



# Project on Seismic Reflection

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# Data Import

## Coordinates:

- Common Shot gather recorded with a 59 channels off-end spread.
- The group interval is about 12.3m
- The first group is 33m far from the source
- The last group is at 747m from the source.

edit trace header coordinates for C:\Program Files (x86)\REFLEX\Seismic\_reflection\_groupA\ROHDATA\RAW\\_\_\_.DAT

trac-nr.	distance	shot-x	shot-y	shot-z	rec.-x	rec.-y	rec.-z	time delay	gain	time collect
1	33	0	0	61900	33	0	61850	0	1	0
2	45,31034469E0	0	0	61900	45,31034469E0	0	61825	0	1	0
3	57,62068939E0	0	0	61900	57,62068939E0	0	61800	0	1	0
4	69,93103408E0	0	0	61800	69,93103408E0	0	61925	0	1	0
5	82,24137878E0	0	0	61800	82,24137878E0	0	61950	0	1	0
6	94,55172348E0	0	0	61800	94,55172348E0	0	61975	0	1	0
7	106,86206817E0	0	0	62000	106,86206817E0	0	61800	0	1	0
8	119,17241287E0	0	0	62000	119,17241287E0	0	61775	0	1	0
9	131,4827575E0	0	0	62000	131,4827575E0	0	61750	0	1	0
10	143,7931022E0	0	0	62000	143,7931022E0	0	61725	0	1	0
11	156,1034469E0	0	0	61700	156,1034469E0	0	62000	0	1	0
12	168,4137916E0	0	0	61700	168,4137916E0	0	62025	0	1	0

TopographyGroupBox: topography (x,z values)  
☒ update shot z-pos.  
☒ update receiver z-pos.  
☒ use x-traceheadercoord.  
☐ apply x-z topography  
☐ get distance along topography

EditGroupBox: apply borehole deviations  
3D-view of boreholes  
project on x  
x <-> y y <-> z  
source <-> rec.  
rec. -> source  
smooth rec. xy-coord.  
factor f. smooth: 4  
☐ smooth shot coord.  
interpolate  
☐ interpolate all  
fileheader coordinates  
data type: single shot  
shot-pos: 0  
shot-offset: 0  
rec.start: 33  
rec.end: 747  
rec.offset: 0  
☐ non equidistant spread  
☐ update only shot coord.

UpdateGroupBox: load from AsciiFile  
save on AsciiFile  
update from fileheader  
update fileheader  
update distances  
coordinate transformation  
reload from file  
save changes  
close

Reflexw dataimport

Fileheader-coordinates  
DistanceDimen: METER  
data type: single shot

rec.start: 33  
rec.end: 747  
lat.offset: 0

shot-pos: 0  
shot lat.offset: 0

number: 0

filename specification  
specification: original name  
prefix:  
filename factor: 1

Time and comment specification  
TimeDimension: ms  
sample number: 0  
time increment: 0  
time resampling: 1  
timerange: 0  
file header: 1024  
trace header: 256

ConversionMode  
conversion sequence: no

format specification  
input format: SEGY  
output format: new 32 bit floating point  
scaling: 1

ControlOptions  
☒ control format  
☐ read traceincr.  
☐ fix endcoord.  
☐ calculate tracincl  
☒ read starttime  
☐ man. samplnr.  
☐ use sweeplength  
☐ read marker  
☐ swap bytes  
☒ IBM  
☐ unsigned  
☐ swap header  
☒ read fileheader  
☐ read traceheader  
☐ ps/ns timeinc  
SEG YCoordinates:  
☐ coord. in degree  
☒ ignore scaler  
☐ ignore group

update traceheaders/gps coordinates  
☐ use data folder  
update traceheaders:  
fileheader  
utm-conversion:  
no  
☐ calculate distances  
☐ offset -> x  
☐ correct for offset

max.traces/file: 1048576  
line distance: 0  
tracnr./2D-line: 0  
trace incr: 0  
☐ meandering  
☐ check tracelength  
☒ move receivers  
☒ move shots

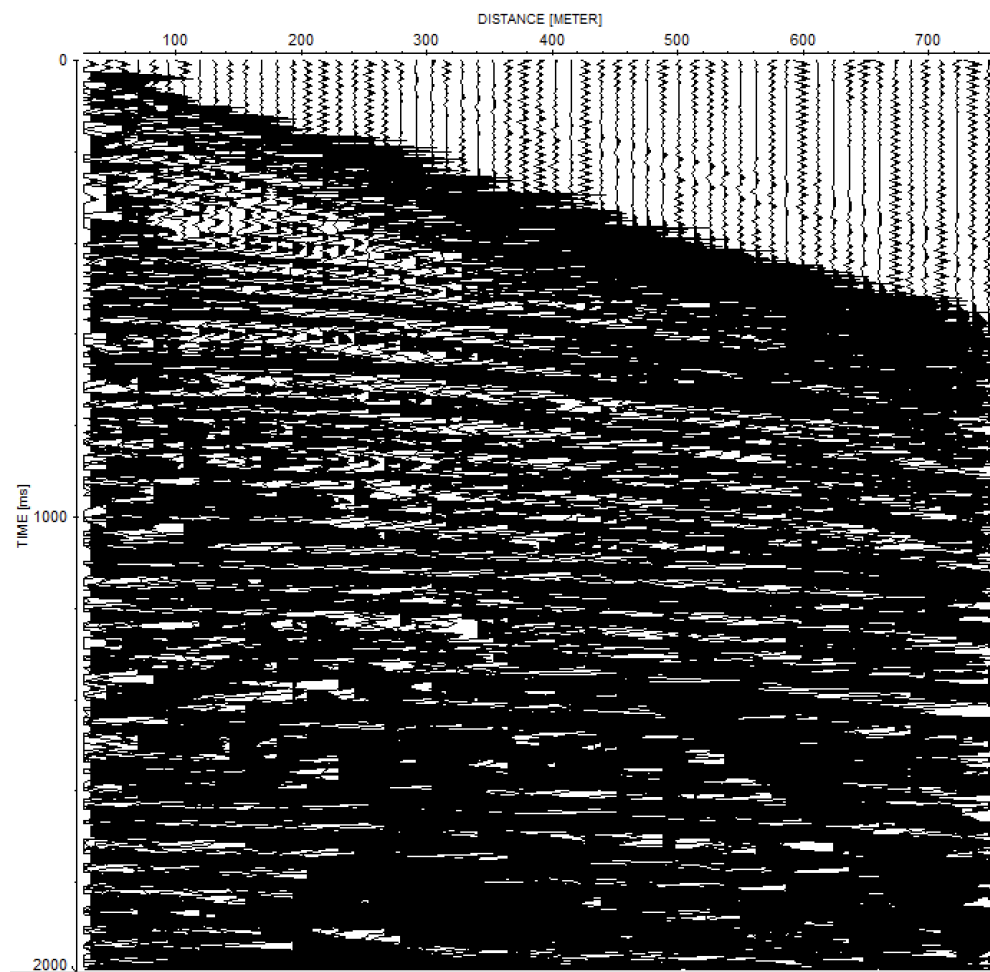
ControlPanel  
Convert to Reflex  
☐ apply processing flow  
☒ CheckExistingFiles  
☐ check data for NAN  
☒ PrimaryFile  
☐ SecondaryFile  
Exit  
Help



