GEMINI

A new underground seismic-isolation facility at LNGS

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INFN - LNGS

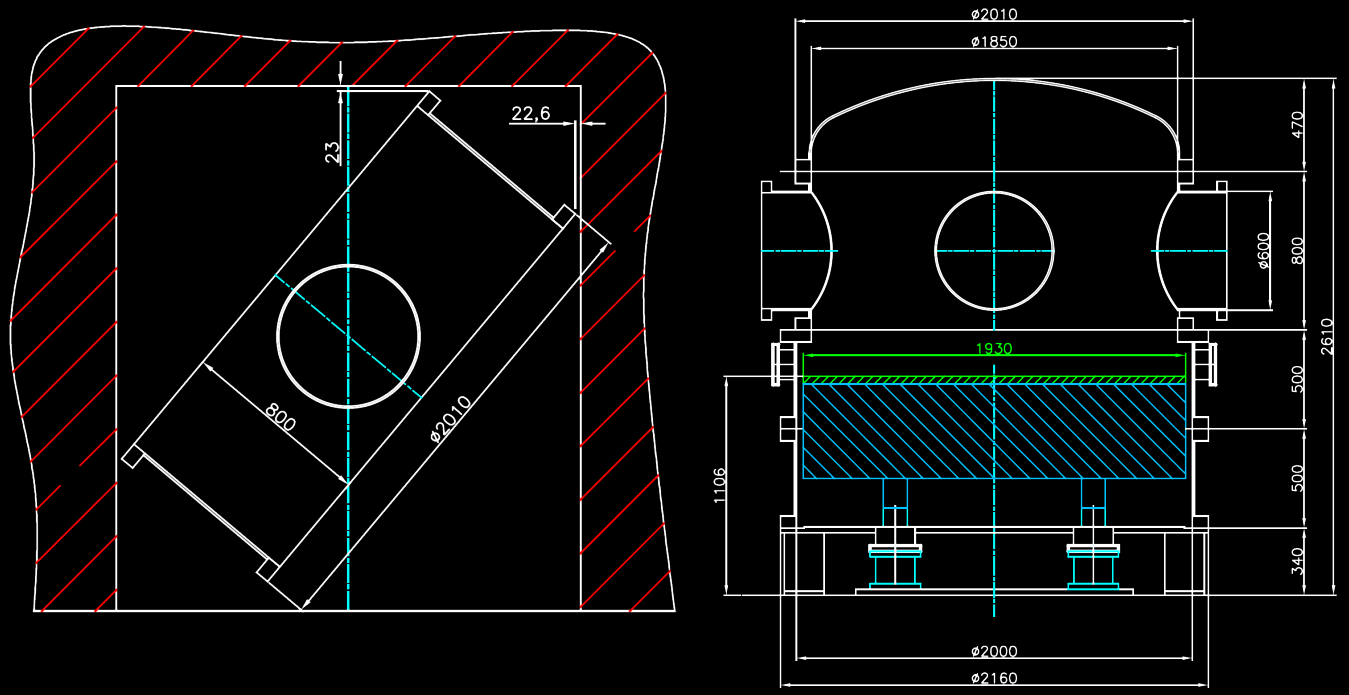
GEMINI

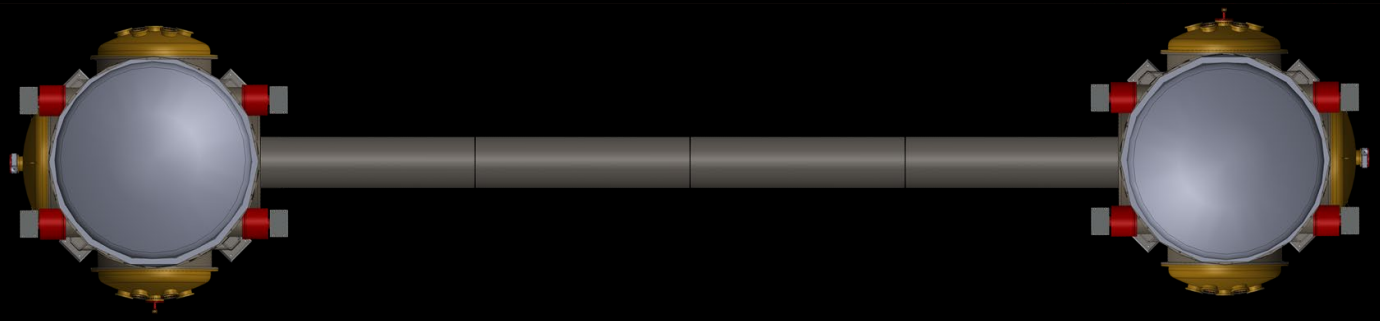
- Funded through two PNRR projects:
  ETIC (890k€, LNGS; 385k€ GSSI) and Vitality - ASTRA (250k€, GSSI)

- Seismic isolation facility: development of sensing and control system for the Einstein Telescope; LNGS is a perfect location to carry out these studies
- Test platform for novel inertial sensors (room&cryo temperature);
- Installation and utilization of an underground environmental monitoring system

Vacuum System

Initial simulation





Two chambers connected by vacuum pipe.

