

Plans for Enhanced and Advanced LIGO





Stefan Ballmer On behalf of the LSC













Stefan Ballmer, Caltech

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Enhanced LIGO Goal





Enhanced LIGO scope

- Switch to DC readout
- Upgrade to 35 Watt Laser
- A few miscellaneous things



DC Readout

- Switch to DC readout
 - In-vacuum Output Mode Cleaner & Detection bench, on...
 - Seismic isolation platform (ISI) and...
 - Double pendulum suspension
 - HAM6 isolation septum



Layout HAM6 Septum / ISI / OMC





OMC suspension



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Output Mode Cleaner (OMC)



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Tip-tilt mirrors

- Suspension for 2" steering optics
- 14.5 mrad range
- Dither at ~1kHz, 6.8urad range



Bram Slagmolen

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Laser Power

- Upgrade to 35 Watt Laser
 - Laser provided by AEI/LZH
 - New high-power IO Faraday isolator
 - Drag-whip optics (reduce absorption)
 - Upgrade Thermal compensation system



35 Watt amplifier

- AdvLIGO medium power stage
- Operational at AEI/LZH
- Integration/Tests with LIGO electronics ongoing



35 Watt amplifier prototype

• Will be shipped to Caltech in June for further characterization

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Faraday Isolator

- Needs to handle 100W without significant beam deflection
- >40dB of isolation demonstrated



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Thermal Compensation System Intensity stabilization

- CO2 laser upgrade to 35 Watt
- Requires Intensity stabilization



Tobin Fricke

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Miscellaneous

• Retrofit large optics earthquake stops (fused silica tip)



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Installation Timeline

		2007									2008												2009		
	Activity Name	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March
1	ENHANCE LIGO INTERFEROMETERS																								
2	S5																								
3	S5 SCIENCE DATA			1			Ŷ																		
4	L1 INTEGRATION & COMMISSIONING																								
5	S5 POST-RUN LLO		- 4				×	Ŷ																	
6	L1 BREAK VACUUM							Ť																	
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14	L1 READY FOR S6 (!?!)																					•			
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17	H1 PSL/IO INSTALL & COMMSSION								Δ_																
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25	H1 READY FOR S6 (!?!)																					•			
26																									
27	PATHFINDING										PATHFINDI	NG													
28	SYNCHRONIZATION													[SYNCH	RONIZATION	l								
29	JOINT COMMISSIONING																		JOINT C	OMMISSION	ING				
		April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March

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• ...see some Gravitational Waves ?

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Advanced LIGO

- If you have just tuned in...
 - Second generation of detectors in LIGO
 - ~Factor 10 in amplitude sensitivity
 - ~Factor 4 lower frequency 'wall'
- Quantum Limited at most frequencies
 - requencies [™] ■ Recombined Fabry-Perot Michelson[®]
 - ~20x higher input power
 - Signal recycling \rightarrow tunable
- Gravitational gradient, thermal noise limits
 - 40 kg fused silica masses
 - Fused silica suspension
 - Aggressive seismic isolation



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AdvLIGO News

- Summary up to March by David Shoemaker at Baton Rouge LIGO-VIRGO meeting:
 - http://www.ligo.caltech.edu/docs/G/G070066-00/

Since March

- Seismic Isolation down-select:
 - HAM-ISI (stiff, active) vs HAM-SAS (low Eigen-freq., mostly passive)
 - AdvLIGO will use HAM-ISI, because:
 - Schedule pressure, HAM-ISI is more mature
 - Expected interaction between soft system and multiple suspension

advancedligo AdvLIGO and Enhanced LIGO

- Most aspects of Enhanced LIGO involve AdvLIGO technology:
 - Output Mode Cleaner (OMC)
 - OMC suspension
 - Internal Seismic Isolation (ISI)
 - 35Watt Laser is AdvLIGO Medium Power Stage
 - High Power Faraday
 - High Power Thermal Compensation system
- Provides early test bed
 - Reduces AdvLIGO risk
 - Reduces the amount of new hardware for AdvLIGO installation
 - i.e. reduces AdvLIGO commissioning time

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advancedligo Advanced LIGO Summary

- Good progress on designs and prototype tests
- Lots of hardware already provided for Enhanced LIGO
- Advanced LIGO is on the President's FY2008 budget
 - US Congress will address US federal budget for FY2008 in the next few month

• Advanced LIGO has an ever-better chance of seeing October 2007 funding!