

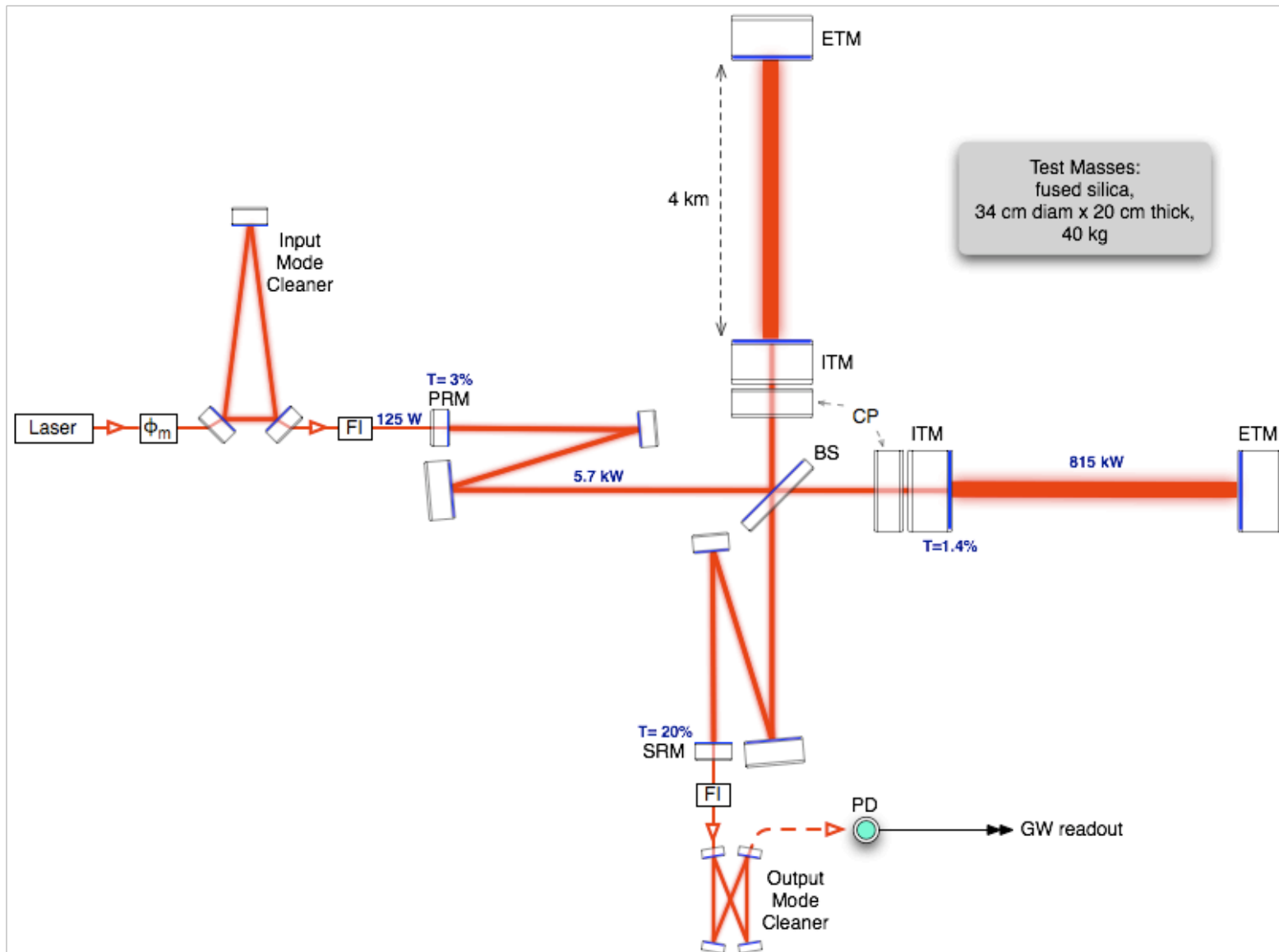


Advanced LIGO Project

Contact David Shoemaker, dhs@mit.edu, with questions



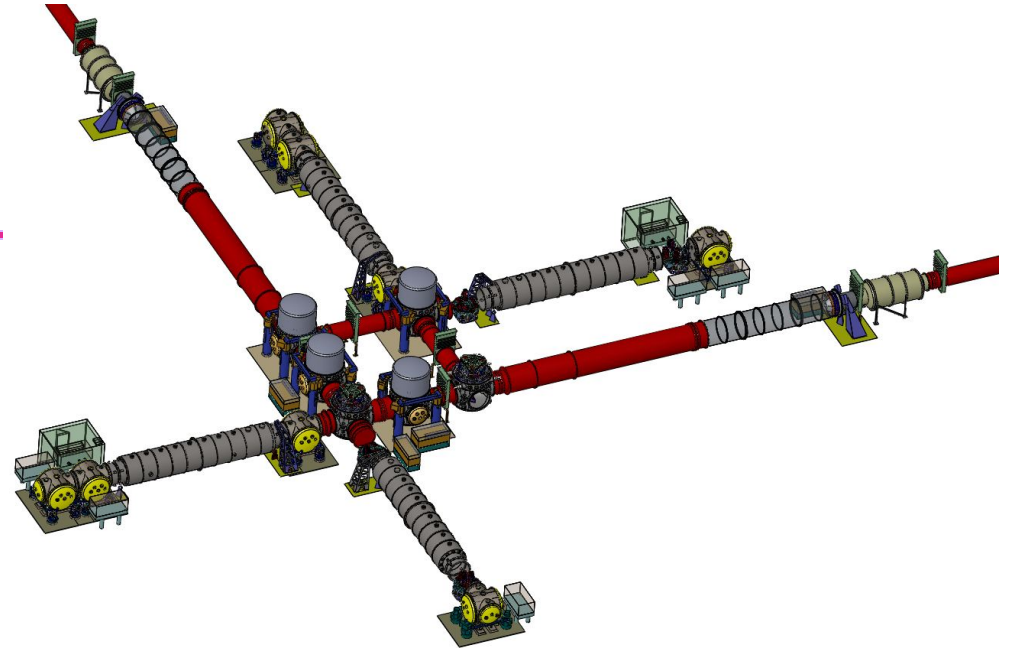
Systems: Interferometer Design





Advanced LIGO Scope

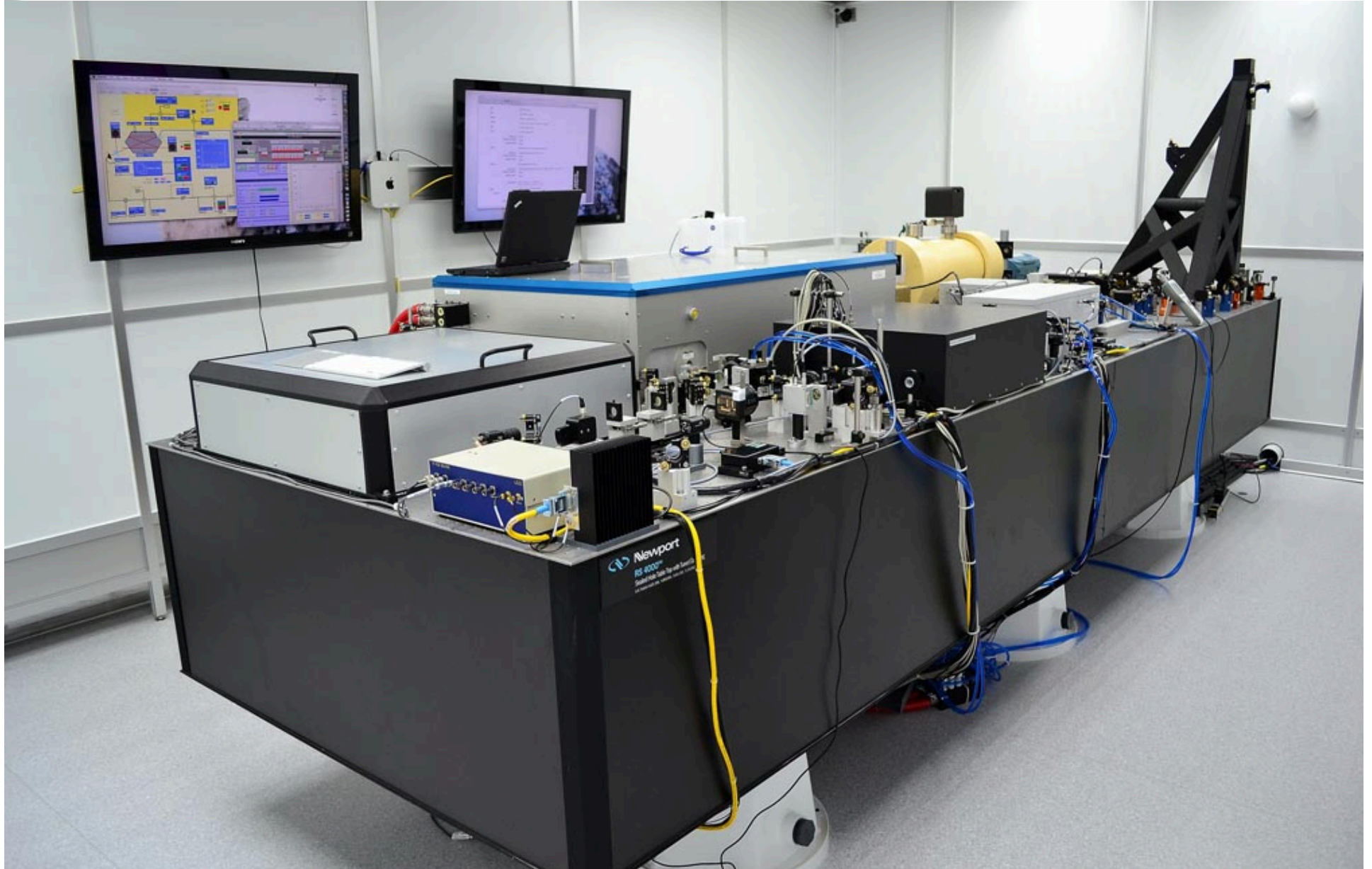
- Re-use of 99% of vacuum system, buildings, technical infrastructure
- Replacement of virtually all initial LIGO detector components



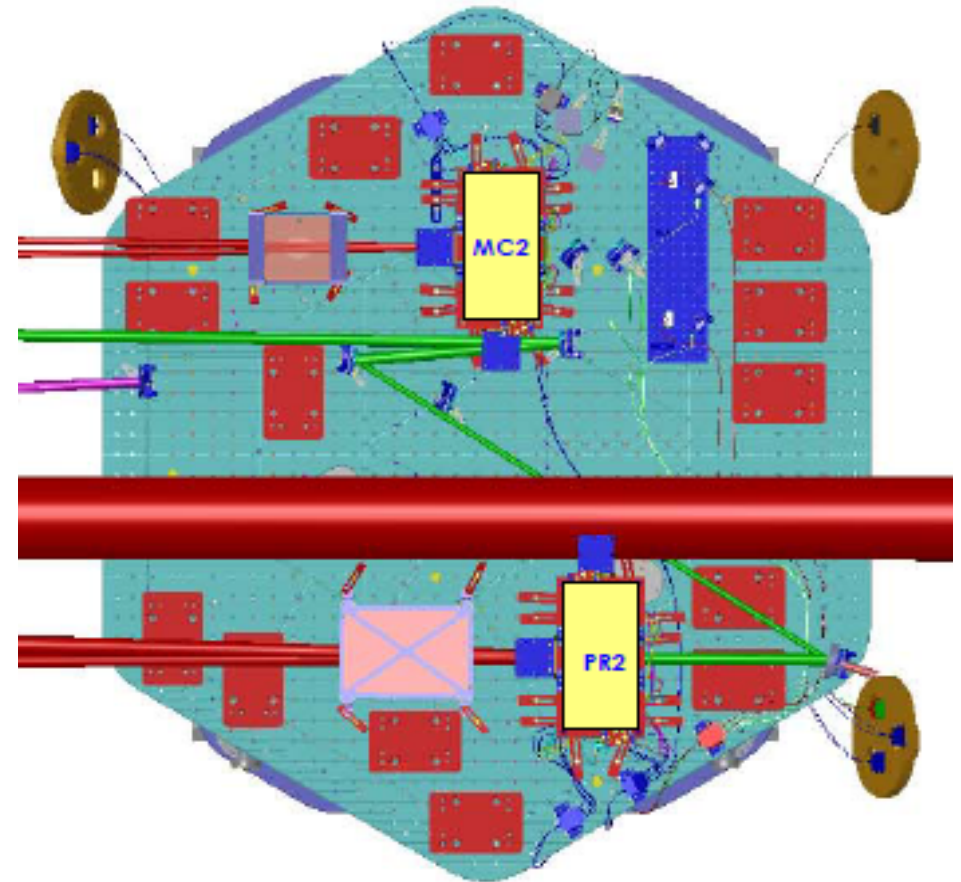
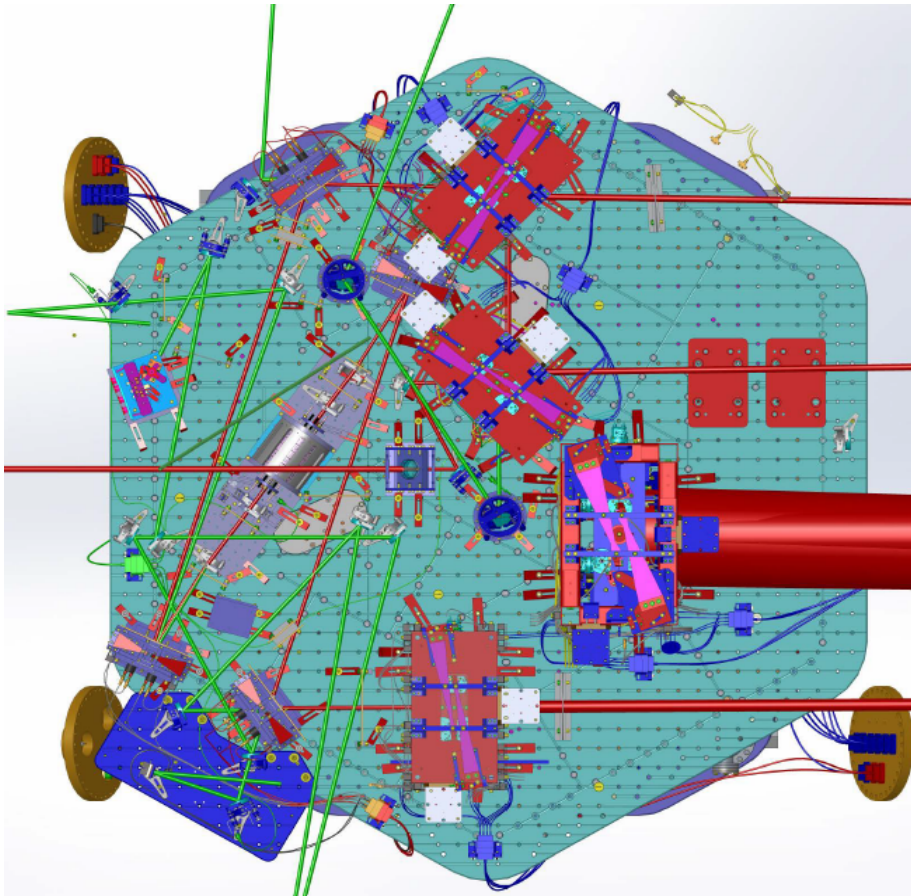
- Three interferometers, as for Initial LIGO
 - » One interferometer now planned to be placed in India
- All three interferometers 4km in length
 - » For initial LIGO, one of the two instruments at Hanford was 2km



