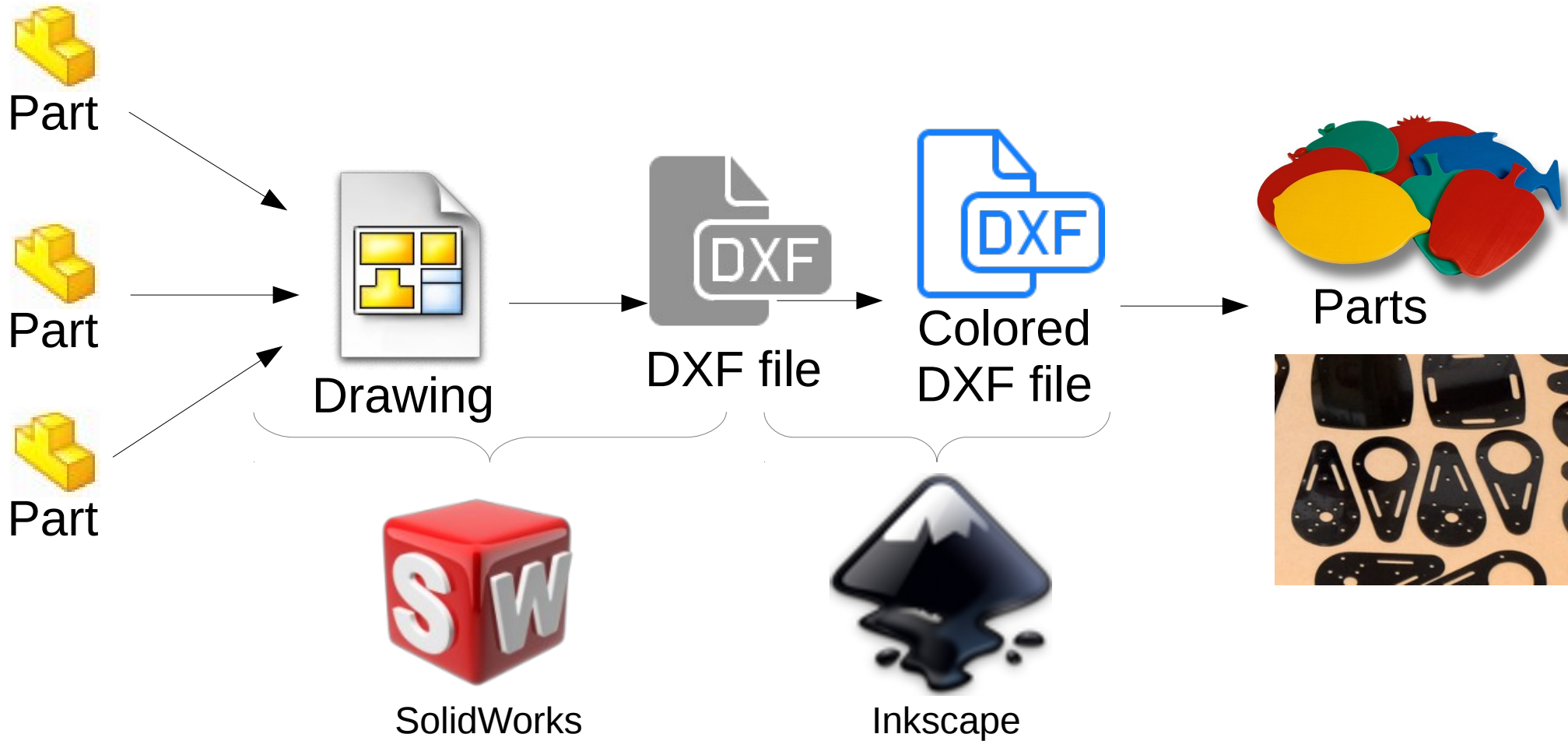


# 15-294 Rapid Prototyping Technologies:

## Laser Cutter Intro

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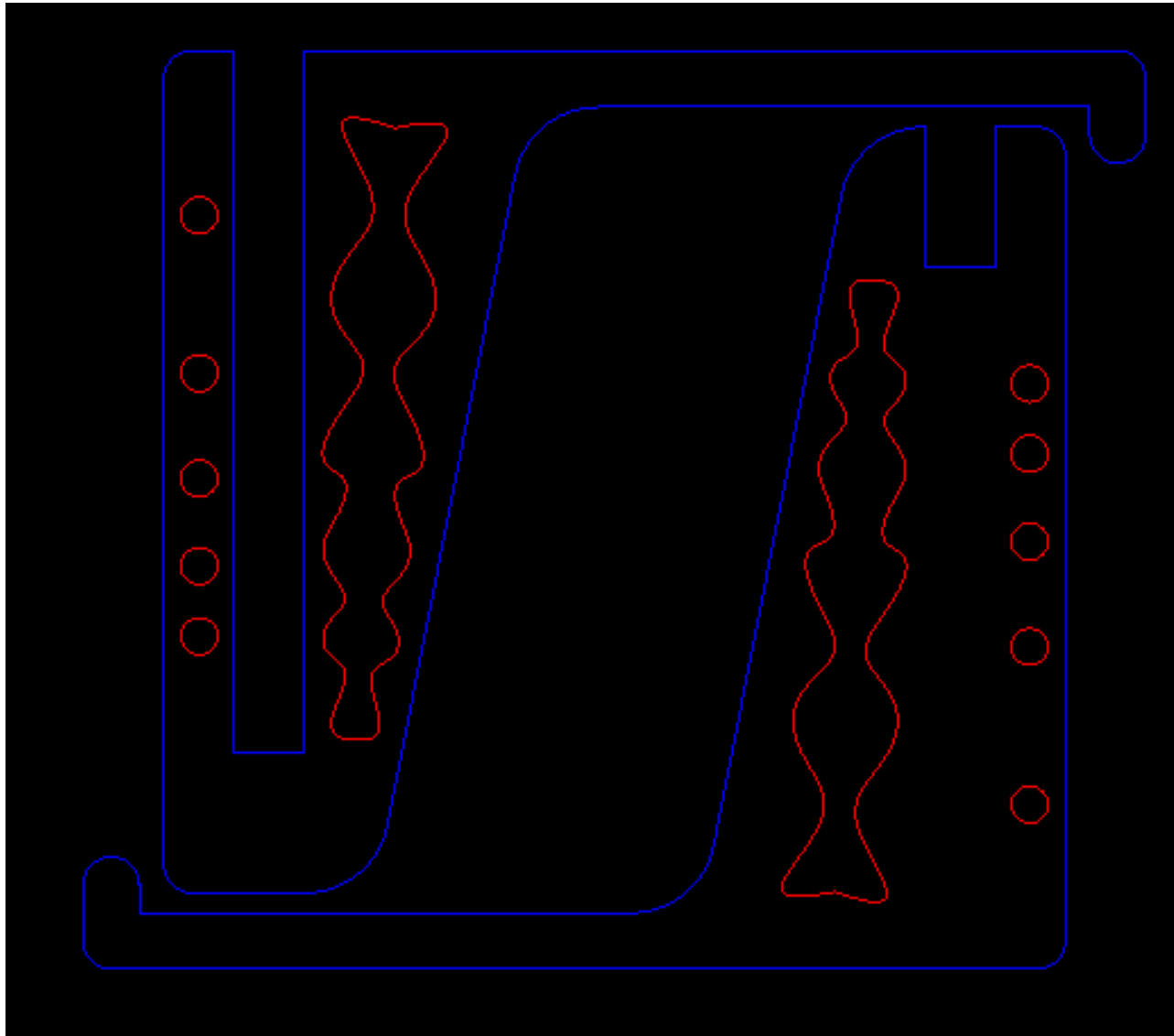
# From Design to Plastic



# What the Colors Mean

- On older laser cutters, color meaning is fixed:
  - Red means “cut”
  - Black or blue means “engrave”
- On modern laser cutters, color meanings are user-definable.
  - Use color to define the cut ordering.
  - Always cut the holes first, then cut the outline.
  - Example: holes = red, outline = blue.
  - So tell the cutter to do red first, then blue.

