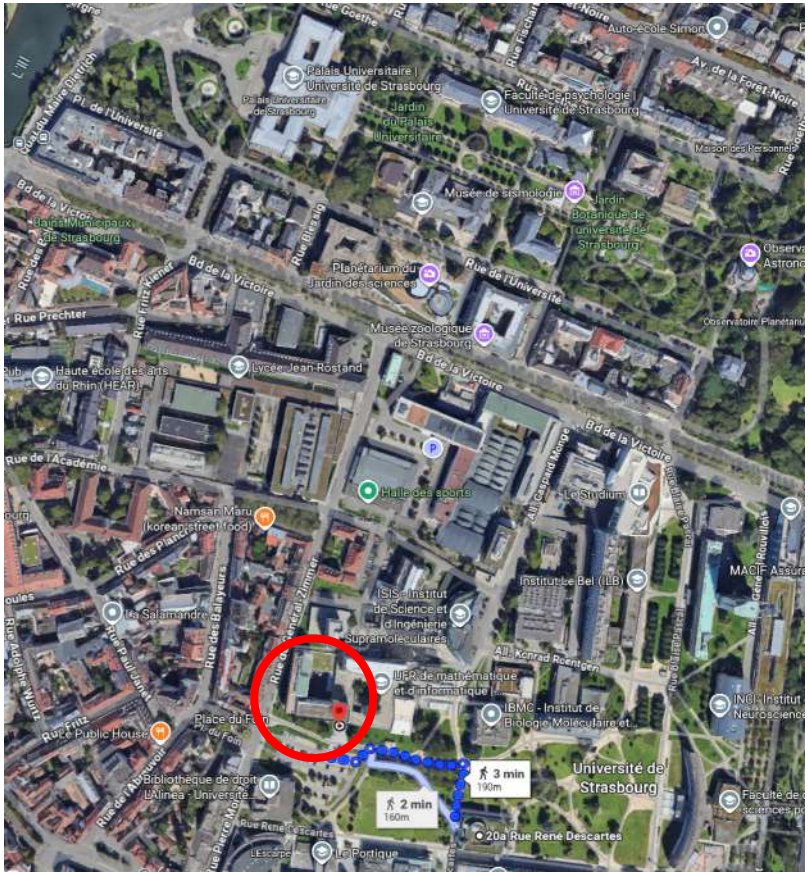
Geosciences for the energy system transition | GeoT

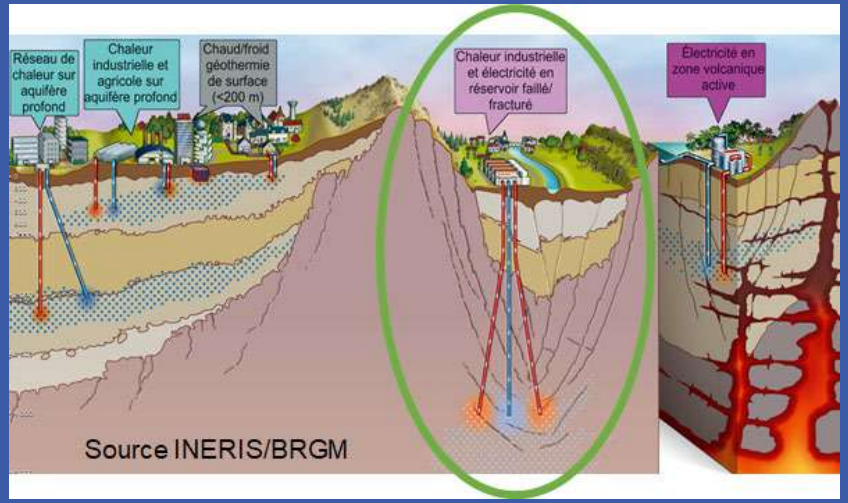
The Interdisciplinary thematic institutes of the University of Strasbourg & cnrs & Inserm funded under the Excellence Initiative program

Jean Schmittbuhl, CNRS/Univ. Strasbourg

École & observatoire
des **sciences de la Terre**
de l'Université de Strasbourg et du cnrs



ITI GeoT scientific objectives



Deep groundwater: below the critical zone, separated from the biosphere but accessible from the surface

- a non-solid ore
- a vehicle for natural resources
- entering and leaving the biosphere (environmental risk)
- involved in the initiation of earthquakes (seismic risk)

