DESTRESS

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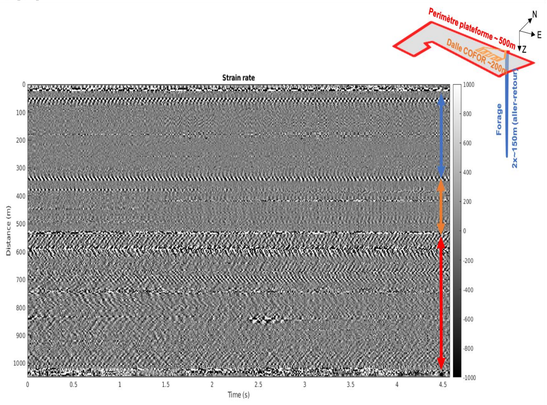
Task 2.4 : Synergies and standardisation

Innovative monitoring technology

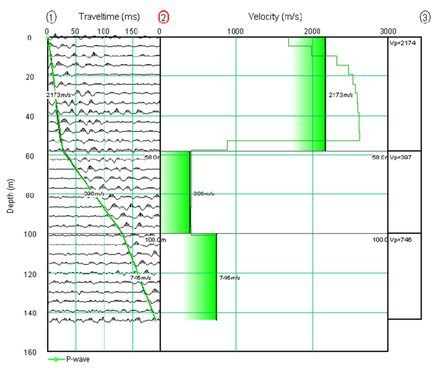
In deep geothermal energy, and in the French case, the legislation requires environmental and technical monitoring of power plants and doublets.
Commonly to do this, few seismological sensors (5 per project) and punctual monitoring (each 3 years for injection well and each 6 years for production well) are provided by operators.
But in order to improve our monitoring, the ESG teams tested new monitoring methods using fiber optic. 3 objectives for 3 deployments forming a 3D geometry:

- 500m fiber around the power plant
- 200m fiber on the concrete hosting the drilling machine
- 150mx2 fiber in a shallow well (150m deep)

The first objective was to compare the noise level on the different deployments.
Then a passive monitoring was recorded during several days in order to test the seismic noise correlation on data acquired by optical fiber and in a second time to possibly detect microseisms. Terabytes of data are now in treatment!



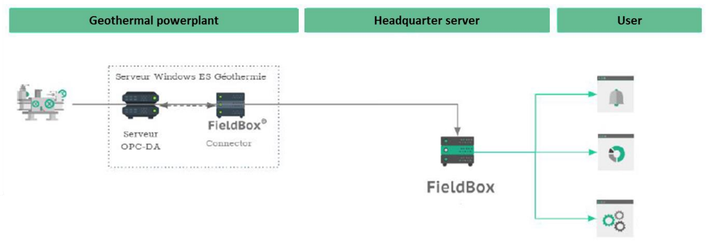
As part of a deep geothermal project, usually made up of at least 2 wells, the drilling machine remains on the platform for several months. The advantage of the optical fiber placed into the concrete is to monitor the state of stress of the concrete slab and anticipate possible concrete failure that can be dramatic for a project.



Shallow drilling was also used to determine velocity laws in the shallow layers of the subsoil. This data can be particularly useful for the construction of a velocity model in order to correct static errors in the context of the relocation of microseismic events. It can also be used as an antenna to detect possible microseismic events.

Data management strategy

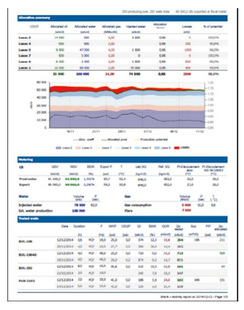
A geothermal power plant is equipped with around 300 sensors from pressure gauge to the valve opening state indicator.
The industrial operation of a power plant also requires monitoring of equipment and regular reporting.
The other major problem in the context of data management is the supervision software, which can vary from one plant to another.
Thus, a data management homogenization project was launched and deployed on the Rittershoffen and Soultz-sous-Forêts power plants by the ESG teams.



