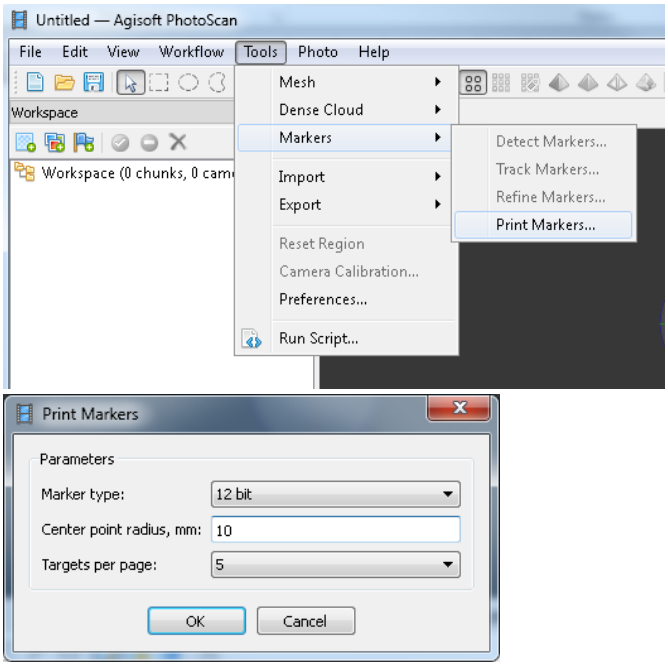
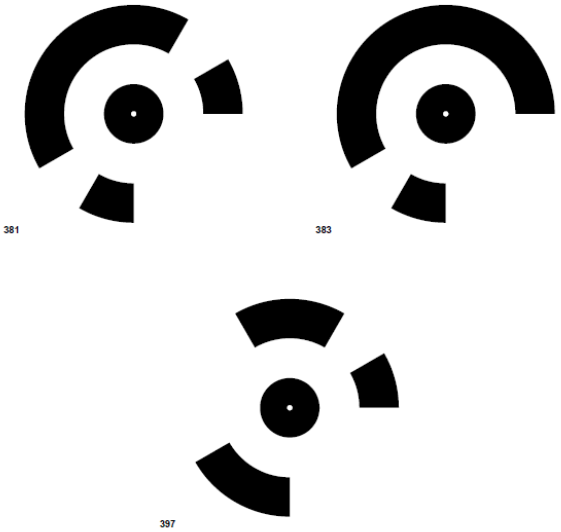
This short guide shows how to use 3 of PhotoScan's coded targets placed on the floor to orient and scale your scene. The required equipment is a printer to print the targets, and a tape measure to find the distances between them!

1. In PhotoScan Pro , use the Tools->Markers->Print Markers menu to create a PDF file of markers. Accept the default options of, 12 bit, 10mm radius, and 5 per page.

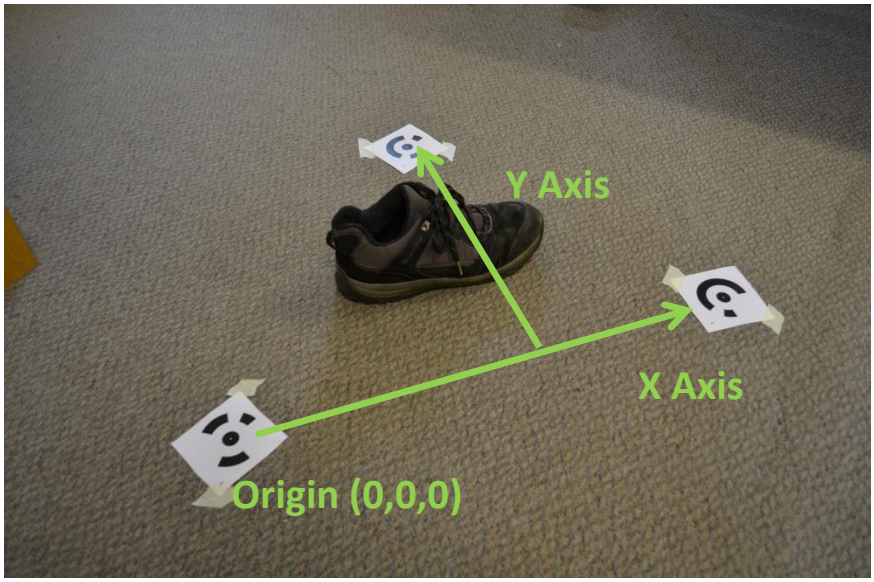


2. Open the PDF file, print a single page from somewhere near the middle, and cut out 3 of the markers:

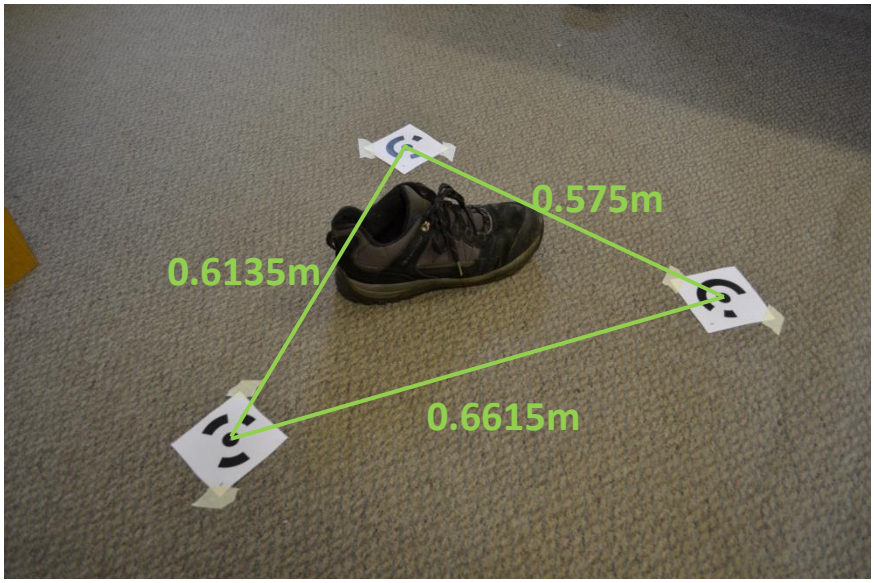


3. Place the 3 markers on the ground around the object you are scanning, in an approximately equilateral triangle. One of these triangles will define your coordinate system origin (0,0,0), another the direction of the X axis, and the 3rd the XY plane. Place your object in the scene