Key roles in the development of renewable resources and the energy transition:

- Geothermal energy
- Production of lithium & native hydrogen
- Heat storage
- CO_2 sequestration

ITI GeoT general organisation

Geosciences for the energy system transition | GeoT
The **interdisciplinary thematic** institutes
of the University of Strasbourg & cnrs & Inserm

Research cluster

École et observatoire des **sciences de la Terre** Université de Strasbourg
Institut **Terre & Environnement** de **Strasbourg** | ITES | UMR 7063 de l'Université de Strasbourg & cnrs & ENGEES
BCSF RENASS

Geosciences

Engineering

iCUBE

lisec UR 2310
saga Sociétés, Acteurs, Gouvernement en Europe UMR 7363
crem centre de recherche sur les médiations communication • langue • art • culture

Social sciences

Education cluster

M1/M2 GeoT

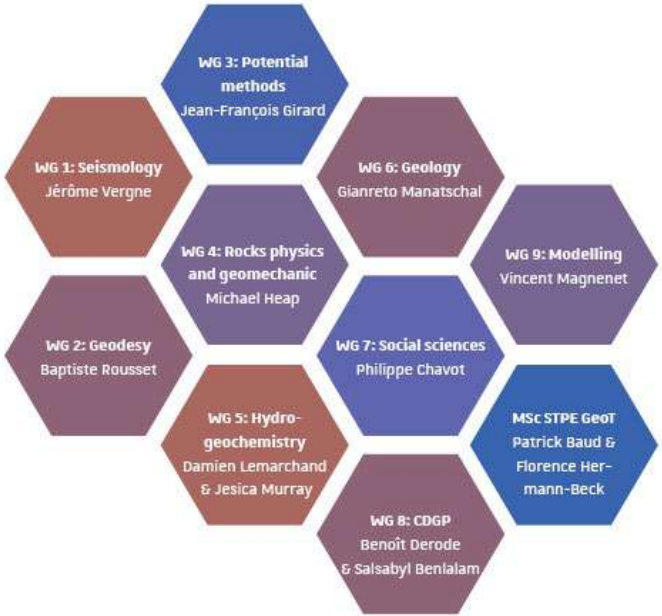
École et observatoire des **sciences de la Terre** Université de Strasbourg
École doctorale **Sciences** de la terre et de l'**environnement** | ED 413
IFP SCHOOL

Members

- 68 25%

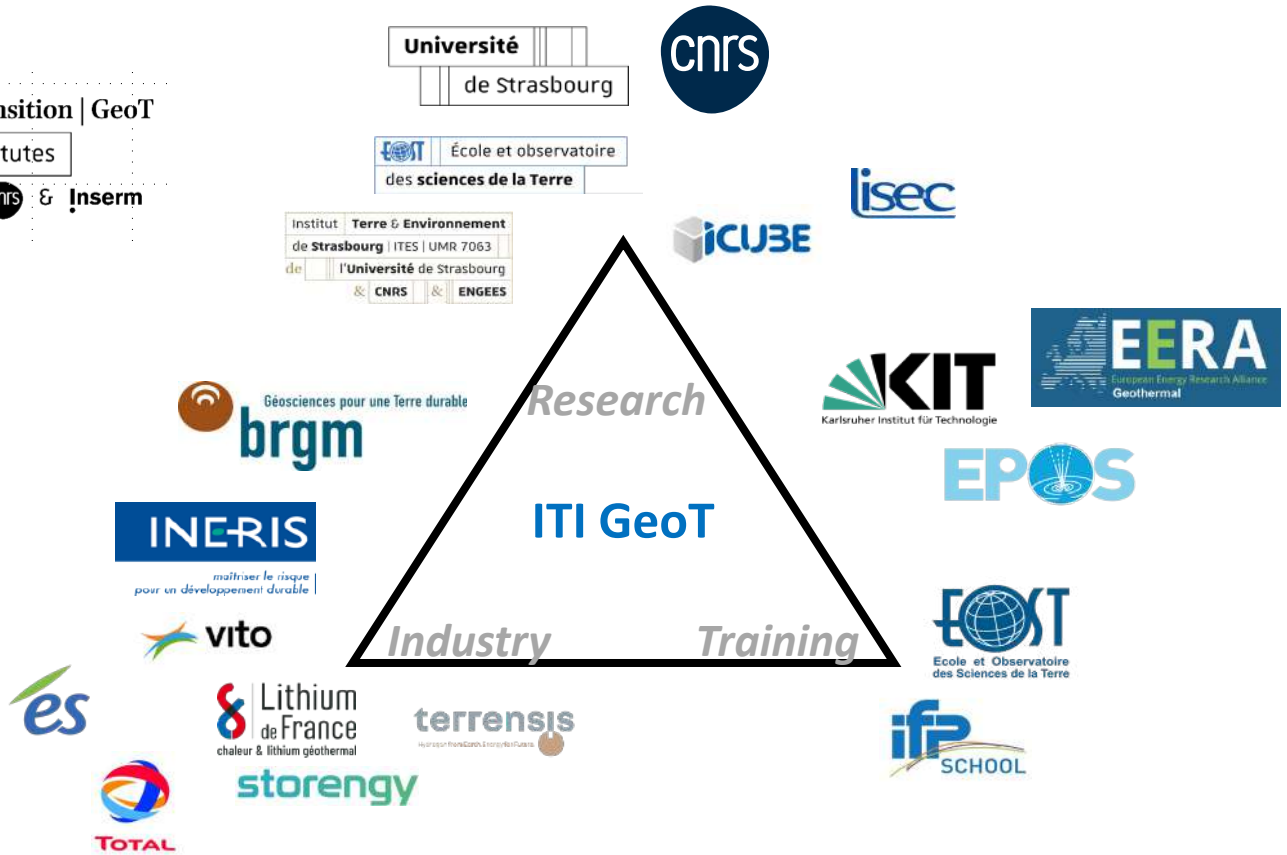
Long-term and short-term positions (11 PhD, 5 Post-docs, 3 engineers)

