

Fiber Laser

Standard Operating Procedure

Lab: NPL

Department: Physics

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Section 1: Overview

The Nuclear Physics Laboratory (NPL) uses a class IV fiber laser. This laser poses a potentially serious safety hazard if the proper safety procedures and precautions are not understood. Before operating the laser or being in the nominal hazard zone (the deer stand) while it is on, one must have taken the appropriate Division of Research Safety training and have read this standard operating procedure.

Section 2: Risks and Warnings

This laser is class IV and, if improperly used, can result in **permanent loss of vision**. It also poses a skin and fire hazard. The light emitted by this laser is infrared and thus **cannot be seen by the naked eye**. Not only is direct exposure of the beam dangerous, but also its **diffuse reflections**. Be aware that laser eye wear is not made to withstand a powerful beam for long periods of time.

Below is a selection of warnings from the user's manual:

- **Invisible laser radiation.** Avoid direct exposure to the beam. Direct viewing of the beam may cause serious eye and skin damages and possible vision loss; never operate system with fiber disconnected or a broken fiber. Do not view fiber end directly when optical instrument is powered.
- **Disable the laser output** before connecting or disconnecting an optic fiber cable on the instrument.
- **Do not open the device.** Invisible laser radiation could affect the operator if this condition is not respected.
- Any check of the optical connectors must be processed when the laser source is not supplied and by filtering observation optical systems.
- The device must operate without any impact or vibration.

Section 4: Safety and Control Measures

There are two main areas that interact with the laser: the **nominal hazard zone** and the **laser control zone**. The nominal hazard zone is any area at the same height as the laser (usually this is the “deer stand”). The laser control area is the computer desk capable of controlling the laser remotely via software.

General safety precautions in the nominal hazard zone:

- **The red warning light** is to always be on while the laser is operational.
- **Access to the nominal hazard zone** is to always be gated with appropriate signs while the laser is operational. This prevents people from unknowingly wandering into the nominal hazard zone.
- **The use of protective eye ware** is required in the nominal hazard zone while the laser is operational
- **For any power above 50 milliwatts**, the attenuating curtains must be lowered to *help* protect from diffuse reflections
- Familiarize yourself with the location of the fire extinguisher in the nominal hazard zone.

General safety precautions in the laser control zone:

- **The red warning light** is to always be on while the laser is operational. This light is controlled in the laser control zone.
- **Access to the nominal hazard zone** is to always be gated with appropriate signs while the laser is operational. This prevents people from unknowingly wandering into the nominal hazard zone.
- **The operational status of the laser can only be determined by the laser itself.** For instance, if the power is changed from 1 Watt to .01 Watts on the laser control computer, this is not sufficient to assume the power is actually .01 Watts. You must query the laser for the power as measured by itself internally. Queries to the laser are required to have full confidence in the current settings of the laser.
- Familiarize yourself with the location of the fire extinguisher in the laser control zone.

Section 3: Procedures

For any of these procedures always make sure laser alignment is done at the lowest possible power. Also know there exists no power level where direct eye to beam contact is safe.

Polarization of Helium 3:

1. Check to make sure fire extinguishers are available
2. Turn on the red warning light
3. Dawn the appropriate safety goggles
4. Gate the entrance to the nominal hazard area
5. Lower the attenuation curtains
6. Remove the key from the laser control area and use it to turn on the laser
7. Ensure proper contact is established between the laser and the laser control computer
8. Perform experiment
9. When finished, turn of the laser via software.
10. Remove the laser key and return it to it's original location
11. Turn off the red warning light
12. Un-gate entrances

Circular Polarization Calibration:

1. Check to make sure fire extinguishers are available
2. Turn on the red warning light
3. Dawn the appropriate safety goggles
4. Gate entrance to the nominal hazard area
5. Remove the key from the laser control area and use it to turn on the laser
6. Ensure proper contact is established between the laser and the laser control computer
7. Set laser to lowest possible power setting
8. Ensure seating at the calibration table is high enough such that your eyes are significantly above the beam
9. When finished, turn off the laser and remove the key
10. Return the key to it's original location
11. Remove the laser key and return it to it's original location

Transferring the fiber between MEOP cell and calibration mounts:

1. Make sure the laser is off and the key is not in
2. Carefully un-mount the laser from current mount. Take special notice of the actual fiber in it's entirety. Make sure it does not get caught on anything in the environment or that it is not tripped over
3. Mount it to the new mount, ensure that the fiber is sufficiently isolated from walkways.

Section 5: Emergency Response

In the event of a laser accident, immediately ensure that the laser is turned off to no longer emits light. Provide for the safety of personnel as needed. If a laser eye injury is suspected, have the injured person keep their head upright and still to restrict bleeding in the eye and contact a physician for evaluation as soon as possible.

If the issue is less pressing, Eric's phone number is: 217-714-0688

