

Long-term measurements of infrasounds at Sos Enattos mine, one of the candidate sites for the Einstein Telescope

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20-22 February 2025



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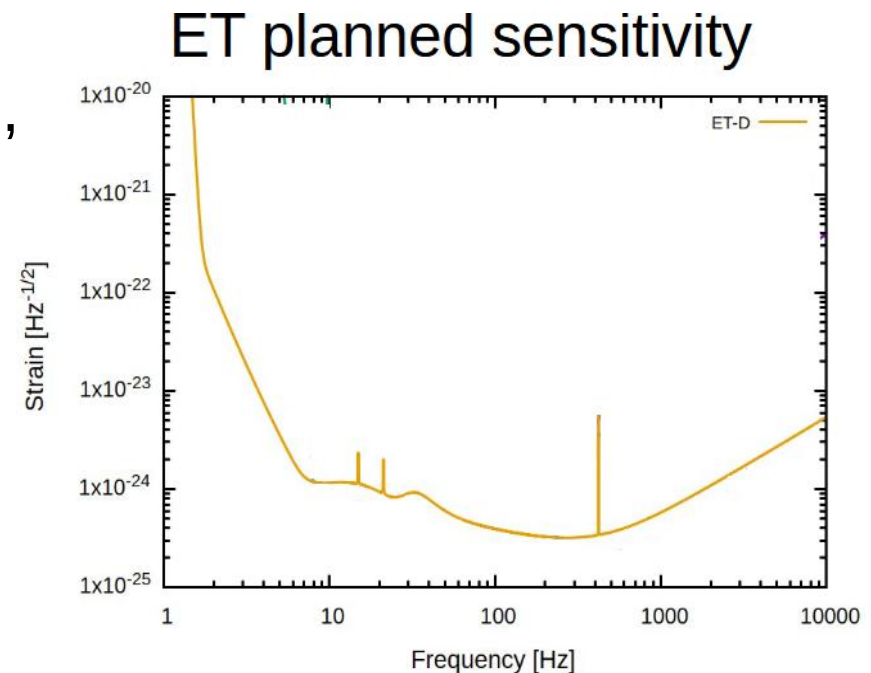


The infrasound installation in Sardinia

- Sosenattos mine: a place similar to the destination site for the telescope
- Aim of the project: characterization of the infrasound field in the mine
- Infrasound are one of the components of the Newtonian noise

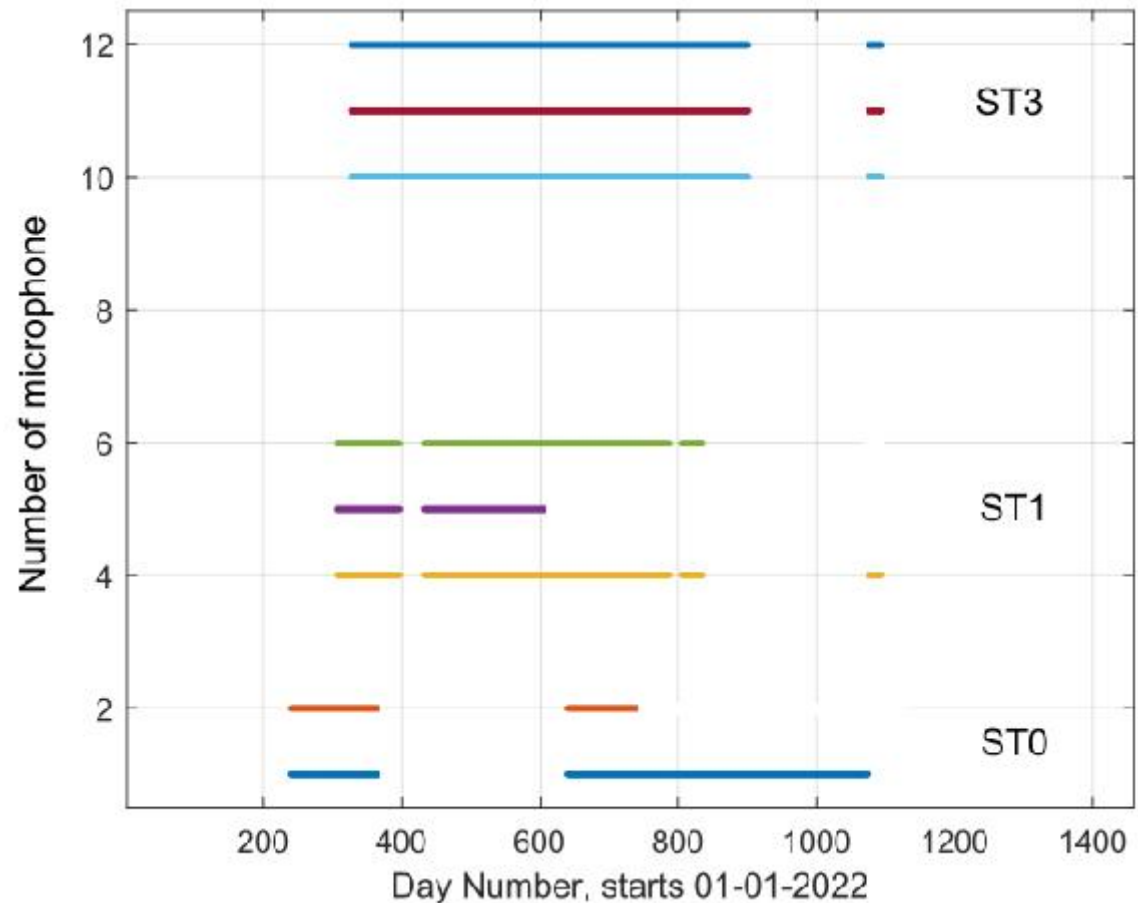
Setup:

- Multipoint infrasound measurements, (8 microphones placed)
- Two types of infrasound sensors (infrasound microphones):
 - GRAS 47AC 1/2"
 - Astrocent microphones



Data from Sardinia

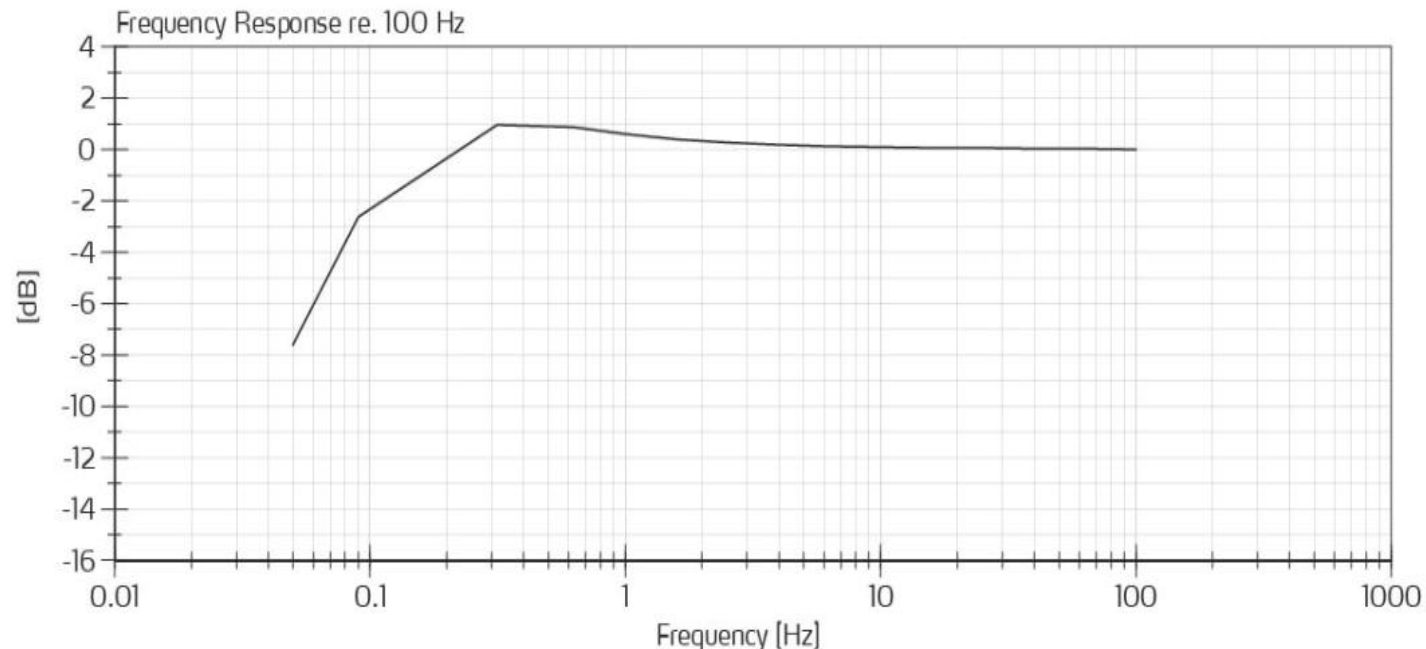
- More than 2 years of data (since 21st Nov. 2022 till now 12th Dec 2024)
- Data stored at public:
https://intra.astrocent.camk.edu.pl/sos_enattos/
- Data miniseed format
- ST0: 1608 days of data 2x microphones (804 per mic.)
- ST1: 1540 days of data 3 microphones (513 per mic.)
- ST3: 1812 days of data 3 microphones (604 per mic.) data till 19.02.2025



