



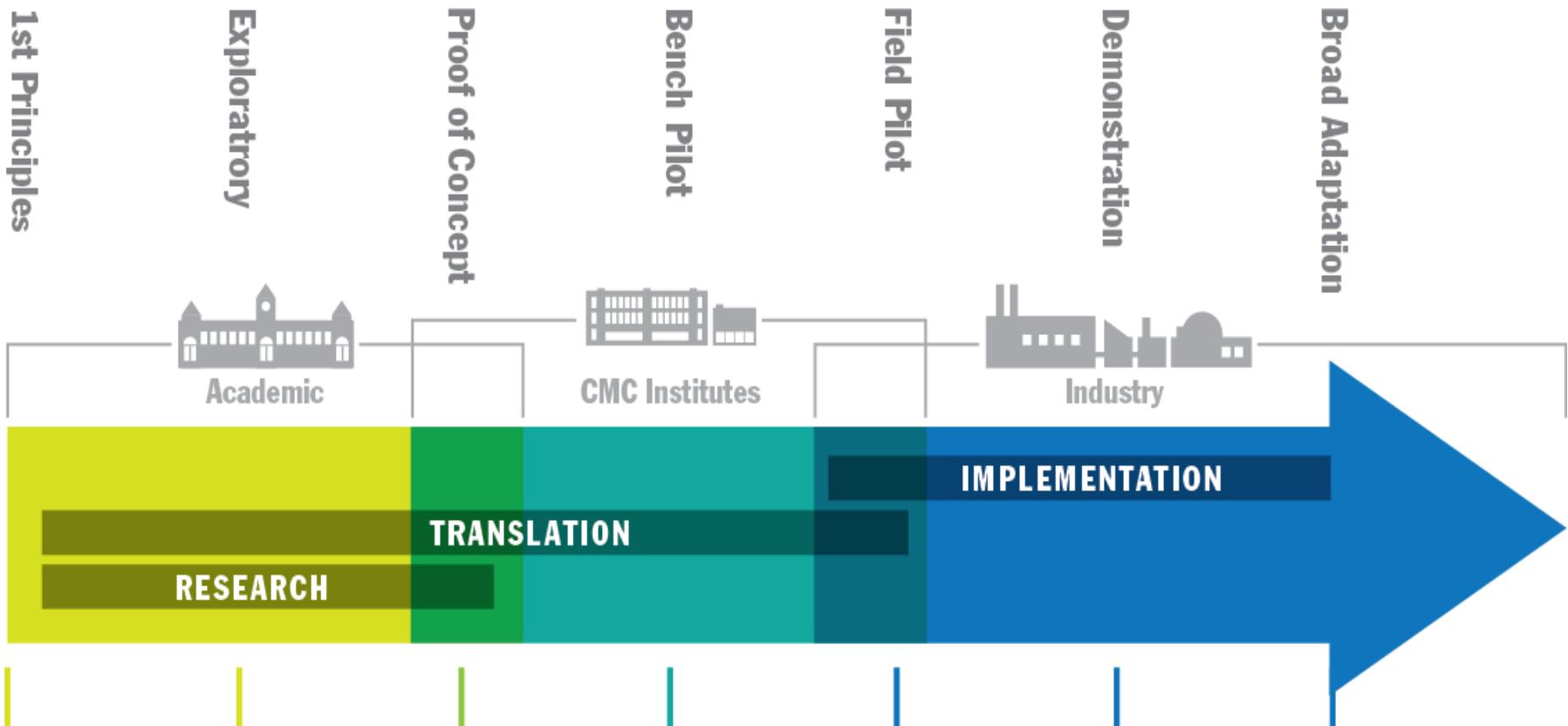
A 3C-3D seismic survey at a new field research station near Brooks, Alberta

Don Lawton¹, Malcolm Bertram, Kevin Bertram, Kevin Hall, Helen Isaac, Jessica Dongas, Davood Nowroozi

¹ University of Calgary & the Containment and Monitoring Institute (CaMI), CMC Research Institutes, Inc.



Ideas to impact



Time / Investment / Public to Private Funding

CaMI Field Research Station (FRS)

- There is a need to better characterize containment risks for injection or production of fluids into/from reservoirs.
- FRS is a unique benchmarking and evaluation program for monitoring subsurface fluids.
- FRS is being developed by CaMI in collaboration with the University of Calgary, with an emphasis on HQP development.
- CREWES has a significant opportunity at the FRS for seismic research

Containment & monitoring needs/applications

- Secure carbon storage (CCS)
- Steam chamber containment and conformance.
- Enhanced petroleum recovery.
- Shale gas and tight oil (hydraulic fracturing).
- Legacy wells – fugitive emissions.
- Acid gas or produced water disposal.
- Induced seismicity risk analysis and mitigation.

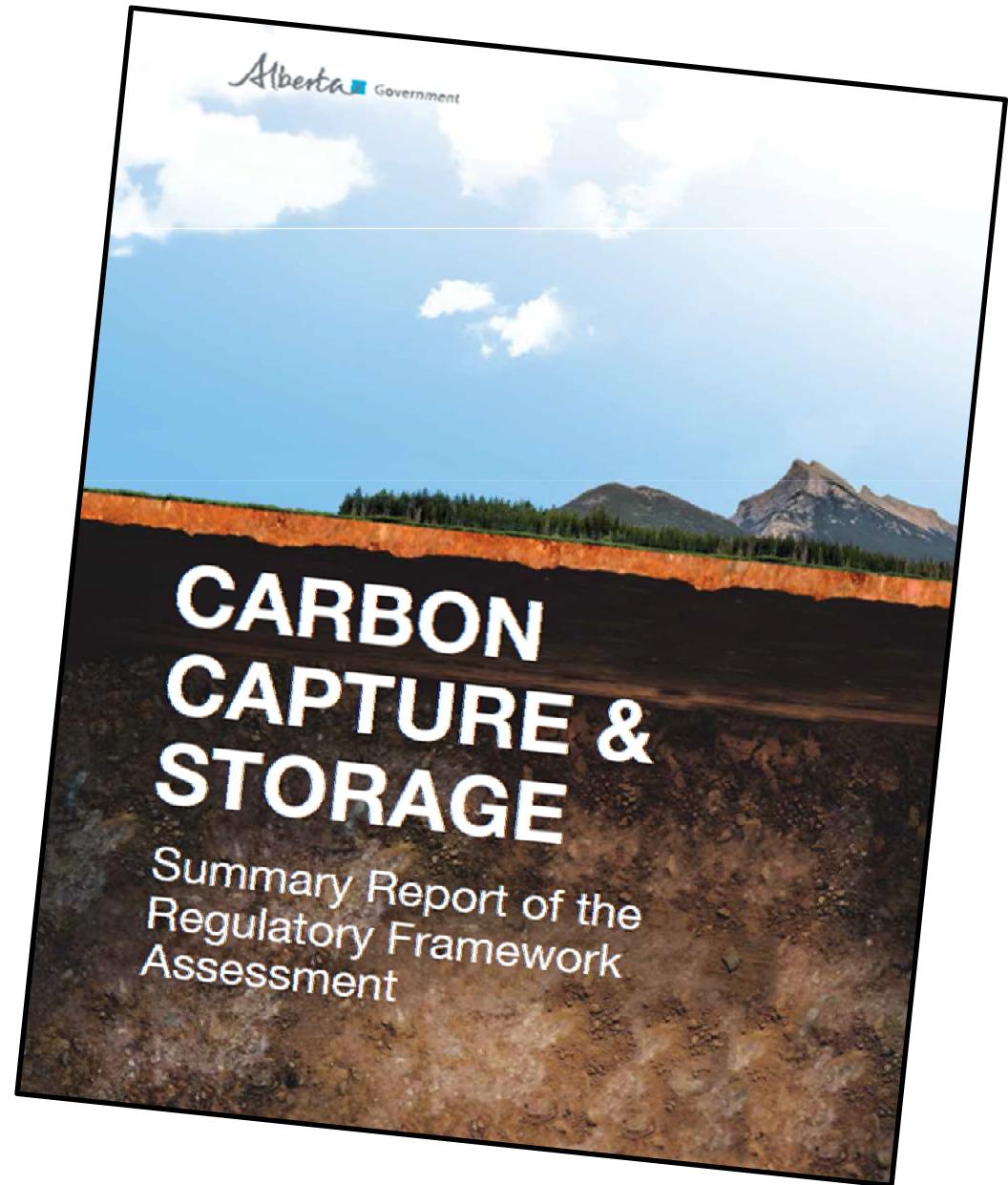


Cap rock integrity

CCS RFA

**Government
of Alberta
Regulatory
Framework
Assessment**

(August 2013)



RFA recommendation

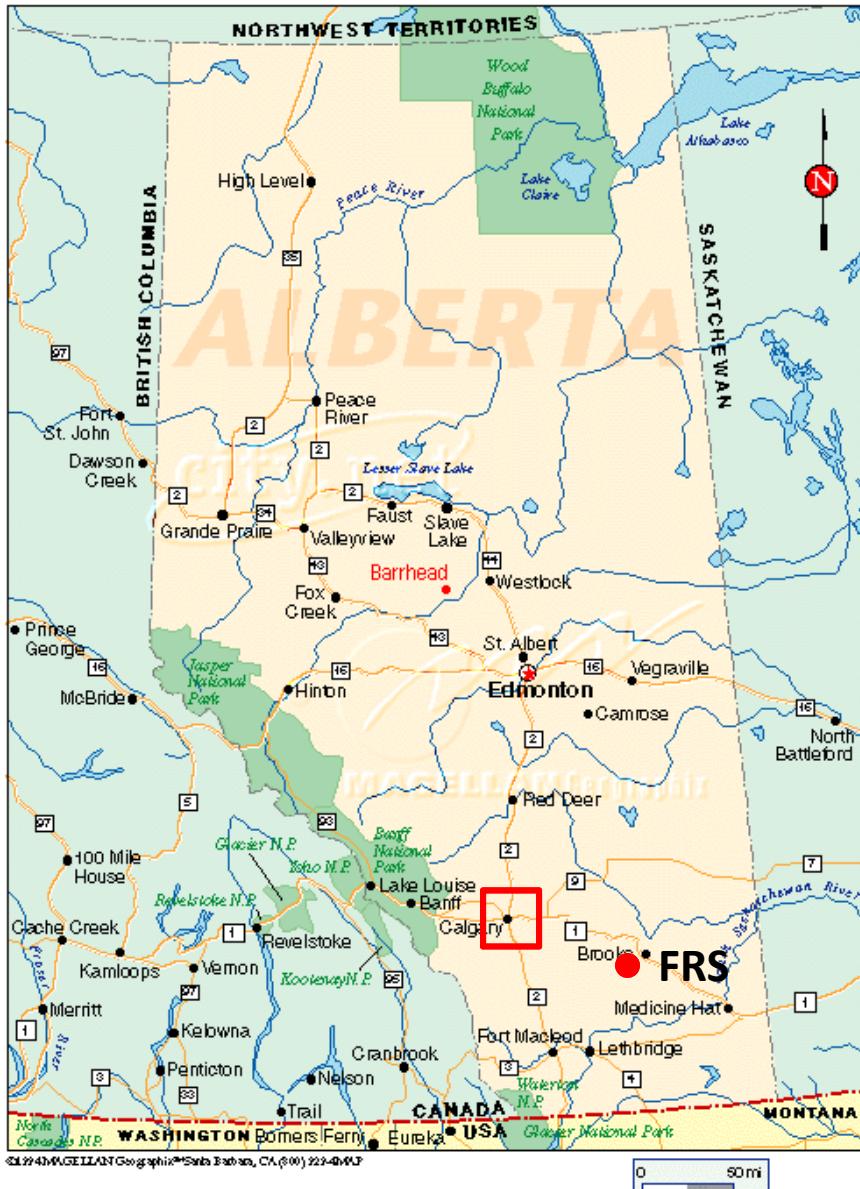
Risk Assessment, Monitoring, and Technical Requirements

“Require MMV and closure plans to be based on a project-specific risk assessment, and include the use of best available technologies to monitor the atmosphere, surface, ground and surface water, and subsurface.”

