



FWI Preparation

NZ 3D Processing

14 October 2020

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INSTITUTE FOR GEOPHYSICS



Passion for Geoscience

- **Objective:**

To evaluate FWI initial model and wavelet.

- **Procedure:**

Initial depth velocity model was converted and smoothed from legacy time RMS model. This is used for FWI synthetic shot modelling.

FWI synthetic shot data is compared with real shot data for both streamer and OBN survey to evaluate the initial model.

- **Display:**

Initial velocity, source wavelet, and FWI synthetic.

- **Observation and Recommendation:**

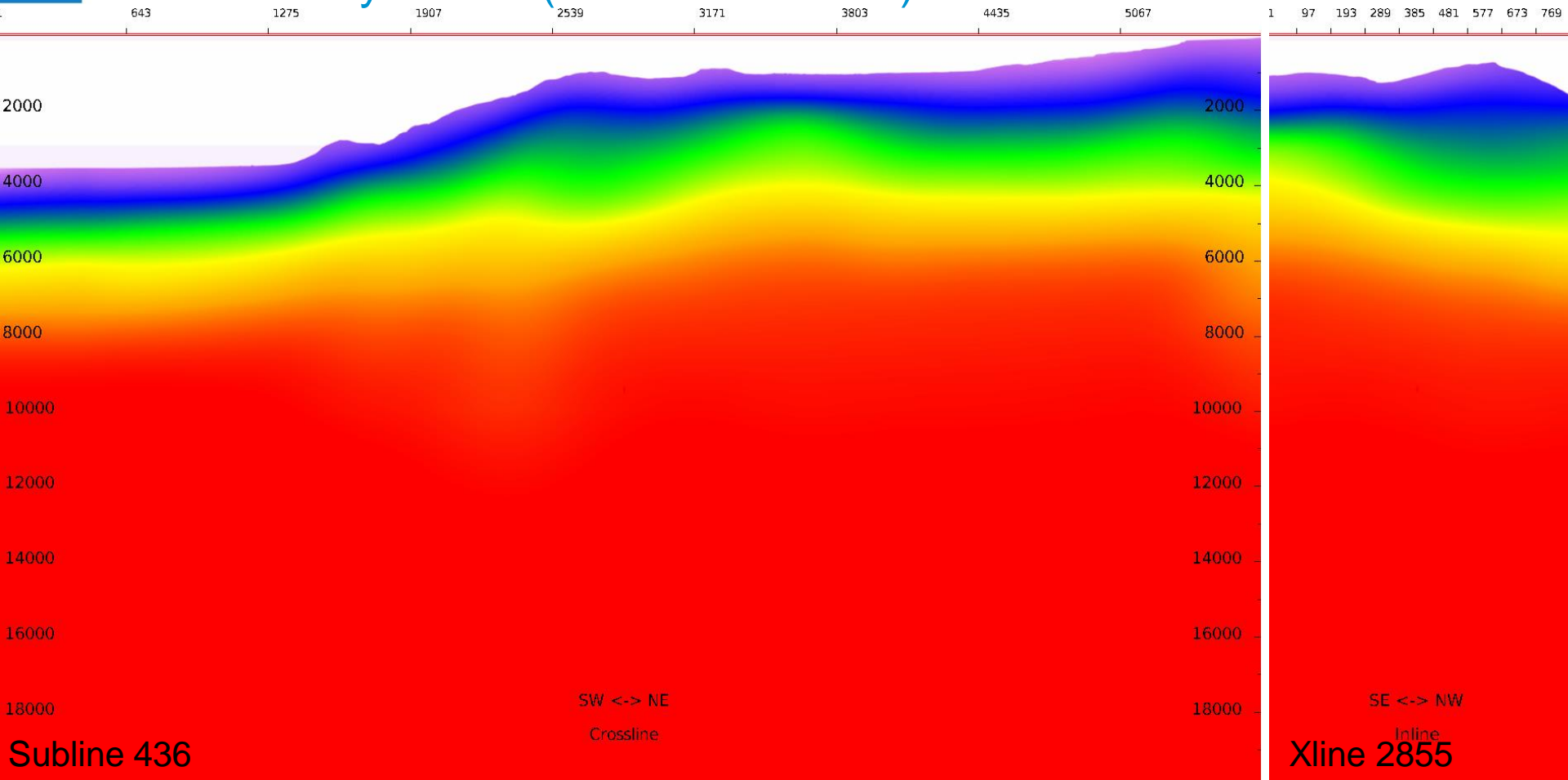
The water velocity of the initial model is quite reasonable. At some places the velocity just beneath sea floor may be too fast.

Current OBN data seems to have recording issues. The shape of the wavelet from real data does not match with synthetic data.

Initial Velocity Model



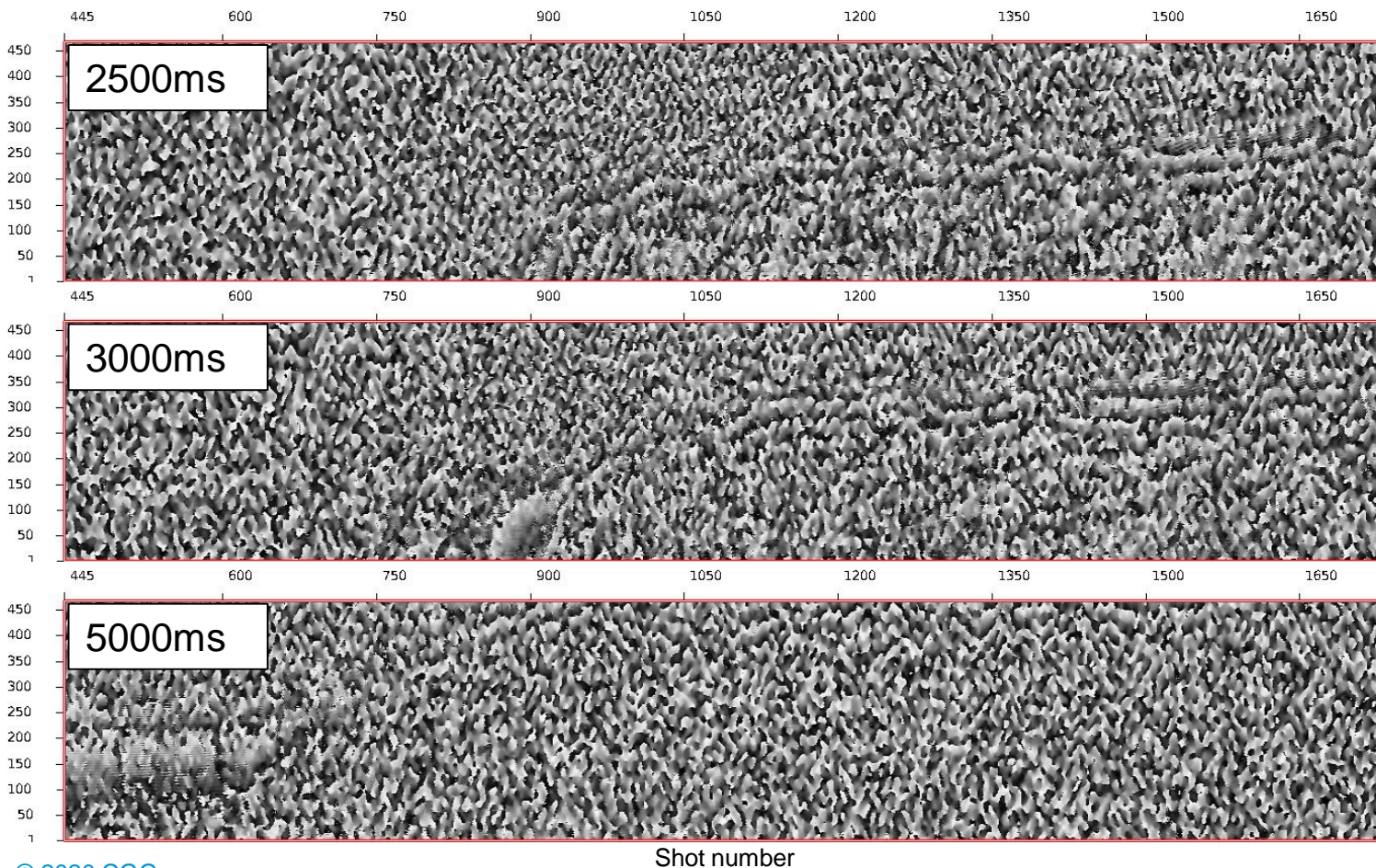
Initial Velocity Model (12.5m x 18.75m)



