



GeoLaB

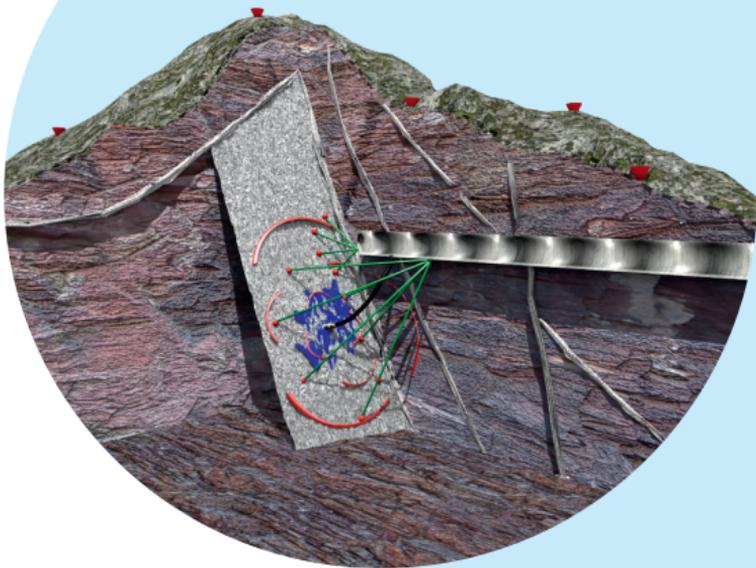
Geothermal Research Lab



THE CHALLENGE

- » Achieving economically viable and environmentally friendly geothermal utilization by EGS (Enhanced Geothermal Systems)
- » Developing safe, targeted stimulation strategies to unlock the vast energy potential of crystalline reservoirs
- » Strengthening social acceptability through the development of sustainable technologies and participatory research approaches





THE PLANNED RESEARCH INFRASTRUCTURE

- » Underground research laboratory
- » Depth: ~400 metres
- » access tunnel and experimental galleries
- » Injection drillings, sensor drillings, monitoring stations

REAL CONDITIONS FOR GEOTHERMAL RESERVOIR RESEARCH

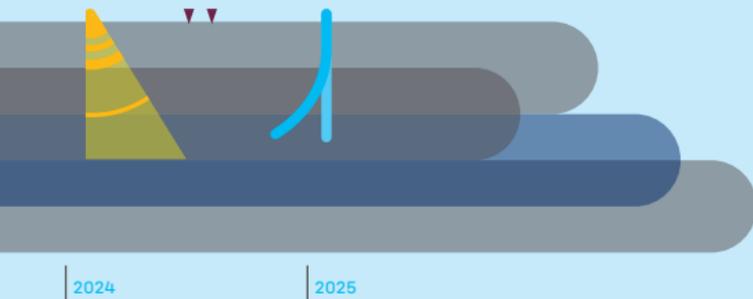
- » Designed as geothermal reservoir simulator bridging the gap between lab and reservoir scale
- » Target rock: Fractured crystalline rock as analogue of geothermal reservoir rocks of the Upper Rhine Graben
- » Investigation of thermal-hydraulic-mechanical-chemical processes in space and time in complexity of reality

THE CURRENT STATUS

- » Exploration phase: detailed site investigation of the Tromm (Odenwald, Germany) to assess its geoscientific suitability
- » Exploration drilling: two >500 m deep boreholes, one fully cored

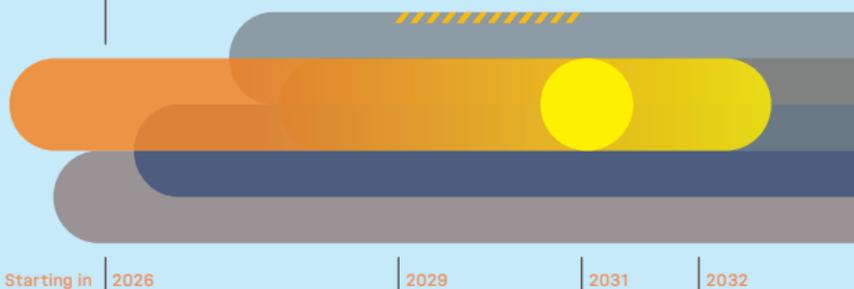
2024–25 | Site Exploration Phase

- 1 Seismics
- 2 Geophysics
- 3 Exploratory Drilling



Starting in 2026 | Laboratory Implementation Phase

- 4 Planning & Approval
- 5 Gallery Construction
- 6 Test Operation
- 7 Research Operation