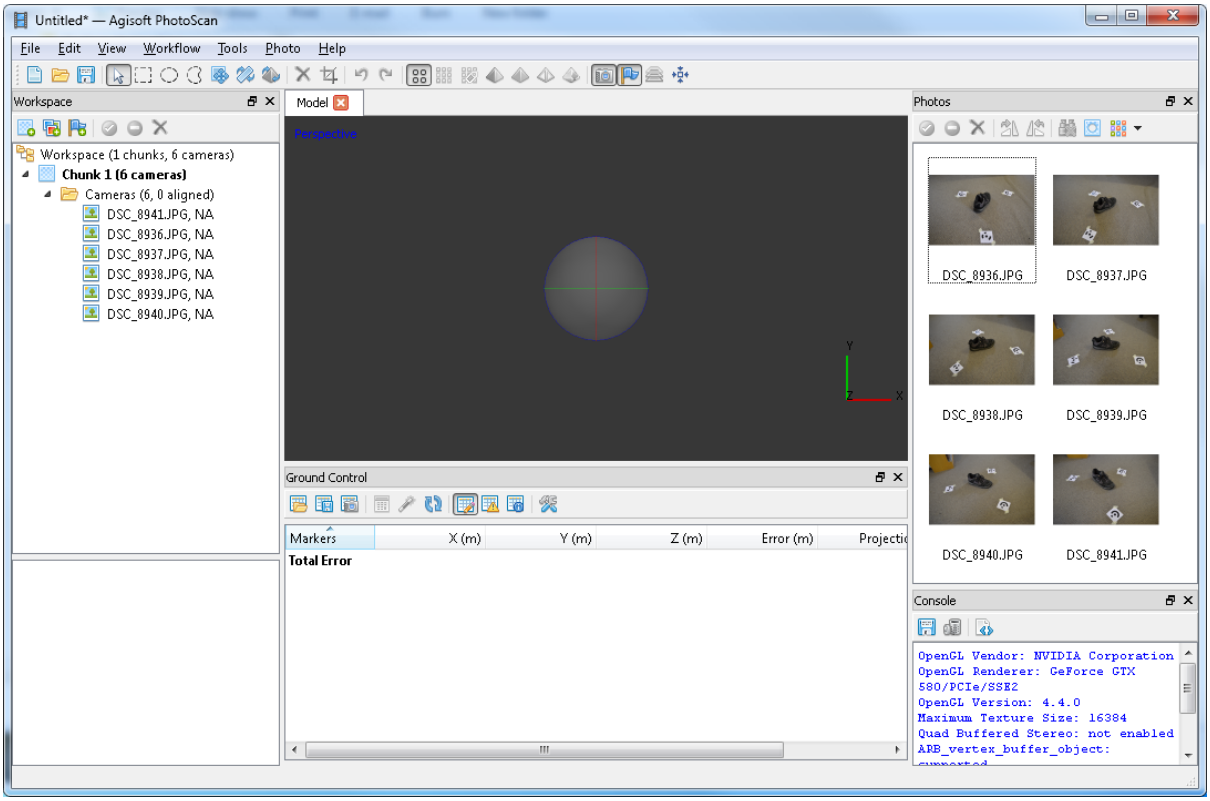
aligned to the 2 markers that will define the X axis.



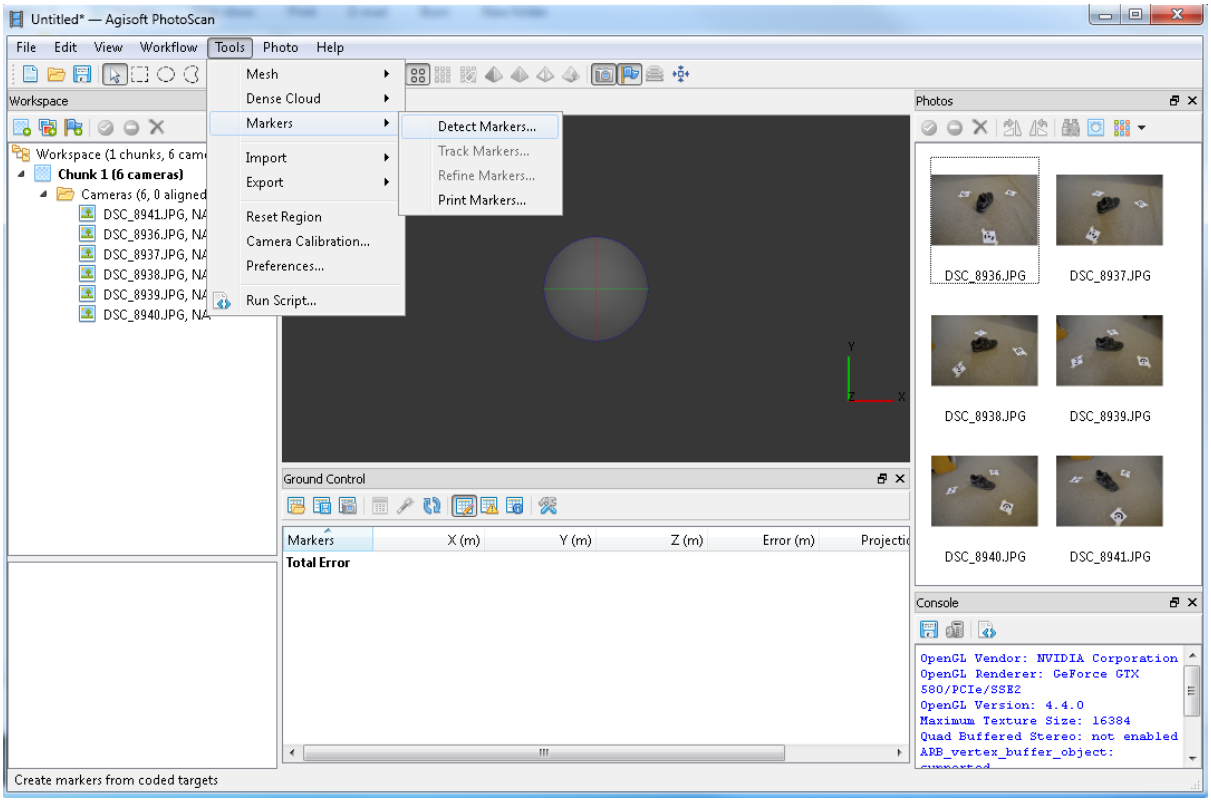
4. Measure the distances between each pair of markers using a tape measure, nearest millimetre or even half millimetre is not really necessary, but the more accurate the better the result will be.