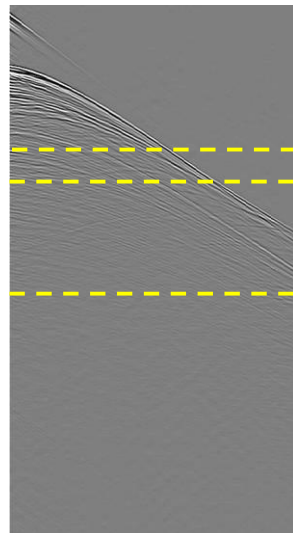


Seq 018 Gun 1 Cable 2 Phase Time Slice: 2.0Hz

5



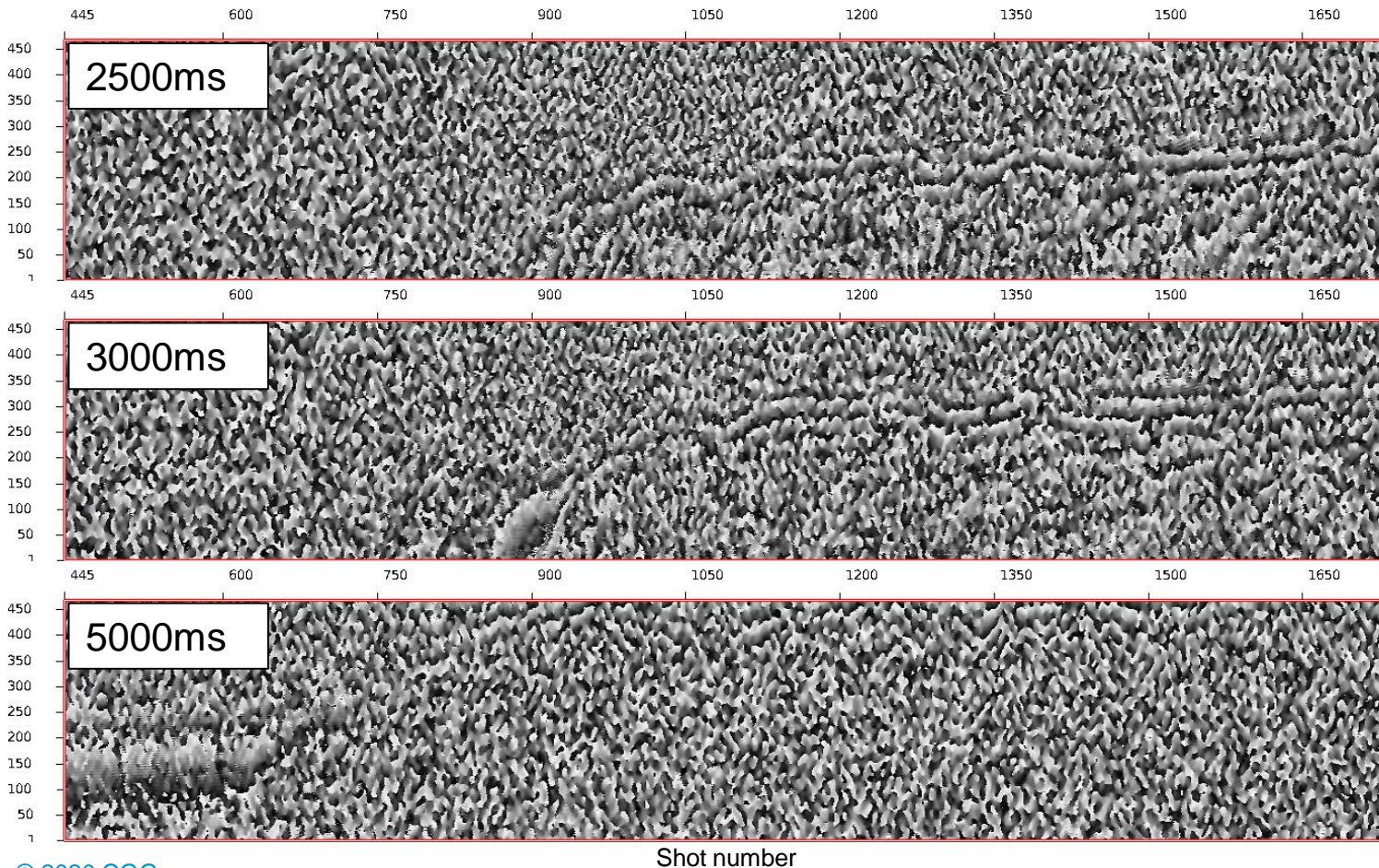
- Noise is dominate below 2 Hz.
- It is not recommended to start FWI at this frequency.





Seq 018 Gun 1 Cable 2 Phase Time Slice: 2.5Hz

6

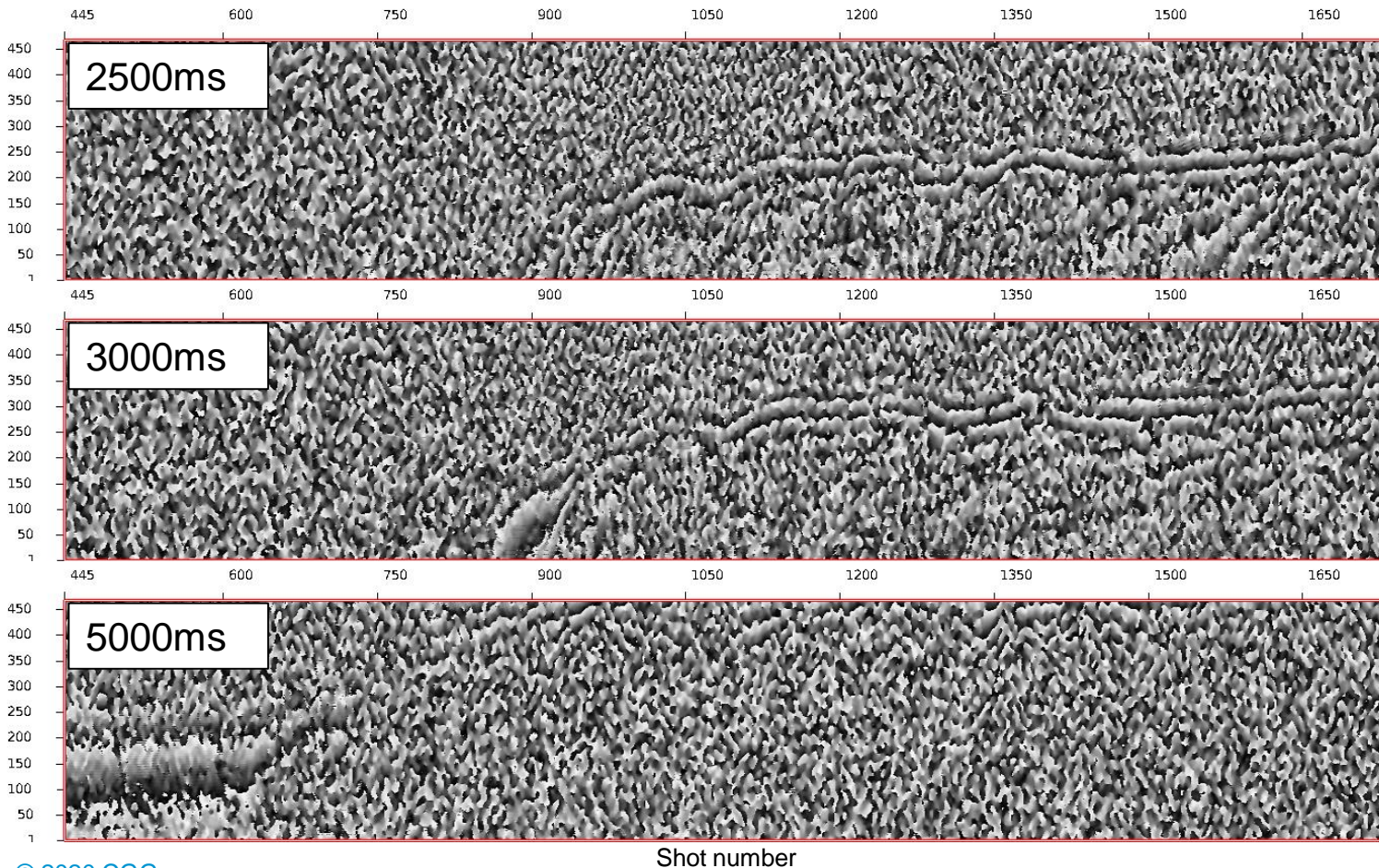


- Continuous signal appears at 2.5 Hz
- It is recommended to start FWI at this frequency.



