

“Focus Stacking”

How To Get More DOF,
Sharper Subjects,
And/Or Fuzzier Backgrounds

Rik Littlefield

At the Tri-City Digital Photography Club, Kennewick WA, 2/7/2013

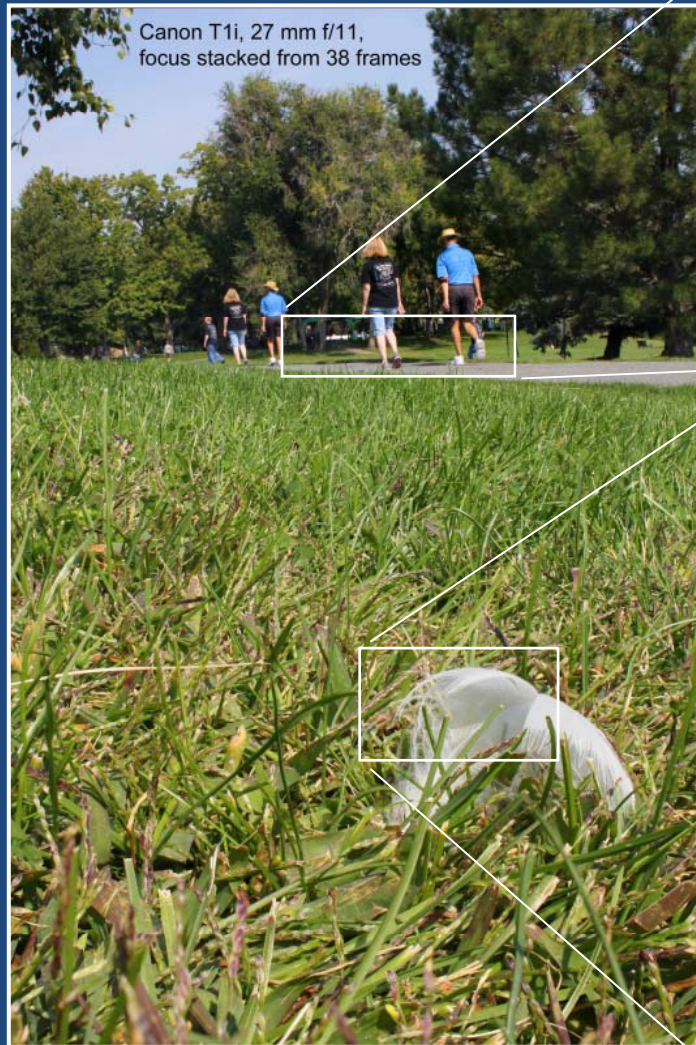
Introduction to Focus Stacking



Computer
Software



You Can Make It Sharp Everywhere

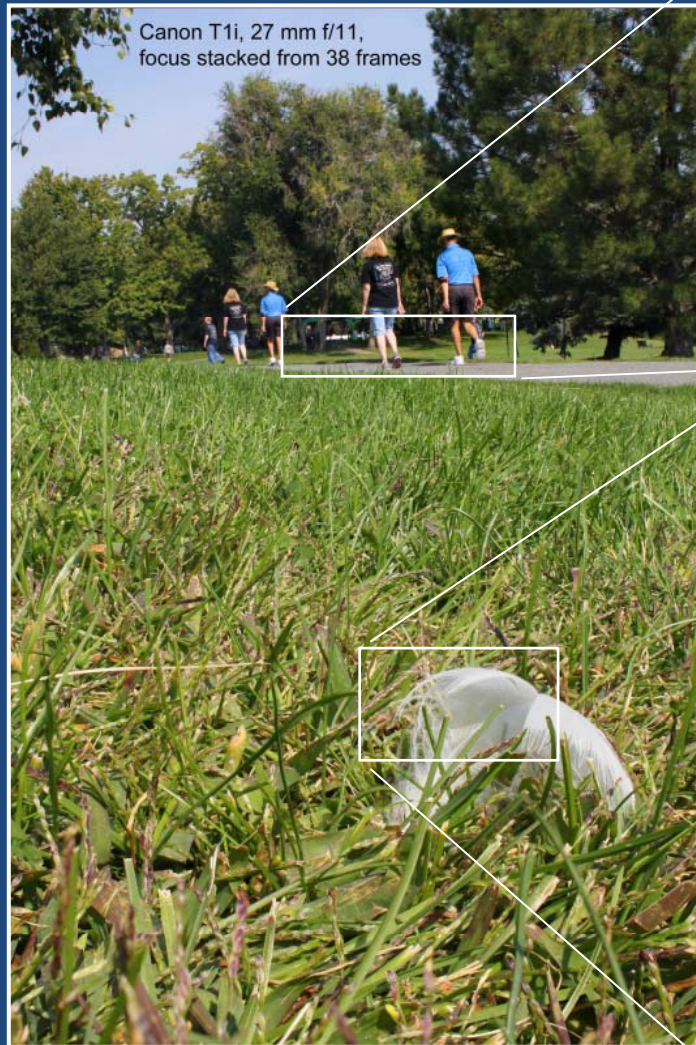


Or Sharp Just Where You Want It

Canon T1i, 27 mm f/11,
focus stacked from 15 frames



f/11, 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



$f/8$,
stacked
(2 images)



$f/8$



$f/32$



$f/56$



$f/140$



Let's Look At Some Examples Of Focus Stacking

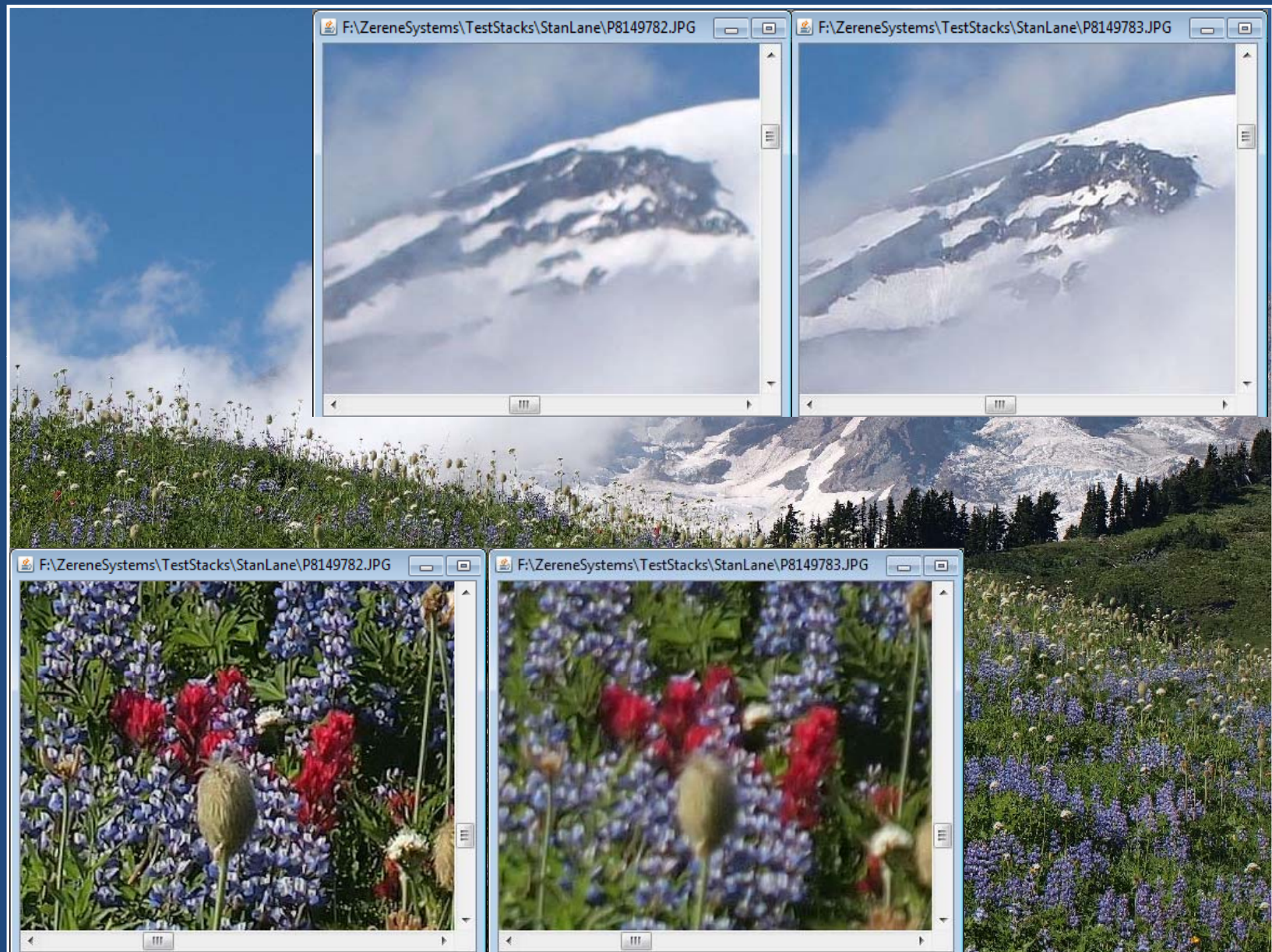


Mt. Rainier, 3 Frames



Image by Stan Lane

Showing The Focus Variation

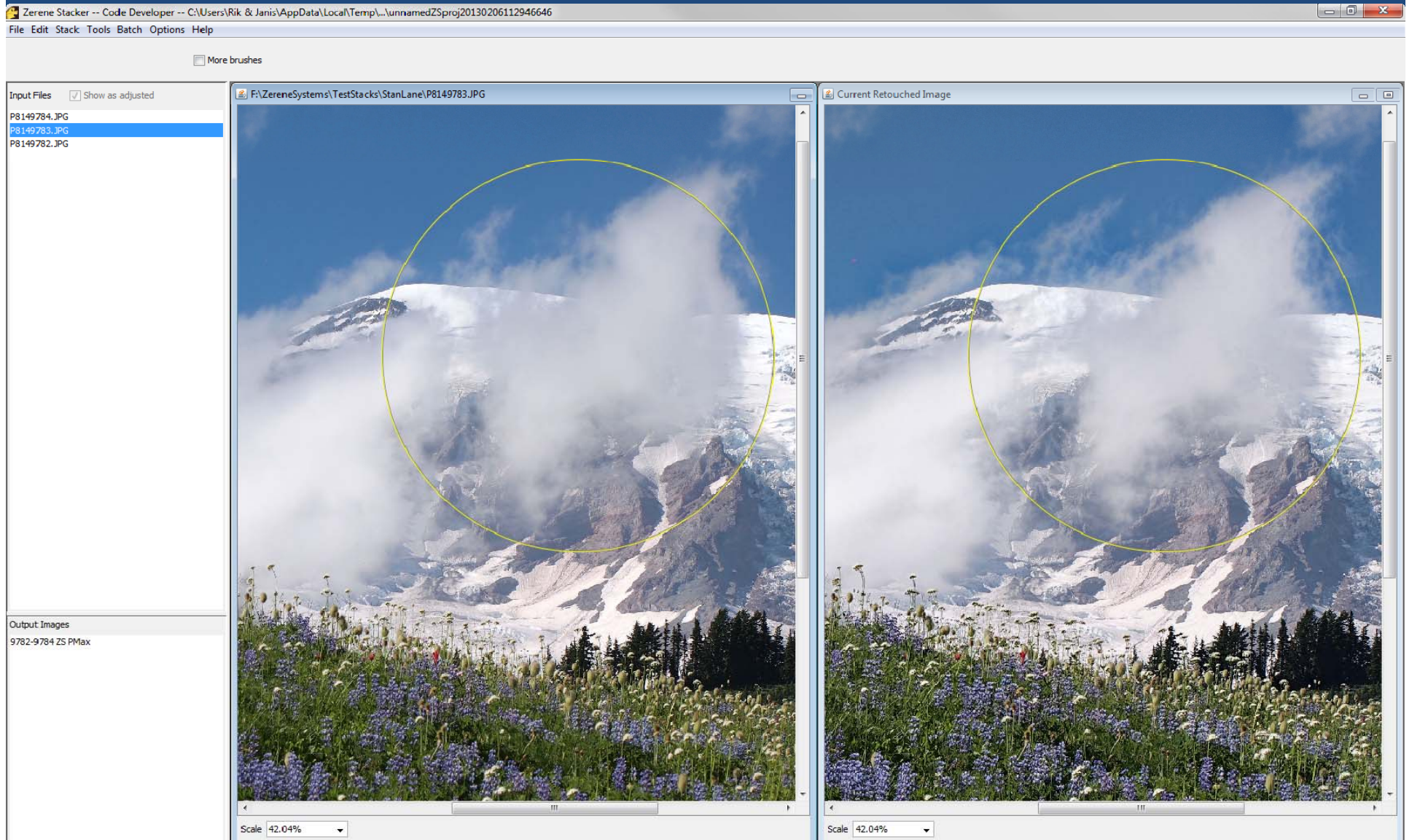


First Output Shows Motion Artifacts

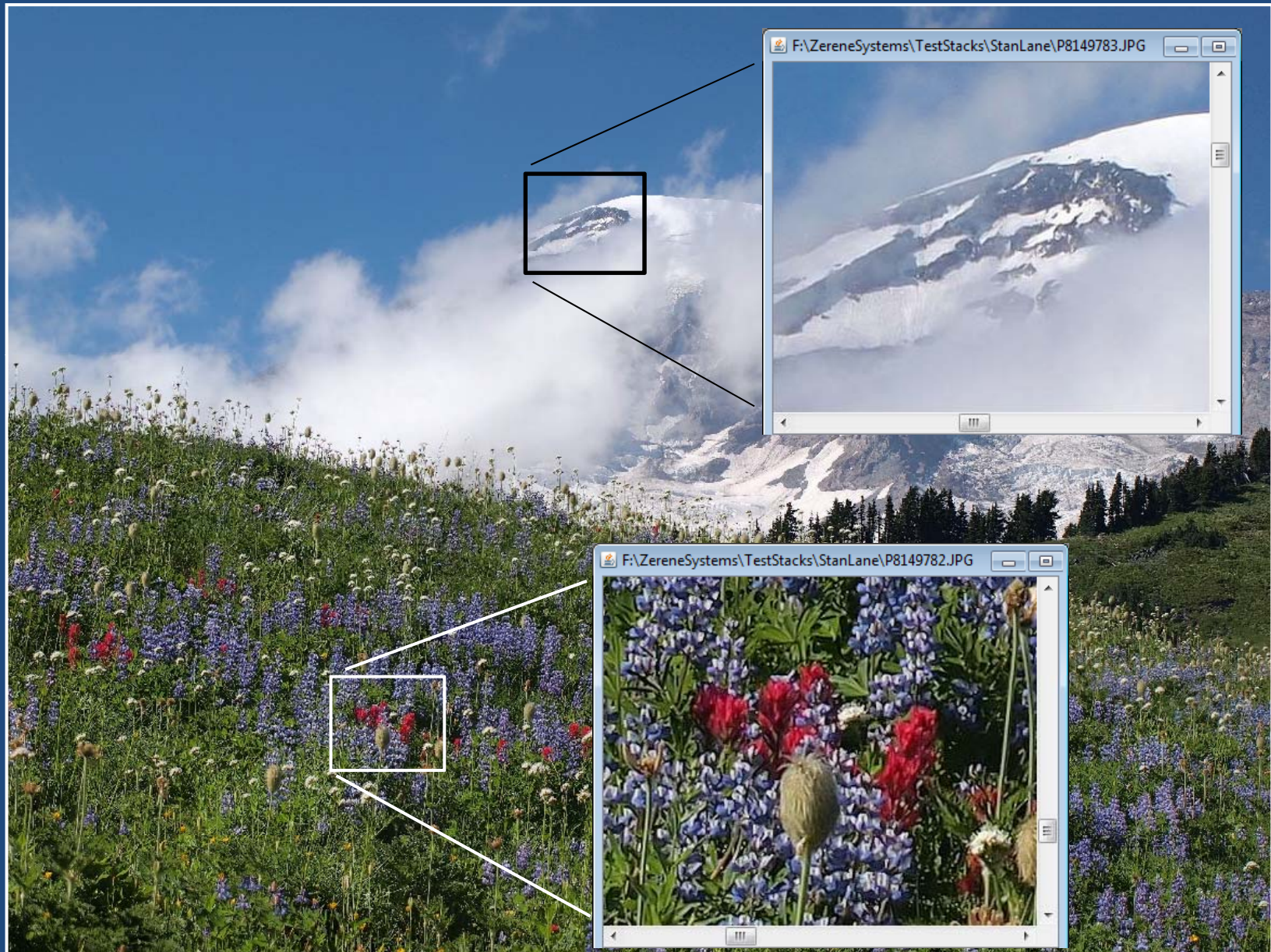
C:\Program Files\ZereneStacker\9782-9784 ZS PMax



Fixing The Sky By Retouching



Finished Composite – Sharp Everywhere



Mt. Rainier, 3 Frames



Image by Stan Lane

Apparently Routine Closeup: DOF Control



From “The Art of Focus Stacking”, Michael Erlewine, <http://macrostop.com>

A Similar Example: Some Forget-Me-Nots



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

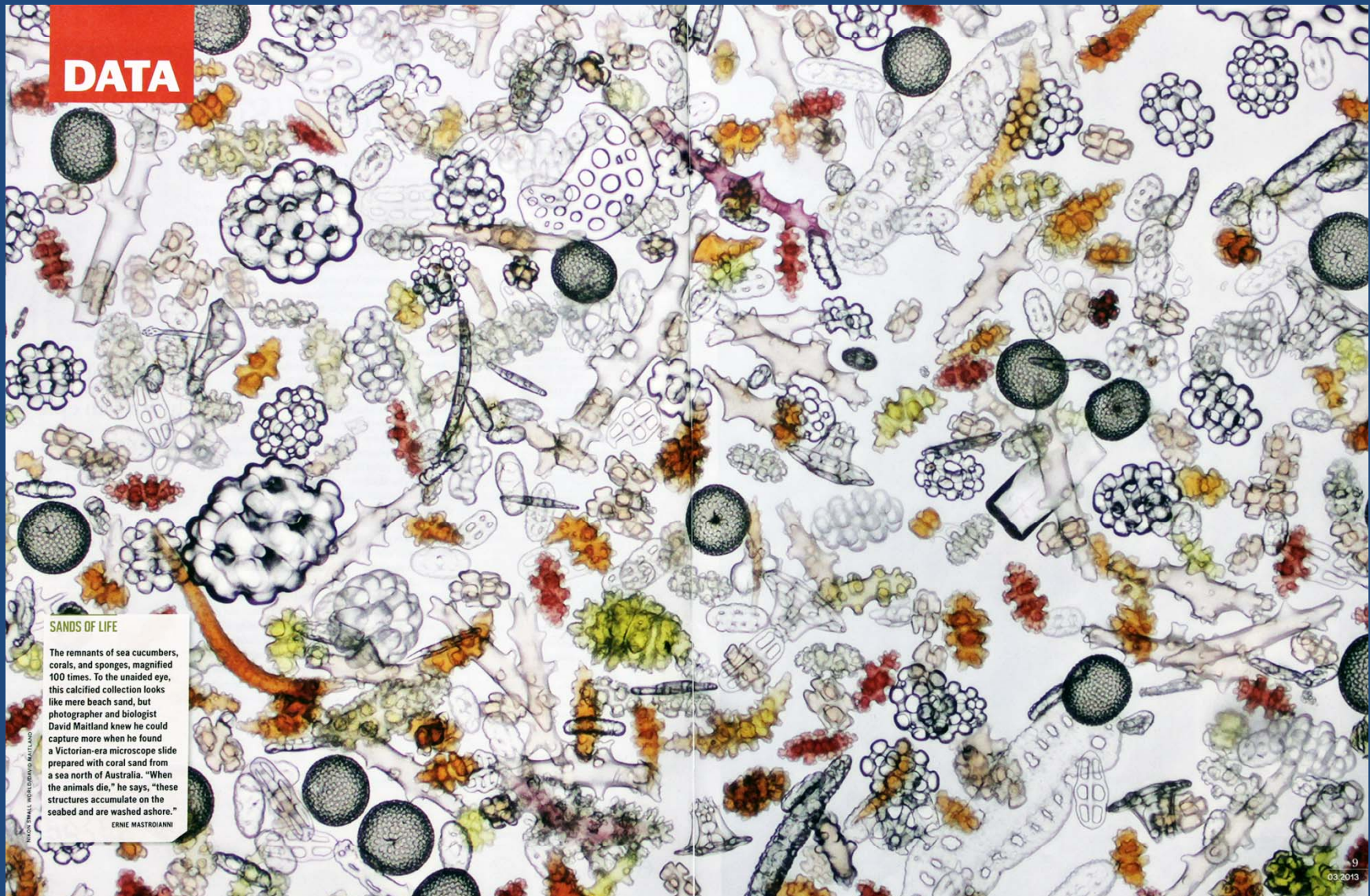
“Extreme Macro”



John Hallmén in Sierra Magazine.

See more at <http://www.morfa.se>

Microscopy



David Maitland in Discover Magazine, from
<http://www.nikonsmallworld.com/galleries/photo/2012-photomicrography-competition>

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...

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.



