No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SURVEY OF BANGLADESH (SOB)

BANGLADESH DIGITAL MAPPING ASSISTANCE PROJECT (BDMAP)

Operation Manuals

1) **Operation Manual for Aerial Triangulation on Match-AT**
2) **Operation Manual for DTM/Orthophoto**
3) **Operation Manual for Digital Plotting**
4) **Activity Report and Operation Manual for GIS Data Management**
5) **Operation Manual for Digital Compilation**

March 2012

Asia Air Survey Co., Ltd.
Aero Asahi Corporation

Bangladesh Digital Mapping Assistance Project (BDMAP)

Operation Manual for Aerial Triangulation

On

MATCH-AT

Ver. 2

August 2011

Introduction

1. General

This Operation Manual is prepared by officers of Survey of Bangladesh who were trained in Bangkok in Thailand for Aerial Triangulation with MATCH-AT as the one of the programs of IDMS project of Bangladesh. They prepared the Operation Manuals during the Factory Training in there. BDMAP made some compilation to the Operation Manuals and made some amendment to make let anybody can understand and operate smoothly without troubles on actual job done.

BDMAP expects SOB that the operation manual should be revised time to time according to the improvement of aerial triangulation progress, developing of software and technology. It means this Manual is not the final one but just "Version 1" and has to be revised in future. Please note that this kind of manual should be positioned as REFERENCE only.

Followings are the name of trainees and officers who were trained on factory training program in Bangkok and participated for preparation of this Operation Manual.

- Mr. Shahadat Hossain
- Md. Abdullah Al Rakib
- Mr. Arifur Rahman
- Sheikh Motiur Rahman
- Sara Afroz
- Mahbuba Haque

2. MATCH-AT

2-1. Generals

MATCH-AT is the software for the Arial Triangulation and products of Trimble INPHO Photogrammetric System providing highly precise automatic digital aerial triangulation based on the advanced and unique image processing algorithms.

All the processing steps of "MATCH-AT" are fully automated for achieving highest productivity. The workflow is logical and easy from the project setup, the precise multi-ray tie point matching and integrated bundle adjustment, up to the block analyzing with graphical support.

There is a rigorous support for GPS and IMU data, including calibration of bore-sight miss-alignment, as well as shift and drift corrections.

An integrated multi-window stereo module is at hand for both, comfortable stereoscopic verification as well as measurement of control points and additional tie points.

With its advanced sub-block handling ”MATCH-AT” is designed for processing the photogrammetric projects with block sizes of **20,000** images and even more.

Due to its flexible data exchange capability of “MATCH-AT” integrates into the workflow of any third-party photogrammetric system.

2-2. FEATURES of MATCH-AT

With frame images:

- Single, automated process for point selection, point transfer and measurement, along with an integrated bundle block adjustment requires minimum user interaction.
- Support of any film or digital frame sensors (nadir and oblique).
- No limitations for block size, shape or overlap. With sub-block handling (see below) projects with block sizes of 20,000 images and even more can be processed.
- Tie points are automatically collected in image areas best contributing to the strength and quality of the block. Von Gruber positions can be used, or other patterns in case of special image overlap situations.
- High precision tie point correlation (˜0.1pixel) is achieved by an advanced combination of feature-based and least-squares matching, with multi-threading support.
- Effective tie point matching also in poorly textured, as well as mountainous areas.
- Strong internal quality control of tie points by performing robust bundle block adjustment in each level of the image pyramid.
- Flexible weighting schemes for all types of observations
- Multi-camera support in one block, and camera-specific self-calibration parameter sets (12 or 44 parameters). The results of self-calibration are made available as a dense correction grid for camera re-calibration and for further use in any subsequent applications
- Fully automatic interior orientation:
  - Automatic detection of fiducial marks
  - User definable fiducial mark templates
- Project-wide photo display with correct topology, and auto image-selection for interactive, guided control point measurement
- Advanced sub-block handling:
  - Sub-blocks make it easy to administrate, visualize and analyze large blocks

- Free block adjustment, i.e. sub-blocks can be adjusted without control points
- Sub-blocks can be merged for final project-wide block adjustment

➢ GPS data handling with shift & drift determination

➢ IMU data handling:
  - Preprocessed GPS/IMU data from POS AV/POSEO by Applanix and AEROControl by IGI
  - Altitude data are used as constraints in the integrated block adjustment
  - Bore-sight misalignment calibration

➢ Optionally the triangulation can be made in a local space rectangular coordinate system for avoiding tensions caused by map projections

➢ Powerful graphical block analyzer:
  - Easy visual checking of large data sets
  - Visualization of image footprints, overlaps, ground control and tie points, and photo connections, residuals, error ellipses and more

➢ Smooth transfer of exterior orientation data to stereoplotters (e.g. Summit Evolution) and other photogrammetric applications, such as OrthoMaster or MATCH-T

➢ Export/import formats:
  - DAT/EM Summit Evolution, BAE SocetSet, Z/I project, Aviosoft Ori, ABC-PC, AP32, Phorex/Pex, PATB, Bluh, Bingo

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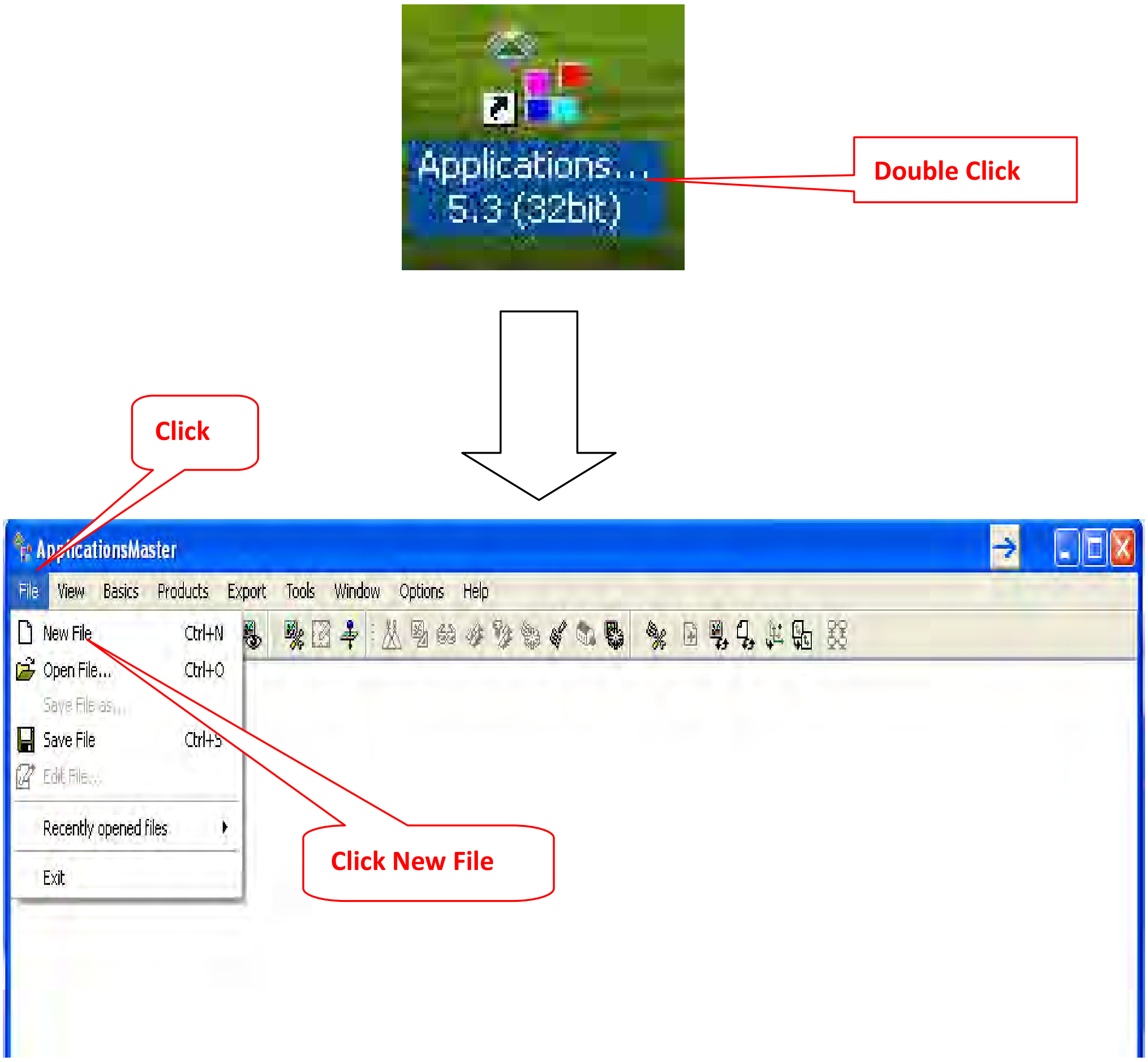
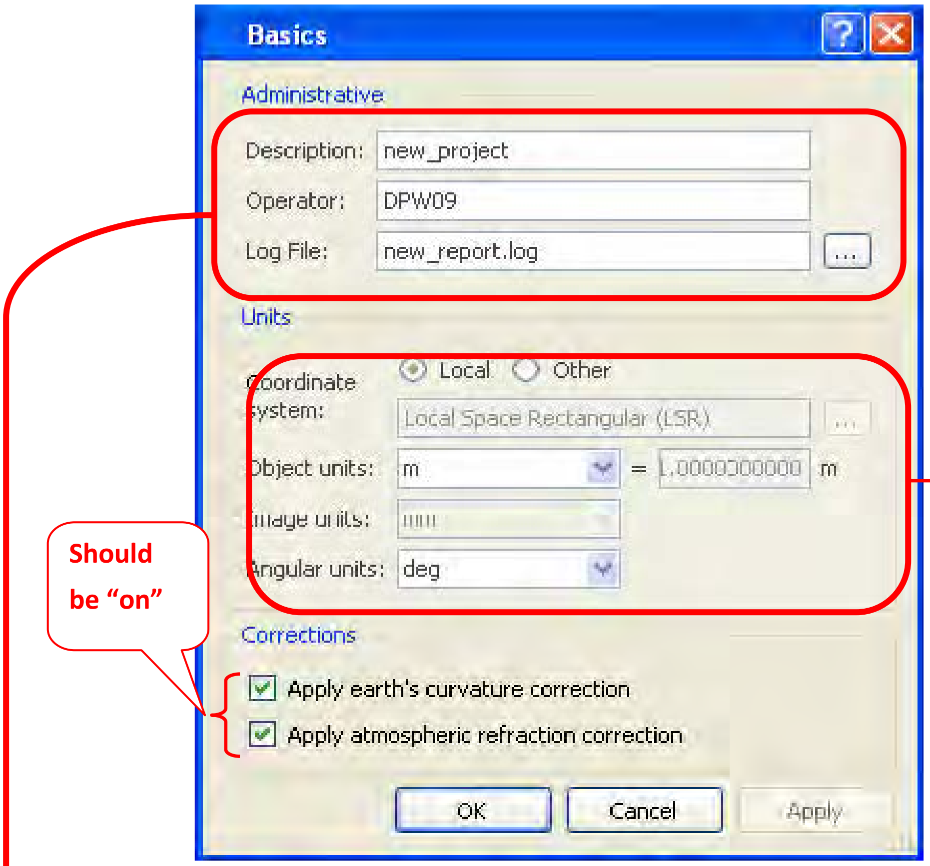
Chapter 1. Project Setup (Basic setup)

Chapter 1. Project Setup (Basic setup)





Administrative

Description : Project Name, Ex.: IDMS

Operator : ex: Rakib

Units

Coordinate System : "Local "Should be "ON"

Object Units : m (meter)

Angular units : deg

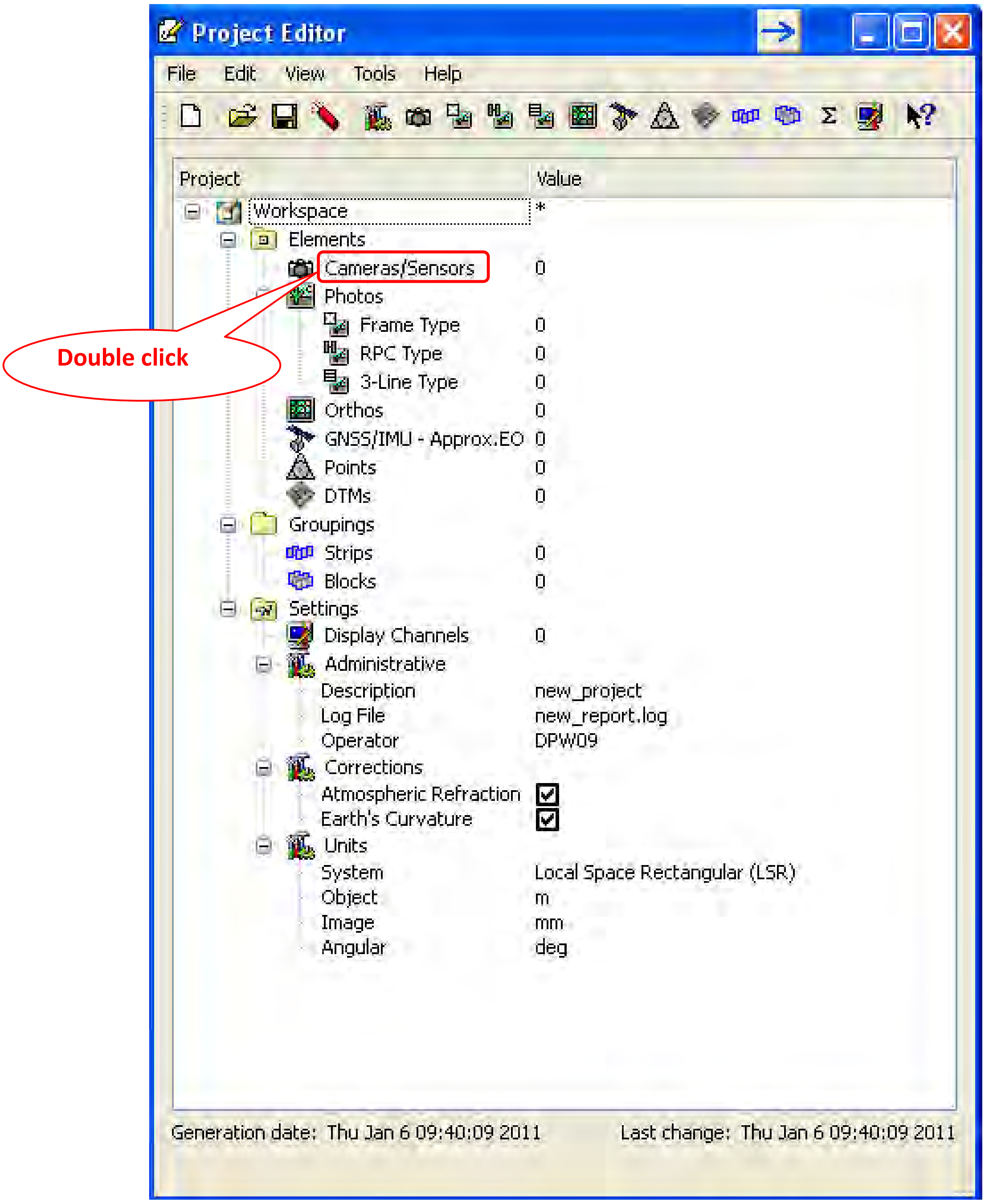
<Procedure>

***After completing project setting, save to any directory.**

Ex: Click file --> Save --> Drive C --> Your name --> Project name --> Save

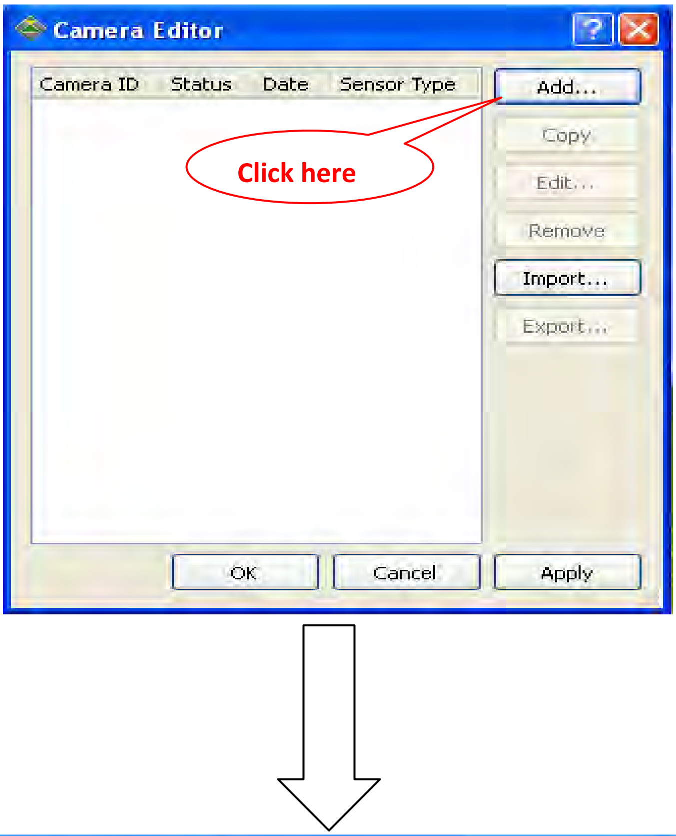
Chapter 2. Camera Setup

Chapter 2. Camera Setup



<Procedure>

*** For camera setting, firstly double click "cameras/sensors"**

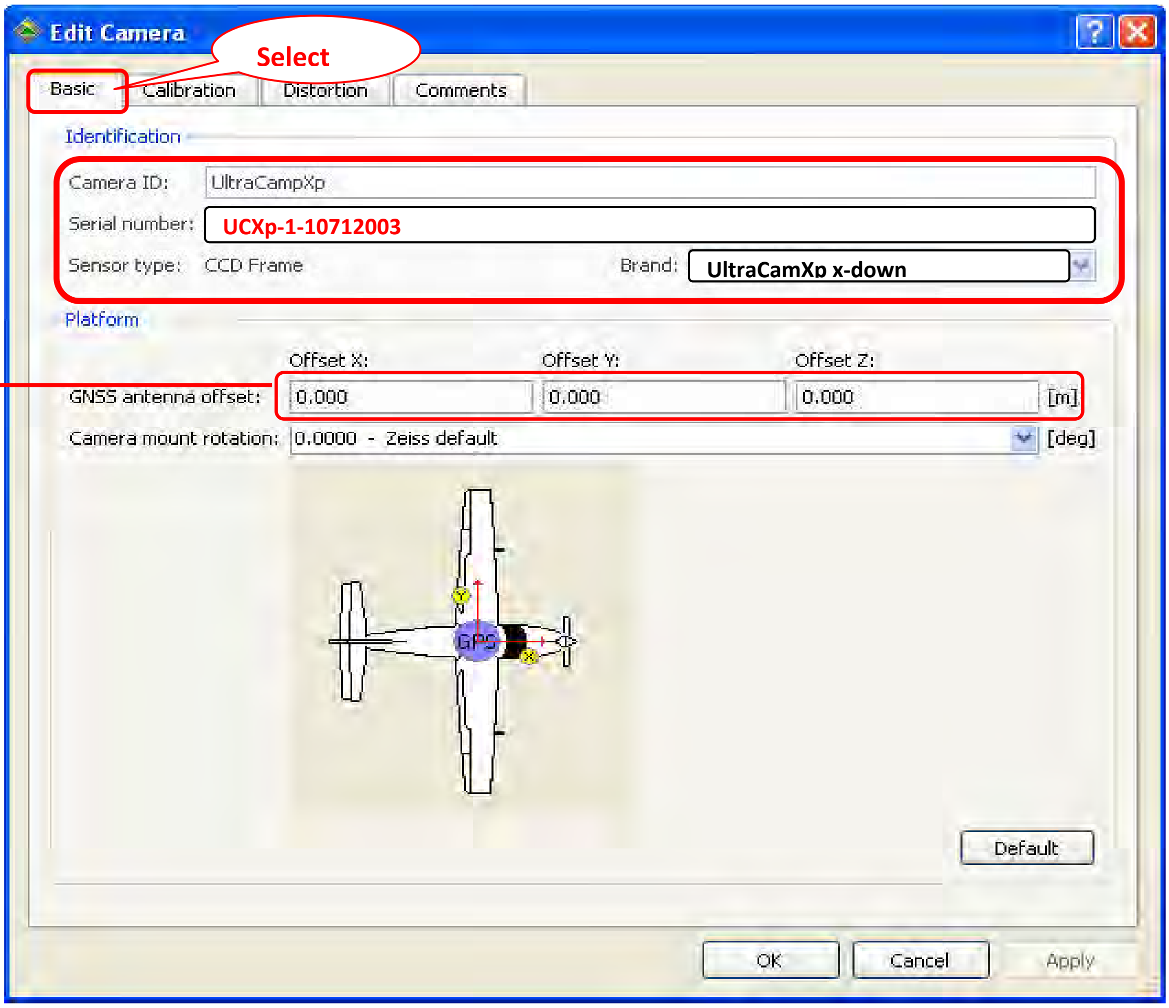


<u>Add new camera:</u>

Camera ID: UltraCamXp

Sensor type: CCD Frame

Brand: UltraCamXp x-down (According to image coordinate)



<Procedure>

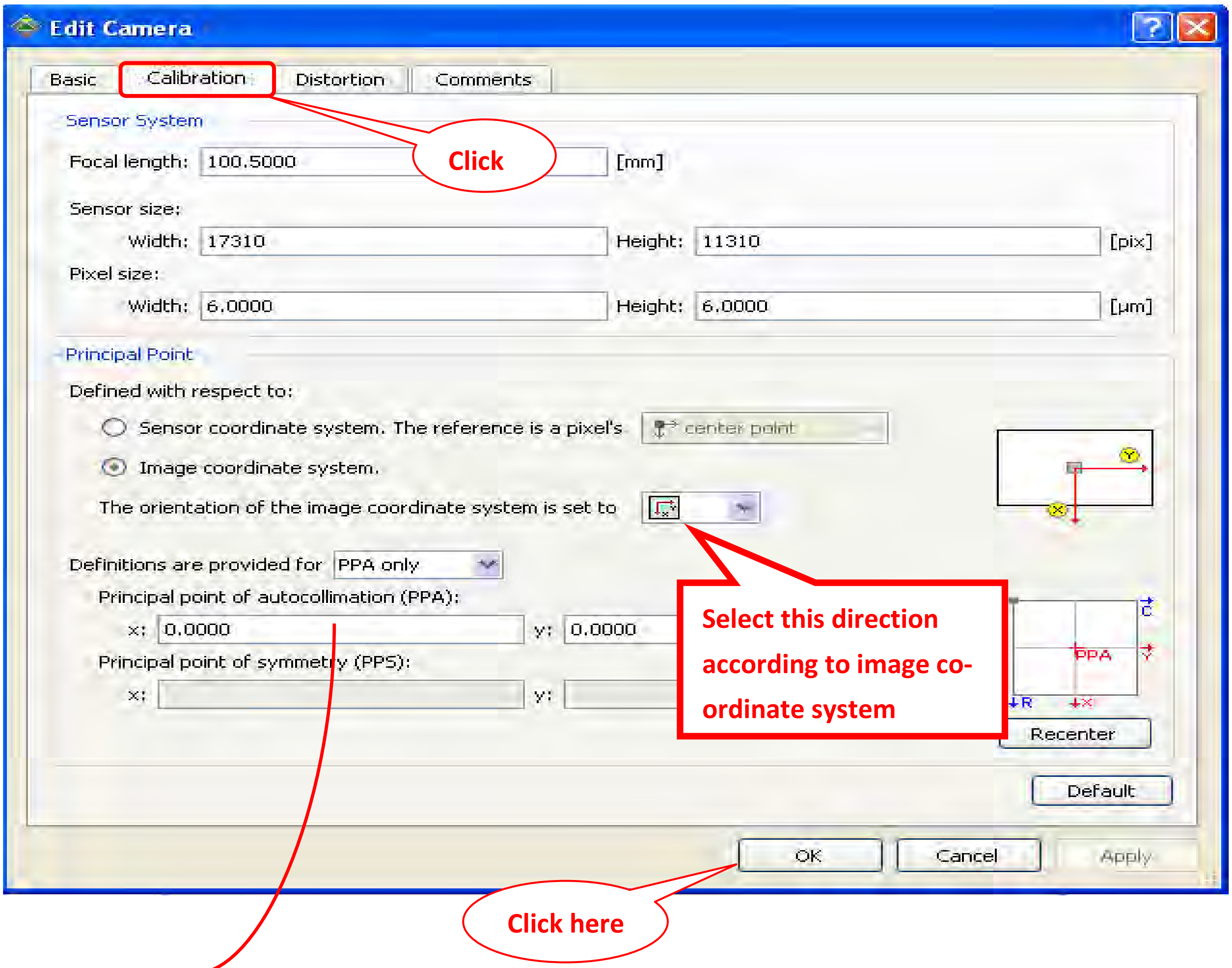
Basic:

Camera ID : UltraCamXp

Serial No : UC-SXP-1-10712003 (From Camera Certificate)

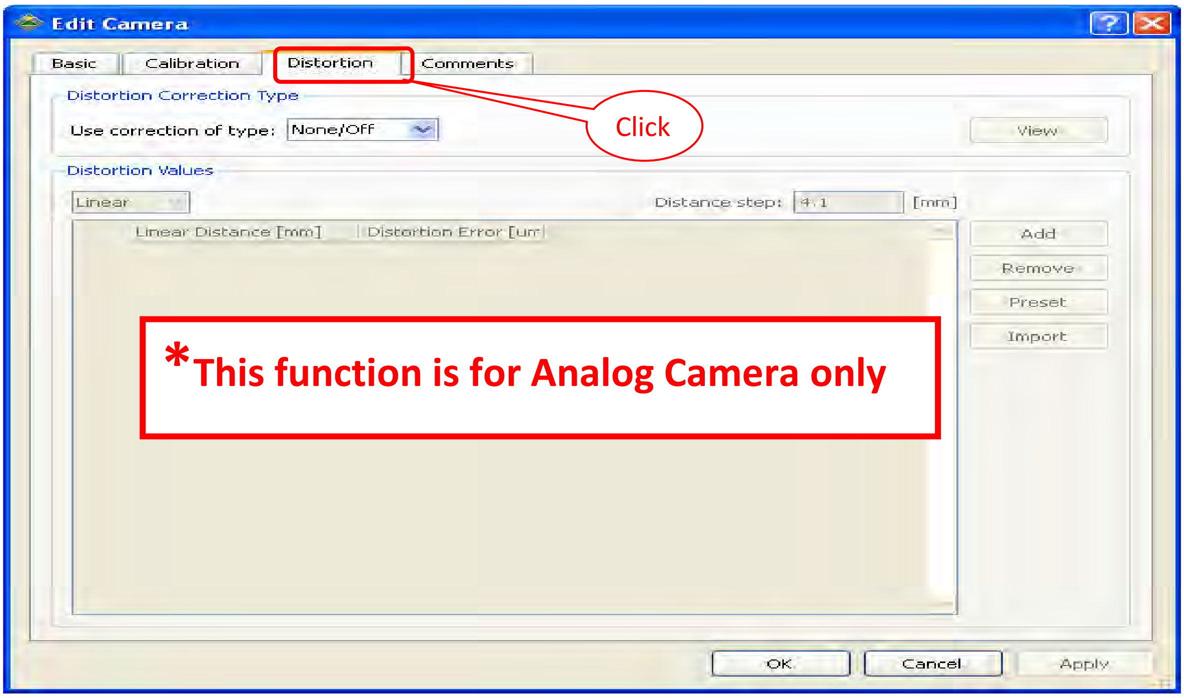
Platform:

GNSS ANTENNA OFFSET: Input antenna offset value from camera calibration certificate (Ultracam camera has no antenna offset value)

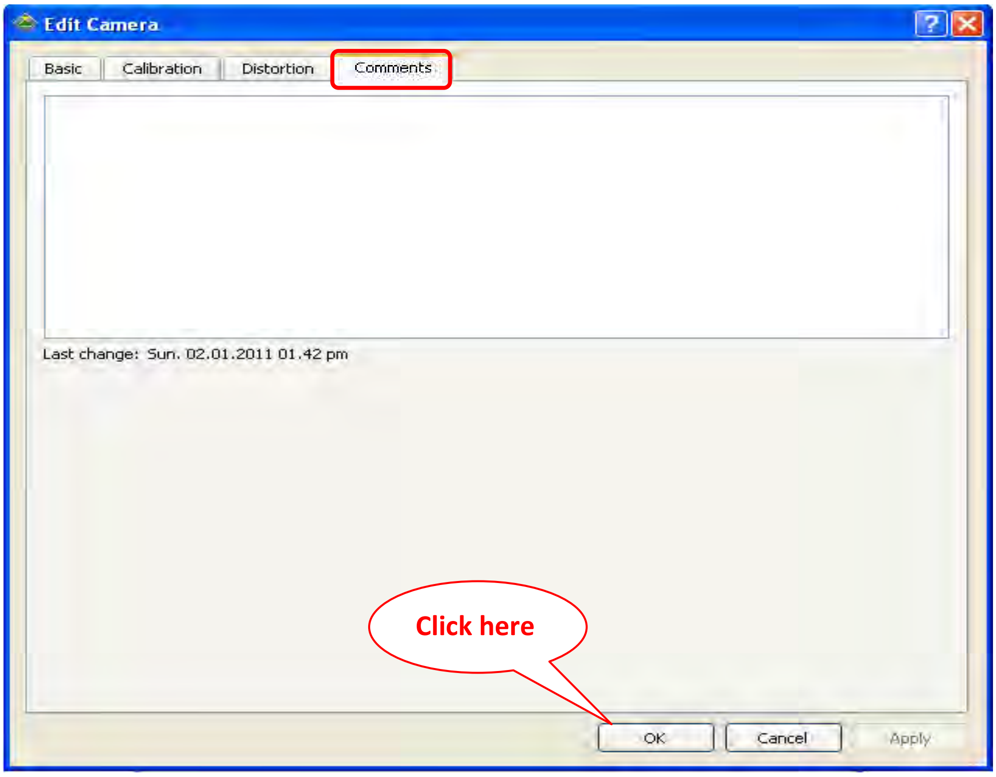


Calibration: **Input PPA value from Camera certificate**

Ex: X=0.000, Y=0.000 for Ultracam Xp Camera



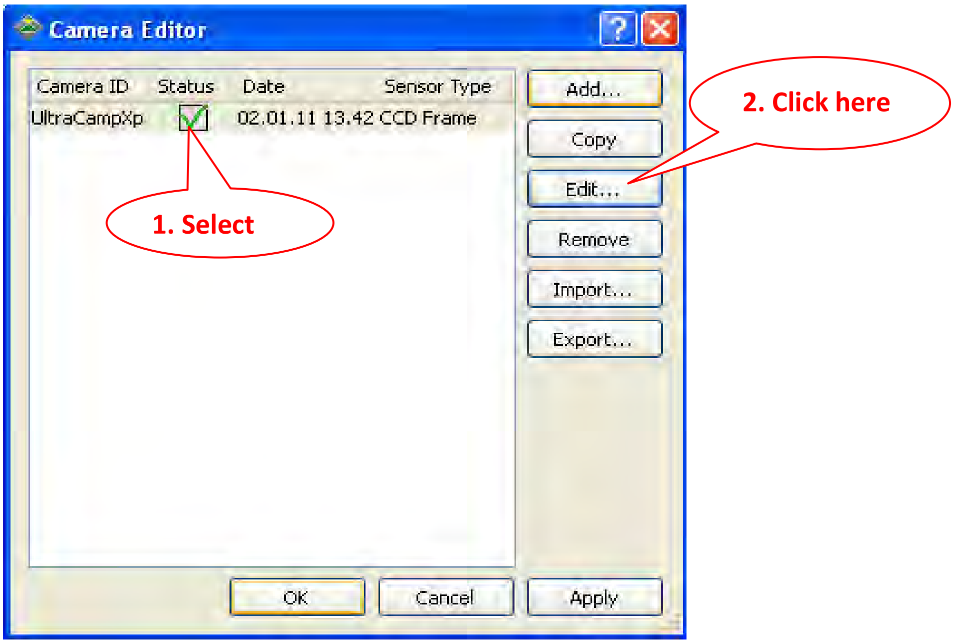
Distortion: UltraCamXp Camera is not required for Distortion



Comments: If you have any comments, write in the box and then click "Apply" and "OK"

Now, the Camera setup is complete. After that if there need any corrections, you can Edit and correct it as shown in next procedure.

<Edit Camera>



Edit camera setting:

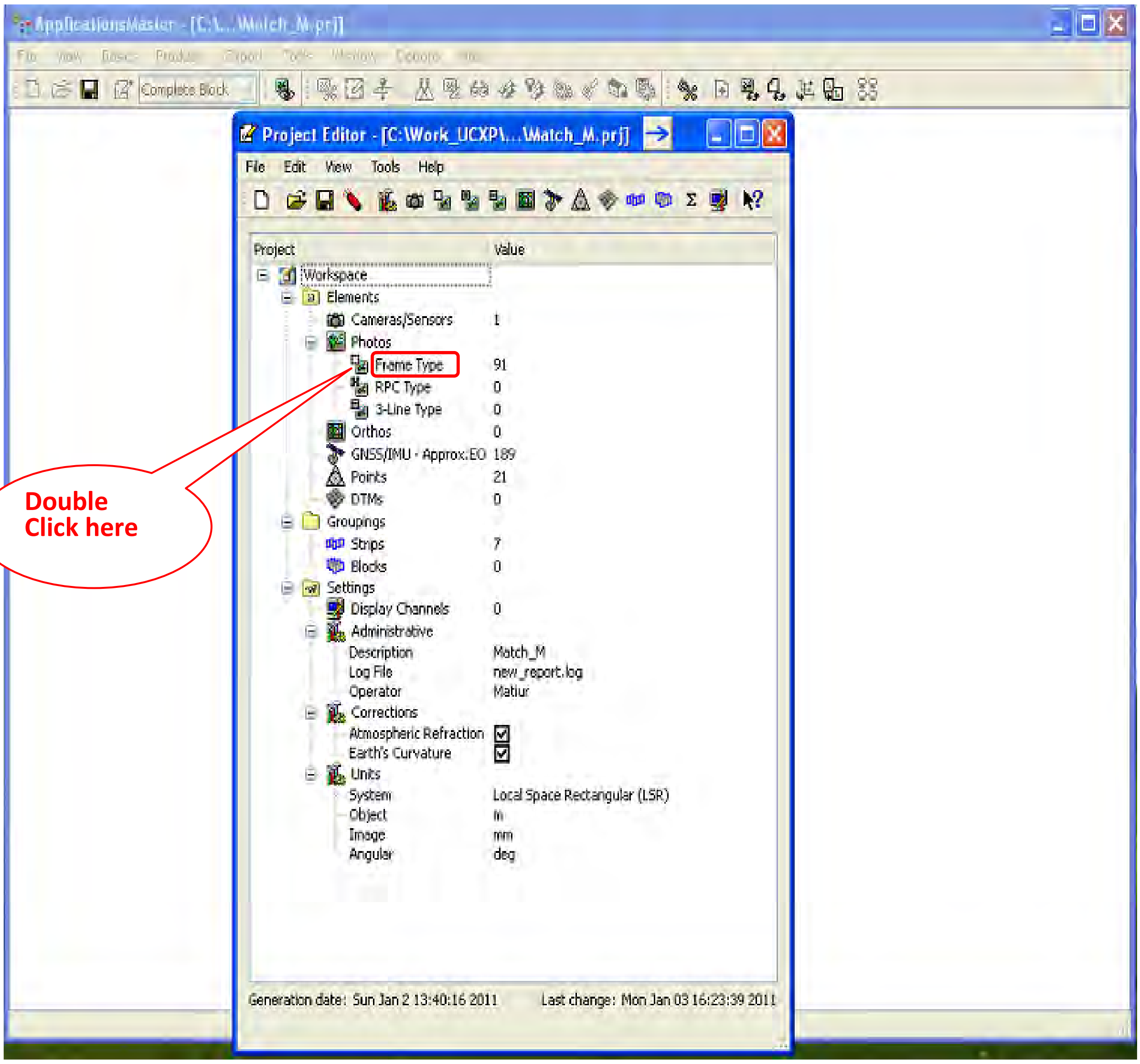
<Procedure>

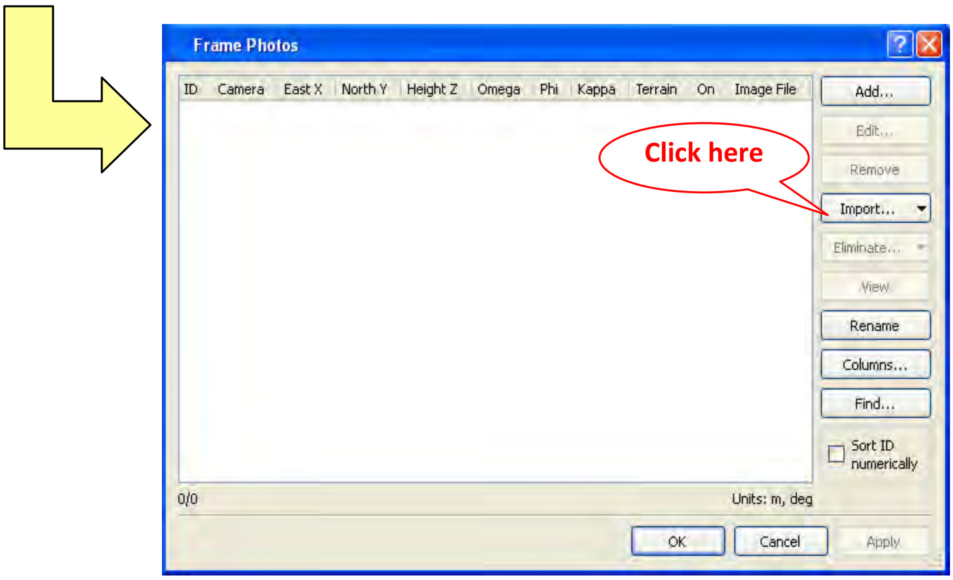
*** If there is need any corrections for camera setting, then select the previous "Camera ID", click "Edit" and previous camera setting page will open.**

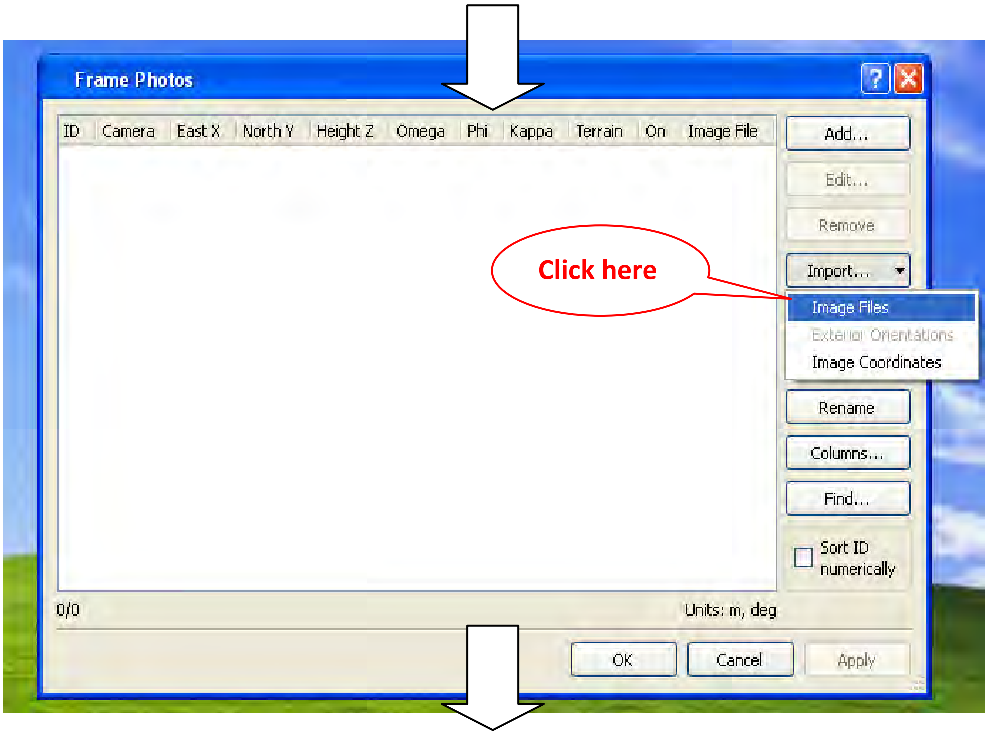
*** After edit something, click "Apply" and "OK", then Camera setting is complete.**

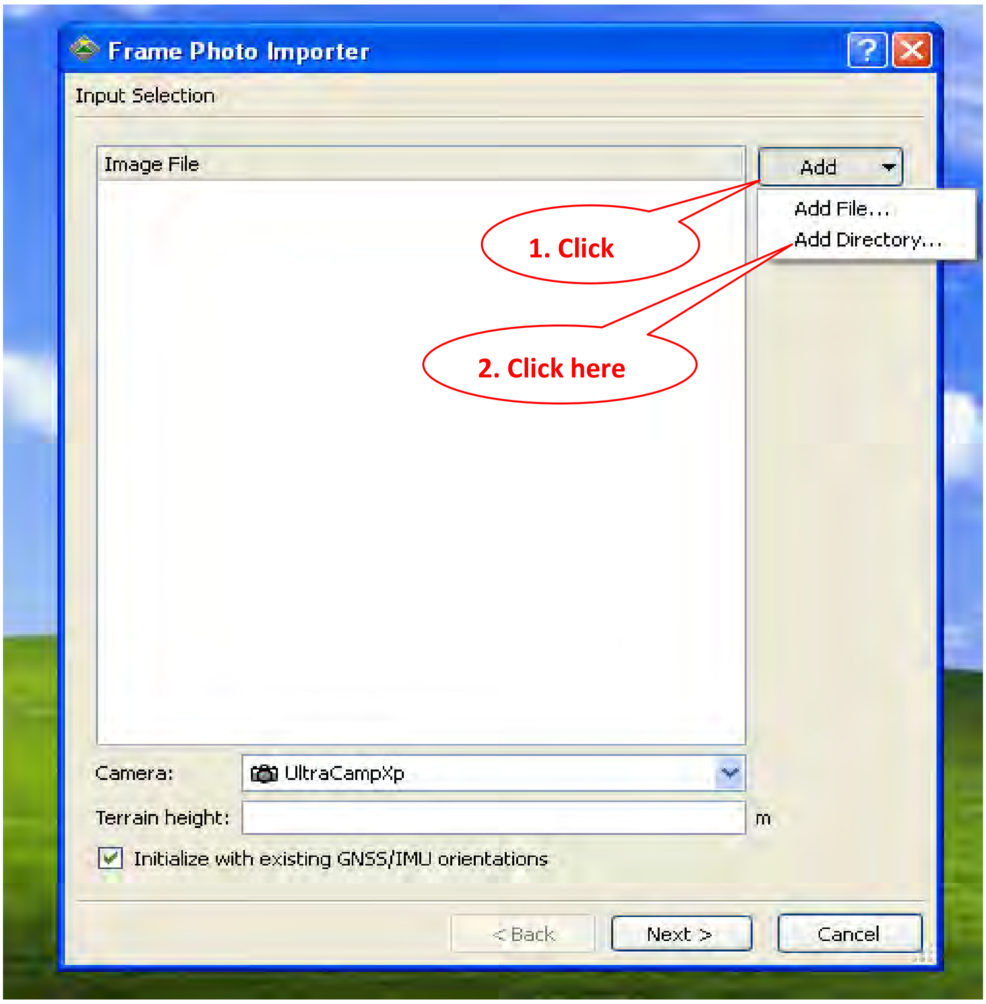
Chapter 3. Image Import

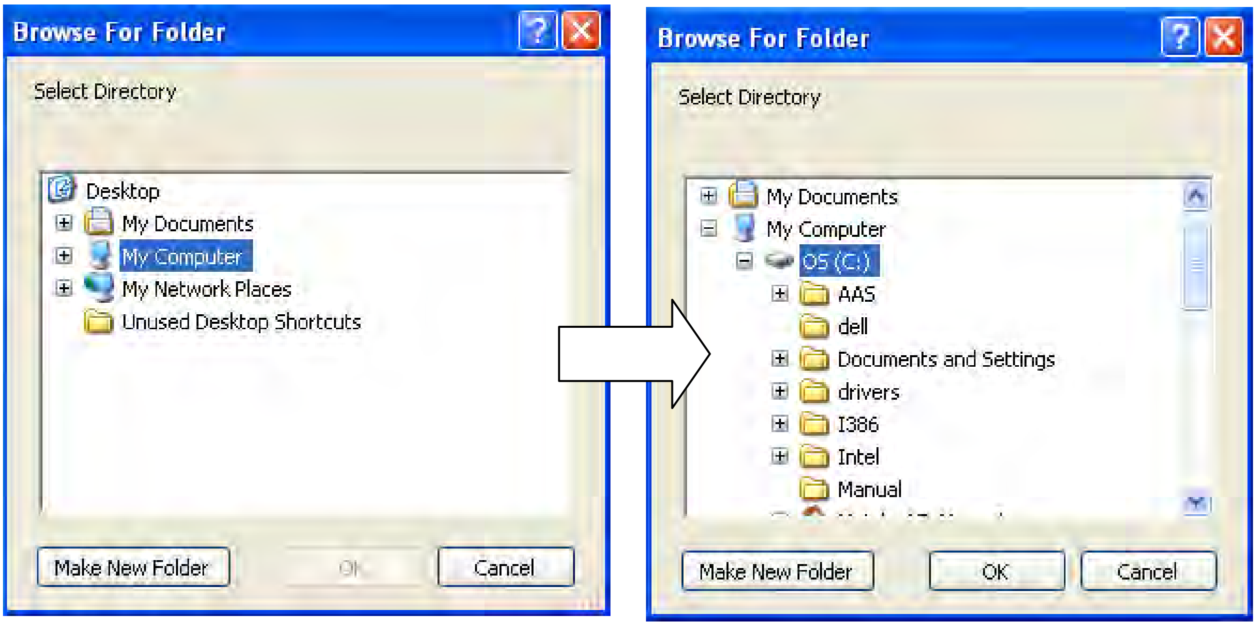
Chapter 3. Image Import

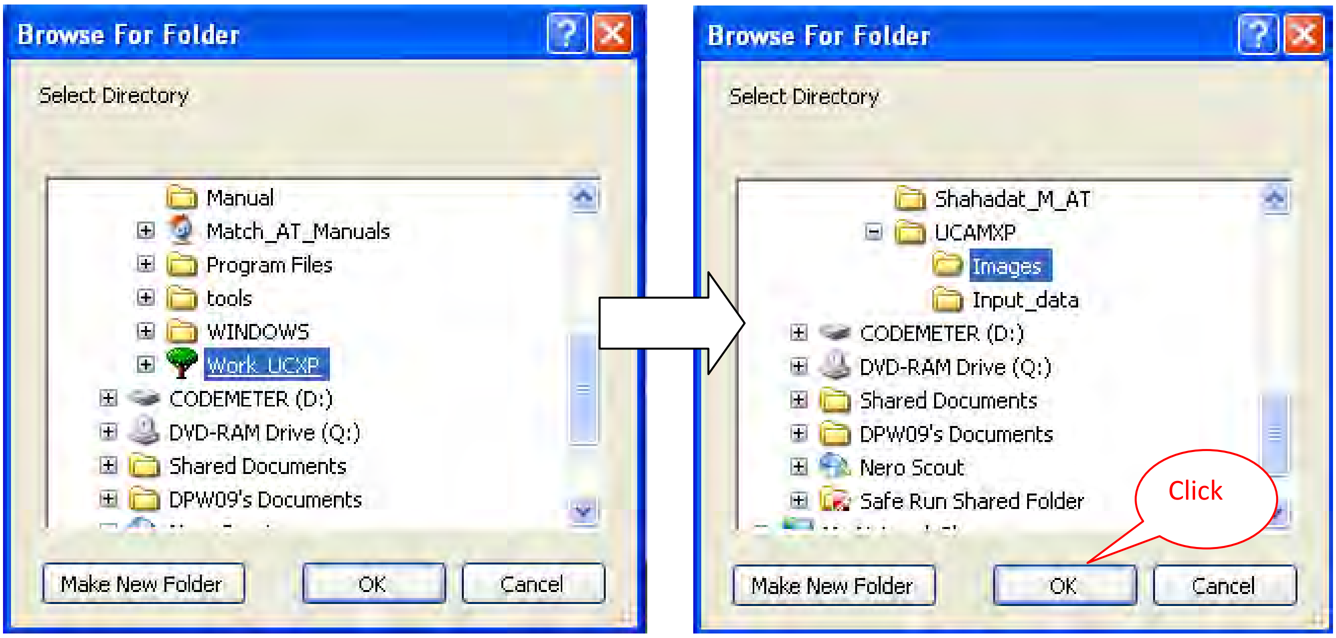


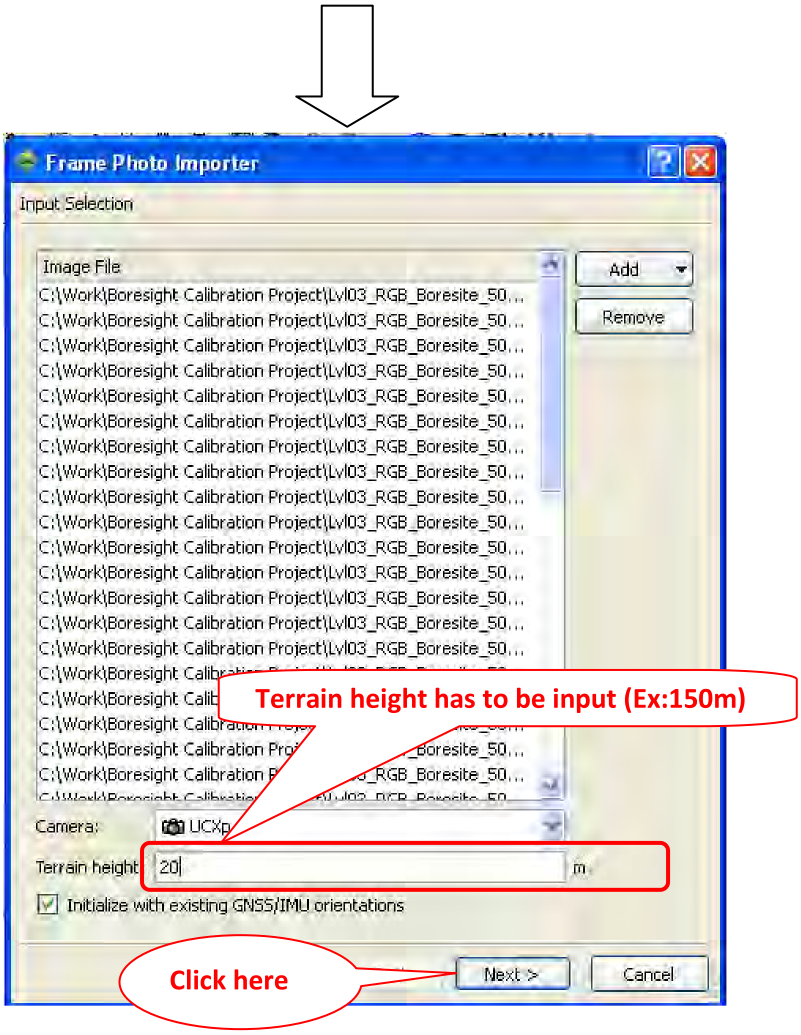



Frame Photos
ID
Camera
East X
North Y
Height Z
Omega
Phi
Kappa
Terrain
On
Image File
Add...
Edit...
Remove
Import...
Click here
Image Files
Exterior Orientations
Image Coordinates
Rename
Columns...
Find...
Sort ID numerically
0/0
Units: m, deg
OK
Cancel
Apply