LLO PSL installation

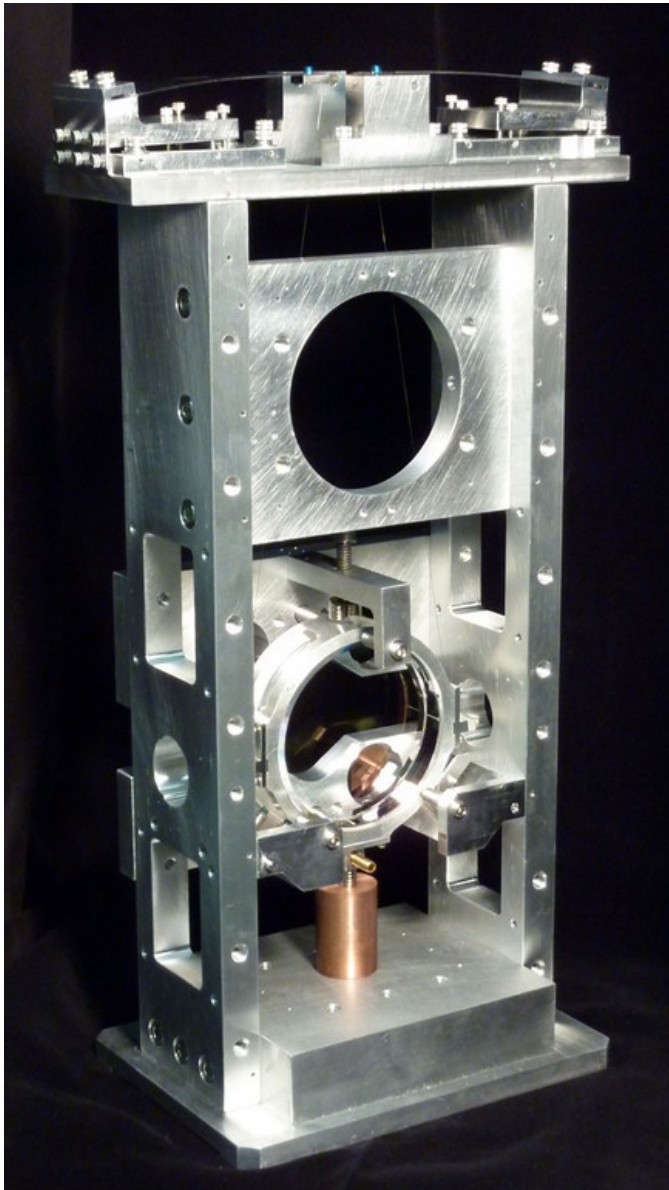


Input Optics Layout



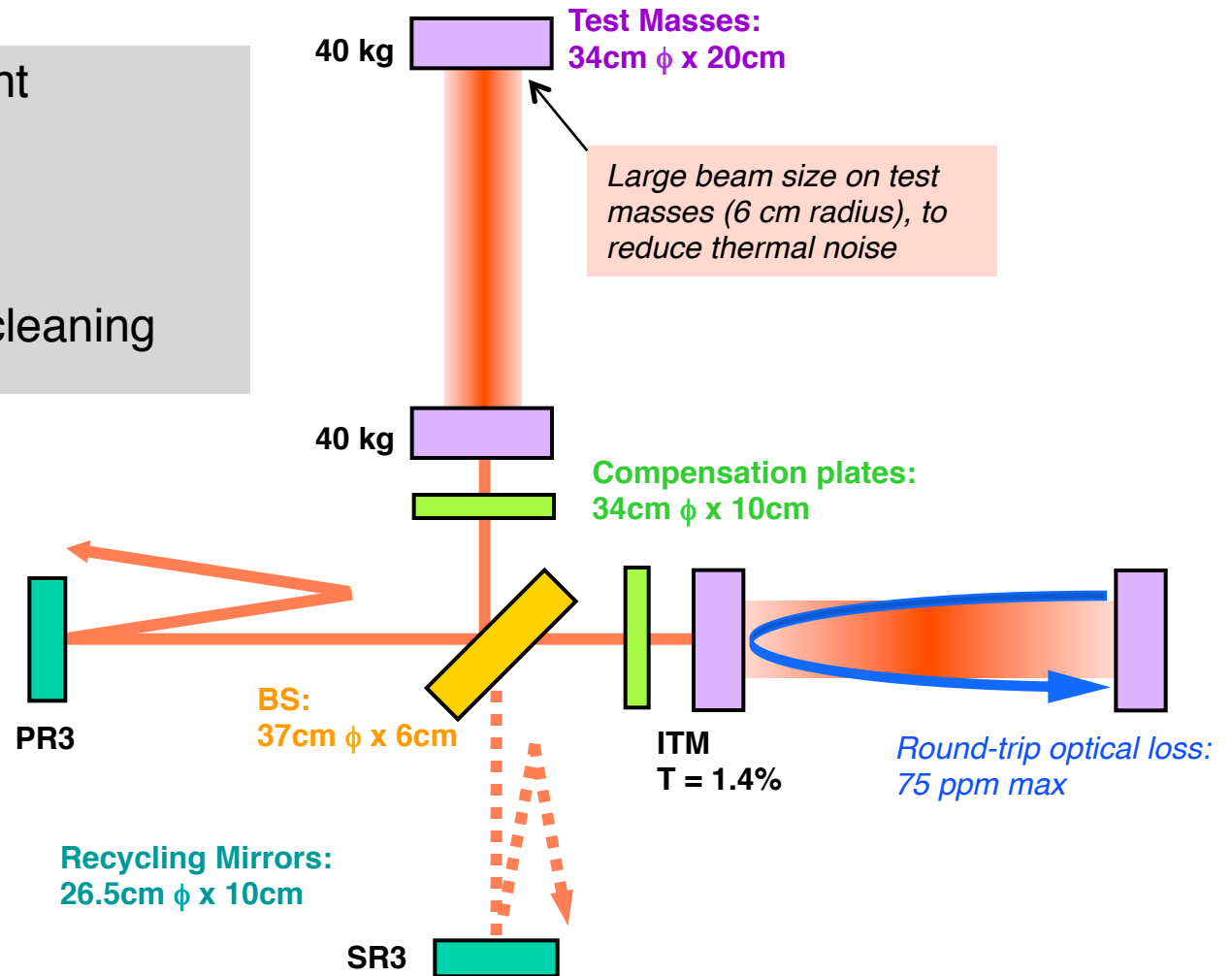


Input Optics Suspensions



Core Optics Components

- Substrate procurement
- Substrate polishing
- Dielectric coatings
- Metrology
- Transport, handling, cleaning



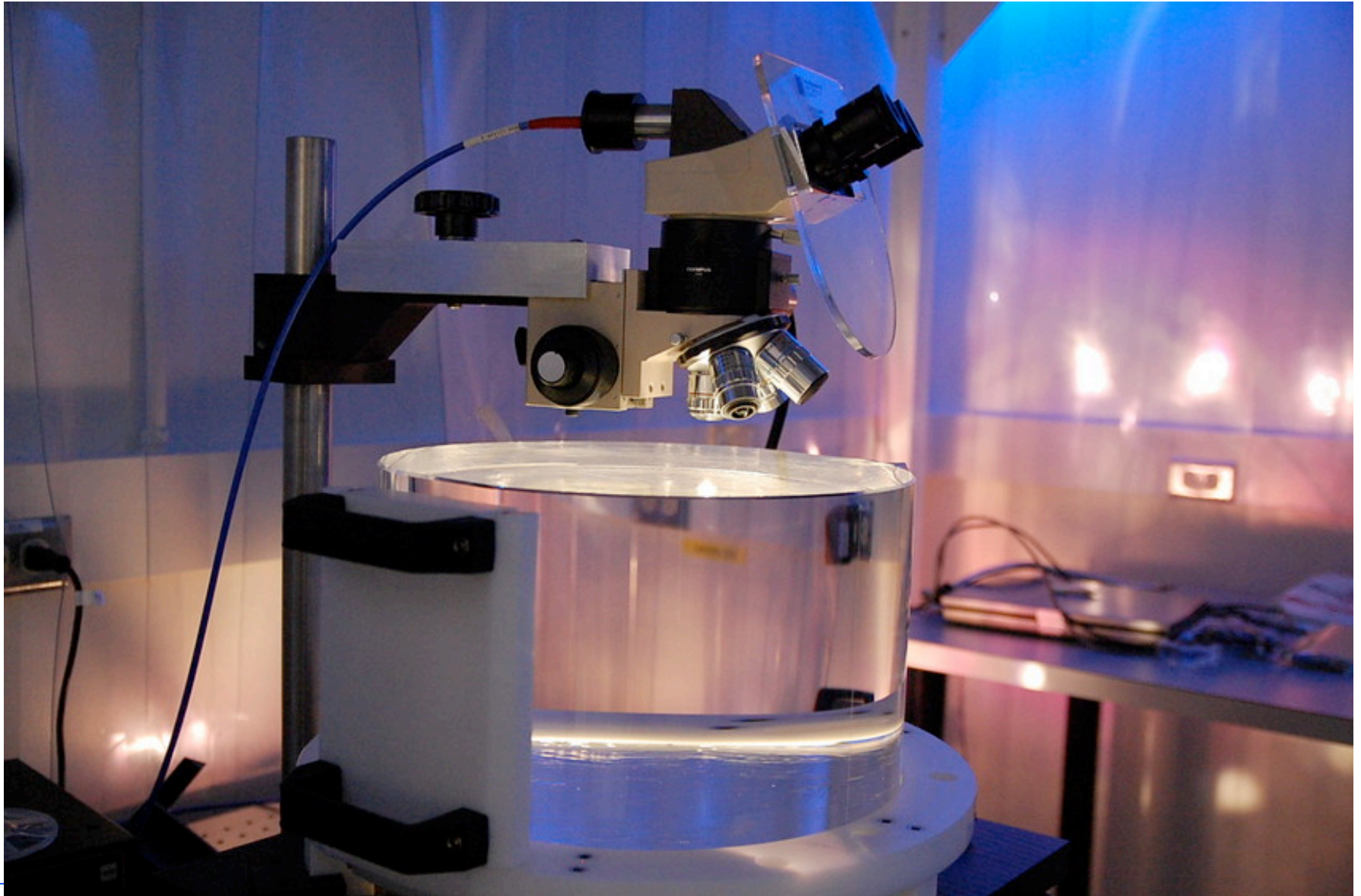
All COC are fused silica substrates with ion-beam sputtered dielectric coatings



