

Metashape (Agisoft), End-to-End

(This is an adaptation by Niels Bargfeldt and Tom Brughmans of a tutorial originally created by: Porter, Samantha T., McFadden, Colin (2018). Capturing 3D Objects with the Camera You've Already Got. Workshop presented at MinneWebCon, Minneapolis, MN, USA.

This document will walk you through the steps for creating a high quality, full (top and bottom) 3D model using photogrammetry in AgiSoft Metashape. This only scratches the surface of what is possible within Metashape.

For more information, we recommend the Metashape manual, the Metashape forums (<http://www.agisoft.com/forum/index.php>) or YouTube.

This tutorial is appropriate for reasonable data sets (<500 images) on a reasonably fast machine. Different approaches will be necessary for very large data sets (or very slow computers).

In Depth Guide

Note: The following workflow is meant to balance model quality and computation time and will not be optimal for all data sets.

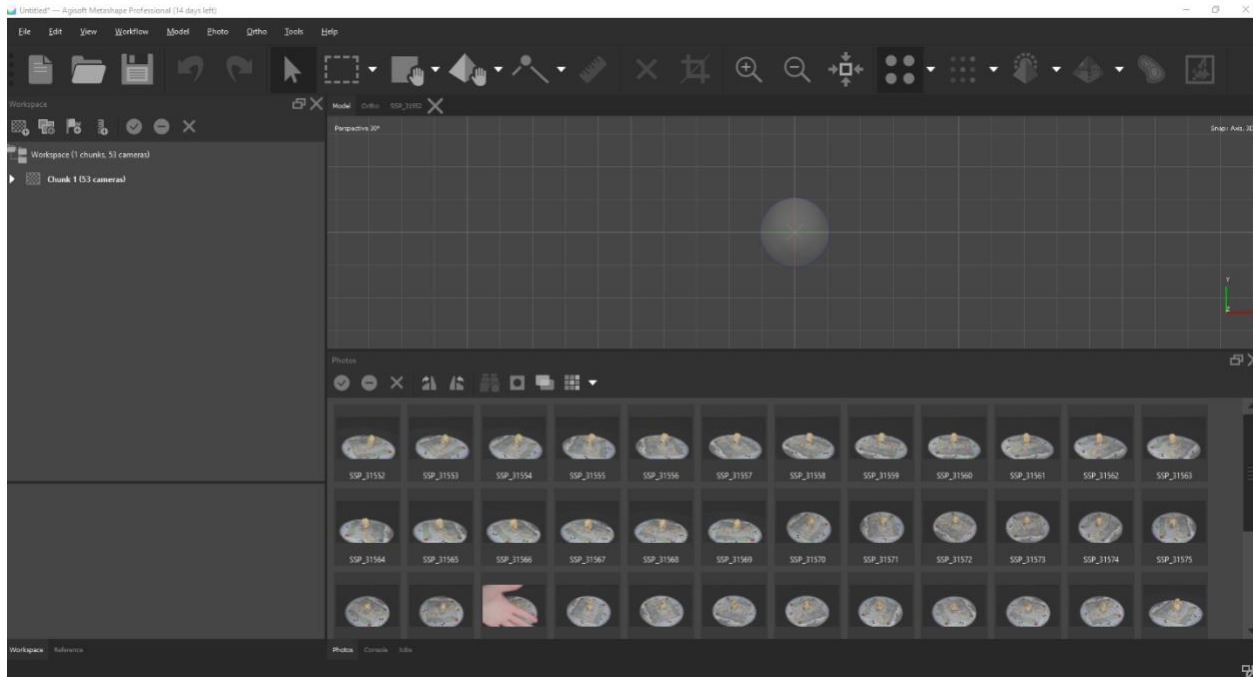
Import Photos

Metashape accepts files in the JPEG, PNG and TIFF formats (along with some less commonly used types). If you've shot RAW, process those files with a tool like Lightroom or Photoshop to ensure that the maximum amount of highlight and shadow detail is preserved then export to TIFF.

If your images contain **significant problems**, like people walking through the background, you may wish to edit these files before import. Replace problem sections with pure white in an image editor.

To add images, click [Workflow > Add Photos](#). Select the photos you would like to add, and click [Open](#).

If you're working with an object and have captured it in multiple sets (top and bottom), work with a single set at a time. The only exception is if you've shot with a pure white or black background and don't have any extraneous data. In this case, our photo set does contain extra data in the form of a scale / fiducial and putty used to hold the object upright.

