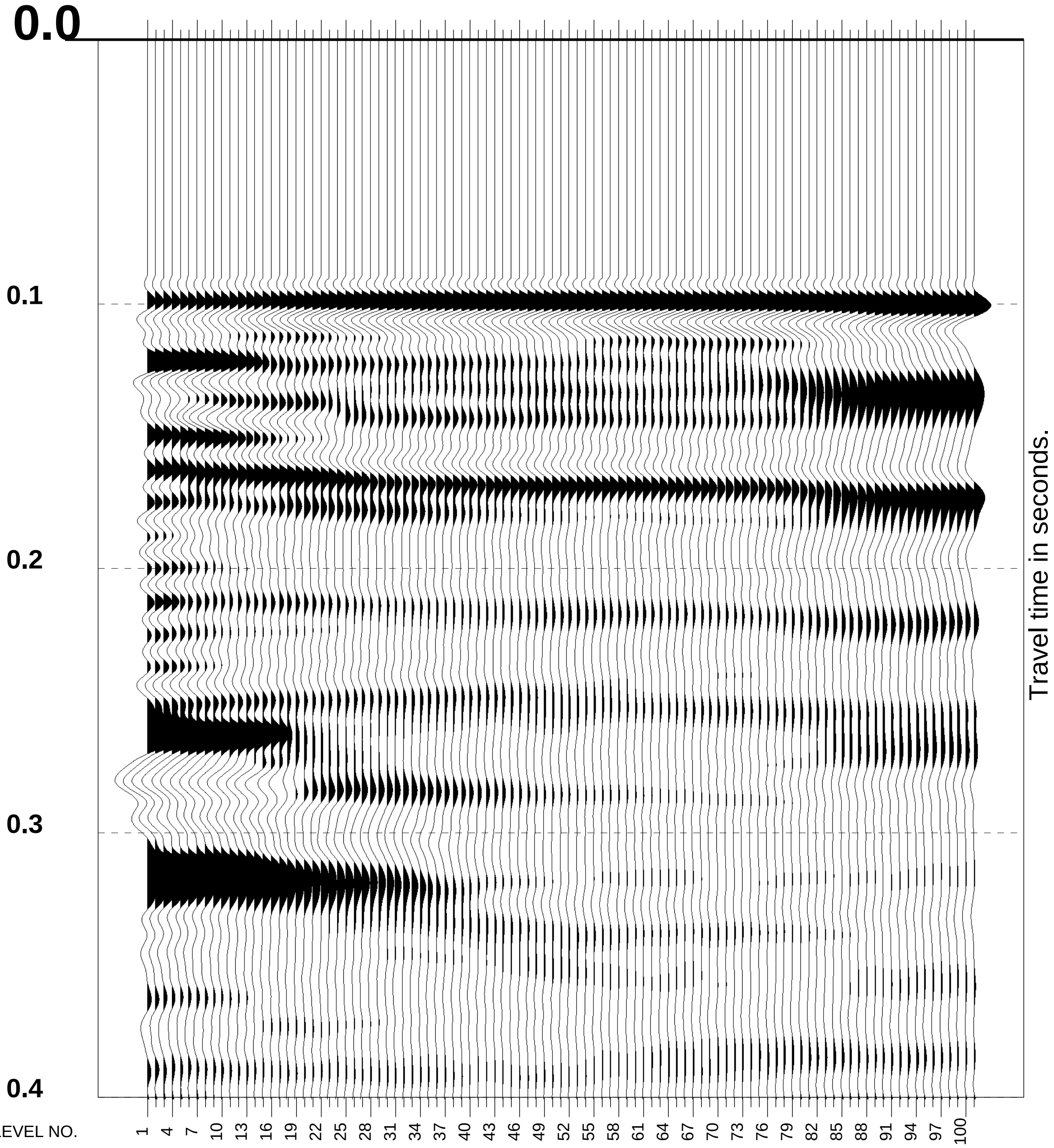
Smooth Downgoing P
25 Points Median Filter

Normal polarity.
RMS global scaling.
Swing 12.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
66.120	100.00	100.00
68.210	115.00	115.00
70.970	130.00	130.00
73.770	145.00	145.00
76.390	160.00	160.00
78.690	175.00	175.00
83.710	190.00	190.00
86.389	205.00	205.00
88.330	220.00	220.00
91.900	235.00	235.00
95.723	250.00	250.00
99.510	265.00	265.00
103.07	280.00	280.00
107.65	295.00	295.00
111.72	310.00	310.00
114.66	325.00	325.00
119.15	340.00	340.00
123.14	355.00	355.00
126.94	370.00	370.00
131.56	385.00	385.00
136.15	400.00	400.00
139.06	415.00	415.00
143.84	430.00	430.00
148.81	445.00	445.00
154.12	460.00	460.00
158.97	475.00	475.00
163.57	490.00	490.00
169.00	505.00	505.00
173.69	520.00	520.00
177.49	535.00	535.00
181.02	550.00	550.00
185.74	565.00	565.00
189.08	580.00	580.00
191.92	595.00	595.00



DISPLAYED: 26 May 2010

WELL : DH4. DISPLAY NO. : B2A. Panel : C. Page : 1 of 1

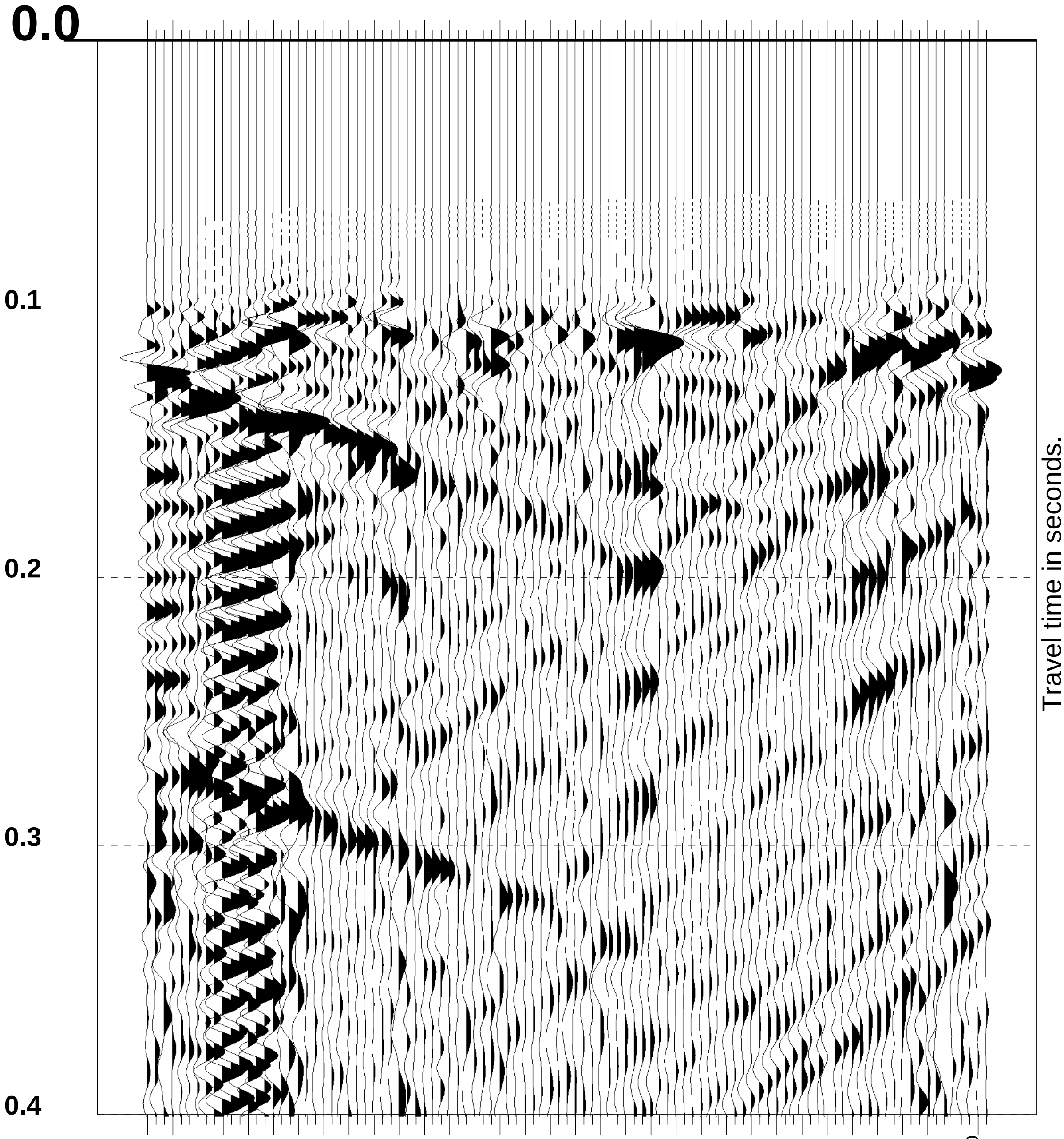
1st Residual Wavefield
Total minus Smooth Dng. P.

Normal polarity.
RMS global scaling.
Swing 12.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB	LEVEL NO.
66.120	100.00	100.00	1
68.210	115.00	115.00	4
70.970	130.00	130.00	7
73.770	145.00	145.00	10
76.390	160.00	160.00	13
78.690	175.00	175.00	16
83.710	190.00	190.00	19
86.389	205.00	205.00	22
88.330	220.00	220.00	25
91.900	235.00	235.00	28
95.723	250.00	250.00	31
99.510	265.00	265.00	34
103.07	280.00	280.00	37
107.65	295.00	295.00	40
111.72	310.00	310.00	43
114.66	325.00	325.00	46
119.15	340.00	340.00	49
123.14	355.00	355.00	52
126.94	370.00	370.00	55
131.56	385.00	385.00	58
136.15	400.00	400.00	61
139.06	415.00	415.00	64
143.84	430.00	430.00	67
148.81	445.00	445.00	70
154.12	460.00	460.00	73
158.97	475.00	475.00	76
163.57	490.00	490.00	79
169.00	505.00	505.00	82
173.69	520.00	520.00	85
177.49	535.00	535.00	88
181.02	550.00	550.00	91
185.74	565.00	565.00	94
189.08	580.00	580.00	97
191.92	595.00	595.00	100



WELL : DH4. DISPLAY NO. : B2A. Panel : D. Page : 1 of 1

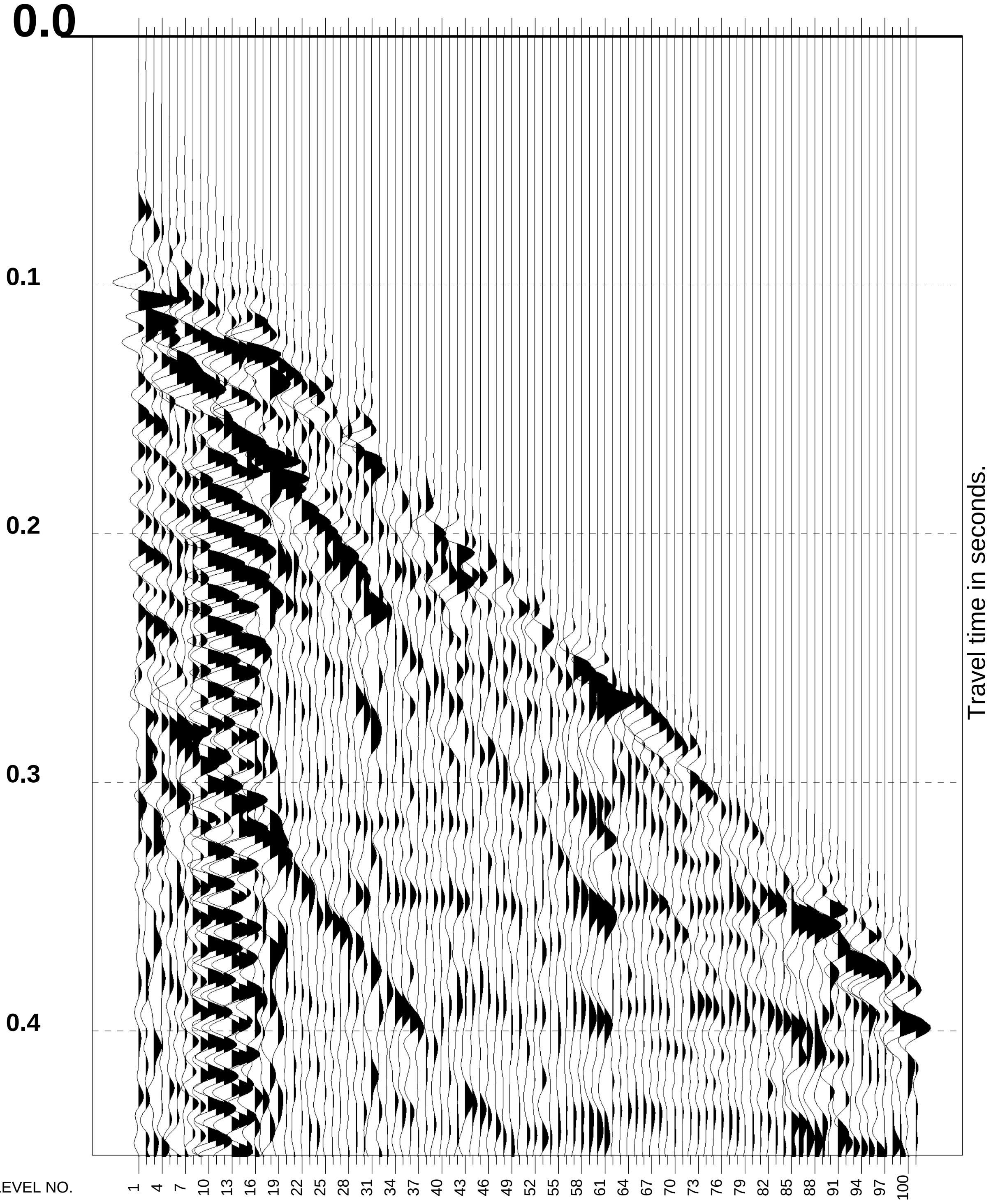
1st Residual Wavefield
Total minus Smooth Dng. P.

Normal polarity.
RMS global scaling.
Swing 12.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	66.120	68.210	70.970	73.770	76.390	78.690	83.710	86.389	88.330	91.900	95.723	99.510	103.07	107.65	111.72	114.66	119.15	123.14	126.94	131.56	136.15	139.06	143.84	148.81	154.12	158.97	163.57	169.00	173.69	177.49	181.02	185.74	189.08	191.92
MEASURED DEPTH (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00
TVD (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00



DISPLAYED: 26 May 2010

READ WELL SERVICES
P.O. BOX 193, N-1378 NESBRU NORWAY
TEL. (+47) 66851800 FAX. (+47) 66851870

University of Svalbard
WELL : DH4

Zero Offset VSP

DISPLAY NO. :B2B

Extraction of Downgoing P,
Upgoing P and Res. Wavefields.

POLARITY : NORMAL
TIME SCALE : 40 cm/s
HORIZONTAL SCL 1: 4000 Measured Depth

PROCESSING PARAMETERS

1-11: See display group B2A.
12. Separation of 1st residual wavefield into smooth upgoing wavefield
and 2nd residual: 17 Points median filter.
13. Sph. div. comp (T/T0)**1.4 & Bandpass: 6(18)-90(72) Hz(dB/Oct) ZPH
-------> Panel A : Smooth Upgoing Wavefield.
-------> Panel B : 2nd Residual Wavefield.
13. Separation 2nd res. into res. dng. & 3rd. res. w/13 pts. median,
dip 0.15/0.55 ms/m. Separation 3rd res. into res. wavef.& 4th
res. w/13 pts. median, dip -0.30/-0.02 ms/m. Alignment: 100ms
14. Sph. div. comp (T/T0)**1.4 & Bandpass: 6(18)-90(72) Hz(dB/Oct) ZPH
-------> Panel C,D : Residual Downgoing & 3rd Residual Wavefield.
-------> Panel E,F : Residual Alignments & 4th Residual Wavefield.
14. Shift to TWT. Extraction of residual upg. wavefield: 13 Pts. dip
median applied to 4th residual wavefield. Dip : -0.65/-0.25 ms/m
15. Sph. div. comp (T/T0)**1.4 & Bandpass: 6(18)-90(72) Hz(dB/Oct) ZPH
-------> Panel G : Residual Upgoing Wavefield.
›
15. Subtraction of smooth upg. wavef., res. dng. wavef., res. wavef.
and residual upgoing wavef. from total wavef.: 5th residual.
16. Alignment of 5th residual with direct P at 100 ms.
17. Sph. div. comp (T/T0)**1.4 & Bandpass: 6(18)-90(72) Hz(dB/Oct) ZPH
-------> Panel H : 5th Residual. Total Minus Smooth Upg.& Residuals.
FIRST ARRIVALS ALIGNED AT 100 MS.
›
17. Extract final downgoing P from 5th residual: 9 Pts Median.
18. Sph. div. comp (T/T0)**1.4 & Bandpass: 6(18)-90(72) Hz(dB/Oct) ZPH
-------> Panel I : Final Downgoing P. FIRST ARRIVALS AT 100 MS.
›
18. Upgoing wavefield: Shift to TWT. Subtraction of fin. dng. P, res.
dng. wavef., res. wavef. and res. upg. wavef. from total wavef.
19. Sph. div. comp (T/T0)**1.4 & Bandpass: 6(18)-90(72) Hz(dB/Oct) ZPH
-------> Panel J : Raw Upgoing Wavefield.
›
19. Spike removal median filter, 7 pts. with replacement factor 4.0.
20. Sph. div. comp (T/T0)**1.4 & Bandpass: 6(18)-90(72) Hz(dB/Oct) ZPH
-------> Panel K : Raw Upgoing Wavefield after spike removal.
›
PANEL A-G, J & K DISPLAYED AT TWO-WAY TIME; H & I AT 100 MS ALIGNMENT.

NORMAL POLARITY, MINIMUM PHASE :
IS EQUAL TO SEG POSITIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE TROUGH AND A NEGATIVE NUMBER ON TAPE"
NORMAL POLARITY, ZERO PHASE:
IS EQUAL TO SEG NEGATIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE CENTRAL TROUGH AND A NEGATIVE NUMBER ON TAPE"

WELL : DH4. DISPLAY NO. : B2B. Panel : A. Page : 1 of 1

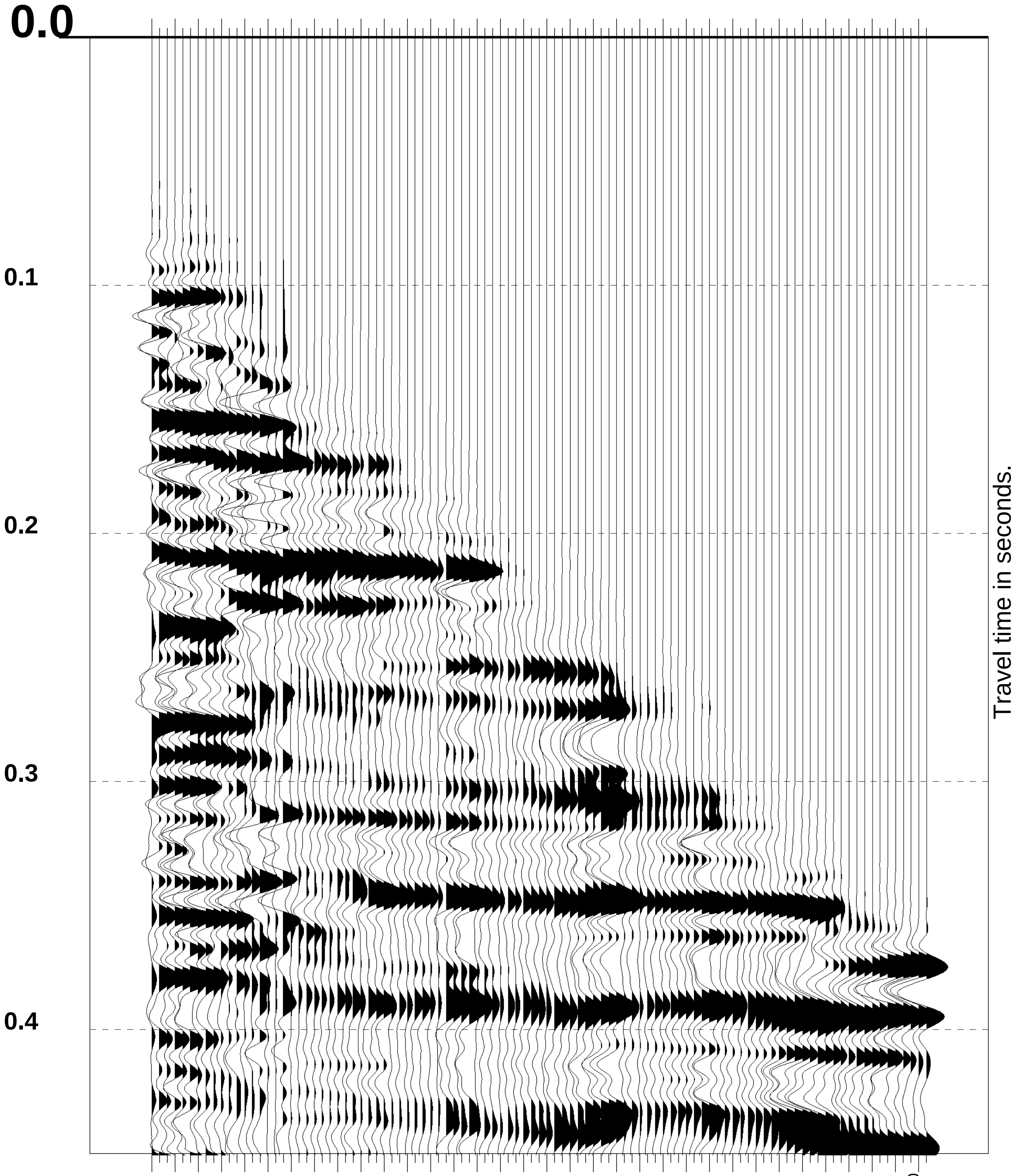
Smooth Upgoing Wavefield Extracted From 1st Residual

