Advanced LIGO Project
Overview and Status

aLIGO Team Meeting

27 April 2011

David Shoemaker

Advanced LIGO Project Leader

What's this presentation?

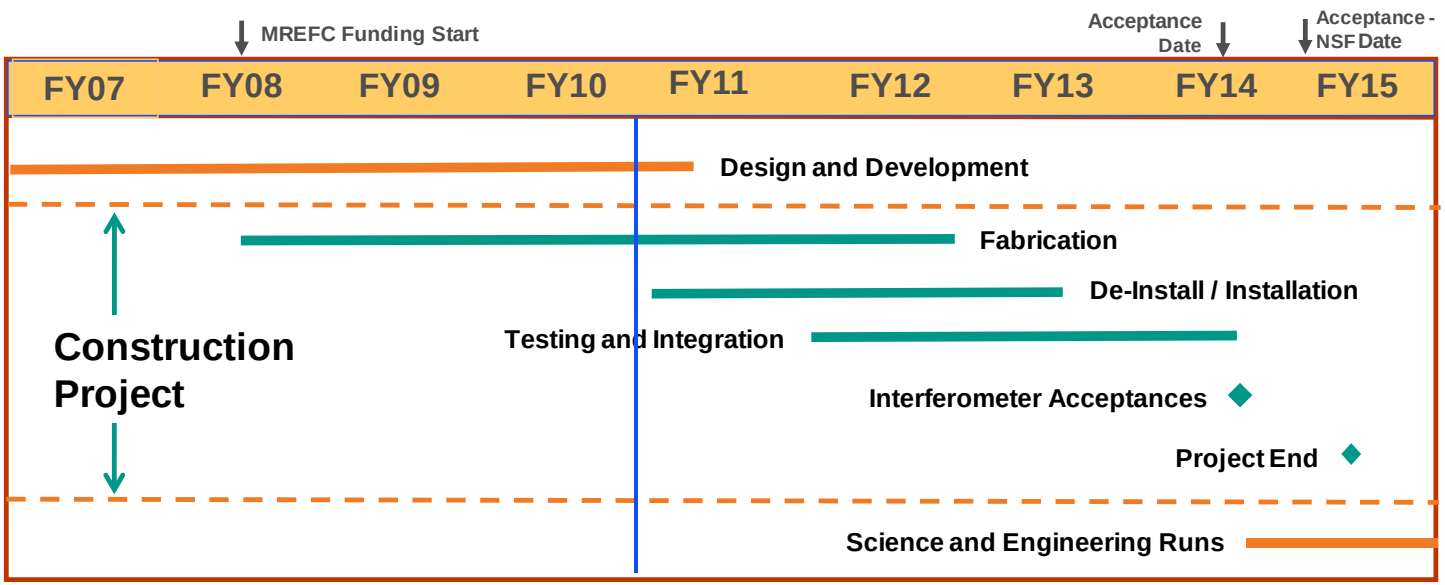
- How far along are we?
- What have we done this year?
- What happens over the next year?

Project Overview – Big Picture

- Scope
  - Replace/Upgrade all detector components for 3 Interferometers
  - Procurement, Installation, Commissioning to Acceptance
  - Acceptance criterion - 2 hours locked – then hand back off to Operations
- Cost
  - NSF funded - $205.12M
  - UK funded - ~$7.8M (total with design ~$14M)
  - Germany funded - ~$8.9M (total with design ~$14M)
  - Australia funded - ~$1M (total with design $1.7M)
- Baseline Time Frame
  - Seven years: April 2008 - March 2015
  - Detector Acceptance dates Nov 2014 (or maybe earlier!)
- Staffing
  - Currently at 166 full-time people!
  - ~574 FTE-yrs total

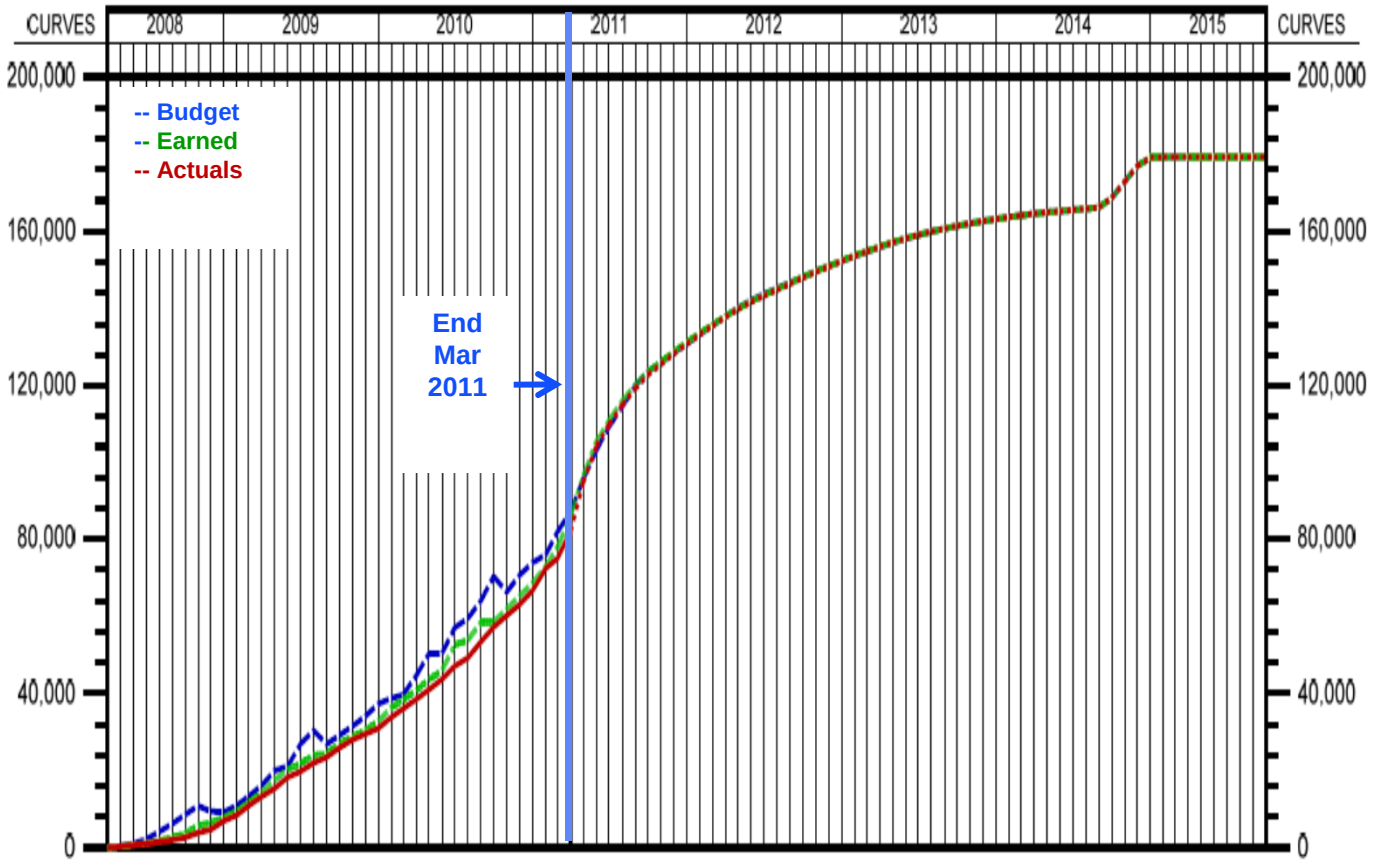
Project Schedule

- Start procurements & prepare sites Apr FY2008 - end production mid 2013
- Continue development in parallel, finishing most design by end FY2011
- Start de-install/install at sites for L1 and H2 interferometers Oct 20, 2010
- H1 de-install/install starts Jan 2012
- Test integrated portions of interferometer in phases as install proceeds
- Accept L1 by Jun 2013: H2 by Jan 2014: H1 by Jun 2014 (Internal schedule)
- End Mar 2015 after installation of data storage and analysis computers



Schedule Status

- **Project is 1/2 way through planned duration** 38 months into 74 months total
  - » On track to end on schedule
- Spent $82M, against baseline budget of $179M

