Focus Stacking Capture and Processing

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with content from Frank Richards

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This Is Part 1 of 3 Sessions on Expanding the Range of your Camera

- **Focus Stacking** – Combine images taken at different focal distances to increase *depth of field*
- **High Dynamic Range** – Combine images with range of exposures to *increase dynamic range*
- **Panorama** – Stitch together adjacent scenes to *expand the field of view*

Depth of Field (DOF)

Definition

The depth of field (DOF) is the distance between the nearest and the furthest objects that are in acceptably sharp focus in an image captured with a camera.

Depth of Field determined by

- Focal length
- Aperture
- Distance to subject

Depth of field calculators online and for phone

- I use Depth of Field Master online
  https://www.dofmaster.com/dofjs.html
- And “Digital Depth of Field” app on my phone

Depth of Field (DOF)

Impact of Variables

Parameter	Focal Length	Aperture	Distance
Focal Length	Shorter = Greater DOF	Fixed	Fixed
Aperture	Fixed	Smaller = Greater DOF	Fixed
Distance to Subject	Fixed	Fixed	Longer = Greater DOF

85mm f/1.8
f/9, 1/80, ISO 64

Foreground
in Focus

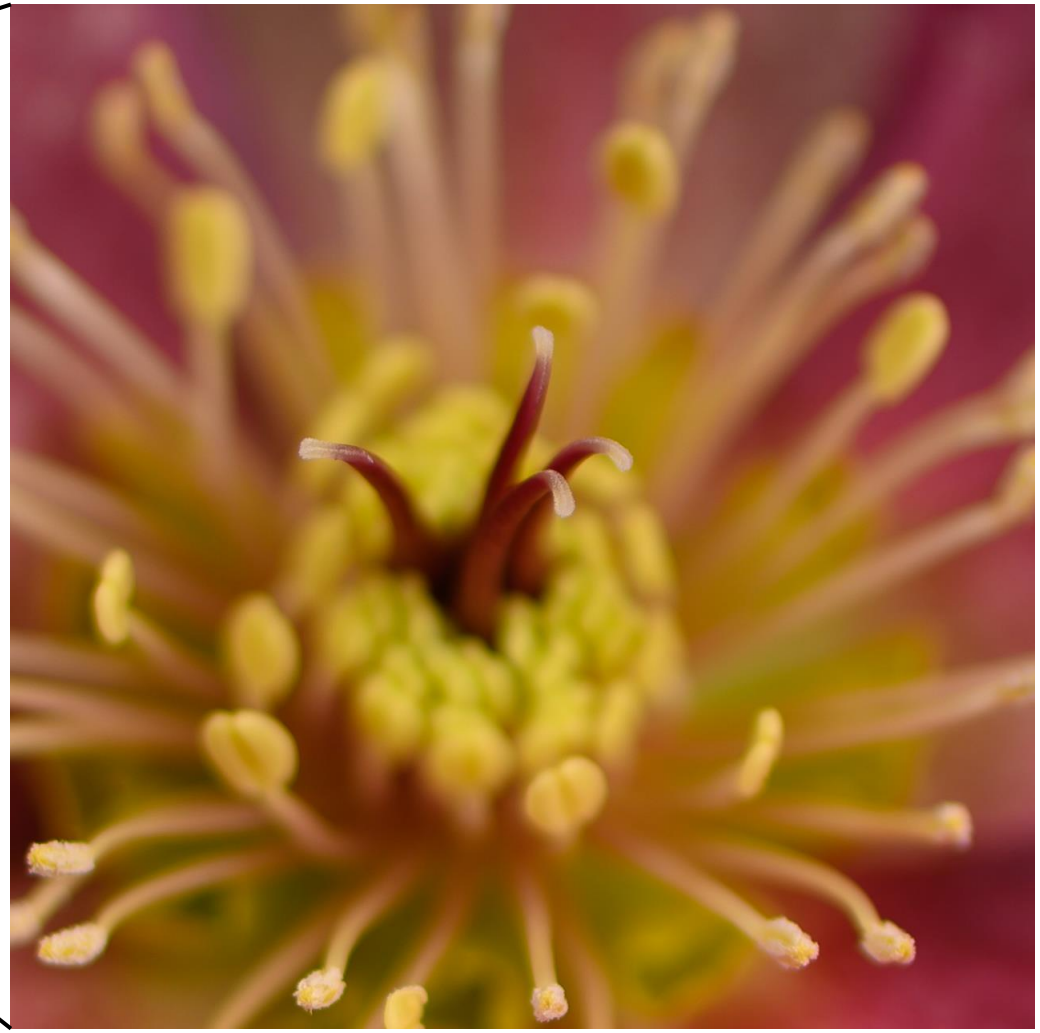
85mm f/1.8
f/9, 1/80, ISO 64

Background
in Focus

85mm f/1.8
f/9, 1/80, ISO 64

All
in Focus

105mm macro f/2.8
f/9, 1/80, ISO 64




21 Shot Stack

What and Why Focus Stacking

- Have you looked at a scene and wondered why it looks different in your photo? Your eyes adjust focus as you look from point to point while a photo focuses on just one DOF slice at a time
- With focus stacking, images are captured with different focus points and combined to create an image with more DOF than is possible with a single exposure.
- Focus stacking can use sharpest aperture
  - A wide-open aperture provides a shallow depth of field
  - A small aperture (high f-stop) will increase depth of field but can result in soft focus due to diffraction. May also have to reduce shutter speed or increase ISO which increases noise
  - For most lenses, the aperture that results in the sharpest focus is 2-3 stops from wide open
- Both macro and landscape photography may benefit from focus stacking
  - Macro - individual images have a very shallow depth of field
  - Landscape (or large object) - may have a large separation between foreground and subject
- Do you need to focus stack. Take a test shot to see if the image is acceptably sharp throughout to see if focus stacking is really necessary

Two Ways to Capture Images for the Stack

- Move the focus point by refocusing the lens

- Start with foreground
- Adjust lens to change focus distance
- Image gets smaller as focus distance increases
- DOF increases as with focus distance increases
- Focus stack can cover from foreground to infinity

- Move the camera

- Start with closest detail
- Use rail to move camera in DOF steps
- Each image stays the same size and
- DOF stays the same
- Subject size is limited by length of rail

Two Methods for Refocusing

- Move the focus point by refocusing the lens

- Manually - Focus on closest point, shoot, focus further in and shoot. Repeat until reach the desired furthermost point.
  - Smaller and more steps for macro and closeups
  - Larger and fewer steps for landscapes and more distant objects
- Camera controlled – setup parameters in the camera and start the action. The camera does everything else.

Nikon Focus Shift Shooting

- Set parameters
- Press Start

Considerations when Capturing Image for the Stack

- Compose your shot while focusing on nearest feature you'd like to be sharp. Your subject will be largest when close
- The depth of field for each subsequent photo overlaps the depth of field from the prior photo
- Using smallest aperture (highest f-stop) that is sharp for lens you are using. Higher f-stop values provide larger DOF and need for fewer images.
- More closely spaced focusing distances often produce more consistent and natural looking sharpness, but try to avoid overdoing it as it takes longer to capture and process the stack
- Keeping the exposure dynamic range down rather than shooting with harsh, contrasty lighting will give your stacking software a better chance to create a decent stack
- If your software supports it, use RAW to provide processing latitude
- Use a self-timer or remote shutter release to avoid camera shake when shooting manual
- Use dark frames to separate sequence from surrounding images and other sequences. This will make it easier to tell where each series starts and stops

