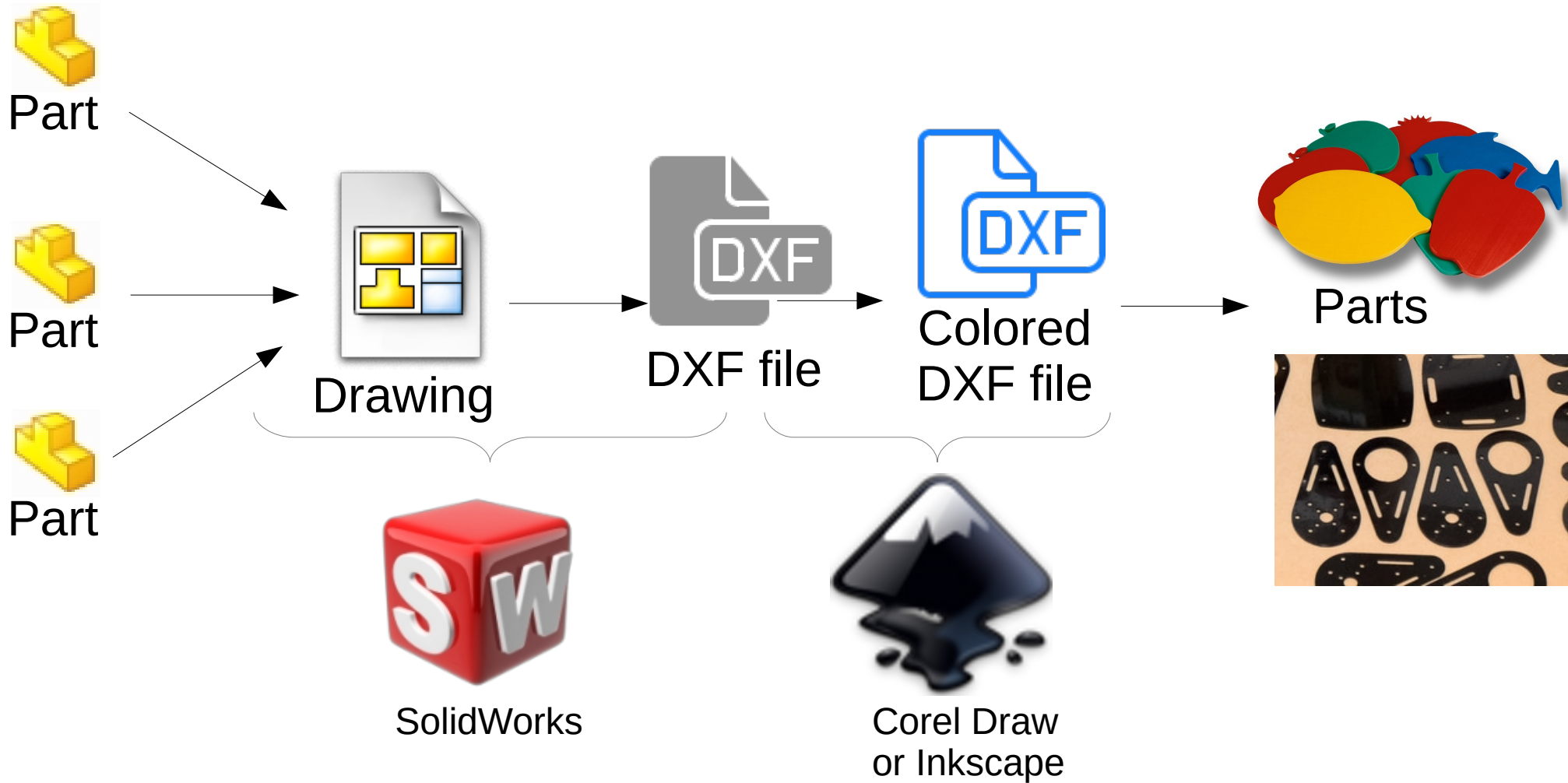


# 15-294 Rapid Prototyping Technologies:

## Laser Cutter Intro

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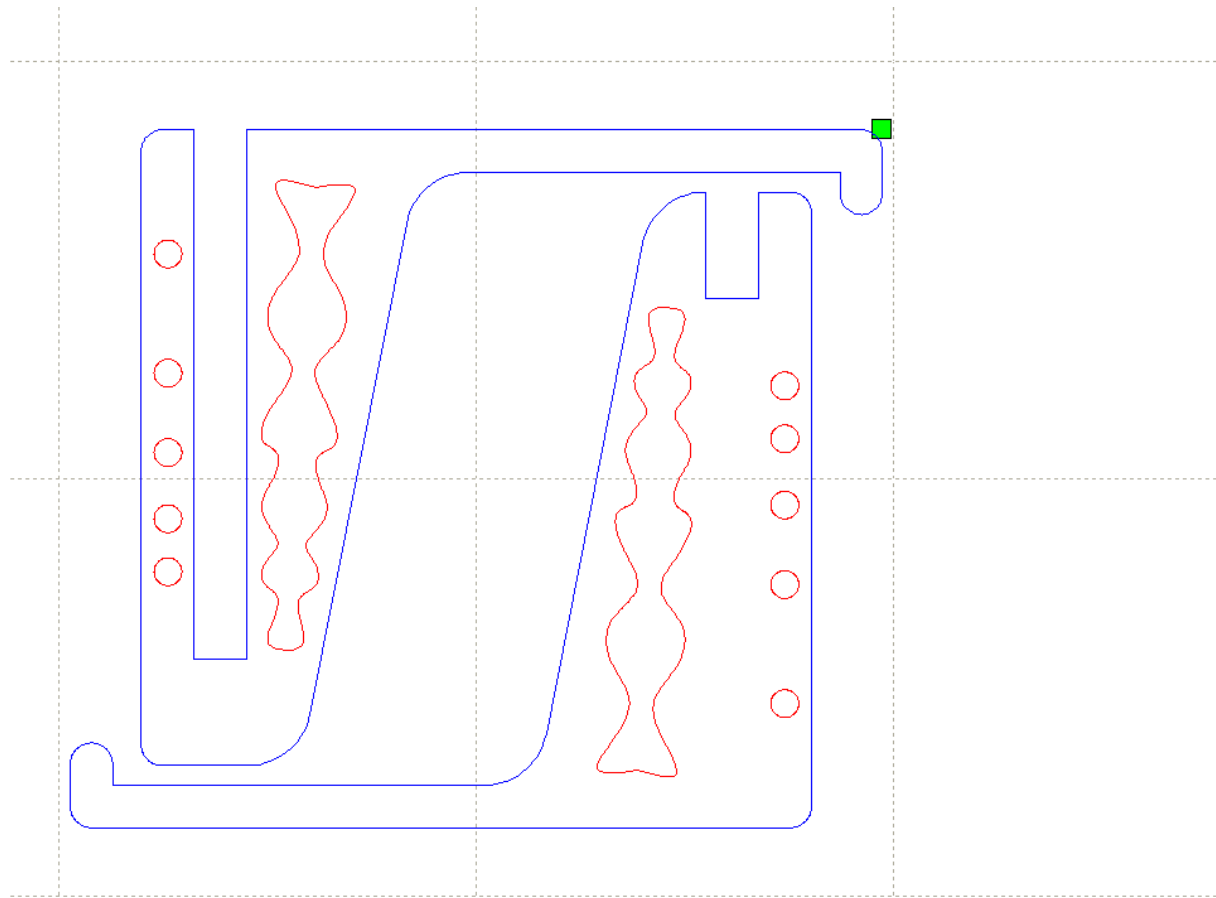
# From Design to Plastic



# 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



# Fusion Pro by Epilog Laser



# A Laser Tube



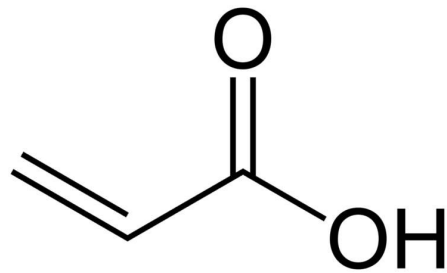
# How It Works

- Cutting laser (invisible, high power, dangerous!)
- Compressed air to clear debris
- Exhaust system with filtration
- Settings based on material type and thickness:
  - Power level (up to 100%)
  - Cutting speed (slower speed cuts deeper)

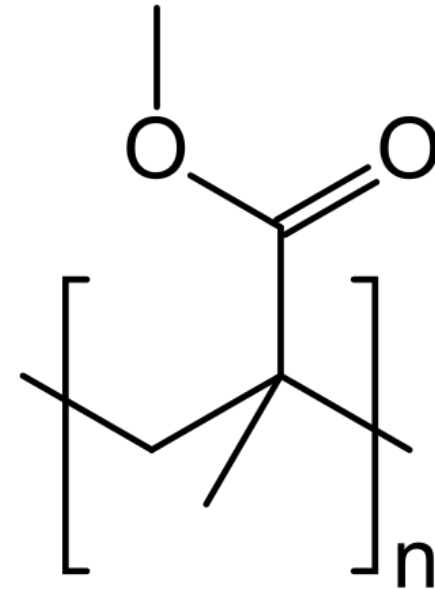


# What Is Acrylic?

- 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.

