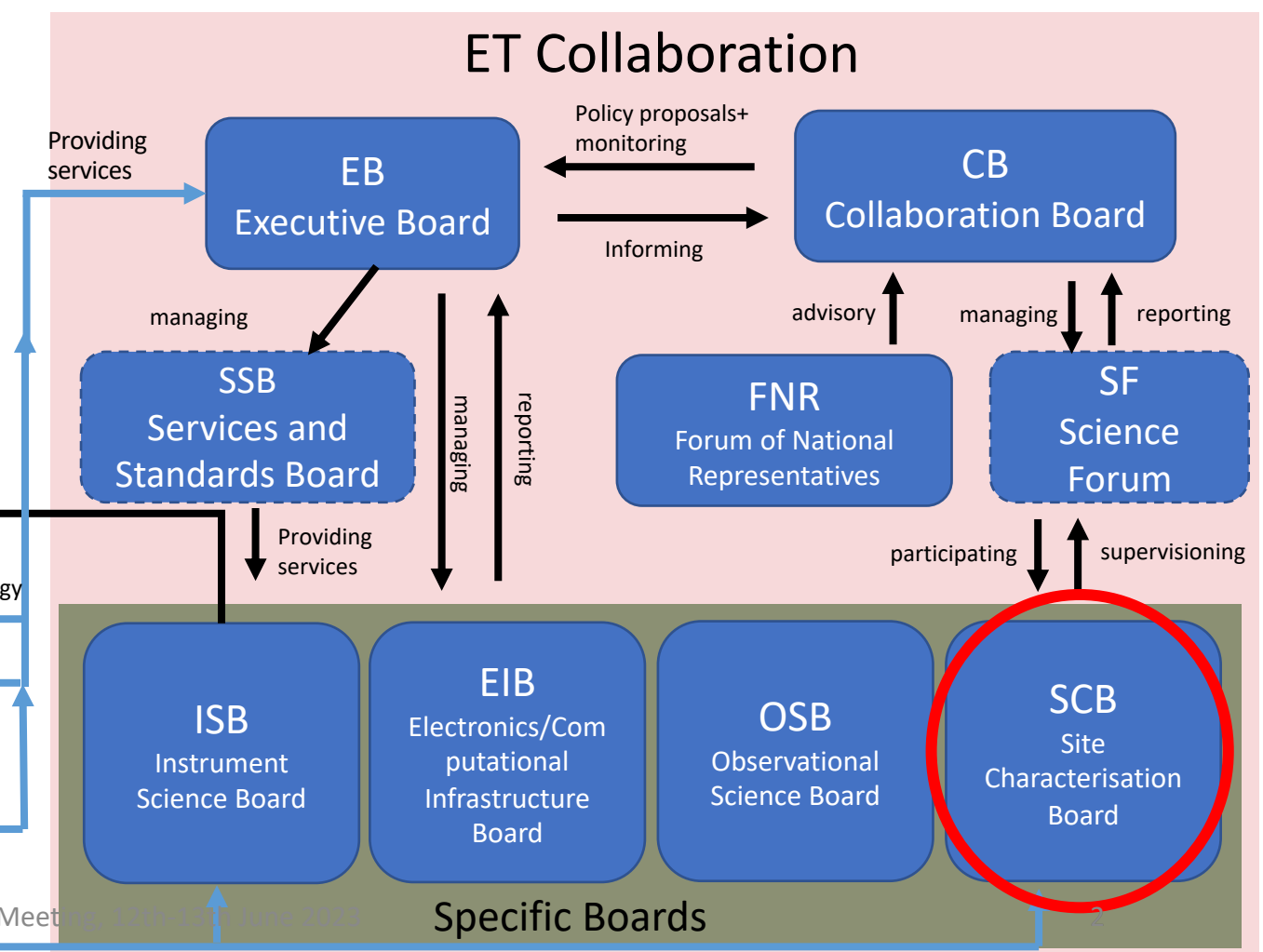
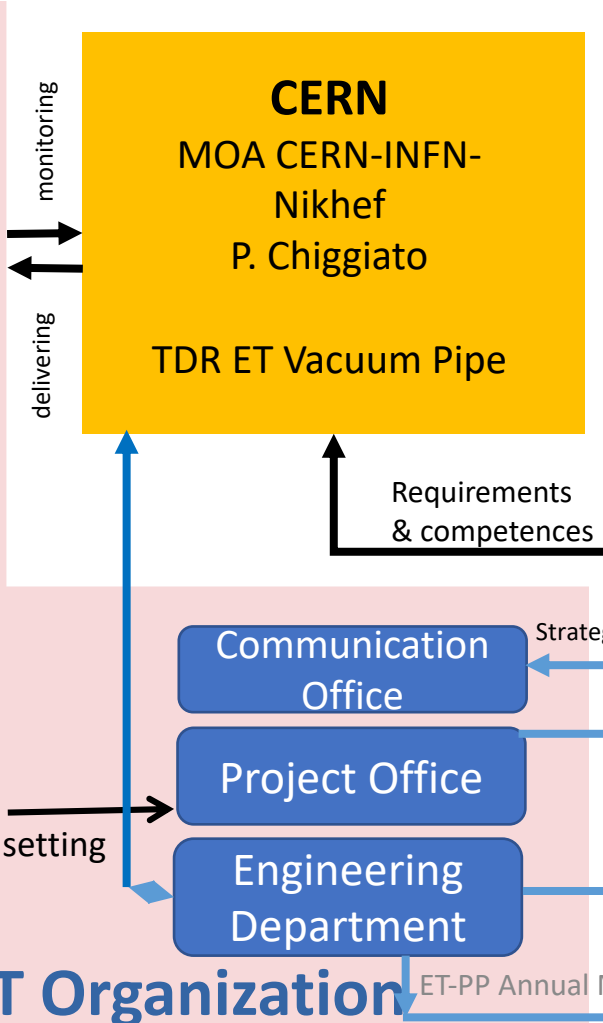
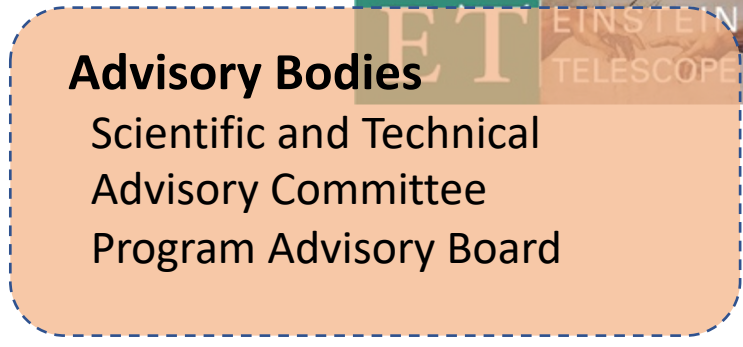
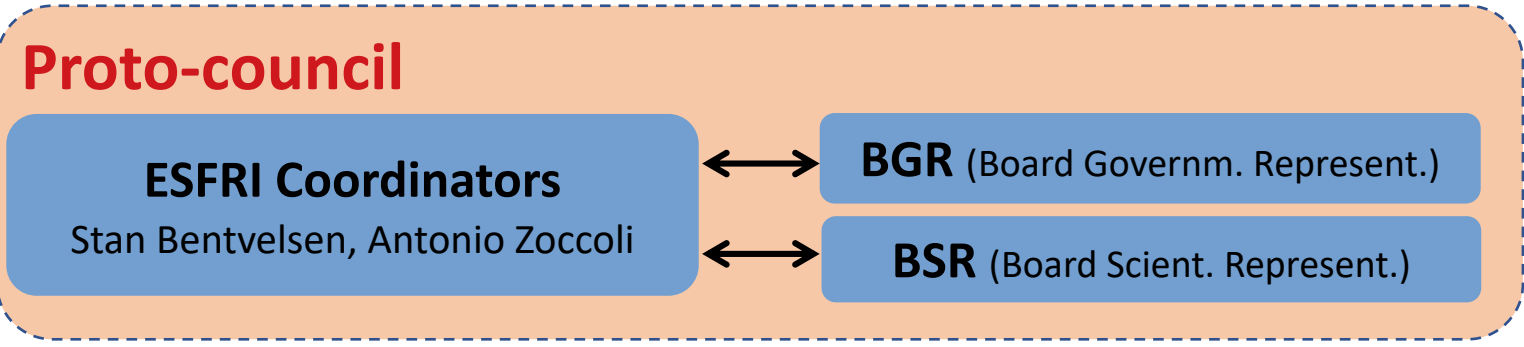


