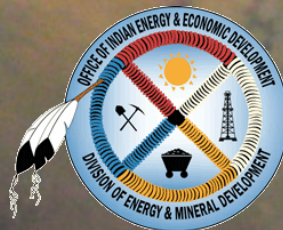


Preliminary 3D Depth Migration of a Network of 2D Seismic Lines for Faults Imaging at a Pyramid Lake, Nevada Geothermal Prospect

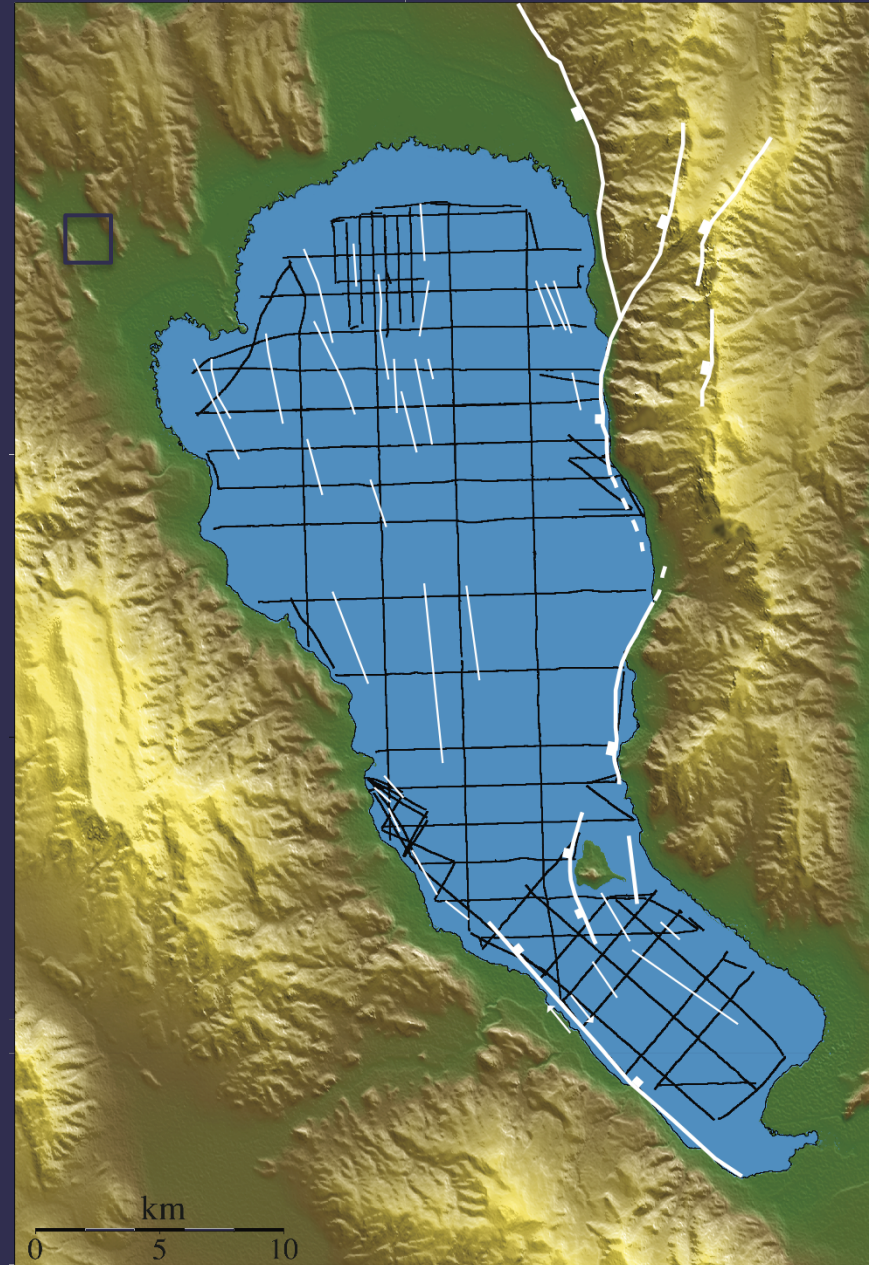
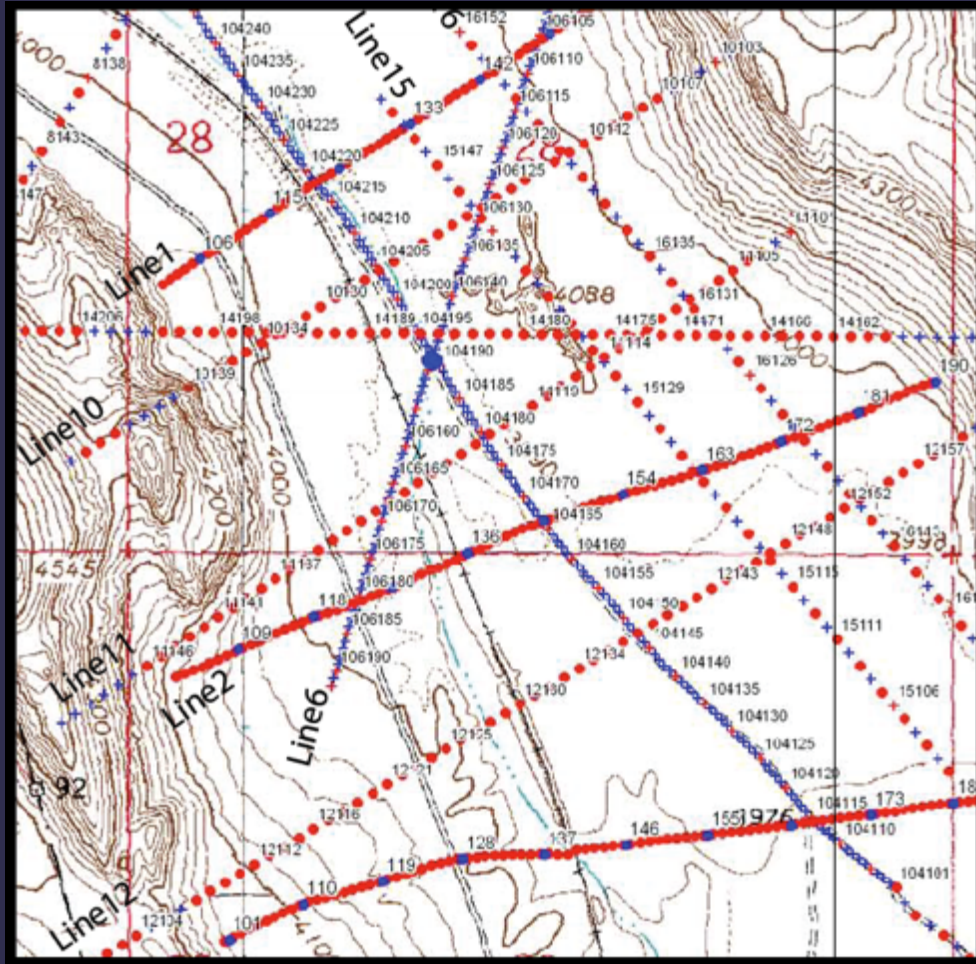
RN Frary¹, JN Louie¹, S Pullammanappallil², and A Eisses¹

