The laser is awesome and fun to play with, but it is an

INDUSTRIAL MACHINE

NOT A FRAKKING PRINTER

YOU DO NOT LEAVE IT UNATTENDED

EVER

I'M SERIOUS

Things to be careful of:

- FIRE
- ventilation
- laser tube cooling
- don’t bump the laser

Laser checklist

- ventilation operational
- coolant pump operational
- coolant fluid not too hot
- nothing blocking the laser gantry
- home
- touch off
- file in the right position - entirely in lazzorable area
- file looks right
- file is the right size
- material is in the right place
- power set to ZERO before start
- operating power not too high (never above 15 mA)
- feed rate seems reasonable (F command)
- staying to watch the laser while it operates

Step 0: Check things

- Check **where** the **fire extinguishers** are. There should be one in the laser room, one outside the door of the laser room, and one in the kitchen. Go check to make sure you know where at least two of them are.
- Check that you **know how to use the fire extinguisher**. Pull it off the wall so that you know how it's held on and will be able to grab it *quickly* if you need to.
- Check the **state** of the **coolant water**. Is there enough of it? Is it full of nasty crud? It needs to be replaced fairly often. If it's looking a little grungy, you need to at least pull out the pump and wipe off any weird stuff with a paper towel. If it's looking bad, replace the water. We use distilled water and vinegar. Now that we have found that we need to replace the water frequently, we may go back to tap water. Ask around for how to replace the water and what to replace it with. You'll want an extra pair of hands around anyway.
- Check the **temperature** of the **coolant water**. If everything's been off, it should be at room temperature. Once the laser has been running for a while, the water will warm up. We don't know at what temperature we'll run into issues, but it should never get too hot to touch. Uncomfortably warm water is probably a cue to turn everything off and let it sit for an hour or so. Or design a better way of keeping the water cool.

Step 1: Turn on the power

- Check that the **laser** is **off** (red and green switches).
- Flip the **switch** on the wall behind the laser. This switch turns power on to:
  - the ventilation fan
  - the coolant pump
  - the laser
  - the laser computer
- Check that the **coolant pump is working**: Pinch the tube coming out of the coolant tank to feel for flow. If you don't feel any water flowing, don't go any further! Figure out why the pump isn't running and fix it!
- Listen for the **ventilation fan**. If it's not running, don't go any further.
- Check that nothing is **in the laser bed** that could block the gantry

If either the **fan** or the **coolant pump** is not operational, **DON'T GO ON UNTIL YOU FIX THE PROBLEM**!!

Step 2: Turn on the computer

- Press the power button (oooh, bet you didn't see that coming!)
- Open "**launch lazzor**"
- **Import** your file
- Check that your file looks reasonable
- **Disengage EStop** in **EMC**
- Turn on **power** in **EMC**
- Turn on the **green power switch** on the laser (this powers the gantry, not the laser tube)

Step 3: Home the laser and position your file

- Place your **material** in the laser and **tape** it down using painter's tape. (The tape is to prevent your material from moving during the cut. It can easily vibrate and cause your material to shift which totally sucks, especially in the middle of a long cut! I would also recommend paper as a first pass, just to look for issues before ruining perfectly good wood/ acrylic.)
- **Home** the **x**, **y,** and **z** axes (use radio buttons, press home) (Homing z doesn't do anything in this case, but it won't work if it's not homed. The software is designed for a mill which would have a z axis.)
- Change the **view** so that you are looking down the z axis. (optional, but it helps to be able to see what's going on)
- **Touch off** (position your file)

Explanation of touch off: Since you've just homed it, the current position of the laser is the minimum x and y position allowed. In an ideal world, you might set this point to (0,0). However, in many cases this doesn't make sense. Perhaps your file is doing weird things and made all the y coordinates negative (the plugin sometimes does this). Perhaps you want to position your file in a different part of the bed.

To set the **coordinates** of the **current position** of the laser, select the axis you want to modify and press the "touch off" button. The dialog that pops up lets you set the current value of that coordinate.

The red box is the area the laser can cut in. It is 9"x13.1". If you don't see this, you either don't have the view set correctly or your file is too big or too small.