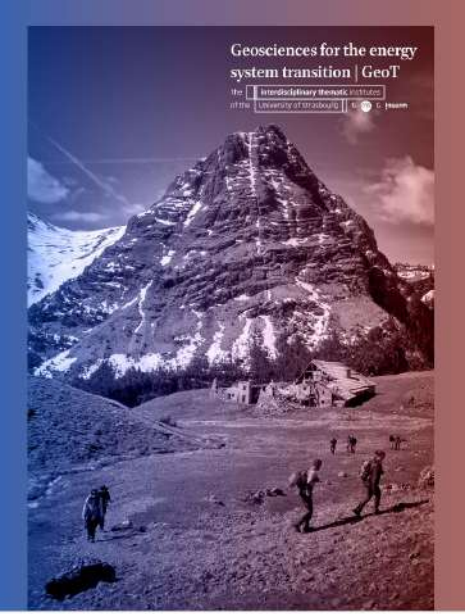
- 9 disciplines = Working Groups



ITI GeoT Partners

Geosciences for the energy system transition | GeoT
The interdisciplinary thematic institutes
of the University of Strasbourg & cnrs & Inserm





GeoT Master

École et observatoire des sciences de la Terre
Université de Strasbourg

SCHOOL

UR 2310

Geology | Geophysic | Geochemistry | Seismic
Controversy | Engineering | Computer
Data analyses | Geothermal | Artificial Intelligence
Modelling | Scientific Communication