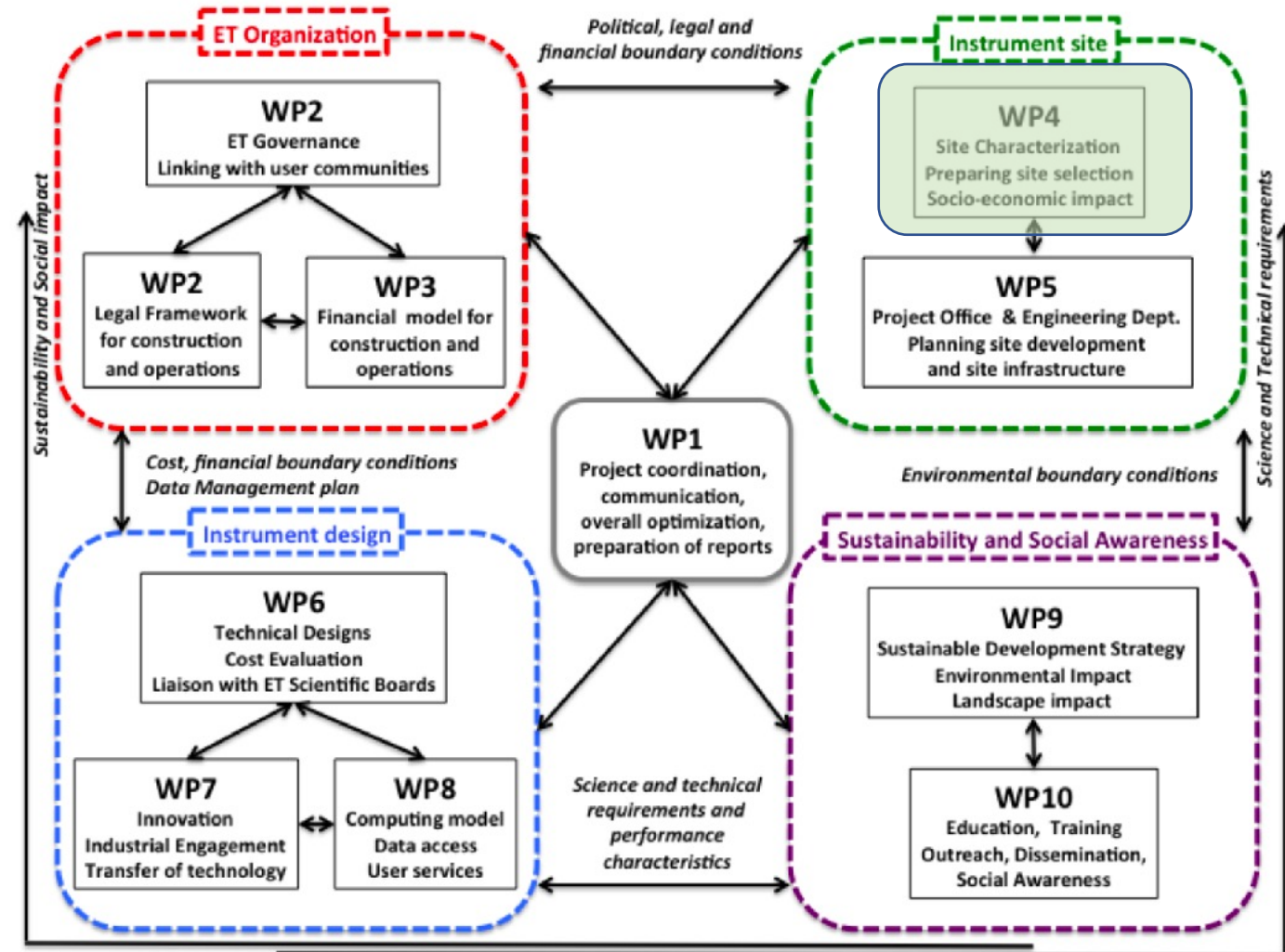
WP4
**Site Characterization &
Preparation Board
overview**

W. Walk & D. D'Urso



INFRADEV: ET-PREPARATORY PHASE

- ET governance
- Legal framework
- Financial Model
- WP4: Site characterization
- Project Office & engineering
- Technical design
- Innovation
- Computing Model
- Sustainability Strategy and Environmental impact
- Outreach



WP4 Milestones

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*** Not ready

**Dedicated SPB Workshop (together with ISB related WPs) in Oct.
At ET annual Meeting final presentation**

Report expected by the end of 2023

(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* **By July 2023**
- **D4.2 - M15/INFN:** *Updated socio-economic impact studies. Scan of accessibility, quality of life etc.*
- **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)

You are here: ET - Einstein Telescope Wiki Pages > SPB Web > WebHome (20 Jan 2023, Bulik)

Edit

Attach

Subscribe

SPB - Site Preparation & Characterization Board

Composition of the Board

Chairs

Domenico D'Urso (ddurso@uniss.it), Wim Walk (wim.walk@nikhef.nl)

Divisions under the ET Collaboration

- **WD1: Physical Variables and Characterization** : Luca Naticchioni (luca.naticchioni@roma1.infn.it), Shahar Shani Kadmiel (shahar.shani.kadmiel@knmi.nl)
- **WD2: Geology** : Leonardo Casini (casini@uniss.it), Frédéric Nguyen (f.nguyen@uliege.be), Wim Walk (wim.walk@nikhef.nl)
- **WD3: Bidbooks** : Tomasz Bulik (tb@astrouw.edu.pl)

Divisions under the PD

- **WD4: Cost timing and risk assessment**
- **WD5: Legal and site preservation**
- **WD6: Socio-economic and environmental impact**

Meetings

The SPB general meeting is scheduled every 2 weeks on Wednesday, 4PM CEST/CET.

- [SPB general meetings and minutes](#)

Documents and useful links

Mailing list: et-spb@list.infn.it Subscribe [here](#)

Want to join ?

<https://wiki.et-gw.eu/SPB/WebHome>

https://lists.infn.it/sympa/subscribe/et-spb?previous_action=review

ET-PP Annual Meeting, <https://lists.infn.it>



SPB-WD1: Milestones and Deliverables

Division Milestones:

- **M1.1: physical variables:**
ET-0012A-23, discussed and finalized at the II SPB Workshop (Jan 2023)
<https://apps.et-gw.eu/tds/?content=3&r=18113>
- **M1.2: measurements recommendations and standards:**
ET-0013A-23, discussed and finalized at the II SPB Workshop (Jan 2023)
<https://apps.et-gw.eu/tds/?content=3&r=18114>
- **M1.3: data format standards and analysis tools (*draft*):**
Draft delivered,
<https://drive.google.com/file/d/1EmddYQSXZYxmJHMwvOYq6E3b2FIJkNcN/view?usp=sharing>

Status Activities



SPB-WD1 – WP1

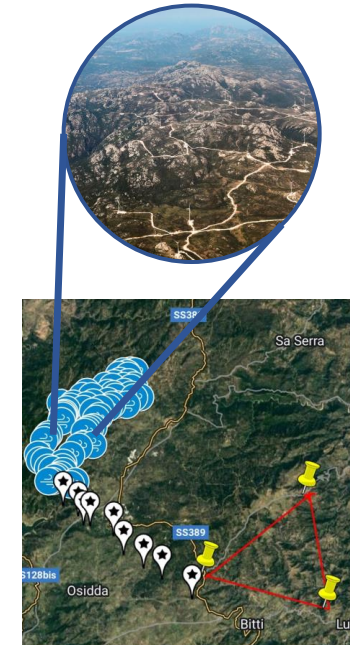
C. Giunchi & S. Shani-Kadmiel

General achievements:

- Long-term seismic monitoring of both sites started and going on;
- Borehole drilled at both (three) sites;
- First results published in several papers.