Examples

7 Images

10 Images

4 Images

3 Images

6 Images

3 Images

9 Images

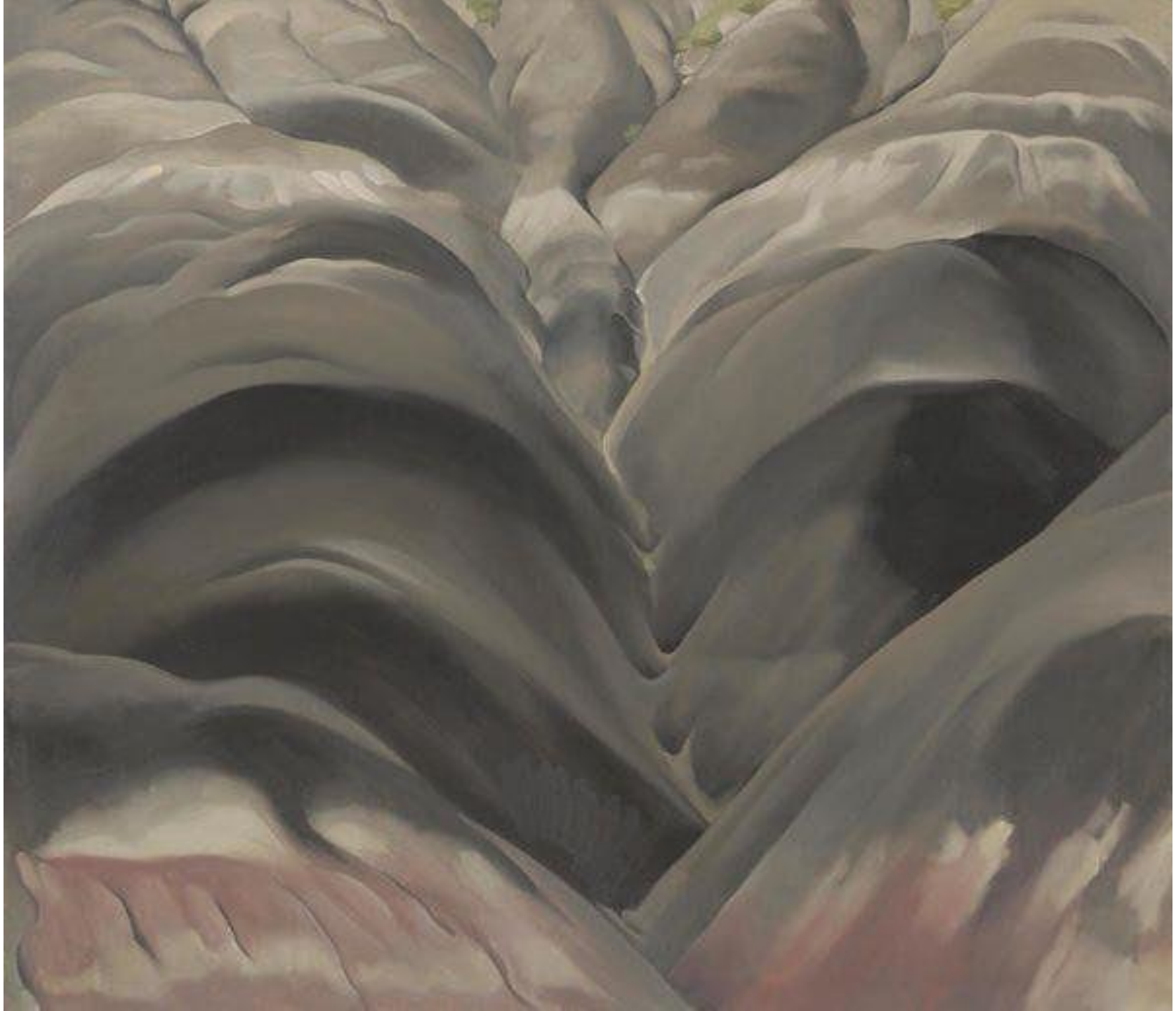
15 Images

10 images – 7 used

4 Images

Manual Refocusing Example

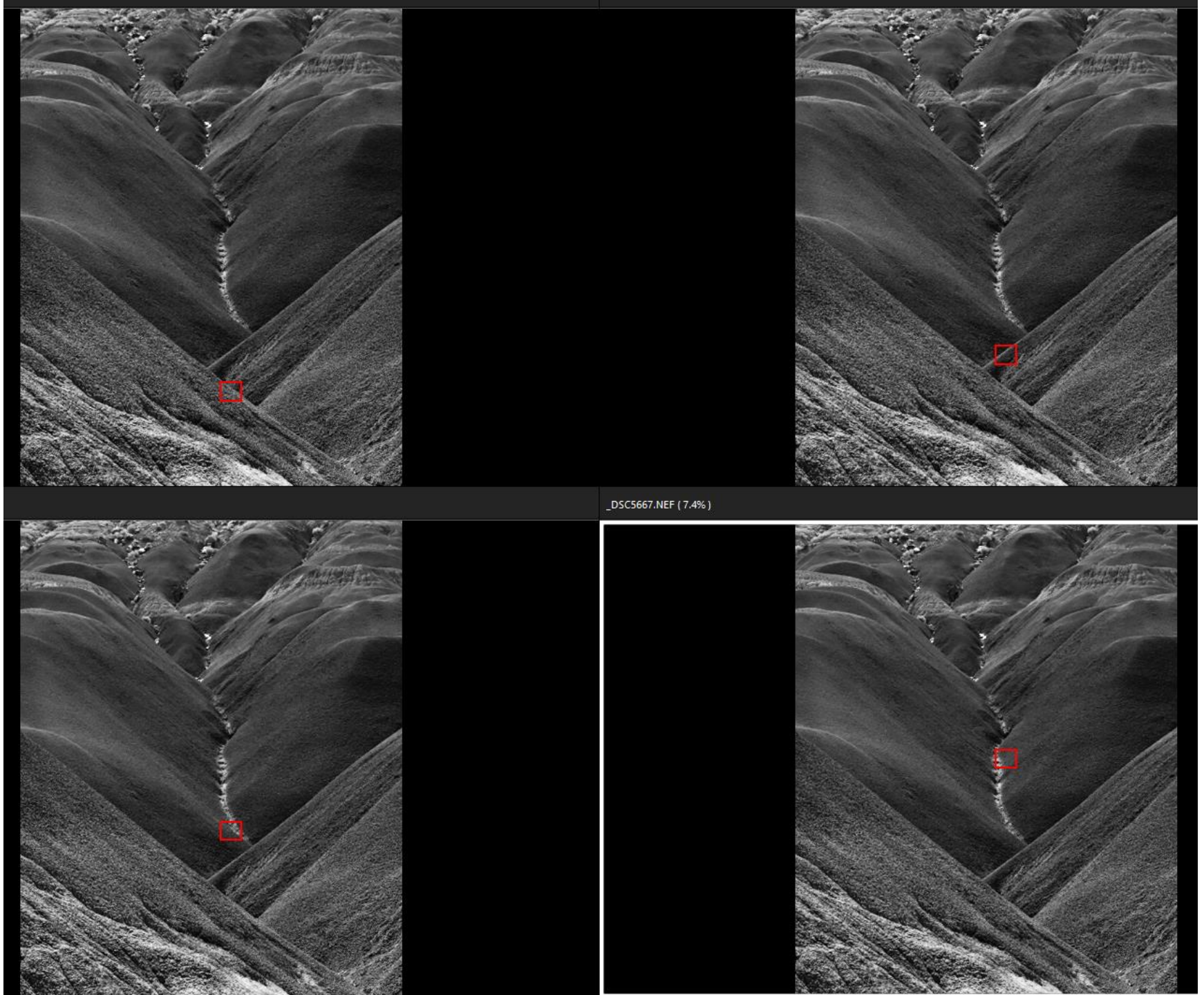
The Black Place by Georgia O'Keeffe



The Black Place by Dennis Fritsche

Nikon Z7ii
24-120mm/f4
@81mm
f/8
1/125
ISO 64

8 photo stack