# Cut the Holes First, Then the Outline

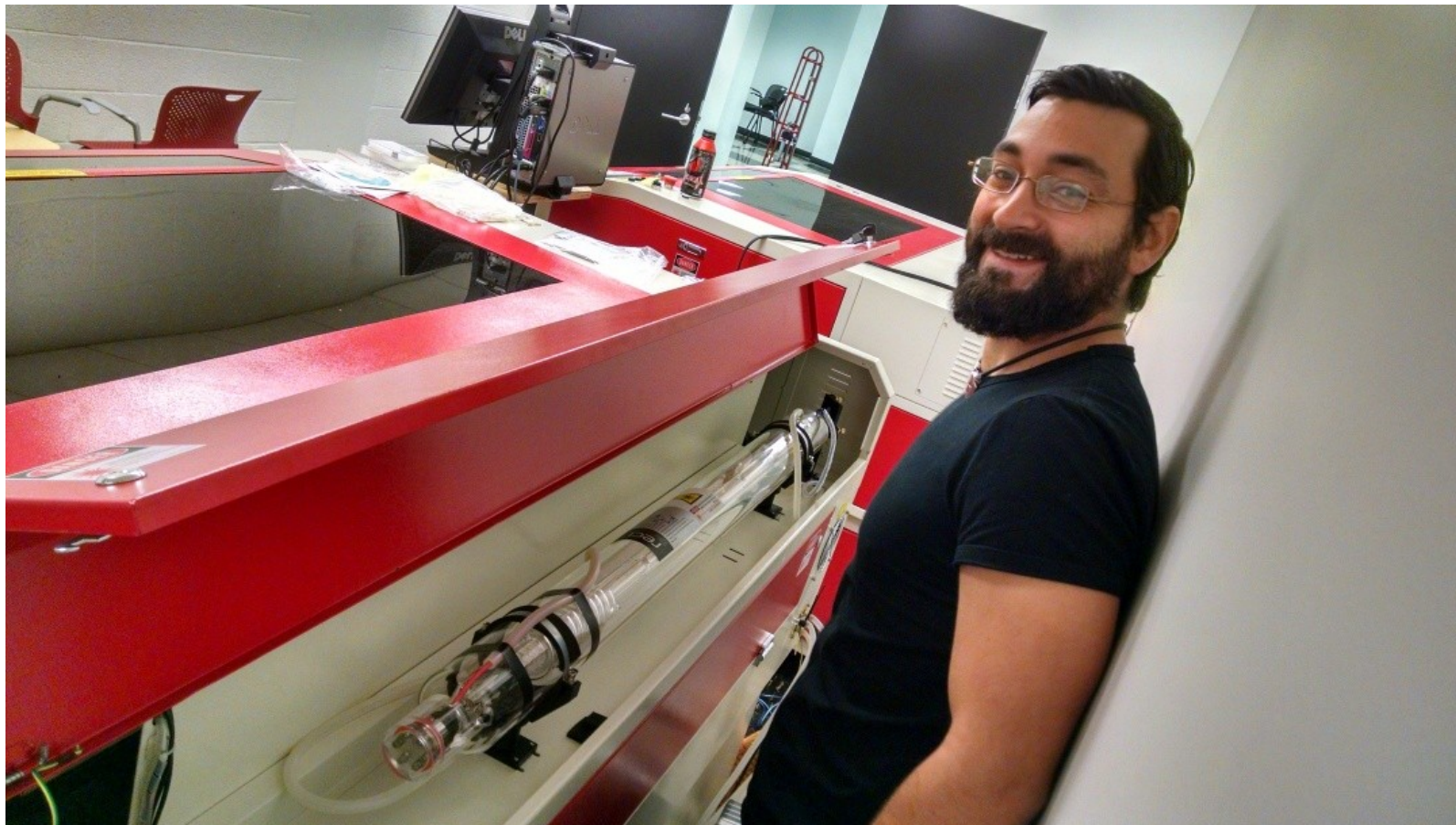


# Rabbit Laser RL-80-1290

- 80 watt CO<sub>2</sub> laser
- 1200x900 mm bed
- Exhaust filter
- Chiller



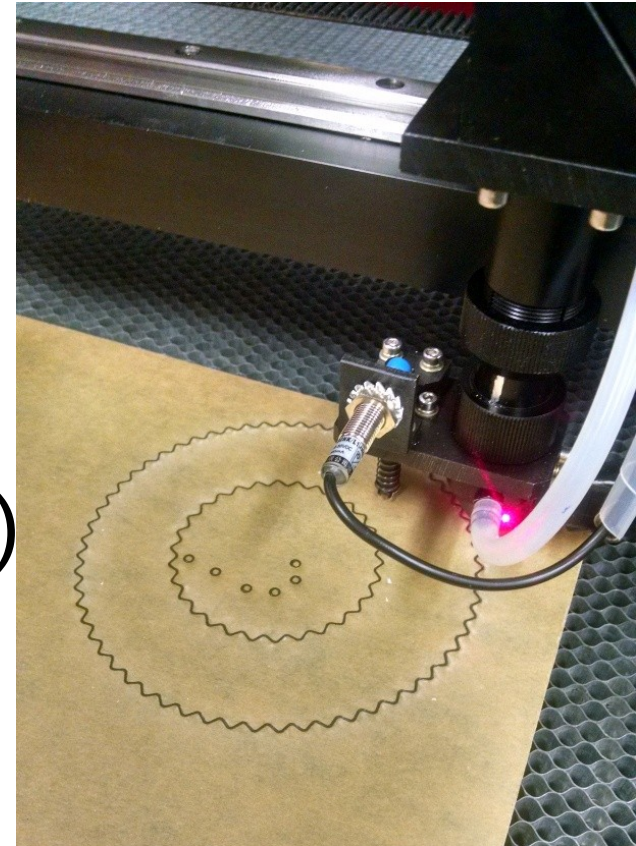
# The Laser Tube





# How It Works

- Pointing laser (red, low power)
- Cutting laser (invisible, high power, dangerous!)
- Coolant chiller (stay below 32° F)
- Compressed air to clear debris
- Exhaust system with filtration
- Settings based on type of material:
  - Power level (never go above 85%)
  - Cutting speed (slower speed cuts deeper)



# RL-80-1290 Control Panel

Emergency Stop  
(E-Stop) Button

- Leave the E-Stop on.
- Leave the key turned on.
- Use the three small buttons to turn the lighting, laser tube, and blower on or off.





# RL-80-1290 Control Panel



# Lasercut53 Client Program

The screenshot displays the Lasercut53 Client Program interface. The main workspace shows a blue laser cut path on a light blue background. A dimension line indicates a width of 50 mm (~ 2 inches). The design includes a vertical strip with four circular holes, a central wavy shape, and a right-side wavy shape with five circular holes. A red arrow indicates the cutting direction. The control panel on the right includes a table for layer settings, navigation buttons, and machine controls.