Sardinia updates:

- Temporary seismometer deployments to study the vibration input and decay due to wind farms;
- Ambient noise characterization (just published: M. Di Giovanni et al., *Temporal variations of the ambient seismic field at the Sardinia candidate site of the Einstein Telescope*, Geophysical Journal International, <https://doi.org/10.1093/gji/ggad178>);
- New long-term seismic stations will be deployed in the area;



From the XIII ET Symposium

Status Activities



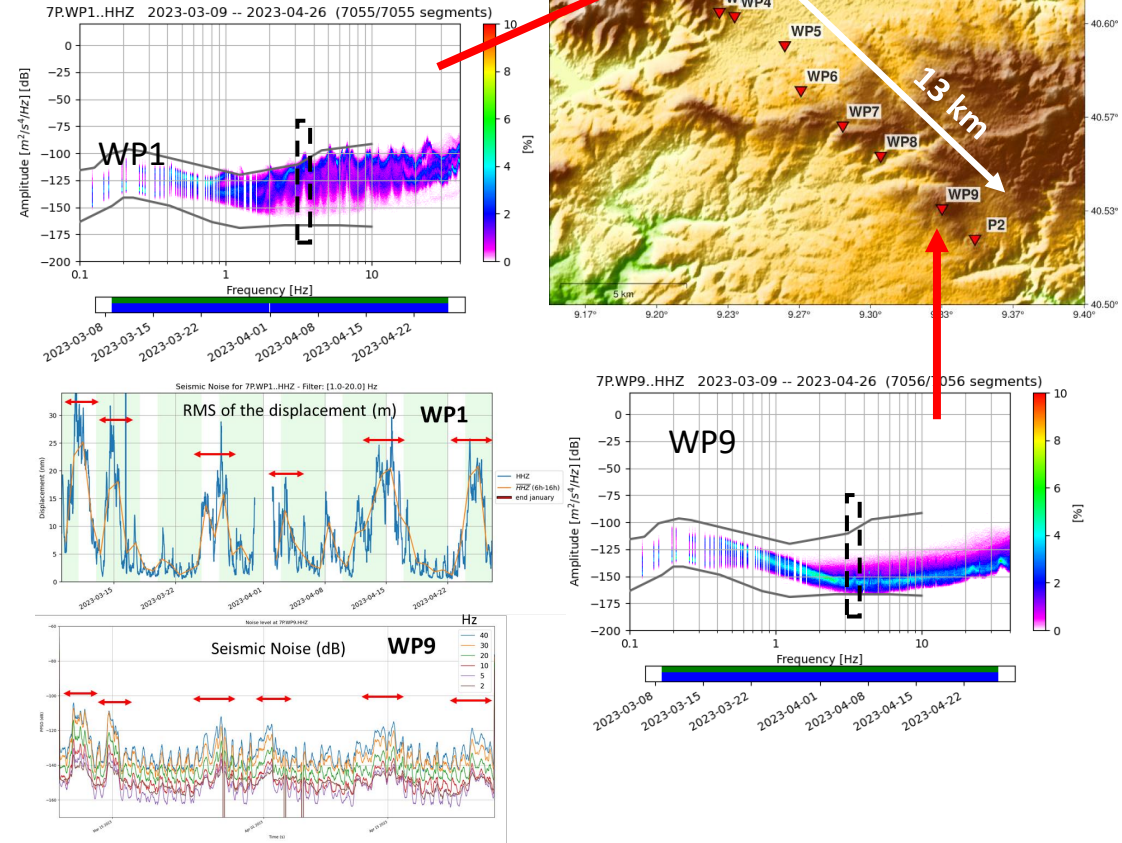
SPB-WD1 – WP1

C. Giunchi & S. Shani-Kadmiel

Wind farm study in Sardinia: a first look at data

- Main peak at 3Hz + harmonics close to the wind farm;
- Only main peak + first few harmonics close to P2, visible wrt to the low background (NLNM);
- Wind-correlated increase of noise rms;
- Analysis ongoing: spectral features and correlation with wind measured at weather stations close to the windfarm and with rotational speed of wind turbines.

From the XIII ET Symposium



10

L. Naticchioni, SPB/WD1 status - XIII ET Symposium – Cagliari, 8-12 May 2023

Status Activities

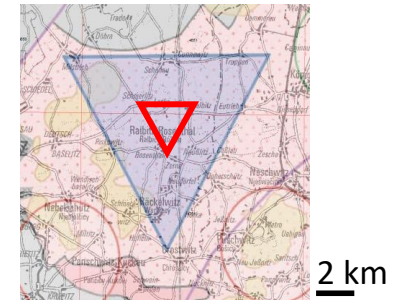


SPB-WD1 – WP1

C. Giunchi & S. Shani-Kadmiel

Lausitz Update:

- Currently 1 surface station running, 1 borehole station at 160m depth and 1 borehole station at 165m depth. The station at 165m depth will be lowered to 245m depth in the next couple of months. Additionally, there is one barometer running to monitor air pressure.
- The geophysical/geological site investigation is planned, currently waiting for the funding to be released. This will entail:
 - *Ambient noise monitoring* in the area of the possible ET location to have a 3D image of the contact between granodiorite and sedimentary rocks;
 - *Shallow reflection seismics* around the current borehole;
 - Identify 3-4 further borehole locations;
 - Constructing a 3D geological model based on all literature data;
 - *Characterisation of the cores.*
- The plan is to start in early summer with first results early 2024.