GRAS 47AC 1/2" CCP Infra-Sound Microphone Set

Condenser microphone set for infra-sound measurements in open acoustic fields

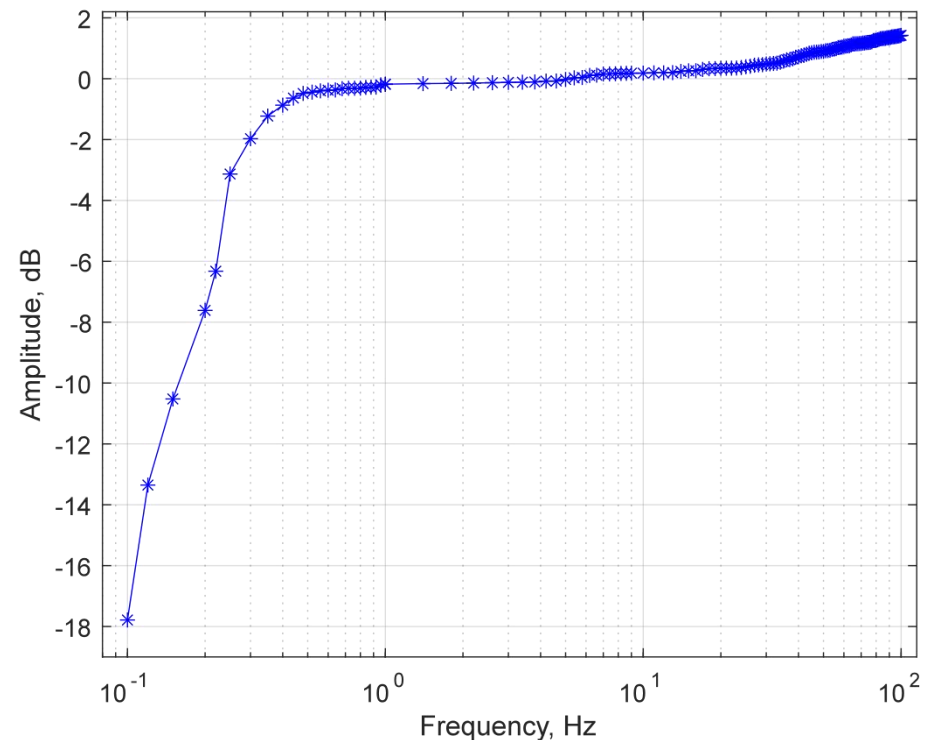
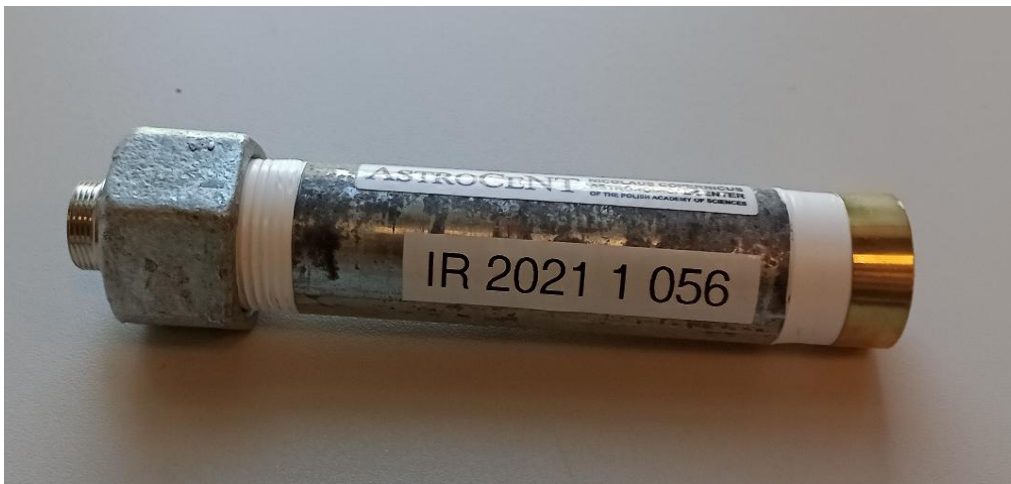
- frequency range: **0.09 Hz** to 10 kHz
- dynamic range: 20 dB(A) to 148 dB
- sensitivity: **8 mV/Pa**



<https://www.grasacoustics.com/products/special-microphone/infra-sound-microphones/product/712-47ac>

