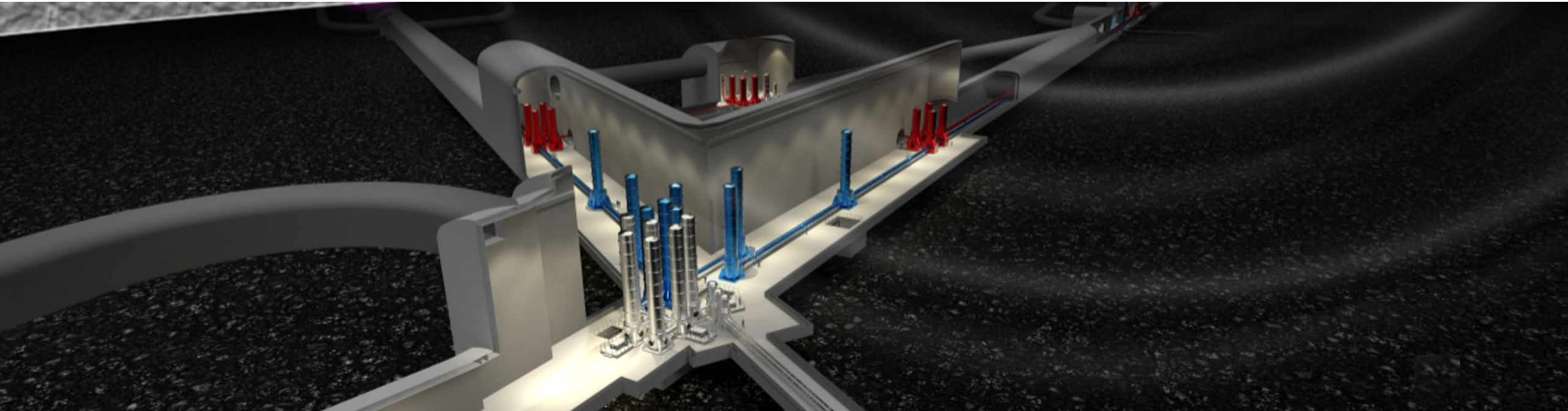
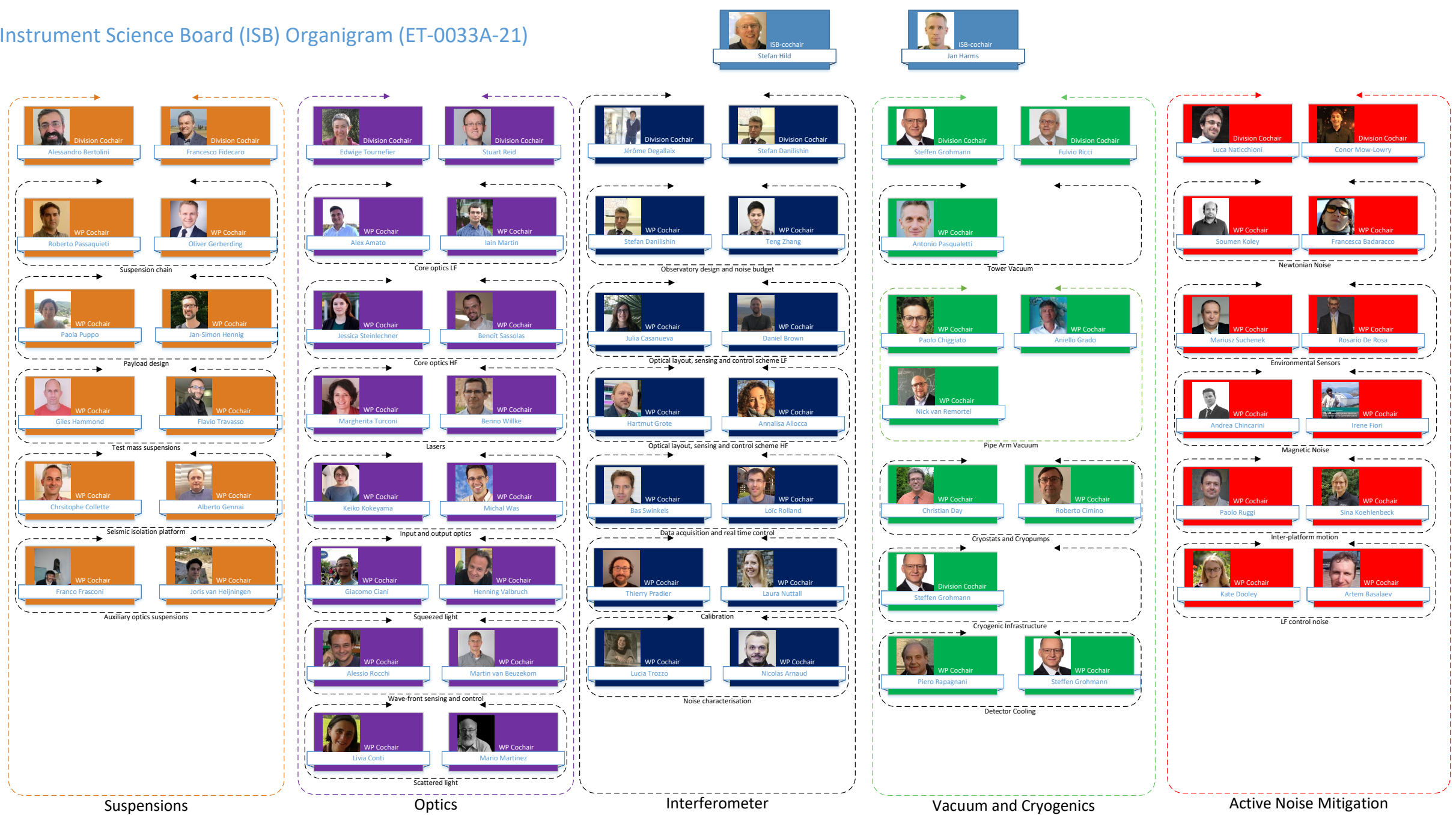


ET Instrument Science Board



Jan Harms
Stefan Hild

ET Instrument Science Board (ISB) Organigram (ET-0033A-21)



ET ISB Wiki

You are here: [ET - Einstein Telescope Wiki Pages](#) > [ISB Web](#) > [WebHome](#) (11 May 2023, JanHarms)

Instrument Science Board

Composition of the Board

Chairs

Jan Harms (jan.harms@gssi.it), Stefan Hild (stefan.hild@maastrichtuniversity.nl)

Divisions

- **Active Noise Mitigation** : Jan Harms (jan.harms@gssi.it), Conor Mow-Lowry (c.m.mow-lowry@vu.nl)
- **Infrastructures** : Raul Fuentes (raul.fuentes@gut.rwth-aachen.de), Maria Marsella (maria.marsella@uniroma1.it)
- **Interferometer** : Jérôme Degallaix (j.degallaix@lma.in2p3.fr), Stefan Danilishin (stefan.danilishin@maastrichtuniversity.nl)
- **Optics** : Edwige Tournier (tourniefi@lapp.in2p3.fr), Stuart Reid (stuart.reid@strath.ac.uk)
- **Suspensions** : Alessandro Bertolini (alberto@nikhef.nl), Francesco Fidecaro (francesco.fidecaro@unipi.it)
- **Vacuum and Cryogenics** : Steffen Grohmann (steffen.grohmann@kit.edu), Fulvio Ricci (fulvio.ricci@roma1.infn.it)

ISB mailing lists

- et-isb-board@mail.ego-gw.it (outdated:et-isb@lists.infn.it) (ISB chairs and division chairs)
- [Et-isb-all](#) (everybody)
- [Et-isb-anm](#) (Active Noise Mitigation division)
- [Et-isb-board](#) (ISB chairs and division chairs -- not yet active)
- [Et-isb-ifo](#) (Interferometer division)
- [Et-isb-infra](#) (Infrastructures division)
- [Et-isb-opt](#) (Optics division)
- [Et-isb-susp](#) (Suspensions division)
- [Et-isb-vac](#) (Vacuum and Cryogenics division)

<https://wiki.et-gw.eu/ISB/WebHome>

Materials Database

- [Materials Database](#)

Meetings and Events

- [Schedule for ISB board meetings and minutes](#)
- [Schedule and information for meetings of ISB divisions and working groups](#)
- [ET project Google calendar](#)
- [General meetings and workshops](#)
 - [11th ET symposium](#) (30 November 2020 to 3 December 2020)
 - [ET-ISB Workshop](#) (29 March and 31 March 2021) [Workshop summary document](#)
- [INFRA-TECH 2022 EU call](#)

Documents and useful links

- [ET documentation system](#)
- [ET Git server](#)
- [ET Mattermost server](#)
- [Mandate and organigram of the Instrument Science Board](#)
 - Mandate: [ET-0085A-20](#)
 - Organigram: https://wiki.et-gw.eu/ISB/WelcomePage#Organization_and_contacts
 - List of contacts: [ET-ISB_contacts.pdf](#)
- [ET design report update 2020](#) (ESFRI proposal)
- [ET related R&D facilities](#)
- [ET FAQ - Infrastructure and detector](#)
- [ISB Welcome page](#)

