

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY
-LIGO-
CALIFORNIA INSTITUTE OF TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Procedure	LIGO-M030117-00-W	6/13/03
Standard Operating Procedure Photon Calibrator Laser Operating in Optics Laboratory		
<u>SPONSOR</u> D. Cook		

LHO Laser Safety Officer

LIGO Hanford Observatory
Route 10, Milemarker 2
Richland, WA 99352
Phone (509) 372-8191
Fax (509) 372-8137
E-mail: info@ligo-wa.caltech.edu

California Institute of Technology
LIGO Project – MS 51-33
Pasadena CA 91125
Phone (626) 395-2129
Fax (626) 304-9834
E-mail: info@ligo.caltech.edu

LIGO Hanford Site Safety Officer

LIGO Livingston Observatory
19100 LIGO Lane
Livingston, LA 70754
Phone (225) 686-3100
Fax (225) 686-7189
E-mail: info@ligo-la.caltech.edu

Massachusetts Institute of Technology
LIGO Project – MS 20B-145
Cambridge, MA 01239
Phone (617) 253-4824
Fax (617) 253-7014
E-mail: info@ligo.mit.edu

WWW: <http://www.ligo¹.caltech.edu>

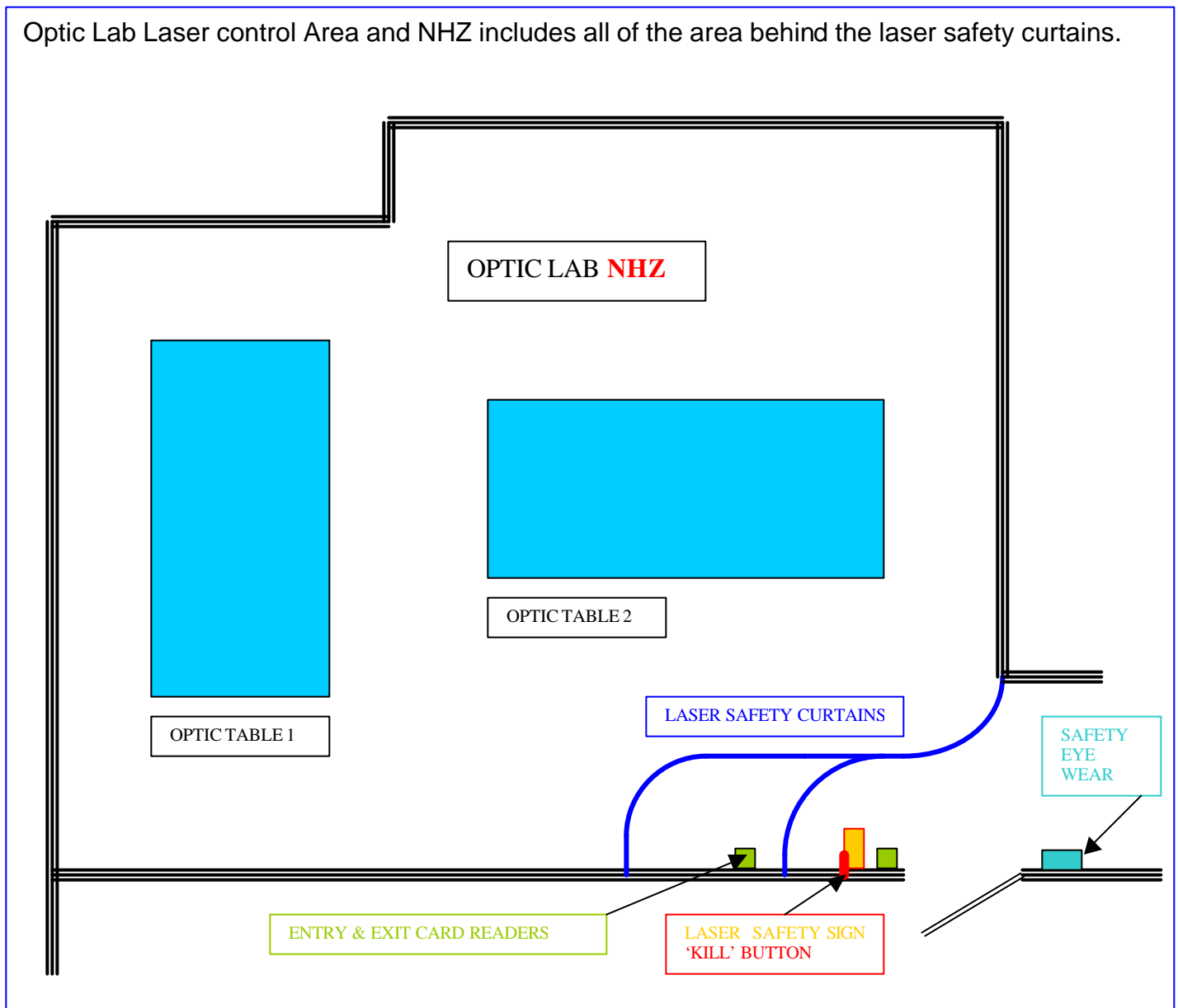
1 PURPOSE AND SCOPE

This Document is the Standard Operating Procedure (SOP) for the LIGO Photon Calibrator Laser when it is operating in the Optics Laboratory (Lab). This SOP is designed to ensure the safety of all personnel and equipment in and around the area where the LIGO Photon Calibrator Laser is operating. Its role within the overall laser safety plan is described in LIGO-M0300131-A-W, [LIGO Hanford Laser Safety Plan](#).

This SOP contains the essential procedures required for the safe operation of the LIGO Photon Calibrator Laser when operating in the Optics Lab and is approved by both the LIGO Hanford Observatory (LHO) Laser Safety Officer and the LHO Site Safety Officer.

2 LABORATORY LAYOUT

The LIGO Photon Calibrator Lasers will be located in the Optics Lab Laser Control Area for testing and assembly. The lab layout is shown below. The laser, its enclosure and ancillary optical components are mounted on Optics Table 1. The designated Nominal Hazard Zone (NHZ) includes all of the area behind the laser safety curtains, shown below.



3 LASER DESCRIPTION