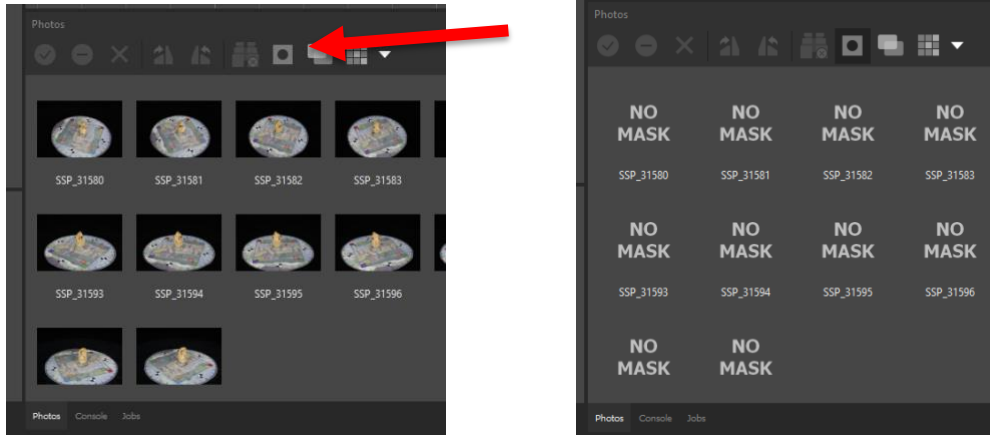


Mask your Photos (Maybe)

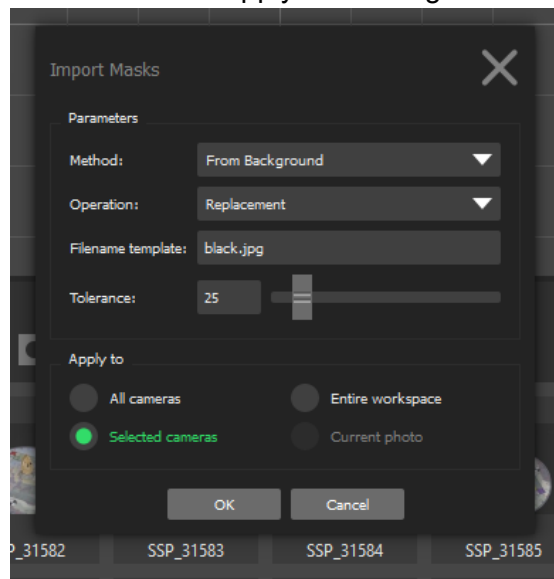
If you've captured an object, and it was shot on a solid background (black, white, etc), now would be a good time to mask out the solid color background. The software will subsequently ignore these masked pixels. This both saves computation time, and gives you a cleaner point cloud.

Metashape is able to create image masks from a reference image. Our background is black, so we want a black reference image. This background image must have the same pixel dimensions as the images in your data set. It can be created by opening one of your photos in an image editing program (e.g. PhotoShop, GIMP, or paint), selecting all pixels, and filling them in with the appropriate color. Save this as a new file. In this case, we've already created this image ("black.jpg") for you.

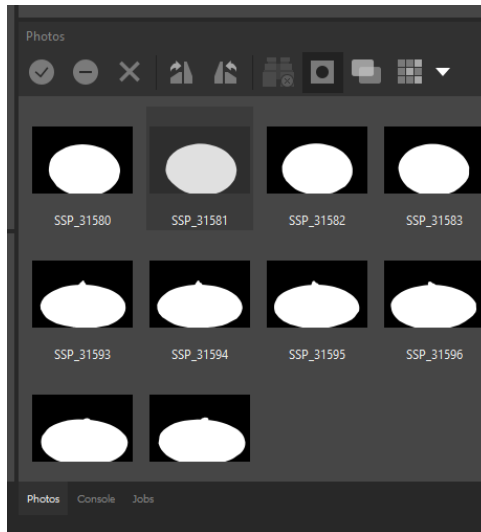
You can see previews of your image masks by clicking the following icon in the Photos pane:





Select all your photos, right click, and select [Masks > Import Masks](#) OR click [File > Import > Import Masks](#). Use the settings as listed in the image below. “From Background” means we will import masks from a reference ‘background’ image. “Replacement” means we will be overriding any existing masks with this function. The tolerance sets how far from the reference image pixels need to be to be included in the image mask. You may need to experiment with this value. Since all of our images are currently grouped together, assuming all your images are selected, there will be no difference in the “Apply To” settings. Press OK.



