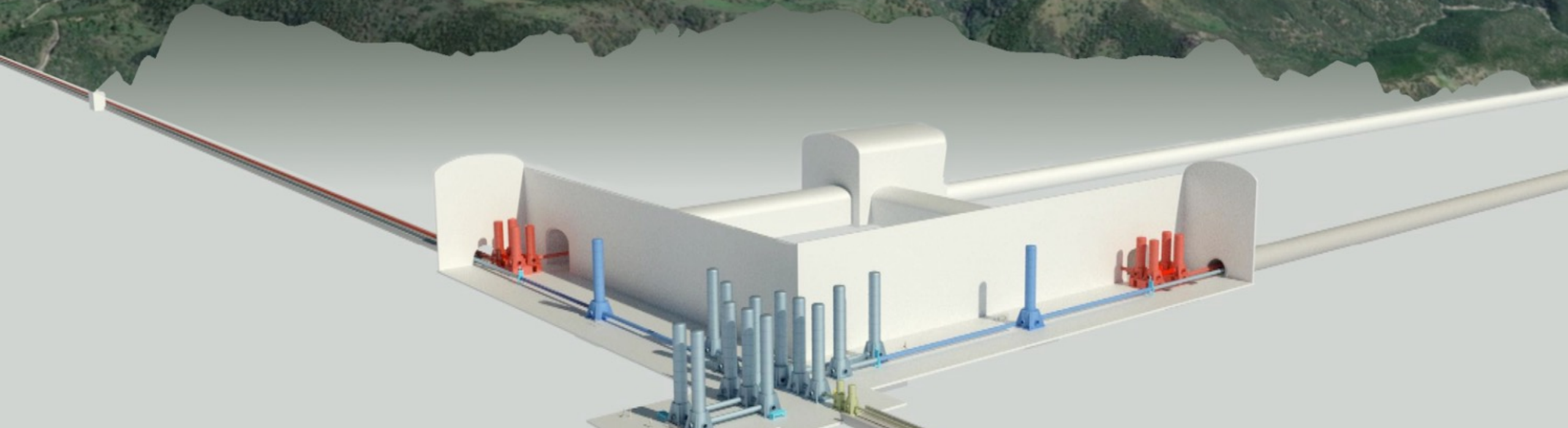


SPB status and updates

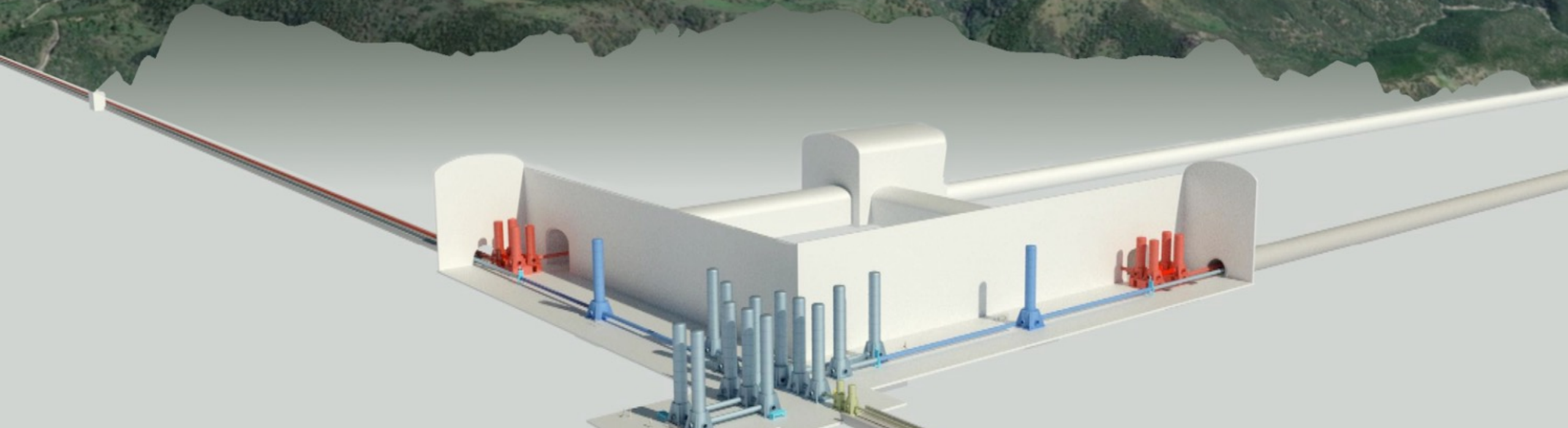


Outline



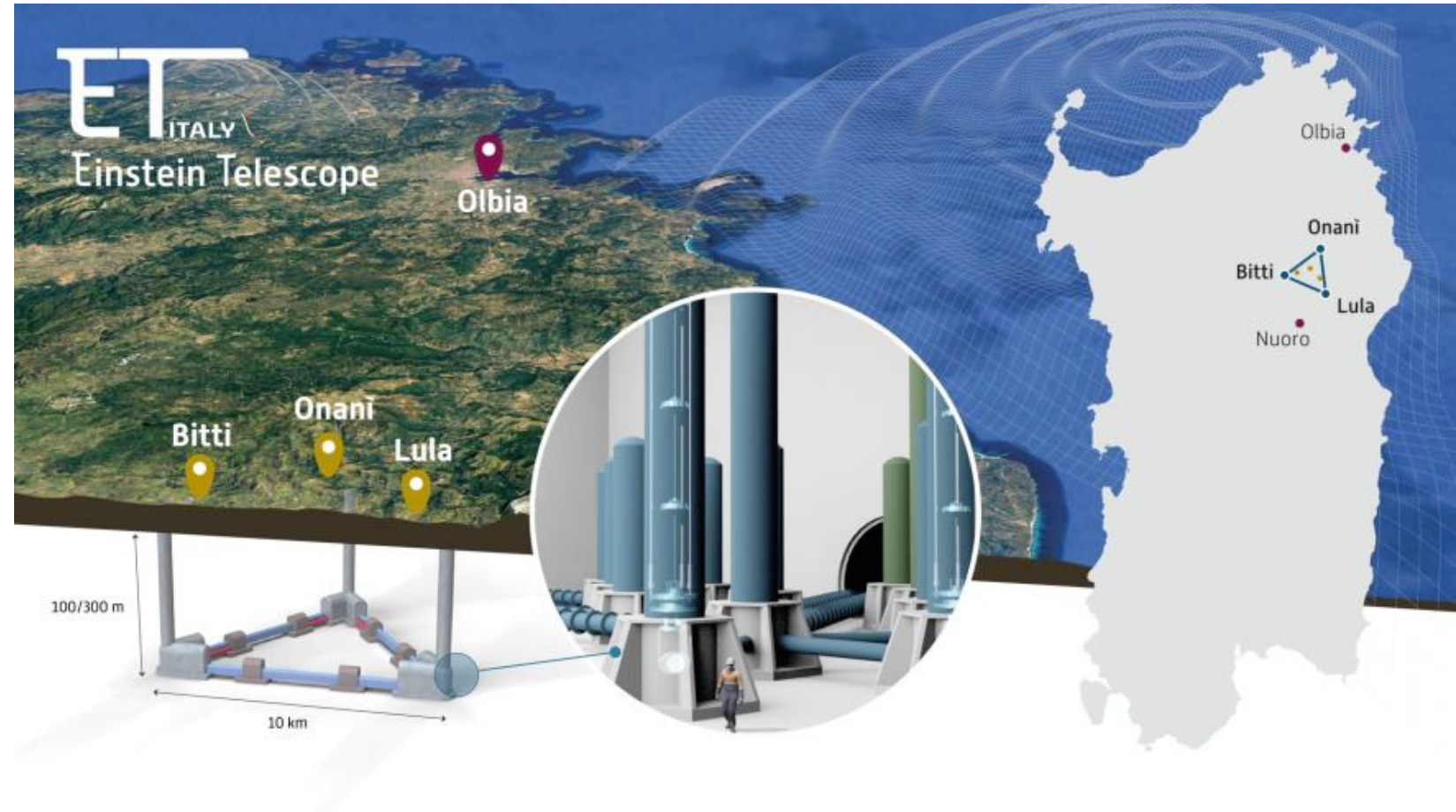
- Sardinia Candidature: status and updates
- EMR Candidature: status and updates
- SPB Workshop follow-up: status
- ET-PP WP4: status
- Interaction with ETO

Sardinia Candidature: status and updates



The Italian Site – Sos Enattos area

- Sos Enattos: former mine with underground access guaranteed through tunnels and shaft
- In the area of the mine, the SARGRAV laboratory, a seed of ET, aims to host underground experiments, cryogenic payloads, low frequency and cryogenic sensor development that need low seismic and anthropogenic noise