CaMI Field Research Station

- Undertake controlled CO₂ release at 300 m & 500 m depth; ~1000 t/yr.
- Develop improved monitoring technologies.
- Determine CO₂ detection thresholds.
- Monitor fugitive gas emissions.
- University & industry field training & research, integrating engineering and geoscience
- Provide quantitative monitoring protocols to regulators and industry.
- Accelerate public outreach & education.
- Provide on-site fuel cell for CO₂ source and natural gas utilization; energy storage; energy efficiency

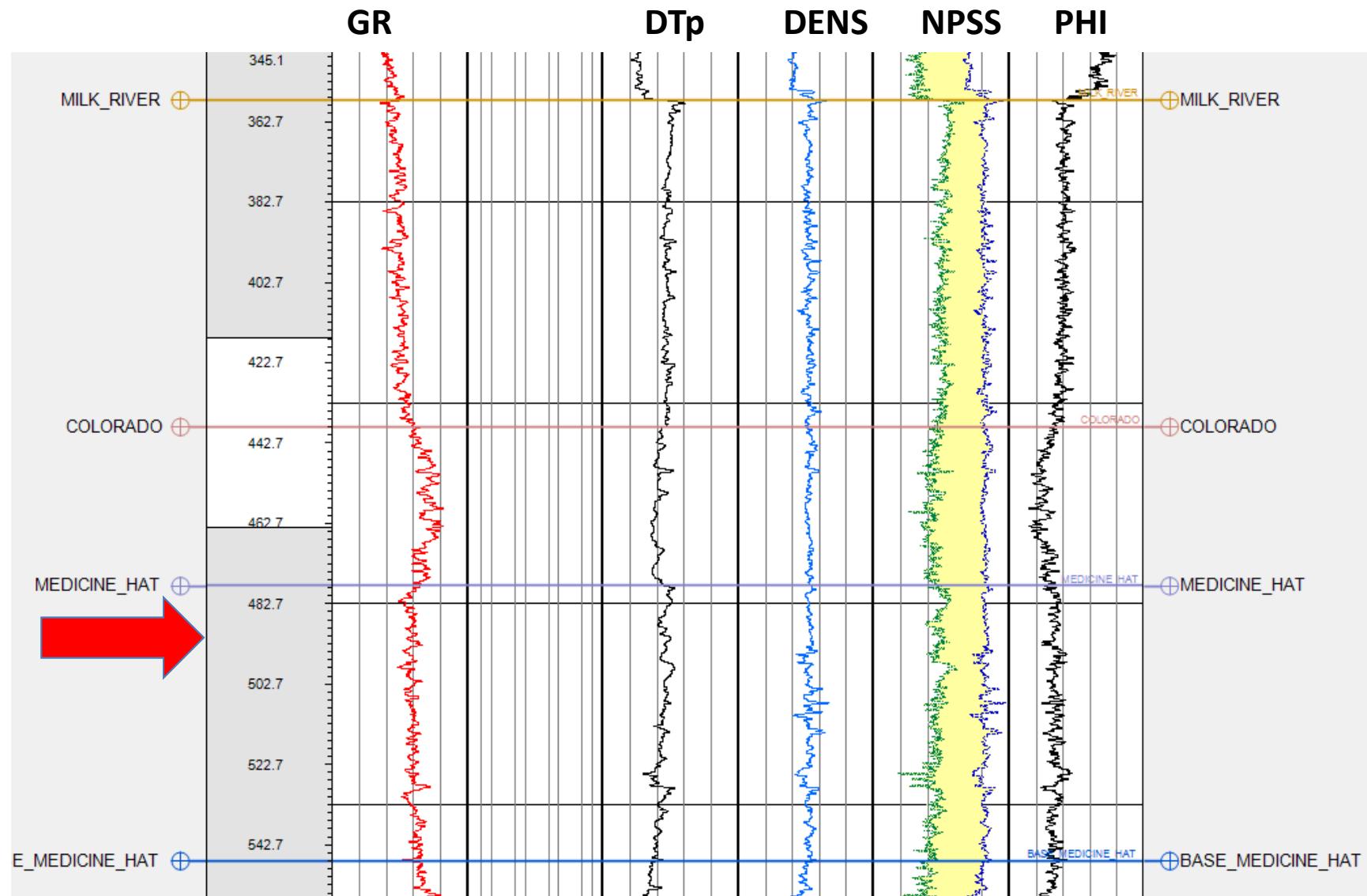
Location of the FRS – Newell County



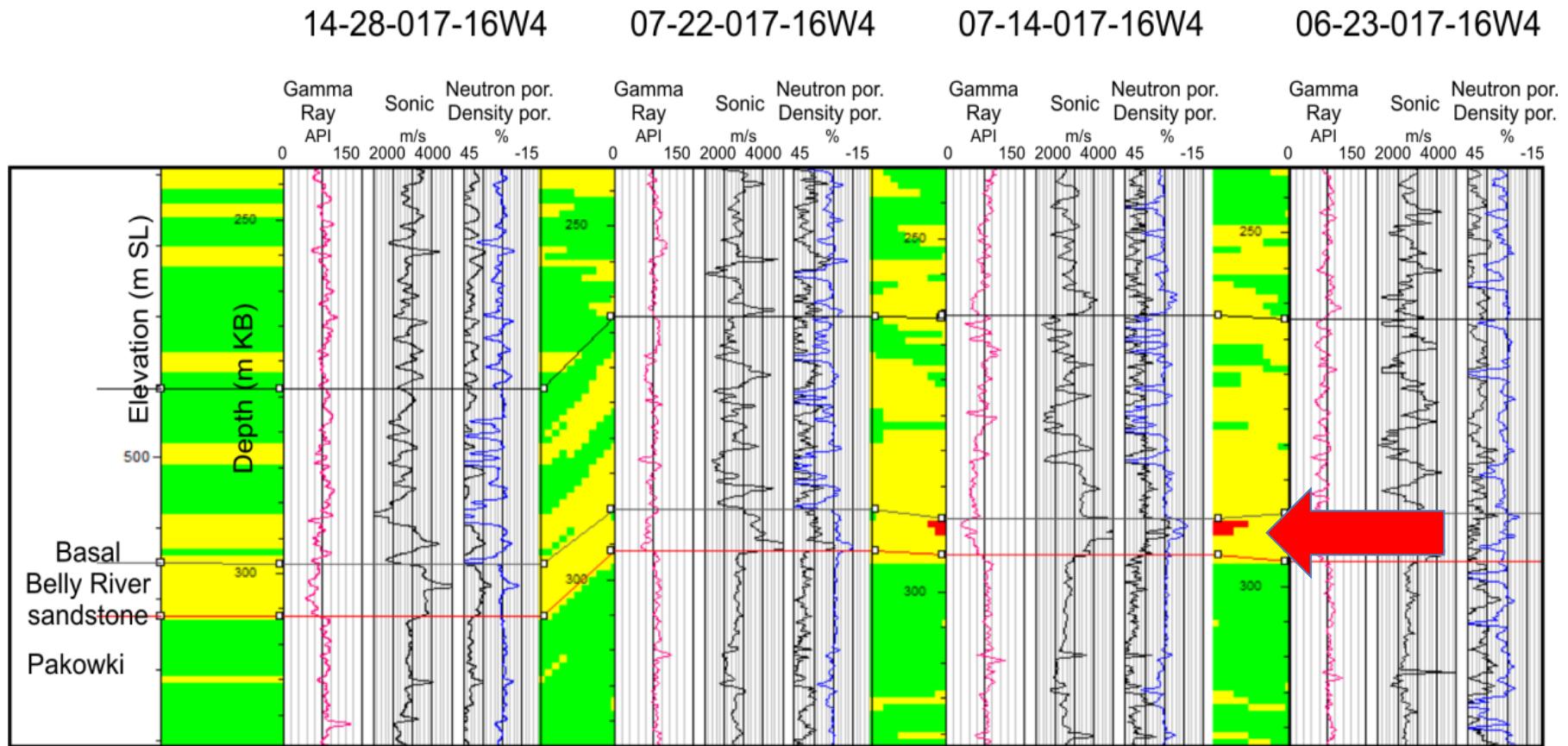
FRS site – courtesy Cenovus



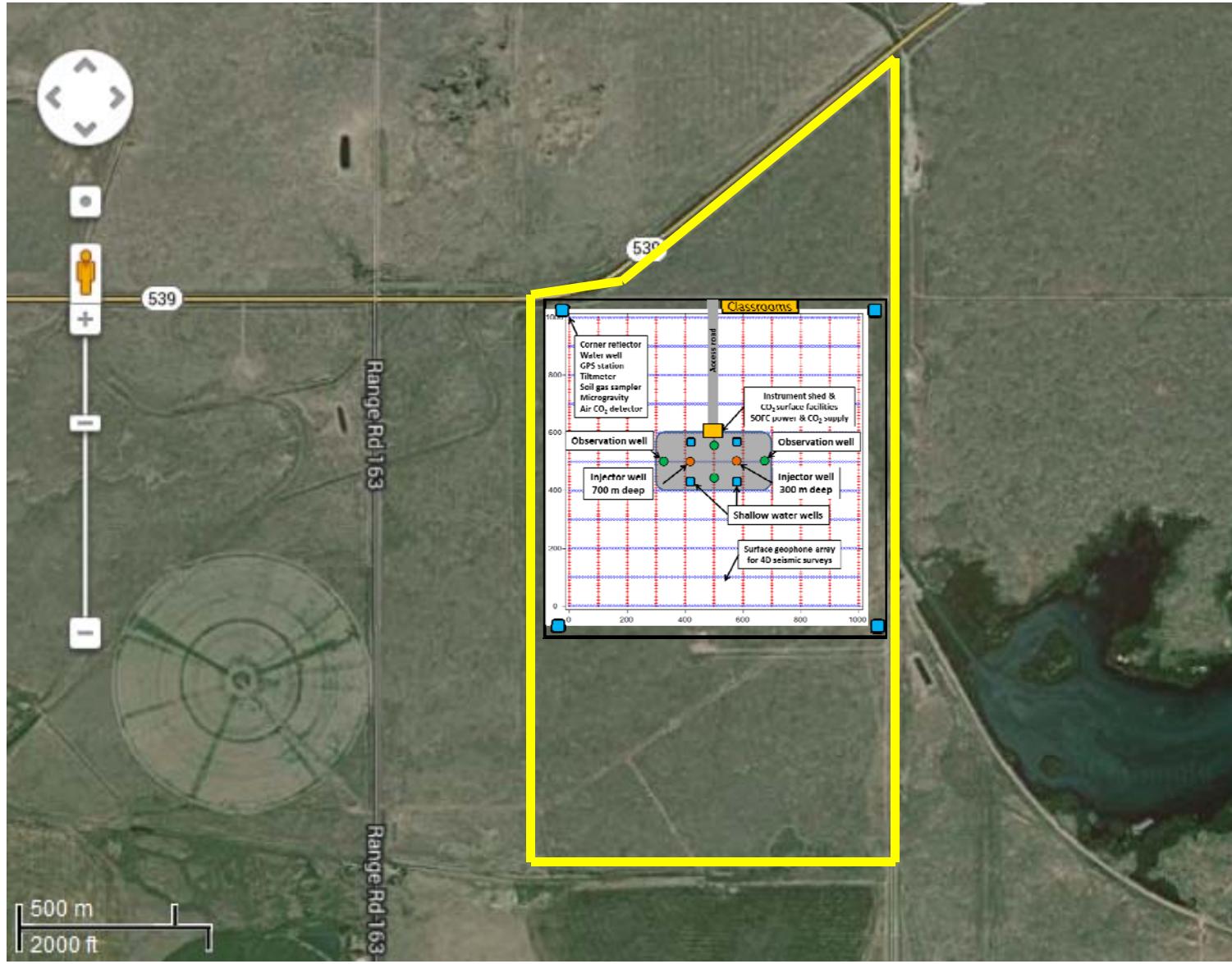
Medicine Hat Sand, Newell County