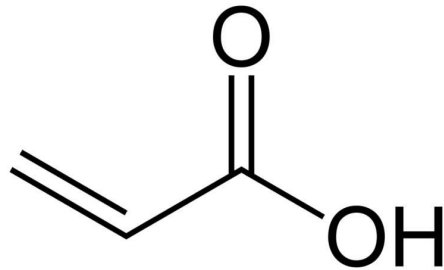
layer	Mode	Speed	Power
Red	Cut	<input checked="" type="checkbox"/> 16.00	80.0
Blue	Cut	<input checked="" type="checkbox"/> 16.00	80.0

Control Panel:

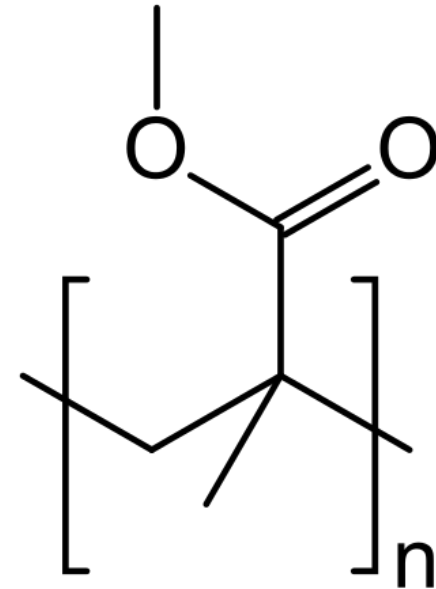
- Buttons: Up, Down, All, Calculate
- Axis controls: Y+, Z+, X-, Datum, X+, Z Datum, Y-, Z-
- Options:  Slow,  Step, Length: 50.00
- Laser: Power: 10.00
- Times: 1, Delay: 0
- Buttons: Run Box, Clip Box,  Immediate
- Buttons: Start, Pause, Stop
- Machine: [Dropdown], Download

# What Is Acrylic?

- Polymer of acrylic acid:  
poly (methyl methacrylate)



Acrylic acid



poly (methyl methacrylate)

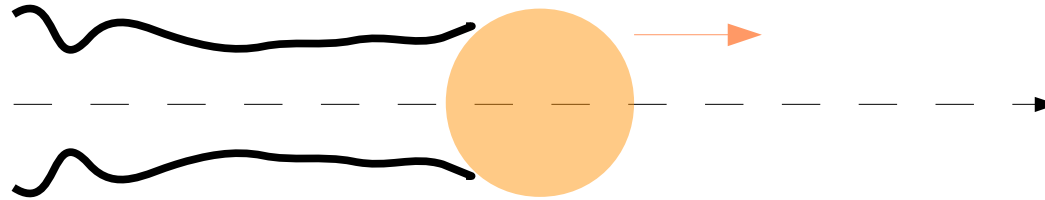
- Also known as Plexiglass, Lucite, Perspex...
- Can be either *cast* or *extruded*. Cast is better for laser cutting; extruded is easier to thermoform.

# Thickness Variance

- We order 1/8 inch cast acrylic sheets.
- What we get:
  - Sometimes 0.125 inch sheets.
  - Sometimes 0.118 inch (3 mm) sheets.
- Thickness tolerance +0.015 to -0.025 inches.
- Thickness can vary:
  - From one batch to another
  - From one edge of a sheet to the other edge!
- Thickness matters for press fit.

