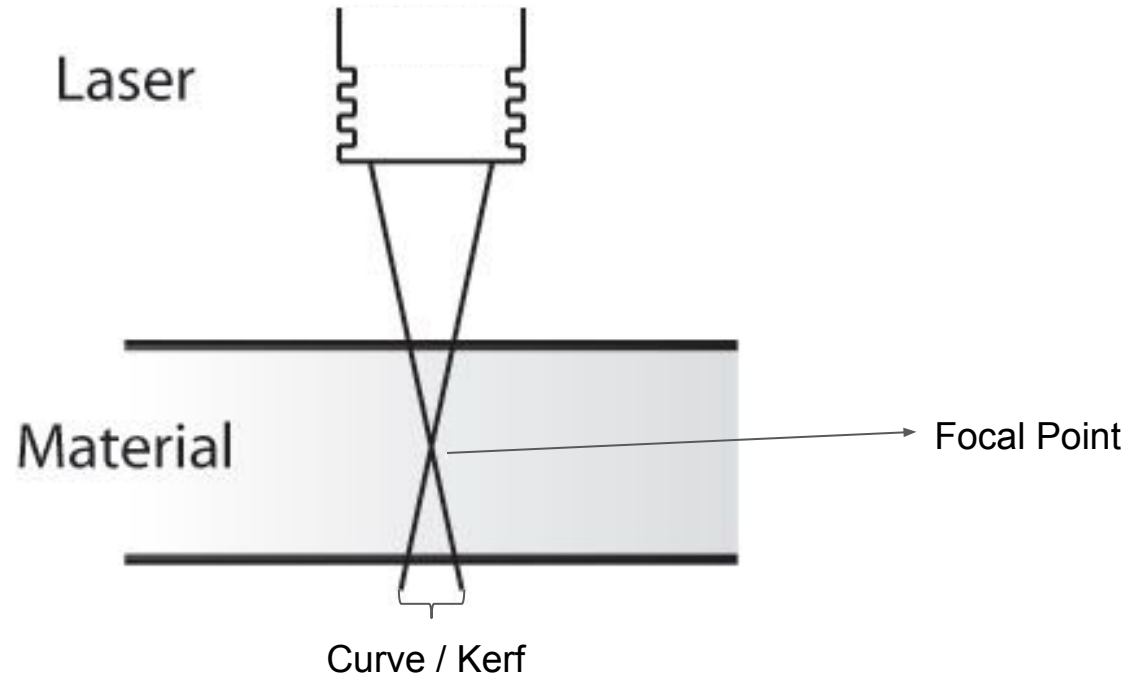# Laser cutting for beginners

# How does it work?

Terminology

- Raster / Bitmap
  - Grid of X and Y coordinates with values in each coordinate. In this case, each coordinate represents a pixel and its values.
- Vector
  - Creation of digital images through a sequence of commands or mathematical statements that place lines and shapes in a plane

Design techniques

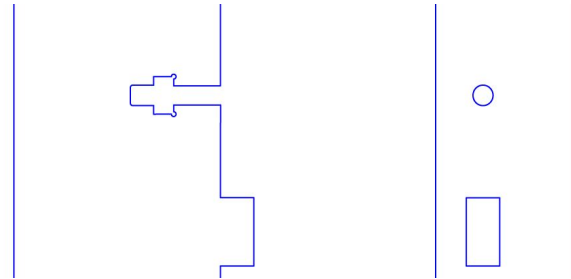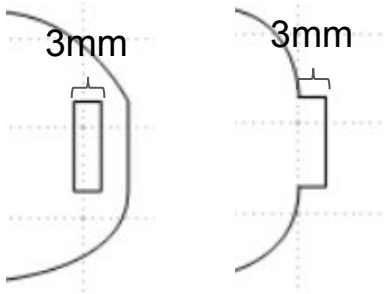Just because you cut in 2d doesn't mean your product has to be 2d

Techniques - Half Slots

- Consisting of two halves
- Pressure fit is usually strong enough
- Remember to put slots on opposite ends

