Pinned Specimen & Label Photography

Terrestrial Parasite Tracker

M. Smith

Macroscopic Solutions, LLC

A. Caywood

Milwaukee Public Museum

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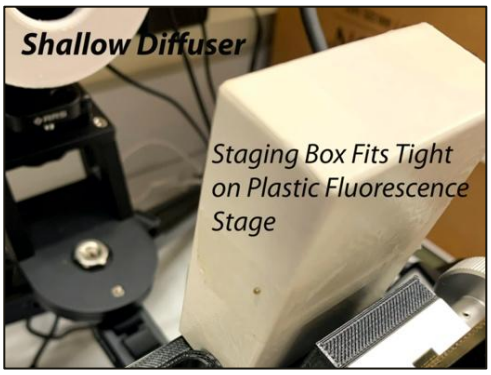
Pinned Specimen & Label Photography Workflow

This guide describes a basic image capture workflow for pinned, wet and slide mounted specimens using the Macropod Pro system. Images of labels should be taken with a point and shoot or smartphone camera, instructions included. Please review Macroscopic Solution's Macropod Pro Manual and video tutorials (http://macroscopicsolutions.com/tutorials/) to acquaint yourself with the proper assembly, operation, and storage of the Macropod equipment prior to continuing with this guide.

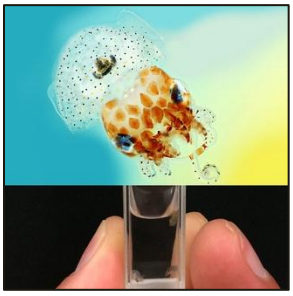
Preparation

Pinned Specimens

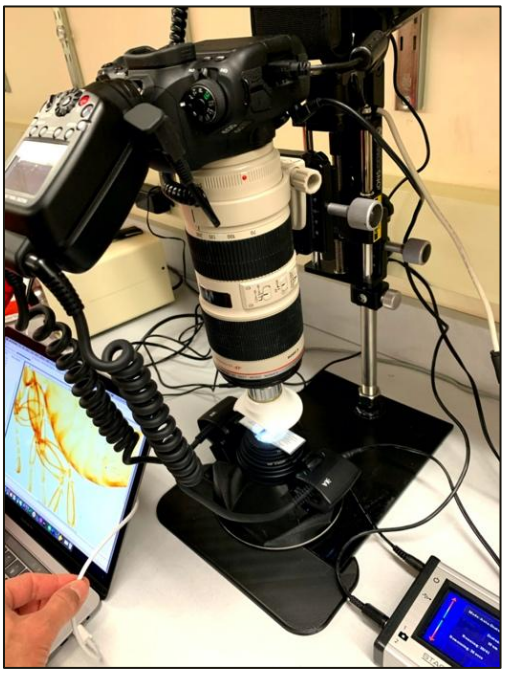
The Macropod comes with two plate attachments for the stage; an aluminum L-plate and a plastic stage made for imaging samples in fluorescent light. This plastic stage also holds slides and the box for shooting pinned specimens. These stages attach directly to a rack and pinion stage mounted on the StackShot servo assembly. To photograph the pinned specimens, you will stage them in the small white box lined with grey felt and foam, and set the box on the stage. This box works best for lateral views of specimens. You may wish to construct other removable stage boxes to accommodate other views, such as dorsal or labels. The stage fits snug on the plastic stage for fluorescence creating a more stable staging area for specimens. The short and shallow diffuser should be used when imaging specimens placed in an insect box.



Wet Specimens



Wet specimens are to be placed inside crystal cuvettes and are imaged similar to the way pinned specimens are photographed above. Clear epoxies can be used to create platforms inside the cuvettes for better positioning of the specimens. The cuvette should be situated inside the white box, and the pinned specimen photography method is used.



Slide Specimens

The Macropod includes a Petrographic analyzer designed to be used with the vertical stage. The analyzer uses step down rings to accommodate different sized slides. A vertical stand base extender keeps the analyzer level, while a magnet keeps it stable. The tutorial videos section on www.macroscopicsolutions.com has a complete step-by-step tutorial on how to use this.

Specimen Image Station Equipment

You will need the following pieces of equipment:

- ☐ Computer
  - Back up hard drive
- ☐ **Macropod Pro System**
  - **Canon 6D & Macro lens**
    - **Power source** (battery or AC power cable)
    - **Shutter cable** (camera →computer)
    - **USB cable** (camera → computer)
  - **Flash system** (Flash body + Flash CP-4EN Powerpack)
    - **12 AA batteries**
    - **CP-4EN External Power Pack**
    - **Battery charger**
  - **Camera Mount + Stack Shot system**
    - **Stack Shot Servo**
    - **Stack Shot Controller**
    - **Motor cable** (Controller → servo) + **AC power cable**
  - **Light diffuser**
  - **Pinned Specimen box**
- ☐ Label Photo System
  - Camera or Smart phone
  - Battery charger/cord
  - Card reader/USB cord
  - Camera/smart phone stand
  - Label platform
- ☐ Other equipment
  - Additional pinned specimen boxes
  - Forceps
  - Glue
  -

Note: **The items in bold come with the Macropod system**. You have the option of using the either the cable connections discussed on page 15 of the Macropod Pro Manual or enabling the wireless connection options on page 16. Select the connections that work best with your institution's workspace and hardware.

Specimen Image Station Software

Before starting, install/ensure access to the following programs:

- **EOS Remote Utility**
-  **Zerene Stacker**
- Any utility/drivers/program required by your point and shoot camera or smart phone for the transfer of images.
- If needed, back up hard drive drivers.

Suggested additional software includes:

- A spreadsheet program (Sheets, Excel, etc) for tracking specimens and images.
- Photo processing software (Adobe Photoshop or Lightroom, Irfanview, etc).

Specimen Preparation

- Ensure specimens are prepared for photography as your pre-digitization curation procedures dictate.
- If technicians are not photographing whole drawers or all specimens within a taxonomic group, discuss selection criteria with your technicians or establish how you will communicate to technicians which specimens have been selected for photography.

