PiTOP
Sito test di geofisica di pozzo
Borehole geophysical test site

EGU General Assembly 2025

OGS National Institute of Oceanography and Applied Geophysics

EGU General Assembly 2025
Vienna, 27 April–2 May 2025

GI1.1: Open session on geoscience instrumentation and methods

Integrated geophysical studies at the OGS PITOP testing site: an interdisciplinary approach for subsurface characterization

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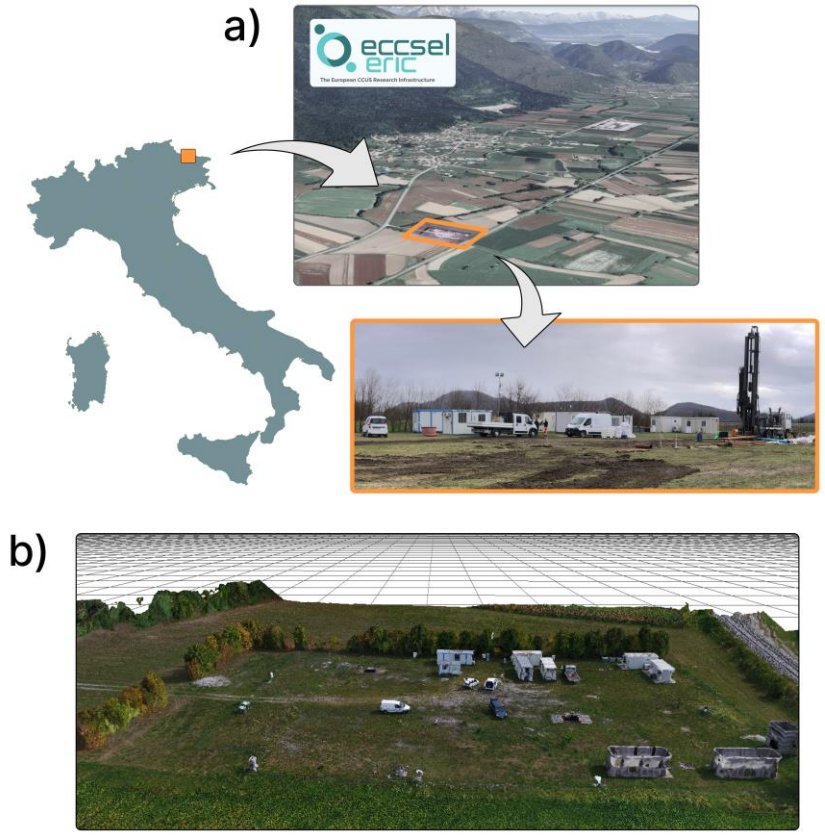
PITOP: a testing site for integrated geophysical studies



PITOP covers an area of 22,000 m^2 and it was designed and developed with the aim of providing a facility for the study and **experimentation** of **geophysical methods**, new **technologies,** including **drilling technologies,** and **borehole/surface tools** in **realistic conditions**

- ✓ Wells
- ✓ Acquisition systems
- ✓ Seismic instrumentation
- ✓ Geoelectric instrumentation

