



# Densely distributed sensor networks for seismic wave detection in complex environments for civil engineering applications

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DC06

# Purposes and goals

seismic surface waves and passive seismic sources (noise), unconventional seismic receivers

developing, testing and validation of monitoring tools

assessment of natural risks and detailed characterization of the shallow subsurface in urban areas

- A few different techniques of inversion and data processing for greater scales
- More sophisticated/low-cost spatially distributed sensors (MEMS, DAS)

- Estimation of different inversion and data processing techniques applicability to small-scale tasks and task of seismic noise
- Development and testing of new approaches to medium properties determination

# The Scrovegni Chapel in Padova: DAS and geophone measurements

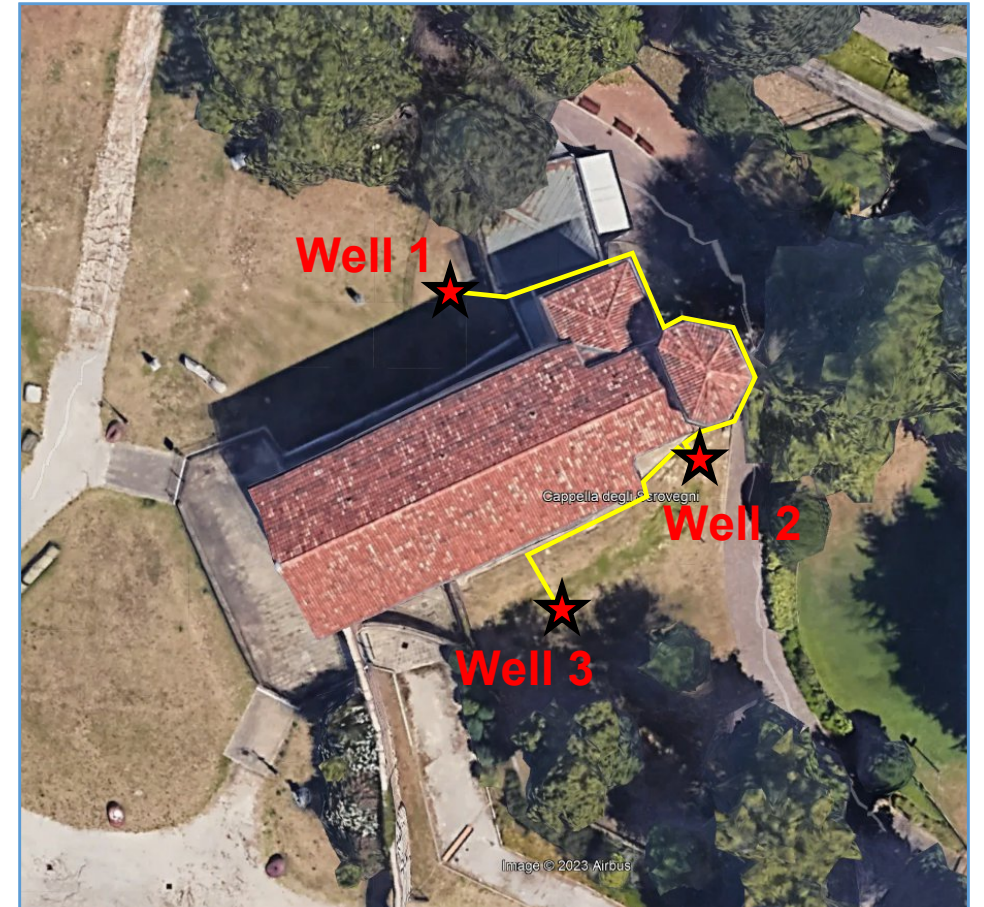
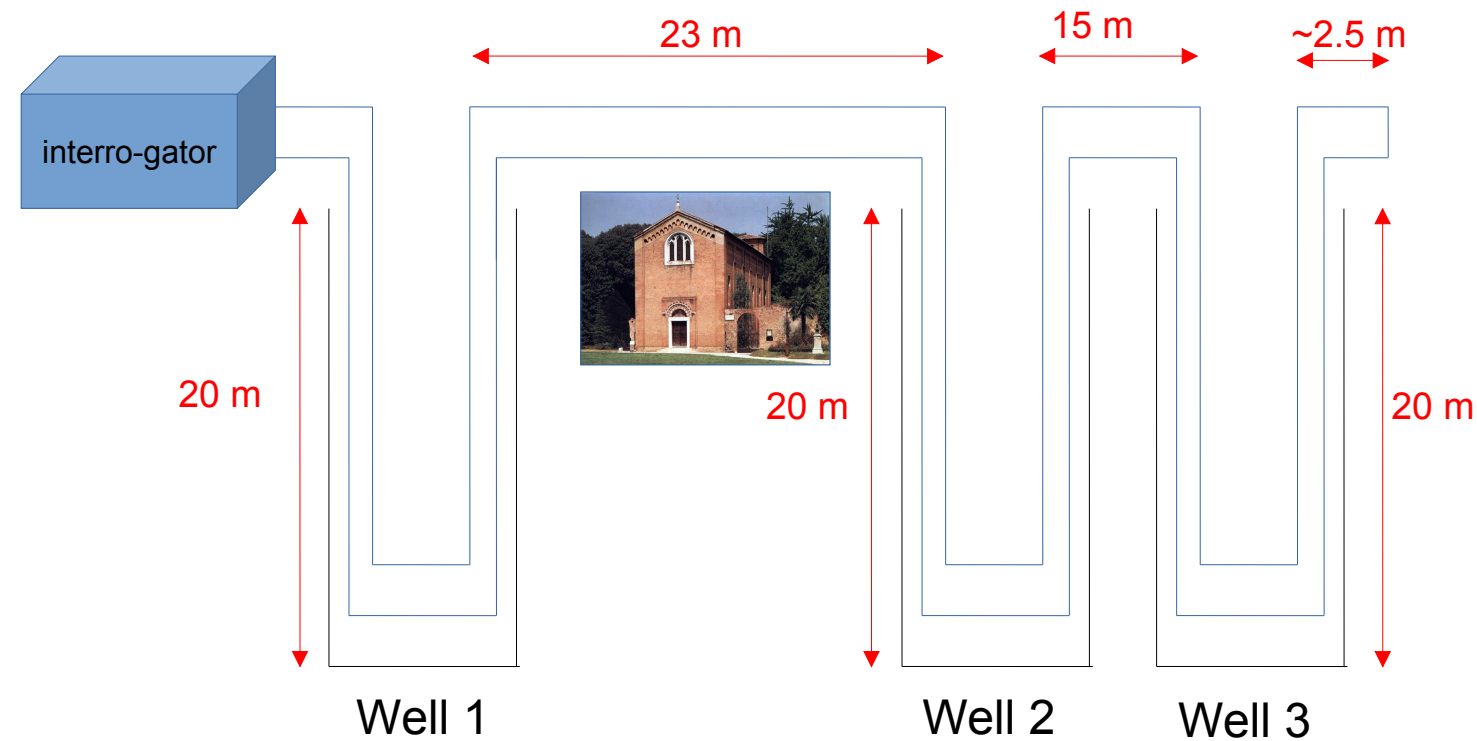
- Previous seismic studies near the the Scrovegni chapel with active and passive sources : Barone at el.,2022, Barone at el.,2023
- Conducting measurements for cultural heritage preservation
- Carrying out of VSP in three wellbores with active sources => 2D velocity model extraction + DAS system testing
- Recording with passive seismic sources – estimation of DAS availability to make a quality record of ambient noise for further tomography-approach