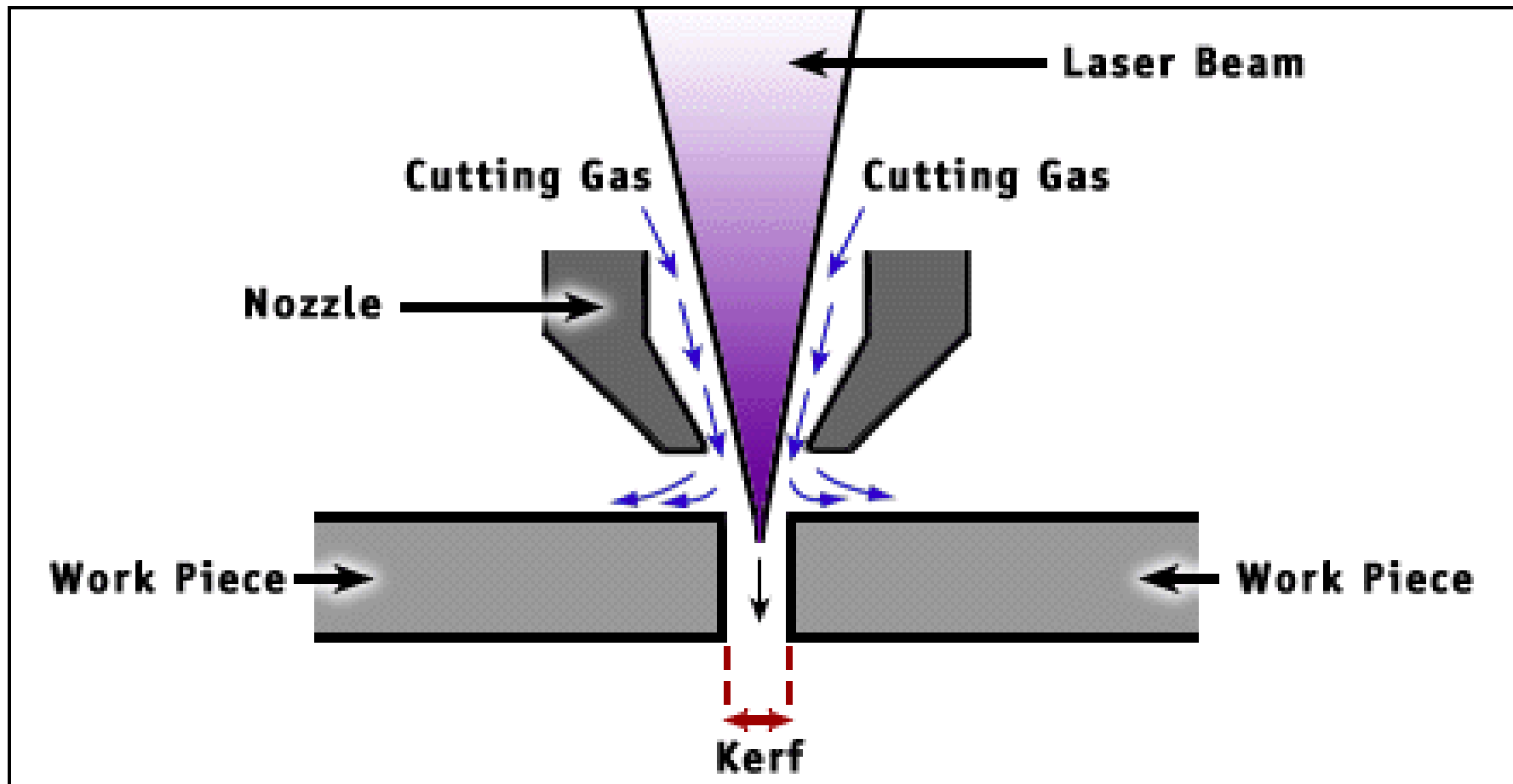
# Beam Width

- The beam cuts by burning and melting.
- The width of the beam is non-negligible.





