

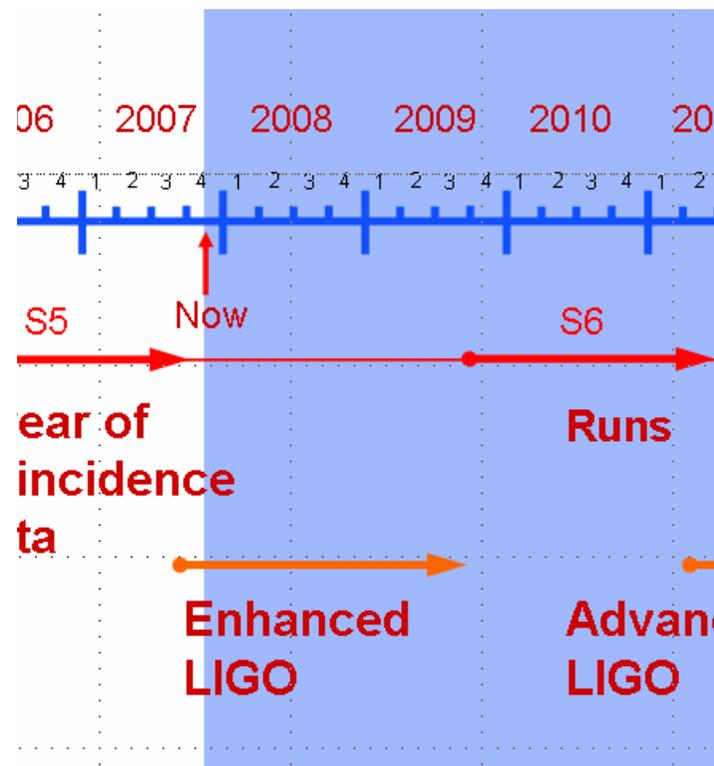
Status of LIGO and GEO

LIGO-G070892-00-Z

Matt Evans

with many slides begged, borrowed and stolen from
Mike Landry, Albert Lazzarini, Harald Lück and Bruce Allen

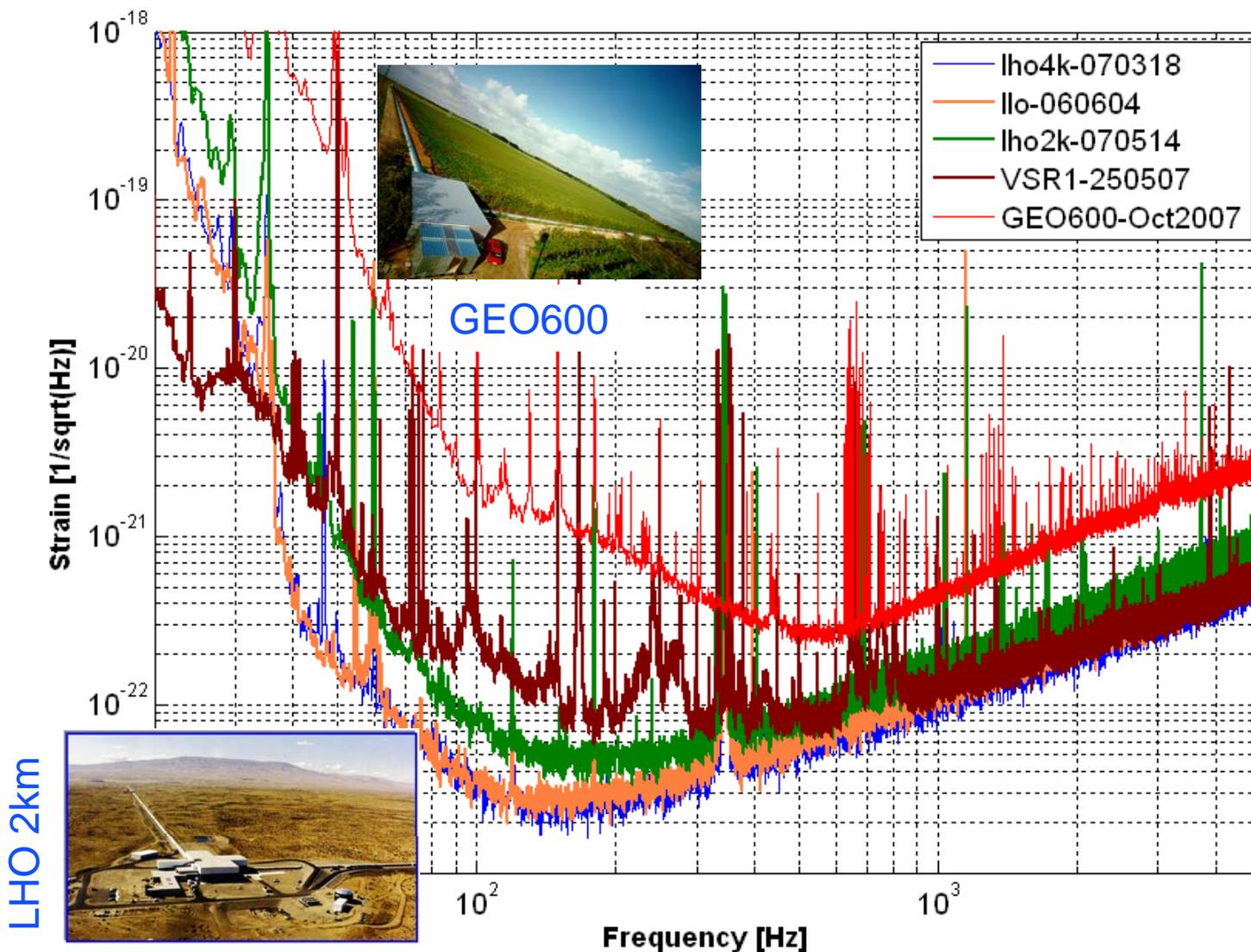
- On 21 September -- L1+H1+H2 3X coincidence exceeded 1 year of observation in science mode – S5 ended October 1
- S5 close-out activities occupied October
- Enhancements to initial LIGO (4 km interferometers) have started (Enhanced LIGO, eLIGO)
 - Installation phase until Feb 2008
 - Commissioned by Jan 2009, observe 2009-2010
- H2 (2 km interferometer) Astrowatch program in conjunction with GEO600
 - Minor improvements to H2 planned during the Enhanced LIGO installation phase
 - Provide best-effort coverage during 2008 - 2009 inter-run period between S5 and S6