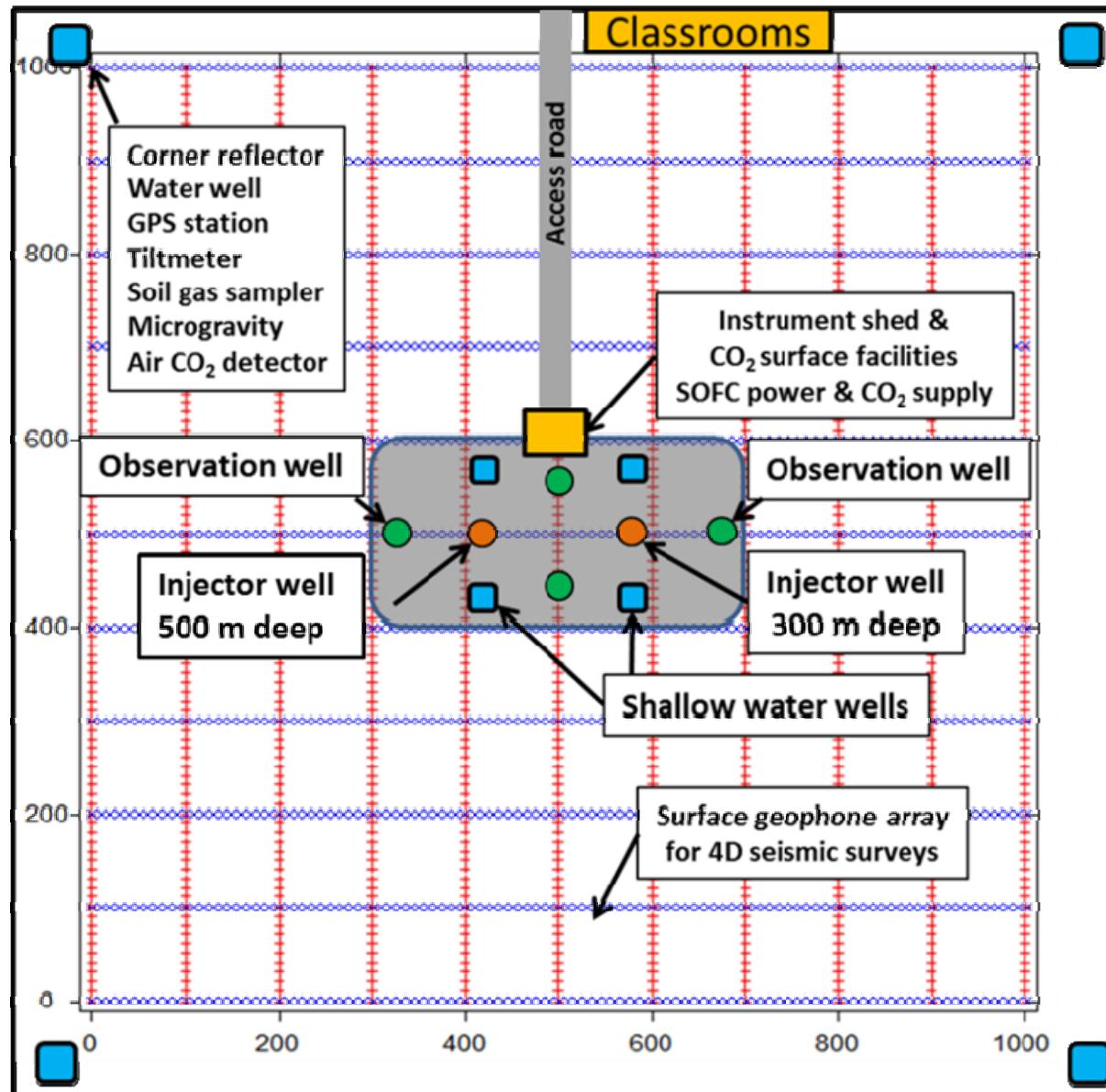
Basal Belly River, Newell County



CaMI.UofC Field Research Station



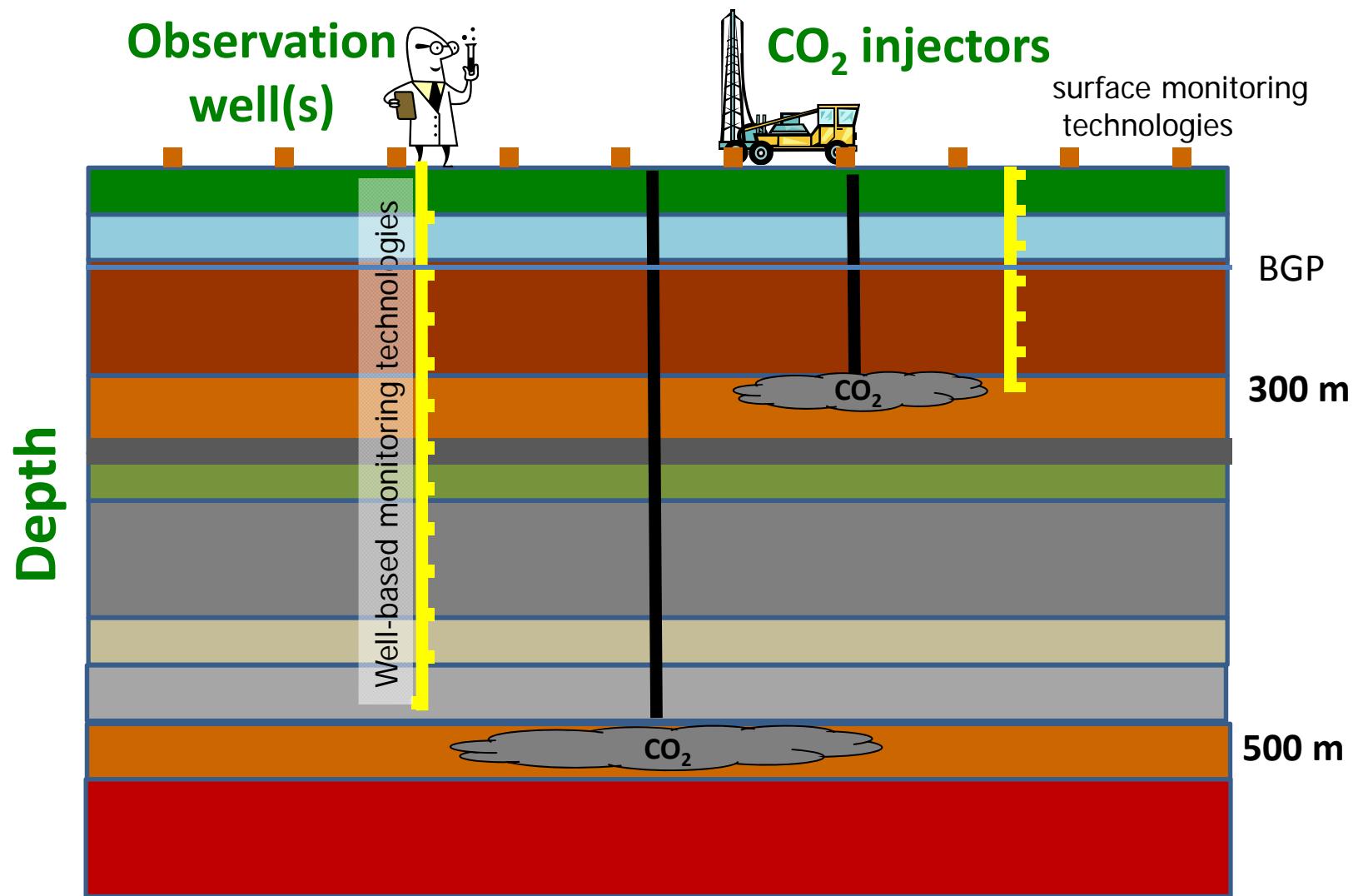
FRS surface layout



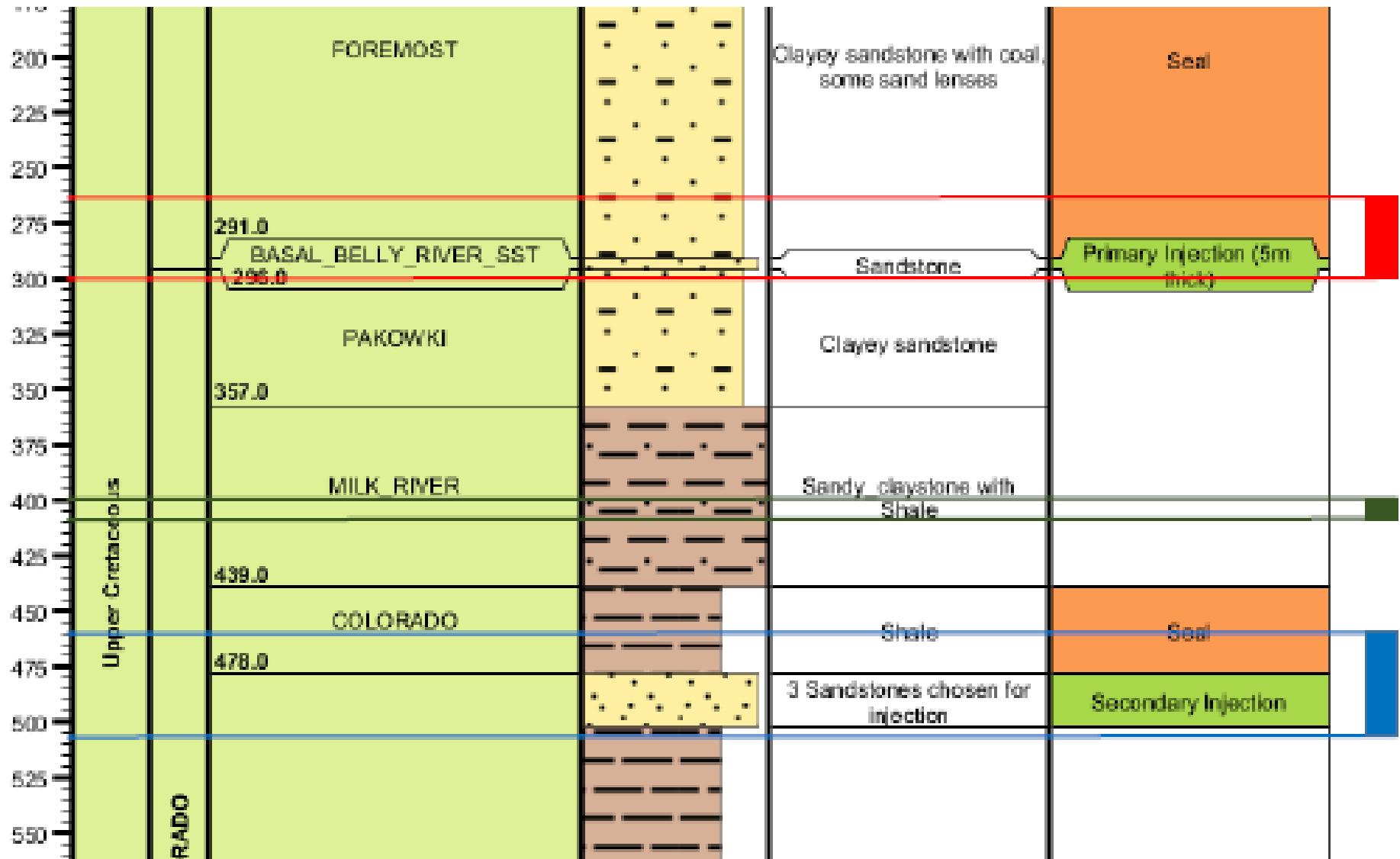
CaMI FRS technologies

- 3D-3C surface seismic surveys
- 3D vertical seismic profiles
- Cross-well seismic surveys
- Microseismic surveys
- Full logging suites & core analysis
- Fibre-optic monitoring technologies (DAS, DTS)
- Fibre-optic accelerometers & geophones
- Geomechanics analysis
- Geochemical sampling/tracers
- Groundwater monitoring surveys
- Environmental geophysical surveys
- Casing gas, soil & atmospheric surveys
- Tiltmeters & DGPS surveys
- InSAR imaging and interpretation
- Fuel cell h/p CO₂ supply

