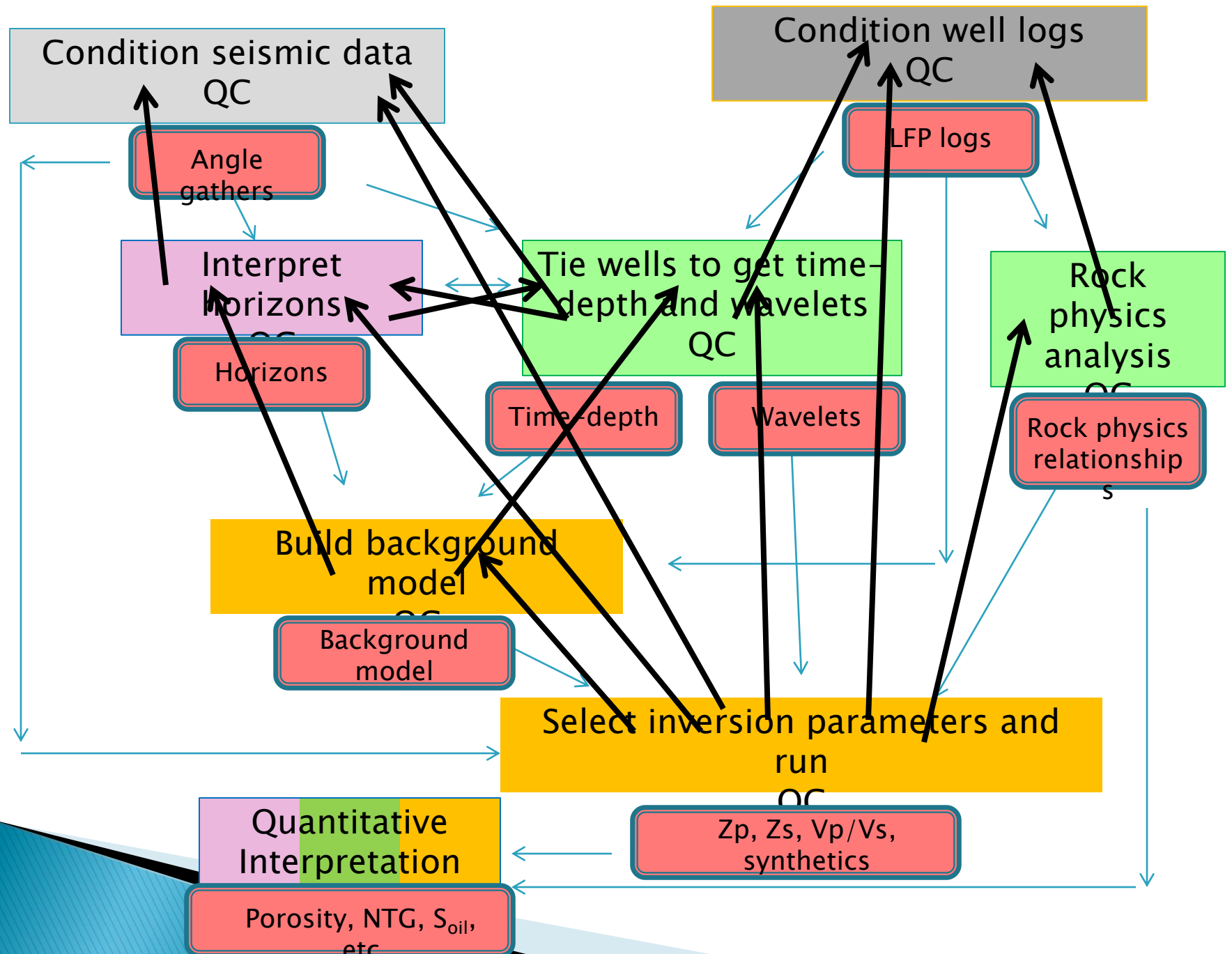


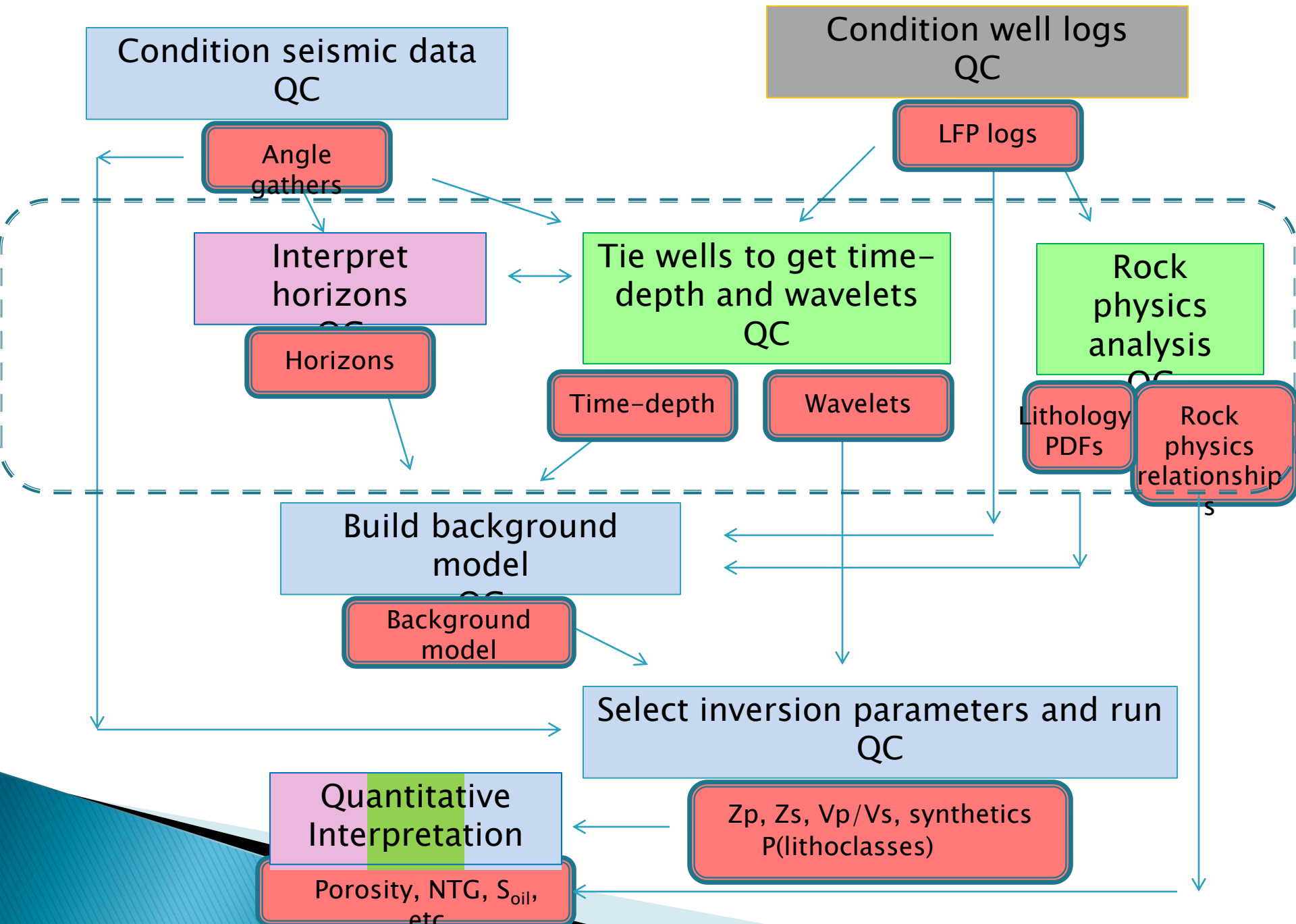
Examples

Peter Harris
Deep Vision Ltd and Sharp Reflections

Deterministic AVA Inversion Workflow



PCUBE-type AVA Inversion Workflow



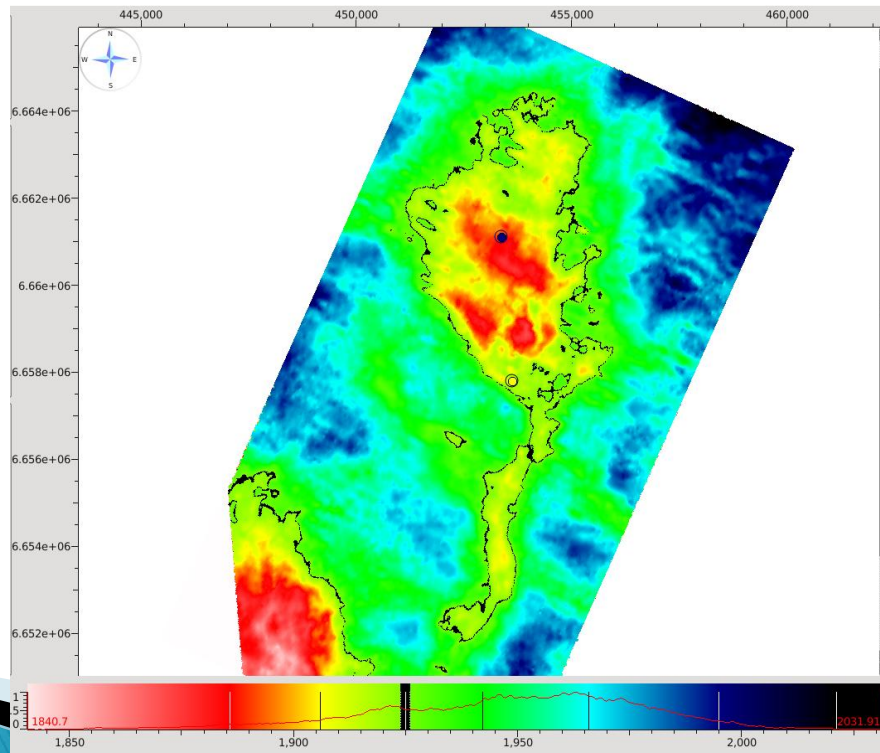
Method

Buland, A., and H. Omre, 2003, Bayesian linearized AVO inversion: *Geophysics*, **68**, 185–198.
Buland, A., et al, 2008, Bayesian lithology and fluid prediction from seismic prestack data: *Geophysics*, **73**, C13–C21.

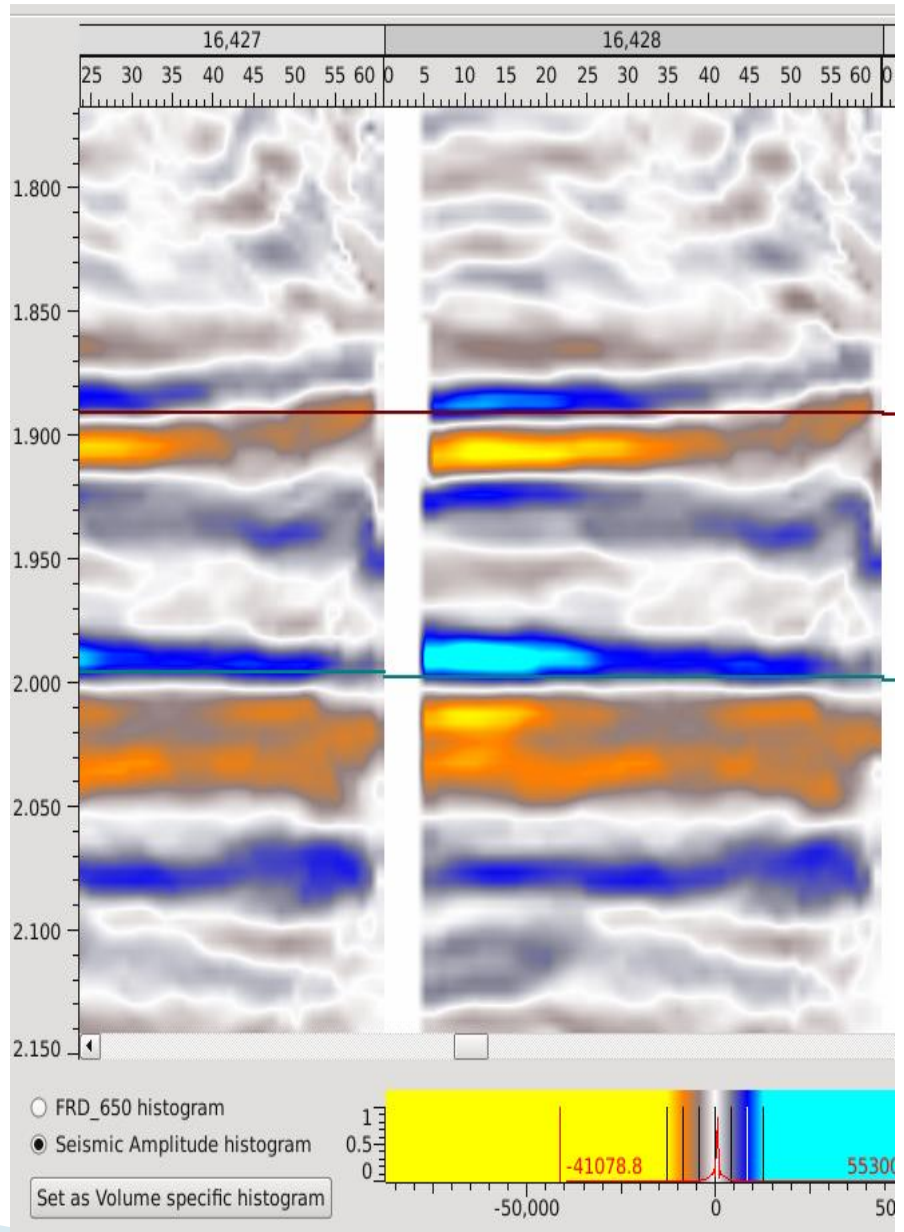
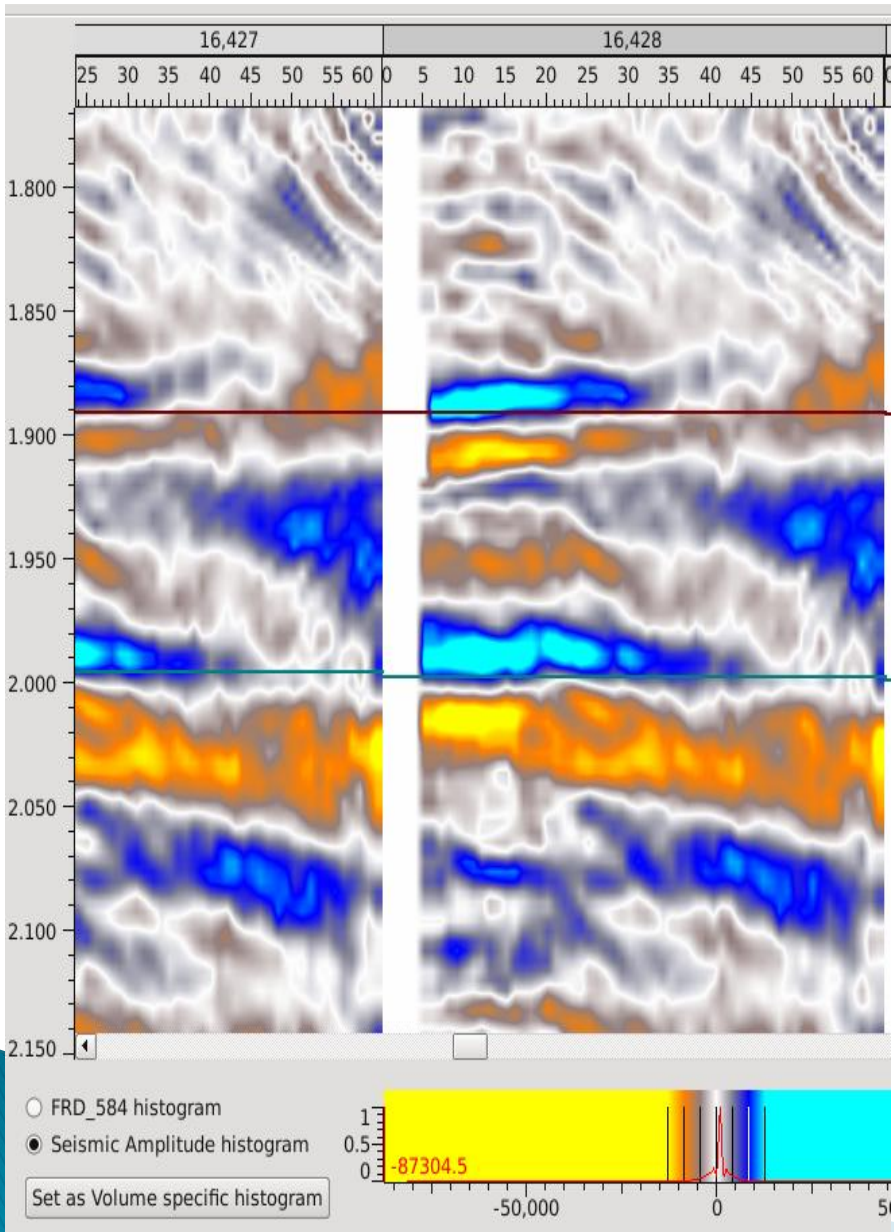
- 1) Define categorical facies classes.
 - 2) Specify the rock properties by likelihood functions $p(\mathbf{m}|f)$ for each facies.
 - 3) Specify spatial prior probabilities $p(f)$ for the facies.
 - 4) Derive the prior model $p(\mathbf{m})$ for the elastic parameters from equation 7.
 - 5) Approximate the elastic prior model with a Gaussian model $p_*(\mathbf{m})$.
 - 6) Estimate the seismic wavelet and the noise covariance.
 - 7) Calculate the solution of the Bayesian AVO inversion using equations 8.
 - 8) Calculate the posterior facies probabilities using equations 11–14.
- Rock physics
- Initial model
- Well tie
- Deterministic inversion
- Bayesian facies classification
-