Seq 018 Gun 1 Cable 2 Phase Time Slice: 3.0Hz

7

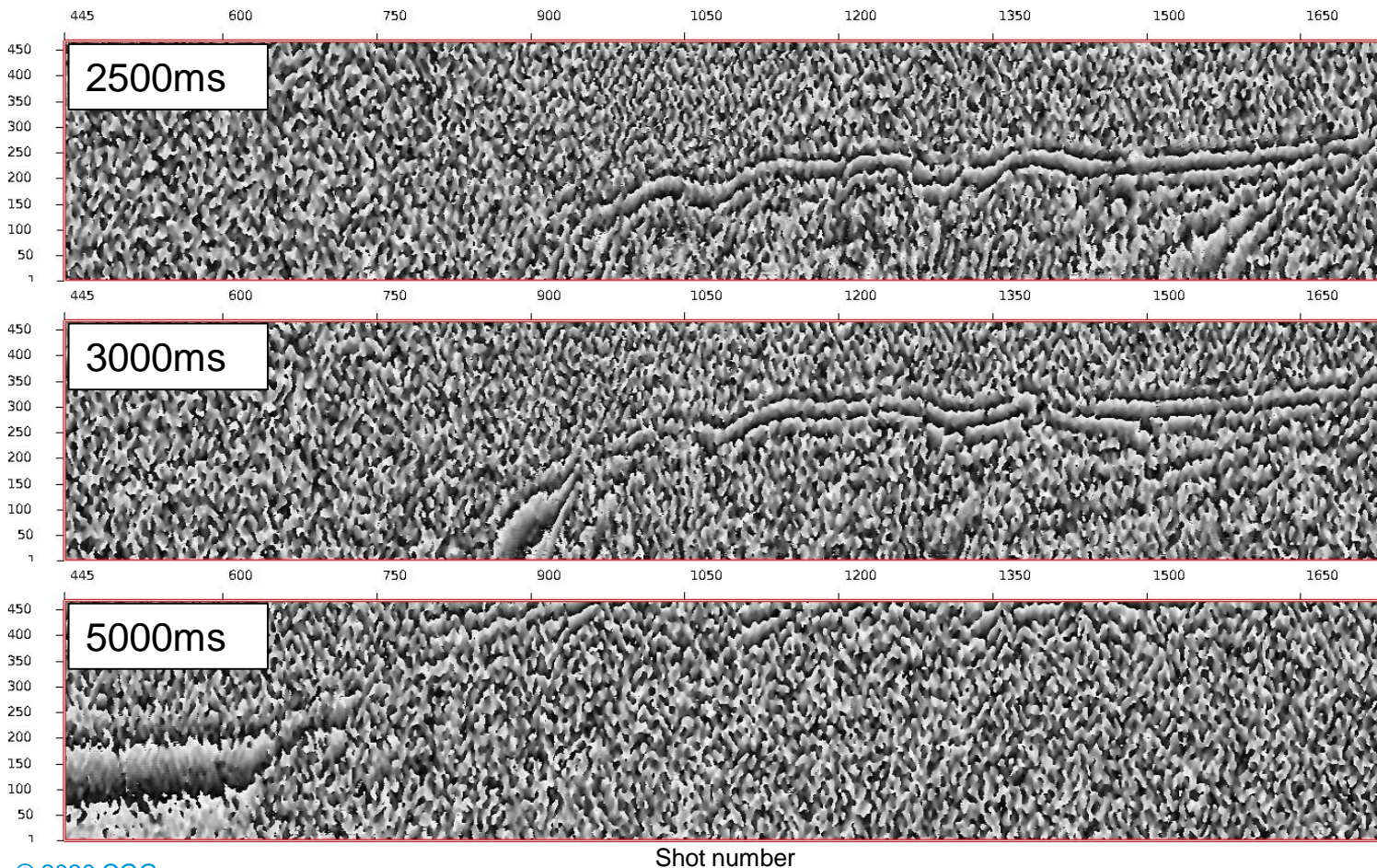


- More continuous signal appears at 3 Hz.



Seq 018 Gun 1 Cable 2 Phase Time Slice: 3.5Hz

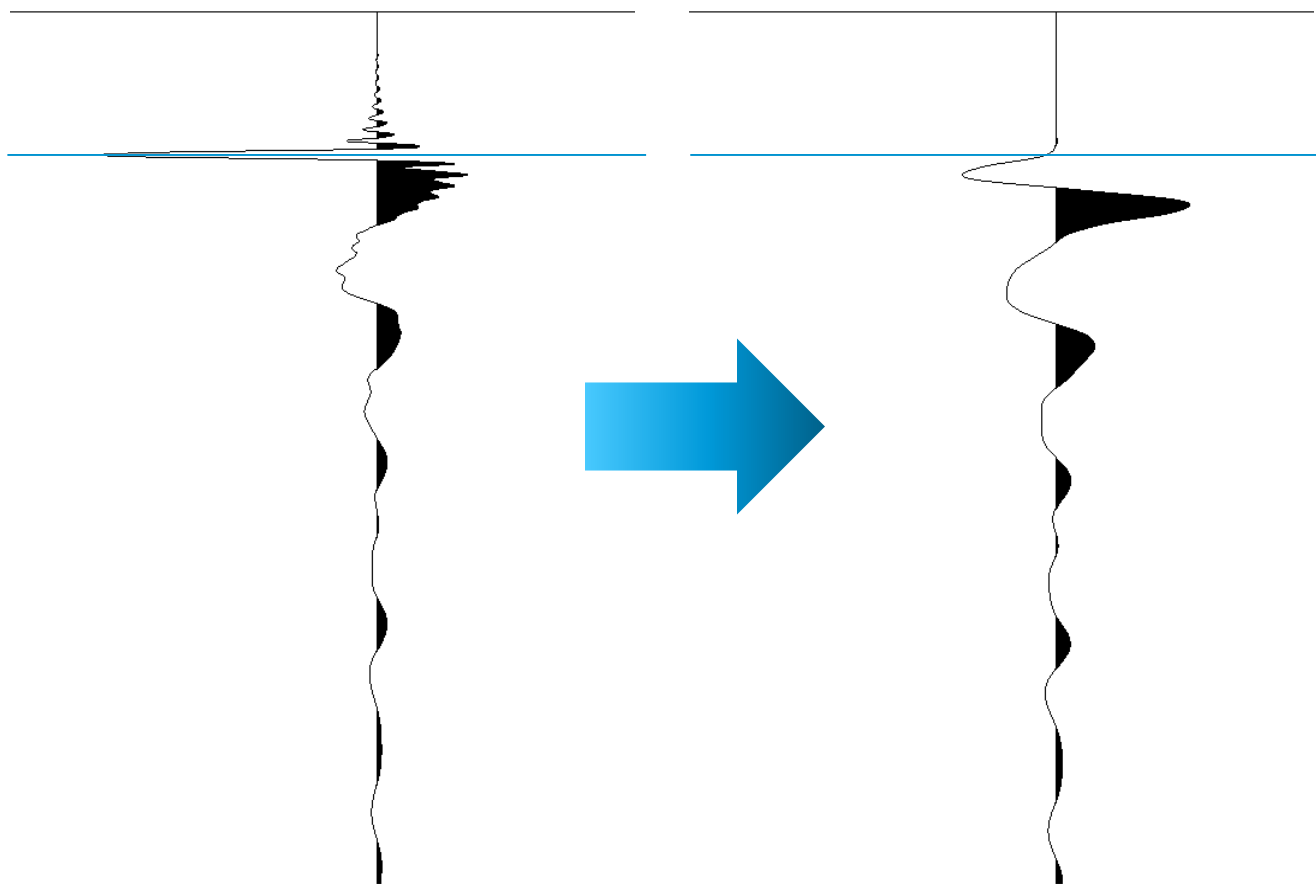
8



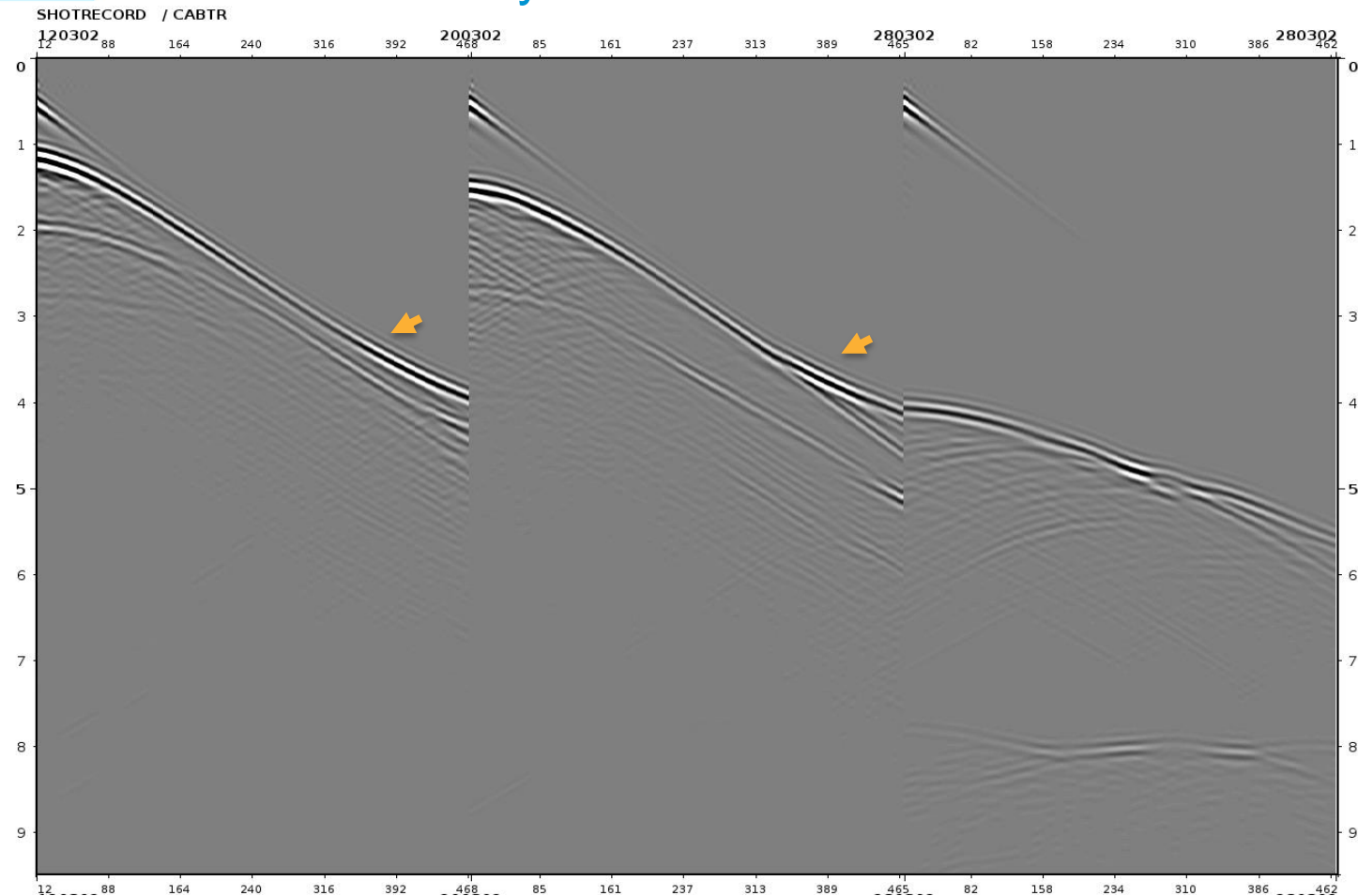
- More continuous signal appears at 3 Hz.

