“Focus Stacking”

How To Get More Depth Of Field, Sharper Subjects, And/Or Smoother Backgrounds

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“Focus Stacking”

How to get more depth of field, sharper subjects, and/or smoother backgrounds?

- Step 1) Shoot multiple images with changing focus.

Step 2) Run all those through a computer to “pick out the sharp bits”.

- This only works with subjects that don’t move.
Introduction to Focus Stacking

Computer Software
You Can Make It Sharp Everywhere
Or Sharp Just Where You Want It

Canon T1i, 27 mm f/11, focus stacked from 15 frames
f/11 and 38 frames, isn’t that like f/380?
No, it’s not. There was some fine print...

“Let there be light!” **

** Caveats and disclaimers:

1) Stopping down loses light, but you can make that up with longer exposures.

2) Stopping down also loses resolution, and there’s no way to get that back. (It’s one of those “laws of physics” things.)
Stopping Down Causes Diffraction Blur

- \( f/8 \)
- \( f/32 \)
- \( f/56 \)
- \( f/140 \)

\( f/8 \), stacked (2 images)
Let’s Look At Some Examples Of Focus Stacking

Stan Lane

Macro and Close-up Photography
Text and Photos by Michael Erlewine

Explore, Enjoy, and Protect the Planet

ENDANGERED?
WHO CARES?

DISCOVER
Showing The Focus Variation
First Output Shows Motion Artifacts
Fixing The Sky By Retouching
Finished Composite – Sharp Everywhere
Apparently Routine Closeup: DOF Control

A Similar Example: Some Forget-Me-Nots

Bart van der Mark,  http://www.flickr.com/photos/bartvandermark/4586315503/sizes/o/in/photostream/
Microscopy

Focus Stacking is Now Accepted by National Geographic...
It’s a *Varroa* mite, one cause of colony collapse disorder.
Summary So Far

Advantages:

• Can have (lots) more DOF while keeping sharpness

• Better control of DOF --
  Can have nicely blurred background with whole subject sharp

Disadvantages:

• Static subjects only

• Plan ahead...
Resources For Focus Stacking

• Software:
  – Photoshop CS4 and later, full version only
    (most commonly installed, but also the lowest quality for this job)
  – CombineZP (cheapest — freeware)
  – Helicon Focus (most famous — top of Google searches)
  – Zerene Stacker
    (most popular — more Flickr postings & Nikon Small World winners
     than all others combined)
Resources For Focus Stacking

(This list is not exhaustive...)

• Shooting aids
  – AF motor control
    • CamRanger (Canon & Nikon, wireless to smartphone, tablet, laptop, even desktop)
    • Helicon Remote (Canon & Nikon, multiple platforms, mostly wired, no iOS)
    • Magic Lantern (Canon only, runs inside camera)
    • DslrController (Canon wired to Android tablet or smartphone)
    • qDslrDashboard (Canon & Nikon, multiple platforms, mostly wired)
    • ControlMyNikon (Nikon only, Windows only, but very good)
    • Breeze Systems DSLR Remote Pro & NKRemote (Canon & Nikon on Windows, Canon only on Mac)
  – Automated focus rail
    • StackShot
Resources For Focus Stacking

• Websites:
  – http://photomacrography.net/forum
  – http://zerenesystems.com

• Rik Littlefield
  – support@zerenesystems.com
Where I Fit In...

1) Manage & edit a strictly non-commercial website dedicated to the photography of small subjects.
2) Develop & document ideas for techniques and equipment.
3) Design, code, document, and support Zerene Stacker.
Let’s Run Through A Full Example...

- Close up with some flowers in a garden
- Canon T1i DSLR with 18-55 mm kit lens
- CamRanger for wireless focus control
- Process in Photoshop
- Brief comparison with Zerene Stacker
Shooting With The CamRanger

Subject, Camera, and CamRanger (on tripod in garden)

Camera Controls and Live View (on Android tablet in kitchen)
CamRanger Connected To Camera

CamRanger (with built-in battery)

USB cable

Camera (with battery installed)
CamRanger Screen On Tablet
We Now Have A Stack

15 frames
Stacking In Photoshop

Load Files into Stack...
Stacking In Photoshop
Stacking In Photoshop
Stacking In Photoshop

In Photoshop, you can stack images by using the 'Load Layers' dialog box. This allows you to choose multiple files and load them into an image stack. You can specify the 'Use' for the layers, whether to attempt to automatically align source images, and whether to create a smart object after loading layers.
Stacking In Photoshop
Stacking In Photoshop

Auto-Align Layers...
Stacking In Photoshop
Stacking In Photoshop

![Stacking In Photoshop](image-url)
Stacking adds the masks
Stacking In Photoshop

Stacking adds the masks
Stacking adds the masks, but they’re not always very good...
Details by Zerene Stacker
Anyway...

Different packages have different characteristics.

Just try them and see which you prefer.

