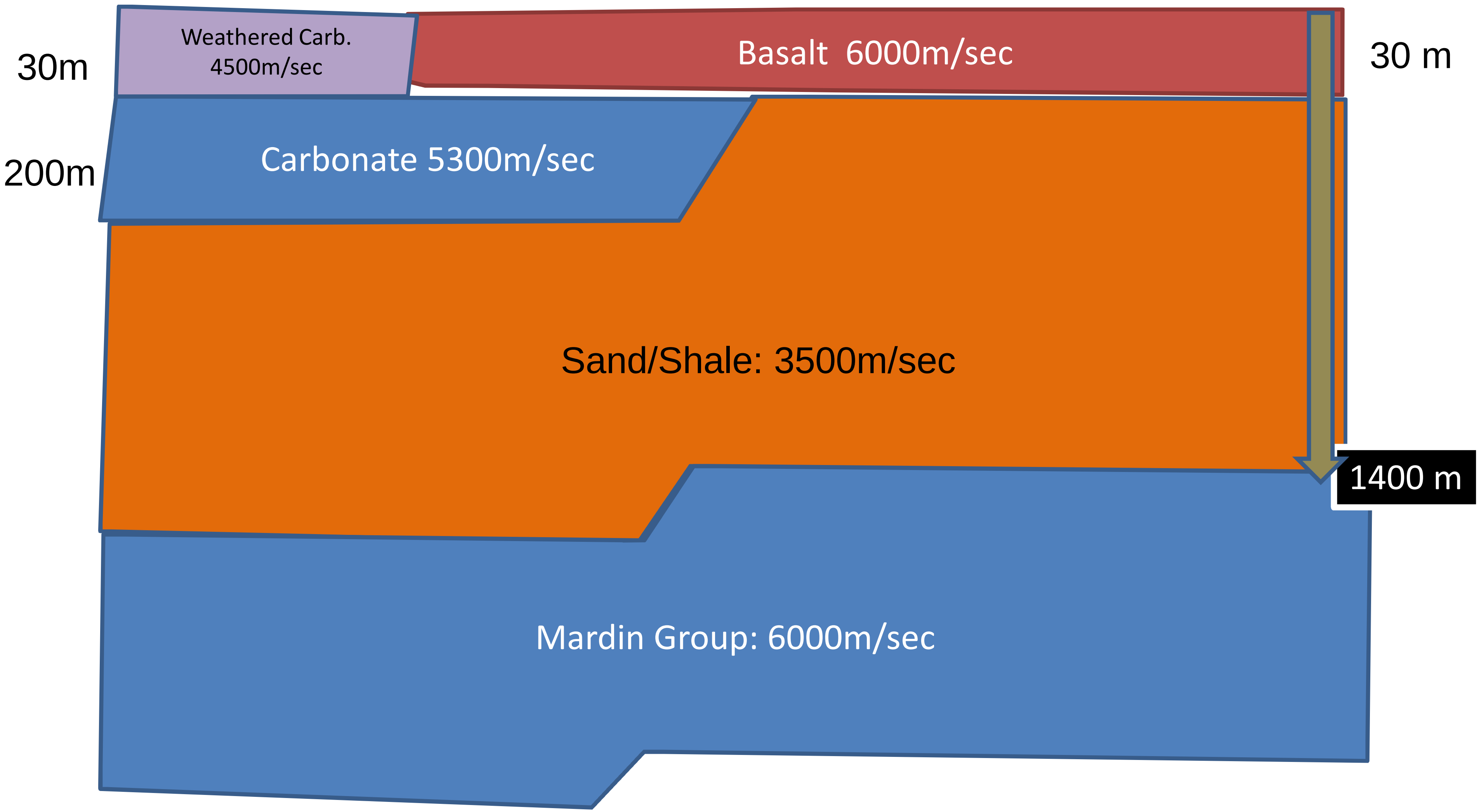
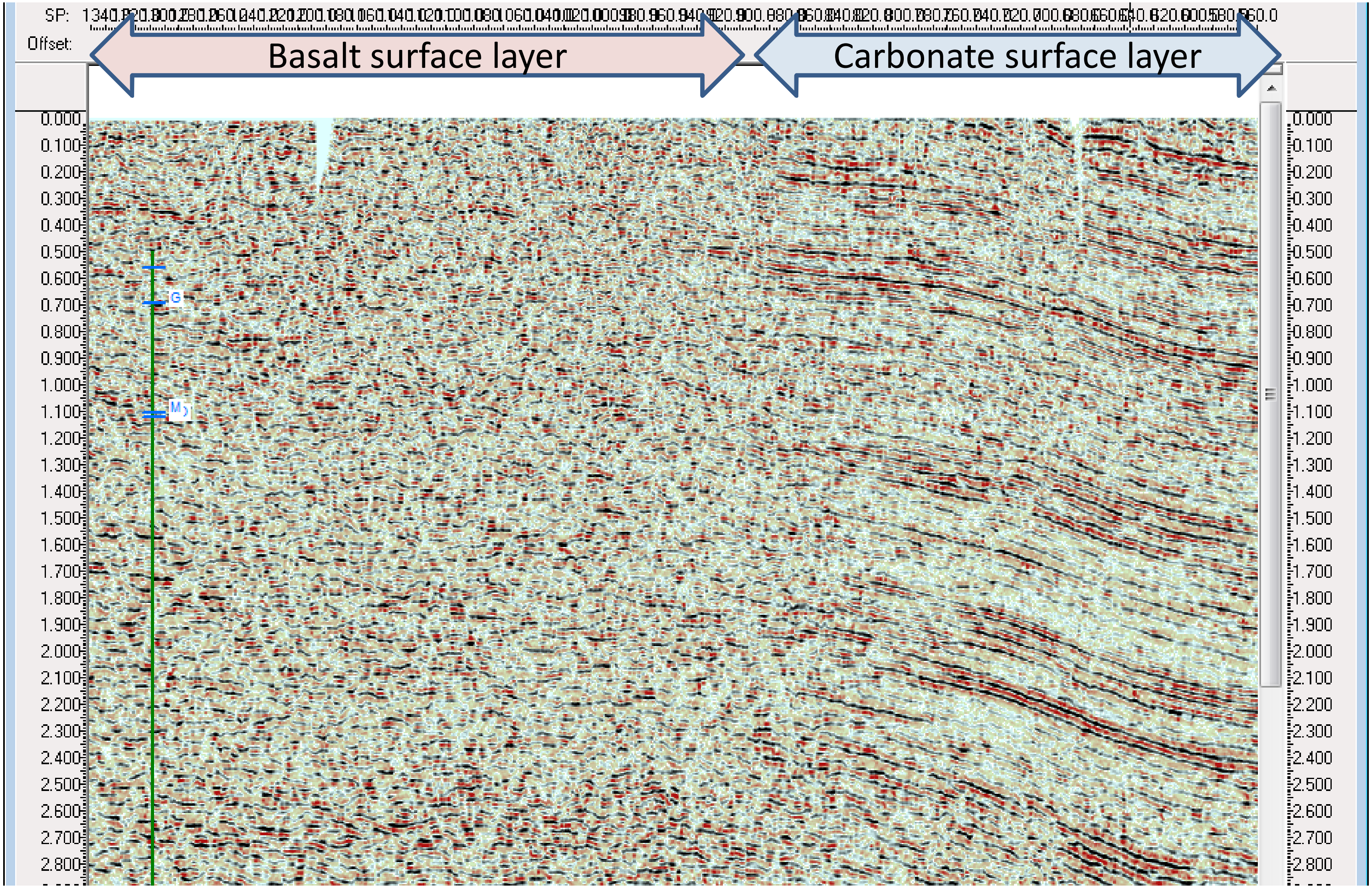
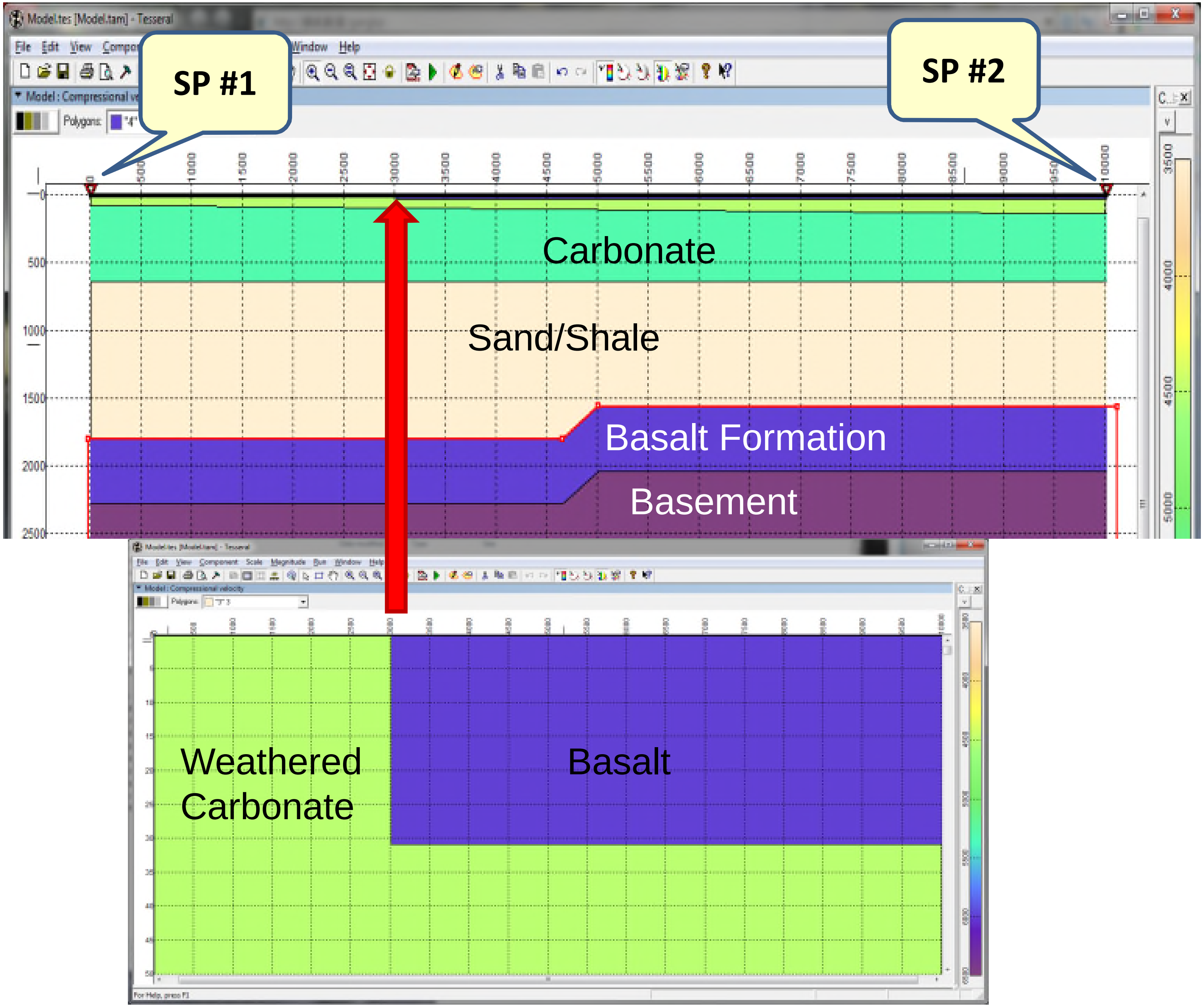
Reference Model



