


Preparatory activities for the ET sustainable design in Sardinia



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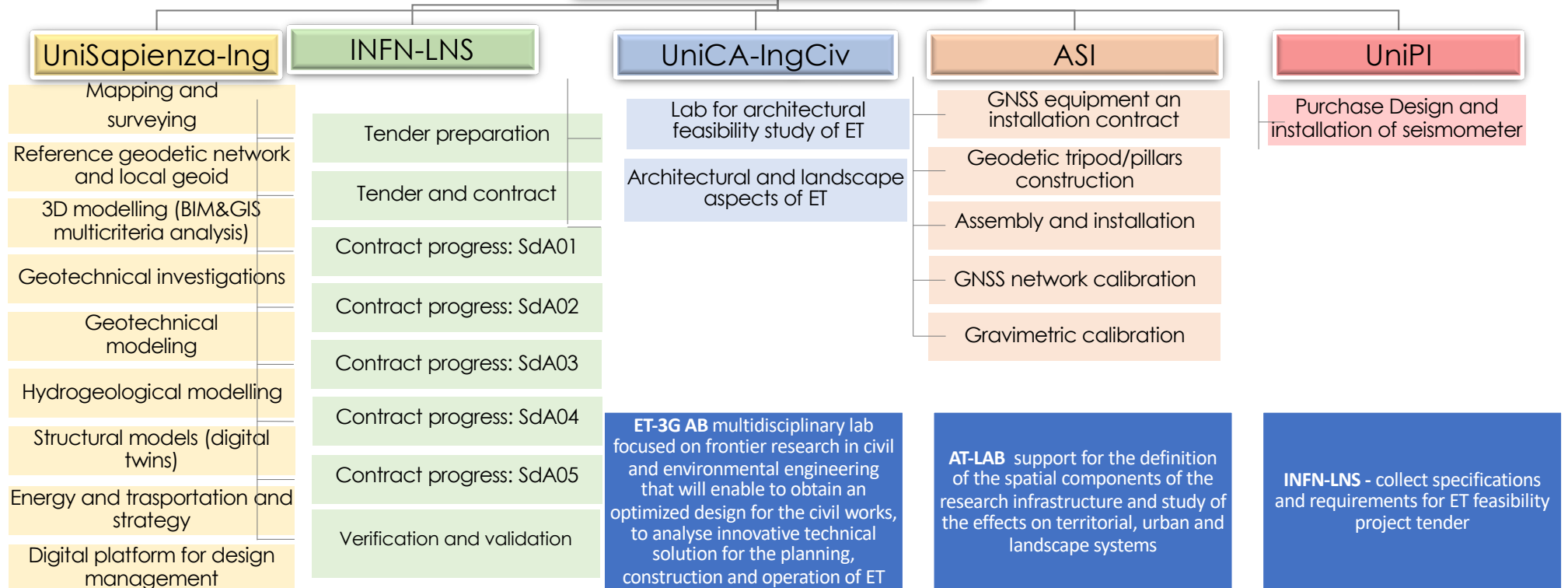
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SPB meeting -25 january 2023

EWP6 - SUSTAINABLE DESIGN



Finanziato dall'Unione europea
NextGenerationEU

Avviso pubblico per 3254 del 28-12-2021 per "Rafforzamento e creazione di Infrastrutture di Ricerca" da finanziare nell'ambito del PNRR, Missione 4, "Istruzione e Ricerca" - Componente 2, "Dalla ricerca all'impresa" - Linea di investimento 3.1, "Fondo per la realizzazione di un sistema integrato di infrastrutture di ricerca e innovazione".