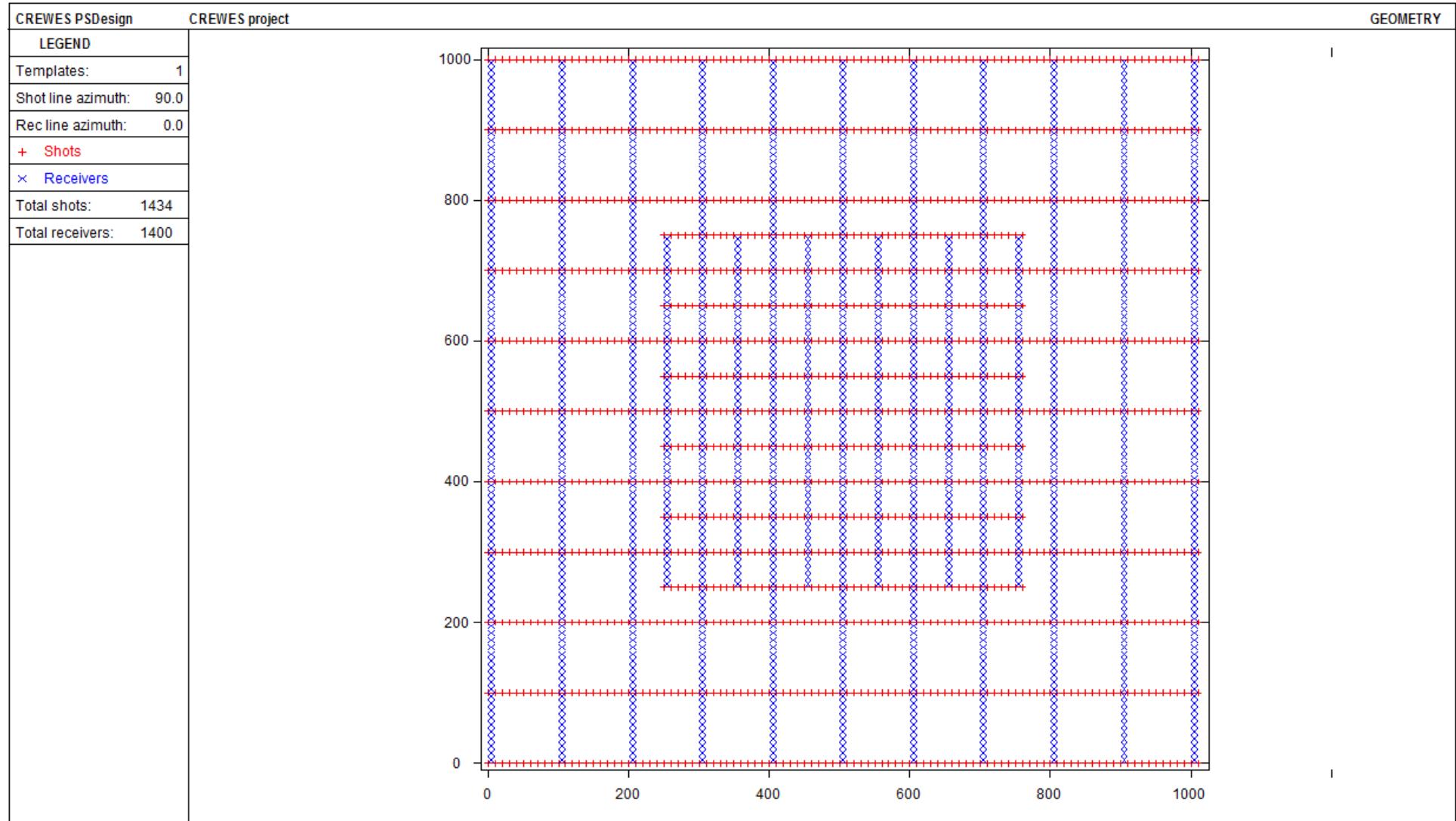
CaMI FRS project



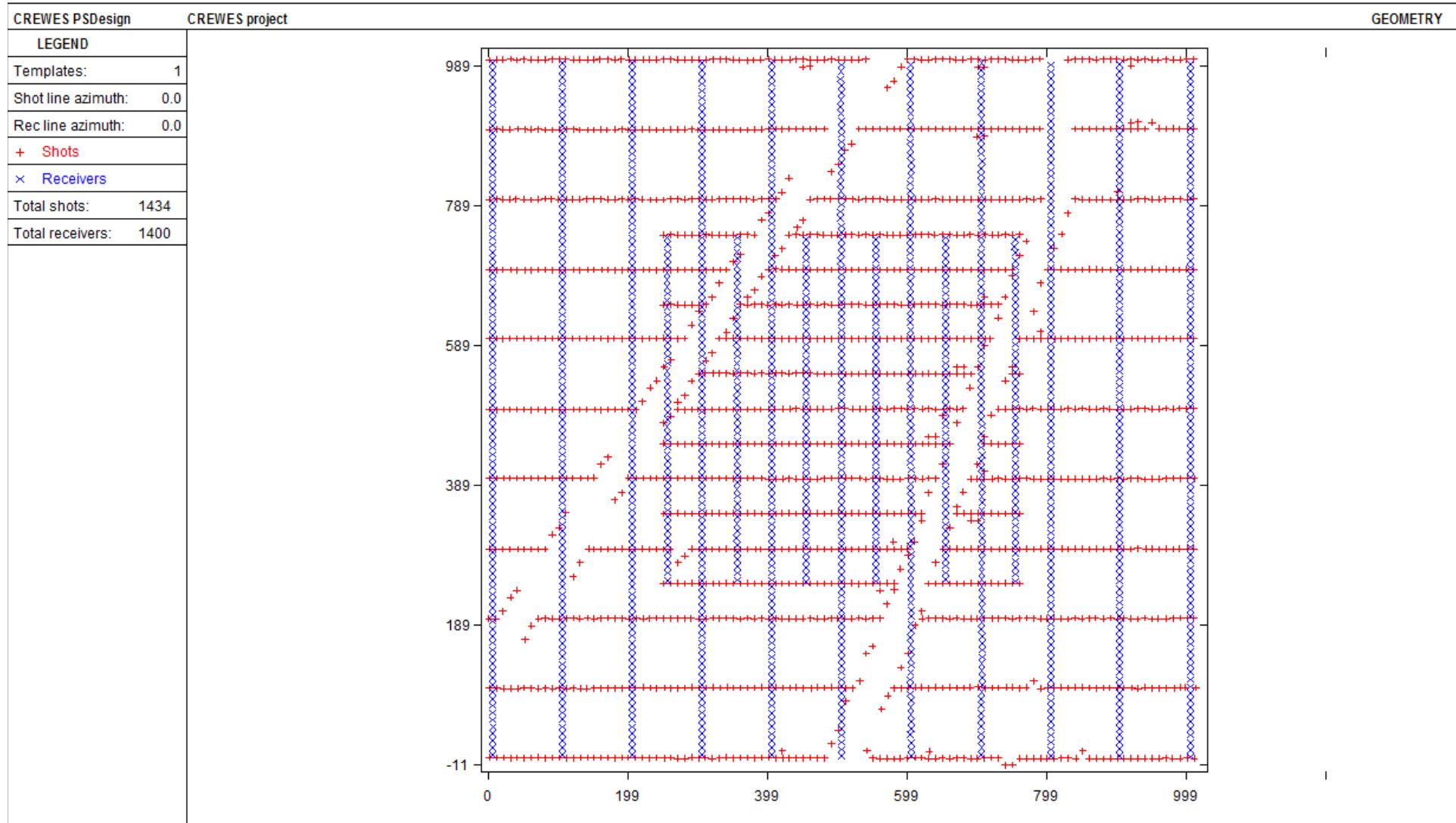
FRS core intervals well#1



FRS baseline seismic program (pre-plan)



FRS baseline seismic program (field)