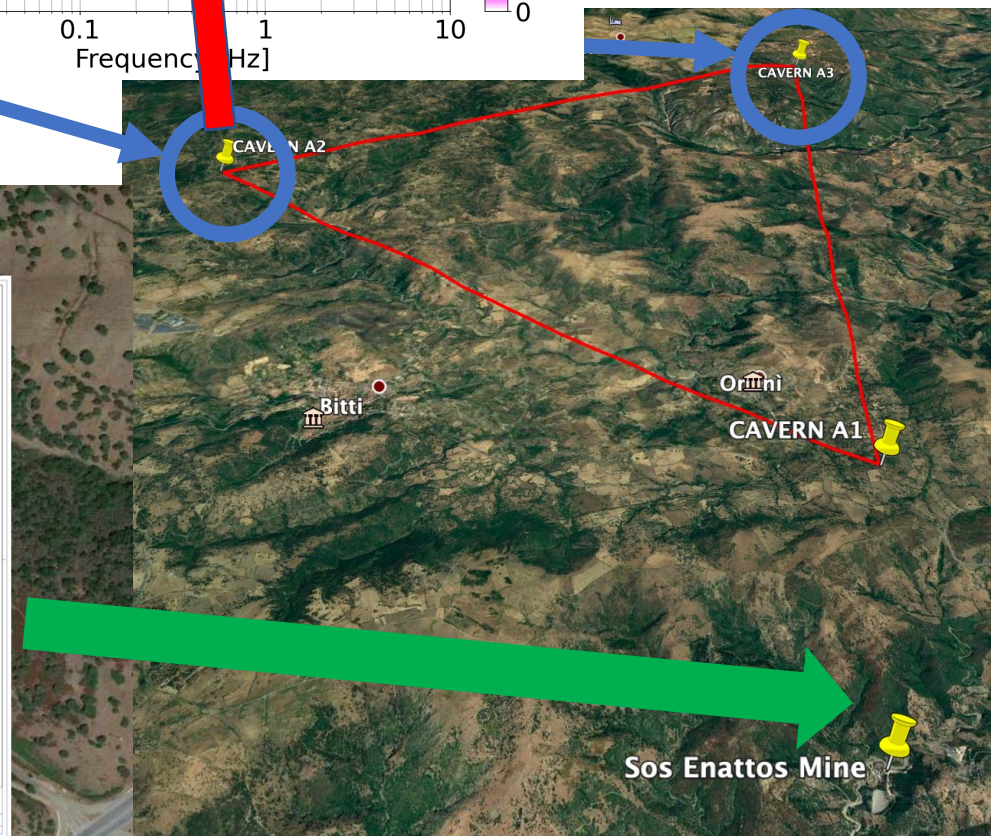
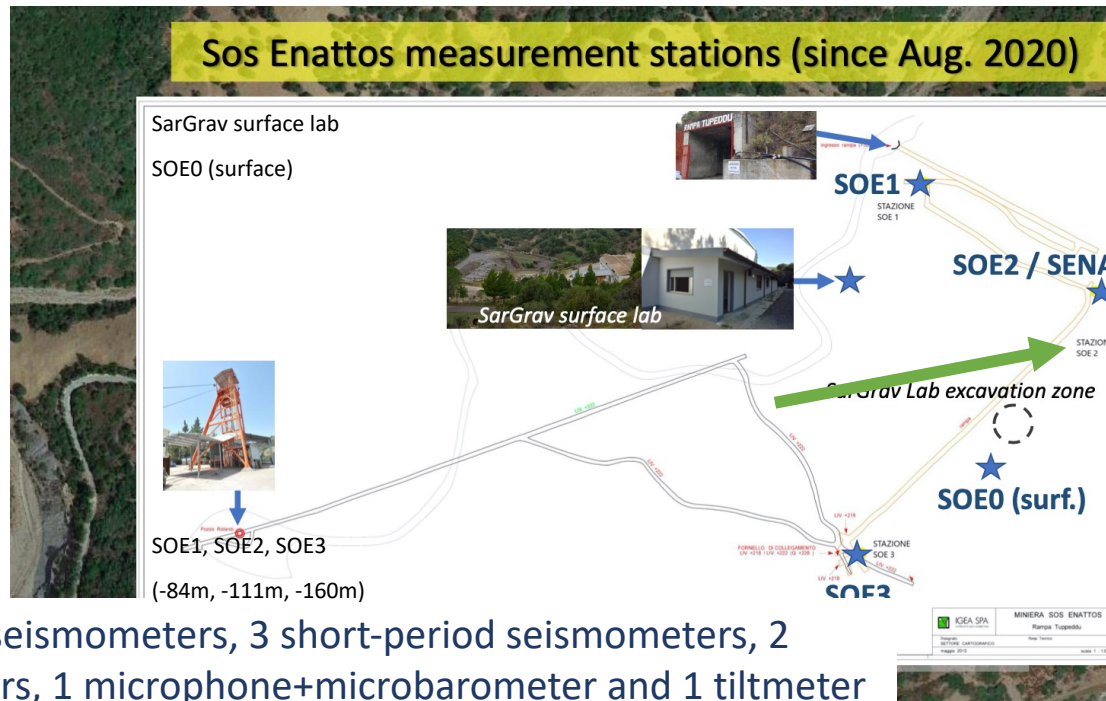
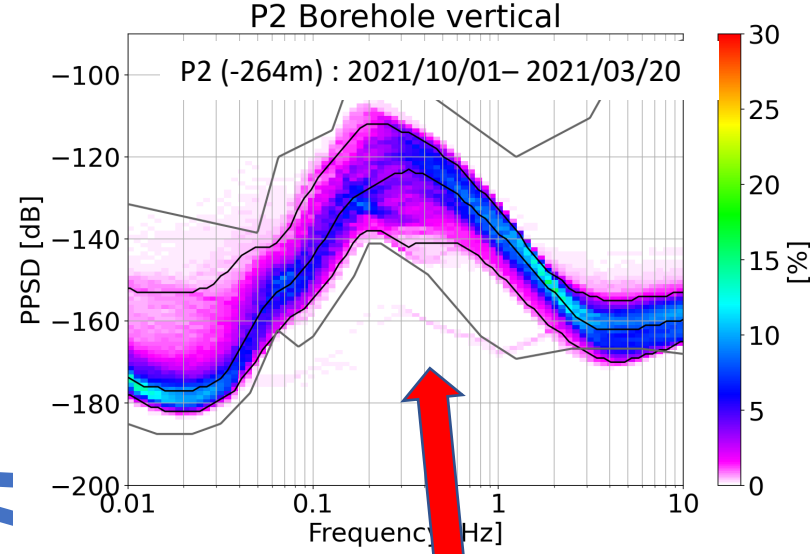


