LASER CUTTER 101

- Parts of Laser Cutter
- Examples of Student Creations
- Safety Concerns
- Fire Safety
- Approved Materials
- Non-Approved Materials
LASER CUTTER 101

Laser Cutter Parts

- Computer
- Laser Carriage
- Door
- Bed
- Z-axis buttons
LASER CUTTER 101 Student Creations

Images of various student creations made using laser cutters.
LASER CUTTER 101

Safety Concerns

Don’t look at the laser for an extended period

Only use materials approved by BeAM

Stay for the ENTIRE TIME you use the cutter

No PVC or Teflon – they release harmful gases!

90 MINUTES MAX
In case of fire:

- Grab fire blanket
- Open the door
- Lay blanket on bed
- Close the door
- Get a staff member
BeAM provides the following materials for free:

- Plywood (⅛" and ¼" thicknesses)
- Clear acrylic (⅛ " and ¼" thicknesses)
- Cardboard
- Bristol paper

You can bring in other materials (paper, natural rubber, felt) but you MUST get them approved by BeAM staff.
**LASER CUTTER 101**  
**Materials to Avoid**

- No PVC or Teflon
- Laser cutter will not cut metal

Cannot be bigger than bed of laser cutter:
- Murray: 32" by 18"
- Hanes: 48" by 24"

Consult with BeAM staff about any material not provided by BeAM
DIGITAL DESIGN

DOWNLOAD DESIGN SOFTWARE
SETTING UP ILLUSTRATOR
ILLUSTRATOR QUICK GUIDE
BEGINNER PROJECT GUIDES
3 MAIN FUNCTIONS OF LASER CUTTER
VECTOR VS RASTER
VECTOR GRAPHICS
RASTER GRAPHICS
Illustrator and Photoshop are both part of the Adobe Creative Cloud Suite. Don’t have the Adobe Creative Cloud Suite? Download it for free: adobe.unc.edu
• Open Adobe Illustrator and start a new document
• Always choose ‘Art and Illustration’
• Set the unit of measure to INCHES
  • Murray: Set the size to 32in wide and 18 in tall.
  • Hanes: Set the size to 48in wide and 24 in tall.
• Under pre-sets, click ‘advanced options’
  • Color mode: RGB
  • Resolution: 300 pixels/inch

OR use the template provided at www.beam.unc.edu/resources!
Illustrator Quick Guide

WHAT IS ILLUSTRATOR?
Adobe Illustrator is a desktop graphic design program used to create both print and digital designs, including logos, posters, banners, flyers, and billboards. It is a standard program used by graphic designers to create professional designs and branding.

KEYBOARD SHORTCUTS
Use Ctrl on PCs and Cmd on Macs

<table>
<thead>
<tr>
<th>Ctrl z</th>
<th>Undo</th>
<th>Ctrl c</th>
<th>copy</th>
<th>Ctrl r</th>
<th>shows ruler</th>
<th>A</th>
<th>White arrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ctrl +</td>
<td>Zoom in</td>
<td>Ctrl v</td>
<td>paste</td>
<td>Ctrl *</td>
<td>show grid</td>
<td>V</td>
<td>Black arrow</td>
</tr>
<tr>
<td>Ctrl -</td>
<td>Zoom out</td>
<td>Ctrl f</td>
<td>paste in front</td>
<td>Ctrl d</td>
<td>transform again</td>
<td>T</td>
<td>Type tool</td>
</tr>
</tbody>
</table>

HOW TO
1. Create text
2. Draw basic lines and shapes
3. Place images
4. Use the graph tool
go.unc.edu/Bp2c9

BASIC TOOLS
White arrow (Direct Selection Tool) moves individual anchor points
Pen Tool creates anchor paths along straight and curved paths
Text Tool creates and edits text
Shape Tool creates rectangles, ellipses, stars

Artboard Tool edits shape/size of document
Graph Tool creates graphs and charts
Fill/Stroke Colors

Line Tool creates lines and arcs
Brush Tool draws paths and shapes
DIGITAL DESIGN

Beginner Projects

*Click any project below to access the guided instructions

Jigsaw Puzzle

Keychain

Trinket Box
DIGITAL DESIGN: 3 Main Functions of Laser Cutter

- **Vector Cutting**: Cuts all the way through the material.
- **Vector Etching**: Thinline etches or “scores” the material.
- **Raster Etching**: Etches graphics with gradients onto the material.
**DIGITAL DESIGN: Vector vs. Raster**

**Vector:** things that will *score* or *cut*

- Line thickness = .001 in
- Line colors = RGB red, blue, green, yellow, black, cyan, magenta, orange

**Raster:** things that will *etch* back and forth

- Line thickness ≠ .001 in
- Line colors = anything other than those 8 RGB colors (e.g. CMYK, RGB purple, etc.)
Digital image made of **paths** determined by mathematical statements

**BOTH** of these things must be true:

- Its line thicknesses are equal to .001”
- It uses only the following colors:
  - RGB red, RGB blue, RGB green, RGB yellow, RGB black, RGB cyan, RGB magenta, RGB orange
DIGITAL DESIGN: Raster Graphics

Made of squares of solid color called **pixels**

At least one of these things is true:

- Its line thicknesses are not equal to .001"
- It uses colors from outside the laser cutter’s list (e.g. CMYK colors, RGB brown or RGB purple, etc.)
POWER & SPEED

POWER AND SPEED DEFINED
POWER AND SPEED EFFECTS
READING THE POWER & SPEED BOARDS
BALTIC BIRCH PLYWOOD SETTINGS
ACRYLIC SETTINGS
CARDBOARD & BRISTOL BOARD SETTINGS
USING THE POWER & SPEED BOARDS
DETERMINING ORDER
SETTINGS IN ILLUSTRATOR
**POWER & SPEED** Defined for Laser Cutting

**Power** = a percentage of the laser’s maximum output

**Speed** = how fast the laser carriage is traveling

<table>
<thead>
<tr>
<th>Color</th>
<th>Mode</th>
<th>Power</th>
<th>Speed</th>
<th>PPI</th>
<th>Z-Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Rast/Vect</td>
<td>50.0%</td>
<td>100%</td>
<td>1000</td>
<td>Off</td>
</tr>
<tr>
<td>Magenta</td>
<td>Rast/Vect</td>
<td>100%</td>
<td>5.0%</td>
<td>1000</td>
<td>Off</td>
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<tr>
<td>Yellow</td>
<td>Rast/Vect</td>
<td>100%</td>
<td>50%</td>
<td>1000</td>
<td>Off</td>
</tr>
<tr>
<td>Cyan</td>
<td>Rast/Vect</td>
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<td>5.0%</td>
<td>1000</td>
<td>Off</td>
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<tr>
<td>Green</td>
<td>Rast/Vect</td>
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<td>100%</td>
<td>1000</td>
<td>Off</td>
</tr>
<tr>
<td>Red</td>
<td>Rast/Vect</td>
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<td>6.0%</td>
<td>1000</td>
<td>Off</td>
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<tr>
<td>Blue</td>
<td>Rast/Vect</td>
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<td>100%</td>
<td>1000</td>
<td>Off</td>
</tr>
<tr>
<td>Orange</td>
<td>Rast/Vect</td>
<td>100%</td>
<td>5.0%</td>
<td>1000</td>
<td>Off</td>
</tr>
</tbody>
</table>
POWER & SPEED  Raster & Vector Power/Speed Effects

Vector images: cutting vs. etching

Raster images: lighter vs. darker etching
Power and Speed boards can be found on the wall next to the laser cutter in the Makerspace as well as on the following pages for you to access at home.

Top output is for *raster* at that power/speed.

Bottom output is for *vector* at that power/speed.

Some speeds are *not* recommended because of how long they will take.
**POWER & SPEED**

**Baltic Birch Plywood (0.121” or 0.255”)**

<table>
<thead>
<tr>
<th>Baltic Birch Plywood – Thickness ~ 0.121”/3.07mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>P10/S100</td>
</tr>
<tr>
<td>P60/S100</td>
</tr>
<tr>
<td>P100/S90</td>
</tr>
<tr>
<td>P100/S40</td>
</tr>
<tr>
<td>P100/S5</td>
</tr>
</tbody>
</table>

*Not recommended for rastered content*

<table>
<thead>
<tr>
<th>Baltic Birch Plywood – Thickness ~ 0.255”/6.48mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>P10/S100</td>
</tr>
<tr>
<td>P60/S100</td>
</tr>
<tr>
<td>P100/S90</td>
</tr>
<tr>
<td>P100/S40</td>
</tr>
<tr>
<td>P100/S5</td>
</tr>
</tbody>
</table>

*Not recommended for rastered or vector content*
POWER & SPEED  Acrylic (0.121” or 0.255”)

Acrylic - Thickness 0.121”/3.09mm

Acrylic - Thickness 0.255”/6.48mm

Not recommended for rastered or vector content.
POWER & SPEED  Cardboard & Bristol Board
In order to save time, determine your initial power and speed settings **before** you get on laser cutter.

You can do this using the Power/Speed Boards from previous pages or use the boards in the Makerspaces next to the Laser Cutters.
POWER AND SPEED  Determine Order

You can decide what order to cut or etch things by choosing what order the colors go in.

It is better to raster or etch things before cutting. Cutting can cause pieces of material to move around, affecting later rasters.

For example: If you were to cut out the red part of the keychain on the right before you etched the BeAM logo and wording, the keychain would be separated from the larger piece of wood and can move around while the rest of the design is cut.

Record the order for yourself so you remember it!
To get to Power and Speed settings:

- Open Illustrator file on laser cutter computer
- File → Print
- Click ‘Setup’
- Click ‘Preferences’
ULS = Universal Laser System Software

Access step-by-step instructions on downloading the ULS Software from BeAM using the following link:

https://beam.unc.edu/files/2019/01/LaserCutter_SoftwareSOP_01012019.pdf
Zoom View:

- Can magnify specific part of design
- Can be helpful for small details
Focus View:

- Controls the x and y position of the laser carriage.
- Click on a point on the screen and the laser carriage moves to that point on bed.
- When laser cutter door is open, a red light will show where the laser is pointed.
- Helpful for determining where your design will actually cut on the material.
- Click on all corners of your design to make sure your design fits on the material.
Relocate View:

- Allows you to adjust placement of your design.
- Helpful in conjunction with the nozzle tool – if you find your design doesn’t line up on the material, click and drag it with the relocate view.
- Look at rulers on both the screen and the laser cutter to make sure design is placed where you want it to be.
- Can choose ‘To Pointer’ button to snap design to location of the laser carriage.
Duplicate View:

- This tool allows you to duplicate your design.
- Put in how many times you want to duplicate along the x axis, and how many times along the y, and it will do so.
- For example: 3 along x and 3 along y means you will get 9 of your design arranged in a 3 by 3 square.
Estimate View:

-Predicts how long your job will take to run. Remember there is a 90 minute limit for all students using the laser cutter.

-Required that you click ‘Start’ on the timer before each job to check the time.

-If colors are greyed out at any point in any of these views, something’s wrong.
TOOL PREP & CUT

- Verify cut with beam staff
- Turning on air flow
- Focusing the laser
- Closing the glass door
Before you can use the laser cutter you must have your Illustrator file approved by a BeAM Staff member.

Verifying the illustrator file will reduce common errors associated with laser cutting to save time using the laser cutter.

Reminder once you are on the laser cutter there is a 90 minute time limit on the machine per person.

Make sure to check out our Laser Cutting FAQ page.
TOOL PREP & CUT
Turning on Air Flow

MURRAY

HANES

Ensure all ventilation is on before operating machinery.

1. Air Valve
2. Exhaust
3. Main Exhaust

Must Be On

Must Be On
Focusing the laser makes sure the laser is right height for working with your material the way you want it to.

Using the calibration tool, slide it under the front of the laser cutter carriage until notch rests just under carriage.
Make sure to close glass door properly before beginning your cut. If the door is not properly shut the laser will not cut, it will outline the path in safe-mode using the red laser as an outline.
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- Focusing the laser
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