CEP LASER

Laser Safety Guidelines

Before commencing work with Class 4 lasers, you must read this document, and sign the annex LSR-HRR that the Technological staff will give you to confirm this and your agreement to abide by the protocols contained herein.

The principal aim of this document is to outline the elements of good laser practice as they apply specifically to experiments currently being undertaken in the CLPU laser facility.

1. Description of activity: CLPU laser facility

In this laboratory various Class 4 pulsed and CW lasers are employed to investigate laser-matter interactions and nonlinear propagation as well as laser-characterization studies.

Depending on the experiment, several laser beams (they can have different wavelengths) are used. To facilitate this, laser pulses travel along well defined beam paths in the lab.

Three possible outputs can be used from this laser system. The first 5fs output from the pumped Ti:sapphire oscillator; the second the seed from the oscillator after passing a multipass amplifier obtaining 2.5mJ in less than 25fs compressed; by a hollow-fiber post-compression system a third exit is available achieving more than 600μJ in around 5fs. The mode-locked oscillator is optically pumped by cw diode-pumped laser while amplifiers are optically pumped by pulsed diode-pumped lasers. There is the possibility of CEP-locking these three possible exists.

2. Laser types in use

Description	Laser type	Manufacturer	Pulse characteristics	Wavelengths	Pulse energies
25 fsmultipass	Diode pumped Ti:sapphire	Femtolasers	23fs, 1kHz	760-840	2.5 mJ
Oscillator	Diode pumped Ti:sapphire	Femtolasers	5 fs, 78MHz	640-990	nJ
Post-compression system	Diode pumped Ti:sapphire	Femtolasers	6 fs, 1kHz	680-940	600 μJ
CW pump laser	Nd:YAG	Coherent	CW	532	6 W
Pulsed pump laser	Nd:YAG	Coherent	10 ns, 1kHz	532	30 mJ

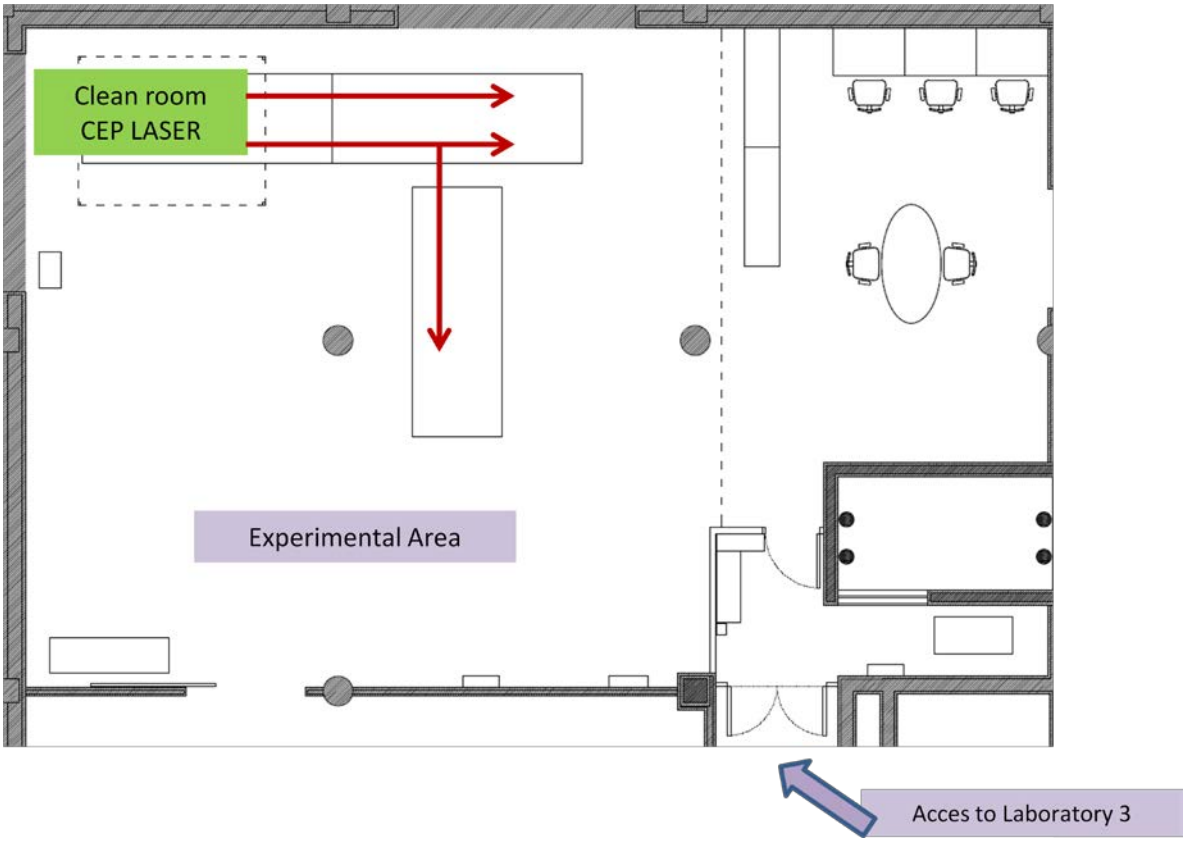
As a general rule, all of these laser emissions are capable of causing severe eye damage (BLINDNESS) if viewed directly, or as a specular (i.e., mirror-like) reflection. Control measurements (careful planning, beam pipes, blocking of reflections, safety eyewear) must be taken to avoid this.