Recent / current / upcoming ISB Activities

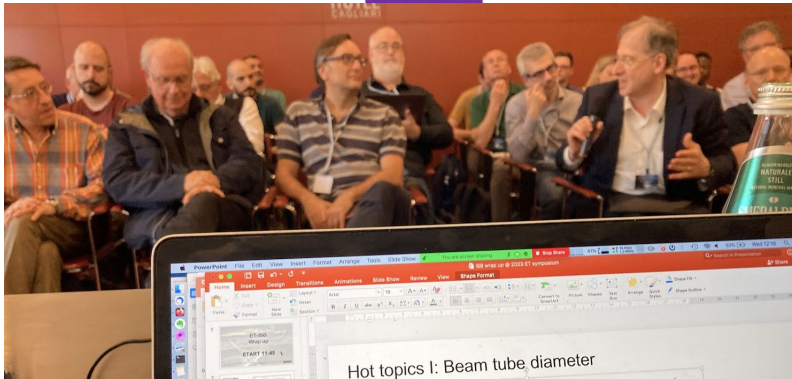
- Regular meetings of all ISB divisions to discuss sub-system designs, R&D progress, instrument science
- More than 1000 entries in the first PBS version contributed by the ISB (of course, changes will still be made, and a finer structure is required)
- R&D facilities / activities survey: there will be an online form to be compiled by all groups with R&D facilities

Level	PBS code	Level 3	Level 4	Level 5	Level 6	Level 7	Short description
5	1.1.5.4.1			Test-mass towers			
6	1.1.5.4.1.1				mu-metal sheath		~ 1-3 mm mu-metal layer wrapped around the main vacuum chamber - dimensions to
6	1.1.5.4.1.2				Active Compensating coils (ACC)		configuration is still under study. Could be as large as ~5 m diameter along laser axis, or
6	1.1.5.4.1.3				power-supply and controls for ACC		in case of AHC
6	1.1.5.4.1.4				Self compensated coils (SCC)		As an alternative to active or passive Helmholtz coils, one could use self compensated c
6	1.1.5.4.1.5				sensors for ACC/PHC		
6	1.1.5.4.1.6				Passive Helmholtz Coils (PHC)		passive solution to be decided in addition to or as possible running configuration of the
6	1.1.5.4.1.7				permanent magnets passive shielding		Additional mu-metal shields around permanent magnets of the marionette. the test m
6	1.1.5.4.1.8				selected low-heterogeneity driving magnets		configuration and tests to be decided
5	1.1.5.4.2			Optics towers			
6	1.1.5.4.2.1				mu-metal sheath		~ 1-3 mm mu-metal layer wrapped around the main vacuum chamber - dimensions to
6	1.1.5.4.2.2				Passive Compensating Coils (PCC)		passive/active solution to be decided
6	1.1.5.4.2.3				Self compensated coils (SCC)		As an alternative to active or passive Helmholtz coils, one could use self compensated c
6	1.1.5.4.2.4				sensors for PHC		
6	1.1.5.4.2.5				permanent magnets passive shielding		Additional mu-metal shields around permanent magnets of the marionette. the test m
6	1.1.5.4.2.6				selected low-heterogeneity driving magnets		configuration and tests to be decided
6	1.1.5.4.2.7				Local sources permanent magnets shields		e.g. Faraday isolators + mu-metal and Fe shields
5	1.1.5.4.3			Power distribution			
6	1.1.5.4.3.1				Twisted/interleaved cabling		Rules to be communicated in interface with INFRA: 2-phase / 3-phase power distributic
6	1.1.5.4.3.2				Local passive shields		Fe/Al/Cu sandwiches around power cabling in sensitive areas. Closed box cable trays a
6	1.1.5.4.3.3				Local Active Shielding with single coils		locally active coils for specialized spaces and selected frequencies
6	1.1.5.4.3.4				Sensors on key junctions		Current + magnetic sensors near key active elements (e.g. electronic racks)
6	1.1.5.4.3.5				Remote Control systems		monitoring and switching remotely automated / sensors equipped
5	1.1.5.4.4			Data/signal distribution			
6	1.1.5.4.4.1				Local passive shields		Fe/Al/Cu sandwiches around signal cabling in sensitive areas

Hot topics I: Beam tube diameter

1. Start from laser beam (60cm for HF, 45cm for LF), clear aperture of 85cm, and 62cm for a diameter of 10.
2. Space needed for scattered light mitigation (i.e. baffels). 2x8cm
3. 1.+2. gives inner diameter? Or vacuum conductivity needs to go in here as well?
4. Mechanical integrity of tube (wall thickness, stiffening rings, corrugation?).
5. Add to outside diameter space for potential baking (insulation etc).
6. Add service space: i) maintenance and fixing of vacuum tubes. ii) vacuum instrumentation.

Decision to give to CERN inner diameter of 1.00m for each HF and LF tubes.



Wiki page for R&D Facilities

https://wiki.et-gw.eu/ISB/R_and_D_facilities

Overview of ET related R&D facilities

This is aimed to be a living wiki page to collect information on the different R&D facilities related to ET, so that the community can get a transparent overview of ongoing activities, planned activities, capabilities of the test beds etc.

ETpathfinder

- R&D topics covered: Full interferometer test bed aiming at testing techniques and concepts at low noise (~1e-18m), cryogenics, sorption coolers, silicon mirrors, lasers (1550nm, 2090nm), interferometry concepts, seismic isolation systems, control techniques.
- Webpage: www.etpathfinder.eu/
- Design report: <https://www.etpathfinder.eu/wp-content/uploads/2020/03/ETpathfinder-Design-Report.pdf>
- Overview paper: <https://opscience.iop.org/article/10.1088/1361-6382/ac8fdb>
- Contact person: Stefan Hild, stefan.hild@maastrichtuniversity.nl

LMA

- R&D topics covered: coating on small and large parts, optical simulations
- Webpage: <http://lma.in2p3.fr>
- Design report:
- Overview paper: [Large and extremely low loss: the unique challenges of gravitational wave mirrors](#)
- Contact person: [Jerome Degallaix](#)

AEI-10m

- R&D topics covered: Sub-SQL Interferometer 10m Fabry-Perot Michelson without recycling limited by SQL 50-500 Hz ca. 10^{-19} m $\sqrt{\text{Hz}}$, sub-SQL techniques (after interferometer installation/commissioning finished), Seismic isolation: testing sensors and actuators, small suspensions (100g mass), other general test and investigations in detector like environment, precision optics, thermal noise interferometer at 1064nm,
- Webpage: <https://10m.aei.mpg.de>
- Design report: [Kentaro10mVer2.pdf](#)
- Overview paper:(Warning! Some plans have significantly changed since publication) <https://doi.org/10.1088/0264-9381/27/8/084023>
- Contact person: david.wu@aei.mpg.de

CoMET - Coating Materials for Einstein Telescope

The CoMET laboratory will be built in Rovigo (completion by second half of 2024) for the production of GW-quality research samples.

- R&D topics covered: Production of high-quality research samples with highly controlled conditions to enable the study of new amorphous coating materials
- Webpage:
- Design report:
- Overview paper:
- Contact person: Marco Bazzan ([marco.bazzan\[at\]unipd.it](mailto:marco.bazzan[at]unipd.it)), Giacomo Ciani ([giacomo.ciani\[at\]unipd.it](mailto:giacomo.ciani[at]unipd.it))

CAOS

- R&D topics covered:
- Webpage:
- Design report:
- Overview paper:
- Contact person:

E-TEST

- R&D topics covered: Prototype of large 100 kg suspended cryogenic silicon mirror, radiative cooling strategy (non contact), low-frequency hybrid isolation stage, cryogenic sensors and electronics, laser and optics at 2 microns, a low thermal noise coating
- Webpage: <https://www.etest-emr.eu/>
- Design report: <https://arxiv.org/abs/2212.10083>
- Overview paper:
- Contact person: Christophe Collette, christophe.collette@uliege.be

The wiki page complements the online survey. The wiki information will not be used to construct a database.

