LIGO Status

Gary Sanders

GWIC Meeting

Perth

July 2001

This Talk

- Technical Status
- Five Year Plan
- Collaboration

LIGO Plans

schedule

	1996	**Construction Underway (mostly civil)**
	1997	**Facility Construction (vacuum system)**
	1998	**Interferometer Construction (complete facilities)**
	1999	**Construction Complete (interferometers in vacuum)**
	2000	**Detector Installation (commissioning subsystems)**
⇨	**2001**	**Commission Interferometers (first coincidences)**
	2002	**Sensitivity studies (initiate LIGO I Science Run)**
	2003+	**LIGO I data run (one year integrated data at $h \sim 10^{-21}$)**
	2006+	**Begin 'advanced' LIGO installation**

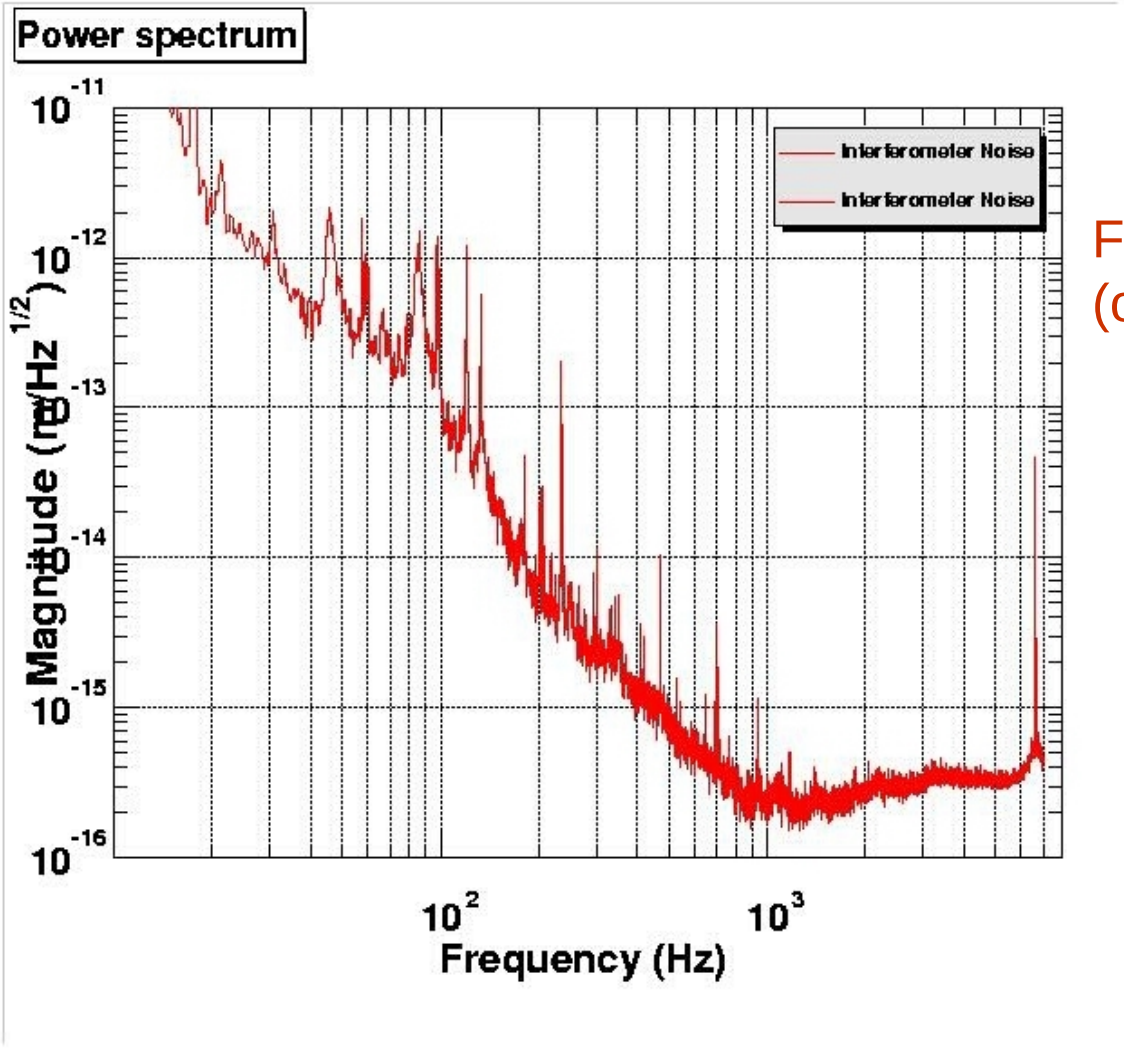
Installation Status

- LHO 2km, LHO 4km and LLO 4km interferometers
  - » All installation complete
  - » Commissioning underway
- Data Acquisition/Control Network infrastructure complete at both sites
  - » Basic functionality in place; still working on reliability, enhancements
- Olympia earthquake forced repairs and realignment of 2 km LHO interferometer
  - » Magnets broken off some suspended optics
- Commissioning beginning with higher power

