Trichrome Stipple Light

Directions for Image pre-processing

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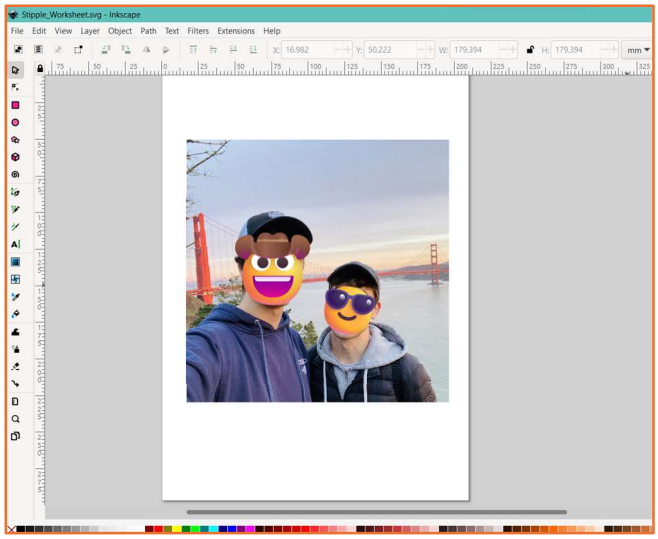
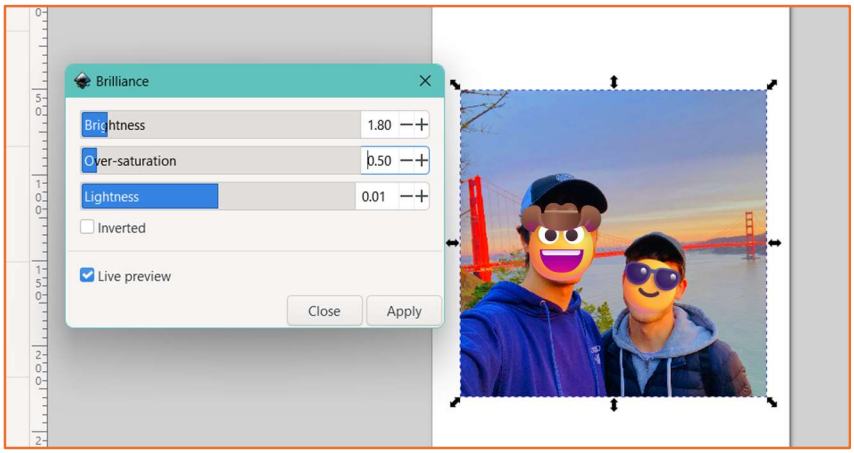
Getting Started

There are three parts to this pre-processing, and we'll go from Inkscape, to StippleGen, then back to Inkscape. You can use any image you like for this project: Dogs, cats, family, friends, landscapes, significant others, or anything else! However, photos that work best for this project are vibrant with good contrast and without too much detail. Be sure to crop your picture to a square aspect ratio before beginning. Start by opening a new **Inkscape Document**, then import your **square** image onto the document.



Before we start sampling the document in StippleGen, we need to make a few edits to the picture. The end result will be pretty colorful, but more subtle colors tend to be washed out. It helps to brighten the tones and saturation. Thankfully this is easy in Inkscape! You can apply a variety of effects to adjust the color of your image.

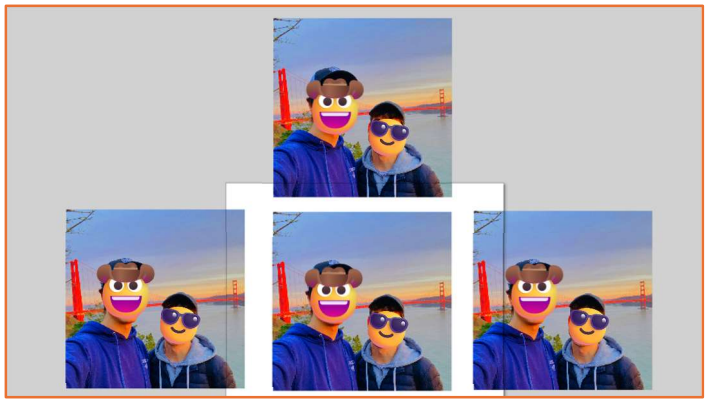
Select your image, then in the menu bar select Filters > Color > Brillance.