# Raw Data

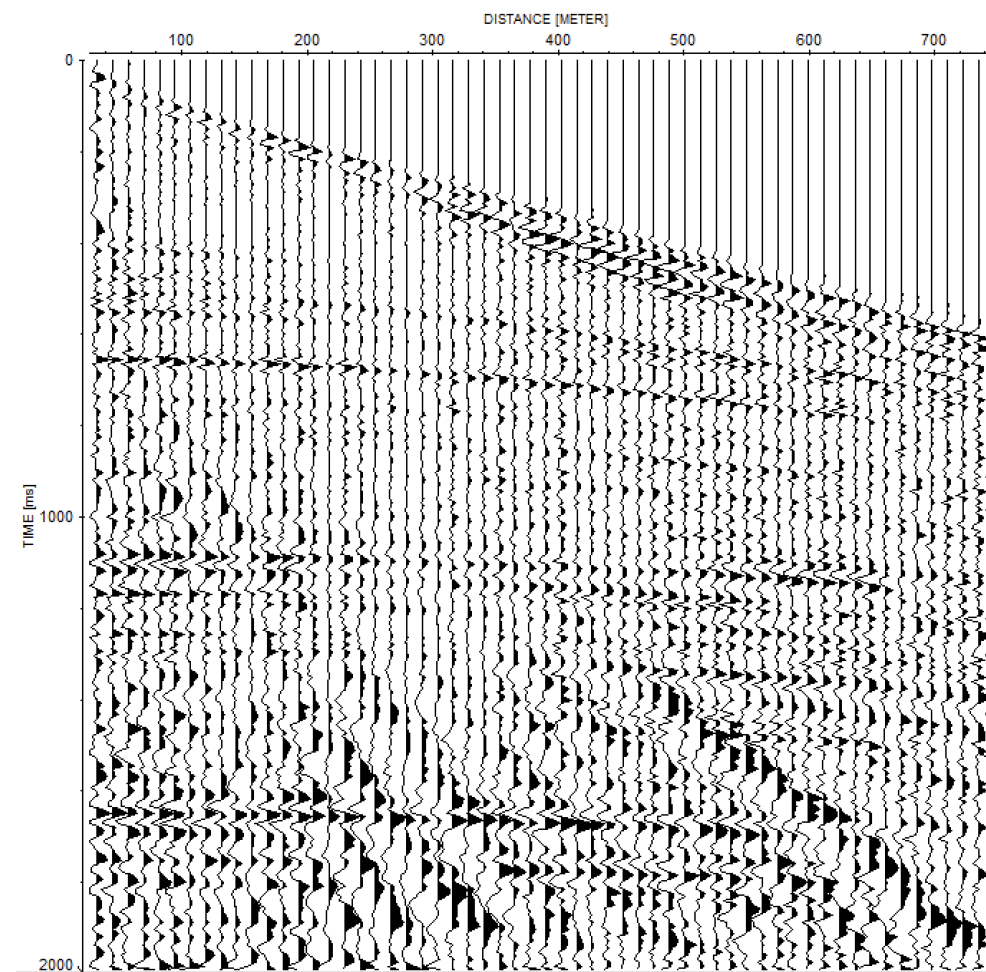
Wigglemode

without trace normalization



Wigglemode

with trace normalization

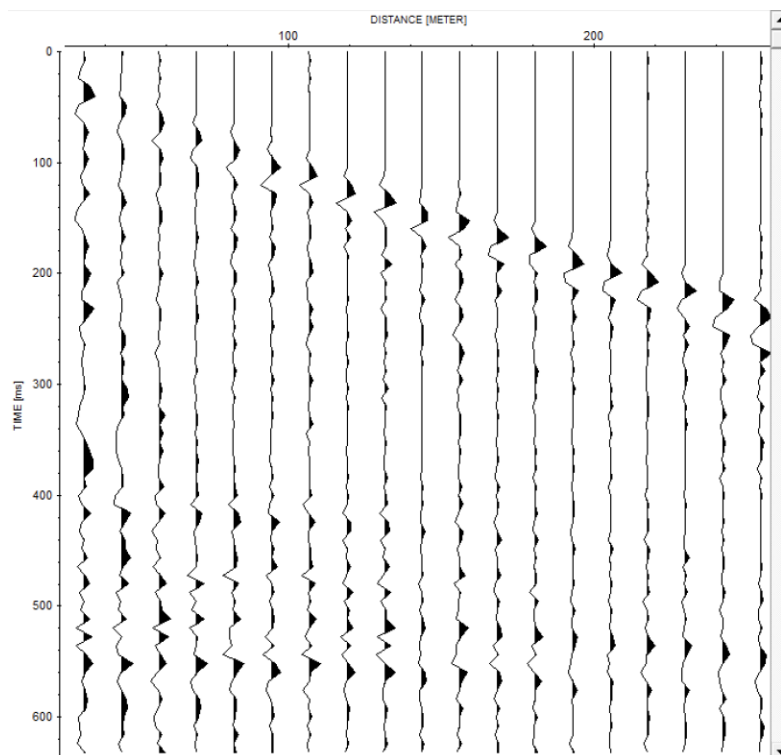




# Resampling at 1 ms

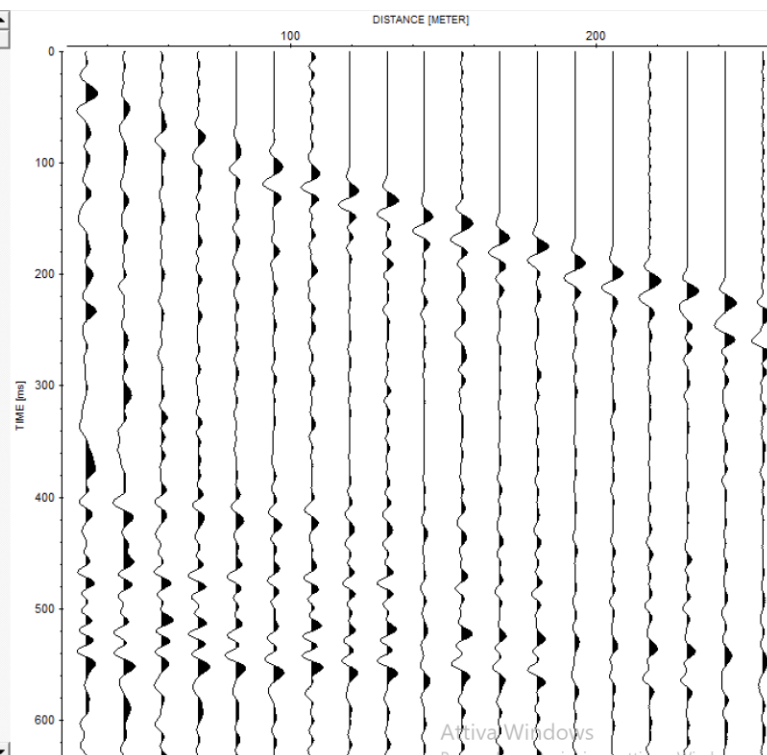
Sampling interval at 8ms:

Zoomed section



Sampling interval at 1ms:

Zoomed section



1D-Filter

filter specification

- ☐ meanfilter
- ☐ medianfilter
- ☐ bandpassfrequency
- ☐ bandpassbutterworth
- ☐ filter/timedependent
- ☐ notchfilter/frequ.
- ☐ spectrum spikes
- ☐ deconvolution
- ☐ deconvolution/shap.
- ☐ subtract-mean(dewow)
- ☐ subtract-DC-shift
- ☐ crosscorrelation
- ☐ autocorrelation
- ☒ resampling
- ☐ walsh bandpass
- ☐ shaping
- ☐ extract wavelet

working range

- ☐ time
- ☒ frequency

trace number: 12

original filtered

original spectrum 691.47 -34.682 ms

filtered spectrum

Filter parameter

timeincr. ms 1 0 0 0

☐ Apply on example trace

ProcessingLabel 1

☐ SequenceProc.

☐ close after processing

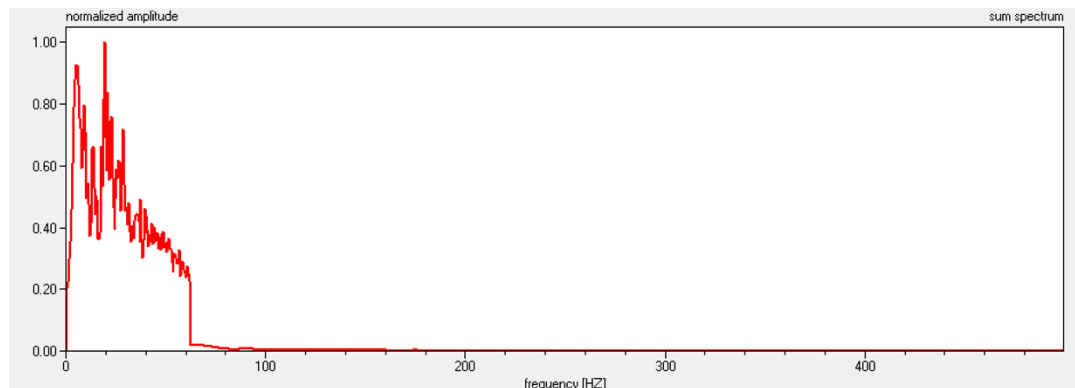
Start Close



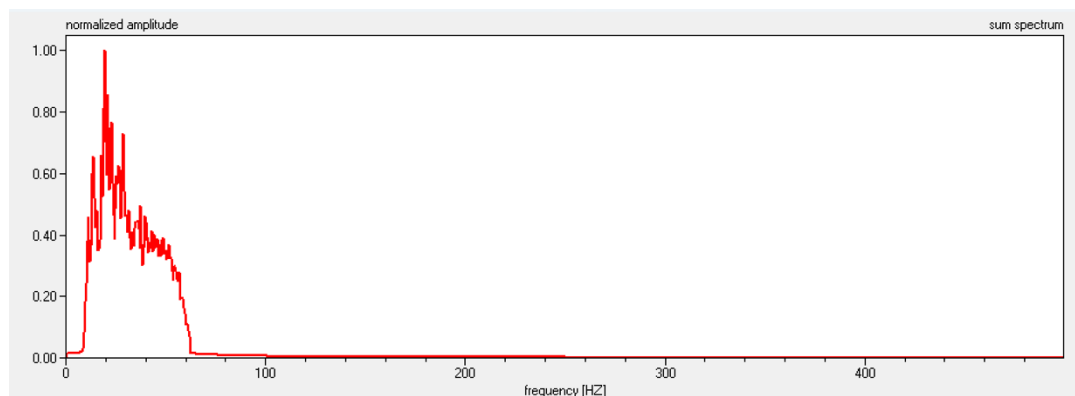
# Passband Filter

We filter the data to remove the low frequency components (lower than 10Hz) because are mostly due to the ground roll.

