Making and using cross-spread domains in 3D seismic processing

Dávid Pintér

Eötvös Loránd University, Department of Geophysics and Space Science, Budapest
(pinterdavid@gmail.com)

Meeting of Young Geoscientists 2014

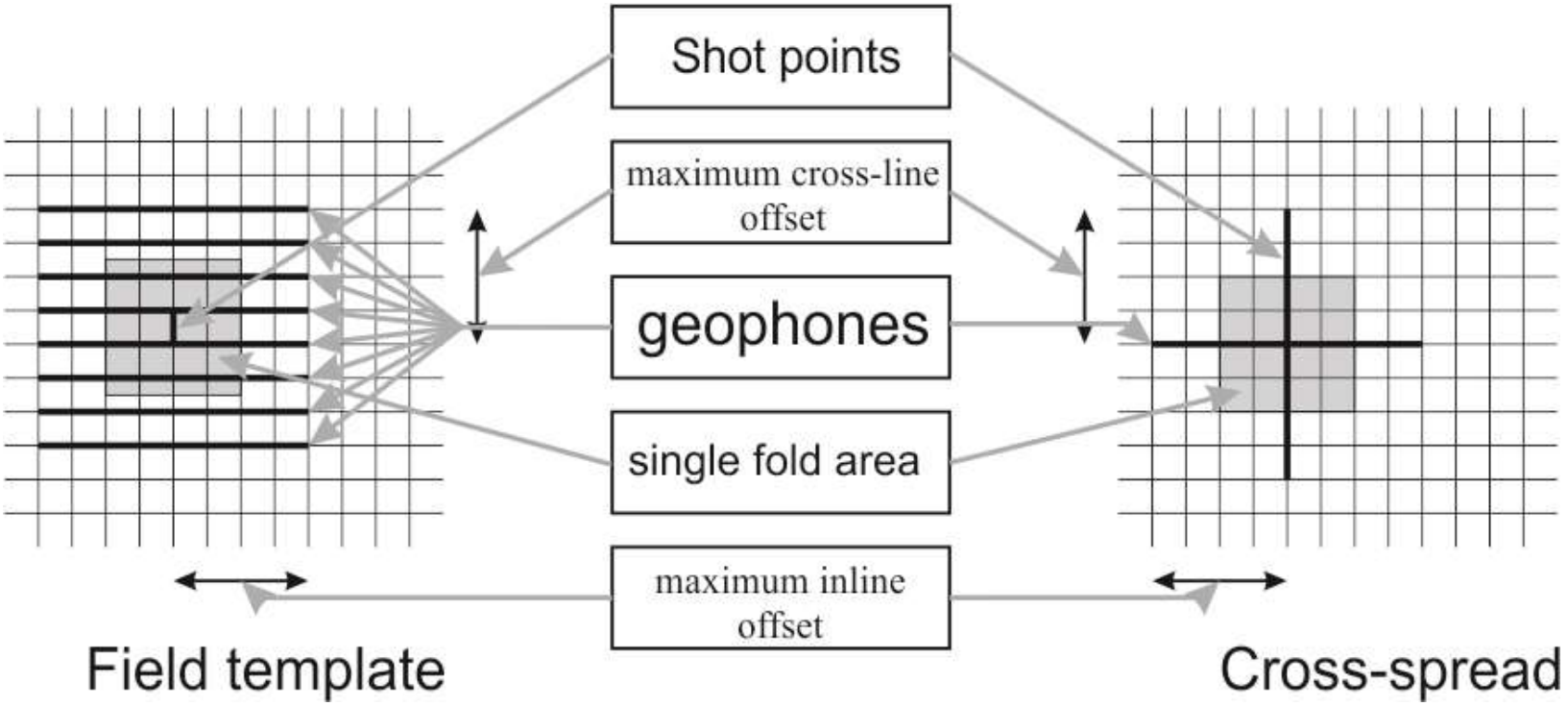
Contents

1. What is the cross-spread domain?
2. Creating cross-spreads
3. Using – FK filtering of synthetic and real data
4. Summary, conclusions

What is cross-spread domain?

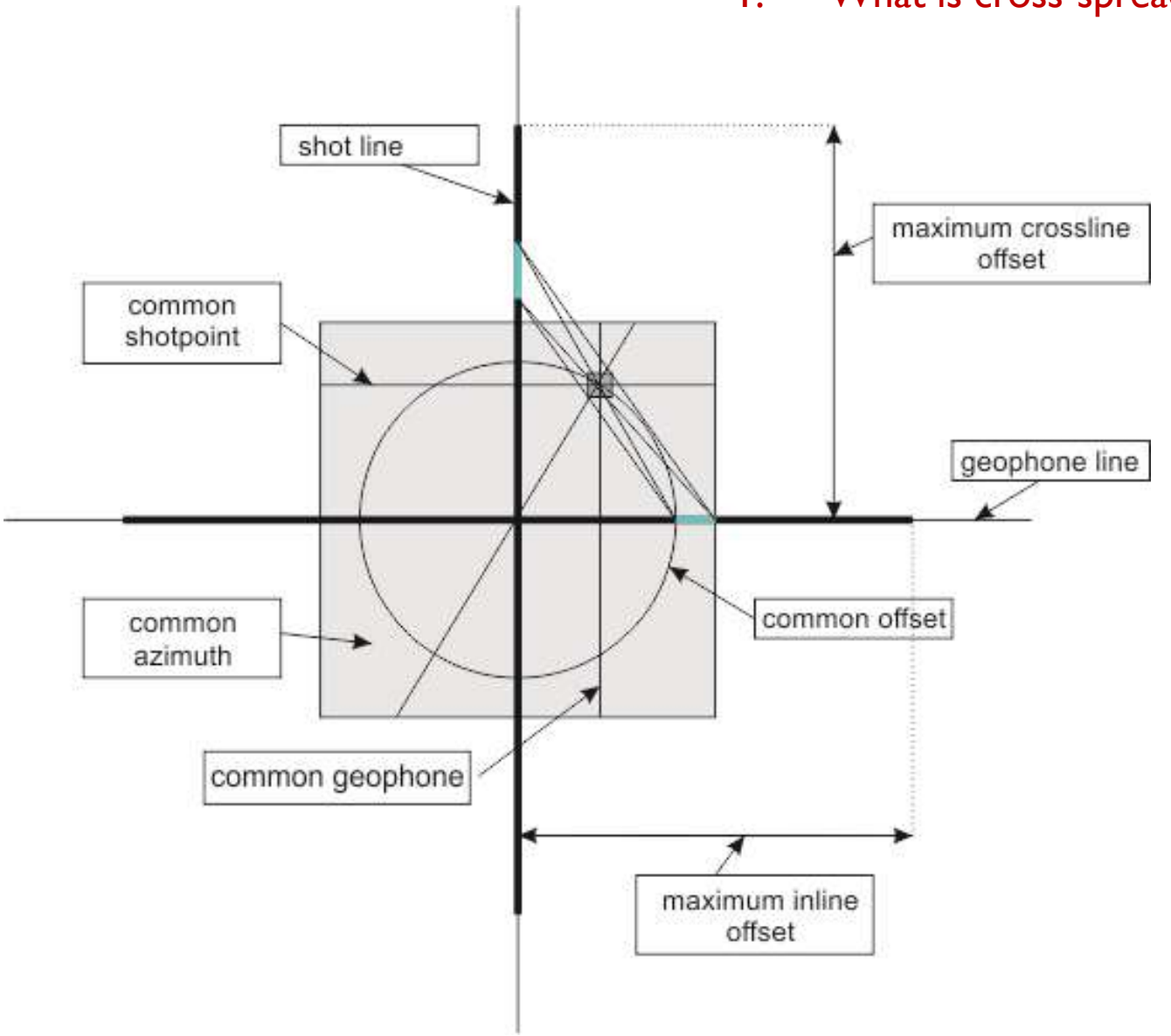
- A special sorting of seismic traces obtained by a 3D acquisition.
- The sorting does not change the traces and after processing the traces can be sorted to another domain.
- The main advantages: the attributes of the traces (azimuth, offset) change in a continuous way.