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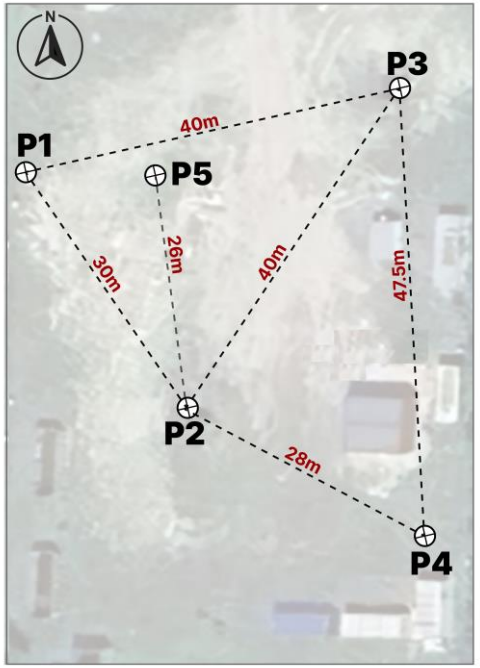
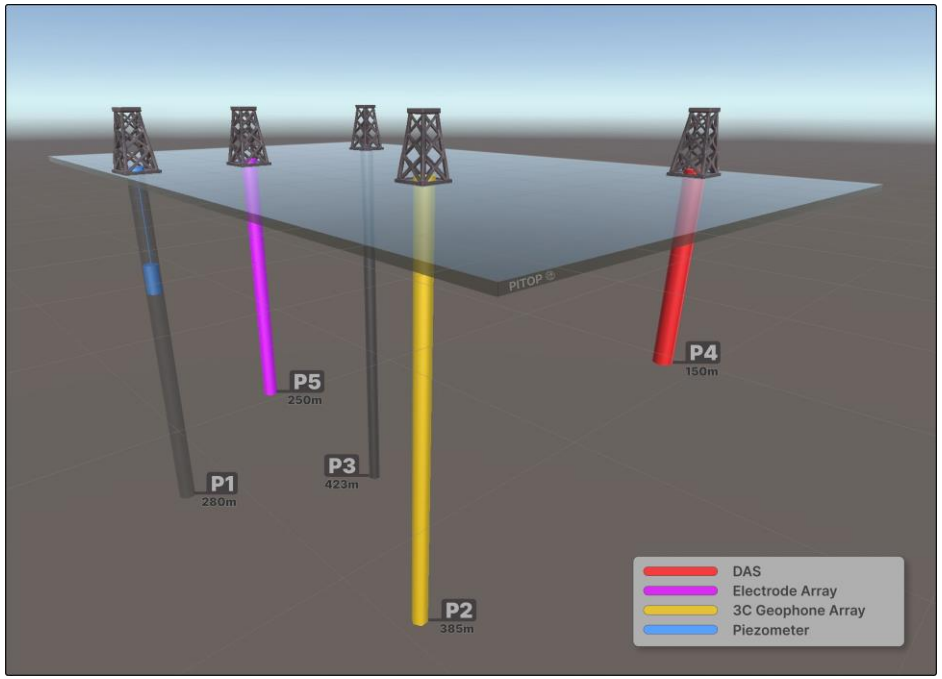
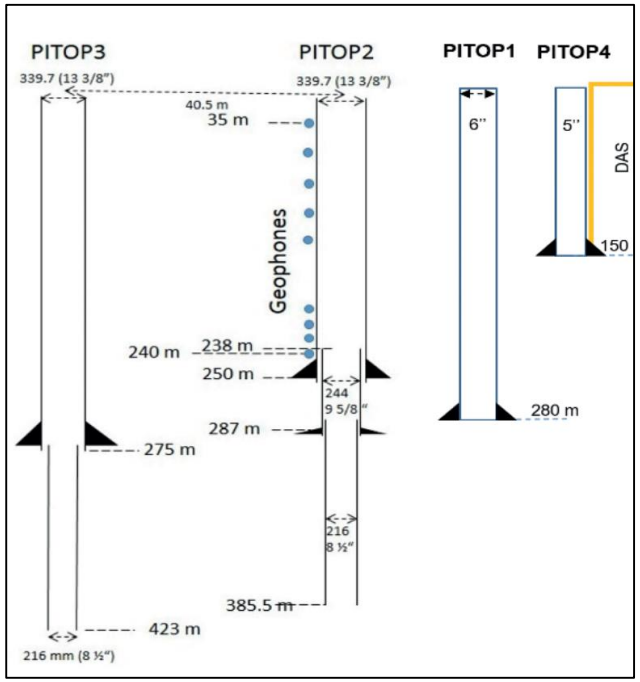
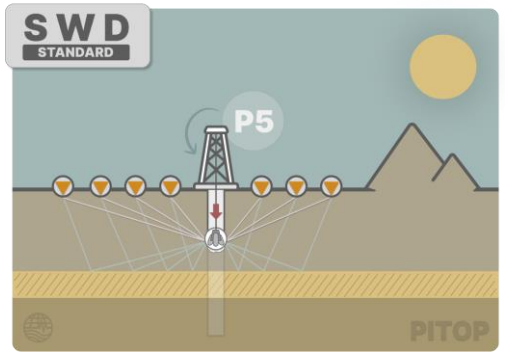
PITOP wells

