

# EIT in geophysics application of EIDORS

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# EIT in geophysics

## EIT in geophysics

- Developed in 1920 by the brothers Schlumberger for mining prospecting.
- Rock resistivity varies on several orders of magnitude and carry informations on the rock nature, its porosity and its water content.
- The geometry of the electrode array defines the spatial resolution (order of meters) and the penetration depth (until 500m).

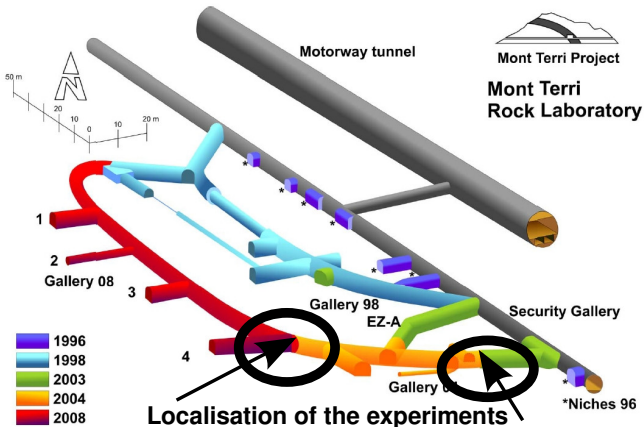
## Adaptation of EIDORS to geophysics

- Takes into account the geometry of the electrodes array
- Simultaneous inversion of huge data sets

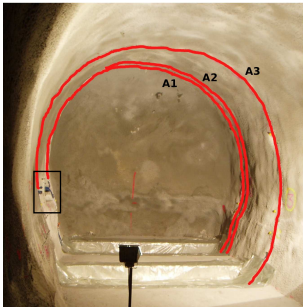
⇒ Possibility to construct a 3D EIT of geological objects

# Mont Terri underground laboratory

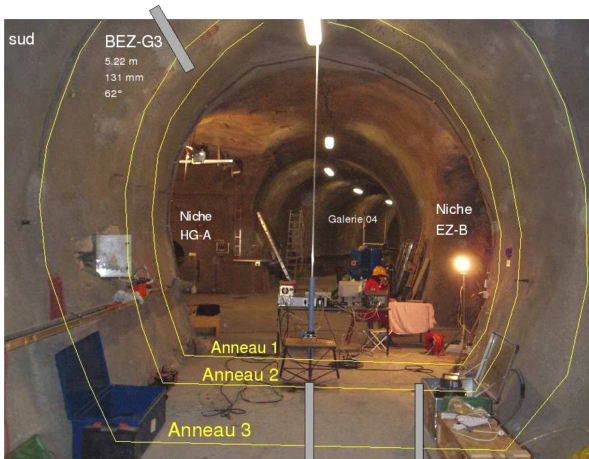
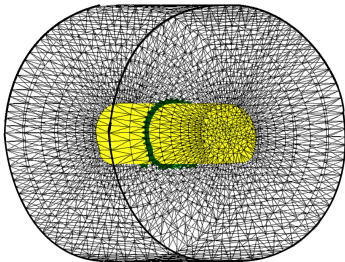
- Presence of opalinus clay which shows interesting properties for nuclear waste storage such as : low diffusion coefficient, low permeability, sealing capacity, insulator...
  - Study of the impact of excavations on clays.
- ⇒ Damaged zone, made of microcracks shows a higher resistivity.



# Geometrical configuration



July 2004



September 2007

BEZ-G1  
7.00 m  
131 mm

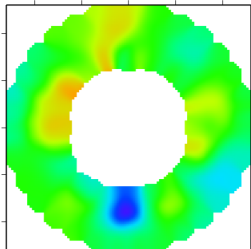
BEZ-G2  
7.00 m  
131 mm

## Apparent resistivity

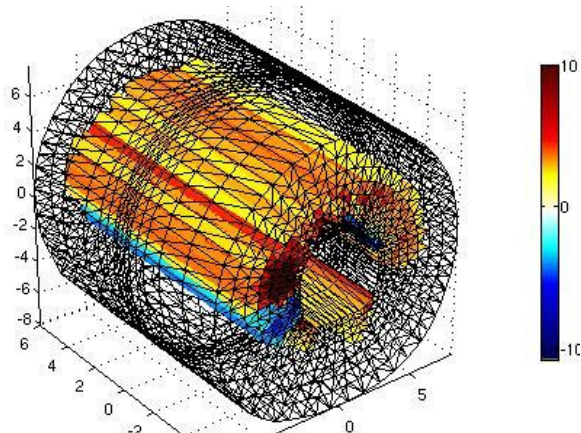
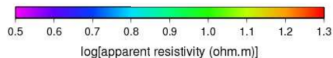
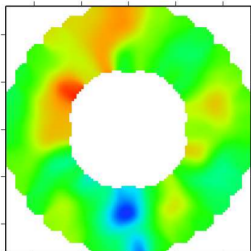
## Resistivities

