Finanziato dall'Unione europea
NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA
INFN

CAOS: an international laboratory for prototyping ET suspensions

Nicolò Baldicchi
(Università degli studi di Perugia, INFN Perugia)
On behalf of the CAOS collaboration

Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
INFN

CAOS

Centro per Applicazioni sulle Onde gravitazionali e la Sismologia

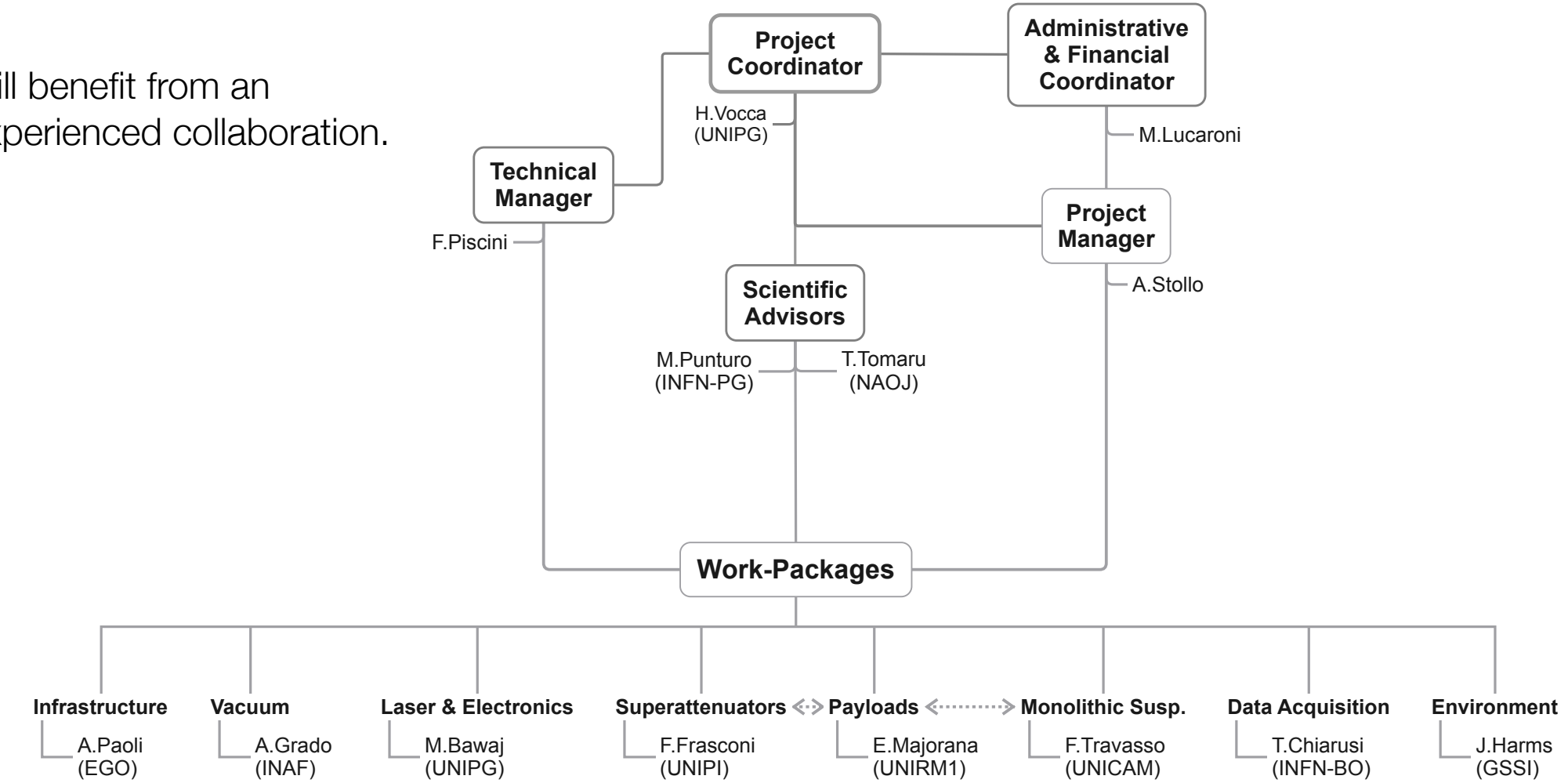
CAOS (Center for applications on gravitational waves and seismology) will be an international facility in Perugia to develop new technologies for seismic filtering.