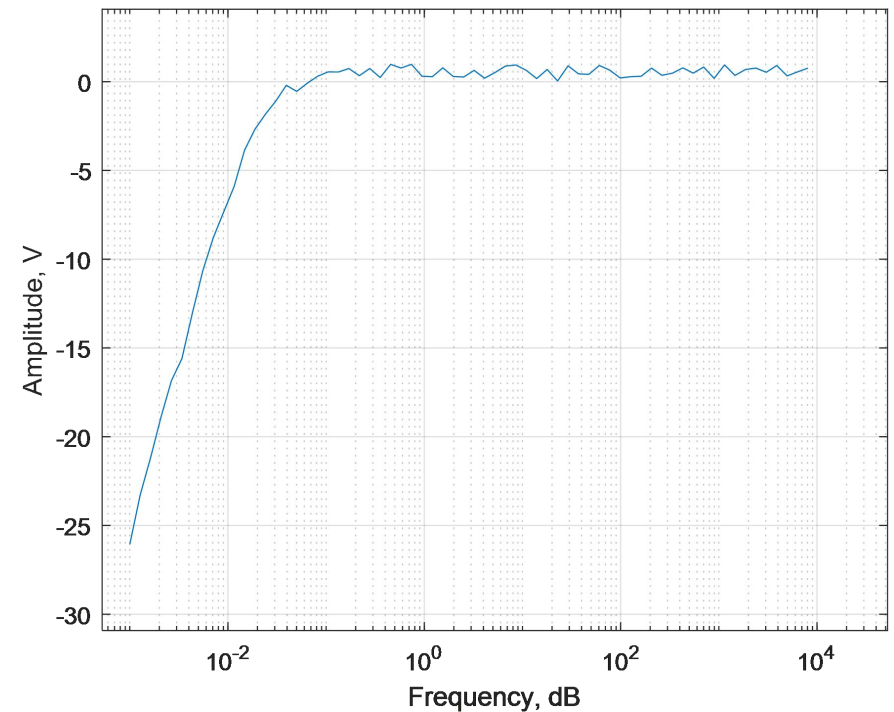
Infrasound microphones - Astrocent

- Developed by the Astrocent team
- Low-cost infrasound microphone ~100 EU
- Frequency range from **0.1 Hz** to 120 Hz (AC47 Gras from 0.09 Hz to 20 kHz)
- Sensitivity: **2.5 mV/Pa**
- Distortion max. 1.5 dB



Improved Infrasound microphones - Astrocent

- Developed by Astrocent team
- Low-cost infrasound microphone ~100 EU
- Frequency range from 0.04 Hz to 120 Hz (AC47 Gras from 0.09 Hz to 20 kHz)
- Sensitivity: 46 mV/Pa
- Distortion max. 1 dB



Sos Enattos mine

The mine consists of tunnels with caverns



Caverns:



ST0 - Surface Station

- Autonomus system, power supply from solar panels
- 1x GRAS 47AC 1/2", 1x microphone developed by Astrocent
- data synchronized by GPS, 1 pps signal (1 Hz)

November 2022

+2 years

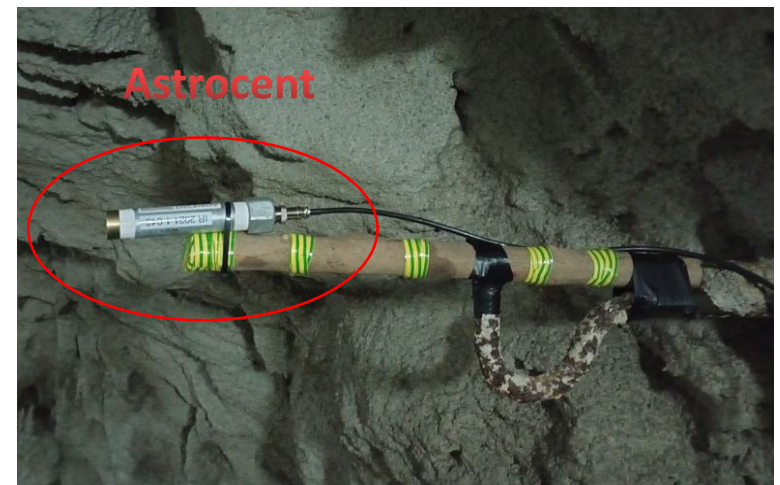
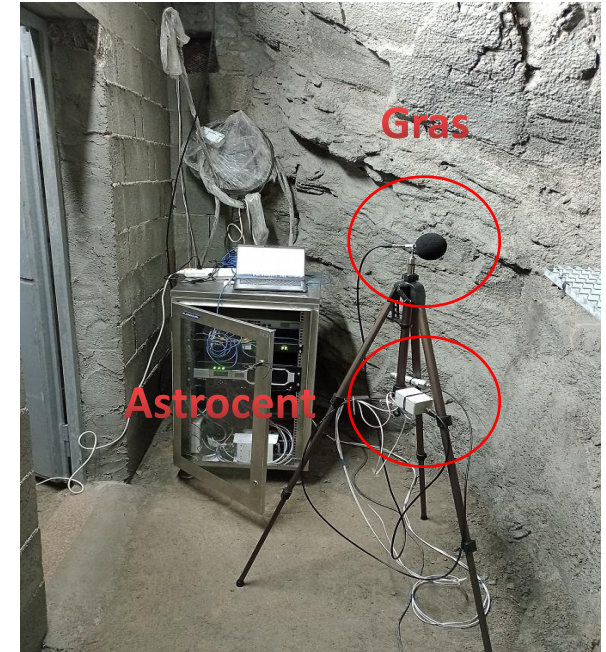
December 2024



