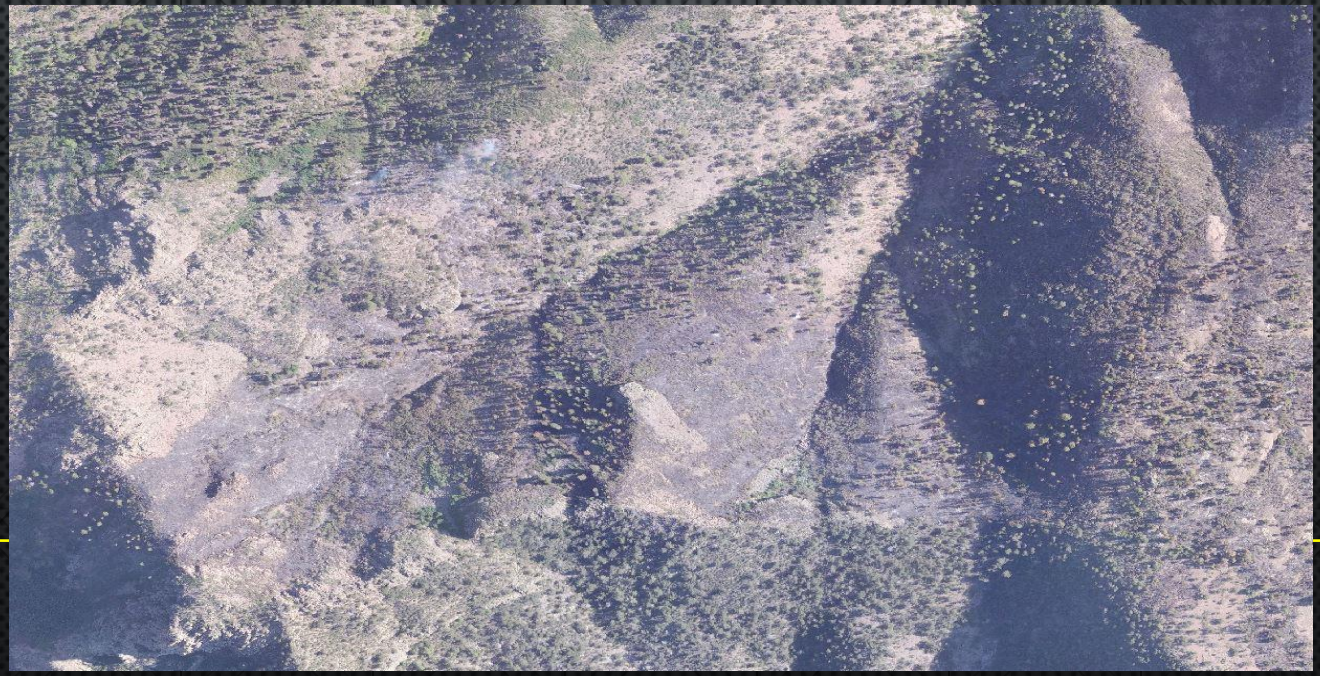
BASICS OF PROCESSING FIRE IMAGERY



OBJECTIVES

- Demonstrate the workflow for processing photos and deriving data products using photogrammetry
- Converting TIFF files to JPG for viewing
- Sorting Photos
- Be able to set up Photoscan
- Load Photos
- Run Processes to create basic products

PURPOSE

- This Presentation is to provide the user with a very basic step by step
- The spatial accuracy of map products will be only as good as the aircraft GPS provides

CONSIDERATIONS

How were the photos collected?

- What were the time intervals?
- What altitude above the highest point?

What format if thermal images were collected? (TIFF preferred)

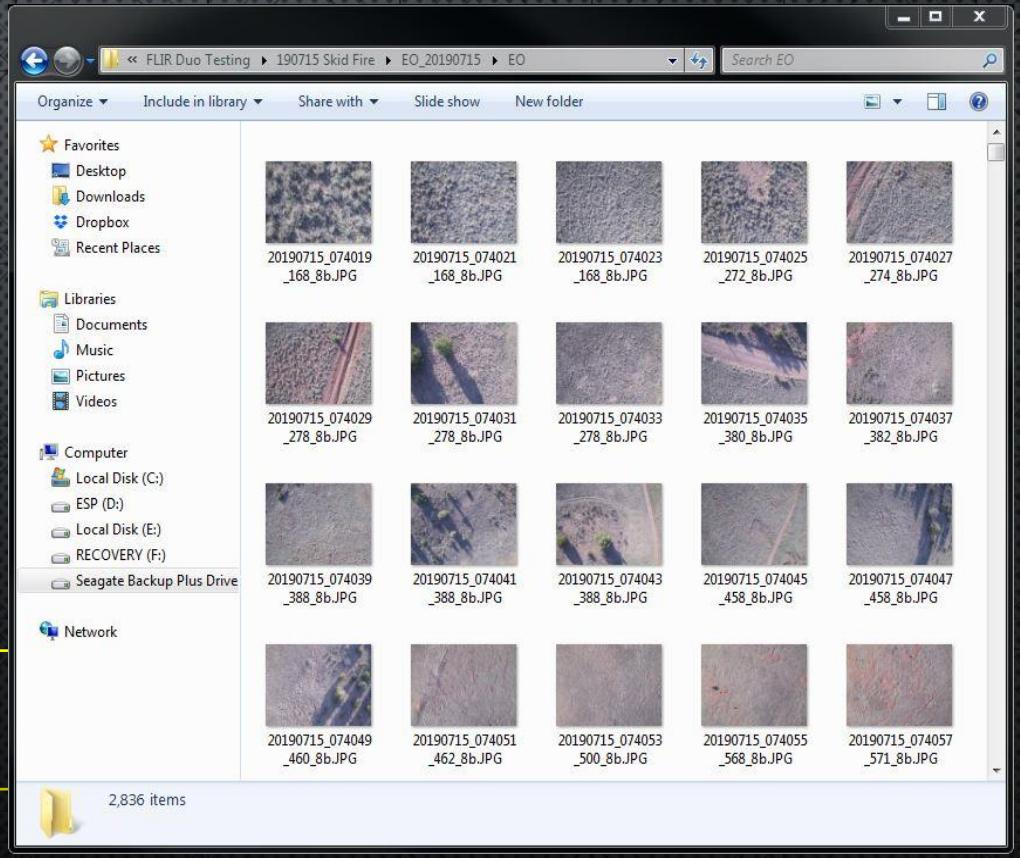
Which camera profile was used to collect? (Flight must use narrowest camera needed)

CONSIDERATIONS USED IN THIS PRESENTATION

- This presentation uses the Skid Fire as an example
- Flight was 2500’ above the highest point in terrain
- Flown with the Silent Falcon and FLIR Duo camera

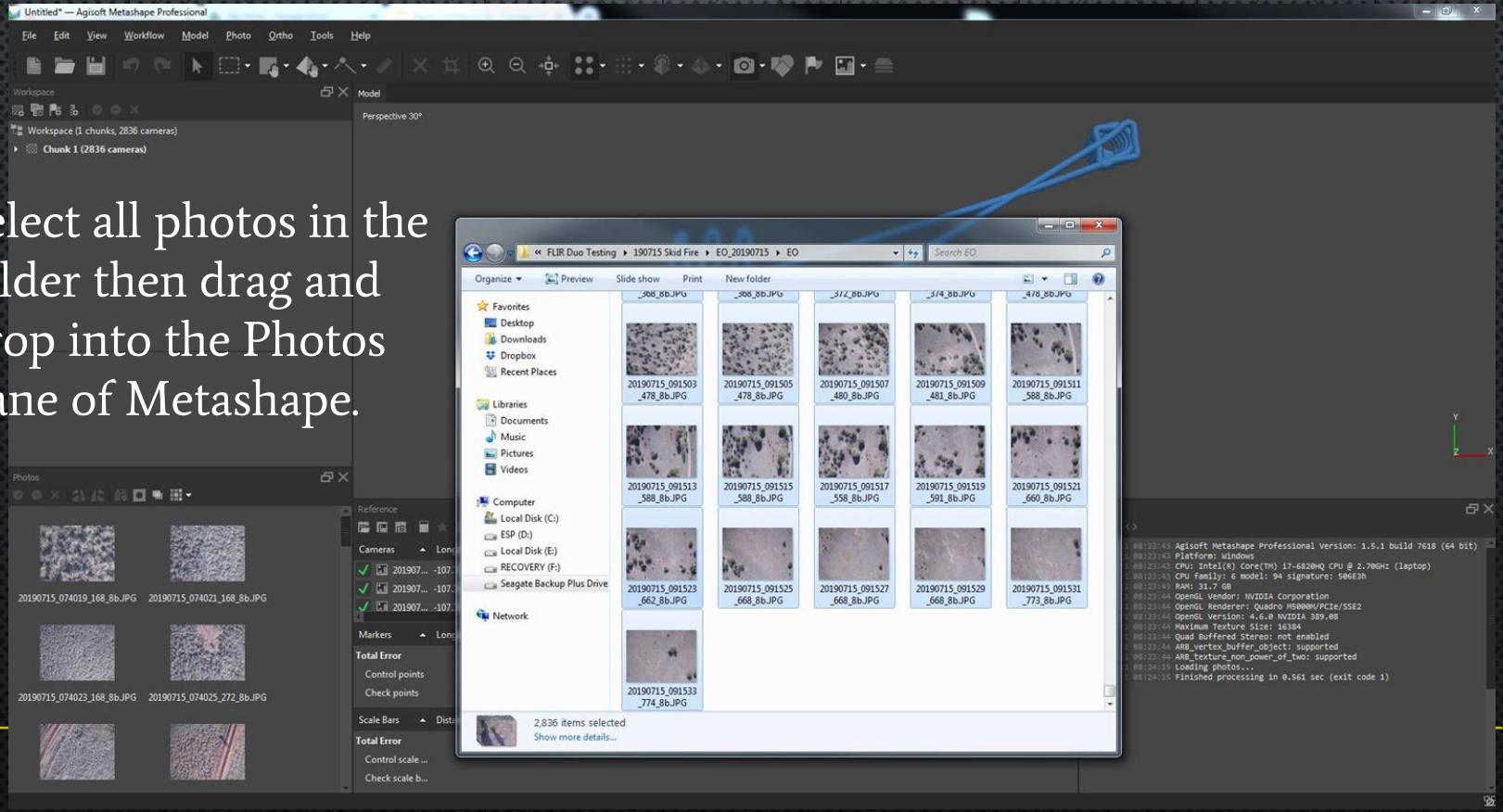
VIEW PHOTOS

Photos are in the folder to view and begin sorting. Note this folder has 2836 images. Images are geotagged and data is in the Exif. Make a copy of this folder to work from.



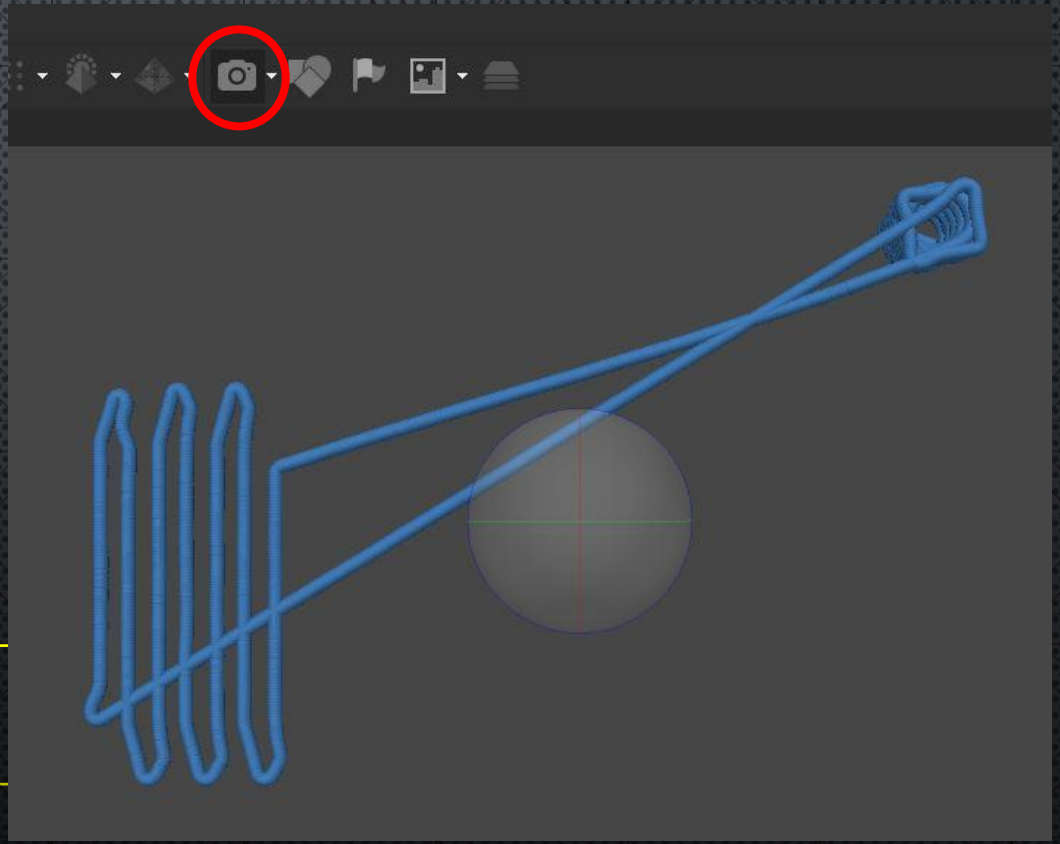
SORTING PHOTOS

Select all photos in the folder then drag and drop into the Photos Pane of Metashape.



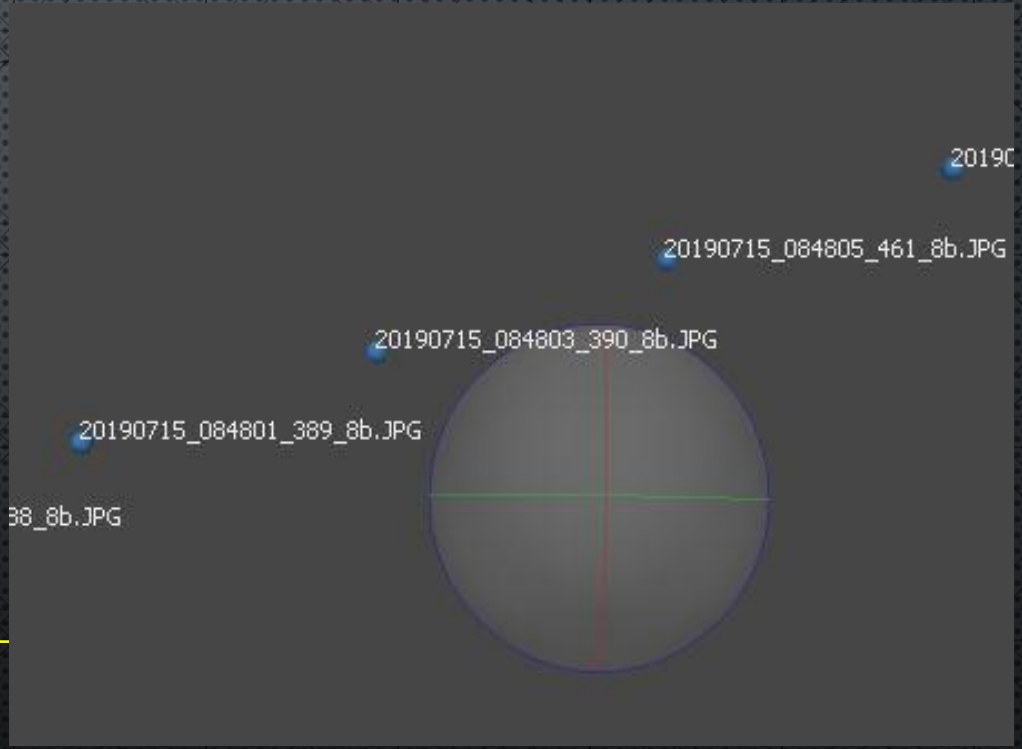
SORTING PHOTOS

In the model pane if the Camera is highlighted each image will appear as a blue dot. Note a large number of photos are not in the fire area, they were taken during the climb, descent, approach and departure from the fire.



