University of Isfahan

Geomatics and Surveying Departmant

Software Tutorials

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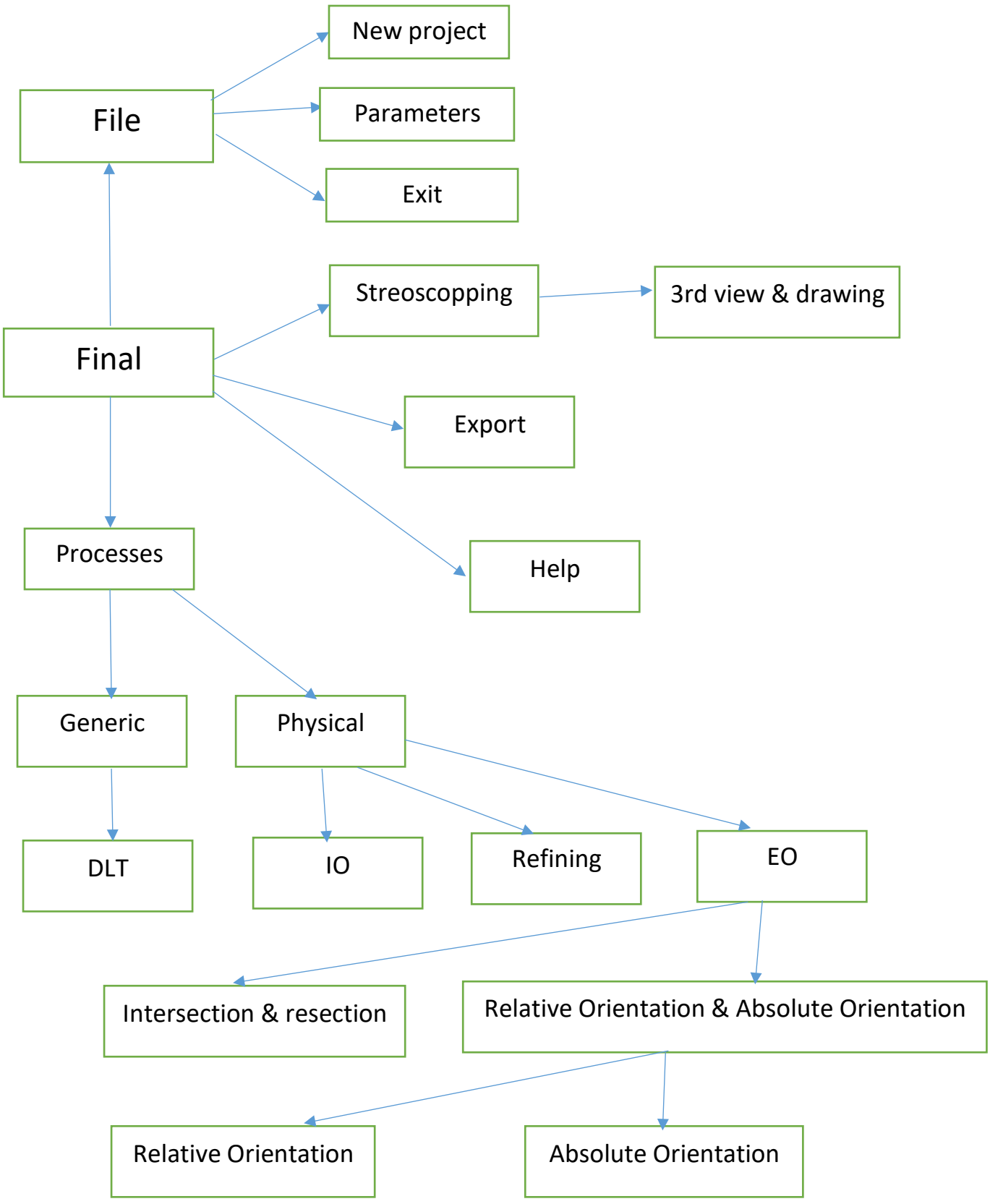
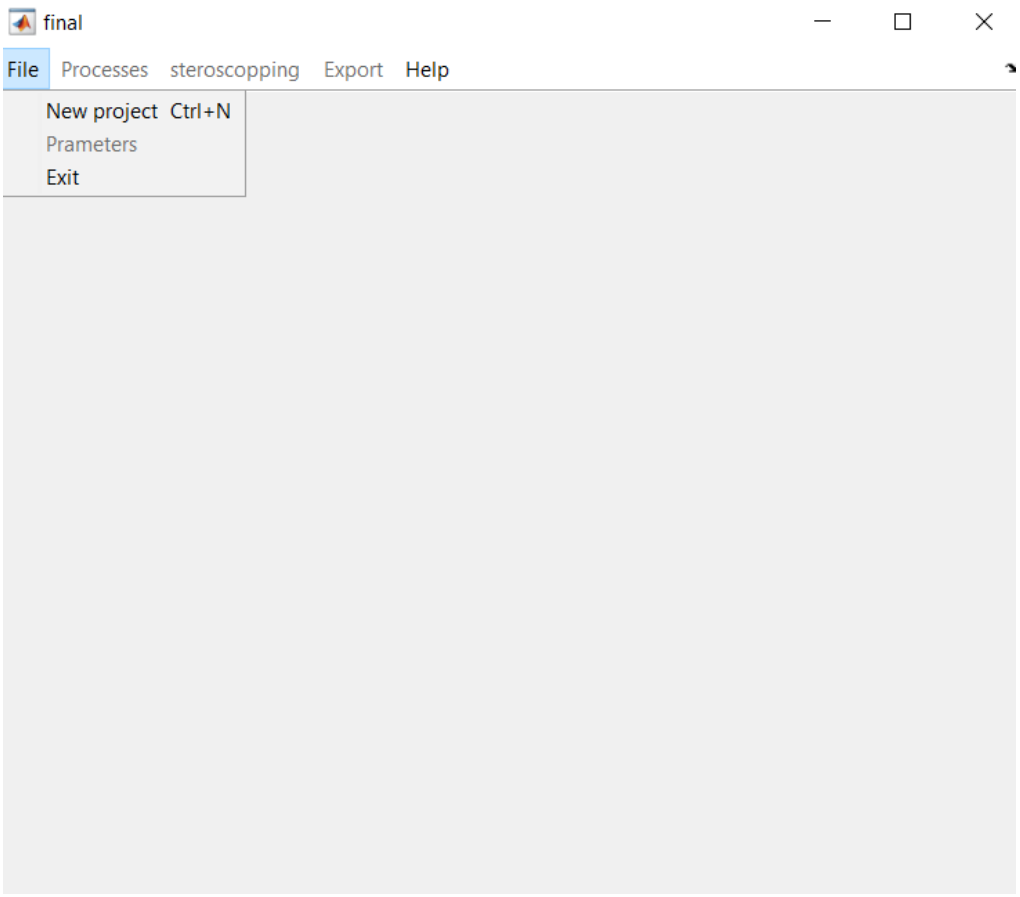
General Structure