Commissioning Status

- LHO 2 km interferometer
  - » Modecleaner testing uncovered problem with laser light scattering into suspension sensors – moved to lower power while redesign underway
  - » Full interferometer locked at low input power (100 mW)
    - All longitudinal degrees of freedom controlled
    - Partial implementation of wavefront-sensing alignment control
  - » Commissioning interrupted by earthquake repairs/susp. sensor replacement
  - » LHO 2 km modecleaner successfully tested to full power in last few weeks!
- LLO 4 km interferometer
  - » Careful characterization of laser-modecleaner subsystems
  - » Single arm testing complete (both arms locked individually)
  - » Recombined Michelson with Fabry-Perot arms locked successfully
  - » Repetition of 2 km integrations taking much less time than expected
- LHO 4 km Interferometer
  - » PSL and modecleaner locked, with new suspension sensors, digital suspension controllers

2 km Noise Spectrum (pre-earthquake)



Factor of 20 improvement (over E2 spectrum):

- Recycling
- Reduction of electronics noise
- Partial implementation of alignment control

Plan to Reach Science Run

- May
  - » E4 run: LLO 4 km, operating in recombined mode + LHO environmental data
- May - July
  - » LHO 2k, bring full interferometer back on-line, sensitivity studies
  - » LLO 4k suspension sensor replacement, bring back on-line
  - » LHO 4k, PRM locking (no arms yet)
- August - Sept
  - » E5: LHO 2k in full recycled configuration, LLO 4k in recombined configuration(?), LHO 4k in recombined configuration
- Sept - Oct
  - » LLO 4k, attain full interferometer lock, sensitivity studies
  - » LHO 2km sensitivity studies, 4k lock full interferometer

Plan to Reach Science Run, Part 2

- Oct - Nov
  - » E6: triple coincidence run with all 3 interferometers in final optical configuration (“upper limit run”)
- Oct – early 2002
  - » Improve sensitivity and reliability
  - » Alternate diagnostic testing with engineering runs
- Jan 2002
  - » Papers documenting LIGO detector design and performance
- Apr 2002
  - » Drafts of upper limit papers

Status of LIGO Laboratory Program and Funding

- 2001 completes the LIGO construction and early operations funding originally granted from NSF.
- In December 2000, LIGO Laboratory submitted a proposal for funding of LIGO operations, science and R&D during 2002 through 2006.
  - » This program includes support of the LSC program in observational science and analysis and advanced detector development
- Last week, the NSF Director's Review Board acted favorably on our proposal including most of the funds requested
- The National Science Board review occurs in early August
- Funding for the next 5 years for LIGO appears to be progressing well through the official process.

Advanced LIGO Construction Funding

- Working plan has been to install the first new interferometers in 2006, after completing the Science Run.
  - » This requires construction approval for the 2004 fiscal year.
- President Bush's fiscal 2002 budget delayed all new starts in the NSF (and other agencies) by one year
  - » ALMA, Ice Cubed, …
- Congress may restore one or two projects
- NSF construction projects (Major Research Equipment) likely to be delayed by one year.
- LIGO is proceeding ahead and will pay close attention to this process

Collaboration with other projects

- TAMA
  - » Isolation systems, noise and optical modeling, RSE, thermal noise,…
- ACIGA
  - » Laser, sapphire, configurations, isolation research in progress
  - » New high power test bed in preparation with LIGO participation
    - – Part of the advanced LIGO program
- GEO
  - » Extensive collaboration for advanced LIGO in lasers, suspensions, optics, interferometer configurations, modeling, system design
  - » Full partnership MOU re data sharing and analysis signed in June
- Virgo
  - » Recent addition of coating development as a joint activity
  - » Draft data sharing and data analysis MOU developed and for discussion here

“…goal is to operate as a single machine.” - Giazotto