Navigate to the folder containing your reference image and click “Open.” Note that if you’re using Windows, it may not show that your reference image is actually there (but it probably is). Once you’ve clicked “Open” If you’ve turned on mask previews, your masks should start appearing in the Photos pane. If it looks like your masks are not following the contours of your object, feel free to cancel the operation and try again with a different tolerance setting.



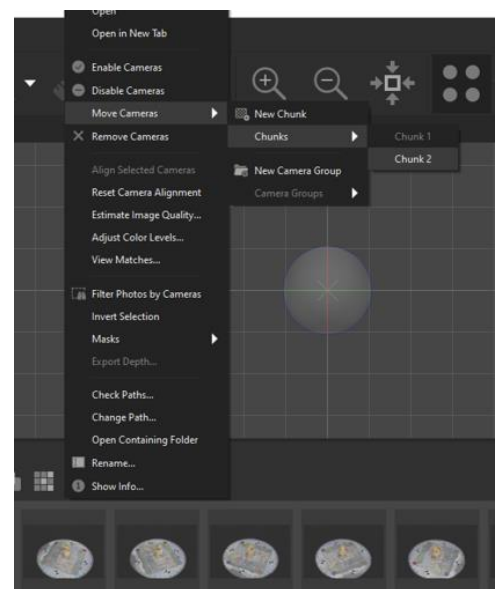
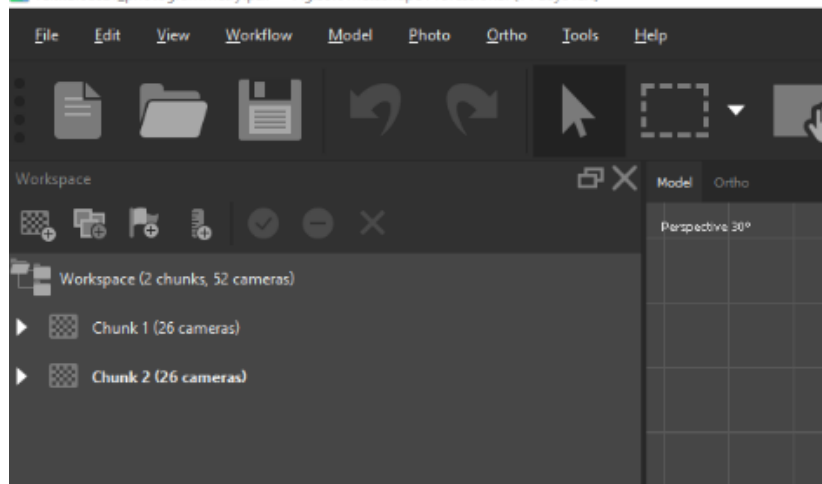
Working with Chunks

Metashape processes projects in different groups or “chunks.” We want our project to contain chunks that correspond to the way in which our object was photographed: one chunk with the object right side up, and one chunk with the object upside down. This transition is marked in our data set by a blurry picture of a hand. Click the  icon to turn off mask view. Find the image of the hand, and  select all following images. Right click, and select [Move Cameras > New Chunk](#).

Chunks are visible in Workspace pane on the left side of your screen. To switch between different chunks, double click on a chunk. Similarly, to select different views within a chunk, click the disclosure triangle and then double click the view you want. Whatever is **bold** in the sidebar is the active view.

You can now delete the image of the hand by right clicking on its thumbnail in the Photos pane, and clicking [Remove Cameras](#).

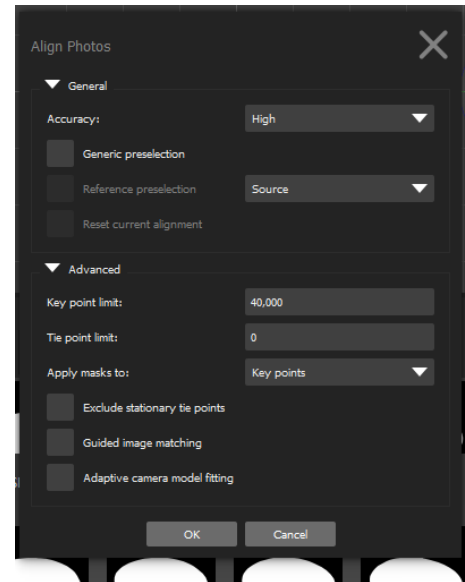
[feltkursus21_photogrammetry.psx](#) — Agisoft Metashape Professional (14 days left)



Align Photos

We'll work with one chunk at a time for now. Select Chunk 1. The first step is to roughly align your photos. This will tell us whether the photos are likely to work well for photogrammetry.