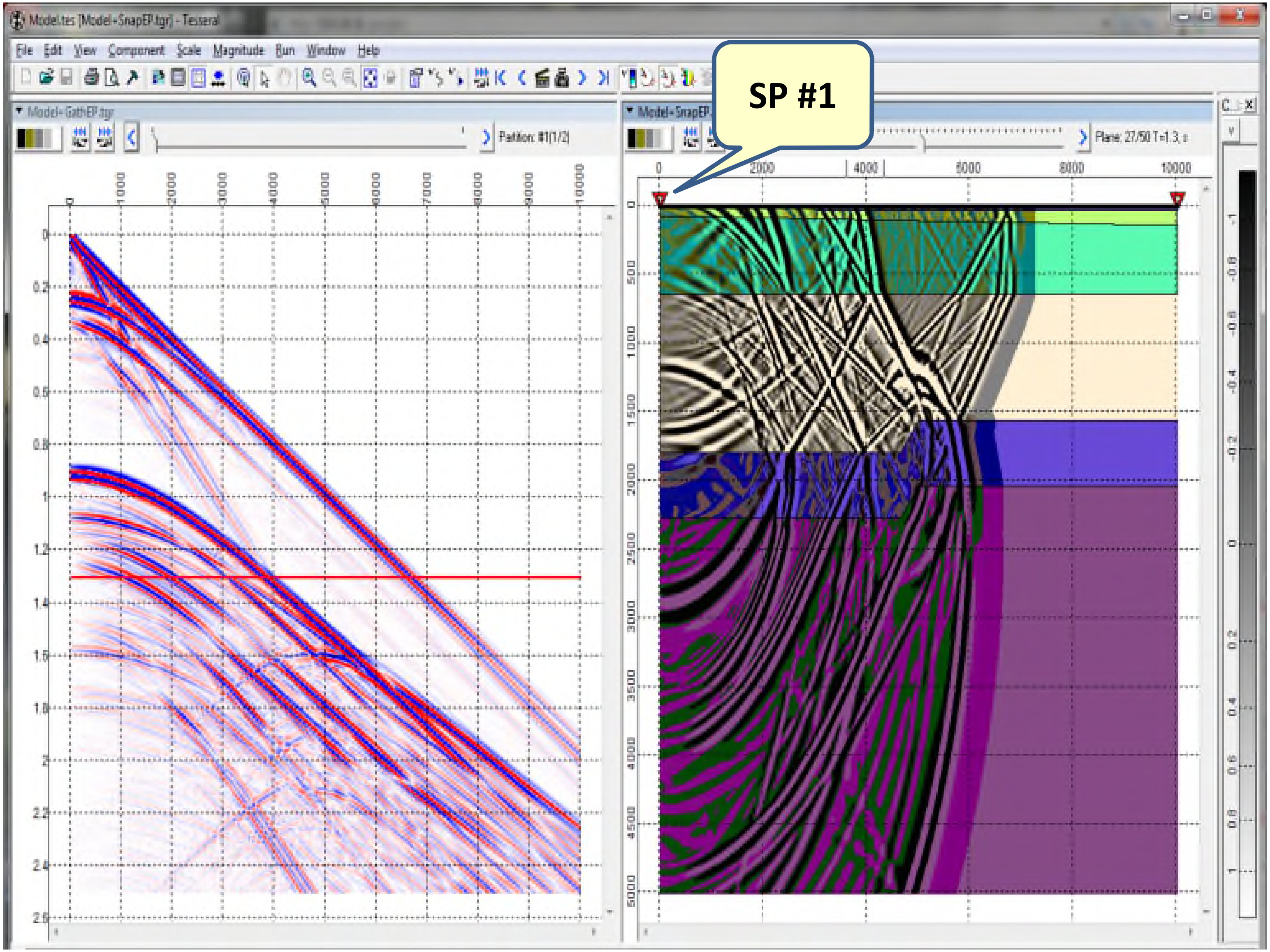
Reference Seismic Cross-section



1. Preliminary Shallow Model with thickness of Basalt layer equal to 30 m

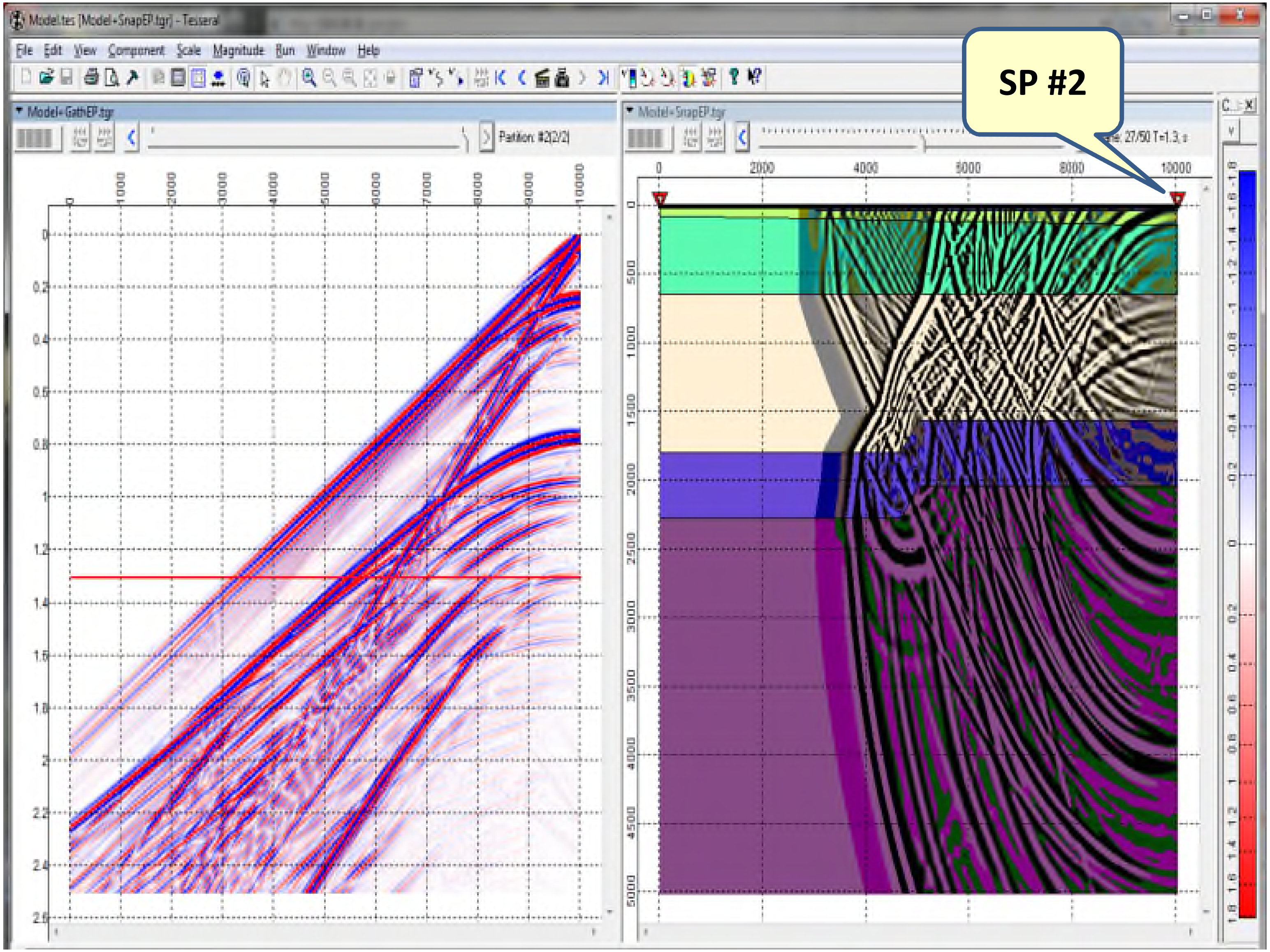


1. Preliminary Shallow Model with thickness of Basalt layer equal to 30 m



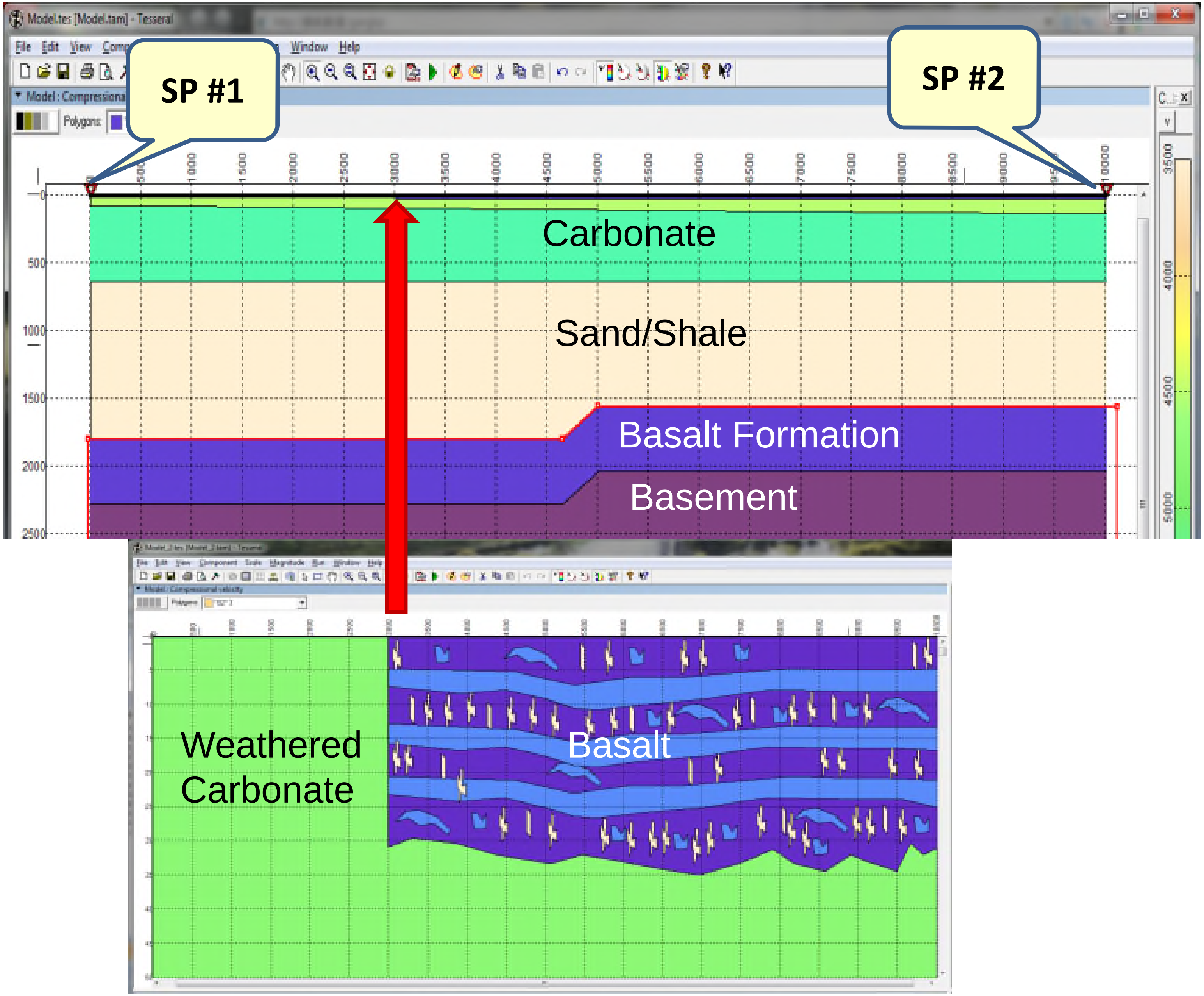
Synthetic Gather using Elastic FFM with fo=35Hz and Δ X=10 m from Weathered Carbonate side.