Resources For Focus Stacking

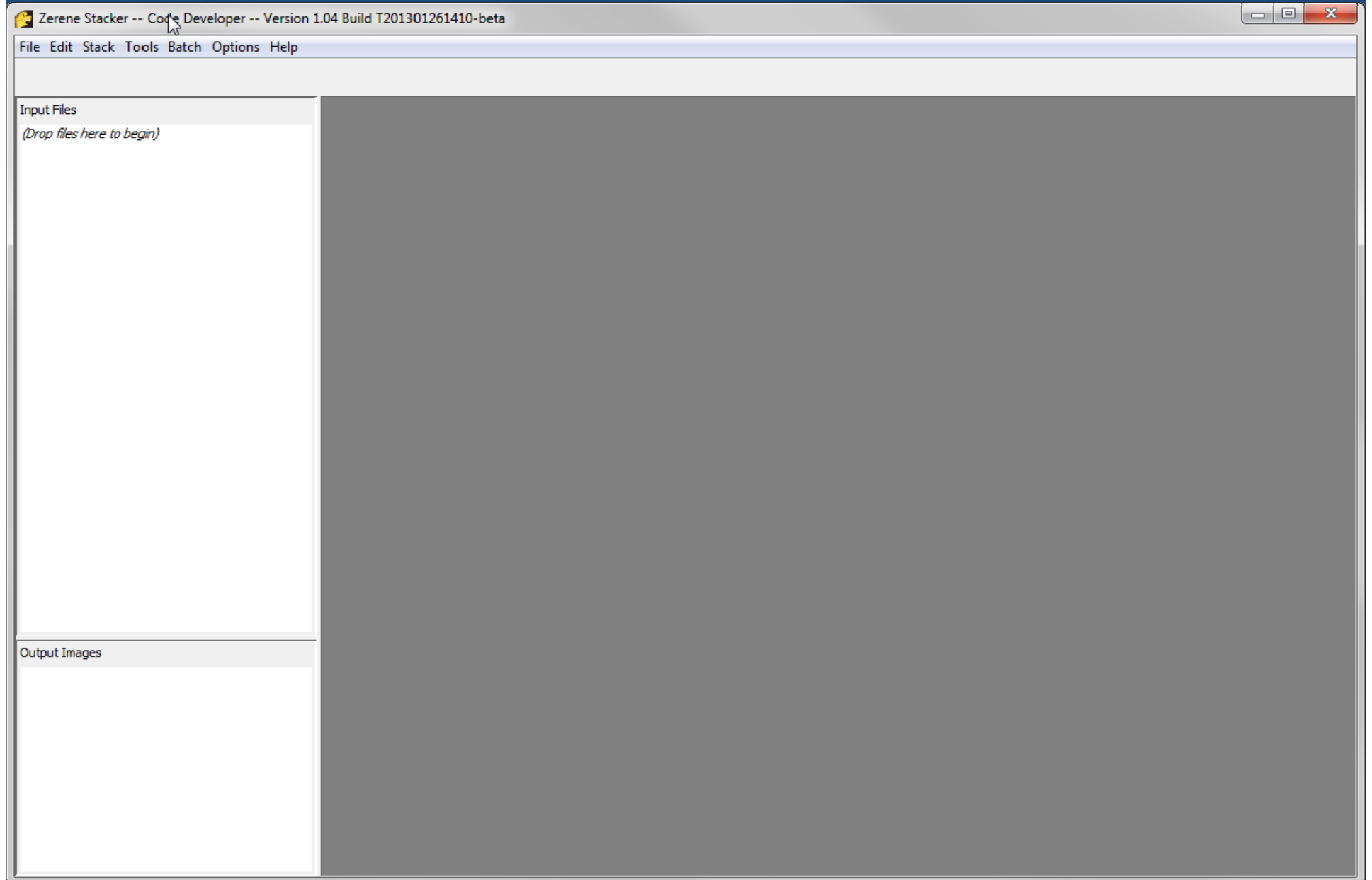
- Software:
 - Photoshop CS4 and later, full version only (most commonly installed)
(but also the lowest quality for this job)
 - CombineZP (cheapest — freeware)
 - Helicon Focus (most famous —top of Google searches)
 - Zerene Stacker (most popular — more Flickr postings than all others combined)
- Websites:
 - <http://photomacrography.net>
 - <http://zerenesystems.com>
- Rik Littlefield
 - support@zerenesystems.com

Break Time!

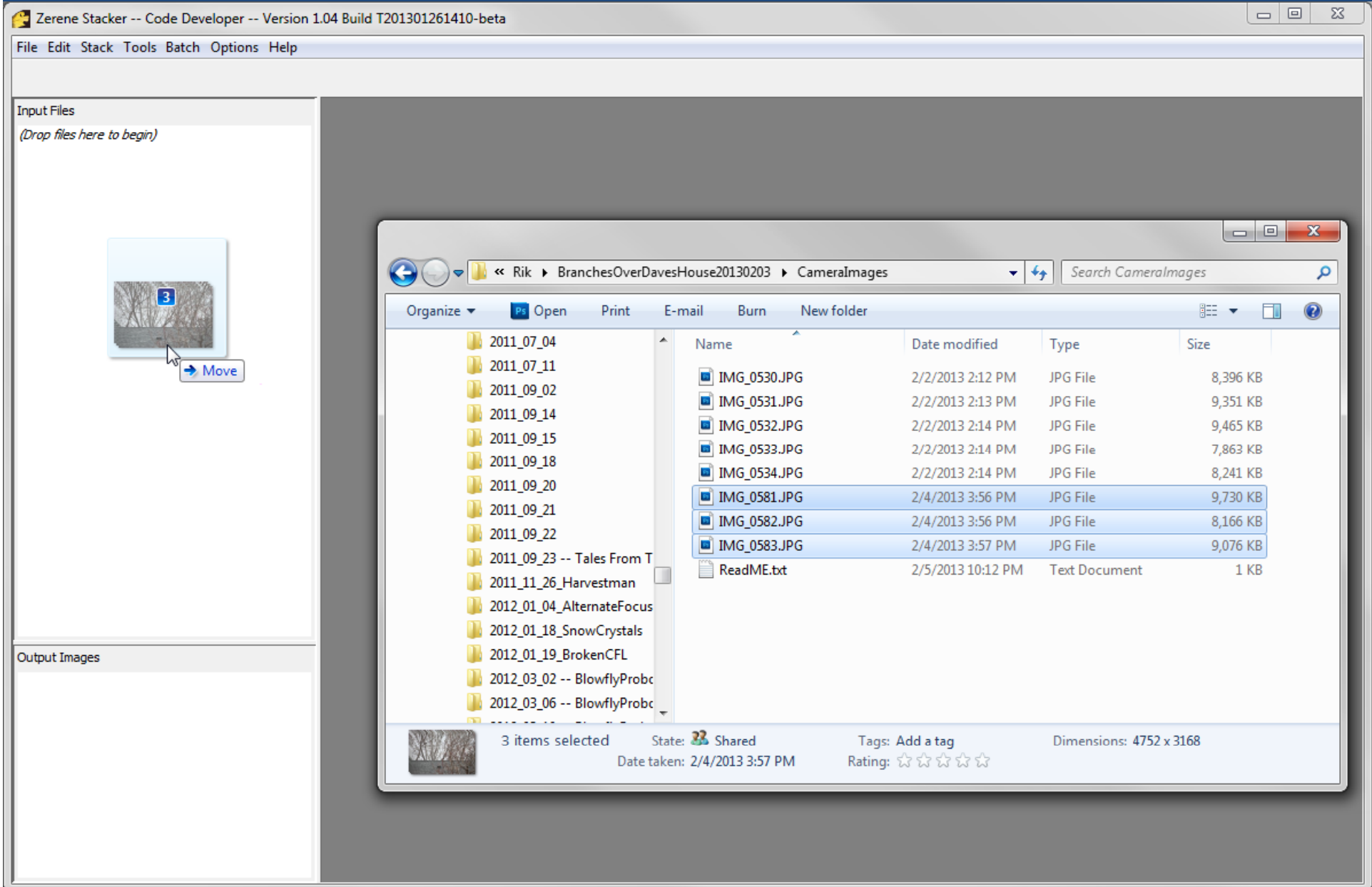
Zerene Stacker License Editions

- **Computers:** Windows, Macintosh, Linux, 32- and 64-bit, every license works on all platforms, mix & match is OK.
- **Personal:** \$89, hobbyists only. Provides all key functions including retouching and 64-bit mode.
- **Student:** \$39, same functionality as Personal.
- **Professional:** \$289. Unrestricted use, adds advanced functions such as StackShot control.
- **Upgrades:** just the difference in license price.
- **Updates:** free.

