

X-Mailer: QUALCOMM Windows Eudora Version 6.2.1.2

Date: Fri, 15 Aug 2008 10:08:57 -0700

To: Tom Carruthers <tcarruth@nsf.gov>, Beverly Berger <bberger@nsf.gov>

From: Phil Lindquist <lindquist\_p@ligo.caltech.edu>

Subject: Large Facilities Projects Monthly Report (End of July 2008)

Cc: "Phil Lindquist" <lindquist\_p@ligo.caltech.edu>,

Jay Marx <marx\_j@ligo.caltech.edu>,

"Stan Whitcomb \ (E-mail\)" <whitcomb\_s@ligo.caltech.edu>,

Linda Turner <turner@ligo.caltech.edu>,

"Thomas B. Lucatorto" <toml@nist.gov>, dcc@ligo.caltech.edu,

Albert Lazzarini <lazz@ligo.caltech.edu>,

Dave Beckett <beckett@ligo.caltech.edu>,

Dave Reitze <reitze@phys.ufl.edu>,

Joseph A Giaime <jgiaime@ligo.phys.lsu.edu>,

Deborah L Muhammad <dmuhammad@ligo-la.caltech.edu>

Subject: **LIGO End of July 2008 Highlights**

Reference: **LIGO-M080318-00-P**

## General

Enhanced LIGO progress continues, and we are on track to begin the tag-team commissioning phase, which will culminate in the sensitivities for the two four-kilometer interferometers needed for the next science run.

## LSC

The annual LSC MOU review was held at MIT on July 24 and 25. Reviewers for this year's panel were Stefan Ballmer, Peter Fritschel, Eric Gustafson, Gregg Harry, Mike Landry, Szabi Marka, Nergis Mavalvala, Maria Alessandra Papa, Fred Raab, Keith Riles, Norna Robertson, Peter Saulson, and Alan Weinstein. In addition to reviewing the progress and MOUs for LSC groups, the panel also heard a presentation on research progress and plans in the LIGO Lab. A final report has been written, and LSC groups are receiving comments from the panel.

The LSC Data Analysis and Instrument Science White Papers are currently being revised. They should be ready by mid-August.

## Publications

Published or accepted for publication:

- The Burst paper "Implications for the Origin of GRB 070201 from LIGO Observations" was published in the July 10 issue of Ap. J. V681, p1419 - the first S5 paper in print.
- The CW (Continuous Wave) paper "Einstein@Home search for periodic gravitational waves in LIGO S4 data" was accepted for publication in Phys. Rev. D. The referee noted "It is well organized and clearly written and can be published without changes."

Submitted:

- The Burst paper "First joint search for gravitational-wave bursts in LIGO and GEO600 data" has been posted on the arXiv: <http://arxiv.org/abs/0807.2834>

## **Education and Outreach**

### Livingston Observatory

#### Student Programs

- The LIGO Science Education Center (SEC) hosted 22 Southern University SMART-PAC 11th and 12th grade advanced math students, 31 LSU Science Smorgasbord Girls Scouts, 40 2nd through 5th grade students from Skills Enhancement Academy, and 15 Homeschool students and parents.

#### Teacher Programs

- We conducted three teacher professional development (PD) workshops.
- We hosted two professors from Dillard University and one professor from Louisiana State University at Monroe to discuss future LIGO teacher professional development workshops as Louisiana Systemic Initiatives Program (LaSip) partners.

#### Education Research

- LIGO SEC staff met with Marcia Carter, Assistant Director for Science, Louisiana Systemic Initiatives Program (LaSip) to discuss possible research methods and strategies to measure teacher training effectiveness and student field trip impact on learning. The intended research will be conducted with teachers and students from LaGearUP schools.

#### Public Outreach

- We conducted two public tours of the LIGO and LIGO SEC facilities. We hosted 35 visitors.

#### Staff Professional Development

- Staff attended a LSTA (Louisiana Science Teachers Association) workshop on Incorporating Literacy Strategies in the Science Classroom.
- SEC Staff attended CPR training.