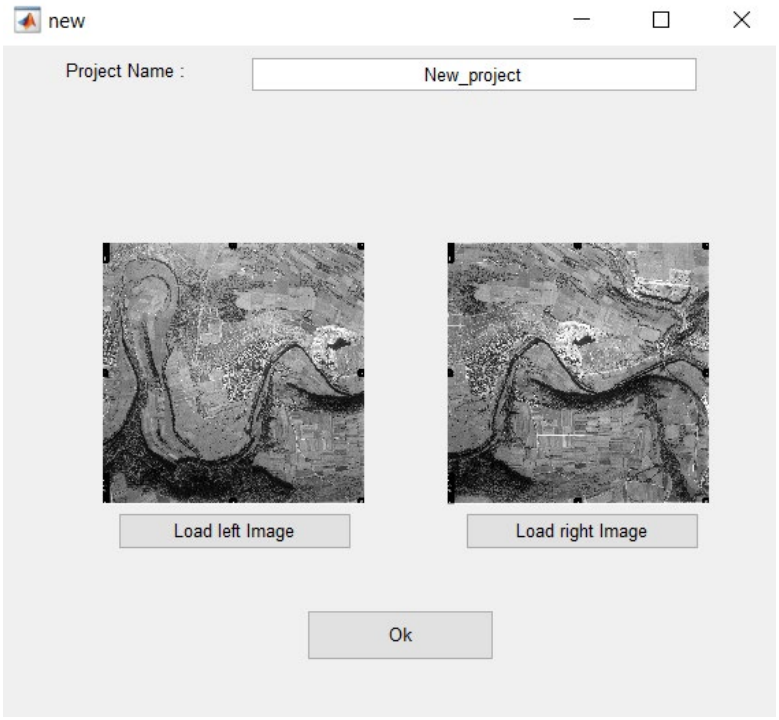


Starting program

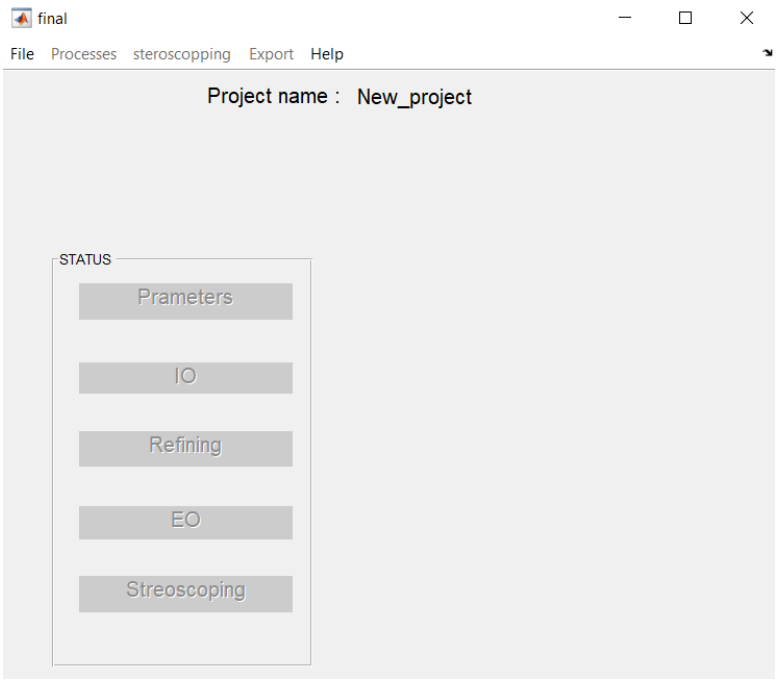
After opening the software, a screen like the one below will open, in order to create a new project, you must select the New project option from the File section or press Ctrl+N.