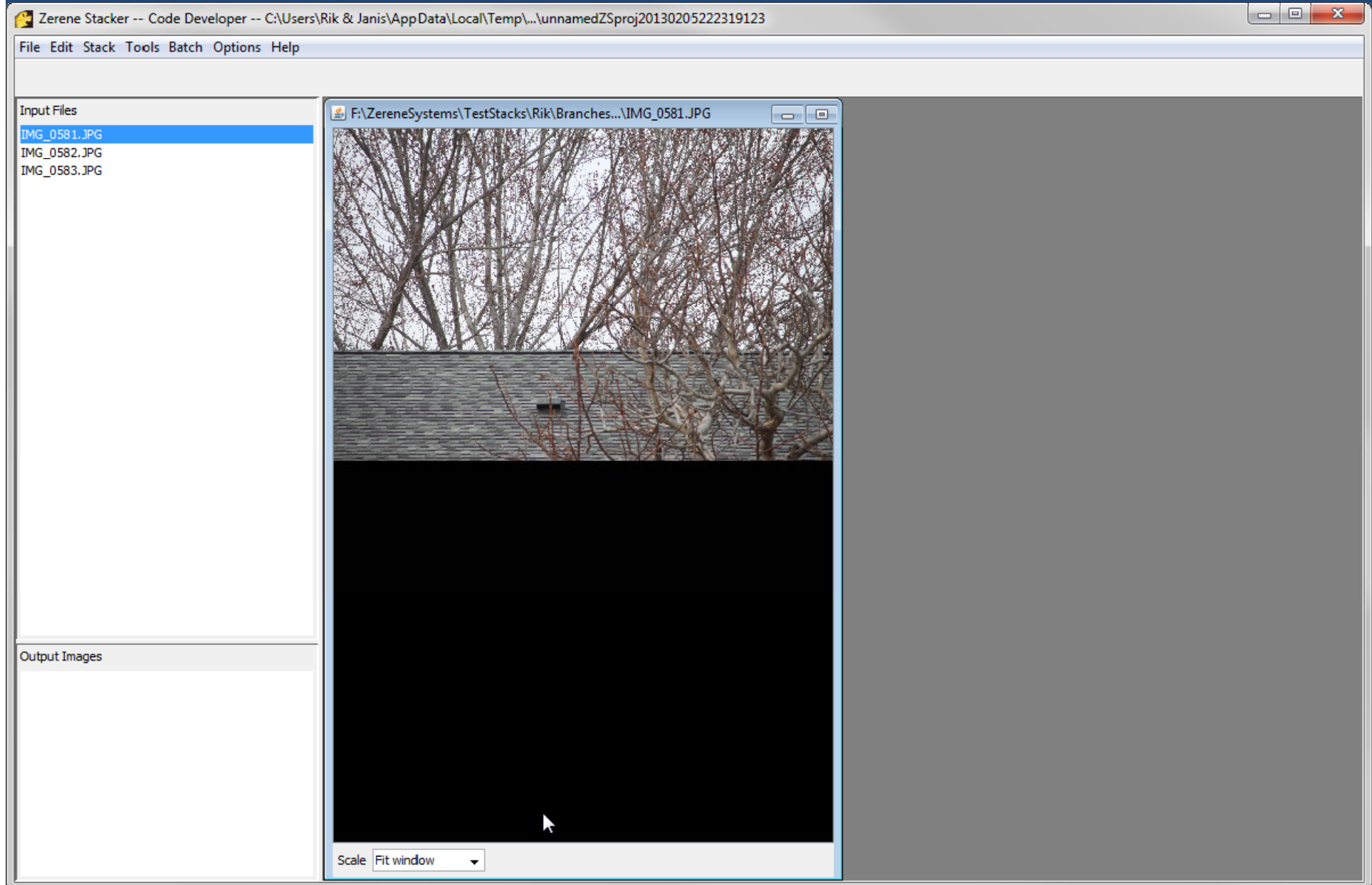
Zerene Stacker Workflow



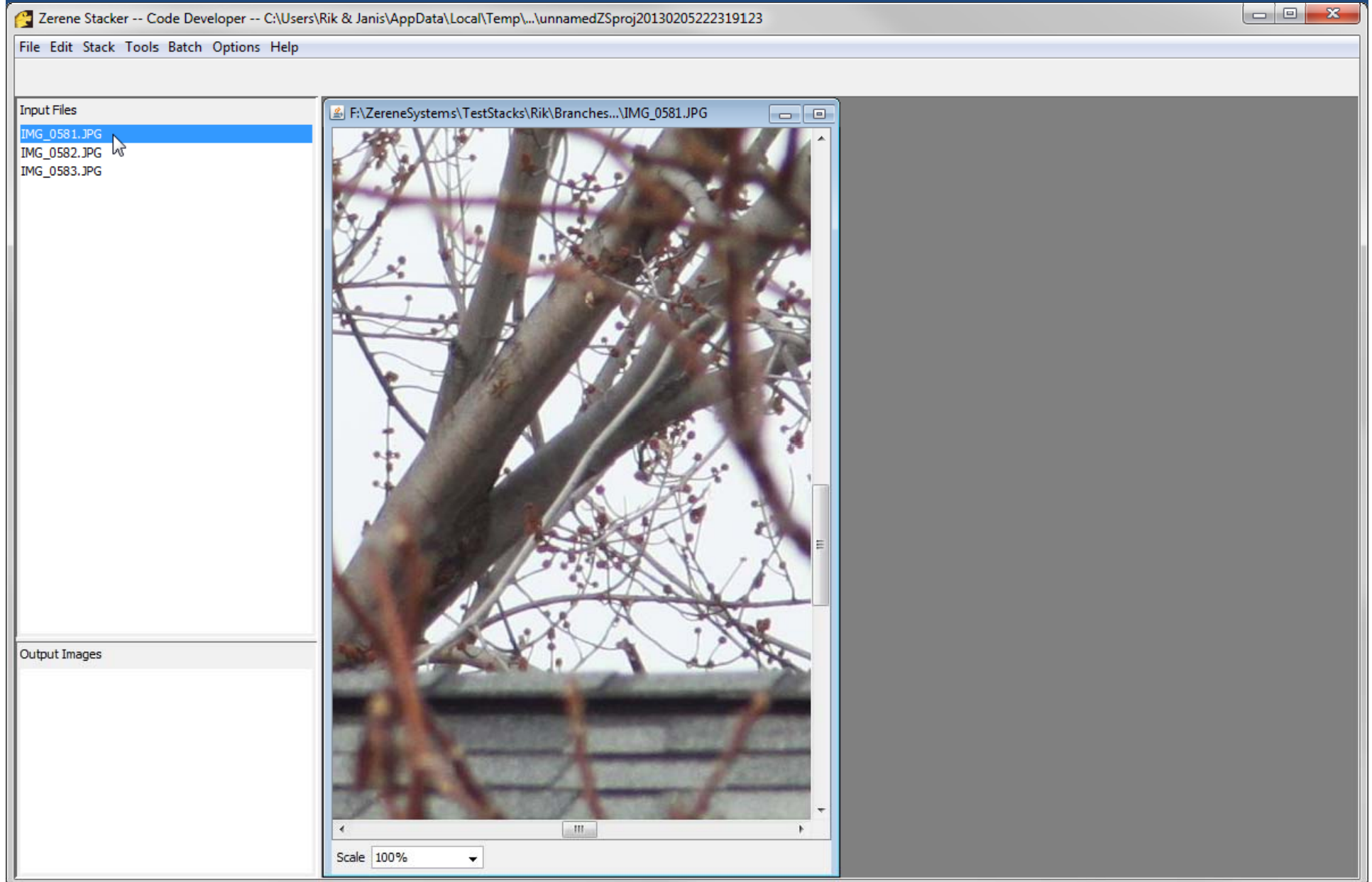
Zerene Stacker Workflow



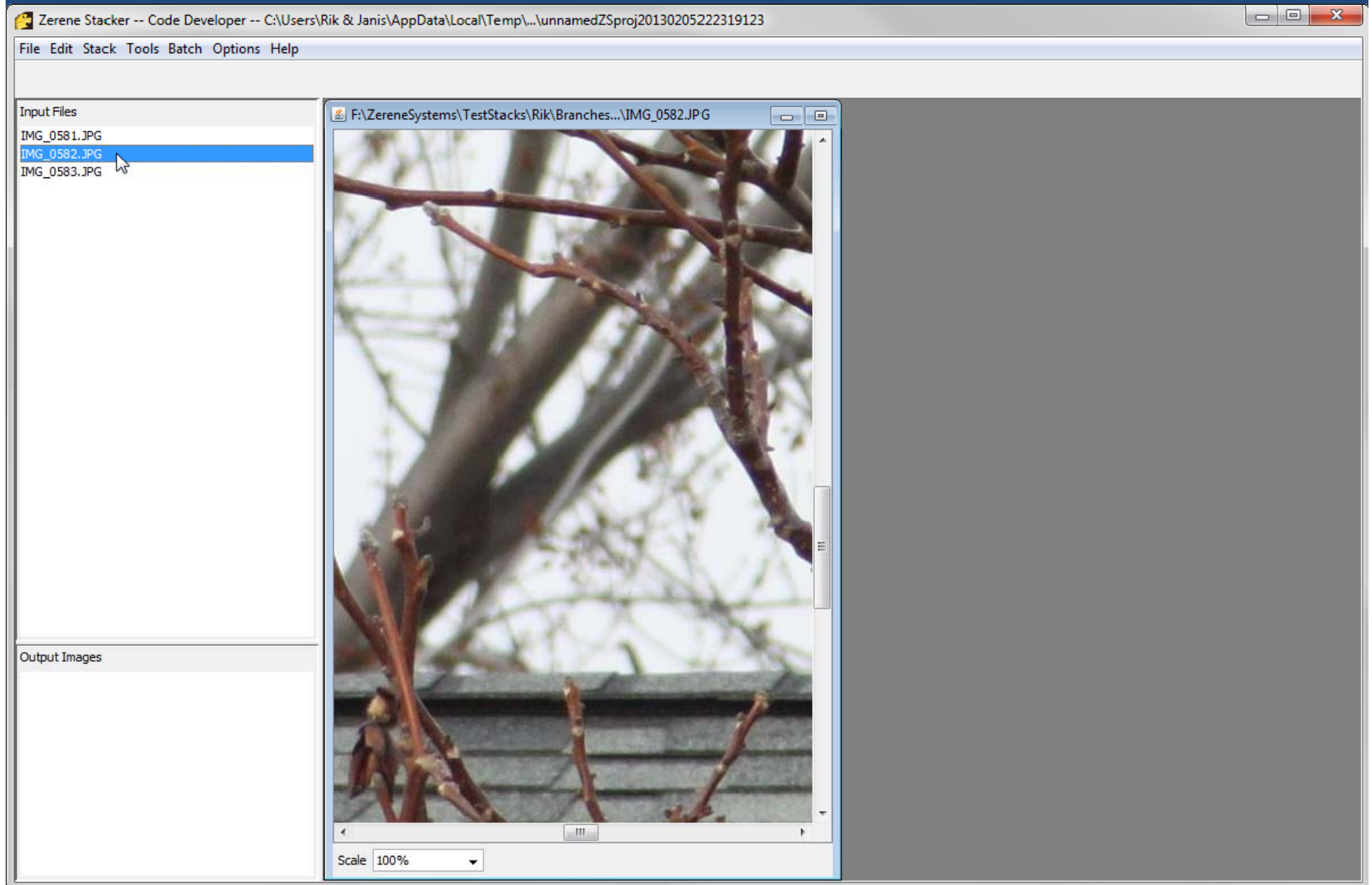
Zerene Stacker Workflow



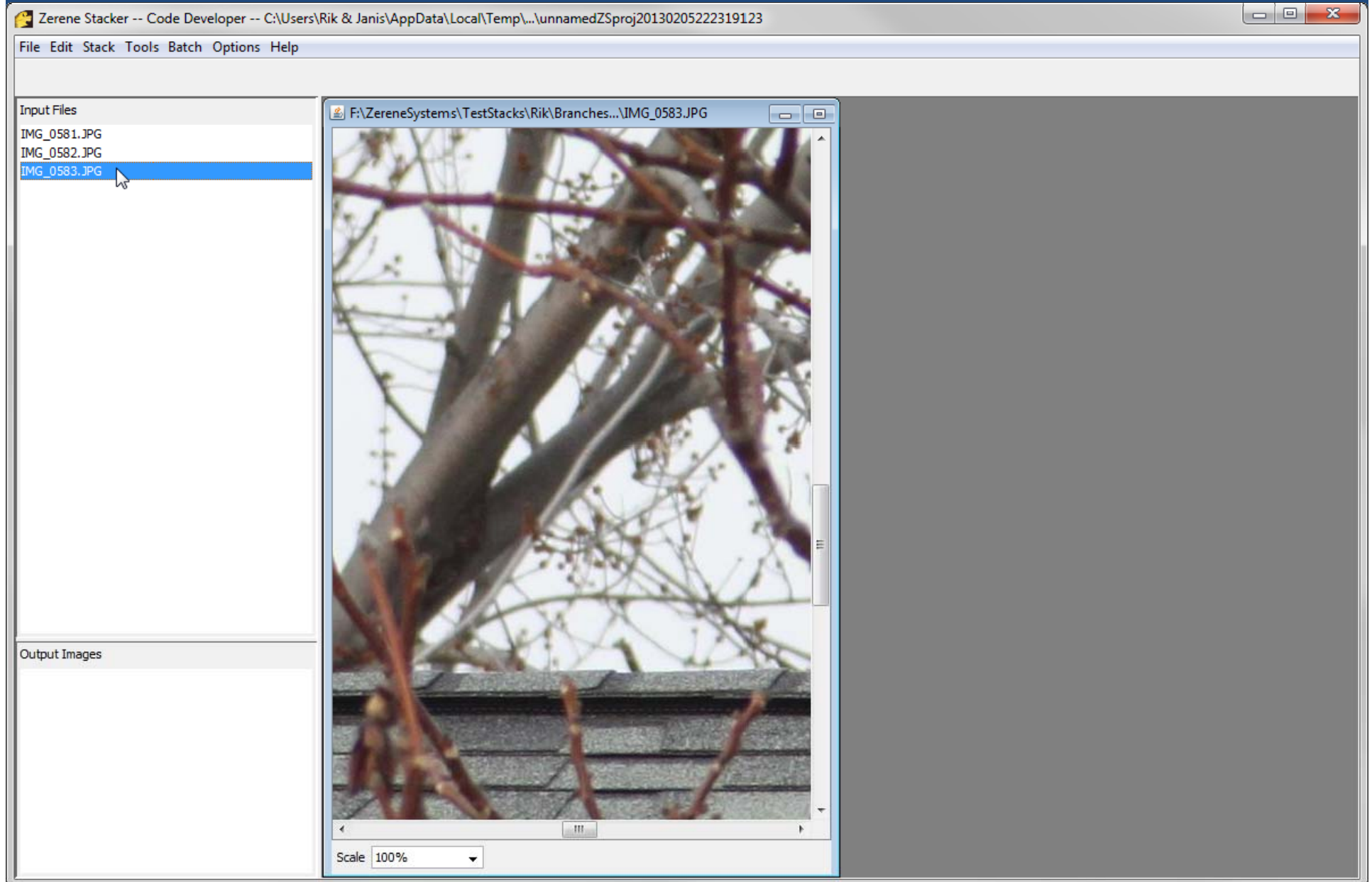
Zerene Stacker Workflow



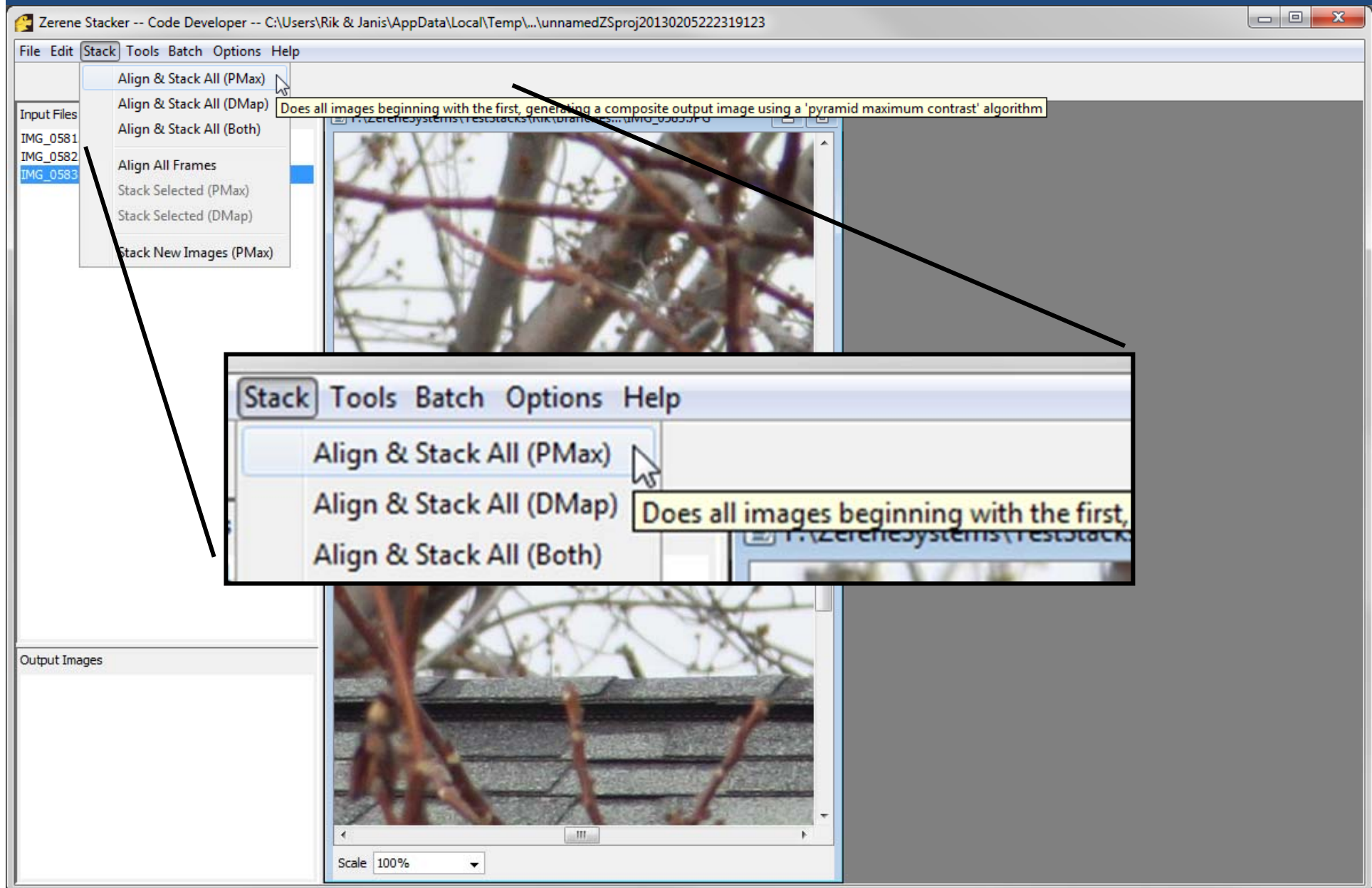
Zerene Stacker Workflow



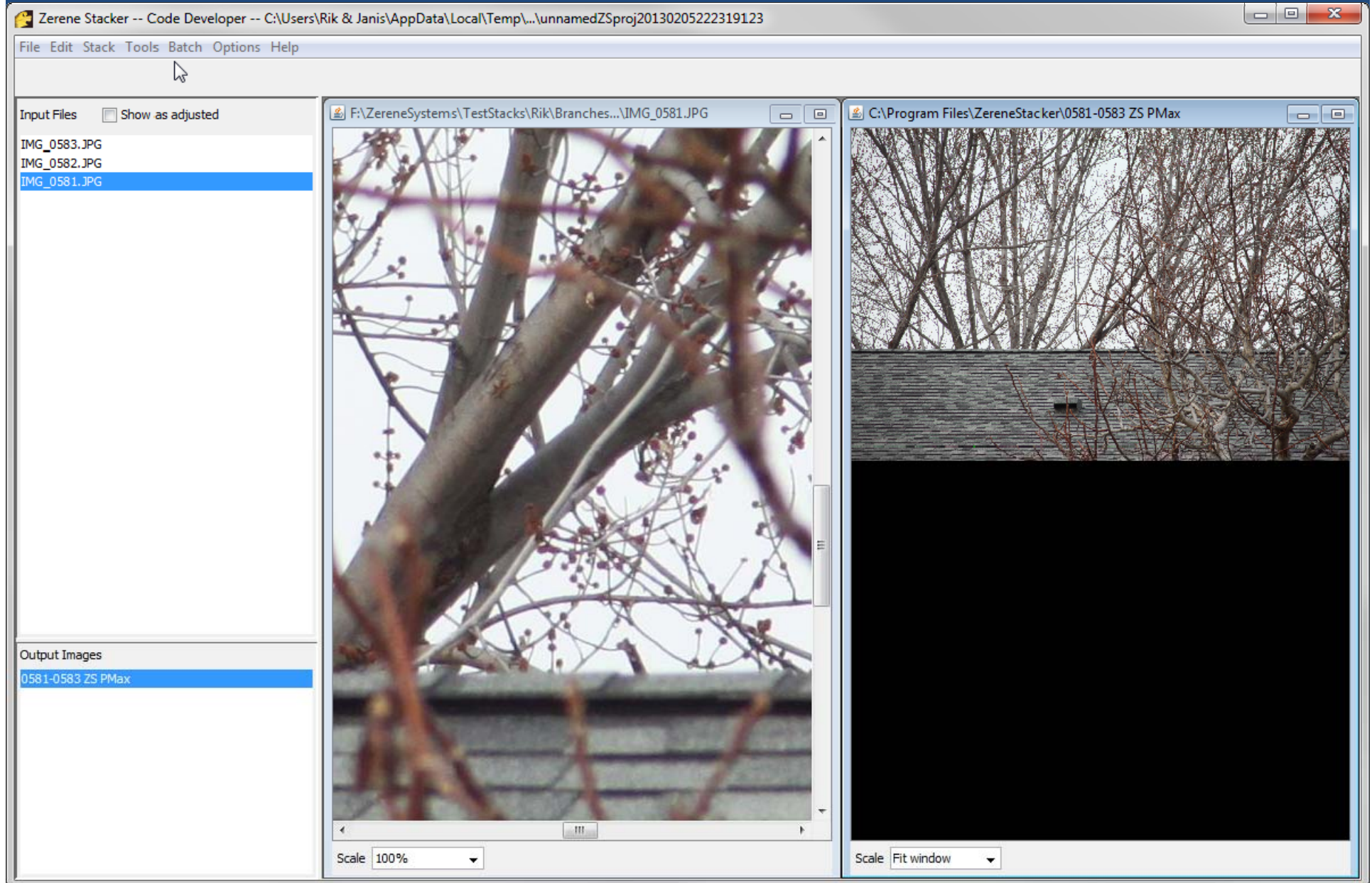
Zerene Stacker Workflow



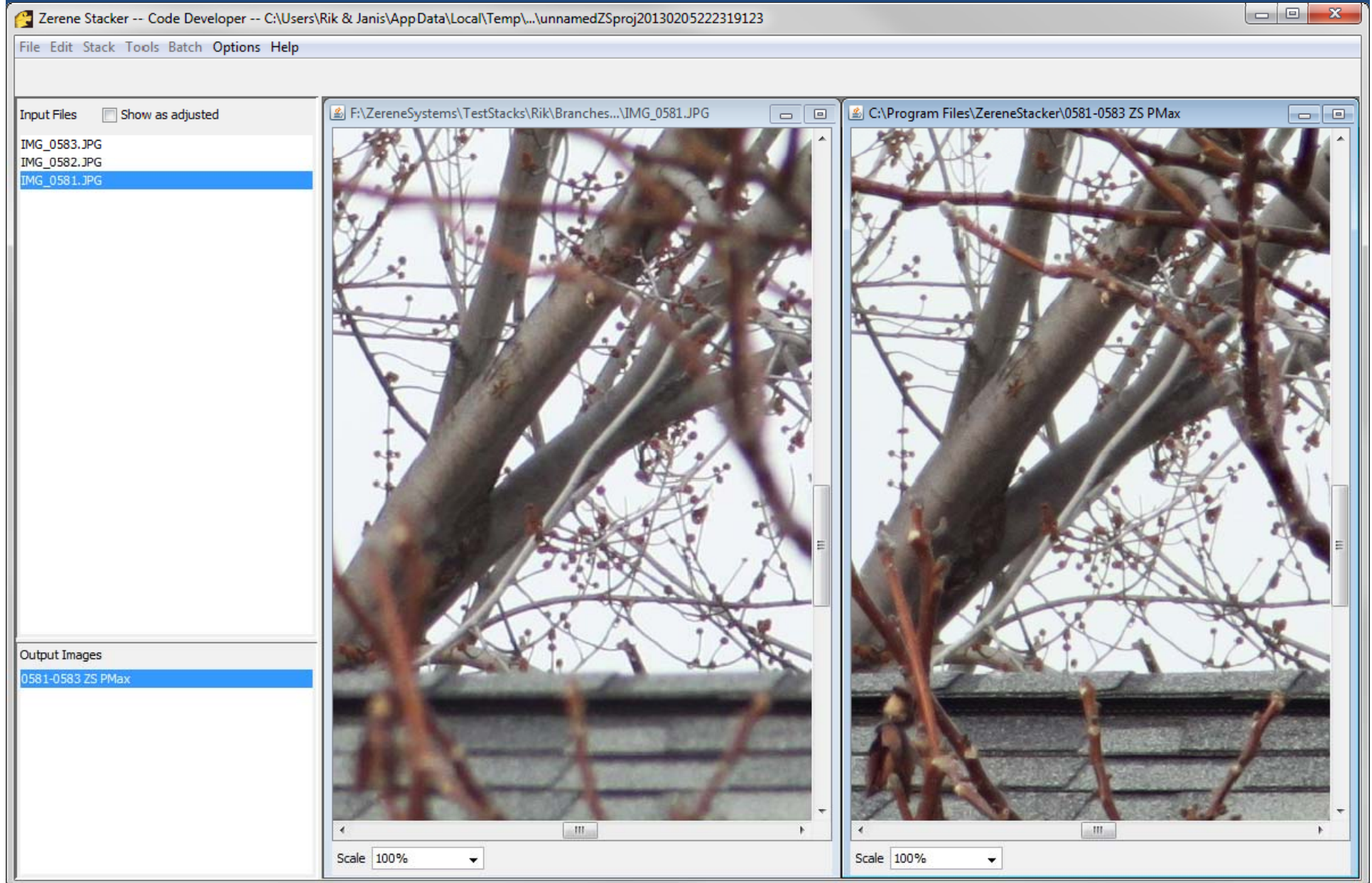
Zerene Stacker Workflow



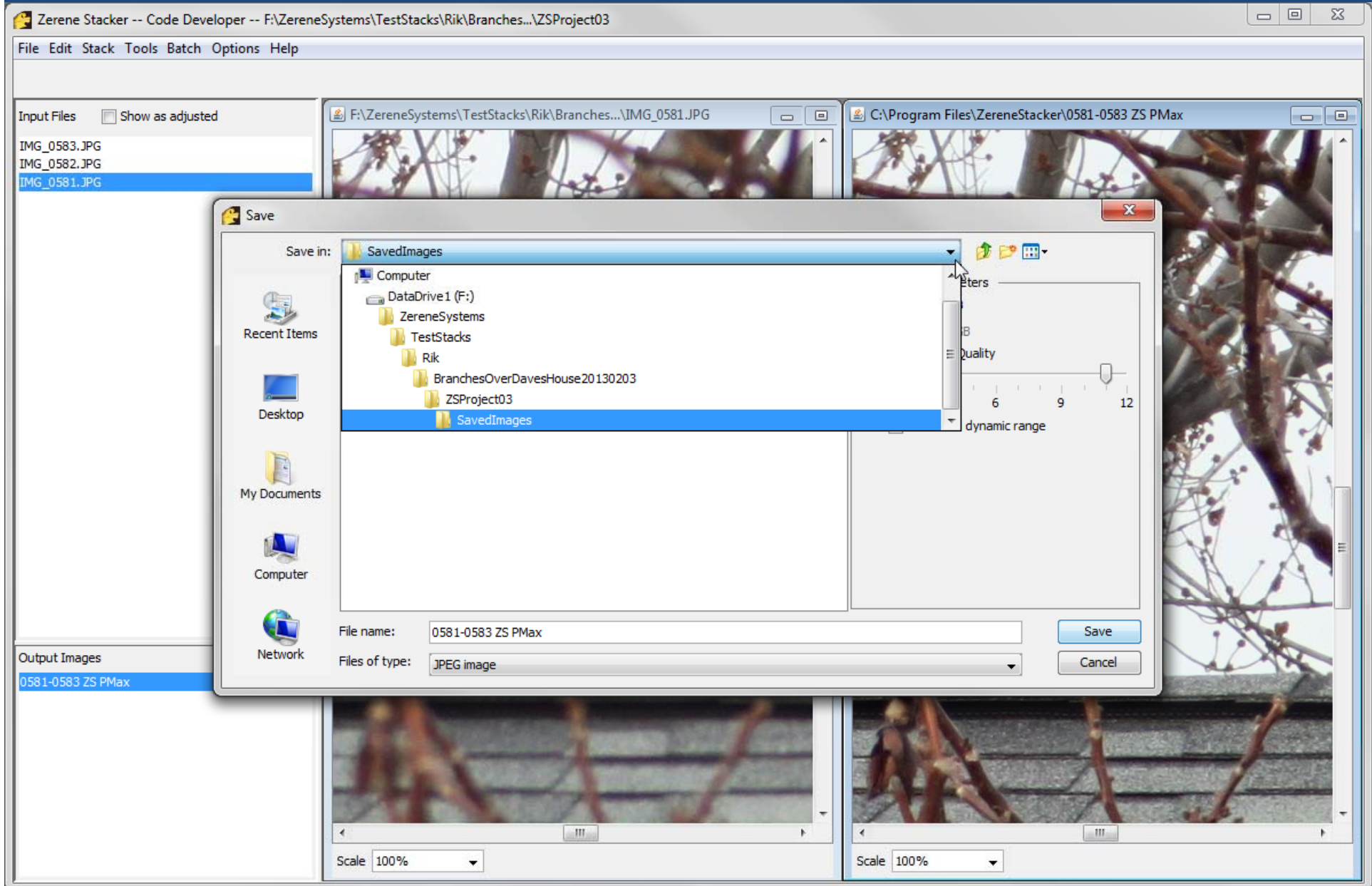
