VIRGO_MIUR_ET: INTERFEROMETRIA 3G E R&D FOR SEISMIC NOISE SUPPRESSION

F. Frasconi – INFN Pisa

Preventivi 2019 anno finanziario 2020

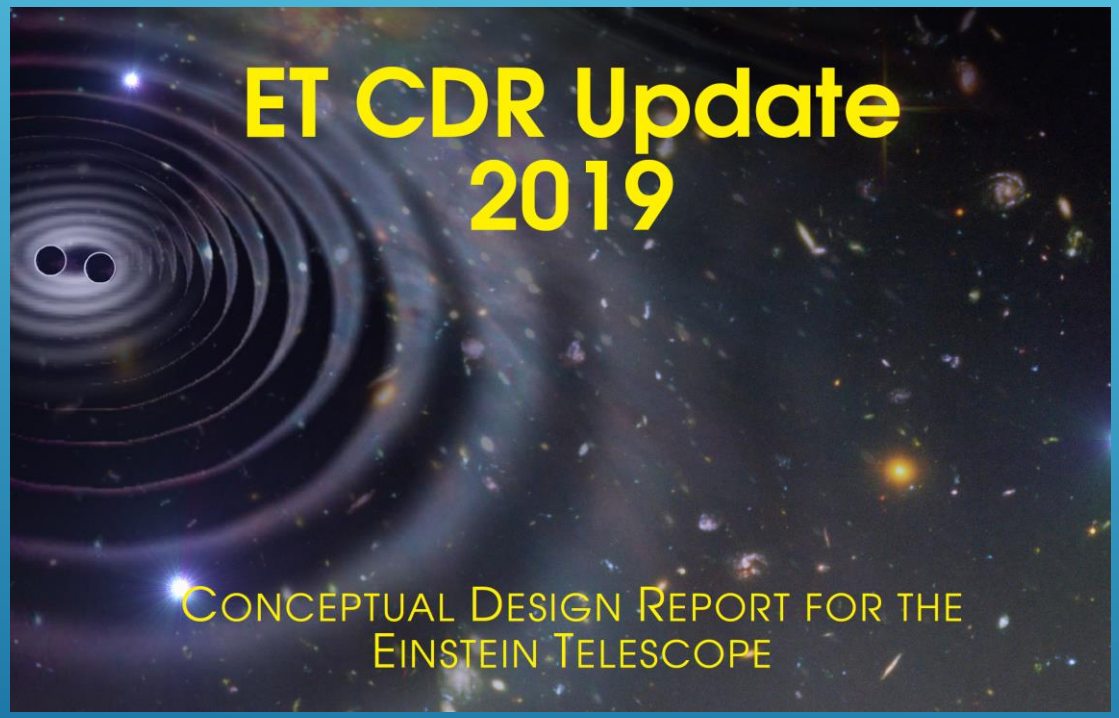
INFN Sezione di Pisa ; July 2, 2019

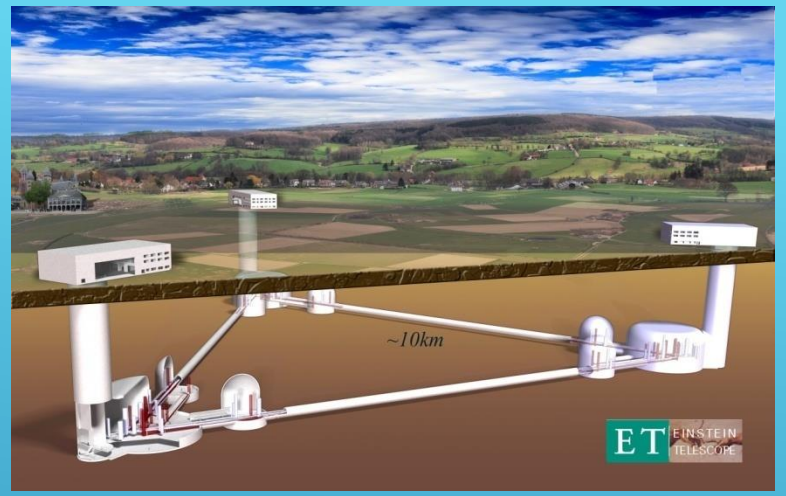
GW OBSERVATIONS: THE FUTURE

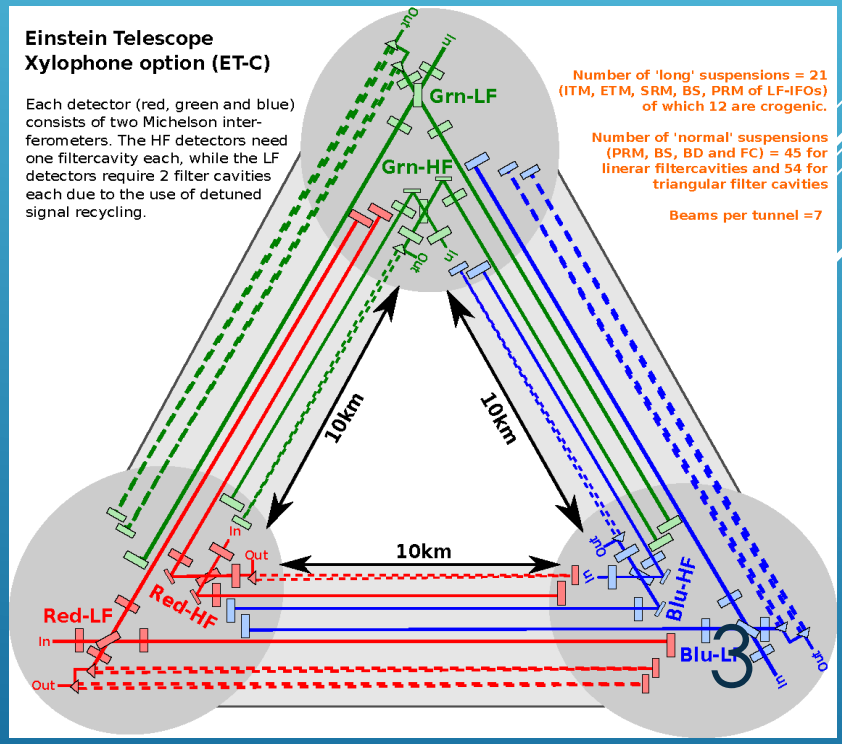
- The Einstein Telescope (ET) conceptual design study document delivered in 2011;
- The aim of the ET Project is the realization of a large scale GW Observatory in Europe (3rd generation detector);