## Spectrum before filtering



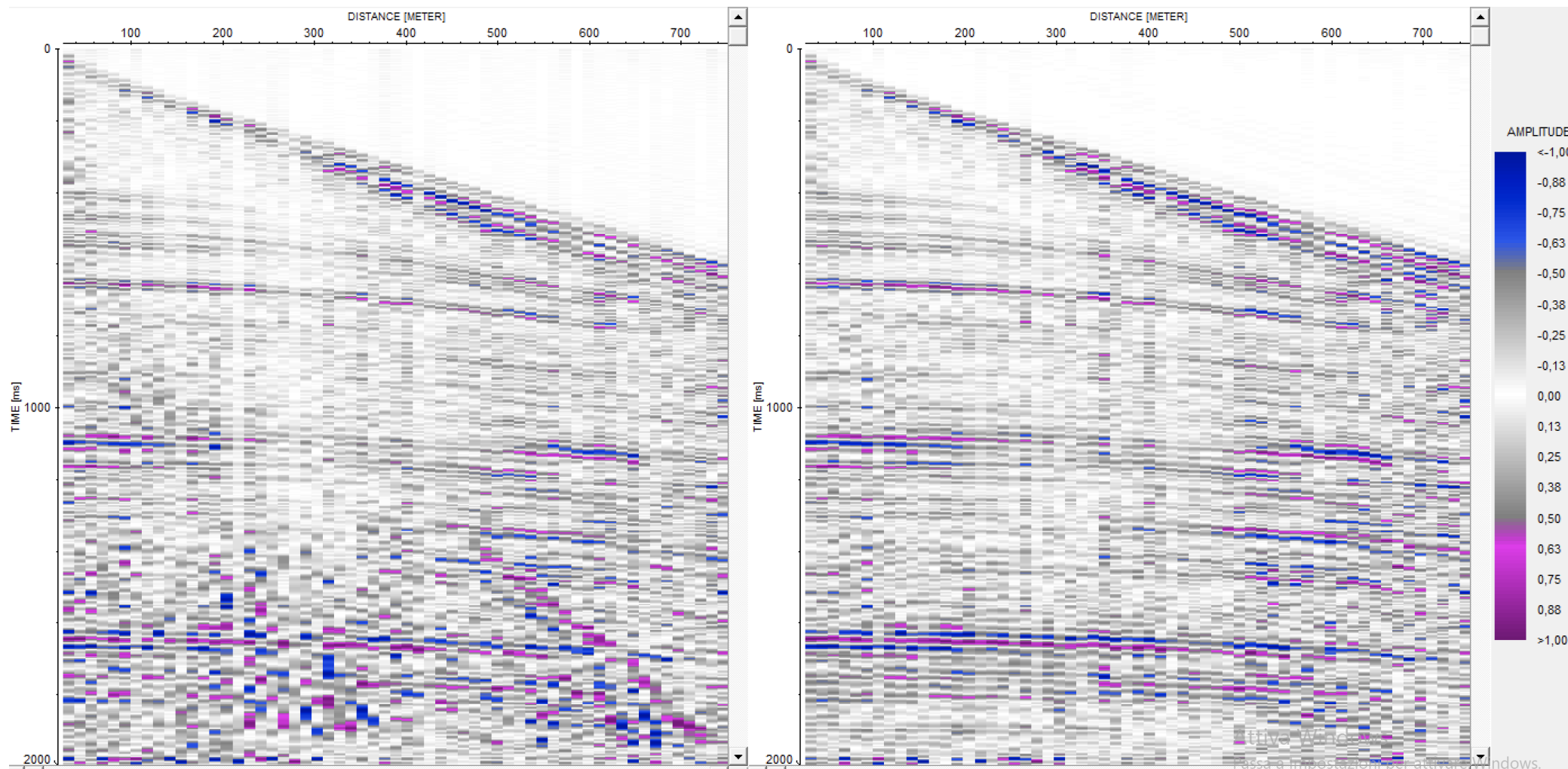
## Spectrum after filtering



The 1D-Filter software interface is shown. It includes a 'filter specification' section with radio buttons for various filters, with 'bandpassbutterworth' selected. A 'distance range' section has checkboxes for 'all traces' and '1. trace', with '1. trace' selected. A 'trace number' dropdown is set to 3. The 'Filter parameter' section has input fields for 'lower cutoff' (10), 'upper cutoff' (60), 'upper plateau' (0), and 'upper cutoff' (0). A 'ProcessingLabel' dropdown is set to 2. The 'Apply on example trace' checkbox is unchecked. The 'SequenceProc.' checkbox is unchecked. The 'close after processing' checkbox is unchecked. The 'Start' and 'Close' buttons are visible. The interface also displays 'original' and 'filtered' waveforms and their corresponding spectra.