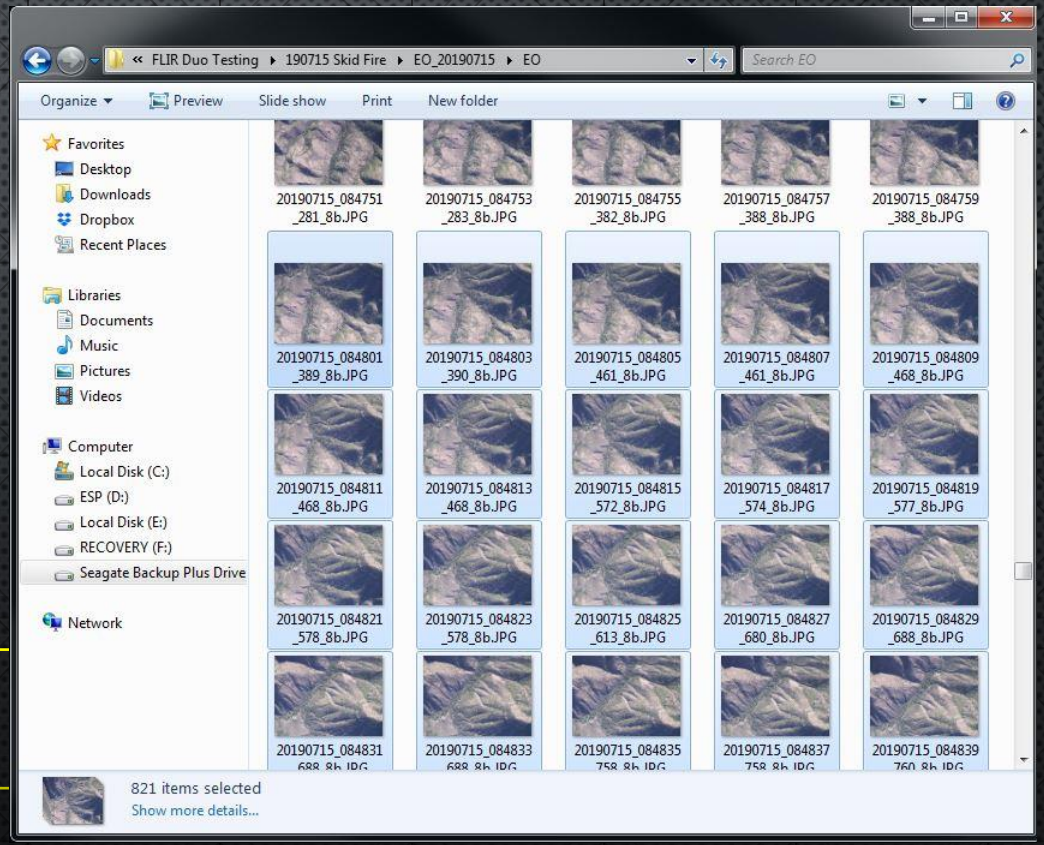
SORTING PHOTOS

Determine an appropriate point to cut the lines of photos. In this example it will be just outside the fire area. Photos are named using date and time stamp. Scroll in close to the point of breaking the flight line and you will see the names. Select a photo and take note of it and the direction of UAS travel.



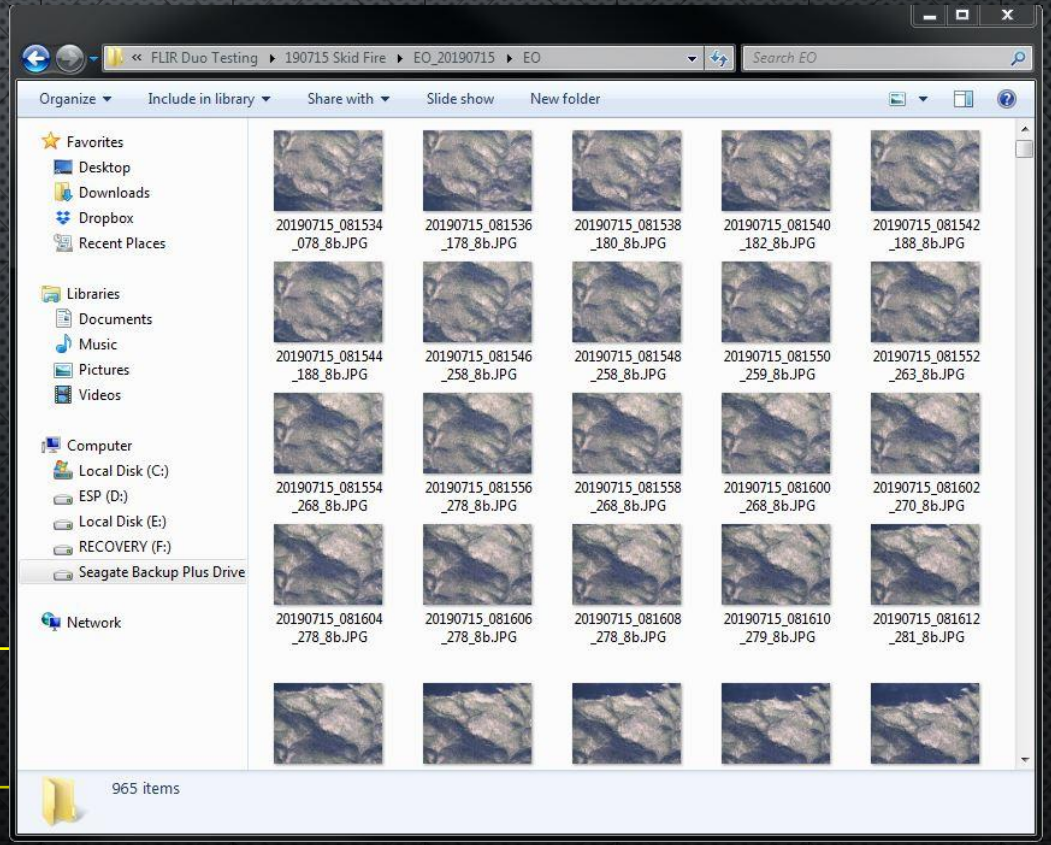
SORTING PHOTOS

Locate that image in the folder. In the previous slide we know that the UAS was enroute to Home. Also can confirm by location of image in folder, its ⅔ down. Highlight from that image to the bottom and delete. Note this deleted 821 images. Repeat for the beginning of the flight.



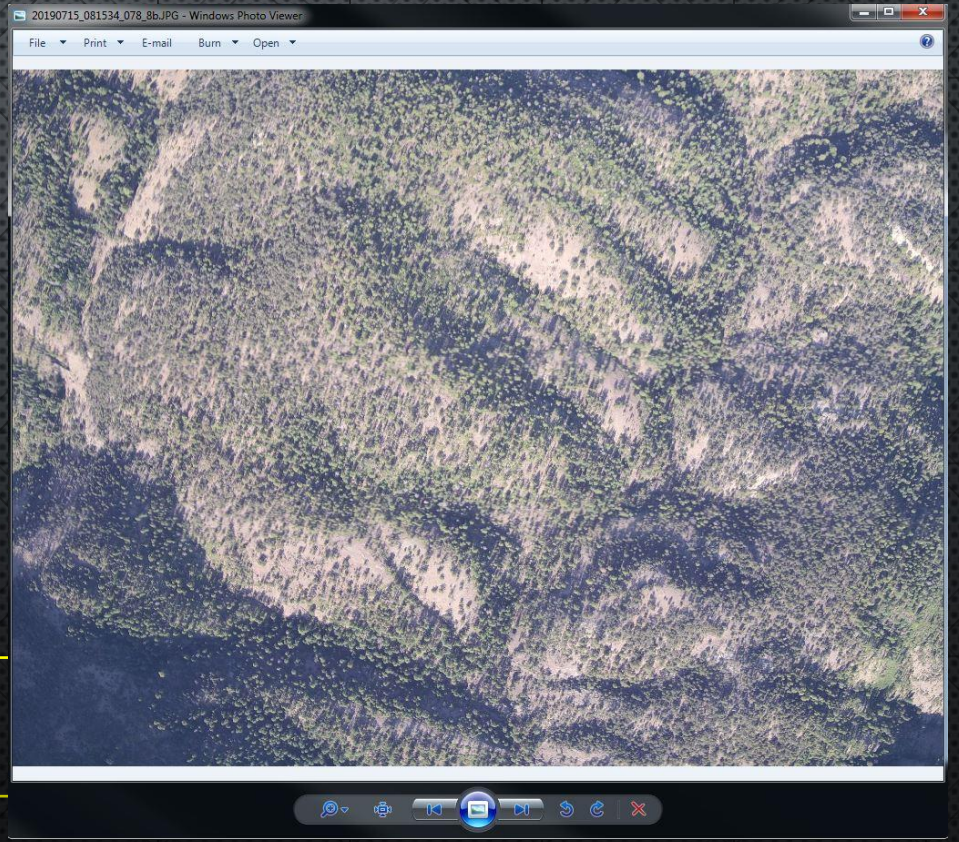
SORTING PHOTOS

We are now left with 965 from the original 2836. This can be further refined using 2 methods. First use the ODS to determine the time interval between images for the flight. In this example the Capture Interval was 11.92 seconds. We can take every fifth photo since this was 2 second triggers.



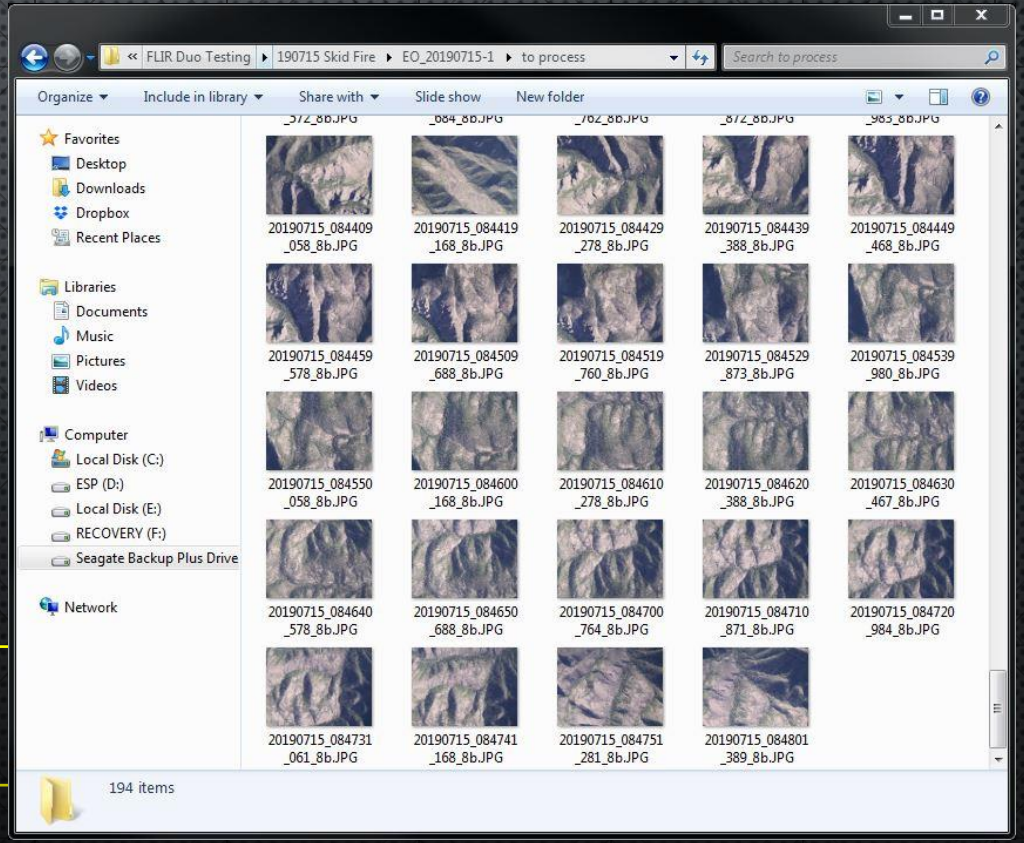
SORTING PHOTOS

Second, open the image in Windows Photo Viewer. Locate a landmark that is easily seen. Press the forward button to the next image and cycle to watch the landmark move. Estimate the Overlap. Close to 66% (landmark in 3 photos) is needed to process, in steep terrain more may be needed.



SORTING PHOTOS

In this example it was determined that every 5th photo would be close to 66% overlap. Now there are only 194 images left to process.