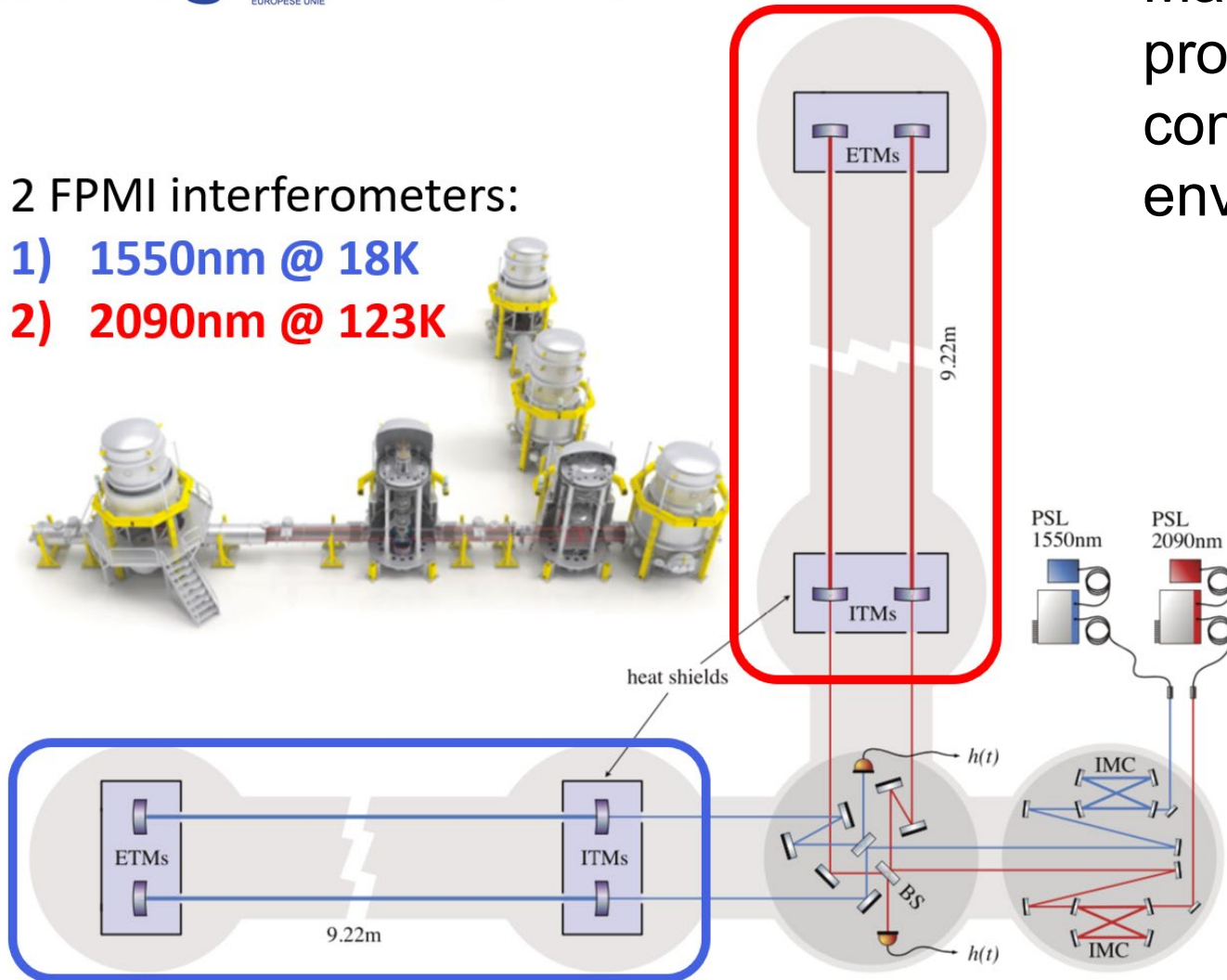
Etpathfinder in Maastricht

See Monday talk
by Sarah Luise Kranzhoff



2 FPMI interferometers:

- 1) 1550nm @ 18K
- 2) 2090nm @ 123K



Main target:
provide a testbed for ET technologies /
concepts and qualify them in low-noise
environment.



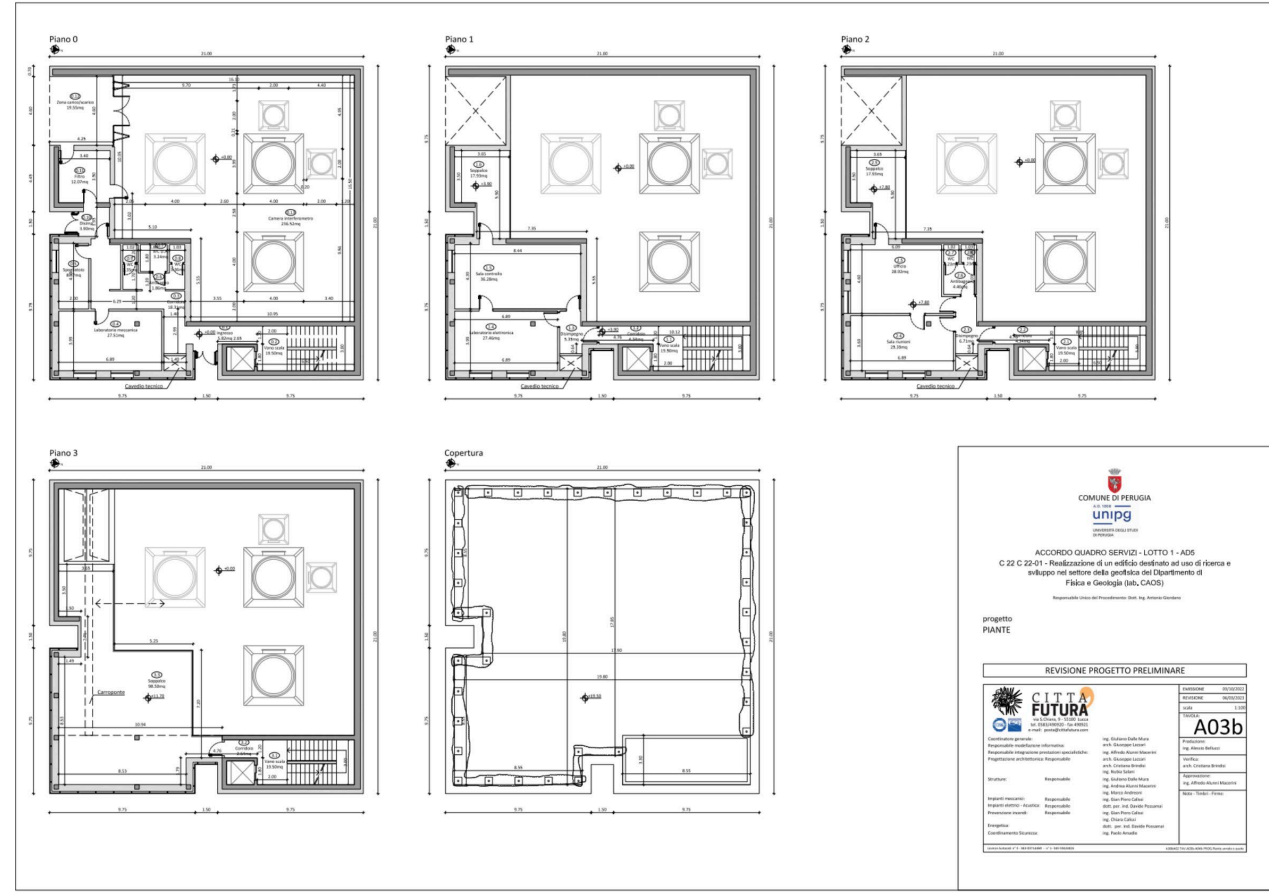
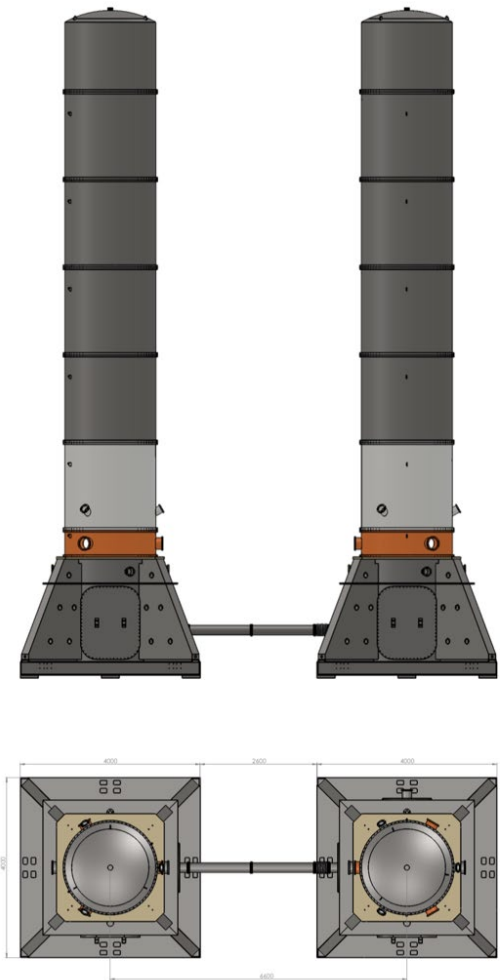
CAOS: Centro per Applicazioni sulle Onde gravitazionali e la Sismologia



New facility at the University of Perugia



Development of specific technology for the third-generation GW detectors, and follow out in many other sectors, first of all that of seismology.



