

What can we Expect for the "Upper Limit" Run

A Personal Reading of Tea Leaves and Stone Tablets



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LSC Meeting

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LIGO Hanford Observatory





Lab Goals

- Overall goals
 - » Bring interferometers, and data acquisition and analysis capability rapidly to the ability to collect and analyze coincidence data to address the scientific goals of LIGO.
 - » Initiate scientific running in 2002 interleaved with progressive noise and availability studies
 - » Advance both the interferometer commissioning and the commissioning of our analysis capability in a mutually balanced manner
 - » Milestone, for the use of engineering run data to exercise the complete analysis pipeline
- Definitions:
 - » Engineering runs (Ex): data taking runs that are primarily motivated by the Laboratory detector improvement program
 - » Science runs (Sx): intended to produce a data product for the LSC with scientific goals and resulting in publications



Intermediate Term LIGO Lab Planning

- “E6” run before the end of 2001 (December for two full weeks)
 - » At least one interferometer at each observatory with at least one interferometer in full recycled configuration
 - » Goal of significant locked coincidence data, but sensitivity not guaranteed
 - » Laboratory responsibility, with participation open to LSC members in the LIGO I working groups. Data available to upper limits groups
 - » Analysis goal: sensitivity curves (February), full analysis (April)
 - » if not successful, repeat the E6 run in January 2002
- S1 run May 2002.
 - » Prime purpose to carry out the first scientific searches
 - » Joint responsibility of the Laboratory and the LSC
 - » Sensitivity goal is a two site coincidence with 3 interferometers running and the achieved scientific reach 10x better than “E6”
- S2 run
 - » At least 10x improvement in scientific reach beyond S1, following completion of S1 analysis
- Interleaving of E and S runs with improved scientific reach until design sensitivity and reliability are obtained



Detector Status

- All in-vacuum installation complete
 - » Continuing installation and commissioning of control systems
- LHO 2 km interferometer
 - » Locks in recycled configuration for ~1 hour times
 - » Sensitivity $\sim 10^{-17}$ rms
 - » Working to improve both
- LLO 4 km interferometer
 - » Locked as Michelson with F-P Arms
 - » Problem with seismic noise at low frequencies
- LHO 4 km interferometer
 - » Commissioning just beginning



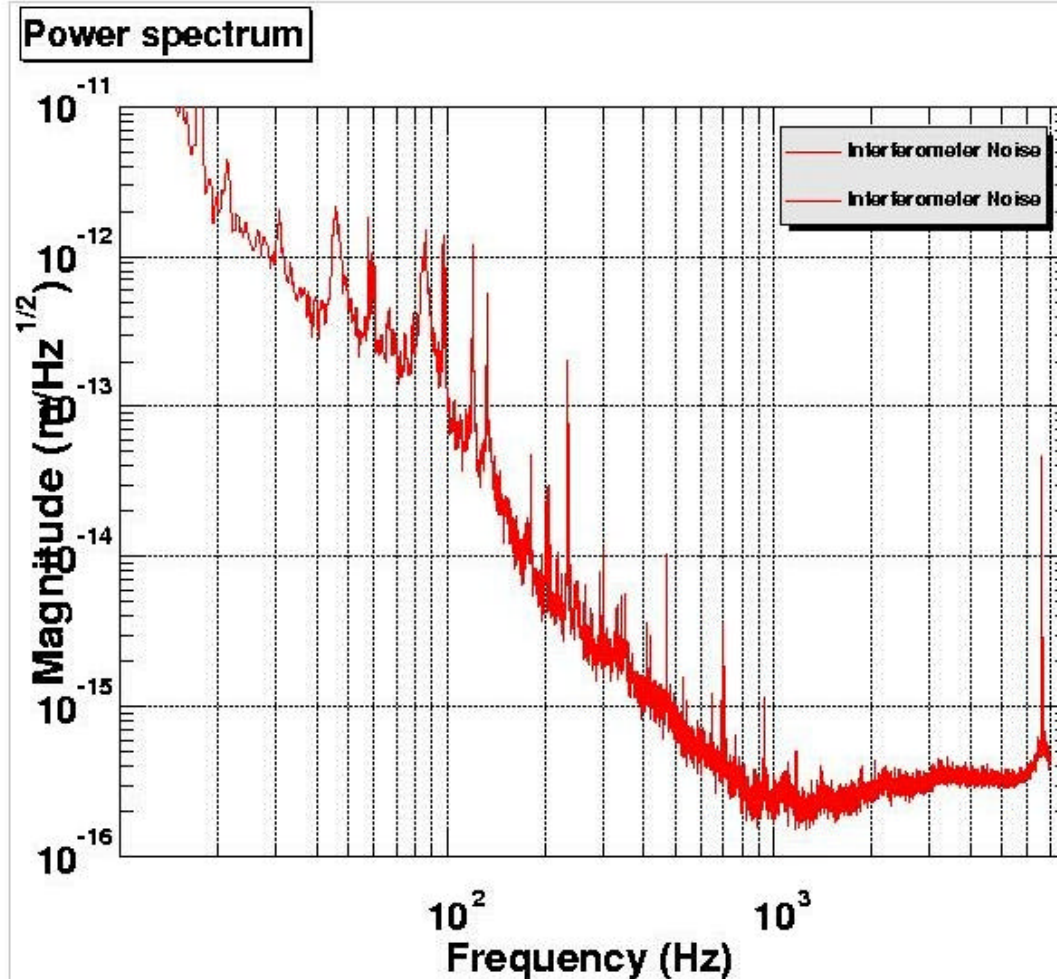
So, what will we have?