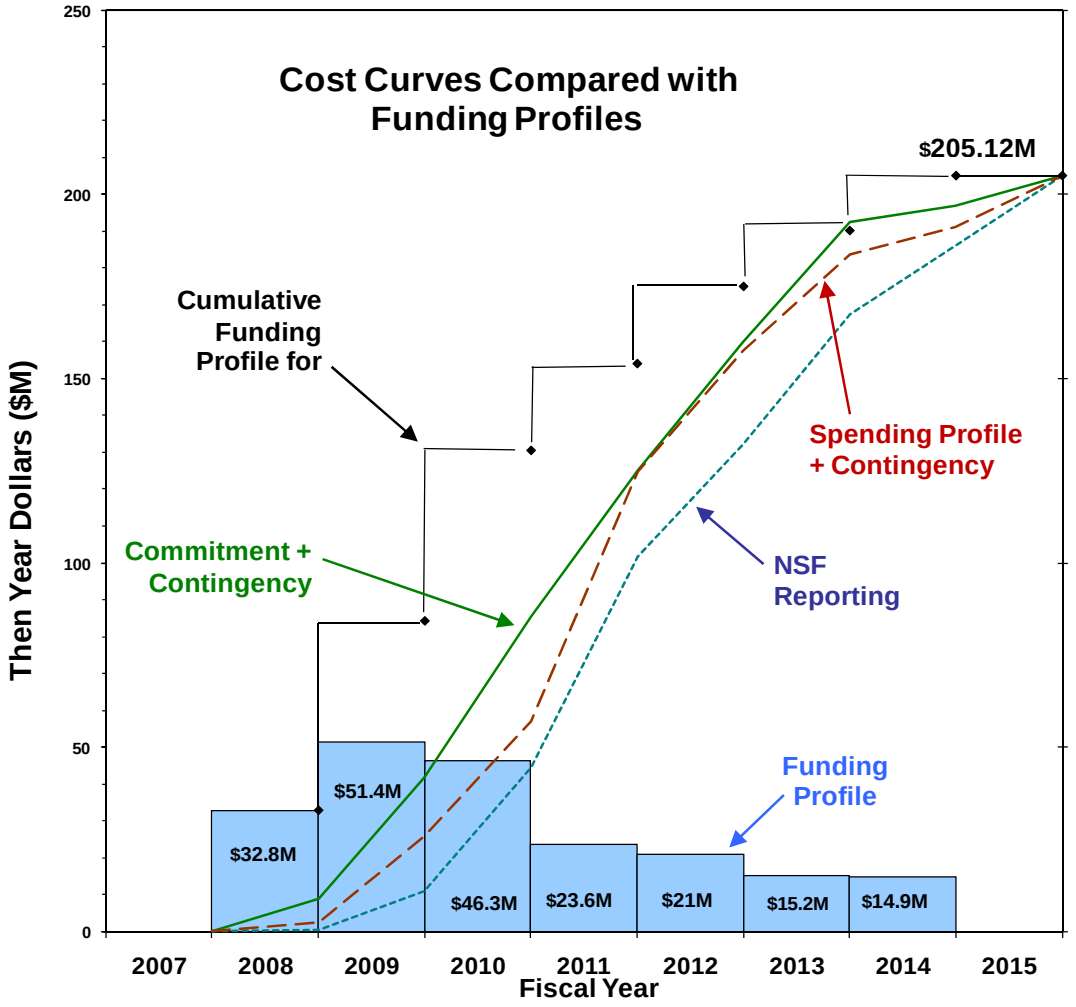


- **2011 is a peak year for activities**

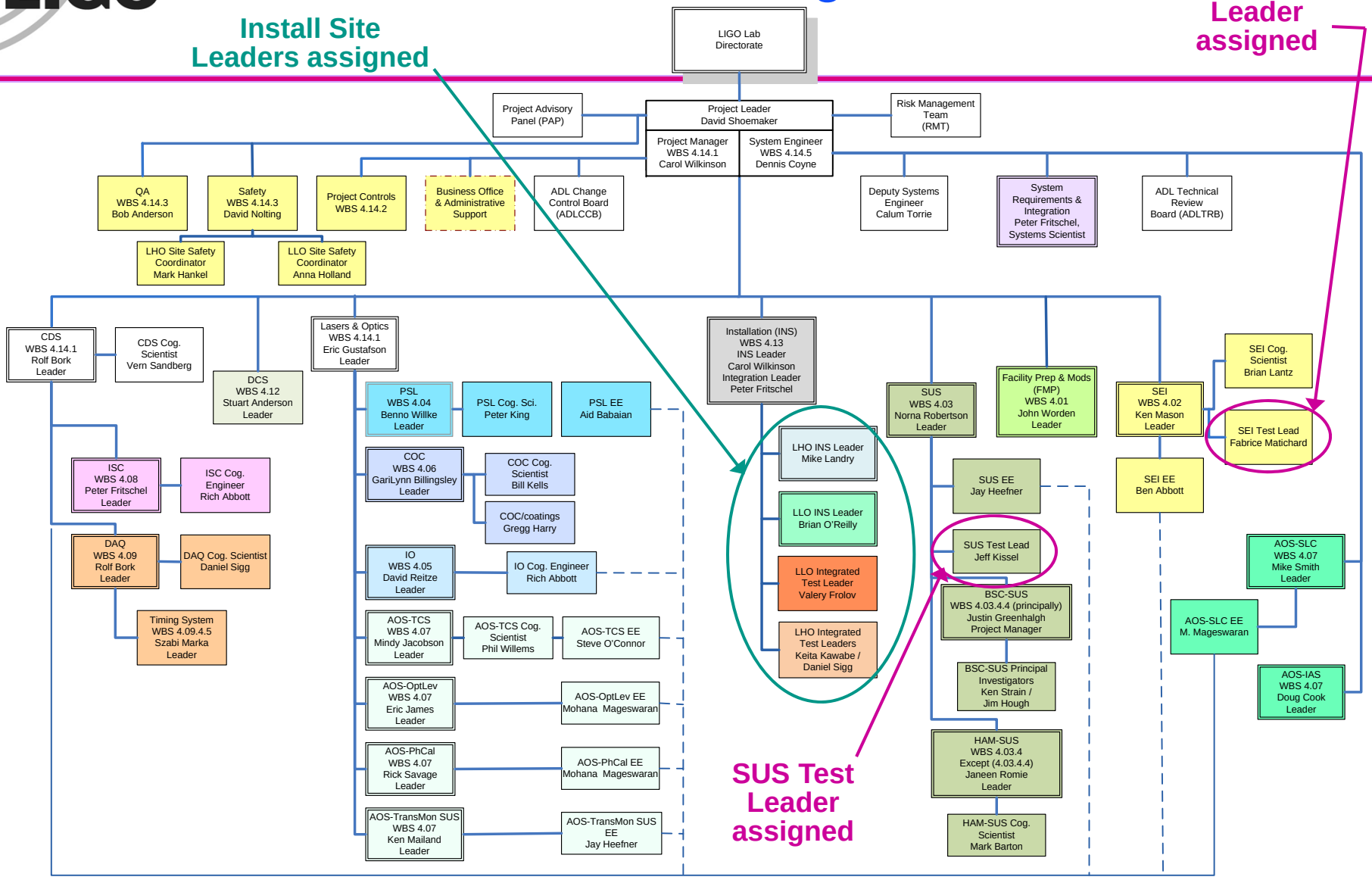
Funding

- Have received all requested funding to date
- NSF subject to the government funding confusion
- Waiting to hear about remaining funds for this year, but
- We have a 'head of steam' – no immediate problems
- NSF is very well respected by both Republicans and Democrats
- aLIGO regarded very positively by the NSF

- **If anyone can continue full speed ahead, it will be aLIGO**



Advanced LIGO Org Chart



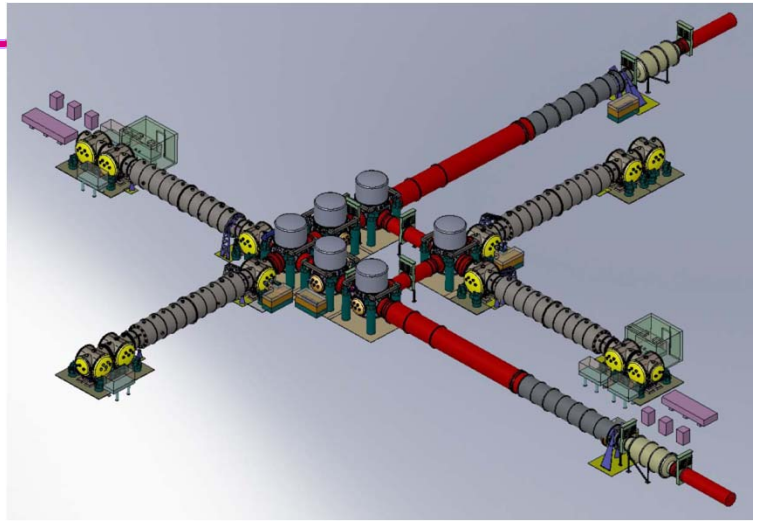
Advanced LIGO Project Organization

LIGO-M070069-v11
14 April 2011

Technical Status

Facilities Modification & Preparation (FMP): Status

I/O Tube Rollups



Flange Sets

Mid-Station Spool

Chamber Cleaning

- Developed tooling & procedure for removing oxide layer

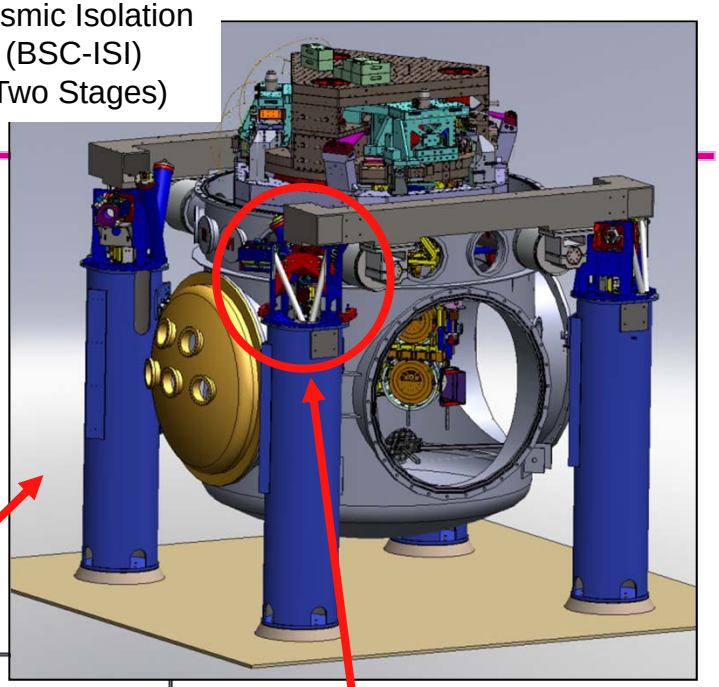
- Inadvertent contamination of WHAM12
  - » Accidently used the wrong compressor during a WHAM12 chamber cleaning test (not oil free)

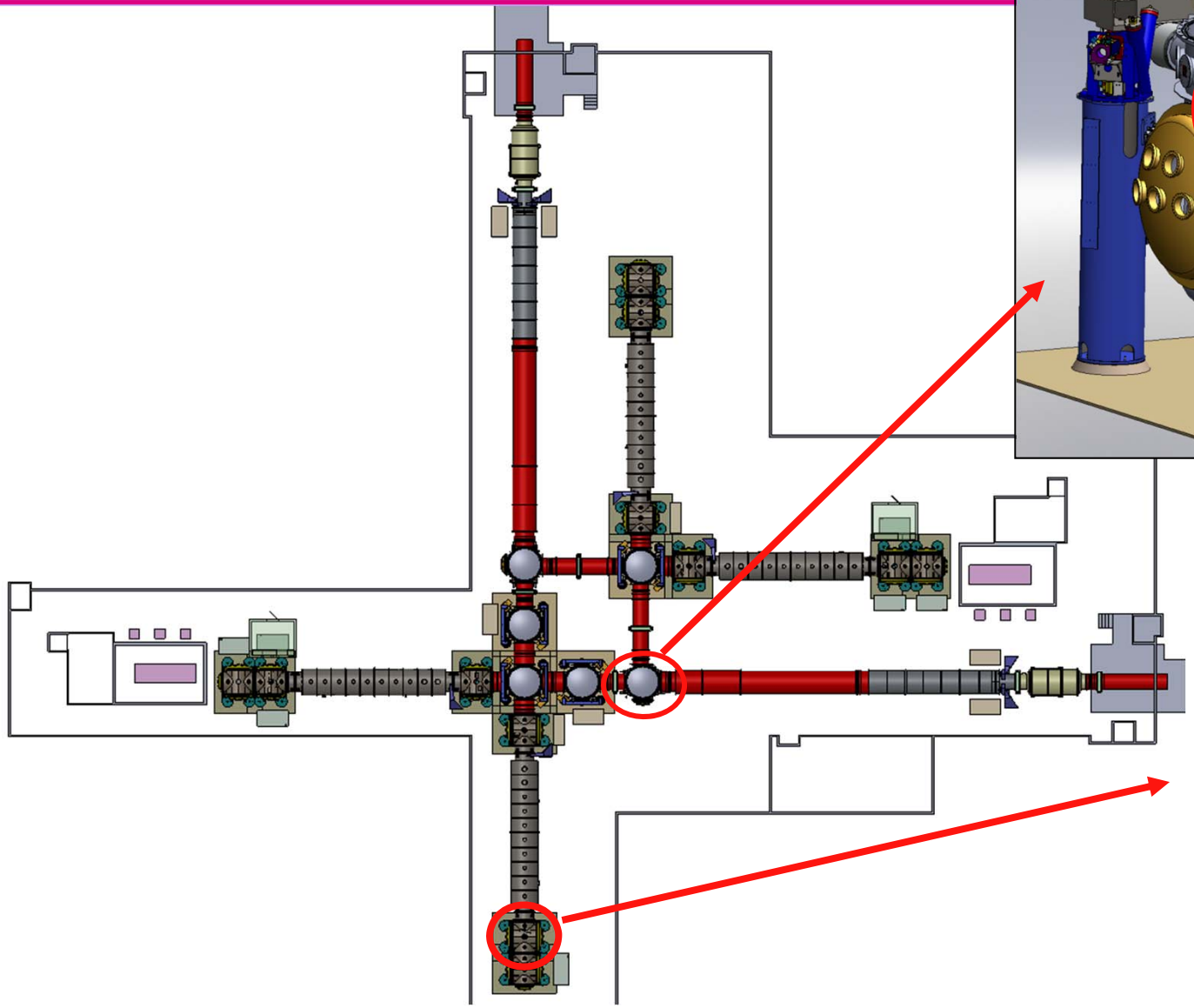
Wire Brush Rotary Tool
(in HAM12)

