



Status of LIGO and GEO

LIGO-G070892-00-Z

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

GWDAW12 – Boston, December 2007



The Post S5 Era



- 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

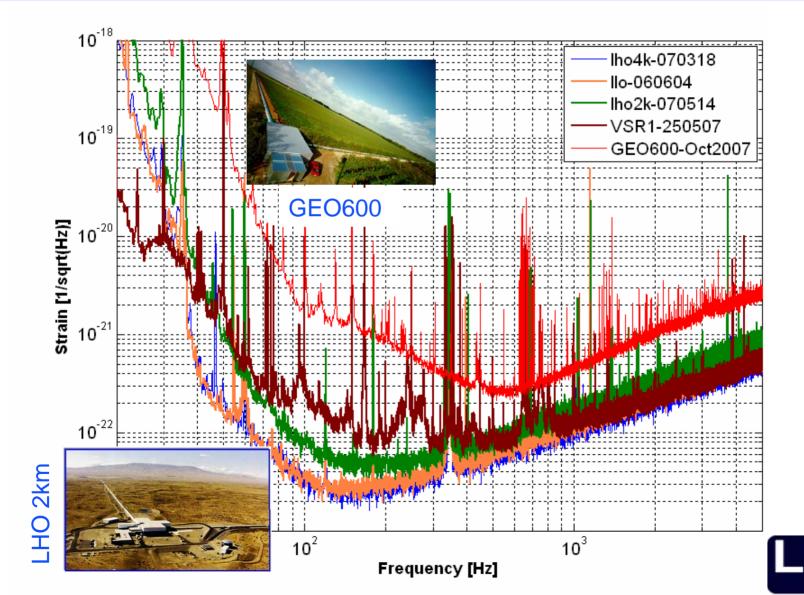
- What ?
 - Science data run starting Nov. 2007
- Why ?
 - Cover the time when LIGO/VIRGO are upgrading
 - Galactic supernova rate about 1/50 years
- Who ?

Image from members.cox.net/~k5xi/summer_milky_way.jpg

- GEO600, LIGO H2 as upgrades permit, and bars
- Similar to S5 running conditions

S5 Strain Sensitivities of LSC/Virgo





LIGO Enhanced LIGO: What's new?



- 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

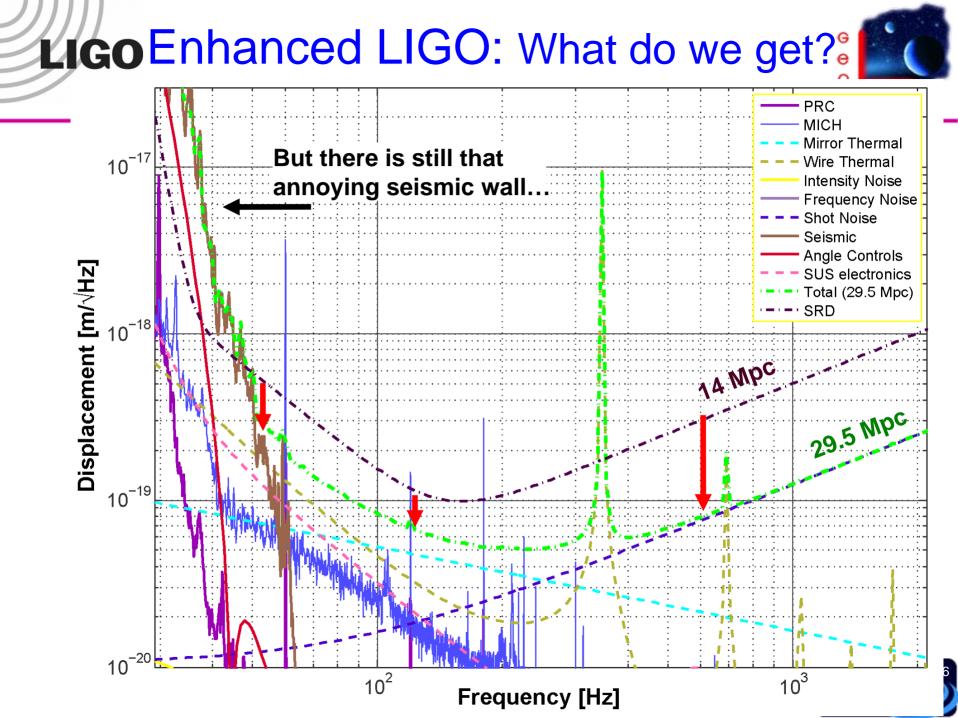
- AdL HAM SEI system in HAM6
- OMC on AdL double suspension
- In-vac AdL photodetectors
- Isolation septum with window
- Thermal Compensation
 - Upgraded power & beam shaping









