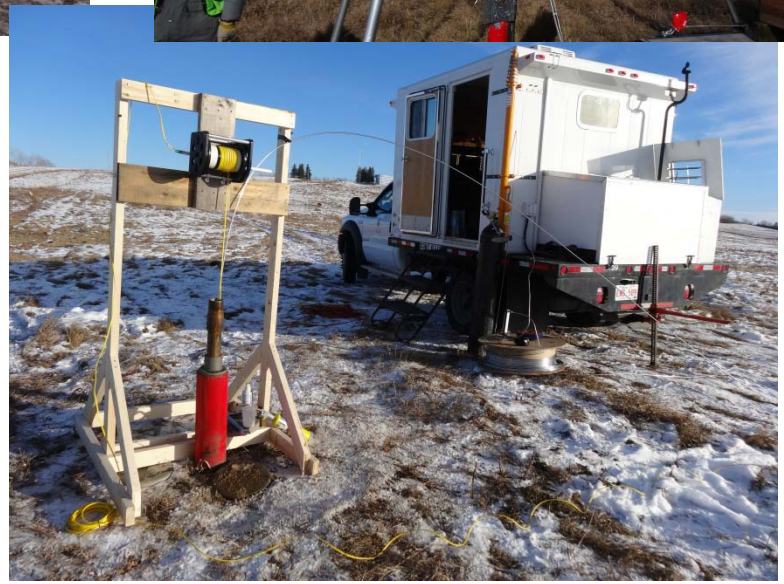
Priddis Projects

June to November 2014



CREWES

June 30 Install coiled tubing in Well 4

October 21 Well logging in Well 2

October 24 **Shot holes drilled and loaded**

October 30 Install optical accelerometers in Well 2

November 3-4 Layout spread for seismic project

November 5-6 Shoot seismic project

November 18-20 Test CO_2 optical sensor

Test cell at the Priddis Geophysical Observatory

Coiled tubing install June 30 1014

The rig arrives on site

The coiled tubing drive unit

Steel coiled tubing with the bottom end sealed was installed in well 4 to a depth of 130 m.
Outside diameter of 2.875 inches, inside diameter about 2.5 inches.
The coiled tubing and installation was provided by Sanjel Corporation.

The finished product

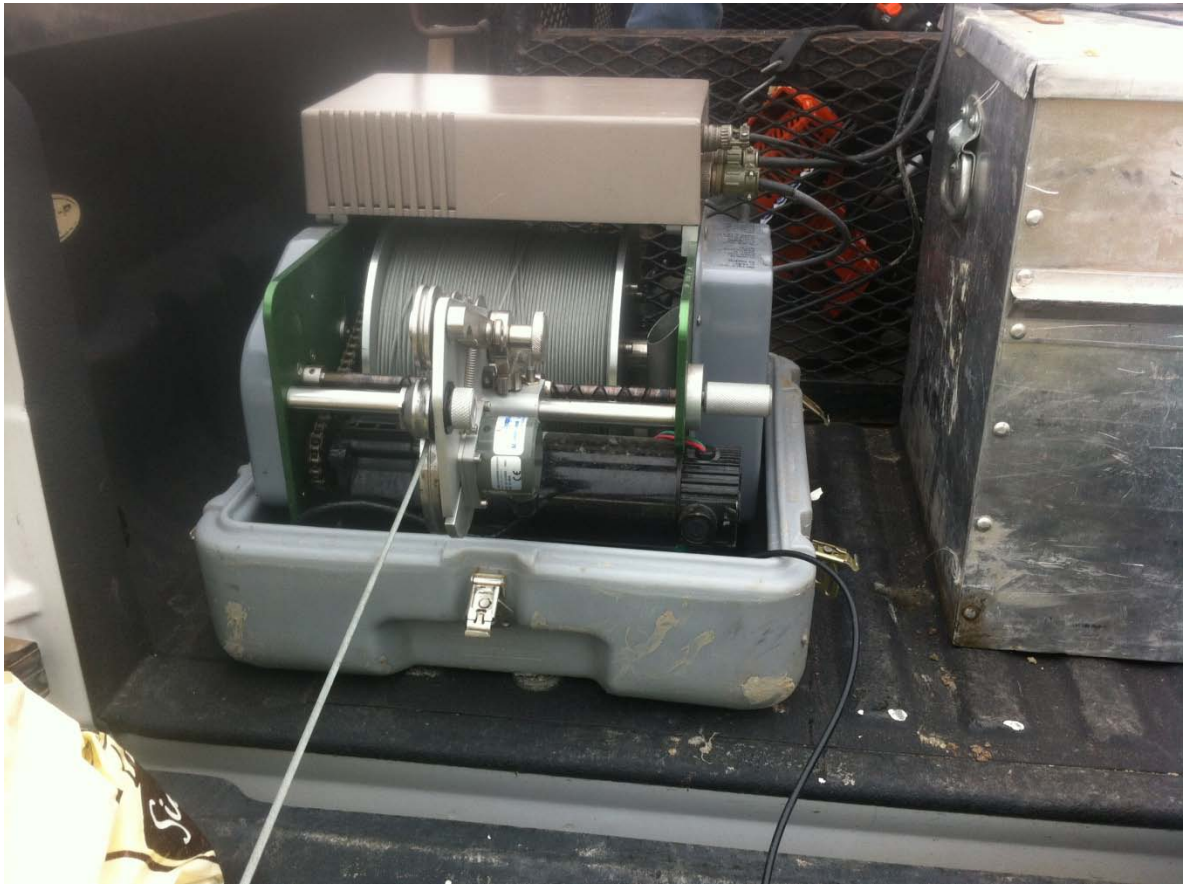
Installation supervised by Kevin Hall

To be continued……

Logging of well 2

October 21 2014

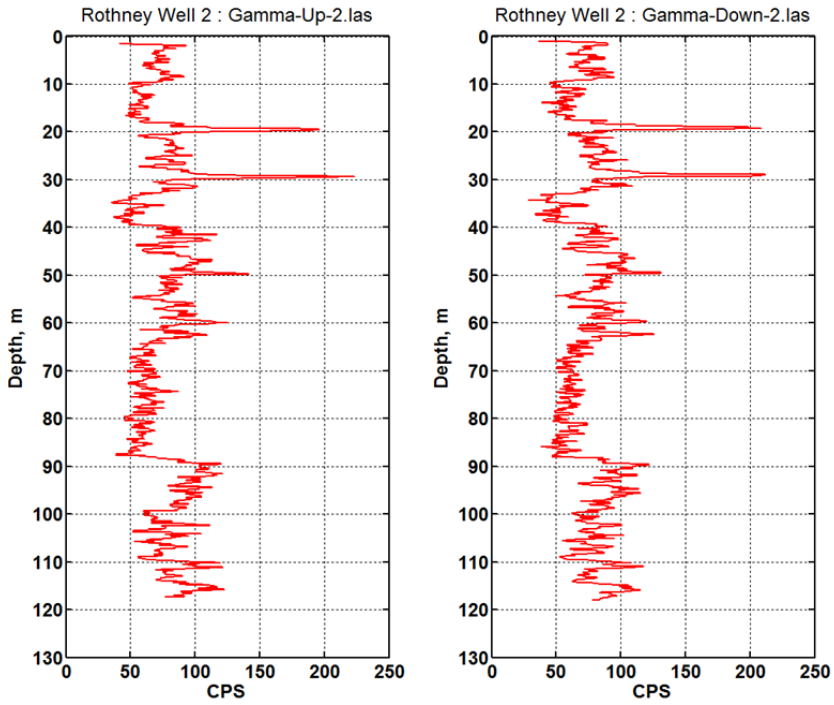
Well 2 with pulley set up



Wireline winch in back of cable truck

Logging carried out by Kevin Hall, Kevin Bertram and Joe Wong. Adult supervision provided by Gary