Finanziato dall'Unione europea - NextGenerationEU

Progetto IR00000004 - ETIC - Einstein Telescope INFRASTRUCTURE CONSORTIUM

"PROGETTO DI FATTIBILITÀ TECNICO-ECONOMICA, COMPRENSIVO DELLA ESECUZIONE DELLE INDAGINI E DEI SONDAGGI E DELLA VALUTAZIONE PRELIMINARE DI IMPATTO AMBIENTALE, PER LE OPERE INFRASTRUTTURALI, IN SOTTERRANEA E IN SUPERFICIE, EDILI E IMPIANTISTICHE DEL RIVELATORE DI ONDE GRAVITAZIONALI EINSTEIN TELESCOPE NELLA REGIONE SARDEGNA"

University of Pisa (Scienze della Terra) in-situ network for contributing to the extraction of a detailed geological model

Italian Space Agency (ASI) geodetic control network

Preliminary plan of surveys and investigations

- *documentation necessary to announce the tender within the limits of the available budget*

- *Location problem*

- *Detail/integration after geometry/localization WP6, (pre-award or during the the project)*

- *CTS reference interacting with SPB and ET-Italia*



Investigation plans

takes into account the preliminary nature of the current state of knowledge

the geometric and locational field,

aimed at quantifying the surveys within available budget



Technical specifications

all possible activities to be carried out as part of the investigation

documentation necessary to launch the tender ensure the achievement of the expected results

defined with the specification of the necessary in-depth analysis



estimate of expenditure for survey plan

price list verifies the final cost to be used as a basis for the tender for carrying out the surveys

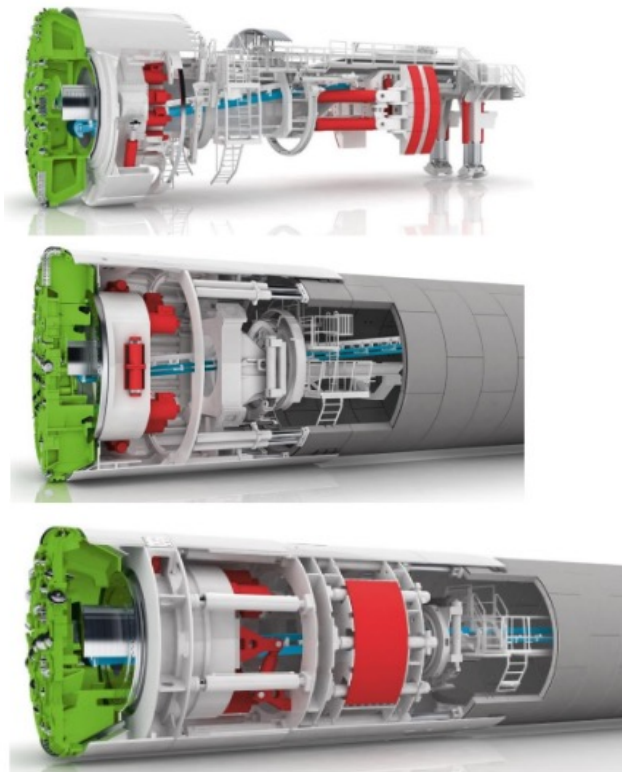
limits deriving from, embryonic state of the information on the infrastructure

Preliminary plan of surveys and investigations

		number	Measuring points/tests	linear meters (laying or drilling)	Map scale
▪ Lidar survey and detailed celerimetric surveys	geo-structural surveys (rocky outcrops and related statistical-structural analysis)	80 (at least 1 every 500 m)			
	Geognostic surveys ((at least 3000m continuous core drilling using wireline)	20		5000	
▪ Geological, geomorphological and hydrogeological surveys	Permeability tests in Lugeon type hole	4	80		
	Video inspection			2000	
	Dilatometric tests	10	200		
	Prove penetrometriche SPT	30			
▪ Geological report including Local Seismic Response	Installation of piezometers	10		2500	
	Down-Hole tests	4	1000		
	Cross-Hole tests	4	1000		
▪ Characterization Activity Report	Indirect seismic surveys of the refraction type (of at least one stretch per km)			6000	
	samples of land	50			
▪ Environmental investigations aimed at detecting underground gases	samples of rocks or aggregates	250			
	reclamation of explosive devices on an area 5 x 5 m in correspondence of the vertical investigations and in the hole			5	
	Geological Map				> 1:10000
	Geomorphological map				> 1:10000
	Hydrogeological map				> 1:10000
	Technical Lithological Paper				> 1:10000
	Acclività Map				> 1:10000