Sardinia Site

Long-term measurements



Characterization of the Bitti and Onani corners:
Surface and underground seismic and environmental measurements



4 broadband seismometers, 3 short-period seismometers, 2 magnetometers, 1 microphone+microbarometer and 1 tiltmeter distributed over underground and surface stations

News and updates



- Tender of the PNRR ETIC project for the preliminary feasibility study for ET in Sardinia has been assigned
- Assumptions: ET located in the area of Sos Enattos (NU, Italy), considering both triangular (six interferometers inserted in a system of tunnels and caverns with an equilateral triangle layout on a side about 11 km) and L shape (two interferometers inserted in a system of tunnels and caverns with an 'L' layout on a side about 16 km) configurations.
- Modeling and Layouts
- Preliminary cost estimate (excavation)
- Evaluation of TBM configuration and tunnel monitoring
- Preliminary indications on the management of excavated lands and rocks
- Preliminary strategy on the management of excavated soil and rock

A screenshot of a news article from the Einstein Telescope website. The article title is 'EINSTEIN TELESCOPE: CORDATA DI AZIENDE ITALIANE GUIDATA DA ROCKSOIL SI AGGIUDICA LA GARA DA OLTRE 12 MILIONI DI EURO'. The date is 'Febbraio 5, 2024' and it is '3 min read'. The image shows a 3D architectural rendering of the telescope's cavernous interior, with large blue and red cylindrical structures and workers in orange safety gear.

News and updates

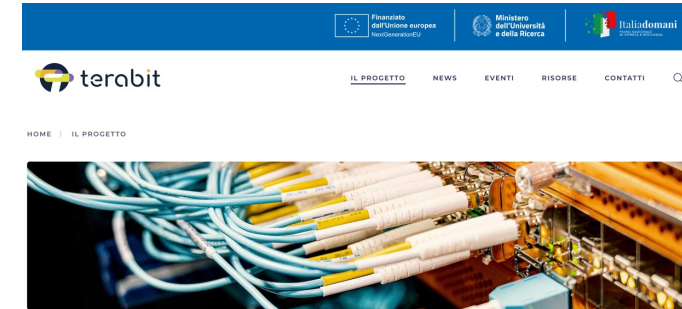


➤ In the next months Sos Enattos area will be reached at 1 TB/s (founded by the TeraBit project)

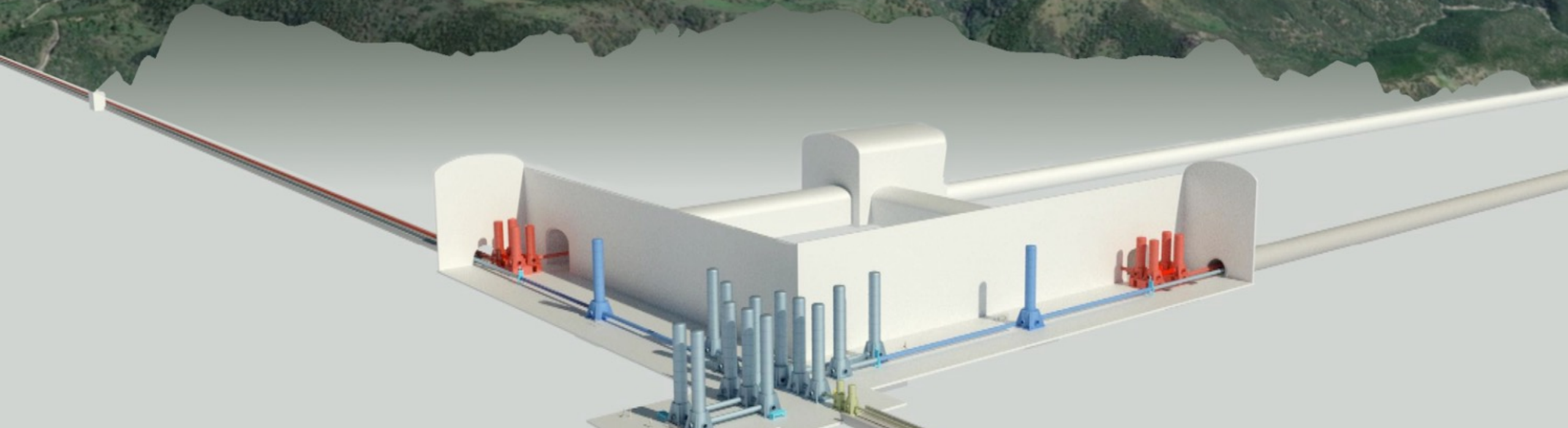
➤ Acoustic measurement campaign at P2 & P3 borehole areas in Sardinia to be planned