Frame Photo Importer
Input Selection
Image File
Add
Add File...
Add Directory...
1. Click
2. Click here
Camera:
UltraCampXp
Terrain height:
m
Initialize with existing GNSS/IMU orientations
< Back
Next >
Cancel


Browse For Folder
Select Directory
Desktop
My Documents
My Computer
My Network Places
Unused Desktop Shortcuts
Make New Folder
OK
Cancel
Browse For Folder
Select Directory
My Documents
My Computer
OS (C:)
AAS
dell
Documents and Settings
drivers
I386
Intel
Manual
Make New Folder
OK
Cancel

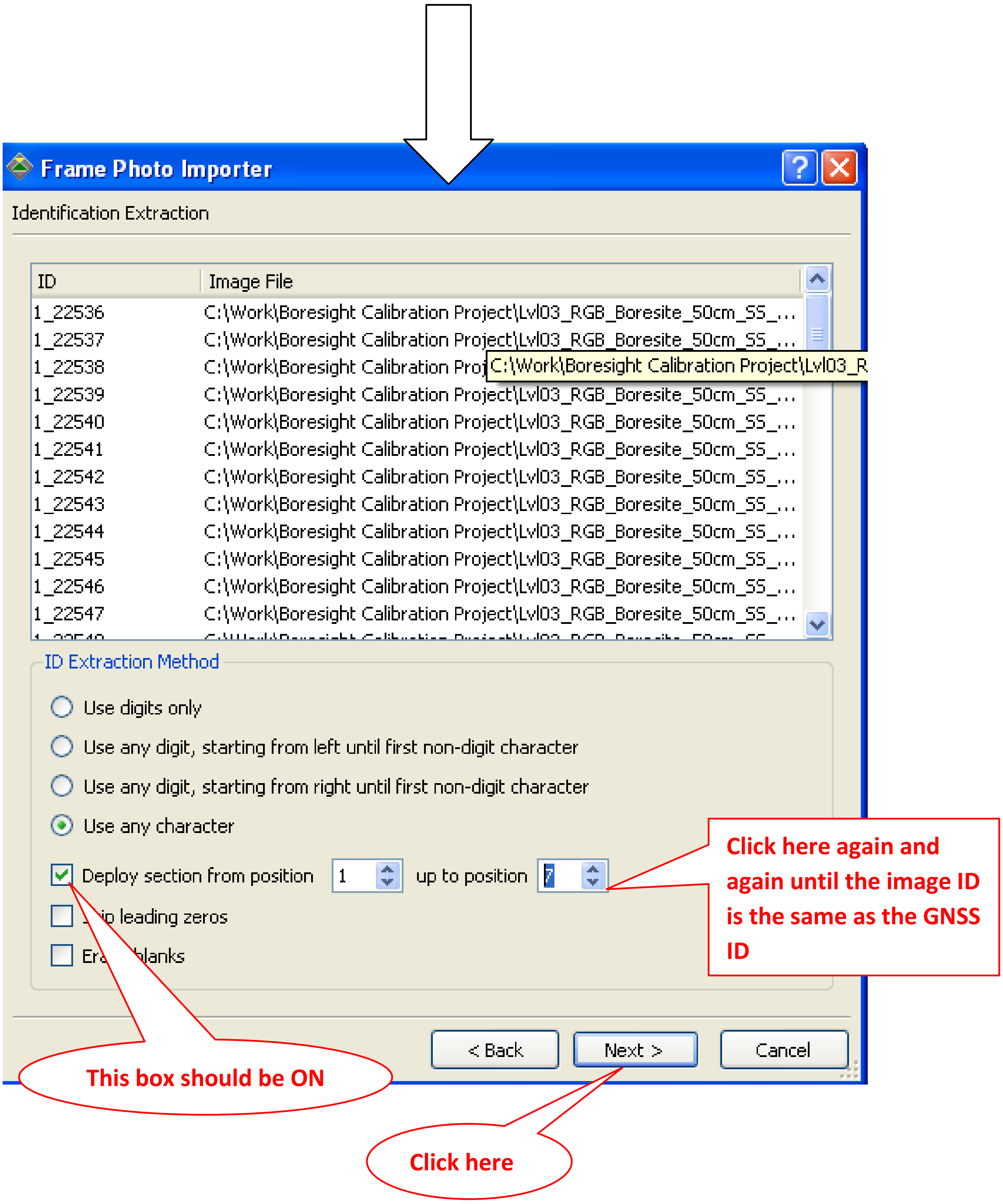

Browse For Folder
Select Directory
Manual
Match_AT_Manuals
Program Files
tools
WINDOWS
Work_UCXP
CODEMETER (D:)
DVD-RAM Drive (Q:)
Shared Documents
DPW09's Documents
Make New Folder
OK
Cancel
Browse For Folder
Select Directory
Shahadat_M_AT
UCAMXP
Images
Input_data
CODEMETER (D:)
DVD-RAM Drive (Q:)
Shared Documents
DPW09's Documents
Nero Scout
Safe Run Shared Folder
Click
Make New Folder
OK
Cancel



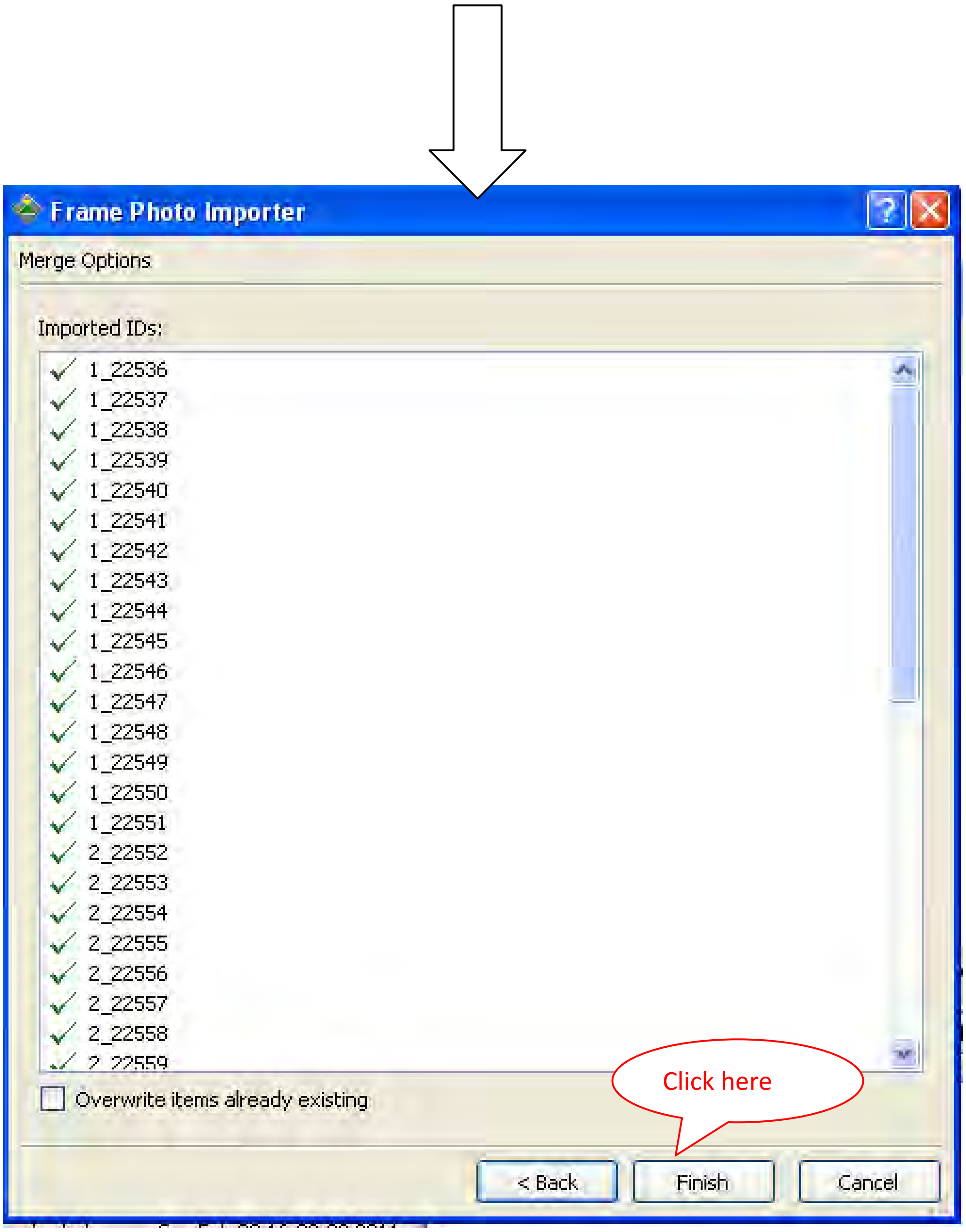
<Procedure>

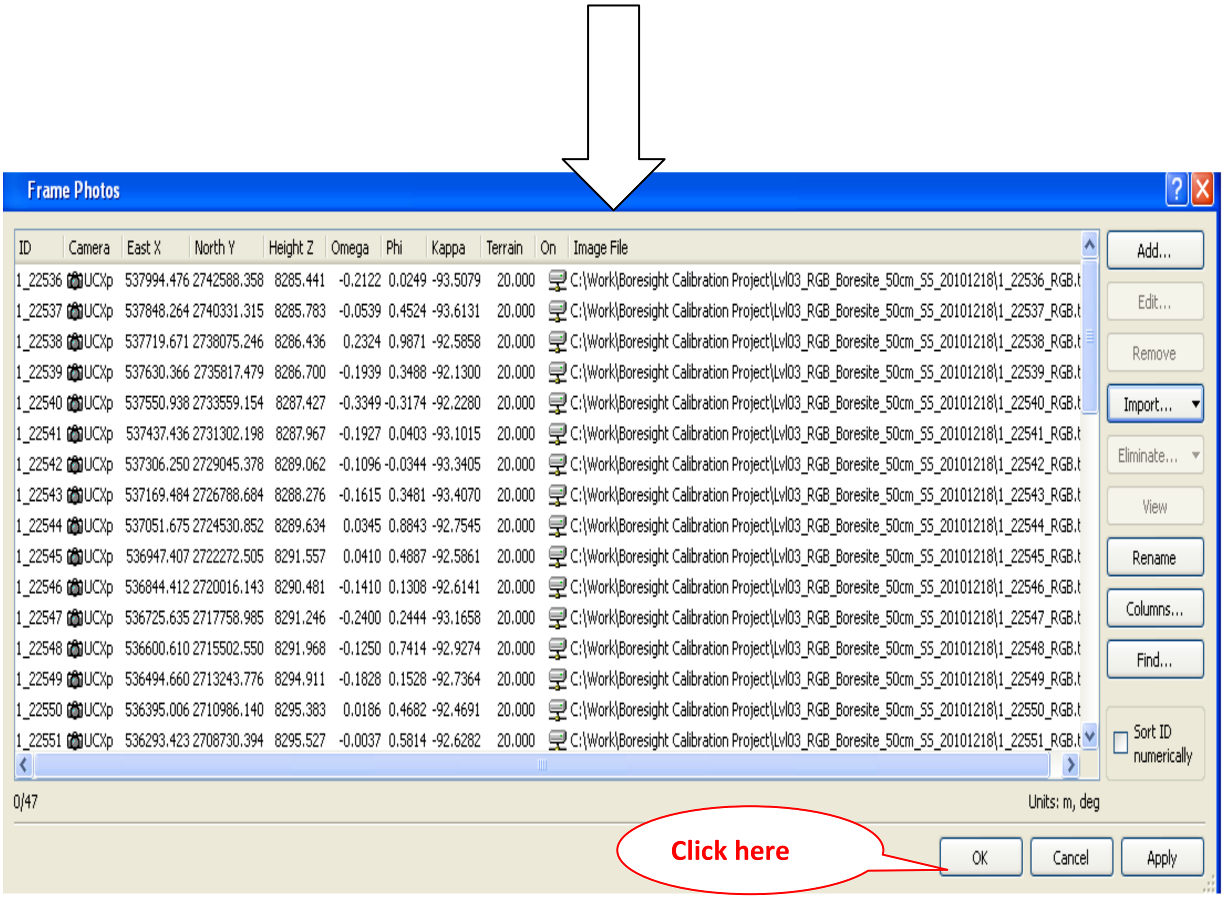
<u>For Image Setup:</u>

*** Double click "Frame type"--> Click "import"--> Click "image Files"--> Click "add"--> select "Add Directory"-->Now go to folder where images are stored and select image and "OK".**



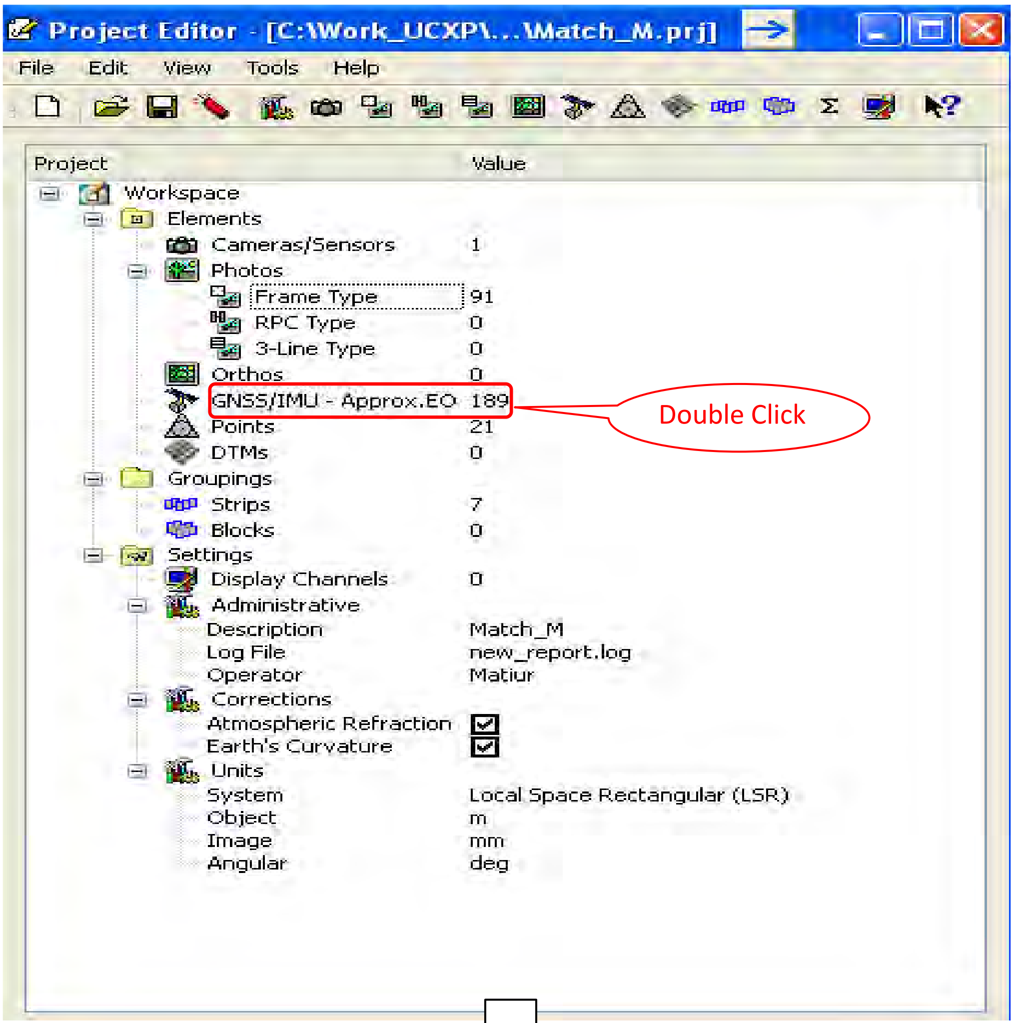
Frame Photo Importer
Identification Extraction
ID
Image File
1_22536
C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_...
1_22537
1_22538
1_22539
1_22540
1_22541
1_22542
1_22543
1_22544
1_22545
1_22546
1_22547
ID Extraction Method
Use digits only
Use any digit, starting from left until first non-digit character
Use any digit, starting from right until first non-digit character
Use any character
Deploy section from position
1
up to position
7
leading zeros
blanks
< Back
Next >
Cancel
Click here again and again until the image ID is the same as the GNSS ID
This box should be ON
Click here

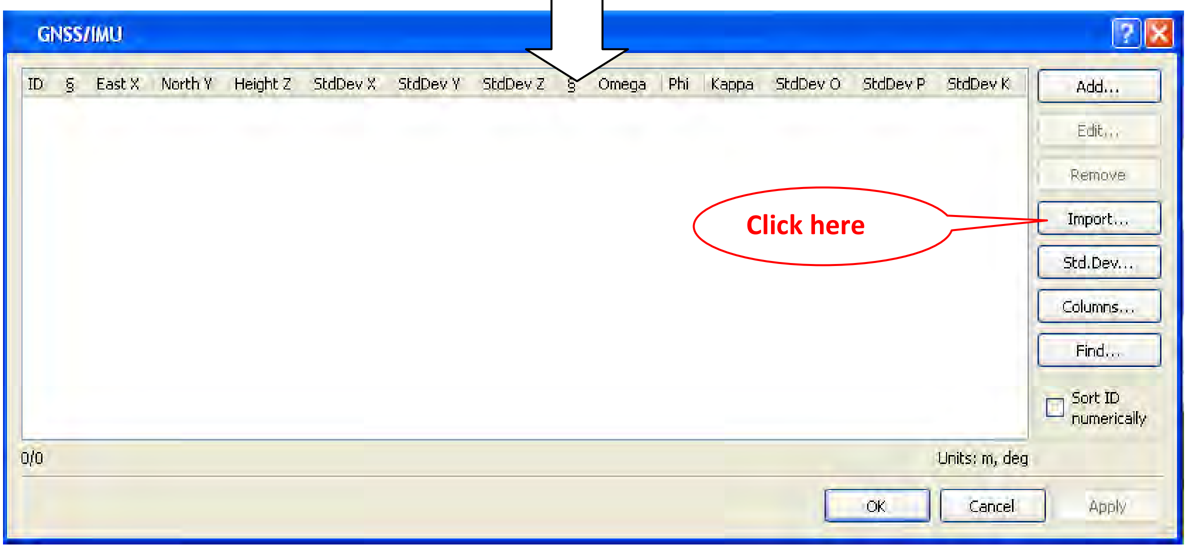

Frame Photo Importer
Merge Options
Imported IDs:
1_22536
1_22537
1_22538
1_22539
1_22540
1_22541
1_22542
1_22543
1_22544
1_22545
1_22546
1_22547
1_22548
1_22549
1_22550
1_22551
2_22552
2_22553
2_22554
2_22555
2_22556
2_22557
2_22558
Overwrite items already existing
Click here
< Back
Finish
Cancel


Frame Photos
ID Camera East X North Y Height Z Omega Phi Kappa Terrain On Image File
1_22536 UCXp 537994.476 2742588.358 8285.441 -0.2122 0.0249 -93.5079 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22536_RGB.t
1_22537 UCXp 537848.264 2740331.315 8285.783 -0.0539 0.4524 -93.6131 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22537_RGB.t
1_22538 UCXp 537719.671 2738075.246 8286.436 0.2324 0.9871 -92.5858 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22538_RGB.t
1_22539 UCXp 537630.366 2735817.479 8286.700 -0.1939 0.3488 -92.1300 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22539_RGB.t
1_22540 UCXp 537550.938 2733559.154 8287.427 -0.3349 -0.3174 -92.2280 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22540_RGB.t
1_22541 UCXp 537437.436 2731302.198 8287.967 -0.1927 0.0403 -93.1015 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22541_RGB.t
1_22542 UCXp 537306.250 2729045.378 8289.062 -0.1096 -0.0344 -93.3405 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22542_RGB.t
1_22543 UCXp 537169.484 2726788.684 8288.276 -0.1615 0.3481 -93.4070 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22543_RGB.t
1_22544 UCXp 537051.675 2724530.852 8289.634 0.0345 0.8843 -92.7545 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22544_RGB.t
1_22545 UCXp 536947.407 2722272.505 8291.557 0.0410 0.4887 -92.5861 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22545_RGB.t
1_22546 UCXp 536844.412 2720016.143 8290.481 -0.1410 0.1308 -92.6141 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22546_RGB.t
1_22547 UCXp 536725.635 2717758.985 8291.246 -0.2400 0.2444 -93.1658 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22547_RGB.t
1_22548 UCXp 536600.610 2715502.550 8291.968 -0.1250 0.7414 -92.9274 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22548_RGB.t
1_22549 UCXp 536494.660 2713243.776 8294.911 -0.1828 0.1528 -92.7364 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22549_RGB.t
1_22550 UCXp 536395.006 2710986.140 8295.383 0.0186 0.4682 -92.4691 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22550_RGB.t
1_22551 UCXp 536293.423 2708730.394 8295.527 -0.0037 0.5814 -92.6282 20.000 C:\Work\Boresight Calibration Project\Lvl03_RGB_Boresite_50cm_SS_20101218\1_22551_RGB.t
Add...
Edit...
Remove
Import...
Eliminate...
View
Rename
Columns...
Find...
Sort ID numerically
0/47
Units: m, deg
Click here
OK
Cancel
Apply

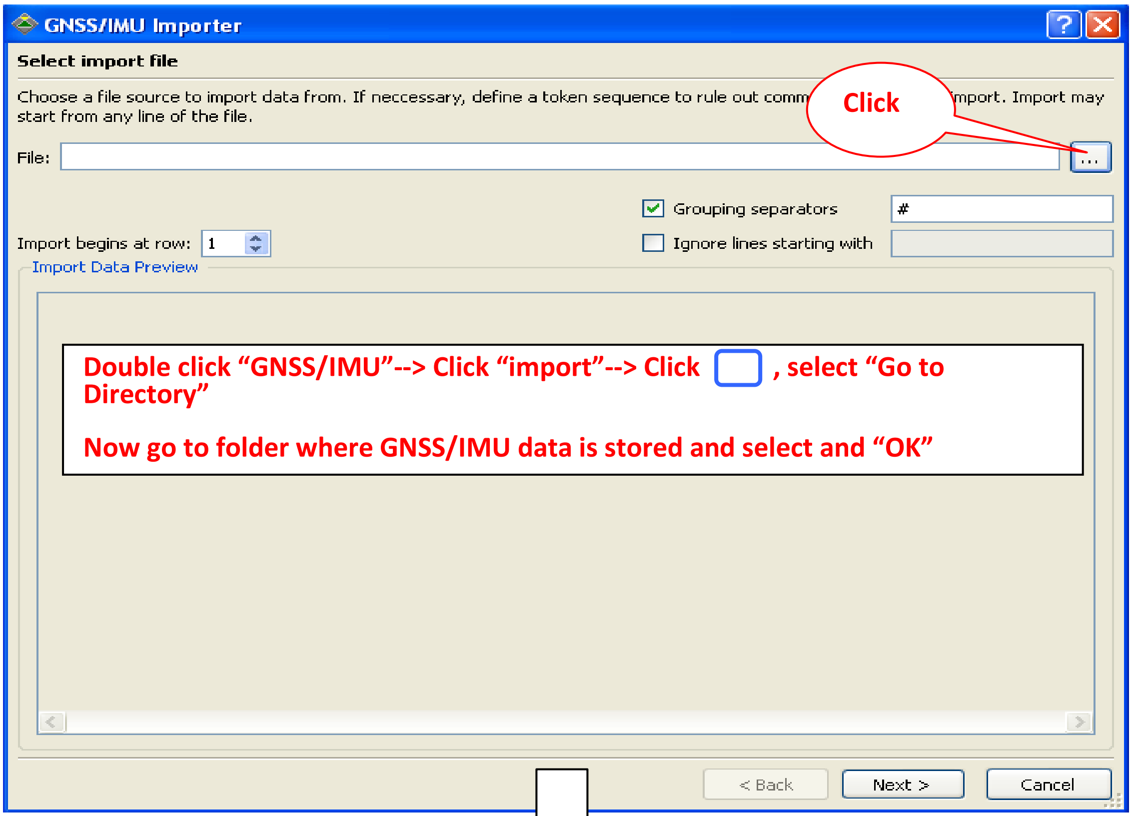
Chapter 4. Input GNSS/IMU Value

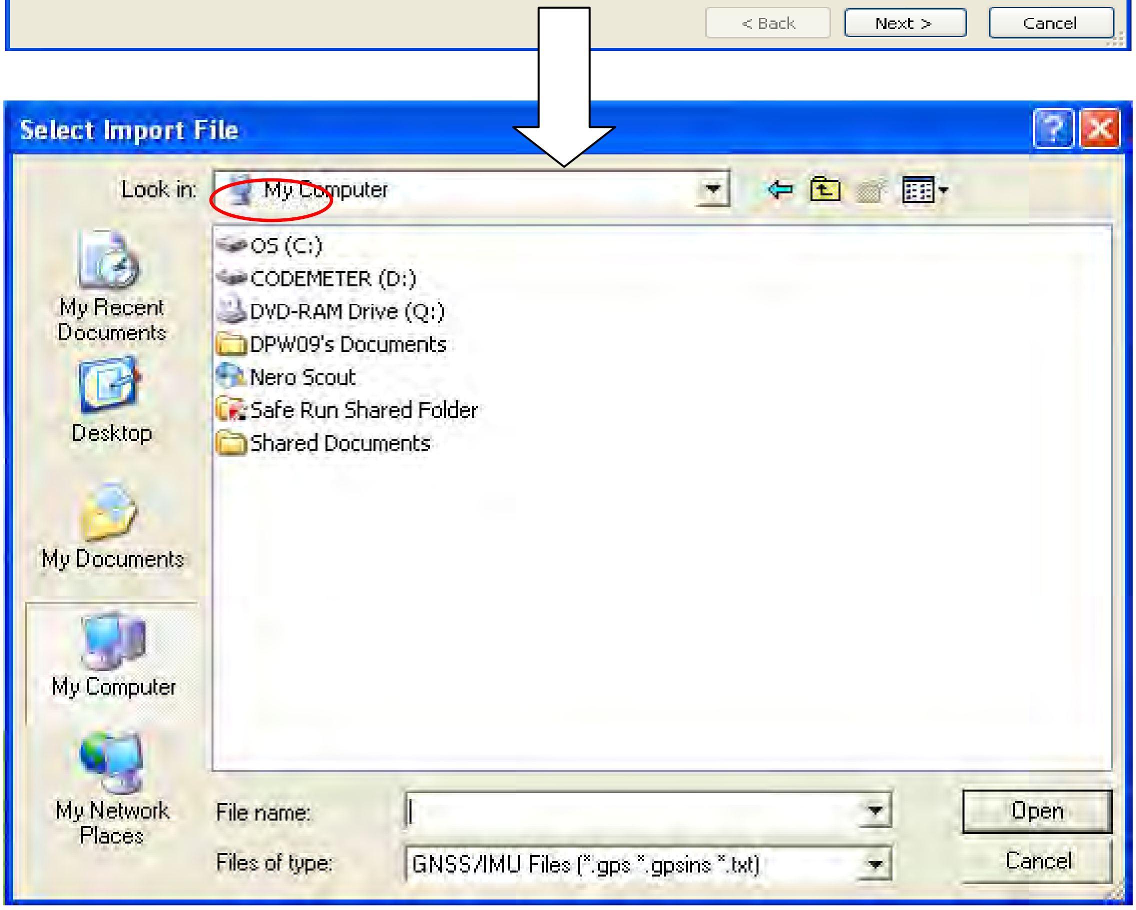
Chapter 4. Input GNSS/IMU Value

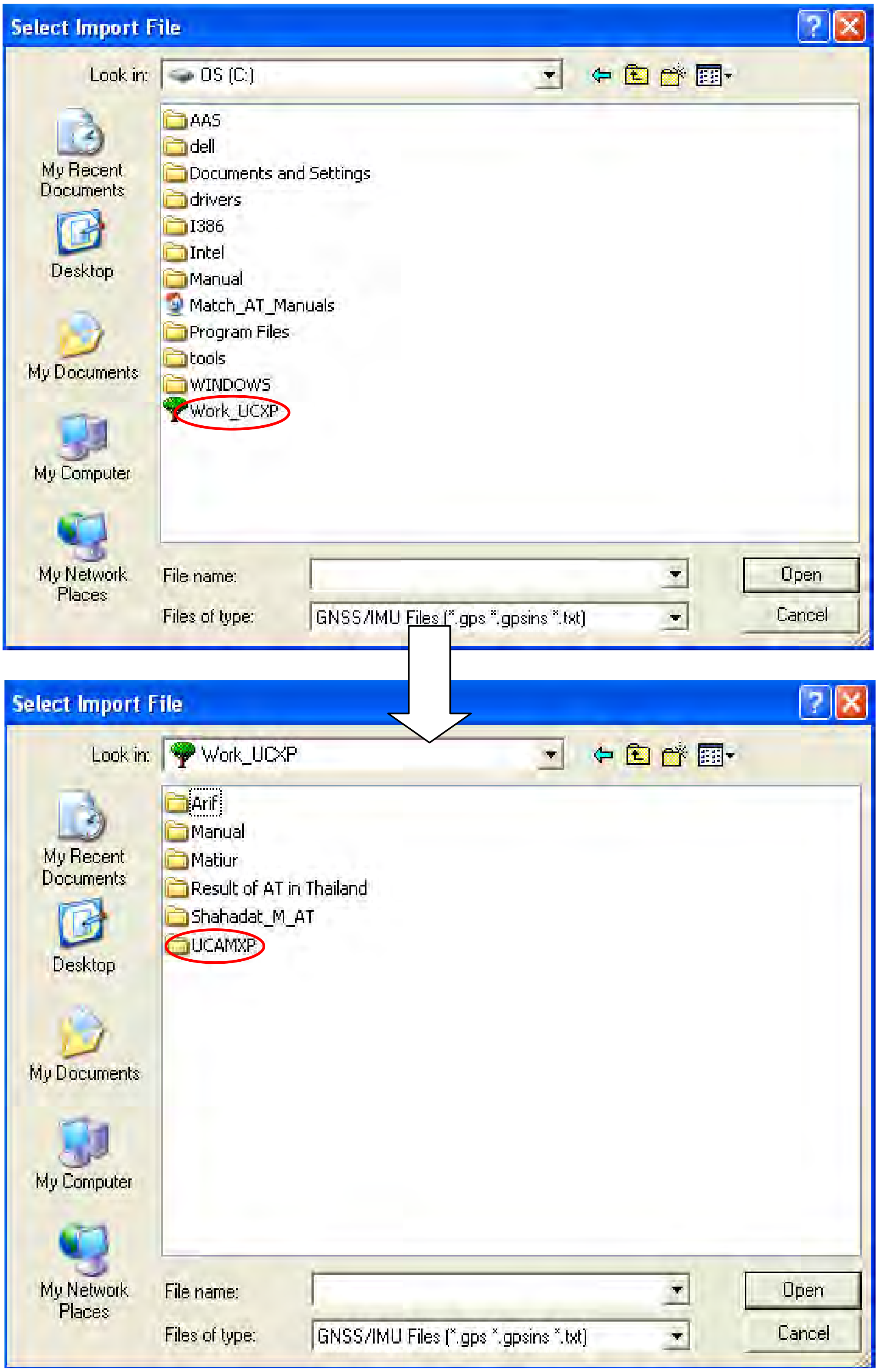


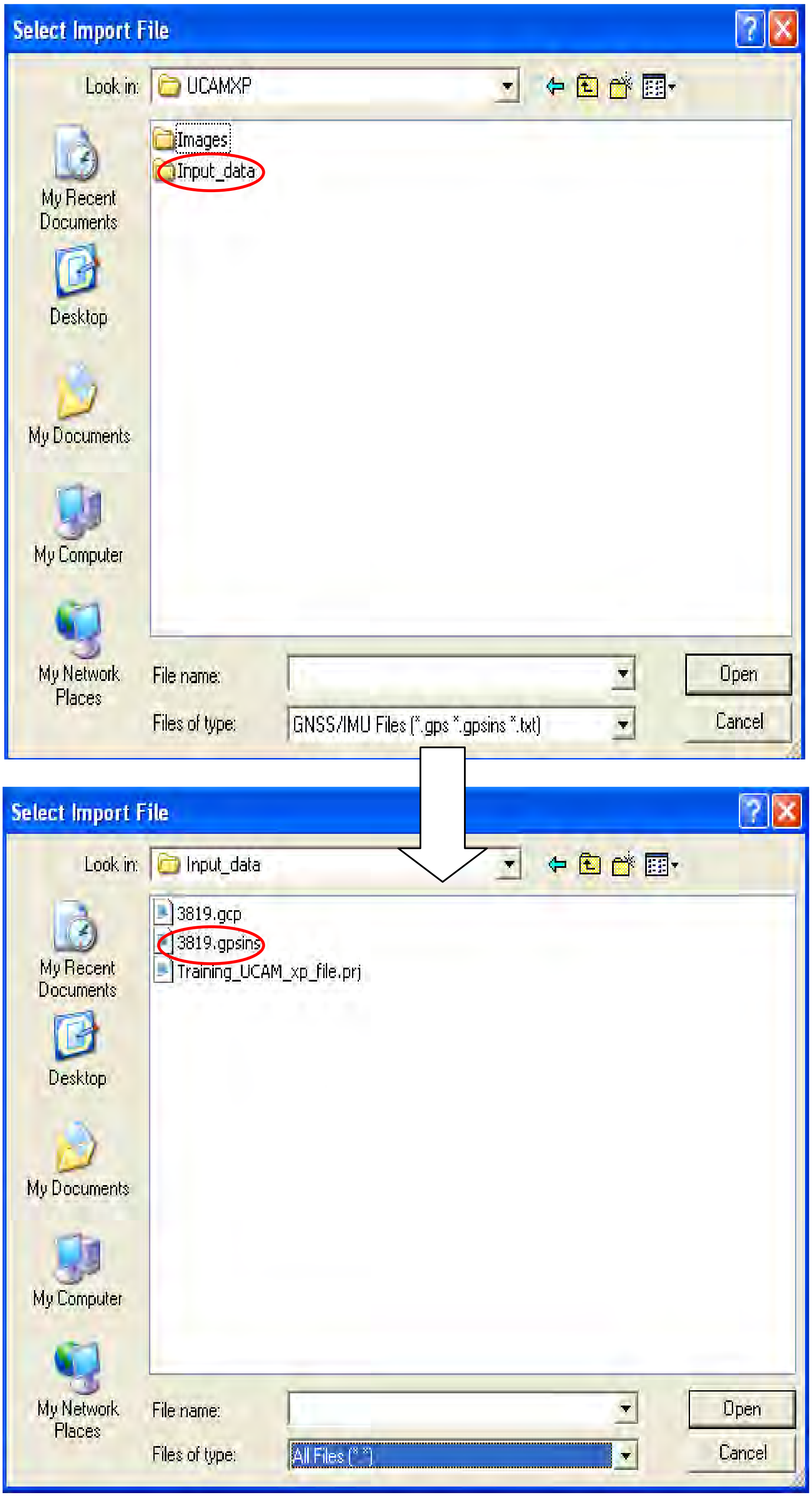


*Select folder in which to save GNSS/IMU data.





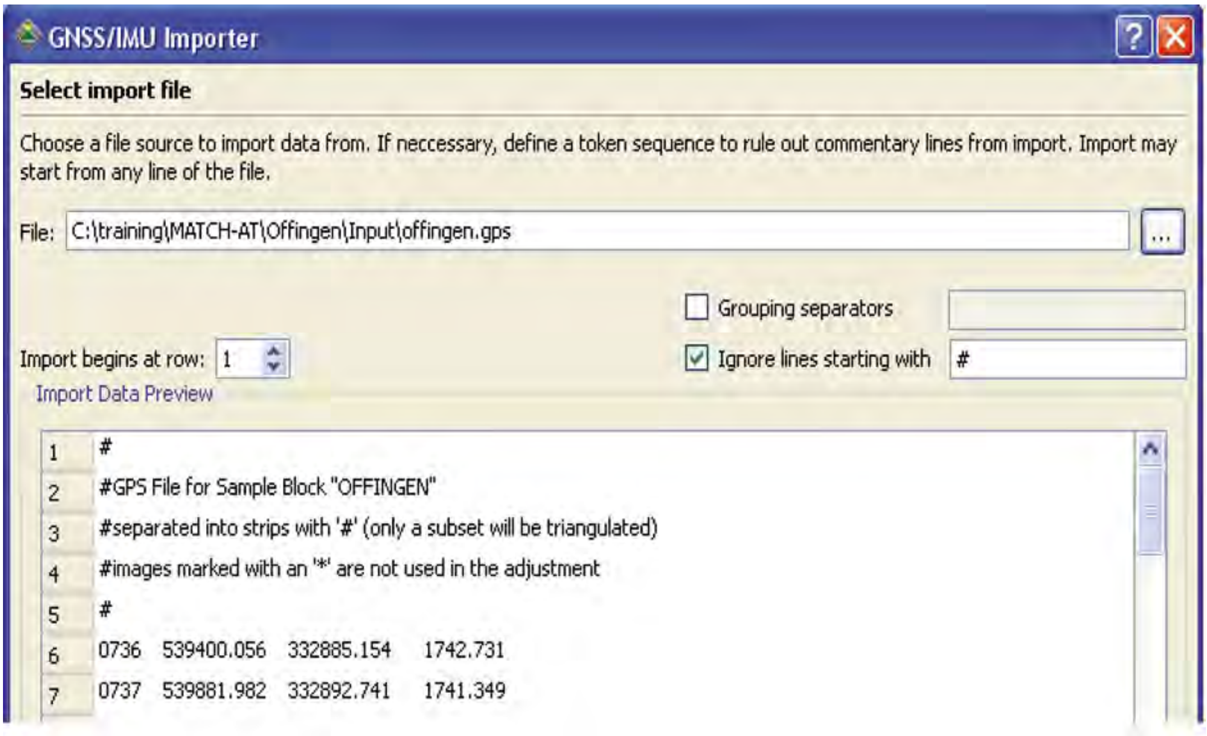

Select Import File
Look in: OS (C:)
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
AAS
dell
Documents and Settings
drivers
I386
Intel
Manual
Match_AT_Manuals
Program Files
tools
WINDOWS
Work_UCXP
File name:
Files of type: GNSS/IMU Files (*.gps *.gpsins *.txt)
Open
Cancel
Select Import File
Look in: Work_UCXP
Arif
Manual
Matiur
Result of AT in Thailand
Shahadat_M_AT
UCAMXP
File name:
Files of type: GNSS/IMU Files (*.gps *.gpsins *.txt)
Open
Cancel



Select Import File
Look in: UCAMXP
Images
Input_data
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name:
Files of type: GNSS/IMU Files (*.gps *.gpsins *.txt)
Open
Cancel
Select Import File
Look in: Input_data
3819.gcp
3819.gpsins
Training_UCAM_xp_file.prj
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name:
Files of type: All Files (*.*)
Open
Cancel

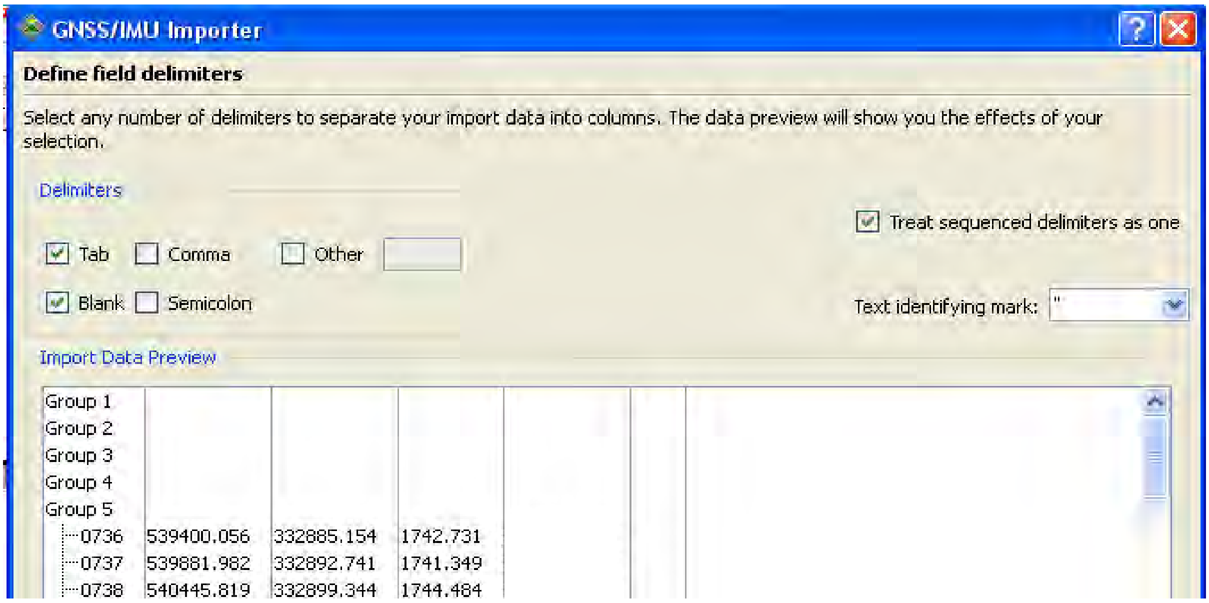
<Procedure>

* Input the identify letter of comment low in the GPS file (In this case “#”). Then “Next”



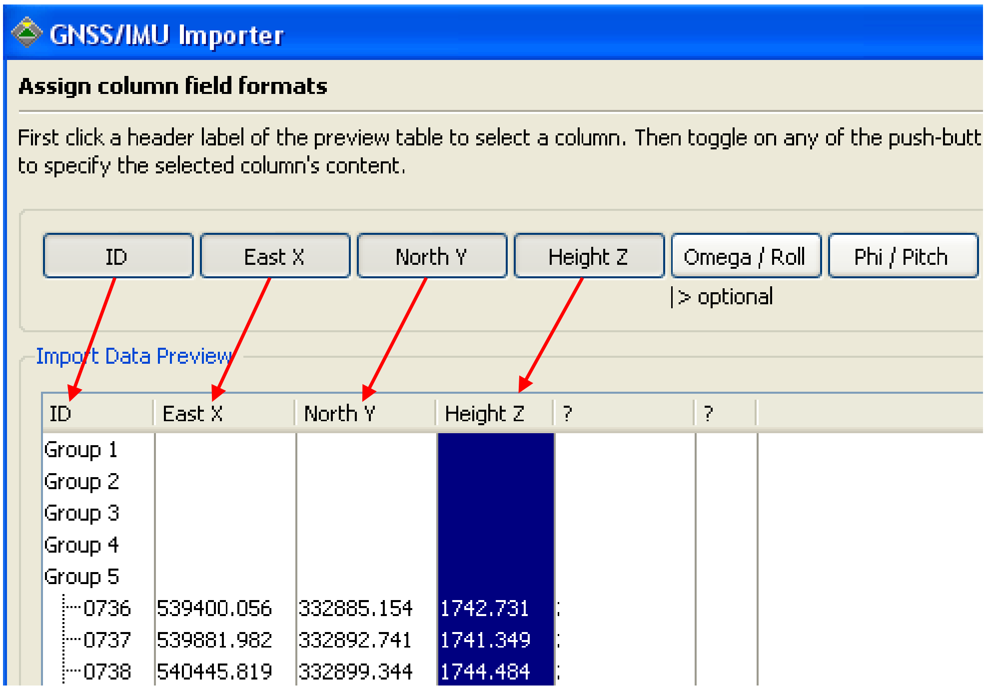
<Procedure>

* Input the identify letter for separation between ID, X, Y, etc in the GPS file (In this case “blank”). Then “Next”.