By choosing the above option, a window will open where you have to define a name for the project and open two photos (Dataset Folder).

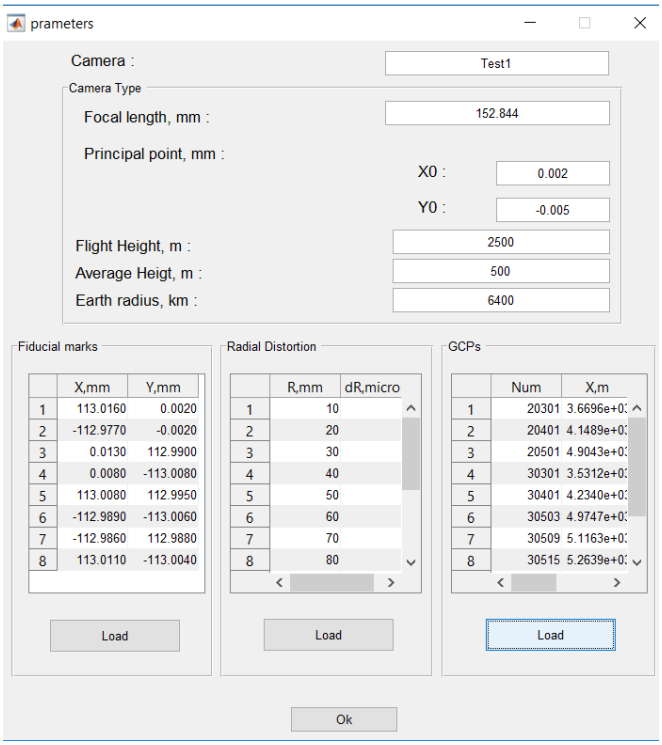


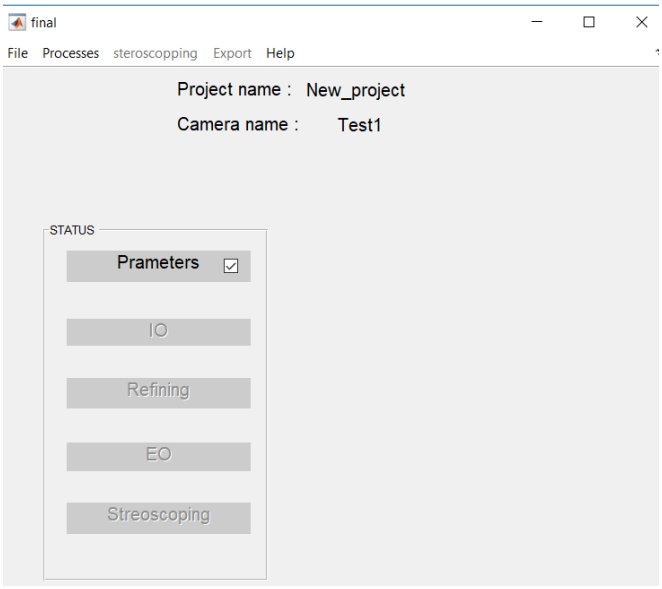
By pressing Ok, you will return to the first page. At this stage, the project name and stages are shown, and since no stage has been completed, all the stages are turned off.



To introduce the parameters, select Parameters from the File menu. In the opened page, we enter the name of the camera, the focal length, the principal point offset, the flight height, the average height of the area, the radius of the ground, the fiducial marks file, the radial distortion file and the GCPs file and click OK.

By clicking OK and returning to the main screen, the Pramaters option is activated and the name of the camera is displayed. The Processes menu is also activated.



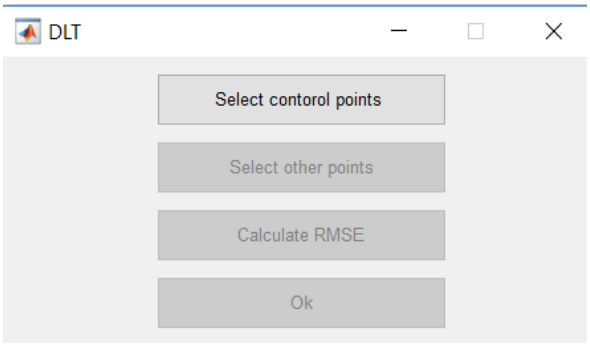


DLT

1. Two approaches can be used to reach the ground space.
2. General equations → DLT
3. Physical equations

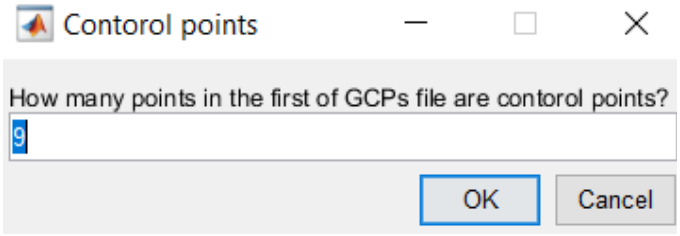
To use DLT, we go through the following steps