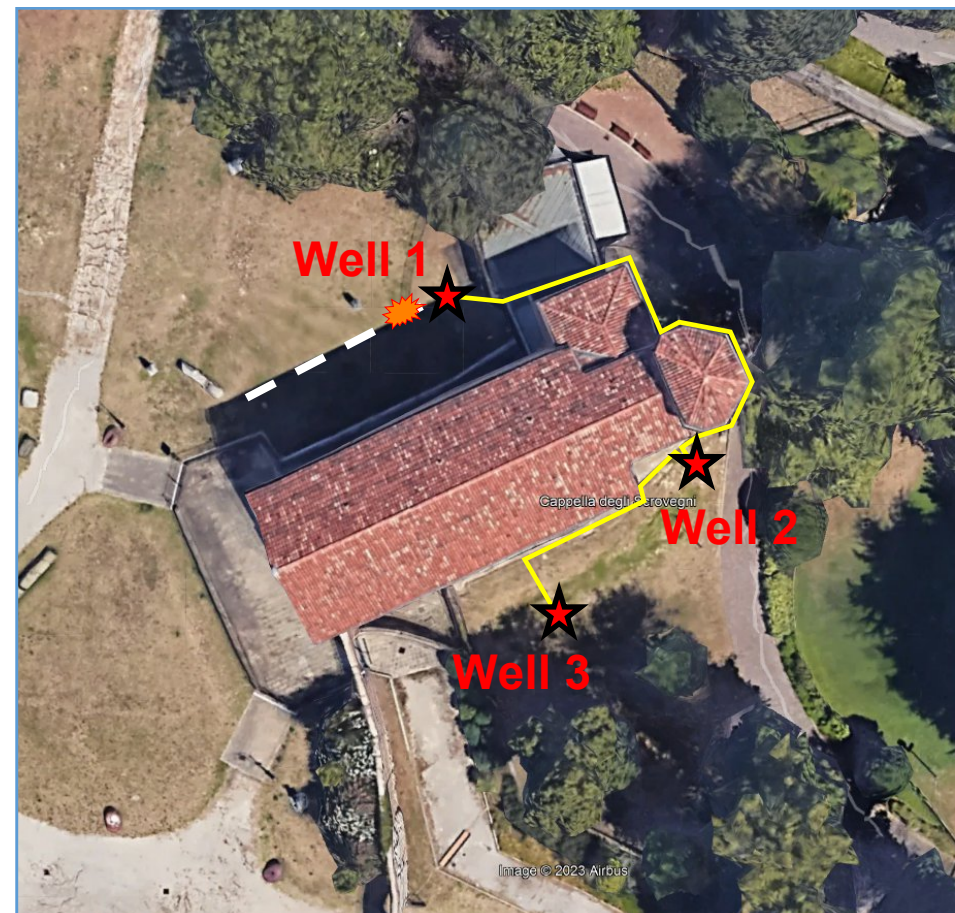
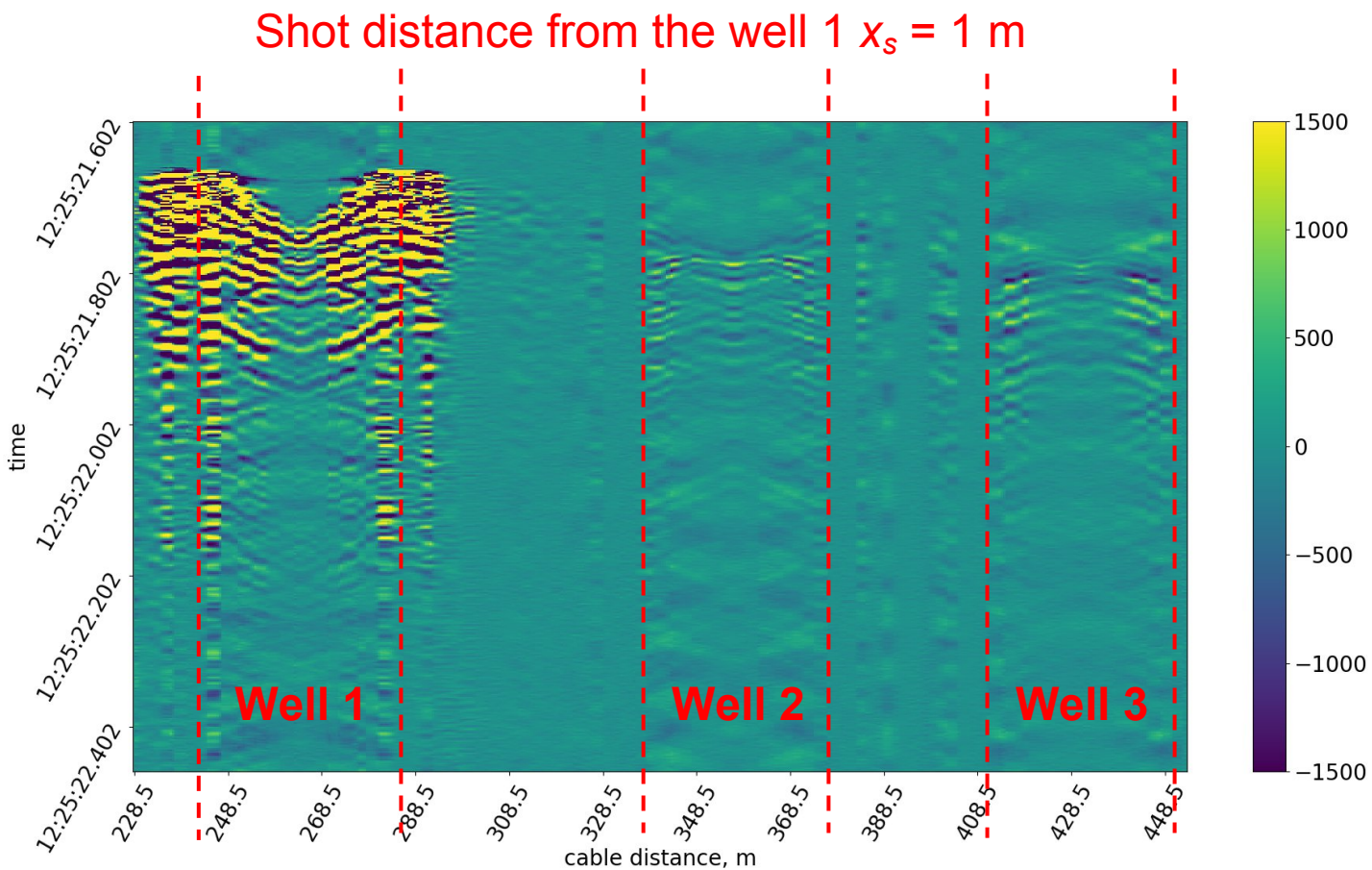
La Cappella degli Scrovegni, Padova