- The ET design built up a pan-European community (ET Science Team) supporting the project.

- The **ET Collaboration born** in April 2018 and **LoI has been signed** (9th ET Symposium at EGO site, April 20, 2018)

- The ET research infrastructure is a giant scale GW interferometer, cryogenic and underground.







THE RESEARCH INFRASTRUCTURE

ET OBSERVATORY

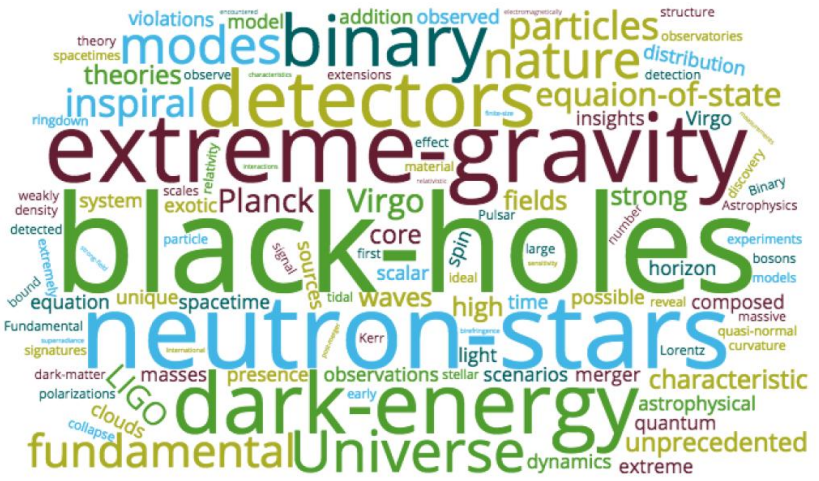
- Scientific Document in preparation:

  Einstein Telescope (**ET**) in Europe

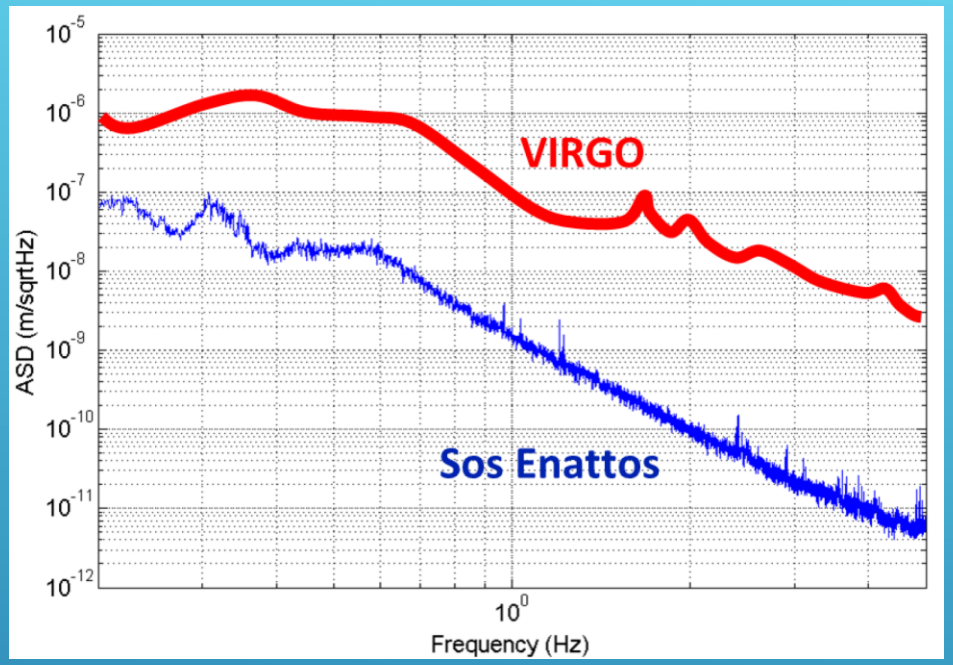
  Cosmic Explorer (**CE**) in USA

Gravitational-Wave Astronomy with the Next-Generation Earth-Based Observatories

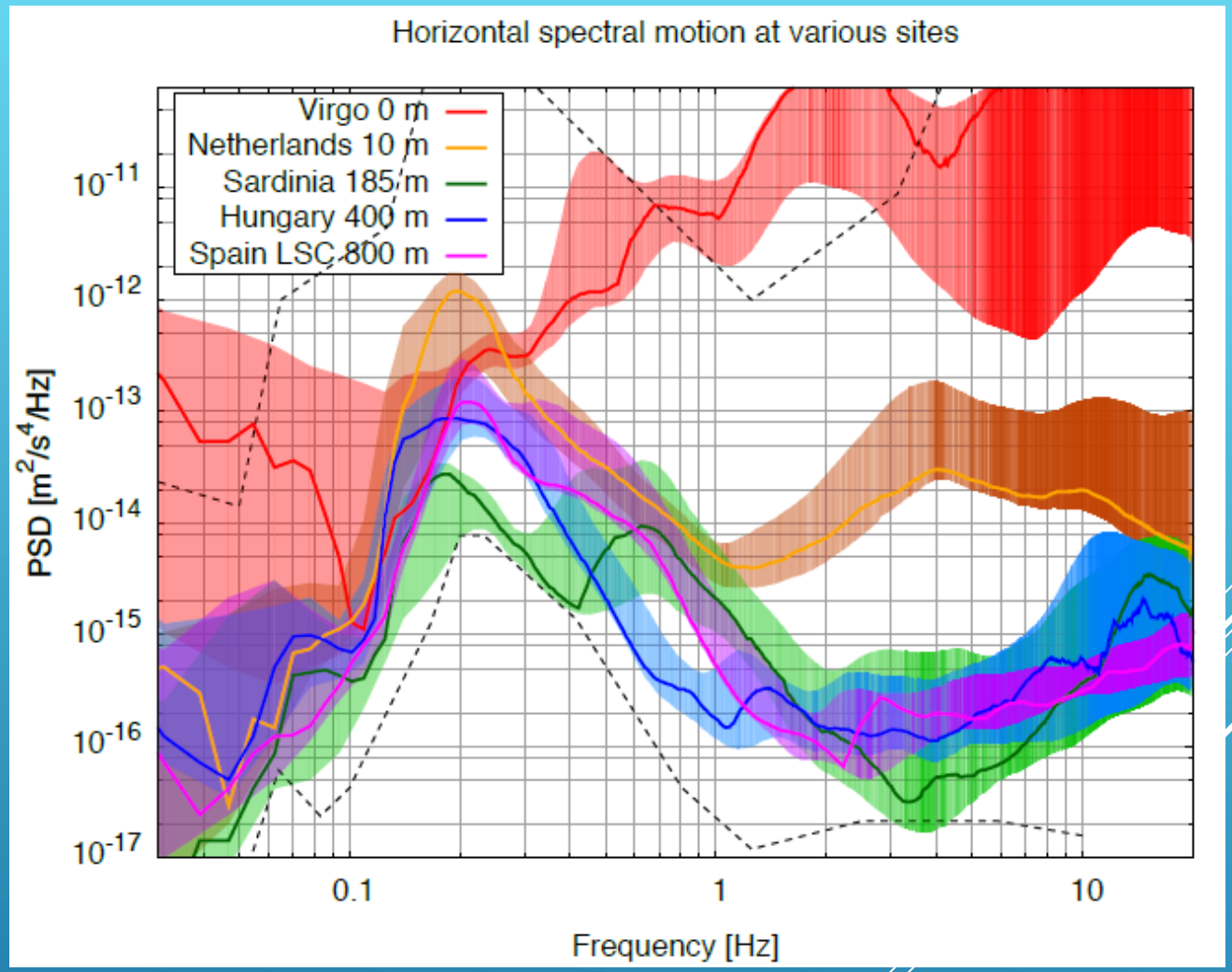
Exploring the Universe from Planck to Hubble Scales



