Lesson 1:
INTRODUCTION TO APL

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Course: Laboratory of Atmospheric Remote Sensing
Laurea Magistrale in Atmospheric Science and Technology

OBJECTIVE OF THE LABORATORY WORK:
Observation of atmospheric aerosol and wind speed using active and passive remote sensing techniques

Theory:

1) Introduction to Remote Sensing
2) Remote sensing of wind and turbulence (SODAR)
3) Generality of Atmospheric Aerosol
4) Aerosol Absorption and Scattering
5) Remote sensing of aerosol (LIDAR and spectroscopy)
6) Interaction between radiation and aerosol in the visible range

Experiment:

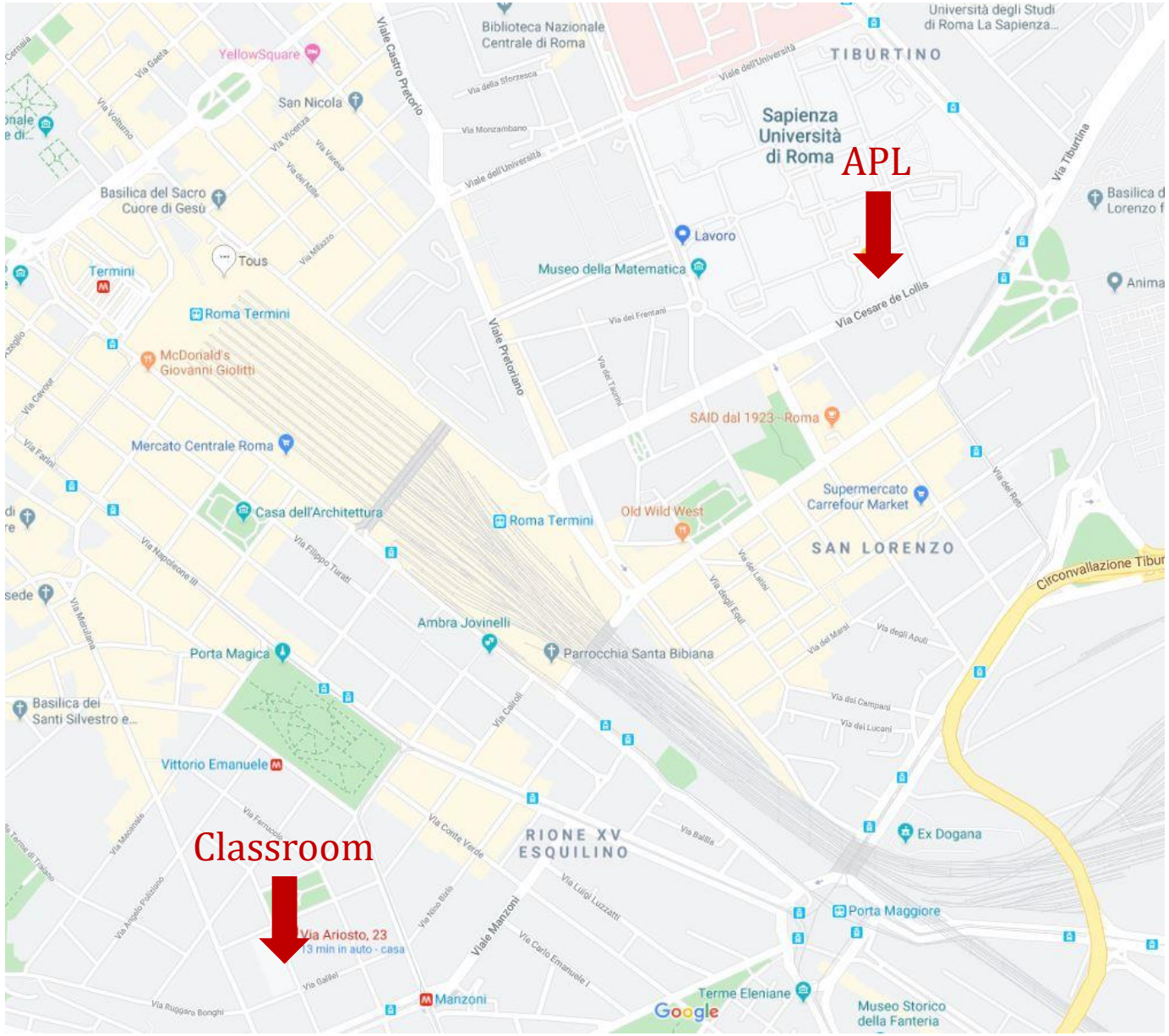
1) Building and aligment of a Cassegrain telescope
2) Acquisition of a LIDAR profile
3) Retrieval of aerosol optical parameters
4) Retrieval of wind data and comparison with numerical simulations