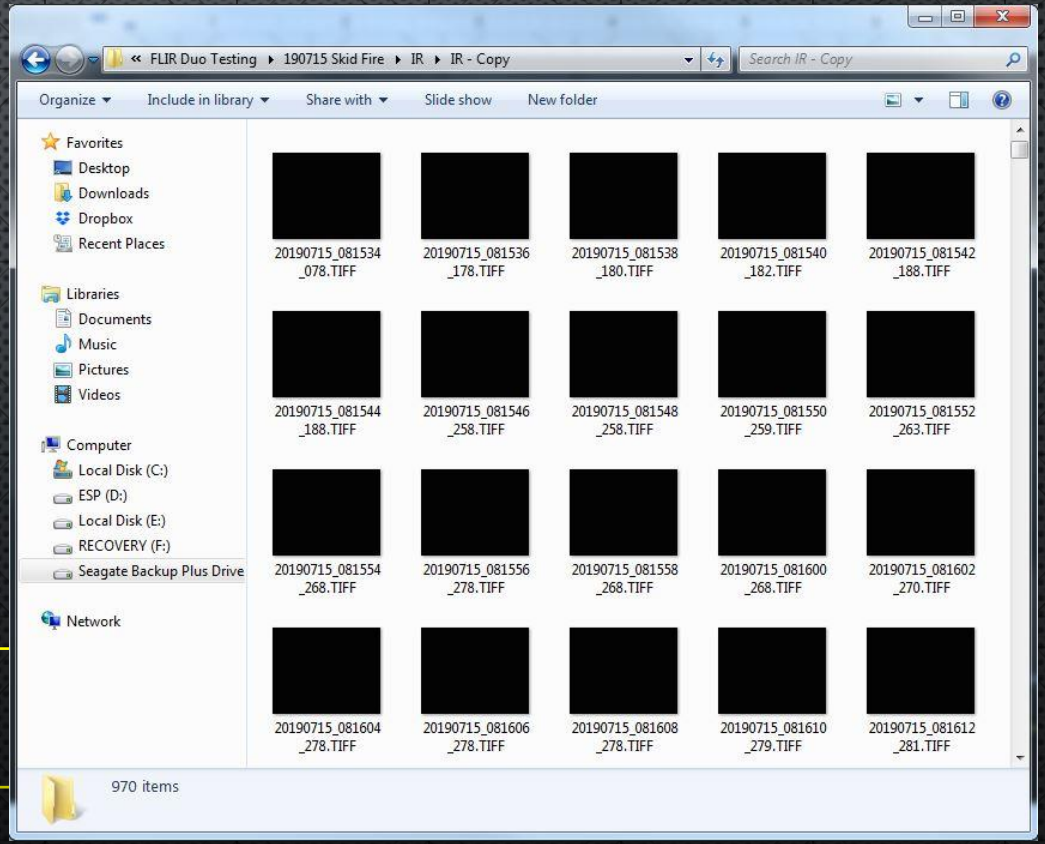


VIEW AND SORTING IR PHOTOS

- TIFF formatted images will appear black, data is present just not visible
- If visible thermal images are needed convert to JPG using ImageJ
- Recommend not processing JPG images, use for viewing only
- Same process is used for sorting
- IR images use same naming conventions, use the same image numbers to cut the flight lines as used in the EO photos

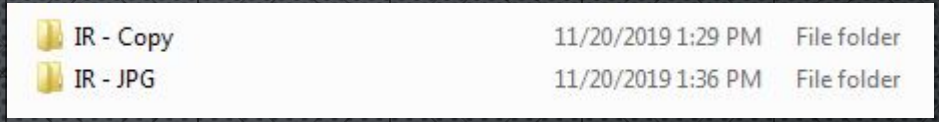
VIEW IR PHOTOS

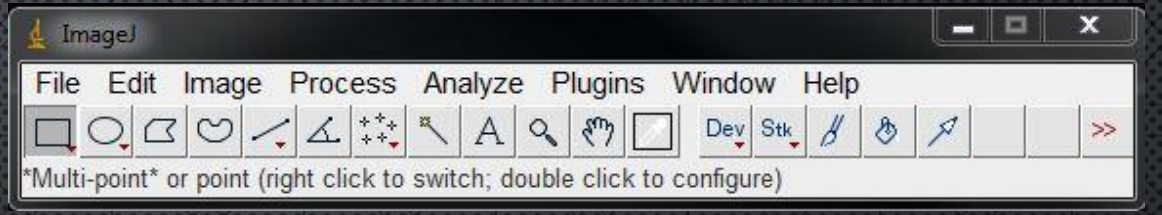
- This folder contains 970 TIFF images
- To actually view the TIFF format needs converted to JPG
- Converting loses the temp data embedded in the TIFF files
- JPG is a compressed format that is undesirable for deriving data

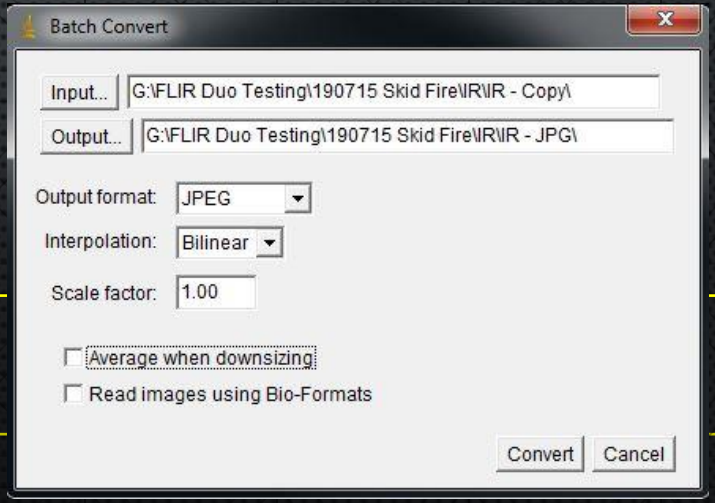


VIEW IR PHOTOS

1. Organize folders
2. Open ImageJ from its folder
3. Process > Batch > Convert
4. Select Input and Output folders as shown
5. Set Output Format to JPG
6. Convert

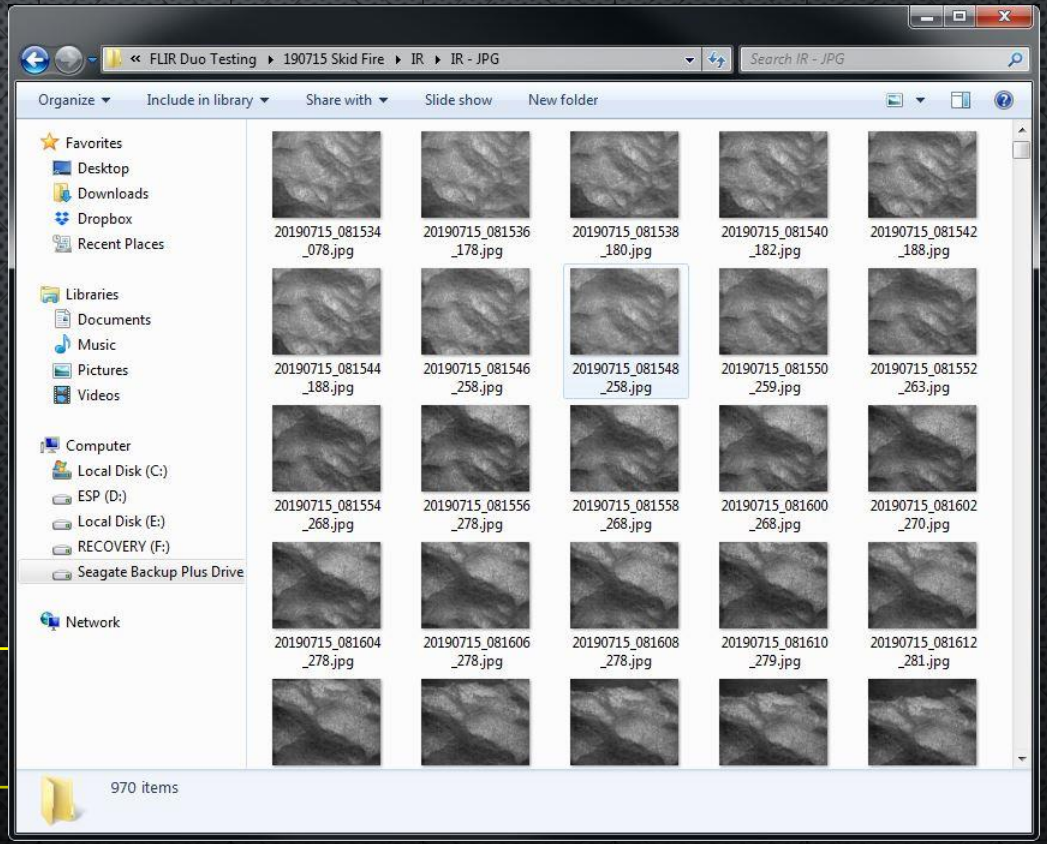






VIEW IR PHOTOS

Now thermal images can be viewed and sorting determinations can be made. Once determinations are made sort the TIFF files in the same way.

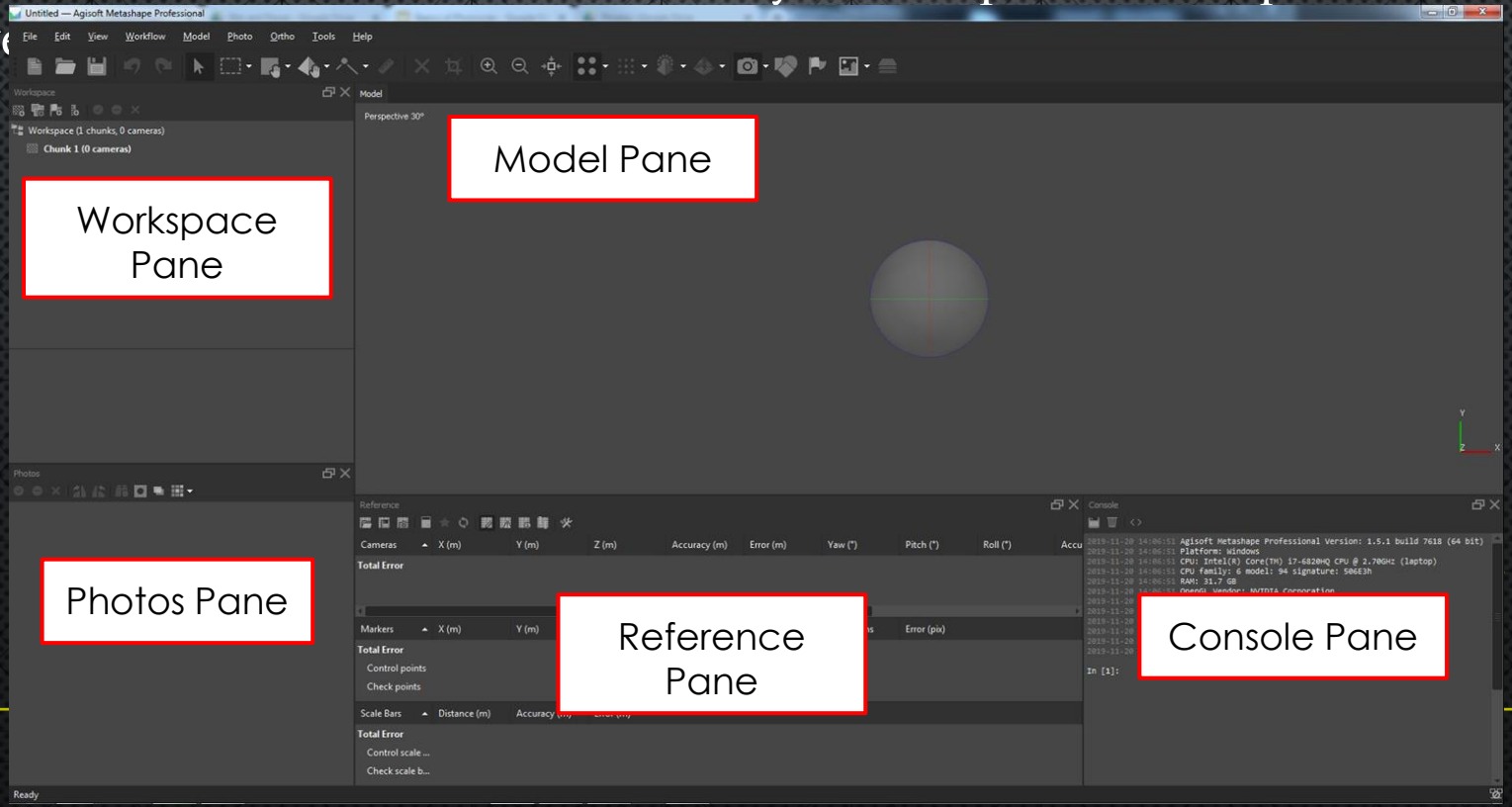


METASHAPE FLOW OVERVIEW

- Load Photos
- Alignment - Geometry is used with geotags to build a sparse point cloud
- Refine - Improves the spacial accuracy of the model
- Gradual Selection - removes points with bad geometry
- Build Dense Cloud - Builds a dense point cloud based on remaining points in the sparse cloud
- Build DEM - Needed to generate the Orthophoto
- Build Orthos
- Export desired products

METASHAPE SETUP

Setup the Workspace and organize the 5 panes as below. This maximizes efficient workflow. Panes can be tricky to manipulate, once placed will be save