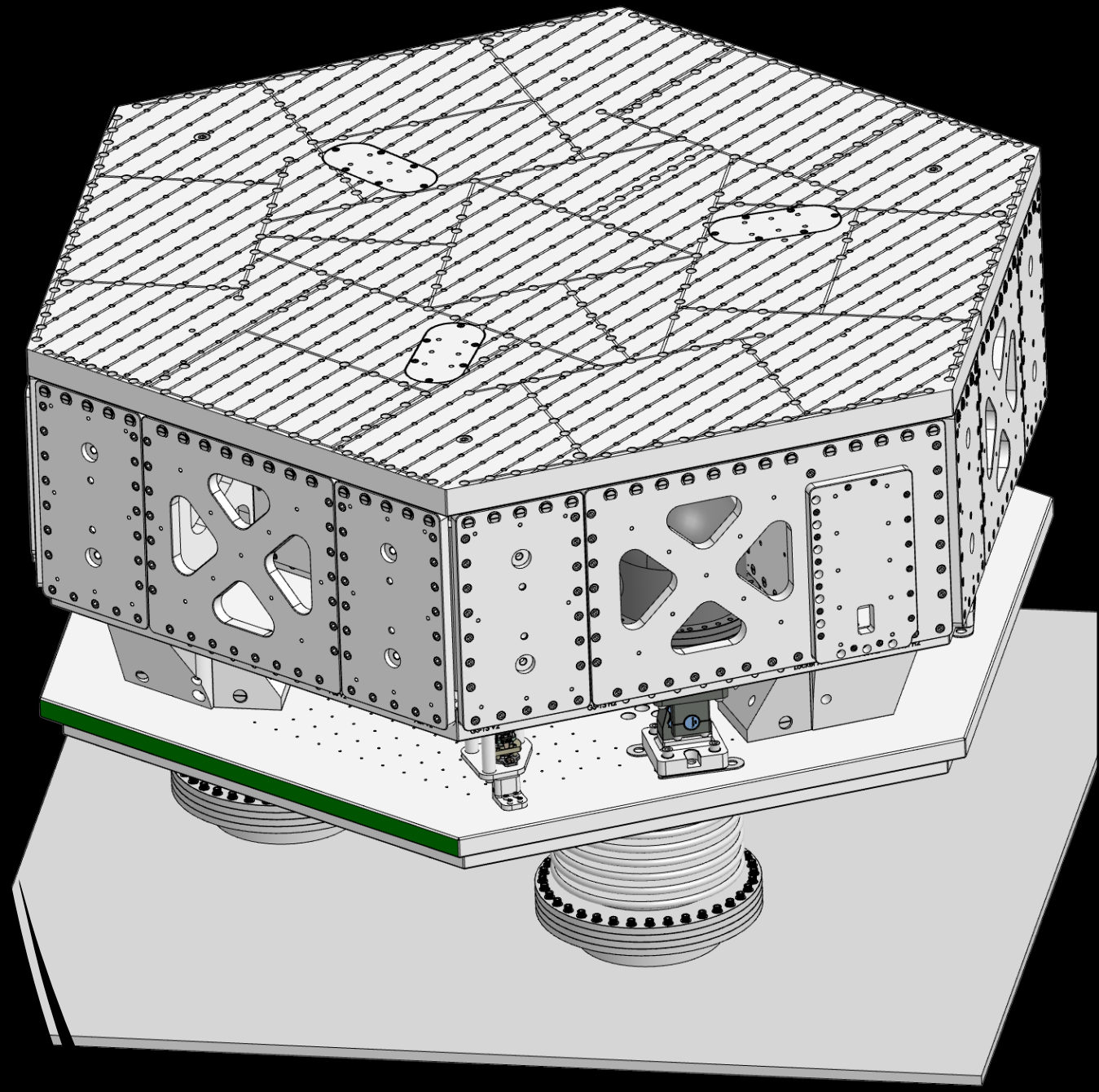
Tunnel entrance dimensions put strong limitations on chamber geometry.