¹Nevada Seismological Laboratory, Reno, NV

²Optim, Reno, NV



Efficient network of 2D lines gives WAZ coverage



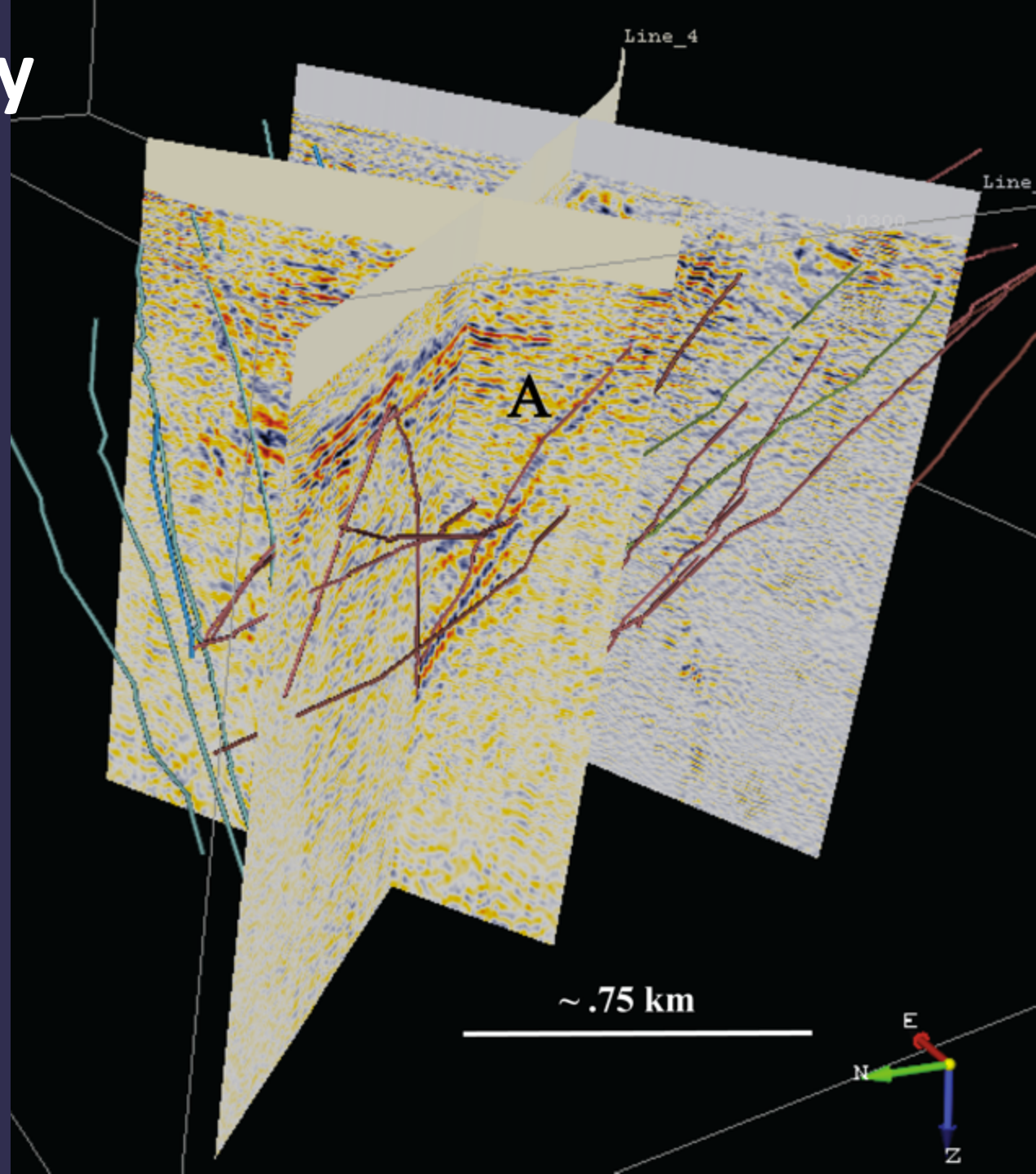
Techniques

- Objective: Image faults and fault intersections
 - Likely locations for geothermal production (Curewitz and Karson, 1997) especially in Nevada (Faulds, et al., 2004)
- Nonlinear velocity optimization
 - Simulated annealing method (Pullammanappallil and Louie, 1994) to produce high resolution velocity models from first-arrivals
- Pre-stack Kirchhoff depth migration
 - Directly images subsurface structures oriented in any direction (Louie, et al., 1988 and Louie, et al., 2002)
 - Operator antialiasing (Lumley, et al., 2001)