ACCORDO QUADRO SERVIZI - LOTTO 1 - ADS
 C 22 C 22-01 - Realizzazione di un edificio destinato ad uso di ricerca e sviluppo nel settore della geofisica del Dipartimento di Fisica e Geofisica (Inf, CAGS)

progetto: **PIANTE**

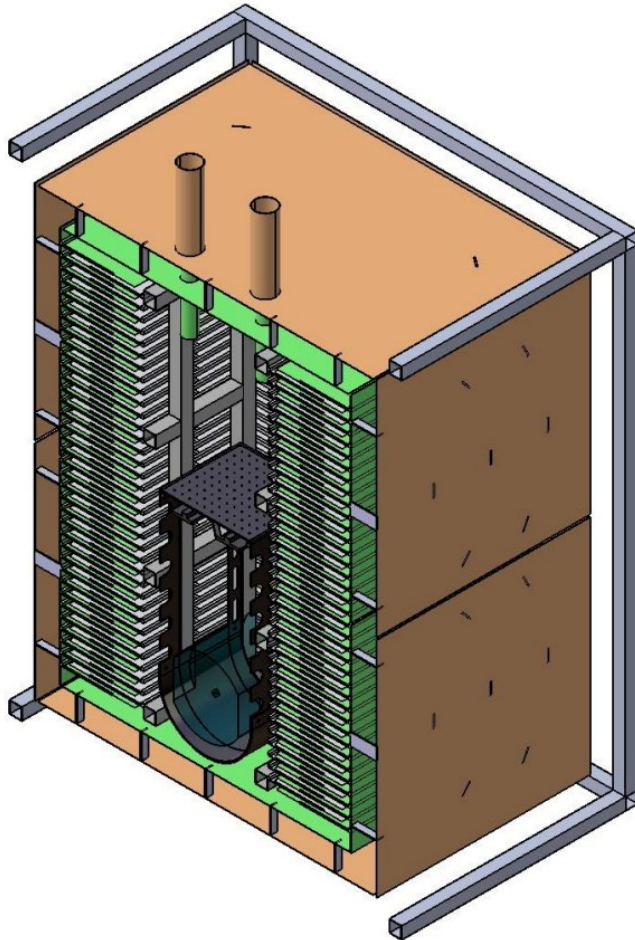
REVISIONE PROGETTO PRELIMINARE	
	A03b
Coordinatore generale: Ing. Stefano Della Porta Responsabile coordinamento generale: Ing. Stefano Della Porta Responsabile coordinamento generale: Ing. Stefano Della Porta Responsabile coordinamento generale: Ing. Stefano Della Porta	Architetto: Ing. Stefano Della Porta Architetto: Ing. Stefano Della Porta Architetto: Ing. Stefano Della Porta Architetto: Ing. Stefano Della Porta
Progettista: Ing. Stefano Della Porta Progettista: Ing. Stefano Della Porta Progettista: Ing. Stefano Della Porta Progettista: Ing. Stefano Della Porta	Progettista: Ing. Stefano Della Porta Progettista: Ing. Stefano Della Porta Progettista: Ing. Stefano Della Porta Progettista: Ing. Stefano Della Porta

See Monday talk by Helios Vocca

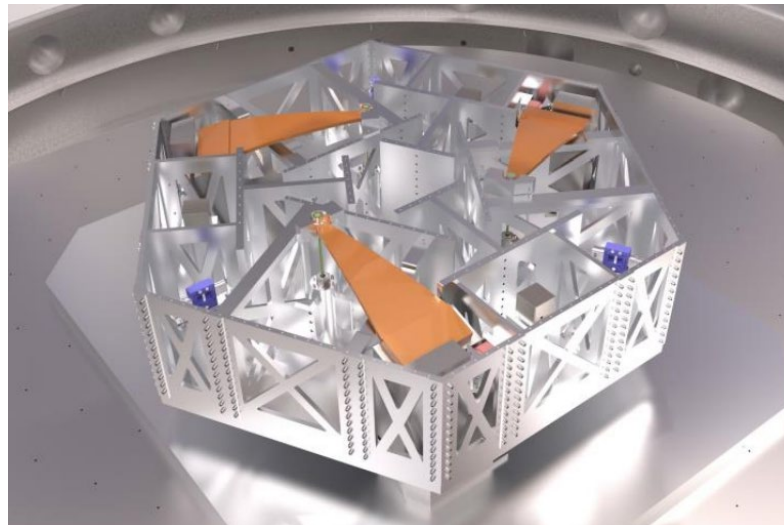
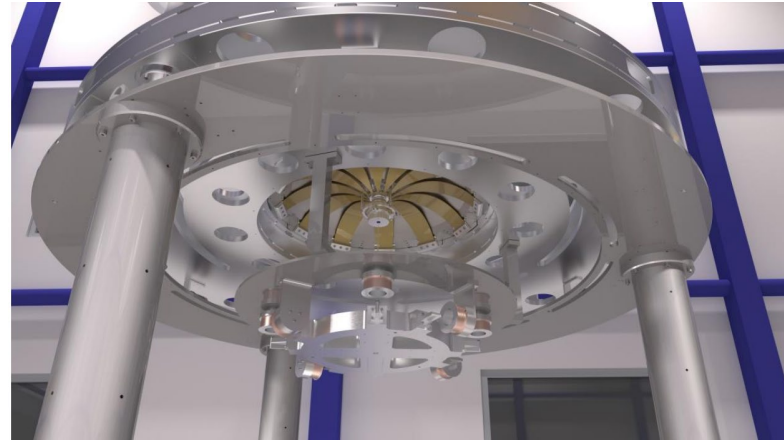
E-TEST : Einstein Telescope EMR Site and Technology



Radiative cooling

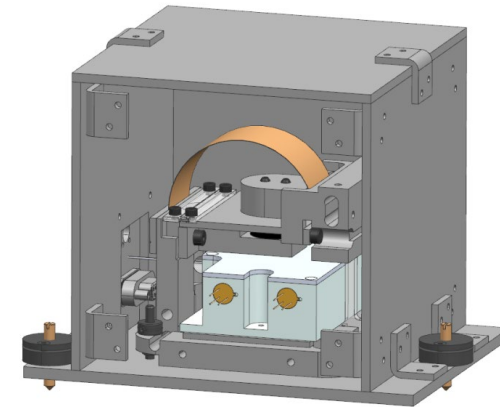
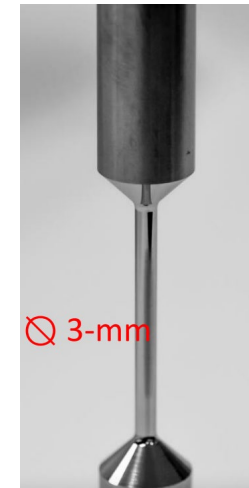


Vibration isolation



E-TEST objectives

- Large mirror (100 Kg)
- Cryogenic temperature (10-20 K)
- Isolated at low frequency (0.1-10 Hz)
- Compact suspension (4.5 meters)



See Monday talk
by Chiara di Fronzo

SAR-GRAV Laboratory

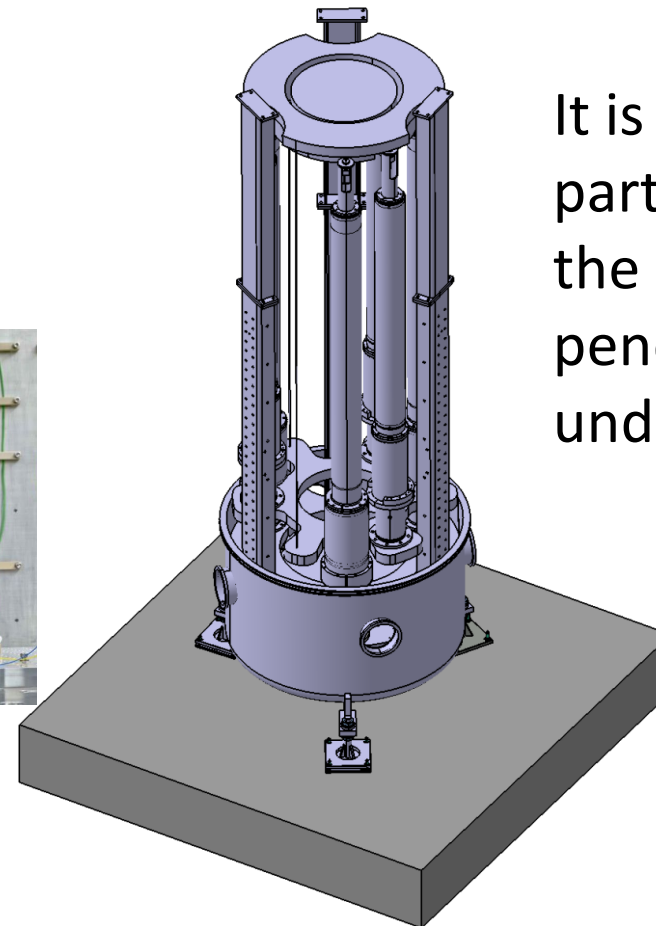
SAR-GRAV hosts ET activities as well as Geophysics and Fundamental Physics activities

Cavern that should host the Archimedes experiment



PNRR project “Monitoring Earth Evolution and Tectonics” (MEET)

