



**Attachment LAS to the
Memorandum of Understanding LIGO-M970077-00
between the German/British Collaboration (GEO 600) for the
Detection of Gravitational Waves (GEO600)
and the
Laser Interferometer Gravitational Wave Observatory (LIGO)
For The Period
August 15, 2008 - August 14, 2009**

This Attachment LAS to the Memorandum of Understanding LIGO-M970077-00 defines the role of the German/British Collaboration (GEO 600) for the Detection of Gravitational Waves (GEO600) as a Member of the LIGO Scientific Collaboration (LSC), and a member of the Lasers Development Group (LDG). The period of performance for the activities in this Attachment is from August 15, 2008 - August 14, 2009.

1. Collaboration

The Lasers Development Group (LDG) is the scientific collaboration for defining and developing future high power lasers for use in advanced subsystems for the initial LIGO interferometers or in entirely new advanced interferometers.

MOU Attachment LAS defines the roles and responsibilities of groups in this development group.

2. Participation

During the period August 15, 2008 - August 14, 2009, the members of GEO600 will participate in in LDG in the following areas:

a. Laser Development

The GEO laser group is developing and will fabricate the Advanced LIGO pre-stabilized laser system (PSL). This includes the laser development and fabrication at the Laser Zentrum Hannover (LZH) as well as the development of the power and frequency stabilization feedback control loops, the spatial control of the beam profile and the interfacing to the AdvLIGO computer control and data acquisition system.

Furthermore the GEO laser group is responsible for maintenance and upgrades of the PSL at the GEO600 detector and at the AEI 10m prototype. A small effort of this group is devoted to R&D towards laser systems and their stabilization for third generation gravitational wave detectors.

During the period July 15, 2008 to July 15, 2009, the GEO600 laser group will work on the following tasks:

200W laser

We will continue to optimize the high power resonator layout of the 200W laser with the main goals being to find a robust operation point, to increase the range of the length actuator for long-duration injection locking stretches and to reduce the free-running power fluctuations.

Furthermore experiments will be performed to investigate if a higher doping concentration of the laser crystals would be advantageous, which is more commonly used by industry and which can be produced with less crystal-to-crystal fluctuations.

We will fabricate, assemble and commission the next iteration of the high power stage, namely the engineering prototype. The spare #1 35W front end laser (to be produced as well during this MOU phase) will be used for this prototype. (The engineering PT front end cannot be used as it is at Caltech.) Once this laser is in operation we will characterize its performance, in particular the free running fluctuations and the available actuators for stabilization loops.

We will continue to fabricate the 35W front end laser (observatory #3, spare #1, spare #2). Furthermore the fabrication of the AdvLIGO diagnostic breadboards will continue.

AdvLIGO PSL integrated test

The integrated PSL test at the AEI will continue with the reference system 35W laser. We plan to install and operate all PSL stabilization loops at the same time and measure their performance as well as the frequency dependent couplings between the different loops. Lockacquisition, drift compensations and long term monitoring will be performed using the EPICS RT control system. The required interfaces (field boxes) will be designed and fabricated.

GEO-HF pre-stabilized laser

After the test of squeezing techniques at the GEO600 detector an upgrade of the laser to a power of 35W is planned. During this MOU period we will fabricate and prepare the laser and its stabilization components for the installation at the GEO site.

R&D

We will continue fundamental investigations to reduce the limit to which power fluctuations can be sensed and we will continue investigations devoted to laser sources for third generation gravitational wave detectors.

b. Other Contributions

The GEO laser group will prepare and hold the preliminary design review for the AdvLIGO PSL.

Benno Willke will serve as the PSL subsystem leader and as the chair of the LSC lasers working group.

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 GEO600 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

GEO600 will perform research within the structures established by the LIGO Laboratory and the LSC where appropriate. In particular, activities described in Item 2 will be carried out within the Lasers Development Working Group of the LSC.

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



Karsten Danzmann
Principal Investigator(s)
GEO600



David Reitze
LSC Spokesperson