Zerene Stacker Workflow



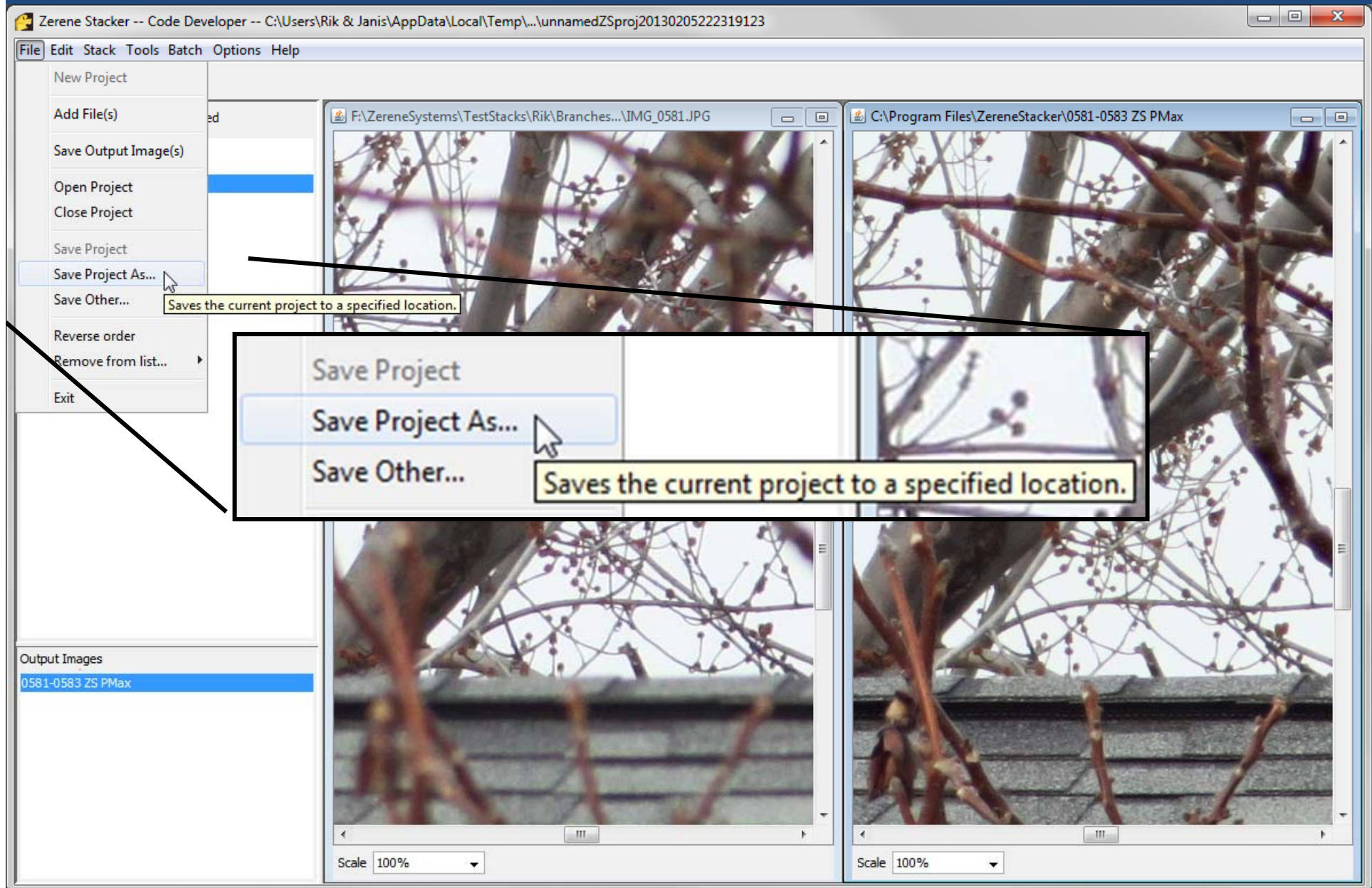
Zerene Stacker Workflow



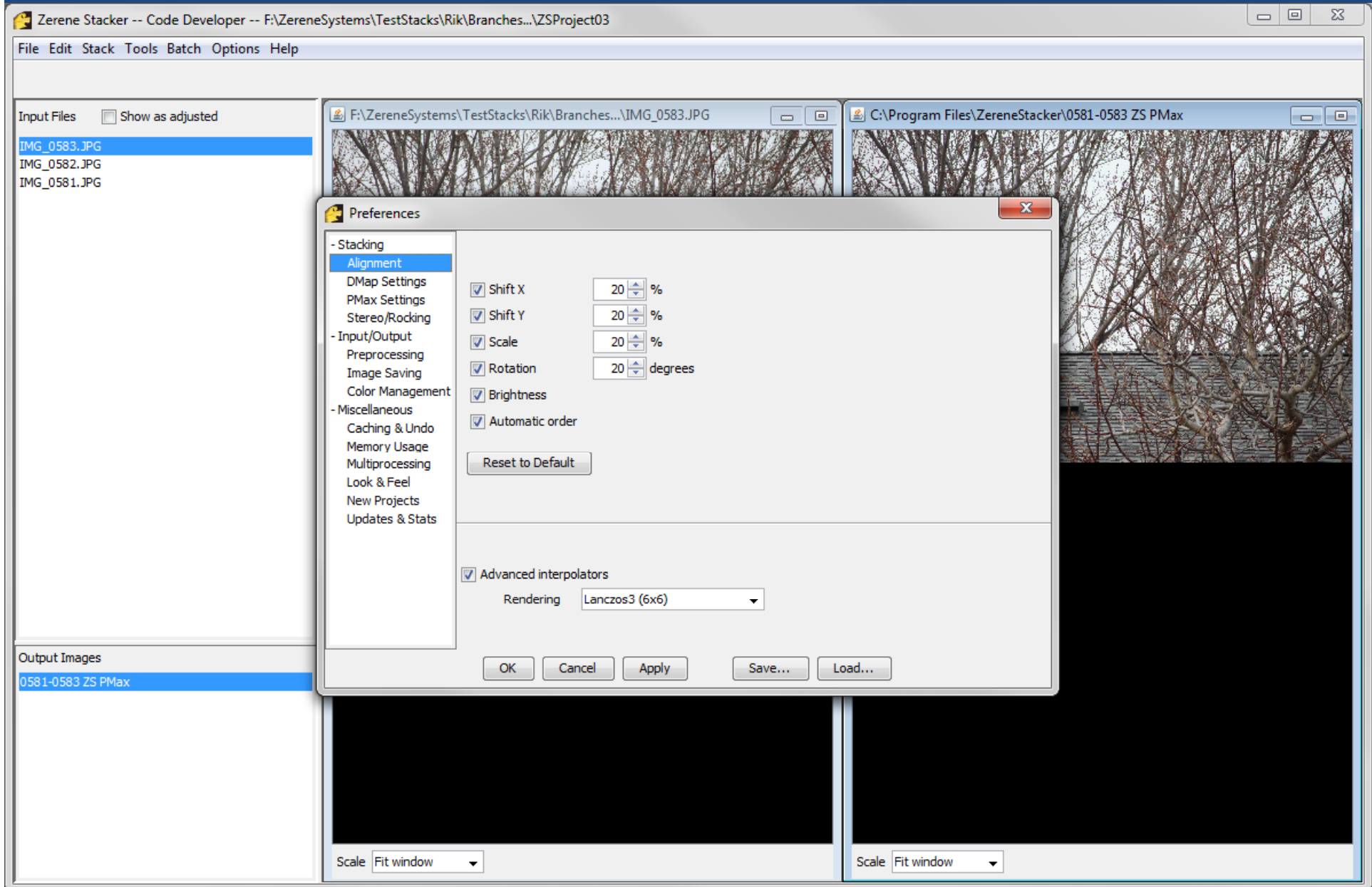
Zerene Stacker Workflow



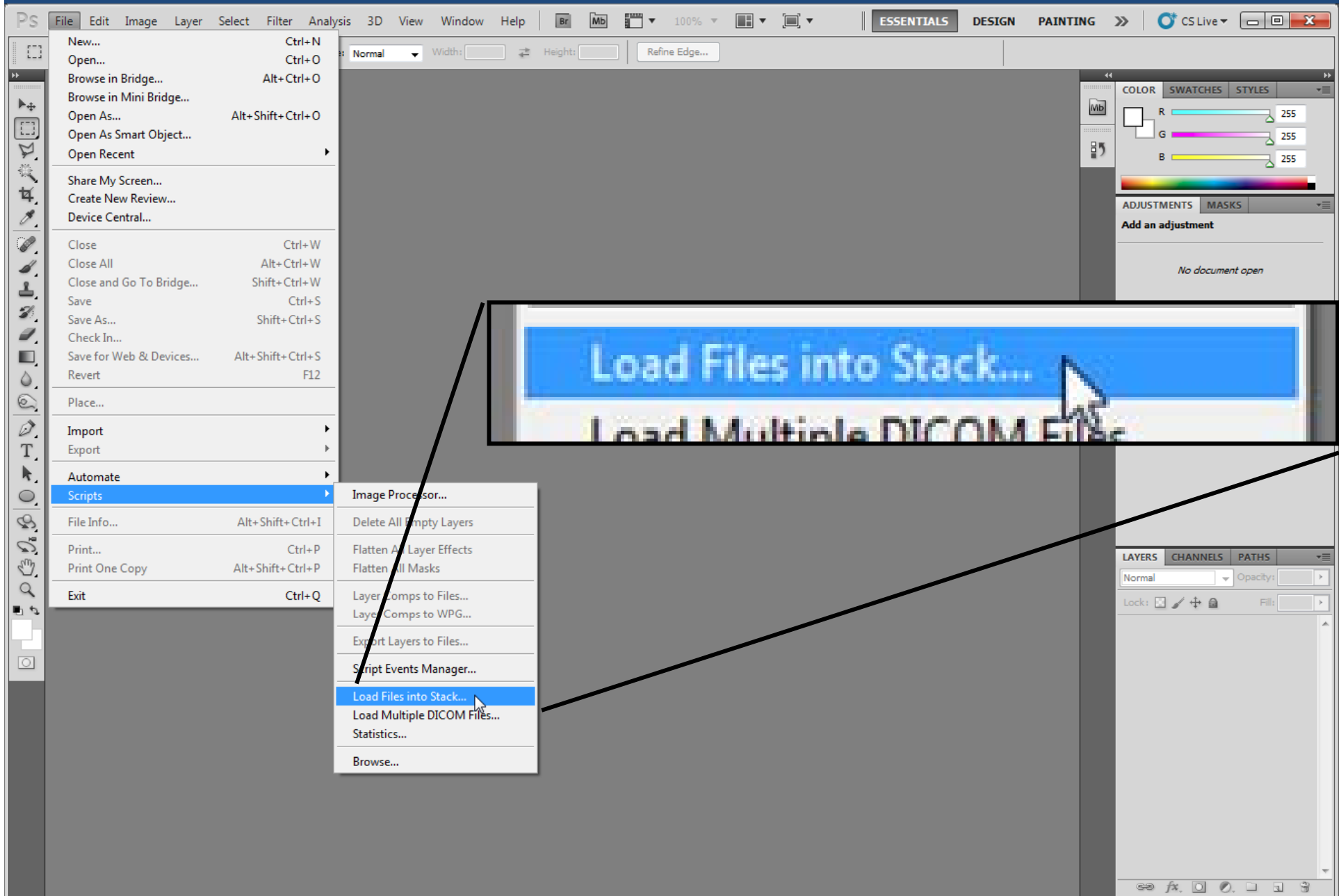
Zerene Stacker Workflow



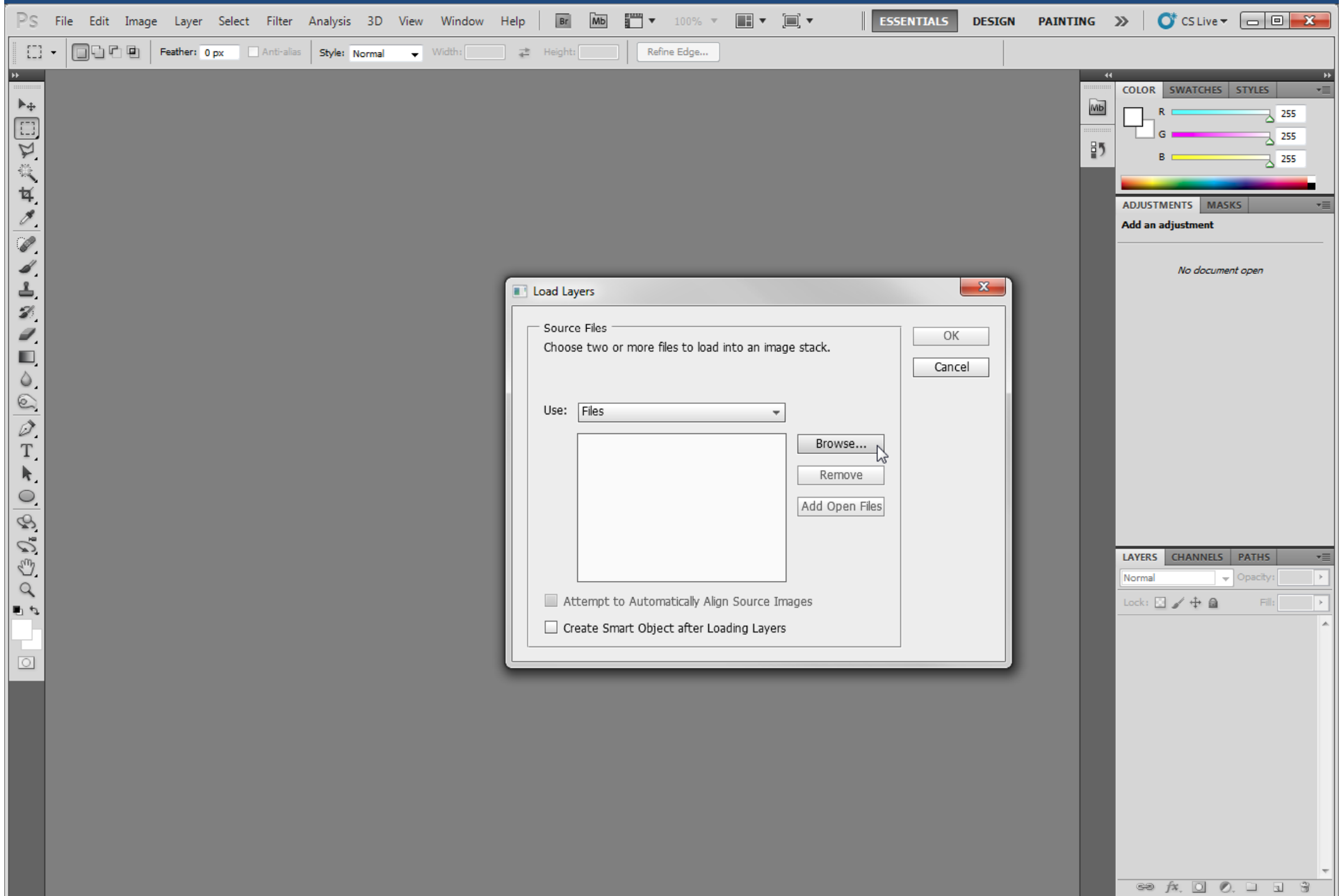
Zerene Stacker Workflow



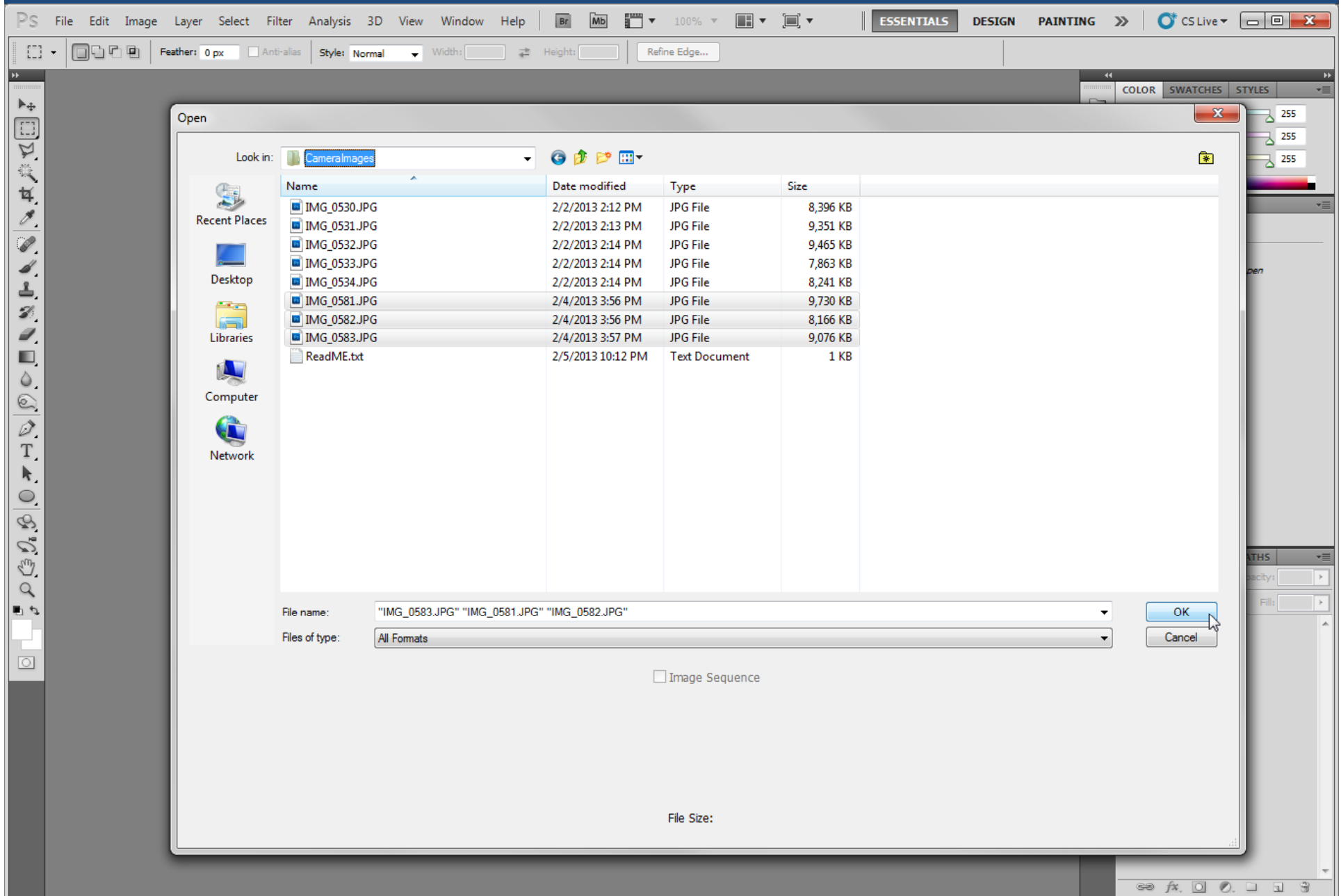
Photoshop Workflow



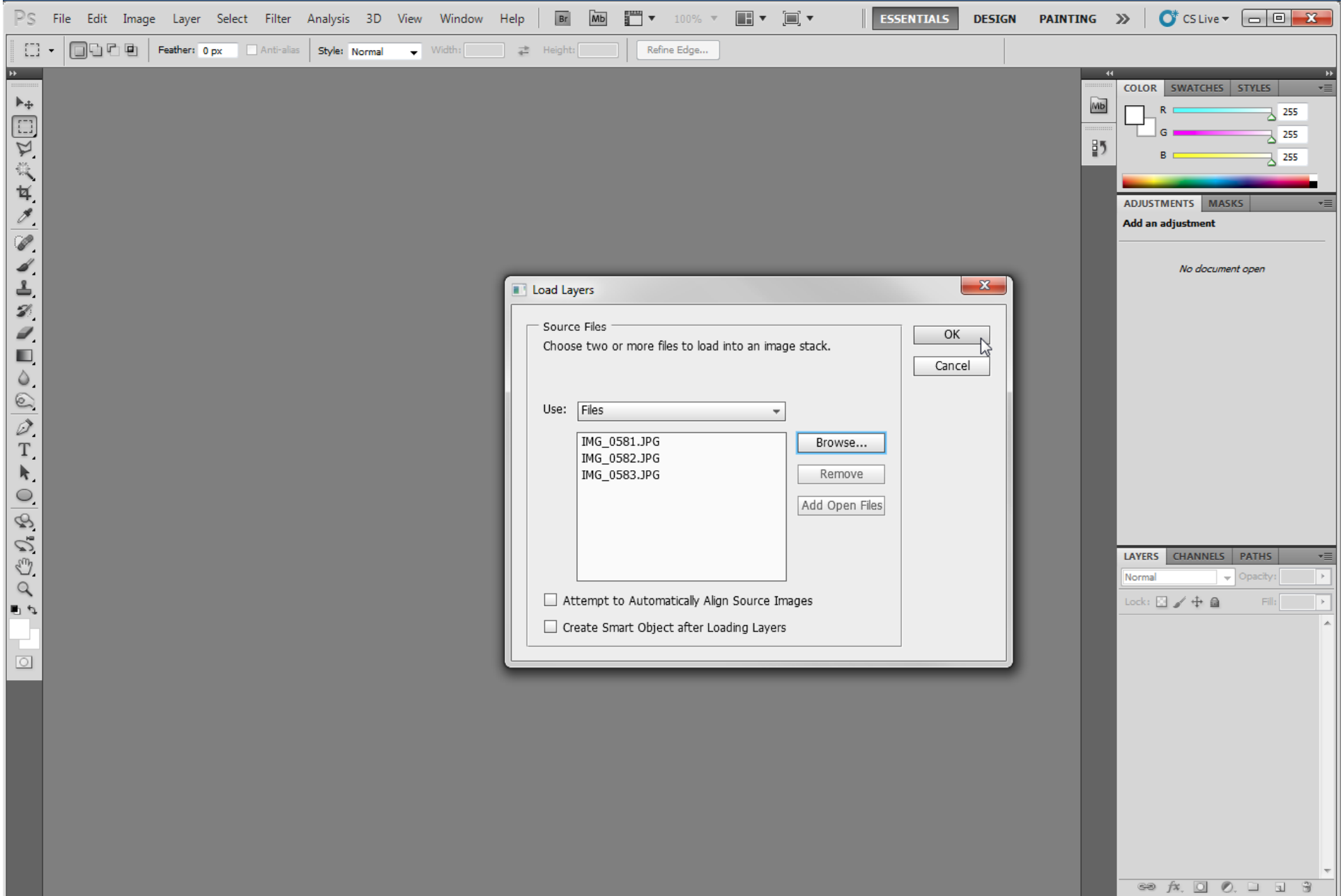
Photoshop Workflow



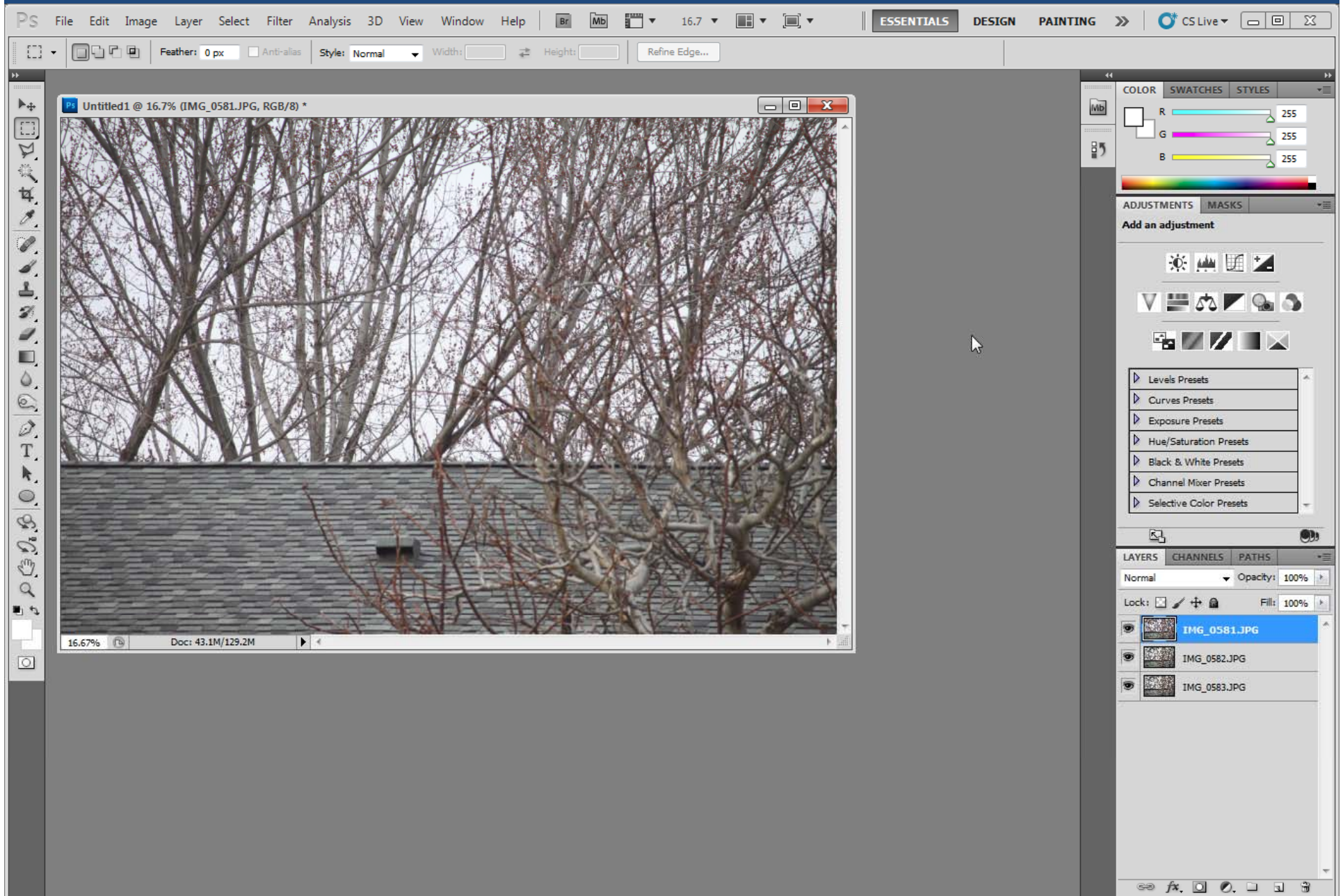
Photoshop Workflow