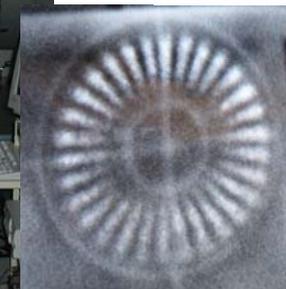
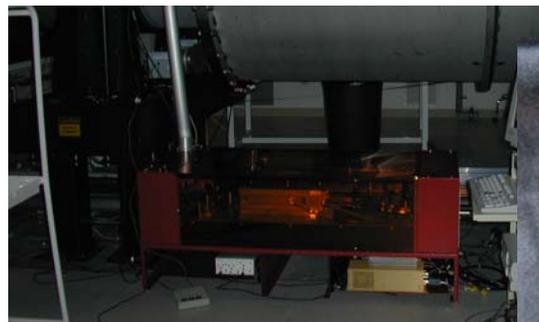
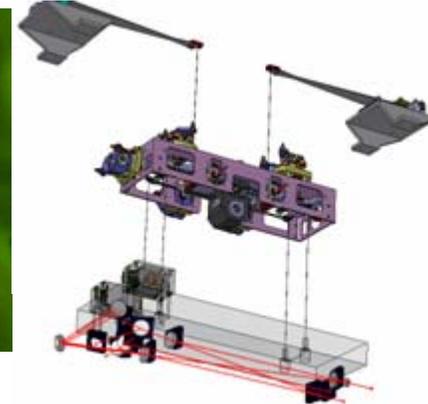
Astrowatch

- What ?
 - Science data run starting Nov. 2007
- Why ?
 - Cover the time when LIGO/VIRGO are upgrading
 - Galactic supernova rate about 1/50 years
- Who ?
 - GEO600, LIGO H2 as upgrades permit, and bars
 - Similar to S5 running conditions