3mm

3mm
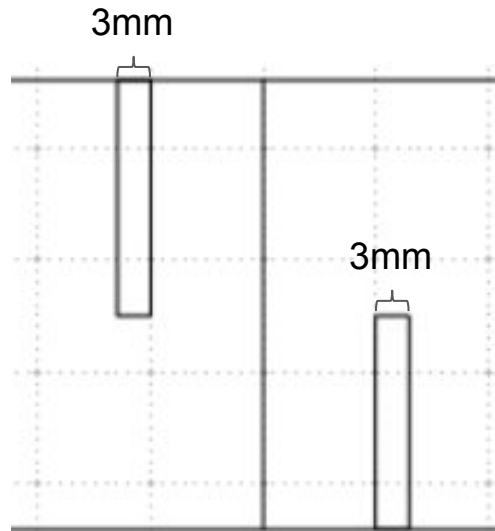
Techniques - Tabs

- Consisting of a "tab" side and a "slot" side
- Similar concept used in finger joints or box joints
- Requires glue to hold
- Easy to plan

3mm

3mm

Techniques - Living hinge

- Weaken a stiff material enough to bend it
- Requires some calculations to custom fit exact curves
- Visually appealing and allows for non right-angles
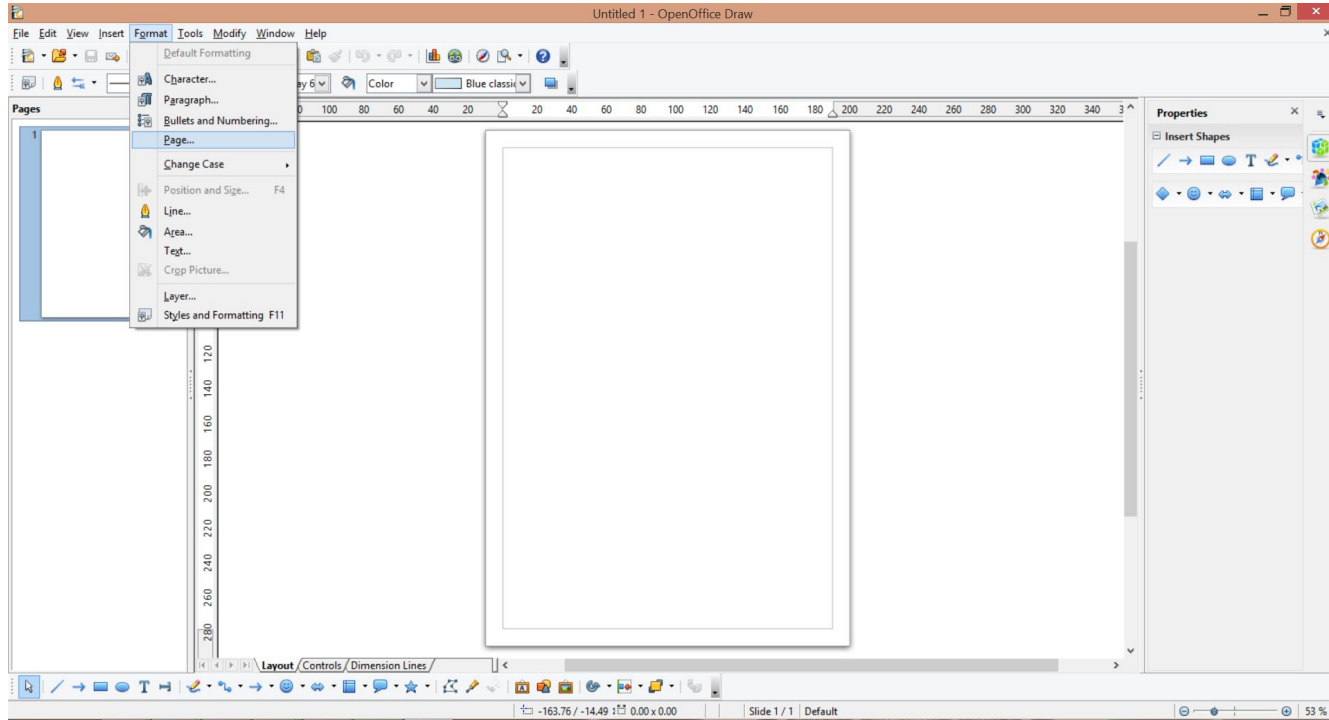- Weaker than other methods
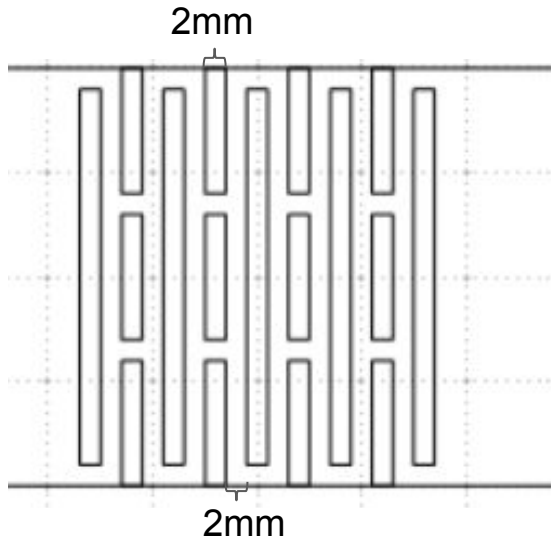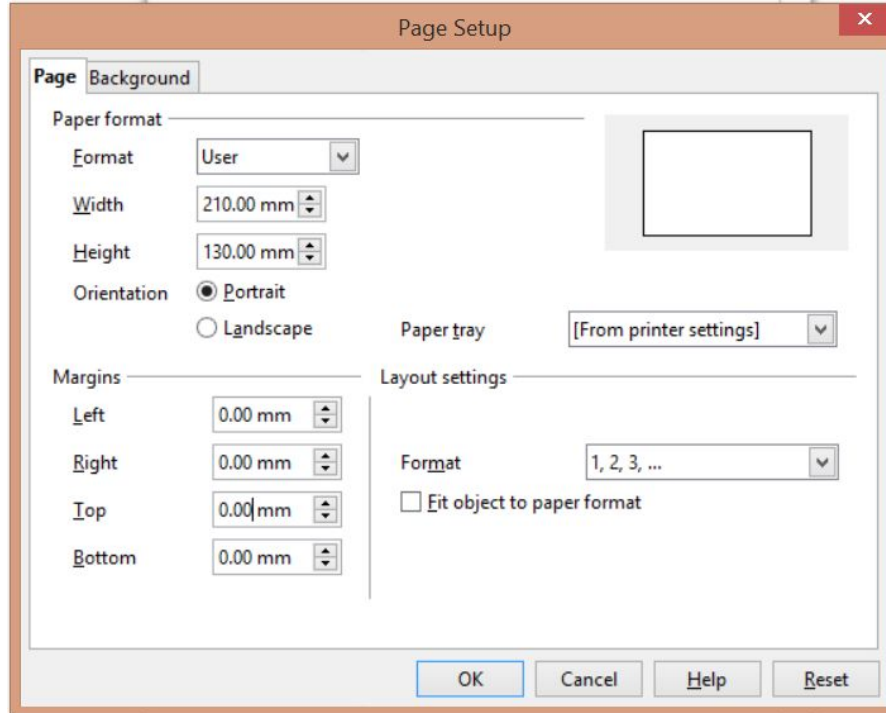
Design process - Conceptualisation