Fault Discovery *with 2D depth migration*

Geologists doubted
fault at A before
imaging

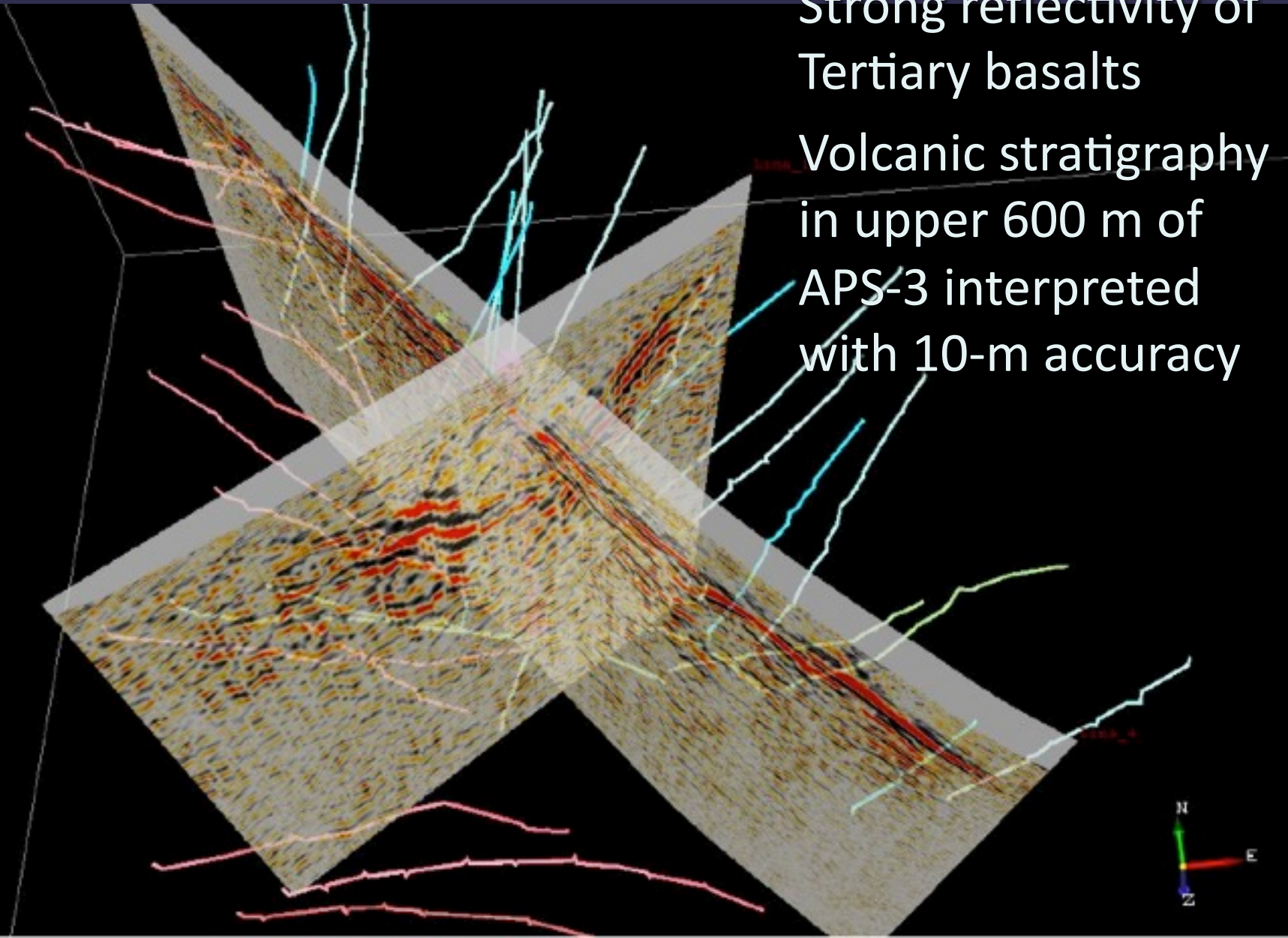
Fault gouge in well
APS-3 at 1300 m
depth, within 27 m
of seismic
interpretation



