# Laser Cutting 101

Lesson 2

This lesson's coverage:

- What is a vector image?
- What is vector cutting?
- Running a Vector Cut
- Considerations
- Warnings
- Finding Optimal Vector Settings
- Other Tips and Tricks

What is a vector image?

- These are images determined by points, which are connected by lines and curves
- Lines and curves are defined mathematically
- Distinctly different from a raster image, made up of an array of colored points
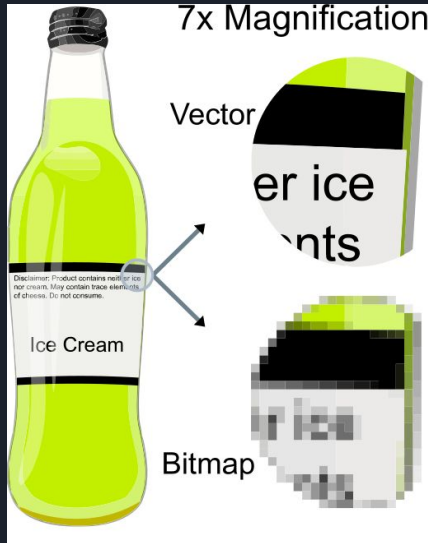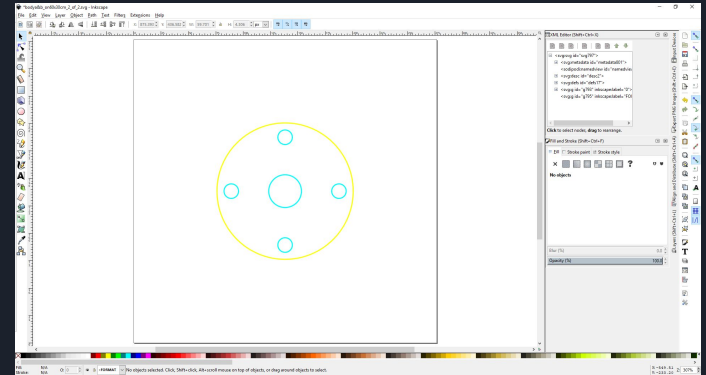
What is vector cutting?

The laser uses a vector images lines and points to define paths for the laser head to follow.

- The laser marks continuous lines instead of points
- The lines are defined by size; not pixels
- These lines may cut through the material, or mark to a desired depth
- Our laser allows very precise power control on vector projects
- The laser also enables up to seven different layers