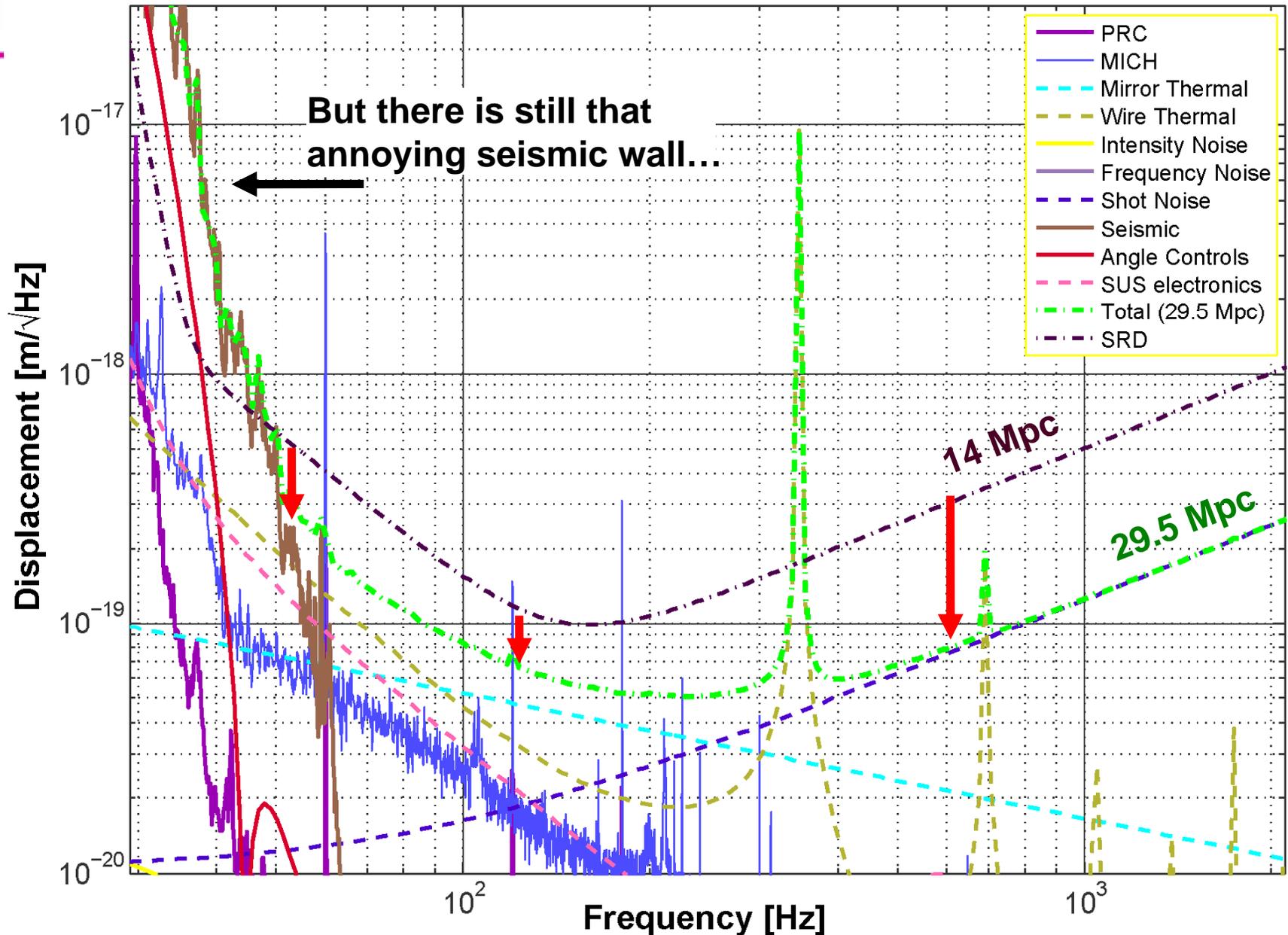
S5 Strain Sensivities of LSC/Virgo



- **35 W Laser**
 - 3.5x increase in power
 - The “front-end” of the AdL laser
 - Supplied by LZH/AEI as part of Adv. LIGO
- **High Power Input Optics**
 - AdL EO Modulators (UF)
 - AdL Faraday Isolators (UF & IAP, Russia)
- **DC Readout of GW Strain**
 - AdL readout scheme (DC instead of RF)
 - AdL Output Mode Cleaner cavity
- **AS detection in vacuum**
 - AdL HAM SEI system in HAM6
 - OMC on AdL double suspension
 - In-vac AdL photodetectors
 - Isolation septum with window
- **Thermal Compensation**
 - Upgraded power & beam shaping