Enough comparisons... Let’s look at some more possibilities!
Feather In The Park:
Kit Lens, “Magic Lantern” Firmware
Macro Landscape Using Compact Camera

Canon A710
hung upside down
under a tripod
Macro Lens on Geared Tripod Head
Tabletop setup:  macro rail & lens
More options...a hand-driven screw table

Producing An Image Like This

John Hallmén, http://www.johnhallmen.se/studio-stacks/3xixz6bjwv1cichn9dyw6zxmrnwt6
My Personal Passion Is Small Things
This is a common “bluebottle” fly.

0.001 mm resolution,
3.75 mm depth of field
“looks like SEM, but with natural colors”
For small things, focus stacking is critical

Stacked composite

What You Can See At One Moment
Here’s The Setup That Shot The Fly

Almost all this stuff can be purchased at Amazon!

- “StackShot” automated rail
- Canon T1i camera
- Nikon microscope objective
- Vivitar telephoto (“tube lens” for objective)
- Canon 580 EX II flash
- Manfrotto 819-1 arm
- Adorama 2-axis rail
- Giottos mini ballhead
- Slik 504QF II tripod
- Cut, drilled & painted 2x4 wood
Feather On A Table

62 frames, shot at 5X on sensor using A/F motor focusing with microscope objective
4.4 mm total field width

This crop, ½ mm = 1/50 inch
Manual focus step to 0.5 µm (one wavelength of green light)
Visionary Digital’s BK Plus System
GIGAmacro’s package deal

**GIGAmacro**
Professional Imaging System

- Canon T2i DSLR Camera 18MP with USB Interface
- Precision Z Axis with Quick Release Camera Plate
- Flexible Light Positioning Arms
- Ultra Bright LED Color Calibrated Lighting with Active Cooling
- Precision NEMA 23 Micro-Stepping Motors (XYZ)
- Embedded Electronics & Control Panel
- Precision Linear Bearings & Hardened Steel Rails
- Canon 100mm Macro or Canon MPE-65mm Lenses
- Telecentric Optics for Parallax Correction
- Home & Limit Protection Switches
- Aluminum Structure & High Durability Surface Area
- Computer with Capture, Stacking, Stitching, & Viewing Software
- Quick Positioning USB Controller

Released Nov 2011
Four Chambers Studio
GIGAmacro.com
Or Reverse a Standard Zoom Lens

This is a shockingly simple and cheap way to get high magnification with useful quality.

Fotodiox reverse adapter, $7.95 and free shipping at Amazon.com
Low-tech approach

“Typical setup I use for flower bits shots”

Brian Valentine (username “LordV” on Flickr)
Brian’s result: “Fuchsia Anthers”
Macro Stacking with the CamRanger
The Result (one frame)...
The Result (stacked from 71 frames)...
Closer...and rocking (from 1 stack)
Closer...and rocking (from 1 stack)
Closer... and rocking (from 1 stack)
Wing Scales of Sunset Moth

(*Chrysiridia rhipheus*, 20X objective, 128 frames @ 0.002 mm)
A Closer View of Those Scales

(about “500X”)
Single Frame versus Stacked

(Sunset Moth: *Chrysiridia rhipheus*, 20X objective, 128 frames @ 0.002 mm)
photomacrography.net has lots of descriptions of setups for macro/micro work
“The solutions are frighteningly simple when you see what can be cannibalised and bolted together”

Chris Raper (new stacker)

Built and photographed by Dr. Tony Thomas

As discussed at http://www.photomacrography.net/forum/viewtopic.php?p=94421#94421
The Bottom Line:

Just do whatever it takes
to get numerous images
from the same viewpoint
but in different focus planes
Remember These Examples...
Or This New One…

John Hallmén, field stack
Which Would You Rather Have?

Single shot, f/22

Focus Stacked, 25 frames @ f/8

Images courtesy George D. Lepp, 2/7/2013
One Last Time...
So, What Do You Want To Do?
Recap & References

• Focus stacking gives sharp images and large depth of field

• Recommended software:

• Web forum dedicated to photography of small things
  http://www.photomacrography.net

• For more information
  email: support@ZereneSystems.com
Zerene Stacker License Editions

- **Computers**: Windows, Macintosh, Linux, 32- and 64-bit, every license works on all platforms, mix & match is OK.

- **Upgrades**: just the difference in license price.

- **Updates**: free.

- **30-day Free Trial**: fully functional, all features, no restrictions, no registration needed.

- **Professional**: $289, allows unlimited sale of images, includes all advanced functions such as Lightroom plug-in, faster processing, built-in controls for StackShot.

- **Prosumer**: $189, hobbyists only, same features as Professional.

- **Personal**: $89, hobbyists only. Provides all key functions including retouching and 64-bit mode.

- **Student**: $39, same features as Personal.
To See The Slides Again...

This slide set can be found at http://zerenesystems.com

It’s in the “Tutorials” section, linked at the bottom of page.