Dowload MSc GeoT flyer

Ensuring a decarbonized future through renewable georesources research

Eost Master of Sciences

SCHOOL

4 Semesters

120 Credits

7 à 10 MOBIL'ITI grant/ year

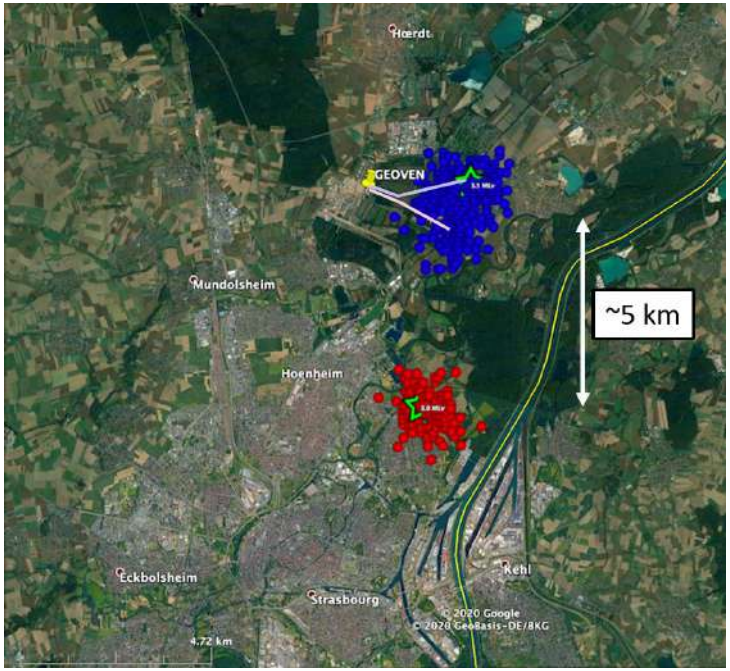
10 % Field courses / Autumn school

40% Internship and practical courses

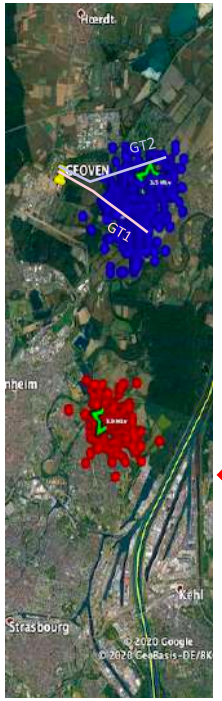
ITI GeoT Research priorities

1. Deep geothermal energy: The Strasbourg case study

- Expert feedback of the Geoven geothermal project (Vendenheim)
- Development of a comprehensive geological, hydrogeological, geophysical, and geomechanical model of the Strasbourg reservoir
- Design and deployment of new monitoring networks for urban environments
- Updating Traffic Light Systems
- Involvement in new Strasbourg projects
- Data management and preservation (CDGP)