Installation feasible according to initial simulation.

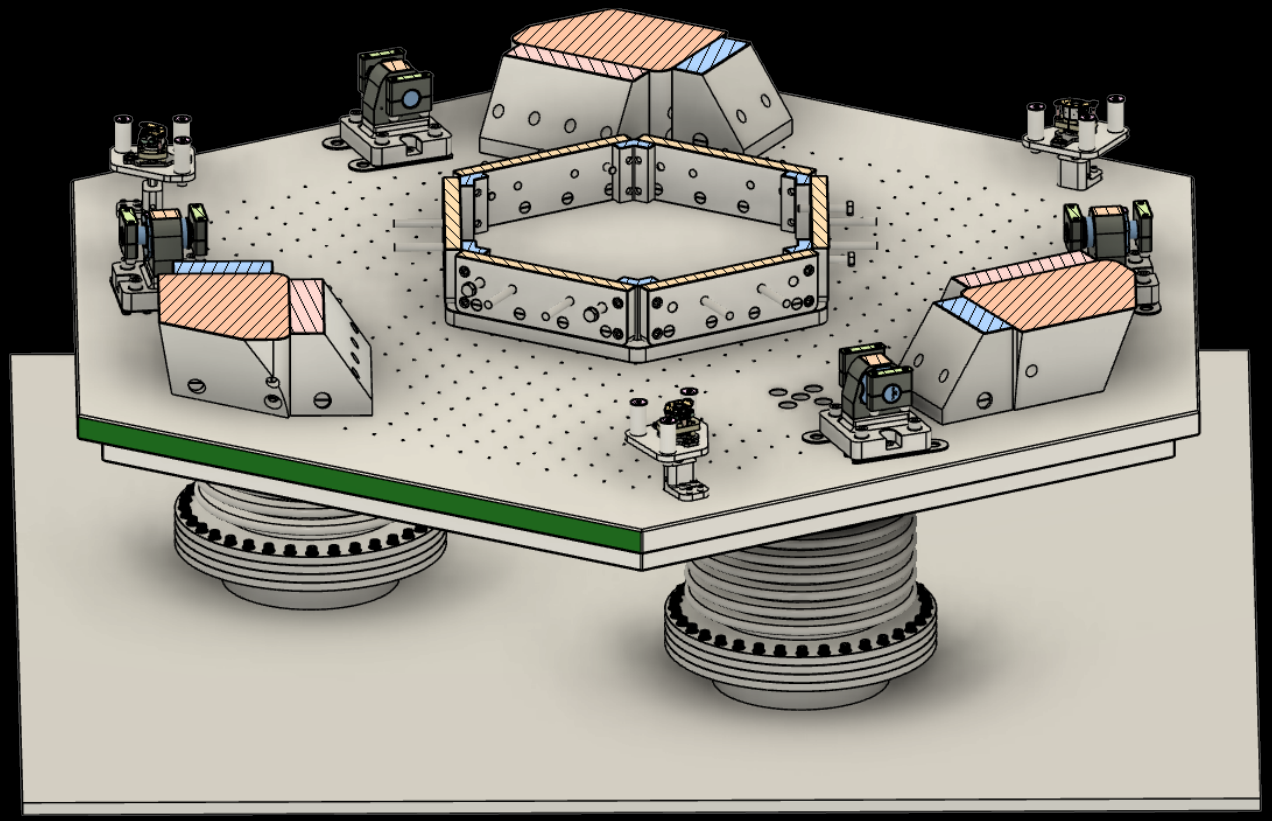
Several companies participate in the call for tenders.