Principal Investigator: Giulio Selvaggi, INGV



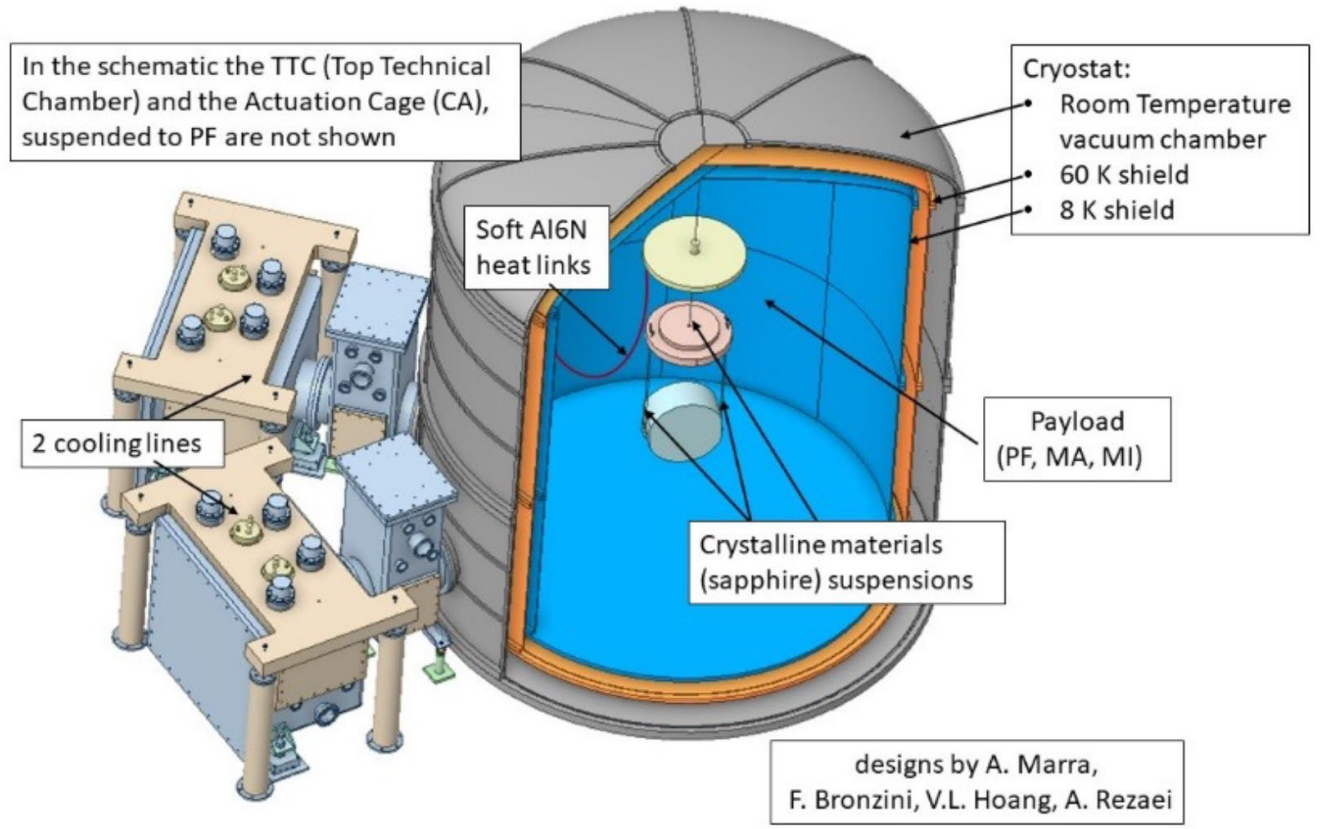
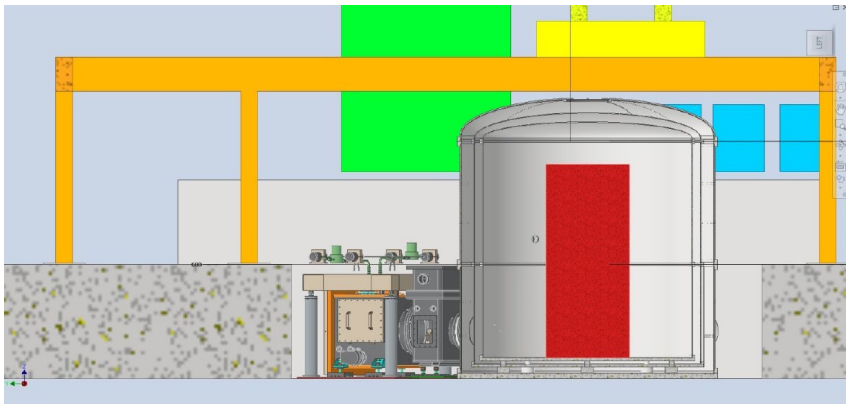
It is planned to test at least partially a preliminary version of the double-suspended inverted pendulum in a quiet underground environment.

See Monday talk
by Enrico Calloni

Amaldi Research Center at Roma La Sapienza



Facility dedicated to cryogenics development for ET.



Build prototype payload

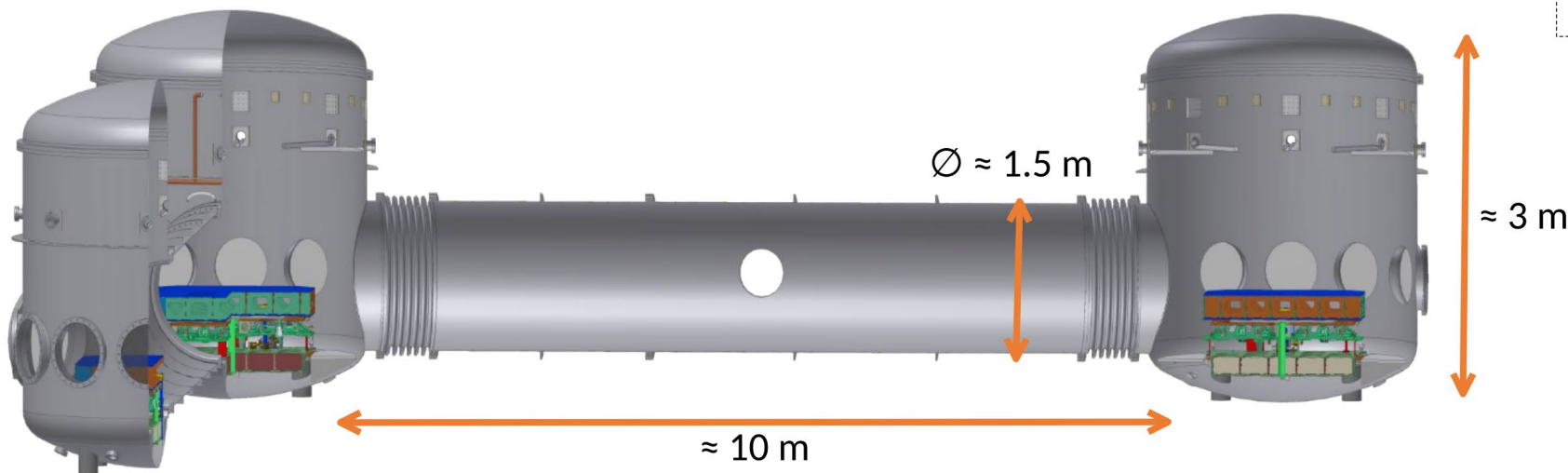
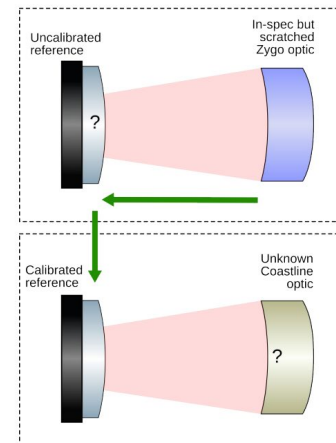
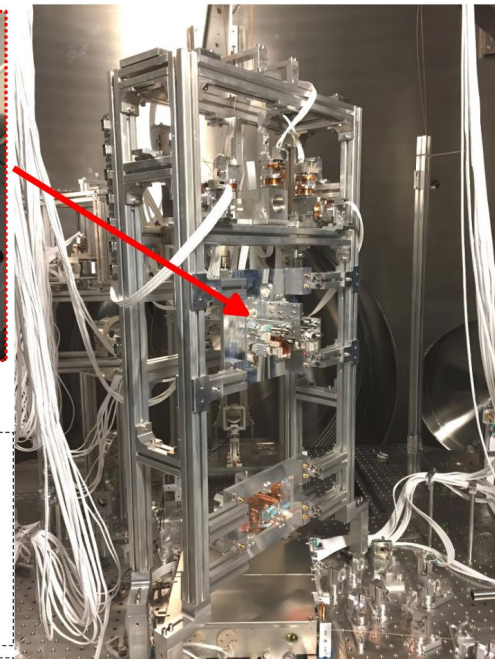
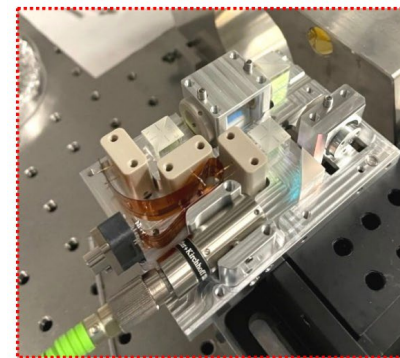
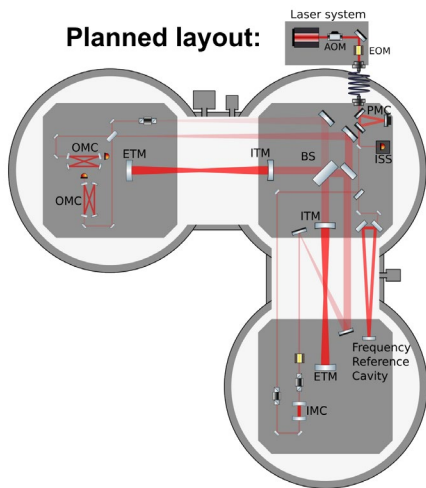
See Monday talk by Ettore Majorana