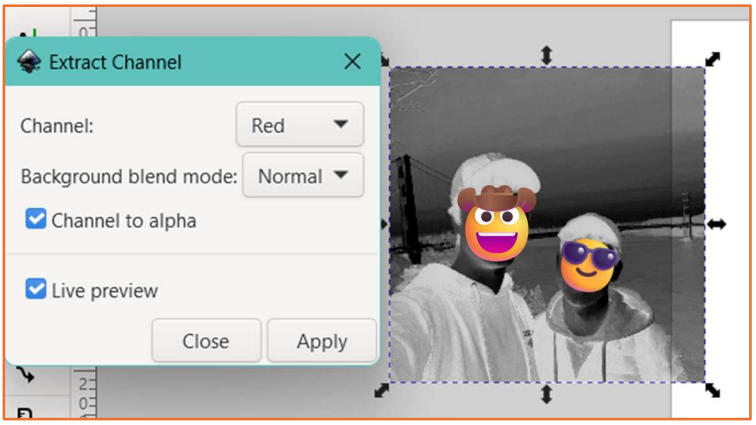
Select “Live Preview” and adjust the brightness, Over-saturation, and lightness if needed. You want your image to be pretty over saturated, but not excessively bright. Contrast is the key here! Think dark lines, and colorful tones. When you’re happy with your image, move on to the next step.

Splitting the Channels into RGB

Next, copy your image three times to create 4 images in total on the same sheet like in the image below.



The bottom three images will become our color channels red, green, and blue. Select the first image, then select Filters > Colors... > Extract Channel... . The dialog box that opens lets you select several channels. Start with Red and *be sure to select “Channel to alpha”*. This is necessary for the next step!

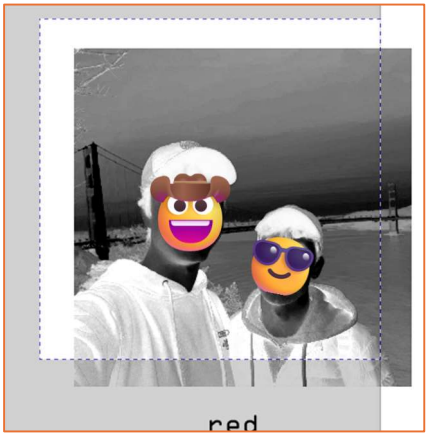


Take a look at your spooky red channel image. Does it make sense to you? Red hues will show up dark, while colors with very little red should show up white. For example, the blue sweater shows up white because it has almost no red in it. Bright colors like a cloudy sky or white background will have a mix of all the colors. The darker the color, the more the stipple dots will cluster around that area in the next step (*which is, by the way, the key working principle of this project!)*

Repeat this for the other two channels, until you have 3 grayscale images of your color channels. It helps to do this in order from red to green to blue, so you don’t mix them up! Your end result should look like this:

The color channels come out as transparent. This introduces errors when trying to export as a JPEG in the next step in which everything is super dark. To fix this, make 3 white squares with the same dimensions as your channel images. (To make this easy, adjust the dimensions of your images to a 7in x 7in square. This tool bar is typically at the top.)

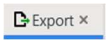
Place the white squares *directly* underneath your images. Be sure that they are exactly the same size as your image (7" x 7")! Adjust the layer order by going to the layers tab and putting the white squares behind your images so this works correctly. Use the **align and distribute** tool to make this easier. Once you have both, select them and click "group". Again, all images must have the same dimensions!



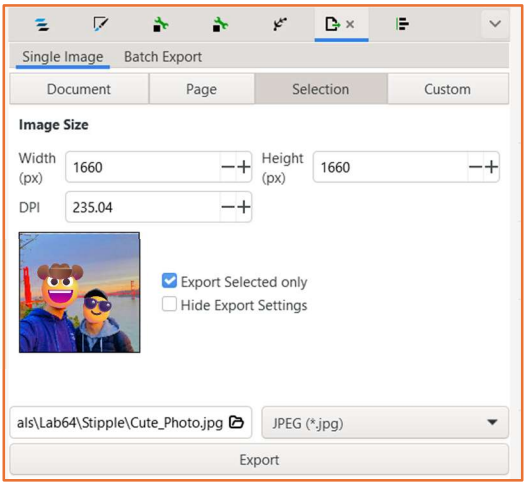
(The image above shows both the white square and the color channel for this explanation but move it so that it's directly under the color channel). Do this for the 3 color channel images and then move on to exporting.