Results of inversion - Ring 1  
 Difference 2004/12-2004/07

07  
 2004



12  
 2004

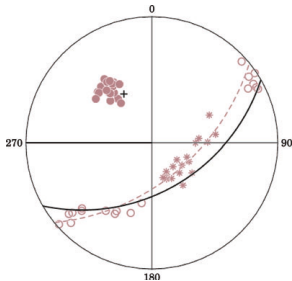
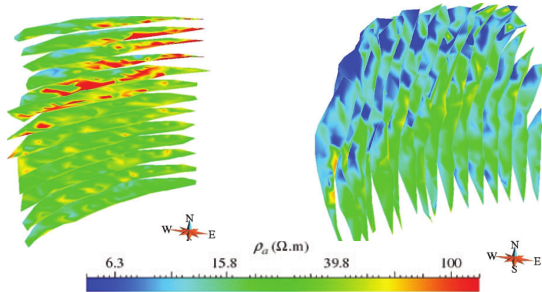
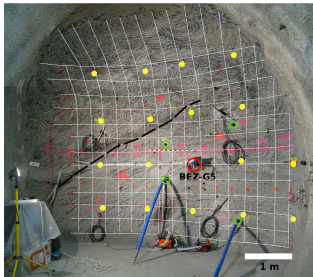


# Anisotropy

Configuration

Horizontal measurements

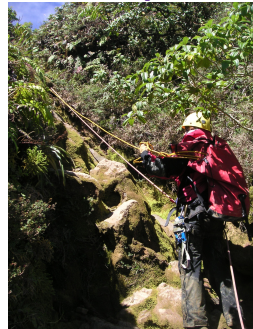
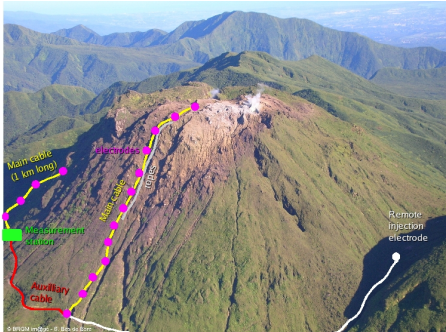
Vertical measurements



Observation of anisotropy induced by the clay bedding

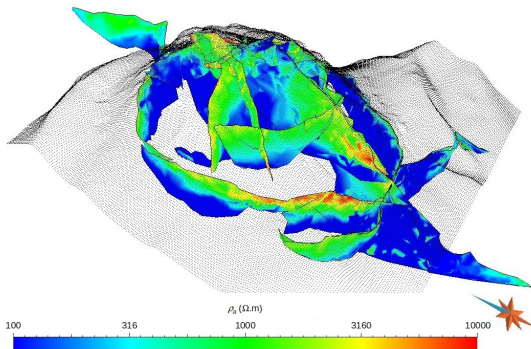
⇒ Necessity to take it into account in the forward model

# La Soufrière de Guadeloupe



# First results

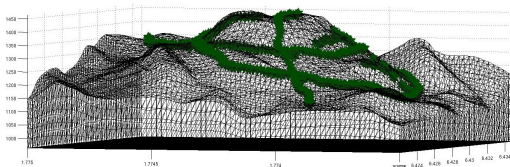
Observation of strong resistivity contrasts.



- Low resistivity area corresponds to fumarolic zones with a high acidity.
- Medium resistivity zone corresponds to not altered primary volcanic deposits.
- High resistivity zone corresponds to rock avalanche blocks.

⇒ Necessity to make a 3D inversion to precise the interpretations.

Nicolin *et al.*, 2006



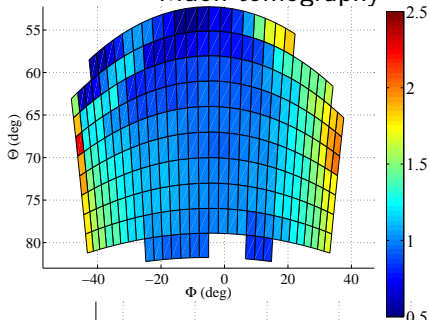
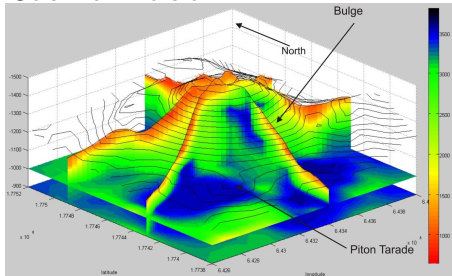




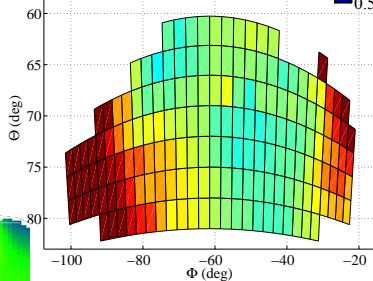
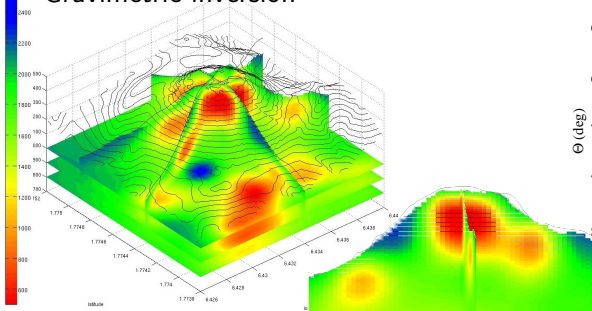
Seismic inversion

Joint inversions

Muon tomography



Gravimetric inversion



## Developments required

EIDORS is a software compatible with geophysics.

- Construction of forward models which take into account the anisotropy.
- Introduction of infinite elements to construct models closer from geological media.
- Development of joint inversion with data sets sensitive to other physical parameters.