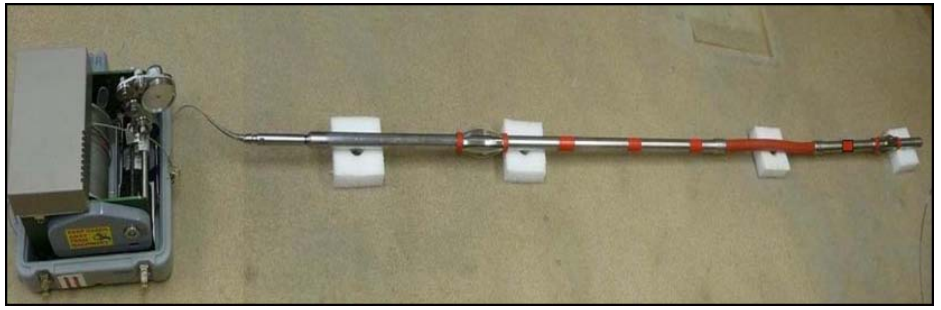
Gamma ray tool

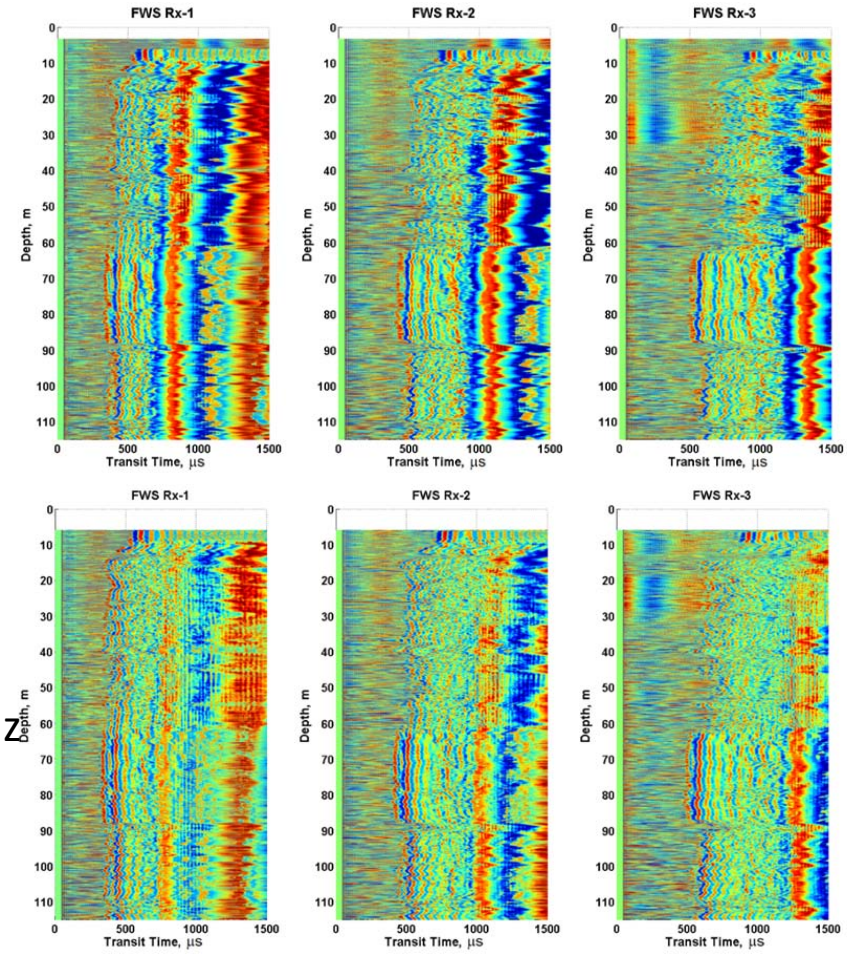


UP DOWN

Tool travel direction

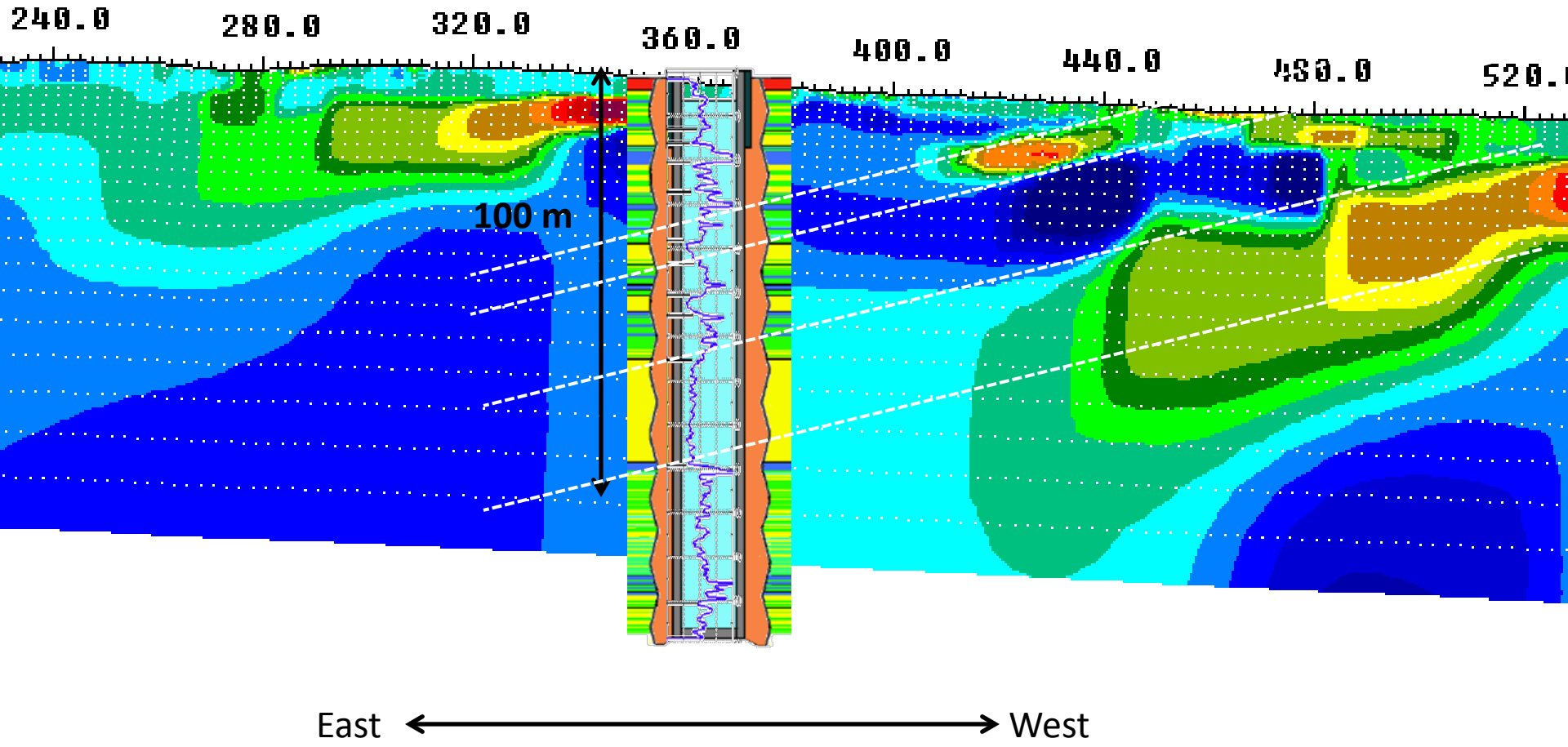
Full waveform sonic tool





From: Priddis 2014 broadband surface and walkaway VSP seismic experiment, Hall et al., CREWES 2015

Results from logging of well 4 compared to ERT at Priddis



Shot hole drilling and loading

October 24 2014

Shot hole rig arrives early morning

Drilling in the south paddock

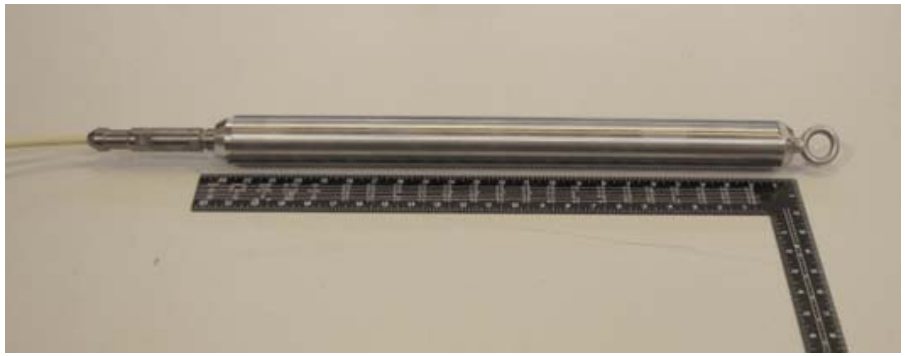
Shot parameters:
0.125 Kg at 5 m depth
Spaced at 6 m (every second flag)

Dynamite sticks for the shots

Rig met and supervised by Kevin Hall

Shot hole drilling October 24 2014

Optical accelerometers



Six 3-component optical accelerometers 20 m apart
Manufacturer: US Seismic Systems Inc.
Installed in Well 2 at PGO for November 2014 seismic project

The nitrogen driven clamp system mounted on the sensor

Kevin Hall watching a pelican in Los Angeles during visit to USSI in April 2015.

Optical accelerometers installed October 30

The downhole cable ready to deploy

Installation of the cable in well 2

Cable clamped ready to record

Spread layout November 3 2014

Spread layout November 3

Spread layout November 3

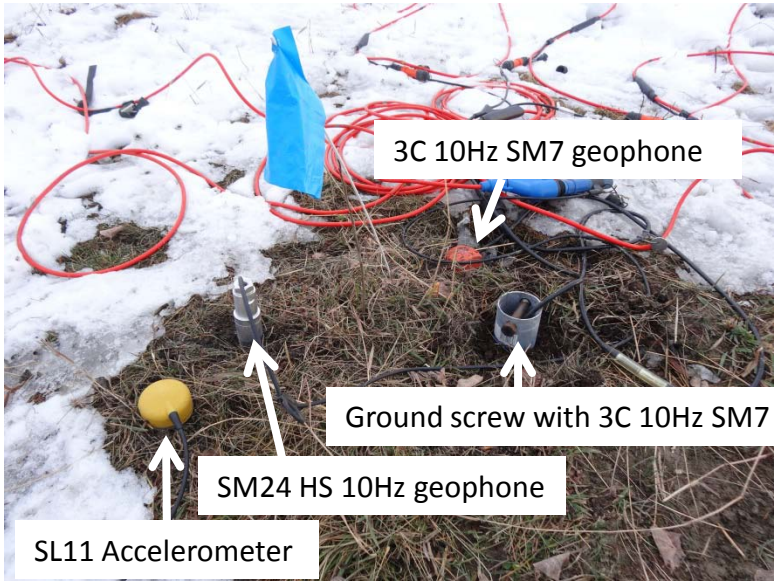
Line	Direction	Source	Stations	Spacing	Details
TH6	E->W	Dynamite	2101 - 2181 by twos	6 m	0.125 kg at 5 m depth
TH6	E->W	UNIVIB	2083.5 - 2169.5 by twos	6 m	Linear 1.5-180.0 Hz 16 s sweep
TH1-02	NE->SW	Dynamite	2101 - 2181 by twos	6 m	0.125 kg at 5 m depth
TH1-01	N->S	Dynamite	2101 - 2181 by twos	6 m	0.125 kg at 5 m depth
TH1-04	NW->SE	Dynamite	2101 - 2181 by twos	6 m	0.125 kg at 5 m depth

Sources

Line	Direction	Recorder	Receivers	Receiver Type	Components	Stations	Orientation	Spacing	Details
TH6	E->W	Aries SPML 1	SM-7	10 Hz geophone	V,H1,H2	1101 - 1180 by ones	Vertical, Magnetic North	3 m	Nail type casing in augured hole
		Aries SPML 2	SM-7	10 Hz geophone	V,H1,H2	1143 - 1165 by twos	Vertical, Crossline North	6 m	Groundscrews screwed into augured pilot hole
		Hawk	SM-24	10 Hz high-sensitivity geophone	V	1083 - 1271 by twos	Vertical	6 m	Alternating spike in ground and whole case in ground
		G3i	SL-11	accelerometer	V	1083 - 1271 by twos	Vertical	6 m	Alternating spike in ground and whole case in ground
TH1-02	NE->SW	Aries SPML 1	SM-7	10 Hz geophone	V,H1,H2	3101 - 3180 by ones	Vertical, Magnetic North	3 m	Nail type casing in augured hole
TH1-01	N->S	Aries SPML 1	SM-7	10 Hz geophone	V,H1,H2	5101 - 5180 by ones	Vertical, Magnetic North	3 m	Nail type casing in augured hole
TH1-04	NW->SE	Aries SPML 1	SM-7	10 Hz geophone	V,H1,H2	7101 - 7180 by ones	Vertical, Magnetic North	3 m	Nail type casing in augured hole
Testhole1	Vertical	Aries SPML 2	GS-20DM	28 Hz geophone	V,H1,H2	1 - 45	Unknown	3.06 m	Strapped to outside of casing, depth range 6.77 to 141.41 m, cemented.
Testhole2	Vertical	USSI	Optiphone	accelerometer	V,H1,H2	1 - 6	Unknown	20 m	Clamped to inside of casing, depth range 15 to 115 m, cemented.