GEM-IP

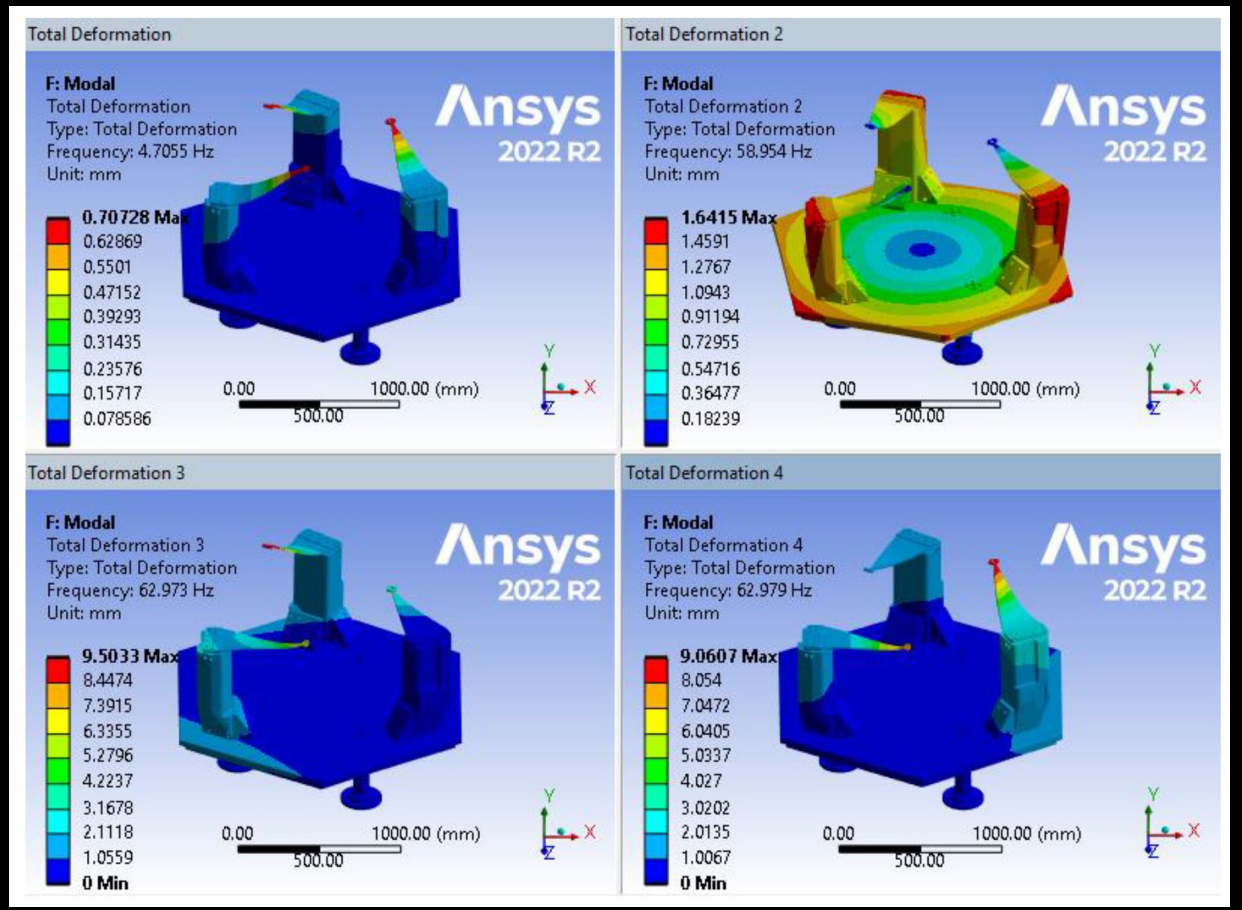
- GEMINI Inertial Platform
  - Starting point of the design: LIGO HAM-ISI
  - Design modifications, vibration analysis, and executive drawings produced by LNGS mechanical engineers
  - Tenders received and under evaluation