➤ Wind turbine Noise assessment in the Italian site candidate for Einstein Telescope:

- data analysis on going
- measurement campaign of noise produced by new generation wind turbines already in operation in Sicily to be planned



EMR Candidature: status and updates



News and updates



- Technical feasibility study on the Einstein Telescope commissioned by Nikhef: the Dutch consultancy Tunnel Engineering Consultants (TEC), a permanent joint venture between Royal HaskoningDHV and Witteveen+Bos, will carry out the technical feasibility study in cooperation with the Swiss partners Amberg, Lombardi and the Belgian Tractebel.
- Assumptions: The Einstein Telescope will have a triangle of three vacuum corridors, each ten kilometres long, at 250 to 300 metres below the Earth's surface. There, sensitive lasers and vibration-free suspended mirrors will continuously measure gravitational waves.
- Suitability of the subsoil, the best position of the three points of the triangle and all the technical challenges involved in building tunnels at depth.



Einstein Telescope ▾ News Projects Join us! Contact ▾

News

Technical feasibility study by leading engineering firms

The underground Einstein Telescope will be Europe's most advanced observatory for gravitational waves. Four international consulting firms will study whether the soil of the Meuse-Rhine Euregio is suitable to house the Einstein Telescope.

25 January 2024 — Written by Gieljan de Vries

The Einstein Telescope is of great importance for physics and astronomy, becoming one of the world's most sensitive observatories for gravitational waves. The Netherlands, Belgium and Germany are jointly investigating whether to host this world-class observatory in their border region, the Meuse-Rhine Euregio.

Commissioned by the Dutch research institute Nikhef, a technical feasibility study on the Einstein Telescope is now starting. The Dutch consultancy **Tunnel Engineering Consultants** (TEC), a permanent joint venture between Royal HaskoningDHV and Witteveen+Bos, will carry out the technical feasibility study in cooperation with the Swiss partners **Amberg**, **Lombardi** and the Belgian **Tractebel**.

Hot topics



- Seismic and Newtonian noise
- Magnetic noise
- People from both Site Characterization Teams will join the ANM effort

Newtonian Noise



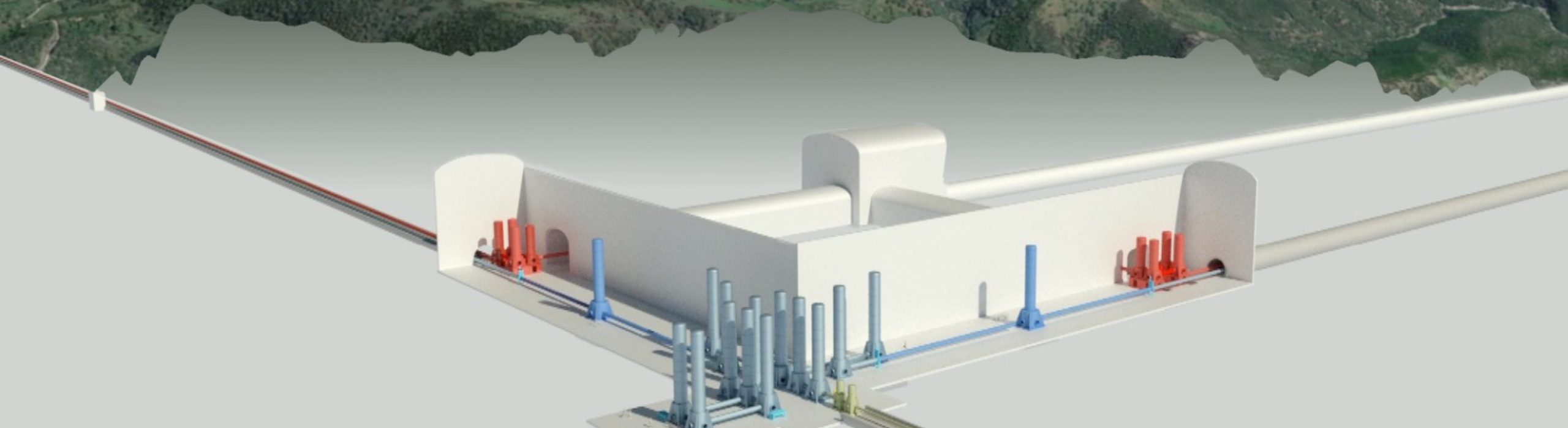
- NN WP should indicate the reference tool
- Shared common software framework already available for NN estimation as a base for future work and studies
- Starts with model and implementation for generic geologies
- Identify possible useful benchmark to verify NN estimation
- Definition of Mitigation System for NN subtraction. Project Breakdown Structure has been produced by ISB-ANM. There will be a short updated about next Friday at 4pm. At the next SPB meeting there will be a general presentation about the design of Env monitoring and the NN cancellation system

