INFN
Istituto Nazionale di Fisica Nucleare
Laboratori Nazionali di Frascati

Status of the Sardinia site

TETI Team for Einstein Telescope Italy

G. Bisoffi, L. Latronico INFN
on behalf of TETI

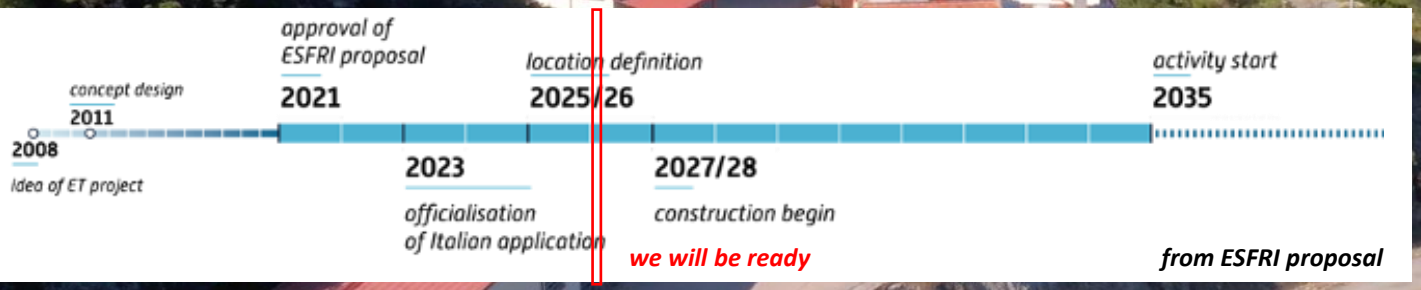
XV ET Symposium, Bologna, May 30 2025

ET ITALY
Einstein Telescope

Olbia

The Italian candidate site for ET: Sos Enattos, Sardinia

- ✓ INFN leads the proposal, for *either* a 2L or Δ configuration
- ✓ INAF and INGV support the proposal with complementary science and expertise
- ✓ A ready-to-tender, civil engineering study - delivered by 2025, compliant with the ESFRI timeline



NATIONAL SUPPORT

- The Italian and Sardinia regional goverments provide strong and continuous financial support (1.3 B€ granted)

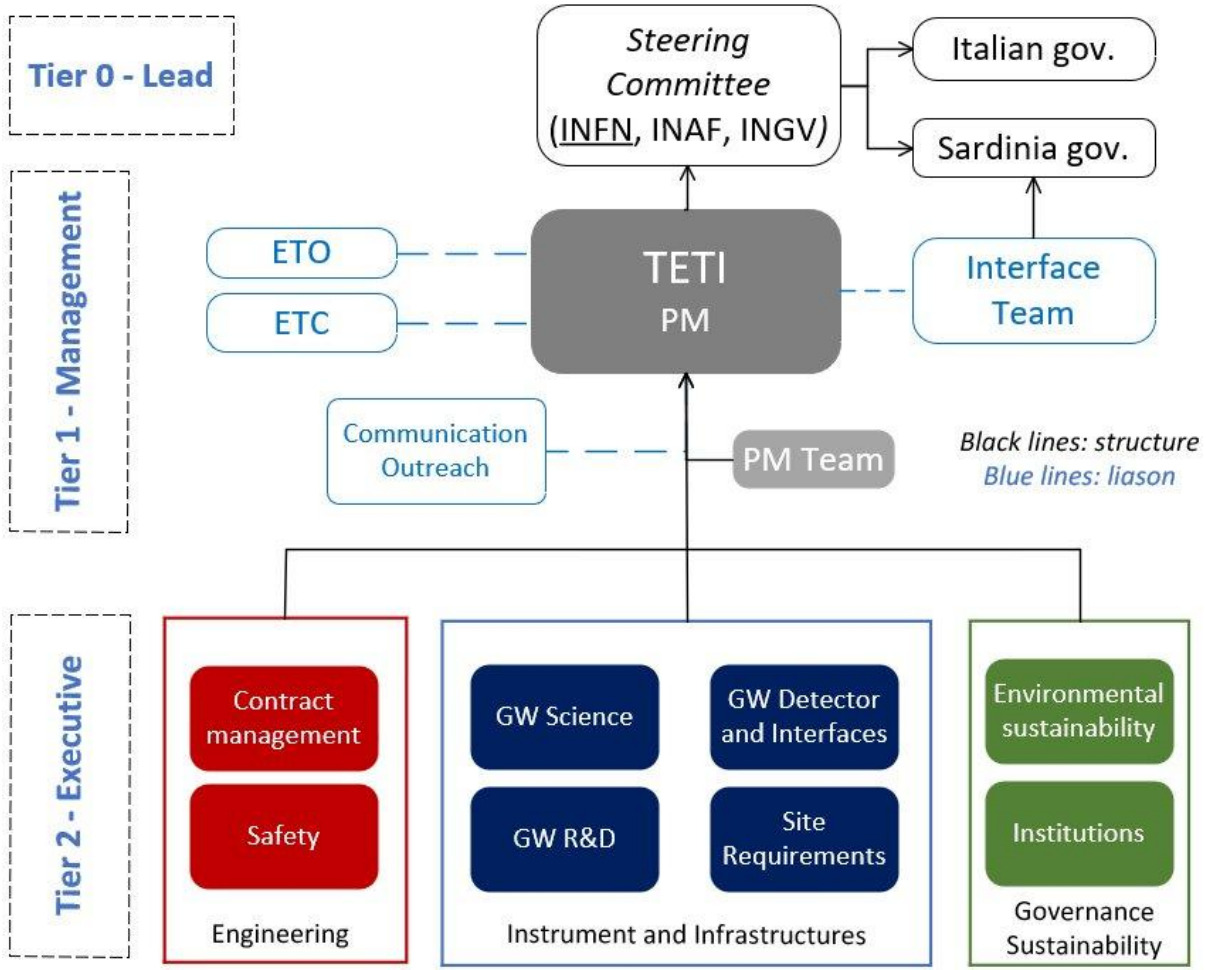
Investment for site development (already allocated)							Total € 146 M
€3.5 million	€17+15	€4+2 milions	€50 milion	€2.5 + 12 milion	€ 6 milion	€10+10 milion	€14 milion
SAR-GRAV lab By Autonomous Region of Sardinia (RAS)	ET Project By Ministry of University and Research (MUR)	PRIN/FIS ET Tech and Science (and post-docs NRRP) by MUR	NRRP ETIC project By MUR	NRRP MEET and TERABIT By MUR	Earth Telescope initiative By INGV	SUNLab by RAS, INFN, INAF, INGV	Requalification of roads to the site and SUNLab By RAS

INVESTMENTS FOR THE CONSTRUCTION OF THE LABORATORY IN SARDINIA total **1.3 billion**

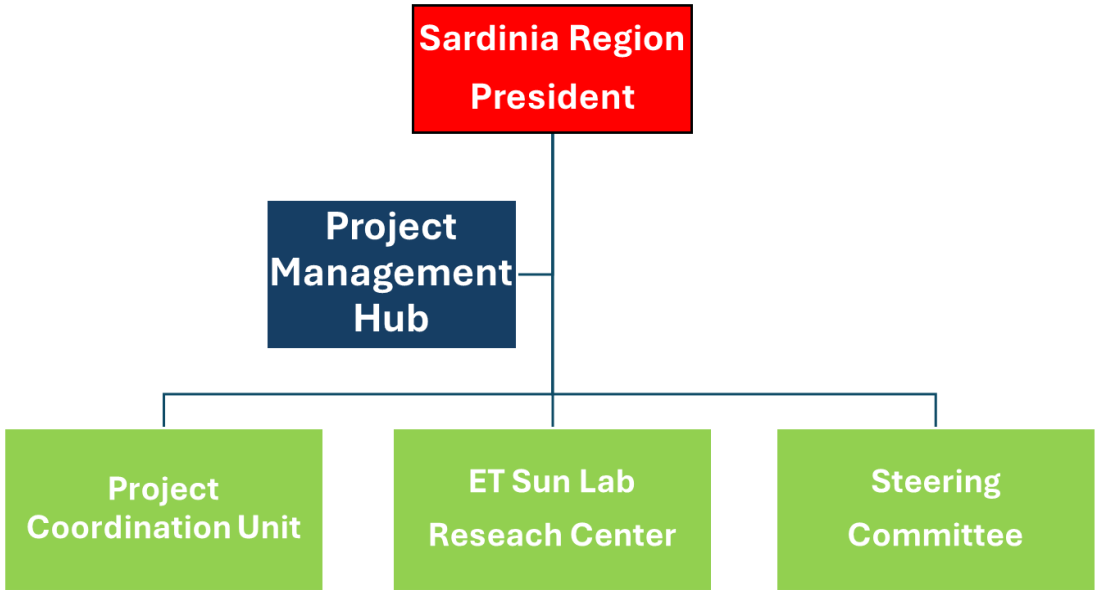
€350 million
by Autonomous Region of Sardinia

€950 million
by Italian Government

Team for ET in Italy



Sardinia Region Support Unit



REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

Very busy 6 months in Sardinia

REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

2 Jul 2024
Cooperative Scientific agreement Italy - Spain

23 Oct 2024
DEL. 41/9
Candidacy Support actions defined

28-30 Oct 2024
G7 Science and Technology

13 Nov 2024
DEL. 43/72
Sos Enattos site handed-off to INFN for SUNLab construction

19 Dec 2024
Agreement for Candidacy support Committee (Sardinia Region, Universitiies of Caligliari and Sassari, INAF, INGV, INFN)