Workspace Pane

Model Pane

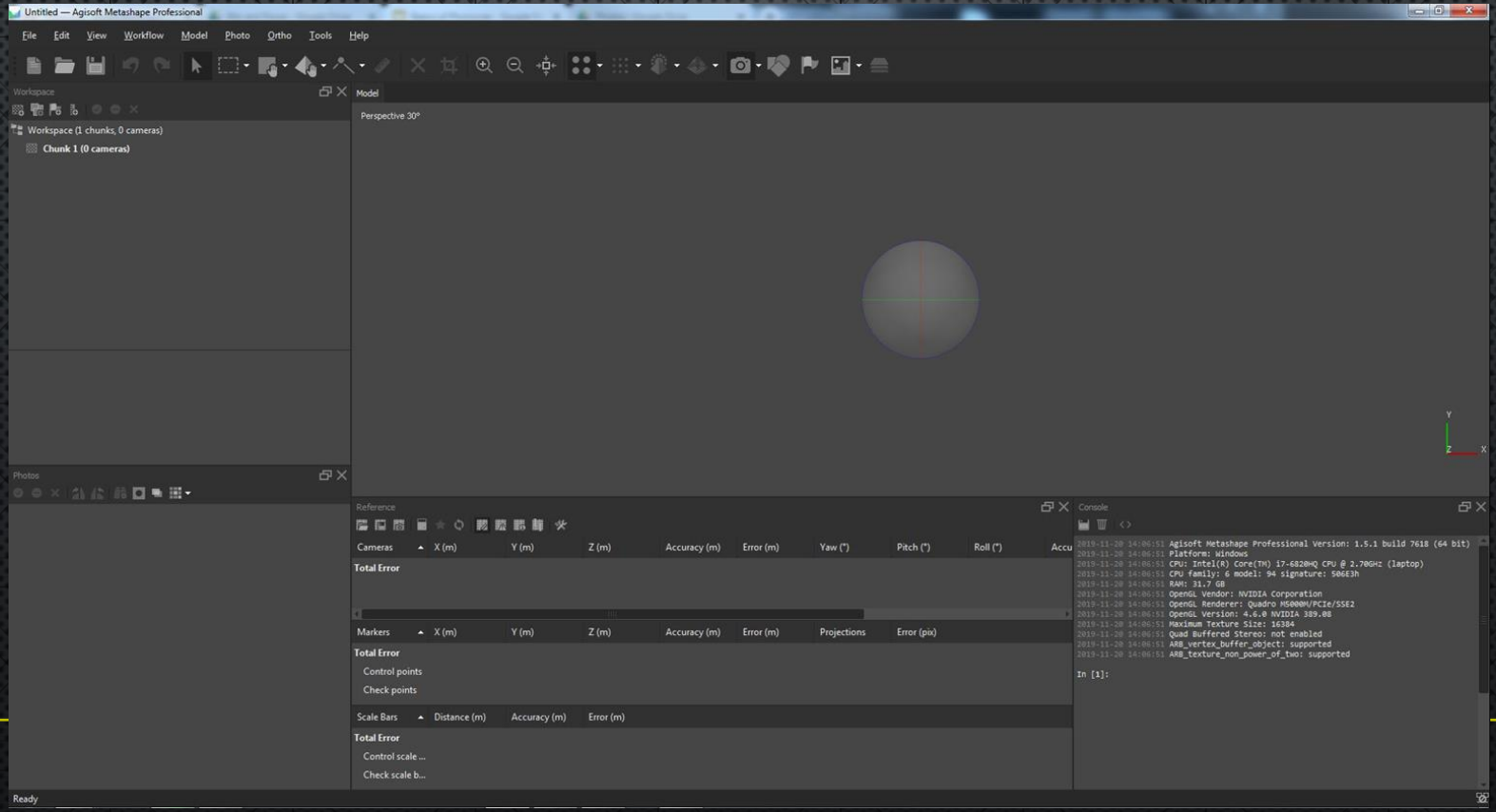
Photos Pane

Reference Pane

Console Pane

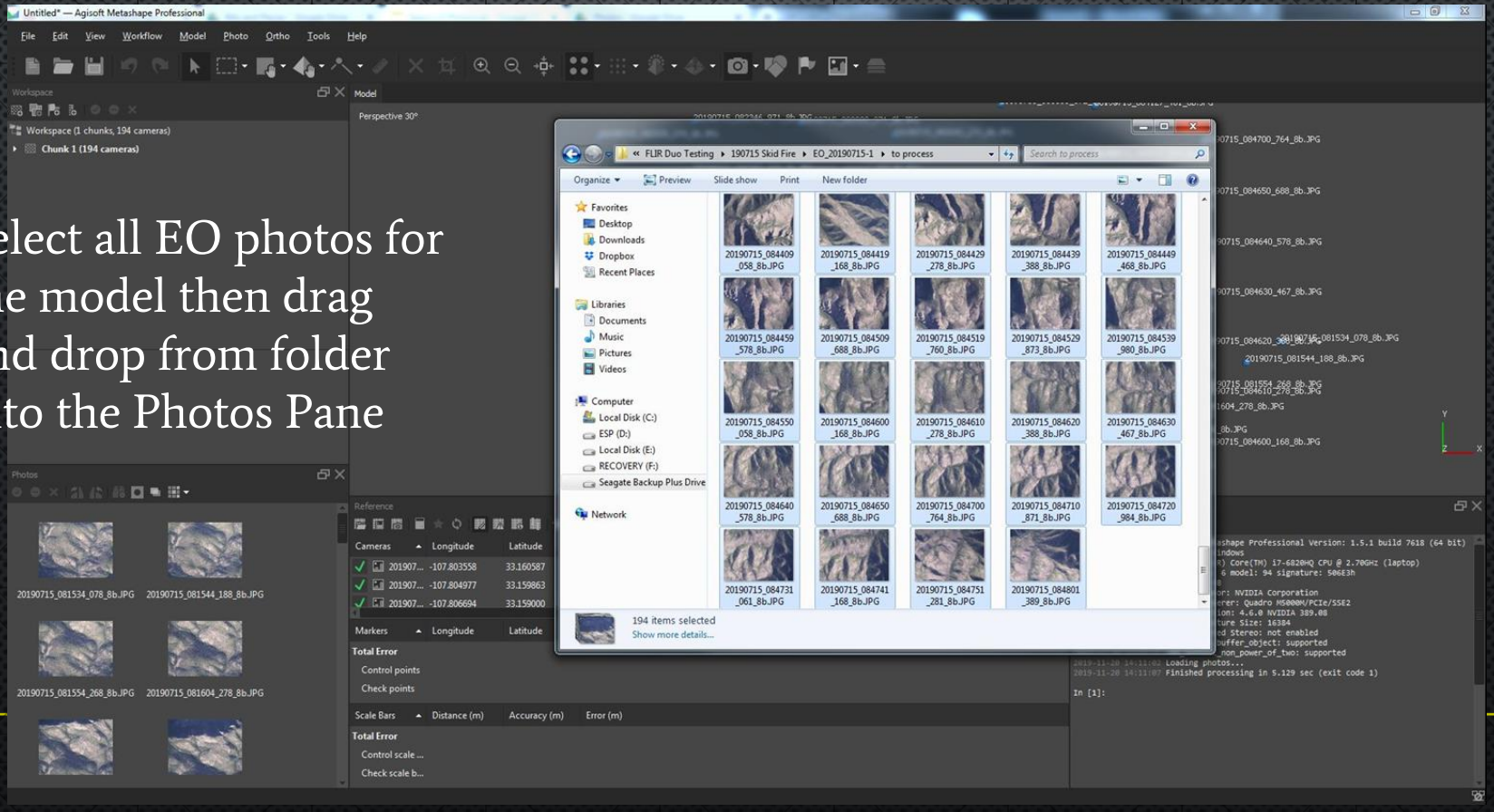
METASHAPE SETUP

Once setup and arranged the program should appear like this



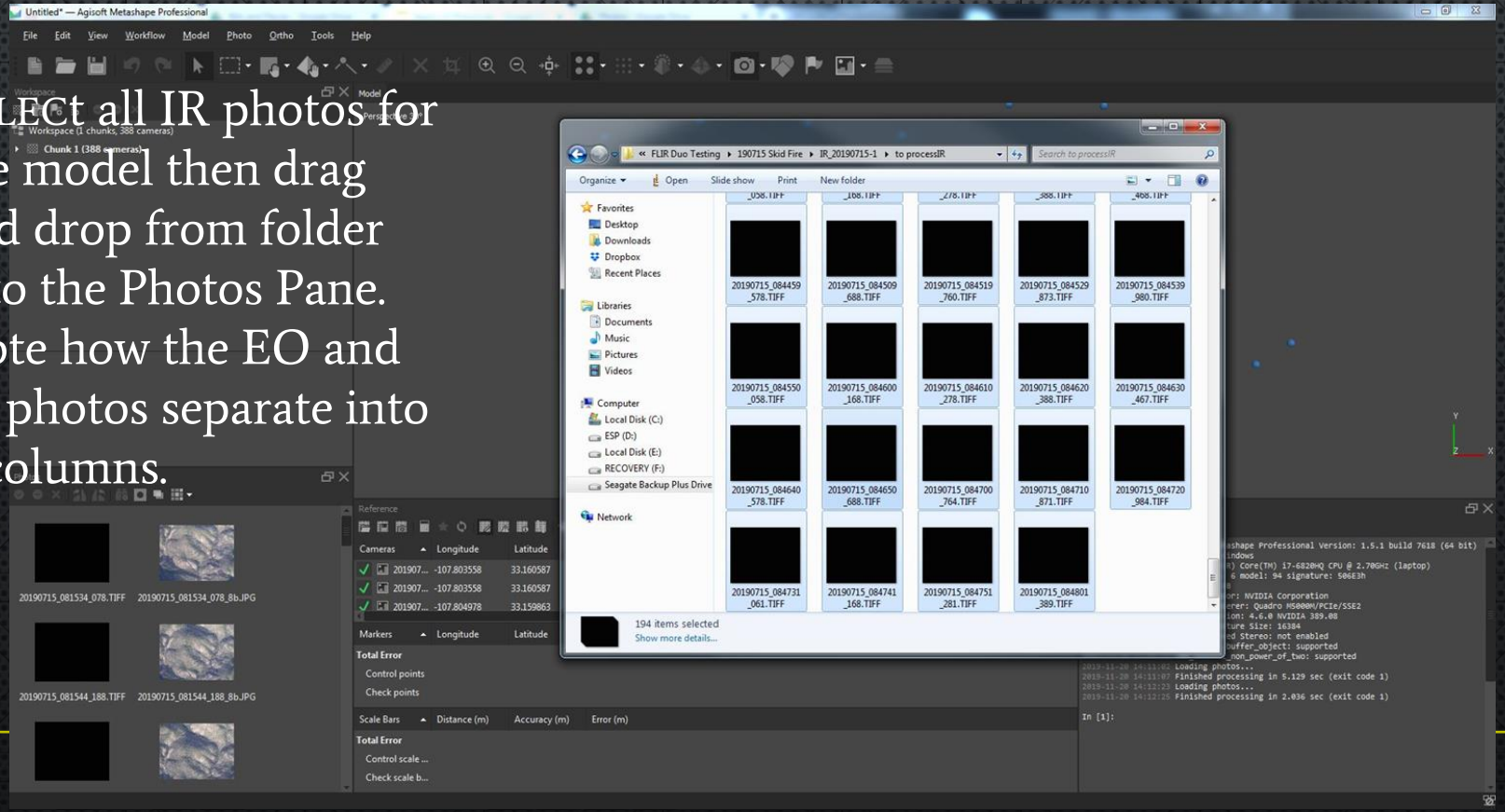
STARTING THE PROCESS

Select all EO photos for the model then drag and drop from folder into the Photos Pane

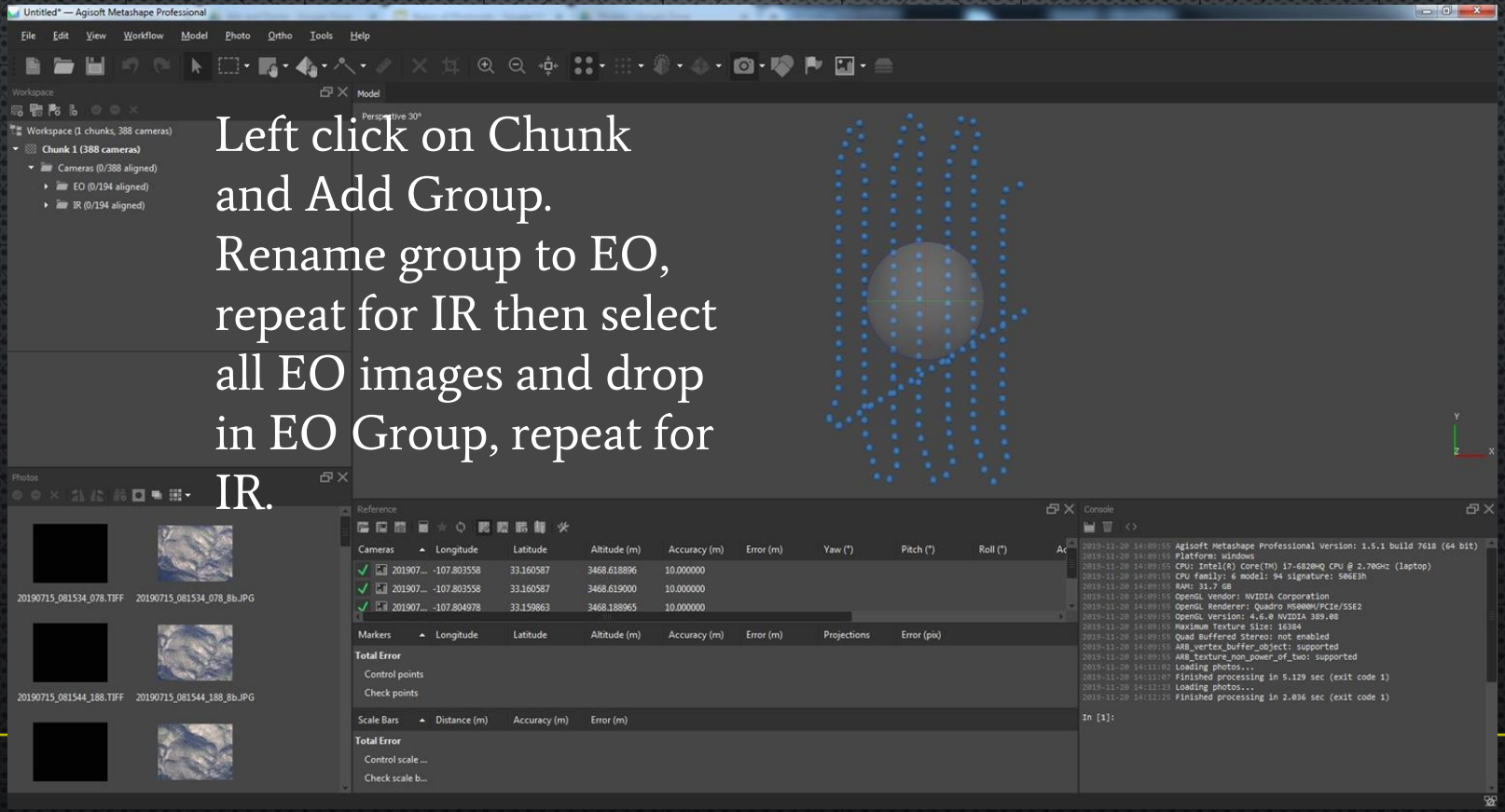


STARTING THE PROCESS

SELECT all IR photos for the model then drag and drop from folder into the Photos Pane. Note how the EO and IR photos separate into 2 columns.



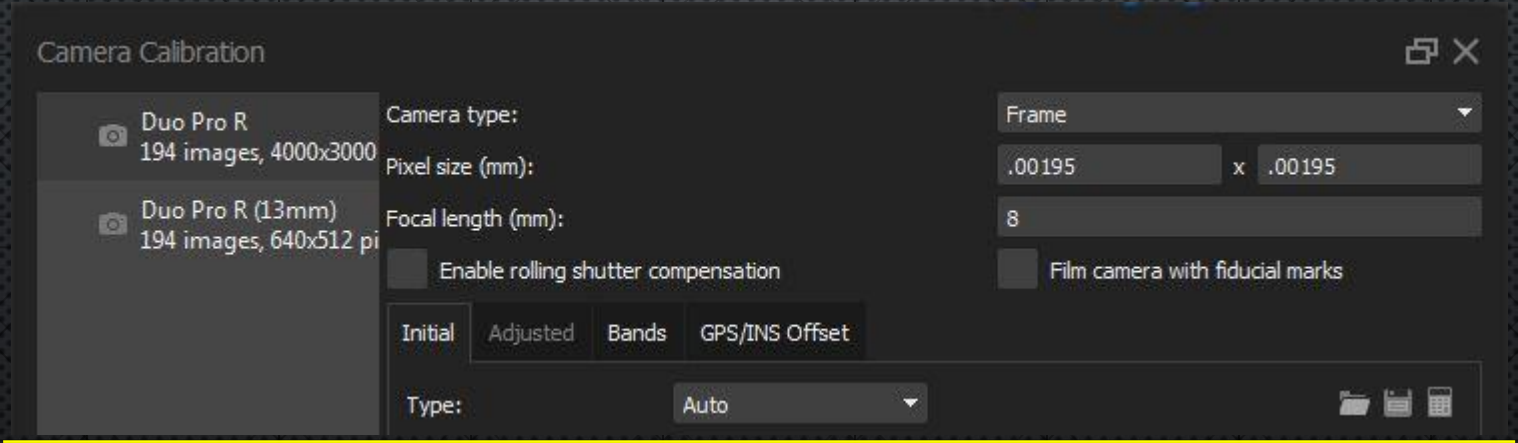
STARTING THE PROCESS



Left click on Chunk and Add Group. Rename group to EO, repeat for IR then select all EO images and drop in EO Group, repeat for IR.

