



Laboratori Nazionali del Sud Università degli Studi di Sassari



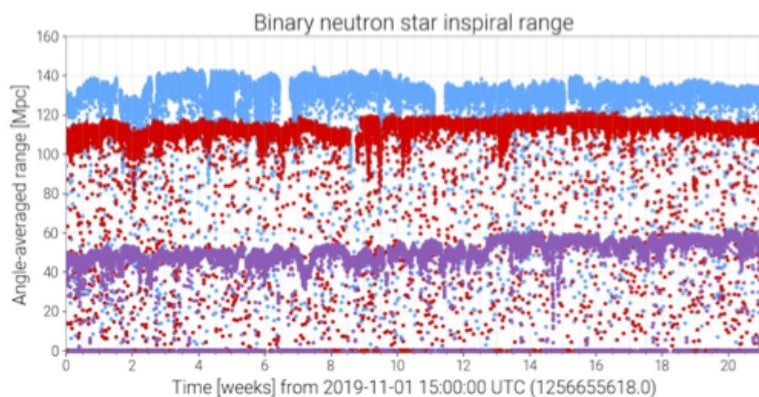
- VIRGO: Search for Burst Multi-messenger event candidates
- ET: Sos Enattos Characterization and Candidature

VIRGO: O3 results

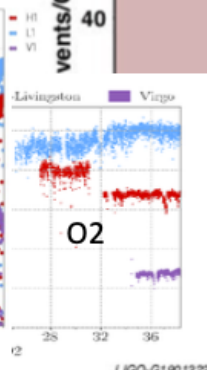


Congratulations on O3!

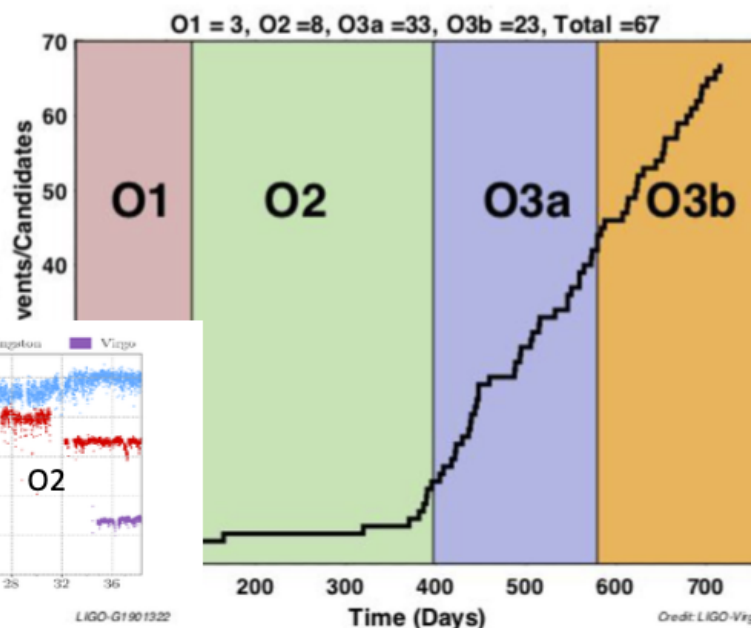
- 11 months of observations
- 56 public alerts
- 2 papers released!
- Dozens of papers in prep!



Credit: P.Brady, LVC Operations Workshop



ET-Punturo



Credit: LIGO-Virgo Collaboration

6

2

VIRGO: Burst Multi-messenger event candidates

GRB analysis during O3a O3a period: April 1st - October 1st, 2019

• Burst Analysis Status

- IFOs sensitivity for burst
 - 45 Mpc for Virgo, 108 Mpc for Hanford and 135 Mpc for Livingston
- 141 GRBs reported by Fermi and Swift
 - 105 analysed (74%) by X-pipeline
 - About 15 were analysed by Sassari's group

VIRGO: Burst Multi-messenger event candidates

FRB analysis during O3a

• **Burst Analysis Status**

- 5 public Fast Radio Bursts (FRBs) to be analysed during O3
- All FRBs listed on FRB Catalog, as well as their properties:
 - FRBCat frbcat.org/
 - Wikipage <https://wiki.ligo.org/Bursts/O3FRBs>
- The analysis design of joint GW-radio transient is being conducted by Sassari's group
- **FRB190417** is under analysis at the moment
 - Test the input file created and the waveforms injected as sources of radio multi messenger event
 - Design to be used by the entire burst GRB/FRB group