Step 4: FIAR TEH LAZZOR

- **CHECK THAT THE COOLANT PUMP IS OPERATIONAL** (Yes, again. You don't want to be the person who forgot to check and broke the laser tube.)
- **CHECK THAT THE VENTILATION SYSTEM IS OPERATIONAL** (Yes, again. Not breathing toxic fumes is important. It also keeps things cleaner)
- Did you check that the **coolant pump** and **ventilation** system are operational? Really? **Are you sure?** Go check again.
- Do you know where the **fire extinguisher** is and how to use it? Are you sure? Turn around, and go pull it off the wall and put it back again just to make sure you'll be able to do it quickly in an emergency.
- Ok! Everything looks ok and safe? Onwards!
- Turn the **grey knob all the way down** (CCW) (This knob controls the amount of power going to the laser tube.)
- Turn on the **red power switch** on the laser (this turns power on to the laser tube)
- **Position the laser** (using manual gcode or the arrow keys) over your material, but not somewhere you care about

- Use the **red pushbutton** above the laser power switch to fiar teh lazzor. Turn the grey knob slowly and carefully until it seems to be at the right power level. Check the wiki for some sample feeds and speeds. If this seems to be way off, **STOP**. The laser may need cleaning or focussing.

DO NOT EVER EXCEED 15 mA

(as read on the meter on the laser)

Step 5: Run your file

- I'd **recommend** running it at very low power and just marking **paper**, especially if this is the first time you're cutting a piece. Then you can place your material on top of the paper and be sure it's properly positioned.
- **Run** your file by pressing the **play button** at the top of the screen.
- **Watch carefully!** for:
  cutting speed: does it seem to be going too fast or too slow?
  listen for **skipping steps**! This sounds like grinding. (It shouldn't really happen anymore since things are better calibrated and have limitations on speed/acceleration)
  stuff catching on **fire**
  stuff not **venting** properly
  anything bad!
- If you have a problem:
  major issue: turn off the main power switch No, I don’t care that this is bad for the computer, etc. We want to remove power from the system if anything serious is going on
  minor issue: press the stop button in EMC
  minor fire: flip **off** the **red laser switch** to turn off power to the laser. If turning off the laser stops the fire, press the stop button in EMC. Turn down the laser power and try again. (You can resume from the middle of the file with a couple different methods.)
- **DO NOT LEAVE**
- **REALLY, DON'T LEAVE**
- **KEEP WATCHING,** OR AT LEAST HANGING AROUND **UNTIL IT'S DONE**
- **FIRE CAN HAPPEN EVEN IF YOU’RE DOING EVERYTHING RIGHT**
- **A LASER TUBE FAILURE CAN HAPPEN EVEN IF YOU’RE DOING EVERYTHING RIGHT**
- **DO NOT LEAVE THE LASER UNATTENDED**
- Some materials generate a bright light while being cut. Using your phone to watch it helps. We also have a piece of dark acrylic you can place over the viewport. Be careful.

Step 6: Take your piece out and admire it

- Before opening the laser, **turn off the red laser power switch**. (Yes, there's an interlock. It's also really easy to defeat. It doesn't take much effort to turn off the switch and is generally a good habit to form.)
- Open the laser and pull out your piece.

Troubleshooting:

To resume from stop:

- record the line at which you stopped the laser
- if the problem was step skipping, home the machine
- look at the gcode and find the beginning of the block that you stopped in
- restart from the beginning of the block
- if the problem was step skipping, be extra careful listening for skipped steps
- if the problem was step skipping, record the problem on the wiki and let the list know. The laser really shouldn't be doing this anymore. This indicates that something needs tuning (either acceleration is too high or the gantry is misaligned). We'll need to deal with it.

Some notes about fire:

Expect fire to happen, respect the tool, and know how to deal with it.

I can’t emphasize how important it is to know where the fire extinguishers are and how to use them. It is absolutely imperative that you know this before using the laser.

If there’s a (self sustaining) fire in the laser, you’ll need to open the laser in order to get the extinguisher in. This is a bad scene, since if the fire’s been going on for a little while, you’ll end up with a very hot lid. This is something we need to fix, but you need to be aware of it if you’re using the laser now.

Fire can happen **even if you’re doing everything right**. So **STICK AROUND AND WATCH THE LASER**, especially if you’re cutting and not just etching. Often they’ll happen in the middle of a job, after you’ve run for a while with no problem. This is because the material (acrylic in particular) heats up as you laser it, making it more prone to flash into flame the more you’ve cut it.

The majority of fires will be extinguished by just turning off the laser - especially if you’re watching and catch it as soon as it starts. This is why it’s super important to always watch the laser while it cuts. Expect fire to happen, and be ready for it.

The fire risk in the laser is VERY HIGH, but *manageable*. If you expect fire to happen and know what to do, it won’t cause problems. Make sure you know what to do in an emergency.

If you don’t know what to do, you could burn down the building and/or die.