The main focus of CAOS will be:

- prototyping new test mass suspensions
- new materials and strategies for last stage suspension
- low noise control system
- possible seismological applications

Board

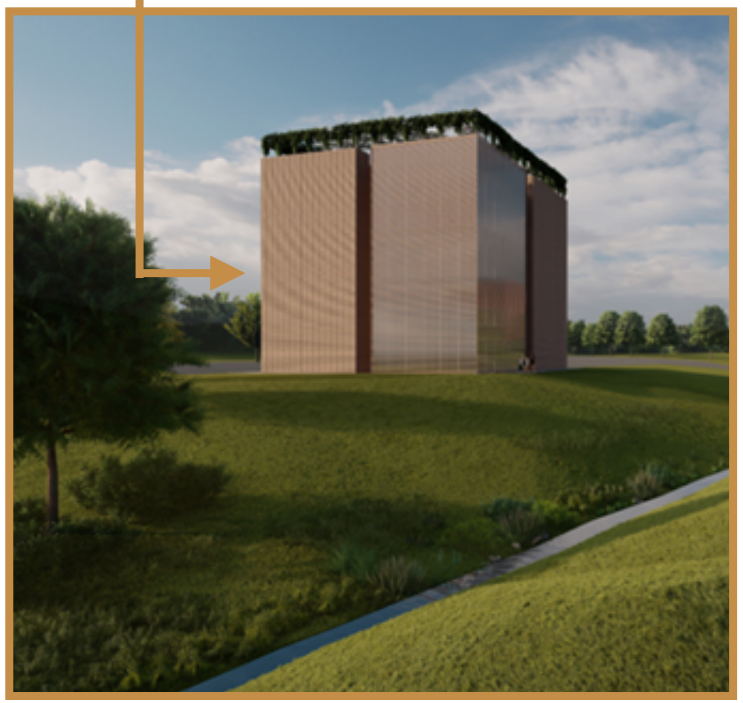
The CAOS laboratory will benefit from an International and well experienced collaboration.

