LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

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Standard Operating Procedure for the 2 W, 1560nm NP Photonics Laser in West Bridge B102

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Distribution of this document:
Lasers and Optics

This is an internal working note
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Introduction

This document is the Standard Operating Procedure (SOP) for 2 W, NP Photonics laser located in B102 (later moved to the new lab space). This laser is used for the assembly of the Lee Mcculler RBQ experiment

The RFLPXA laser is a Class 4, fiber Bragg grating (FBG) laser system with output at 1560nm, with an absolute maximum output of 2 W.

Room B102

The floor plan of Room B102 is shown in Figure 1. **The area indicated by hatching is the Nominal Hazard Zone.** The area between the laser safety barrier and the entrance door is non-hazard area that is designated for storing and donning laser safety glasses.

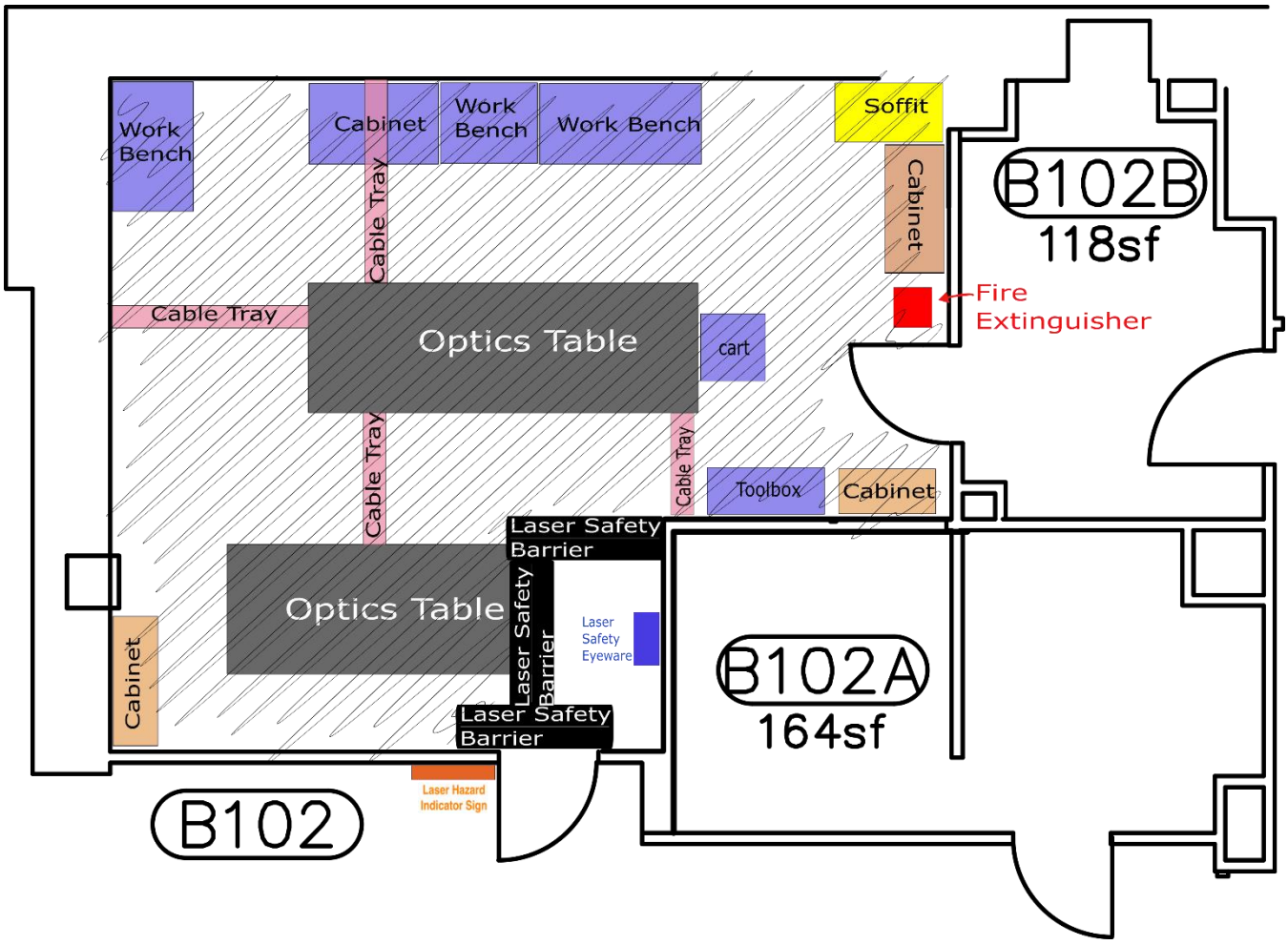

Figure 1. The floor plan for Room B102.