Exporting to JPEG

You'll need to export all 4 images (full color, and 3 channels) into a format StippleGen can use. When you manufacture the acrylic plates, you'll have red, green, blue, and black channels. The black one is necessary because you can't create a dark spot with clear acrylic and light.

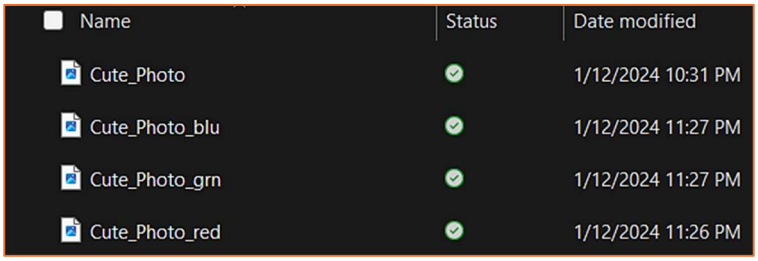
In the right panel, select 

and the "Selection" tab. Drag a box around both your image and the white square underneath to select them both. Reduce the dimensions to 1660 px by 1660 px, and JPEG as the output format. Take note of the output location. (You can change it if you like – it helps to keep all your files in the same folder.) Click export.



You might get a "Low Quality" warning. This is because Inkscape is primarily a *vector graphics* editor which is (in principle) a lossless image format that uses equations to save images. JPEG ruins all of this but that's okay for our purpose!

Do this for the rest of your images but add a label to the file name to keep track of the channels. At the end, your files should look like this:



StippleGen2

This is the step where most of the magic happens. If you haven't downloaded and installed StippleGen2 yet, do so from the Evil Mad Scientist GitHub here: https://github.com/evil-mad/stipplegen/releases/tag/v2.31 This is light-weight software that will do the critical image processing for us. Inkscape doesn't have a similar tool (yet). It'll also rev up your CPU so this is a good time to plug in your computer!

We are encoding color information into patterns of dots. Pretty wild right? Because of that, it's super important that we *maintain the color information* between the steps in this part. So whatever options you decide on in StippleGen2, make sure it's **consistent** between the color channels.

Open Stipple Gen. You'll notice it begins to sample an image of the actress Grace Kelly. Watch it for a bit so you get an understanding of what this program is doing. In each generation, the image becomes clearer.

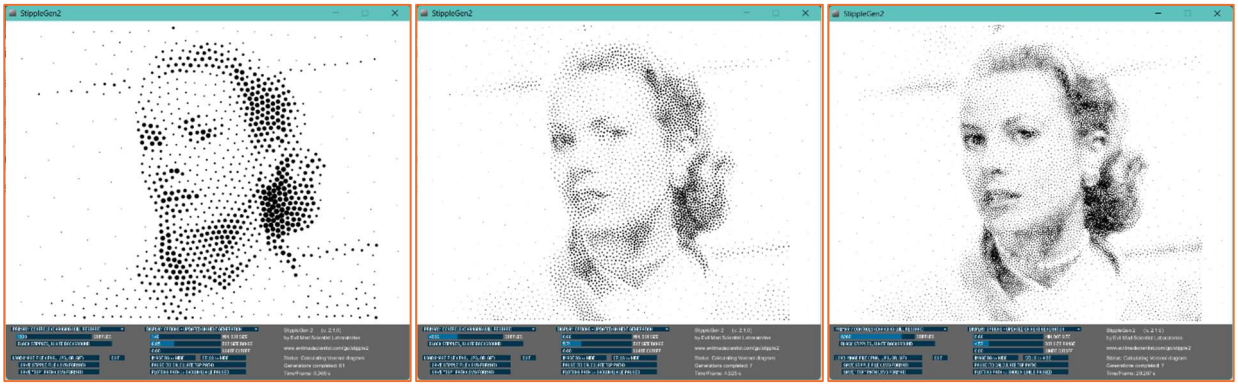
We'll start with your full color image. StippleGen 2 will process this as a grayscale image which we'll use as our black channel. Select LOAD IMAGE FILE (.PNG, .JPG, OR .GIF) and grab your file. We'll play around with the basic settings to optimize your stipple image. But to summarize ahead of time, we want to keep these few points in mind:

- Stipples should be as big as possible without touching each other or clumping up.
- Increasing the stipple count will also increase how long the next generation takes.
- The bigger the dot, the bigger the illumination.
- More stipples = more detail.
- White cutoff helps remove errant stipples.

