

Introduction to Focus Stacking

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Richland, WA

Puget Sound Camera Club Education Night (online) January 30, 2023

You Don't Need to Take Notes

These slides are available online.

See the “Tutorials” section at

<https://zerenestacker.com>

Where I Fit In...

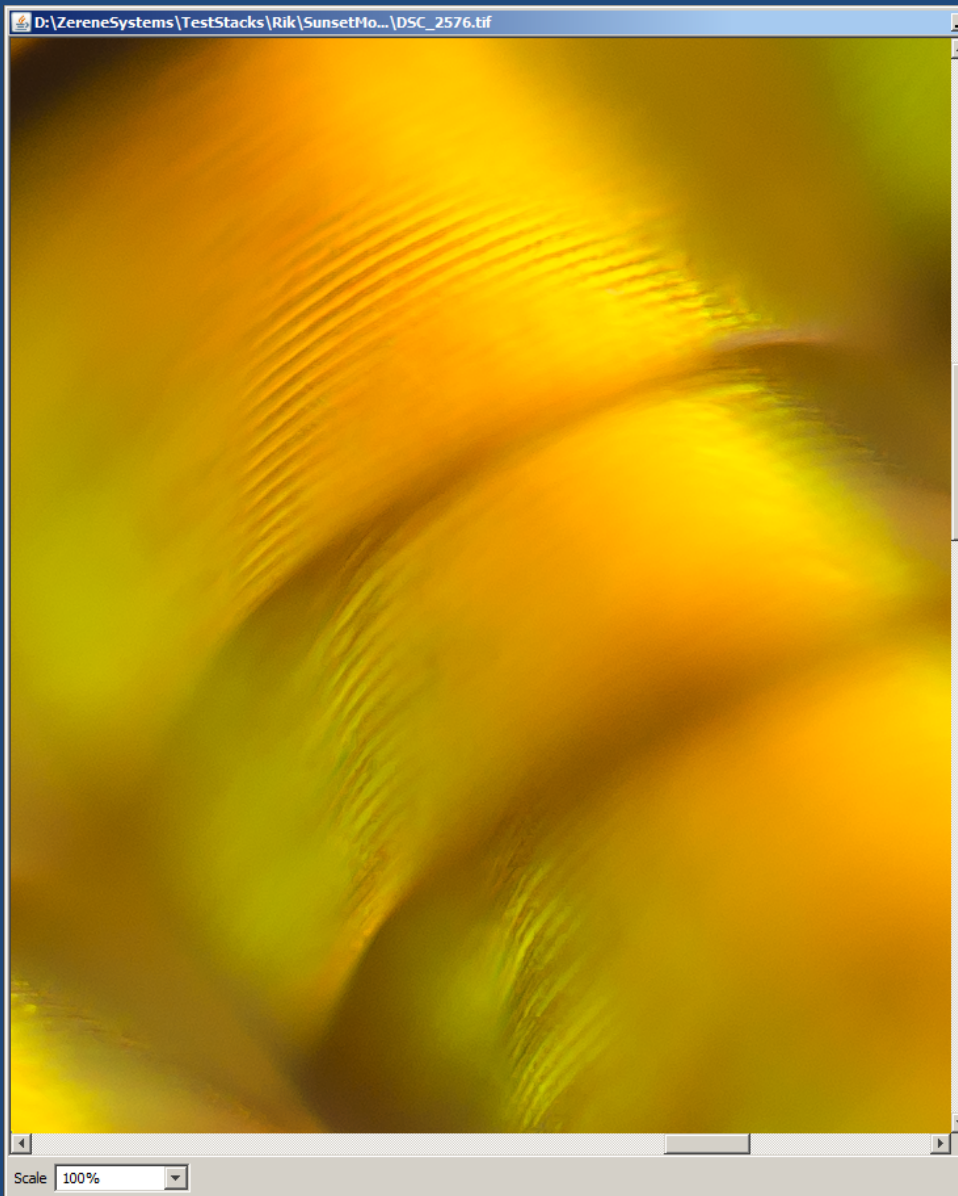
- 1) Write & support Zerene Stacker
- 2) Manage & edit a strictly non-commercial website dedicated to the photography of small subjects
- 2) Develop & document ideas for techniques and equipment



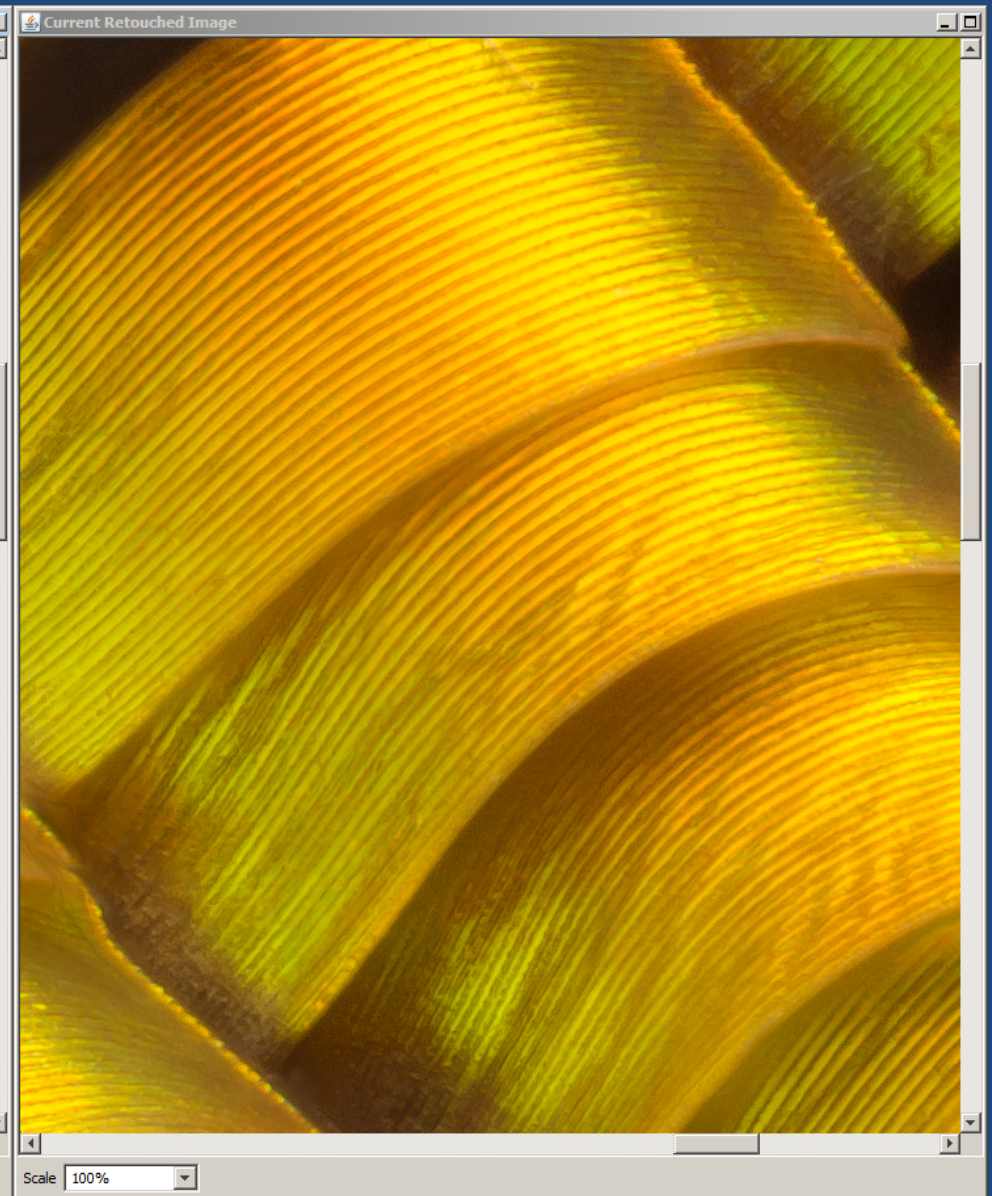
I Like Focus Stacking For Small Things

Wing scales of a Sunset Moth -- frame width here about 0.1 mm

Single Frame



Stacked, focus step 0.002 mm



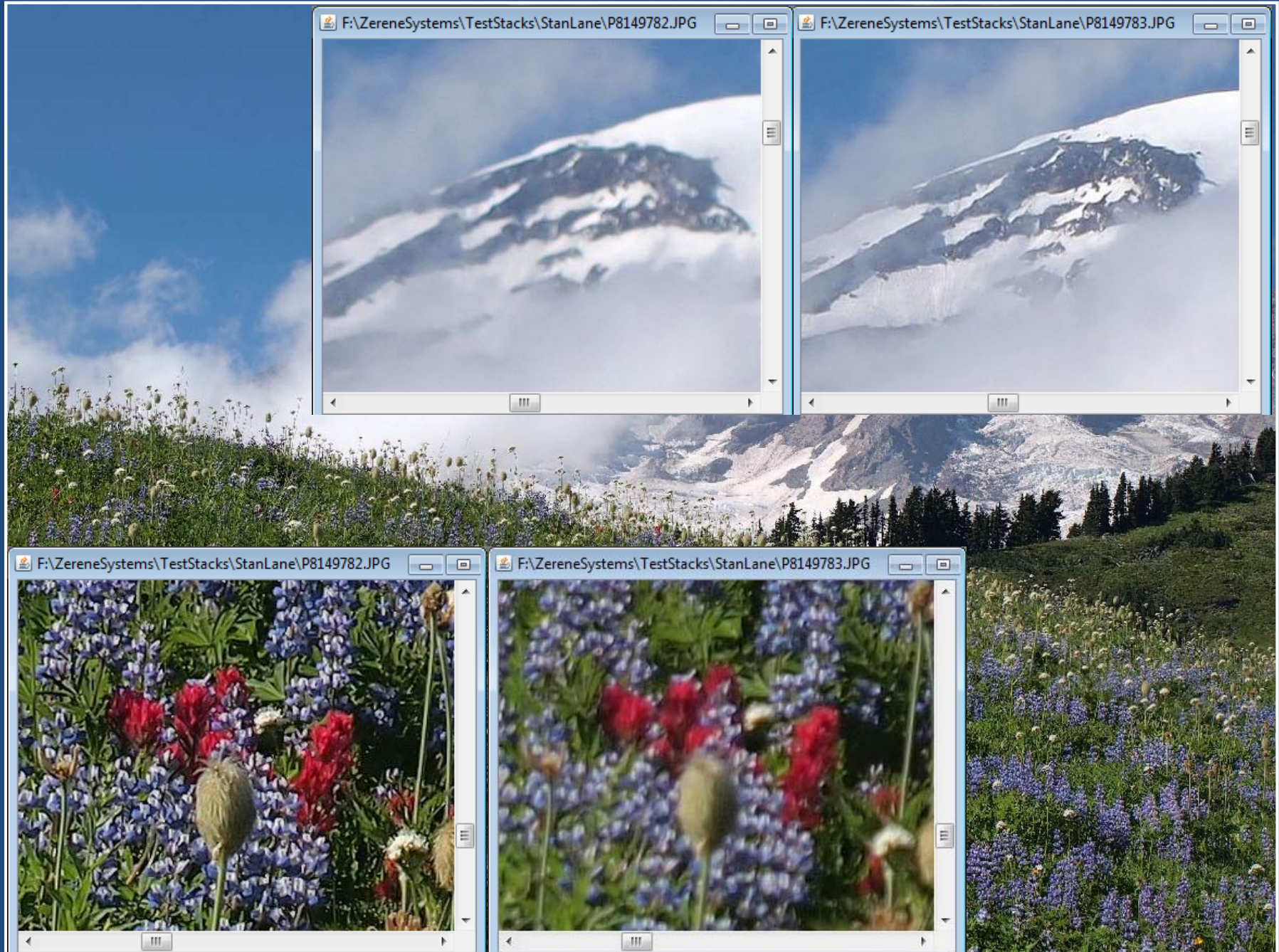
But It's Handy for Big Subjects Too

(Mt. Rainier, assembled from 3 Frames)



Image by Stan Lane

Why Focus Stack Mt. Rainier?



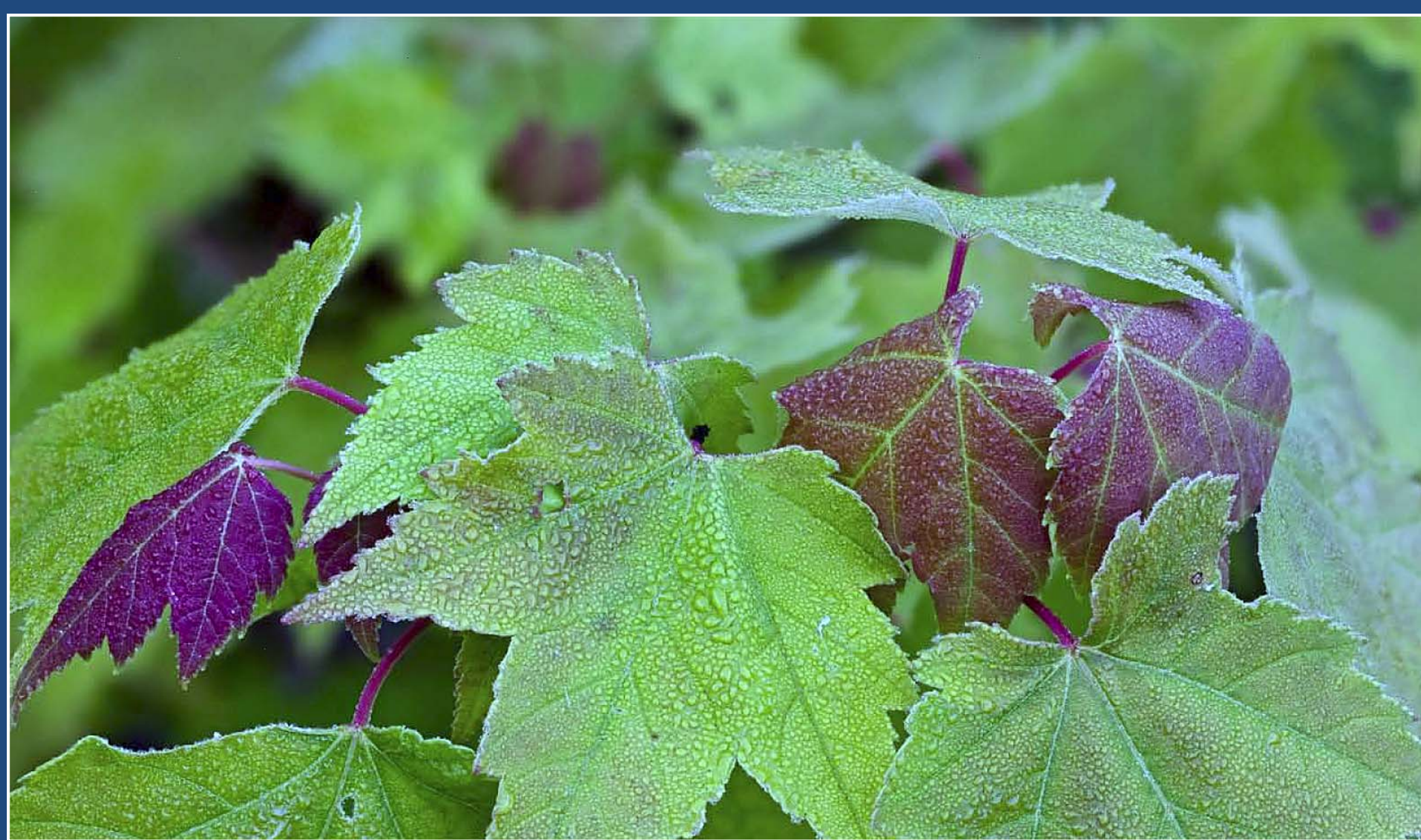
Mt. Rainier, Sharp Everywhere



Mt. Rainier, Sharp Everywhere



Apparently Routine Closeup: DOF Control



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

Focus Stacking: Why and How

Why: Get more depth of field, sharper subjects, smoother backgrounds

How:

Step 1) Shoot multiple images, changing focus.

Step 2) Run this “stack” of images through a computer to pick out the sharp bits.

Static subjects only – plan ahead.

A Simple Example... Here's the Scene



As Seen by the Camera (f/8)

From general photographic experience we know that the zone through which light enters the camera is limited by the aperture of the lens. The amount of light entering the camera is determined by the area of the aperture. This area is called the *depth of field*. The depth of field is the zone in which the picture goes from sharp to blurry. The illustrations overlaid demonstrate this concept.

For a typical photograph taken outdoors with a 50 mm lens at $f/4$, with the subject 10 feet (3 m) away, the depth of field is a full 3 feet (0.9 m). Anything within that zone will be rendered quite sharply. But put that identical lens, still set at the *same* aperture, on extension tubes so that it can focus at $1\times$ (1:1)—about 2 inches (5 cm) from the subject—and the depth of field is only one sixty-fourth of an inch (0.4 mm). This

As Seen by the Camera (f/8)

From general photographic experience we know that for some distance in front of, and for some distance behind the point of focus, the image is acceptably sharp. This zone of adequately clear focus surrounding the object focused upon is called the *depth of field*. The decline in sharpness is gradual on either side of the exact plane of focus, and no specific location exists where the picture goes from sharp to fuzzy. The illustrations overleaf demonstrate this concept.

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As Seen by the Camera (f/8)

Unfortunately, the optical and physical facts of close-up life are such that if we bring to close-

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For a typical photograph taken outdoors with a 35 mm lens at $f/8$, with the subject 10 feet (3 m) away, the depth of field is a full 3 feet (0.9 m). Anything within this zone will be considered quite sharp. But just the slightest focus shift will be noticeable, as evidenced when we change the focus to 5 ft (1.5 m) from the subject—and the depth of field is only one very fourth of its first 0.9 m. This

Stacking 15 Frames (f/8)

of close-up life are such that if we bring to close-

DEPTH OF F

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A Single Frame (f/32)

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Stacking 6 Frames (f/8)

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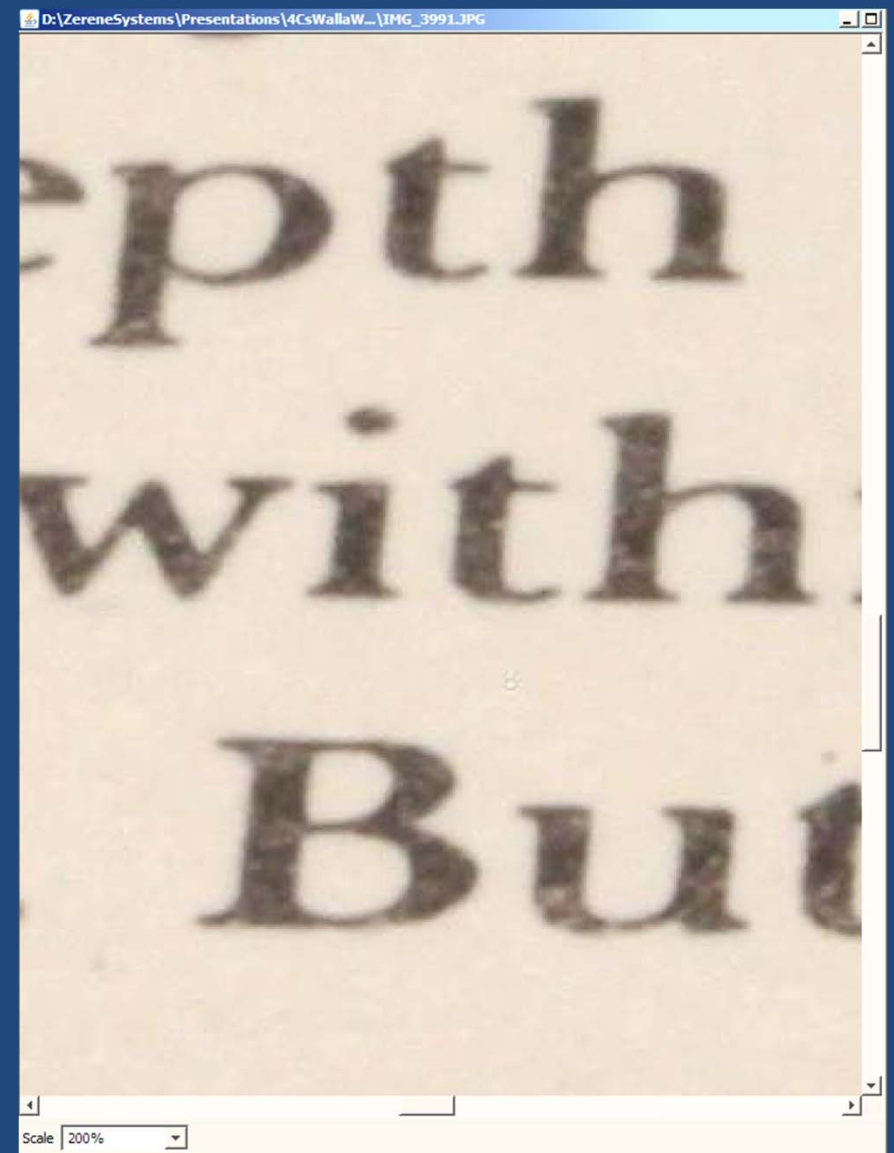
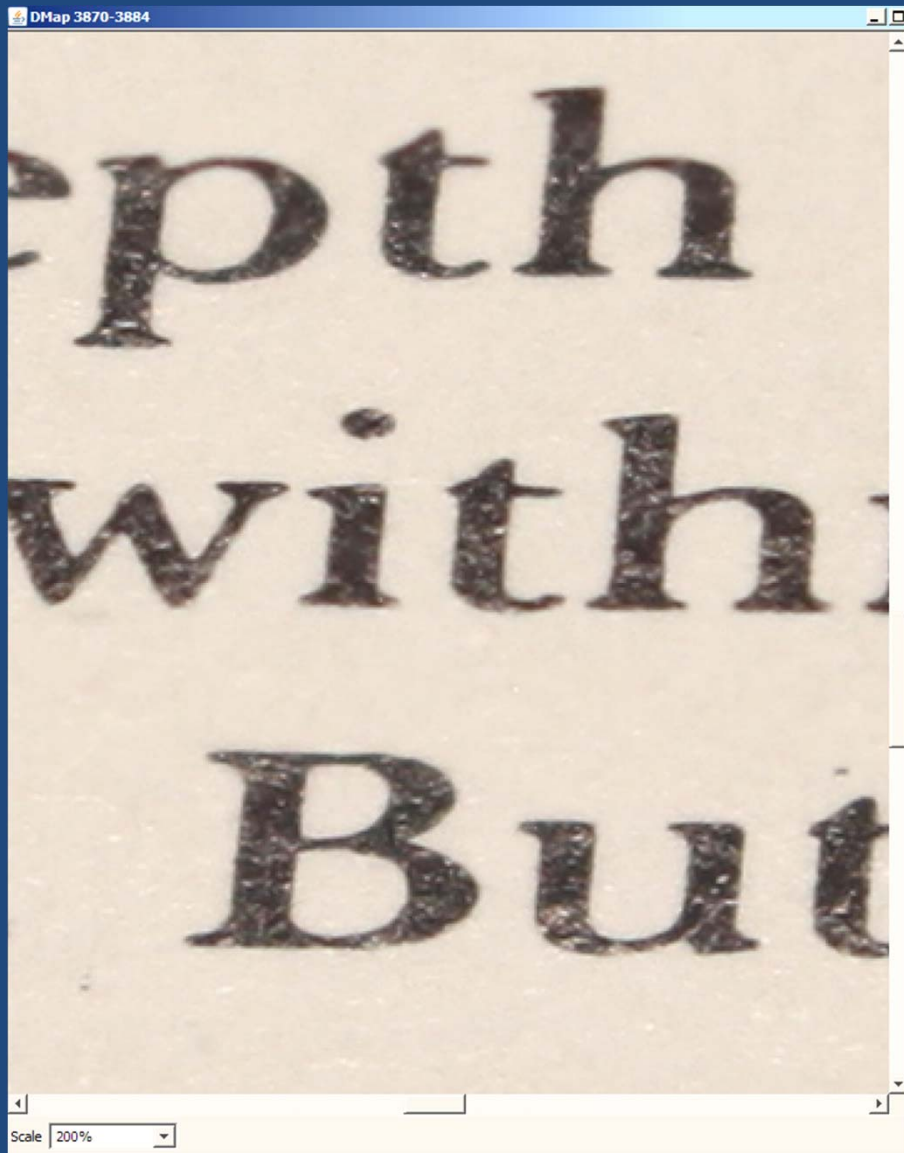
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Stacking Is Sharper Than Stopping Down

Stacked, f/8

(at 200%)

One Frame, f/32



Quick Recap So Far

Why: Get more depth of field, sharper subjects, smoother backgrounds

How:

Step 1) Shoot multiple images, changing focus.

Step 2) Run this “stack” of images through a computer to pick out the sharp bits.

Static subjects only – plan ahead.

You May Have a Few Questions...

The most common:

- How many frames do I need?
- What aperture should I use?
- How should I step focus?
- Should I use manual exposure, or automatic?
- Do I need any special equipment?
- What software should I use?
- How big of a computer does this take?

And the Answer Is...

“IT DEPENDS!”

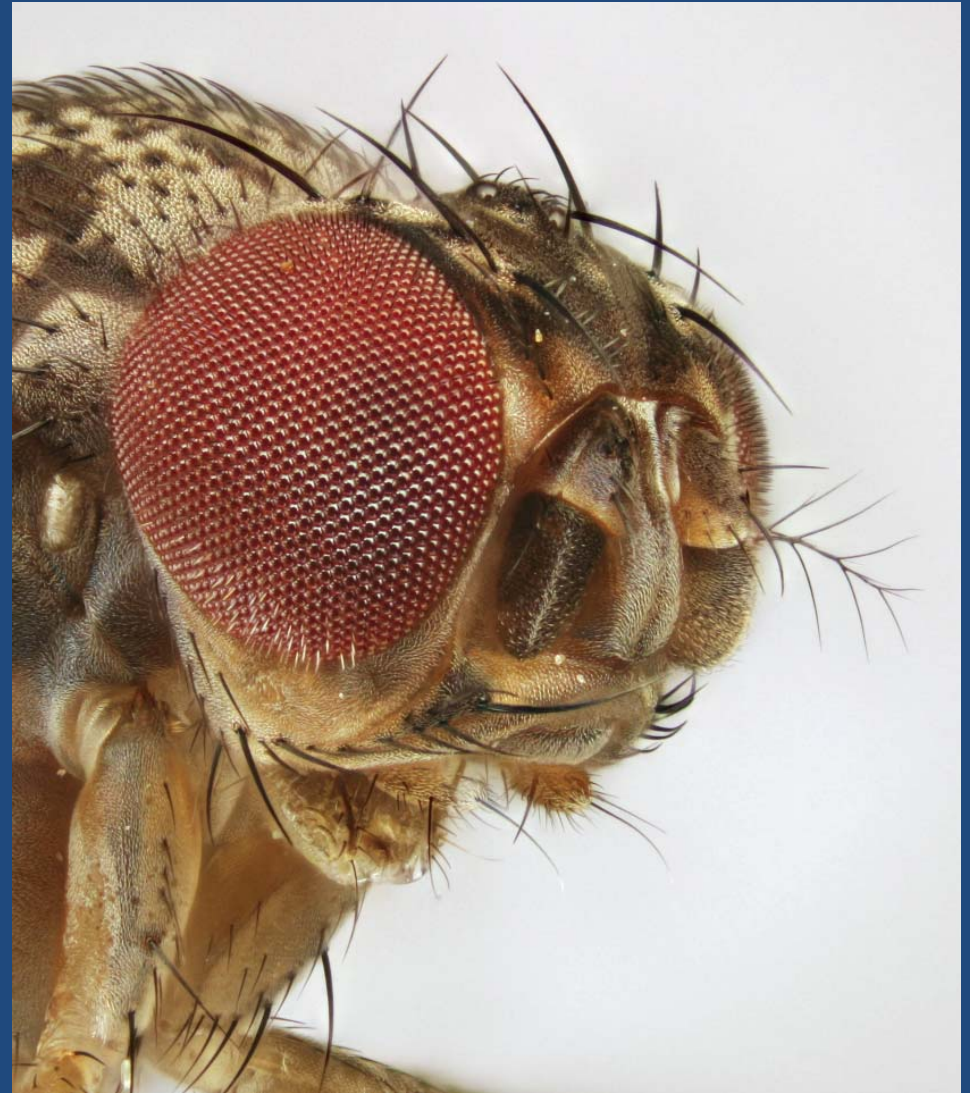
How Many Frames Do I Need?

at least two

sometimes hundreds



Painted Hills with grass in foreground



Fruit fly through 100X microscope

What Aperture Should I Use?

Best advice:

Stop down as far as possible,
while still getting the sharpness you want.

Three common choices:

1. Sharpest for the lens you're using
2. Farther open for more blurred background
3. Farther closed for fewer frames

How Should I Step Focus?

There are two common choices:

1. Use the lens focus ring or motor

- usually the best approach, if it's feasible at all

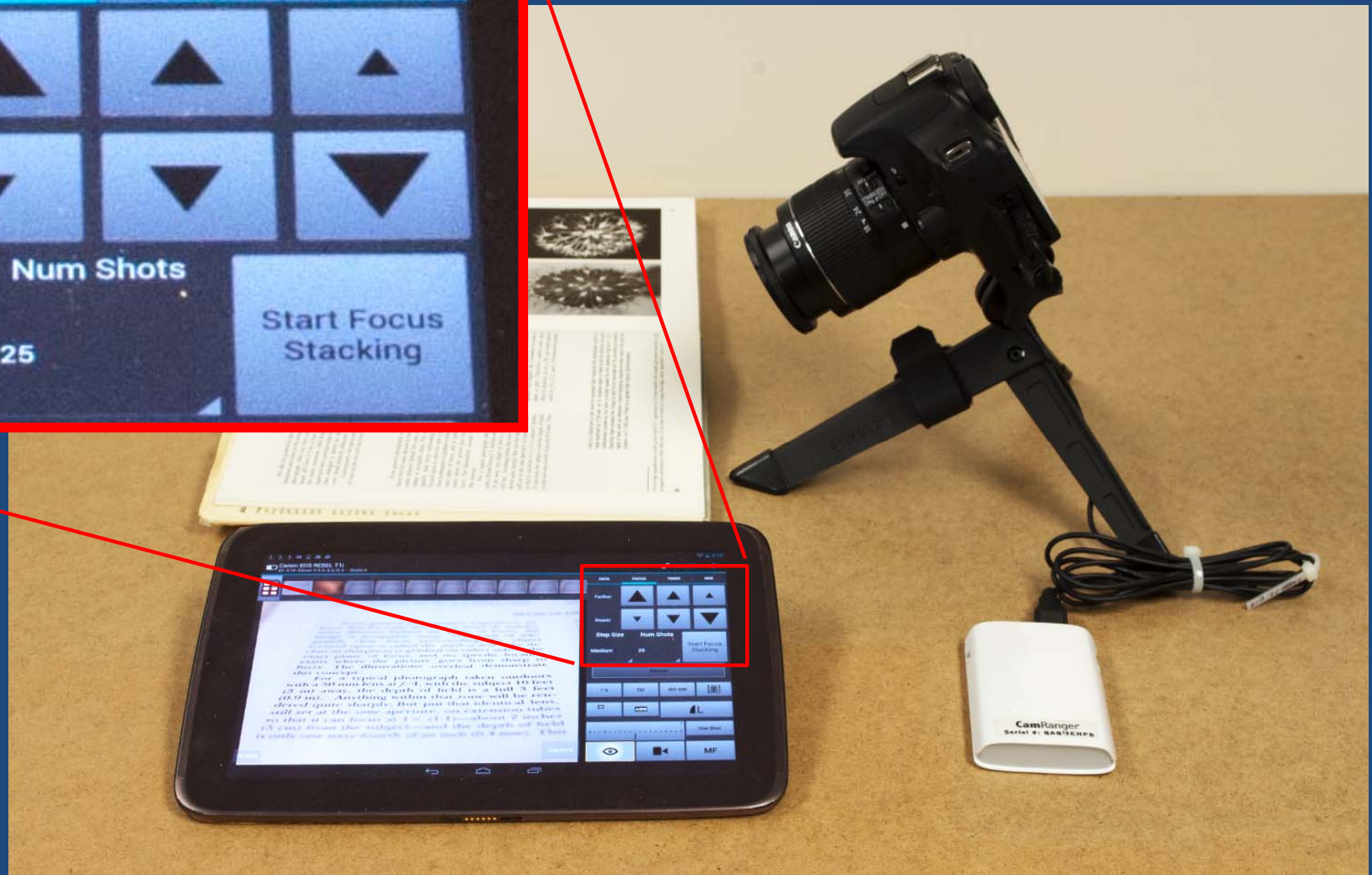
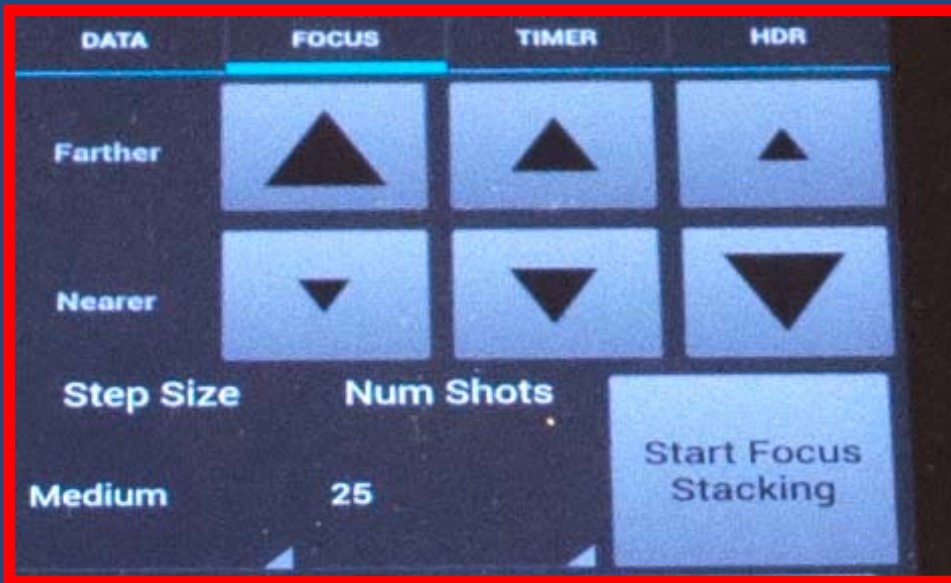
2. Move the camera and lens as a unit

- most effective with small subjects, e.g. $< 1''$

Both can be automated, if you like.

The Example Was Shot with CamRanger

Automated control of focus motor (“turn the ring”)



Stepping Focus: Lots of Options

Move the optics, move the camera



Move the subject



Every one of these methods is useful in some circumstances.

What's the Best Method To Step Focus?

(It depends...)

Type of Subject		Focusing Method							
Description	Typical # Frames	Lens Ring (manual)	Lens Ring (AF motor)	Focus Rail (gear)	Focus Rail (manual screw)	Focus Rail (motor screw)	Microscope Focus Block	Bellows Front	Bellows Rear
Landscape	5	Excellent	Excellent	Impossible	Impossible	Impossible	Impossible	Good	Ideal
Bouquet of flowers	10	Good	Excellent	Awful	Awful	Awful	Impossible	Good	Ideal
Single rose	20	Challenging	Excellent	Mediocre	Mediocre	Mediocre	Impossible	Mediocre	Ideal
Raisin	40	Challenging	Excellent	Good	Good	Good	Good	Awful	Excellent
Fruit Fly	200	varies!	varies!	Impossible	Tedious	Excellent	Excellent	Mediocre	Good
Eye of Fruit fly	many	varies!	varies!	Impossible	Difficult	Excellent	Excellent	Impossible	Mediocre

This is from the Zerene Stacker web page,

“Is it better to use a focus rail or the ring on my lens?”

So What Can Go Wrong?

- Changes of magnification are OK –
software can perfectly correct for those.
- Changes of perspective are a problem –
there's no way to correct for those.

Move the lens as little as possible.

Be sure nothing changes except focus.

Do Not Do This!

Focused on background leaf



and focused on foreground petal



Do Not Do This!

and focused on foreground petal



and focused on foreground petal



Compare The Results

Focused “by rail”



Focused “by ring”



Automation For Stepping Focus

(This list is certainly not exhaustive, and probably not current!)

– AF motor control to “turn the focus ring”

- In-camera (fairly common in recent models)
- Add-on tools
 - CamRanger
(Canon & Nikon, wireless to smartphone, tablet, laptop, even desktop)
 - Helicon Remote (Canon & Nikon, multiple platforms, mostly wired)
 - 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

– Automated focus rail

- StackShot, WeMacro, MJKZZ, et.al.

StackShot Rail

Automated stepping to 2 μm (0.002 mm = 0.00008 inch)



Which Software?

Reasonable options:

- Zerene Stacker
 - emphasis on high quality output, especially with deep stacks
- Photoshop CS4 and later, full version only
 - most commonly installed, but also the lowest quality for this job
- Helicon Focus — longest history, good functionality, runs fast
- Affinity Photo — like Photoshop but one-time purchase
- Lots of others — often in camera support software

Other Common Questions

What kind of computer?

- Most modern ones work fine.
- Zerene Stacker works on Windows, Mac, Linux, prefers 1-2 GB every 10 megapixels, no limit on # of frames.

Do I need special equipment?

- No, but you might want some after a while.
- Focus stacking allows closer macro than ever before.