VIRGO: Attività 2021

- Data analysis of VIRGO-LIGO data:
 - ❑ Search for Burst Multi-messenger event candidates, related to GRB or FRB

Richieste: 10 keuro per missioni

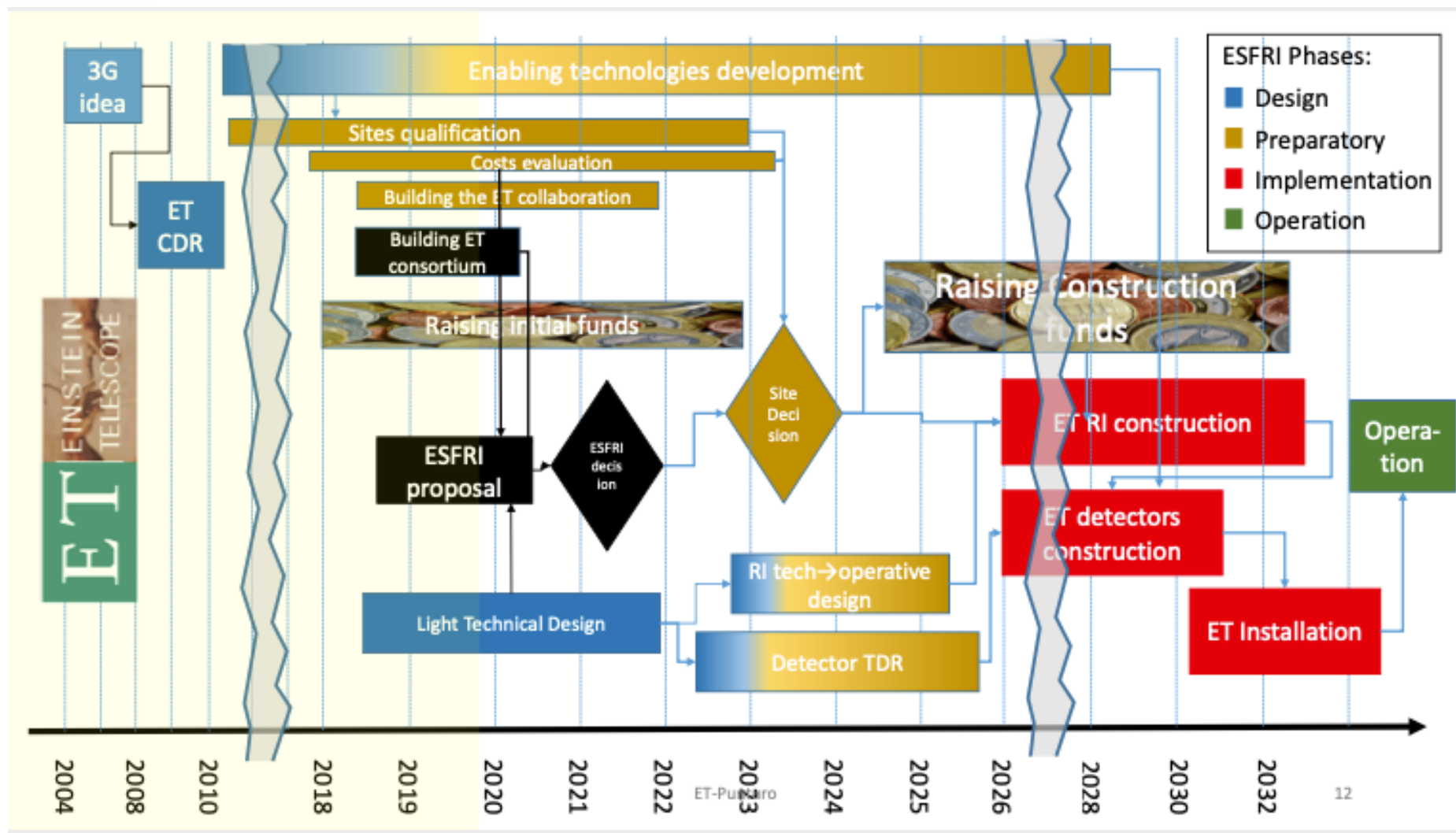


VIRGO: Anagrafica/Richieste 2021

Personel	Virgo FTE
Massimo Carpinelli	0.50
Domenico D'Urso	0.50
Davide Rozza	0.50
Viviana Scherini	0.20
Valeria Sipala	0.40
Iara Tosta e Melo	0.50
Tot	2.7