FWI Synthetic VS Real Data Streamer





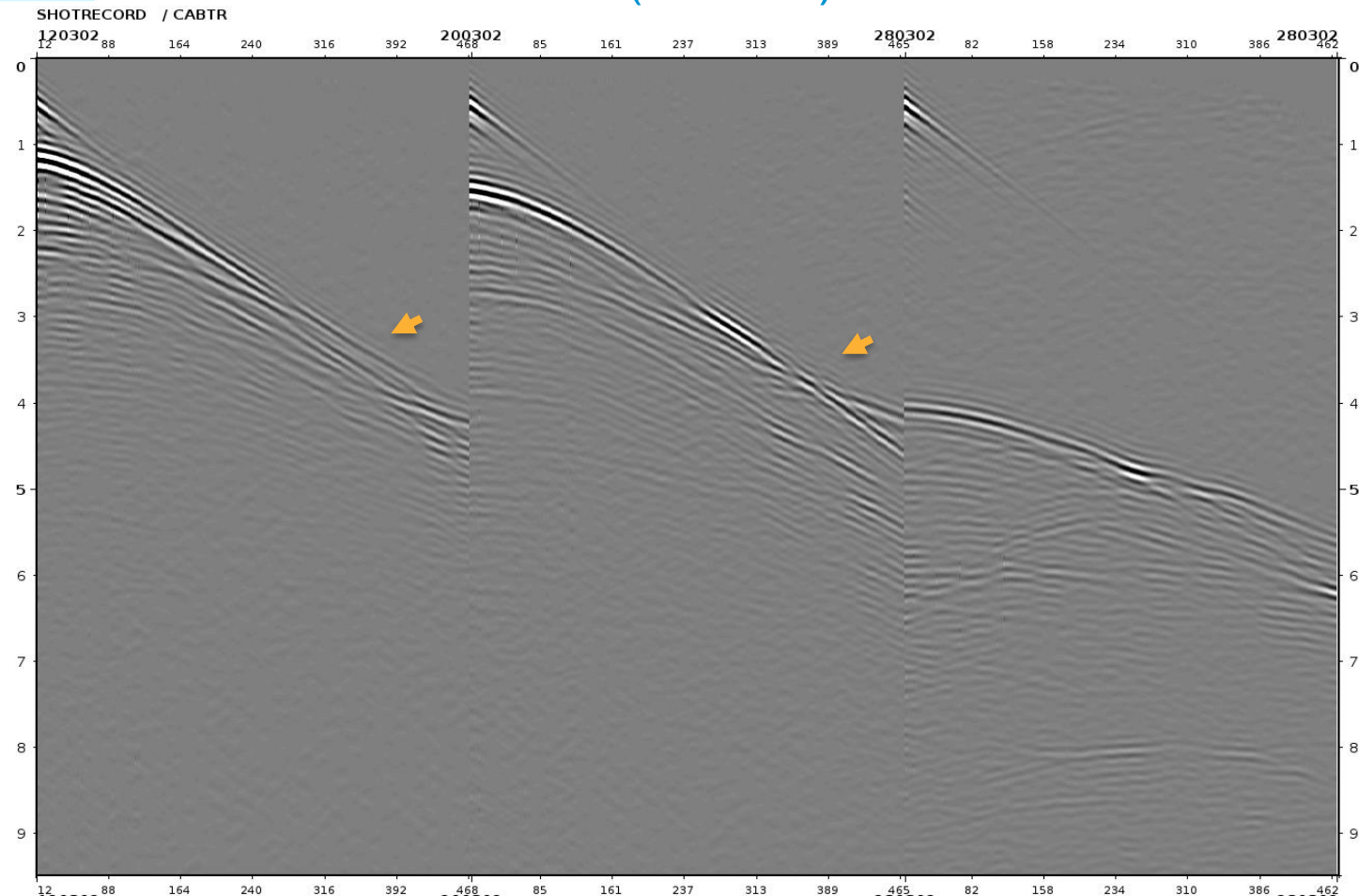
- A 20 Hz (40 dB/Oct) minimum phase filter is applied to both source wavelet and seismic data for FWI synthetic and inversion.



- FWI Synthetic shots generated up to 10 Hz.

Streamer: Real Data (<10 Hz)

12



- Synthetic and read data have a good match around water bottom reflection.
- Differences are observed in the diving wave zone indicating velocity errors in the initial model.

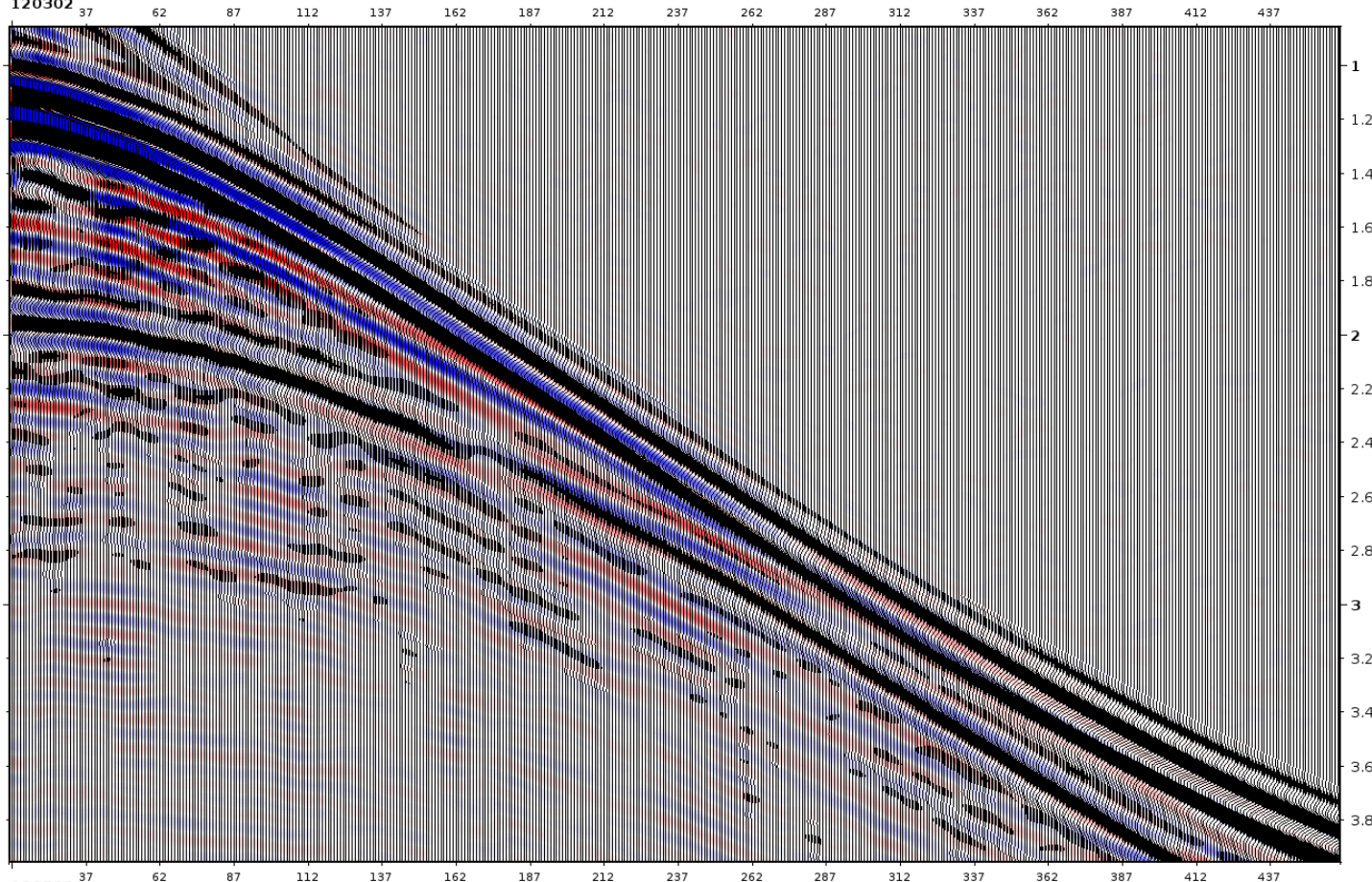


Streamer Shallow: FWI Synthetic Overlay on Real

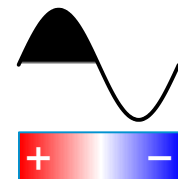
13

SHOTRECORD / CABTR

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- Synthetic and real data have a good match around water bottom reflection.
- Differences are observed in the diving wave zone indicating velocity errors in the initial model.