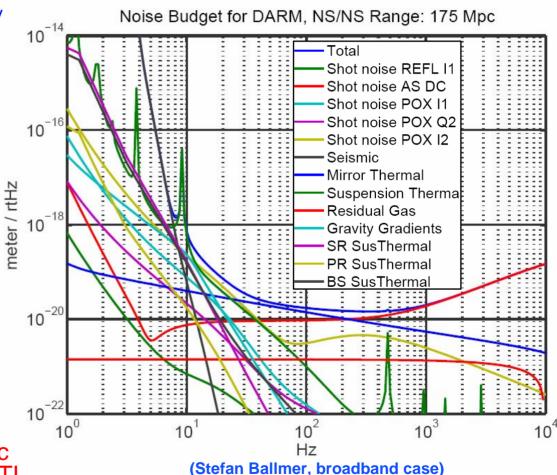




Advanced LIGO



- 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!





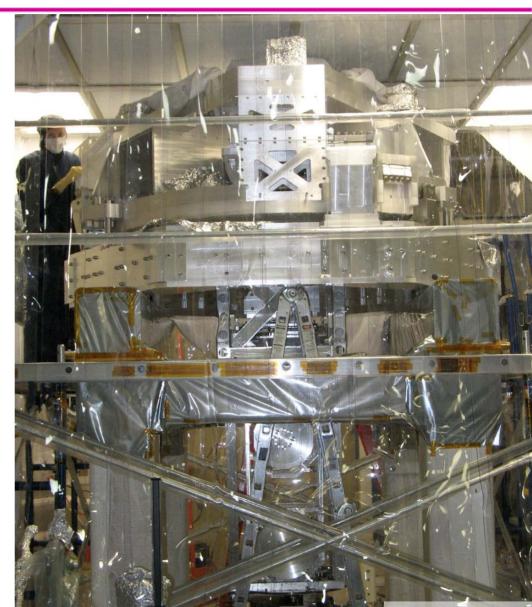
BSC seismic isolation



- Final prototype for Advanced LIGO BSC now being tested at MIT: 2 stages, 6 DOF per stage active control
- 12 position sensors

advancedligo

- 18 inertial signals: 6 L4-C, 6 GS-13 and 3 STS-2
- Mated to the quad suspension noise prototype





Quad suspension



- 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)