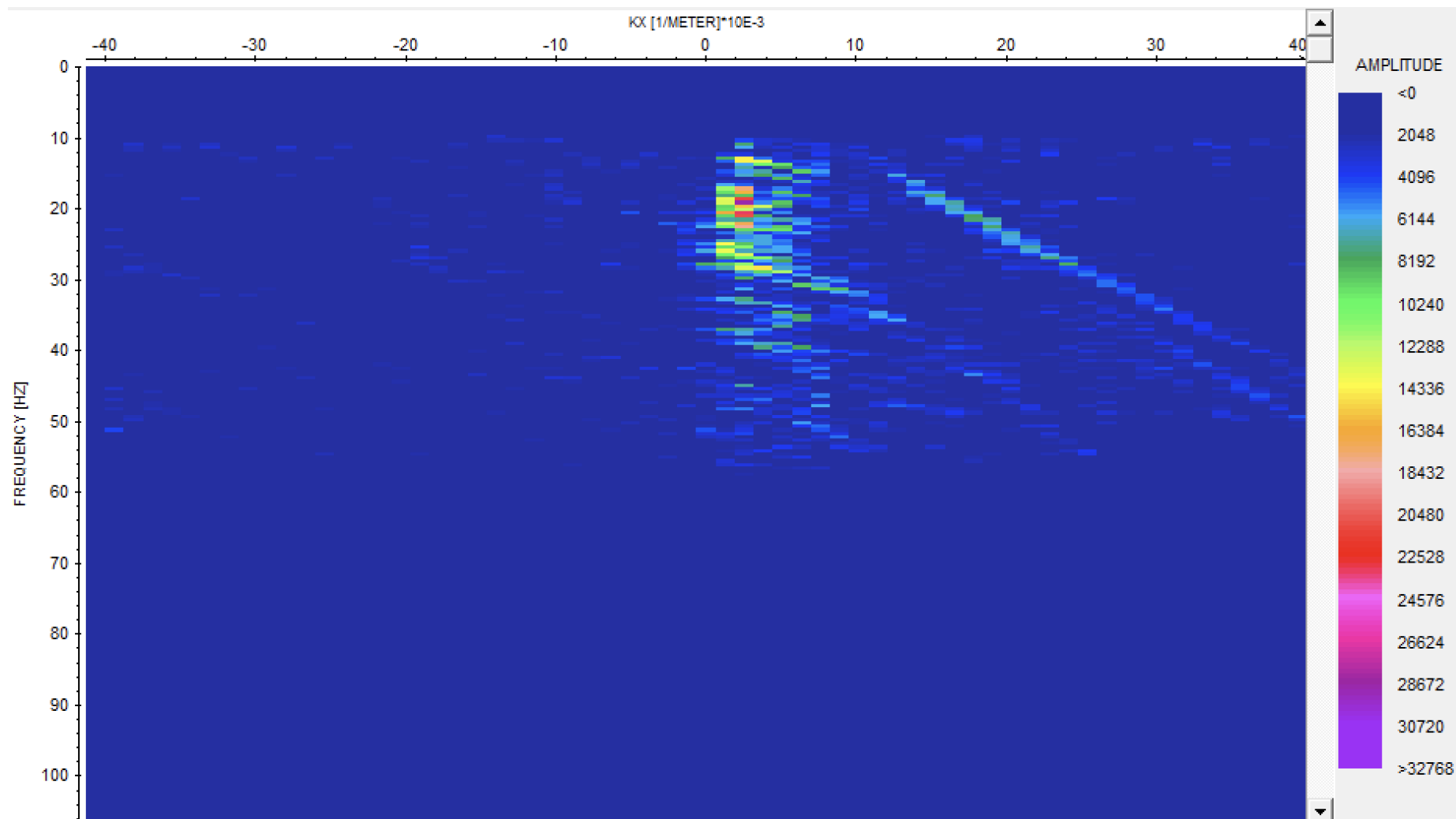


# Comparison Original vs Bandpassbutterworth





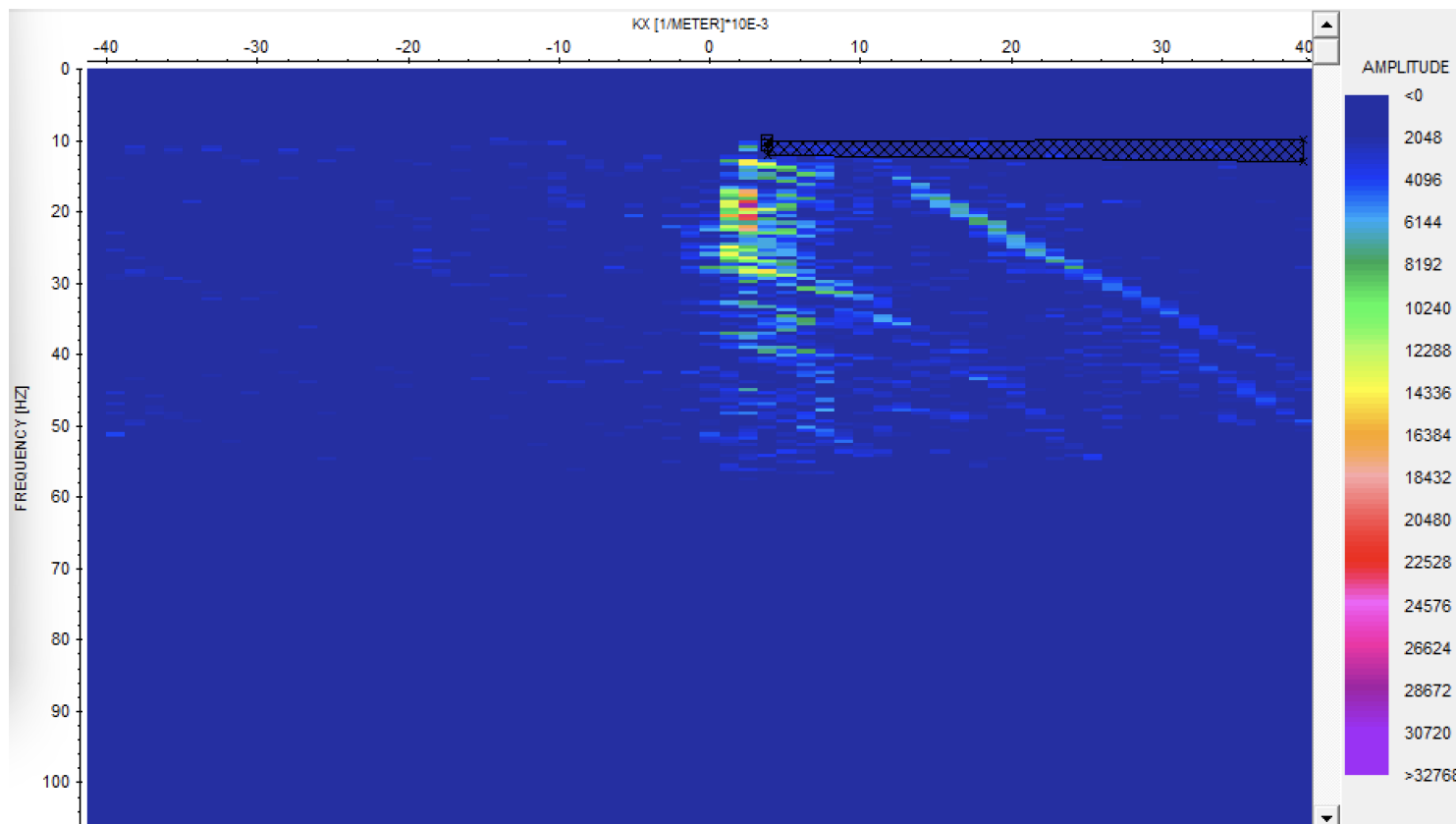
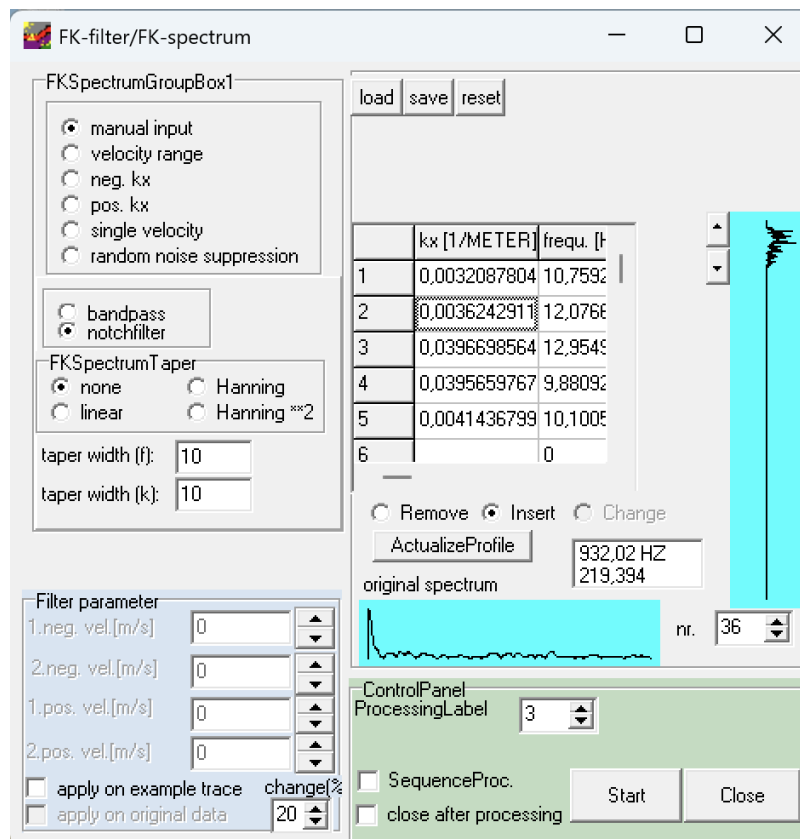
# FK Spectrum of the Original Dataset





# Ground Roll Removal

## First FK filter design:







# Aliasing Removal

## Second FK filter design:

FK-filter/FK-spectrum

load save reset

FKSpectrumGroupBox1

☒ manual input  
☐ velocity range  
☐ neg. kx  
☐ pos. kx  
☐ single velocity  
☐ random noise suppression

☐ bandpass  
☒ notchfilter

FKSpectrumTaper  
☒ none ☐ Hanning  
☐ linear ☐ Hanning \*\*2

taper width (f): 10  
taper width (k): 10

	kx [1/METER]	frequ. [Hz]
1	-0,0412508770	-0,2717
2	-0,0410647802	0,27171
3	-0,0004022197	-1,0868
4	0,0002491255	131,237
5	-0,0413439273	132,052
6		0

☐ Remove ☒ Insert ☐ Change

ActualizeProfile 0,00000  
original spectrum 204,036 HZ

nr. 1

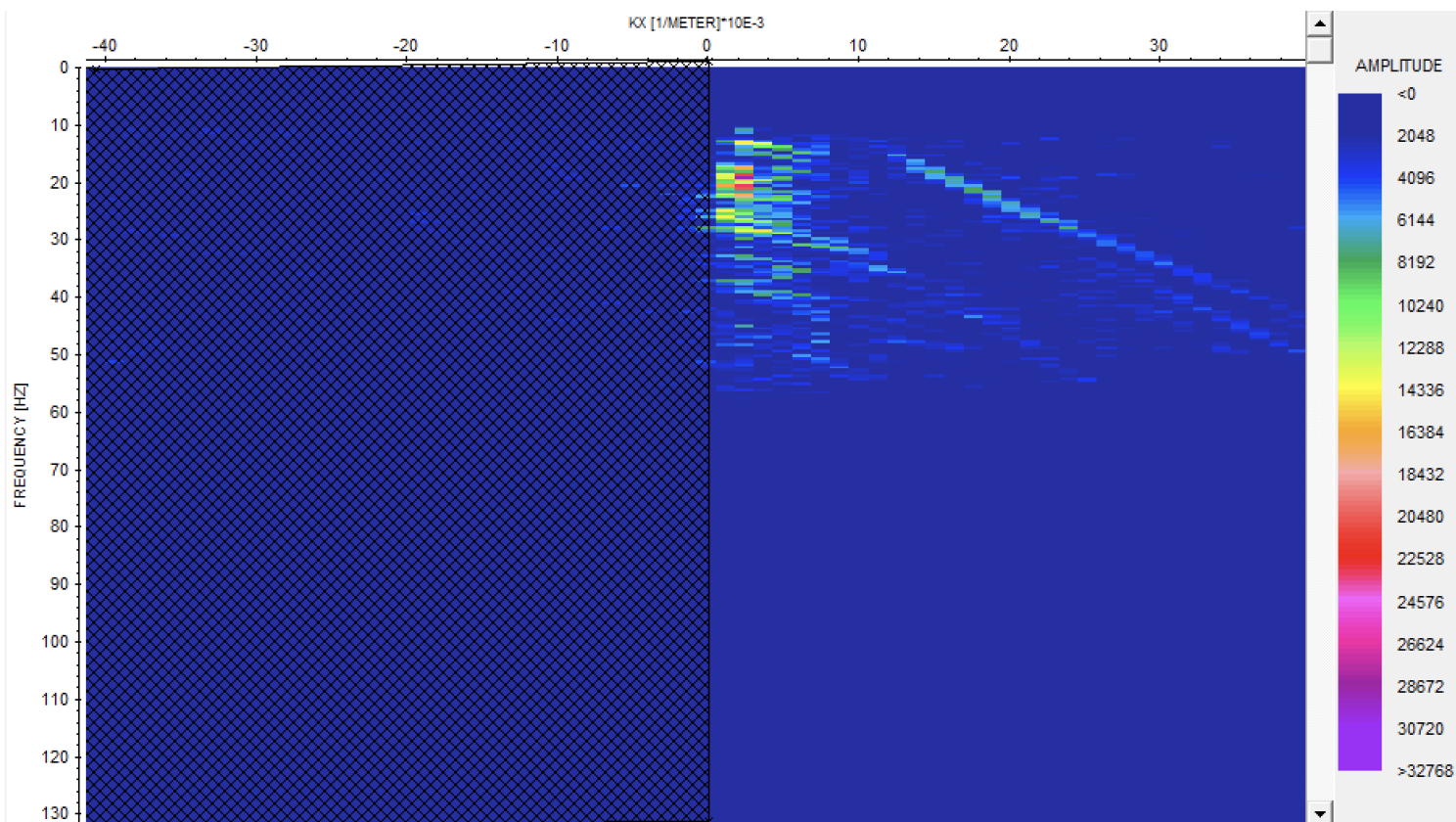
Filter parameter  
1.neg. vel.[m/s] 0  
2.neg. vel.[m/s] 0  
1.pos. vel.[m/s] 0  
2.pos. vel.[m/s] 0