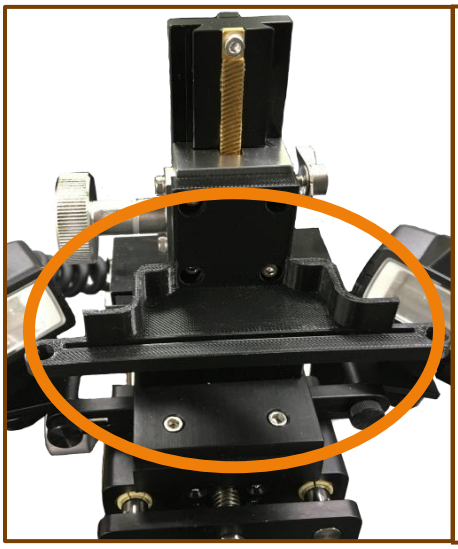
Output

This image production workflow will create the following products:

- **Specimen images**
  - Dorsal
  - Lateral Left (unless lateral right provides a better view of the specimen)
- **Label images**
  - Typically one image, unless data is printed on the reverse of a label

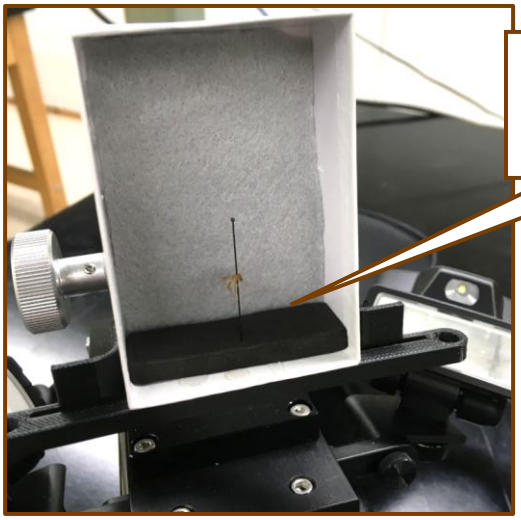
Zerene Stacker will export .tif and .jpg images. Institutional requirements for archival images will vary; please bear in mind that .jpgs will be needed for uploading images to the web and plan your image production and processing accordingly. If you are photographing type specimens, you should set your camera to shoot in raw and export a .tif. For all other specimens, use the Large Fine .jpg setting on the camera and export a .jpg.

The Macropod comes with two plate attachments for the stage; an L-plate and one with a groove for slides (pictured below). These stages attach directly to the mount and servo assembly. To photograph the pinned specimens, you will stage them in the small white box lined with grey felt and foam, and set the box on the stage. This box works best for lateral views of specimens. You may wish to construct other removable stage boxes to accommodate other views, such as dorsal or labels.



The Slide plate (left) attaches to the stage on the servo mount.

The pinned specimen box (below) fits on either the L-plate (right) or the slide plate; you can use whichever works best for your workflow.



Optional Macropod pinned specimen box

Example alternate specimen stage

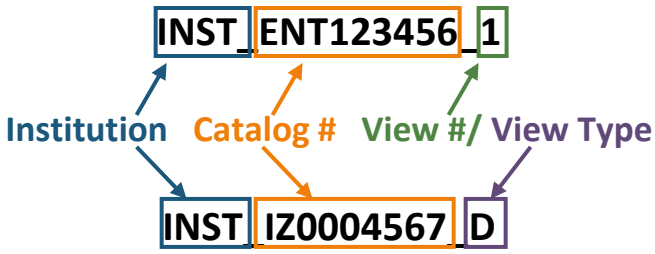
Example Label stage.

This stage is designed for label photography using a point & shoot or smart phone camera.

It is constructed out of a small unit tray filled with foam, so labels can be re-pinned to the specimen after the photographs without needing to move the labels.

Filenames

If you do not have an established file naming procedure for your images, create one. For convenience in linking the images to the correct specimen record, you should include the specimen's catalog number in the filename. Additional pieces of information in the filename may include: institution id/acronym, view number, or view type. View types may include: dorsal, Dor, D; ventral, Ven, V; lateral, LatL, LL, LatR, LR; Label. For example:



If you are uploading images to SCAN, the catalog number in the image filename must be in the same format as it is found in the SCAN specimen record in order to link the image to the digital record. If your institution has established filenames and procedures for export to the web, follow those conventions.

Depending on what makes sense for your collection, filename structure, and workflow, you may name files at several points in the process:

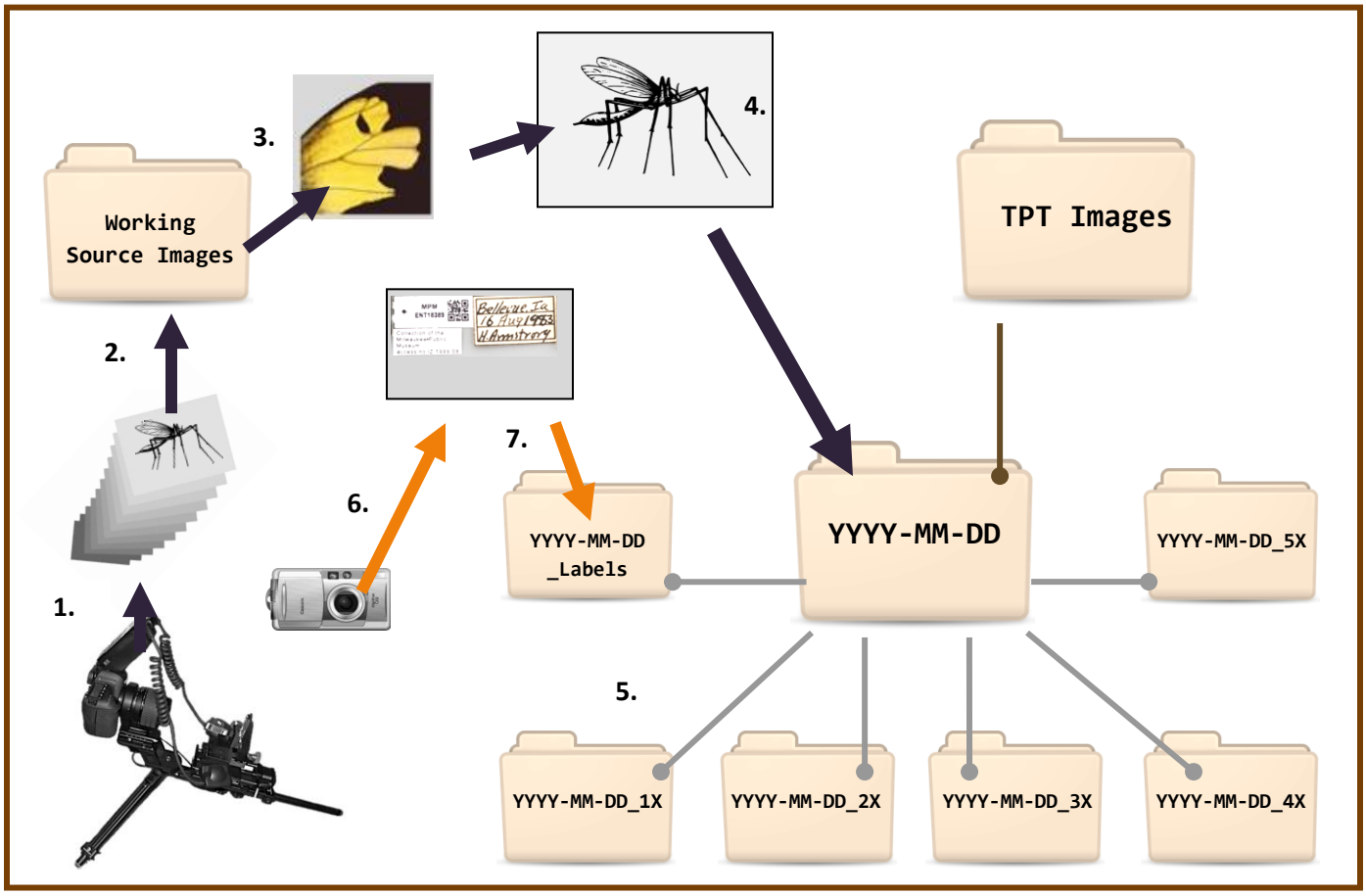
- At time of capture from a list of pre-populated filenames.
- At time of capture from the specimen's label information (taxon or specimen #).
- During image processing.