1. **Preliminary Shallow Model** with thickness of Basalt layer equal to 30 m

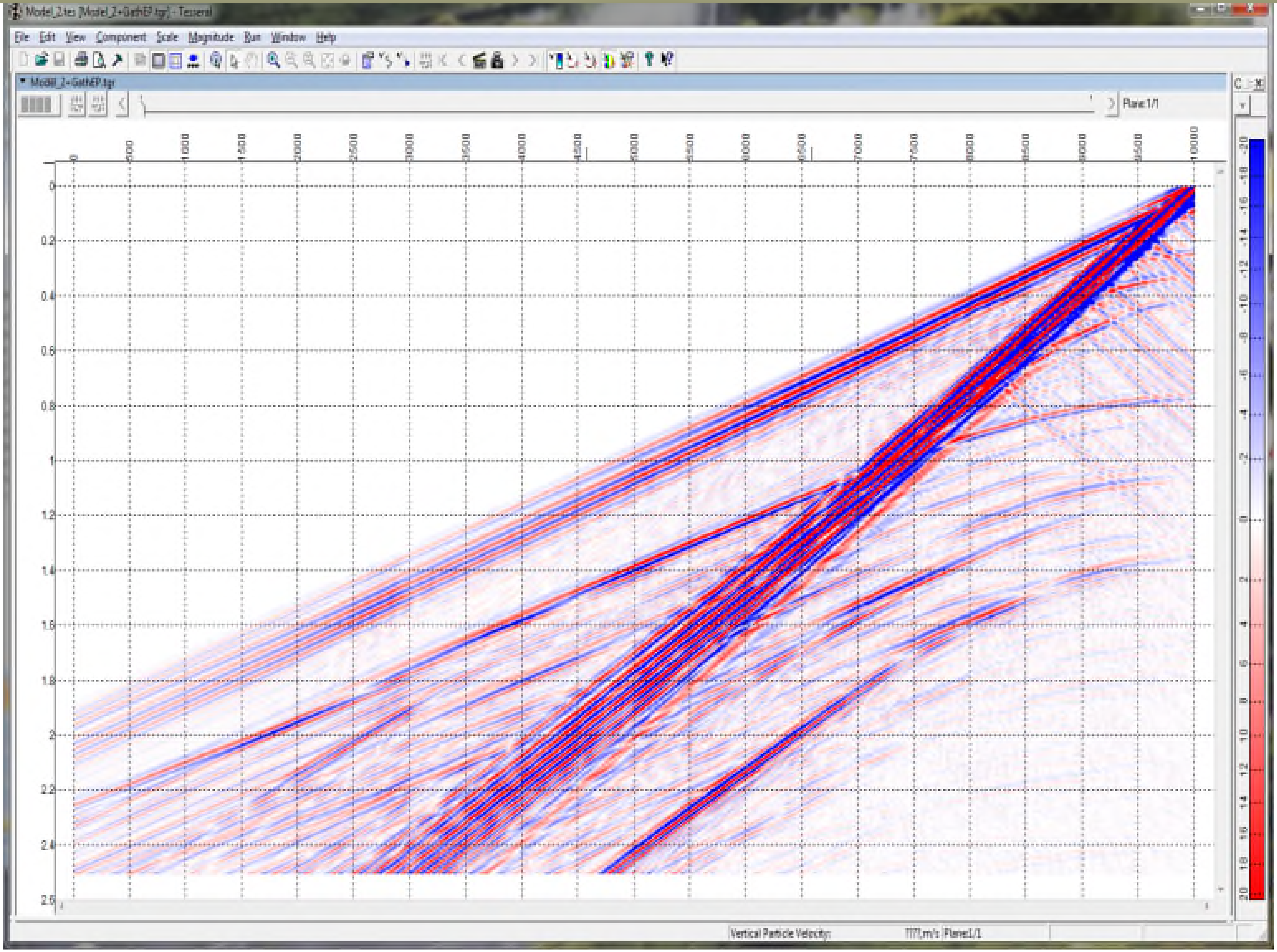


Synthetic Gather using Elastic FFM with fo=35Hz and Δ X=10 m from Basalt side.

