To continue with this course, by now you should have familiarity with Job Coordinates and Job Origin options. In this section we progress from line operations to fill operations.

All laser operations come down to just two things:

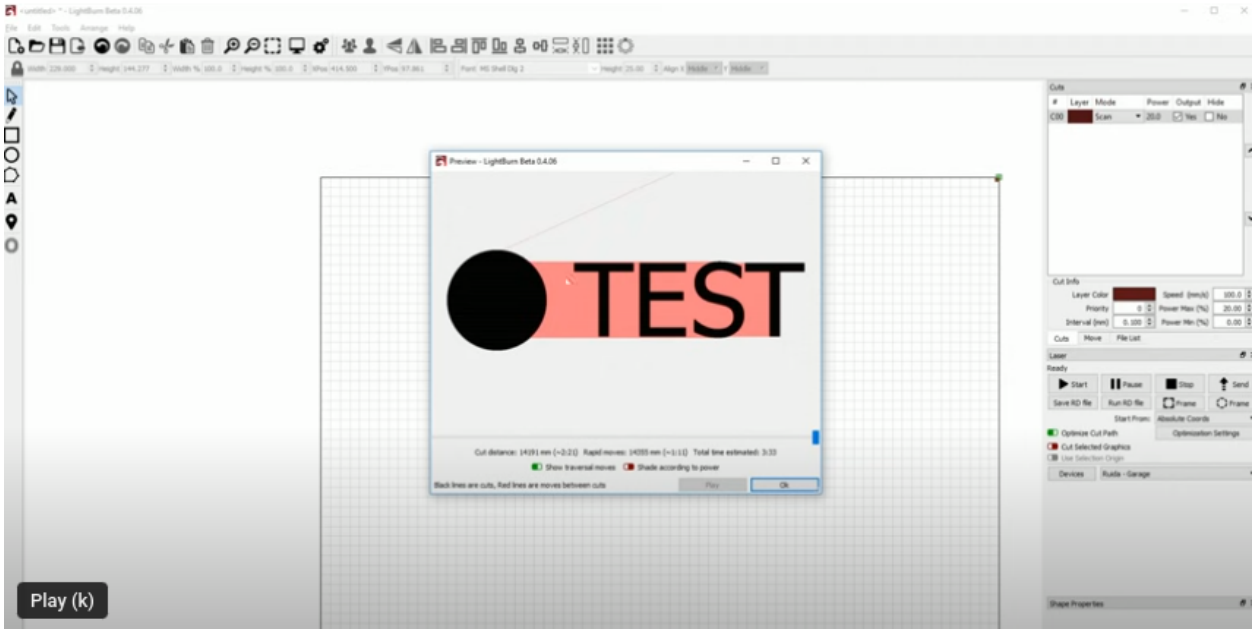
1. Controlling the laser intensity
2. Controlling the movement of the gantry

Using these two operations, the common tasks of the laser can be divided into categories, including:

1. Cutting/scoring operations (aka profiles)
2. Engraving operations, including both raster and vector engraving

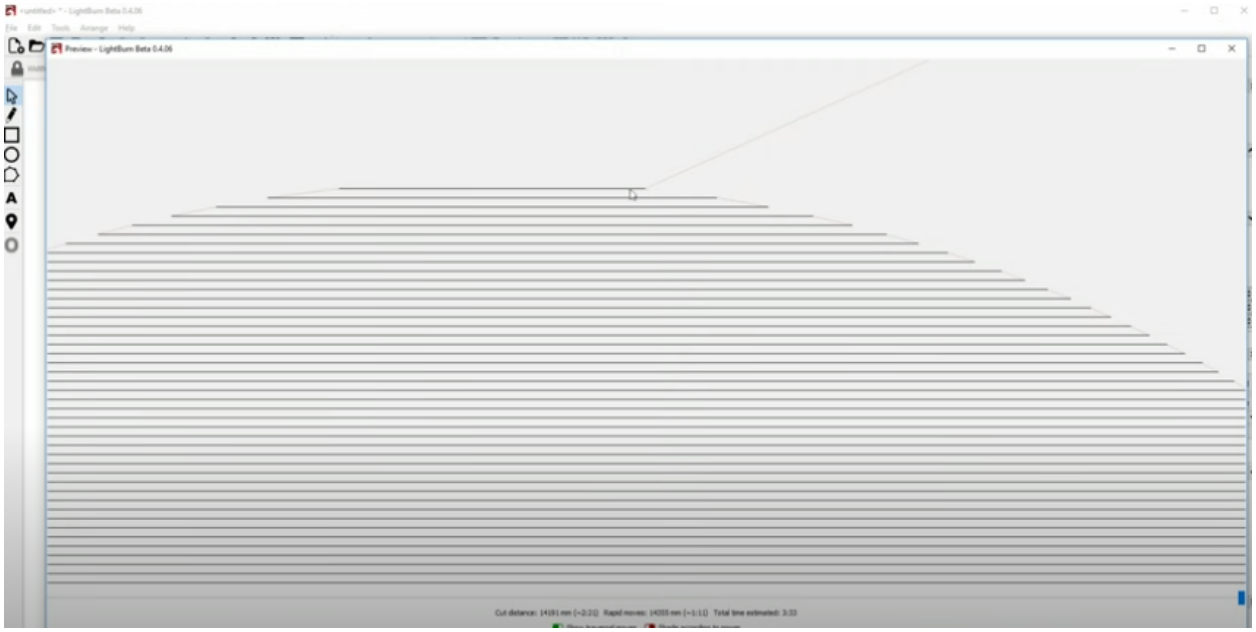
In reality, a cutting operation is just a vector engraving set to a high power level - high enough to cut through the material in one or more passes.

Engraving, marking, etching, these are the same operations. Both image and vector engraving do the same thing, but use different file formats.
An image engrave uses a raster image.
A vector engrave uses an enclosed vector and creates a fill of many lines to burn a solid image.



Example shape and text set to “fill” to create a vector engraving.

If we zoom in on the simulator, it becomes obvious that the “fill” is in fact many parallel lines, confined by the outline of the vectors.



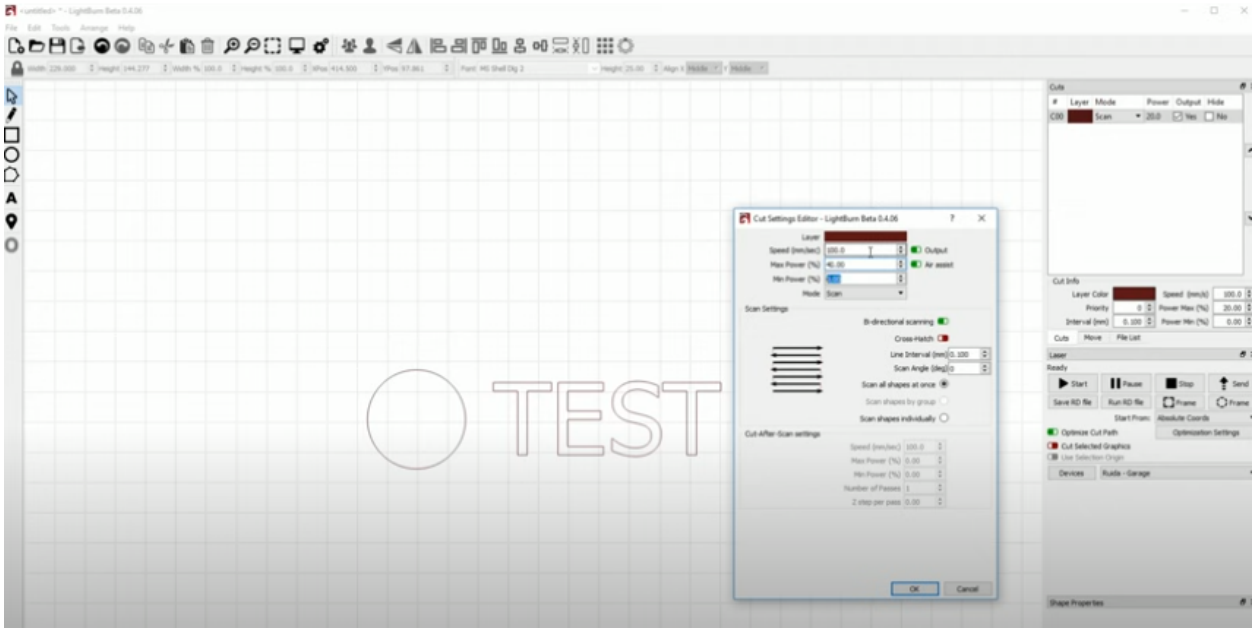
Once the pattern of movements has been generated, different “shades” of engrave can be achieved by setting the power level of the laser (a value between 0 and 100%) and the speed of the laser head, as controlled by the stepper motors. This speed will be dependent on the specifics of the machine.

The Ortur Laser Master 2 (LU2-4) has a maximum power of 5500mw.

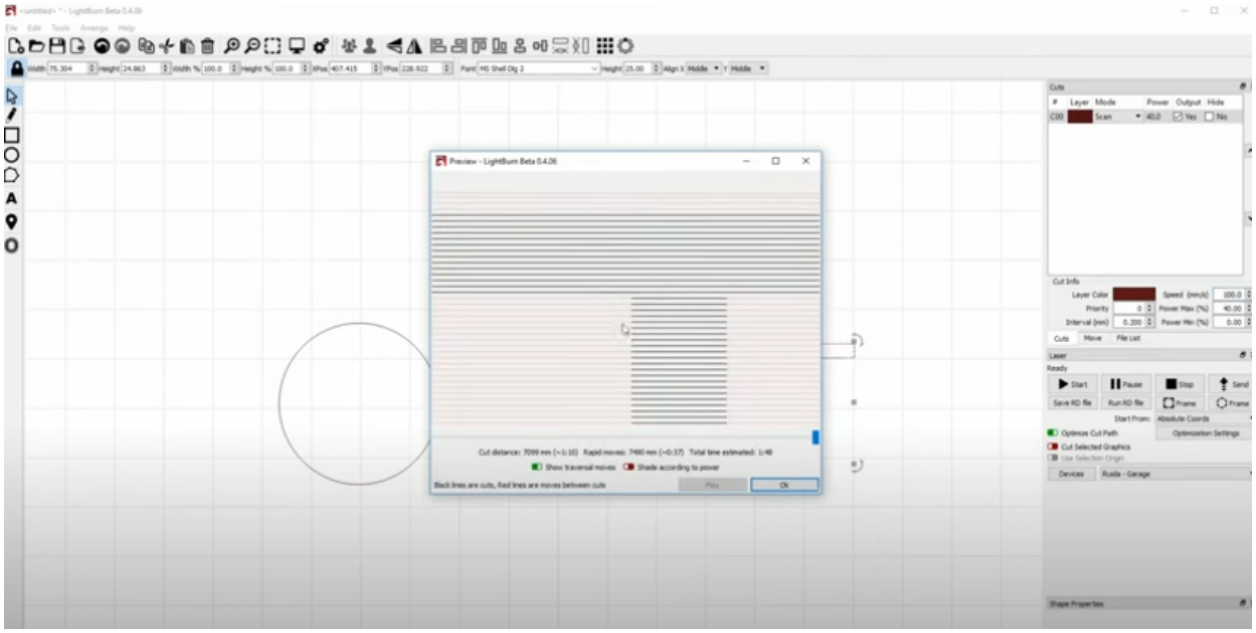
In our makerspace for example, the Omni/Ruida style machines can move at a maximum rate of 600 mm/second. The smaller Ortur based lasers, on the other hand, have a maximum speed of 10000mm/min - or 160mm/second. This is roughly 25% of the maximum speed of the larger laser, although in real terms it is rare to run either laser at full speed.

The maximum speed of the Ortur laser is **10000mm/min, and the maximum power is 100%**. This is the very fastest and most intense we can run the machine at that maximum speed.

To set this power and speed, we need to use the settings of the layer that our vector is on:



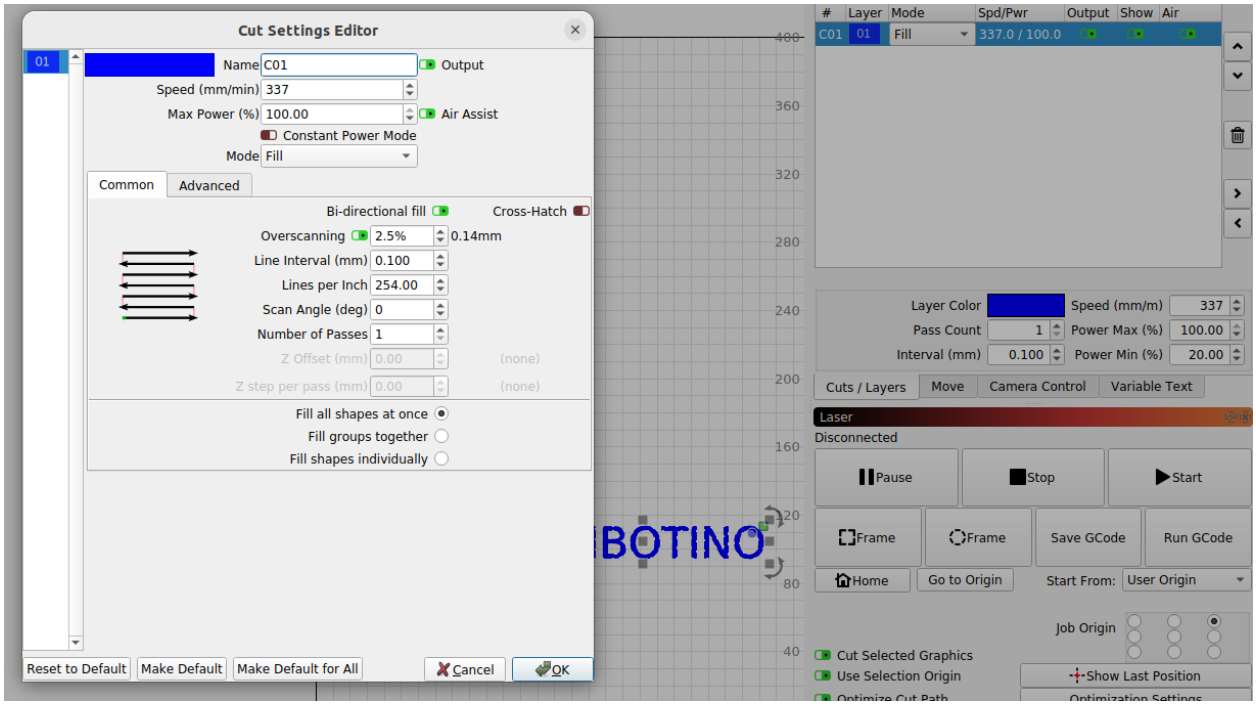
Another factor to know about is something called “interval”. This is how far apart the lines composing the fill are placed. The interval is something that can be modified and controlled.