The laboratory work is performed by a team made of three/four students.
The final report will be individual.

Grading:
Written report to summarize the laboratory works and the result of the experiments (50%).
Oral presentation and discussion (50%).

Suggestions:
Use a logbook where:

- Keep track of every measurement with its error
- Design sketches of the experimental configurations
- Report useful formula
- Keep note of the operation on the instruments


APL
Classroom
Biblioteca Nazionale Centrale di Roma
Università degli Studi di Roma La Sapienza...
TIBURTINO
Sapienza Università di Roma
YellowSquare
San Nicola
Basilica del Sacro Cuore di Gesù
Tous
Termini
Roma Termini
McDonald's Giovanni Giolitti
Mercato Centrale Roma
Casa dell'Architettura
Lavoro
Museo della Matematica
Via Cesare de Lollis
Viale Pretoriano
SAID dal 1923 - Roma
Supermercato Carrefour Market
Old Wild West
SAN LORENZO
Ambra Jovinelli
Parrocchia Santa Bibiana
Porta Magica
Basilica dei Santi Silvestro e...
Vittorio Emanuele
RIONE XV ESQUILINO
Ex Dogana
Via Ariosto, 23
3 min in auto - casa
Viale Manzoni
Manzoni
Porta Maggiore
Terme Eleniane
Museo Storico della Fanteria
Google


Viale Regina Elena
3
19
Piazzale del Verano
Medicina Legale
Banca
Ufficio Postale
Obitorio
Bar
Servizi Generali
Fisiologia Umana
Fisiologia Generale
Botanica
Orto Botanico
Genetica
Alloggi
Aule
310
71
Scienze Statistiche
Scienze Politiche
C.i.a.o.
Biblioteca
Aula Magna
Rettorato
Lettere e Filosofia
Scienze Umanistiche
Laboratori
A.DI.S.U.
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Viale dell'Università
Giurisprudenza
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Geologia
Mineralogia
Zoologia
Fisica
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Asilo Nido
Fisica
Chimica
Chimica Farmaceutica
Neurologia
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Aule
Officine
Teatro
Igiene
Ortopedia
Scienze dello Spettacolo
Aule
Bar
Piazzale Aldo Moro

GENERAL SAFETY RULES IN LABORATORY

- Be fully focused on your activities in the lab
- Be aware of what people in the lab are doing
- Correctly use work tools and the safety and individual protection devices that are available. Ask laboratory personnel if you have any doubt in the use of tools
- Do not tamper with, deactivate, damage, remove and inappropriately use safety, signal or control devices
- Do not obstruct/hide escape routes (corridors and stairs), emergency exits and access to fire-fighting equipment (hydrants, extinguishers, etc.) with your objects

GENERAL SAFETY RULES IN LABORATORY

- For powering the electronic means connect

  the plug directly to the nearest electrical cabinet.