Stations

ST1, ST3 - in every station 3x infrasound microphones

- Data synchronized by NTP server via Internet
- 1x Gras + 1x Astrocent microphone (inside the cavern)
- 1x Astrocent (outside the cavern)

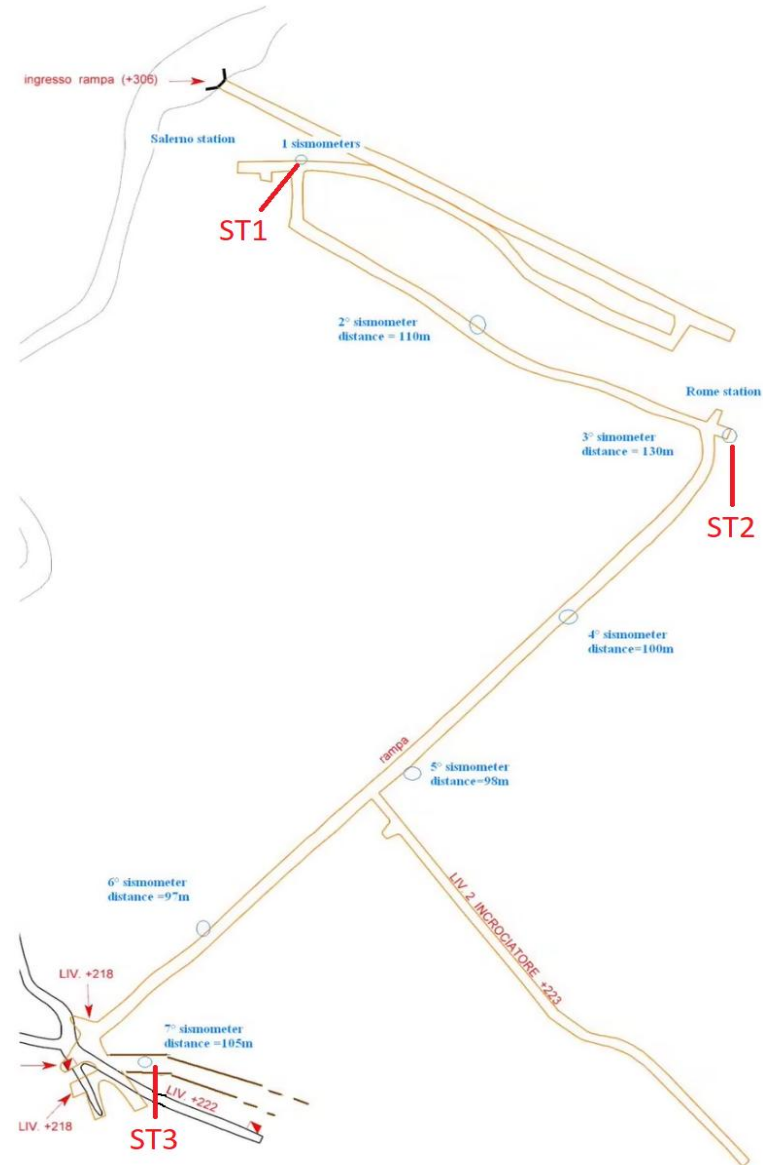


Sardinia - Sos Enattos Mine

ST1 (300 m)