Oxide Layer
Removed
(HAM12)

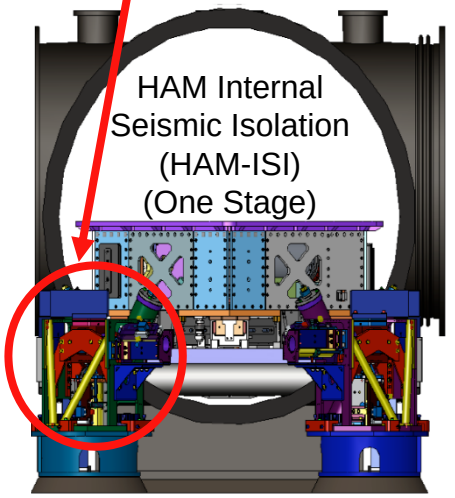
BSC & HAM Vacuum Chambers & Seismic Isolation Systems

BSC Internal Seismic Isolation (BSC-ISI) (Two Stages)

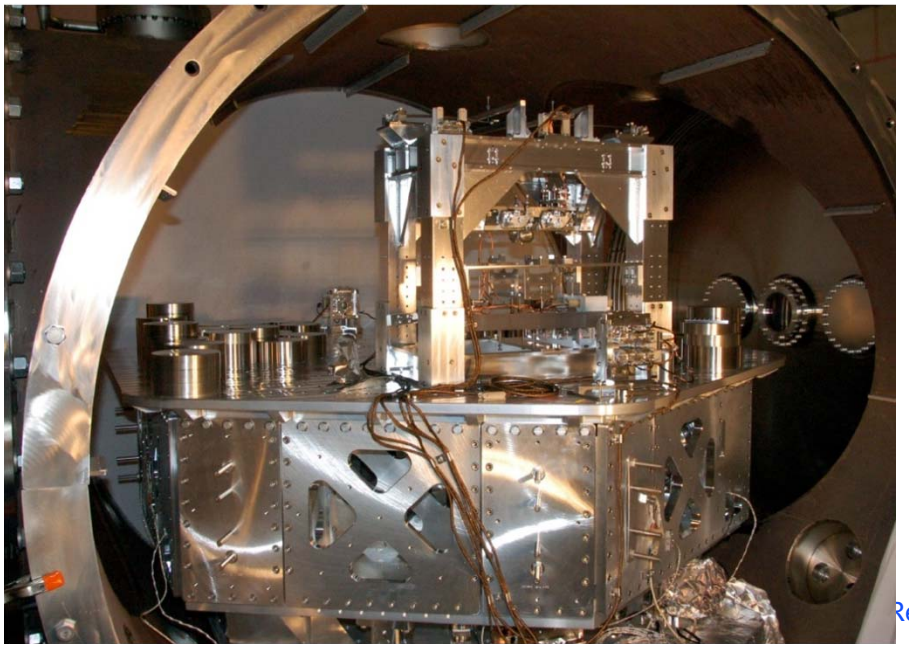




Hydraulic External Pre-Isolator (HEPI)

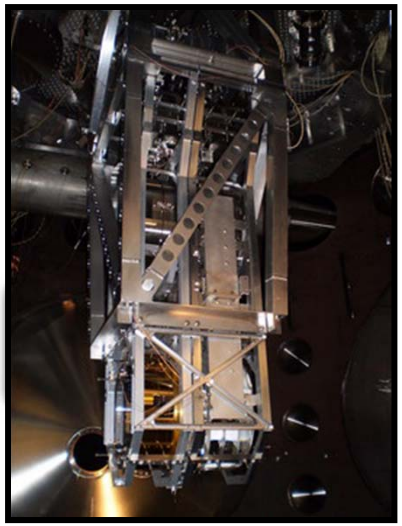


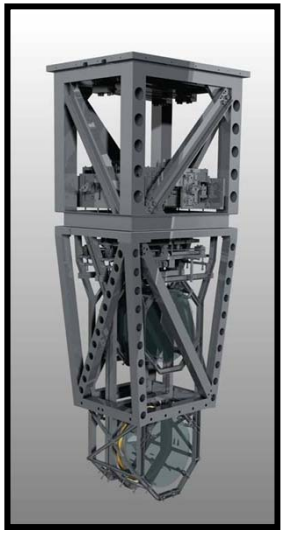
HEPI, BSC, HAM Isolators



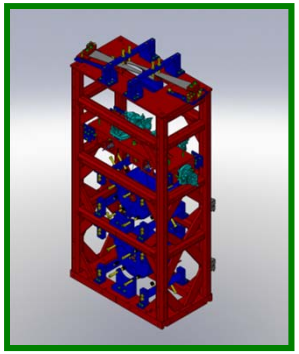
Suspension Subsystem (SUS)

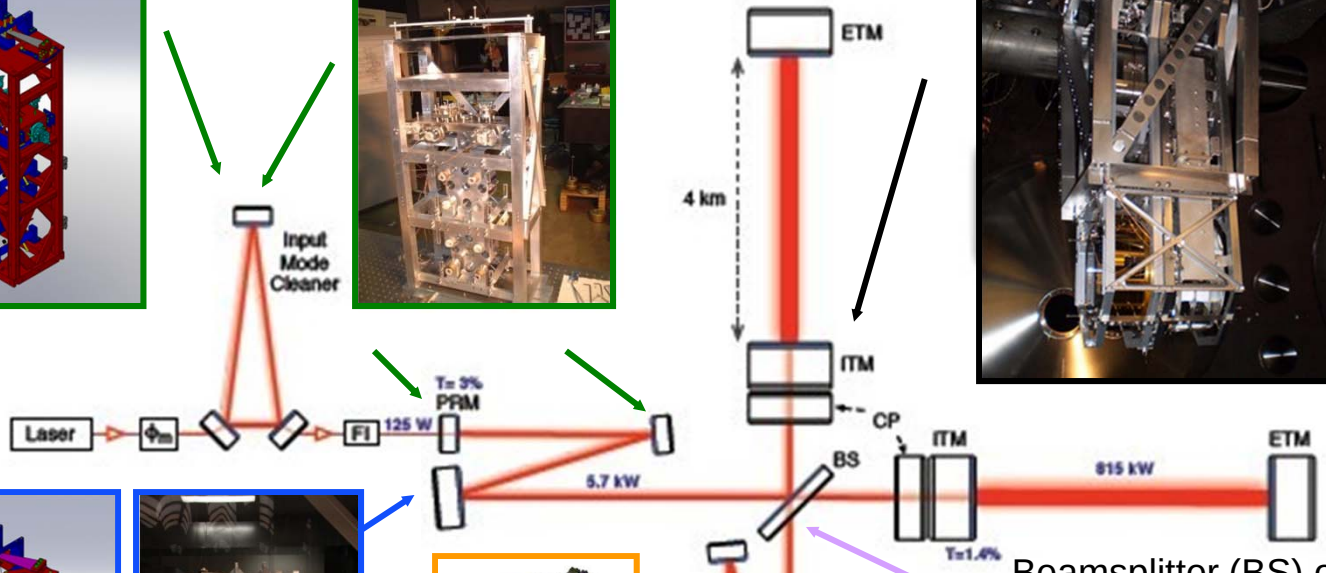
Test Mass (TM) Quad

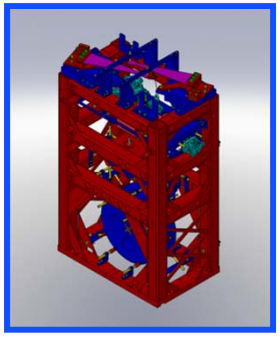




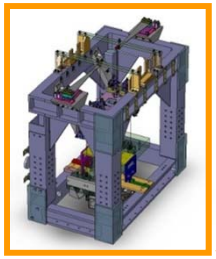
HAM Small Triple Suspension (HSTS)

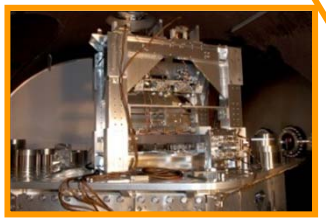




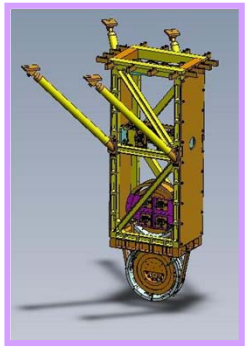


HAM LargeTriple Suspension (HLTS)