2. Preliminary Shallow Model with boulders and fractures inclusions and rigidity in Basalt layer

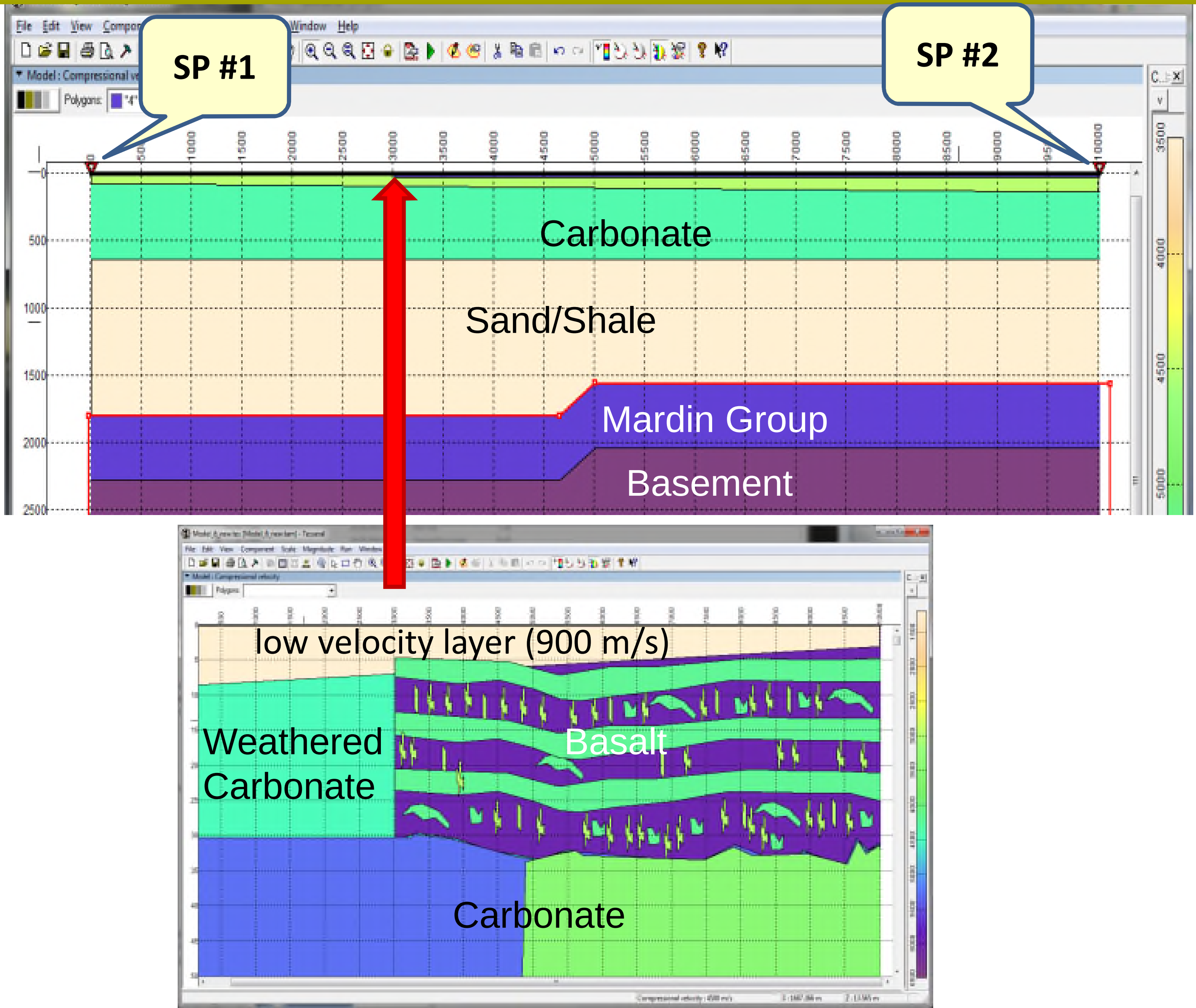


2. Preliminary Ogunduk Shallow Model with boulders and fractures inclusions and rigidity in Basalt layer

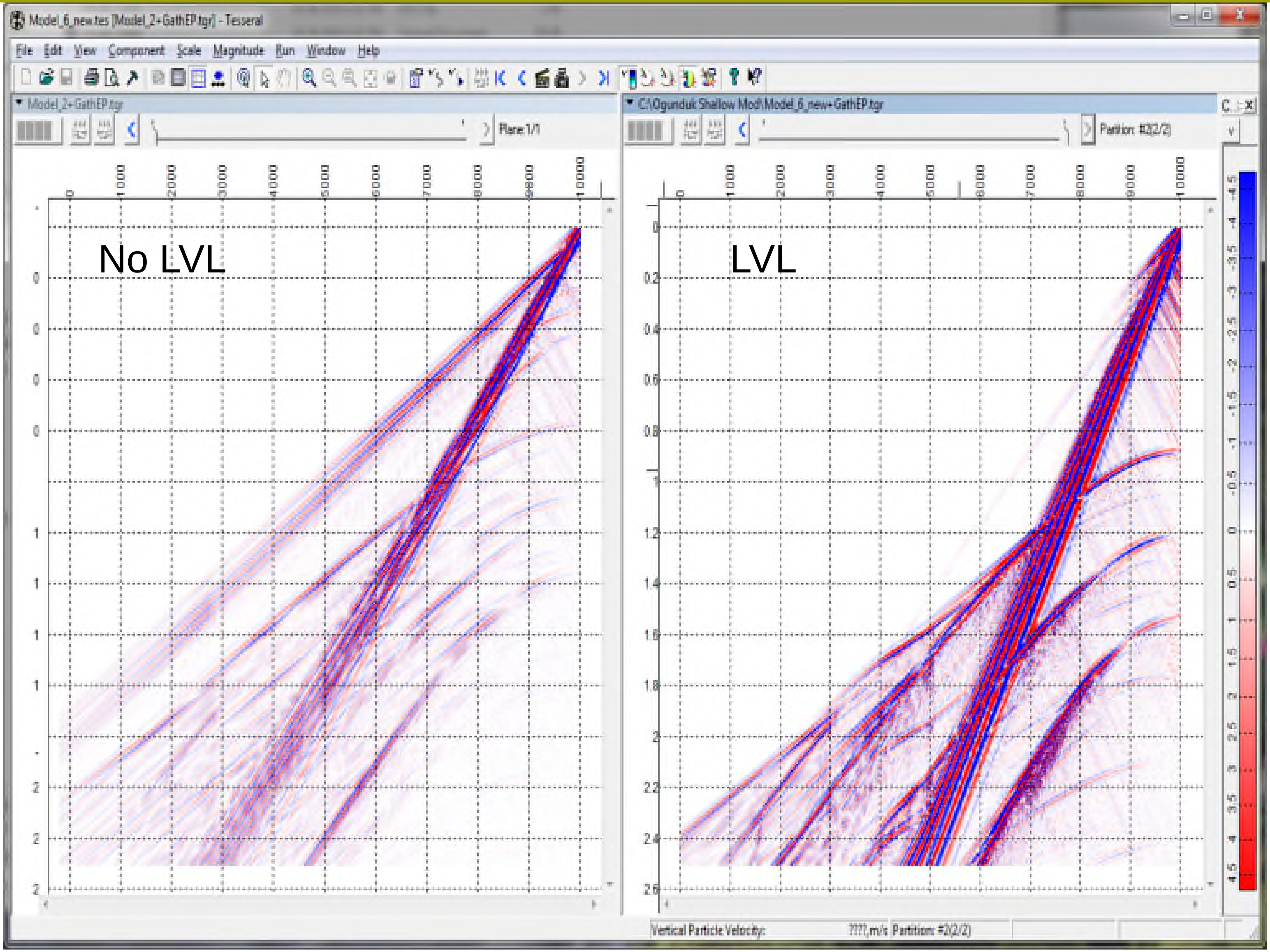


Synthetic gather over Basalt layer for a model with boulder, fracture and rigidity inclusions.