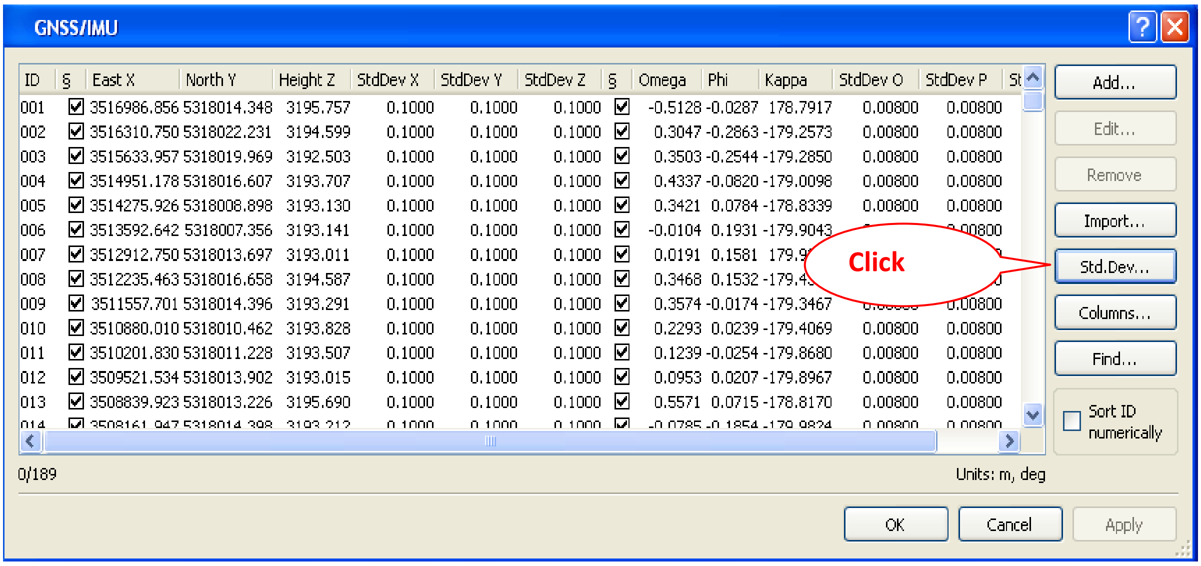


<Procedure>

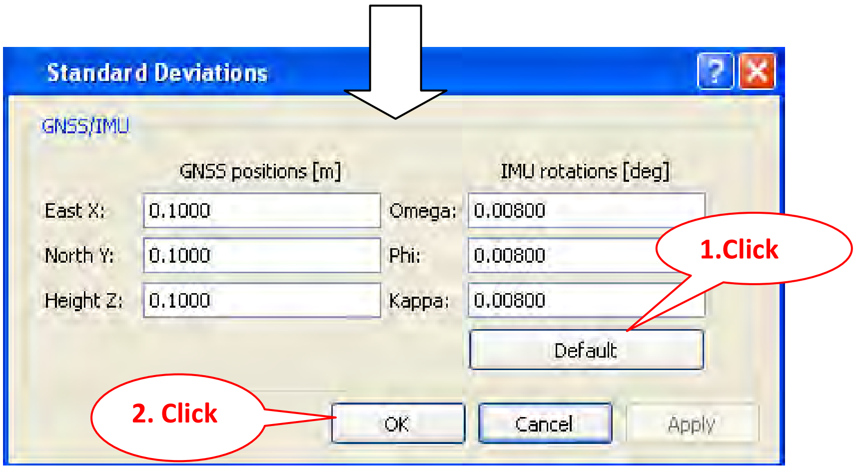
* Choose each field and Click corresponding class (example, the left field corresponds "ID" button).

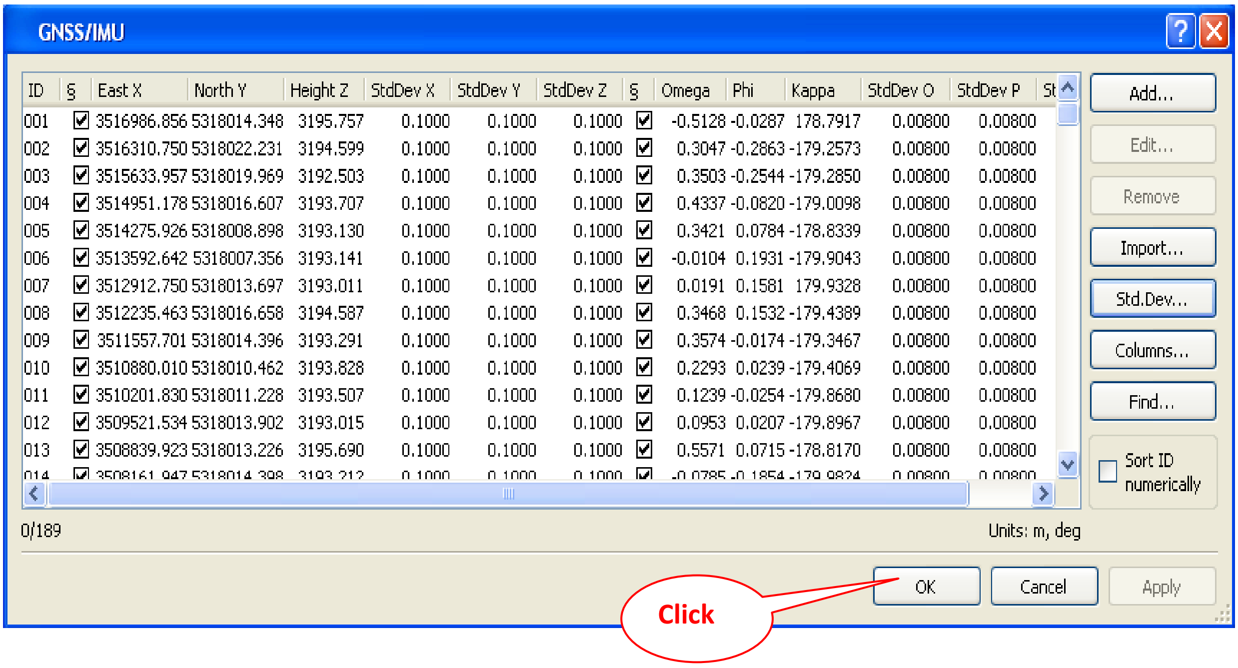


Then "Next". Then go "Next" until Finish.



Value of standard deviation is depending on the method of GPS_IMU. However when click the default button following values comes automatically.





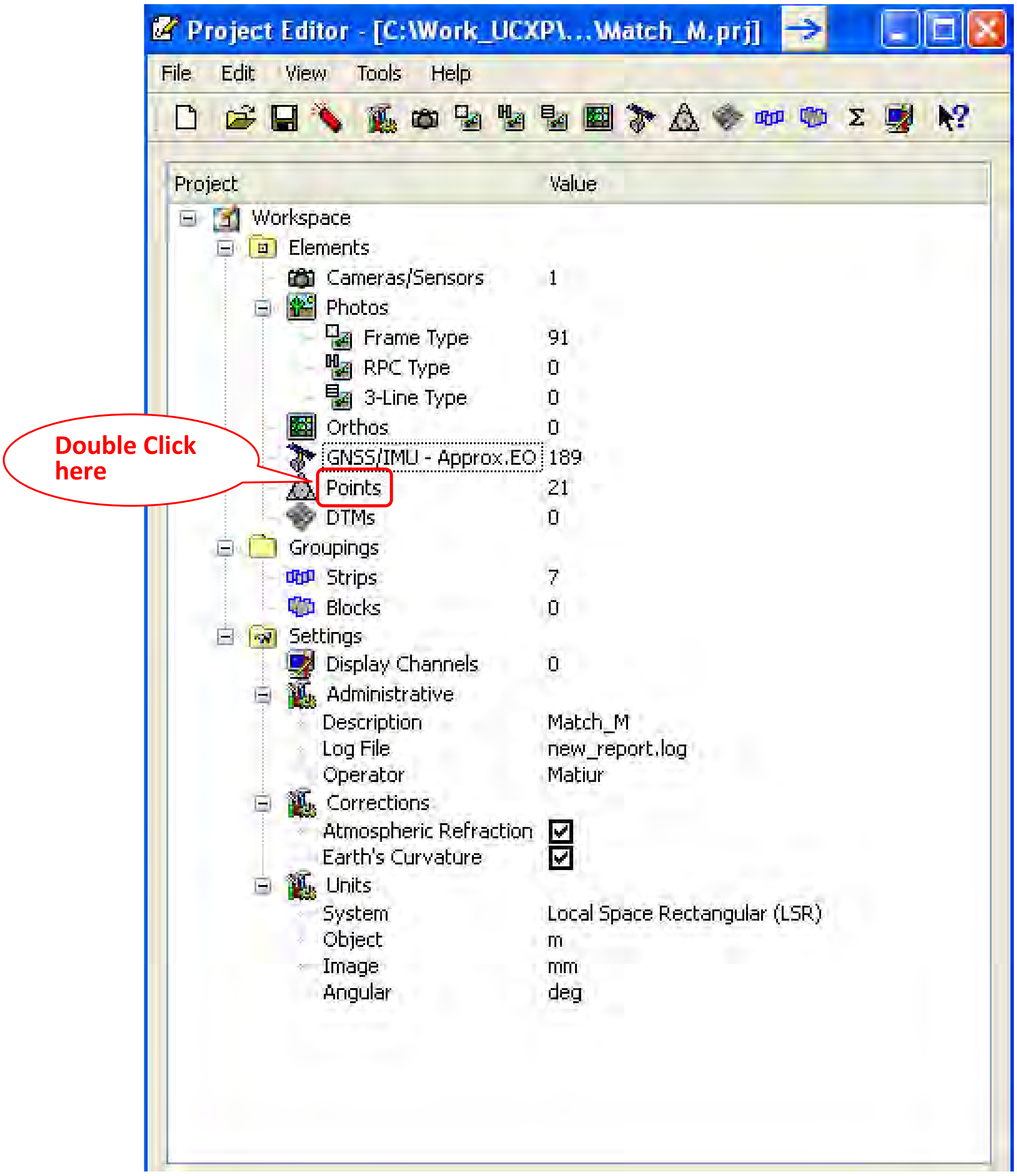
<Procedure>

*** Double Click "GNSS/IMU" Import--> Go to directory where GNSS/IMU data are stored--> select "GNSS/IMU data"--> "Open".**

***ATTN: Sometime have to input "Standard deviation" in manually and "OK"**

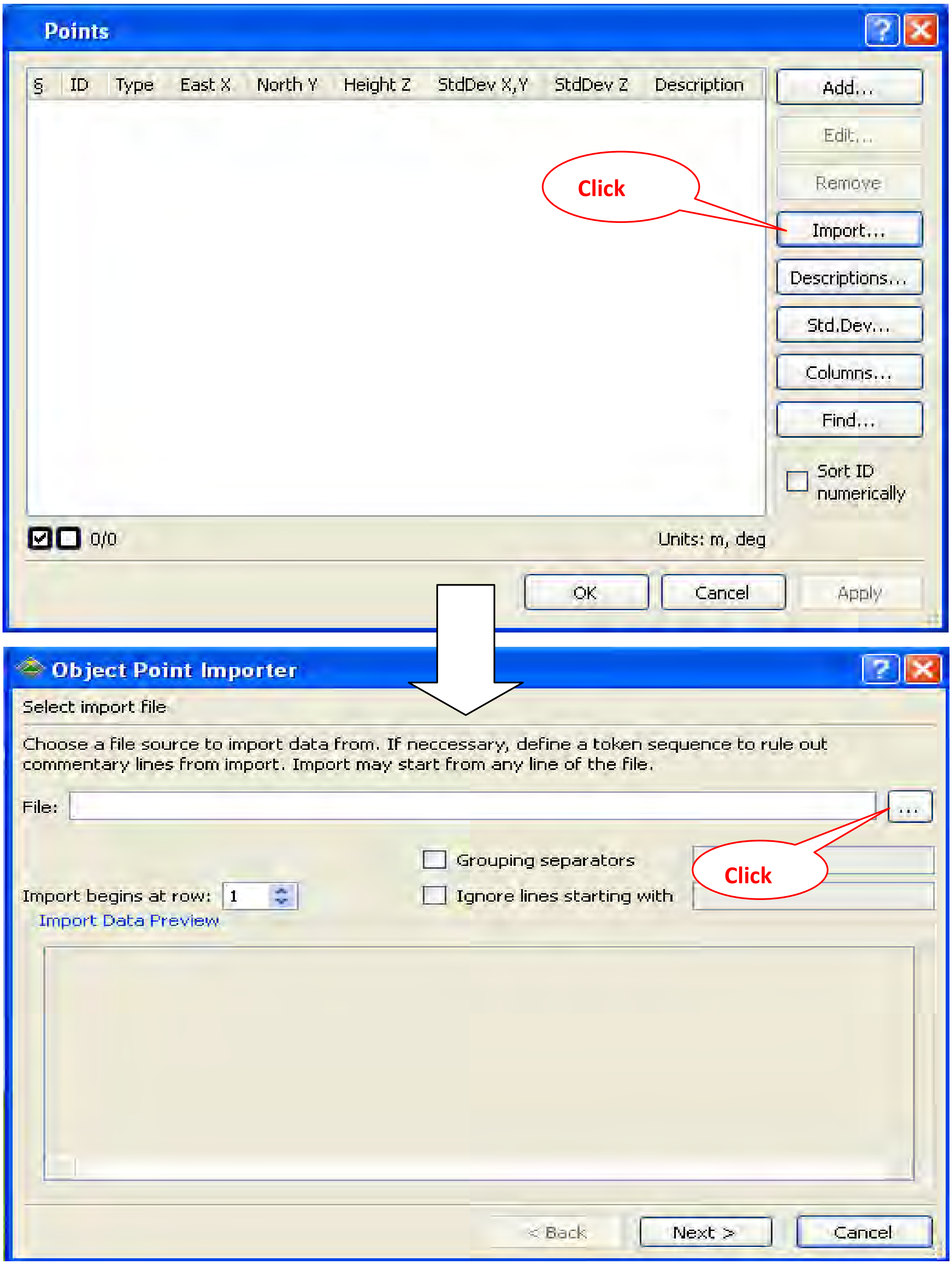
Chapter 5. GCP (Ground Control Point) Setup

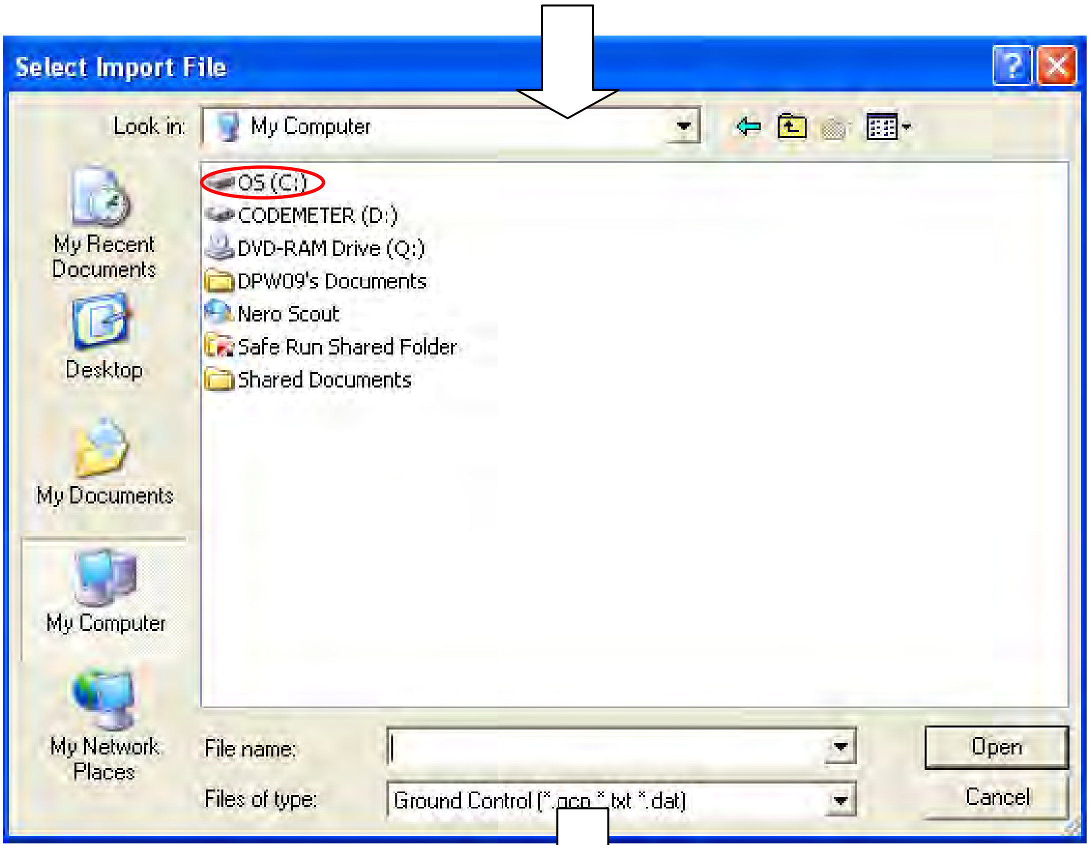
Chapter 5. GCP (Ground Control Points) Setup

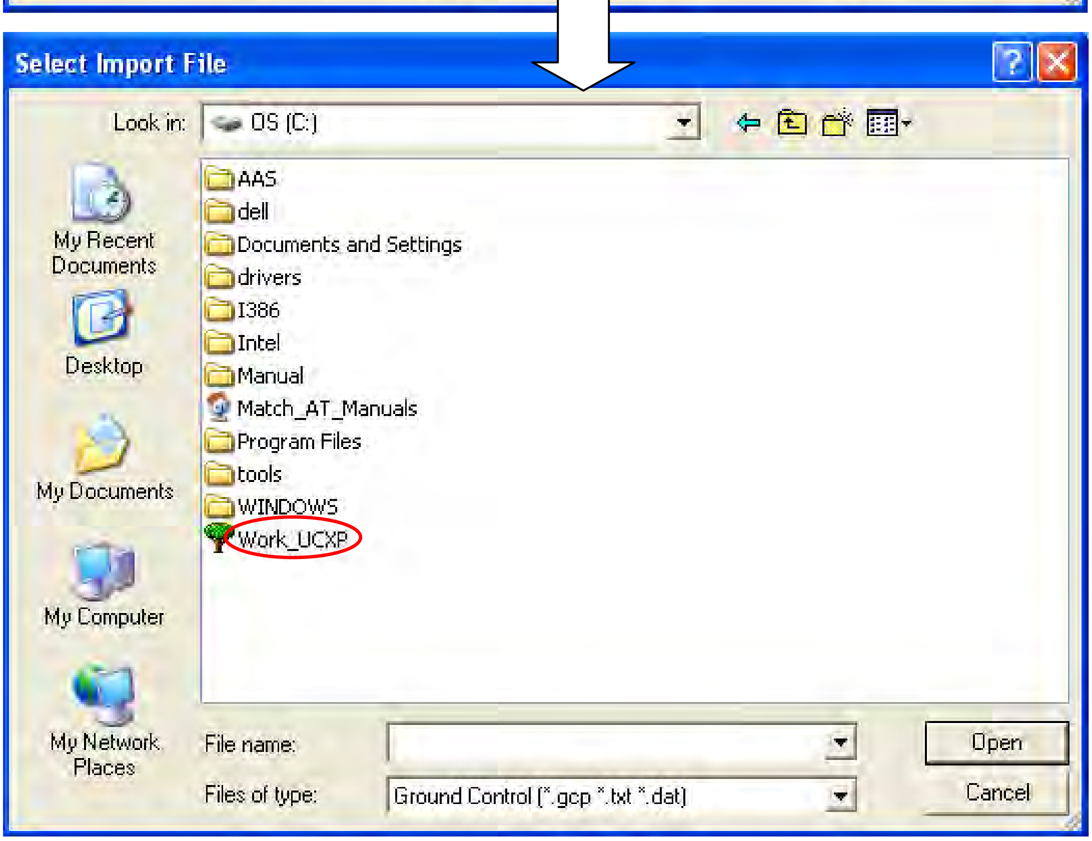


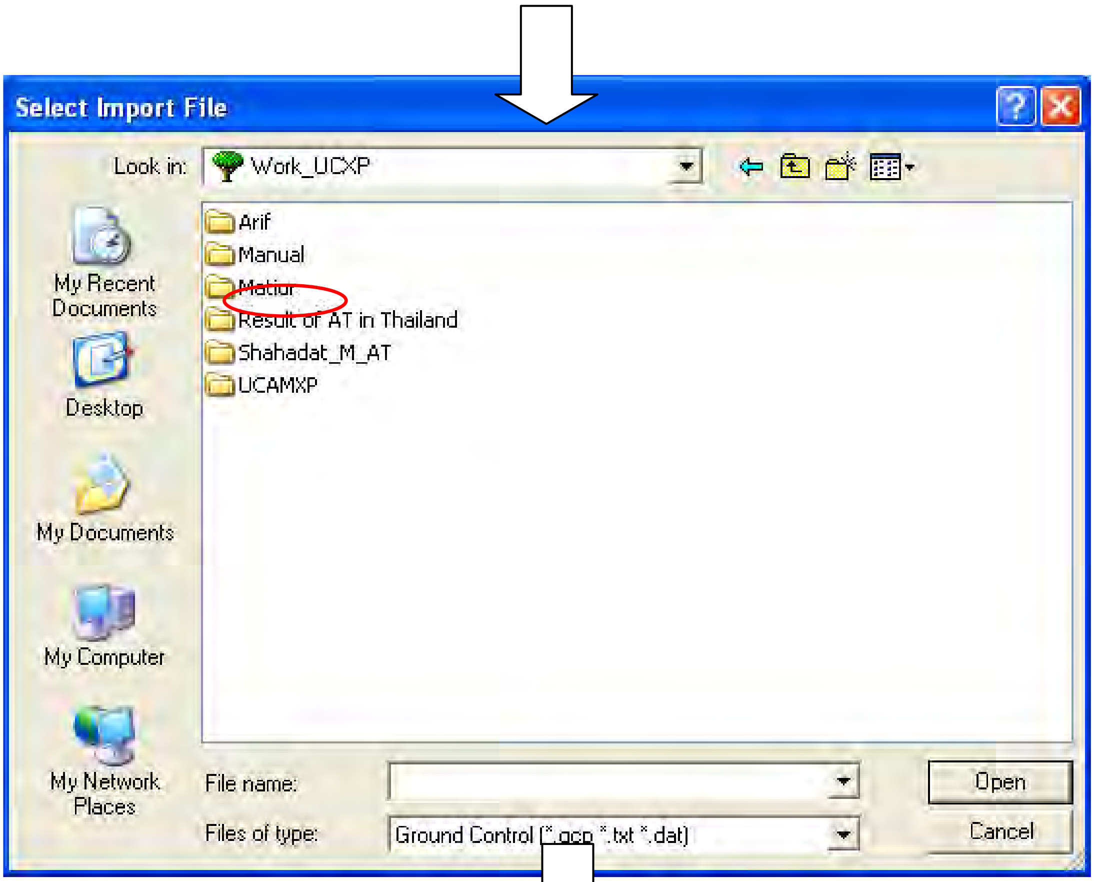
<Procedure>

For GCP Setup: Double click “Points”--> Click “import”--> Click [ ] --> Go to Directory-->Now go to folder where GCP is stored and select and “OK”

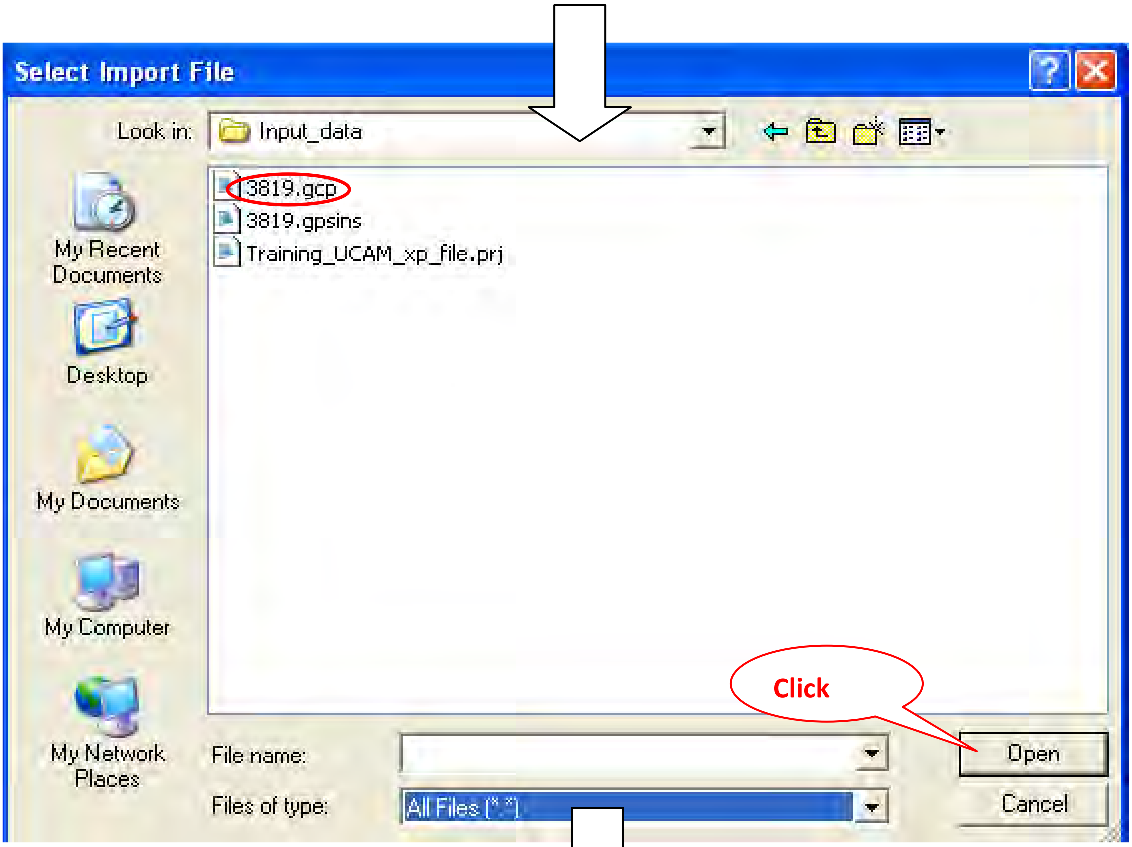



Select Import File
Look in:
My Computer
OS (C:)
CODEMETER (D:)
DVD-RAM Drive (Q:)
DPW09's Documents
Nero Scout
Safe Run Shared Folder
Shared Documents
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name:
Files of type:
Ground Control (*.gcp *.txt *.dat)
Open
Cancel

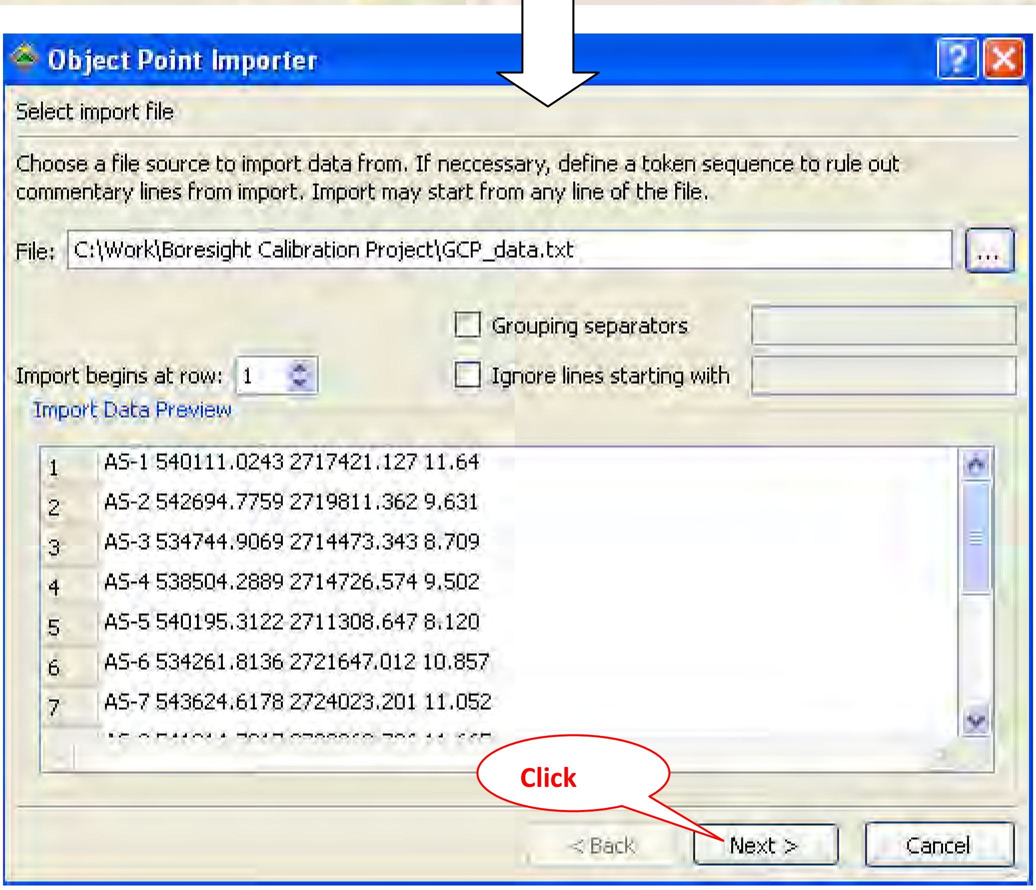

Select Import File
Look in:
OS (C:)
AAS
dell
Documents and Settings
drivers
I386
Intel
Manual
Match_AT_Manuals
Program Files
tools
WINDOWS
Work_UCXP
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name:
Files of type:
Ground Control (*.gcp *.txt *.dat)
Open
Cancel


Select Import File
Look in:
Work_UCXP
Arif
Manual
Matiur
Result of AT in Thailand
Shahadat_M_AT
UCAMXP
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name:
Files of type:
Ground Control (*.gcp *.txt *.dat)
Open
Cancel

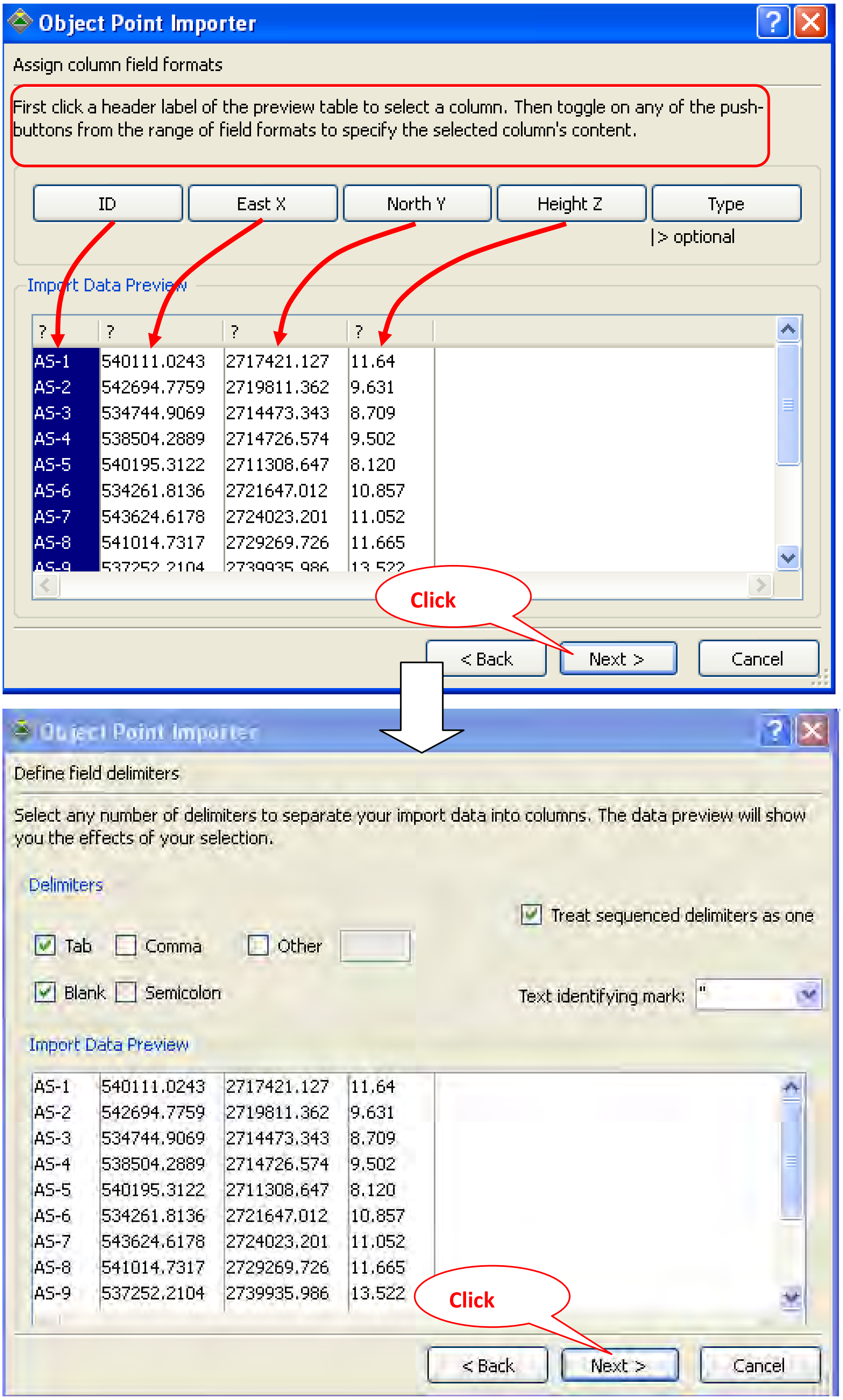

Select Import File
Look in:
UCAMXP
Images
Input_data
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name:
Files of type:
Ground Control (*.gcp *.txt *.dat)
Open
Cancel

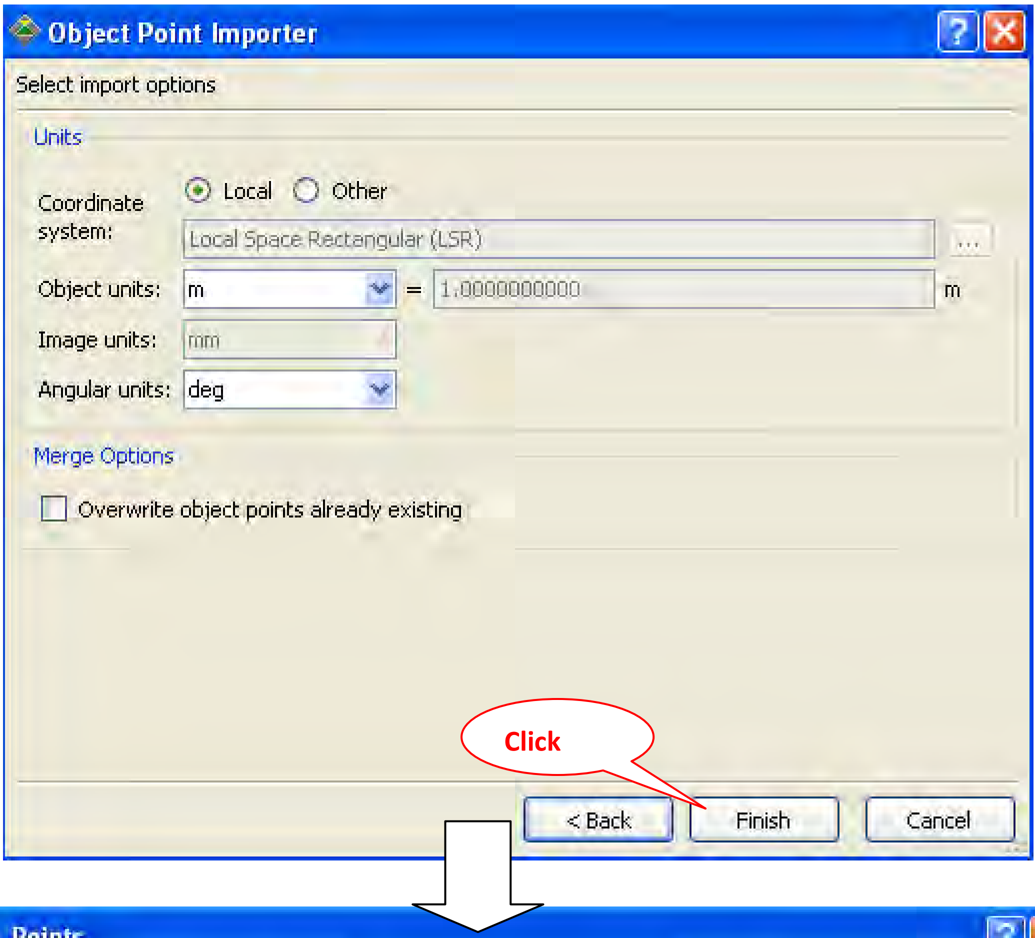


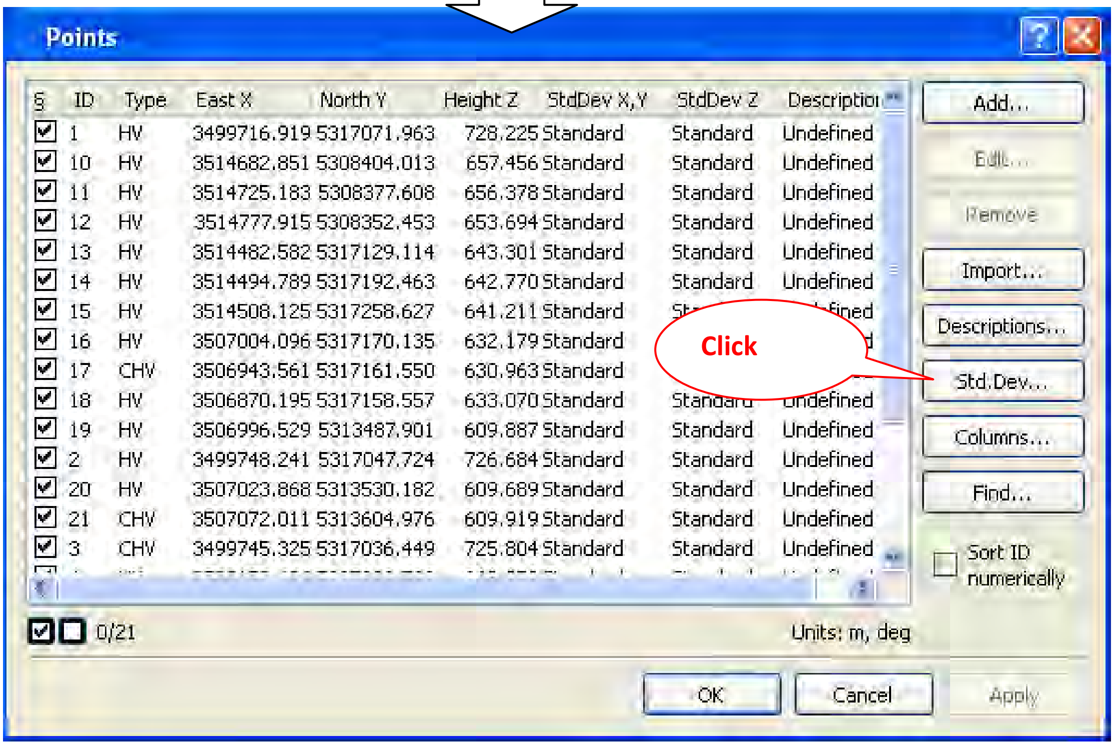
Select Import File
Look in:
Input_data
3819.gcp
3819.gpsins
Training_UCAM_xp_file.prj
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name:
Files of type:
All Files (*.*)
Click
Open
Cancel



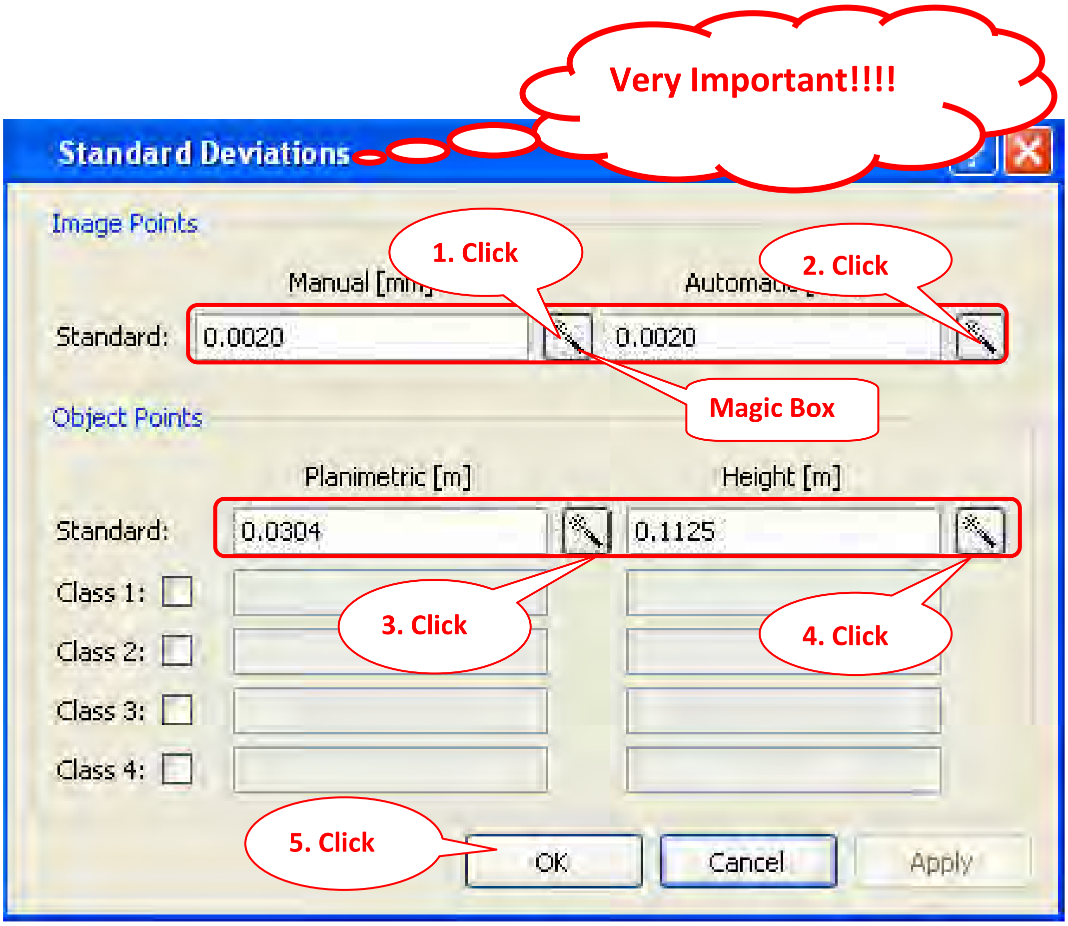
Object Point Importer
Select import file
Choose a file source to import data from. If neccessary, define a token sequence to rule out commentary lines from import. Import may start from any line of the file.
File: C:\Work\Boresight Calibration Project\GCP_data.txt
Grouping separators
Import begins at row: 1
Ignore lines starting with
Import Data Preview
1 AS-1 540111.0243 2717421.127 11.64
2 AS-2 542694.7759 2719811.362 9.631
3 AS-3 534744.9069 2714473.343 8.709
4 AS-4 538504.2889 2714726.574 9.502
5 AS-5 540195.3122 2711308.647 8.120
6 AS-6 534261.8136 2721647.012 10.857
7 AS-7 543624.6178 2724023.201 11.052
Click
< Back
Next >
Cancel


Object Point Importer
Assign column field formats
First click a header label of the preview table to select a column. Then toggle on any of the push-buttons from the range of field formats to specify the selected column's content.
ID
East X
North Y
Height Z
Type
|> optional
Import Data Preview
AS-1 540111.0243 2717421.127 11.64
AS-2 542694.7759 2719811.362 9.631
AS-3 534744.9069 2714473.343 8.709
AS-4 538504.2889 2714726.574 9.502
AS-5 540195.3122 2711308.647 8.120
AS-6 534261.8136 2721647.012 10.857
AS-7 543624.6178 2724023.201 11.052
AS-8 541014.7317 2729269.726 11.665
Click
< Back
Next >
Cancel
Object Point Importer
Define field delimiters
Select any number of delimiters to separate your import data into columns. The data preview will show you the effects of your selection.
Delimiters
Treat sequenced delimiters as one
Tab
Comma
Other
Blank
Semicolon
Text identifying mark:
Import Data Preview
AS-1 540111.0243 2717421.127 11.64
AS-2 542694.7759 2719811.362 9.631
AS-3 534744.9069 2714473.343 8.709
AS-4 538504.2889 2714726.574 9.502
AS-5 540195.3122 2711308.647 8.120
AS-6 534261.8136 2721647.012 10.857
AS-7 543624.6178 2724023.201 11.052
AS-8 541014.7317 2729269.726 11.665
AS-9 537252.2104 2739935.986 13.522
Click
< Back
Next >
Cancel

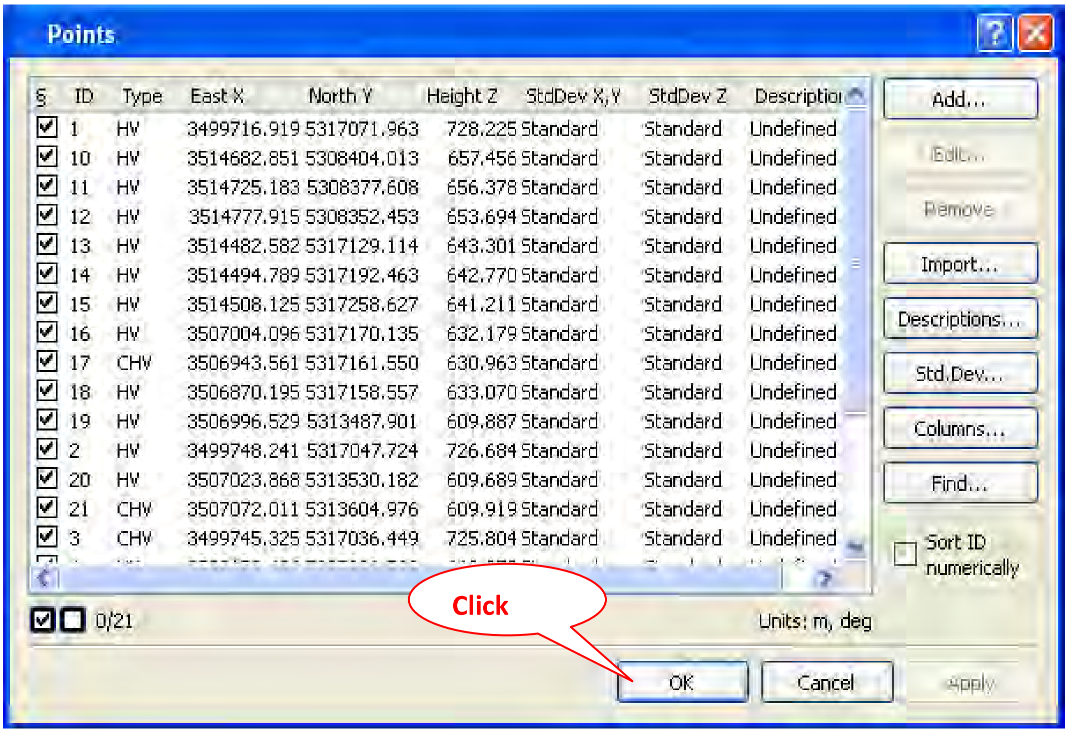




§	ID	Type	East X	North Y	Height Z	StdDev X,Y	StdDev Z	Description
☑	1	HV	3499716.919	5317071.963	728.225	Standard	Standard	Undefined
☑	10	HV	3514682.851	5308404.013	657.456	Standard	Standard	Undefined
☑	11	HV	3514725.183	5308377.608	656.378	Standard	Standard	Undefined
☑	12	HV	3514777.915	5308352.453	653.694	Standard	Standard	Undefined
☑	13	HV	3514482.582	5317129.114	643.301	Standard	Standard	Undefined
☑	14	HV	3514494.789	5317192.463	642.770	Standard	Standard	Undefined
☑	15	HV	3514508.125	5317258.627	641.211	Standard	[illegible]	[illegible]
☑	16	HV	3507004.096	5317170.135	632.179	Standard	[illegible]	[illegible]
☑	17	CHV	3506943.561	5317161.550	630.963	Standard	[illegible]	[illegible]
☑	18	HV	3506870.195	5317158.557	633.070	Standard	Standard	Undefined
☑	19	HV	3506996.529	5313487.901	609.887	Standard	Standard	Undefined
☑	2	HV	3499748.241	5317047.724	726.684	Standard	Standard	Undefined
☑	20	HV	3507023.868	5313530.182	609.689	Standard	Standard	Undefined
☑	21	CHV	3507072.011	5313604.976	609.919	Standard	Standard	Undefined
☑	3	CHV	3499745.325	5317036.449	725.804	Standard	Standard	Undefined



The standard deviation specified for observation groups determine the weighting of those observations. The smaller standard deviation values mean that the higher weight and more accurate observations are carrying out. If necessary, 5 different sets of standard deviations can be entered assigned to ground control points in order to work with different accuracy classes.