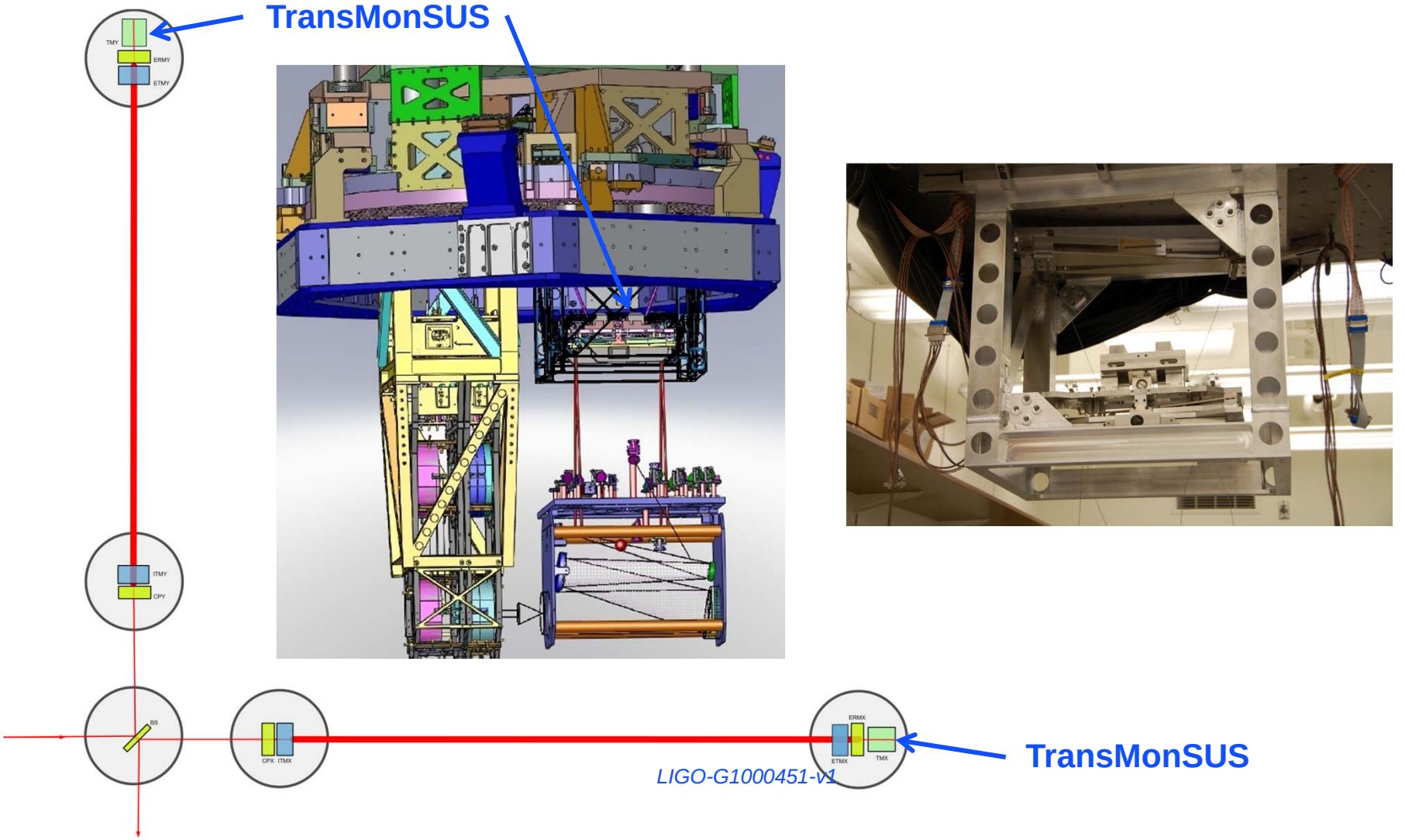


Beamsplitter (BS) or Fold Mirror (FM) Triple



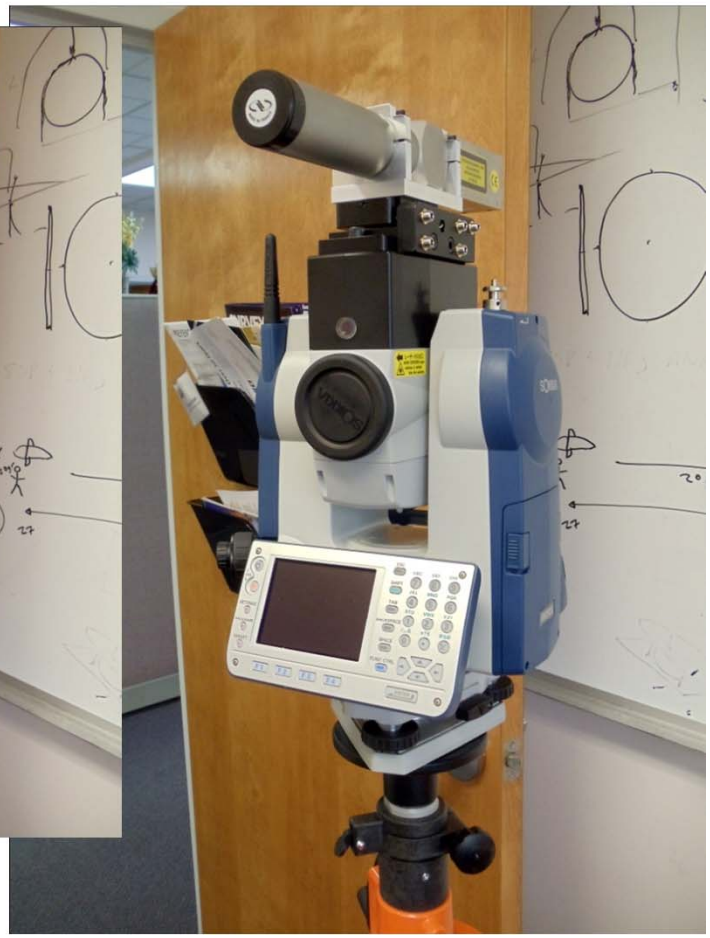
Output Mode Cleaner (OMC)

Transmission Monitor Suspension (TMS)



Initial Alignment

Goniometer base for aligning the laser autocollimator to the total stations



Sokkia model SetX1 with Newport Laser autocollimator mounted up

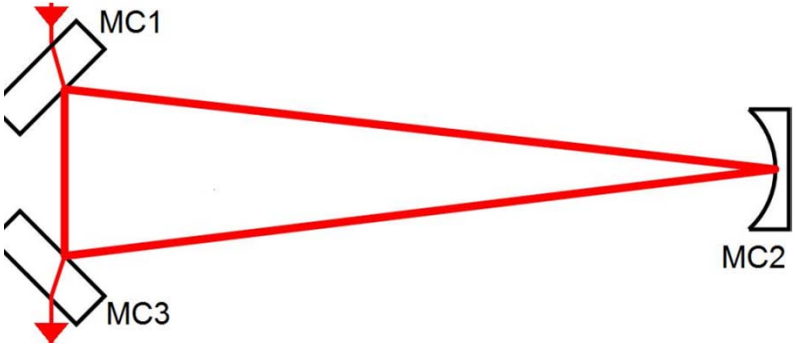
Pre-Stabilized Laser

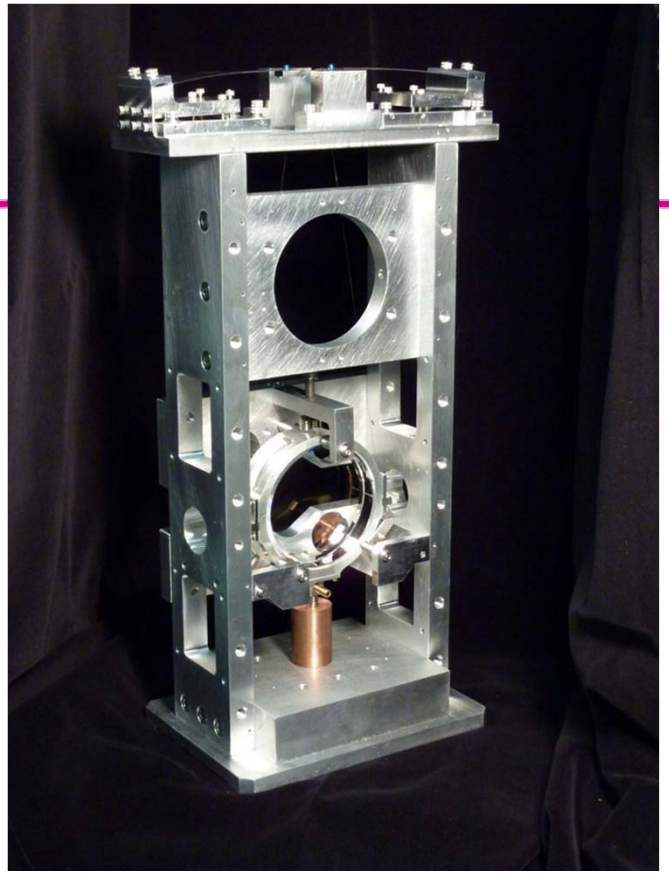
Laser Area Enclosure: HEPA filtered airflow & acoustic shielding