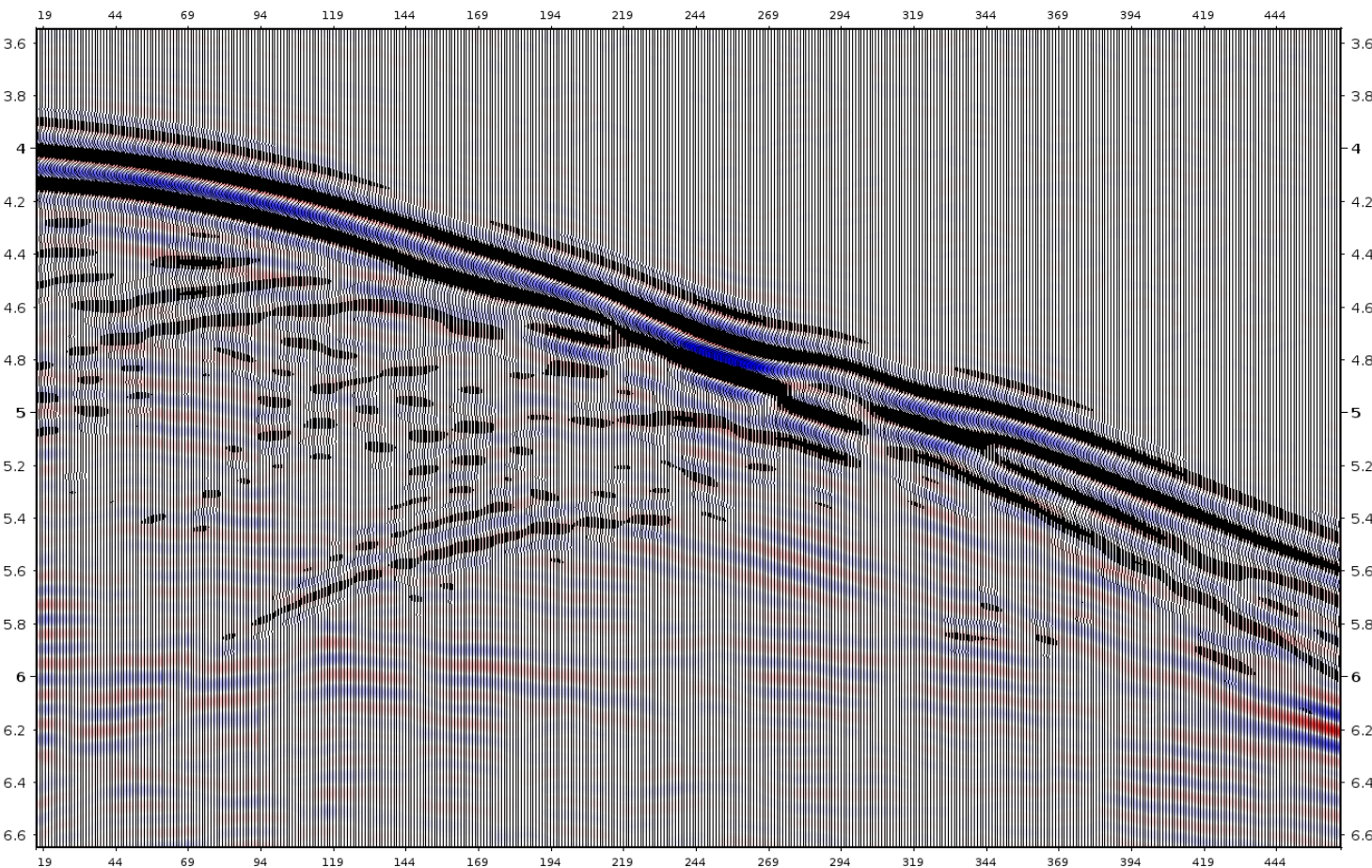




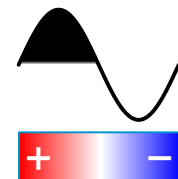
Streamer Deep Water: FWI Synthetic Overlay on Real

14

SHOTRECORD / CABTR



- In the deep water area, no clear diving wave energy is recorded due to limited cable length.
- Water bottom reflection energy of synthetic data matches with that of real data, indicating a good water velocity in the initial model.