The example workflow in this document will rename images at time of capture from a pre-populated list of image names. ***For additional information, please refer to the SCAN Batch Upload instructions:*** https://scan-all-bugs.org/?page_id=2696

Folder System

Through the Macropod system you will capture .jpg images; your stack can be exported from the Zerene stacker software as a .tiff or a .jpg. Your label camera output is determined by the model you select. This workflow will assume that image capture and image processing will happen in different sessions. If needed, establish your archival image format as well as the desired products of your processing session (derivative types, application of digital scales, etc).

If you are not processing images the same day they are created, in addition to a filename structure, you should establish a foldering system on your computer and back up hard drive that will allow for easy back up and processing. For example, if you don't plan on retaining the source images after stacking, **you could folder in the following structure:**



1. The Macropod is set to capture a group of source images.
2. Images are sent to a Working Source Images folder on the computer.
3. Zerene Stacker takes the source images from the working folder and creates a stacked image.
4. The stacked image is renamed and exported to the day's session folder.
5. If adding digital scales during processing, it may be convenient to organize images by magnification.
6. Labels are captured by smartphone or camera.
7. At the end of the day's session, the images are uploaded to the computer and placed in the label subfolder within the day's session folder.
8. Before capturing the next macropod image, you should empty the Working Source Images folder.

Initial Software Settings

EOS Utility

Ensure linked software is turned off in “preferences.”

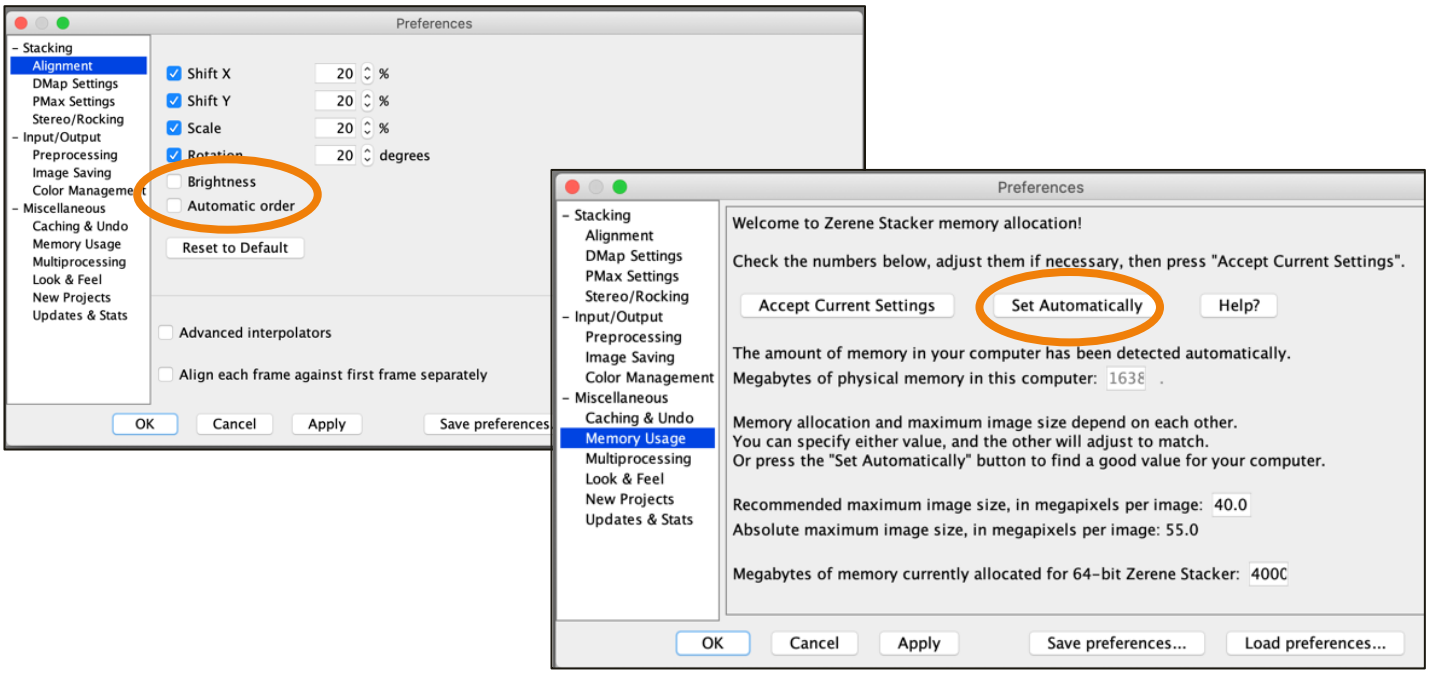
Have the program start automatically when the camera is tuned on.