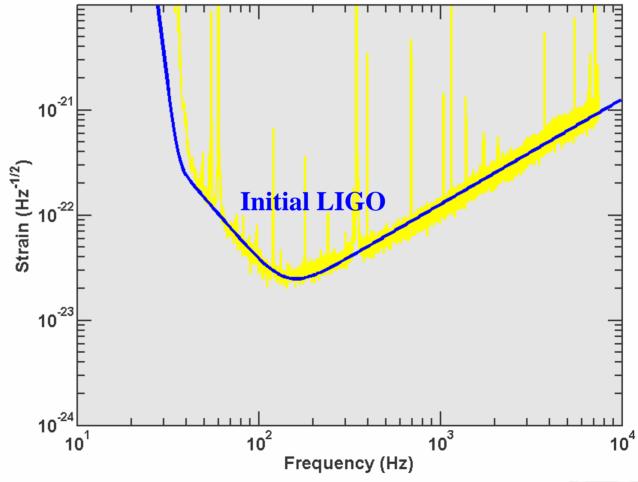




Summary



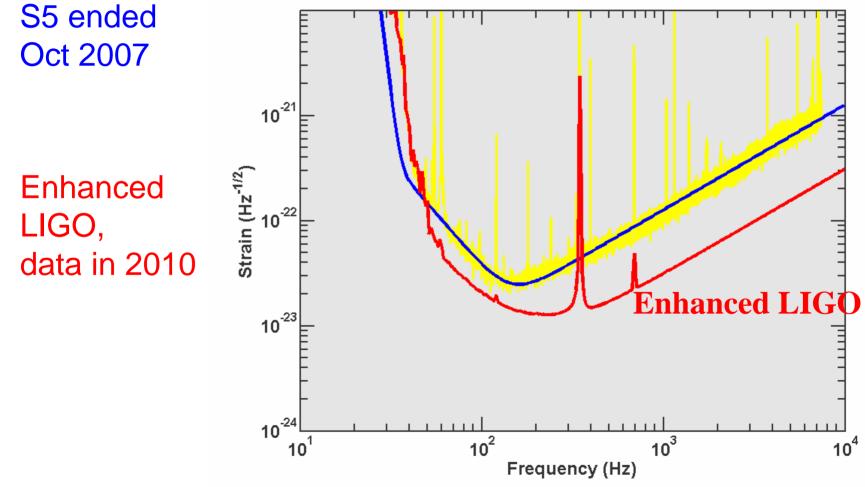
S5 ended Oct 2007









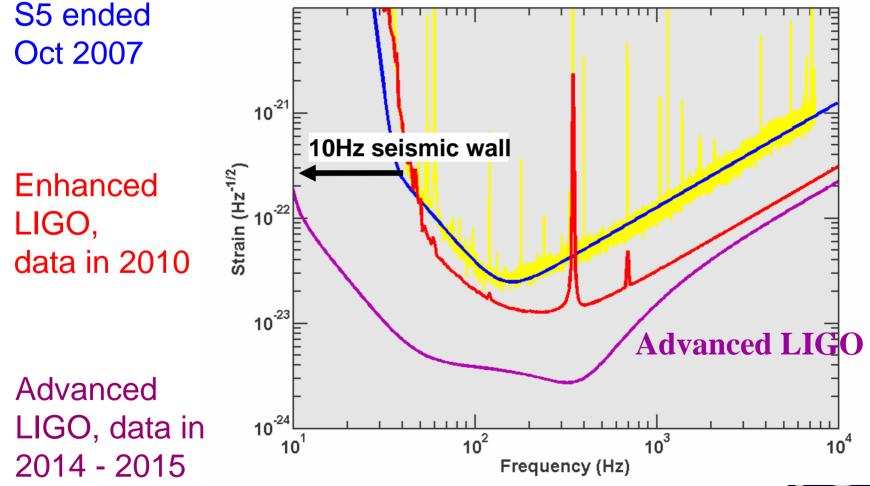










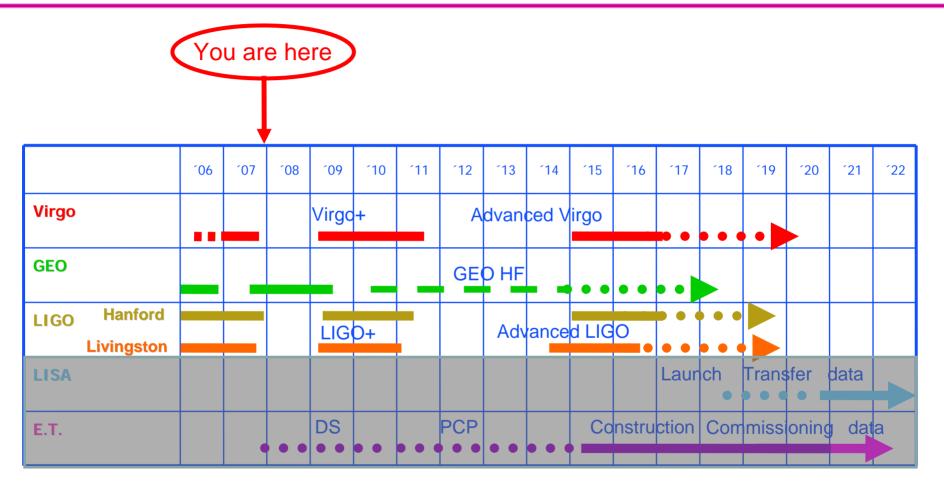




Timeline

LIGO





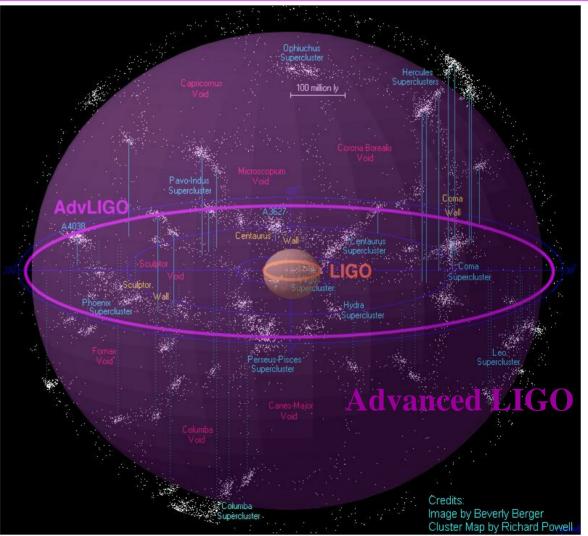
 1st Generation
 2nd Generation
 3rd Gen.







