

Extended Focus in Macro Photography

By Neal Immega

A fundamental problem with macro photography is getting enough depth of field to properly image the subject. Even when cost-is-no-object, photographers find that they cannot buy lenses with extremely large F-Stops (small iris) without running into the diffraction limitation*. An F-64 lens is at the limit, and even it does not have enough depth of field.

Software Solutions: Let's say you want a photo of a spiny trilobite, and all parts of it are to be in focus. The obvious answer is to take multiple pictures of the trilobite with the focus at different positions and combine them. You can do this with Adobe Photoshop, but the software is expensive and the process a pain. I have found an excellent solution to the problem with the CombineZ5 (for version 5) program written by Alan Hadley. AND, it is free. An excellent review of three of the programs that will combine photos can be found at http://www.outbackphoto.com/workflow/wf_72/essay.htm

The Technique section at <http://www.outbackphoto.com> is full of useful techniques that might not have occurred to you. I highly recommend the Web site.

The home Web site for CombineZ5 is on the Web site of <http://www.hadleyweb.pwp.blueyonder.co.uk/CZ5/combinez5.htm>

Since Web sites change a great deal, it is useful to know that you can find this by putting "CombineZ5" into Google. You should check this site occasionally because Mr. Hadley is actively developing new software all the time. You may download all the software from this site. I have mirrored the software on the Houston Gem and Mineral Society site because it is so useful, and I want to make sure that we have a working copy. [Click here for downloadable files.](#)

The CombineZ5 program is complex, and the instructions sketchy. The process that I present here is a way to get work done with a low learning curve. It will take you a great deal of time to get to the next level where you can do everything that Mr. Hadley say you can do.

Shoot your pictures from a tripod. You may take your successive focus pictures by moving the focus screen so that the auto focus point is on different parts of the trilobite, or you may change the focus setting from near to farther away. I have found it hard to take more than 4 pictures that are significantly different with my Minolta A200 lens at a 200 mm setting.

Running the program: Download the software, the help files, and the examples. The file *CombineZ5.exe* does not need to be installed. It just runs. You will need to have *fftw3.dll* in the same directory on your hard drive as *combinez5.exe*. The file *gdipplus.exe* is needed if you have a pre-Windows XP machine.

You will need to install a macro that I have customized for large pixel files: "**Do Stackbig.mac**"

Do the following steps:

1. Execute (run) *combinez5.exe*
2. Load in **A.jpg** from the **eldredgeops** example with **File > New** and then find **A.jpg**
3. **Macro > Edit Macros**
4. Click on **Do Stack**
5. **Load Macro**
6. Select **Do Stackbig.mac** (from the combinez5 program directory), then click on **OK**
7. **X** (cancel) the macro list
8. Exit the program with **File > Exit**

Let's run the Elredgeops example. You will be using 800 x 600 pixel files to speed up the processing. The program handles 8 megapixel files just fine, but they take longer. The files are labeled A, B, C with

the A file having the area closest to the lens in focus. You may name your files with letters or numbers, but they must sort in focus order—near to far.

Simple Case

File > New - load A,B,C jpg

Macro > Do Stackbig You will be presented with an image. If this is satisfactory, then you are nearly done.

Save the final picture with **Save Frame As**, or you may save all the steps with **Export Rectangles**.

The program can adjust easily for size and position differences, but if you have a tilt between images, you will need a manual process.

Manual Align

When CombineZ5 runs, it makes a log window called **CombineZ5 Progress**. Scroll through the file and find the **Align all Frames** section, **Second Pass**. If the scale = 1.0000, the auto align process worked perfectly. However, suppose the scale is less. Look at the images with the Up/Down Arrow keys and see if they are too bad. You might want to zoom in by making a box with the cursor and right-clicking with the mouse.


Suppose you need to do a manual align. Reload your files. Read the helpfile *18points.htm*. Basically you pick two points on image A and the same two points on image B and tell the program to register the points on top of each other. Do steps A and B and then B and C in that order.



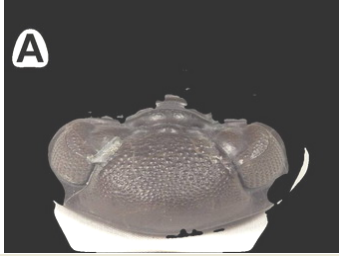
Then go run **Macro > Do Stackbig**.


Editing

You probably will find that the program does a nearly perfect job of selecting which file has in-focus pixels.

That is not to say that it is perfect. Suppose you need to edit the images. You will see these headings at the top of the CombineZ5 window. I have labeled each file internally with the letters A, B, and C.

Command	Vfull	Vfullplane	A1	Picture
File/New load your images				
Macro/Do Stackbig	New-out999		New-out999	
This is your unedited output				
P				This turns on the editing mask.
Edit the masks as you see fit.		Zoom in on a part of the image with the mouse and then click right. Click on the black areas to reveal the image. Right-click when you are done and then press <Esc>. You flip between A,B,C masks with the Up/Down key. Remember that typing B allows you to change the brush size. Read the help file <i>12editing_pixels.htm</i> .		

Command	Vfull	Vfullplane	A1	Picture
Up/Down to C mask		Picture	C	
Frame – new from visible		Copy998-picture	Copy998-picture	
Up/Down to B mask		Picture	B	
Frame - new from visible		Copy997-picture	Copy997-picture	
Up/Down to A mask		Picture	A	
Frame – new from visible		Copy996-picture	Copy996-picture	
P				Turns off the masks.
Up/Down to C mask	Copy998-picture		Copy998-picture	
Frame – make transparent (no)	Copy998-picture		Copy998-picture	Makes the black areas null.
Stack – choose frames – don't use frames below	Copy998-picture		Copy998-picture	.
Rectangle – paste active over	Copy998-picture		Copy998-picture	Only add the 3 frames with the masks

Command	Vfull	Vfullplane	A1	Picture
Frame – new from visible	Copy995-picture		Copy995-picture	

Note that the editing process produces a picture that is not as polished as the one produced automatically. It has shadows where the other one is smooth. Do a **Save As** to get the final output.

Run the spiny trilobite and accept the defaults, and see what you get. Often you do not need to edit the images.



*diffraction limit – The problem is that light acts like a wave when it goes through a hole. Stopping down a lens increases the depth of field, but light going through extremely tiny holes diffracts, and the image becomes blurry. F64 is about the limit for 35 mm lenses. Digital cameras have a much smaller sensor

size than the active size of 35 mm film (24x36 mm) and so have a diffraction limit smaller than F64. Even if you could bypass the diffraction limit, a lens for 35 mm cameras that would stop down to F256 still would not have enough depth of field to put this trilobite uniformly in focus. The photographer who takes pictures of the minerals at the Houston Museum of Natural Science uses a camera with 3x5 sheet film and an F128 lens. He says that he has about \$20,000 in his equipment, and he uses film exclusively for the final shot. These pictures were shot with a Minolta A200 digital camera, which will stop down to F11.