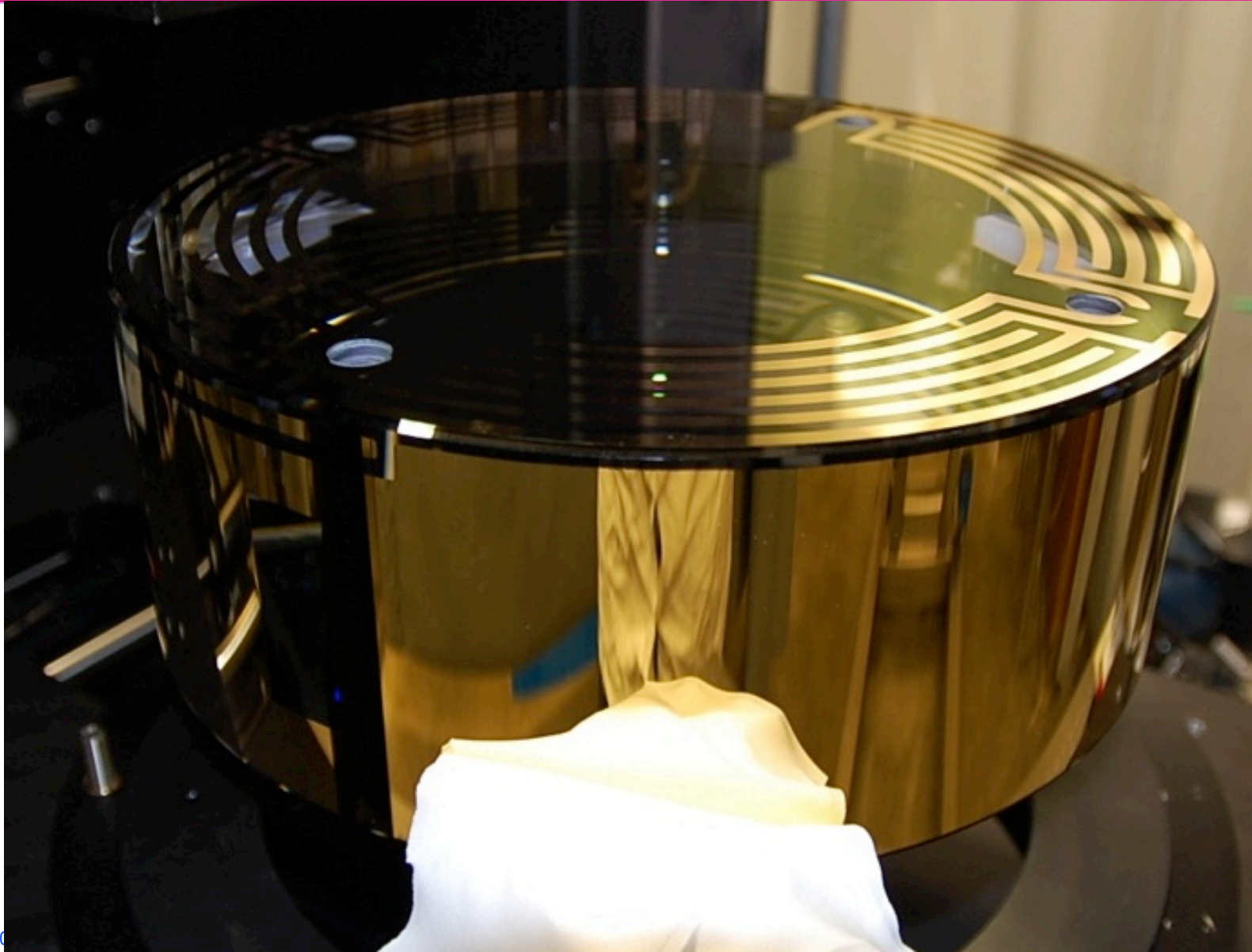
Test Mass Optic Metrology



Test Mass Optic inspection



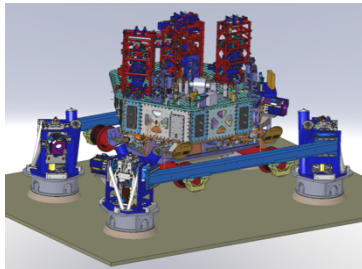
Test Mass reaction plate with actuator circuits



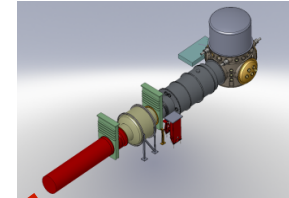
Seismic Isolation Subsystem (SEI)

6 HAM chambers:

- 6 HEPI
- 5 ISI

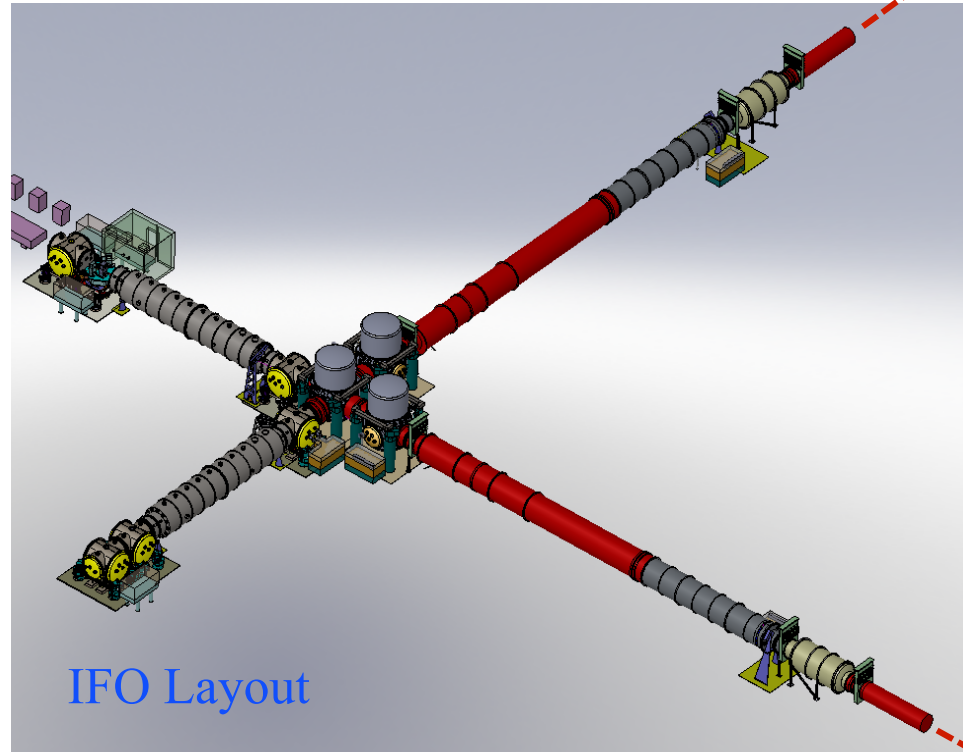
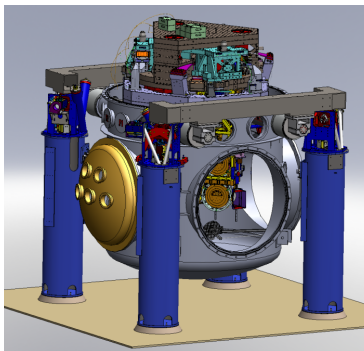


- Hydraulic External Pre-Isolator (HEPI)
- Internal Seismic Isolator (ISI)

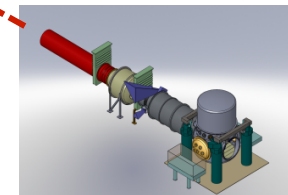


5 BSC Chambers:

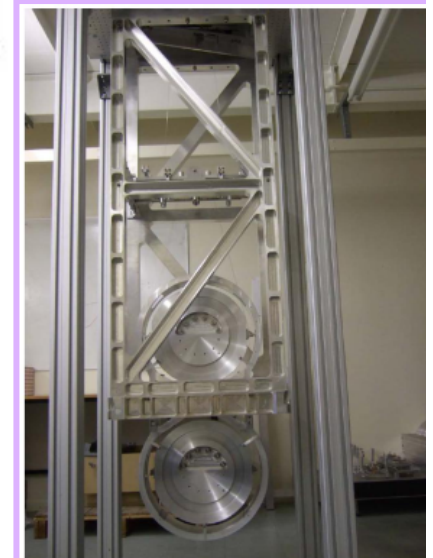
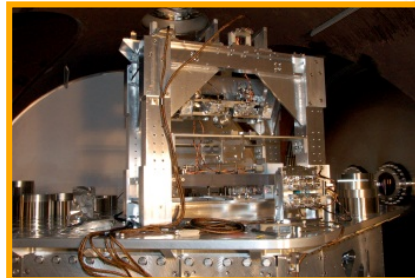
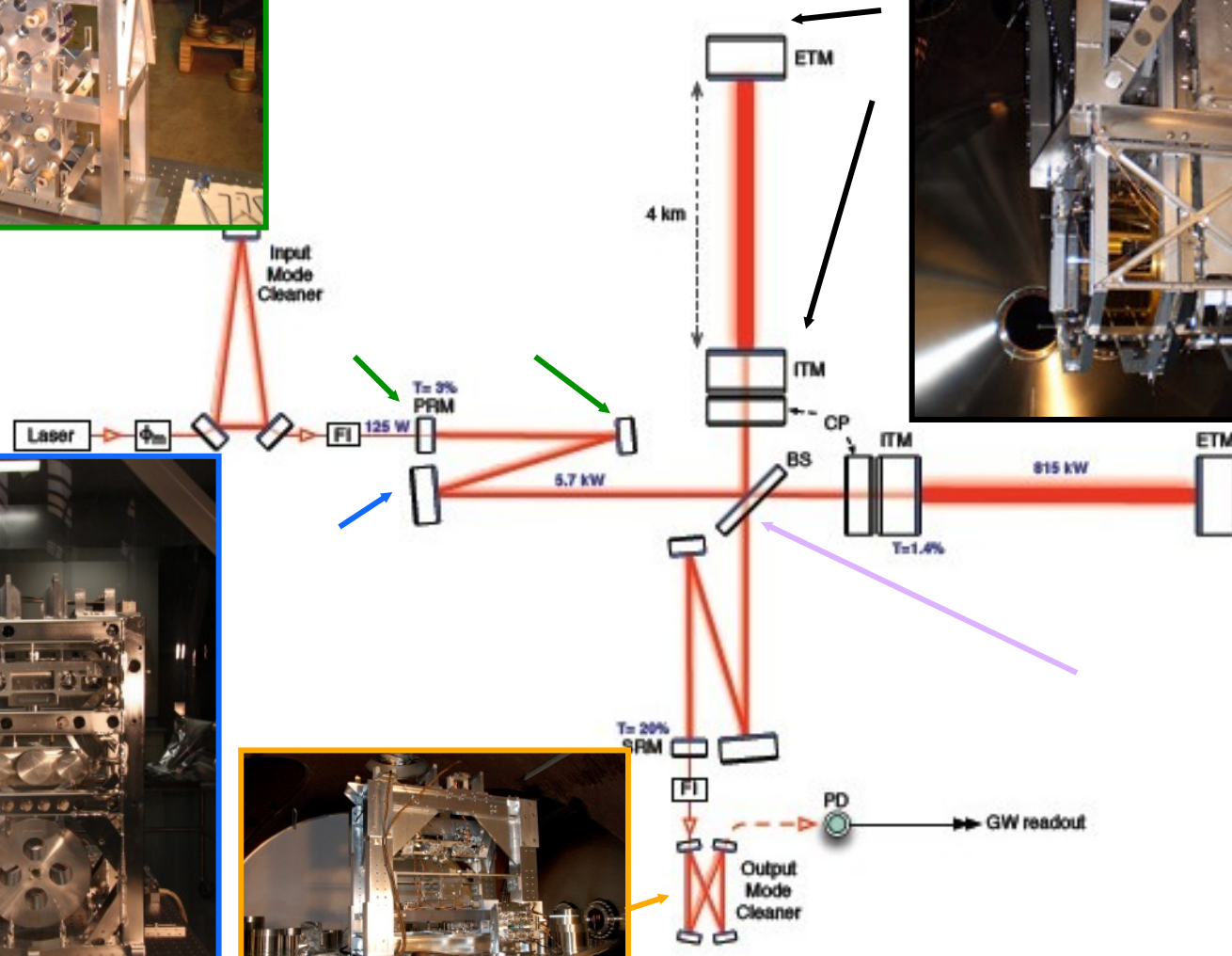
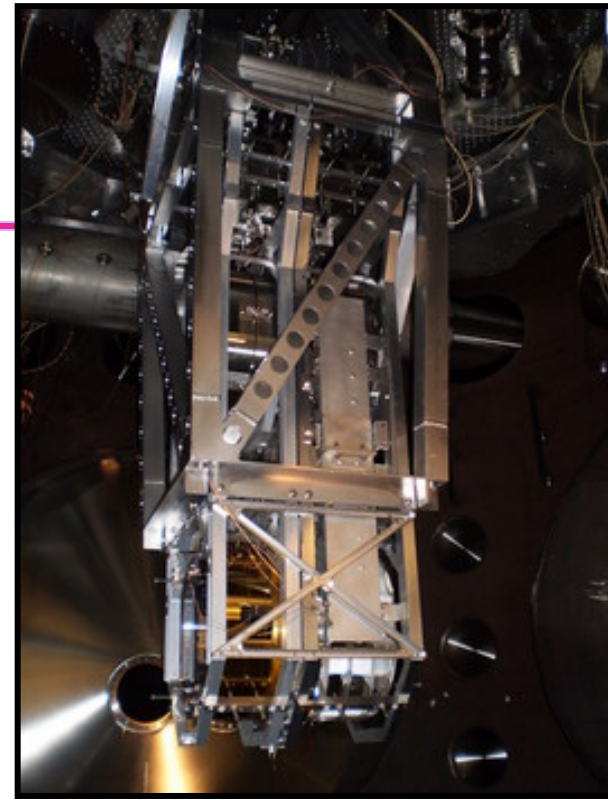
- 5 HEPI
- 5 ISI