GWIC, GWIC-3G, GWIC-3G-SCT-Consortium



- **Sites selection for 3rd Generation GW Detectors in progress**



THE ITALIAN SITE FOR ET

- **Sos Enattos mine – Sardinia (Italy) the best site in Europe to host ET Observatory**

VIBRATION ISOLATION FOR ET

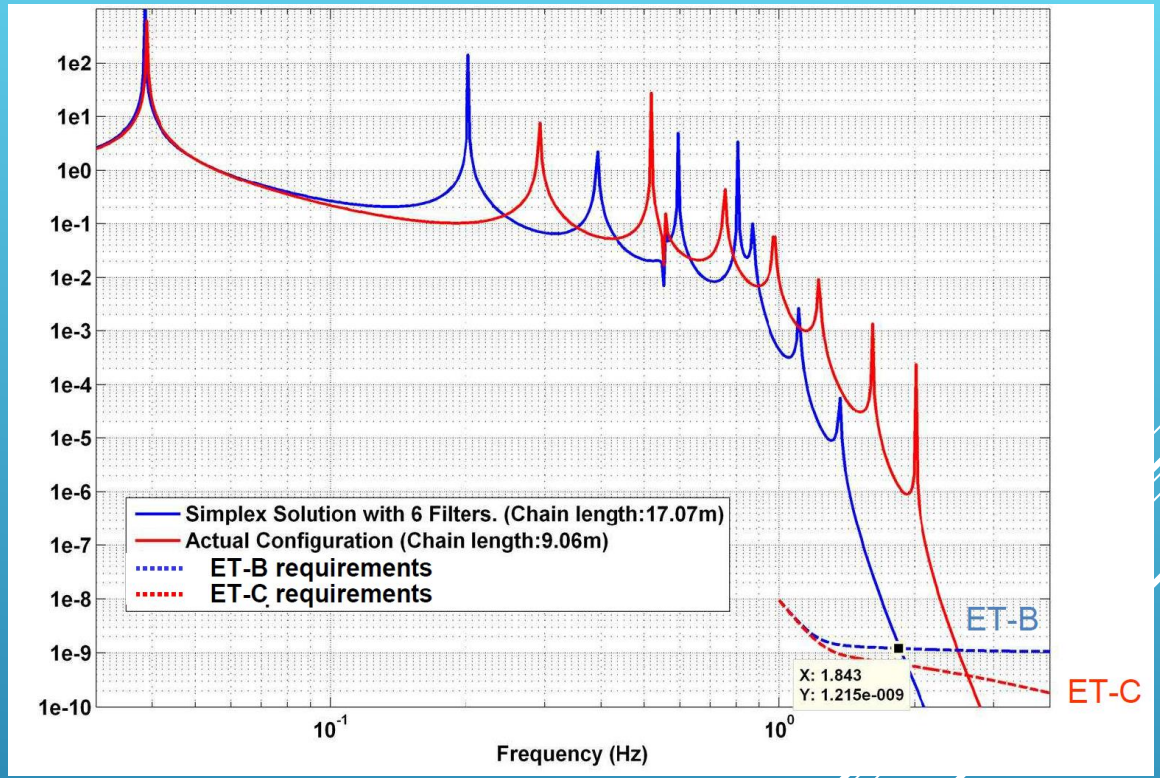
- **Reference solution (*see ET Conceptual Design Study*):**

  technology available Superattenuator (SA) - hybrid system

  height 17 m (9m AdV)

  cut-off frequency ~ 2Hz (~ 3Hz in AdV)