The objective is threefold:

- To have a unique system to collect, store and classify all type of data
- To have a user friendly reporting tool to save time
- To have “Artificial Intelligence” ready platform

The project entered its operational phase with the deployment of the various OPC servers allowing the connection of the various IT entities and the supervision servers of the power stations.
All historical data from the 2 sites will be integrated into the database.
The implementation of this software overlay will significantly improve the efficiency of reporting operations which can be extremely time-consuming and above all will allow us to compare, quickly and easily, all of the data pushed into the database.

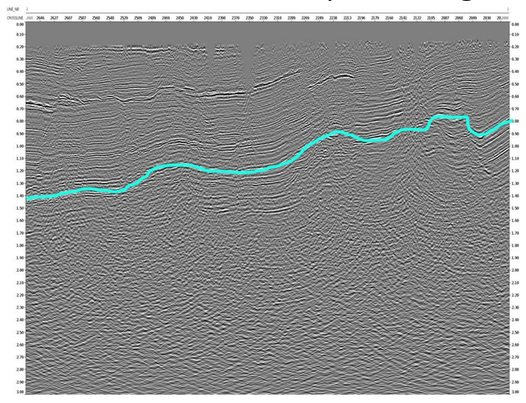


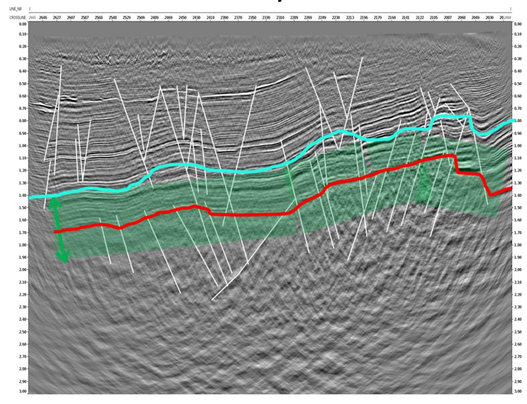
Geothermal exploration : 3D seismic reflection

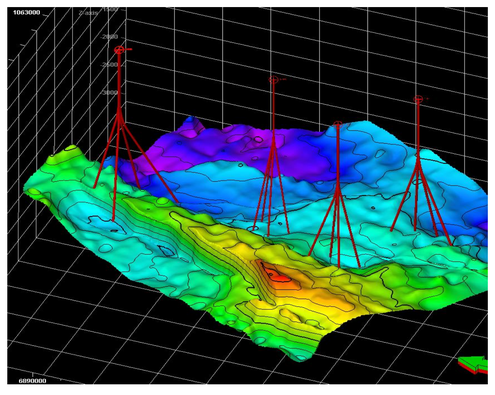
It is common to see exploratory programs dedicated to deep geothermal energy only dealing with 2D reflection seismic technology (Richard et al., 2018).
However, in the oil industry and for several decades, the relevance of 3D seismic acquisitions has been shown because it has led to a significant drop in dry wells.
If certain European countries have carried out 3D seismic campaigns for the exploration of geothermal deposits, no acquisition of this type had been made in mainland France.
As part of the development of these exclusive research permits, Strasbourg Electricity has undertaken to carry out a large-scale 3D seismic study, 180 km², in order to obtain detailed imagery of the entire geological structure of the subsoil. Having contiguous PERs, a significant economy of scale could be obtained by pooling the share of exploration on each PER (Richard et al., 2019).
Before really being able to benefit from this upscale, several months of work were necessary in order to mitigate the strong noise level acquired on such noisy onshore acquisition. We benefited from the state-of-the art processing workflow from CGG Massy to tackle all the challenges we faced (Richard et al., 2020).

The 2 objectives were simple:

- Reduce geologic risk to increase Probability of Success (PoS) of geothermal project to attract more investor
- Multi-doublet project possible to improve the profitability of projects.







With regard to the figure above, the campaign was a success. 1km of deep imagery was gained (green layer on the middle image) compared to the old seismic surveys and the granite roof was even trackable over the entire cube (cyan is Muchelkalk and in red the top of the granite).
These results led to the definition of at least 3 projects of two doublets each. This was possible for the simple reason that it was possible to target several major flaws from the same platform. The first drilling operations should start within 2 years.

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