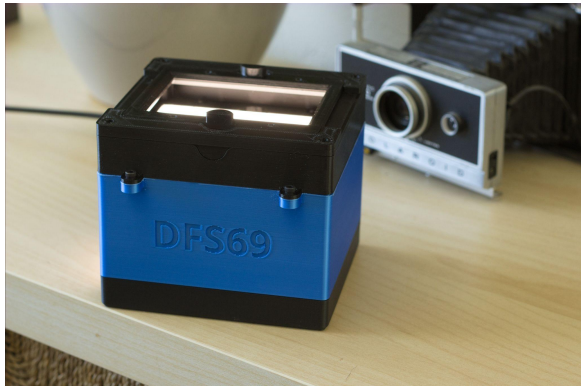
DSLR Film Scanner, 6x9 (DFS69)

Assembly Instructions



What is the DFS69?

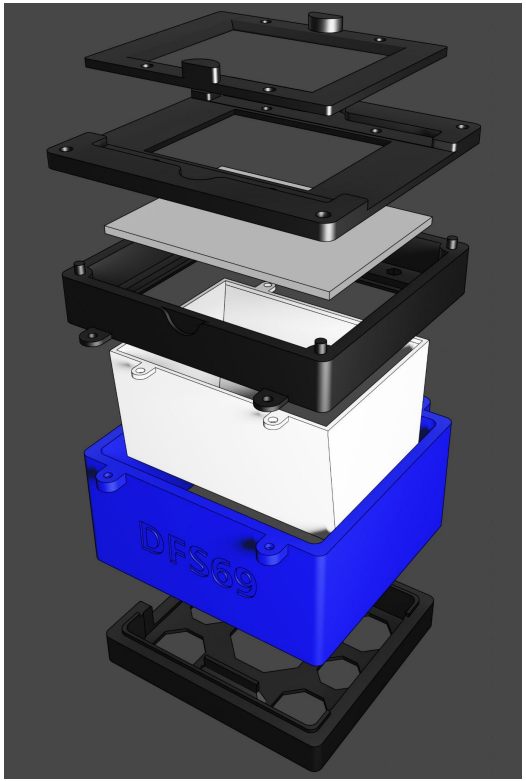
The DFS69 is a device for digitizing (or “scanning”) analog film using a DSLR or mirrorless camera with a macro lens. The acronym, DFS69, is derived from **D**SLR **F**ilm **S**canner, **6**x**9**.

Film scanners capable of scanning 120 film can be very expensive to acquire, which may discourage people from using 120 film.

The DFS69 was developed as an affordable companion to the MP120TC 3D printed 120 film technical camera. The idea is, once you have the camera printed and you’re using it, you’ll likely want a way to get the images you shot into a computer for editing. The DFS69 allows you to do this.

Features

- It's designed to be 3D printed on virtually any 3D printer, most parts print without supports and no fancy hardware (like heat set inserts) are needed.
- It uses an inexpensive VIJIM VL120 LED video light by default (95+ CRI, 3 hours on a full charge, adjustable color temperature and brightness).
- It can support any format: 35mm, 6x4.5, 6x6, 6x7, 6x8, and 6x9. You just need to print the correct carrier and top plate for your format.
- It holds your film firmly (but not too firmly). The top plate is held to the carrier using mini magnets, and the film rides in a 0.16mm deep channel.
- The carrier assembly is positioned on the light spacer using 4 pins, so you can quickly and easily adjust your film position and dust it.
- A secondary diffuser is employed for more even lighting and evenly distributed color. **Note**: although the light is even enough for good quality negatives, you will need corrective procedures if you use the VL120 and low-contrast or thin negatives. See the addendum for details on these procedures.
- It can easily be used with a different light source. If you have a good light panel/box already, you can just print the spacer and the carriers you need. Or, you can redesign the lighting base to use whatever light source you want.
- It's FREE! You can get STL or STEP files from https://williamskg6.wixsite.com/mp120tc/about-4