Make certain white balance is set to custom:

Display	Mode	Color Temperature (Approx. K: Kelvins)
AWB	Auto	3000 - 7000
	Daylight	5200
	Shade	7000
	Cloudy, twilight, sunset	6000
	Tungsten light	3200
	White fluorescent light	4000
	Flash use	Automatically set*
	Custom (p.140)	2000 - 10000
K	Color temperature (p.141)	2500 - 10000

Zerene Stacker

Left Screen Shot: Ensure Brightness and Automatic Order are turned OFF
Right Screen Shot: Click Set Automatically and Accept Current Settings to allocate memory usage.



Illuminating the Specimen

Help and Tutorials

This is a help section where Macroscopic Solutions shares walkthrough video tutorials for their imaging systems.

- OFFICIAL FORUM
- Macropod PRO
- Macropod Micro Kit
- Macropod PRO 3D Modeling
- Macropod MacroCore 2 Axes
- Macropod MacroCore 3 Axes
- Macropod MicroCore 3 Axes
- Macropod Petrographic
- Focus Stackers Facebook

Detailed descriptions to illuminate pinned/wet specimens and slide mounted specimens are found in the tutorial section on www.macroscopicsolutions.com.

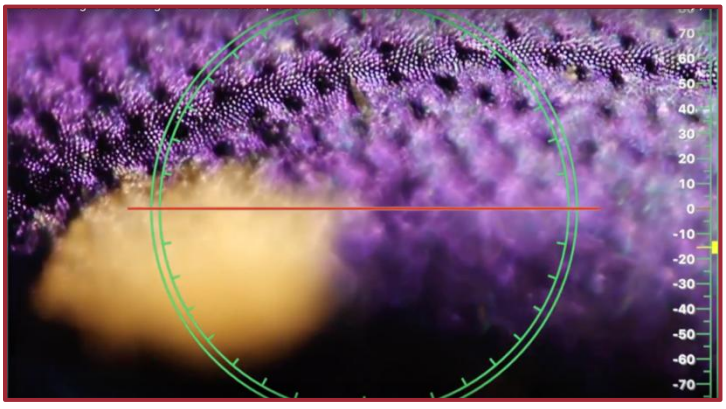
Please hover over the "Macroscopic Solutions" tab and select the Help & Tutorial video for your requirement.

Diffusers should be used to direct light onto specimens.
Never point the flash directly towards the specimen; direct them toward the diffuser to bounce light on the specimen!

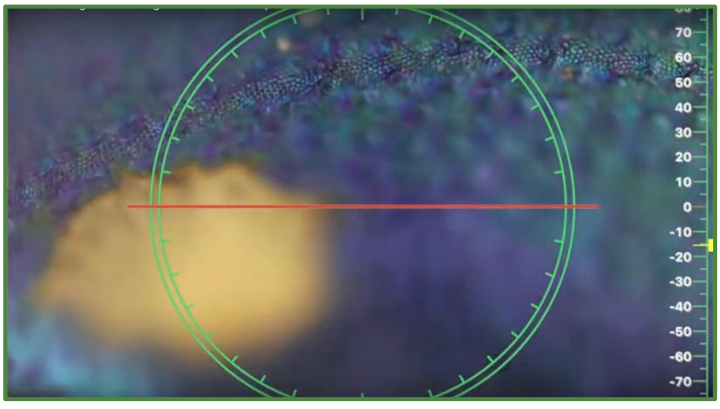
The small aperture objective diffuser is for 50 and 100x objectives.
The large aperture objective diffuser is for 7.5, 10 and 20x objectives.
The MP-E 65mm diffuser (large cup) is for short working distance.
The MP-E 65mm diffuser (large flat) is for long working distance.
The Turtledove diffusers are for field use and 100mm 3D modeling.

You are looking for balanced, reflected light. The image on the left is a BAD example, the image on the right is a GOOD example.

BAD



GOOD



Sample Workflow

The workflow described below is one of several possible workflows; your collection and institutional requirements for archiving images will influence the workflow and its products. Please refer to the Macropod Pro Manual for additional details on operating the Stackshot Controller, camera, and Zerene Stacker.

		STEPS	NOTES
SESSION START UP	COMPUTER	Open computer software: ☐ EOS Utility (choose remote shooting.) ☐ Zerene Stacker ☐ Specimen & Photo tracking spreadsheet. ☐ Set up session folder. ☐ Prepare your tracking spreadsheet.* ☐ Pre-populate filenames for each specimen (dorsal, lateral, label).*	* If you are not using a specimen and image tracking spreadsheet, you can skip these last two steps.
	CAMERA	Set up/turn on the Macropod: ☐ Canon 6D* ☐ Stack Shot Controller ☐ Flash (should operate on "lock" mode.) ☐ Press the button to turn the dial and set camera to AutoFocus (A). ☐ Put the light diffuser on the end of the lens. Set up/turn on the Point & shoot/ Smart phone: ☐ Camera ☐ Align camera & Label stage.	*The camera comes pre-set on capturing Large Fine jpgs.
	SPECIMEN	☐ Remove session specimens from storage. ☐ Review specimens: consider size and condition.*	* If possible, it is useful to photograph similarly-sized specimens as a group to reduce the need to adjust the camera magnification and equipment from specimen to specimen.
IMAGE CAPTURE	SPECIMEN	☐ Remove labels from the pin and put specimen in first staging tray (Lateral). ☐ Put staging tray into holder on the Stackshot servo.*	* Note which parts on the specimen will be closest to the camera and the furthest away.
	LABELS	☐ Place labels on label stage and align the stage under the camera. ☐ Focus camera on the labels. ☐ Photograph the labels.	