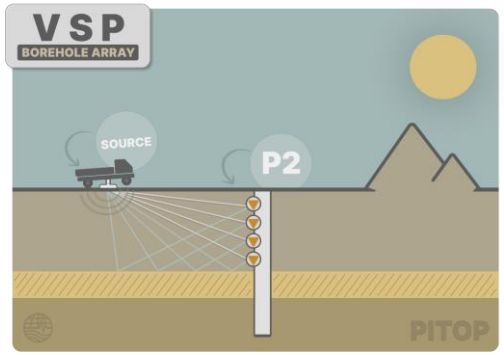

N
P1
P2
P3
P4
P5
40m
30m
26m
40m
47.5m
28m
WELL DISTANCE
TOP VIEW

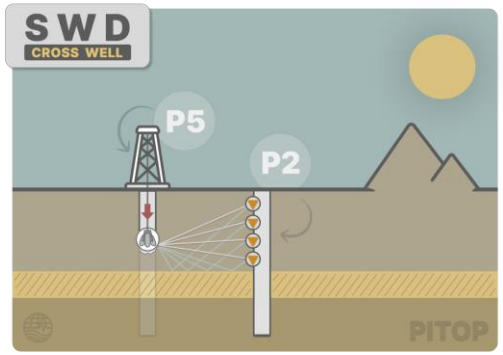

P1
280m
P5
250m
P3
423m
P2
385m
P4
150m
DAS
Electrode Array
3C Geophone Array
Piezometer


PITOP3
PITOP2
PITOP1
PITOP4
339.7 (13 3/8")
339.7 (13 3/8")
40.5 m
35 m
Geophones
240 m
238 m
250 m
244
9 5/8"
287 m
275 m
216
8 ½"
385.5 m
423 m
216 mm (8 ½")
6"
5"
DAS
150
280 m

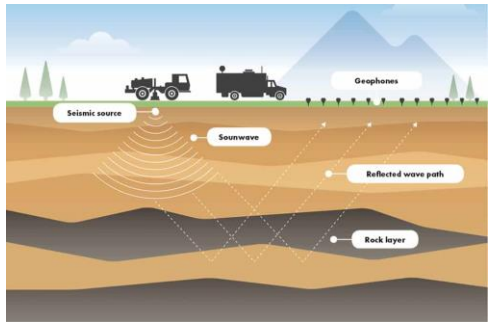
Examples of geophysical setups in PITOP



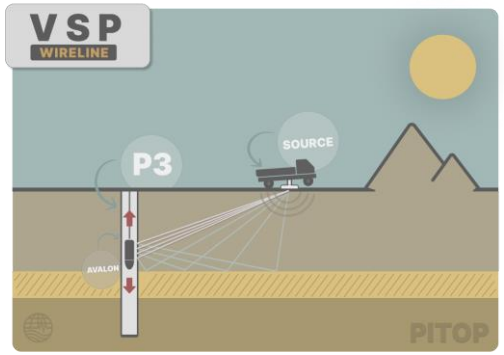




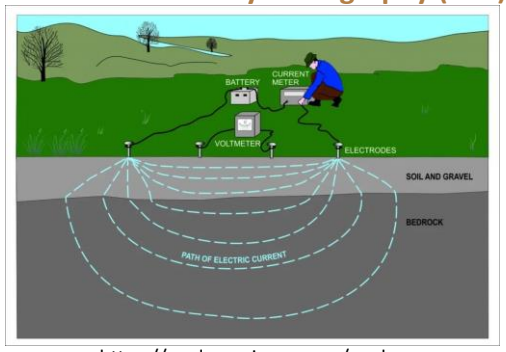
Surface seismic



https://energyinformationaustralia.com.au/seismic-surveys/



Electrical Resistivity Tomography (ERT)



https://geologyscience.com/geology-branches/geophysics/electrical-resistivity-surveys/

Seismic Instrumentation: sources

National Institute of Oceanography and Applied Geophysics

Vibroseis MiniVib

ELVIS VII surface vibrator

The vibrator source with the horizontal vibrator kit (mounted).