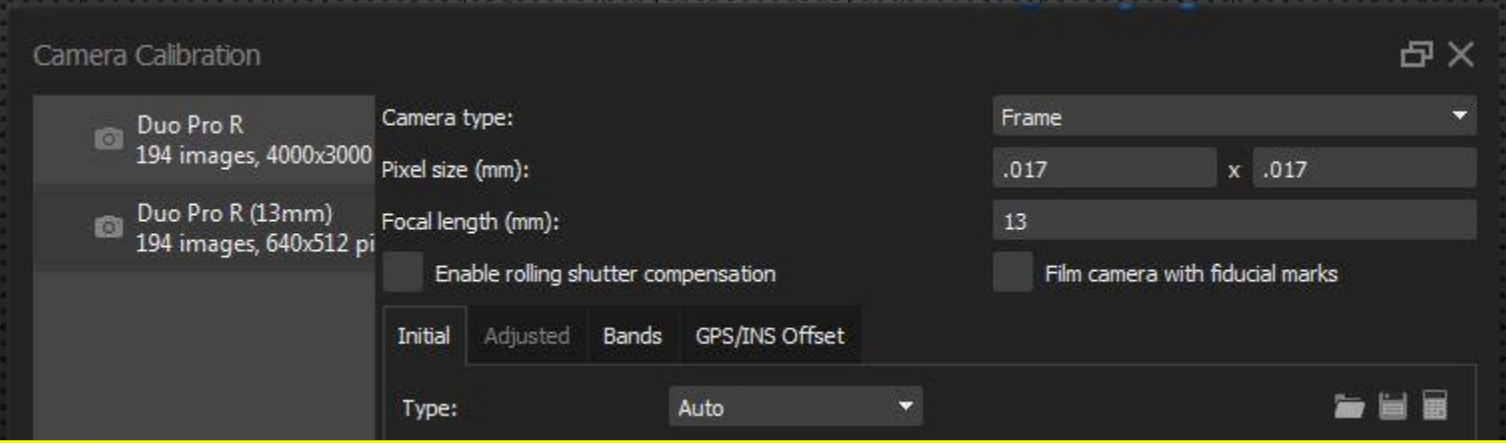
CAMERA CALIBRATION

Click Tools and select Camera Calibration. Make sure the boxes under Frame match what is shown in the picture below. Note Duo Pro R is highlighted.



CAMERA CALIBRATION

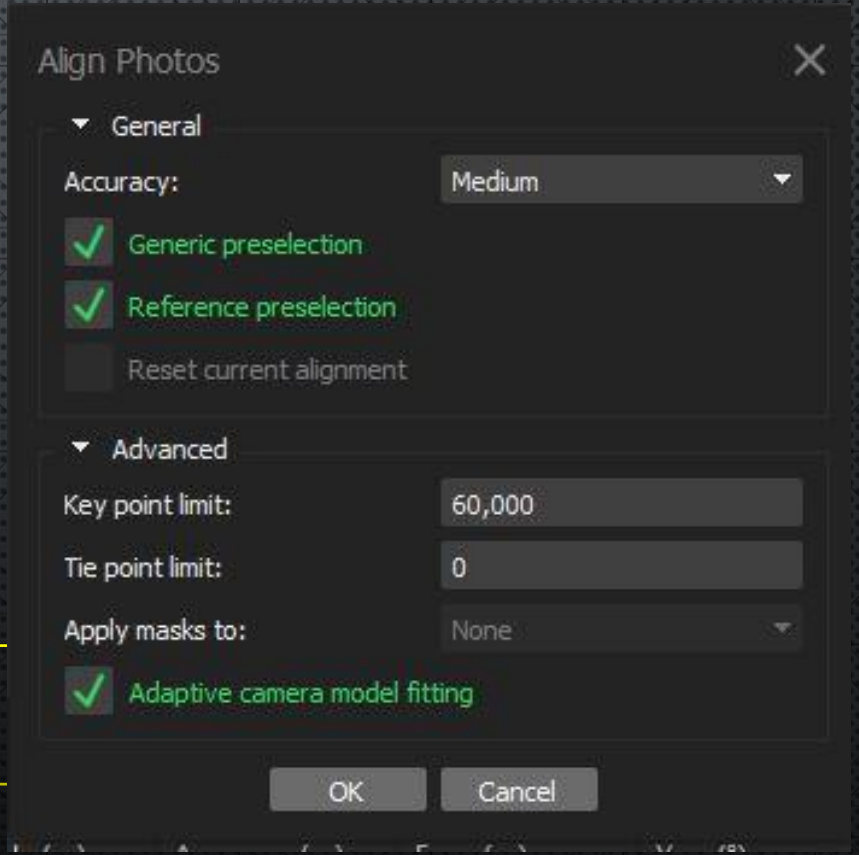
Make sure the boxes under Frame match what is shown in the picture below. Note that the other set of images is highlighted (13mm).



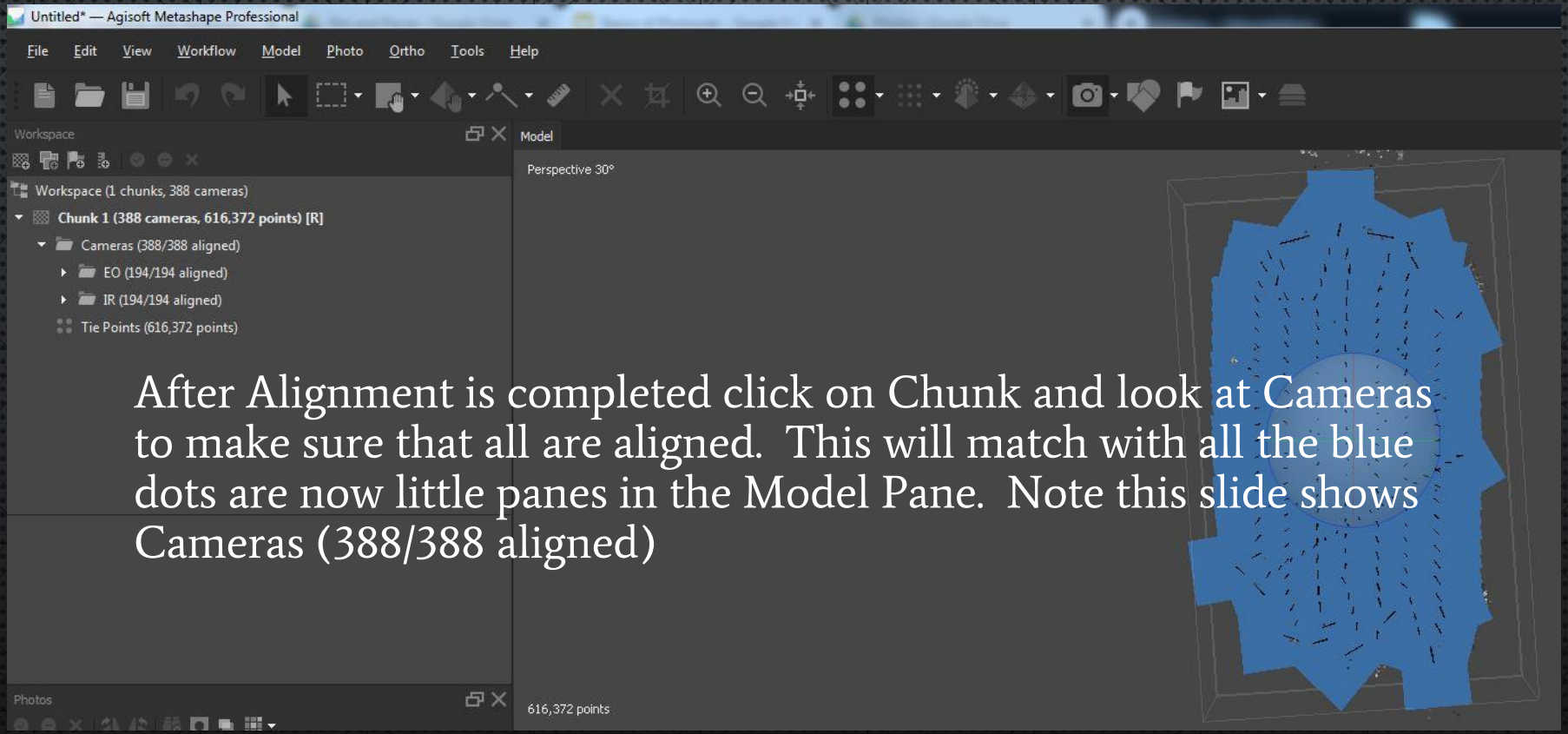
ALIGNMENT

Click Workflow Tab and select Align Photos. Match settings below and click OK.

This will take a bit to run. This example with a Photogrammetry laptop took 14 minutes and 38 seconds.



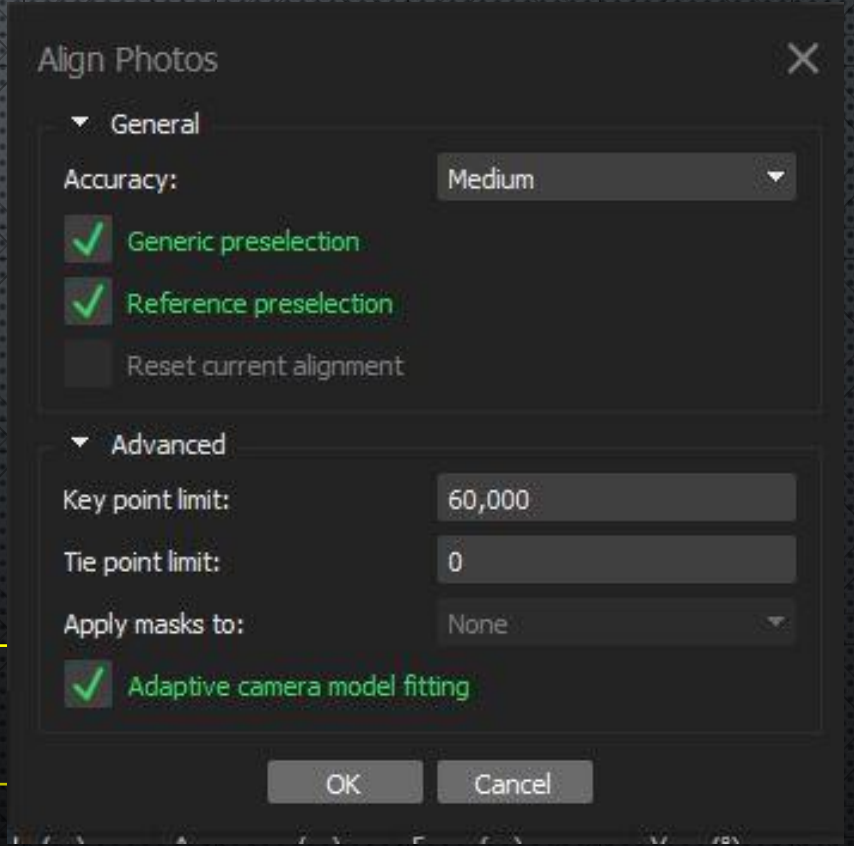
AFTER ALIGNMENT



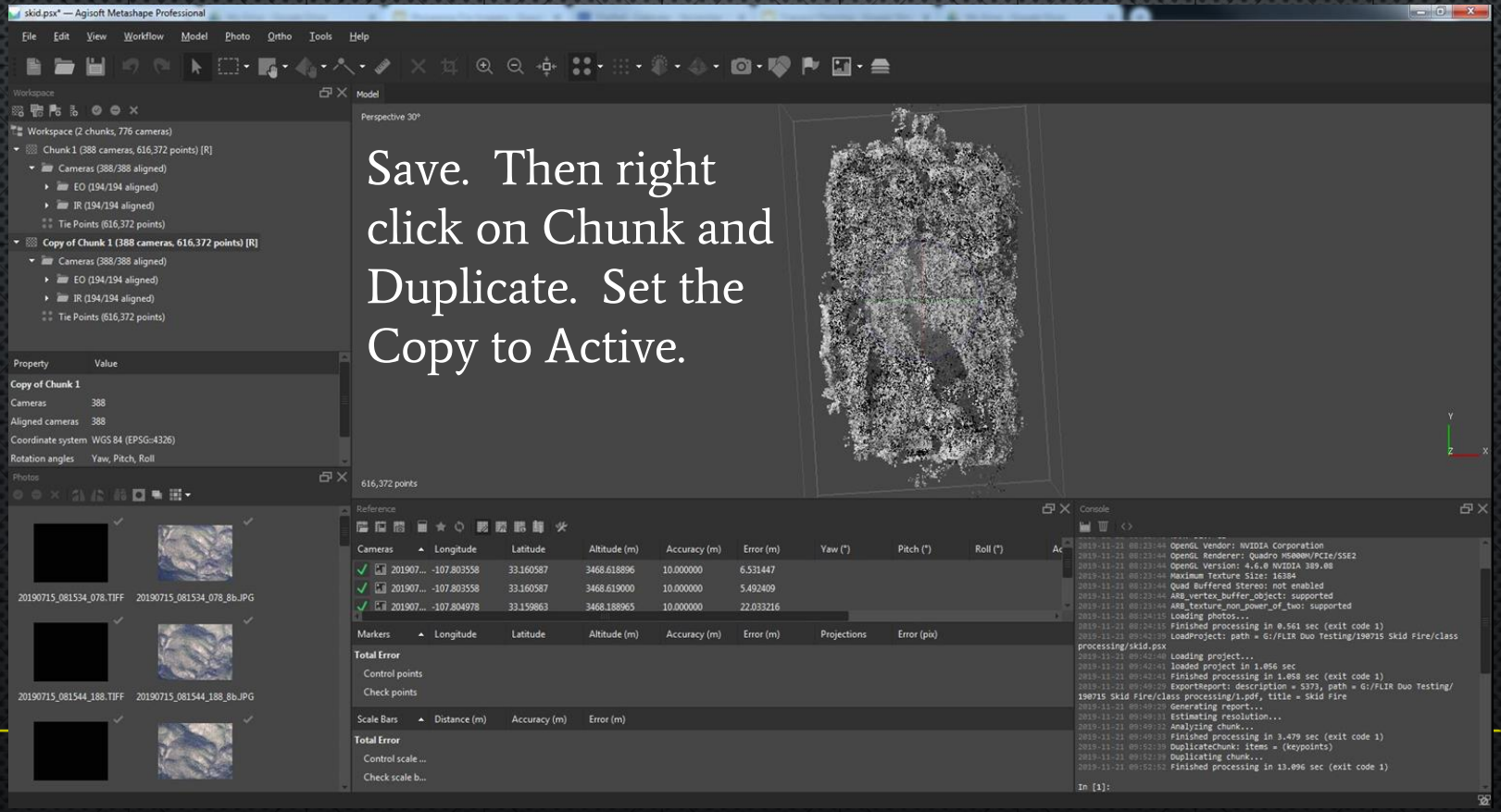
After Alignment is completed click on Chunk and look at Cameras to make sure that all are aligned. This will match with all the blue dots are now little panes in the Model Pane. Note this slide shows Cameras (388/388 aligned)

AFTER ALIGNMENT

IF a few images do not align run again with all 3 top boxes unchecked

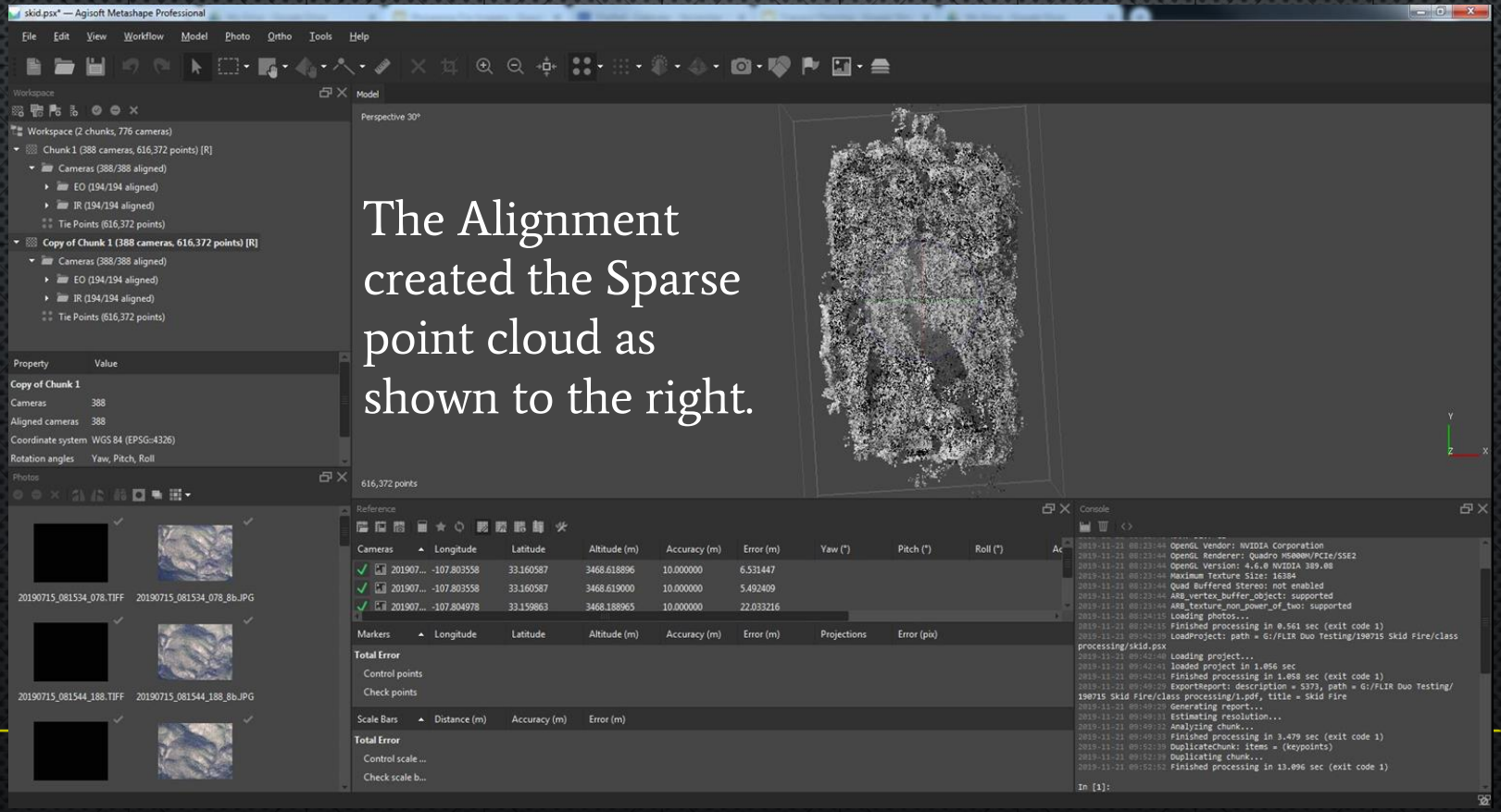


SAVE AND DUPLICATE



Save. Then right click on Chunk and Duplicate. Set the Copy to Active.

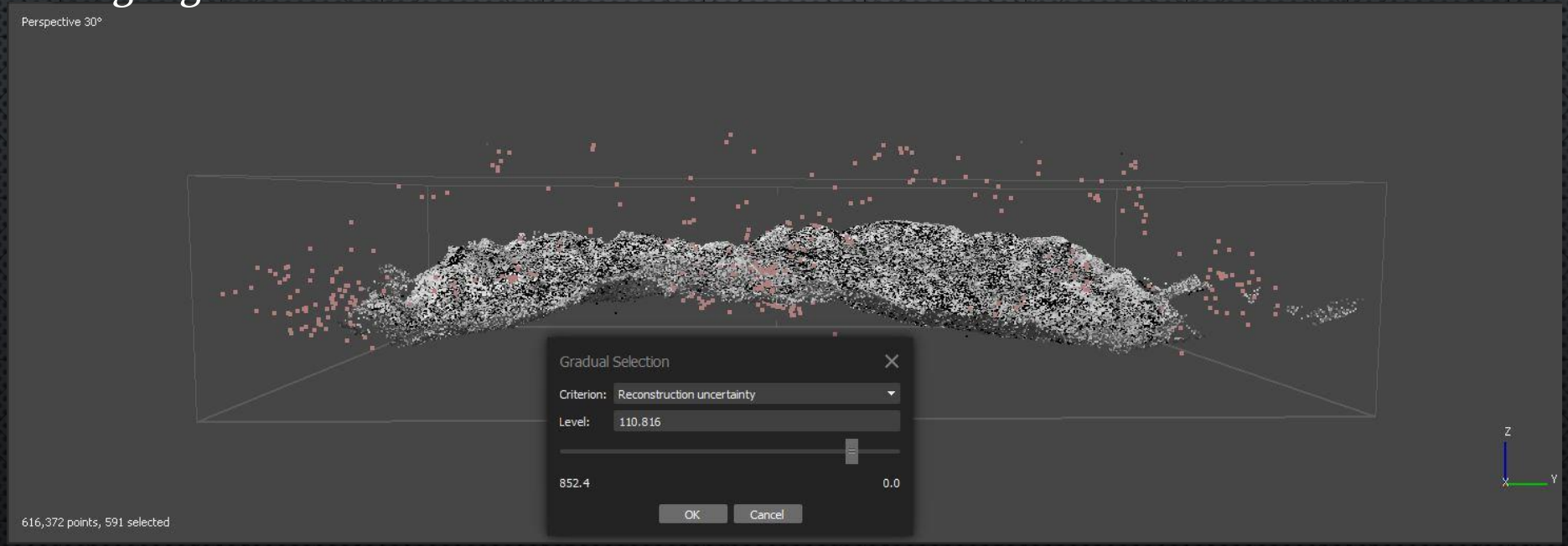
POINT CLOUD



The Alignment created the Sparse point cloud as shown to the right.

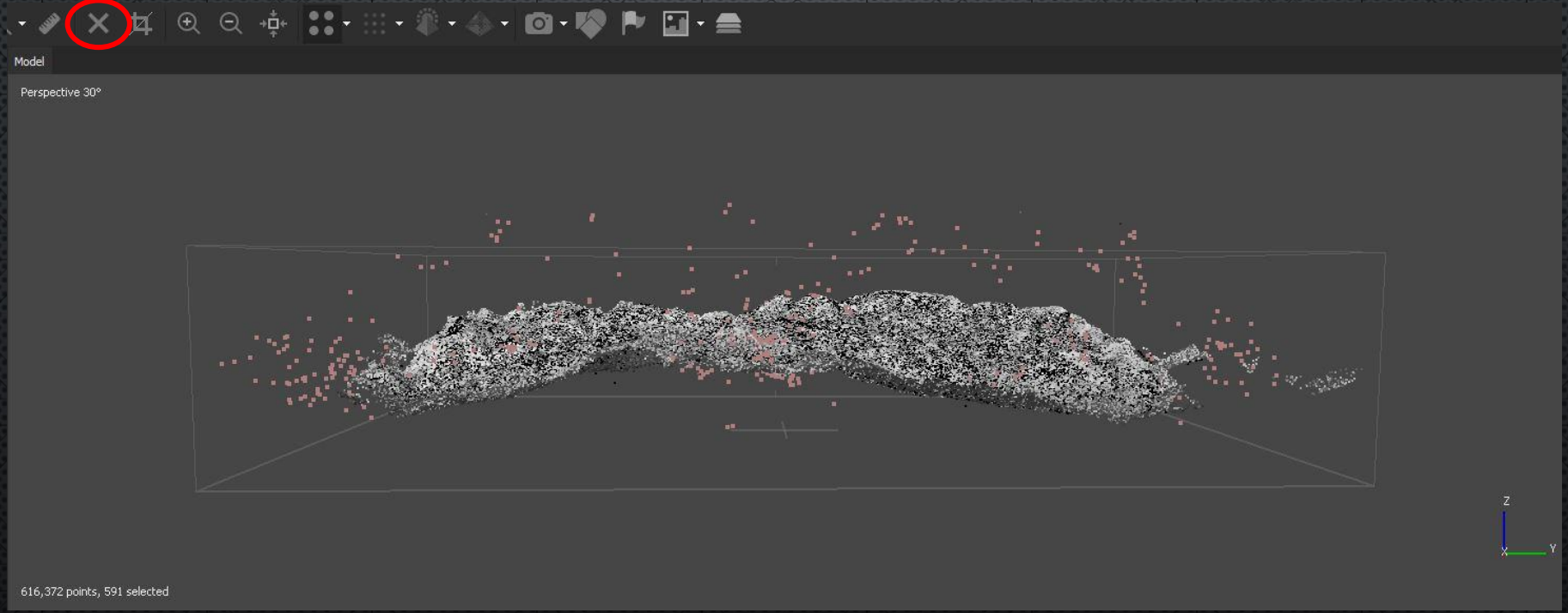
GRADUAL SELECTION

Click the Model tab and select Gradual Selection. In the dialog box drop down select Reconstruction Uncertainty. Slide the rule to the right and observe the points being highlighted. Move slider until the points that need removed are highlighted.



GRADUAL SELECTION

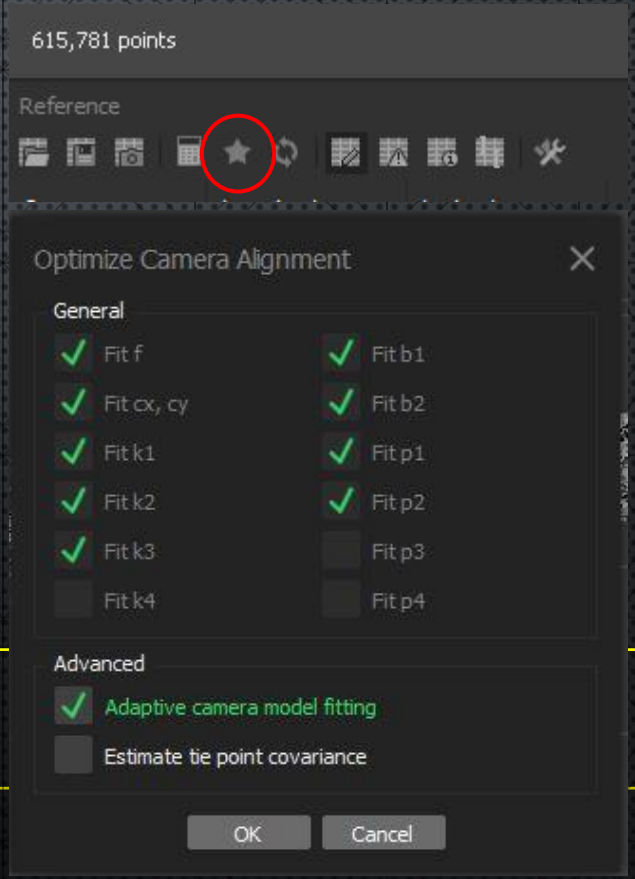
Click OK on Gradual Selection. Then click the X in the menu bar above model. The highlighted points will disappear.



OPTIMIZE

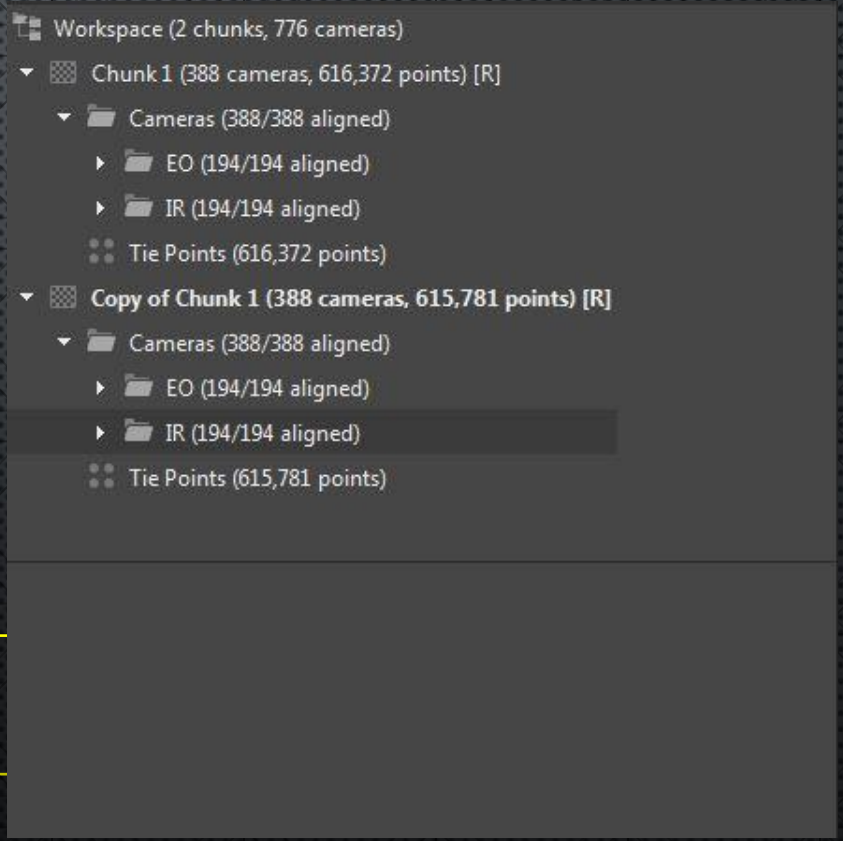
Click the Optimize Star, circled to the left.

Match the checkboxes as shown and Click OK.

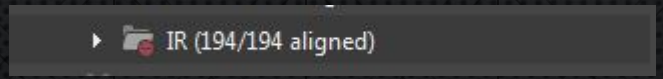


DENSE POINT CLOUD

In Workspace Pane highlight the IR Group.
Right click and Disable Cameras.

