



Advanced LIGO

Update for Virgo-LSC meeting

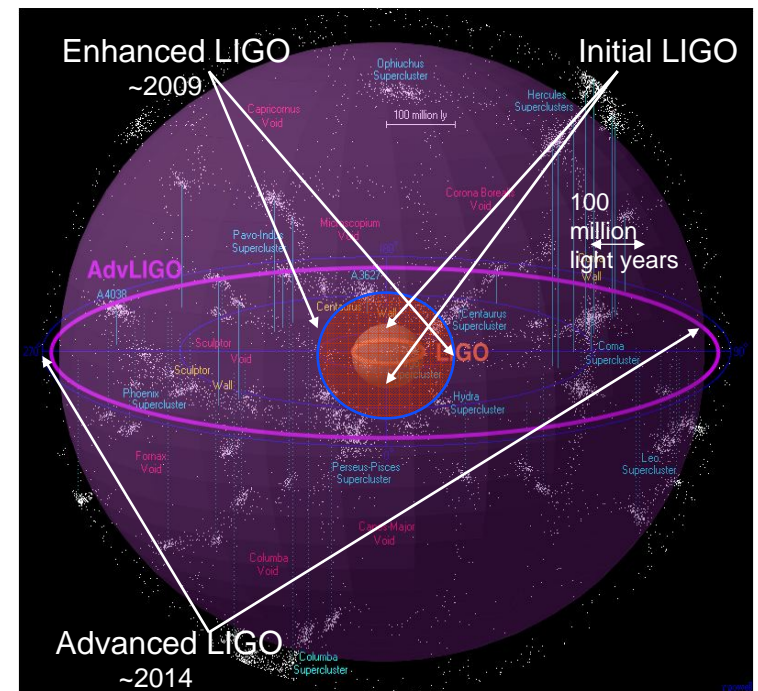
September 08

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Status of Advanced LIGO

- **Project started in April 2008**
 - » Funding, schedule as requested
 - » **Thank you, NSF!**
- Project ½ year old
 - » Startup transient not completely damped (it is hard to spend money responsibly!)
 - » Some significant contracts placed – test mass substrates, seismic isolation parts
 - » Still wrapping up development – many reviews...but things going well.

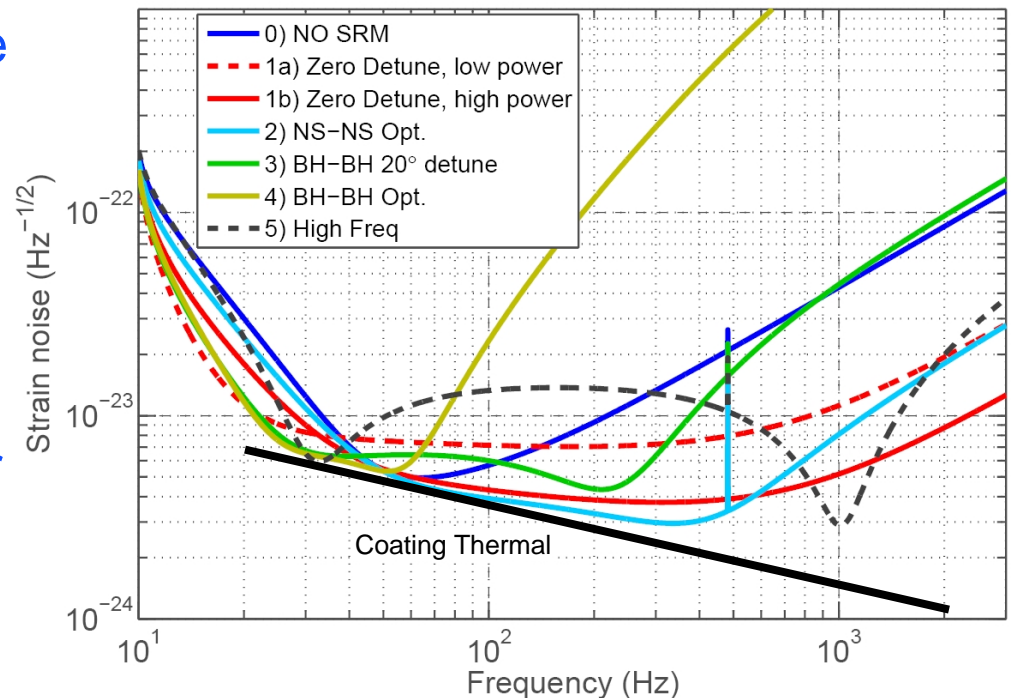




What is Advanced LIGO?

