

# Environmental sensors not only in science

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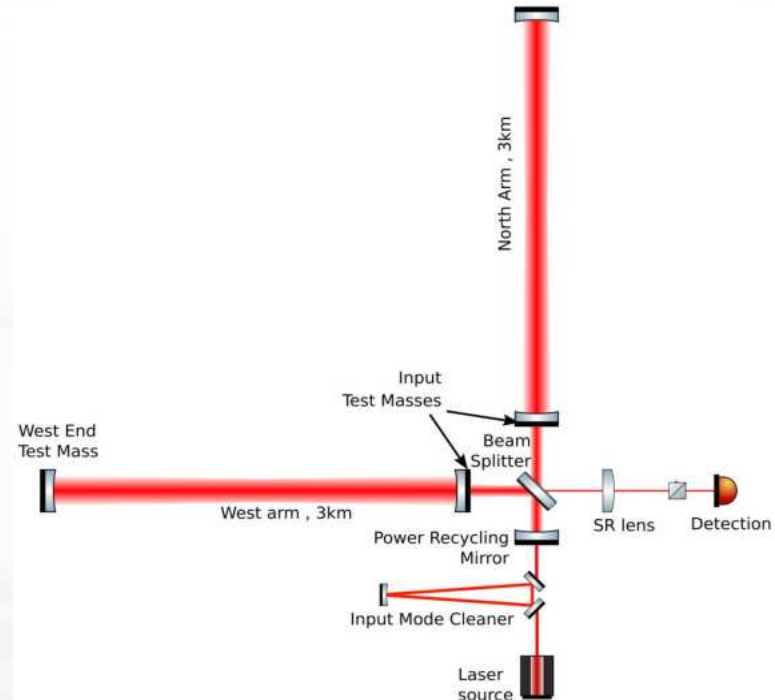
Geoplanet - Sopot, November 28-29 2024

# Environmental Sensors

- Seismic and infrasound monitoring in Gravitational Wave Observatory - VIRGO
- Laser interferometer
- 3-km arms



<http://public.virgo-gw.eu>

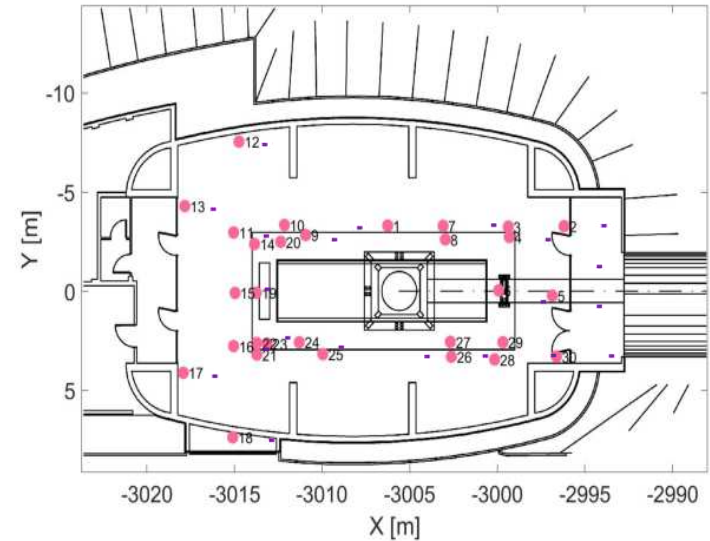


# Seismic and infrasound monitoring - VIRGO

Installed sensors in **NEB**, **WEB**, **CEB** buildings:

- CEB 85 (55 seismics + 30 infrasounds)
- NEB 38 (30 seismics + 8 infrasounds)
- WEB 56 (30 seismics + 26 infrasounds)

Total 179 seismic (115) and infrasound (64) sensors



Pink circles – seismometers

Violet rectangles – microphones

# Seismic monitoring - VIRGO

- Seismic sensors
- Innoseis sensors based on 4.5 Hz, geophone

Old

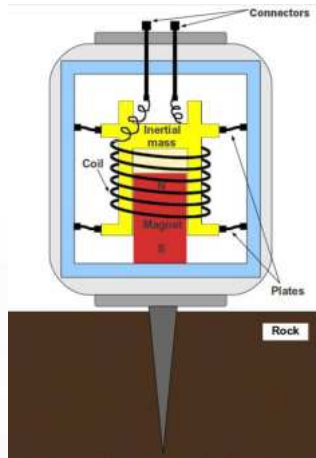


New



# Low cost seismic sensor

- Typical - geophone
- Passive devices and typically a spring-mounted wire coil moving within the field of a case-mounted permanent magnet to generate an electrical signal



<https://shop.raspberrysake.org/product/geophone-earth-sensor-cut-open/>  
[https://link.springer.com/content/pdf/10.1007%2F978-3-642-35344-4\\_172.pdf](https://link.springer.com/content/pdf/10.1007%2F978-3-642-35344-4_172.pdf)