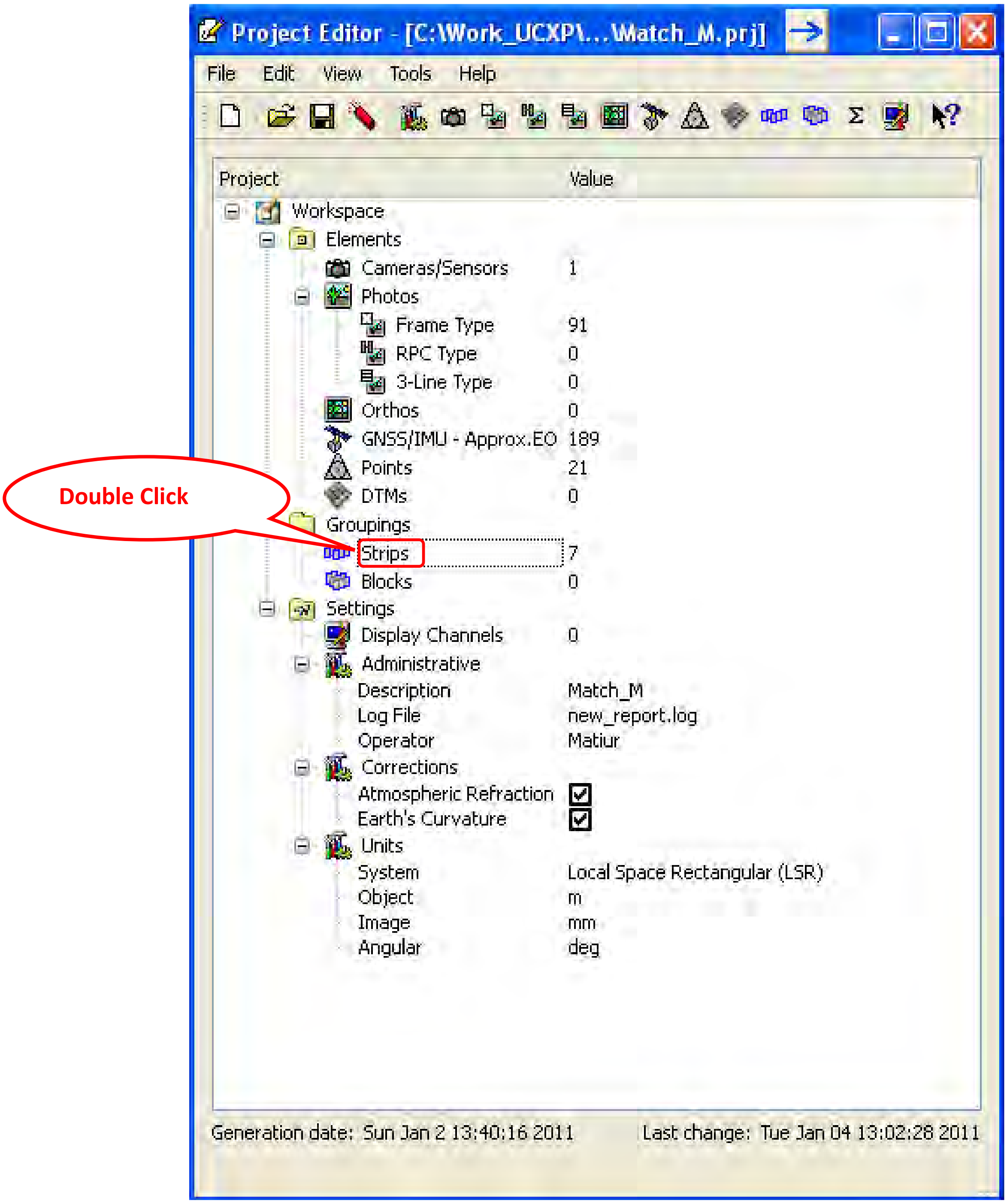


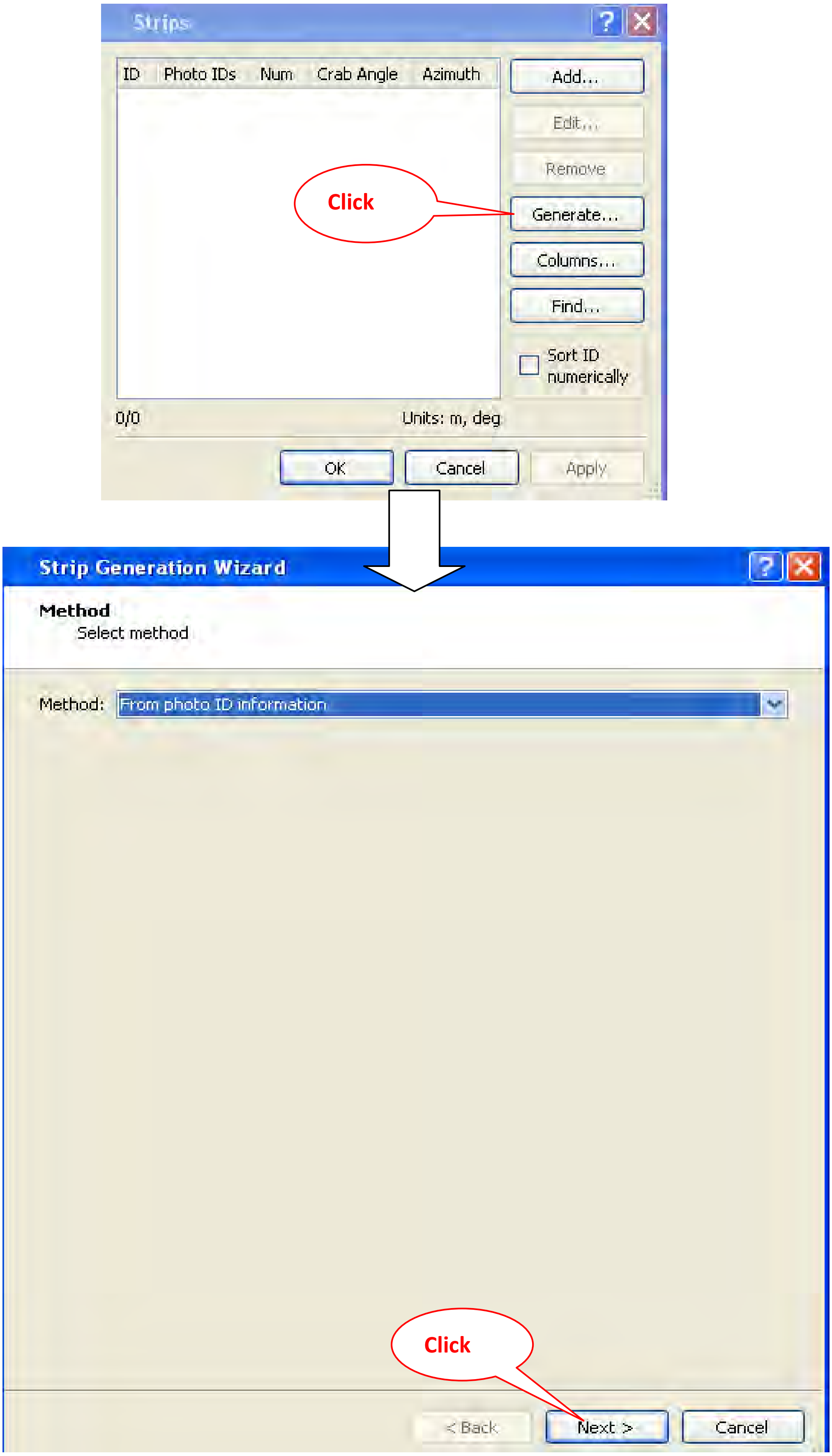
<Procedure>

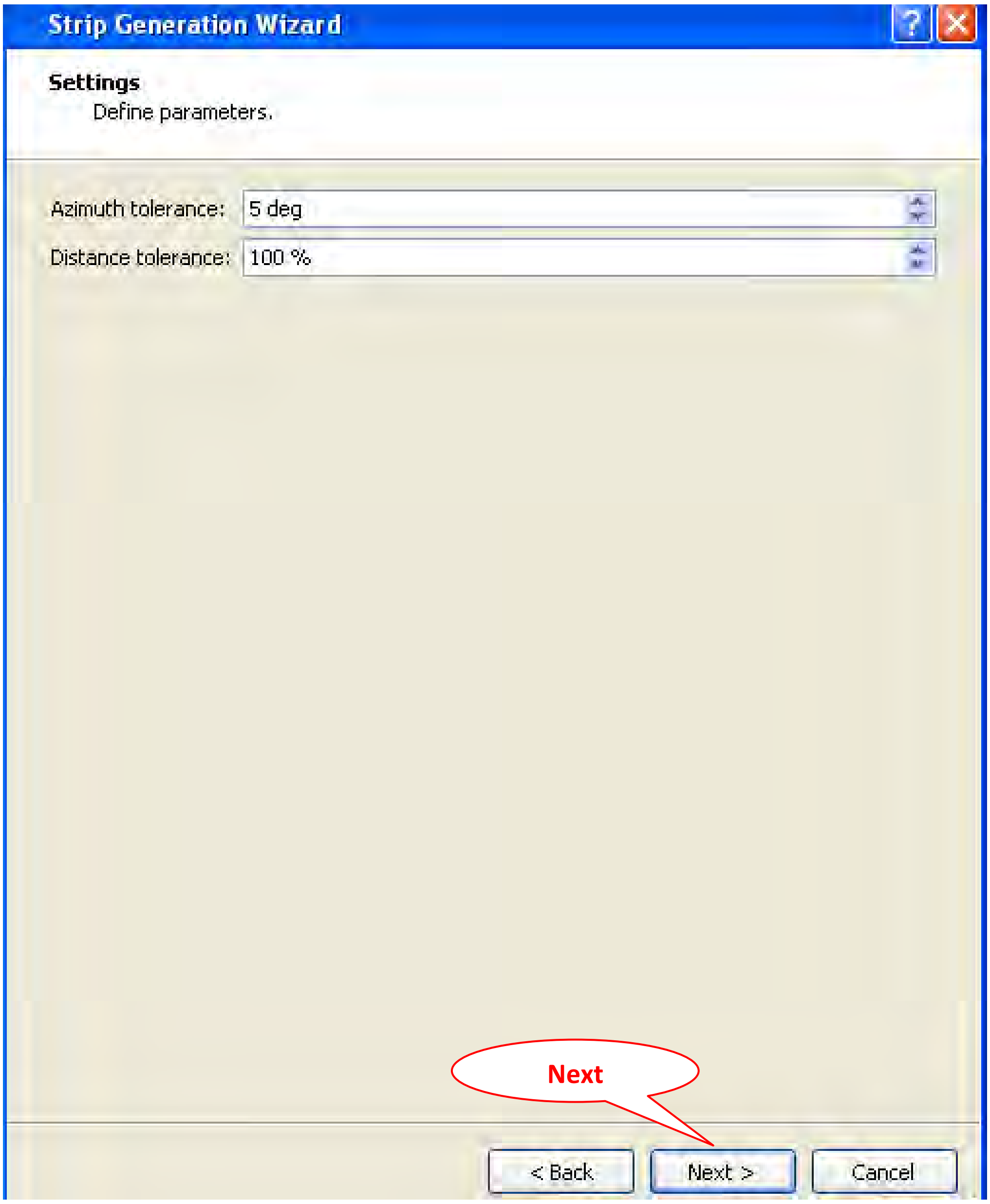
*** After click “magic box”, “Standard Deviation” will be input automatically and Click “OK”. After this procedure is completed on each “magic box” individually for all “magic box”, then click “Apply” & “OK”.**

Chapter 6. Strip Setting (Automatic System)

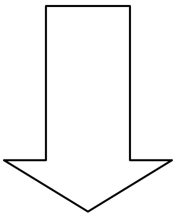
Chapter 6. Strip Setting (Automatic System)

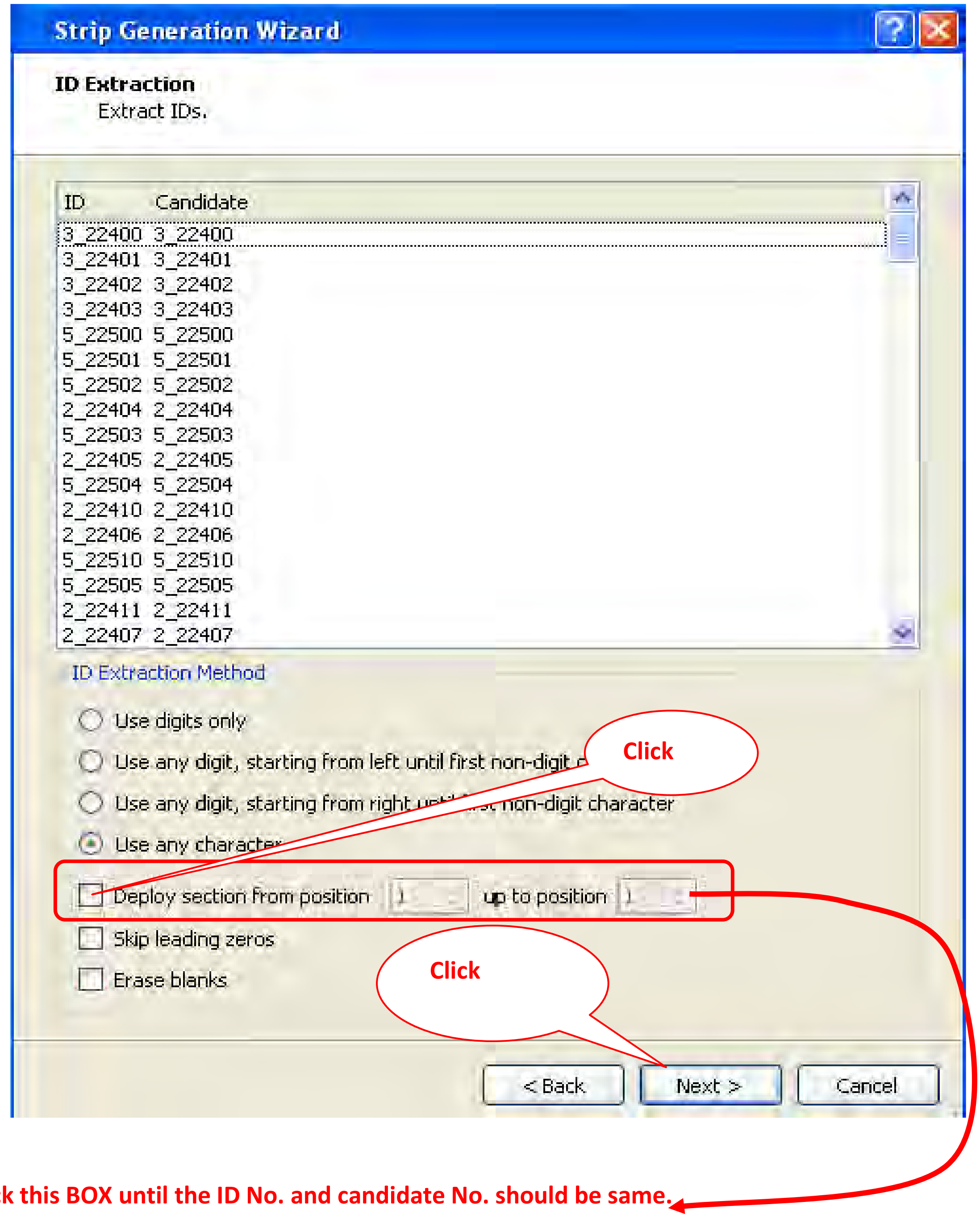



Strips
ID
Photo IDs
Num
Crab Angle
Azimuth
Add...
Edit...
Remove
Click
Generate...
Columns...
Find...
Sort ID numerically
0/0
Units: m, deg
OK
Cancel
Apply
Strip Generation Wizard
Method
Select method
Method:
From photo ID information
Click
< Back
Next >
Cancel

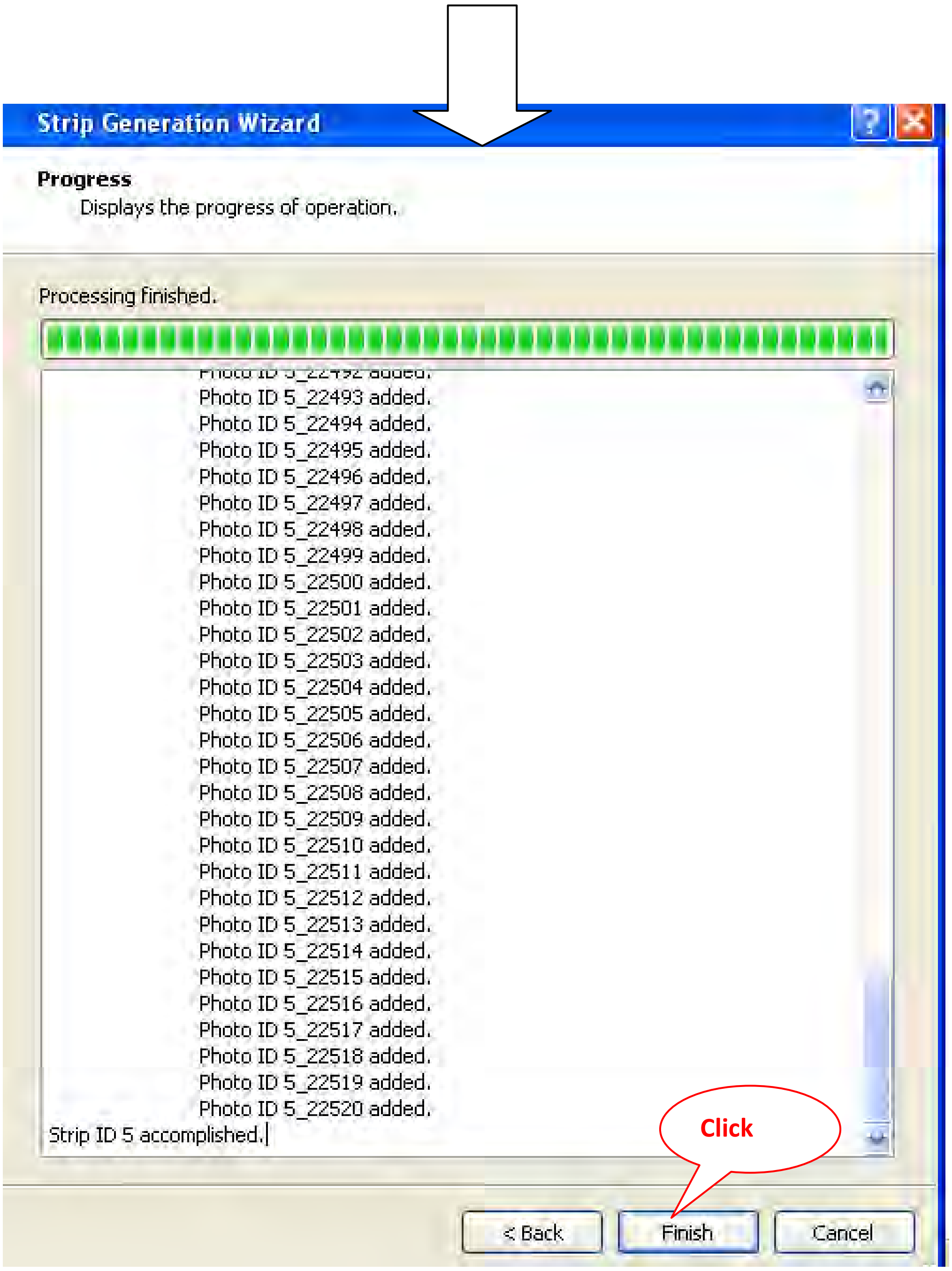


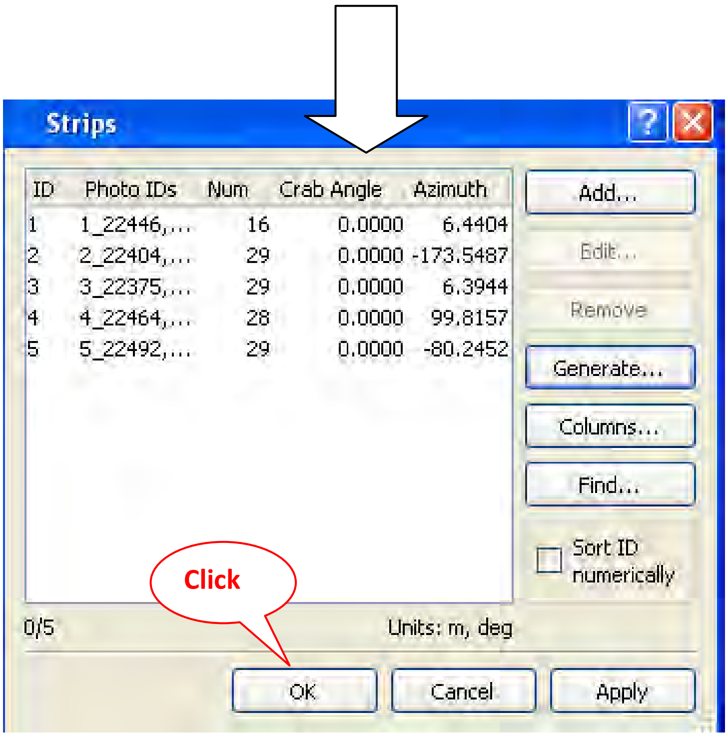
Strip Generation Wizard
Settings
Define parameters.
Azimuth tolerance:
5 deg
Distance tolerance:
100 %
Next
< Back
Next >
Cancel





Click this BOX until the ID No. and candidate No. should be same.


Strip Generation Wizard
Progress
Displays the progress of operation.
Processing finished.
Photo ID 5_22493 added.
Photo ID 5_22494 added.
Photo ID 5_22495 added.
Photo ID 5_22496 added.
Photo ID 5_22497 added.
Photo ID 5_22498 added.
Photo ID 5_22499 added.
Photo ID 5_22500 added.
Photo ID 5_22501 added.
Photo ID 5_22502 added.
Photo ID 5_22503 added.
Photo ID 5_22504 added.
Photo ID 5_22505 added.
Photo ID 5_22506 added.
Photo ID 5_22507 added.
Photo ID 5_22508 added.
Photo ID 5_22509 added.
Photo ID 5_22510 added.
Photo ID 5_22511 added.
Photo ID 5_22512 added.
Photo ID 5_22513 added.
Photo ID 5_22514 added.
Photo ID 5_22515 added.
Photo ID 5_22516 added.
Photo ID 5_22517 added.
Photo ID 5_22518 added.
Photo ID 5_22519 added.
Photo ID 5_22520 added.
Strip ID 5 accomplished.
Click
< Back
Finish
Cancel



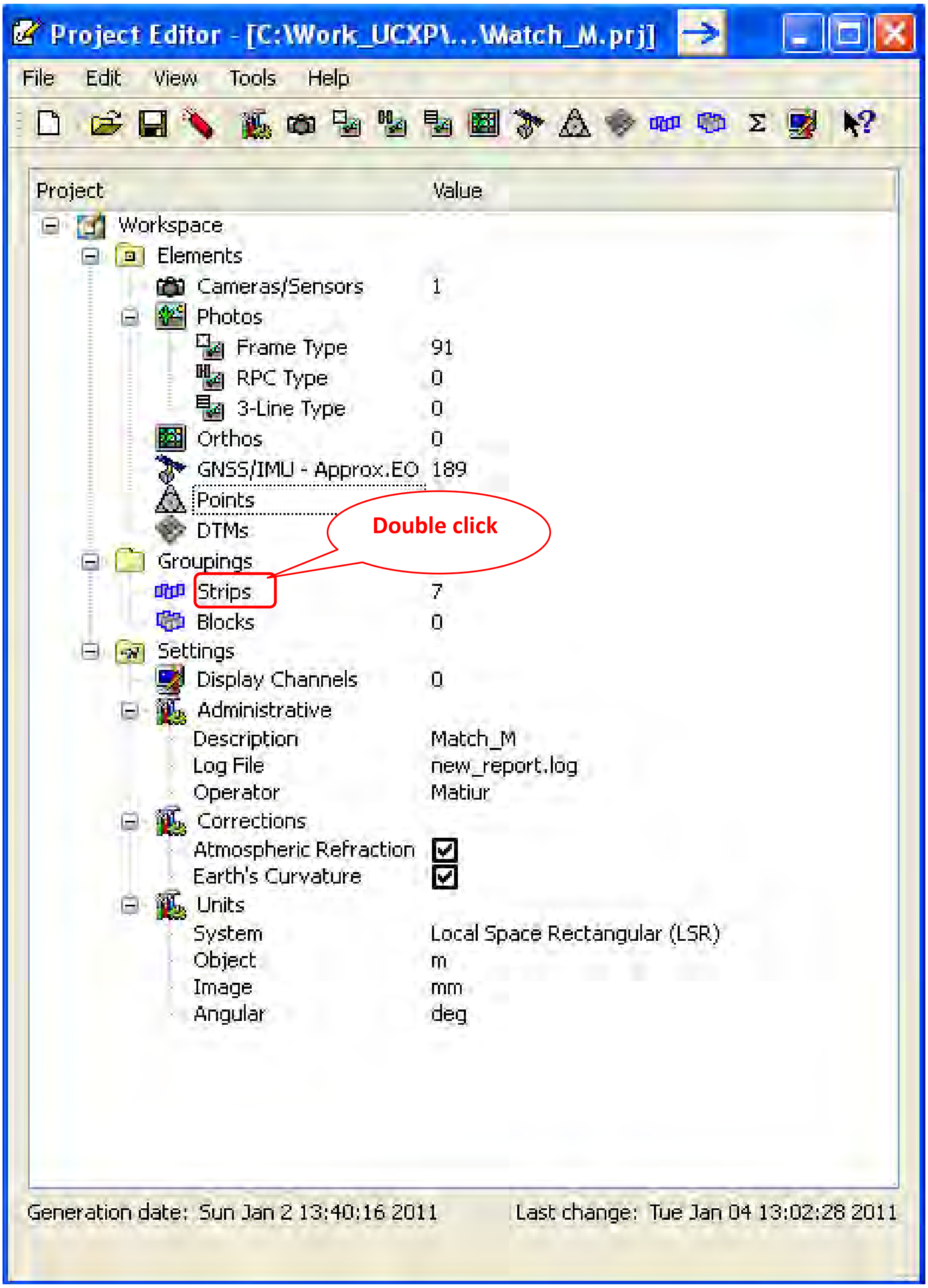
<Procedure>

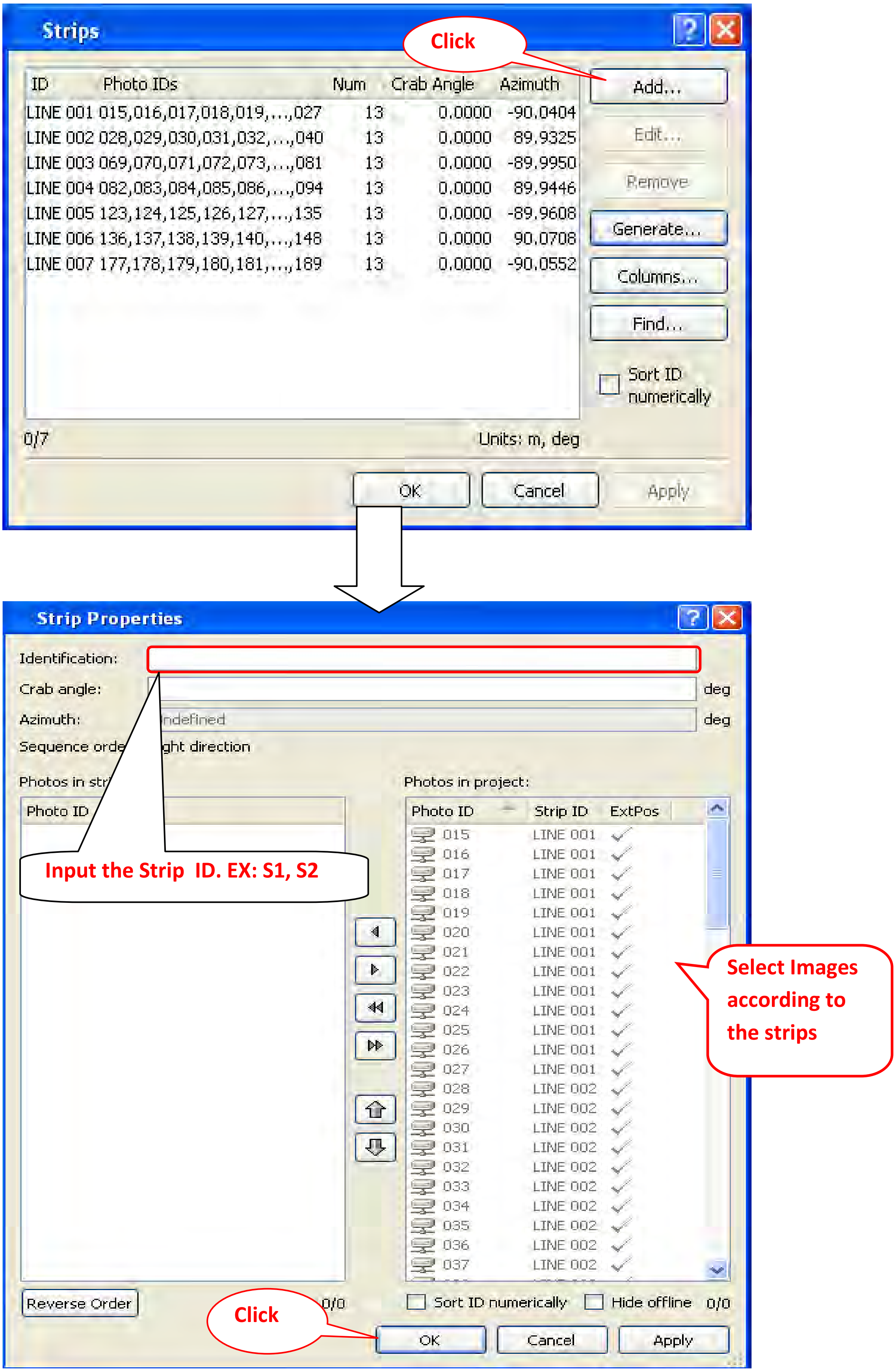
Double click "Strip"--> "Generate"-->"Next"--> Select "Deploy section" from position box & click up to position arrow until the image & GNSS ID No. become the same-->"Next"

-->"Finish" --> "Apply" & "OK."(Strip setting completed.)

Chapter 7. Manual Strip Setting

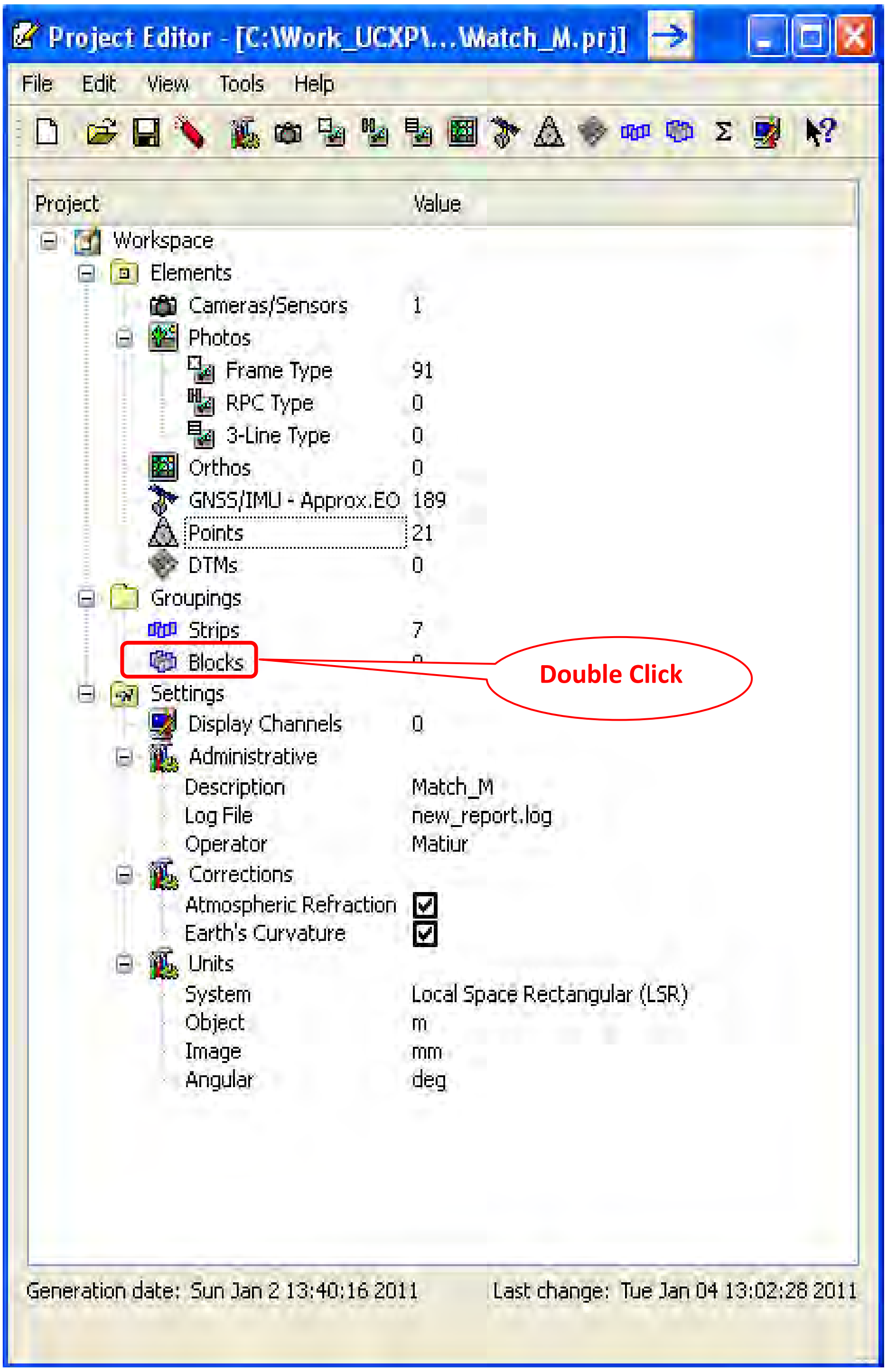
Chapter 7. Manual Strip Setting

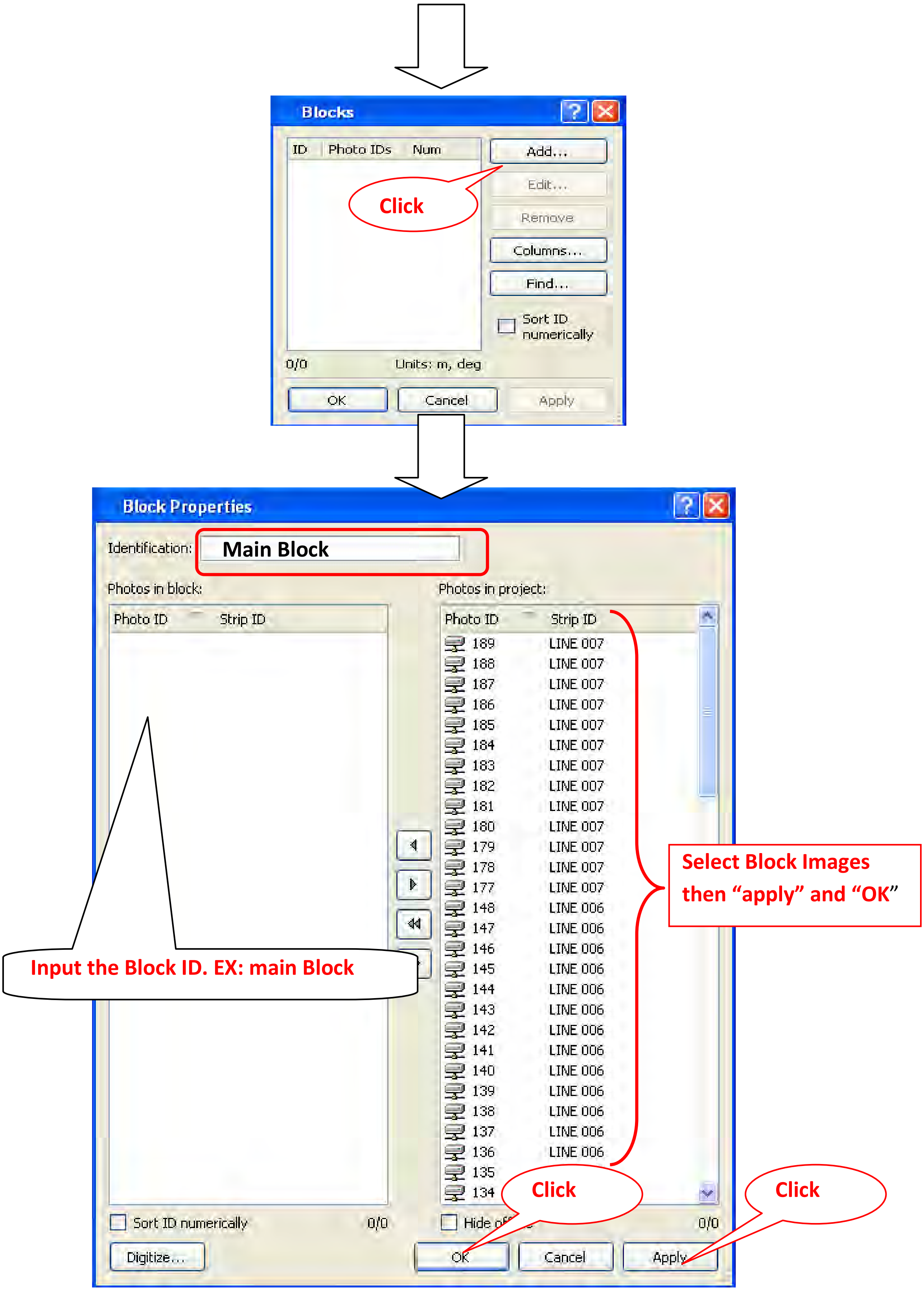



Strips
Click
ID Photo IDs Num Crab Angle Azimuth
LINE 001 015,016,017,018,019,...,027 13 0.0000 -90.0404
LINE 002 028,029,030,031,032,...,040 13 0.0000 89.9325
LINE 003 069,070,071,072,073,...,081 13 0.0000 -89.9950
LINE 004 082,083,084,085,086,...,094 13 0.0000 89.9446
LINE 005 123,124,125,126,127,...,135 13 0.0000 -89.9608
LINE 006 136,137,138,139,140,...,148 13 0.0000 90.0708
LINE 007 177,178,179,180,181,...,189 13 0.0000 -90.0552
Add...
Edit...
Remove
Generate...
Columns...
Find...
Sort ID numerically
0/7
Units: m, deg
OK
Cancel
Apply
Strip Properties
Identification:
Crab angle:
deg
Azimuth:
deg
Sequence orde
ght direction
Photos in str
Photos in project:
Photo ID
Photo ID Strip ID ExtPos
Input the Strip ID. EX: S1, S2
Select Images according to the strips
Reverse Order
Click
0/0
Sort ID numerically
Hide offline
0/0
OK
Cancel
Apply

Chapter 8.   Block Setting

Chapter 8. Block Setting



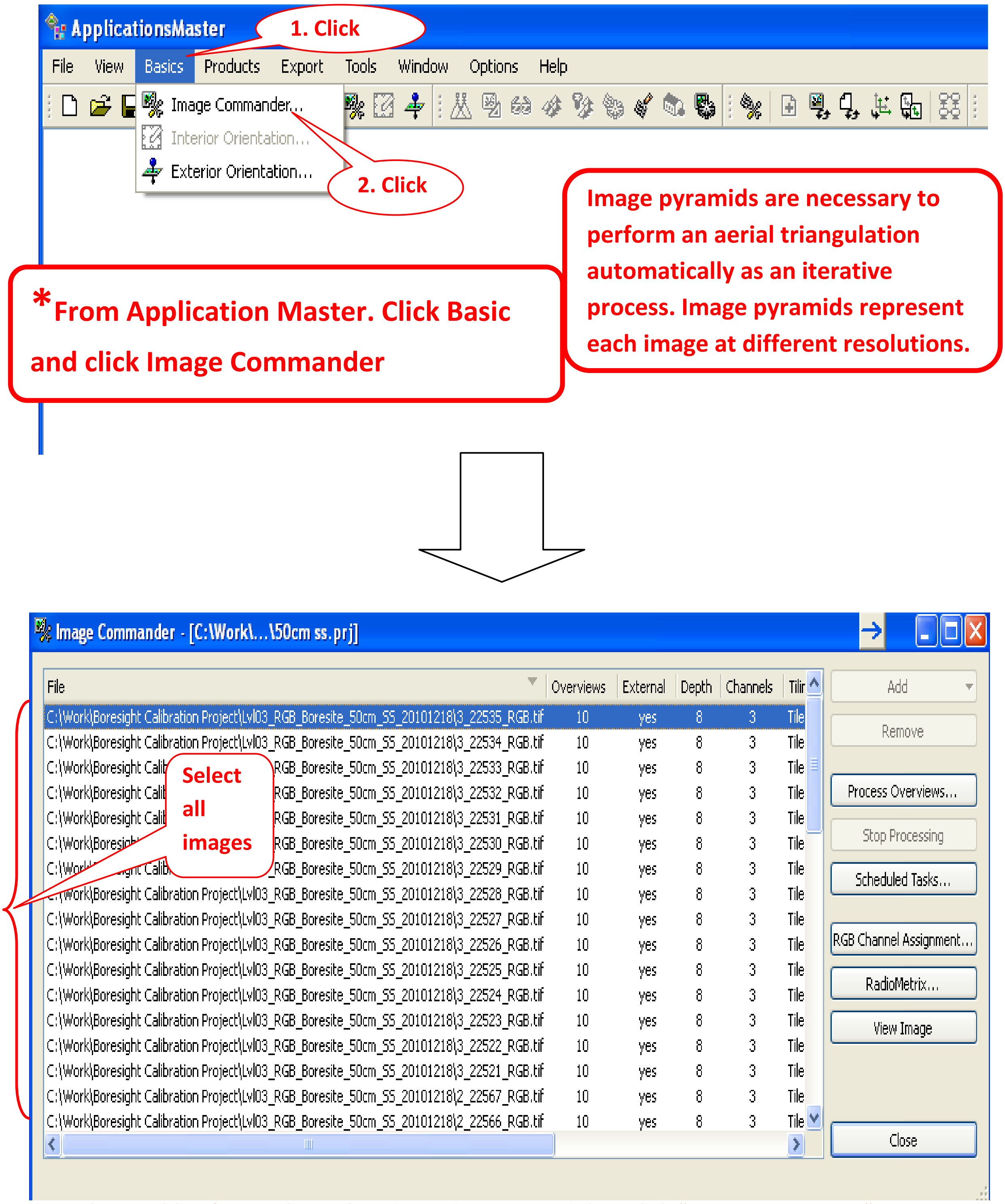


* The Basic Setup has completed

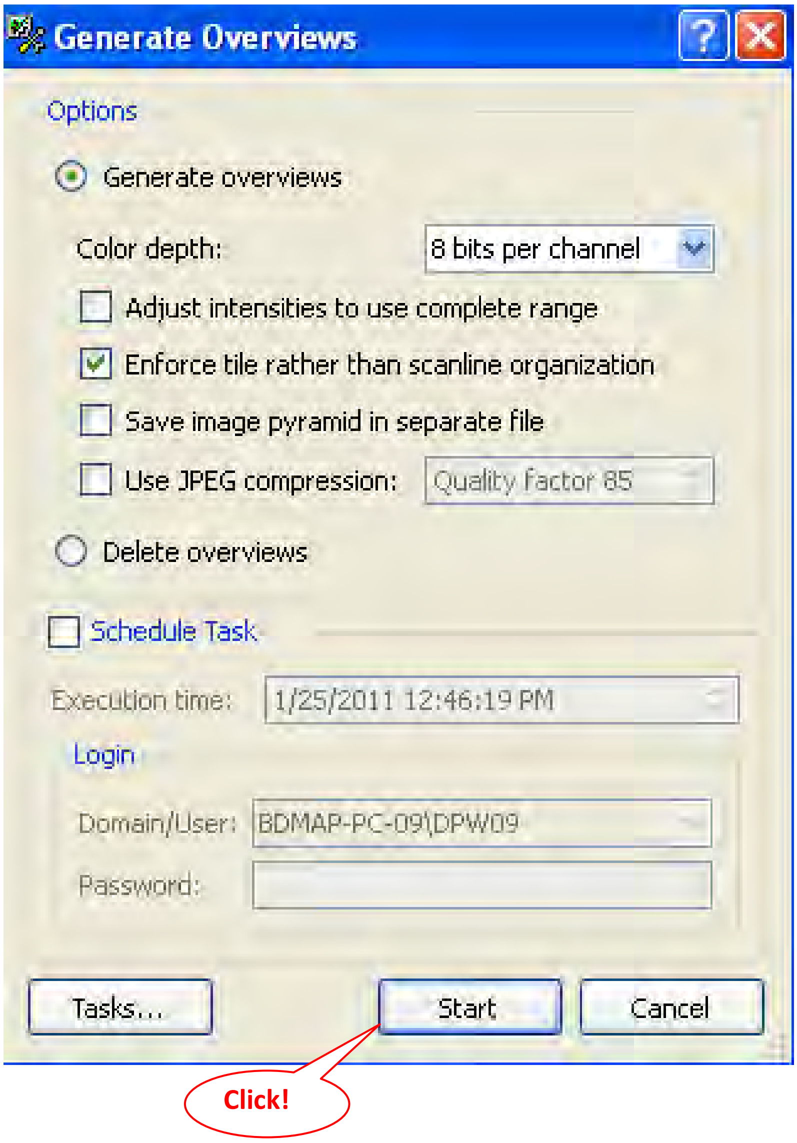
After completing **Project Setup**, you must save the project, otherwise it has possibility to miss all project data

Chapter 9. Image Pyramid Creation

Chapter 9. Image Pyramid Creation



From above table of image list, select desired images and then click "process overviews".