1. What is cross-spread?



Vermeer (2002)

1. What is cross-spread domain?



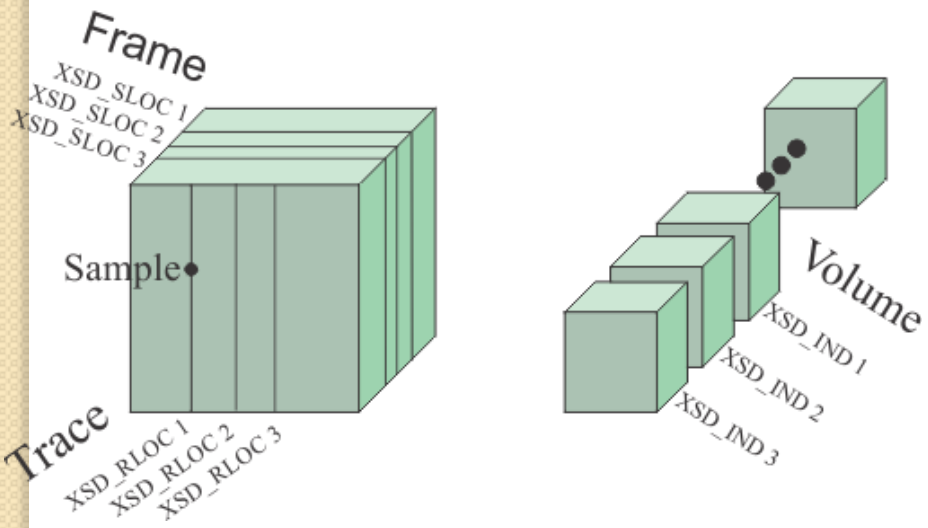
Characteristic features of the cross-spread

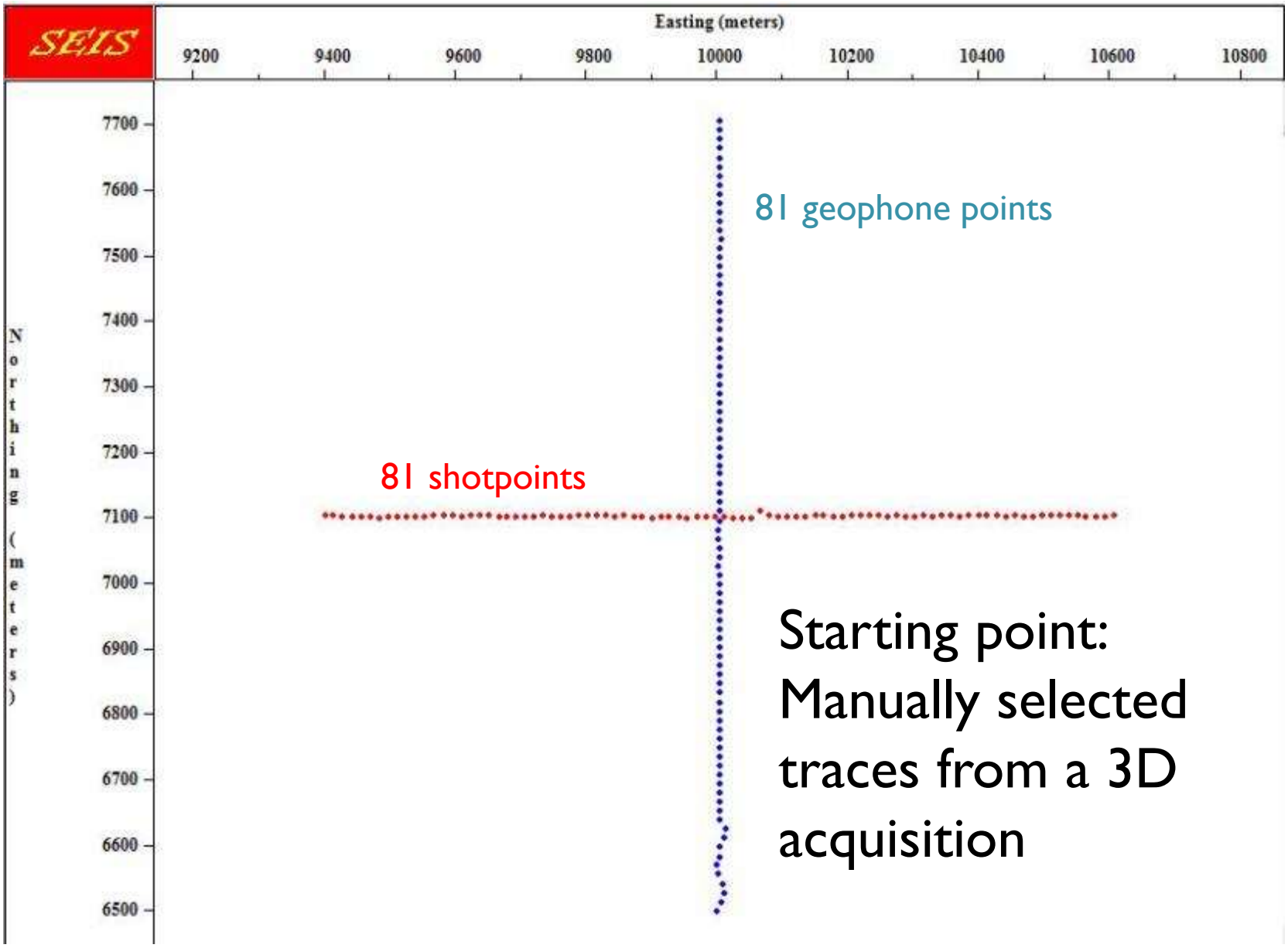
Vermeer (2002)