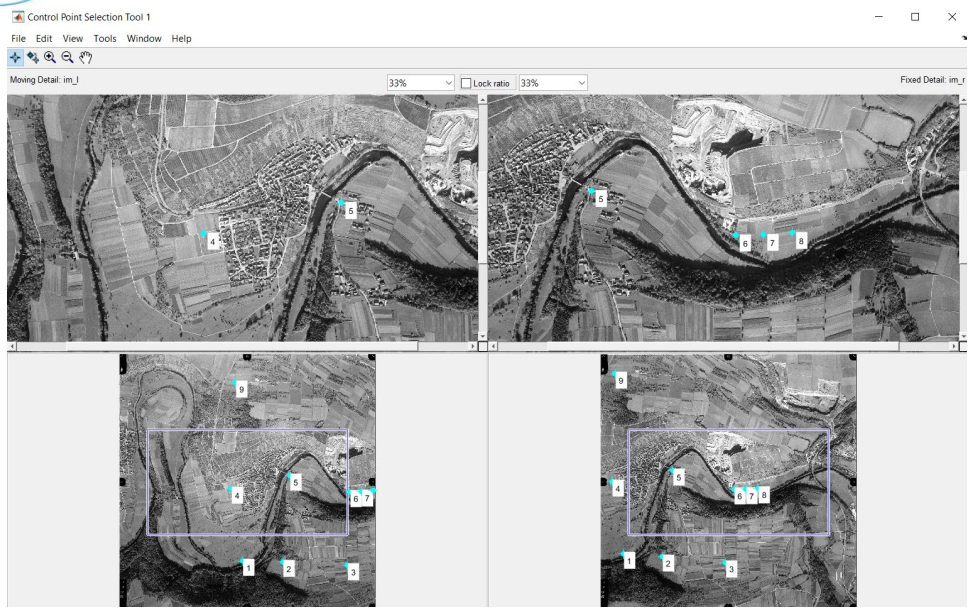
Processes→Generic→DLT



By selecting the first option, a window will open that will receive the number of control points that are at the beginning of the GCPs file, and then enter a window to select them on two images.

It should be noted that the points are entered in the same order as they are in the file and in the same number as entered.



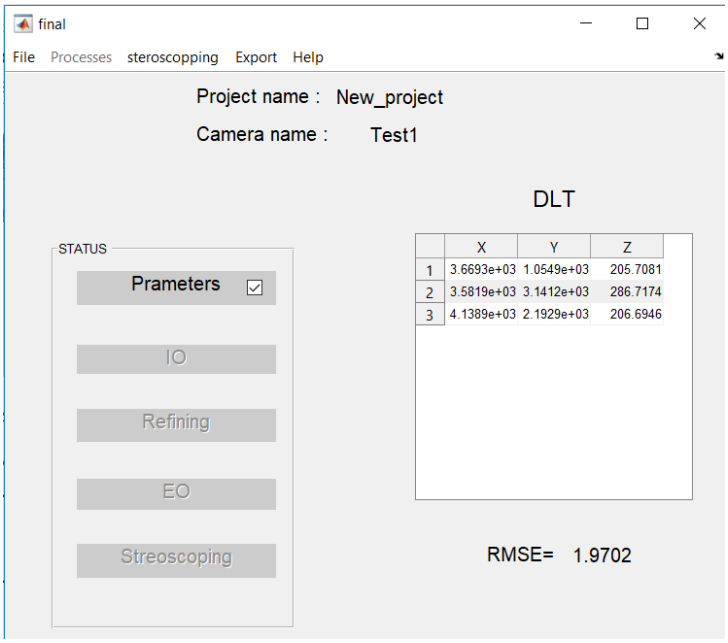


In this window, we first do the necessary zoom, then click  and specify the point on the two images. After selecting two points, to select the third point, we can use  that by selecting on one image, it will show us the approximate location on the other image, which can be transferred to its original location with a slight change.

After selecting all the necessary points, we close the window and select the next options that have been activated and select the points in the same way and exit.

At the end, we press OK to return to the main page. On this page, the table of points and also the RMSE (if the option is selected and the operation is performed) are shown to us.

Export and Stereoscoping menus are also activated.


final
File
Processes
steroscopping
Export
Help
Project name : New_project
Camera name : Test1
DLT
X
Y
Z
1 3.6693e+03 1.0549e+03 205.7081
2 3.5819e+03 3.1412e+03 286.7174
3 4.1389e+03 2.1929e+03 206.6946
STATUS
Prameters
IO
Refining
EO
Streoscoping
RMSE= 1.9702

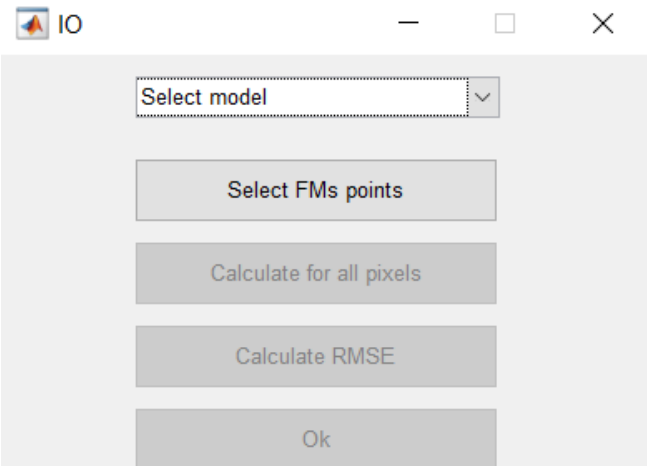
Physical equations

In this model, there are two methods: 1. intersection and resection 2. relative orientation and then absolute orientation.