The background

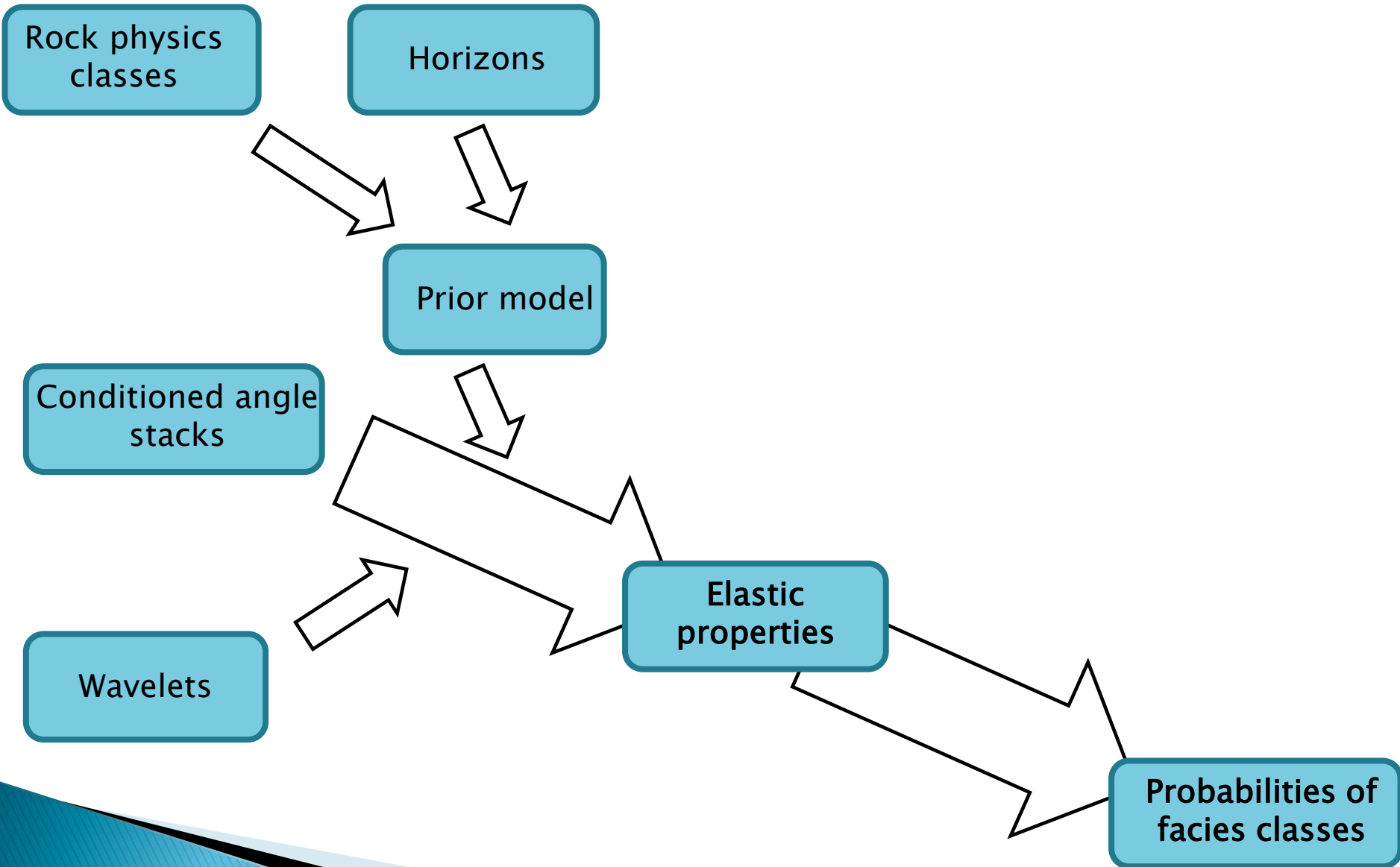
- Odin field, Norwegian sector, North Sea
- Frigg formations sands capped by lower Eocene shales
- Up to 80m high porosity sand
- 4-way closure appears to be submarine fan enhanced by differential compaction.



