Attachment OPS to the Memorandum of Understanding LIGO-M070064-00 between the Eotvos University (EOTVOS) and the Laser Interferometer Gravitational Wave Observatory (LIGO)

For The Period

August 15, 2007 - August 14, 2008

This Attachment OPS to the Memorandum of Understanding LIGO-M070064-00 defines the role of the Eotvos University (EOTVOS) as a Member of the LIGO Scientific Collaboration (LSC) in the areas of detector commissioning, detector characterization, and operations support in the initial LIGO interferometers. The period of performance for the activities in this Attachment is from August 15, 2007 - August 14, 2008.

1. Collaboration

Together, the LIGO Laboratory and the LIGO Scientific Collaboration (LSC) are responsible for implementing and exploiting the initial LIGO detector through its science data runs. LSC groups are encouraged to contribute to the commissioning, characterization, and operation of the LIGO detectors, as members of working groups established by the LIGO Laboratory and the LSC.

2. Participation

During the period August 15, 2007 - August 14, 2008, the members of EOTVOS will participate in the initial LIGO detector research program in the following areas:

a. Detector Commissioning

First prepare and later station student(s) at an observatory for extended periods (months) to help the commissioning effort.

b. Detector Characterization

EGRG will initially contribute to detector characterization studies at one, important front. EGRG will characterize the coupling and its time dependence during the S5 run between the gravitational wave channel (DARM-ERR) and the neighboring channels within the same DAQ unit at the 960Hz frequency range. The baseline study will use the existing “DuoTone” sinusoid type timing signals for each IFO. This study shall give a good handle on the amount of crosstalk versus time at that frequency. EGRG will attempt to rely on existing tools ranging from software lock-in amplifiers through IEEE digital scope algorithms to DMT monitor results if possible.

Custom tools will only be created for this phase if absolutely necessary. Depending on the results, if there are interesting features or trends, EGRG later might decide to develop a specialized DMT monitor to automatize this investigation for the long term. Knowing the general level of crosstalk around 960Hz, shall help EGRG to estimate how much of the other (wideband, colored, etc.) signals on neighboring channels could have "crosstalked" into the gravitational wave channel. Depending on this result, direct broadband measurements for each channel might become necessary later. EGRG shall also examine the viability to create a "synthetic" data stream to be subtracted from the gravitational wave datastreams based on the crosstalk measurements and the signals present in neighboring channels. (It might or might not be feasible and useful.)

c. Detector Operations

Prepare students and postdocs and later participate in scientific shifts during science runs.

d. Other Contributions

PEM system enhancement for Advanced LIGO (and potentially for eLIGO):

Presently one fairly important aspect of the physical environment of the detectors is not monitored directly: the low frequency ($<$10Hz) acoustic environment.

As infrasonic acoustic waves

(a) can travel large distances,
(b) are generated on or near site,
(c) can easily penetrate buildings with little attenuation and
(d) may couple into the resonances of the suspension/isolation structures situated at low frequencies ($\sim$1Hz)

it is advisable to directly and sensitively monitor them at multiple locations.

EGRG will develop a

(a) self contained,
(b) electrically isolated (surges, lightning, etc.),
(c) networked,
(d) DC powered and
(e) ultra-low RFI/RMI emission

multi-instrument capable pods ready to integrate into LIGO's, eLIGO's and AdvLIGO's data archival structure.

It is envisioned that these pods can be installed both indoors or outdoors and have multi sensor capabilities. The minimum sensor deliverable shall be the low frequency acoustic environment monitor, but it is expected that other sensors can be easily integrated into the system if needed. Design work will be done in consultation with expert LSC personnel to ensure compatibility and end-user satisfaction. Development and prototype delivery/test timeline can be developed as the basic plans/interface requirements mature and become widely accepted.

Worked planned for 2007-2008:

Pod:

EGRG will work on the design of the generic environmental monitoring pod. A preliminary design concept will be selected, the prototype will be constructed. The interface to the LIGO data acquisition system will be defined. In parallel to the real pod, a dummy instrument pod (with no data collecting facilities) will be constructed to test the LIGO interfacing and to check for potential electrical noise problems.

Infrasound detector:

We will explore commercially available detectors and develop an initial detector design ourselves to decide the best approach. The systematics introduced by the infrasound background on the experiment will be evaluated. This will be used to specify the necessary sensitivity and frequency range of interest. A calibration sound source is in the design phase. With the prototypes finished, the performance of the design will be verified and the necessity of individual calibrations will be evaluated.

3. Resource Sharing

The LIGO Laboratory will contribute resources including allocation of appropriate scientific and engineering personnel, research facilities, and funding in support of the effort in Item No. 2, as indicated below.

a. Research accommodations for EOTVOS group members while on LIGO research assignment at any LIGO Laboratory site.

   Not Applicable

b. Access to LIGO data through established LSC channels in support of this work.

   Not Applicable

4. Coordination and Reporting

EOTVOS will perform research within the structures established by the LIGO Laboratory and the LSC where appropriate.
In particular, with reference to activities described above:

2a will be carried out in coordination with the LIGO Laboratory Commissioning Leader.

2b will be carried out within the Detector Characterization Working Group of the LSC.

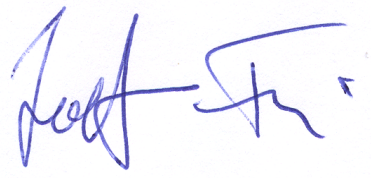
2c will be carried out in coordination with the LHO or LLO Site Head.

This includes keeping the Group leaders informed of activities and plans, reporting to the group at meetings and telecons, and through technical documents submitted to the LIGO Document Control Center.
In addition, an annual report will be submitted with the update to this Attachment, giving a summary status on research by topic as indicated in Item No. 2, including progress against the milestones if any, significant accomplishments such as new insights/discoveries or publications, issues of concern if any, and an indication of invested time.
This Attachment will be updated at least annually with a plan of activities for the succeeding one-year period. These documents will be due one month before the close of the period of performance under this Attachment.

5. Computer Code

All computer code delivered to the LSC under this Attachment must be developed in consultation with the LSC Data Analysis Software Working Group (DASWG) and archived, documented and reviewed as determined by that group.

Jay Marx
LIGO Laboratory Director



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