Workflow in PROMAX Seisworks:

3D orthogonal acquisition → Loading geometry data into the database → Creating cross-spread indexes for every traces (XSD_IND) → Producing special JavaSeis framework → Extending cross-spread attributes to trace headers

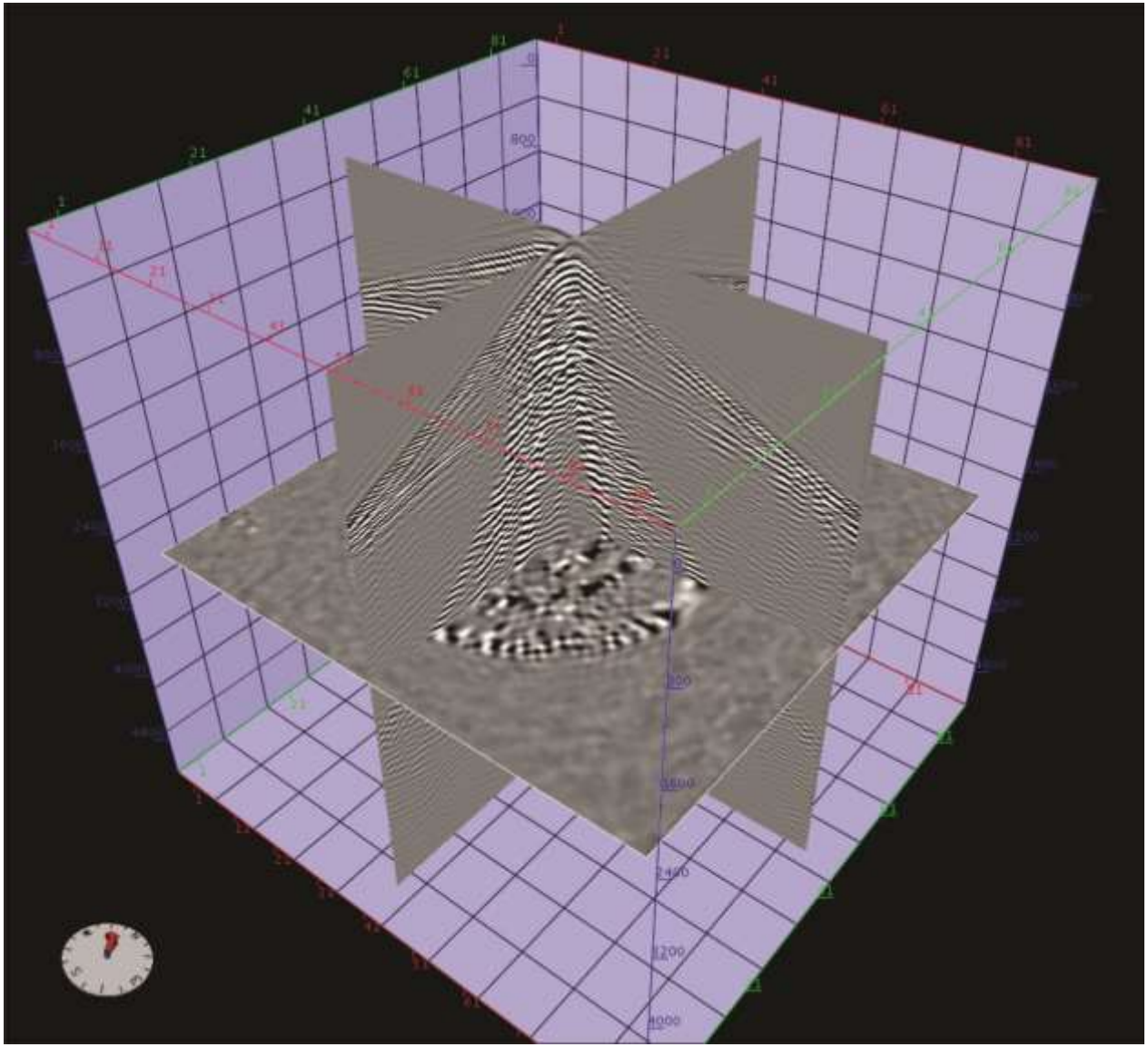
Sorting into cross-spread:

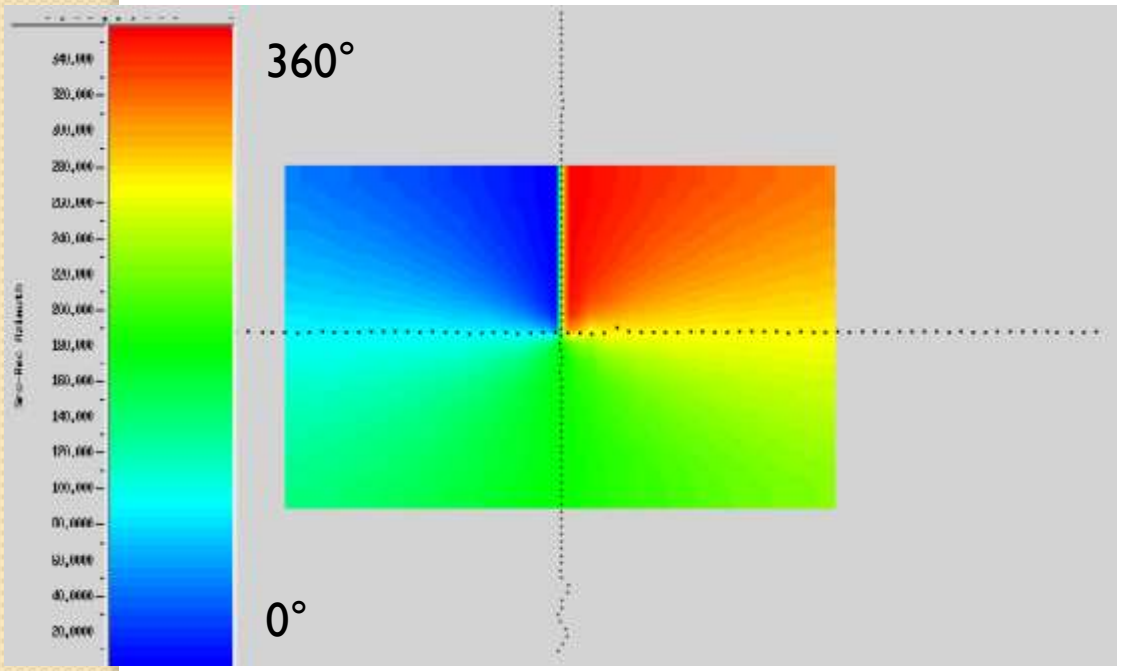


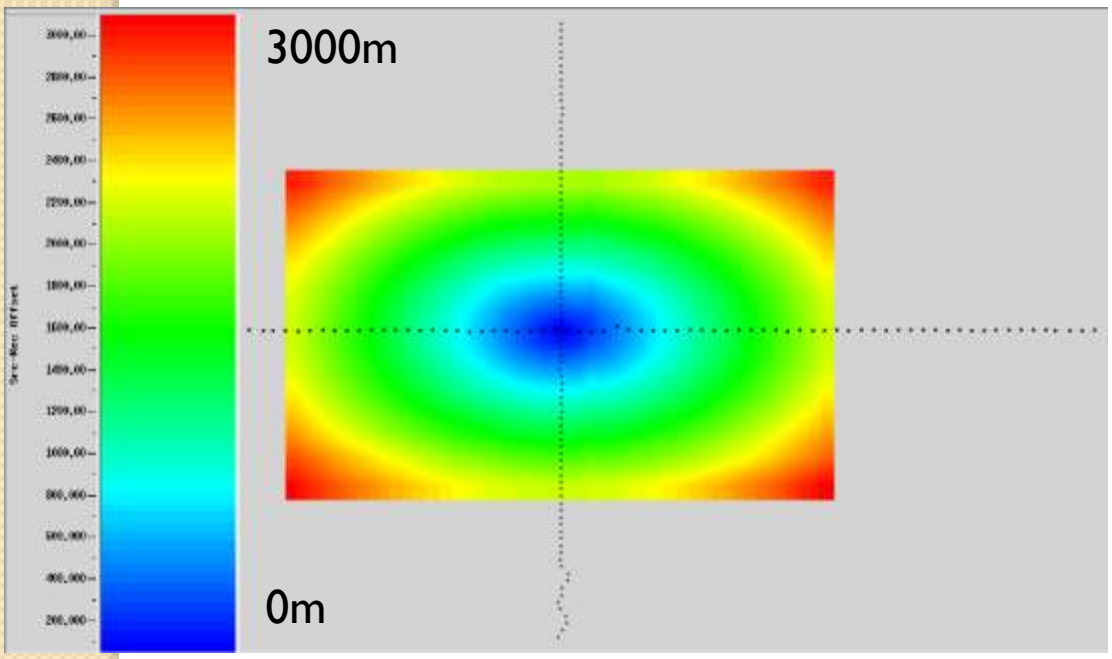


Starting point: Manually selected traces from a 3D acquisition

3D volume of the selected traces:



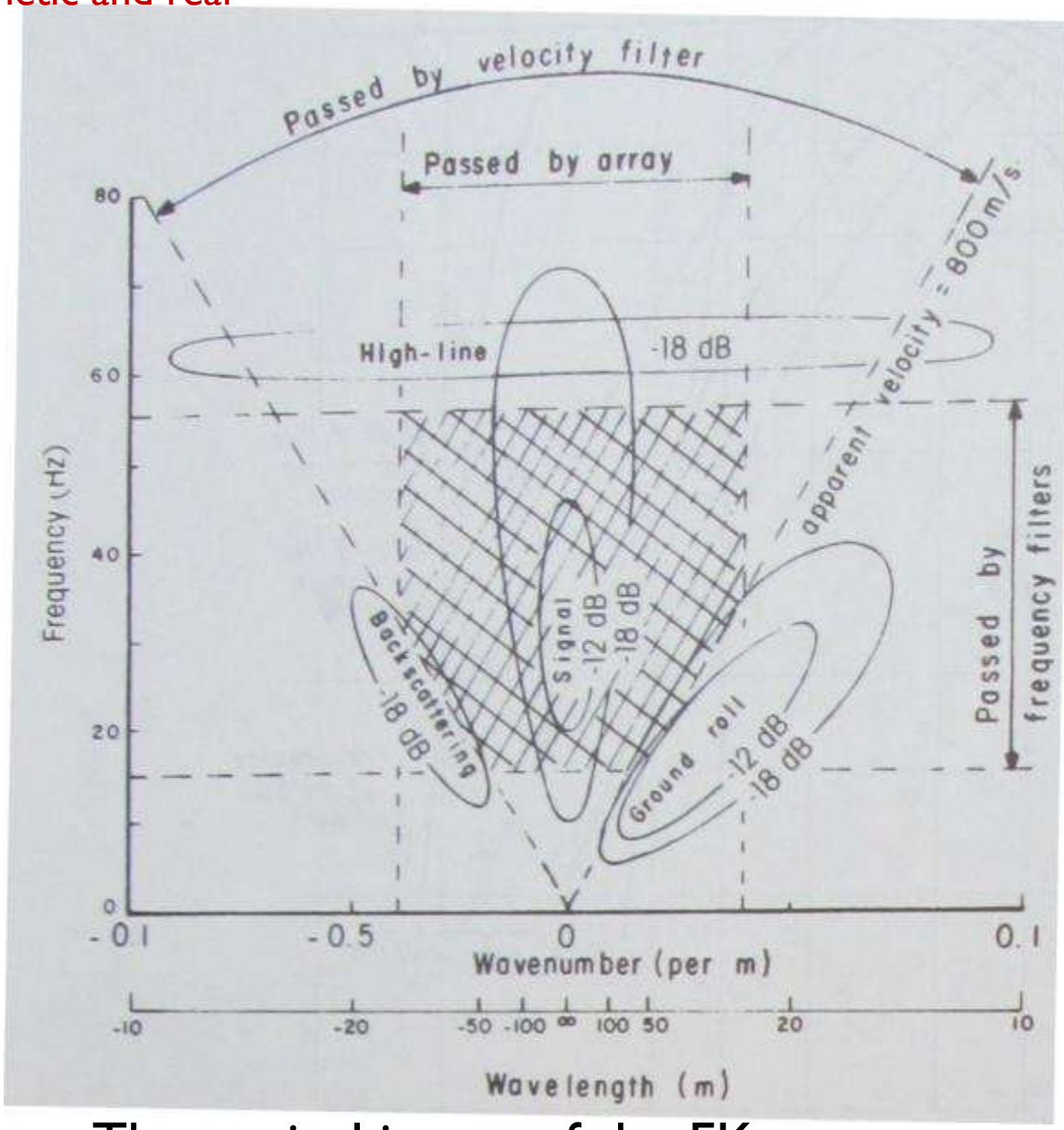




The continuous distribution of the azimuth and offset after sorting by cross-spread.