The LIGO Photon Calibrator Laser is a Class III IR laser. The output from this laser is in the near infrared region of the electromagnetic spectrum and is therefore not visible to the human eye.

The relevant operating parameters for the LIGO Photon Calibrator Laser are:

- 1047 nm to 1350nm wavelength
- 500 W maximum power output
- Continuous wave output

4 HAZARDS

A Class III laser is a hazard to the eye from the direct beam, maybe a hazard from a diffuse reflection. Infrared lasers pose an additional hazard because the output radiation is not visible to the unaided human eye.

5 CONTROLS

5.1 Access Controls

- The Optics Lab has an **Entry** and **Exit** proximity reader installed and is part of the Laser Safety Access System. The Entry reader unlatches the first curtain to gain access to the NHZ. Access controls, alarms and all transactions for this area are recorded and monitored in the Control Room.
- Only those with an access card validated for this SOP will be allowed to enter the NHZ without an escort when the laser is capable of operating (Power supply energized).
- An illuminated Laser Safety Warning sign 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 Lab Laser Control Area, outside the double entrance curtains.
- A schematic layout of the Optics Lab Laser Control Area showing the location of the LIGO Photon Calibrator Laser and notice identifying emergency contact people are posted near the laser safety warning sign.
- A copy of this SOP is also posted at the entrance to the Optics Lab Laser Control Area.
- Attached to the first laser safety curtain at the entrance to the NHZ is a sign stating **“WHEN WARNING LIGHT IS ON, RESTRICTED ACCESS, AUTHORIZED PERSONNEL ONLY. ALL OTHERS MUST BE ESCORTED BY AN AUTHORIZED PERSON PROPER SAFETY EQUIPMENT IS REQUIRED.”**
- If additional lasers are running simultaneously, Access Cards must be valid for these additional lasers as well.
- **Any authorized person escorting unauthorized personnel inside the NHZ shall assume responsibility for compliance with all governing laboratory laser safety procedures.**