Let's Run Another 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 Zerene Stacker
- Brief comparison with Photoshop

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



Camera
(with battery installed)

USB cable

CamRanger
(with built-in battery)

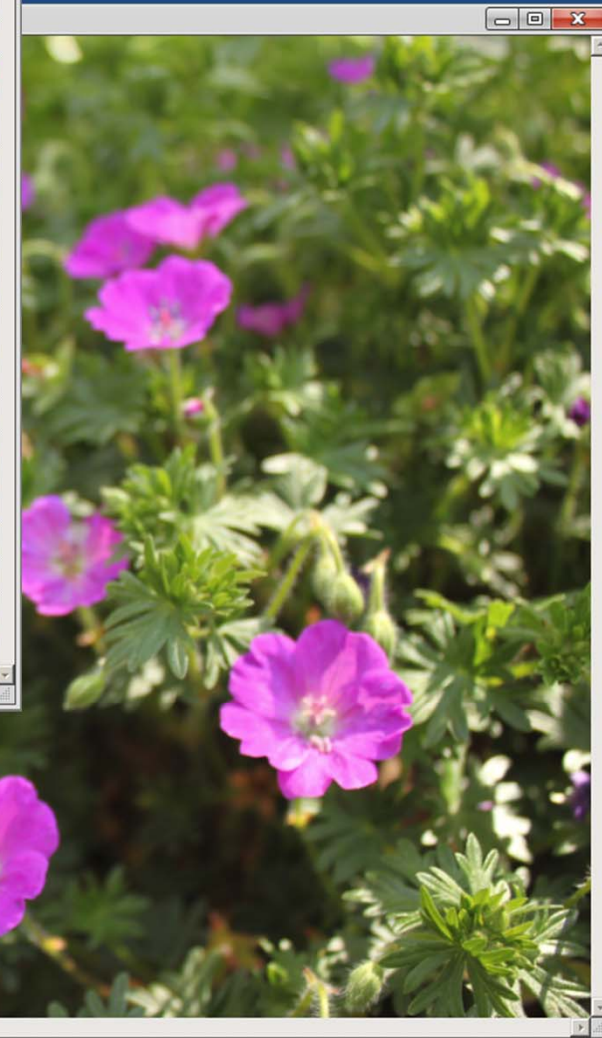
CamRanger Screen On Tablet



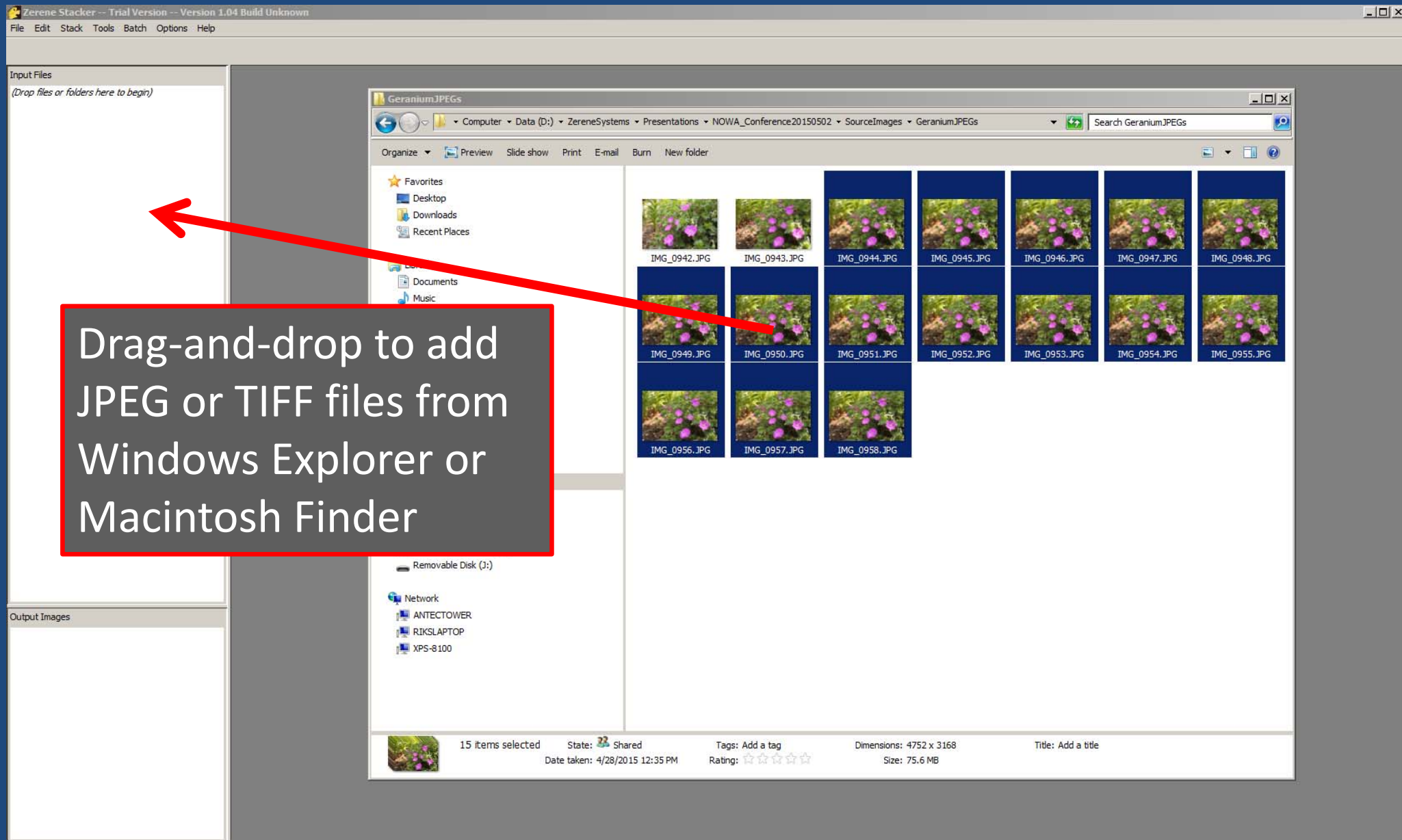
We Now Have A Stack



15 frames
at f/4

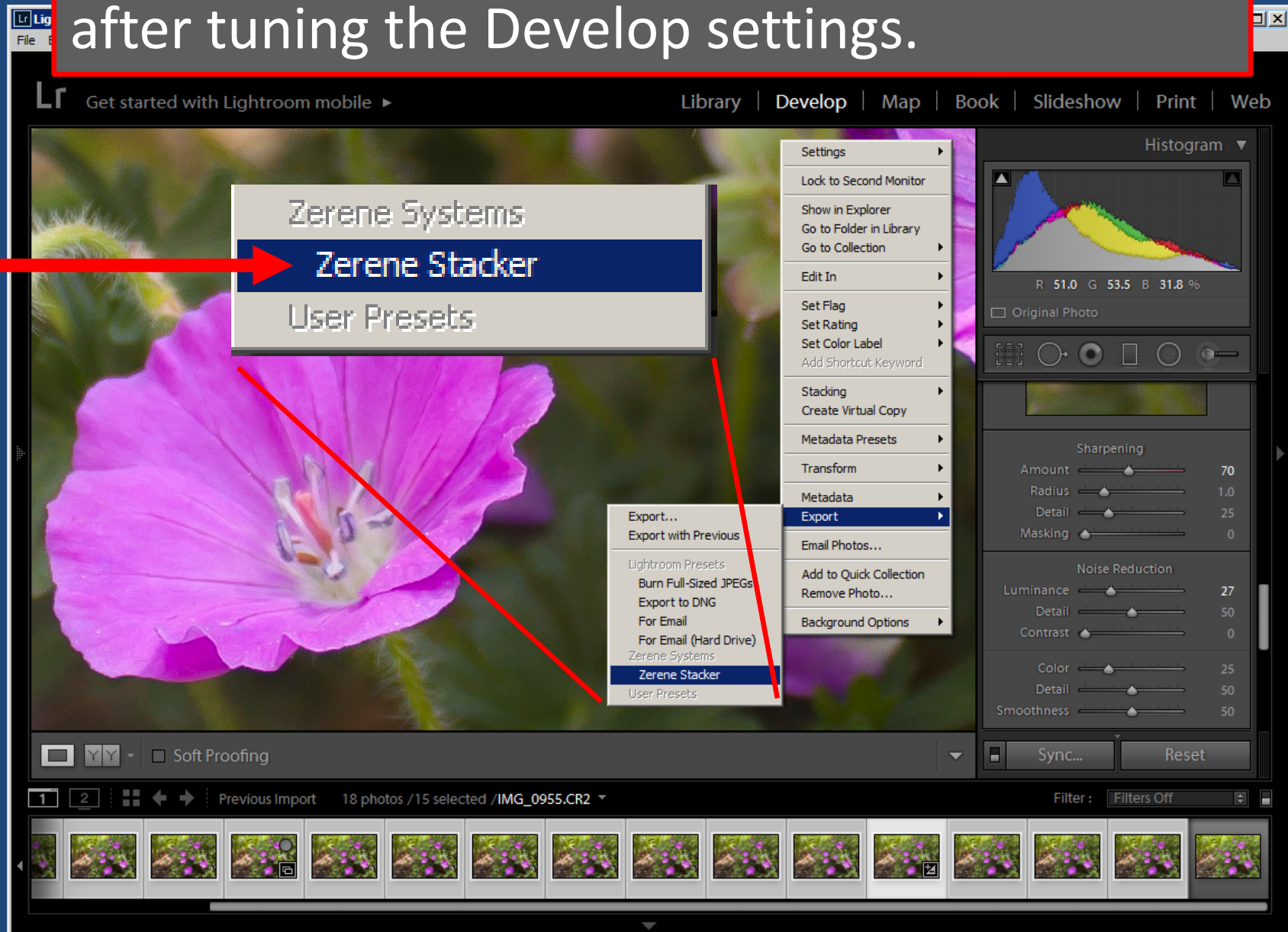


Load Images into Zerene Stacker

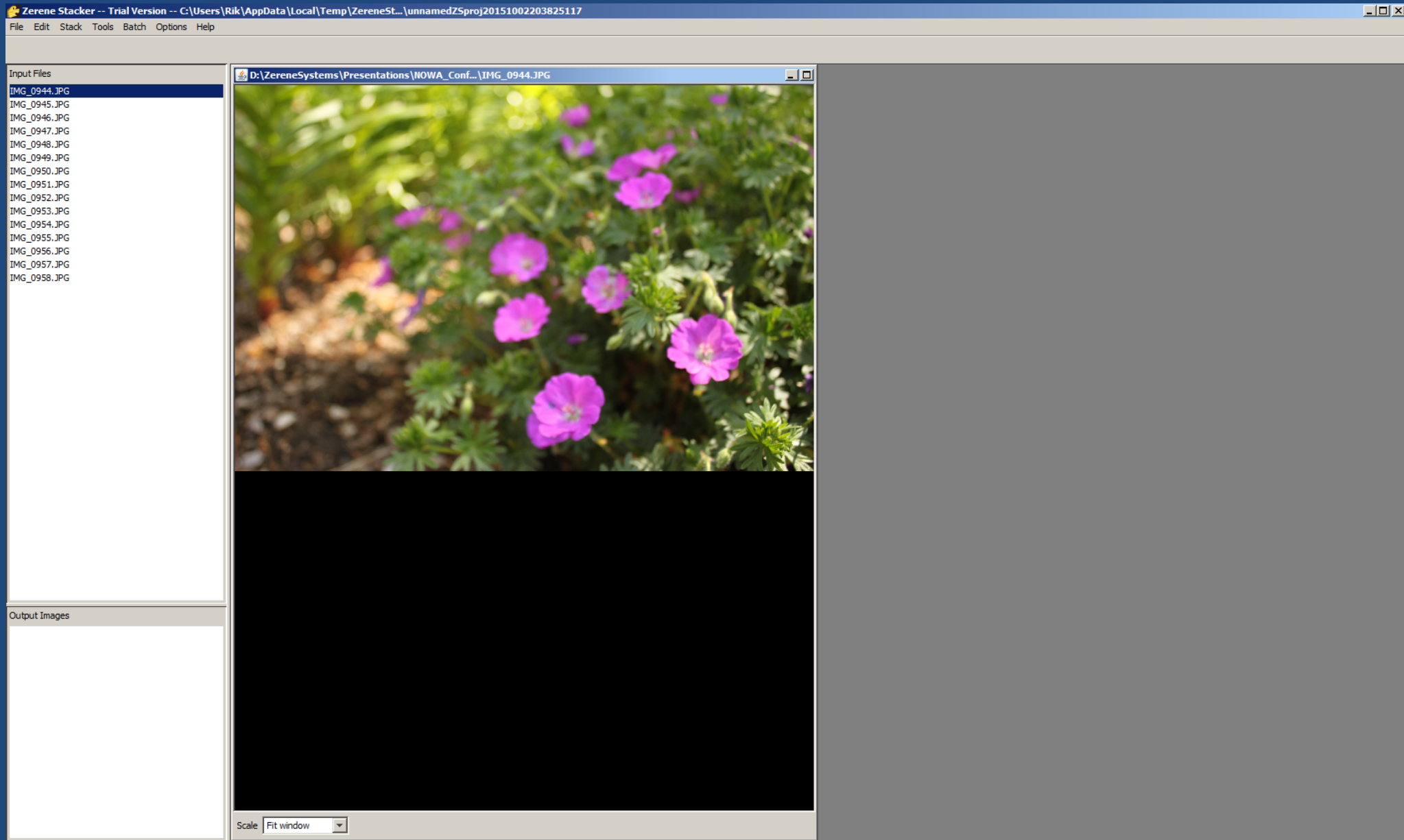


Load Images into Zerene Stacker

Select and Export any format from Lightroom, after tuning the Develop settings.

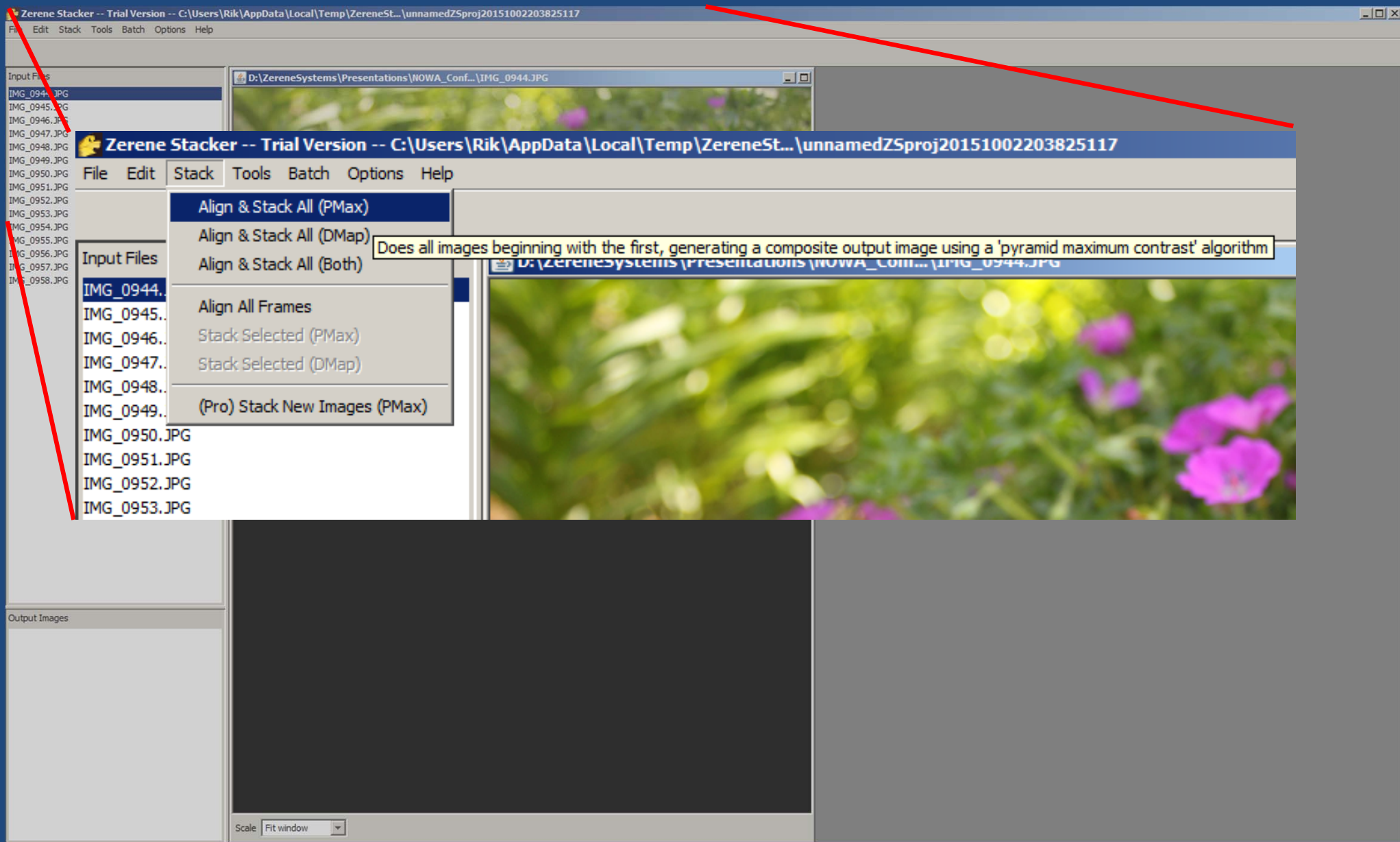


Processing in Zerene Stacker

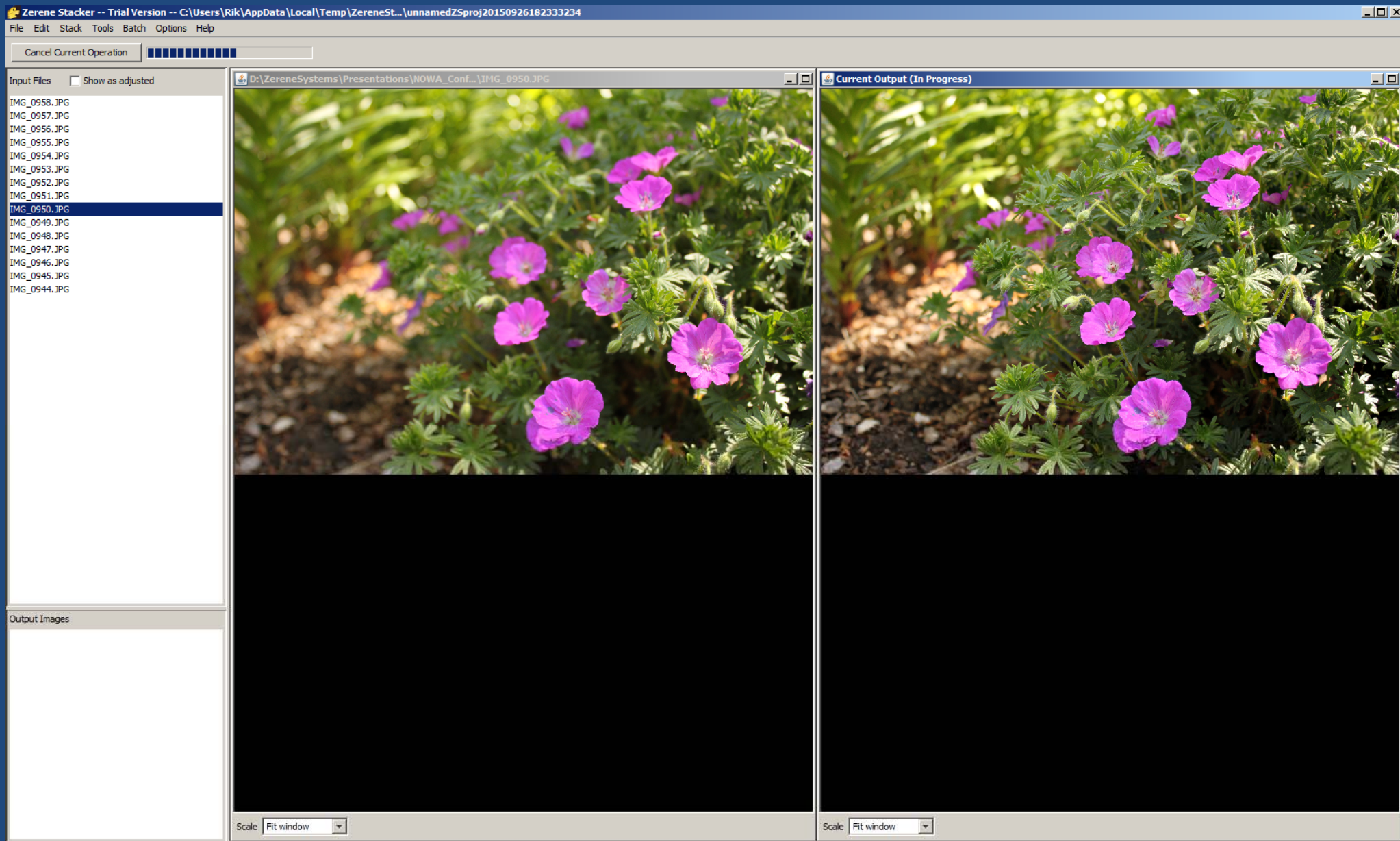


Processing in Zerene Stacker

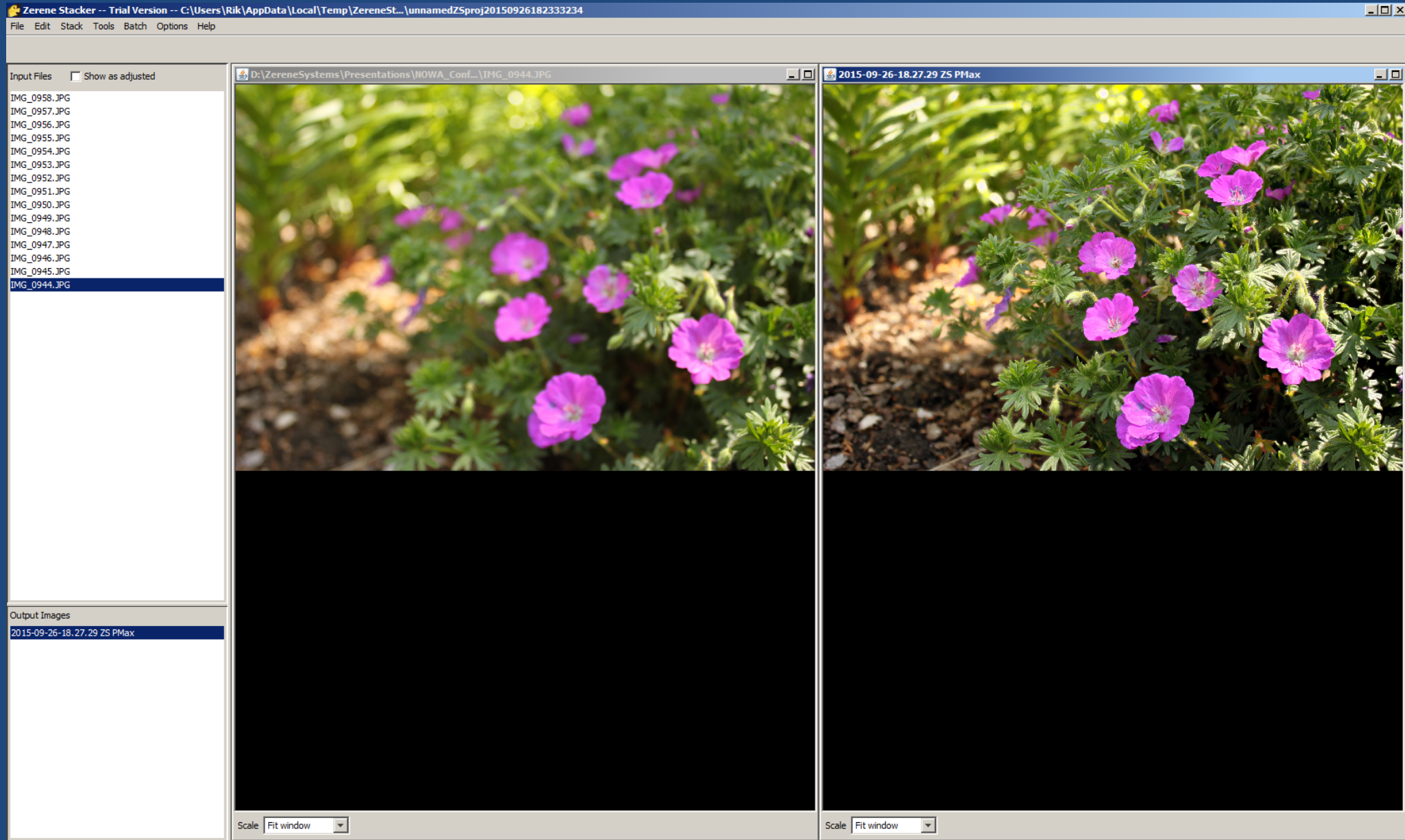
PMax method (“Pyramid Maximum”)



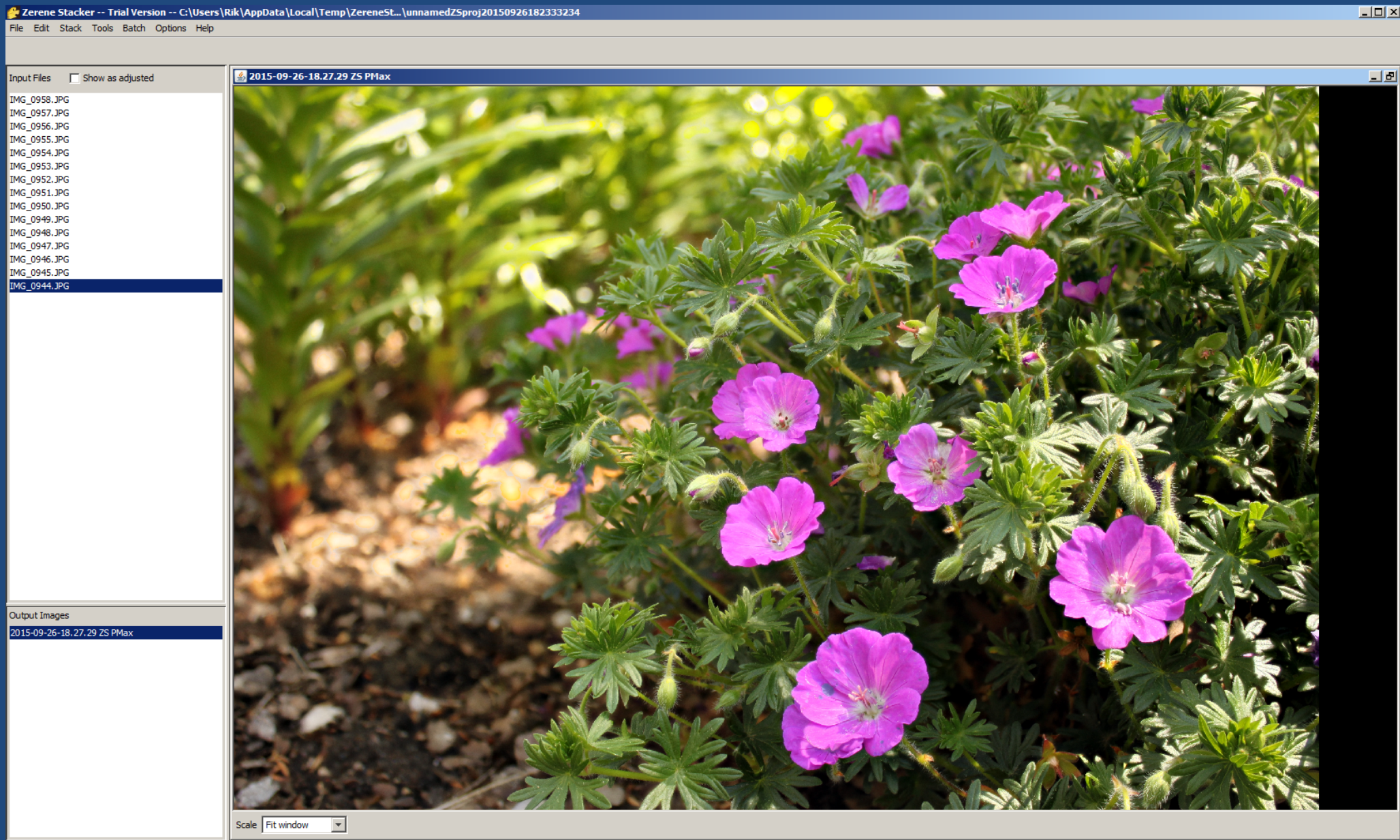
Processing in Zerene Stacker



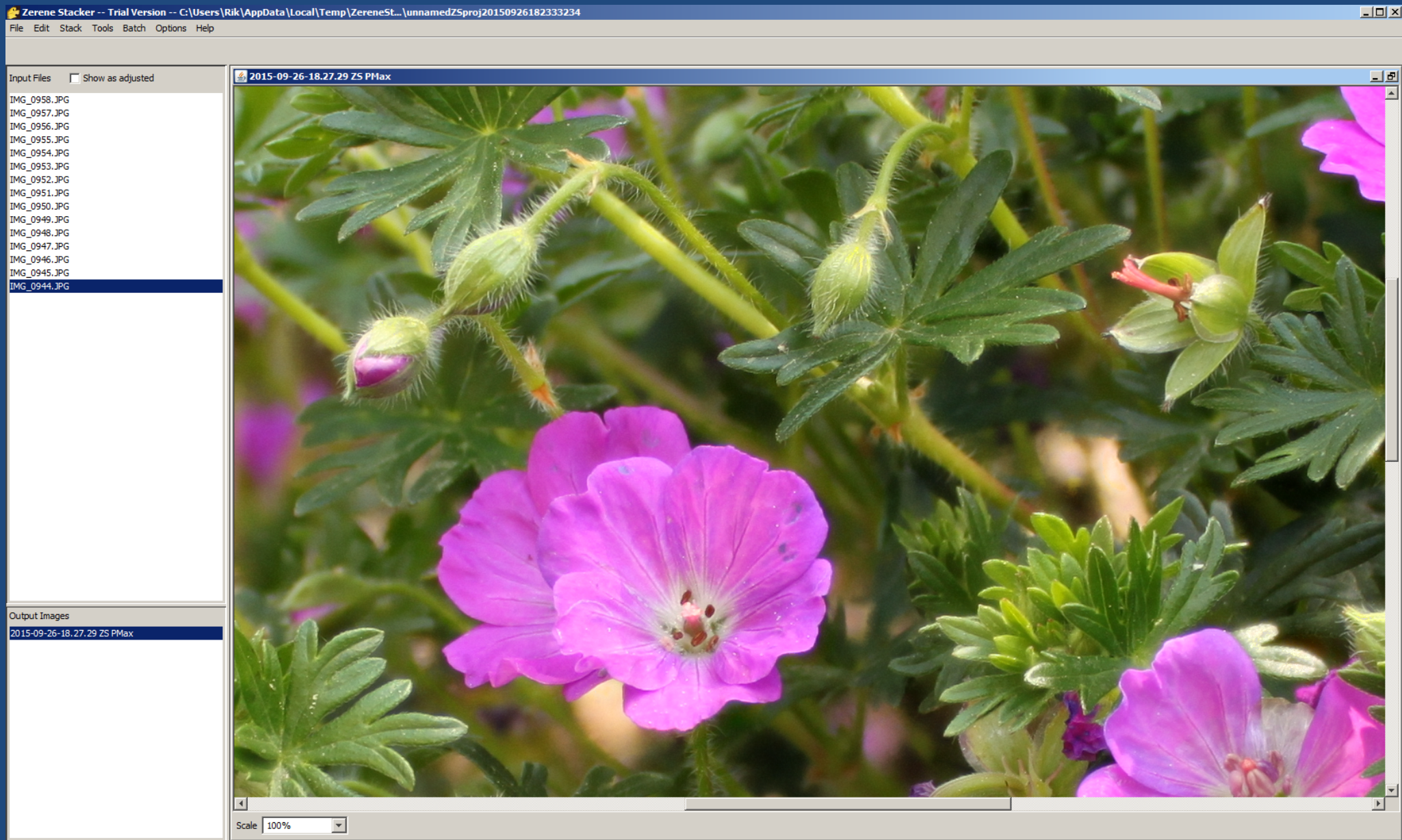
Processing in Zerene Stacker



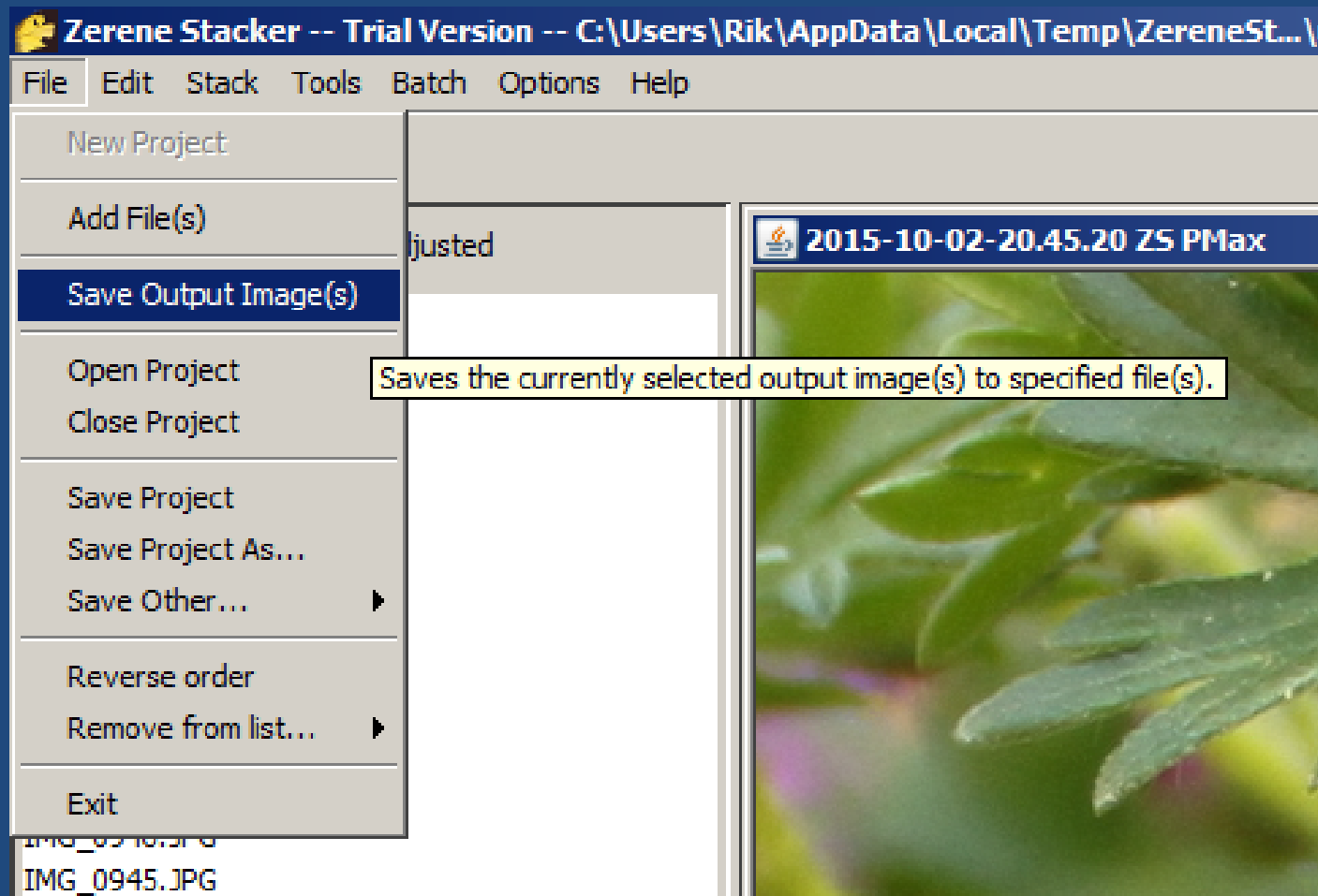
Processing in Zerene Stacker



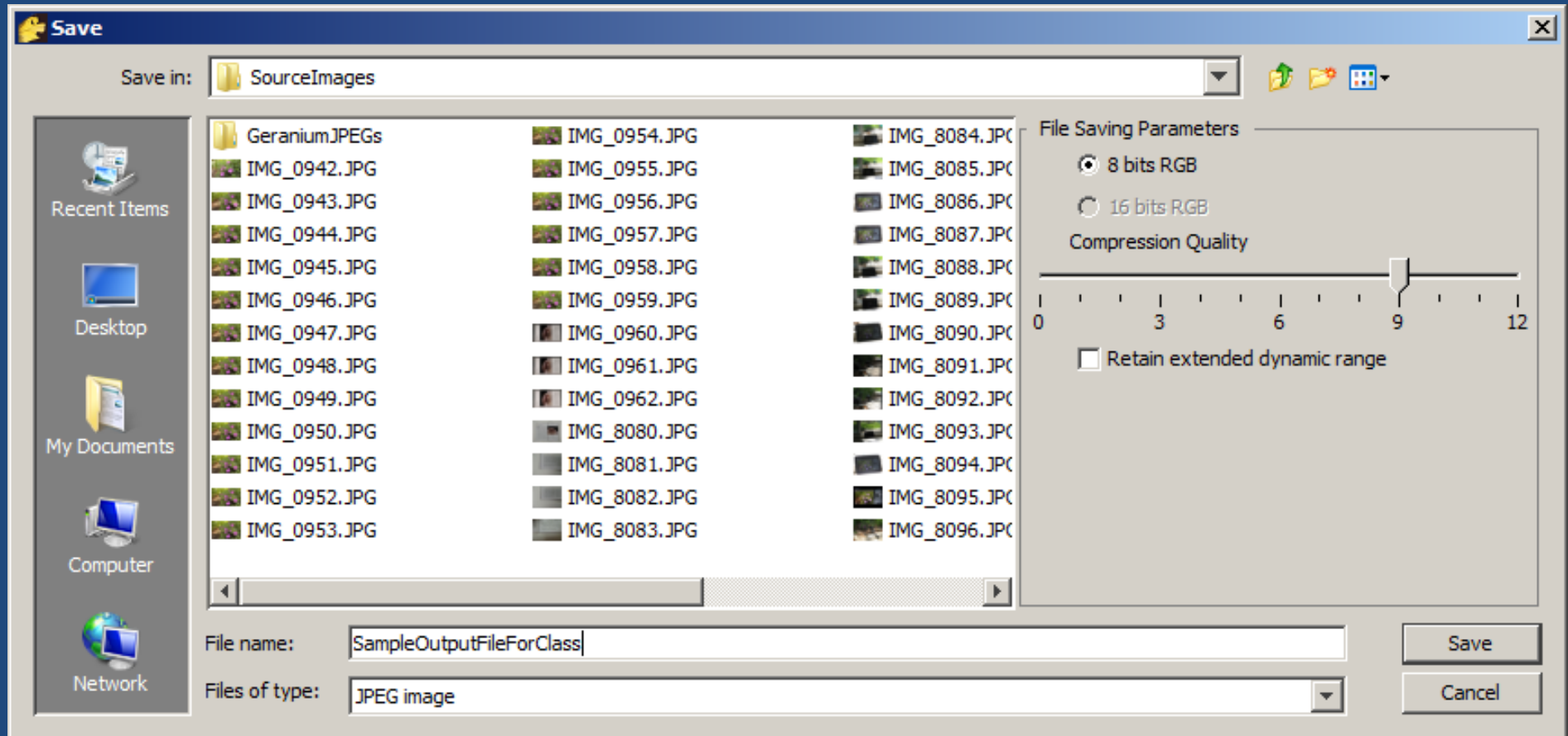
Processing in Zerene Stacker



Processing in Zerene Stacker

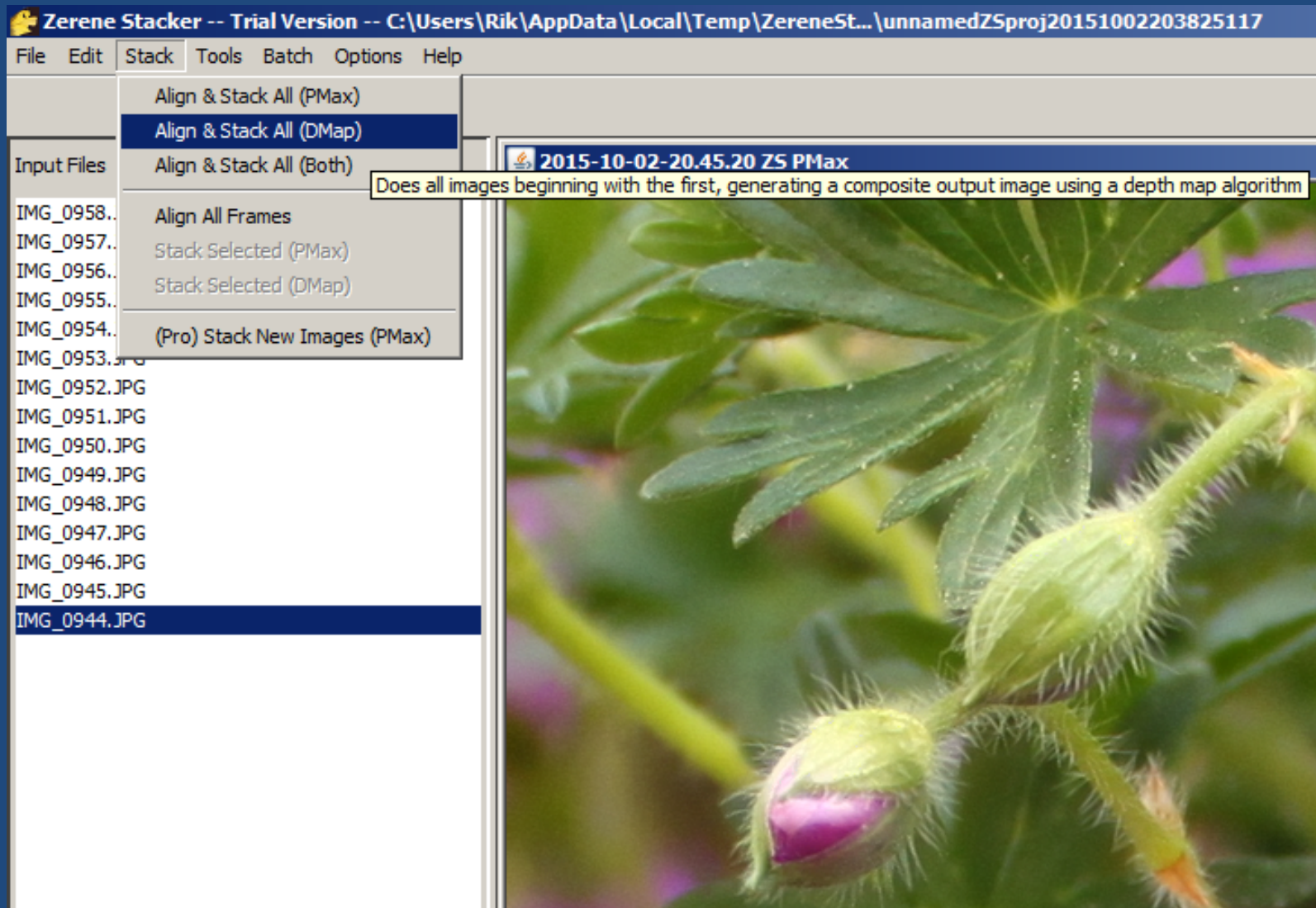


Processing in Zerene Stacker



Processing in Zerene Stacker

DMap method (“Depth Map”)