☐ apply on example trace change(%)  
☐ apply on original data 20

ControlPanel  
ProcessingLabel 4

☐ SequenceProc.  
☐ close after processing

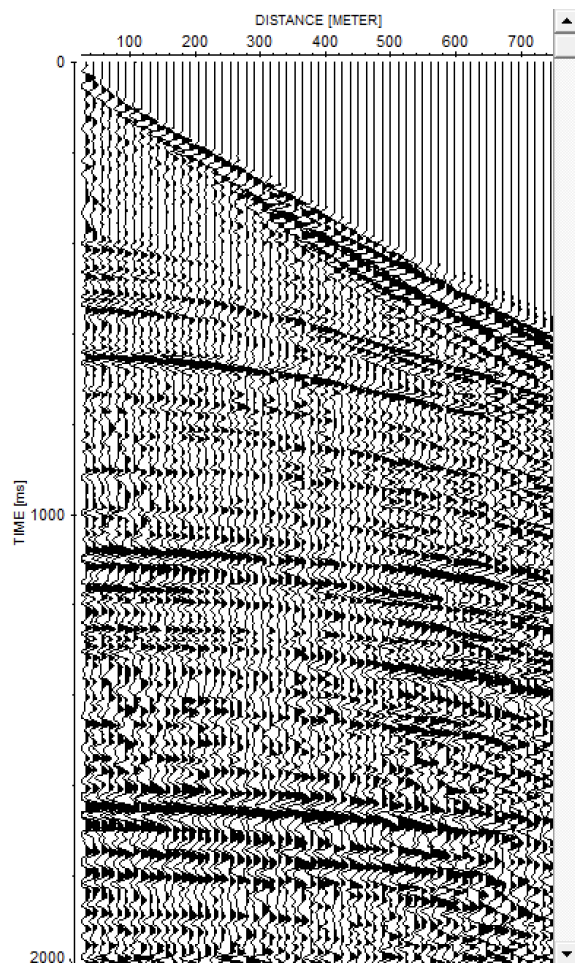
Start Close





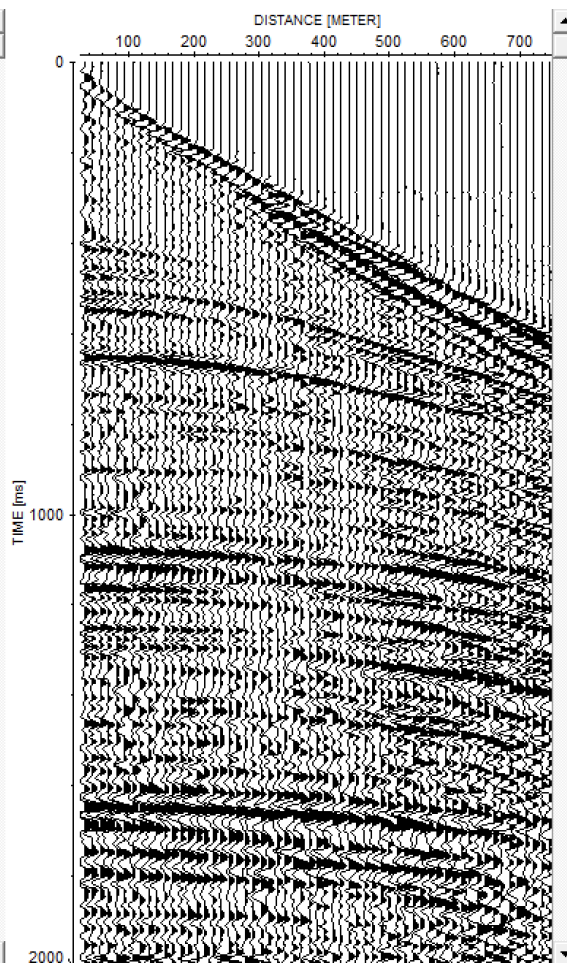
# Comparison Before and After FK Filters

Before FK filters



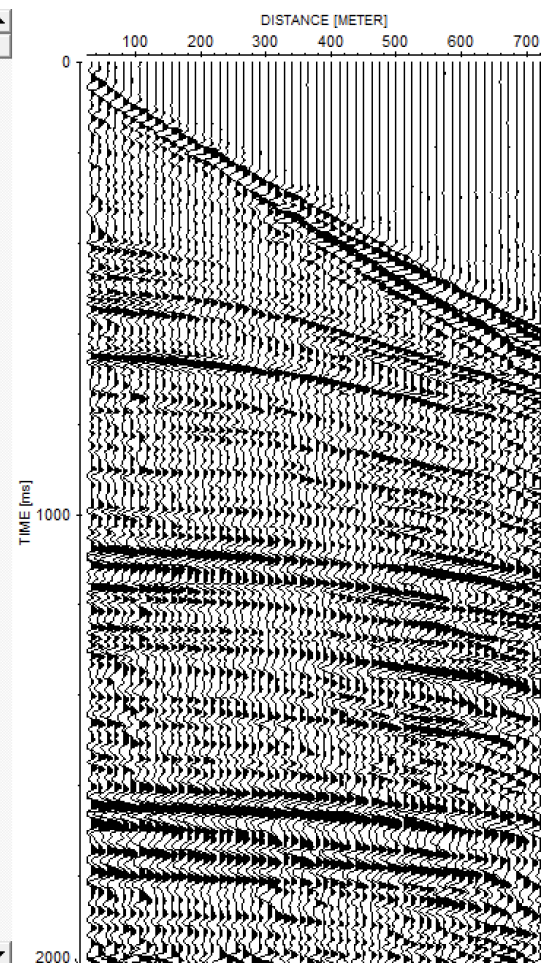
After Ground Roll removal

First FK filter



After Aliasing removal

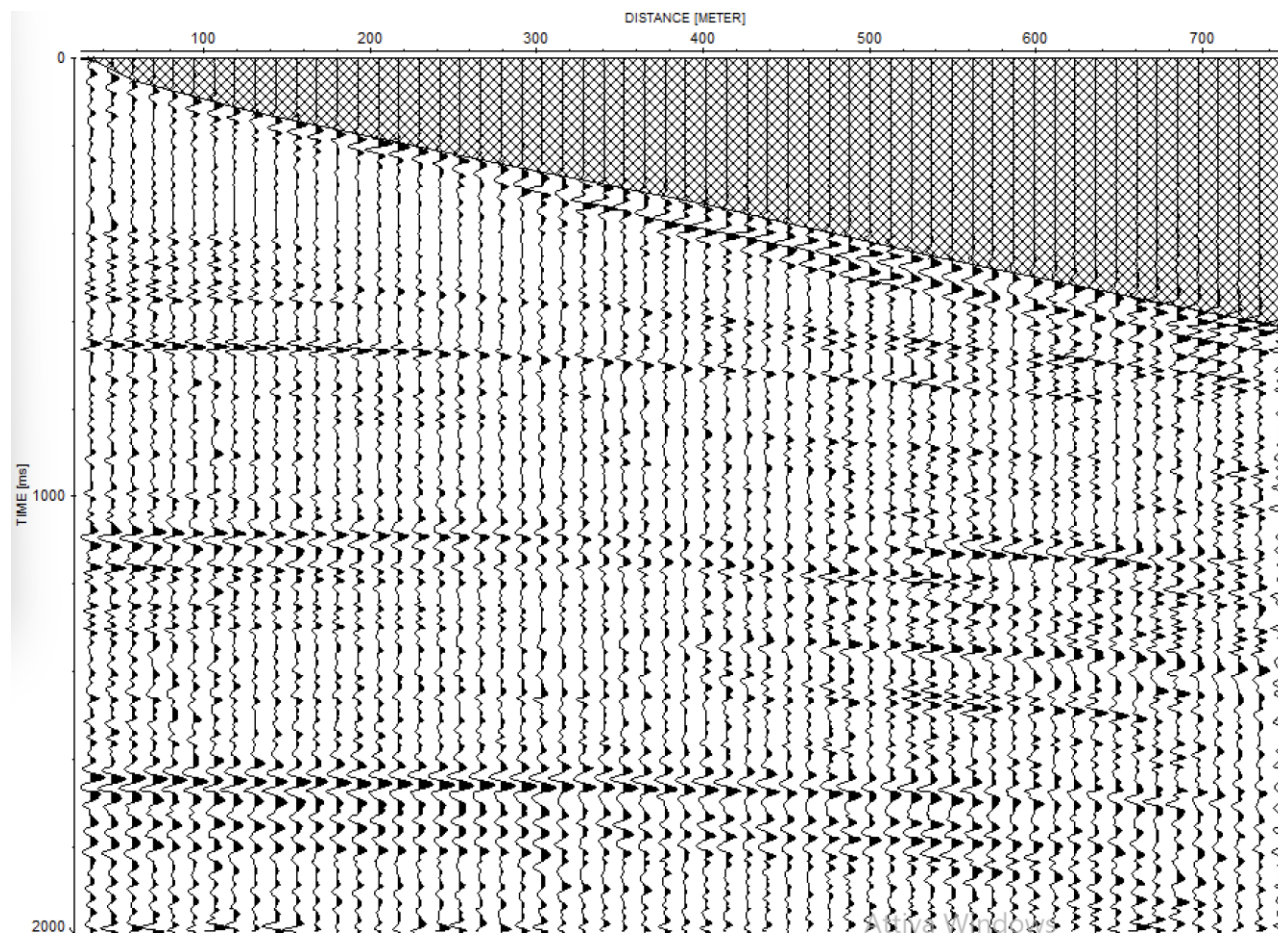
Second FK filter





# Muting

## Muting curve design:



StaticCorrection/muting

Static corrections/muting

- ☐ static correction
- ☐ dynamic correction
- ☐ move starttime
- ☒ muting
- ☐ surgical muting
- ☐ time cut
- ☐ correct max. phase
- ☐ corr.max.phase/wrap
- ☐ correct picked phase
- ☐ correct for 2 layers
- ☐ correct 3D topography
- ☐ suppress multiples

MutingGroupBox

- ☒ mute data above muting curve
- ☐ mute data below muting curve

Filter parameter

taper window [ms] 0

muting window [ms] 2000

0

0

☐ apply on example trace change(%) 20

☐ apply on original data

load save reset

load pick data

apply on whole line

	dist.[METER]	time [ms]
1	28,51642799	3,17968
2	57,76943207	50,8744
3	130,4840546	124,006
4	277,5848694	241,653
5	402,1191101	333,863
6	536,6829224	451,510

☐ Remove ☒ Insert ☐ Change

ActualizeProfile

original spectrum

nr. 1

ControlPanel

ProcessingLabel 5

☐ SequenceProc.