Receivers

November 2015 seismic project



One receiver station on line 1

The usual chaos (intersection of 4 lines)

Optical accelerometer recorder

Adapter boards for downhole 3c in well 1

Acquisition of the seismic project

Dynamite

0.125 Kg dynamite at 5 m depth every 6 m

Univib

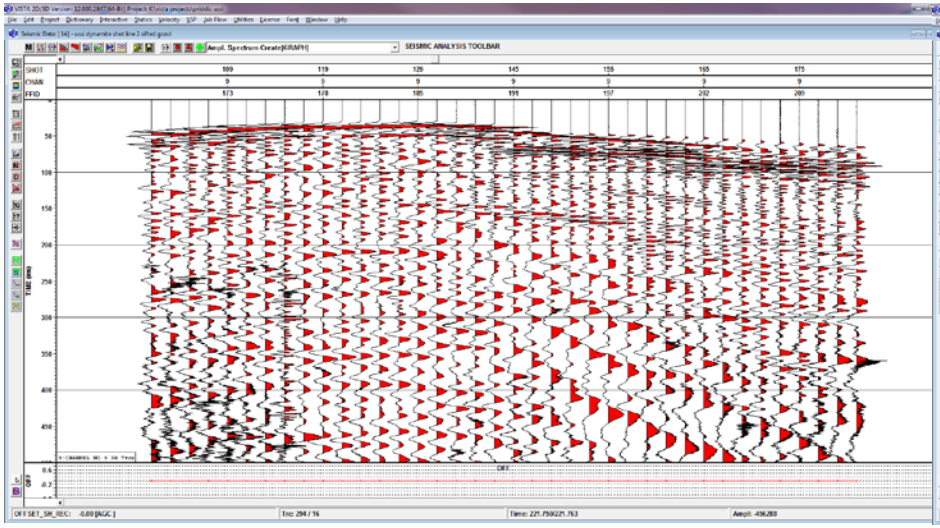
1.5-150 Hz linear sweep, two sweeps per vibe point; VP every 6 m

Kevin Hall as shooter

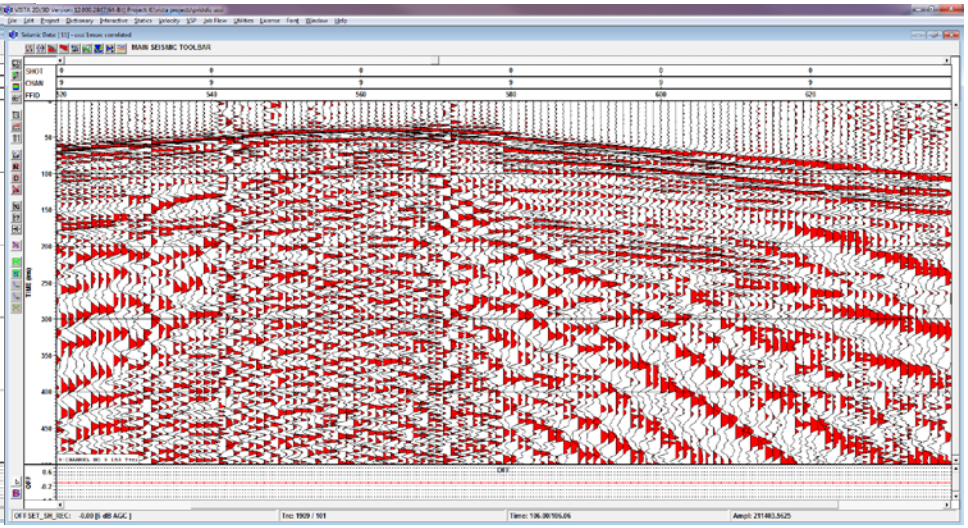
Optical accelerometers

The “recorder” arriving

Monitor screens for the accelerometers



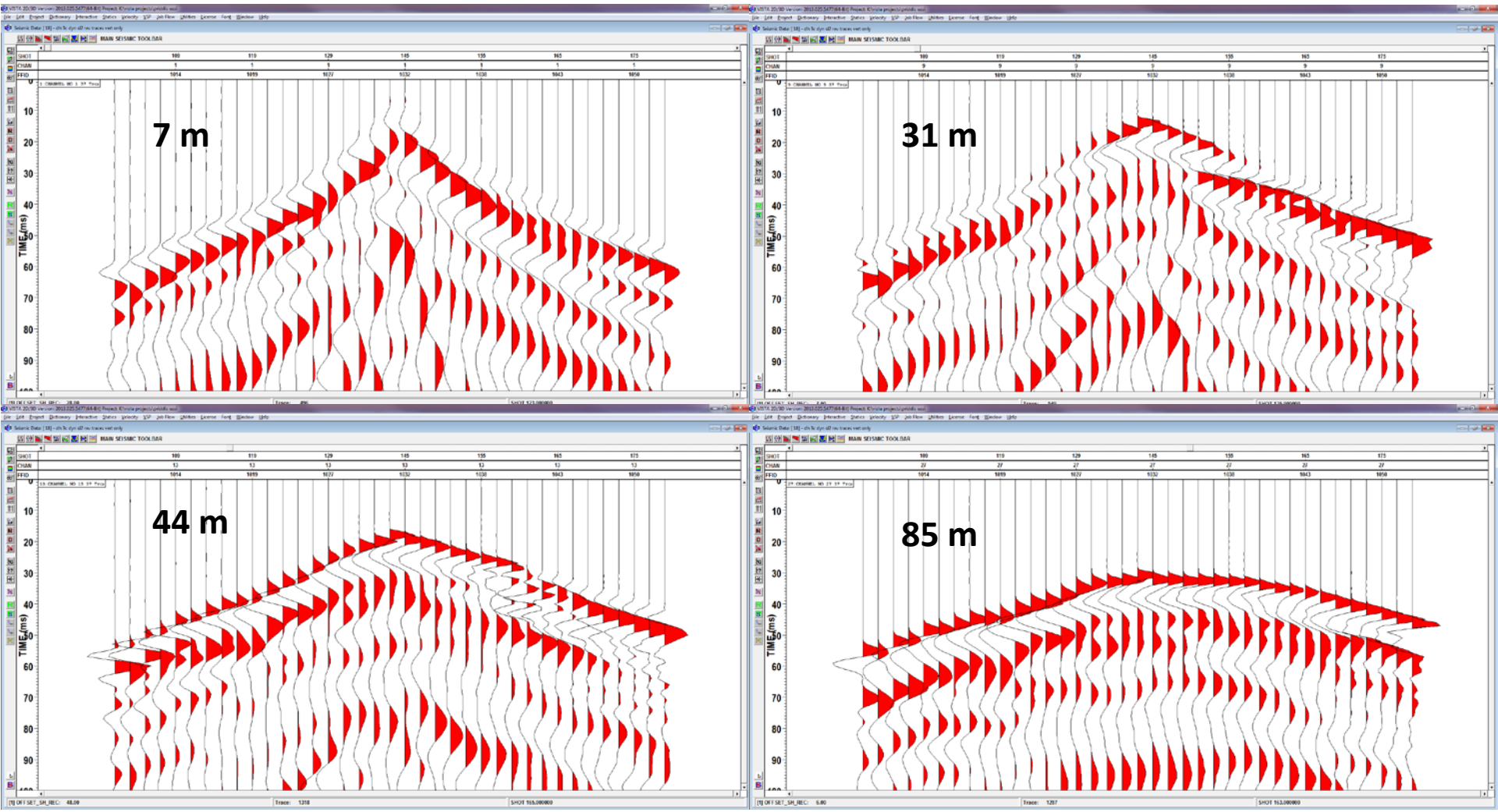
Dynamite



Univib

Vertical element receiver gathers for shots on line 2; 55 m depth; 0-500 msec

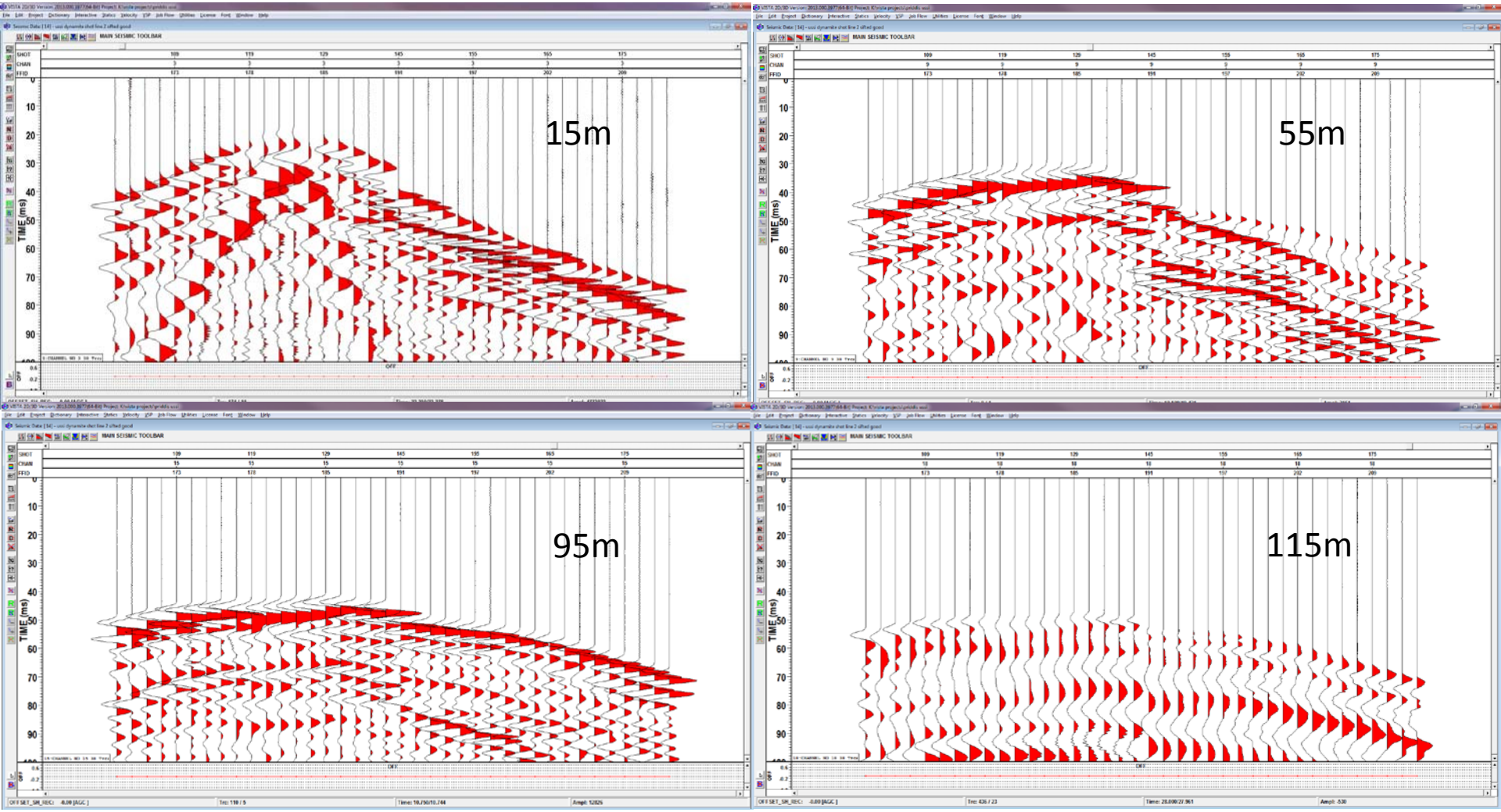
Downhole geophone (well 1) vertical element receiver gathers