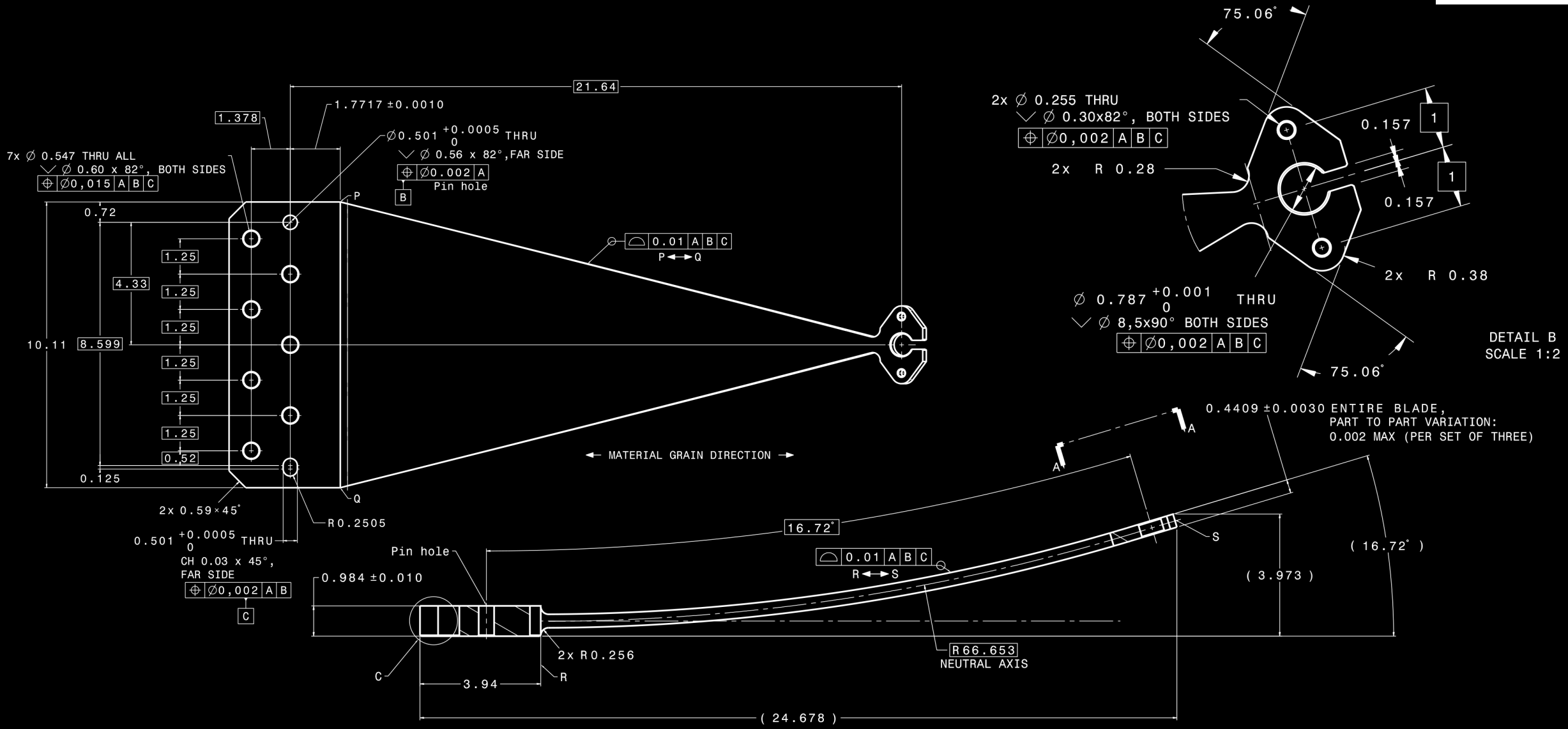
GEM-IP: Stage 0



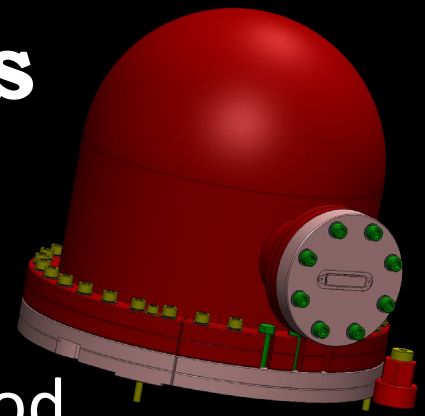
100Hz HAM-ISI (unconstrained)
70Hz GEM-ISI (under load)



Maraging Steel Spring Blades
(had to be taken out of the call for tenders)