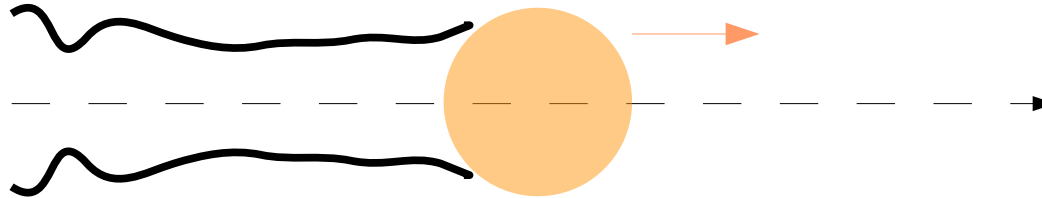


# Thickness Variance

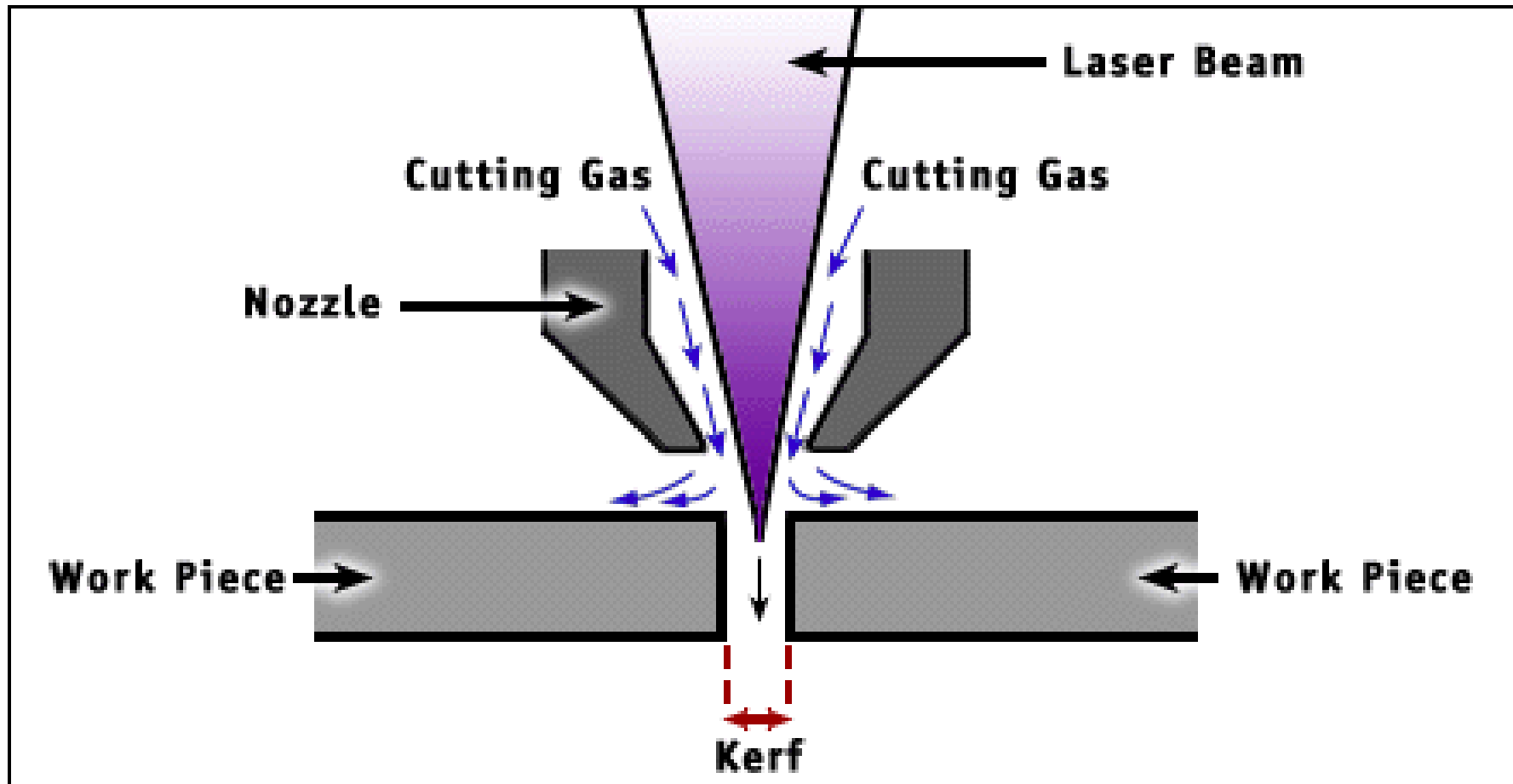
- We order 1/8 inch cast acrylic sheets.
- What we get:
  - Sometimes 0.125 inch sheets.
  - Sometimes 0.118 inch (3 mm) sheets.
- Thickness tolerance +0.015 to -0.025 inches.
- Thickness can vary:
  - From one batch to another
  - From one edge of a sheet to the other edge!
- Thickness matters for press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