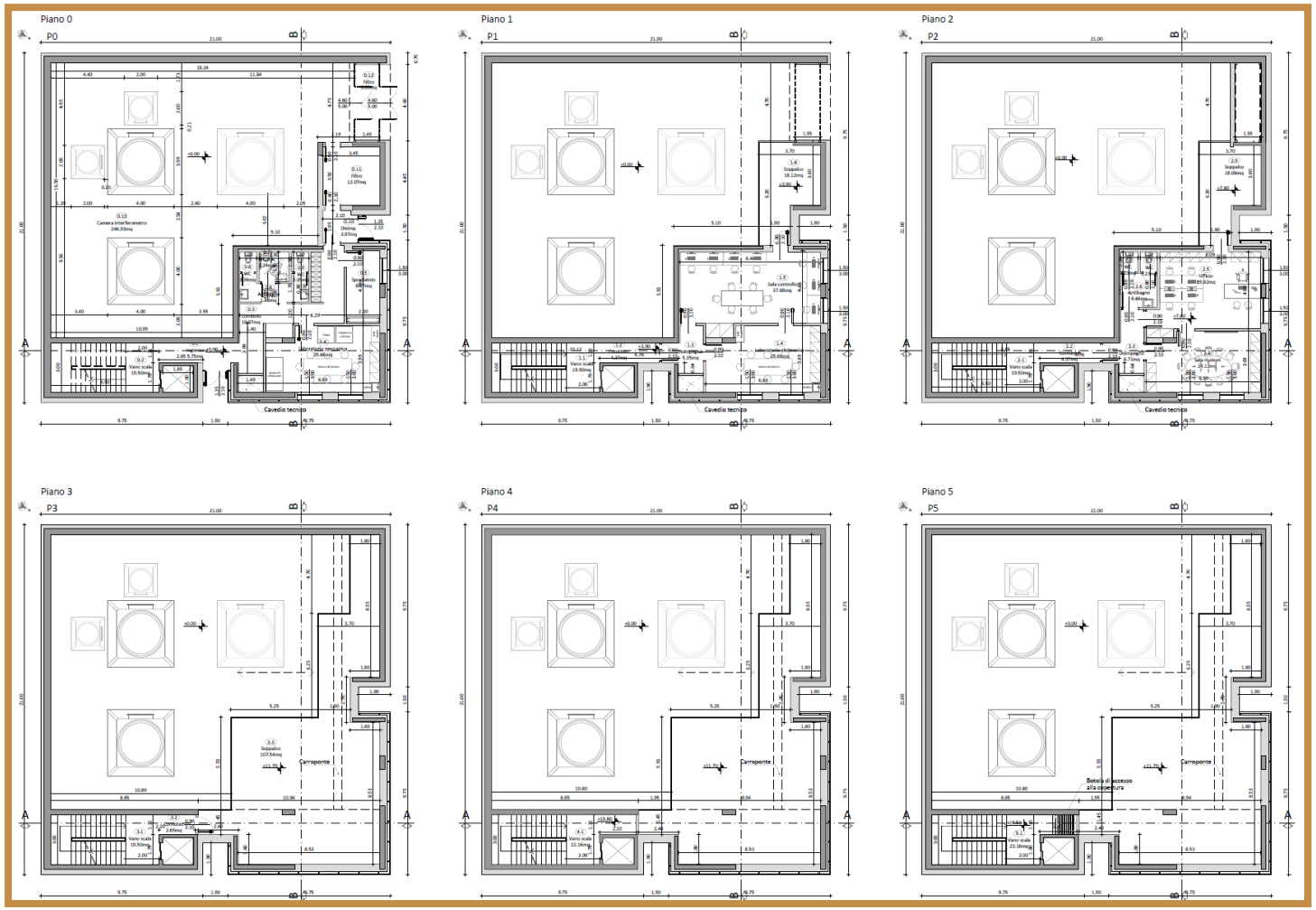


Building

Plant area: 441 sq m

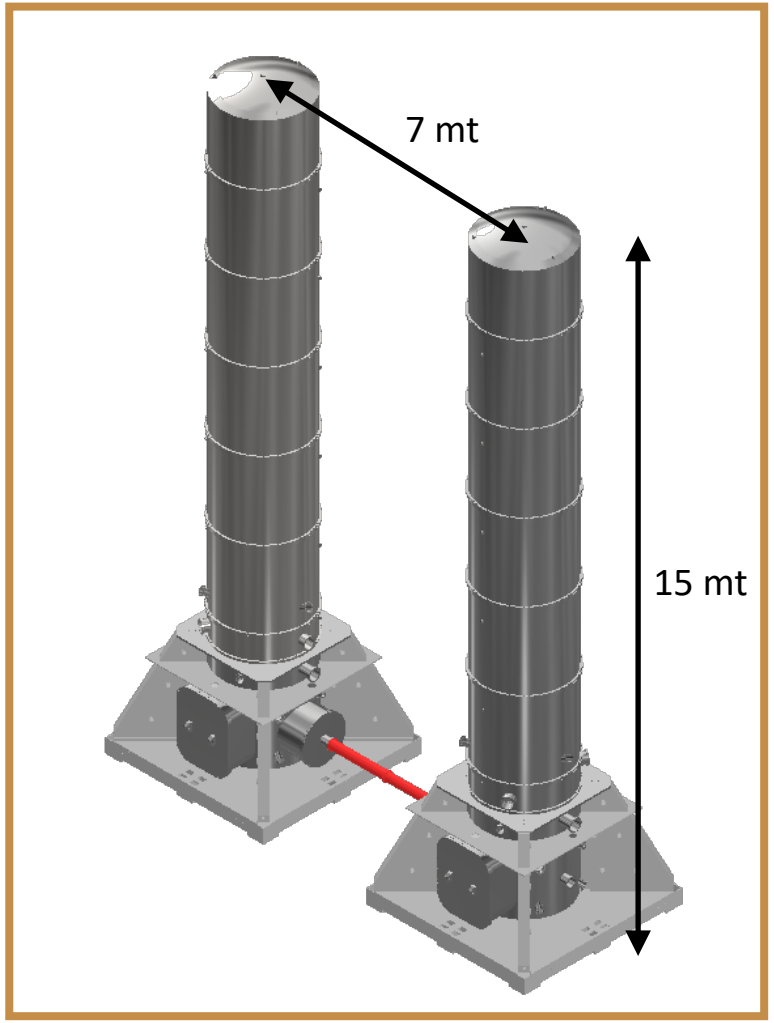
Internal height: 21 m

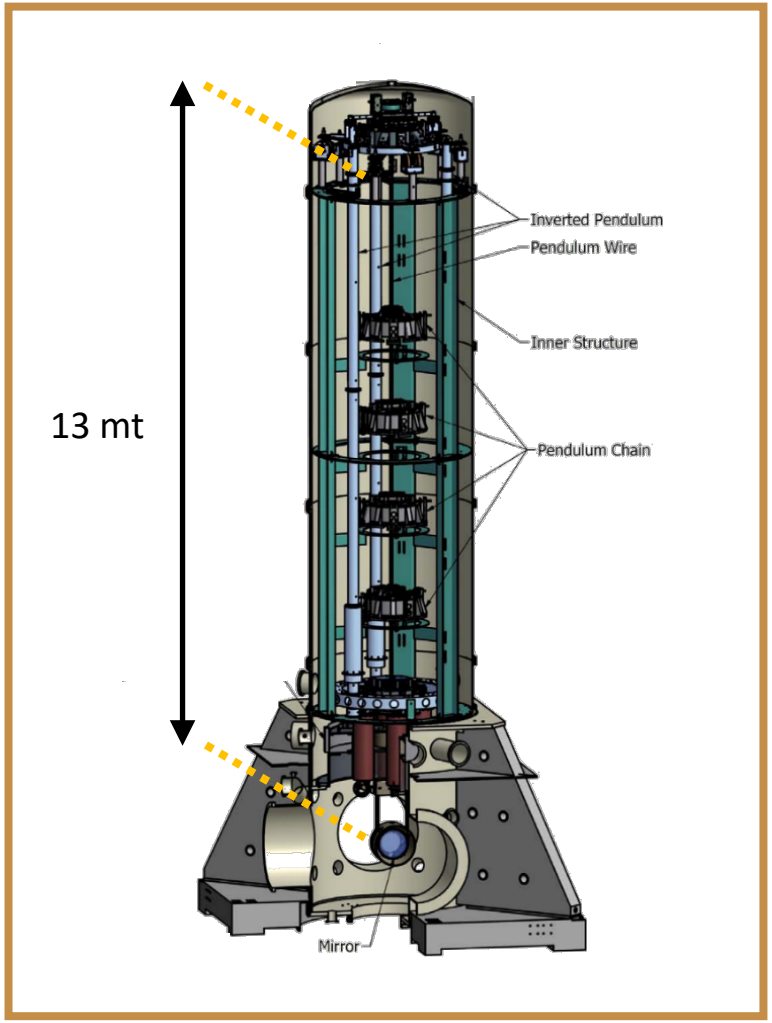




Set-up

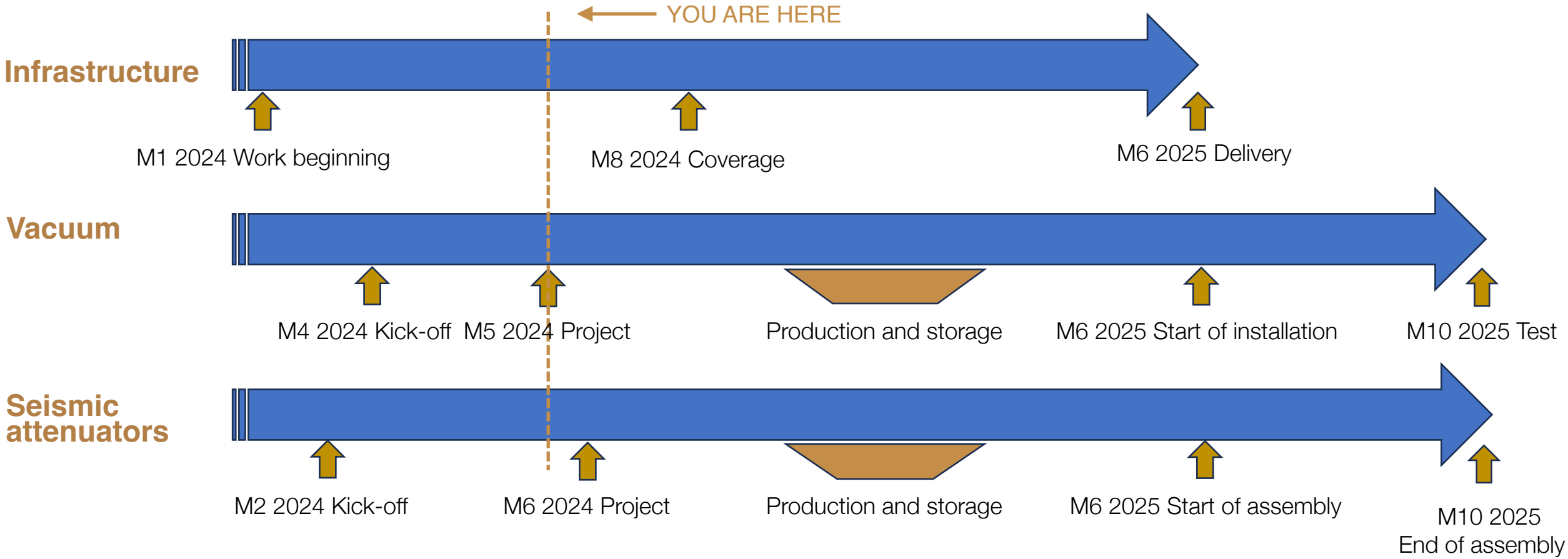
- ~7 mt long Fabry-Perot cavity
- 15 mt tall vacuum towers
- 13 mt long suspensions including:
  - Inverted pendulum
  - Cascade filters with monolithic maraging wires
  - …





Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
INFN

Timeline of the project



Current analyses (in progress)