Authorized users of the above lasers are: supervisors, trained postdoctoral fellows students (compulsory with a supervisor or trained postdoctoral fellow's help), laser technicians.

3. Protocol

- Installation or changes must be discussed with a supervisor prior to operation of Class 4 laser systems.
- In the case of any change or problem related to the laser beam, the CEP Laser Supervisor (LS) must be consulted (cmendez@clpu.es).
- Laser beam paths and associated optics must be planned together with the lab Coordinator (msanchez@clpu.es) or the CEP Laser Supervisor (LS) to minimize the possibility of stray reflections.
- Termination of each main laser beam must be planned also with lab supervisors or Lab Coordinator (LC).
- Provision of suitable laser safety eyewear must be addressed.
- When starting the experiment, the CEP Laser Supervisor (LS)[1] will be responsible for activating or deactivating the **laser warning signs** in the display devoted to this whenever the laser is turned on and off.
- Each Experimental Station Supervisor (XSS) or Experiment Supervisor (XS)[2] will be responsible for activating or deactivating the **Experimental Area warning signs** in the display devoted to this whenever the status of his/her Experimental Area changes.
- All new laser users or visitors must receive an orientation to the laser use area by an authorized laser user.
- Alignment may be carried out by authorized persons, no one else may be present in the vicinity during this procedure and watches, bracelets and other reflective jewelry should be removed.
- Check stray reflection for every element you put in the beam path.
- Suitable beam blocks must be installed to block these stray reflections.
- If possible, install beam pipes to cover longer runs of laser beam.
- Under no circumstances must direct viewing of the laser beam be attempted even if the beam has been attenuated. There must be no exceptions to this (obvious!) rule.
- All optics must be checked for damage, and stability of optics mounts verified.
- Try to align with the lowest possible laser energy at which it is possible to visualize the laser beam in an appropriate fashion. The method of visualization is dependent on the wavelength: for UV or visible light, the beam can be viewed on a fluorescent card. An invisible infrared beam may be visualized using CCDs, heat sensitive papers or an IR viewer.
- Remember that lone working is inherently more hazardous than normal procedures and should only be undertaken when there is no alternative and only if it is safe to do so.
- Use proper safety methods when working with high voltage (contact the lab supervisors or Lab Coordinator (LC), don't wear any jewelry, wear rubber bottom shoes, set up your work area away from possible grounds, and don't work alone).

[1] Or person authorized by the LS
[2] Or person authorized by the XSS or XS



Sketch of CEP laser beam lines

4. Laser accidents

Some common unsafe practices that are cause of preventable accidents are:

- Not wearing protective eyewear or using a wrong one during alignment/working procedures.
- Misaligned optics and upwardly directed beams- pay particular attention to periscopes, and reflections from windows and beam splitters/combiners.
- Improper methods of handling high voltage.
- Lack of protection from non-beam hazards.
- Failure to follow safety protocols.
- Bypassing interlocks and laser housing.
- Insertion of reflective materials into beam paths.
- Lack of pre-planning.
- Operating unfamiliar equipment without supervision.

5. Laser alignment

It has been reported that some sixty percent of laser accidents in research settings occur during the alignment process.

Laser alignment guidelines to help prevent accidents should include:

- Restricted access.
- Laser protective eyewear.
- Class 4 laser users must have received appropriate training and instruction.
- The individual who moves or places an optical component on an optical table is responsible for identifying and terminating each and every stray beam coming from that component.
- Watches and reflective jewellery should be taken off before any alignment activities begin.
- Beam blocks must be secured.
- Check the stability and rigidity of all optical mounts.
- When the beam is direct out of the horizontal plane, it must be clearly identified.
- The lowest possible/practical power must be used during alignments.
- When possible, a coarse alignment should be performed with a HeNe or cw diode alignment laser.

6. Annexes

6.1 Laser Safety Registration- CEP

This sheet must be signed by external users before commencing work with class 4 lasers.

By signing below, you confirm that you have read the 'laser safety guidelines' document, assisted to a training session or be an expert user and you agree to abide by the protocols and guidelines contained herein.

Institution		
Name	Signature	Date

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