			(kEuro)
Missioni	N. 6 Meeting Nazionali I fisico x 3 gg		4.5
	N. 3 Meeting Internazionali I fisico x 3 gg		5.5
Tot			10.0

ET Roadmap





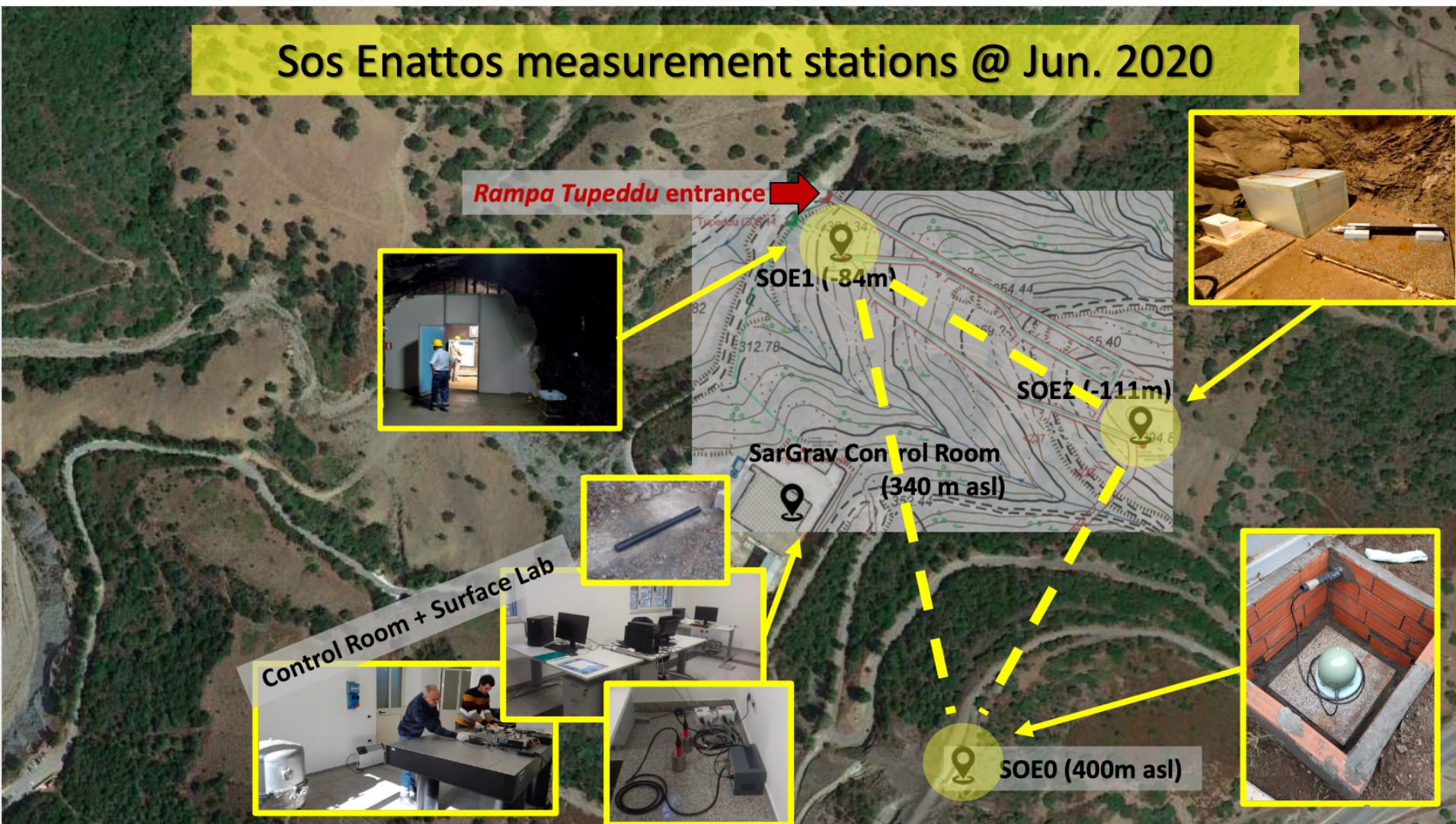
ET: Sos Enattos Characterization

- Sensors on site
 - ❑ 3 broadband triaxial seismometers (1 surface vault installation + 2 underground);
 - ❑ 2 short-period triaxial seismometers (first seed of a new array);
 - ❑ 2 magnetometers (1 buried at surface, 1 underground).