First, for both methods, we must do internal orientation. For this, we go through the following steps.

Processes→Physical→IO

In the opened window, we have to select the model and select the number of fiducial marks and its location like DLT, and then by clicking on the Calculate for all pixels option, internal orientation is done for all pixels, and if needed, we can calculate the RMSE of the method.

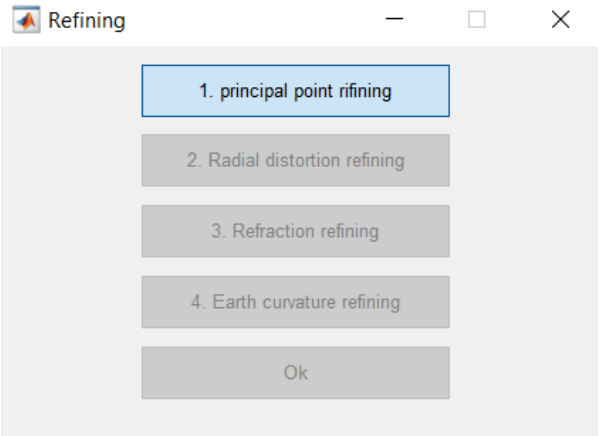


After doing OK, we return to the main screen where the IO option is ticked and the Export menu is activated, and the Refining option is activated in the Processes menu in the Physical section, which is related to refining.

Refinement consists of four stages that refine the internal justification in the previous stage.

These four steps are as follows.

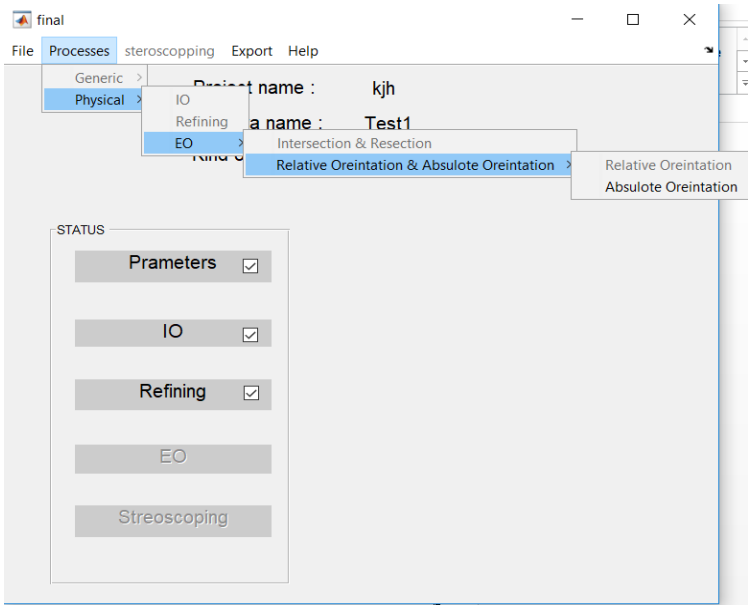
1. principal point refining 2. Radial distortion 3. Refraction 4. Earth curvature

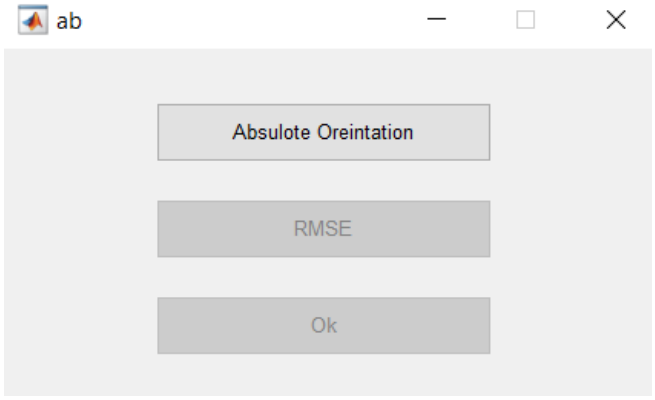


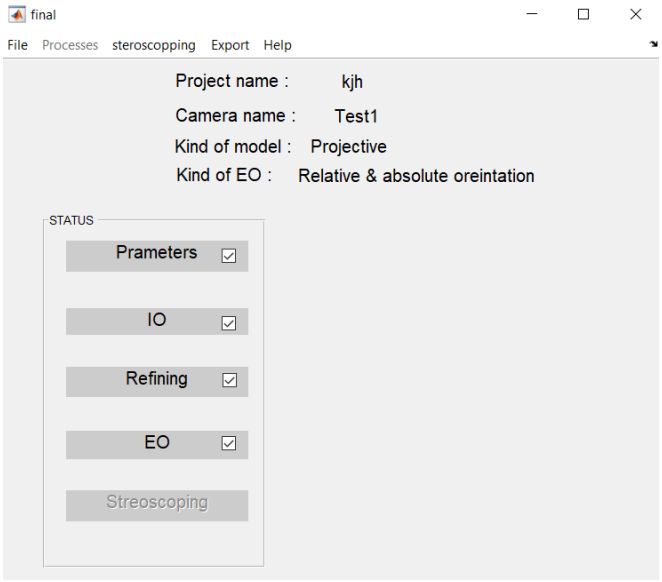
After clicking OK, as in the previous step, we will return to the main page and the filter check will be activated, and EO will be turned on in the Processes menu, and the option to get the output in Export will be activated (the following is the same).