3. Preliminary Shallow Model with boulders and fractures inclusions and rigidity in Basalt layer and low velocity layer (900 m/s)

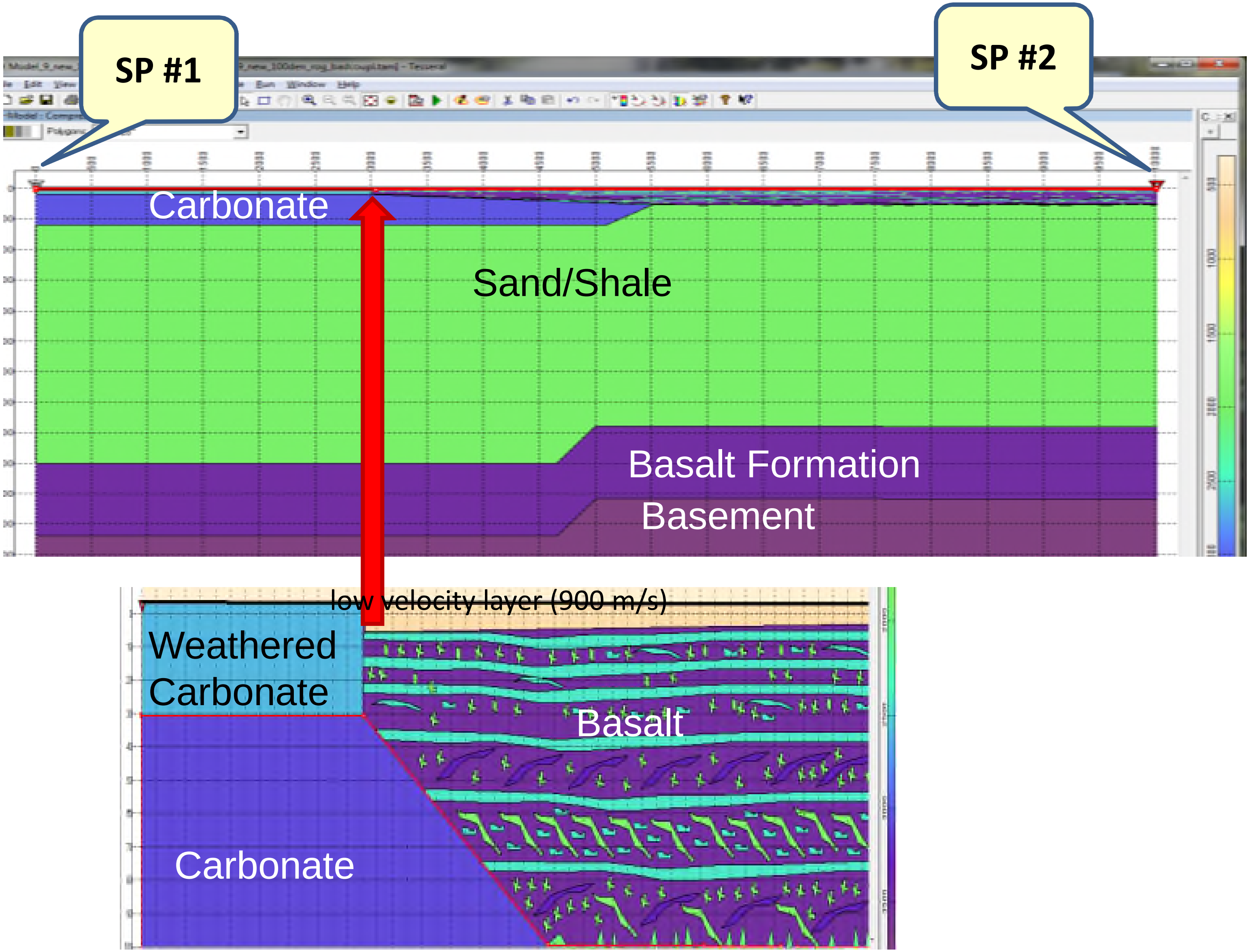


3. Preliminary Shallow Model with boulders and fractures inclusions and rigidity in Basalt layer and low velocity layer (900 m/s)