IMAGE CAPTURE: Specimen View 1		☐ Check image to make sure focus is correct.	
	CAMERA	☐ In EOS Utility, turn on Live View. ☐ Choose a fixed magnification to correspond with tables 1-6.	
	STACKSHOT CONTROLLER	☐ Use Auto-Distance. ☐ Align the specimen in the frame. ☐ Use the arrows to focus on point on the object FURTHEST from you.** ☐ Click "Set Start Position Box." ☐ Choose the point CLOSEST to you.** ☐ Click "Set End Position Box." ☐ Set the step size.	* Be aware of where the end of the diffuser ends and where the servo ends; when you are adjusting focus you do not want to push the specimen stage into the diffuser. **You should go just beyond the point where the object is in focus in each direction.
	CAMERA	☐ Turn the Camera to MANUAL mode (**M**) on the dial, refer to table for settings. ☐ If needed, adjust the settings on your flash and camera.*	* Start from the Camera Settings listed in tables 1-6 in this document.
	COMPUTER	In the EOS Utility: ☐ **CLOSE THE LIVE VIEW** ☐ **Set the folder location for the images to stack.** ☐ Open the Quick Preview (Under "Other Functions")	
	STACK SHOT CONTROLLER	☐ Hit "Start."	
	CAMERA	When the camera is done taking image, ☐ Press the button to turn the dial and set camera to AutoFocus (**A**). ☐ Turn off the flash.	
	COMPUTER	In Zerene Stacker: ☐ Select File>New Project. ☐ Select File>Add files.* ☐ Select the stack you have just taken & press Open. ☐ Under Stack, choose "Align & Stack Using PMax" (first option). ☐ If the image is correct (in focus, no parts out of the frame), export the image to the appropriate folder to await processing. ☐ Select File>Close Project.	*You can also drag and drop the file from your desktop or the Windows File Explorer.

		☐ If using a holding folder for image stacks, clear the folder. ☐ Verify image was renamed correctly on export.	
IMAGE CAPTURE: Specimen View 2	**SPECIMEN**	☐ Put specimen in second staging tray (dorsal).* ☐ Put staging tray into holder on the Stackshot servo.	* Note which parts on the specimen will be closest to the camera and the furthest away.
	COMPUTER	☐ In EOS Utility, turn on Live View.	
	STACKSHOT CONTROLLER	☐ Use Auto-Distance. ☐ Align the specimen in the frame. ☐ Use the arrows to focus on point on the object FURTHEST from you.** ☐ Click "Set Start Position Box." ☐ Choose the point CLOSEST to you.** ☐ Click "Set End Position Box." ☐ Set the step size.	* Be aware of where the end of the diffuser ends and where the servo ends; when you are adjusting focus you do not want to push the specimen stage into the diffuser. **You should go just beyond the point where the object is in focus in each direction.
	CAMERA	☐ Turn the Camera to MANUAL mode (**M**) on the dial. ☐ If needed, adjust the settings on your flash and camera.*	* Start from the Camera Settings listed in tables 1-6 in this document.
	COMPUTER	In the EOS Utility: ☐ **CLOSE THE LIVE VIEW** ☐ **Set the folder location for the source images.** ☐ Open the Quick Preview (Under "Other Functions")	
	STACK SHOT CONTROLLER	☐ Hit "Start."	
	CAMERA	When the camera is done taking images, ☐ Press the button to turn the dial and set camera to AutoFocus (**A**). ☐ Turn off the flash.	

	COMPUTER	In Zerene Stacker: ☐ Select File>New Project. ☐ Select File>Add files.* ☐ Select the stack you have just taken & press Open. ☐ Under Stack, choose "Align & Stack Using PMax" (first option). ☐ If the image is correct (in focus, no parts out of the frame), export the image to the appropriate folder to await processing. ☐ Select File>Close Project. ☐ If using a holding folder for image stacks, clear the folder. ☐ Verify image was renamed correctly on export.	*You can also drag and drop the file from your desktop or the Windows File Explorer.
	SPECIMEN	☐ Put labels back on the pin and return the specimen to its unit tray.	
	COMPUTER	☐ If using a holding folder for image stacks, clear the folder. ☐ Update your tracking spreadsheet.	
	Repeat Image Capture steps with additional specimens until ready to shut down for the day.		
SESSION SHUT DOWN	**SPECIMEN**	☐ Return your specimens to storage.	
	CAMERA	Macropod: ☐ Turn the Camera to **OFF**. ☐ Turn off flash. ☐ Charge camera and flash batteries. ☐ Remove the light diffuser and replace the lens cap. Label camera: ☐ Transfer label images to the computer. ☐ Turn off camera. ☐ If needed, charge batteries.	
	STACK SHOT CONTROLLER	☐ Turn off the Stack Shot Controller.	
	COMPUTER	In Windows: ☐ Verify all specimen images have been correctly renamed during export from Zerene Stacker. In Zerene Stacker: ☐ Close your last project and exit the program.	

		In EOS Utility: ☐ Close the program. Tracking spreadsheet: ☐ Update spreadsheet. ☐ Optional: rename label images. ☐ Close spreadsheet. ☐ **Back up session images.** ☐ **Shut down computer.**	
If needed, ensure equipment is properly stored until the next session. Tidy your workspace.			

The following pages describe the starting point settings for the Macropod PRO 3D.

Table 1. High Quality Operational Settings Imaging Pinned and Wet Specimens using the MP-E 65mm 1-5x

Table 2. High Efficiency Operational Settings Imaging Pinned and Wet Specimens using the MP-E 65mm 1-5x

Table 3. High Quality Operational Settings Imaging Slides with Petrographic Analyzer using the MP-E 65mm 1-5x

Table 4. High Efficiency Operational Settings Imaging Slides with Petrographic Analyzer using the MP-E 65mm 1-5x

Table 5. Operational Settings Imaging Pinned and Wet Specimens using the MICRO KIT

Table 6. Operational Settings Imaging Slides with Petrographic Analyzer using the MICRO KIT

These settings are a starting point and may vary depending on the size and shape of the specimen. The only variables requiring adjustment are Flash Output and ISO. Adjust Flash first, ISO second. Do not exceed an ISO of 2000. For reference, you may wish to print a copy of these instructions, including the following tables, and keep notes on which specimen sizes and number of steps work best for you at different levels of magnification.

Use Auto-Distance, not Auto-Step. Click "Auto-Step" (Preset) and select "Auto-Distance." Select Start/End and program the step size below. The step size correlates directly with the Aperture for a specific magnification.

Bear in mind that exposure settings work together and adjusting one setting will impact the other settings and the image quality. For minor adjustments, try:

- If an image is too bright (overexposed) try decreasing the ISO first, decreasing flash power second.
- If an image is too dark, try increasing the ISO first, increase flash power second.

See p. 32 of the *Macropod Pro Manual* for more details on fine tuning your exposure.

Operational Settings Imaging Pinned and Wet Specimens using the MP-E 65mm 1-5x

Table 1. Settings for High Quality (Paratype and Holotype Specimens, Publication Quality Imaging)

	Flash	Shutter	Aperture	ISO	Step Size	Specimen Size
1X	1/64	1/200	F4.0	100	.40 mm	~2-4 cm
2X	1/64	1/200	F4.0	200	.16 mm	~2 cm
3X	1/32	1/200	F4.0	160	.08 mm	~1 cm
4X	1/8	1/200	F4.0	200	.06 mm	~5 mm
5X	1/8	1/200	F4.0	160	.04 mm	~1 mm

For High Quality imaging, reset the camera to shoot in RAW and save your output image as a .tif.

Table 2. Optimal (M) Camera Settings for Fast Workflow (General Databasing)

	Flash	Shutter	Aperture	ISO	Step Size	Specimen size
1X	1/32	1/200	F8.0	100	.85 mm	~2-4 cm
2X	1/32	1/200	F8.0	200	.30 mm	~2cm
3X	1/32	1/200	F8.0	400	.18 mm	~1 cm
4X	1/32	1/200	F8.0	600	.13 mm	~5 mm
5X	1/32	1/200	F8.0	800	.08 mm	~1 mm

For general database imaging, set the camera to shoot Large Fine jpgs and save your output image as a jpg.

Operational Settings Imaging Slides with Petrographic Analyzer using the MP-E 65mm 1-5x

Table 3. Optimal (M) Camera Settings for High Quality (Paratype and Holotype Specimens, Publication Quality Imaging)

	Flash	Shutter	Aperture	ISO	Step Size	Specimen Size
1X	1/512	1/200	F4.0	100	.40 mm	~2-4 cm
2X	1/256	1/200	F4.0	100	.16 mm	~2 cm
3X	1/128	1/200	F4.0	100	.08 mm	~1 cm
4X	1/64	1/200	F4.0	100	.06 mm	~5 mm
5X	1/64	1/200	F4.0	200	.04 mm	~1 mm

For High Quality imaging, reset the camera to shoot in RAW and save your output image as a .tif.

Table 4. Optimal (M) Camera Settings for Fast Workflow (General Databasing)

	Flash	Shutter	Aperture	ISO	Step Size	Specimen size
1X	1/256	1/200	F8.0	100	.85 mm	~2-4 cm
2X	1/128	1/200	F8.0	100	.30 mm	~2cm
3X	1/64	1/200	F8.0	100	.18 mm	~1 cm
4X	1/64	1/200	F8.0	200	.13 mm	~5 mm
5X	1/64	1/200	F8.0	300	.08 mm	~1 mm

For general database imaging, set the camera to shoot Large Fine jpgs and save your output image as a jpg.

Operational Settings Imaging Pinned, Wet Specimens and Slides using the Micro Kit

For High Quality imaging, reset the camera to shoot in RAW and save your output image as a .tif. For general database imaging, set the camera to shoot Large Fine jpgs and save your output image as a jpg.

Table 5. Operational Settings Imaging Pinned and Wet Specimens using the MICRO KIT

	Flash	Shutter	Aperture	ISO	Step Size	Specimen Size
7.5X	1/64	1/200	F2.8	100	12.5 µm	~1 mm
10X	1/32	1/200	F2.8	200	10 µm	~.75 mm
20X	1/32	1/200	F2.8	400	5 µm	~.50 mm
50X	1/16	1/200	F2.8	200	2 µm	~.25 mm
100X	1/16	1/200	F2.8	600	1 µm	~.1 mm

Table 6. Operational Settings Imaging Slides with Petrographic Analyzer using the MICRO KIT

	Flash	Shutter	Aperture	ISO	Step Size	Specimen size
7.5X	1/128	1/200	F2.8	100	12.5 µm	~1 mm
10X	1/64	1/200	F2.8	100	10 µm	~.75 mm
20X	1/32	1/200	F2.8	100	5 µm	~.50 mm
50X	1/16	1/200	F2.8	200	2 µm	~.25 mm
100X	1/16	1/200	F2.8	300	1 µm	~.1 mm

Post Processing and Scale Bars

Scale bars can be added to final images, so long as the correct magnification is documented. To apply scale bars, save the .jpg and use Photoshop to add a scalebar layer. To add a scalebar layer, simply drag a scalebar that corresponds to the magnification used. Export image as a .jpg.