Volcanic Stratigraphy

Strong reflectivity of
Tertiary basalts

Volcanic stratigraphy
in upper 600 m of
APS-3 interpreted
with 10-m accuracy

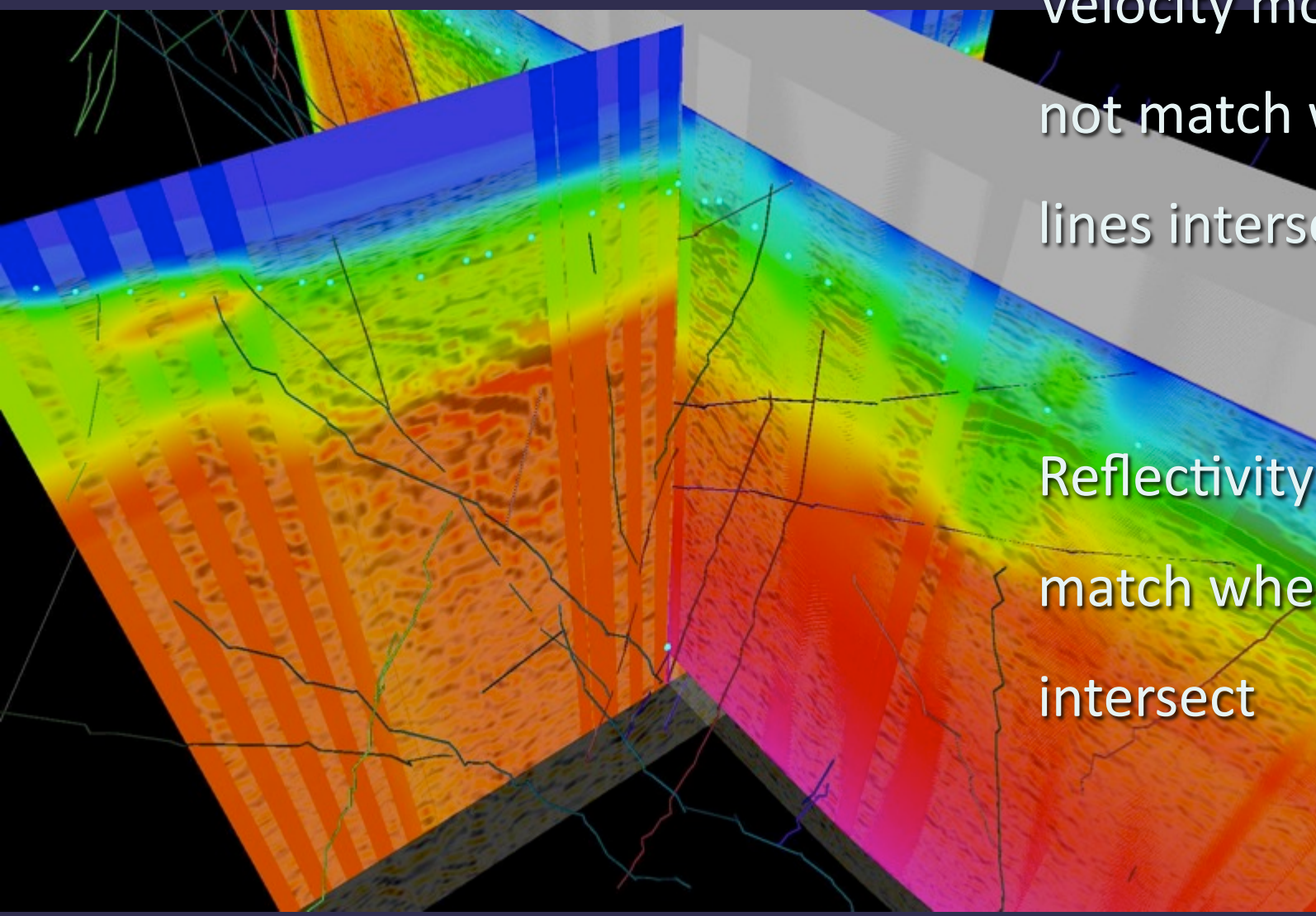


Current State: 2D

Discovered new fault sets

- Fault-plane image quality depends on survey orientation
