Standard Operating Procedure
LIGO 10-W Laser in Optics Laboratory

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1 PURPOSE AND SCOPE

This Document is the Standard Operating Procedure (SOP) for the LIGO 10-Watt Laser when it is operating in the Optics Laboratory. It is designed to ensure the safety of all personnel and equipment in and around the area where the LIGO 10-W laser is operating in the optics laboratory. Its role within the overall laser safety plan is described in LIGOM990148, LIGO Livingston Laser Safety Plan.

This SOP contains the essential procedures required for the safe operation of the LIGO 10-W laser in the Optics Laboratory and is approved by both the LIGO Livingston Observatory (LLO) Laser Safety Officer and the LLO Site Safety Officer.

2 LABORATORY LAYOUT

The LIGO 10-Watt Laser is located in the Optics Laboratory Laser Control Area within the Optics Laboratory. The laboratory layout is shown in Figure 1. The laser and ancillary optical components are mounted on Optic Table 1 or 2. The designated Nominal Hazard Zone (NHZ) includes all of the area behind the laser safety curtains.

Figure 1: Layout of Optics Laboratory Laser Controlled Area
3 LASER DESCRIPTION

The LIGO 10 W Laser is Class IV Nd3+:YAG laser. The output from this laser is in the infrared region of the electromagnetic spectrum and is therefore not visible to the human eye. This laser emits radiation from two apertures, the main output beam and a sample beam. The relevant operating parameters for the LIGO 10 Watt Laser are:

MAIN BEAM

- 1064 nm wavelength
- 12 W max. power output
- Continuous wave output
- 1.35 mrad beam divergence

SAMPLE BEAM

- 1064 nm wavelength
- 70 mW max. power output
- Continuous wave output
- 1.35 mrad beam divergence

4 HAZARDS

A Class IV laser is a hazard to the eye or skin from the direct beam, maybe a hazard from a diffuse reflection, and may also be a fire hazard. Infrared lasers such as the LIGO 10 W Laser pose an additional hazard because the output radiation is not visible to the unaided human eye.

- Two potentially dangerous output beams are described in Section 3, above.
Items of concern:
- Cleaning compounds: Methanol, Ethanol and Acetone.
- High voltage from RF photo detectors.

5 EMERGENCY INFORMATION

CALL 911 for emergencies.
- A list of phone numbers can be found on the “Hazard Placard” post at the entrance to the Laser Control Area. There are numbers for both during and after work hours.
6 CONTROLS

6.1. Access Controls

A Laser Safety Warning placard with the message, “DANGER VISIBLE AND/OR INVISIBLE LASER RADIATION - AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION,” is mounted at the entrance to the Optics Laboratory Laser Control Area, outside the double entrance curtains. Additionally, an illuminated Tri-Lume sign is hard-wired such that energizing the power supply to the laser within the Optics Laboratory Laser Control Area automatically energizes the electric Tri-Lume warning sign.

The Optics Laboratory has some active control devices. An electrical interconnect between the laser and the Laser Safety Warning Sign controls the illumination of the sign. Power to the laser power supply is by way of a dedicated power cord. The dedicated power cord is to have a Lock and Tag boot installed and signed by the Laser Safety Officer prior to energizing the laser.

Wearing the appropriate laser safety eyewear is mandatory before opening the first laser safety curtain to enter the Laser Controlled Area when the Laser Safety Warning sign is illuminated.

The Laser Safety of the Laboratory also relies on:

- A number of physical barriers and beam dumps.
- Training.- Personnel must be a Registered Laser Personnel for this system to enter the Laser Controlled Area without an escort.
- Written, approved Standard Operating Procedures.
- The Laser Safety Warning sign is part of a monthly maintenance schedule to insure it’s reliability.
- A copy of this SOP, a list of Registered Laser Personnel for this system, Hazard Placards and Emergency Information are posted at the entrance to the Laser Control Area
- An Emergency “kill” switch at the entrance to the Laser Control Area.

The Laser Controlled Area is considered to be safe to enter if either of the following exists:

- When the Laser Safety Warning sign is in the “NO HAZARD” position, indicating the power to the laser power supply via the dedicated power cord has been unplugged
- Depressing the Emergency Off switch which “kills” the power to the Laser Safety Warning Sign and to the laser power supply.

6.2. Emergency OFF Switches

An Emergency OFF switch is located near the laser warning sign at the entrance to the Laser Control Area. This switch kills the input power to the laser.

6.3. Electrical Controls

All control and monitoring functions for the LIGO 10-Watt Laser are accessed via the laser power supply located in the rack next to the optics table.
6.4. Eye Protection

Required protective eyewear for the LIGO 10-Watt Laser must have an optical density (OD) of greater than 5.0 for 1064 nm wavelength radiation.

7 OPERATING PROCEDURES

1. It is the responsibility of each person working within the NHZ to ensure that LIGO standards for safe laser operation are being followed at all times.
2. All persons entering the NHZ are required to wear eye protection, as described in Section 5.4., above, before entering and at all times while working within the NHZ.
3. Before entering the NHZ each person must announce his or her intent to enter and await a reply from anyone already within the NHZ.
4. Prior to powering up the laser, the user shall ensure that all persons in the NHZ are aware of his intent to power up the laser and that they are in compliance with all laser safety requirements, eye protection in particular.
5. When placing objects such as mirrors, lenses, power meters, or beam dumps, into or near the laser beam paths, the power shall be reduced to a level consistent with good safety practices.
6. After powering off the laser, the user shall remove the key from the laser power supply and return it to the designated storage area.
7. Before leaving the laser running unattended, the user shall check that no stray beams are unblocked.