Technical Details

Design: Geosym GmbH
Generated wave types: P/S
Power supply: 12 V DC
Drive system: Cascaded linear motor
Peak force: Approx. 1100 N
Frequency range: 20-240 Hz
Investigation depth: Depending on geology
Up to 200 m and more for S-wave
Up to 300 m and more for P-wave
Total weight: 130 kg

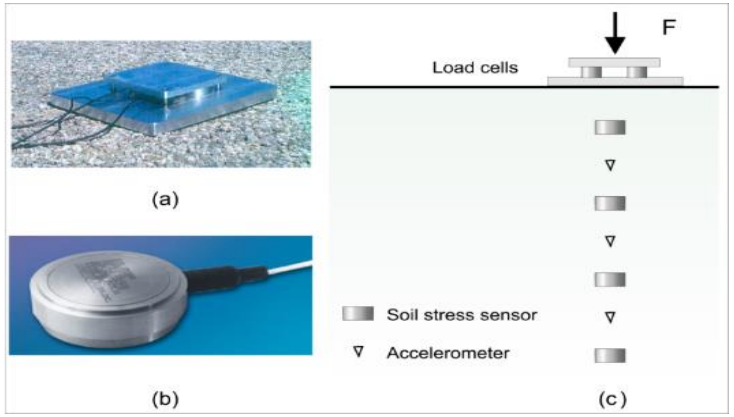
Borehole source

To generate the sparker pulses within the borehole the p-wave sparker probe **SBS 42** is used (left). The SBS 42 consists of a probe tube and a rubber tube system. The sparker predominantly produces high frequency p-waves even over large distances as shown below.

Seismic Instrumentation: surface receivers

Seismic surface receivers available at PITOP: Summit X One

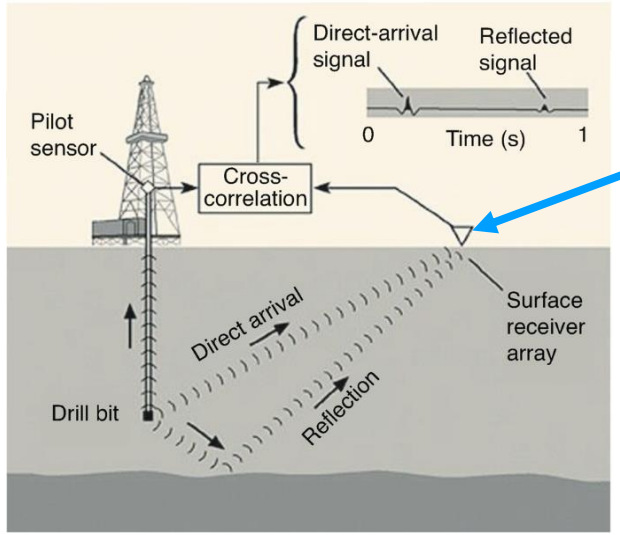
https://www.dmt-group.com/products/geo-measuring-systems/summit-x-one.html

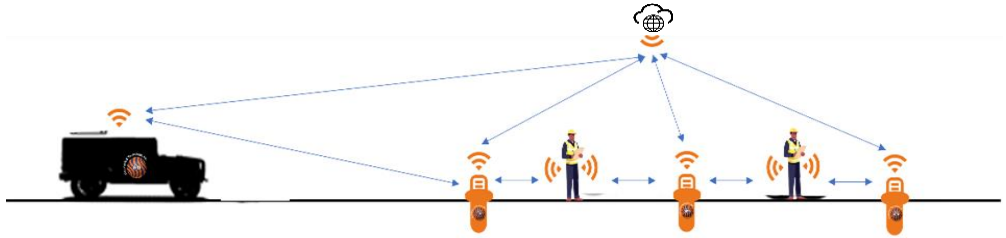


Bellezza et al. 2025

Seismic Instrumentation: surface receivers

New 800 wireless nodes **(NuSeis),** for a **total of 1600 channels,** mono and three components geophones





NuSeis Description:

- Long battery life: providing up to 45 days of continuous operation.
- Wireless recording units
- GNSS and BLE comms: easy deployment and retrieval.
- SEG standard data formats: compatible with all major seismic processing software.
- Expandable storage
- Rugged and durable