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	66.120	68.210	70.970	73.770	76.390	78.690	83.710	86.389	88.330	91.900	95.723	99.510	103.07	107.65	111.72	114.66	119.15	123.14	126.94	131.56	136.15	139.06	143.84	148.81	154.12	158.97	163.57	169.00	173.69	177.49	181.02	185.74	189.08	191.92
MEASURED DEPTH (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00
TVD (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00



LEVEL NO. 1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79 82 85 88 91 94 97 100

WELL : DH4. DISPLAY NO. : B2B. Panel : B. Page : 1 of 1

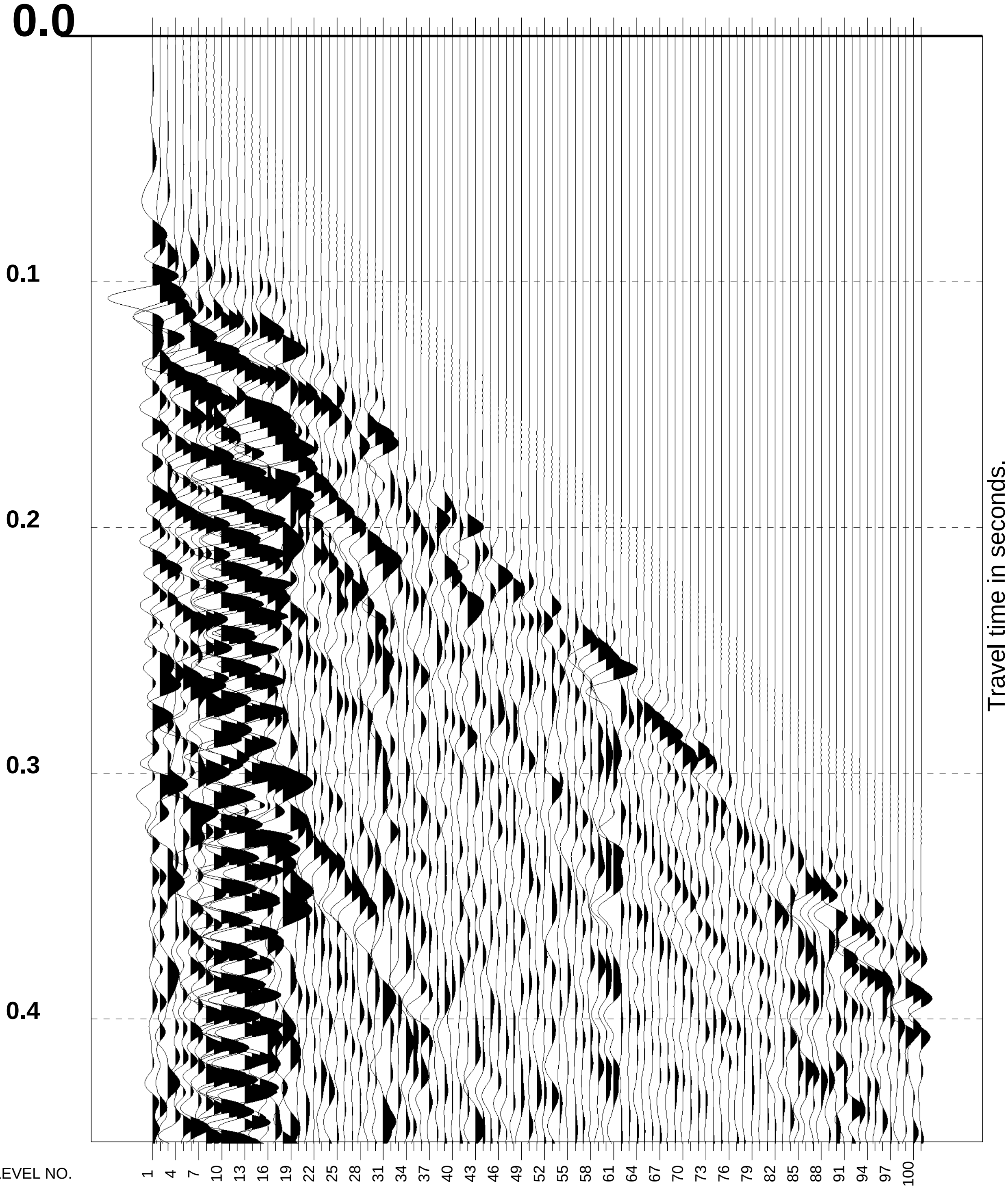
2nd Residual wavef. after extracting smooth up P

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
66.120	100.00	100.00
68.210	115.00	115.00
70.970	130.00	130.00
73.770	145.00	145.00
76.390	160.00	160.00
78.690	175.00	175.00
83.710	190.00	190.00
86.389	205.00	205.00
88.330	220.00	220.00
91.900	235.00	235.00
95.723	250.00	250.00
99.510	265.00	265.00
103.07	280.00	280.00
107.65	295.00	295.00
111.72	310.00	310.00
114.66	325.00	325.00
119.15	340.00	340.00
123.14	355.00	355.00
126.94	370.00	370.00
131.56	385.00	385.00
136.15	400.00	400.00
139.06	415.00	415.00
143.84	430.00	430.00
148.81	445.00	445.00
154.12	460.00	460.00
158.97	475.00	475.00
163.57	490.00	490.00
169.00	505.00	505.00
173.69	520.00	520.00
177.49	535.00	535.00
181.02	550.00	550.00
185.74	565.00	565.00
189.08	580.00	580.00
191.92	595.00	595.00



WELL : DH4. DISPLAY NO. : B2B. Panel : C. Page : 1 of 1

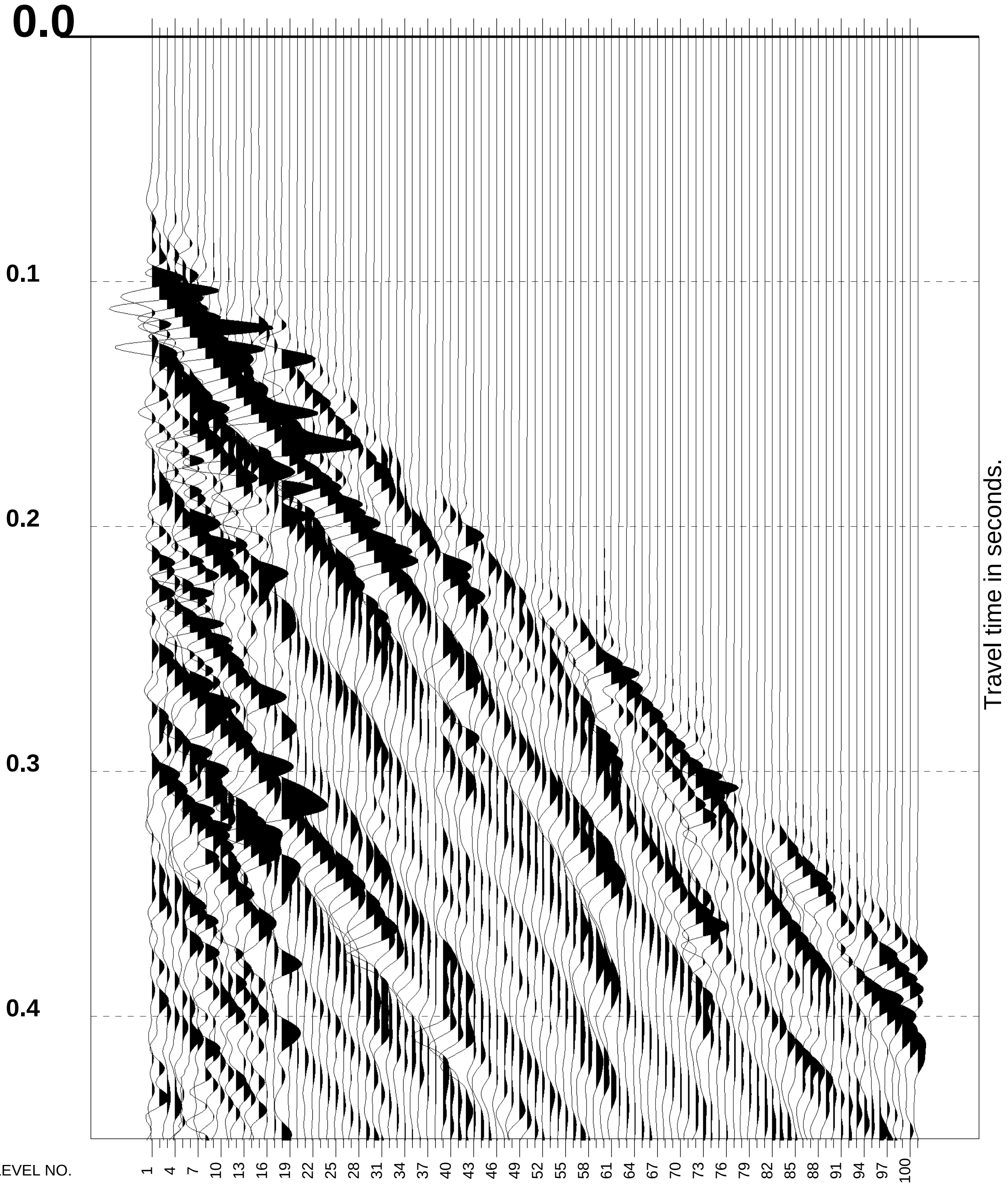
Residual Dng. Wavefield Extracted from 2nd Residual

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
66.120	100.00	100.00
68.210	115.00	115.00
70.970	130.00	130.00
73.770	145.00	145.00
76.390	160.00	160.00
78.690	175.00	175.00
83.710	190.00	190.00
86.389	205.00	205.00
88.330	220.00	220.00
91.900	235.00	235.00
95.723	250.00	250.00
99.510	265.00	265.00
103.07	280.00	280.00
107.65	295.00	295.00
111.72	310.00	310.00
114.66	325.00	325.00
119.15	340.00	340.00
123.14	355.00	355.00
126.94	370.00	370.00
131.56	385.00	385.00
136.15	400.00	400.00
139.06	415.00	415.00
143.84	430.00	430.00
148.81	445.00	445.00
154.12	460.00	460.00
158.97	475.00	475.00
163.57	490.00	490.00
169.00	505.00	505.00
173.69	520.00	520.00
177.49	535.00	535.00
181.02	550.00	550.00
185.74	565.00	565.00
189.08	580.00	580.00
191.92	595.00	595.00



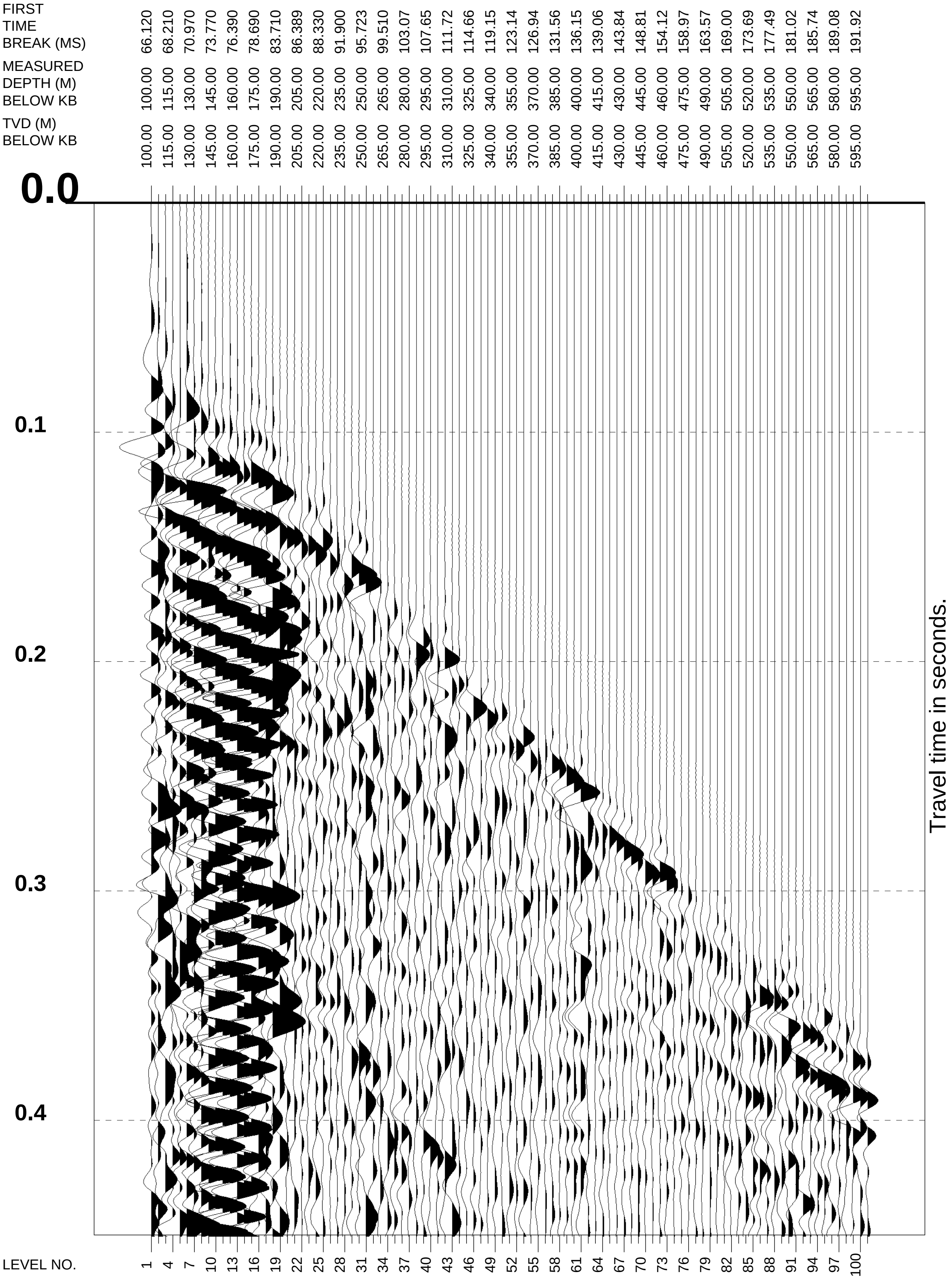
WELL : DH4. DISPLAY NO. : B2B. Panel : D. Page : 1 of 1

3rd Residual wavefield after extracting Res. Dng. Wavef.

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s



WELL : DH4. DISPLAY NO. : B2B. Panel : E. Page : 1 of 1

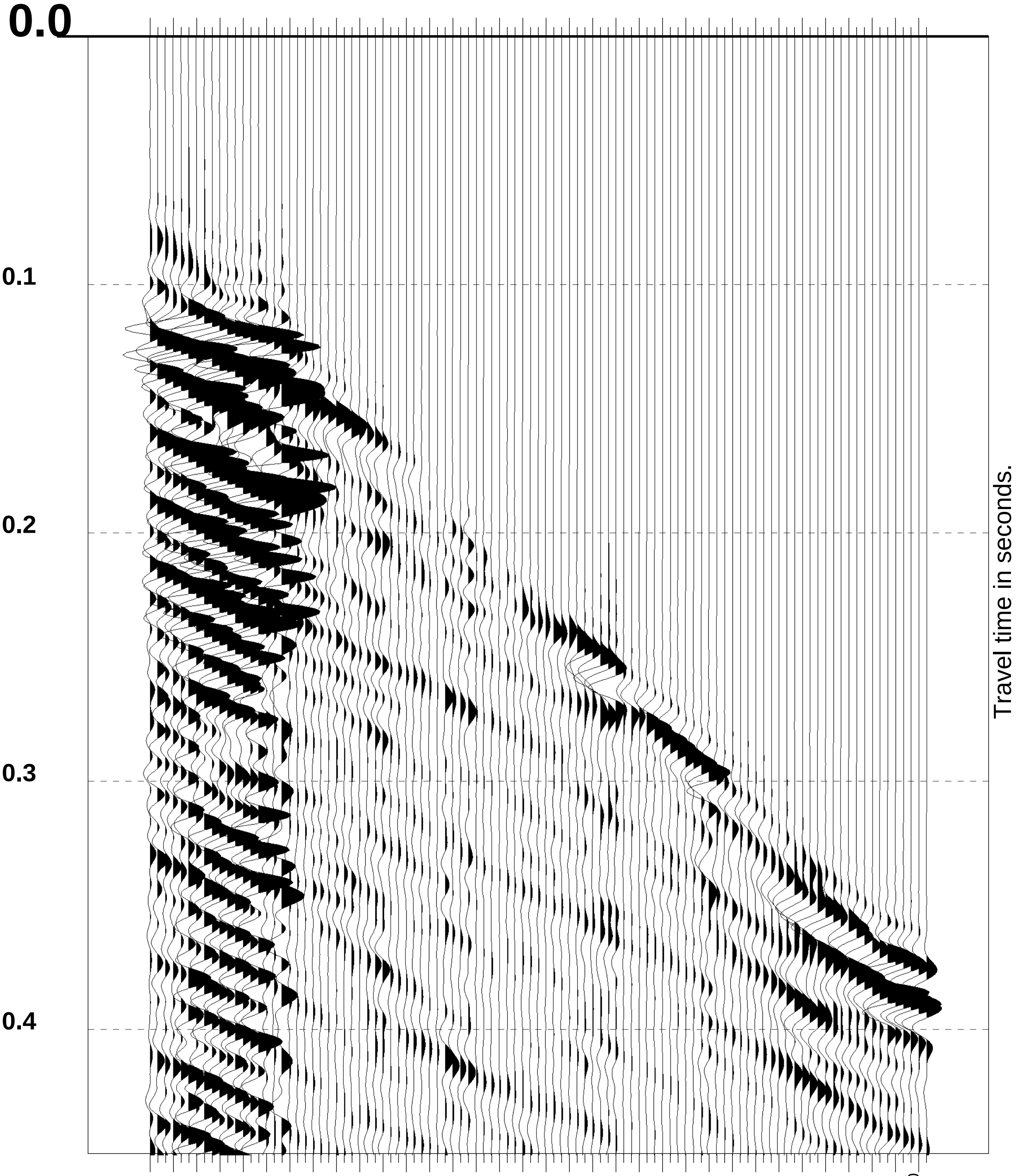
Residual Wavefield. Extracted from 3rd Residual

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	66.120	68.210	70.970	73.770	76.390	78.690	83.710	86.389	88.330	91.900	95.723	99.510	103.07	107.65	111.72	114.66	119.15	123.14	126.94	131.56	136.15	139.06	143.84	148.81	154.12	158.97	163.57	169.00	173.69	177.49	181.02	185.74	189.08	191.92
MEASURED DEPTH (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00
TVD (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00



LEVEL NO. 1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79 82 85 88 91 94 97 100

DISPLAYED: 26 May 2010

WELL : DH4. DISPLAY NO. : B2B. Panel : F. Page : 1 of 1

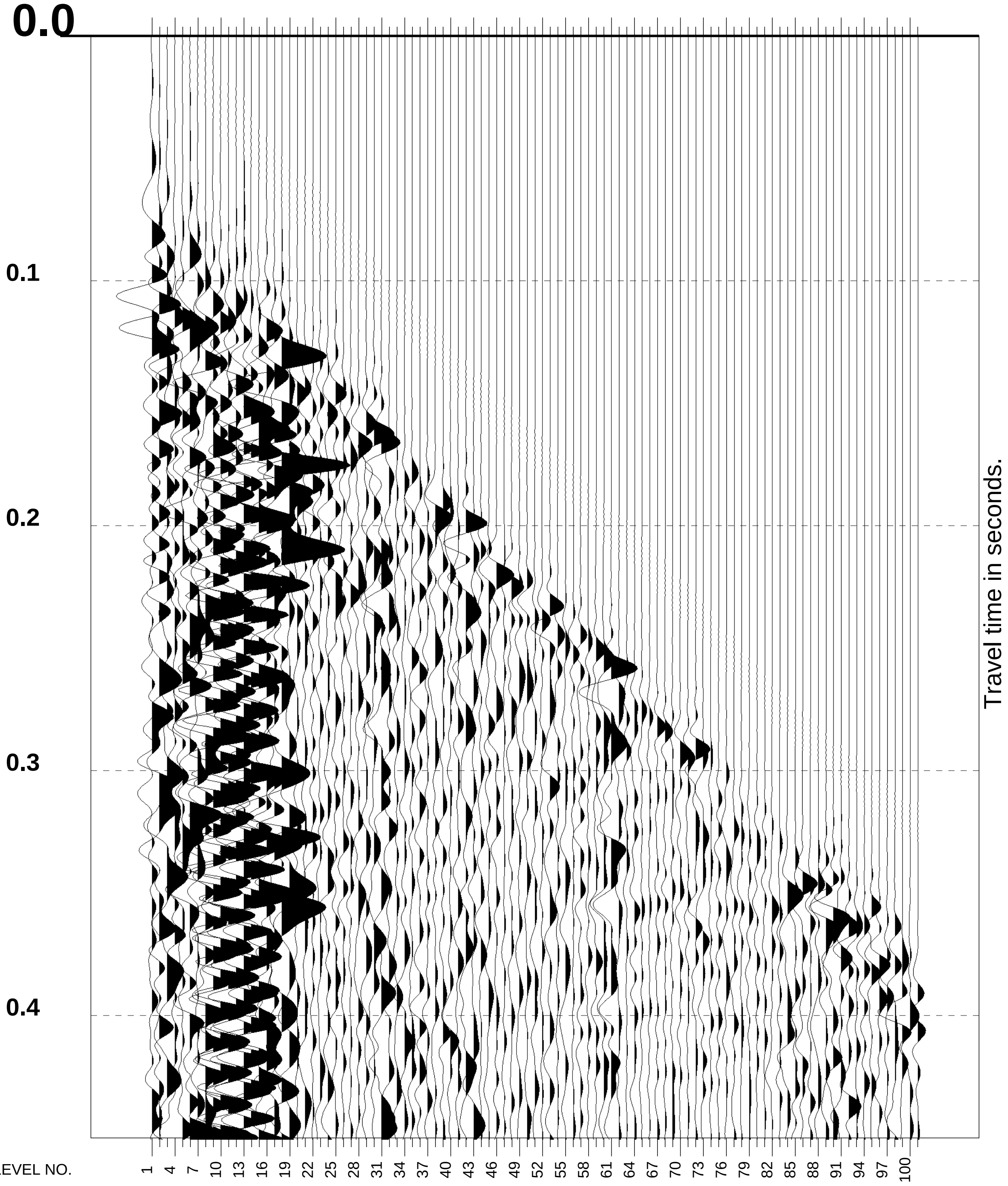
4th Residual Wavefield.

