Project Program: Focus on SPB

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SPB

SPB general mission

- The SCB/SPB must lead the effort on the Einstein Telescope site related activities
  - It must coordinate the activities to acquire the required characteristics for each site proposing to host the Einstein Telescope;
  - Collect, organize and/or produce all the characterizations and documentation needed for a fair comparison of the sites;
  - Propose a common framework and common basis for the evaluation of the candidate sites.

Defined at PD-SC chairs meeting on April 20, 2022

SPB site characterization

- Physical Variables
  - Define surface and downhole measurements to be performed for accurate noise characterization and site description in terms of geophysical, geological and geotechnical information.
  - Environmental studies including seismic surveys. Coordination of measurements to be performed (long-term, short-term, passive and active measurements). Geophysical and technical investigation. Coordination of measurements to be performed.
  - Definition of unique data formats for sensor data acquisition. Set up of (or identify) a database to collect and to share the various data acquired at each site with all ET collaborators. Definition of software tools and recipes to be used for data analysis

Defined at PD-SC chairs meeting on April 20, 2022

SPB former divisions

- WD1: Physical Variables and Characterization
- WD2: Geology
- WD3: Bidbooks
- WD4: Cost timing and risk assessment
- WD5: Legal and site preservation
- WD6: Socio-economic and environmental impact

Structure is currently changing

SPB Divisions

- WD1: Noise Measurements
  - WD1.1: Seismic Noise
  - WD1.2: Gravimetry, Geodesy and Geodynamics
  - WD1.3: Magnetic Noise
  - WD1.4: Acoustic and atmospheric noise
- WD2: Noise Evaluation
- WD3: Geological and Geotechnical Evaluation

PP and SPB – Guide for definition of activities

- For SPB the proposed categories were defined in order to cover all the required physical characterization to fully understand the site potential.
- The effect of a specific noise produced by each environmental disturbance is supposed to be part of the specific noise study.
- A further guide to definition of the activities was also given by presence of research groups effectively working on these topics.

PP activities for SPB

1	**Seismic Characterization**
1.1	Surface and underground seismic noise
1.2	Localization of anthropogenic seismic noise sources
1.3	Site characterization for Newtonian Noise (sensor distribution optimization)
2	**Electromagnetic Characterization**
2.1	Surface and underground magnetic noise
2.2	Impact of local EM noise sources (trains, windmills, …)
3	**Air**
3.1	Surface acoustic noise including wind (for atmospheric Newtonian noise studies)
3.2	Infrasound/air pressure underground propagation
3.3	LIDAR + Cloud camera for atmospheric Newtonian Noise
4	**Rock**
4.1	Faults and fractures
4.2	Rock mechanical data and mass characterization
5	**Water**
5.1	Hydrogeological model
5.2	Hydraulic conductivity and porosity of the underground environment

A quick look to the activities

- Seismic Characterization
  - Surface and underground seismic noise:
    - This activity is already in progress since years for all the candidate sites;
    - Many groups are contributing on this topic;
    - Besides providing material for the site selection, this activity also give information for a better designing of the environmental monitoring system for ET.
  - Localization of anthropogenic seismic noise sources
    - Often developed together with the previous one;
    - Impact of seismic anthropogenic noise on underground infrastructure
    - Impact of noise from ET large equipment on the detector (Largely based on Virgo/LIGO/KAGRA experience);

A quick look to the activities

- Seismic Characterization
  - Site characterization for Newtonian Noise
    - This activity also is in progress in parallel to Surface and underground seismic characterizations;
    - Many groups working on this very delicate argument;
    - Expecting also to provide the best sensor distribution for NN subtraction;

A quick look to the activities

- Electromagnetic Characterization
  - Surface and underground magnetic noise
    - Activity already ongoing from several years;
    - Natural EM noise (far from artificial sources) enough well understood;
    - Only provide for lower limit on EM noise;
    - Need to be extended for HF and RF noise;
  - Impact of local EM noise sources
    - Impact from large civil infrastructure like trains, windmill;
    - Past studies already provided some hints;
    - Also in this case the Virgo/LIGO/KAGRA experiences are very valuable;

A quick look to the activities

- Air
  - Surface acoustic noise including wind
    - Mainly for atmospheric Newtonian noise studies;
    - Possible impact on underground infrastructures;
    - There are groups working on this topic;
  - Infrasound/air pressure underground propagation
    - Noise contribution already observed in KAGRA;
    - Some activity is ongoing in underground environment;
  - LIDAR + Cloud camera for atmospheric Newtonian Noise
    - For temperature gradient measurements;
    - Can contribute to atmospheric NN;

A quick look to the activities

- Rock
  - Faults and fractures
  - Rock mechanical data and mass characterization
    - Many groups are active on both these activities;
    - They provide for a better understanding of the underground environment;
    - Both are critical parameters for the static and stability of the underground facilities;
- Water
  - Hydrogeological model
  - Hydraulic conductivity and porosity of the underground environment
    - They allow to determine the needed draining for the underground galleries;
    - Strongly dependent by the depth and by the local lithology;

Possible editors

Names selected on the basis of their present involvement in the corresponding activity

Seismic Characterization	
Surface and underground seismic noise	Carlo Giunchi
Localization of anthropogenic seismic noise sources	Giovanni Diaferia
Site characterization for Newtonian Noise (sensor distribution optimization)	Soumen Koley
Electromagnetic Characterization	
Surface and underground magnetic noise	Rosario De Rosa
Impact of local EM noise sources (trains, windmills, …)	Irene Fiori
Air	
Surface acoustic noise including wind (for atmospheric Newtonian noise studies)	Tomislav Andric
Infrasound/air pressure underground propagation	Marius Suchenek
LIDAR + Cloud camera for atmospheric Newtonian Noise	
Rock	
Faults and fractures	Giovanni Luca Cardello
Rock mechanical data and mass characterization	Marius Waldvogel
Water	
Hydrogeological model	Frederic Nguyen
Hydraulic conductivity and porosity of the underground environment	Philippe Orban

SPB after site selection

- The SPB activities listed in the PP will not end after the site selection;
- Indeed, an effective monitoring of the site activity can be pursued in the PP context, concerning the devising of hardware apparatuses dedicated to the site, before, during and after the installation of the interferometer parts.