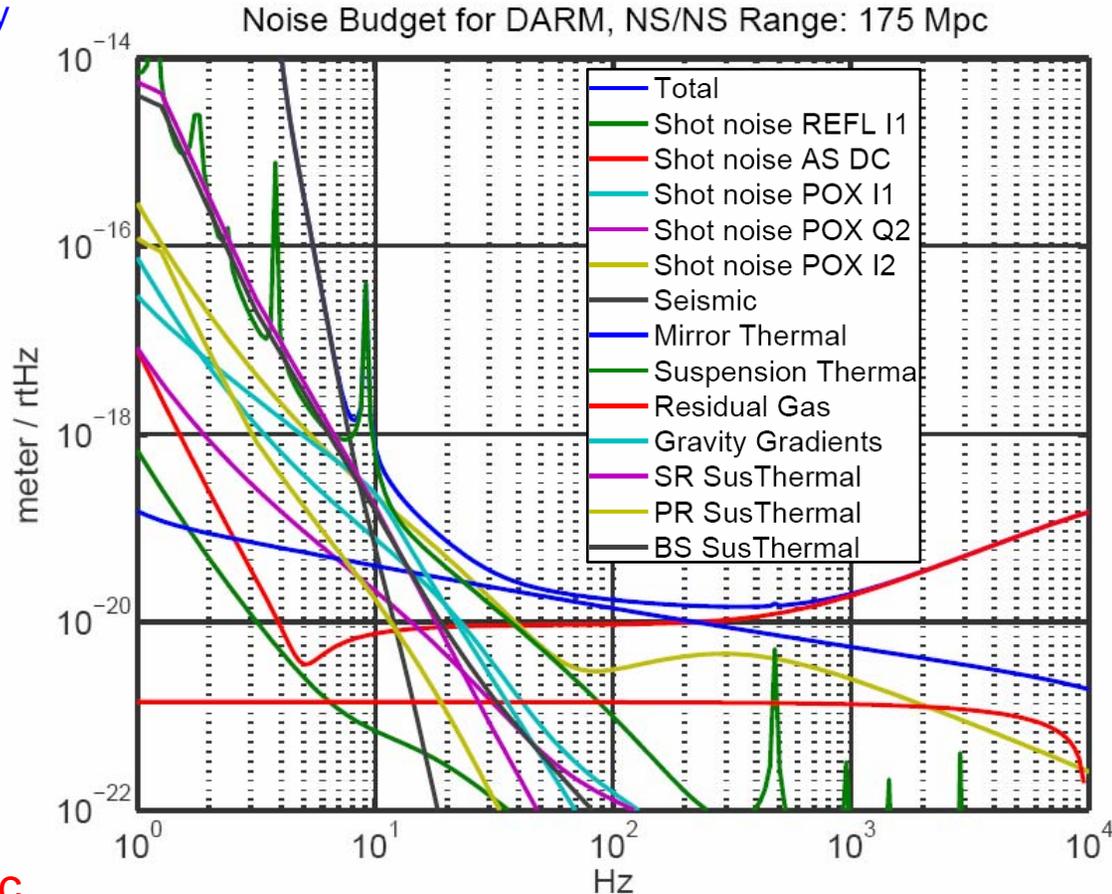
LIGO Enhanced LIGO: What do we get?