22 jan 2025
DEL. 4/11
ET Project Support Unit created

Feb-March 2025
Kick-off technical meetings with regional offices in charge of environment authorizations
Closeout by December 2025

19 Mar. 2025
DEL. 15.26
1. *Agreement to rule access to TERABIT ultra-high bandwidth to regional community*
2. *ET Website translated in Sardininan*

3 mar. 2025
Public call for interest to companies to develop Key Enabling Technologies for ET
~100 positive responses

4 Apr 2025
DEL 17/9
Resources allocated for
1. *Minghetti dam rework*
2. *Vertex V1 access road refurbishment*
3. *Steering committee work*

Italian national law 41, Apr. 21 2023 binding authorizations of new industrial activities in the ET area to Ministry of Research approval with INFN consultancy

ITALIAN PROPOSAL SCOPE

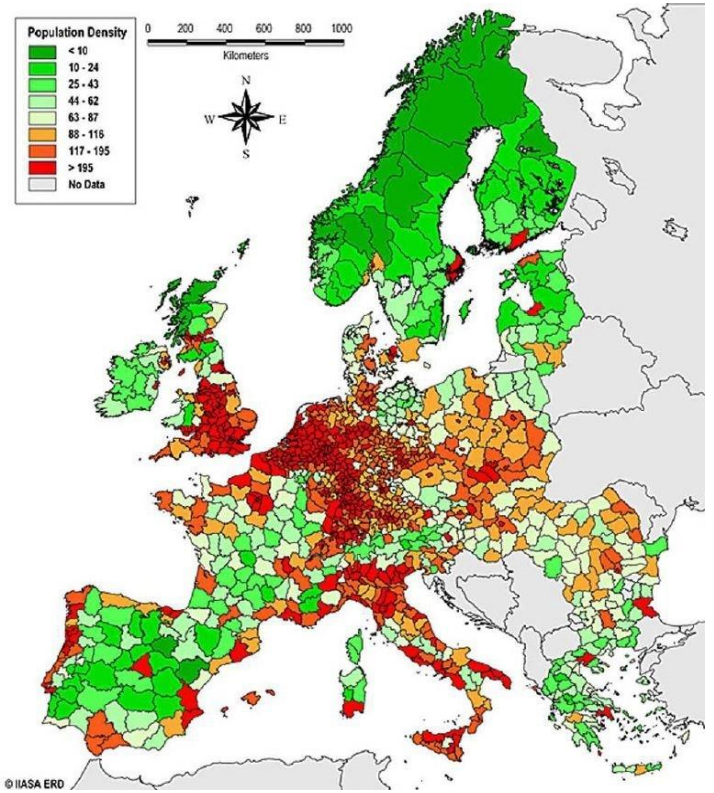
All relevant aspects covered in detail

- Socio-economic impact of the project
- Experimental site
- Civil engineering of underground areas
- Environmental impact and sustainability
- Involvement of industrial ecosystem

Study on the Economic impact of hosting ET in Sardinia

In-depth study on:

- ✓Economic-relevant features of the site
- ✓Estimates of global and local effects
  - both for 2L and Δ
  - separately for construction and operation phases
- ✓Impact on local communities



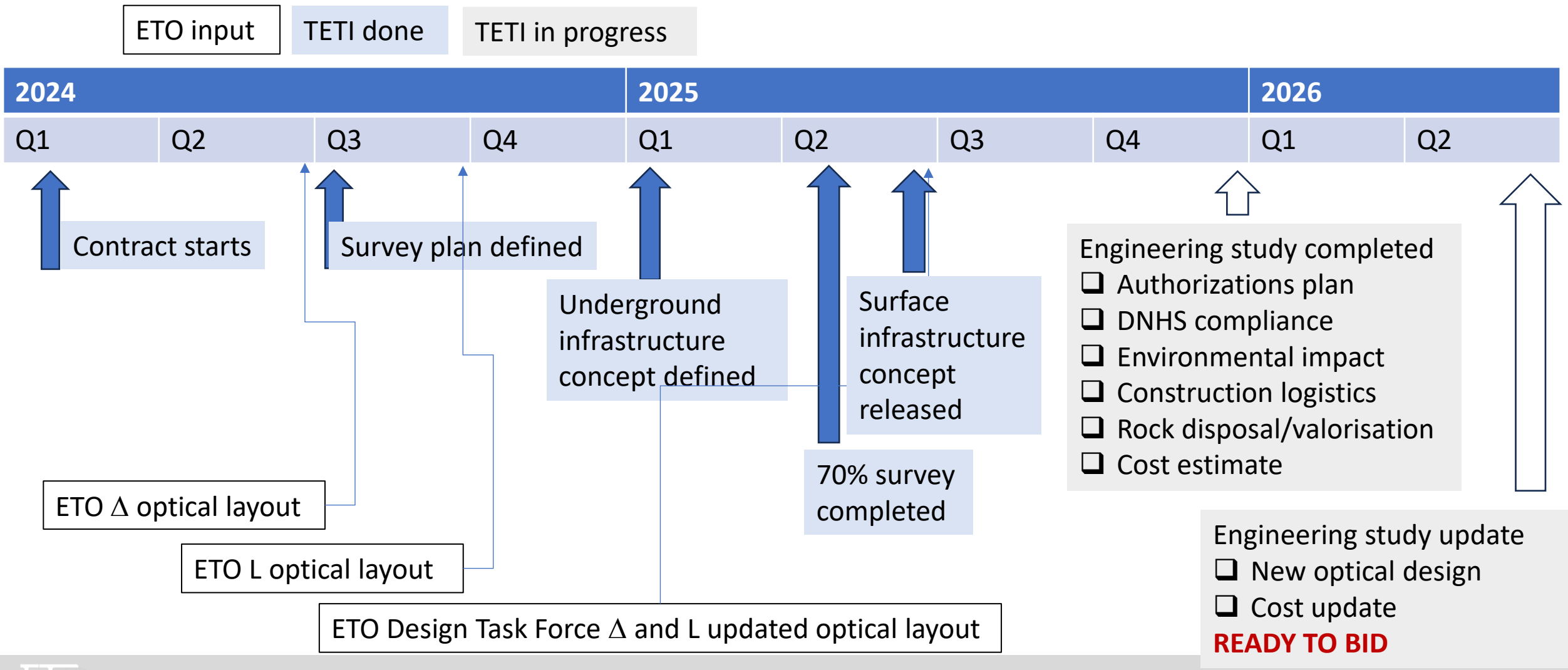
The Sos Enattos UNderground Lab

In view of the installation of the ET infrastructure:

Realization of a Research Center in the Sos Enattos former-mine (10M€ from RAS + 10M€ from INFN-INAF-INGV) for:

- ✓ noise-related experiments, ET validation tests in low noise condition, ET prototypes
- ✓ Earth Telescope, to study mechanisms impacting the seismic activities, plate tectonics, magnetic field
- ✓ dissemination, outreach and training

TETI Activities Timeline



Main deliverables of the pre-feasibility study (confirmed)

Consortium of 7 highly professional companies, led by Rocksoil, and funded by MUR/INFN with NextGenEU (PNRR)

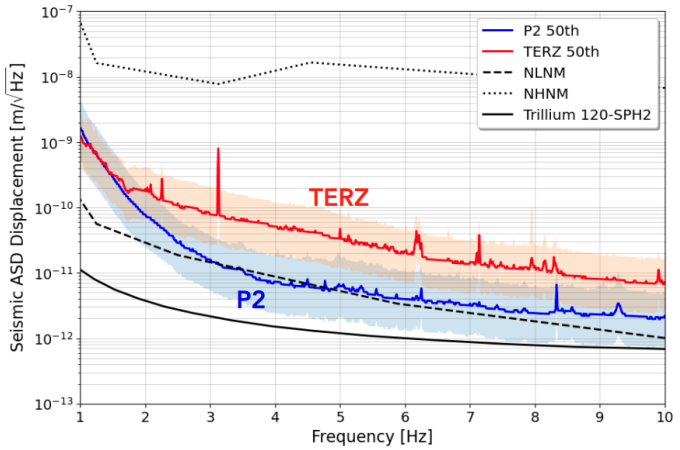
D1	Plan geo Analyses
D2	Underground Civil Concept
D3	Surface Civil Engineering
D4	Technical plants
D5	Civil underground DNSH Impact
D6	Geo Analyses
D7	Civil Undeground Feasibility
D8	Authorisations
D9	Validation

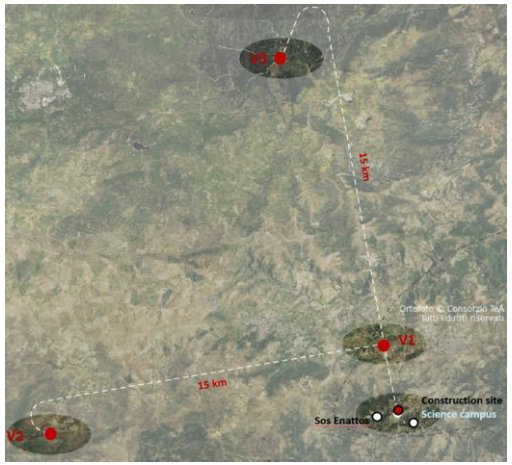
~900 Documents planned

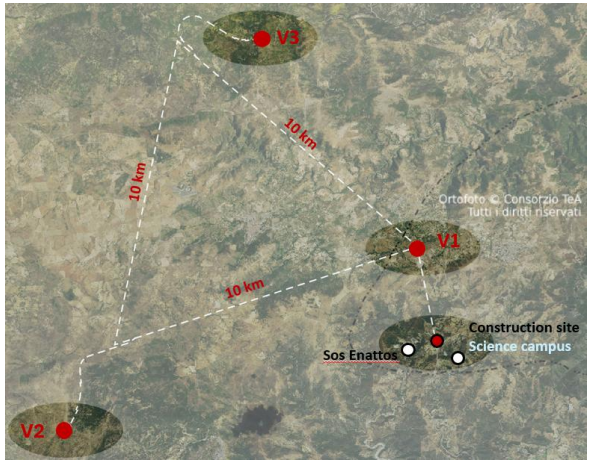
~400 delivered so far on underground excavation, surface engineering, technical implants

