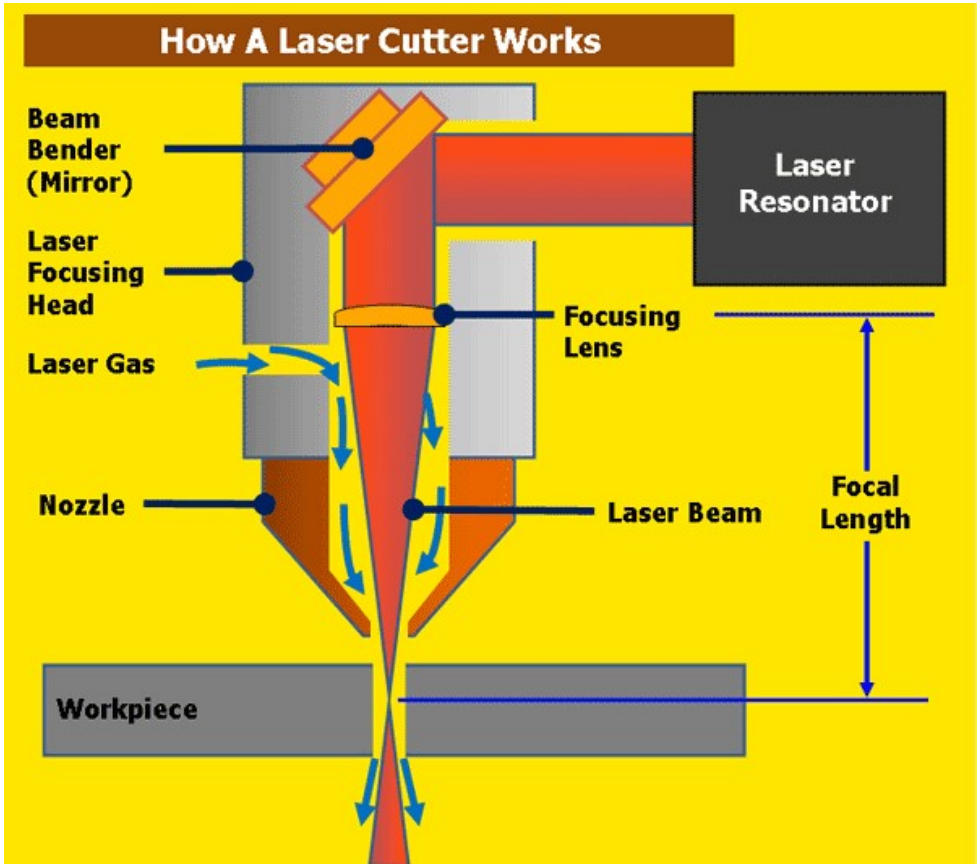
NJIT | Makerspace

Intro to
CO_2 Laser Cutting

What Can I Do With the CO_2 Laser?

- CO_2 laser cutters and engravers are excellent for making precise 2-dimensional cuts in a variety of materials, as well as engraving
  - Engraving is destructively marking the surface of the material

The CO_2 Laser Simplified



- Laser energy is propagated within a CO_2 gas chamber
- It exits the tube and is reflected off a mirror, then through a focusing lens, and finally onto the workpiece

Usable Materials

CO_2 ONLY

List of materials										
Material EN	Material DE	cutting			engraving			marking		
		CO_2	Fiber	Flexx	CO_2	Fiber	Flexx	CO_2	Fiber	Flexx
Plastic										
Acrylonitrile butadiene styrene (ABS)	Acrylnitril-Butadien-Styrol-Copolymer (ABS)	✓		✓	✓		✓		✓	✓
Acrylic/PMMA (Plexiglas, Altuglas,	Acryl/PMMA (Plexiglas®, Altuglas®,	✓		✓	✓		✓		✓	✓
Laminate	Laminate	✓		✓	✓		✓		✓	✓
Rubber	Gummi	✓		✓	✓		✓			
Polyamide (PA)	Polyamid (PA)	✓		✓	✓		✓		✓	✓
Polybutylene terephthalate (PBT)	Polybutylenterephthalat (PBT)	✓		✓	✓		✓		✓	✓
Polycarbonate (PC)	Polycarbonat (PC)	✓		✓	✓		✓		✓	✓
Polyethylene (PE)	Polyethylen (PE)	✓		✓	✓		✓		✓	✓
Polyester (PES)	Polyester (PES)	✓		✓	✓		✓		✓	✓
Polyethylene terephthalate (PET)	Polyethylenterephthalat (PET)	✓		✓	✓		✓		✓	✓
Polyimide (PI)	Polyimid (PI)	✓		✓	✓		✓		✓	✓
Polyoxymethylene (POM) -Delrin®	Polyoxymethylen (POM) - Delrin®	✓		✓	✓		✓		✓	✓
Polypropylene (PP)	Polypropylen (PP)	✓		✓	✓		✓		✓	✓
Polyphenylene sulfide (PPS)	Polyphenylensulfid (PPS)	✓		✓	✓		✓		✓	✓
Polystyrene (PS)	Polystyrol (PS)	✓		✓	✓		✓		✓	✓
Polyurethane (PUR)	Polyurethan (PUR)	✓		✓	✓		✓		✓	✓
Foam	Schaumstoff	✓		✓	✓		✓		✓	✓
Miscellanious										
Wood	Holz	✓		✓	✓		✓			
Mirror	Spiegel					✓	✓		✓	✓
Stone	Stein				✓		✓			
Paper (white)	Papier (weiß)	✓		✓	✓		✓	✓		✓
Paper (colored)	Papier (färbig)	✓		✓	✓		✓	✓	✓	✓
Food	Lebensmittel				✓		✓	✓		✓
Leather	Leder	✓		✓	✓		✓	✓		✓
Fabric	Textilien	✓		✓	✓		✓			
Glass	Glas				✓		✓			
Ceramics	Keramik					✓	✓	✓	✓	✓
Cork	Kork	✓		✓	✓		✓	✓		✓

This list of materials can be found on the NJIT Makerspace website!

Marking Metals

List of materials										
Material EN	Material DE	cutting			engraving			marking		
		CO_2	Fiber	Flexx	CO_2	Fiber	Flexx	CO_2	Fiber	Flexx
Metal										
Aluminum	Aluminium					✓	✓		✓	✓
Aluminum, anodized	Aluminium, eloxiert					✓	✓	✓	✓	✓
Chromium	Chrom					✓	✓		✓	✓
Precious metal	Edelmetall					✓	✓		✓	✓
Metal foils up to 0.5mm (Aluminum, Brass, Copper, precious metal)	Metallfolie bis zu 0,5mm (Aluminium, Messing, Kupfer, Edelmetall)		✓	✓		✓	✓		✓	✓
Stainless steel	Edelstahl					✓	✓		✓	✓
Stainless steel (Thermark®)	Edelstahl (Thermark®)							✓	✓	✓
Metal, painted	Metall, lackiertes				✓		✓			
Brass	Messing					✓	✓		✓	✓
Copper	Kupfer					✓	✓		✓	✓
Titanium	Titan					✓	✓		✓	✓

Only *specific* coatings on *specific* metals can be marked by the CO_2 laser

CO_2 ONLY

Non-Usable Materials

Warning !

Processing of the following materials is not permitted:

Carbon, Polyvinyl chloride PVC, Polyvinyl butyral PVB, Polytetrafluorethylene PTFE (Teflon), carbon fiber, beryllium oxide and materials containing halogen (fluorine, chlo-rine, bromine, iodine and astatine), epoxy- or phenolic resins

Take care when processing the following materials:

Manganese, chromium, nickel, cobalt, yttrium and lead. Material with the naming addition "flame-retarding" since it might contain bromine.

Notice

Any material not listed above may only be processed with written approval of Trotec.

We recommend to run a material processing test with the above mentioned mate-rial using the appropriate

Trotec assumes no responsibility for any consequences of laser processing in any application such as medical or pharmaceutical applications.

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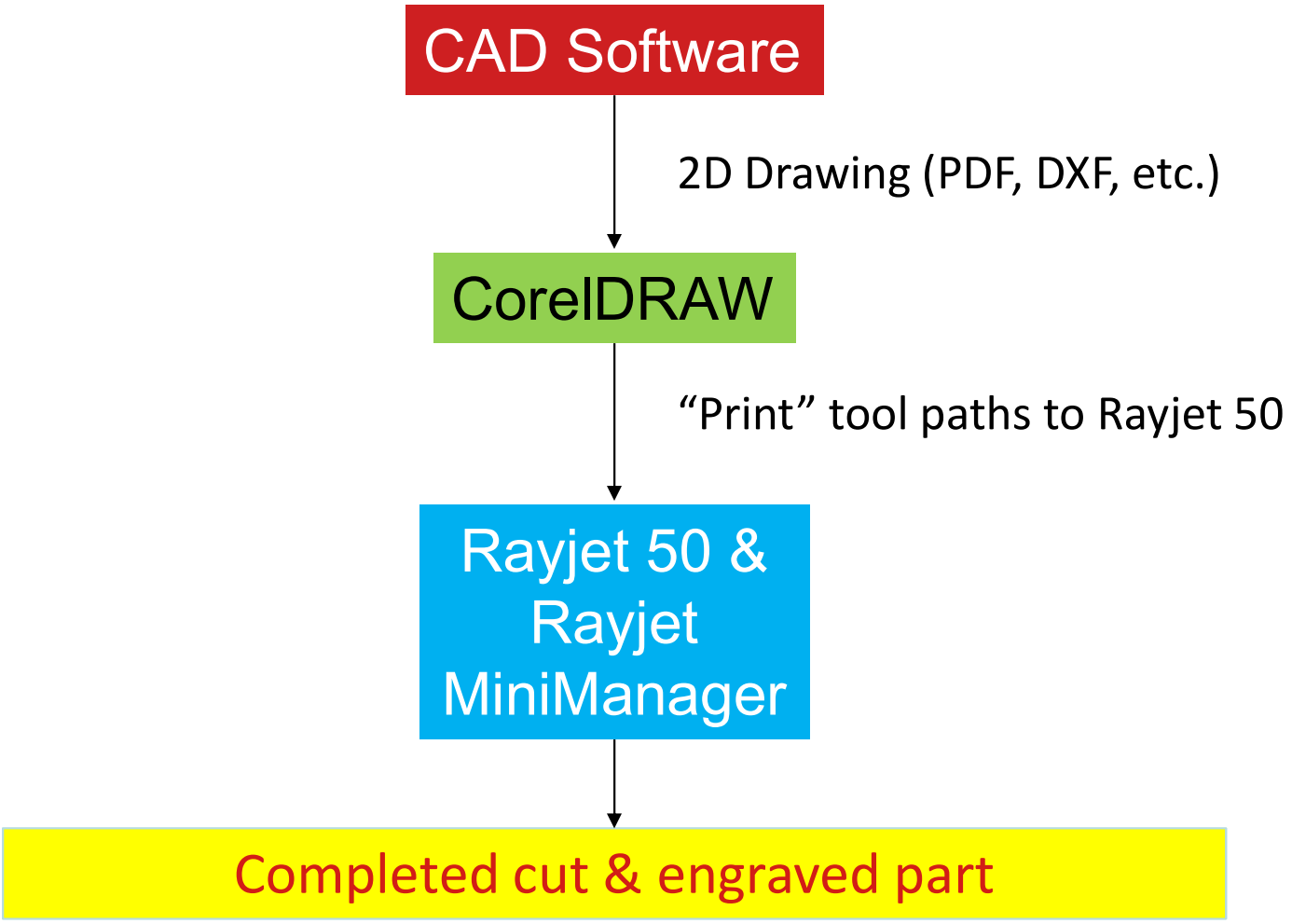
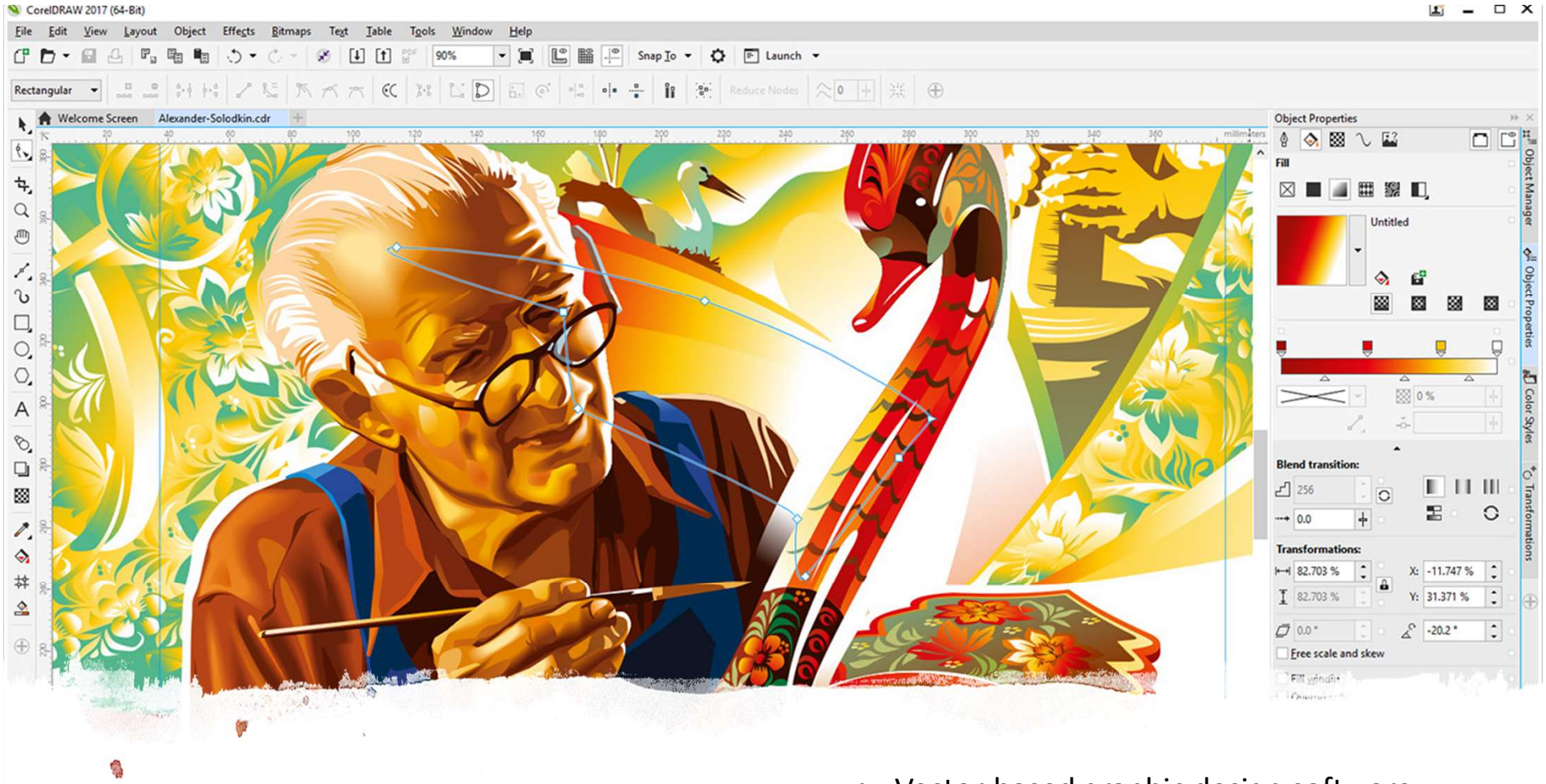
NO METALS can be cut or engraved on our Rayjet 50 laser cutters

Workflow

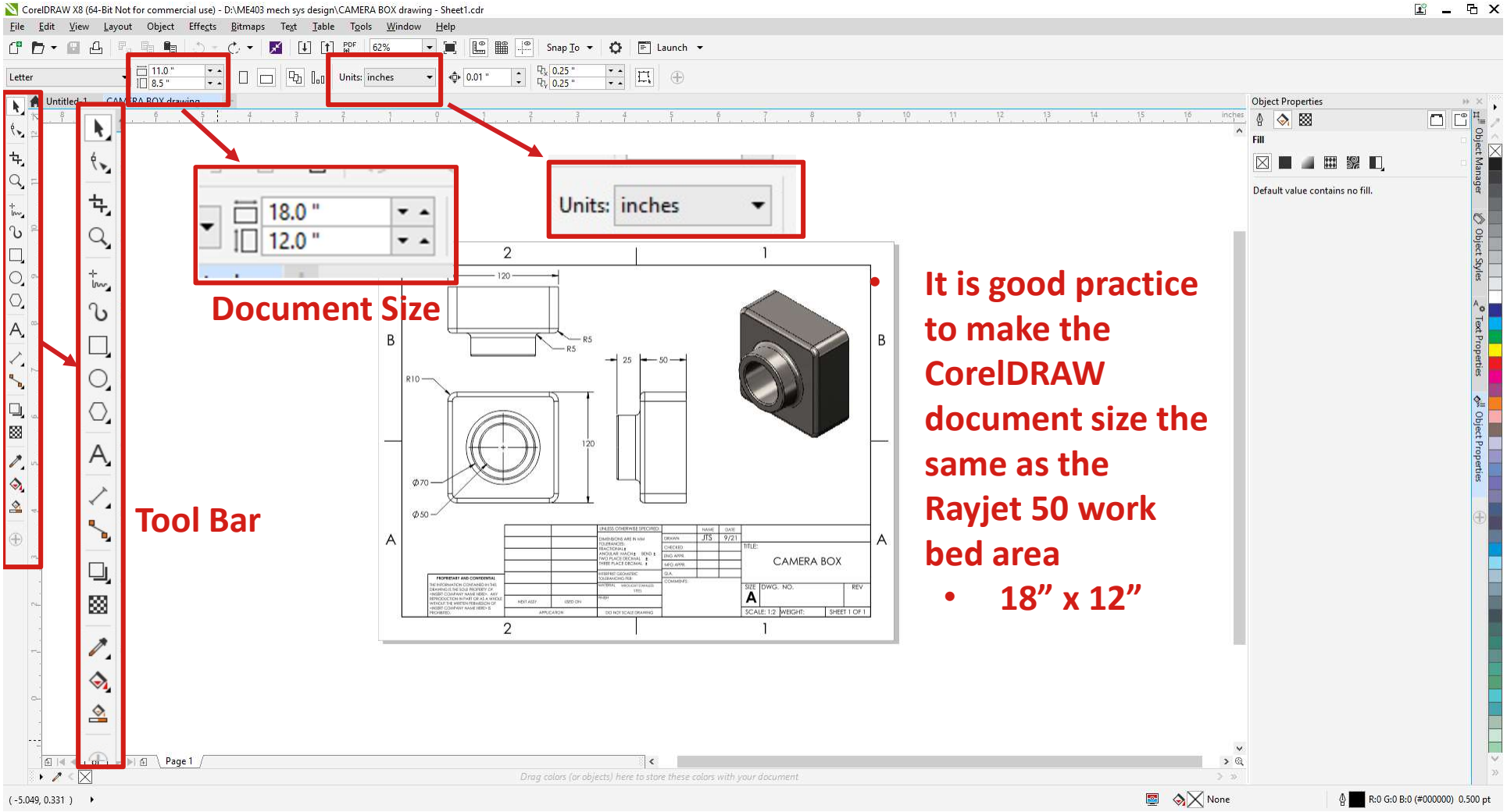

CAD Software
2D Drawing (PDF, DXF, etc.)
CorelDRAW
“Print” tool paths to Rayjet 50
Rayjet 50 & Rayjet MiniManager
Completed cut & engraved part



What is CorelDRAW?

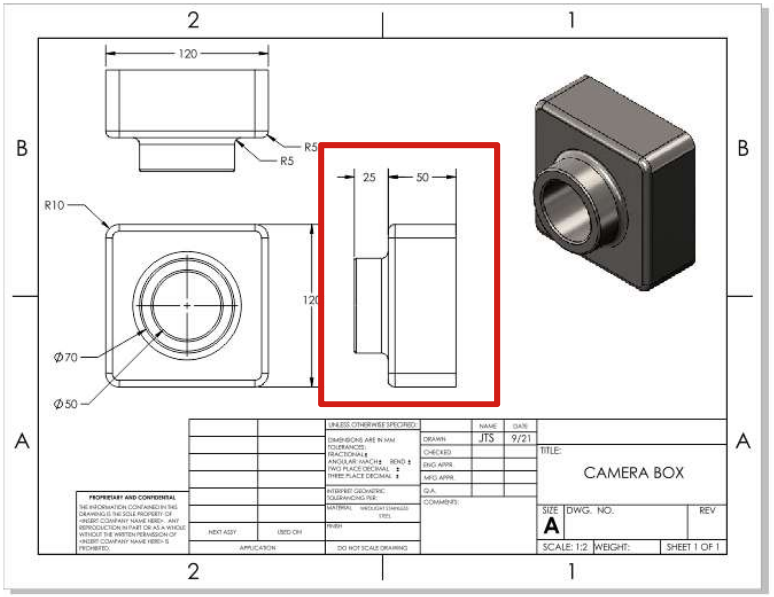
- Vector based graphic design software, like Adobe Illustrator
- We will primarily be using it to scale, colorize and position engineering CAD drawings that the Rayjet software will convert into a toolpath

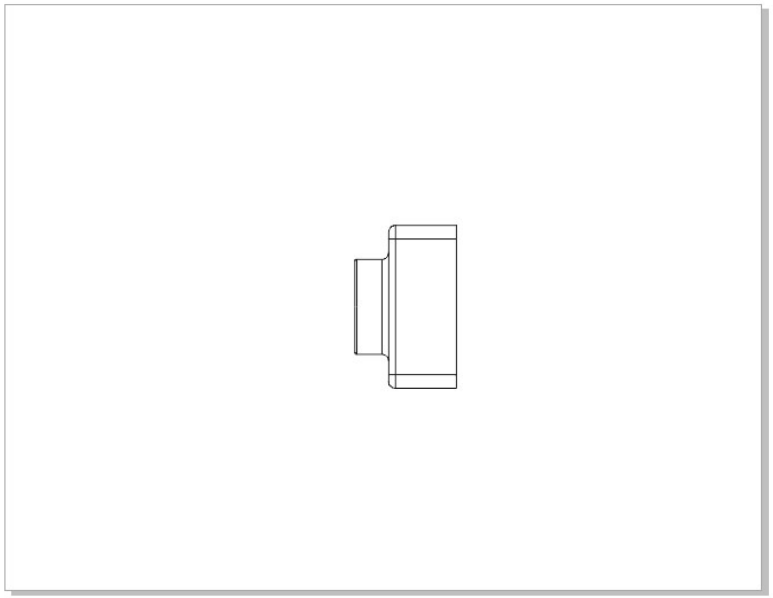
CorelDRAW Workspace



CorelDRAW Process Example

Let's say we wanted to cut a side profile of our drawing from a thin wood veneer board, and the edge lines will be engraved



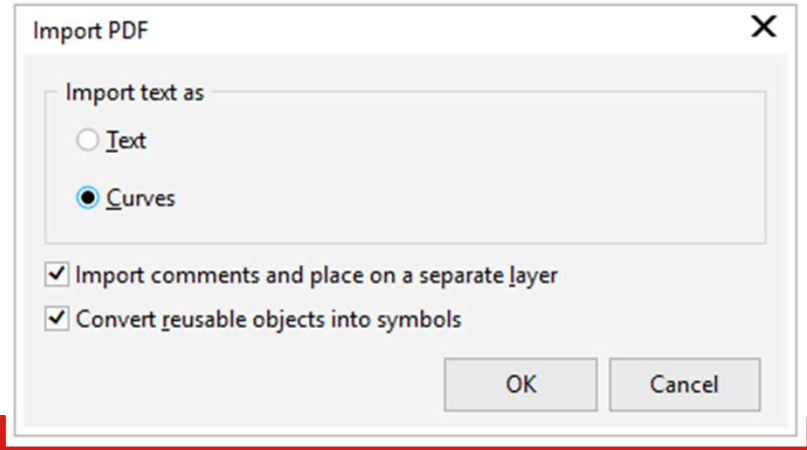


- Detailed Drawing from Solidworks
- We are only interested in the boxed drawing view

- We will copy desired dimensioning lines and values **into a "workspace" CorelDRAW document** using the "pick tool"

Opening a Workspace File & PDF

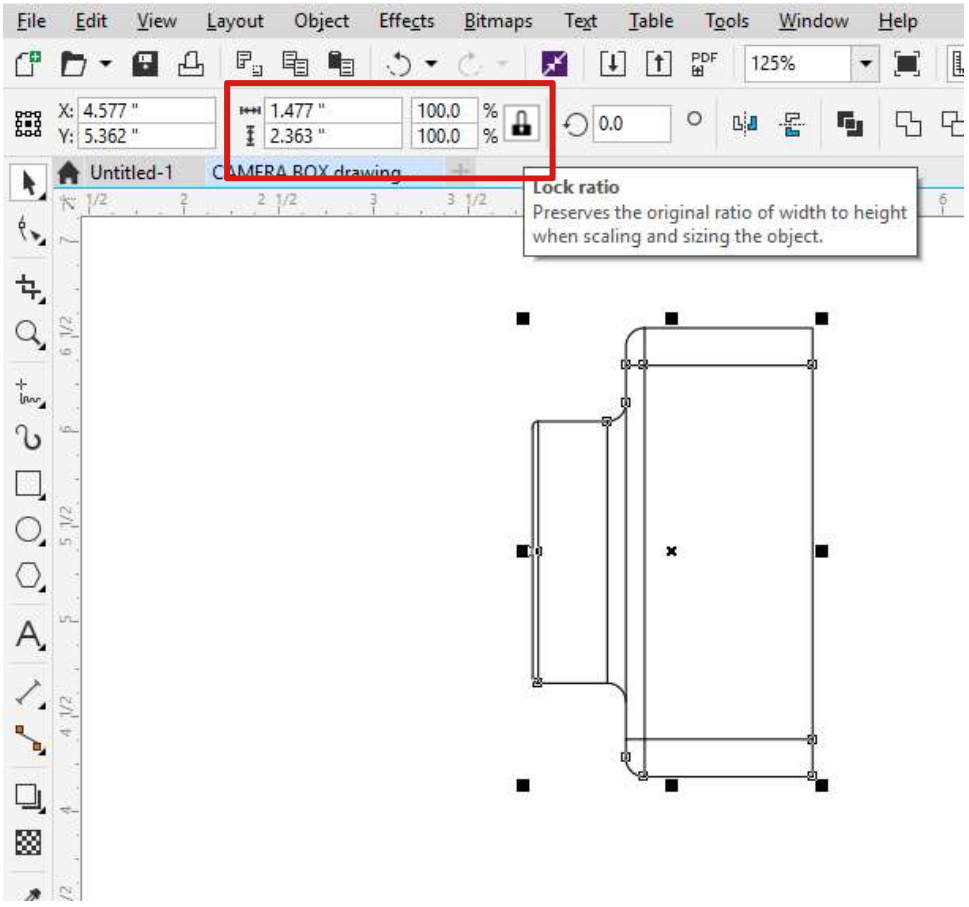
- Open CorelDRAW from the desktop
- Open the file **“workspace.cdr”** from the desktop. This has the dimensions of the laser cutter’s workspace
- **Immediately save a copy of this file with your own file name!**
- File -> Open, and select your CAD drawing saved as a PDF or DXF
- Click “OK”



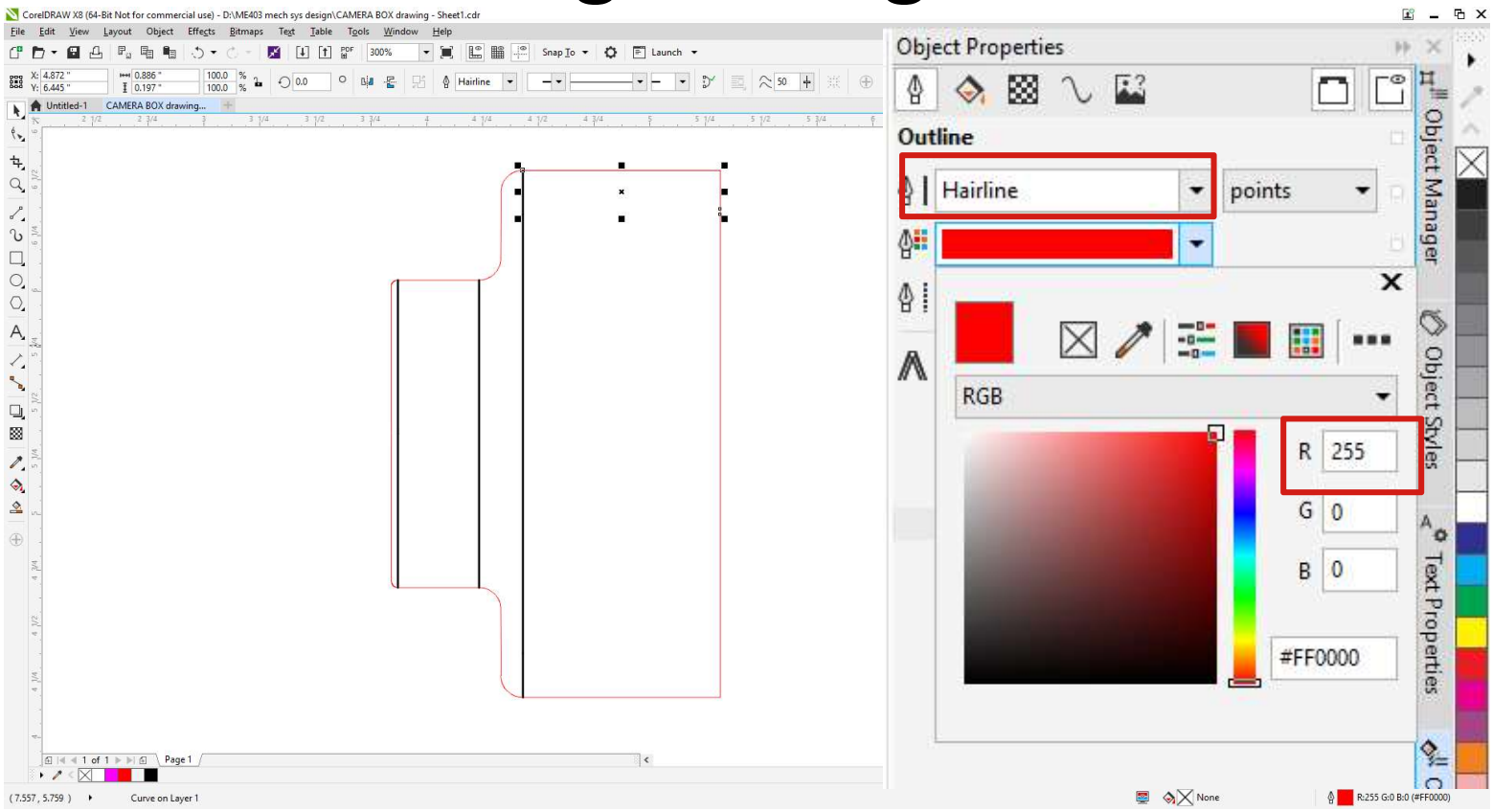
Making Sure Drawing is to Scale

Make sure the dimensions of your final cut are to the dimensions stated in the drawing, or other size

- It is critical to know the **overall dimension in either the x or y-axis** to set the proper cutting scale
- **Click the lock** to ensure the that x and y dimensions scale in the original ratio of the drawing
- Input either the overall x or y dimension to properly scale the drawing

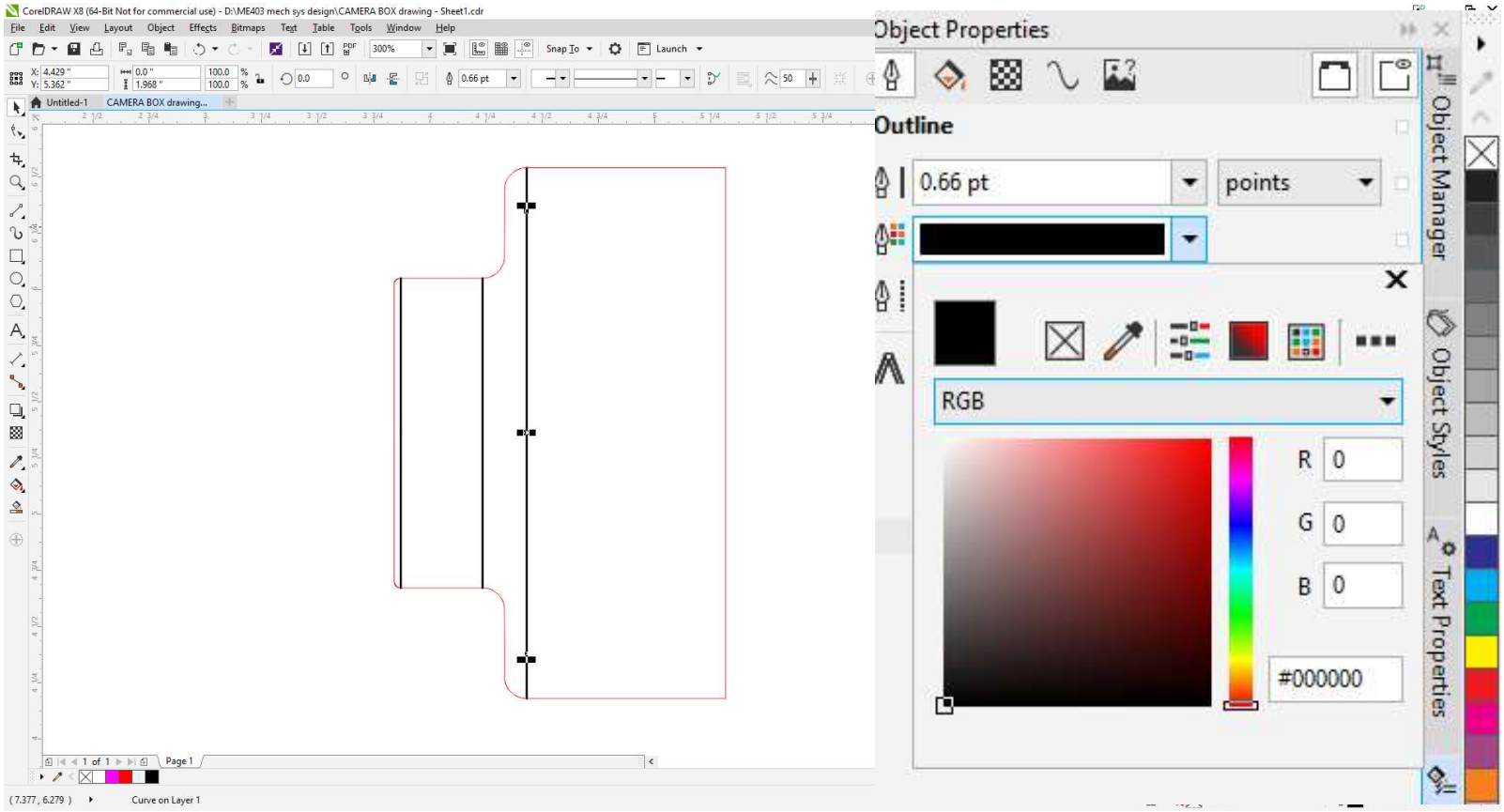


Setting Cutting Lines



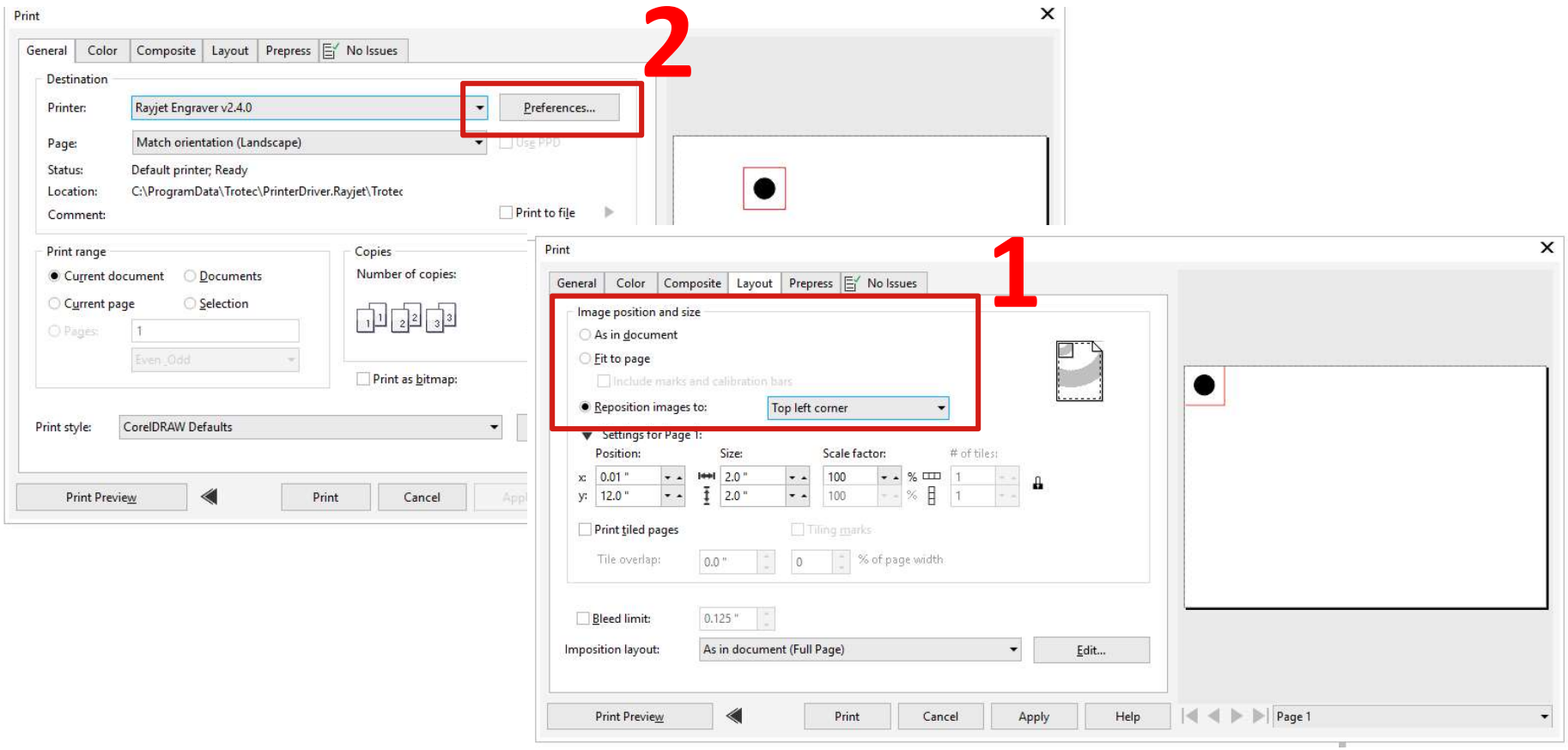
- Cutting lines must be RGB color **255,0,0**
- Cutting lines must have a thickness of **“Hairline”**

Setting Engraving Lines



- Engraving **lines or areas** must be RGB color **0,0,0**
- Engraving **lines or areas** can have **any thickness**

Print Dialogue & Drawing Alignment

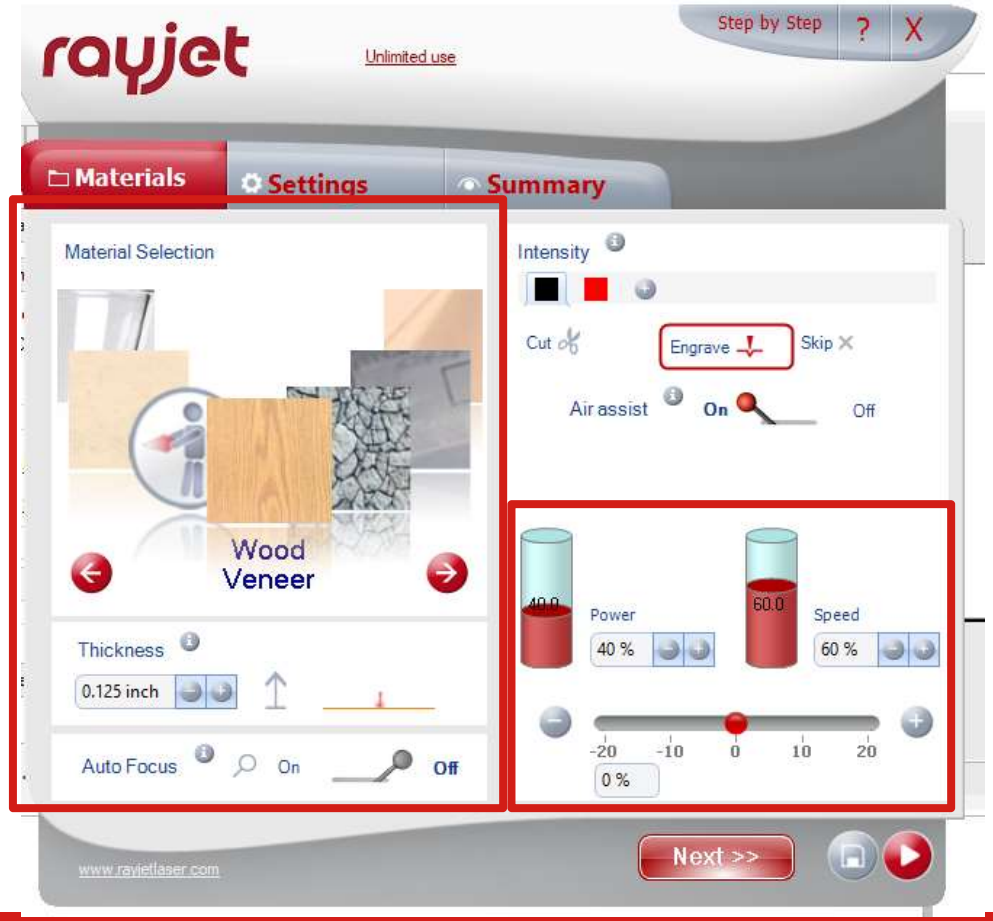


- Clicking “Print” opens the top-left window. Make sure “Rayjet Engraver” is the printer
- Go to the “Layout” tab to reposition image to “Top left corner”
- Go back to the “General” tab and click the “Preferences” button

Preferences & Rayjet Cutting Settings

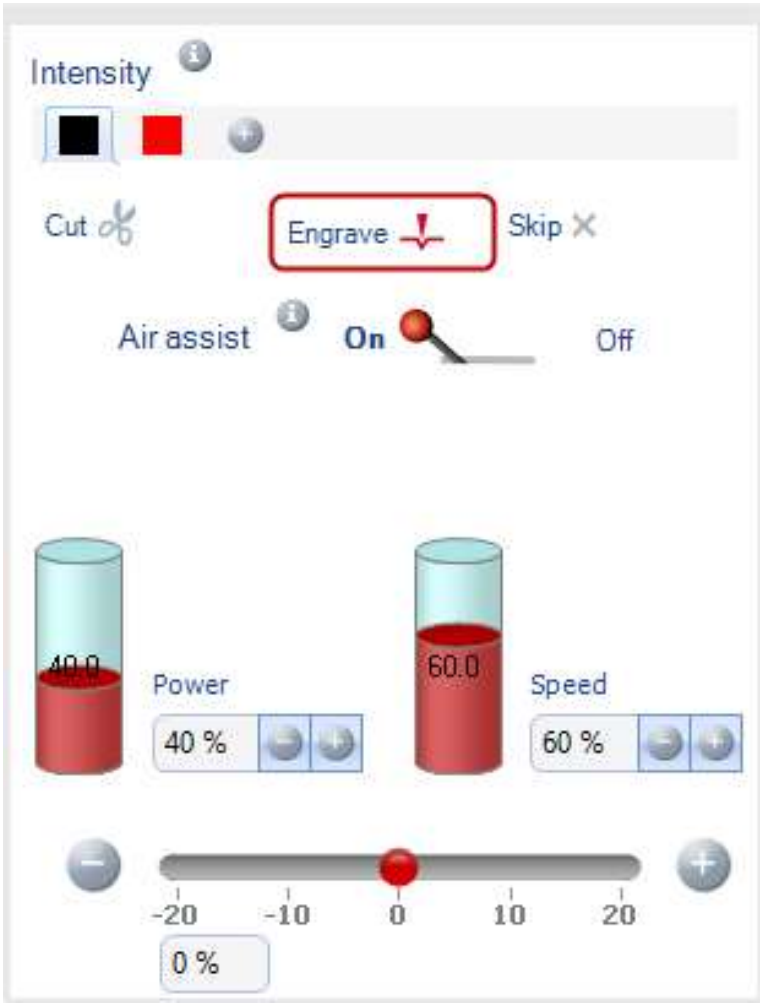
Material type, thickness and cutting/engraving intensity will be set in this interface

- Material selection and thickness of material
- Set **“Auto Focus”** to **“Off”**



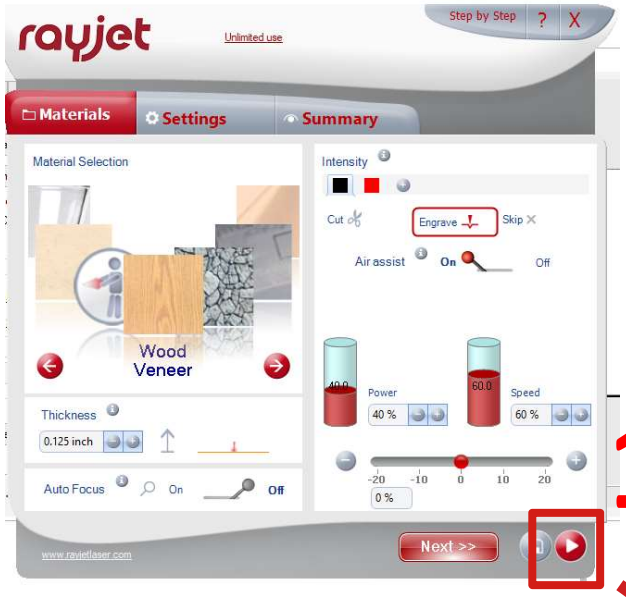
- **“Intensity”** as a combination of Power and Speed (feed rate)

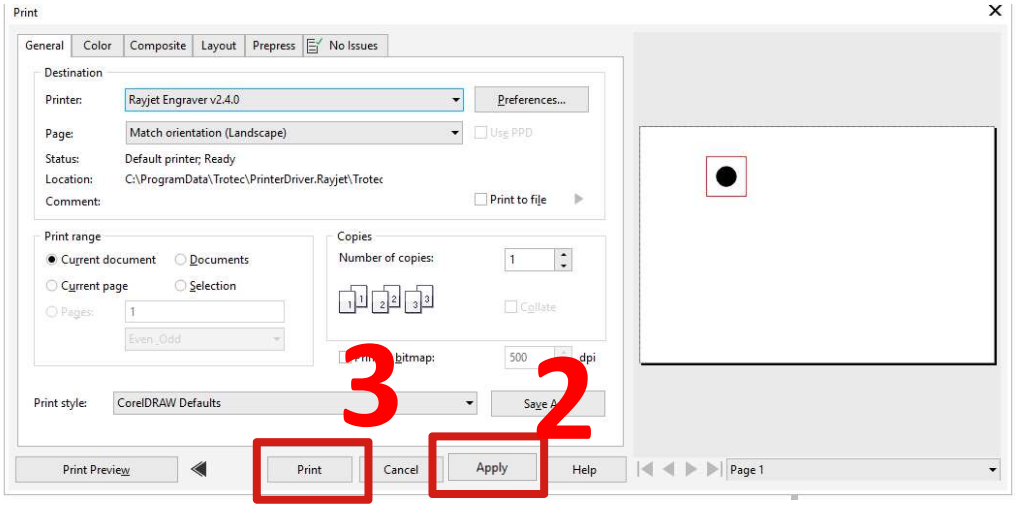
Power, Speed & Percentage



- The colors set in CorelDRAW correspond to cutting and engraving intensity levels in the Rayjet software
  - You can add more colors for different intensities!
- **"Air assist"** pushes air through the workspace and through the external carbon filter
  - Turn this **off** if you are cutting fabric or paper!
- Start with a material preset, **then** experiment with the intensity settings **as needed**
  - Increasing power → cutting intensity **increases**
  - Increasing speed → cutting intensity **decreases**
  - **Use the sliding percentage bar!**
  - **Or adjust one setting at a time!**

Sending Job to Rayjet MiniManager





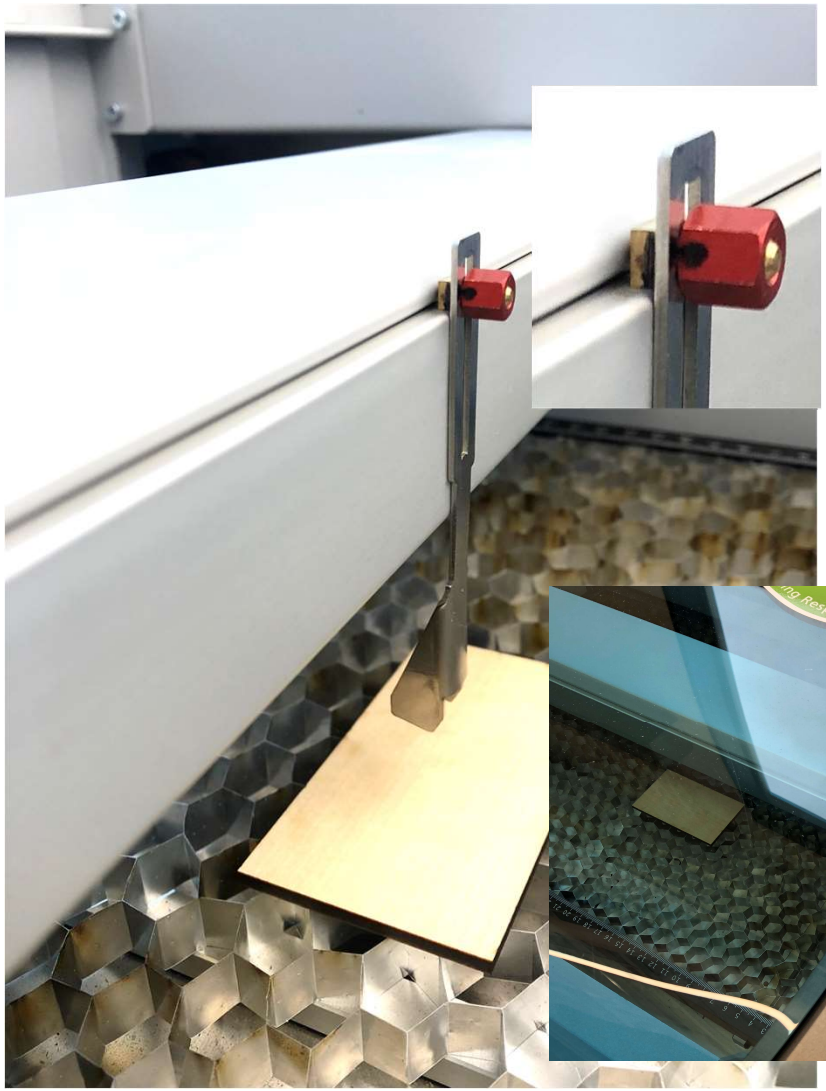
The Rayjet 50

! The power switch is behind the unit, above where the power cord is inserted

The Rayjet 50

- Exhaust system
  - Filters particles and fumes emitted from the material being cut/engraved
  - **Exhaust system should turn on automatically, ensure that this system is running while the laser is cutting/engraving**

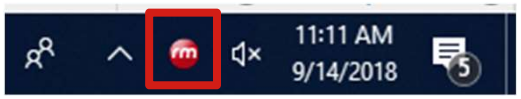
Setting Focal Distance



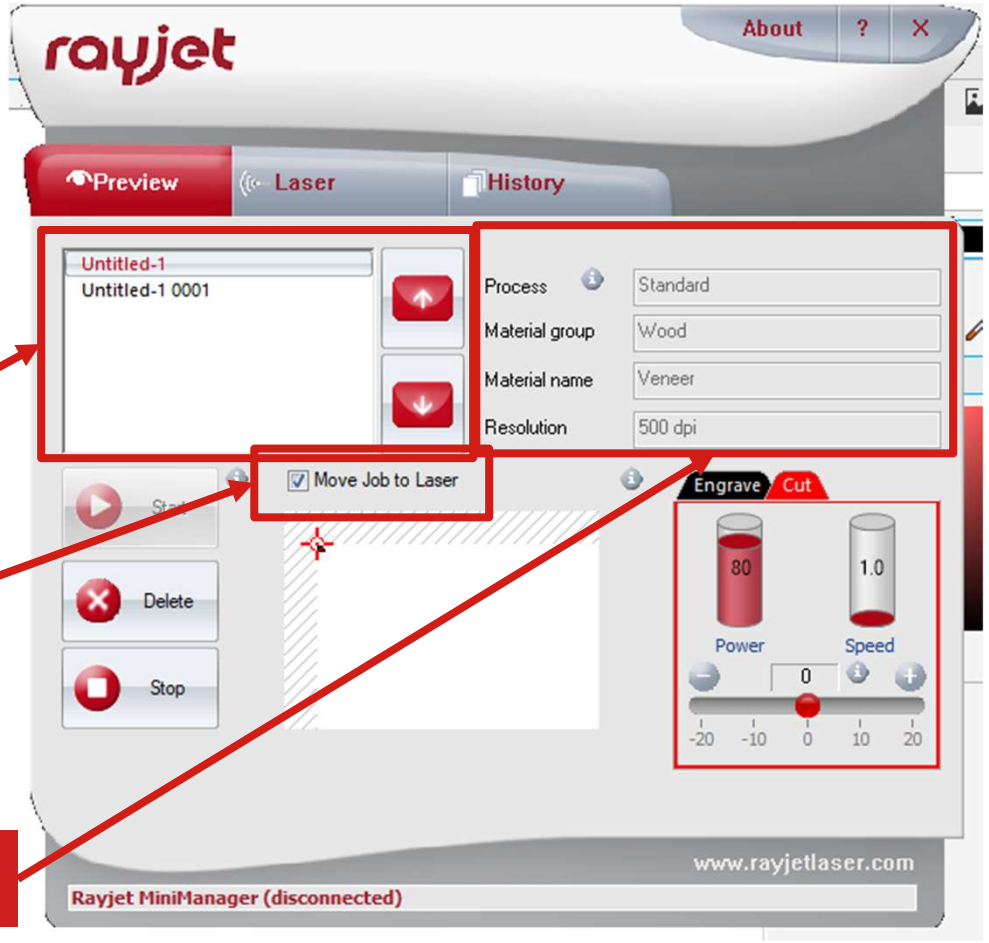
- The calibrated “focus tool” is used to set the focal distance from the lens to the workpiece and must be done for **every cut/engrave**
- Rest the brass prism of the focus tool on the external ledge of the gantry cover directly above your workpiece

- Raise the workbed with the physical arrow buttons on the top of the Rayjet
- The moment the focus tool comes into contact with the workpiece and **falls off gantry**, you are focused.

Rayjet MiniManager Job Queue



- Open your job in the job queue by clicking the Rayjet MiniManager icon on the taskbar

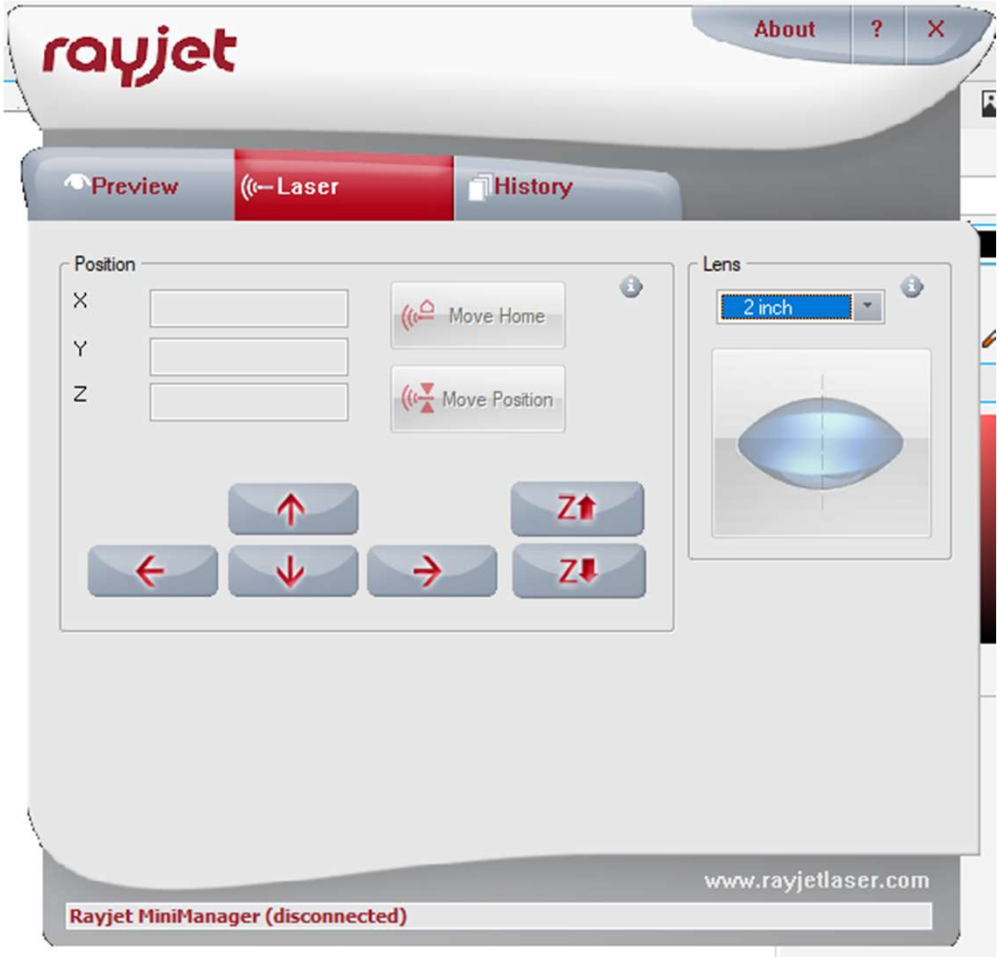


Job Queue

Move Job to Laser

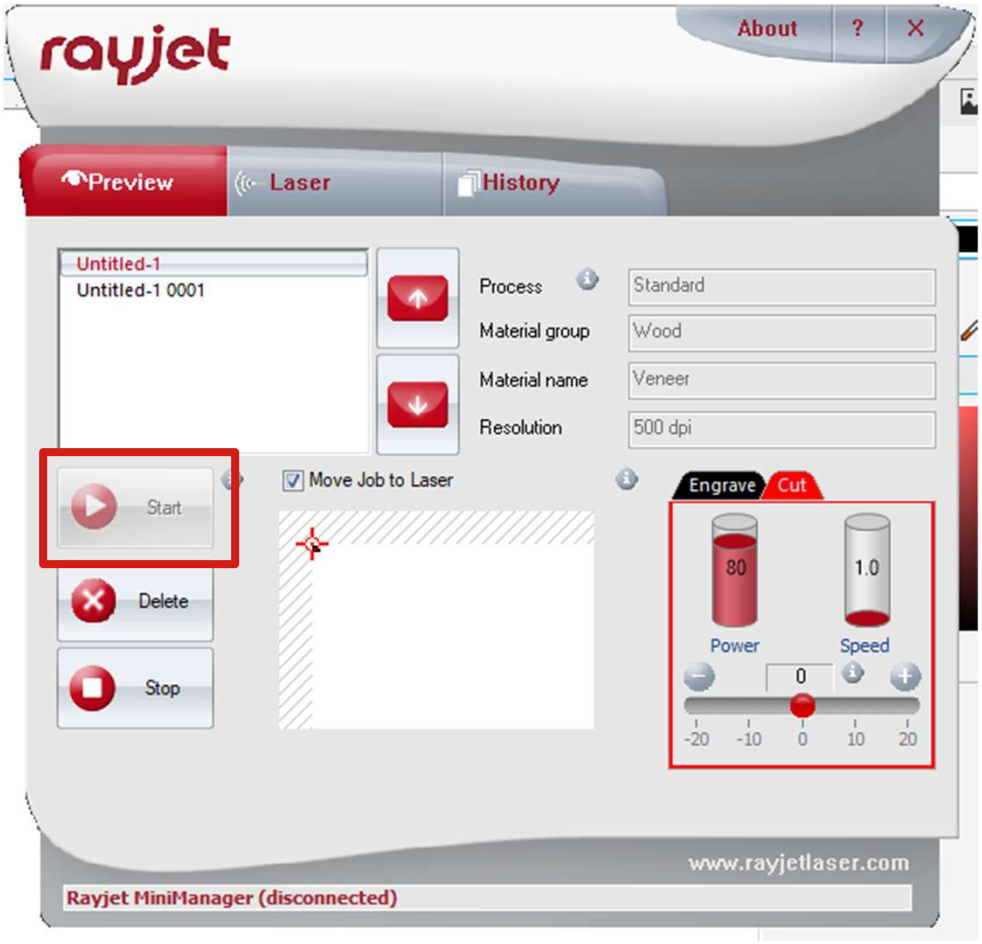
Saved Settings

Positioning Job on Workpiece



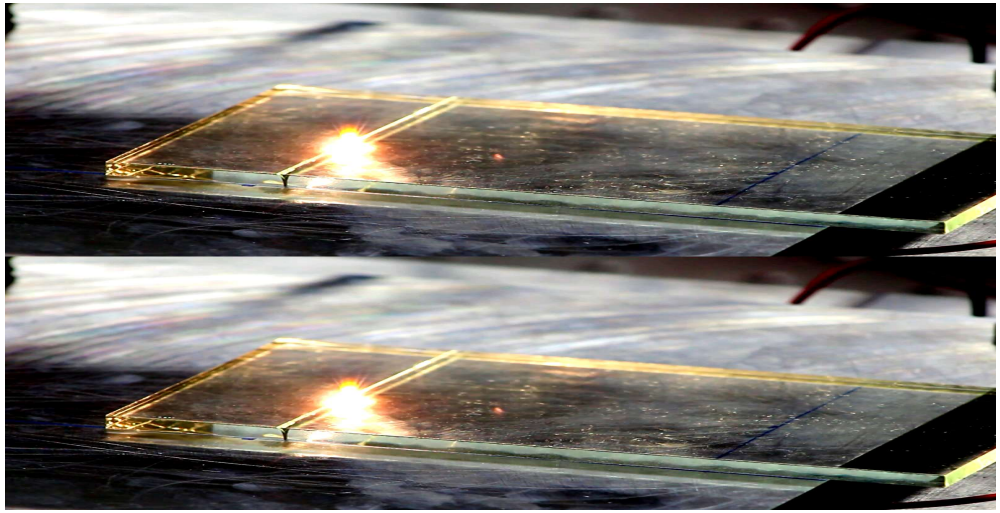
- Use this tab to position the laser to the top left corner of where you would like your cut or engrave to begin
- **Be sure "Lens" is set to "2 inch"**

Starting Job



- Make sure your job is highlighted and click the **"Start"** button
- Once you execute a job, the name of that job will become grayed out
  - If you would like to redo a job, you will need to right-click and **reset the job** before you can start it again

Small Fires!



- You will notice small fires or flashes on your workpiece as the laser cuts or engraves
- Normally this is ok as long as the fire is intermittent and small
- If you notice a large and consistent fire while cutting, **immediately stop the job using the stop button on the Rayjet and keep the lid closed!**
  - **Check to make sure you are using an approved material and proper intensity settings**

Computer Access

Password: (PC Name) + 123
E.g. Rayjet1123

We look forward to seeing your creations!

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Available Training Sessions

After this training, consider attending…

- **Intro to 3D Printing**