

Focus Stacking

Part 2 - Macro

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Dennis Freeman

dennisfreeman4510@msn.com

Why Focus Stack when Doing Macro?

Close focus creates too narrow depth-of-field



Robber fly: 150mm, f/2.8 macro, 1.3 second exposure at ISO 200, f/9

All of desired subject in focus



Focus stacked from 8 different images, all 1.3 sec exposures, ISO 200, f/9



Macro has Very Small Depths of Field

- [photopills.com/calculators/dof-macro](https://www.photopills.com/calculators/dof-macro)



Example: Canon 5D IV



Camera

Canon EOS 5D, 5D Mark II, 5D Mark III, 5D Mark IV, 5DS, 5DS R



Canon 100mm f/2.8 Macro Lens



Focal length

100



mm

Aperture

f/14



Focusing distance

400



millimeters



Magnification

1.00x (1:1.0)

Effective aperture

f/28.5

Depth of field

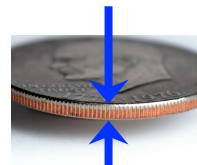
1.71 mm

Smallest Subject which can fill the image

24 mm

Safe step size for stacking (20% image overlapping)

1.37 mm



1.7 mm



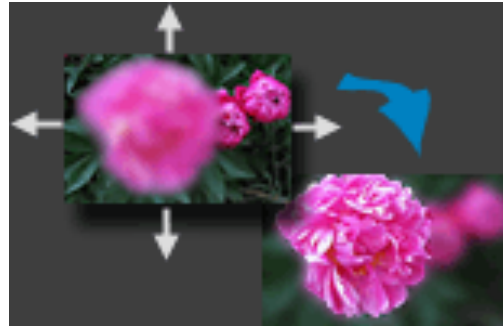
24mm

35mm

What are the Steps to get a Single Sharp Image?



1. Capture Multiple Images with Different Focal Points



2. Align Images Pixel-by-Pixel: Remove 2D position differences and geometric distortions.



3. Merge: A composite image is then created based on the sharpest regions from each of these separate images.

e.g. automatically in Photoshop or other S/W

Example images at varying subject focus points



Bright green indicates in-focus

Two Approaches to Obtaining a Set of Sequentially Focused Images:

- Automatic Focus-Bracketing
- Manual Focus Stacking

Automatic “Focus-Bracketing” Setup

(may need a light source too – flash, LED panel, reflector, ...)

Remote Shutter
Release (or timer)



Camera

Autofocusing Macro lens
(or extension tube, etc)



Ball Head

Clamp

Tripod

“Focus Bracketing”

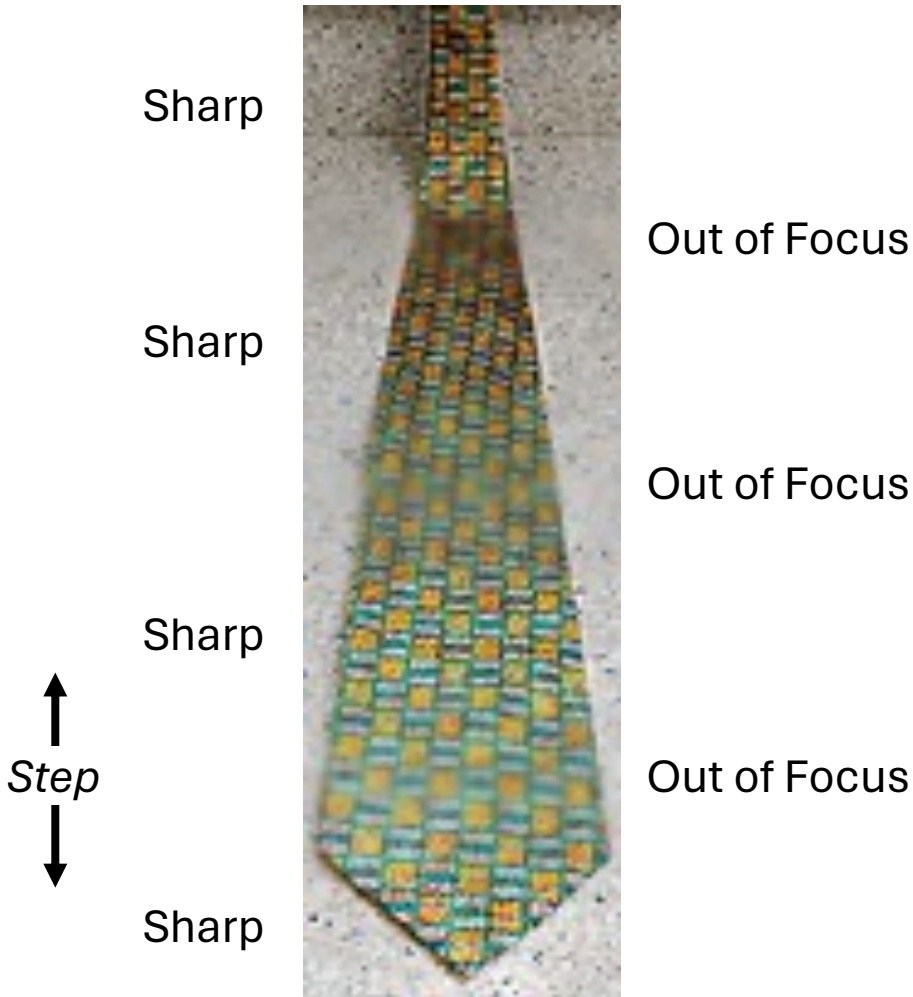
(or Nikon’s “Focus-Shift Shooting”)

- Some cameras can create a sequence of progressively focused images automatically. This is called Focus Bracketing - in the camera menu.
- You need to use an autofocus lens, in AF Mode.
- You need to select the step size, e.g. 1-10 and number of steps. “1” is a small step and a lot of images. A “10” is a big step and possibly poor focus results (esp Nikon). So, maybe “3” or “4”?
- You can do an experiment to see:

Determine good step sizes for Focus Bracketing

1. Focus on the nearest part of your subject.
2. Set the step size & the number of shots to a fairly high number, like 20.
3. Kick off Focus Bracketing to take a series of images.
4. Bring them into your favorite image editor.
5. Pick one spot in the image and find the shot in the series where that spot is the sharpest.
6. Look at that spot in the shots immediately before and after that shot.
7. Can you see any difference in sharpness in the spot you picked?
8. If no, the step size could be bigger.
9. If yes, is that amount of blur acceptable to you?
10. If yes, then you're done; use the step size you used for the test for your actual photography.
11. If no, try again with a smaller step size.

Example - Step Size is too Large:



- Be careful to avoid wave-like depth of field which can result from focusing distances which are too widely spaced.
- Either use a bigger f-stop or add more images and a smaller step size.
- Try using the camera's "Live View" to examine the focus results and adjust focus distance spacing.
- Even better, you could tether your camera to a laptop (if supported) so that you can see an enlarged preview and control the focusing distance precisely.

Manual “Focus-Stacking” Setup

(may need a light source too – flash, LED panel, reflector, ...)

Remote Shutter
Release (or timer)



Camera

Manual Focus
or Autofocusing
Macro lens
(or extension
tube, etc)

Macro Rail

Clamp

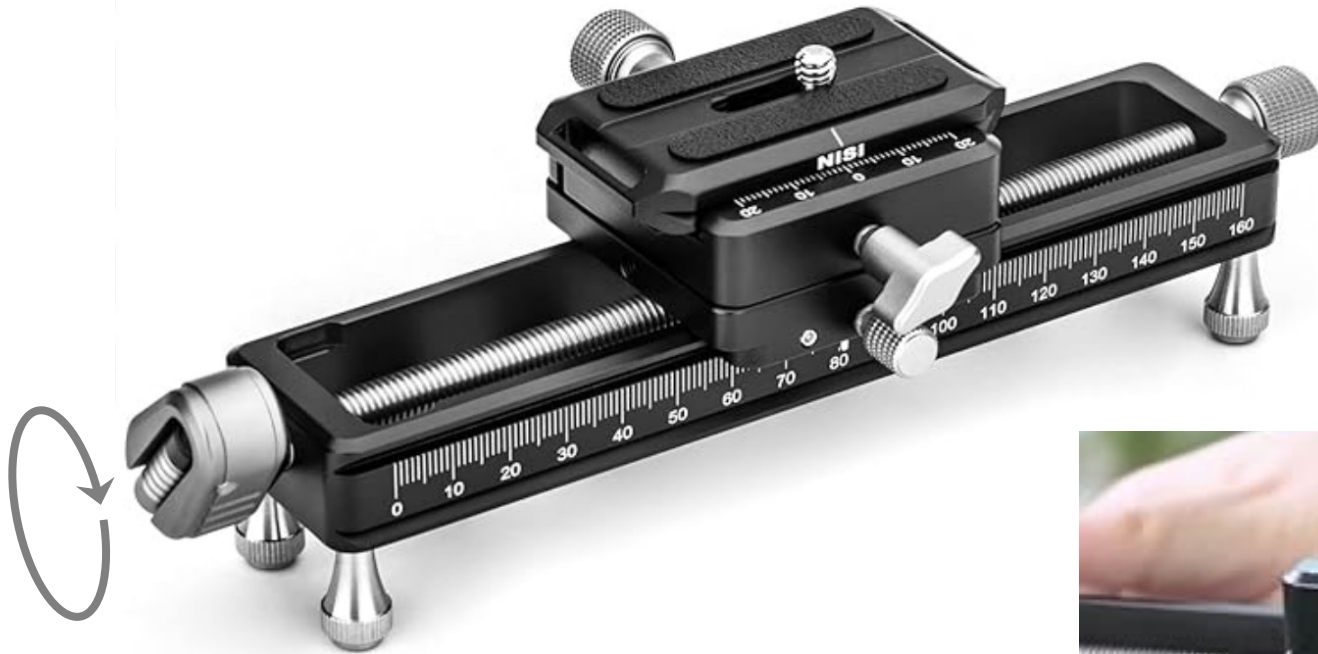
Ball Head

Tripod



Macro Focusing Rail

Move the Camera & Lens.
Do not touch focusing
controls!

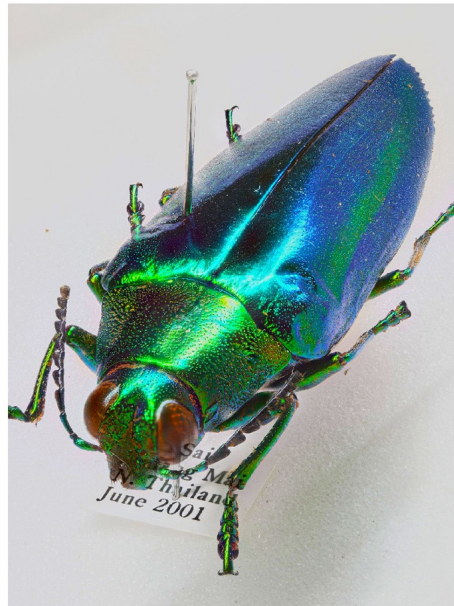
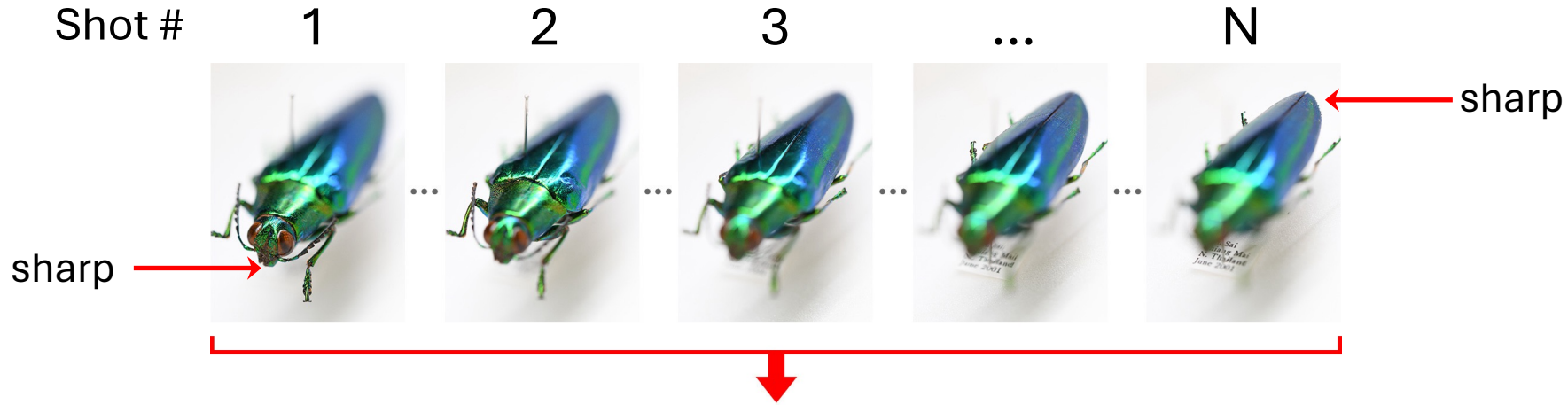


1.25mm camera travel per full rotation of handle

Rotational screw adjustment gives precise control



Take images from front to back, overlapping $>25\%$ of sharp-portions



Combine in software

Camera Settings

- To reduce the number of images required choose as high an f-stop as possible without losing too much light or inducing visible softening due to diffraction. f/11-f/16 often work great with full-frame cameras.
- Set ISO low to reduce noise (e.g. 100-200)
- May need long shutter speed (and nothing moving) or flash to get exposure.

In-the-Field Focus Stacking

- Try between 1/16th and 1/32th flash power.
- Start with the front of the subject. Once you've taken a shot, then move your camera & lens slightly forward – the tiniest movement is sufficient. Fire off another shot and repeat this until you have got to the back of your subject. (Then work your way back to the front – image order doesn't matter)
- Do not change the focus point using your lens or camera controls. Your camera stays set up the way you started, and it's *you* that moves forwards and backwards (try not to move up/down, side-to-side).



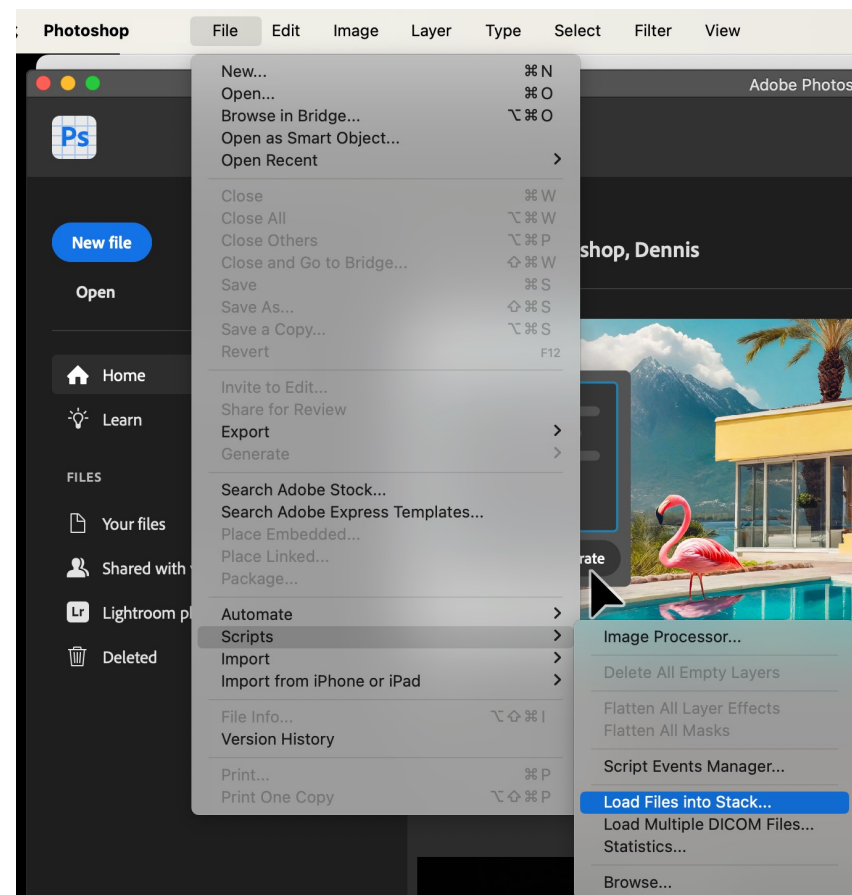
Focus Stacking Software

(links & details on pluses/minuses in Backup)

- Skylum Luminar Neo
- Adobe Photoshop
- Helicon Focus
- ON1 Photo RAW
- Zerene Stacker
- Picolay (free photo stacking software)