Supplies Needed

To build a DFS69, you will need the following:

- A well-calibrated 3D printer capable of printing 120mm x 120mm x 100mm. An example might be a Creality Ender 3 or clone.
- 3D printer filament. Matte black works best for the carrier assembly and spacer. Matte white works best for the light cone. Any other desired color can be used for the base and light tray.
- 8X mini disc magnets for each film carrier, 4mmx2mm in size
- 8X M3 nuts and 8X M3x8mm screws
- A piece of 100mm x 75mm x 3mm translucent (not transparent) acrylic for the secondary diffuser
- A VIJIM VL120 light (for the default configuration)
- Flat Black and Flat White paint

Light Sources

By default, the DFS69 employs a Vijim VL120 light source. This light is inexpensive and can cover up to 6x9. Note that Vijim is a division of Ulanzi and Ulanzi sells the same VL120 light with more advanced controls for more money. If you cannot locate a Vijim VL120, you can try looking for the Ulanzi.

Other light sources can be used, and the light source's size dictates what formats can be scanned. The table to the right describes those currently available.

Light	Format(s) Covered	Files To Use
Vijim VL120 (or Ulanzi VL120)	Up to 6x9	VL120_Base VL120_Light_Cone_Mount VL120_Light_Tray
Ulanzi VL49	Up to 6x6	VL49_Base VL49_Light_Cone_Mount
Phottix M180	Up to 6x9	Phottix_M180_Base Phottix_M180_Light_Cone

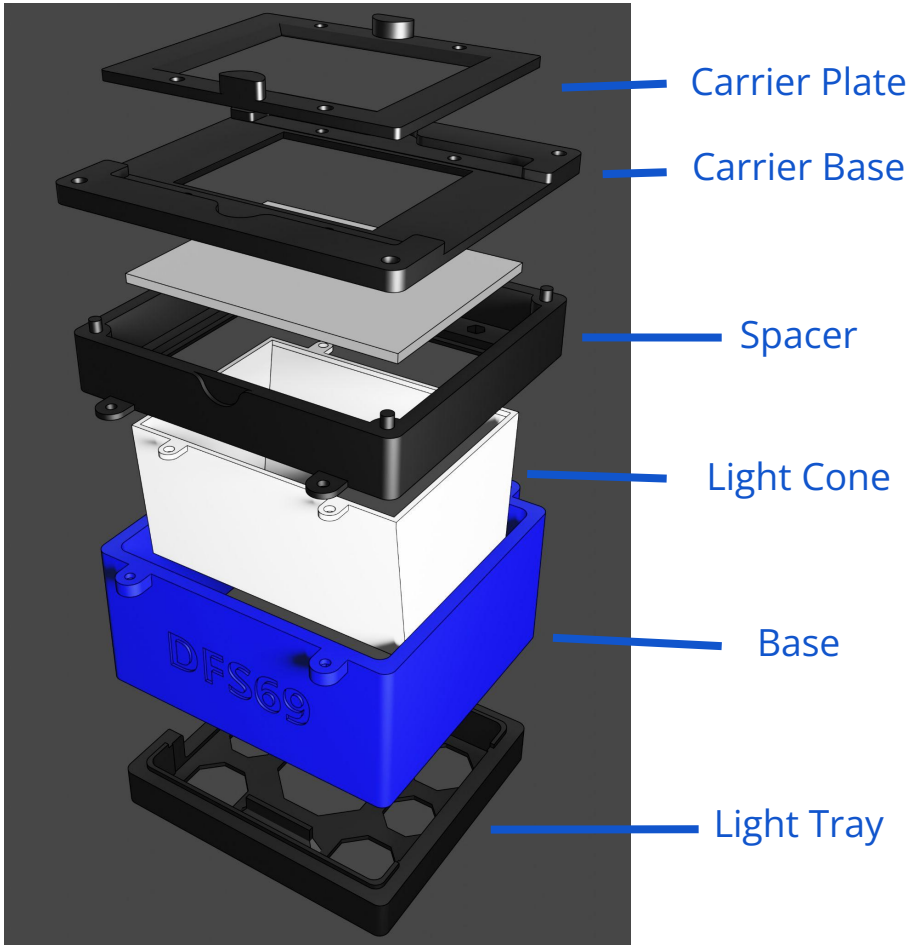
Note: for negatives with good density and contrast, you can get away with the VL120 light, but for negatives with poor contrast or thin density, you will need to compensate for unevenness that will then become visible. See the addendum for details on what steps to take.