ST2

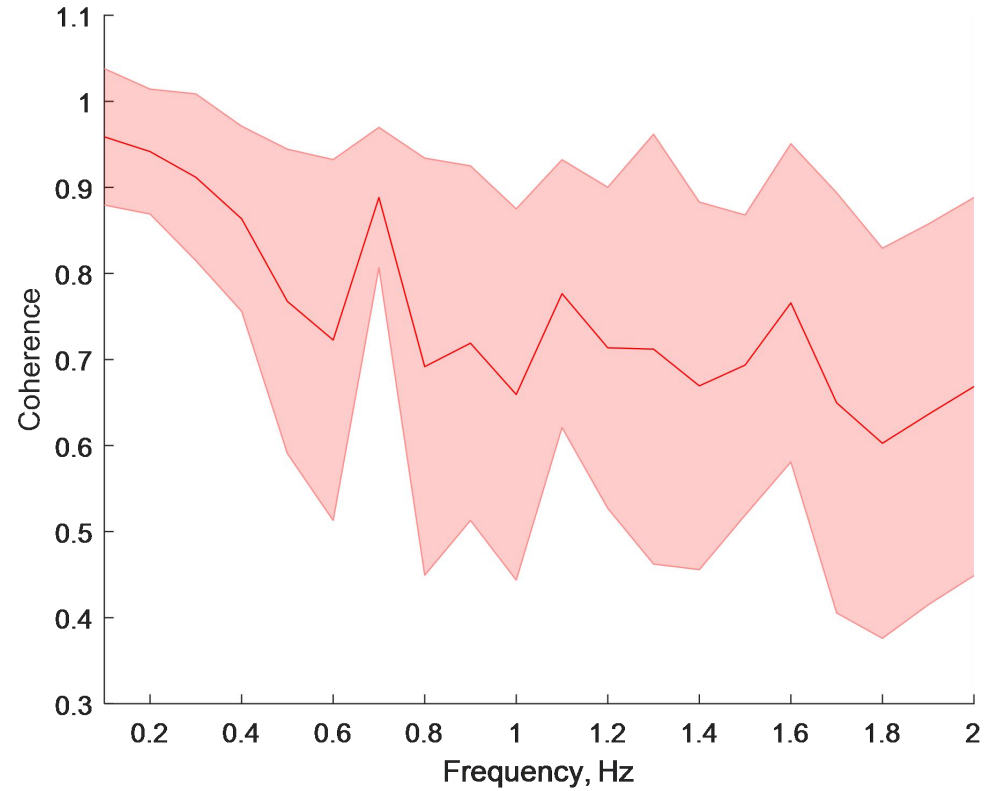
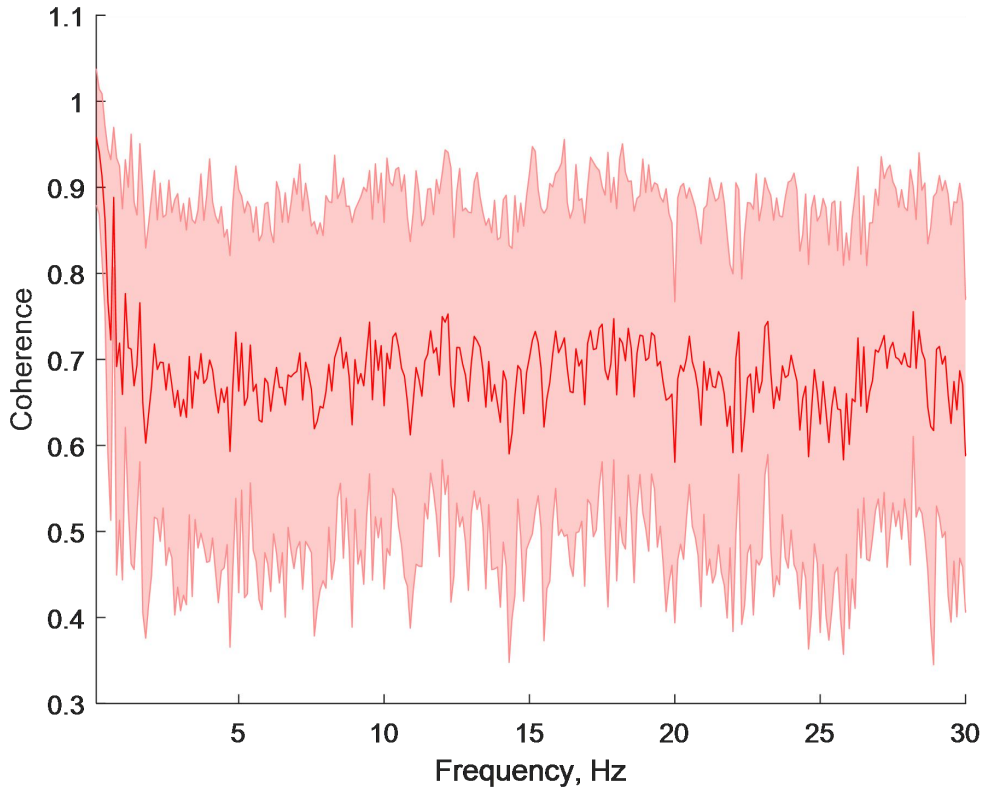
ST3 (222 m)



 IGEA SPA INGEGNERIA GEOLOGICA	MINIERA SOS ENATTOS
	PERCORSO SOTTERRANEO
Disegnato SETTORE CARTOGRAFICO	Resp. Tecnico
LUGLIO 2015	scala 1 : 1.000