# DAS acquisition scheme

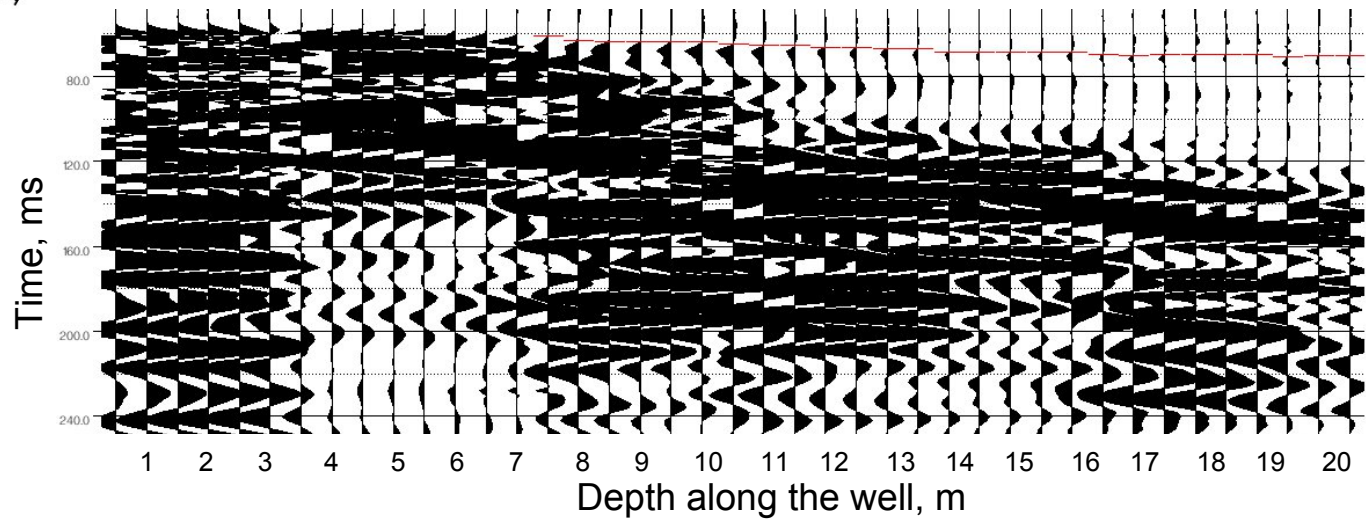
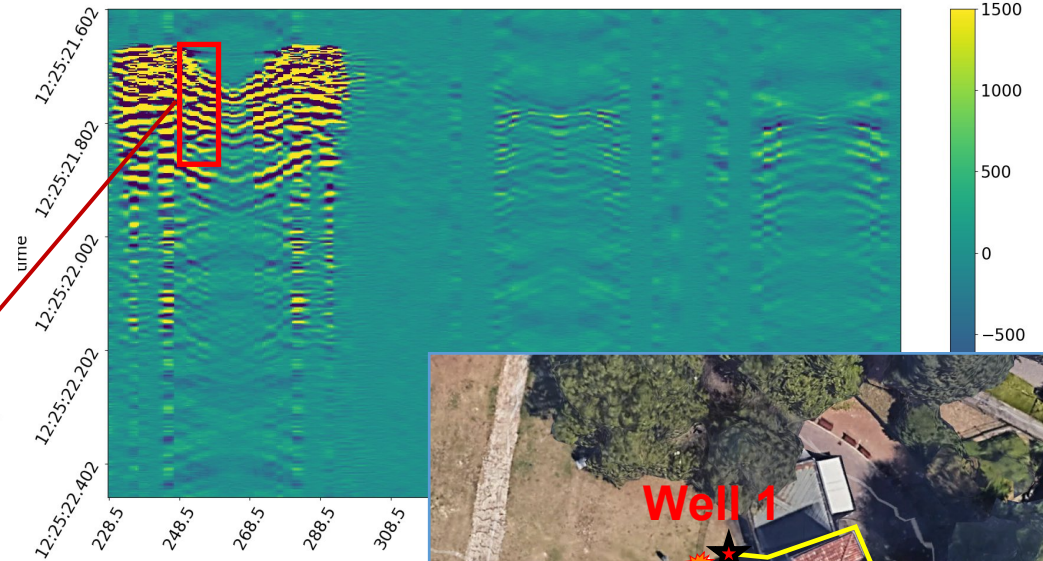
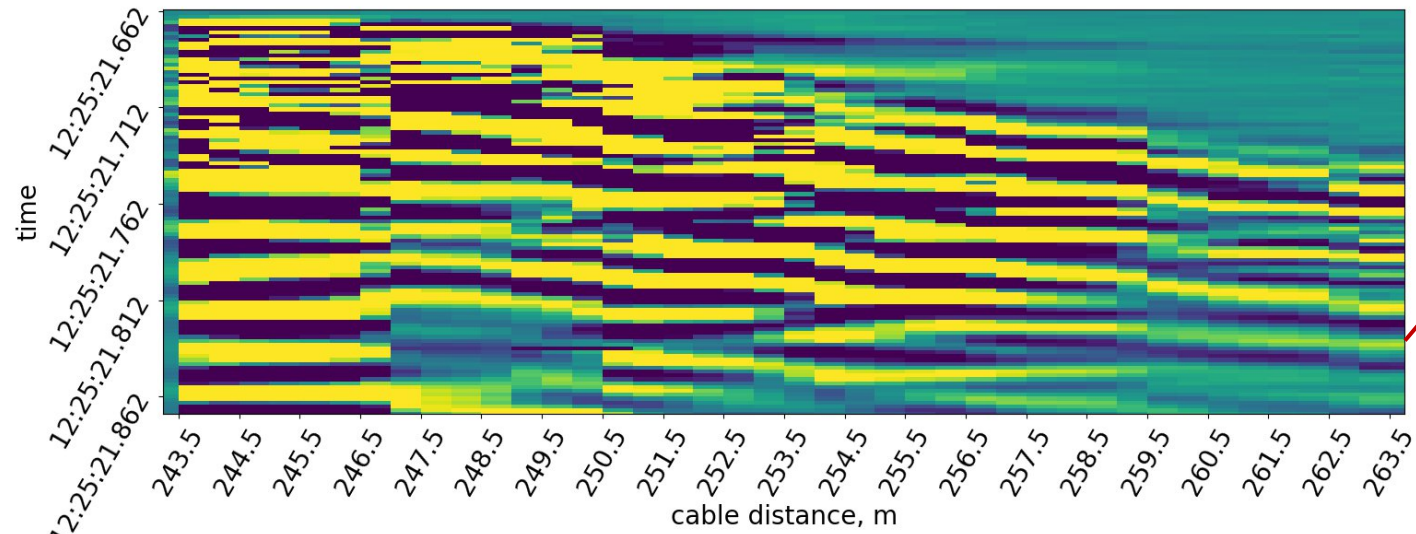
Gauge length	3 m
Spatial resolution	0.5 m
Time resolution	0.002 s
Total cable length	704 m