- **Development of a SW simulator to be used on NGSA.**

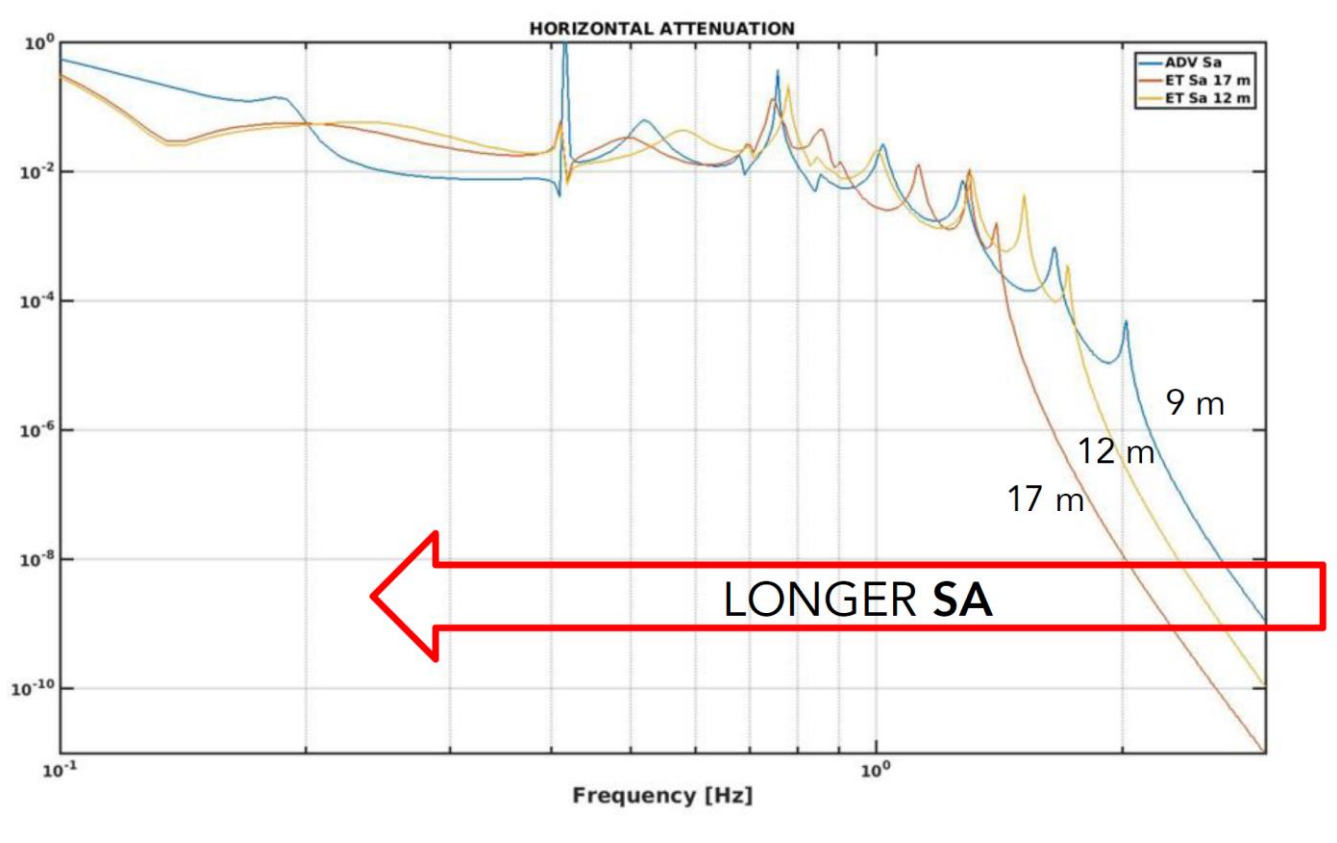


AVAILABLE TECHNOLOGY

- SA works properly since about **20 years** ;
- The stability of the Advanced VIRGO ITF is very good.
  Thanks to SA a duty cycle up to **90% per week** is reached;