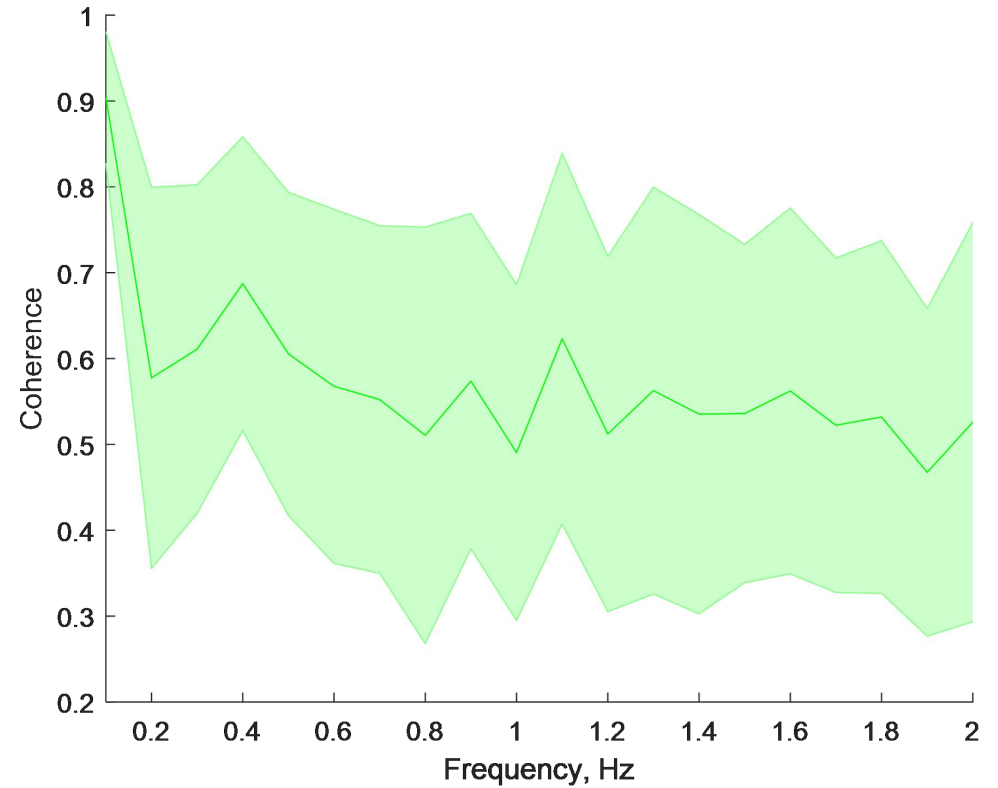
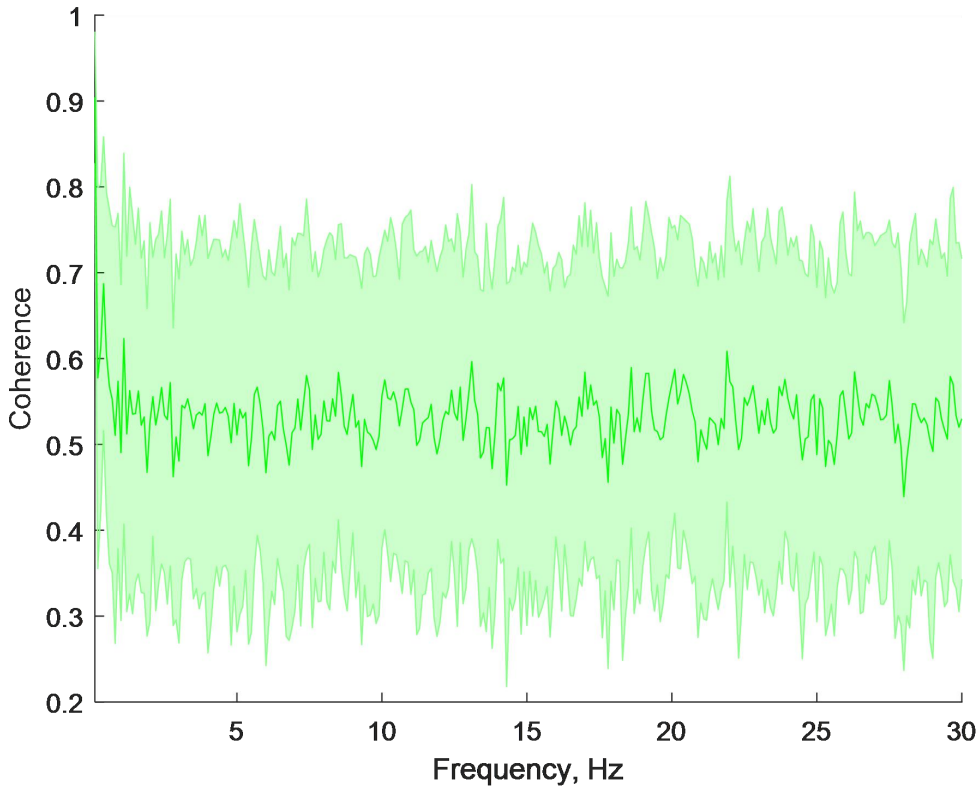
Coherence inside the mine ST1 & ST3