- Data acquired at the SarGrav control room, transmitted via UMTS link to remote server (INGV-PI server → ET repository).

An alternative access point will be implemented through INFN-CA network.

Sos Enattos measurement stations @ Jun. 2020





ET: Sos Enattos Candidature

Next Steps

- A third underground measurement station (SOE3) joins the network (infrastructure ready) for a broadband seismometer (*Nanometrics Trillium I 20H* or *T360*);
- SOE2 infrastructure improvement (ongoing in the first weeks of June 2020);
- **Surface array of short-period seismometers** (10x *Nanometrics Trillium20*, 40x *InnoSeis 5Hz* geophones, 20x 2s-class geophones) at Sos Enattos;
- Infrasound microphone arrays to be deployed in surface and underground;
- Geological survey along the ET “triangle” with georesistivimeter probe.



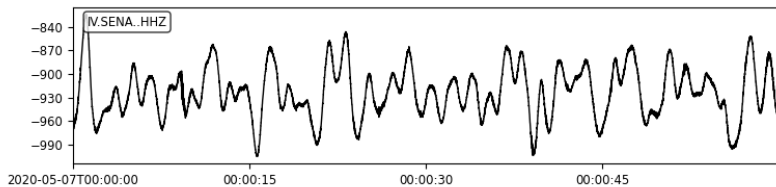
ET: Sos Enattos Candidature

Next Steps

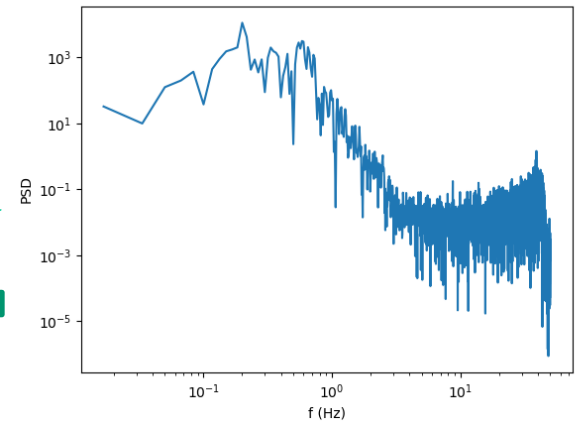
- Borehole excavation (2020)
- Long-period borehole microseismic measurements at depth 250-300m with broadband borehole seismometers (*Nanometrics Trillium I 20 BH Slim*);
- Surface seismic measurements at the corners close to the boreholes with broadband seismometers (*Nanometrics Trillium I 20H*).

First analysis of seismic sensor data submitted

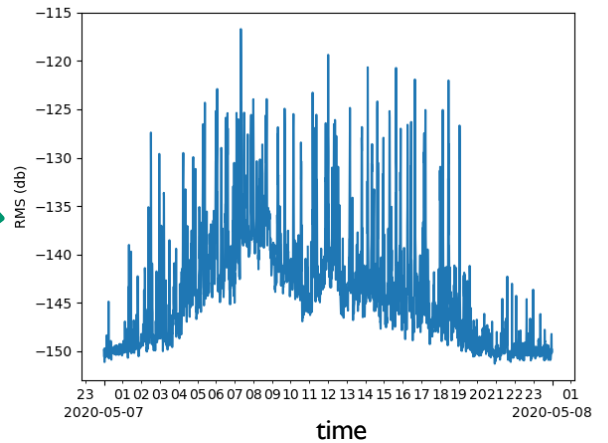
2020-05-07T00:00:00 - 2020-05-07T00:00:59.99