Gathers for all shots on line 2

Displaying first 100 msec, AGC 100 msec

Accelerometer vertical receiver gathers for dynamite shots on line 2

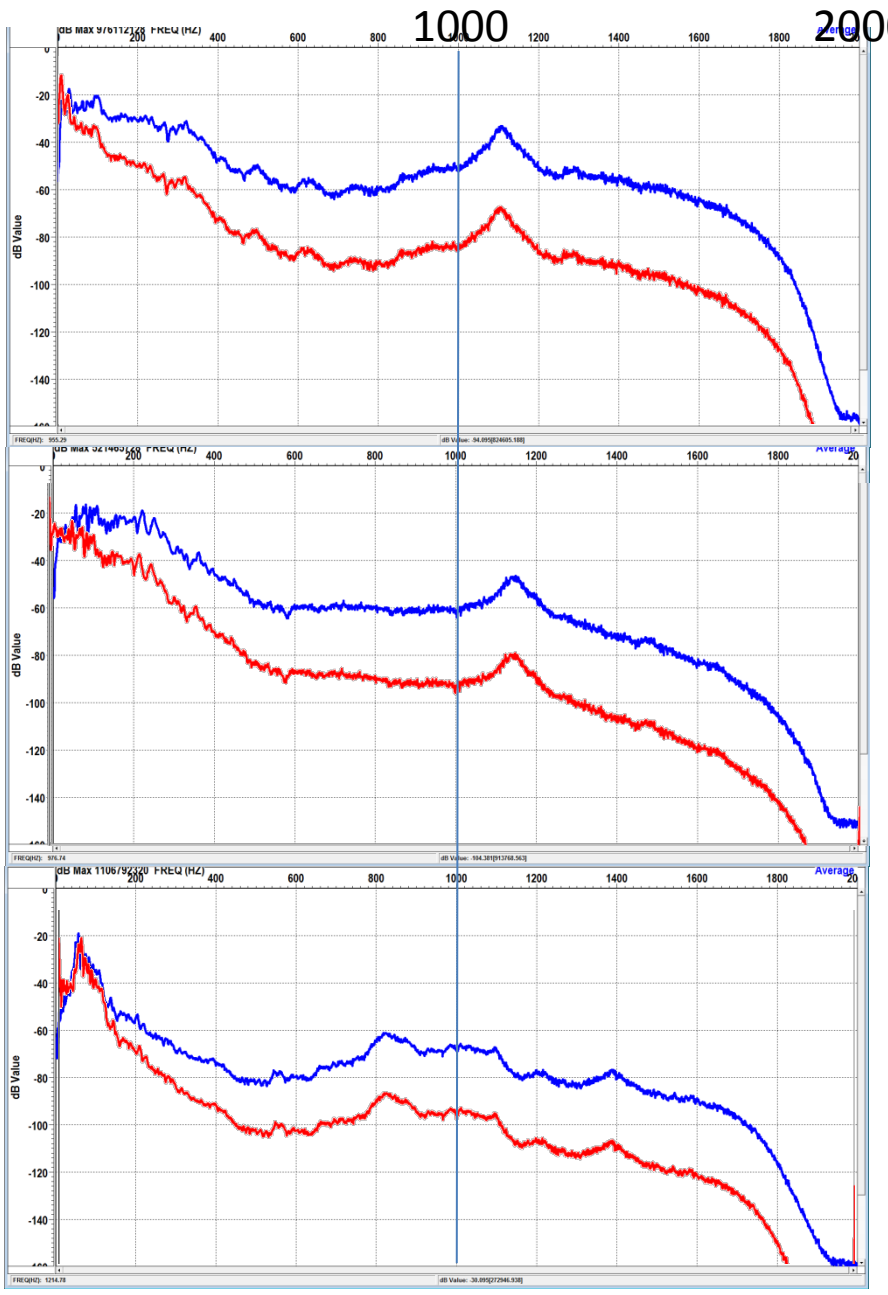


Gathers for all shots on line 2

Displaying first 100 msec, AGC 100 msec

Spectra of accelerometer receiver gathers for dynamite shots on line 2

First second of data



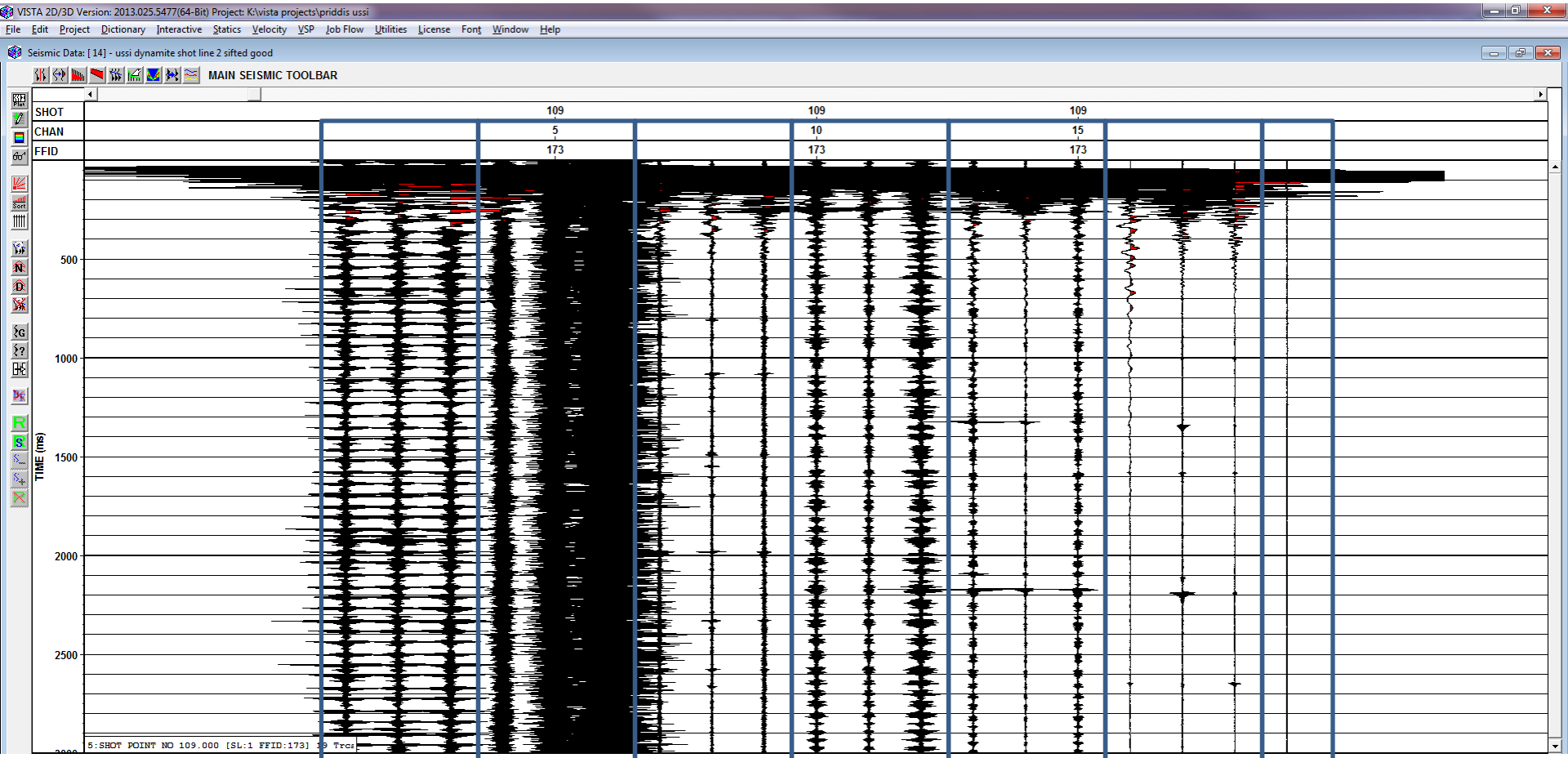
15m

55m

115m

Blue: original data (acceleration)
Red: after integration (velocity)

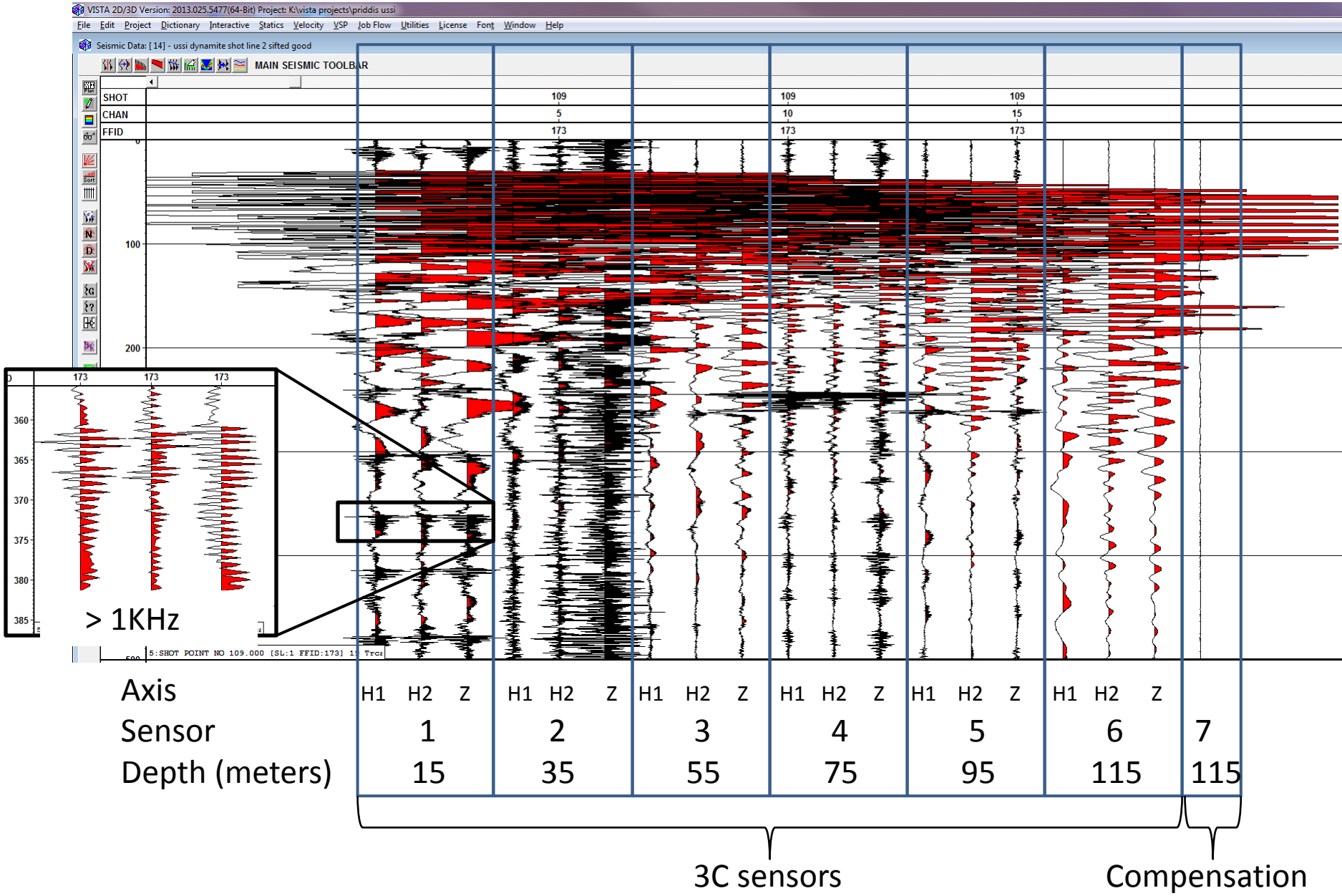
Optical accelerometer shot gather



Axis	H1	H2	Z	H1	H2	Z	H1	H2	Z	H1	H2	Z	H1	H2	Z	H1	H2	Z	
Sensor		1			2			3			4			5			6		7
Depth (meters)		15			35			55			75			95			115		115