# Acquisition scheme + DAS data structure



# DAS data structure: first break picking



Shot distance  
from the well 1  
 $x_s = 1$  m

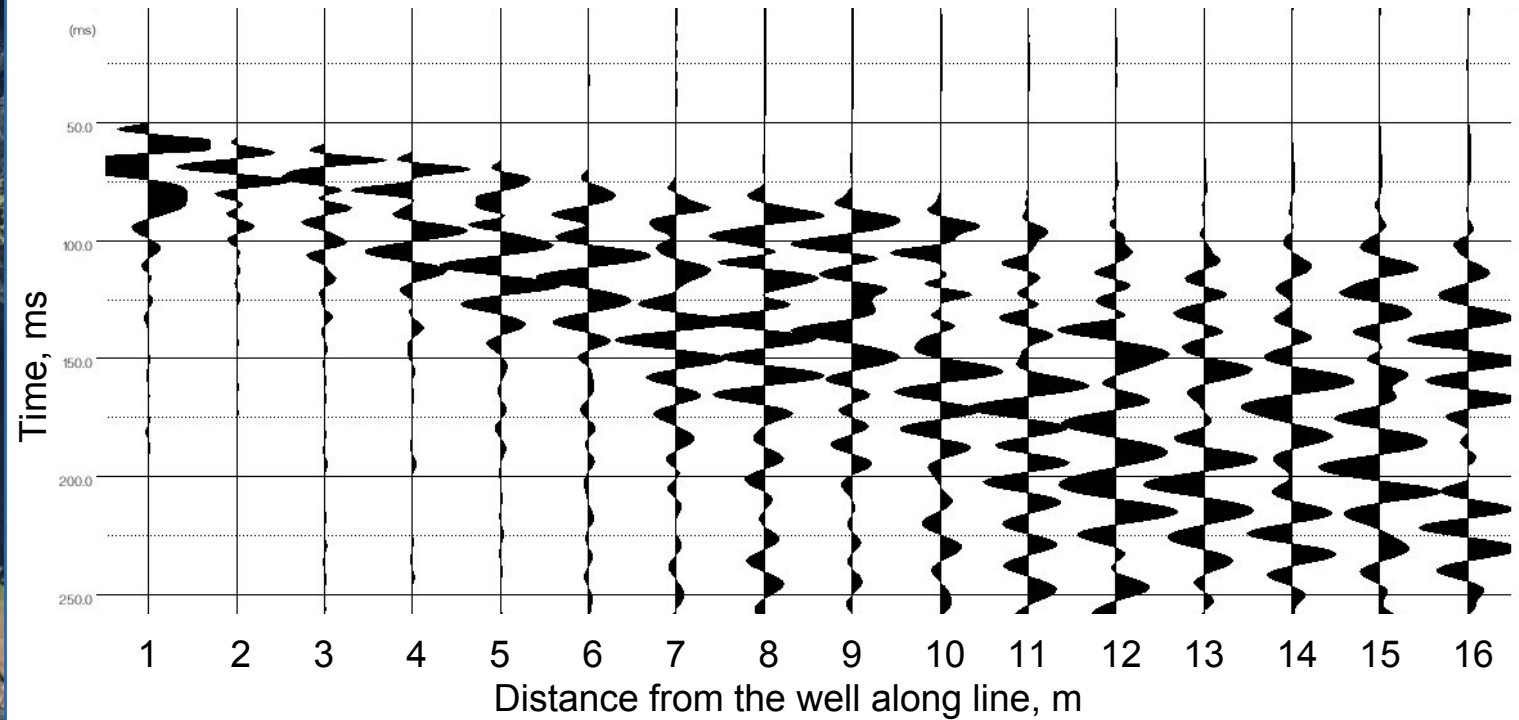


# Acquisition scheme + traditional geophones data structure

Geophone SmartSolo IGU16-HR



Line 1, short distance from the well  $x_s = 1$  m

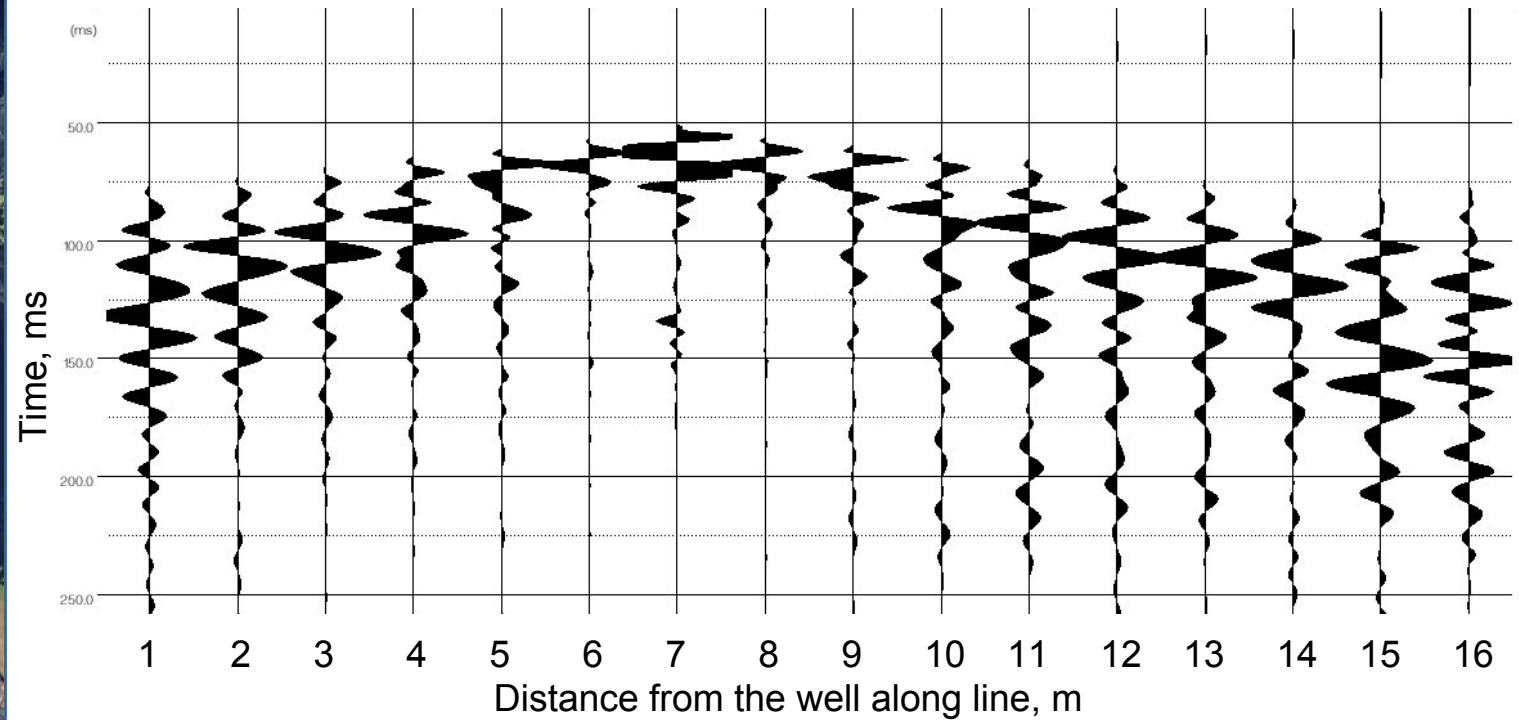