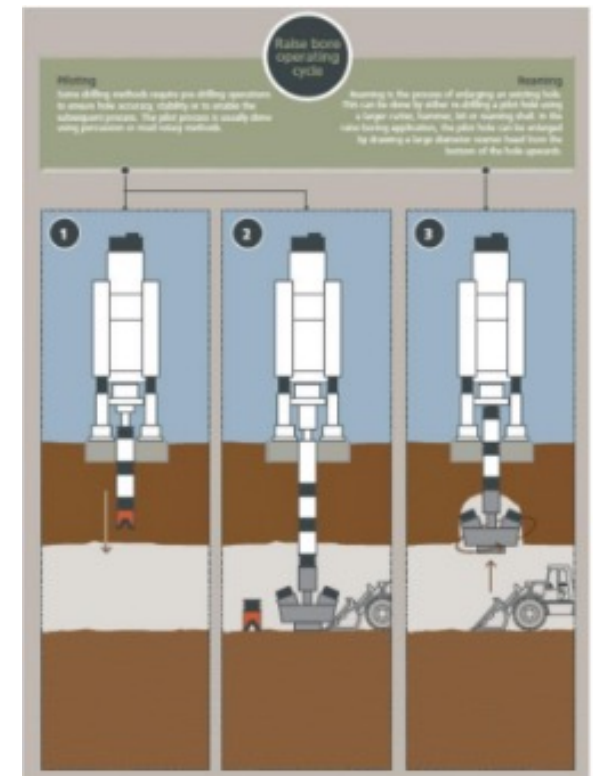
Research activities on the mechanized excavation of the tunnels of the ET project in support of the technical feasibility study-economic excavation in the Sardinia region