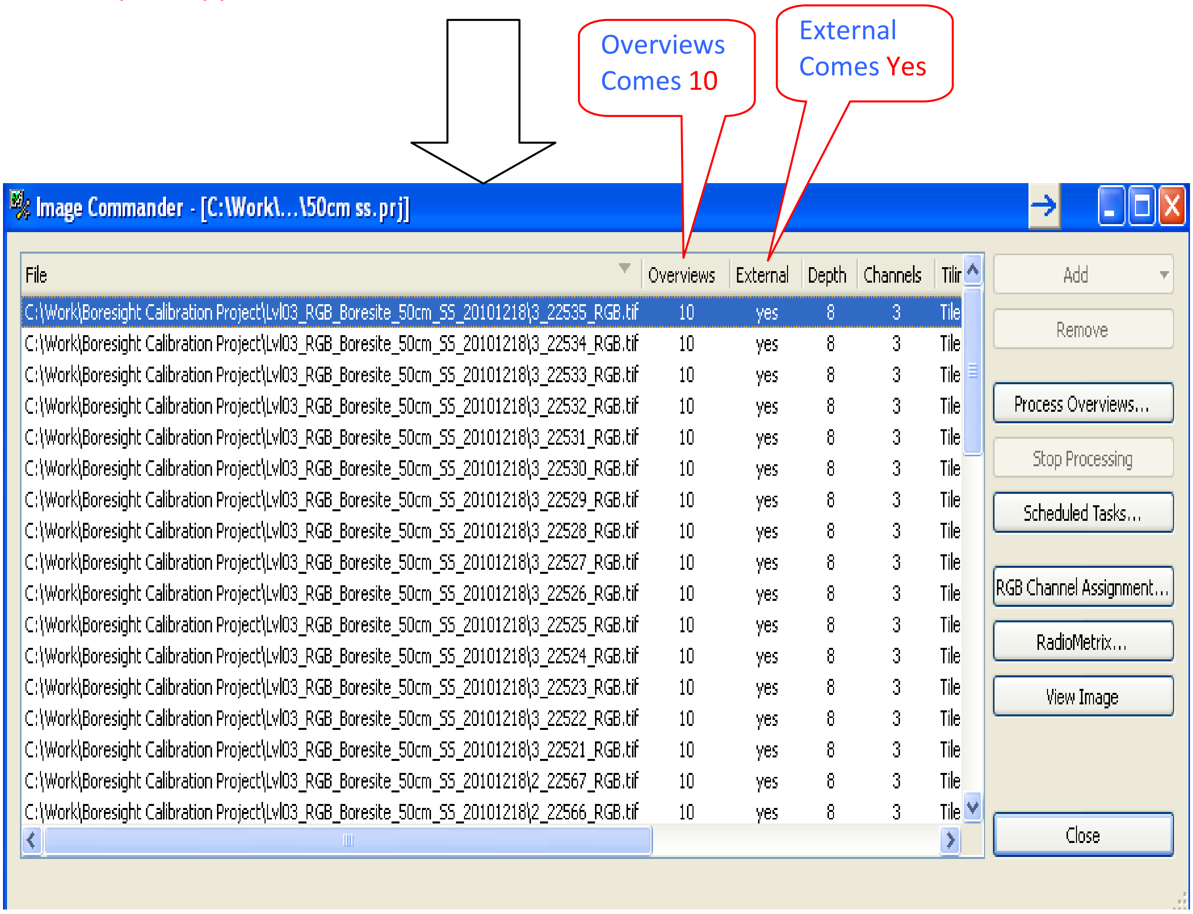


<Procedure> For image pyramid creation:

Ex: Click **"Basics"**-->Click **"Image commander"**-->Select all images-->Click **"Process Overviews"**-->Click **"Start"**

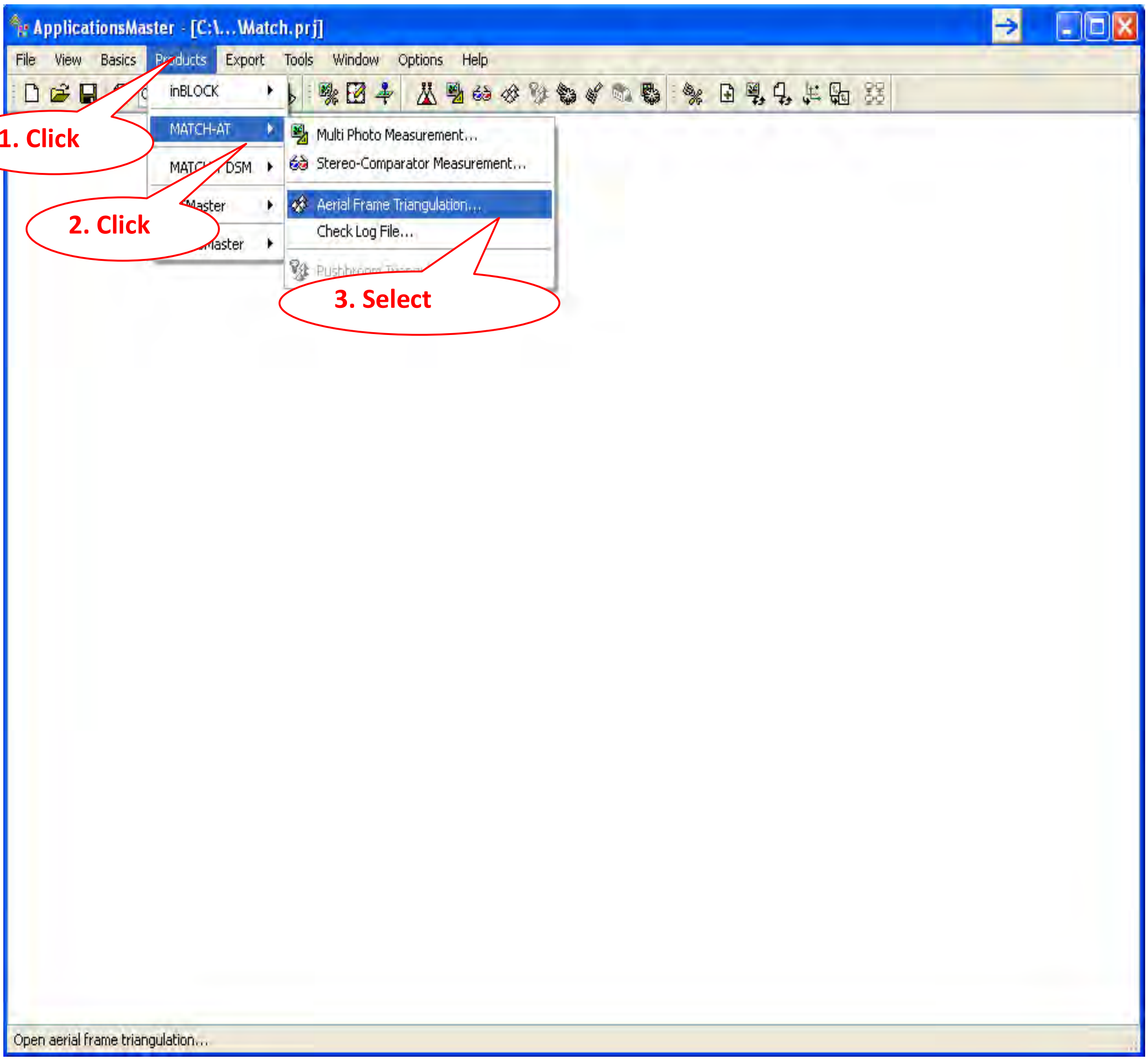
* This Process will continue and it takes several times. After completing pyramid, then **"close".**

After completed pyramid creation then



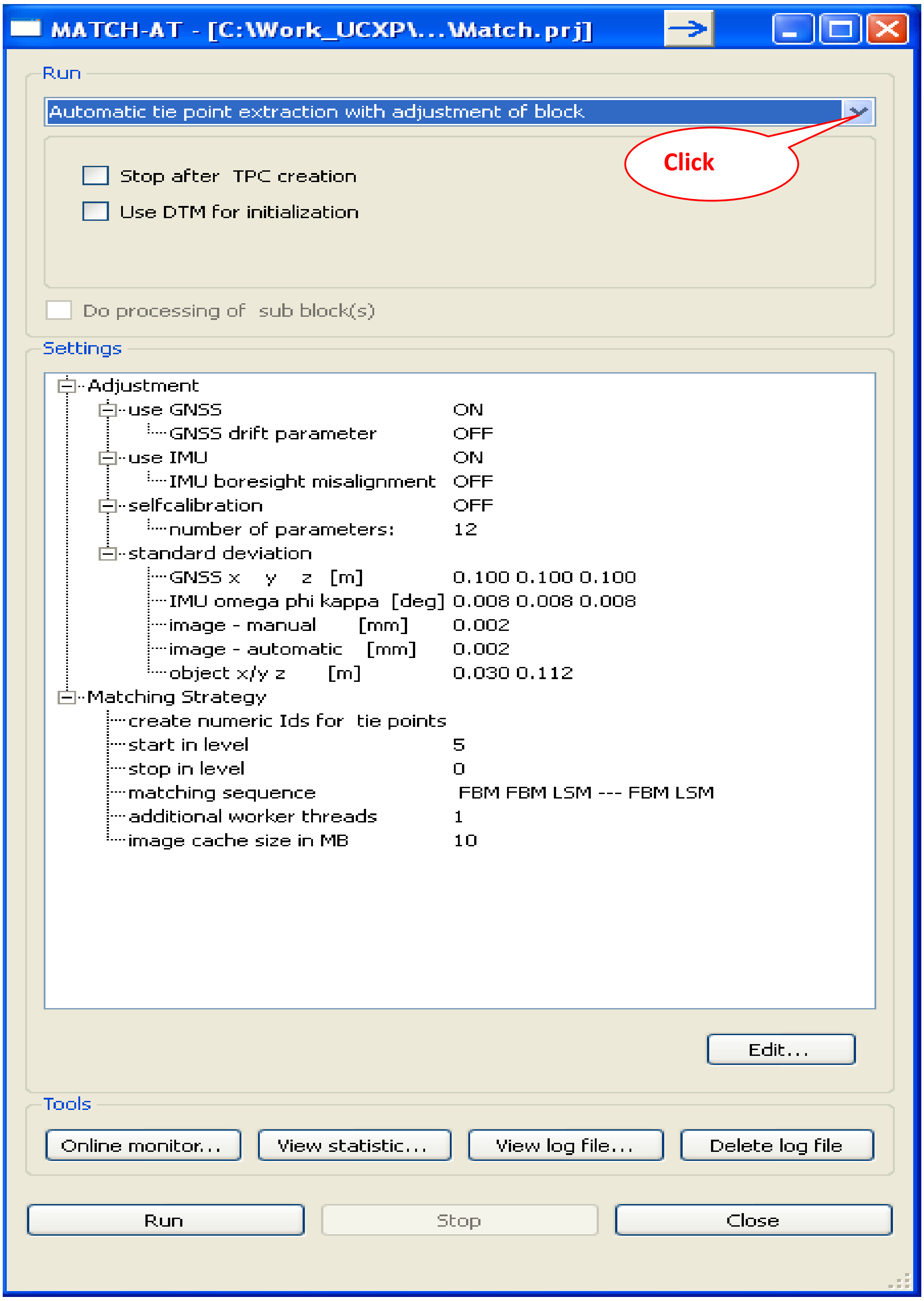
Chapter 10. Automatic Tie Point Processing

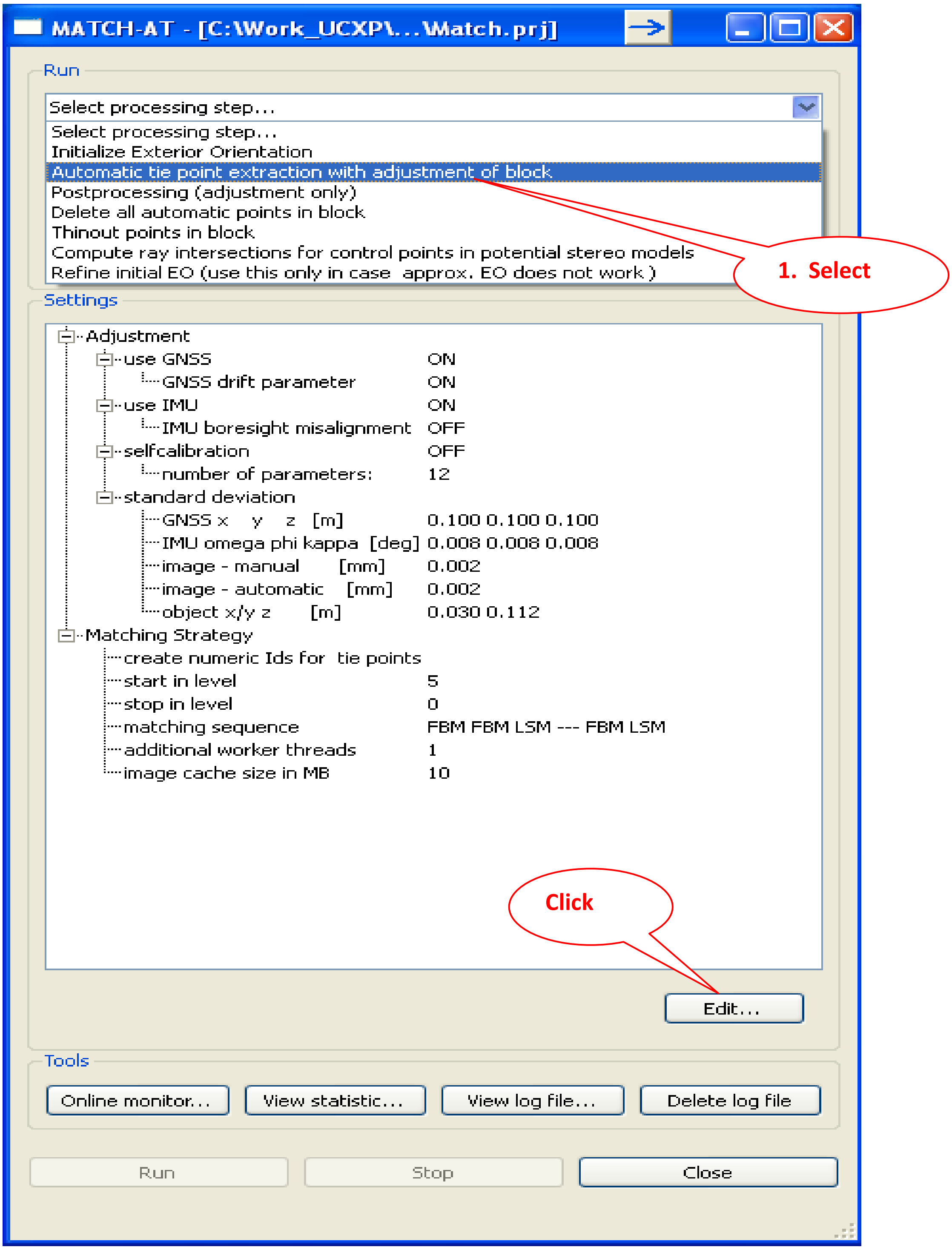
Chapter 10. Automatic Tie point Processing



<Procedure>

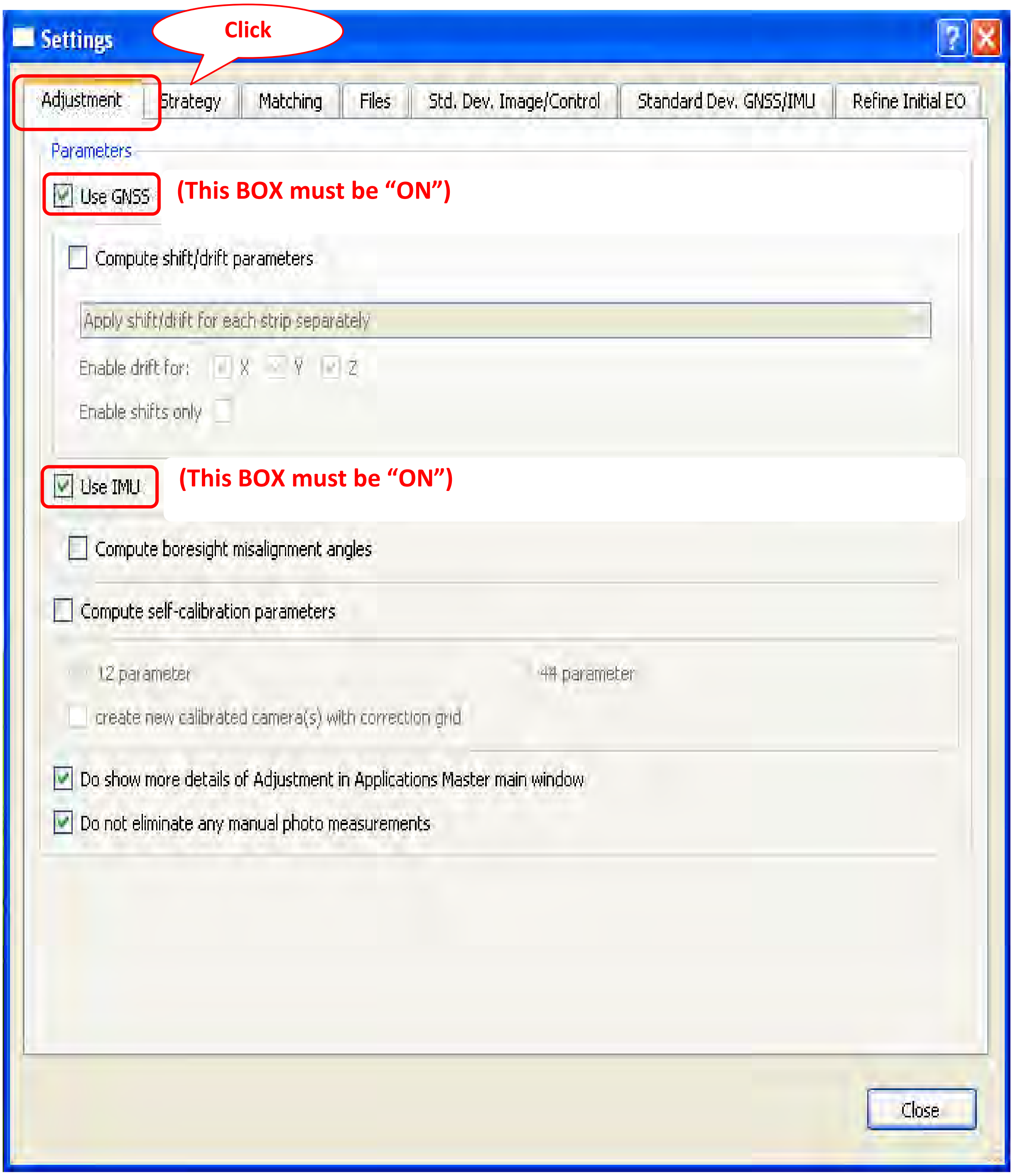
*** Click “product”--> “MATCH-AT”--> “Aerial Frame Triangulation”**


MATCH-AT - [C:\Work_UCXP\...\Match.prj]
Run
Automatic tie point extraction with adjustment of block
Click
Stop after TPC creation
Use DTM for initialization
Do processing of sub block(s)
Settings
Adjustment
use GNSS ON
GNSS drift parameter OFF
use IMU ON
IMU boresight misalignment OFF
selfcalibration OFF
number of parameters: 12
standard deviation
GNSS x y z [m] 0.100 0.100 0.100
IMU omega phi kappa [deg] 0.008 0.008 0.008
image - manual [mm] 0.002
image - automatic [mm] 0.002
object x/y z [m] 0.030 0.112
Matching Strategy
create numeric Ids for tie points
start in level 5
stop in level 0
matching sequence FBM FBM LSM --- FBM LSM
additional worker threads 1
image cache size in MB 10
Edit...
Tools
Online monitor...
View statistic...
View log file...
Delete log file
Run
Stop
Close



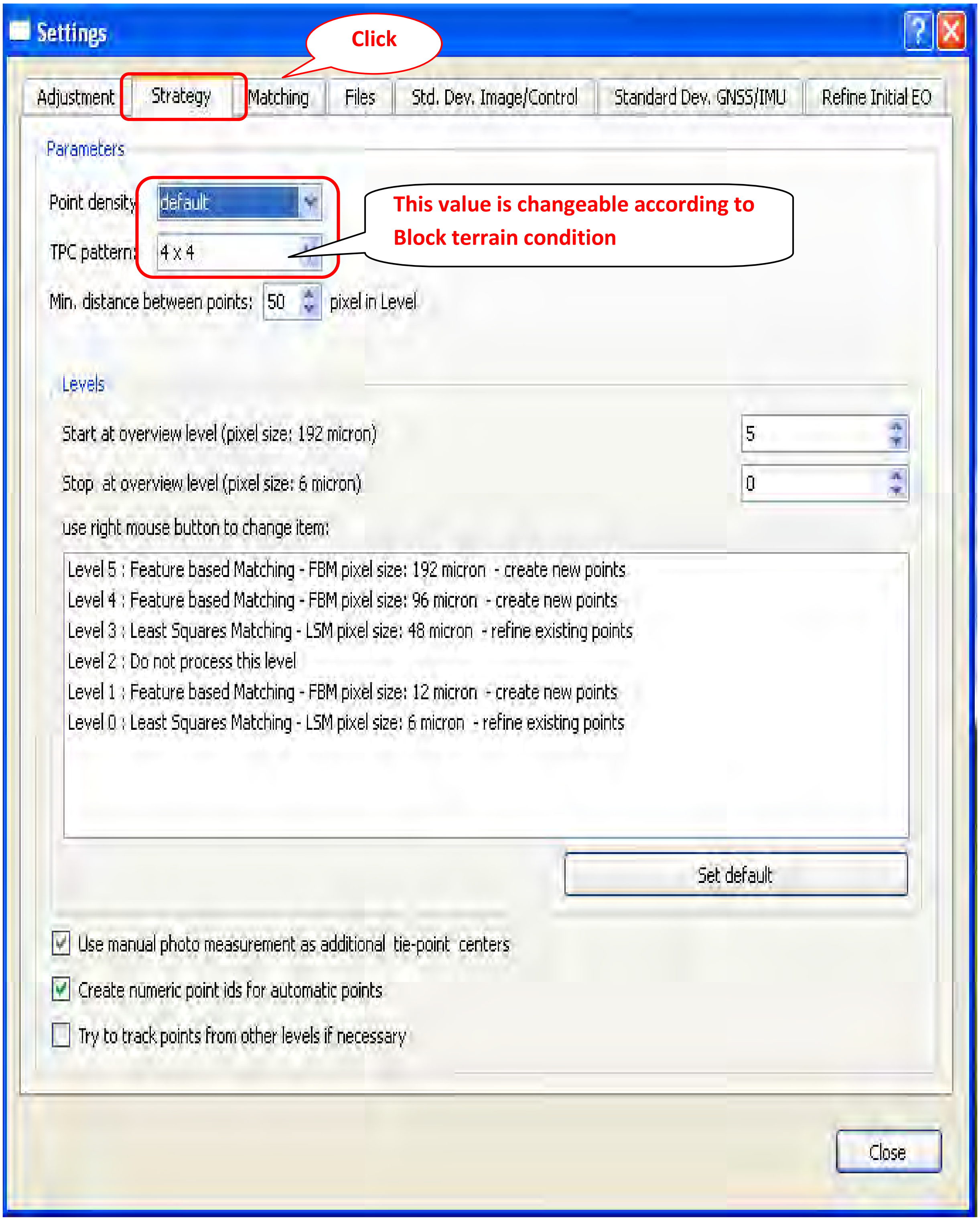
<Procedure>

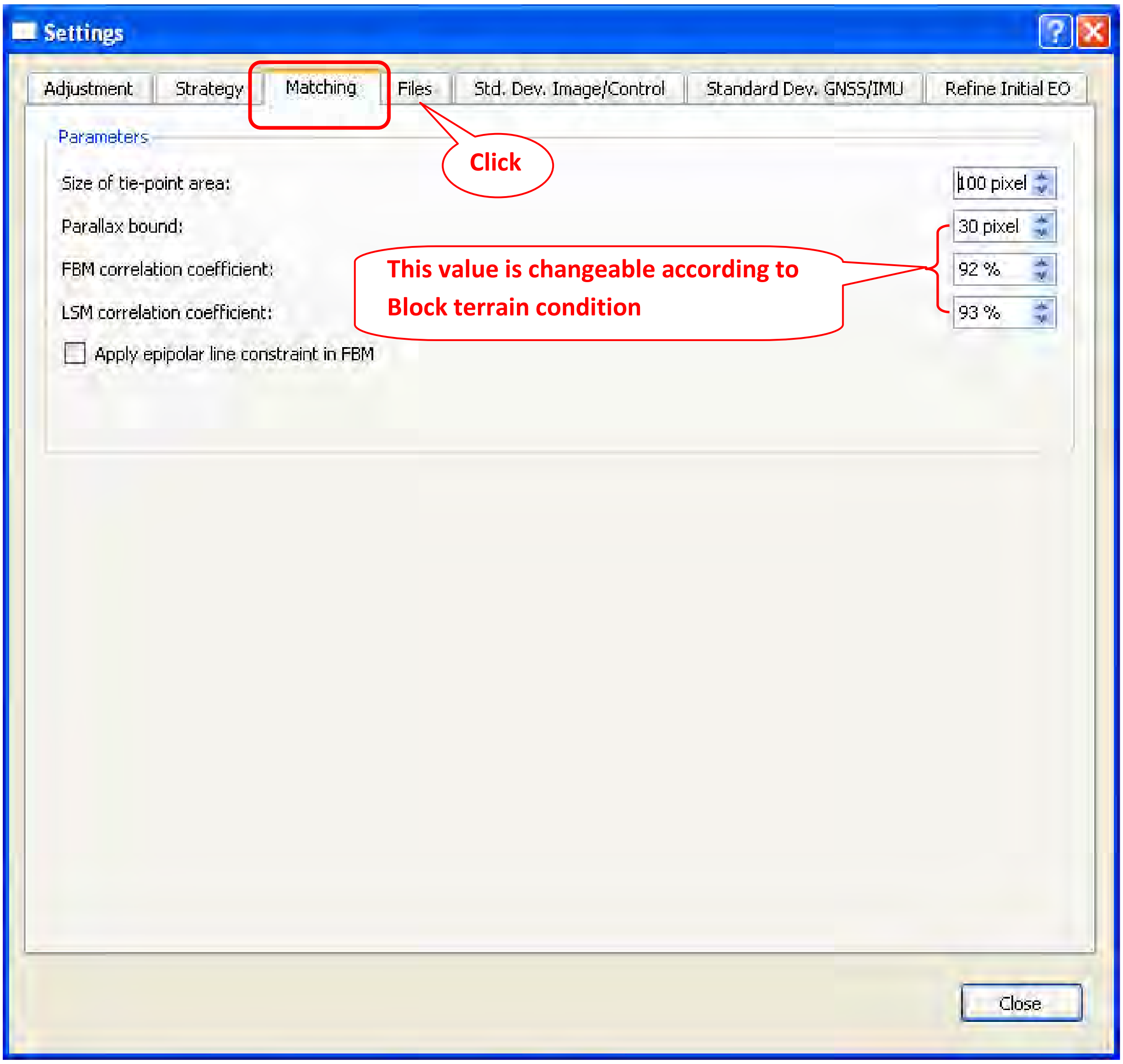
*** Click "Arrow"--> "Select Automatic Tie point extraction with adjustment of block"--> "Edit"**

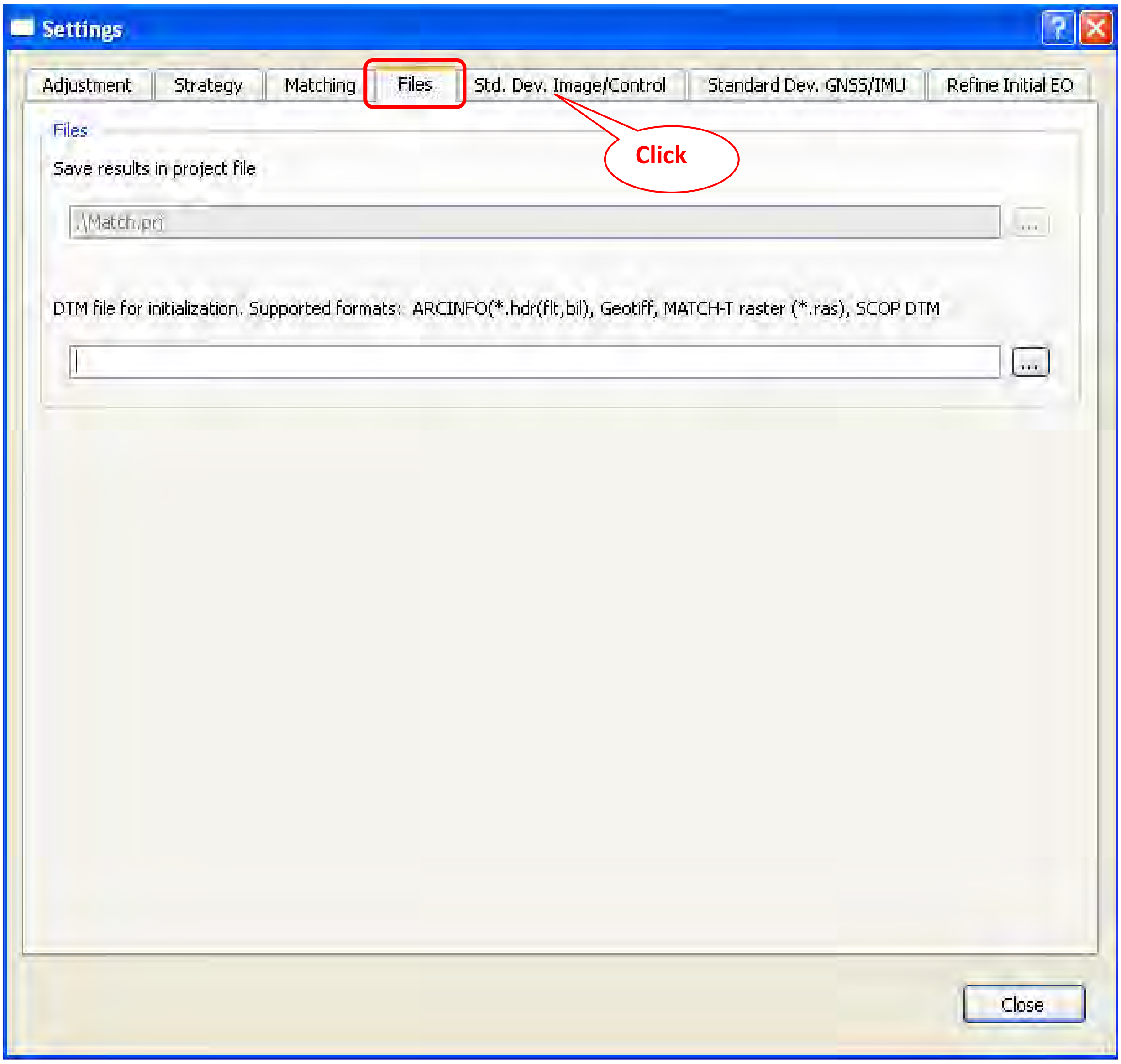


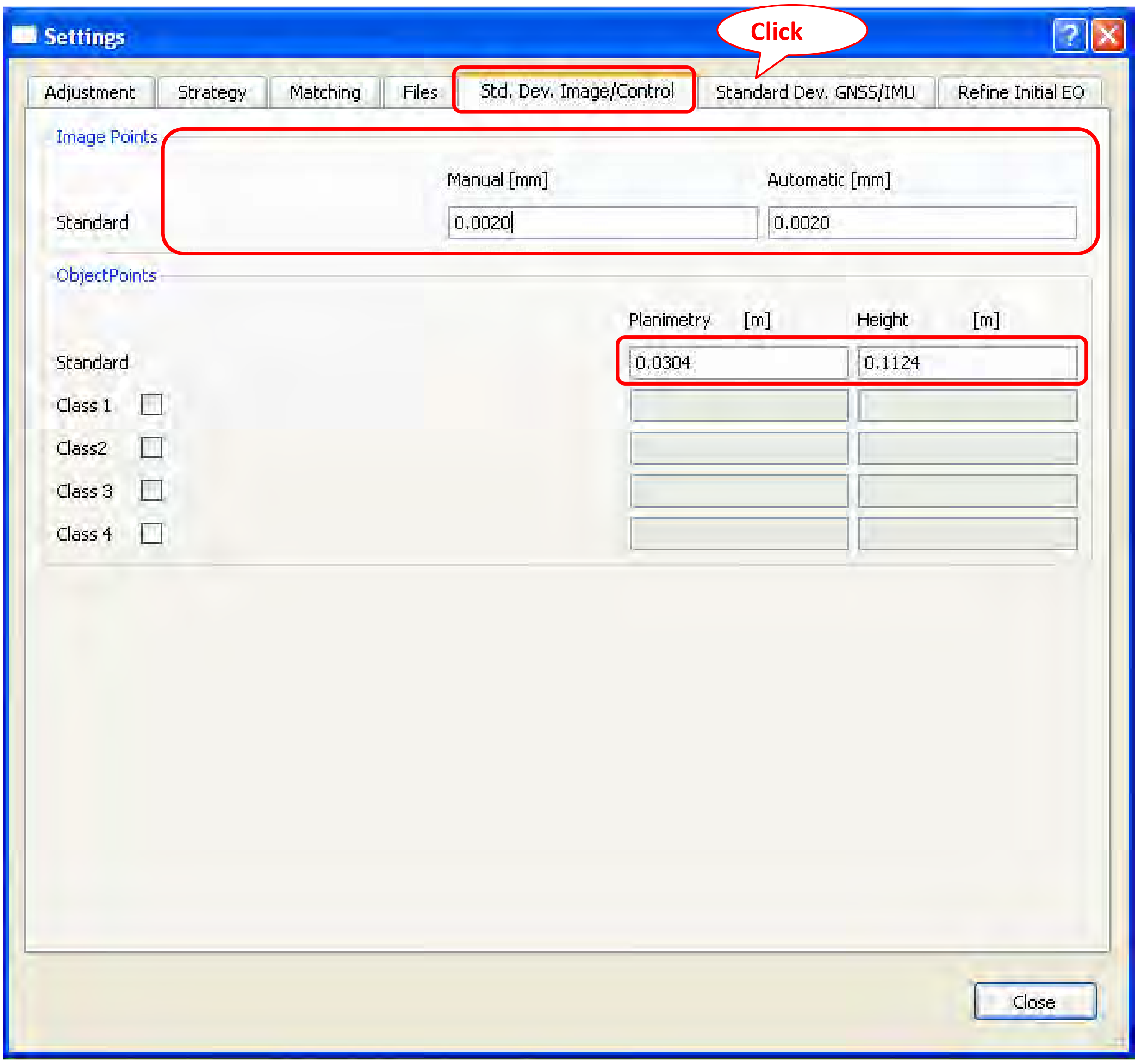
<Procedure>

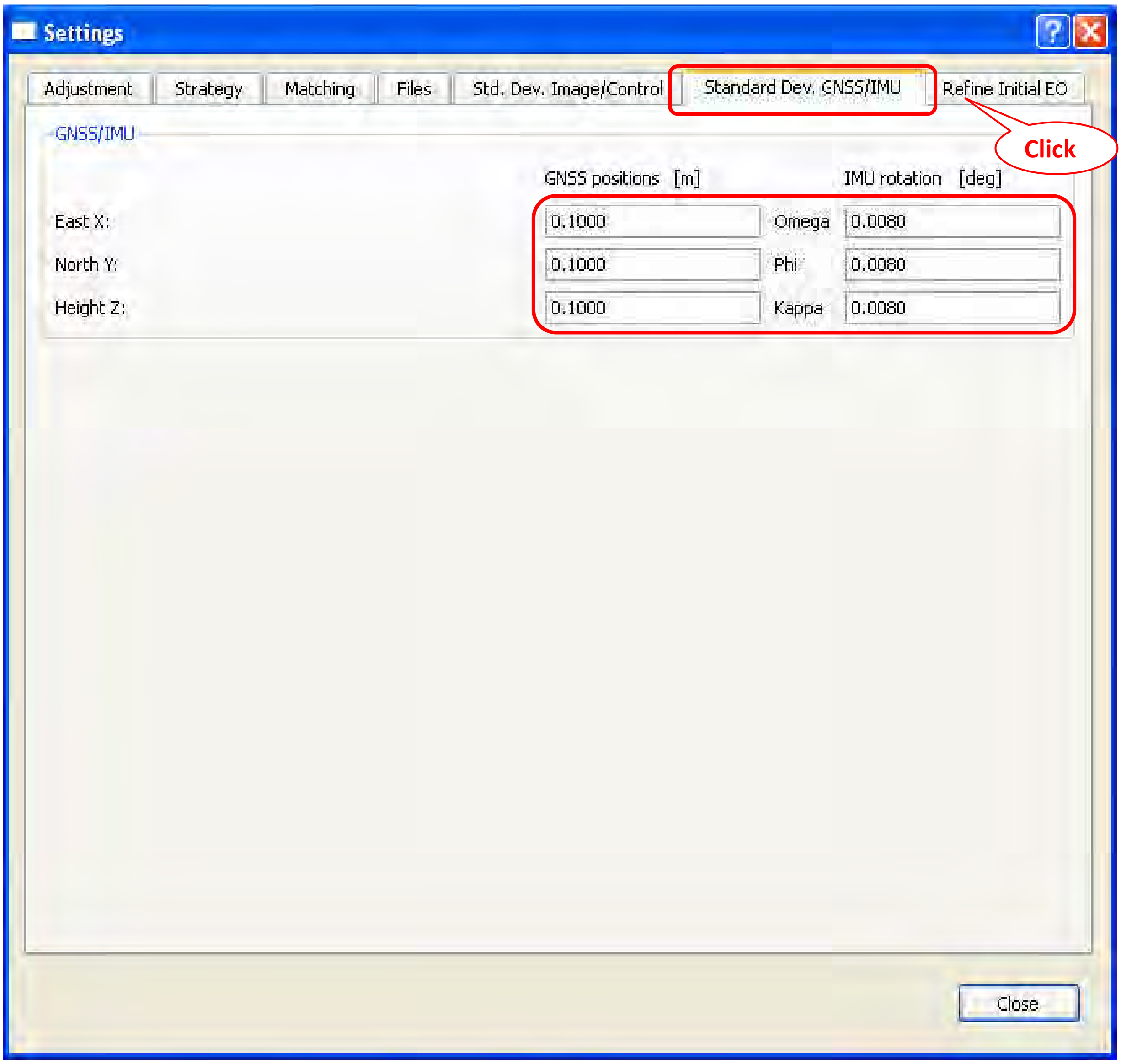
*** "Use GNSS" and "Use IMU" Should be checked. After input all data, click "strategy"**


Settings
Click
Adjustment
Strategy
Matching
Files
Std. Dev. Image/Control
Standard Dev. GNSS/IMU
Refine Initial EO
Parameters
Point density
default
TPC pattern:
4 x 4
This value is changeable according to Block terrain condition
Min. distance between points: 50 pixel in Level
Levels
Start at overview level (pixel size: 192 micron) 5
Stop at overview level (pixel size: 6 micron) 0
use right mouse button to change item:
Level 5 : Feature based Matching - FBM pixel size: 192 micron - create new points
Level 4 : Feature based Matching - FBM pixel size: 96 micron - create new points
Level 3 : Least Squares Matching - LSM pixel size: 48 micron - refine existing points
Level 2 : Do not process this level
Level 1 : Feature based Matching - FBM pixel size: 12 micron - create new points
Level 0 : Least Squares Matching - LSM pixel size: 6 micron - refine existing points
Set default
Use manual photo measurement as additional tie-point centers
Create numeric point ids for automatic points
Try to track points from other levels if necessary
Close

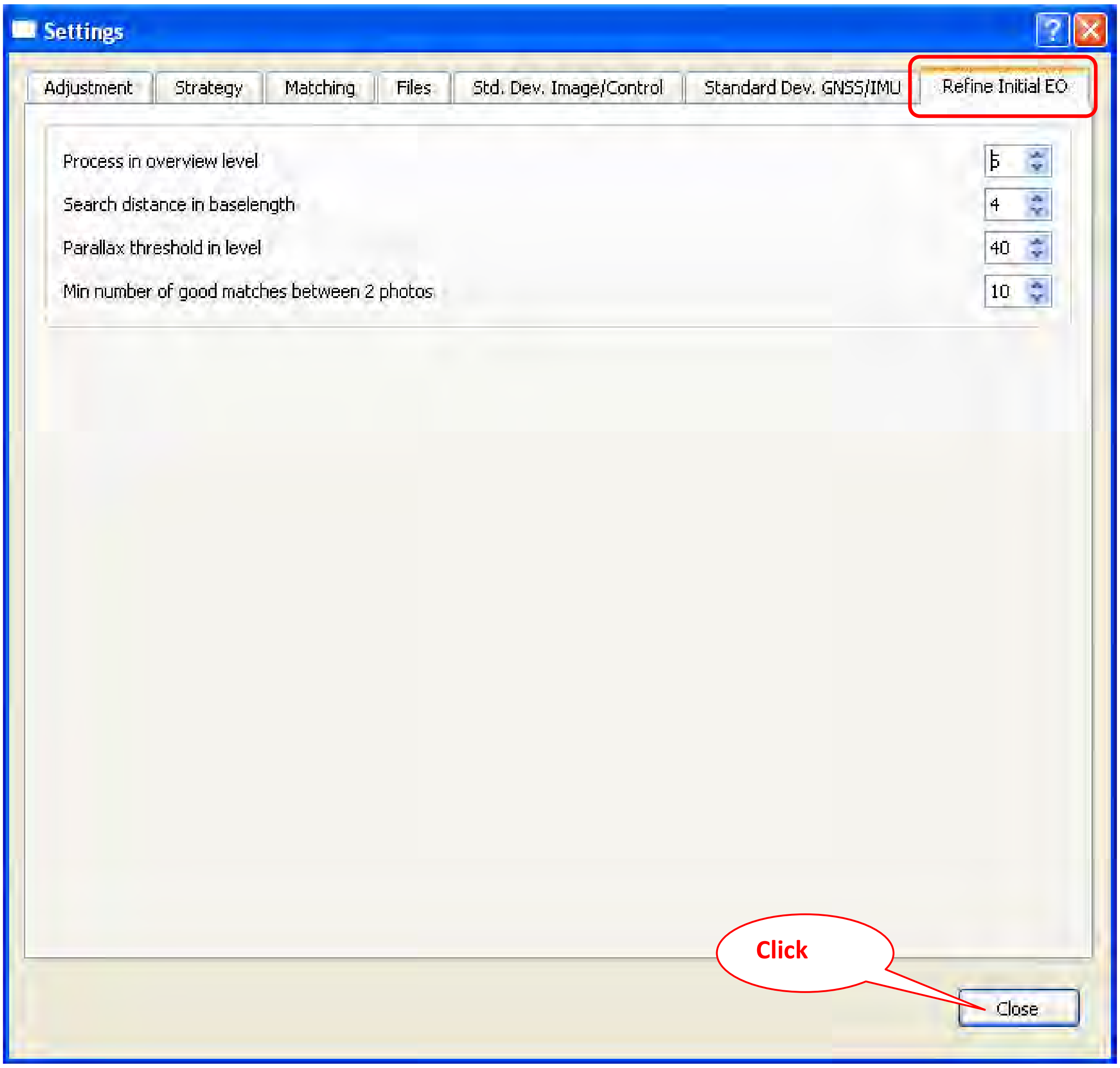

Settings
Adjustment
Strategy
Matching
Files
Std. Dev. Image/Control
Standard Dev. GNSS/IMU
Refine Initial EO
Click
Parameters
Size of tie-point area:
100 pixel
Parallax bound:
30 pixel
FBM correlation coefficient:
92 %
LSM correlation coefficient:
93 %
This value is changeable according to Block terrain condition
Apply epipolar line constraint in FBM
Close

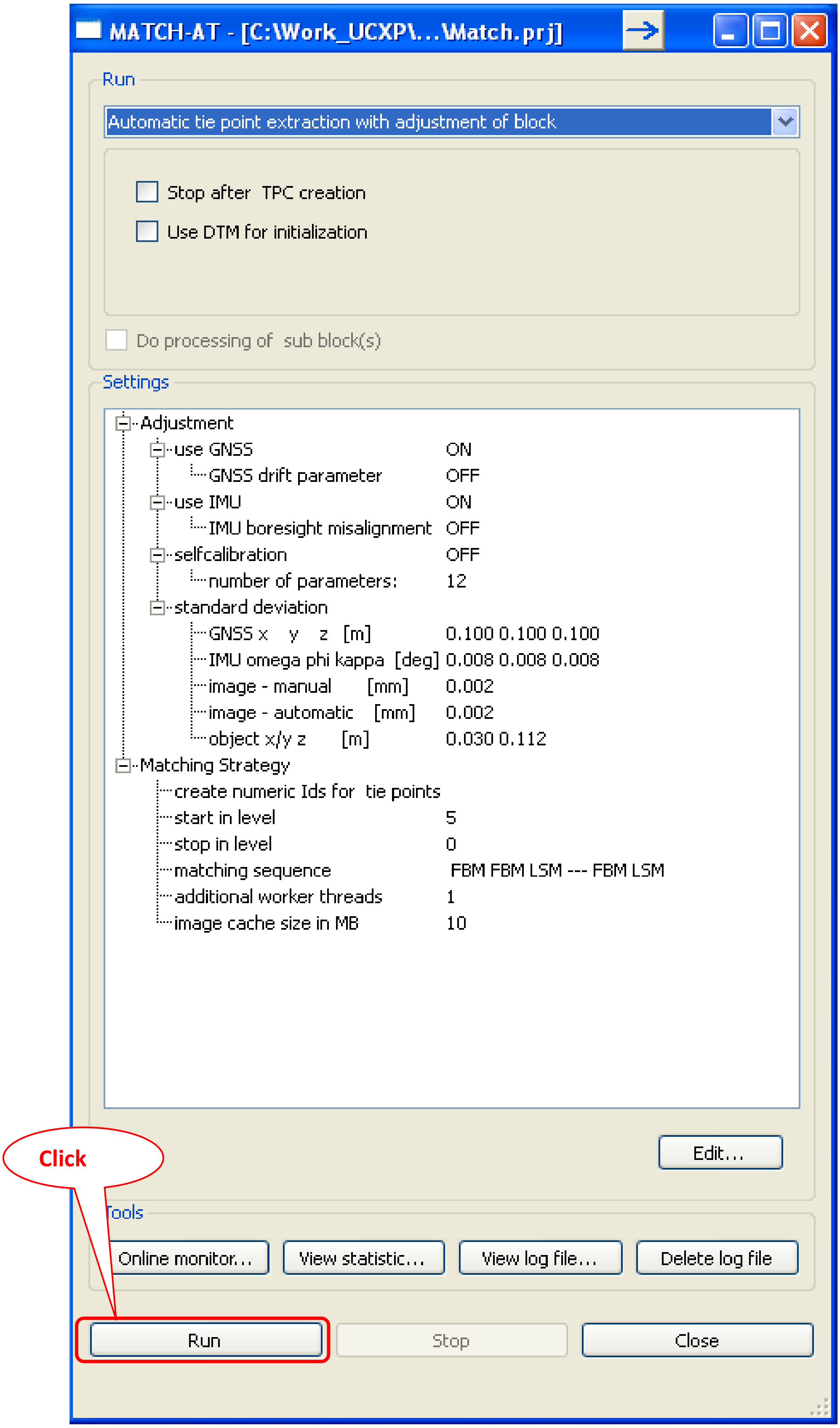

Settings
Adjustment
Strategy
Matching
Files
Std. Dev. Image/Control
Standard Dev. GNSS/IMU
Refine Initial EO
Click
Files
Save results in project file
.\Match.prj
DTM file for initialization. Supported formats: ARCINFO(*.hdr(flt,bil), Geotiff, MATCH-T raster (*.ras), SCOP DTM
Close


Settings
Click
Adjustment
Strategy
Matching
Files
Std. Dev. Image/Control
Standard Dev. GNSS/IMU
Refine Initial EO
Image Points
Manual [mm]
Automatic [mm]
Standard
0.0020
0.0020
ObjectPoints
Planimetry [m]
Height [m]
Standard
0.0304
0.1124
Class 1
Class2
Class 3
Class 4
Close

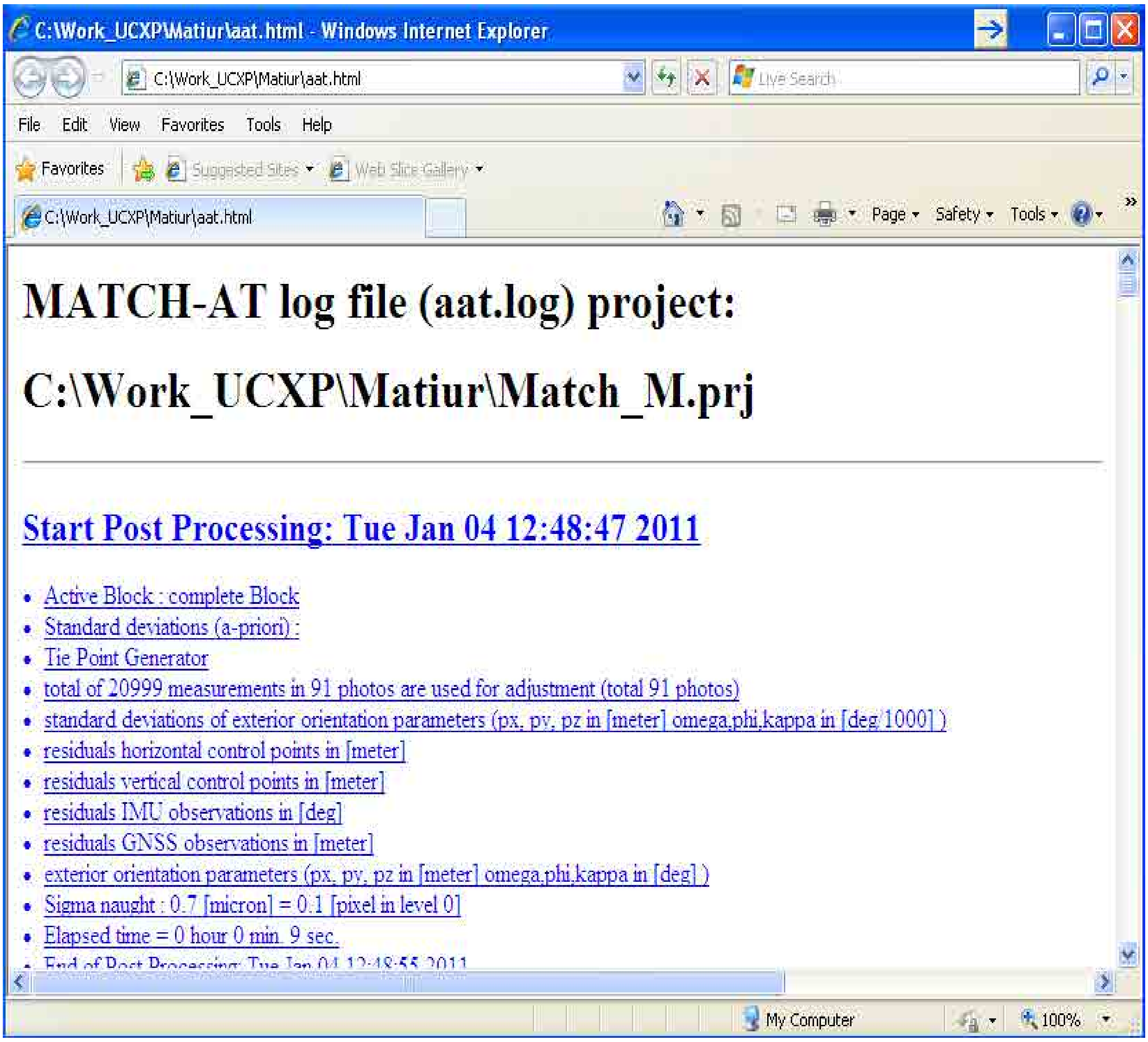


Settings
Adjustment
Strategy
Matching
Files
Std. Dev. Image/Control
Standard Dev. GNSS/IMU
Refine Initial EO
Click
GNSS/IMU
GNSS positions [m]
IMU rotation [deg]
East X:
0.1000
Omega
0.0080
North Y:
0.1000
Phi
0.0080
Height Z:
0.1000
Kappa
0.0080
Close