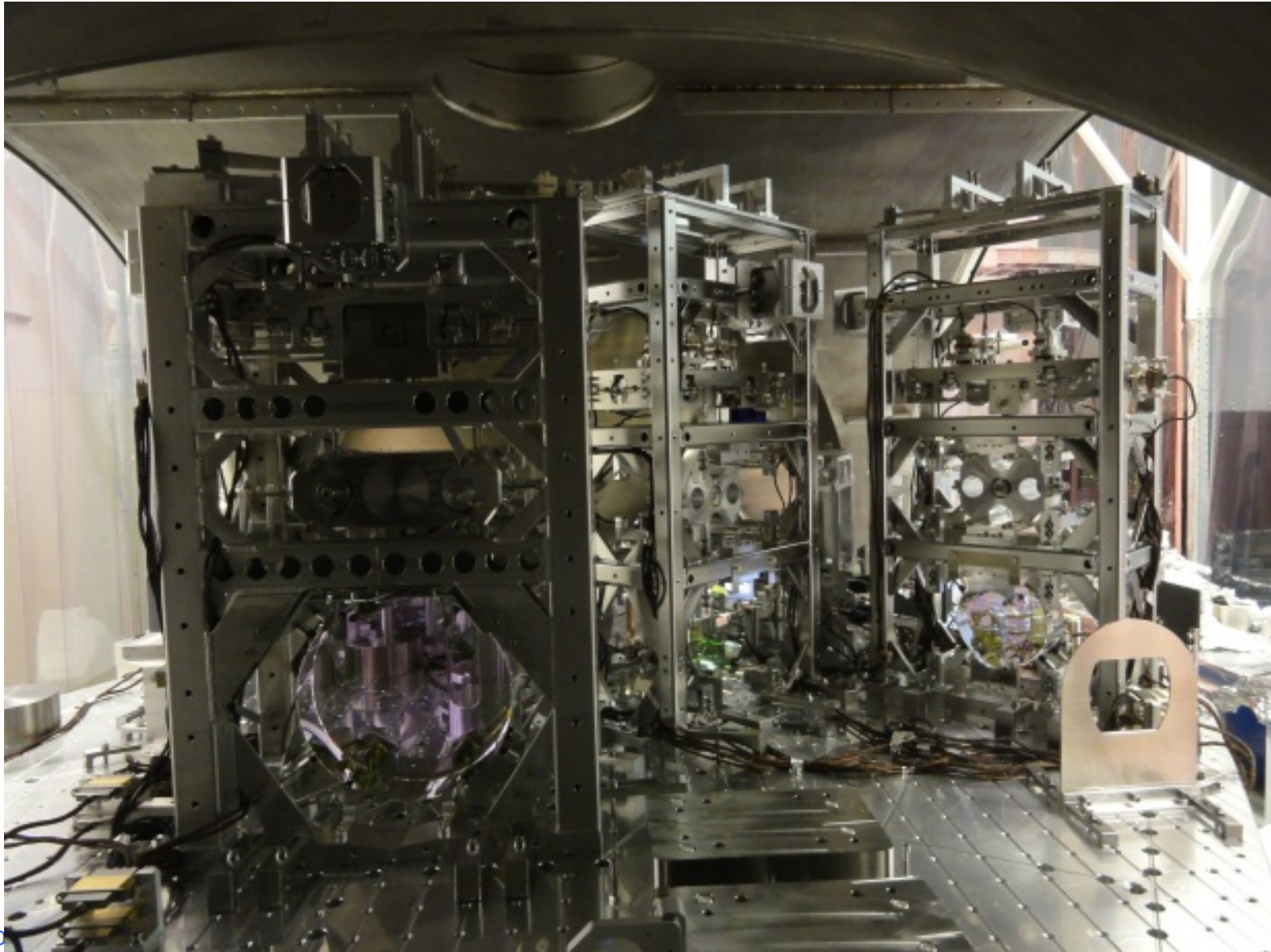
IFO Layout



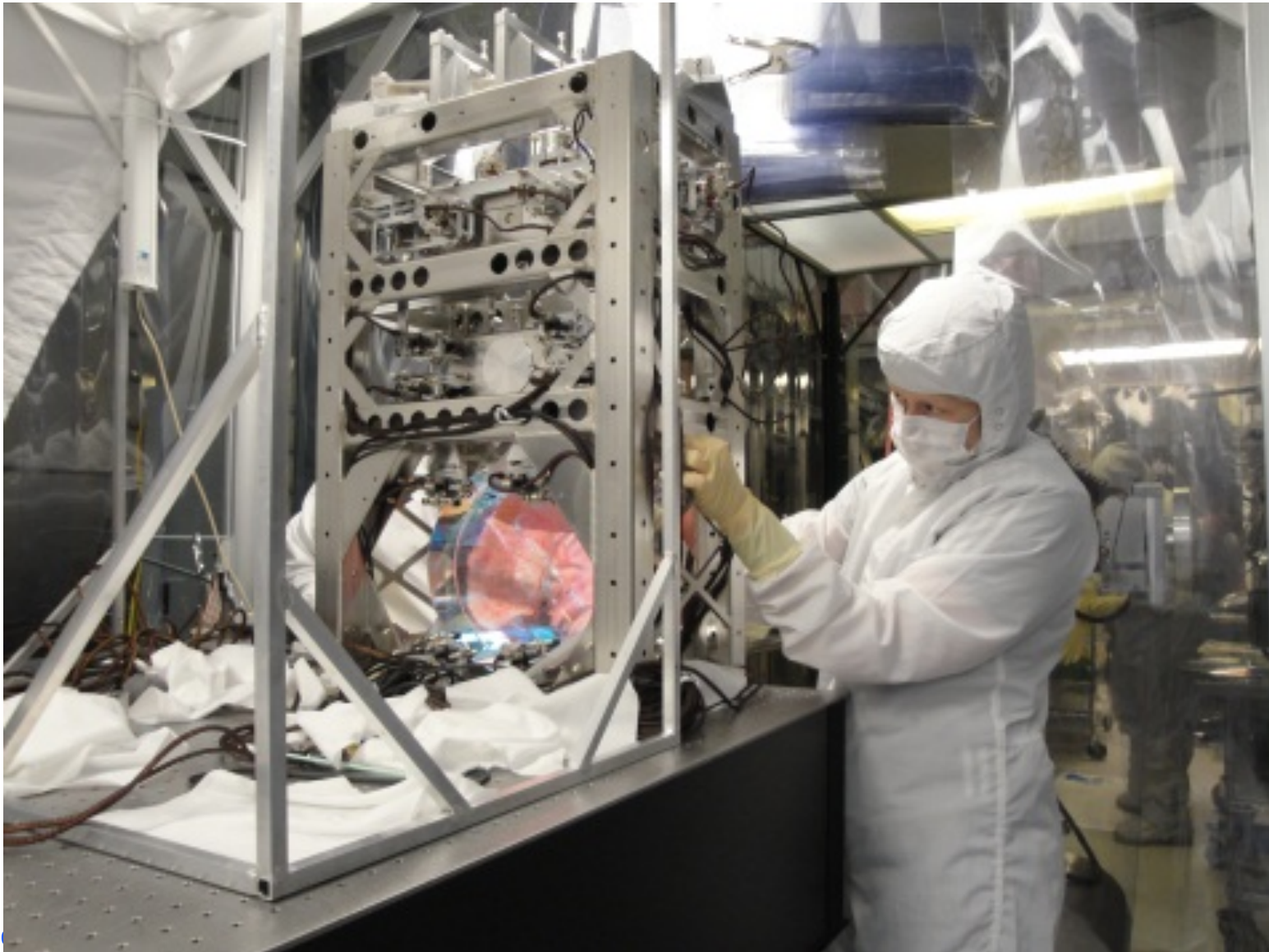
Suspension System (SUS)