ST1 & ST3 Gras 47 AC



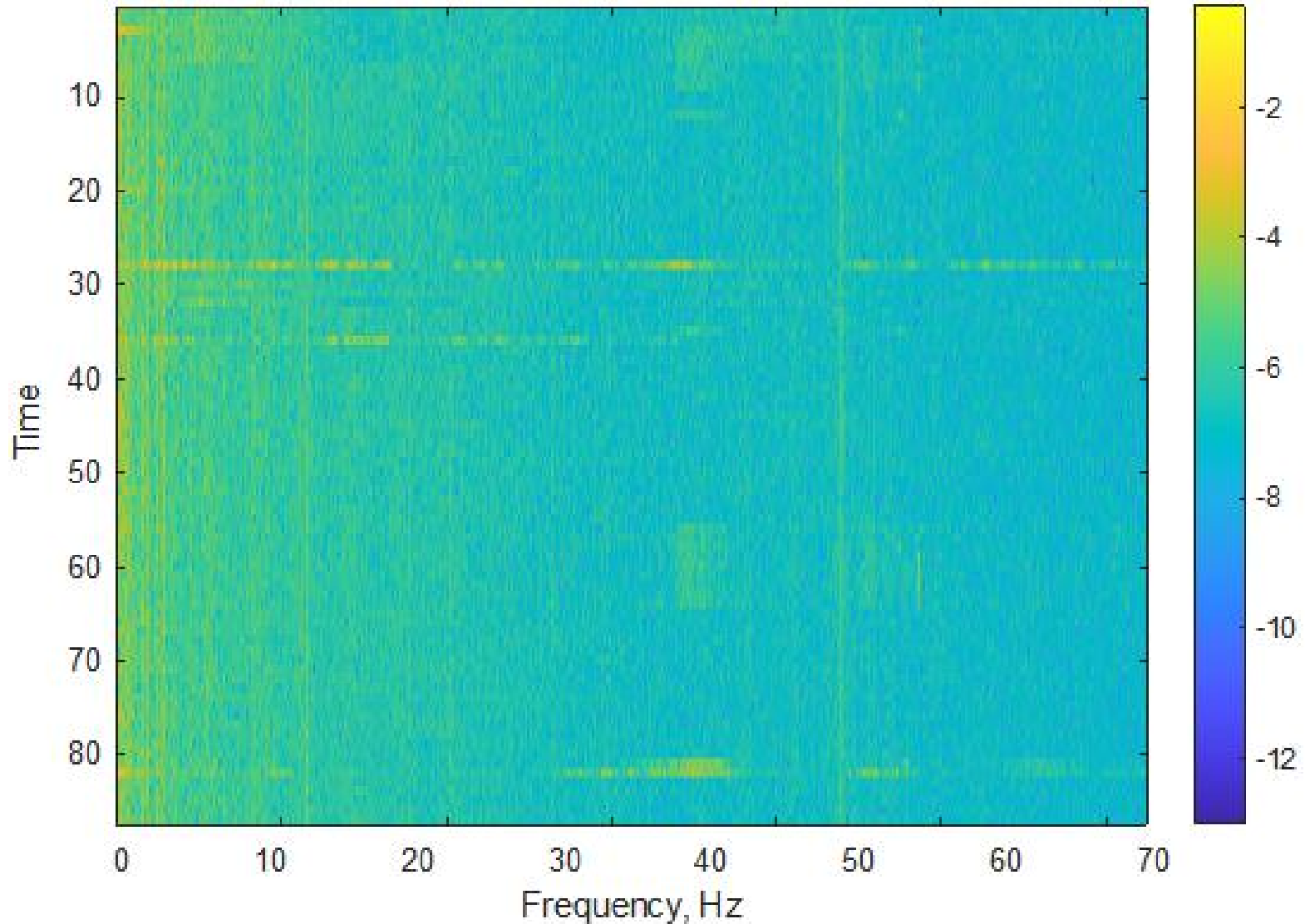
Coherence ST0 (surface) & ST1/3 (inside)

GRAS 47 AC



Long-term ST3 (inside mic.)

GRAS 47 AC



Conclusions

- Very high coherence between microphones below 0.6 Hz, inside and outside sensor
- Data from the weather station is also available, we want to study the effect of wind speed on the infrasound signal level
- Sosnattos now 4x infrasound microphones inside the mine, 2 outside

Thank you for your attention
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