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	66.120	68.210	70.970	73.770	76.390	78.690	83.710	86.389	88.330	91.900	95.723	99.510	103.07	107.65	111.72	114.66	119.15	123.14	126.94	131.56	136.15	139.06	143.84	148.81	154.12	158.97	163.57	169.00	173.69	177.49	181.02	185.74	189.08	191.92
MEASURED DEPTH (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00
TVD (M) BELOW KB	100.00	115.00	130.00	145.00	160.00	175.00	190.00	205.00	220.00	235.00	250.00	265.00	280.00	295.00	310.00	325.00	340.00	355.00	370.00	385.00	400.00	415.00	430.00	445.00	460.00	475.00	490.00	505.00	520.00	535.00	550.00	565.00	580.00	595.00



WELL : DH4. DISPLAY NO. : B2B. Panel : G. Page : 1 of 1

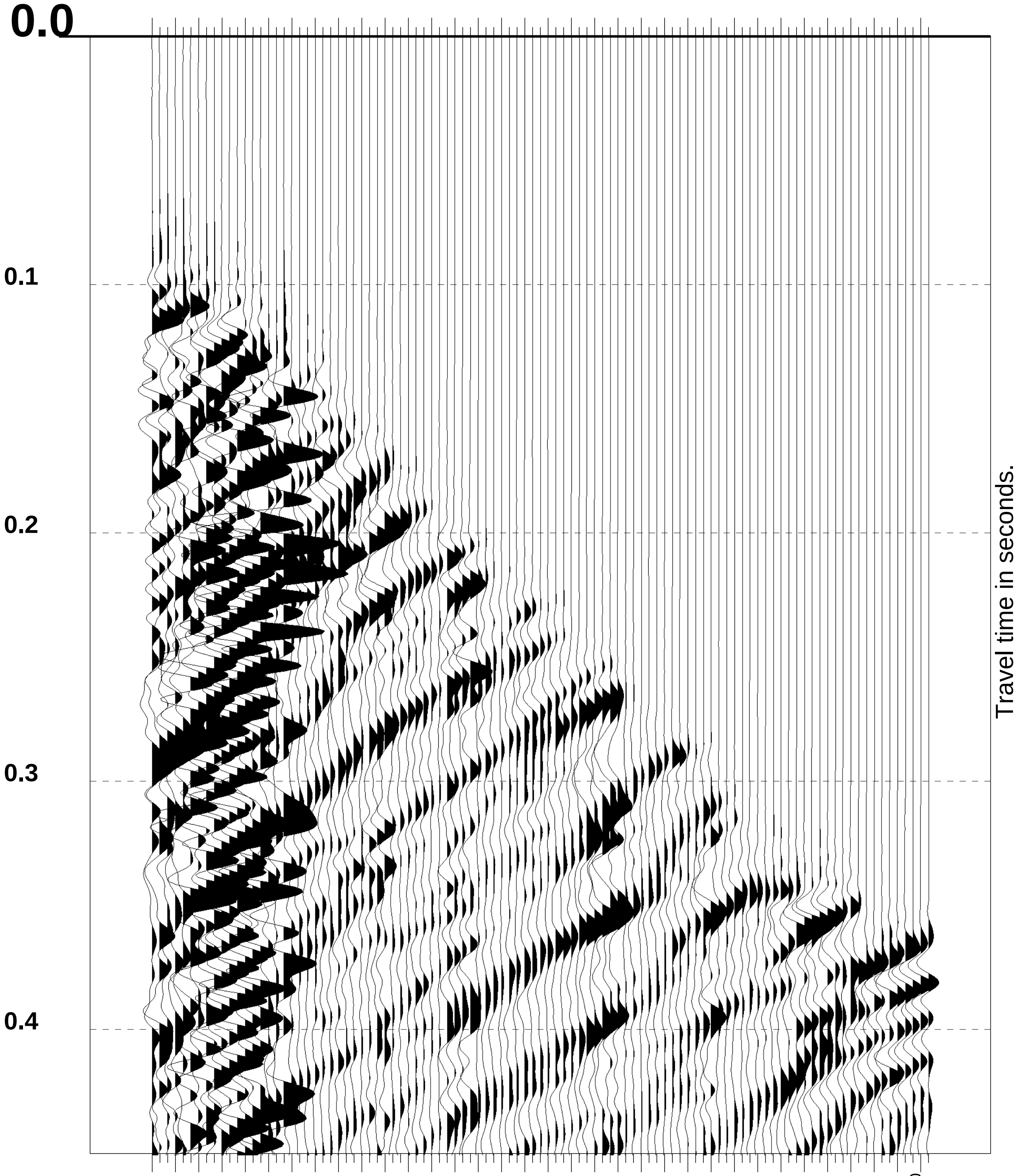
Residual Upg. Wavefield. Extracted from 4th Residual.

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

LEVEL NO.	FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
1	66.120	100.00	100.00
4	68.210	115.00	115.00
7	70.970	130.00	130.00
10	73.770	145.00	145.00
13	76.390	160.00	160.00
16	78.690	175.00	175.00
19	83.710	190.00	190.00
22	86.389	205.00	205.00
25	88.330	220.00	220.00
28	91.900	235.00	235.00
31	95.723	250.00	250.00
34	99.510	265.00	265.00
37	103.07	280.00	280.00
40	107.65	295.00	295.00
43	111.72	310.00	310.00
46	114.66	325.00	325.00
49	119.15	340.00	340.00
52	123.14	355.00	355.00
55	126.94	370.00	370.00
58	131.56	385.00	385.00
61	136.15	400.00	400.00
64	139.06	415.00	415.00
67	143.84	430.00	430.00
70	148.81	445.00	445.00
73	154.12	460.00	460.00
76	158.97	475.00	475.00
79	163.57	490.00	490.00
82	169.00	505.00	505.00
85	173.69	520.00	520.00
88	177.49	535.00	535.00
91	181.02	550.00	550.00
94	185.74	565.00	565.00
97	189.08	580.00	580.00
100	191.92	595.00	595.00



WELL : DH4. DISPLAY NO. : B2B. Panel : H. Page : 1 of 1

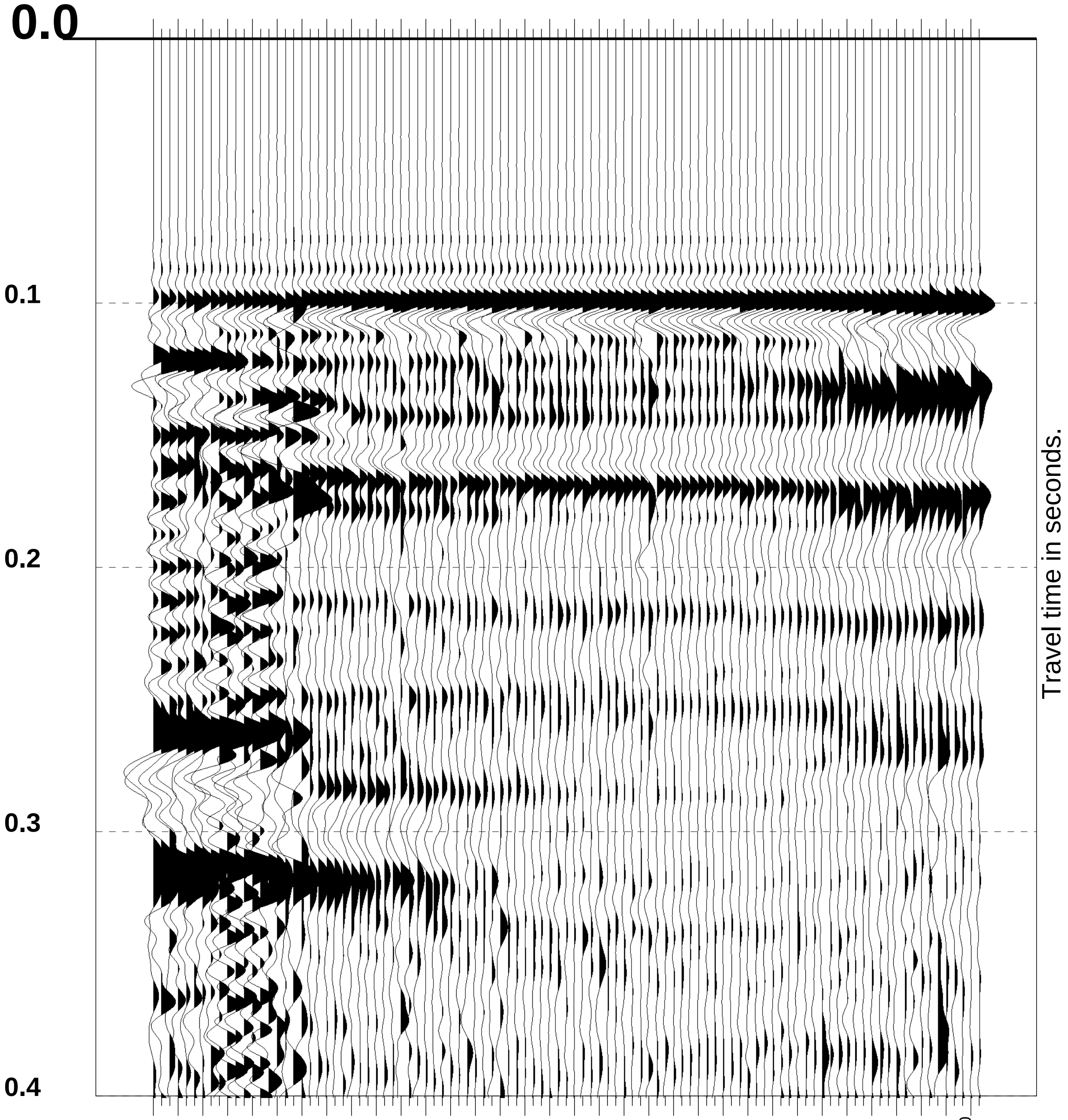
5th Residual. Total Minus Smooth Upg. & Res. Wavefields.

Normal polarity.
RMS global scaling.
Swing 14.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

LEVEL NO.	FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
1	66.120	100.00	100.00
4	68.210	115.00	115.00
7	70.970	130.00	130.00
10	73.770	145.00	145.00
13	76.390	160.00	160.00
16	78.690	175.00	175.00
19	83.710	190.00	190.00
22	86.389	205.00	205.00
25	88.330	220.00	220.00
28	91.900	235.00	235.00
31	95.723	250.00	250.00
34	99.510	265.00	265.00
37	103.07	280.00	280.00
40	107.65	295.00	295.00
43	111.72	310.00	310.00
46	114.66	325.00	325.00
49	119.15	340.00	340.00
52	123.14	355.00	355.00
55	126.94	370.00	370.00
58	131.56	385.00	385.00
61	136.15	400.00	400.00
64	139.06	415.00	415.00
67	143.84	430.00	430.00
70	148.81	445.00	445.00
73	154.12	460.00	460.00
76	158.97	475.00	475.00
79	163.57	490.00	490.00
82	169.00	505.00	505.00
85	173.69	520.00	520.00
88	177.49	535.00	535.00
91	181.02	550.00	550.00
94	185.74	565.00	565.00
97	189.08	580.00	580.00
100	191.92	595.00	595.00



WELL : DH4. DISPLAY NO. : B2B. Panel : I. Page : 1 of 1

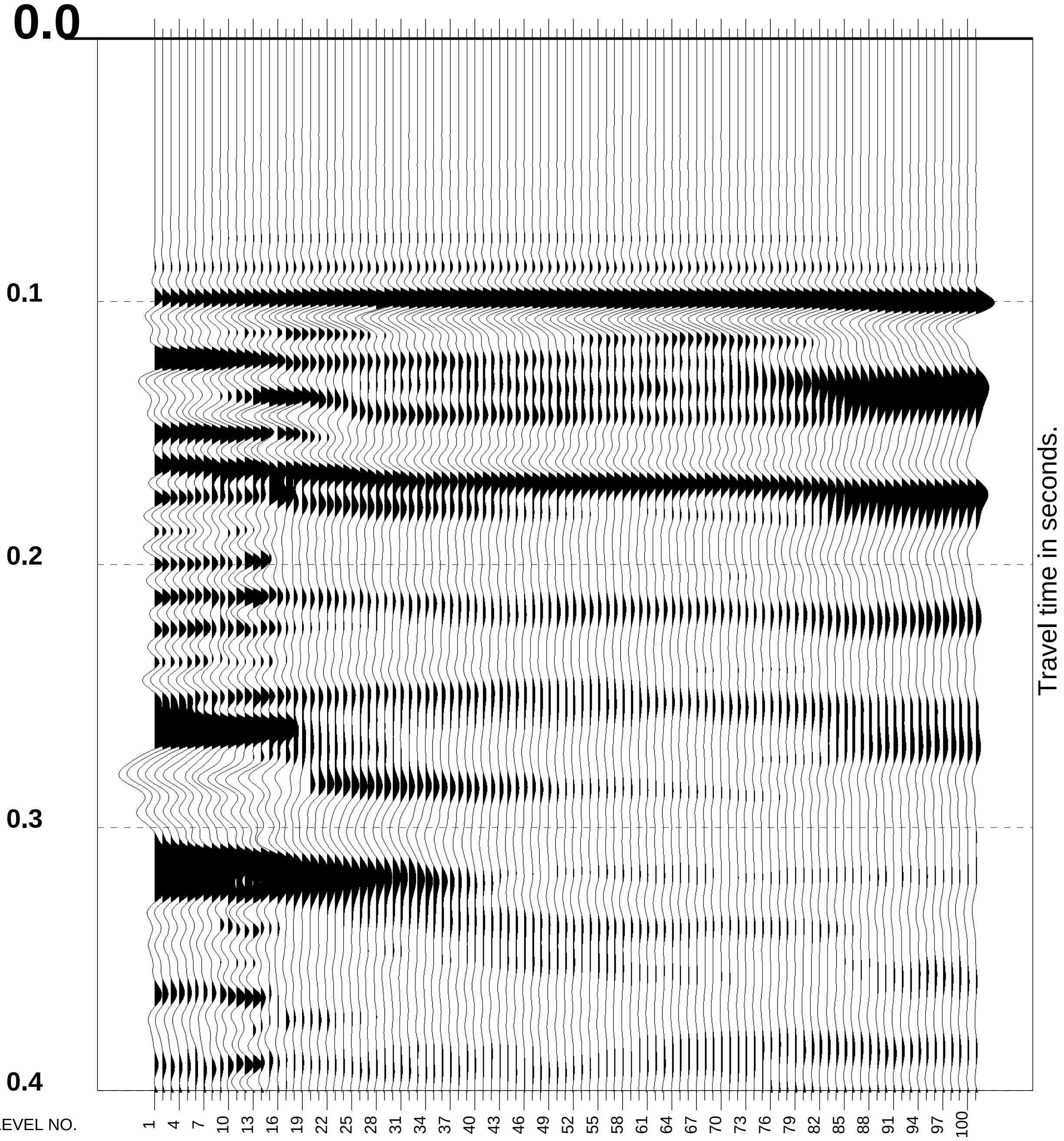
Final Downgoing P. Extracted from 5th Residual.

Normal polarity.
RMS global scaling.
Swing 14.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
66.120	100.00	100.00
68.210	115.00	115.00
70.970	130.00	130.00
73.770	145.00	145.00
76.390	160.00	160.00
78.690	175.00	175.00
83.710	190.00	190.00
86.389	205.00	205.00
88.330	220.00	220.00
91.900	235.00	235.00
95.723	250.00	250.00
99.510	265.00	265.00
103.07	280.00	280.00
107.65	295.00	295.00
111.72	310.00	310.00
114.66	325.00	325.00
119.15	340.00	340.00
123.14	355.00	355.00
126.94	370.00	370.00
131.56	385.00	385.00
136.15	400.00	400.00
139.06	415.00	415.00
143.84	430.00	430.00
148.81	445.00	445.00
154.12	460.00	460.00
158.97	475.00	475.00
163.57	490.00	490.00
169.00	505.00	505.00
173.69	520.00	520.00
177.49	535.00	535.00
181.02	550.00	550.00
185.74	565.00	565.00
189.08	580.00	580.00
191.92	595.00	595.00



WELL : DH4. DISPLAY NO. : B2B. Panel : J. Page : 1 of 1

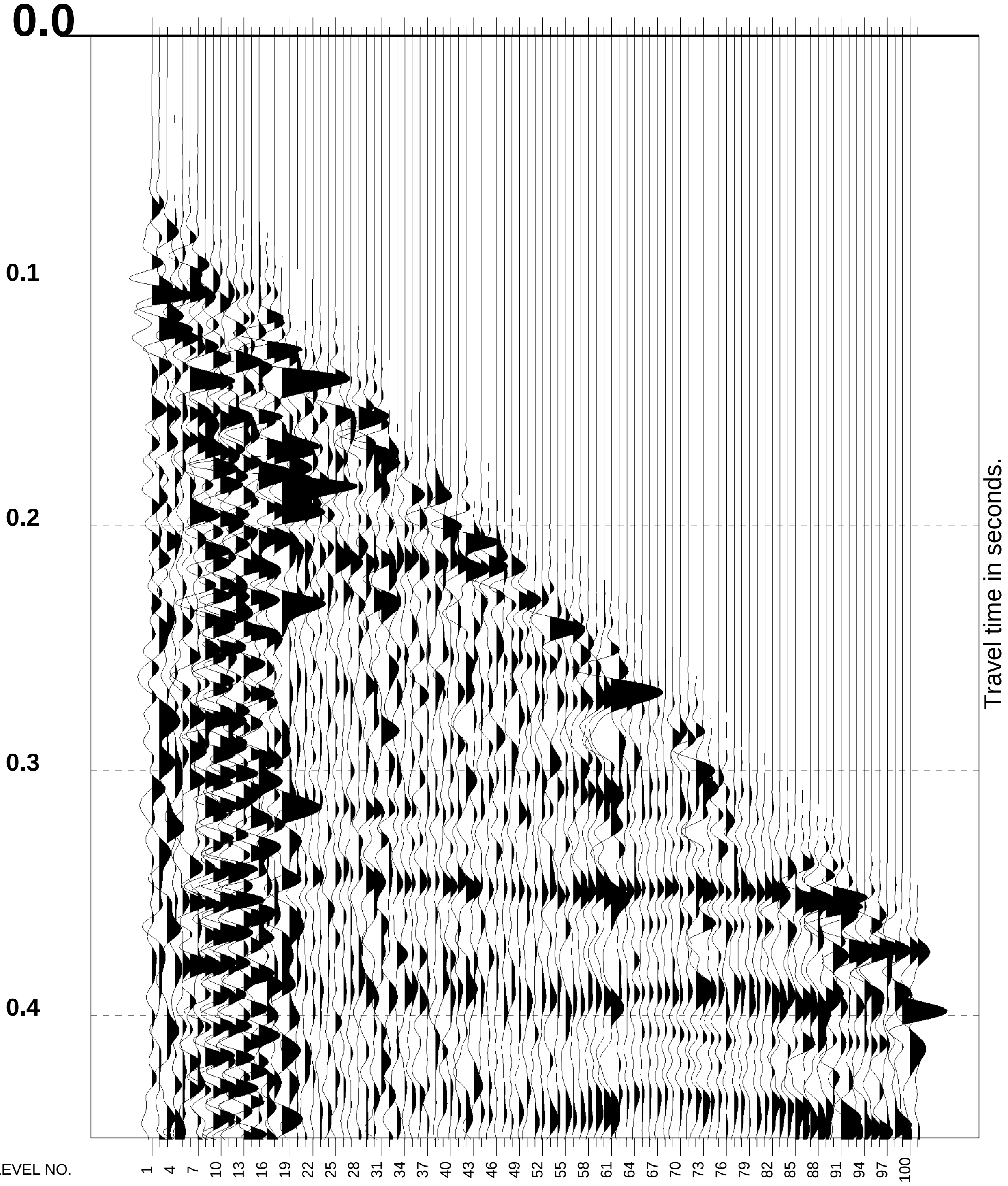
Raw Upgoing Wavefield.