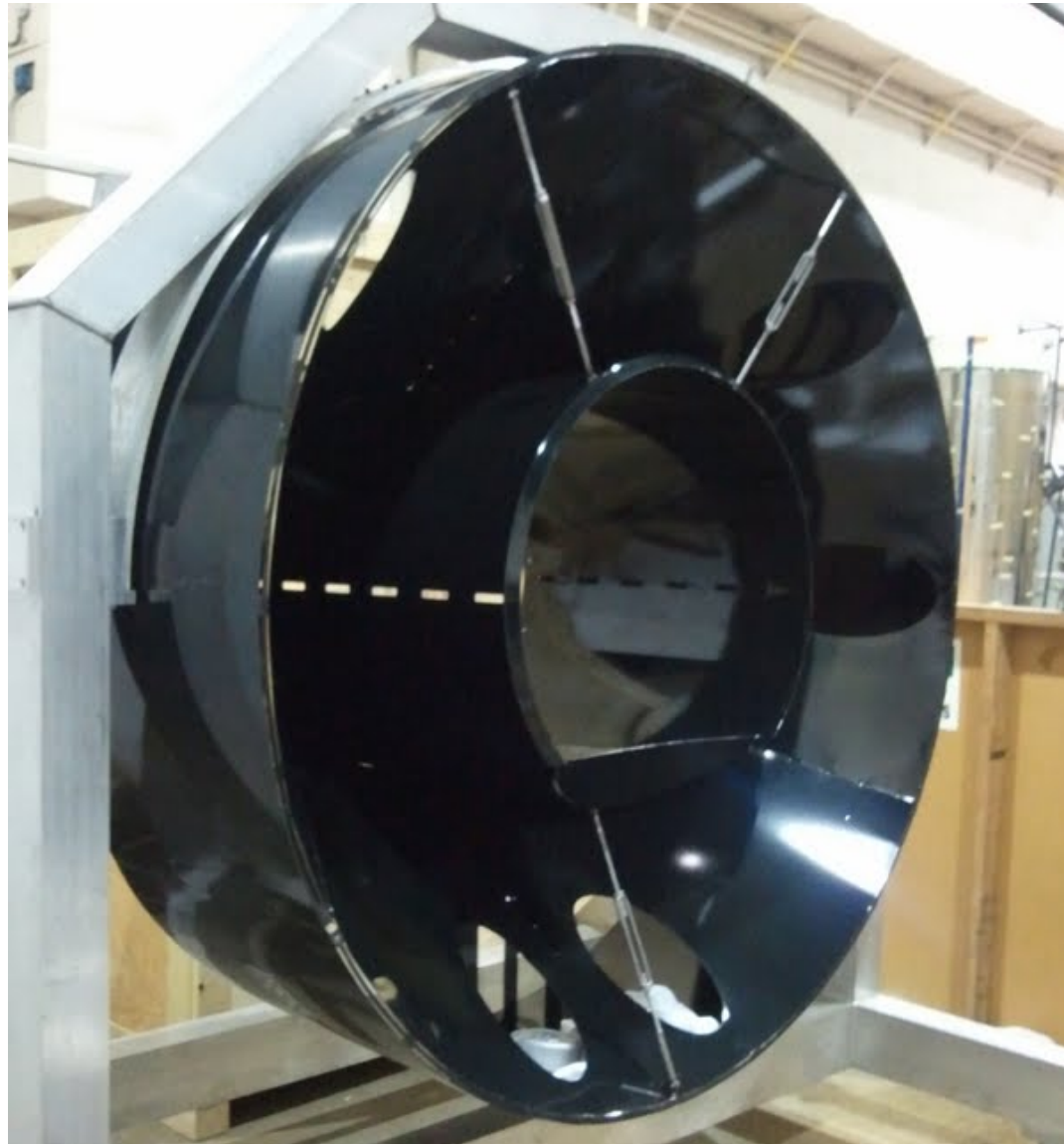
Small optic suspensions



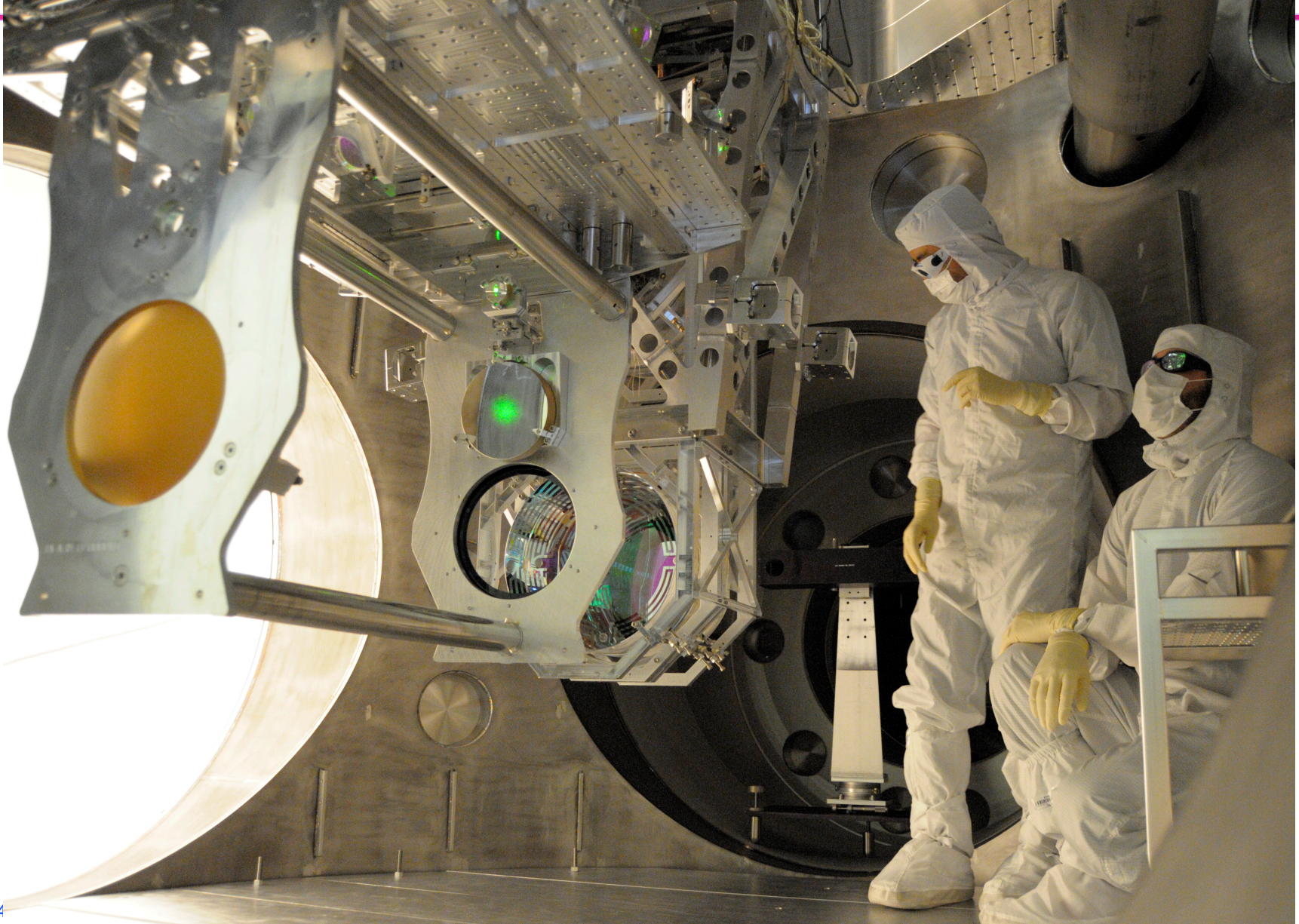
Suspension in assembly



Stray Light Control baffle

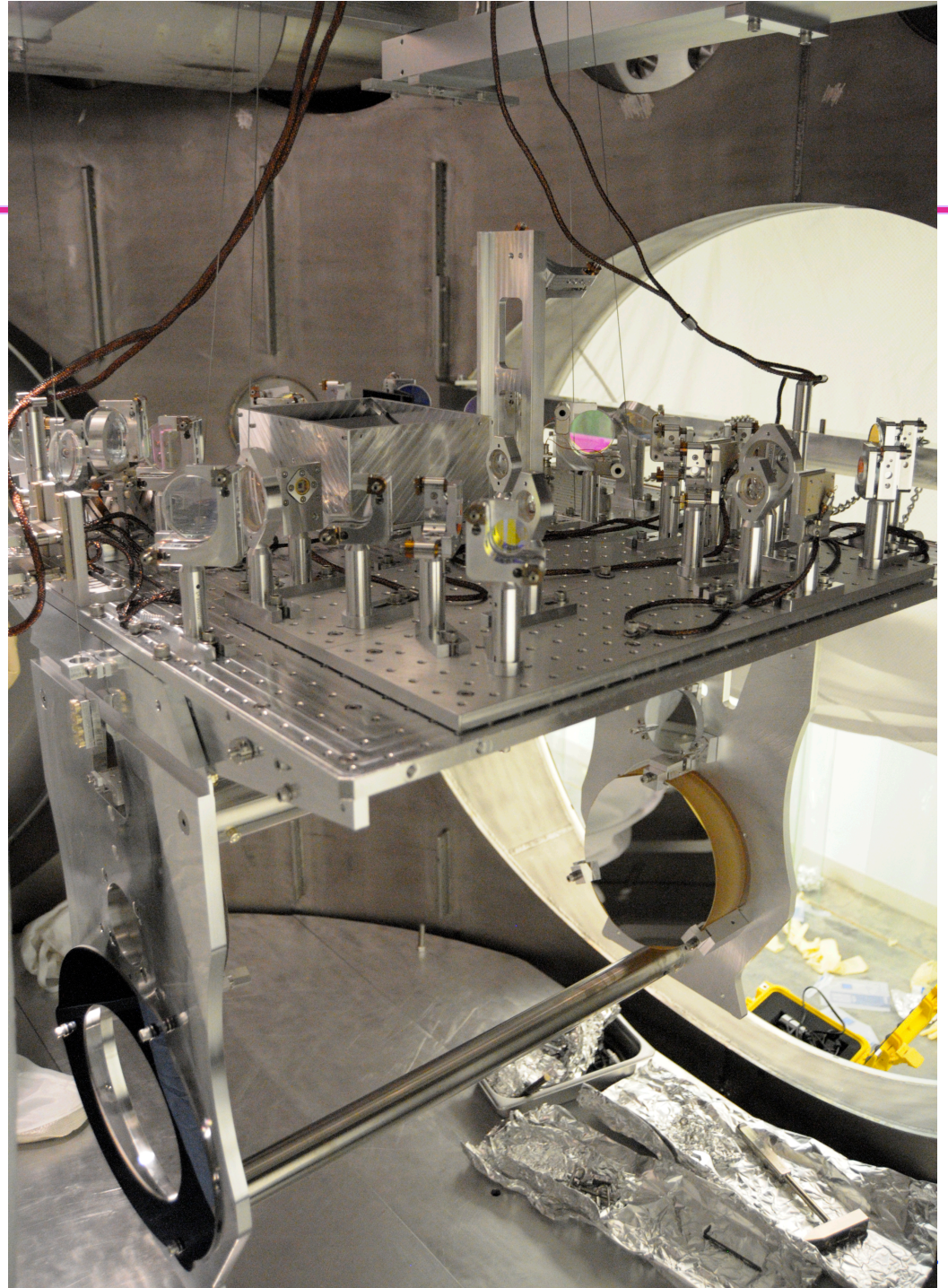


Transmission Monitoring System (TMS)