Click [Workflow > Align Photos](#). Photo alignment sets the stage for the rest of your processing, so it's important not to set your processing quality too low in order to save time. For this project, we suggest the settings shown to the right. It takes a bit longer, but setting the Accuracy to Highest could help for this dataset.



Here's what these settings actually mean:

Accuracy: When set to high, the software will look at all pixel in the image individually. When set to Medium, the software will downscale the image by a factor of 4 before performing the operation. Setting this to Low will downscale the image further 4 times. Using Medium or Low settings can save a lot of time, but can also produce not so great results. Usually, it's best to leave this on High.

Generic preselection: Should the software make guesses about what images will match? Activating this box can save time, but sometimes results in suboptimal alignment.

Key point limit: The total number of reference points the software will look for.

Tie point limit: The number of reference points the software will look for between images. Setting this to 0 tells the program not to use a limit.

Apply masks to: When should the software ignore data in masked areas? By applying masks to key points, we are telling the software to ignore these areas completely.

Adaptive camera model fitting: This one's complicated. Agisoft says it, "enables automatic selection of camera parameters to be included into adjustment based on their reliability estimates. For data sets with strong geometry it helps to adjust more parameters during initial camera alignment. For data sets with weak camera geometry it helps to prevent divergence of some parameters." It's mostly magic. Sometimes we find it actually produces worse results, so in this case we're not going to use it.

When you're ready, click OK. Depending on your computer and the number of photos in your set, this process make take anywhere from a few seconds to a few minutes.

Do a quick spot-check. If the “Show Cameras” button isn’t already enabled, toggle it in the status bar (red arrow above). Do the cameras more or less look like they’re clustered how you’d expect? Sometimes, one or two images may look out of place (blue arrows above). Before proceeding, right click on these images in the Photos pane and click Disable.

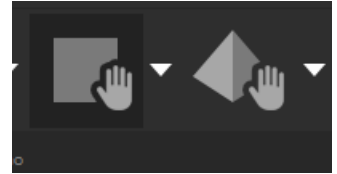
You should begin to see a very low quality representation of your object. Repeat this step for your second chunk.

If things look crazy - if your cameras don’t appear, or the point cloud is just a random set of points, repeat with a higher key point limit. You will need to check the box next to “Reset current alignment.” If it still fails, you may have issues with your captured photos.

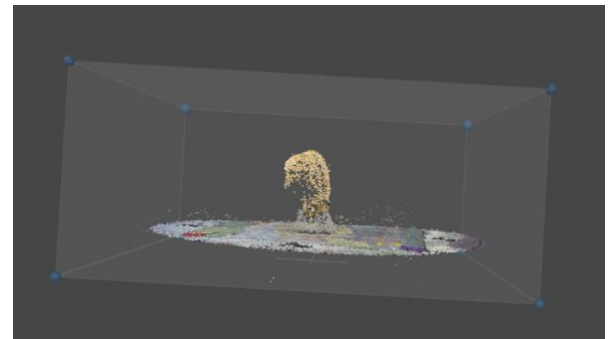
Build a Dense Cloud

Note from 2020: The software has been updated since this document was originally written. As an alternative to this process, instead of building a dense cloud you can create a mesh directly (workflow > build mesh, and then use the *Depth Maps* method). This method can be used in place of anywhere a Dense Cloud is required.

A dense cloud will begin to fill in your object. First, we need to adjust our bounding box. This tells Metashape which parts of your scene are important. The two controls shown on the right are useful for adjusting your bounding box. The first adjusts the size of the box, and the second adjusts the rotation of the box.