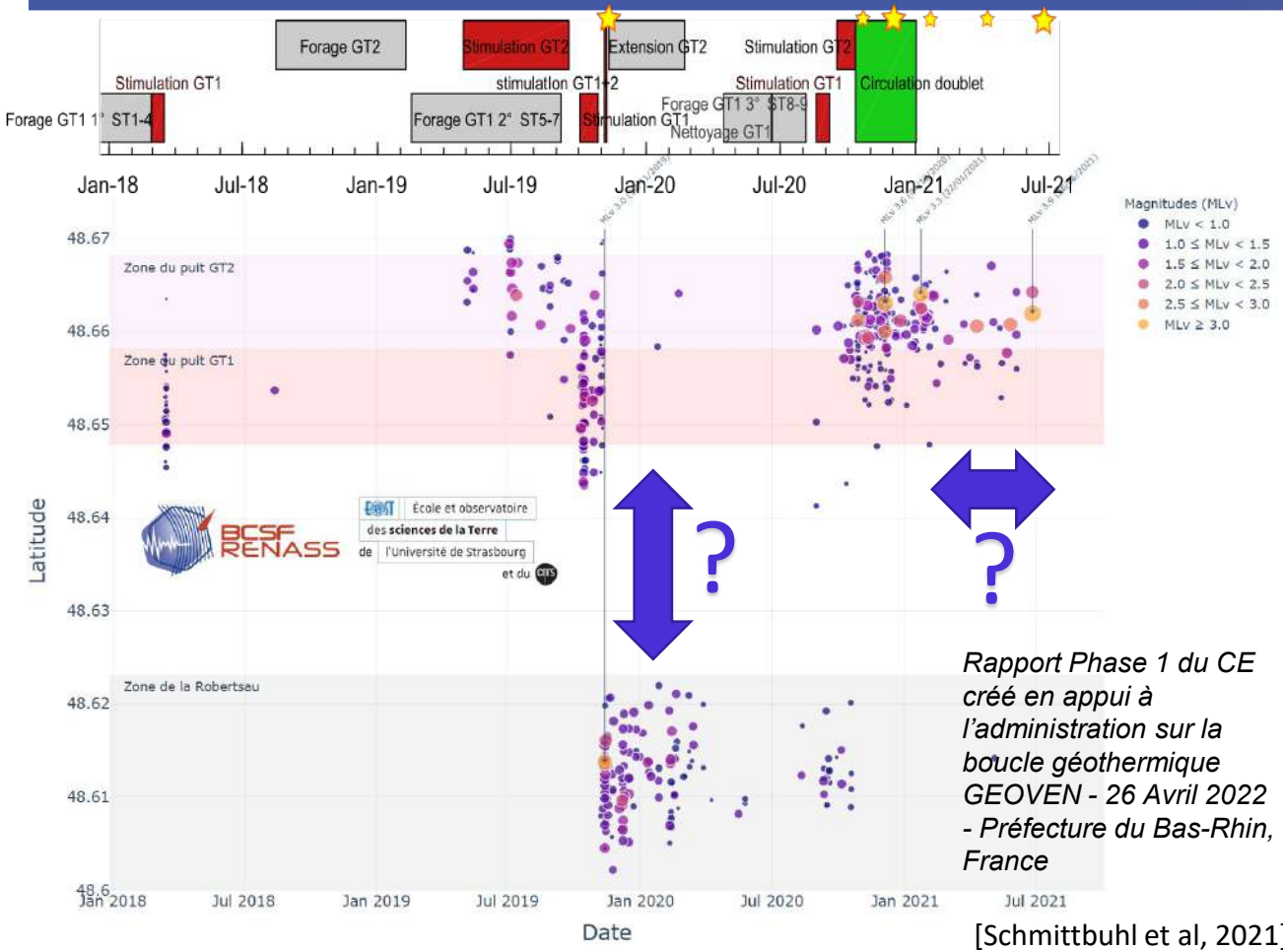
https://cdgp.eost.unistra.fr/



Sismicité depuis 2018 (BCSF-RENASS)

Essaim nord

Essaim sud



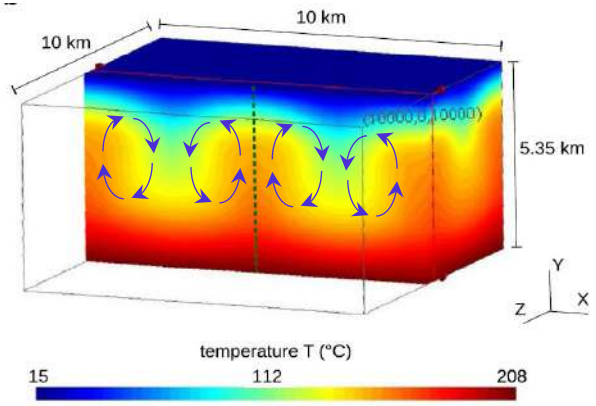
Rapport Phase 1 du CE créé en appui à l'administration sur la boucle géothermique GEOVEN - 26 Avril 2022 - Préfecture du Bas-Rhin, France

[Schmittbuhl et al, 2021]

ITI GeoT Research priorities

2. Deep hydrothermal activity and the energy system transition

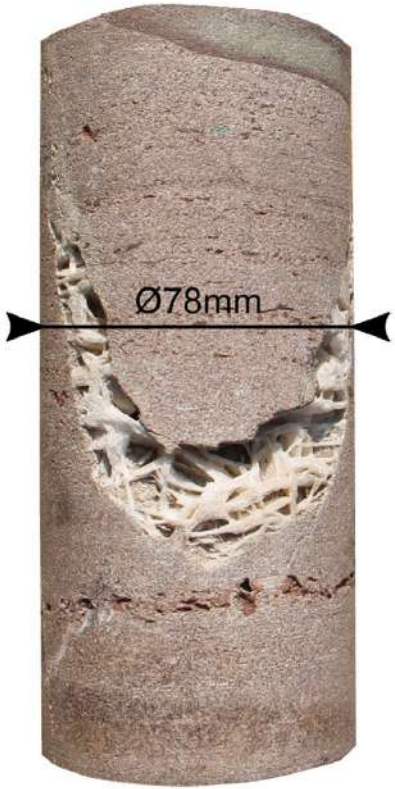
- Spatial variability of characteristic scales and timescales
- The geological structures involved (e.g. faults, basement-cover transition, lithology, physical properties, etc.)
- The mechanisms of weathering, rock / fluid partitioning, kine
- THMC modeling of convection loops and their stability
- Impacts for the use of heat (geothermal energy, heat storage
- Impacts for mineral exploitation (lithium)
- Impacts for native hydrogen production
- Impacts for CO_2 storage
- Coupled phenomena