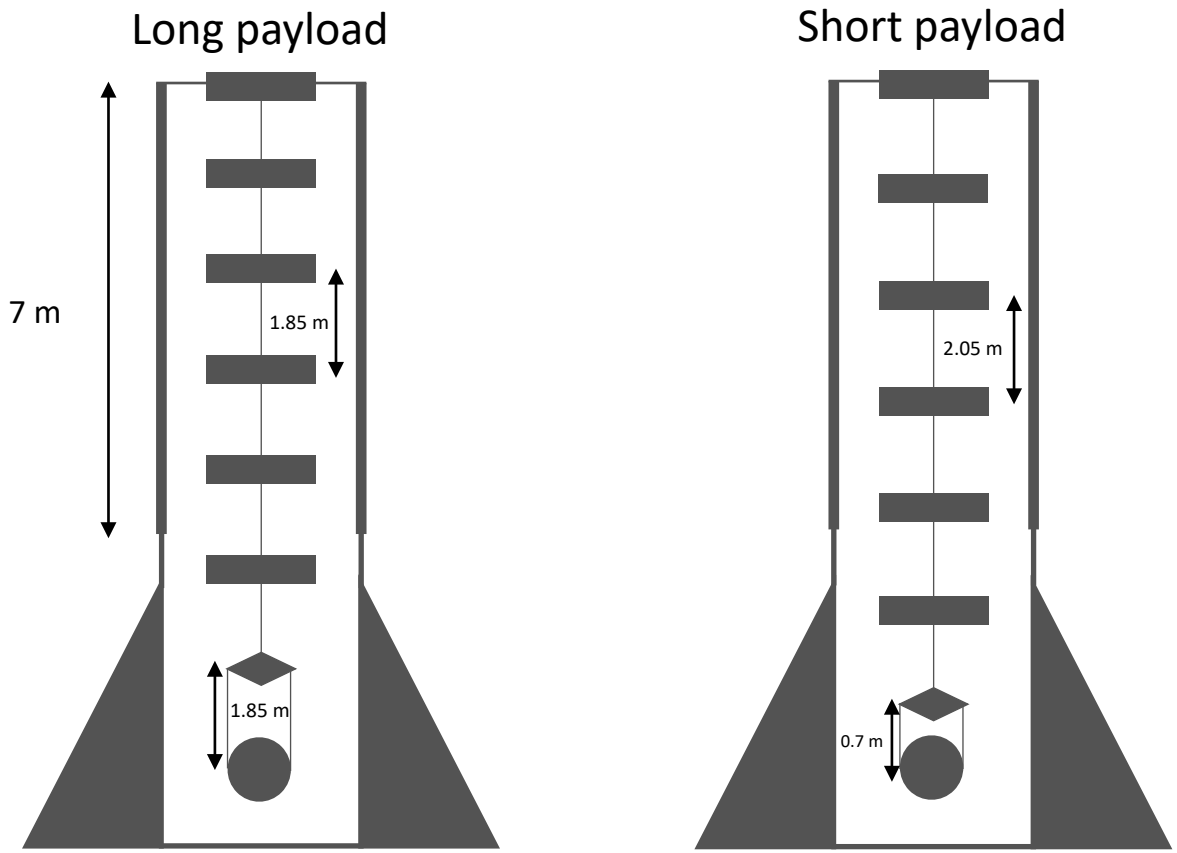
Two main configurations are currently under study:

Long payload: last stage suspension fibers length as long as the upper stages:

- Pros: pendulum mode of the payload at a lower frequency, i.e $f_{FS} \approx 0.4$ Hz
- Cons: violin mode of the fibers at a lower frequency, i.e. $f_{FS} \approx 147$ Hz

Short payload: last stage suspension fibers length kept at 0.7 m like in Virgo:

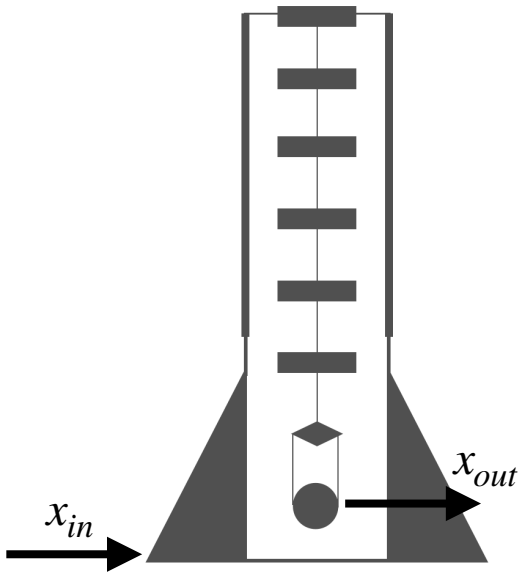
- Pros: violin mode of the fibers at an higher frequency, i.e. $f_{FS} \approx 390$ Hz
- Cons: pendulum mode of the payload at an higher frequency, i.e. $f_{FS} \approx 0.6$ Hz