PMax versus DMap

A Quick Comparison

PMax

- + No learning curve
- + Better with tricky overlaps
- Accumulates noise
- Alters contrast and colors

Best for:

Bristly bugs, complex foliage

DMap

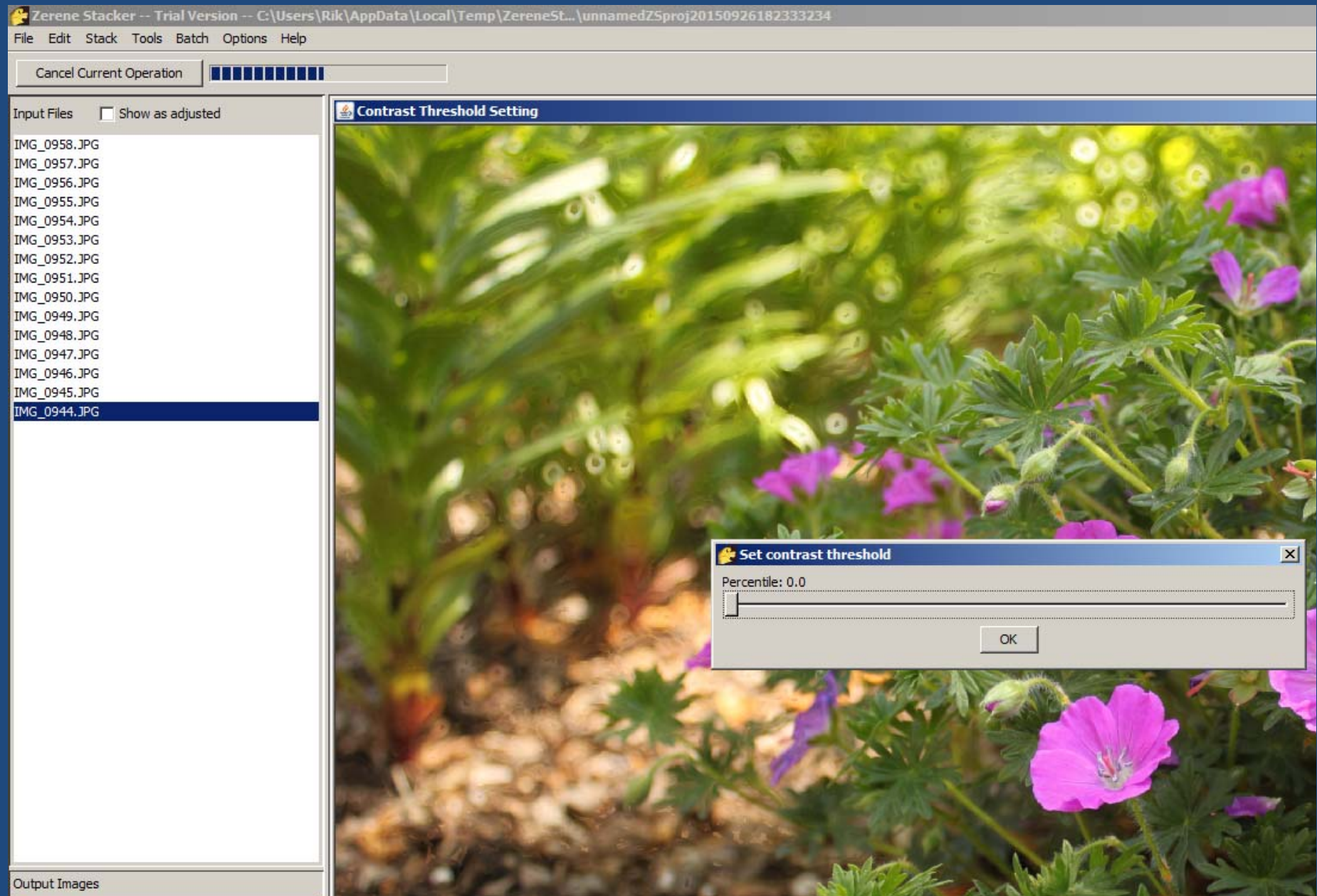
- Several controls to learn
- Not as good with overlaps
- + Does not accumulate noise
- + Does not alter color/contrast

Best for:

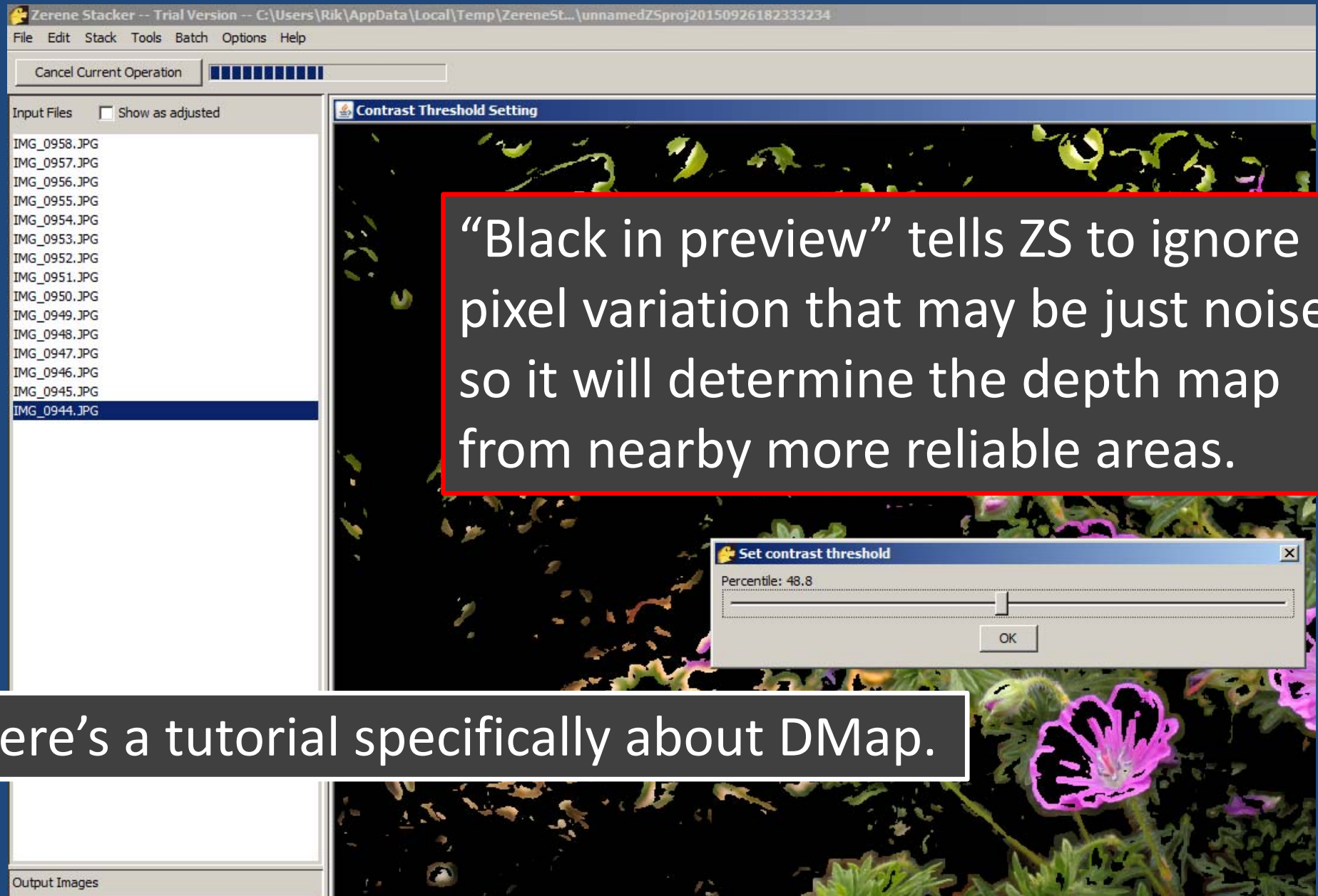
Rich tones and colors

Often it's best to combine these by retouching.

Processing in Zerene Stacker

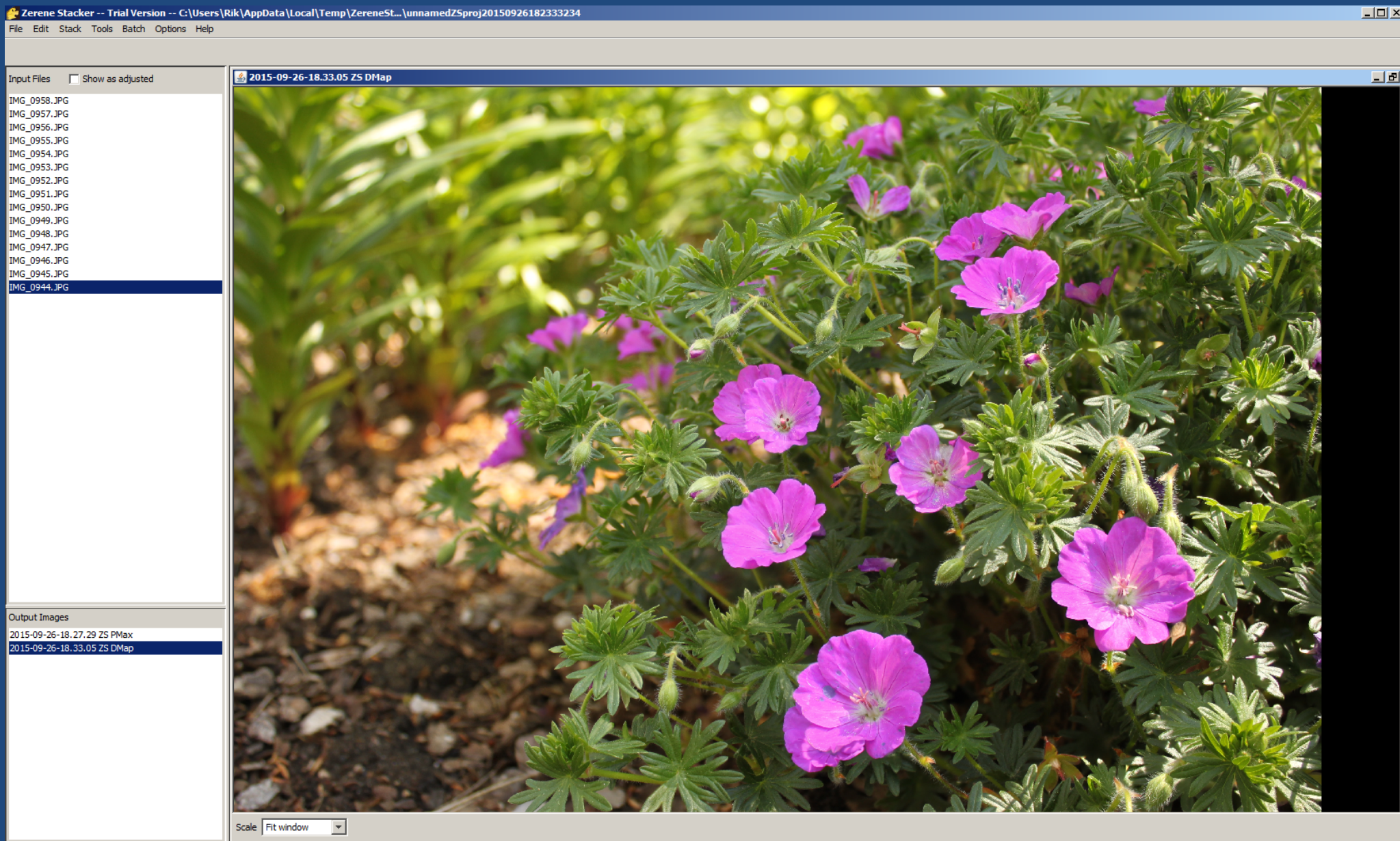


Processing in Zerene Stacker

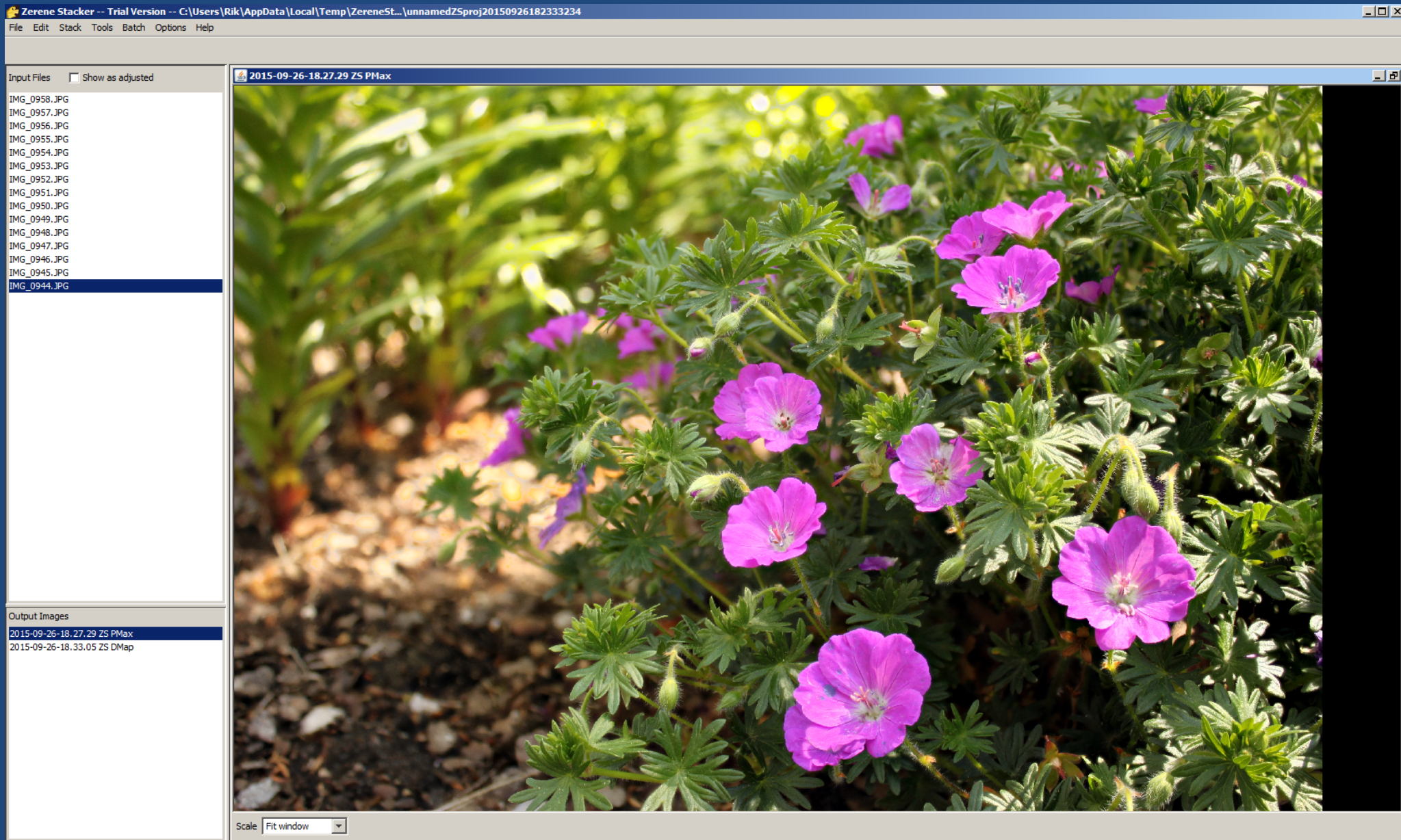


There's a tutorial specifically about DMap.

Processing in Zerene Stacker



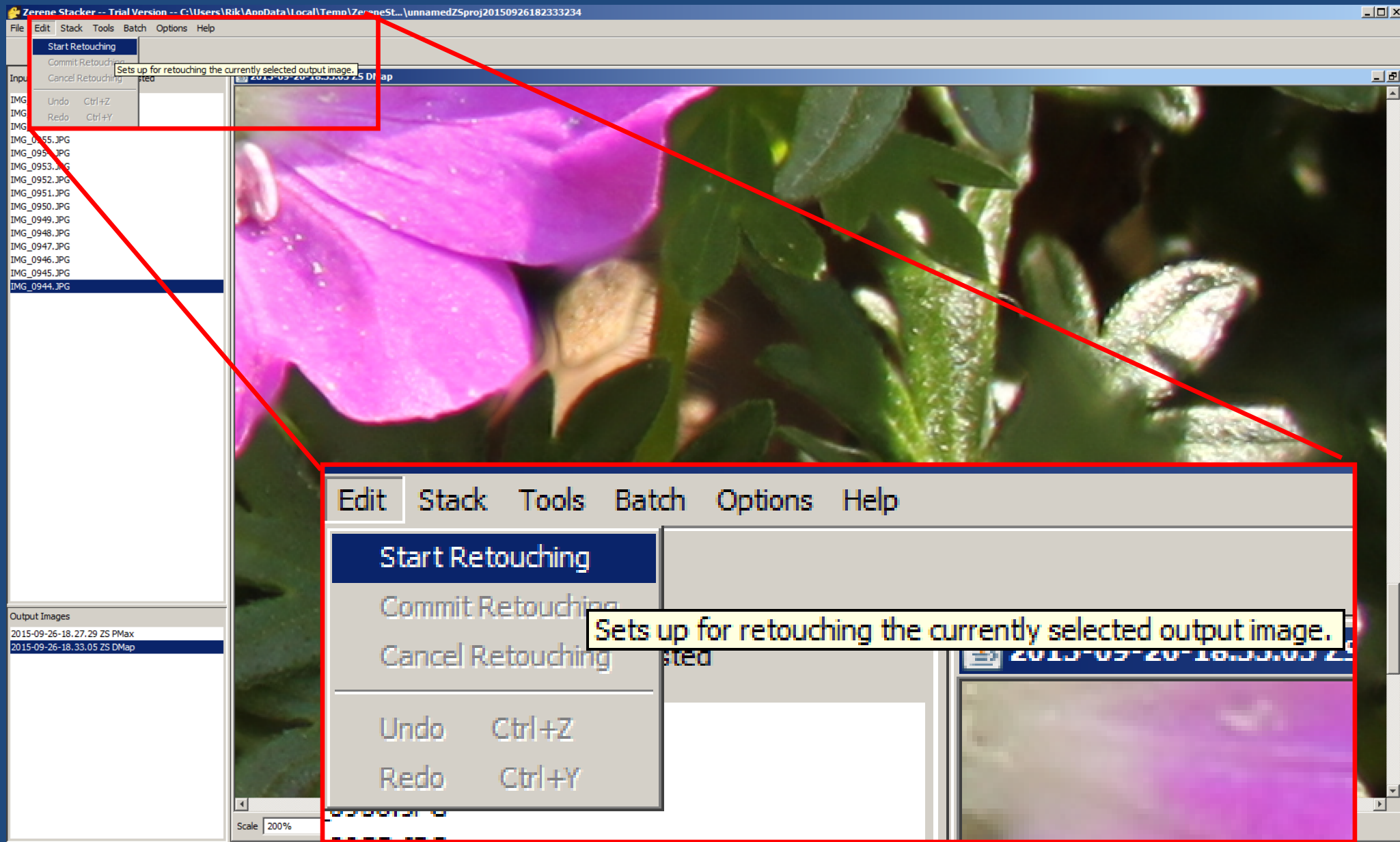
Processing in Zerene Stacker



Processing in Zerene Stacker

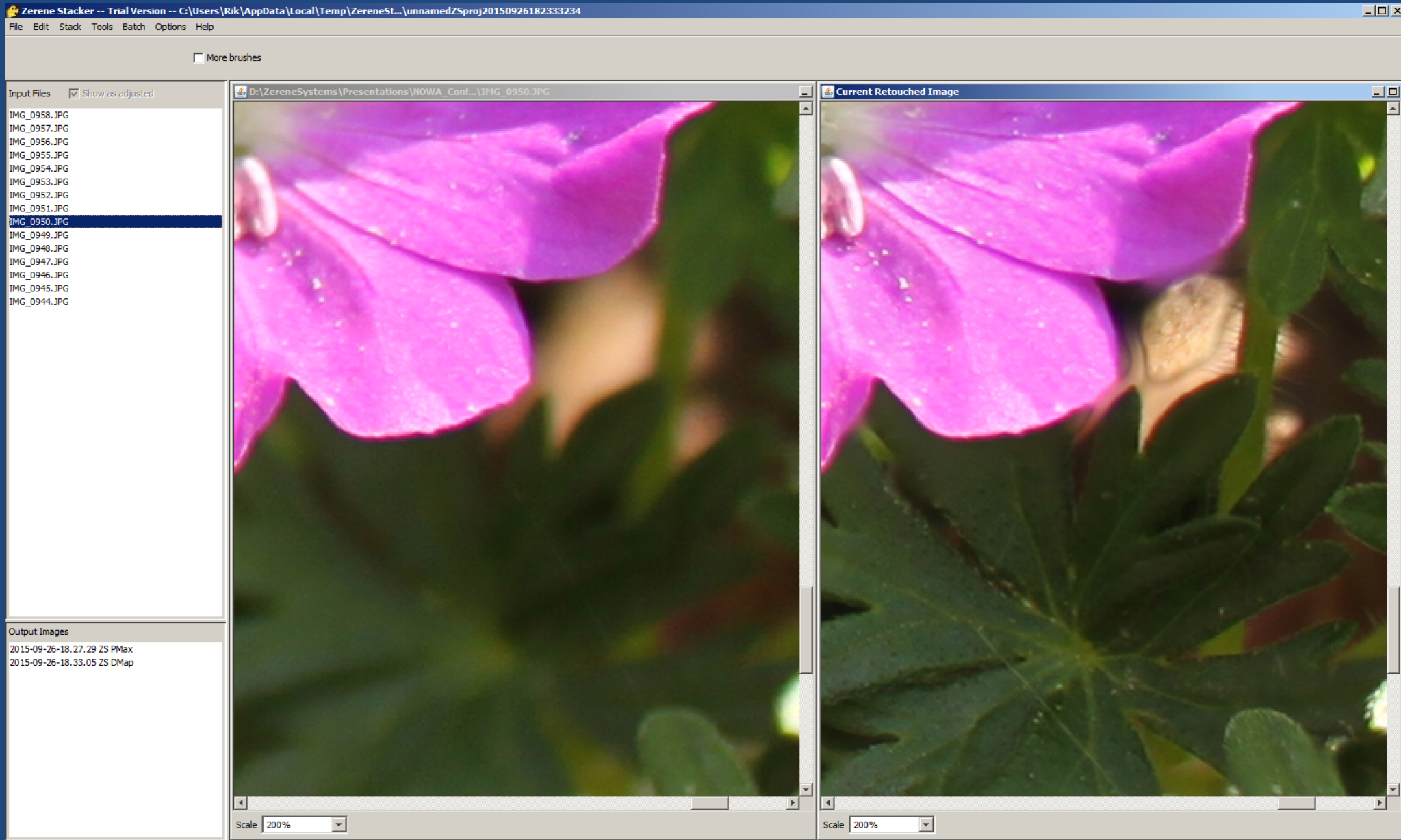


Processing in Zerene Stacker



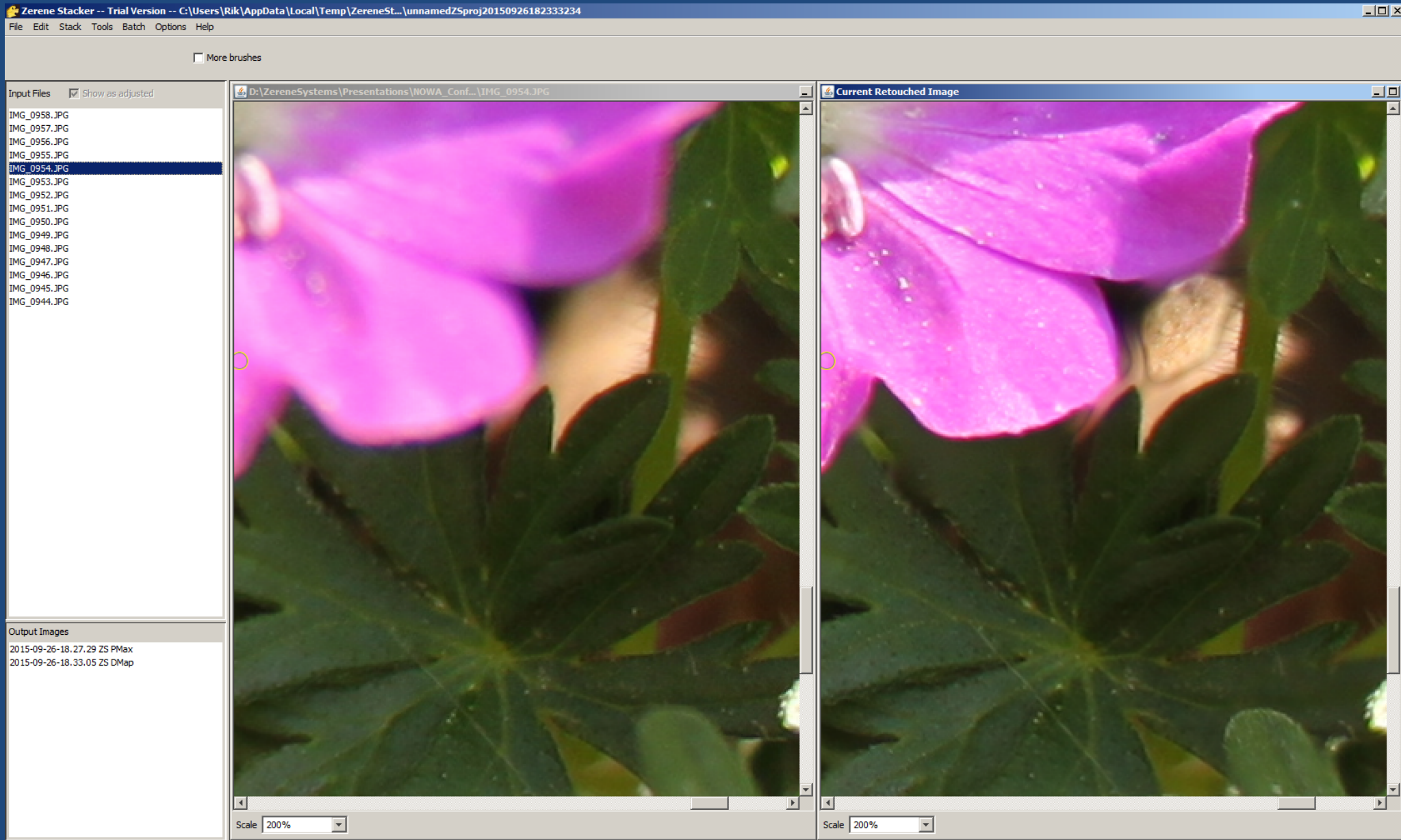
Processing in Zerene Stacker

Three input images contribute to this area



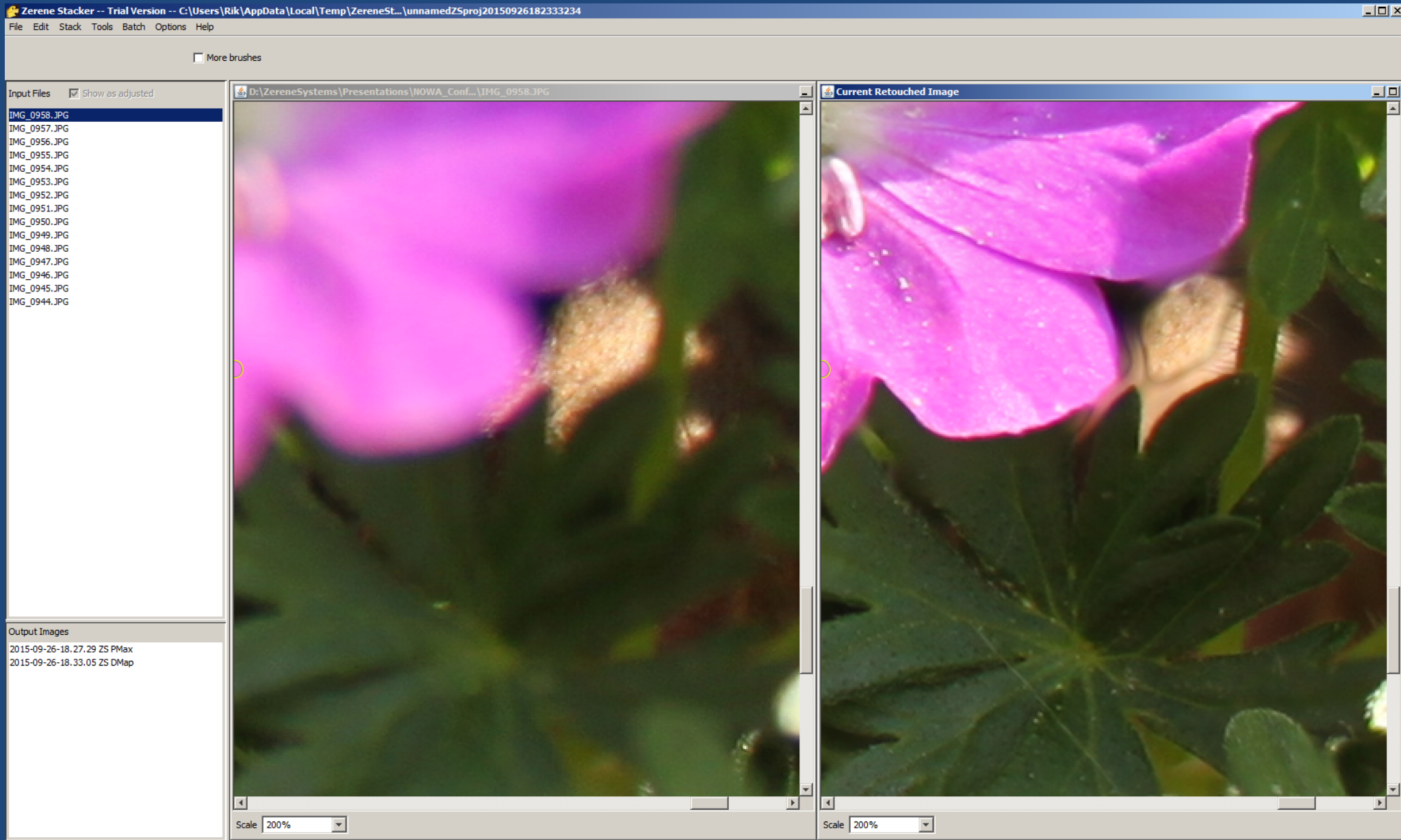
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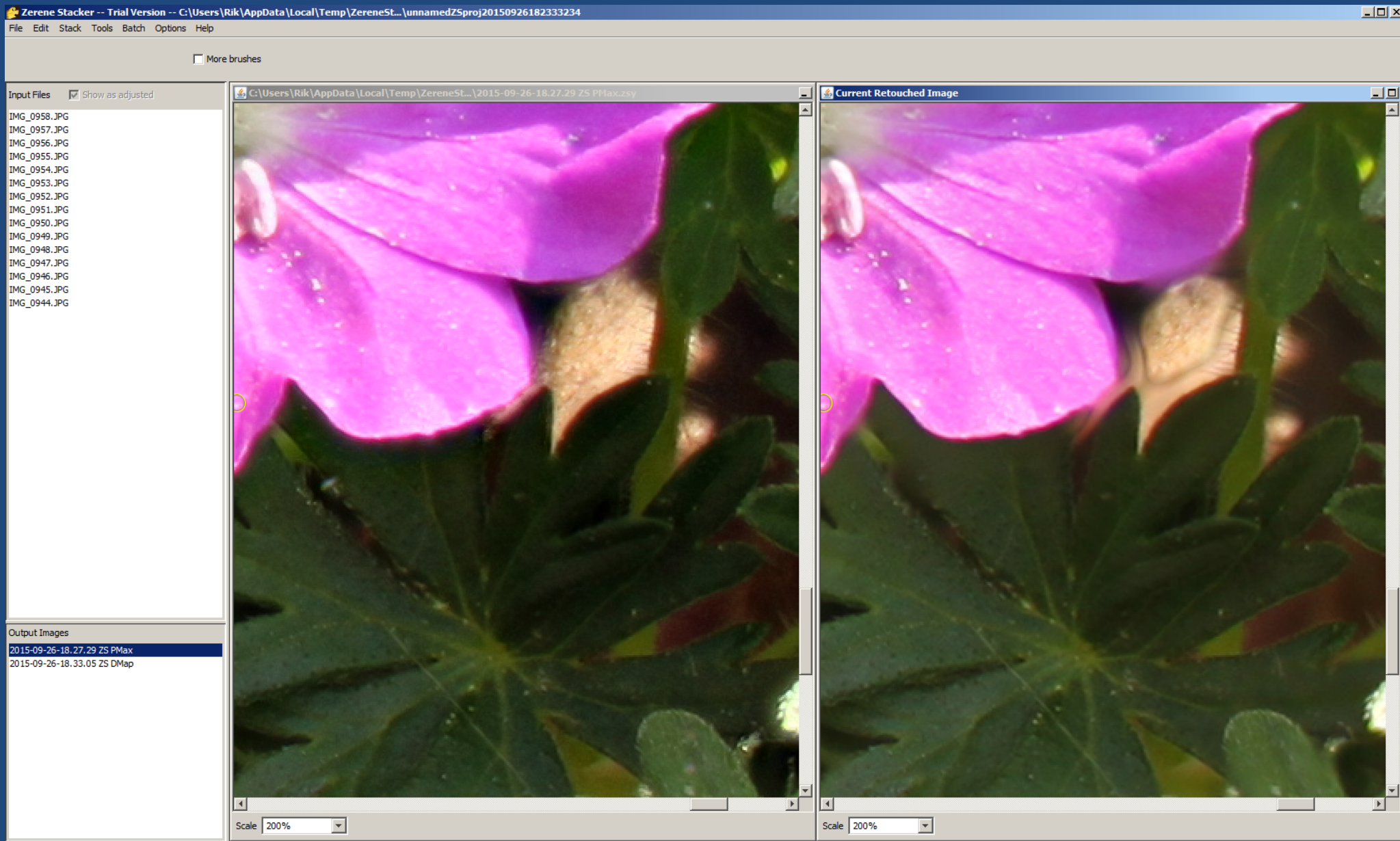
Processing in Zerene Stacker

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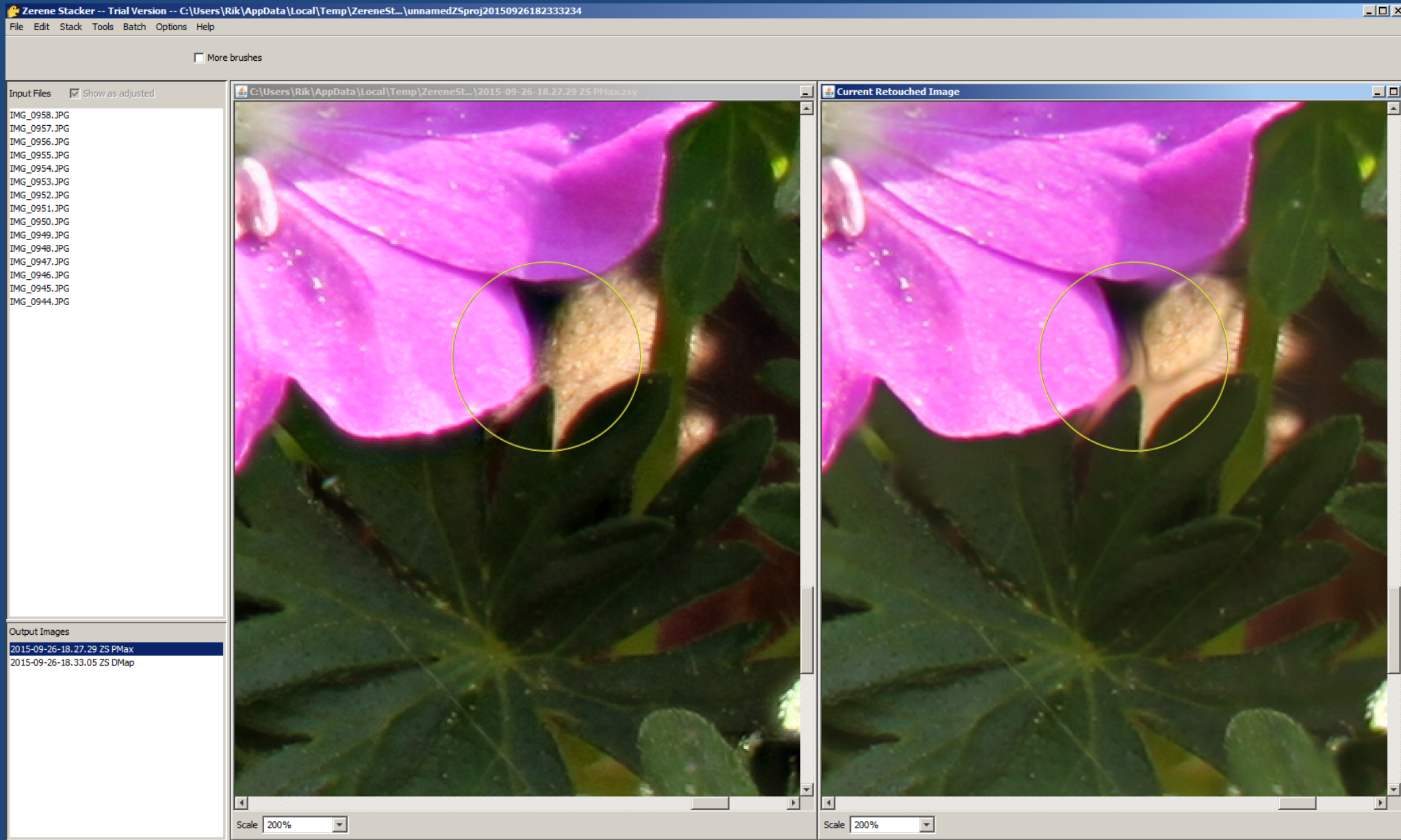