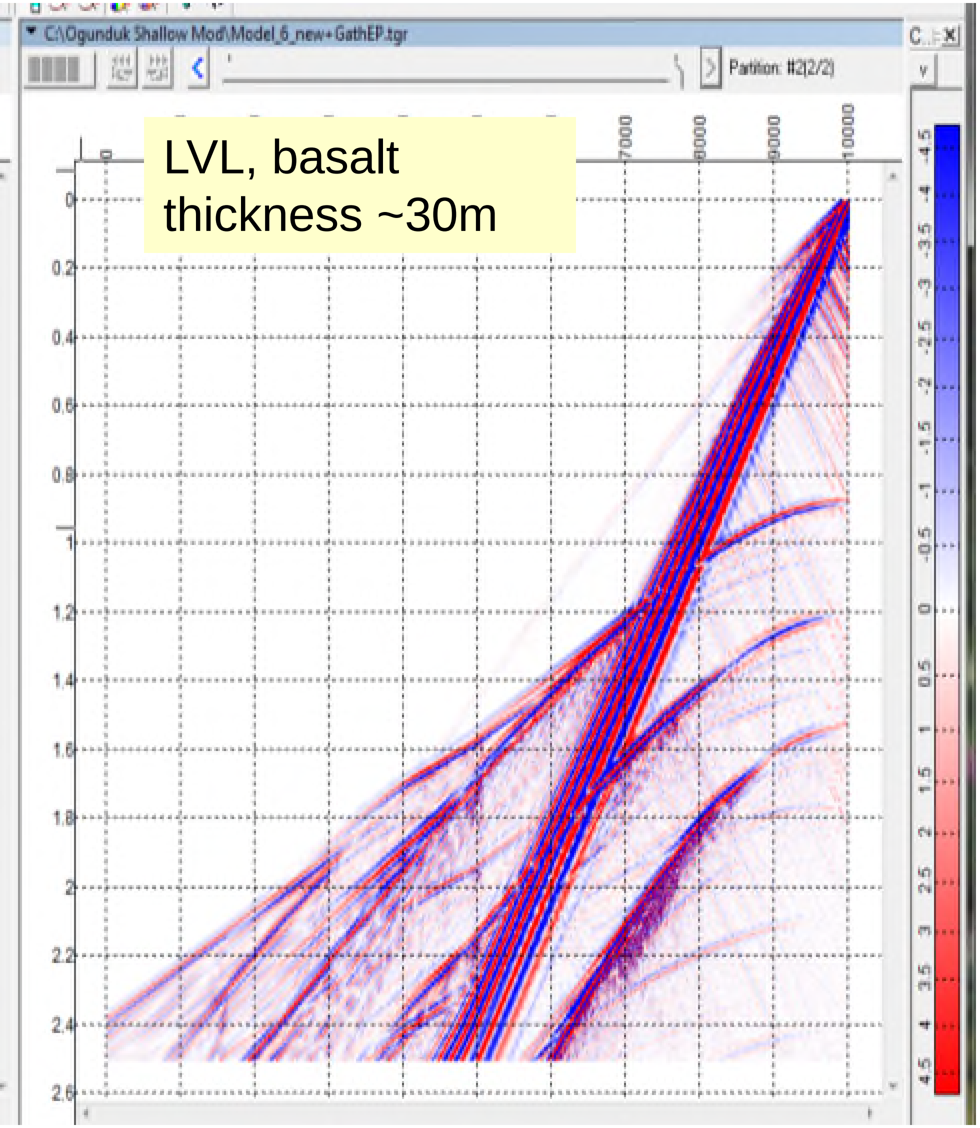


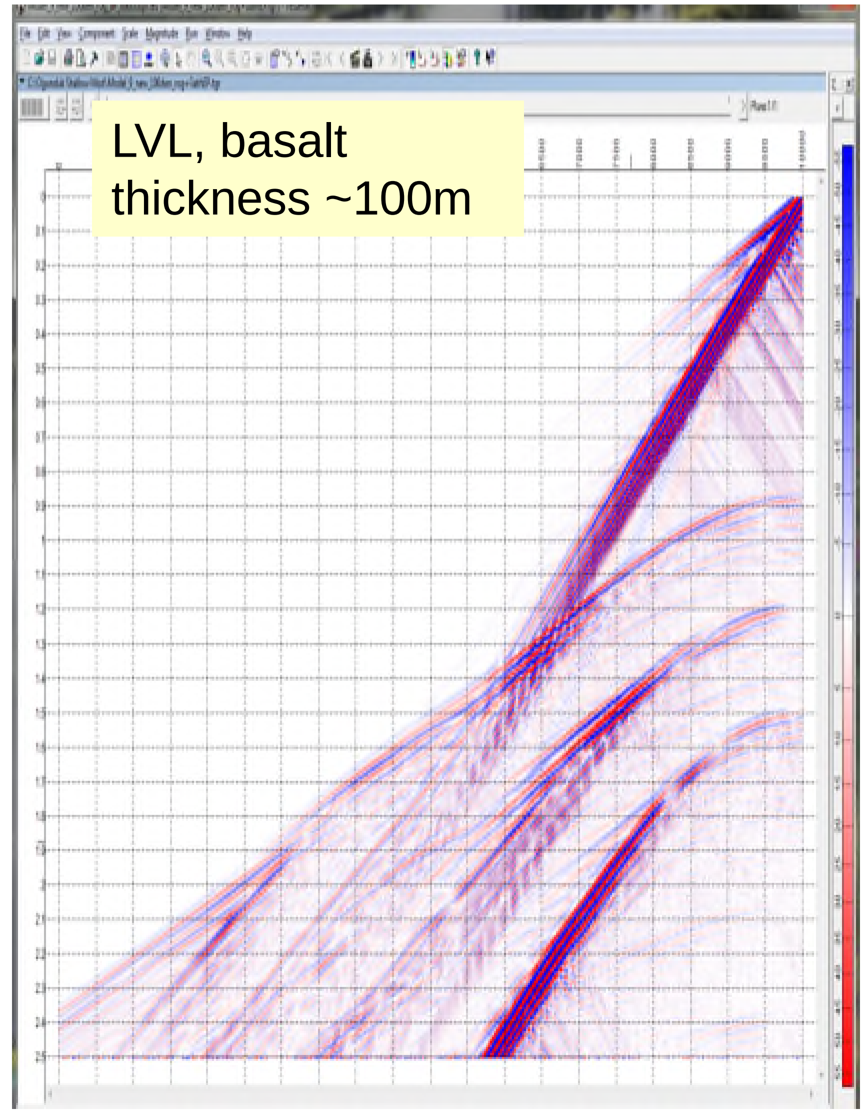
Comparison Synthetic Gathers with and without low velocity layer.

4. Modified Shallow Model (thickness of a basalt layer is up to 100m), complicated with low velocity layer (900 m/s), boulders and fractures



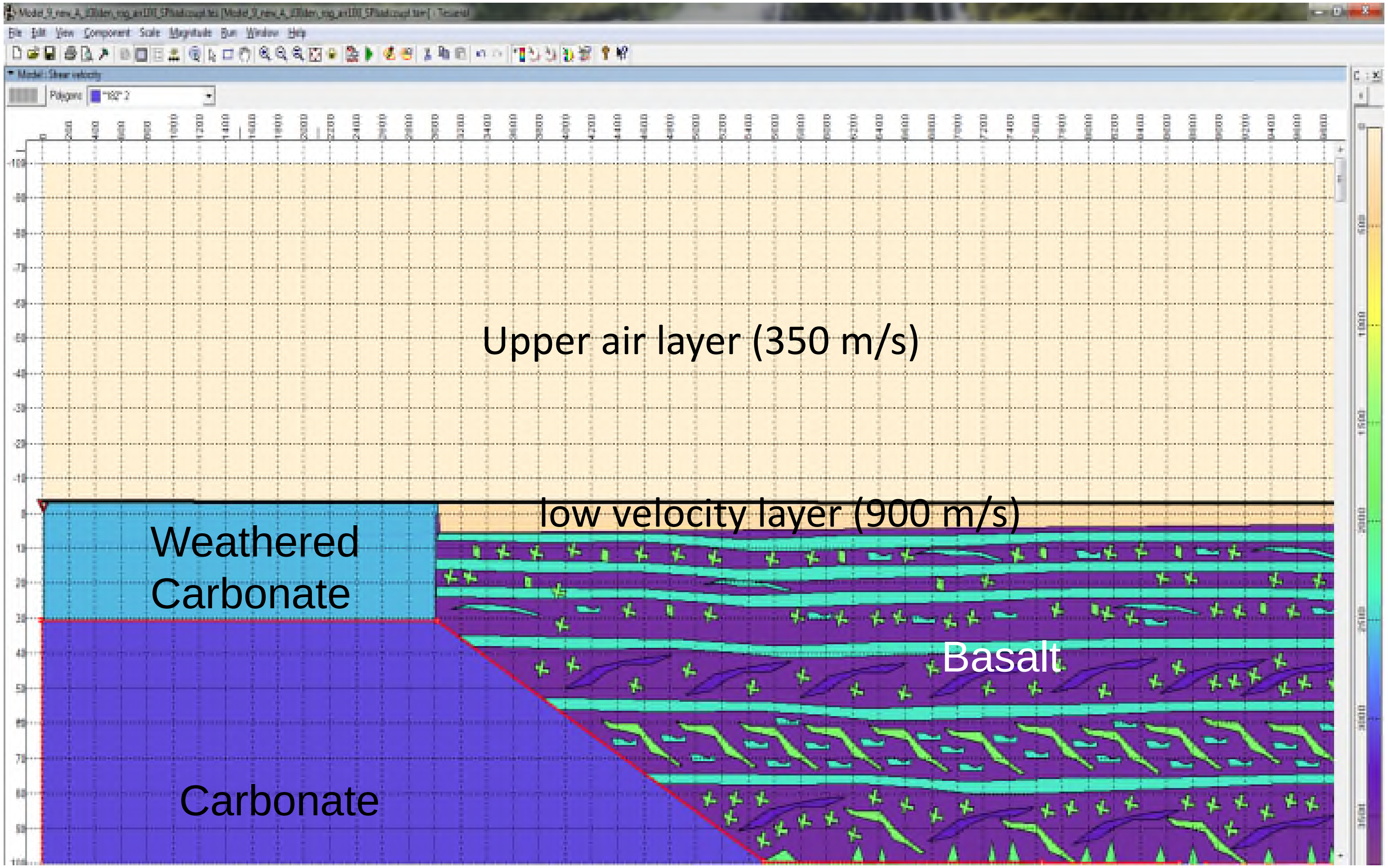
4. Modified Shallow Model (thickness of a basalt layer is up to 100m), complicated with low velocity layer (900 m/s), boulders and fractures