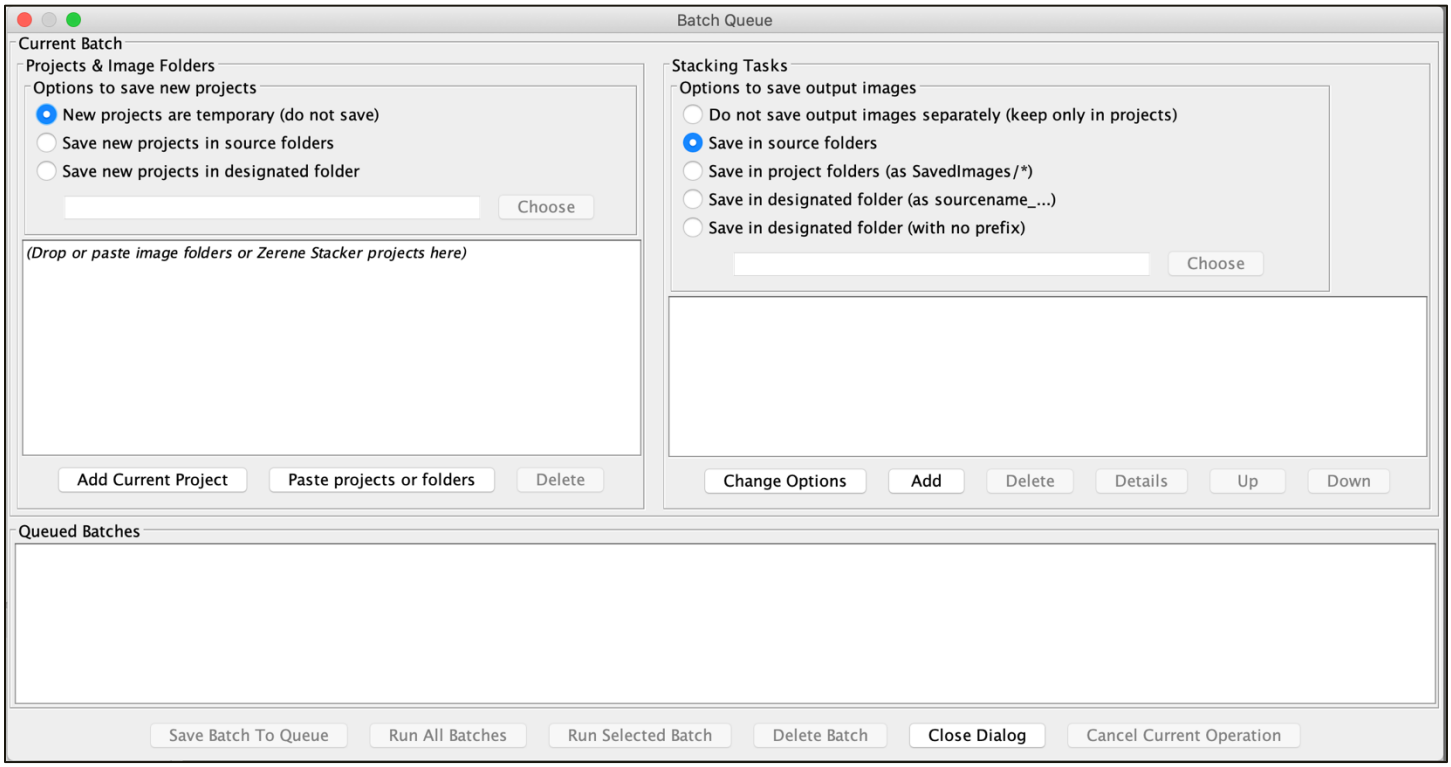
The following video is a guided tutorial.

https://www.youtube.com/watch?v=KlaE4bxx87o

Batch Stacking

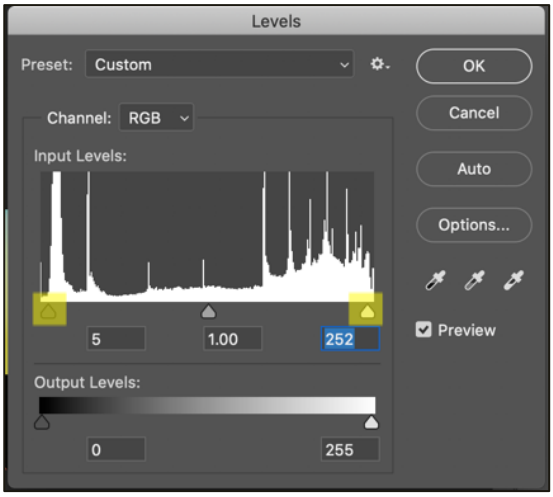
Batch > Show Batch Dialogue

Batch stacking is a valuable time-saving tool when images are being captured in rapid succession. Folders of individual stacks can be processed simultaneously to create final output images overnight or after the imaging is completed. To use in Zerene Stacker, go to “Batch” > “Batch Dialogue” then drag and drop folders, select stack all PMAX, save in source folder or in designated folder, save batch in queue and run all batches.



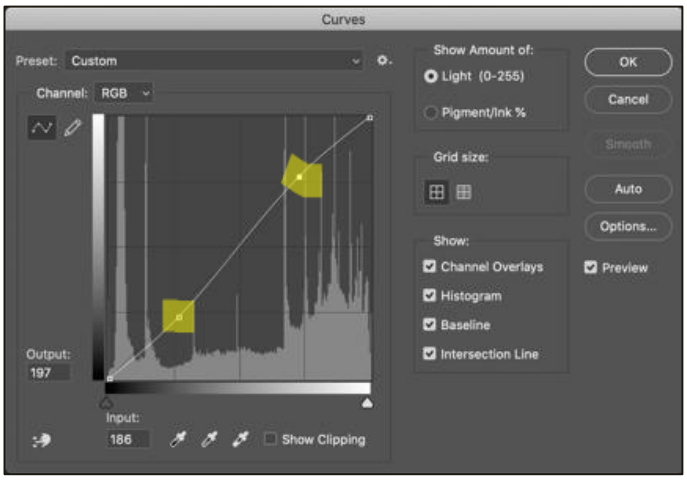
Levels Image > Adjustments > Levels

Drag left and right levers so that they arrive at the beginning and end point of the first rise in the spectrum channel. Move the Dark Gray lever slightly to the right towards the first spike. Drag the White Lever to the left towards the start of the first spike. Click OK.



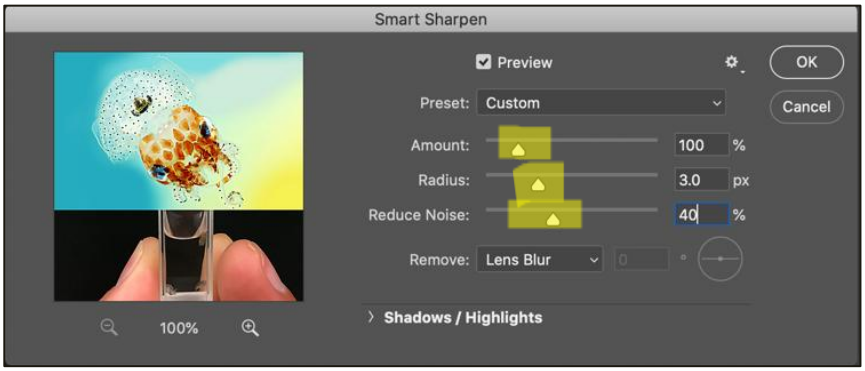
Curves Image > Adjustments > Curves

Drag the profile of the curve to match the profile shown in the image to the right.



