User Training for the
“Laboratorio di Ateneo”

PoliFAB

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Laser equipment

General description

In PoliFAB's cleanroom there are installations using different types of lasers. This document is aimed at informing users of the risks related to laser equipment usage and training on the operating procedures for this kind of instruments. The following table lists the laser instruments installed at PoliFAB and their location in the cleanroom.

Instrument	Location	λ (nm)	Class	Power	PPE
Lasse	Magnetic thin films	266, 355, 532, 1064	4	0.125 J, 0.250 J, 0.5 J, 1 J for 7 ns puls and repetition up to 10 Hz.	Goggles + collective protection equipment
Lasse	Magnetic thin films	635-670, 831	3R	< 5 mW	Goggles
Metricon	Metrology	633, 1310, 1550	3B	< 10 mW	Goggles

The most significant risks related to laser operation involve eyes and skin. The different types of lasers are classified in growing risk classes:

Class 1: Lasers which are safe under reasonably predictable working conditions, including the use of tools for beam observation.

Class 1M: Lasers emitting light in the wavelength range between 302.5 nm and 4000 nm and which are safe under reasonably predictable working conditions, but can become dangerous if the operator uses optical elements for beam observation.

Class 2: Lasers emitting visible radiation in the wavelength range between 400 and 700 nm; eye protection is normally granted by the spontaneous defense reactions including eyelid reflex. This reaction provides sufficient protection under reasonably predictable working conditions, including the use of optical elements for beam observation.

Class 2M: Lasers emitting visible radiation in the wavelength range between 400 and 700 nm; eye protection is normally granted by the spontaneous defense reactions including eyelid reflex; however, beam observation may be dangerous if the operator uses optical elements.

Class 3R: Lasers emitting radiation in the wavelength range between 180nm e 1mm, where direct beam observation may be dangerous. Avoid direct eye exposure even without optical elements for the observation.

Class 3B: Lasers which are normally dangerous in case of eye exposure to the direct or reflected beam; diffused radiation is normally not dangerous.

Class 4: Lasers capable of producing dangerous diffused reflections; can cause skin burns and may be a risk of fire and electrocution. Their operation requires extreme care.

Operating instructions

When using laser instrumentation, the operators must take the maximum care of their actions in order to minimize the risks related with their work, acting in the highest possible safety for themselves and for the others. Lasers must be equipped with a safety key or switch device. In case of class 2 lasers, users must ensure they do not deviate direct of reflected beams towards their eyes or other people's eyes. Special care is required during alignment anche check operations.

Adequate protective goggles are mandatory if alignment or check necessities create the risk of prolonged exposure to direct or reflected beams. Class 3 lasers may be dangerous if the beam, direct or reflected (by watches, rings, pens...) strikes an unprotected eye. In addition to what is valid to class 2 lasers, it is mandatory to block the laser path with a non reflecting barrier. It is also mandatory to use protective goggles if a human eye may accidentally cross the beam. All parts of the enclosure which may be removed during maintainance, making radiation accessible to the eyes, must be equipped with safety interlocks (to prevent the access during normal operation). Health surveillance for laser operation is required in order to prevent or highlight any eye damage. For class 4 lasers, in addition to what said for classes 2 and 3, operators must prevent damage to the eyes and to the skin also from any reflection of the beam and diffused light, as well as fire risk. Precautions to be adopted include a design project that considers the whole beam path. The laser must be operated in a limited access area. In order to ensure the maximum possible protection in the restricted area, the whole beam path including the target area, must be confined with barriers that avoid accidental exposure to the beam. In case of pulsed systems it is particularly important that the project considers fire risk. In case of continuous wave lasers, safety interlocks must cut off the laser power supply or block the beam with barriers.

For what concerns the class 4 laser (Nd:YAG quadrupled) present in the magnetic thin films area, a sliding door defines a restricted access area. Before switching on the laser, users must ensure that the door is closed and all windows blinds are closed. When the laser is on it is forbidden to stay inside the restricted area unless wearing protective goggles with adequate optical density. The sliding door must remain closed and laser operation must be clearly indicated by the blinking light outside the restricted area. Users operating this laser must ensure that nobody enters without protective goggles.

In case of emergency

In case of accidents during cleanroom work, the operator must act in total safety for him/her-self and for colleagues present in the laboratory. Even in case of accidents without damage to people or things, the operator must report as soon as possible and with as much detail as possible to the laboratory Staff personnel. The operator must also inform the Staff in case of situations or behaviors that could be dangerous for people and for the cleanroom itself, or that could be in contrast to the prescriptions reported in this document and the other cleanroom safety training documents.

In the event of a health emergency, defined as any situation where one or more operators show health problems, even of light intensity, it is necessary to evaluate how dangerous the event is. Only after checking that the accident scene is not dangerous for other users, you can help the involved operators. At the same time it is mandatory to inform the Staff about the events. In case Staff members are not available and the event can be dangerous for other users, you must activate the fire alarm. In case of health emergency, defined as risk to human life, or whenever assistance from qualified sanitary operators is needed, any user can call the emergency number 112. After this, inform the Staff personnel.