Processing in Zerene Stacker

PMax puts them together cleanly

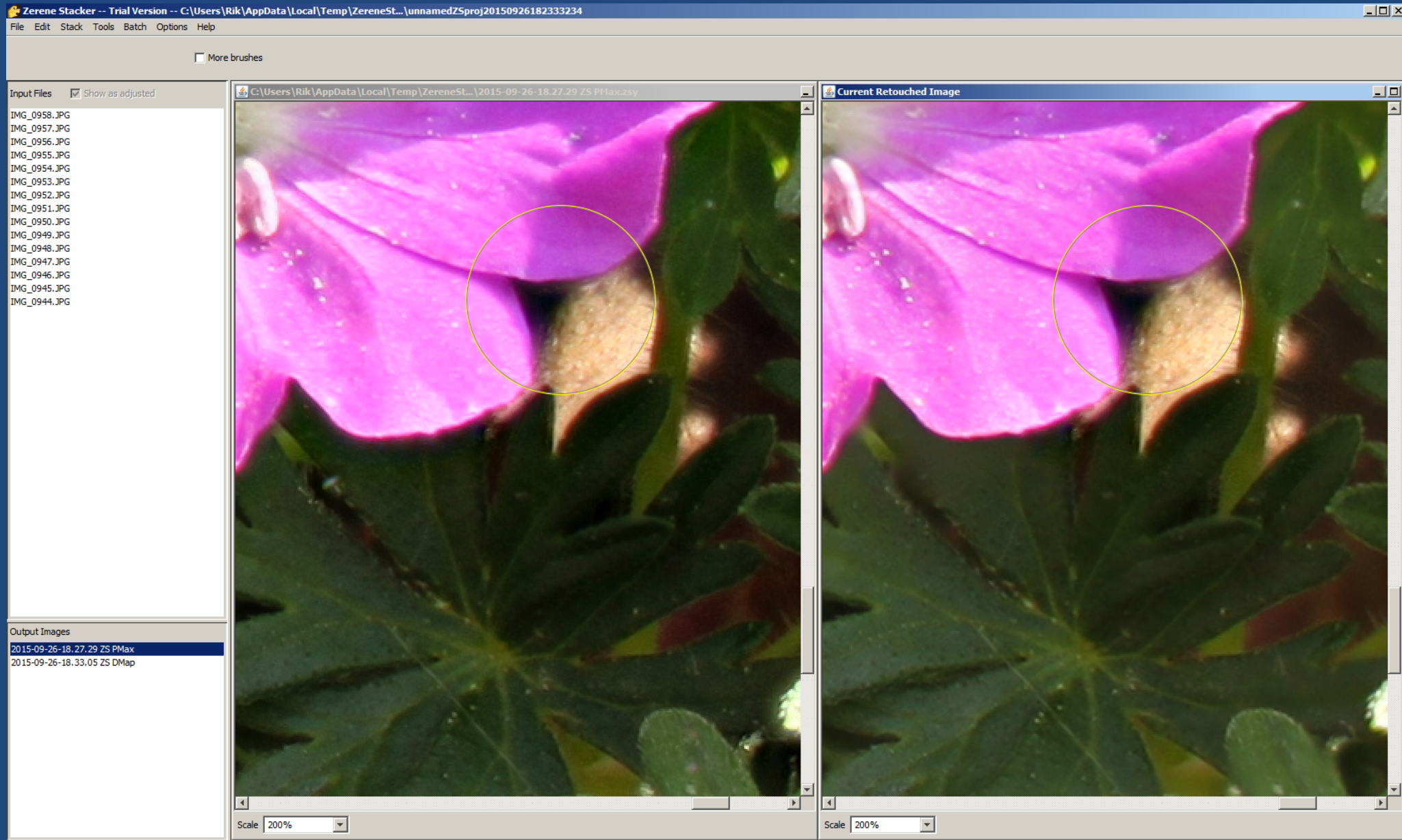


Processing in Zerene Stacker

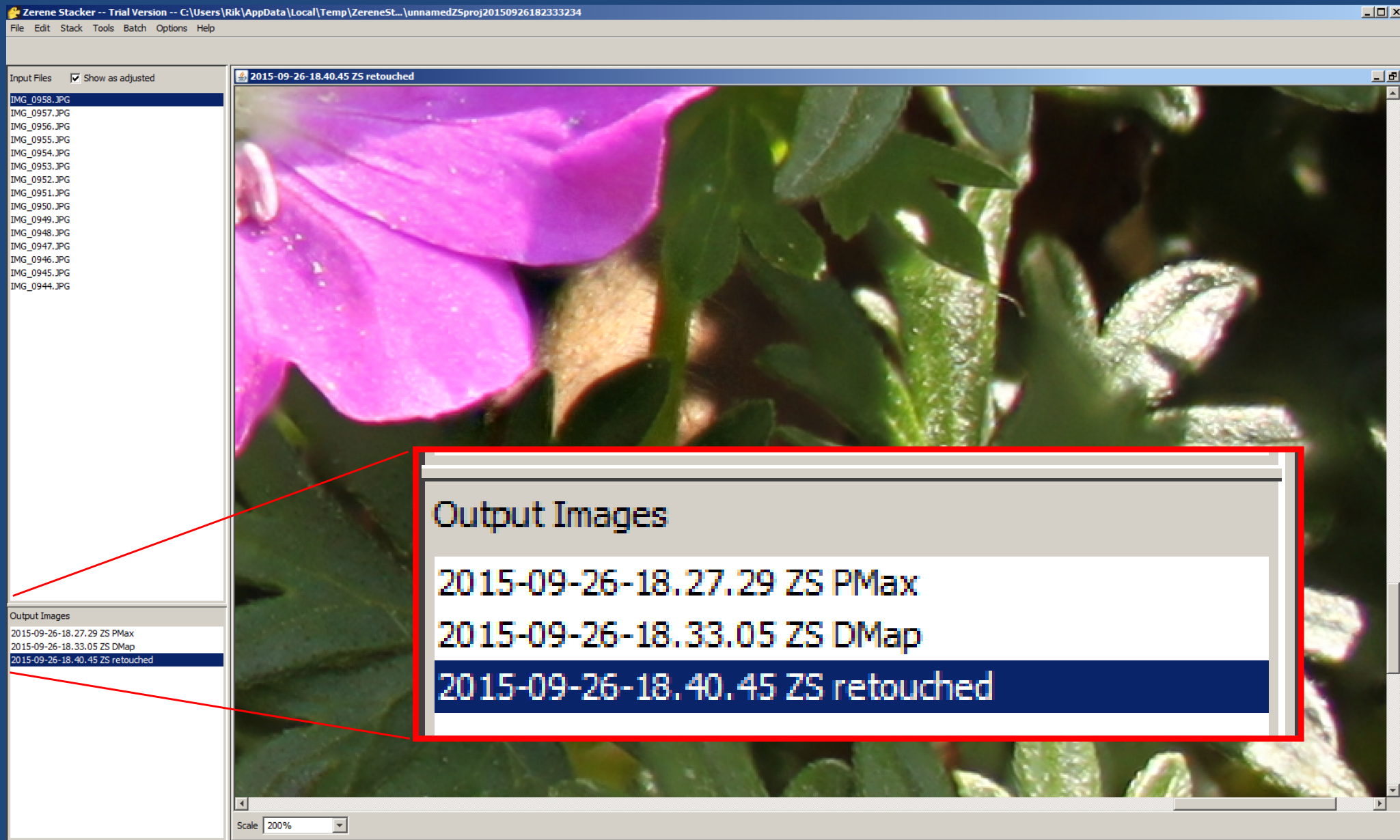


Processing in Zerene Stacker

DMap after retouching

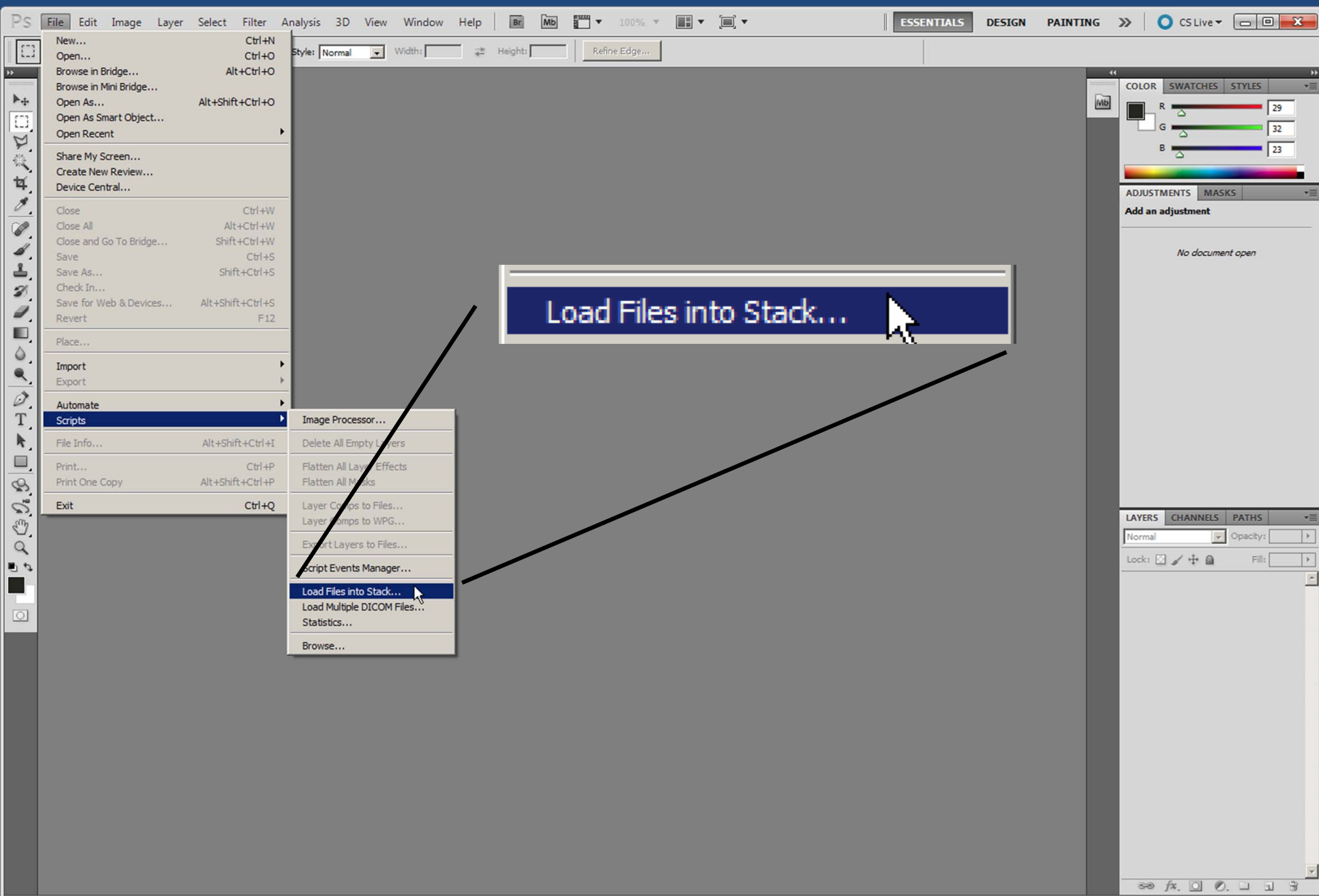


Processing in Zerene Stacker

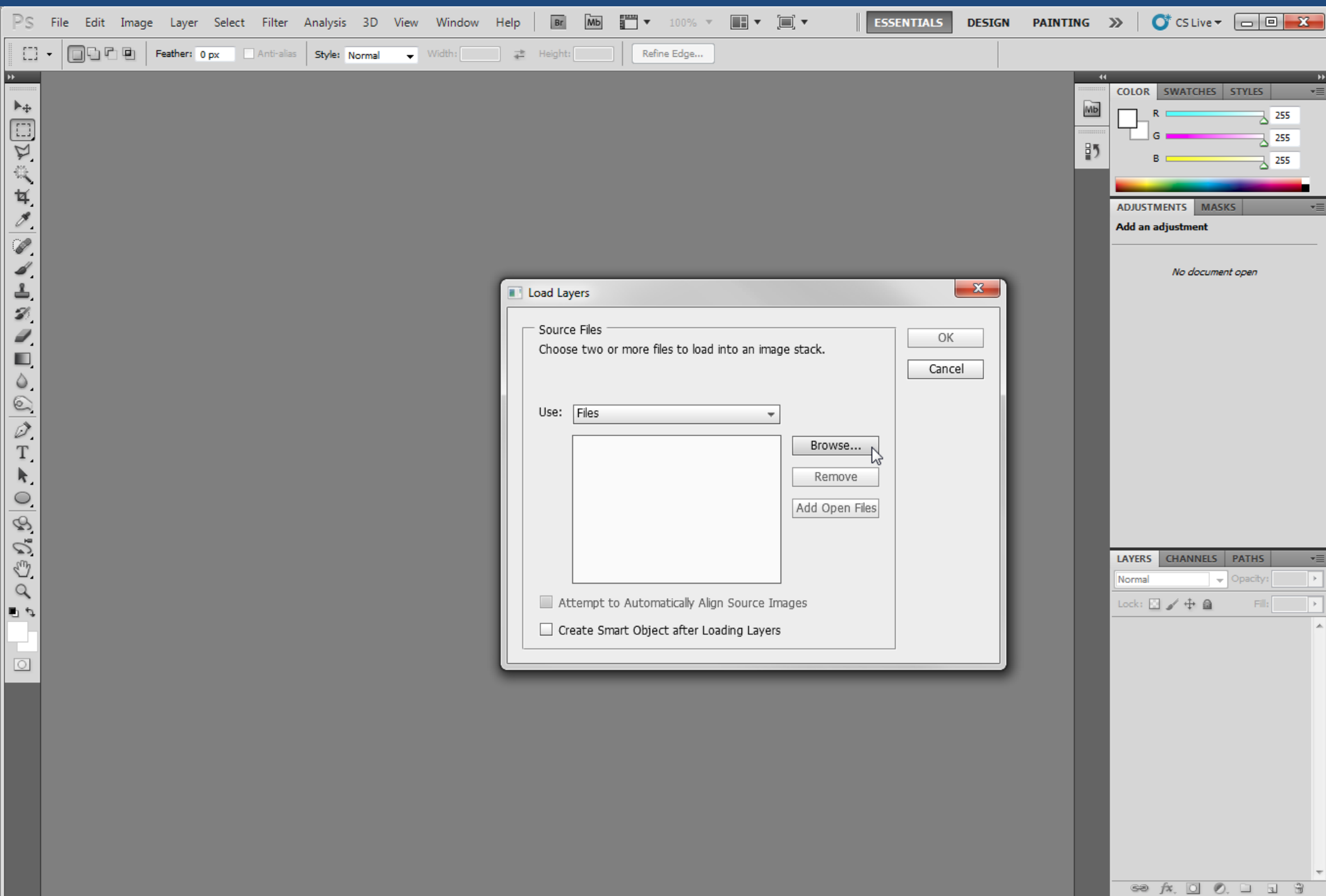


Stacking In Photoshop

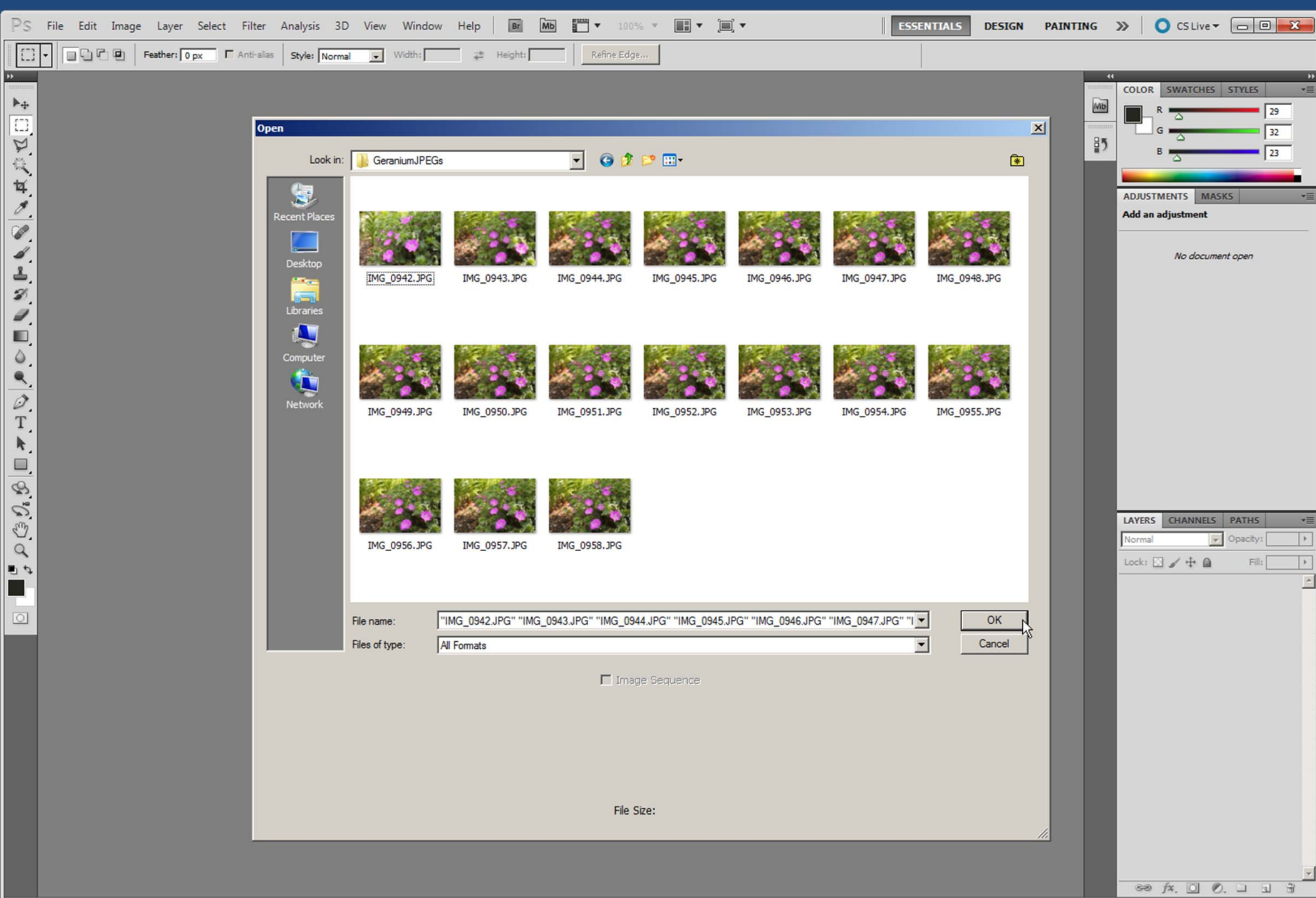
Stacking In Photoshop



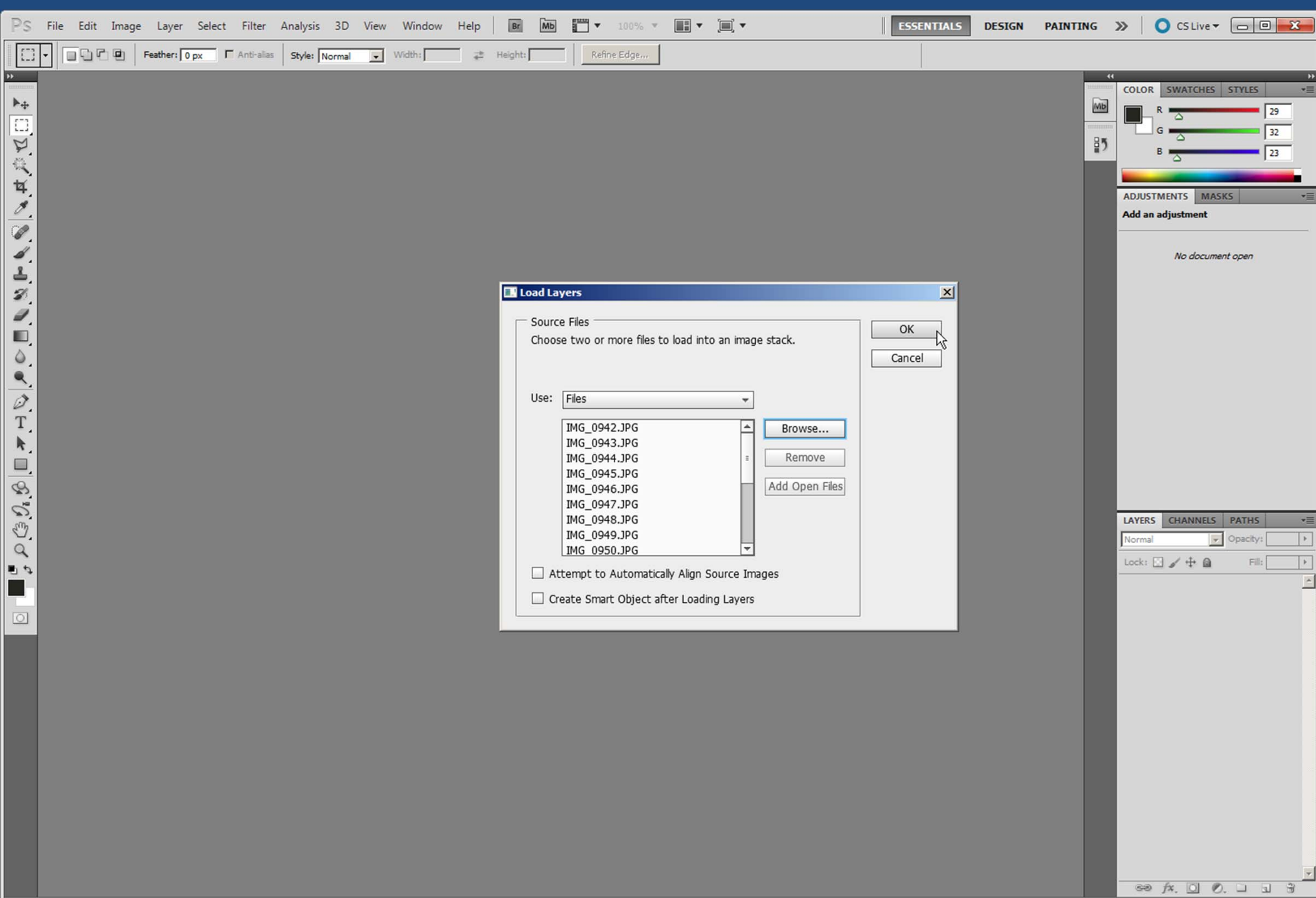
Stacking In Photoshop



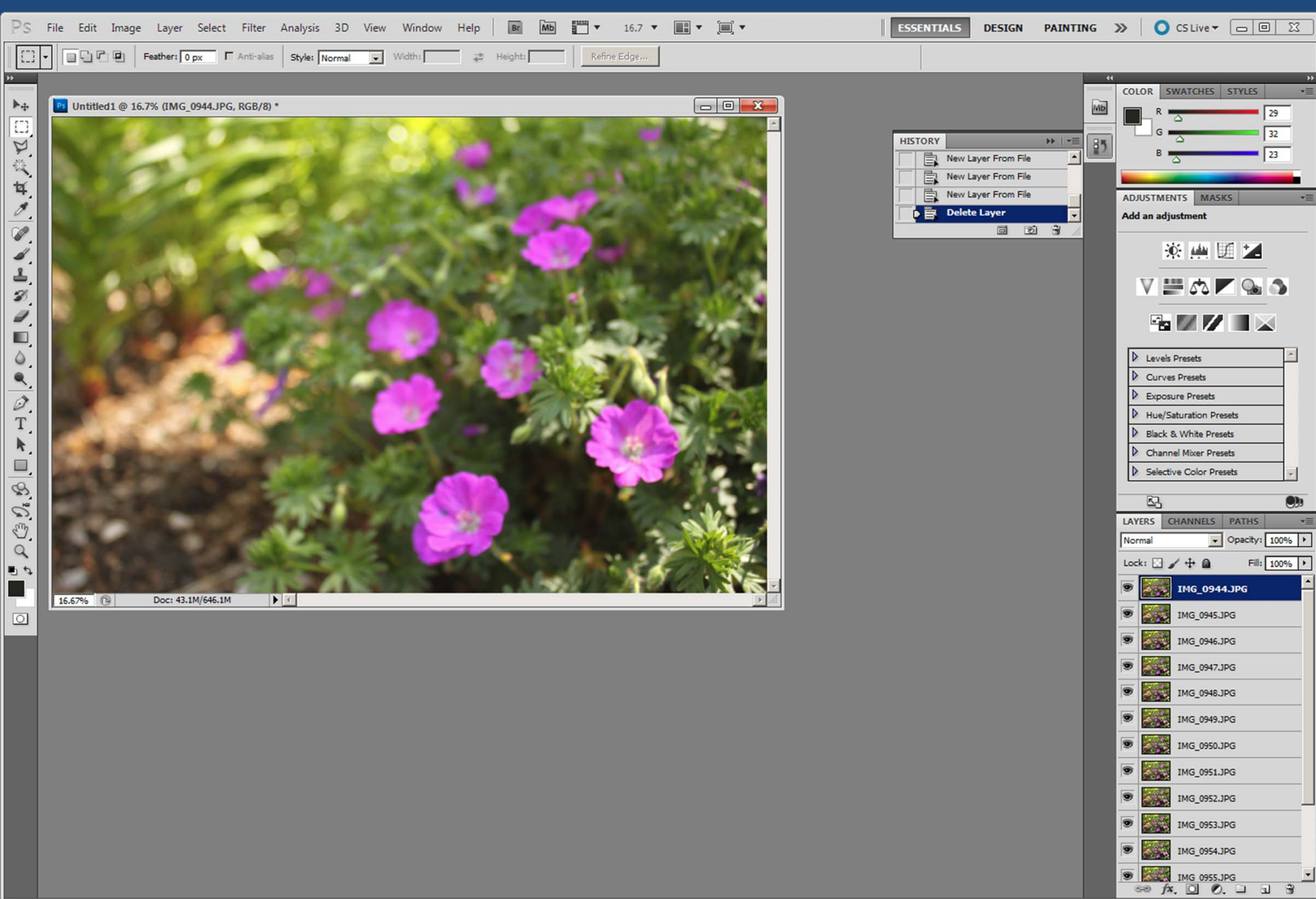
Stacking In Photoshop



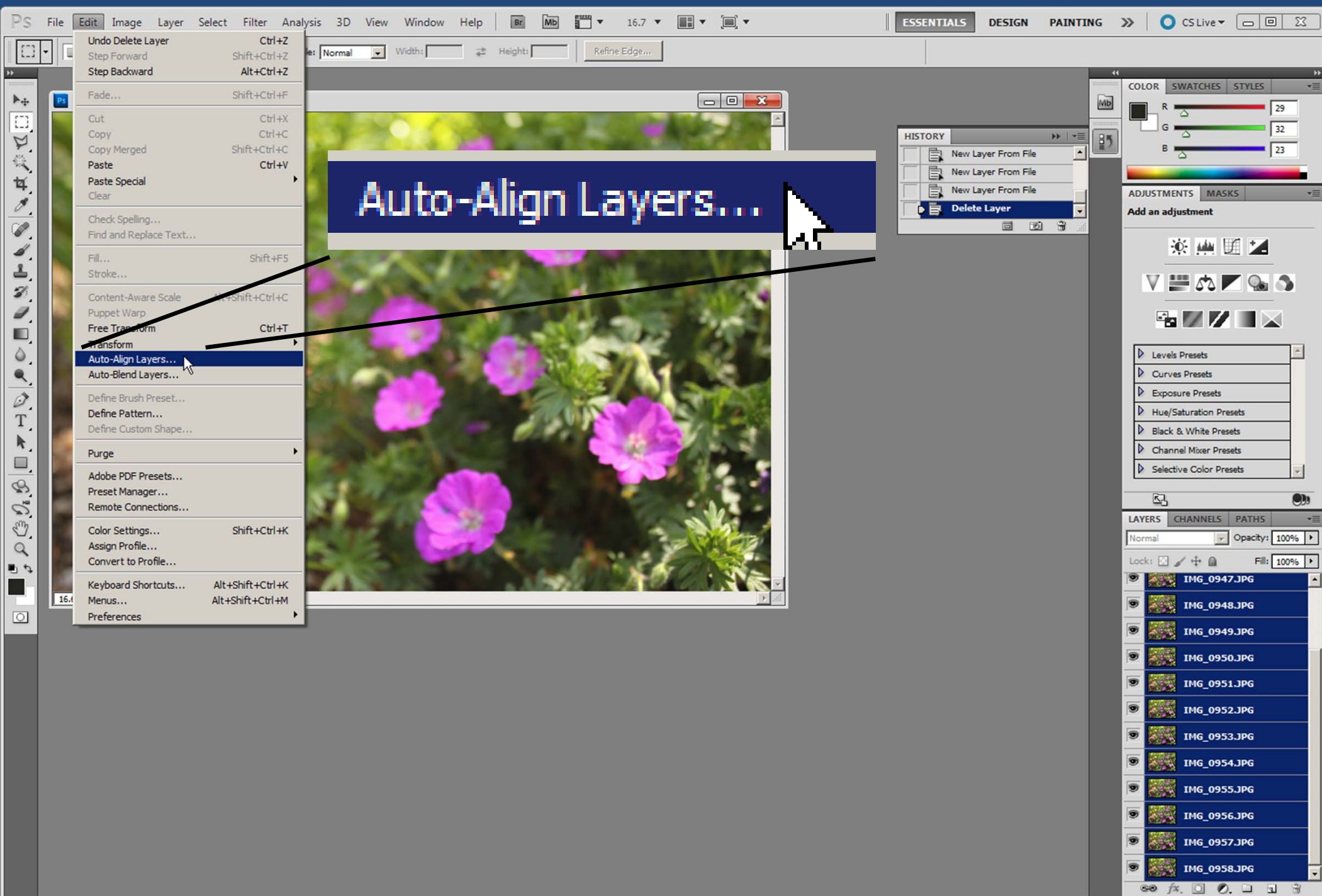
Stacking In Photoshop



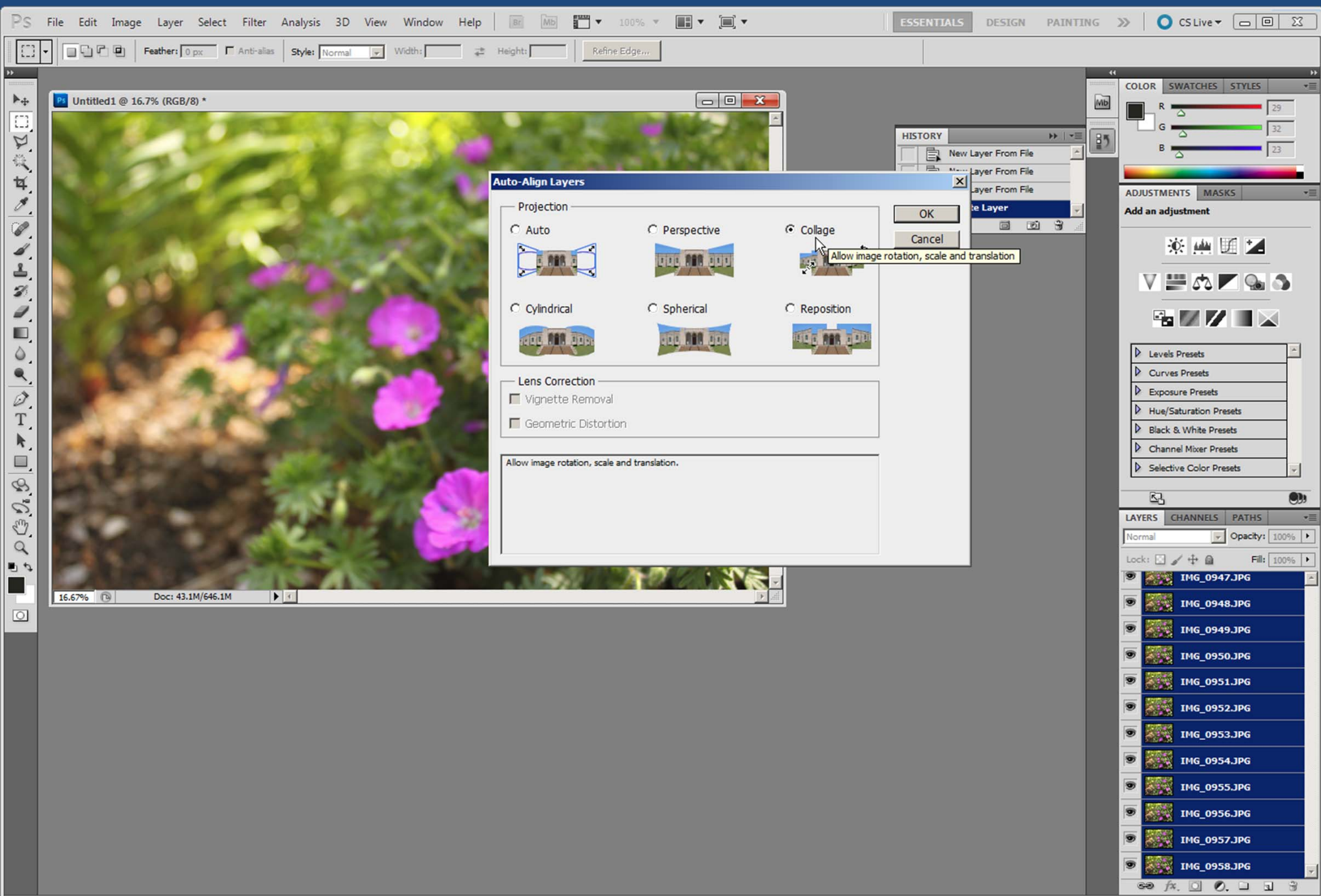
Stacking In Photoshop



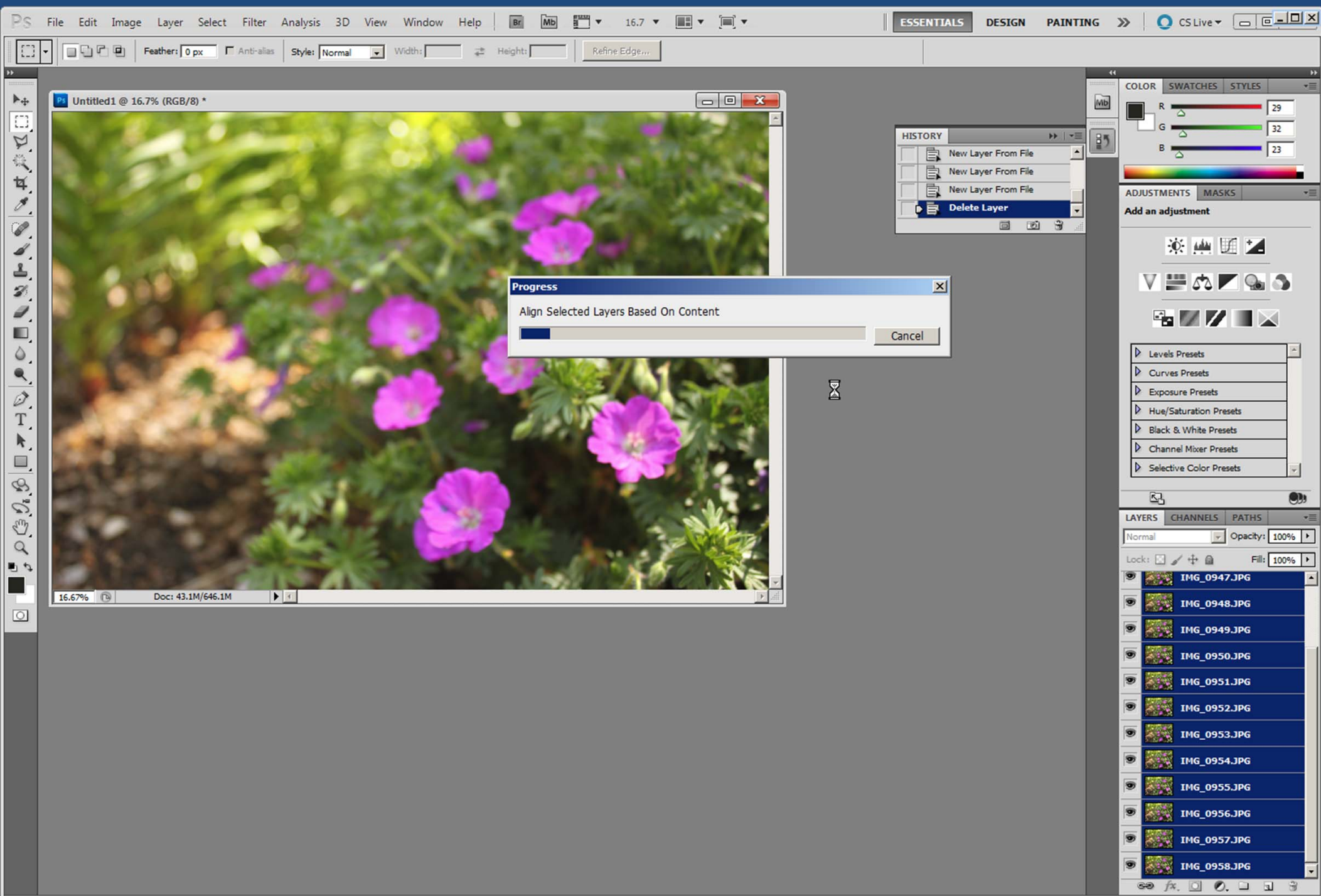
Stacking In Photoshop



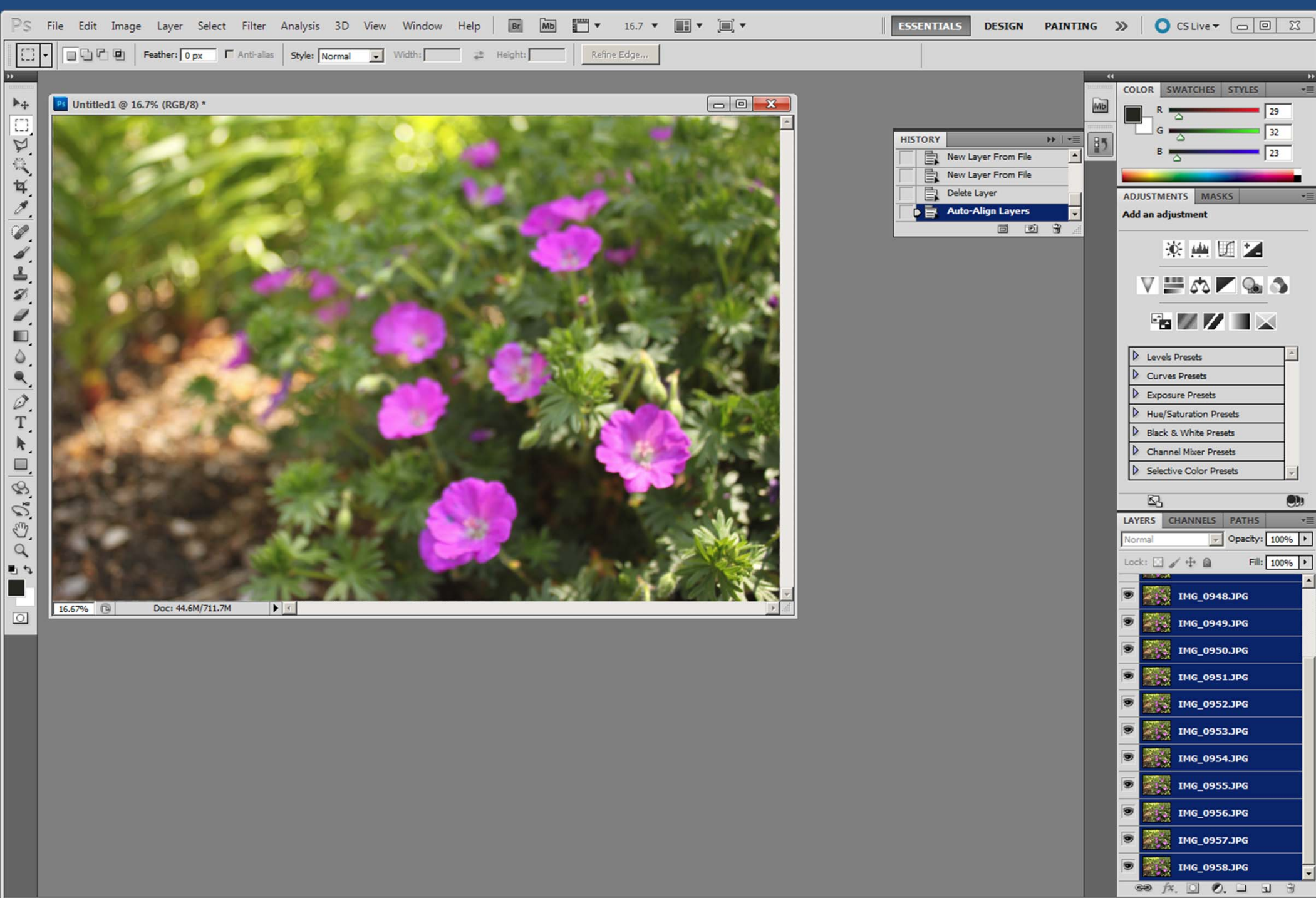
Stacking In Photoshop



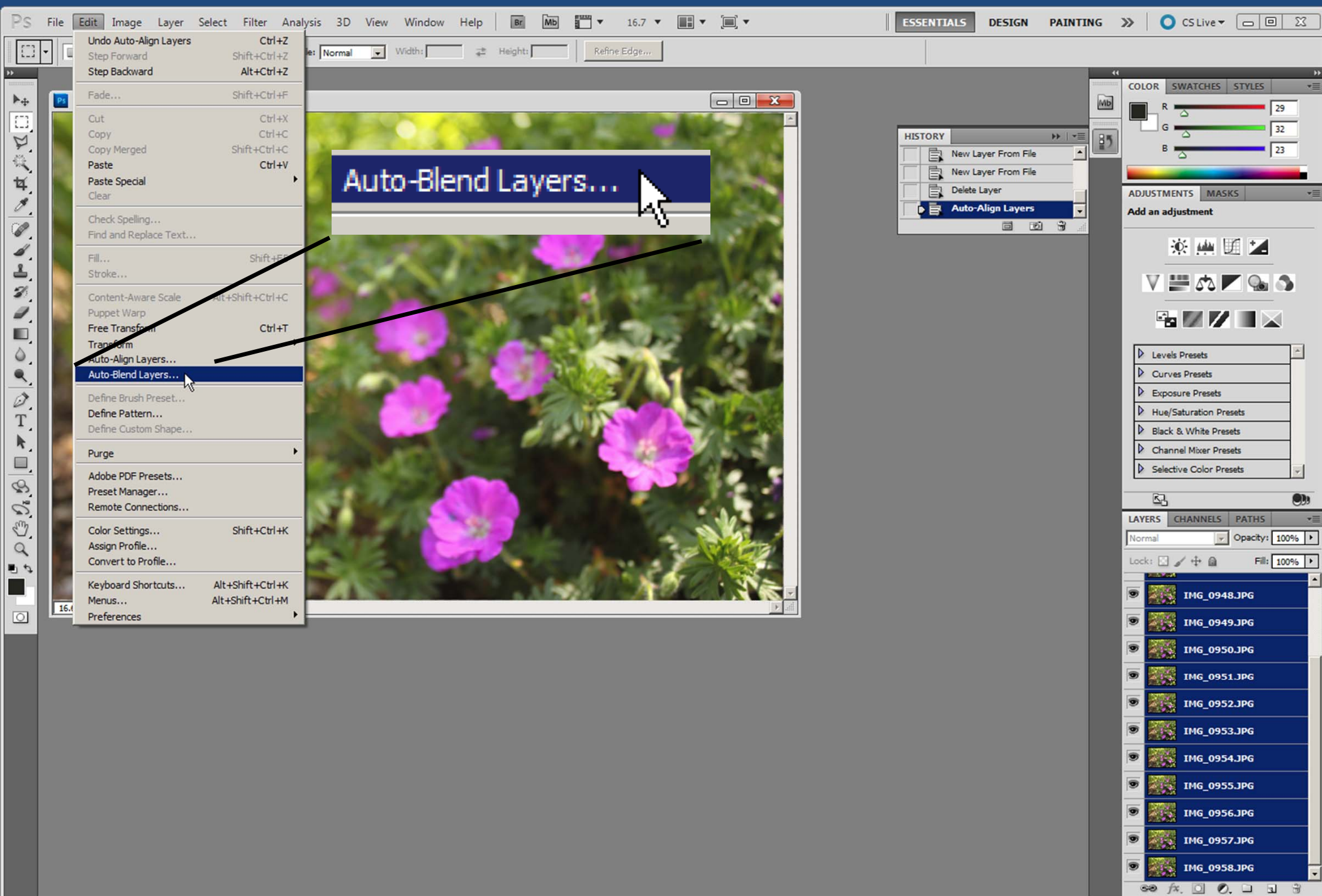
Stacking In Photoshop



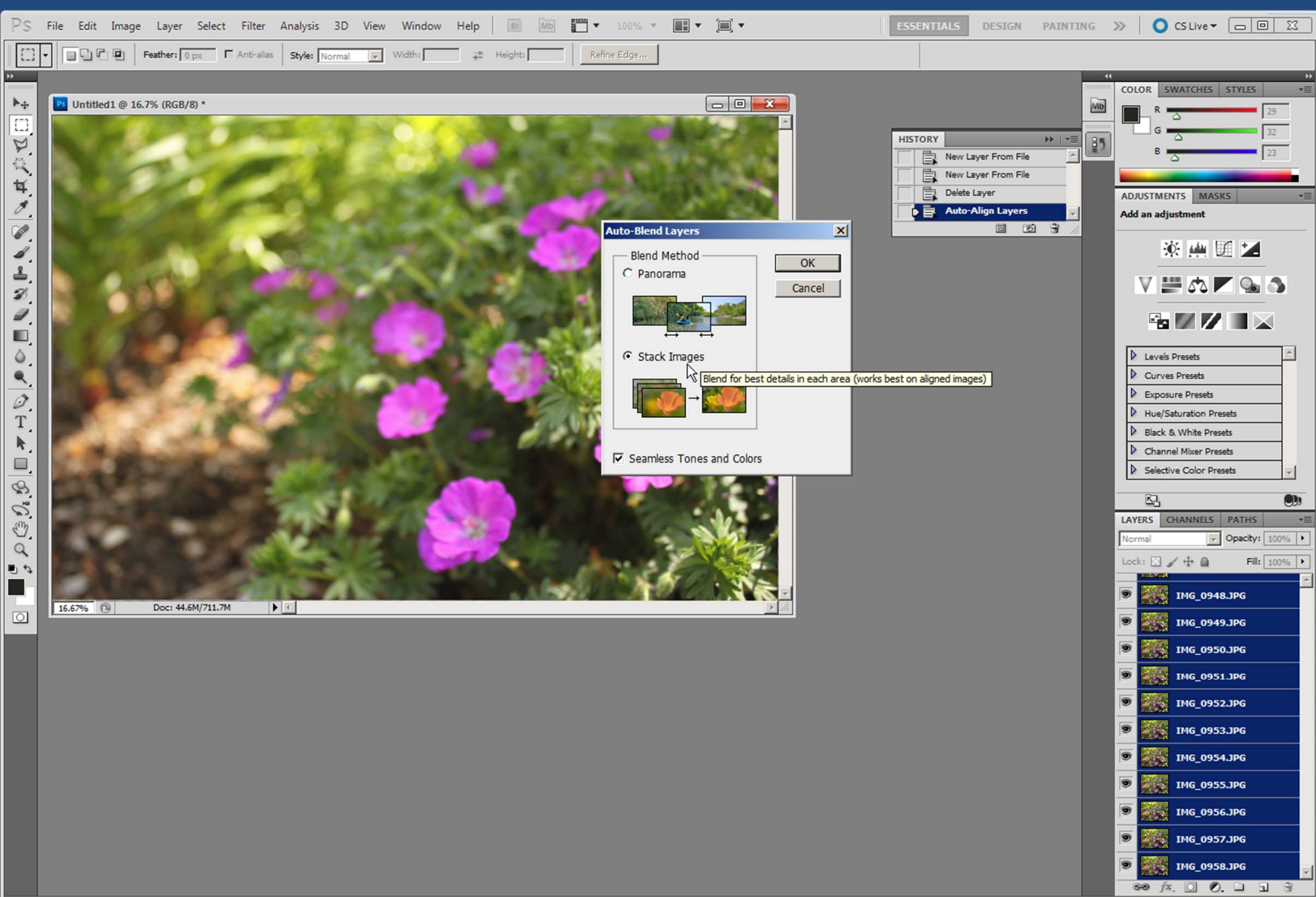
Stacking In Photoshop



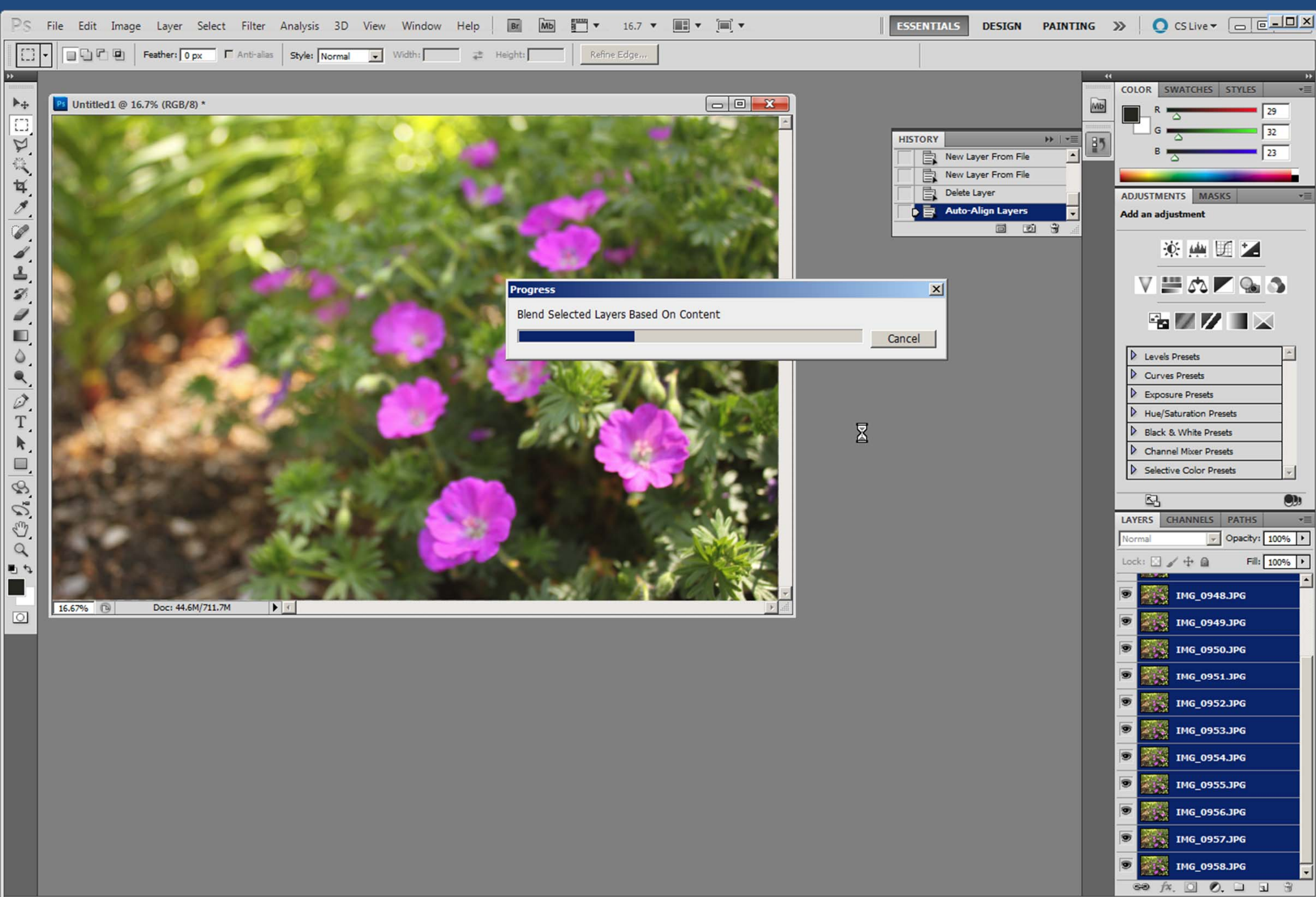
Stacking In Photoshop



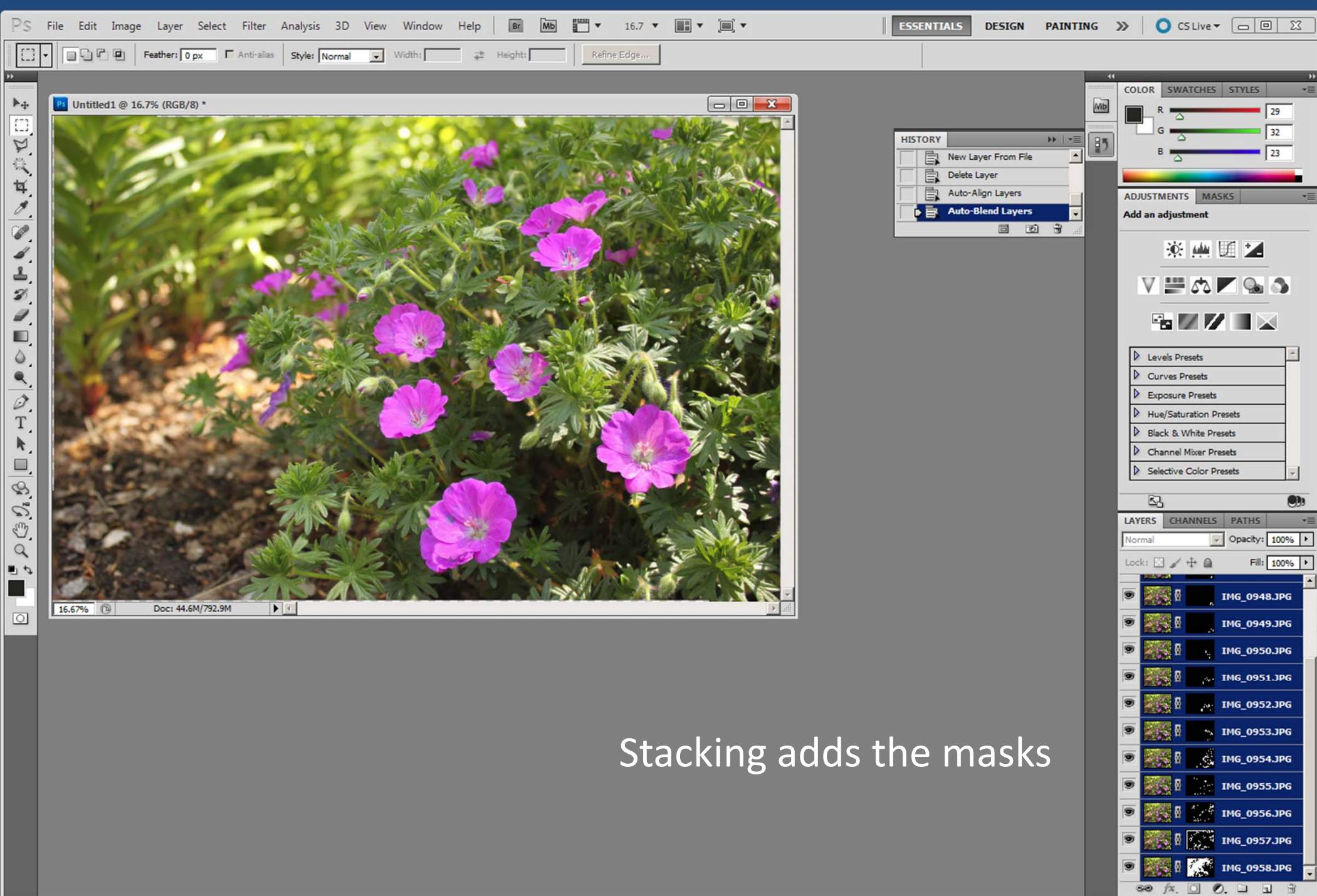
Stacking In Photoshop



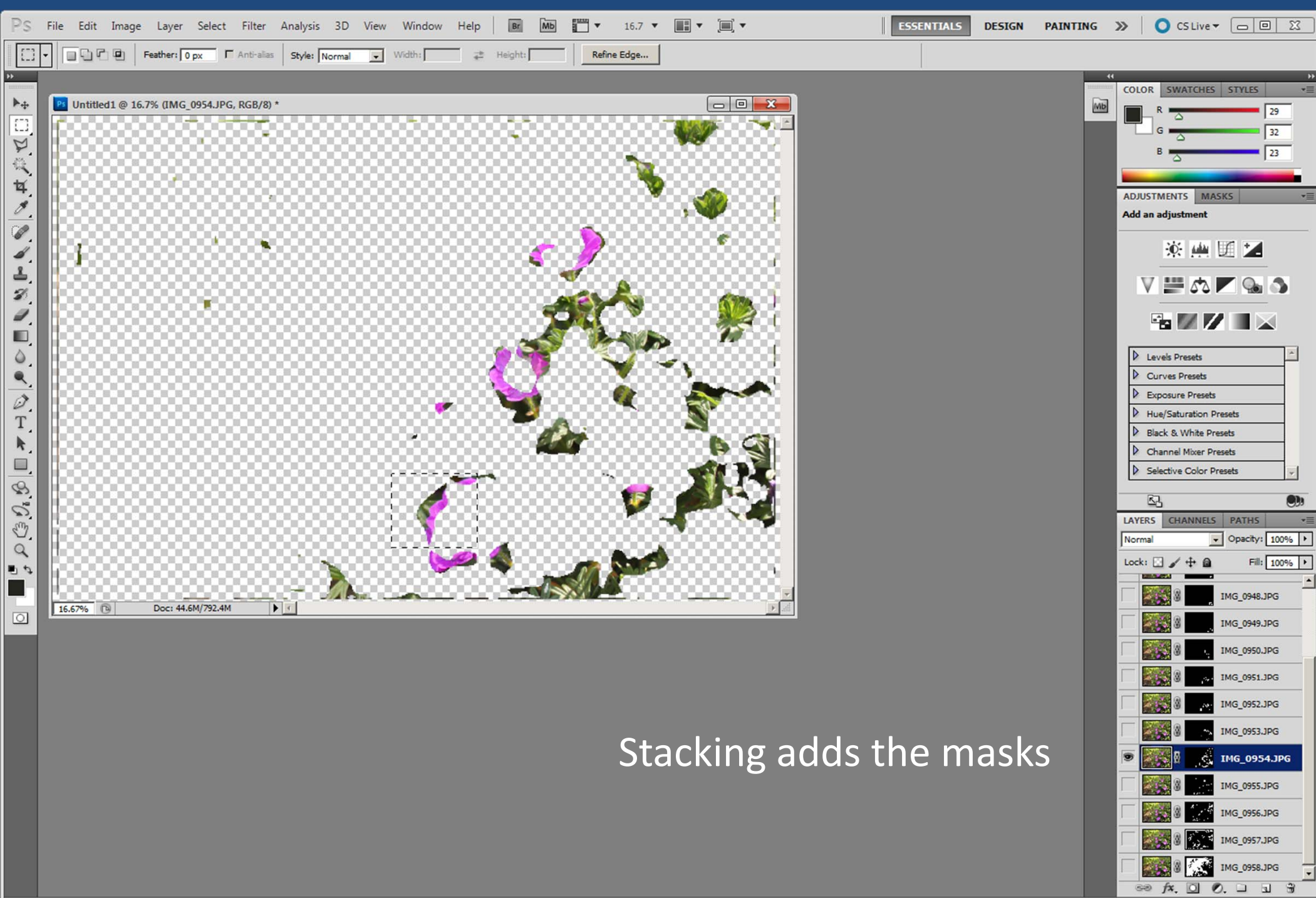
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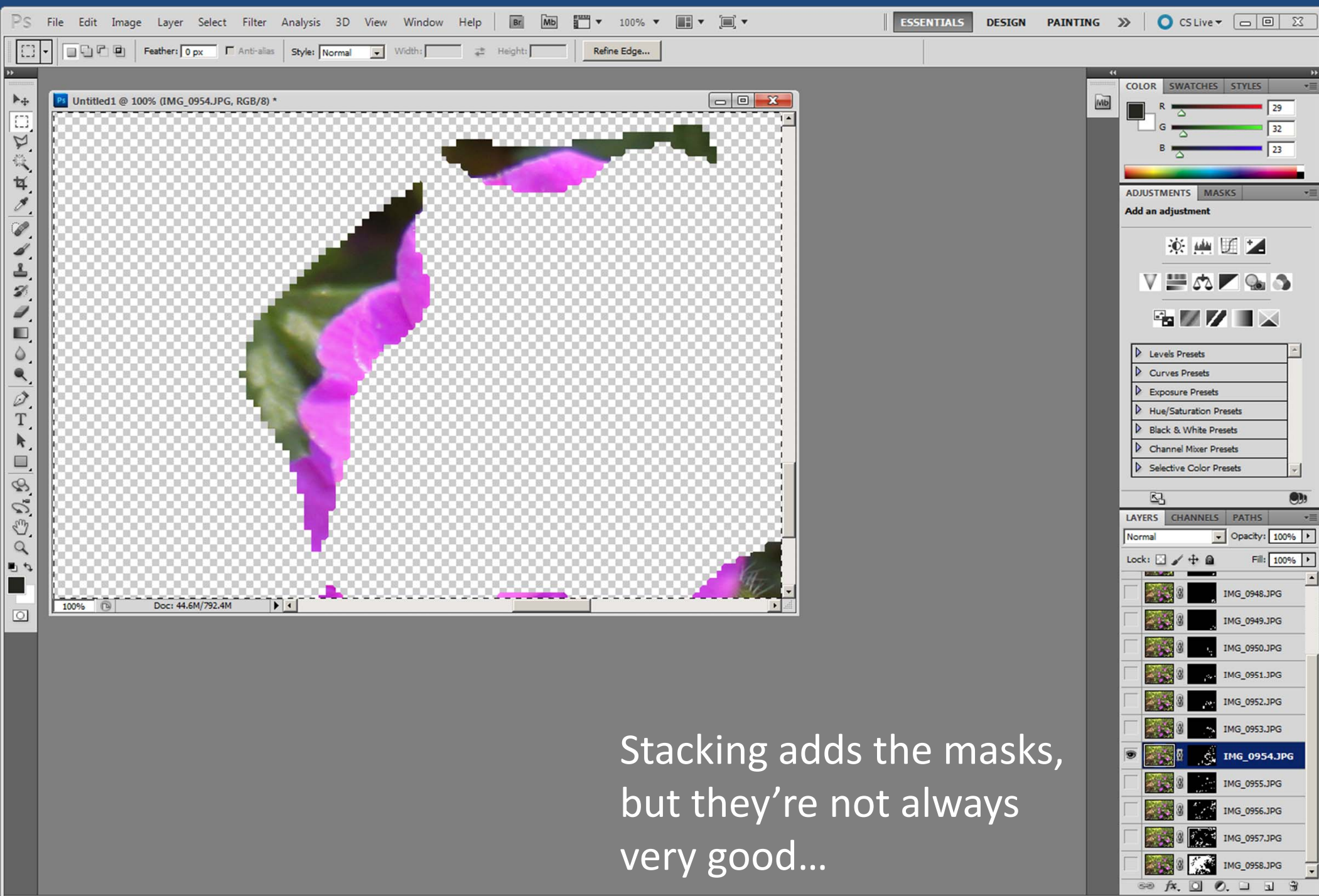
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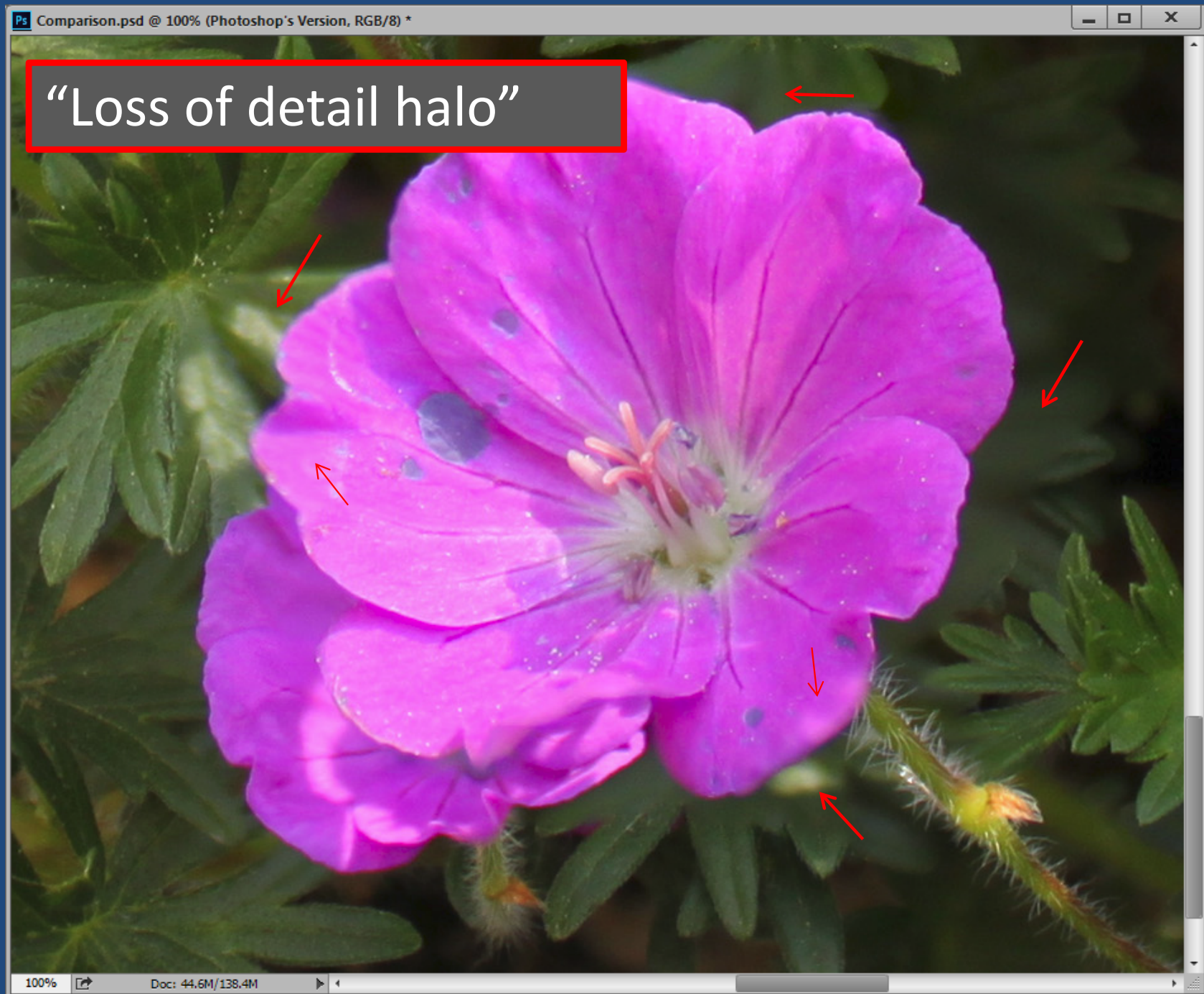
Stacking In Photoshop



Stacking In Photoshop



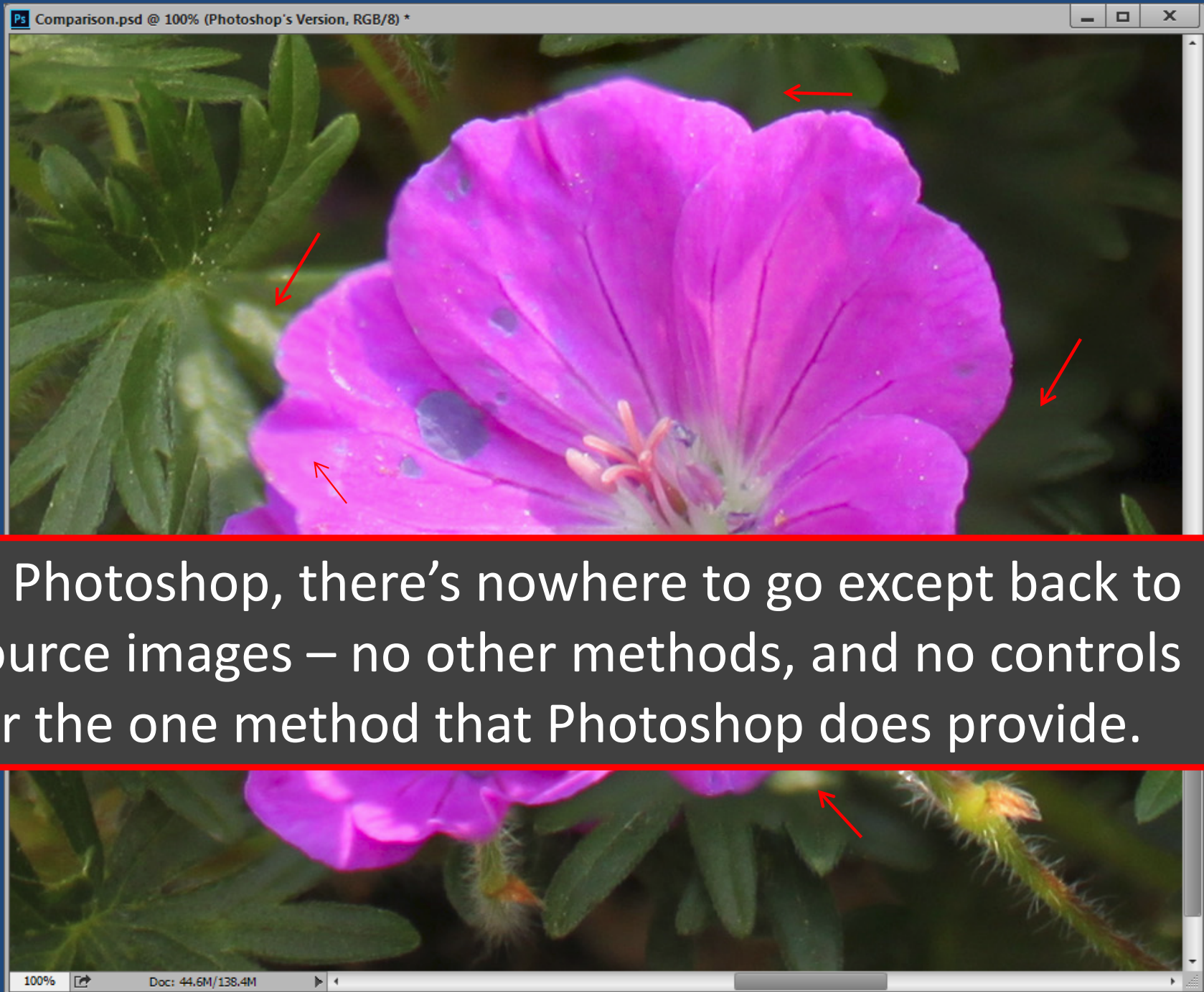
Details by Photoshop



Details by Zerene Stacker



Details by Photoshop



In Photoshop, there's nowhere to go except back to source images – no other methods, and no controls for the one method that Photoshop does provide.

What Problems Appear in “Good” Stacks?

- Edge streaks
- Defect trails
- Transparent foreground
- Halos
 - Loss of detail (already saw this)
 - Dark/light bands in uniform background

Edge Streaks

Cause: inconsistent framing – usually handheld stacks or wobbly setups

Solution: shoot wider & crop, sometimes can retouch from source image



Defect Trails

Cause: sensor dust (dark) or warm pixels (bright)

Solutions: 1) clean the sensor, 2) use shorter exposure with more light, 3) retouch after stacking, 4) use dust & defects mask while stacking

One Source Image



Stacked Result



This Stack Is Surprisingly Difficult

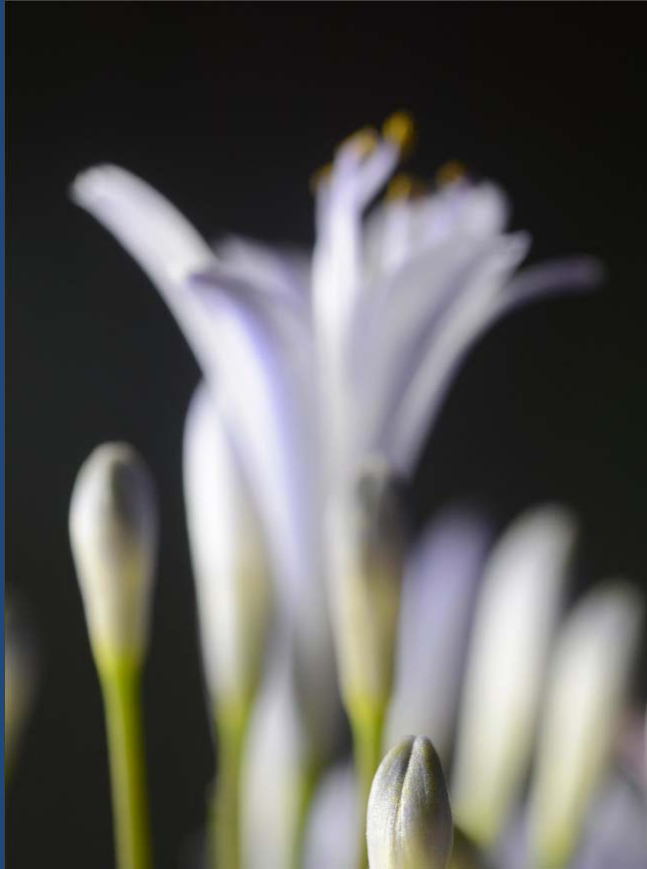
It looks so simple.

What could possibly
go wrong?