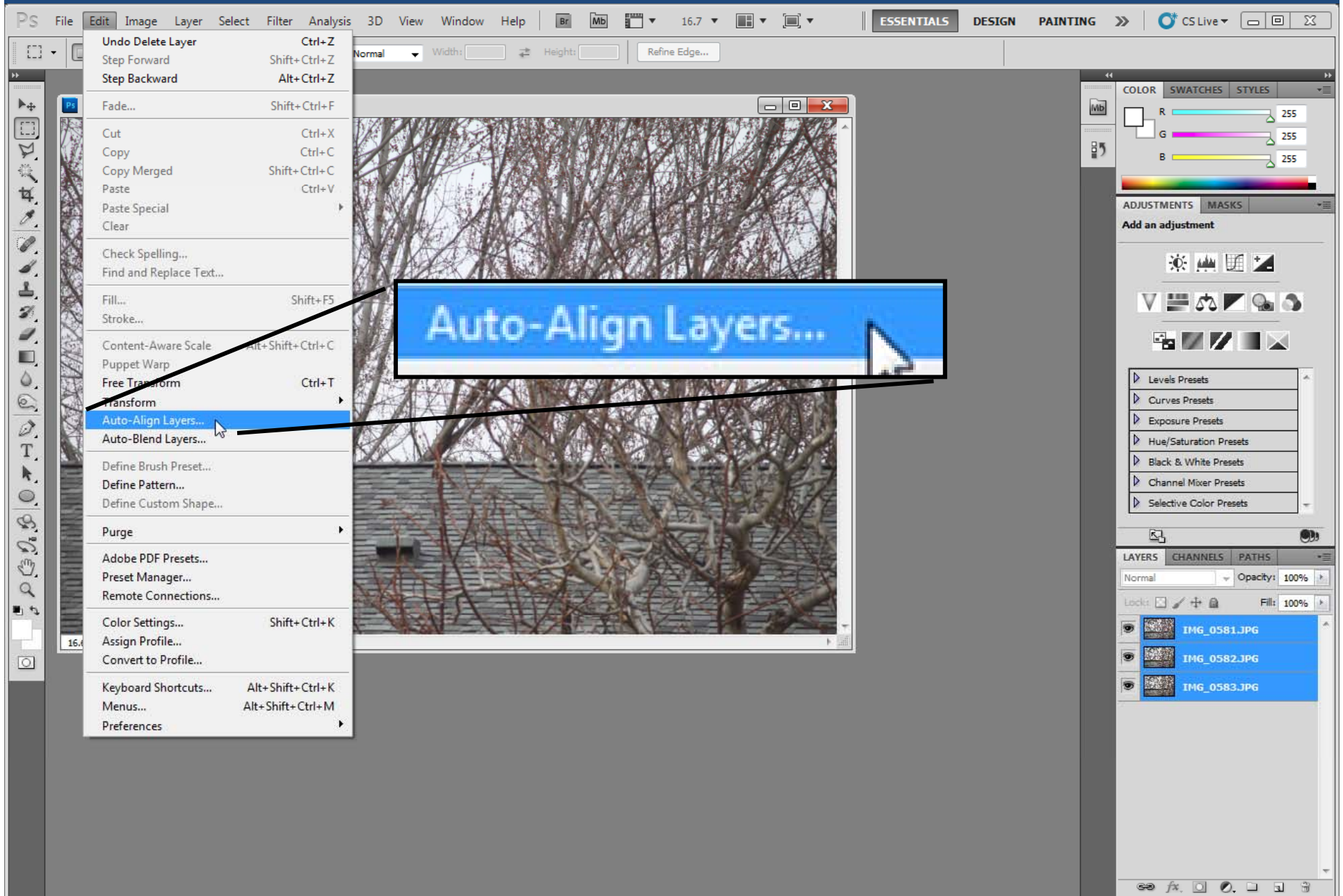
Photoshop Workflow



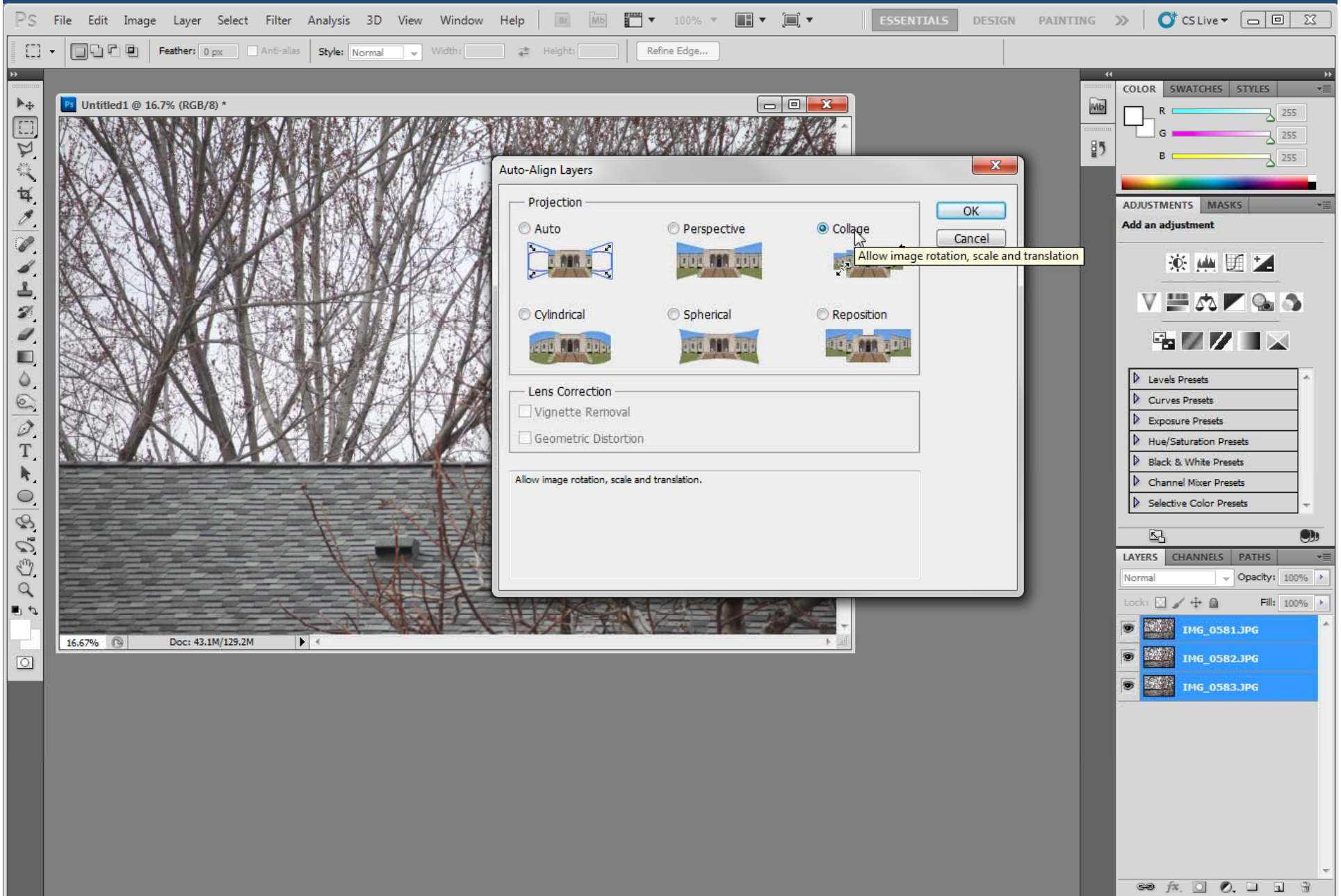
Photoshop Workflow



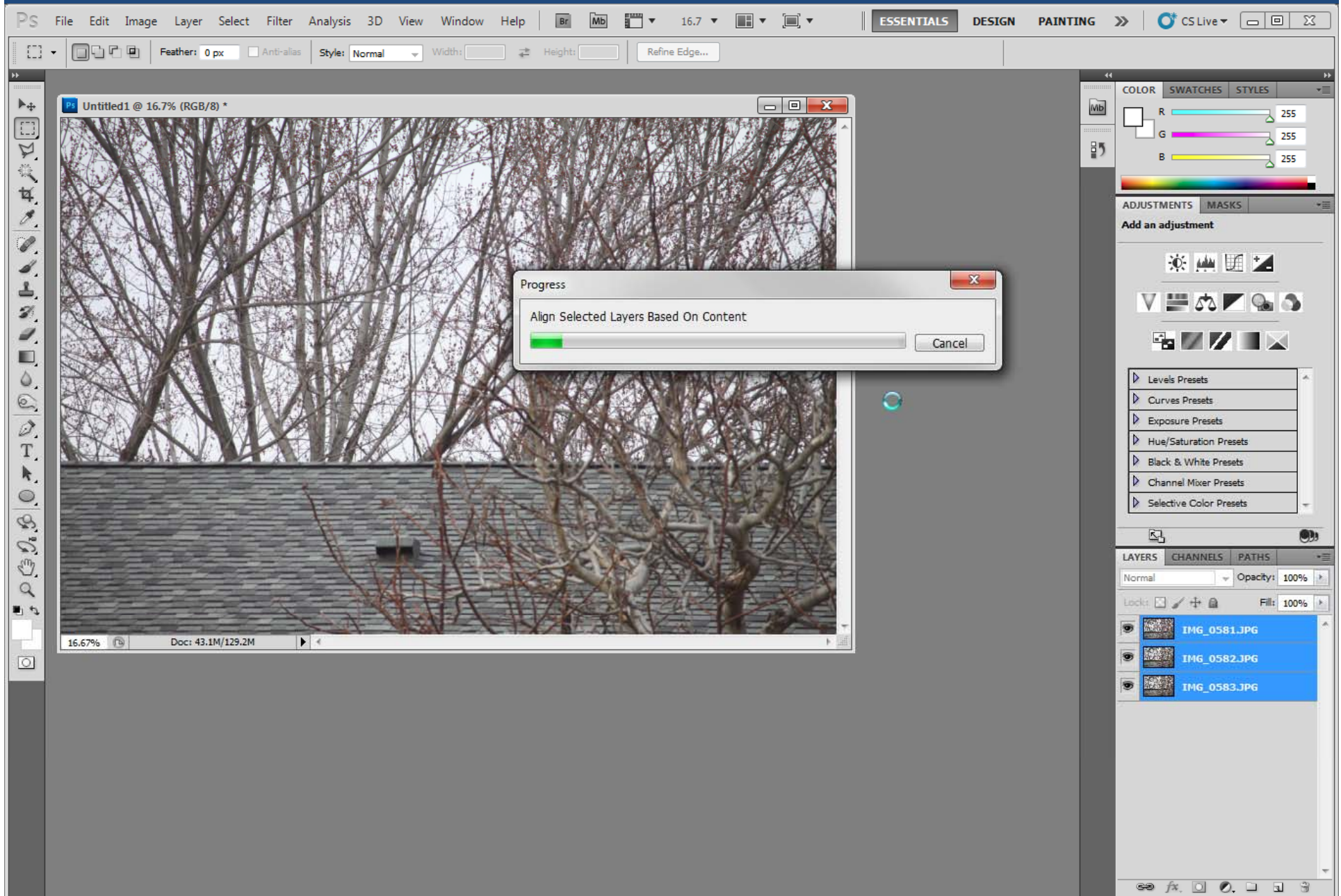
Photoshop Workflow



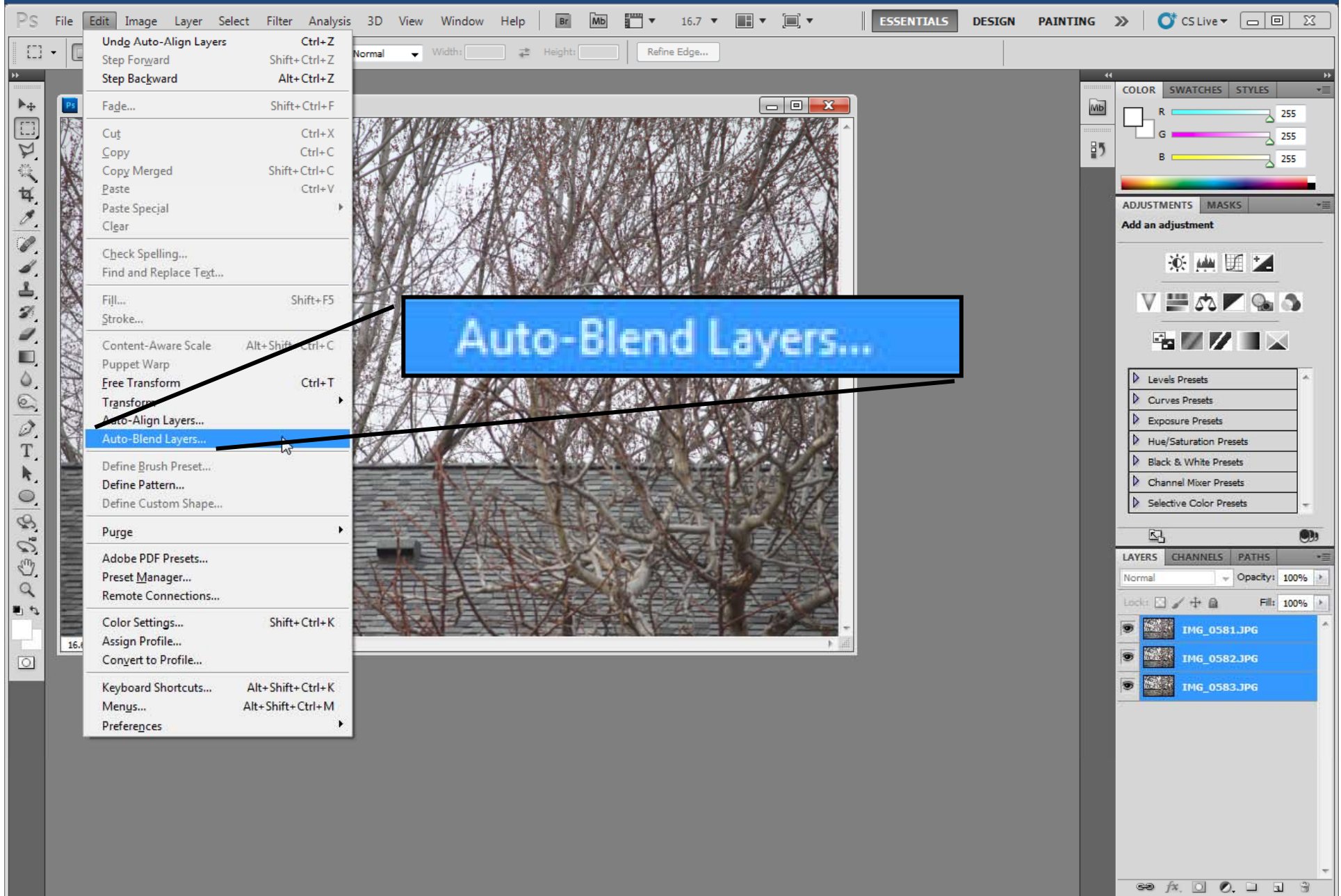
Photoshop Workflow



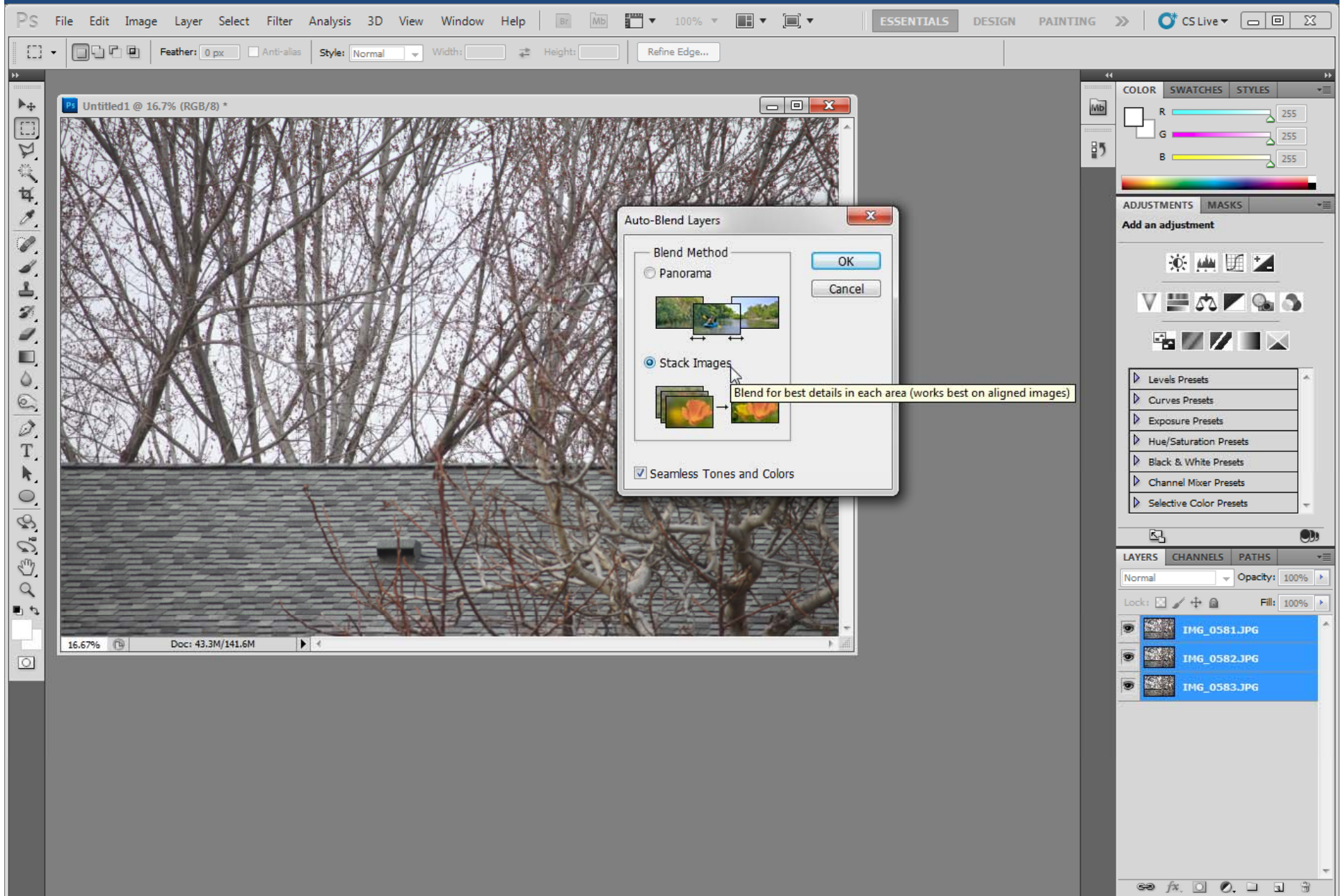
Photoshop Workflow



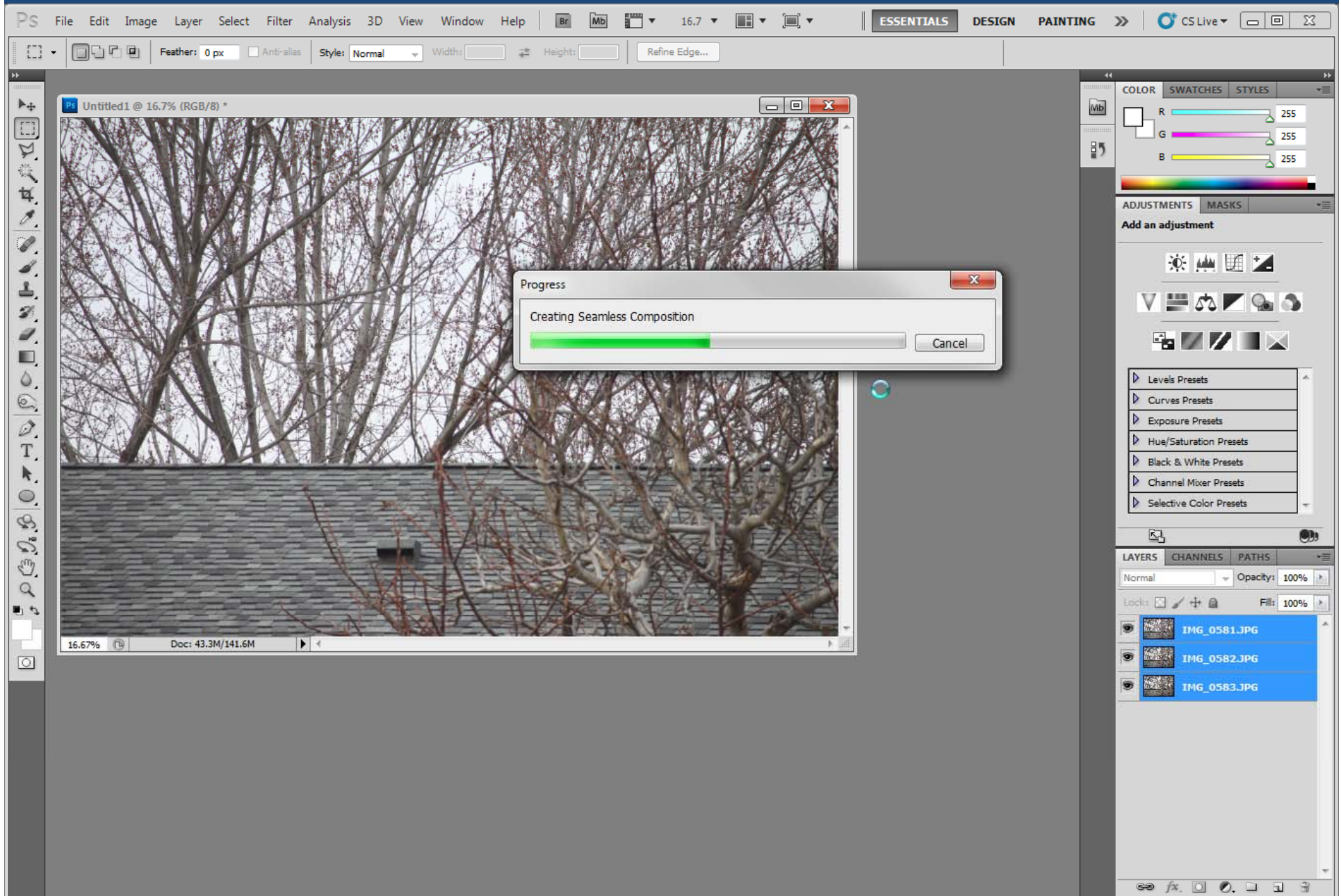
Photoshop Workflow



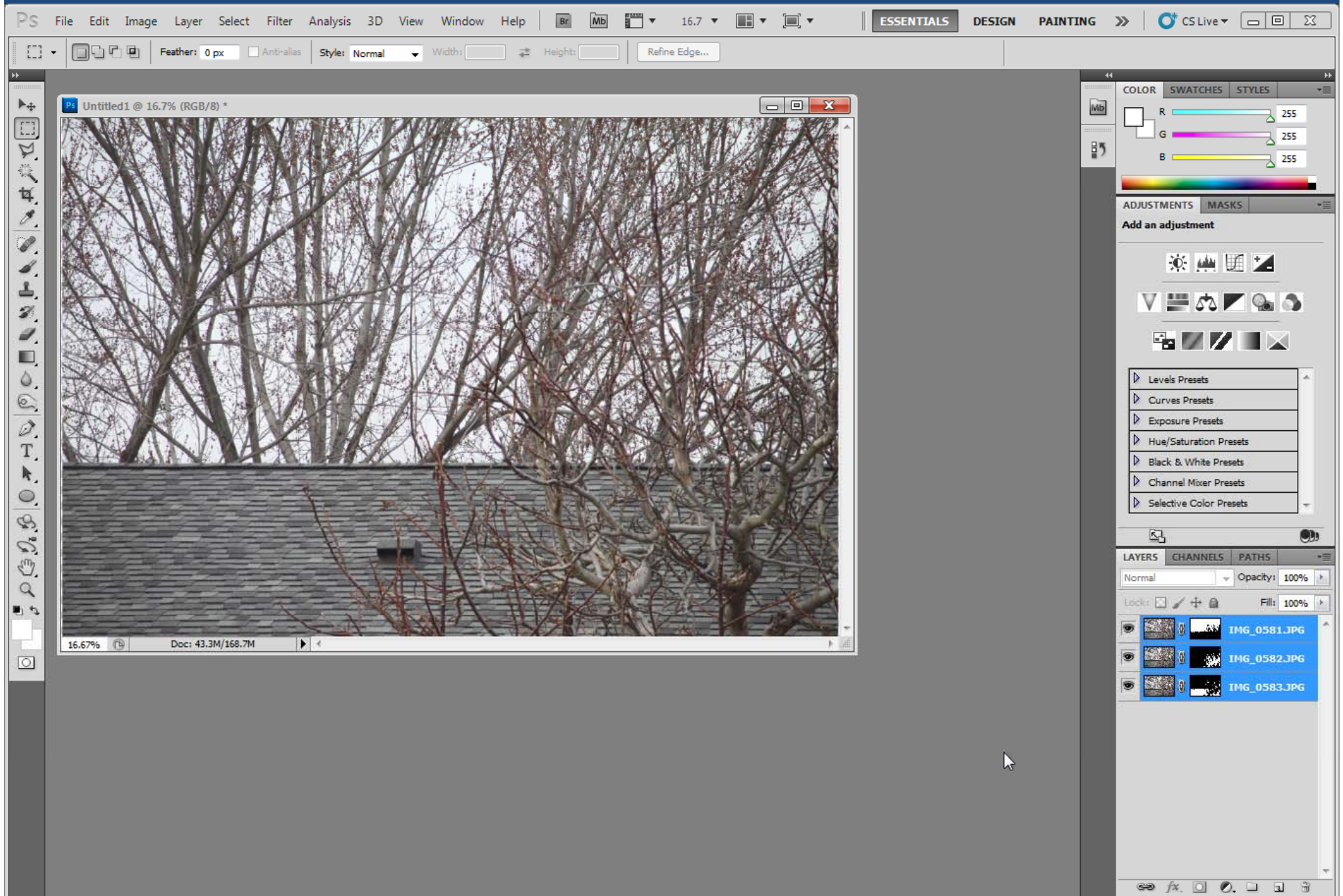
Photoshop Workflow



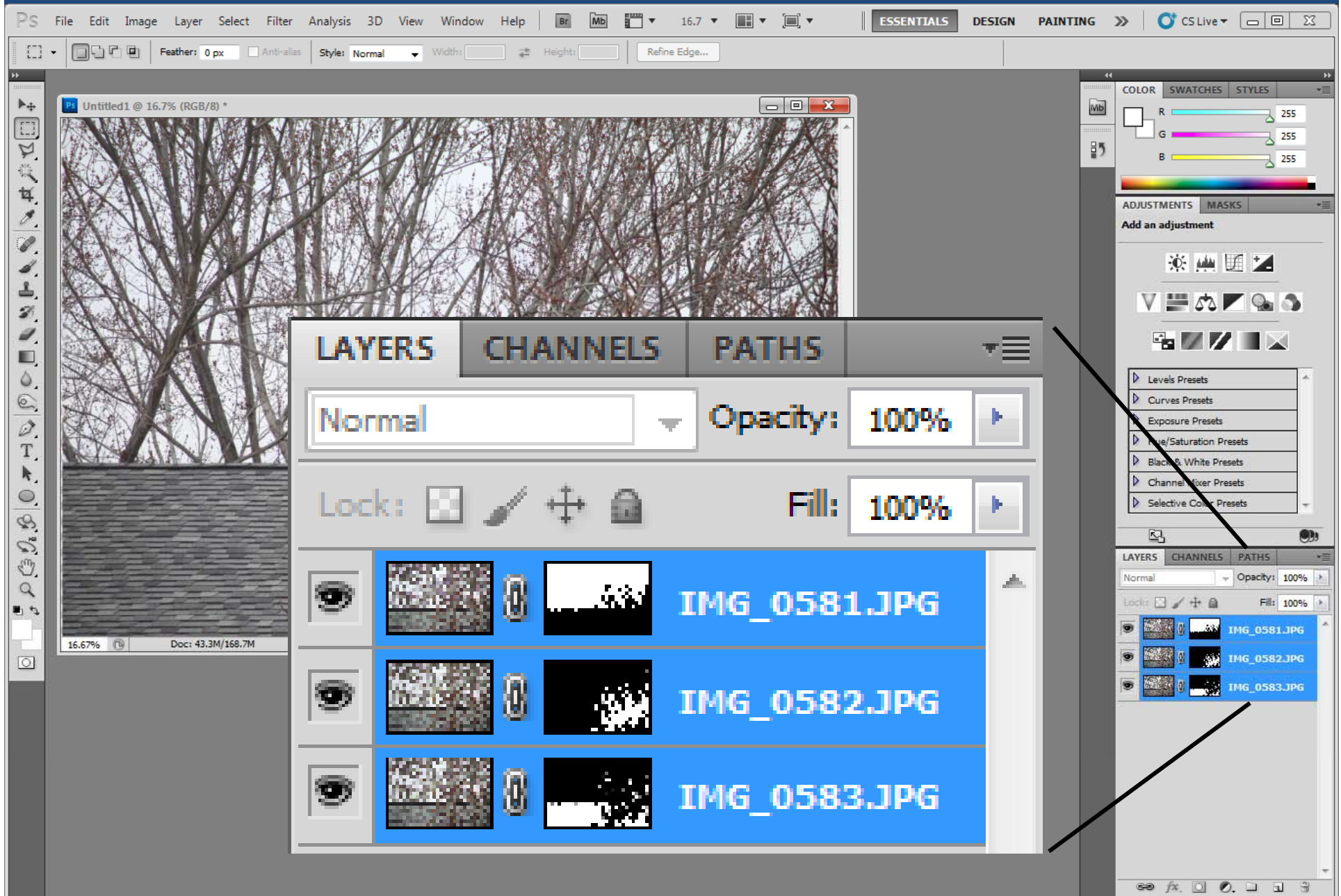
