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Title: Reflection processing of the large-N seismic data from the Source Physics Experiment (SPE)

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Reflection processing of the large-N seismic data from the Source Physics Experiment (SPE)

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Advisors: Dr. Ting Chen and Dr. Cathy Snelson

Los Alamos National Laboratory

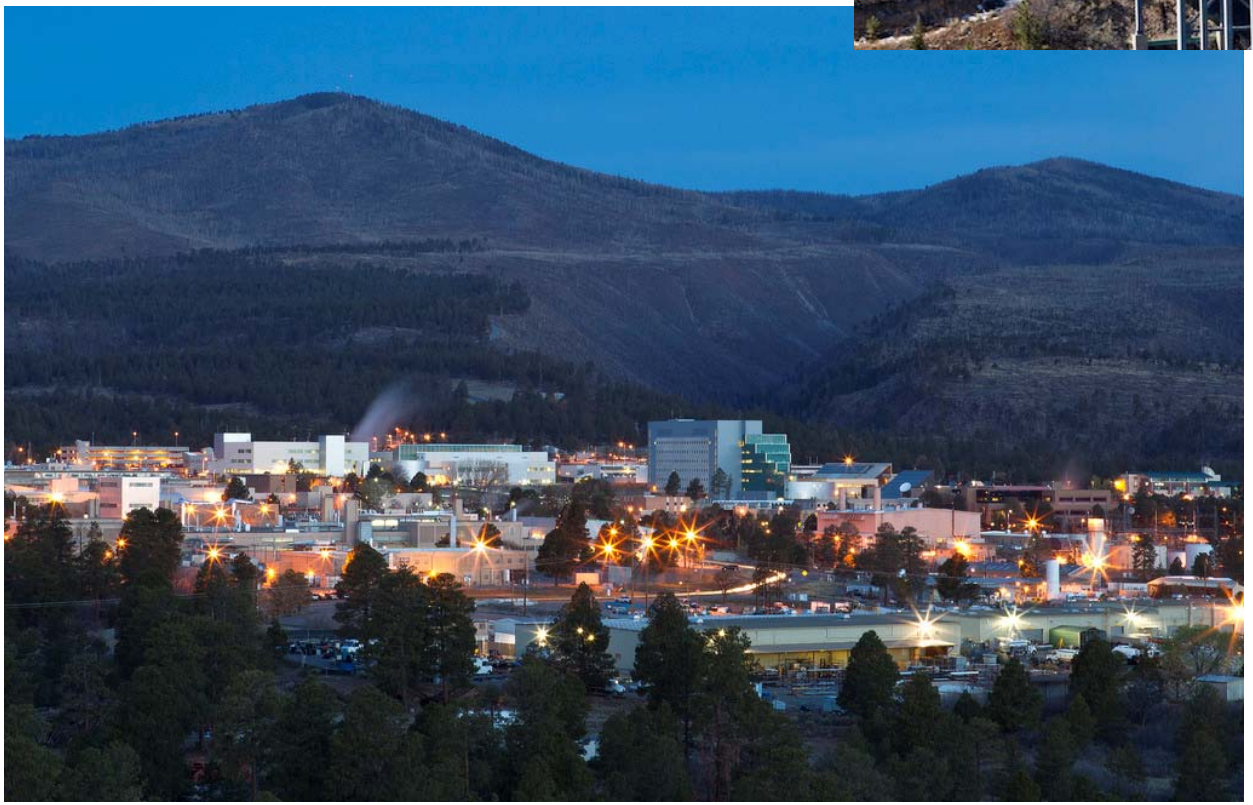
LANL: Brief History

- Established in 1943 for the purpose of designing the building the atomic bomb (Manhattan Project)
- Oppenheimer and Groves in charge
- Trinity: first detonation of nuclear bomb, July 16, 1945
- Little Boy (uranium): Hiroshima, August 6, 1945
- Fat Man (plutonium): Nagasaki, August 9, 1945

Information and photograph from: http://www.lanl.gov/about/history-innovation/index.php

LANL Today

http://serviceinternships.com/internship-experience-los-alamos-national-lab/



http://www.lanl.gov/discover/news-release-archive/2015/August/08.25-ey-lanl-new-cybersecurity-tools.php