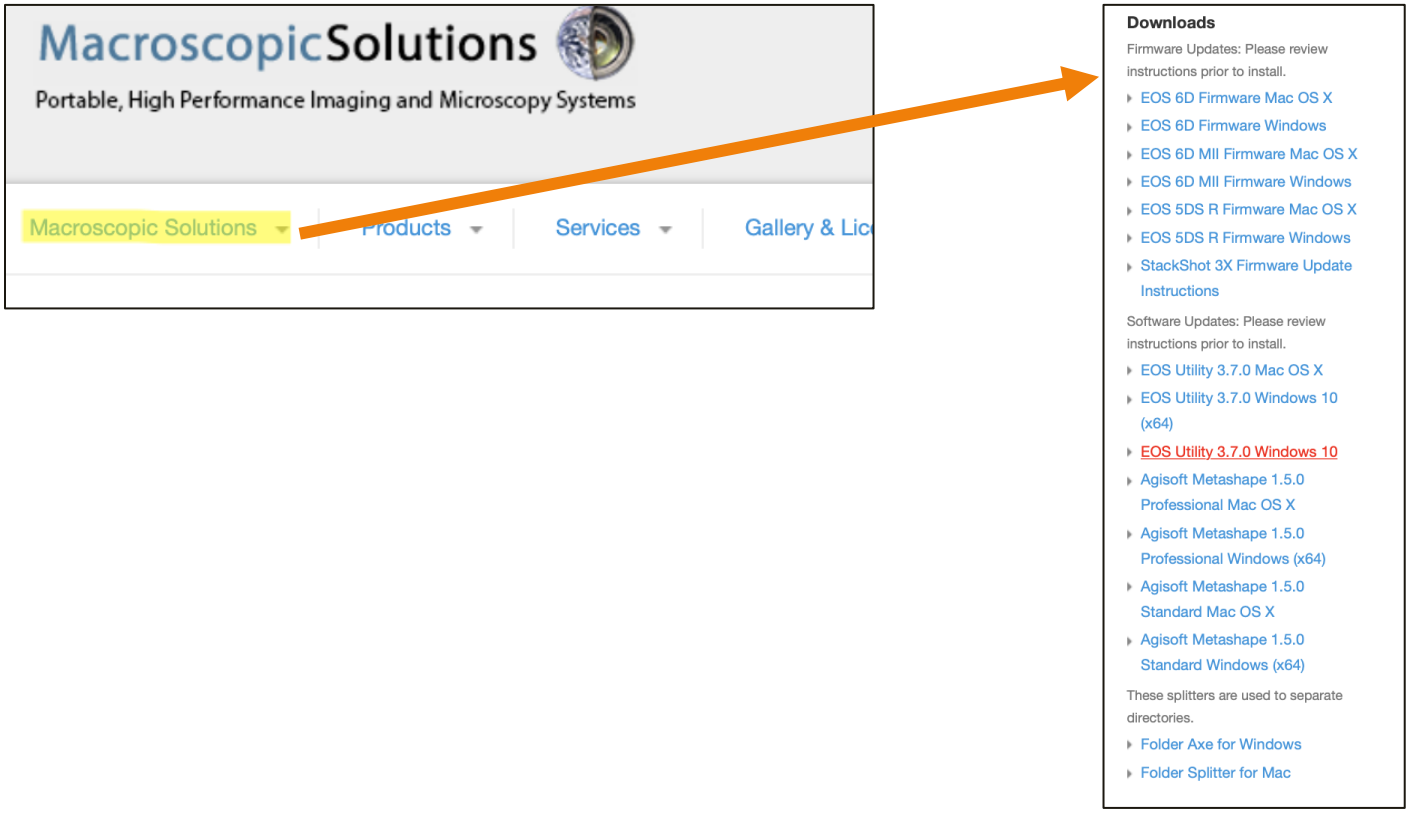
Sharpening Filter > Sharpen > Smart Sharpen

Make sure you're removing "Lens Blur"
Amount: 100%
Radius: 3.0 px
Reduce Noise: 40%



Keeping your Hardware up to Date

Firmware and software updates can be downloaded and installed from the “Macroscopic Solutions” tab on www.macroscopicsolutions.com.



Camera Maintenance

Camera

Dust

It is very important to remove the lens caps when the camera and lens are not far apart. When changing lenses, always slowly add the dust caps and remove when the camera and lens are within centimeters. If the dust cap is removed and the camera is moved over a great distance, it will collect dust. This dust will cause problems for the final output images.

General Rules:

1) If you're not experienced, never attempt to clean the camera sensor yourself. It is a very meticulous and time-consuming process. Macroscopic Solutions has offered to clean camera bodies for no cost. Contact mark@macroscopicsolutions.com when the camera needs to be cleaned.
2) Never take your camera to be cleaned at a camera cleaning center. They do not understand the problems related to focus stacking and while they are effective at cleaning larger dust particles, they ignore and usually add to the problem for smaller, more problematic particles.
3) If you have experience, Macroscopic Solutions recommends that sensors be cleaned with the EyeLead Gel Stick.

Err 20, 30 and 40

DSLR camera bodies are prone to shutter failures. They are rated for 100,000 images; however, the StackShot is calibrated to a shutter frequency that prolongs the life of the camera body to be rated for around 3,000,000 images.

If a shutter failure occurs, contact Macroscopic Solutions. They will consider the economics of replacing the camera body over fixing the failed shutter. If a fix is the appropriate course of action, Macroscopic Solutions will loan a replacement camera body for no charge to prevent down time. Send the failed camera body to Macroscopic Solutions to complete the repair. Shutter replacements generally cost between $350-$600 per replacement. Replacements include a 6 month warranty.

Lenses

Dust

Lenses are easier to clean. Dust often accumulates on the back of the lens. Macroscopic Solutions recommends using the EyeLead gel stick to gently remove dust particles from the glass.

The same rules apply with dust caps. Always keep dust caps in place until they are ready for use.

Objectives

Oil

It is very important to apply mineral oil or a similar lubricant to the threads of the Mitutoyo objectives and the 77mm objective adapter. The threads will begin to shave metal over time, which gets onto the optics and causes a problem with dust. This problem is entirely preventable as long as the threads are sufficiently lubricated.

Macroscopic Solutions also recommends applying oil and lubricant onto the plastic threads of the protective cases.

Be careful not to get oil on the glass of the objectives!!

Shock

NEVER DROP THE OPTICS > ALL OPTICS HAVE PRECISION SEATED FITTINGS. SHOCK WILL CAUSE THESE FITTINGS TO BUST LOOSE RESULTING IN A SIGNIFICANT LOSS IN CLARITY AND PEERFORMANCE. ALWAYS HANDLE OPTICS WITH TWO HANDS.