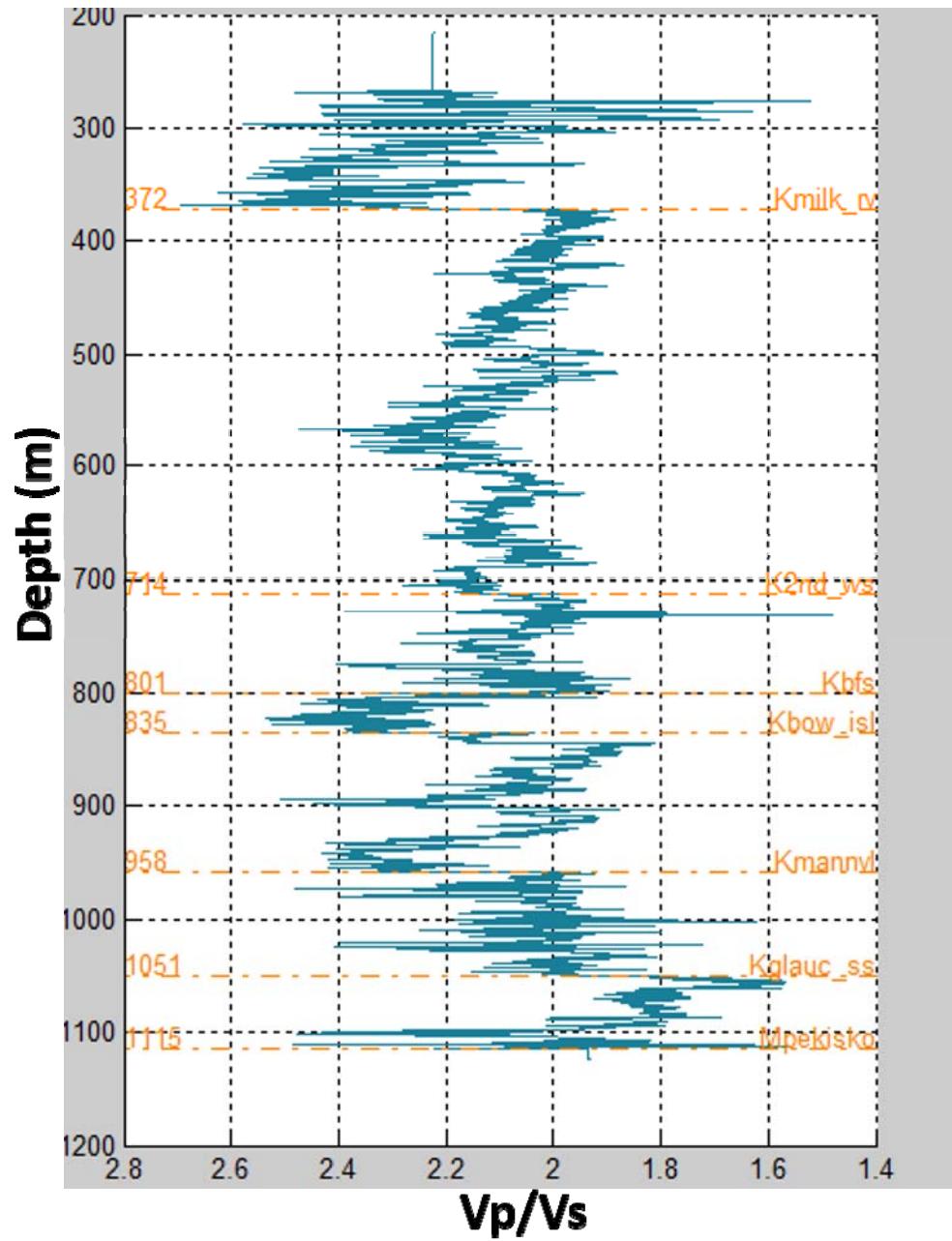


FRS baseline seismic program source

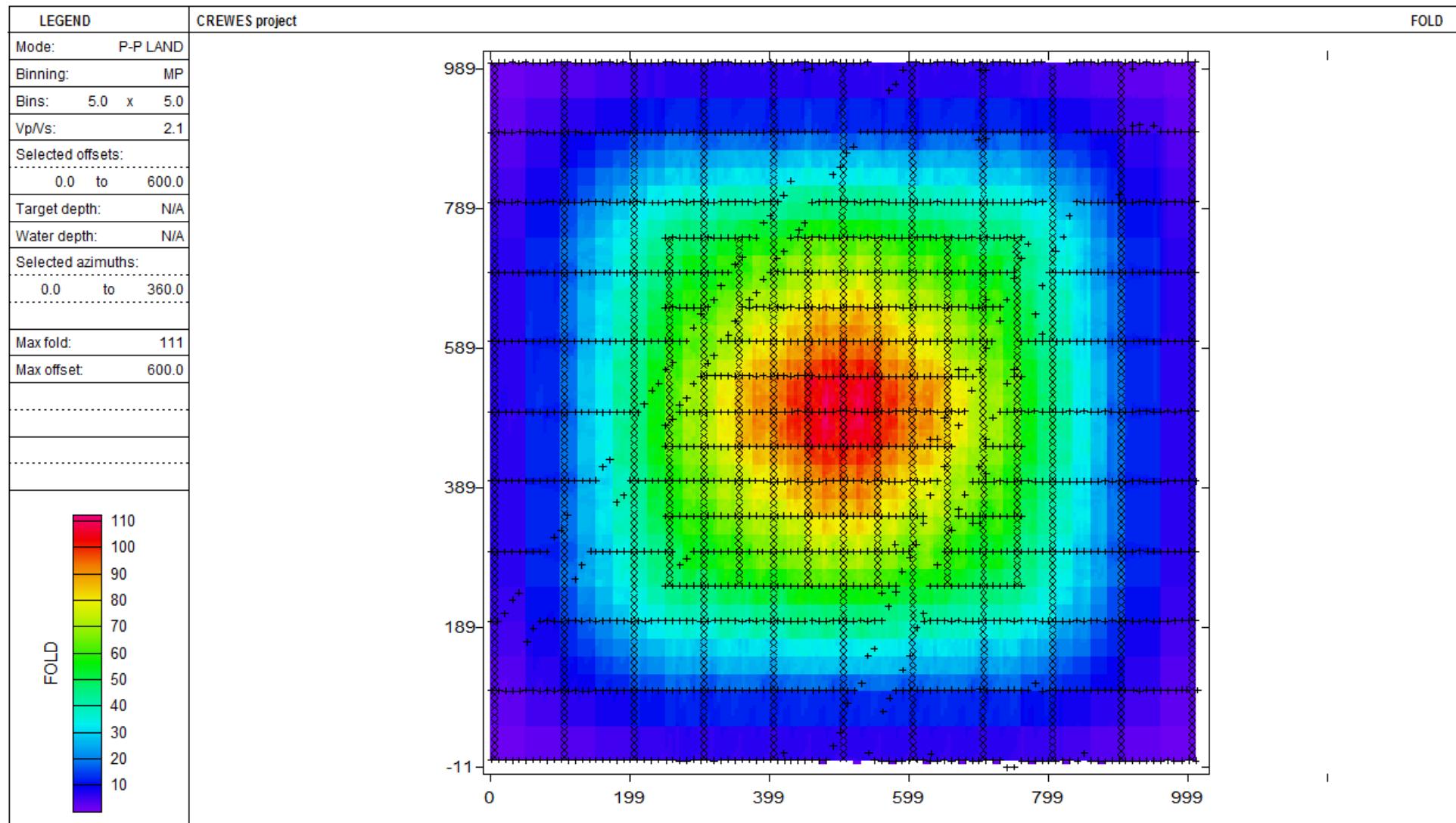


2 sweeps 8-150 Hz over 16 s

V_p/V_s

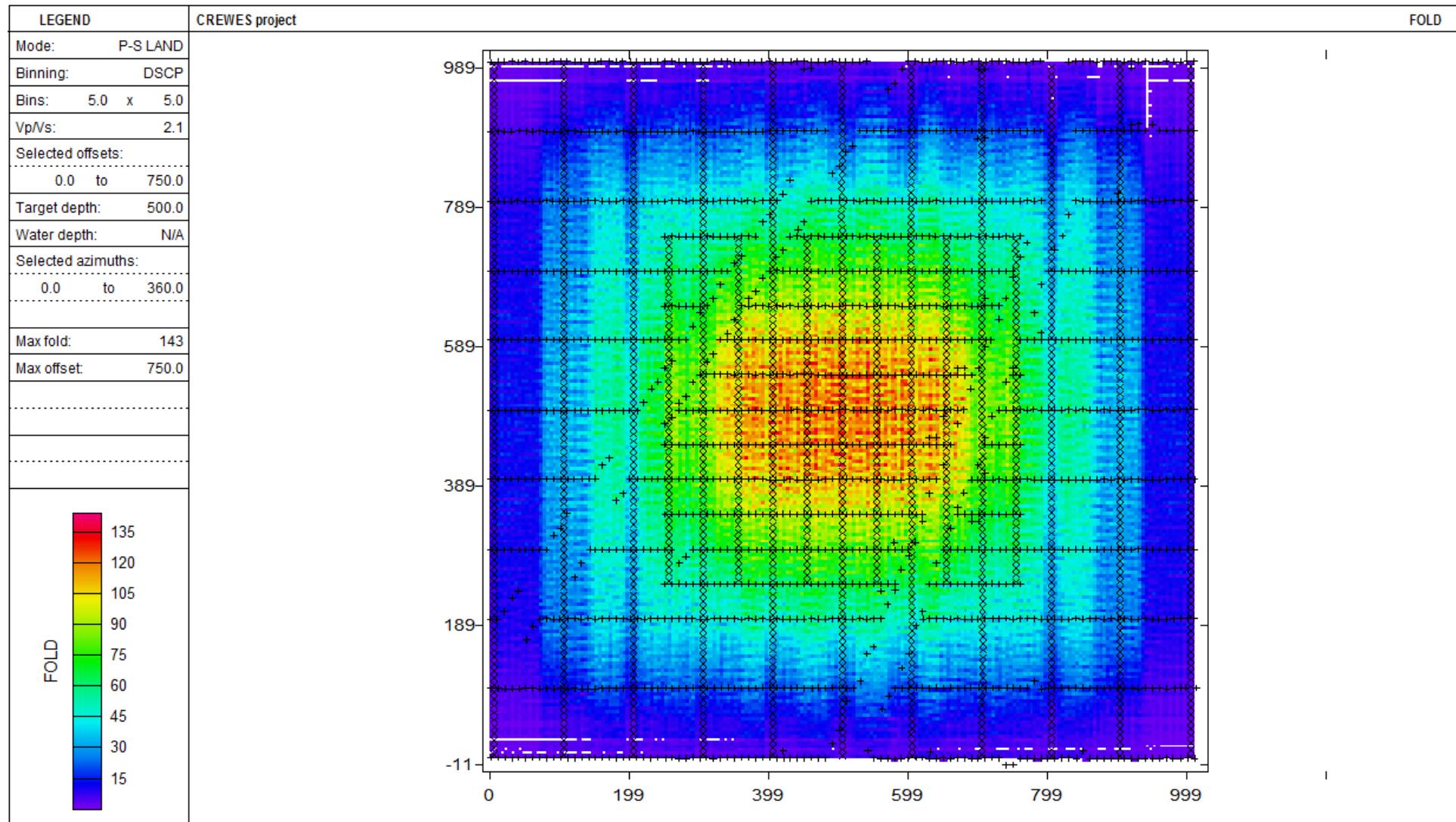


FRS baseline PP fold 600 m offset



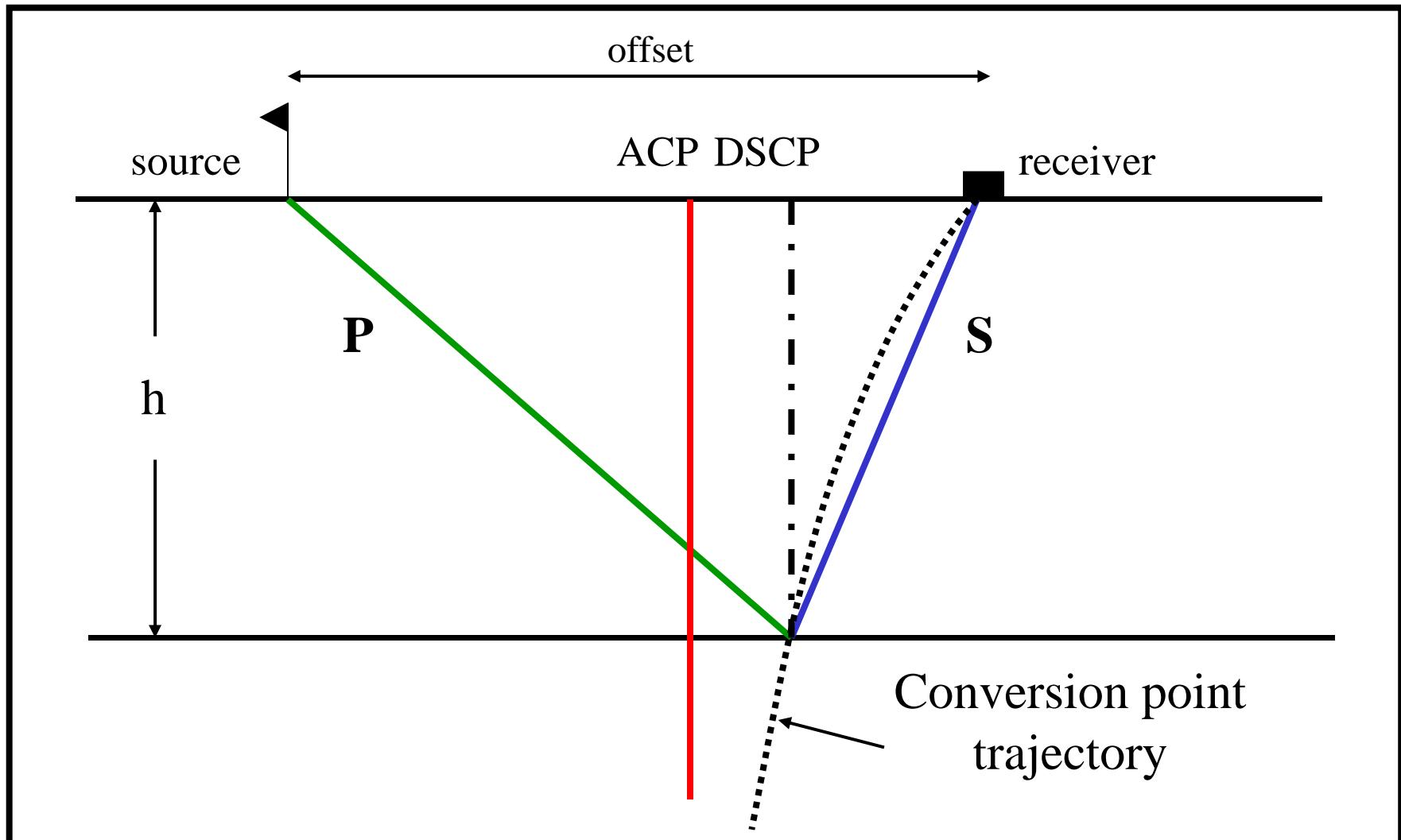
Maximum offset = 1000 m

FRS baseline PS fold 750 m offset; $V_p/V_s = 2.1$

