THE LSC AND ITS ROLE

LIGO Operations and Scientific Research Sub-Panel

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LIGO Scientific Collaboration Member Institutions

University of Adelaide ACIGA
Australian National University ACIGA
California State Dominquez Hills
Caltech LIGO
Caltech Experimental Gravitation CEGG
Caltech Theory CART
University of Cardiff GEO
Carleton College
Cornell University
University of Florida @ Gainesville
Glasgow University GEO
University of Hannover GEO
Harvard-Smithsonian
India-IUCAA
IAP Nizhny Novgorod
Iowa State University
Joint Institute of Laboratory Astrophysics
LIGO Livingston LIGOLA
LIGO Hanford LIGOWA
Louisiana State University
Louisiana Tech University
MIT LIGO
Max Planck (Garching) GEO
Max Planck (Potsdam) GEO
University of Michigan
Moscow State University
NAOJ - TAMA
University of Oregon
Pennsylvania State University Exp
Pennsylvania State University Theory
Southern University
Stanford University
University of Texas@Brownsville
University of Western Australia ACIGA
University of Wisconsin@Milwaukee

LSC Membership and Function

- Recommended by Barish and McDaniel Committee
- Founded in 1997, now includes 35 research groups with 355 members
- Membership and roles determined by MOU between Project and Institution
- MOU updated yearly and posted
- Agreement by LSC

LSC functions

- Determine the scientific needs of the project
- Set priorities for the research and development
- Present the scientific case for the program
- Carry out the scientific and technical research program
- Carry out the data analysis and validate the scientific results
- Establish the long term needs of the field

Additional LSC roles during operations

- Maximize scientific returns in the operations of LIGO Laboratory facilities
- Determine the relative distribution of observing and development time
- Set priorities for improvements to the LIGO facilities.
- Actively participate in operations and provide scientific guidance at the sites.

Mechanisms

- LSC White Paper on Detector Research and Development
  - describes near term program and goals
  - areas of research for long range program
  - iterated as new results become available
  - second iteration
- LSC Data Analysis White Paper
  - algorithm development for astrophysical sources
  - techniques for detector characterization
  - validation and test of software
  - long range goals for software and hardware
  - first iteration

LIGO

Mechanisms

- Publications and presentations policy
  assure integrity of scientific and technical results
  provide recognition of individual and institutional contributions

- Proposal driven data analysis
  formation of groups to make specific analysis proposals
  proposals posted and open to the entire collaboration
  proposals reviewed by LSC executive committee

ORGANIZATION

- **LCS working committees**

Technical development committees

- Suspensions and isolation systems - control of stochastic forces
  David Shoemaker MIT
- Optics - reduction in sensing noise / thermal noise
  David Reitze University of Florida
- Lasers - reduction in sensing noise
  Benno Willke University of Hannover GEO
- Interferometer configurations - detector control and response
  Ken Strain   University of Glasgow GEO

ORGANIZATION

Software and data analysis committees

- Astrophysical sources and signatures
  Bruce Allen University of Wisconsin @ Milwaukee
  Barry Barish LIGO lab liaison

- Detector characterization and modelling
  Keith Riles University of Michigan
  Daniel Sigg LIGO lab liaison

- Software coordination committee and change control board
  Alan Wiseman Data analysis and software coordinator
  University of Wisconsin @ Milwaukee

GOVERNANCE and OPERATIONS

- LSC meetings in March and August

  LSC Council meeting (membership, governance…..)

- Executive committee meetings monthly

  Spokesperson, data and software Coordinator, committee chairs,
  Director and Deputy Director of the LIGO Laboratory

- Working committees meet monthly or more frequently

Astrophysical source upper limit groups

- Combined groups of experimenters and theorists
- Develop data analysis proposals

Purpose:

- Test the LIGO Data Analysis System
- Set scientifically useful upper limits using engineering data
- Publish first astrophysically interesting results from LIGO

Groups:

Burst sources : Sam Finn Penn State, Peter Saulson Syracuse

Inspiral sources: Pat Brady Univ of Wisc., Gabi Gonzalez Penn State

Periodic sources: Stuart Anderson Caltech, Michael Zucker MIT

Stochastic backgrd.: Joe Romano, UT Brownsville, Peter Fritschel MIT

- *Coincidence engineering data runs fall 2001*

Mock Data Challenges

- Test and validation of the LDAS pipeline
- Joint Laboratory and LSC function

Accomplished

8/2000: Data conditioning and pre-processing common to all searches
Sam Finn *chair* Caltech, PSU, UTB, ANU

1/2001: Binary inspiral template search using MPI
Pat Brady *chair* Caltech, UWM, UTB

Planned

3/2001: Use of relational databases to store/access/mine LIGO event data

9/2001: Use of archival system to store/access LIGO raw frame data

>5/2001: Test algorithms for all major types of searches

Examples of LSC Activities

- Process to formulate conceptual design of the LIGO advanced detector
- Upper limit to binary inspiral events from 40m prototype data
- Kalman filter string mode removal
- Time frequency technique to search for transients

More examples in breakout sessions

Conceptual design of LIGO advanced detector

- Continuing program outlined in 1989 LIGO proposal
- Initial Laboratory concept
  - reduced sensing noise -- 100 watt laser
  - reduced thermal noise and improved test mass control -- multi stage suspension
  - reduced seismic noise --- external active isolation
  - Projected result: sensitivity gain of 5 @ 100 Hz, sensitive bandwidth increase factor of 2
- LSC committee deliberations and White Paper iteration
  - Technical assessment, experience across LSC, schedule impact of change
    - change in interferometer configuration --narrow and broad band operation
    - major change in seismic isolation -- improve control and bandwidth
    - tested multi stage suspension with improved thermal noise
    - sapphire test mass option
- Projected result: sensitivity gain 15@100Hz, sensitive bandwidth increase factor of 10
- Major commitments in R&D and implementation by LSC institutions