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
66.120	100.00	100.00
68.210	115.00	115.00
70.970	130.00	130.00
73.770	145.00	145.00
76.390	160.00	160.00
78.690	175.00	175.00
83.710	190.00	190.00
86.389	205.00	205.00
88.330	220.00	220.00
91.900	235.00	235.00
95.723	250.00	250.00
99.510	265.00	265.00
103.07	280.00	280.00
107.65	295.00	295.00
111.72	310.00	310.00
114.66	325.00	325.00
119.15	340.00	340.00
123.14	355.00	355.00
126.94	370.00	370.00
131.56	385.00	385.00
136.15	400.00	400.00
139.06	415.00	415.00
143.84	430.00	430.00
148.81	445.00	445.00
154.12	460.00	460.00
158.97	475.00	475.00
163.57	490.00	490.00
169.00	505.00	505.00
173.69	520.00	520.00
177.49	535.00	535.00
181.02	550.00	550.00
185.74	565.00	565.00
189.08	580.00	580.00
191.92	595.00	595.00



WELL : DH4. DISPLAY NO. : B2B. Panel : K. Page : 1 of 1

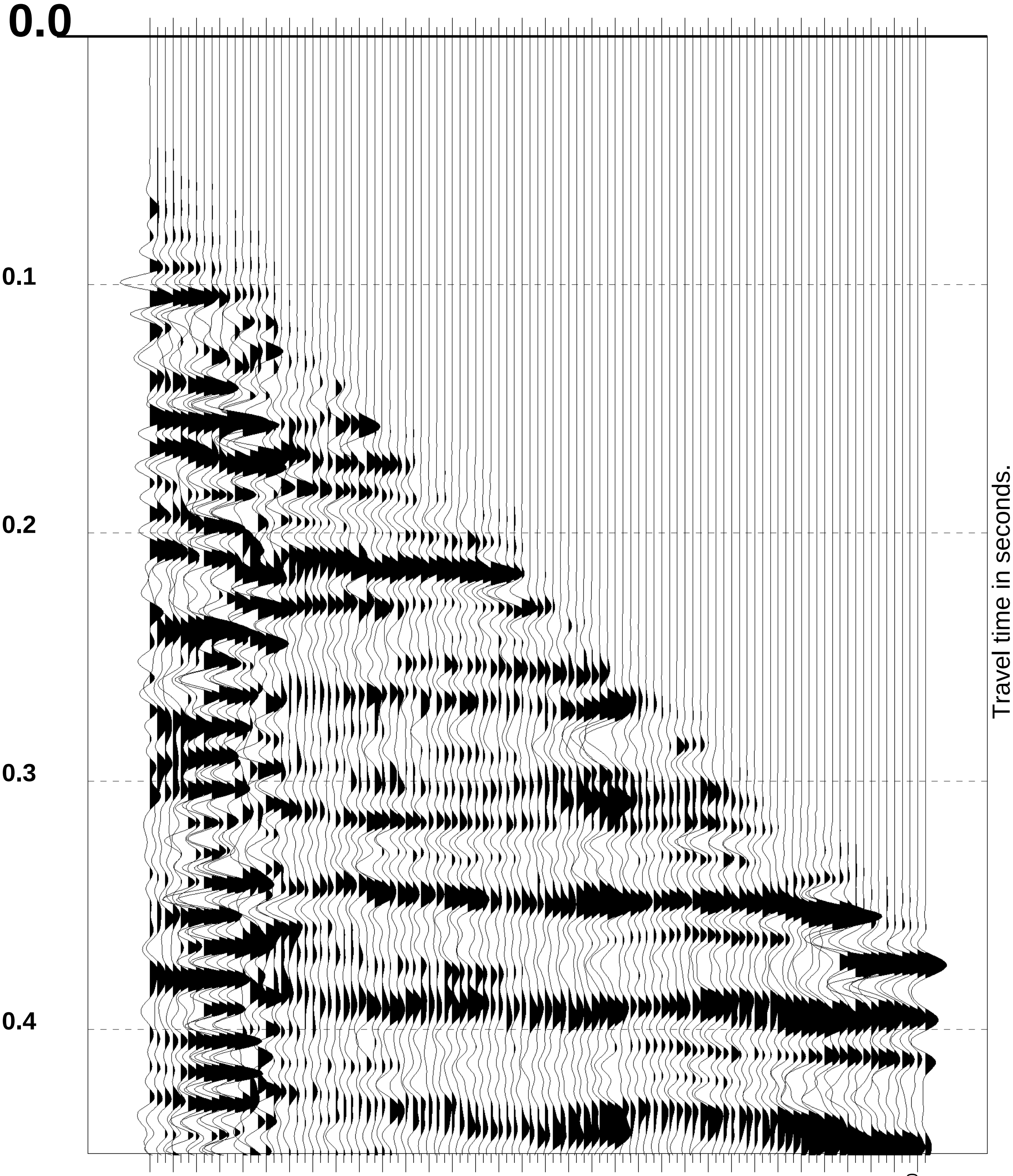
Raw Upgoing Wavefield after Spike Removal.

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

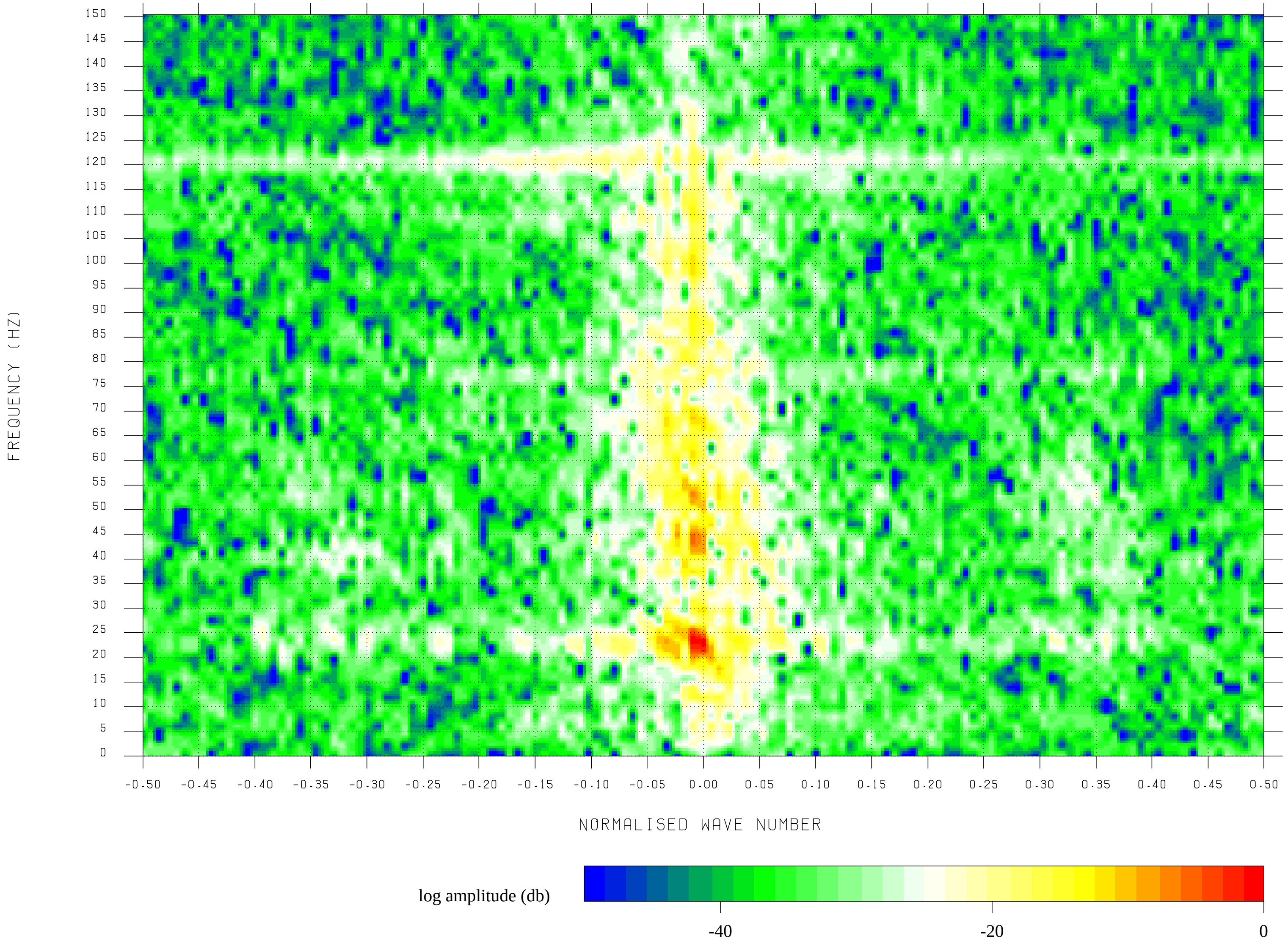
Vertical scale 40 cm/s

LEVEL NO.	FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
1	66.120	100.00	100.00
4	68.210	115.00	115.00
7	70.970	130.00	130.00
10	73.770	145.00	145.00
13	76.390	160.00	160.00
16	78.690	175.00	175.00
19	83.710	190.00	190.00
22	86.389	205.00	205.00
25	88.330	220.00	220.00
28	91.900	235.00	235.00
31	95.723	250.00	250.00
34	99.510	265.00	265.00
37	103.07	280.00	280.00
40	107.65	295.00	295.00
43	111.72	310.00	310.00
46	114.66	325.00	325.00
49	119.15	340.00	340.00
52	123.14	355.00	355.00
55	126.94	370.00	370.00
58	131.56	385.00	385.00
61	136.15	400.00	400.00
64	139.06	415.00	415.00
67	143.84	430.00	430.00
70	148.81	445.00	445.00
73	154.12	460.00	460.00
76	158.97	475.00	475.00
79	163.57	490.00	490.00
82	169.00	505.00	505.00
85	173.69	520.00	520.00
88	177.49	535.00	535.00
91	181.02	550.00	550.00
94	185.74	565.00	565.00
97	189.08	580.00	580.00
100	191.92	595.00	595.00



DISPLAYED: 26 May 2010

F2. FK Plot of Upwave input to Deconv., 0.2-0.5 s



READ WELL SERVICES
P.O. BOX 193, N-1378 NESBRU NORWAY
TEL. (+47) 66851800 FAX. (+47) 66851870

University of Svalbard
WELL : DH4

Zero Offset VSP

DISPLAY NO. :B2C
Deconvolution of
Downgoing Wavefield, ZPH.

POLARITY : NORMAL
TIME SCALE : 40 cm/s
HORIZONTAL SCL 1: 4000 Measured Depth

PROCESSING PARAMETERS

1-17: See display group B2B.
18: Selection of traces for deconvolution.
19. Spherical divergence compensation: (T/T0) ** 1.4.
20. Alignment of direct P at 100 ms.
21. VSP Deconvolution:
    Anticipation : 50 ms
    Design window : 1200 ms
    Operator length : 1250 ms
    Desired output :
    Bandpass filter 6(18) - 90(24) Hz(dB/Oct) Zero Phase.
    Operator design on down P extracted with 7 pts. median.
22. Bandpass filter: 6(18) - 90(72) Hz(dB/Oct) Zero Phase.
-------> Panel A : Deconvolved Downgoing Wavefield, ZPH.
FIRST ARRIVALS ALIGNED AT 100 MS.

NORMAL POLARITY, MINIMUM PHASE :
IS EQUAL TO SEG POSITIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE TROUGH AND A NEGATIVE NUMBER ON TAPE"
NORMAL POLARITY, ZERO PHASE:
IS EQUAL TO SEG NEGATIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE CENTRAL TROUGH AND A NEGATIVE NUMBER ON TAPE"

DISPLAYED: 26 May 2010

WELL : DH4. DISPLAY NO. : B2C. Panel : A. Page : 1 of 1

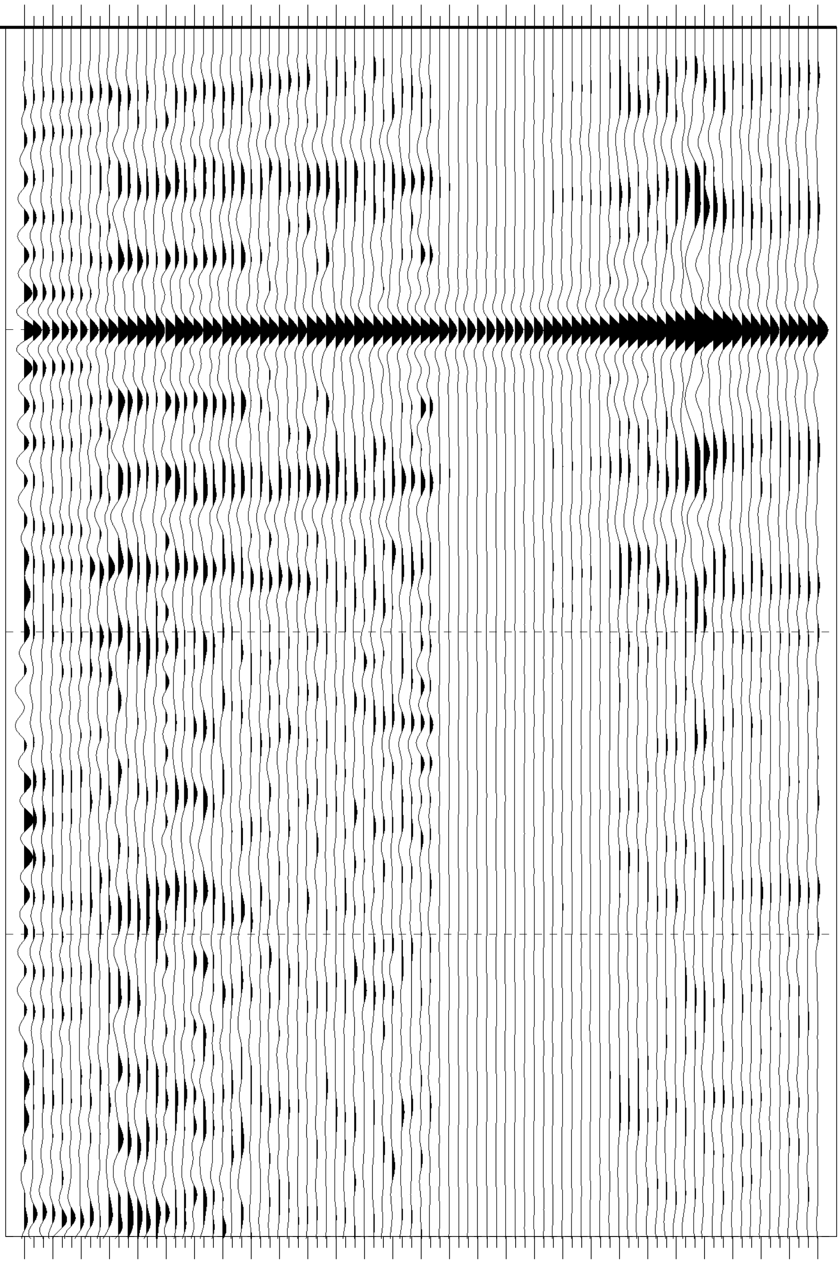
Dec. Downgoing Wavefield
6 (18) - 90(72) Hz(dB/Oct) ZPH

Normal polarity.
RMS global scaling.
Swing 4.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

LEVEL NO.	FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
1	80.440	180.00	180.00
4	84.620	195.00	195.00
7	86.695	210.00	210.00
10	89.500	225.00	225.00
13	93.070	240.00	240.00
16	96.810	255.00	255.00
19	100.52	270.00	270.00
22	104.28	285.00	285.00
25	109.15	300.00	300.00
28	112.59	315.00	315.00
31	116.27	330.00	330.00
34	120.55	345.00	345.00
37	124.76	360.00	360.00
40	128.66	375.00	375.00
43	133.37	390.00	390.00
46	137.01	405.00	405.00
49	140.30	420.00	420.00
52	145.15	435.00	435.00
55	150.07	450.00	450.00
58	155.50	465.00	465.00
61	160.15	480.00	480.00
64	165.58	495.00	495.00
67	170.51	510.00	510.00
70	174.76	525.00	525.00
73	178.62	540.00	540.00
76	182.30	555.00	555.00
79	186.99	570.00	570.00
82	189.90	585.00	585.00
85	193.24	600.00	600.00



DISPLAYED: 26 May 2010

READ WELL SERVICES
P.O. BOX 193, N-1378 NESBRU NORWAY
TEL. (+47) 66851800 FAX. (+47) 66851870

University of Svalbard
WELL : DH4

Zero Offset VSP

DISPLAY NO. :B3

Upgoing Wavefield, Zero Phase
Vertical Component

POLARITY : NORMAL
TIME SCALE : 40 cm/s
HORIZONTAL SCALE: See each panel.

PROCESSING PARAMETERS

1-17: See display group B2B.
18: Selection of traces for deconvolution.
19. Spherical divergence compensation: (T/T0) ** 1.4.
20. Bandpass filter 6(18) - 90(72) Hz(dB/Oct) Zero Phase
---------> Panel A : Raw Upgoing Wavefield after Spike Removal.
DISPLAYS AT TWO-WAY TIME
›
20. Alignment of direct P at 100 ms.
21. VSP Deconvolution:
Anticipation : 50 ms, Design window : 1200 ms
Operator length : 1250 ms, Desired output :
Bandpass filter 6(18) - 90(24) Hz(dB/Oct) Zero Phase.
Operator design on down P extracted with 7 pts. median.
22. Shift to TWT.
23. Bandpass filter 6(18) - 90(72) Hz(dB/Oct) Zero Phase
---------> Panel B : Deconvolved Upgoing Wavefield
›
23. Median filter noise rejection (5 points).
24. Bandpass filter 6(18) - 90(72) Hz(dB/Oct) Zero Phase
---------> Panel C : Enhanced Deconvolved Upgoing Wavef.
›
24. Generation of corridor input to stacking.
25. Bandpass filter 6(18) - 90(72) Hz(dB/Oct) Zero Phase
---------> Panel D : Corridor Input to Stacking
›
25. Average Stacking.
26. Bandpass filter 6(18) - 90(72) Hz(dB/Oct) Zero Phase
---------> Panel E : Corridor Stack
›
24. Compute transposed VSP.
25. Bandpass filter 6(18) - 90(72) Hz(dB/Oct) Zero Phase
Corridor stack made from traces 2 - 8.
---------> Panel F : Corridor Stack from Transposed VSP
---------> Panel G : Transposed VSP
›
23. Median filter noise rejection (7 points)
24. Extraction of residual wavefield.
25. Bandpass filter 6(18) - 90(72) Hz(dB/Oct) Zero Phase
---------> Panel H : Residual Residual Wavefield
DISPLAYS AT TWO-WAY TIME

NORMAL POLARITY, MINIMUM PHASE :
IS EQUAL TO SEG POSITIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE TROUGH AND A NEGATIVE NUMBER ON TAPE"
NORMAL POLARITY, ZERO PHASE:
IS EQUAL TO SEG NEGATIVE POLARITY DEFINED AS: "AN INCREASE IN ACOUSTIC IMPEDANCE WITH DEPTH IS REPRESENTED BY A WHITE CENTRAL TROUGH AND A NEGATIVE NUMBER ON TAPE"

WELL : DH4. DISPLAY NO. : B3. Panel : A. Page : 1 of 1

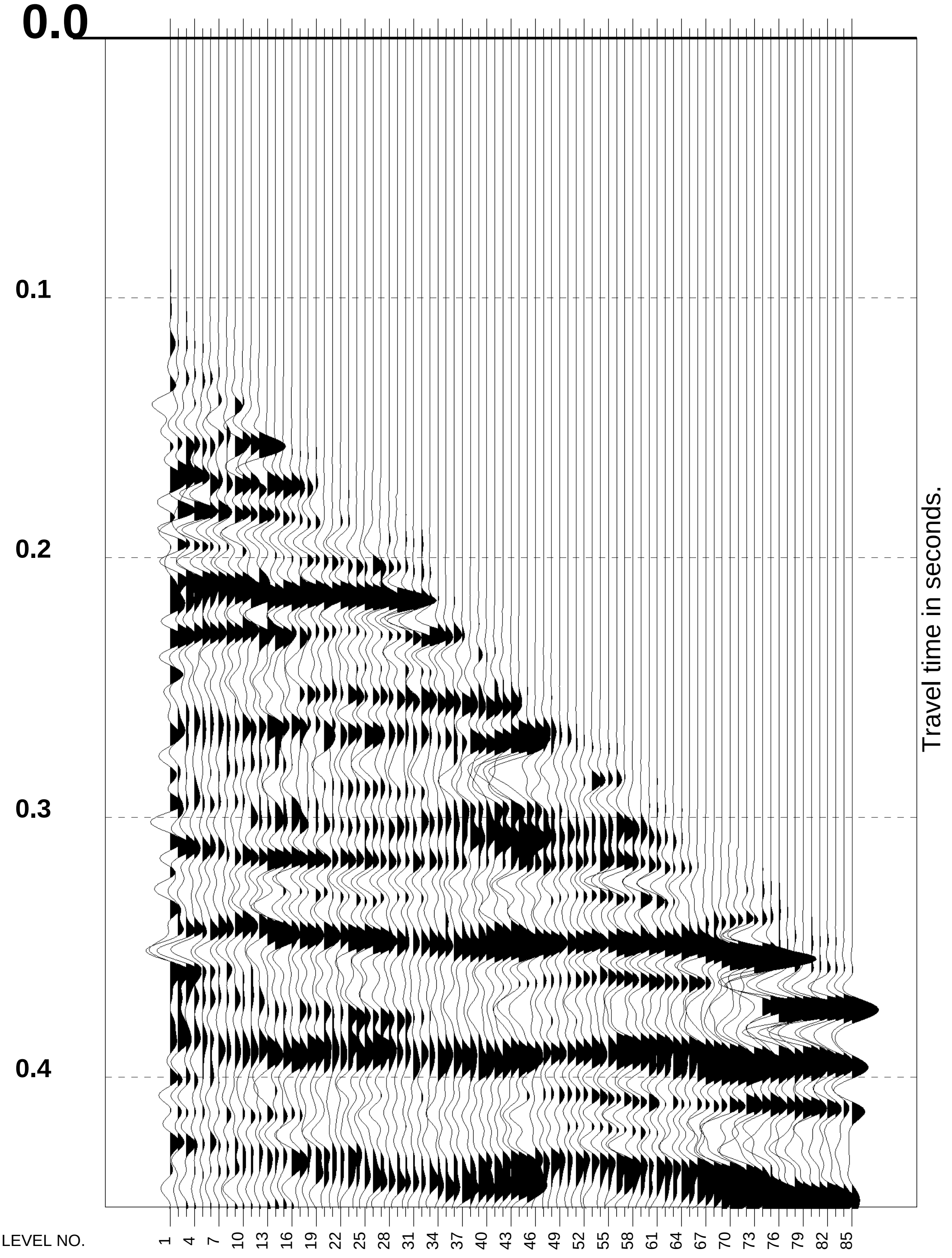
Raw Upgoing Wavefield after Spike Removal.