Parts

The DFS69, in its default configuration, consists of these 3D printed parts.

Note that the diffuser seen in the image is not 3D printed - you use a piece of translucent acrylic.

Also note that the light is not shown. It sits in the light tray at the bottom of the assembly.



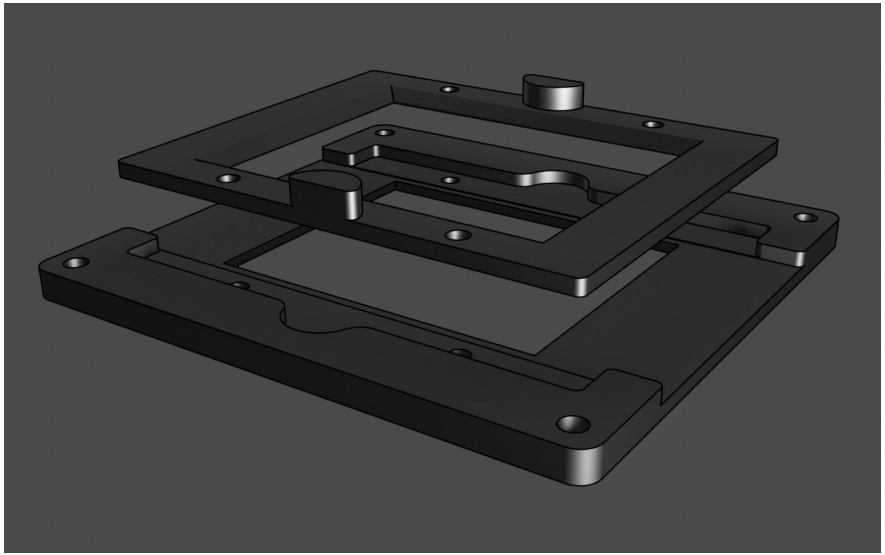
Parts - Carrier

The film carrier consists of **2 parts**: the **carrier base** and the **carrier plate**. The plate affixes to the base using 4 mini magnets, which attract to 4 corresponding mini magnets in the base.

For any specific film size, you will need to print the appropriate carrier plate and matching carrier base.

The carrier assembly mounts on the spacer via 4 pins on the corners of the carrier base. This way the carrier can be easily removed for positioning and dusting the film.

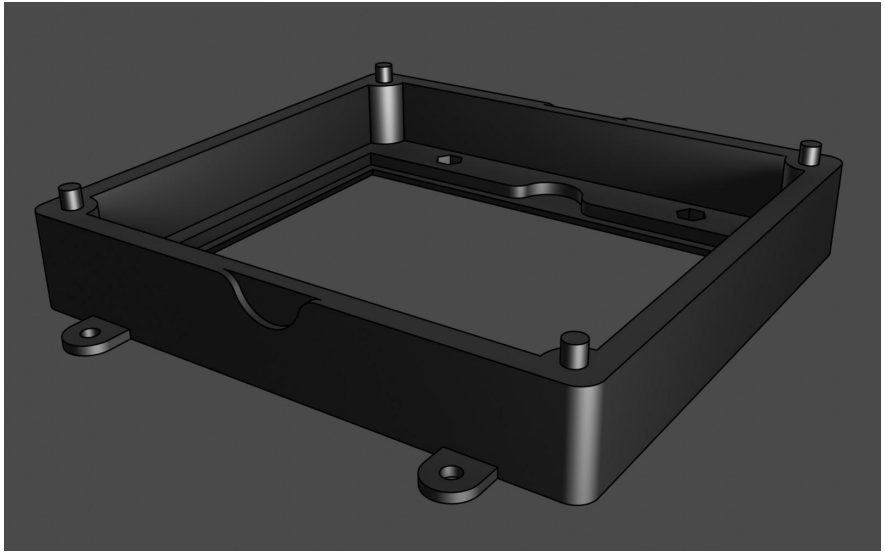
Carrier files for 35mm, 6x4.5, 6x6, 6x7, 6x8, and 6x9 are provided.



