LSC Six-Month Progress Report

Organization University of Florida Laser Interferometric Gravitational Wave Group (UFLIGO)

LIGO-M000085-00-M

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Attachment A – Progress Report

a) Input Optics (IO) Installation
- Installation of the IO for the 2k Hanford detector including final alignment of the components and locking of the mode cleaner was completed.
- Commissioning and characterization of the 2k IO, including measurements of frequency and amplitude noise, beam jitter, core optics mode matching, and overall optical efficiency, was initiated.
- Installation of the IO for the Livingston 4k detector, including optics installation and alignment on the PSL table, small optics preparation, in vacuum optics installation, and alignment of the mode cleaner, was initiated and substantially completed.
- All IO components for the Hanford 4k detector have been acquired and fabricated.

b) End-to-end model
- Simulation modules for the IO control system and development of the IO interfaces to other Hanford 2k simulation modules (PSL and core optics modules) were implemented. The first version of the IO simulation module for Hanford 2k interferometer is complete. The simulation modules for two IO control loops (length/frequency and alignment sensing control) have also been implemented.
- LIGO documentation (T990099-00-D, T990100-00-D) describing the IO simulation module was prepared.

c) Data Analysis
- A transform tuned to violin resonances has been constructed. Possible anomalies in data near a violin resonance, due to interference arising from a violin mode being stimulated at different times, have been investigated.
- Separate line removal techniques, one discussed by Bruce Allen in the GRASP manual and the other by Alicia Sintes and Bernard Schutz (PRD), were implemented and applied to both Caltech and Glasgow data. Line removal emerges as a possible simple and efficient form of data compression.
- A likely method for identifying non-gaussian behaviour in the frequency domain has been developed and used to compare the impact of different line removal techniques. Comparison with other methods of qualifying frequency domain data is in progress.

Attachment C – Progress

a) EOM testing
- Testing of dynamic amplitude modulation at the Hanford 2k detector was completed. It was determined that acoustic excitation of specific optical components modulates the light at low frequencies. Suspect components and reduced amplitude modulation were identified.

b) Faraday Isolator Development
- Preliminary data on thermally compensated two crystal Faraday isolator designs was obtained using 60 W laser. Thermally induced birefringence was reduced and isolation ratio was improved by 10X over conventional isolator designs.

c) Alternative Modulator Architectures
- Development of requirements on modulation depth and pointing stability for Mach Zehnder based modulation scheme was initiated. This work will be continued pending outcome of high power modulator tests.

Attachment D – Progress Report 8/15/99-2/15/00

a) AIC Experiments
- The initial UF planning for the prototype suspended interferometer (to be built at Glasgow) was completed, including staffing needs and conceptual designs. In particular, the design of a locking scheme for the LIGO II strawman design (based on the Florida locking scheme which is being tested by a bench top experiment) is in the final stages. The LIGO II locking scheme will be designed for various detunings and reflectivities of the signal recycling mirror. Also, the initial analysis of the degradation of locking scheme due to thermal deformations with MELODY was initiated. Final results will depend on the chosen locking scheme.

b) Tabletop Dual Recycling
- The tabletop experiment is now fully aligned and all amplifiers and drivers are built, tested and installed. Successful locking of the Fabry-Perot Michelson with signal recycling has been demonstrated.
- Mode matching has been improved to a level where locking all degrees of freedom can be attempted.
- The bench top using now measured reflectivities and losses for all optical elements was modeled. The results are very promising. Investigations of the electronic problems (ground loops, impedance mismatches) are underway.

c) Novel Interferometer Designs
- A new all reflective interferometer meant as a possible candidate for LIGO II (and based on Gaussian optics) was modeled. Preliminary results of a design study were presented at the Aspen conference.