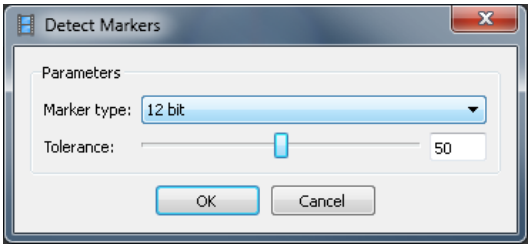


5. Take some photos of your object, including the 3 markers and import to the PhotoScan.

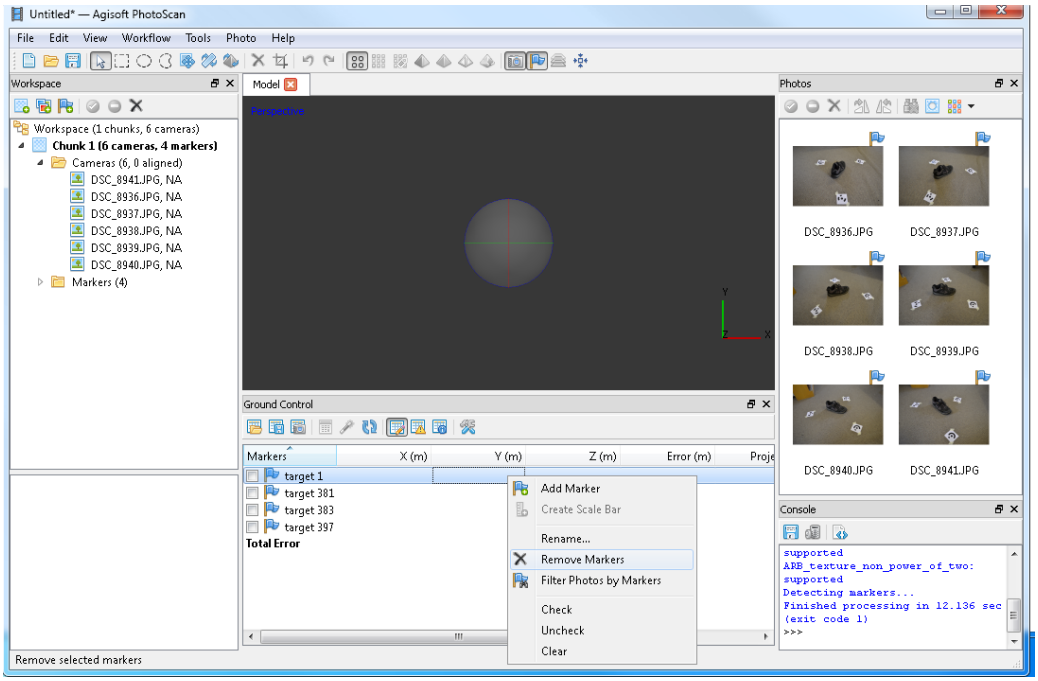


6. Use Tools->Markers->Detect Markers to identify the markers positions in each photo, and accept the default options:



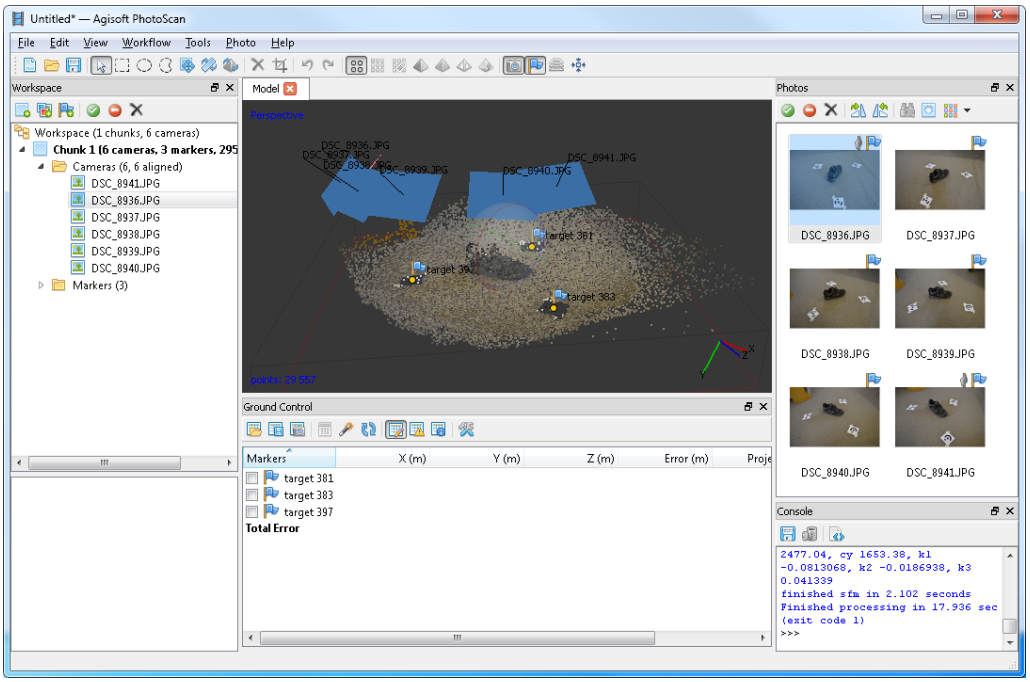


7. The detected markers will be shown in the ground control pane. Check that the numbers correspond with the markers you placed in the scene. In this case PhotoScan has identified an erroneous ‘target 1’, so remove it:



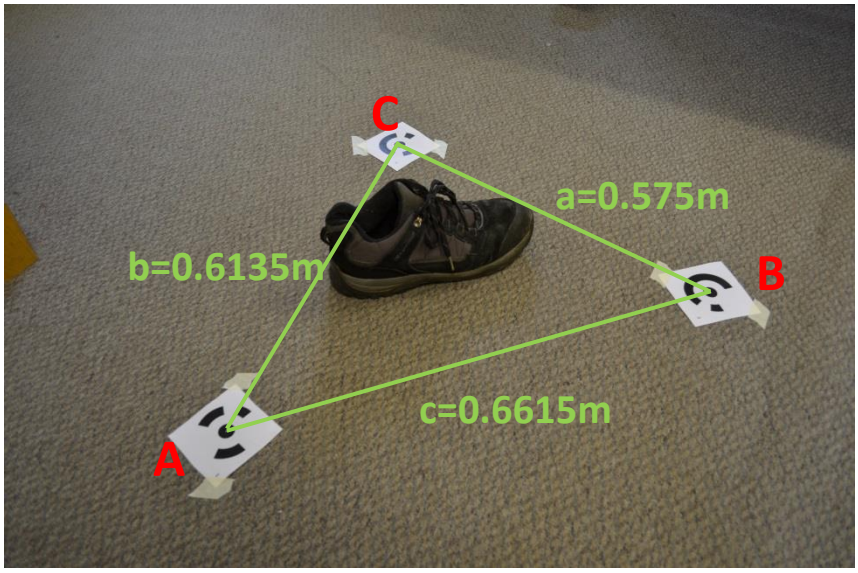
8. Then check the remaining markers have been correctly placed in all photos, and adjust if necessary.

9. Align your photos using your own favourite method, and check that the markers appear in the correct position in the 3D model view:



10. Now a little bit of maths to work out the coordinates of the 3 markers!

We will name the 3 sides of the triangle a, b and c, and the points opposite each side A, B and C:



We know already that **point A** will be our origin, so the coordinates are simply **(0, 0, 0)**

We know that **point B** defines the direction of the X Axis so the coordinates will be (c, 0, 0), in this case **(0.6615, 0, 0)**

To calculate the coordinates of **point C** we need to find the angle at **point A**, which requires the Cosine Rule:

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

So the angle at A =

$$A = \cos^{-1}\frac{b^2 + c^2 - a^2}{2bc}$$

Then the X coordinate of point C is given by

$$b\cos A$$

And the Y coordinate of point C is given by

$$b\sin A$$

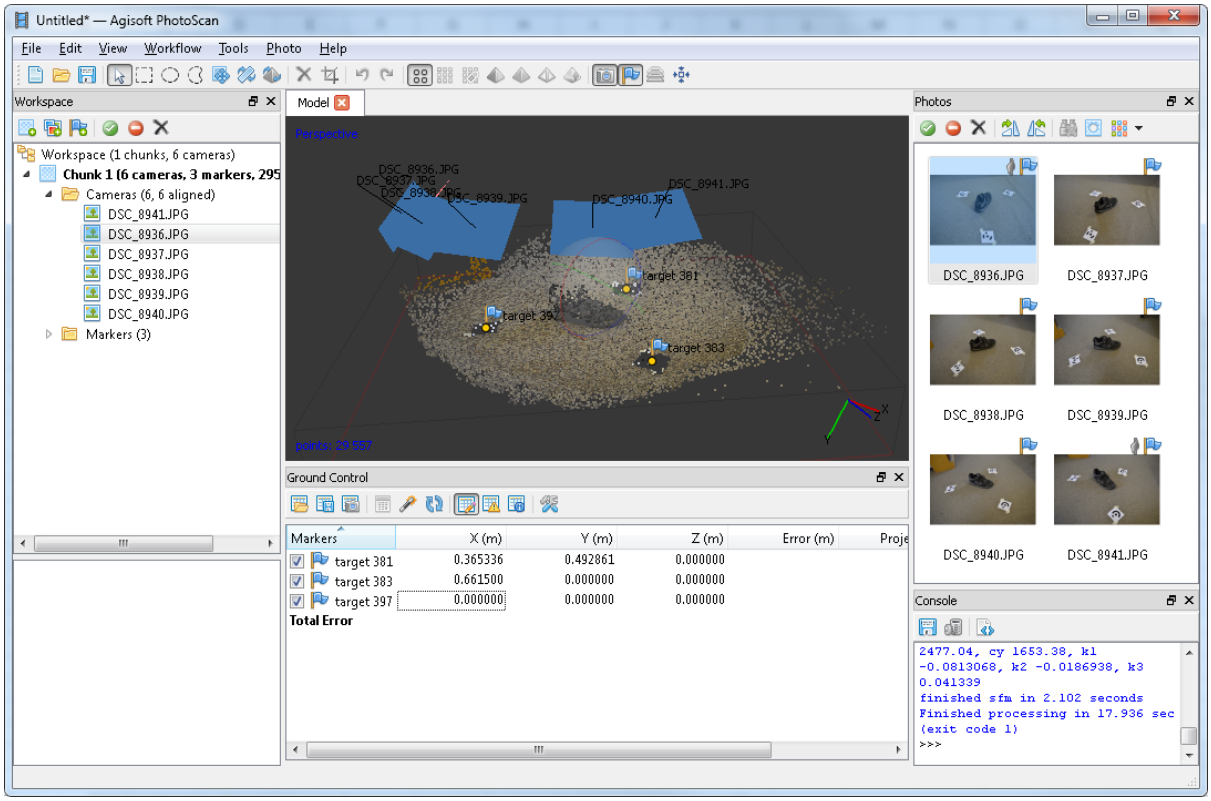
And we know b = 0.6135, and it's on the floor so Z = 0, so the coordinates of **point B** are **(0.6135 cos A, 0.6135 sin A, 0)**

