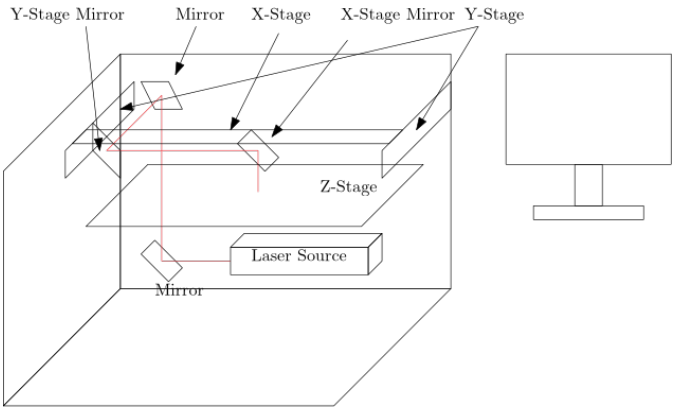
Chapter 44

All About CO_2 Lasers

44.1 CO_2 Laser Cutter



44.2 CO2 Laser Cutting

- Materials: No chlorines, no fluorines
- Organic Materials
  - Wood, Paper, Cardboard
  - Natural Rubber
  - Some Plastics cut well, others melt
  - Fiberglass
- Metals don't typically work

44.3 Raster vs Vector

http://www.fastprint.co.uk/blog/raster-vs-vector-the-easy-to-understand-guide.html

44.4 Cut, Engrave, Raster

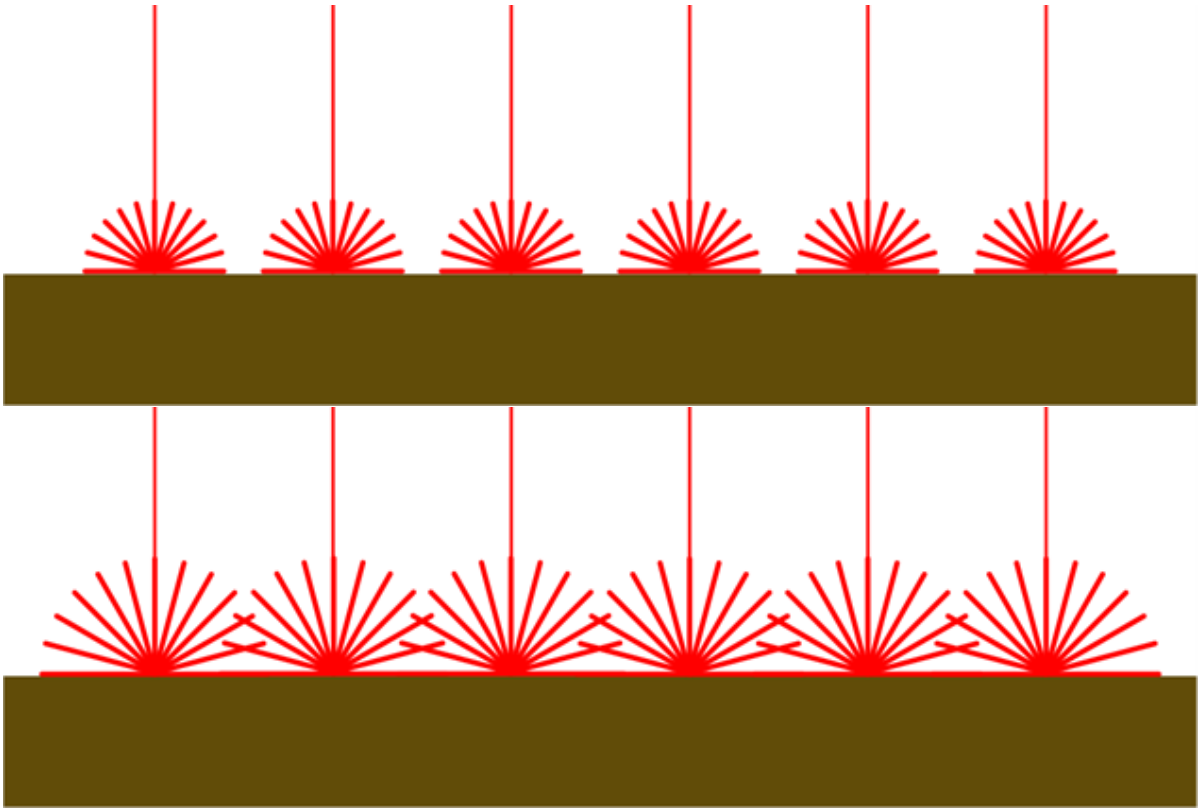
https://lasercuttingsheffield.wordpress.com/engraving-and-cutting/