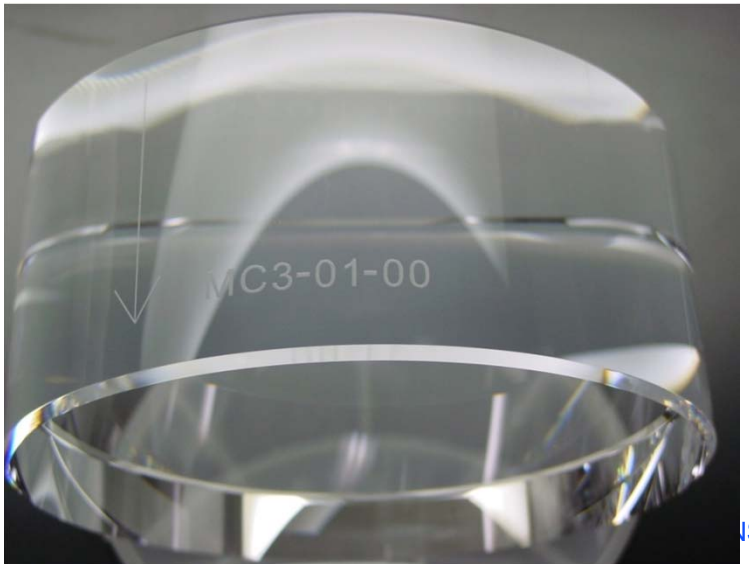
Pump Laser Diodes in remote room

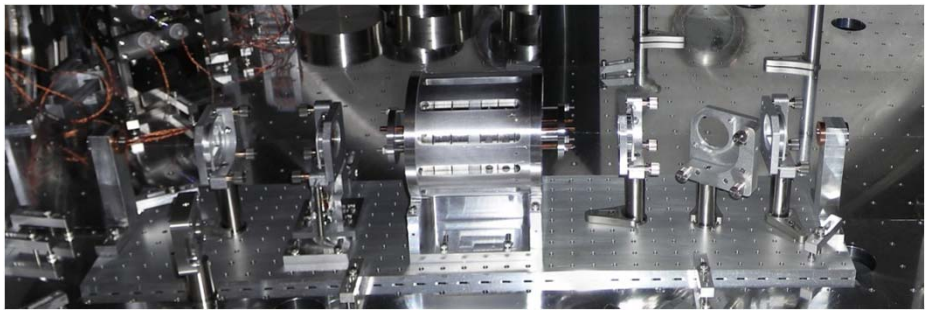
Laser Stabilization Electronics

Input Optics

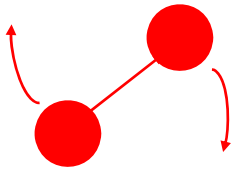


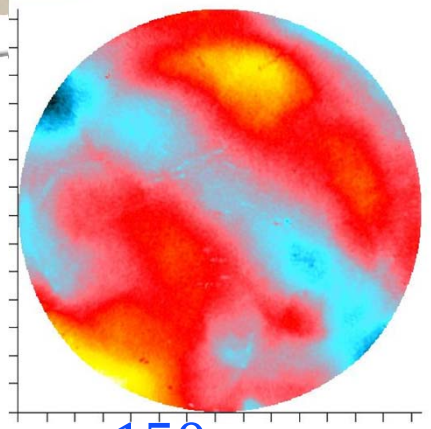




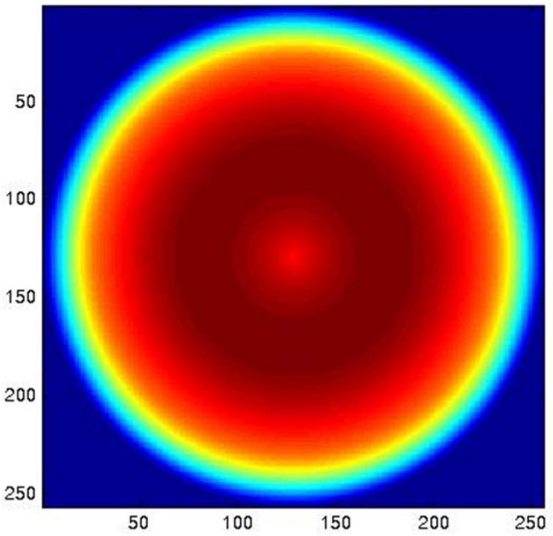


Core Optics – Test Masses



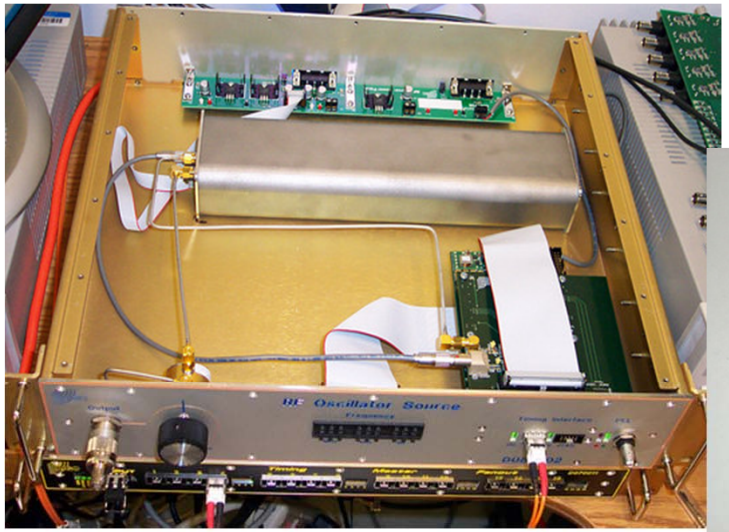


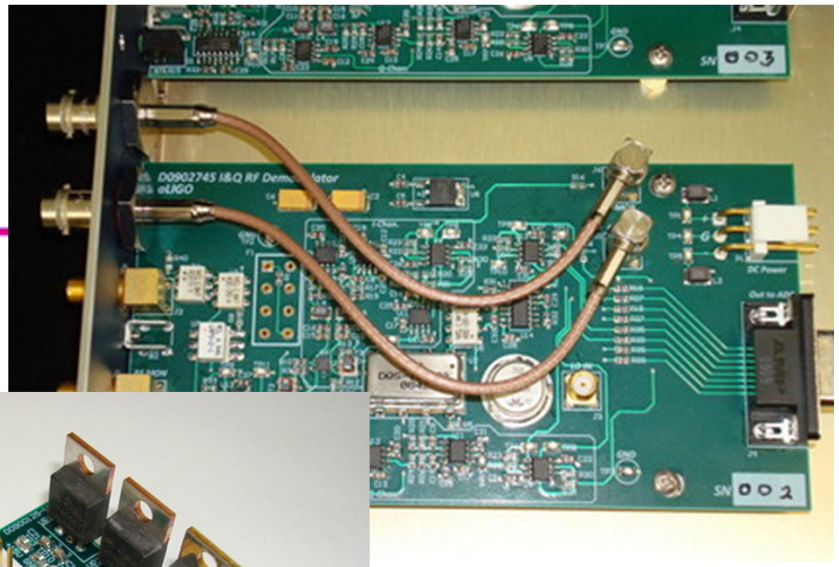
150 mm

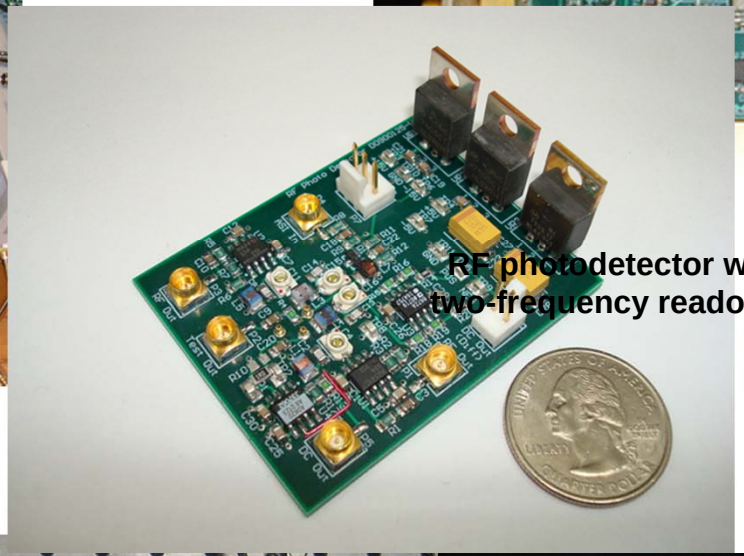


250 mm

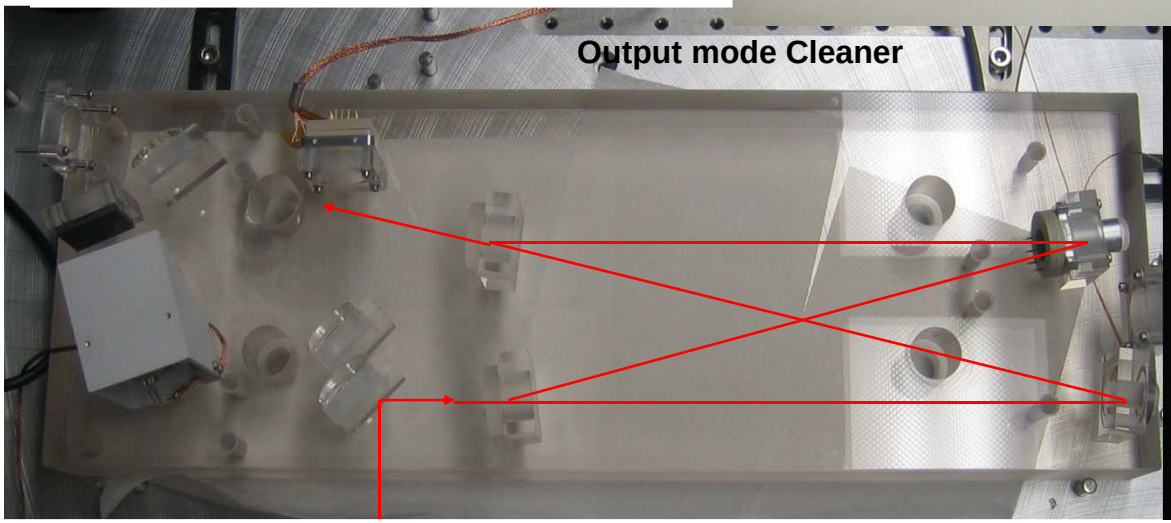