This is all a bit laborious so I created an excel sheet to do it for you on dropbox here: https://db.tt/WCZexxWg

		distance (m)		
	a	0.575	m	
	b	0.6135	m	<- Enter edge lengths here in meters
	c	0.6615	m	
		radians	degrees	
	Angle @A	0.932915	61.41586	
		x	y	z
Target 397	A position	0	0	0
Target 383	B position	0.6615	0	0
Target 381	C position	0.365336	0.492861	0

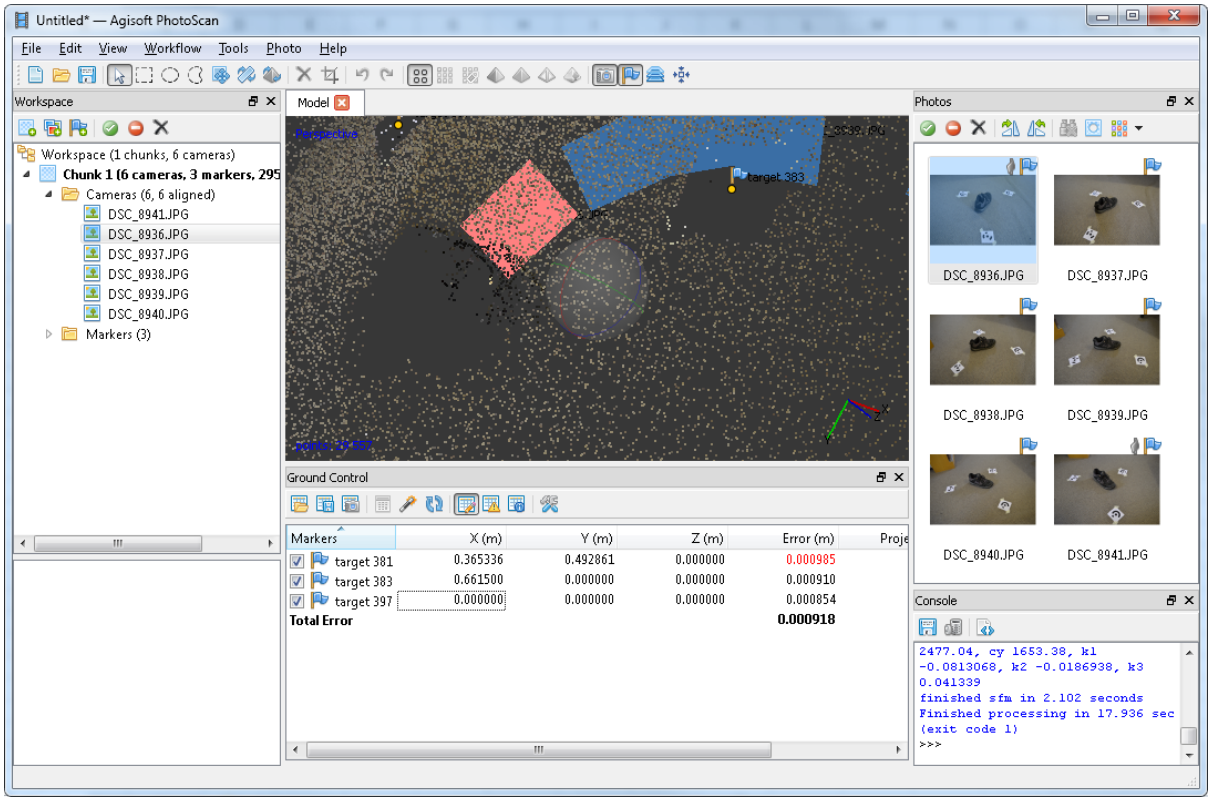
11. Enter the coordinates into the appropriate spaces in the ground control pane in PhotoScan Pro. Note: they may not be in the same order as shown in the excel sheet, so work out which

markers correspond to A, B and C:

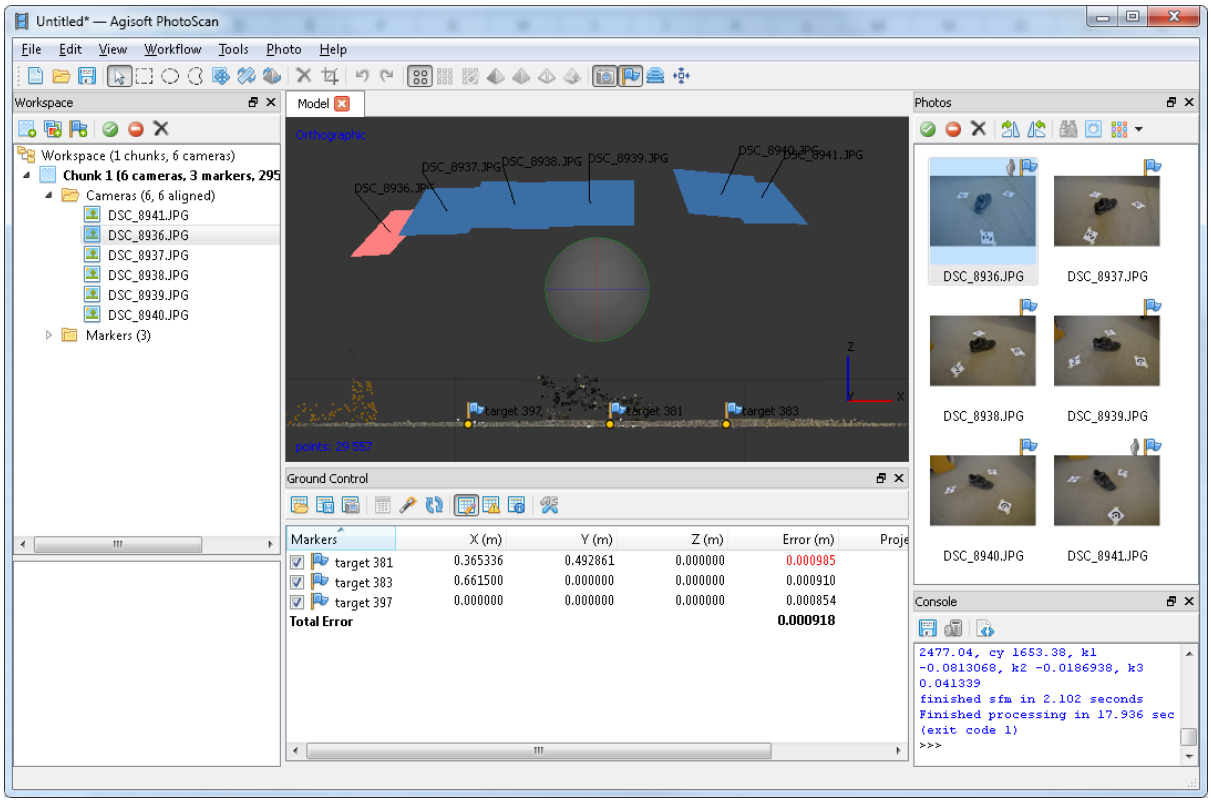


12. Click the update button ( ) in the ground control pane. This will scale and orient your scene based on the coordinates you entered. You should see very tiny error values if you have done everything correctly. If you have errors larger than a few millimetres you have probably either ‘mismeasured’ a distance, entered it in the calculations incorrectly, entered the ground control coordinates incorrectly, mixed up one marker with another somewhere

along the line, or PhotoScan misidentified one of the markers in the detect markers phase.

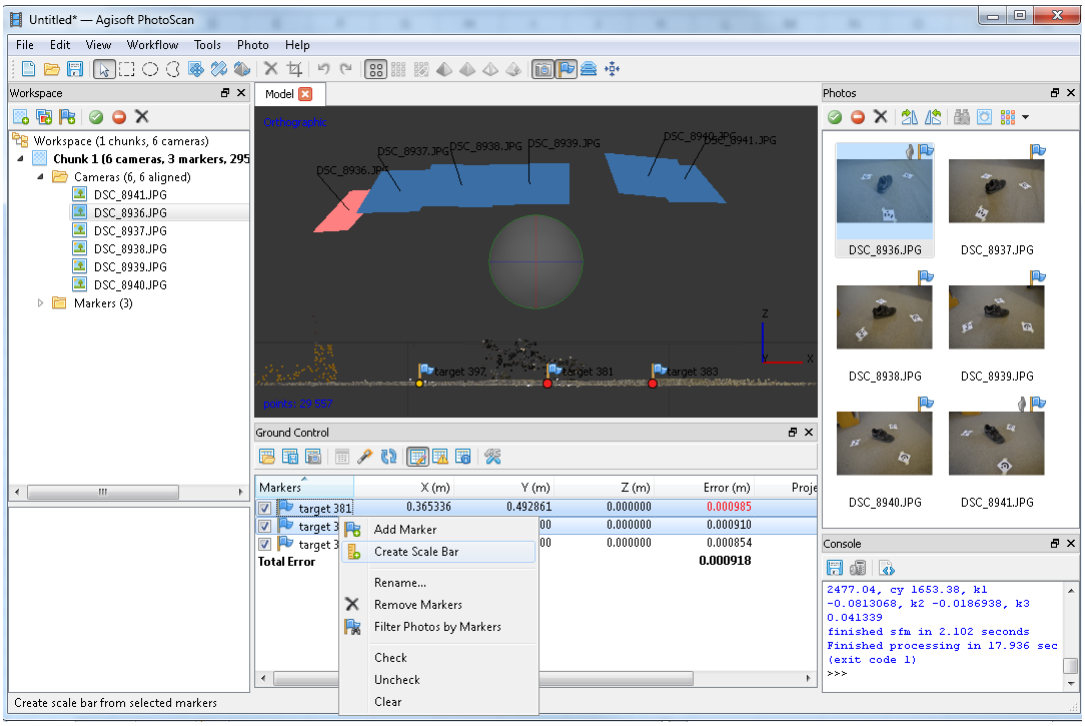


13. Now you can hit Numpad keys 7 (top), 1 (front) and 3 (right) to test that the object is aligned correctly in your new coordinate system. Use numpad key 5 to switch to orthographic view too:

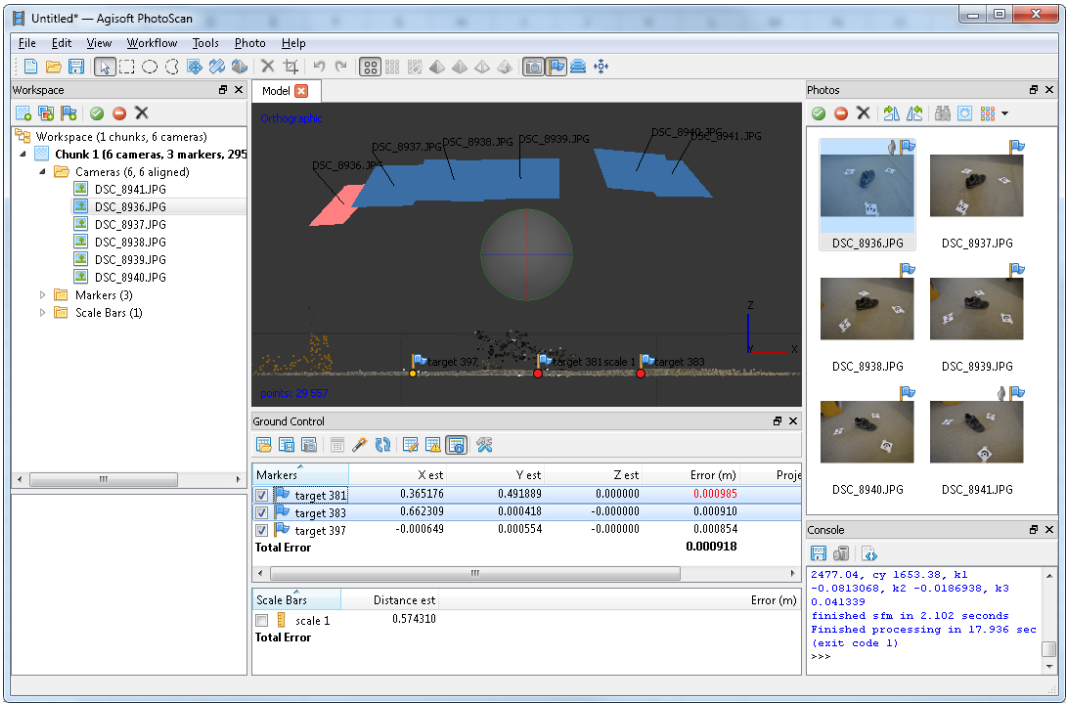


14. Finally to check the validity of your results, you can create scale bars between each pair of markers, and switch to estimated values in ground control to confirm that the

measurements match those taken with the tape measure. To create a scale bar, select 2 markers, right click and select ‘Create Scale Bar’:

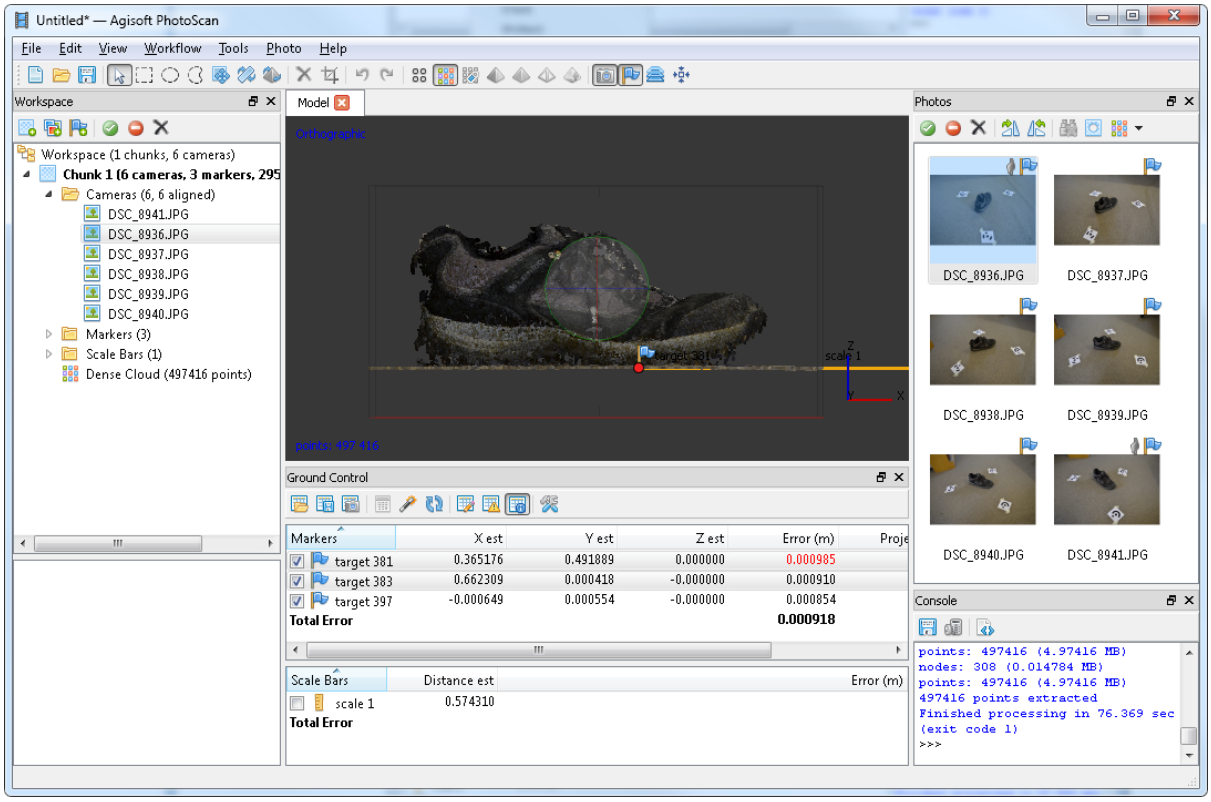


15. Then if it isn’t visible, you will need to drag up the scale bar pane from the bottom of the ground control pane. Switch to estimated values ( ) and confirm that the distance is somewhere very close to that measured. In this case it is within 1mm which is decent enough. You could repeat this for the other distances if you like.