Data conditioning



Pcube: Bayesian Inversion

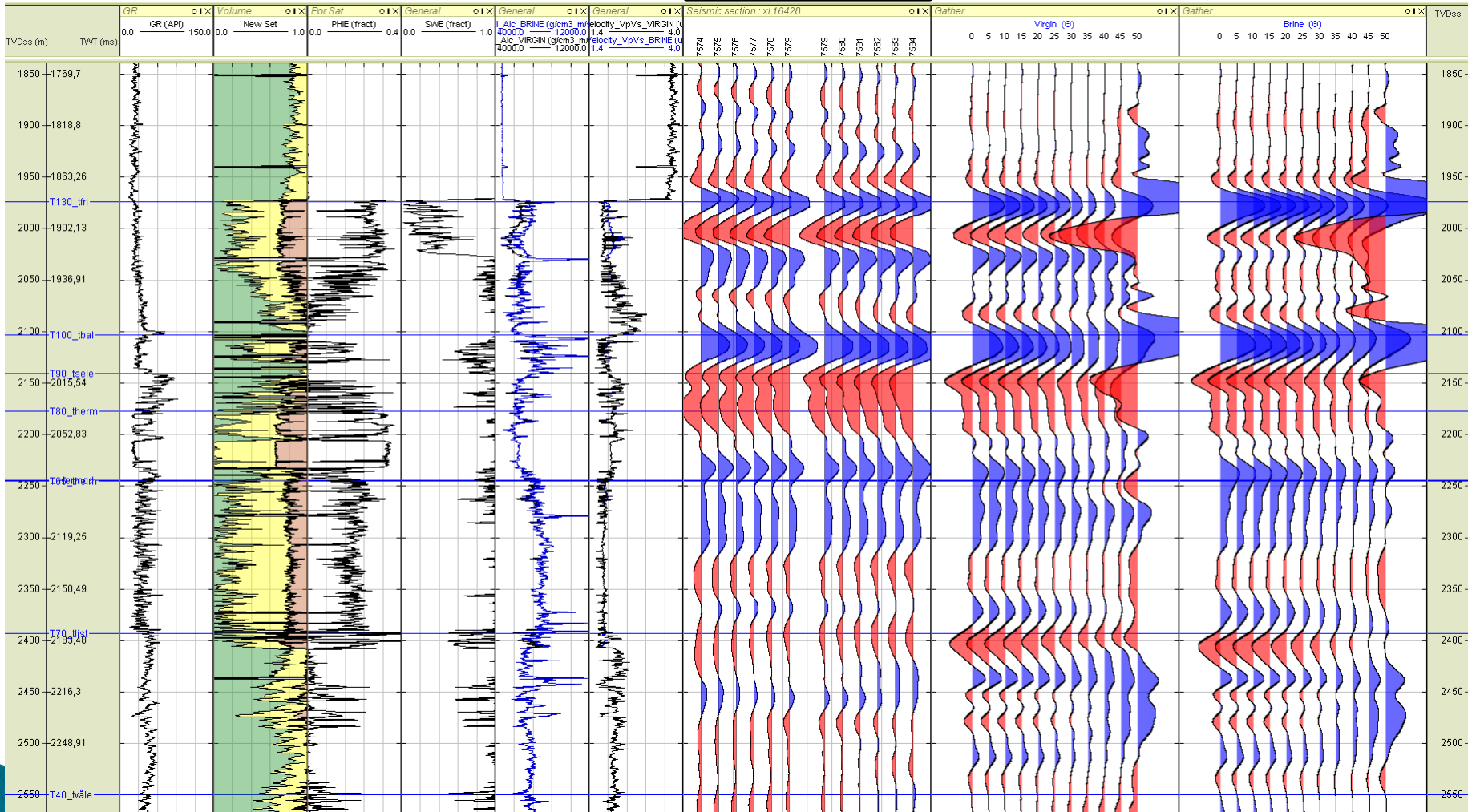


Well work: synthetics

Seismic near angle stack

In-situ synthetic

Brine synthetic

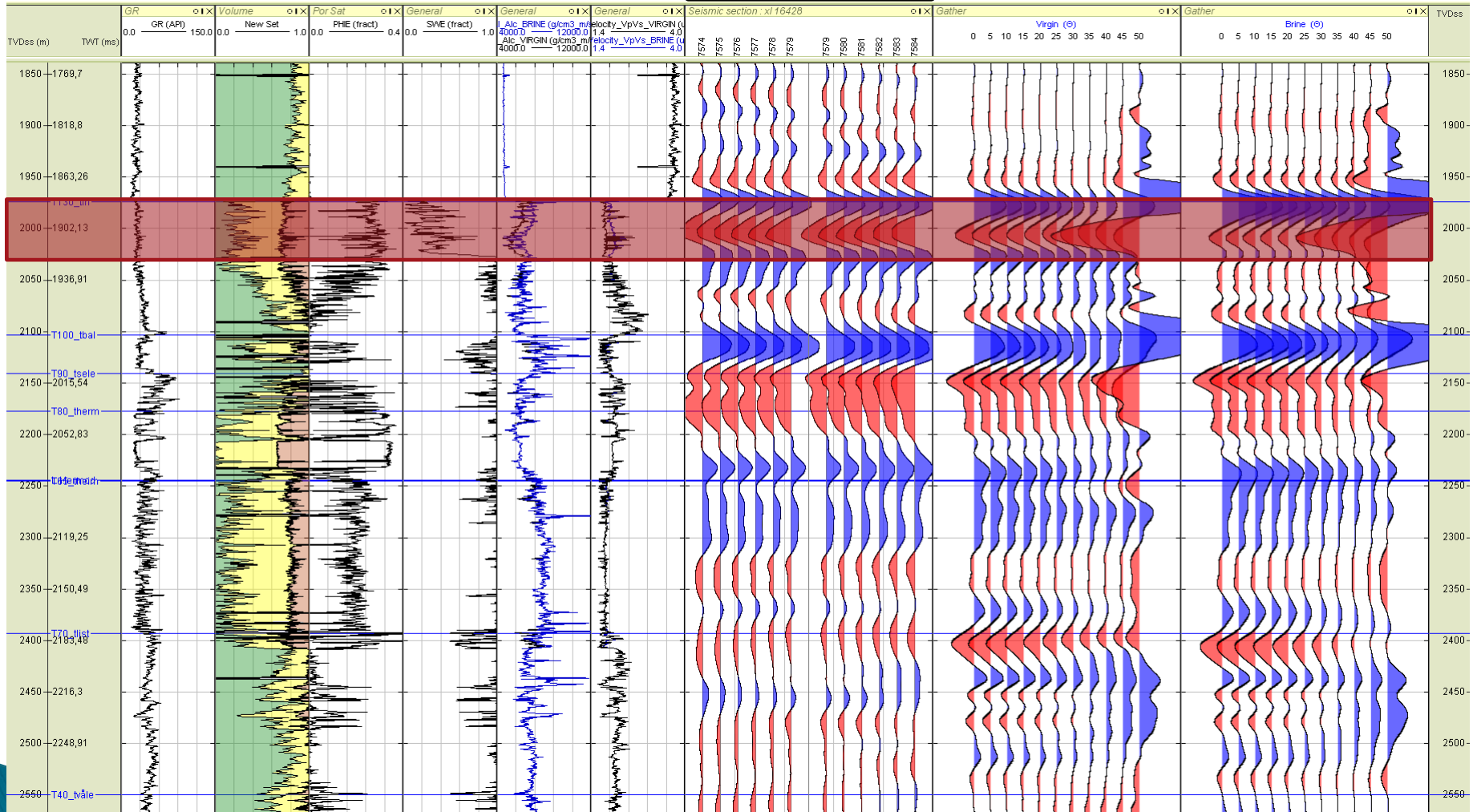


Well work: synthetics

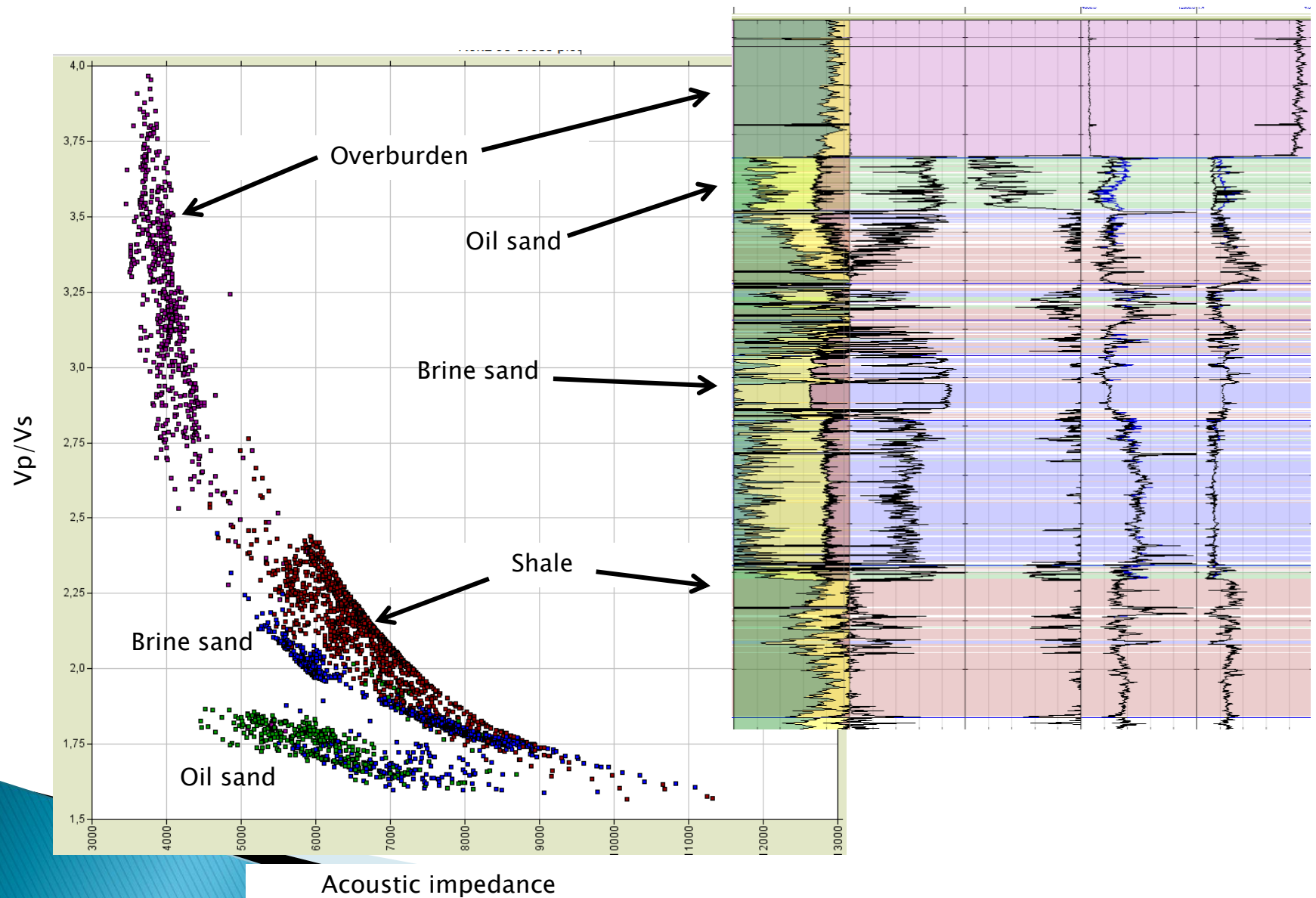
Seismic near angle stack

In-situ synthetic

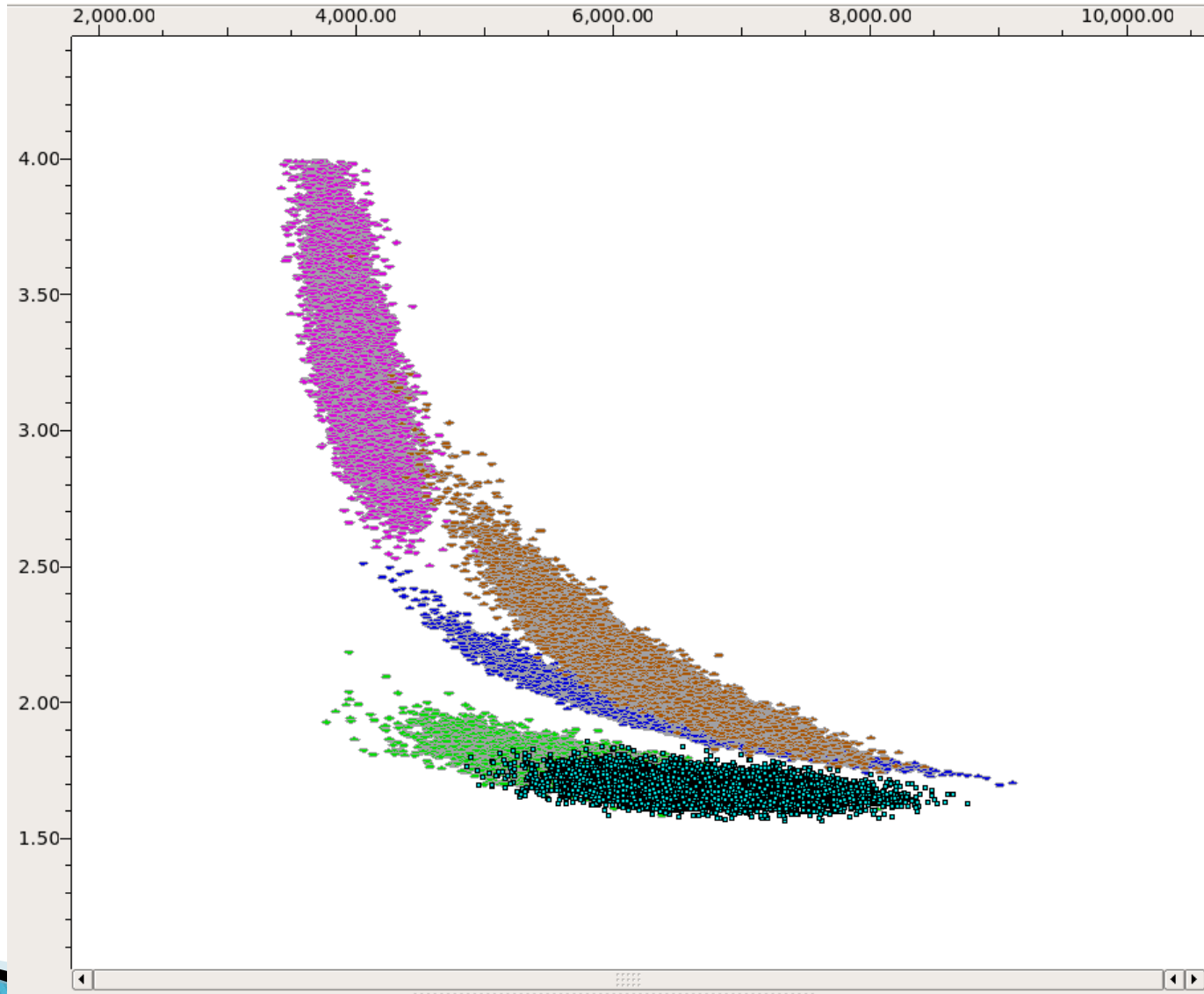
Brine synthetic



Well work: litho-classes

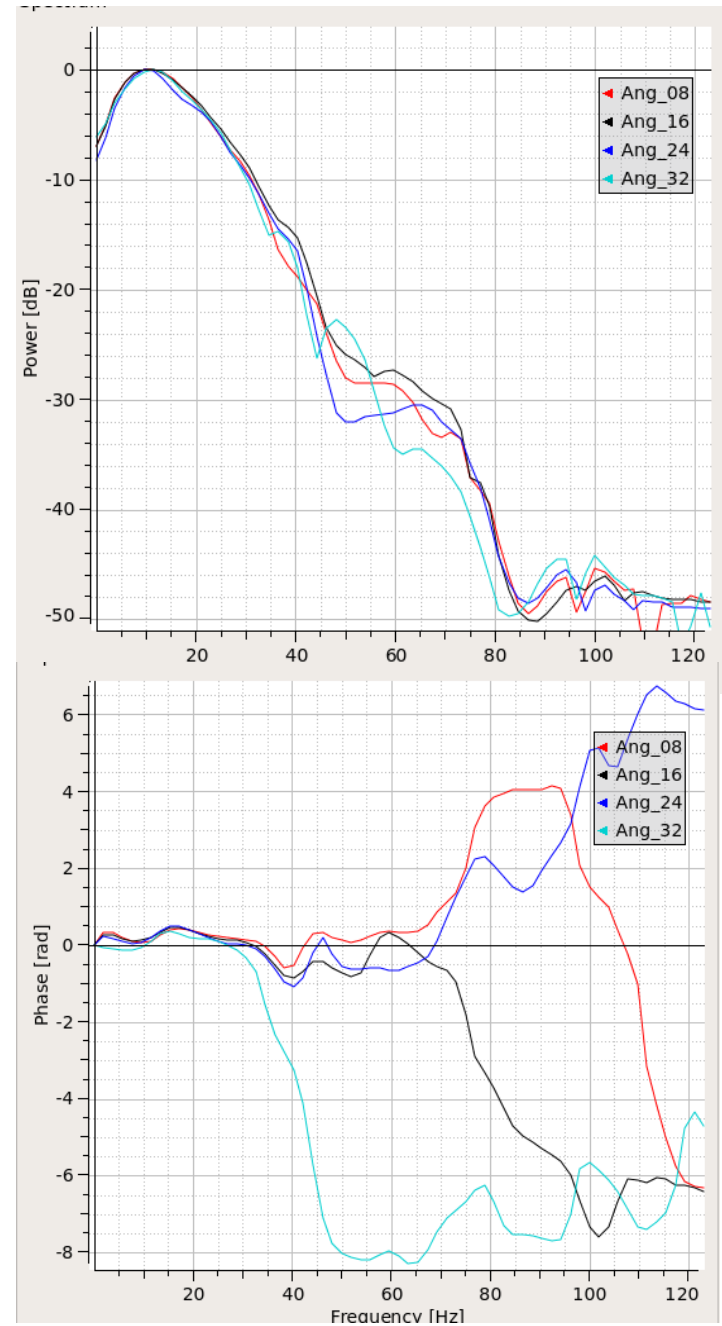
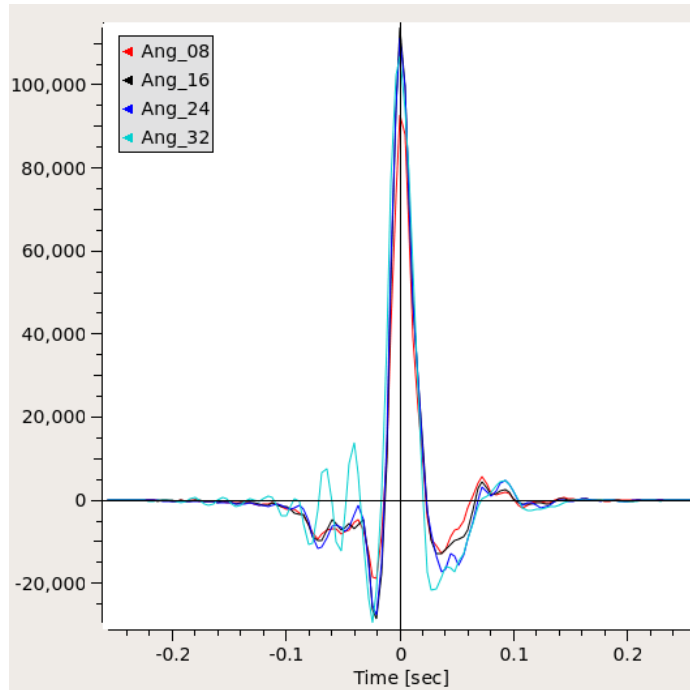