ISC: Gravitational Wave channel readout



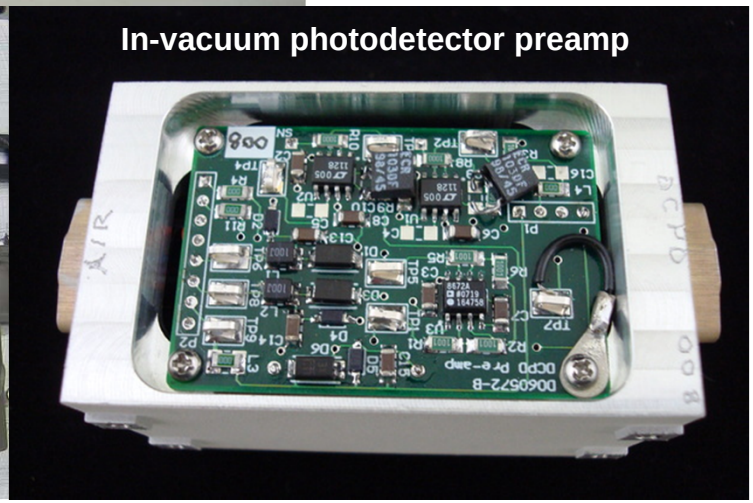




RF photodetector w/ two-frequency readout

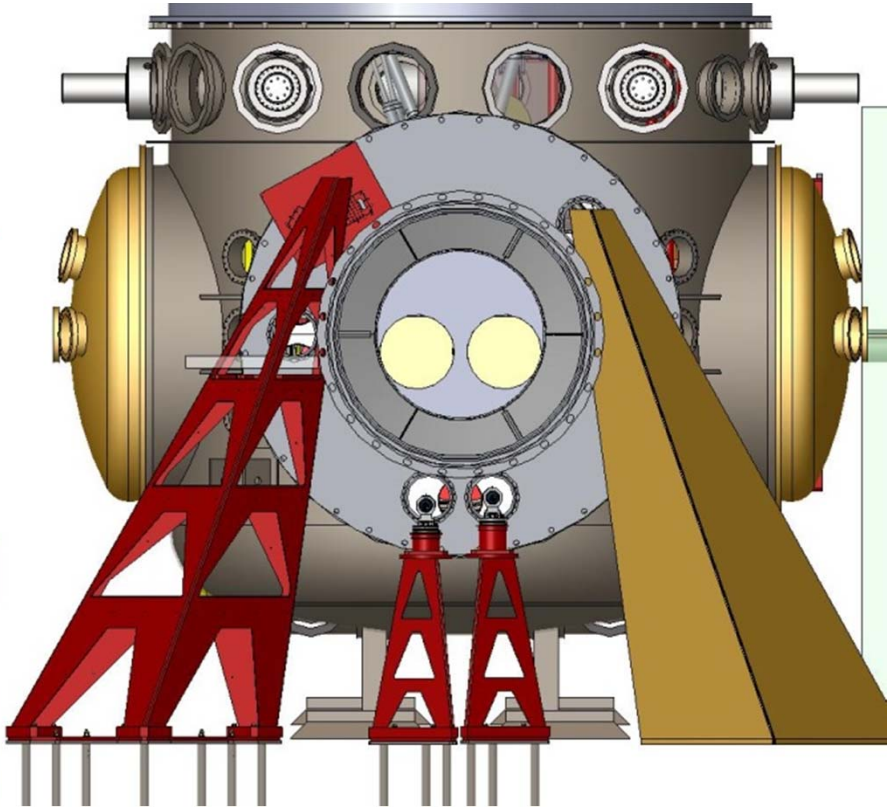


Output mode Cleaner

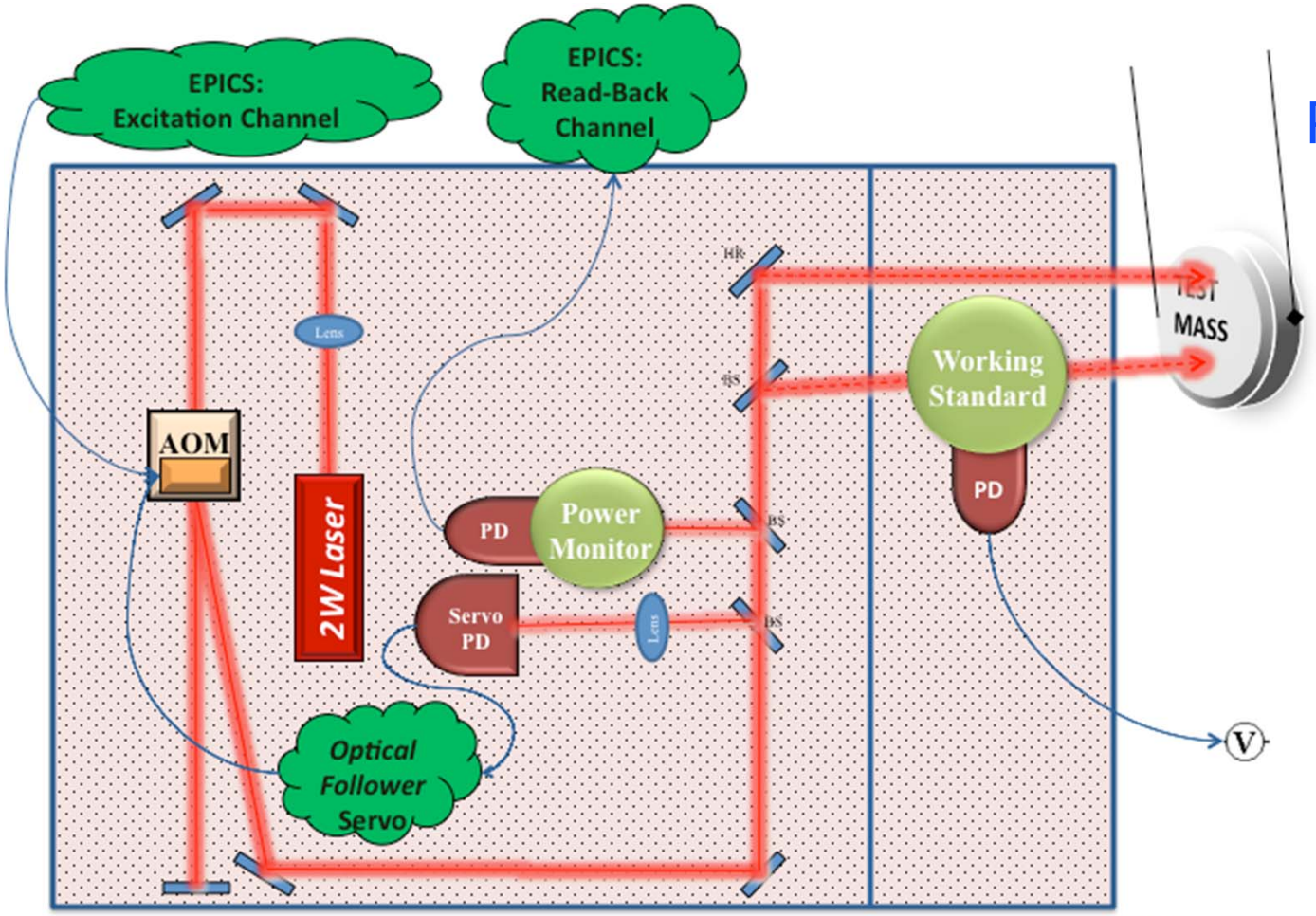


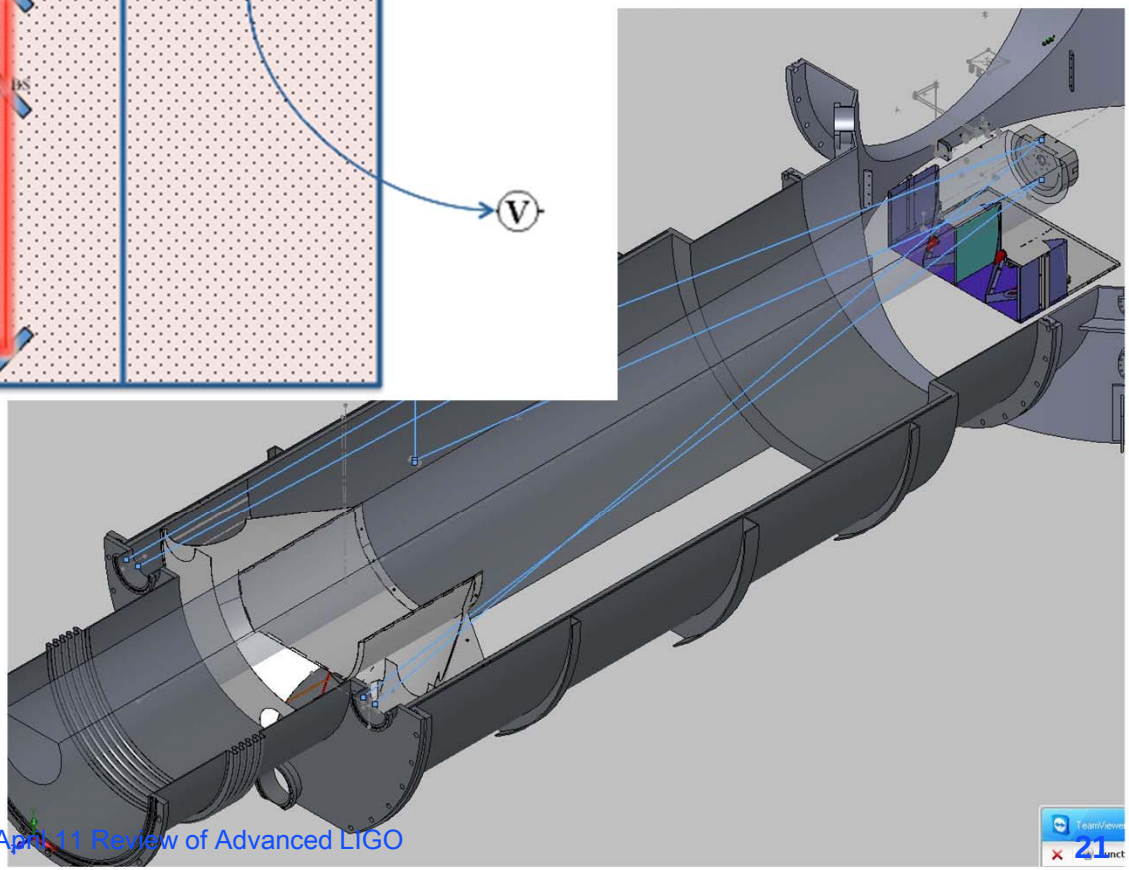
In-vacuum photodetector preamp

Optical Levers



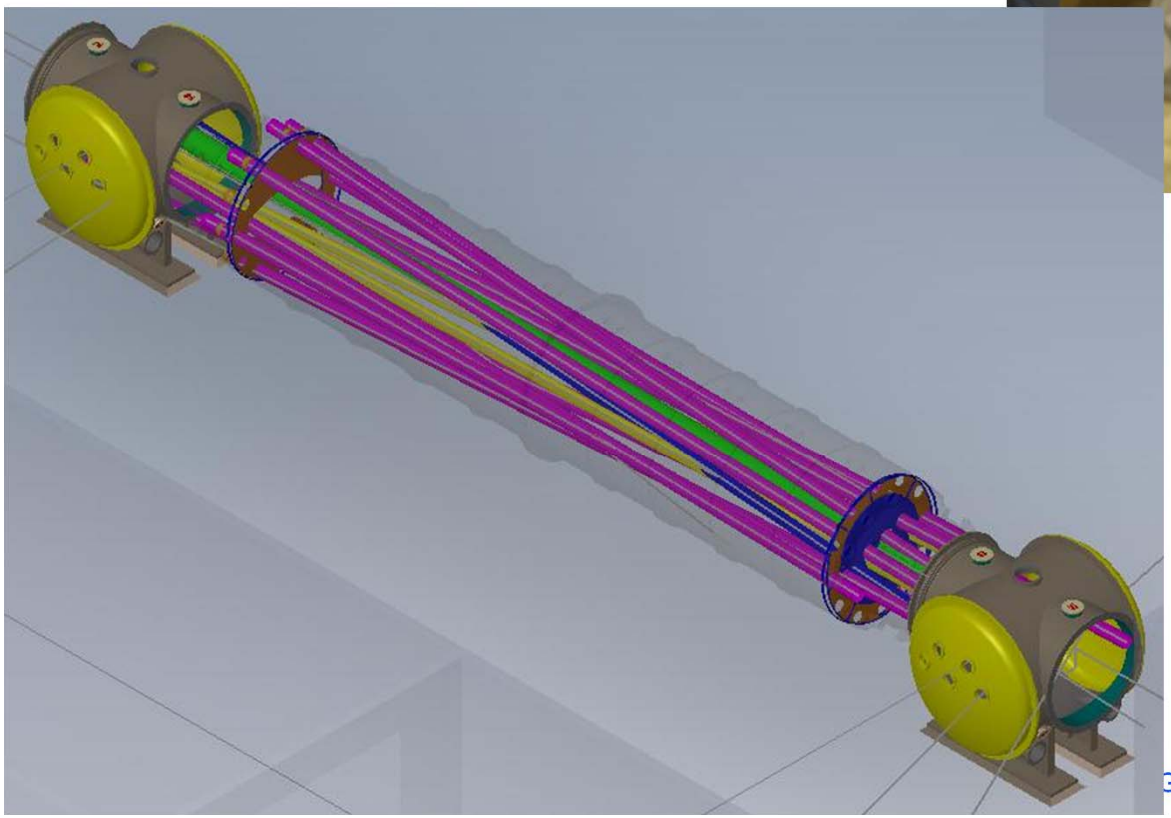
Photon Calibration



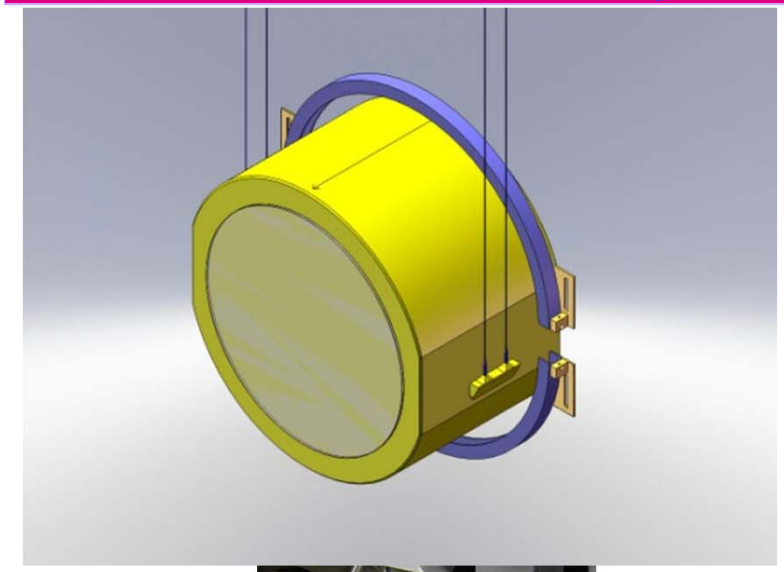


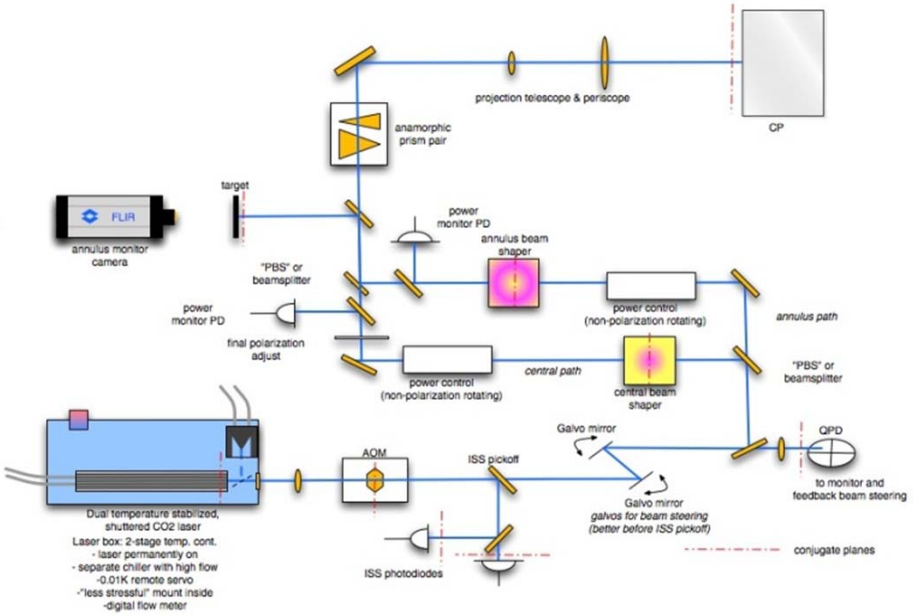
LIGO

Scattered Light Control



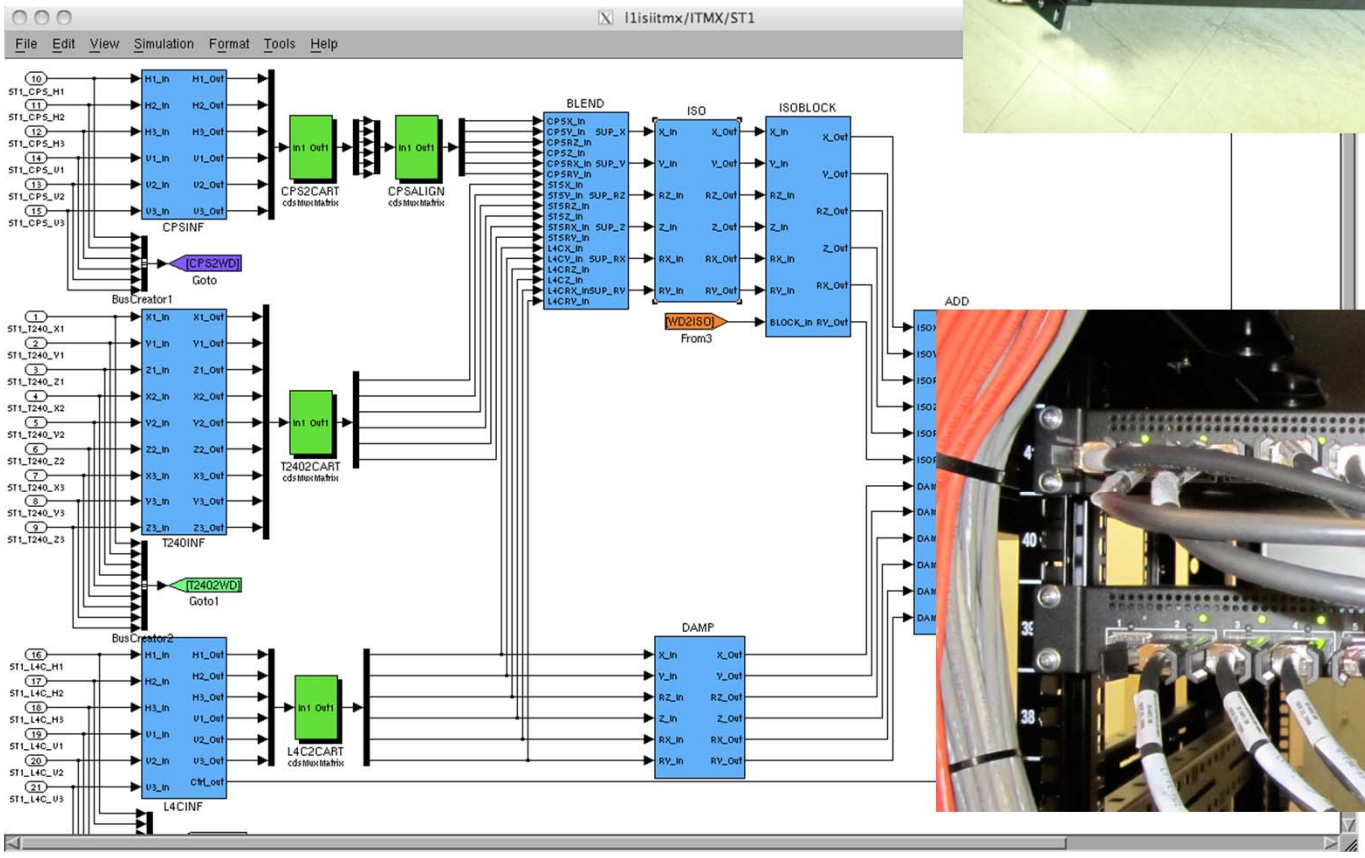