☐ close after processing

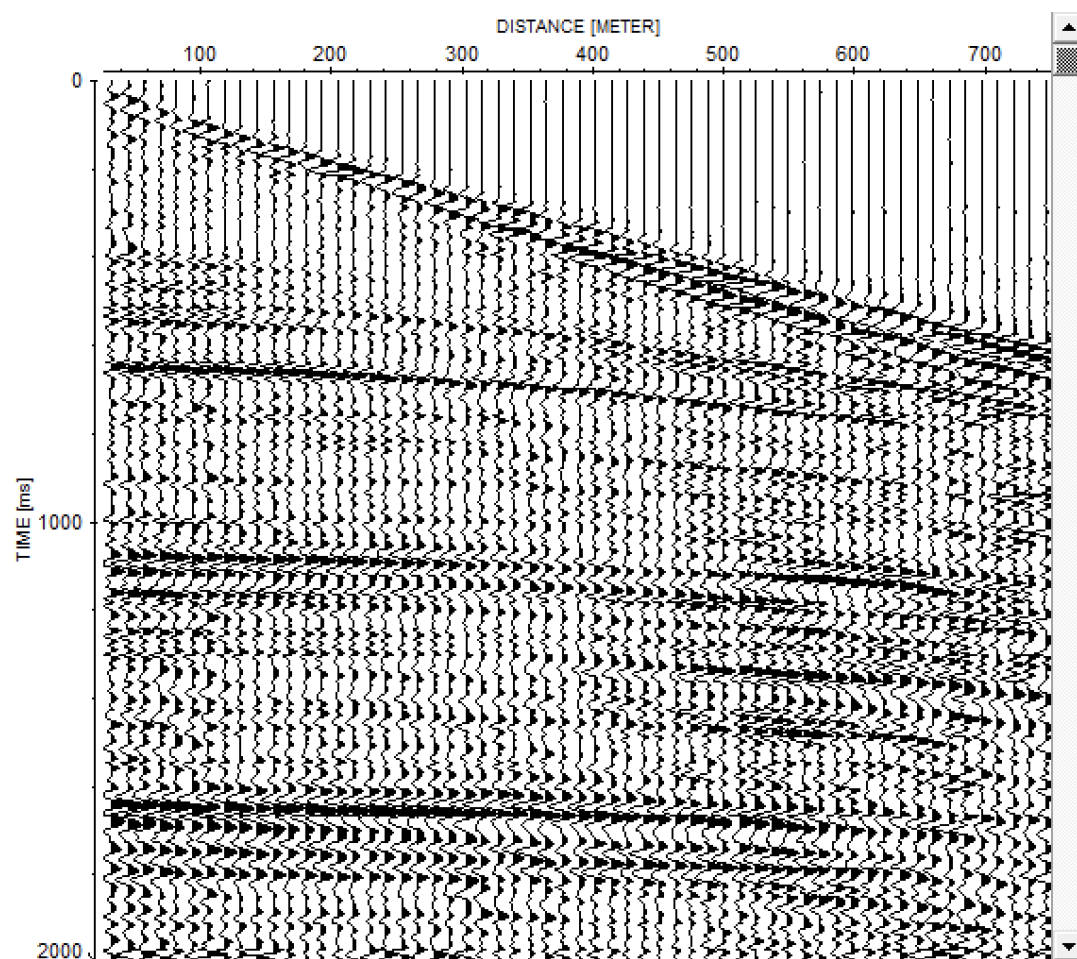
Start Close



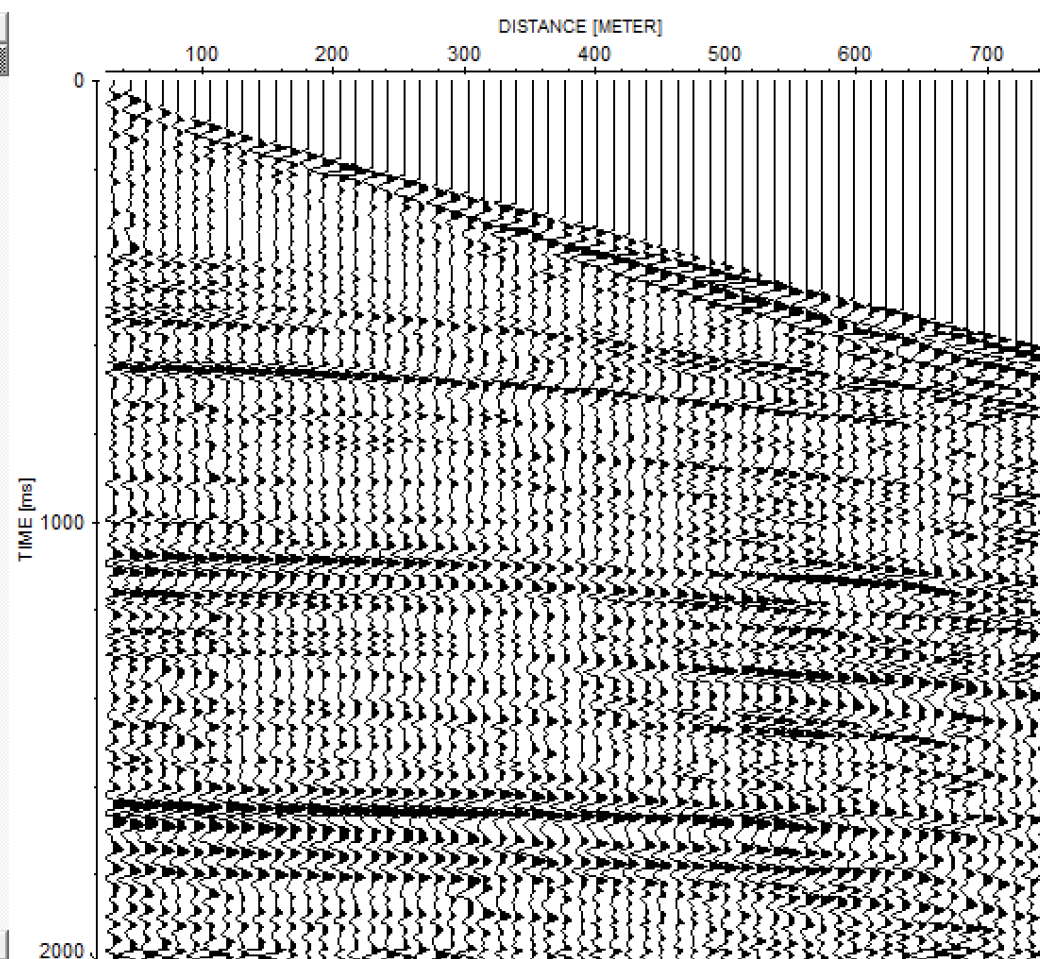


# Comparison Before and After Muting

Before Muting



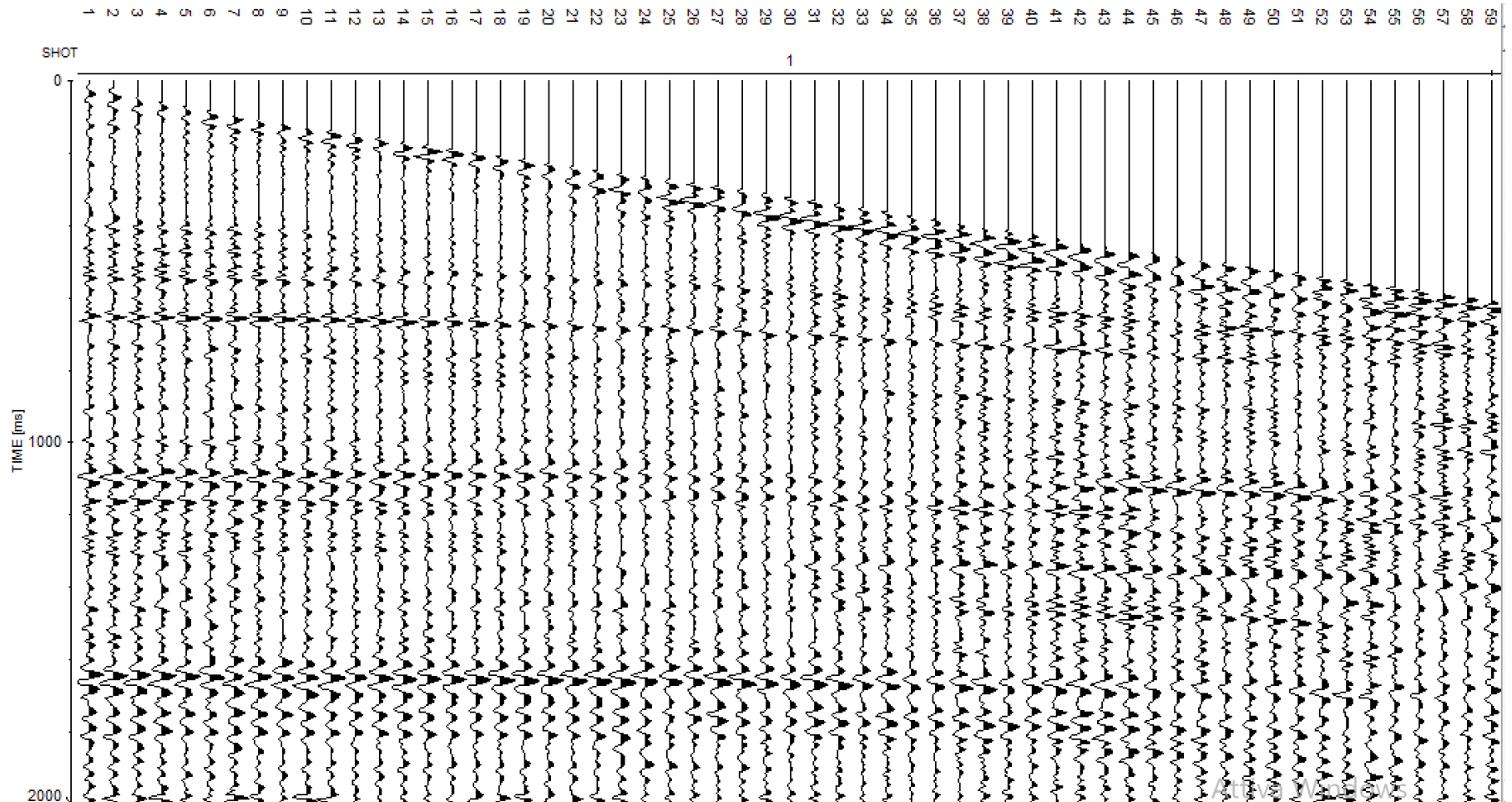
After Muting





# CMP Visualization

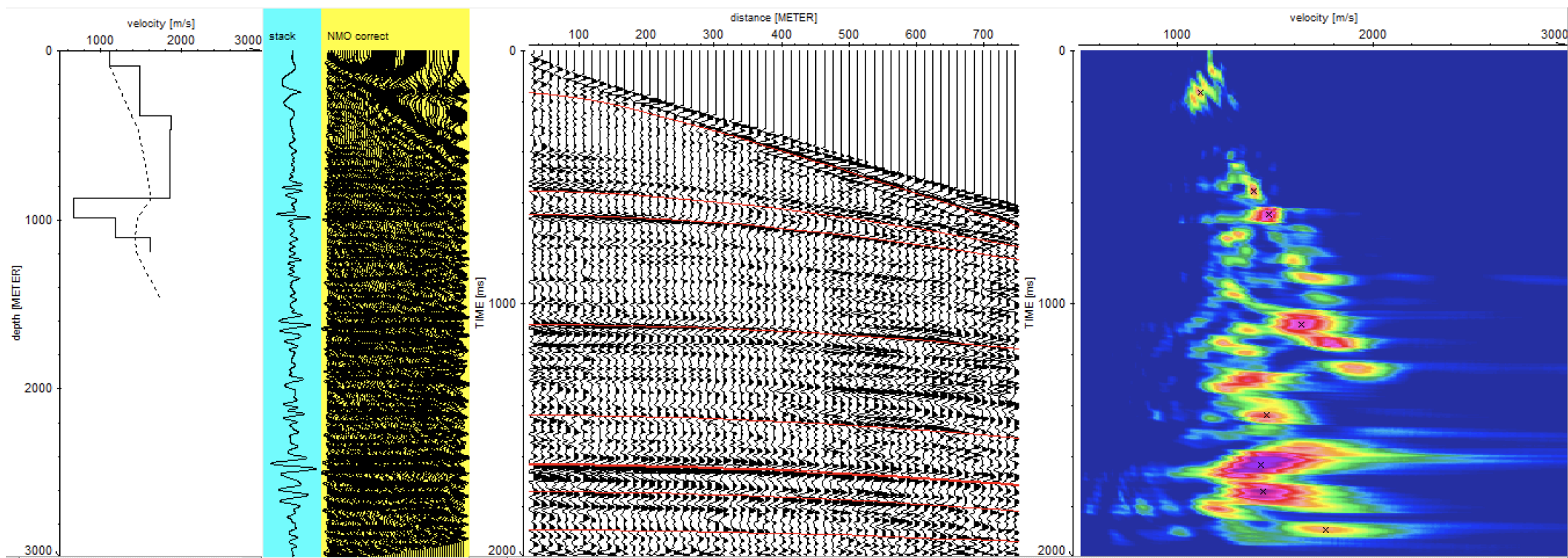
- Sorting: shot
- Second axis: offset
- Number of shots: 1