Number	TITLE OF THE WORK	SCALE	DOCUMENT CODE																				
			ORDER				CONFIG		PHAS	RTI		DOC TYPE		DISCIPLINE						PROGR.			REV.
	GENERAL WORKS																						
	Timetable	**RTP**																					
5	ACTIVITY B - BUILDINGS AND UNDERGROUND STRUCTURES: CONCEPT	-	E	T	I	C	E	C	0	R	K	C	R	G	E	0	0	0	0	0	0	1	A
	L-SHAPED CONFIGURATION	**GDP**																					
	GENERAL																						
	INVESTIGATION PLAN																						
	RISK ANALYSIS																						
	ACTIVITY B - BUILDINGS AND UNDERGROUND STRUCTURES	**ROCKSOIL**																					
	L-CONFIGURATION																						
	GENERALE	-																					
11	L-configuration planimetric-altimetric location report	-	E	T	I	C	C	L	B	R	K	R	H	G	N	0	0	0	0	0	0	1	A
12	Report on water disposal principles	-	E	T	I	C	C	L	B	R	K	R	H	G	N	0	0	0	0	0	0	2	A
13	Report on underground works execution methods	-	E	T	I	C	C	L	B	R	K	R	H	G	N	0	0	0	0	0	0	3	A
14	L-configuration plan - alternative locations on orthophoto	1:50000	E	T	I	C	C	L	B	R	K	P	L	G	N	0	0	0	0	0	0	1	A
15	L-configuration plan - alternative locations on geological map	1:50000	E	T	I	C	C	L	B	R	K	P	L	G	N	0	0	0	0	0	0	2	A
16	L-configuration profiles - alternative locations	1:75000	E	T	I	C	C	L	B	R	K	P	F	G	N	0	0	0	0	0	0	1	A
17	L-configuration plan of the project on orthophoto	1:50000	E	T	I	C	C	L	B	R	K	P	L	G	N	0	0	0	0	0	0	3	A
18	L-configuration plan of the project on geological map	1:50000	E	T	I	C	C	L	B	R	K	P	L	G	N	0	0	0	0	0	0	4	A
19	L-configuration profile of the project	1:75000	E	T	I	C	C	L	B	R	K	P	F	G	N	0	0	0	0	0	0	2	A
20	Operation phase - Tender base project plan	1:200	E	T	I	C	C	L	B	R	K	P	L	G	N	0	0	0	0	0	0	5	A
21	Operation phase - Project comparison plan - Tender base	1:1000	E	T	I	C	C	L	B	R	K	P	L	G	N	V	R	0	0	0	0	1	A
22	Operation phase - Internal circulation plan	1:500	E	T	I	C	C	L	B	R	K	P	L	G	N	V	R	0	0	0	0	2	A
23	Operation phase - Movement of ferrules - Plan	1:500	E	T	I	C	C	L	B	R	K	P	L	G	N	V	R	0	0	0	0	3	A
24	Construction phase - Movement of pipes with trolleys - Plan	1:500	E	T	I	C	C	L	B	R	K	P	L	G	N	V	R	0	0	0	0	4	A
25	Operation phase - Cross-sections of overall dimensions - Table 1/9	1:100	E	T	I	C	C	L	B	R	K	S	T	G	N	V	R	0	0	0	0	1	A

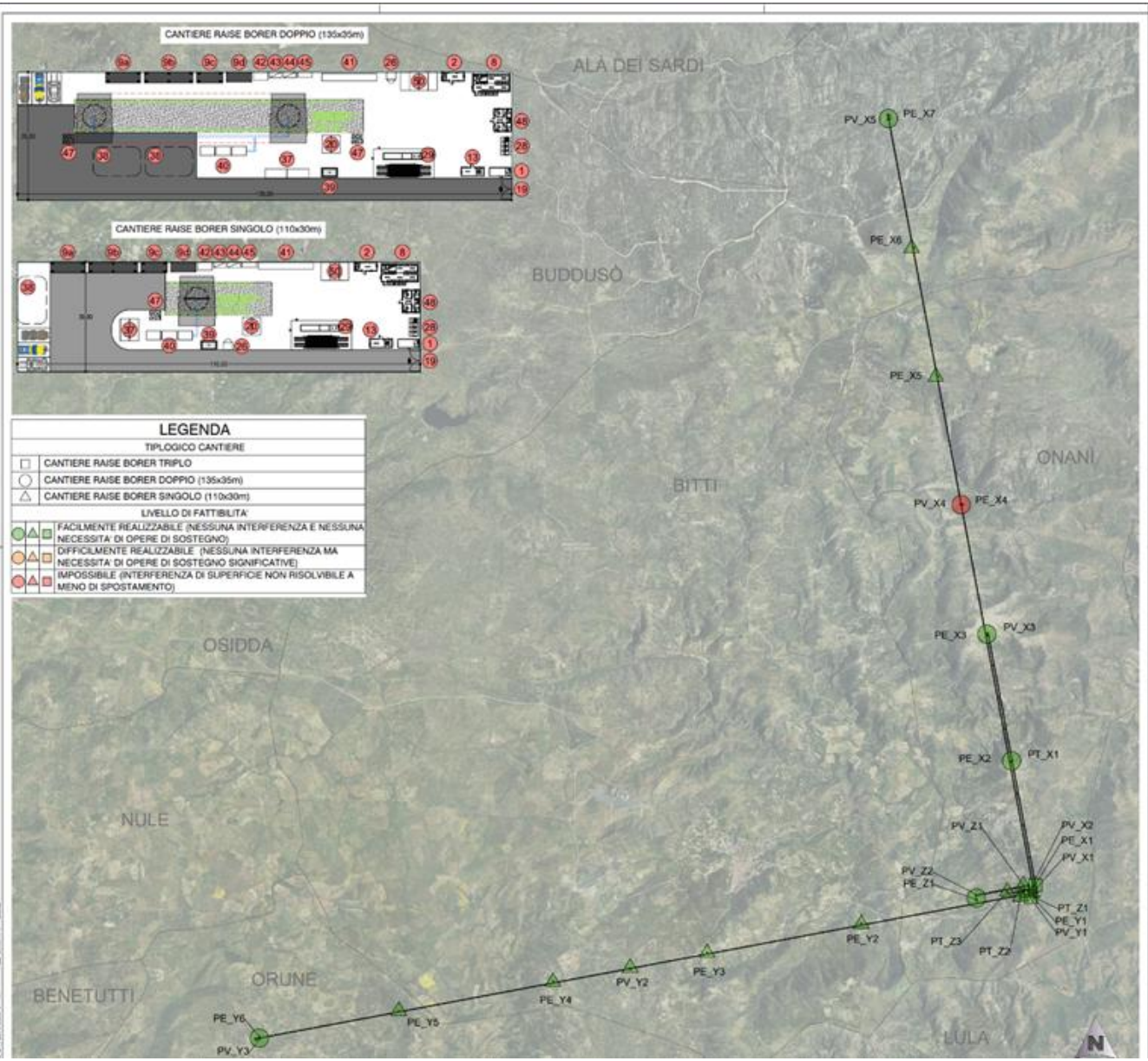
Sos Enattos site has unique advantages







- Extremely quiet
  - very low seismic and anthropic noise
- Single access point for construction
  - lower cost, environmental impact, overall shorter construction
- One construction site - minimum impact
- Worksite to be converted into science campus at the end of the construction
- A single accessible tunnel to extract material and insert excavation machinery
- Water drainage by gravity
  - no pumps during science run, mechanical noise disturbance minimized