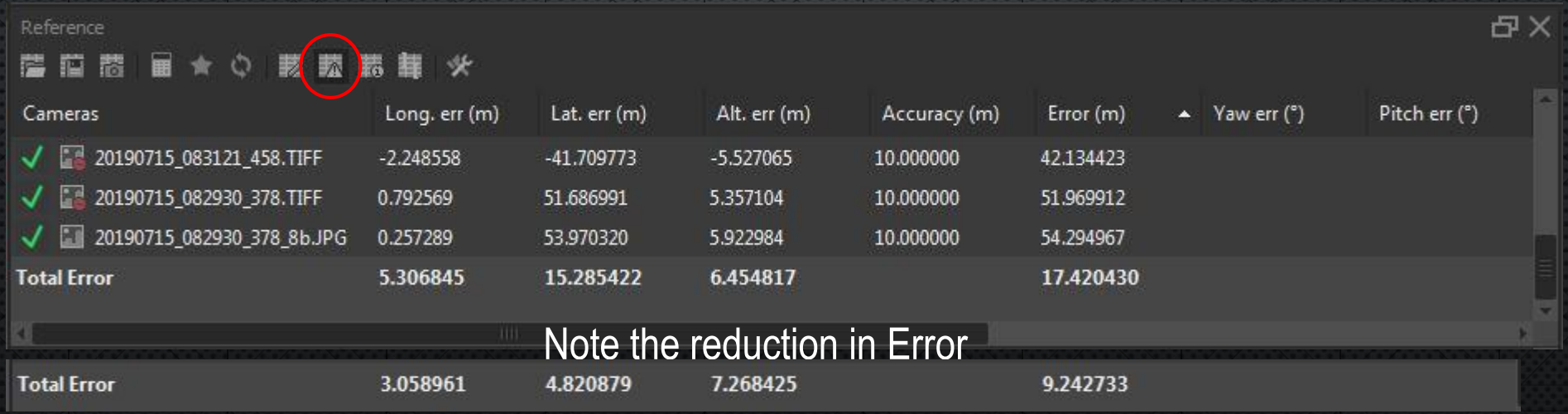


Disabled will appear as below.



ERROR REDUCTION

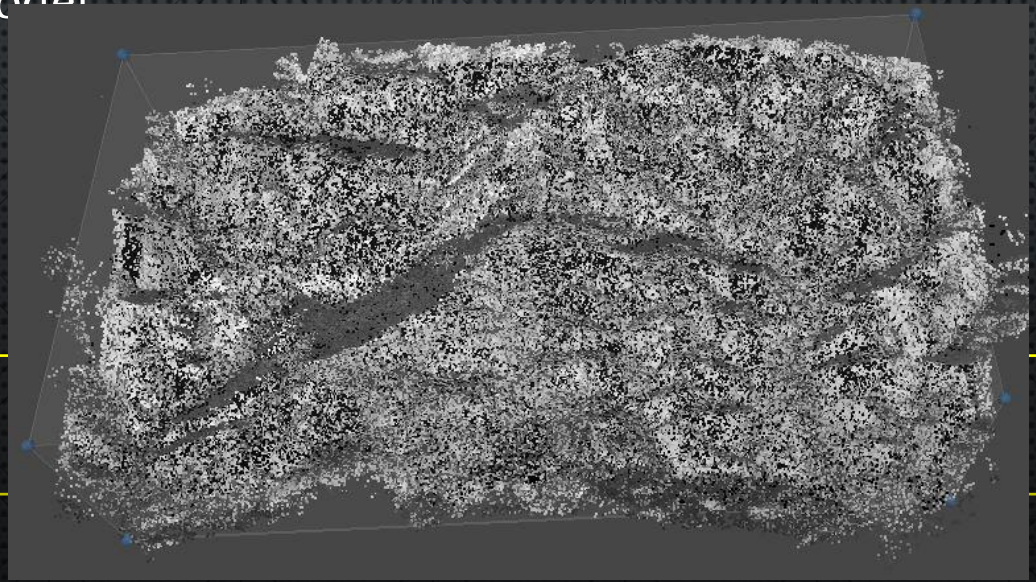
Select View Error as shown in RED circle and scroll to bottom. View Total Error row.. IF the box is checked the location values for that image are true, if not MS ignores those values. Sort by clicking the Error(m) column. Uncheck boxes for up to ⅔ of the photos. Optimize again. Uncheck more up to ¾ of the checkboxes. Optimize a last time.



SAVE WORK

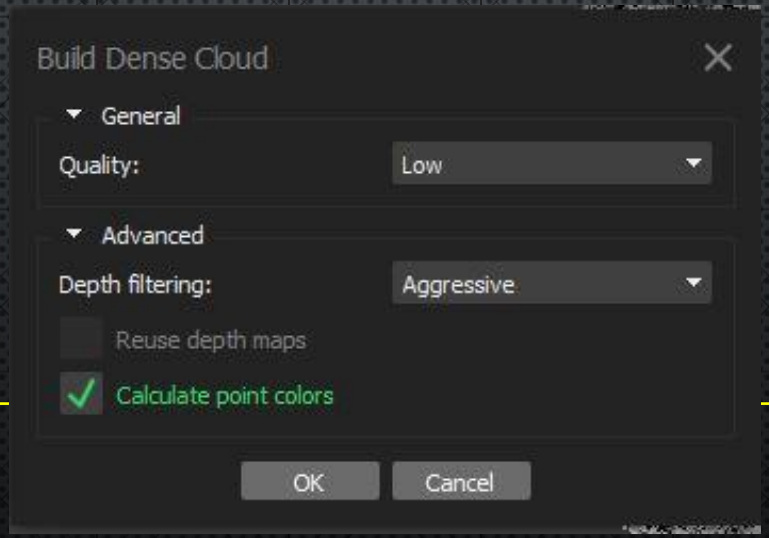
SETTING BOUNDING BOX

Click the Resize Region dropdown  and select Resize Region. Click and hold blue dot to drag and place box on the area that is to be modeled. In general bring the horizontal boundaries just inside of the ragged edge, make sure the vertical boundaries are well above and below the model



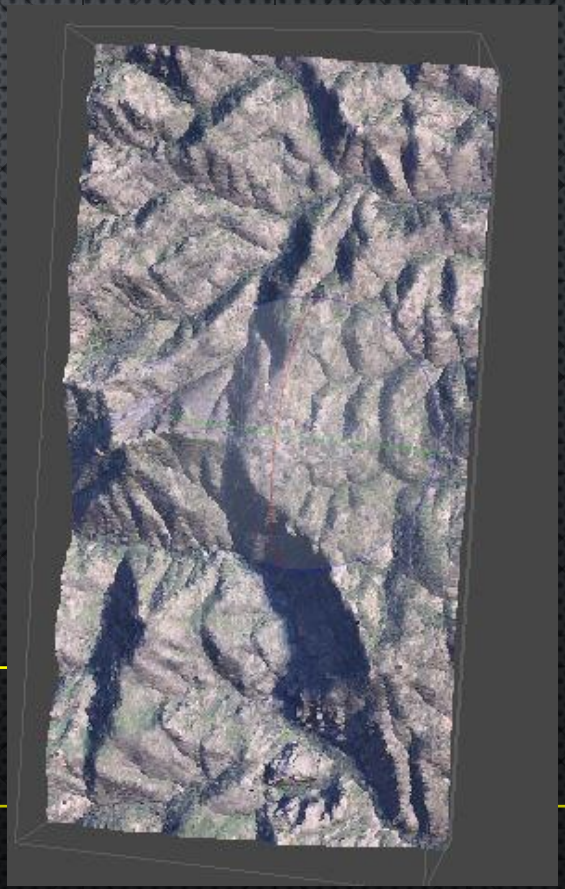
BUILDING DENSE CLOUD

Click Workflow and select Build Dense Cloud. Use settings below. This will take some time to process. This example with a photogrammetry laptop took 6 minutes 22 seconds.



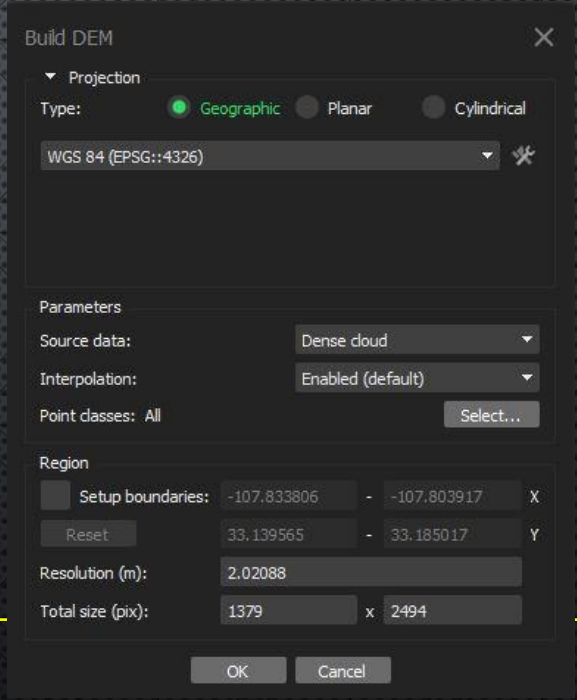
DENSE CLOUD

Click the Dense Cloud button  to view the Dense Cloud. Note there is a lot more detail now in the model.



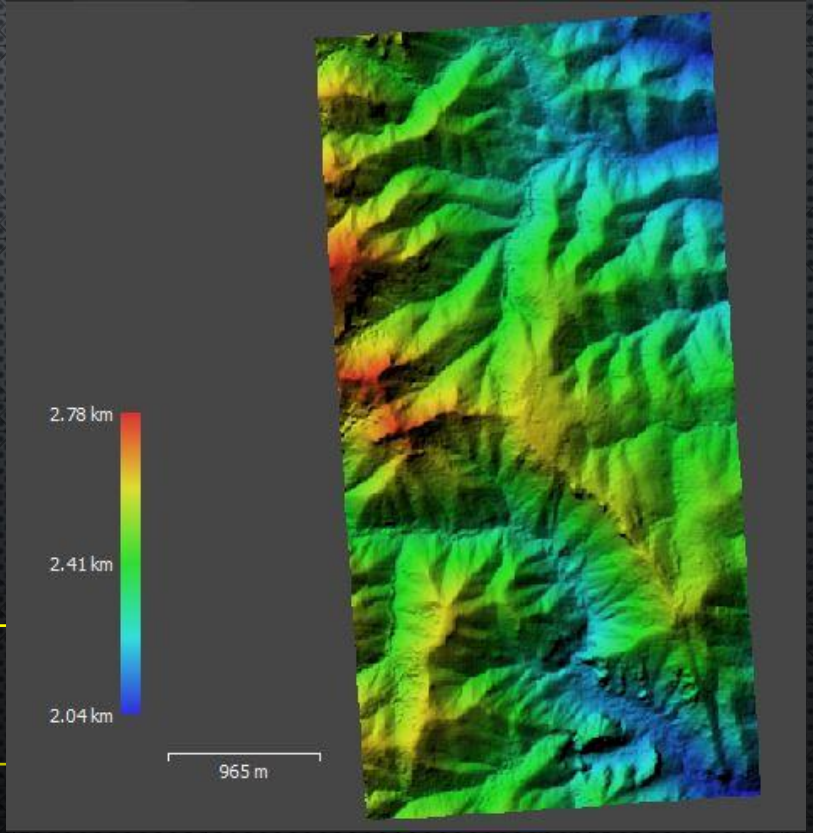
BUILDING THE DEM

Click Workflow and select Build DEM. Use settings shown.
Click OK.



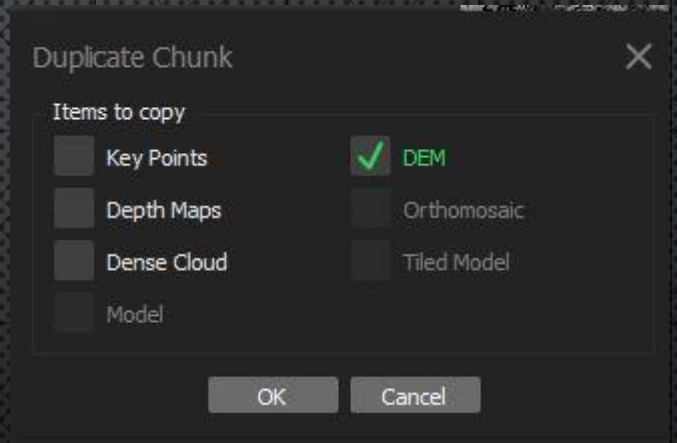
DEM

Double click on DEM in Workspace Pane to view. DEM will open a tab contained in the Model pane. When finished click the X of the Tab labeled Ortho.



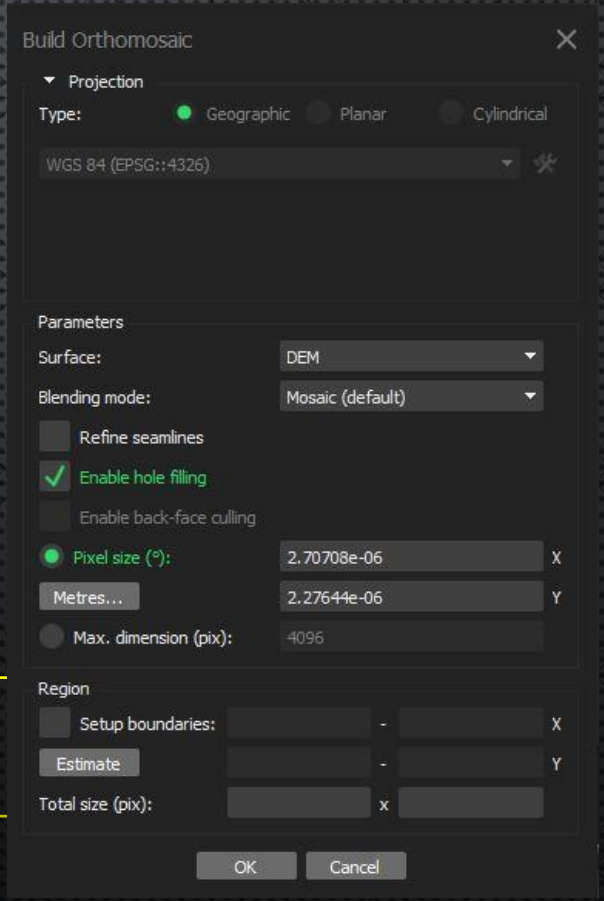
SAVE AND COPY

Save.
Duplicate the Copy of Chunk 1 only bringing over the DEM and rename EO Chunk.
Duplicate again with only the DEM and rename IR Chunk.