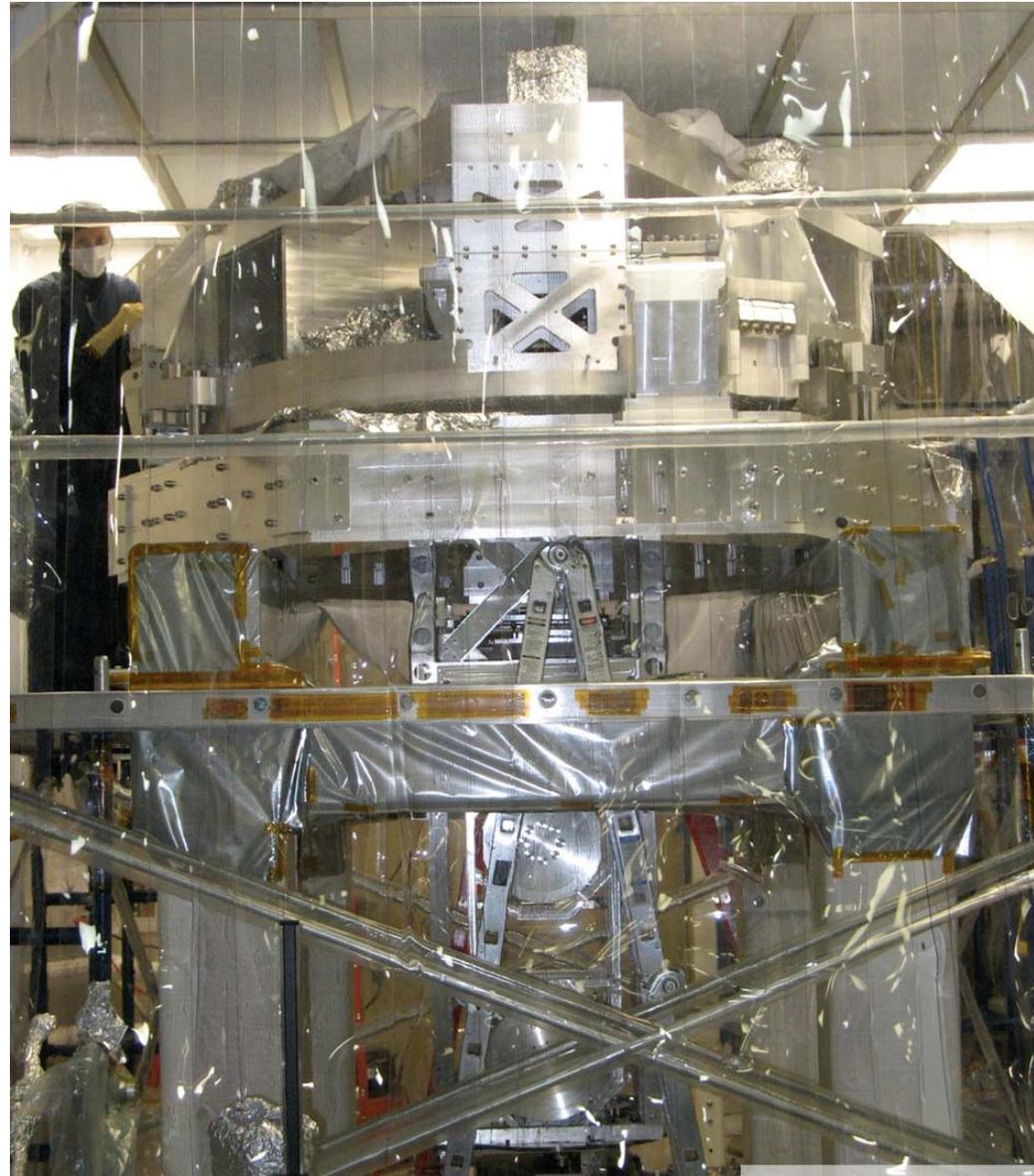
Basics

- Factor ~10X in amplitude sensitivity (over S5 Initial LIGO)
- Factor ~4X lower frequency 'wall'
- Mostly quantum limited at highest power & midrange frequencies
 - Dual Recycled Fabry-Perot Michelson
 - ~20X higher input power
 - Signal recycling → tunable
- For lower power & lowest frequencies, limited by gravitational gradient, thermal noise limits
 - 40 kg fused silica masses
 - Fused silica suspension