- Draw rough sketches, don't worry about the details
- Rough out the size of the finalised product and its proportions
- Estimate material needed, size and type
- Don't be afraid to start over!
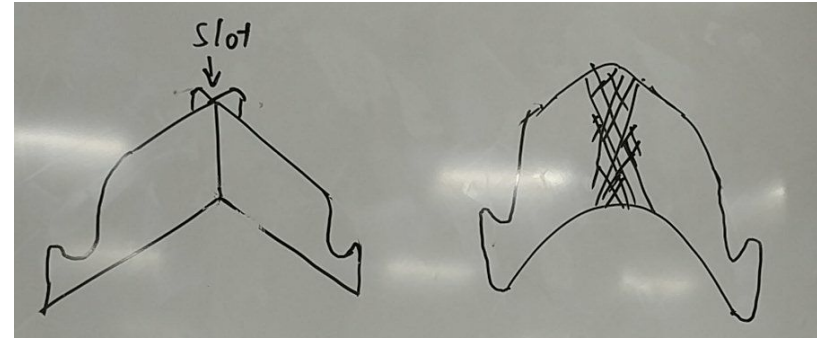
Design process - Planning (Page size)

Design process - Planning (Page size)

Design process - Planning

- There's no such thing as being too prepared! Measure twice cut once!
  - Rough prototypes, you can err on the side of too loose
  - Final prototype, err on the side of too tight
- 'Flatten' your concept sketches
  - You can mock up with cardboard or foamcore
  - Look up online designs for best practices
- Leave reasonable gaps between parts
- Don't forget basic geometry!
  - Remember when you draw circles, the width and height are **diameters** not radius