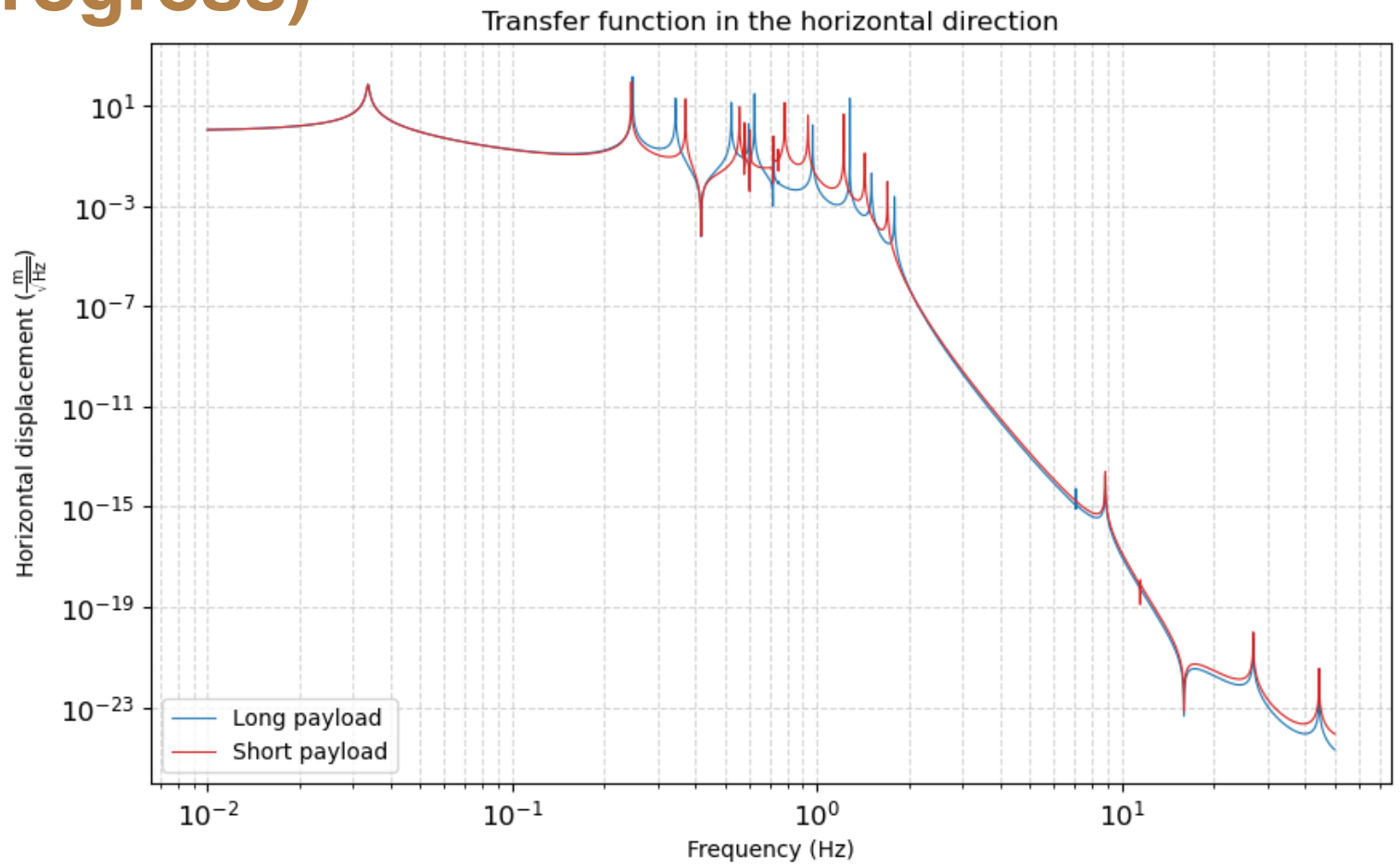


For the following simulations Fused Silica fibers have been considered

Current analyses (in progress)

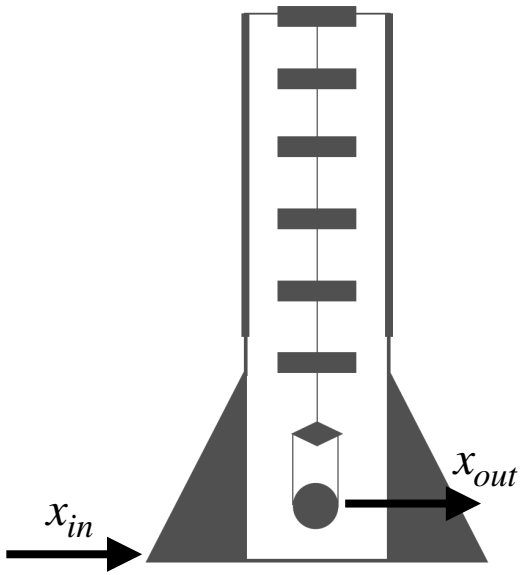
Simulations run with OCTOPUS, Matlab based software coded by Paolo Ruggi at EGO.