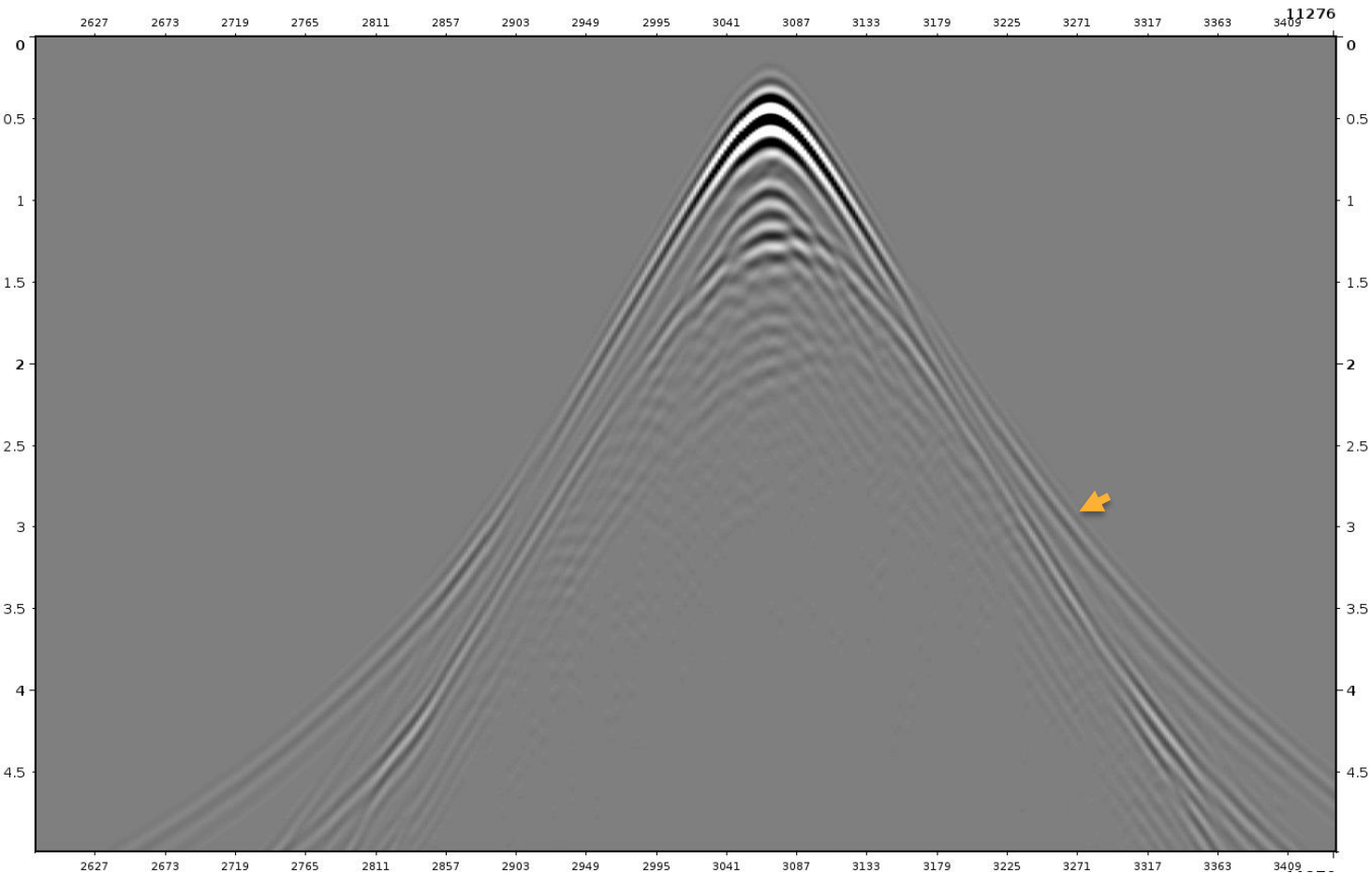


FWI Synthetic VS Real Data Streamer





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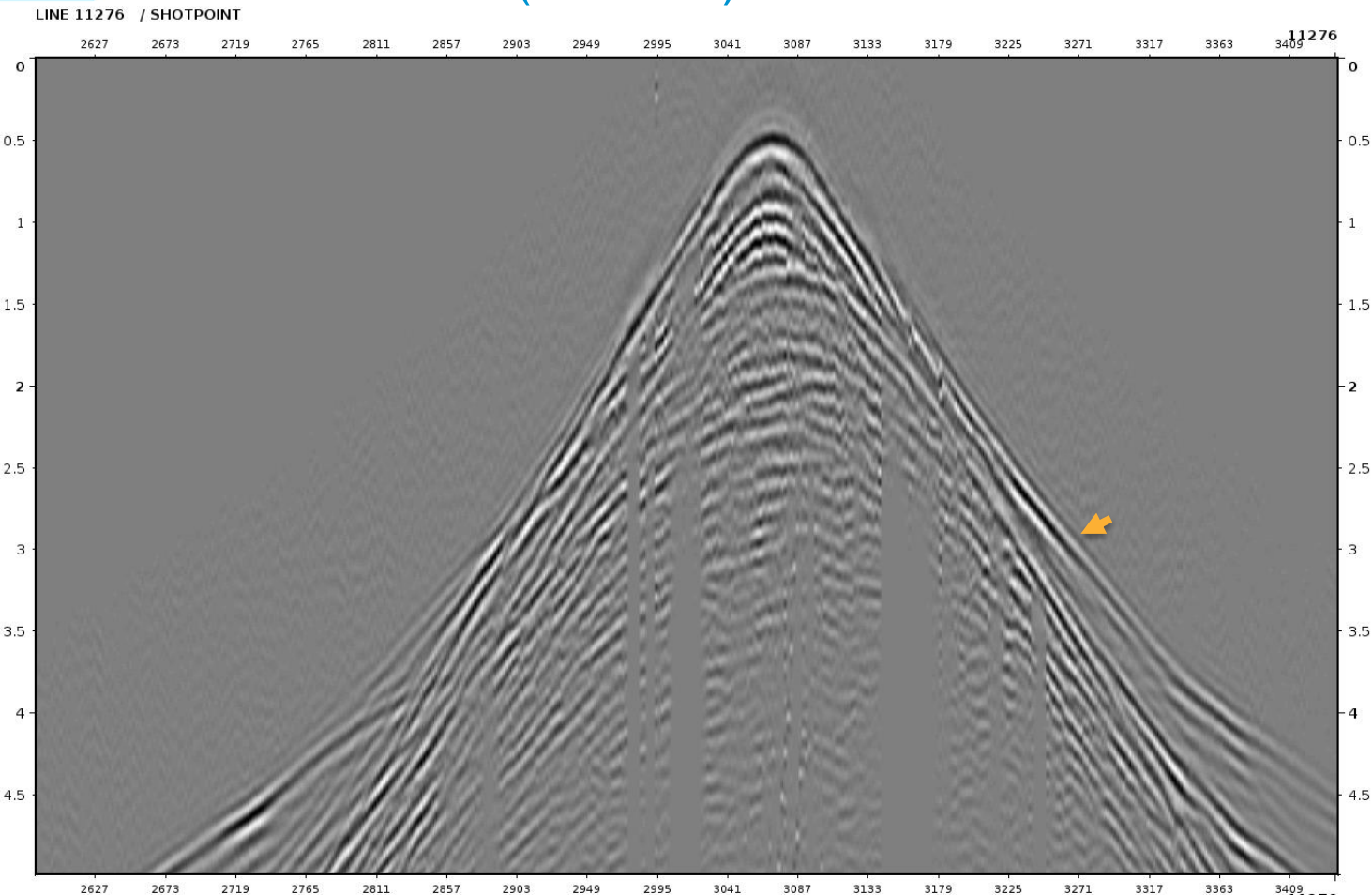


- FWI Synthetic data generated up to 10 Hz.



OBS: Real Data (< 10 Hz)

17



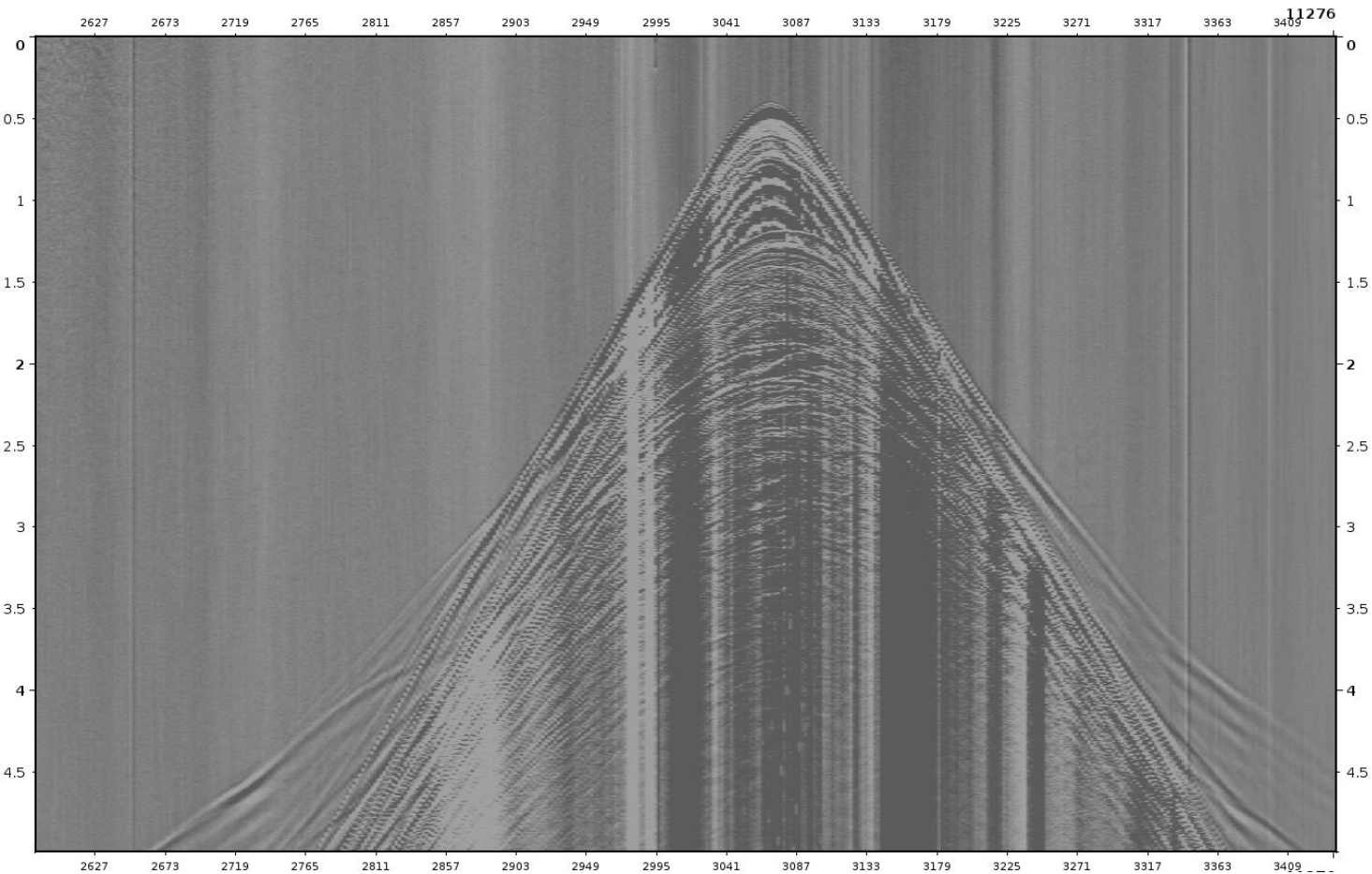
- Compared with FWI synthetic data, the real data matches at a few places (Orange Arrow).
- The shape of wavelets do not match between synthetic and real data.



OBS: Real Data (Raw)