- *Expect* LHO interferometers to be operating in recycled configuration
 - » Depends on success with digital suspension controllers
- LLO may operate in recycled, or possibly just recombined, mode
 - » Final decision about 1 November
 - » Analog suspension controllers -> different channel names, noise, filtering, limits, etc.
- Expect (but do not guarantee!) up to x10 improvement over already achieved
- Most PEM channels will be operational (though of lower priority than main interferometer components)



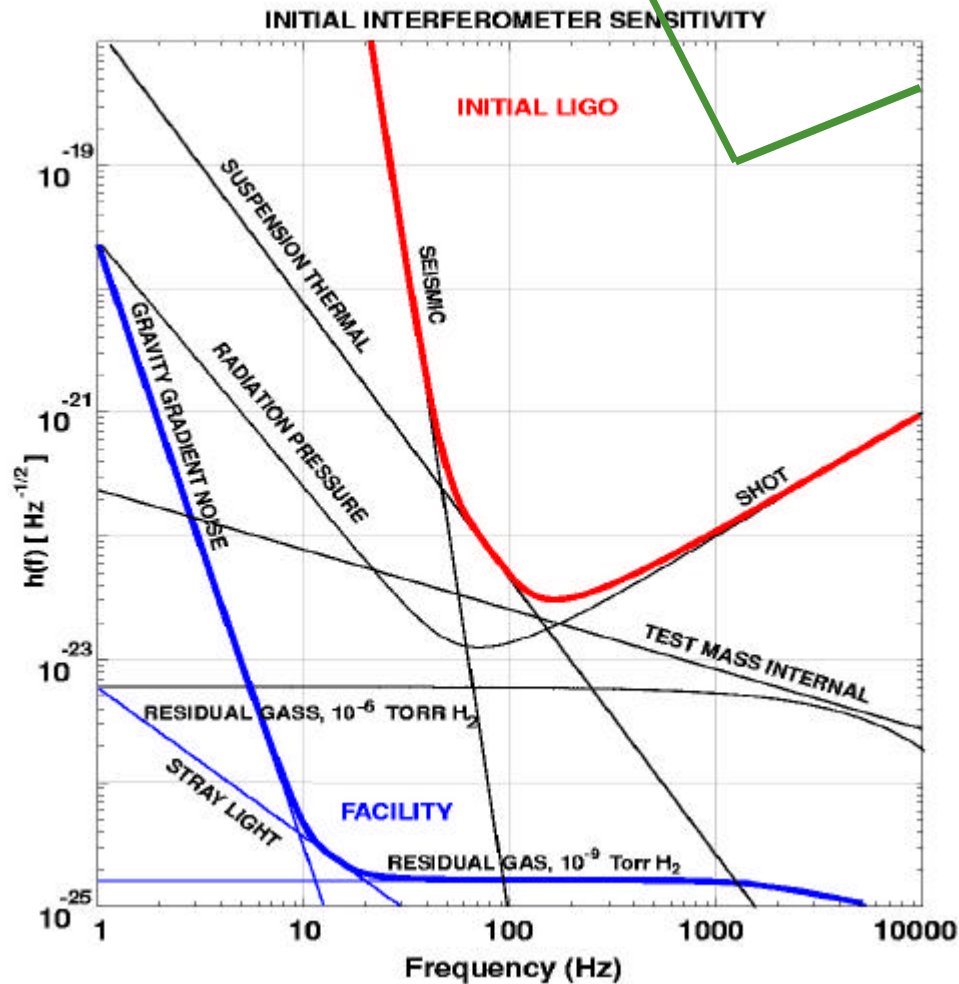
Sensitivity?

Sensitivity expected to be better than already achieved w/ 2 km





Initial LIGO Sensitivity Goal



- Strain sensitivity
 $< 3 \times 10^{-23} \text{ 1/Hz}^{1/2}$
at 200 Hz
- ✦ Sensing Noise
 - » Photon Shot Noise
 - » Residual Gas
- ✦ Displacement Noise
 - » Seismic motion
 - » Thermal Noise
 - » Radiation Pressure



When?

Option 1

Option 2
(maximal quiet
time for LLO)

December 2001							December	2001
Sun	Mon	Tue	Wed	Thu	Fri	Sat		
25	26	27	28	29	30	1		
2	3	4	5	6	7	8	←	→
9	10	11	12	13	14	15	←	→
16	17	18	19	20	21	22	←	→
23	24	25	26	27	28	29	←	→
30	31	1	2	3	4	5	←	→

Expressions of preference are welcome!



Discussion

- Questions?
- Comments?
- Complaints?