3. Using – FK filtering of synthetic and real data

The FK filtering needs well sampled traces as input data. In 3D, it is provided only by cross-spreads

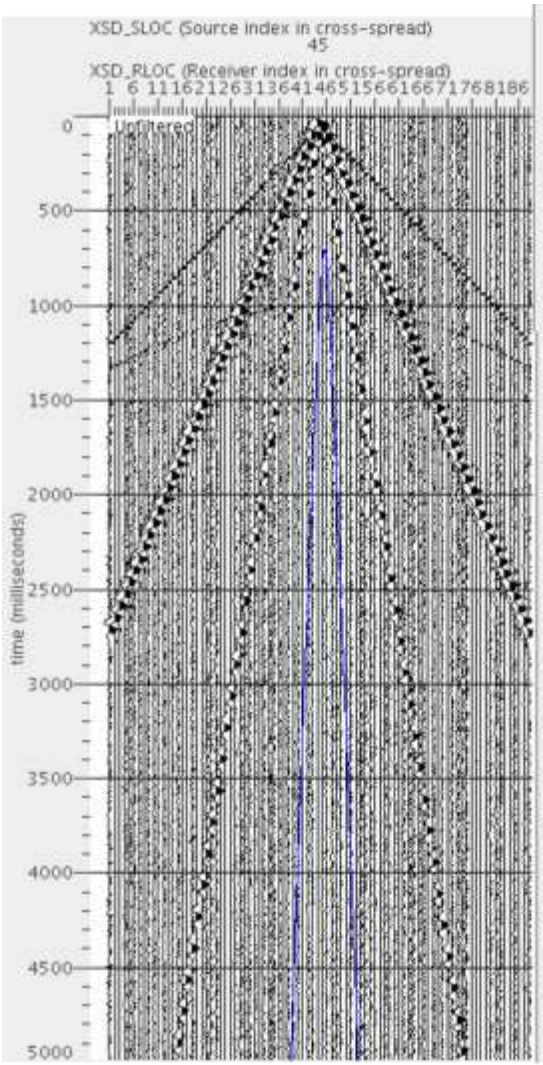


Theoretical image of the FK spectra

Sheriff (2002)

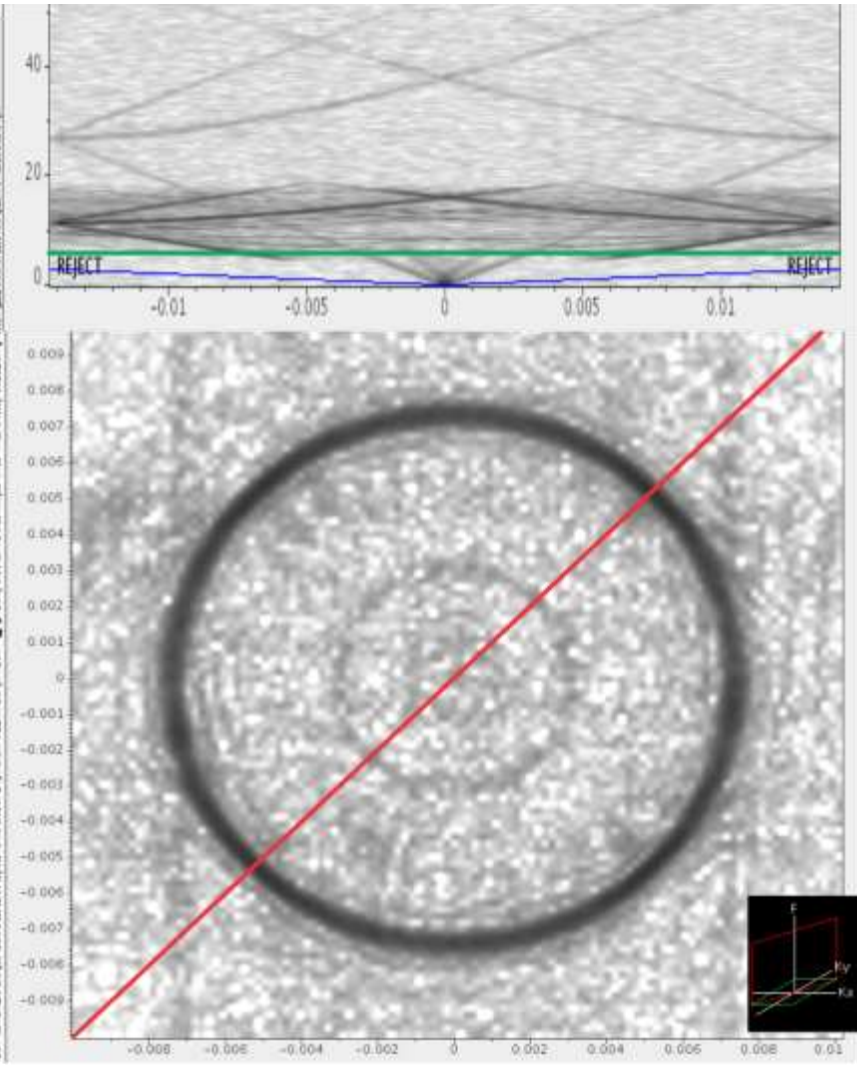
3. Using – FK filtering of synthetic and real data

FKK panel of synthetic data.