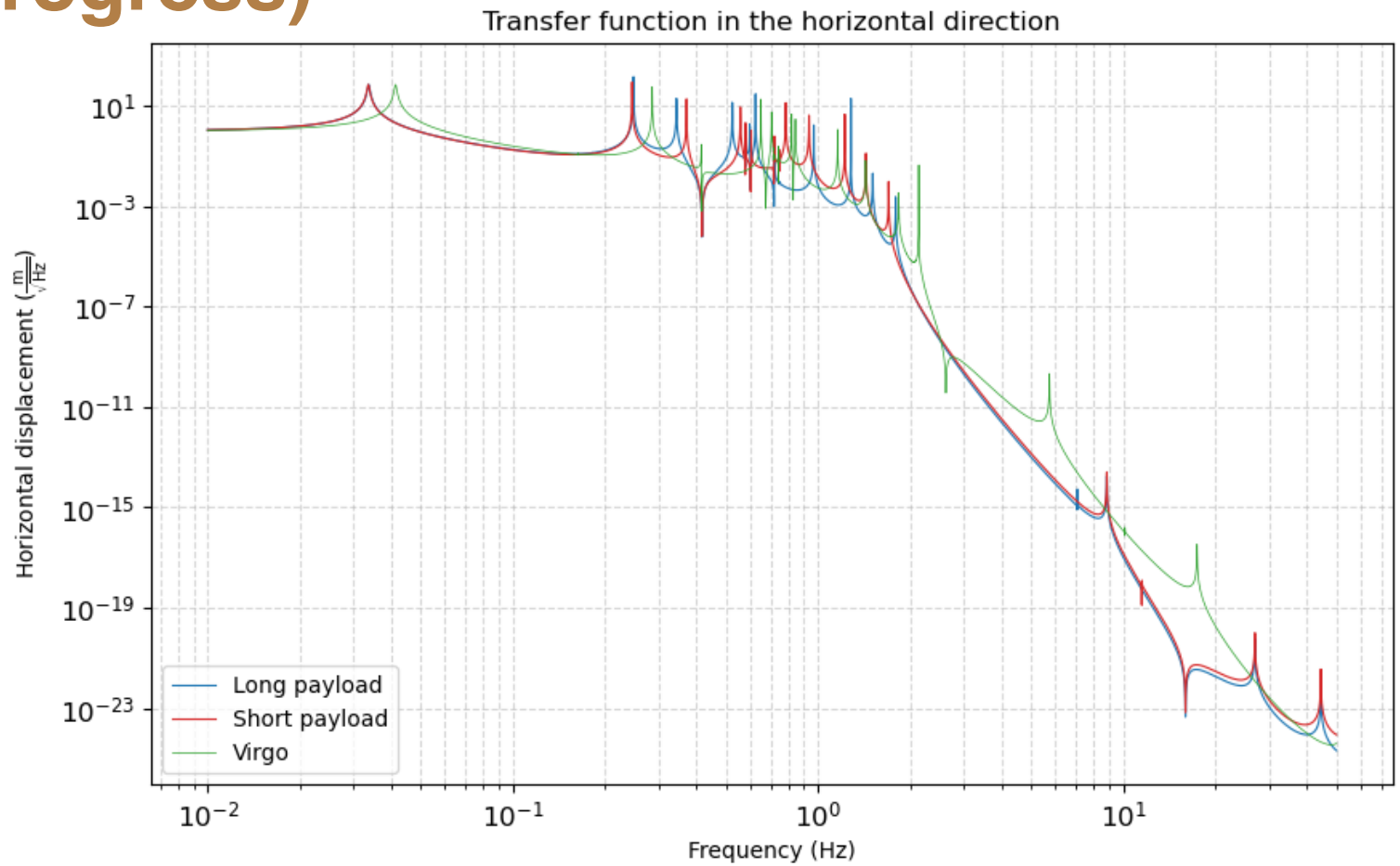




Current analyses (in progress)

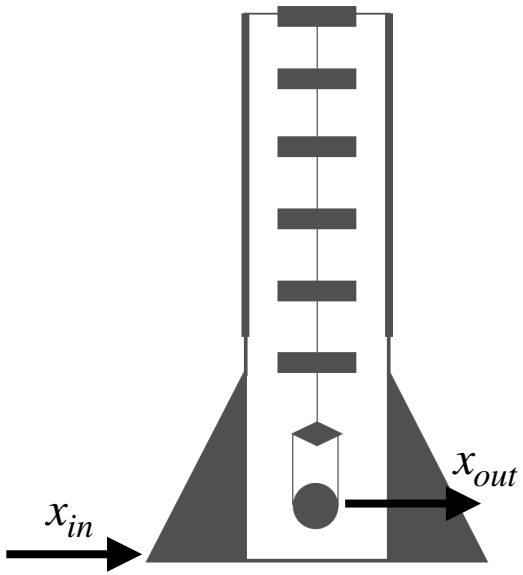
Simulations run with OCTOPUS, Matlab based software coded by Paolo Ruggi at EGO.