Parts - Spacer

The spacer positions the carrier up away from the light source so that dust/scratches and surface texture of the light source is far enough away from the film to be out of focus. In the default configuration, it also holds the translucent acrylic secondary diffuser, which sits in an inset, but is easily removed for cleaning/dusting.

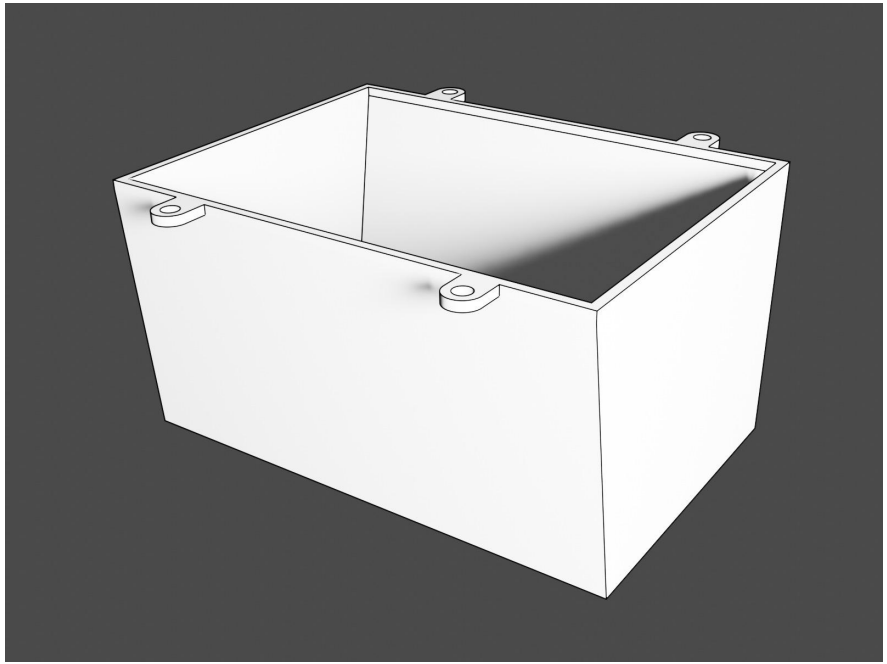
The spacer includes 4 insets for captive M3 nuts to allow screwing the light cone to the bottom of the spacer. It also includes 4 external tabs for the purpose of attaching the base with M3 screws.



Parts - Light Cone

The LED light for this scanner is built from 120 separate LED “beads”. Some beads are warm, and some beads are cool. In operation, these beads are visible. The secondary diffuser is included to even out the light brightness and color, but needs some distance between the light and the diffuser. The light cone provides this distance and directs the light to the diffuser.