Unfiltered seismic section

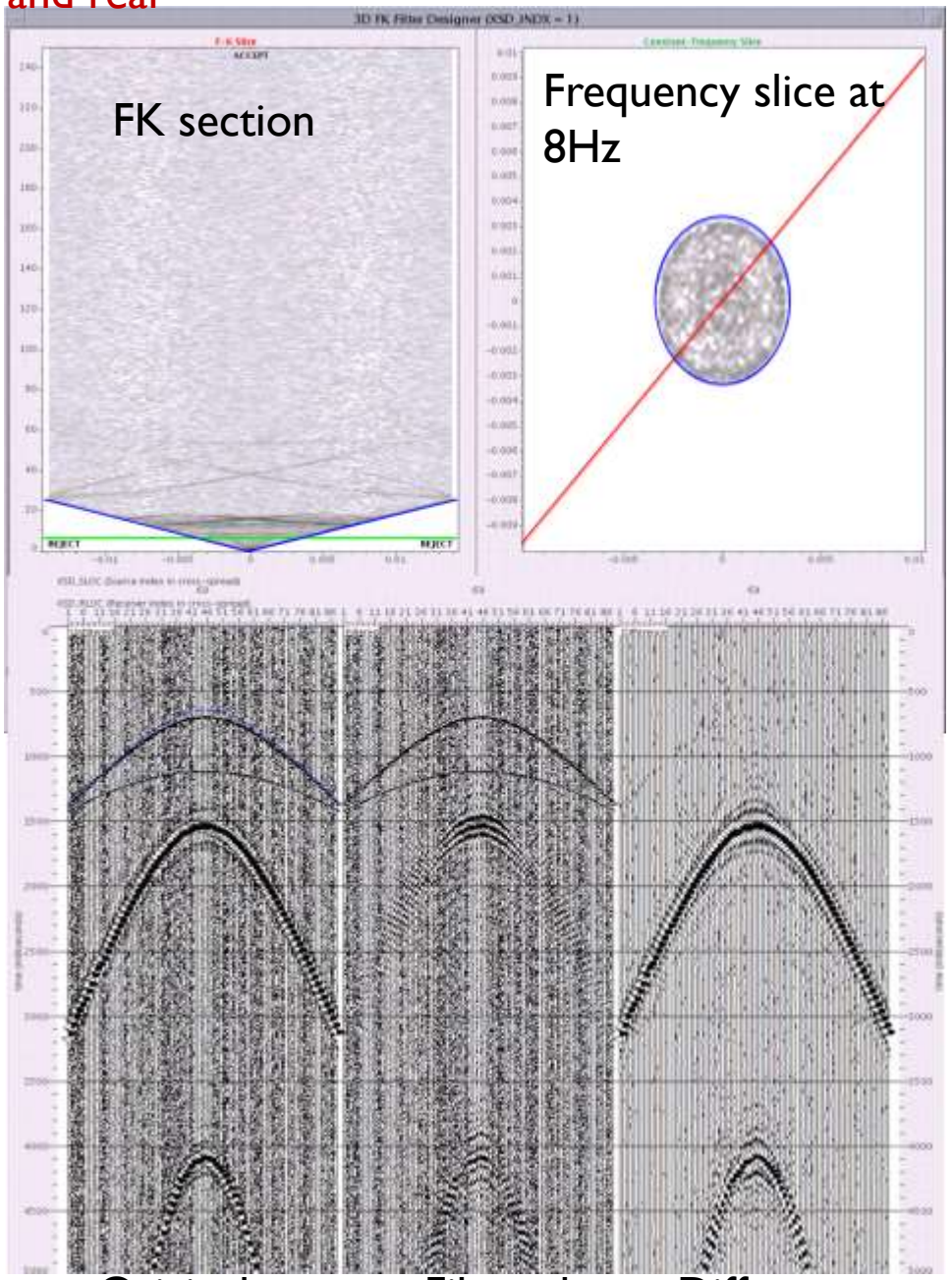
FK section



Frequency slice at 6 Hz

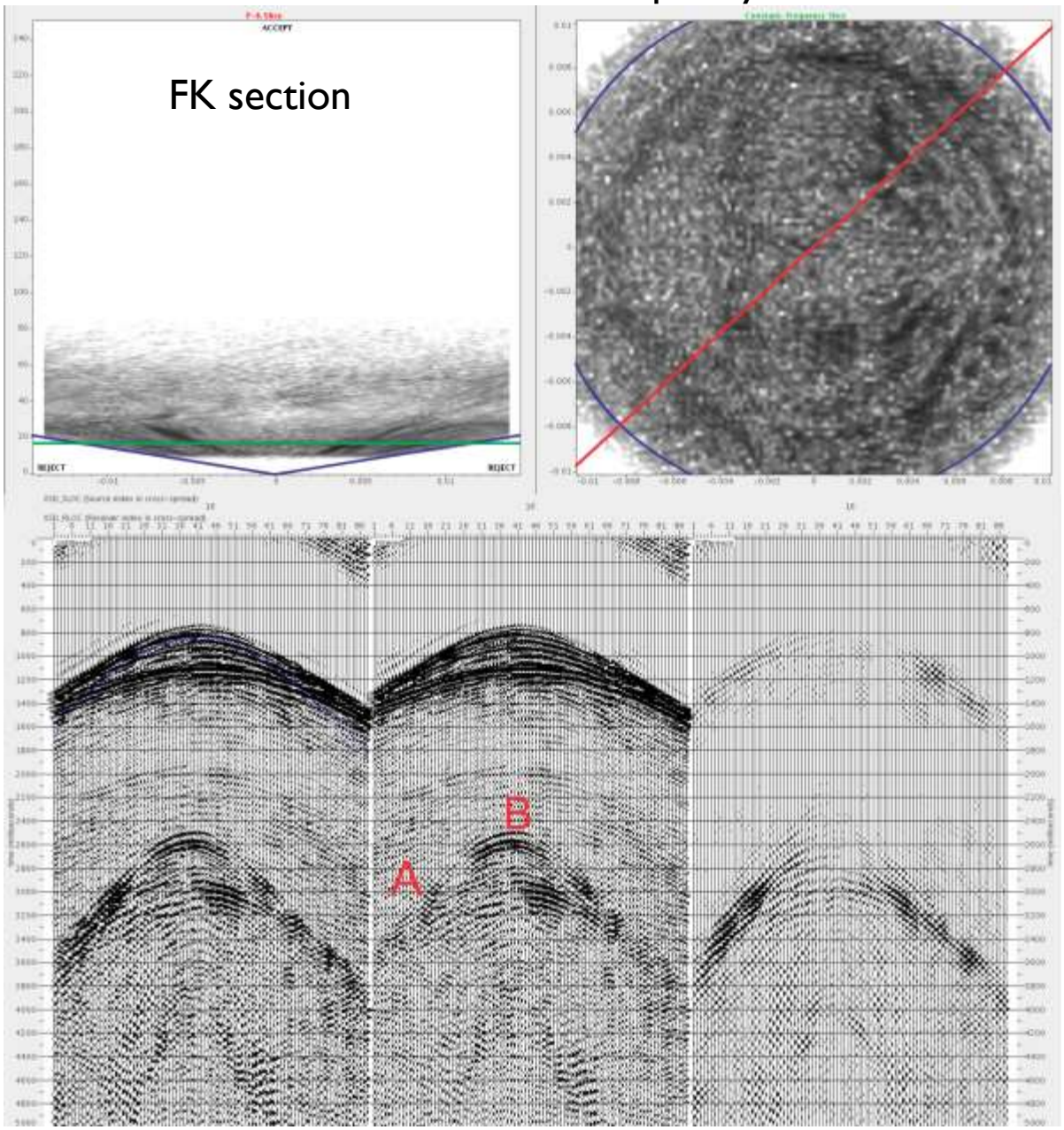
3. Using – FK filtering of synthetic and real data