# Acquisition scheme + traditional geophones data structure

Geophone SmartSolo IGU16-HR



Line 1, short distance from the well 1  $x_s = 7$  m



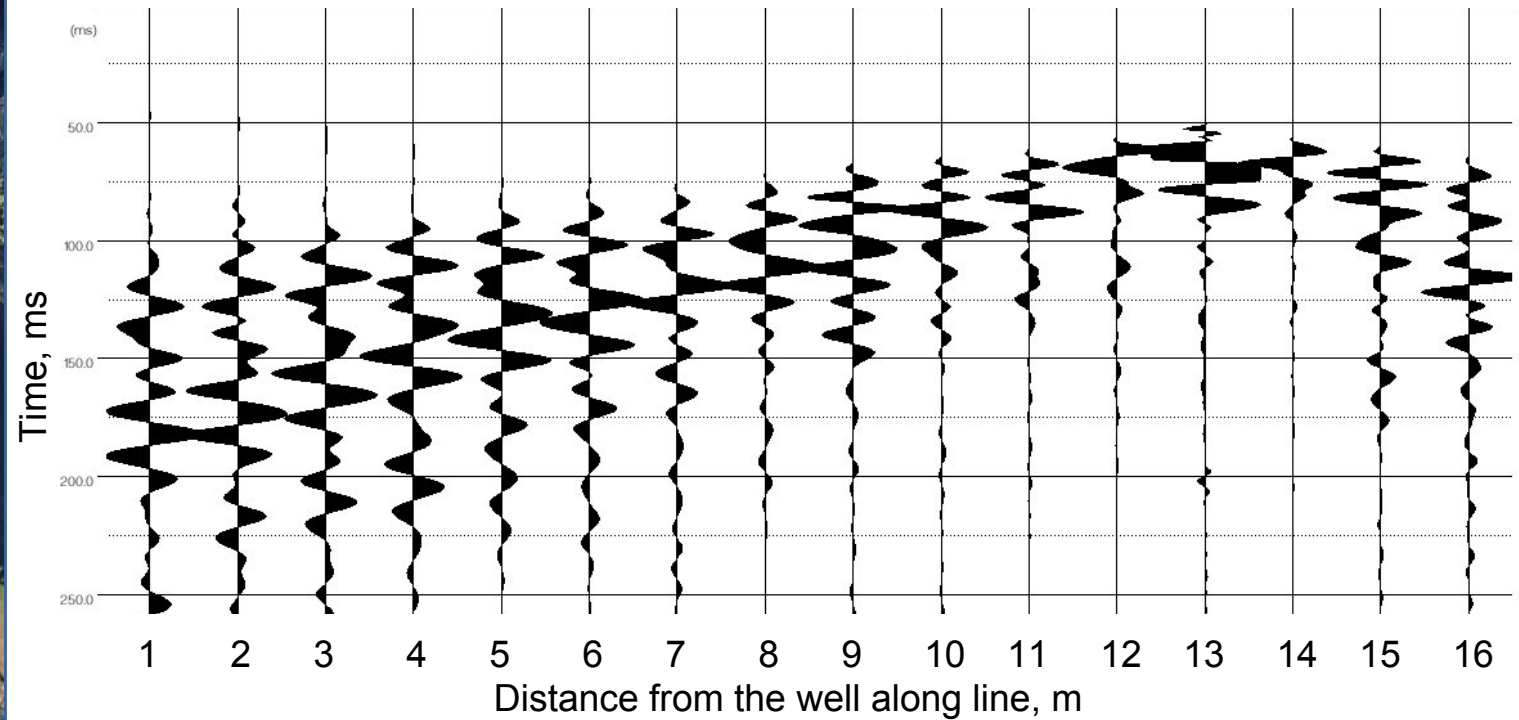


# Acquisition scheme + traditional geophones data structure

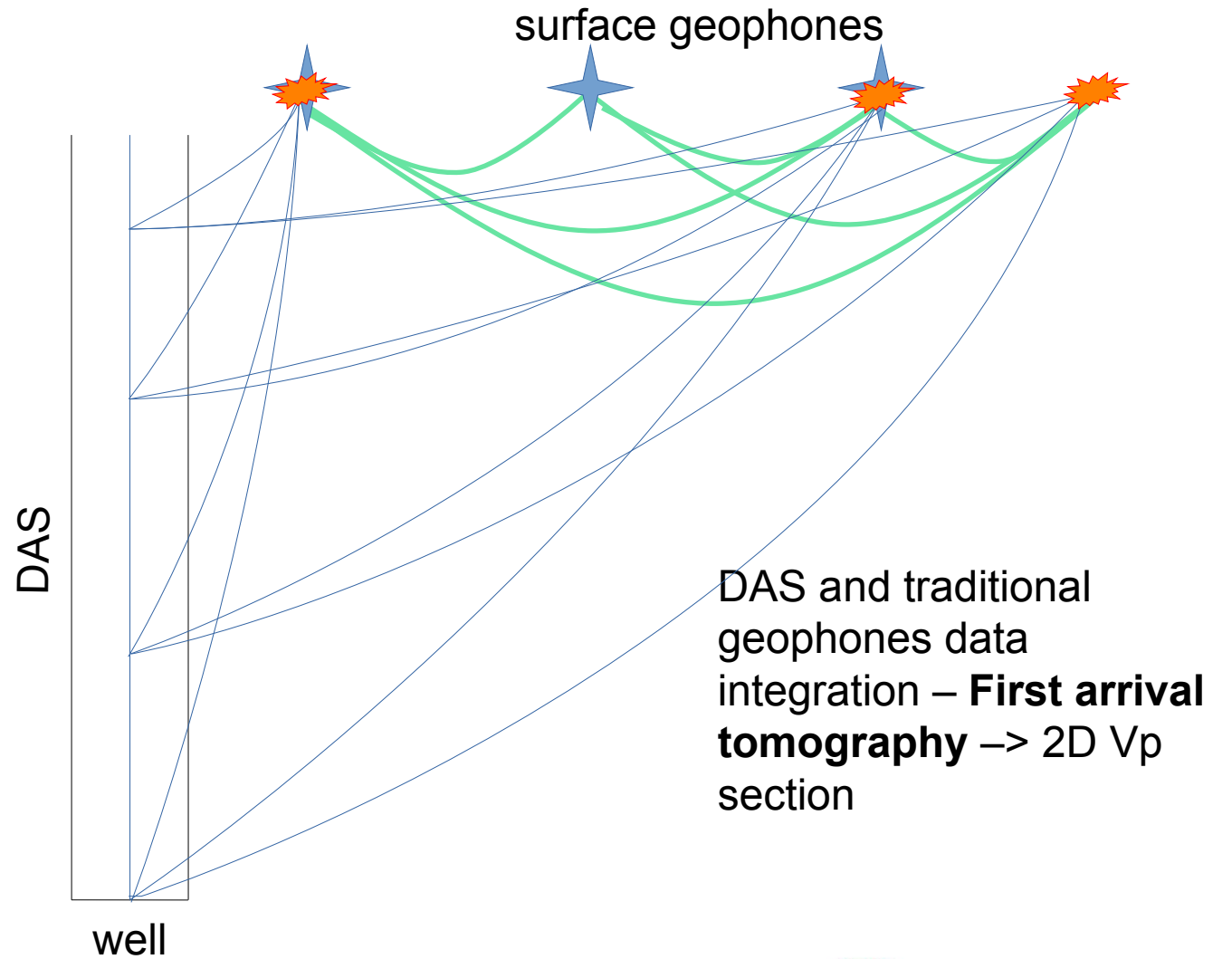
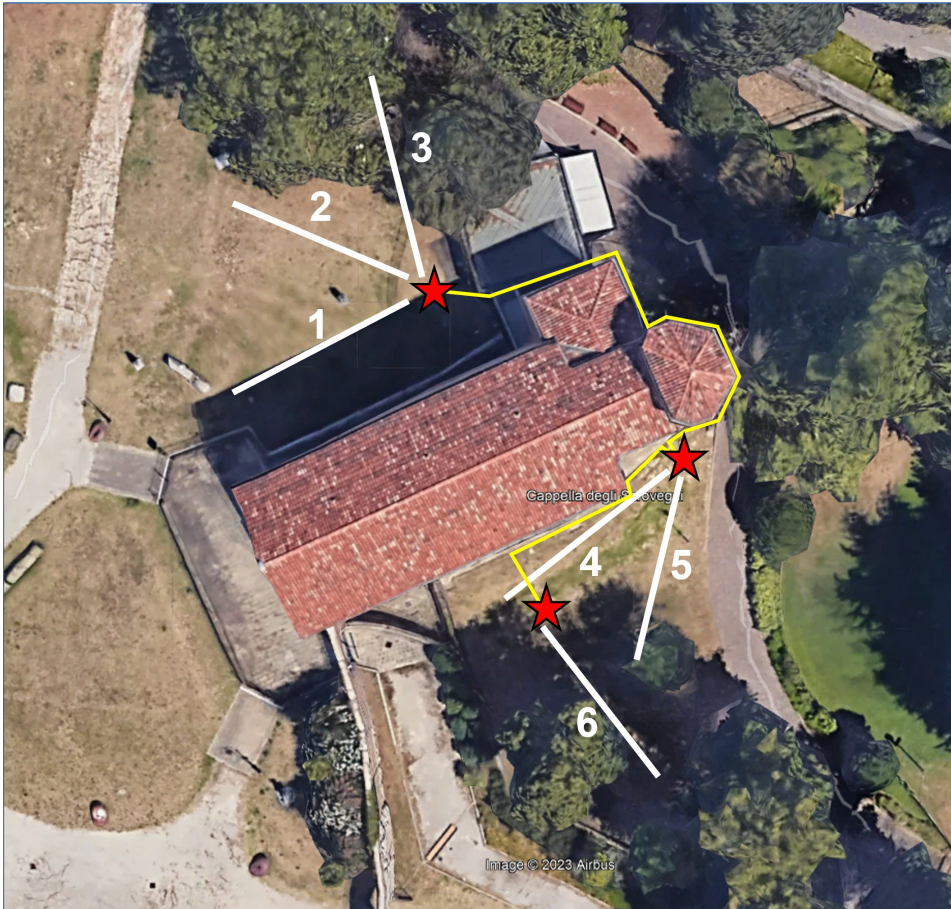
Geophone SmartSolo IGU16-HR



