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| Title: | Laser Incident Lessons Learned and Action List |
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| Intended for: | Lessons Learned from the laser incident will be distributed inside and outside the DOE complex |
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# Laser Incident Lessons Learned and Action List

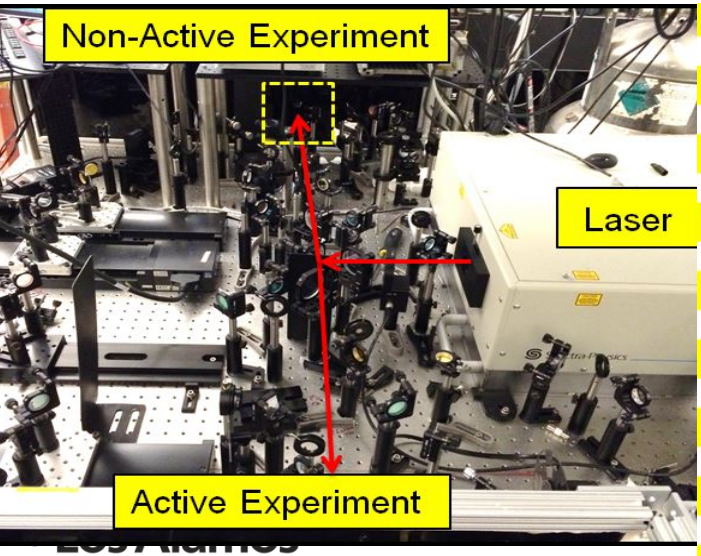
# Laser Incident Description

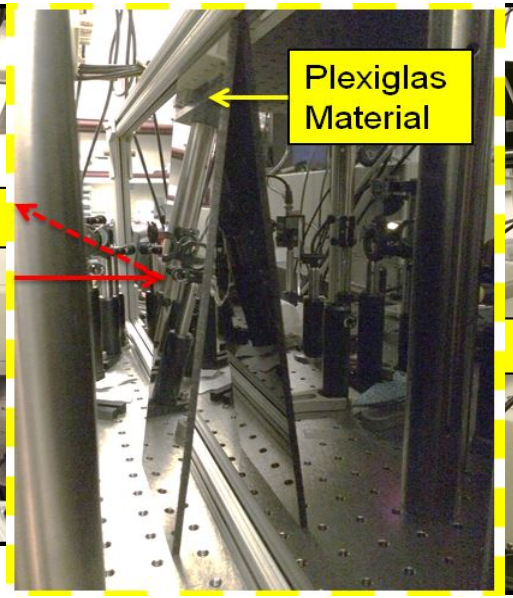
On Thursday November 19, 2015, LANL postdoc received an eye injury from a reflected, non-visible laser beam (Class 4, pulsed, wavelength 800 nanometer). The setup is configured to split the laser output into two work areas in which qualified operators conduct research experiments. During this incident, the laser output beam was being projected to both experimental work areas, although only one experimental area was actively being used. The second laser beam directed to the second work area was blocked by an inappropriate device (Plexiglas, reflective, non-normal incidence) that reflected substantial portion of the beam toward the first setup. In preparation for the measurements, worker stepped on the stepstool and decided to remove the laser goggles to better see the micrometer readings which were difficult to see due to insufficient lighting. Immediately, he noticed a flash of light in his eye. The operator quickly replaced the laser eye-wear and then, using an infrared viewer, located a stray laser beam being reflected from the plexiglas beam block.