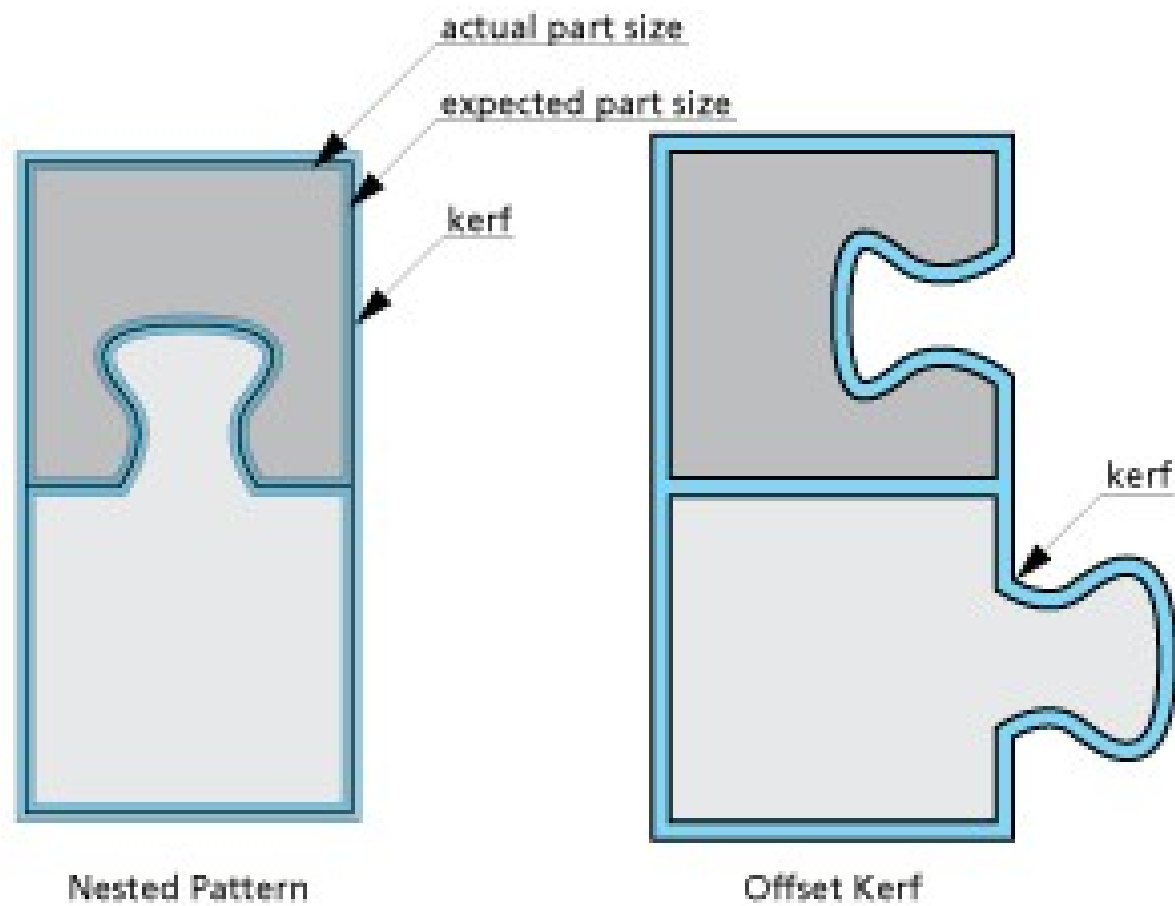
# Kerf



# Kerf

- Typically 0.08 to 0.45 mm (3 to 18 thousandths of an inch), depending on:
  - Laser optics and focusing
  - Type of material
  - Thickness of material
- Consequences:
  - Parts will be undersize
  - Holes will be oversize
- Example: 0.1 inch diameter spirograph holes:
  - Measured diameter 0.106 inches (kerf 0.006")

# Kerf



Offset compensates for  
lost material

# Cut Residue

- Sometimes parts are discolored due to:
  - Smoke/ash plume from the melting plastic.
  - Residue from the honeycomb re-melting and contaminating the part.
- Wiping with isopropanol (rubbing alcohol) can clean up the part.
- Acetone (nail polish remover) sometimes works better.

# How to Get a Press Fit

- Measure the actual thickness of your sheet.
- Make the slot tighter than the actual thickness, to take the kerf into account.
- If a slot is too tight, use a file to open it up.



# Safety

- Fire extinguisher and smoke/heat alarm.
- Remember the E-Stop button.
- Chiller temp must be below 32° F.
- Never open the door while the laser is active.
- Never cut materials not on the approved list:
  - Acrylic or Delrin are okay.
  - Cardboard, thin wood, and MDF (fiberboard) are okay.
  - Ask about other materials.
- Lots of stuff that's bad to cut:
  - ABS plastic will catch fire
  - Anything with chlorine, e.g. styrofoam, vinyl: poison gas!