Advantages and disadvantages of excavation with TBM and traditional method

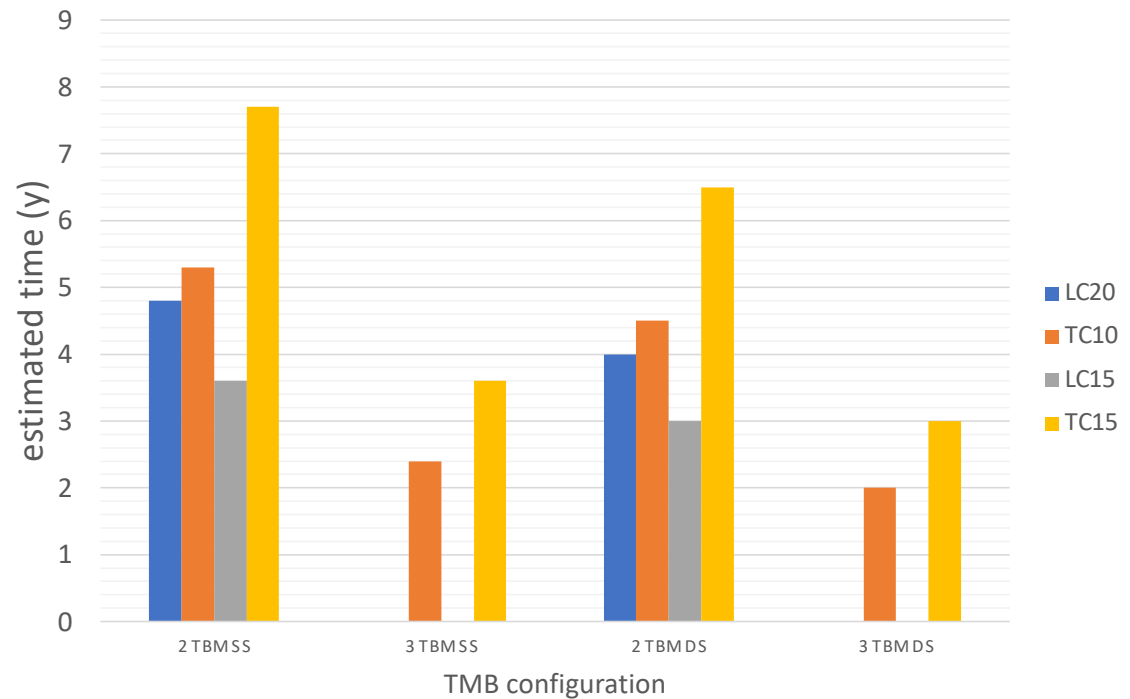


- Gripper TBM
- Single shield TBM
- Dual shield TBM

Methodology of excavation of emergency exits, tunnels accessories and wells.