The AEI 10 m Prototype Facility

Main goal: Sub- λ interferometry
Studies of vibration isolation / control



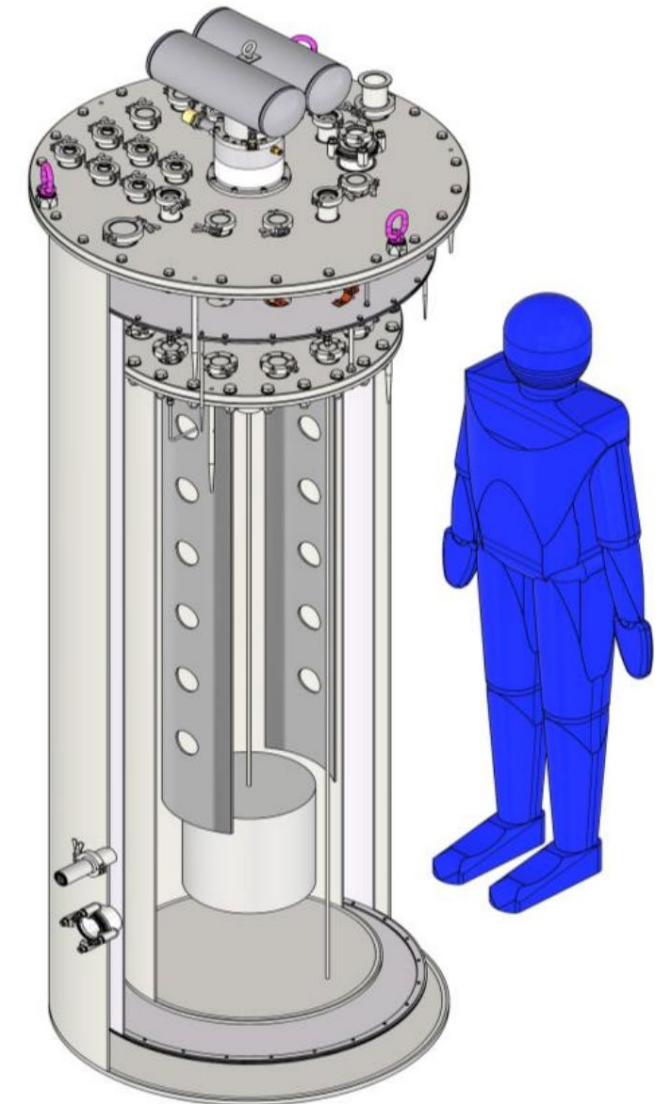
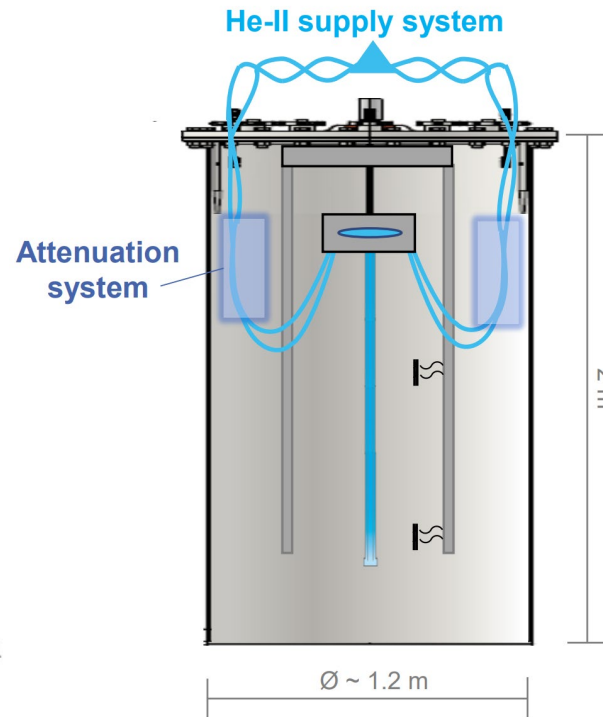
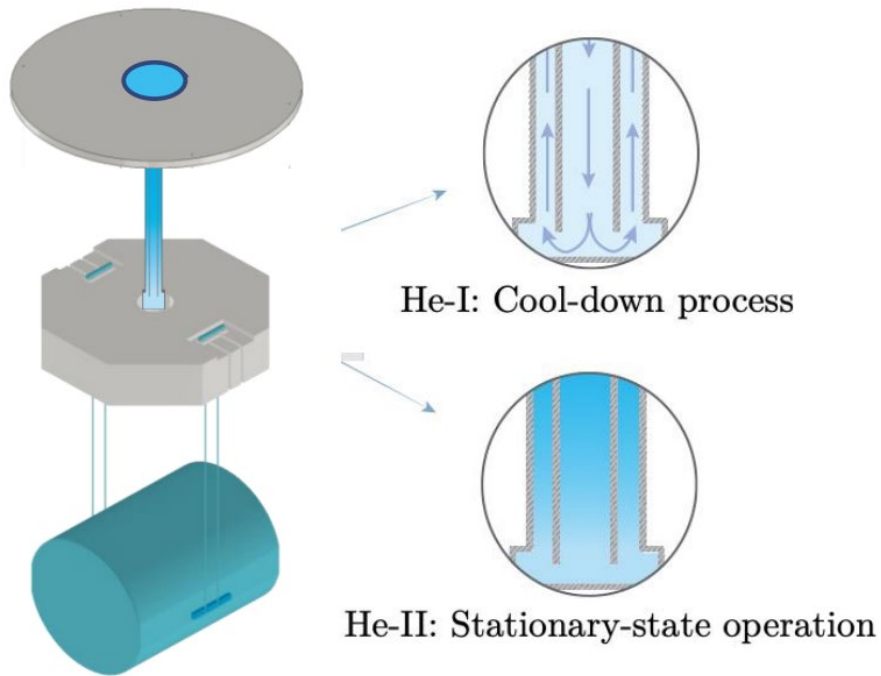
Fused-silica welding



See Monday talk
by David Wu

Test facility for experimental investigations of the He-II based ET-LF payload cooling concept