(the 'if you have been on Mars' slide)

- Replacement of all of the LIGO detector components, reuse of the facilities – vacuum, buildings
- Three 4km instruments – two at Hanford, one at Livingston
- Signal-recycled power-recycled Fabry-Perot Michelson
- Some tunability, can be used over a range of input laser power
- Limited by quantum noise at most frequencies at high input power, thermal noise otherwise





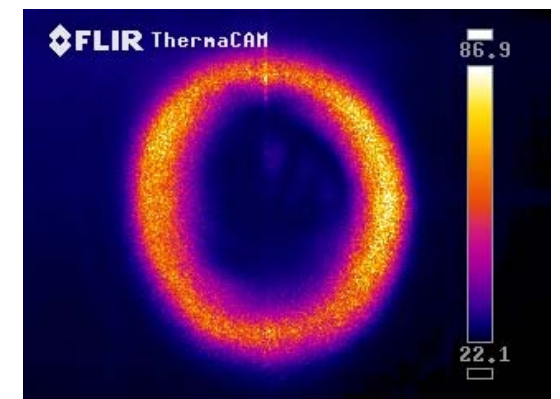
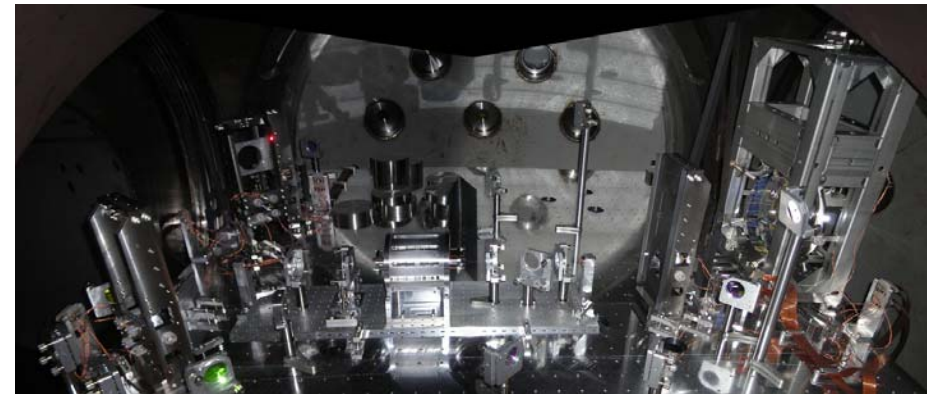
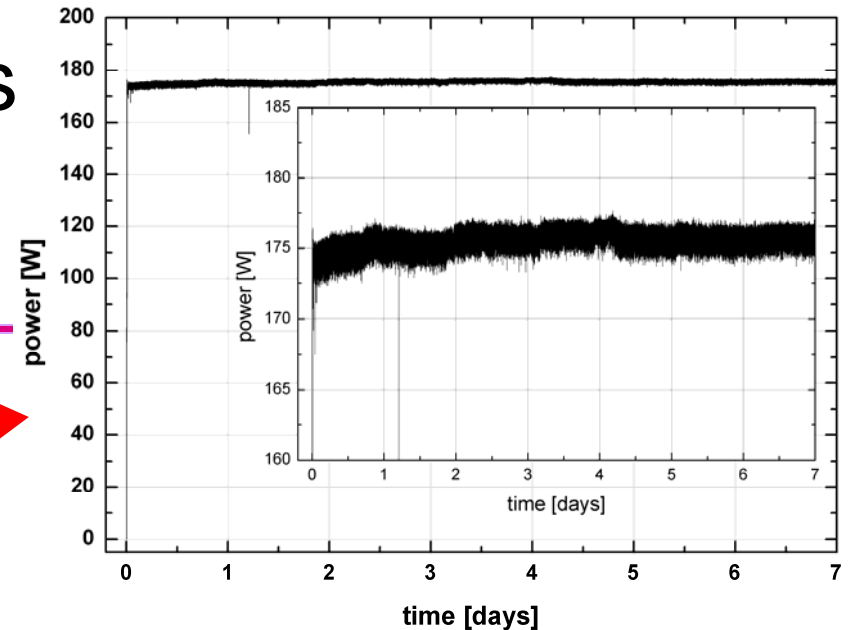
When is Advanced LIGO? (how do things dovetail?)