- Excellent imaging of Tertiary volcanic stratigraphy
- Faults and stratigraphy verified from wells

The 3D Problem



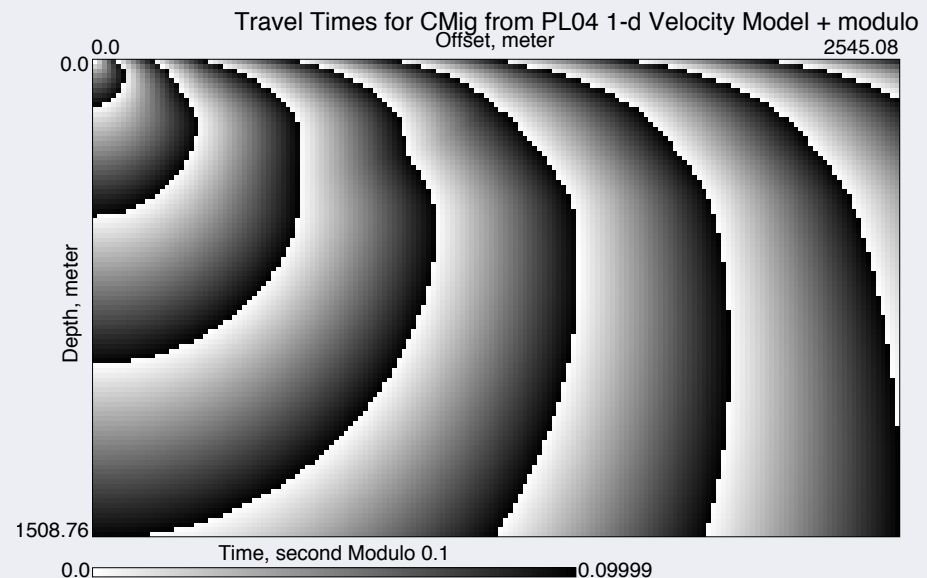
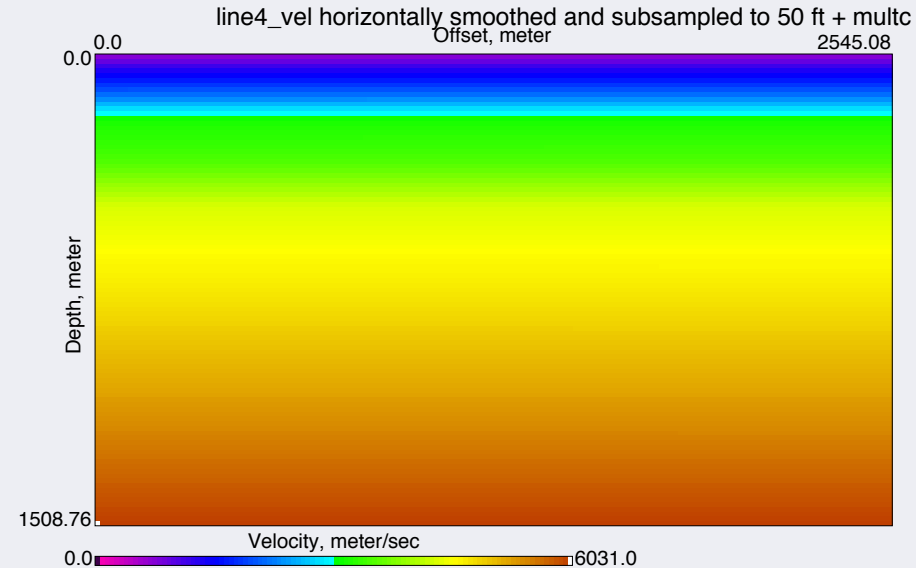
Velocity models do not match where lines intersect