ITI GeoT Research priorities

3. Fracture healing in deep reservoirs

- Characterization of fault healing phenomena and matrix porosity
- Impact on the permeability of reservoirs
- Impacts on the mechanical properties of reservoirs (e.g. stiffness of faults, cohesion, failure criterion, seismicity, etc.)
- Evolution of exploration methods
- Evolution of reservoir stimulation strategies

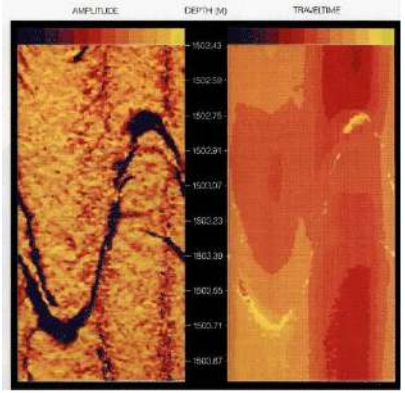


EPS1 – 1374m

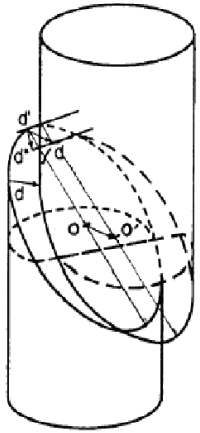
ITI GeoT Research priorities

4. Aseismic deformation in deep fractured reservoirs

- Highlighting aseismic deformation in reservoirs (e.g. seismic, geodetic, inclinometer, fiber optic, geological setting, etc.)
- Analysis of seismic / aseismic deformation partitioning mechanisms (rock mechanics)
- Modelling
- Inclusion of aseismic deformation in monitoring, TLS
- Developing stimulation techniques for aseismic deformation



Existing fracture



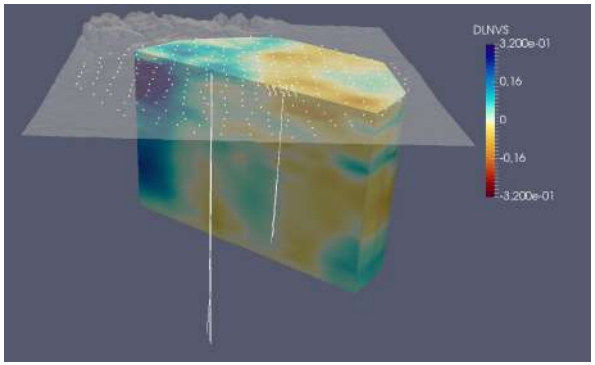
Borehole geometry result from shear displacement along existing fracture (general case):