In the stage of external orientation, one of the 2 mentioned approaches can be used. (The steps are the same as before).

In the following figures, relative orientation is done and then absolute orientation is done.







Streoscopping

After completing the DLT steps, or intersection and resection, or relative and absolute orientatiob, the Streoscopping menu will be activated, by selecting the 3^d viewing & drawing option in this menu, a window will open and two photos will be displayed in it with appropriate zoom. We select a common point on both pictures and then click 3^d viewing & drawing and enter a window size to show us the area around that common point in both images.

With the help of parallax and zoom tools, we fix the parallax of an area and then start drawing.

When drawing polygons, when we reach the last vertex, it is enough to double-click so that the software itself connects the last vertex to the beginning vertex.

In drawing the lines, we put a point and drag it along the desired direction, the line is drawn by releasing the mouse.

For unknown complications, we can draw as desired by moving the mouse.

Point effects are determined by clicking.

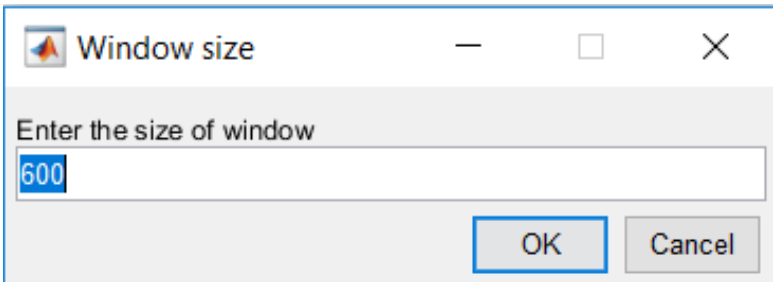
By selecting the shape and dragging it the shape will be moved, we can delete it by right-clicking on it.

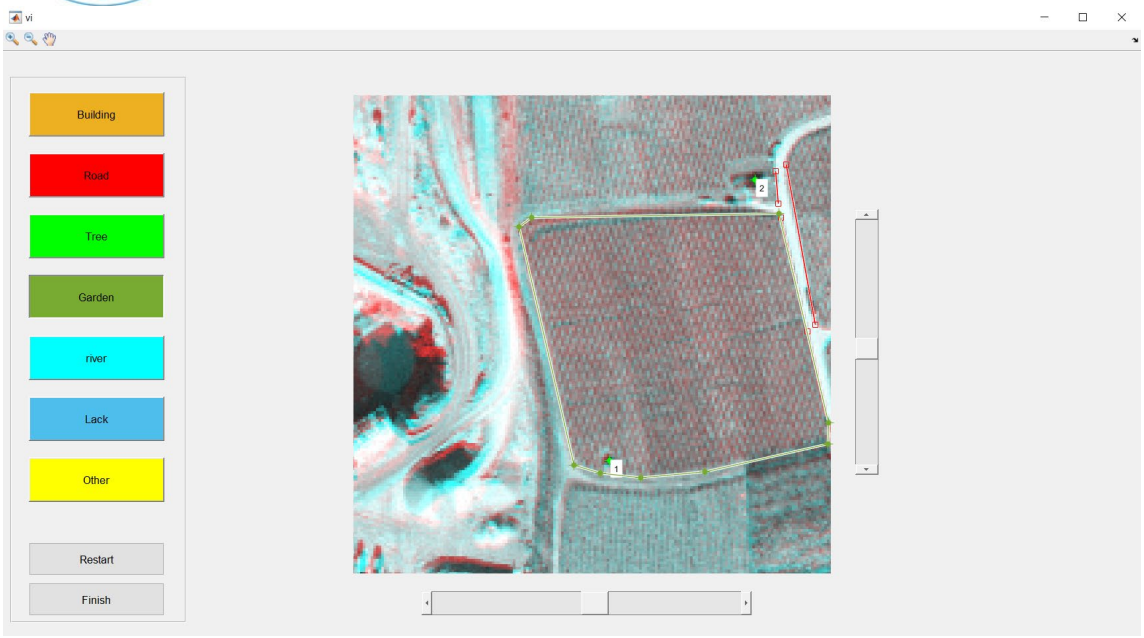
If we want to draw several features of the same type continuously, it is enough to press a button after finishing the drawing without clicking, so that the command will be executed again.

At the end, we press Finish and we return to the main screen where the option related to Streoscopping is activated.

By returning to this page, the Export menu is also activated for the Streoscopping, and by selecting it, the drawing coordinates will be taken to the ground coordinates according to the model that has been made and can be output from it.