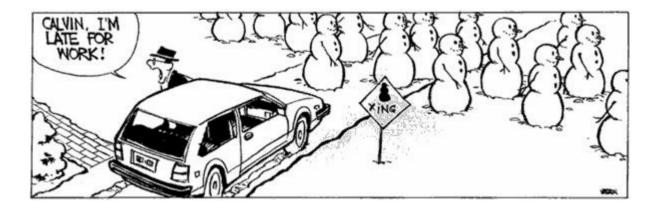
Will you be ready for all that space ??













eLIGO Schedule



	Activity Name	Start	Revised Start	rt Date	Revised Finish	%		2007 2008														2009								
		Date	Date		Date	Complete	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
1	ENHANCE LIGO INTERFEROMETERS																													
2	S5																													
3	S5 SCIENCE DATA	11/1/05	11/1/05	9/3/07	10/1/07	0.0%						Samo	•																	
4	L1 INTEGRATION & COMMISSIONING																													
5	S5 POST PUNITIO	9/4/07	10/2/07	10/15/07	10/29/07	0.0%						÷																		
6	L1 BREAK VACUUM	10/15/07	10/29/07	10/15/07	10/29/07	0.0%							• ,																	
7		10/15/07	10/29/07	10/29/07	11/12/07	0.0%								mo																
8	L1 SEI INSTALL	10/30/07	11/13/07	12/12/07	12/26/07	0.0%							<	-																
9	L1 OMC SUS INSTALL & COMMISSION	12/13/07	12/27/07	1/9/08	1/23/08	0.0%									-															
10	L1 ISC INSTALL & COMMISSION	1/10/08	1/24/08	4/23/08	5/7/08	0.0%																								
11	L1 PSL/IO INSTALL & COMMISSION												-																	
12	L1 INTEGRATED COMMISSIONING	8/19/08	7/16/08	12/26/08	1/22/09	0.0%	_		_		_									1	-		anna					mm		
13	11 SELCOMMISSIONING	4/2: 8	5	2/17/08	1/15/08	0.0%													9											
14	L1 READY FOR S6	2/26/05	2	12/26/0	1/2 /9	e																					V			
15	H1 INTEGRATION & COMMISSIONING																						- 7				Ч			
16	S5 POST-RUN LHO												•																	
17	H1 PSL/IO INSTALL & COMMSSION	11/27/07	11/27/07	4/28/08	4/28/08	0.0%								4					_	}										
18	H1 BREAK VACUUM	10/29/07	11/26/07	10/29/07	11/26/07	0.0%							•																	
19	H1 VE WORK	10/29/07	11/26/07	11/30/07	12/28/07	0.0%							C		innin.															
20	H1 SEI INSTALL	12/3/07	12/31/07	1/29/08	2/26/08	0.0%									,															
21	H1 SEI COMMISSIONING	1/30/08	2/27/08	4/22/08	5/20/08	0.0%										C														
22	H1 OMC SUS INSTALL & COMMISSION	4/23/08	5/21/08	5/13/08	6/10/08	0.0%													-	- <u>+</u>										
23	H1 OMC INSTALL & COMMISSION	5/14/08	6/11/08	7/15/08	8/12/08	0.0%														-		-								
24	H1 INTEGRATED COMMISSIONING	7/16/08	8/13/08	12/26/08	1/23/09	0.0%																-								
25	H1 READY FOR S6	12/26/08	1/23/09	12/26/08	1/23/09	0.0%																					•			
26																														
27	PATHFINDING	10/29/07	10/29/07	5/9/08	5/9/08	0.0%										PATH	FINDING													
28	SYNCHRONIZATION	5/12/08	5/12/08	8/1/08	8/1/08	0.0%														SY	NCHRONI	ZATION	1							
29	JOINT COMMISSIONING	8/4/08	8/4/08	1/9/09	1/9/09	0.0%																		JOIN	T COMMIS	SIONING				
							Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar