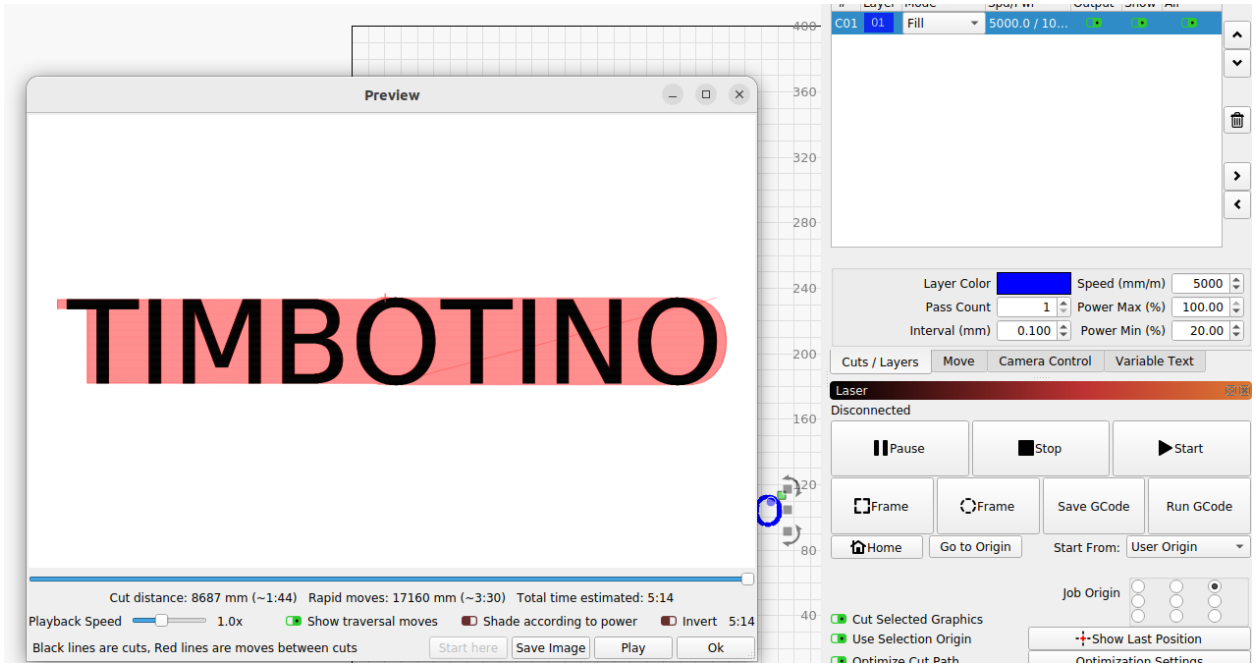
By default the interval is set to .1mm for an Ortur laser. Try changing it to .2mm, and you will find that the laser operation time is significantly reduced. Note that you will only be able to see this in the “preview” window, as interval does not get rendered in the main window.

More Notes on Fills:

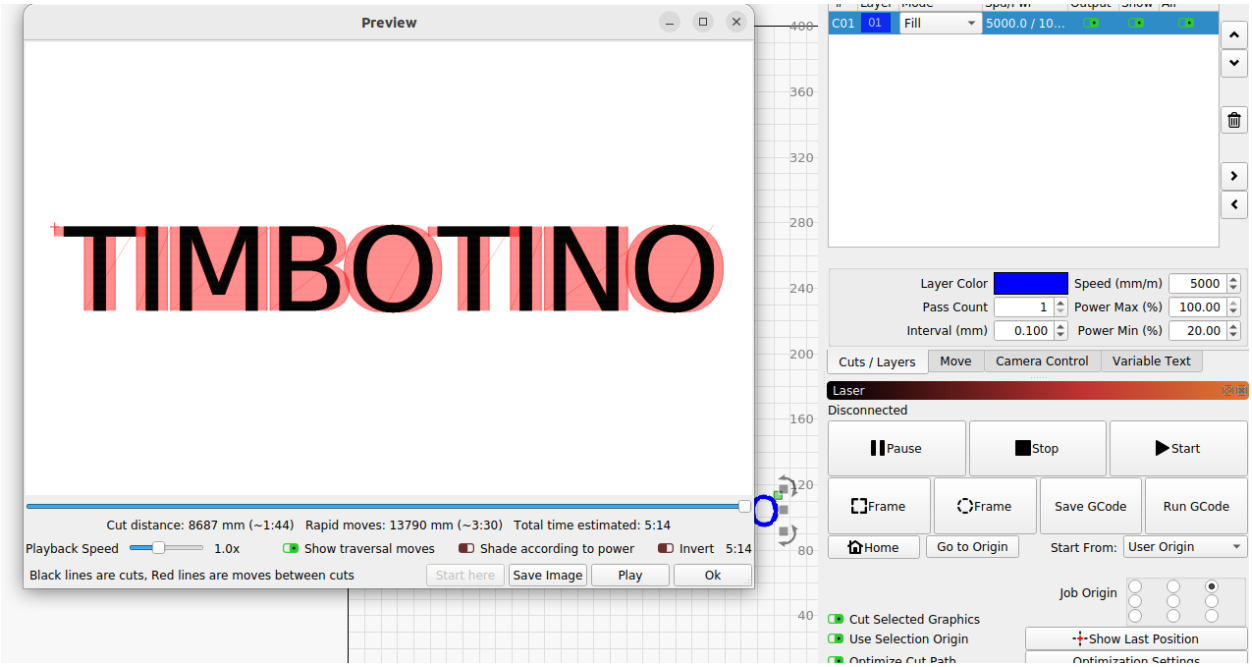
There are some other options to know about with fill operations, and these can have significant impact upon production time. They have to do with the fill options:



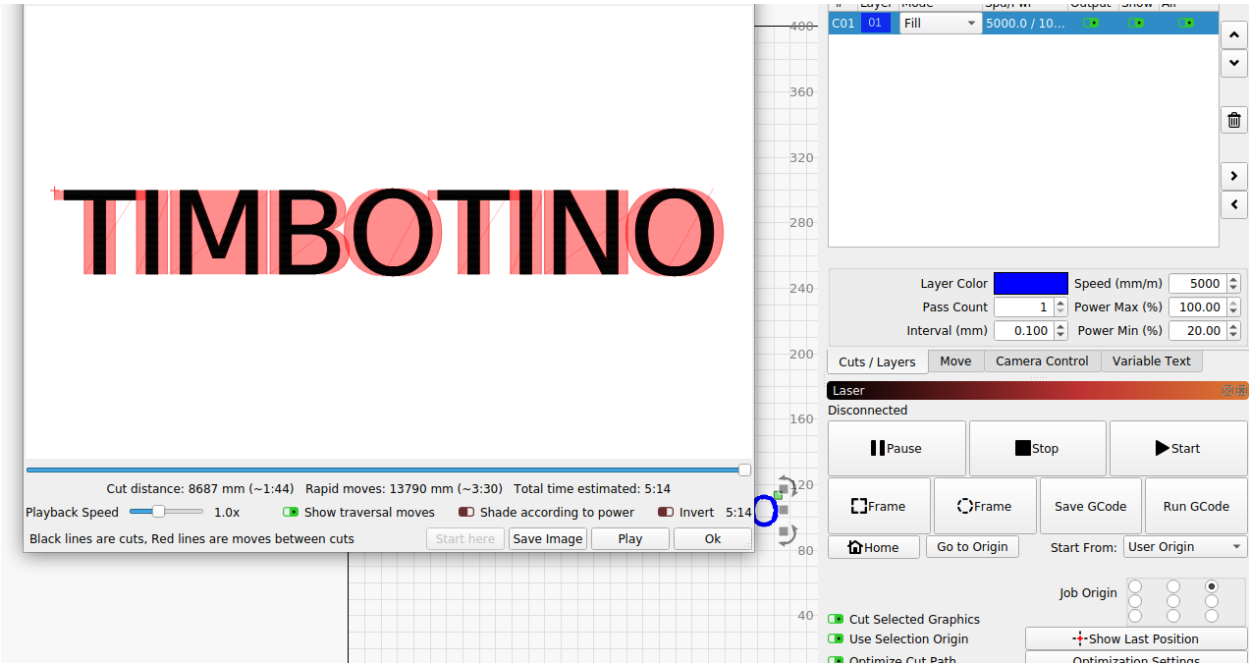
Note in the image above the option “Fill all shapes at once” is selected. This will cause the raster line to traverse the entire line of text in each pass. This can be seen by looking at the preview window.



Try changing the option to see the difference in the operation. In the layer settings, choose “fill groups”. To see the difference you’ll need to convert the text to paths, which will “group” each character.



And in this case, the last option “fill shapes individually” will make little difference to the operation:



Raster Images

The second way of creating fills is to use an image. Be aware that rendering images is more time-consuming and difficult than vector fills, and has more options available.

To render an image, the software does an image analysis and uses the greyscale value of each pixel to determine the intensity of the laser while creating scan lines. The algorithm used to render the image can be changed based on the kind of image being used.

For landscapes, portraits, and detailed images you can use:

- Stucki
- Dither
- Newsprint
- Greyscale (varies the intensity of the laser as well as the pattern)

Greyscale engraving usually works best by going slow with low power, but it really depends on the image you use and the ability of your laser.

For something like a graphic, a sign, or other simple shape your better option is:

- Ordered
- Threshold (for no shading)

These are for different scenarios. Threshold will basically reduce an image to black or white (on or off). It is good for removing artifacts from a background to produce a clean, simple graphic.

Ordered will allow you create more nuanced shades, but is also usually for simple graphic designs instead of detailed images.

With these methods, in dark areas the laser will be turned on longer, and in light areas it will be turned off more.
Interval can be used in rendering images just like in rendering fills for vectors.

Overscan

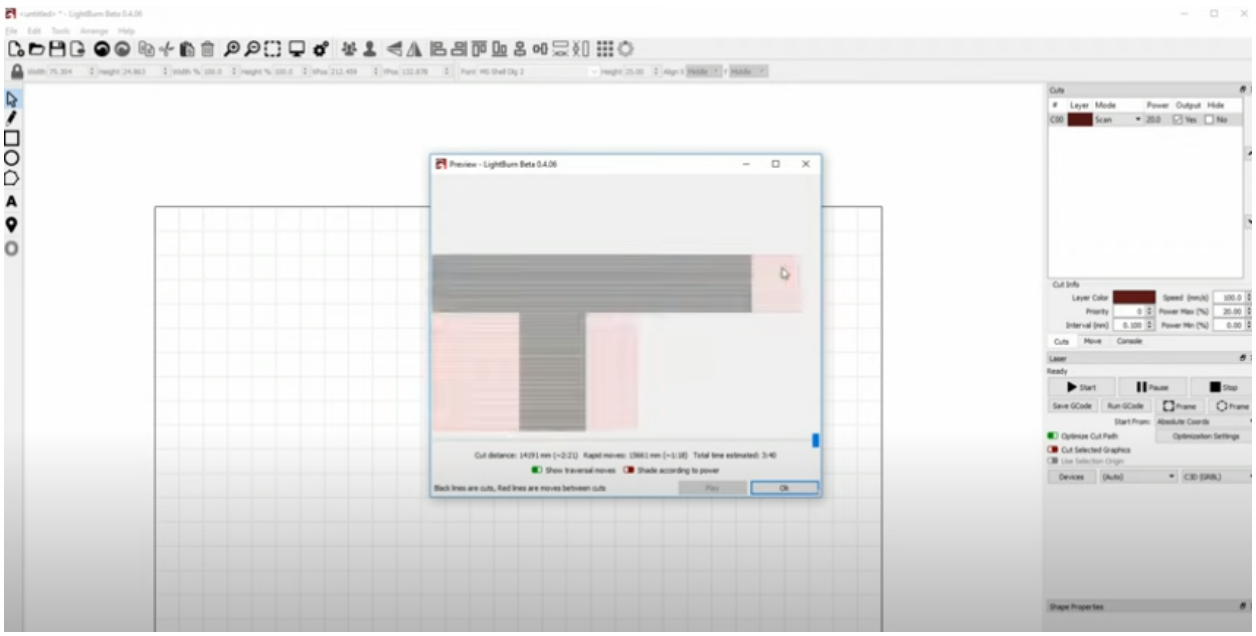
You may have noticed in the preview window that the traversal lines show outside of the actual burn lines, as though the laser is moving past the end of the burn. This is intentional.

Overscan allows the laser to go past the end to avoid having the laser rest in place too long when it reaches the end of its travel.

Ruida (CO2) based lasers tend to do overscan in their hardware, but diode based lasers running on Gcode need to do overscan at the software level.

The amount of overscan used is a ratio of the current speed of the laser. So longer lines when the laser builds up more speed tend to need more overscan.

This is important to know about, because if the edges of your operation appear jagged or too dark, you may need to enable or increase the overscan.



Traversal lines show the overscan in place around the text.

Note: if you have overscan enabled, it will increase the needed area on the bed. So for example if your image is exactly against the edge of the work area, you will not be able to use overscan as it would take the laser head beyond the workable area.

https://ortur.net/en-ca/pages/materials-reference