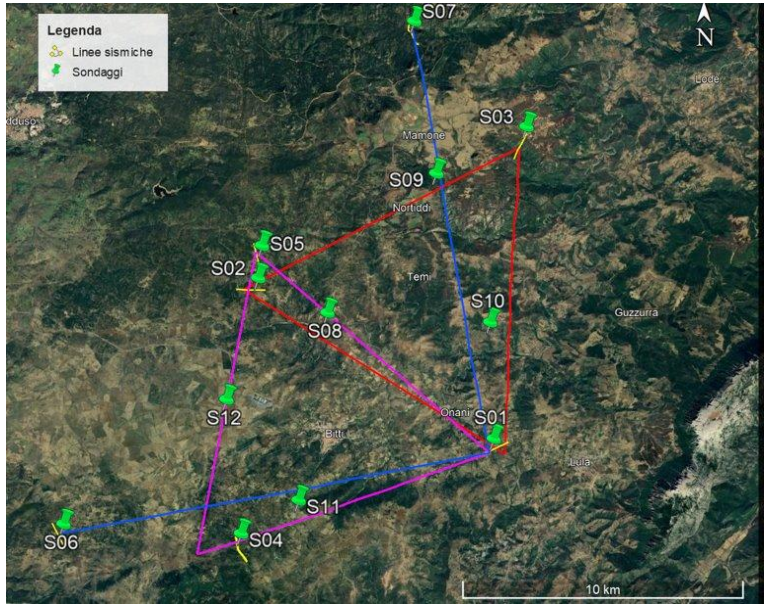
LEGENDA INSTALLAZIONI	
Pos.	Descrizione
1	GUARDIANIA
2	INFERMERIA
3	SPOGLIATOIO
5a	CABINA RECEZIONE ENEL
5b	CABINA DI DISTRIBUZIONE 40'
5c	CABINA DI DISTRIBUZIONE 20'
5d	CABINA GRUPPO ELETTROGENO
13	REFETTORIO
19	ACCESSO/USCITA
26	CONTENITORE PER OFFICINA
28	CONTAINER RACCOLTA DIFFERENZIATA
29	LAVARUOTE
31	DEPOSITO PER IL SALE
38	STOCCAGGIO MATERIALE DI SCAVO
39	DISTRIBUTORE DIESEL
40	1a-2a-3a VASCHA DI DECANTAZIONE E RICICLO DELL'ACQUA
41	STOCCAGGI PER TUBI DI PERFORAZIONE
42	ELETTROCOMPRESSORE
43	PACCHETTO IDRAULICO
44	PACCHETTO ELETTRICO
45	POMPA PER CALCESTRUZZO
47	BLOCCO DI ANCORAGGIO PER L'AVVOLGIMENTO DEL CAVO
48	UFFICI DI CANTIERE
50	PARCHEGGI

Surface well site plan

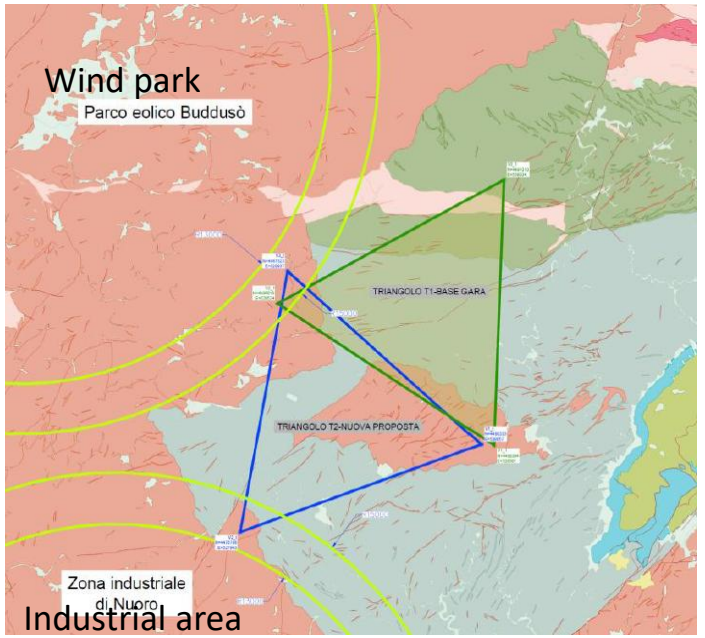
- Exact location of wells, identified also according to local surface conditions (properties, water catchment area, …)
- The few sensitive ones impose minimum displacements

A site with unique properties for ET

- Extremely low sismicity and anthropic noise
- Outstanding soil and rock quality (structural stability and hydrogeology)
- No water issues
- A government ruling established a buffer zone around the observatory