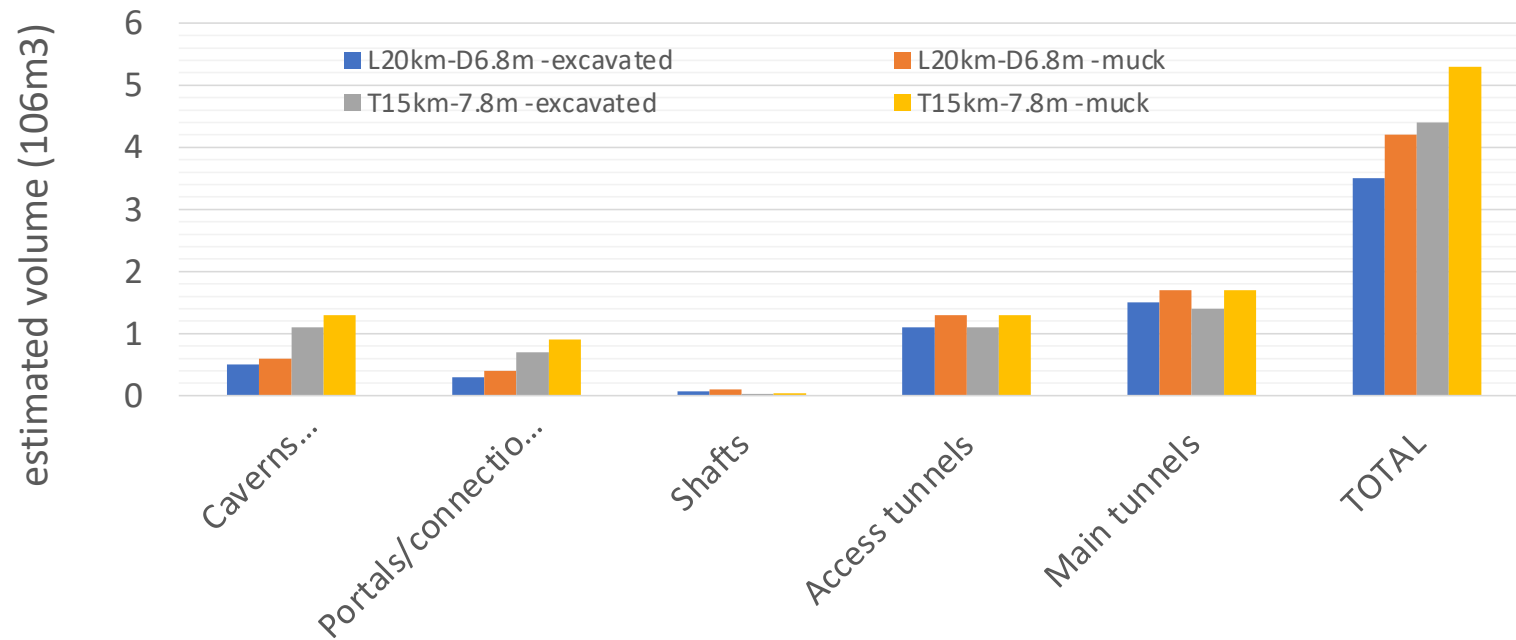


- TC10 and LC20 configuration
- two or three TBMs already positioned at the vertices advancing in parallel; digging from one vertex to another without intermediate exits.
- two TBMs of the triangle configuration, to consider the passage of a machine from one tunnel to another;
- feed speed calculated considering the ROP and U values averaged with respect to the occurrence of the formations encountered along each route
- These values are in the range 14-19 m/dayshifts of 24 hours and 345 working days per year



Estimated time for the construction of the main tunnels considering different configurations and assuming - ROP=2m/h for both formations.

Preliminary indications on the management of excavated lands and rocks

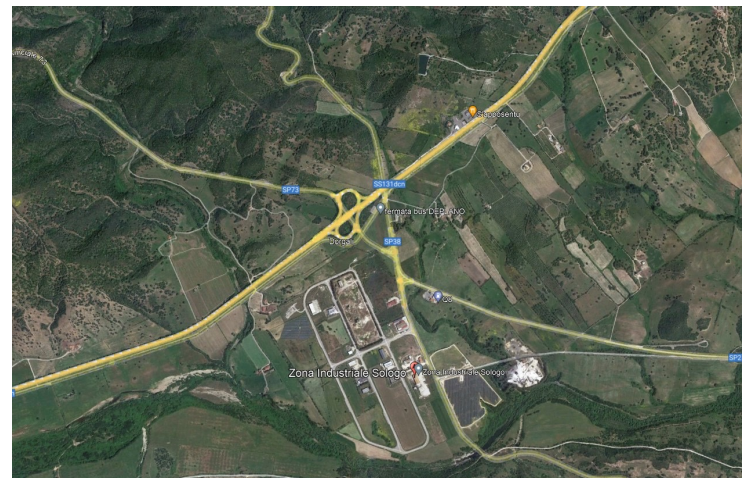
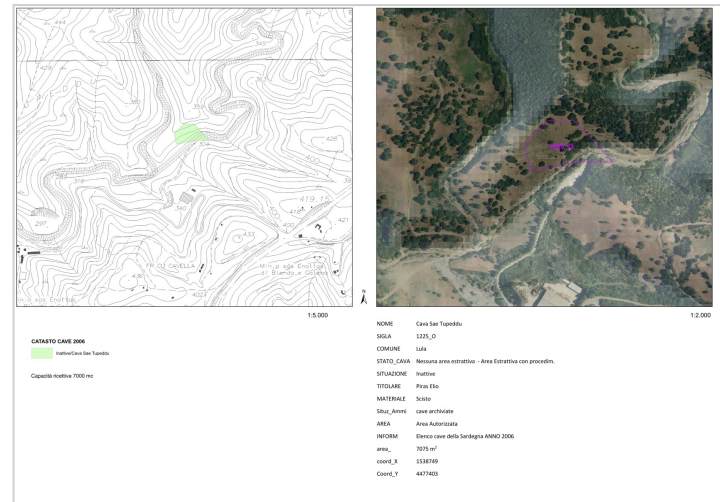
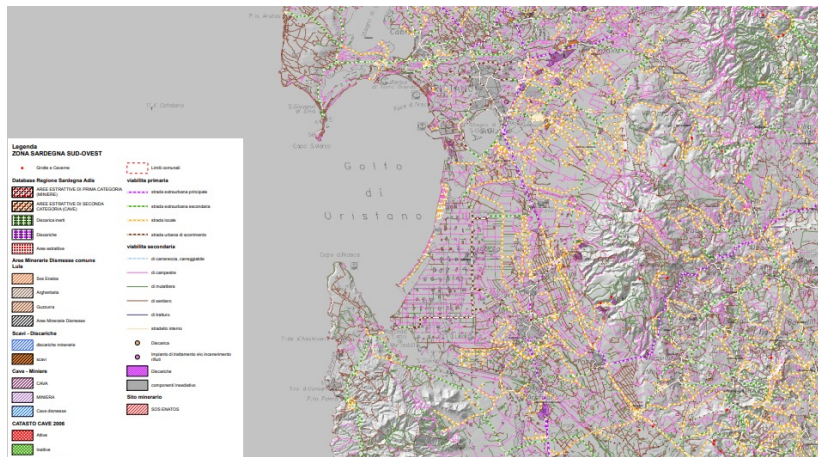