The Individual Frames Still Look Simple

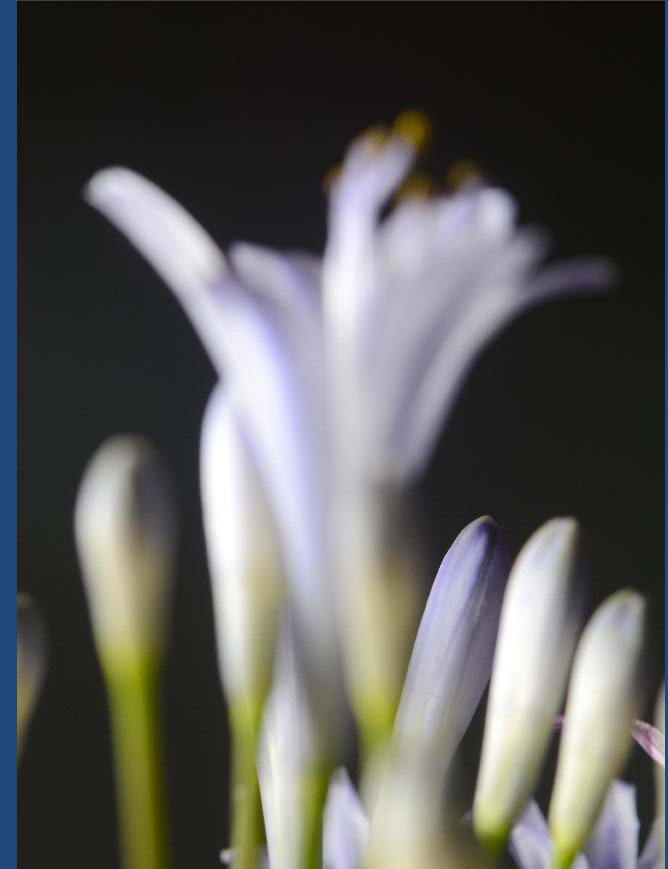
Front



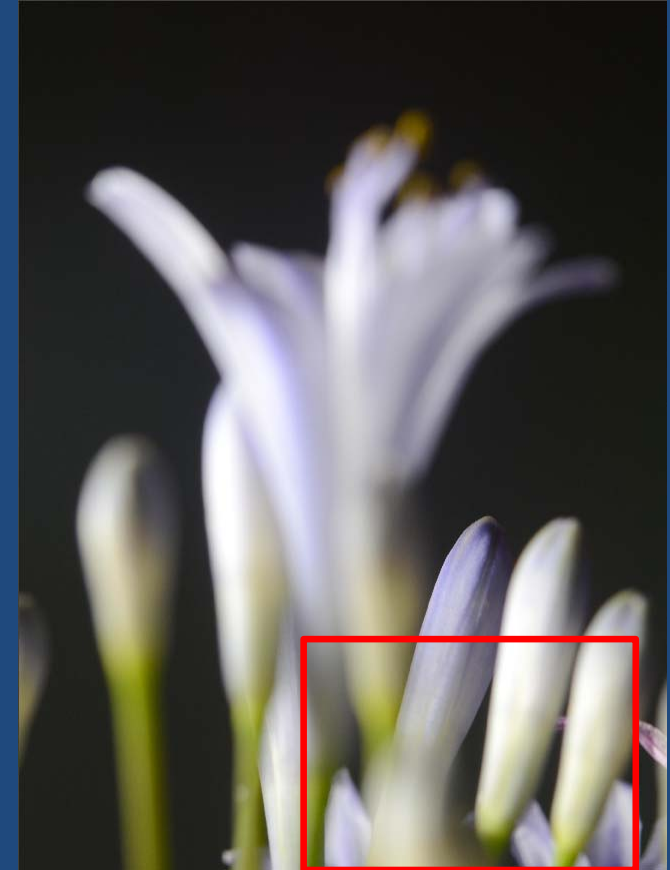
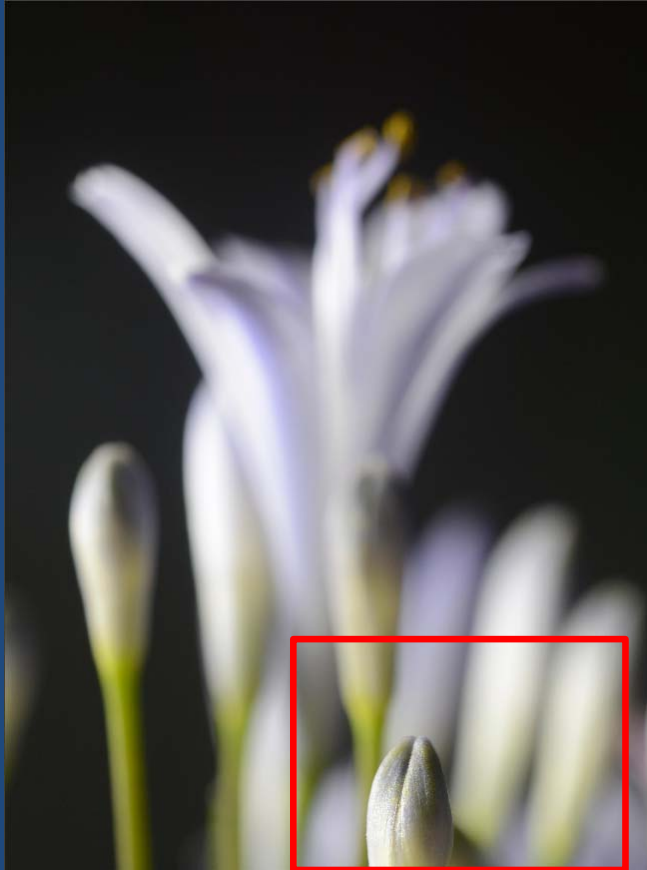
Middle