Well work: litho-classes

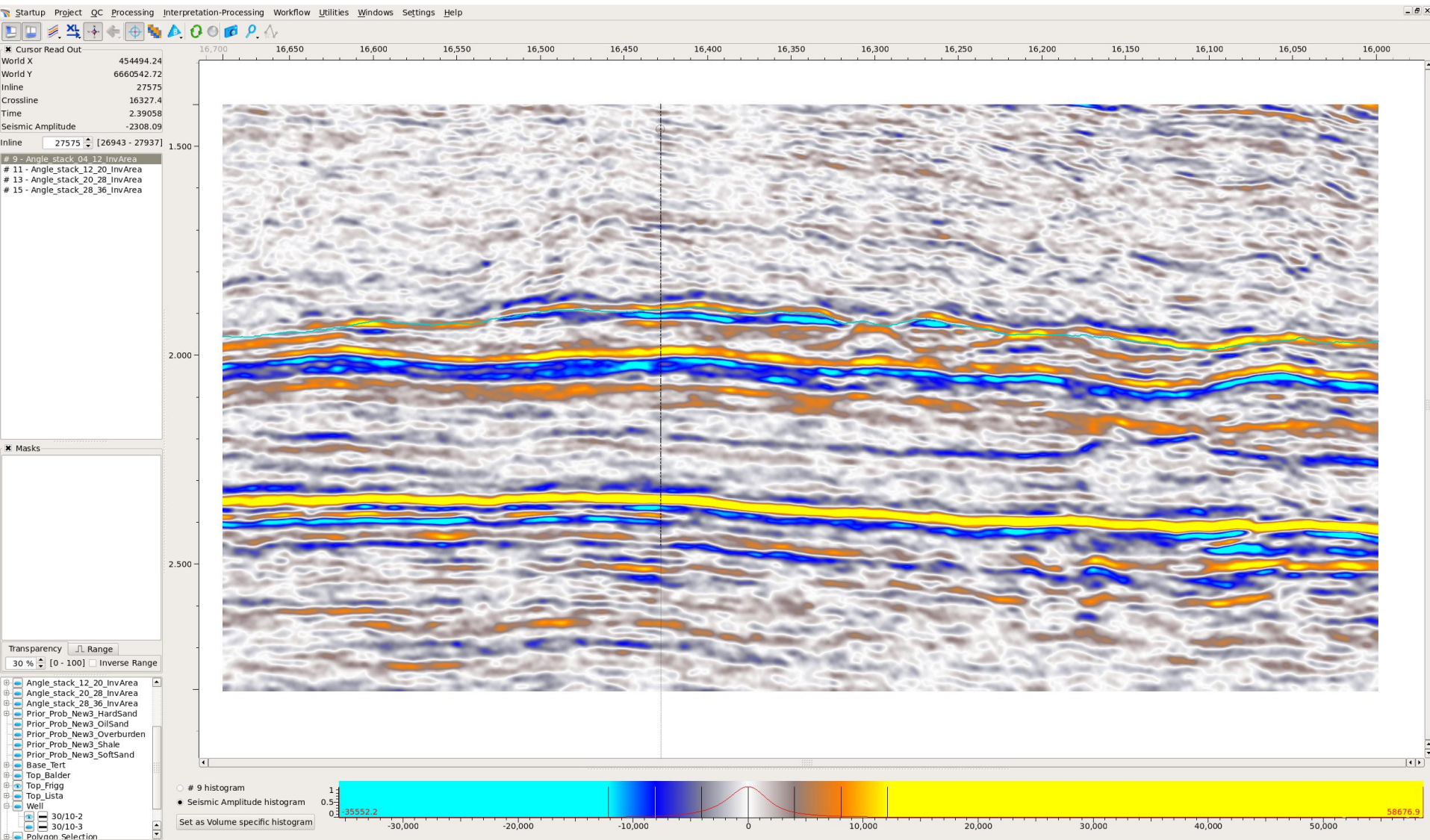


Well work: wavelets

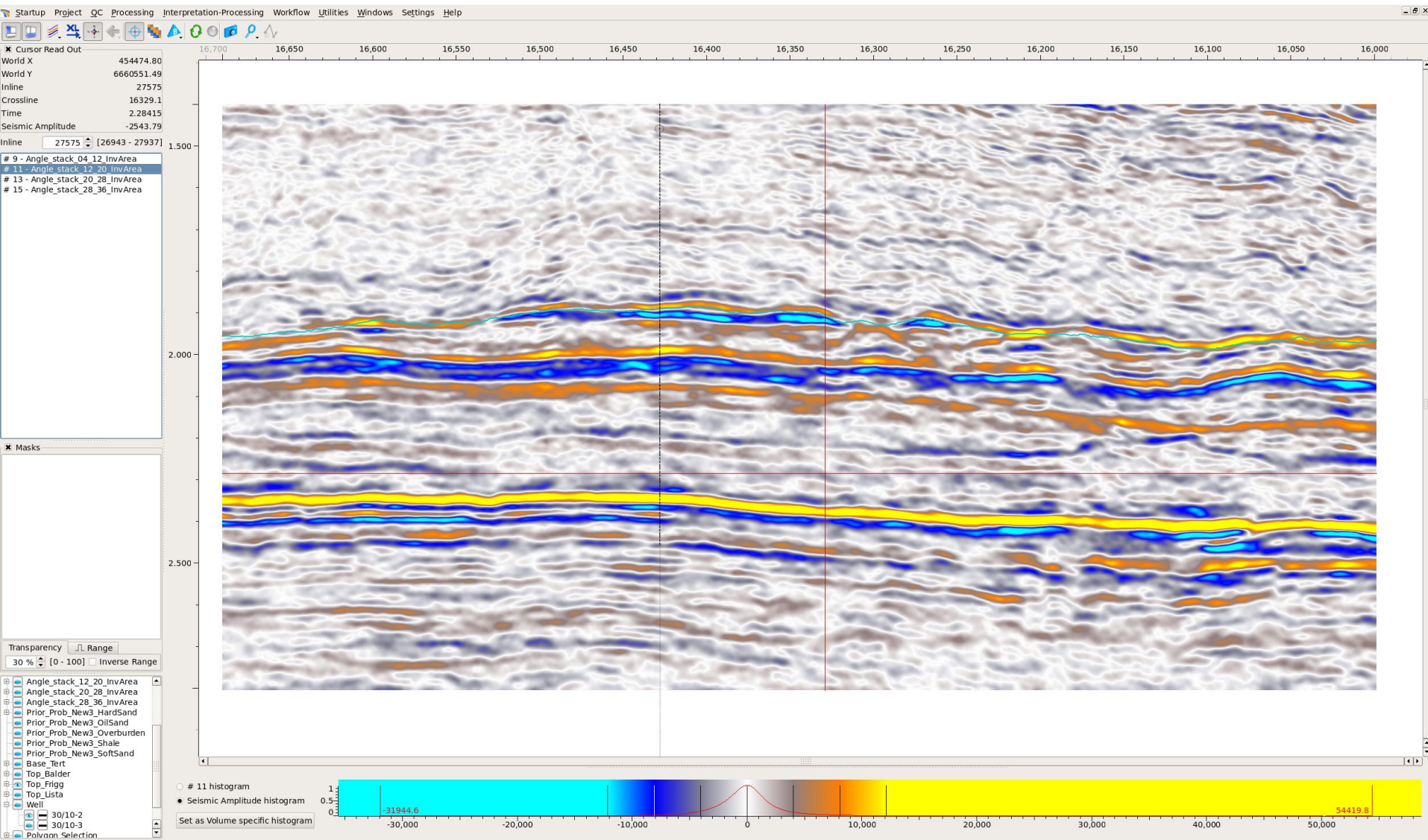
One per angle stack
30/10-2



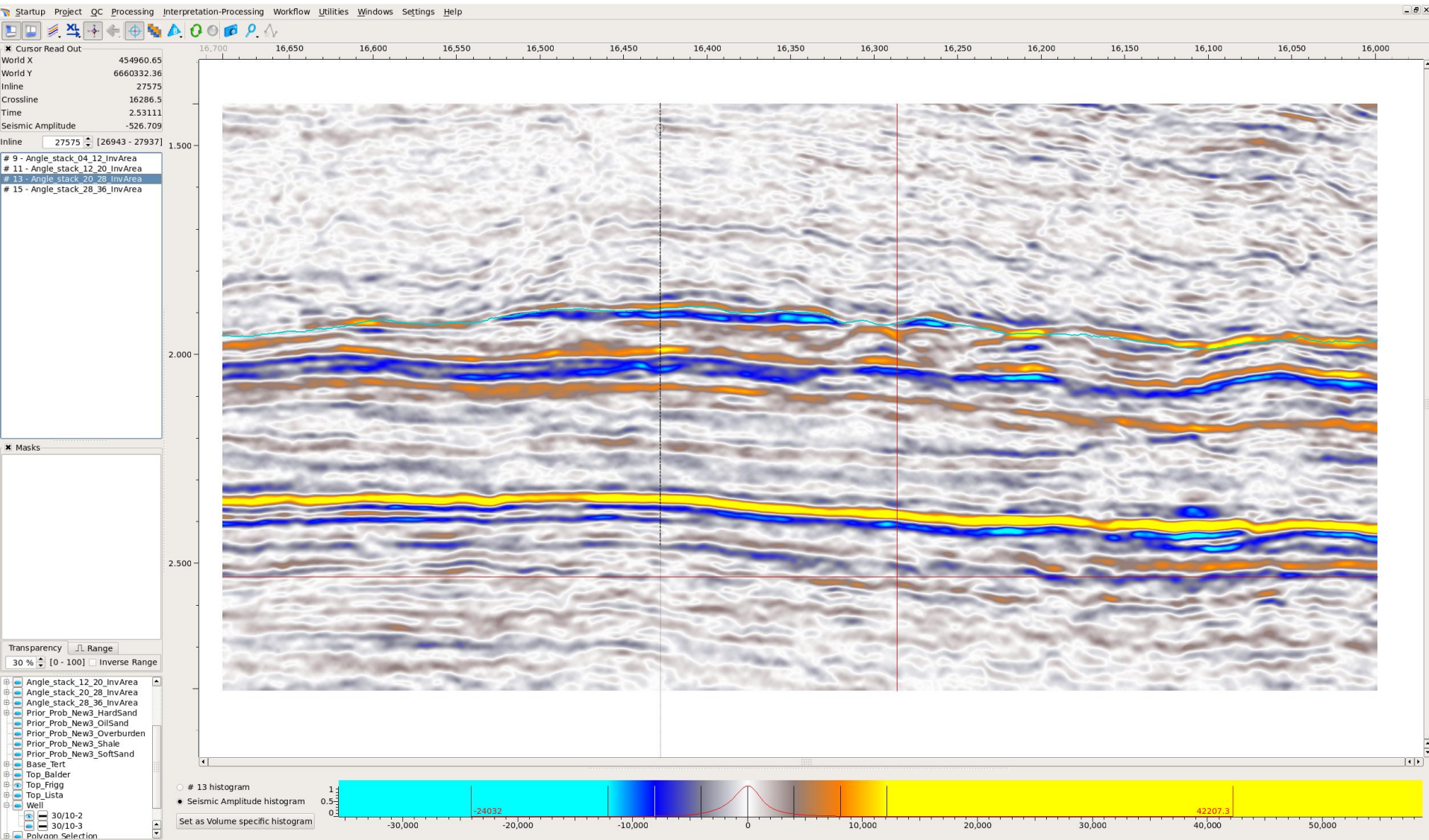
Angle stacks, 4°–12°



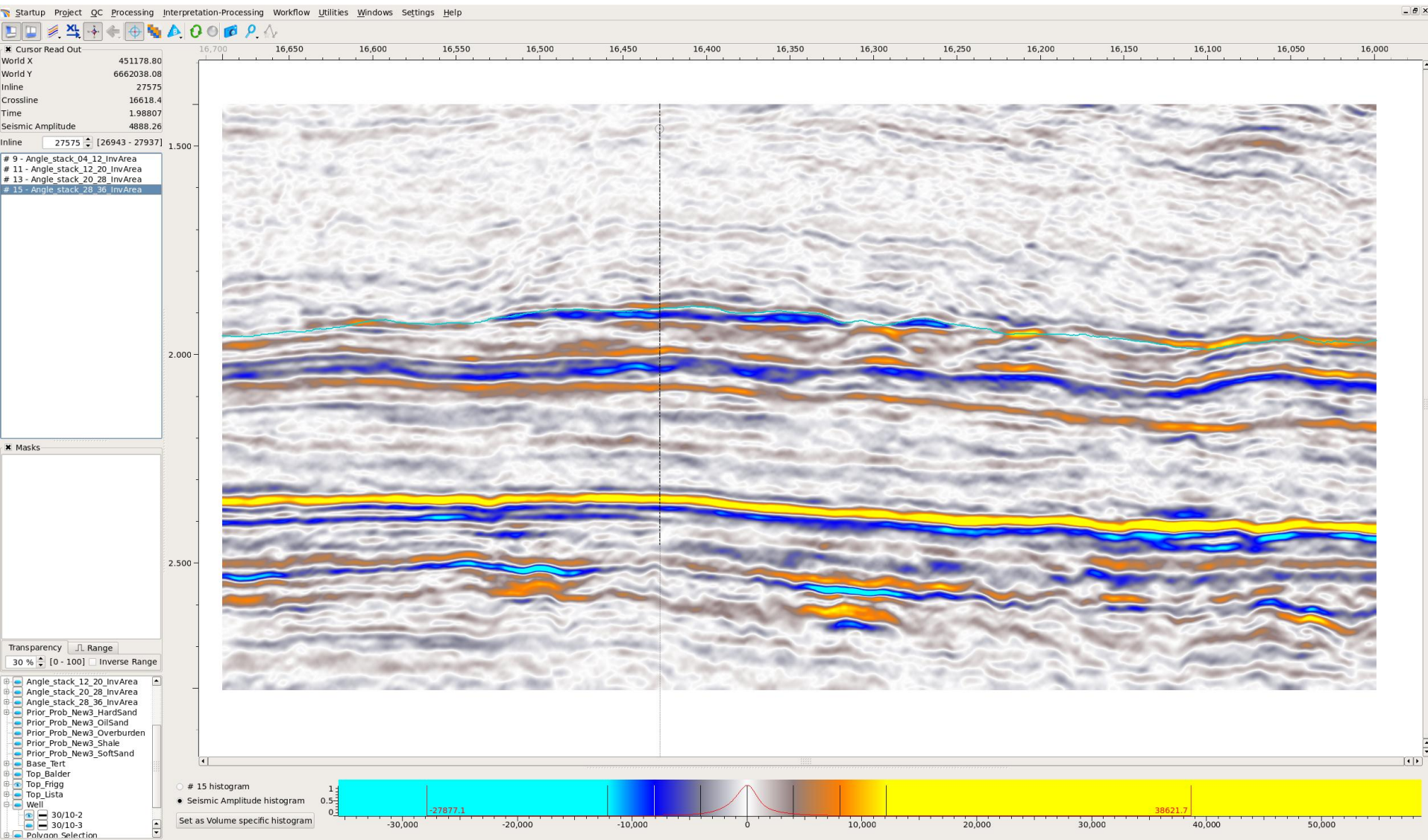
Angle stacks, 12°–20°

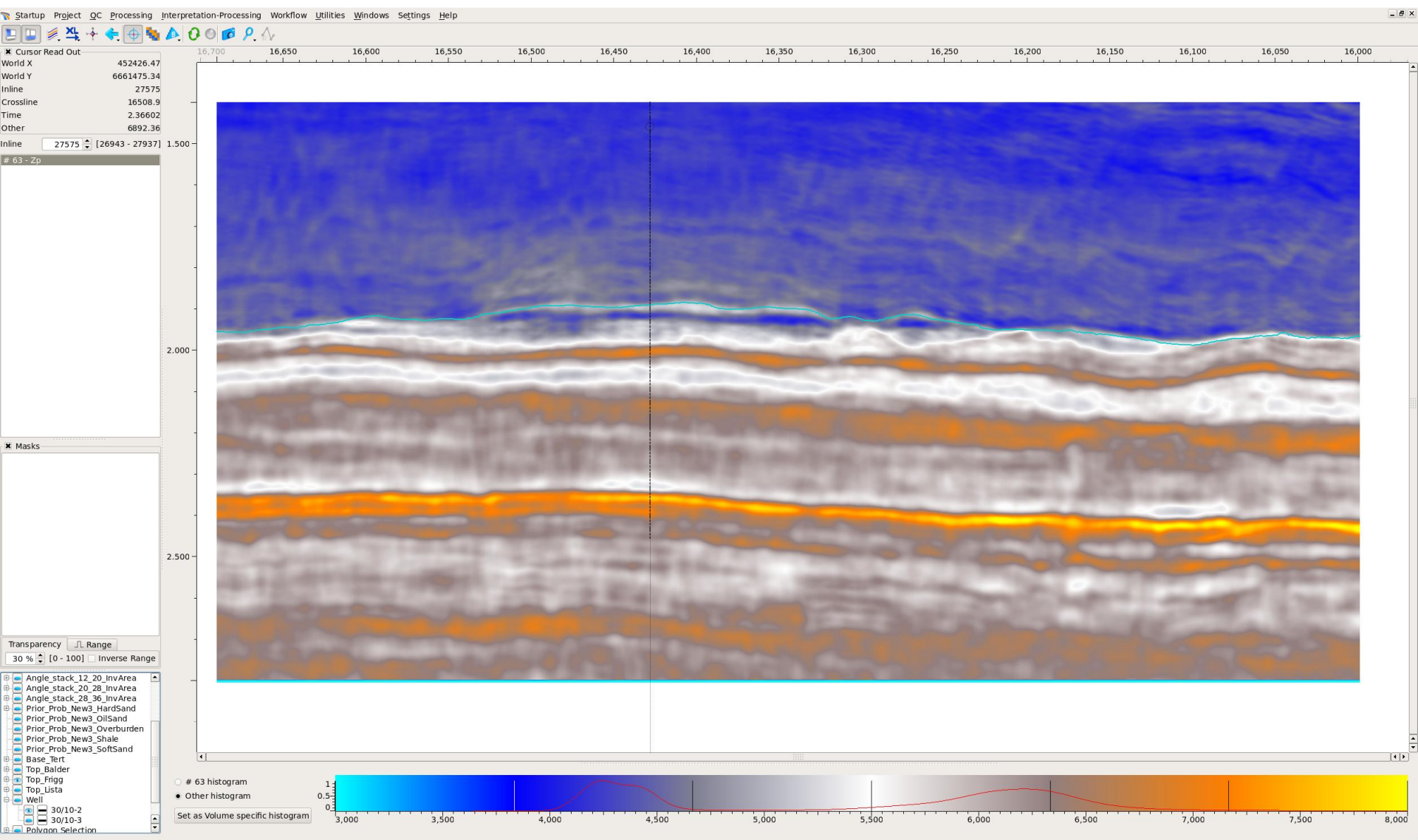


Angle stacks, 20°–28°