# Beam Width

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



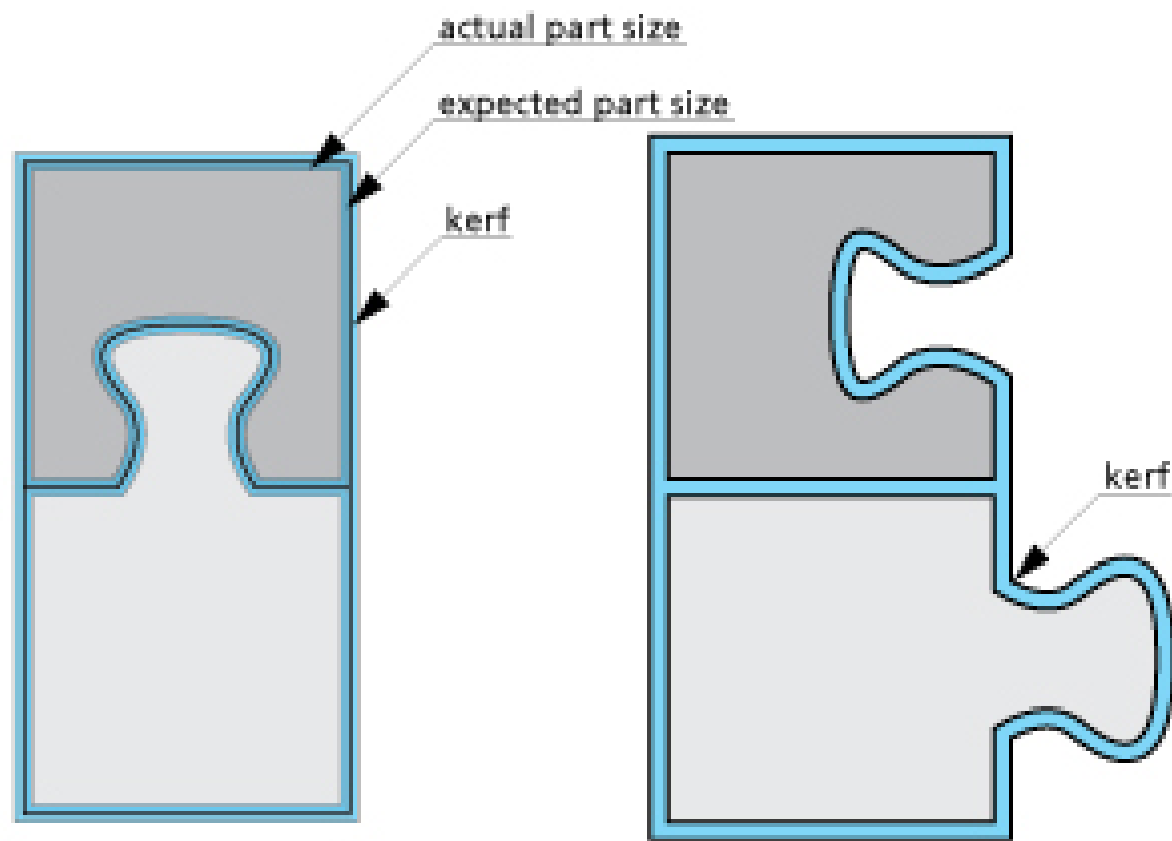
# Kerf



# 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



Nested Pattern

Offset 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.
- IDeATe supplies plastic cleaner.



# 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.
- Never open the door while the laser is active.
- Never cut materials not on the approved list:
  - Acrylic, Delrin, cardboard, thin wood, MDF (fiberboard), and Yupo paper are all okay.
  - Ask about other materials.
- Lots of stuff that's bad to cut:
  - ABS plastic will catch fire
  - PETG produces oily smoke that dirties the lens and mirrors
  - Anything with chlorine, e.g. styrofoam, vinyl: poison gas!