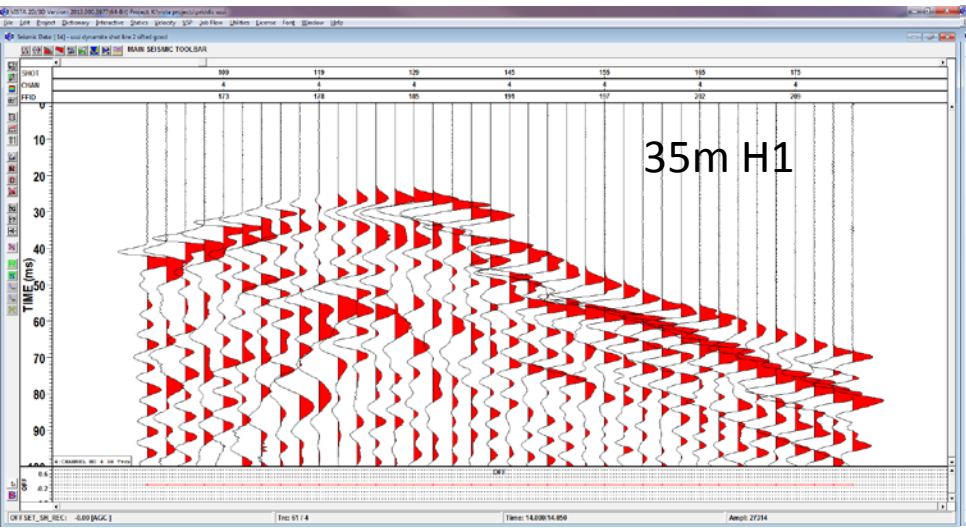
Shot gather for dynamite shot on line 2 at SP109 (3 seconds)

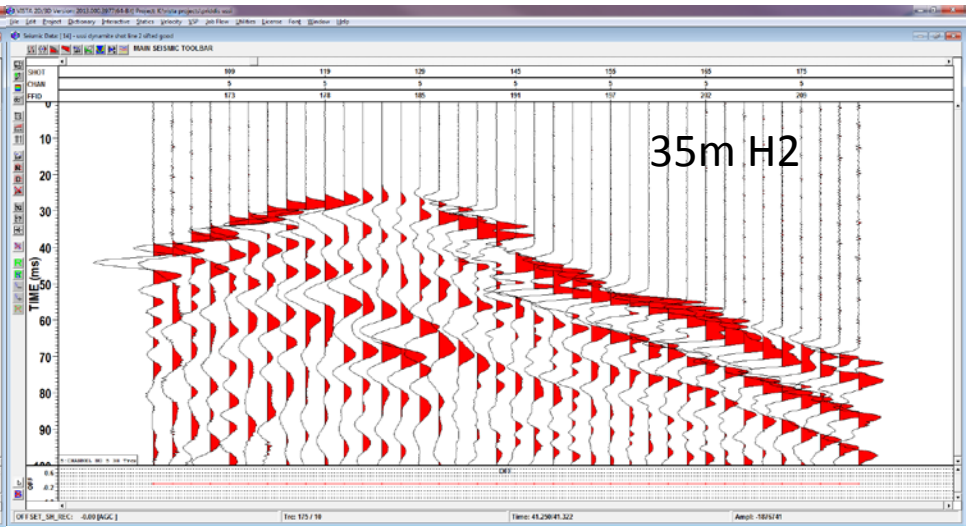
Optical accelerometer shot gather SP 2109

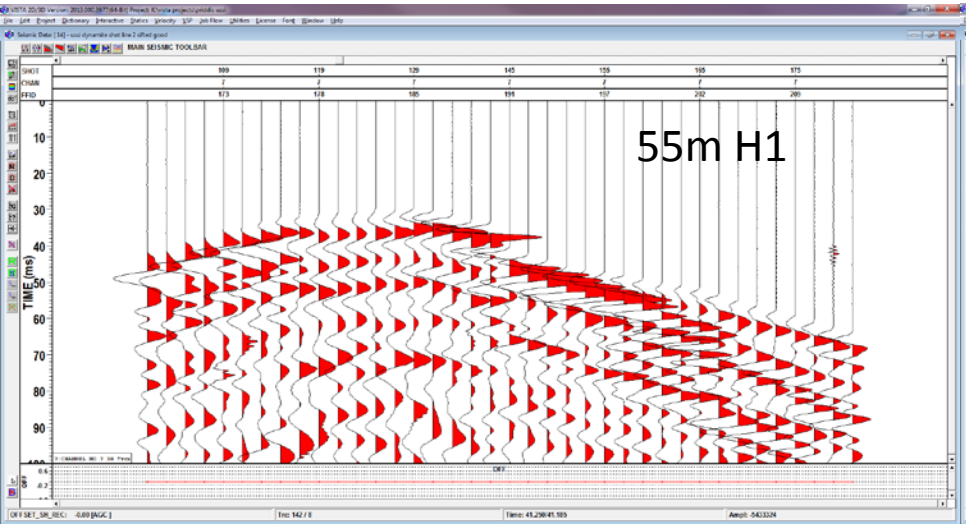


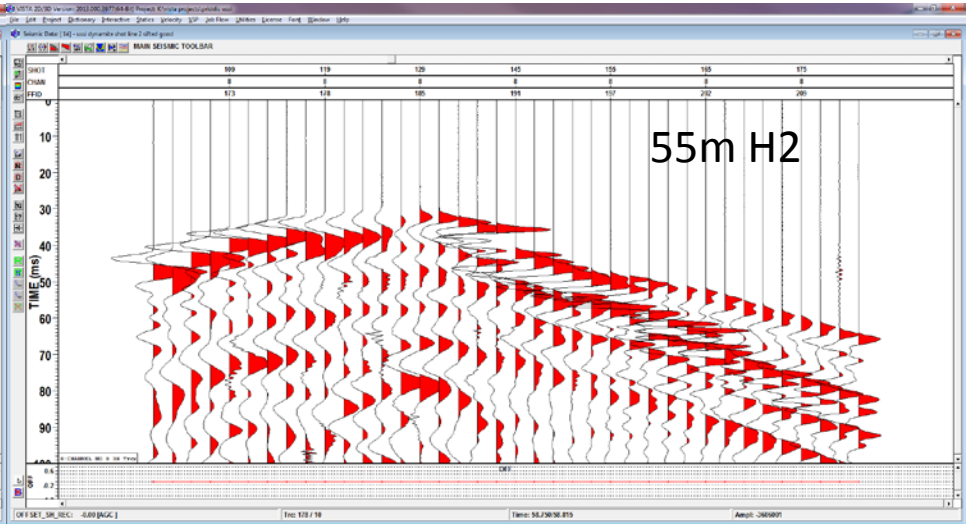
First 500 msec of data to show high frequency noise bursts