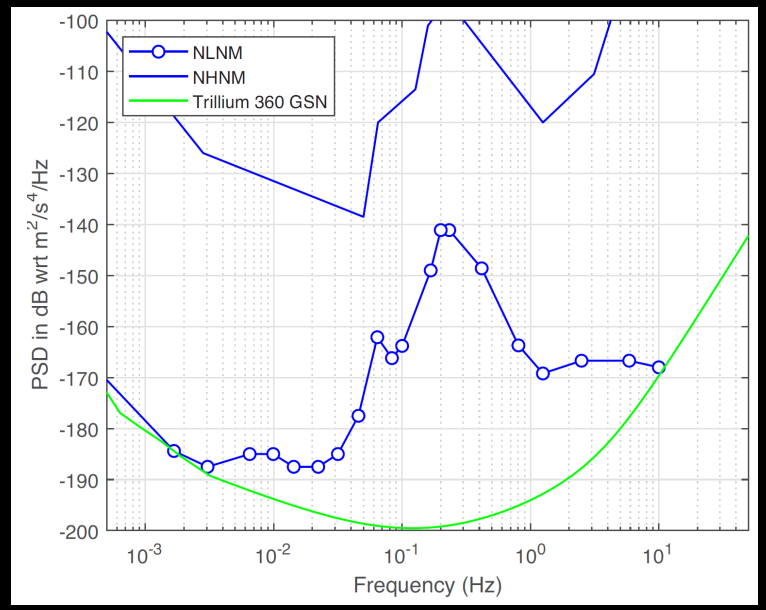
On-platform Seismometers

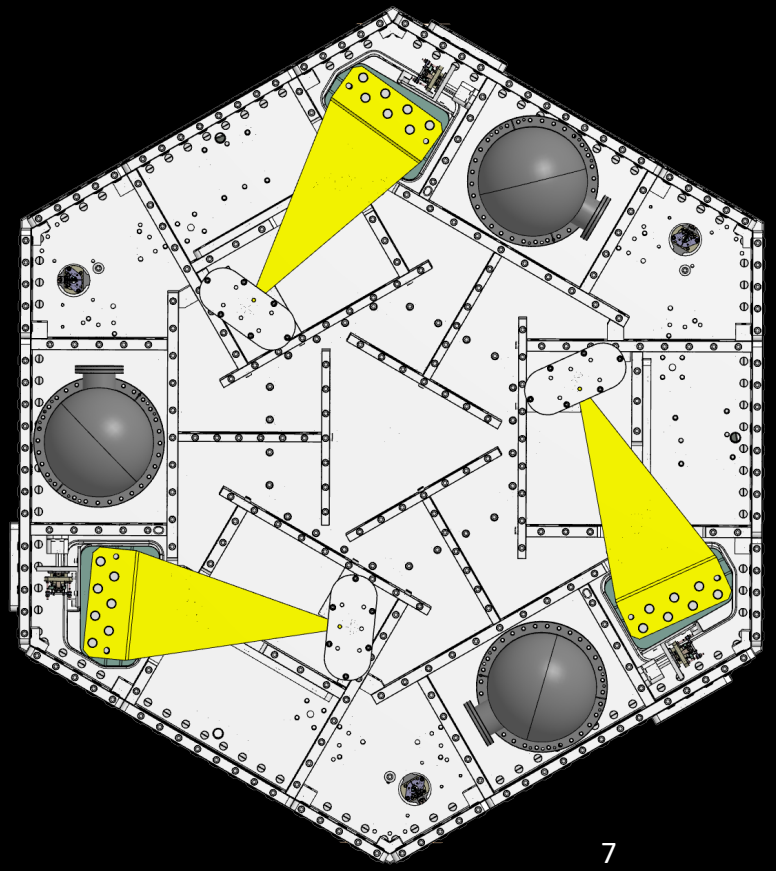


Nanometrics T360 GSN Vault