- Group interval: 12,3m
- Channels: 59



# Velocity Analysis

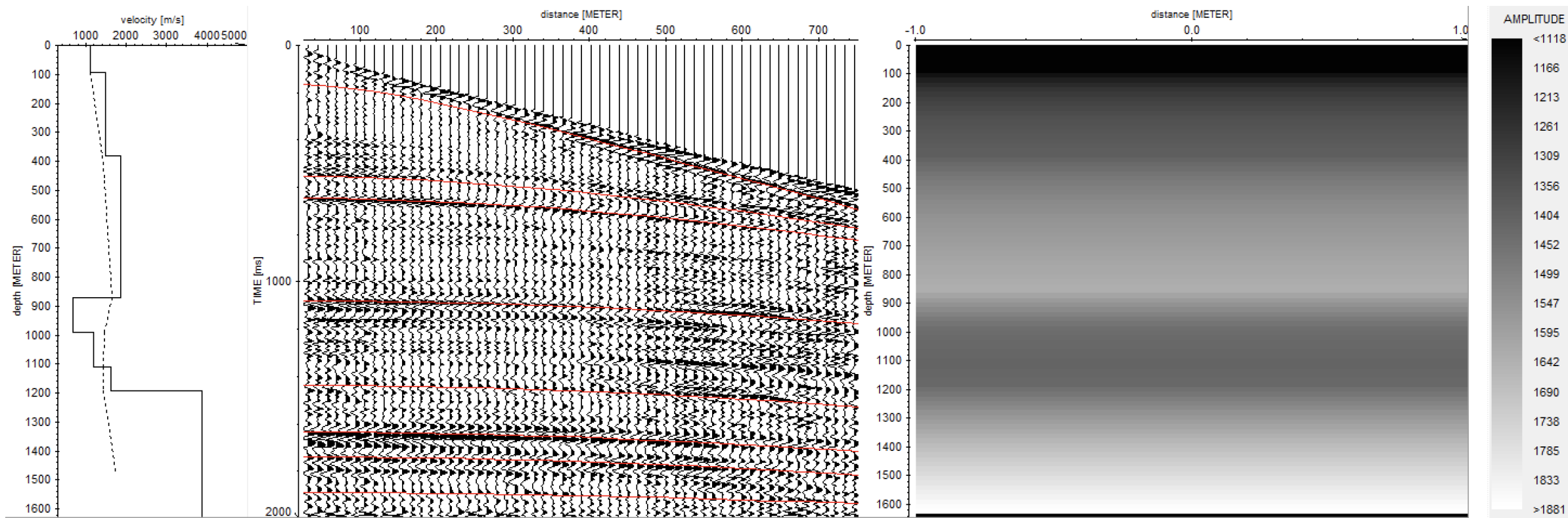
## Parameters:

- Operator: Semblance (because it is sensitive to both amplitude and waveform difference)
- Time window: 40 (comparable with the wavelet duration)
- Minimum velocity: 500 m/s
- Maximum velocity: 3000 m/s
- Velocity interval: 10 m/s