Accelerometer horizontal receiver gathers for dynamite shots on line 2





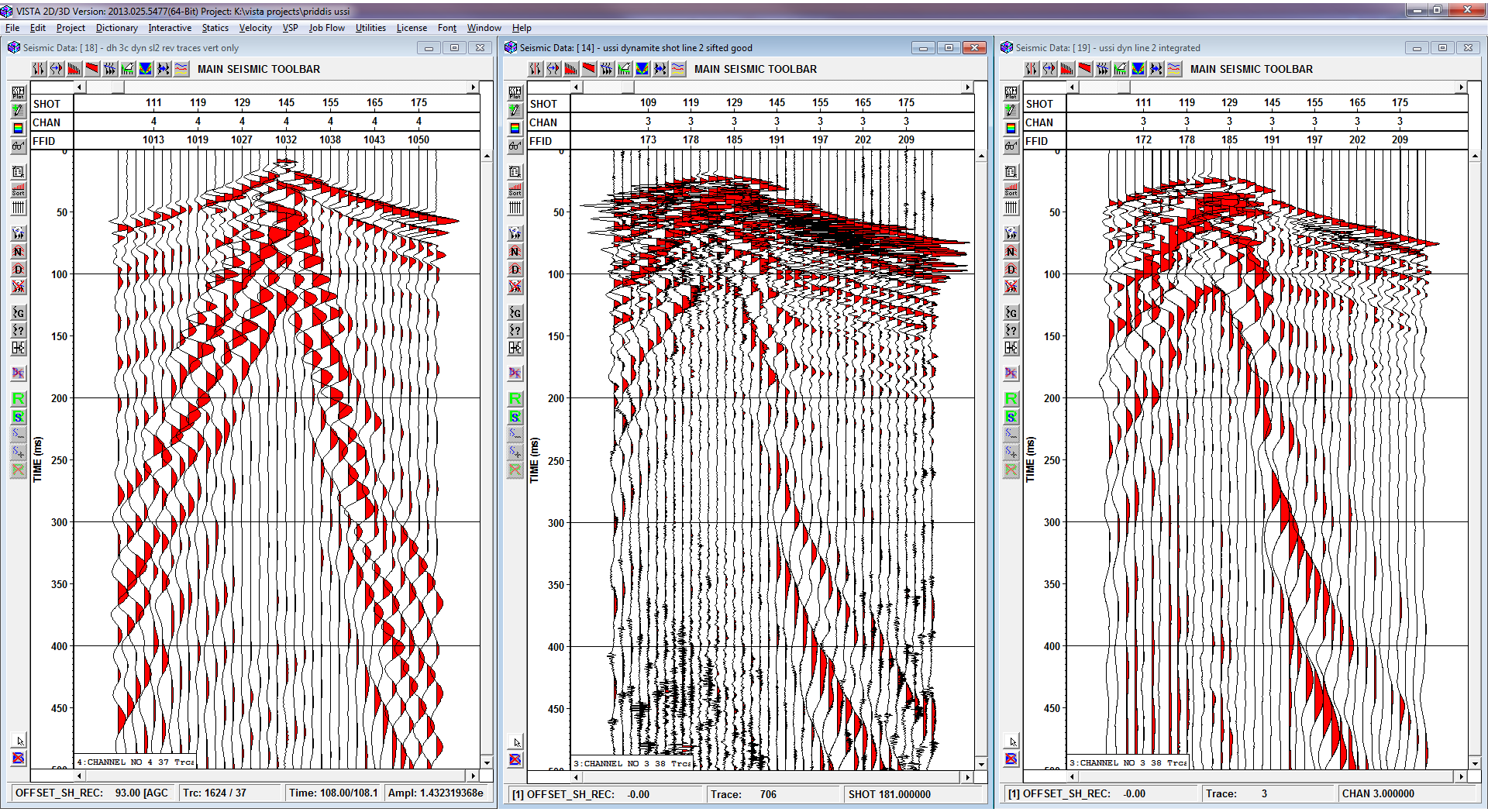




First 100 msec showing the polarity reversal as the shot azimuth changes

Downhole geophone and accelerometer vertical receiver gathers

Accelerometer data sampled at 0.25 msec, geophones sampled at 1 msec



Geophone at 16m

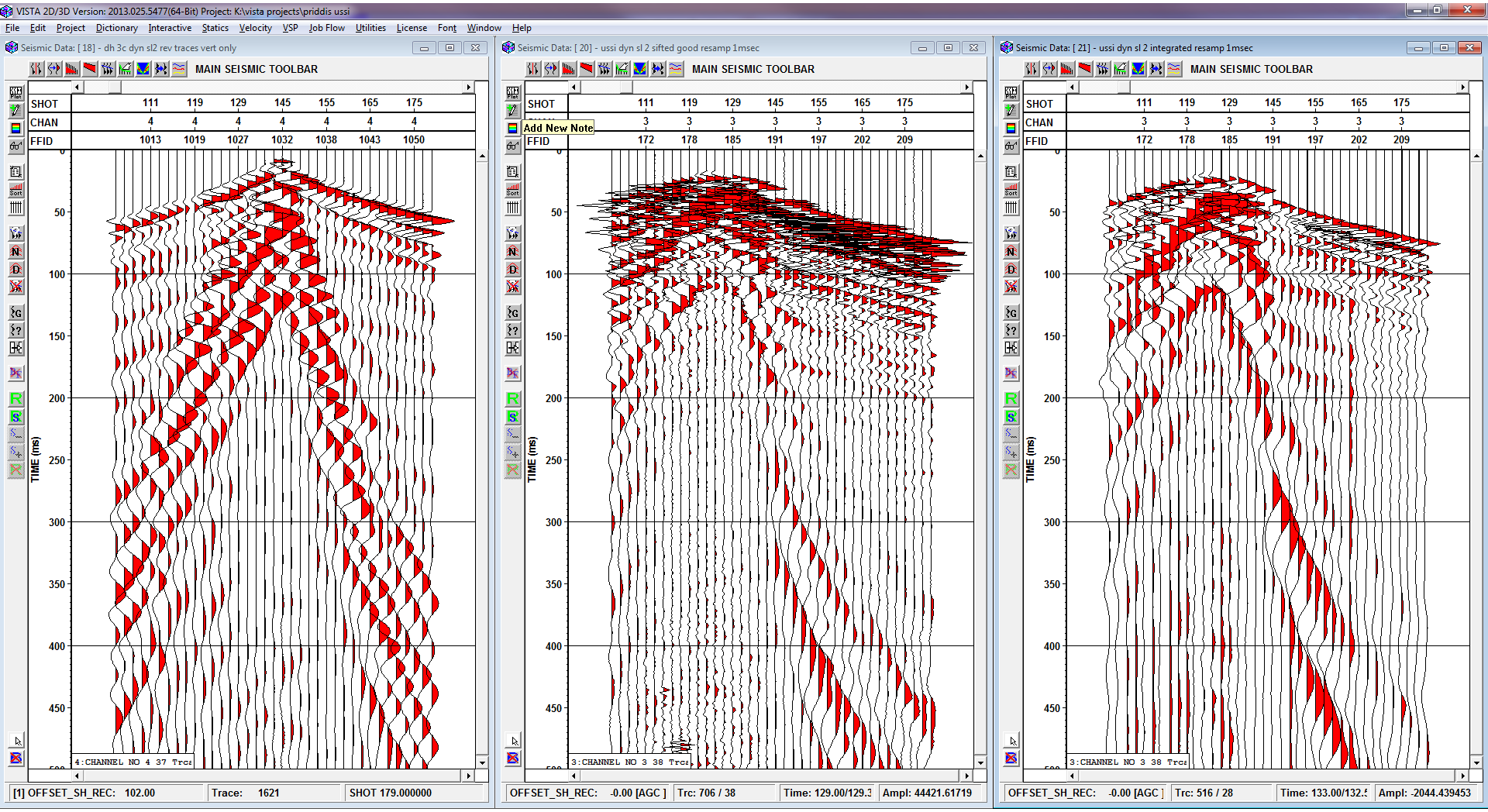
Accelerometer at 15m

Integrated accelerometer

All shots on line 2. AGC 500 msec

Downhole geophone and accelerometer vertical receiver gathers

Accelerometer data resampled to 1 msec



Geophone at 16m

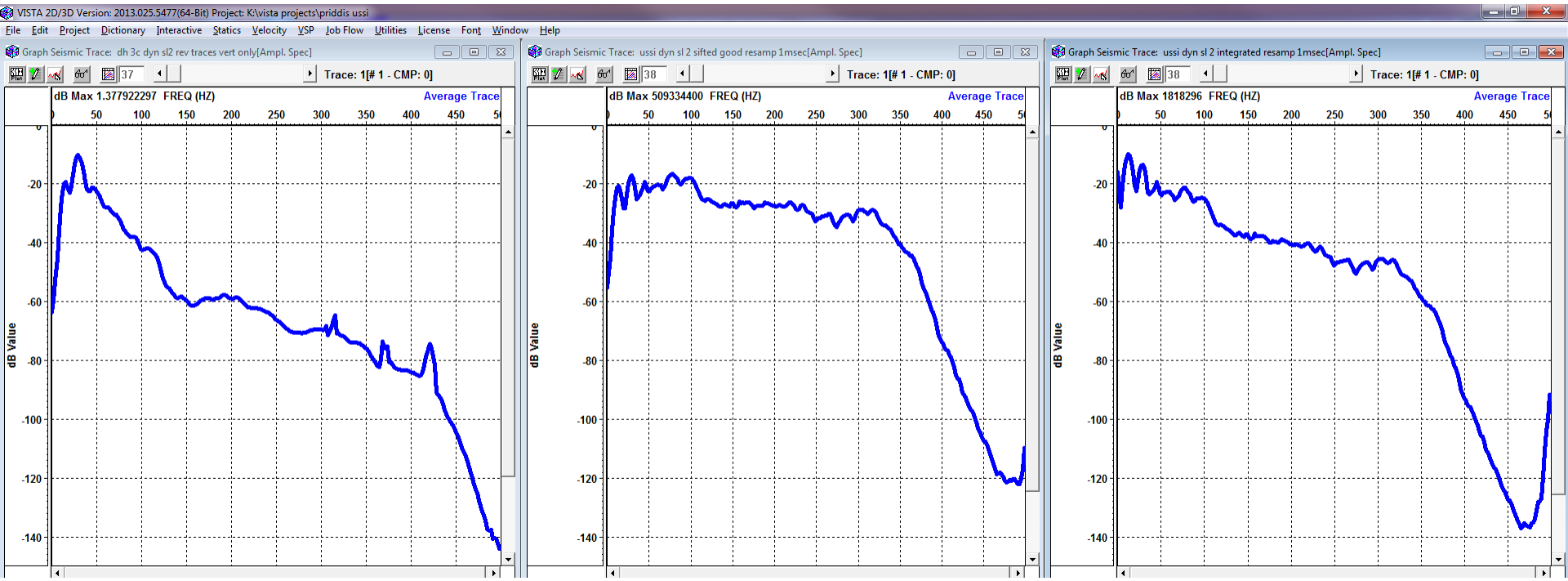