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DAS implementation in PITOP

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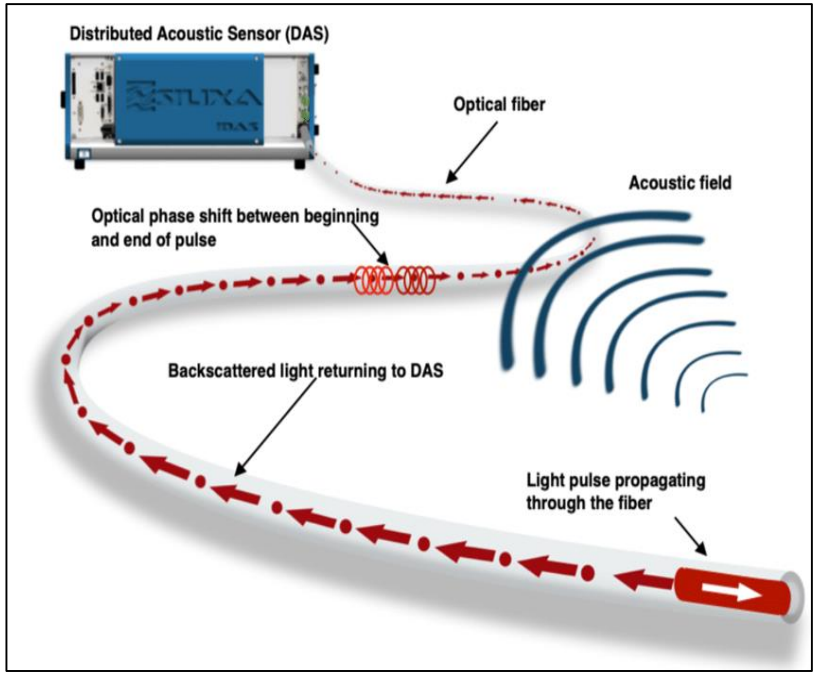
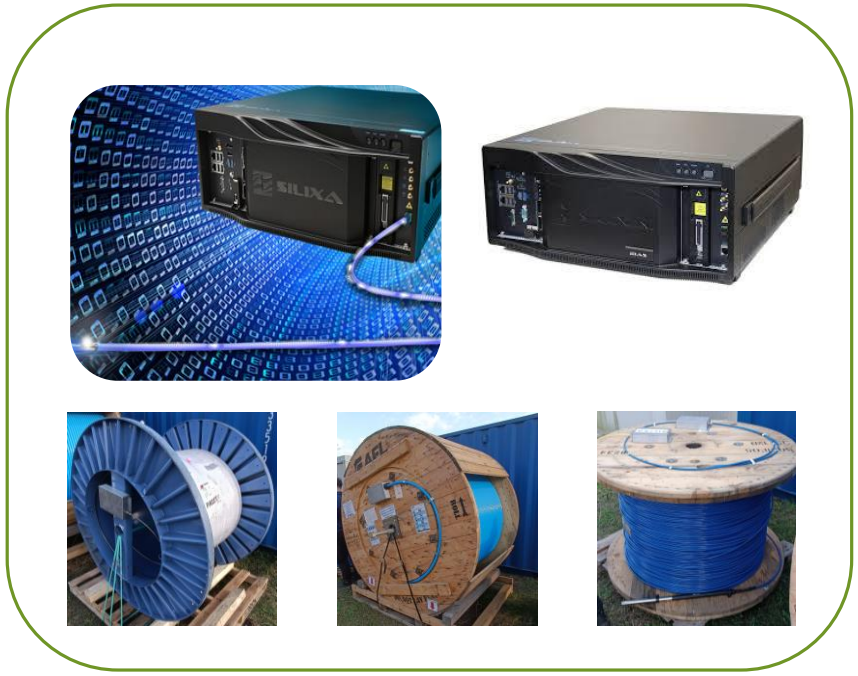
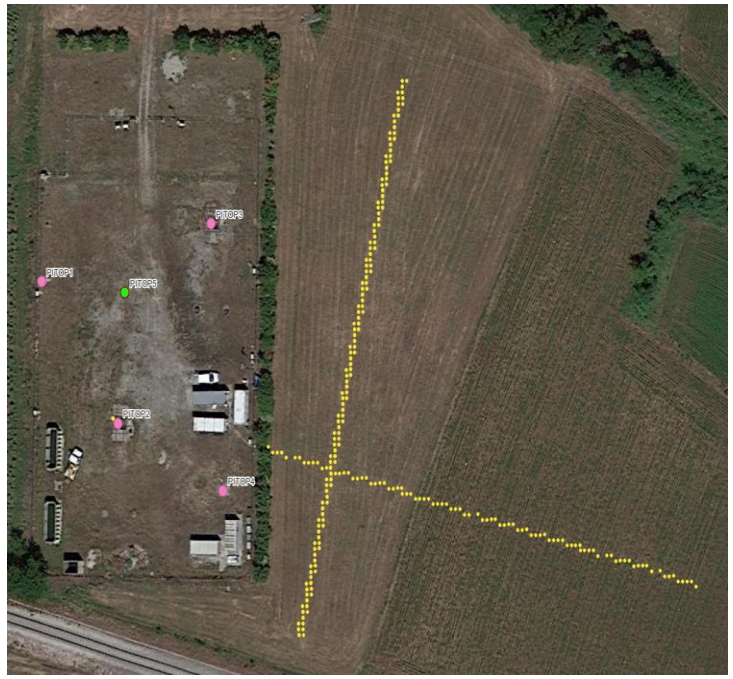
Distributed Acoustic Sensing (DAS): fiber optic cables and interrogators