Hazards

Laser Radiation Hazards

The FBG laser is an infrared laser and is invisible to the naked eye. The output power of this laser alone can be operated above the accessible emission limit (AEL) of 1.9 mW and 96 mW for both eye and skin respectively. Extreme caution should be taken when operating the laser with the amplifier.

Electrical Hazards

The system is powered using a standard 60 Hz, 120 V wall connection. There are no electrical hazards when operating the laser.

Fire Hazards

Operating this laser imposes minor fire hazards when operating at maximum emission output. Ensure the beam is only directed at approved optics equipment or qualified beam dumps. **Check Figure 1 for fire extinguisher location.** Fire extinguisher #00007776.

Hazard Controls

Access Controls

There are no active access controls to West Bridge Room B102.

Beam Controls

The laser will remain on at all times to increase the operating life length of the laser.

Safety Sign

A laser hazard indicator sign is located at the outside of the room. Whenever there is a possibility to use the laser beam for a task, this sign should be turned on by a switch next to the entrance door.

Laser Safety Eyewear

The use of laser safety eyewear is mandatory whenever the laser power supply is energized. A minimum optical density (OD) of +3 at 1550 nm is required. When the amplifier is introduced a minimum of OD 7+ 1550nm is required. C2KG5 laser safety goggles are stored in the entrance area. These goggles have filtering at the following wavelengths:

OD 6+ @530-570nm
OD 4+ @655-664nm
OD 5+ @665-679nm
OD 6+ @680-695nm
OD 7+ @696-1550nm

Always double check the listed filtering on the side of the goggles before entering the laser hazard area.

○ Handling of the optical fiber

The laser source output is a PM, FC/APC Bulkhead optical fiber. This will initially be connected to a fiber coupler, where the max output of this fiber is 2 W. The laser source should be turned off when handling the output fiber.

▪ Training

Users of the ULN15TK laser BOOSTIK amplifier should have received the LIGO Project's basic laser safety training. They are not permitted to operate the laser by themselves until they have received this training.

▪ Operating Procedures

Specific Use:

The steps for powering on to full laser power in B102 using the NP Photonics laser amplifier are as follows:

1) Verify that the system power key switch is in the OFF (0) position.
2) Turn the AC power entry rocker switch on the back of the unit from O (off) to 1 (on)
3) Turn the key switch that is located on the front panel from OFF (0) to ON (1) A green indicator LED will light up and verify that the electrical power is supplied to the system.
4) Wait for ~10 minutes for the seed laser temperature to stabilize. Turn the SEED OUTPUT key switch to ON (1). This enables the seed laser to emit light. The green indicator LED located above the seed laser's optical output ports will light up to show that the seed laser I emitting optical power.
5) Once the seed laser is turned on, it will take some time (~15-20 minutes) for its temperature to restabilize. During this time the seed laser will not yet operate to all specifications. The laser may temporarily emit two longitudinal modes. – indicated by the red indicator labeled "2nd mode" in the software program. Once the seed has stabilized, any amplifiers can be turned on.
6) Make sure the amplifier output fiber is directed to a high power optical power meter or to the free space experiment set up.
7) To energize the high power output, set the AMP OUTPUT enable rocker switch to ON (1). The Amplifier Enable LED will come on. Note that if the Amplifiers are turned on before the seed is stable the software will hold the amplifiers in a disabled state until the seed laser is ready.
8) For > 2 W systems, there are two stages of amplifiers, whereas for < 2W systems there is only a signle amplifier stage.
9) For a =< 2 W system, the amplifier stage1 will turn on at a predetermined current level (nominally zero current). At this point, GUI software can be used to make adjustments to amplifier stage 1 current/power.

Shutdown Procedures:

1. Use the GUI, or the RS232 command line to slowly reduce the amplifier output to the minimum as described in notes above.
2. Disable the amplifier output by setting AMP OUTPUT to OFF (0).
3. Disable the seed laser output by setting the seed output switch to OFF (0).
4. Turn the system power's key switch to OFF (0) position.
5. Set the AC power entry switch on the back of the unit to the OFF position.

General Use:

Items such as jewelry and watches should not be worn while manipulating beams on the optical table.

Caution should be exercised when one's head passes through the plane of the laser beam.

Prior to turning on the laser or enabling via the Laser Enable PushButton Switch:

- check the beam path to ensure that there are no reflective objects in the beam path that may unintentionally deflect the beam
- alert any personnel in the room that the laser is about to be operated and ensure that everyone is wearing the appropriate laser safety eyewear
- check that the laser warning sign is illuminated

Prior to turning off the laser, placing the laser in standby or close the shutter:

- scan the optical table for any stray beams and correct the situation as necessary

Emergency Procedures

In case of an emergency, call x5000.