Using FKK filter on synthetic data with 1800 m/s



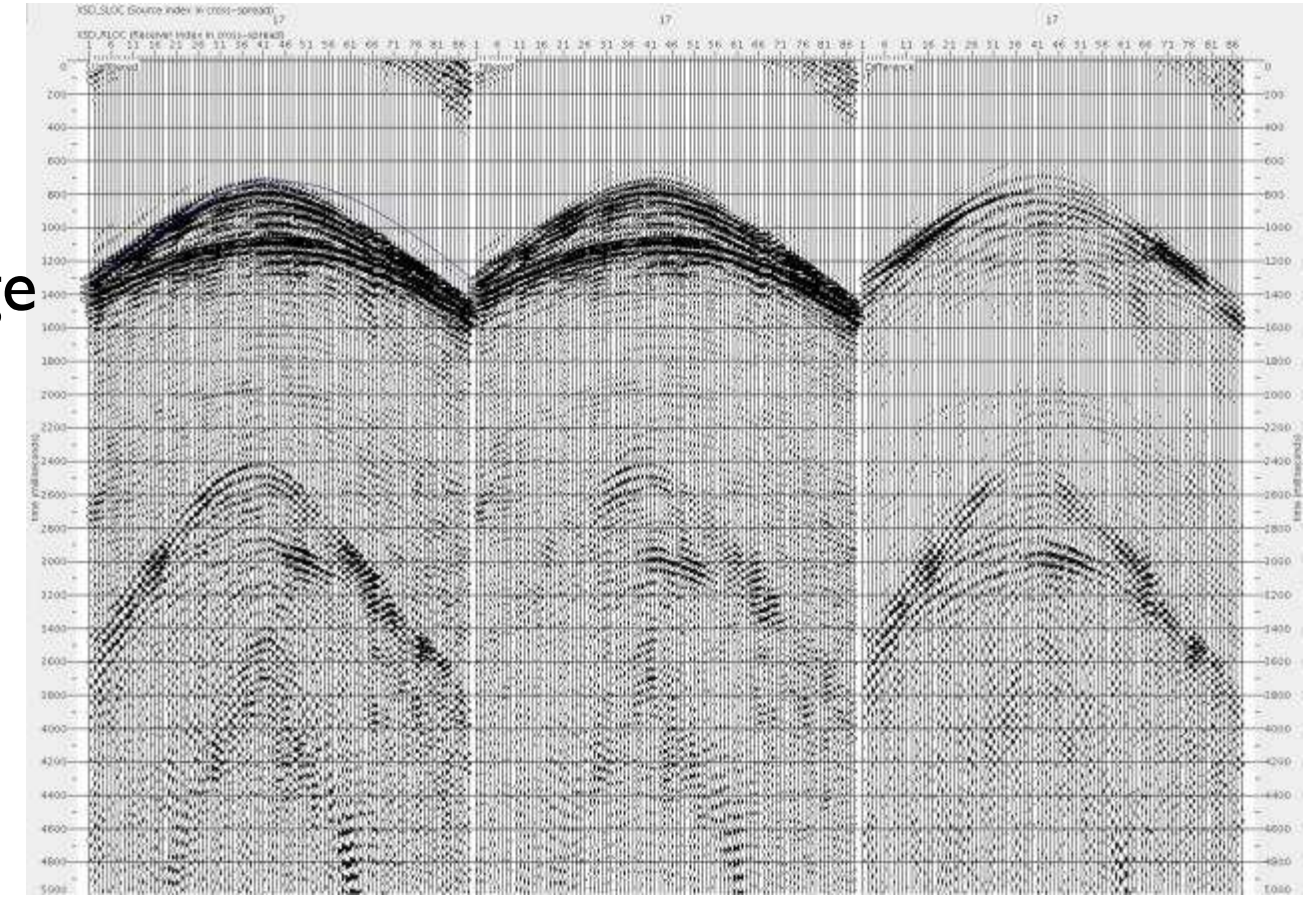
3. Using – FK filtering of synthetic and real data

Using FKK filter on real data with 1500 m/s



3. Using – FK filtering of synthetic and real data

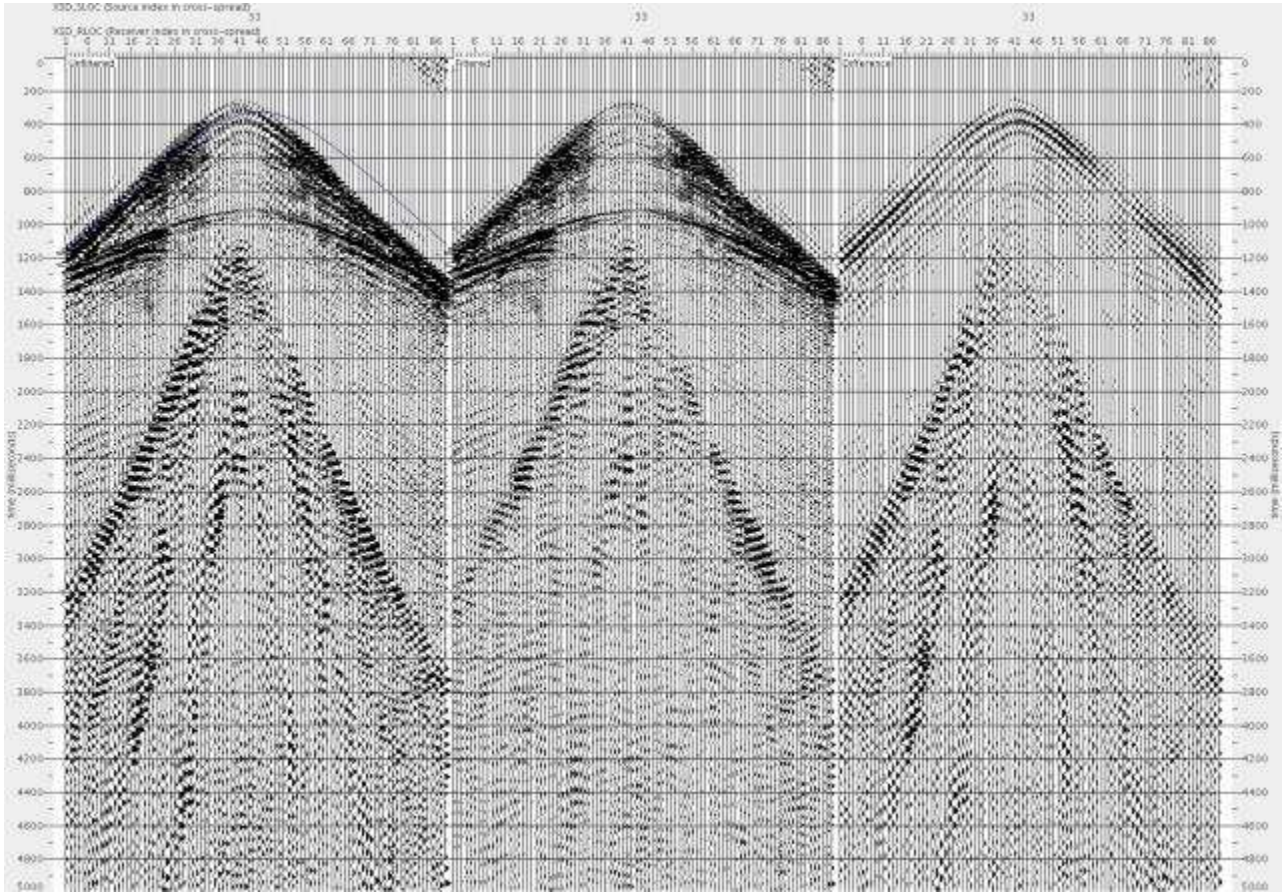
Using FKK filter at large offset with 2000 m/s