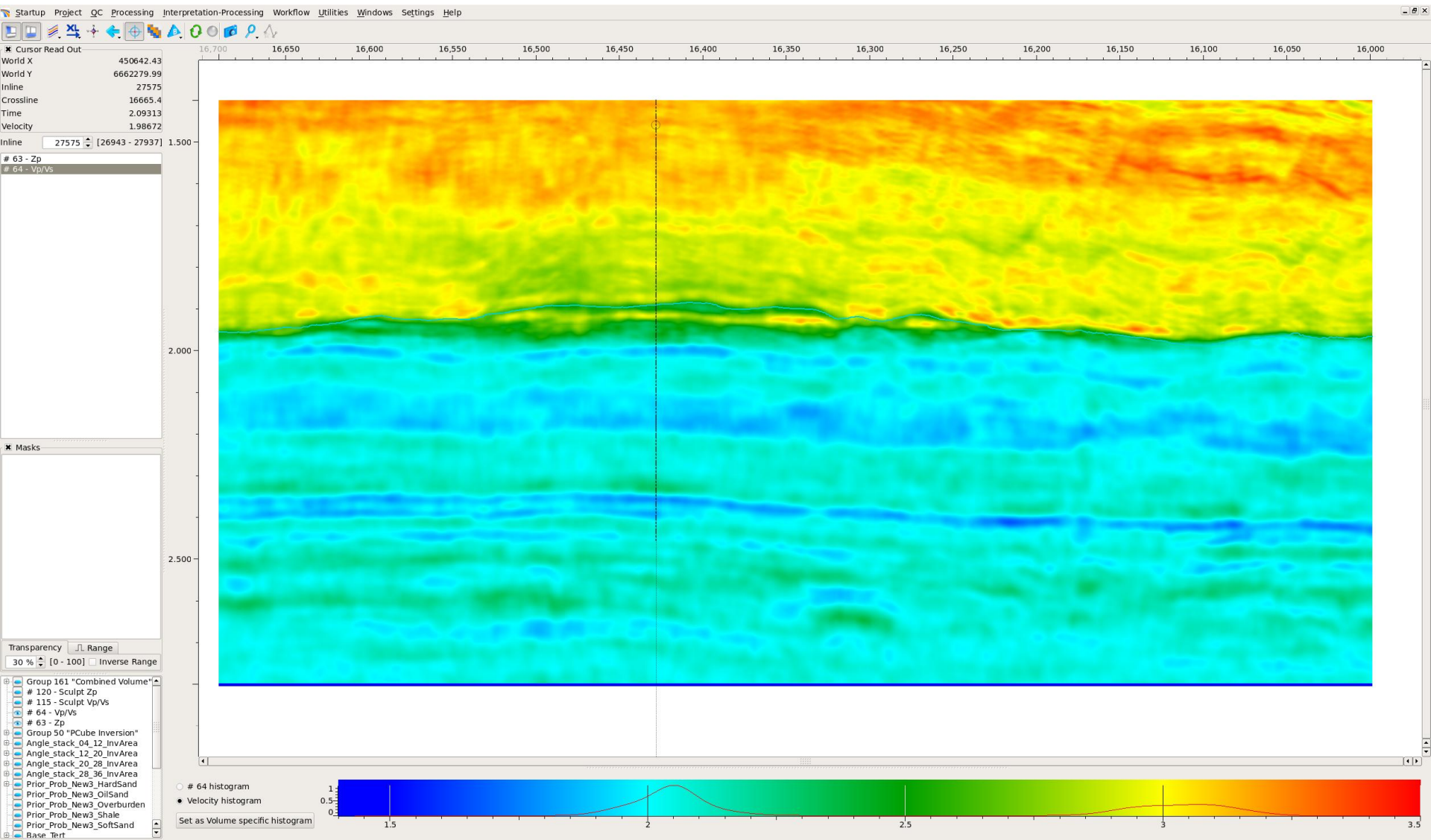


Angle stacks, 28°–36°

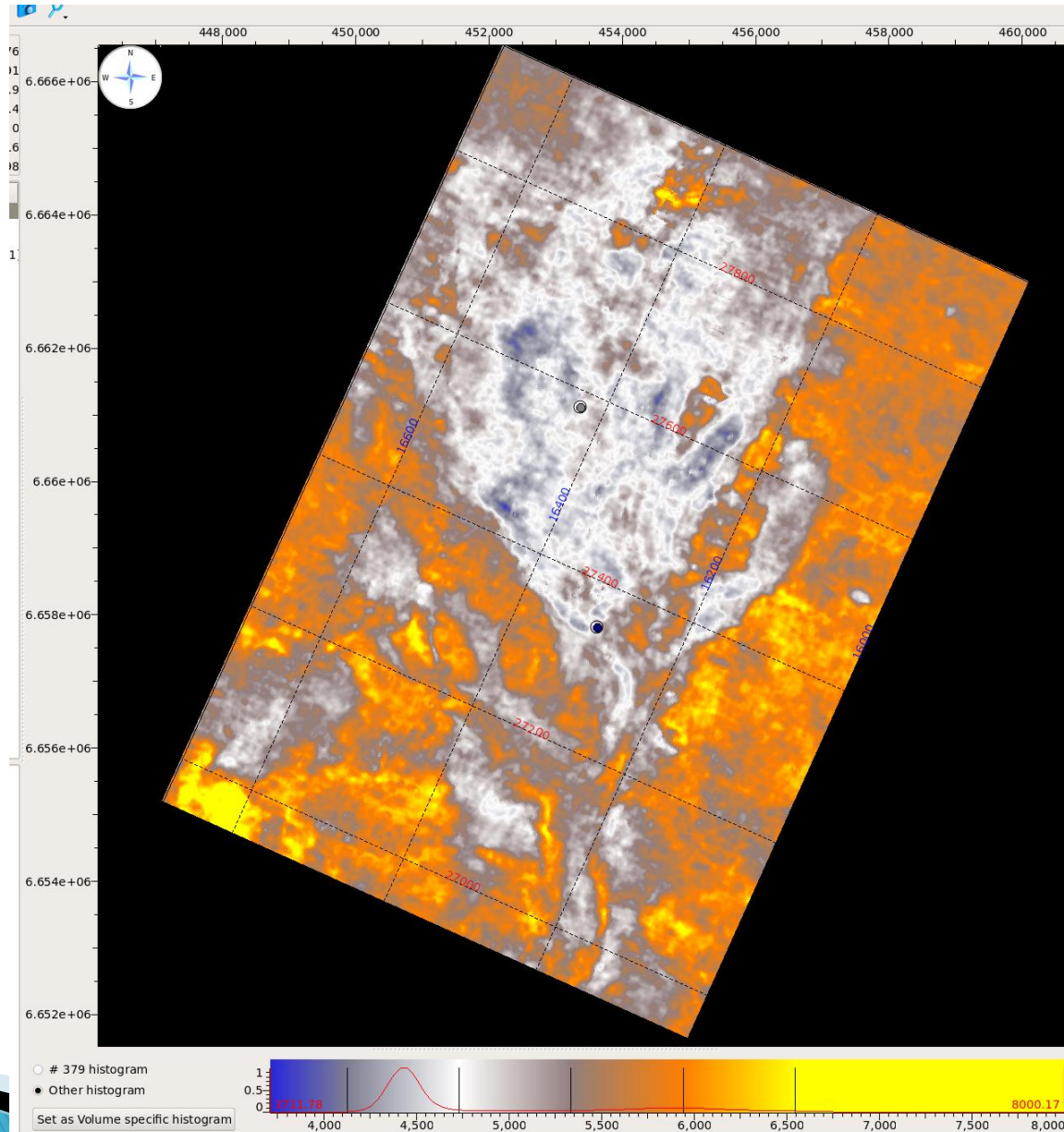




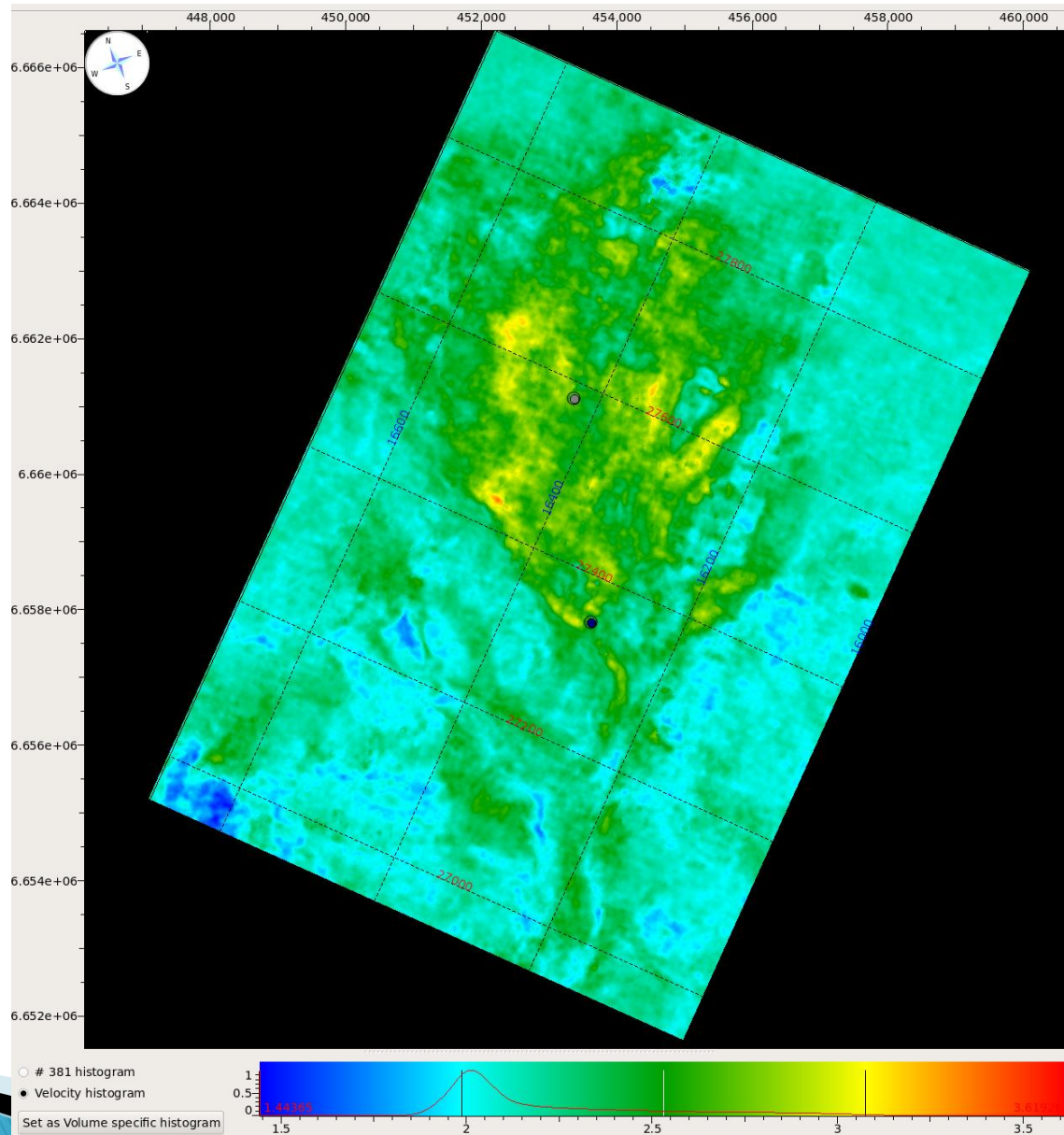
Vp/Vs



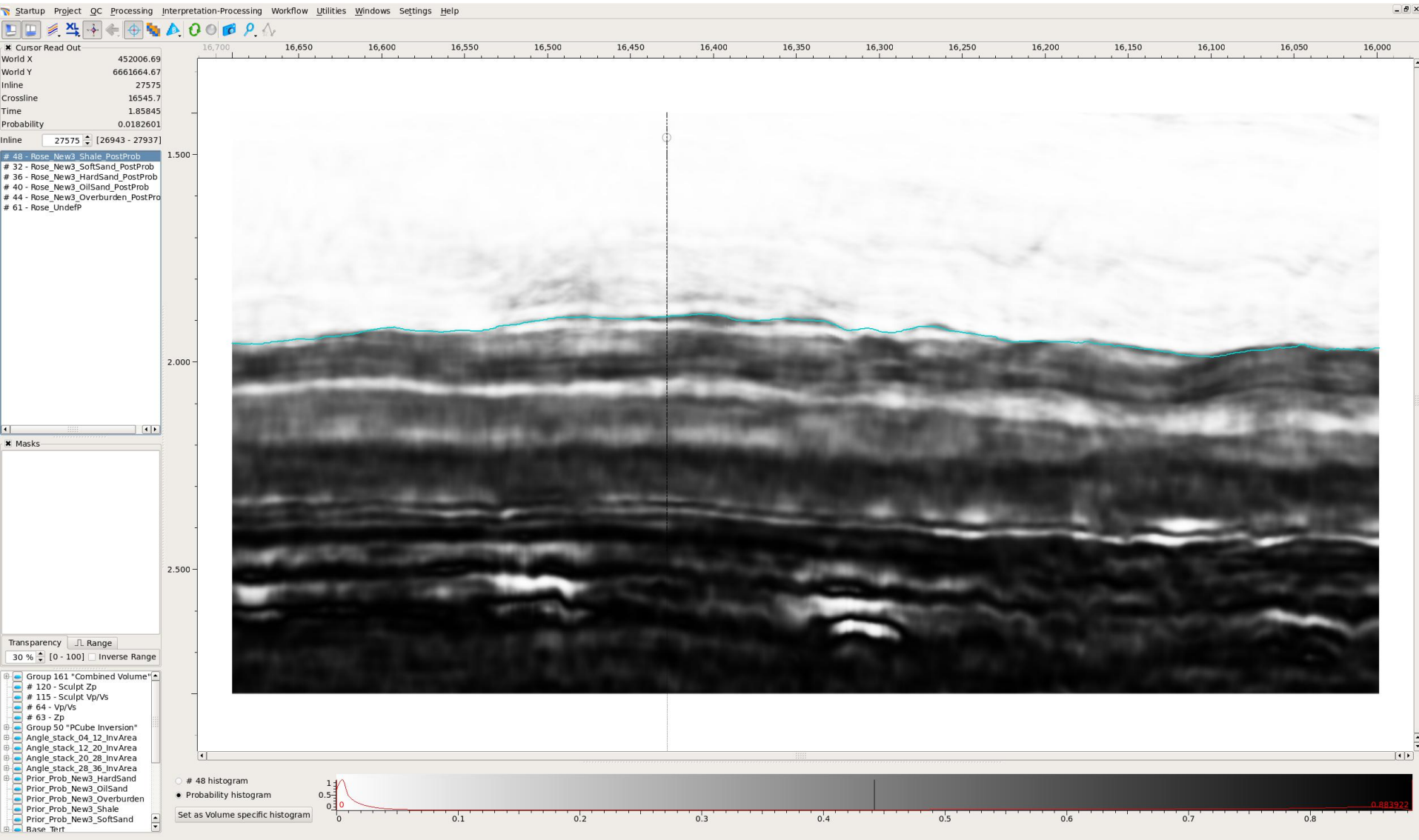
Zp 16 ms below Top Frigg



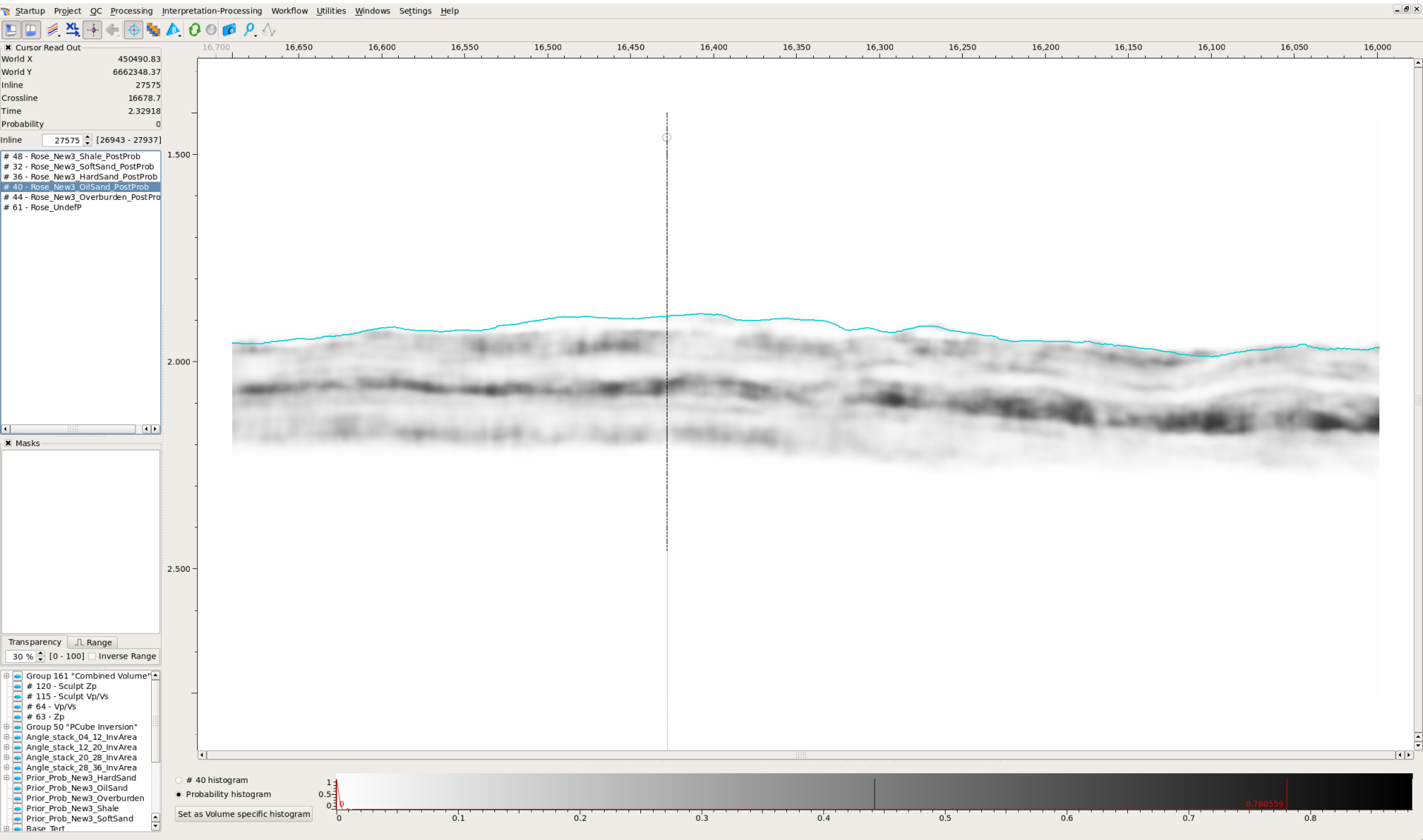
Vp/Vs 16 ms below Top Frigg



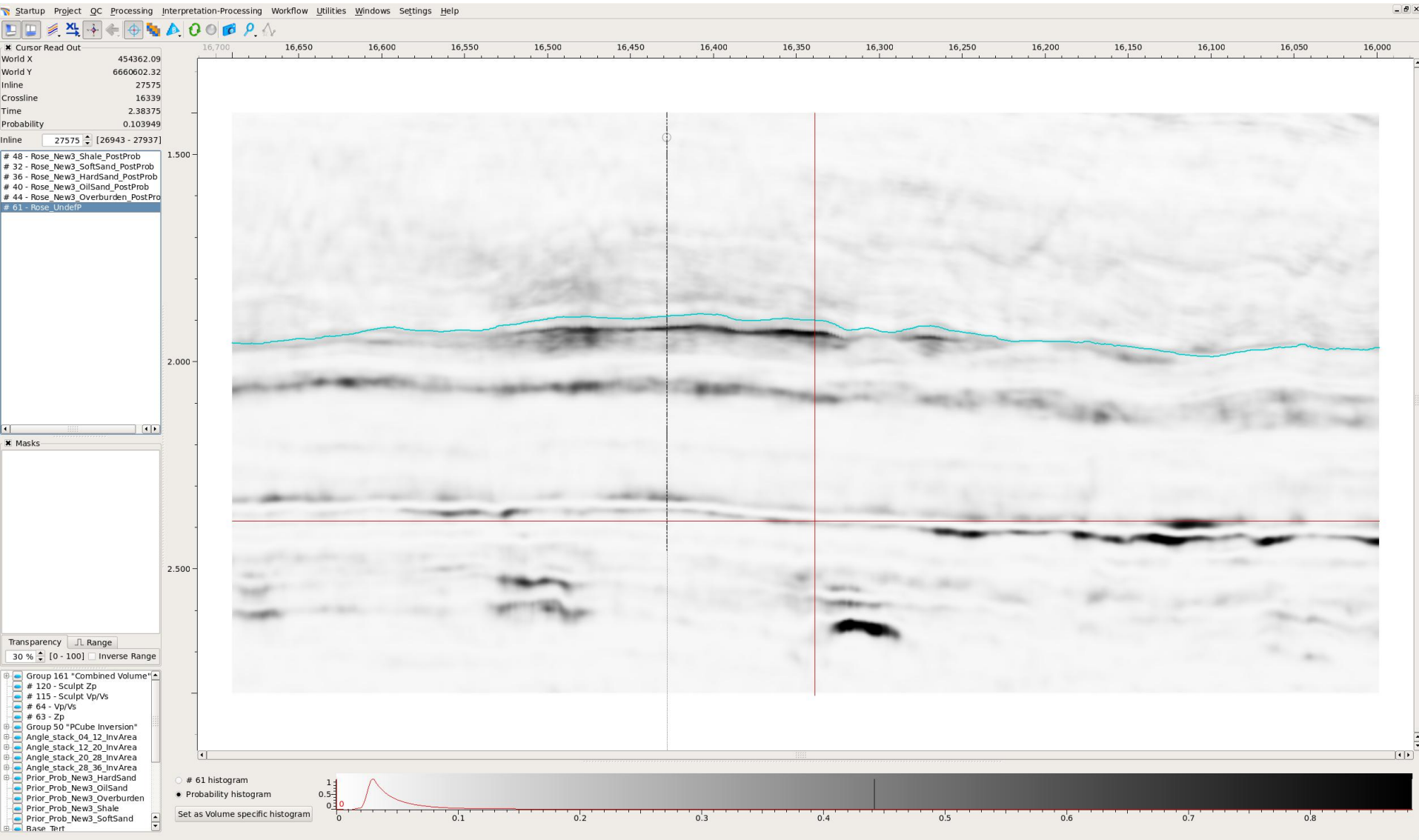