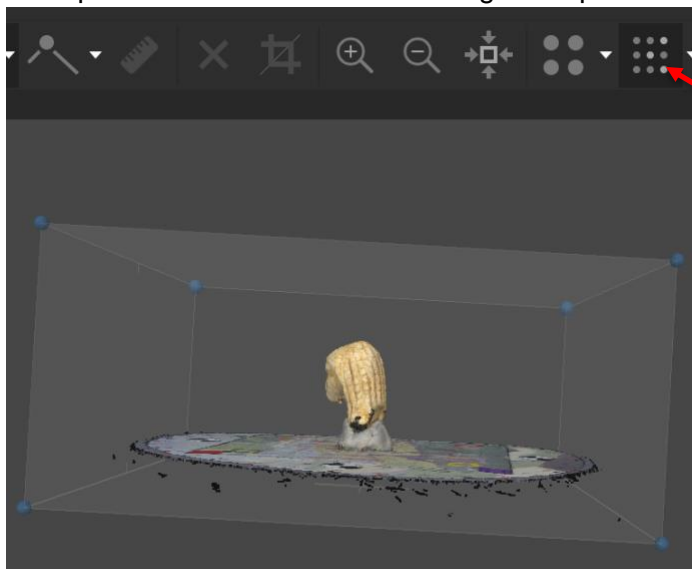


Use these to make sure your object fits within the bounding box, keeping the box as small as possible (this will make your processing faster). When you're done, click back to the cursor (arrow) button.



Now build your dense cloud. Click [Workflow > Build Dense Cloud](#). Let's set the quality to Medium. Click OK. This process should go relatively quickly.

When the process is finished, click on the Dense Cloud icon in the toolbar. It looks like a bunch of colored squares. You should see a recognizable version of your object! Don't worry too much about holes under the subject's chink. Downward facing areas are hard to reconstruct. These will be captured in the second set of images. Repeat this step for your second chunk.



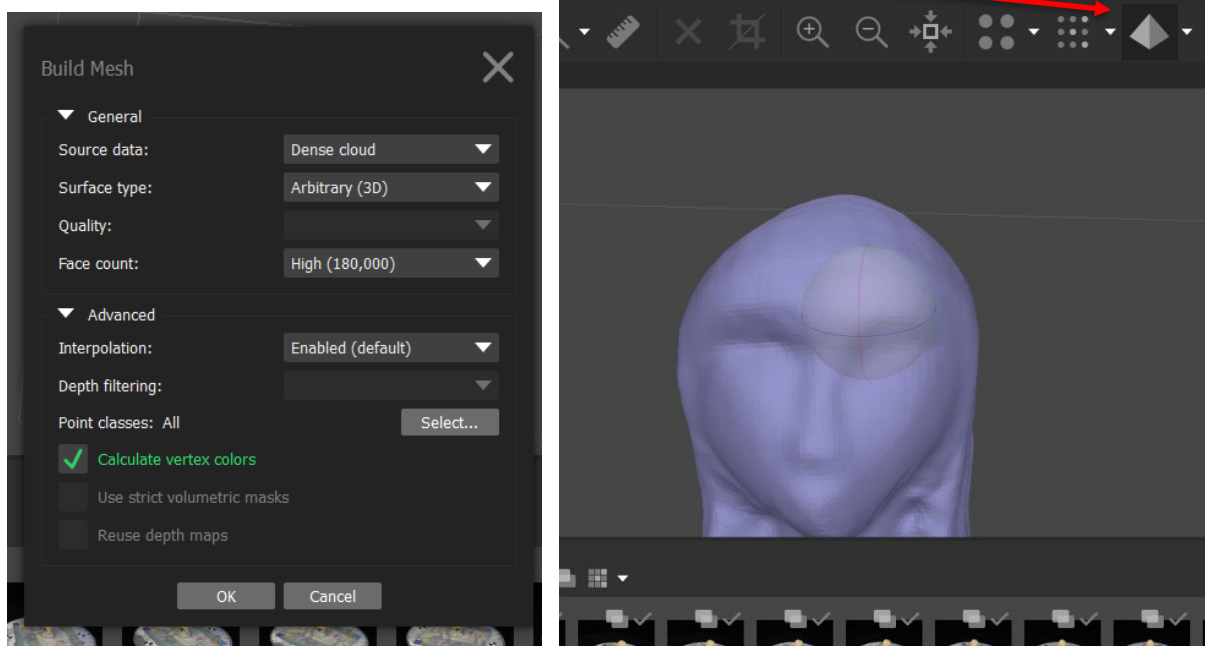
Point Cleaning

Now it's time to clean our object to remove any bad data. This is a lot like working in any image editor. Use the selection tools to delete bad data, and then click the "X" in the toolbar to delete it. You can also hit delete on your keyboard (fn+delete on a Mac). To deselect points, hold down the Shift key. Remove any parts of the scene that you don't want in your final object - floors, backgrounds, etc. You don't need to obsess over every last point at this stage. For the data set we've given you, this may not be necessary thanks to our masks! Do this for both chunks.

Create a Mesh

Click [Workflow > Build Mesh](#). Use the settings as shown below.