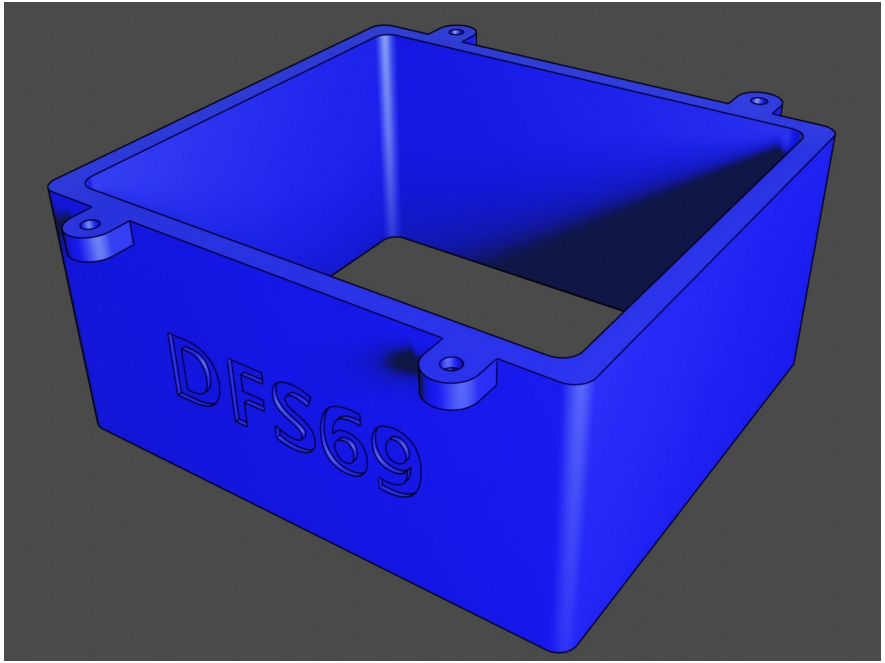
Note: The light cone acts somewhat as a mixing chamber. The color of the interior surface will be visible to your camera. As such, you should make certain that the interior surface is as neutral white as you can get it. Most white filament is not pure white, so you will likely need to do some painting of the interior surfaces.



Parts - Base

The base is a mostly decorative, but also partly structural component. It makes the assembled device more stable, holds the spacer orthogonal to the surface upon which the scanner's light tray is placed, and makes it look nicer.

If desired, you can choose to print this part in any desired color for customizing the scanner's appearance.

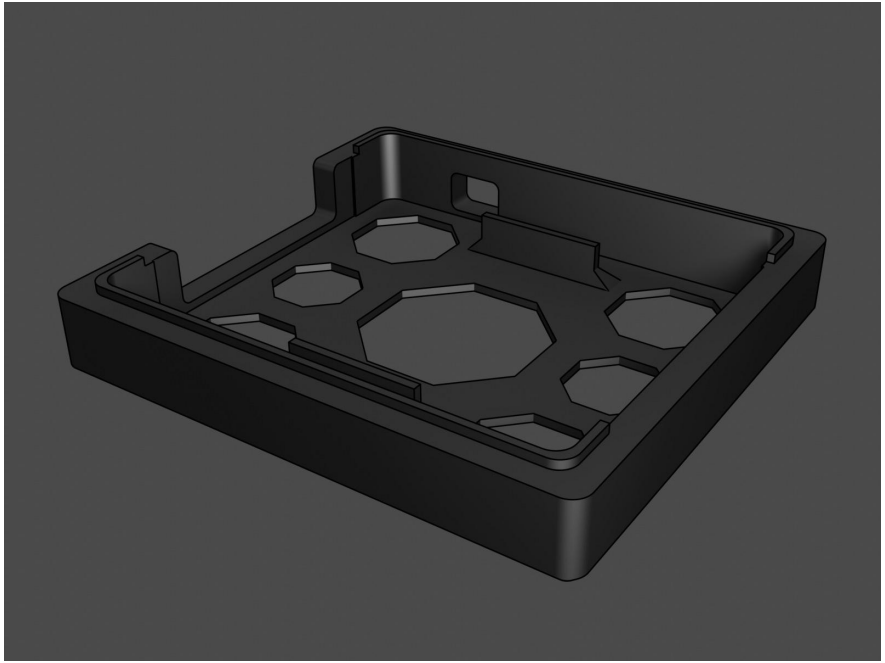


Parts - Light Tray

The Vijim VL120 light sits inside the Light Tray, which has mounting lips on its edges upon which the base sits.