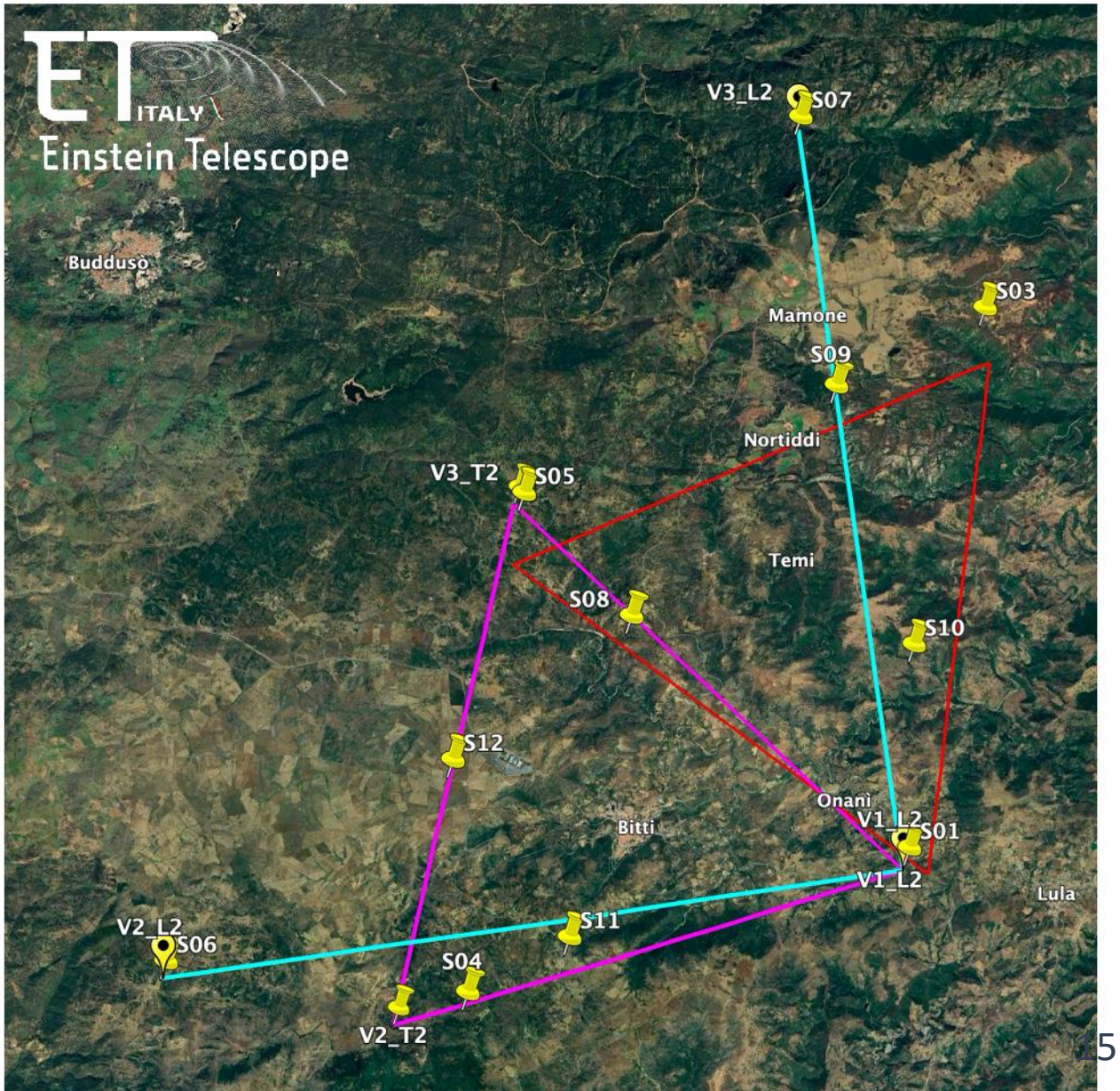
9 surveys done, 1in progress

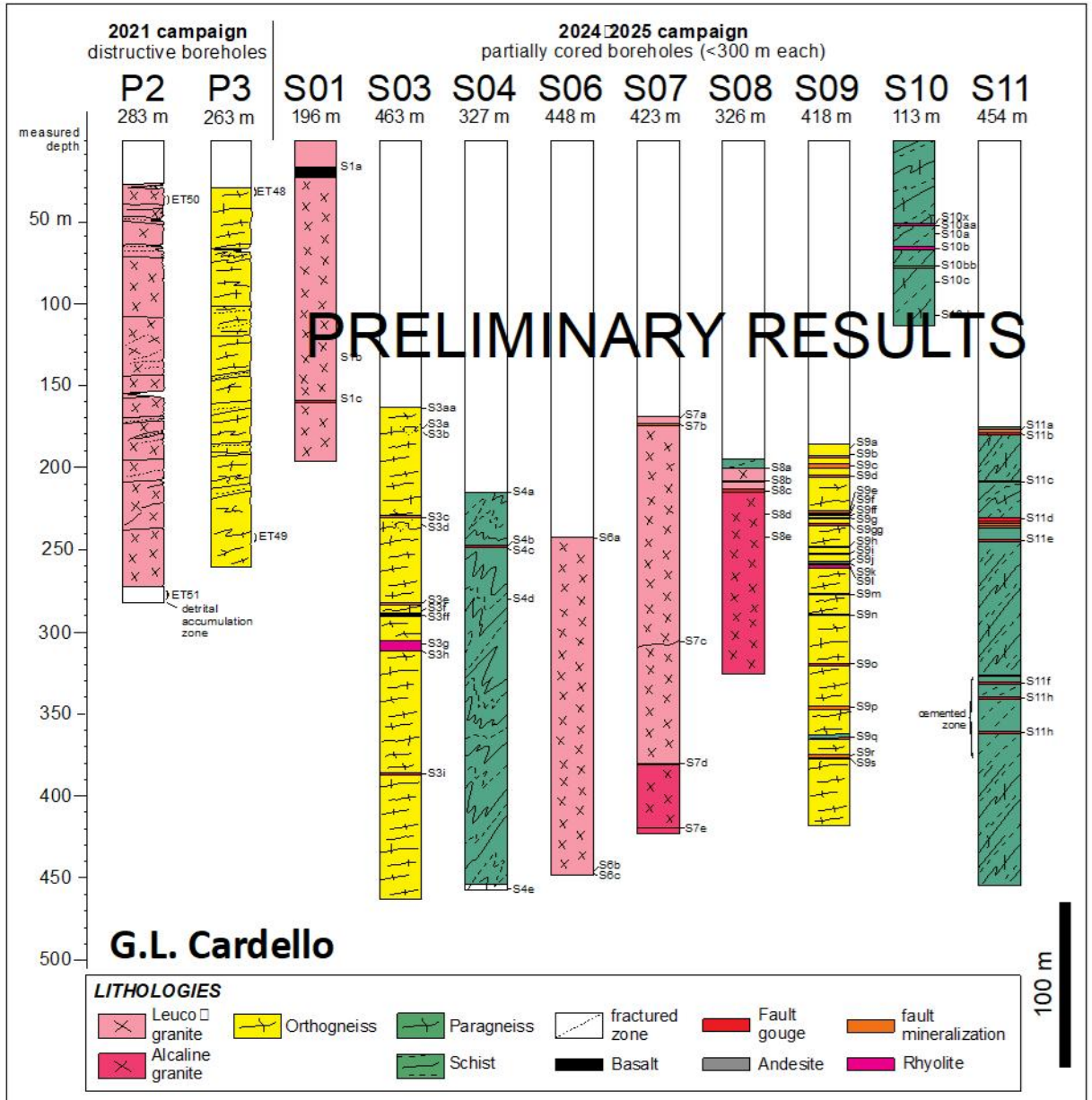


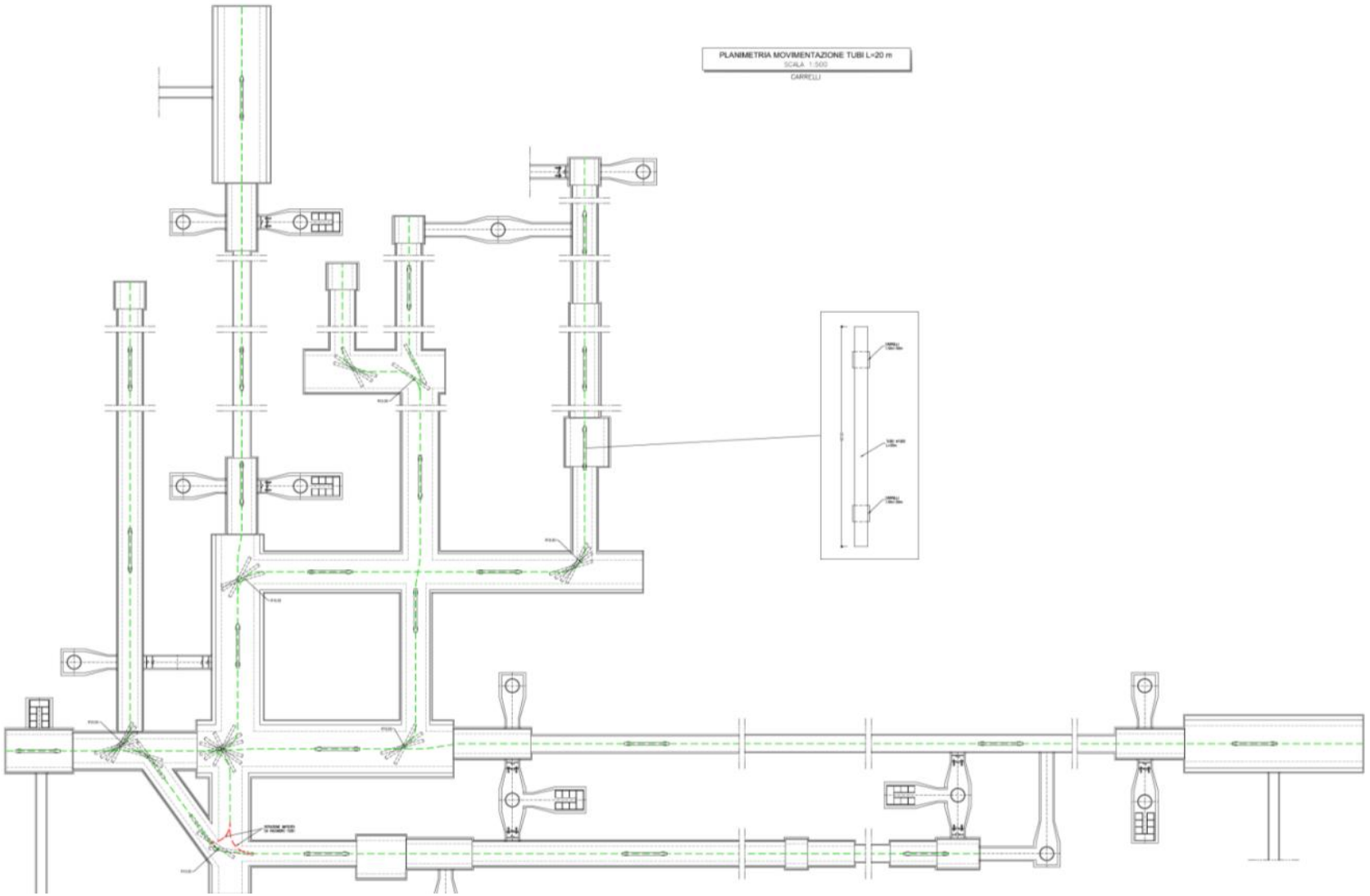
Granodiorites on all vertices

GEOLOGICAL EXPLORATION AND NEW CONFIGURATION

uniss
UNIVERSITÀ DEGLI STUDI DI SASSARI





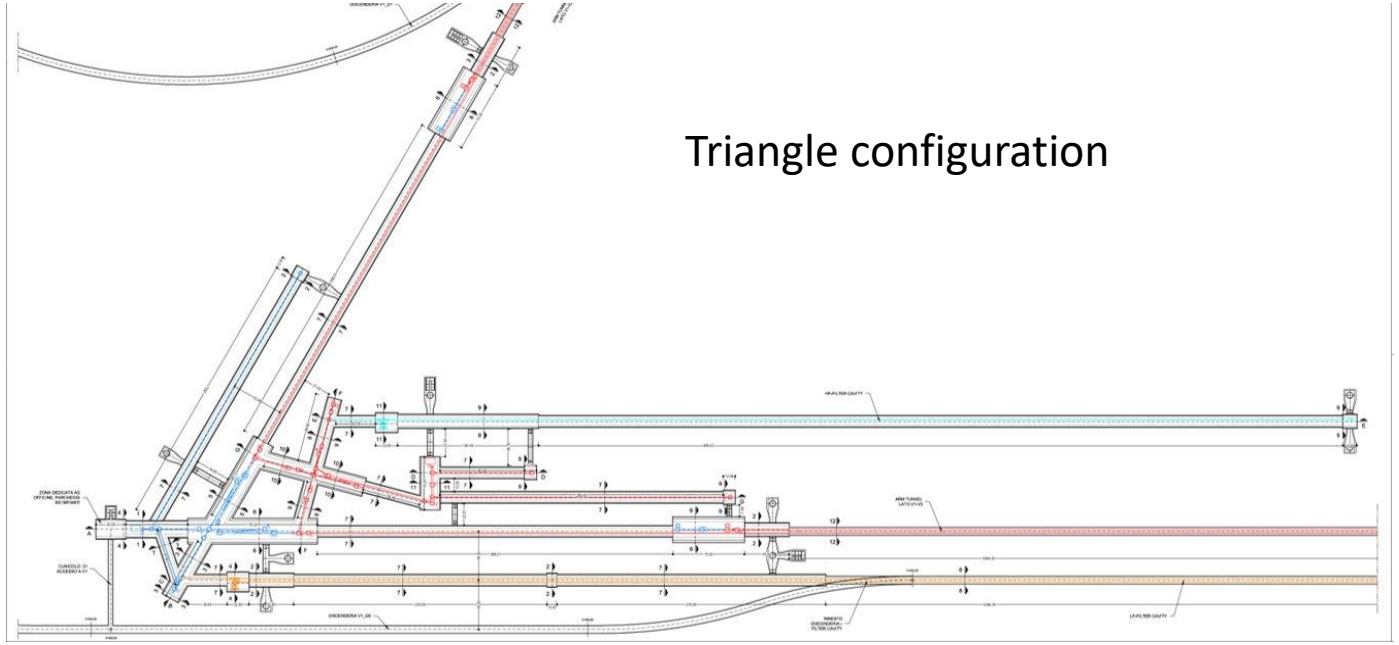


Logistics

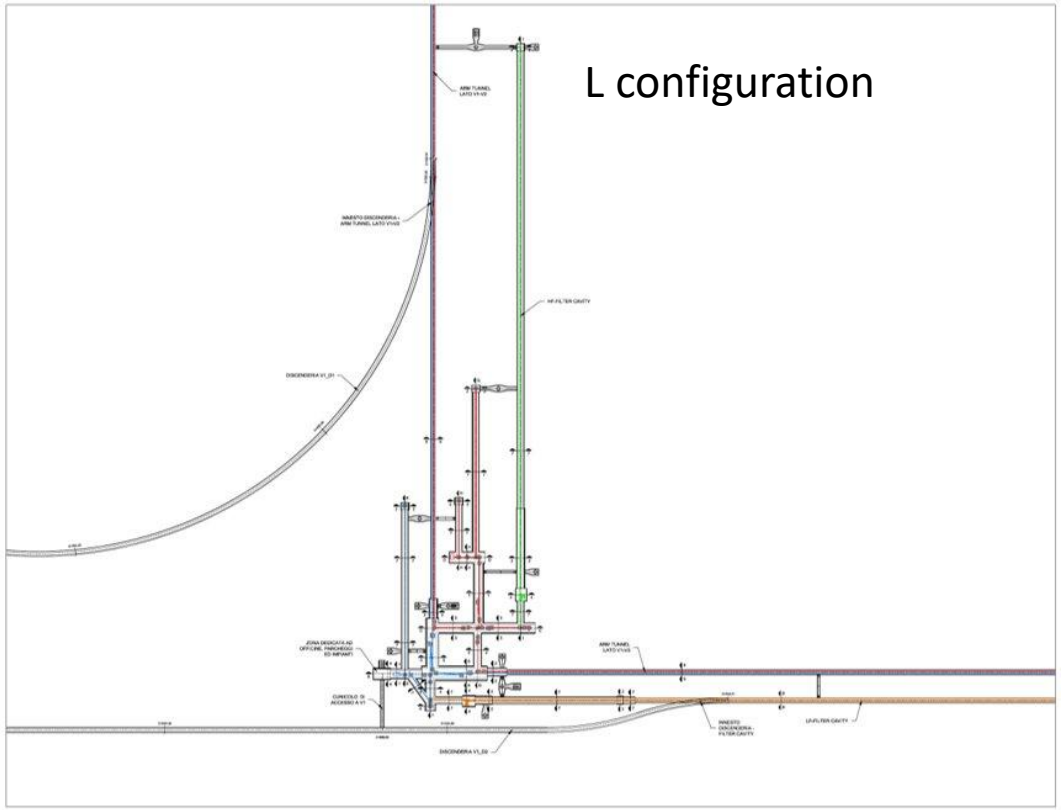
The transportation and handling sequence for 20-meter vacuum pipes in all tunnels and caverns has been studied and optimized to ensure safe and efficient installation

Underground infrastructure concept being developed in detail

Compliant with 2024 ETO design – will accommodate Task Force layout