The end of this section includes the recommended settings but read ahead to get a description of each one. Let's start with Stipple count.

Stipple Count

The stipple slider simply increases the number of dots in your image. The more dots you have, the more detailed your image will become, but the longer it'll take to generate a full image. (It can take several minutes to make a single generation if you push this past 8000!). Take a look at the example below using the default image:

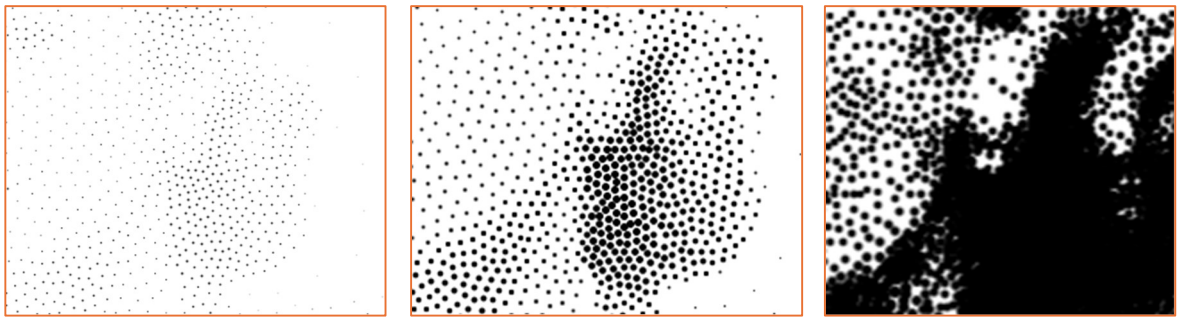


1000 stipples (left), 4000 stipples (middle), and 8000 stipples (right) with adjusted dot size to prevent clumping.

The more stipples you have, the more "literal" your image will be. The fewer you have, the more "impressionist" your image will be. However, keep in mind that you'll have 4 total images making up your stack. You'll also need enough room between the stipple for the other 3 colors to shine through. If you choose 4000 dots, your final stipple light will be made up of 16,000 dots!

Stipple Dot Size

Min Dot Size determines the minimum size of the smallest dot, while Dot Size Range changes the variance between the smallest dot and largest dot. The key to good dot illumination lies in the depth and surface area of each dot. Since the acrylic is illuminated on the side, the dots obstruct the bouncing light and reorient them perpendicular to the acrylic sheet, collectively forming an image. Clumping the dots removes how much illumination each dot will emit. Conversely, dots that are too small will not illuminate enough and you'll get inadequate light shining through. Here's an example:



Three different Min Dot Size settings. Left is set to 0 – you can't see anything! Right is set 8 – way too much clumping. The middle image is good enough! :)

The goal is to get the largest dots you can without them totally overlapping.

White Cutoff

This setting is straight-forward. White cutoff removes the dots where very little to no color information exists. You may notice tiny white dots at the left and right of your square image in stipple gen. Increasing white cutoff removed these and in effect, removes "noise" from the image. It'll also leave you with a nice square-shaped collection of dots for the next part. Increase this value to between 0.05 and 0.1.

Summary

You'll only need to play around with settings once before repeating this process with your color channel images. Keep in mind that the detail won't be great (or even recognizable) for any one image, but between all 4 you'll get a good reconstruction of it. Additionally, there's no way to enter an exact number into the sliders but try to get close. Here are the settings we recommend:

- Stipples: 3000 to 6000
- White Cutoff: 0.05 to 0.1
- Min Dot Size: 0.25 to 0.8
- Dot Size Range: 3.5 or less
- Generations: 15 to 20 (or until no difference)

These don't have to be exact, and you should use whatever settings work best with your image. Afterall, each image will have different needs!

When you're satisfied with the image, select "Pause (To calculate TSP path)" and then "Save Stipple File". Save your first Stipple file as the black channel and add .svg to the file name.

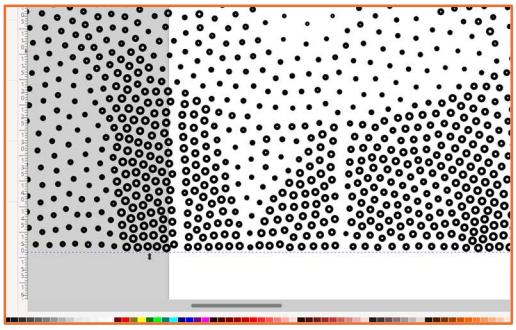
You just made your first stipple image! Now click “pause” again and load your next channel and repeat this process until you have all of your channels saved as “.svg” files. When you’re done, move on to the next step.