DAS principle



DAS equipment at PITOP



DAS fibers in trenches at PITOP

Seismic Instrumentation: borehole receivers

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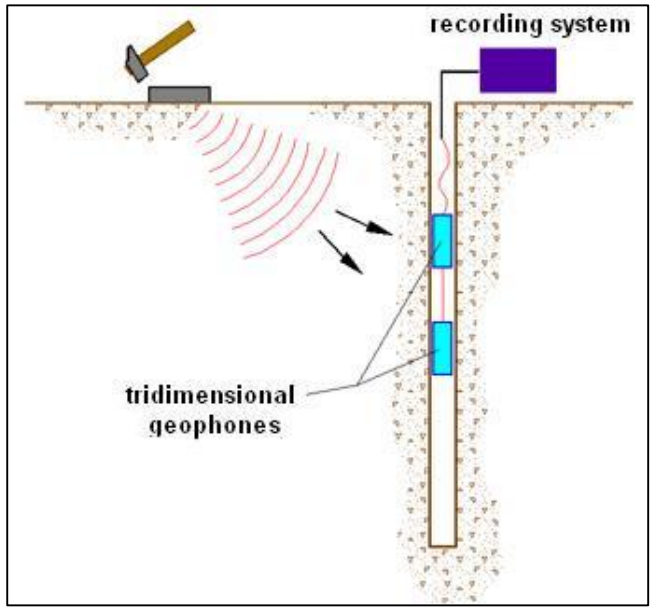
Mobile geophones

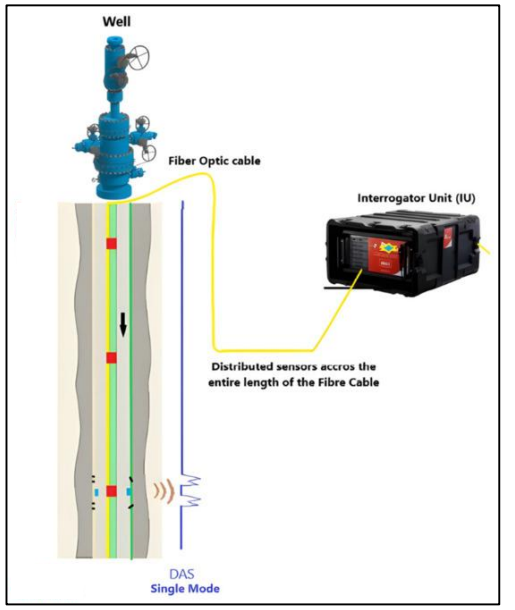
Avalon ASR-1 and GSR-1

Cemented 3C Geophones



https://help.geostru.eu/downhole/en/introduzione.htm

DAS Fiber optic (installed)