Photoshop Workflow



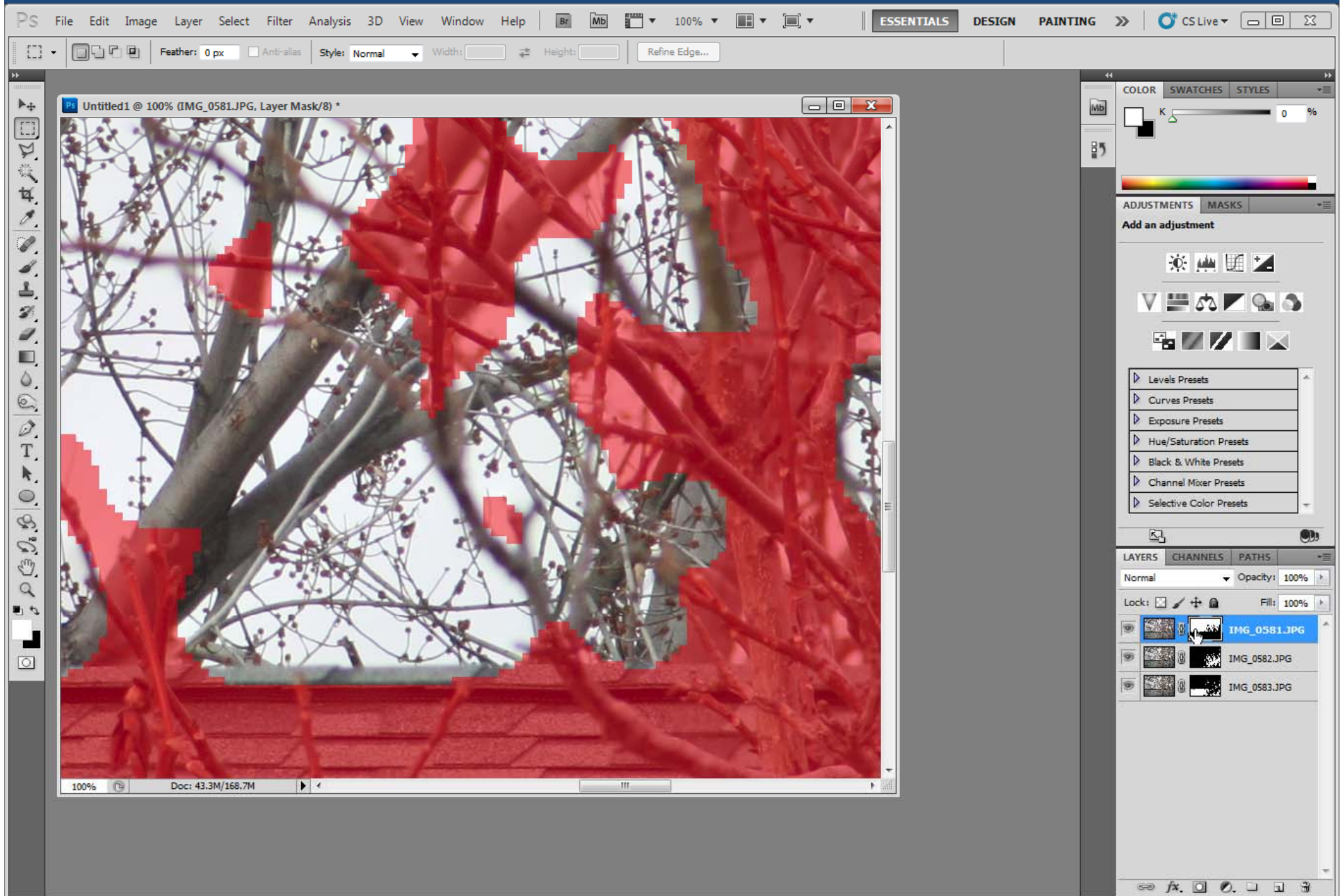
Photoshop Workflow



Photoshop Workflow



Photoshop Workflow



Photoshop versus Zerene

Result by Zerene (PMax)



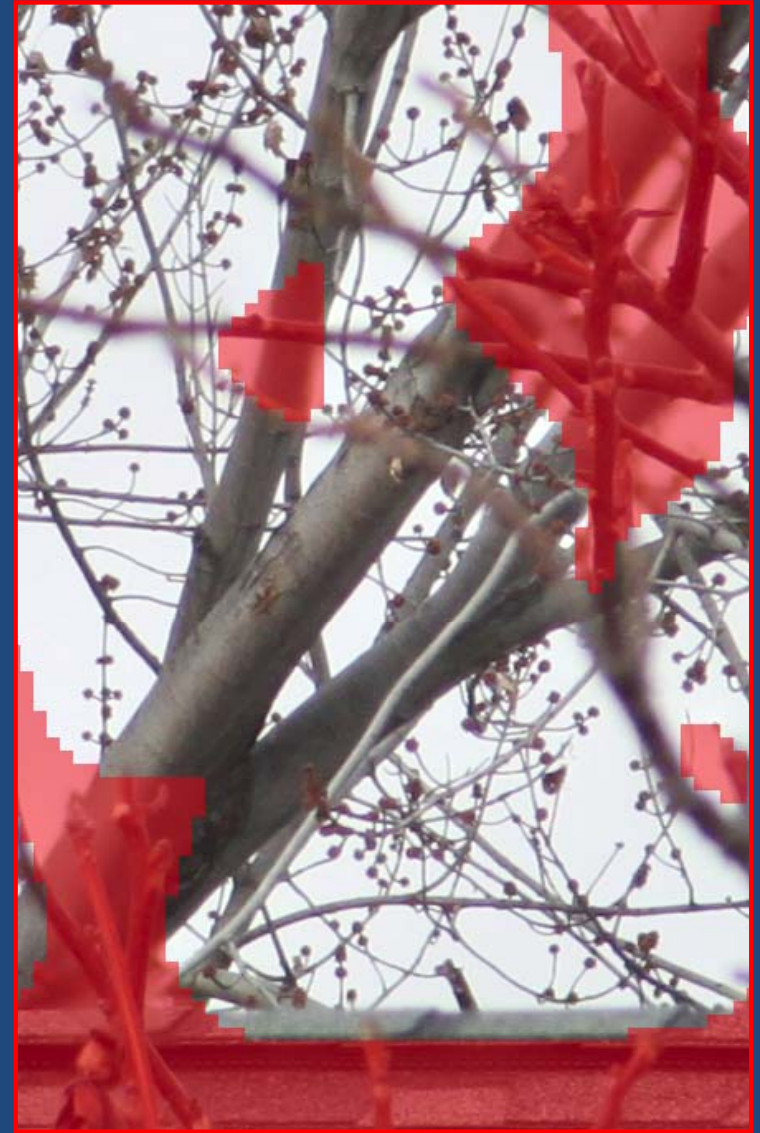
Photoshop versus Zerene

Result by Photoshop



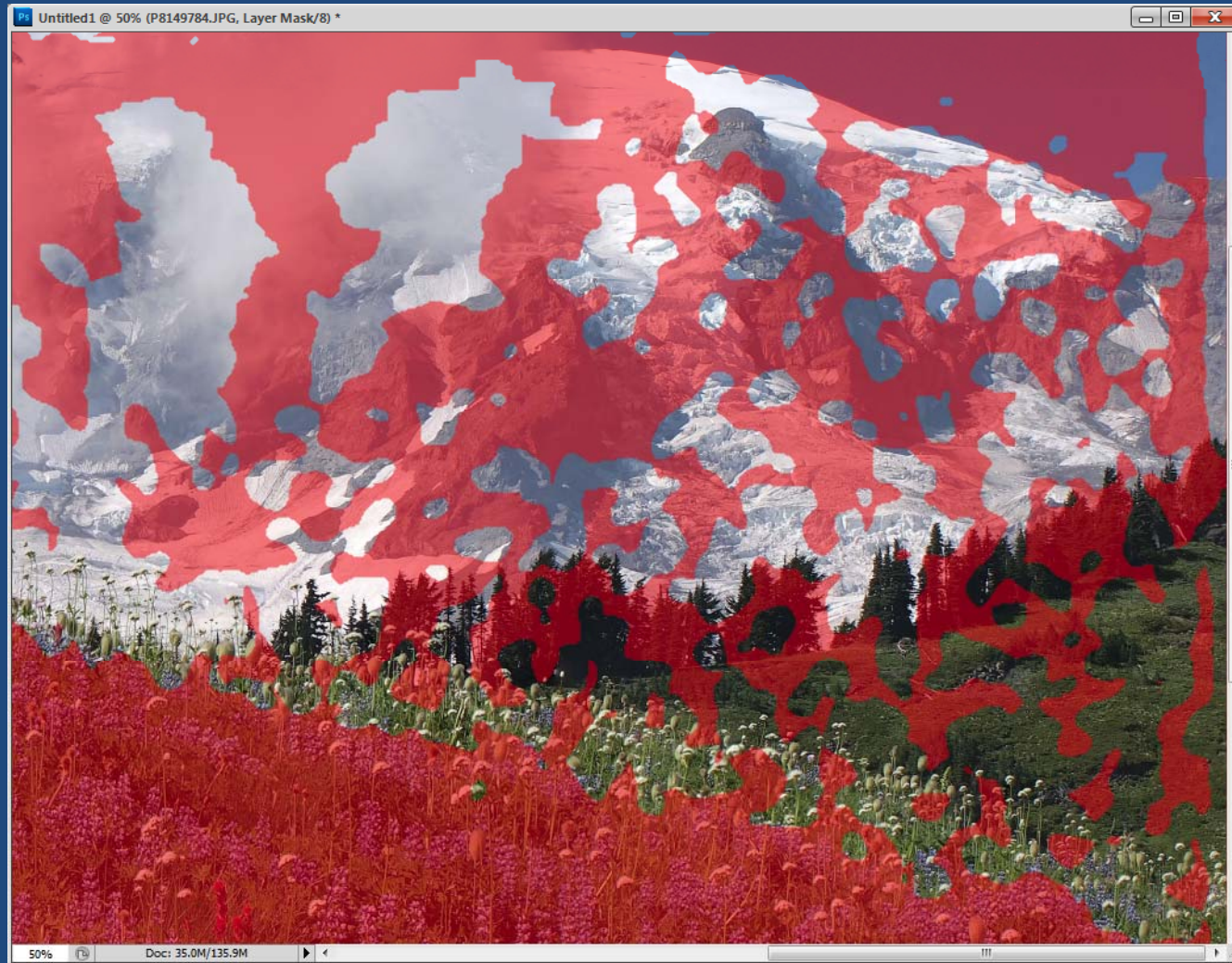
Photoshop versus Zerene

Mask by Photoshop



Revisiting Mt. Rainier

Mask by Photoshop



Anyway...

Different packages have different characteristics.

Just try them and see which you prefer.