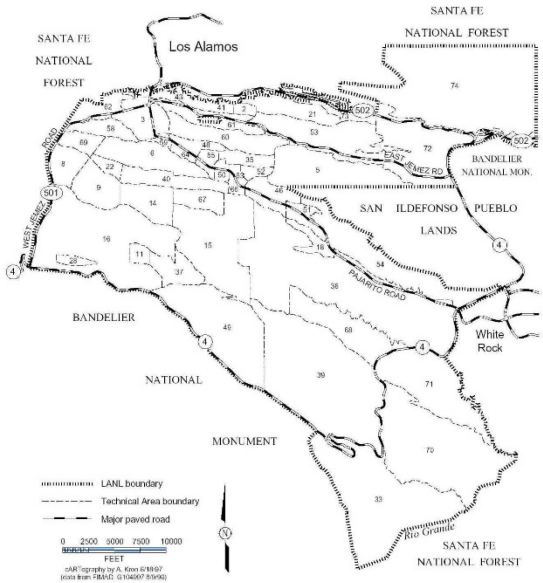


Figure 2-1. Active technical areas at Los Alamos National Laboratory.

http://cryptome.org/eyeball/lanl/lanl-eyeball.htm

SPE Purpose

- Develop a more physics-based model for nuclear explosion identification
- Understand the development of S-waves from explosion sources
- Enhance nuclear test ban treaty monitoring

http://www.pnnd.org/article/parliamentarians-and-north-korean-nuclear-test

Snelson, C. M., R. E. Abbott, S. T. Broome, R. J. Mellors, H. J. Patton, A. J. Sussman, M. J. Townsend and W. R. Walter (2013), Chemical Explosion Experiments to Improve Nuclear Test Monitoring, Eos Trans. AGU, 94(27), 237.

SPE & Large-N Seismic Deployment

- Multi-institutional, interdisciplinary project, DOE funded
- Series of chemical explosions at NNSS (Nevada National Security Site)
- Purpose: understand the development of S-waves from explosive sources
- Purpose of Large-N: improve the geologic model of the SPE location as well as ground-truth propagation of S-waves