 - Aggressive seismic isolation
- Many of these systems will be tested in eLIGO, but the seismic isolation is new... come to LASTI and see it!



(Stefan Ballmer, broadband case)

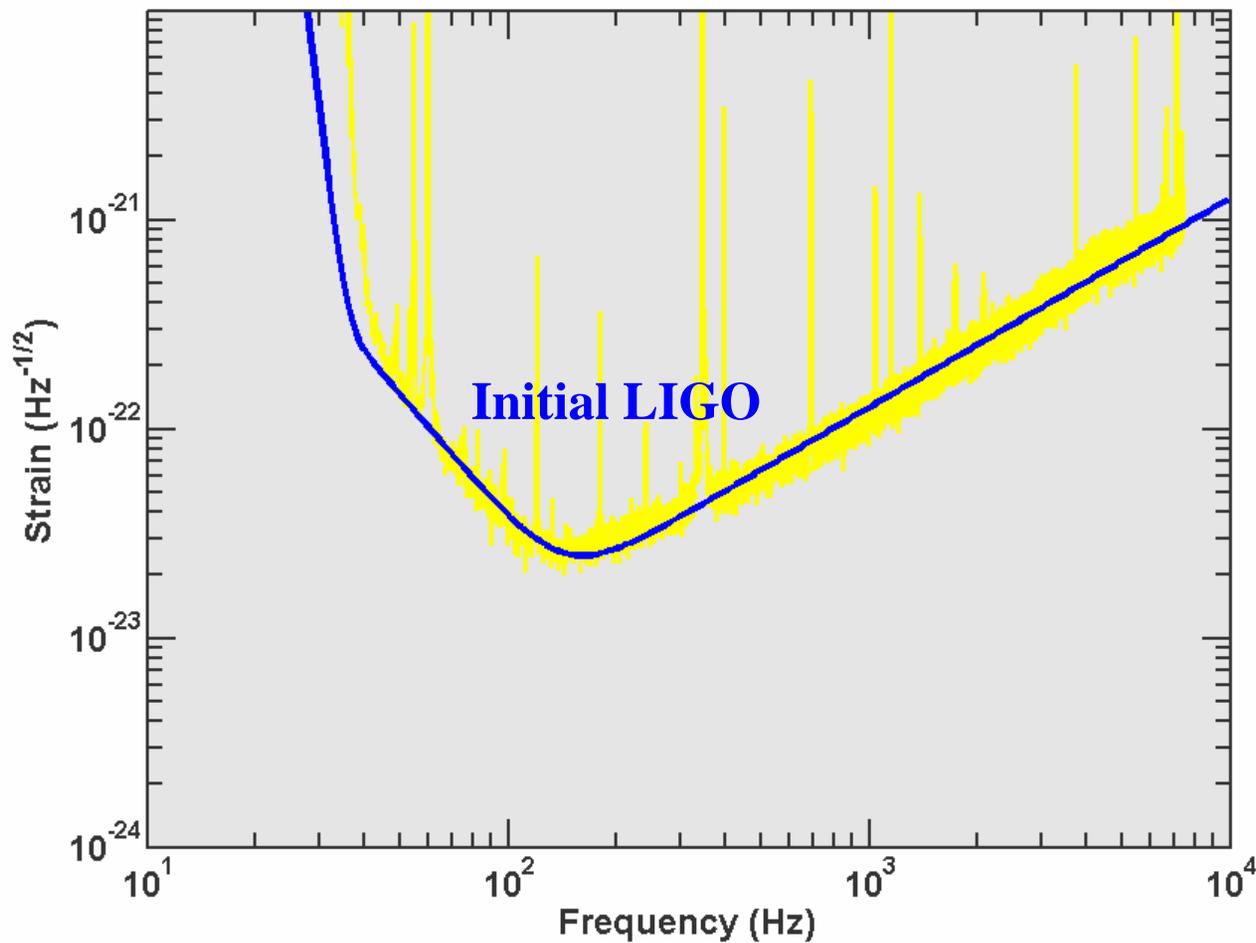
- Final prototype for Advanced LIGO BSC now being tested at MIT: 2 stages, 6 DOF per stage active control
- 12 position sensors
- 18 inertial signals: 6 L4-C, 6 GS-13 and 3 STS-2
- Mated to the quad suspension noise prototype



