LSC Six-Month Progress Report

LIGO-M000105-00-M

Organization Syracuse University Experimental Relativity Group (SUERG))

Report Date 02/15/2000

Attachment A

Participation Peter Saulson -- 20% prior to 1 Jan 2000, 80% since 1 Jan 2000
Steven Penn -- 20%

Item - Task 8-a

Between 15 Aug 1999 and 1 Jan 2000, Peter Saulson traveled once each to Hanford and Livingston to participate in LIGO installation activities. P. Saulson also sat in on the weekly LLO and LHO installation telecons.

Since 1 January, P. Saulson has resided in Louisiana, and has worked at LLO as LLO Interferometer Commissioning Leader. Activities have included preliminary planning of the commissioning program for the PSL and IOO subsystems, start of preparation of training materials for operators and visiting scientists, and assisting Site Head, Mark Coles, in planning the scientific content of the outreach program.

Item - Task 8-b

Steven Penn has made several trips to LHO to coordinate his work on the Data Monitoring Tool with Daniel Sigg and John Zweizig. S. Penn's main responsibility has been testing the ability to port DMT to Linux systems.

While at LHO, S. Penn has also participated in the effort to diagonalize LIGO I suspensions.

Attachment B - Isolation/Suspension/Thermal Noise

Participation Peter Saulson -- 80% prior to 1 Jan, 20% since 1 Jan
Steven Penn -- 80%
Gregg Harry -- 100%
Andri Gretarsson -- 100%
Scott Kittelberger -- 100%

Item - Task 8-a

The group co-wrote a paper (with members of the Glasgow group) on surface losses in fused silica fibers and ribbons, and how they enter into the design of LIGO II suspensions. This work was led by Gregg Harry and Andri Gretarsson.

A. Gretarsson and G. Harry also carried out calculations on how to scale surface losses from measurements in fibers or other thin samples up to expected thermal noise in full-size test masses.

In addition, a system for measuring how the Q of fused silica fibers vary with temperature was built. A fiber sits inside an oven that can be taken anywhere from room temperature to 500 degrees C. The measurement of fiber Q at temperatures up to 80 C was started.

Item - Task 8-b

This item is on hold, pending improvements in the anelastic aftereffect apparatus. (See Item 8-d, below.)

Item - Task 8-c

G. Harry has led the program in measuring losses in coatings laid down on fused silica substrates. G. Harry carried out Q measurements on thin fused silica slides, both before and after they received an REO high reflectivity coating. The measurements showed noticeable degradation of the Q. These results suggest that coating losses might add significant thermal noise, compared to that of a hypothetical LIGO II fused silica test mass of Q = 3 x 10^7. Results of this phase of the experiment were presented at the Amaldi meeting, and will appear in its proceedings.

To address questions about whether lack of a superpolish on the slides might have skewed the result, G. Harry has now embarked on a new series of measurements, with the assistance of Sheila Rowan. G. Harry has obtained a superpolished blank of fused silica, to which S. Rowan bonded a small "ear" using the silicate bonding technique. G. Harry has now hung the sample from a fine fused silica fiber welded to the ear, and is about to measure Qs of the uncoated sample. Subsequently, the sample will be coated by REO, and the Qs will be compared to search for excess loss.

Item - Task 8-d

William Startin has just defended his thesis on this task. In that work, he and Steven Penn substantially advanced the performance of the anelastic aftereffect technique. Measurements with a statistical uncertainty in loss angle of a few parts in 10^8, at frequencies of 1 Hz can now be achieved. Unfortunately, moving to this level of sensitivity also revealed signs of systematic errors in measured loss angle of a few parts in 10^7. The source of these errors appears to be in the way the samples in the apparatus are supported.

New graduate student Scott Kittelberger has been working with S. Penn to address this problem. They have designed a new vise for squeezing the sample, to make it easier to align; this in turn will allow use of much more compliant sample suspension techniques, such as a fine wire suspension system. They are also working to carefully balance the forces from the two PZT actuators that do the squeezing. It is hoped that the influence of the sample support will be removed, and that believable measurements of the anelasticity of the samples will be feasible.

Item - Task 8-e

Graduate student A. Gretarsson now has a conceptual design for the violin mode sensor. He will perform measurements on a pendulum that has its rigid-body body modes electronically damped, rather than relying on a fast steering mirror to track a swinging pendulum. A. Gretarsson has successfully built and damped such a pendulum. He is about to start on construction of the sensor itself.

Item - Task 8-f

Activity on this item has mainly consisted of informal discussions with other members of the Suspension Working Group.