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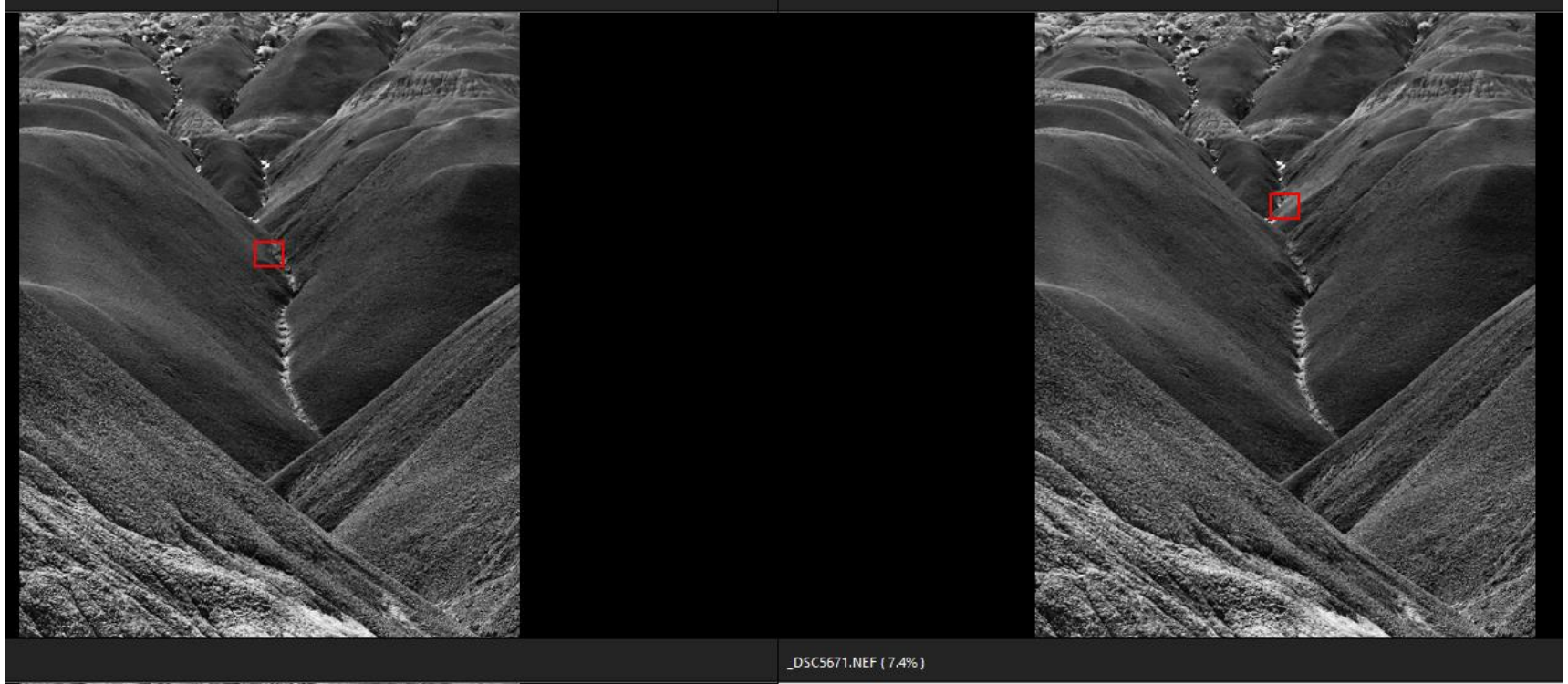

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Combining the Images Into a Single Image

1. Use Photoshop layers to mask and erase different parts of the image. Good for two or maybe three images. Free if you have Adobe Photographer Package.
2. Use Photoshop Blend tool. Works on any number of layers but slow for a great many. Free if you have Adobe Photographer Package.
3. Use specialty software.
   - Helicon Focus. Easy to use. Integrates with Lightroom. Can take RAW images and return a DNG.
   - Zerene Stacker. Favored by for ability to edit the stack.
4. They all work and all have problems now and again. Sometimes need to try different ones.

Processing Demonstrations

Photoshop layers and mask

Photoshop Blend

Helicon Focus

Questions?