Settings
Adjustment
Strategy
Matching
Files
Std. Dev. Image/Control
Standard Dev. GNSS/IMU
Refine Initial EO
Process in overview level
5
Search distance in baselength
4
Parallax threshold in level
40
Min number of good matches between 2 photos
10
Click
Close

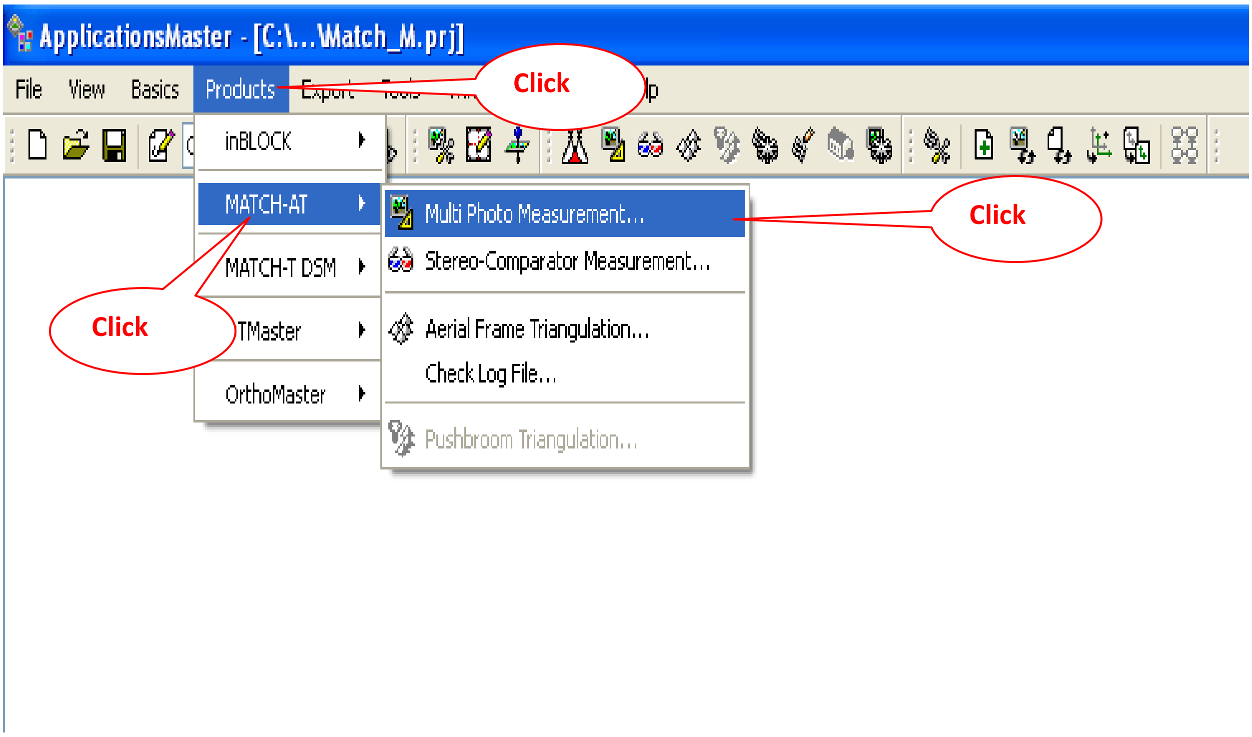

MATCH-AT - [C:\Work_UCXP\...\Match.prj]
Run
Automatic tie point extraction with adjustment of block
Stop after TPC creation
Use DTM for initialization
Do processing of sub block(s)
Settings
Adjustment
use GNSS ON
GNSS drift parameter OFF
use IMU ON
IMU boresight misalignment OFF
selfcalibration OFF
number of parameters: 12
standard deviation
GNSS x y z [m] 0.100 0.100 0.100
IMU omega phi kappa [deg] 0.008 0.008 0.008
image - manual [mm] 0.002
image - automatic [mm] 0.002
object x/y z [m] 0.030 0.112
Matching Strategy
create numeric Ids for tie points
start in level 5
stop in level 0
matching sequence FBM FBM LSM --- FBM LSM
additional worker threads 1
image cache size in MB 10
Edit...
Click
Tools
Online monitor...
View statistic...
View log file...
Delete log file
Run
Stop
Close

Log file (After processing)



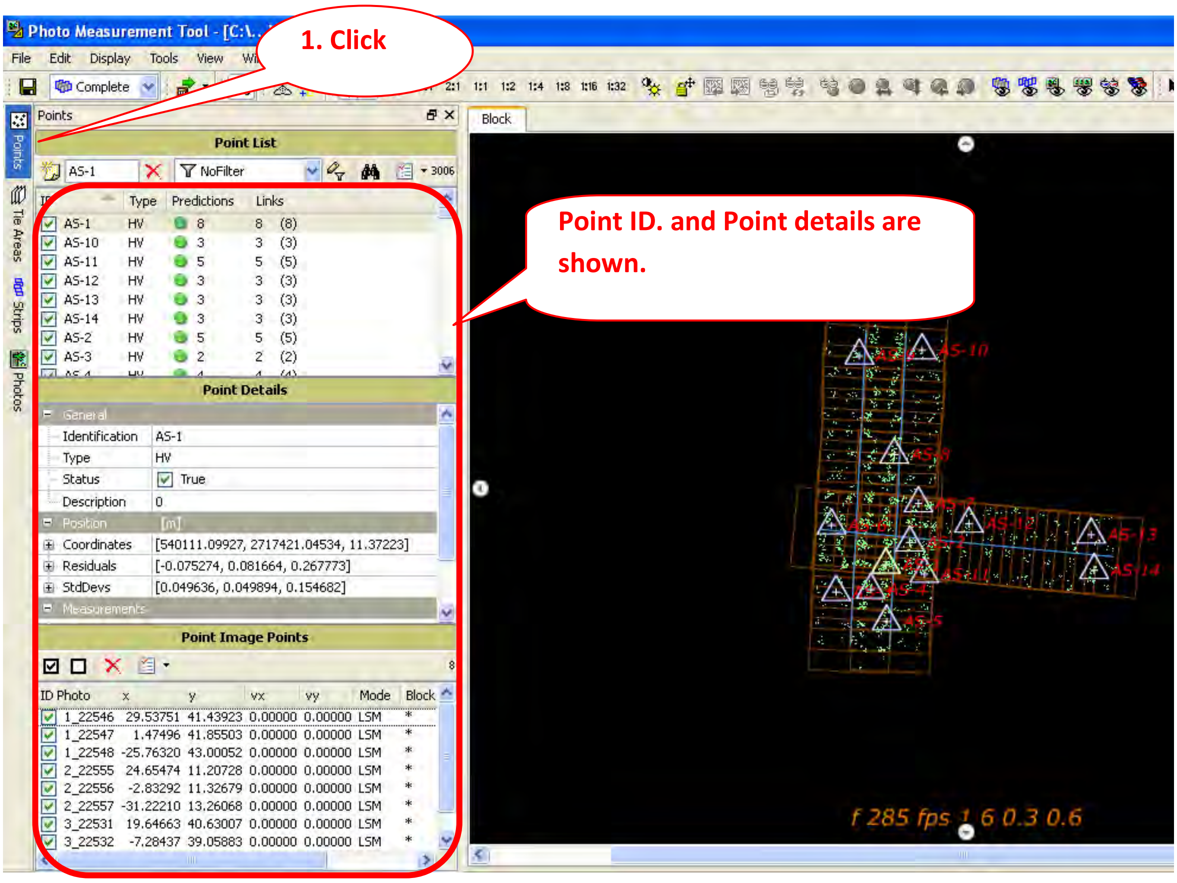
*We can see the detail result from this "Log File"

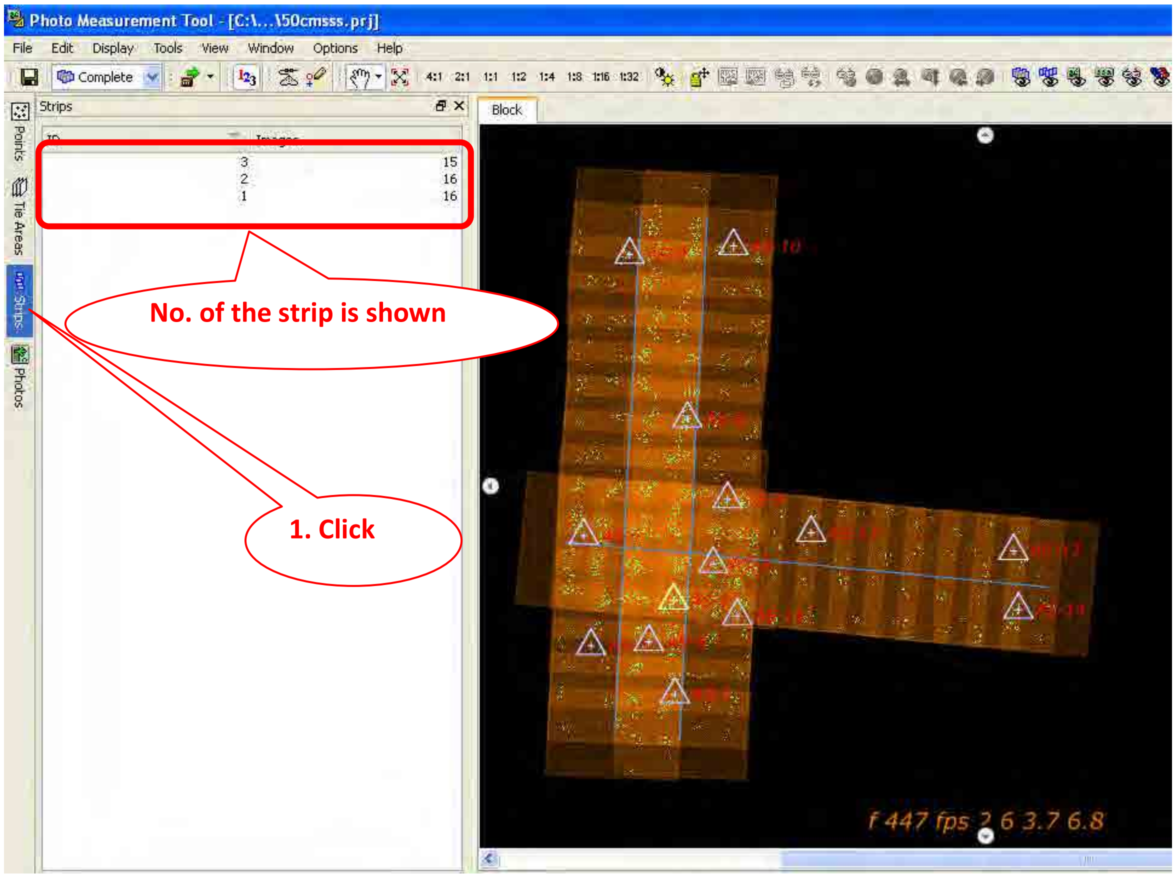
After Tie Point extraction we can see the shape of Block, Point position, Number of strip, Photo position etc.

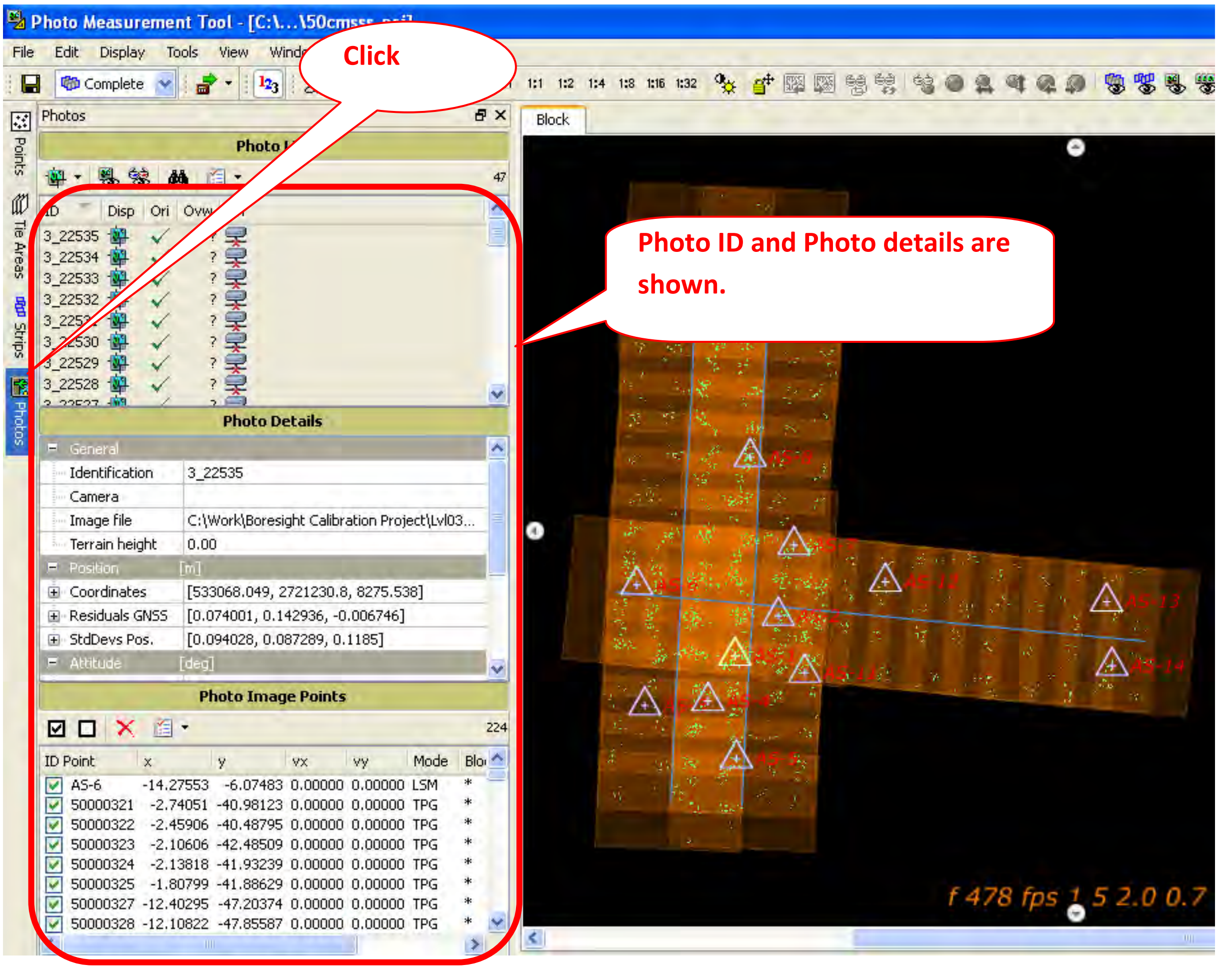


<Procedure>

*** Click "product"--> "MATCH-AT"--> "Multi Photo Measurement"**


1. Click
Point ID. and Point details are shown.

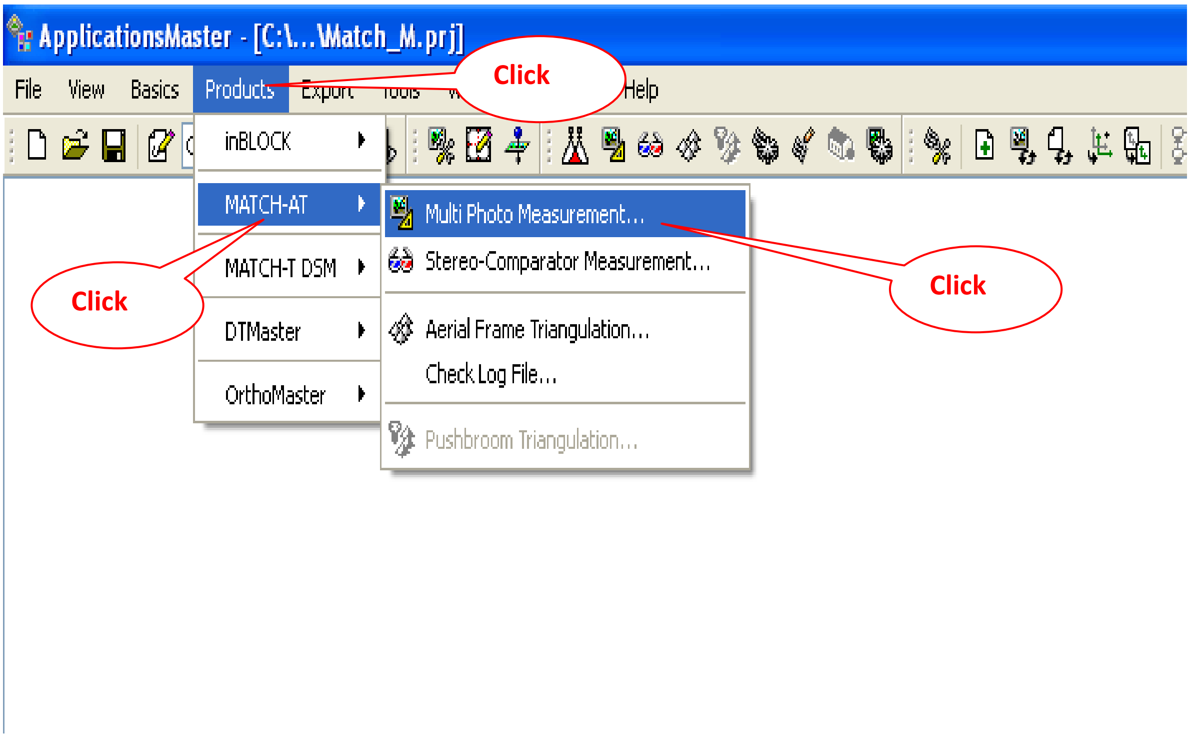

No. of the strip is shown
1. Click


Click
Photo ID and Photo details are shown.

Chapter 11. GCP Measurement

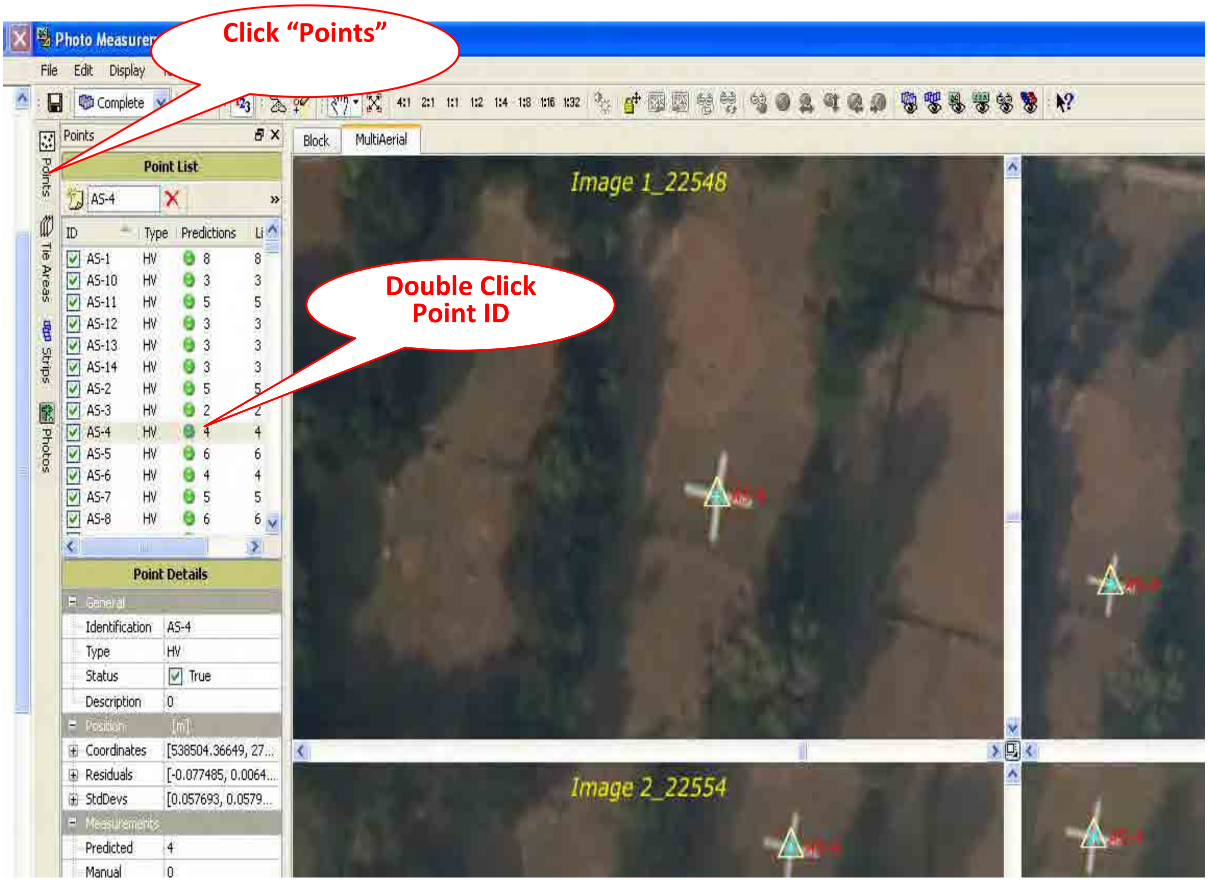
(Multi photo measurement)

Chapter 11. GCP Measurement (Multi photo measurement)

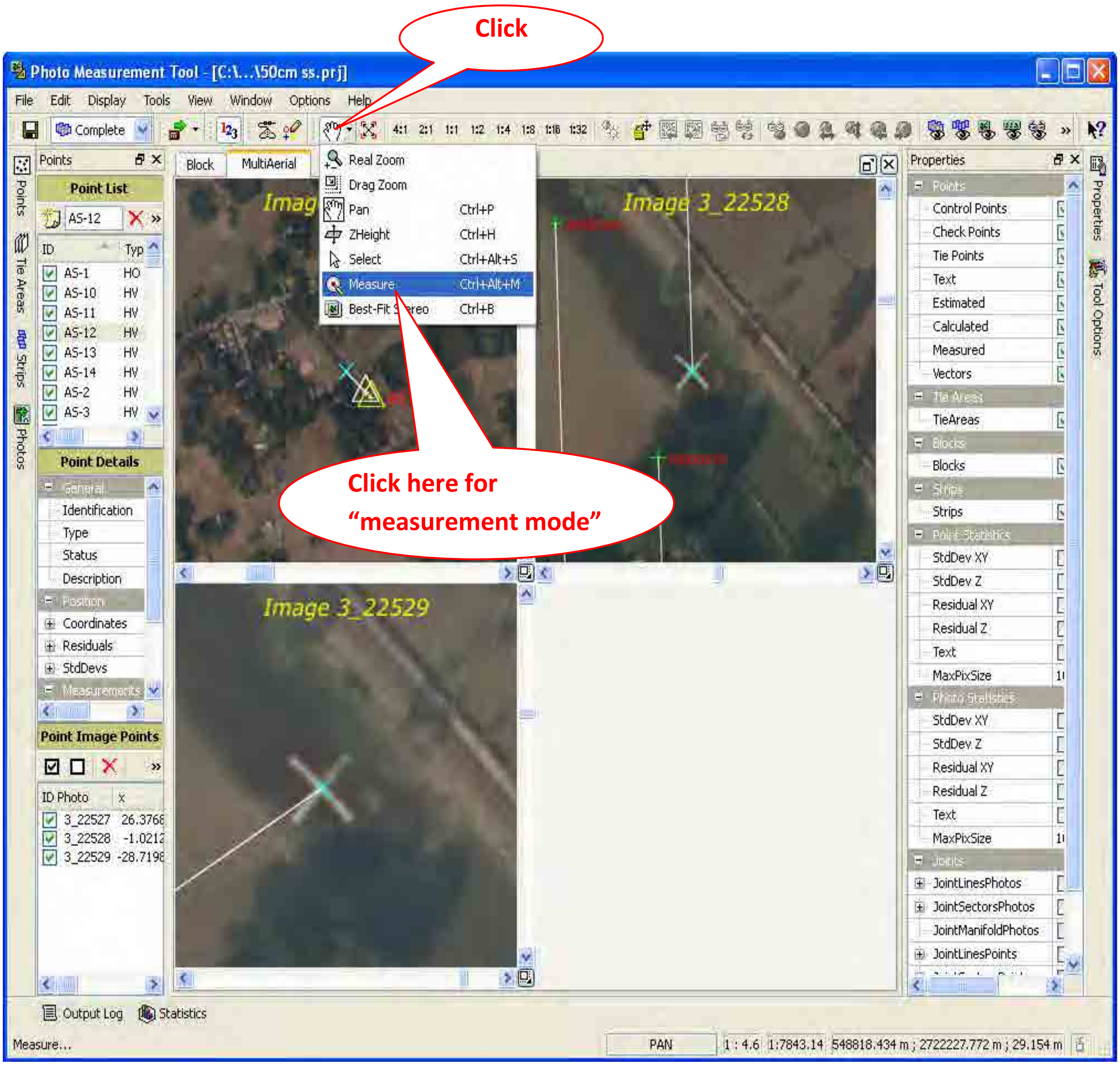


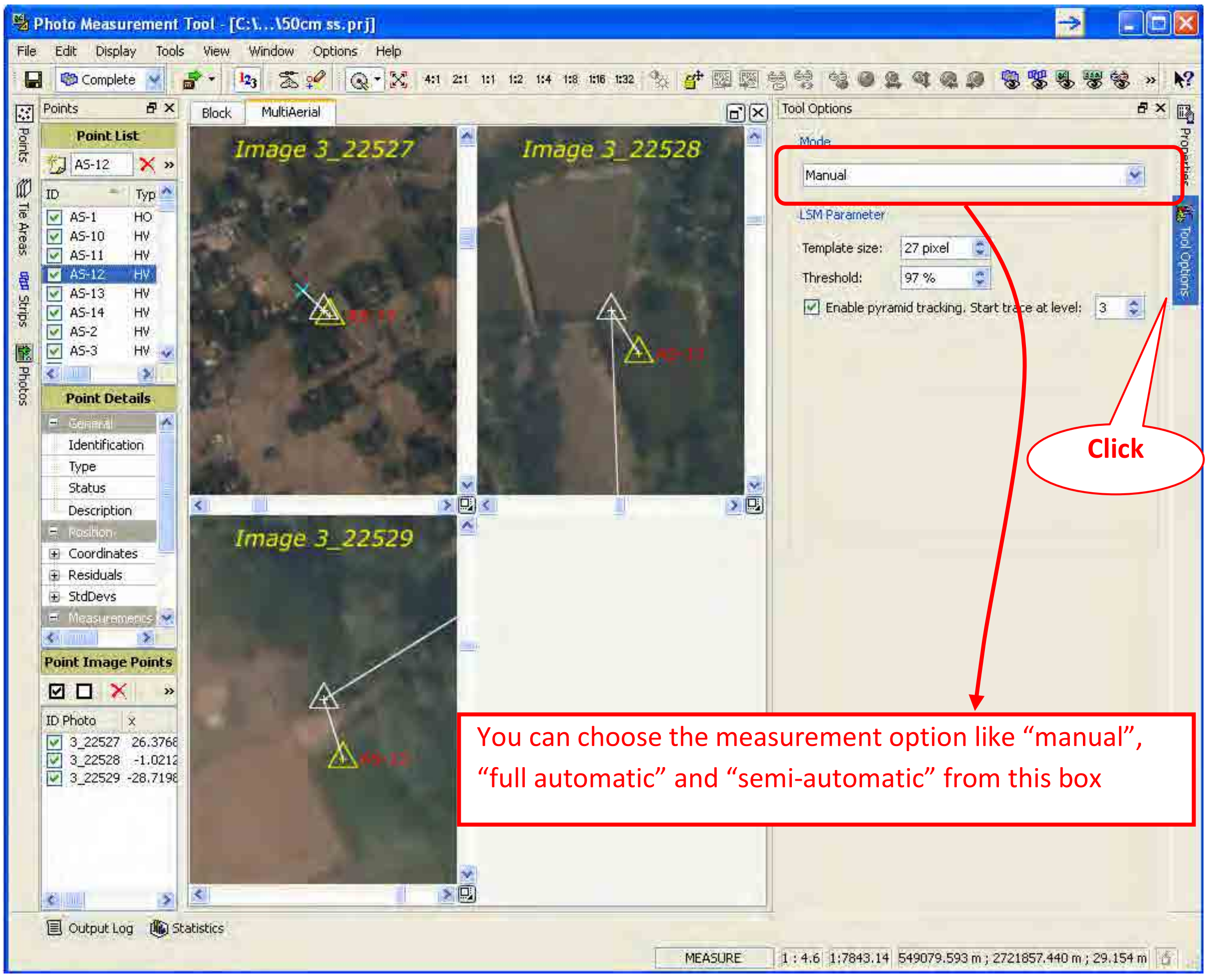
<Procedure>

*** Click “product”--> “MATCH-AT”--> “Multi Photo Measurement”**



Click "Points"
Double Click Point ID
Photo Measurement
File
Edit
Display
Complete
Points
Point List
AS-4
ID
Type
Predictions
AS-1 HV 8 8
AS-10 HV 3 3
AS-11 HV 5 5
AS-12 HV 3 3
AS-13 HV 3 3
AS-14 HV 3 3
AS-2 HV 5 5
AS-3 HV 2 2
AS-4 HV 4 4
AS-5 HV 6 6
AS-6 HV 4 4
AS-7 HV 5 5
AS-8 HV 6 6
Point Details
General
Identification AS-4
Type HV
Status True
Description 0
Position [m]
Coordinates [538504.36649, 27...
Residuals [-0.077485, 0.0064...
StdDevs [0.057693, 0.0579...
Measurements
Predicted 4
Manual 0
Block
MultiAerial
Image 1_22548
Image 2_22554
Tie Areas
Strips
Photos


Click
Photo Measurement Tool - [C:\...\50cm ss.prj]
File Edit Display Tools View Window Options Help
Complete
Real Zoom
Drag Zoom
Pan Ctrl+P
ZHeight Ctrl+H
Select Ctrl+Alt+S
Measure Ctrl+Alt+M
Best-Fit Stereo Ctrl+B
Image 3_22528
Image 3_22529
Click here for
"measurement mode"
Points
Point List
Point Details
Point Image Points
Properties
Output Log
Statistics
Measure...
PAN



All GCP have to be measured following the same as above procedure and "close".

Measuring point;

1. **Select measuring mode with view – view – Measure**

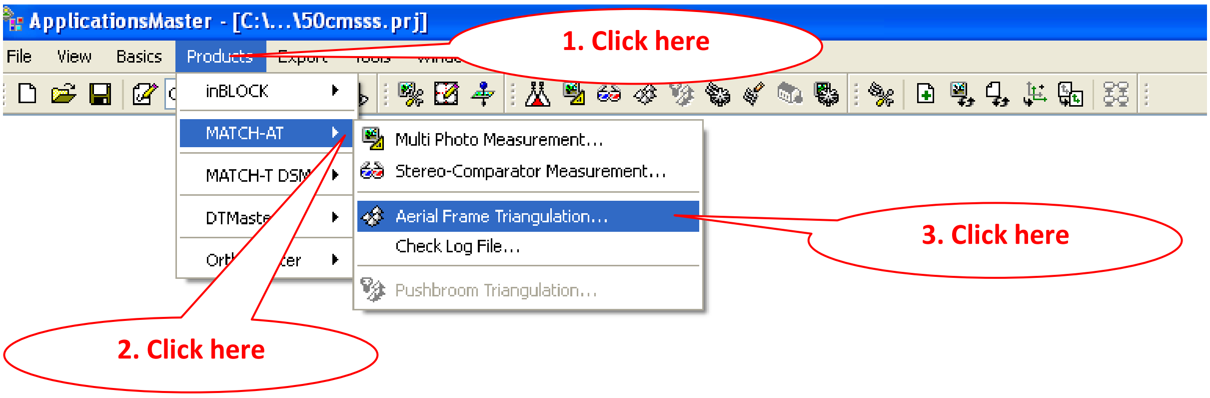
2. **Open the multi-stereo view, if you would like to measure the points stereoscopically (view – display – multi-stereo viewer)**

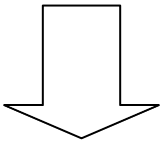
3. **Check the point measurement options and set the mode to manual**

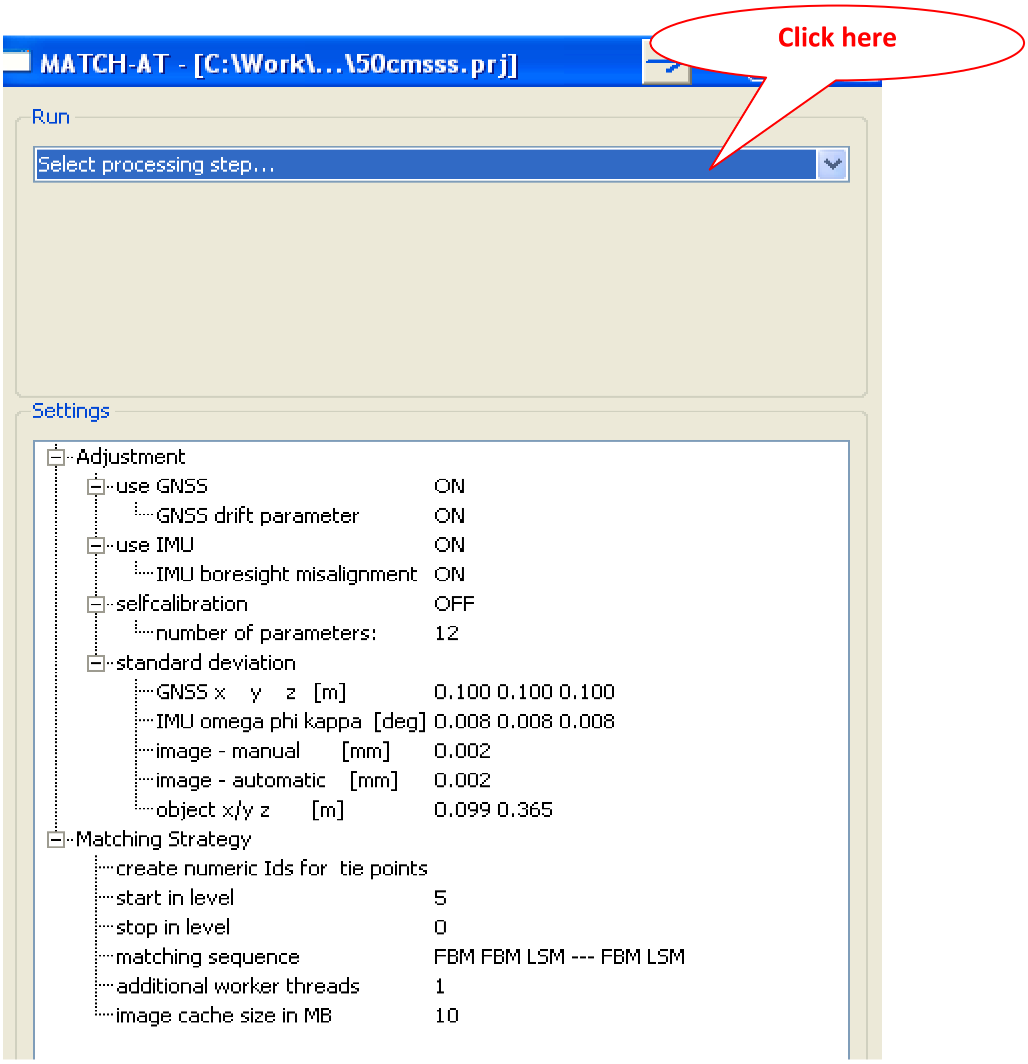
4. **Use the Zoom function to get the good view on the designated point position**

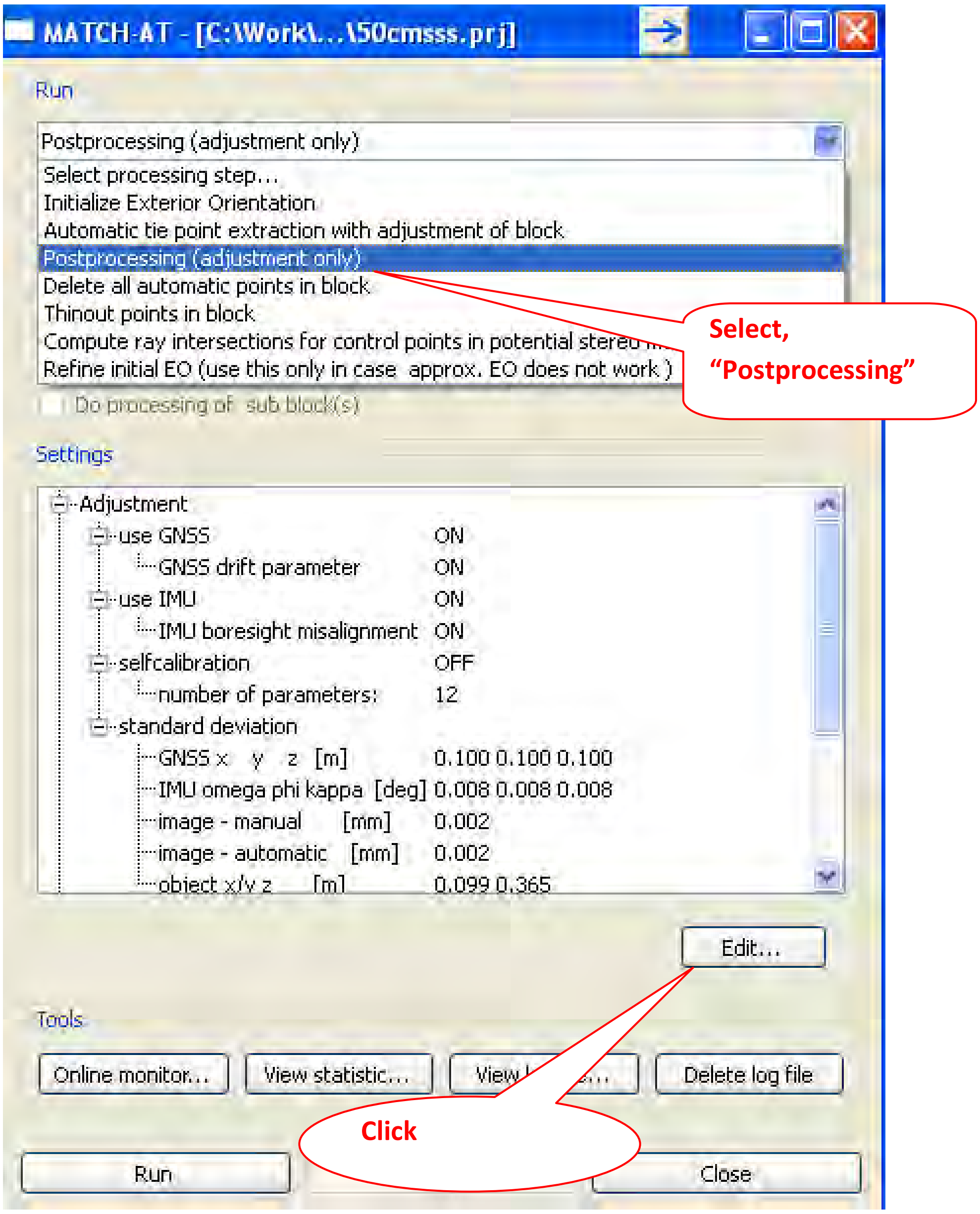
5. **Measure the position in the multi-aerial or multi-stereo views**

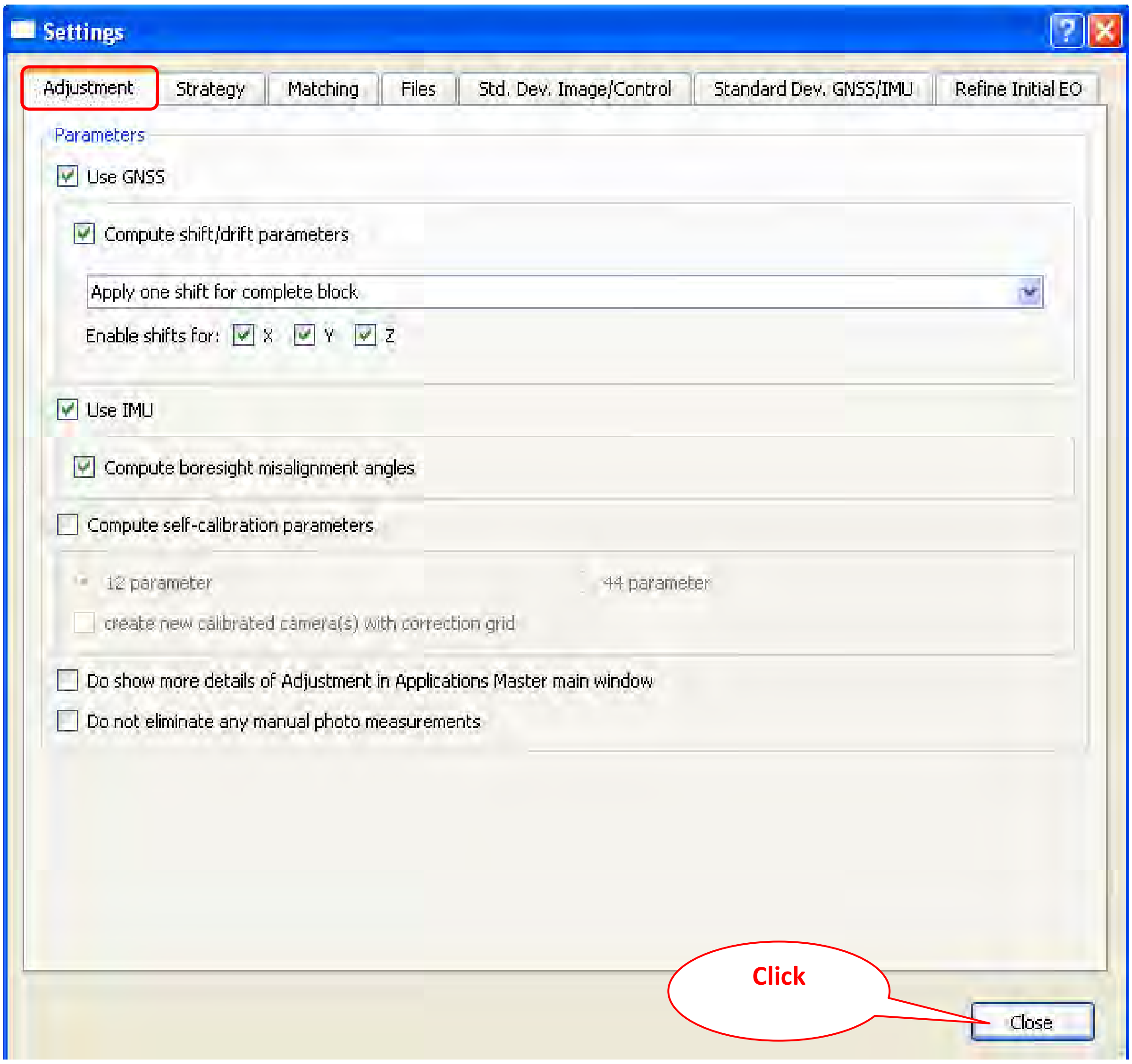
*Post Processing System:



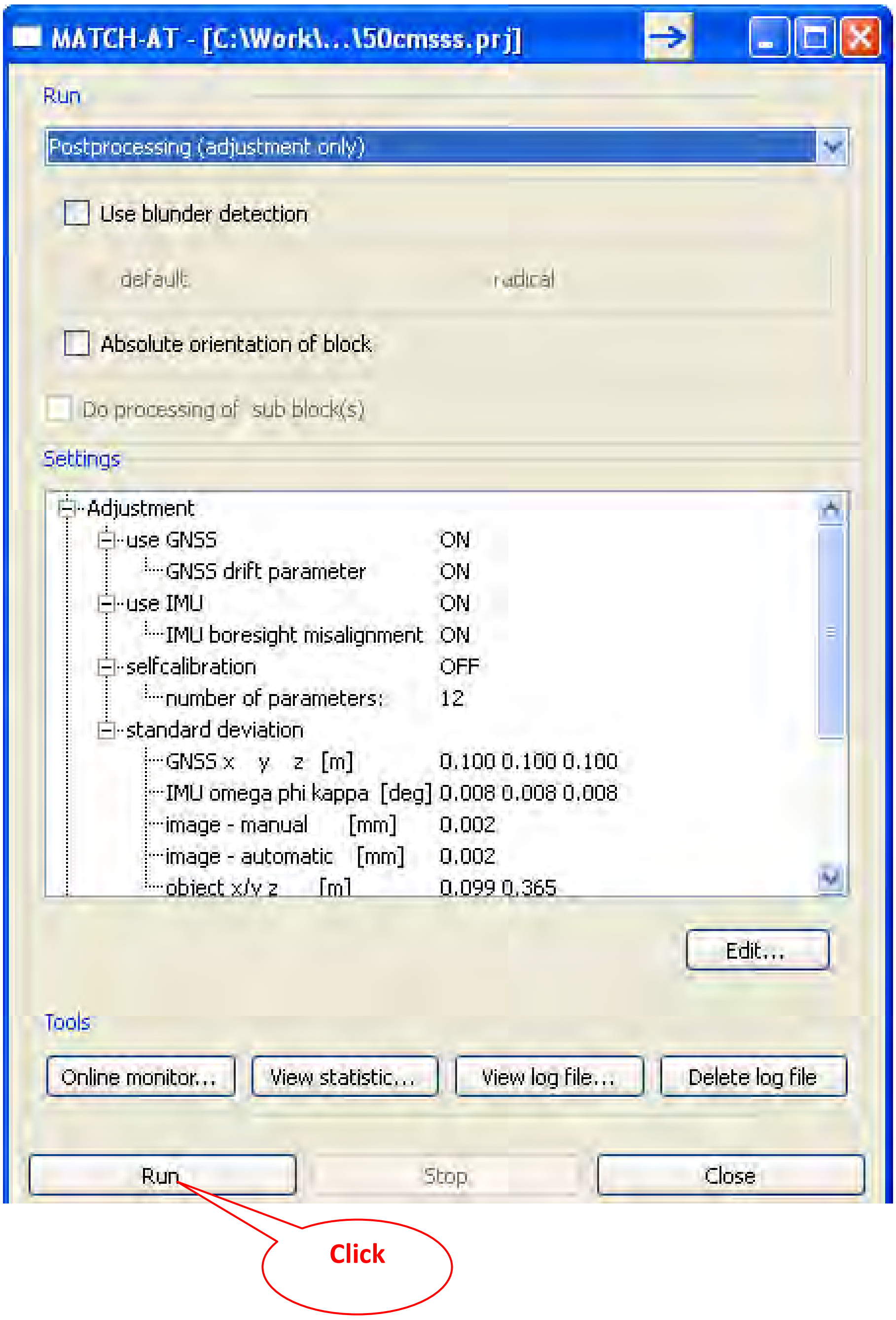





MATCH-AT - [C:\Work\...\50cmsss.prj]
Run
Postprocessing (adjustment only)
Select processing step...
Initialize Exterior Orientation
Automatic tie point extraction with adjustment of block
Postprocessing (adjustment only)
Delete all automatic points in block
Thinout points in block
Compute ray intersections for control points in potential stereo m...
Refine initial EO (use this only in case approx. EO does not work)
Do processing of sub block(s)
Settings
Adjustment
use GNSS ON
GNSS drift parameter ON
use IMU ON
IMU boresight misalignment ON
selfcalibration OFF
number of parameters: 12
standard deviation
GNSS x y z [m] 0.100 0.100 0.100
IMU omega phi kappa [deg] 0.008 0.008 0.008
image - manual [mm] 0.002
image - automatic [mm] 0.002
object x/y z [m] 0.099 0.365
Edit...
Tools
Online monitor...
View statistic...
Delete log file
Run
Close
Select, "Postprocessing"
Click