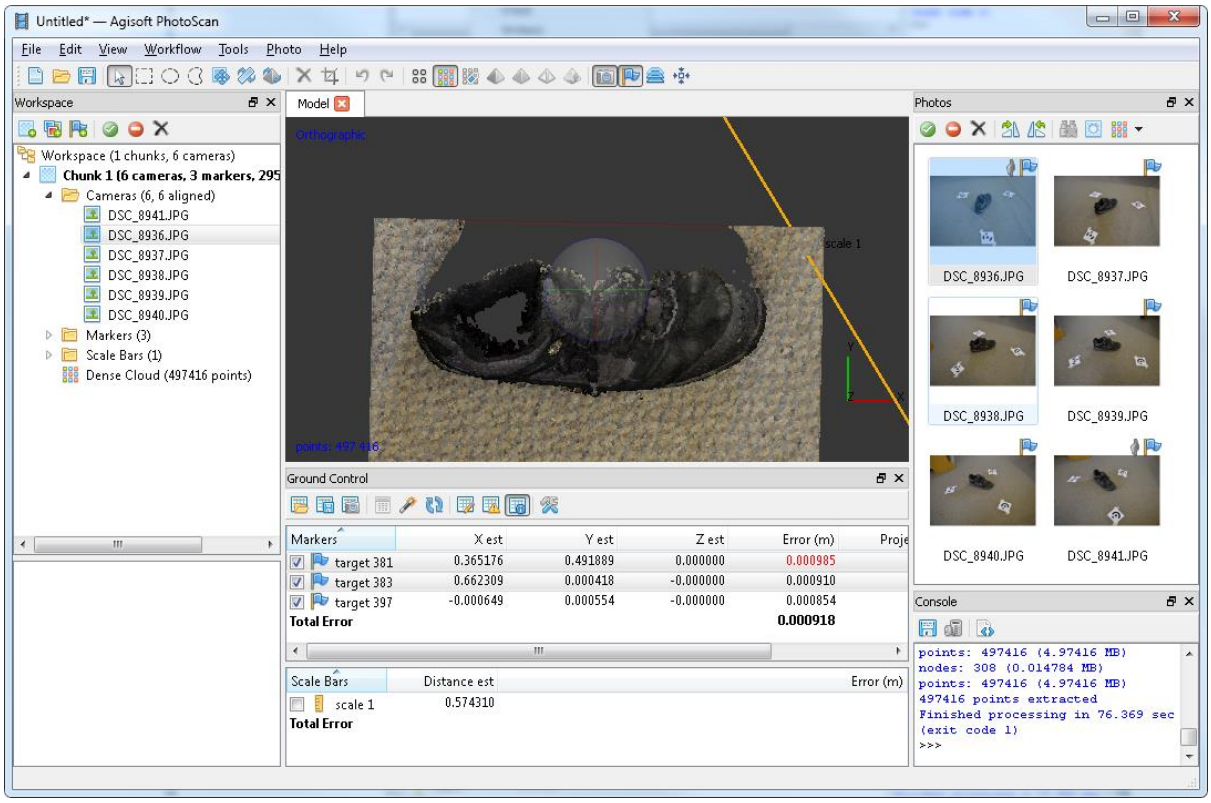


16. You can now proceed to build your dense cloud and mesh etc, but you could also do that before performing steps 6-15 above if desired:

Front:


Untitled* — Agisoft PhotoScan
File Edit View Workflow Tools Photo Help
Workspace
Workspace (1 chunks, 6 cameras)
Chunk 1 (6 cameras, 3 markers, 295
Cameras (6, 6 aligned)
DSC_8941.JPG
DSC_8936.JPG
DSC_8937.JPG
DSC_8938.JPG
DSC_8939.JPG
DSC_8940.JPG
Markers (3)
Scale Bars (1)
Dense Cloud (497416 points)
Model
Orthographic
target 381
scale 1
points: 497 416
Photos
DSC_8936.JPG
DSC_8937.JPG
DSC_8938.JPG
DSC_8939.JPG
DSC_8940.JPG
DSC_8941.JPG
Ground Control
Markers X est Y est Z est Error (m) Proje
target 381 0.365176 0.491889 0.000000 0.000985
target 383 0.662309 0.000418 -0.000000 0.000910
target 397 -0.000649 0.000554 -0.000000 0.000854
Total Error 0.000918
Scale Bars Distance est Error (m)
scale 1 0.574310
Total Error
Console
points: 497416 (4.97416 MB)
nodes: 308 (0.014784 MB)
points: 497416 (4.97416 MB)
497416 points extracted
Finished processing in 76.369 sec
(exit code 1)
>>>

Top: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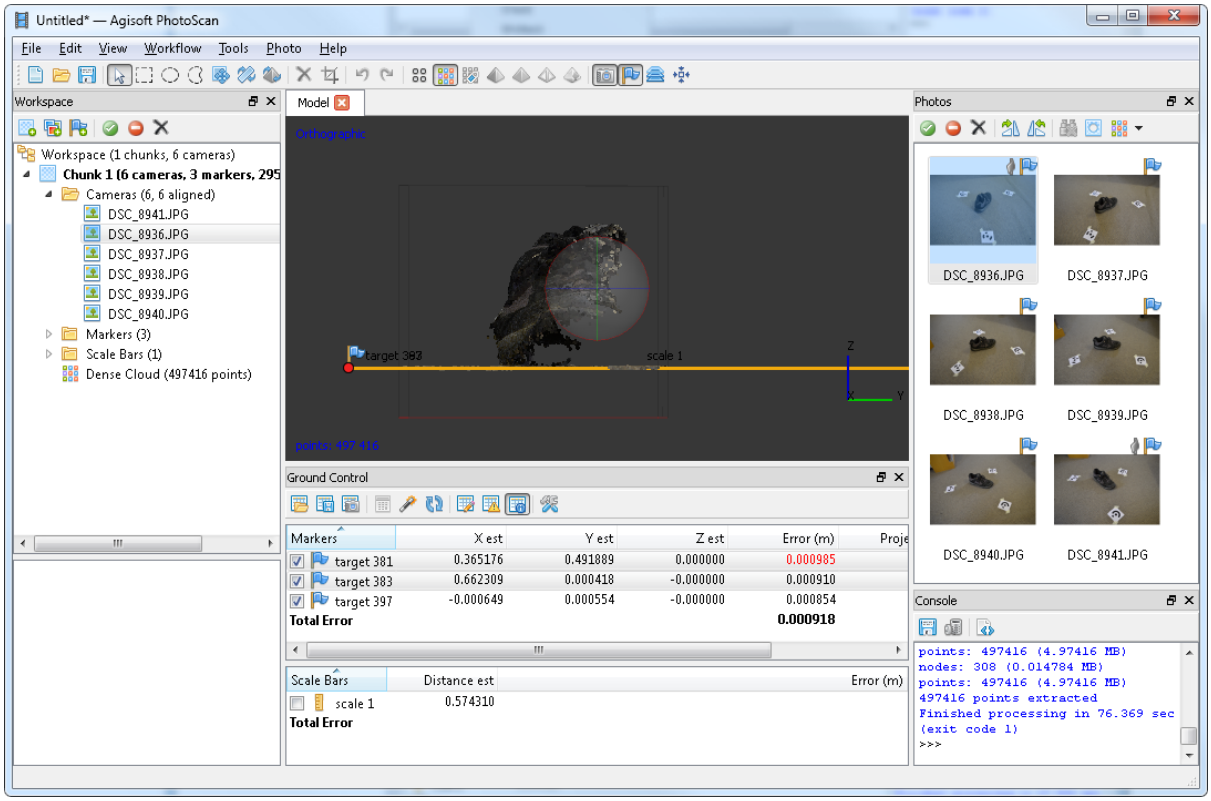
nodes: 308 (0.014784 MB)
points: 497416 (4.97416 MB)
497416 points extracted
Finished processing in 76.369 sec
(exit code 1)
>>>

Right:



17. If this is a set up that you are likely to repeat, and you can be sure that the markers will not move, then you can export ( ) these marker coordinates, and simply import them into your next project rather than entering manually. You do not need to export orientations or estimated values, although orientations may be useful if using a multiple fixed camera rig.