Shale posterior probability



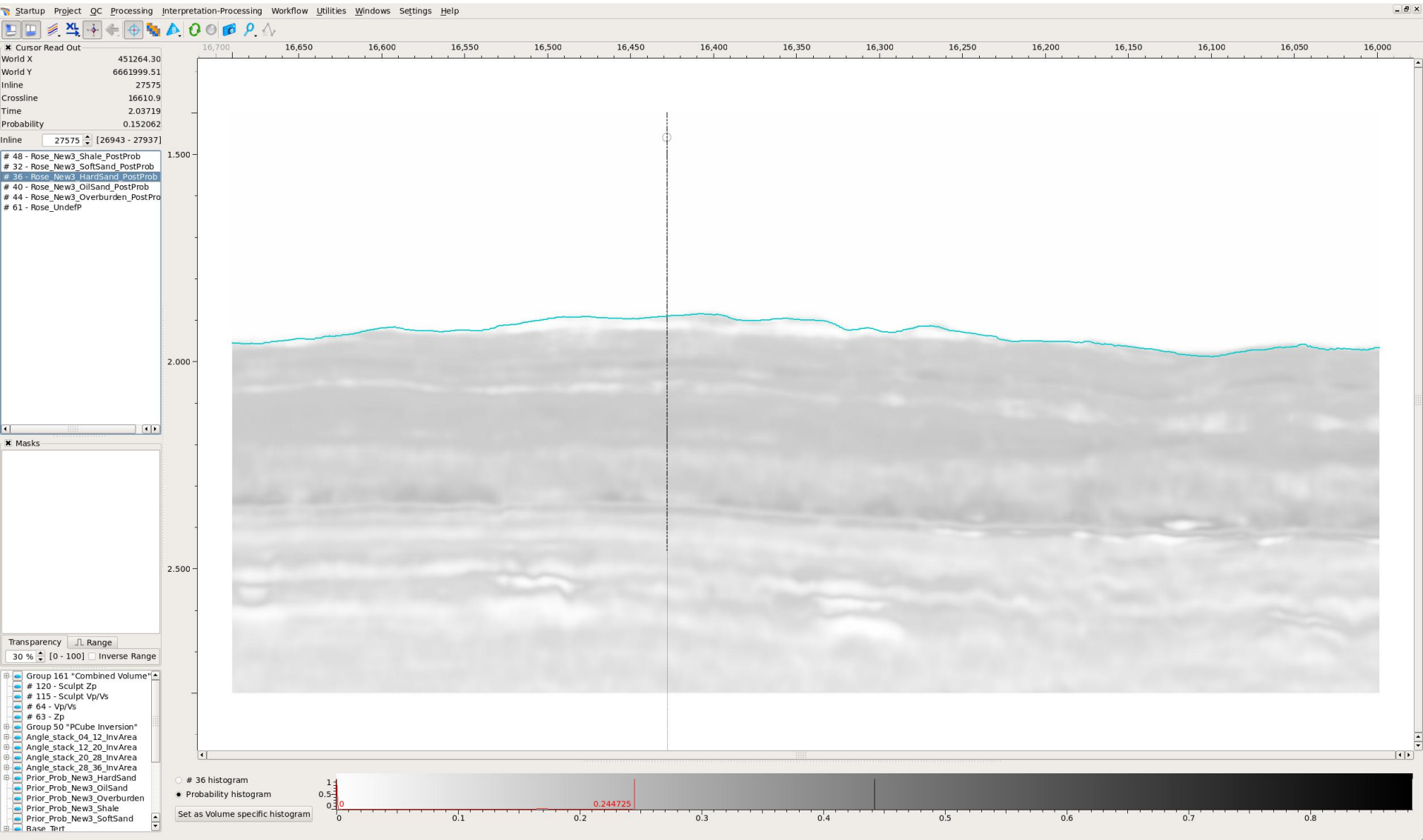
Oil sand posterior probability



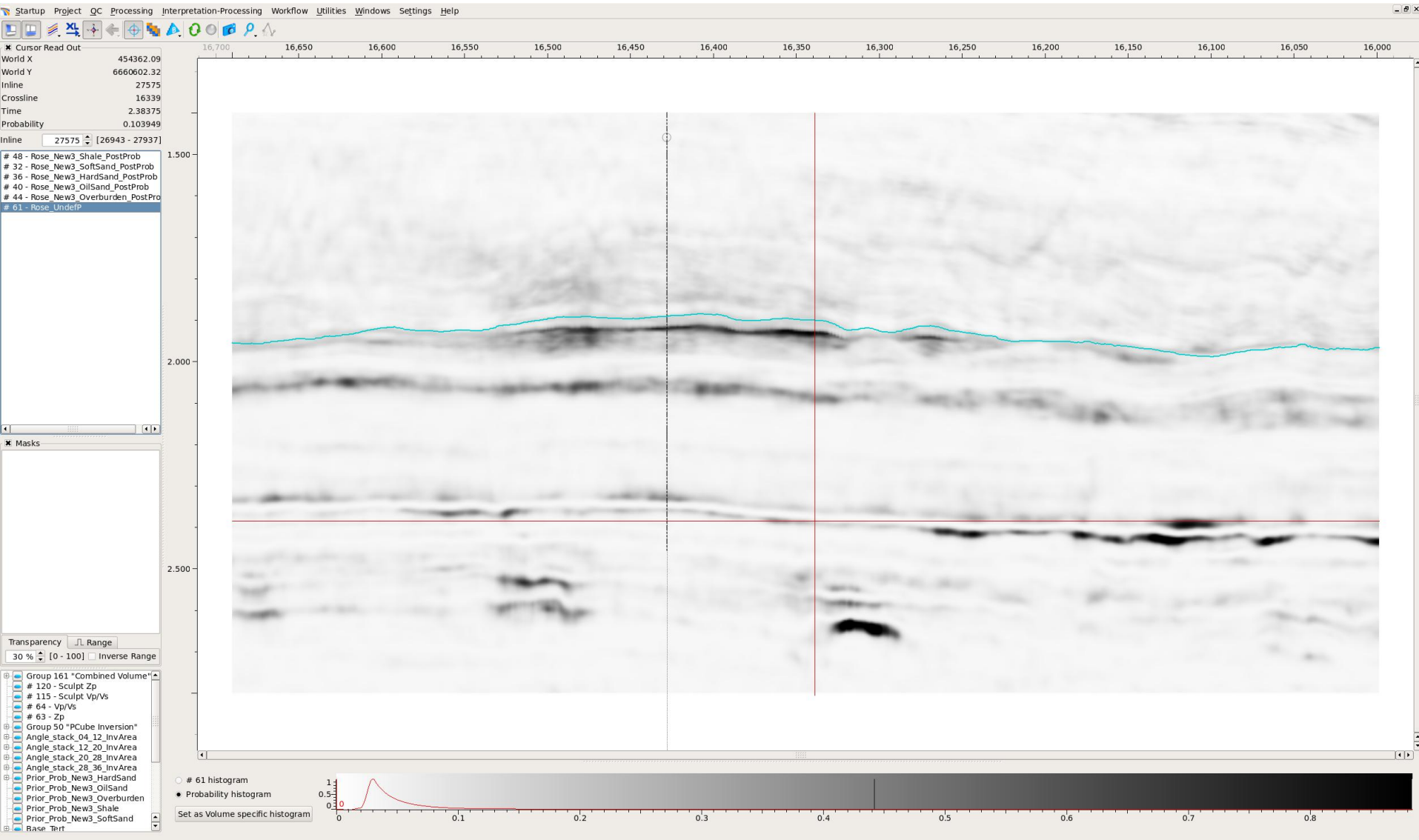
Undefined class posterior probability



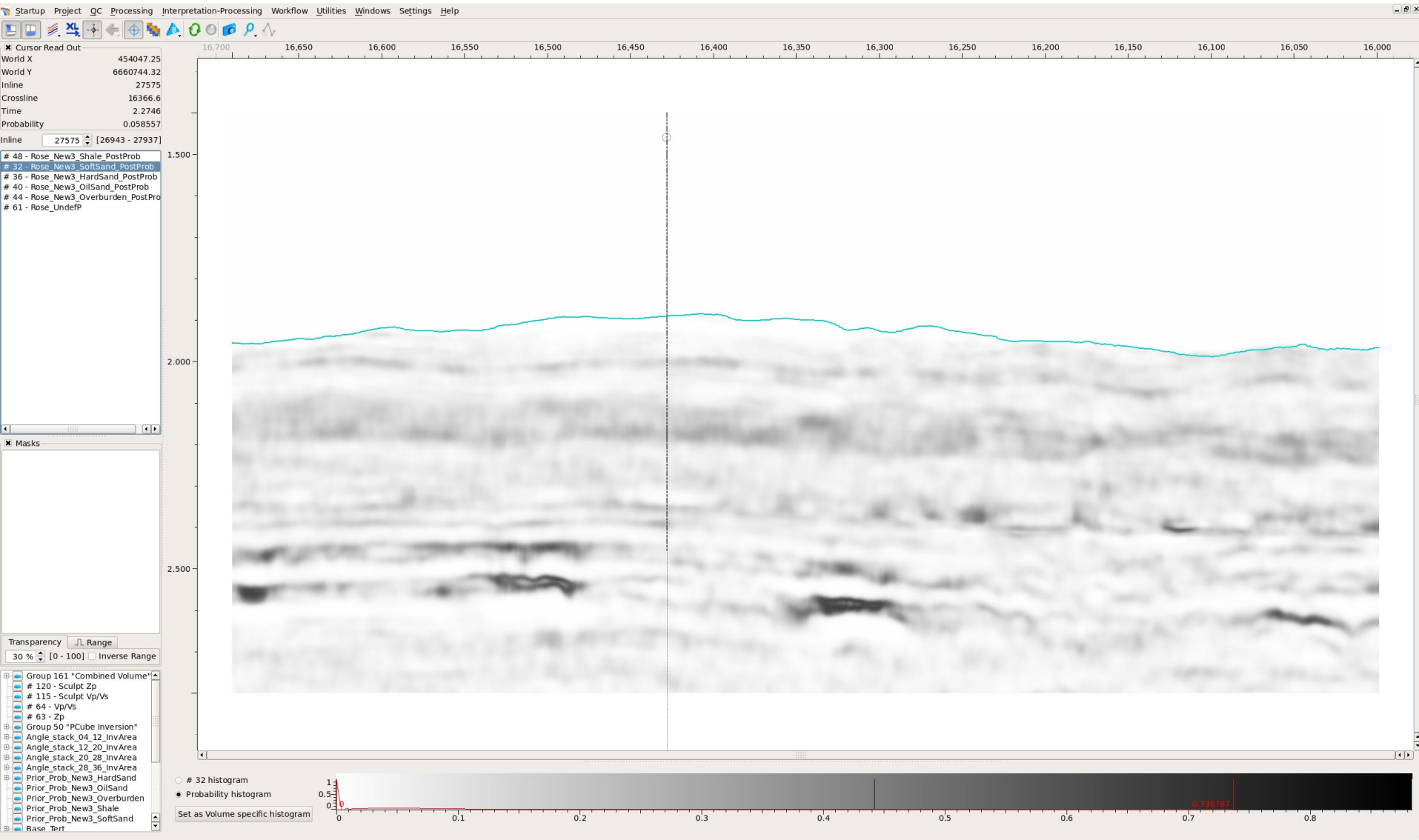
Hard sand posterior probability



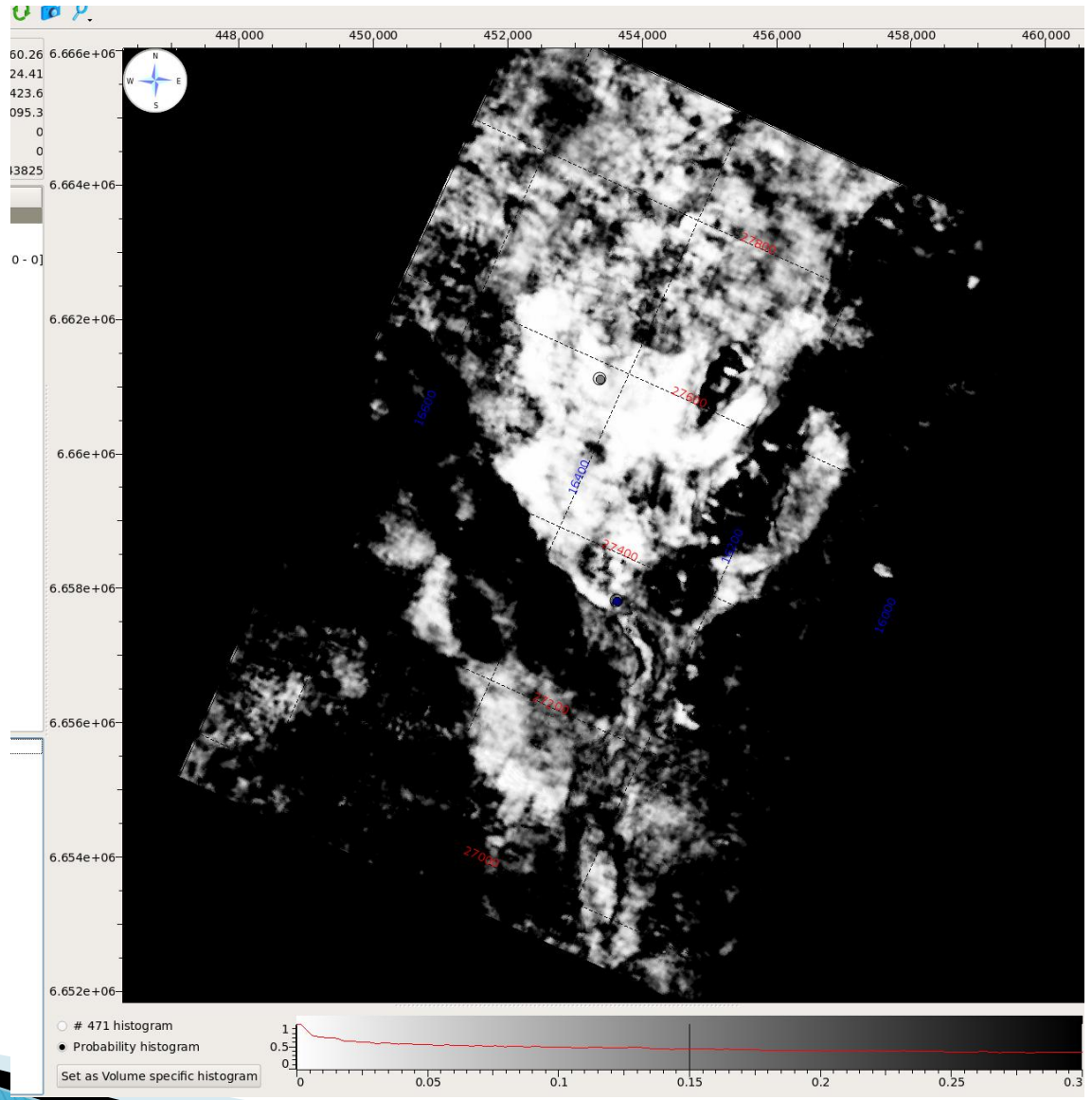
Soft sand posterior probability