U.S. DEPARTMENT OF ENERGY

Lawrence Livermore National Laboratory

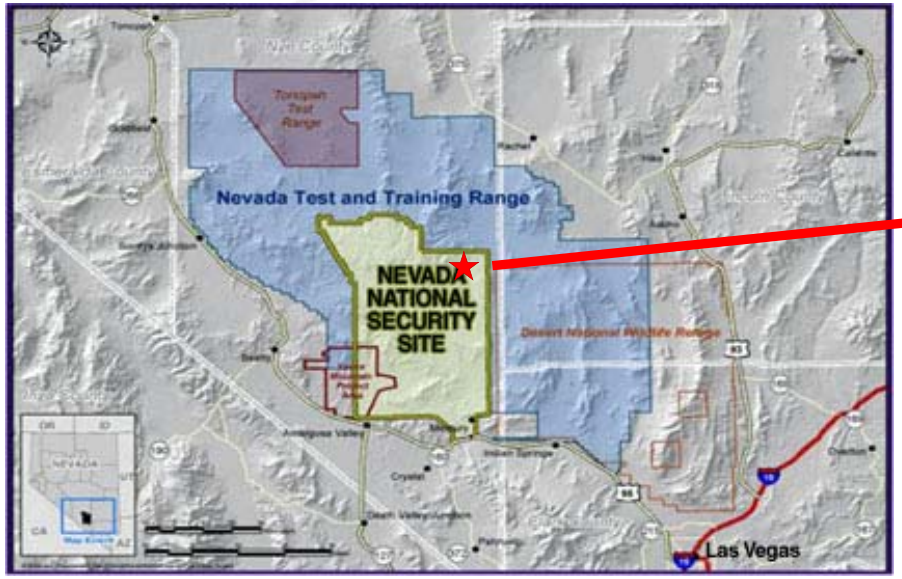
Sandia National Laboratories

National Security Technologies

University of Nevada, Reno

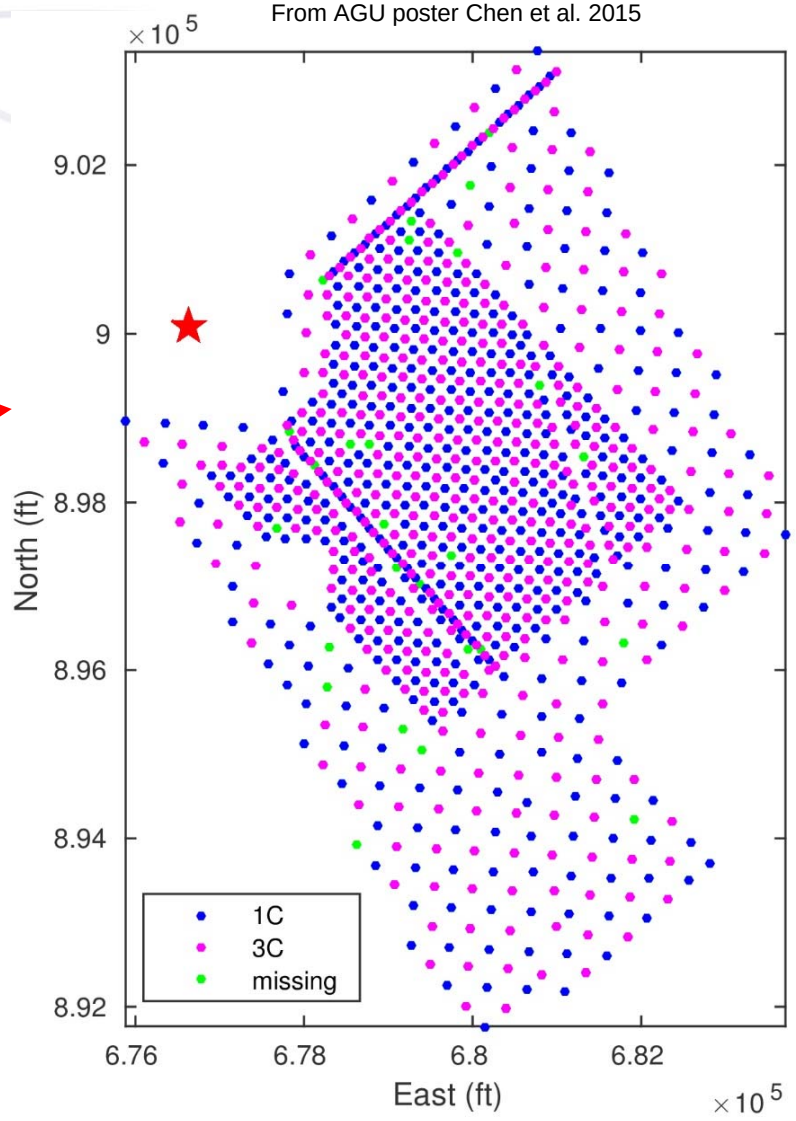
Los Alamos NATIONAL LABORATORY EST 1943

Large-N Layout



http://www2.nstec.com/pages/NNSS-Mission.aspx

From AGU poster Chen et al. 2015

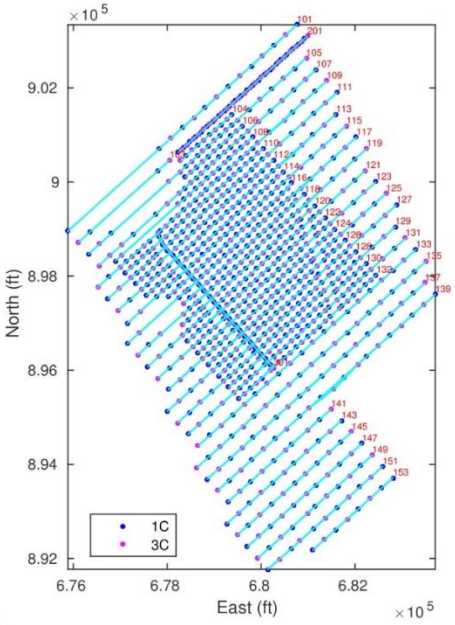


- Large array of 1C and 3C geophones (large-N) 500 of each
- Recorded seismic activity for a month