Making The Trotec File

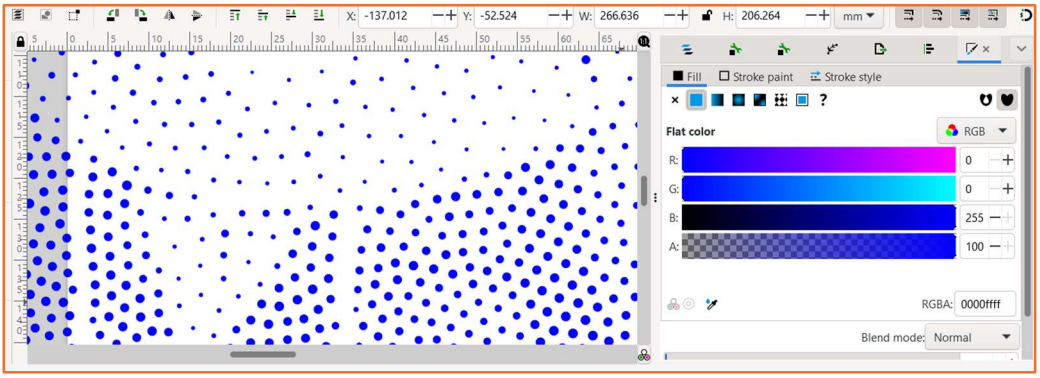
All of your hard work will need to be assembled into a master SVG file which we’ll use to engrave the acrylic blanks. For this open Inkscape again and create a new document with a canvas size of 20” x 5”. You can also use the “Trichrome Trotec Template” to make the last step a little easier.

IMPORTANT NOTE: Save often! Depending on your system, Inkscape might not be able to handle a large number of objects. Performing too many operations too quickly might crash the program. Do these next steps slowly and let Inkscape render everything fully.

Import your first stipple by selecting File > Import... and navigate to your folder. Use the default settings for import. Your stipple drawing will be around 4000 tiny dots each with their own outline and fill.



As you know in our laser cutting training, the Trotec uses solid-filled shapes with no outlines for engraving, which is the operation we’ll use. Adjust the fill and line settings so your channel is made up of solid dots without outlines.

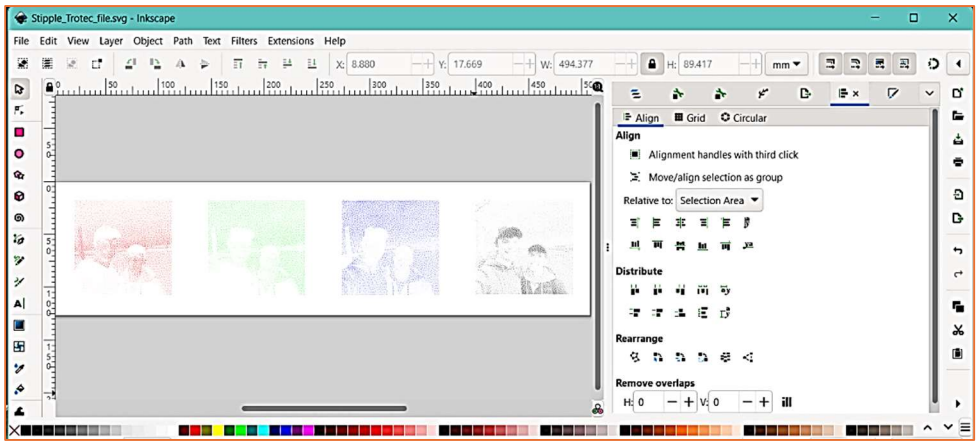


We’ll also set the final dimensions of the image. Our acrylic blanks are 4” x 4” so your image should be no more than 3.3 “ x 3.3” to make room for mounting. Select your stipple and with the aspect ratio locked, adjust the *height* to 3.3” (or lower, up to you). You may notice that your stipple isn’t a

square since the program can output a rectangular image regardless of the input dimensions. The majority of your stipple should be square. You might have errant dots to the left and right if you didn't use white cutoff in the last step, but these can be safely ignored.