Suspension and cooling concept studied for ET-LF

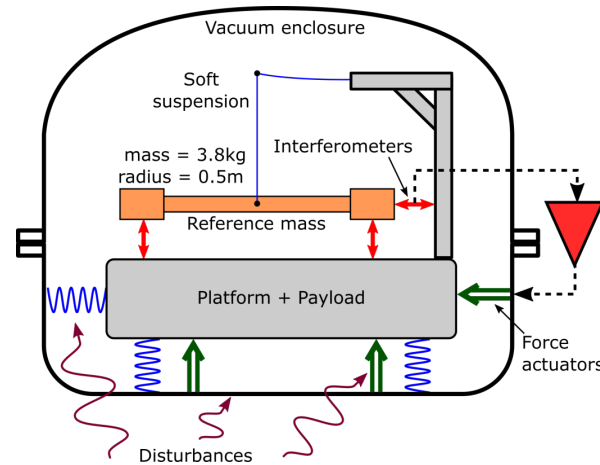


See Monday talk by Xhesika Korovesi

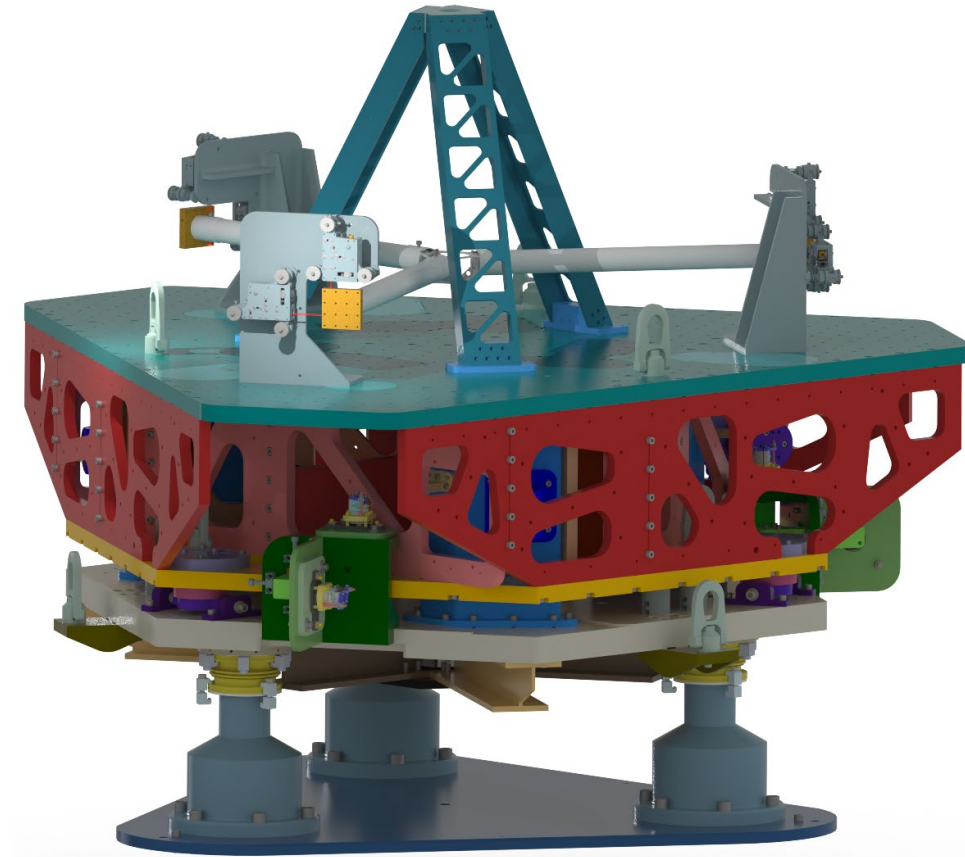
OmniSense at Nikhef



- Interferometric sensing (**HoQI**), compact and proven
- **Fused-silica** suspension
- Closed-loop control
- Careful shielding for thermal fluctuations, acoustics, and E-M
- **Mechanical simplicity**, no cables or magnets.



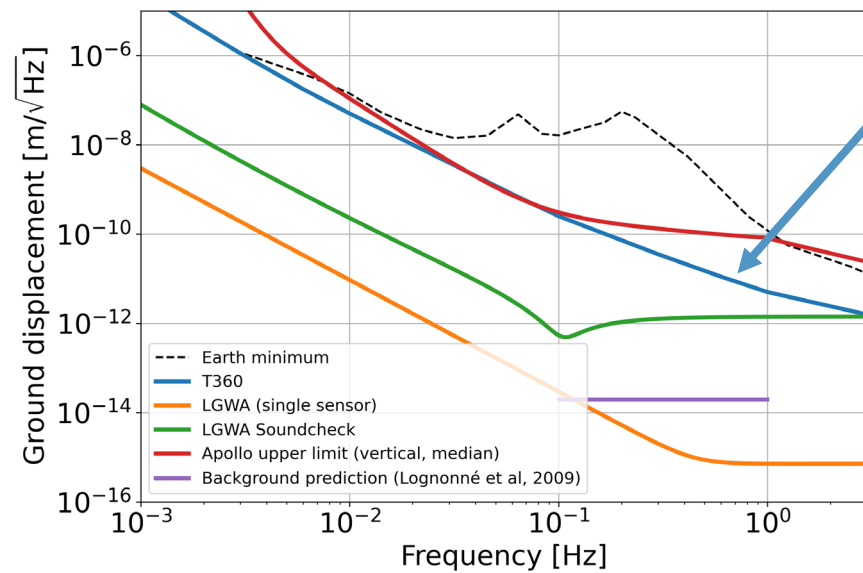
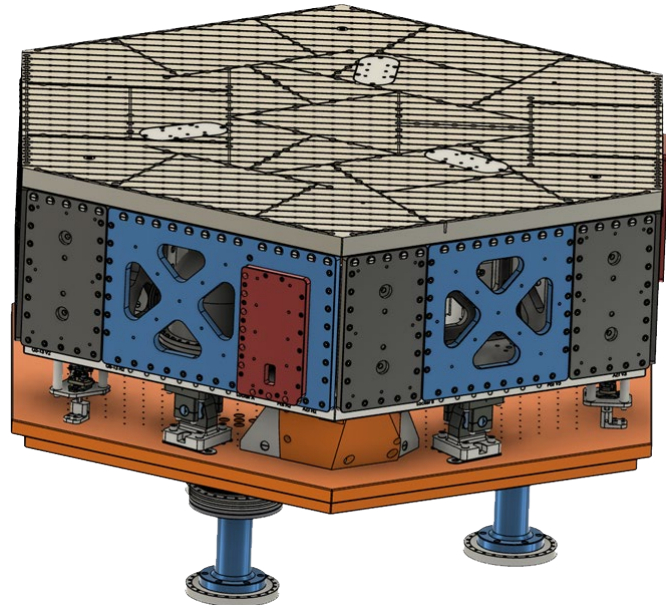
See Tuesday talk by
Conor Mow-Lowry



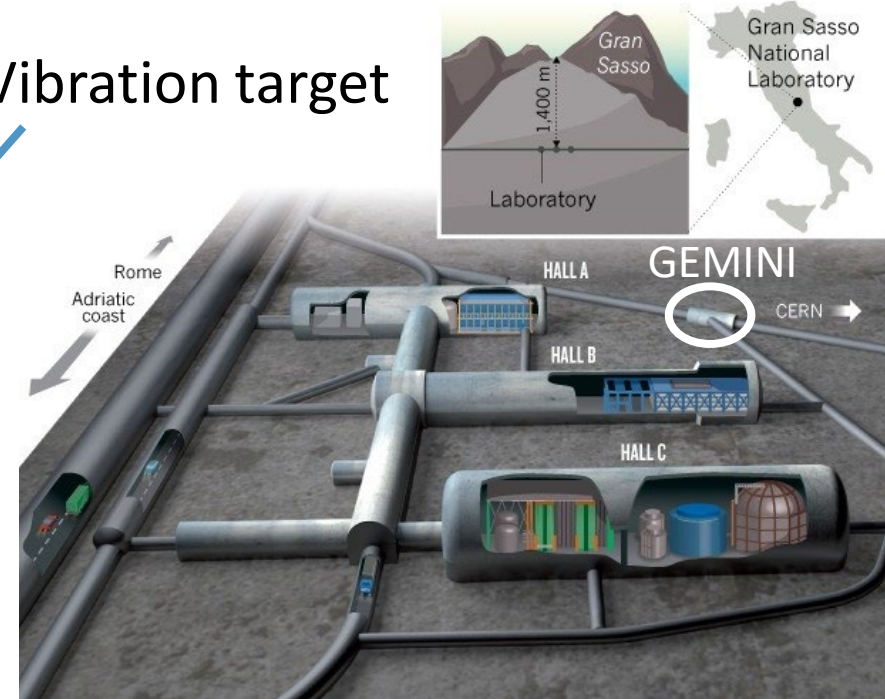
GEMINI at LNGS

Goals

- Test the limits of active seismic isolation in an underground environment
- Inter-platform motion control
- Underground environmental monitoring
- Test new approaches to controls optimization
- Test new inertial sensors



Vibration target

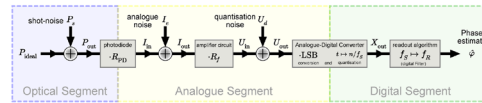


See Tuesday talk
by Jan Harms

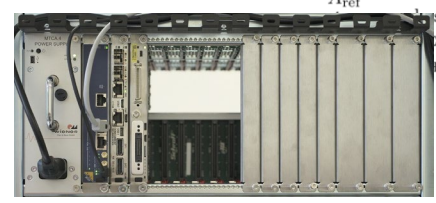
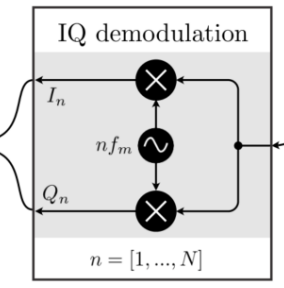
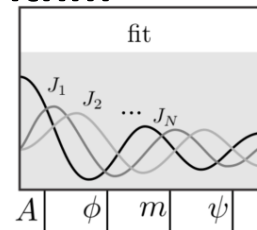
VATI_{Grav} and Compact Laser Interferometry

Main goals:

- test DFMI-based compact displacement sensors on suspensions to reduce control noise
- test inertial sensors with highly sensitive interferometric displacement sensors
- study new suspension control and seismic isolation schemes