This is the only part where supports should be used, and only for the USB-C plug port.

An access hole is provided to be able to reach the light’s controls (on/off, brightness, color temperature).



Print Settings

All parts can be printed without supports except the light tray, provided you orient them properly. You may consider printing with a brim or mouse ears on many of these parts to ensure that the corners of parts do not curl/warp.

Part	Settings
Carrier Plate	Use any printing settings you wish. Black filament is recommended.
Carrier Base	Use black or grey filament. **You must print this at a layer height of 0.16mm!** This is so that the film channel will be properly printed. It is only 1 layer thick where the carrier plate sits, so if you do not see this layer in your slicer print preview, adjust your settings.
Spacer	Use any printing settings you wish. You may print this in any color you like, but if you use anything that isn't neutral, make certain you uniformly paint all interior surfaces matte black
Light Cone	Use any printing settings you wish. You should print this in white if possible. The interior surface should be uniformly painted in neutral matte white paint.
Base	Use any printing settings you wish. You may print this in any color you wish.
Light Tray	Use any printing settings you wish, but use supports for the USB-C port opening. Tree supports are recommended, touching only the build plate, and set your overhang angle at around 50 degrees. Any color is fine.

Painting

When scanning film, it is imperative that any part that can influence color balance or reflect light be properly treated. Even if you choose to use black filament, it is recommended that you do some painting.

1. The interior surface of the light cone should be painted flat white. You should make this as uniform and neutral in color as possible.
2. The interior surfaces of the spacer should be painted flat black. You should make this as uniform as possible. If you used black filament, this is probably not necessary, but still recommended.
3. The bottom surface of the carrier base should be painted flat black, but make sure you do NOT paint the surfaces of the carrier base or carrier plate that come in contact with film!
4. The top surface of the carrier plate should be painted flat black to minimize reflections between the carrier and your camera lens. If you used black filament to print this part, you probably don't need to paint this, but it is still recommended.

NOTE: it is recommended to insert the mini magnets prior to performing any painting of the carrier base or carrier plate.

Assembly

After finishing printing and painting the parts, perform the following to assemble the scanner:

1. Insert the 4 mini magnets into the carrier base. Pay special attention to make sure you install them all with the same polarity. Press them in from the upper surface and make certain that they are completely flush or even sitting slightly below the surface. You may choose to wick some thin super glue into each magnet's hole from the back side.
2. Insert the 4 mini magnets into the carrier plate. Pay special attention to make sure you install them all with the same polarity, and that the polarity attracts them to the carrier base. Press them in from the bottom surface and make certain that they are completely flush or even sitting slightly below the surface. You may choose to wick some thin super glue into each magnet's hole from the top side.
3. Insert M3 nuts into all 8 captive insets. The fit should be tight - you may need to press them into place with some force
4. Screw the light cone to the spacer using 4 M3 screws
5. Screw the base to the spacer using 4 M3 screws
6. Drop the 100mm x 75mm x 3mm translucent acrylic secondary diffuser into the spacer
7. Drop the light into the light tray and if desired, connect the USB-C cord through the opening provided
8. Set the base on top of the light tray

