

Laser Standard Operating Procedure

Our lab contains a number of helium-neon (HeNe) lasers. Several of these are classified as Class 3B lasers. A Class 3B laser is hazardous if the eye is exposed directly.

This document describes requirements to be considered by an authorized user of the lab lasers and describes the normal operation of the laser and any hazards that may be encountered during normal operation. Finally, it explains how to minimize any hazards and how to respond in an emergency situation.

Users of the labs' Class 3B lasers must be fully cognizant of all safety issues involved in the operation of such a device. These personnel are to ensure that the laser is only operated in the manner laid out in this document. Authorized users must be listed on the lab's Laser Permit. They must have completed all required training, including the EH&S Laser Safety Course and individual training on the lasers from Dr. de Bruyn or his designate.

No unauthorized personnel may enter PAB 214B when exposed lasers are in use unless accompanied by an authorized user. All visitors must be briefed on proper safety protocol and must wear appropriate laser protective eyewear located on the premises.

Hazards

A. Laser Hazards: Direct exposure to light from a Class 3B laser, or to specularly reflected laser light, can cause eye damage. While diffuse reflections are not immediately hazardous, they must nonetheless be treated with care and caution..

B. Electrical Hazards: Laser power supplies generate high voltages. Electrical shock or electrocution could result from direct contact with high voltage. Ensure that no liquids are on your gloves or hands when plugging laser power cords into power supply.

C. Chemical: Keep flammable solvents out of beam path.

D. Pressure Hazards: None.

E. Other: None.

Hazard Controls

A. Lasers

1. Lasers are to be operated only by trained and authorized personnel.
2. When exposed lasers are in use, the "Laser in Use" light must be turned on. A physical barrier labeled with a laser warning sign must be positioned between the laboratory door

and the optical table. The door to the laser lab must be closed when an exposed laser is operating.

3. During optical alignments, the door to the optics lab will be closed and a sign posted stating “**Laser alignment in progress. Do not enter. Eye protection required.**”

4. Unauthorized personnel will be only allowed entry to the laboratory during laser operation with the supervision of an authorized user and must wear the appropriate eye protection goggles.

5. Laser protective eyewear for sufficient protection against 633nm radiation are available in PAB 214B. **Laser protective eyewear must always be worn when exposed lasers are in operation.** No filters or other optics will provide suitable protection; use only laser safety protective eyewear. PLEASE NOTE: Laser protective eyewear is wavelength specific and proper selection is important.

6. Specular and diffuse reflections must be controlled using apertures, beam housings and enclosures, and optics. All of these control methods must be in place during normal operation.

7. Laser and optical alignment must be performed only by following the steps outlined in the alignment procedure supplement or alignment section.

8. Perform physical surveys to determine if there are stray beams (specular or diffuse) emanating from each laser and its optics, and then document the beam surveys noting the location of stray beams and the measures taken to control them.

9. If the beam path must be changed significantly by relocating the laser or optics, all users must be notified of the change.

10. The same precautions that are taken for safe operation of the laser must also be followed when adjusting any of the optics in use with the apparatus.

11. When a new principal researcher/experimenter takes over use of the laser system, the new user must conduct a survey for unwanted stray or diffuse beams.

B. Electrical

1. Enclosures for protection against the high voltages of the laser power supply or laser head may only be removed after the power supply has been unplugged from the outlets and after following the safety procedures outlined in the safety and operations manual provided by the manufacturer.

2. Only qualified personnel may perform all internal maintenance to the laser and more than one user must be present when performing said maintenance.

3. Every portion of the electrical system, including the printed circuit cards, should be assumed to be at dangerous voltage level.

C. Chemical

1. Always check that any flammable solvent placed under the laser beam does not ignite or combust by referencing the flash point of the chemical and the temperature increase of the chemical under laser exposure.

D. Pressure

E. Other

Normal Operation

- Inspect all electrical connections for damage and connectivity.
- Ensure that the laser hazard warning signs are posted outside of the door to room 214B
- Labeled light barrier is positioned between the lab door and the optical table.
- Door is closed and all personnel are wearing the appropriate laser protective eyewear.
- Inspect the apparatus for any blockages or apparent misalignment.
- Turn laser on.
- Confirm that the beam path is set up to hit the sample properly.
- During the run, ensure that the laser is hitting the sample correctly.
- Report any anomalous behavior.
- Shut down laser system when experiment is finished.

D. System alignment. See the attached alignment procedure supplement/alignment section for details.

Emergency Procedures

A. Laser accidents: Follow the steps outlined in the Procedure for Laser Accidents in Appendix A.

B. Power outage: If there is a power outage, turn off the laser to avoid a hazardous situation when power is restored.

Appendix A – Procedure for Laser Accidents

In the event of a laser accident, follow the procedure below:

1. Ensure that the laser is shut off.
2. Provide for the safety of the personnel (first aid, evacuation, etc.) as needed. Note — if an eye injury is suspected, have the injured person keep his/her head upright and still to reduce bleeding in the eye. A physician should evaluate laser injuries as soon as possible.
3. Obtain medical assistance for anyone who may be injured.
4. If there is a fire, pull the alarm, and contact the fire department by calling 911. Do not fight the fire unless it is very small and you have been trained in fire fighting techniques.
5. Inform Dr. de Bruyn of the incident as soon as possible.
6. Inform the Office of Environment Health, & Safety (EH&S) as soon as possible.
7. After the incident, do not resume use of the laser system until Dr. de Bruyn and, if required, the Radiation Safety Coordinator, has approved the resumption of research.

Appendix C - Alignment Procedures

Procedural Considerations

1. To reduce accidental reflections, watches, rings, dangling badges, and other reflective jewelry must be taken off before any alignment activity begins.
2. Use of non-reflective tools should be considered.
3. Access to the room/area is limited to authorized personnel only.
4. Perform alignments with a colleague or “buddy.”
5. Review alignment procedures.
6. Identify equipment and materials necessary to perform alignment.
7. Remove all unnecessary equipment, tools, and combustible materials to minimize the possibility of stray reflections and non-beam accidents.
8. Persons conducting the alignment have been authorized by the PI.
9. A ‘Notice’ sign is posted at the entrance when temporary laser control areas are set up or unusual conditions warrant additional hazard information.

External Optics

1. Ensure that all users are wearing laser protective eyewear, warning signs are posted, and laboratory doors are closed. Check that the laser path will be blocked.
2. Turn on the power supply.
3. Set up the first optic, block the beam path optic, and carefully release the original block to ensure that the beam will hit the center of the mirror.
4. Set up two targets in the beam path, unblock the beam, and center the beam using adjustments on the optic.
5. Continue until optics are set up properly.
6. Check for stray beams at each step and again after completing all alignment steps. Please indicate method of documentation of survey (checklist or log, etc.) See section IV.A.8
7. After the alignment is complete, turn off the laser.

9. Replace ALL laser beam enclosures/stops.