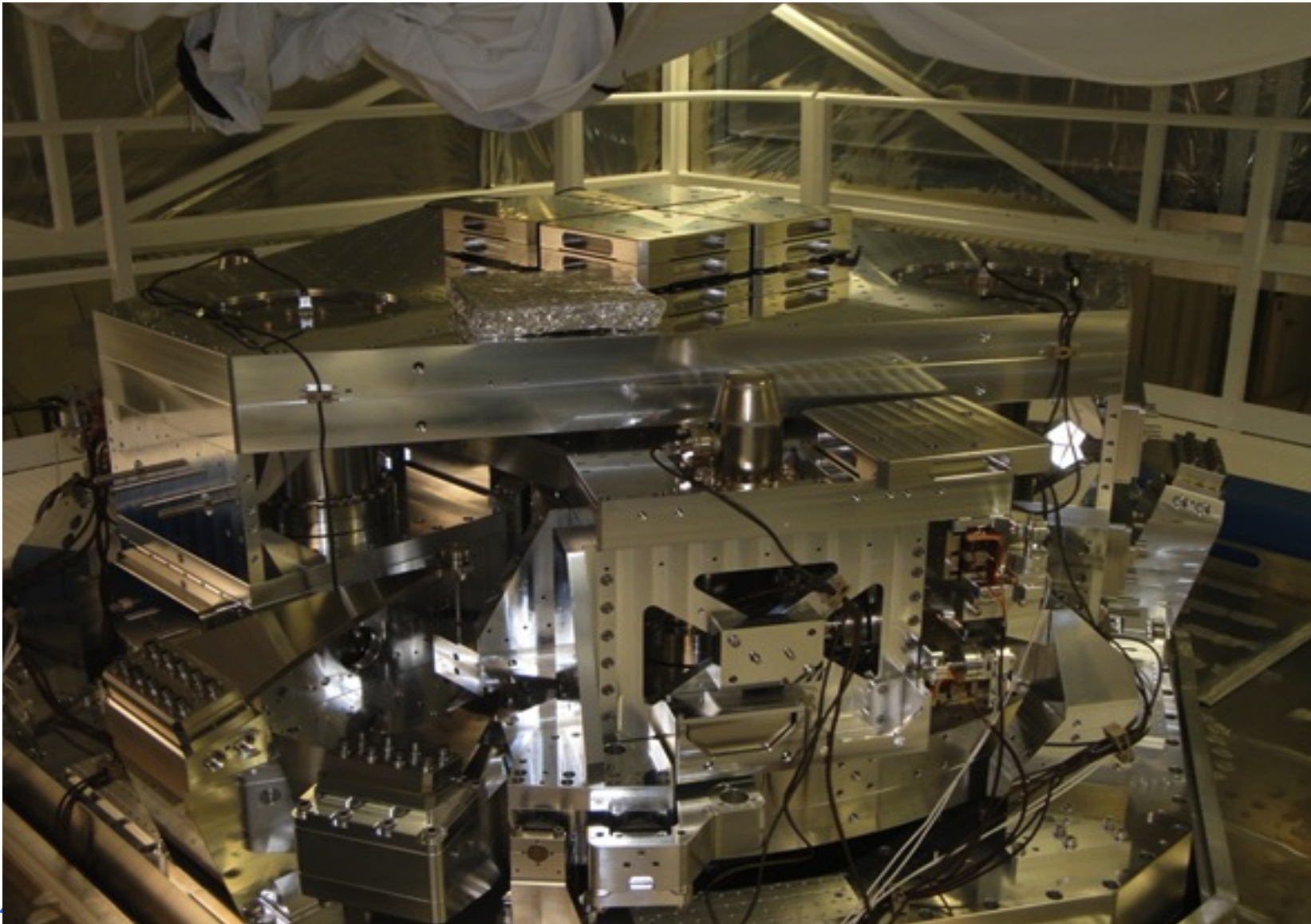




Transmission Monitor



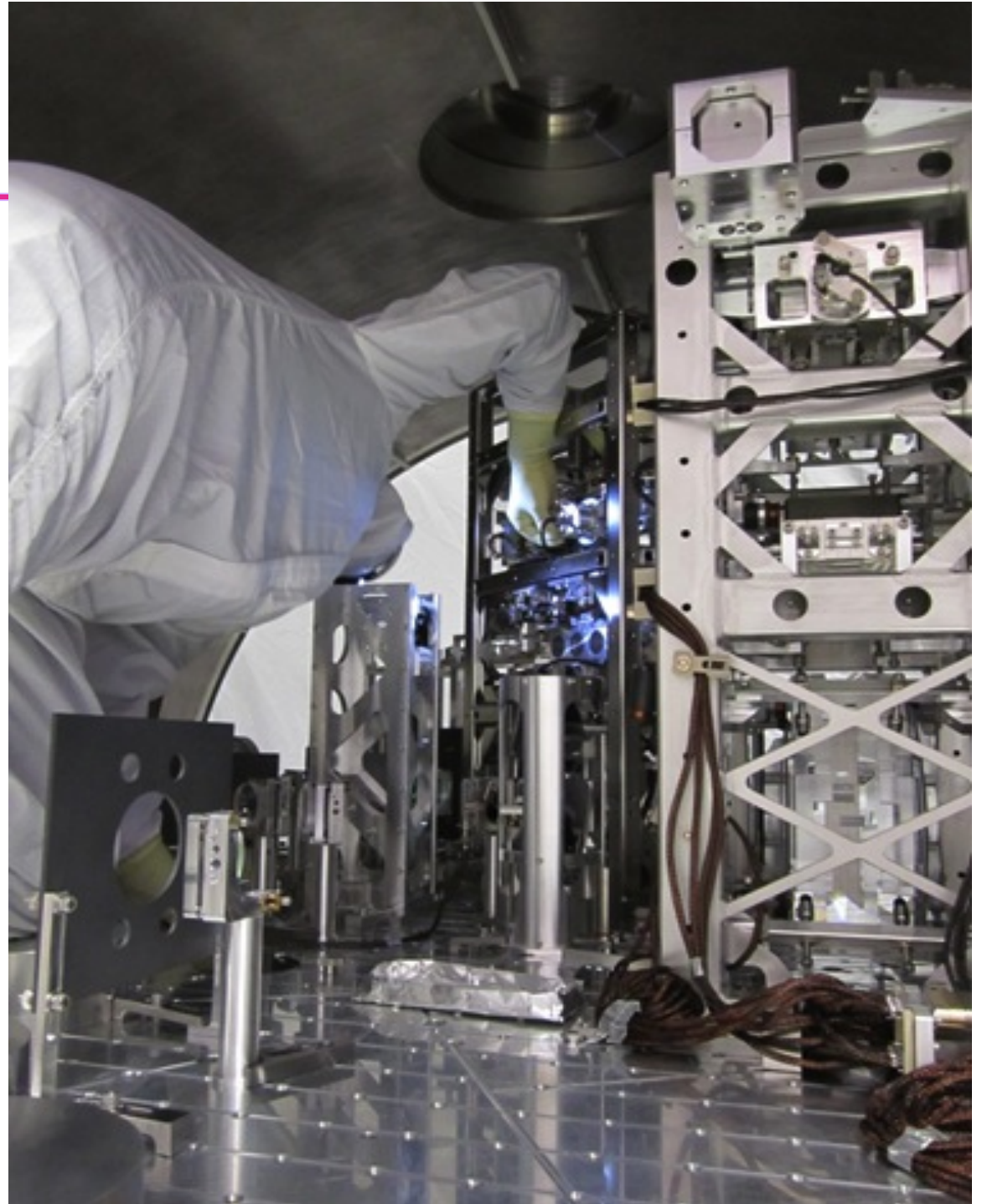
Test Mass Seismic Isolation system



Aligning a Test Mass Optic in its Suspension



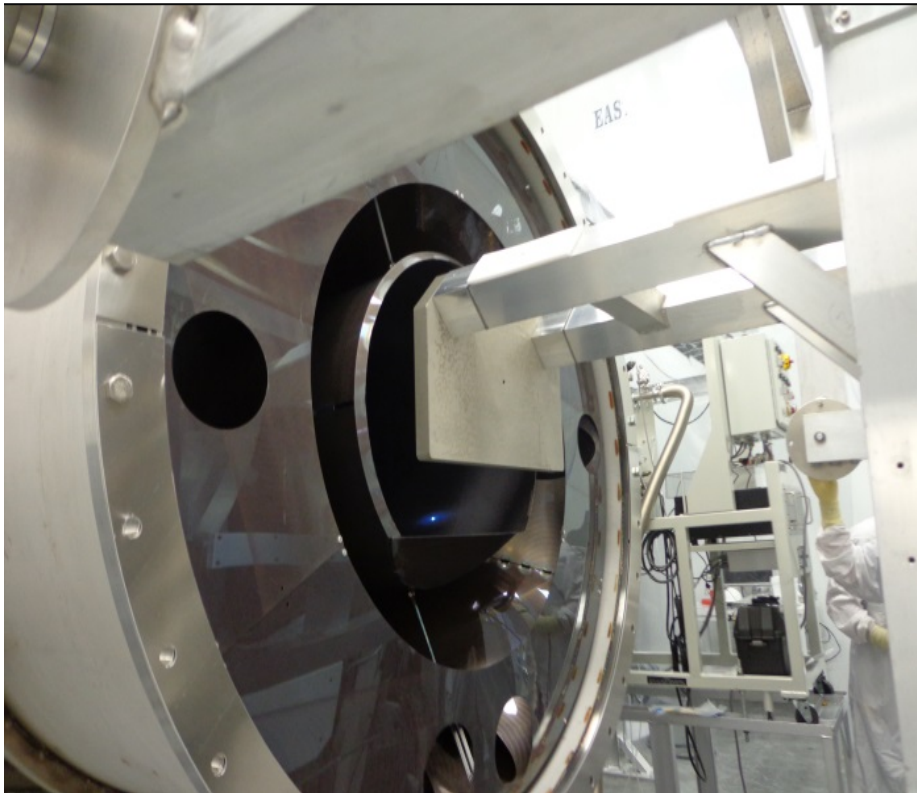
Aligning a small
suspension in situ



Transporting an off-axis coupling telescope assembly



Installing a baffle in the vacuum tube

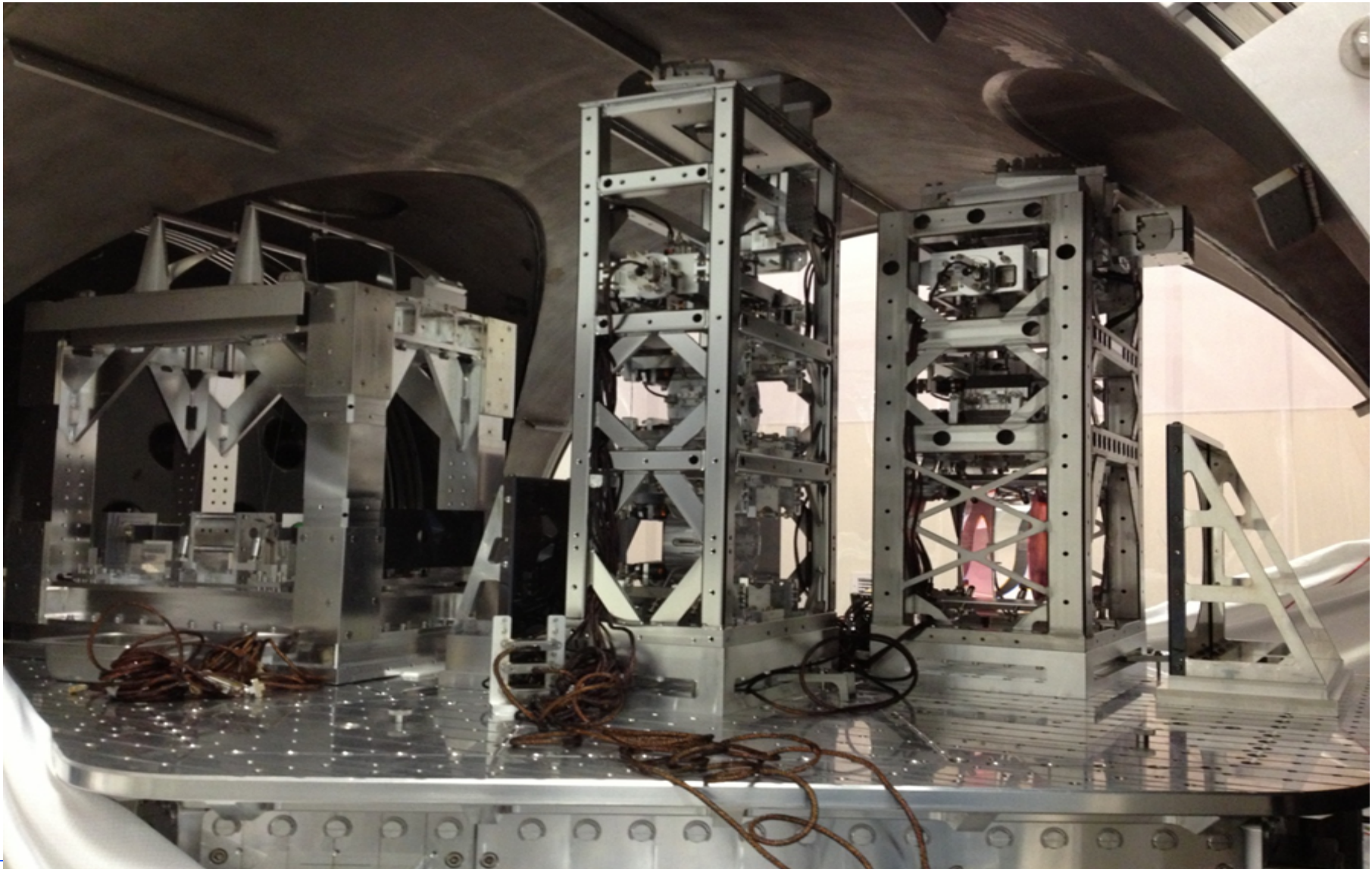




Assembling an
optic in a fast
electromagnetic
shutter



Mode Cleaner suspensions

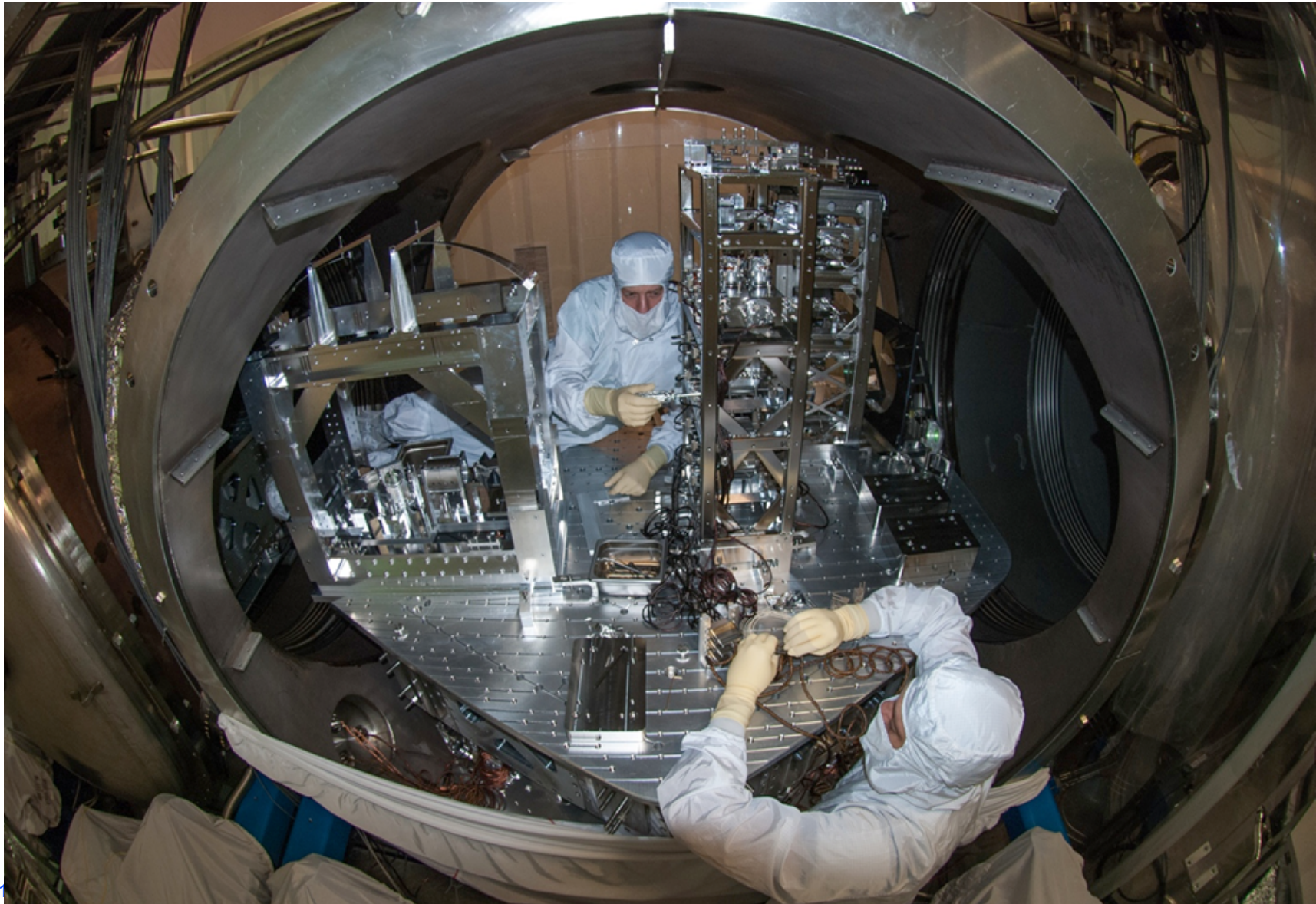




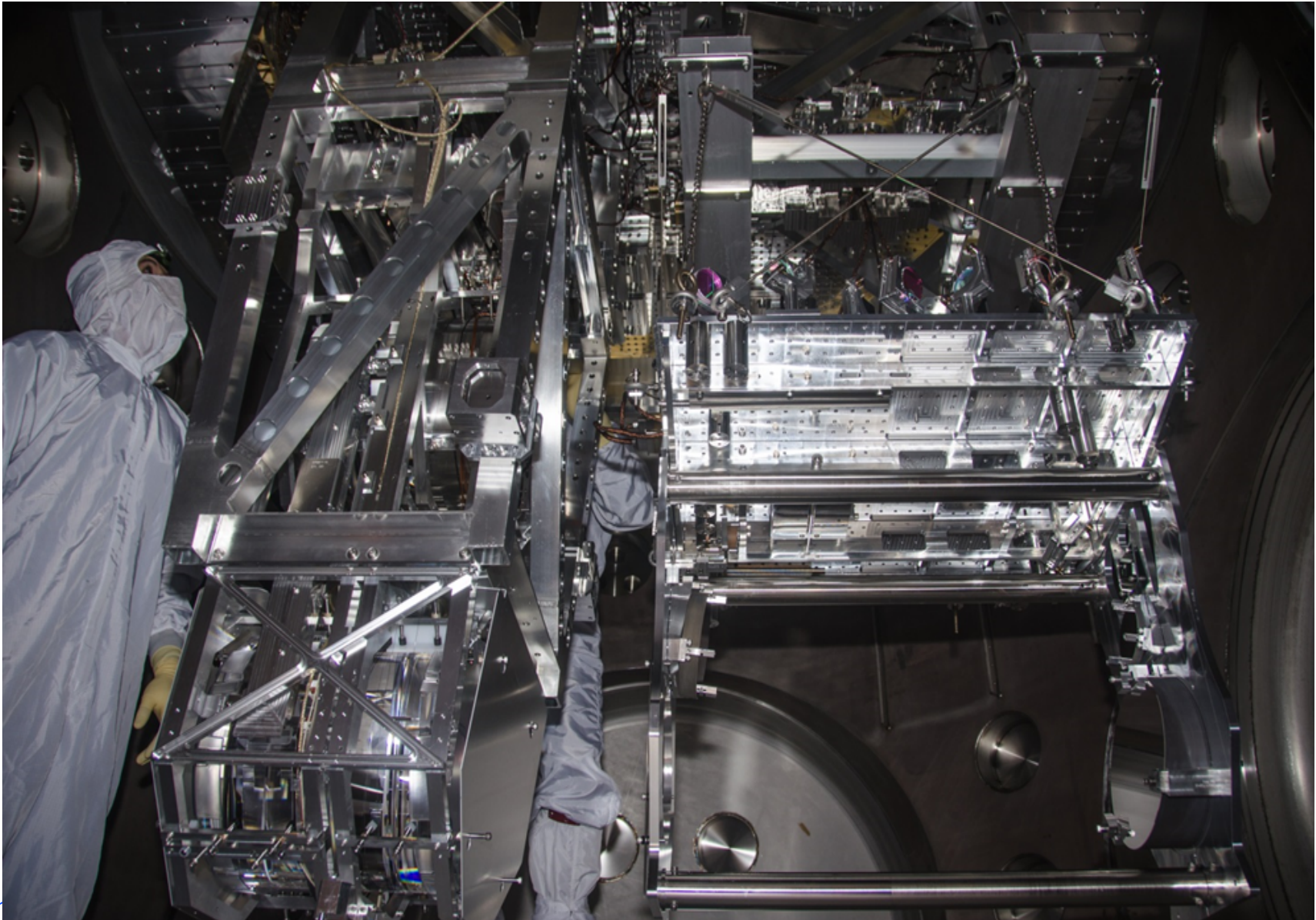
Transporting a seismic isolation system in main clean room



