
Description of the LIGO Laboratory

Barry Barish
LIGO LSC Meeting
Aug 15-16, 1997



LIGO Plans

- Main Activity

- | | |
|------|-------------------------------|
| 1996 | Construction Underway |
| | -mostly civil |
| 1997 | Facility Construction |
| | -vacuum system |
| 1998 | Interferometer Construction |
| | -complete facilities |
| 1999 | Construction Complete |
| | -interferometers in vacuum |
| 2000 | Commission Detectors |
| | -first light; testing |
| 2001 | Engineering Tests |
| | -sensitivity; engineering run |
| 2002 | Initial LIGO Detector Run |
| | - $h \sim 10^{-21}$ |



LIGO Physics

- First Physics Run (~2002-2004)
 - » LIGO I Development Group
 - » Initial LIGO design sensitivity $h \sim 10^{-21}$
 - » one year integrated data (~ 2 year run)
 - » data reserved for LIGO I group for two years from collection
- Enhancements/Data Taking (~2004- ?)
 - » Advanced R&D to reach $h \sim 10^{-22}$
 - » incremental improvements - LIGO II
 - » implemented from 2004, mixed with data taking
- Advanced Detector Configurations
 - » development work begins now
 - » implementation within 10 years ?



LIGO Laboratory *formation*

- Mission and Responsibility
 - » operate Hanford and Livingston
 - » assure scientific vitality of these facilities
 - » provide for acquisition of data, and systems for modeling and data analysis
 - » operate research and test facilities at sites and at MIT and Caltech
 - » support engineering design and fabrication of detector upgrades of new detector systems
 - » carry out R&D toward future LIGO program
 - » support LSC in exploitation of scientific goals
 - » review and coordinate new LIGO research initiatives

- Form a new 'Laboratory' structure to operate the LIGO facilities
 - » see description on LIGO WWW page
 - » Directorate, plus functional operational units for Hanford and Livingston Sites; Detector support, Data Analysis and Computing; Advanced R&D; Research Facilities; Technical and Engineering Support and Administration



LIGO Laboratory

LIGO Science Collaboration

- LIGO Science Collaboration (LSC) will carry out the LIGO research and development program, develop priorities, and enable participation of collaborating groups.
- It will be organized as a separate entity from the laboratory
- The LSC will communicate with the Laboratory thru spokesman (R. Weiss)

Note the Laboratory is the responsible institution for LIGO, operated through a cooperative agreement with the NSF, and through an approved structure to Caltech/MIT, including oversight .

The collaboration is created by and will be responsible to the Laboratory



LIGO Laboratory

MOUs and Attachments

- LIGO Laboratory and each LSC Collaborating Group will work together through a general MOU, plus attachments for each activity (to be updated every 6 months)
 - » the attachments describe the program of the group, the collaborating persons and FTE equivalents; and the requests and responsibilities of the laboratory
- Initial MOUs and Attachments are ALL ready to sign for each institution to be charter members of LSC
 - » 201 collaborators (160 FTEs,)
 - » 20 collaborating groups (including LIGO Labs)
 - » 37 members on collaboration council

(for comparison: CLEO @ Cornell has 25 collaborating groups and 216 collaborators)



Update on the LIGO Project

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Technical Status

facilities

- Hanford Construction (on schedule)
 - » foundation and slab - complete
 - » x and y arm beam tube, enclosure - completed this fall
 - » buildings will be completed this fall

- Louisiana Construction (on schedule)
 - » berm complete, stabilized
 - » civil construction underway
 - » beam tube production installation begins soon

- Technical Status
 - » beam tube dimensions, welding, survey meet specifications.
 - » full 2 km x arm module pumpdown successful(2)
 - pre-bake to $\sim 2 \cdot 10^{-7}$ torr
 - » bakeout planned and schedule for 1998
 - » baffles being implemented and installed



Technical Status

detector

- Initial Detector Design
 - » most subsystems in design phase (50% in preliminary design and 50% in final design)

- Detector focus
 - » Laser development at Lightwave and prestablization at Caltech - final design, reliability
 - » Core Optics - procurements
 - » Input Optics - Florida
 - » Seismic Isolation - procurements; first article
 - » Length and Alignment Sensing - design
 - » Data Acquisition/Data Analysis - design



Technical Status

data and computing

- End to End Simulations
 - » focused on 40 m and validations
- Data Analysis System (DAS)
 - » preliminary design
- Data Formats
 - » frames (VIRGO)
- Data Processing
 - » GRASP package (Allen); 40 m studies
- Detector Diagnostics
 - » being initiated
- 40m prototype data run
 - » demo and testing of DAQ/DAS systems



Status

R & D

- Transition Period
 - » LIGO I detector R&D - PNI, Recycling on 40m
 - » Advanced R&D program beginning In 1997

- Advanced R&D Program
 - » initiate during 1997
 - » LIGO Lab multiyear proposal due October '97

- Elements of LIGO Lab future program
 - » Facilities: 40m (CIT); Upgraded Full Scale(MIT)
 - » Advanced R&D toward LIGO II
 - » Advanced Detector Configurations



Conclusions

LSC formation

- LIGO Construction project on track and about 60% complete
- Hanford and Livingston Sites are now centers of activities
- Time to bring Scientific Community into reality (e.g. form LSC)
 - » LIGO I - hardware, commissioning and data analysis
 - » advanced R & D - enhancements toward LIGO II and advanced detector configurations