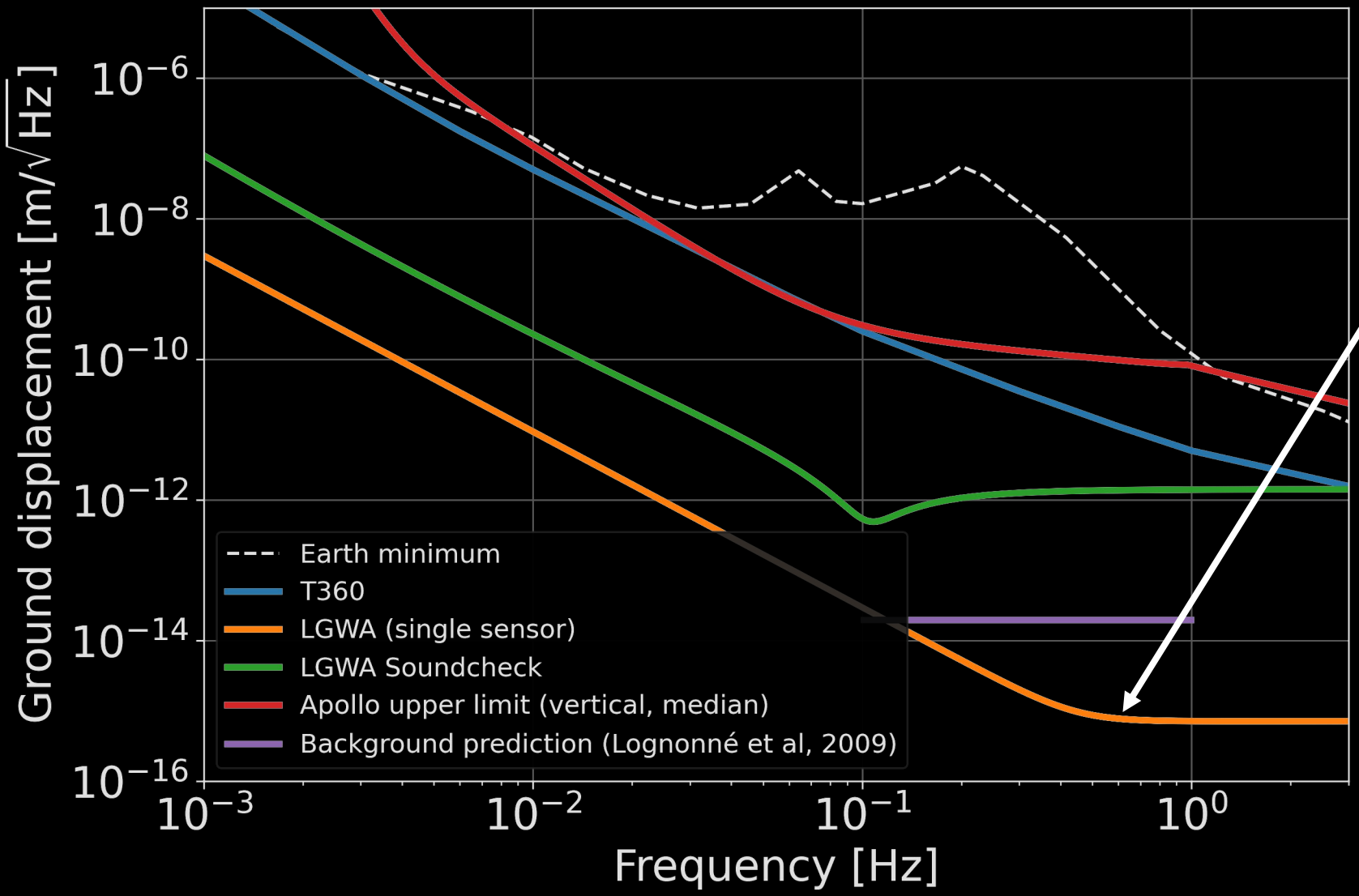
- 6 sensors ordered by GSSI in June

Vacuum pod
(to be ordered in 2024 by GSSI)