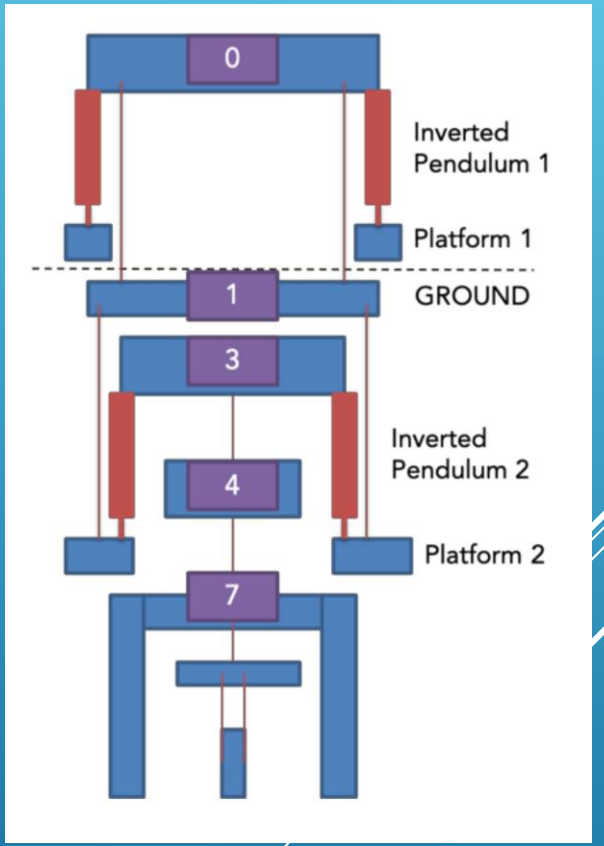
BUT

- Making it longer has fundamental implications and difficulties:
  - cavern cost and/or engineering issues;
- We have a chance to improve the performance further: **alternative solutions**