The volume of excavated and crushed material was obtained by multiplying by a factor of 1.2 the volume of the rock in place, in order to take into account the voids in the pile.

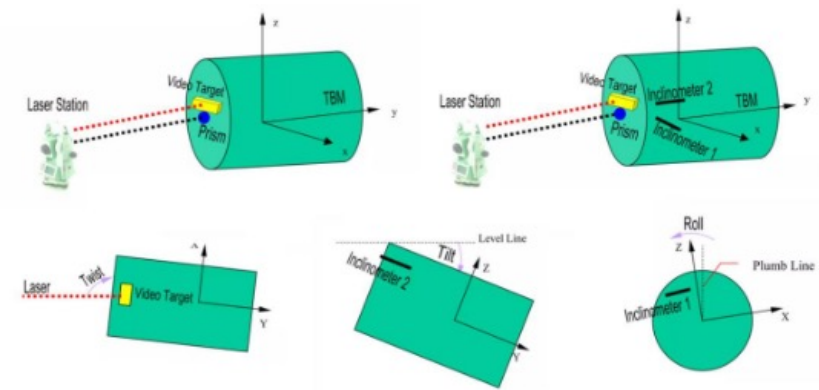
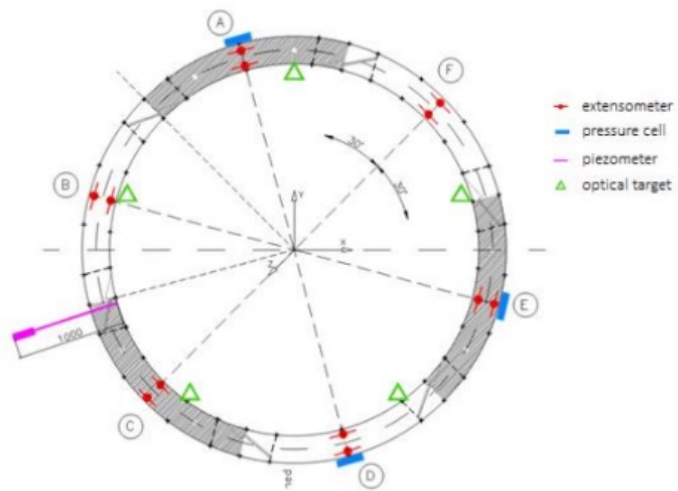
Map of Caves and type of constraints
objective to analyze and verify, in the wide area of the site where the E.T. interferometer should be built, the various active and abandoned production realities as well as some projects being drafted that could require, both in the characterization of their economic cycle and in their realization, volumes of aggregates.