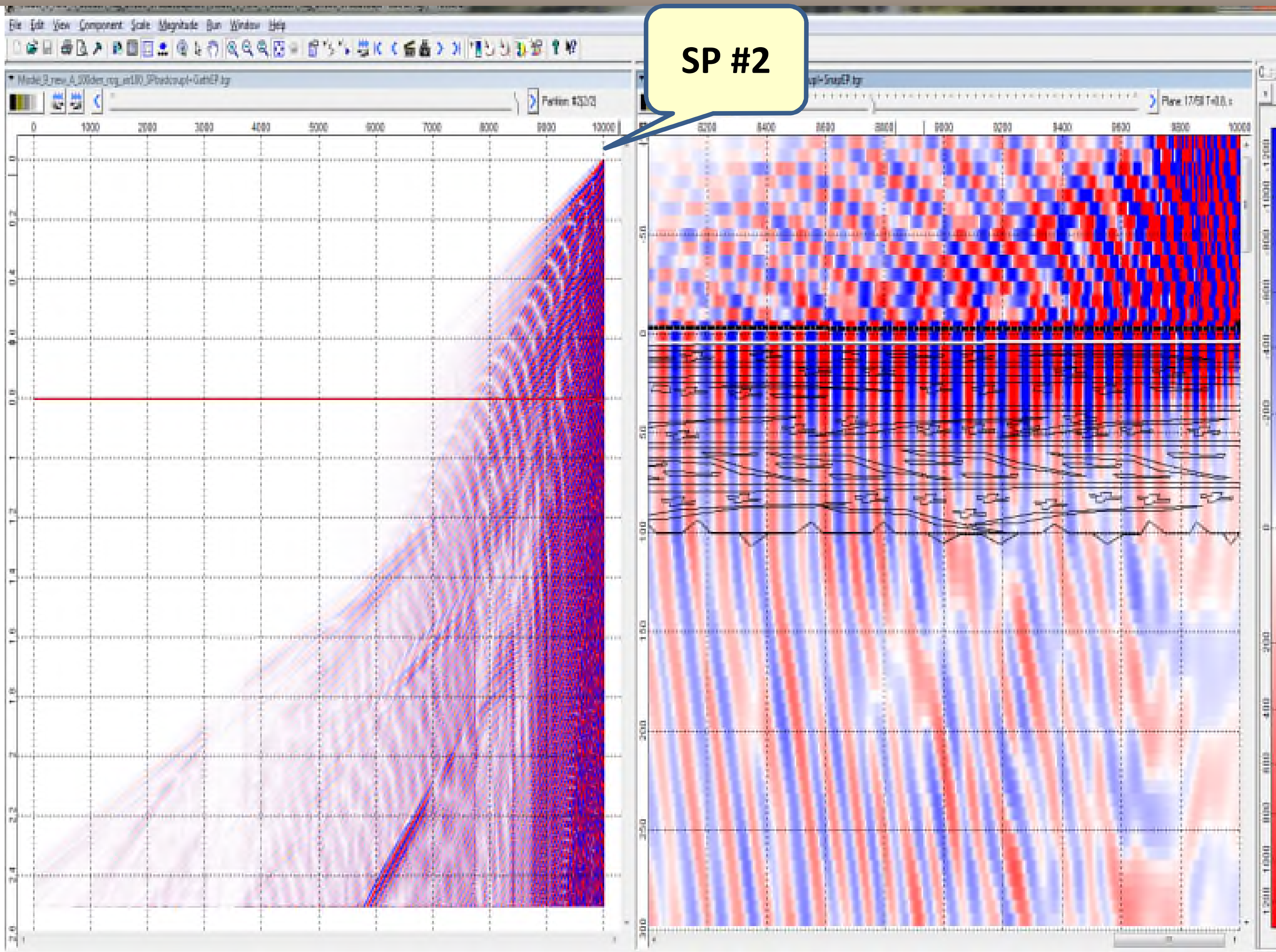


Synthetic Gather from Basalt side doesn't show much deterioration for under-basalt reflectors.

5. Modified Shallow Model, complicated with low velocity layer (900 m/s), boulders, fractures and bad coupling of shot point and receivers

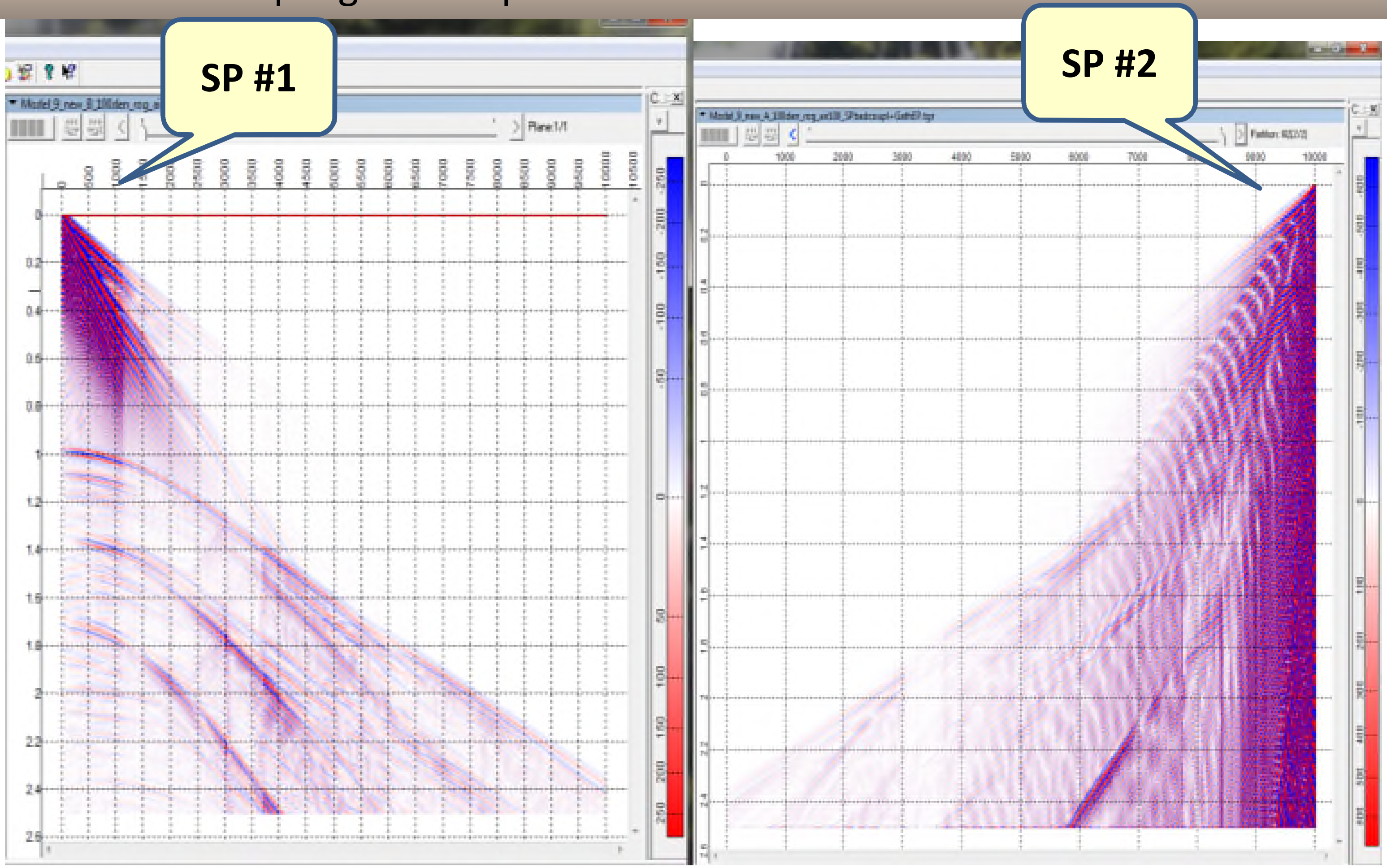


5. Modified Shallow Model, complicated with low velocity layer (900 m/s), boulders, fractures and bad coupling of shot point and receivers