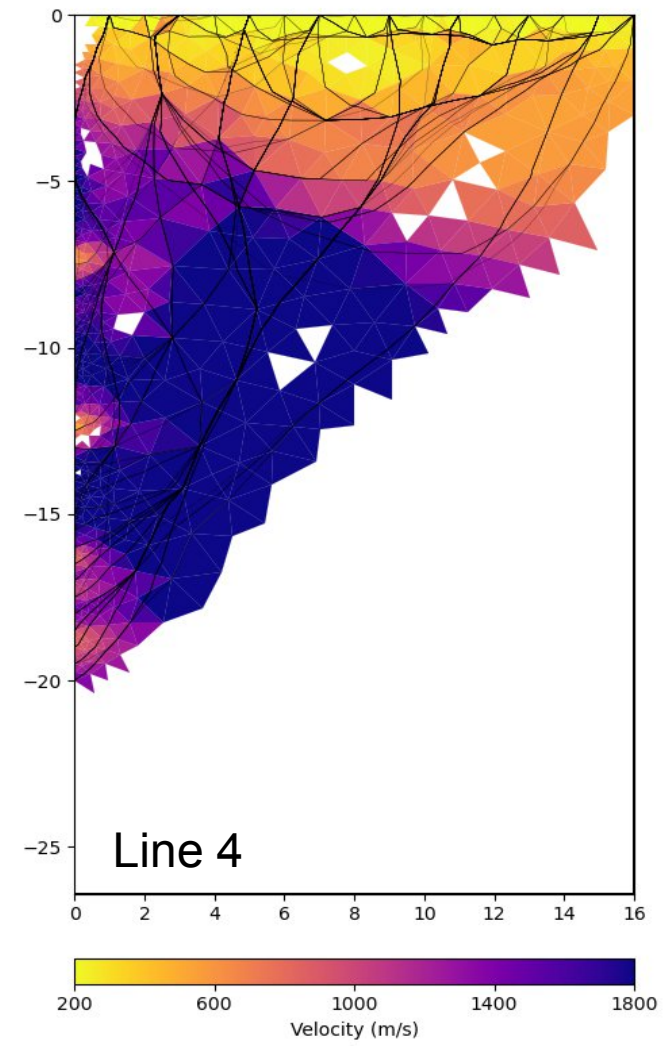
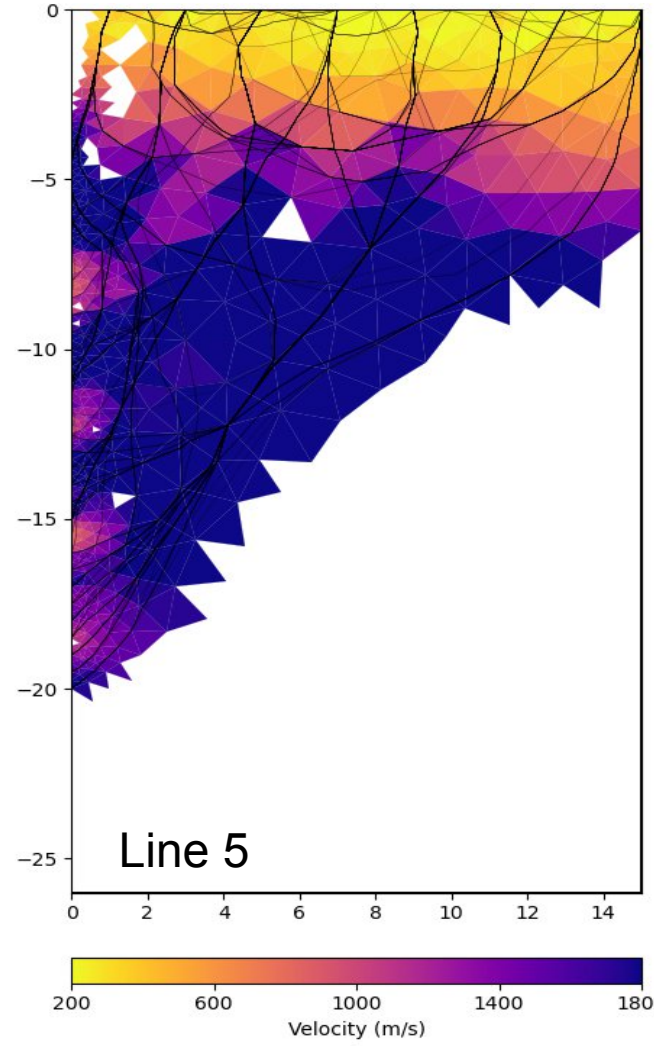
Line 1, short distance from the well  $x_s = 13$  m



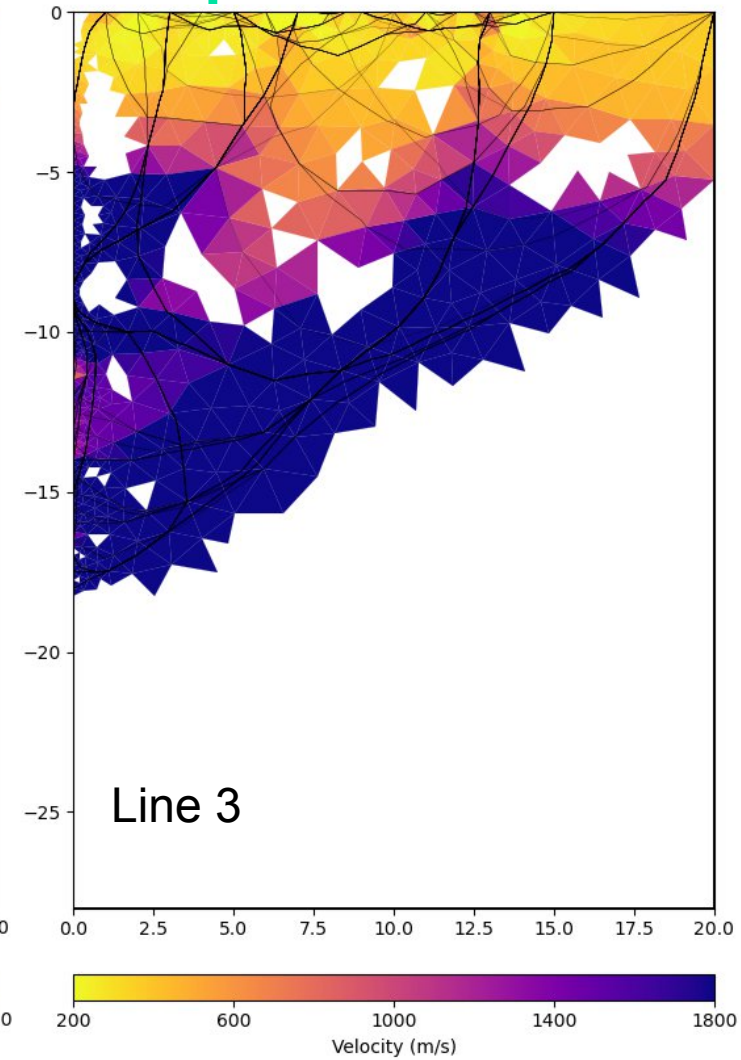
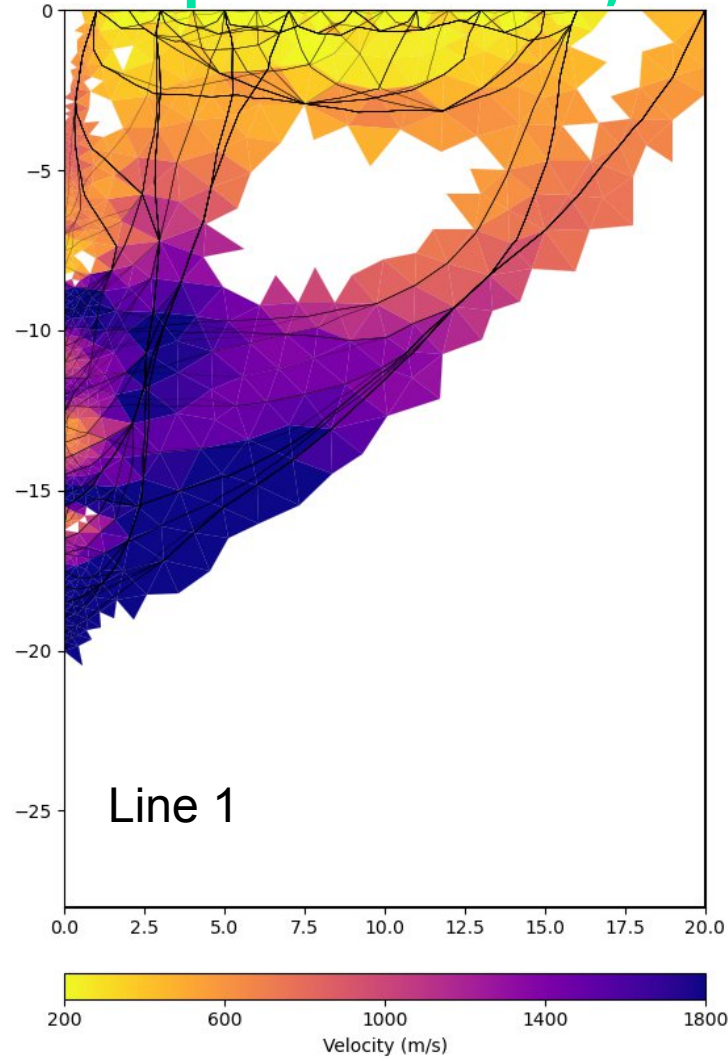
# Acquisition scheme: DAS + traditional geophones