Thermal Compensation System





DAQ/timing


Timing IRIG-B
D0900301
25:03:11
10:12:27
Day Month Year
Hour Min. Sec.
GPS
local
TZ
UTC DST Leap
Timing Interface
On Link Up JTAG
Leap
Pending


l1isiitmx/ITMX/ST1
File Edit View Simulation Format Tools Help
CPSINF
CPS2CART
CPSALIGN
BusCreator1
Goto
BLEND
ISO
ISOBLOCK
From3
T240INF
T2402CART
BusCreator2
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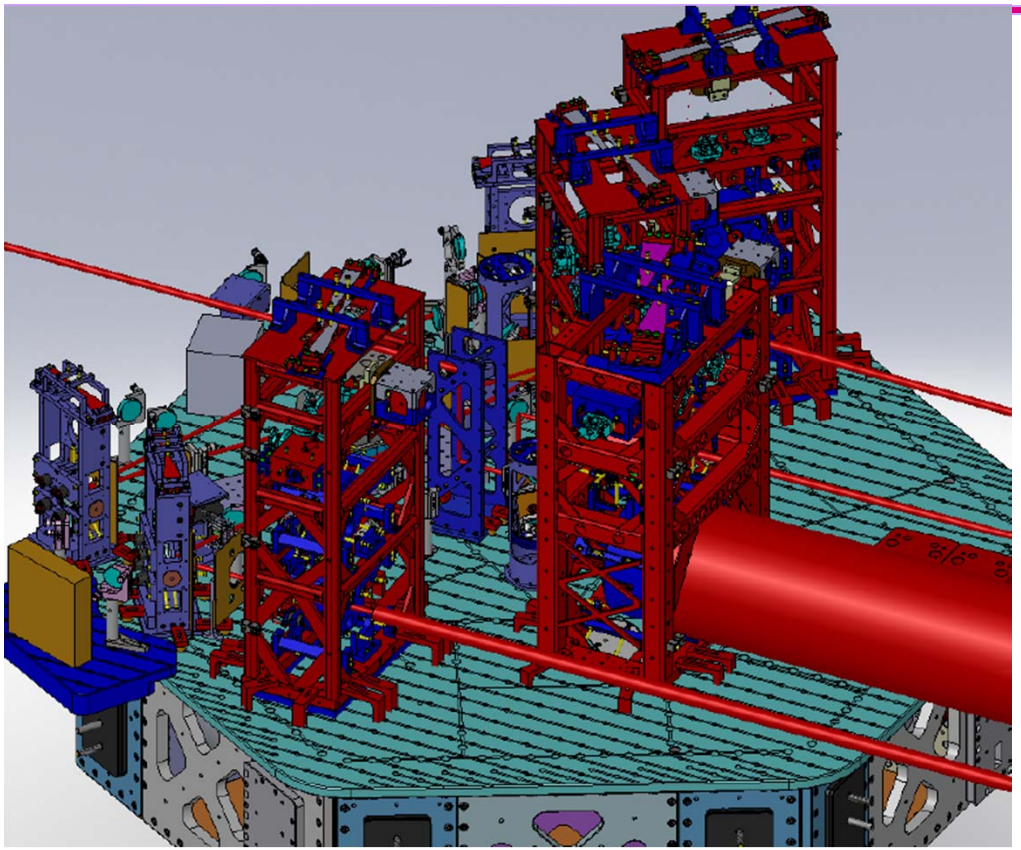
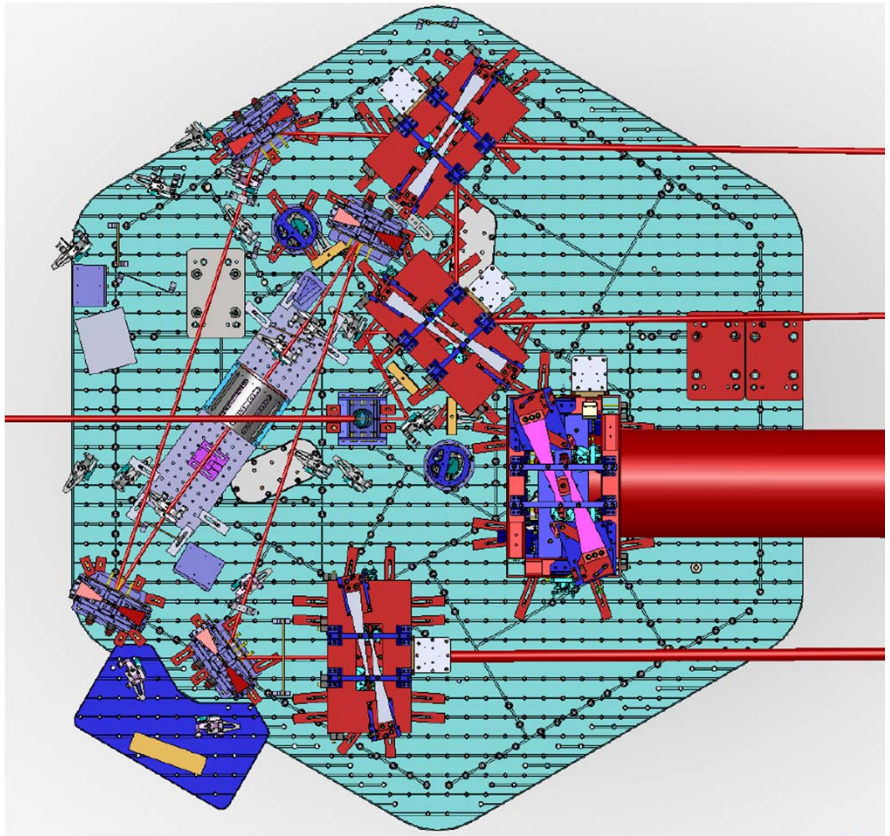
L4CINF
L4C2CART
DAMP
ADD