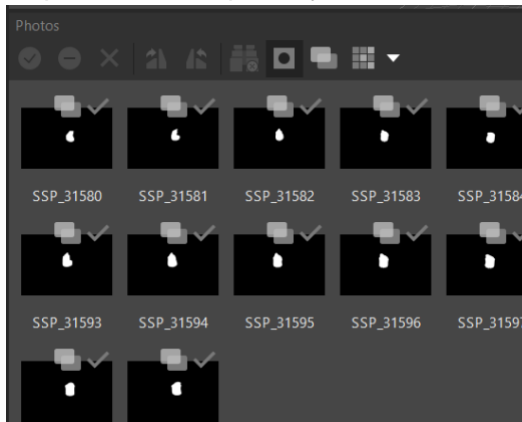
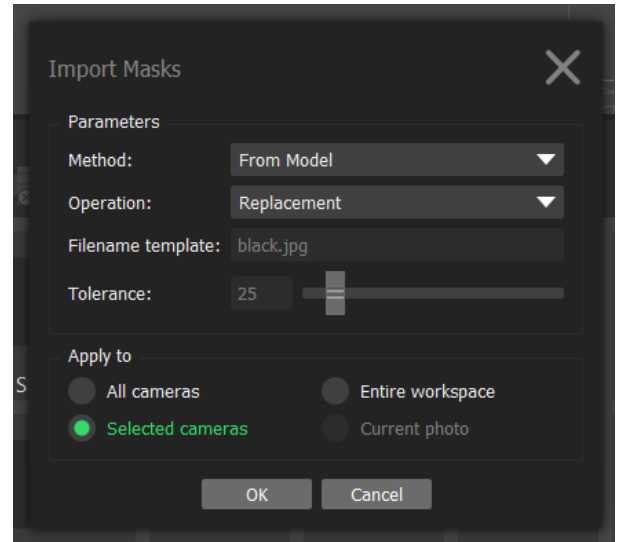
When the process finishes, click the Mesh icon in the toolbar to see how things look. Do this for both chunks.



Mask your Images (Again)

We're going to use our new model to mask our images. First use the selection tools to select any polygons that correspond to your turntable, scale / fiducial, and any supporting material (e.g. putty). Delete by pressing the X button on the toolbar or by hitting delete on your keyboard (fn+delete on a Mac).

Select all of your images (Command-A on the Mac, Control-A on Windows) and then right click and select "Import Masks". The method should be "from model". Click OK. When this finishes, double click some of your images to spot-check. They should have masks outlining your object. This will tell Metashape to ignore the background for all of your future operations. Repeat these steps for your second chunk.



Re-Align your Photos (maybe)

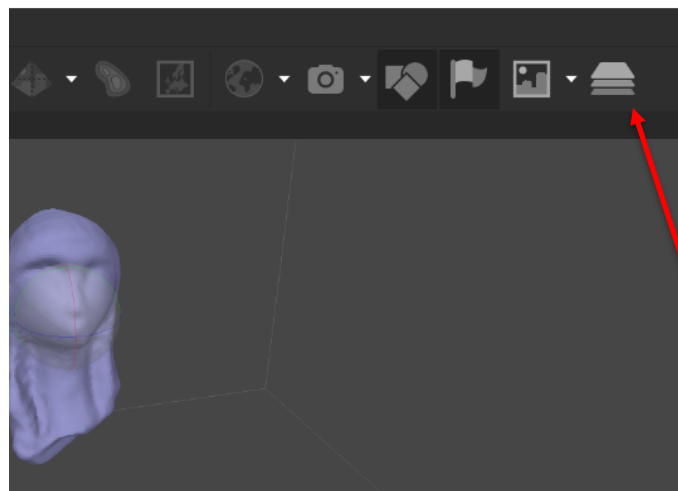
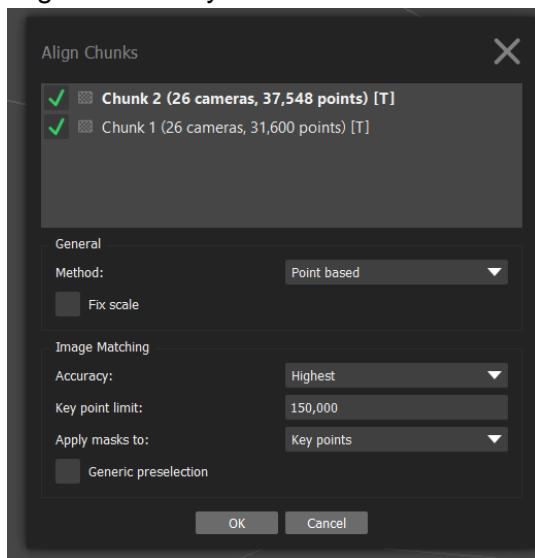
If your images have movement in the background, or other "noise", you may want to realign your images now that they're masked. This time, Metashape will only be looking at your object, which can result in a better alignment. Select "Align Photos" from the Workflow menu. This time, set the Accuracy to "High" and in the advanced menu, be sure to check the "constrain features by mask" option. You likely won't need to do this with the provided object data set.