In the saved file, the points with code one, building, code two, road, code three, tree, code four, green space, code five, river, code six, lake and code seven are also related to other complications.



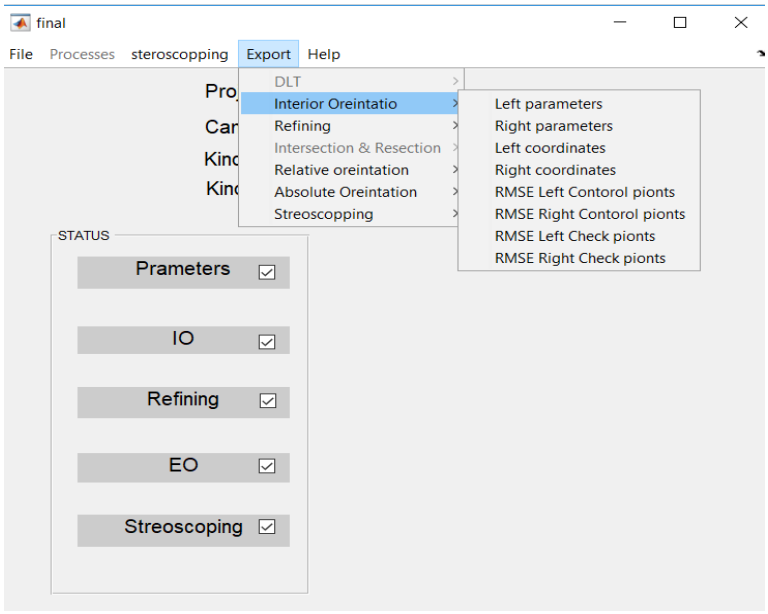

vi
Building
Road
Tree
Garden
river
Lack
Other
Restart
Finish
2
1

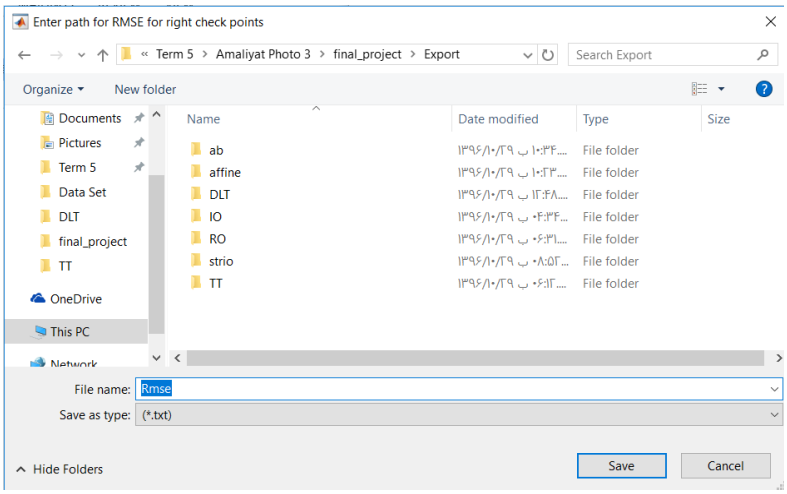
Export

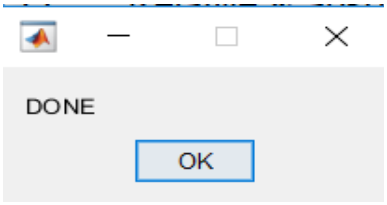
In each of the Processes sub-menus, after performing operations, the corresponding section is activated in the Export menu.

By clicking on the desired output, a window will be opened and the path and name of the file will be received.

By clicking OK and the Done, message appears, the text file (txt) will be saved in the selected path with a specified name.







FMs, radial distortion & GCPs files should be in the following format.

fiducial - Notepad

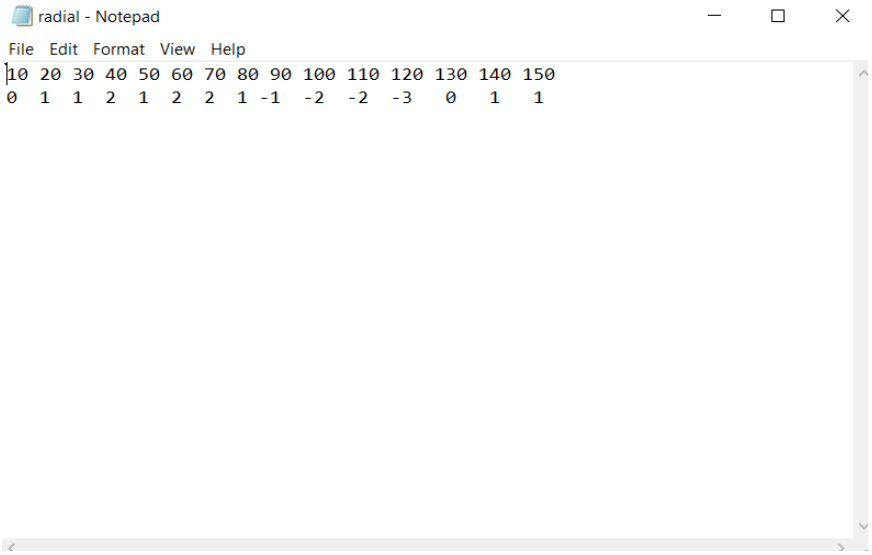
File Edit Format View Help

```
1    113.016          0.002
2   -112.977         -0.002
3      0.013        112.990
4      0.008       -113.008
5    113.008        112.995
6   -112.989       -113.006
7   -112.986        112.988
8    113.011       -113.004
```