- Next generation quad prototype being assembled at LASTI
- Follows one year LASTI testing of full scale “controls” prototype
- New prototype includes silica bonding, ribbon manufacture & ribbon welding
- Coil-magnet drive down to penultimate masses
- Electrostatic drive on bottom stage
- 16 meter cavity locking tests will follow installation of active seismic platform and quad (Jan 08)

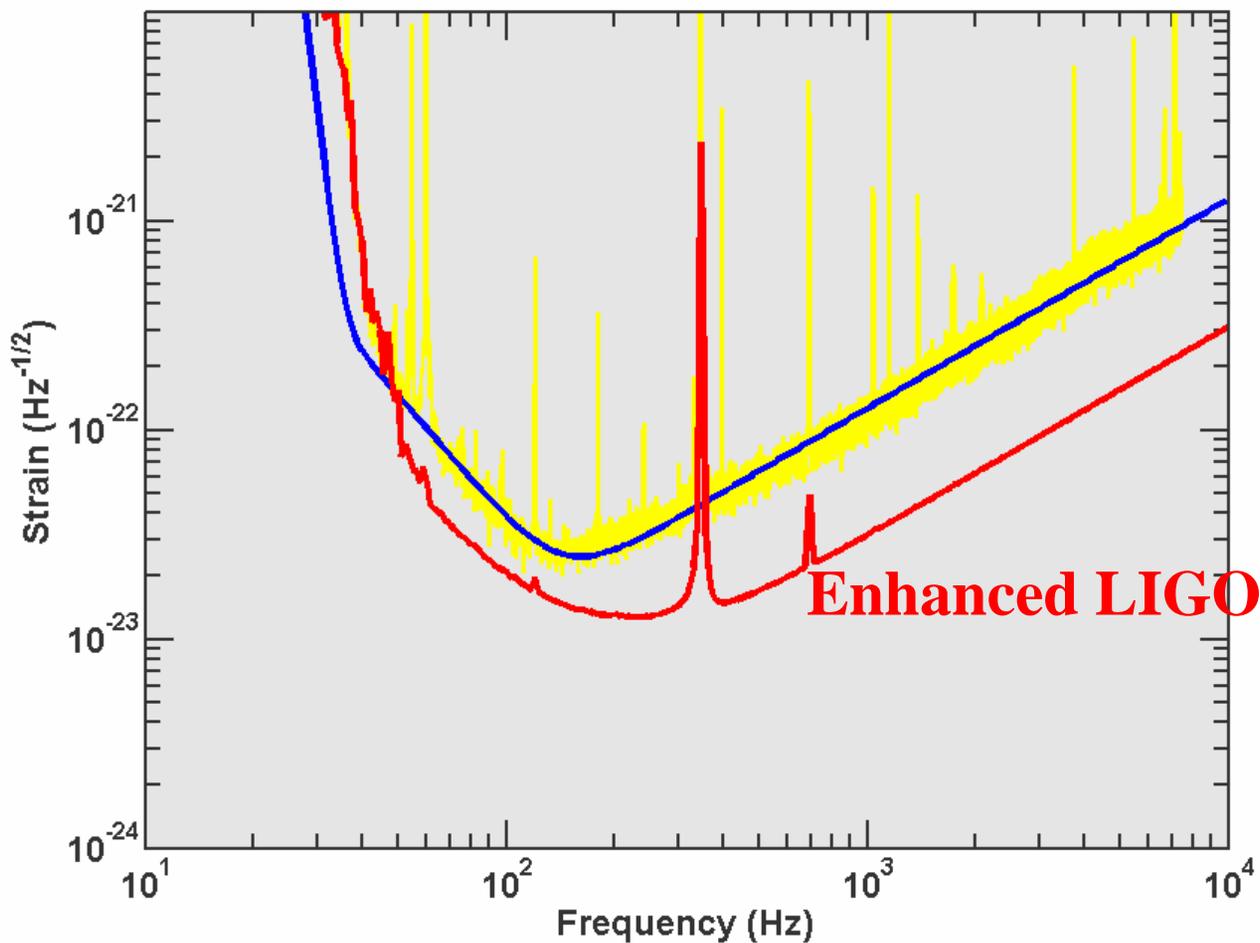