Running a Vector Cut

2 Ways to Send a Cut to RetinaEngrave

- Directly via File (uncommon for us)
- From a vector graphics program
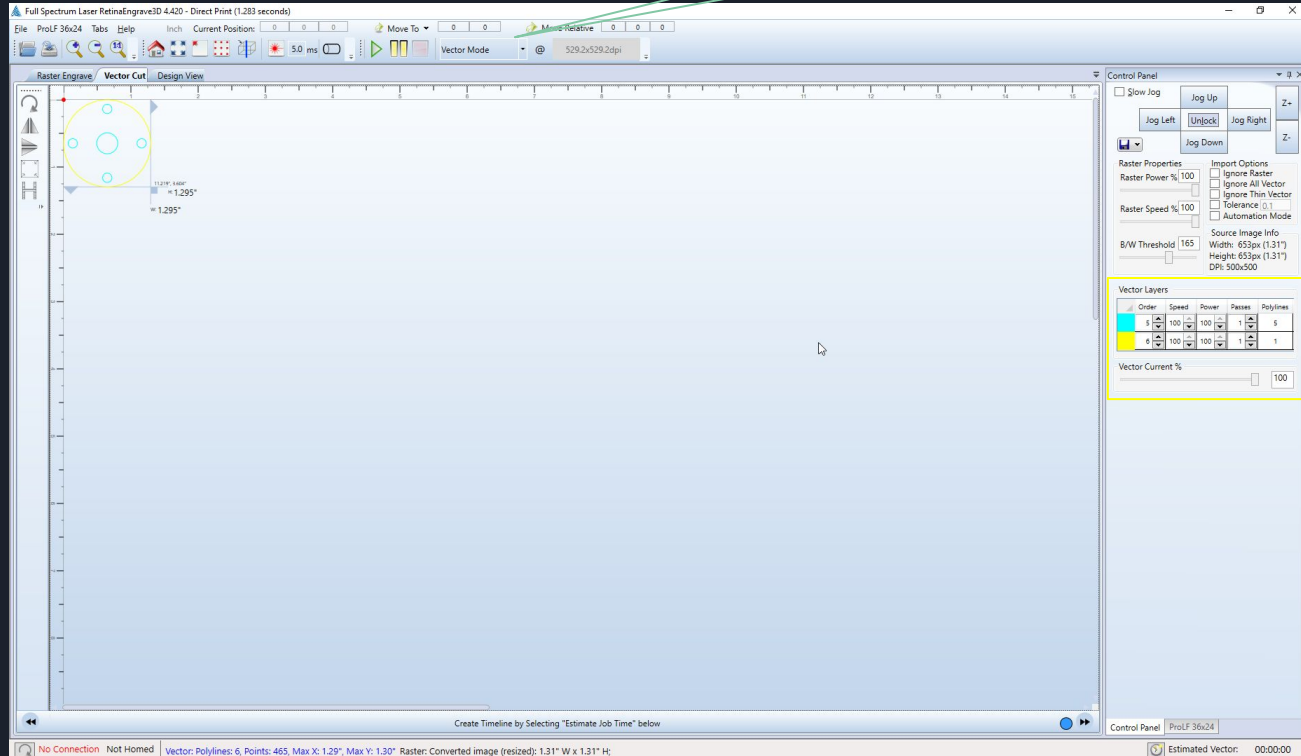- This example uses Inkscape for this cut
- Note the 2 colors

My common workflow goes as such:

- Design Part - Test Assembly	- 1:1 Drawing - Export as .dxf, .pdf, .ai	- Adjust lines - Change colors	- Order Colors - Adjust settings	
CAD Design →	**CAD Drawing** →	**Inkscape** →	**Print to RE** →	**Align and Cut**

Retina Engrave: Vector Cut

(Read manual for more depth)
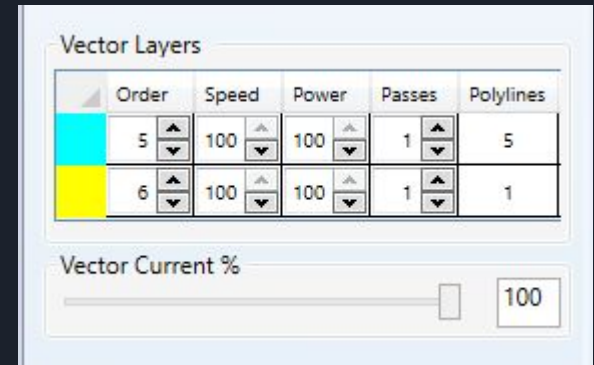
Put In Vector Mode

Primary Settings

There also exists a vector simulation mode. This allows you to preview the manner in which the laser will cut your item on the screen.
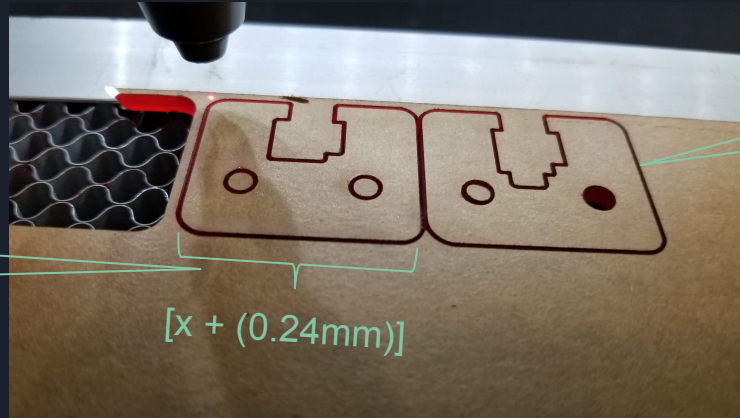
Retina Engrave: Vector Cut
(Read manual for more depth)

