

LSC Six-Month Progress Report

Organization University of Florida Laser Interferometric Gravitational Wave Group

Report Date November 1, 2003

Attachment A

LIGO I Development Group

LIGO I – Progress Report 8/02-11/03

Commissioning of the LIGO Livingston and LIGO Hanford Observatory interferometers

1. Joint LLO/UF scientists positions (Amin, Franzen) – during the past year, UF has hired two scientists based permanently at LLO.

2. LLO Commissioning (Amin, Franzen, Rakhmanov, Reitze):

a) General commissioning activities: Repair IO optical components such as EOMs; PSL repair activities such as installing a new pre-mode cleaner, new laser power supply, and laser heads; in addition, diagnosing rapid oscillations in reference cavity mixer signals at the onset of instabilities and calibration of the photodiodes monitoring the PSL and IO chain; rebuilding and realignment of ISCT 1; improve alignment in the various ISC and IO tables as necessary. Built and operate an optical RF setup to assess the RF quality of the recently installed anti-symmetric port photodiodes.

b) Implementation and characterization of the wavefront sensors (Amin): assisted bringing the final part of the angular sensing and control system online. Nightly activities consist of attempting to close WFS feedback loops to their respective core optics while increasing feedback gain and bandwidth. In addition, perform RF calibration and continuing electrical diagnostics of problematic WFS sensors.

c) The e2e code was used to try to understand the measured ratio between the ASQ response from wiggling of the ETMs in differential mode and the RM respectively. The measured ratio was found to be lower than expected and one result of my simulation indicates that this might be related to asymmetries in the ETM coatings.

d) Force-to-pitch digital filters were constructed, installed and tested to reduce the coupling between the large optics piston and pitch movements. The filters were successfully implemented on all the large optics and also at the mode cleaner.

3. LHO Commissioning (Rakhmanov):

a) Installation of the new pre-modecleaner, replacement of the EOM and alignment of optics on the PSL table.

b) Measurement and analysis of high-frequency dynamic responses of the LHO 4-km arm cavities. These dynamic responses were then used to determine various cavity parameters including the cavity length and the resonance width.

c) Development of a new technique to measure the interferometer arm cavity lengths, which allowed us to reach the precision of 80 microns.

d) Measurement the arm cavity g-factors; from these measurements, we were able to infer the mirror radii of curvature for the first time.

4. Other activities (Williams, Tanner)

a) Completed revisions of most LIGO Input Optics drawings and submitted to the DCC.

5. Investigations of lock loss (Whiting): Examined AS_Q and other channels to determine sequence of events leading to loss of lock in the LLO interferometer.

Staffing for LIGO Science Runs

1. Participated in S1, S2, E9 and E10 runs (all UF LIGO I personnel)

Data Analysis

1. Burst analysis (Klimenko, Rakhmanov):

a) Development of the WaveBurst data analysis pipeline based on wavelet transforms (Klimenko). There was a significant code development to improve the algorithm sensitivity and performance. The multi-node version of the DSO has been developed it reduced the execution time by 50, so all S2 data can be processed in 1.5 days. Also the calibration was added. b) Study of the cross-correlation technique for burst analysis (Klimenko, Rakhmanov). LIGO note published, paper in preparation.

2. Stochastic Analysis (Whiting, Coldwell):

a) Development of and analysis for comparing data windowing options.
 b) Contributed to method in combining correlated data from the Hanford instruments into a single channel which optimizes the residual signal to noise.
 c) Contributed to the stochastic analysis pipeline by getting locked segments information in a form suitable for use in processing the S2 data.

3. Violin modes study (Klimenko, Castiglione)

a) Using S2 data we measured the parameters of violin modes for all LIGO detectors

4. Development of the DMT monitors (Klimenko)

a) Development and maintenance of two LIGO monitors LineMonitor and WaveMon. This monitors were used during S2 run to monitor the performance of LIGO detectors on line.

5. LLO S2 data veto analysis effort for Inspiral and Burst searches (Franzen)

a) Determination of reliable data channels which will be used to exclude false gravitational wave detections using WaveMon.