GCPs - Notepad

File Edit Format View Help

```
20301          3669.625       1056.095       206.590
20401          4148.929       1052.744       238.586
20501          4904.337       1028.159       279.611
30301          3531.229       1924.968       228.451
30401          4233.988       2082.032       207.522
30503          4974.747       1885.084       203.982
30509          5116.276       1893.884       204.363
30515          5263.854       1908.858       203.588
40301          3581.991       3142.414       285.436
40401          4211.716       3182.034       277.742
40504          5250.683       3373.181       225.300
```



Outputs

DLT .١

Point id	X	Y	Z
20301	3669.2503	1054.9377	205.70809
40301	3581.8651	3141.2066	286.71737
Optional	4138.8554	2192.8552	206.69475

Parameters	Left image	Right image
L1	0.89972104	-
L2	-0.0030966447	-
L3	-0.62457109	-
L4	-1861.43	-
L5	0.019980933	-
L6	-0.88932549	-
L7	-0.62865587	-
L8	3190.1788	-
L9	1.1488989e-05	-
L10	-4.5076546e-06	-
L11	-0.00044838521	-
L'1	-	0.86383336
L'2	-	0.013689996
L'3	-	-0.61753549
L'4	-	-2821.6951
L'5	-	0.042930022
L'6	-	-0.87447317
L'7	-	-0.57957985
L'8	-	2947.6585
L'9	-	6.4854854e-06
L'10	-	-1.3953709e-05
L'11	-	-0.00043646728

2. Internal orientation (affine)

	Left image	Right image
a	-0.00043646728	115.028505665722
b	-2.37528183054018e-05	4.60503010981600e-06
c	-2.97731502580890e-05	-2.97836968929700e-05
d	-0.0800496031785867	-0.0800495926319518
e	-115.024276558074	-115.145846654230
f	115.028505665722	115.028460452299
RMSE first step	9.02661622332243e-15	1.20712373766334e-14

# FM	Left image X	Left image Y	Right image X	Right image Y
4	-0.0540542060761311	-112.99002977315	-0.0540825639245099	-112.99002978369
5	113.049538979447	113.032039688164	113.009497697485	113.032024796316
6	-113.010538979447	-113.03203968816	-113.050580261409	-113.03205458001
7	-112.943484773371	112.947990084986	-113.063580261409	112.947945419987
8	112.982484773371	-112.94799008498	113.022497697485	-112.94797520368

3. Refined coordinates (affine)

	K0	K1	K2	K
Radial distortion	5.5572134249749e-05	-1.03551285788e-08	3.777030620582e-13	-
refraction	-	-	-	2.399937132289e-05

# FM	Left image X	Left image Y	Right image X	Right image Y
4	-0.0560589523059466	-112.99459645787	-0.0560873125554478	-112.99459646842
5	113.061753121638	113.051252510217	113.021708464597	113.051239276480
6	-113.026750584901	-113.04125311711	-113.066795242732	-113.04126635179
7	-112.959693728394	112.967199984204	-113.079799405117	112.967150398721
8	112.994697113291	-112.95719770827	113.034713435021	-112.95718119042

4. Intersection and resection

Conformal	Left image	Right image
a	13.2362977446124	12.963509962399
b	-0.0723665460200458	-0.406160985403312
c	3732.80180260552	4904.39189003712

d	1997.299070213	1957.36360418201

External orientation parameters	Left image	Right image
ω	0.00909031665199244	0.0300880896848438
ϕ	0.021060641329168	0.0105890457320775
κ	-0.00383623615551139	-0.0383042077919601
X0	3679.49169955136	4883.6105417681
Y0	2022.41781268244	2033.45801900499
Z0	2245.54673329891	2243.38770914823

Point	**X**	**Y**	**Z**
40301	3582.6927978879	3140.753446976	287.354367657178
40401	4212.35194411761	3182.69951596444	277.111966578739
40504	5252.0245445979	3373.70924597644	225.161155521417

5. Relative and absolute orientation

Relative **orientation** parameters	values
$\Omega 2$	0.019816881
$\phi 2$	-0.010641869
$\kappa 2$	-0.035726019
Y02	0.37748401
Z02	150.64106

Three-dimensional affine	Values
a1	13.4958537496131
a4	-0.0543817908859989
a3	-0.317283777290923

a4	0.0482657011030534
a5	13.4943040111314
a6	0.120661771727761
a7	0.290690117936875
a8	-0.139923818694549
a9	13.5537428089081
a10	3723.13679282744
a11	2003.82567767261
a12	181.400468658638

points	X	Y	Z
40301	3582.6327492618	3138.01855750668	290.312557250742
40401	4211.01170004361	3180.64593858291	278.879545902833
40504	5250.39326945442	3372.76546918957	224.895619869586