



OPTIMIZING FOR SPEED & PRODUCTION

with LightBurn

SETUP

LightBurn = Design and control for lasers.

*Download free trial of LightBurn at:
lightburnsoftware.com*

*Follow along with the slides via
LightBurn Forum > Resources,
or this QR code*



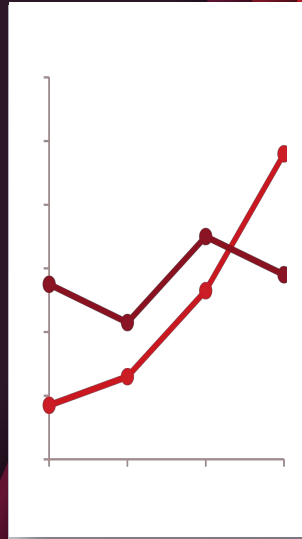
- We will be moving quickly, so it may be tricky to follow along in the software,
- I have uploaded this slide deck so you can reference it at your own pace.
- Show how to find on Forum

HI! I'M BILLIE RUBEN!

- Australian
- Maker of many kinds
- Makerspace & Community Facilitator
- Content Team at LightBurn Software:
 - Documentation
 - YouTube Videos
 - User Experience
 - Graphic Design

WHY OPTIMIZE?

- Costs are rising
- But the odds are in your favor



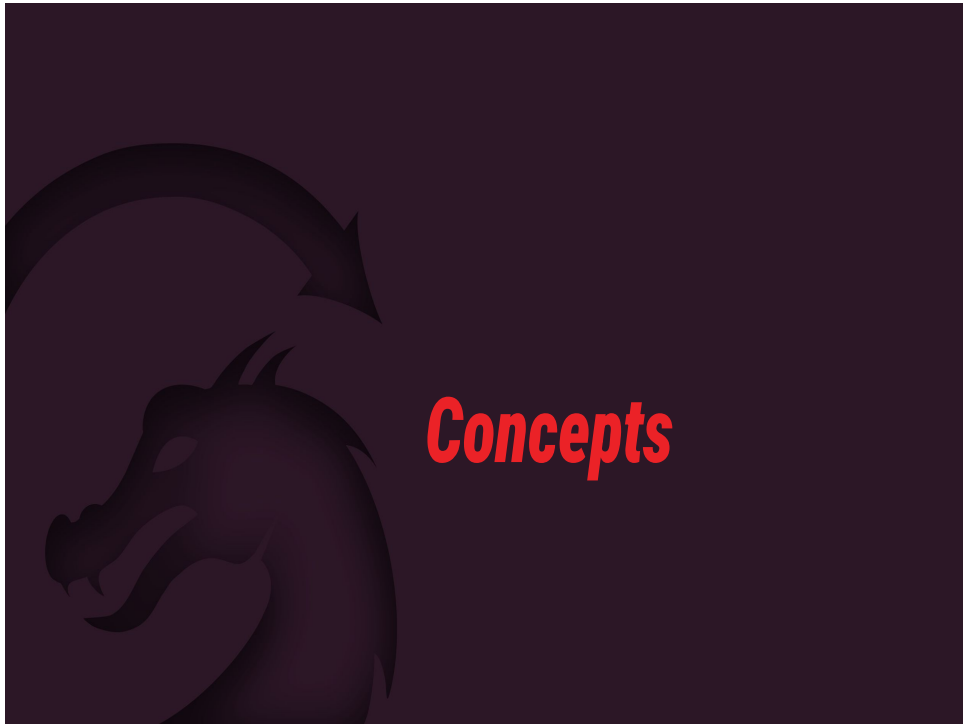
- Material getting more expensive but congrats!
- Laser remains one of the best ways to make money as a maker/ small to medium business.
- How do I know? Australia has highest minimum wage on earth & extremely high shipping - unavoidable costs, yet every 3rd stall at craft markets is a laser business.

HOW WE WILL DO IT:

- Depends on goals/design
- I will demo many today
- + Link to extra resources
Including our documentation
- Book symbol = more info

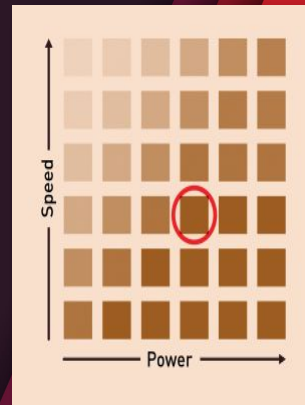


- Many ways to speed up production, what applies depends on goals.
- We will start with some simpler ones, you may know these already, and get more complex.
- Whenever you see the book symbol, I have included links to relevant documentation, in show notes of the presentation.



MAXIMIZE SPEED?

- Sometimes, but it's complicated
- Let's return to this question



- Many folk think to make my jobs quicker, I just need to speed up.
- It's intuitive, like driving in a car - minimize travel distance, and go as fast as you can, right?
- But is it always faster?
- In a car turning right can save you time, even though you travel a longer distance.
- We don't have traffic in Lasers, so this particular example doesn't apply, but there are some different instances where more speed doesn't mean a quicker job, and we will explore those today.
- Let's return to speed question later.

PREVIEW JOBS

- Always Preview Job.
- Black = Cutting/Engraving = Laser ON
- Red = Travel/Rapid Moves = Laser OFF
(Preview > Show traversal moves)
- Note the time estimates



- Always Preview your jobs, both for seeing how long it will take, but also to spot any accidents before you cut into your material.
- Rapid and Cut move distances are listed below preview.
- If you don't see red, click on "Show Traversal Moves"

More Info:

- Preview Window (includes videos):
<https://docs.lightburnsoftware.com/latest/Reference/Preview/#>

PREVIEW ACCURACY

If Preview Inaccurate:

- Edit>Device Settings> Additional Settings
- “Read from Controller” or:
manually adjust “Simulation Settings”



- “Find my laser” when adding a machine pulls device settings from machine.
- If you find the preview estimates are very different to your real-life job time, you can adjust them.
- Change Simulation Settings via Edit>Device Settings> Additional Settings
- Changing Sim Settings does NOT change anything on your controller or your job settings. Just the preview.

More Info

- Video: Get Accurate Job Times in LightBurn:
<https://www.youtube.com/watch?v=s1jCqB233N0>
- Device Settings:
<https://docs.lightburnsoftware.com/latest/Reference/DeviceSettings/AdditionalSettings/>

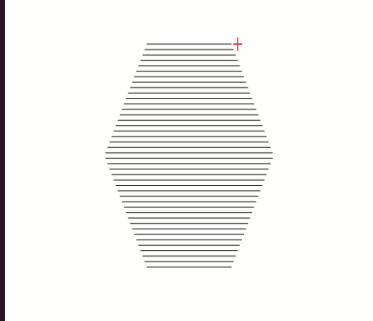
MINIMIZE DISTANCE

- Minimize how far the laser has to move
- Both of laser ON & OFF
- Lots of ways to do this

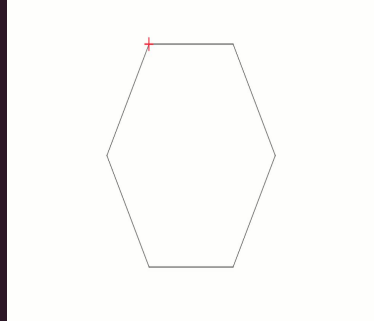
- Generally the less red and black we see in the preview the quicker the job will be.

AVOID RASTER ENGRAVINGS

*Image, Fill, or Offset Layers
use many lines to 'color in' area*



*Line Layers travel far less,
follow the contour/perimeter*



- Two types of ways a laser can move,
 - either by tracing along vector lines,
 - or by filling in an area by 'scanning' back and forth.
- Scanning is used for engraving images and filling closed vector shapes.
- Scanning takes far more time because it has to move much farther.

Further reading:

- Layer modes:
<https://docs.lightburnsoftware.com/latest/Explainers/LayerModes/>
- Image vs Vector:
<https://docs.lightburnsoftware.com/latest/Explainers/ImagesVsVectors/>

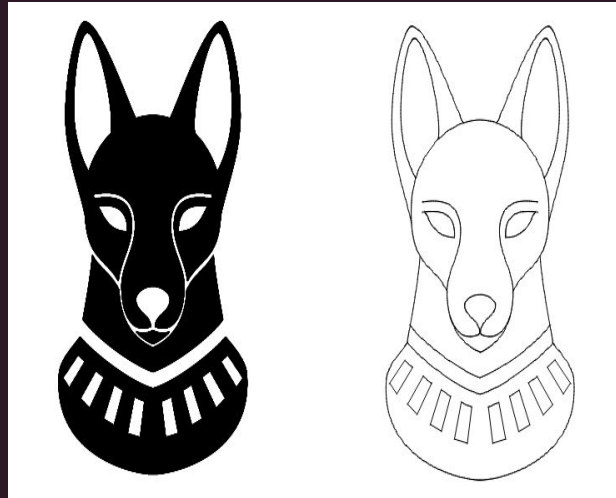
- osedShapes/

-

CUT VS SCORE

- Line Mode isn't cut mode
- Difference between a cut line and a score (engrave/mark) line is your settings.
- Lower power and increase speed to score.

ADJUST THE DESIGN



Engrave with lines, not fills:



You can score a line. A Lot of folk think of line operations as a 'cut', but they don't have to be. With lower power or higher speed, you can avoid cutting all the way through, and instead just score a line.

If you design with this in mind you can **DRASTICALLY** reduce the time of your jobs.

Depends on design. Sometimes you need a fill, e.g if you're removing an area of material, but often you don't. Often an outline will do.

Further reading:

- Layer modes:

<https://docs.lightburnsoftware.com/latest/Explainers/LayerModes/>

- Image vs Vector:

<https://docs.lightburnsoftware.com/latest/Explainers/ImagesVsVectors/>

- Closed vs Open Shapes:

<https://docs.lightburnsoftware.com/latest/Explainers/OpenClosedShapes/>

SPEED UP TEXT

SLOWEST

QUICK

QUICKEST

- This also applies to Text.
- Engraving a word takes a lot longer than outlining it.
- And outlining a word takes longer than a single line font.

SINGLE-LINE FONTS

SHX = format that allows open shapes

1. Download SHX fonts (forum)
2. Add to a folder on your computer
3. LightBurn > Preferences/Settings
4. Set SHX Font Path (to your folder)
5. Apply like normal font
6. Can filter by right-clicking font list

TTF
SXH



- Single line fonts need different format to normal fonts that word or photoshop would use.
- This is to support 'open' geometry (not enclosed shapes)
- Currently we support SHX. SVG fonts (different to SVG generally) are also planned.
- SHX Fonts installed differently,
- These can be downloaded online, there's a pack a user has provided on our forum.
- Save Favorite fonts by selecting a font > right clicking the font selector > add to favorites.

More Info

- SHX Fonts:
<https://docs.lightburnsoftware.com/latest/Reference/Text/#shx-fonts>

- <https://forum.lightburnsoftware.com/t/shx-font-collection/25298>

REMOVE OVERLAPPING LINES

- Laser Window > Optimization Settings > Remove Overlapping Lines
- Distance = how close lines need to be, in order to be considered 'duplicate'



- Tells the Cut Planner to remove lines that are overlapping between two graphics, and would cause the laser to cut in the same place twice.
- The Distance field to the right of the switch controls how close two lines need to be in order for the Cut Planner to remove one of them when sending the job to your laser.

More Info

- Remove Overlapping Lines Documentation
<https://docs.lightburnsoftware.com/latest/Reference/OptimizationSettings/#remove-overlapping-lines>
- Remove Overlapping Lines Video
<https://www.youtube.com/shorts/tHTnb6MURdU?feature=share>
- Grid Array
<https://docs.lightburnsoftware.com/latest/Reference/GridArray/>

REDUCE DIRECTION CHANGES

- Reduce direction changes (slows down)
- Instead of many squares,
I could do bunch of vertical
and horizontal lines.



- Grid Array

<https://docs.lightburnsoftware.com/latest/Reference/GridArray/>

REDUCE PASSES

- Passes = how many times the laser passes over the same section.
- You can often reduce passes by lowering speed and increasing power.



Passes:

- Passes:

<https://docs.lightburnsoftware.com/latest/Reference/CutSettingsEditor/LineMode/#number-of-passes>

WHEN 'SCANNING' IS NECESSARY:

- Images (photos, greyscale graphics)
- Fill areas with flat color
- Remove material from areas

FILL METHODS

- Fill (large areas)
 - Fill Grouping (all, groups, individual)
 - Flood Fill
- Offset Fill
- Manually 'broken' fill



These options control which shapes are engraved at the same time by the laser. If you run your laser fast, or your laser accelerates slowly, it is often most efficient to scan things all at once, so the laser spends most of its time moving at the speed you've chosen, and less time changing direction. If you are engraving slowly, your laser accelerates fast, or the design contains a lot of blank space, it can be more efficient to fill clusters of close shapes, or to fill the shapes one by one.

Fill all shapes at once: The default, this setting means that everything on this layer will be filled at the same time, sweeping back and forth across the whole job. If you are running the laser fast (300 mm/sec or more) this is usually the most efficient option, with some exceptions.

Fill groups together: This setting will fill all shapes in a group at the same time.

Fill shapes individually: This setting fills all shapes one by one.

Advanced Settings:

Flood Fill: calculates an engraving path that attempts to reduce or eliminate travel moves across blank space. It's useful for engraving things like large, empty rectangles, where the blank area in the middle would consume most of the time spent.

More Info

- <https://docs.lightburnsoftware.com/latest/Reference/CutSettingsEditor/FillMode/>

FAST WHITESPACE SCAN

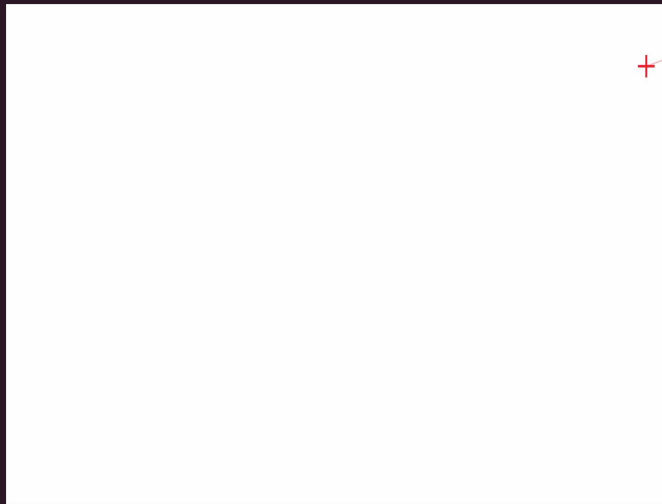
- In Device settings.
- Allows quicker movement through empty areas of fill/image engraving.

This setting boosts your laser's travel speed through blank areas of an image engraving, if the speed you set here is faster than your laser's engraving speed.

This can save a lot of time if you're engraving an image slowly to get a good burn, particularly if there are large blank areas in the image.

<https://docs.lightburnsoftware.com/latest/Reference/DeviceSettings/BasicSettings/#fast-whitespace-scan>

BI-DIRECTIONAL FILL



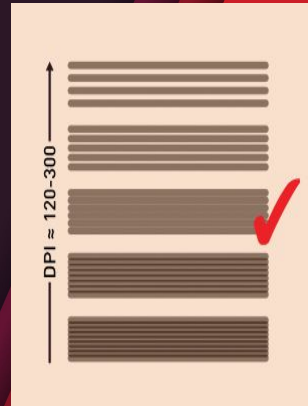
- Found in Cut Settings for Fill/Image Modes
- Turns laser around at each end, drastically saving travel moves
- Reasons to have it off:
 - Your laser has slop/starts and ends don't line up.
 - Unlikely given your machines,
 - but if you do encounter this you can compensate with Scanning Offset Adjustment

More Info:

- Bi-directional Fill Docs:
<https://docs.lightburnsoftware.com/latest/Reference/CutSettingsEditor/ImageMode/#bi-directional-scanning>
- Scanning Offset Adjustment:
<https://docs.lightburnsoftware.com/latest/Guides/ScanningOffsetAdjustment>

LINE INTERVAL

- DPI and Line Interval are linked
- Higher DPI not always better quality
- When lines overlap:
 - Images too dark
 - Details muddy
 - Engravings textured



- Higher DPI isn't better when it causes your scan lines to overlap. This will make muddy designs.
- CO2 actually has rather large beam size compared to Diode or MOPA that Tong spoke about yesterday.
- Ideally you want each line to juuust touch. Use magnifying jewelers loop or USB Microscope to assess.
- Interval or materials test generator tools.

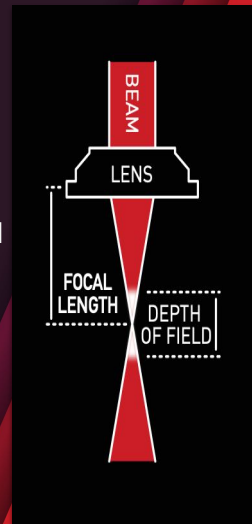
More Info

- Fill Mode
<https://docs.lightburnsoftware.com/latest/Reference/CutSettingsEditor/FillMode/>
- Materials Test
<https://docs.lightburnsoftware.com/latest/Reference/MaterialTest/>

- Test/

LINE INTERVAL

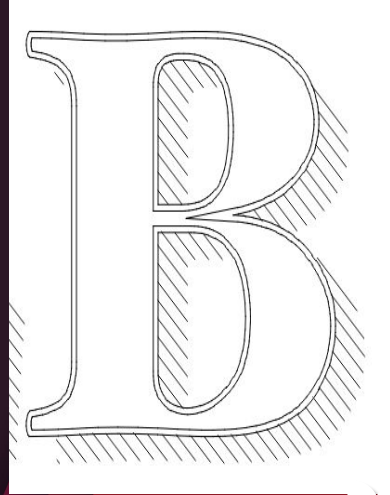
- Minimize scan lines by increasing Line Interval (Layer Settings)
- Defocus increases line width, allows you to increase line interval further
- Defocus via Z Offset (Layer Settings)



- Higher Line interval = larger gap between lines = fewer lines = quicker
- Beam has a 'waist' smallest at focal point
- Either side of this the beam gets thicker
- We can use this to make thicker lines and lower out interval even more.

HACKING LINE INTERVAL

- Very High Line Interval = interesting effects
- Combine with Scan Angle for slanted lines
- SUPER quick

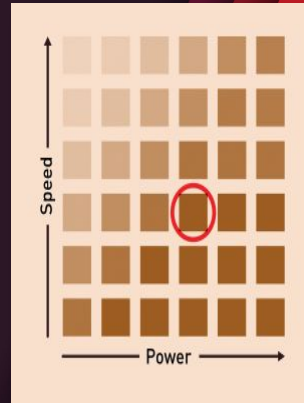


<https://youtu.be/KrAQY9wFv2c?si=CbtAy8wpbHI8L65X>



TEST FOR SUCCESS

- Built-in Material Test
- Mini-tests in unused area of job
- Increase power and speed but watch out for over-scanning



- Increase speed AND power (diagram) if available.
- big material test to find optimal (fastest speed with results)
- If you run too high the laser has to 'overscan' travel far outside the bounds, and on narrow jobs this can increase your time.

More info:

- Material Test:
<https://docs.lightburnsoftware.com/latest/Reference/MaterialTest/>

LAYOUT IS CRITICAL

- Run more than one job at a time
- Stack multiple objects side-by-side
- Align, Distribute, Docking helpful
- Put tall objects on side

- Layout is critical
 - Layout of jobs (particularly when engraving) tall objects, put on side.
 - Duplicate objects, fit horizontally. Multiple objects- stack side-by-side
 - Reduce the red in the preview. halving frame-like jobs and fill groups together (e.g. clock face)
 - Alignment, Distr

MINIMIZE WASTE

- Test for success
- Prototype in cardboard
- Know your boundaries: Jigs (cardboard)
- Efficient Layout: Docking/Nesting
- Tool Layers to keep track of what you've used
- Minimize cleanup with masking
- Remove masking with gaffer tape

- Test for Success:
 - Prototype in cardboard
 - Material tests
 - Big
 - Small around design
 - Minimise material waste (for precious materials)
 - Know your boundaries: Knock up corner
 - Docking & Nesting
 - Tool layer for cut objects

DESIGN QUICKLY - TRACED IMAGE

- Sketch Trace for images with tricky contrast
- Offset out, then back in to make cut lines
- auto group
- shift+click layer to select everything on it
- Sort cuts last



- Sketch Trace
<https://docs.lightburnsoftware.com/latest/Reference/TraceImage/#sketch-trace>
- Offset out, then back in to make cut lines
<https://www.youtube.com/shorts/2xBJ8XGkp5q>
- auto group:
<https://youtube.com/shorts/mYv92lztU3k?si=FhxfztodHw6ipAGB>
- shift+click layer to select everything on it
- Sort cuts last by right-clicking layer menu.
 - Cut operations need to happen last in a job, if you do them before engraving pieces can shift as they fall and your engravings will end up offset.
 - Line operations can be cut but can also be

- scored/marked. The difference is the settings. Slow and high = cut, quick and low = score.
- Sort cuts last ranks things based on operation type (fills and images first) then orders the lines by their speed and power so that the strongest settings will be last.

DESIGN QUICKLY -HANDY TOOLS

- Align, Distribute, Dock
- Array, Virtual Array
- Variable Text
- Tool layers
- Guide lines
- Transform Control Toggles



- Align

<https://docs.lightburnsoftware.com/latest/Reference/Align/>

- Distribute

<https://docs.lightburnsoftware.com/latest/Reference/Distribute/>

- Dock

<https://docs.lightburnsoftware.com/latest/Reference/Dock/>

- Array

<https://docs.lightburnsoftware.com/latest/Reference/GridArray/>

- Virtual Array

<https://docs.lightburnsoftware.com/latest/Reference/GridArray/#create-virtual-array>

- Variable Text

- <https://docs.lightburnsoftware.com/latest/Reference/Va>

- [riableText/](#)
- <https://docs.lightburnsoftware.com/latest/Reference/VariableText/VariableTextFormatting/>
- Tool layers
 - <https://docs.lightburnsoftware.com/latest/Reference/UI/ColorPalette/#tool-layers>
- Guide lines
 - <https://docs.lightburnsoftware.com/latest/Reference/AutomaticGuidelines/#alignment-guides>
- Transform Control Toggles off scale or rotate to prevent mishaps
 - <https://docs.lightburnsoftware.com/latest/Reference/TransformControls/#transform-control-toggles>

SAVE FOR FUTURE YOU

- Settings to Library
- Designs to Art Library
- Cut-out pieces to tool layers

WHEN TO OPTIMIZE?

- When it costs you no extra time:
 - Optimization Settings
 - Reusing known settings
- When the time it takes you to set up is less than the time it saves in the job. E.g.
 - When doing many similar jobs
 - When you are running large engravings

- When is it right to spend time optimizing?

HELP

- Tooltips
- Documentation. So much documentation.
- Loads of videos too
- Hover over tool
& hit F1 (fn+F1 on mac)

LIGHTBURN

BETTER SOFTWARE FOR LASER CUTTERS



- www.LightBurnSoftware.com
- Support@LightBurnSoftware.com
- Docs.LightBurnSoftware.com
- Forum.LightBurnSoftware.com
- [YouTube.com/@lightburnsoftware71891](https://www.YouTube.com/@lightburnsoftware71891)

LIGHTBURN EXPERIENCE

JULY 19-20
METROPOLITAN
PAVILION, NYC



\$25
OFF



TICKETS
\$150 \$125

CODE: LAZERCON-LBX2025

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