# Infrasound monitoring - VIRGO

- Infrasound sensors
- Sensor: condenser microphone, high-impedance preamplifier
- Frequency range from 0.1 Hz to 20 kHz (reduced to range 200 Hz)
- First distributed measurements in VIRGO (deployment 06.2021, 12.2021)

Old



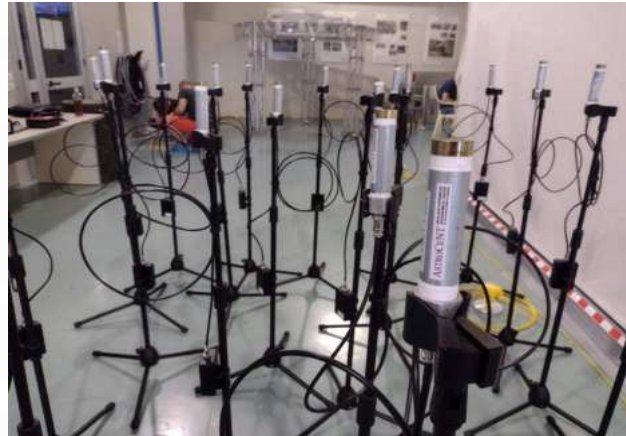
New



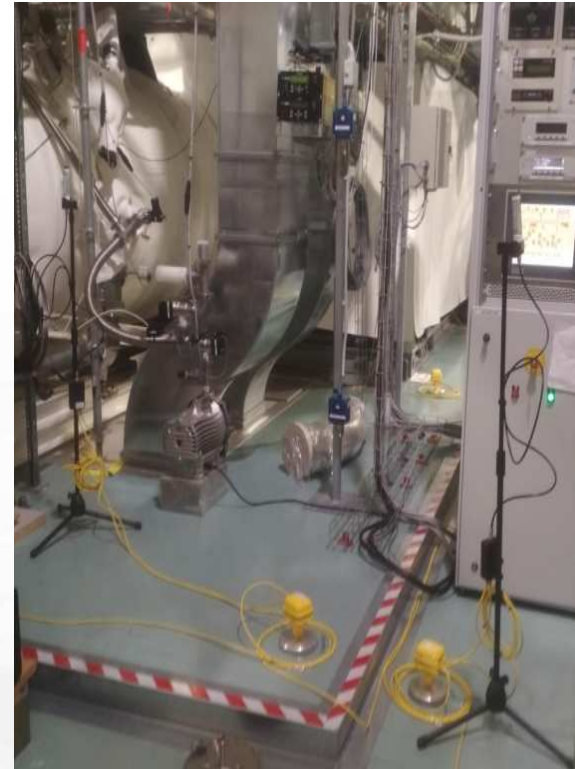
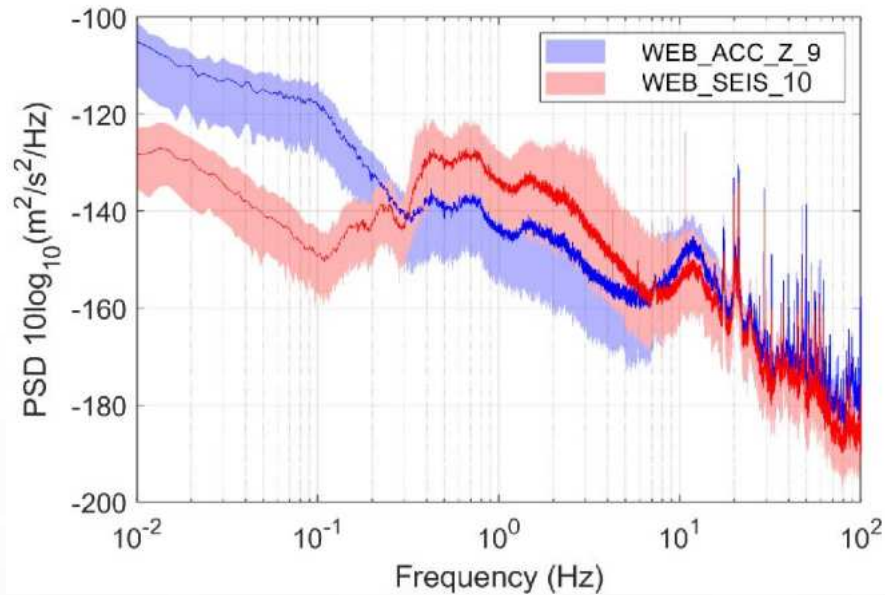


# Seismic and infrasound monitoring - VIRGO

Installed sensors in **NEB**, **WEB**, **CEB** buildings:



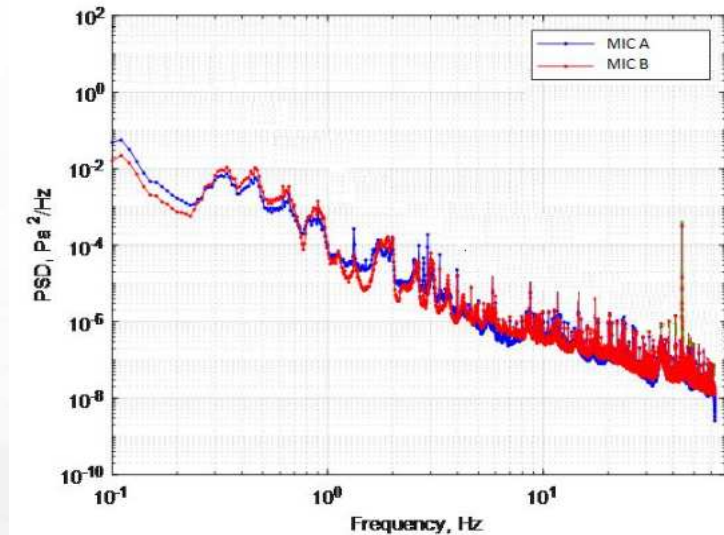
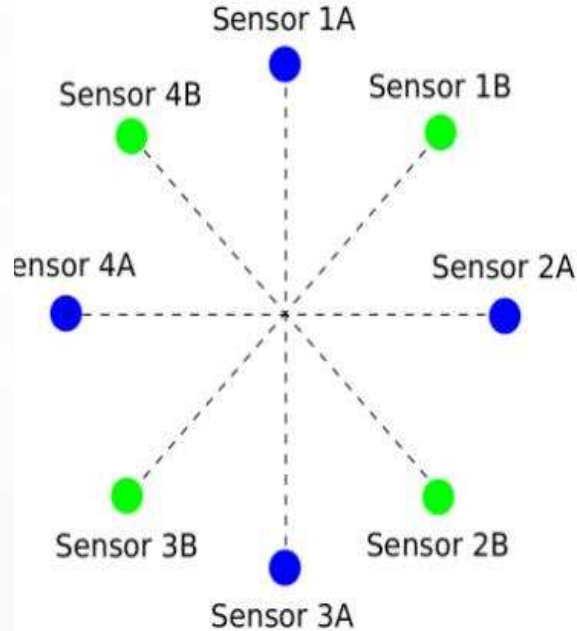
# Seismic and infrasound monitoring - VIRGO





# Infrasound measurements of wind farms

Sensor setup

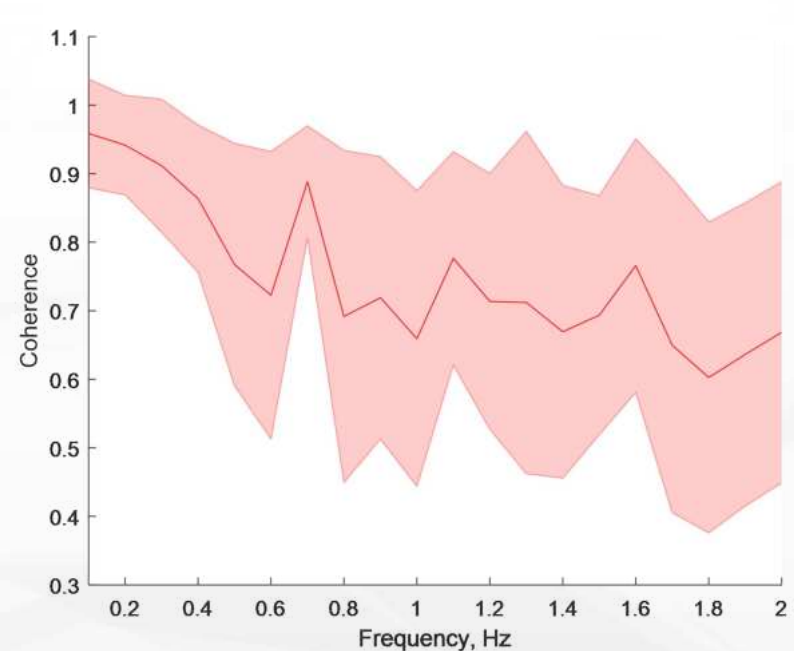
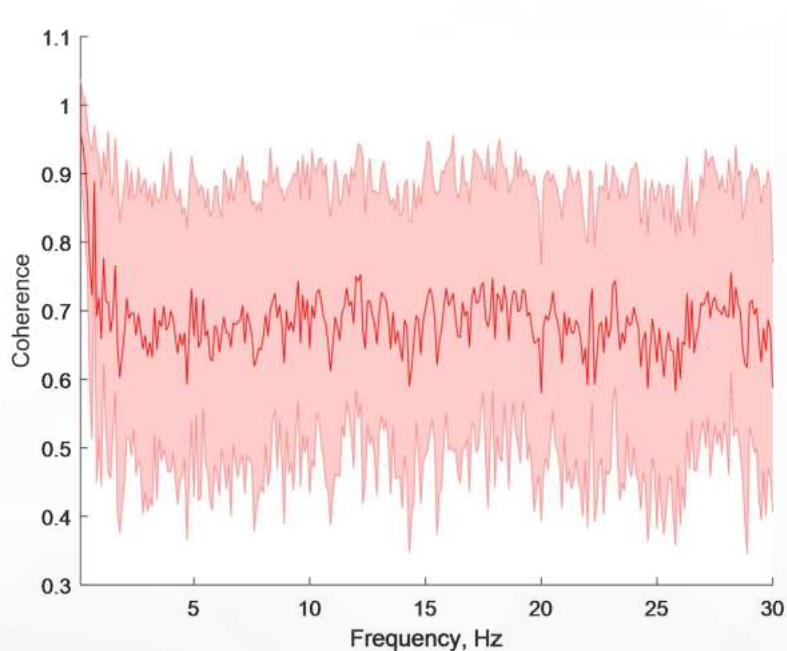