Design process - Drawing

- While not as good as a pen tool (illustrator), open office's curve is still very useful and flexible
- Don't worry about minor mistakes, you can fix it by moving the points later
- Try to make use of simple geometry to achieve your goal
- Use a ruler or caliper to estimate the dimensions of your drawing
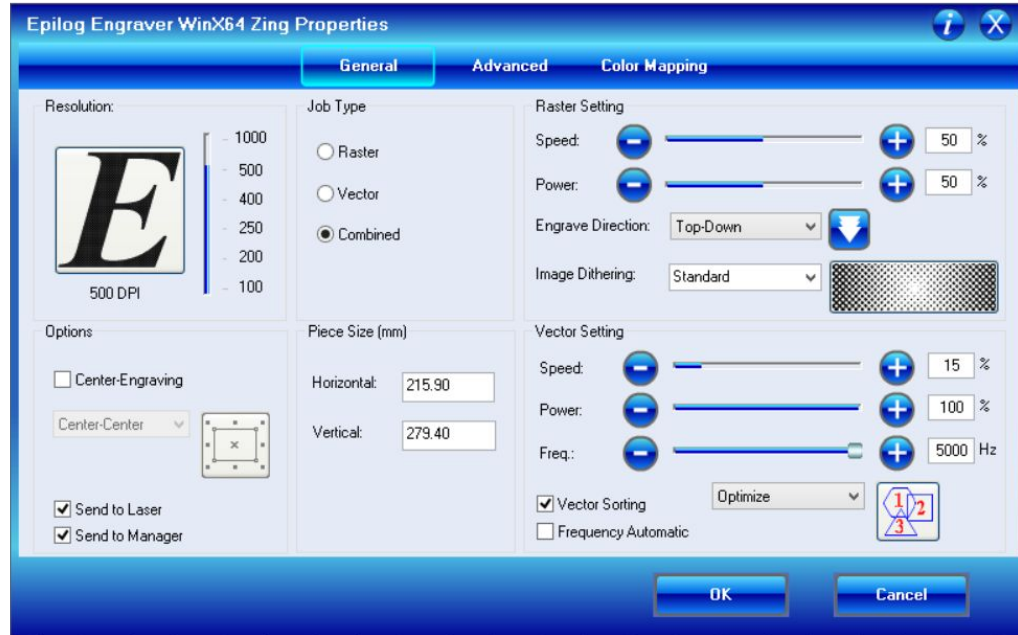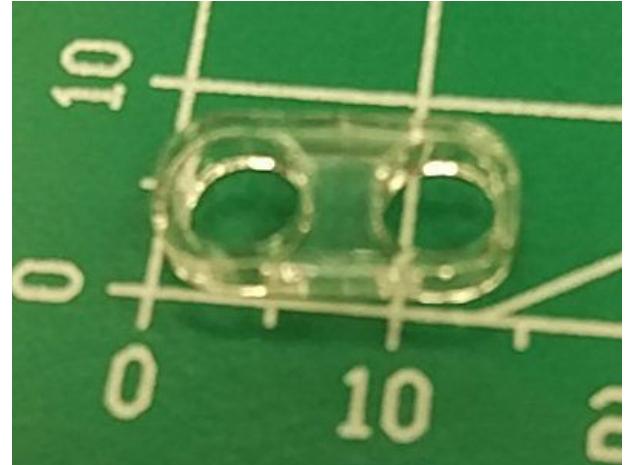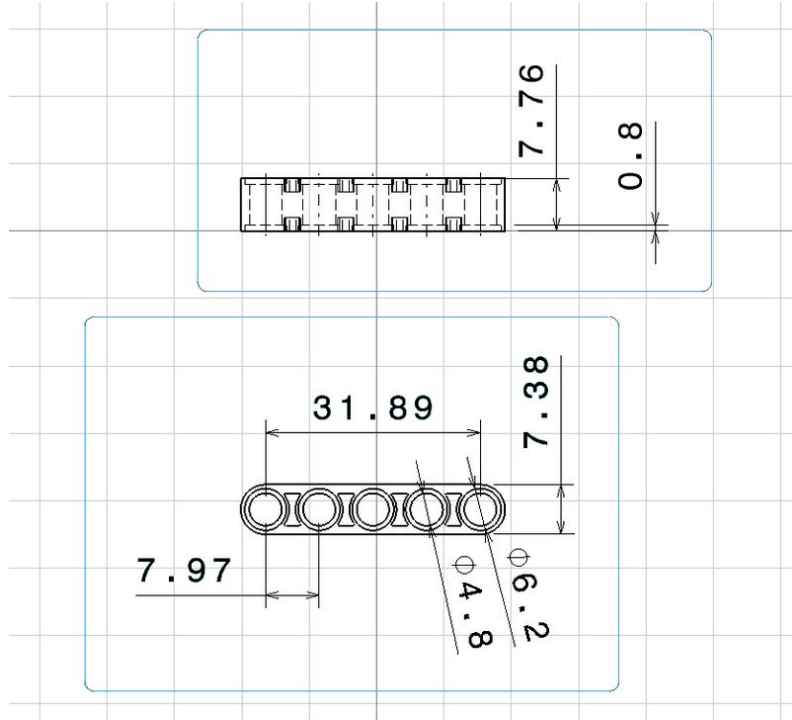- Keep reasonable space between parts
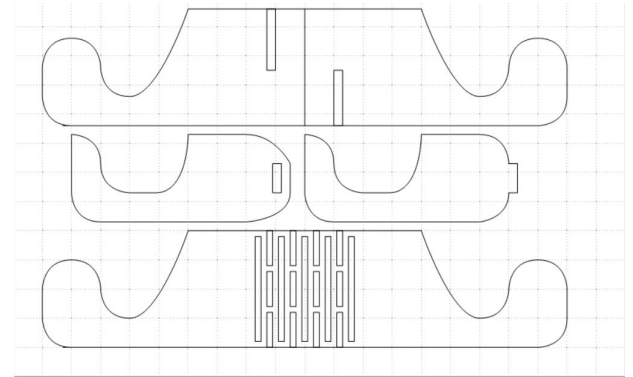
Printing
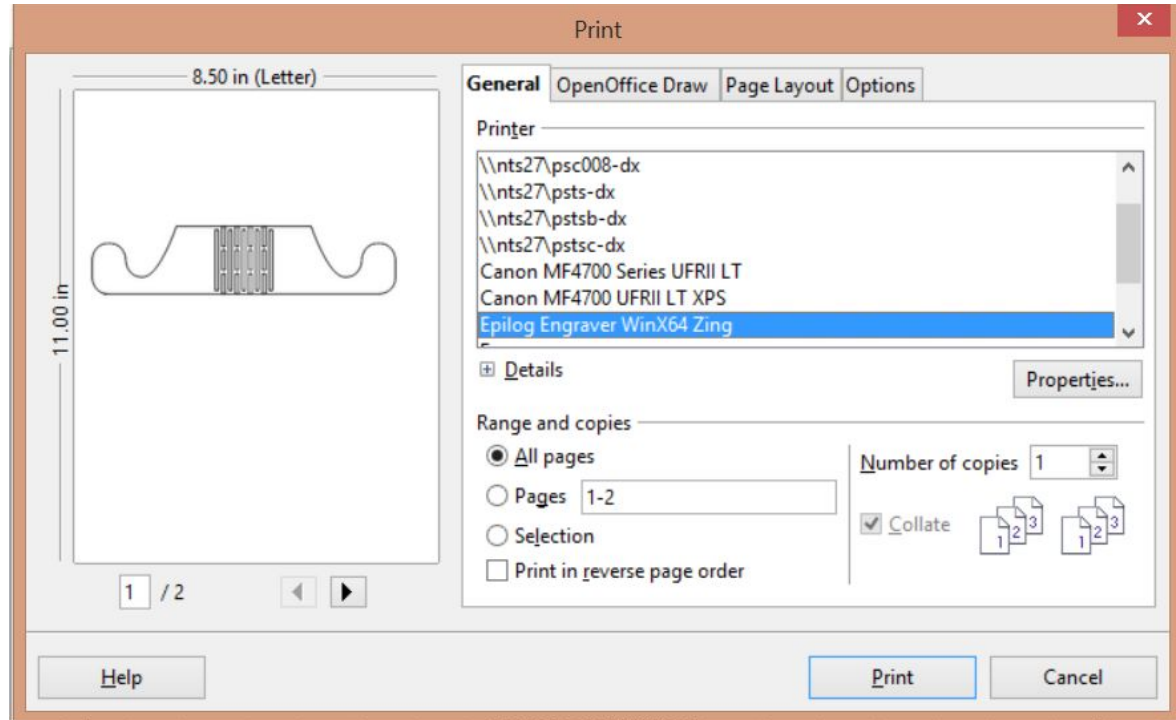
Printing