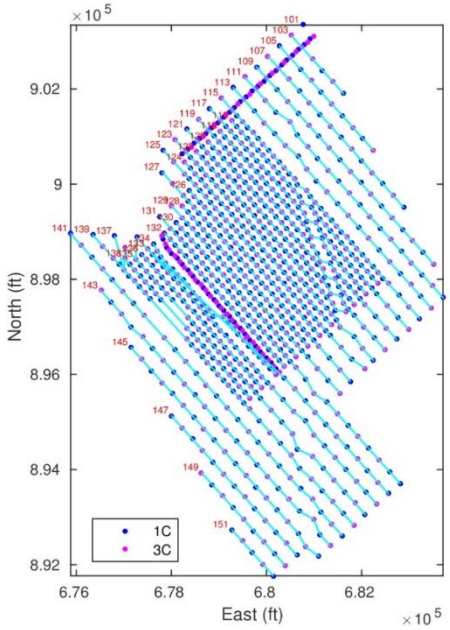
Preliminary Research Tasks

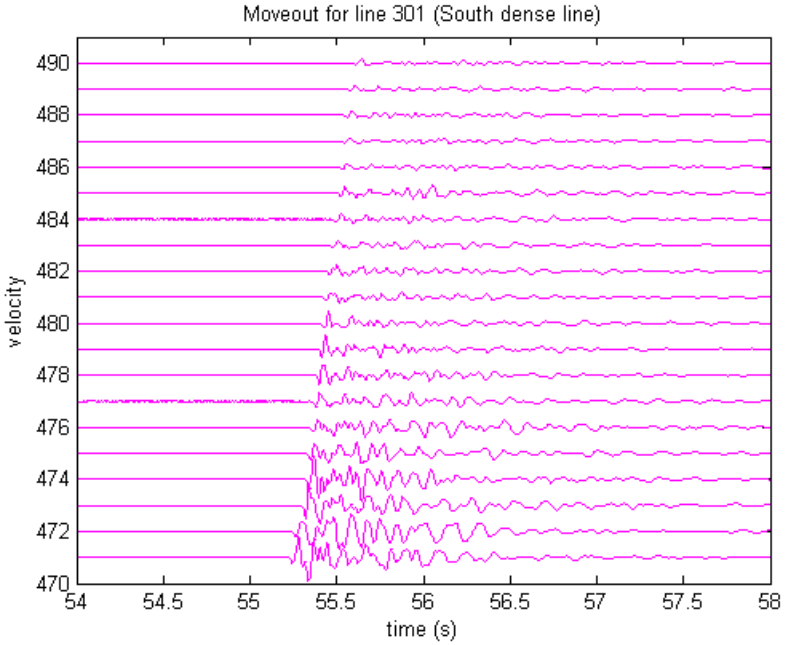
- Check segy trace headers for errors
- Check moveout along the same line/station number