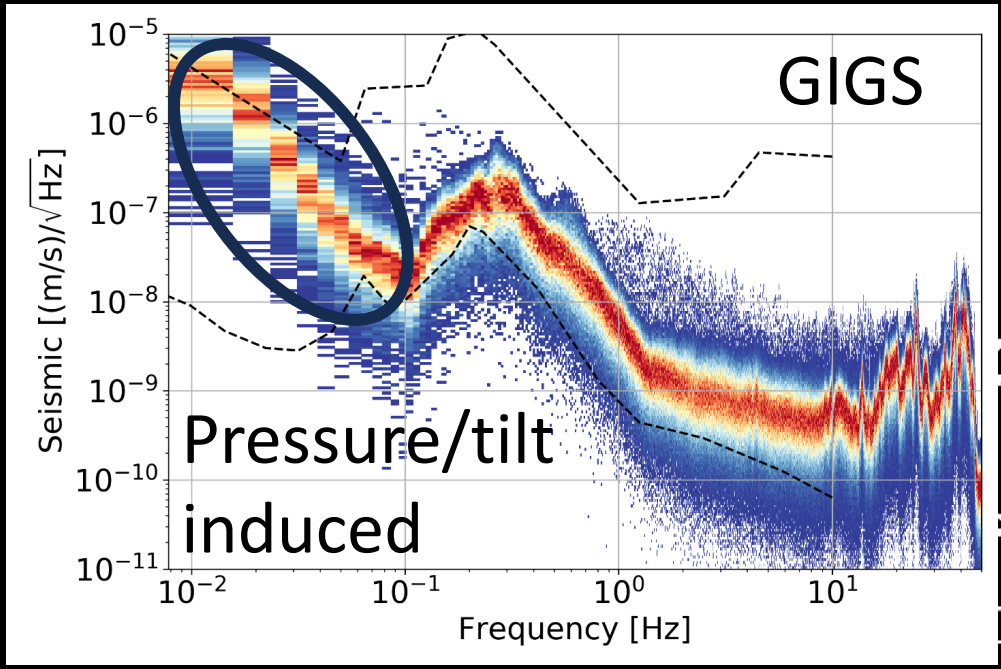
Sensor Test Bed

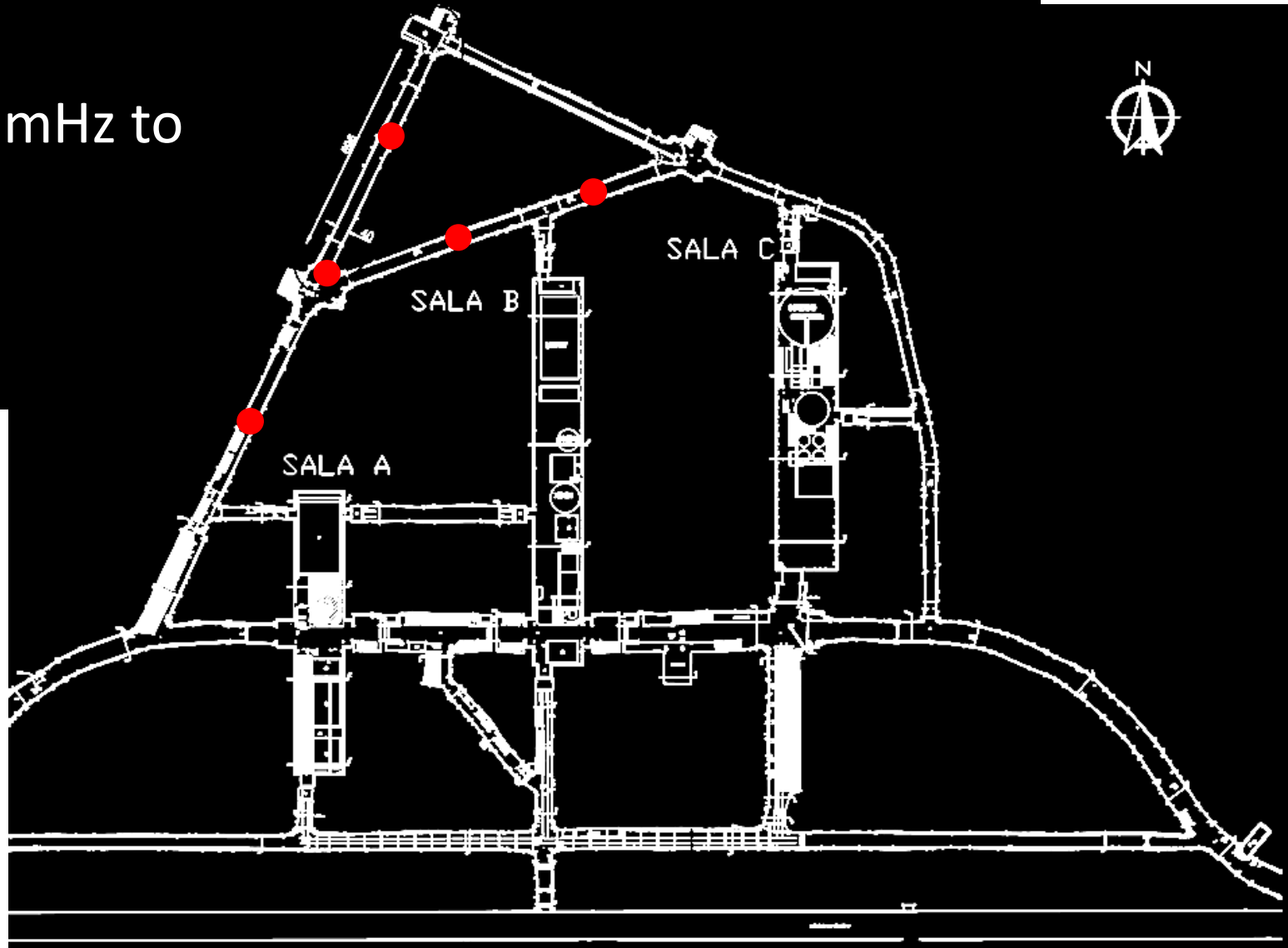


Goal: GEMINI performance good enough for LGWA sensor performance demonstration

Environmental Monitoring System

Network of barometers for 1mHz to 1Hz observations (underground and surface)





Missing Designs / Components

- Actuators and position sensors
  (design in 2024, purchase when funds available: urgent)
- Electronics (purchase in 2024)
- Cryocooler, cryolink and cryobox
  (design / partial purchase in 2024)
- Laminar flow enclosures (purchase in 2024)

When funds become available, acquire

- Maraging steel (MS250 or MS300) spring blades (urgent)
- Barometer/microphone array
- Inter-platform interferometer
- Tiltsensor

Tentative Timeline
(assuming that funds are available when needed)

	2024		2025		2026		2027		2028	
Site preparation										
Construction of vacuum system at site										
Installation of sensors and actuators on mechanical platforms										
Testing of real-time system										
Installation of electronics rack at site										
Installation of platforms into vacuum system										
Commissioning of active seismic isolation system										
Installation of environmental monitoring system										
Installation of cryocooler, thermal link, cryobox										
Installation of inter-platform interferometer										
Commissioning of IPF										