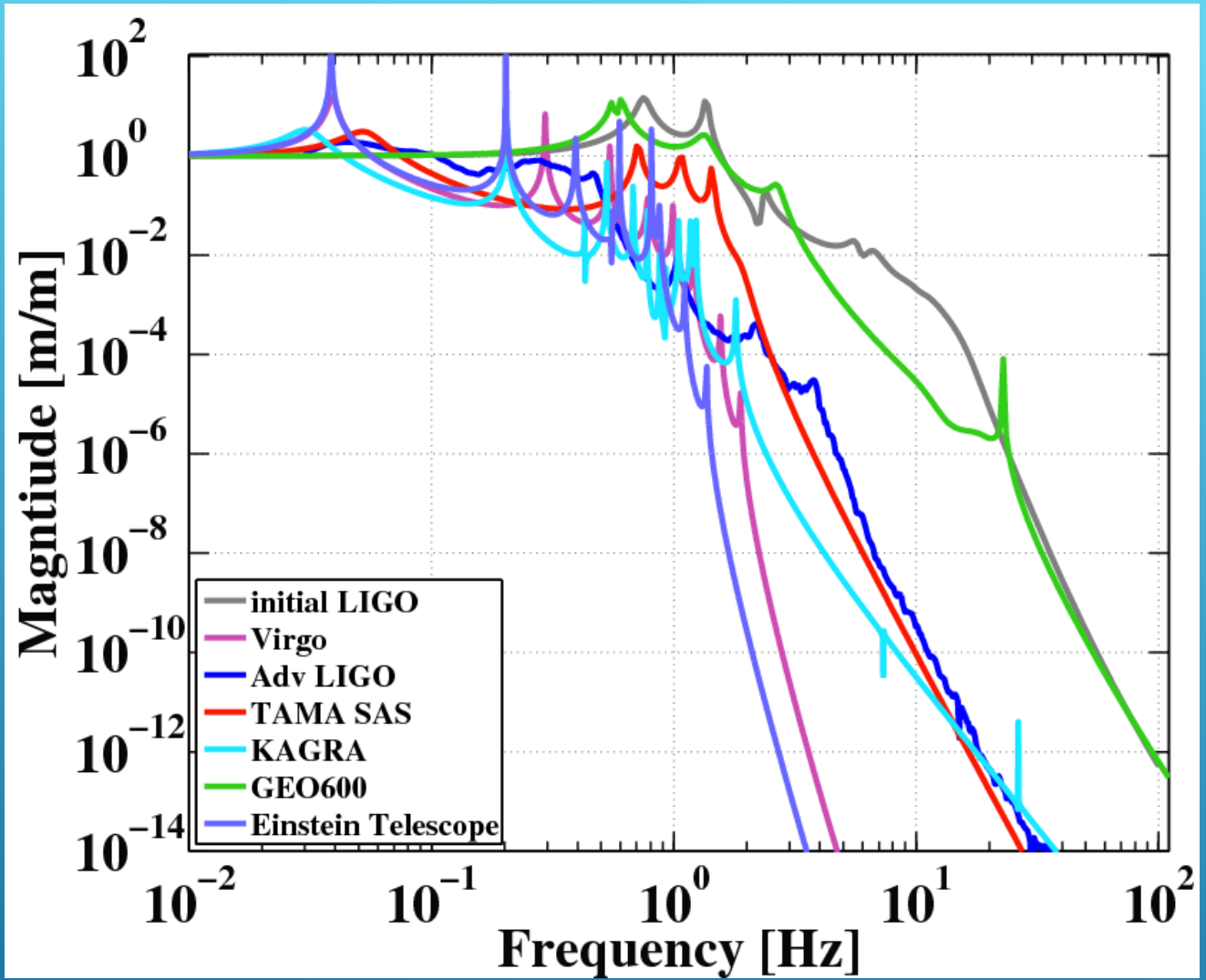


SA/NGSA MODELS

An Alternative Solution: Double IP + Advanced Active Control



Credit: Ruggi-Losurdo

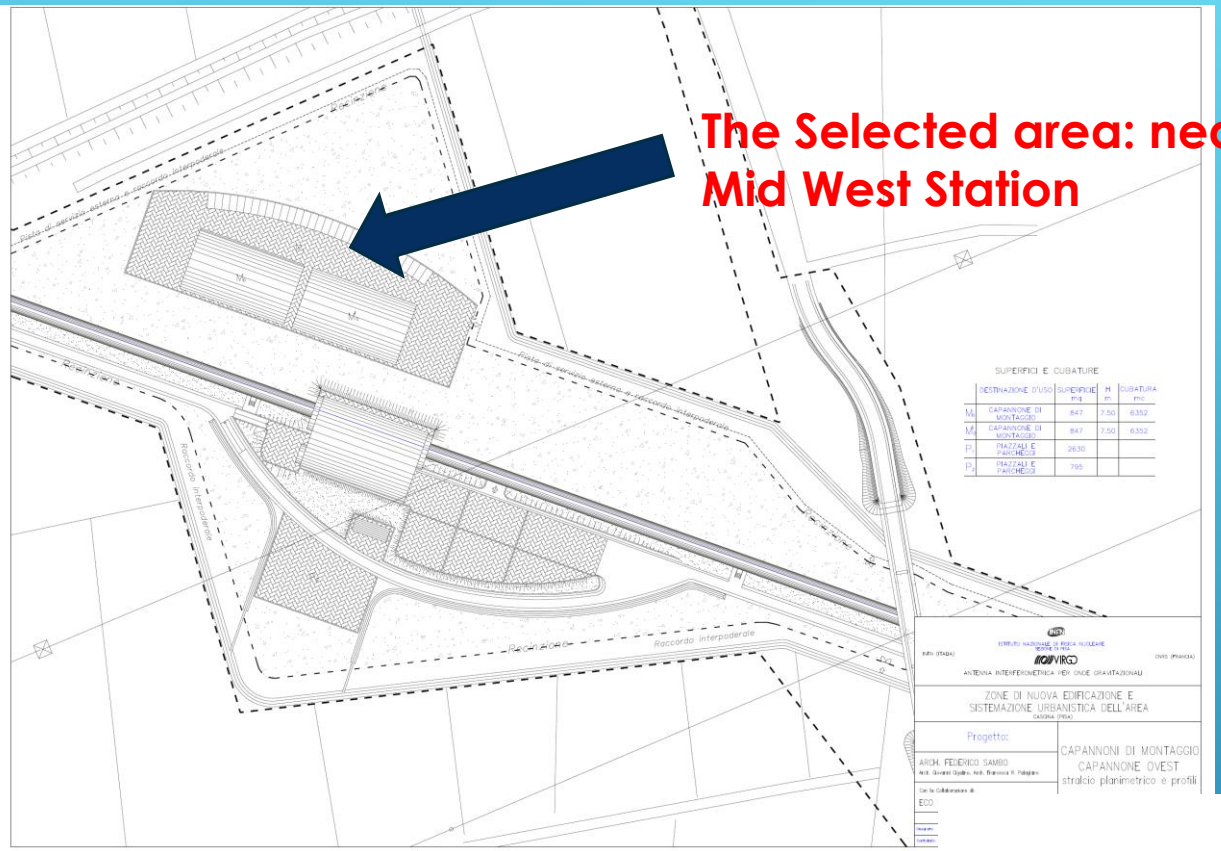


Mechanical Transfer Function of different vibration isolation systems

SEISMIC ISOLATION: PERFORMANCE COMPARISON

ACTIVITIES IN PROGRESS

- **Studies and Developments on New Generation Superattenuator (NGSA) based on the mechanical structure of the AdV SA:**
  - **intermediate step for AdV+ Large Masses Payload suspension**
- **Conceptual design of a New Laboratory to host R&D activities on seismic isolation systems at EGO site (silenced activity to be re-activated @ Pisa);**
- **Requirements definition for underground infrastructures;**
- **Characterization Measurements campaign @ Sos Enattos site (still in progress).**