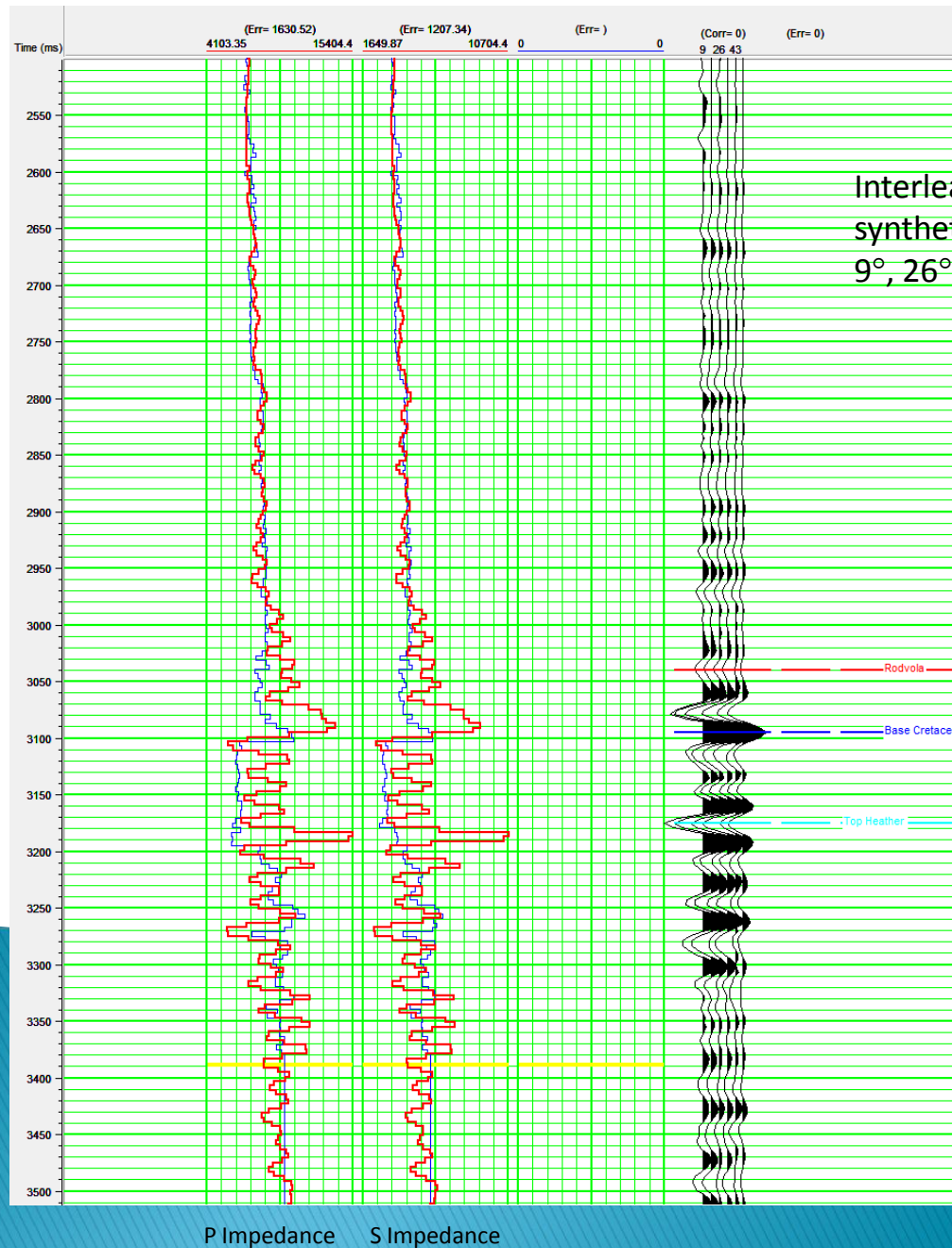
Overburden posterior probability



Minimum shale probability below T. Frigg

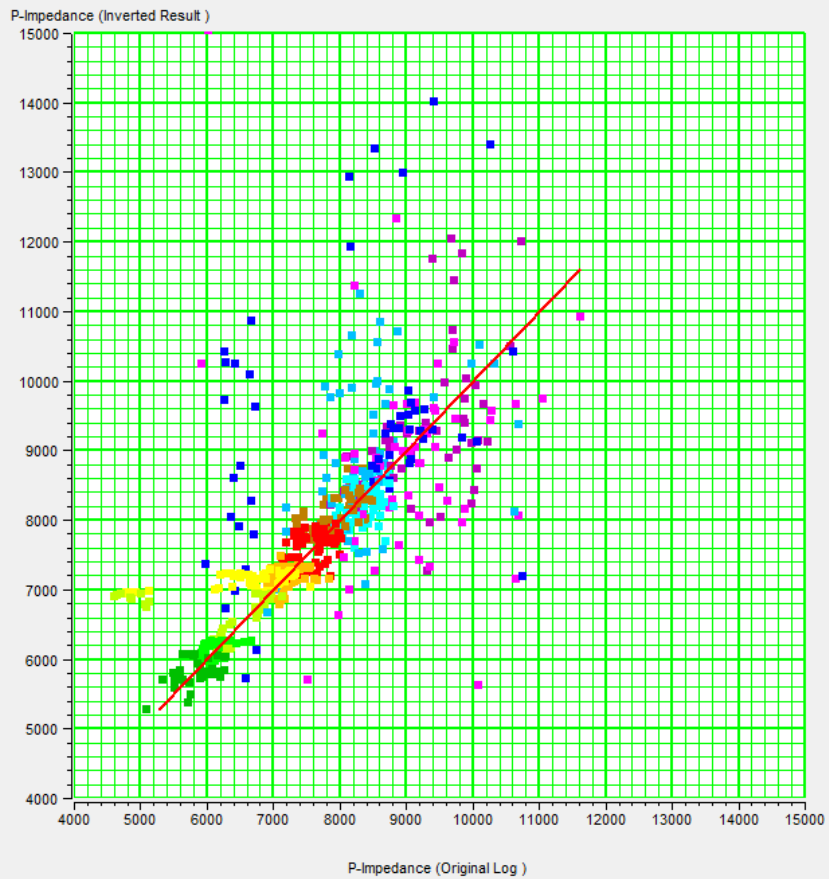


Blind Test

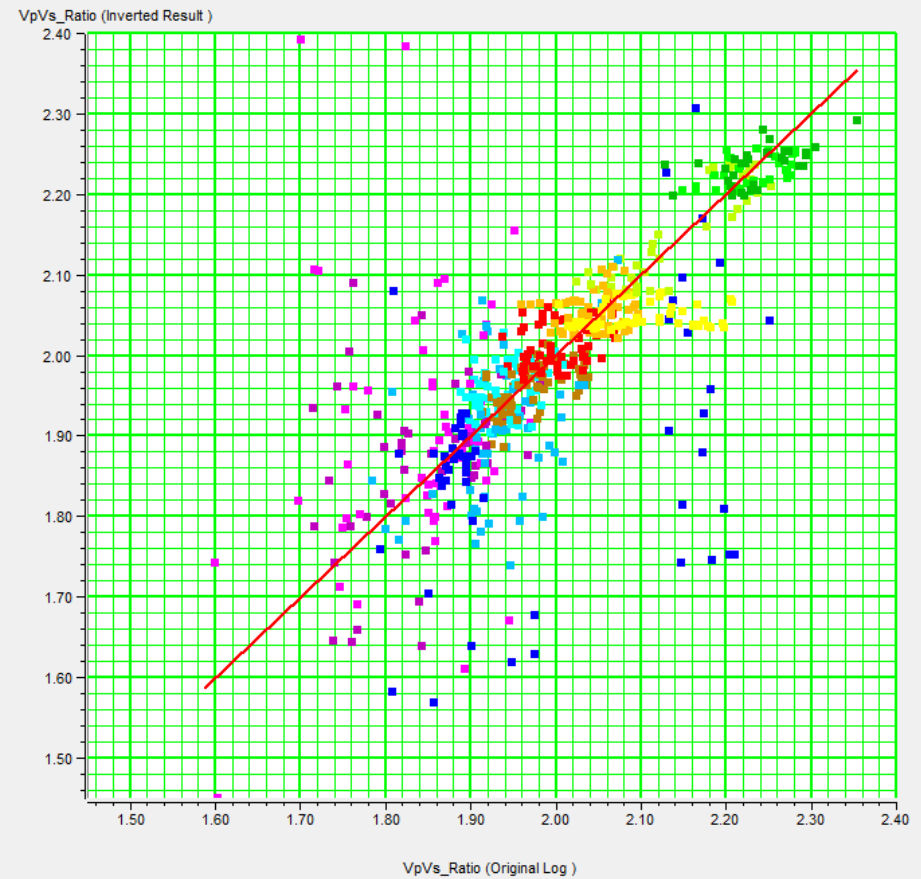


Blind Test

P impedance (inverted) v. P impedance (well)

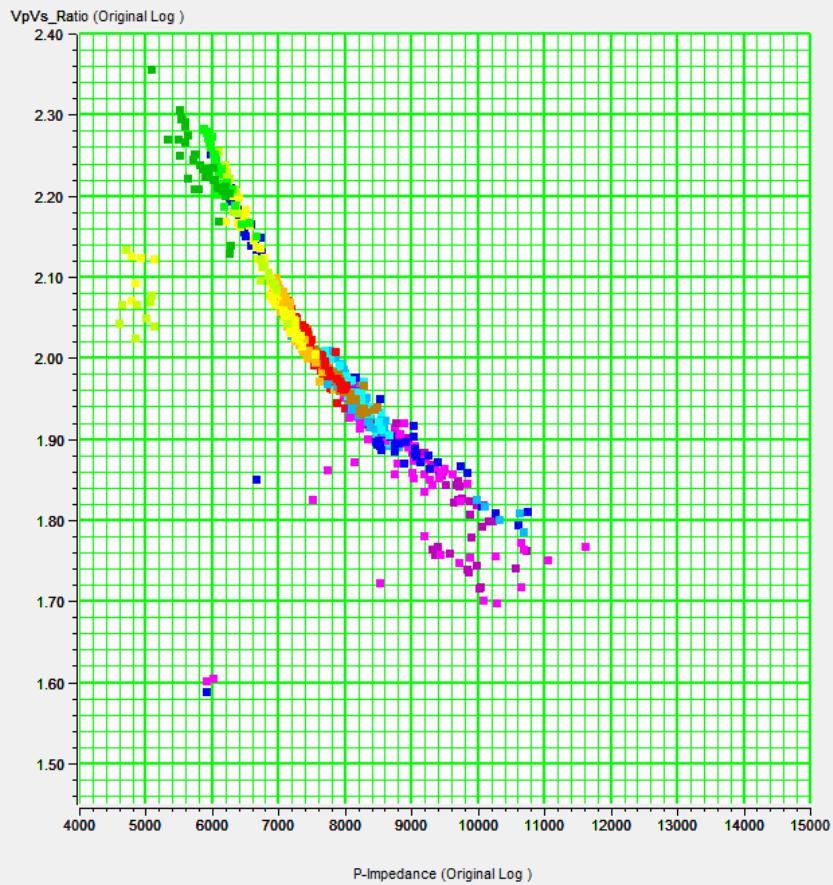


Vp/Vs (inverted) v. Vp/Vs (well)

