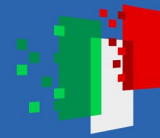




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# SAMaNET: SuperAttenuators development and Magnetic Noise mitigation for ET

Unità di Ricerca – INFN Pisa

F. Frasconi

Assisi (PG) – February 21, 2024

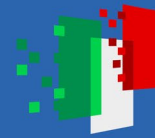




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**Team: INFN Pisa Group** historically involved in the development of the Superattenuators the hybrid system adopted to filter seismic noise and environmental vibrations in GW detectors (more than 25 years experience on the field)

### People:

G. Balestri, G. Cella, F. Frasconi, A. Gennai, L. Orsini, F. Pilo (INFN Pisa permanent staff)  
L. Lucchesi, P. Prospero, F. Spada (**INFN Pisa temporary staff for ETIC Project**)

**Collaboration: INFN Genova Group; A. Chincarini et al.**

Characterization measurements for Magnetic Noise mitigation



## SAMaNET – INFN Pisa

Within the context of the **ET-ETIC Project** the following activities are in progress at **INFN Pisa Laboratory**:

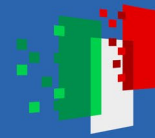
- Experimental setting up with new instruments for the development, test and characterization of new solutions based on technologies for the design and prototyping of next generation Superattenuators of the ET interferometer;
- Studies and performance improvements of passive mechanical filter based on new Magnetic Anti-Spring (nMAS);
- Studies and developments of high performance materials to be used in the design and construction of new elastic elements (blades, wires, etc.);
- Compatibility studies and characterization of mechanical elements to be used in Ultra High Vacuum environment (UHV) and/or at cryogenic temperature.

Development of **low-noise sensors and actuators**:

- Test of new devices and their characterization for e.m. compatibility through high precision measurements;

Development of **new boards for feedback control application** of the Superattenuators:

- Studies and implementation of new feedback strategies for future applications;
- Development and prototyping of an active platform to compensate the micro-tilt motion.



## SAMaNET

### ETIC-PNRR Investment – INFN Pisa

The **INFN Pisa Research Unit** is re-organizing the VIRGO Group Laboratory for the technological challenge around the design and construction of next generation **Superattenuator for the ET giant interferometer**. To this purpose the following investments have been scheduled:

- Magnetic sensors equipped with calibration electronic and power electronic (to be used for e.m. compatibility tests)
- Data acquisition system AD/DA and feedback control unit for laboratory activity
- Mini Water-Jet machine for metallic materials (**recently installed**)
- Spectrum Analyzer 4ch for characterization of New Generation Superattenuators
- Digital Electronic Microscope for diagnostic activity
- Workstation for data acquisition and upgrades of an existing one to be used in the test bench for e.m. compatibility
- Pumping system and sensors for UHV compatibility tests (**Procedure to be started**)



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## Finanziamenti Sinergici - Synergic Activity and Financing

- Open Call for R&D Program of the ET Project – CSN5 INFN **«NGSA: New Generation Super Attenuator»**

*Group Involved: INFN Pisa, INFN Napoli, INFN Cagliari/Sassari*

**Experimental Activity to be ended within 2025 (no financial support from CSN5 in 2025)**



## Ruolo in ET – Involvement in ET Project INFN Pisa Research Unit

The **INFN Pisa Group** is involved in the ET Project since the very beginning. The piled up experience in the development, construction and operation of sophisticated mechanical systems for filtering seismic noise and local vibrations, is proved by more 25 years activity on this field. Thanks to the available technology the second generation detector, **Advanced VIRGO**, for GW observation and studies, has been equipped with the Superattenuators conceived at INFN Pisa where a feedback control system has been also developed.

For all these reasons, we are convinced that our experience on the field could be extremely important for finalizing the project of next generation detector of the ET Giant Laboratory.



## Necessità Future – Future Needs

### SAMaNET – INFN Pisa

- Design and prototyping of new Mechanical Filters with nMAS
- Design and prototyping of New SA in reduced scale (as function of the Laboratory infrastructure)
- Design and prototyping of an active platform
- Final design and construction of new sensors and actuators
- Development and production of new electronics boards for feedback controls