Align your Chunks

Now that we've got two chunks with aligned photos. We need to align the two chunks with each other. Click [Workflow > Align Chunks](#). Make sure "point based" is selected. Set the accuracy to "highest". **Change Apply masks to: Key points.**

After it finishes, you can use the alignment button to preview the alignment. If it looks reasonable, move on to the next step. If it doesn't, you may need to manually align the chunks.

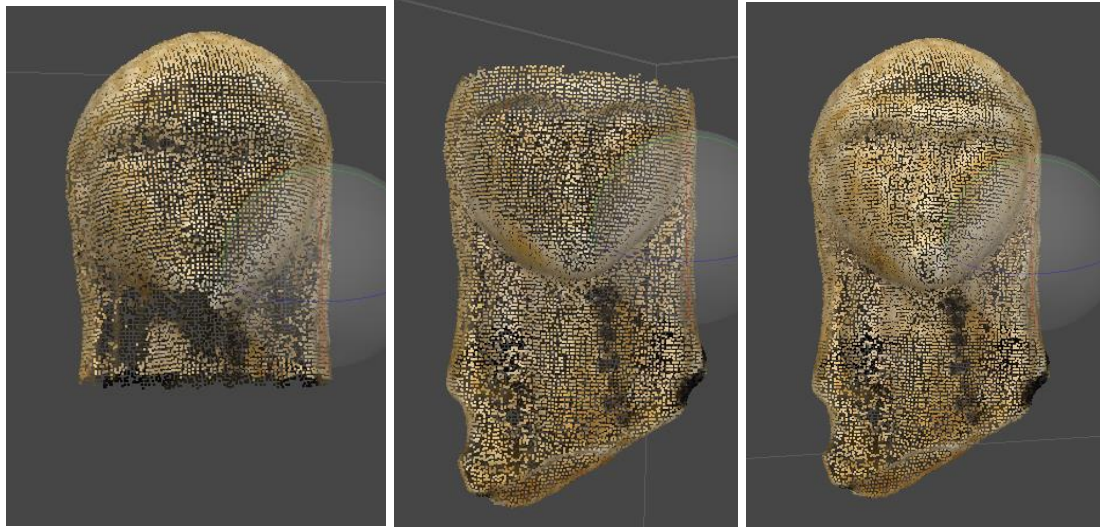
Click the alignment preview button in the toolbar. Check to make sure everything has been aligned correctly



Once you verify that the chunk alignment is correct, be sure to turn the alignment preview off. otherwise you'll get really confused in the next step.

Point Cleaning (Part 2)

Next, we need to delete any extraneous points from the dense point clouds. Use the selection tools to select any points corresponding to the scale / fiducial and supporting material. Generally, it's better to take a little too much data than be conservative and leave extra data in. Make sure you do this for both chunks. Click the alignment preview again to see how things are looking.



chunk 1

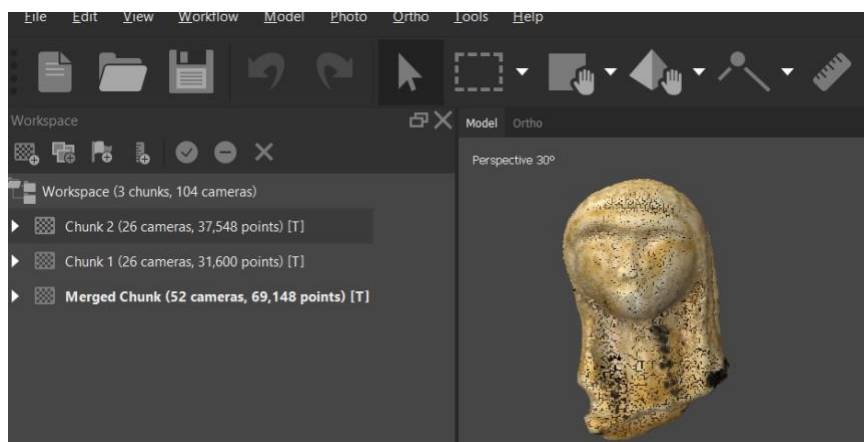
chunk 2

aligned chunks

Merge your Chunks

Now let's bring it all together! Click [Workflow > Merge chunks](#). Select the chunks you want to merge, and click on the box next to "Merge Dense Clouds." Click OK.