Accelerometer at 15m

Integrated accelerometer

All shots on line 2. AGC 500 msec

Downhole geophone and accelerometer vertical element spectra

After resampling the optical sensor to 1 msec

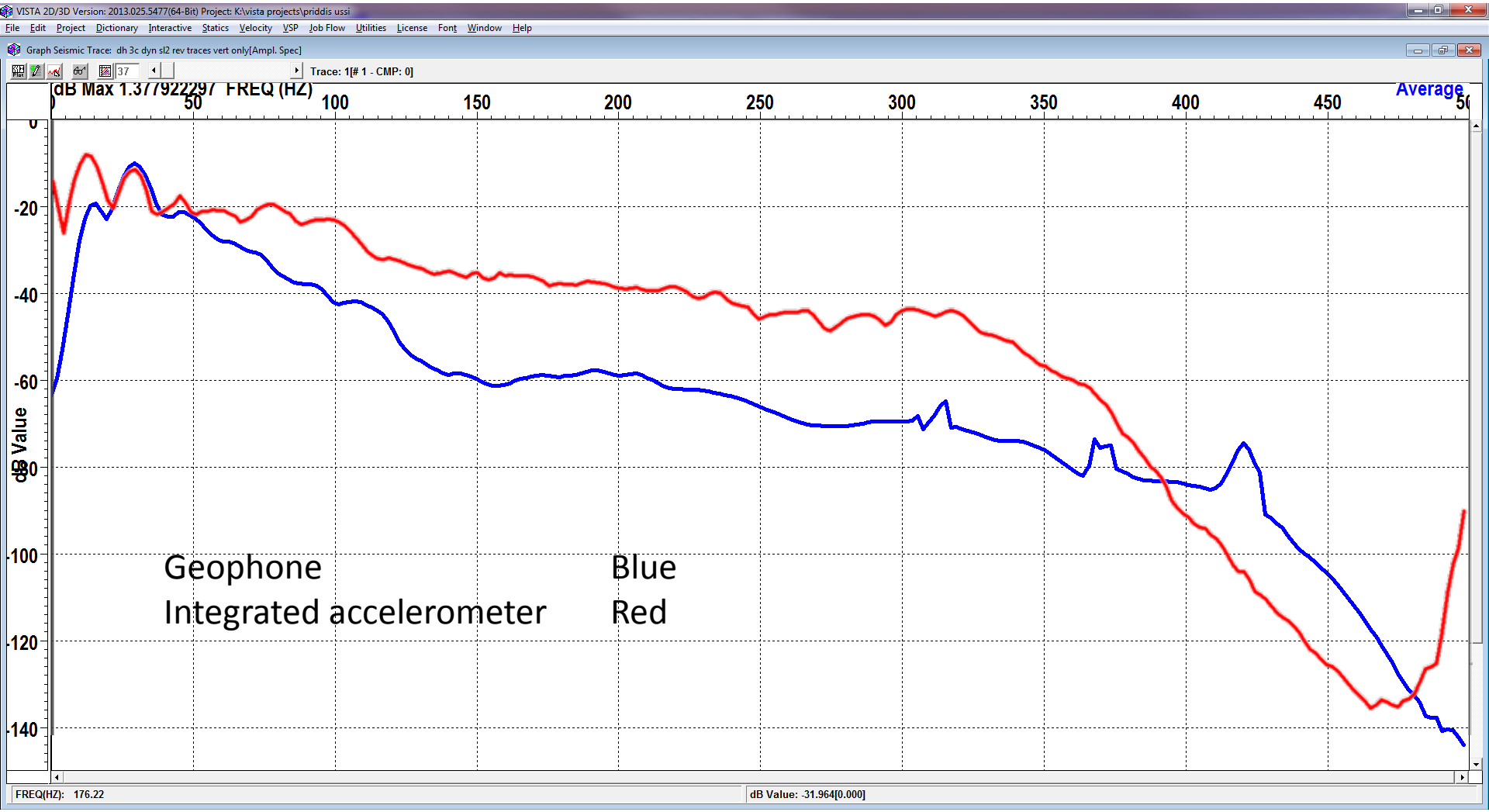


Geophone at 16m

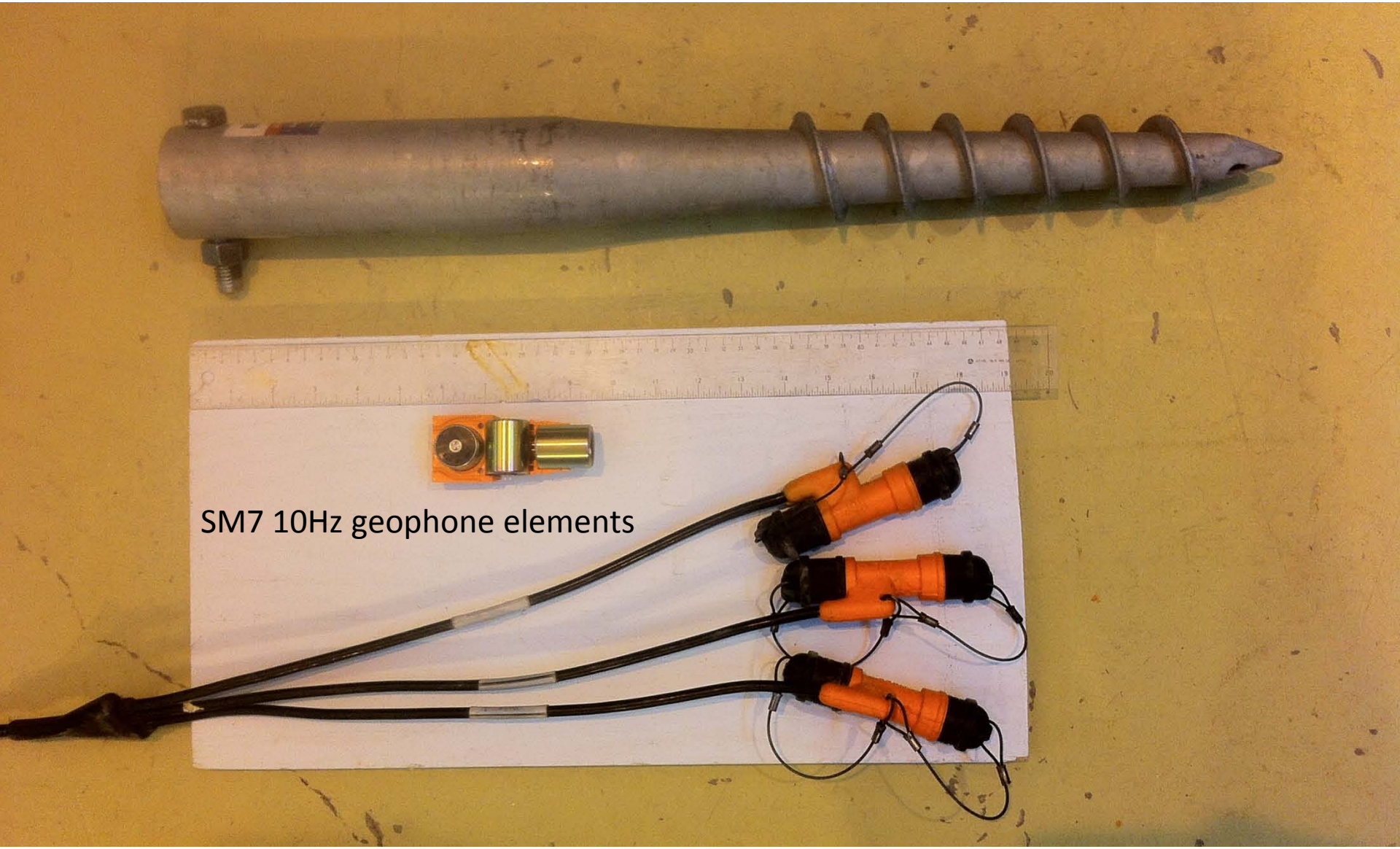
Accelerometer at 15m

Integrated accelerometer

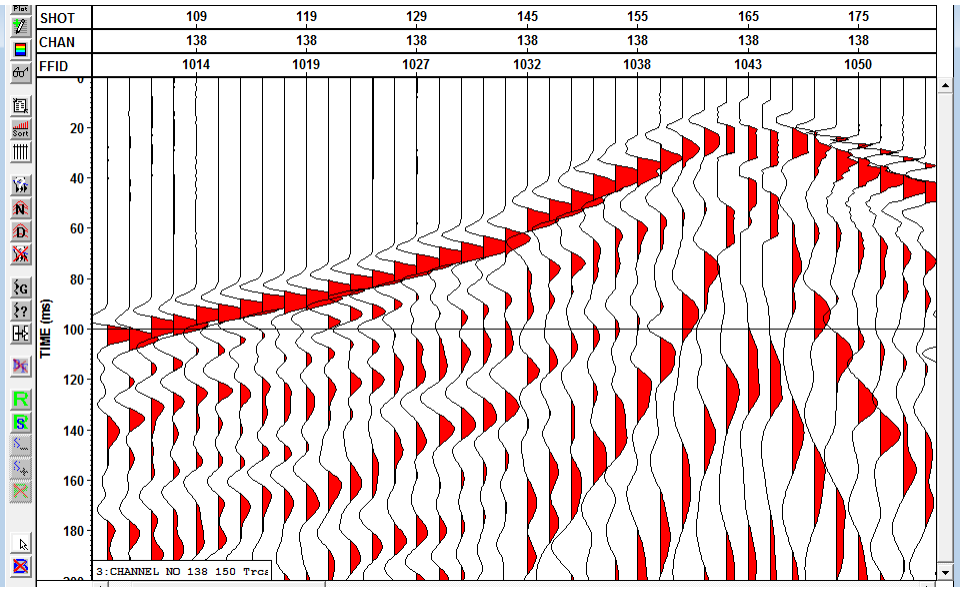
Downhole geophone and accelerometer vertical element spectra



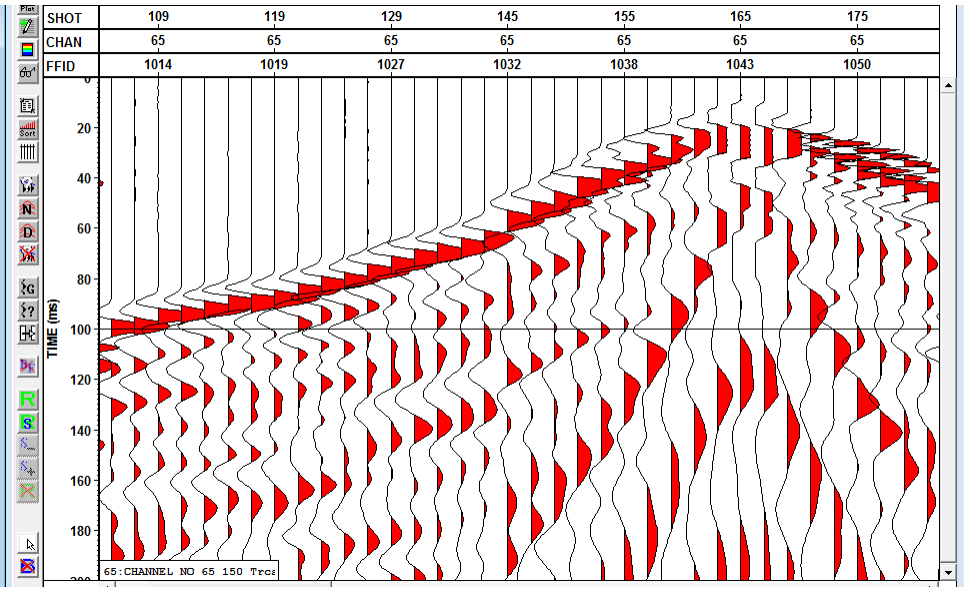
The ground screw experiment



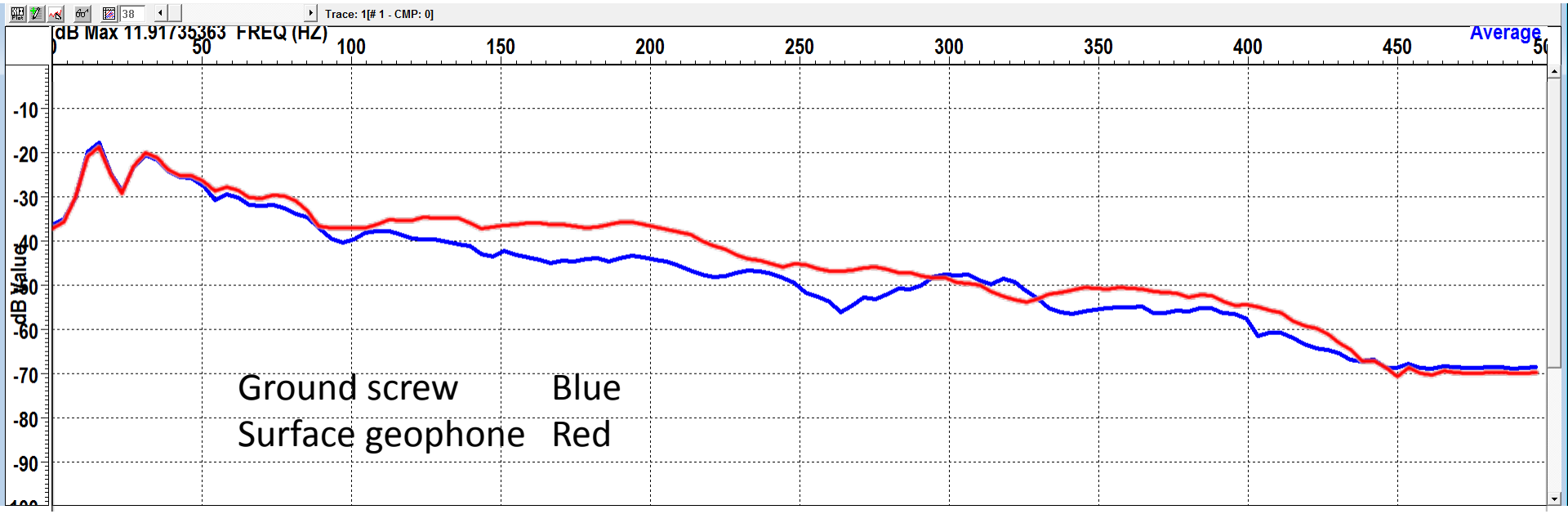
Vertical element receiver gathers for shot line 2