Installing optics in their suspensions



A test mass suspension in the vacuum chamber

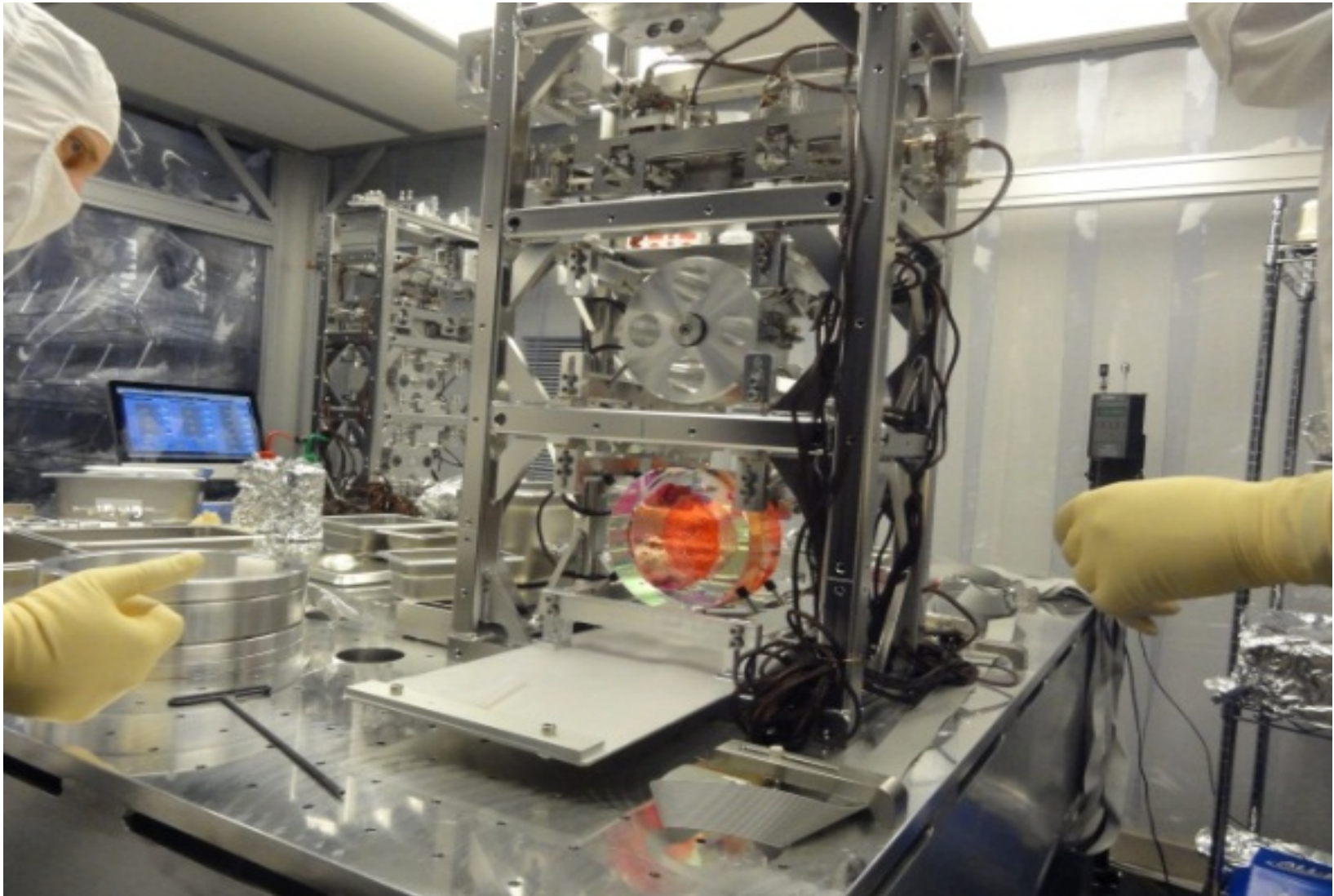




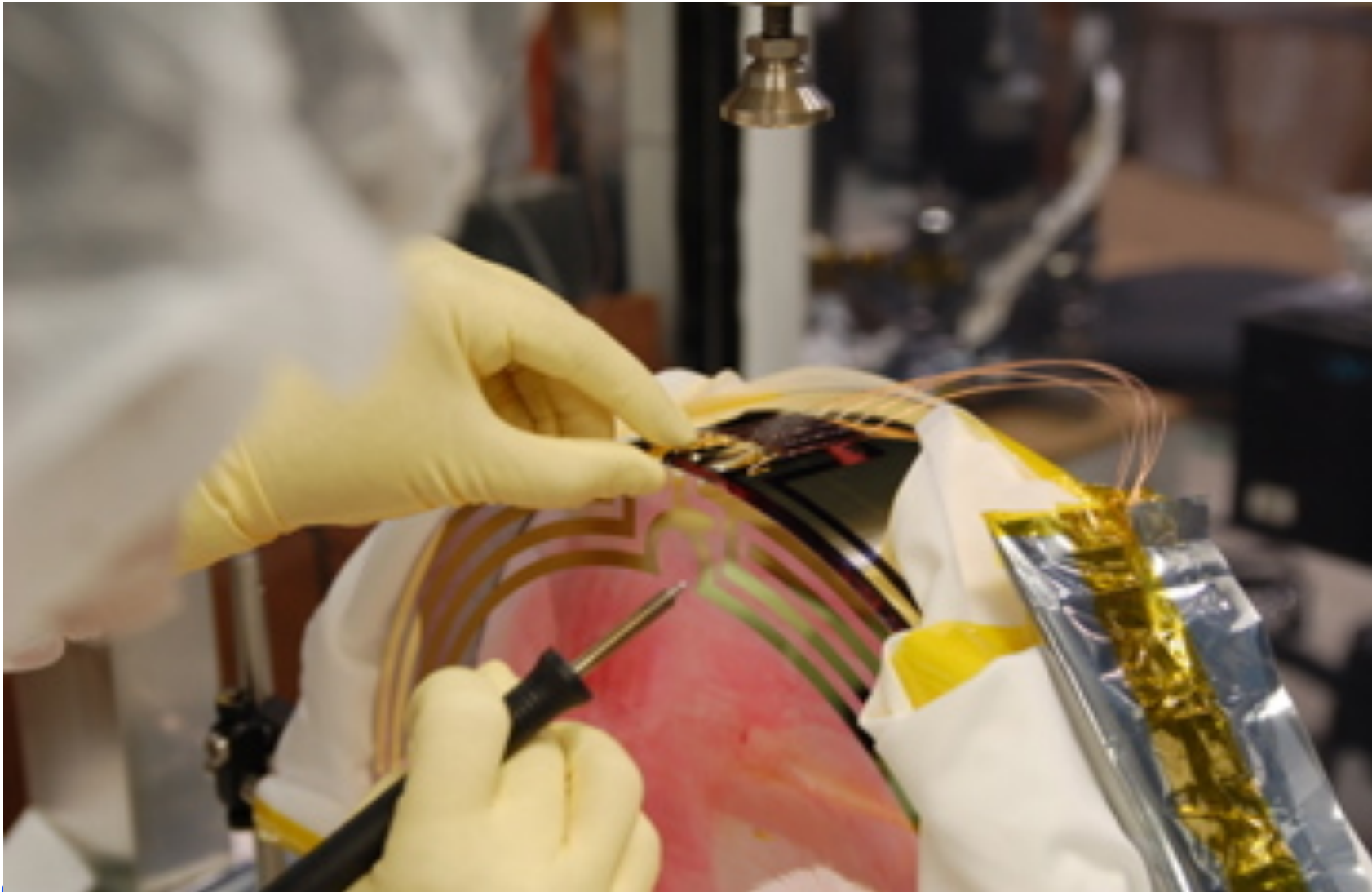
Transporting a seismic isolator from assembly to main hall