18

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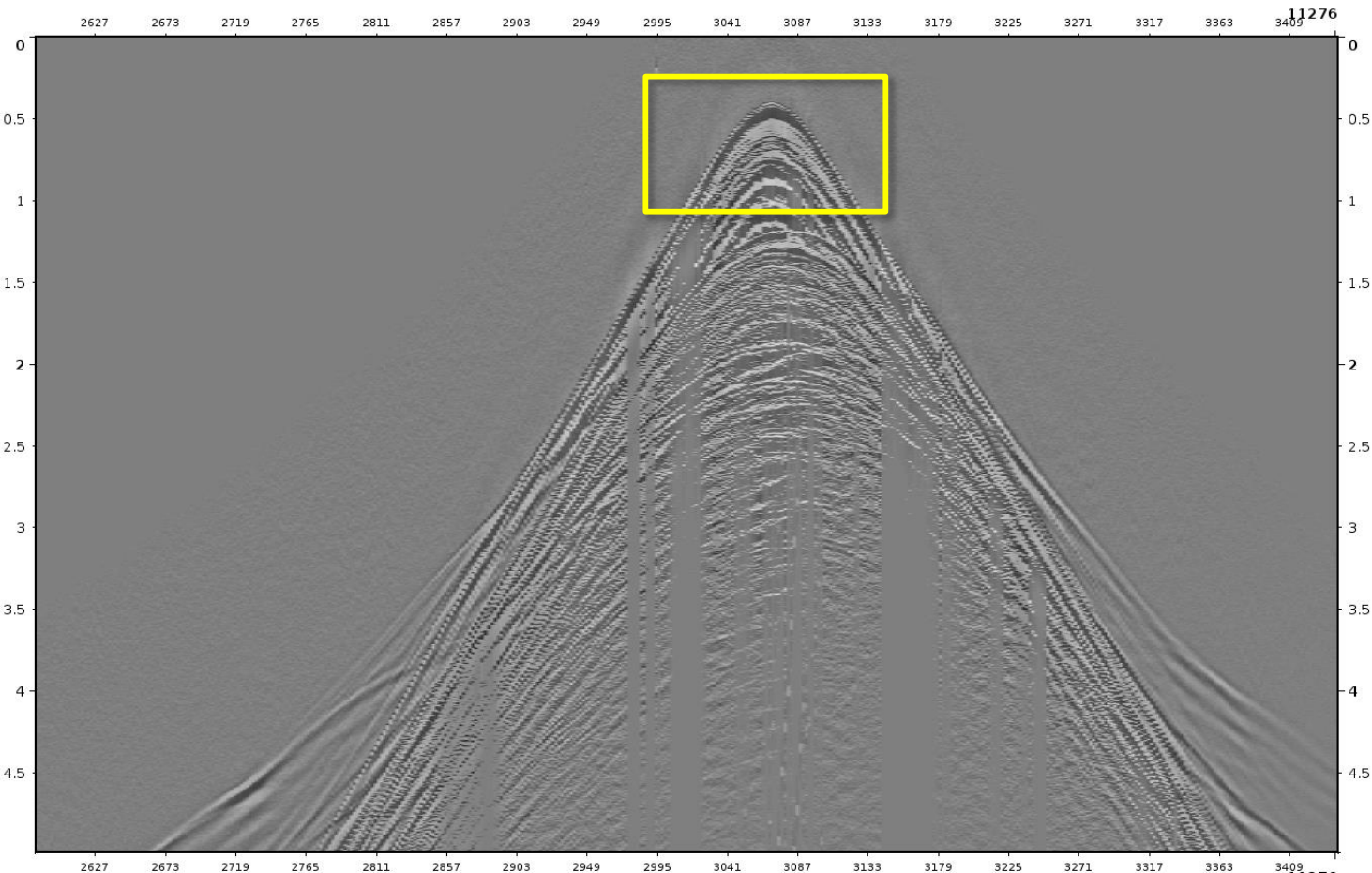
- The color of the raw data seems gray and is not similar with normal seismic data.



OBS: Real Data (>2 Hz)

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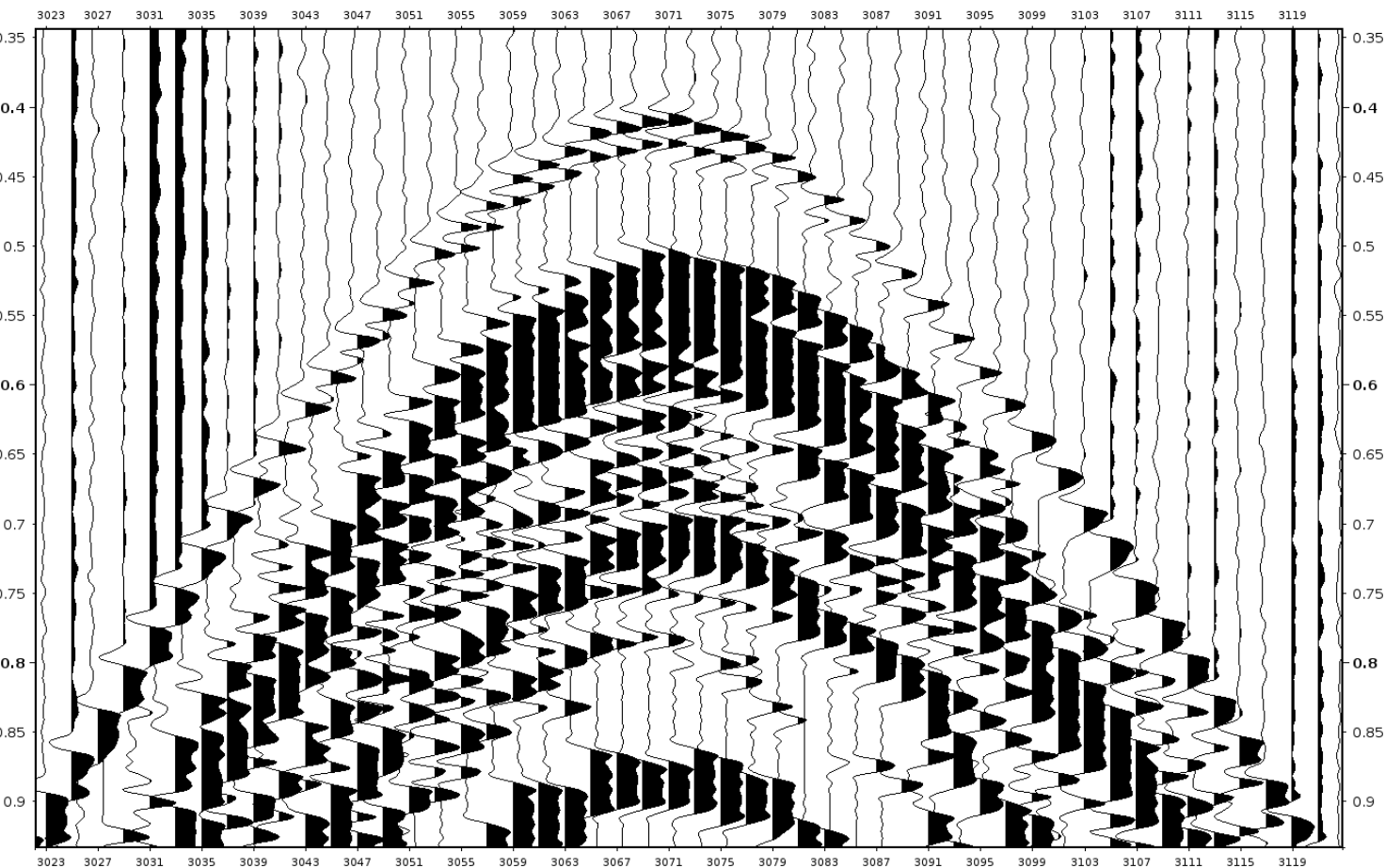
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- After 2 Hz low cut filter, removing DC noise, the color remains abnormal.



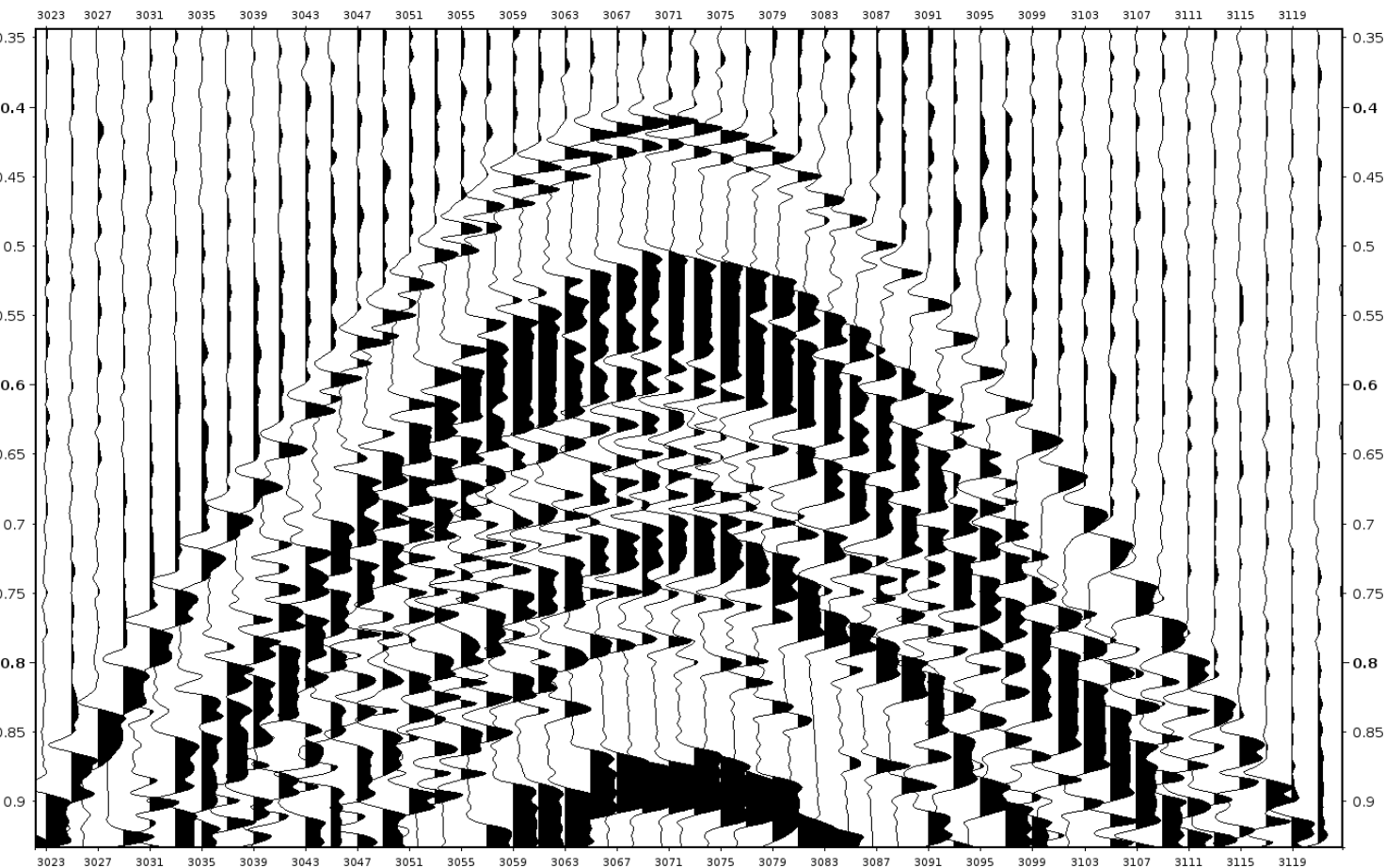
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- The first break energy is recorded as a trough, and followed by the ghost peak. This observation is consistent with streamer data.
- Below the first break, there's around 50ms of negative values that remains almost the same, followed by 50ms of positive with almost same value. This is not normal.