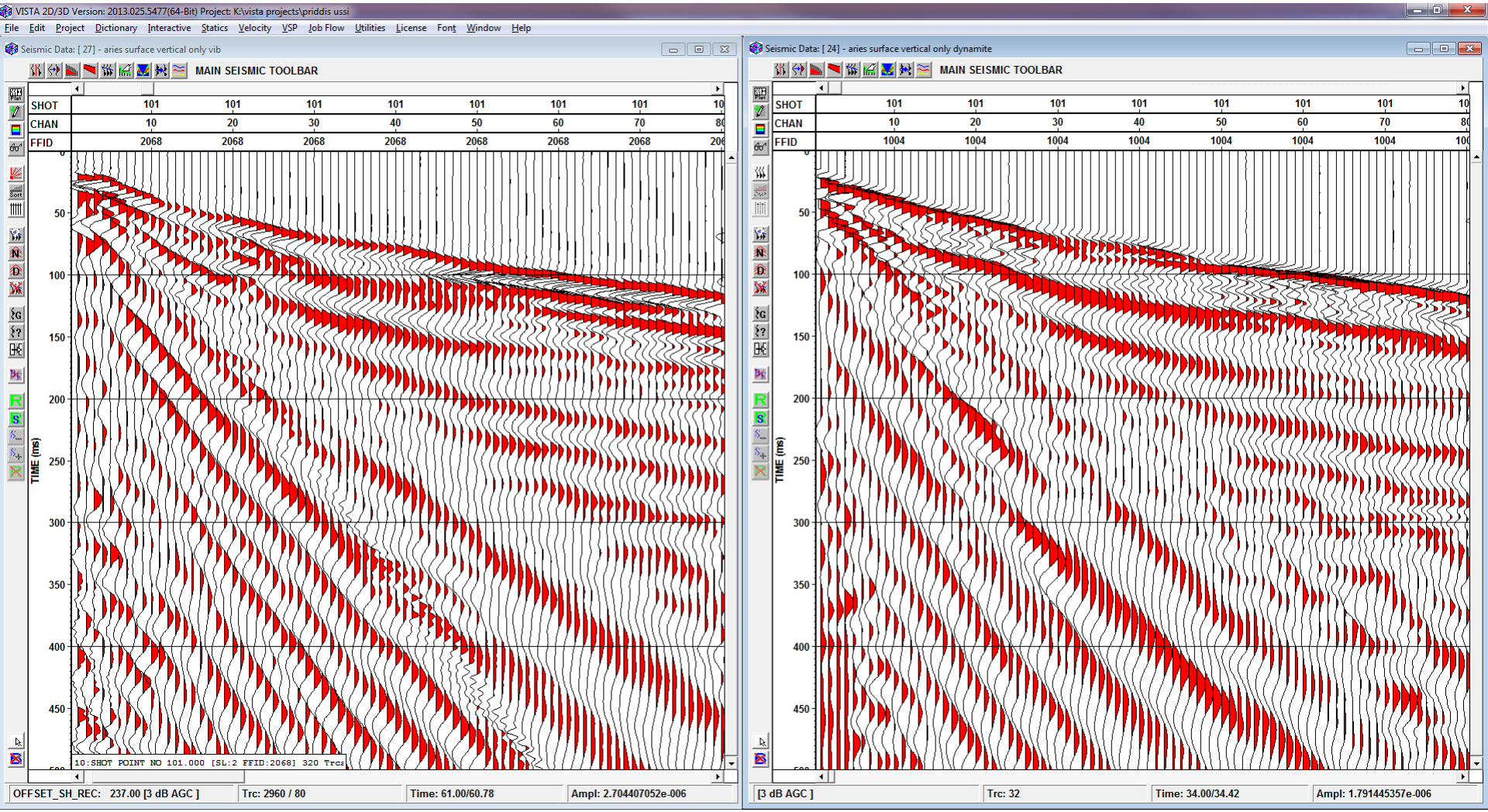
Ground screw



Surface geophone



Shot gathers of vertical element of surface spread on line 1

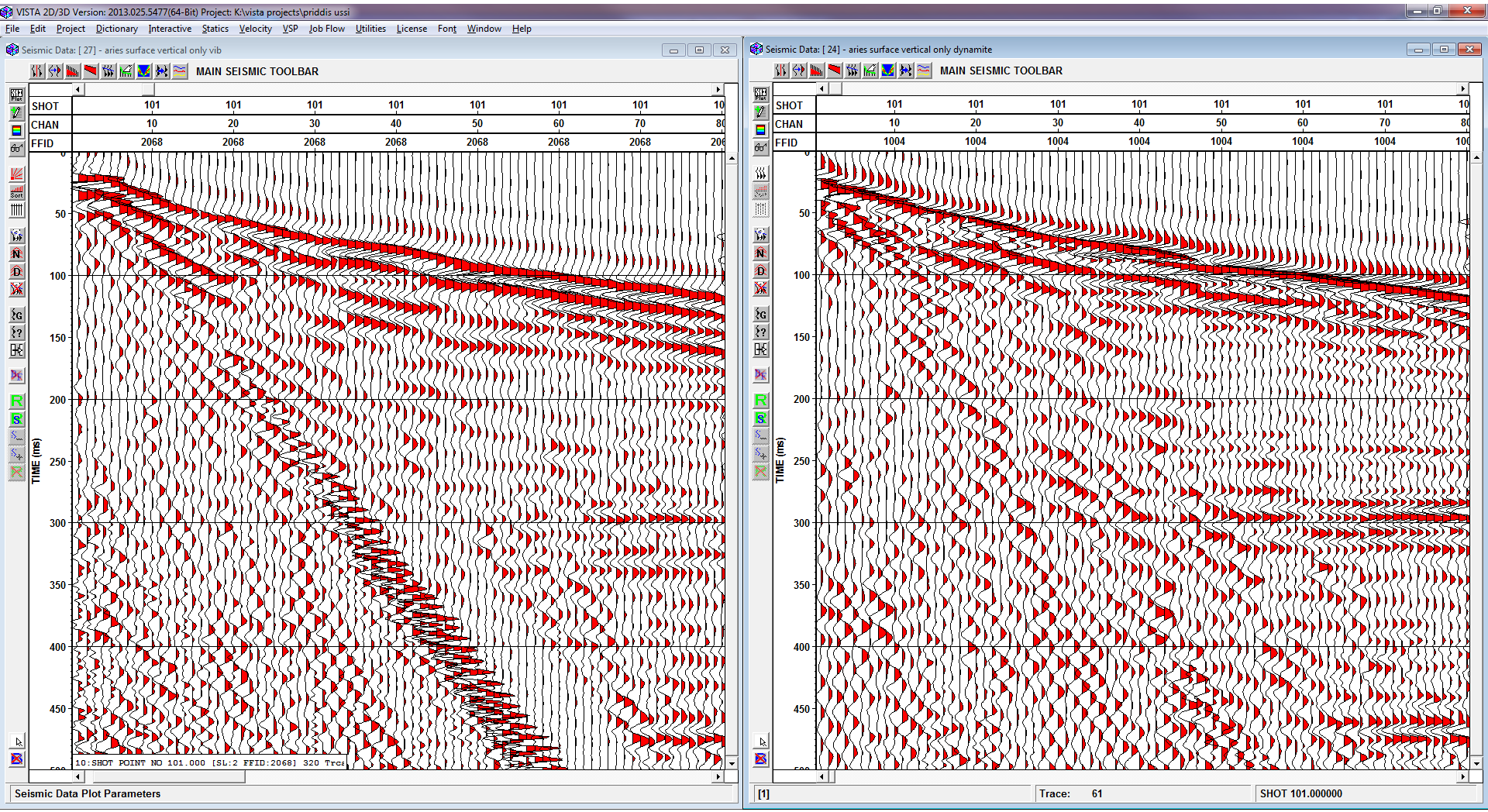


Univib correlated stack

Dynamite

Shot line 2, shot point 101. 500 msec displayed, 200 msec AGC, no filters

Shot gathers of vertical element of surface spread on line 1



Univib correlated stack

Dynamite

Shot line 2, shot point 101. 500 msec displayed, 200 msec AGC, Filters 35-45-200-250

The clean up November 7

Note the lack of snow

The new Priddis Geophysical Observatory pressure test cell

Installing the coiled tubing
30 June 2014

Preparing the top of the tubing for the well head installation
13 November 2014

In 2014 well 4 at the PGO was converted to a pressure test cell:
Rated for pressures up to 3000 psi (20 Mpa)
130 m deep
2.5 inch (6.4 cm) internal diameter

Fiber optic CO_2 detector test

November 18 – 20 2014

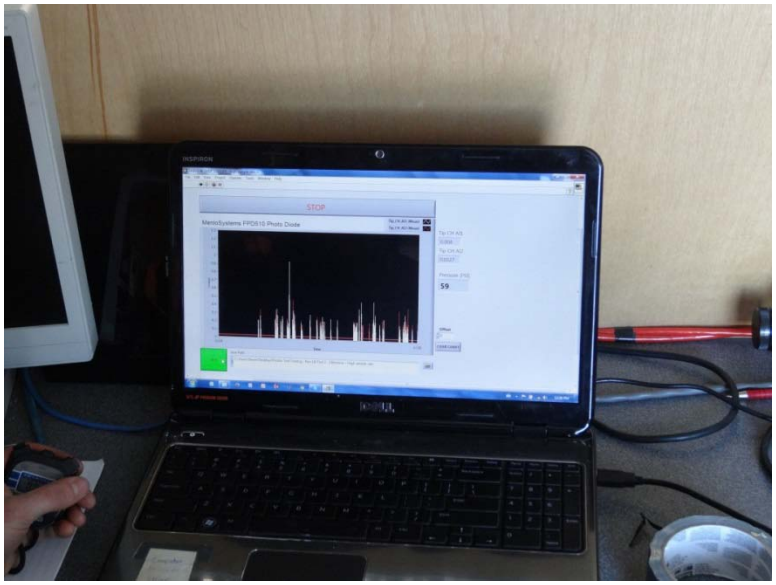
About to insert the
tool into the well

The internal structure of the tool

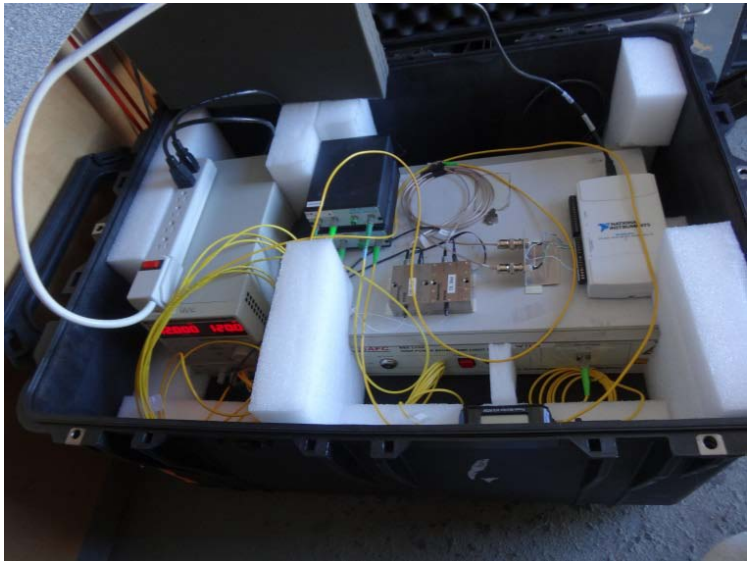
Optical fiber tool developed by University of Victoria to measure CO2 concentrations using refractive index changes with fluid types. There are two sensing ports in the tool.
This was the first deployment of the tool to test the concept.
Tested to 90 feet in well 4 with N_2 bubbled past the sensor.

The first test run

The field setup



Bubbles passing the sensors. The two outputs are displayed in white and red



The optical interrogator, laser, data converter and power supplies

Nitrogen bottle and flow meter

Installation of the well head

Well head components and installation provided by Select Energy Systems Inc.

A satisfied customer

Acknowledgements

Kevin Hall
Students and staff who assisted in the field
Sanjel Corporation
Select Energy Systems Inc.
CREWES
Carbon Management Canada

Comes with instructions

The optical system recorder setup