CAMPAIGN CROSS-BOREHOLE SEISMIC CHARACTERIZATION FOR THE EGS COLLAB PROJECT

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The enhanced/engineered geothermal system (EGS) multi-laboratory and university collaborative (Collab) project brings together skilled and experienced scientists and engineers in the areas of subsurface process modeling, monitoring, and experimentation to focus on intermediate-scale EGS reservoir generation processes and related model validation at crystalline rock sites. Cooperative research under the EGS Collab project will provide a foundation of knowledge and modeling capability that form a bridge to meeting the challenges of EGS development and proliferation. The EGS Collab project is being performed within the re-purposed mine workings (drifts) of Sanford Underground Research Facility (SURF), located in Lead, South Dakota, USA.

At the time of this writing, a suite of sub-horizontal boreholes is being drilled from within one of the SURF mine drifts directly into the surrounding crystalline rock formation. The suite is comprised of one stimulation well, one production well, and several monitoring wells. The goal is to generate fractures radiating from the stimulation well that intersect the production well, and then perform flow testing of this inter-well/fracture system. Stimulation and flow will be monitored with micro-earthquake (MEQ) and acoustic emission (AE) instrumentation that will be grouted into the monitoring wells.

A fundamental component of MEQ/AE monitoring will include novel, campaign-style cross-borehole seismic characterization. The proposed cross-borehole techniques include compressional (P-) wave tomography and shear (S-) wave profiling. Results will provide baseline P- and S-wave velocity models that will be critical in calibrating hypocenter locations from MEQ/AE monitoring, and also yield elastic moduli data/constraints that will be utilized for pre-stimulation modeling. A supplemental goal is to perform velocity change detection analysis by collecting cross-borehole P- and S-wave data between the stimulation and production wells prior and subsequent to fracture stimulation.