  If the cord is too short use only standard extensions cord.
- For any doubt ask your teacher, do not esitate
- You will share the promises with other lab members: DO NOT speek loud, make or receive telephone call, smoke or eat inside the laboratory
- Do not leave unattended your personal belongings
- If you fill tired….take a rest

Read accurately the Student Safety Handbook (vademecum for students)

https://www.uniroma1.it/it/pagina/materiale-informative

MECHANICAL TOOLS

Screw hex socket

Screw flat head

Screw socket head caps

Bolt

Nut screw

Washer

Split washer

HAND TOOLS

Phillips screwdriver

Flathead screwdriver

Allen wrench

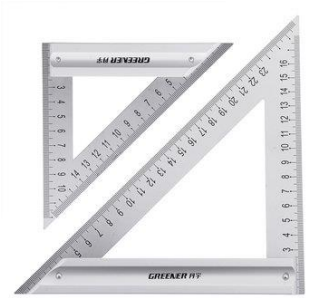
Wrench

Nipper

Combination pliers

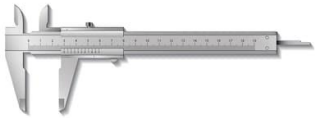
Longnose pliers

MEASUREMENT TOOLS



Set square

Measuring tape

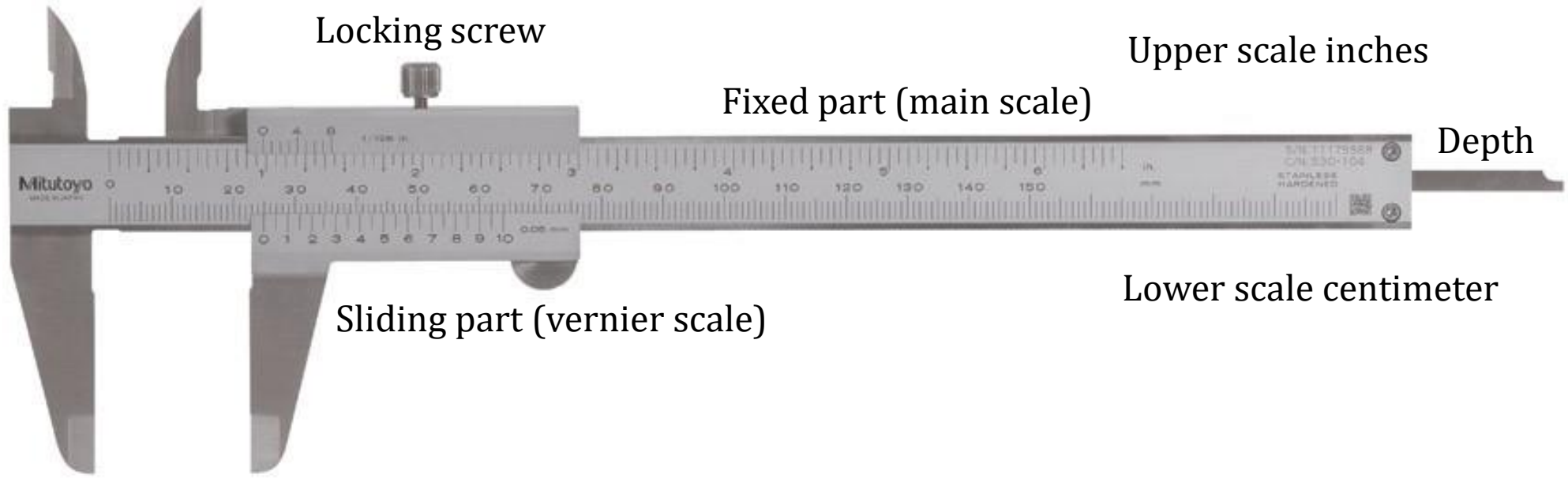


Caliper

GENERAL RULES IN USE OF BOLTS

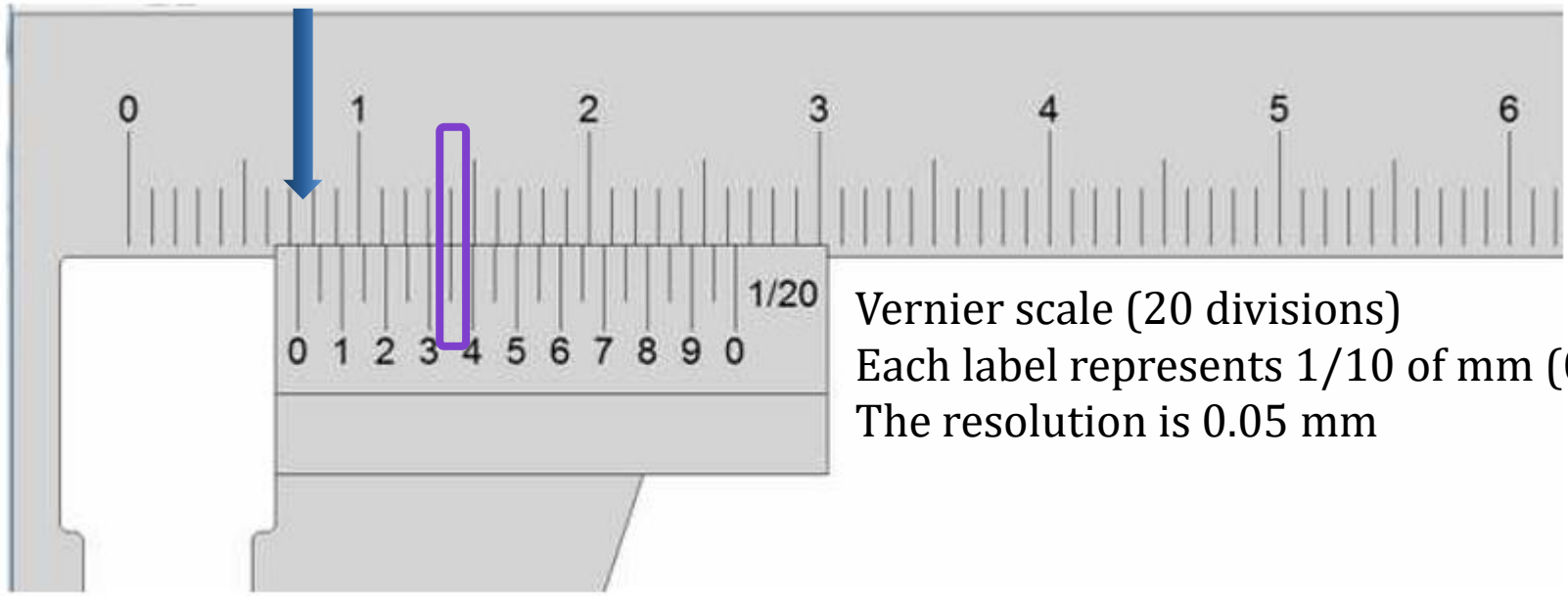
- The bolt thread and dimension must ever match the threaded hole
- Use a bolt long enough to screw in the threaded hole for at least a length corresponding to its diameter Do not use bolts too long; it is a waste of time
- Do not tight too much
- Use washers if is possible
- Use the specific tool to tight bolts. Use nipper only in case the correct tool is not available

VERNIER CALIPER



HOW TO READ THE VERNIER CALIPER

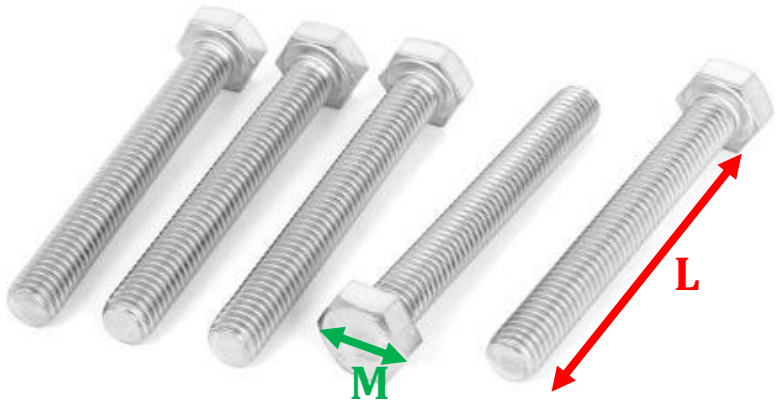
Main scale (1-mm division)
Each label represents 1 cm



Vernier scale (20 divisions)
Each label represents 1/10 of mm (0.1 mm)
The resolution is 0.05 mm

1. Read the main scale where it lines up with the vernier scale zero.
2. If the reading is between two lines just use the smaller value. (the zero-mark is between 7 and 8 mm: the reading is 7 mm)
3. Find the first mark on the vernier scale that lines up perfectly with a line on the main scale. That mark tells you the value of additional digit (the line between 3 and 4 mark of the venier scale lines up with a line in the main scale: the additional reading is 0.35 mm)
4. The final measurement is 7.35 mm with an error of 0.05 mm

STANDARD DIMENSIONS IN THE ATMOSPHERIC PHYSICS LAB



M2-M8 diameter of threaded sector
L = 10-100 mm length from the tip to the base of the head

- Standard linear dimension
  75mm (multiple and submultiple)

- Cylindrical optomechanical parts (optical mounts, tubes)
  diameter = 32 mm, 60 mm, 132 mm

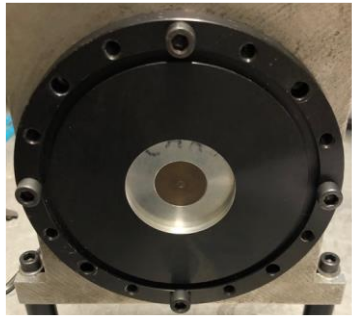
- Optical components (mirrors, lenses, filters)
  diameter = 25 mm, 50 mm, 1', 2''

OPTICAL TOOLS

Laser ring holders

Spacer tube

Diaphram

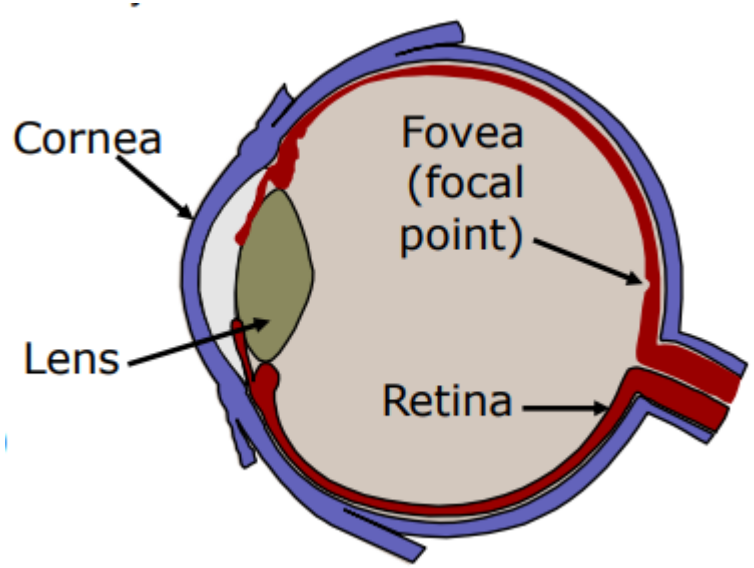


Pinhole system

LASER SAFETY

Different wavelength ranges affect different part of the eye:

- 100-280nm affects cornea surface
- 280-315 nm absorbed by the cornea
- 315-400nm affects the lens
- 400-1400nm affects the retina (enters into the eye)

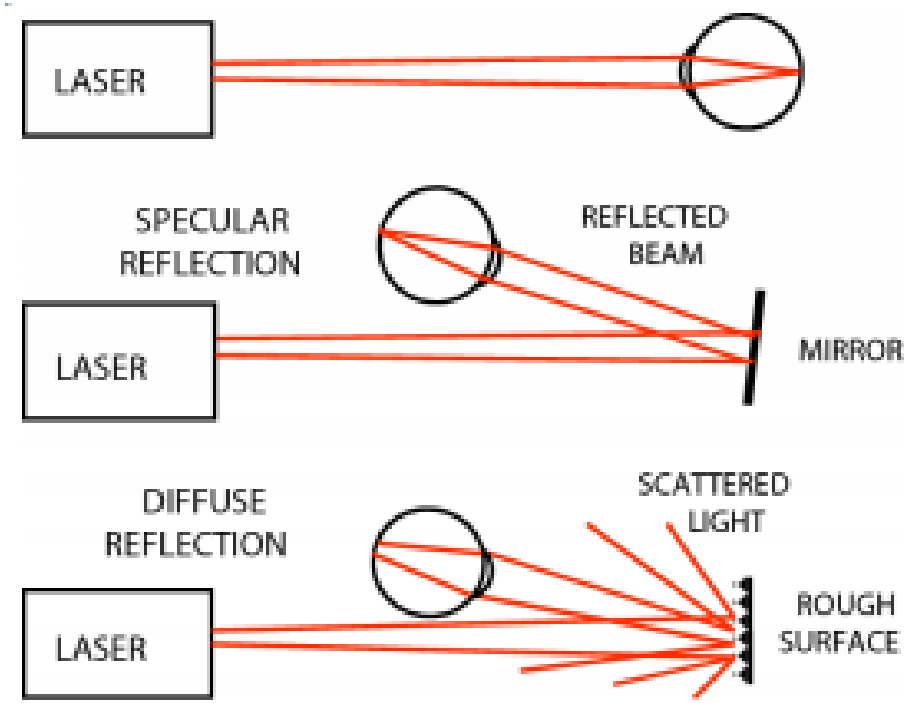


LASER SAFETY

Not only direct exposure, **reflections** are dangerous, too:

- **specular reflection** - which occurs from mirror-like surfaces. The incident beam striking a specularly reflecting surface will leave it essentially unchanged;

- **diffuse reflections** - which occur from rough surfaces such as paper or matt-painted walls. These reflections bear no relation to the direction of the incident radiation.



Non-beam hazards include:

- Electrical Hazards
- Fire Hazards
- Laser Generated Air Contaminants (LGAC)
- Compressed Gases
- Chemical Hazards
- Collateral and Plasma Radiation
- Noise

LASER SAFETY

ZONA CONTROLLATA LASER

APPARECCHIATURA LASER CLASSE IIIA, IIIA, 3B, 4

RADIAZIONE LASER VISIBILE ED INVISIBILE

EVITARE L'ESPOSIZIONE ALLA RADIAZIONE DIRETTA O DIFFUSA

VIETATO L'INGRESSO AI NON AUTORIZZATI

USARE I DISPOSITIVI INDIVIDUALI DI PROTEZIONE PRESCRITTI

PERSONAL PROTECTIVE EQUIPMENT (DPI)

Personal protective equipment includes:
protective eyewear

Selection of eyewear should be based on:
- wavelength(s) being used;
- radiant exposure;
- maximum permissible exposure (MPE);
- optical density of eyewear;
- visible light transmission requirements;
- adequate peripheral vision;
- comfort.

They are NOT SUFFICIENT TO PROTECT EYES FROM STRAYGHT BEAM TO THE EYE.

See in the laser output path is forbidden and hazardous in any case, with or without or the glasses.

MOST DANGEROUS ACTIONS

There are un-countable number of ways to run into trouble using a laser beam.

The alignment of an experiment is among the most dangerous procedure

…but there are several other silly ways to hurts you (i.e. to look into the beam to check if the laser is on, bend forward at the height of the optical beams, etc.)