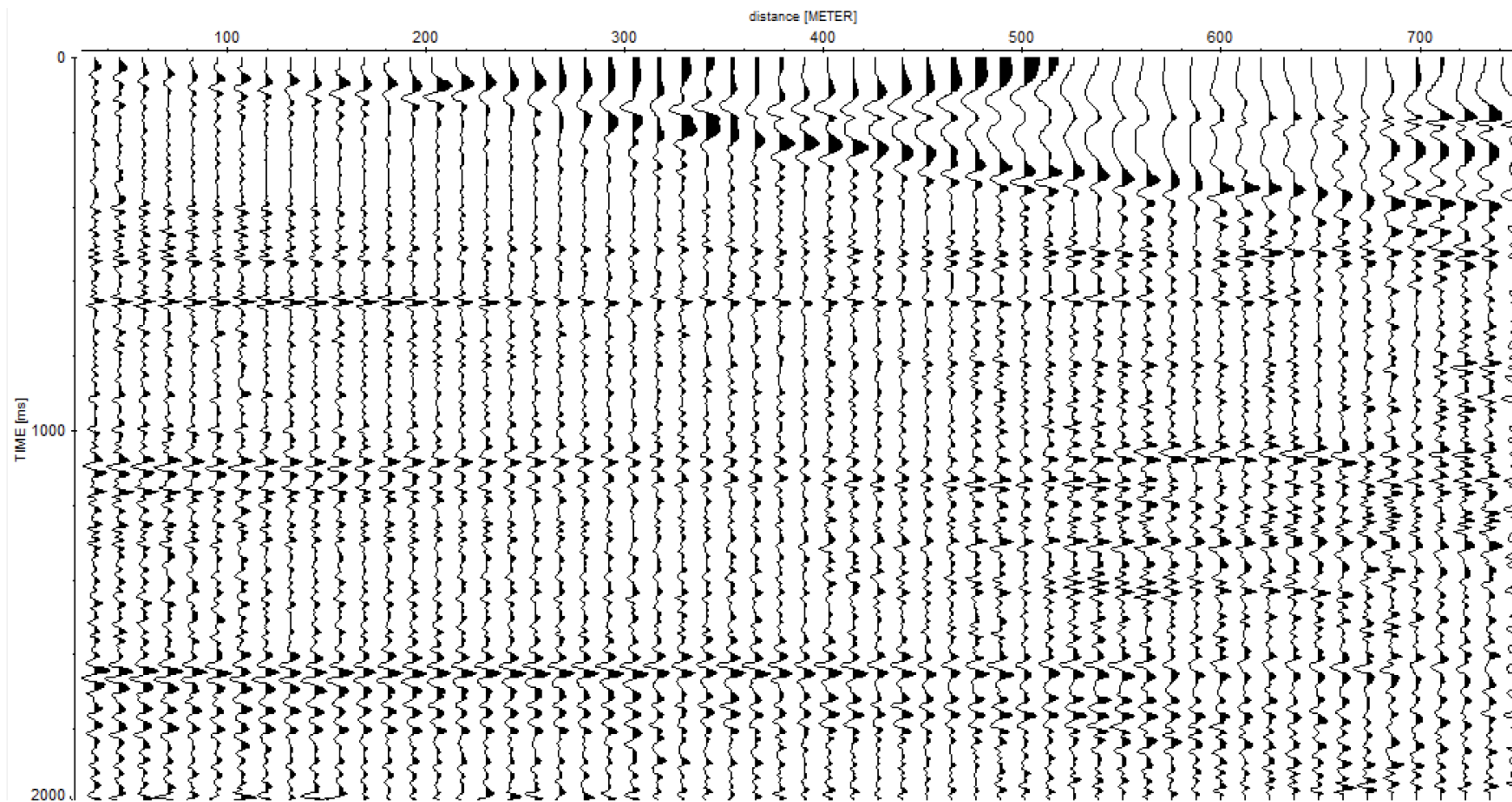
# Velocity Analysis - 2D Model





# NMO Correction

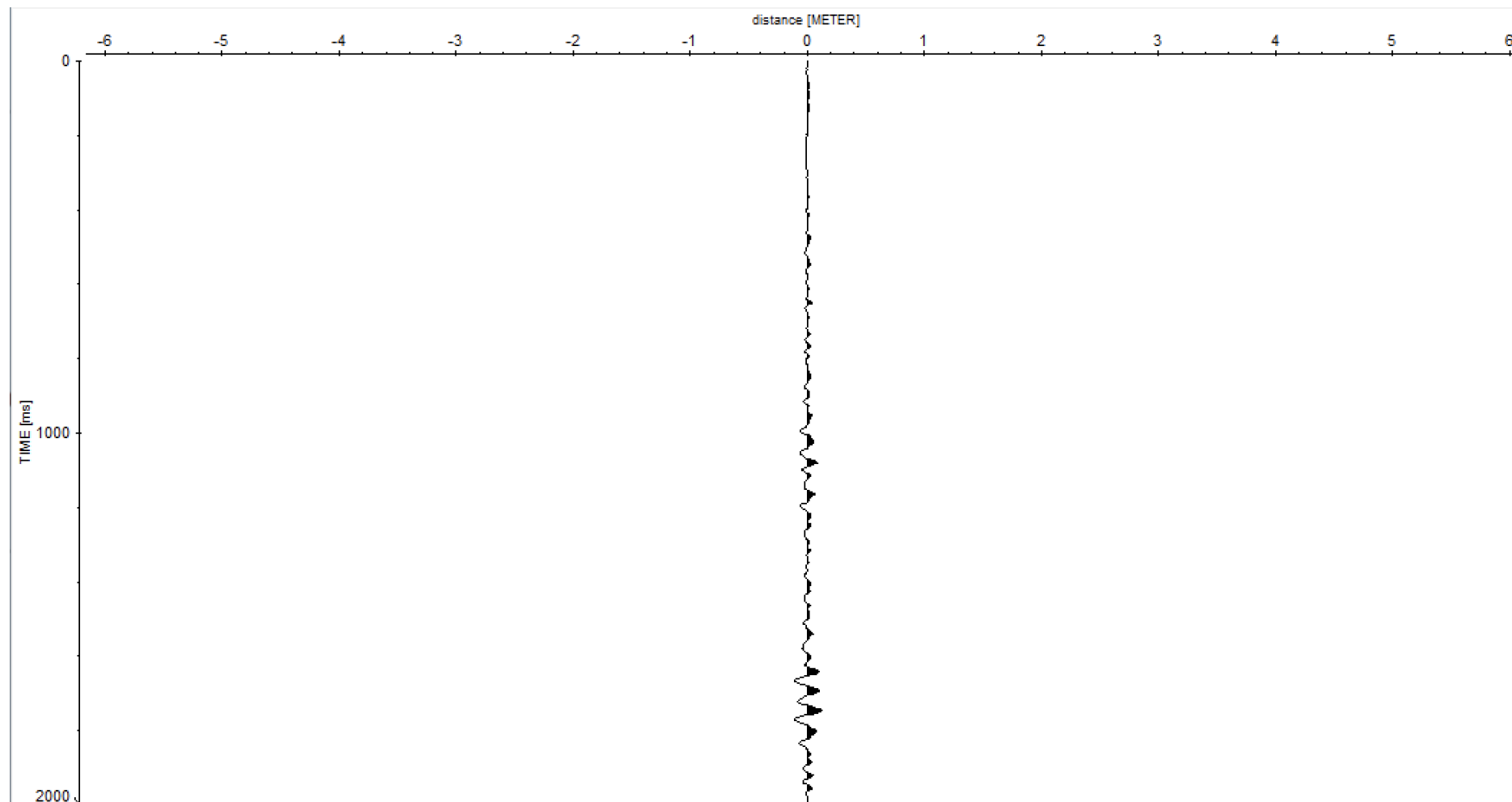
We corrected the data by applying the NMO correction using the 2D velocity model obtained at the previous step.







# Single Trace Stack

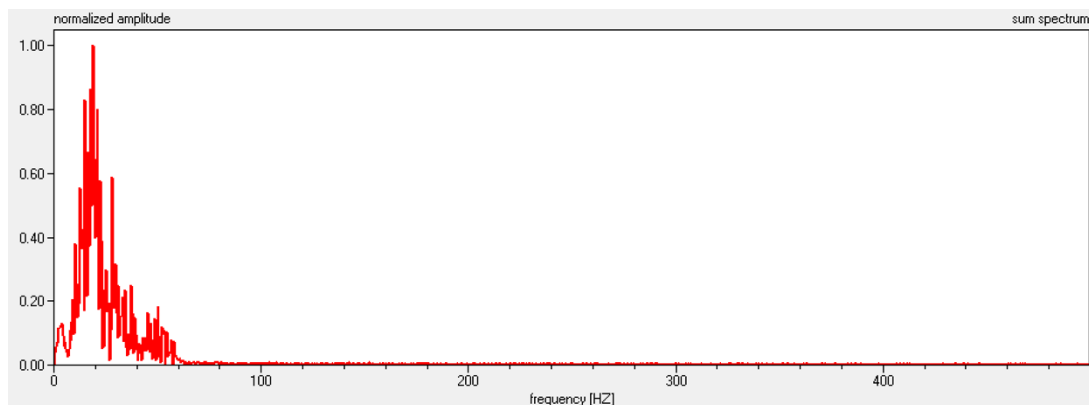




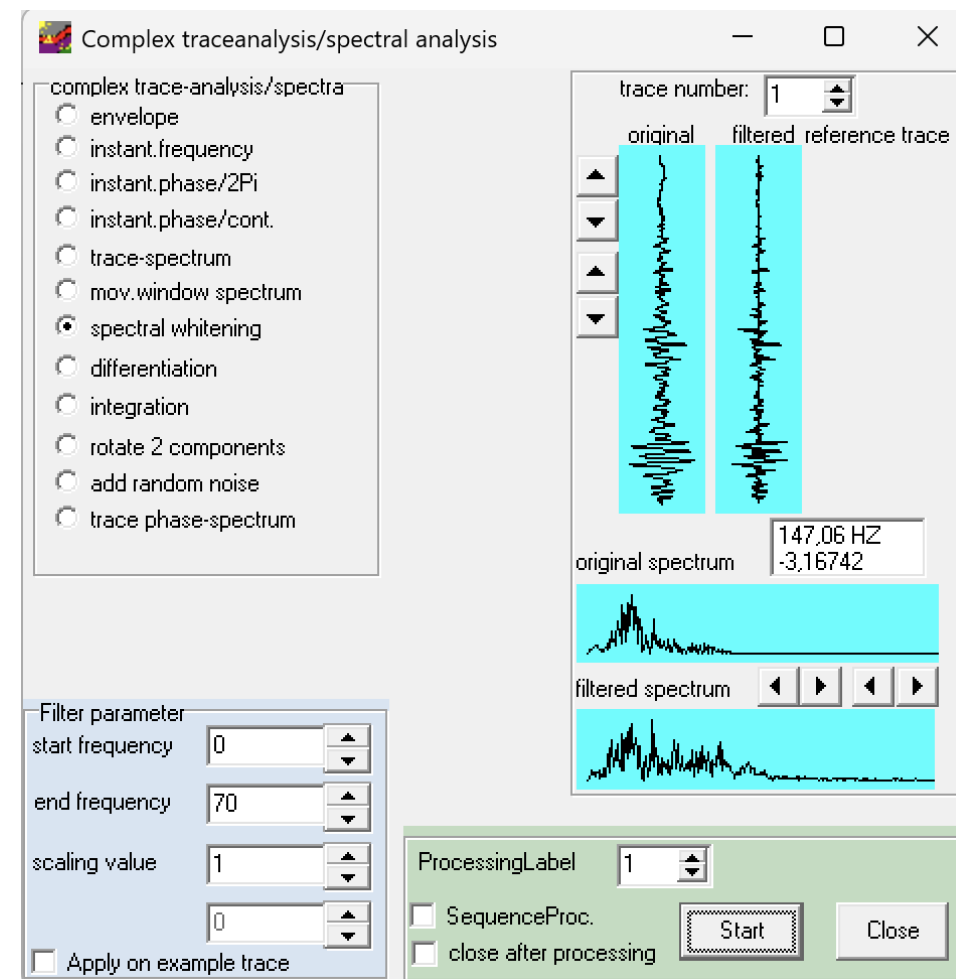
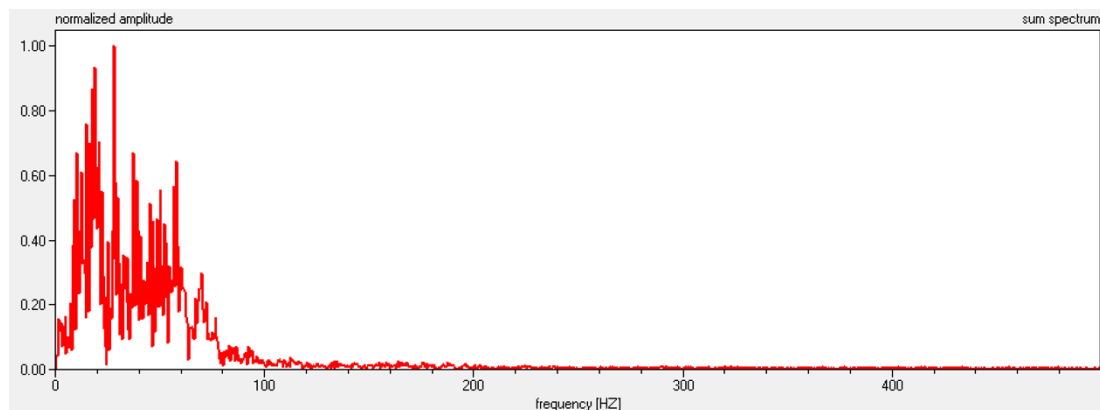
# Deconvolution

We performed deconvolution using Spectral-Whitening function, which is a zero-phase deconvolution. We noticed that the after the deconvolution spectrum is flatter as expected.

## Spectrum before deconvolution



## Spectrum after deconvolution





# Comparison Before and After Deconvolution