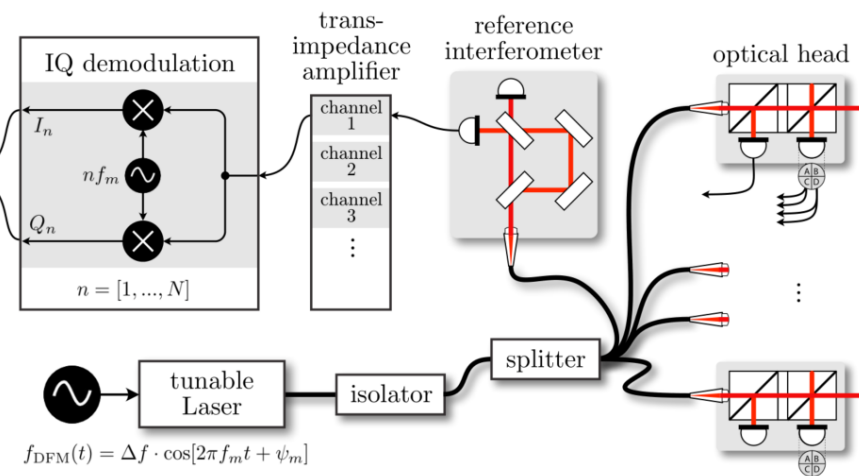


Readout algorithm

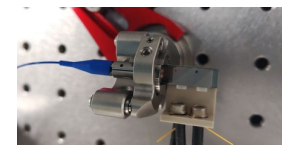


Readout system and electronics

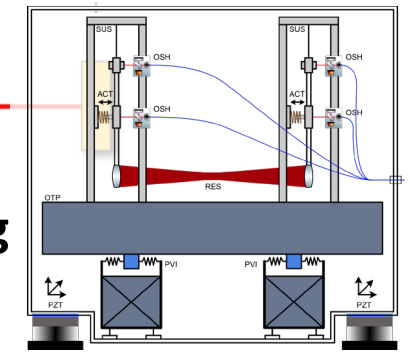
DFMI metrology



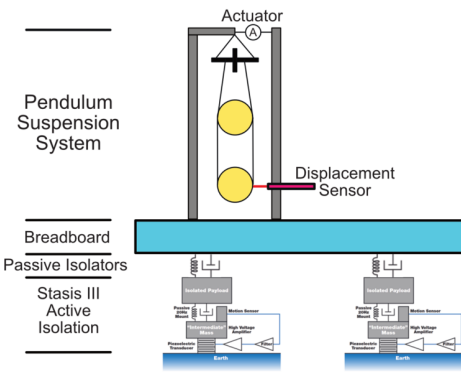
Optical head (COBRI)



See Poster by Meenakshi Mahesh



System-level testing



See Wednesday talk by Oliver Gerberding

LMA - Laboratoire des Matériaux Avancés

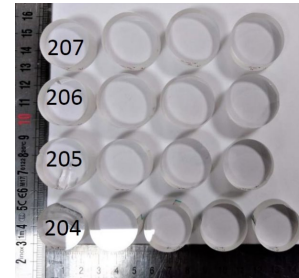


Also investing into substrate growth and polishing

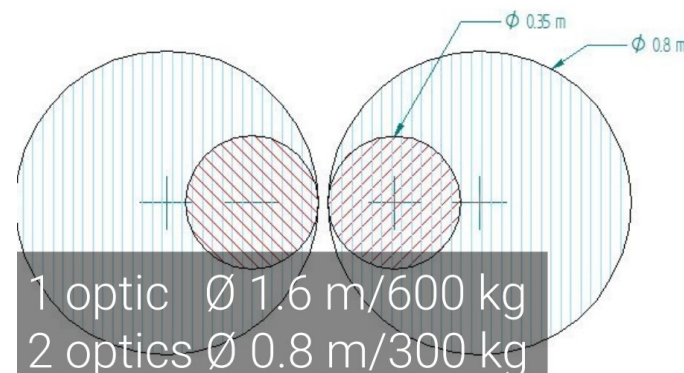
See Wednesday talk by Jerome Degallaix

New large optics coater facility

Aim: produce ET cryo-compatible substrates in sapphire

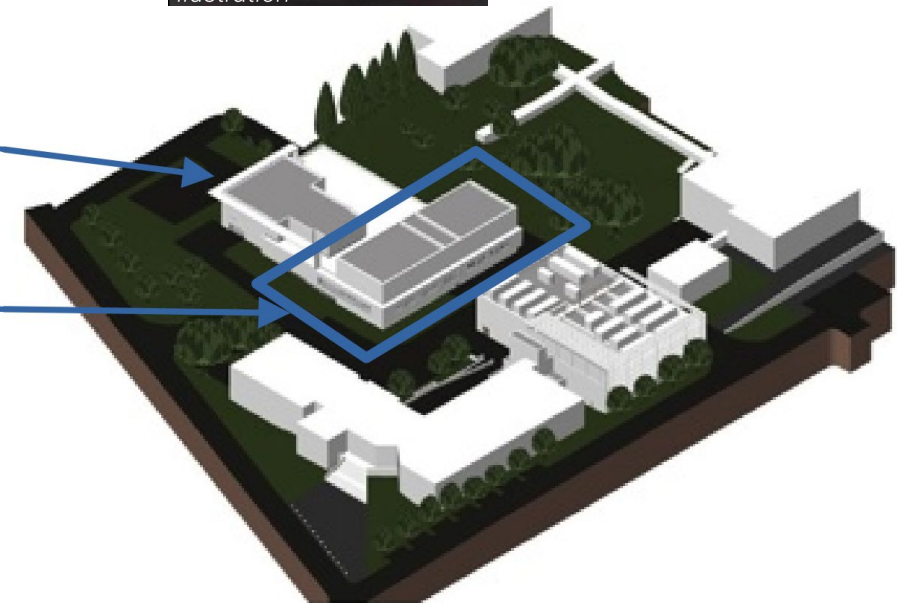


Illustration



Existing LMA building

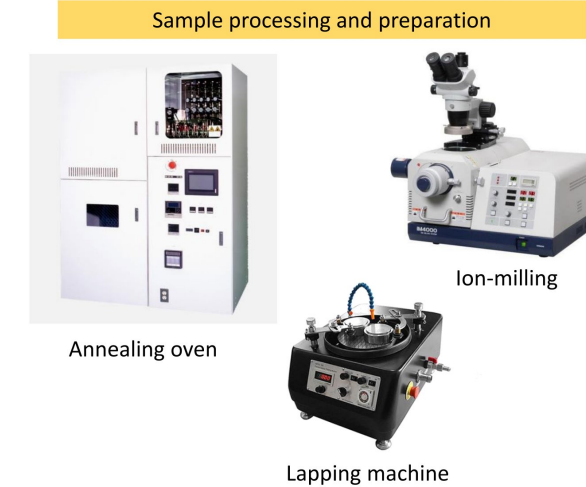
Extension



CoMET - Coating Materials for Einstein Telescope

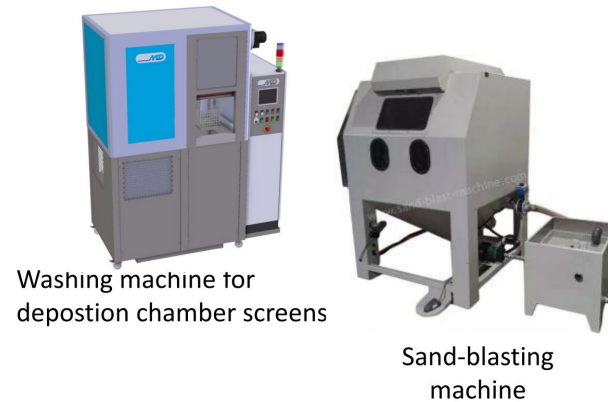
Goals:

- Capability to deposit virtually all the (amorphous) materials of interest for the GW community with the needed level of control.
- Ability to explore different process ranges (energies, growth kinetics etc.)
- Study of the physical processes occurring during deposition



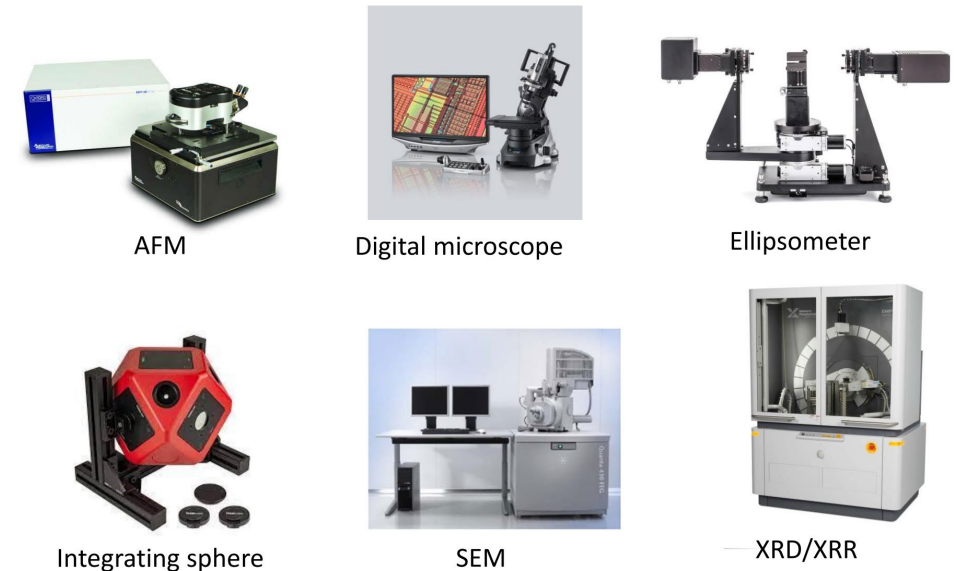
Coating deposition (samples)

- Ion beam
- Magnetron



Deposition chambers maintenance and cleaning

Characterization facilities



See Wednesday talk
by Marco Bazzan /
Giacomo Ciani

