Infrastructure

Division 6 of the ET Instrument Science Board

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Infrastructure Division – Working Group

VII.1 Underground works/infrastructure

VII.2 Surface civil infrastructure

VII.3 Safety issues

VII.4 Service plants

VII.5 Regulatory framework
VII.1 - Underground works/infrastructure

- Geological studies
- Geophysical characterization
- Geotechnical analysis
- Excavation methods
- Groundwater drainage
- Caverns
- Tunnels
- Access tunnels
- Shafts
CAVERNS and CORNER POINTS

→ Outside environmental noise buffer zone
→ Reduced / no flexibility for cavern axis orientation
→ Stable, massive ground (stay away from fault zones)
VII.1 - Underground works/infrastructure

CAVERNS and CORNER POINTS

- Outside environmental noise buffer zone
- Reduced / no flexibility for cavern axis orientation
- Stable, massive ground (stay away from fault zones)
Excavation methods (D&B versus TBM) and accuracy of tunnel alignment (requirements ET > conventional tunnelling) → e.g. Gyroscope controled TBM

- Problematic zones in terms of stability (not identified yet) and high permeability (under investigation)
- Steady state inflow and maybe surface subsidence
VII.1 - Underground works/infrastructure

MAIN TUNNEL – EXCAVATION METHODOLOGY

- Geomechanical characterization
- Geotechnical modelling
- Excavation design
VII.1 - Underground works/infrastructure

IN-SITU ENGINEERING ROCK MASS CHARACTERIZATION

Rock-outcrops in the ET-Area

Example: Route de Val Dieu (Sandstone)

Example: Geostuctural analysis at SAR-GRAV (near vertex V1)
DEEP DRILLING

- Geological exploration and modelling
- Excessive geomechanical testing
- Hydraulic in-situ testing
- Stress measurements
- Geophysical borehole logging
- Environmental noise measurements

No. 2 deep drilling BOREHOLES up to 250-300 m near the V2 and V3 vertex

- Geological and geotechnical characterization;
- Geophysical logs;
- Acoustic camera (BHTV);
- Seismic noise measurements

LIMBURG REGION

Suitable for cavern?

Damping?

Korst?

Fault?

SARDINIA REGION
VII.1 - Underground works/infrastructure

SURFACE GEOPHYSICAL INVESTIGATION

LIMBURG REGION

SARDIANIA REGION

2 km
At larger depth (i.e. > 200m) an impervious lining without drainage is technically challenging and expensive. Tunnel designed impervious with drainage → ongoing steady-state water inflow → Detailed hydrogeological investigations (anticipate) → Inflow reduction by grouting → Tilted design of the telescope → Dewatering facilities far away from noise sensitive infrastructure.
VII.1 - Underground works/infrastructure

ACCESS TUNNELS

Inclined Ramp

Helical Ramp

Vertical Ramp
VII.2 - Surface civil infrastructure

SURFACE INFRASTRUCTURES
VII.2 - Surface civil infrastructure

- Virtual optimization design
- Low environmental noise design
- Digital Twin
- IoT
- GIS/BIM Modelling
VII.3 – Safety issues
Interference with exiting service networks
Additional plants
Connection with existing networks
Innovative photovoltaics
VII.5 - Regulatory framework

➢ excavation material replacement
➢ groundwater disposal
➢ environmental law
➢ natural park and protected areas
➢ contaminated waste
➢ involvement of private partners
➢ Buffer zones
GIS-BIM INTEGRATED MODEL

INFRASTRUCTURE DIVISIONS INTERCONNECTION ANALYSIS

DTM Sardinia Region

ET infrastructures
(underground and surface)
INFRASTRUCTURE DIVISION INTERCONNECTION ANALYSIS

GIS-BIM INTEGRATED MODEL

LULA

SAR-GRAV

11th Einstein Telescope Symposium, 30 Nov – 03 Dec 2020