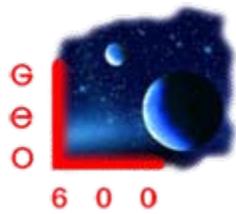
S5 ended
Oct 2007



S5 ended
Oct 2007

Enhanced
LIGO,
data in 2010

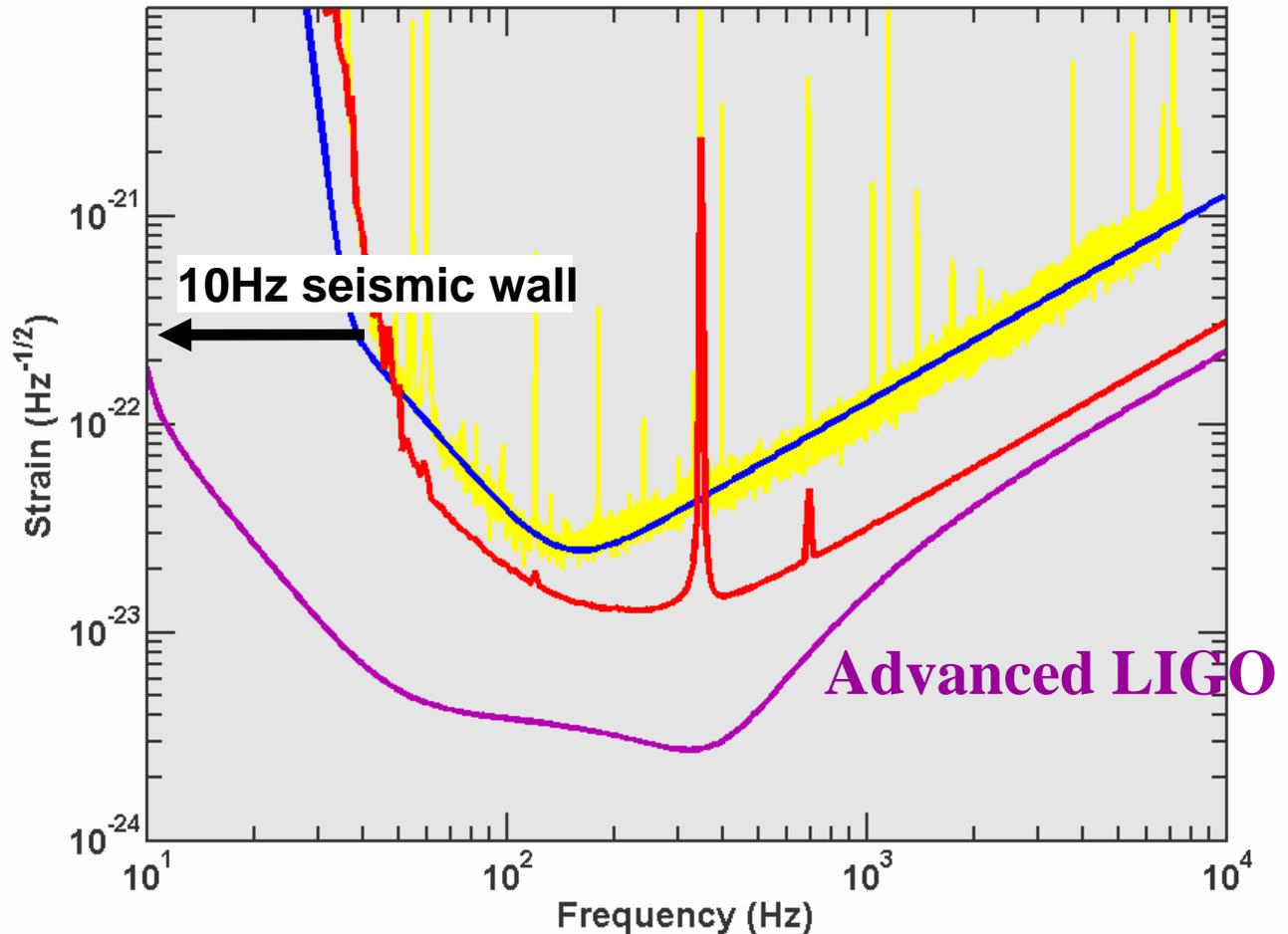




S5 ended
Oct 2007

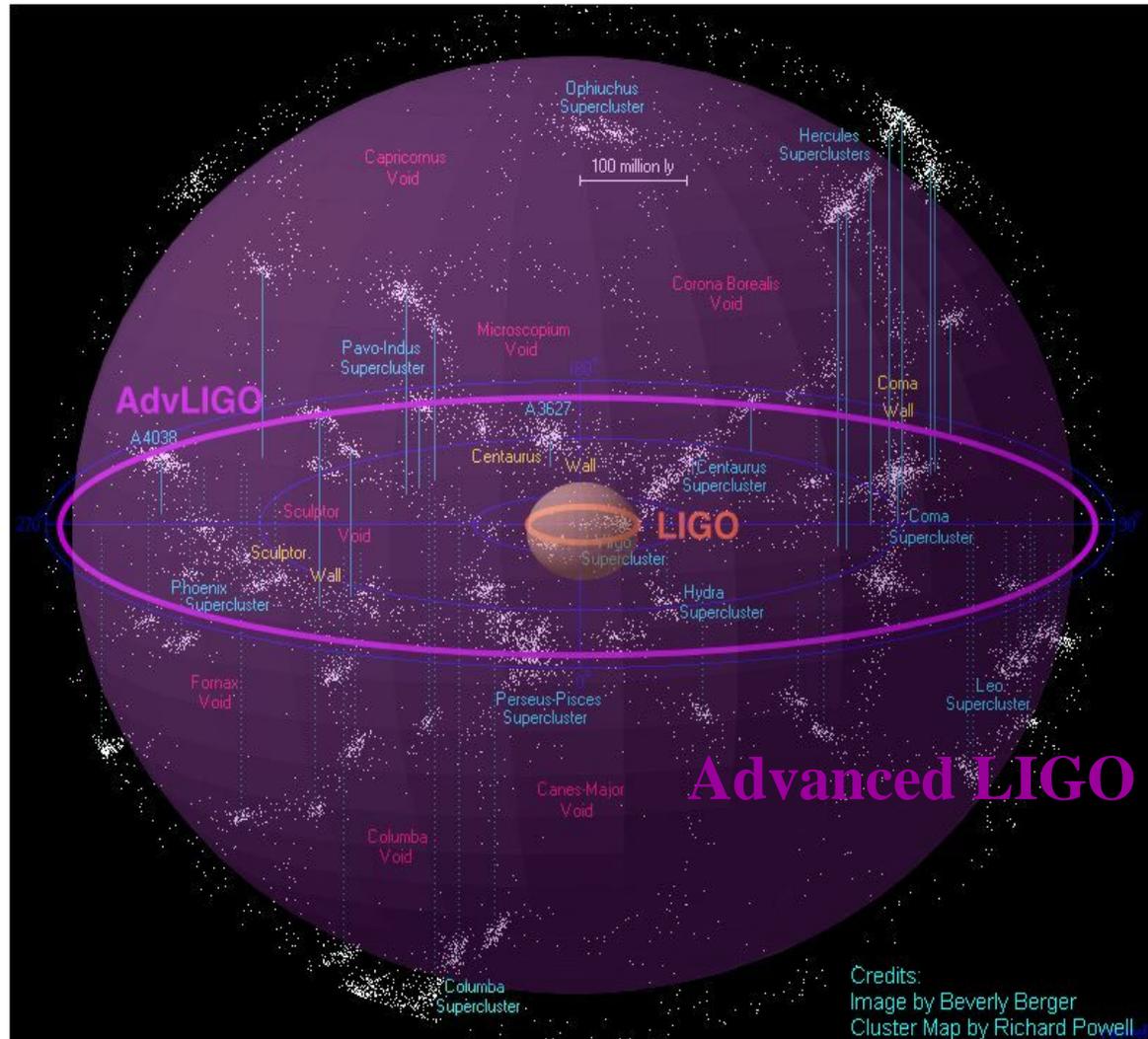
Enhanced
LIGO,
data in 2010

Advanced
LIGO, data in
2014 - 2015





*Will you be
ready for all
that space
??*



Credits:
Image by Beverly Berger
Cluster Map by Richard Powell