Magnetic Noise



- Use case Virgo and KAGRA experience
 - Agreement to share environmental data
- Involvement of Virgo/KAGRA people in the site measurements
- Common tools from VIRGO collaboration to estimate the effect on detector performance
- Measurements @EGO to better estimate the coupling function

ET-PP WP4: status



WP4 Milestones & Deliverables



Milestone name – Date (in months)/Lead Institution

➤ **M4.1 – M3/UW** : *Document detailing the site-specific characteristics that impact ET sensitivity and its duty cycle => **REPORT*** **DELIVERED**

➤ **M4.2 – M10/UW** : *Common methodology to estimate impact of site characteristics on ET sensitivity and operation and, if required, a scheme to compensate it => **REPORT***

(months from ET-PP start date, Sept. 1st)

WP4 Deliverables



Deliverable name – Date (in months)/Lead Institution

- **D4.1- M10/Nikhef:** *Scan of legal procedures, permitting and land acquisitions, i.e. the steps to be taken prior to starting excavations*

- **D4.2 - M15/INFN:** *Updated socio-economic impact studies. Scan of accessibility, quality of life etc.*

Delayed

- **D4.3 - M28/UW:** *Complete quantification of all the aspects impacting the ET performance for each site*

- **D4.4 - M30/INFN:** *Report on 3D geology, hydrology, etc. model with localisation of the ET infrastructure*

- **D4.5 - M42/Nikhef:** *Updated cost and schedule estimates of the excavations, including, if necessary: instrumentation for Newtonian Noise cancellation; costs of debris removal; costs of land acquisition, permitting, etc.*

(months from ET-PP start date, Sept. 1st)

M4.1: “Document detailing the site-specific characteristics that impact ET sensitivity and its duty cycle”

- It falls short of its objectives by not being quantitative enough. **This milestone is not considered reached.**
- Actions:** The required level of detail was available through referenced documents. We will remedy this by inserting the relevant information directly in the milestone document. **This update will be completed by end of March 2024.**

M4.2: “Common methodology to estimate impact of site characteristics on ET sensitivity and operation and, if required, a scheme to compensate it.”

The most important milestone (M3) of WP4 was not met.

➤ **Actions:**

magnetic noise: VIRGO tools

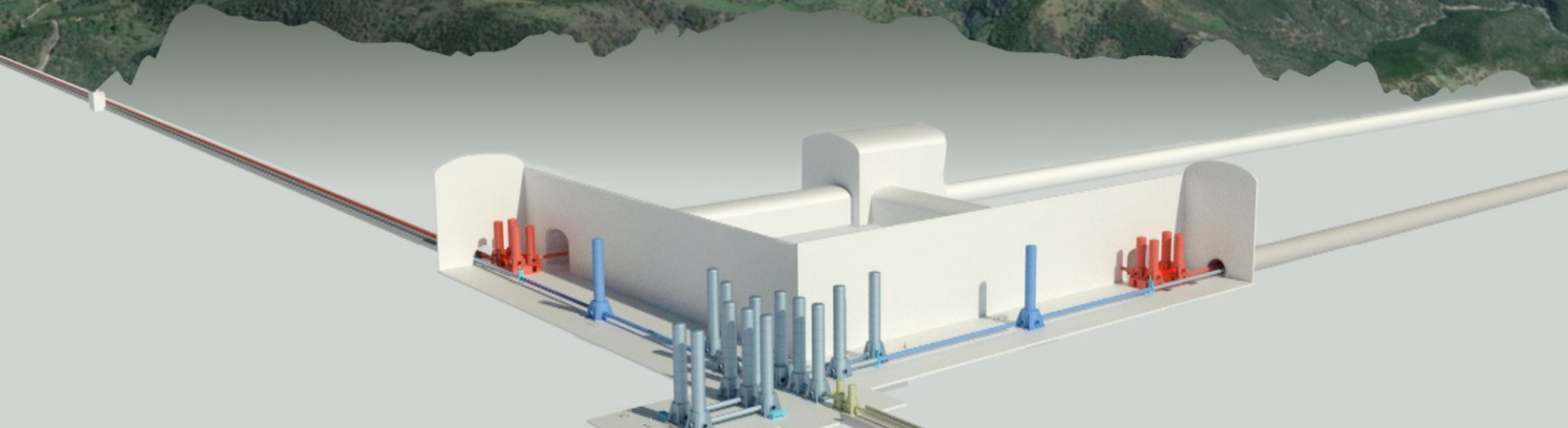
NN noise: let’s start with analytical models using the code already available for ET sensitivity estimation