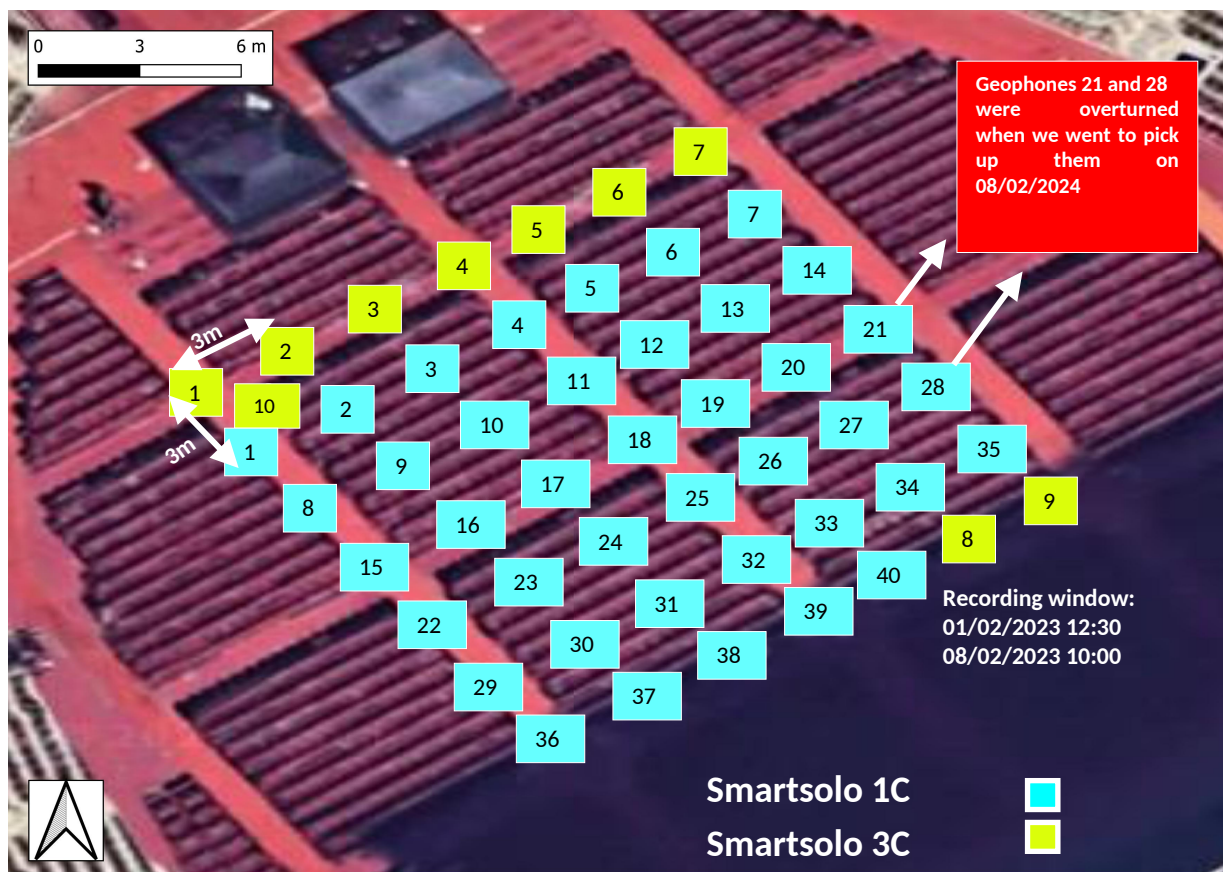
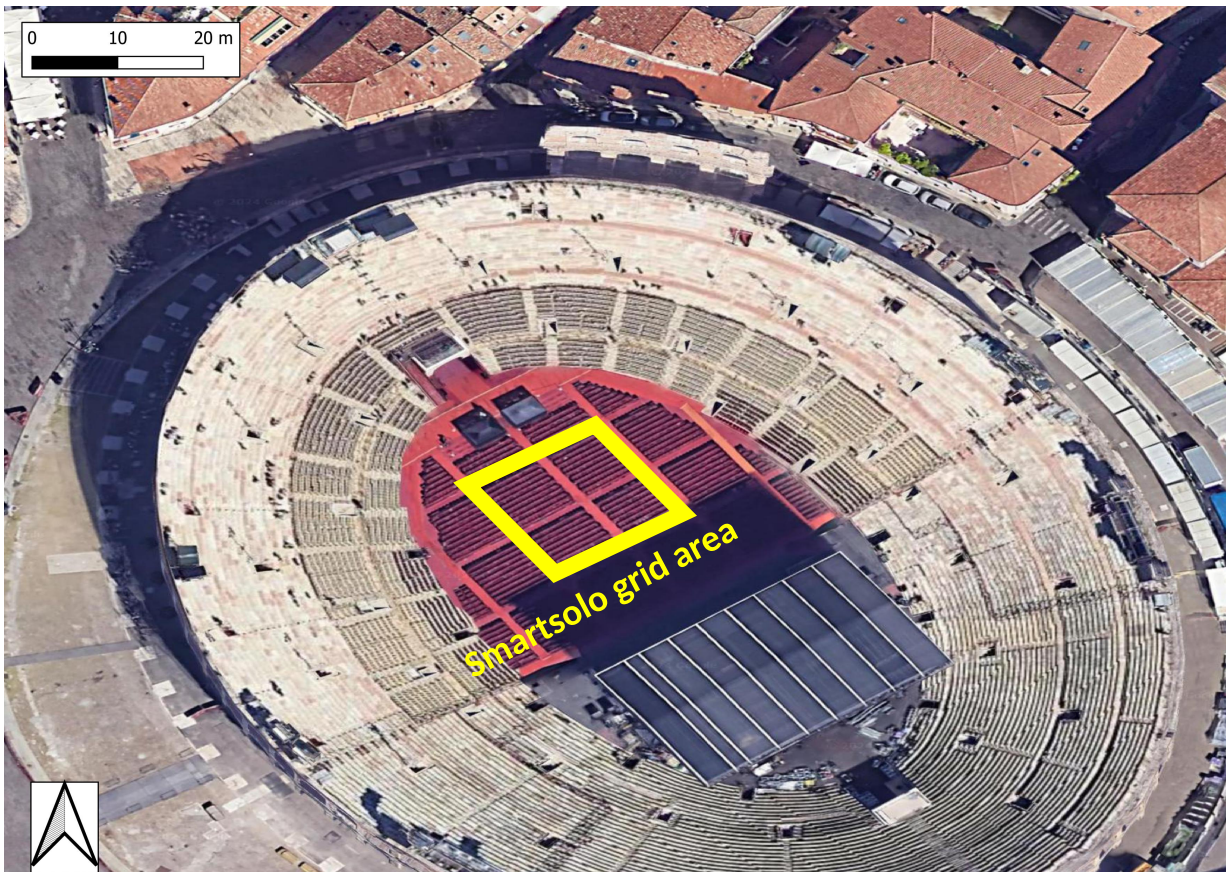
# First arrival tomography: 2D Vp sections, south part