This will create a new chunk, called "Merged Chunks" in your workspace. Double click **Merged Chunk** in your workspace pane. Toggle the alignment preview off again to see the data from just this chunk.



Build another Dense Cloud (optional)

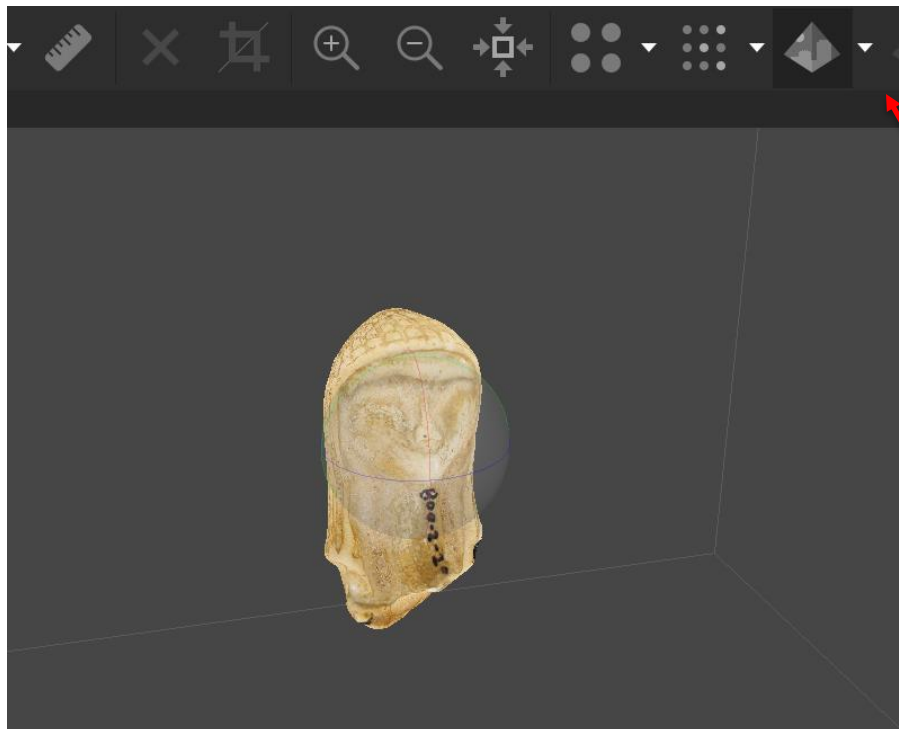
At this point, all of your images are aligned with each other, and you have the beginnings of a full object. We just need to finish it off. Repeat the “Build Dense Cloud” step, but this time select “High” quality. It may be best to skip this for the workshop, since this step can take a long time.

Build a model

Now repeat the “Create a Mesh” stage by clicking [Workflow > Build Mesh](#), again selecting “high” for face count. You can check out your mesh by clicking on the purple pyramid icon.

Build your Texture

Click [Workflow > Build Texture](#). Make sure “Mapping Mode” is “Generic”, and “Blending Mode” is “Mosaic”. (You can play with different blending modes to see which delivers the best quality for your object). Set texture size to 4096x1 to start. If you need a higher quality texture, set it to 4096x2 *etc.* You can check out your texture by clicking the icon of a pyramid with a sun and tree on it in the toolbar.



You're Done!

You can export via the File menu for upload to Sketchfab, or import into a tool like Blender.

Extra!

A Note on Scale

Unfortunately, meshes cannot be scaled in the Standard Edition of Metashape. If accurate object scale is important to your project, you will want to leave a section of scale bar in your final mesh. In other words, keep some of your scale in your bounding box before you build a dense cloud, and don't get rid of these points during masking / cleaning. You can then use a program like Meshlab (which is free) to scale your model.

Automation

Most of the tasks in Metashape can be automated. In fact, you could automate almost every step in the above instructions, except for the manual cleanup. Take a look at the batch settings under the workflow menu. To get started, try this: create both of your chunks, then create a batch that aligns them and densifies them. Then do your cleanup, and create another batch that creates the models, imports the masks from models, realigns them, aligns the chunks, and merges the chunks.