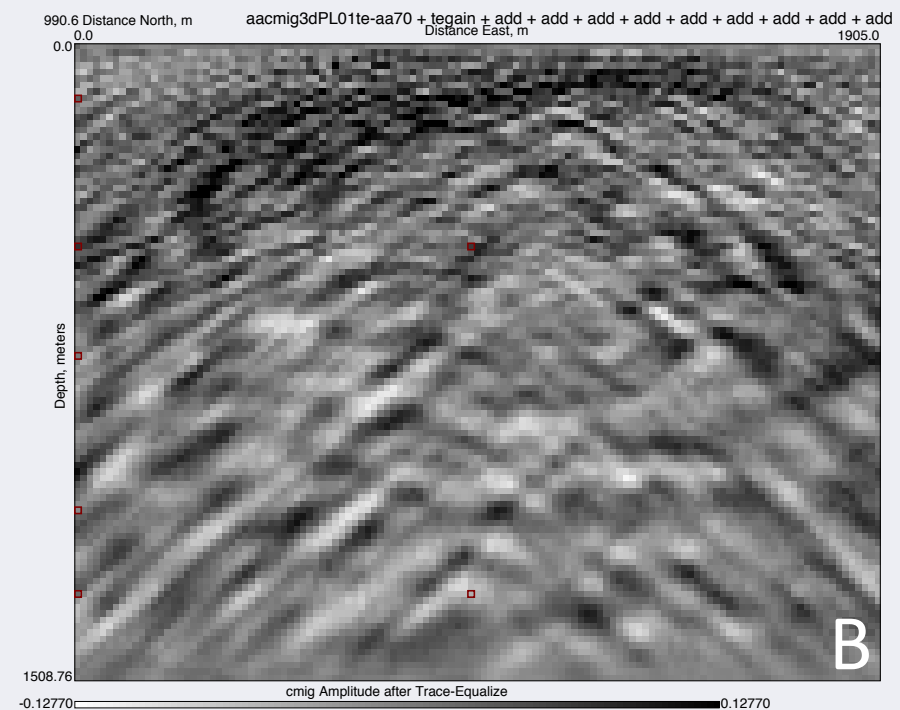
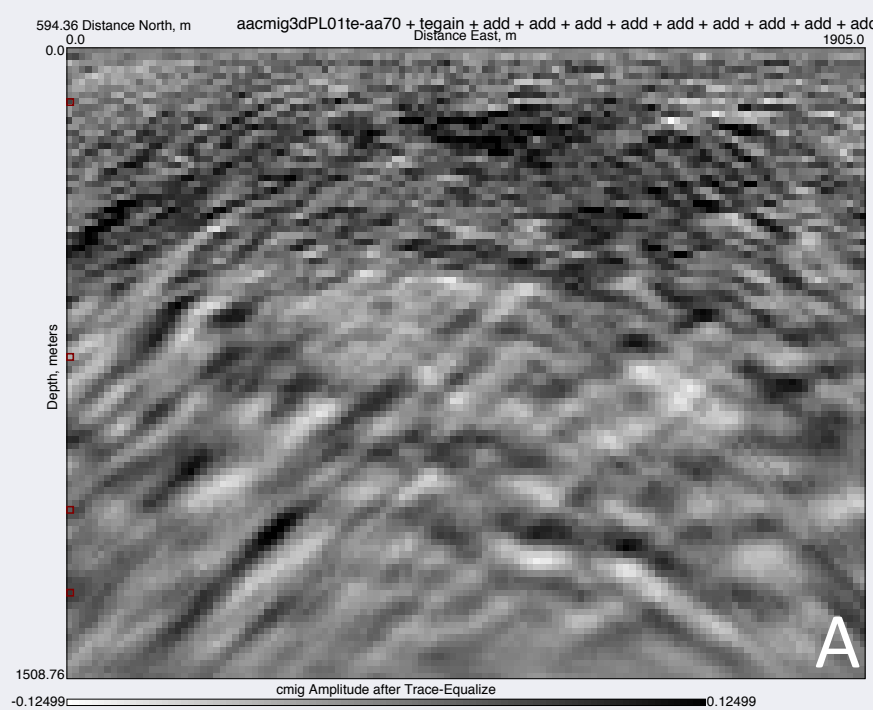
The image shows a 3D visualization of seismic data. It features two intersecting planes, each displaying a color-coded map. The left plane has a blue and white checkered pattern at the top, transitioning into a color gradient from green to yellow to orange. The right plane shows a similar color gradient but with a different pattern. Black lines are drawn across both planes, representing geological features or data paths. The intersection of the two planes is visible, showing how the data from the two different models or surveys do not perfectly align at that point.