Line Numbers



Station Numbers





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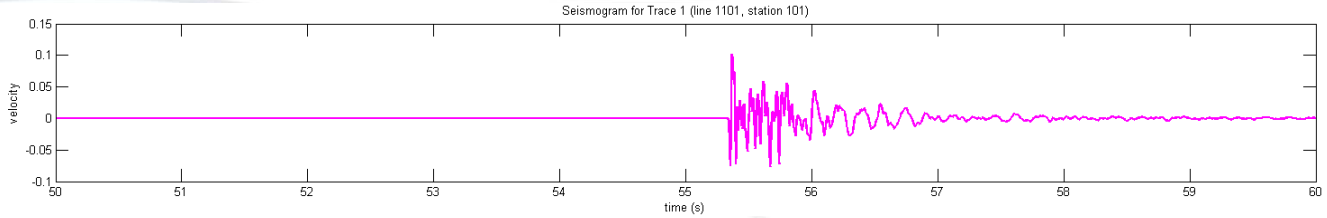
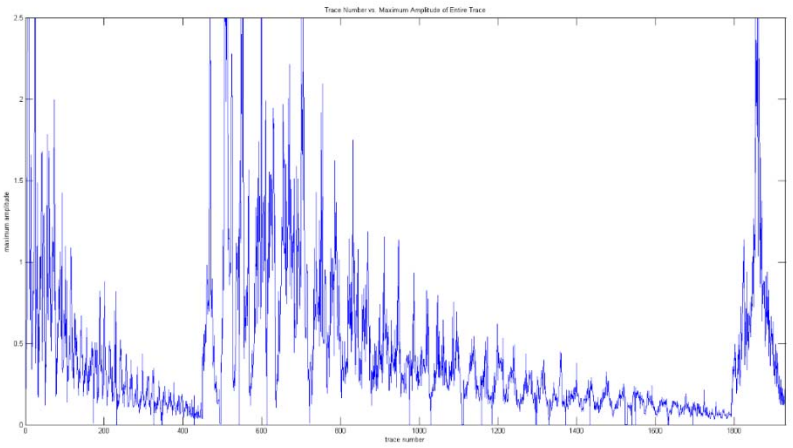
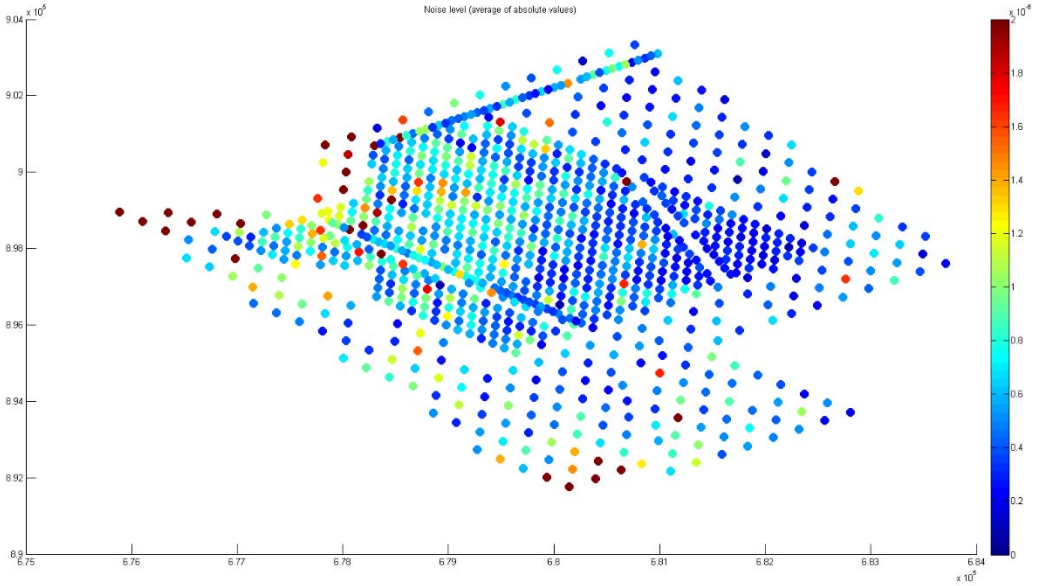
Noise