- 2009
 - » eLIGO installation now complete, in commissioning
 - » In parallel, AdL completes development, fabricates parts
- 2010
 - » eLIGO observes
 - » AdL manufactures, assembles, aligns, tests subsystem parts
- 2011
 - » eLIGO wraps up
 - » Maybe squeezing experiment follows at LHO
 - » Observatory shutdown as early as Feb '11, second Oct '11
- 2012 – INSTALL, integrate, test, tune
- 2013 – First Interferometer Acceptance as early as June '13
- 2014 – Second, third IFO acceptance earliest Jan '14, April '14
- 2015 on – Observe with AdL, interleaving with further tuning



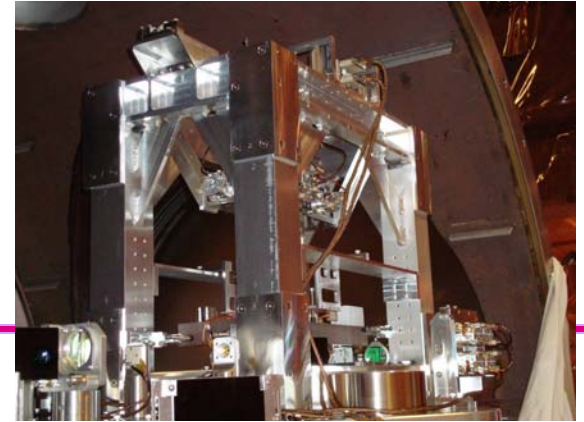
Technical Progress since March

- Laser: continuous running, characterization of 180W system
 - » Preliminary design review at this meeting
 - » 35W lasers installed for eLIGO (180W front end)
- Input Optics: completing design, acquiring components
 - » Faraday, Modulators, etc. installed for eLIGO
- Core Optics: Orders placed for Test Mass optic substrates
 - » Good progress on polishing pathfinder – exceeding specs!
- Auxiliary Optics: established IFO layout for stable recycling cavity
 - » Thermal control systems, baffling for eLIGO

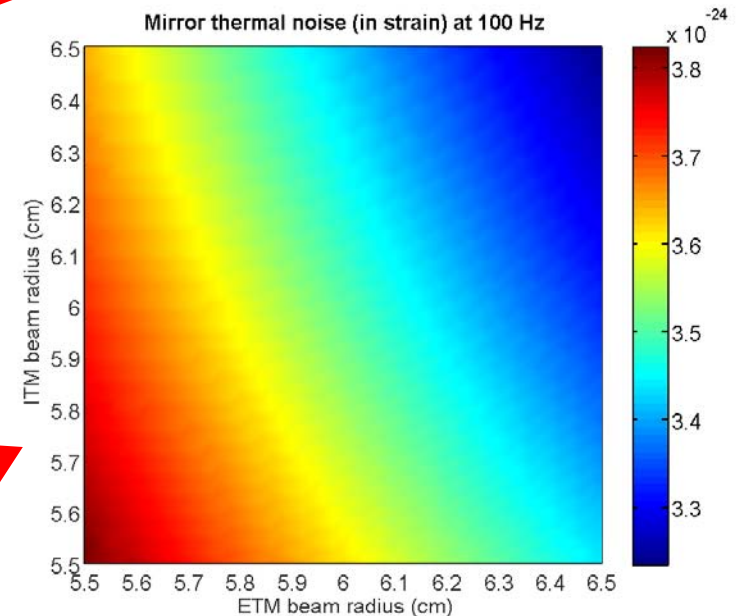
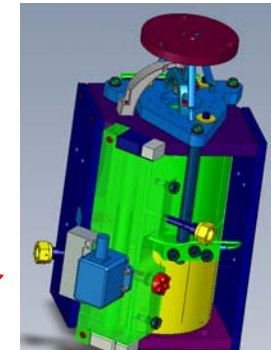




LIGO Technical progress since March



- Suspensions:
 - » Test Mass Quad in fabrication (UK)
 - » Welding techniques in development
 - » Output mode cleaner suspension for eLIGO
- Seismic Isolation:
 - » prototype BSC (test mass) isolator in tuning
 - » HAM (optics chamber) isolators operating to specs in eLIGO
 - » Fabrication of Hydraulic Pre-Isolator (LHO) underway
- Data Acquisition: Preliminary Design complete
 - » Prototype systems for eLIGO, testbeds around the world
- IFO Sensing/Control: setting up for 40m testing
 - » DC readout for eLIGO
 - » Output Mode Cleaner
- Systems, Modeling: gluing it all together