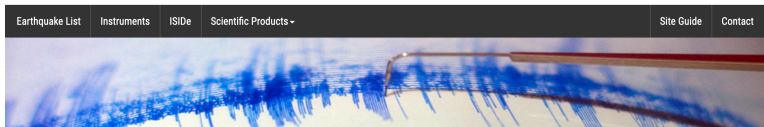
Waveform $\Rightarrow$ PSD



PSD $\Rightarrow$ RMS

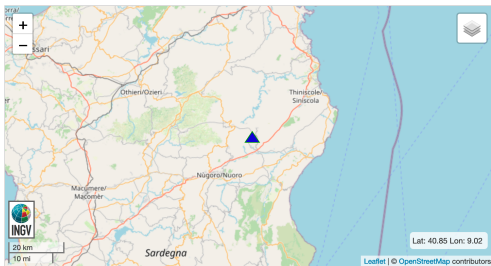


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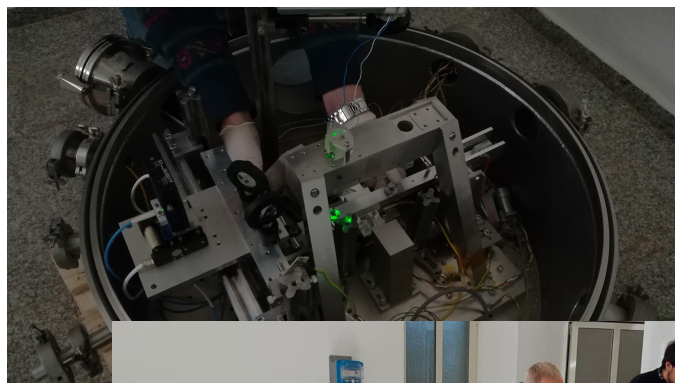


Seismic Station SENA Sos Enattos Mine

Network: IV
Start Date: 2019-10-18T00:00:00
End Date: --
Latitude: 40.4444
Longitude: 9.4566
Elevation: 338
[Download StationXML](#)

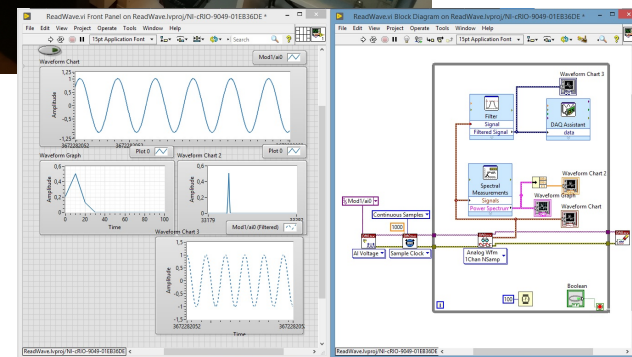
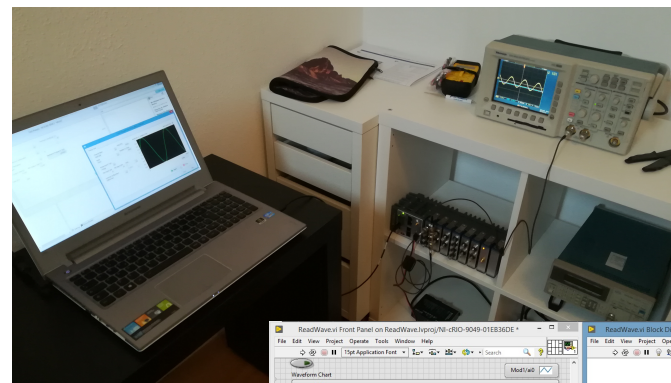


- **Control room preparation**
- **Optical components assembly for the Archimedes balance prototype**



@UNISS

- **Configuration of NI-cRIO-9049 electronic system for Archimedes balance (founded by SarGrav project)**
- **Preliminary test in Real-Time mode**



➤ Candidatura Sos Enattos

- ☐ campagne di campionatura del suolo, operazioni di carotaggio, studi geo-fisici e geo-elettrici sulla natura dei terreni
- ☐ campagne di misura del rumore sismico e ambientale
- ☐ stima degli impatti socio-economici dell'Osservatorio.
- ☐ “sponsorizzazione” sito

Richieste: 10 keuro per missioni

- Misure long-term del segnale sismico in prossimità della localizzazione dei vertici dell'interferometro
- stima noise ambientale (naturale e/o antropico) alla profondità e nella sede prevista per l'infrastruttura
- correlazione con misure analoghe eseguite a diverse profondità all'interno della miniera di Sos Enattos

Richiesta: Installazione e commissioning per 2 sensori TI20SBH/BH

50k euro



ET Anagrafica/Richieste 2021

Personel	Virgo FTE
Massimo Carpinelli	0.10
Domenico D'Urso	0.20
Davide Rozza	0.20
Viviana Scherini	0.30
Iara Tosta e Melo	0.50
Luca Deidda	0.50
Tot	1.8

			(kEuro)
Missioni	N. 6 Meeting Nazionali I fisico x 3 gg		4.5
	N. 3 Meeting Internazionali I fisico x 3 gg		5.5
	Installazione e Commissioning Sensori		50.
Tot			60.0