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	80.440	84.620	86.695	89.500	93.070	96.810	100.52	104.28	109.15	112.59	116.27	120.55	124.76	128.66	133.37	137.01	140.30	145.15	150.07	155.50	160.15	165.58	170.51	174.76	178.62	182.30	186.99	189.90	193.24
MEASURED DEPTH (M) BELOW KB	180.00	195.00	210.00	225.00	240.00	255.00	270.00	285.00	300.00	315.00	330.00	345.00	360.00	375.00	390.00	405.00	420.00	435.00	450.00	465.00	480.00	495.00	510.00	525.00	540.00	555.00	570.00	585.00	600.00
TVD (M) BELOW KB	180.00	195.00	210.00	225.00	240.00	255.00	270.00	285.00	300.00	315.00	330.00	345.00	360.00	375.00	390.00	405.00	420.00	435.00	450.00	465.00	480.00	495.00	510.00	525.00	540.00	555.00	570.00	585.00	600.00



DISPLAYED: 26 May 2010

WELL : DH4. DISPLAY NO. : B3. Panel : B. Page : 1 of 1

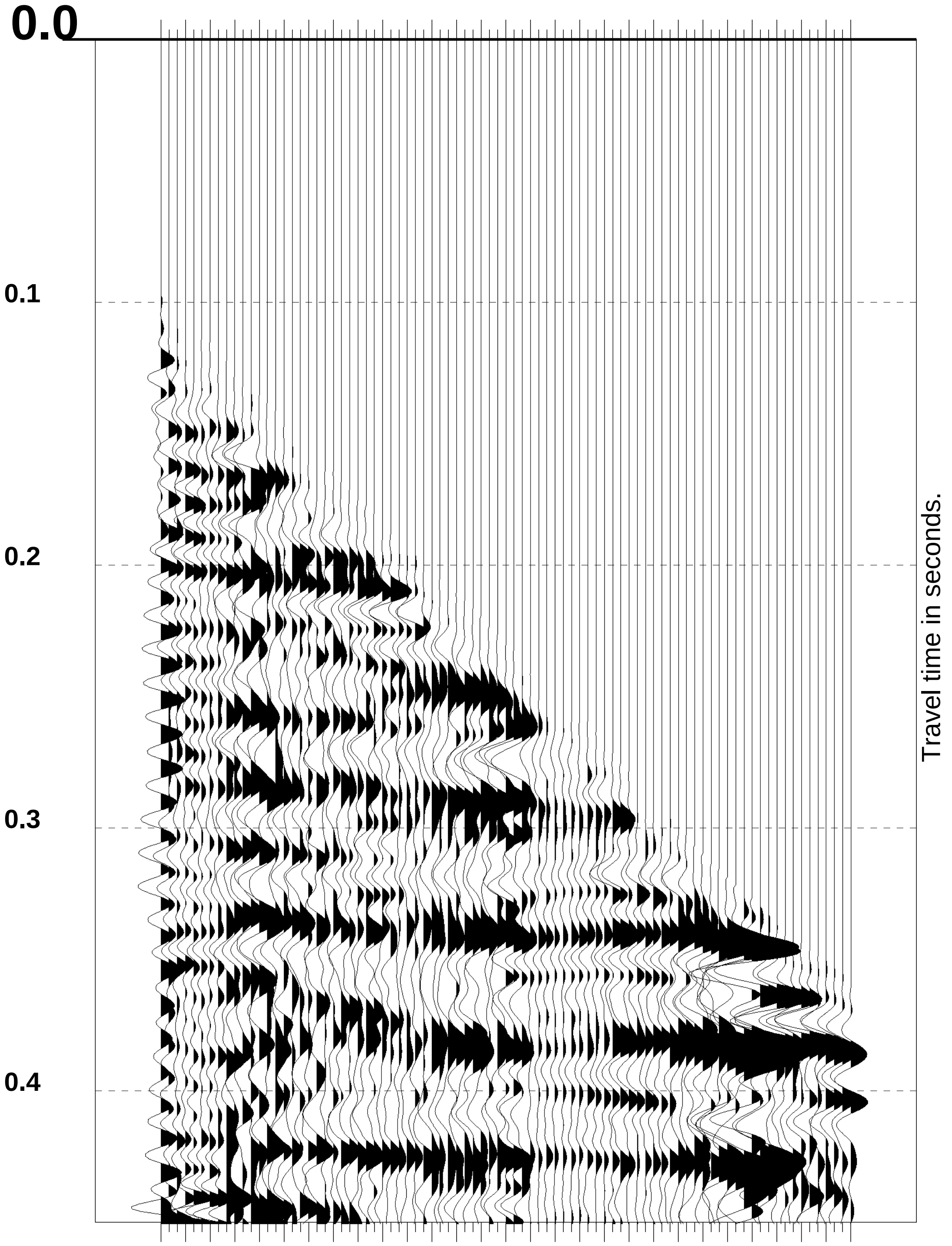
Deconvolved Upgoing Wavefield 6 (18)- 90(72) Hz(dB/Oct) ZPH

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

LEVEL NO.	FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
1	80.440	180.00	180.00
4	84.620	195.00	195.00
7	86.695	210.00	210.00
10	89.500	225.00	225.00
13	93.070	240.00	240.00
16	96.810	255.00	255.00
19	100.52	270.00	270.00
22	104.28	285.00	285.00
25	109.15	300.00	300.00
28	112.59	315.00	315.00
31	116.27	330.00	330.00
34	120.55	345.00	345.00
37	124.76	360.00	360.00
40	128.66	375.00	375.00
43	133.37	390.00	390.00
46	137.01	405.00	405.00
49	140.30	420.00	420.00
52	145.15	435.00	435.00
55	150.07	450.00	450.00
58	155.50	465.00	465.00
61	160.15	480.00	480.00
64	165.58	495.00	495.00
67	170.51	510.00	510.00
70	174.76	525.00	525.00
73	178.62	540.00	540.00
76	182.30	555.00	555.00
79	186.99	570.00	570.00
82	189.90	585.00	585.00
85	193.24	600.00	600.00



WELL : DH4. DISPLAY NO. : B3. Panel : C. Page : 1 of 1

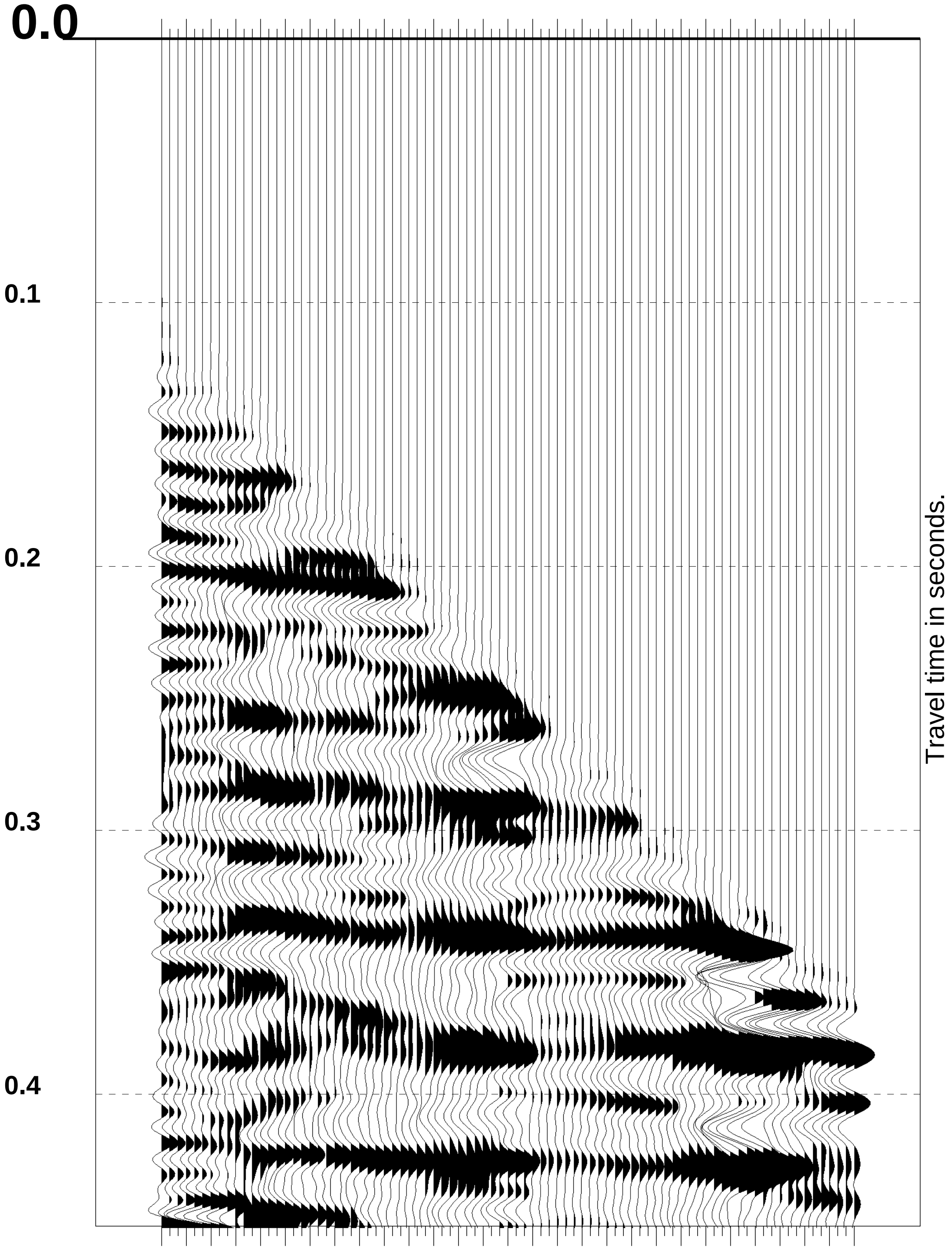
5 Pts. Enhanced Deconv. Upwave 6 (18)- 90(72) Hz(dB/Oct) ZPH

Normal polarity.
RMS global scaling.
Swing 16.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB	LEVEL NO.
80.440	180.00	180.00	1
84.620	195.00	195.00	4
86.695	210.00	210.00	7
89.500	225.00	225.00	10
93.070	240.00	240.00	13
96.810	255.00	255.00	16
100.52	270.00	270.00	19
104.28	285.00	285.00	22
109.15	300.00	300.00	25
112.59	315.00	315.00	28
116.27	330.00	330.00	31
120.55	345.00	345.00	34
124.76	360.00	360.00	37
128.66	375.00	375.00	40
133.37	390.00	390.00	43
137.01	405.00	405.00	46
140.30	420.00	420.00	49
145.15	435.00	435.00	52
150.07	450.00	450.00	55
155.50	465.00	465.00	58
160.15	480.00	480.00	61
165.58	495.00	495.00	64
170.51	510.00	510.00	67
174.76	525.00	525.00	70
178.62	540.00	540.00	73
182.30	555.00	555.00	76
186.99	570.00	570.00	79
189.90	585.00	585.00	82
193.24	600.00	600.00	85



WELL : DH4. DISPLAY NO. : B3. Panel : D. Page : 1 of 1

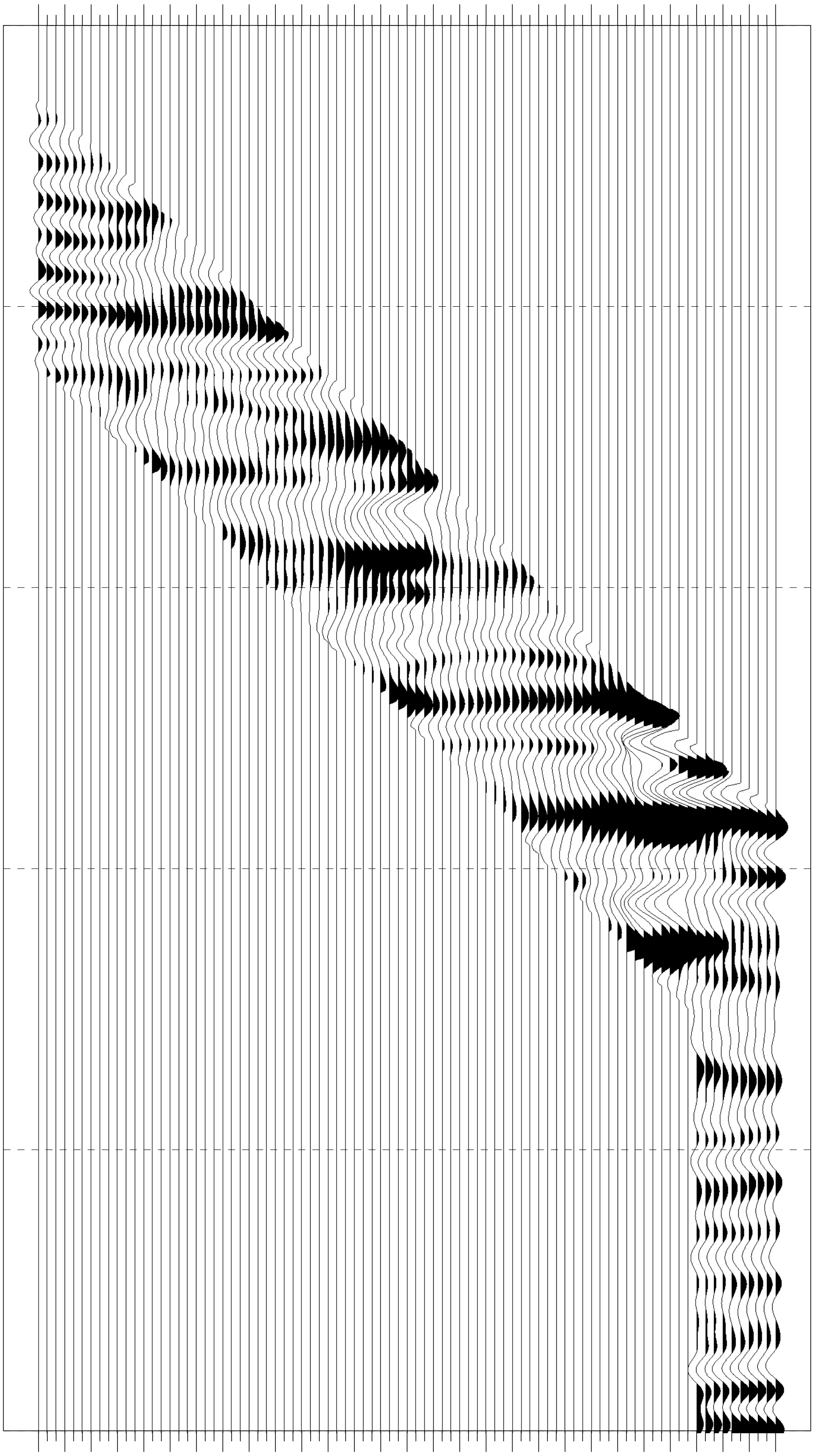
Corridor Input to Stacking
6 (18)- 90(72) Hz(dB/Oct) ZPH

Normal polarity.
RMS global scaling.
Swing 8.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

FIRST TIME BREAK (MS)	122.52	130.22	137.72	146.55	155.76	164.50	173.53	182.56	192.79	201.18	209.92	219.19	228.29	237.18	246.44	255.31	263.37	273.09	283.42	294.21	304.28	315.05	325.34	334.92	343.13	351.38	359.90	367.00	374.36
MEASURED DEPTH (M) BELOW KB	180.00	195.00	210.00	225.00	240.00	255.00	270.00	285.00	300.00	315.00	330.00	345.00	360.00	375.00	390.00	405.00	420.00	435.00	450.00	465.00	480.00	495.00	510.00	525.00	540.00	555.00	570.00	585.00	600.00
TVD (M) BELOW KB	180.00	195.00	210.00	225.00	240.00	255.00	270.00	285.00	300.00	315.00	330.00	345.00	360.00	375.00	390.00	405.00	420.00	435.00	450.00	465.00	480.00	495.00	510.00	525.00	540.00	555.00	570.00	585.00	600.00



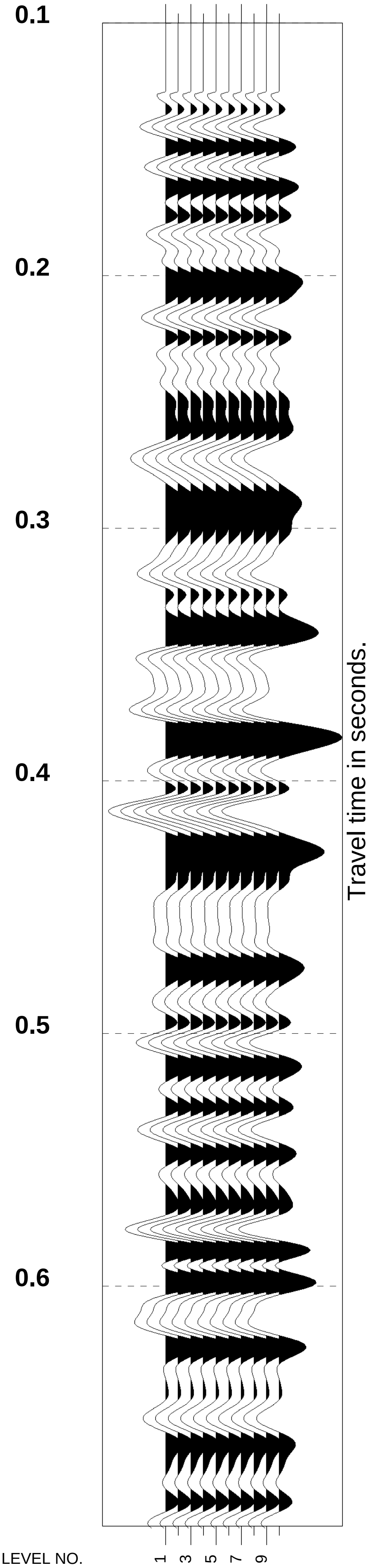
WELL : DH4. DISPLAY NO. : B3. Panel : E. Page : 1 of 1