BUILDING THE ORTHOMOSAIC

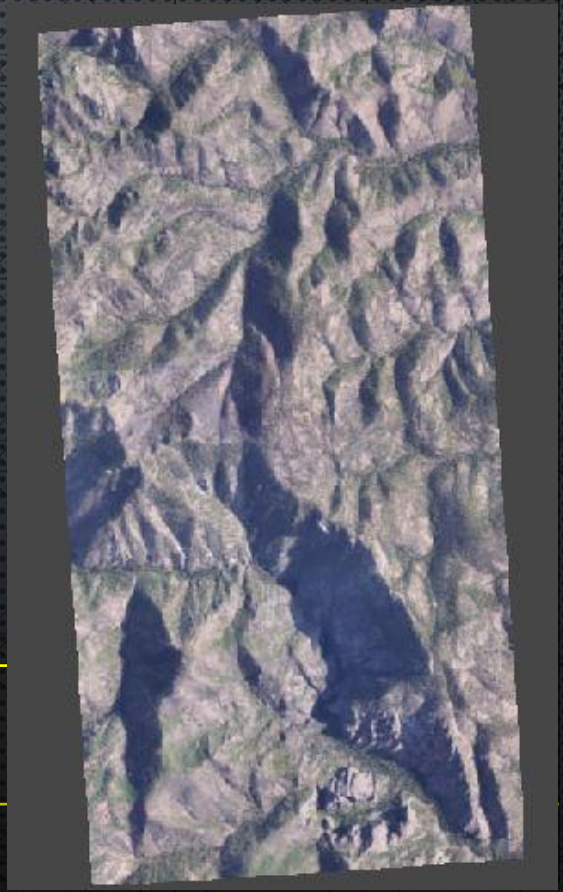
Set EO Chunk as Active. Click Workflow and select Build Orthomosaic. Use settings shown. Click OK.



ORTHOMOSAIC

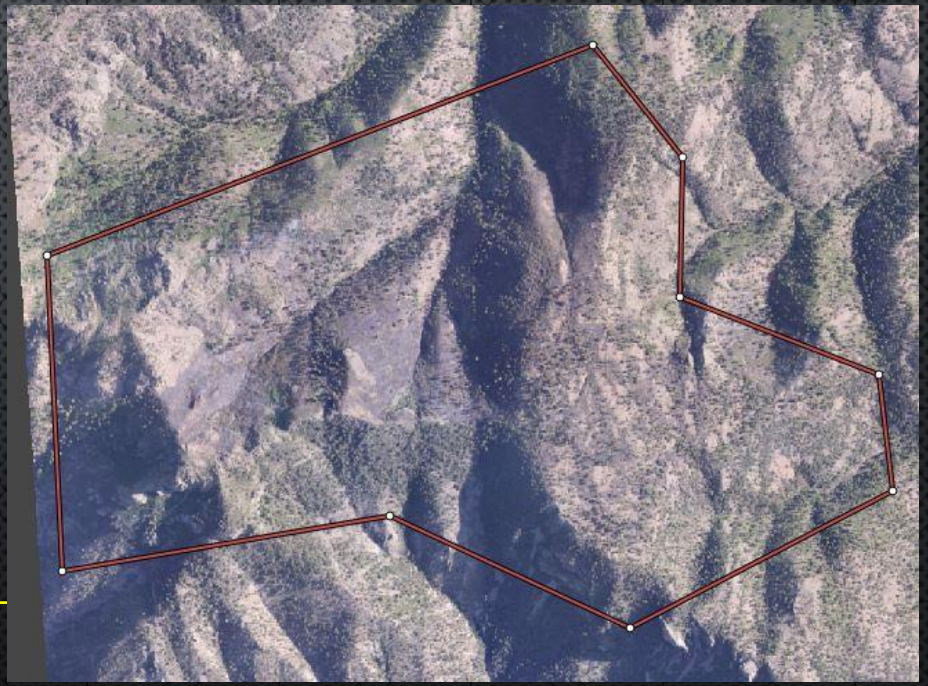
Double click on Orthomosaic in Workspace Pane to view. You can zoom in/out and drag around.

Ortho may be exported at this point if the shape is appropriate.



REFINING THE ORTHOMOSAIC

Click the Polygon arrow  and select Draw Polygon. Click and draw around the fire with a buffer outside of the line. Left click the pointer on the polyline. Select Set Boundary Type and Outer Boundary.



REFINING THE ORTHOMOSAIC

Right click the pointer on the polyline. Select Set Boundary Type and Outer Boundary. Note the line will appear as pictured. Export Shape to import on the IR ortho

Ortho is ready for Export.

IR ORTHOMOSAIC

Set IR Chunk Active and repeat building an Ortho. The ortho will be black to the eye until opened in Arc. The temperature data is embedded in each pixel.

IR ORTHOMOSAIC

IF needed Import the shape from the EO ortho. This allows exportation of the desired shape.
Right click > Set Boundary
Type > Outer Boundary

SAVE AND EXPORT

Save and prepare for exports.

Export:
EO Ortho
IR Ortho
Report

METASHAPE REPORT

This generates a report for the entire process of Photoscan. It will be important to have as Metadata as well as tell you a lot about your model.

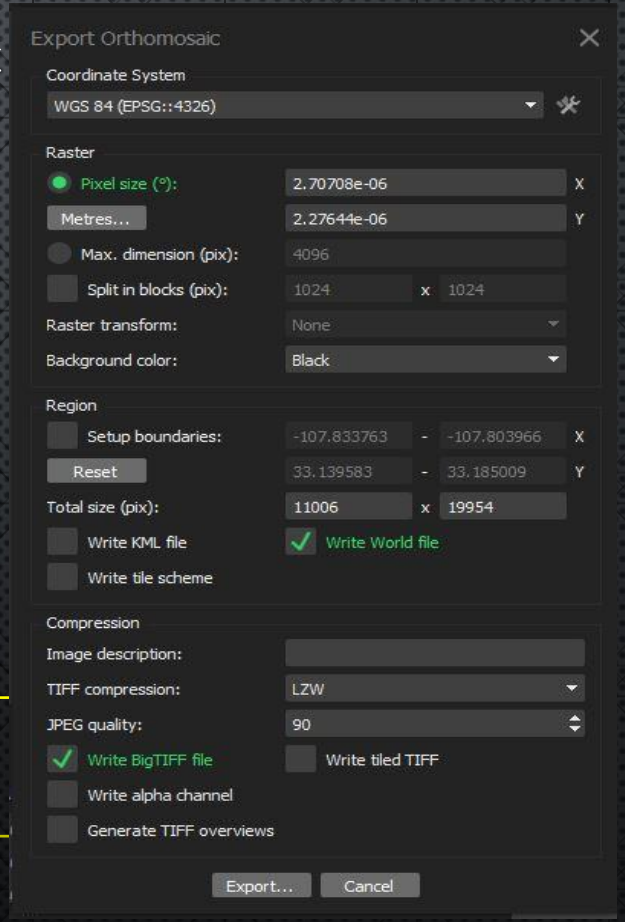
To export. Click File > Export > Generate Report...

Fill the dialog boxes as appropriate and save

EXPORTING ORTHOMOSAIC

Click File > Export > Export Orthomosaic > Export JPG/TIFF/PNG

Match ALL of the settings to the right then click Export and save as TIFF file in next popup.

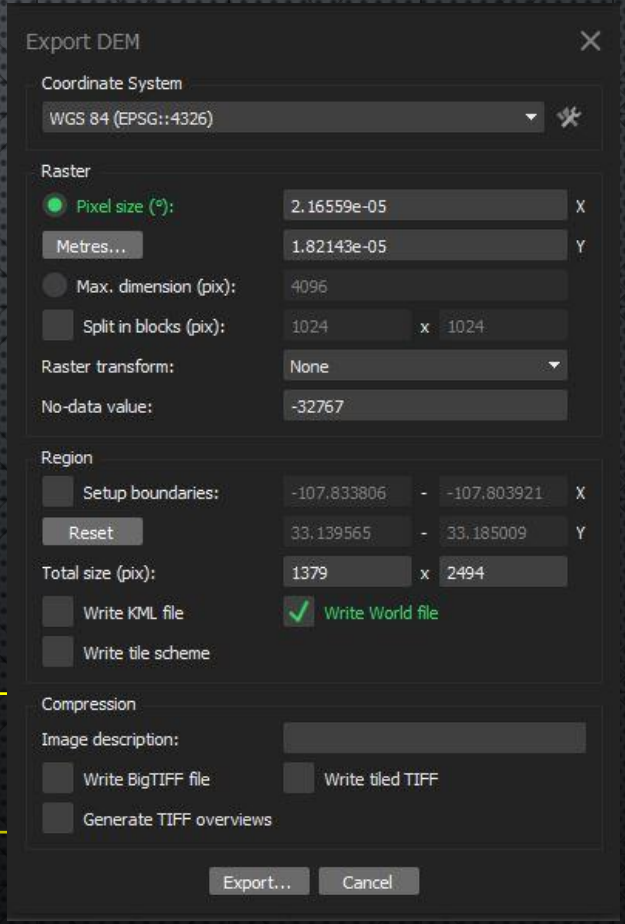


EXPORTING DEM

Only export if needed, a BAER team may request

Click File > Export > Export DEM, Export TIFF/BIL/XYZ

Match ALL of the settings to the right. Click Export and save as TIFF file in next popup.

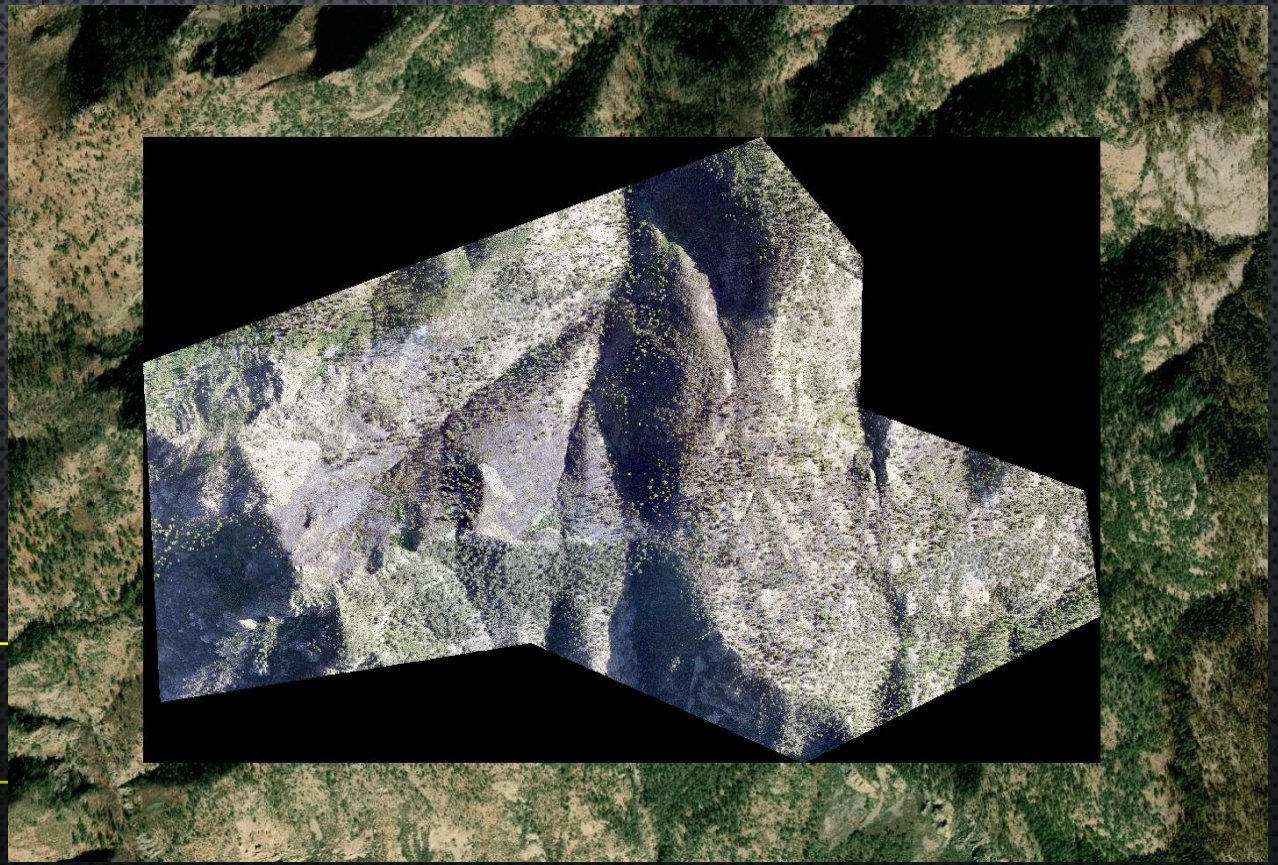


FINISHED

This concludes processing of fire imagery
You should be able to do basic processing and produce simple products
The exports can now be brought into Arc and developed into usable data

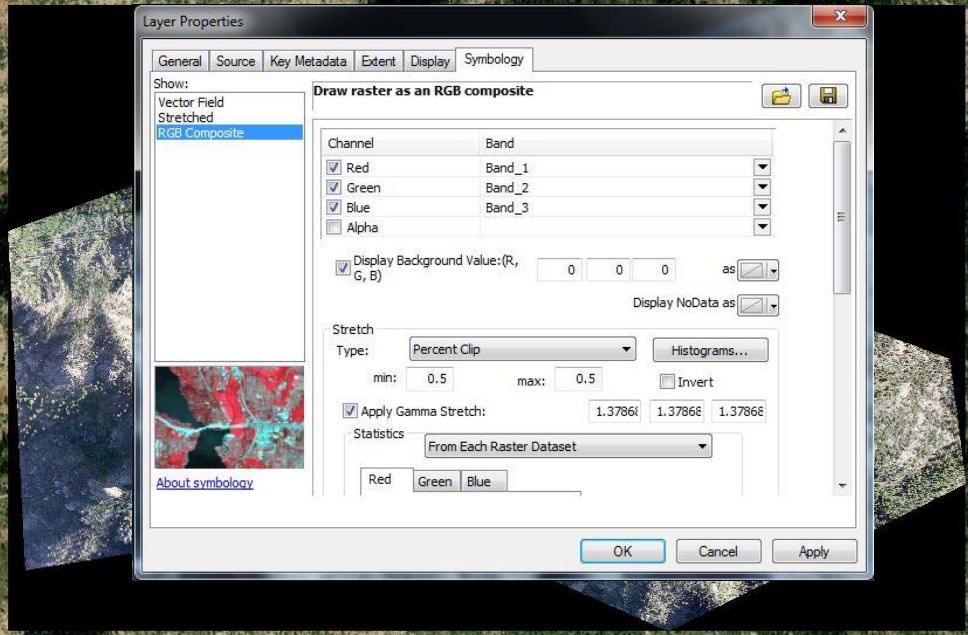
ARC TIPS

Note that Metashape will always export a square or rectangle.



ARC TIPS

Left click layer and properties. Under symbology tab check the box for Display Background Value. Click Apply and OK.



ARC TIPS

Now the new imagery is over layed on the Basemap.

REVIEW

- Students have seen the workflow for processing photos
- Students understand how to sort photos
- Students can convert thermal images for viewing
- Students can setup Metashape and process images
- Students can export products from Metashape

Questions