44.5 Variables

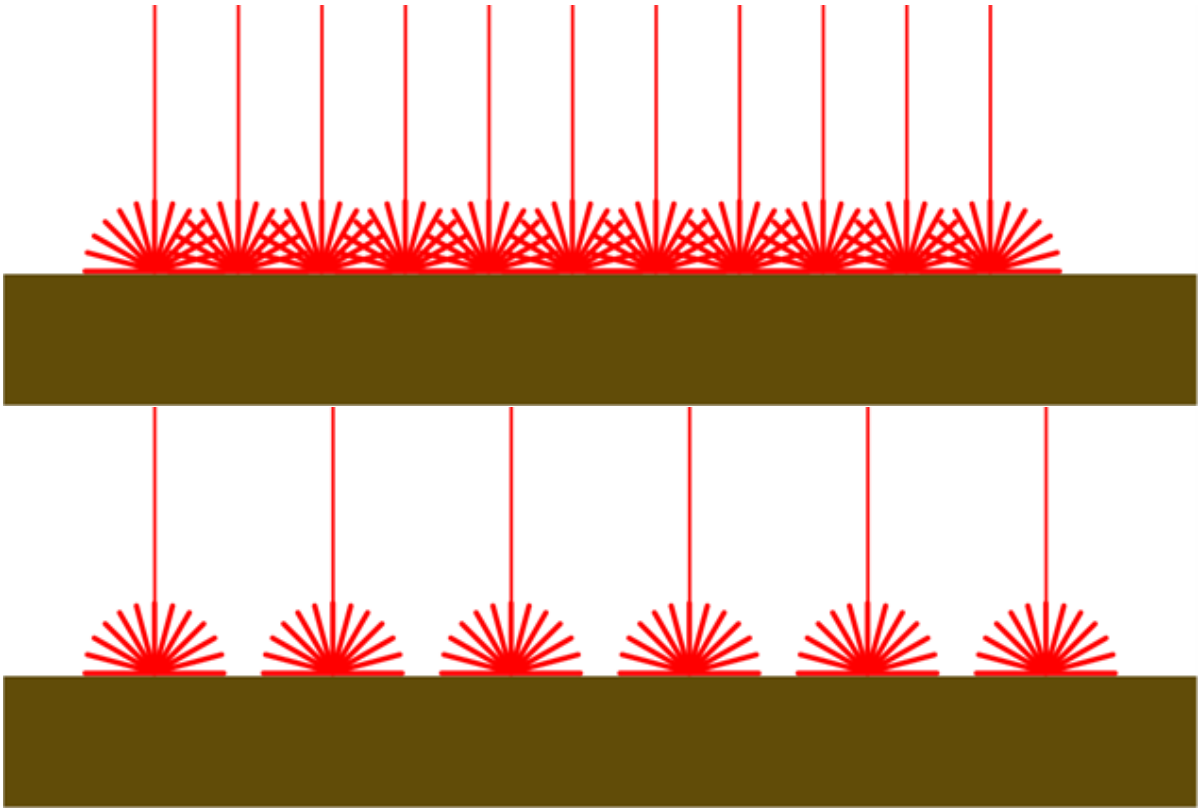
- All about the energy(E) you dump into the material, and the material's ability to be cut by that energy
- E: Energy
- l: length
- P: Power
- v: velocity
- n: number of passes

$$E/l \propto P$$
$$E/l \propto v^{-1}$$
$$E/l \propto n$$

44.6 Power



44.7 Speed



44.7.1 Energy is Proportional to Power over Speed

$$P = E/t$$
$$v = l/t$$
$$E/l = P/v$$

44.8 Speed vs. Power

44.9 Speed vs. Power

Higher speeds can impact cut quality.

44.10 Obtaining Cut Settings

1. Start with the laser cutter at 100% speed and 100% power.
2. Perform a small test cut on your material
3. Check to see if the box falls out of the material when cut.

44.11 Obtaining Cut Settings

44.11.1 Option 1

1. If the material can be fully cut out, divide the power by half and try the cut again,
2. Move the square to the right by a small amount so you don't cut over the same spot twice.