Corridor Stack
6 (18)- 90(72) Hz(dB/Oct) ZPH

Normal polarity.
Trace scaling.
Swing 10.0

Horizontal scale 5 tr/cm

Vertical scale 40 cm/s



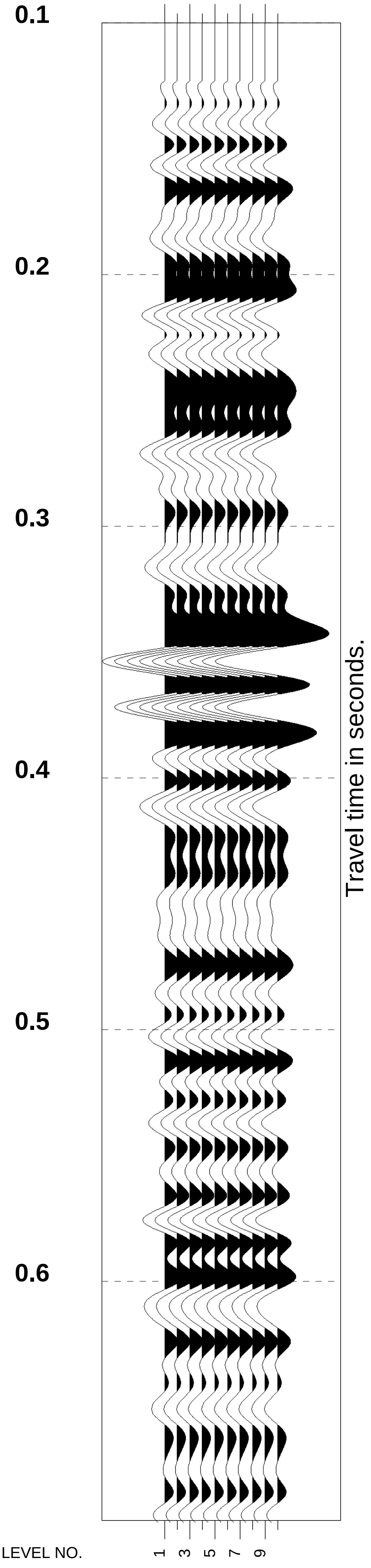
DISPLAYED: 26 May 2010

Corridor Stack from Transposed 6 (18)- 90(72) Hz(dB/Oct) ZPH

Normal polarity.
Trace scaling.
Swing 10.0

Horizontal scale 5 tr/cm

Vertical scale 40 cm/s



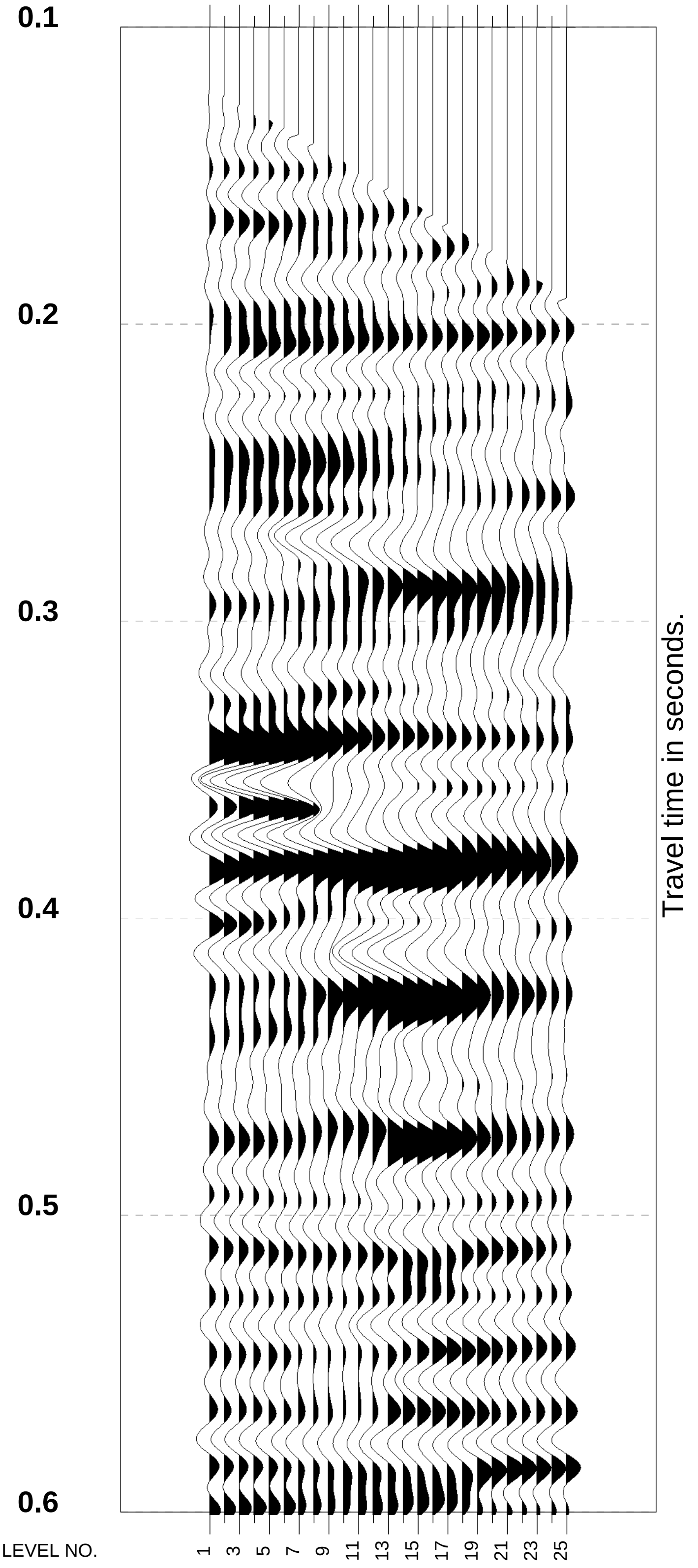
WELL : DH4. DISPLAY NO. : B3. Panel : G. Page : 1 of 1

Transposed VSP
6 (18)- 90(72) Hz(dB/Oct) ZPH

Normal polarity.
RMS global scaling.
Swing 12.0

Horizontal scale 5 tr/cm

Vertical scale 40 cm/s



DISPLAYED: 26 May 2010

WELL : DH4. DISPLAY NO. : B3. Panel : H. Page : 1 of 1

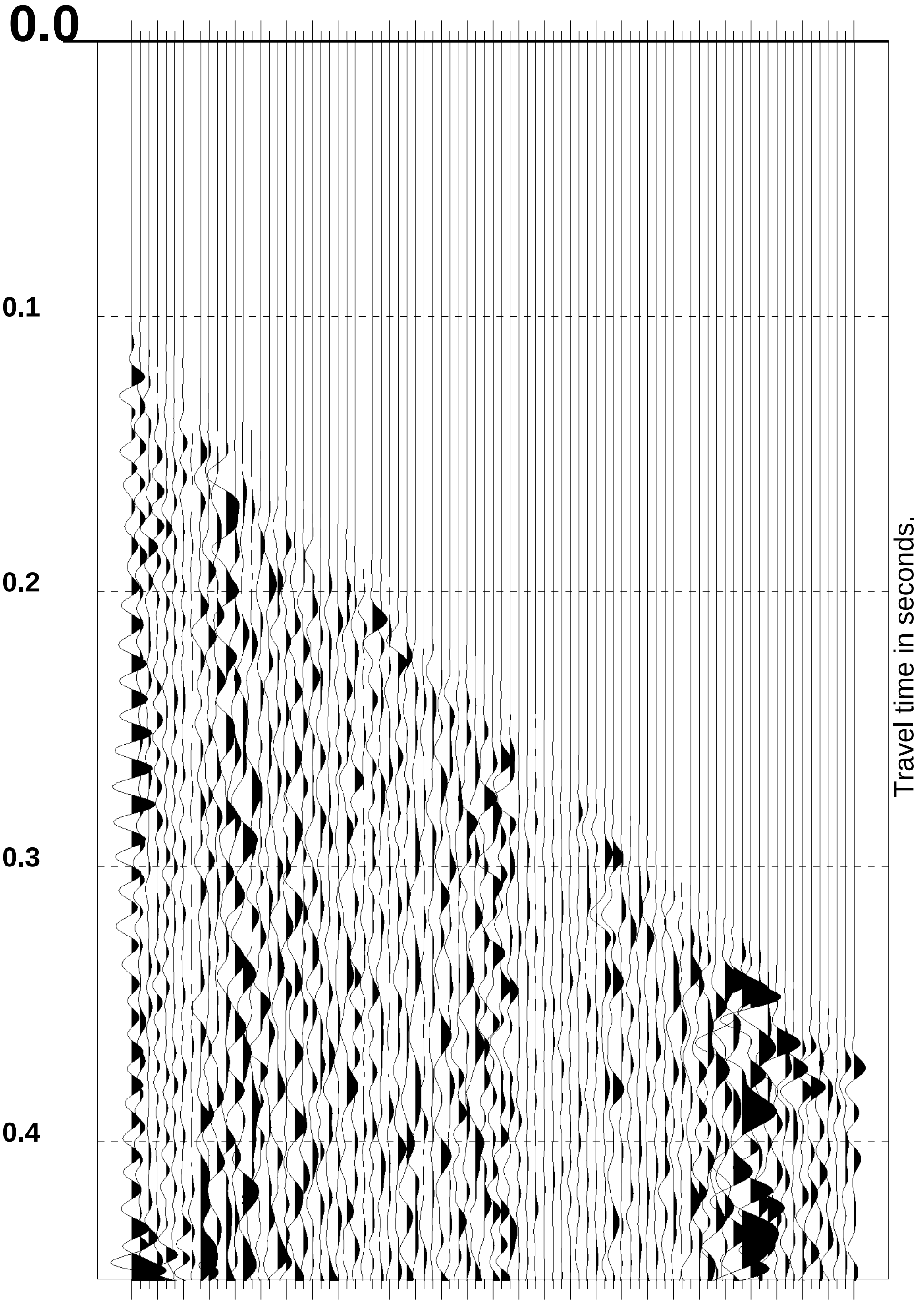
Residual Residual Wavefield 7 Points Median Filter ZPH

Normal polarity.
RMS global scaling.
Swing 8.0

Horizontal scale 1: 4000 Measured Depth

Vertical scale 40 cm/s

LEVEL NO.	FIRST TIME BREAK (MS)	MEASURED DEPTH (M) BELOW KB	TVD (M) BELOW KB
1	80.440	180.00	180.00
4	84.620	195.00	195.00
7	86.695	210.00	210.00
10	89.500	225.00	225.00
13	93.070	240.00	240.00
16	96.810	255.00	255.00
19	100.52	270.00	270.00
22	104.28	285.00	285.00
25	109.15	300.00	300.00
28	112.59	315.00	315.00
31	116.27	330.00	330.00
34	120.55	345.00	345.00
37	124.76	360.00	360.00
40	128.66	375.00	375.00
43	133.37	390.00	390.00
46	137.01	405.00	405.00
49	140.30	420.00	420.00
52	145.15	435.00	435.00
55	150.07	450.00	450.00
58	155.50	465.00	465.00
61	160.15	480.00	480.00
64	165.58	495.00	495.00
67	170.51	510.00	510.00
70	174.76	525.00	525.00
73	178.62	540.00	540.00
76	182.30	555.00	555.00
79	186.99	570.00	570.00
82	189.90	585.00	585.00
85	193.24	600.00	600.00



CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard

WELL : DH4

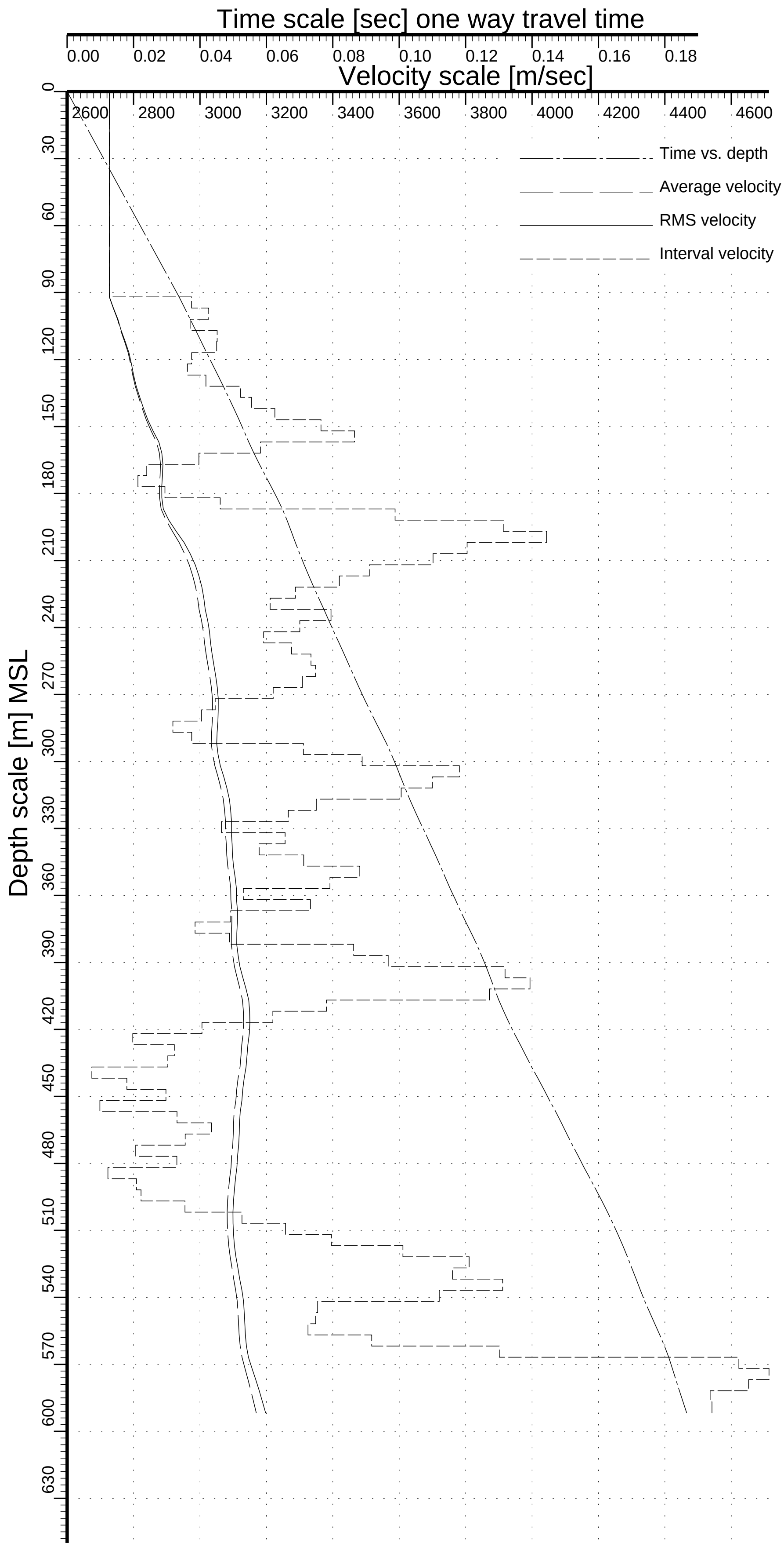
DATE : Mon May 24 15:12:57 2010

ELEVATION OF KELLY BUSHING (MSL) .... =		8.1	METRES
ELEVATION OF SEISMIC REFERENCE DATUM (GL) =		0.0	METRES
DEPTH OF SOURCE BELOW SURFACE .... =		0.0	METRES
SOURCE TO MONITOR OFFSET .... =		81.0	METRES
ELEVATION OF SURFACE AT SOURCE (MSL)..... =		-4.9	METRES
REPLACEMENT VELOCITY .... =		2000.	METRES/S
VELOCITY AT SURFACE .... =		2000.	METRES/S
SOURCE OFFSET FROM WELLHEAD............ =	143.5	59.0	METRES

DEFINITIONS OF VARIABLES AND TERMS USED IN COMPUTATION

RKB	=	Rotary Kelly Bushing
MSL	=	Mean Sea Level
D	=	Measured depth below RKB
TVD	=	True vertical depth below RKB
Z	=	True vertical depth of geophone below MSL
X	=	Horiz. distance between source and geophone
SH	=	Distance from source to nearfield hydroph.
T	=	Measured time from source to geophone
TV	=	Vertical travel time from source to receiver
TE	=	Travel time correction from source to datum
TC	=	Corrected vertical time from datum to geophone
AV.VEL.	=	Average velocity from datum to geophone
RMS VEL.	=	RMS velocity from datum to geophone
INT.Z	=	Interval depth between geophone levels
INT.TC	=	Interval time between geophone levels
INT.VEL.	=	Interval velocity between geophone levels

READ WELL SERVICES	University of Svalbard	WELL : DH4
Display no : **V1**	Velocity plot	Scale : Depth 1: 3000. Time 50.0 cm./sec. Velocity 1: 20000.



CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											91.9	0.0337	2727
	100.0	100.0	91.9					0.0337	2727	2727			
											5.0	0.0017	2975
2	105.0	105.0	96.9	155.2	0.0241	0.0329	0.0025	0.0354	2739	2739			
											5.0	0.0017	3026
3	110.0	110.0	101.9	155.2	0.0247	0.0346	0.0025	0.0370	2752	2753			
											5.0	0.0017	2970
4	115.0	115.0	106.9	155.2	0.0255	0.0363	0.0025	0.0387	2761	2763			
											5.0	0.0016	3052
5	120.0	120.0	111.9	155.2	0.0263	0.0379	0.0025	0.0404	2773	2775			
											5.0	0.0016	3050
6	125.0	125.0	116.9	155.2	0.0271	0.0396	0.0025	0.0420	2784	2786			
											5.0	0.0017	2975
7	130.0	130.0	121.9	155.2	0.0280	0.0412	0.0025	0.0437	2791	2794			
											5.0	0.0017	2962
8	135.0	135.0	126.9	155.2	0.0289	0.0429	0.0025	0.0454	2798	2800			
											5.0	0.0017	3018
9	140.0	140.0	131.9	155.2	0.0299	0.0446	0.0025	0.0470	2805	2808			
											5.0	0.0016	3122
10	145.0	145.0	136.9	155.2	0.0308	0.0462	0.0025	0.0486	2816	2819			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0016	3155
11	150.0	150.0	141.9	155.2	0.0317	0.0478	0.0025	0.0502	2826	2830			
											5.0	0.0016	3226
12	155.0	155.0	146.9	155.2	0.0325	0.0493	0.0025	0.0518	2838	2843			
											5.0	0.0015	3364
13	160.0	160.0	151.9	155.2	0.0334	0.0508	0.0025	0.0533	2853	2859			
											5.0	0.0014	3465
14	165.0	165.0	156.9	155.2	0.0342	0.0523	0.0025	0.0547	2869	2876			
											5.0	0.0016	3182
15	170.0	170.0	161.9	155.2	0.0352	0.0538	0.0025	0.0563	2878	2885			
											5.0	0.0017	2997
16	175.0	175.0	166.9	155.2	0.0363	0.0555	0.0025	0.0579	2881	2889			
											5.0	0.0018	2840
17	180.0	180.0	171.9	155.2	0.0376	0.0573	0.0025	0.0597	2880	2887			
											5.0	0.0018	2813
18	185.0	185.0	176.9	155.2	0.0390	0.0590	0.0025	0.0615	2878	2885			
											5.0	0.0017	2895
19	190.0	190.0	181.9	155.2	0.0403	0.0608	0.0025	0.0632	2879	2885			
											5.0	0.0016	3061
20	195.0	195.0	186.9	155.2	0.0415	0.0624	0.0025	0.0648	2883	2890			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0014	3588
21	200.0	200.0	191.9	155.2	0.0424	0.0638	0.0024	0.0662	2898	2906			
											5.0	0.0013	3913
22	205.0	205.0	196.9	155.2	0.0431	0.0651	0.0024	0.0675	2917	2929			
											5.0	0.0012	4044
23	210.0	210.0	201.9	155.2	0.0439	0.0663	0.0024	0.0687	2938	2952			
											5.0	0.0013	3805
24	215.0	215.0	206.9	155.2	0.0447	0.0676	0.0024	0.0701	2954	2971			
											5.0	0.0014	3702
25	220.0	220.0	211.9	155.2	0.0457	0.0690	0.0024	0.0714	2968	2986			
											5.0	0.0014	3510
26	225.0	225.0	216.9	155.2	0.0467	0.0704	0.0024	0.0728	2979	2997			
											5.0	0.0015	3420
27	230.0	230.0	221.9	155.2	0.0478	0.0718	0.0024	0.0743	2987	3006			
											5.0	0.0015	3287
28	235.0	235.0	226.9	155.2	0.0490	0.0734	0.0024	0.0758	2993	3012			
											5.0	0.0016	3211
29	240.0	240.0	231.9	155.2	0.0502	0.0749	0.0024	0.0774	2998	3016			
											5.0	0.0015	3395
30	245.0	245.0	236.9	155.2	0.0514	0.0764	0.0024	0.0788	3005	3024			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0015	3301
31	250.0	250.0	241.9	155.2	0.0526	0.0779	0.0024	0.0804	3011	3029			
											5.0	0.0016	3192
32	255.0	255.0	246.9	155.2	0.0539	0.0795	0.0024	0.0819	3014	3032			
											5.0	0.0015	3276
33	260.0	260.0	251.9	155.2	0.0552	0.0810	0.0024	0.0835	3019	3037			
											5.0	0.0015	3334
34	265.0	265.0	257.0	155.2	0.0564	0.0825	0.0024	0.0850	3024	3042			
											5.0	0.0015	3348
35	270.0	270.0	262.0	155.2	0.0576	0.0840	0.0024	0.0865	3030	3048			
											5.0	0.0015	3308
36	275.0	275.0	267.0	155.2	0.0589	0.0855	0.0024	0.0880	3035	3053			
											5.0	0.0016	3220
37	280.0	280.0	272.0	155.2	0.0602	0.0871	0.0024	0.0895	3038	3056			
											5.0	0.0016	3046
38	285.0	285.0	277.0	155.2	0.0616	0.0887	0.0024	0.0912	3038	3055			
											5.0	0.0017	3005
39	290.0	290.0	282.0	155.2	0.0631	0.0904	0.0024	0.0928	3038	3055			
											5.0	0.0017	2918
40	295.0	295.0	287.0	155.2	0.0646	0.0921	0.0024	0.0945	3035	3052			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0017	2975
41	300.0	300.0	292.0	155.2	0.0661	0.0938	0.0024	0.0962	3034	3051			
											5.0	0.0015	3311
42	305.0	305.0	297.0	155.2	0.0674	0.0953	0.0024	0.0977	3039	3055			
											5.0	0.0014	3488
43	310.0	310.0	302.0	155.2	0.0686	0.0967	0.0024	0.0992	3045	3062			
											5.0	0.0013	3781
44	315.0	315.0	307.0	155.2	0.0697	0.0980	0.0024	0.1005	3055	3072			
											5.0	0.0014	3700
45	320.0	320.0	312.0	155.2	0.0708	0.0994	0.0024	0.1018	3063	3081			
											5.0	0.0014	3606
46	325.0	325.0	317.0	155.2	0.0720	0.1008	0.0024	0.1032	3071	3089			
											5.0	0.0015	3350
47	330.0	330.0	322.0	155.2	0.0733	0.1023	0.0024	0.1047	3075	3093			
											5.0	0.0015	3266
48	335.0	335.0	327.0	155.2	0.0747	0.1038	0.0024	0.1062	3077	3095			
											5.0	0.0016	3065
49	340.0	340.0	332.0	155.2	0.0762	0.1054	0.0024	0.1079	3077	3095			
											5.0	0.0015	3256
50	345.0	345.0	337.0	155.2	0.0776	0.1070	0.0024	0.1094	3080	3097			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0016	3178
51	350.0	350.0	342.0	155.2	0.0790	0.1085	0.0024	0.1110	3081	3099			
											5.0	0.0015	3312
52	355.0	355.0	347.0	155.2	0.0803	0.1100	0.0024	0.1125	3084	3101			
											5.0	0.0014	3481
53	360.0	360.0	352.0	155.2	0.0816	0.1115	0.0024	0.1139	3089	3107			
											5.0	0.0015	3391
54	365.0	365.0	357.0	155.2	0.0829	0.1130	0.0024	0.1154	3093	3110			
											5.0	0.0016	3130
55	370.0	370.0	362.0	155.2	0.0844	0.1145	0.0024	0.1170	3094	3111			
											5.0	0.0015	3332
56	375.0	375.0	367.0	155.2	0.0858	0.1160	0.0024	0.1185	3097	3114			
											5.0	0.0016	3093
57	380.0	380.0	372.0	155.2	0.0872	0.1177	0.0024	0.1201	3097	3113			
											5.0	0.0017	2985
58	385.0	385.0	377.0	155.2	0.0888	0.1193	0.0024	0.1218	3095	3112			
											5.0	0.0016	3089
59	390.0	390.0	382.0	155.2	0.0903	0.1210	0.0024	0.1234	3095	3111			
											5.0	0.0014	3463
60	395.0	395.0	387.0	155.2	0.0916	0.1224	0.0024	0.1249	3099	3116			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0014	3567
61	400.0	400.0	392.0	155.2	0.0929	0.1238	0.0024	0.1263	3104	3121			
											5.0	0.0013	3919
62	405.0	405.0	397.0	155.2	0.0940	0.1251	0.0025	0.1275	3113	3130			
											5.0	0.0013	3994
63	410.0	410.0	402.0	155.2	0.0951	0.1263	0.0025	0.1288	3121	3139			
											5.0	0.0013	3872
64	415.0	415.0	407.0	155.2	0.0963	0.1276	0.0025	0.1301	3129	3148			
											5.0	0.0015	3381
65	420.0	420.0	412.0	155.2	0.0977	0.1291	0.0025	0.1316	3131	3150			
											5.0	0.0016	3219
66	425.0	425.0	417.0	155.2	0.0991	0.1307	0.0025	0.1331	3132	3151			
											5.0	0.0017	3006
67	430.0	430.0	422.0	155.2	0.1007	0.1323	0.0025	0.1348	3131	3149			
											5.0	0.0018	2797
68	435.0	435.0	427.0	155.2	0.1024	0.1341	0.0025	0.1366	3127	3145			
											5.0	0.0017	2923
69	440.0	440.0	432.0	155.2	0.1040	0.1358	0.0025	0.1383	3124	3142			
											5.0	0.0017	2903
70	445.0	445.0	437.0	155.2	0.1056	0.1375	0.0025	0.1400	3121	3139			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0019	2674
71	450.0	450.0	442.0	155.2	0.1074	0.1394	0.0025	0.1419	3115	3134			
											5.0	0.0018	2780
72	455.0	455.0	447.0	155.2	0.1092	0.1412	0.0025	0.1437	3111	3130			
											5.0	0.0017	2897
73	460.0	460.0	452.0	155.2	0.1108	0.1429	0.0025	0.1454	3109	3127			
											5.0	0.0019	2698
74	465.0	465.0	457.0	155.2	0.1126	0.1448	0.0025	0.1472	3103	3122			
											5.0	0.0017	2931
75	470.0	470.0	462.0	155.2	0.1142	0.1465	0.0025	0.1489	3102	3120			
											5.0	0.0016	3034
76	475.0	475.0	467.0	155.2	0.1158	0.1481	0.0025	0.1506	3101	3119			
											5.0	0.0017	2955
77	480.0	480.0	472.0	155.2	0.1174	0.1498	0.0025	0.1523	3099	3117			
											5.0	0.0018	2806
78	485.0	485.0	477.0	155.2	0.1191	0.1516	0.0025	0.1541	3096	3114			
											5.0	0.0017	2930
79	490.0	490.0	482.0	155.2	0.1207	0.1533	0.0025	0.1558	3094	3112			
											5.0	0.0018	2723
80	495.0	495.0	487.0	155.2	0.1225	0.1552	0.0025	0.1576	3090	3108			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0018	2809
81	500.0	500.0	492.0	155.2	0.1242	0.1569	0.0025	0.1594	3087	3104			
											5.0	0.0018	2822
82	505.0	505.0	497.0	155.2	0.1259	0.1587	0.0025	0.1612	3084	3101			
											5.0	0.0017	2955
83	510.0	510.0	502.0	155.2	0.1275	0.1604	0.0025	0.1629	3082	3100			
											5.0	0.0016	3126
84	515.0	515.0	507.0	155.2	0.1291	0.1620	0.0025	0.1645	3083	3100			
											5.0	0.0015	3258
85	520.0	520.0	512.0	155.2	0.1305	0.1635	0.0025	0.1660	3084	3102			
											5.0	0.0015	3396
86	525.0	525.0	517.0	155.2	0.1319	0.1650	0.0025	0.1675	3087	3104			
											5.0	0.0014	3611
87	530.0	530.0	522.0	155.2	0.1332	0.1664	0.0025	0.1688	3091	3109			
											5.0	0.0013	3811
88	535.0	535.0	527.0	155.2	0.1345	0.1677	0.0025	0.1702	3097	3115			
											5.0	0.0013	3760
89	540.0	540.0	532.0	155.2	0.1357	0.1690	0.0025	0.1715	3102	3120			
											5.0	0.0013	3912
90	545.0	545.0	537.0	155.2	0.1369	0.1703	0.0025	0.1728	3108	3127			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0013	3720
91	550.0	550.0	542.0	155.2	0.1382	0.1717	0.0025	0.1741	3113	3132			
											5.0	0.0015	3354
92	555.0	555.0	547.0	155.2	0.1396	0.1731	0.0025	0.1756	3115	3134			
											5.0	0.0015	3348
93	560.0	560.0	552.0	155.2	0.1410	0.1746	0.0025	0.1771	3117	3136			
											5.0	0.0015	3325
94	565.0	565.0	557.0	155.2	0.1425	0.1761	0.0025	0.1786	3119	3137			
											5.0	0.0014	3517
95	570.0	570.0	562.0	155.2	0.1438	0.1776	0.0025	0.1800	3122	3141			
											5.0	0.0013	3901
96	575.0	575.0	567.0	155.2	0.1450	0.1788	0.0025	0.1813	3127	3147			
											5.0	0.0011	4623
97	580.0	580.0	572.0	155.2	0.1460	0.1799	0.0025	0.1824	3136	3157			
											5.0	0.0011	4714
98	585.0	585.0	577.0	155.2	0.1470	0.1810	0.0025	0.1834	3145	3169			
											5.0	0.0011	4652
99	590.0	590.0	582.0	155.2	0.1480	0.1821	0.0025	0.1845	3154	3179			
											5.0	0.0011	4536
100	595.0	595.0	587.0	155.2	0.1491	0.1832	0.0025	0.1856	3162	3189			