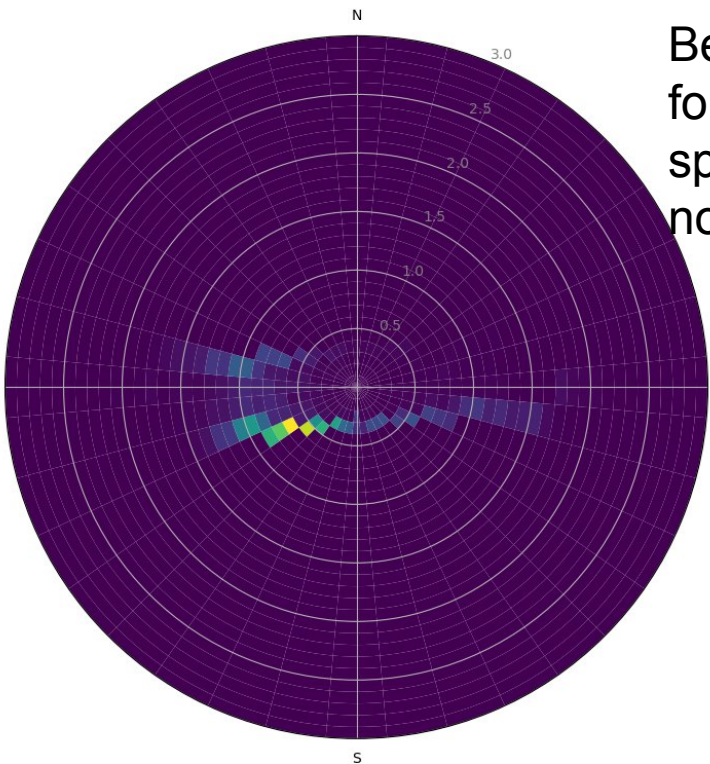
# First arrival tomography: 2D Vp sections, north part



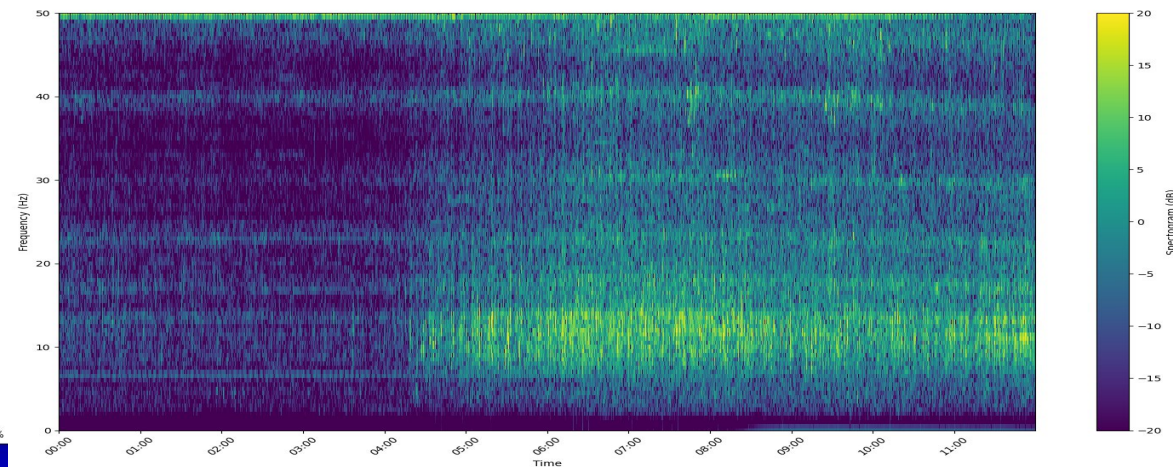
# The Arena of Verona: noise measurements by SmartSolo geophones



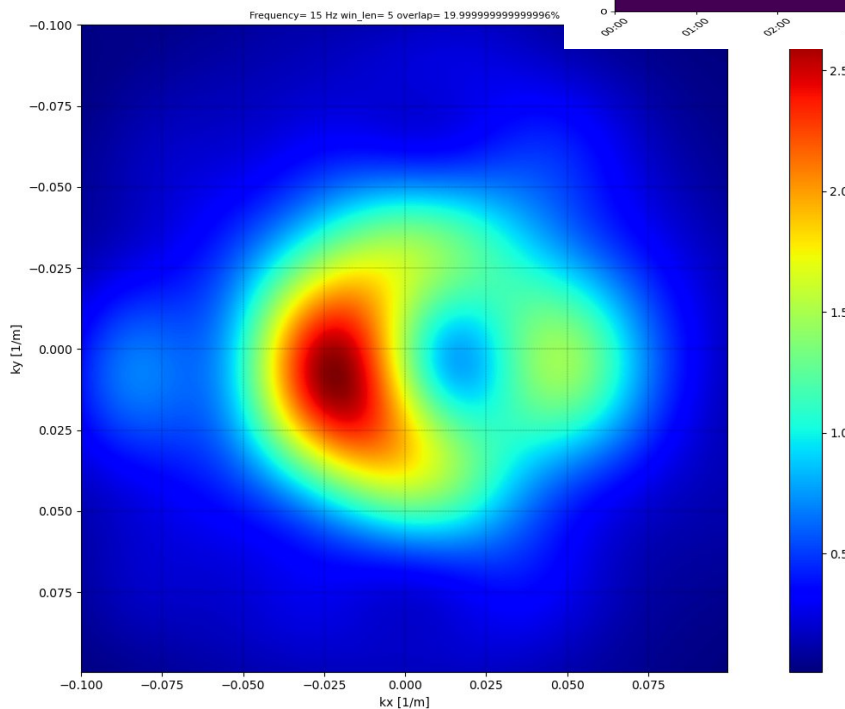
# The Arena of Verona: noise measurements by SmartSolo geophones



Beam-forming for Feb,2, for 9-11 Hz frequency – space distribution of the noise



Noise spectrogram for Feb,2 – time distribution of the noise



Beam-forming for Feb,2, for 10 Hz frequency – space distribution of the noise

# Further steps

- Assess possible biases brought by the DAS configuration compared to point receivers at the small scale of our experiment
- Working with seismic noise data recorded by DAS to determine its applicability for shear wave velocity model retrieval
- 
- 
- 
- Investigation of beam-forming algorithms applicability and restrictions
- 
- Determination of possible screen effect and resonance in the Arena

# Title (Tahoma, 36 pt, left, adjusted)

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e.g For your journal paper

«This research work was performed within the European project USES2 - USES of Novel Ultrasonic and Seismic Embedded Sensors for the non-destructive evaluation and structural health monitoring of infrastructure and human-built objects (<https://www.uses2.eu/>), which has received funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie Grant Agreement No. 101072599. »



- Write your text here

e.g For a USES<sup>2</sup> report

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# Graphic charter

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	27	17	64

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