Triangle configuration

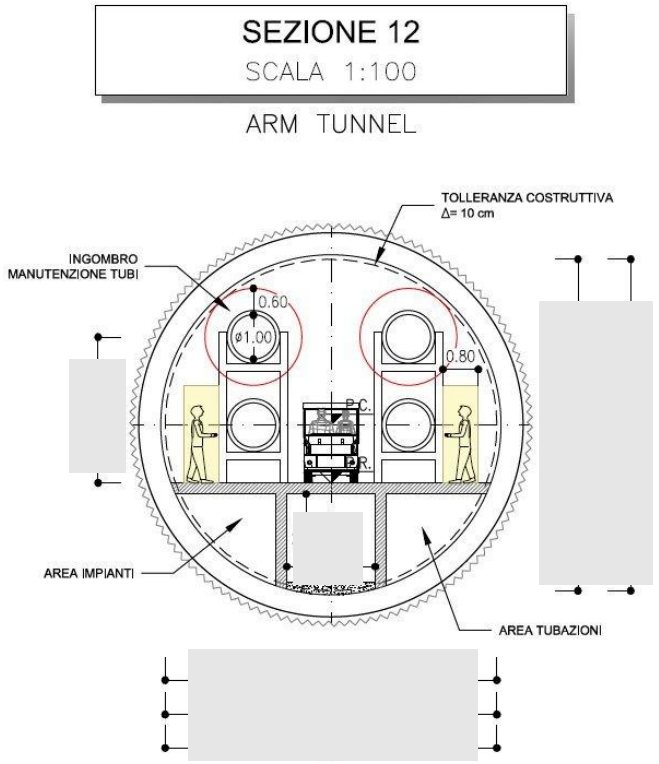


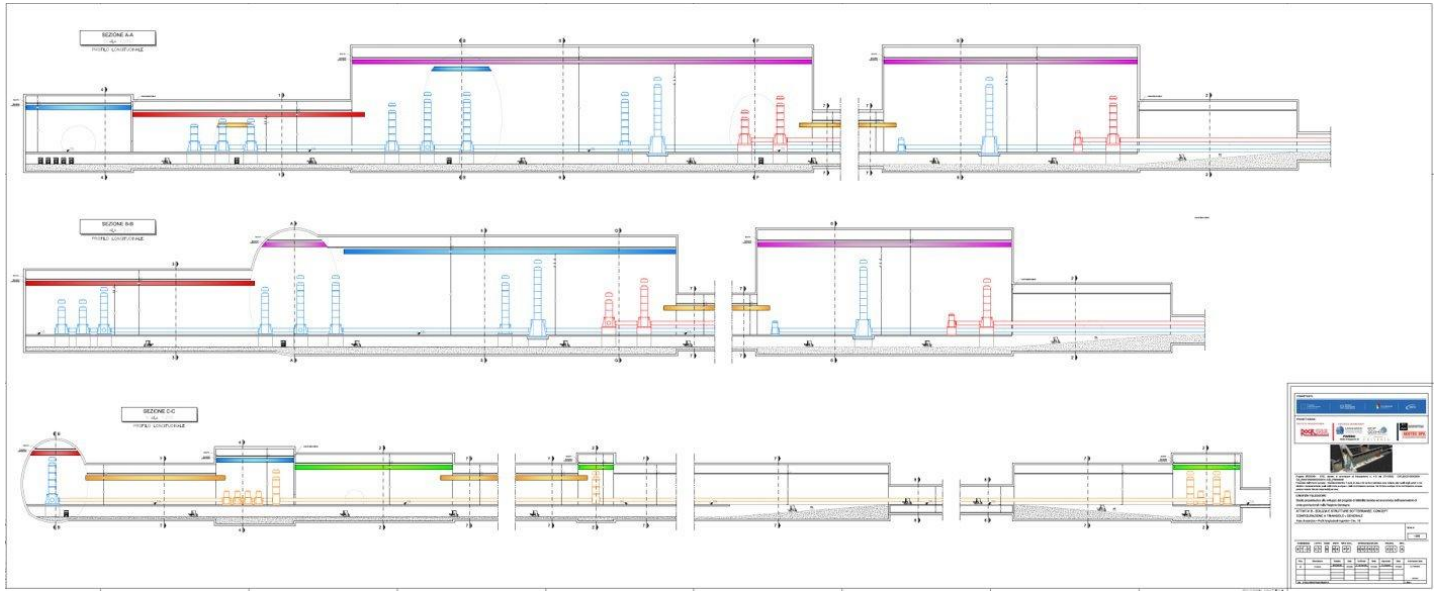
L configuration

Examples of preliminary detailed engineering drawings (preliminary)

Underground infrastructure concept being developed in detail

Compliant with 2024 ETO design – will accommodate Task Force layout



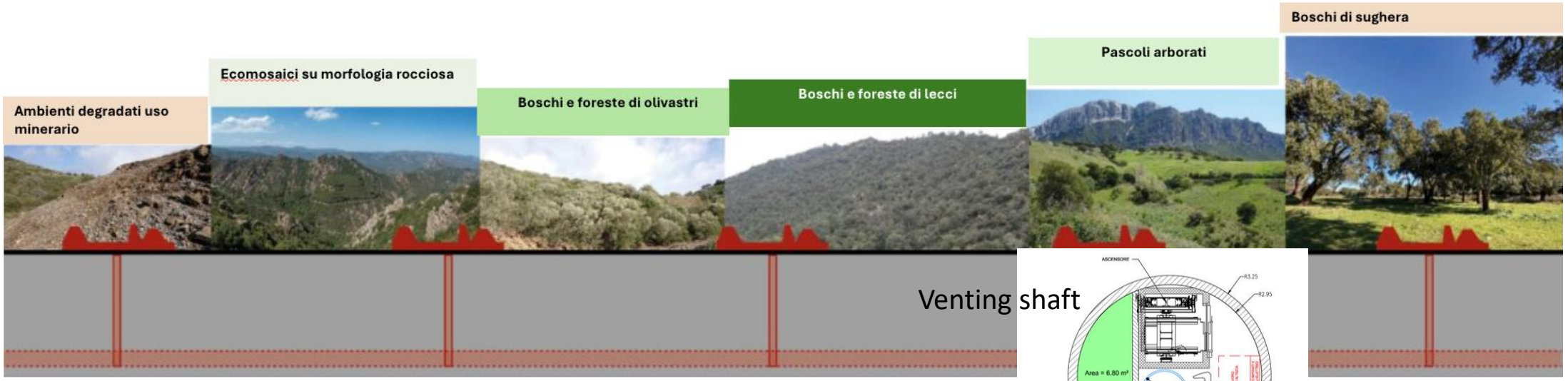


Examples of preliminary detailed engineering drawings (preliminary)

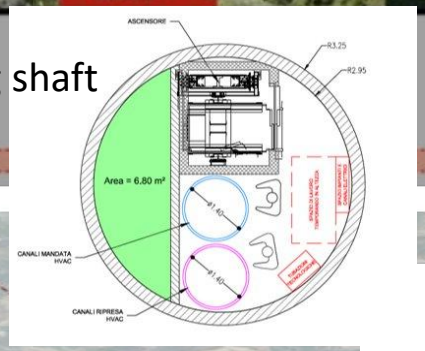
Number and size of caverns and tunnels have a substantial impact on global cost and construction schedule – Task Force outcome will be beneficial