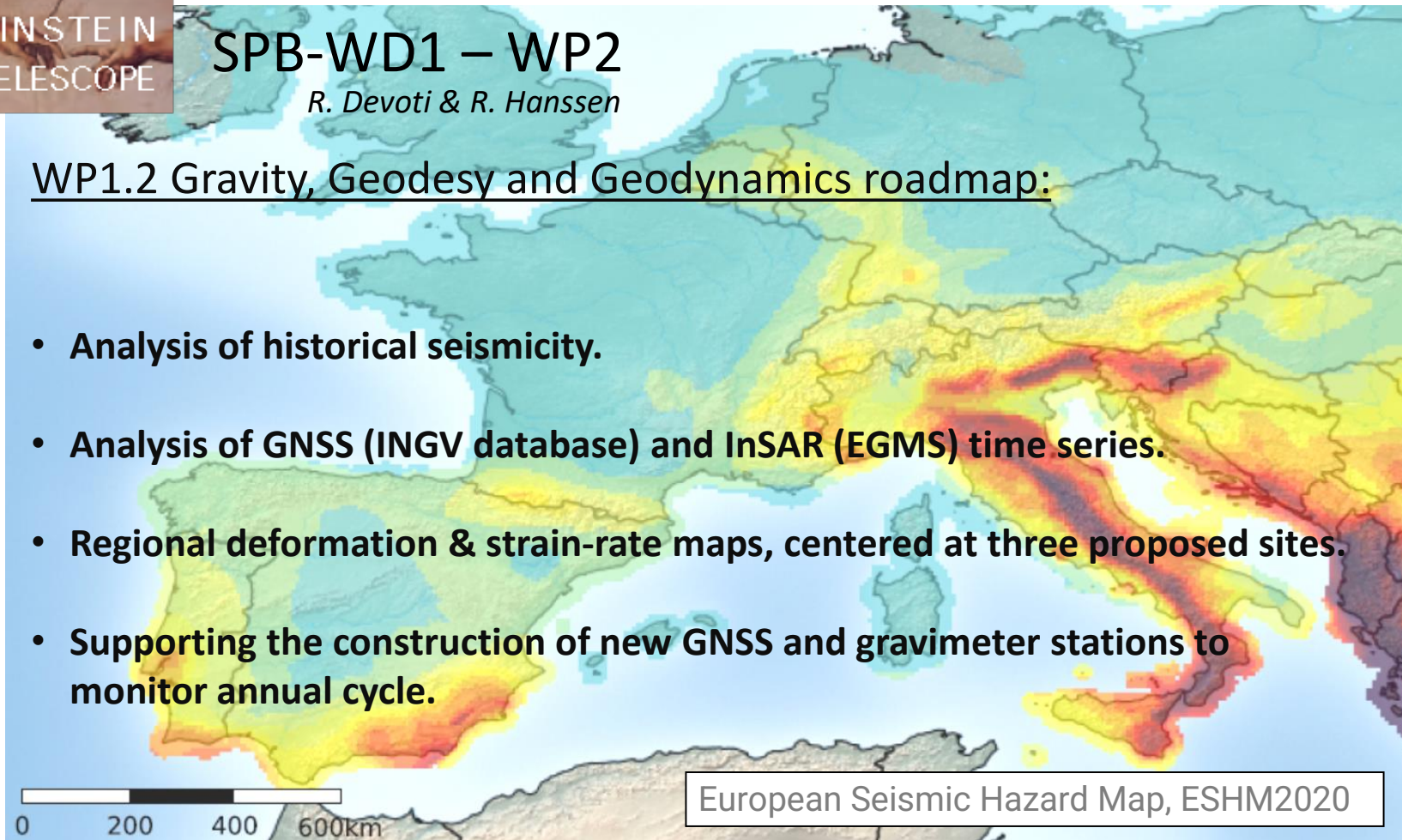
Status activities

SPB-WD1 – WP2

R. Devoti & R. Hanssen

WP1.2 Gravity, Geodesy and Geodynamics roadmap:

- Analysis of historical seismicity.
- Analysis of GNSS (INGV database) and InSAR (EGMS) time series.
- Regional deformation & strain-rate maps, centered at three proposed sites.
- Supporting the construction of new GNSS and gravimeter stations to monitor annual cycle.





SPB-WD1 – WP3

R. De Rosa

Sites Characterization

Currently there are:

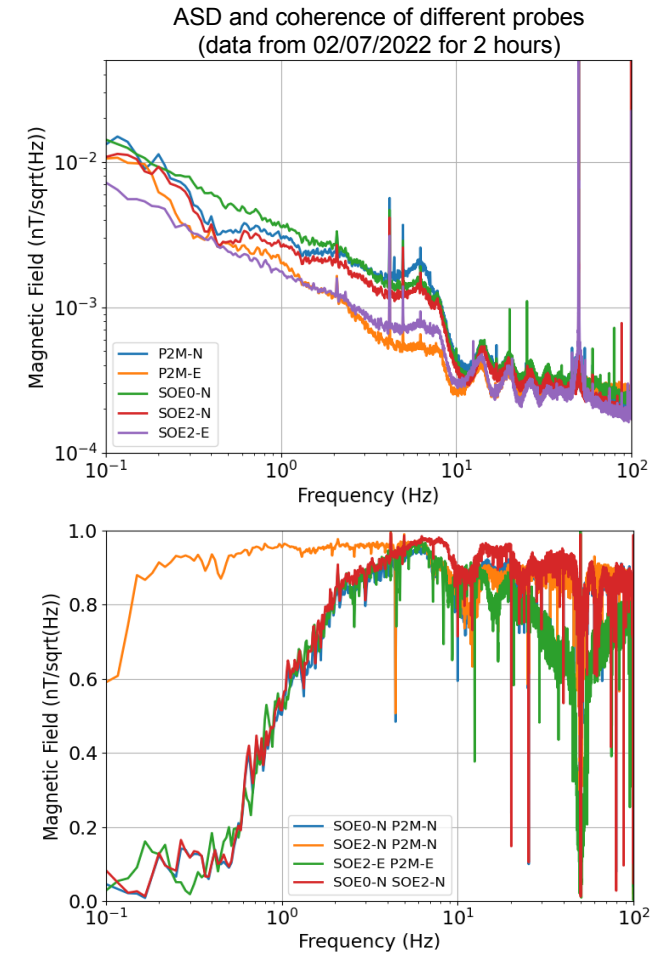
- 1 mag. probe (N-S direction) in surface at Sos Enattos (SOE0)
- 2 mag. probes (N-S and E-W directions) at -111 m underground at Sos Enattos
- 2 mag. probes (N-S and E-W directions) in surface at Bitti (P2)



16

L. Naticchioni, SPB/WD1 status - XIII ET Symposium – Cagliari, 8-12 May 2023

From the XIII ET Symposium



Status Activities



SPB-WD1 – WP4

T. Bulik & S. Shani-Kadmiel

From the XIII ET Symposium

▣ Studies concentrated on Sardinia (international collaboration):

- Installed microphones in the mine:

- Italian (EGO microphones)
- Polish UW (Astrocent microphones) - from Nov 26, '22
- Hungarian campaign -Nov 21-26, '22

- Installed microphones outside the mine:

- Astrocent from Nov 26, '22

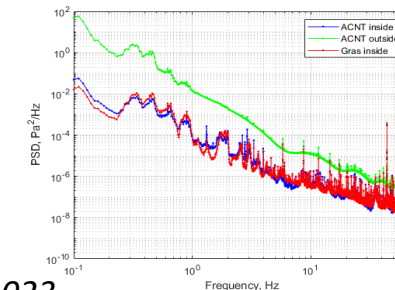
▣ LNGS experiment with noise in large cavern - see talk by Bulik

▣ No updates from the EMR side

▣ Planned GSSI campaign with new microphones and covers.

