



LASER INDUCTION - THE EDGE



State Library
of Queensland



Queensland
Government



Acknowledgement of Country

We acknowledge Aboriginal and Torres Strait Islander peoples and their continuing connection to land and as custodians of stories for millennia. We respectfully acknowledge the land on which we all meet today, and pay our respects to elders past, present and emerging.



INDUCTION SUMMARY

Our Trotec Speedy 300 lasers can cut and etch wood, plastics, paper, cloth and leather quickly and accurately. In this induction you will learn what software you can use, how to prepare design files and how to operate the machine safely.

Once you've completed the induction you can book and use the State Trotec Library of Queensland's lasers at The Edge during Open lab.

Open Lab sessions are a chance to meet up with like-minded makers and tinkerers at The Edge with facilitators to support your creative needs in the space.

Bookings are required to use the equipment and you will be able to book with your SLQ account once you have completed the relevant induction.

Wednesday 1.30pm – 8pm

Thursday 1.30pm – 8pm

Saturday 12pm – 5pm

For more info and to book, head to <https://www.slq.qld.gov.au/visit/spaces/edge>

LASER HISTORY

- **Invention of the Laser (1958):** The concept of the laser (**Light Amplification by Stimulated Emission of Radiation**) was first introduced by Arthur Schawlow and Charles Townes in 1958.
- **Theodore Maiman's Ruby Laser (1960):** Theodore Maiman developed the first working laser using a synthetic ruby crystal, marking a significant milestone in laser technology.
- **CO2 Lasers (1964):** The development of carbon dioxide (CO2) lasers by Kumar Patel opened up new possibilities for industrial applications due to their high power and efficiency.
- **Emergence of Laser Cutters (1970s):** CO2 lasers became integral in the creation of the first laser cutters, which revolutionized manufacturing processes by providing precise and efficient cutting capabilities.
- **Advancements in Fiber and Solid-State Lasers (1980s-1990s):** Innovations in fiber and solid-state laser technologies expanded the range of laser applications, enhancing reliability and reducing maintenance.
- **Integration of Computer Numerical Control (CNC) (1990s):** The combination of laser technology with CNC systems allowed for automated and highly precise control over the cutting process.
- **Diverse Applications (2000s-2020s):** Laser cutters found widespread use in various industries, including manufacturing, aerospace, and healthcare, owing to their versatility in cutting various materials with minimal waste.
- **Ongoing Technological Advancements:** Continuous research and development have led to improvements in laser cutter speed, precision, and affordability, ensuring their continued evolution in diverse fields.

LASER TECHNOLOGY

What is Laser Cutting?

Laser cutters use a focused beam of light, called a laser, to cut through materials. The laser beam is generated in a laser tube and directed by mirrors to the cutting head. The intensity of the laser beam is controlled to melt, burn, or vaporize the material, creating a precise and clean cut.

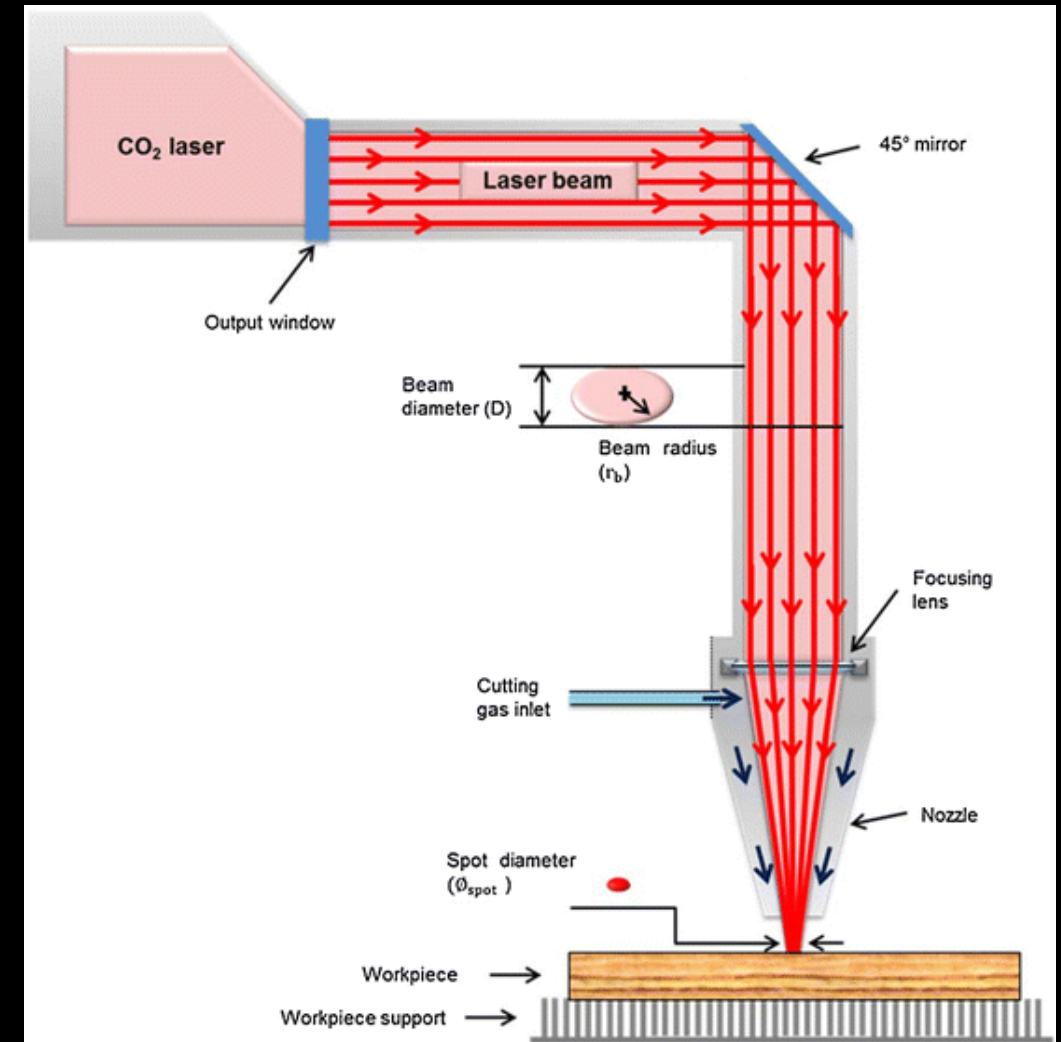
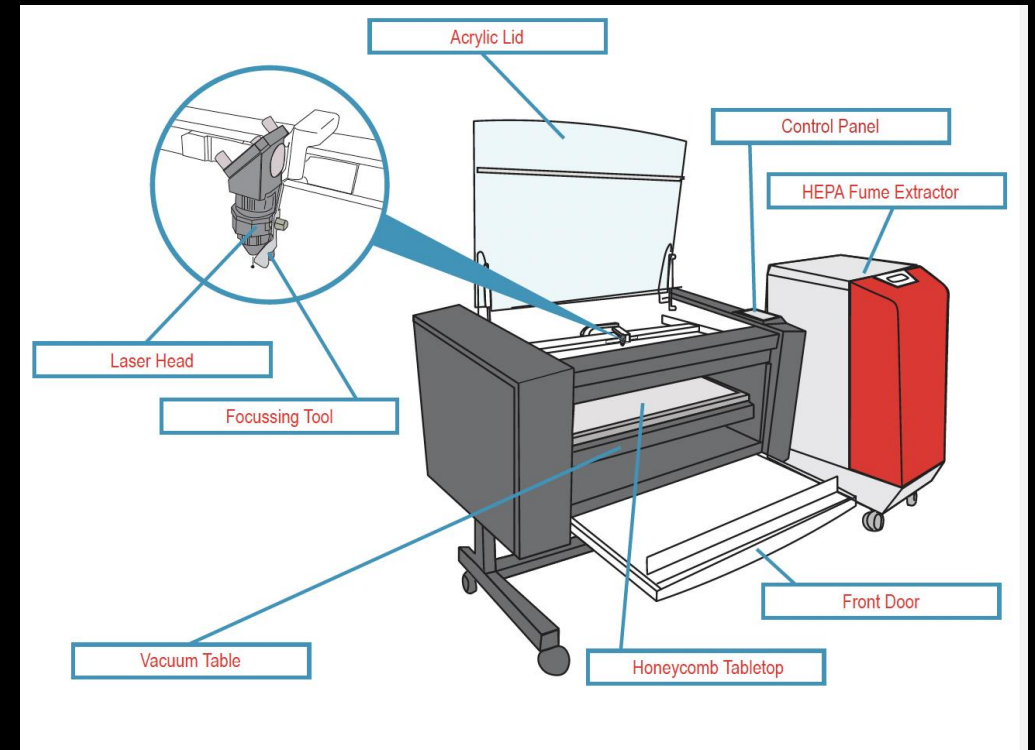


Image from [Factorem](#), Medium

What is a Laser Cutter?

- Motorised mirror on an X, Y axis
- Trotec 80W Carbon Dioxide Laser
- Follows vector line work
- Can cut paper, card, wood, and acrylic. Selection available at The Edge.
- Metal: anodised aluminium can be etched only
- Wood: must check with the supervisor first
- Other Materials: see supervisor



EQUIPMENT OVERVIEW

Is it dangerous?


Yes, there are risks

- Fire Danger
- Laser Radiation
- Eye strain
- Fumes (extractor in place)

Safety Interlocks


No user serviceable parts

Supervisors are always in the space to help and to approve your settings.




all yours


SAFE OPERATING PROCEDURE LASER CUTTER/ENGRAVER




DO NOT use this machine unless you have completed an induction and the Supervisor has given permission




Appropriate footwear with substantial uppers must be worn.



Long and loose hair must be contained or restrained.



CAUTION
LASER RADIATION




LASER PRODUCT
CLASS 2
1 mW CW maximum
400 - 700 nm

The CO2 laser is housed in a sealed enclosure. However, members and staff should avoid any accidental direct eye or skin exposure.

PRE-OPERATIONAL SAFETY CHECKS

1. Ensure that material you intend to cut/engrave is approved. Consult the Supervisor.
2. Only an inducted and competent person should be setting up and operating this equipment.
3. Safety guarding and magnetic lockout devices must never be removed or adjusted.
4. Ensure that a current HOT WORK PERMIT has been obtained from the Security Office.
5. It is mandatory that the exhaust extraction system is attached to the laser cutter and fully functioning. The exhaust air plenum **MUST** be positioned outside the breezeway door.
6. Visually check the area to ensure no slip or trip hazards are present in this workspace.
7. Be aware of other members and staff that may be in the immediate vicinity.

OPERATIONAL SAFETY CHECKS

1. Never attempt to use the laser without having successfully completed the induction.
2. All settings **MUST** be checked by the Supervisor before commencing to cut or engrave.
3. Gently place your material on the table in the upper left corner. Ensure the table is set low enough to avoid knocking the laser head.
4. Carefully focus the laser using the focussing tool; take care to avoid head impact.
5. The top lid must be closed before cutting/engraving can commence.
6. Selecting the material from the database that corresponds to the material on the table will automatically set the correct laser power and speed.
7. To run the job, press 'ENTER'  on the laser control panel.
8. The fume extraction system will turn on automatically.
9. The carriage will move from its current position to the point of first engraving or cutting.
10. The process is now automatic until all passes are complete.

HOUSEKEEPING

1. **DO NOT** leave the laser running unattended. Use the 'PAUSE' button to interrupt the job when necessary.
2. Always leave the honeycomb tabletop free of debris.
3. Keep the work area tidy and clean. Dispose of waste in the appropriate bins.
4. Remember to remove your thumb drive from the computer.

POTENTIAL HAZARDS

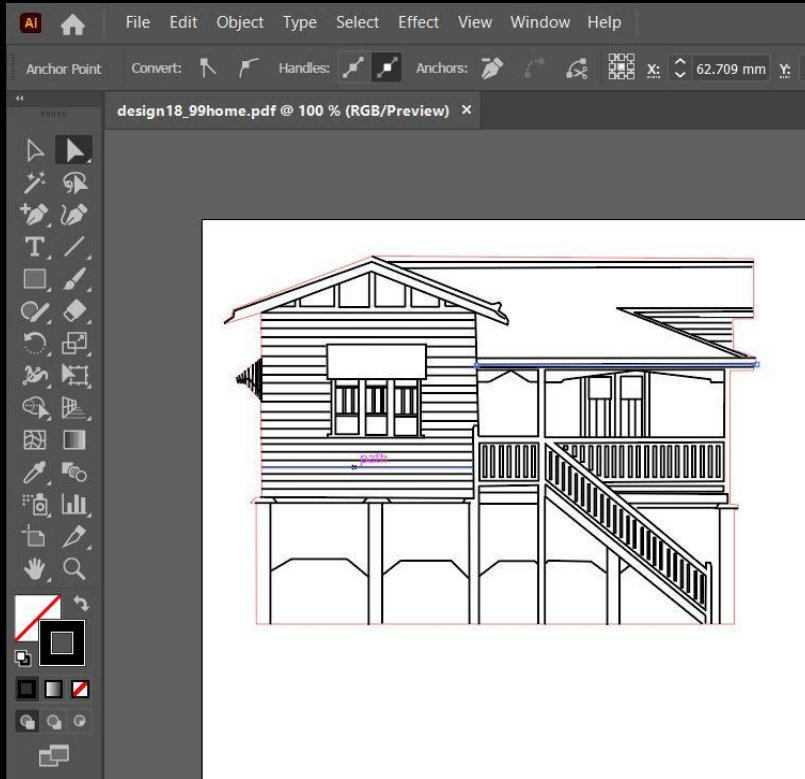
■ Impact, pinch and crush points	■ CO2 laser beam	■ Electrical components
■ Flammable materials	■ Eye injury	■ Manual handling
■ Noxious or toxic particulates & fumes	■ Failure or malfunction	

This SOP does not necessarily cover all possible hazards associated with the tool and should be used in conjunction with other references. It is designed to be used as an adjunct to teaching Safety Procedures and to act as a reminder to users prior to tool use.

The Edge Fabrication Lab Safe Operating Procedure	State Library of Queensland	Records File #: 520_315_227
Author: George Daniel Flood	Version #: 1	Issue Date: 14/07/2020
Uncontrolled when printed		Revision Date: 21/04/2023

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SAFETY



DESIGN

Laser cutters direct a coherent, focussed beam at a material to selectively vaporize it with high precision.

Laser cut files generally start life as a [vector](#) file, which is converted into machine code through special software.

Design software

Some of the most common programs laser users use to create their design files include;

- Adobe Illustrator (available at The Edge)
- Inkscape (available at The Edge)
- Corel Draw (available at The Edge)
- Other vector programs

START GUIDE



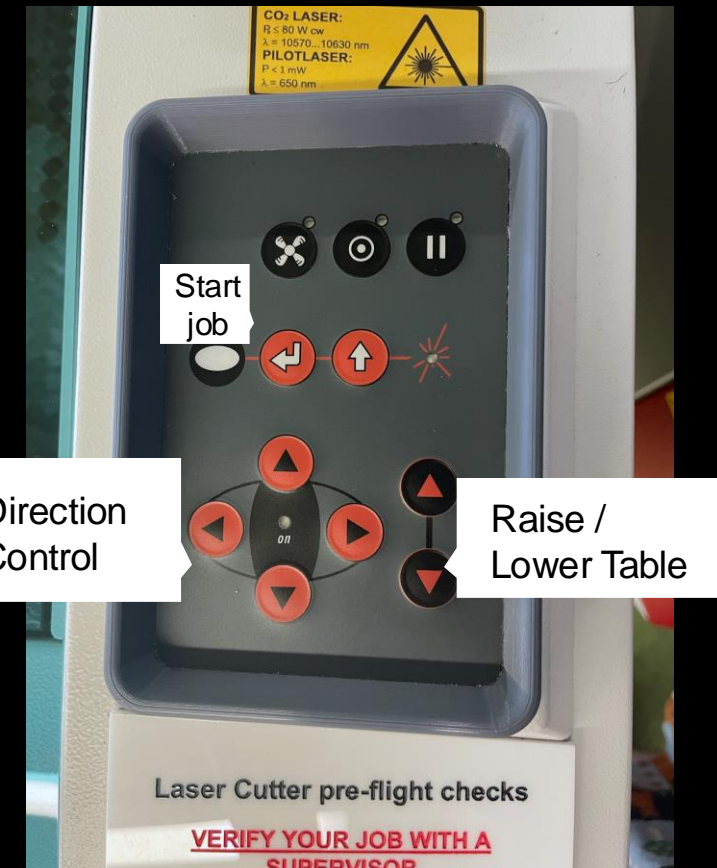
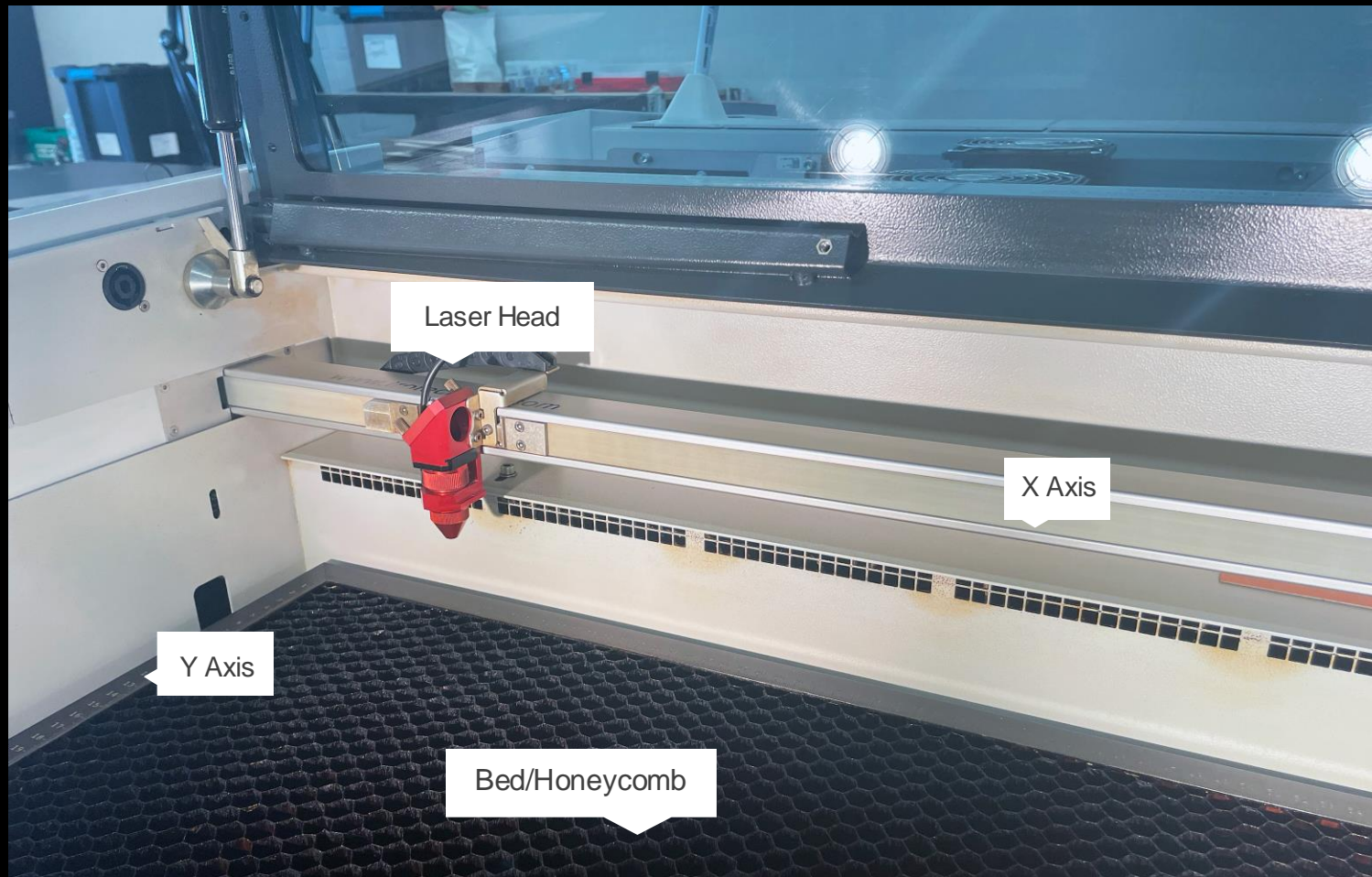
Before you start

- Let the supervisor know you have booked and are ready to use the Laser Cutter.
- Let them know about any the material you want to cut and the size if not using The Edge material. We will need to sight an SDS for new materials.
- No cutting can be done until a Hot Work Isolation Permit has been obtained (the supervisor will have organised one before the start of Open lab).
- To stop the machine:
 - Press the pause button (can press again when ready to re-start)
 - lift the lid (this will abort the job)
 - Press the stop button in the Ruby app

Keep watch at all times:

- Keep an eye on the laser cutter in case of fire or other issues.
- In an emergency, lift the lid to stop the laser and call over a supervisor.

INSIDE THE MACHINE



CONTROL PANEL

FOCAL DISTANCE

Using the buttons on the control panel, move the laser head out over the sheet to be engraved/cut.

Take the laser focussing tool and carefully hang it on the side of the laser head as pictured. It will balance there.

Raise the bed carefully. As the bed approaches the focusing tool, use rapid button clicks to raise the bed incrementally until you see the tool move, indicating contact with the sheet. The tool may fall off its perch, but it doesn't need to.



The focussing tool lives on the front ledge within the laser enclosure as shown. Always return it to this location. Each laser has its own focussing tool. Do not interchange them.

Intro to Ruby

Ruby is the web-based laser software that we use with the laser machines at The Edge.

- Ruby has an RGB 16-colour palette which can have each colour relating to a different laser setting.
- All imported objects must have a **standard stroke colour** - if your object has no stroke colour, it will not import.
- Text should be converted to paths

Vector cutting:

- The stroke width can be set to anything (including zero) as the cut will just follow the centre of the line, using hairline in your design prep can help, particularly if you are making boxes and joins.

Engraving:

- The laser can do a vector engrave (stroke size doesn't matter) or a raster engrave.
- If the stroke has a colour and a thickness, the LINE will be engraved at that thickness.
- If the object has a fill, the OBJECT will be engraved.
- If the stroke and fill colours are different, then the line and the object can have different engrave settings.

4mm Plywood settings example

Rast Engrave 0.3mm

P: 90% V: 90%

R: 0% G: 0% B: 0%



Rast Engrave 0.5mm

P: 90% V: 60%

R: 0% G: 0% B: 255%



Rast Engrave 0.7mm

P: 90% V: 45%

R: 3% G: 255% B: 0%



Rast Engrave 1.0mm

P: 90% V: 30%

R: 255% G: 0% B: 255%



Vector Engrave

P: 20% V: 3%

R: 3% G: 255% B: 255%



Thru Cut

P: 100% V: 0.9%

R: 255% G: 0% B: 0%

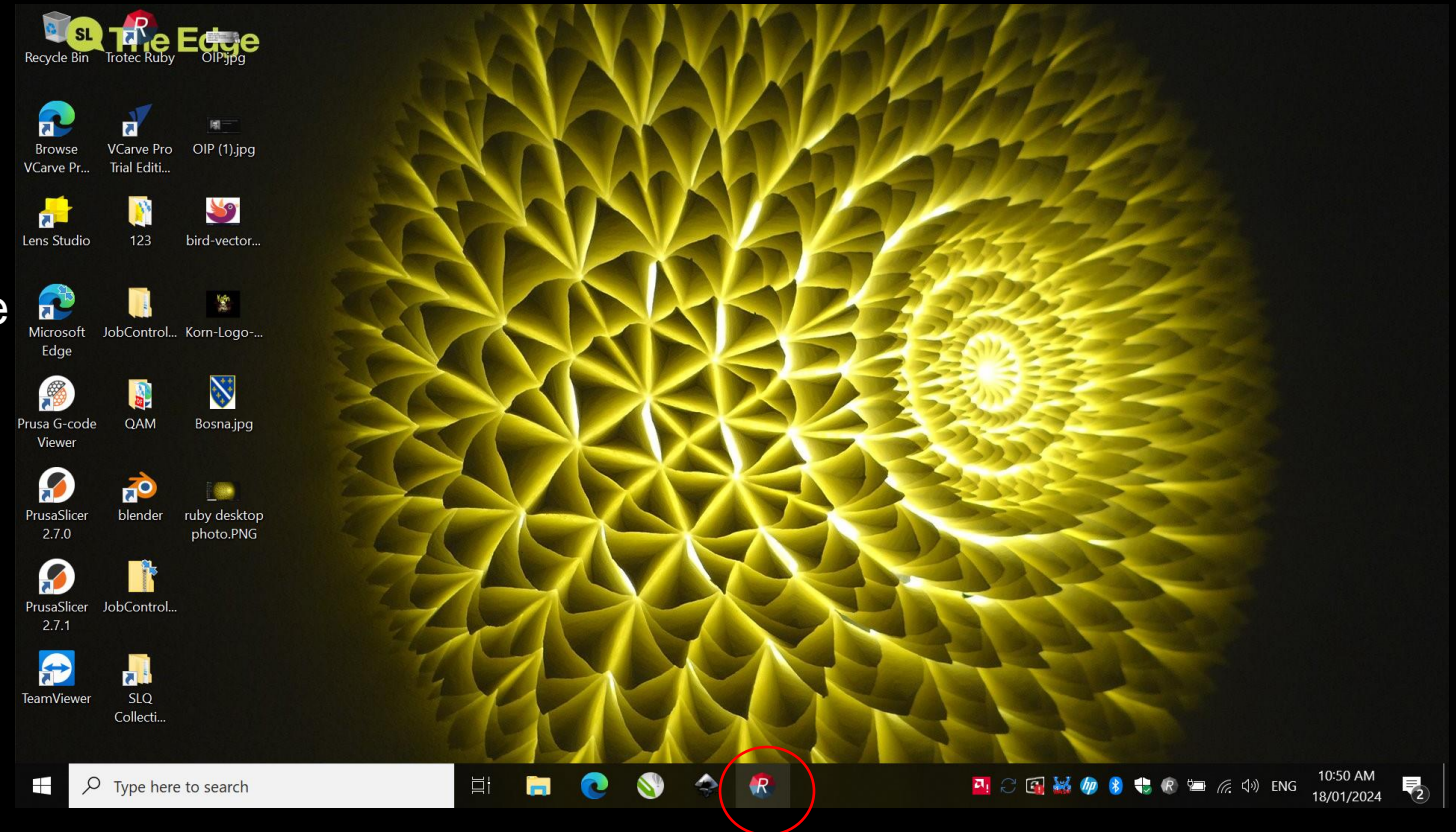


Getting Started

Power up the laptop associated with the laser you intend to use and enter the default username <edgeuser> and password <edgeuser>.

Open Ruby by clicking on the icon in the tray at the bottom of the screen and log in with the default username and password that appears.

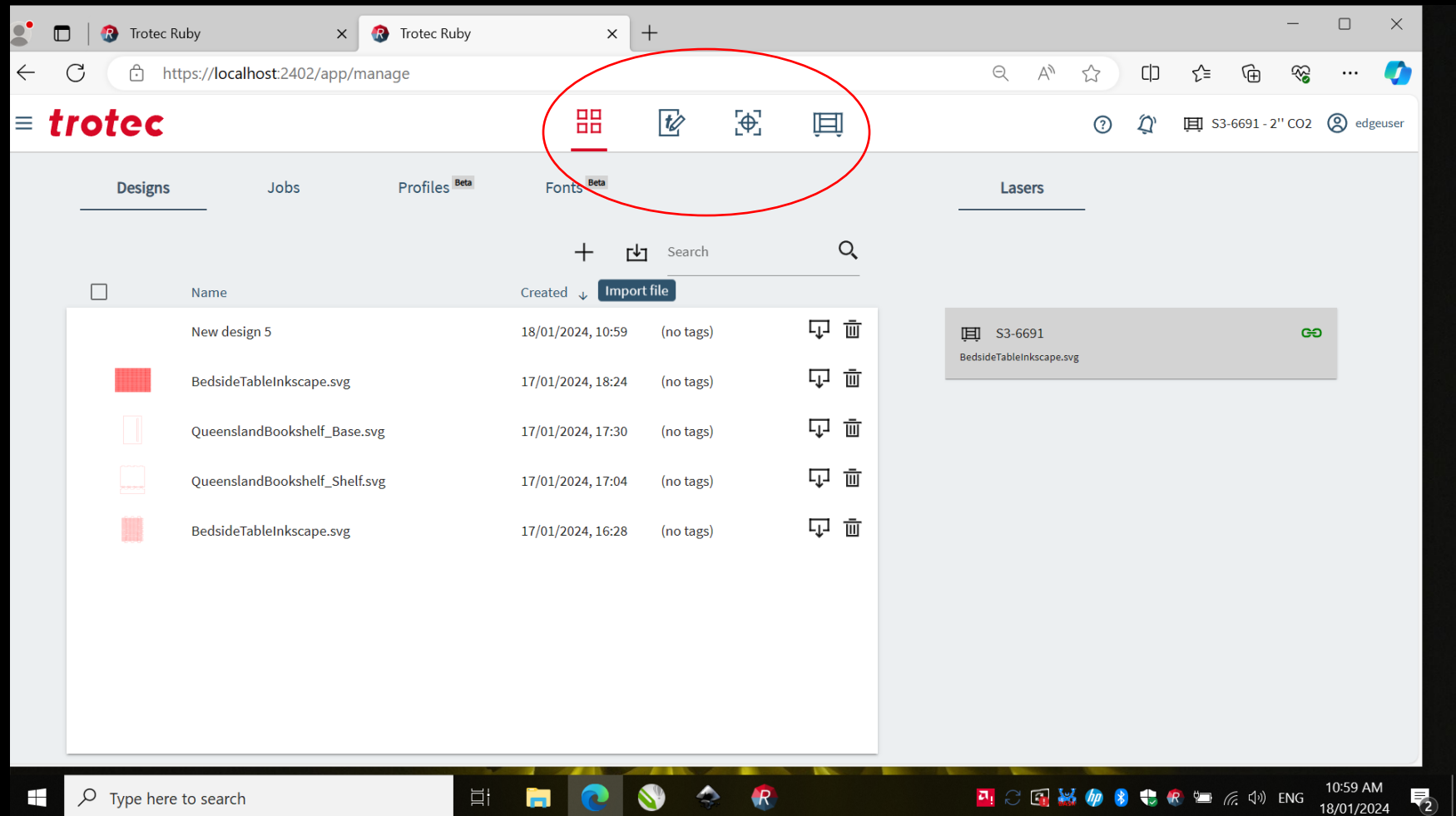
If you are prompted to change the password, **do not** do so, since all laser users must log-in using this account. The email address associated with the account appears in the upper right of the screen.



Setting up a job

There are FOUR tabs or sections of the Ruby software.

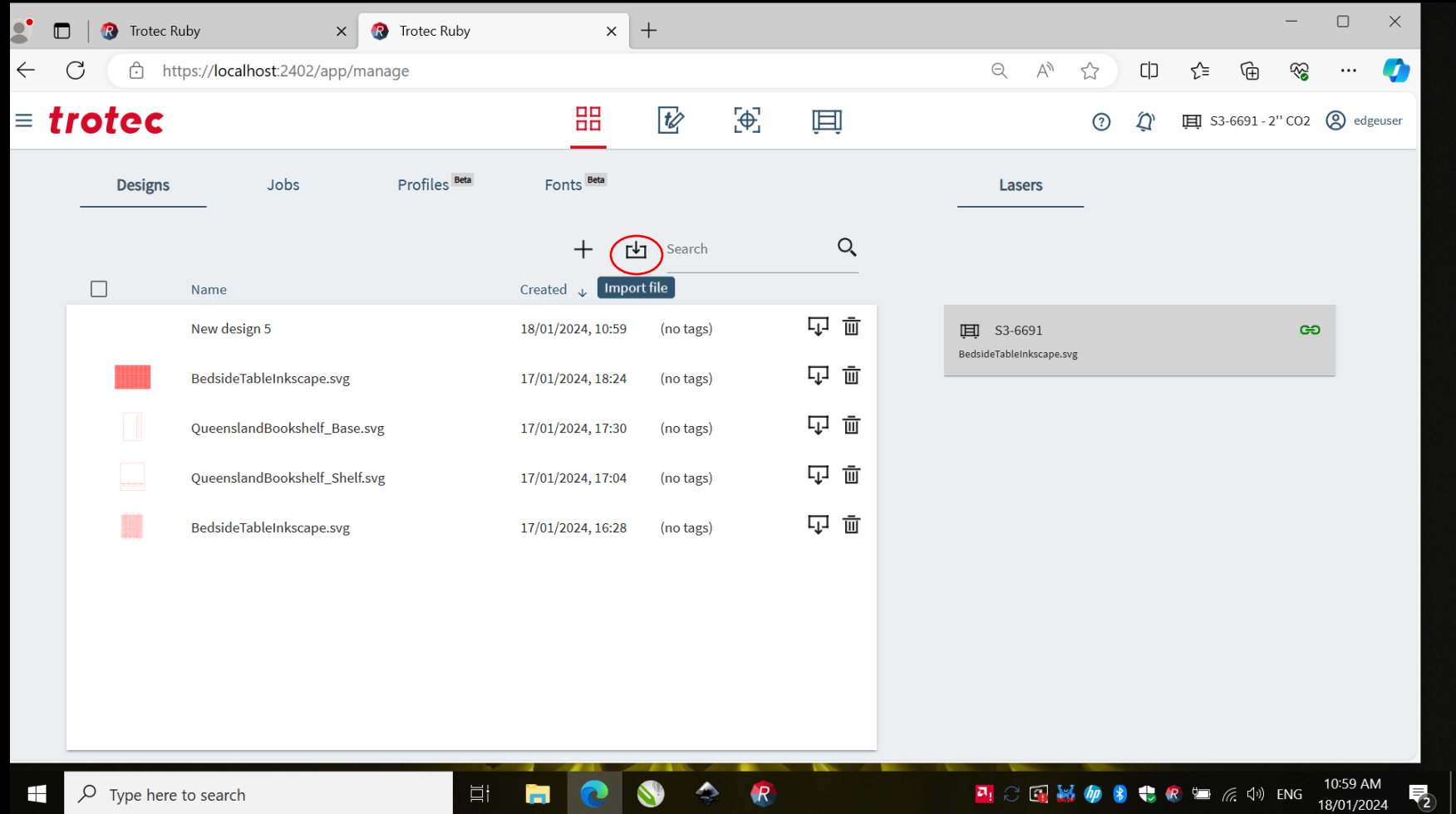
1. MANAGE
2. DESIGN
3. PREPARE
4. PRODUCE



Setting up a job

1. MANAGE

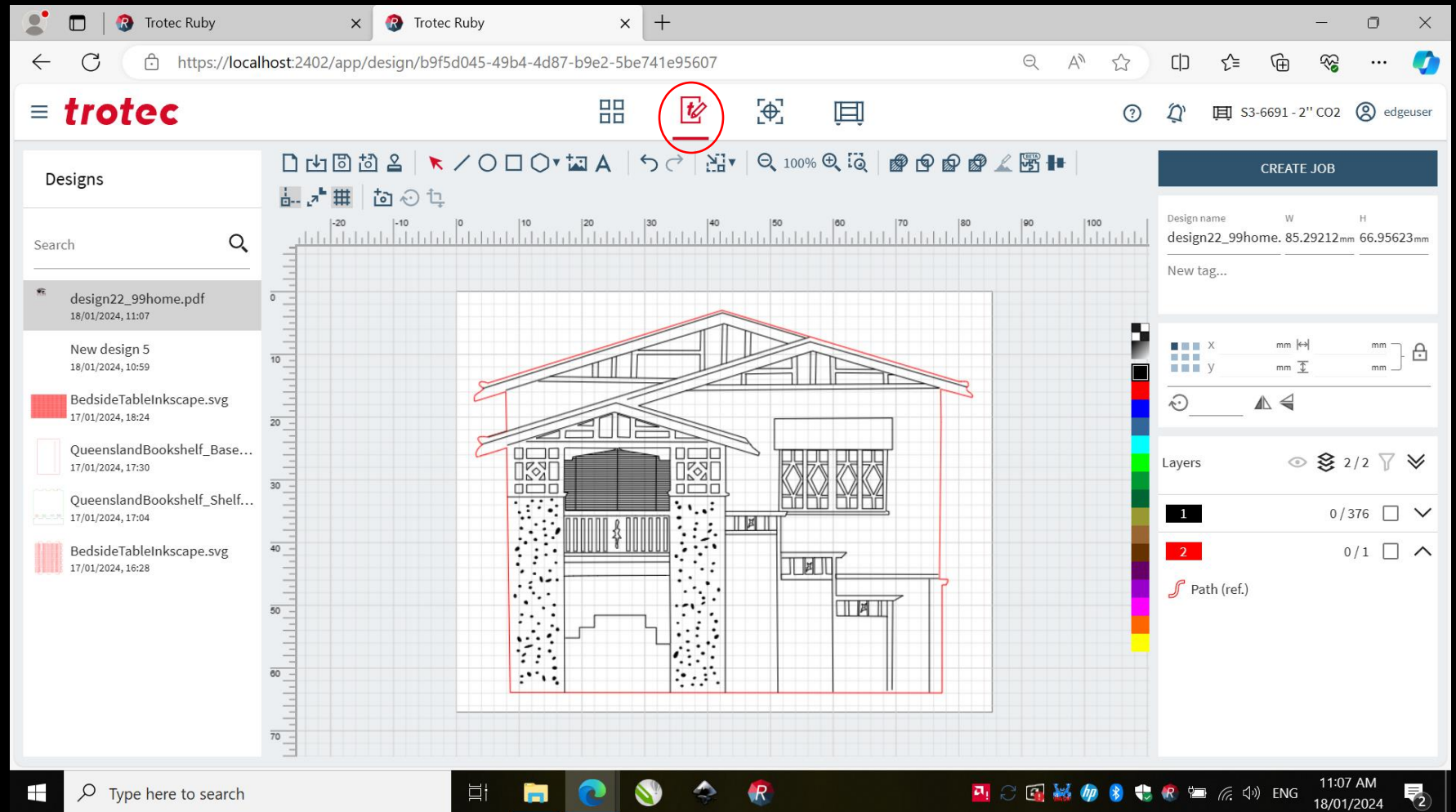
- Import your design
- The queue is usually cleared regularly
- You can download a saved Ruby file if you've got a set-up you want to keep



Setting up a job

2. DESIGN

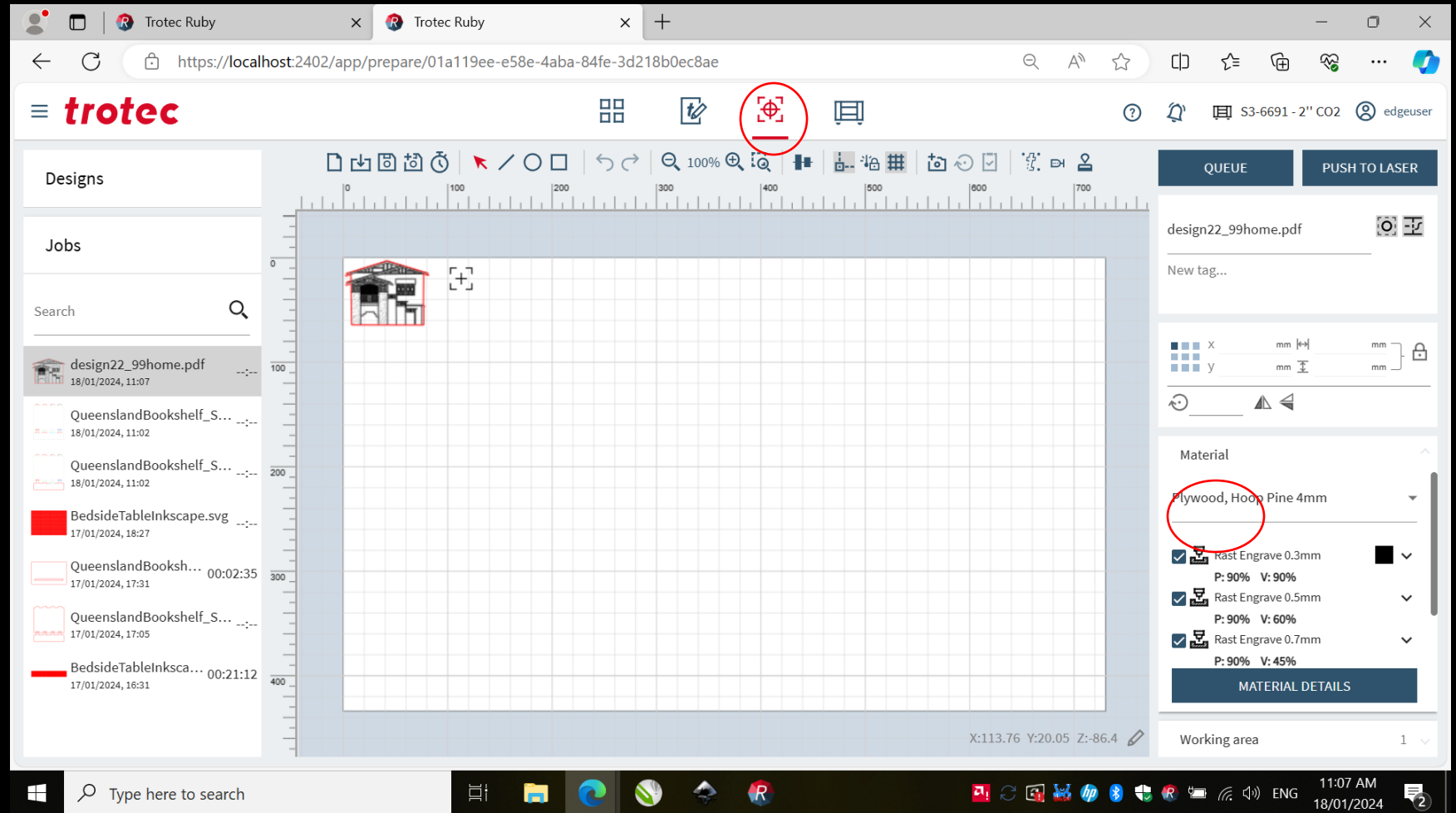
- This is the stage where you will assign your colours or check they are correct
- You can add simple shapes and lines, plus set array and more
- Once you have your design ready, click the border button which will set a 3mm bleed
- Hit the Create Job button when ready



Setting up a job

3. PREPARE

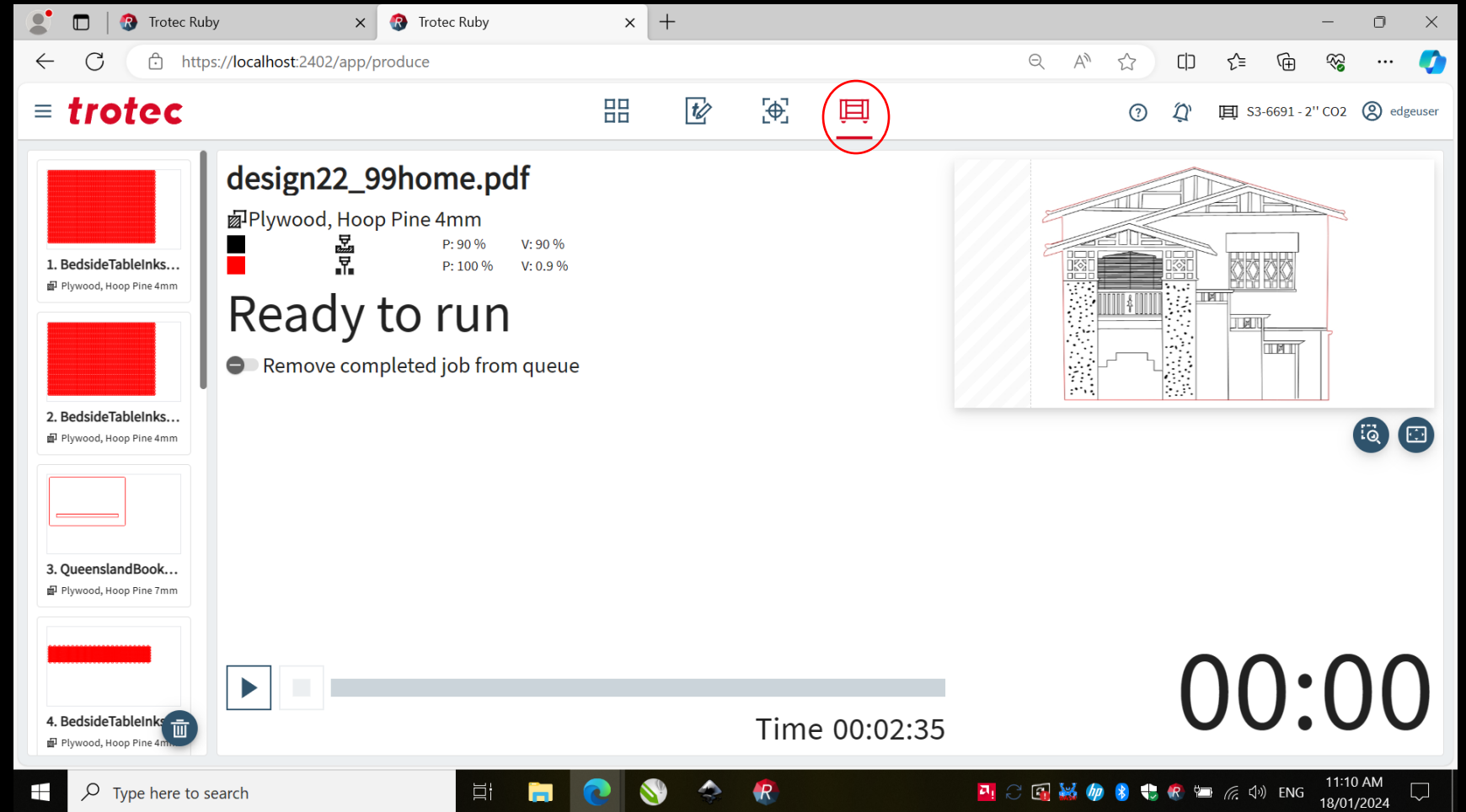
- This screen represents the laser bed, position your design to your material size
- The most important thing you need to do is choose the correct material!
- Click the timer to calculate the length of your job
- Call over a supervisor to get approval to run the machine
- Hit the Push To Laser button when approved



Setting up a job

4. PRODUCE

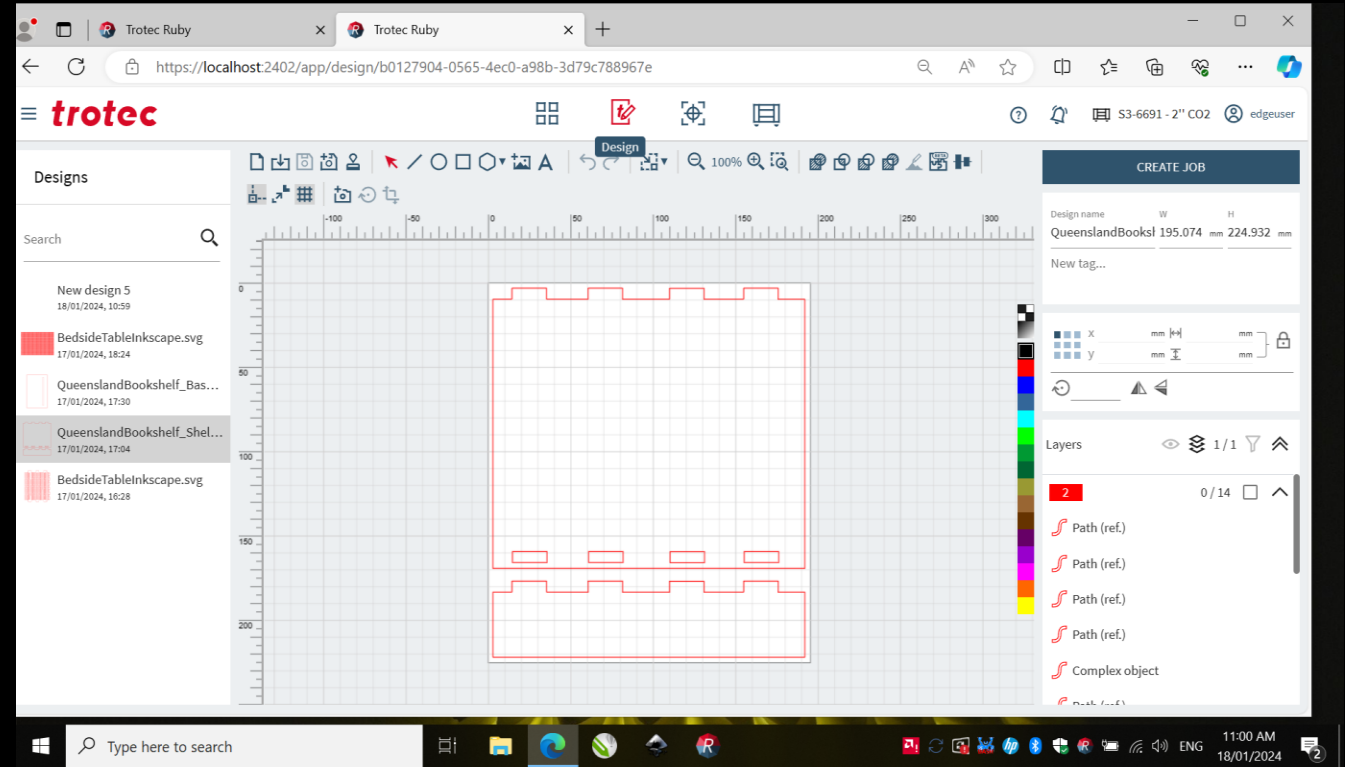
- You should double check this screen to ensure the correct material is assigned
- To start your job we recommend hitting the go button on the laser itself, as it's the best way to see how your job starts and quickly stop if any issues. You can hit the Play button in Ruby as well to start a job.
- If you have clicked the countdown timer in the previous window, you will see the countdown.



Setting up a job

When you set up a job for the laser remember these steps!

- **Assigning colours**
 - Remember to assign one of the 16 colours to your design with the desired effect of what you would like the laser to do e.g. cut, engrave, etc.
- **Creating job**
 - This will turn the imported design into a job to then be cut on the laser.
 - Before hitting create job ensure you have added a 3mm border via the “Fit to Design” button.
- **Creating array**
 - An array can be used to cut a design multiple designs.
 - In the Prepare screen you can select your design and click on the square button to enter the array feature.



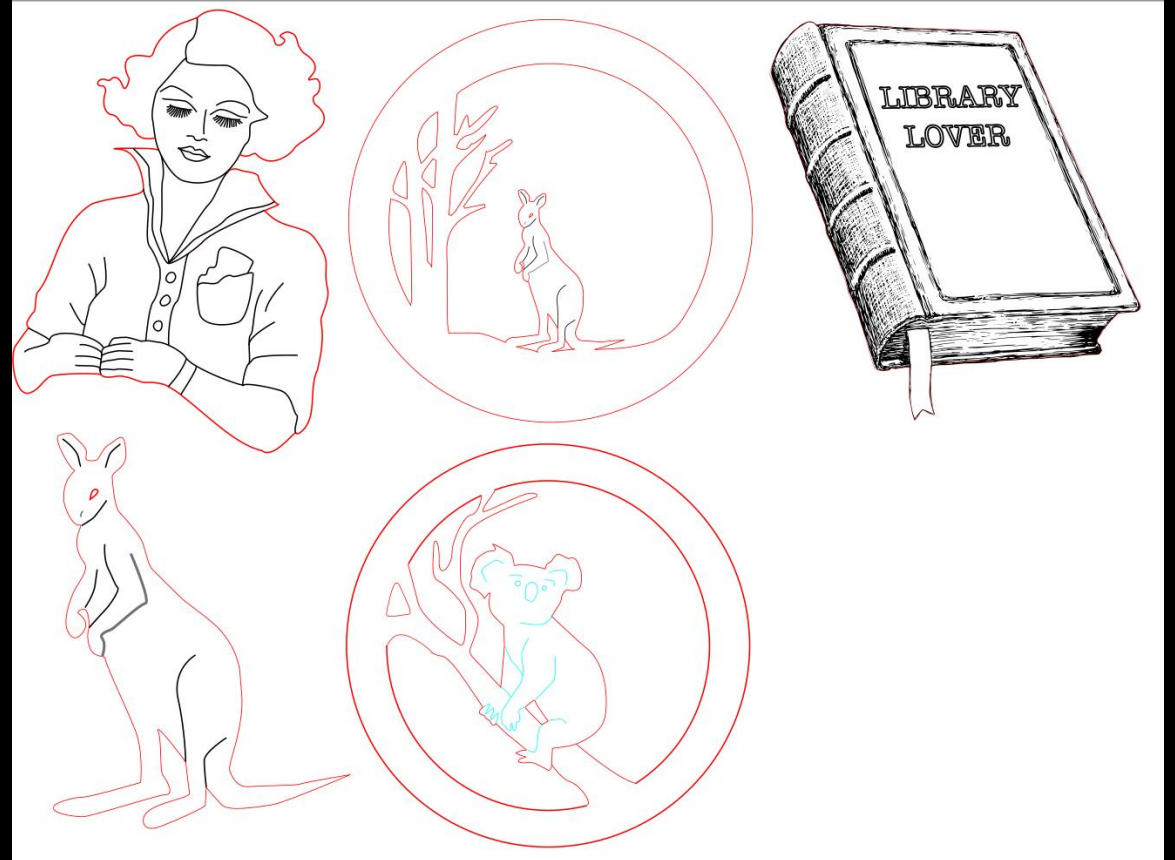
- **Assigning material**
 - Ensure you assign a material before sending to laser.
 - Ensure you have a facilitator check the job as well!

Choose a design

Time to run your own test cut!

Choose from one of the designs on the Wiki page your web browser (which will be open, or your facilitator will navigate you to the page).

You can modify the design using free vector design software, Inkscape. We can turn our test cuts into magnets or keychains, you will need to add a cut hole for a keychain.



Step by step guide

LASER WORKFLOW

Wake the laser from standby mode

- Do this by pressing the button in the top row on the control panel that is showing an amber light
- Ensure the exhaust plenum is placed in the doorway to direct fumes to the outdoors (staff will have done this but alert them if not).
- Make sure the honeycomb bed is correctly located on the vacuum table - or remove it if you are cutting/engraving lightweight materials (eg. paper, fabric) directly on the vacuum table.

Load your material into the laser

- Place your sheet against the rulers in the top left corner of the honeycomb table.
- If you have removed the honeycomb bed, place the material on the vacuum table. Most of the holes in the table will need to be covered to ensure sufficient suction to keep your material flat.
- Sheets that aren't flat can risk head impact. Tape can help to restrain warped material, but badly warped sheets will not be approved for engraving/cutting.

Focus the laser

- Refer to slide 8 "Focal Distance"

RUBY WORKFLOW

Open Ruby & import design

- Turn on the laptop and open the Ruby software (shortcut on the desktop and in the taskbar).
- Import your file or drag & drop the file into the Ruby window.
- If you encounter a problem with one file format, try importing another. There are multiple drawing programs available on the laser laptops if you need to convert your file.

Set up your job file

- Assign the correct palette colours corresponding to the effects you want, then select 'Create Job'.
- Select the material and place your job appropriately for your chosen material, ensuring it fits.

Seek a final check from the facilitator

- Before pushing your job to the laser, you are required to get a final check from a supervisor for safety reasons.
- **Do not** ever start the job without having your settings checked (even if you're just cutting the same design again).

Start the job

- Once Ruby has stated that your job is 'Ready to Run', press the enter button on the laser control panel to start the job.
- The fume extractor will start automatically. The job will start engraving/cutting once the extractor motors are up to speed.
- For safety reasons, you are required to monitor the job while the laser is cutting/engraving. If you need to step away from the laser, you can temporarily interrupt the job by pressing the pause button.

Remove completed job

- The fume extractor will run on for 1-½ minutes after a job has finished to ensure all fumes have been removed from the enclosure. To avoid releasing these fumes into the room you should wait at least 30 seconds after your job is complete before lifting the enclosure lid.
- Move the laser head out of the way so when you take out the cut pieces and remaining material, you don't bump the laser head.
- Clear out any excess bits of material and place in bins provided. If you have cut parts you need to retrieve that have dropped through the honeycomb table, call a supervisor over to assist you.

Frequently asked questions

- Materials
 - We stock a small range of plywood, acrylic, boxboard and PETG for sale via The Brink (Edge Café).
 - If you want to purchase your own material, we approve acrylic bought from Trotec or Acrylics Online for use on our lasers, and plywood purchased from Trotec or Plyco. If you want to cut and/or engrave a material sourced elsewhere, send an email enquiry to appliedcreativity@slq.qld.gov.au that includes a Safety Data Sheet (SDS). We will assess your request and let you know if we approve the material for processing on our lasers.
- Best file types
 - We recommend exporting your file in both PDF and SVG formats. Usually if there is a problem with one file type, having a back-up can ensure the design can be cut.

THANKS FOR
ATTENDING

Please complete our survey that
will be sent out via Eventbrite.

Contact us on
appliedcreativity@slq.qld.gov.au





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