

Metashape workflow

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A) Estimating the camera positions using the pose sphere. This has **only** to be done after you've changed the setup /lens/magnification (but **every** time after a change). It enhances the speed of modelling the in sects measured under the corresponding setup.

1. Scan the corresponding sphere (one that well fits the FOV).
2. When the scan is done, open Metashape.
3. *Workflow -> Add folder*: select folder containing the edof images of the pose sphere as *Single cameras*.
4. Copy the value under *Camera constant/f [px]* from the ScanInformation.pdf in the scan folder of the pose sphere.
5. *Tools -> Camera calibration*: Switch type from *Auto* to *Precalibrated* and replace the f-value.
6. Next to *Fixed parameters -> Select "..."*: check everything except f. *Ok*.
7. *File -> Import -> Import reference*: Select CamPos.txt from the scan folder and set *Coordinate system* to *Local Coordinates (mm)*. (On first import only, you need to set the *Delimiter* to *Space* and check that under Columns Label is set to 1, X to 2, Y to 3 and Z to 4. Uncheck both *Accuracy* fields as well as *Rotation*.) *Ok*.
8. *Workflow -> Align Photos*: Use the following settings:
 - a. *Accuracy: Highest*
 - b. *Generic preselection: yes*
 - c. *Reference Preselection: yes, Source*
 - d. *Advanced*:
 - i. *Key Point limit: 250,000*
 - ii. *Tie Point limit: 250,000*
 - iii. *Exclude stationary points: yes*
 - iv. *Guided image matching: no*
 - v. *Adaptive camera model fitting: no*
9. If you don't see the cameras (blue balls), click on the camera icon to see the cameras. Check if there are any cameras that are obviously wrong regarding their position (should not be the case using the sphere).
10. *Tools -> Optimize cameras*: Check f ONLY, uncheck all other boxes. *Ok*.

11. Use the measuring tool to check the diameter of the tie points of the pose sphere. If it fits (8 and 15 mm, respectively), continue. Else check the f- value und *Tools -> Camera calibration* (compare the f-value in the *Initial* and *Adjusted* tabs).
12. *File -> Export -> Export cameras*; save the xml-file and name it "Calibrated_Cameras_CONFIGURATION_DATE.xml" (for example Calibrated_Cameras_XL_20221026.xml). Copy this file in ALL folders of insects that have been scanned with this setup.

A1) Modelling an insect with a preexisting Calibrated_Cameras_CONFIGURATION_DATE.xml.
Don't forget to save your work after every step!

13. Open Metashape.
14. *Workflow -> Add folder*: select folder containing the edof images of the specimen as *Single cameras*.
15. *File -> Import cameras*: Chose the file you generated in A and use the following settings (if applicable):
 - a. Accuracy: *Highest*
 - b. Generic preselection: *yes*
 - c. Reference Preselection: *yes*
 - d. Key Point limit: *250,000*
 - e. Tie Point limit: *250,000*
 - f. Exclude stationary points: *yes*
 - g. Guided image matching: *no*
16. *Tools -> Optimize cameras*: check *f* only. *Ok*.
17. Resize and rotate the region box so that (only) the specimen lies within the box. The end of the needle can lie outside.
18. Duplicate the chunk (*right-click* on the chunk in the workspace and select *Duplicate*).
19. To eliminate outliers, we now optimize the tie points:
 - a. *Model -> Gradual selection: Criterion -> Reprojection error*: set value (select a value that selects around 10% of points). *Ok*.
 - b. Delete the selected points (press Entf/Del on your keyboard).
20. Repeat:
 - a. *Model -> Gradual selection: Criterion -> Projection accuracy* (select a value that selects around 10% of the original points)
 - b. Delete the selected points (press Entf/Del on your keyboard).