### Hanford Observatory

The Hanford Observatory once again hosted "The Nature of Scientific Inquiry" (WSU Tri-Cities Teaching & Learning graduate course #571), a three-credit two week summer course for teachers that was first offered in 2004. Since 2007 the course has been the central activity of the Southeastern Washington Math Science Partnership, a collaboration that includes LIGO, with funding from the WA Office of the Superintendent of Public Instruction (via the Federal Department of Education). From 7/7/08 to 7/18/08, 27 teachers from the Pasco and Othello school districts, grades 3 through 8, participated in a variety of activities designed to improve instructional skills related to scientific inquiry. They were assisted by six teachers from last summer's program who returned as mentors. Course instruction was provided by WSU Tri-Cities' Judy Morrison, Hanford's Fred Raab, and Columbia Basin College's Todd Rogers.

## **Enhanced LIGO**

Having successfully demonstrated the DC readout (at low power) at Livingston, and the active internal seismic isolation (ISI) system and 35 W laser at Hanford, we shut down both systems this month to complete the upgrade of both four-kilometer interferometers to the full enhanced LIGO configuration.

The Livingston 35 W laser has now been installed and is performing within specifications. Livingston HAM6 (the output auxiliary optics chamber) ISI control algorithms have also been updated to the configuration developed last month at Hanford. This configuration demonstrated that it essentially met Advanced LIGO requirements, which was an important milestone.

Both sites also vented the corner stations to adjust Faraday isolation in the input optics, measure internal power budgets, and install new baffles to improve immunity to scattered-light phase noise. The end stations at Livingston were also vented to complete the SmCo-for-NdFeB magnet replacement on the end test masses (ETMs), as was previously accomplished at Hanford. The X-arm ETM is complete and back in operation, and the Y-arm ETM is being processed in the site optics lab.

Simultaneously the Hanford four-kilometer interferometer Output Mode Cleaner (OMC) and its double-pendulum suspension were assembled, tested and installed into HAM6. Performance was shown to be similar to the Livingston unit, which is now being used routinely for DC readout. Upgraded CO2 laser thermal compensation systems required for high-power operation have also been installed and are undergoing tests.

Once the respective systems have been installed and the gate valves to the beam tubes have been opened and the systems have been degassed, we will be poised to begin joint tag-team commissioning with identical (validated) hardware configurations at both sites. We hope and expect progress on increasing power and noise reduction to be accelerated by having site teams work problems in parallel.

## **Advanced LIGO**

This is a summary of activities conducted under Operations Support for the LIGO Laboratory, along with contributions from other collaborating institutions with the NSF or international support, for Advanced LIGO Development. It complements the Advanced LIGO Project Activities summary in the Advanced LIGO Project Monthly Report.

### Seismic Isolation

Through further work on the in-vacuum Internal Seismic Isolation (ISI) prototype for the auxiliary optics (HAM) chambers at the Hanford Observatory, we have demonstrated that performance levels meet Advanced LIGO requirements at all frequencies to the extent that isolation could be measured given the partial implementation (feed-forward and the hydraulic pre-isolator is not installed on this chamber). This prototype test was considered successful. Tuning of the test-mass (BSC) chamber isolation system at the MIT LASTI test facility continues and progress is also encouraging.

### Suspensions

We are now assembling the second output mode cleaner suspension, destined for the Hanford Observatory. Work continues on the design for the suspensions to be used in the new stable recycling cavity configuration, in preparation for a review in August.

### Pre-Stabilized Laser

We continue characterization of the system at Hannover, Germany, and use of the lasers in enhanced LIGO.

### Input Optics

The University of Florida group, with LIGO Laboratory support, continued aligning and tuning the enhanced LIGO elements, and the detailed design of the input optics for Advanced LIGO.

### Core Optics

The group is working on scatter measurements on the enhanced LIGO optics and extrapolations to Advanced LIGO.

### Auxiliary Optics

All baffles for enhanced LIGO have been delivered to the sites and are ready for imminent installation. We have commissioned the thermal compensation system for enhanced LIGO at Hanford, although a mirror was damaged in the process and must be replaced.

### Interferometer Sensing and Controls

We continued work on commissioning the DC readout as realized for enhanced LIGO.

### Data Acquisition System

We are preparing Preliminary Design documents for a review in August.

### System Engineering and Integration

These are now Advanced LIGO Project activities.