Testing a small suspension system



Soldering wires to test mass electrostatic driver



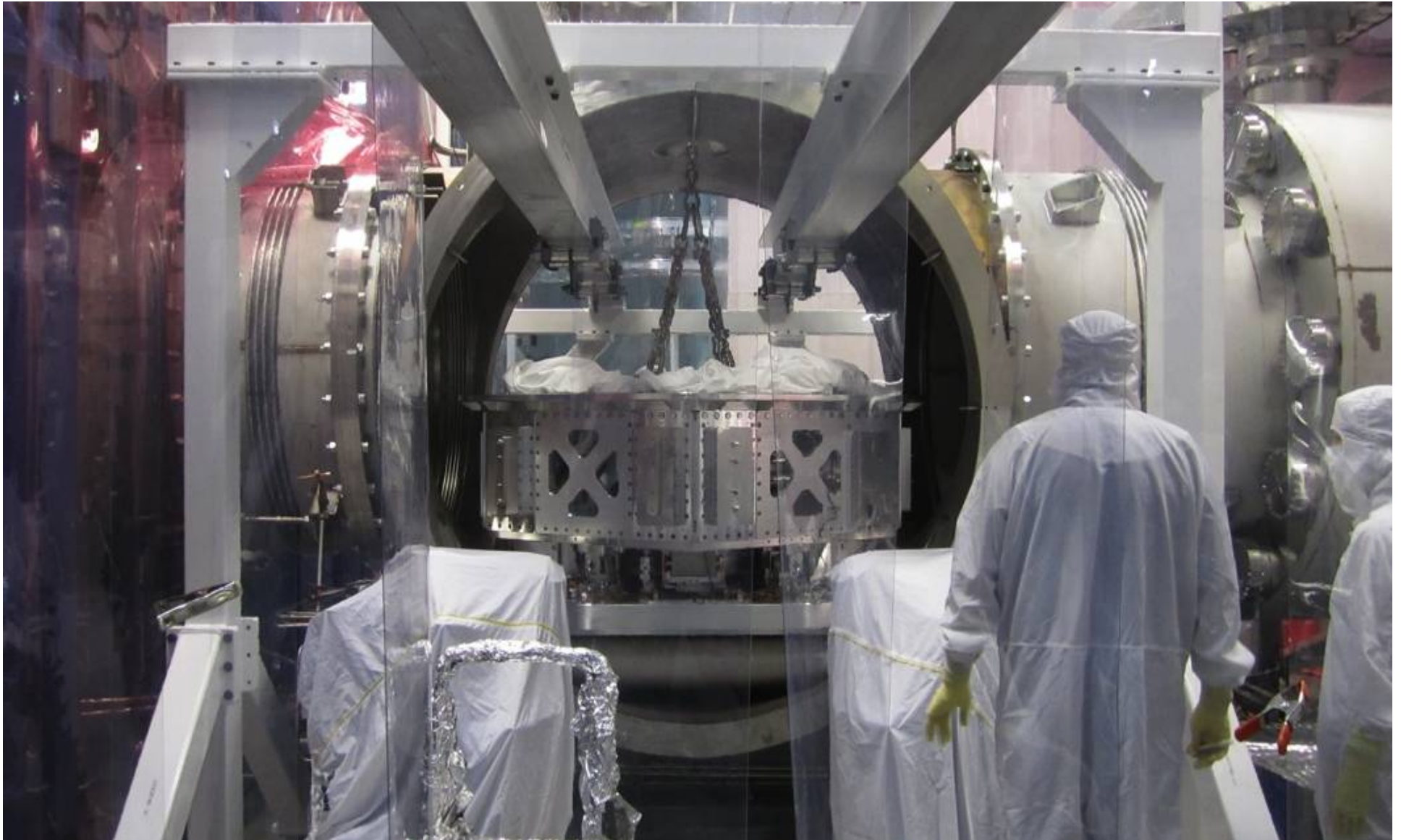


Transporting a seismic isolation system from assembly to installation

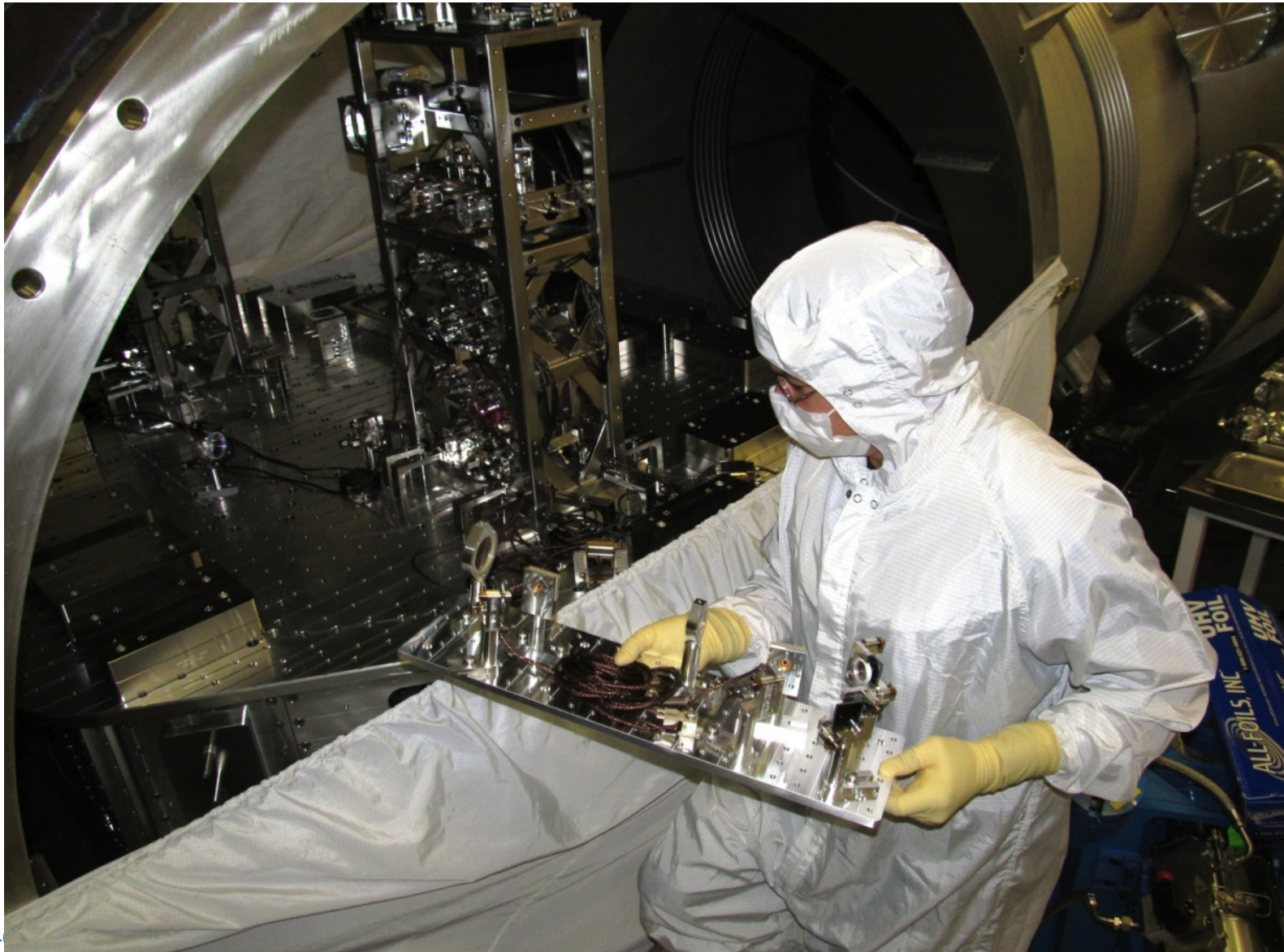




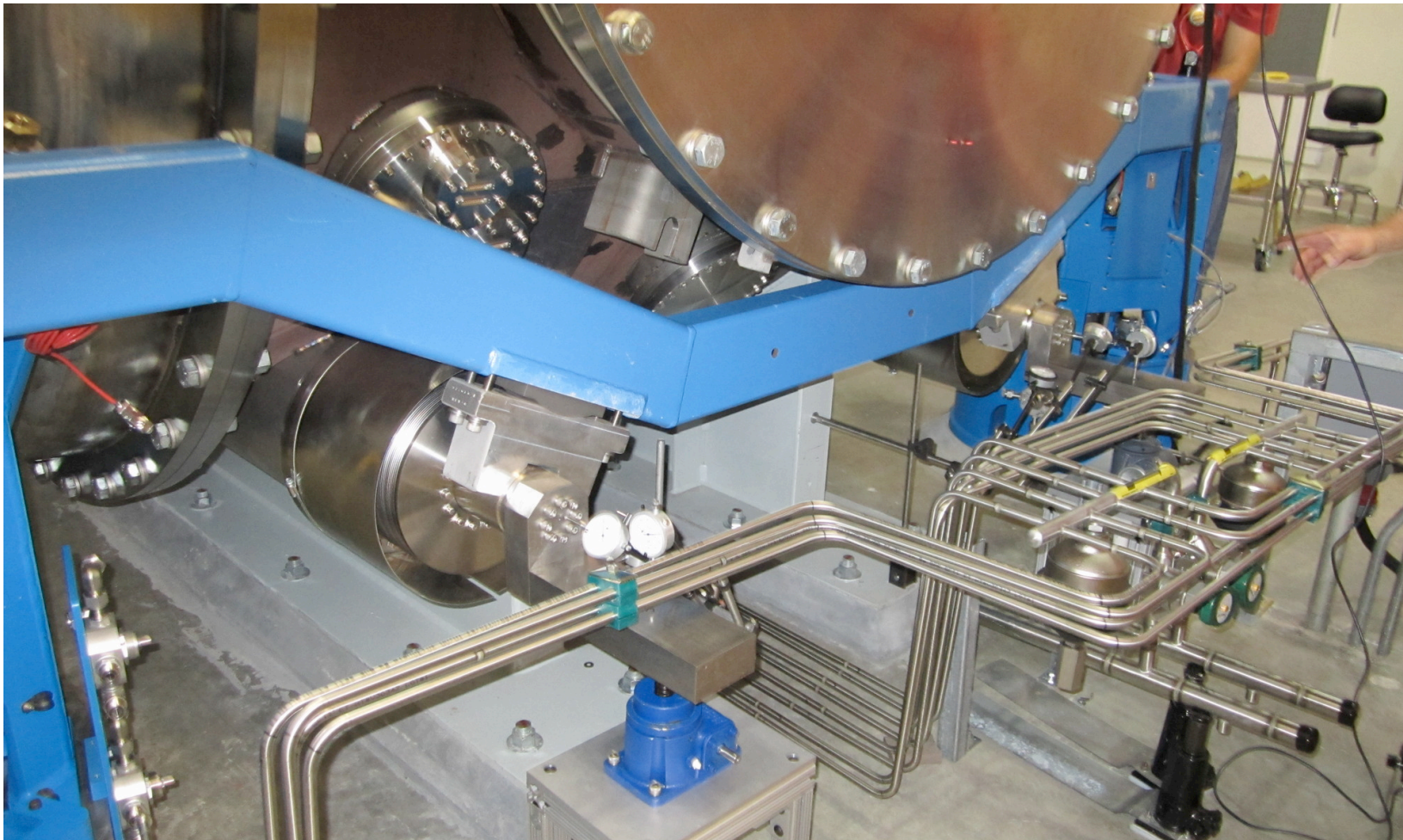
Installation a small seismic isolation system



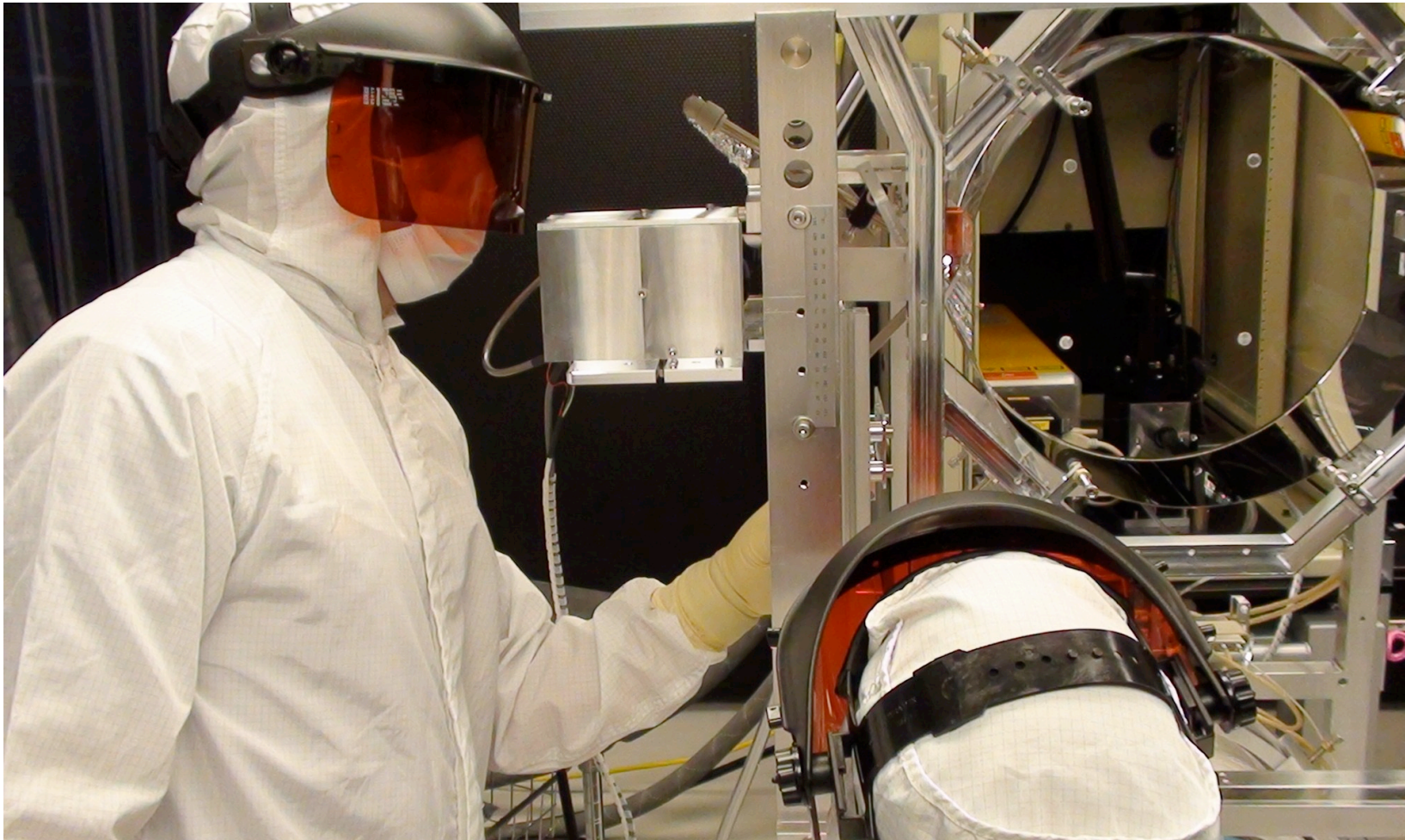
Installing a small optical table



Hydraulic piping for seismic positioners



Welding fused silica suspension fibers with high-power CO₂ laser



Test Mass suspension



Assembly of small optics suspensions





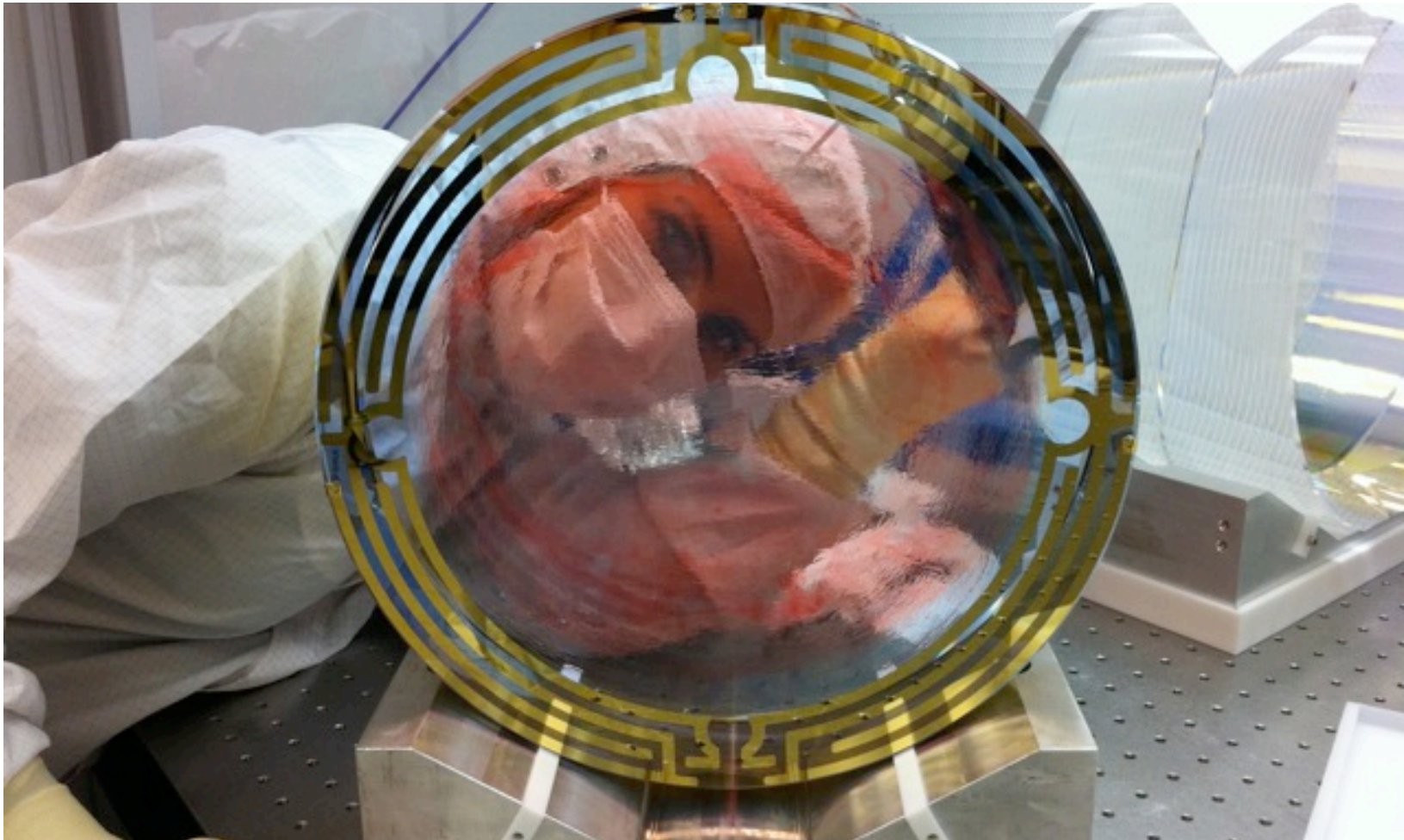
Installing the Pre-Stabilized Laser



Inspection of a Test Mass Optic



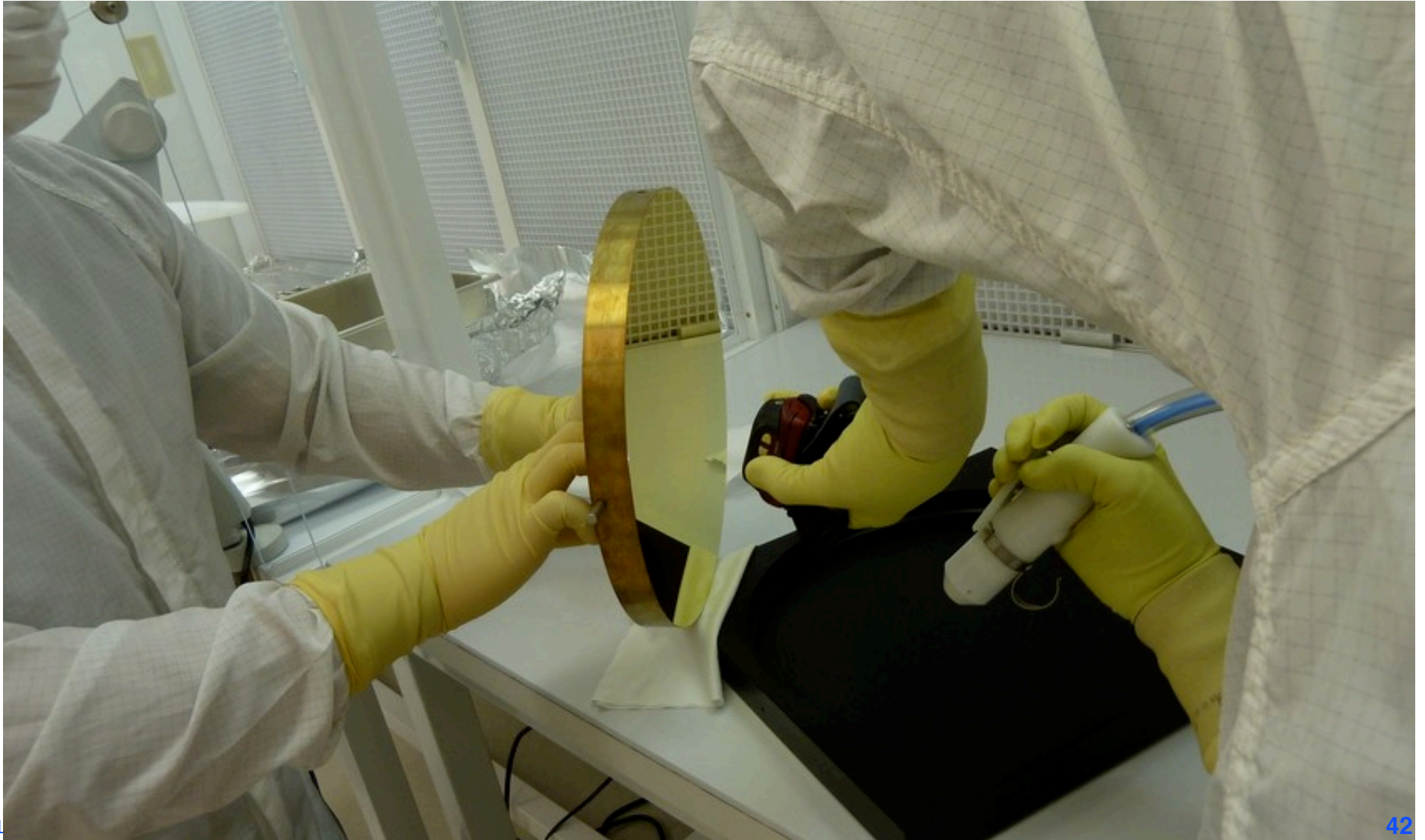
Looking through a compensation plate (protective coating on mirror!)



A baffle being inspected



CO₂ relay mirror being cleaned



Optical table and telescope



Removing a small vacuum tube





Transporting a large vacuum chamber