Adapted from Rafi et al. Appl. Sci. **2024**

Implementation of PITOP with geoelectric equipment

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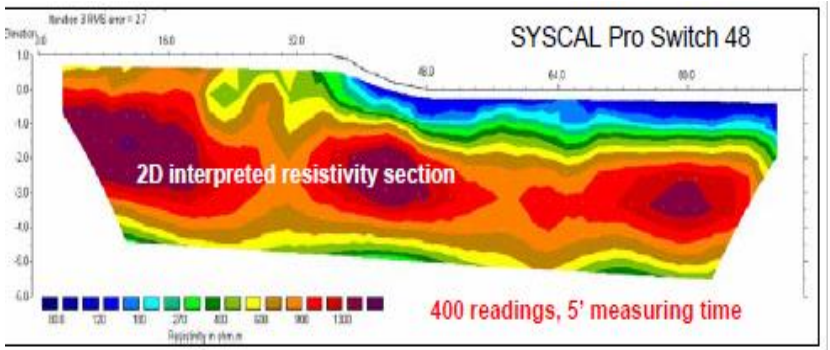
Electrodes array installed in PITOP5

Electrodes arrays (mobile unit)

Iris V-FullWaver for geoelectric surveys

ERT (electrical resistivity tomography)



Representative resistivity map (Syscal Pro)

IT facilities/services in PITOP

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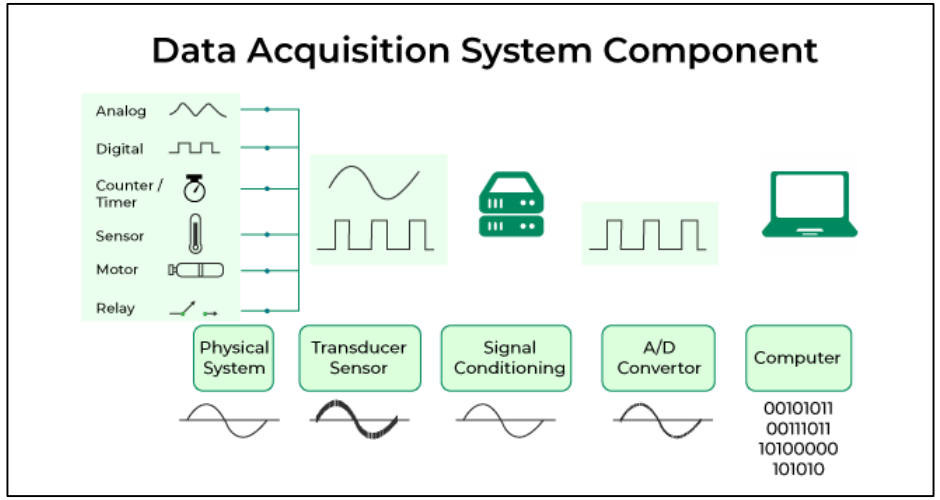
Hardware/software for acquisition systems and data management