CHECK SHOT COMPUTATIONS

COMPANY : University of Svalbard
WELL : DH4

REC. NO .	D	TVD	Z	X	T	TV	TE	TC	AV.VEL.	RMS.VEL.	INT. Z	INT. TC	INT. VEL
	M	M	M	M	S	S	S	S	M/S	M/S	M	S	M /S
											5.0	0.0011	4542
101	600.0	600.0	592.0	155.2	0.1501	0.1843	0.0025	0.1867	3170	3199			

GEOMETRY TABLE

COMPANY : University of Svalbard

WELL : DH4

DATE : Mon May 24 16:05:25 2010

ELEVATION OF KELLY BUSHING (MSL) .... =		8.1	METRES
ELEVATION OF SEISMIC REFERENCE DATUM (GL) =		0.0	METRES
DEPTH OF SOURCE BELOW SURFACE .... =		0.0	METRES
SOURCE TO MONITOR OFFSET .... =		81.0	METRES
ELEVATION OF SURFACE AT SOURCE (MSL)..... =		-4.9	METRES
REPLACEMENT VELOCITY .... =		2000.	METRES/S
VELOCITY AT SURFACE .... =		2000.	METRES/S
SOURCE OFFSET FROM WELLHEAD............ =	143.5	59.0	METRES

GEOMETRY TABLE

COMPANY University of Svalbard
WELL DH4

Level number	Measured depth from KB (m)	True vert. depth from MSL (m)	Two-way Travel time corrected to MSL (sec)	UtmX Shot [m]	UtmY Shot [m]	UtmX Rcv [m]	UtmY Rcv [m]
2	105.0	96.9	0.0708	519024	8681161	518881	8681102
3	110.0	101.9	0.0741	519024	8681161	518881	8681102
4	115.0	106.9	0.0775	519024	8681161	518881	8681102
5	120.0	111.9	0.0807	519024	8681161	518881	8681102
6	125.0	116.9	0.0840	519024	8681161	518881	8681102
7	130.0	121.9	0.0874	519024	8681161	518881	8681102
8	135.0	126.9	0.0908	519024	8681161	518881	8681102
9	140.0	131.9	0.0941	519024	8681161	518881	8681102
10	145.0	136.9	0.0973	519024	8681161	518881	8681102
11	150.0	141.9	0.1004	519024	8681161	518881	8681102
12	155.0	146.9	0.1035	519024	8681161	518881	8681102
13	160.0	151.9	0.1065	519024	8681161	518881	8681102
14	165.0	156.9	0.1094	519024	8681161	518881	8681102
15	170.0	161.9	0.1125	519024	8681161	518881	8681102
16	175.0	166.9	0.1159	519024	8681161	518881	8681102
17	180.0	171.9	0.1194	519024	8681161	518881	8681102
18	185.0	176.9	0.1230	519024	8681161	518881	8681102
19	190.0	181.9	0.1264	519024	8681161	518881	8681102
20	195.0	186.9	0.1297	519024	8681161	518881	8681102
21	200.0	191.9	0.1325	519024	8681161	518881	8681102
22	205.0	196.9	0.1350	519024	8681161	518881	8681102
23	210.0	201.9	0.1375	519024	8681161	518881	8681102
24	215.0	206.9	0.1401	519024	8681161	518881	8681102
25	220.0	211.9	0.1428	519024	8681161	518881	8681102
26	225.0	216.9	0.1457	519024	8681161	518881	8681102
27	230.0	221.9	0.1486	519024	8681161	518881	8681102
28	235.0	226.9	0.1516	519024	8681161	518881	8681102
29	240.0	231.9	0.1548	519024	8681161	518881	8681102
30	245.0	236.9	0.1577	519024	8681161	518881	8681102
31	250.0	241.9	0.1607	519024	8681161	518881	8681102
32	255.0	246.9	0.1639	519024	8681161	518881	8681102
33	260.0	251.9	0.1669	519024	8681161	518881	8681102
34	265.0	257.0	0.1699	519024	8681161	518881	8681102
35	270.0	262.0	0.1729	519024	8681161	518881	8681102
36	275.0	267.0	0.1759	519024	8681161	518881	8681102
37	280.0	272.0	0.1790	519024	8681161	518881	8681102
38	285.0	277.0	0.1823	519024	8681161	518881	8681102
39	290.0	282.0	0.1856	519024	8681161	518881	8681102
40	295.0	287.0	0.1891	519024	8681161	518881	8681102
41	300.0	292.0	0.1924	519024	8681161	518881	8681102

GEOMETRY TABLE

COMPANY University of Svalbard
WELL DH4

Level number	Measured depth from KB (m)	True vert. depth from MSL (m)	Two-way Travel time corrected to MSL (sec)	UtmX Shot [m]	UtmY Shot [m]	UtmX Rcv [m]	UtmY Rcv [m]
42	305.0	297.0	0.1954	519024	8681161	518881	8681102
43	310.0	302.0	0.1983	519024	8681161	518881	8681102
44	315.0	307.0	0.2010	519024	8681161	518881	8681102
45	320.0	312.0	0.2037	519024	8681161	518881	8681102
46	325.0	317.0	0.2064	519024	8681161	518881	8681102
47	330.0	322.0	0.2094	519024	8681161	518881	8681102
48	335.0	327.0	0.2125	519024	8681161	518881	8681102
49	340.0	332.0	0.2157	519024	8681161	518881	8681102
50	345.0	337.0	0.2188	519024	8681161	518881	8681102
51	350.0	342.0	0.2220	519024	8681161	518881	8681102
52	355.0	347.0	0.2250	519024	8681161	518881	8681102
53	360.0	352.0	0.2279	519024	8681161	518881	8681102
54	365.0	357.0	0.2308	519024	8681161	518881	8681102
55	370.0	362.0	0.2340	519024	8681161	518881	8681102
56	375.0	367.0	0.2370	519024	8681161	518881	8681102
57	380.0	372.0	0.2402	519024	8681161	518881	8681102
58	385.0	377.0	0.2436	519024	8681161	518881	8681102
59	390.0	382.0	0.2468	519024	8681161	518881	8681102
60	395.0	387.0	0.2497	519024	8681161	518881	8681102
61	400.0	392.0	0.2525	519024	8681161	518881	8681102
62	405.0	397.0	0.2551	519024	8681161	518881	8681102
63	410.0	402.0	0.2576	519024	8681161	518881	8681102
64	415.0	407.0	0.2601	519024	8681161	518881	8681102
65	420.0	412.0	0.2631	519024	8681161	518881	8681102
66	425.0	417.0	0.2662	519024	8681161	518881	8681102
67	430.0	422.0	0.2695	519024	8681161	518881	8681102
68	435.0	427.0	0.2731	519024	8681161	518881	8681102
69	440.0	432.0	0.2765	519024	8681161	518881	8681102
70	445.0	437.0	0.2800	519024	8681161	518881	8681102
71	450.0	442.0	0.2837	519024	8681161	518881	8681102
72	455.0	447.0	0.2873	519024	8681161	518881	8681102
73	460.0	452.0	0.2908	519024	8681161	518881	8681102
74	465.0	457.0	0.2945	519024	8681161	518881	8681102
75	470.0	462.0	0.2979	519024	8681161	518881	8681102
76	475.0	467.0	0.3012	519024	8681161	518881	8681102
77	480.0	472.0	0.3046	519024	8681161	518881	8681102
78	485.0	477.0	0.3081	519024	8681161	518881	8681102
79	490.0	482.0	0.3115	519024	8681161	518881	8681102
80	495.0	487.0	0.3152	519024	8681161	518881	8681102
81	500.0	492.0	0.3188	519024	8681161	518881	8681102

GEOMETRY TABLE

COMPANY University of Svalbard
WELL DH4

Level number	Measured depth from KB (m)	True vert. depth from MSL (m)	Two-way Travel time corrected to MSL (sec)	UtmX Shot [m]	UtmY Shot [m]	UtmX Rcv [m]	UtmY Rcv [m]
82	505.0	497.0	0.3223	519024	8681161	518881	8681102
83	510.0	502.0	0.3257	519024	8681161	518881	8681102
84	515.0	507.0	0.3289	519024	8681161	518881	8681102
85	520.0	512.0	0.3320	519024	8681161	518881	8681102
86	525.0	517.0	0.3349	519024	8681161	518881	8681102
87	530.0	522.0	0.3377	519024	8681161	518881	8681102
88	535.0	527.0	0.3403	519024	8681161	518881	8681102
89	540.0	532.0	0.3430	519024	8681161	518881	8681102
90	545.0	537.0	0.3455	519024	8681161	518881	8681102
91	550.0	542.0	0.3482	519024	8681161	518881	8681102
92	555.0	547.0	0.3512	519024	8681161	518881	8681102
93	560.0	552.0	0.3542	519024	8681161	518881	8681102
94	565.0	557.0	0.3572	519024	8681161	518881	8681102
95	570.0	562.0	0.3600	519024	8681161	518881	8681102
96	575.0	567.0	0.3626	519024	8681161	518881	8681102
97	580.0	572.0	0.3648	519024	8681161	518881	8681102
98	585.0	577.0	0.3669	519024	8681161	518881	8681102
99	590.0	582.0	0.3690	519024	8681161	518881	8681102
100	595.0	587.0	0.3712	519024	8681161	518881	8681102
101	600.0	592.0	0.3734	519024	8681161	518881	8681102

KEY TO STACK INCLUDE FILE

Heading

```
Client:                                   Well:
DTU type:                                 Inst.delay:
Reference UTM X:                          UTM Y:
Model Reference X:                        Y:
Survey geometry:                          CM:
Survey units:                             Source no.:
Gun depth:                                NFH offset:
Elevation KB:                             Sea depth/Elevation GL:
```

Station Format

```
Station no.
|  Number of traces
|  |     Approximate first break in microseconds
|  |     |       Measured depth of geophone in meter below RKB
|  |     |       |       True Vertical Depth RKB of geophone in meter
|  |     |       |       |        Local X coordinate of planned shot point
|  |     |       |       |        |      Local Y coordinate of planned shot point
|  |     |       |       |        |      |      Local receiver X-coordinate
|  |     |       |       |        |      |      |    Local receiver Y-coordinate
|  |     |       |       |        |      |      |    |
1 11  1246099  4050.0  2756.0    35     43    -7.0 10.0
```

Trace Format

```
        3   3  36.4  -19750  2827       -500    -17423
X       6   3  15.5  -20500  3004         10    -17506
        9   3  38.1  -20670  2805       2805    -16865
|       |   |    |      |      |          |        |
|       |   |    |      |      |          |        Total delay (microseconds)
|       |   |    |      |      |          Residual delay (microseconds)
|       |   |    |      |      Field geometry statics in microseconds
|       |   |    |      System delay in microseconds
|       |   |    Horizontal distance actual / planned shot position in meter
|       |   Instrument number (1 = main tool)
|       Field trace number
Edit flag
```

STACK INCLUDE FILE

```
 -----------------
Client:  University of Svalbard          Well:       DH4
DTU type:            -                   Inst.delay:           0 microsec.
Reference UTM X:     518881.0            UTM Y:       8681102.0
Model Reference X:        0.0            Y:                 0.0
Survey geometry:   Zero Offset VSP       CM:            15.0000
Survey units:      Meters                Source no.:          *
Gun depth:                0.00           NFH offset:      80.71
Elevation KB:             8.05           Sea depth:        0.00

 1     1   66120   100.0   100.0          0         0         0          0
              143     1   155.2 -554410   40355       0 -514055
 2     1   67230   105.0   105.0          0         0         0          0
              142     1   155.2 -705570   40355       0 -665215
 3     1   67920   110.0   110.0          0         0         0          0
              141     1   155.2 -673180   40355       0 -632825
 4     1   68210   115.0   115.0          0         0         0          0
              140     1   155.2 -641400   40355       0 -601045
 5     1   68990   120.0   120.0          0         0         0          0
              139     1   155.2 -667000   40355       0 -626645
 6     1   70030   125.0   125.0          0         0         0          0
              138     1   155.2 -617710   40355       0 -577355
 7     1   70970   130.0   130.0          0         0         0          0
              137     1   155.2-2843850   40355       0-2803495
 8     1   71900   135.0   135.0          0         0         0          0
              136     1   155.2 -617720   40355       0 -577365
 9     1   72750   140.0   140.0          0         0         0          0
              135     1   155.2 -576360   40355       0 -536005
10     1   73770   145.0   145.0          0         0         0          0
              134     1   155.2 -578950   40355       0 -538595
11     1   74730   150.0   150.0          0         0         0          0
              133     1   155.2 -546820   40355       0 -506465
12     1   75210   155.0   155.0          0         0         0          0
              132     1   155.2 -528600   40355       0 -488245
13     1   76390   160.0   160.0          0         0         0          0
              131     1   155.2 -608660   40355       0 -568305
14     1   76840   165.0   165.0          0         0         0          0
              130     1   155.2 -394890   40355       0 -354535
15     1   77870   170.0   170.0          0         0         0          0
              129     1   155.2 -486820   40355       0 -446465
16     1   78690   175.0   175.0          0         0         0          0
              128     1   155.2 -372890   40355       0 -332535
17     1   80440   180.0   180.0          0         0         0          0
              127     1   155.2 -393000   40355       0 -352645
18     1   81790   185.0   185.0          0         0         0          0
              126     1   155.2 -191000   40355       0 -150645
19     1   83710   190.0   190.0          0         0         0          0
              125     1   155.2 -488860   40355       0 -448505
20     1   84620   195.0   195.0          0         0         0          0
              124     1   155.2 -533730   40355       0 -493375
21     1   85180   200.0   200.0          0         0         0          0
              123     1   155.2 -543980   40355       0 -503625
22     1   86630   205.0   205.0          0         0         0          0
              122     1   155.2 -564610   40355       0 -524255
23     1   86640   210.0   210.0          0         0         0          0
              121     1   155.2 -474020   40355       0 -433665
24     1   87560   215.0   215.0          0         0         0          0
              120     1   155.2 -384100   40355       0 -343745
25     1   88330   220.0   220.0          0         0         0          0
              119     1   155.2 -486500   40355       0 -446145
26     1   88920   220.0   220.0          0         0         0          0
       x      118     1   155.2  -78580   40355       0  -38225
27     1   89500   225.0   225.0          0         0         0          0
              117     1   155.2 -488470   40355       0 -448115
28     1   91040   230.0   230.0          0         0         0          0
              116     1   155.2 -428940   40355       0 -388585
29     1   91900   235.0   235.0          0         0         0          0
              115     1   155.2 -360430   40355       0 -320075
30     1   93070   240.0   240.0          0         0         0          0
```