✓ A beginner guide to the installing and running basic pygwinc noise budget (by Mikhail Korobko)
<https://wiki.et-gw.eu/ISB/Interferometer/ObservatoryDesignAndNoiseBudget/BeginnerSGuideToInstallingAndRunningPygwinc>

Update required at the September 2024 review

Milestone to be achieved by April 2025

Interaction with ETO



Host Teams Contributions for ET Collaboration: Site Characterization



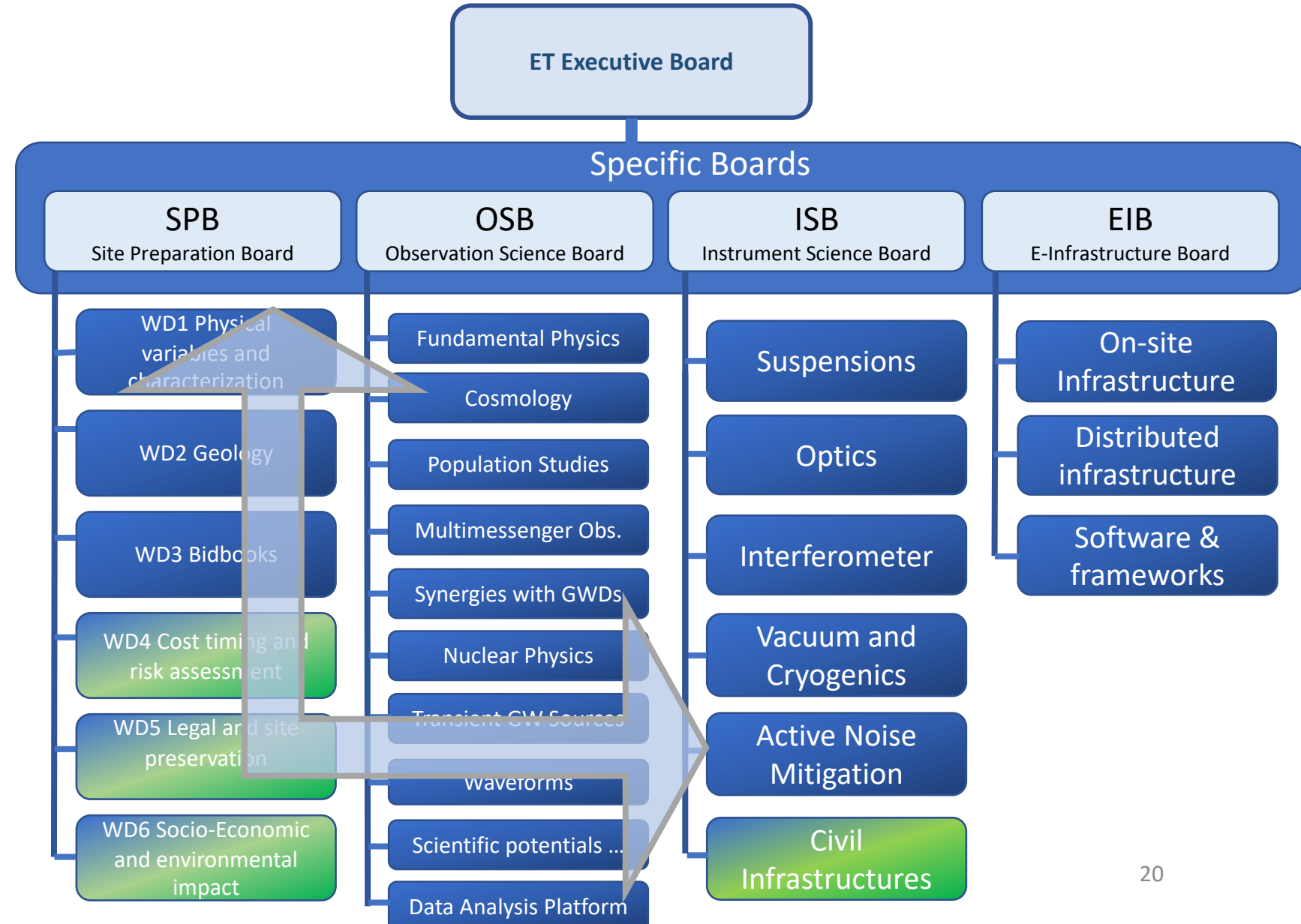
➤ **SiteCharacterization** coordinated in the framework of the **ET Collaboration: Site Preparation Board (SPB)**.

➤ Strong interaction with the Active Noise Mitigation division in the Instrument Science Board (ISB).

ET-LF



understanding of environmental noise effects and reliable mitigation systems



How to coordinate the activity with host teams ?