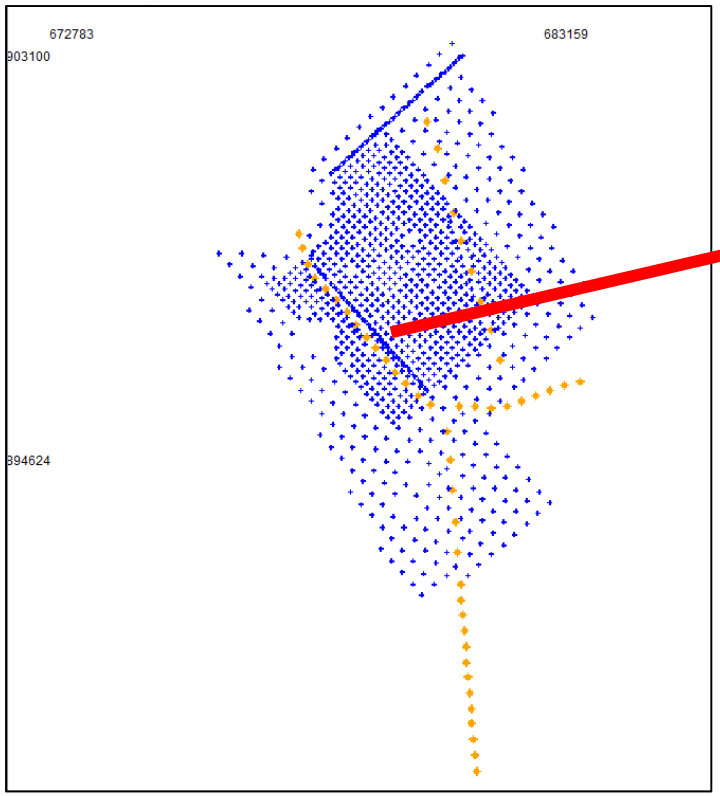


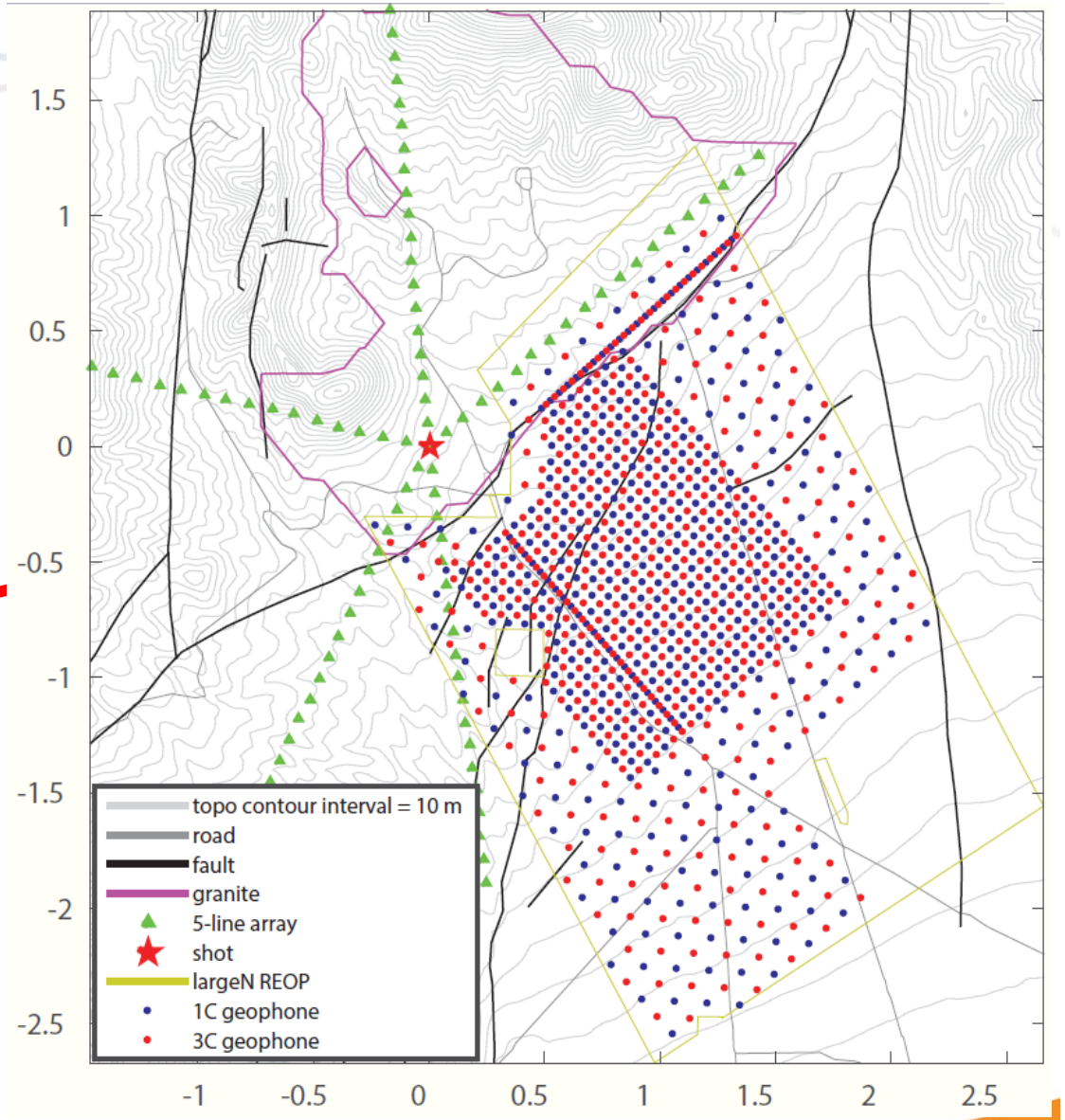
- Plot the noise of each trace (2 methods)
  - Maximum amplitude
  - Average of the absolute values of trace data