3. Continue this process of halving the power until you have it consistently cuts through your part, at least amount of power possible.

44.11.2 Option 2

1. If at 100% speed and 100% power the material is not fully cut out, lower the speed by half
2. Move the square to the right by a small amount so you don't cut over the same spot twice.

3. Continue this process of halving the speed until you have it consistently cuts through your part, at least amount of power possible.

44.12 Cut Settings (25W)*

Layer	Speed	Power	Passes
1-mil polyester	20%	100%	1
MHA acrylic adhesive	20%	100%	1
6-Ply Dick Blick Posterboard	15%	100%	2
6-Ply Dick Blick Posterboard	12%	100%	1
Full Laminate	5%	100%	1

* Your results may vary

44.13 Focus & Height

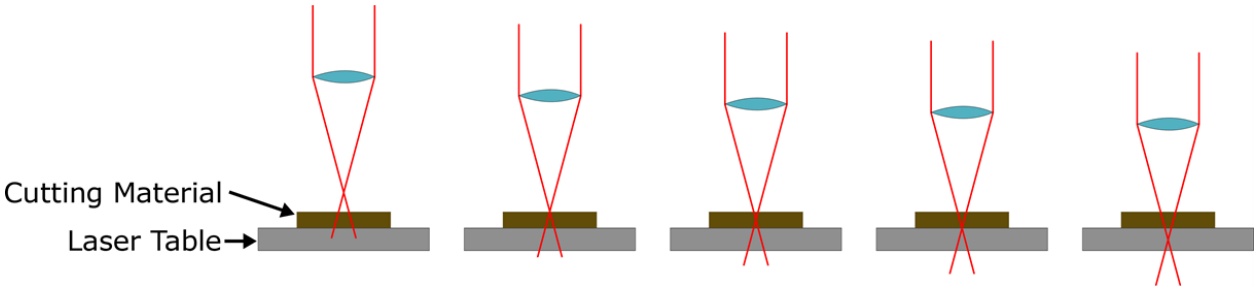


Figure 44.1: caption

44.14 Things to remember

- Test settings on a piece of scrap material. Then record your cut settings as you will need these often.
- Laser cutters often have different power settings for raster and vector. Since we are only doing vector cuts, you can turn off the raster setting.
- Some laser cutters have path optimization options.
  - Select the “inside-out” strategy if available, as this will guarantee that your material, when cut, is not first separated from the surrounding material which is holding it.

- Disable “centering” option, it is a good idea to disable it if you have already defined a page size equal to the laser bed size.

- Each laser is different

44.15 Color-based control

- Set different cut settings, sometimes different z-depths for each color

44.16 Avoiding Smoke & Fire

- Always watch the work piece, never walk away
- Turn on air assist
- Turn on vacuum to remove vapors
- Focus your workpiece – poor focus dumps energy onto the workpiece, heating it up

44.17 Masking

http://www.instructables.com/id/10-Tips-and-Tricks-for-Laser-Engraving-and-Cutting/

44.18 Things you can cut

- Wood, Plywood, MDF, paper, cardstock
- Acrylic sheet
- Many fabrics (including nylon)
- Natural Rubbers
- Polyester(Mylar)
- Polyimide(Kapton)

44.19 Things that may not cut well

- Nylon Sheet (melts)
- Delrin (melts less)
- Foamcore (melting/fires)
- Rubber (smoke, smell, residue)
- Fiberglass
- MDF
- Things that smoke –> requires more cleaning

44.20 Don't cut

- Anything with chlorine or fluorine
  - Many rubbers and plastics
  - PTFE(Teflon)
  - PVC
  - Vinyl
- ABS –> Cyanide gas
- Polycarbonate/Lexan... looks like acrylic, but is NOT

44.21 Advanced Options

- Combine adhesive & rigid, then cut
- Cut, then combine
- Kiss-cut
- Applique
- Masking

44.22 External Resources

- http://www.laseralliance.com/index.php?pg=material_reaction
- http://atxhackerspace.org/wiki/Laser_Cutter_Materials
- http://pythonhosted.org/ezdxf/tutorials/simple_drawings.html
- https://svgwrite.readthedocs.io/en/latest/classes/shapes.html#basic-shapes-examples

- http://startuplabs.schedulething.com/
- http://makezine.com/2011/09/22/identifying-unknown-plastics/
- http://atxhackerspace.org/wiki/Laser_Cutter_Materials
- http://www.laseralliance.com/index.php?pg=material_reaction