▣ Maintaining wiki site: <https://wiki.et-gw.eu/SPB/OtherEvnNoise>

▣ Data stored in: etrepo.df.unipi.it



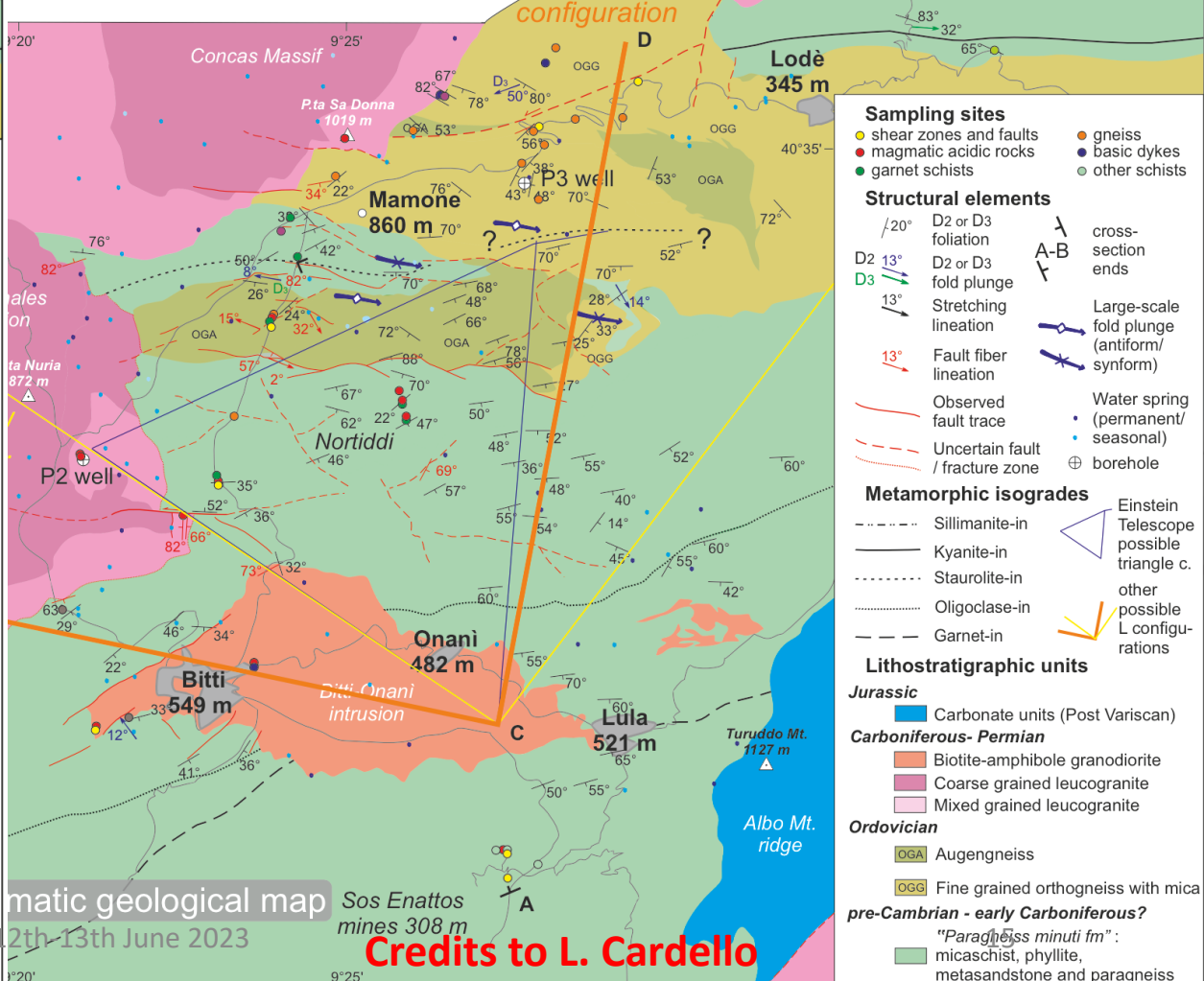
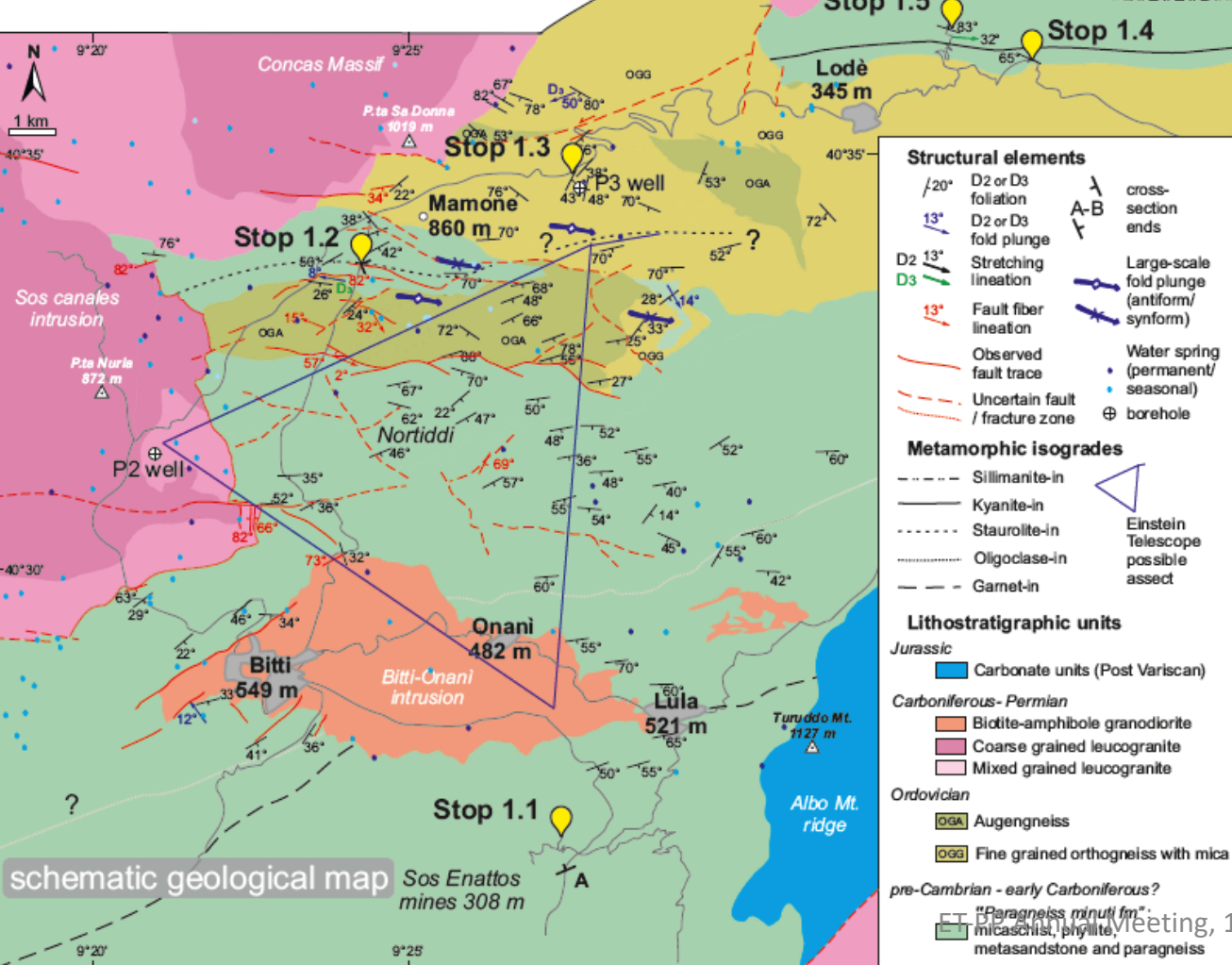
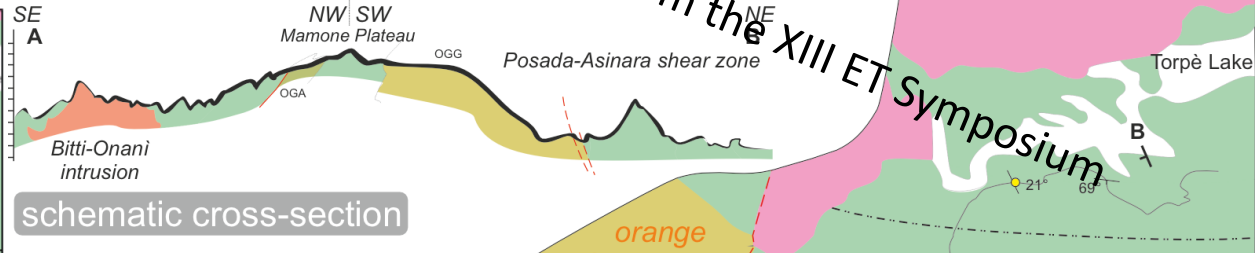
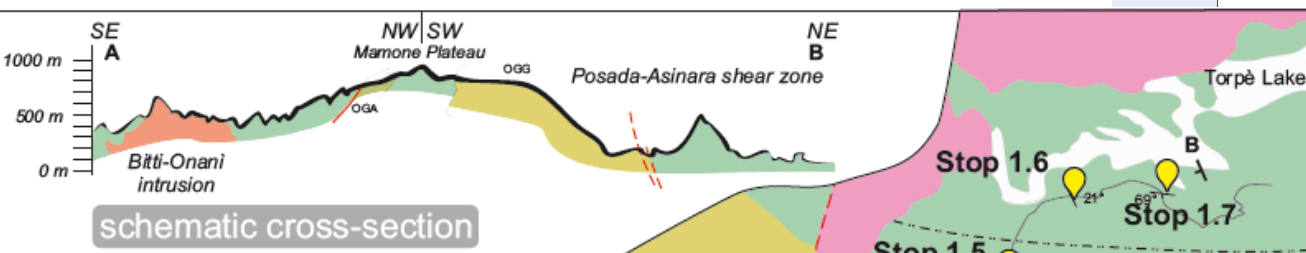
THE 2022 STRUCTURAL MAP



uniss
UNIVERSITÀ DEGLI STUDI DI SASSARI



From the XIII ET Symposium



- Structural elements**
- 20° D2 or D3 foliation
 - 13° D2 or D3 fold plunge
 - Stretching lineation
 - 13° Fault fiber lineation
 - Observed fault trace
 - Uncertain fault / fracture zone
 - cross-section ends A-B
 - Large-scale fold plunge (antiform/synform)
 - Water spring (permanent/seasonal)
 - borehole
- Metamorphic isogrades**
- Sillimanite-in
 - Kyanite-in
 - Staurolite-in
 - Oligoclase-in
 - Garnet-in
 - Einstein Telescope possible aspect
- Lithostratigraphic units**
- Jurassic**
- Carbonate units (Post Variscan)
- Carboniferous- Permian**
- Biotite-amphibole granodiorite
 - Coarse grained leucogranite
 - Mixed grained leucogranite
- Ordovician**
- Augengneiss (OGA)
 - Fine grained orthogneiss with mica (OGG)
- pre-Cambrian - early Carboniferous?**
- "Paragneiss minuti fm": micaschist, phyllite, metasandstone and paragneiss