5.2 Electrical Controls

- All control and monitoring functions for the LIGO Photon Calibrator Laser are accessed via the laser power supply. The laser is connected to dedicated power line that is only energized when the warning sign is activated (Key actuated switch). The “Emergency Kill” button mounted below the laser warning sign will ‘Kill’ the power to all Class IIIB and Class IV lasers in the Optics Lab.

5.3 Eye Protection

- Required protective eyewear for the LIGO Photon Calibrator Laser must have an optical density (OD) of greater than 3.8 for 1047 nm wavelength radiation.
- The laser safety eyewear is *never* intended for intra-beam viewing.

6 OPERATING PROCEDURES

1. When the LIGO Photon Calibrator Laser is operating within the Laser Control Area the laser warning sign must be energized and all persons entering the Laser Controlled Area are required to wear eye protection as described in Section 5.3 above, before entering and at all times while working within the Laser Control Area (NHZ).
2. Prior to powering up the laser, the Responsible Laser Operator (The person actively in charge of the laser), 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.
3. Before entering the Laser Control Area, each person must announce his or her intent to enter and await a reply from the “Responsible Laser Operator”(RLO) already within the Laser Control Area. Each person must enter using their access card to unlatch the first curtain. Next close and re-latch the first curtain before opening the second curtain. Close the second curtain immediately after you enter.
4. Anytime one or more people will be working within the Laser Control Area *or* the laser will be running unattended, ONE person shall be designated the “Responsible Laser Operator.” The name of the Responsible Laser Operator shall be posted near the Laser Controlled Area laser warning sign.
5. The Responsible Laser Operator shall coordinate activities on or in the vicinity of the laser optical table. Multiple independent activities involving manipulation of the laser beams shall only occur simultaneously when the Responsible Laser Operator deems it safe to do so.
6. If multiple lasers are to be operated simultaneously, all “Responsible Laser Operators” (RLOs for each laser system), **must agree** that it is safe to have multiple systems running. All eyewear must be compatible for **all** laser systems running concurrently. When in doubt, consult the Laser Safety Officer. When multiple lasers are being used, **none** of the governing SOP’s shall have conflicting guidelines.
7. Any time the laser beams will be manipulated, e.g. by inserting, removing, or adjusting optical components, persons not directly participating in the beam manipulation activity will move to a safe location until the activity is completed.
8. Before and during insertion or removal of any optical component, the power of all affected laser beams shall be reduced to the lowest working power setting or be blocked up stream by an appropriate device, such as a ceramic wand.
9. All persons manipulating the laser beams, e.g. by placing objects such as mirrors, lenses, power meters, or beam dumps into or near the laser paths, must remove all jewelry such as wrist watches and rings.
10. Immediately after inserting, removing or making significant adjustments to any optical component, the vicinity of the optical table shall be scanned with an infrared viewer or other suitable beam-finding device to ensure that all stray beams are dumped.
11. Scattering of laser light shall be kept to a minimum at all times by maintaining proper alignment of optics, utilization of beam dumps, and ensuring that optics are securely fastened.

12. Each time the laser will be left running unattended, the vicinity of the optics table shall be scanned for stray beams immediately prior to vacating the Laser Control Area. The “unattended” status of the laser shall be clearly posted (yellow cones) or posted near the name of the Responsible Laser Operator at the entrance to the Laser Control Area.
13. If a laser beam is found (reported by any observer), leaving the optics table, the laser will be shut down by the LSO and will remain “**OFF**”, until start up authorization is received from Gary Sanders (LIGO Project General Manager).

It is the responsibility of each person working within the Optics Lab Laser Control Area (NHZ) to ensure that LIGO standards for safe laser operation are being followed at all times.