- So far: ET Collaboration through SPB (SPB chairs indicated directly by host teams)



Characterization results have a strong impact on ETO activity

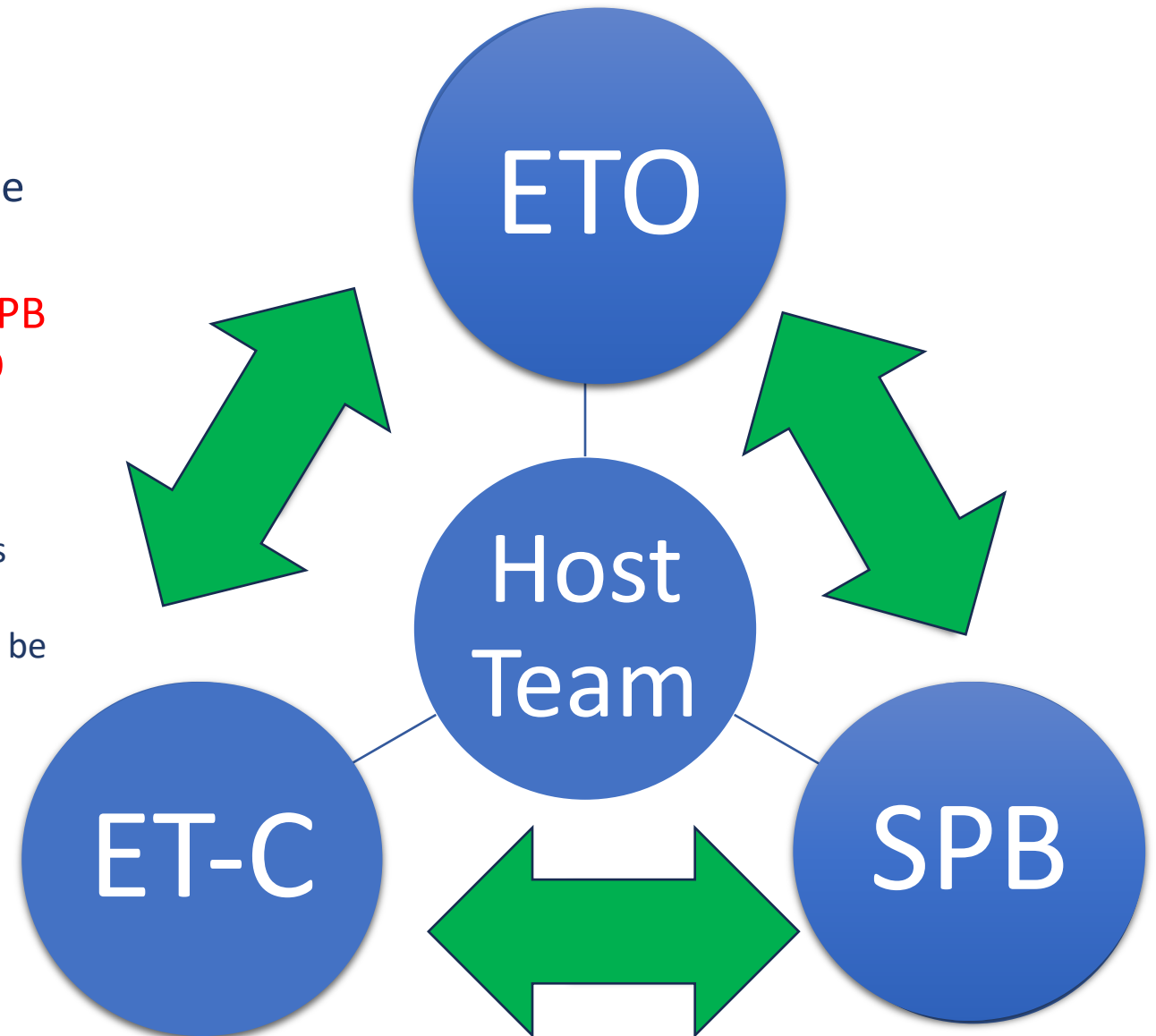
Host Teams Contributions for ETO



- Studies for site-dependent design => contribution to the CE TDR
 - ❑ Plan, cost and timing estimation for waste disposal, land-acquisition, logistics, surface infrastructures (buildings, services, ...)
 - ❑ Identification of all the legal aspects
 - ❑ Site quality preservation
 - ❑ ...
- Develop economic case and deliver socio-economic impact plan
- ...

How to coordinate the activity with host teams?

- Currently regular meetings ETO - EMR team
- ETO interactions with all host teams should be regular
- Interactions should see the participation of **SPB** that **is supposed to take indications from ETO and set standards** for host teams studies
- **ET-C should be involved as well**
 - local administrative, political and economic aspects could have an impact on the ET science case
 - Coherent detector and physics requirement info to be passed to host teams



Conclusions



- Issues to be addressed by ET Coordinators
 - ❑ Not a clear timeline for site candidature:
 - ✓ Sardinia timeline: end of pre-feasibility study by 2025
 - ✓ EMR timeline: ???
 - ❑ Geometry is still under discussion
 - ✓ Sardinia: both geometries
 - ✓ EMR: only triangle
- We need to converge on common tools & methodology (see WP4 ET-PP problems)
- Needs to revisit the interaction with ETO
 - ❑ Meeting ETO-host teams will be held at the end of April 2024 in Geneva