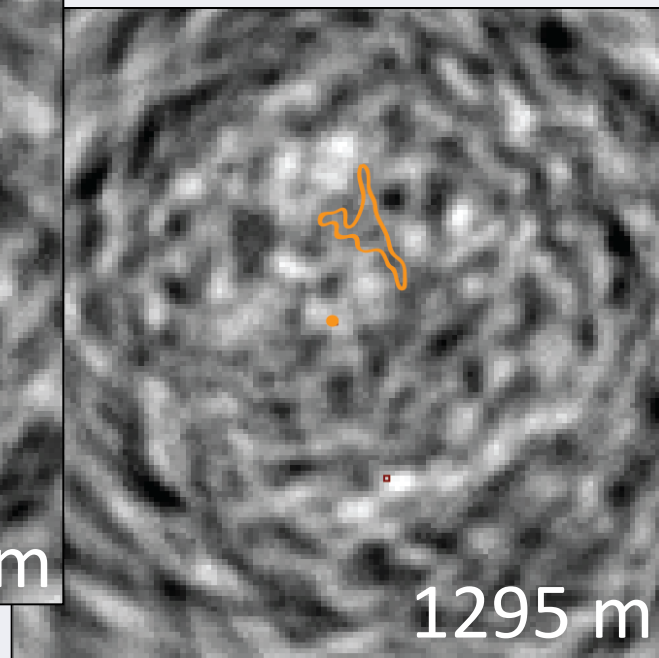
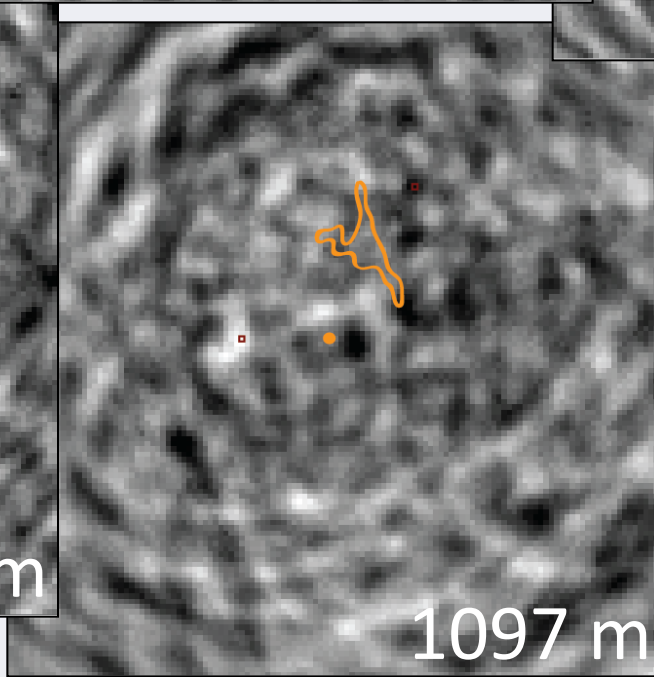
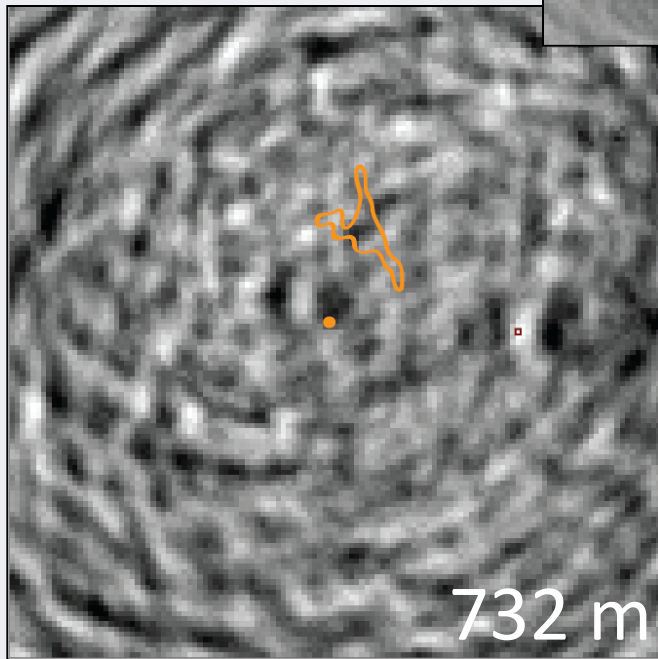
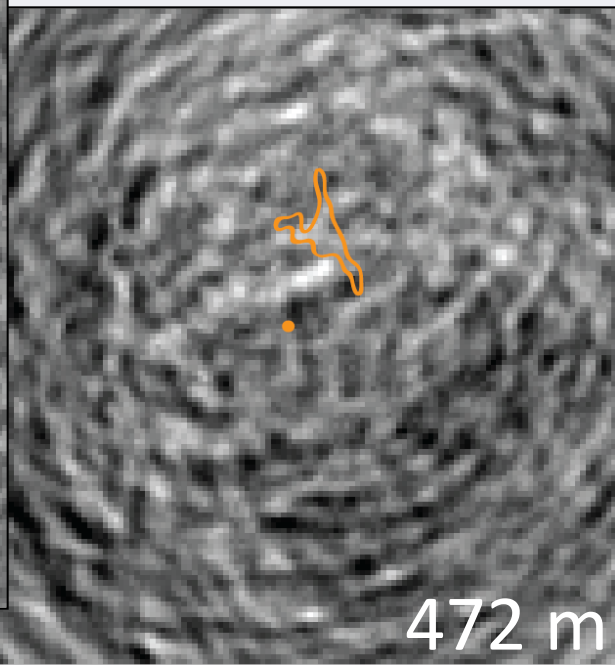
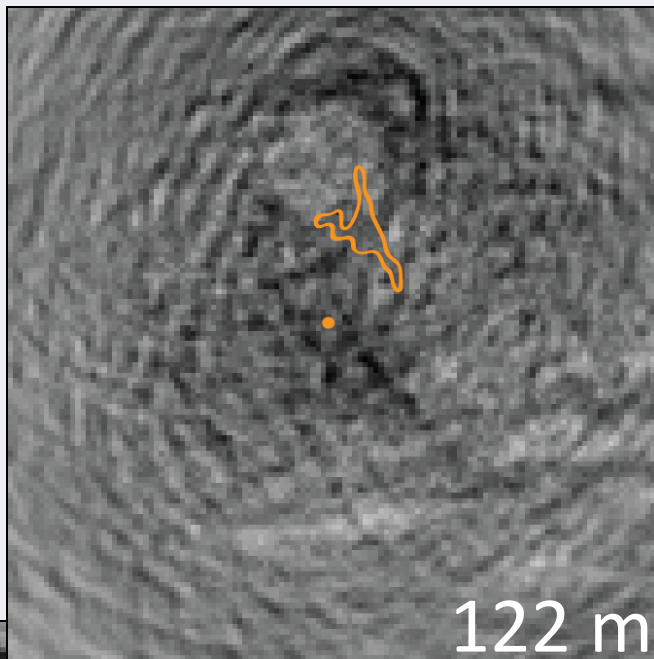
Reflectivity does not match where lines intersect

3D Time Migration

- “Smeared” 1D velocity model
 - Derived from 2D nonlinear velocity optimization
- Pre-stack Kirchhoff time migration







Current State: 3D

Horizontal depth slices

- Faults and stratigraphy verified from wells
- Additional features out of the plane of the 2D sections – especially the northeast-striking feature
- Still need a 3D velocity model

Acknowledgements

- Jim Faulds and Brett Mayhew, Nevada Bureau of Mines and Geology
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- Pyramid Lake Paiute Tribe
- Department of Energy
- Bureau of Indian Affairs