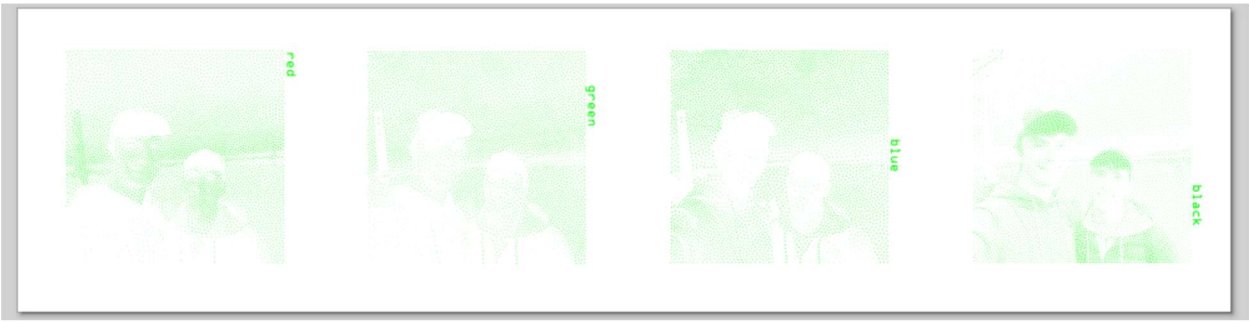
Next, repeat this process with your other 3 stipples. Align them side-by-side on your canvas. We'll change the stipples all to the same color at the end, but it helps to color the stipples so you can keep track of them.

Use Inkscape's alignment tools (Object > Align and Distribute…) to make your 4 stipples on the same horizontal line. Distribute them horizontally as well. Here's what it should look like at this point:

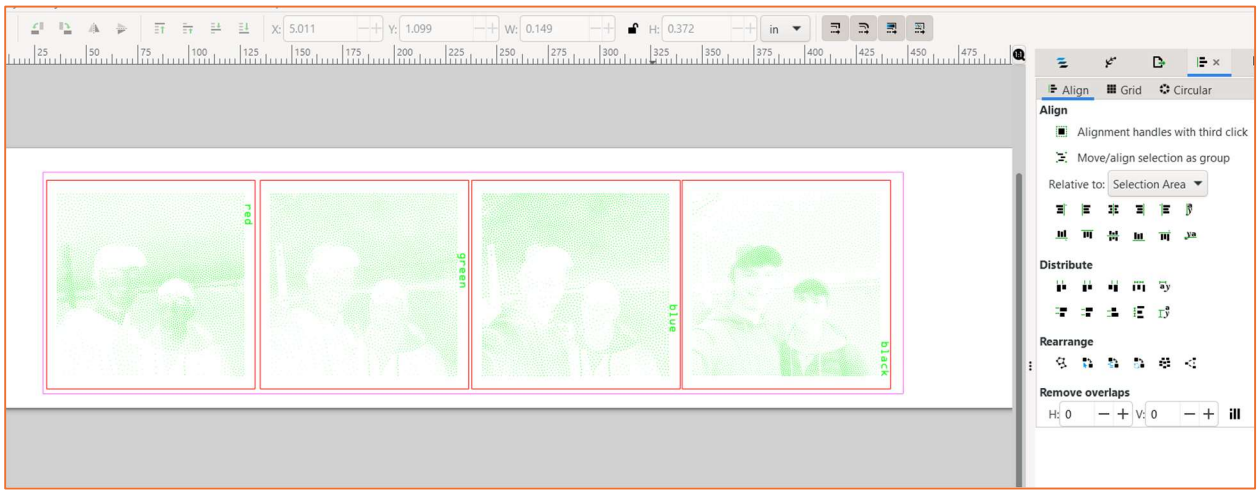


Here you can add text to label the color channels, so you know which is which after engraving them. (Or don't do that and figure it out later – could be fun.) You can also add your name, designs, or text. The stipples act a little like randomly-spaced pixels. Any colors you choose will be blended in the final result.

Now, let's make everything the same color. Everything here will be engraved so using a single color is necessary.



Lastly, we need to make cut lines to free our images from the acrylic. If you used the template, simply place your images in the 4 red squares, then center them using the “Align and Distribute” tool. Otherwise, make 4 red squares yourself using the rectangle tool. Make the dimensions 4” by 4” and then put them centered around your 4 color channels. Your final result should look similar to the image below.



Congratulations on making it this far! You’ve successfully created an advanced design for laser cutting and hopefully learned a ton while doing it. If you’re doing this for a workshop, you’re done as soon as you upload this file to the Lab64 website. Laser cutting is covered in the Stipple Holder assembly guide.