Enough comparisons... Let's look at some more pictures!

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



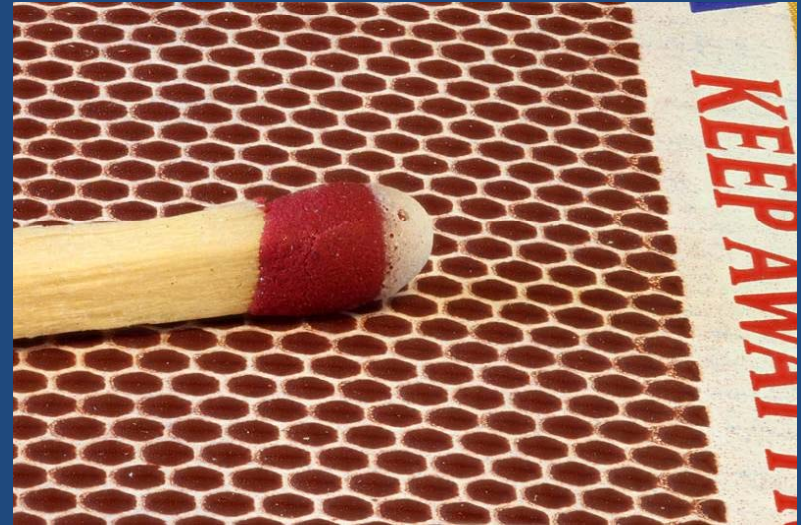
Almost all this stuff can be purchased at Amazon!

- “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 In The Park: Kit Lens, “Magic Lantern” Firmware



Tabletop setup: macro rail & lens



Macro Landscape Using Compact Camera

Canon A710
hung upside down
under a tripod



Macro Lens on Geared Tripod Head

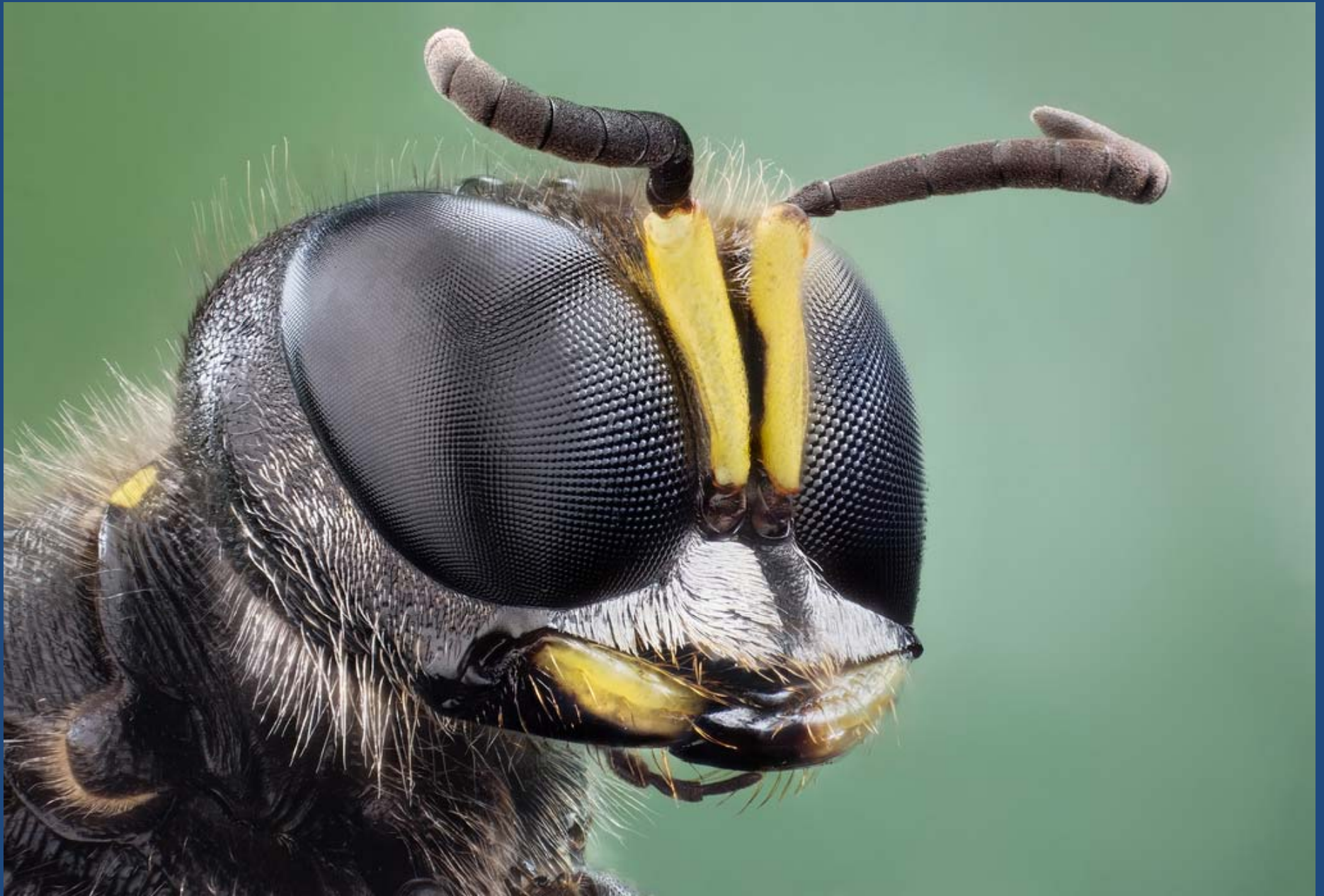


More options...a hand-driven screw table



John Hallmén at <http://www.photomacrography.net/forum/viewtopic.php?t=15711>

Producing An Image Like This

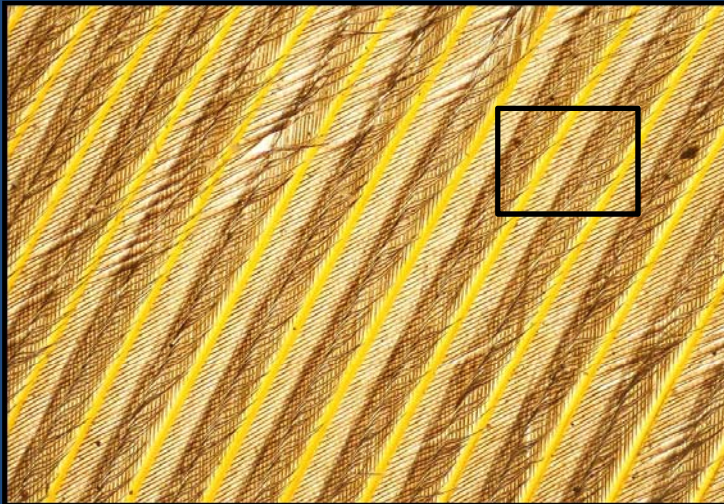


Feather On A Table

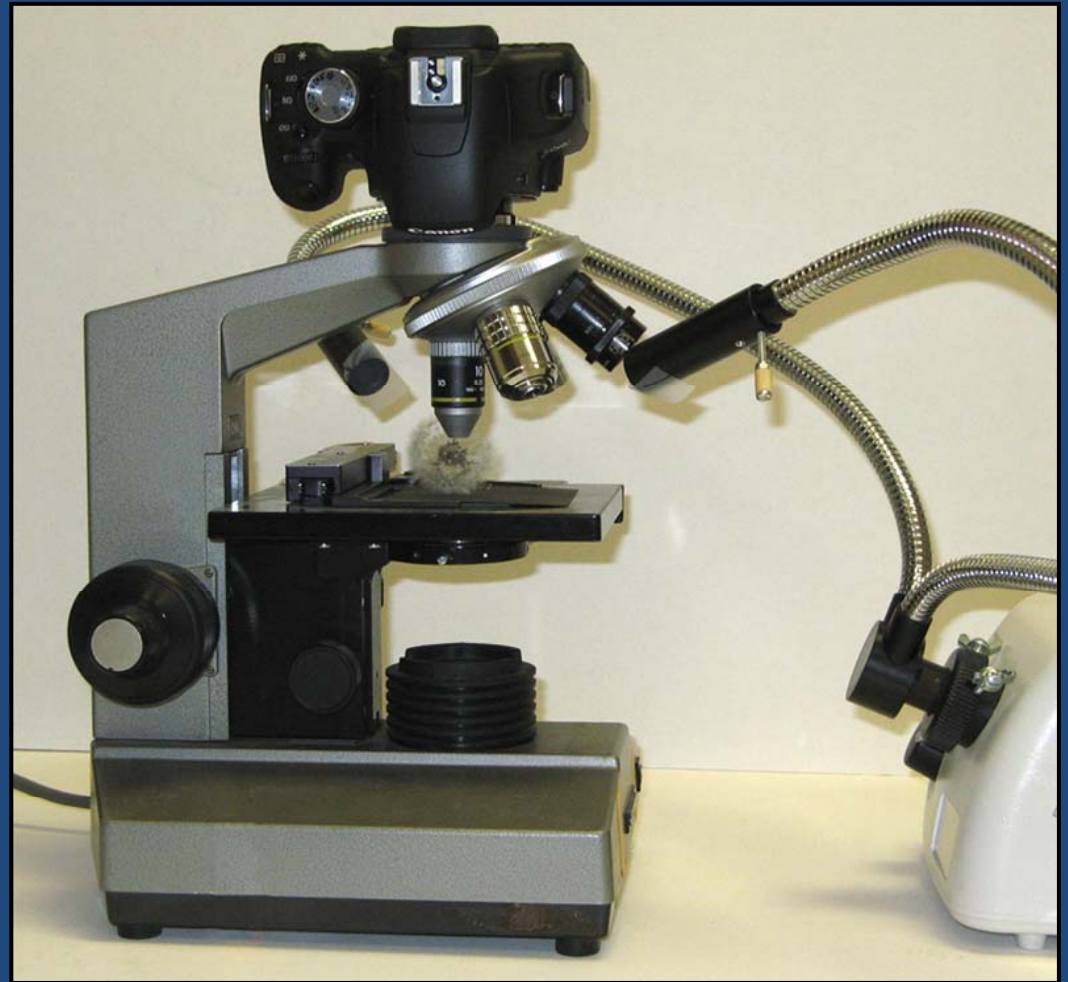


62 frames, shot at 5X on sensor
using A/F motor focusing
with microscope objective
4.4 mm total field width

This crop, $\frac{1}{2}$ mm = $\frac{1}{50}$ inch



Shooting Through a Microscope



Manual focus step to $0.5\ \mu\text{m}$
(one wavelength of green light)