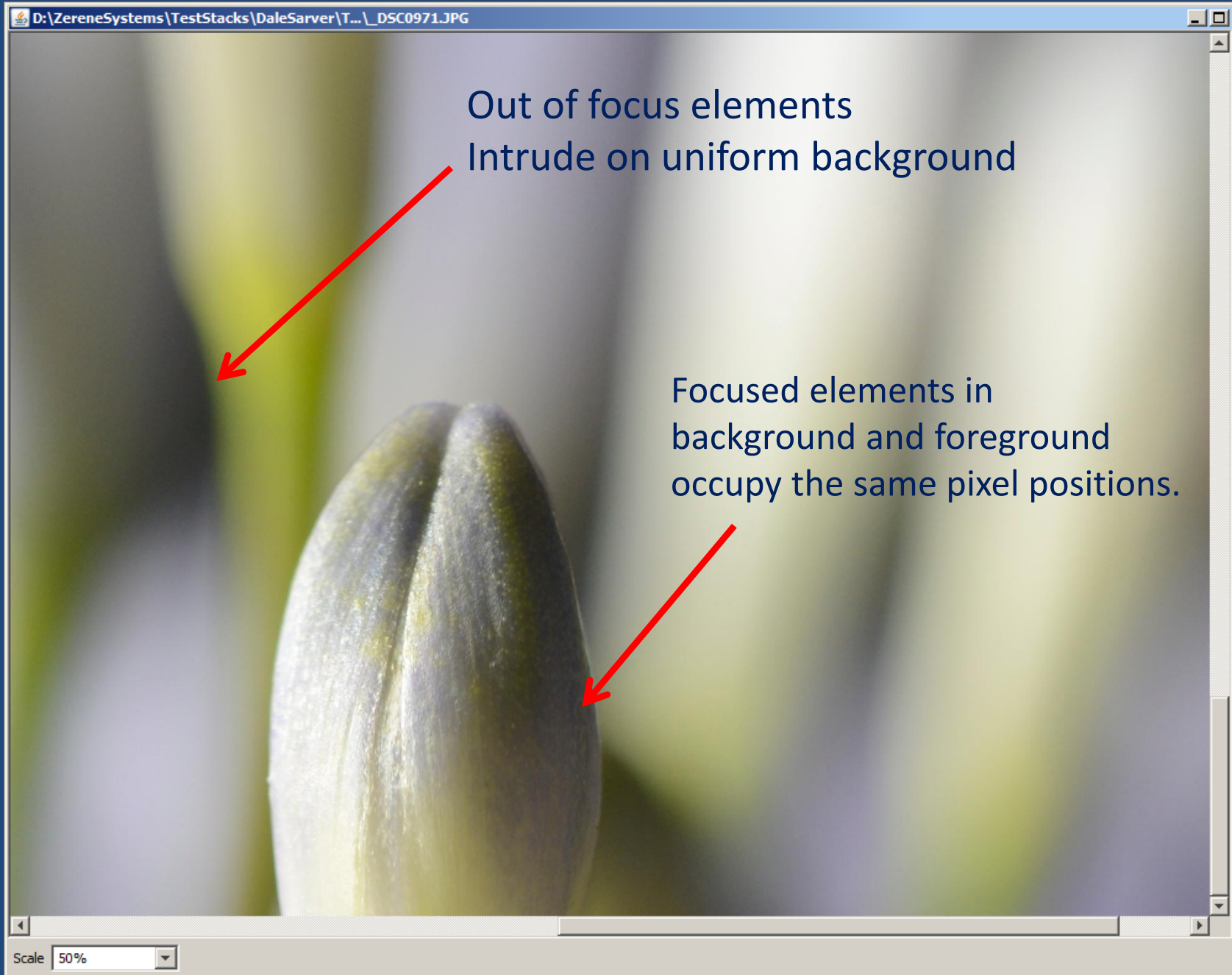
Back



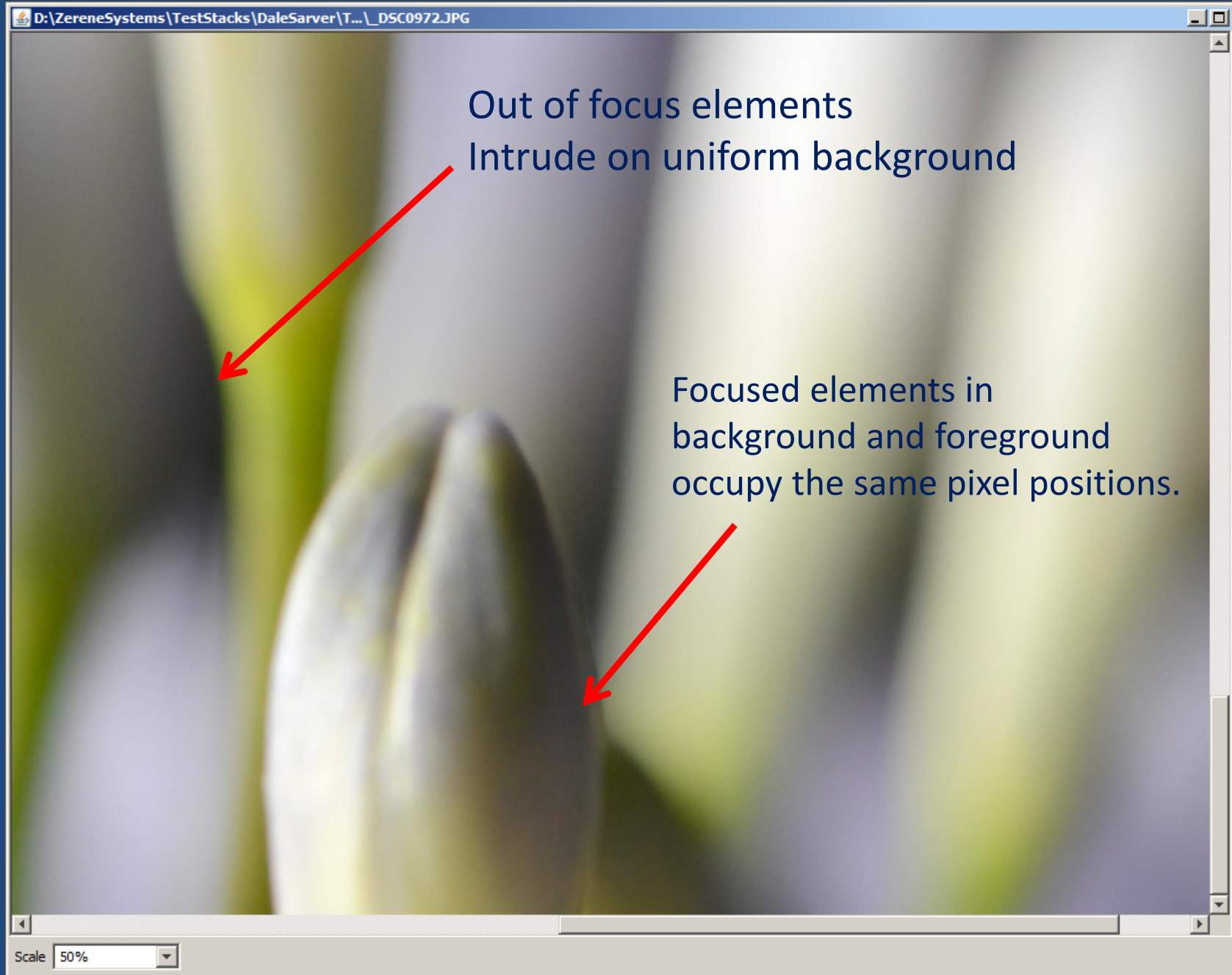
Let's Take a Closer Look



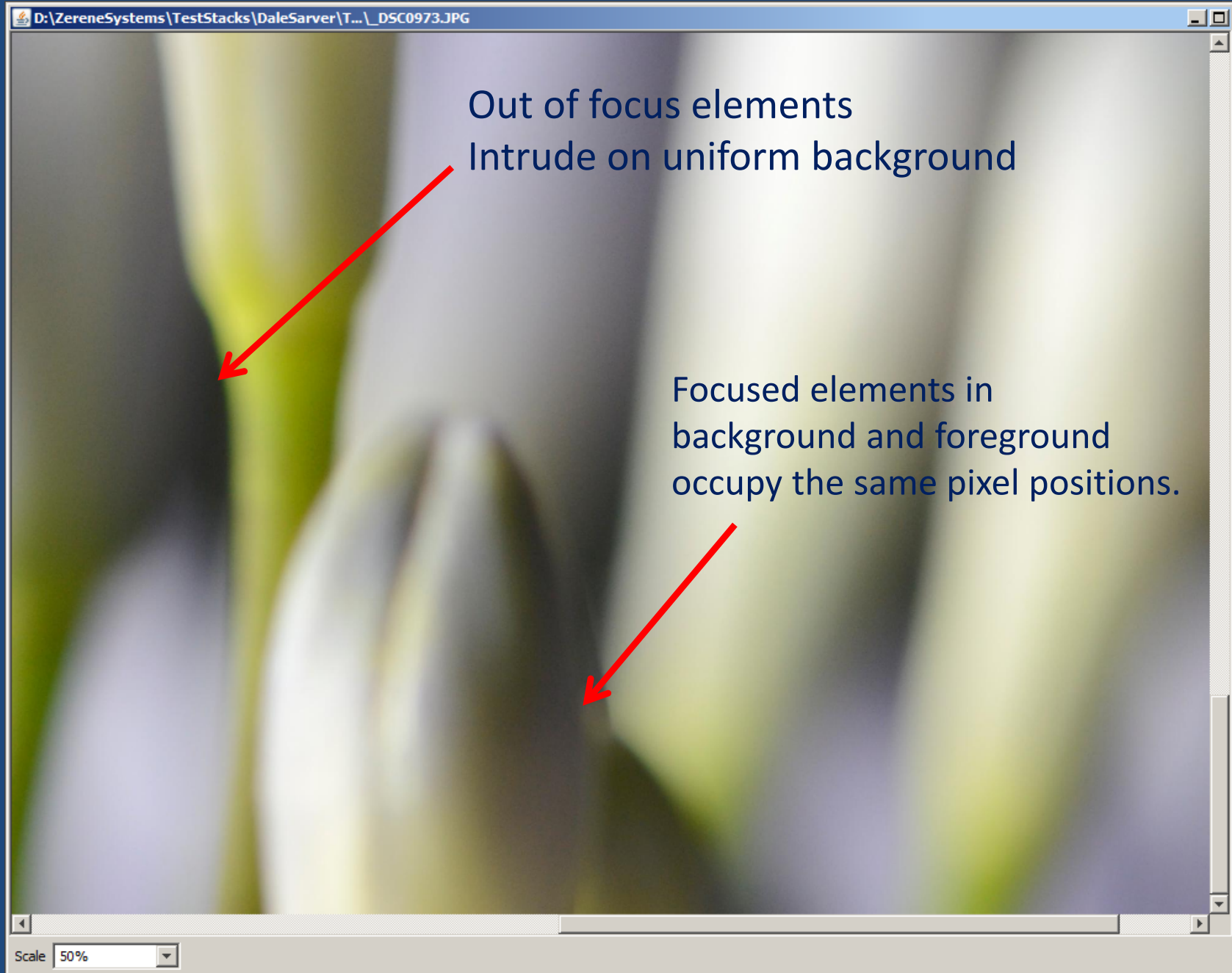
The Sequence Shows a Different Story



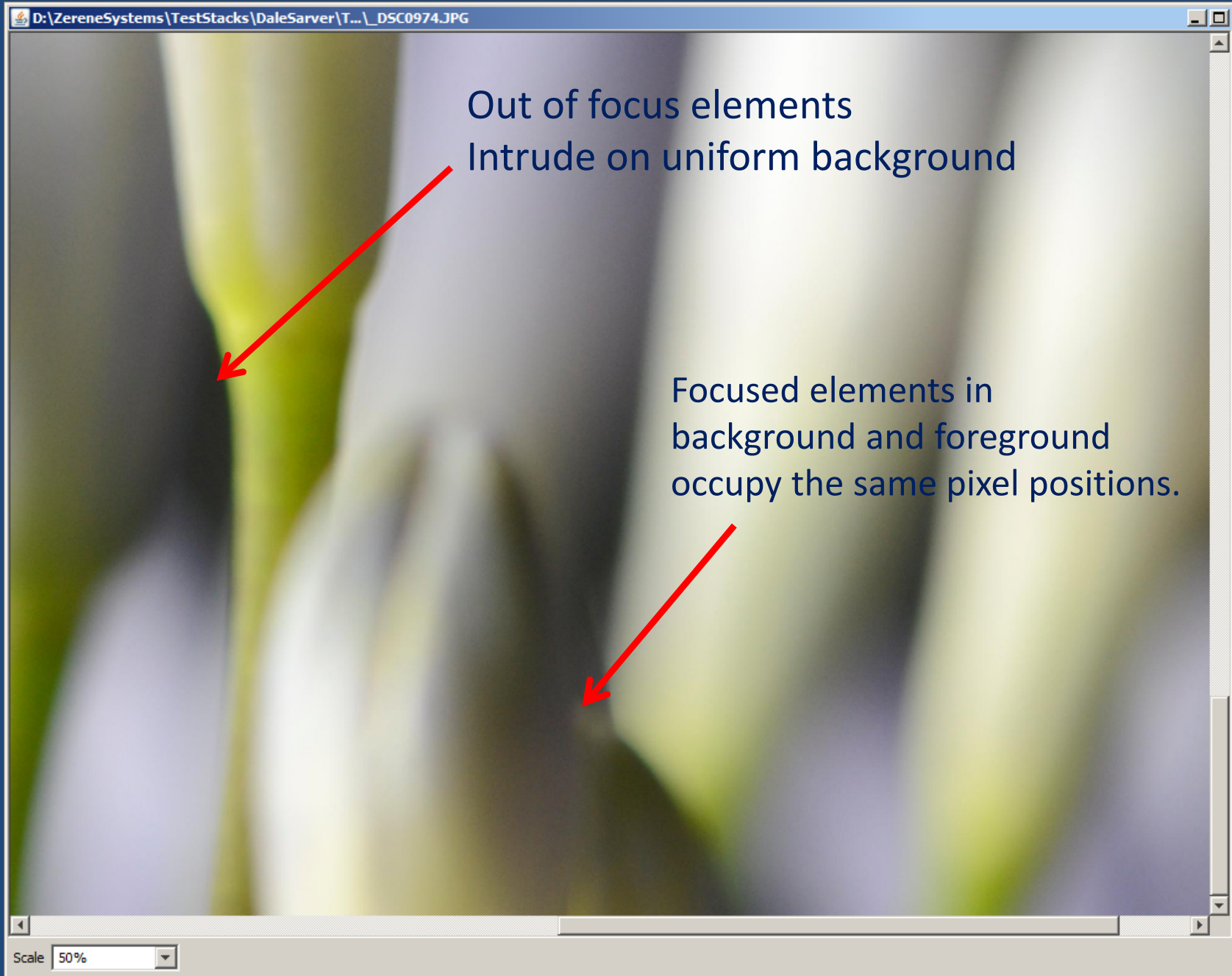
The Sequence Shows a Different Story



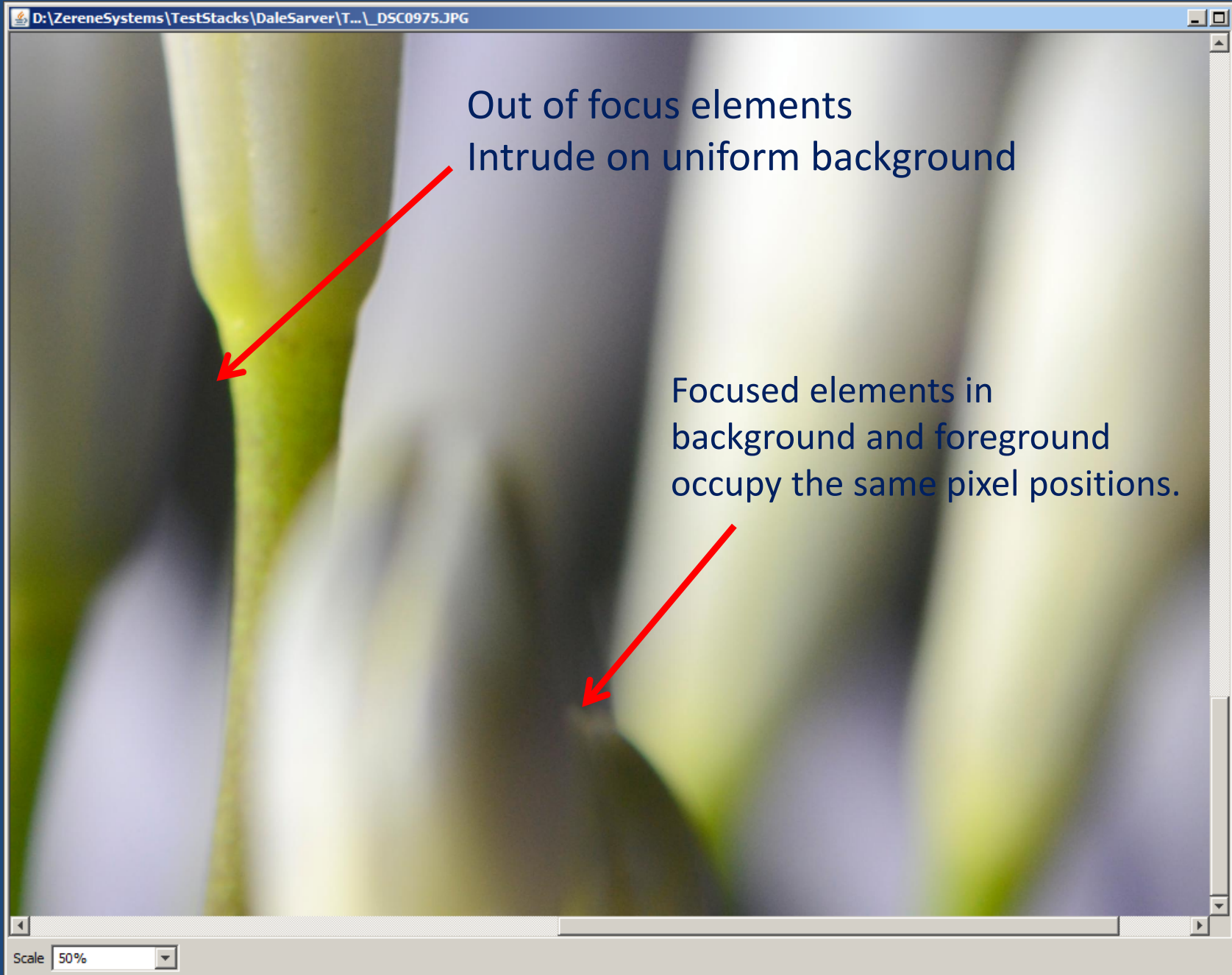
The Sequence Shows a Different Story



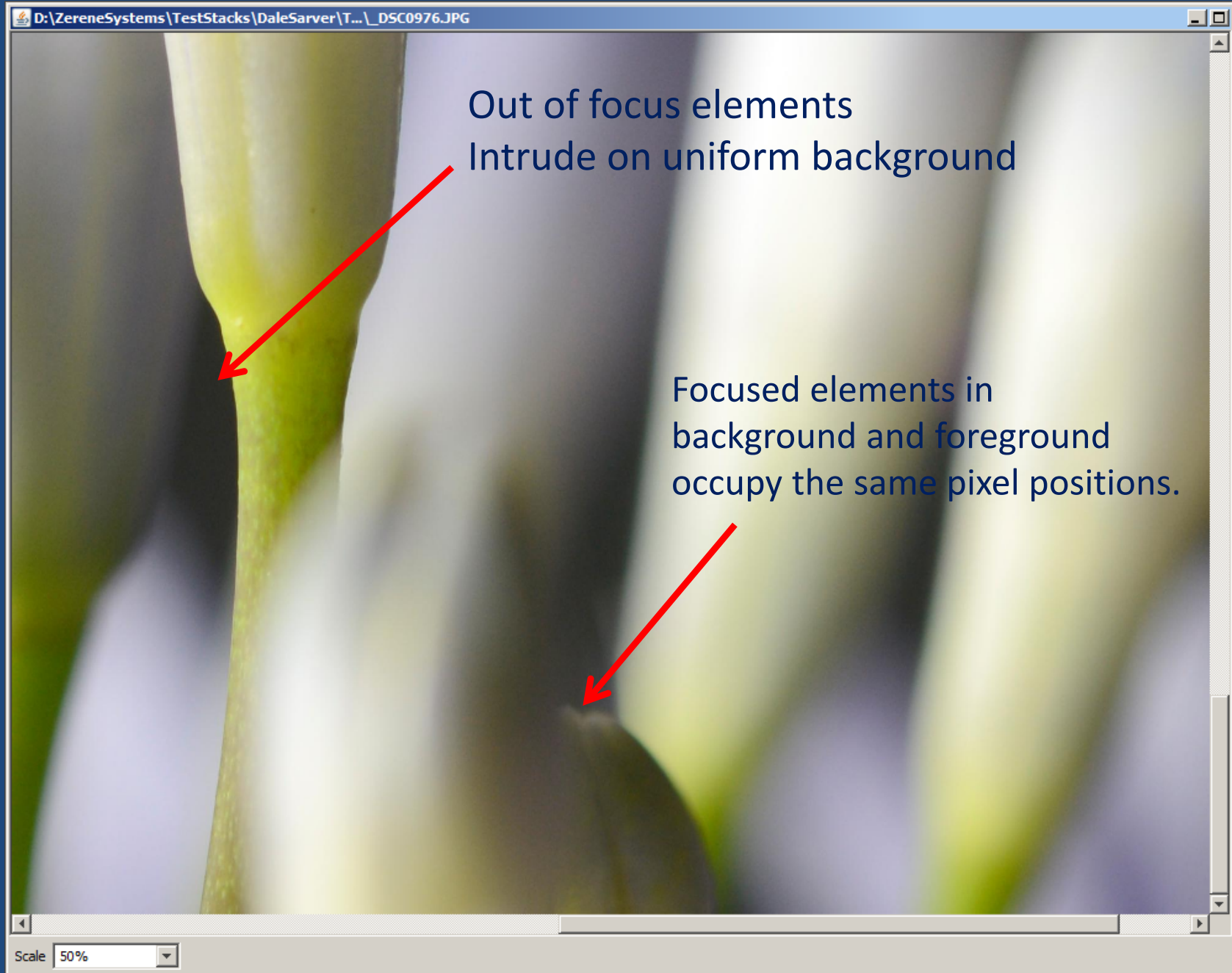
The Sequence Shows a Different Story



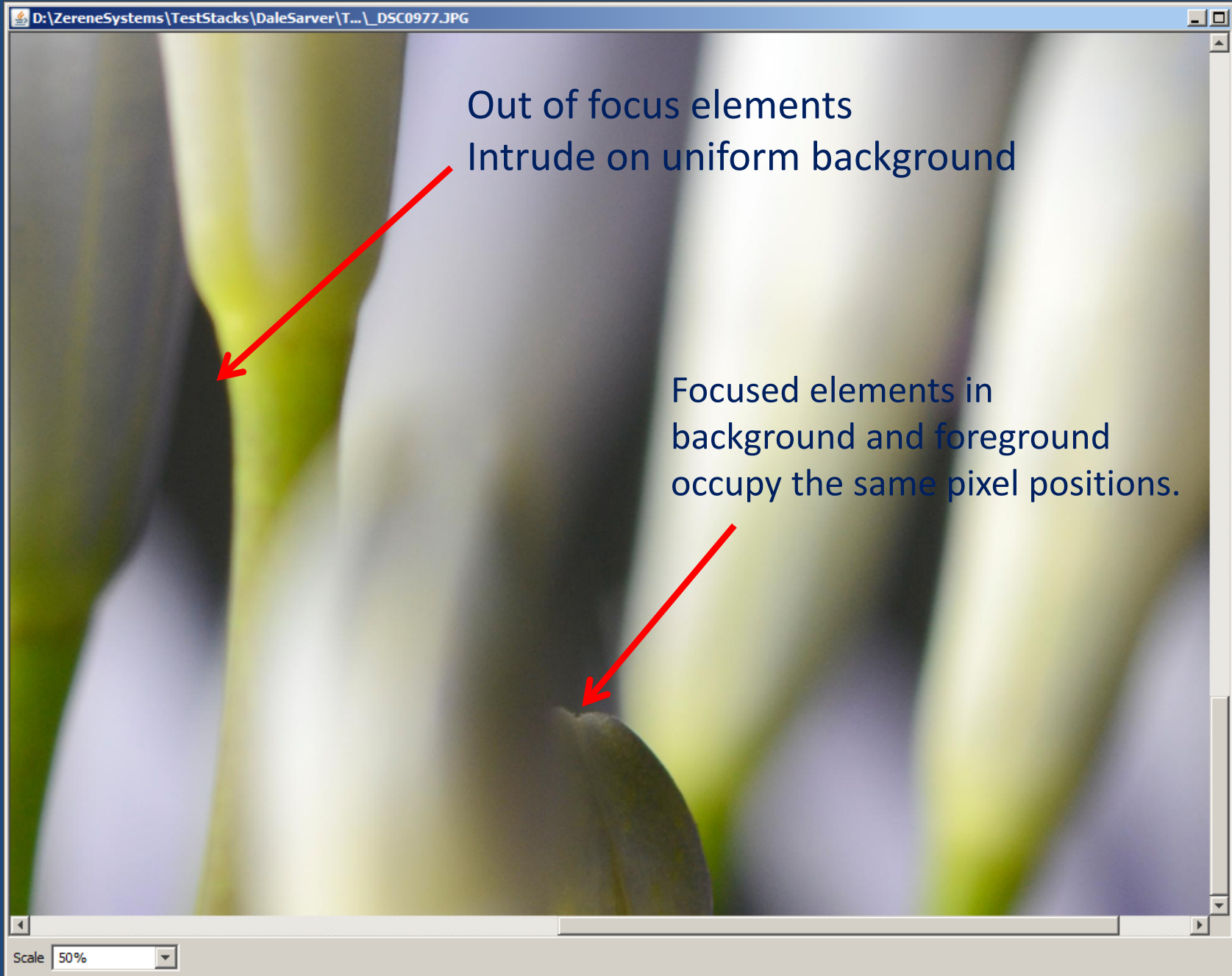
The Sequence Shows a Different Story



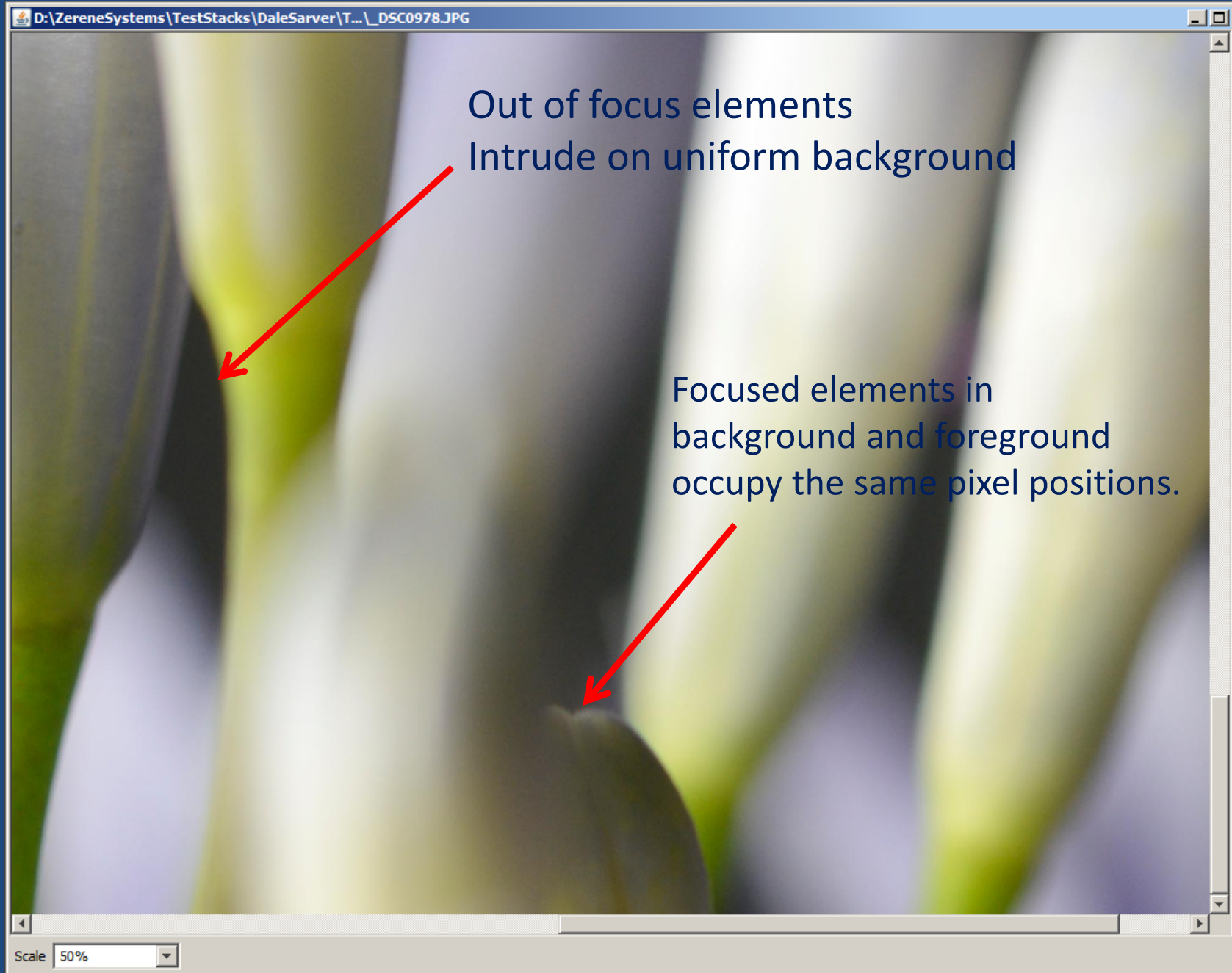
The Sequence Shows a Different Story



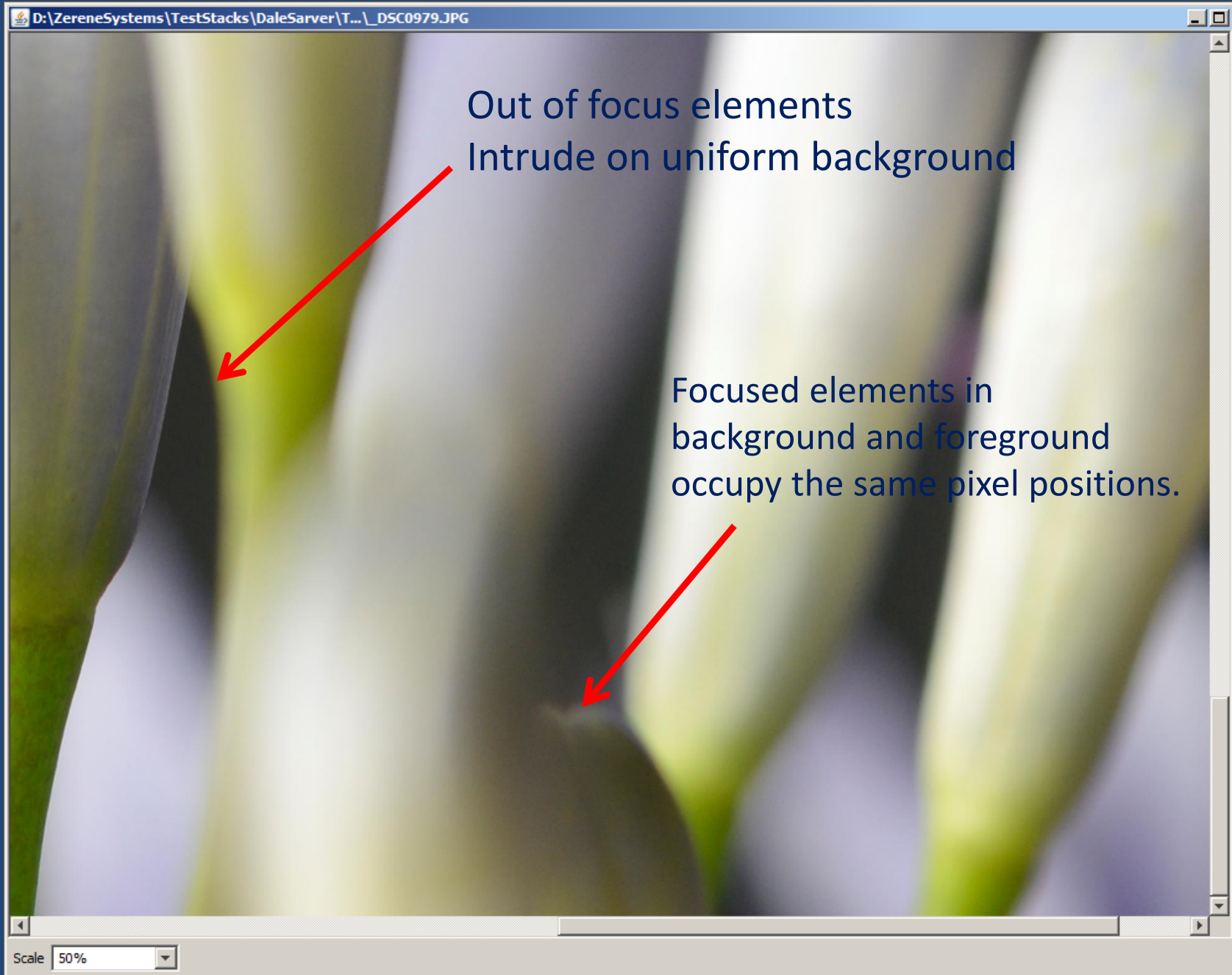
The Sequence Shows a Different Story



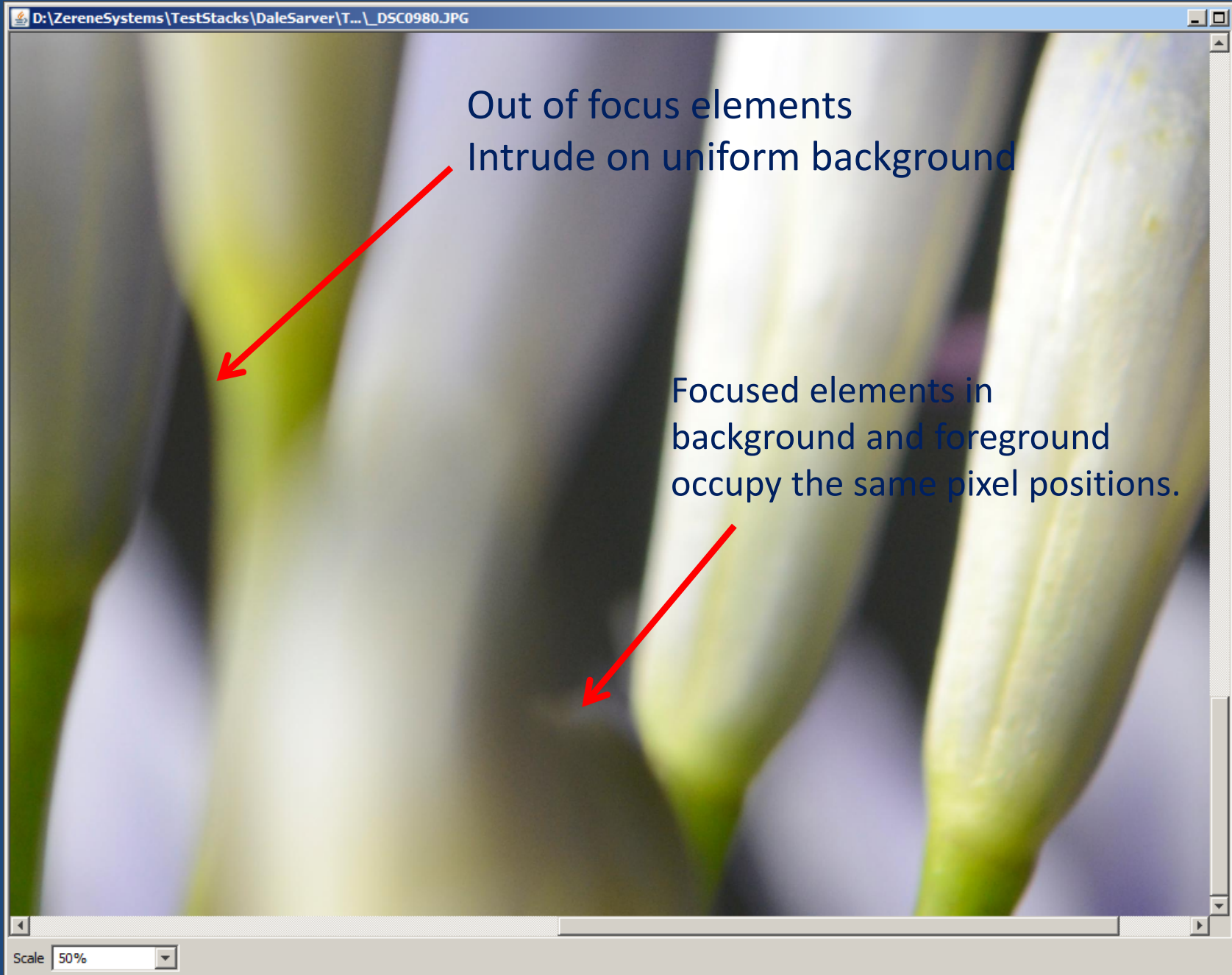
The Sequence Shows a Different Story



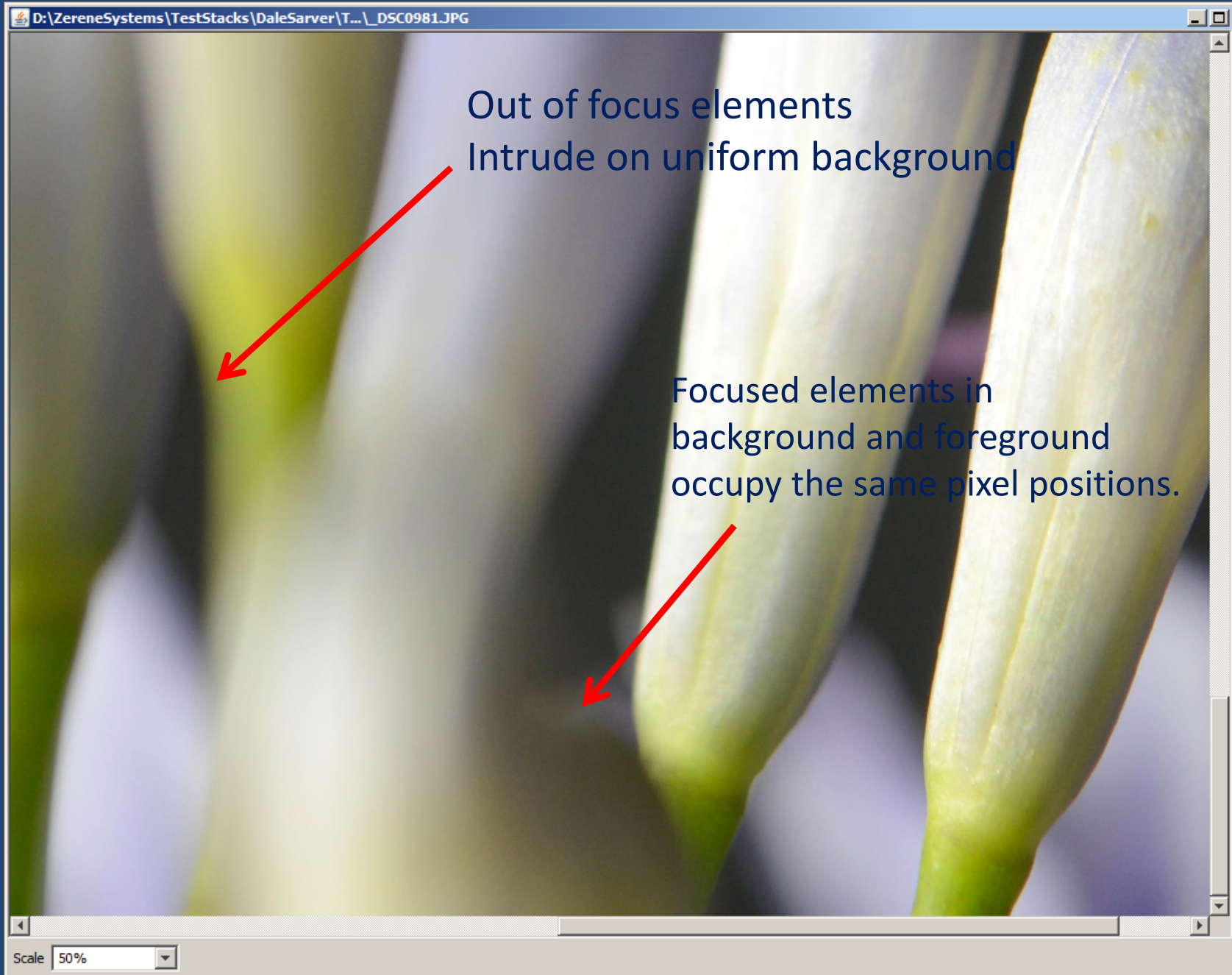
The Sequence Shows a Different Story



The Sequence Shows a Different Story



The Sequence Shows a Different Story



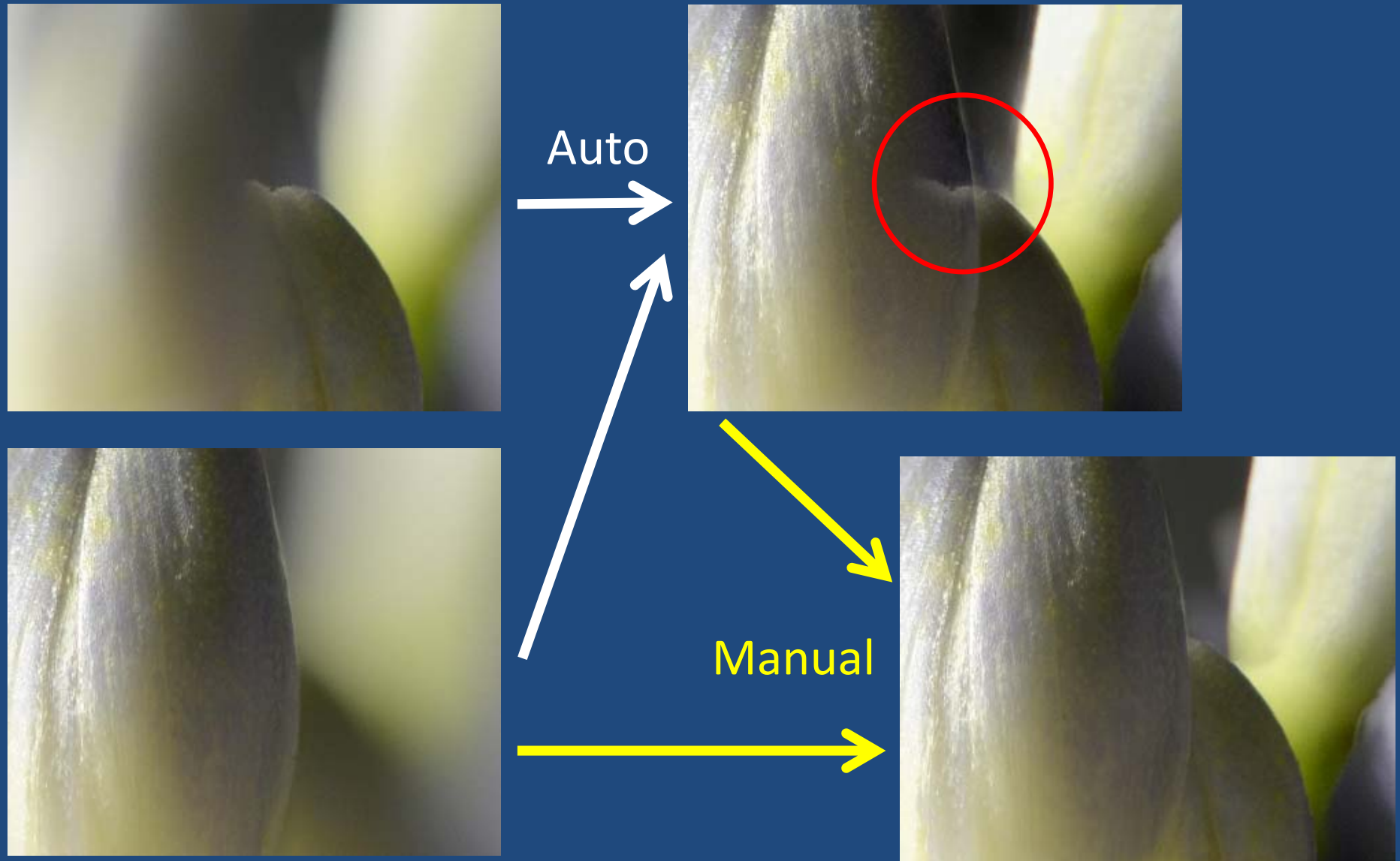
More About Those Last Few Problems...

- Transparent Foreground
- Halos (dark light bands)
in uniform background

Transparent Foreground

Cause: lens looks around foreground to see high contrast background

Solution: retouching

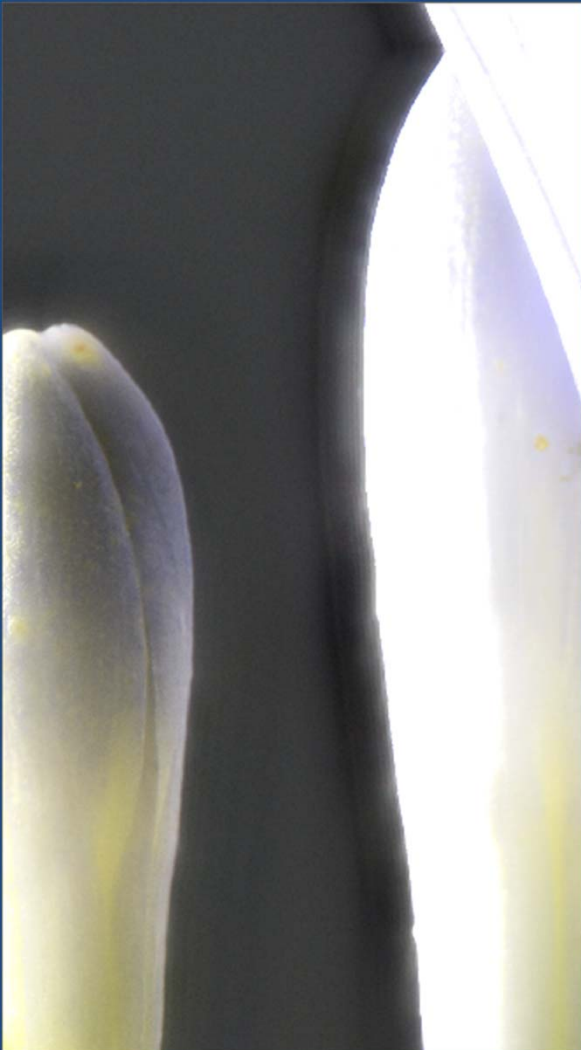


Dark/Light Bands in Uniform Background

Cause: software limitation – tries to preserve “detail” where there isn’t any!

Solution: human guidance – contrast threshold slider, external mask

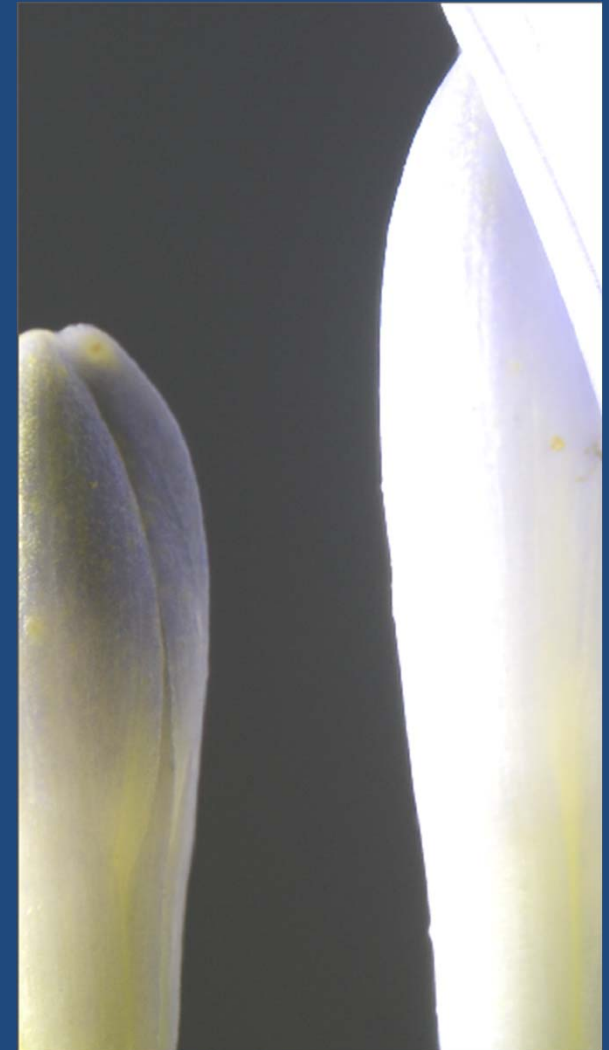
PMax



DMap (no guidance)



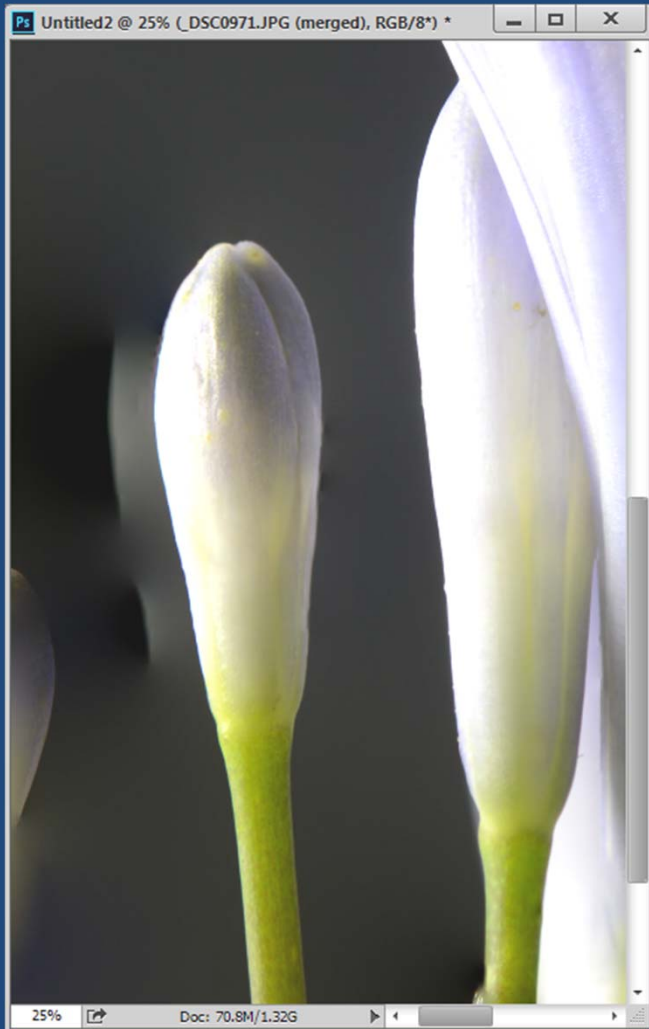
DMap (external mask)



Images are brightened to emphasize halos.

Photoshop with the Difficult Stack

Auto align,
seamless tones & colors



Collage align,
seamless tones & colors



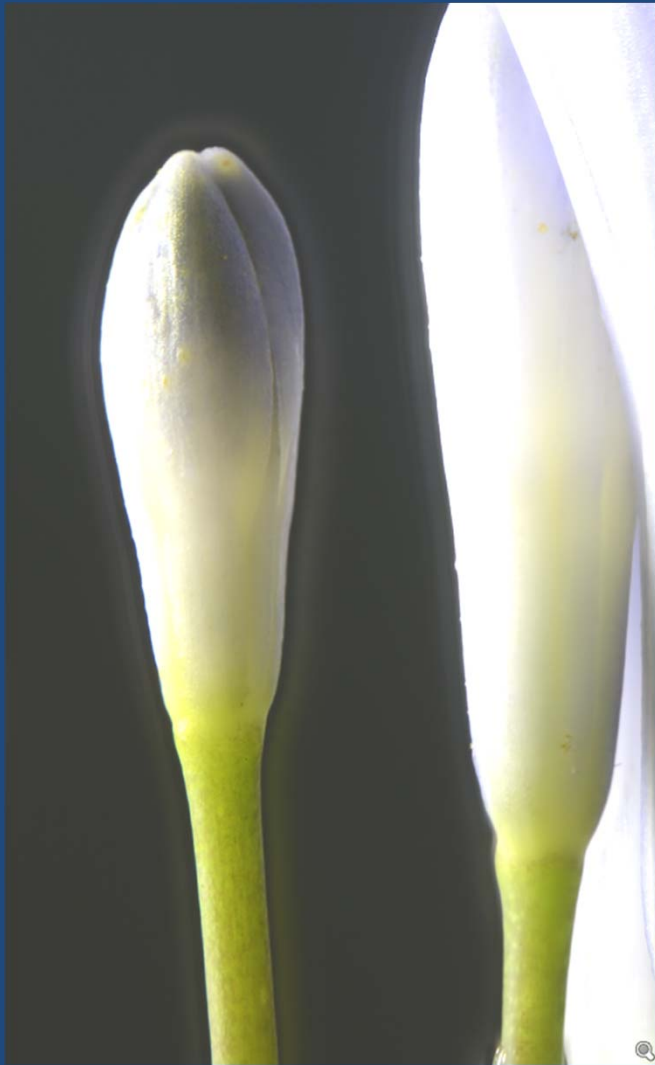
Collage align,
un-check "seamless..."



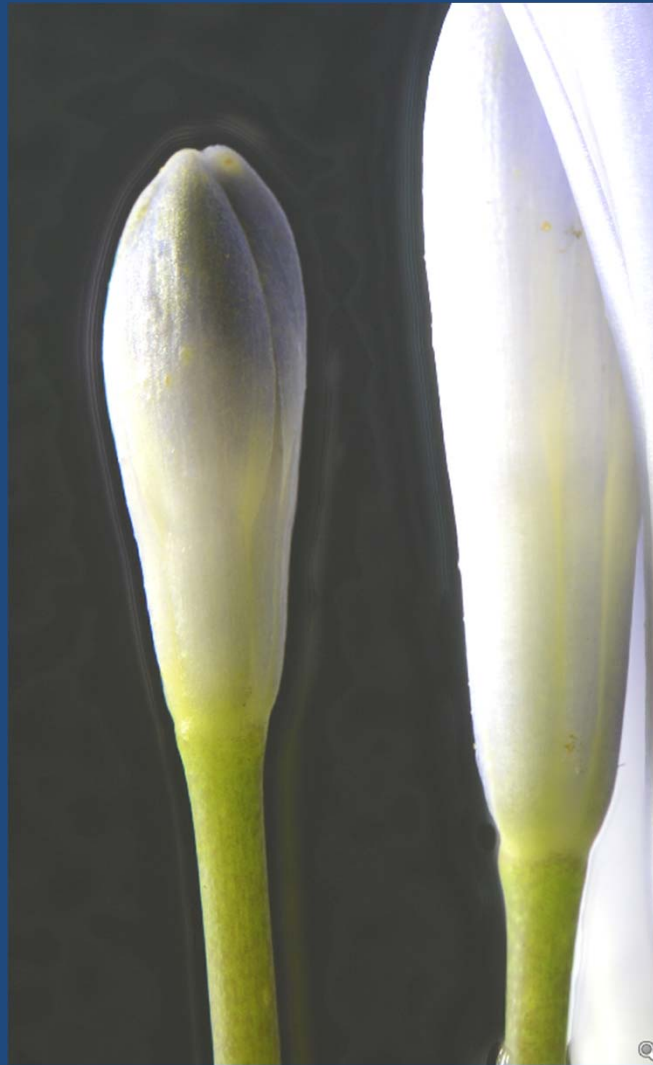
Images are brightened to emphasize halos.

Helicon Focus with the Difficult Stack

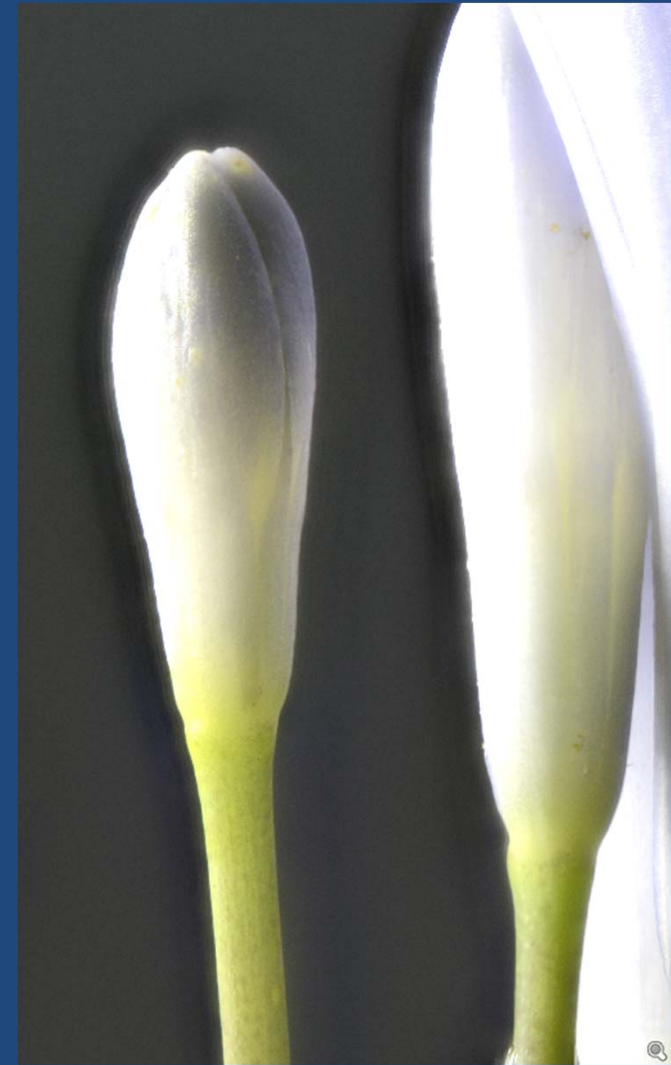
Method "A"
(weighted average)



Method "B"
(depth map)



Method "C"
(pyramid)



Images are brightened to emphasize halos.

The Final Result



Some More Examples Of Focus Stacking



“Extreme Macro”

Explore, Enjoy, and Protect the Planet



**ENDANGERED?
WHO CARES?**

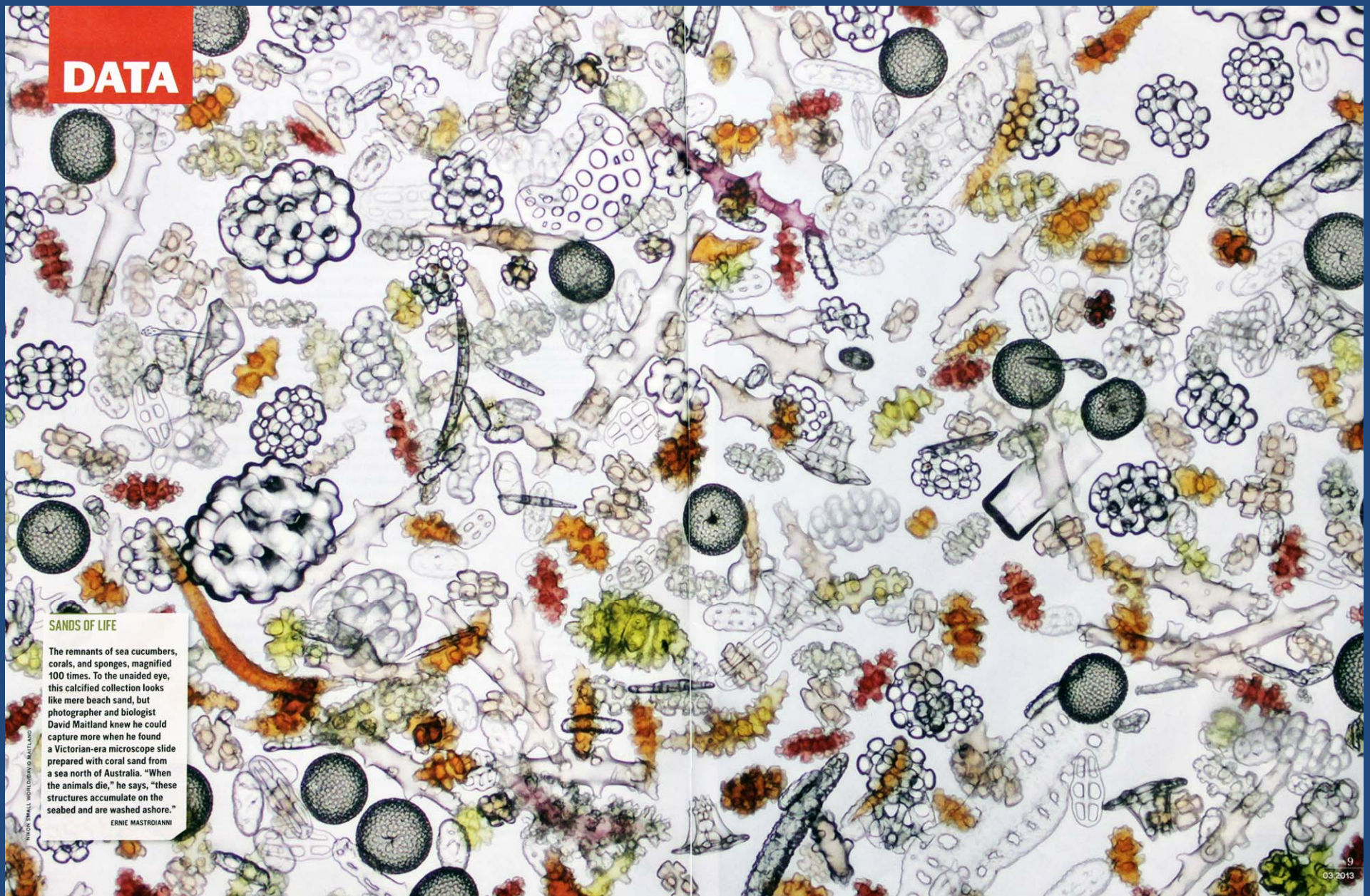
THE MAGAZINE OF THE SIERRA CLUB

MARCH/APRIL 2011

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>

Macro: Forget-Me-Nots

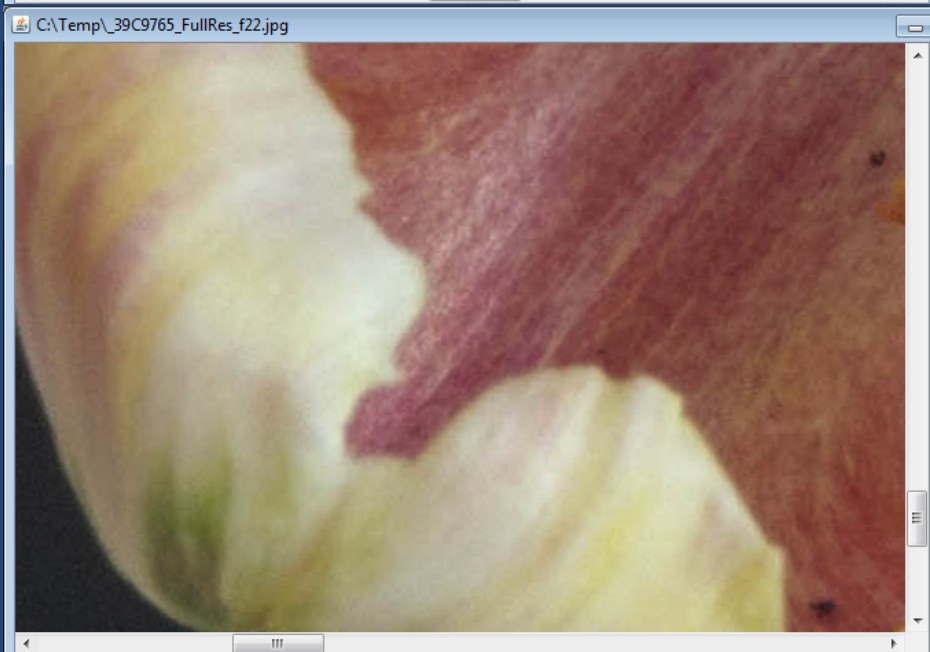
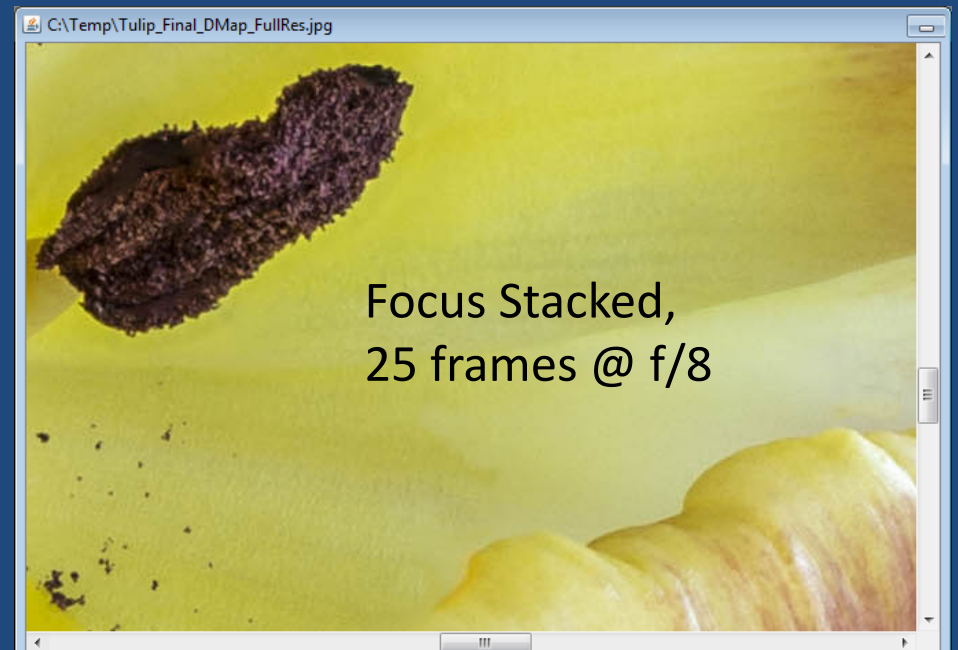
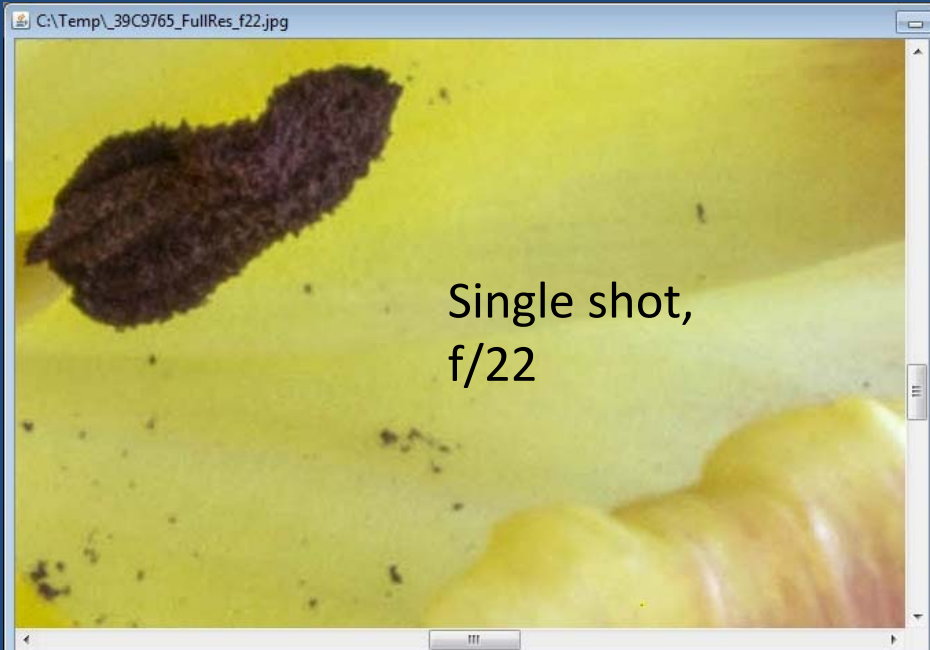


One Last Example...



© George D. Lepp 2013

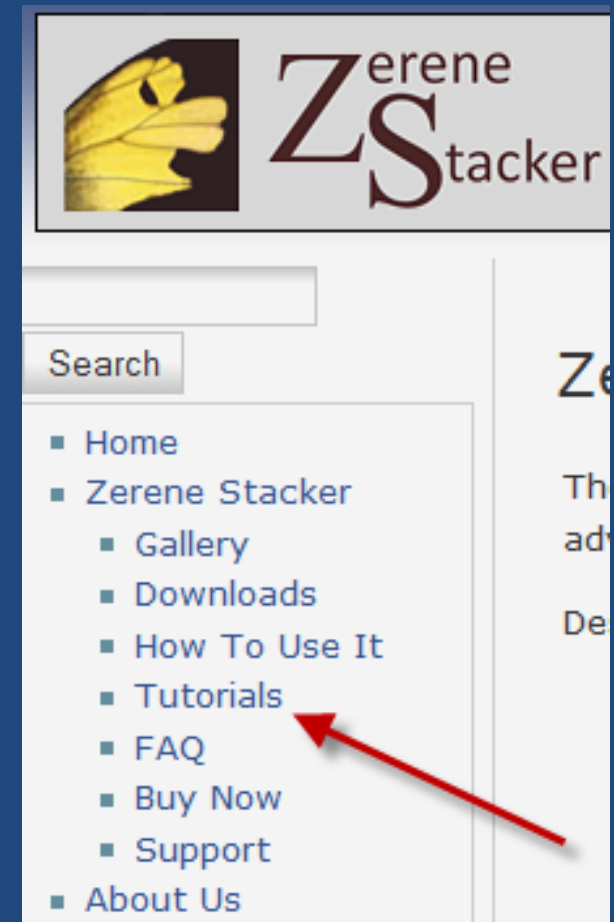
Which Would You Rather Have?



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.



Recommended Presentation Slide Set

- "Introduction to Focus Stacking", presented as a 1 hour course

Recap & References

- Focus stacking gives sharp images and large depth of field
- Web forum dedicated to photography of small things

<http://www.photomacrography.net>

- For more information

email: support@zerenesystems.com

The end...

Reserve Slides...

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 technical features as Professional.
- **Personal:** \$89, hobbyists only. Provides all key functions including retouching and 64-bit mode.
- **Student:** \$39, same features as Personal.

Focus Stacking is Now Accepted by National Geographic...

FOOD The Future of Food natgeofood.com
This story is part of National Geographic's Future of Food initiative, a special five-year project that seeks to show how what we eat makes us who we are.

Brother Adam must have known he had become a beekeeper at an unlucky time. It was 1915, and he was a 16-year-old novice at Buckfast Abbey in southwest England. Rapid bee die-offs have been recorded for centuries, but the catastrophe that confronted the young monk was unprecedented. A mysterious disease had wiped out almost every apiary on

by Charles C. Mann
Photographs by Anand Varma



88 NATIONAL GEOGRAPHIC • MAY 2015