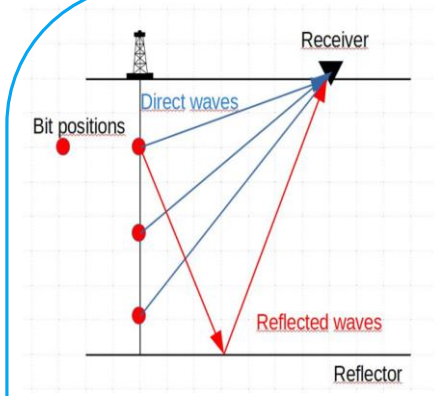


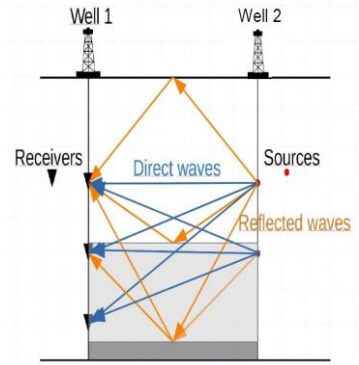
IT Operations Center in PITOP

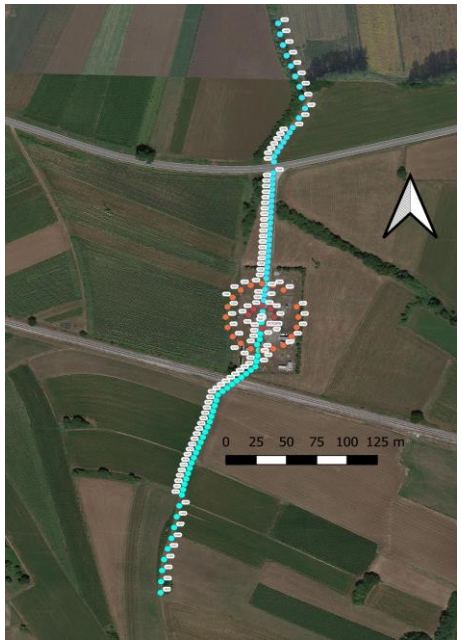
Remote connection to data/instruments through virtual access

Example of integrated studies at PITOP

REALIZATION OF PITOP5 (2024)

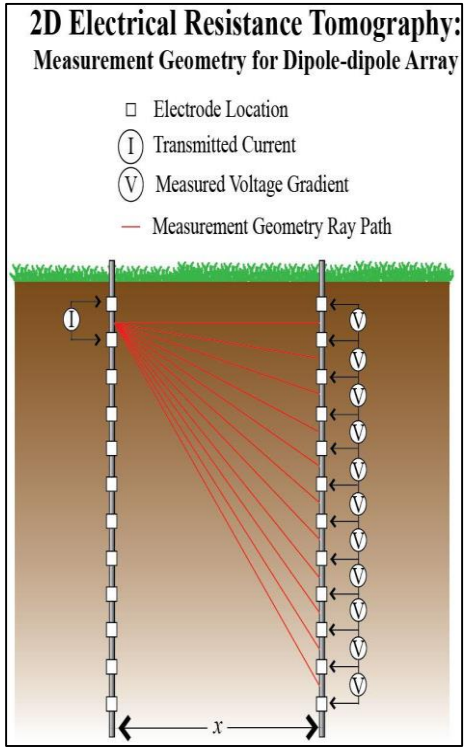






Depoloyment of surface geophones during the drilling of PITOP5

SEISMIC METHODS



Electrodes for surface (V-FullWaver) geoelectric acquistions deployed alongside the surface geophones line

GEOELECTRICAL METHODS

PITOP in summary

Main facilities and instrumentation	Methods/Approaches
NuSeis Nodes Standard Geophones	SWD VSP Surface seismic Cross-well
DAS and interrogators	All seismic surveys
IRIS V-FullWaver and electrodes array	Geoelectrical surveys
Instrumented wells	Seismic and geoelectric surveys
Seismic sources (borehole and surface)	
Remote/virtual access	

- ✓ Studies for **CO2 storage** site characterization and monitoring
- ✓ **Geothermal field** characterization
- ✓ **Hydrogen strorage** site characterization and monitoring
- ✓ **Water resources** applications

Sustainable environment and geoenergy

https://fiinovationblogs.wordpress.com/2014/04/18/

Collaboration opportunities and access to PITOP

- ✓ *As an **OGS infrastructure**, PITOP is involved in **EU Projects** and National Projects (e.g. Geo-Inquire, Eccsellent)*
- ✓ *PITOP is available for **transnational access projects, scientific collaborations, service requests***
- ✓ ***In situ technical support** can be provided*

In 2025, three Transnational Access Requests to PITOP from UK, Germay, France

New research projects, ideas, collaborations?
Please contact us!

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References on PITOP

Scientific paper: Bellezza et al., 2025: Geophysical exploration case histories at the PITOP geophysical test site - A key facility in the ECCSEL-ERIC consortium: an overview. *Bulletin of Geophysics and Oceanography, DOI 10.4430/bgo00480.*

Online video seminar: https://www.geo-inquire.eu/fileadmin/videos/20240711_Eccsel/20240711_Geo-INQUIRE_Seminar_ECCSEL_ERIC.mp4

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Contacts and acknowledgements

Link to PITOP in ECCSEL website:
https://eccsel.eu/catalogue/facility/?id=126

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Thank you