- Sampling sites**
- shear zones and faults
 - magmatic acidic rocks
 - garnet schists
 - gneiss
 - basic dykes
 - other schists
- Structural elements**
- 20° D2 or D3 foliation
 - 13° D2 or D3 fold plunge
 - Stretching lineation
 - 13° Fault fiber lineation
 - Observed fault trace
 - Uncertain fault / fracture zone
 - cross-section ends A-B
 - Large-scale fold plunge (antiform/synform)
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 - borehole
- Metamorphic isogrades**
- Sillimanite-in
 - Kyanite-in
 - Staurolite-in
 - Oligoclase-in
 - Garnet-in
 - Einstein Telescope possible triangle c.
 - other possible configurations
- Lithostratigraphic units**
- Jurassic**
- Carbonate units (Post Variscan)
- Carboniferous- Permian**
- Biotite-amphibole granodiorite
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- "Paragneiss minuti fm": micaschist, phyllite, metasandstone and paragneiss

Meeting, 12th-13th June 2023

Credits to L. Cardello



Finanziato
dall'Unione europea
NextGenerationEU



Ministero
dell'Università
e della Ricerca



Italiadomani
PIANO NAZIONALE
DI RIPRESA E RESILIENZA



Preparatory activities for the ET sustainable design

Maria Marsella – ETIC -WP6 Leader
Sapienza DICEA –Roma1 INFN
maria.marsella@uniroma1.it



ET Symposium –Cagliari – 8-12 may 2023

ET sustainable design

- 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
- Call for tenders of the PNRR ETIC project for the preliminary feasibility study for ET in Sardinia (14 Million of euro , to be assigned by dec. 2023 and delivered by dec. 25) in different geometric configurations

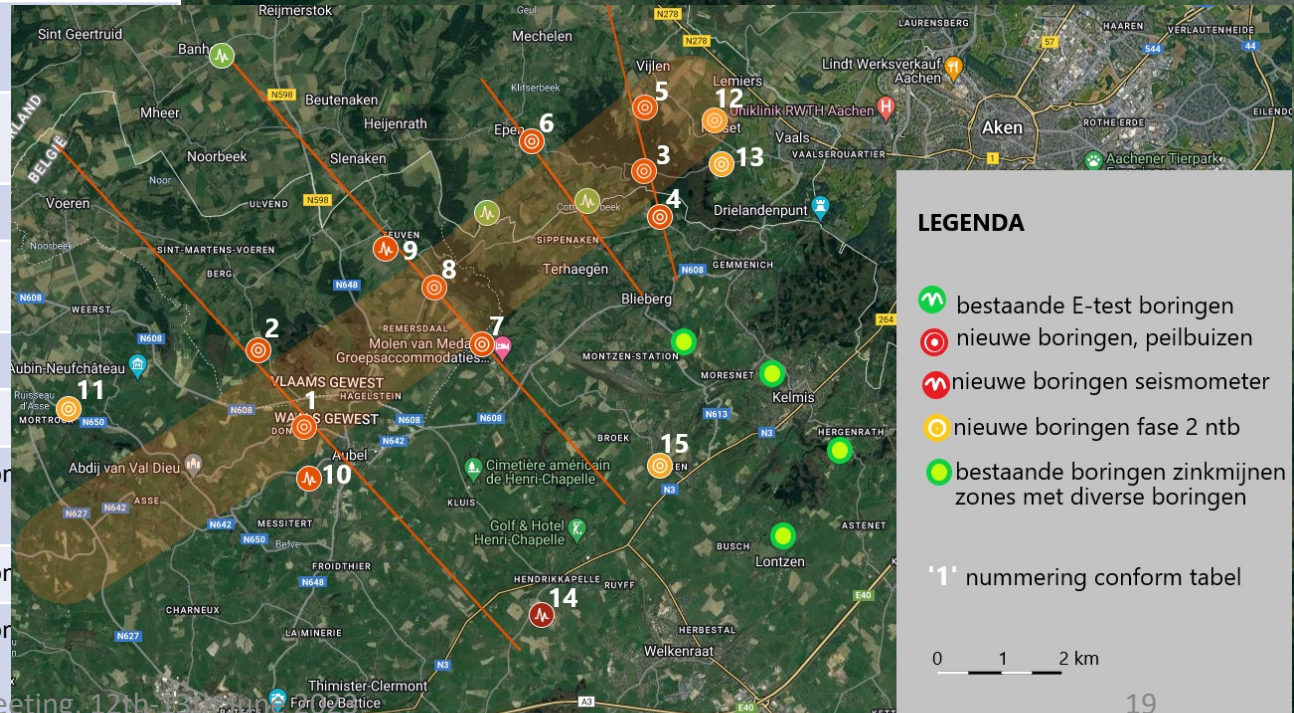
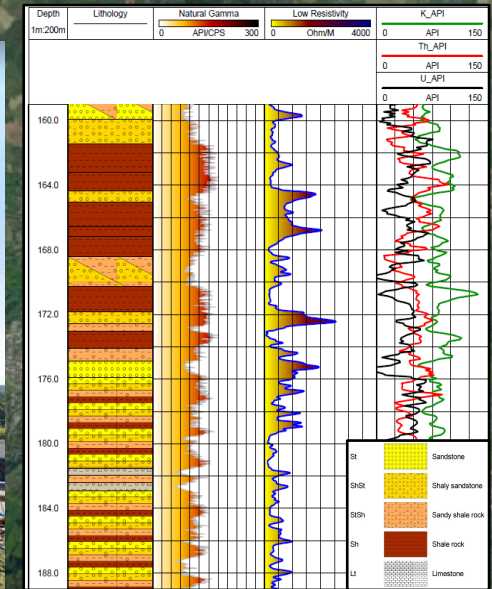
Current status EMR Subsurface de-risking:

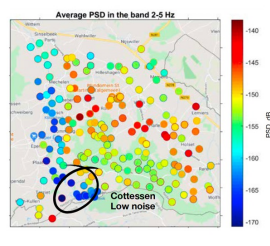
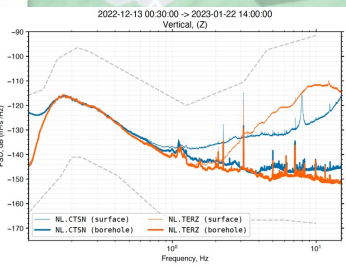
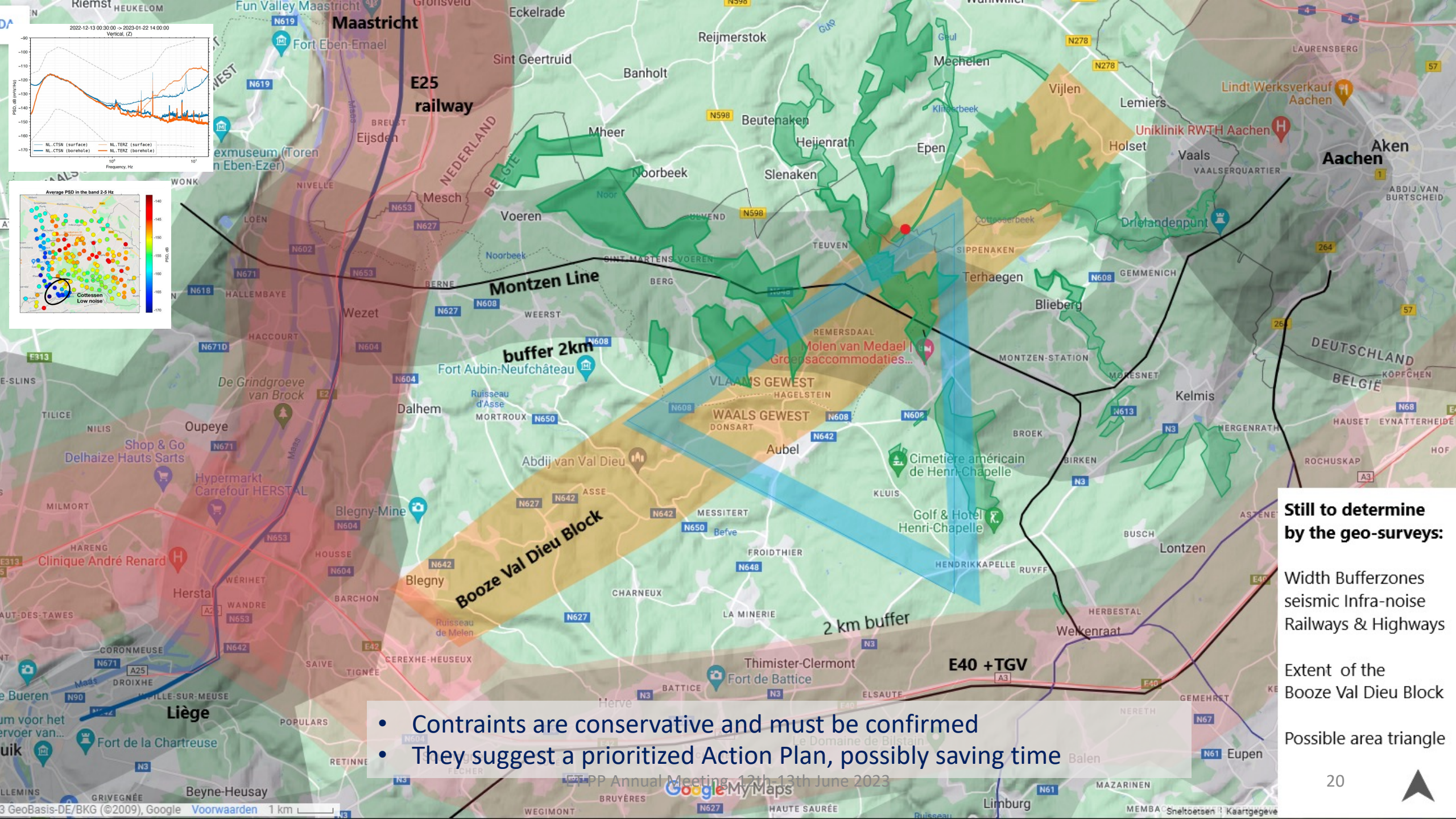
- Initial Geological Model established
- Booze – Val-Dieu block and South-West part of search area suggesting preferred locations for the corner points.
- Measurement program defined to confirm geomechanical aspects:
 - 20 Boreholes, currently drilling
 - Active and Passive Seismic, and ERT / Magnetic campaigns planned
- Anthropogenic noise measurements (train, highways, wind turbines) ongoing

Subsurface is challenging but clear mitigation path forward exists

Planned Boreholes 2023 (first set)

nr	profiel nr	onderzoeklocatie beschrijving	x-coord	y-coord	opmerk
done	-	Terziet 1, 160 m	50.756320	5.906717	
done	-	Terziet 2, 260 m	50.756645	5.906134	Seismom
done	2	Cottessen, 251 m (E-test)	50.759160	5.940609	Seismom
done	4	Banholt, 252 m (E-test)	50.791045	5.814159	Seismom
1	Set 1	Aubel, 250 m (E-Test)	50.709971	5.842804	
2	Set 1	Sint Pieters Voeren (Vlaanderen)	50.726931	5.826128	
3	Set 1	Vijlener Bos Parking	50.765920	5.960121	
4	Set 1	Gemmenich 200 m noord v. tankstation	50.756148	5.965649	
5	Set 1	dal 500 m zuid v. Vijlen	50.781584	5.964245	
6	Set 1	Epen ntb adhv ERT Parkeerplaats	50.772322	5.921207	
7	Set 1	Hombourg 1 km noordelijk van dorp	50.728433	5.903590	
8	Set 1	Obsinnich spoorviaduct Gulp	50.740388	5.887724	
9	Set 1	Teuven bij straat Mostert	50.750040	5.872287	seismom
10	Set 1	Val-Dieu of Aubel-west	50.698617	5.844381	seismom
14	Set 1	Zuid v. Henri-Chapelle,	50.668872	5.924650	seismom





- Constraints are conservative and must be confirmed
- They suggest a prioritized Action Plan, possibly saving time

Still to determine by the geo-surveys:

Width Bufferzones seismic Infra-noise Railways & Highways

Extent of the Booze Val Dieu Block

Possible area triangle



Phase 1 Construction Initial Model	Phase 2 Thorough geophysical and geological investigations to refine subsurface model and focus on a set of risk prioritized trajectories	Phase 3 Selection most promising traject, determination of remaining mitigation	Phase 4 Mitigation selected trajectory
------------------------------------	---	---	--

Initial Model

Pilots

- Construction Baseline Geological Model
- Pilot testing active seismic and EM, conclusions on effectiveness
- Analyze existing cores geomechanically

First set of ~10 boreholes

Second set of ~10 boreholes

- Ranking, procurement and implementation boreholes

Active and Passive Seismic

- Active seismic: procurement and implementation
- Passive seismic campaigns

ERT, Magnetic, Gravimetric surveys, Noise measurements

- Wind turbine noise measurements and conclusion/recommendation
- Passive seismic and ERT measurements.
- Gravitational and Magnetic measurements

Geomechanical Interpretation

- Central de-risking activity
- Intimate involvement of tunneling companies
- Geomechanical analysis of Cores
- mechanically converging trajectories and vertices

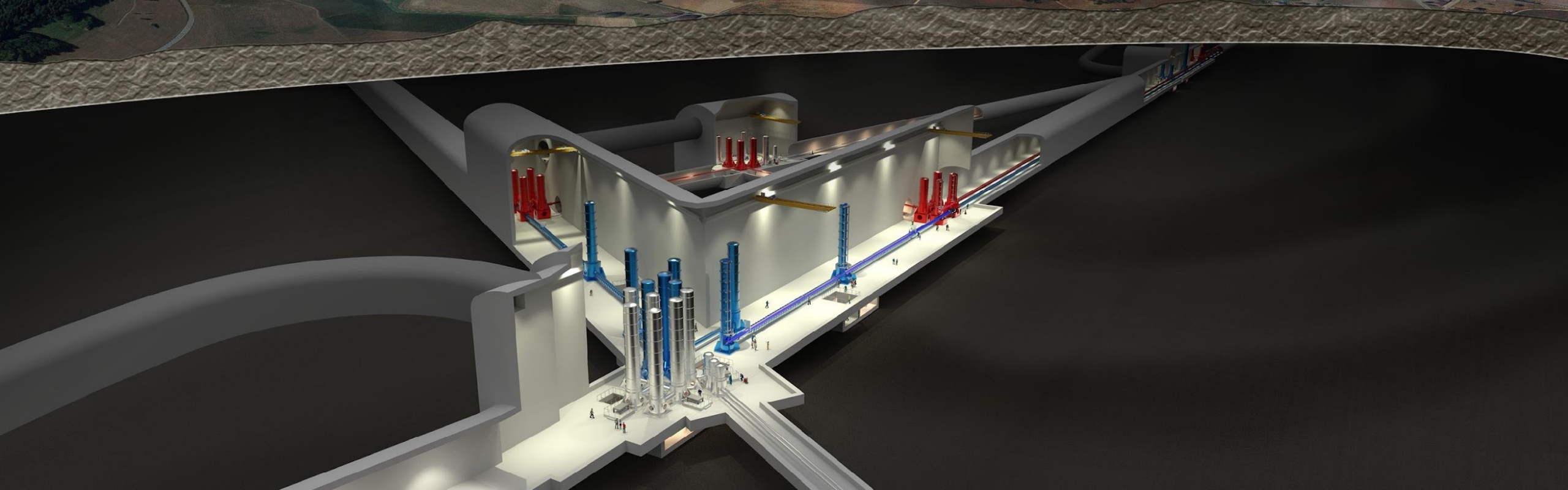
now

Recommendation Bidbook

Critical milestones

Active seismic effective	Sufficient availability drilling firms	Drilling procedures (permits, implementation, costs) effective	Geomechanical translation to feasibility corner points	Refinement of baseline model indicates feasible trajectories	Promising trajectory and corner points identified	Sufficient budget for further mitigation Phase 4	Substantiated recommendation Bidbook
--------------------------	--	--	--	--	---	--	--------------------------------------

