

LSC Six-Month Progress Report

Organization Louisiana State University Experimental Relativity Group (ERG) **LIGO-M000043-00-M**

Report Date 02/15/2000

Attachment A - LIGO I

Participation

Item - Task 8 - a) Seismic Isolation and Suspension

Joe Giaime directed Andrea Stolte in measurements of the transmission function of the first isolation stack at LLO. There is a report in draft form. A graph of these results was shown by Al Lazzarini at GWDAW.

Item - Task 8 - b) Data analysis for detector characterization

A prototype has been written for an algorithm for generalized signal extraction, based on an FFT methods and Wiener filtering. A simple algorithm to allow multiday tests of A/D data integrity has been prototyped, and tested on a PEM system. It has been found, using new seismic data from Livingston, that a time-frequency analysis, based on octave analysis, appears to be able to classify and quantify many types of seismic noise. All three will be presented to the Detector Characterization Group.

Item - Task 8 - d) Supernova monitor

No work has yet been done on a LIGO-based link to the Neutrino detector supernova monitor, because R. Svoboda has been too busy working on the Kam-land neutrino detector upgrade, which was just recently funded.

Item - Task 8 - Detector Characterization

The LSU group has begun work on familiarizing itself with the problems of detector characterization, and has promised to prototype several numerical techniques that have proven to be useful with Cryogenic Detectors.

Item - Task 8 - Detector Installation

During this period, Joe Giaime has become a detector installation director, sharing the job with Dennis Coyne. This involves about 50% of Joe's time.

Item - Task 8 - e) Detector Installation

Joe Giaime continues as part-time installation director (50%)

Item - Task 8 - Physical Environment Measurements - Magnetic Noise

A report on AC magnetic noise was given at the LSC meeting in February by Warren Johnson about measurements at LLO. The question is whether the noise meets LIGO-I spec or not. Spectra of the magnetic gradient were presented at a number of locations outside the BSCs at the Yend station and the corner station of LLO. The conclusion was that there was

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quasi-broad band AC noise at the corner station, generated by some kind of machinery, and that it MAY be well above the specification for mechanical noise coupled to the test masses. Whether it is really above spec or not depends on how much magnetic shielding is provided by the BSC walls, how closely the magnets on the optics can be matched, and especially on whether the *second* gradients of the AC fields are as big inside the chamber as they are outside.

Item - Task 8 - Physical Environment Measurements - Seismic Noise

In the early spring, Mark Coles occasionally observed a very large but narrow noise peak in the seismic spectrum at Livingston. This noise came and went, and was suspected to be caused by the oil pipeline. An experiment was set up by Warren Johnson, using the PEM data acquisition system developed by Shourov Chatterji of MIT, to continuously measure the seismic noise at the Yend station to document how often this signal came and went. About 5 days total of complete time records were recorded on disk. Another ~5 days were recorded by Joe Giaime on chart paper at the Xmid station. No instance of the large noise was seen during all these measurements, so it was concluded that this noise source was now gone. No further data was taken. There has been no writeup of these results.

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Attachment B - Isolation/Suspension/Thermal Noise

Participation

Item - Task 8 - a) LSC Suspension and Isolation Working Group

Giaime has spent 50% of his time on heading up the stiff-spring isolation team. The team finished much of the design phase, and is now in construction phase. Extensive documentation of these wide effort is in preparation for the review committee.

Extended measurements of the seismic noise have begun at LLO, by Michelle Kingham and Dan Busby, with assistance by Joe Giaime and Warren Johnson, to determine what are the extreme seismic noise conditions that a LIGO-II system will realistically encounter.

Item - Task 8 - Active Isolation for Ligo-II

Joe Giaime and Warren Johnson attended the isolation suspension summit at MIT in May. Joe was appointed 'head' of one of the two competing isolation design groups, the so-call stiff isolation team. They are working on design and construction of a 'Rapid Prototype' for demonstrating that an active system, similiar to the JILA active isolation system, can be made robust.

Item - Task 8 - b) Cryogenic Suspension

The direction of research on cryogenic suspension has taken a new turn, in response to the considerable success demonstrated by the Japanese group formed to promote the LCGT, or Large Cryogenic Gravitational Telescope. At the TAMA conference in October they demonstrated solutions to many of the problems that LIGO personnel had thought would be show-stoppers for a cryogenic suspension. We are adjusting our program to make good use of their research, in particular, assuming that cold mirrors (~20 K) are now the better choice.

Item - Task 8 - c) Transient Noise Measurement

Construction of a facility to measure transient noise in LIGO components by J. Giaime has been deferred, due the the start of reconstruction of the Physics building at LSU. This activity may be moved to LLO.

Item - Task 8 - Cryogenic Suspension

At the end of this reporting period (August 99), the NSF awarded the first small grant for research on cryogenic suspensions for a future interferometer. Warren Johnson and Phil Adams will now begin measuring mechanical Q's of material suitable for a cryogenic suspension, and figuring out how to make a LIGO-II type suspension work in a cryogenic system.