Scientists eventually linked the disease to a previously unknown virus. But the research came too late to save Britain's native dark brown honeybee. Almost all the surviving hives were hybrids, the progeny of local drones that mated with foreign-bred queens. The apparently superior vigor of these blends made Brother Adam think about breeding a disease-resistant bee.

In 1950, after years of preparation, he finally got his chance. Commandeering an old abbey car, he traveled over the next 37 years through Europe, the Middle East, and Africa, collecting more than 1,500 queens: the hardworking bees of northern Turkey, the hyper-diverse bees of Crete, the isolated bees of Sahara oases, the deep black bees of Morocco, the tiny orange bees of the Nile, the supposedly placid bees of Mount Kilimanjaro. He took his exotic menagerie to a remote station in the moors, miles from other bees with their unwanted genes. Performing countless breeding tests in pristine solitude, he created the Buckfast bee—a superbee, as it was quickly dubbed. Tan-colored and robust, it was reluctant to sting, zealously productive, and resistant to what had come to be called Isle

fever, an apiculture calamity.

But honeybees were again under assault. An Asian mite with the evocative name of *Varroa destructor* had invaded Europe and America. "Only a fully resistant, genetically endowed race or strain," Brother Adam proclaimed in 1991, will be "the ultimate answer to this menace." But before he could begin work, Buckfast's abbot, convinced that Brother Adam's growing fame conflicted with his vocation, removed him from his post. He died, heartbroken, in 1996. "Nobody really took his place at the abbey," says Clare Densley, who two years ago restarted Buckfast's storied beekeeping operation.

All the while, on the island of Sri Lanka, in 2007, a "bee disorder"—swarm, fertility—suddenly struck the Americas. News of "global agriculture" and "trophe for the planet" fed: insect pollination, mostly from honeybees, is critical to one-third of the world's food supply.

Bees researchers, many inspired by Brother Adam, rushed to understand colony collapse. Most have concluded it is not a single problem, as first thought, but a lethal amalgamation of pests, pathogens, habitat loss, and toxic chemicals; varroa mites are a critical component. Most large-scale beekeepers now use pesticides to kill

IMAGE COMPOSED OF 200 DIGITALLY MERGED PHOTOGRAPHS
SOURCE: HARRY H. LAIDLAW JR. HONEY BEE RESEARCH FACILITY

Charles C. Mann's latest book is 1493: Uncovering the New World Columbus Created. Anand Varma, a biologist who raised bees for this story, specializes in photographs that illuminate science.

chemicals, some bee researchers are returning to Brother Adam's approach: Superbee Version 2.0. Only this time, they are using the tools of biology, including genetic modification. Others tout the opposite approach, one even more natural than Brother Adam's. No chemicals, no manipulation—let the bees evolve on their own! "Unfortunately, none of these approaches has yet produced a sufficiently mite-resistant and

bee that's a game changer," Keith Delaplane, director of the University of Georgia's honeybee program, told me. Meanwhile, he says the pressures on the bee are enormous. "I stand in front of beekeepers and say, 'You all tell me the success stories.' I do not see any hands going up."

HONEYBEES ARE SUPERBIOLOGISTS. Honeybees are hive minds. Honeybees are linguistic networks:

What Is That Thing?

By Charles C. Mann

Photographs by Anand Varma



In 2007 headlines shouted about “colony collapse disorder,” a frightening new phenomenon that was wiping out hives around the world. Most researchers now believe that it is actually a deadly mix of pests, pathogens, pesticides, and habitat loss. The single worst element is *Varroa destructor*, a pinhead-size Asian mite, shown here atop a bee pupa.

It's a *Varroa* mite, one cause of colony collapse disorder.