		114	1	155.2	-379270	40355	0	-338915	
31	1	94270	245.0	245.0		0	0	0	0
		113	1	155.2	-462480	40355	0	-422125	
32	1	94980	250.0	250.0		0	0	0	0
		112	1	155.2	-289030	40355	0	-248675	
33	1	95890	250.0	250.0		0	0	0	0
	x	111	1	155.2	-408970	40355	0	-368615	
34	1	96810	255.0	255.0		0	0	0	0
		110	1	155.2	-441080	40355	0	-400725	
35	1	97980	260.0	260.0		0	0	0	0
		109	1	155.2	-760530	40355	0	-720175	
36	1	99510	265.0	265.0		0	0	0	0
		108	1	155.2	-423310	40355	0	-382955	
37	1	100520	270.0	270.0		0	0	0	0
		107	1	155.2	-406280	40355	0	-365925	
38	1	101860	275.0	275.0		0	0	0	0
		106	1	155.2	-335760	40355	0	-295405	
39	1	102960	280.0	280.0		0	0	0	0
		105	1	155.2	-610090	40355	0	-569735	
40	1	104280	285.0	285.0		0	0	0	0
		104	1	155.2	-444110	40355	0	-403755	
41	1	106090	290.0	290.0		0	0	0	0
		103	1	155.2	-486240	40355	0	-445885	
42	1	107650	295.0	295.0		0	0	0	0
		102	1	155.2	-587350	40355	0	-546995	
43	1	109150	300.0	300.0		0	0	0	0
		101	1	155.2	-369110	40355	0	-328755	
44	1	110560	305.0	305.0		0	0	0	0
		100	1	155.2	-365650	40355	0	-325295	
45	1	111720	310.0	310.0		0	0	0	0
		99	1	155.2	-882950	40355	0	-842595	
46	1	111900	310.0	310.0		0	0	0	0
	x	98	1	155.2	-859900	40355	0	-819545	
47	1	112070	310.0	310.0		0	0	0	0
	x	97	1	155.2	-801610	40355	0	-761255	
48	1	112240	310.0	310.0		0	0	0	0
	x	96	1	155.2	-743310	40355	0	-702955	
49	1	112420	310.0	310.0		0	0	0	0
	x	95	1	155.2	-685020	40355	0	-644665	
50	1	112590	315.0	315.0		0	0	0	0
		94	1	155.2	-589090	40355	0	-548735	
51	1	113750	320.0	320.0		0	0	0	0
		93	1	155.2	-558970	40355	0	-518615	
52	1	114660	325.0	325.0		0	0	0	0
		92	1	155.2	-930070	40355	0	-889715	
53	1	116270	330.0	330.0		0	0	0	0
		91	1	155.2	-495270	40355	0	-454915	
54	1	117660	335.0	335.0		0	0	0	0
		90	1	155.2	-694300	40355	0	-653945	
55	1	119150	340.0	340.0		0	0	0	0
		89	1	155.2	-701230	40355	0	-660875	
56	1	120550	345.0	345.0		0	0	0	0
		88	1	155.2	-802460	40355	0	-762105	
57	1	122040	350.0	350.0		0	0	0	0
		87	1	155.2	-631930	40355	0	-591575	
58	1	123140	355.0	355.0		0	0	0	0
		86	1	155.2	-615220	40355	0	-574865	
59	1	125000	360.0	360.0		0	0	0	0
		85	1	155.2	-673620	40355	0	-633265	
60	1	125920	365.0	365.0		0	0	0	0
		84	1	155.2	-454310	40355	0	-413955	
61	1	126940	370.0	370.0		0	0	0	0
		83	1	155.2	-431960	40355	0	-391605	
62	1	128660	375.0	375.0		0	0	0	0
		82	1	155.2	-215090	40355	0	-174735	
63	1	130640	380.0	380.0		0	0	0	0
		81	1	155.2	-237950	40355	0	-197595	
64	1	131560	385.0	385.0		0	0	0	0
		80	1	155.2	-363890	40355	0	-323535	
65	1	133370	390.0	390.0		0	0	0	0

```
                79     1    155.2 -246080   40355        0 -205725
  66     1  134540   395.0   395.0         0          0        0          0
                78     1    155.2 -145880   40355        0 -105525
  67     1  136370   400.0   400.0         0          0        0          0
                77     1    155.2 -701710   40355        0 -661355
  68     1  136690   400.0   400.0         0          0        0          0
         x      76     1    155.2 -693170   40355        0 -652815
  69     1  137010   405.0   405.0         0          0        0          0
                75     1    155.2 -615480   40355        0 -575125
  70     1  137910   410.0   410.0         0          0        0          0
                74     1    155.2 -587430   40355        0 -547075
  71     1  139060   415.0   415.0         0          0        0          0
                73     1    155.2 -373890   40355        0 -333535
  72     1  140300   420.0   420.0         0          0        0          0
                72     1    155.2 -356450   40355        0 -316095
  73     1  141960   425.0   425.0         0          0        0          0
                71     1    155.2 -427610   40355        0 -387255
  74     1  143840   430.0   430.0         0          0        0          0
                70     1    155.2 -500550   40355        0 -460195
  75     1  145150   435.0   435.0         0          0        0          0
                69     1    155.2 -802300   40355        0 -761945
  76     1  146900   440.0   440.0         0          0        0          0
                68     1    155.2 -521700   40355        0 -481345
  77     1  148810   445.0   445.0         0          0        0          0
                67     1    155.2 -428940   40355        0 -388585
  78     1  150070   450.0   450.0         0          0        0          0
                66     1    155.2 -430290   40355        0 -389935
  79     1  152020   455.0   455.0         0          0        0          0
                65     1    155.2 -449000   40355        0 -408645
  80     1  154380   460.0   460.0         0          0        0          0
                64     1    155.2 -656690   40355        0 -616335
  81     1  155500   465.0   465.0         0          0        0          0
                63     1    155.2 -783370   40355        0 -743015
  82     1  157030   470.0   470.0         0          0        0          0
                62     1    155.2 -462740   40355        0 -422385
  83     1  158970   475.0   475.0         0          0        0          0
                61     1    155.2 -351650   40355        0 -311295
  84     1  160150   480.0   480.0         0          0        0          0
                60     1    155.2 -328450   40355        0 -288095
  85     1  161950   485.0   485.0         0          0        0          0
                59     1    155.2 -321260   40355        0 -280905
  86     1  163570   490.0   490.0         0          0        0          0
                58     1    155.2 -508950   40355        0 -468595
  87     1  165580   495.0   495.0         0          0        0          0
                57     1    155.2 -629490   40355        0 -589135
  88     1  167130   500.0   500.0         0          0        0          0
                56     1    155.2 -440410   40355        0 -400055
  89     1  169000   505.0   505.0         0          0        0          0
                55     1    155.2 -391390   40355        0 -351035
  90     1  170510   510.0   510.0         0          0        0          0
                54     1    155.2 -371050   40355        0 -330695
  91     1  172090   515.0   515.0         0          0        0          0
                53     1    155.2 -375000   40355        0 -334645
  92     1  173690   520.0   520.0         0          0        0          0
                52     1    155.2 -508790   40355        0 -468435
  93     1  174760   525.0   525.0         0          0        0          0
                51     1    155.2 -596520   40355        0 -556165
  94     1  176300   530.0   530.0         0          0        0          0
                50     1    155.2 -294910   40355        0 -254555
  95     1  177490   535.0   535.0         0          0        0          0
                49     1    155.2 -507910   40355        0 -467555
  96     1  178620   540.0   540.0         0          0        0          0
                48     1    155.2 -550070   40355        0 -509715
  97     1  179850   545.0   545.0         0          0        0          0
                47     1    155.2 -485130   40355        0 -444775
  98     1  181020   550.0   550.0         0          0        0          0
                46     1    155.2 -554730   40355        0 -514375
  99     1  182300   555.0   555.0         0          0        0          0
                45     1    155.2 -388130   40355        0 -347775
 100     1  183070   560.0   560.0         0          0        0          0
```

	x	44	1	155.2	-472520	40355		0	-432165	
101	1	183840	560.0	560.0		0	0		0	0
		43	1	155.2	-494290	40355		0	-453935	
102	1	184850	560.0	560.0		0	0		0	0
	x	42	1	155.2	-480560	40355		0	-440205	
103	1	185860	565.0	565.0		0	0		0	0
		41	1	155.2	-407440	40355		0	-367085	
104	1	186990	570.0	570.0		0	0		0	0
		40	1	155.2	-533400	40355		0	-493045	
105	1	188220	575.0	575.0		0	0		0	0
		39	1	155.2	-482260	40355		0	-441905	
106	1	189080	580.0	580.0		0	0		0	0
		38	1	155.2	-480920	40355		0	-440565	
107	1	189440	585.0	585.0		0	0		0	0
		37	1	155.2	-1082890	40355		0	-1042535	
108	1	190640	590.0	590.0		0	0		0	0
		36	1	155.2	-1348860	40355		0	-1308505	
109	1	191920	595.0	595.0		0	0		0	0
		35	1	155.2	-1574540	40355		0	-1534185	
110	1	193360	600.0	600.0		0	0		0	0
		34	1	155.2	-2664890	40355		0	-2624535	
111	1	194800	600.0	600.0		0	0		0	0
	x	33	1	155.2	-2591800	40355		0	-2551445	
112	1	196240	600.0	600.0		0	0		0	0
	x	32	1	155.2	-2492180	40355		0	-2451825	
113	1	197680	600.0	600.0		0	0		0	0
	x	31	1	155.2	-2392570	40355		0	-2352215	
114	1	199120	600.0	600.0		0	0		0	0
	x	30	1	155.2	-2292950	40355		0	-2252595	
115	1	200560	600.0	600.0		0	0		0	0
	x	29	1	155.2	-2193330	40355		0	-2152975	
116	1	202000	600.0	600.0		0	0		0	0
	x	28	1	155.2	-2093710	40355		0	-2053355	
117	1	203440	600.0	600.0		0	0		0	0
	x	27	1	155.2	-1994100	40355		0	-1953745	
118	1	204880	600.0	600.0		0	0		0	0
	x	26	1	155.2	-1894480	40355		0	-1854125	
119	1	206320	600.0	600.0		0	0		0	0
	x	25	1	155.2	-1794860	40355		0	-1754505	
120	1	207760	600.0	600.0		0	0		0	0
	x	24	1	155.2	-1695240	40355		0	-1654885	
121	1	209200	600.0	600.0		0	0		0	0
	x	23	1	155.2	-1595630	40355		0	-1555275	
122	1	210640	600.0	600.0		0	0		0	0
	x	22	1	155.2	-1496010	40355		0	-1455655	
123	1	212080	590.0	590.0		0	0		0	0
	x	21	1	155.2	-1396390	40355		0	-1356035	
124	1	213520	590.0	590.0		0	0		0	0
	x	20	1	155.2	-1296770	40355		0	-1256415	
125	1	214960	590.0	590.0		0	0		0	0
	x	19	1	155.2	-1197160	40355		0	-1156805	
126	1	216400	590.0	590.0		0	0		0	0
	x	18	1	155.2	-1097540	40355		0	-1057185	
127	1	217840	590.0	590.0		0	0		0	0
	x	17	1	155.2	-997920	40355		0	-957565	
128	1	219280	590.0	590.0		0	0		0	0
	x	16	1	155.2	-898300	40355		0	-857945	
129	1	220720	590.0	590.0		0	0		0	0
	x	15	1	155.2	-798690	40355		0	-758335	
130	1	222160	590.0	590.0		0	0		0	0
	x	14	1	155.2	-699070	40355		0	-658715	
131	1	223600	590.0	590.0		0	0		0	0
	x	13	1	155.2	-599450	40355		0	-559095	
132	1	225040	590.0	590.0		0	0		0	0
	x	12	1	155.2	-499830	40355		0	-459475	
133	1	226480	590.0	590.0		0	0		0	0
	x	11	1	155.2	-400220	40355		0	-359865	
134	1	227920	590.0	590.0		0	0		0	0
	x	10	1	155.2	-300600	40355		0	-260245	
135	1	229360	590.0	590.0		0	0		0	0

	x	9	1	155.2	-199980	40355	0	-159625	
136	1	230800	595.0	595.0		0	0	0	0
	x	8	1	155.2	-1160680	40355	0	-1120325	
137	1	232240	595.0	595.0		0	0	0	0
	x	7	1	155.2	-610680	40355	0	-570325	
138	1	233680	595.0	595.0		0	0	0	0
	x	6	1	155.2	-62680	40355	0	-22325	
139	1	235120	600.0	600.0		0	0	0	0
	x	5	1	155.2	-690880	40355	0	-650525	
140	1	236560	600.0	600.0		0	0	0	0
	x	4	1	155.2	-345900	40355	0	-305545	
141	1	238000	600.0	600.0		0	0	0	0
	x	3	1	155.2	-6920	40355	0	33435	
142	1	239440	600.0	600.0		0	0	0	0
	x	2	1	155.2	0	40355	0	40355	
143	1	240880	600.0	600.0		0	0	0	0
	x	1	1	155.2	0	40355	0	40355	

Borehole Seismic Survey

Field Report

100m Offset Source

Well #4

UNIS

A check shot survey was acquired at the request of UNIS in Well #4 at Nordlysstasjonen on Svalbard. This was required as part of a larger project, including a second check shot and formation monitoring. A dynamite source was used and one good shot per level was recorded. Data recording began at a depth of 600m and was completed at a depth of 100m. No problems occurred with the Read Well Services equipment during the acquisition of the data.

Survey Details

Survey Date	5 & 6 February 2010
Survey Type	100m Offset Source
Job Reference	1084
Country	Norway
Client	UNIS
Well Name	Well #4
Well Location East	518881.17
Well Location North	8681102.35
Rig Name	Nordlysstasjonen
Depth Units	Metres
Survey Datum	MSL
Well Reference level	DF
Elevation of Reference level w.r.t datum	8.05m
Total Depth	600m
Casing Details	60mm
Wireline contractor	Store Norske Spitsbergen
Observer	Anja Reinholdtsen
Client Representative	Helge Johansen, UIB
Acquisition System	GSP
Geophone System	Single ESR
Geophone Type	Gimballed
Geophone Sample Interval	1 millisecond
Record Length	6 second
Zero Point	Gimbal Cartridge

Source Type	Dynamite 0.5Kg
Observer at Source	Anja Reinholdtsen
Source Elevation	4.9m above msl
Source Easting	519024.68
Source Northing	8681161.36
External Reference Delay	0 ms
Source Reference Channel	7
Predicted Fire Channel	7
Fire Control	Relay A
Source Environment	Snow/Tundra
Weathering Velocity	2000m/s
Weathering Depth	70m
Elevation Velocity	2000m/s
Reference Pick	Positive Break
Geophone Pick	Negative Break
Source Monitor	Oyo Geospace Land Geophone
Source Monitor Easting	518954.04
Source Monitor Northing	8681121.85
Source Monitor Elevation	5.9m above msl

Well deviation used in processing.

READ WELL SERVICES

COMPANY : UNIS
WELL   : DH4

Coordinates are relative to wellhead at:

UTM X =   518881.17 m
UTM Y = 8681102.35 m

MD RKB	TVD RKB	Northing	Easting
0.00	0.00	0.00	0.00
650.00	650.00	0.00	0.00

SEGY FORMAT DESCRIPTION

Tape Format

Each file on tape consists of a reel ('line') header, followed by series of (trace) data records. The last (trace) data record in each file is followed by an EOF mark. The last file on tape is followed by multiple EOF marks.

Reel Identification Header

The reel header consists of two records, one 3200 byte record of text in EBCDIC code, in the form of forty 80-character 'cards' and one 400 byte record of binary coded information. The EBCDIC header contains text describing the data. The binary coded data has the following format (only recorded information is listed):

Binary code – right justified

Byte Nos.	:	Contents
13-14	:	Number of data traces per record
15-16	:	Number of auxiliary traces per record
17-18	:	Sample interval in microseconds (for this SEGY file)
19-20	:	Sample interval in microseconds (for original field recording)
21-22	:	Number of samples per data trace (for this SEGY file)
23-24	:	Number of samples per data trace (for original field recording)
25-26	:	Data sample format code (1 = 4 byte floating point)
27-28	:	CDP fold
29-30	:	Trace sorting code
31-32	:	Vertical sum code (1 = No sum)

Trace Identification Header

Each trace data record consists of the 240 bytes trace header followed by the trace data. The trace header has the following binary coded format (only recorded information is listed):

Byte Nos.	:	Contents
1–4	:	Trace sequence number within line
5–8	:	Trace sequence number within SEGY file ('reel')
9–12	:	Original field record number
13–16	:	Trace number within original field record
21–24	:	CDP ensemble number
25–28	:	Trace number within CDP ensemble
29–30	:	Trace identification code (1 = seismic data)
31–32	:	Number of vertically summed traces yielding this trace
115–116	:	Number of samples in this trace
117–118	:	Sample interval in microseconds for this trace

The trace data following the trace header is in a code defined by bytes 25-26 of the binary reel header record.

Normal Polarity, Minimum Phase:

is equal to SEG positive polarity defined as: An increase in acoustic impedance with depth is represented by a white trough and negative number on tape.

Normal Polarity, Zero Phase:

is equal to SEG negative polarity defined as: An increase in acoustic impedance with depth is represented by a white central trough and negative number on tape.

```
READ  WELL  SERVICES
********************************************************************************

VSP  RAW  SEGY  FILES

CLIENT              :   University in Svalbard
WELL                :   DH4
SURVEY              :   Zero Offset VSP
VSP ACQUIRED        :   5 Feb 2010
RWS REF.            :   sva1



VSPZO_RAW_1.SEGY
NEAR FIELD HYDROPHONE MONITOR, 143 TRACES
No of traces        :  143
No of samples/trace : 4000
Sample rate         : 1.0000[ms]      1000[us]


VSPZO_RAW_2.SEGY
RECEIVER GEOPHONES, Z COMPONENT, 143 TRACES
No of traces        :  143
No of samples/trace : 4000
Sample rate         : 1.0000[ms]      1000[us]


VSPZO_RAW_3.SEGY
RECEIVER GEOPHONES, X COMPONENT, 143 TRACES
No of traces        :  143
No of samples/trace : 4000
Sample rate         : 1.0000[ms]      1000[us]


VSPZO_RAW_4.SEGY
RECEIVER GEOPHONES, Y COMPONENT, 143 TRACES
No of traces        :  143
No of samples/trace : 4000
Sample rate         : 1.0000[ms]      1000[us]
```

```
READ  WELL  SERVICES
********************************************************************************

VSP  COMPUTED  SEGY  FILES

CLIENT              :   University in Svalbard
WELL                :   DH4
SURVEY              :   Zero Offset VSP
VSP ACQUIRED        :   5 Feb 2010
PROCESSED BY        :   READ Well Services, Oslo, Norway
RWS REF.            :   sva1

NOTE : NORMAL POLARITY IS DEFINED AS: AN INCREASE IN ACOUSTIC IMPEDANCE WITH
DEPTH IS REPRESENTED BY A NEGATIVE NUMBER ON FILE. NORMAL POLARITY IS DENOTED
AS 'NPOL' AND REVERSE POLARITY AS 'RPOL'.



VSPZO_COMPUTED_1.SEGY
RAW STACK, VERTICAL Z COMPONENT, 101 TRACES
No of traces        :  101
No of samples/trace : 4000
Sample rate         : 1.0000[ms]      1000[us]


VSPZO_COMPUTED_2.SEGY
RAW STACK, HORIZONTAL H1 COMPONENT, 101 TRACES
No of traces        :  202
No of samples/trace : 4000
Sample rate         : 1.0000[ms]      1000[us]


VSPZO_COMPUTED_3.SEGY
RAW STACK, HORIZONTAL H2 COMPONENT, 101 TRACES
No of traces        :  101
No of samples/trace : 4000
Sample rate         : 1.0000[ms]      1000[us]


VSPZO_COMPUTED_4.SEGY
DOWNWAVE INPUT TO DECONVOLUTION, Z COMPONENT, 101 TRACES
No of traces        :  101
No of samples/trace : 5000
Sample rate         : 1.0000[ms]      1000[us]


VSPZO_COMPUTED_5.SEGY
UPWAVE INPUT TO DECONVOLUTION, Z COMPONENT, 85 TRACES
No of traces        :   85
No of samples/trace : 5000
Sample rate         : 1.0000[ms]      1000[us]


VSPZO_COMPUTED_6.SEGY
DECONVOLVED DOWNWAVE, 6-90 HZ ZPH RPOL, Z COMPONENT, 85 TRACES
No of traces        :   85
No of samples/trace : 5000
Sample rate         : 1.0000[ms]      1000[us]


VSPZO_COMPUTED_7.SEGY
DECONVOLVED UPWAVE, 6-90 HZ ZPH RPOL, Z COMPONENT, 85 TRACES
No of traces        :   85
No of samples/trace : 5000
Sample rate         : 1.0000[ms]      1000[us]
```

```
VSPZO_COMPUTED_8.SEGY
ENHANCED DECONVOLVED UPWAVE, 6-90 HZ ZPH RPOL, Z COMPONENT, 85 TRACES
No of traces       :   85
No of samples/trace : 5000
Sample rate        : 1.0000[ms]      1000[us]


VSPZO_COMPUTED_9.SEGY
CORRIDOR STACK, 6-90 HZ ZPH NPOL, 10 TRACES
No of traces       :   10
No of samples/trace : 5000
Sample rate        : 1.0000[ms]      1000[us]


VSPZO_COMPUTED_10.SEGY
CORRIDOR STACK FROM TRANSPOSED, 6-90 HZ ZPH NPOL, 10 TRACES
No of traces       :   10
No of samples/trace : 5000
Sample rate        : 1.0000[ms]      1000[us]
```