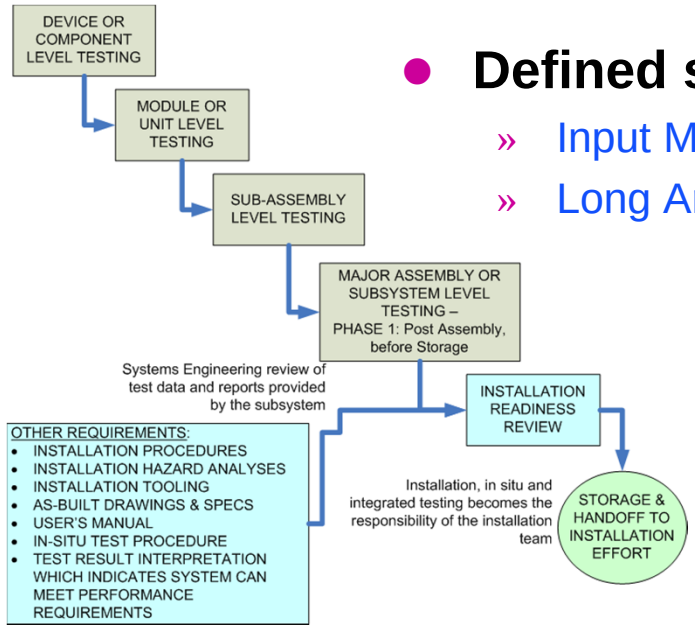
Systems -- Integrated Layouts



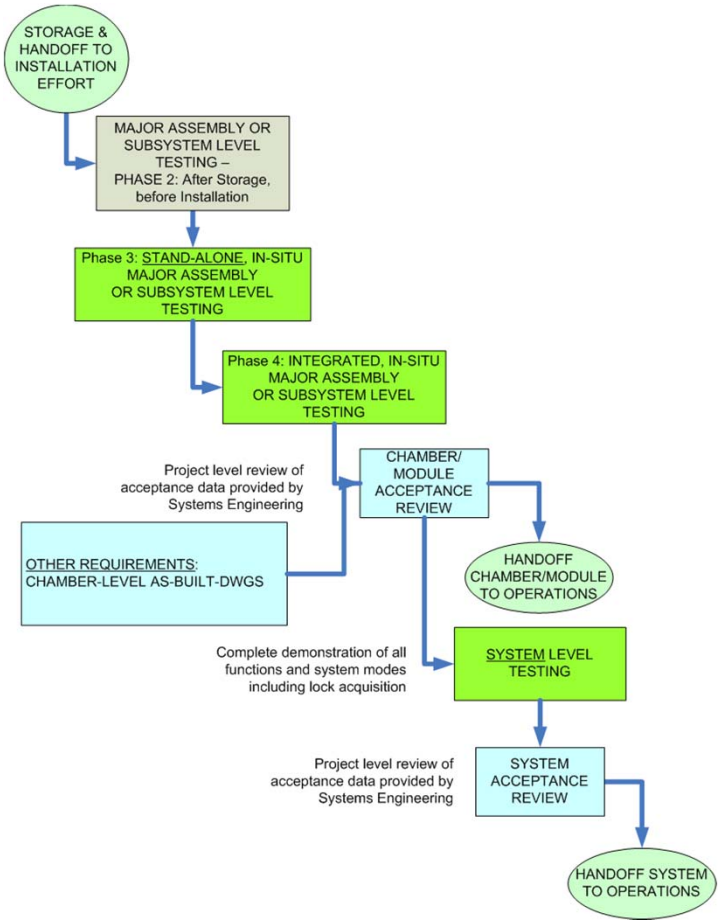


Sub-system and System Testing

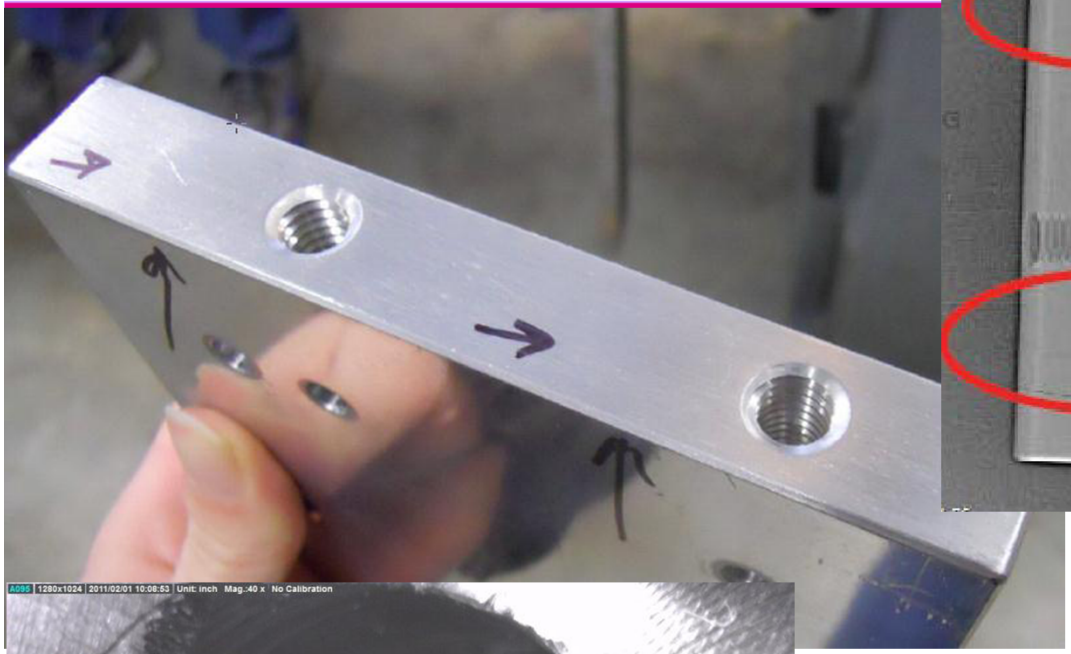
- Defined requirements for Subsystem and System level testing
  - » Documentation
  - » Review
  - » Data archival
  - » Acceptance criteria

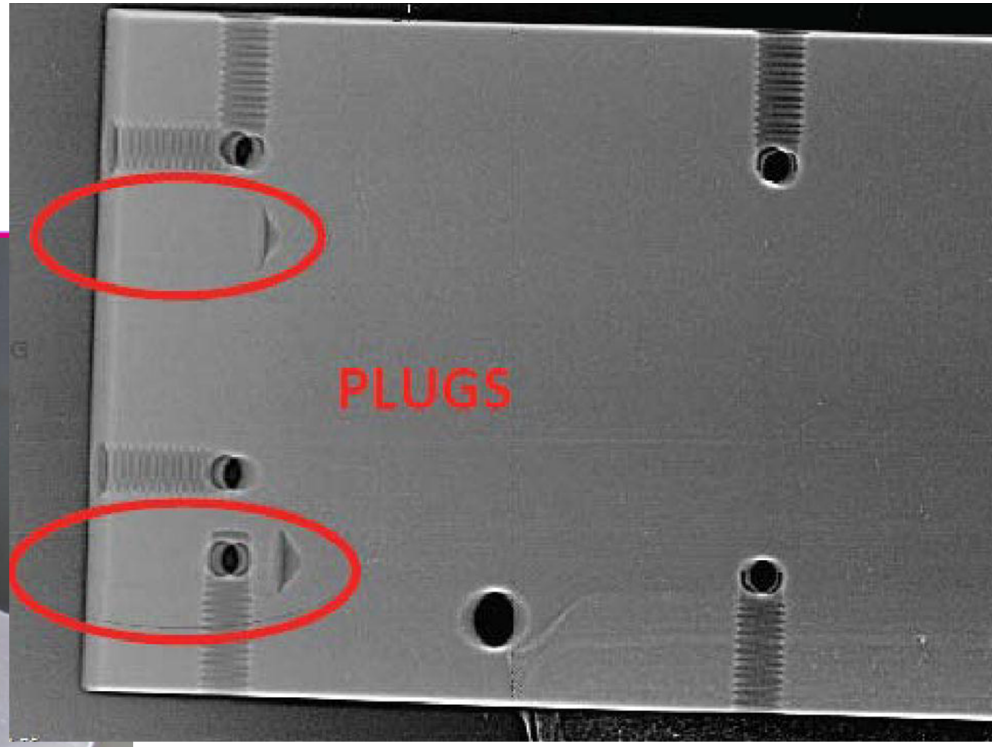


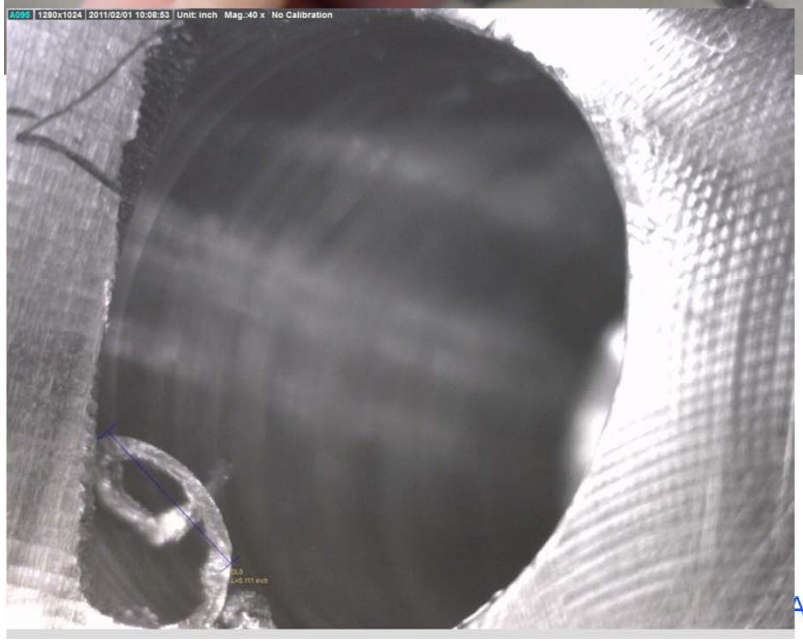
- **Defined system test plans**
  - » Input Mode Cleaner
  - » Long Arm Cavity



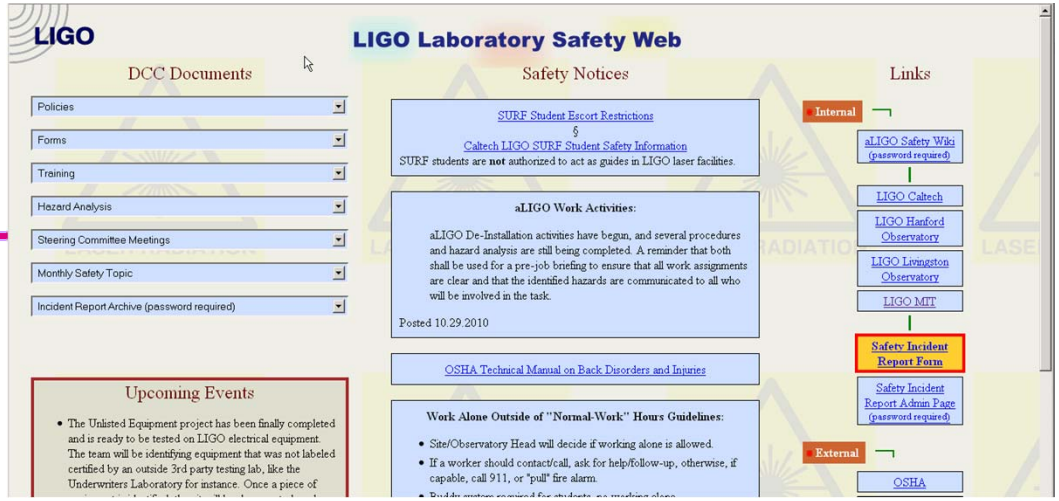
Quality Assurance, Manufacturing







Safety



- Safety Officer at LLO,
- New site aLIGO officers at LLO and LHO

- Some paperwork…

- But the real message is:

Please work safely, and help others to work safely.

What will we accomplish this coming year?

- Facilities –
  - Receive install tooling, clean rooms, vacuum equipment, and H2 electronics building;
- Seismic Isolation –
  - Take delivery of all parts; Complete all HAM and BSC seismic units for L1 and H2.
- Suspensions –
  - Pull fibers / bond optics for the H2 single arm integration.
  - Complete all procurements.
  - Assemble and test suspensions needed to support L1 vertex and H2 single arm cavity testing.
- Pre-Stabilized Laser –
  - Deliver lasers and infrastructure components for installation at H2 and L1. Continue fabrication of H1 laser components and infrastructure.
- Input Optics –
  - Take delivery of all optics; assemble IMC and MMT for H2 and L1;
  - assemble and test all optic isolation and baffles.

What will we accomplish this coming year?

- Auxiliary Optics –
  - » Finish designs;
  - » assemble Stray Light Control, Optical Levers, Initial Alignment System, Transmission Monitor Suspension, and Thermal Compensation components for H2 arm lock testing and L1 vertex tests
- Core Optics/Test Masses –
  - » Complete metrology facility
  - » deliver optics for L1 vertex and H2 arm lock test
- Inteferometer Sensing and Control –
  - » Procure all components; assemble components for H2 arm lock test and L1 vertex tests; start assembly of remaining components
- Data Acquisition –
  - » Complete delivery of all computer systems, networking, timing, and SW
- Installation and Integration –
  - » Install L1 vertex and H2 single arm cavity. Start single arm cavity test at H2. Start PSL/IO Table Testing for L1

And so….

The Project is going very well,

thanks to the team