Customization

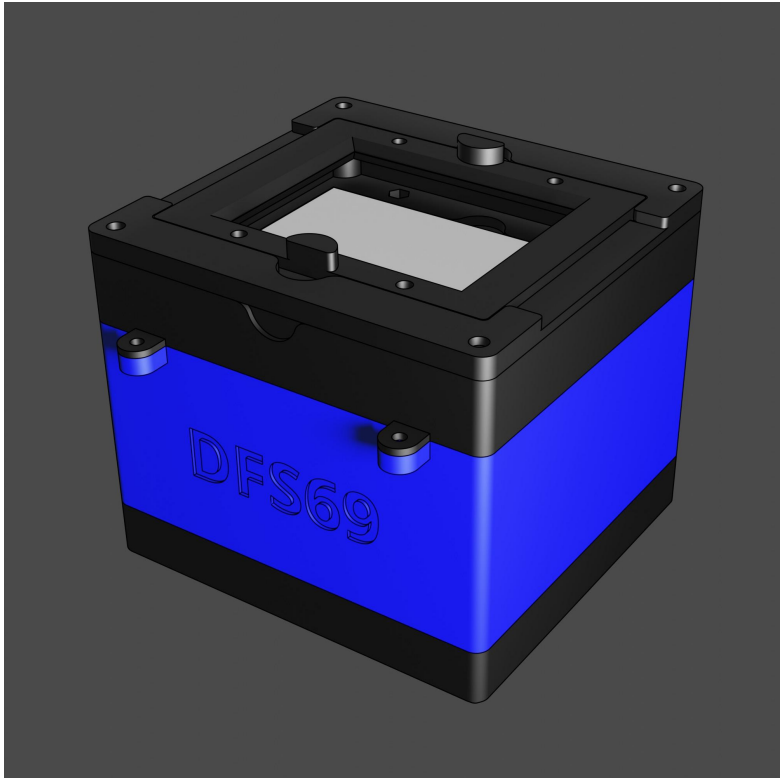
STL and STEP files are provided for this device. You may choose to customize the device as you see fit.

Some configurations do not require all parts. If, for example, you already have an even, diffused light panel for a light source, you may omit printing the base and light cone, and can probably even omit the secondary diffuser.

The light cone and base may be altered to use any light source you wish. Users have expressed interest in adapting flashes or halogen bulbs with the spacer and carrier parts. The STL and STEP files have been provided to allow this.

Licensing

The DFS69 is provided to the community using a Creative Commons Attribution-NonCommercial 4.0 license This means you can Share or Adapt/Remix it, as long as you provide attribution and don't sell the design. See this page for more details.



Procedures for Thin/Low Contrast Negatives

The VL120 light is sufficiently even for negatives of good density and contrast. However, for negatives that are thin or have low contrast, the unevenness present will become visible in your image files.

This can be corrected out in Photoshop (or GIMP) using the process to the right.

1. Photograph the negative carrier with no negative in it. Fill the frame as much as possible, with the opening in the location you will photograph negatives. Focus on the edge of the carrier, not the diffuser. This will be your “Correction” image.
2. Photograph the negatives you wish to digitize
3. Process the “Correction” image:
    a. In Photoshop, open the “Correction” image. Open in 16-bit mode! Do not apply any brightness/contrast/curves/exposure corrections whatsoever! Apply lens corrections now.
    b. Crop the “Correction” so no black pixels appear around the edges.
    c. Apply a Gaussian blur of about 20 pixels. This is to smooth out any noise from the sensor or any dust that managed to get on the diffuser.
4. For each image you with to process:
    a. Open the image in Photoshop, opening it in 16-bit mode. Do not apply any brightness/contrast/curves/exposure corrections whatsoever! Apply lens corrections now.
    b. Straighten if necessary and then crop the image, cropping to the edges of the negative carrier opening. If you have any film base showing, leave it (don’t crop it off).
    c. Scale the “Correction” image so its pixel dimensions match your image that you’re processing.
    d. In the image you are editing, invert it but do not apply contrast/brightness/curves/levels
    e. Add an Exposure Adjustment layer
    f. Alt-click the Adjustment layer mask
    g. Copy the “Correction” image and paste it into the Adjustment layer mask
    h. Alt-click the Adjustment layer mask to close editing of it
    i. Change the Adjustment layer blending mode to Hard Light
    j. Add a Curves Adjustment layer
    k. Adjust the Curves to taste
    l. Flatten the image and then continue to edit as you see fit