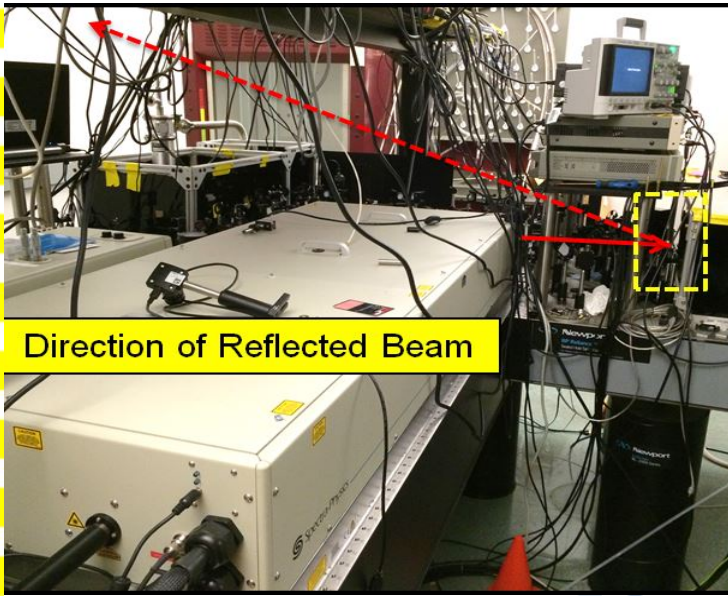
The operator did not think he had sustained any injury and continued working. Later that day, however, he noticed a blurry spot in the vision of his left eye. He notified his supervisor on Friday morning, November 20, 2015, and was taken by CINT management to Sandia National Laboratories (SNL) medical facility for evaluation. SNL Medical did not find any abnormalities, but referred the operator to a local ophthalmologist for further evaluation. Further evaluations by the ophthalmologist on November 21 and November 23 identified a small spot of inflammation near the fovea on the retina in his left eye. The ophthalmologist stated that this spot would most likely heal on its own and that the blurry spot on the operator's vision would go away. A follow-up visit was scheduled. The employee was released back to work without restrictions.

# Incident Causes

- Insufficient communication between users of shared laser beam – second beam was active when not in use
- Selection of inappropriate material (reflective surface, susceptible to laser damage) and position for the beam block
- Operator of the second setup had not verified safety conditions (blocking stray reflections) after modifying the setup (changing/blocking the beam path)
- Limited illumination impaired visibility of the instrumentation readings
- Operator removed laser protective eyewear



# Immediate Actions at LUMOS SNL/LANL Laser Labs

- Laser labs were walked-down and assessed by management and LSO for safety/house-keeping to ensure activities with similar conditions are safe to perform.
- Inappropriate beam blocks were taken out of service.
- Appropriate non-reflecting beam stops/blocks/dumps were properly positioned. Verified that no stray beams are present in the labs
- Discussed details/causes of the incident with the LUMOS team and identified preventive measures

# Preventive Measures and Controls

- Insufficient communication between users of shared laser beam – second beam was active when not in use, operator was not aware
- Operator of the second setup had not verified safety conditions (blocking stray reflections) after modifying the setup (changing/blocking the beam path)
  - Improve communication between laser users when multiple independent laser systems are present or when one laser beam is used for multiple experiments. White boards with current experiment status will be installed at the CINT-Core (CINT-LUMOS team is already using them at LANL)
  - Abnormal activities (laser alignment, “dark” measurements, etc) will be communicated at weekly team meeting, through LUMOS email list, and appropriate door signs with activity description and effective dates (most of these are already included in IWD, but will be updated accordingly)
  - IWD Procedure revisions – Laser/setup operator is responsible for terminating unused beams at point of propagation and checking/blocking stray reflections after modifying beam path. All authorized operators will be encouraged to perform pre- laboratory inspections (Inspect NHZ with IR viewer, configuration of optical table and status of lasers).

# Preventive Measures and Controls

- Selection of inappropriate material (reflective surface, susceptible to laser damage) and position for the beam block
  - Assess the need for, procure and use only appropriate laser beam control devices (beam blocks should be placed vertical, appropriate for wavelength and power of laser, and are non-reflective)
- Limited illumination impaired visibility of the instrumentation readings
  - Provide task lights/flash lights for every setup to assist with low visibility tasks.
  - Ensure proper house-keeping to prevent tripping/bumping hazards in abnormal conditions (IWD)
- Operator removed laser protective eyewear
  - Under no circumstances may protective eye wear be removed during laser operations
  - Some equipment manuals suggest removing eye wear to check for laser propagation/spectrum during alignment. This is unacceptable - appropriate equipment (IR cards, IR viewers, cameras with telescopes) will be procured and used instead to minimize the risk of injury (IWD)