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- The mining sector
- The regulatory framework of mining activities in Sardinia
- The Regional Plan of Mining Activities - PRAE
- Mining and surety policies
- Geology, land use, the Hydrogeological Plan
- Landfills for aggregates
- Delivery and recycling plants
- Active quarries and inactive quarries
- Design and planning of the infrastructure of the territory: The sites for reuse
- Acquisition of all excavated materials
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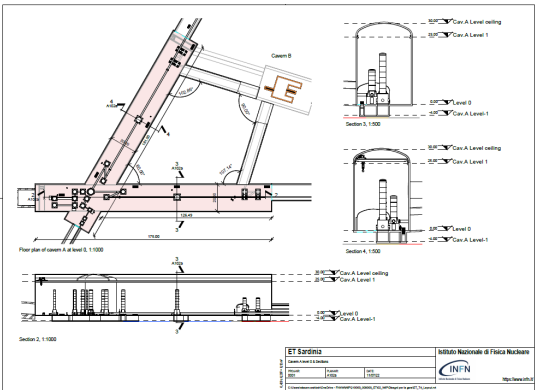
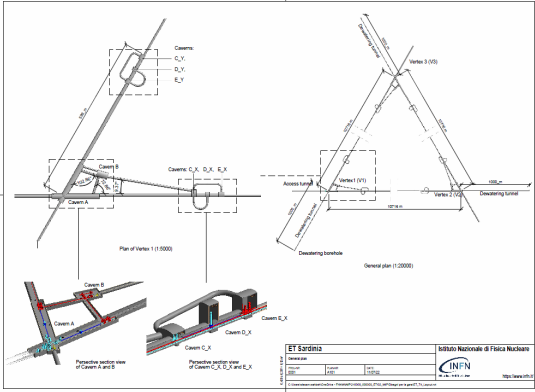
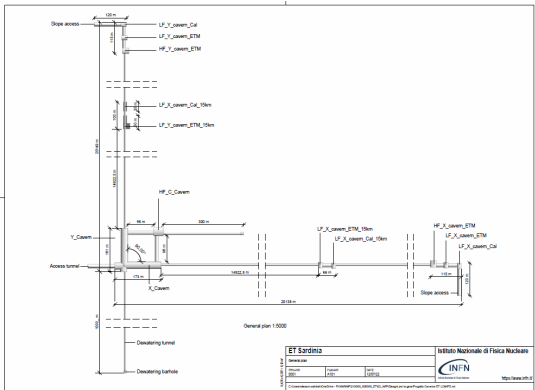
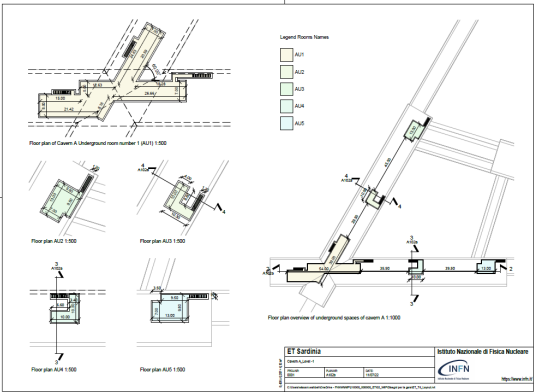
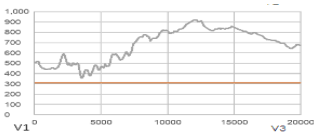
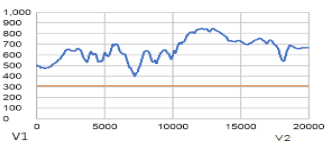
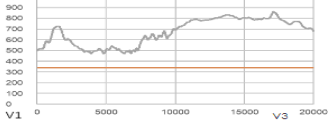
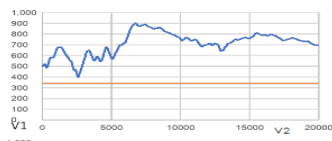
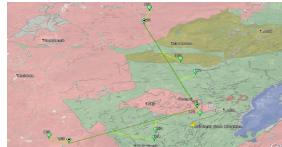
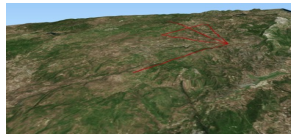
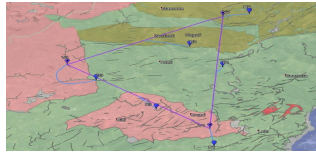
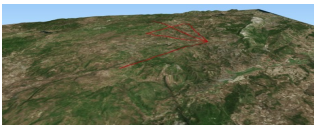