Original Filtered Difference

3. Using – FK filtering of synthetic and real data

Using FKK filter at small offset with 2000 m/s



Original Filtered Difference

Summary, conclusions

- Making cross-spreads from 3D orthogonal seismic data can be carried out.
- Traces in this domain are appropriate inputs for 3D FK filter
- The filter is suitable for suppress noise caused by ground roll.

Possibility of further researches:

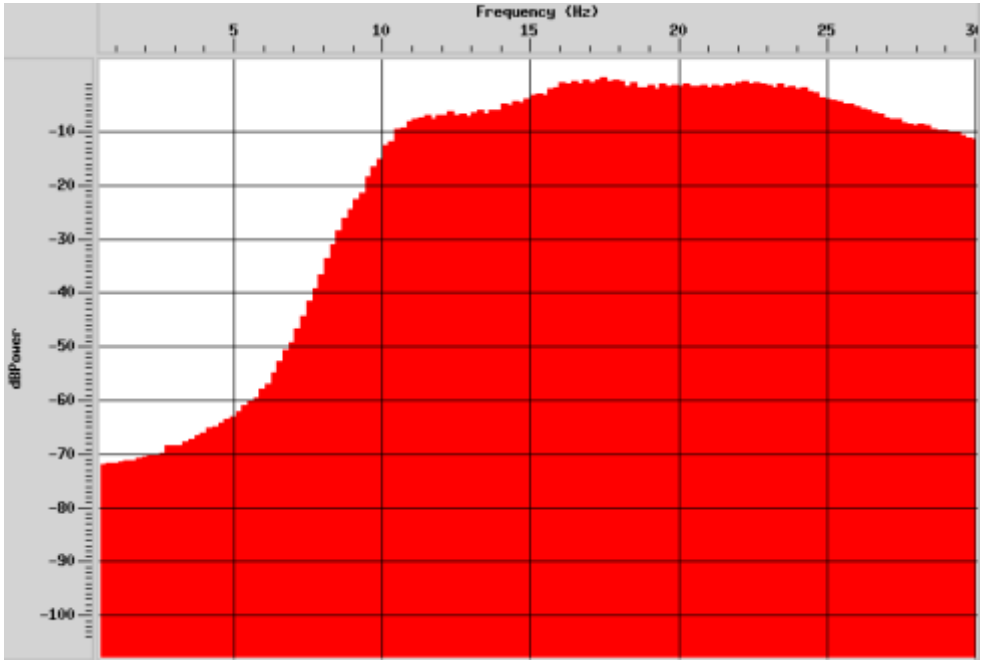
- Experiments with other non-regular acquisitions, and other geophone distances
- Comparing FKK filter with other methods of ground roll suppression
- Trying other applications of cross-spreads (e. g. 3D Radon filter)
- Experiment with NMO corrected data.

Acknowledgements:

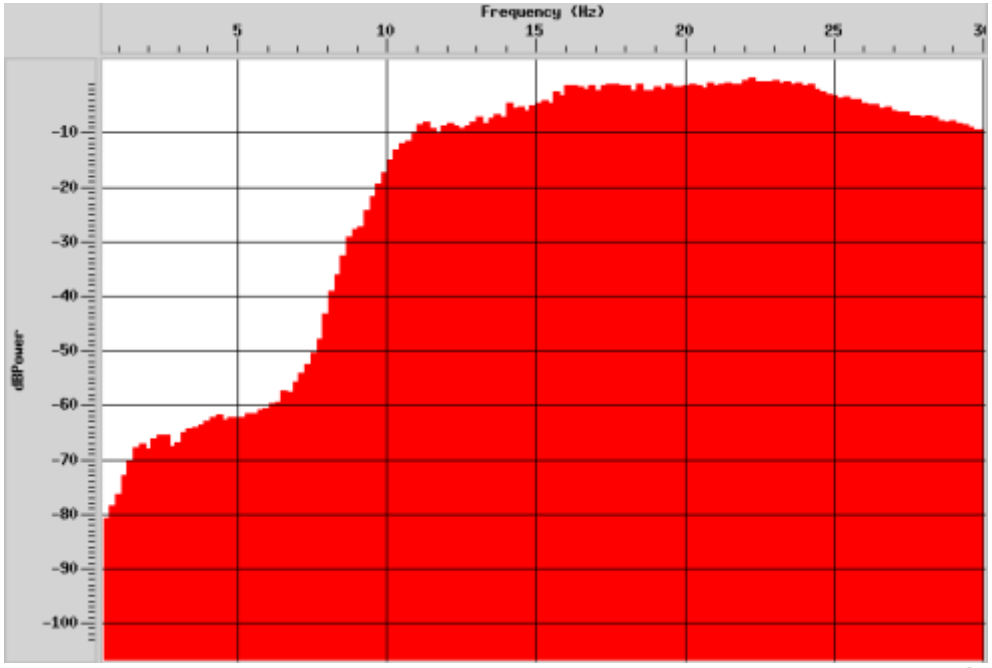
Thank Krisztina Németh, Gábor Göncz and István Sebe for the help and thank MOL Plc. for the raw data.

Thank you for your attention!

Power spectra before filtering



Powerspectra after filtering



Sweep parameters:

• Sweep type	linear
• Sweep length	14 sec
• Sweep range frequency	8 – 90 Hz

FKK after NMO: