

Laser Cutter Preparation .
The Laser Cutter is located in the
Solid Space Fabrication and Prototyping Lab.
School Of Interactive Arts And Technology.
Simon Fraser University, Surrey.
Room 3702. Card key access.

Disclaimer:

Solid Space cannot guarantee jobs will be completed by deadline dates. If work is needed urgently you may need to make other arrangements.
Solid Space cannot be held responsible for incomplete or poorly designed projects.

1.0

Introduction to the Laser Cutter in The Solid Space Lab.

The laser cutter at SIAT is a Co2, 50 watt, X-660 Universal laser cutter and engraver. It has a bed that can accommodate material sheets up to 18" x 32" in size.

The laser cutter is a '2D' machine capable cutting profile shapes out of certain materials, as well as engraving (or rastering) designs or pictures into certain materials. 2D programs such as Coreldraw and Illustrator can be used to create the parts to be cut.

The laser cuts material by emitting a very focused, intense beam that can pierce through material by essentially burning it. It is done in pulses so fast, the beam appears as if it's steadily on.

Actual cutting vs. engraving on the laser is achieved through the relationship between laser power (intensity), the speed at which it is programmed to travel, and the material type. The power and speed settings can be adjusted under the the laser's software utility. The slower the laser is made to travel at a given power setting, the deeper the cut. The faster it travels at the same power setting- the shallower the cut. Fast travel speeds and low power settings means the Laser will simply mark, or engrave materials as opposed to cutting. Faster travel can also mean slightly lower accuracy and less precise linework. This is all controlled through a printer driver setup in Coreldraw.

Rastering is achieved through moderating the settings too, except the laser makes the design through a rapid back and forth motion, much like how an inkjet printer prints pictures. The rastering process also allows use of bitmap imagery.

The laser in Solid Space cannot cut through metals, ceramics, or glass.

Parts to be cut are laid out on drawing page in the appropriate vector program, to scale, in inches
The page size will correspond with the material sheet size.

SIAT UNDERGRADUATE STUDENTS MUST USE CORELDRAW TO FINALIZE THEIR CUTTING FILES. IT IS IN LABS SC3130 AND SC3140, FOR WINDOWS.

Consult with the Production Technologist if you need to raster engrave your files (such as doing a picture on a piece of wood).

1.1 Laser Cutter Appointments and Access.

You must e-mail the Lab staff to set-up an appointment for the Laser cutter. Jobs require you to bring the material, files and be physically present.

Appointment procedures and file requirements may vary if you are taking a undergraduate class with a Solid Space component such as IAT 337. As such, you will be dealing with your TA for coordinating Laser booking and file submission. TAs or Instructors will need to communicate with the class and ensure the files adhere to guidelines **before setting bookings for students to come to the Lab to cut.**

For specifics as to SIAT Undergrad use and use by others such as Graduate students, see ***Sections 3.1-4.0***

The laser cutter is booked in half hour increments, to a maximum of 3 hours.

- **Clients are required to supply their own material, cut to size.**
- **Files and materials must be ready to go for the booking. If not, you will be asked to fix any issues and return after setting a new appointment.**

As well, students with materials that need to be cut to size for Laser Cutting should book power tool use *prior* to their Laser booking, or have the vendor cut it if its a very large sheet. Students unprepared will be asked to leave and rebook their appointment.

2.0 Laser Cutter Material Requirements.

The laser cutter has a **MAXIMUM 18" x 32"** material-sheet size but **will not cut to the full extent** of those dimensions.

- **Materials must be flat. If not, they will not be cut!!!!**

Bowed or bent materials will not only cut poorly but also may damage the laser head/cone as its working.

2.1: A List of Acceptable Materials for Cutting and Marking.

This may change from time to time as equipment and procedures change in the Lab.

To cut:

- Masonite (aka HDF, Hardboard): up to 3/16" thick, smooth BOTH sides
- Bristol board, Matte board, Museum board. Edges may char
- Corrugated cardboard: up to 1/4". Other thicknesses, please ask
- Regular Hardwoods: up to 1/8" thick. 1/4" under certain circumstances. Edges will char
- Interior Plywood: up to 3/16" thick. 1/4" under limited circumstances. Edges will char. Smaller higher grade sheets are good. Ensure they are flat

ABSOLUTELY NO EXTERIOR GRADE PLYWOOD WILL BE CUT.

- Plexiglas, Lucite, Acrylic : up to 1/4" thick for cutting, cast preferred.
- Particleboard. (aka Chipboard): Up to 1/4"
- Papers, Vellum: Please ask, allow time for tests
- Depron Foam, thin styrofoam: Please ask, allow time for tests
- Some natural fabrics on a TBD basis. Allow time. Fabric needs to be prepared.

To mark or engrave: All of the above, plus:

- Certain fabrics can be marked provided they are prepared correctly, please ask, allow time
- Most regular Hardwoods. Exotics: Please ask. Some may not work
- Anodized aluminum and some metals with special coatings: Please ask, allow time for tests
- Tile and Glass: Please ask, allow time for tests

Prohibited materials: IF YOUR PLASTIC IS A MYSTERY IT WILL NOT BE CUT. If unsure, ask.

- **PVC, vinyl, other synthetic materials that may have chloride in them.**
- **Styrene, Lexan**
- **Thick woods for cutting (although can be engraved or marked)**
- **Reflective materials**

Prohibited materials could damage the machine, release toxic gas, or take excessively long times to process, resulting in fires. If there is a unique need or requirement for research purposes, please consult the Production Technologist.

If buying plastic, make sure you are buying confirmed, preferably new acrylic sheet or 'Plexiglass'. Ask the vendor if you need to, and keep a bill of sale with a description of the product with you. In the past, so-called 'acrylic' scraps from vendors have turned out otherwise, resulting in an uncut project.

3.0

General: Setting Up Your Drawing.

No matter the starting program of use is, do the following when getting ready to lay out your design

- **Set up your drawing to work on a 1:1 scale, in inches.**
- **Keep in mind the cutter sheet size limits. If it does not fit on a 18"x 32" sheet, it won't fit onto the laser bed.**
- **Remember: the laser won't cut to the full extent of the sheet, so leave about a 1/8" margin if using a full sheet.**

Also be cognizant of the fact that the laser lens has a 'kerf' (or thickness) of .005" and cuts to the center of your lines. This is usually not an issue, but with pieces requiring a certain type of fit or sizing it may be, and you will have to design your drawing accordingly

Coreldraw is what the laser uses. As such, this document will address the general issues with that. For raster engraving pictures, etc, contact the Production Technologist. Again, SIAT Undergraduate students must use Coreldraw to finalize their cutting files.

See *Section 4.0 for Corel file set-up tips*

3.1

General File Requirements for Laser Cutter Submissions.

Most laser cutting at SIAT is vector cutting- or the cutting out of 2D shapes.

For vector cutting:

- **Use only 'hairline' vector paths- no fills- set up in a drawing program such as Coreldraw or Illustrator.**
- **No double or overlapping lines. (such as 2 squares sharing a side or sitting right over each other). Double check for them and delete them if they exist.**
- **"tab" or create gaps in line work for layouts with lots of tiny parts or when cutting out text (they can get lost if they are all cut free from the sheet as the laser is cutting). Consult with the Production Technologist if you need help or have questions about this, ahead of time,**
- **Use different coloured linework for lines that need to be cut or marked at different depths.**

See Section 4.0

Consult with the Production Technologist if you need to raster engrave your files (such as doing a picture on a piece of wood).

3.2

Getting The files Processed: SIAT Undergrads with Applicable Classes.

Artwork may be produced in most vector programs, but **final output files for cutting must done in Coreldraw X4.**

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Coreldraw (.cdr' file format) is what the Lab uses and is what the output files should be laid out in. In other words, all the components of your design that need to be cut, have to be laid out in the correct 18" x 32" sheet (page) size, in a 1:1 scale. Details as to how to set that up are in **Section 4.0**

Your final laid out ready-to-go 'cutter' file, **in .cdr format**, must be named:

FirstName_LastName__ModelTitleCutter_Date_Class

Again, you will be dealing with your TA for laser booking and the final file submission.

3.3

Getting the Files Processed: For SFU Graduate Students and Faculty at SIAT and Outside SIAT.

Ensure your program of use can export or output to Corel. Good formats to use for export to Corel are .eps (if coming **directly** from Illustrator to Corel.) Save as a legacy "version 8 Illustrator" .eps

Please note some formats may have inherent issues, depending on the program of origin. If possible, it's strongly recommended that Coreldraw be used throughout. **See Section 5.0, 'Using Solidworks and CAD programs and other Issues'.**

A good working methodology is to setup a master art file to assist in generating your layouts and a final 'cutter' file that is the one actually used for final output. Your final laid out, ready-to-go 'cutter' file, in .eps or format, must be named:

FirstName_LastName__ModelTitleCutter_Date

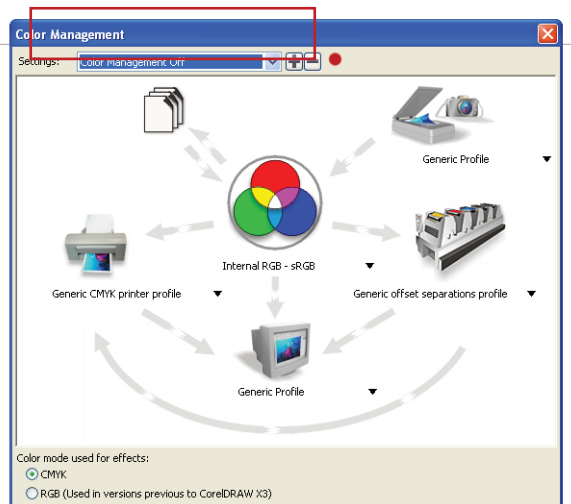
Sizing and other file requirements are in **Sections 1.0-3.3, 4.0-4.2 of this document.**

4.0 Initial Set-Ups Tips In Coreldraw.

The laser cutter interacts with Corel through a printer driver. The driver uses a basic CMYK palette with a 'red', 'green', 'blue' and 'orange' colour designation from Coreldraw to tell the laser how and what to cut. The properties screen that shows this is described more in **Section 4.2**

If you need to separate elements of your file according to how it needs to be cut (such if you want to engrave text into a design and then cut out the pieces) you will need to do this by assigning colours to your linework, These colours should correspond to the pen colors of the laser, and, can be assigned different actions.

If so, you may want to set up your colour working environment for a better transition into the Lab, to ensure no confusion occurs. Use the Corel default CMYK **colour palette** but turn colour management OFF (the colours will now look the same and make sense when you come into the lab to cut)

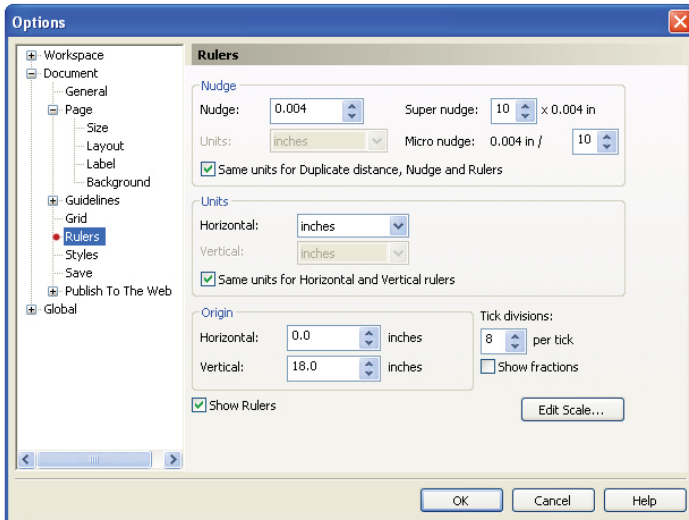


4.1 Page Layout.

THE MOST IMPORTANT STEP, AND REQUIRED, IS SETTING UP YOUR PAGE BOUNDARIES TO BE 32" IN WIDTH, AND THEN 18" IN HEIGHT.

Do this through the Corel menu:

1. Go to 'Layout>Page Setup'. In the dialog box, in the left side roll-out, ensure you are under 'Page—Size', and fill in the correct numbers.



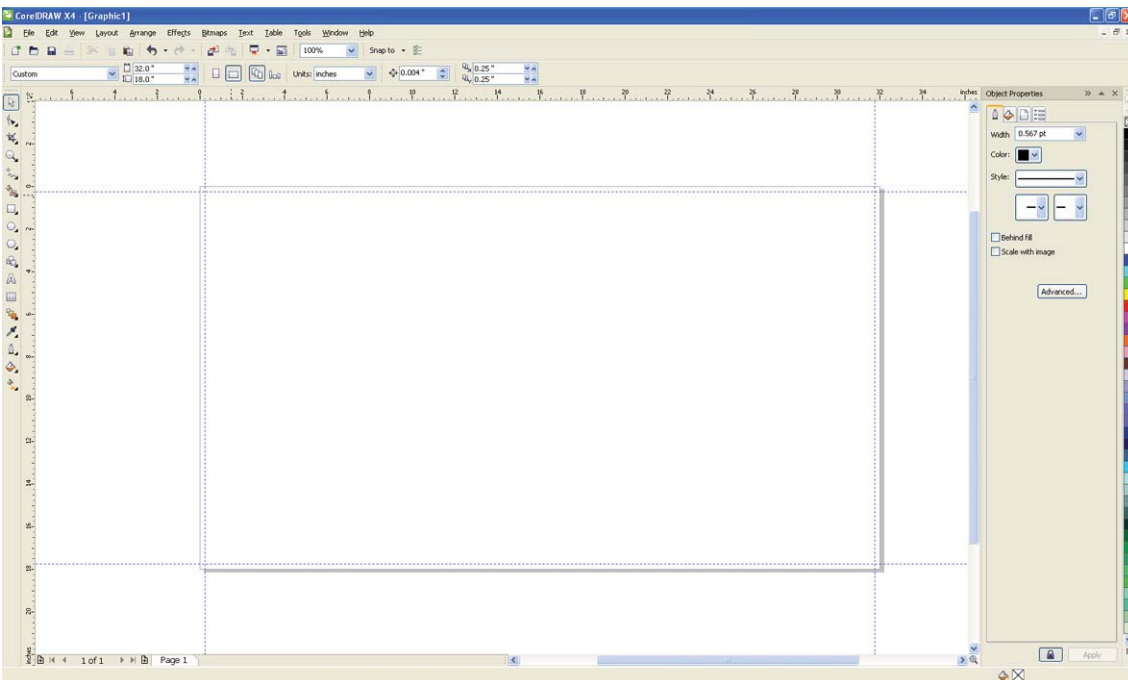
2. The origin (0,0) of the drawing needs to be in the top left corner of your page boundaries.

You can set this up precisely under 'Layout>Page Setup', in left side roll out.

Navigate to the 'Rulers', then under 'origin' field on the right, set it up as Horizontal: '0' and Vertical: 18"

It's also a good idea to set up small margin, of about .125" if you are working to the full sheet size.

End result:



4.2 Organizing Your Linework According To What Has to be Done.

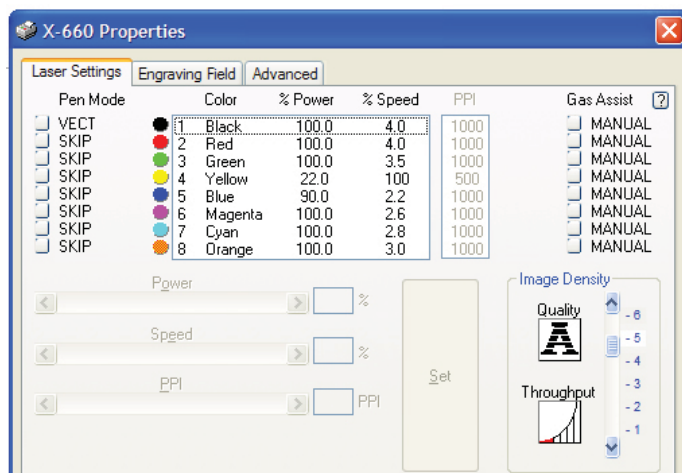
Note: All vector work (lines meant to cut out, or engrave smooth paths like with a pen) must have hairline pen widths, with no fills.

As mentioned in Section 4.0, assign linework needing different actions with different colours. Note that as a rule the laser will always raster (images, fills) first, then cut

It is also important to note, there is an order to the cutting, based mostly on the pen colours. As an example (actions may vary)

1. Black- Inside cuts or raster (doing picture type things or logos on your material).
2. Red- Vector engrave lightly
3. Green- Final part cut out.

Shown again is the driver setup in Corel, and the ordering of pen colours:



Black will be the first action, then red, etc. Once again, the ordering is important if you have lettering you want on your parts, or parts that need to be marked before they are 'cut loose'. Trying to engrave parts just cut loose is no fun and usually means a failed project :(.

5.0 Using Solidworks and CAD programs and other Issues:

If you have drawings from a 3D model, (the resulting profiles) that need to be laser cut, you will need work appropriately to have your files export and cut well. Solidworks will try and automatically rescale your drawing in a number of ways when going to an exportable drawing sheet, be careful of this and double check your sizes when in Corel.

Note: Your Solidworks drawing should be set up in inches.

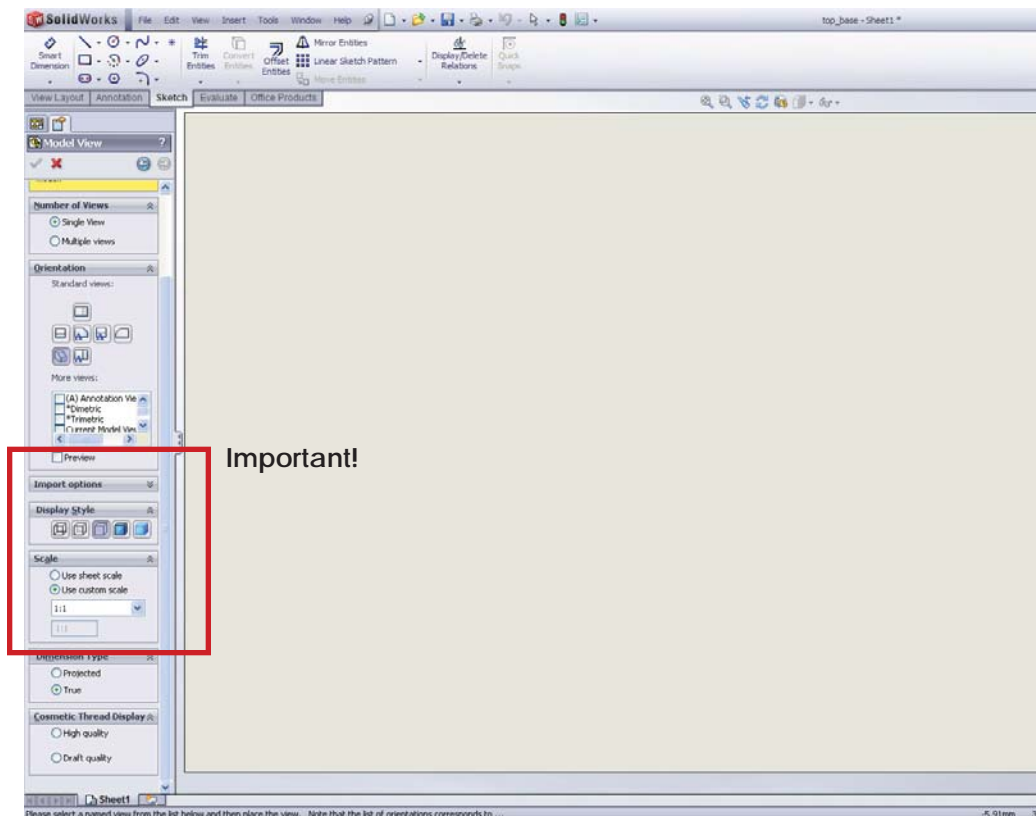
1. Start by going to the 'File' menu and go 'create drawing from part'

- **When creating your drawing sheet, ensure it's on a 1:1 scale and that the model views are too (1).**

Depending on your initial setup in Solidworks, your drawing sheets may be in mm. Create a custom sheet in the 32" x 18" (812.8mm x 457.0mm) size, through either typing in the converted mm values or making it in inches.

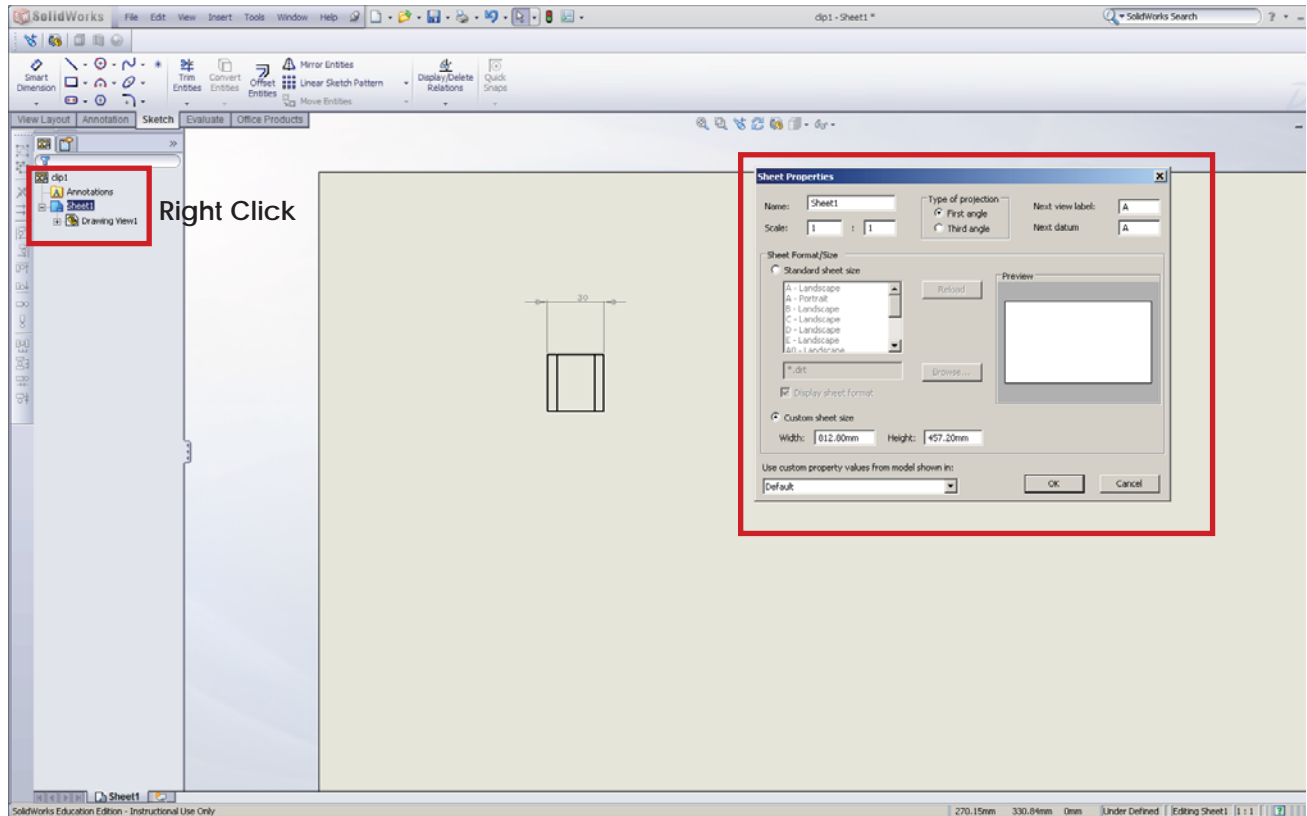
- **When you generate your 2D drawing sheet, 'Dimension projection' is set to 'True' (A).**

(A) Example shown:



- When finished with this, double check your sheet size/scaling by going to the 'FeatureManager design tree' (while still looking at your drawing layout, not model) and right click on 'sheet properties.' This will bring up settings which you can check (B)

(B) Example shown:



2. When done, go to 'save as' and it will save 2D information/profiles you have set-up of your model. You can export directly to CorelDraw by saving as a '.dwg' or similar CAD format. Or, If you still need to work on it in Illustrator, you can save as and 'ai' file.

- You can draw a 1inch x 1inch reference square in your Solidworks drawing sheet source file to ensure your scaling is correct when it comes into Corel or another program. It can also help pinpoint problems, or fix them, should issues occur.

With exporting and importing especially, and artwork creation in general, you must make sure you have no overlapping or double lines. No files will be accepted with that, and you will need to fix it before commencing with any cutting.

Also ensure your curves and line work is smooth. Exporting under certain circumstances can result in heavily segmented curves.