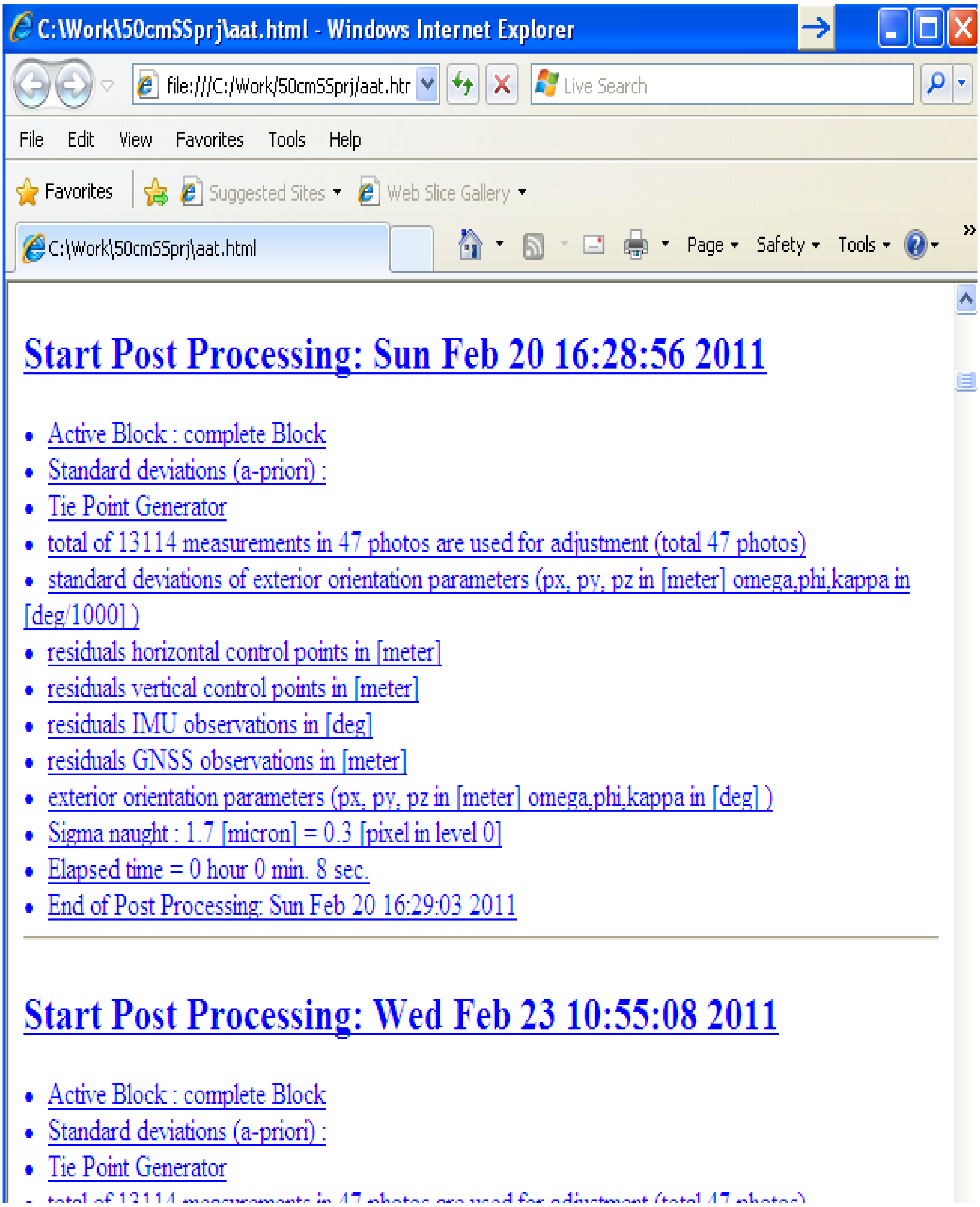


Settings
Adjustment
Strategy
Matching
Files
Std. Dev. Image/Control
Standard Dev. GNSS/IMU
Refine Initial EO
Parameters
Use GNSS
Compute shift/drift parameters
Apply one shift for complete block
Enable shifts for: X Y Z
Use IMU
Compute boresight misalignment angles
Compute self-calibration parameters
12 parameter
44 parameter
create new calibrated camera(s) with correction grid
Do show more details of Adjustment in Applications Master main window
Do not eliminate any manual photo measurements
Click
Close



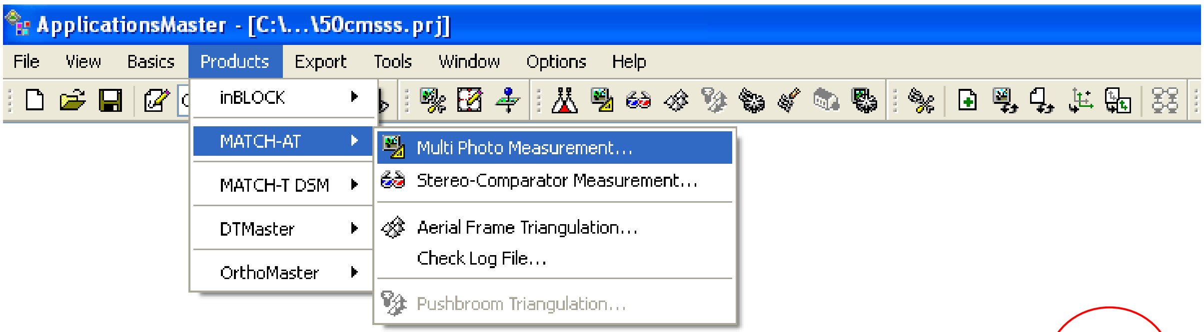
MATCH-AT - [C:\Work\...\50cmsss.prj]
Run
Postprocessing (adjustment only)
Use blunder detection
default
radical
Absolute orientation of block
Do processing of sub block(s)
Settings
Adjustment
use GNSS ON
GNSS drift parameter ON
use IMU ON
IMU boresight misalignment ON
selfcalibration OFF
number of parameters: 12
standard deviation
GNSS x y z [m] 0.100 0.100 0.100
IMU omega phi kappa [deg] 0.008 0.008 0.008
image - manual [mm] 0.002
image - automatic [mm] 0.002
object x/y z [m] 0.099 0.365
Edit...
Tools
Online monitor...
View statistic...
View log file...
Delete log file
Run
Stop
Close
Click

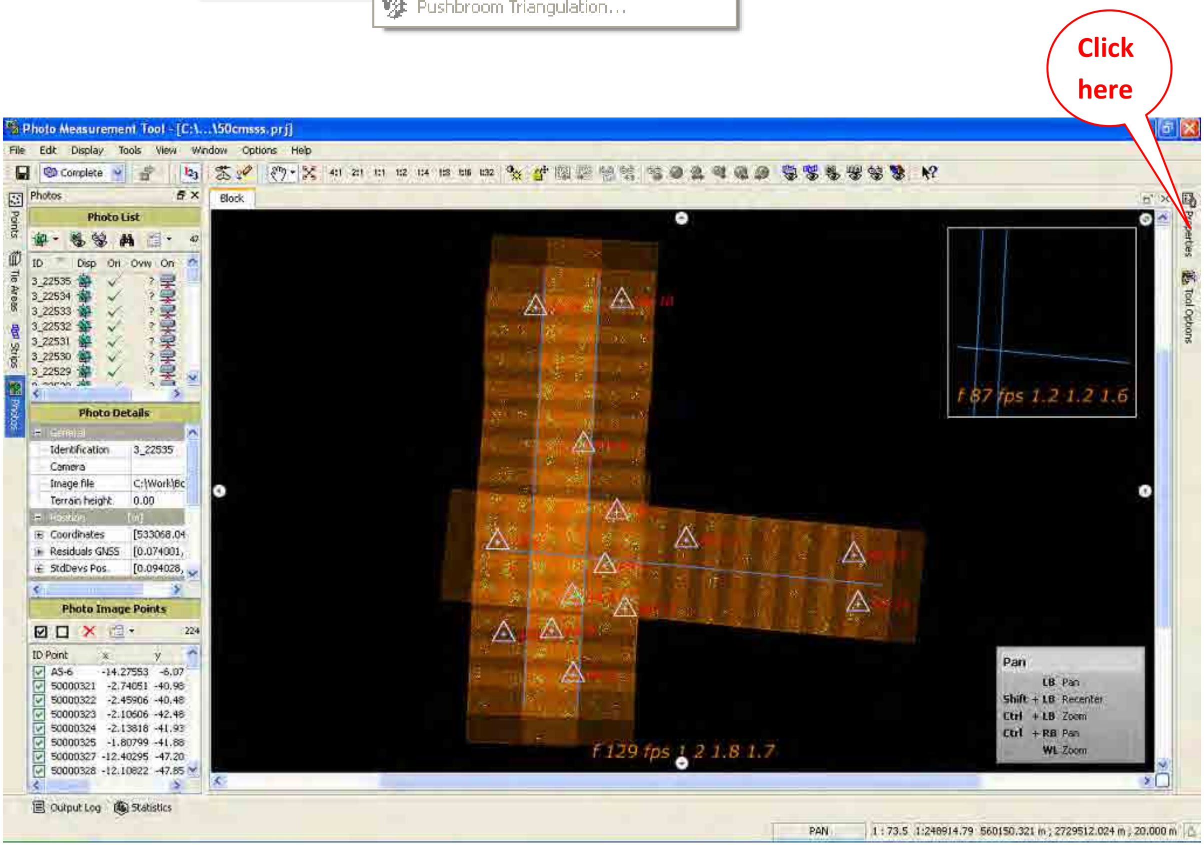
Result of GCP measurement (Post Processing)

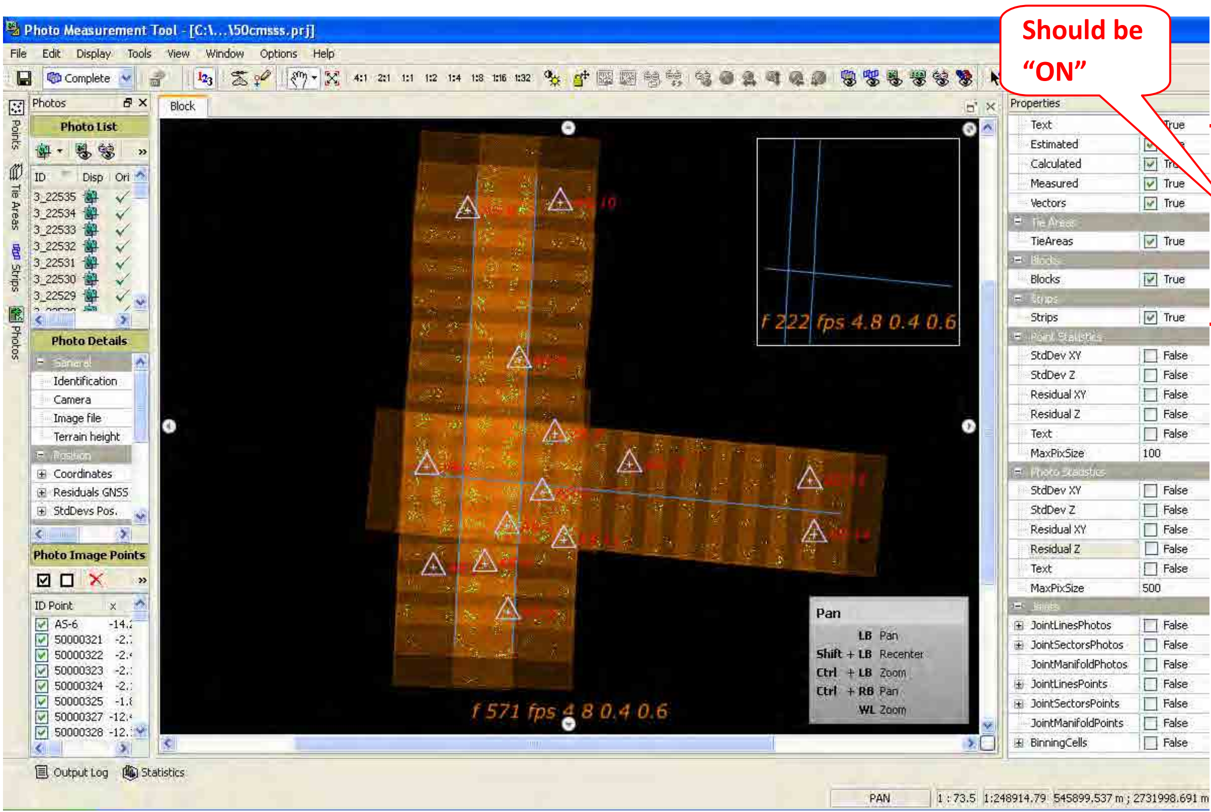


Chapter 12. Graphical Analysis of Post Processing

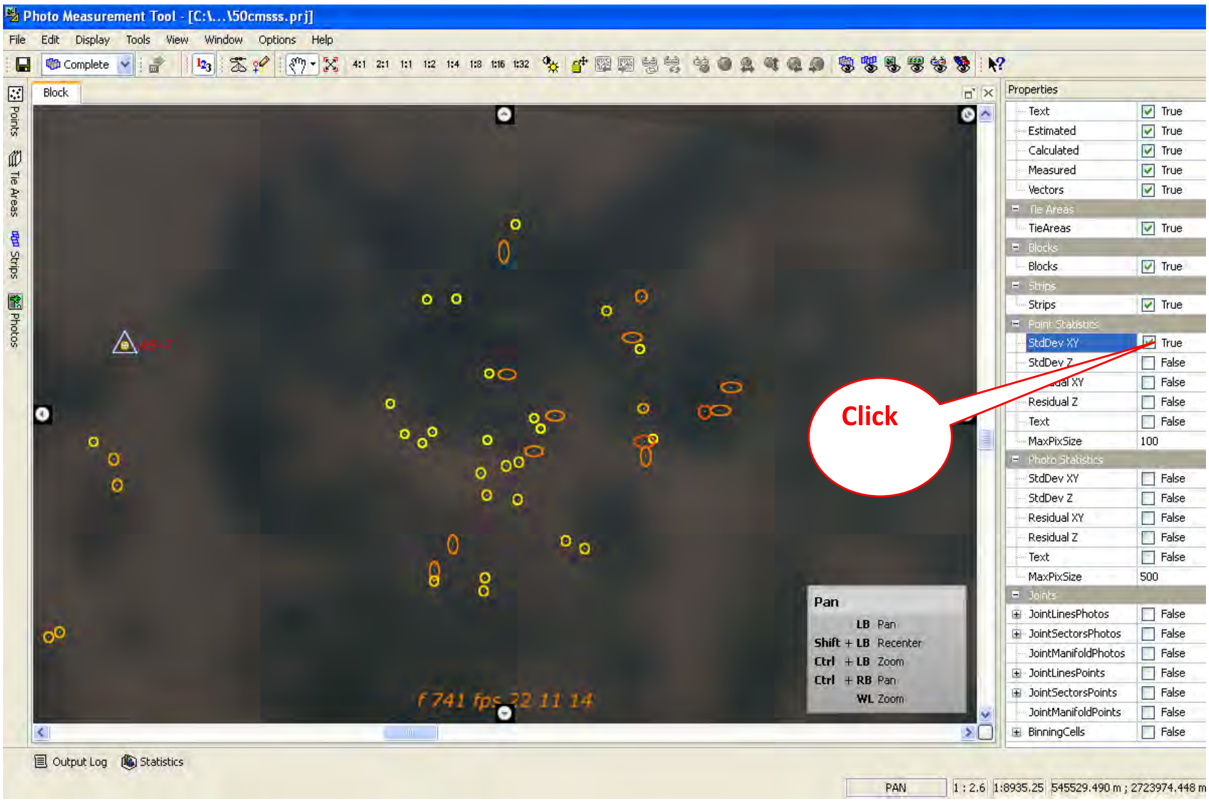
Chapter 12. Graphical Analysis of Post Processing







The properties TAB allows defining different analysis settings. Further more, from here it is possible to active or de-active the display of elements such as Control Point, Tie Point etc.



We can see the Standard deviation of all points by graphically. Standard deviation show the quality of point measurements. A standard deviation represents the maximum error the determined coordinate might have. The residual, however, shows the true difference between the given position and the adjusted position. Points that are measured in only two photos or that are measured with bad intersections, will show a large ellipse, may be not round but more elliptic. The block geometry will affect the size of standard deviation ellipses and the shape (round or elliptic) of photo canters. Generally in the block centre only small round ellipses should exist. At the block edges, ellipses might be a little bit larger.


Photo Measurement Tool - [C:\...\50cmss.prj]
File Edit Display Tools View Window Options Help
Click
The Standard deviation in
"Z" is displayed as a
Properties
Text True
Estimated True
Calculated True
Measured True
Vectors True
TieAreas True
Blocks True
Strips True
StdDev XY False
StdDev Z True
Residual XY False
Residual Z False
Text False
MaxPixSize 100
StdDev XY False
StdDev Z False
Residual XY False
Residual Z False
Text False
MaxPixSize 500
JointLinesPhotos False
JointSectorsPhotos False
JointManifoldPhotos False
JointLinesPoints False
JointSectorsPoints False
JointManifoldPoints False
BinningCells False
Pan
LB Pan
Shift + LB Recenter
Ctrl + LB Zoom
Ctrl + RB Pan
WL Zoom
Output Log
Statistics

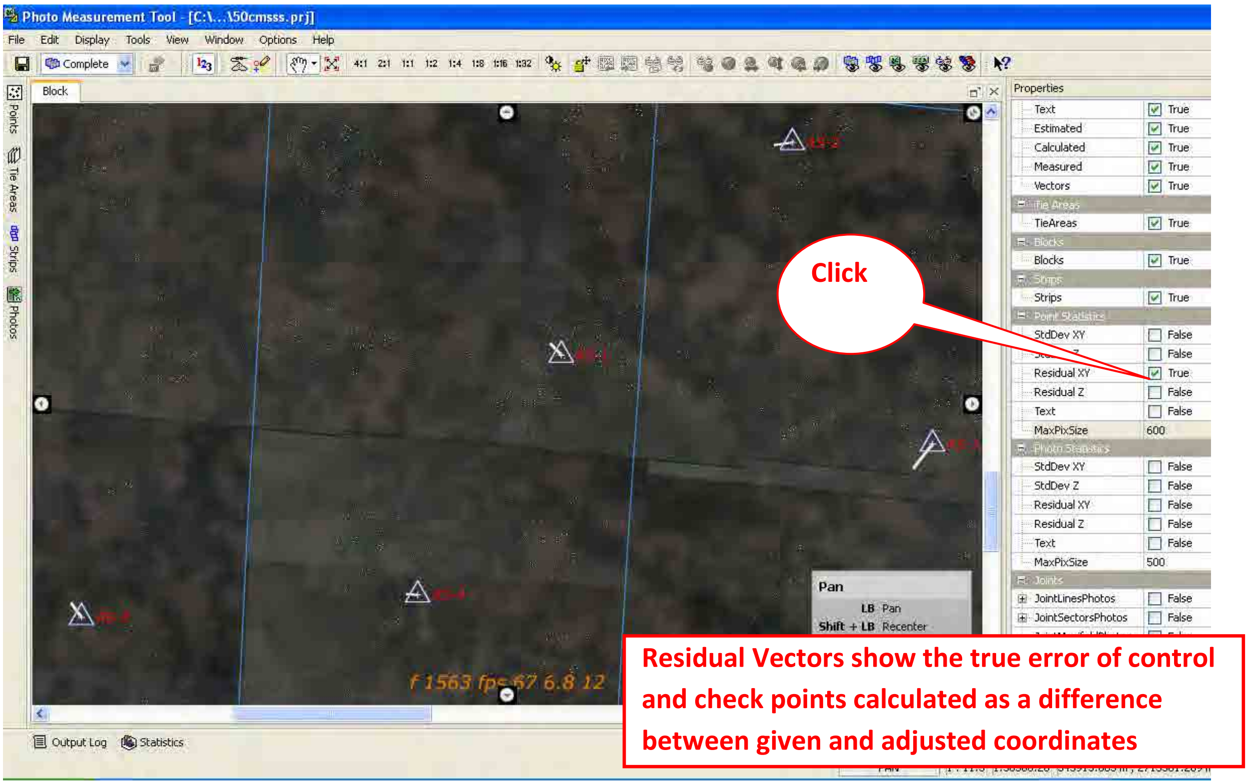


Photo Measurement Tool - [C:\...\50cmss.prj]
File Edit Display Tools View Window Options Help
Click
Properties
Text True
Estimated True
Calculated True
Measured True
Vectors True
TieAreas True
Blocks True
Strips True
StdDev XY False
Residual XY True
Residual Z False
Text False
MaxPixSize 600
StdDev XY False
StdDev Z False
Residual XY False
Residual Z False
Text False
MaxPixSize 500
JointLinesPhotos False
JointSectorsPhotos False
Pan
LB Pan
Shift + LB Recenter
Output Log
Statistics
Residual Vectors show the true error of control
and check points calculated as a difference
between given and adjusted coordinates

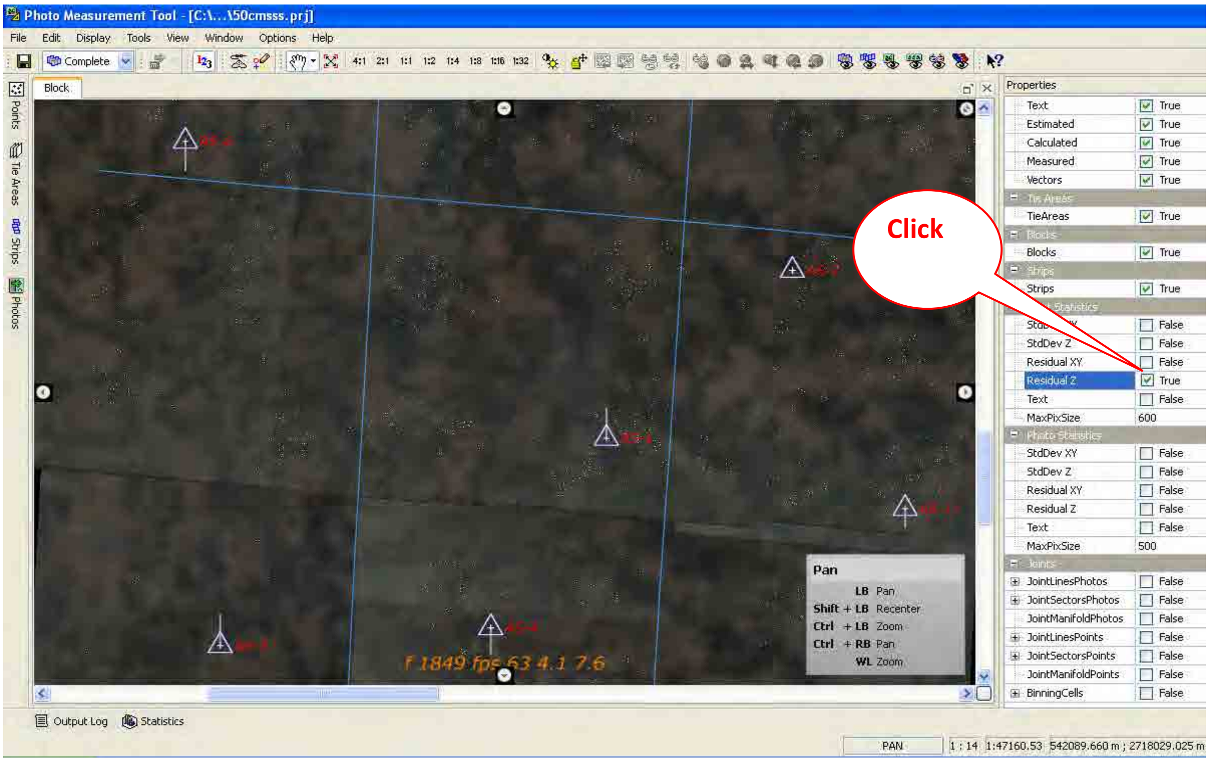


Photo Measurement Tool - [C:\...\50cmsss.prj]
File Edit Display Tools View Window Options Help
Complete
Block
Points
Tie Areas
Strips
Photos
Click
Properties
Text True
Estimated True
Calculated True
Measured True
Vectors True
TieAreas True
Blocks True
Strips True
StdDev Z False
Residual XY False
Residual Z True
Text False
MaxPixSize 600
StdDev XY False
StdDev Z False
Residual XY False
Residual Z False
Text False
MaxPixSize 500
JointLinesPhotos False
JointSectorsPhotos False
JointManifoldPhotos False
JointLinesPoints False
JointSectorsPoints False
JointManifoldPoints False
BinningCells False
Pan
LB Pan
Shift + LB Recenter
Ctrl + LB Zoom
Ctrl + RB Pan
WL Zoom
Output Log
Statistics
PAN
1 : 14
1:47160.53
542089.660 m ; 2718029.025 m

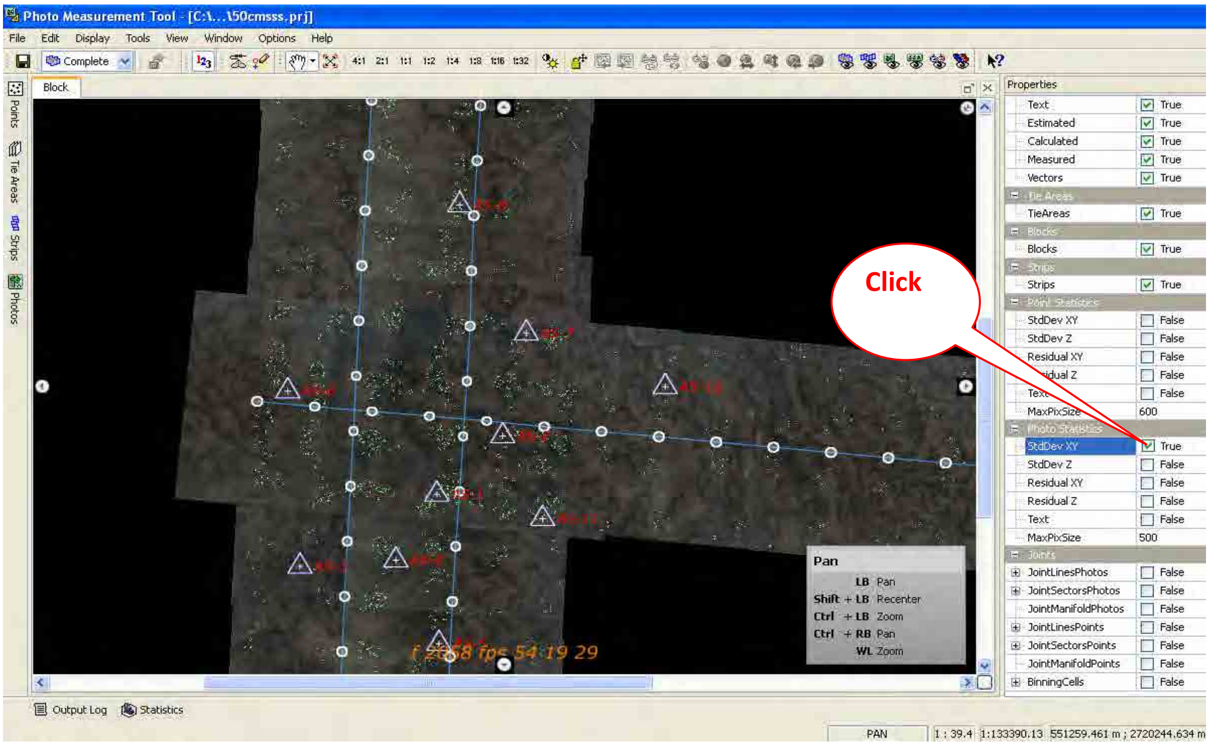


Photo Measurement Tool - [C:\...\50cmsss.prj]
File Edit Display Tools View Window Options Help
Complete
Block
Points
Tie Areas
Strips
Photos
Click
Properties
Text True
Estimated True
Calculated True
Measured True
Vectors True
TieAreas True
Blocks True
Strips True
StdDev XY False
StdDev Z False
Residual XY False
MaxPixSize 600
StdDev XY True
StdDev Z False
Residual XY False
Residual Z False
Text False
MaxPixSize 500
JointLinesPhotos False
JointSectorsPhotos False
JointManifoldPhotos False
JointLinesPoints False
JointSectorsPoints False
JointManifoldPoints False
BinningCells False
Pan
LB Pan
Shift + LB Recenter
Ctrl + LB Zoom
Ctrl + RB Pan
WL Zoom
Output Log
Statistics
PAN
1 : 39.4
1:133390.13
551259.461 m ; 2720244.634 m

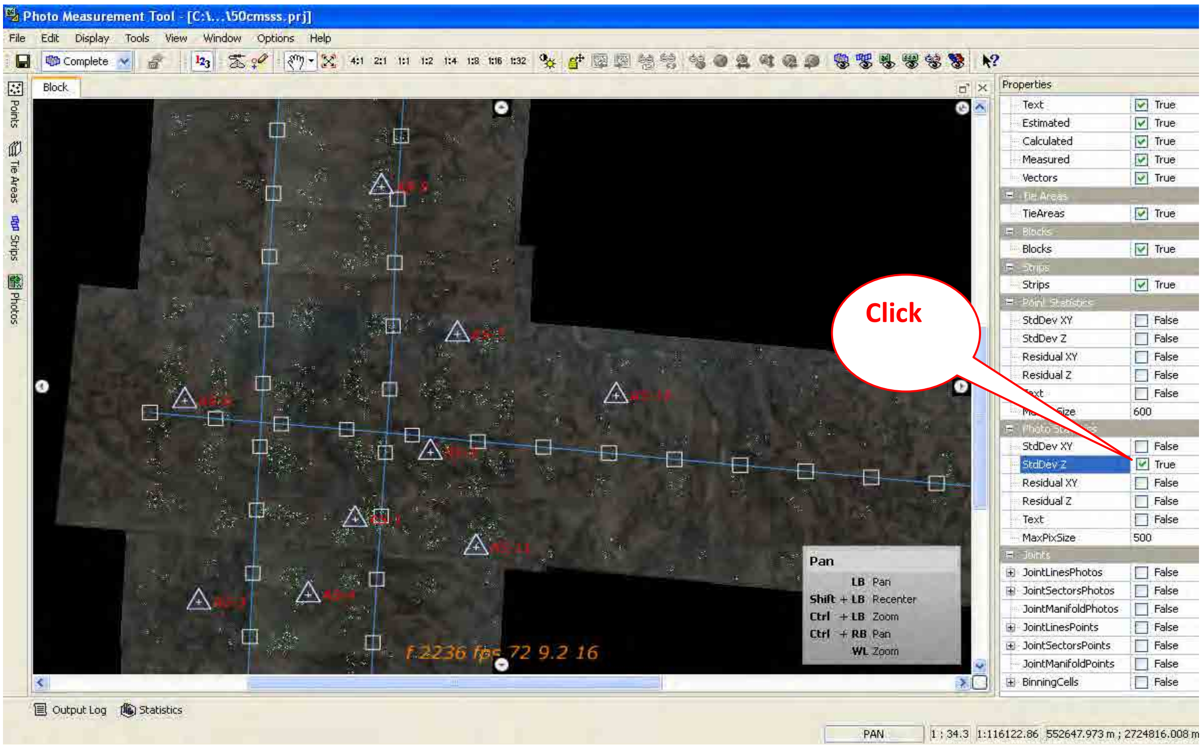


Photo Measurement Tool - [C:\...\50cmsss.prj]
File Edit Display Tools View Window Options Help
Complete
Block
Points
Tie Areas
Strips
Photos
Properties
Text True
Estimated True
Calculated True
Measured True
Vectors True
TieAreas True
Blocks True
Strips True
StdDev XY False
StdDev Z False
Residual XY False
Residual Z False
StdDev XY False
StdDev Z True
Residual XY False
Residual Z False
Text False
MaxPixSize 500
JointLinesPhotos False
JointSectorsPhotos False
JointManifoldPhotos False
JointLinesPoints False
JointSectorsPoints False
JointManifoldPoints False
BinningCells False
Click
Pan
LB Pan
Shift + LB Recenter
Ctrl + LB Zoom
Ctrl + RB Pan
WL Zoom
Output Log
Statistics
PAN

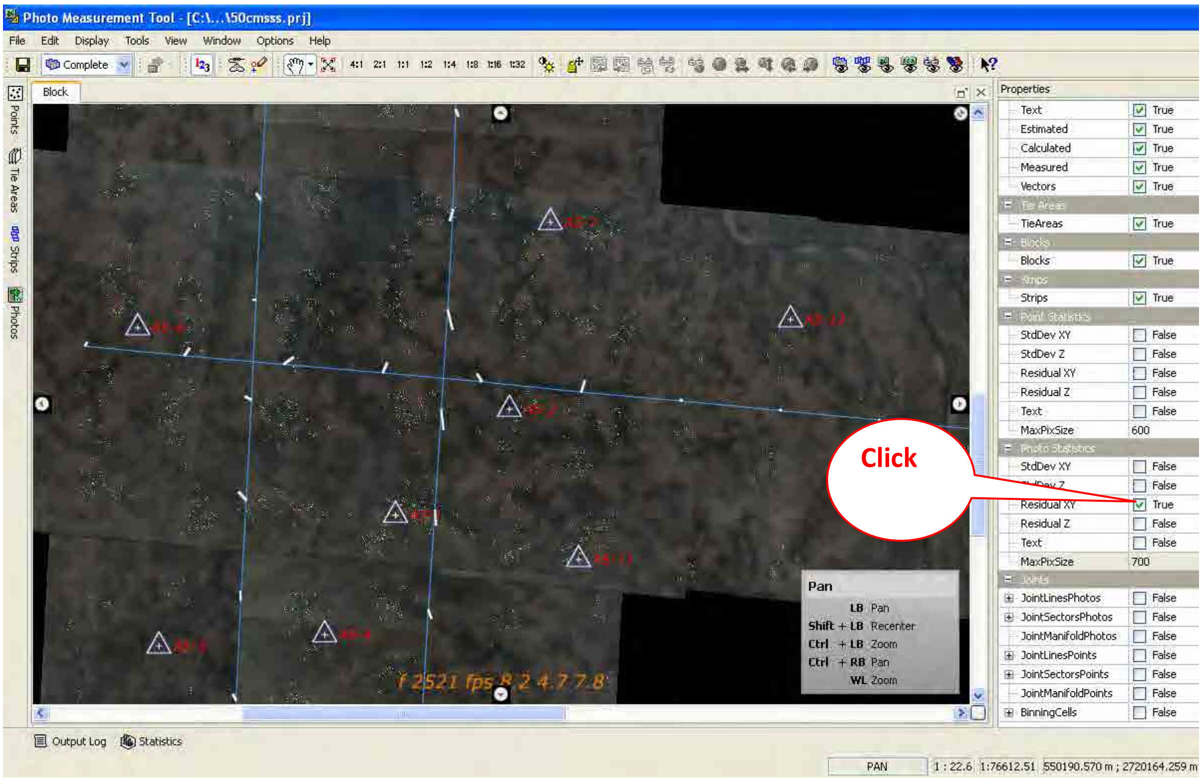
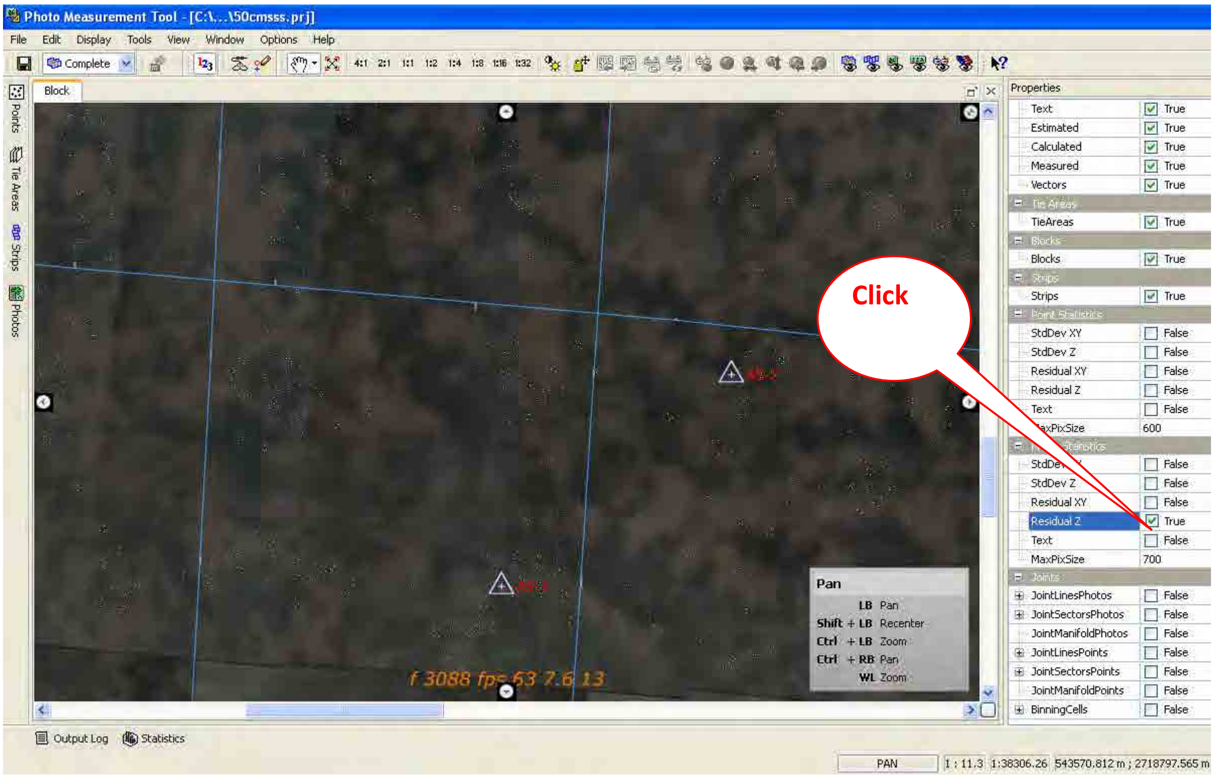


Photo Measurement Tool - [C:\...\50cmsss.prj]
File Edit Display Tools View Window Options Help
Complete
Block
Points
Tie Areas
Strips
Photos
Properties
Text True
Estimated True
Calculated True
Measured True
Vectors True
TieAreas True
Blocks True
Strips True
StdDev XY False
StdDev Z False
Residual XY False
Residual Z False
Text False
MaxPixSize 600
StdDev XY False
Residual XY True
Residual Z False
Text False
MaxPixSize 700
JointLinesPhotos False
JointSectorsPhotos False
JointManifoldPhotos False
JointLinesPoints False
JointSectorsPoints False
JointManifoldPoints False
BinningCells False
Click
Pan
LB Pan
Shift + LB Recenter
Ctrl + LB Zoom
Ctrl + RB Pan
WL Zoom
Output Log
Statistics
PAN



Check LOG File:

After completion of an AT RUN, you want to get some information about statistics and result for every processed pyramid level. This information is written to the report of LOG file during the RUN. You either can look at this ASCII file or you click on button labeled “Check log file” in the “MATCH-AT” Submenu of the main window “Application Master”.

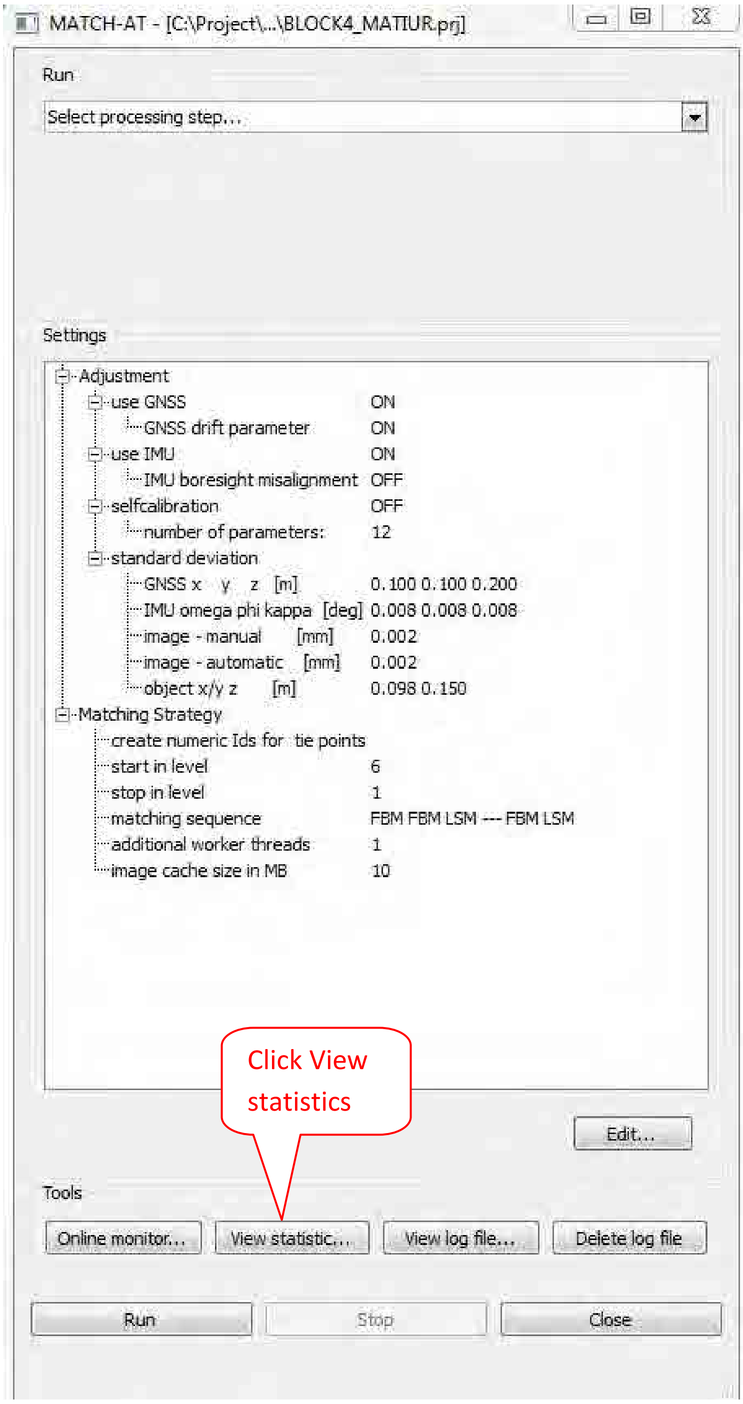
Statistics Viewer:

During the triangulation MATCH-AT, create binary statistics file. This file stores very detailed information about the adjustment computation. To have very detail analysis, this viewer can be used to read out the statistics file.

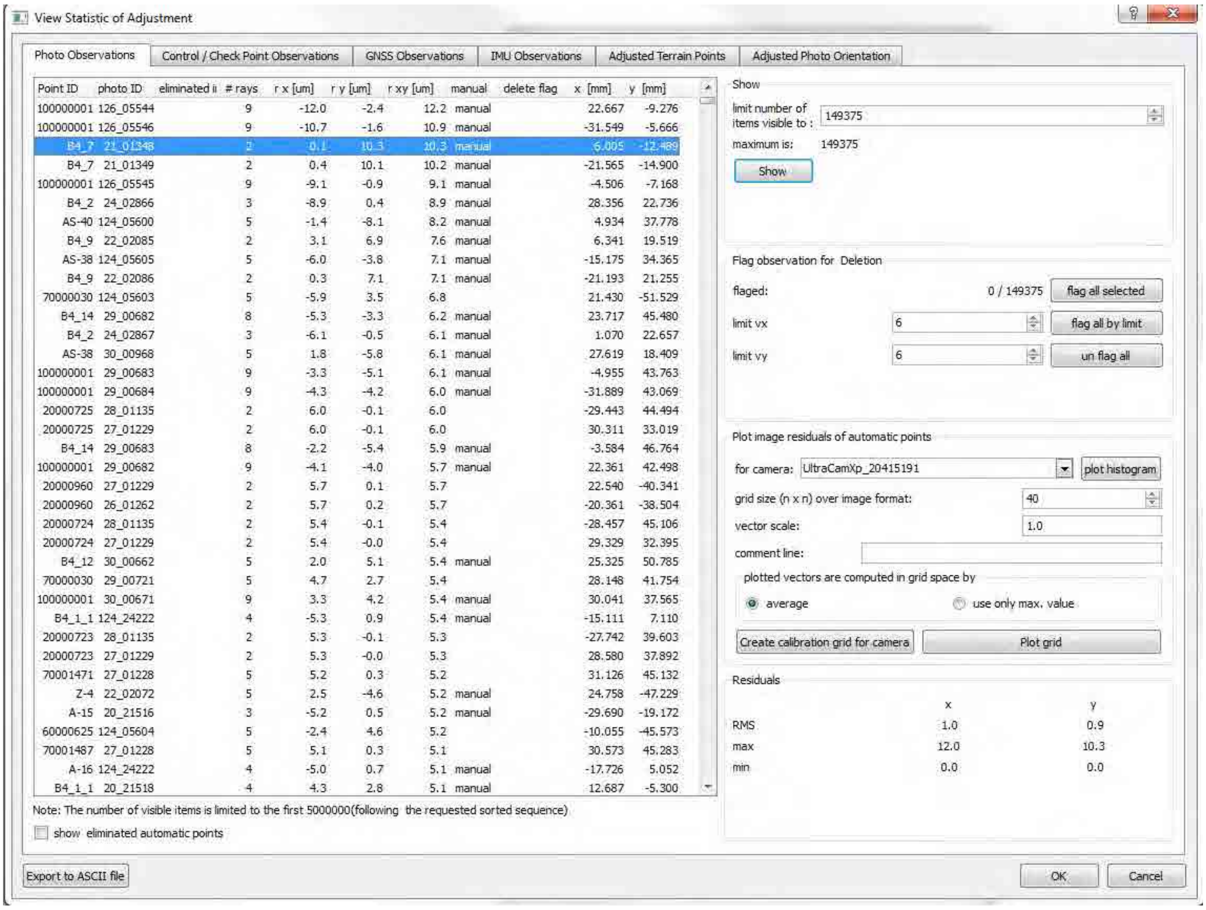
Chapter 13. View Statistic of Adjustment

Chapter 13. View Statistic of Adjustment

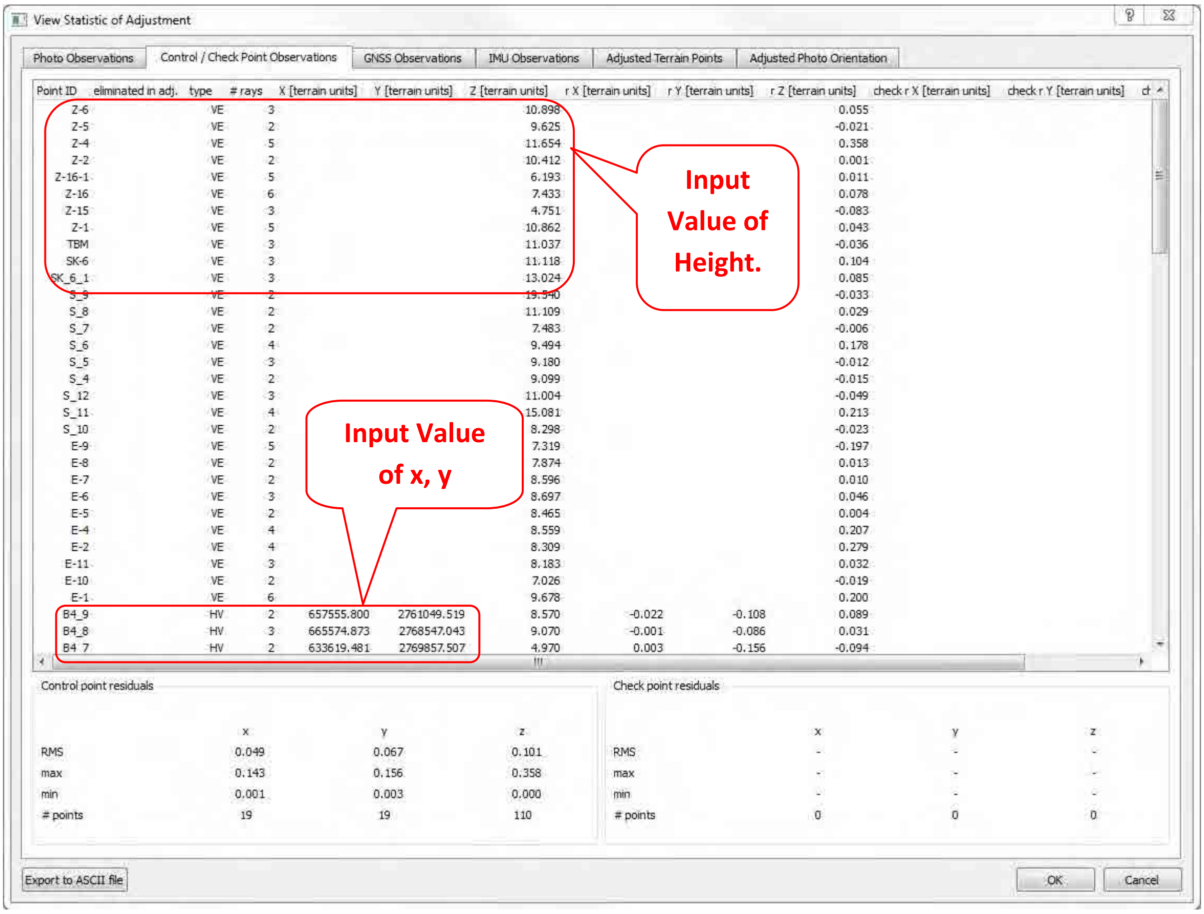
Step1: Open Application Master --> Product --> Match AT --> Aerial Triangulation. Then click View Statistic of Adjustment.



