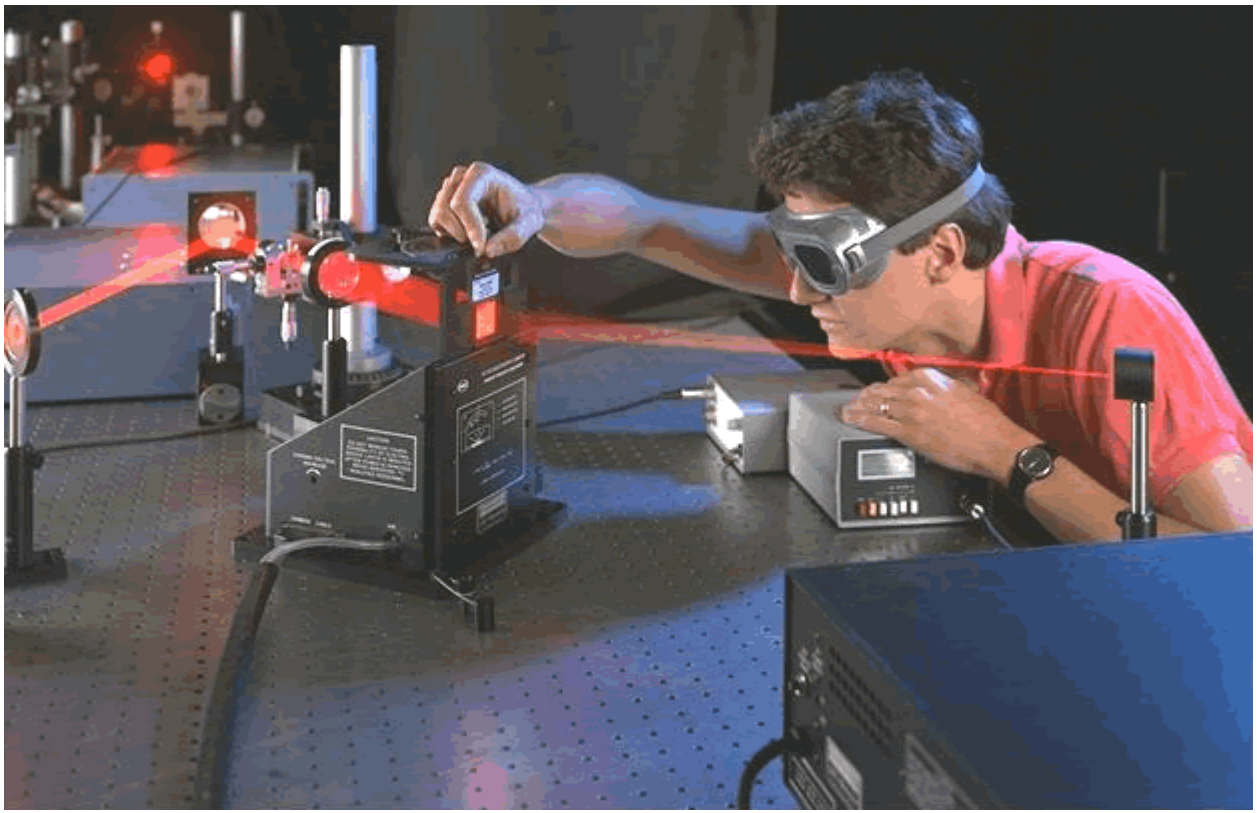
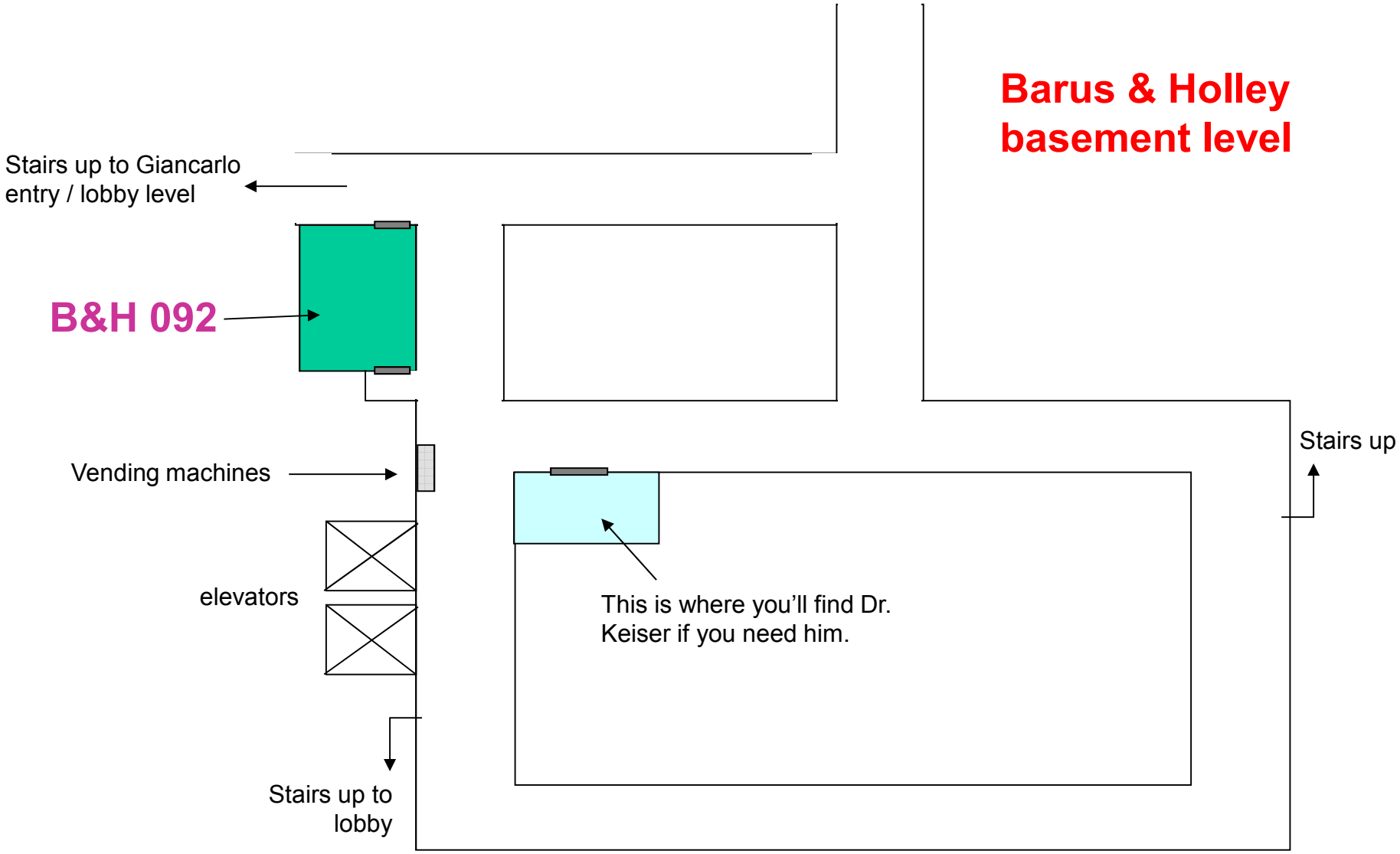
Laser lab: safety and procedures



The location



Laser safety

1. Eye safety

The main hazard from lasers is eye damage.

DO NOT LET ANY LASER BEAM ENTER YOUR EYE.

The lasers used in this lab are low-power lasers. So scattered light from rough surfaces is not hazardous. But a direct beam, either from the laser or from a reflection off of a mirrored surface, could be damaging. Therefore

DO NOT LET ANY LASER BEAM ENTER YOUR EYE.

The laser beam should always propagate in a plane parallel to the surface of the table, roughly six inches above the surface. Reflections are most likely to occur in this plane. If you bend over, your eye will cross through this plane. So, always be aware of where all stray beams are, so that you

DO NOT LET ANY LASER BEAM ENTER YOUR EYE.

Laser safety

2. Electrical safety

The secondary hazard from lasers is electrical. When energized, our laser tube operates above 1000 volts. Touching this would be extremely unpleasant. Therefore do not touch the laser tube when it is energized.

You can tell if it is energized by looking at the warning light on the power supply, next to the power switch. Don't trust the glow of the tube – if things malfunction, the tube might not be glowing but could still be energized.

Note: it is ok to touch the four alignment adustment knobs even while the tube is energized. Just don't touch the tube itself.

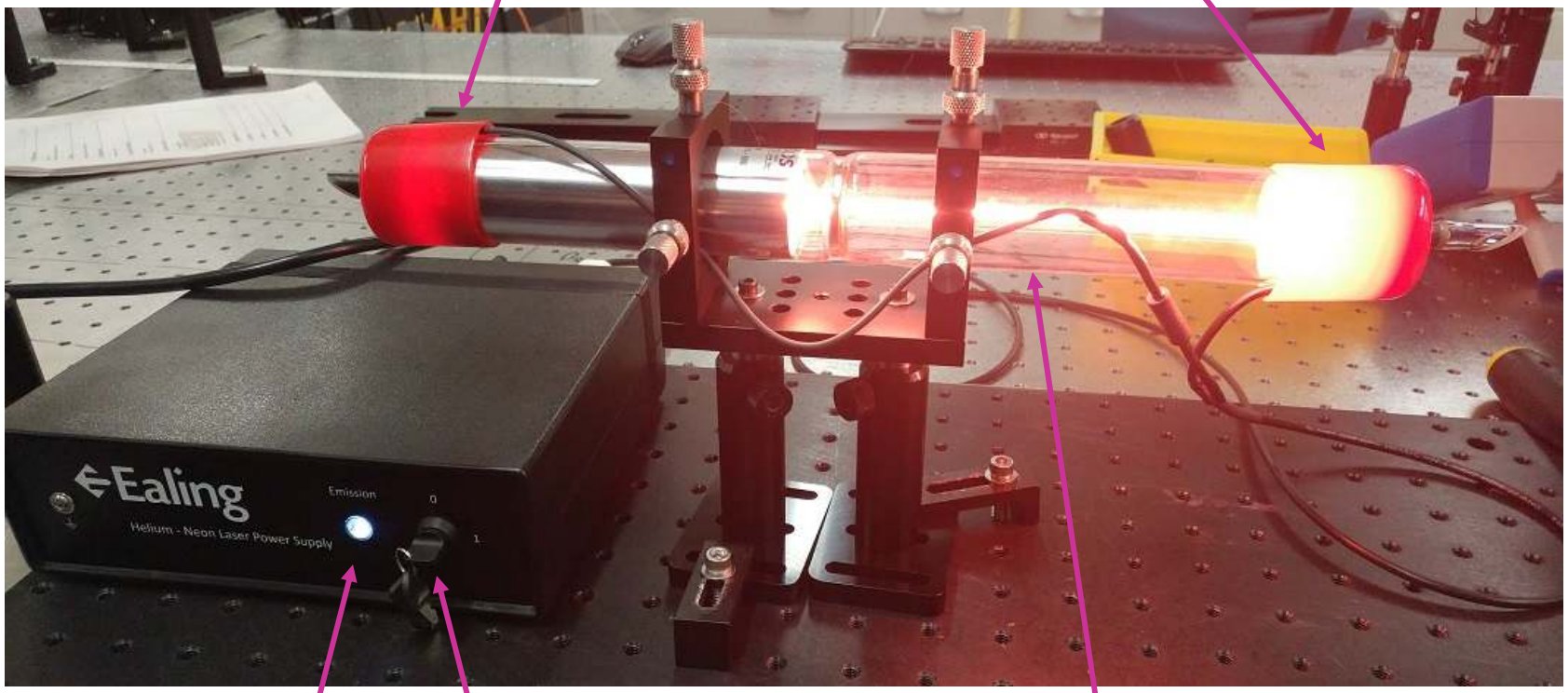
Also

DO NOT LET ANY LASER BEAM ENTER YOUR EYE.

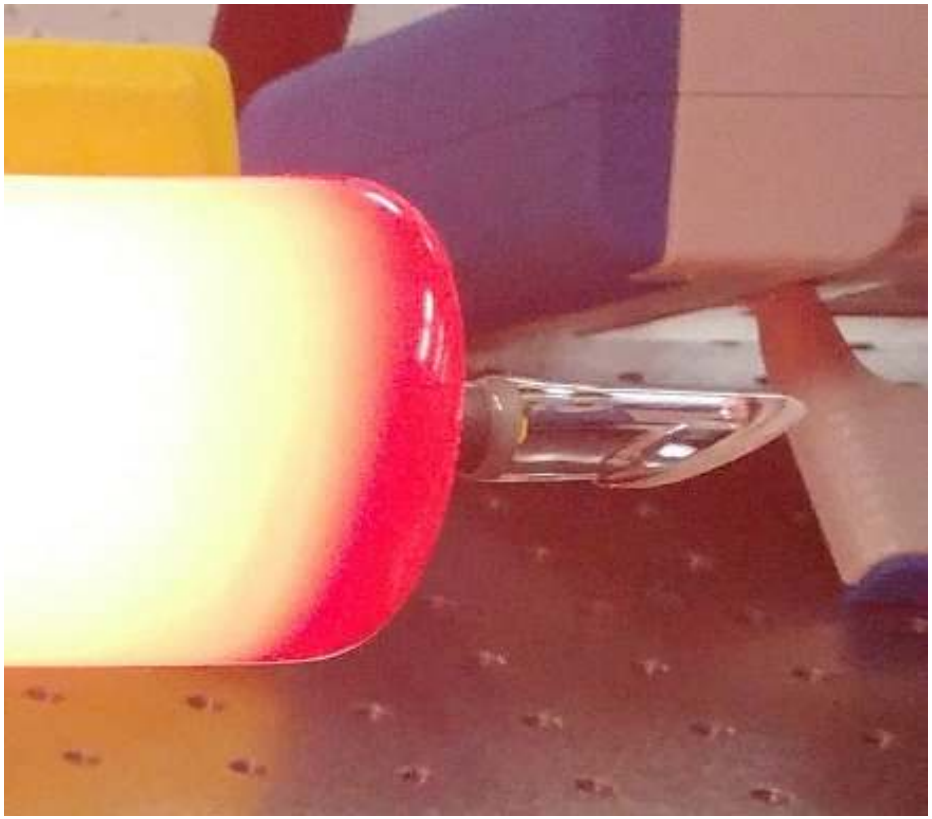
(just in case you forgot)

The HeNe tube and power supply

This is the gain medium of the laser you will be building. It is a helium-neon tube, inside a glass envelope, with a power supply for providing the high voltage.



Can I touch the windows on the ends of the HeNe tube?



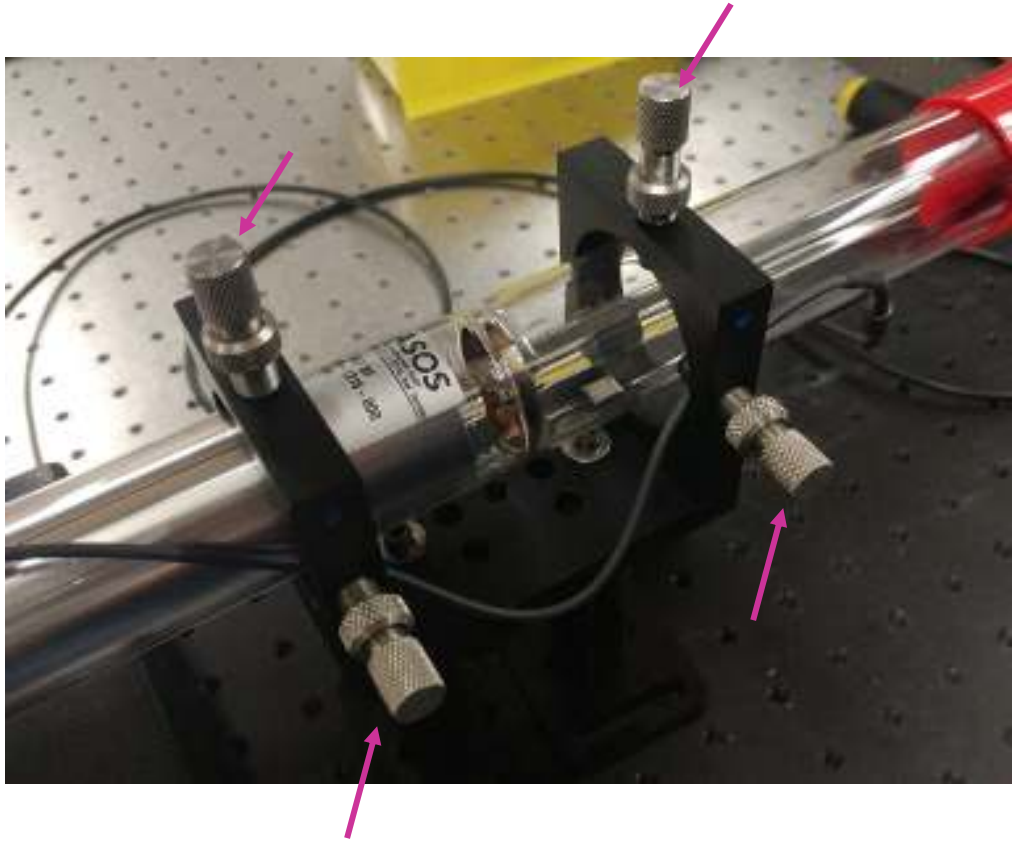
NO.

This is a close-up view of one of the two end windows of the HeNe tube.

Notice that it is set at an angle – can you guess why?

NEVER TOUCH EITHER OF THESE WINDOWS. They scratch very easily. Even a small fingerprint will make it impossible for the laser to operate.

Can I touch the knobs on the tube mount?

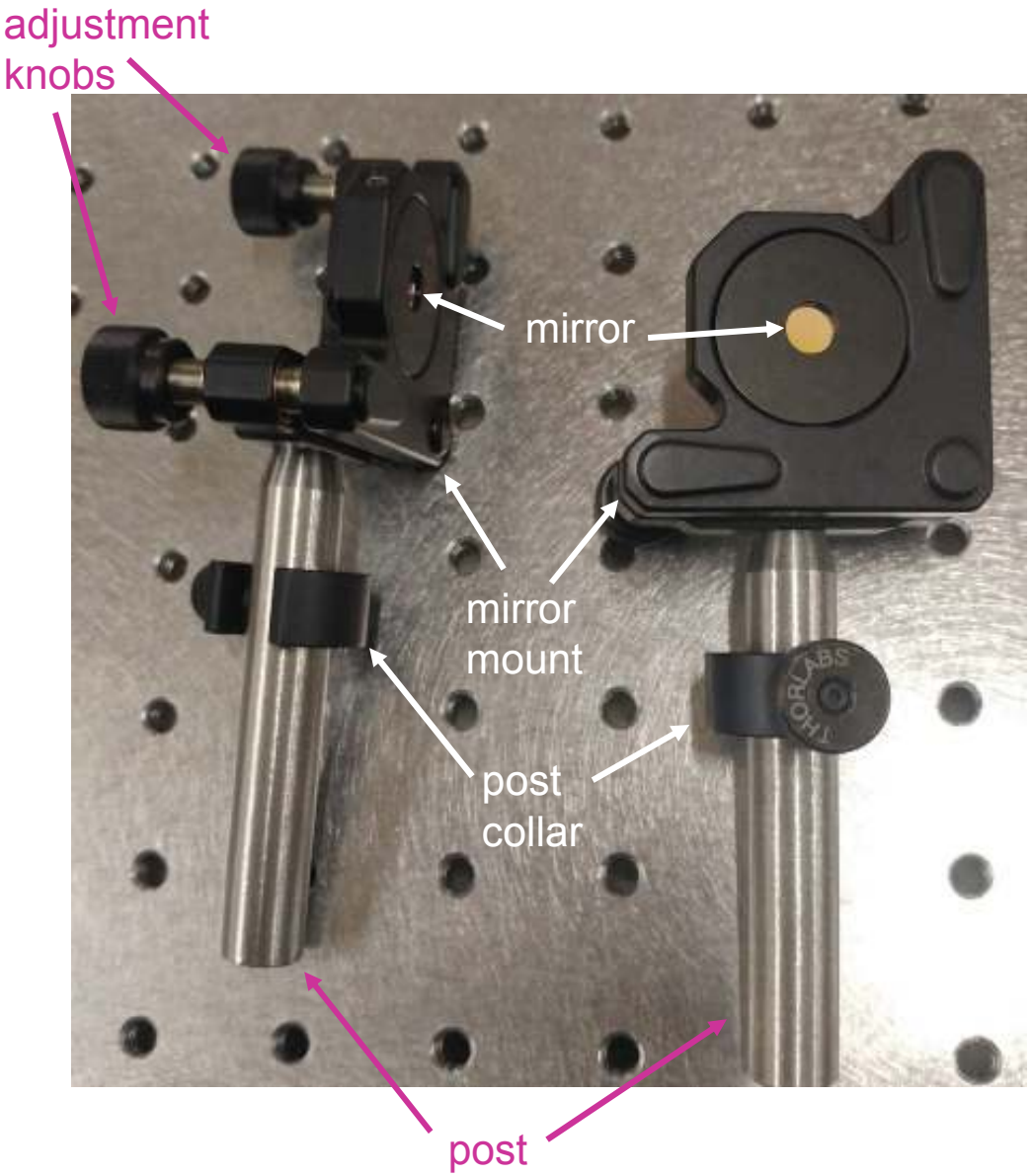


Yes, although you might not want to do that.

The tube is already very well aligned. It should need no further alignment (or, maybe just the tiniest little tweaks). It is difficult to align from scratch, so avoid moving it by anything more than the tiniest little bit.

However, the four knobs are perfectly safe to touch even when the tube is energized: there is no electrical hazard.

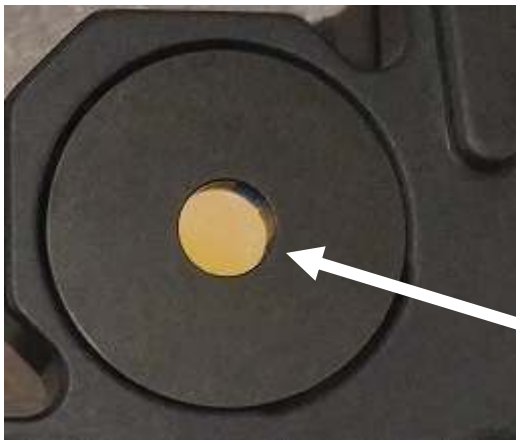
What is a mirror mount and how does it work?



This picture shows the two laser mirrors that you will be using. They are already mounted in mirror mounts. The two knobs can be adjusted to tip and tilt the mirror to its desired angle.

You should not need to turn these knobs very much. When the laser is working, even a small turn of either knob will make it stop working. It takes some touch to turn them just a little bit.

Can I touch the mirror surfaces?



The mirror surfaces are extremely delicate. Any slight scratch will destroy them.

So we **NEVER TOUCH THE OPTICS**.

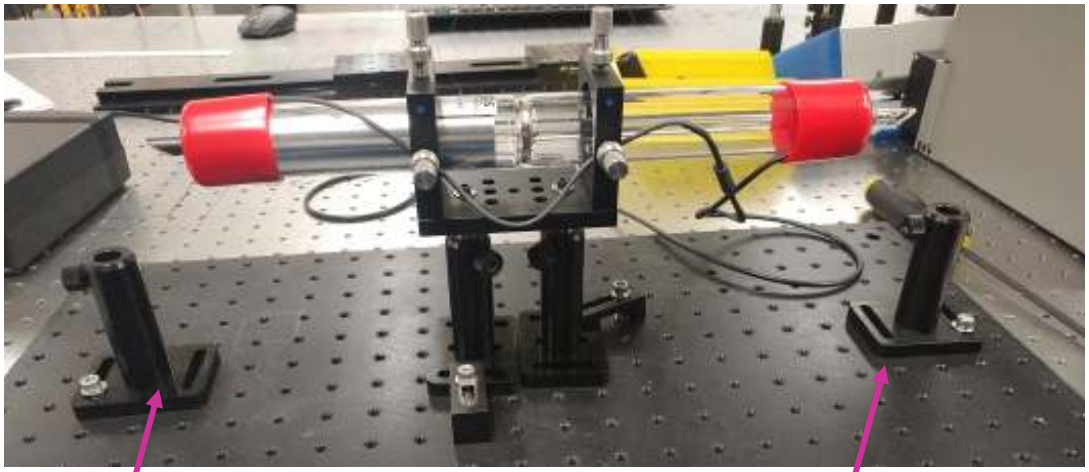
Don’t even blow on them.

Looking at them is ok though…

If you suspect that the mirrors are damaged or dirty or anything else, ask an expert for help.

Optics should be handled only by the mount, never by the optical surface.

What about those post holders?



You will find the tube set up with two post holders already screwed to the breadboard, one on either end of the tube.

These are the ones you will use when you first align the laser. Do not move them.

To mount a mirror, just slide the post into the holder and tighten the thumb screw to hold the mirror in place.

When you do that, be careful not to allow the mirror surface to get touched by anything at all.

After the thumb screw is tight, you can make fine adjustments to the tip and tilt of the mirror using the mirror mount's adjustment knobs.

What is an iris and how does it work?

An iris is a circular aperture that can be used to make sure a laser beam is pointing in the correct direction and at the correct height.

It also blocks scattered light that doesn't make it through the central opening.

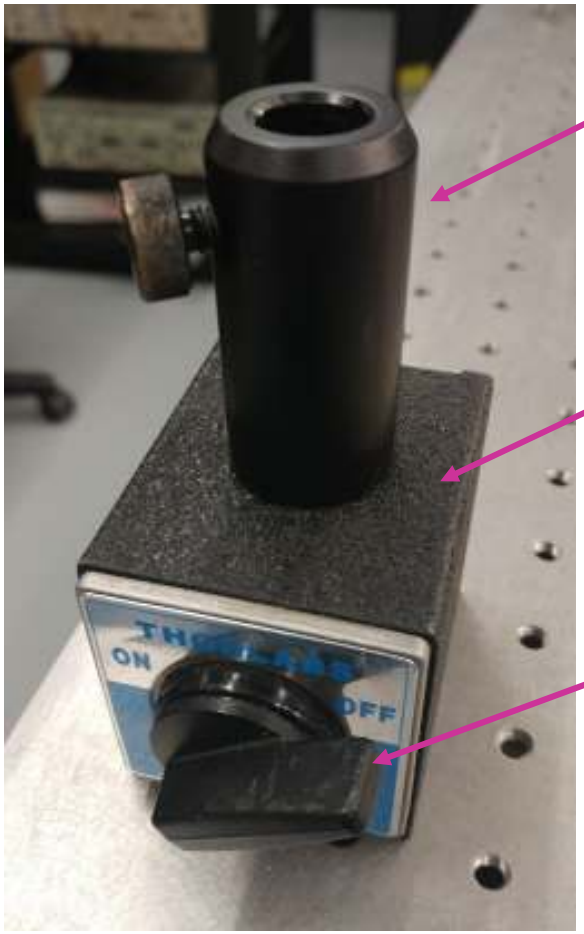
The size of the opening is variable, depending on the size of the laser. Just slide the lever on top from left to right and back.

Can I open and close the iris?

Yes. Just be gentle with it. You may find it useful to adjust the size of the opening when aligning the laser mirrors.

You should not remove the iris from its post holder, or unscrew the post holder from the table. The iris location and height above the table has been carefully set so that we can always be sure the alignment laser beam is pointing in the right direction.

What is a mag base and how does it work?



A magnetic base makes it easy to move optics around on the table and secure them, without having to constantly loosen and tighten screws.

Flipping the lever switch to “on” rotates the magnet so that it is pointing towards the table. In this way, the base will be secured to the table.

Flipping the switch to “off” frees the base so that it can be moved around.

The alignment laser

You are going to align the HeNe laser using another laser to guide the alignment. We will call this the “alignment laser”. It is also a HeNe, manufactured by Uniphase.

It has been carefully aligned before the lab, and is a pain to realign, so don’t touch the tube. You can turn it on and off with the key on the front of the Uniphase power supply.

The optical power meter

This is the device that you will use to measure the optical power generated by the laser. It consists of a head and a controller.

There are many buttons.
You only need to push one of them: the red one (on/off)

controller

LCD display

on/off button

head

When making measurements, direct the laser beam into the center of this circular opening, at normal incidence.

After the device starts up, it will display the optical power entering the head on the LCD display. Notice that the units are also displayed, and they update automatically: nW (nanowatts), μW (microwatts), and so on.

The optical power meter

There is only one way that you can damage this item: by dropping it.

So don't drop it.

controller

LCD display

on/off button

head

When making measurements, direct the laser beam into the center of this circular opening, at normal incidence.

When using the power head, screw its mount to the table so that it doesn't get knocked over accidentally.

At the end of the lab, turn the power off.