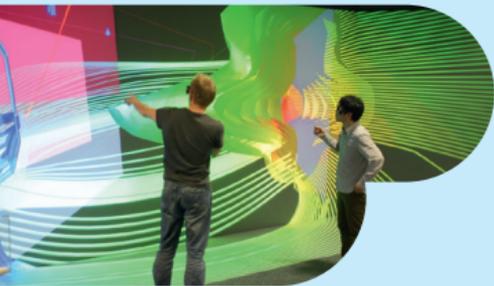
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DIGITAL GEOLAB

A digitalization and virtual reality concept is being implemented from the outset of the complex infrastructure project. The digital twin integrates multidisciplinary data, models, and numerical simulations, including geological models, engineering designs, experimental planning, and monitoring strategies. It supports:

- » Site investigation
- » Infrastructure planning, construction and operation
- » Planning, execution of experiments
- » Visual analytics
- » Communication with stakeholders



STRATEGIC SIGNIFICANCE

- » Energy system resilience and security of supply
- » Research at the forefront of science
- » Competence retention in geotechnologies
- » Establishing international cooperations
- » Ensuring global competitiveness
- » Accelerating technology transfer
- » National value creation

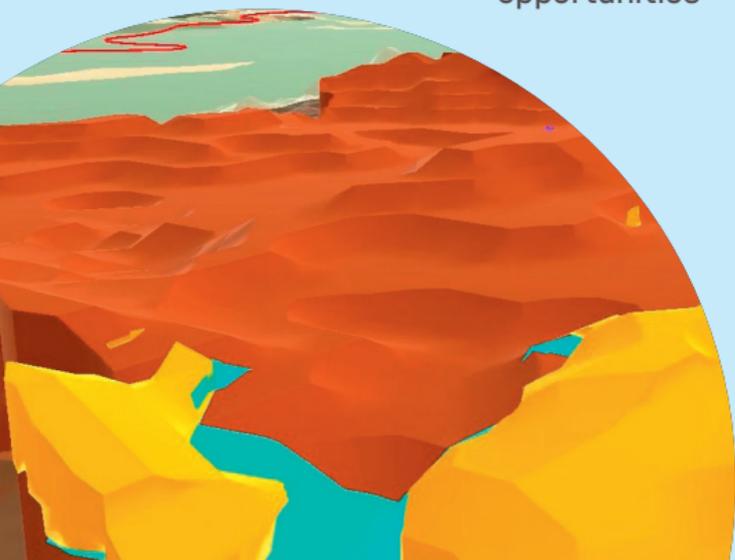
SHAPING INNOVATION TOGETHER

RESEARCH BEYOND GEOTHERMAL

- » Environmental sciences, e. g., biogeochemical cycles, climate change impacts
- » Materials science, e. g., corrosion-resistant materials
- » Digitalization
 - Methods of numerical modelling
 - Artificial intelligence and virtual reality
 - Industry 4.0
- » Geotechnologies and engineering, e. g.:
 - Drilling techniques and borehole safety
 - Sensor technologies
 - Artificial Intelligence in exploration technology

GEOLAB OFFERS

- » Modern research infrastructure with digital twin
- » Platform for cutting-edge research
- » Reservoir simulator specifically designed for geothermal energy research
- » Transparent research and Citizen Science
 - » Cooperation and investment opportunities



GET IN TOUCH

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GEOLAB - A STRATEGIC DEVELOPMENT INVESTMENT OF THE HELMHOLTZ ASSOCIATION