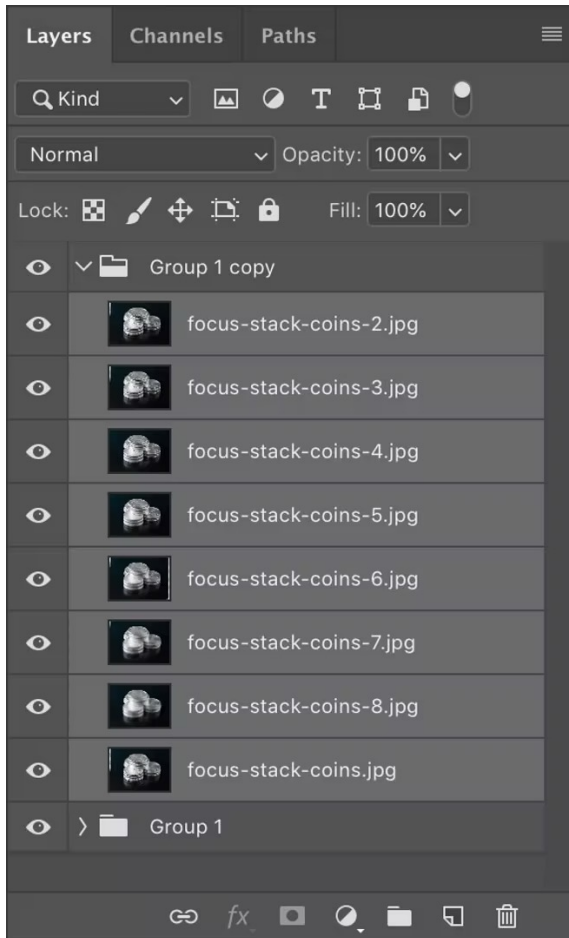
Processing in Photoshop

- Import the Images.
- Open the images as layers in Photoshop by choosing File > Scripts > Load Files into Stack; navigate to the image files and click OK.



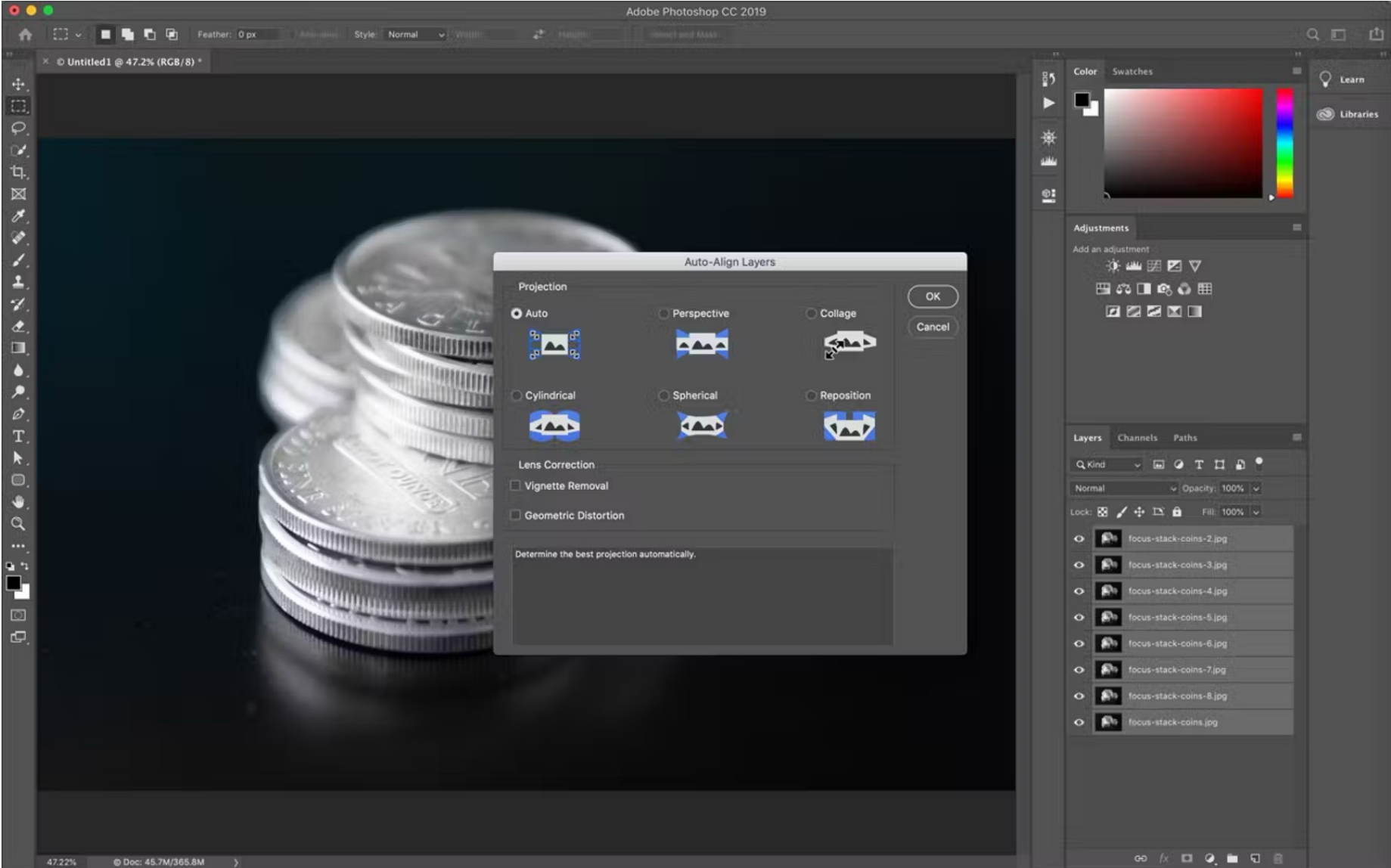
If using Lightroom, from the menu:
>Photo>Edit In>Open as Layers in Photoshop...
This is the spot you will arrive at.