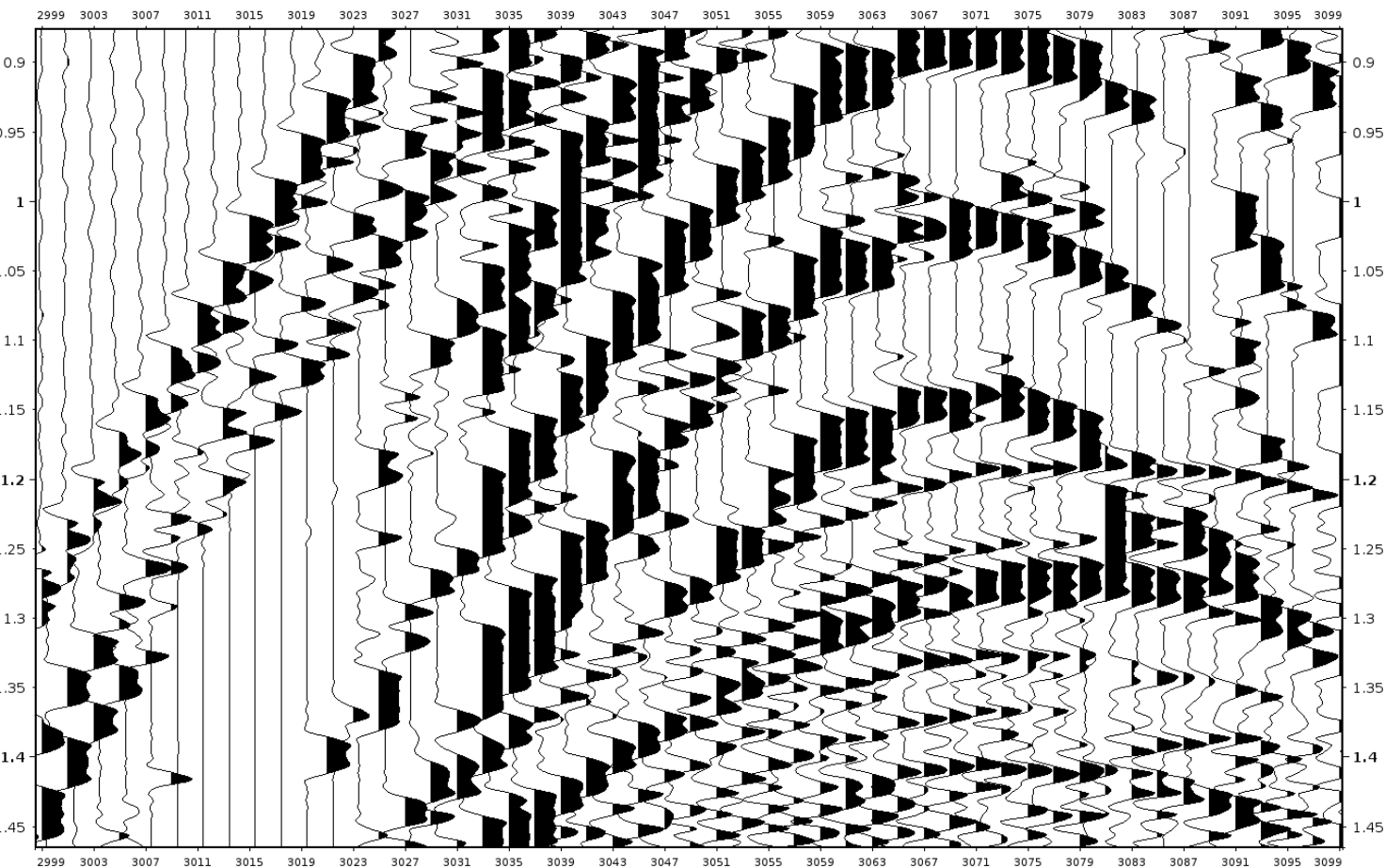
LINE 11276 / SHOTPOINT



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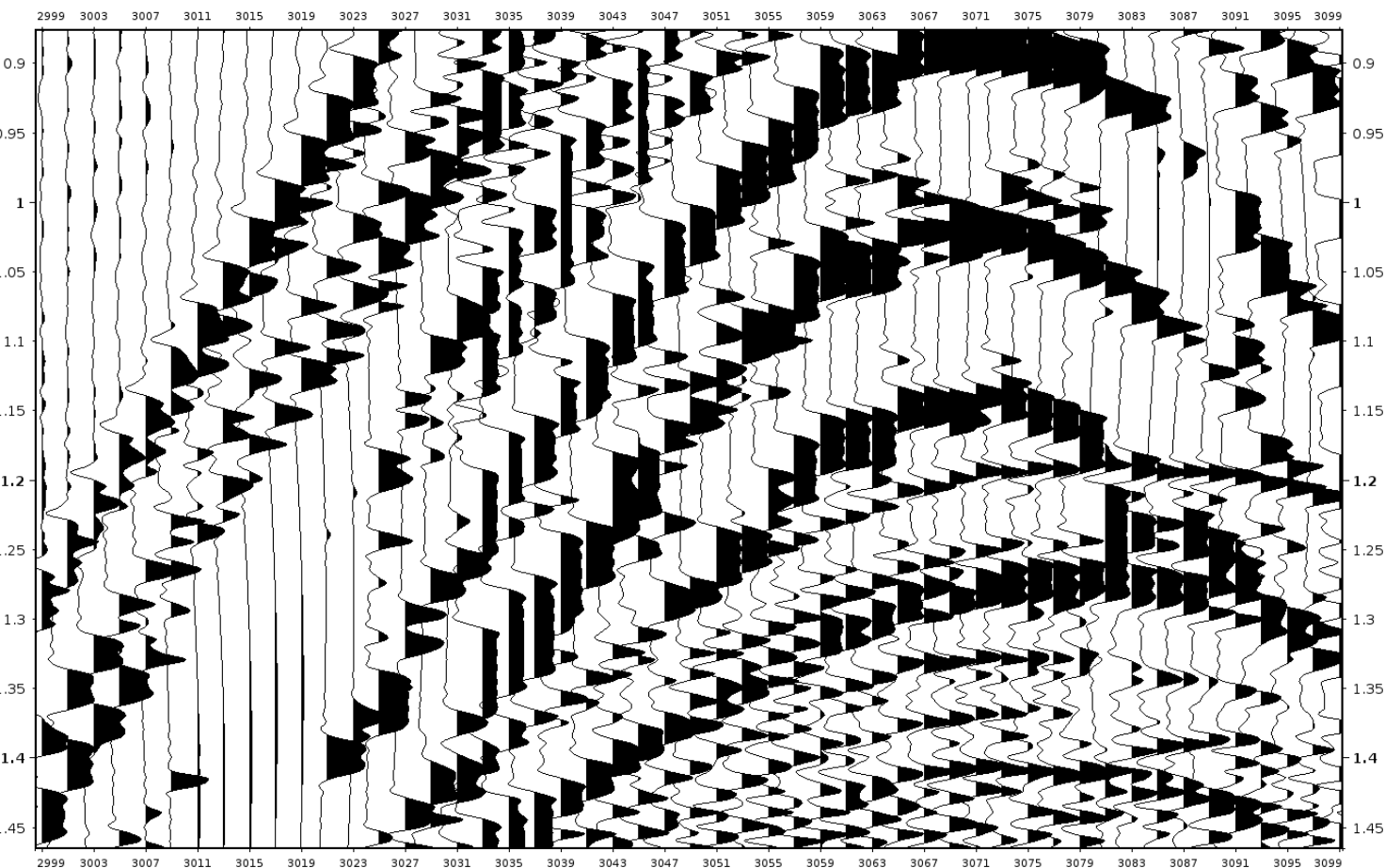
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- Similar observation can be found elsewhere, where the “constant” values extend a much longer period.



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- Similar observation can be found elsewhere, where the “constant” values extend a much longer period.

- The shape of the wavelet is one of the key components for FWI inversion.
- FWI synthetic data matches well with streamer data around water bottom, indication a reasonable water velocity in the initial model.
- FWI synthetic data does not match well with OBS data around water bottom.
- The OBS data shows abnormal recordings that will affect the FWI.