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



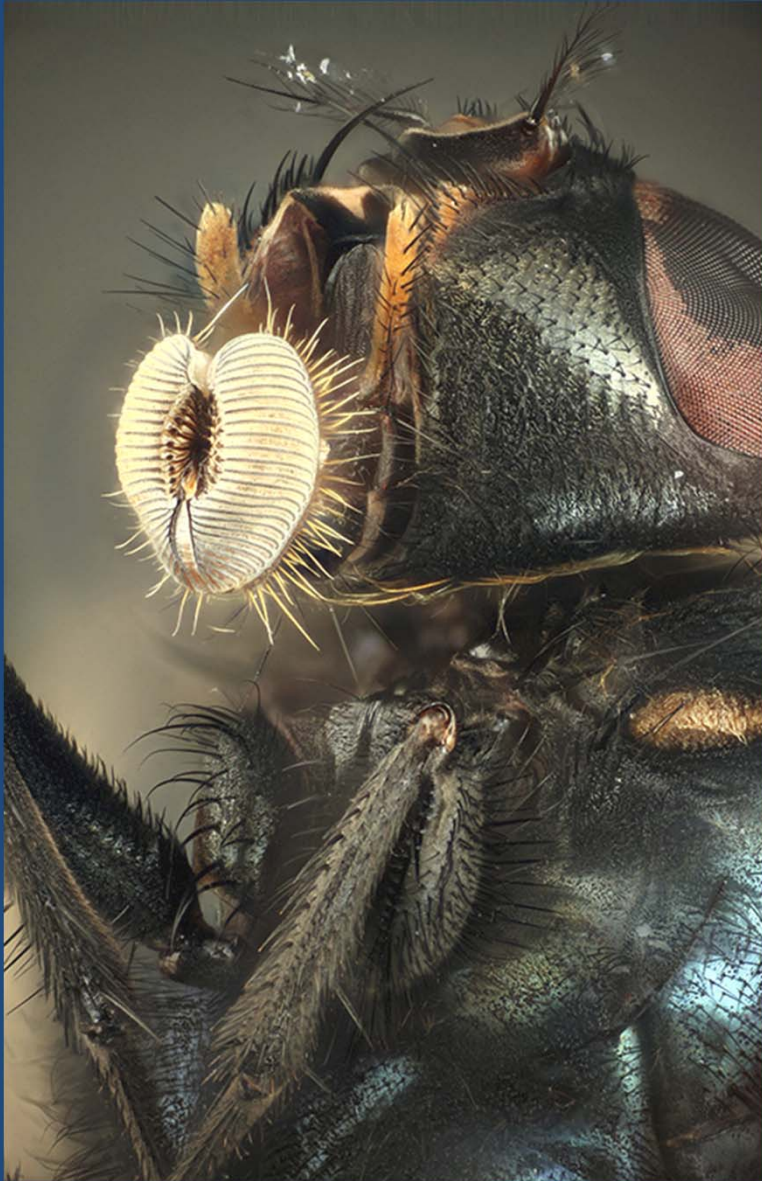
Producing An Image Like This



John Hallmén, <http://www.johnhallmen.se/studio-stacks/3xixzx6bjwv1cichn9dyw6zxmrnwt6>

My Personal Passion Is Small Things

This is a common “bluebottle” fly.

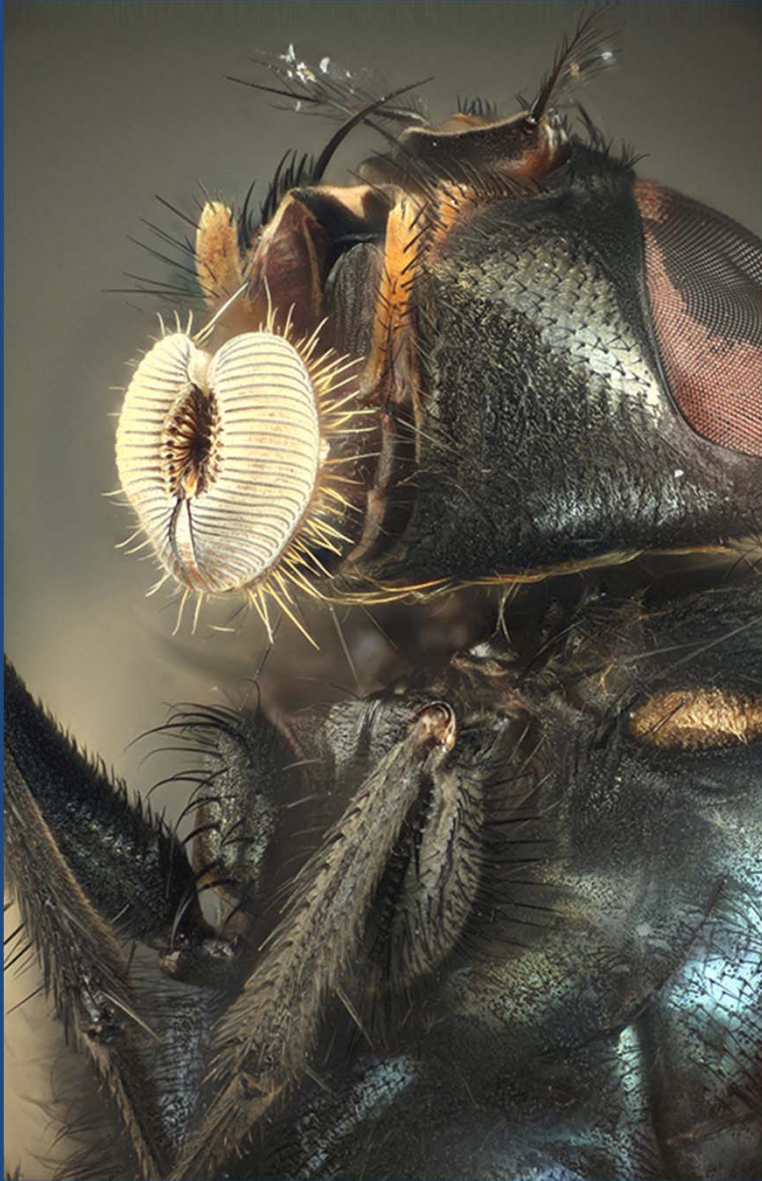


0.001 mm resolution,
3.75 mm depth of field
“looks like SEM, but with natural colors”

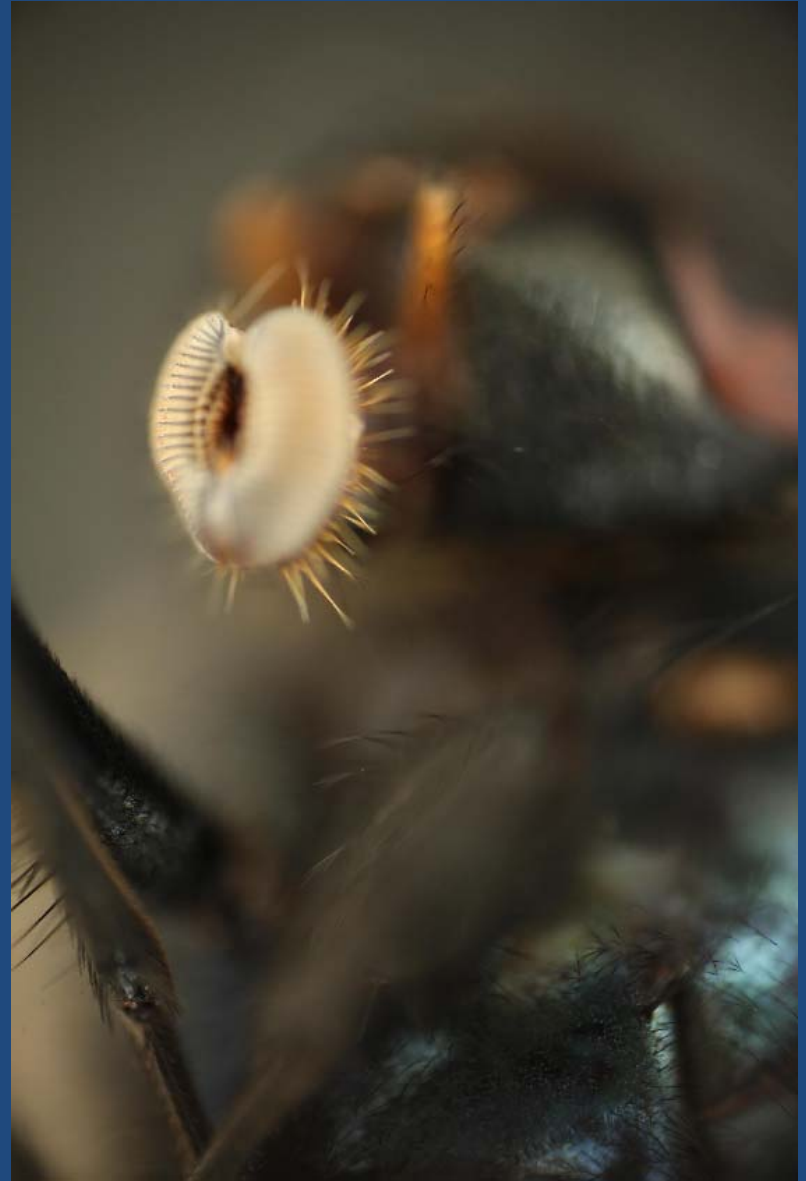


For small things, focus stacking is critical

Stacked composite



What You Can See At One Moment



Here's The Setup That Shot The Fly



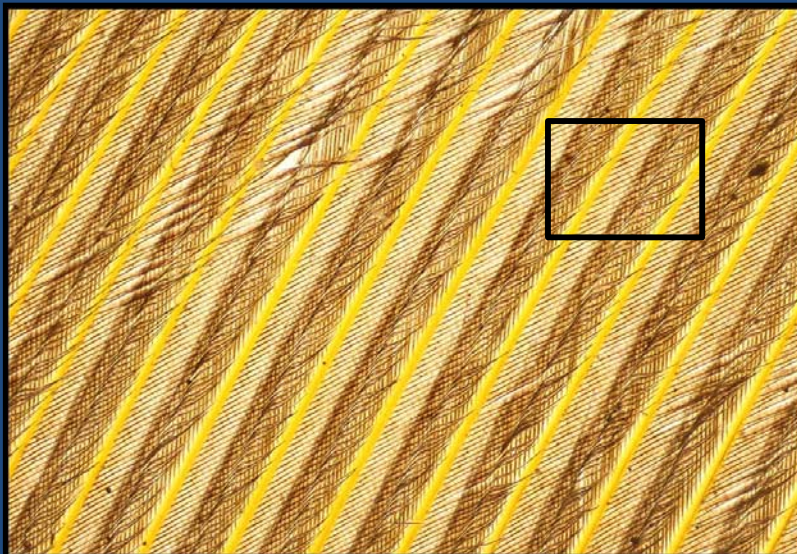
- “StackShot” automated rail
- Canon T1i camera
- Nikon microscope objective
- Vivitar telephoto (“tube lens” for objective)
- Canon 580 EX II flash
- Manfrotto 819-1 arm
- Adorama 2-axis rail
- Giottos mini ballhead
- Slik 504QF II tripod
- Cut, drilled & painted 2x4 wood

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



Shooting Through a Microscope



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

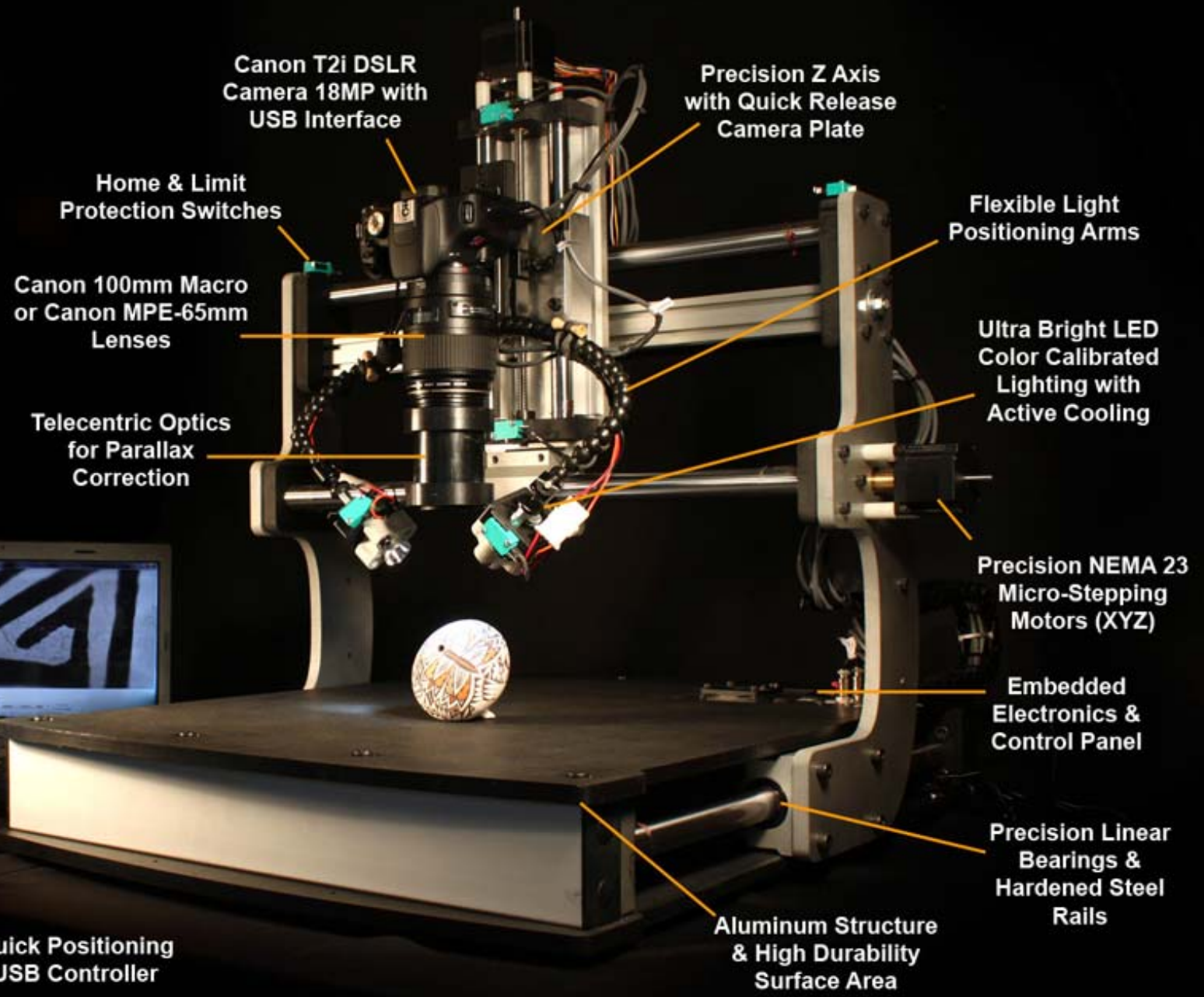
Visionary Digital's BK Plus System



GIGAmacro's package deal

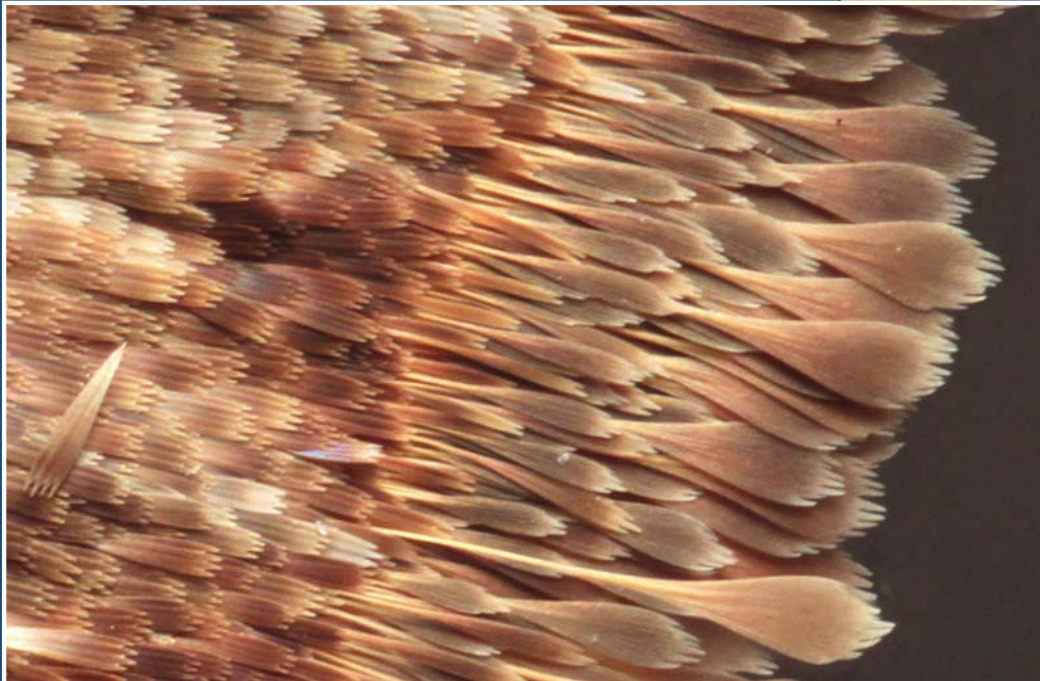
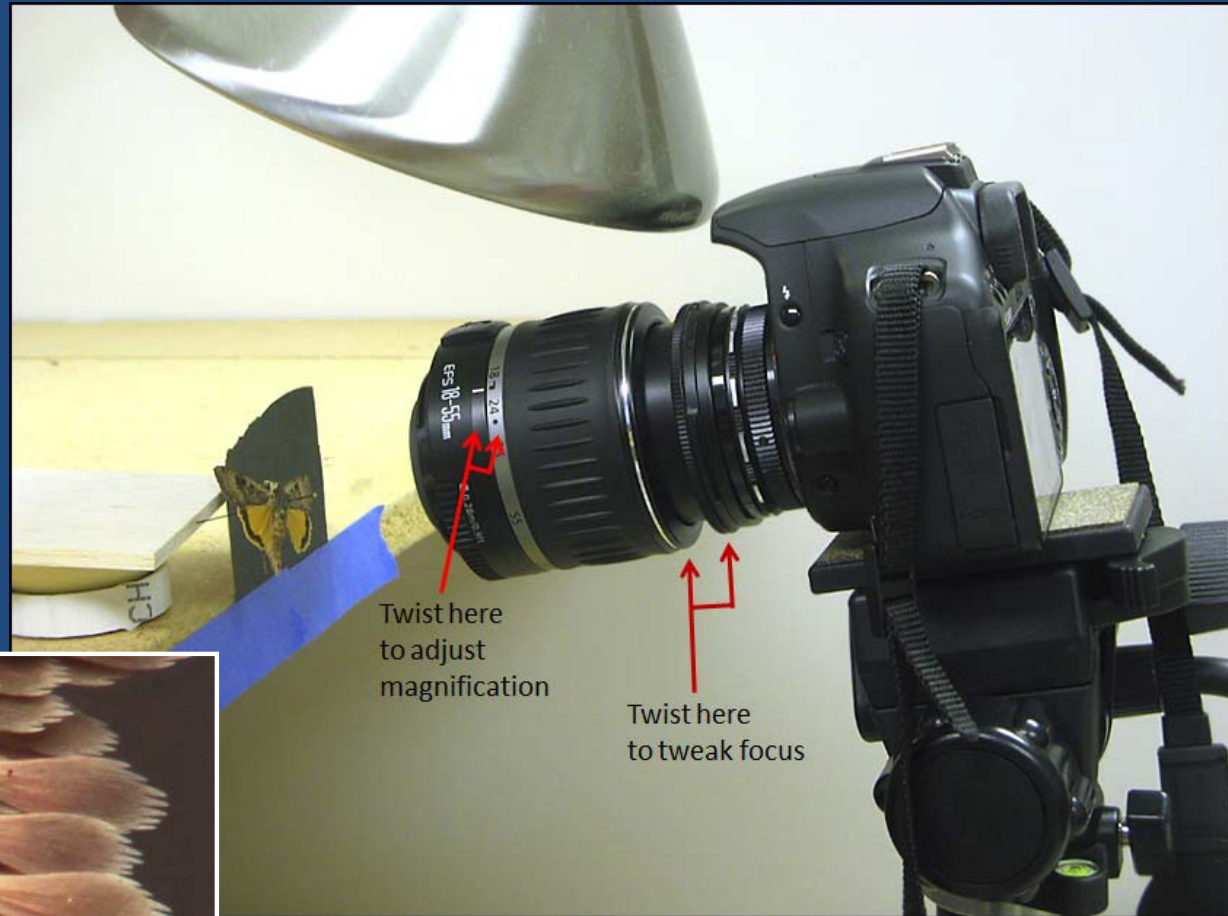
GIGAmacro Professional Imaging System

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](https://www.amazon.com)

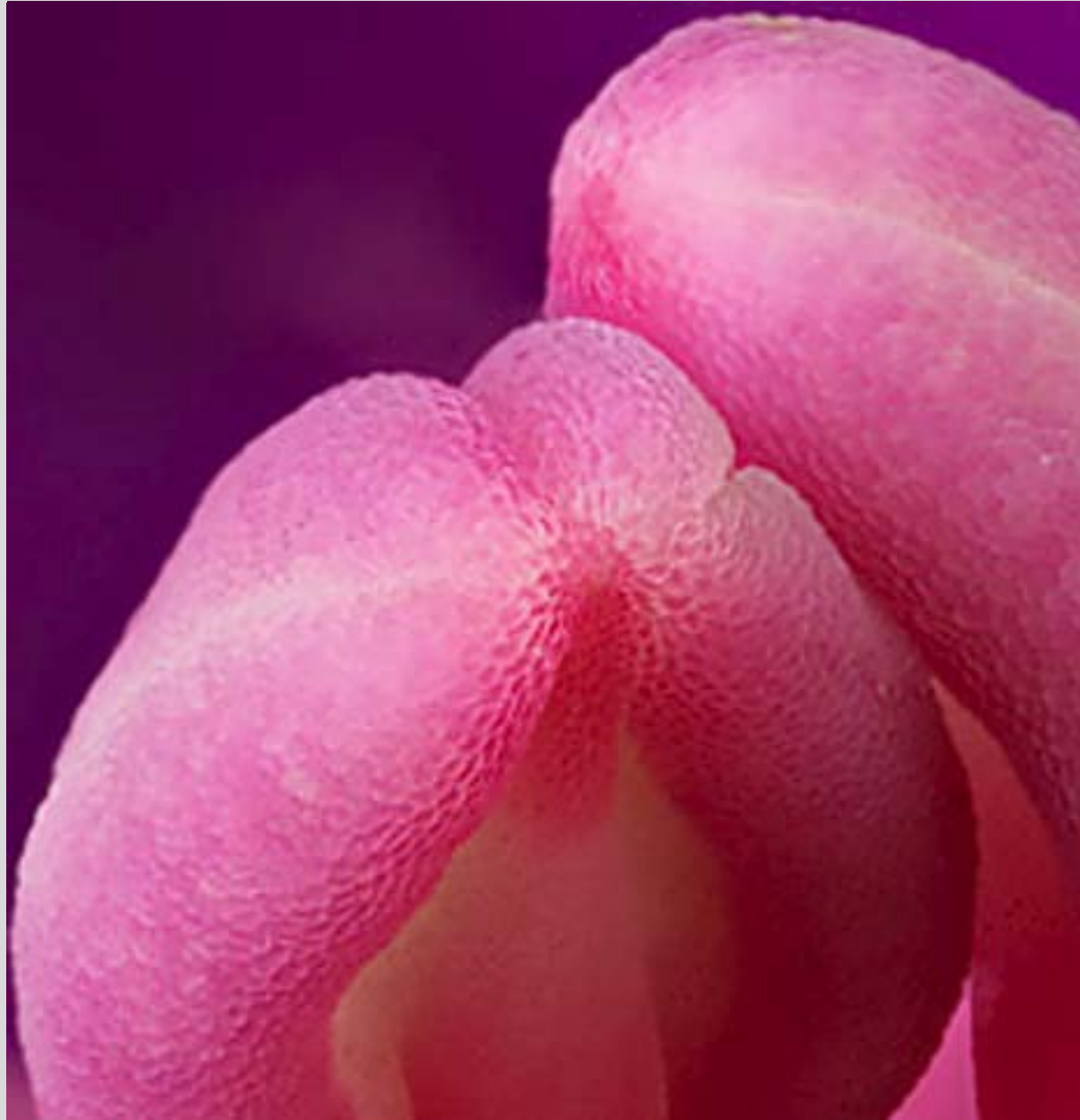
Low-tech approach



“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)

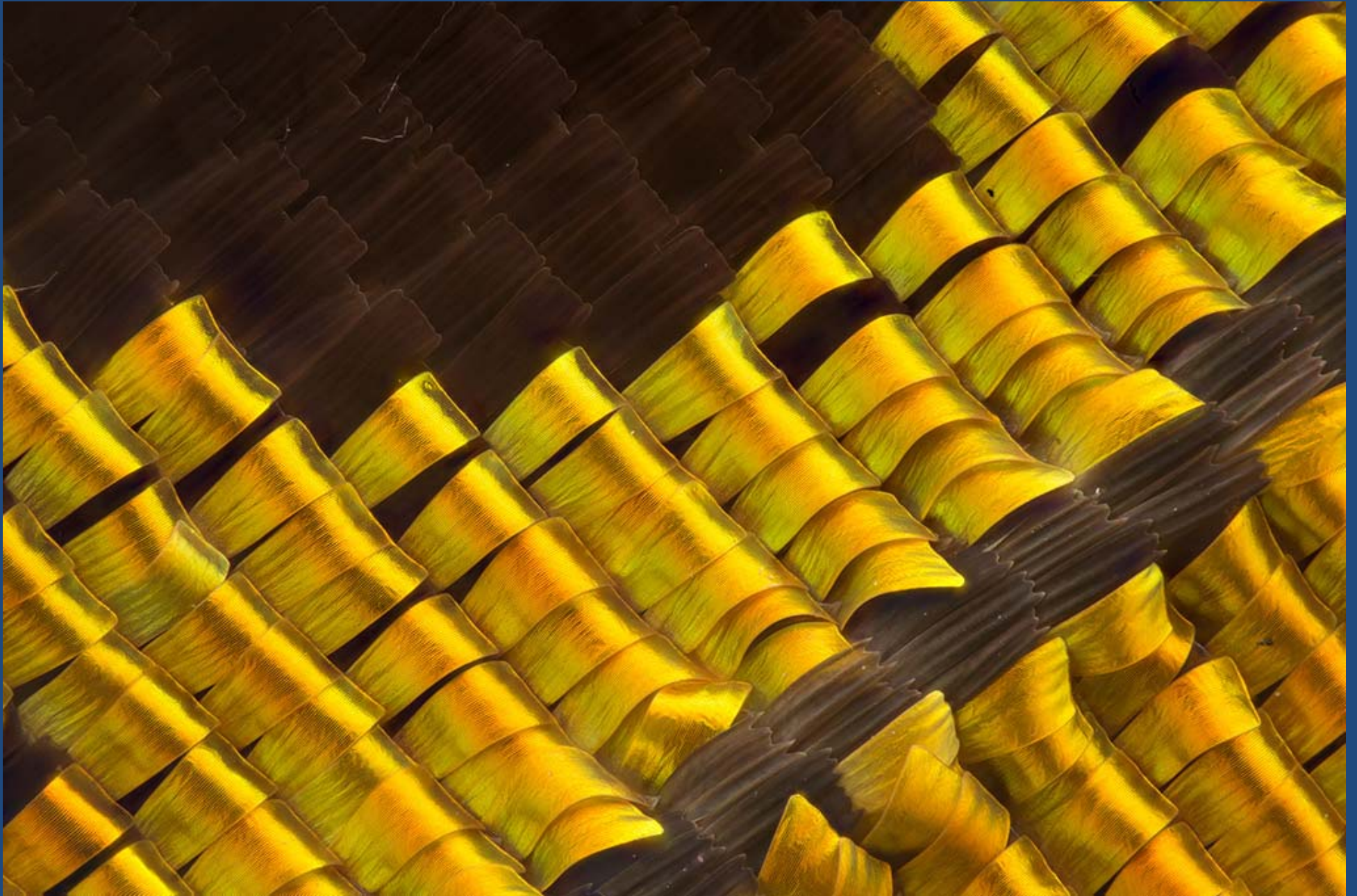


Closer...and rocking (from 1 stack)



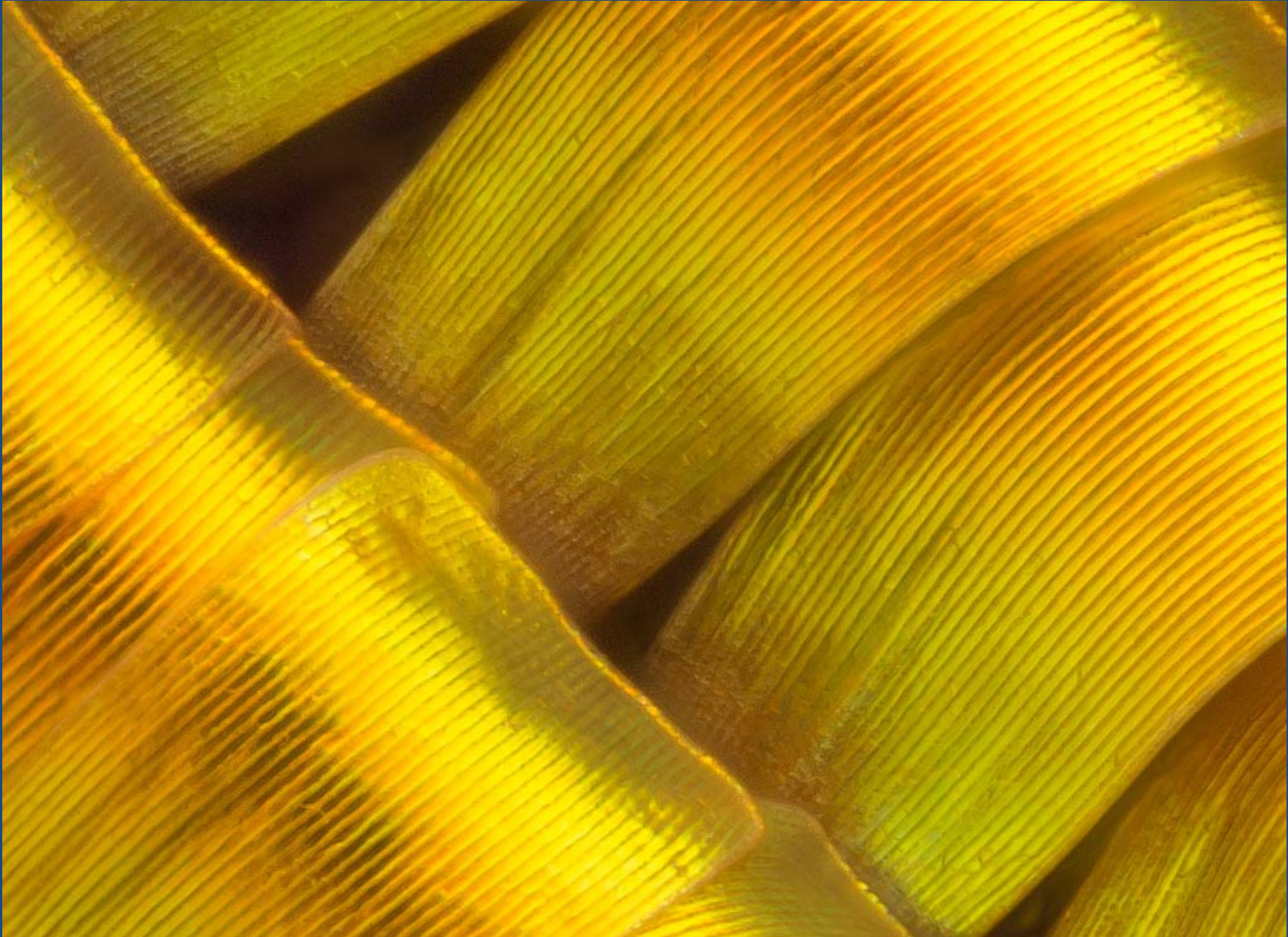
Wing Scales of Sunset Moth

(*Chrysiridia rhipheus*, 20X objective, 128 frames @ 0.002 mm)



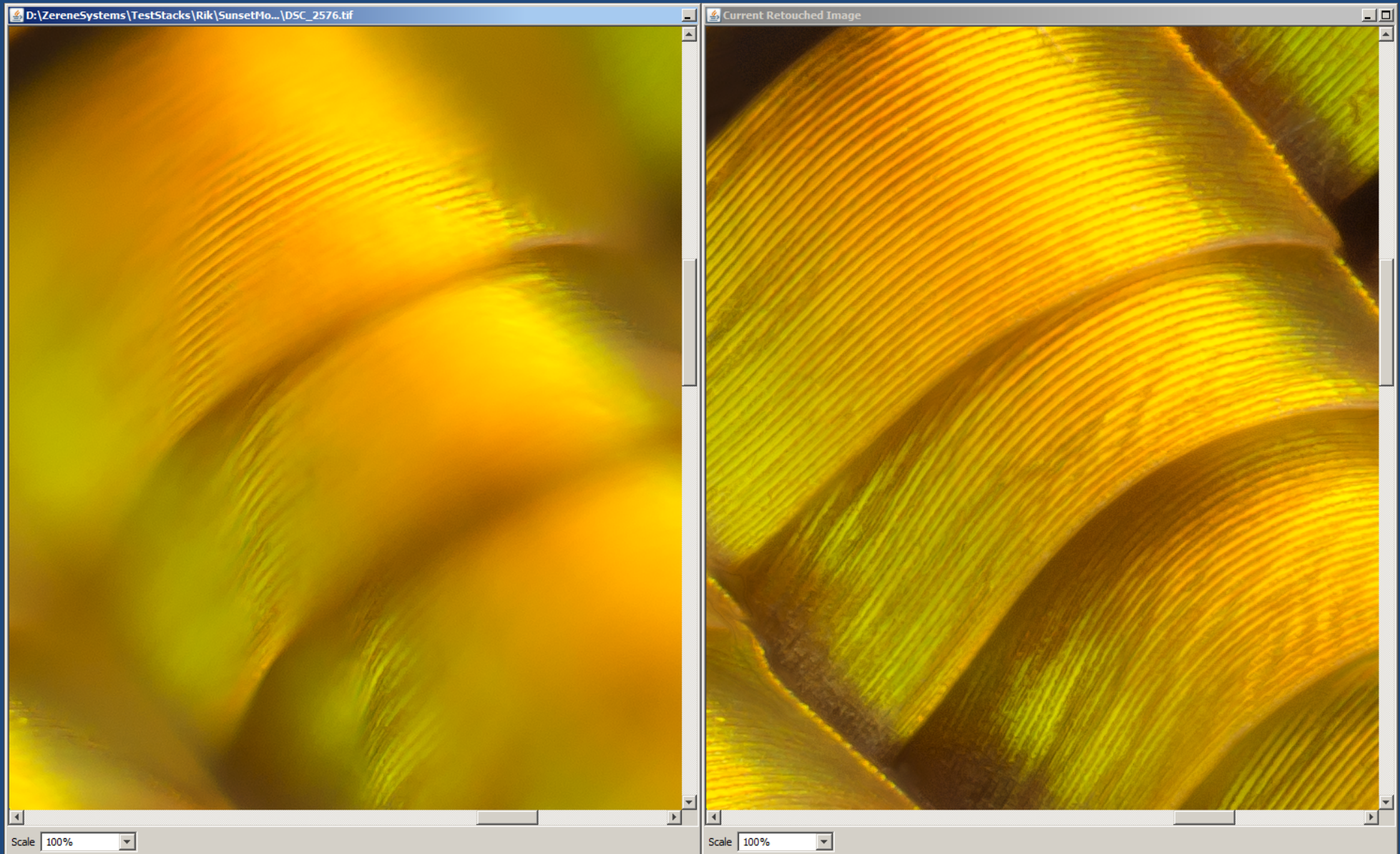
A Closer View of Those Scales

(about “500X”)




Single Frame versus Stacked

(Sunset Moth: *Chrysiridia rhipheus*, 20X objective, 128 frames @ 0.002 mm)



Firefox ▾ www.photomacrogra... x stackersoftwaredownl... 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

rlittlefield
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?

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](#)

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

rlittlefield: [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

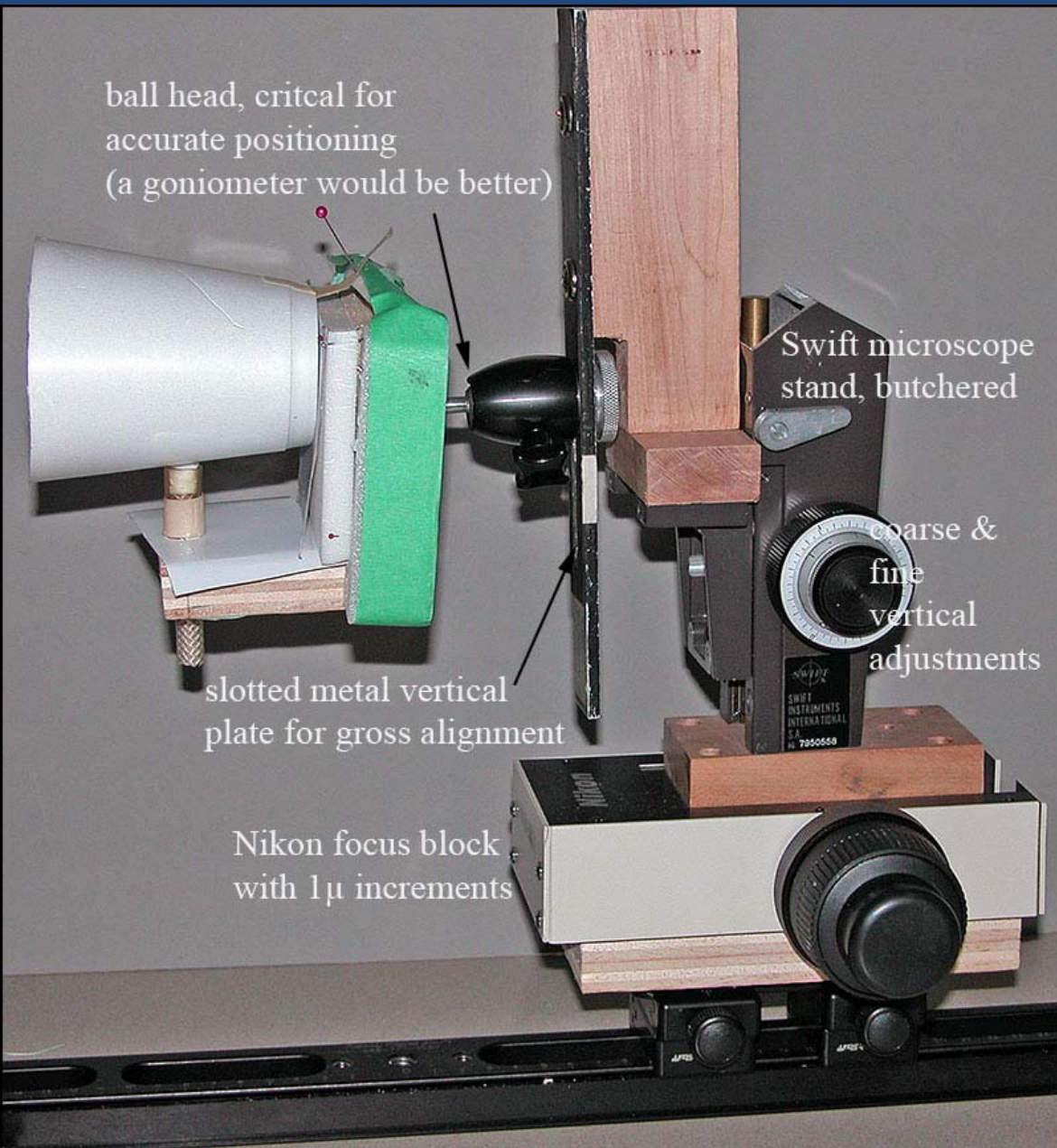
Edited May 2, 2010, to add some more links.
Edited July 7, 2010, to add some more links.

Find: spider Next Previous Highlight all Match case

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