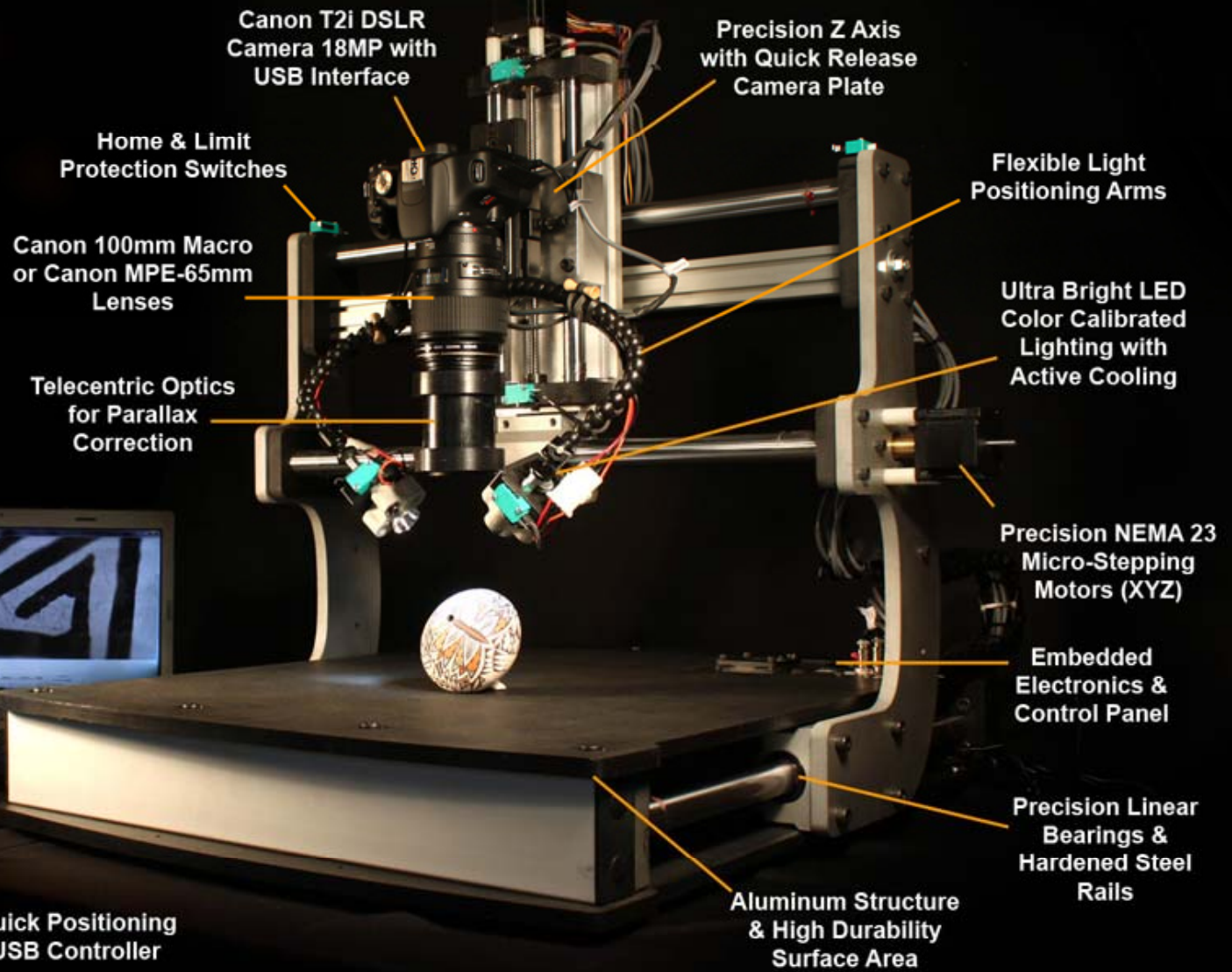
Visionary Digital's BK Plus System



GIGAmacro's package deal

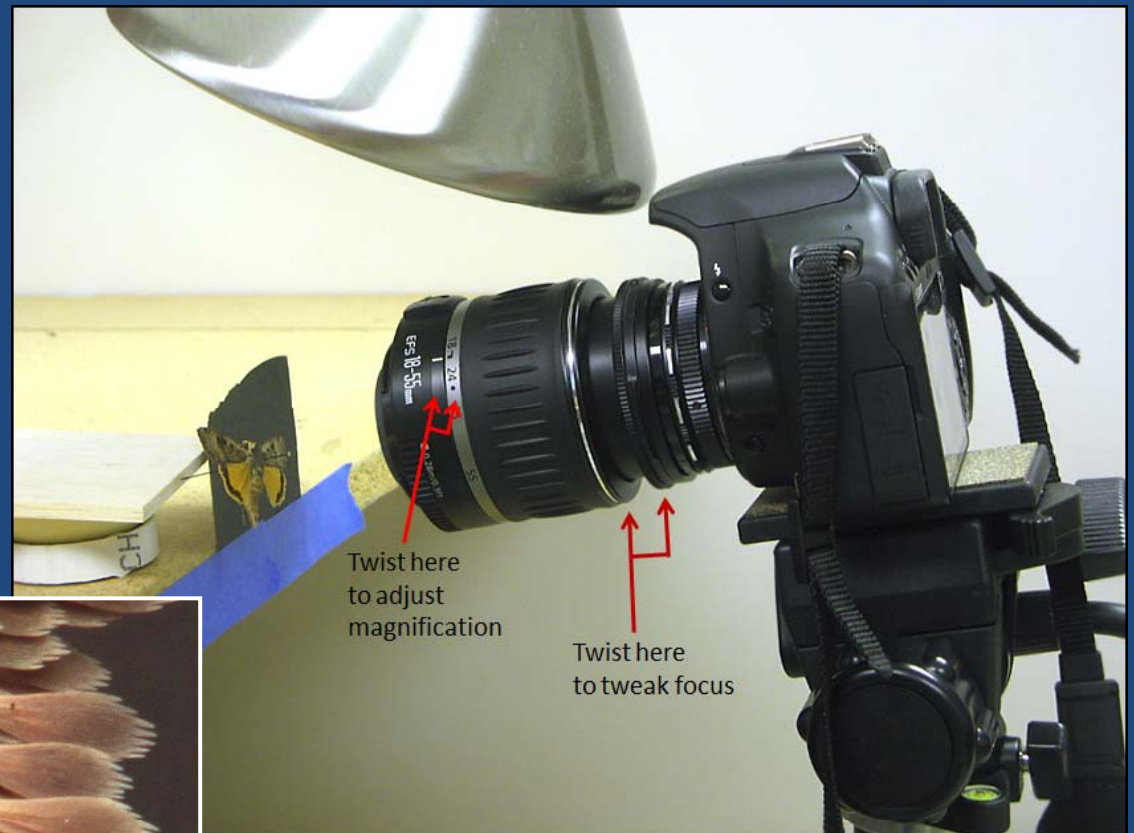
GIGAmacro Professional Imaging System

Released Nov 2011
Four Chambers Studio
GIGAmacro.com



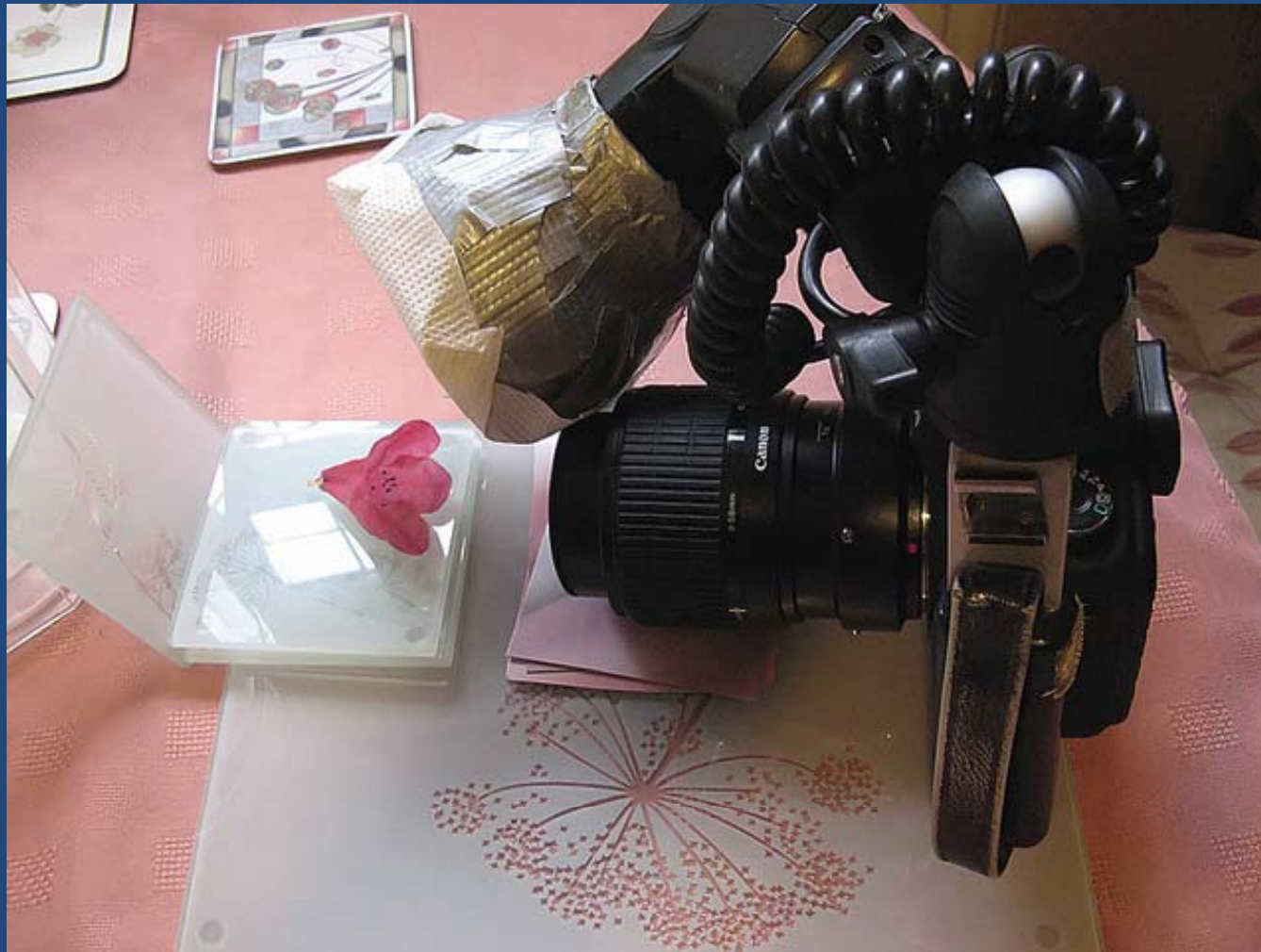
Or Reverse a Standard Zoom Lens

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

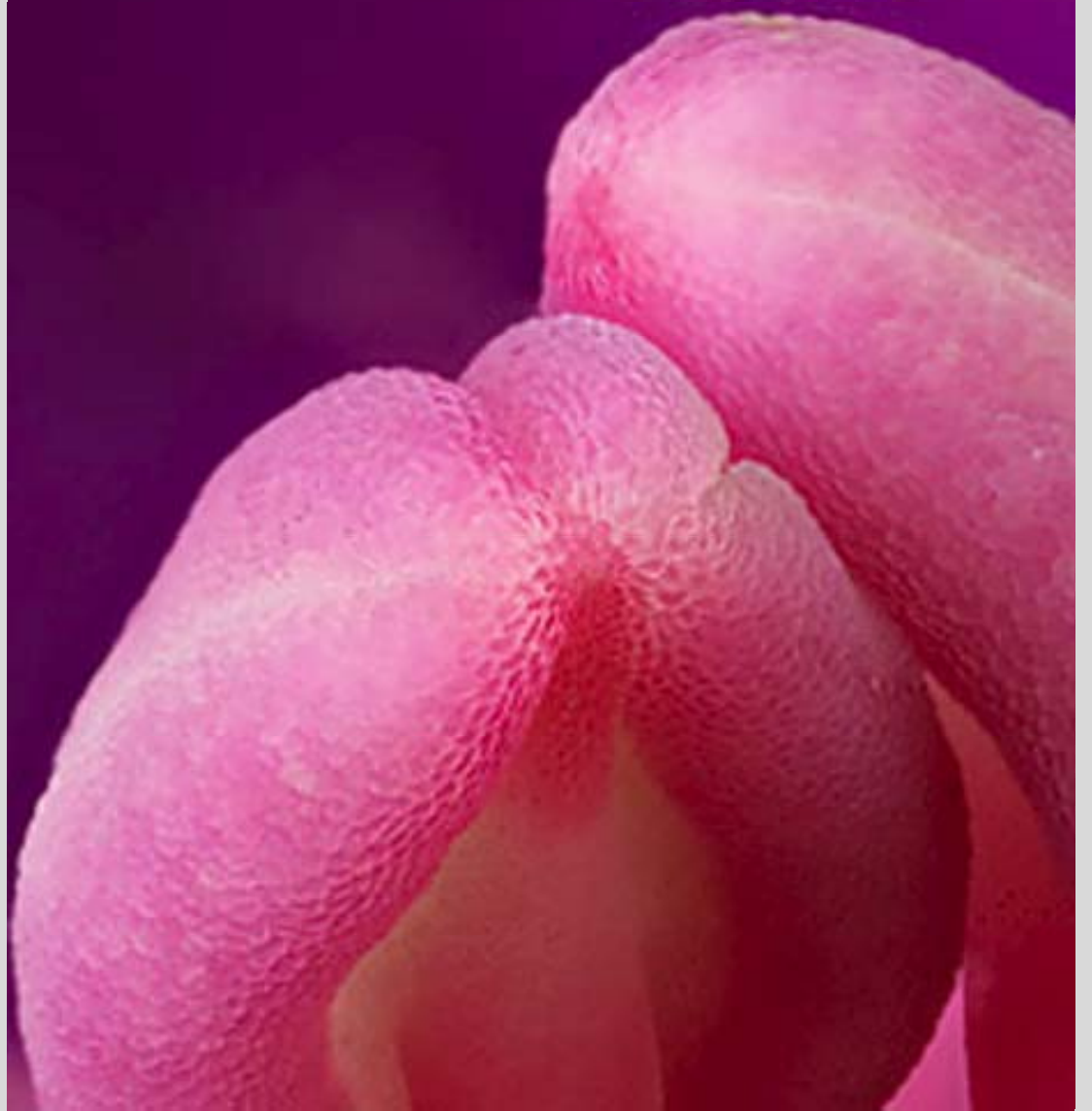
Low-tech approach



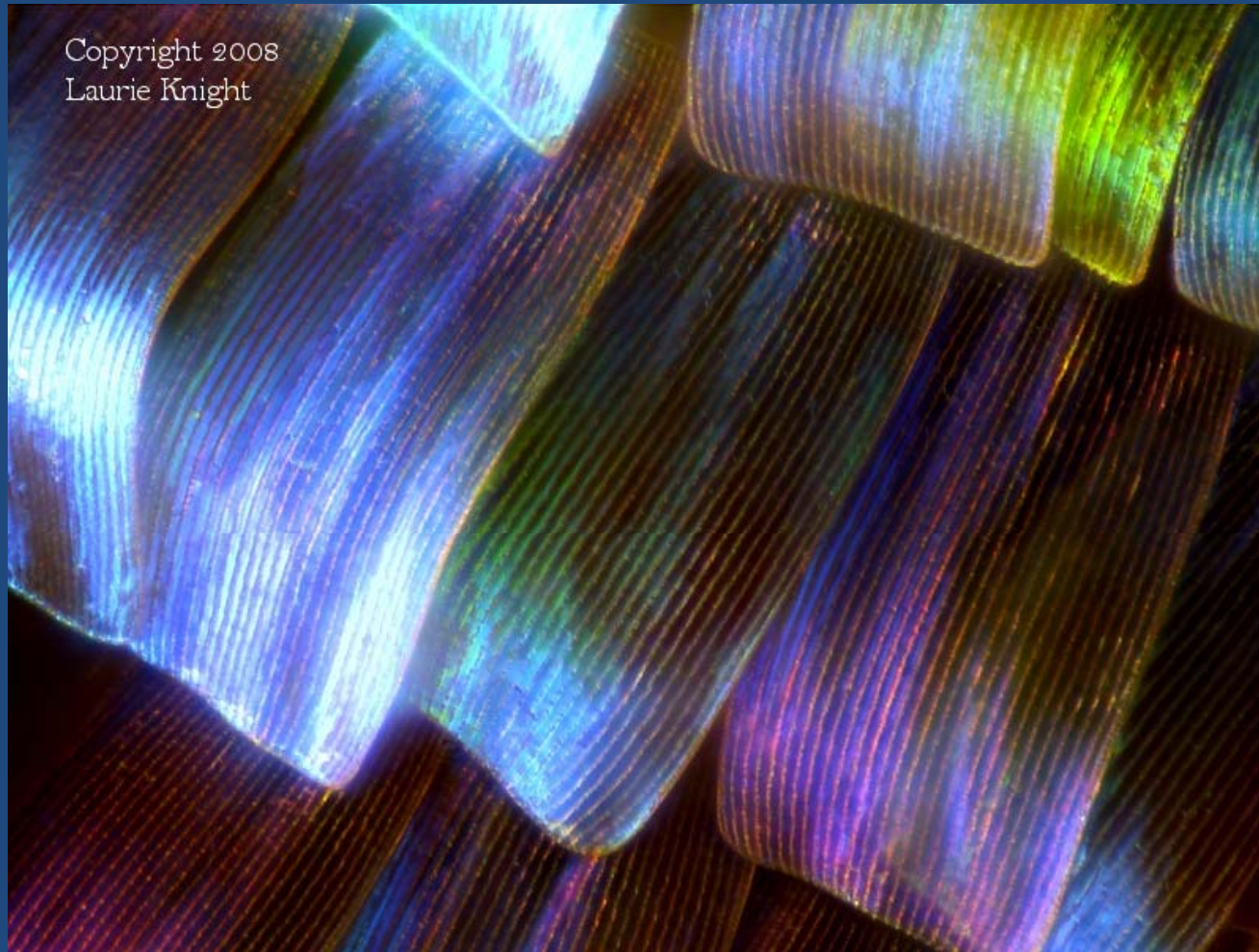
“Typical setup I use for flower bits shots”

Brian Valentine (username “LordV” on Flickr)

Brian's result: "Fuchsia Anthers"



Urania riphaeus wing scales at 400X*



* What you'd see through a 400X microscope (40X objective)

Firefox ▾ www.photomacrogra... x stackers:softwaredownl... x Stop Forum Spam x Mail :: Sent: Re: sampl... x Tri-City Digital Photog... x www.photomacrogra... x +

← → www.photomacrography.net/forum/viewtopic.php?p=55311#55311 ☆ Google

rjlittlefield
Site Admin

Joined: 01 Aug 2006
Posts: 11876
Location: Richland,
Washington State, USA

Posted: Sun Feb 07, 2010 10:49 pm Post subject: List of links in FAQ: What's the best way to focus?

quote edit IP

Additional links to setups and discussions for high magnification work:

Charles Krebs: [Tabletop "macro" setup](#).

Many contributors, covering [Nikon](#), [Olympus](#), [Meiji](#), [Swift Focus Blocks & Setups](#).

Chris S: ["Bratcam" \(focus blocks and goniometers\)](#)

Chris S: [A field rig \(a bit of the Bratcam\)](#)

LordV: [sliding by hand on glass table mat](#) (more [HERE](#))

liuto: [Proxxon table and linear stages](#)

rjlittlefield: ["afocal" setup through microscope](#)

rjlittlefield: [bellows on microscope base](#)

RogelioMoreno: [infinity objective on telephoto lens](#)

seta666: [linear stage with micrometer drive, mounted on mini tripod](#). For part numbers, visit the Flickr link and hover over parts of the image.

Pau: [vertical macro setup](#), using salvaged microscope for fine focus.

januszj: [horizontal setup](#), using microscope base including the stage for focus and specimen holding.

Tomatito: horizontal setup using Lego blocks for structure (see [HERE](#), images 5-6) and Proxxon precision vise ([HERE](#), image 2) for subject movement.

Keks: an "all directions" setup using the StackShot, [HERE](#).

Marc Iwaniec, Thorlabs stages and goniometers, [HERE](#).

Wil Milne: extending the stage of a microscope base, [HERE](#).

John Hallmén: simple off-the-shelf stacking setup using Proxxon screw table, [HERE](#).

naturephoto1: studio macro rig with goniometers, focus block, and screw rail, [HERE](#)

Hokan: a Velmex rig, [HERE](#).

daemonoropsis, StackShot mounted on Arca/Swiss rails & breadboard, [HERE](#).

ecooper, Laboval 4 microscope body lying on its back, [HERE](#).

noah212, microscope turret on bellows, [HERE](#)

--Rik

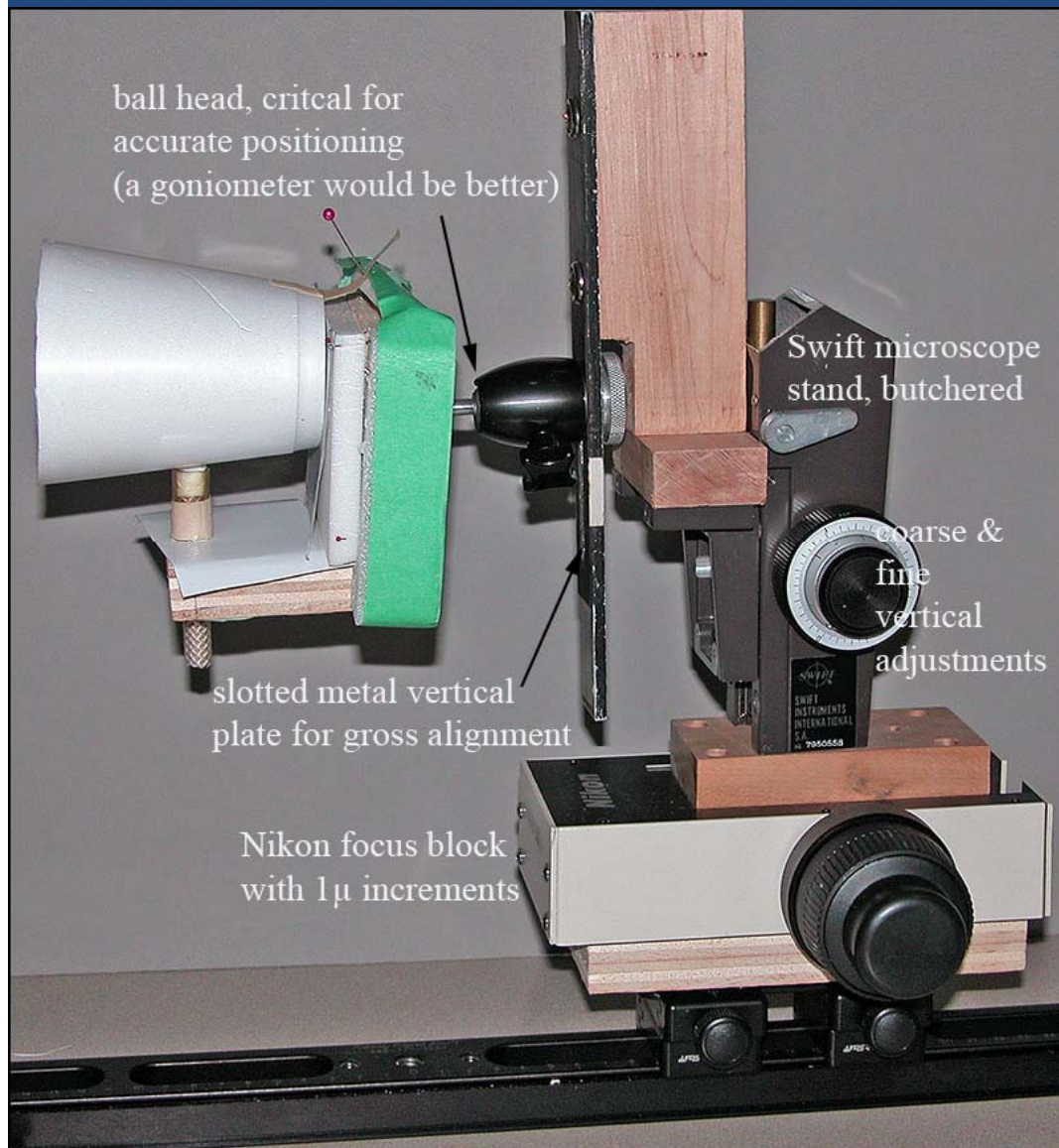
Edited May 2, 2010, to add some more links.
Edited July 7, 2010, to add some more links.

photomacrography.net
has lots of descriptions of setups
for macro/micro work

x Find: spider Next Previous Highlight all Match case

“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...



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



Or This New One...



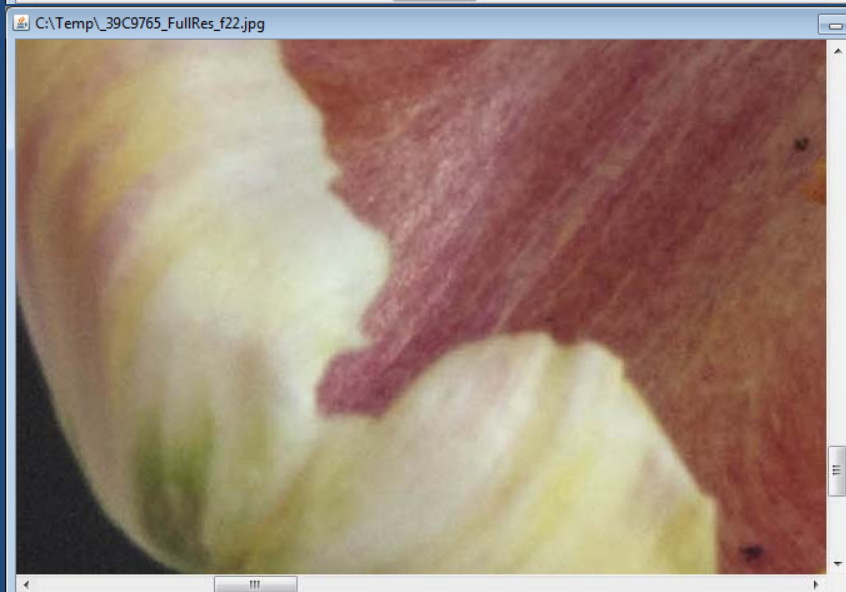
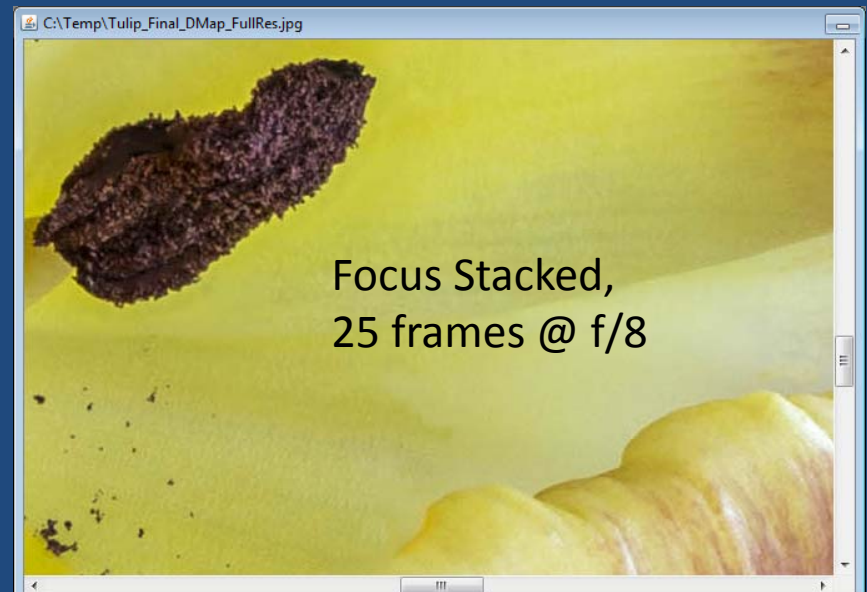
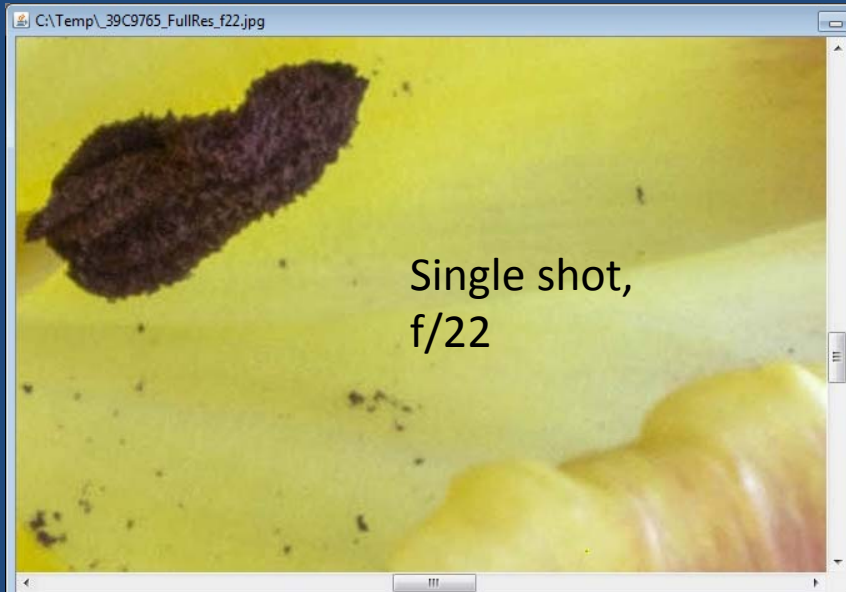
John Hallmén, field stack

Or This One...



© George D. Lepp 2013

Which Would You Rather Have?



Images courtesy George D. Lepp, 2/7/2013

One Last Time...



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



So, What Do You Want To Do?

Recap & References

- Focus stacking gives sharp images and large depth of field
- Recommended software:

Zerene Stacker, <http://ZereneSystems.com/stacker>

- Web forum dedicated to photography of small things

<http://www.photomacrography.net>

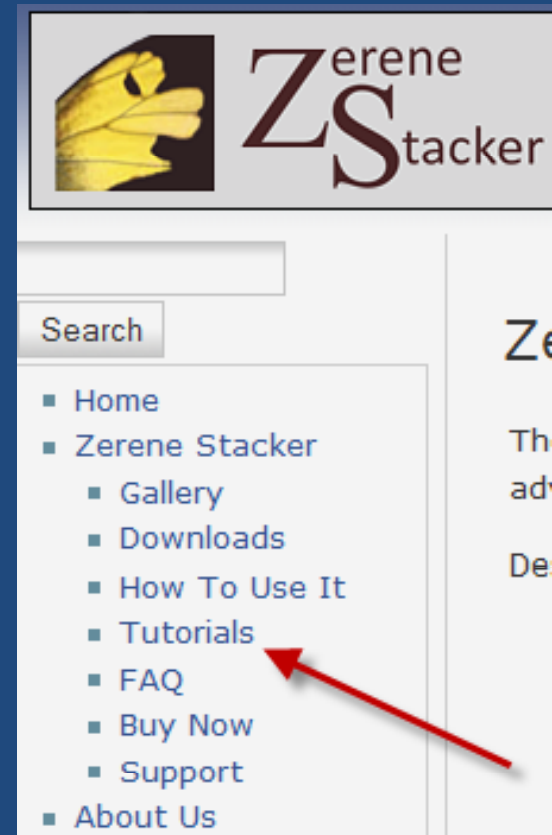
- For more information

email: support@ZereneSystems.com

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.



Presentation Slide Set

- A slide set providing an introduction to focus stacking, presented at the Tri-City Digital Photography Club on 2/7/2013, can be viewed as PDF at http://zerenesystems.com/presentations/TCDPC_20130207/FocusStackingForTCDPC.pdf (15 MB download).