SPB – WD3 Bidbook



➤ Site Characteristics

- Physical variables
- Geological, geophysical and geotechnical information
- Costs and timing
- Legal aspects and site quality preservation
- Socio-economic-environmental impact
- Risk Assessment
- Bidbook: standard, monitoring and collecting**

Bidbook content

Chairs: Tomek Bulik, Rosario De Rosa (Sardinia) and Martijin Rumpen (EMR)

- the needed legal documentation
- the procedures to realize the ET infrastructure
- the timing
- the cost according the evaluations of the infrastructure team, of the collaboration (for the detectors) and of the Host Teams for what concerns the specific costs
- the financial plan distinguishing the infrastructure from the detectors
- the site related risk assessment
- the socio-economic impact
- The environmental impact
- The scientific performance according to the standards defined by the collaboration
- ...

Bidbook content

- **Common Template for scientific aspects!**
- Standards and best practices for site noise measurement and evaluation
- Evaluation of site characteristics on ET performances (Host Teams and ET Collaboration)
- Site noise mitigation (ET Collaboration)
- Costs and timing (Host teams and PD/Project Dept./Infrastructures)
- Risk assessment (scientific -> ET Collaboration)

Expected Output

- The output of this activity is a template of bidbook, a list of required documents (legal, formal, ...)

SPB role

- SPB suggests to the agencies, through the PD, and to the collaboration, through the Executive Board, a methodology to compare the bid books.
- SPB collects and implements suggestions on that methodology by the PD, the Executive Board, the infrastructure team, ...
- SPB monitors the production of the bidbooks, the respect of the standards and of the timing.
- SPB collects all the documentation within the due time and performs an initial comparison according to the methodology

Discussion evolution of SPB/SCB

- Split WD3 (bidbook) into two activities:
 - ❑ Collaboration will have responsibility on standards and coordinating with WD1/2 and other related ET Boards
 - ❑ ETO will take care of the formal bidbook processes (framework, communication with BGR, ...)
 - Split WD4 (costs, schedules & risk ass.): risk related to scientific aspects will, mitigation strategy and so on will be under the responsibility of the Collaboration
 - SPB/SCB chairs to report at regular meetings of ETO management
- To be discussed with PD/EB ...

Discussion just started

WD5: *legal issues & site preservation*

Windturbines

Very popular, even more so with present electricity prices



EMR

Netherlands:- ban on new windturbines

- discussions on future human activities that may affect ET performance adversely ongoing

Belgium:

- discussions ongoing with notably Engie (large windturbine supplier) regarding new initiatives.
- 2-3 existing initiatives challenged in court

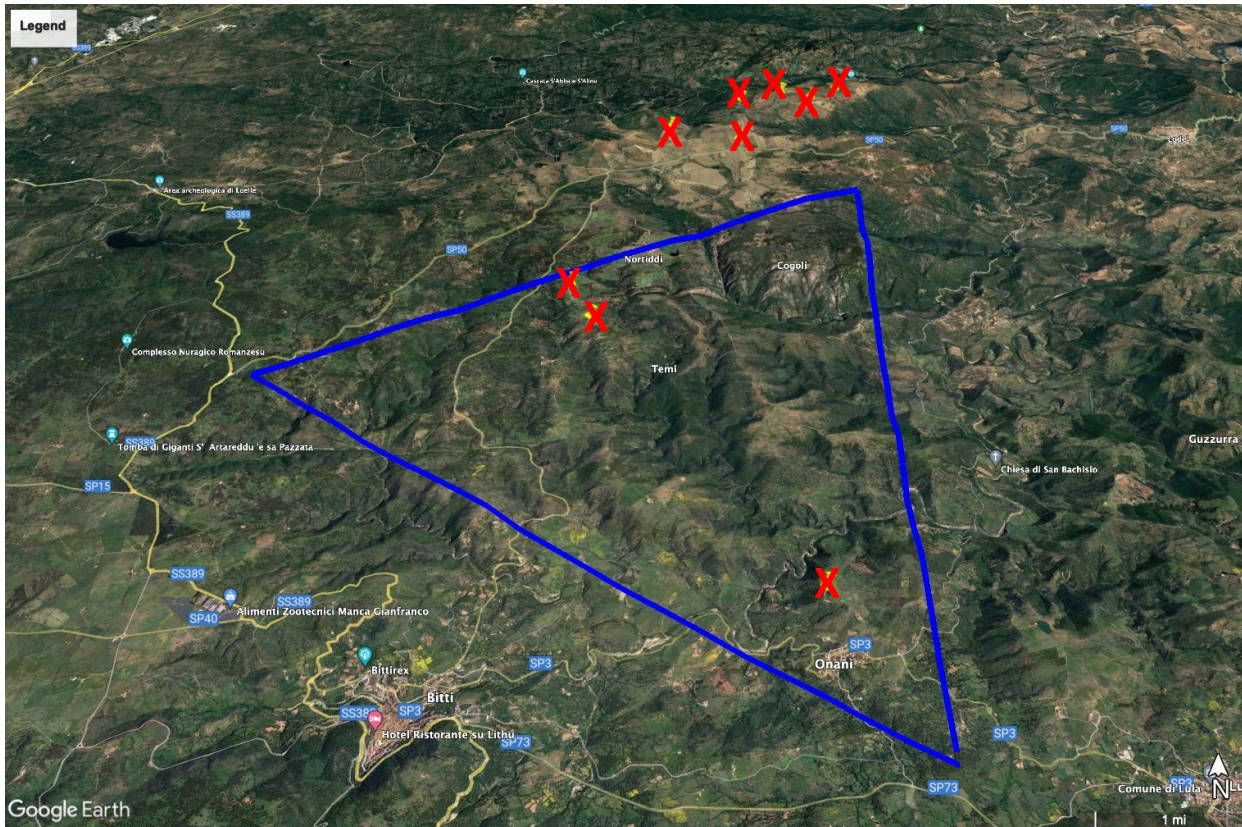
Germany: - ?

More measurement campaigns in preparation (with Engie)

WD5: *legal issues & site preservation*

Windturbines

Very popular, even more so with present electricity prices



Sardinia

- All the windturbine projects have been stopped
- future human activities that may affect ET performance adversely have to be approved by the INFN
- Measurement campaigns in April with **existing windmills**

Next Urgent Steps

- SPB organizational chart completion (urgent)
- Urgent tasks: study of wind farm noise (vibrational, EM, acoustic), measurement of ambient magnetic noise (surface and V-channel in borehole) and possible railway sources at EMR.
 - Evaluation of local noise source impact (Windmills measurements) and definition of a safety range
- Agreement on data interpretation and analysis to be discussed within the ISB devoted working group
 - Dedicated SPB workshop in october
- Start the activity on Bidbook!

- Common paper
 - Seismic comparison between borehole measurements at the sites.

Want to join ? <https://wiki.et-gw.eu/SPB/WebHome>

https://lists.infn.it/sympa/subscribe/et-spb?previous_action=review