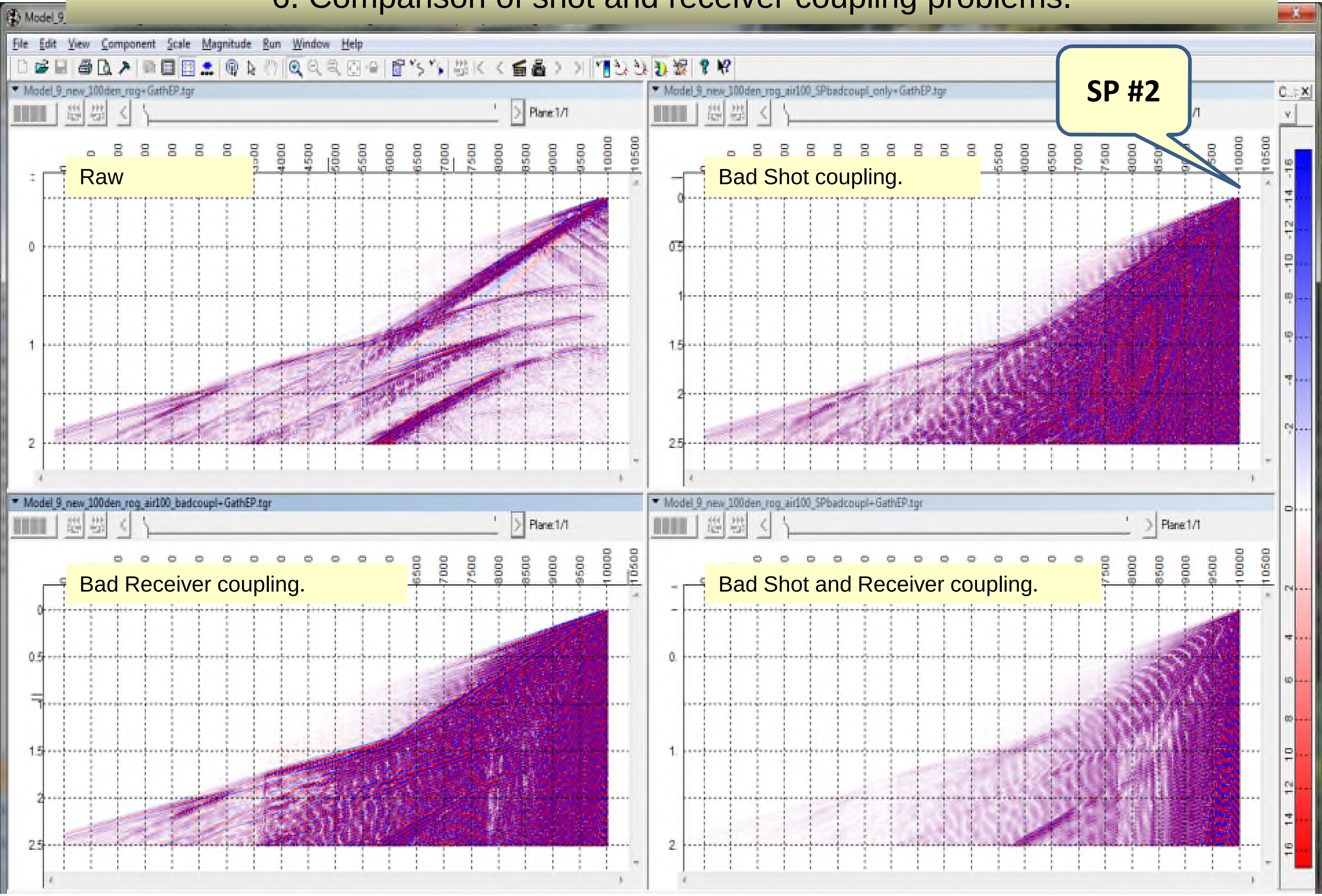
Synthetic Gather on model complicated with low velocity layer (900 m/s), boulders, fractures and bad coupling of shot point and receivers.

5. Modified Shallow Model, complicated with low velocity layer (900 m/s), boulders, fractures and bad coupling of shot point and receivers

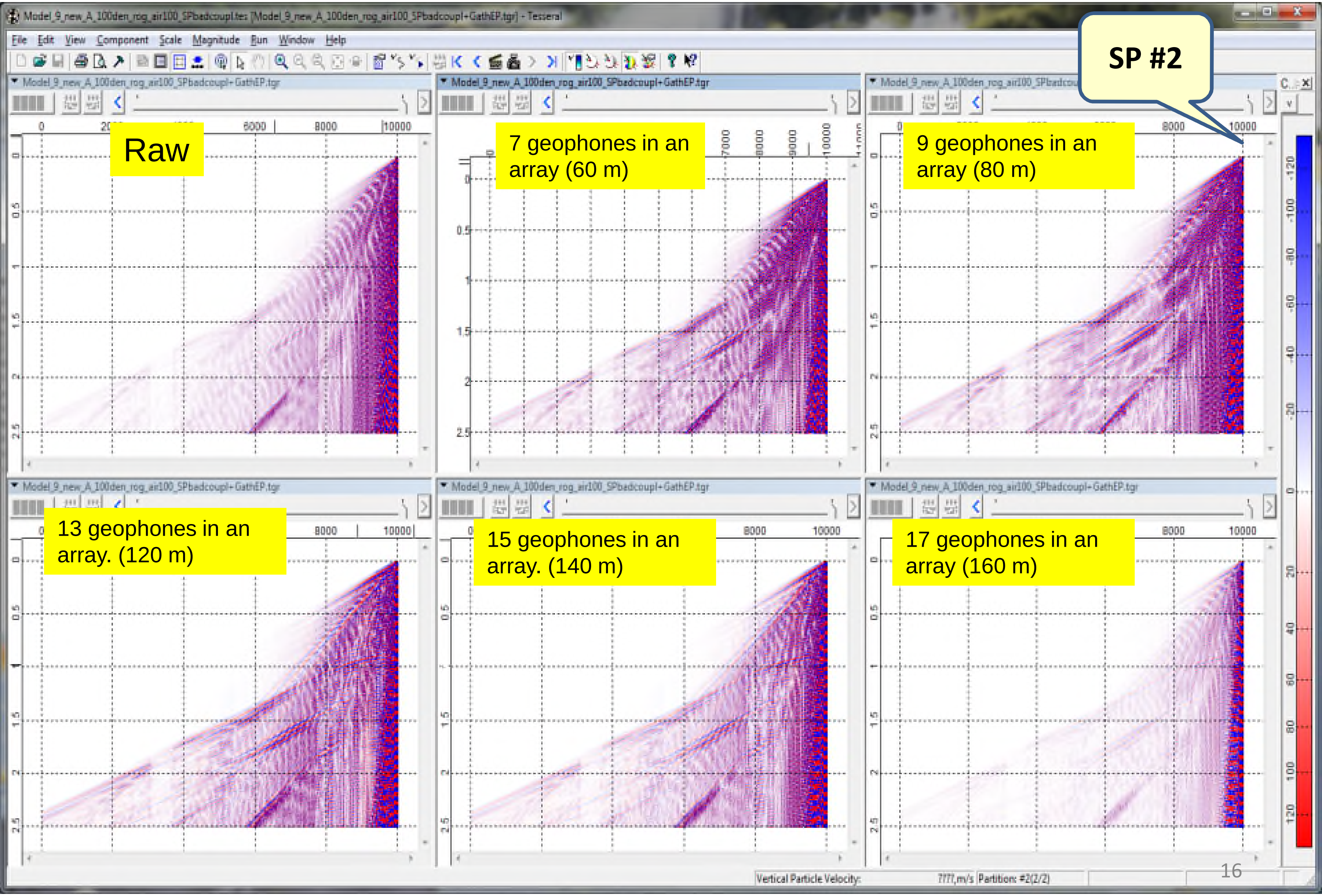


Comparison both synthetic gathers from Weathered Carbonate without bad couplings on smaller offsets and from Basalt sides on model complicated with low velocity layer (900 m/s), boulders, fractures and bad coupling of shot point and receivers.

6. Comparison of shot and receiver coupling problems.



7. Comparison different receiver array parameters for Synthetic Gather over Basalt layer



Conclusions

- Results of this stage of modeling (stage #1) show that basal cover do not represent impenetrable barrier for seismic energy to reach deeper target layers and then being recorded by receivers on the surface as reflected waves. Nevertheless, such conditions create quite strong hindrance surface waves, considerably attenuate seismic energy penetrating basalt layer and distort direct wave propagation path.
- Most of attention at stage of seismic survey must be paid to better receiver and source coupling over basalt layer. Drilling shallow holes for better planting of receivers may be also proposed. It may also allow to considerably attenuate effects of high frequency noise within thin day surface layer (skin-effect) of rigid rocks (like basalt is).
- High frequencies for sweep signal (over 60 Hz) also can deteriorate seismic field records for such conditions.
- To attenuate effect of surface waves within basalt layer we must be used grouping (or trace mixing) on base 70 – 120m. This trace mixing, or various types of noise suppression, could be applied in the processing center to help preserve diffraction patterns which are attenuated with too much horizontal mixing.
- To attenuate effect of wavefront distortions (down going spreading from the source on top of basalt) caused by basalt layer indicates the need for depth migration, which allows taking such effects into account. Additionally model itself is representing considerable lateral velocity changes (see slide 1), which can be consistently taken into account only by PSDM.