Alignment control and monitoring



Layout and positioning of the detector ET hypothesis

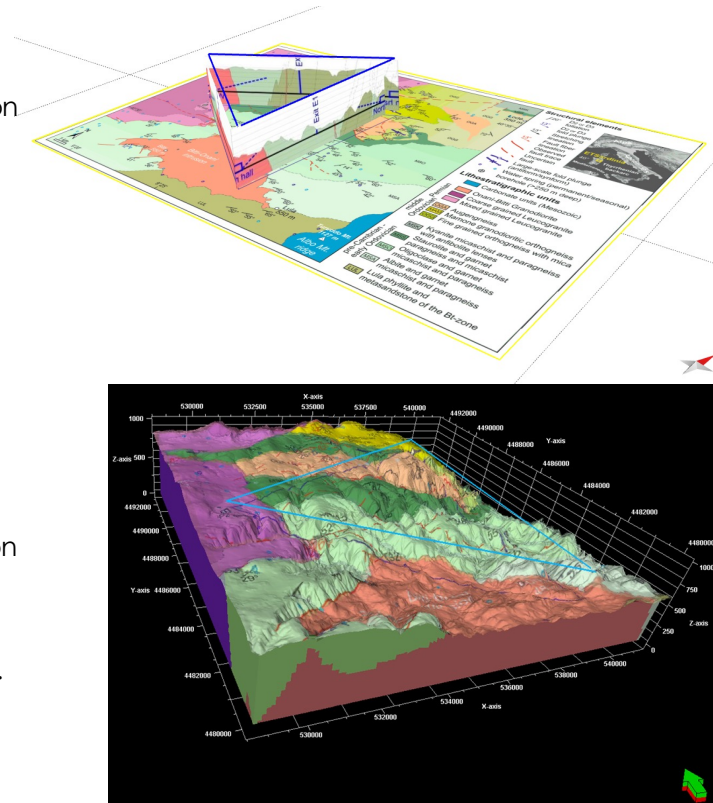
Multi-criteria analysis



Geological Database

construction of a homogeneous database, in which all the available geological, geophysical and geographical data have been included to support the subsequent modelling phases

- 3D geological model calibrated with surface/subsurface geological information from the literature and recent studies (including wells, geological, geoelectric, tomographic and seismic sections)
- represents a first 3D quantitative data of the main geological trends of the subsoil and the relative rocky volumes
- Make geographical information homogeneous (e.g. coordinates, elevation of seismic / tomographic / geoelectric sections and wells)
- Retrieve precise georeferenced data related to geophysical surveys (navigation and digital data of 2D tomography and geoelectrical acquisitions), and geological information (e.g. maps and additional data already georeferenced).
- Retrieve digital P2 and P3 well log data (including VSP profile speeds)
- Seismic reflection interpretation and digital production of stack speeds



- Digital terrain models
- Topographic maps / aerial / satellite photos
- Geological and thematic maps (sometimes already available in GIS environment), such as structural maps, hydrogeological maps.
- Geological/structural sections
- Well data for deep geognostic surveys (e.g. lithology, stratigraphy and digital logs,) and for water (e.g. presence and distribution of water, their characteristics, and piezometric levels)
- Geophysical acquisition data (geoelectric, tomographic and seismic line sections)
- Geotechnical data (e.g. properties of soils and rocks, and geomechanical characterizations)
- Gravimetric charts. Magnetic or magneto-telluric
- Seismic reflection data
- Soil and rock velocity data

Next steps

- ✓ Complete the specialized studies and organize meeting by inviting consultants/experts
- ✓ Establish an external technical-scientific engineering committee (CTS) and consolidate the internal technical-scientific profiles for the control and guidance for civil works design
- ✓ Form thematic working groups (scientific referents) for consultation for the definition of relevant parameters for design, risk identification, maintenance and operations needs, etc. for the benefit of the bidbook