- Layers: Up to 7
  - Blue, Red, Magenta,Green, Cyan, and Yellow
  - That is 6; I recommend avoiding black for vector cuts
- User may decide order of cut with the **Order** setting
  - Laser cuts in numerical order (1, 2, 3…)
  - In this case, Cyan is first
- **Speed:** decides how quickly the laser moves along lines
- **Power:** adjusts actual voltage applied to the tube
- **Passes**: how many times the laser head runs over that color
- **Polylines**: Number of curves defined in your drawing
- **Current**: Adjusts current applied to tube (for materials with different hardness)

Vector Layers

	Order	Speed	Power	Passes	Polylines
	5	100	100	1	5
	6	100	100	1	1

Vector Current %   100

Considerations

- The laser is now making long strokes in vector
- Heat is more quickly concentrated
  - More easily ignites material
- Kerf: The amount of material removed by a laser-cut line
  - ~0.24mm total kerf, centered on cut, depending on thickness of material
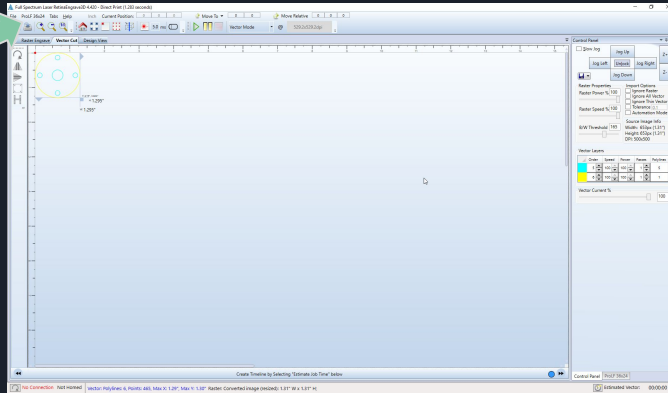 - ~0.12mm each side

0.24mm kerf
0.12mm to the left
0.12mm to the right

This dimension was made 0.24mm larger to compensate for the kerf.

[x + (0.24mm)]

Optimizing Settings

Estimate a settings range, and find the 2 settings that cut through your material the fastest at the lowest power.

Starting the Cut

- DO THE SAME LASER CHECKS AS FOR A RASTER JOB
- If you don't remember these, review LESSON 1
- Everything, besides the specific vector settings, can be done the same as with a raster etch job
  - Perimeter sweep
  - Starting the job
  - Focusing the laser
  - Material selection
  - Etc…

Before Moving On

- This lesson is intended to be taught by someone that has gone through the tutorials and/or Laser 101 already.
- If you have not taken Laser 101 in person, please review my etching and vector tutorials (they have a bit more detail) at these links:
  - [Full Spectrum Laser Pro 36x24 Intro and Quick Start](#)
  - [Full Spectrum Laser Pro 36x24 Vector Cutting with Solidworks and InkScape](#)

Assignment

The group will have 45 minutes. Material testing as a group is allowed. All other parts are individual.

- Create a vector drawing for a program
- Cut a "donut" out of a flat material
  - 2 inch outer diameter
  - 1 inch inner diameter
- Be as accurate as possible
  - Use calipers
  - 1.995 - 2.005 inches outer diameter is within range
  - 0.995 - 1.005 inches is within range as well
- With practice, you should achieve results within +/- 0.003"