# Infrasound sensors in the Sosenattos mine



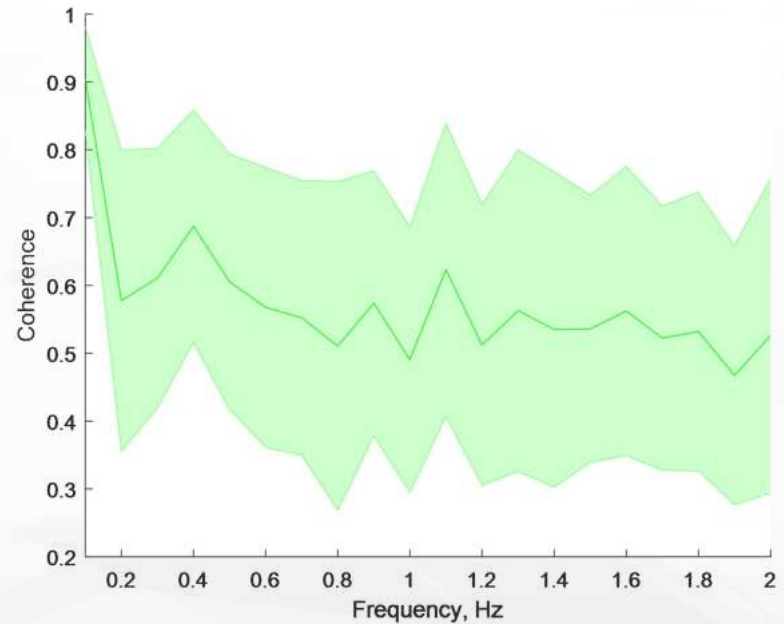
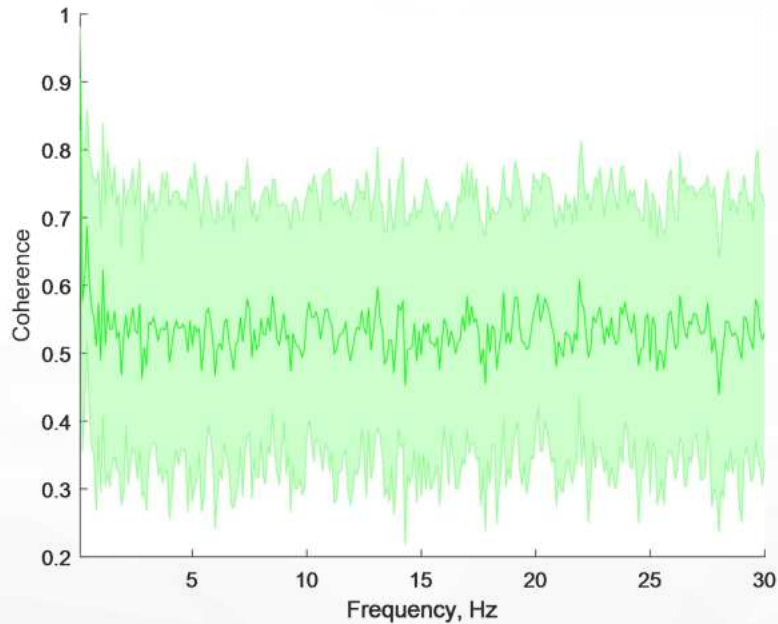
# Infrasound sensors in the Sosenattos mine

## Coherence inside mine sensors



# Infrasound sensors in the Sosenattos mine

## Coherence inside sensors with outside





# Thank you for your attention



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