21. *Workflow -> Build model -> Use the following parameters:*
- a. Source: *Depth maps*
 - b. Surface type: *Arbitrary 3D*
 - c. Quality: *Ultra High*
 - d. Face count: *High*
 - e. *Advanced:*
 - i. Interpolation: *Enabled (default)*
 - ii. Depth filtering: *Mild*
 - iii. Calculate vertex colors: *Yes*
22. To remove unneeded insular meshes:
- a. *Model -> Gradual Selection: Criterion*
 - b. *Connected component size: set to 99. Ok.*
 - c. Delete the selected small objects.
23. Use the free-form-selection tool to select the needle as good as possible and remove.
24. To fill the holes in the model:
- a. *Tools -> Mesh -> Close holes*
 - b. Set to 100%. *Ok.*
25. *Workflow -> Build Texture: use the following parameters:*
- a. Texture type: *Diffuse Map*
 - b. Source data: *Images*
 - c. Mapping mode: *Generic*
 - d. Blending mode: *Mosaic (default)*
 - e. Texture size: *4096*
 - f. *Page count: 1*
 - g. *Advanced:*
 - i. Enable hole filling: *yes*
 - ii. Enable ghosting filter: *yes*
26. *File -> Export -> Export Model: Choose the directory of the dataset, enter name of the dataset, and choose Wavefront Object -> save. Use the following parameters:*
- a. Coordinate system: *Local coordinates (mm)*
 - b. Vertex colors: *yes*
 - c. Vertex normal: *yes*
 - d. Export texture: *yes, png*
 - e. Include comment: *no*
 - f. Use UDIM texture layout: *no*
 - g. Save alpha channel: *yes*
27. *File -> Export -> Cameras: Choose the directory of the dataset, enter name of the dataset ("DATASET_Calibrated_Cameras_CONFIGURATION_DATE.xml") and save.*

B) Modelling an insect if NO preexisting Calibrated_Cameras_CONFIGURATION_DATE.xml file is available. Don't forget to save your work after every step!

1. Open Metashape.
2. *Workflow -> Add folder*: select folder containing the edof images of the pose sphere as *Single cameras*.
3. Copy the value under *Camera constant/f [px]* from the ScanInformation.pdf in the scan folder of the pose sphere.
4. *Tools -> Camera calibration*: Switch type from *Auto* to *Precalibrated* and replace the *f*-value.
5. Next to *Fixed parameters -> Select "..."*: check everything except *f*. *Ok*.
6. *File -> Import -> Import reference*: Select CamPos.txt from the scan folder and set *Coordinate system* to *Local Coordinates (mm)*. (On first import only, you need to set the *Delimiter* to *Space* and check that under Columns Label is set to 1, X to 2, Y to 3 and Z to 4. Uncheck both *Accuracy* fields as well as *Rotation*.) *Ok*.
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 - d. *Advanced*:
 - i. *Key Point limit: 250,000*
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 - iii. *Exclude stationary points: yes*
 - iv. *Guided image matching: no*
 - v. *Adaptive camera model fitting: no*
8. If you don't see the cameras (blue balls), click on the camera icon to see the cameras. Check if there are any cameras that are obviously wrong regarding their position (should not be the case using the sphere).
9. *Tools -> Optimize cameras*: Check *f* ONLY, uncheck all other boxes. *Ok*.
10. The resulting point cloud might look a bit "blown up" still, this is a matter of "*f*".
11. *Tools -> Optimize cameras*: check *f* only. *Ok*.
12. Resize and rotate the region box so that (only) the specimen lies within the box. The end of the needle can lie outside.
13. Duplicate the chunk (*right-click* on the chunk in the workspace and select *Duplicate*).
14. To eliminate outliers, we now optimize the tie points:
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 - a. Coordinate system: *Local coordinates (mm)*
 - b. Vertex colors: *yes*
 - c. Vertex normal: *yes*
 - d. Export texture: *yes, png*
 - e. Include comment: *no*
 - f. Use UDIM texture layout: *no*
 - g. Save alpha channel: *yes*
22. *File -> Export -> Cameras: Choose the directory of the dataset, enter name of the dataset ("DATASET_Calibrated_Cameras_CONFIGURATION_DATE.xml") and save.*