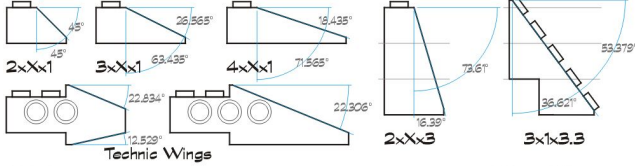*Different settings are used for different materials! Please consult lab managers or datasheets

Example

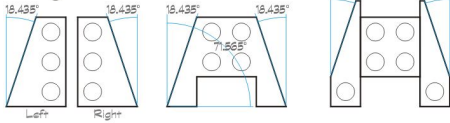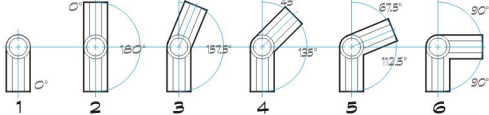# Reference http://tinkernology.blogspot.sg/
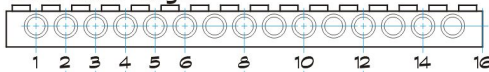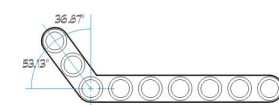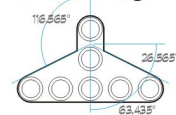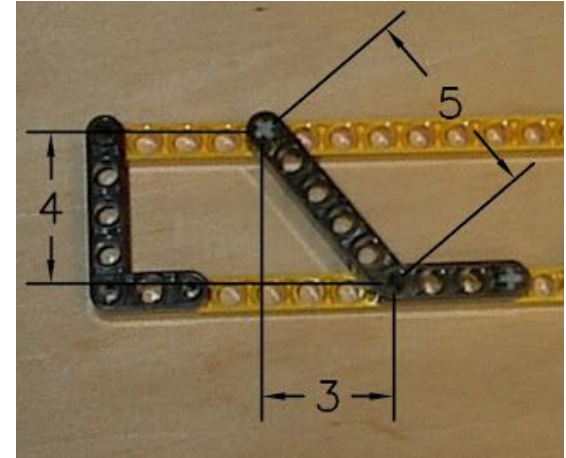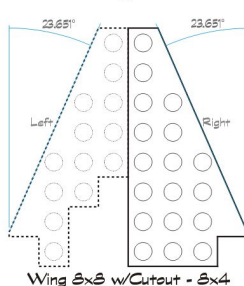
Troubleshooting

- Vectors are etching / not cutting
  - Are your lines too thick?
- Pressure fit objects too loose
  - Fix with glue
  - Remember the kerv of the laser!
  - '3mm' acrylic are usually 2.85mm
- Etching bitmap has lots of noise / unwanted pixels
  - Clean up the image
  - Etch with the paper on first
- Laser zeroed wrongly
  - Copy the image onto a new document
  - Contact the lab managers (DO NOT zero on your own)

Extra Information

- CNC
  - Computer Numerical Control - Commonly used to mistakenly describe CNC mill, CNC represents all machines controlled by calculations and position values, (eg. milling machine, laser cutter, 3d printer)
- G-Code
  - Widely used series of commands to control CNC machines
- Zero Position
  - Position where the laser will take reference from. On the Zing epilogue it's at the top left of the print.
- Laser output
  - Less than 20w : Laser Engraver (can cut thin pieces of paper
  - 20w or above: Laser Cutter and engraver