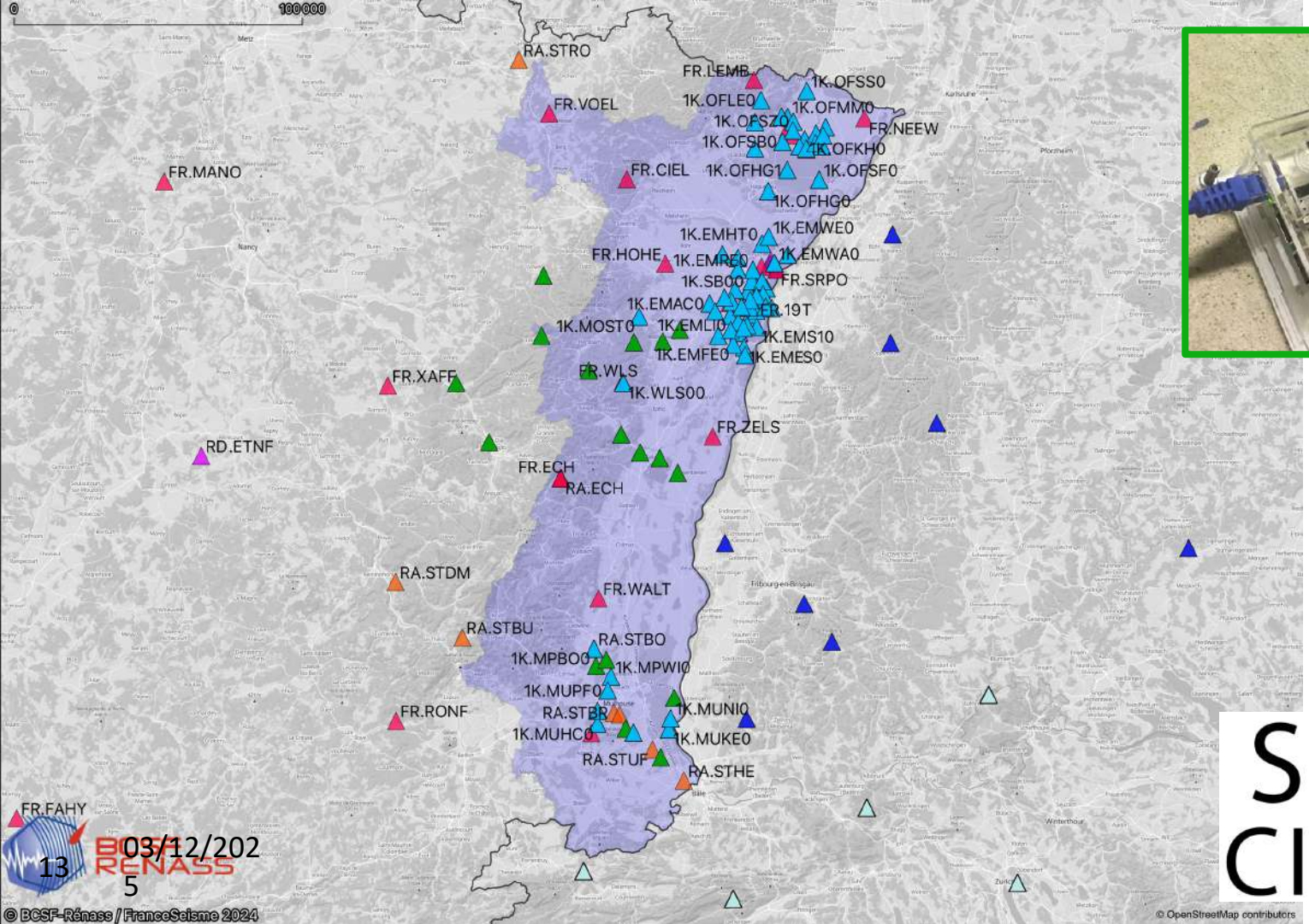
d = Displacement
d' = Strike component
d" = Dip component

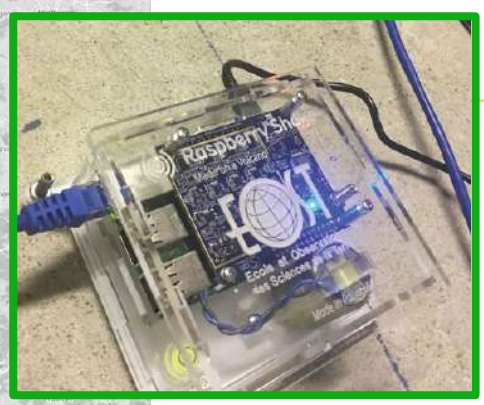
ITI GeoT Research priorities

5. Innovations in monitoring deep reservoirs

- Innovation in seismic network design (e.g. dense networks, optical fibers, low-cost sensors, etc.)
- Expansion of the Bcsf-Rénass for monitoring anthropogenic seismicity
- Diversification of monitoring (i.e. broadening of bandwidth): from very low frequency geodesy to short period seismology
- Data distribution (e.g. FAIR standards, participation in EPOS TCS AH)
- Best practice guides, sharing of operator / public observatory surveillance
- Societal impacts







ANR PrESENCE

DEEP
Innovation for De-Risking Enhanced Geothermal Energy Projects

SISM CITOYEN

Deep Reservoir Observatory Project (ORP@ EOST))

Starting point:

- Data distribution/archiving (CDGP)
- Encourage participatory science (citizen seismology) - scientific mediation
- Develop expertise - coordinate research programs on deep reservoirs (funding)

Ambitions:

- Development of independent data acquisition (long-term monitoring, crisis, specific regional instrumentation)
- Coordination with national services for the development of seismic networks and for the classification of induced events (RLBP, RAP, BCSF-Renass, IsDeform, etc.)
- Creation of “black boxes” (civil aviation) for industrial projects (embargoes)
- Enhanced support for public policy – contribution to site monitoring committees (CSS)Translated