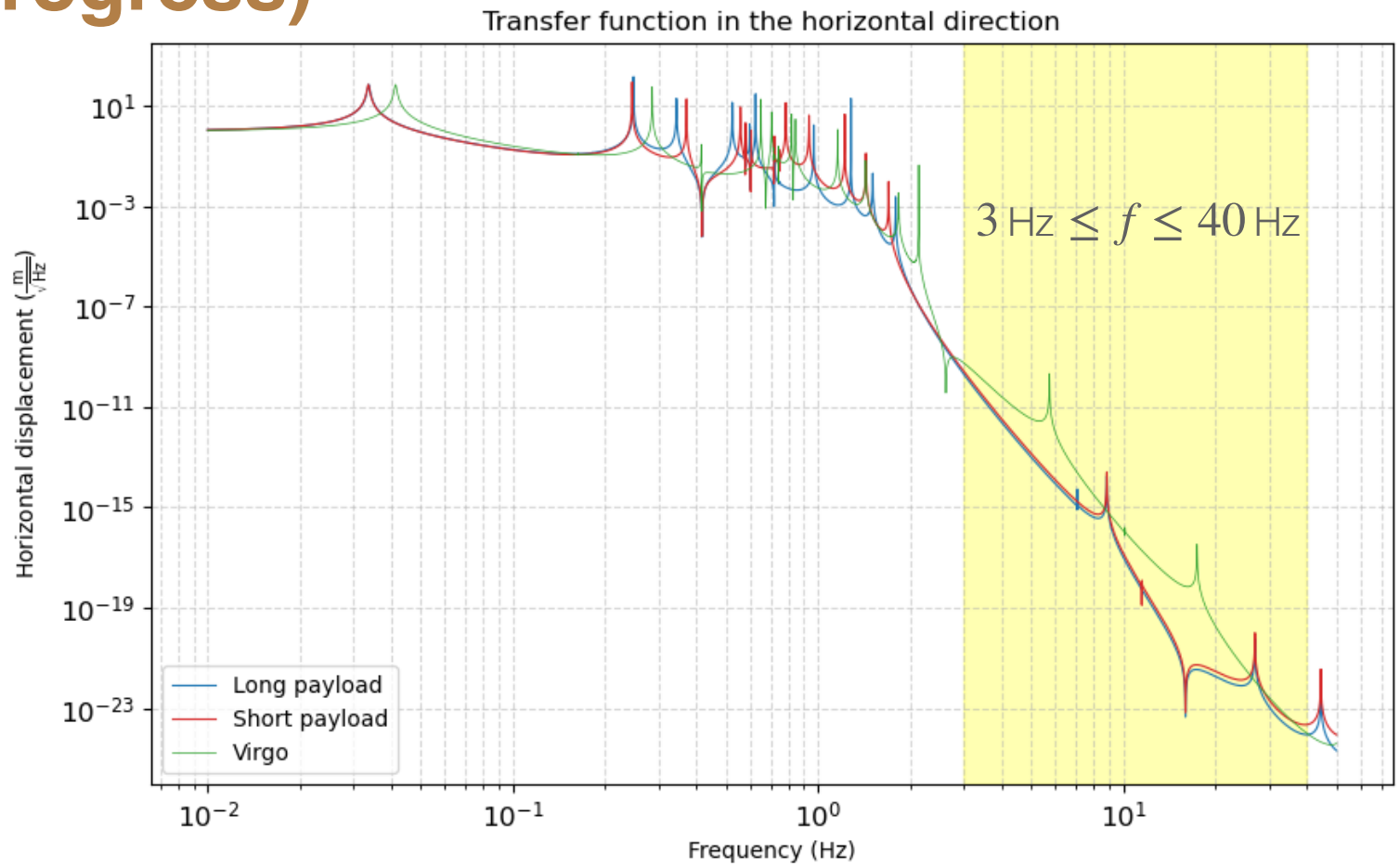




Current analyses (in progress)

Simulations run with OCTOPUS, Matlab based software coded by Paolo Ruggi at EGO.





Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
INFN

Conclusions

- Analyses on more suspension configurations are still underway
- Many parameters are still under study i.e. :
  - Height of the base of the towers
  - Length of the inverted pendulum legs
  - Last stage susp. config. (filter 7 - marionetta - test mass)
- The two configurations presented here appear almost equivalent in the horizontal transfer function in the ET-LF frequency range of interest ($3 \gtrsim f \gtrsim 40$ Hz)
- In the same frequency range there is a substantial gain in horizontal attenuation compared to the Virgo SAT in both of the configurations

(See L. Lucchesi poster "The Superattenuator for seismic noise suppression of the CAOS project")

Finanziato dall'Unione europea
NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA
INFN

Thank you for your attention!