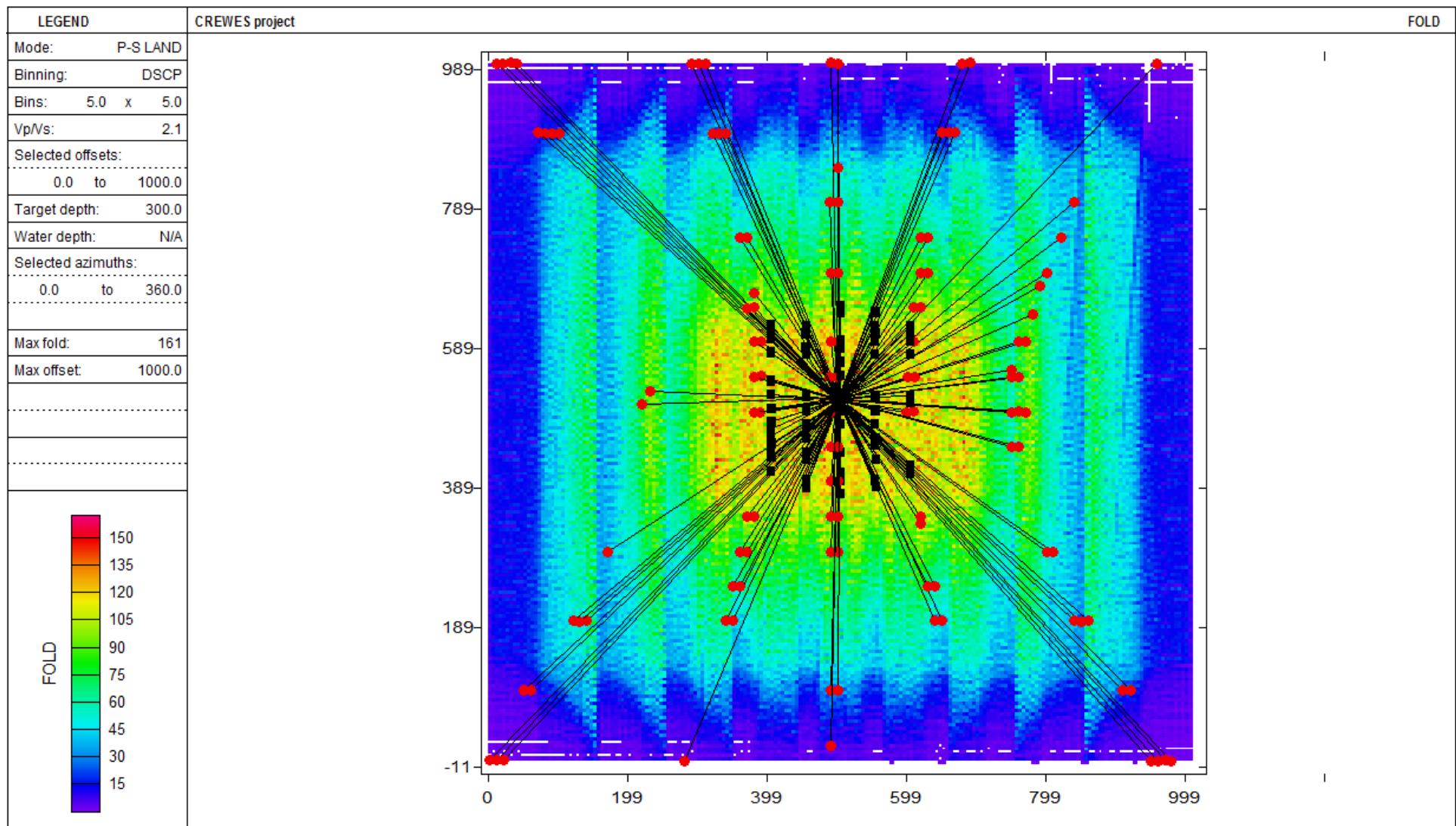


Depth = 500 m

Depth specific conversion point mapping

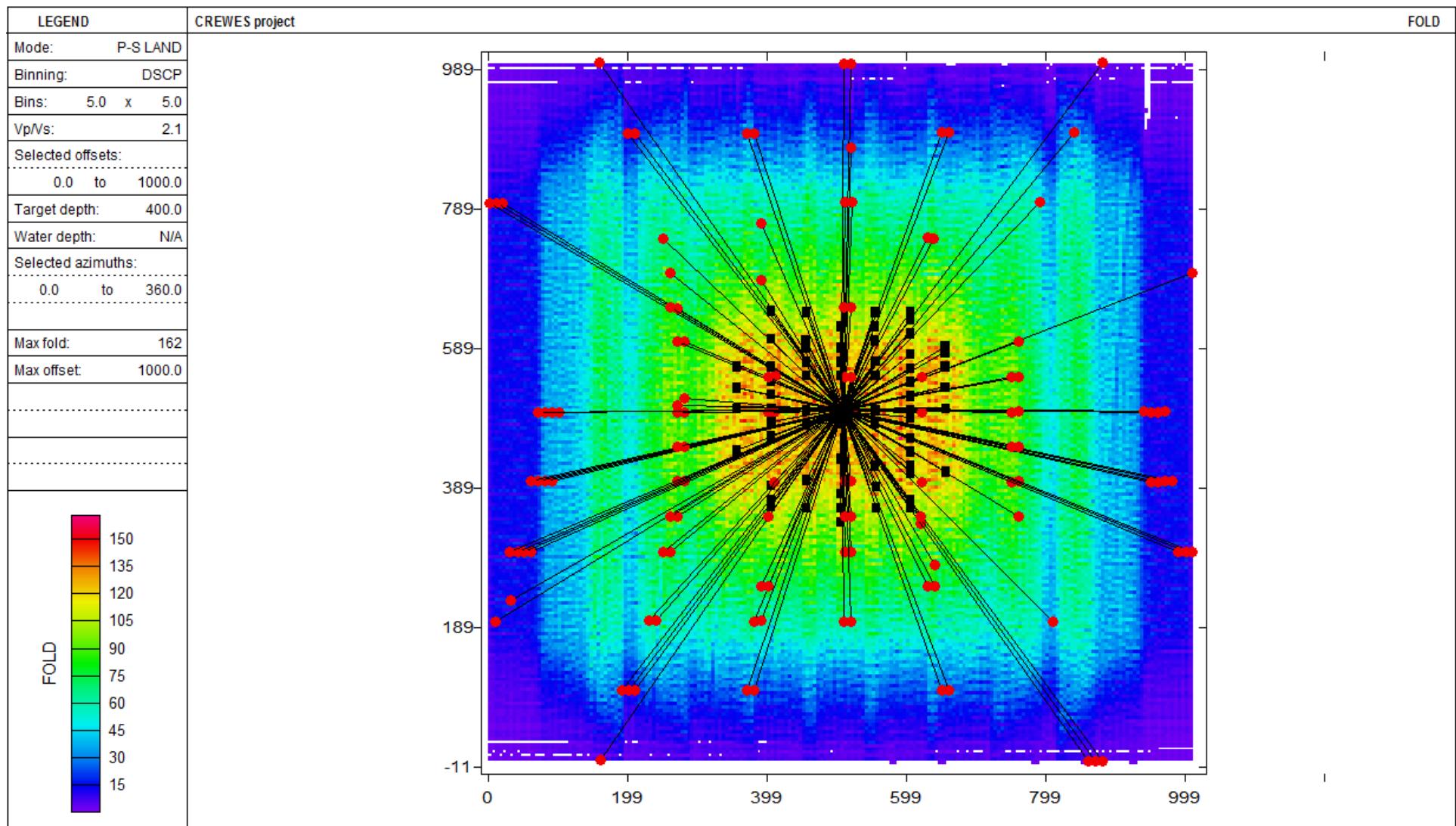


PS design; depth = 300 m



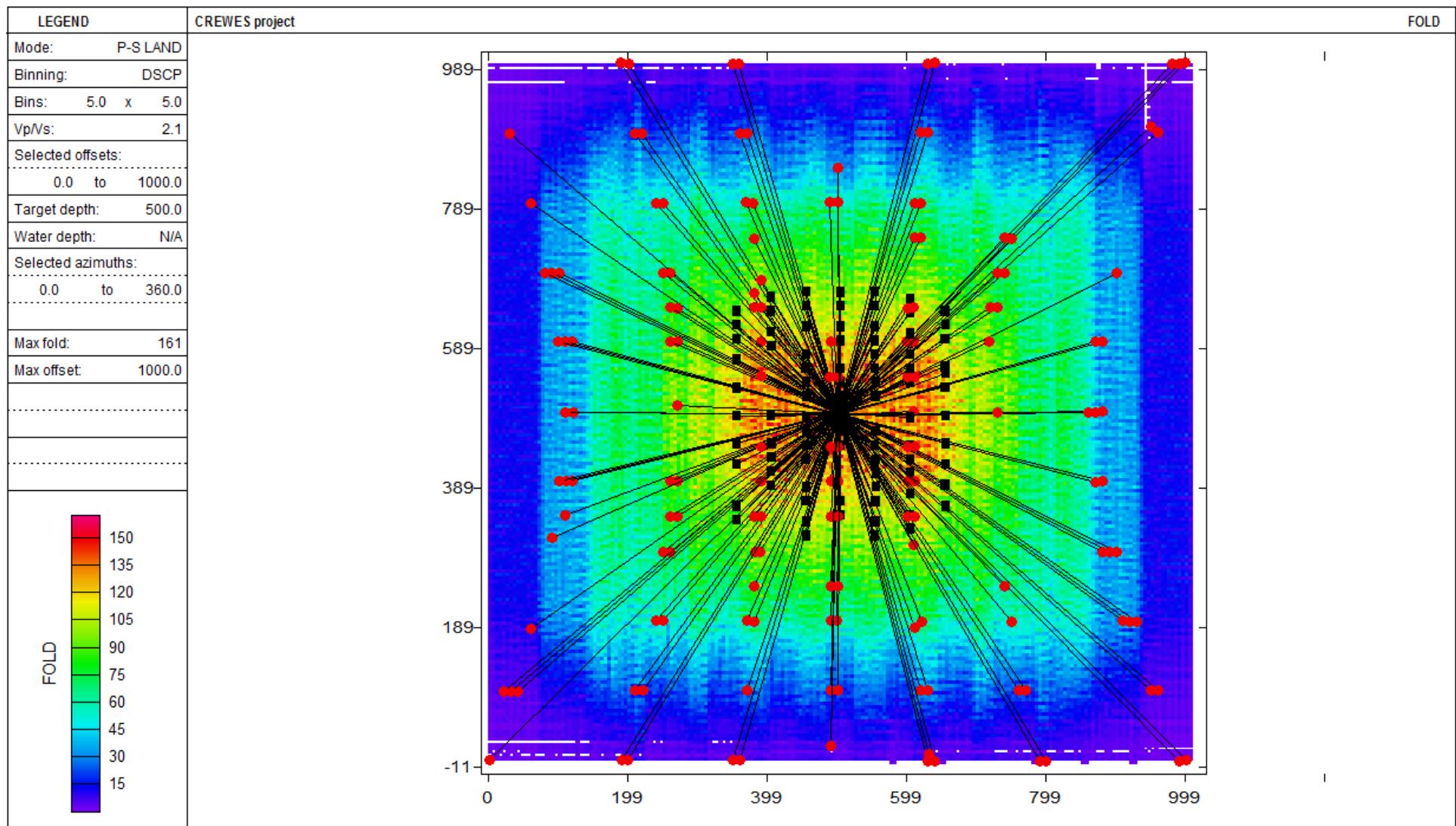
Maximum offset = 1000 m

PS design; depth = 400 m



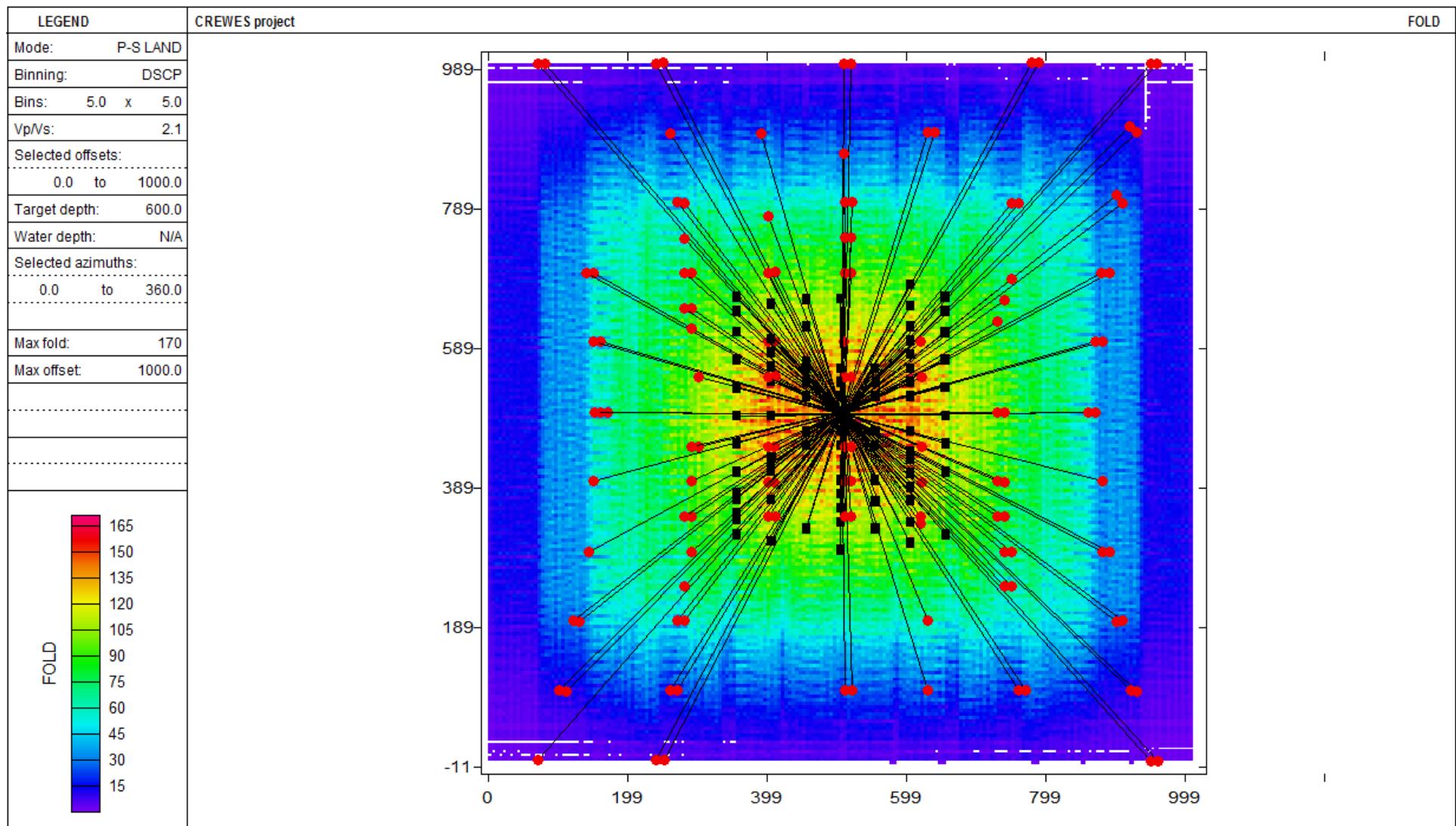
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PS design; depth = 500 m