Protect your originals



Recommend selecting the layers and grouping them into a folder (Windows/Mac: press Ctrl/Command-G), and then duplicating that folder (press Ctrl/Command-J). If Photoshop's automatic align or blending isn't to your liking, you have a backup copy of untouched layers.

Select the layers in the Layers panel and choose Edit > Auto-Align Layers. Leave “Auto” selected in the Auto-Align Layers dialog and press OK.



Select the layers in the group and choose Edit > Auto-Blend Layers. In the dialog that appears, select Stack Images and (optionally) turn off Content Aware Fill Transparent Areas. Click OK.



Photoshop then creates a layer mask for each layer that allows the sharpest areas to remain visible.



Done with Focus Stacking

- However there are certain situations, when Photoshop really struggles to get clean and satisfying results.
- It often requires you to clean up errors or manually mask areas back in afterwards, hence why it is always a great idea to make copies of each layer and never overwrite them, so you can always come back and edit them again.

Sometimes a Problem ...

- Whenever you have an object overlapping another, Photoshop might create an unsharp halo around the closest object.
- This is caused by the fact, that on the layer with the object further away in focus, the object closer is unsharp and hence wider than it will be on the other frame, covering the actual details of the object further away.

#1



WILD
MACRO
wildmacro.de

#2



WILD
MACRO
wildmacro.de

#3



WILD
MACRO
wildmacro.de

#4



WILD
MACRO
wildmacro.de

Have to go in and edit the masks part to remove out-of-focus halo of snout from the merge

BACKUP

Focus Stacking Software

- Skylum Luminar Neo

- Affordable one-time price
- AI-powered focus stacking tool
- Easy to use
- Effective one-click presets
- Impressive AI tools
- Especially useful as a [Lightroom Plugin](#)
- Limited photo management features
- Limited print and export options
- No free trial

- Adobe Photoshop

- Powerful image correction tools
- Intricate adjustment tools for focus stacked images
- Plentiful online tutorials and communities
- Advanced layer management
- Impressive Generative Fill tool
- Auto-align isn't perfect
- Expensive
- Steep learning curve

[Photoshop Focus Stacking Tutorial](#)

- Helicon Focus

- Dedicated focus stacking
- No-nonsense interface
- Advanced stacking tools
- Free trial available
- Expensive
- Advanced for beginners
- Outdated UI

- ON1 Photo RAW

- Impressive retouching tools
- Supports RAW format
- Contains HDR
- Compatible with some [Photoshop plugins](#)
- Updated AI tools
- The mobile app is basic
- Cluttered user interface
- Limited focus stacking features
- Needs a powerful computer to run fast

Focus Stacking Software, con't

- Zerene Stacker
 - User-friendly interface
 - Supports large image files
 - Offers a Lightroom plugin
 - Quick rendering
 - Automatic image retouching
 - No RAW converter

- Picolay (Free Photo Stacking Software)
 - Free installation
 - Editable slideshows
 - 3D image creation tools
 - Basic image enhancement tools
 - Some formats are not supported
 - Limited features
 - Outdated design and UI