Underground infrastructure concept being developed in detail

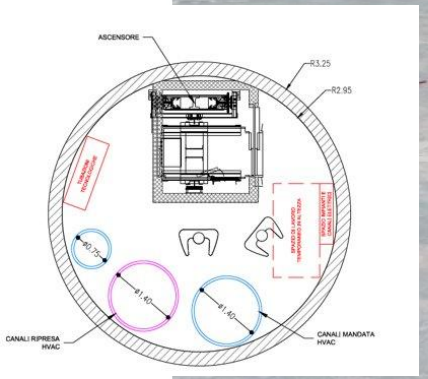
Safety concept derived from CERN and vetted by Italian fire brigade

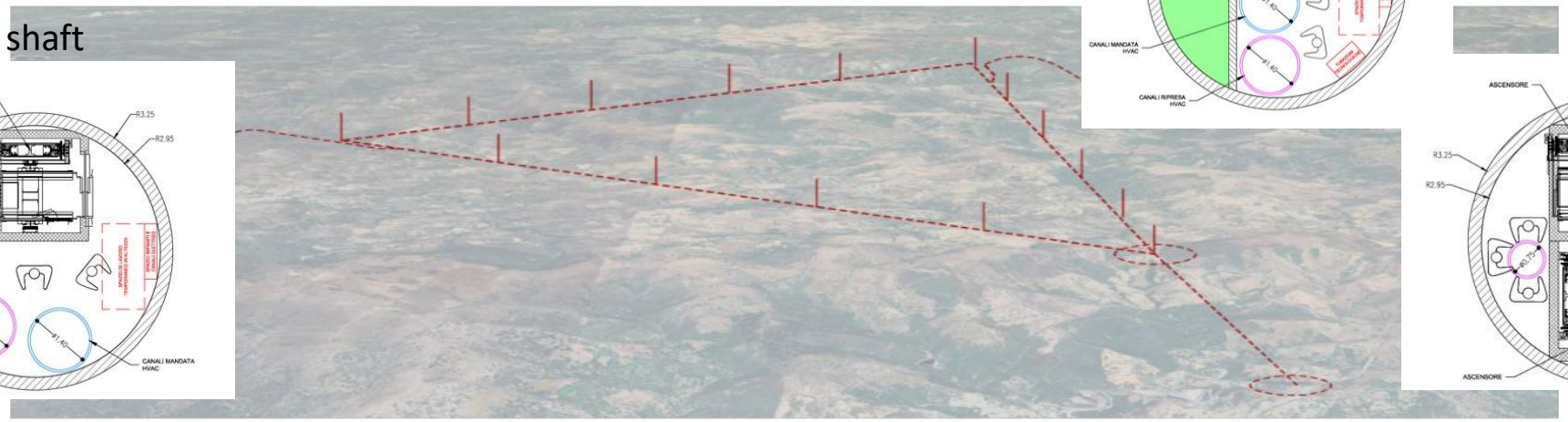


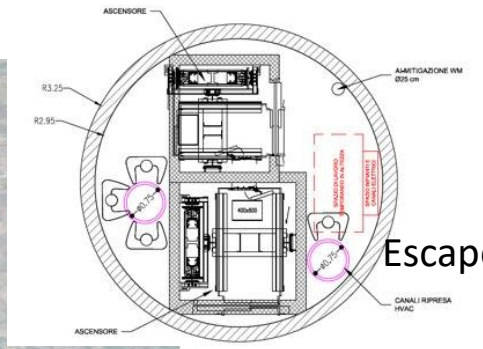
Venting shaft



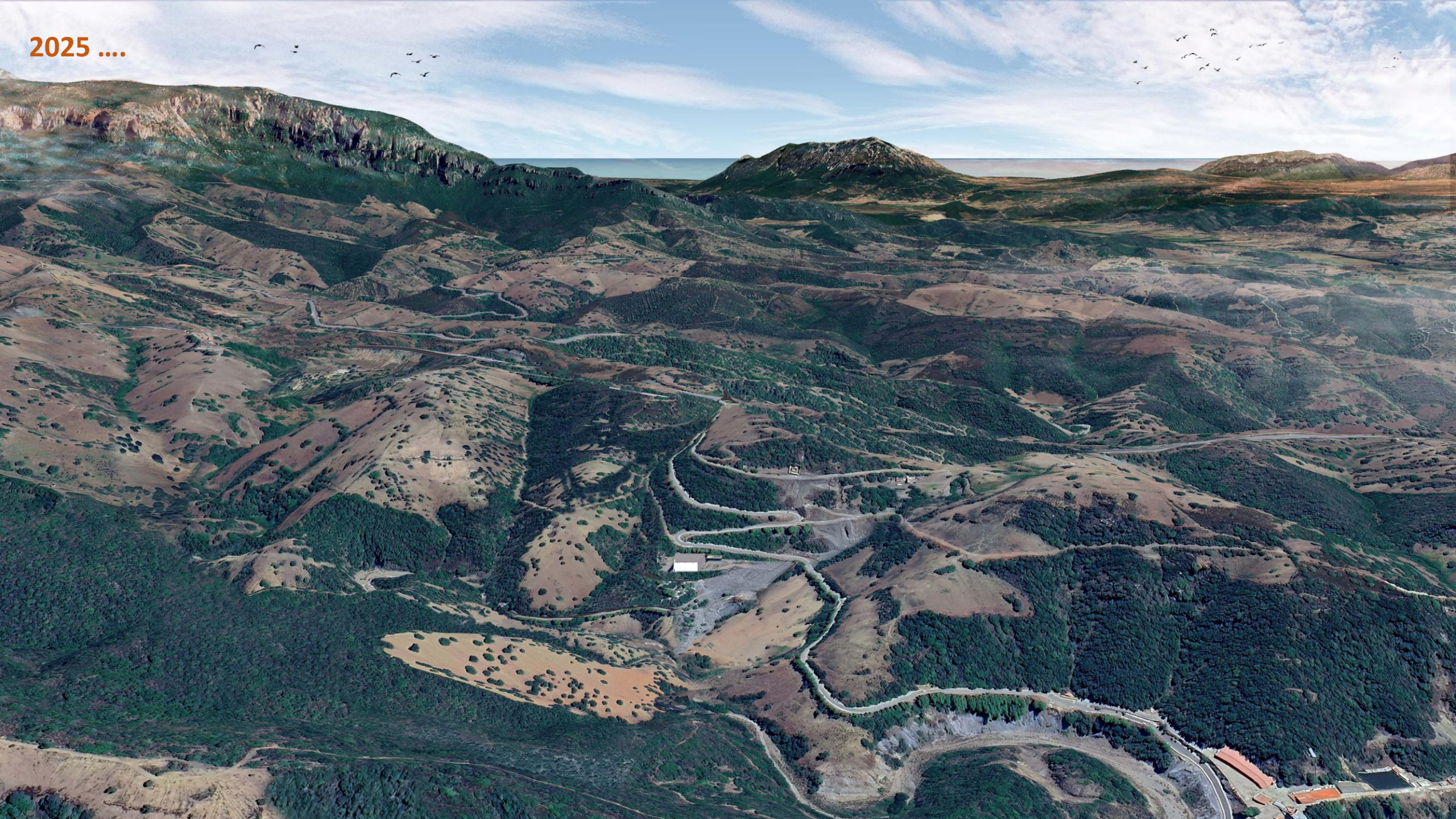
Technical shaft



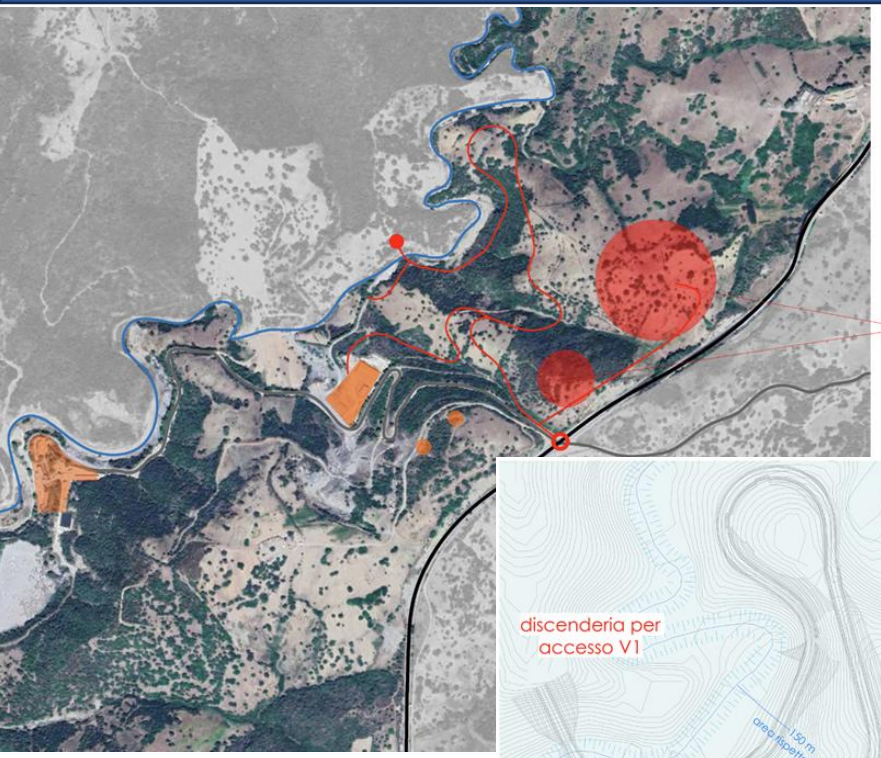


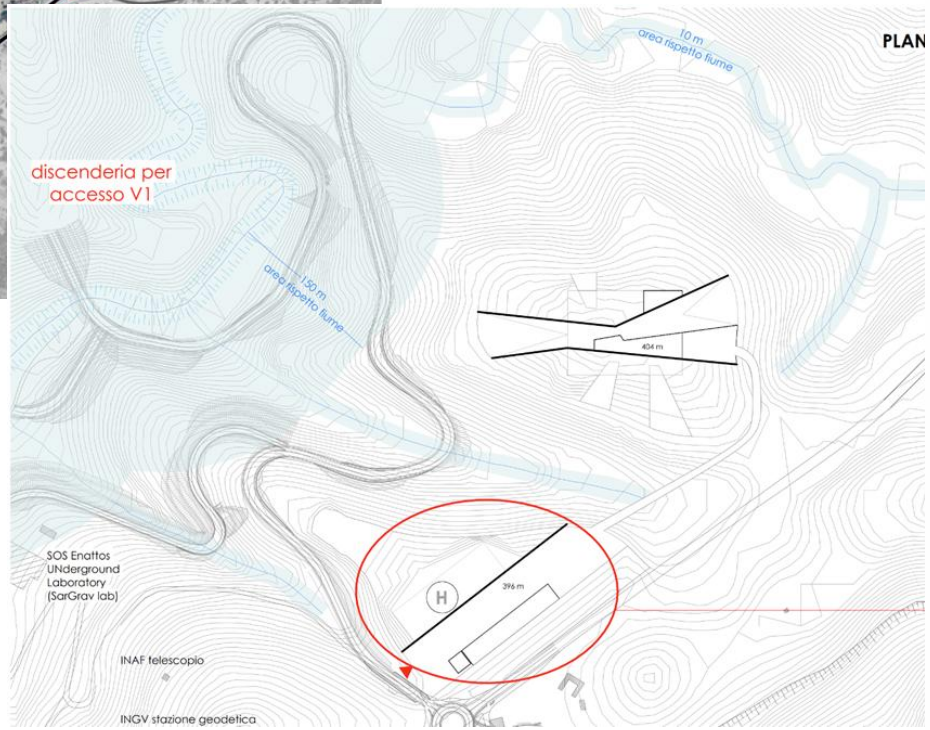


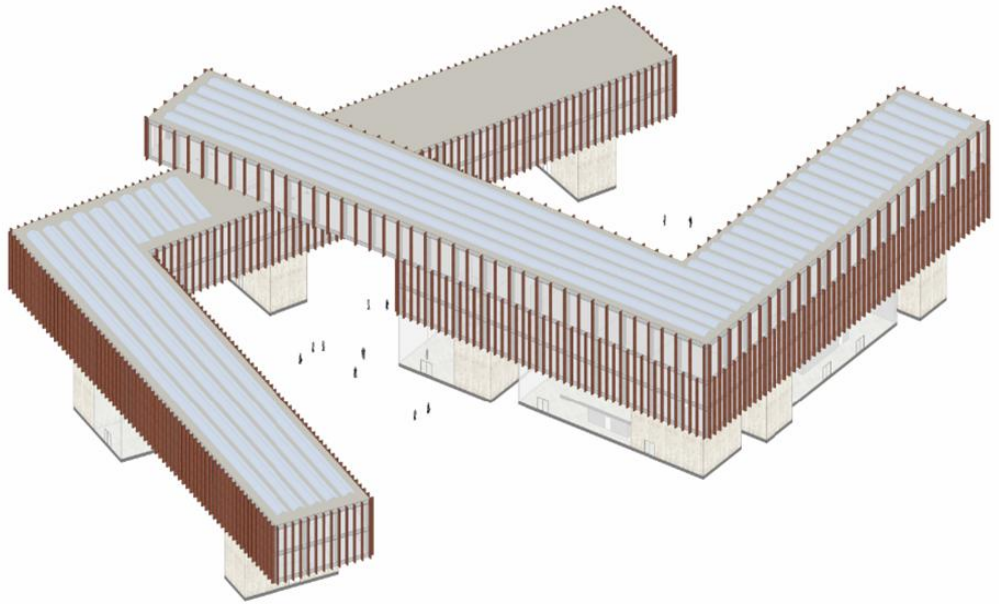
Escape shaft


2025 ....

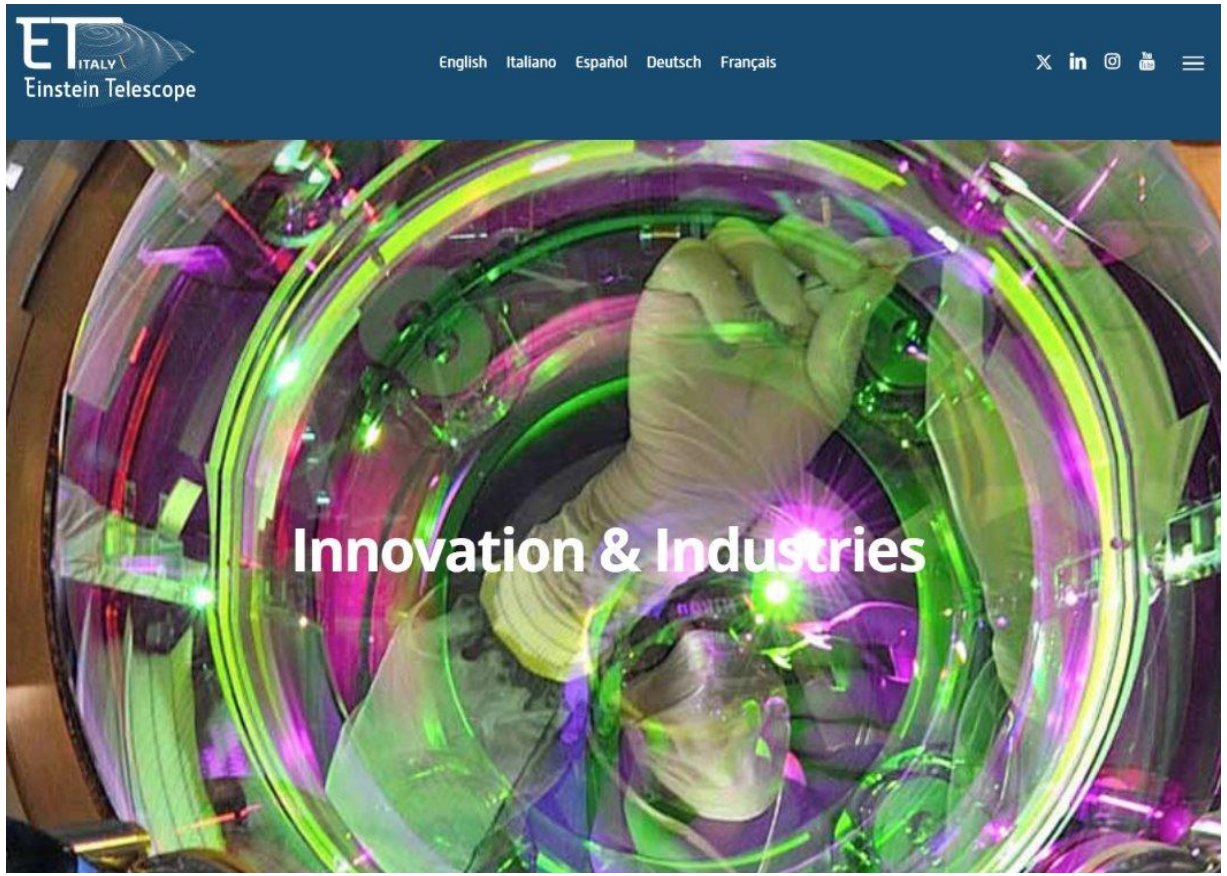
Main construction yard and then research center







ET meets industries in Italy



~100 Italian companies involved in R&D and procurements for ET as of today

Local industry involvement

A call for expressions of interest for the development of innovative technological solutions in the field of Key Enabling Technologies (KETs), in connection with the Einstein Telescope (ET) project.

~70 companies From Sardinia applied, with ~70 projects

1. Vacuum pipe insulation
2. Virtual Reality and Artificial Intelligence
3. O-Ring manufacturing
4. Electromagnetic compatibility
5. Development of magnetometer instruments or new technologies
6. Indoor and outdoor environmental monitoring
7. Acoustic design of underground infrastructures
8. Logistics
9. Other activities related to the Einstein Telescope (ET) project and Key Enabling Technologies

https://www.sardegnaricerche.it/index.php?xsl=370&s=462248&v=2&c=3169&nc=1&sc=&archivio=2&qr=1&qp=3&vd=2&sb=1

Take home

- The Sos Enattos has outstanding unique advantages
  - Noise, geology, environment, economic growth

- The comprehensive project for ET in Sardinia is advancing quickly
  - For L and T configurations
  - Ready by end of 2025, in line with ESFRI
  - It will be updated to Task Force design
  - It will release a ready-to-tender study for civil engineering infrastructures