1. Easy access area from outside with minimum impact on ITF data taking during the construction
2. Possibility to connect the new area with the existing one: gate available
3. Wide space for infrastructure construction and parking area

A NEW EXPERIMENTAL LABORATORY

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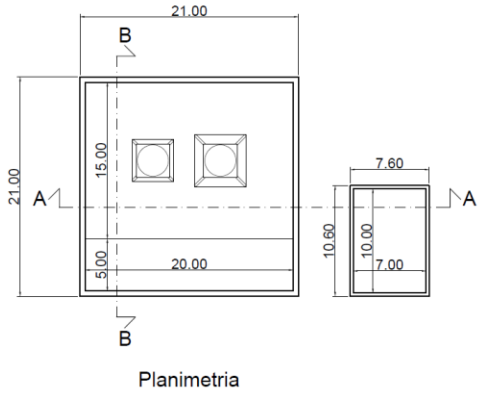
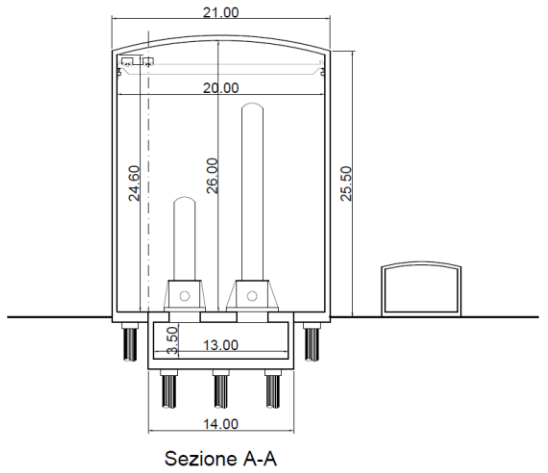
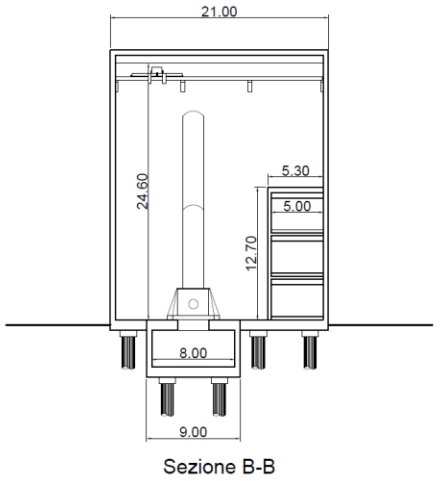
Soluzione 1 facilities interne







ANAGRAFICA & RICHIESTE FINANZIARIE (PRELIMINARI)

Anagrafica **VIRGO_MIUR_ET** – Sezione INFN Pisa 2020

Nome	FTE	Item
Franco FRASCONI (CL)	40%	R&D Seismic Isolation, New Building, Caratterizzazione sito Sos Enattos
Giancarlo CELLA	20%	R&D Seismic Isolation, Caratterizzazione sito Sos Enattos
Giovanni LOSURDO	50%	Specifiche per infrastrutture sotterranee, Caratterizzazione sito Sos Enattos, R&D Seismic Isolation
Massimiliano RAZZANO	10%	R&D Seismic Isolation, Caratterizzazione sito Sos Enattos
Francesco FIDECARO	20%	Caratterizzazione sito Sos Enattos
Andrea MOGGI	10%	R&D Seismic Isolation
Valerio BOSCHI	20%	R&D Seismic Isolation and Feedback Control Strategy

Missioni: 6 kEuro

- Viaggi sul sito Sos Enattos
- Meeting di Collaborazione

Consumi: 25 kEuro

- Prototipizzazione anti-molle magnetiche per NGSA

Document on detailed R&D program for next Generation Detector to be prepared soon (next Sept.)

TOTALE: 31 kEuro