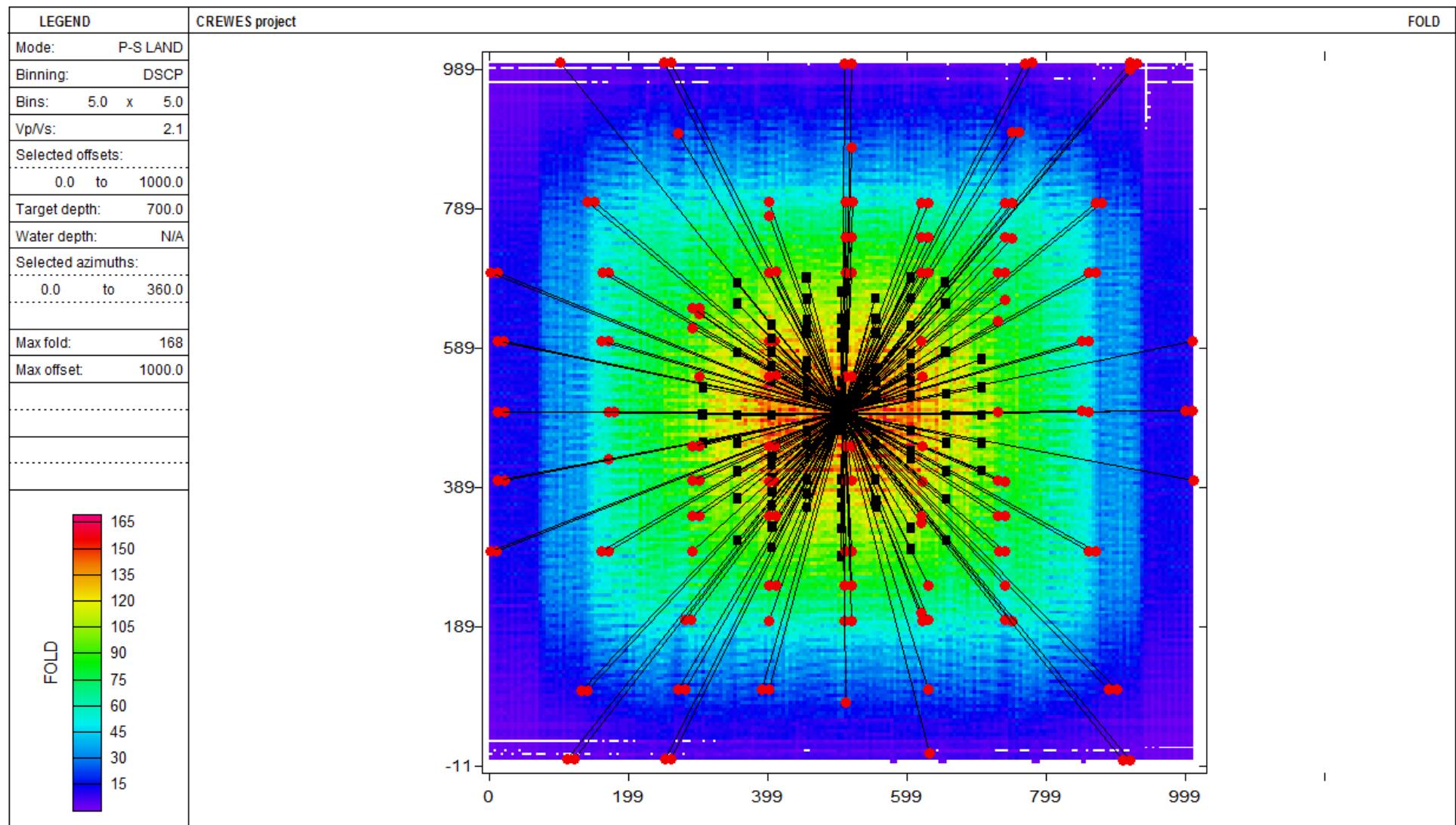
Maximum offset = 1000 m

PS design; depth = 600 m



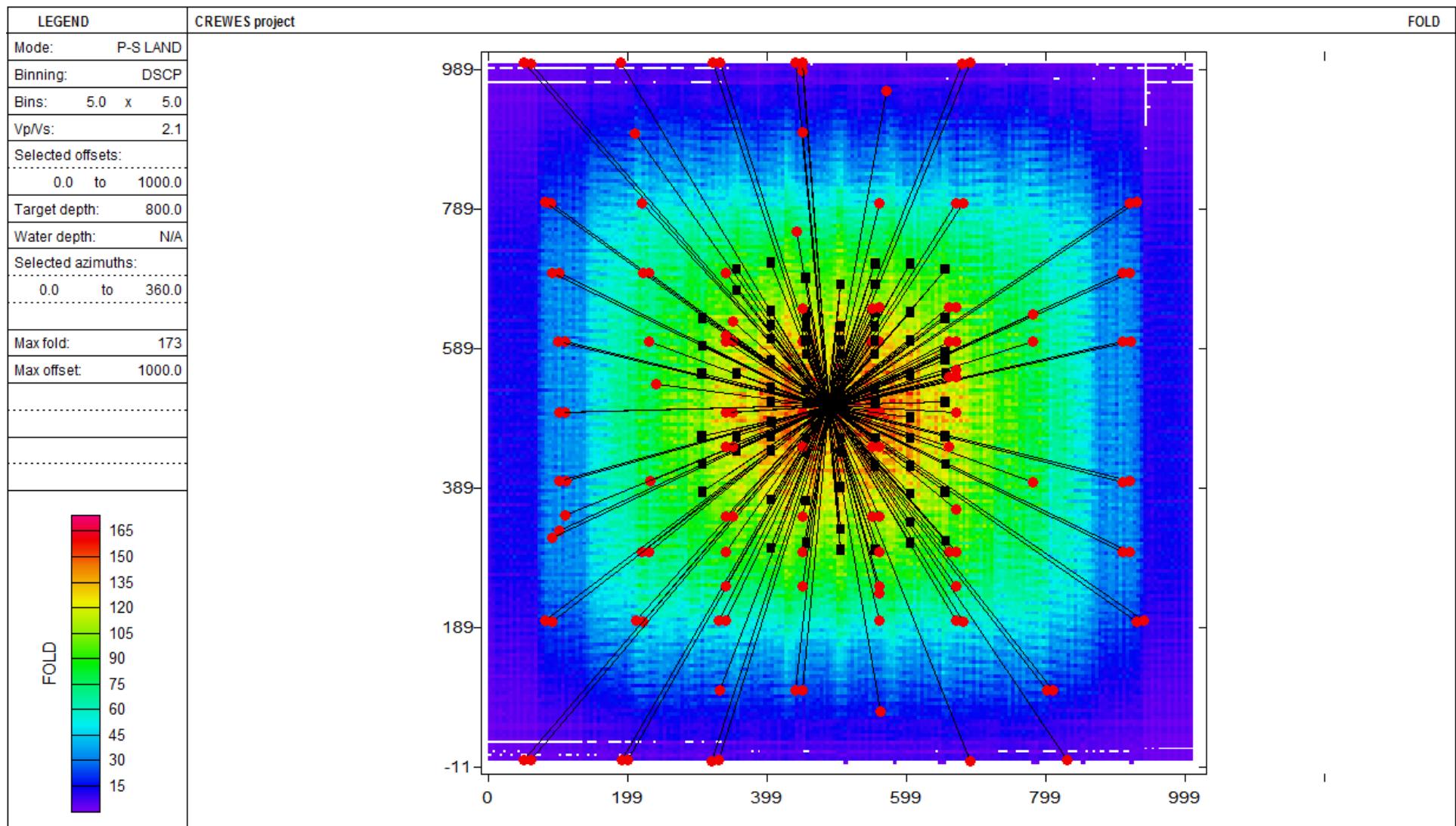
Maximum offset = 1000 m

PS design; depth = 700 m



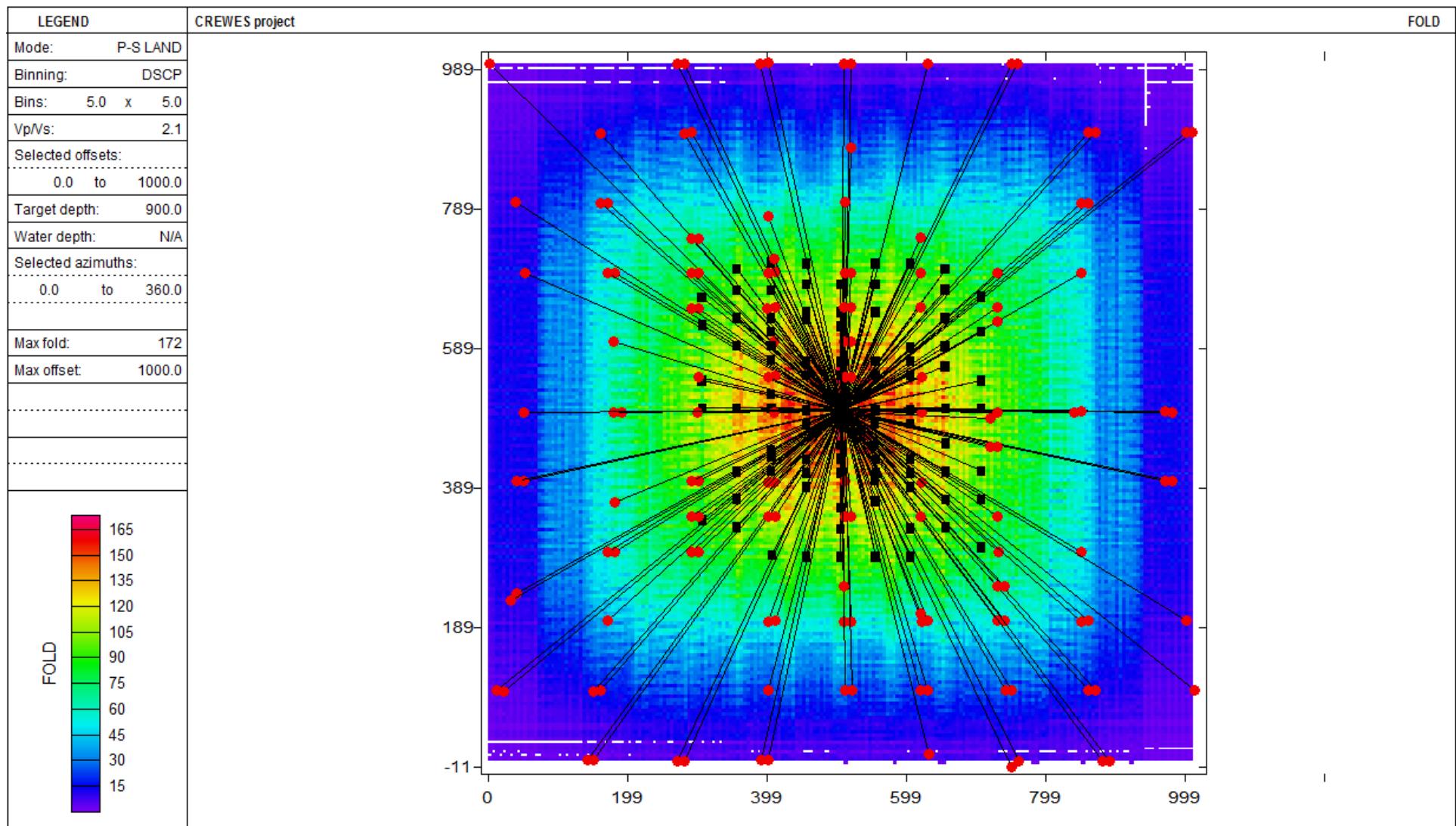
Maximum offset = 1000 m

PS design; depth = 800 m



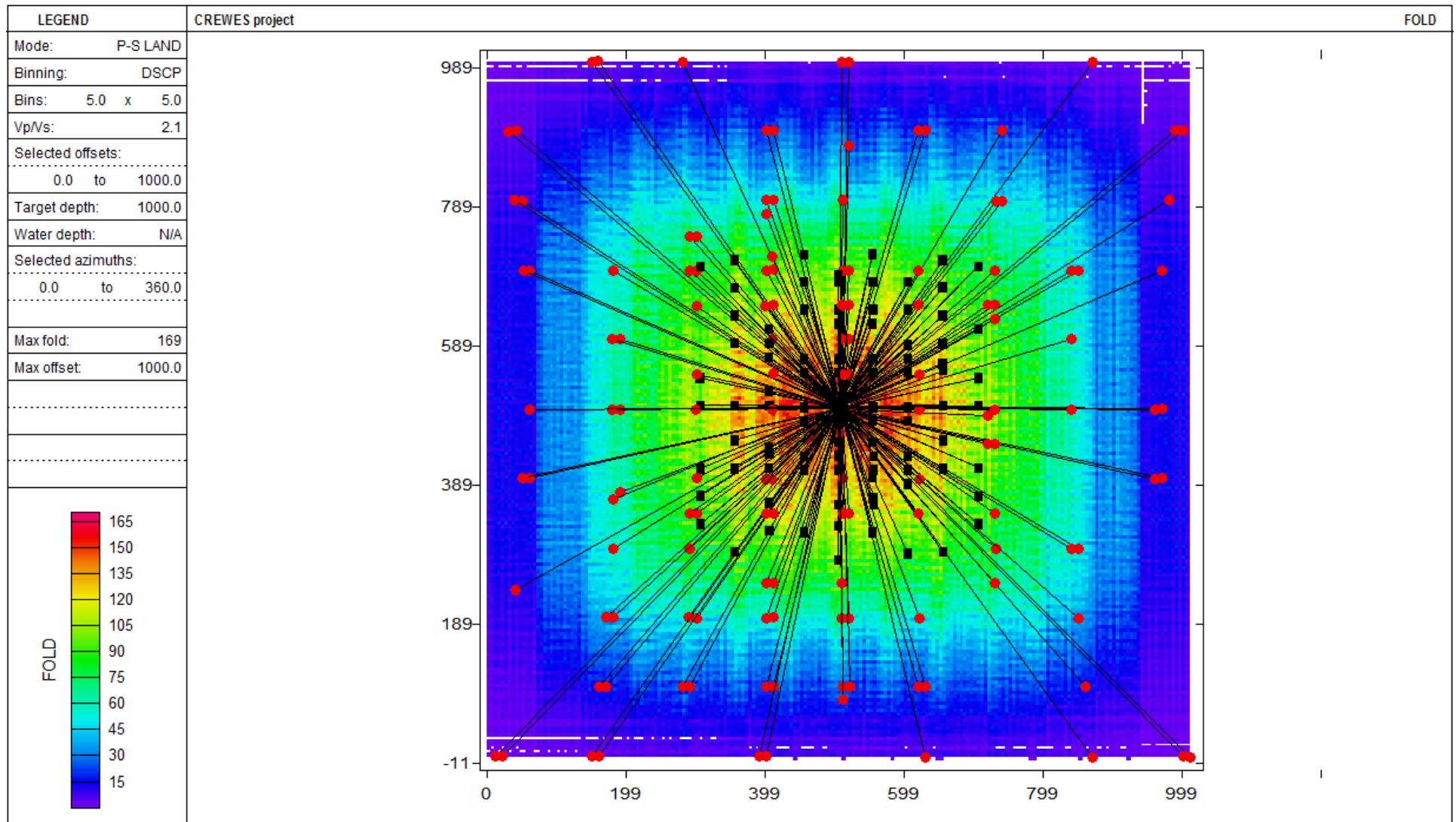
Maximum offset = 1000 m

PS design; depth = 900 m



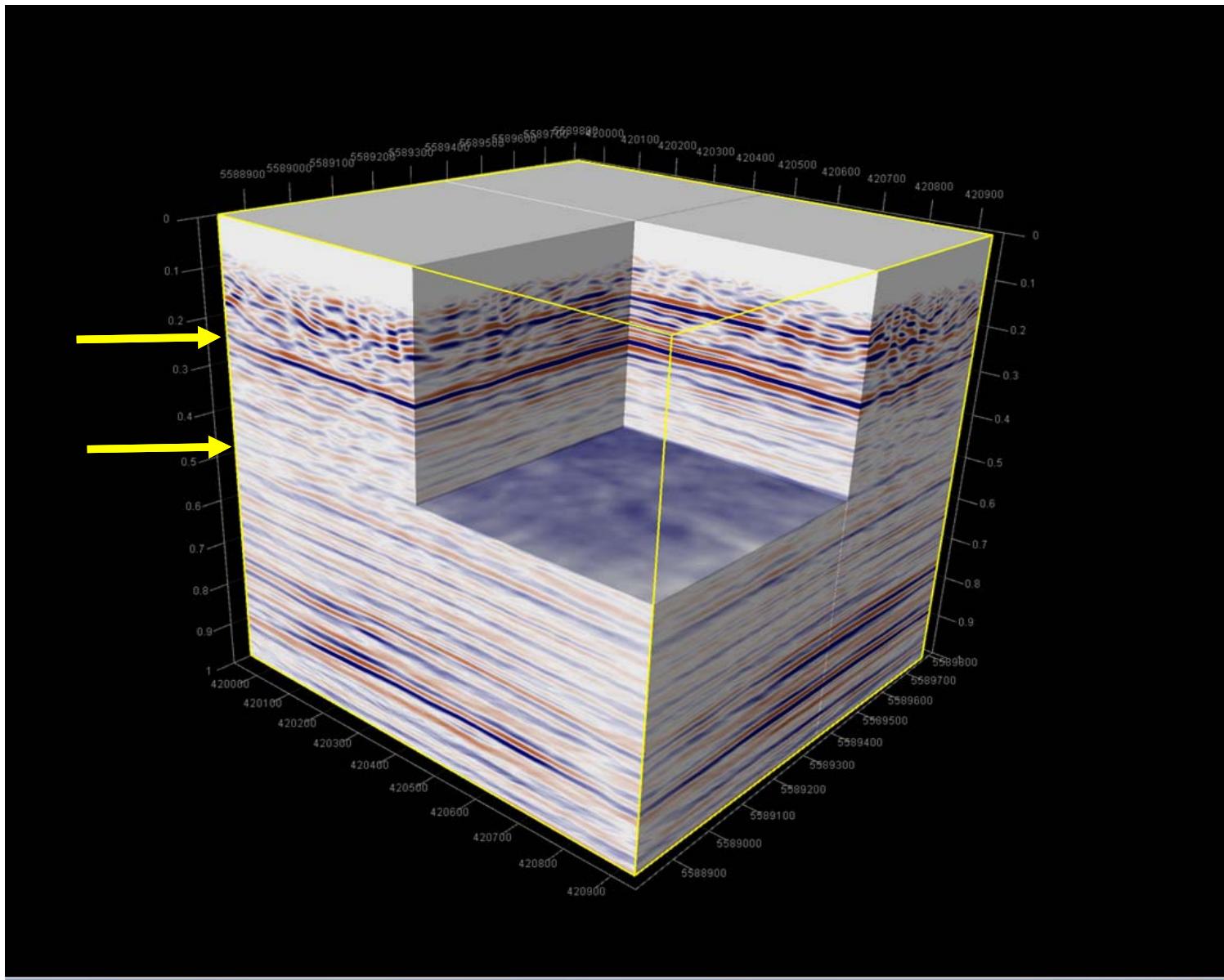
Maximum offset = 1000 m

PS design; depth = 1000 m

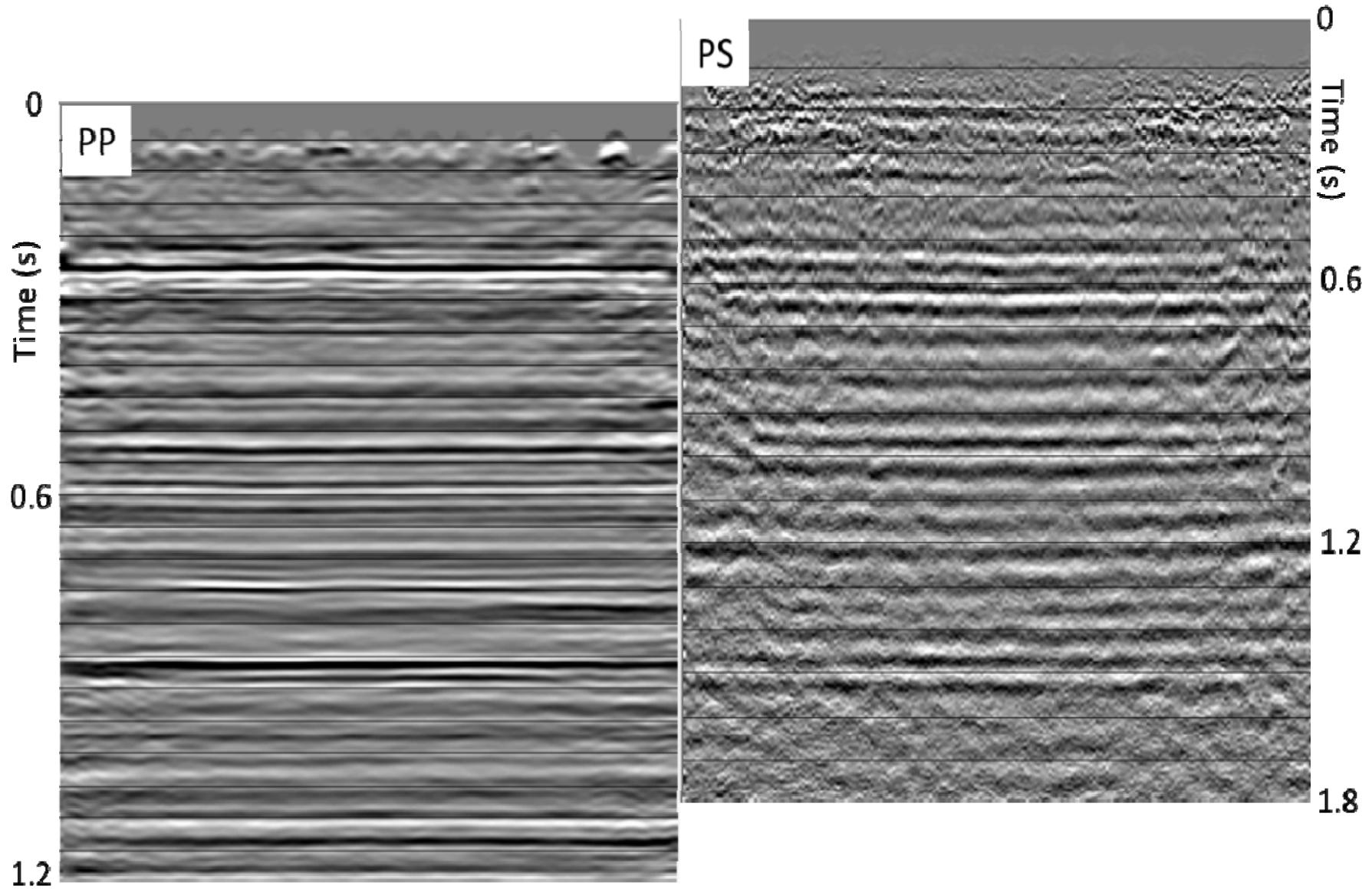


Maximum offset = 1000 m

FRS baseline PP volume



FRS PP-PS correlation



Summary

- Field site selected, east-central Alberta
- Capex funding in place: \$9 million CDN
- Industry subscription for full access
- FRS plan implemented through Schlumberger Carbon Services
- Public outreach program completed
- Baseline 3C-3D survey completed
- Well #1 permitting in progress – completion imminent
- Well drilling and infrastructure emplaced: 2015
- Other field sites proposed - network

Acknowledgements

- CMC Research Institutes, Inc.
- University of Calgary
- CREWES sponsors
- Schlumberger Carbon Services
- Cenovus
- Tesla Exploration