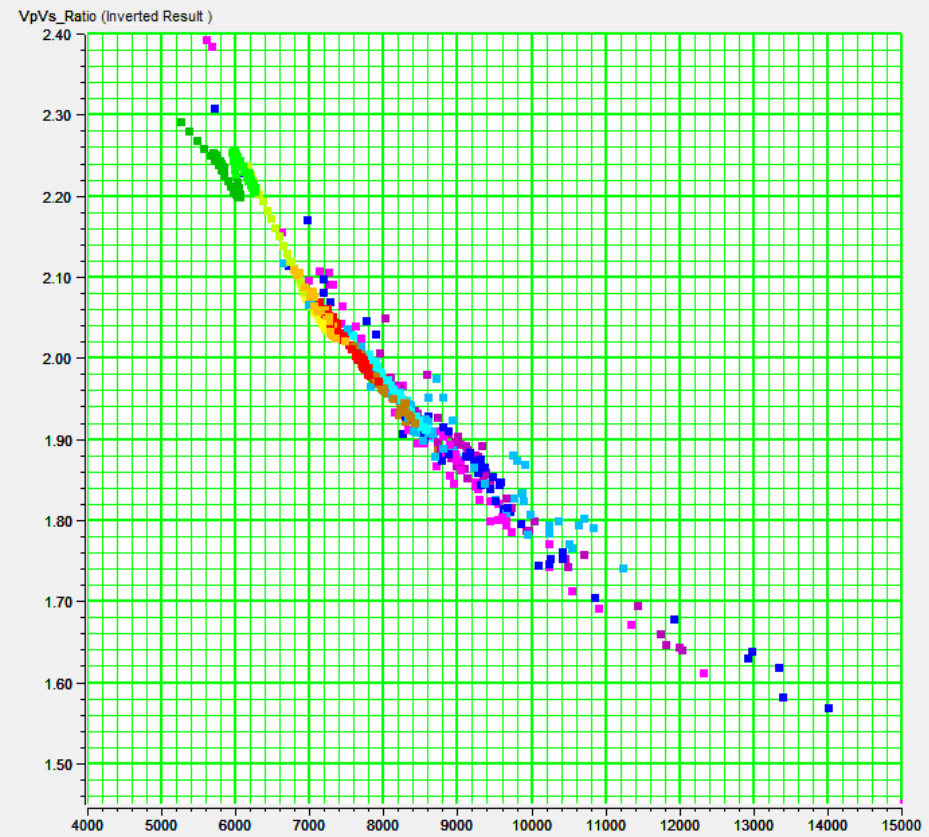


Blind Test

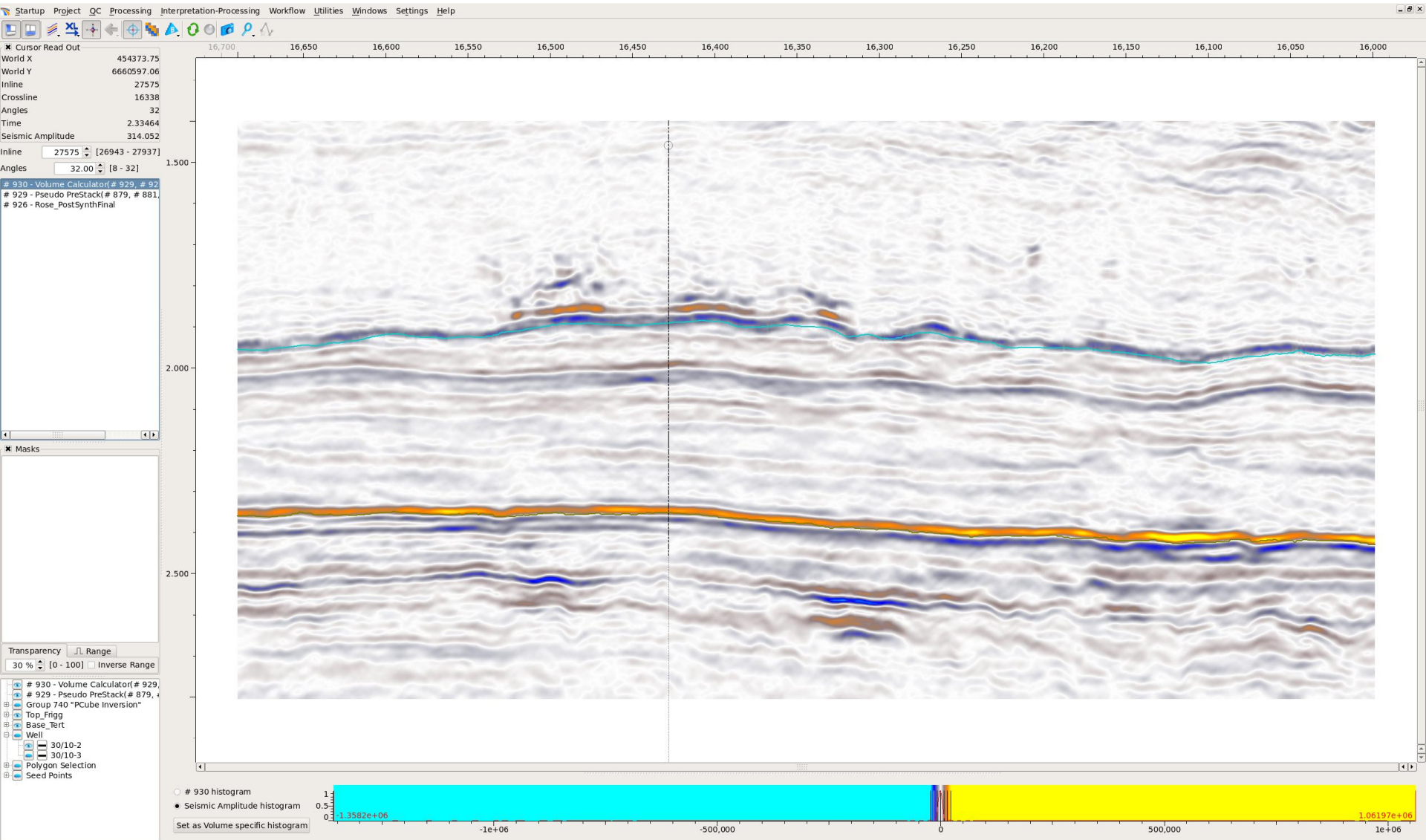
Vp/Vs (well) v. P impedance (well)



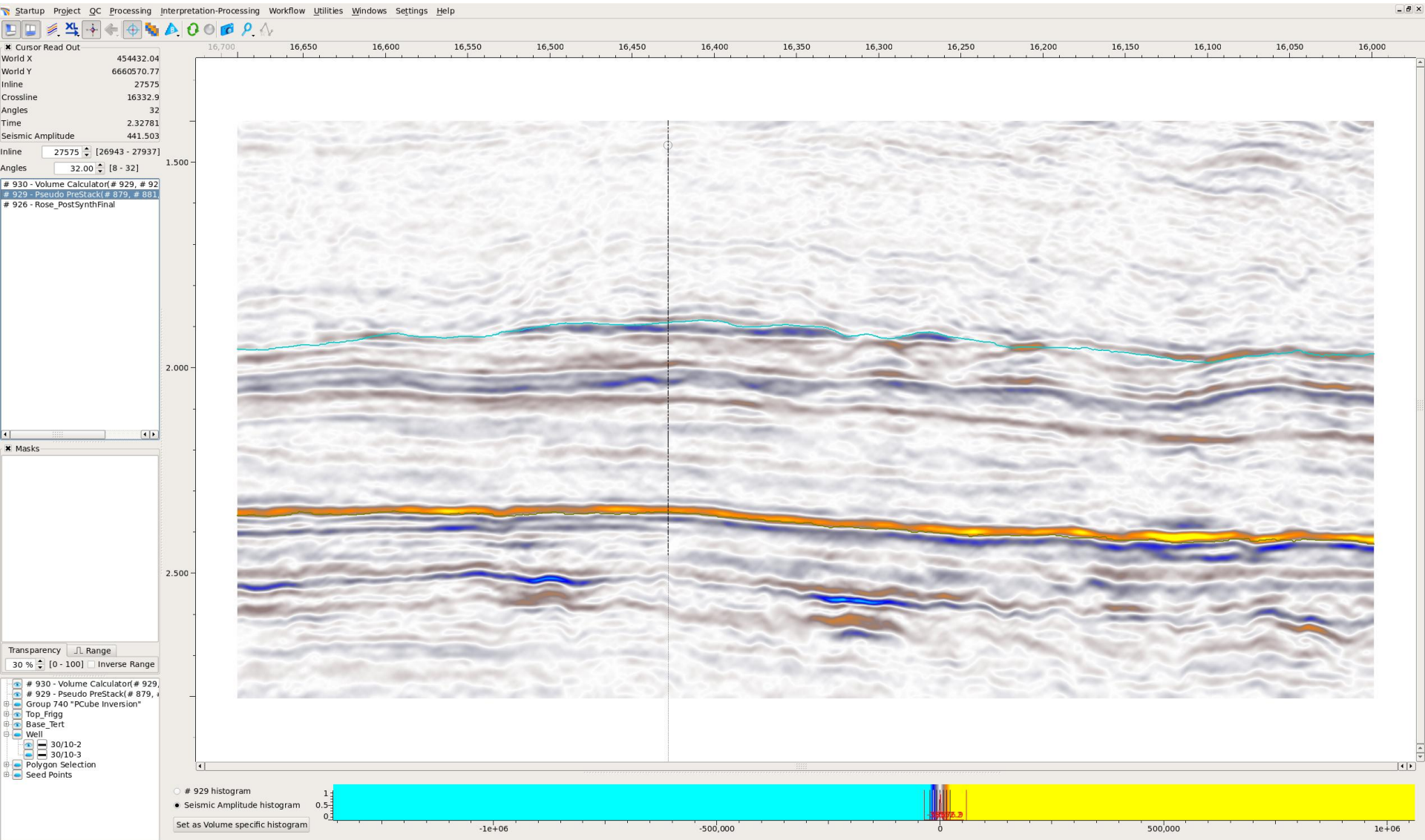
Vp/Vs (inverted) v. P impedance (inverted)



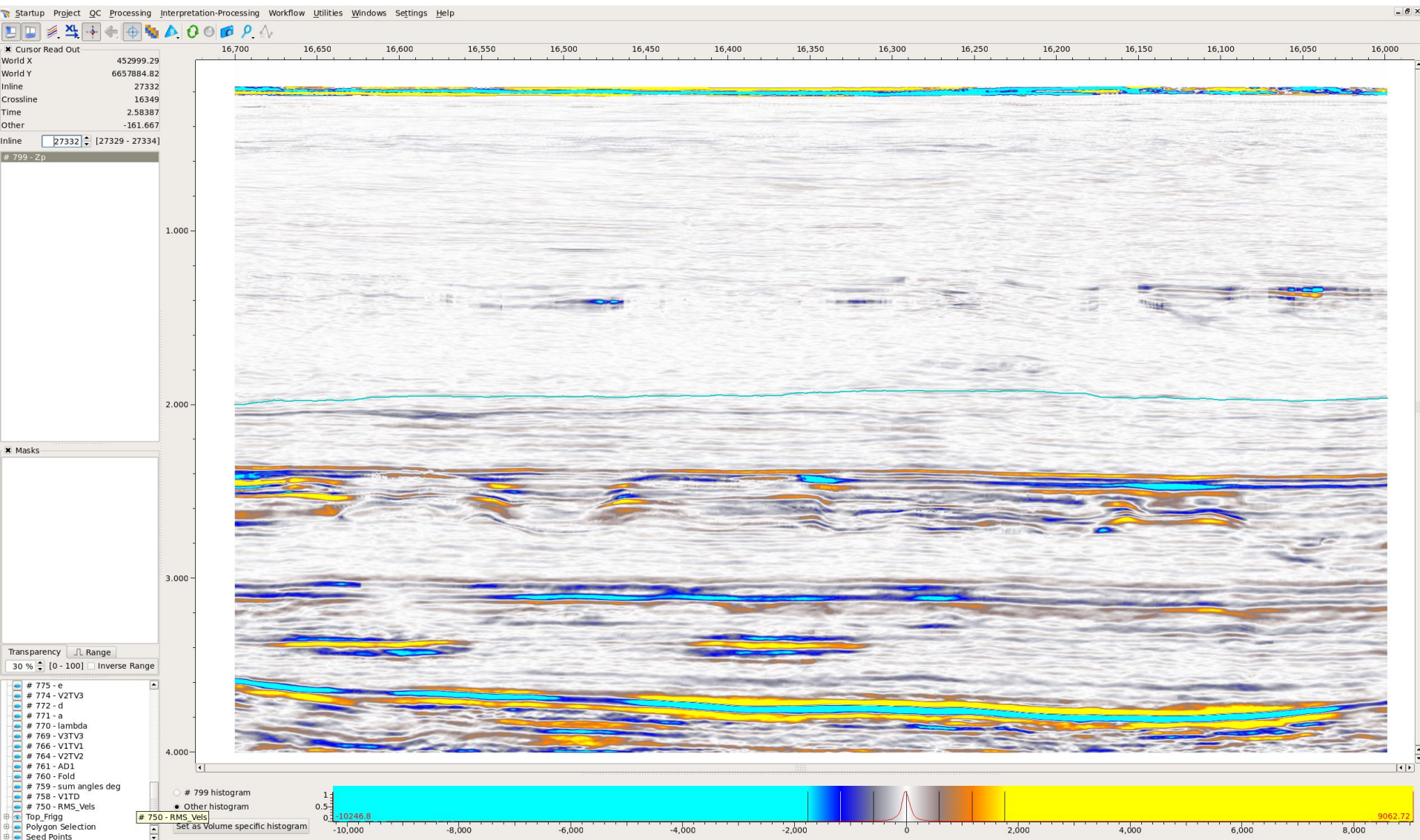
Residuals



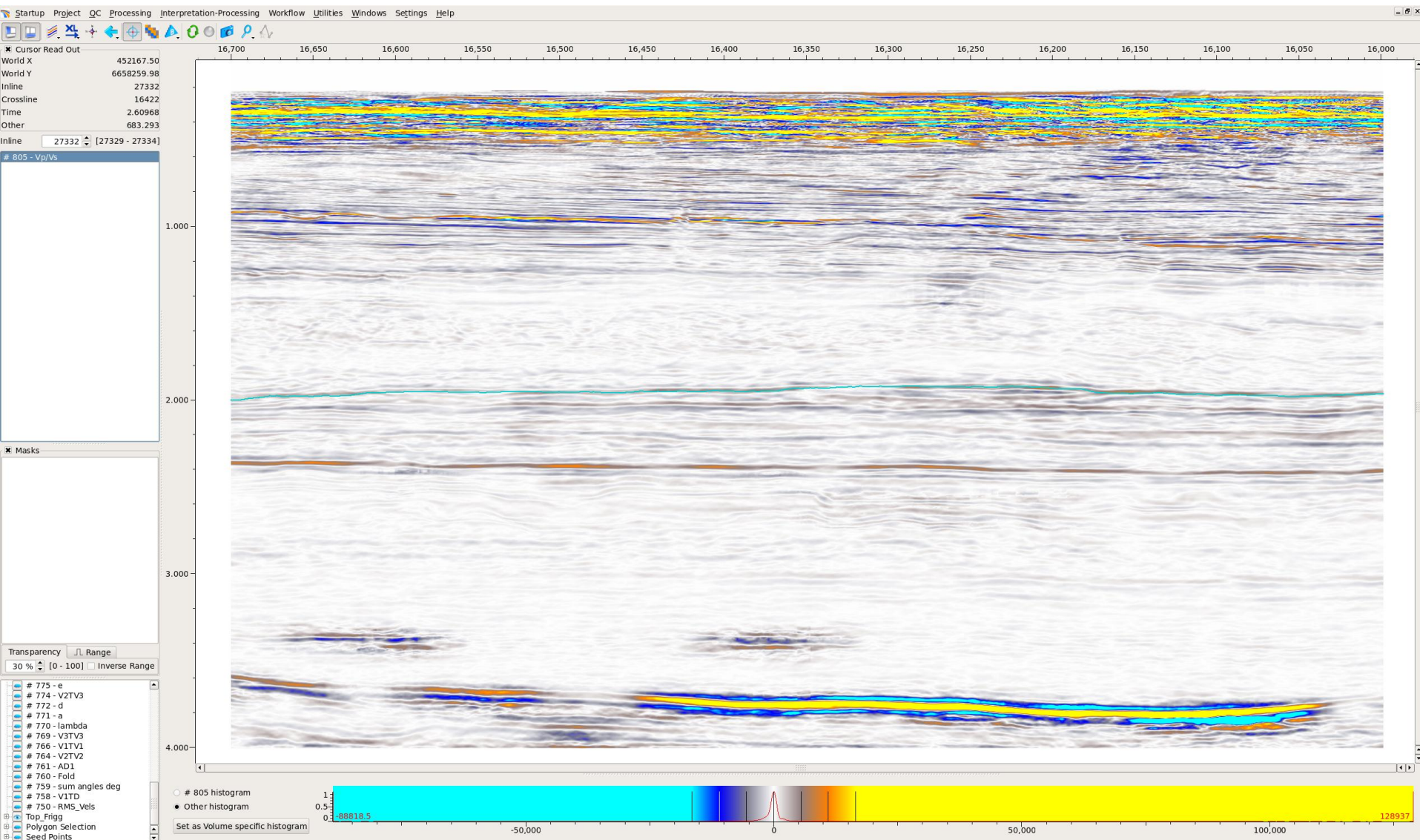
Residuals



Zp reflectivity



Vp/Vs reflectivity



Density reflectivity!!