Of interest to the LSC

- Control Room software
 - » Real-time $h(t)$ to be computed by LSC; interface and hardware to be provided
 - » DTT, Dataviewer: base to remain as is; improvements, MatLab based tools to come from LSC
 - » SVN/Bugzilla to be used for Configuration Control
- Commissioning plans
 - » Objective is to get Advanced LIGO making astrophysically interesting observations as early as possible
 - » Thinking about specific approaches to commissioning
 - » E.g., start with a low-power, non-signal recycled instrument?
 - » Likely sources play a role here – e.g., IMBH binaries very attractive...what is their population?
 - » Interface with NSF-promised Project scope – need to ‘accept’ interferometers in a timely way
 - » Will be exploring this over coming year – want to get Project further along before any definitive proposal is established



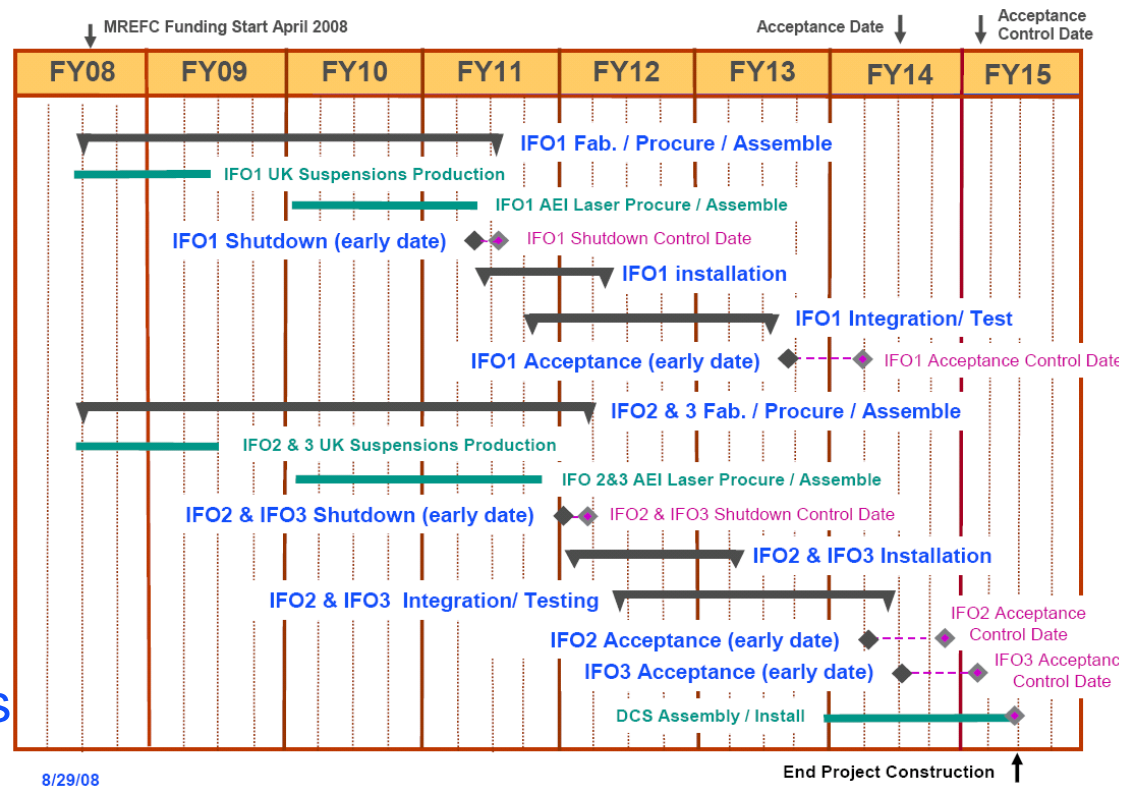
LSC participation in Project epoch

- UK, Max Planck contributions – Thank you!
- Two paths for contributions:
- All US ‘on-task’ Project effort must be supported by AdvLIGO directly, through subcontract with Caltech
 - » Present/planned: U. Florida, Columbia, Stanford, ANU, Adelaide
 - » Discussions with others underway
- Risk reduction, ‘Enhanced Advanced LIGO’ elements, post-subsystem-acceptance tuning, data quality monitors, post-project commissioning software, etc. all can be proposed directly to the NSF as independent contributions to Advanced LIGO
 - » Talk about it with us to check relevance, on/off task status
 - » Lab participation in NSF review process a final check



Next ~6 months:

- A bit of design work, and a lot of development reviews
- On the Project scope:
 - » Input Optics procures long lead items
 - » Core Optics polishing contract started
 - » HEPI fabrication mostly complete for Hanford
 - » HAM Seismic Isolation starts fabrication
 - » Site Buildings readied for assembly/storage activities
 - » UK starts deliveries of Quadruple suspensions



A busy time! We could not ask for more.