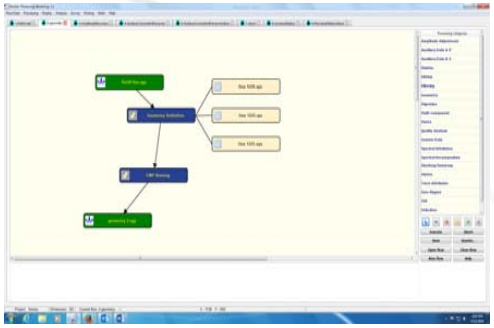


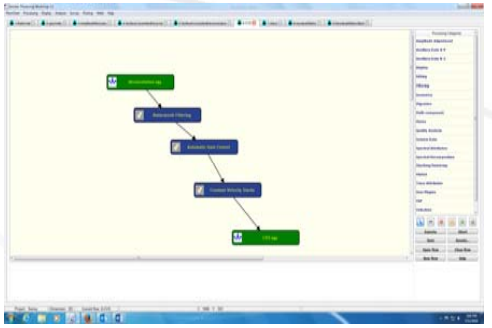
South Dense Line





Reflection Model





- Using SPW (Seismic Processing Workshop)
- Butterworth filtering
- Spherical divergence
- Surface consistent decomposition and deconvolution
- Automatic gain control
- Constant velocity stacking
- Residual statics corrections (might/might not be necessary)

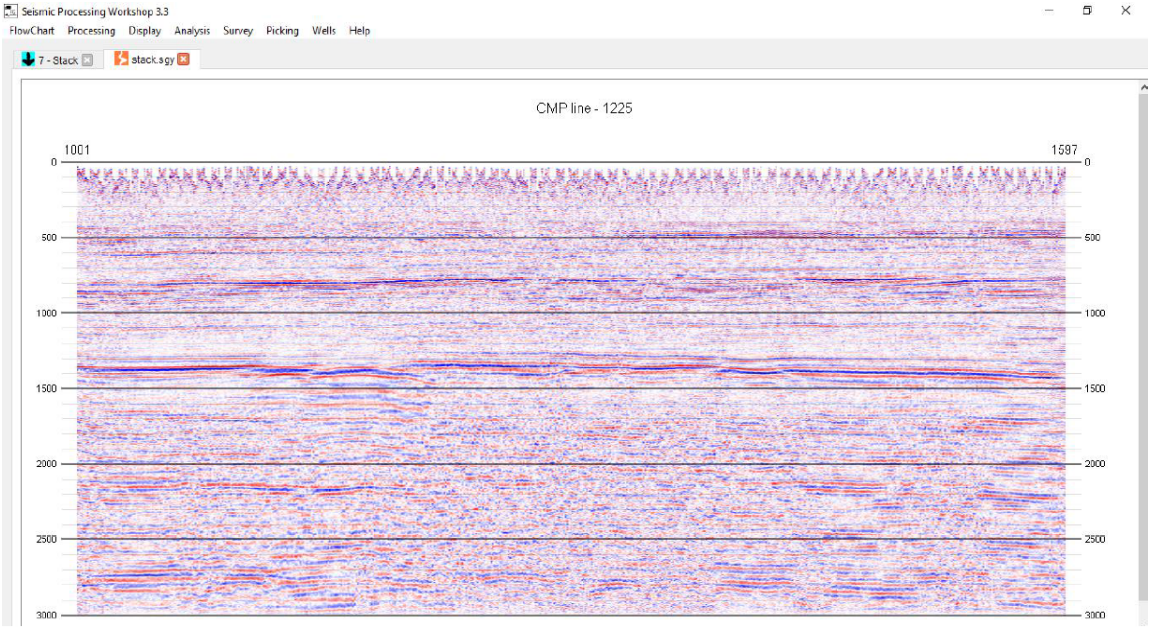


Image from SPW tutorial by Matthew Ralston