13.1 **Photo Observation**:



13.2 Control/ Check Point Observation:



Point ID	eliminated in adj.	type	# rays	X [terrain units]	Y [terrain units]	Z [terrain units]	r X [terrain units]	r Y [terrain units]	r Z [terrain units]	check r X [terrain units]	check r Y [terrain units]
Z-6		VE	3			10.898			0.055		
Z-5		VE	2			9.625			-0.021		
Z-4		VE	5			11.654			0.358		
Z-2		VE	2			10.412			0.001		
Z-16-1		VE	5			6.193			0.011		
Z-16		VE	6			7.433			0.078		
Z-15		VE	3			4.751			-0.083		
Z-1		VE	5			10.862			0.043		
TBM		VE	3			11.037			-0.036		
SK-6		VE	3			11.118			0.104		
SK_6_1		VE	3			13.024			0.085		
S_9		VE	2			19.540			-0.033		
S_8		VE	2			11.109			0.029		
S_7		VE	2			7.483			-0.006		
S_6		VE	4			9.494			0.178		
S_5		VE	3			9.180			-0.012		
S_4		VE	2			9.099			-0.015		
S_12		VE	3			11.004			-0.049		
S_11		VE	4			15.081			0.213		
S_10		VE	2			8.298			-0.023		
E-9		VE	5			7.319			-0.197		
E-8		VE	2			7.874			0.013		
E-7		VE	2			8.596			0.010		
E-6		VE	3			8.697			0.046		
E-5		VE	2			8.465			0.004		
E-4		VE	4			8.559			0.207		
E-2		VE	4			8.309			0.279		
E-11		VE	3			8.183			0.032		
E-10		VE	2			7.026			-0.019		
E-1		VE	6			9.678			0.200		
B4_9		HV	2	657555.800	2761049.519	8.570	-0.022	-0.108	0.089		
B4_8		HV	3	665574.873	2768547.043	9.070	-0.001	-0.086	0.031		
B4_7		HV	2	633619.481	2769857.507	4.970	0.003	-0.156	-0.094		

Control point residuals

	x	y	z
RMS	0.049	0.067	0.101
max	0.143	0.156	0.358
min	0.001	0.003	0.000
# points	19	19	110

Check point residuals

	x	y	z
RMS	-	-	-
max	-	-	-
min	-	-	-
# points	0	0	0

13.3 GNSS Observations:

View Statistic of Adjustment

Photo Observations | Control / Check Point Observations | GNSS Observations | IMU Observations | Adjusted Terrain Points | Adjusted Photo Orientation

Photo ID	Strip ID	Camera ID	eliminated in adj.	X [terrain units]	Y [terrain units]	Z [terrain units]	r X [terrain units]	r Y [terrain units]	r Z [terrain units]
30_00970	19	UltraCamXp_20415191		616627.119	2710114.159	8289.188	0.046	0.011	-0.121
30_00969	19	UltraCamXp_20415191		614365.416	2710075.719	8288.743	-0.101	0.038	0.138
30_00968	19	UltraCamXp_20415191		612104.639	2710035.684	8288.799	0.073	-0.078	0.032
30_00967	19	UltraCamXp_20415191		609843.311	2709993.070	8286.186	-0.025	-0.001	0.004
30_00966	19	UltraCamXp_20415191		607582.947	2709946.594	8283.354	0.008	0.030	-0.054
30_00677	18	UltraCamXp_20415191		707092.972	2712076.707	8308.341	0.072	0.052	-0.111
30_00676	18	UltraCamXp_20415191		704830.654	2712039.968	8307.060	0.020	0.109	0.039
30_00675	18	UltraCamXp_20415191		702568.819	2711977.381	8307.957	0.052	-0.007	0.189
30_00674	18	UltraCamXp_20415191		700307.267	2711891.004	8309.964	0.170	-0.105	0.209
30_00673	18	UltraCamXp_20415191		698045.043	2711812.342	8309.704	0.037	0.078	-0.067
30_00672	18	UltraCamXp_20415191		695782.752	2711754.023	8309.650	0.148	0.118	-0.349
30_00671	18	UltraCamXp_20415191		693520.844	2711725.807	8307.452	-0.023	-0.106	-0.359
30_00670	18	UltraCamXp_20415191		691256.934	2711713.675	8309.146	-0.242	-0.003	-0.321
30_00669	18	UltraCamXp_20415191		688994.906	2711681.754	8310.172	-0.194	-0.019	-0.275
30_00668	18	UltraCamXp_20415191		686733.113	2711621.428	8307.679	-0.137	0.252	-0.131
30_00667	18	UltraCamXp_20415191		684471.531	2711554.925	8307.640	-0.050	-0.091	-0.034
30_00666	18	UltraCamXp_20415191		682209.164	2711492.777	8306.053	0.003	0.115	-0.027
30_00665	18	UltraCamXp_20415191		679947.684	2711439.702	8307.188	-0.005	0.023	0.008
30_00664	18	UltraCamXp_20415191		677685.344	2711400.161	8308.401	0.110	-0.003	0.077
30_00663	18	UltraCamXp_20415191		675423.767	2711374.235	8307.753	0.093	-0.137	0.201
30_00662	18	UltraCamXp_20415191		673160.986	2711343.914	8306.919	-0.033	-0.184	0.263
30_00661	18	UltraCamXp_20415191		670898.845	2711304.615	8306.762	-0.108	-0.091	0.157
30_00660	18	UltraCamXp_20415191		668637.312	2711252.451	8306.079	-0.092	-0.046	0.225
30_00659	18	UltraCamXp_20415191		666375.459	2711180.442	8306.955	-0.155	-0.018	0.083
30_00658	18	UltraCamXp_20415191		664114.252	2711104.957	8308.127	0.060	0.001	0.154
30_00657	18	UltraCamXp_20415191		661852.852	2711042.225	8308.123	0.006	0.024	0.036
30_00656	18	UltraCamXp_20415191		659591.201	2710999.879	8306.098	-0.020	-0.010	0.057
30_00655	18	UltraCamXp_20415191		657330.121	2710970.608	8306.085	0.067	-0.024	0.060
30_00654	18	UltraCamXp_20415191		655067.761	2710939.681	8306.931	0.030	0.059	0.082
30_00653	18	UltraCamXp_20415191		652805.962	2710903.677	8307.090	0.044	-0.041	0.056
30_00652	18	UltraCamXp_20415191		650544.552	2710857.867	8306.314	0.136	0.012	0.042
30_00651	18	UltraCamXp_20415191		648283.292	2710808.969	8305.316	-0.042	-0.098	0.177

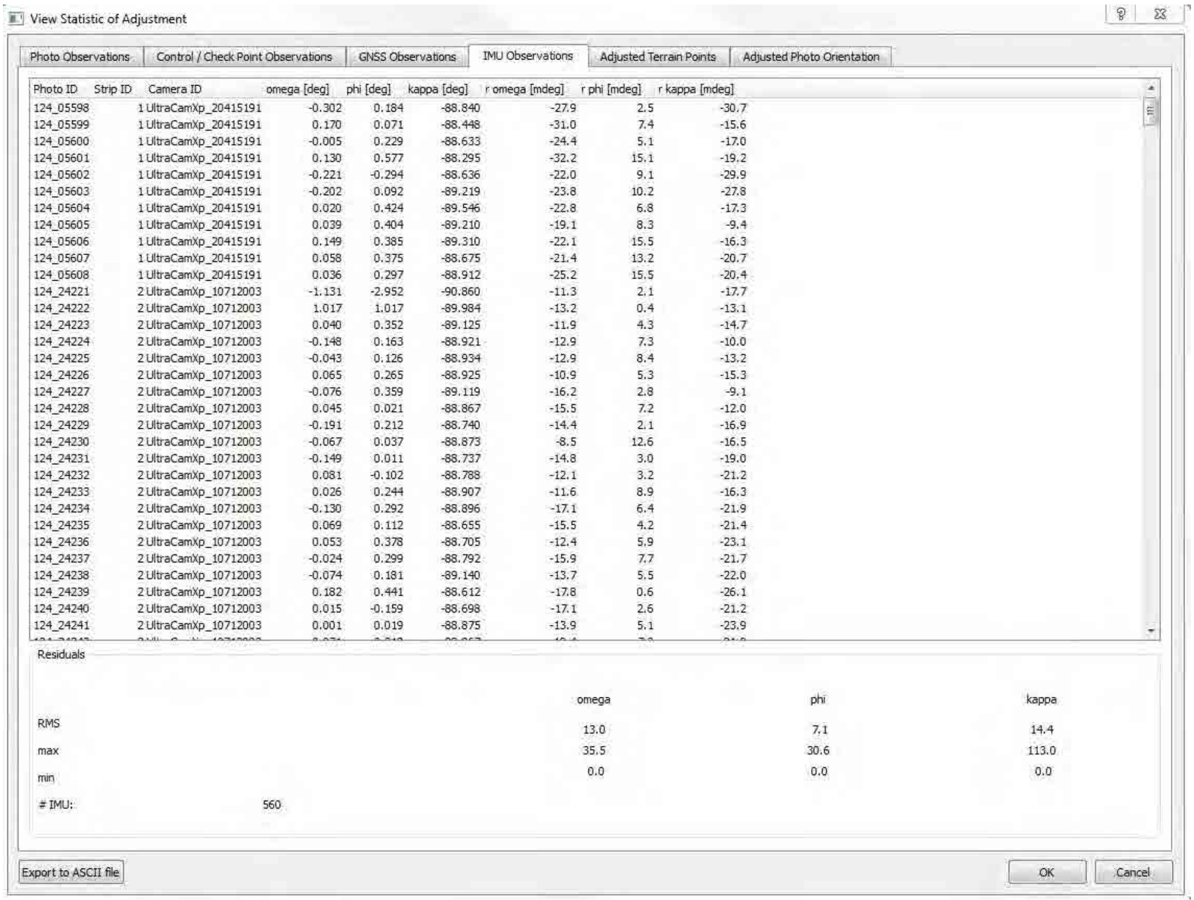
Residuals

	X	Y	Z
RMS	0.128	0.097	0.196
max	0.742	0.485	1.179
min	0.000	0.000	0.000

GNSS: 560

Export to ASCII file | OK | Cancel

13.4 IMU Observations:



View Statistic of Adjustment

Photo Observations | Control / Check Point Observations | GNSS Observations | IMU Observations | Adjusted Terrain Points | Adjusted Photo Orientation

Photo ID	Strip ID	Camera ID	omega [deg]	phi [deg]	kappa [deg]	r omega [mdeg]	r phi [mdeg]	r kappa [mdeg]
124_05598	1	UltraCamXp_20415191	-0.302	0.184	-88.840	-27.9	2.5	-30.7
124_05599	1	UltraCamXp_20415191	0.170	0.071	-88.448	-31.0	7.4	-15.6
124_05600	1	UltraCamXp_20415191	-0.005	0.229	-88.633	-24.4	5.1	-17.0
124_05601	1	UltraCamXp_20415191	0.130	0.577	-88.295	-32.2	15.1	-19.2
124_05602	1	UltraCamXp_20415191	-0.221	-0.294	-88.636	-22.0	9.1	-29.9
124_05603	1	UltraCamXp_20415191	-0.202	0.092	-89.219	-23.8	10.2	-27.8
124_05604	1	UltraCamXp_20415191	0.020	0.424	-89.546	-22.8	6.8	-17.3
124_05605	1	UltraCamXp_20415191	0.039	0.404	-89.210	-19.1	8.3	-9.4
124_05606	1	UltraCamXp_20415191	0.149	0.385	-89.310	-22.1	15.5	-16.3
124_05607	1	UltraCamXp_20415191	0.058	0.375	-88.675	-21.4	13.2	-20.7
124_05608	1	UltraCamXp_20415191	0.036	0.297	-88.912	-25.2	15.5	-20.4
124_24221	2	UltraCamXp_10712003	-1.131	-2.952	-90.860	-11.3	2.1	-17.7
124_24222	2	UltraCamXp_10712003	1.017	1.017	-89.984	-13.2	0.4	-13.1
124_24223	2	UltraCamXp_10712003	0.040	0.352	-89.125	-11.9	4.3	-14.7
124_24224	2	UltraCamXp_10712003	-0.148	0.163	-88.921	-12.9	7.3	-10.0
124_24225	2	UltraCamXp_10712003	-0.043	0.126	-88.934	-12.9	8.4	-13.2
124_24226	2	UltraCamXp_10712003	0.065	0.265	-88.925	-10.9	5.3	-15.3
124_24227	2	UltraCamXp_10712003	-0.076	0.359	-89.119	-16.2	2.8	-9.1
124_24228	2	UltraCamXp_10712003	0.045	0.021	-88.867	-15.5	7.2	-12.0
124_24229	2	UltraCamXp_10712003	-0.191	0.212	-88.740	-14.4	2.1	-16.9
124_24230	2	UltraCamXp_10712003	-0.067	0.037	-88.873	-8.5	12.6	-16.5
124_24231	2	UltraCamXp_10712003	-0.149	0.011	-88.737	-14.8	3.0	-19.0
124_24232	2	UltraCamXp_10712003	0.081	-0.102	-88.788	-12.1	3.2	-21.2
124_24233	2	UltraCamXp_10712003	0.026	0.244	-88.907	-11.6	8.9	-16.3
124_24234	2	UltraCamXp_10712003	-0.130	0.292	-88.896	-17.1	6.4	-21.9
124_24235	2	UltraCamXp_10712003	0.069	0.112	-88.655	-15.5	4.2	-21.4
124_24236	2	UltraCamXp_10712003	0.053	0.378	-88.705	-12.4	5.9	-23.1
124_24237	2	UltraCamXp_10712003	-0.024	0.299	-88.792	-15.9	7.7	-21.7
124_24238	2	UltraCamXp_10712003	-0.074	0.181	-89.140	-13.7	5.5	-22.0
124_24239	2	UltraCamXp_10712003	0.182	0.441	-88.612	-17.8	0.6	-26.1
124_24240	2	UltraCamXp_10712003	0.015	-0.159	-88.698	-17.1	2.6	-21.2
124_24241	2	UltraCamXp_10712003	0.001	0.019	-88.875	-13.9	5.1	-23.9

Residuals

	omega	phi	kappa
RMS	13.0	7.1	14.4
max	35.5	30.6	113.0
min	0.0	0.0	0.0

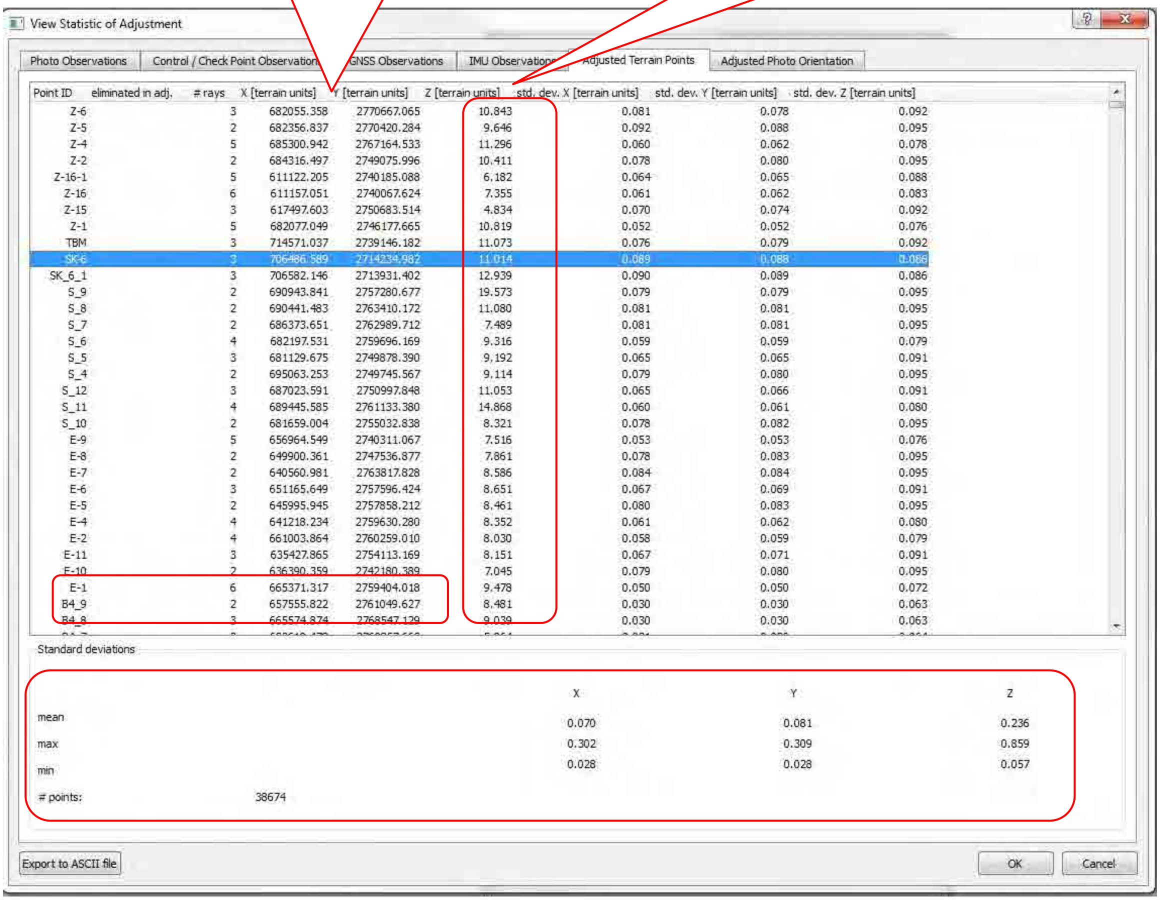
IMU: 560

Export to ASCII file | OK | Cancel

13.5 Adjusted Terrain points:

After completion of AT, We can easily compare what is the difference between input and output value.

After completion of AT, we can easily compare what is the difference between input and output value.



View Statistic of Adjustment

Photo Observations | Control / Check Point Observation | GNSS Observations | IMU Observations | Adjusted Terrain Points | Adjusted Photo Orientation

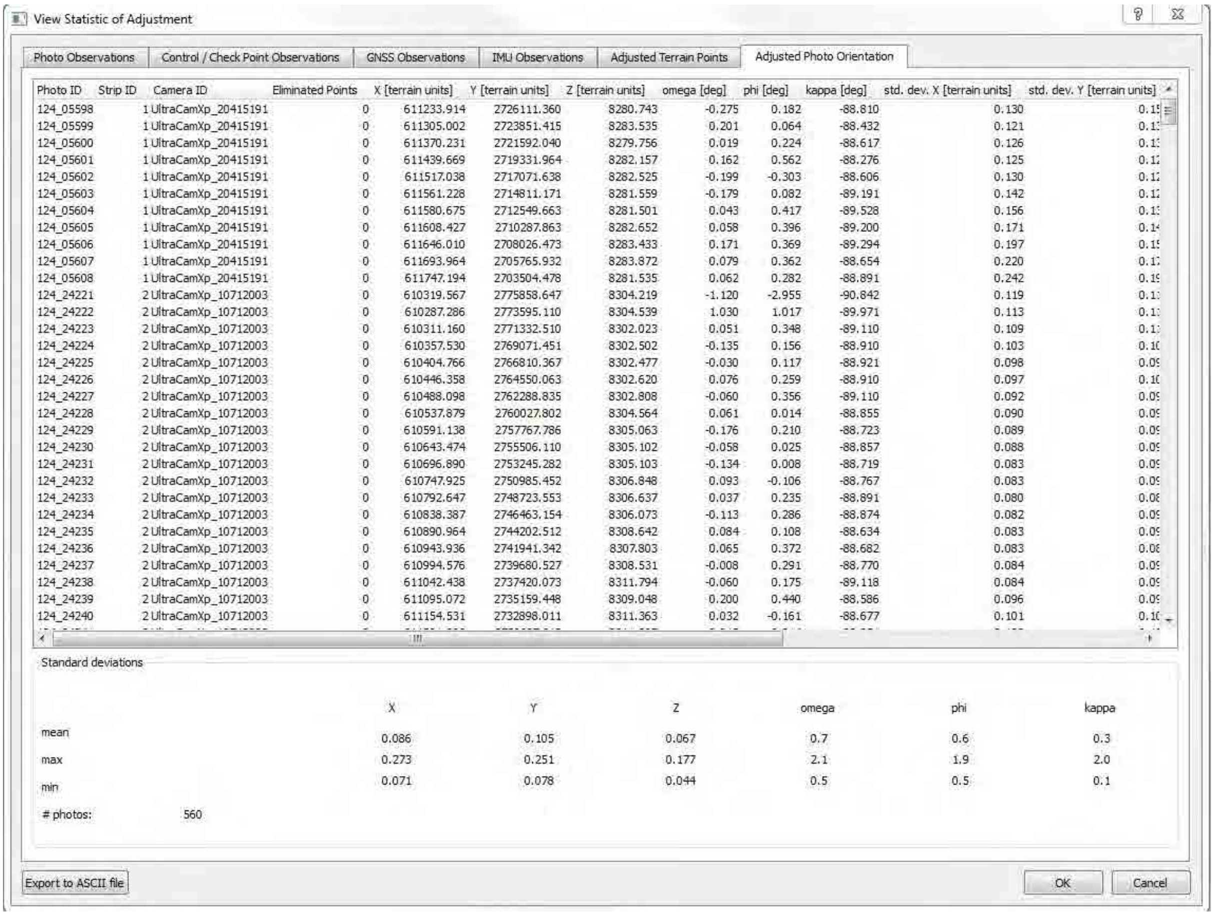
Point ID	eliminated in adj.	# rays	X [terrain units]	Y [terrain units]	Z [terrain units]	std. dev. X [terrain units]	std. dev. Y [terrain units]	std. dev. Z [terrain units]
Z-6		3	682055.358	2770667.065	10.843	0.081	0.078	0.092
Z-5		2	682356.837	2770420.284	9.646	0.092	0.088	0.095
Z-4		5	685300.942	2767164.533	11.296	0.060	0.062	0.078
Z-2		2	684316.497	2749075.996	10.411	0.078	0.080	0.095
Z-16-1		5	611122.205	2740185.088	6.182	0.064	0.065	0.088
Z-16		6	611157.051	2740067.624	7.355	0.061	0.062	0.083
Z-15		3	617497.603	2750683.514	4.834	0.070	0.074	0.092
Z-1		5	682077.049	2746177.665	10.819	0.052	0.052	0.076
TBM		3	714571.037	2739146.182	11.073	0.076	0.079	0.092
SK-6		3	706486.589	2714234.982	11.014	0.089	0.088	0.086
SK_6_1		3	706582.146	2713931.402	12.939	0.090	0.089	0.086
S_9		2	690943.841	2757280.677	19.573	0.079	0.079	0.095
S_8		2	690441.483	2763410.172	11.080	0.081	0.081	0.095
S_7		2	686373.651	2762989.712	7.489	0.081	0.081	0.095
S_6		4	682197.531	2759696.169	9.316	0.059	0.059	0.079
S_5		3	681129.675	2749878.390	9.192	0.065	0.065	0.091
S_4		2	695063.253	2749745.567	9.114	0.079	0.080	0.095
S_12		3	687023.591	2750997.848	11.053	0.065	0.066	0.091
S_11		4	689445.585	2761133.380	14.868	0.060	0.061	0.080
S_10		2	681659.004	2755032.838	8.321	0.078	0.082	0.095
E-9		5	656964.549	2740311.067	7.516	0.053	0.053	0.076
E-8		2	649900.361	2747536.877	7.861	0.078	0.083	0.095
E-7		2	640560.981	2763817.828	8.586	0.084	0.084	0.095
E-6		3	651165.649	2757596.424	8.651	0.067	0.069	0.091
E-5		2	645995.945	2757858.212	8.461	0.080	0.083	0.095
E-4		4	641218.234	2759630.280	8.352	0.061	0.062	0.080
E-2		4	661003.864	2760259.010	8.030	0.058	0.059	0.079
E-11		3	635427.865	2754113.169	8.151	0.067	0.071	0.091
E-10		2	636390.359	2742180.389	7.045	0.079	0.080	0.095
E-1		6	665371.317	2759404.018	9.478	0.050	0.050	0.072
B4_9		2	657555.822	2761049.627	8.481	0.030	0.030	0.063
B4_8		3	665574.874	2768547.129	9.039	0.030	0.030	0.063

Standard deviations

	X	Y	Z
mean	0.070	0.081	0.236
max	0.302	0.309	0.859
min	0.028	0.028	0.057
# points: 38674			

Export to ASCII file | OK | Cancel

13.6 Adjusted Photo Orientation:



View Statistic of Adjustment

Photo Observations | Control / Check Point Observations | GNSS Observations | IMU Observations | Adjusted Terrain Points | Adjusted Photo Orientation

Photo ID	Strip ID	Camera ID	Eliminated Points	X [terrain units]	Y [terrain units]	Z [terrain units]	omega [deg]	phi [deg]	kappa [deg]	std. dev. X [terrain units]	std. dev. Y [terrain units]
124_05598	1	UltraCamXp_20415191	0	611233.914	2726111.360	8280.743	-0.275	0.182	-88.810	0.130	0.15
124_05599	1	UltraCamXp_20415191	0	611305.002	2723851.415	8283.535	0.201	0.064	-88.432	0.121	0.1
124_05600	1	UltraCamXp_20415191	0	611370.231	2721592.040	8279.756	0.019	0.224	-88.617	0.126	0.1
124_05601	1	UltraCamXp_20415191	0	611439.669	2719331.964	8282.157	0.162	0.562	-88.276	0.125	0.1
124_05602	1	UltraCamXp_20415191	0	611517.038	2717071.638	8282.525	-0.199	-0.303	-88.606	0.130	0.1
124_05603	1	UltraCamXp_20415191	0	611561.228	2714811.171	8281.559	-0.179	0.082	-89.191	0.142	0.1
124_05604	1	UltraCamXp_20415191	0	611580.675	2712549.663	8281.501	0.043	0.417	-89.528	0.156	0.1
124_05605	1	UltraCamXp_20415191	0	611608.427	2710287.863	8282.652	0.058	0.396	-89.200	0.171	0.14
124_05606	1	UltraCamXp_20415191	0	611646.010	2708026.473	8283.433	0.171	0.369	-89.294	0.197	0.15
124_05607	1	UltraCamXp_20415191	0	611693.964	2705765.932	8283.872	0.079	0.362	-88.654	0.220	0.1
124_05608	1	UltraCamXp_20415191	0	611747.194	2703504.478	8281.535	0.062	0.282	-88.891	0.242	0.19
124_24221	2	UltraCamXp_10712003	0	610319.567	2775858.647	8304.219	-1.120	-2.955	-90.842	0.119	0.1
124_24222	2	UltraCamXp_10712003	0	610287.286	2773595.110	8304.539	1.030	1.017	-89.971	0.113	0.1
124_24223	2	UltraCamXp_10712003	0	610311.160	2771332.510	8302.023	0.051	0.348	-89.110	0.109	0.1
124_24224	2	UltraCamXp_10712003	0	610357.530	2769071.451	8302.502	-0.135	0.156	-88.910	0.103	0.10
124_24225	2	UltraCamXp_10712003	0	610404.766	2766810.367	8302.477	-0.030	0.117	-88.921	0.098	0.09
124_24226	2	UltraCamXp_10712003	0	610446.358	2764550.063	8302.620	0.076	0.259	-88.910	0.097	0.10
124_24227	2	UltraCamXp_10712003	0	610488.098	2762288.835	8302.808	-0.060	0.356	-89.110	0.092	0.09
124_24228	2	UltraCamXp_10712003	0	610537.879	2760027.802	8304.564	0.061	0.014	-88.855	0.090	0.09
124_24229	2	UltraCamXp_10712003	0	610591.138	2757767.786	8305.063	-0.176	0.210	-88.723	0.089	0.09
124_24230	2	UltraCamXp_10712003	0	610643.474	2755506.110	8305.102	-0.058	0.025	-88.857	0.088	0.09
124_24231	2	UltraCamXp_10712003	0	610696.890	2753245.282	8305.103	-0.134	0.008	-88.719	0.083	0.09
124_24232	2	UltraCamXp_10712003	0	610747.925	2750985.452	8306.848	0.093	-0.106	-88.767	0.083	0.09
124_24233	2	UltraCamXp_10712003	0	610792.647	2748723.553	8306.637	0.037	0.235	-88.891	0.080	0.08
124_24234	2	UltraCamXp_10712003	0	610838.387	2746463.154	8306.073	-0.113	0.286	-88.874	0.082	0.09
124_24235	2	UltraCamXp_10712003	0	610890.964	2744202.512	8308.642	0.084	0.108	-88.634	0.083	0.09
124_24236	2	UltraCamXp_10712003	0	610943.936	2741941.342	8307.803	0.065	0.372	-88.682	0.083	0.08
124_24237	2	UltraCamXp_10712003	0	610994.576	2739680.527	8308.531	-0.008	0.291	-88.770	0.084	0.09
124_24238	2	UltraCamXp_10712003	0	611042.438	2737420.073	8311.794	-0.060	0.175	-89.118	0.084	0.09
124_24239	2	UltraCamXp_10712003	0	611095.072	2735159.448	8309.048	0.200	0.440	-88.586	0.096	0.09
124_24240	2	UltraCamXp_10712003	0	611154.531	2732898.011	8311.363	0.032	-0.161	-88.677	0.101	0.10

Standard deviations

	X	Y	Z	omega	phi	kappa
mean	0.086	0.105	0.067	0.7	0.6	0.3
max	0.273	0.251	0.177	2.1	1.9	2.0
min	0.071	0.078	0.044	0.5	0.5	0.1

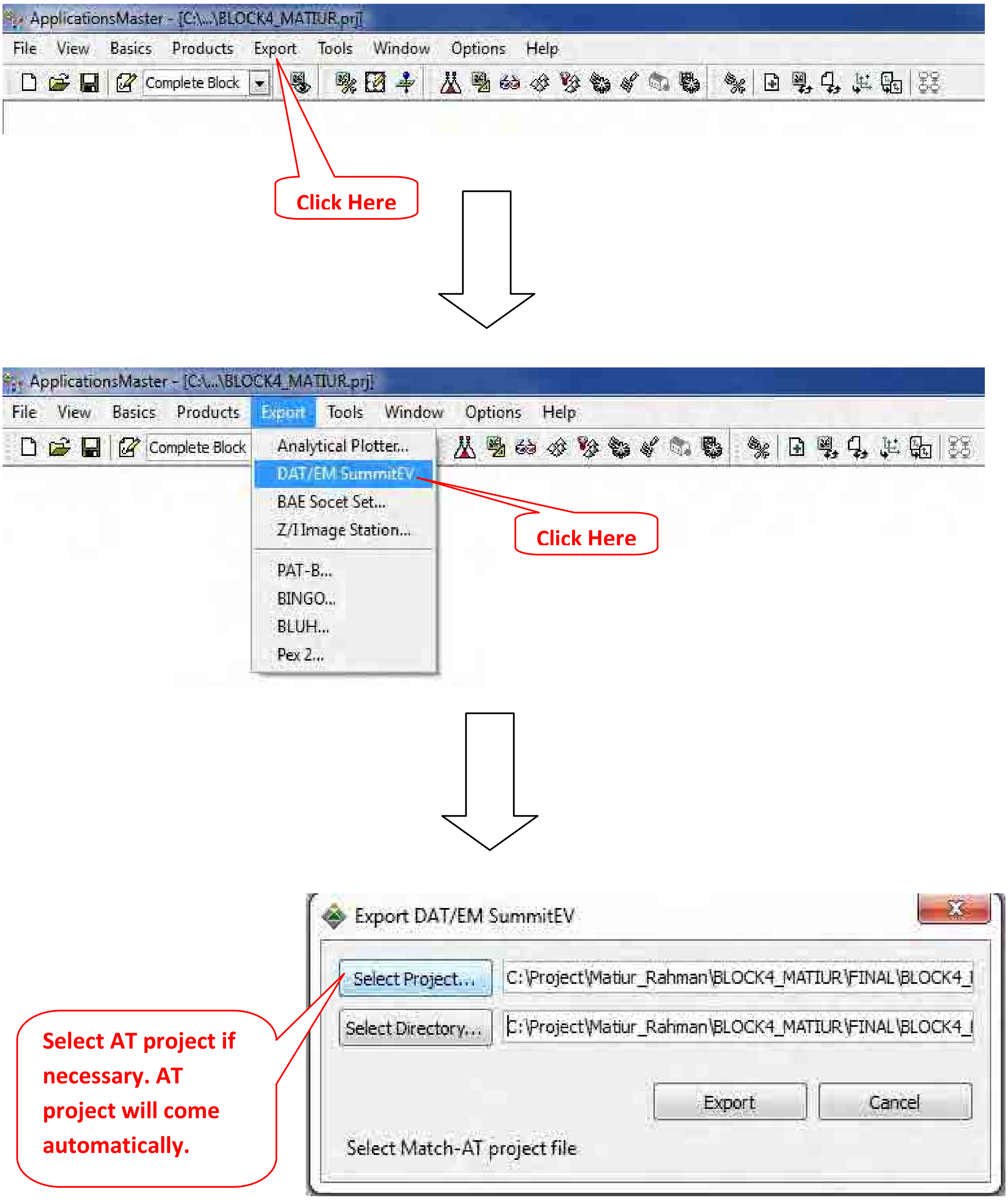
photos: 560

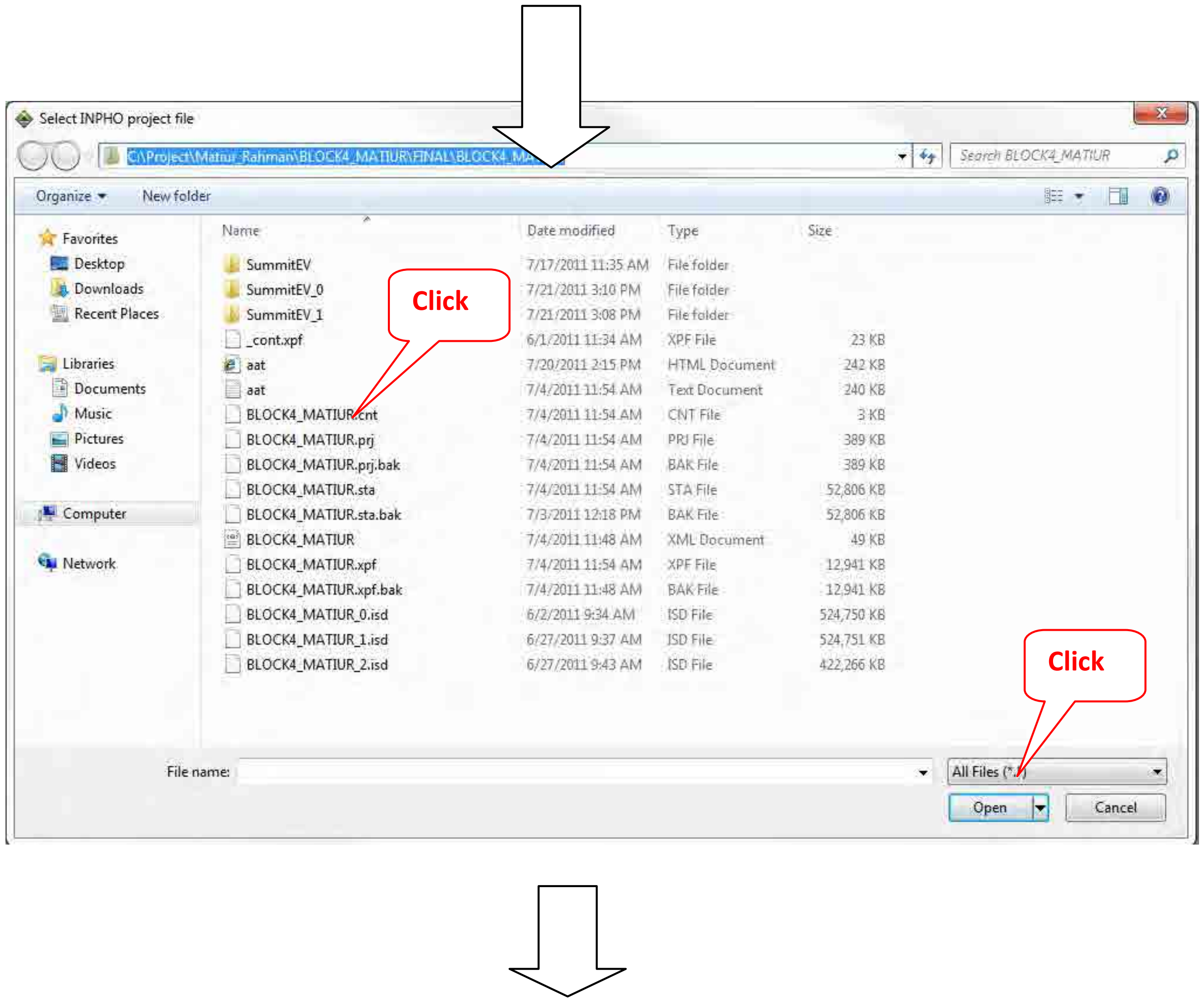
Export to ASCII file | OK | Cancel

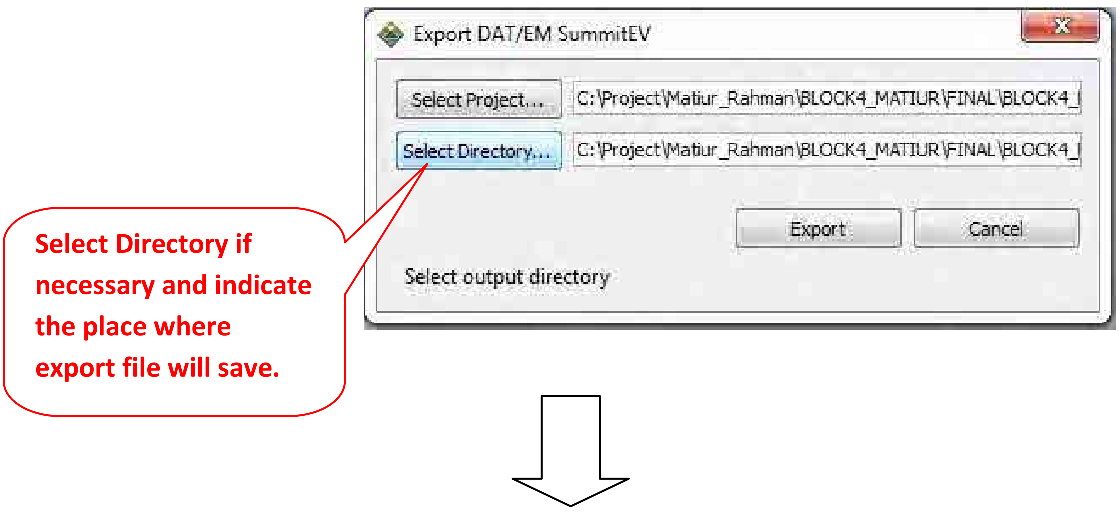
Chapter 14. Export MATCH A.T. Project to Summit EV

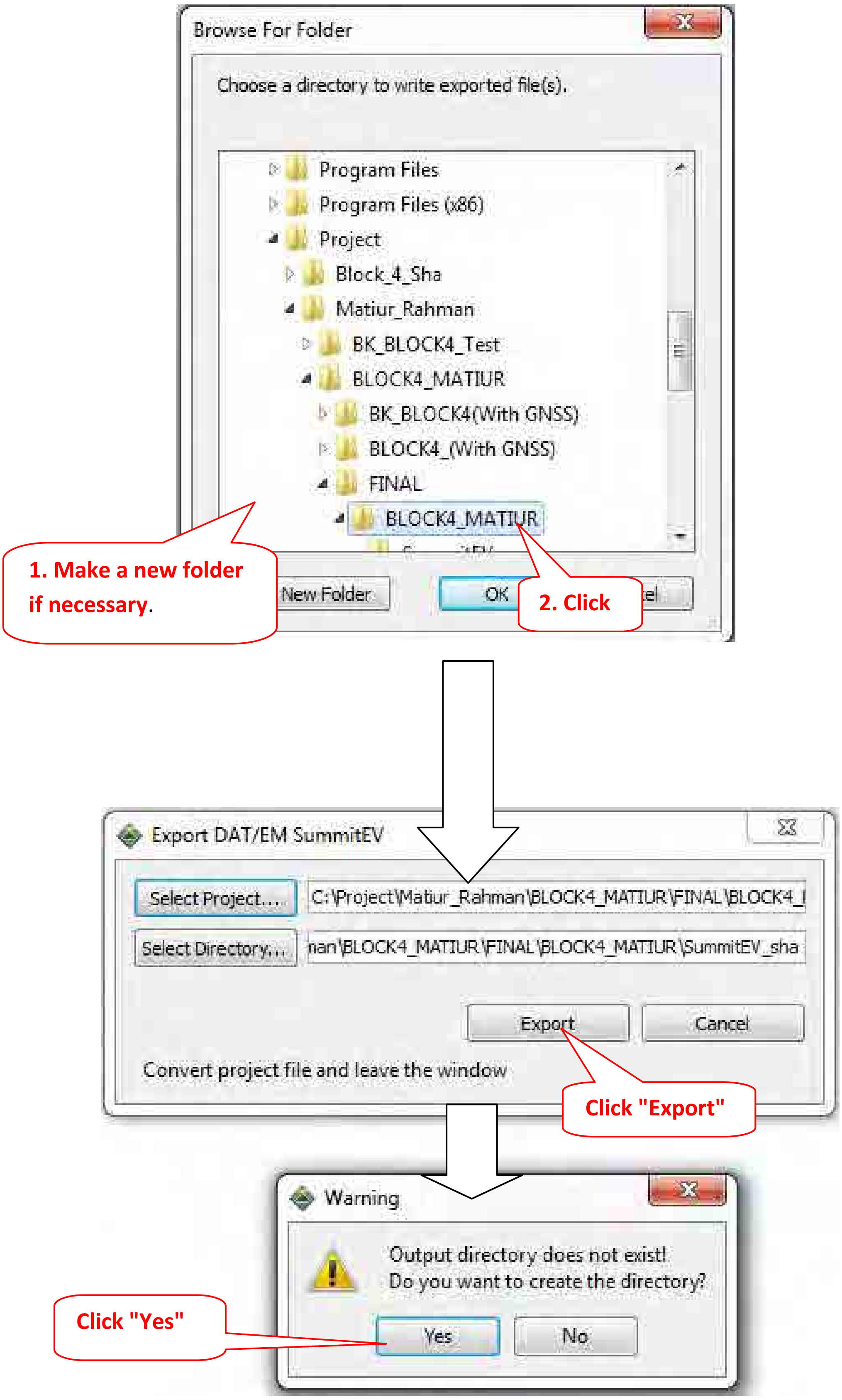
Chapter 14. Export MATCH A.T project to Summit EV

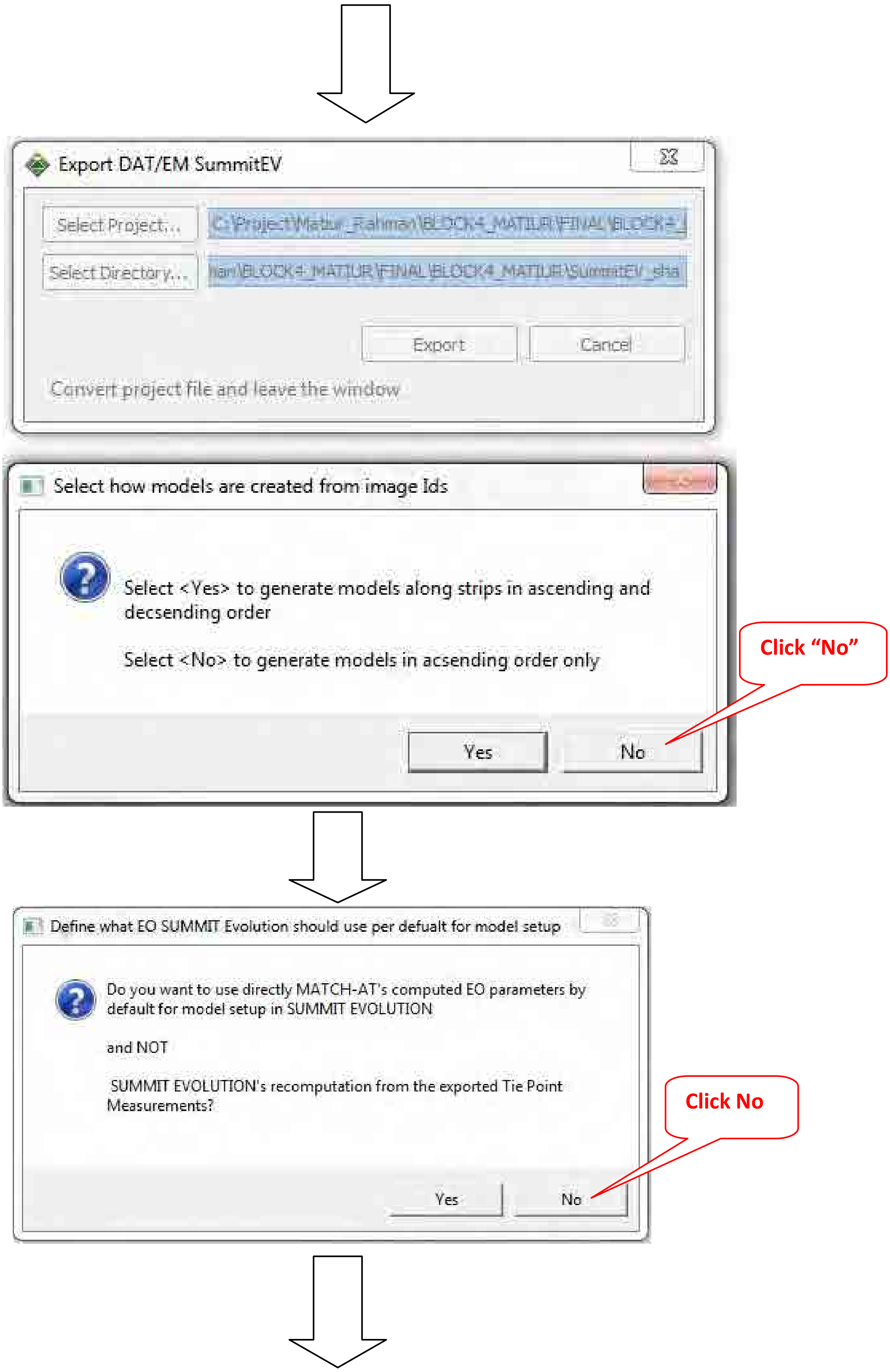
Step 1 : Open "ApplicationsMaster"→ File → Open or Recent File → A.T Project (Ex.- Block4_Matiur)

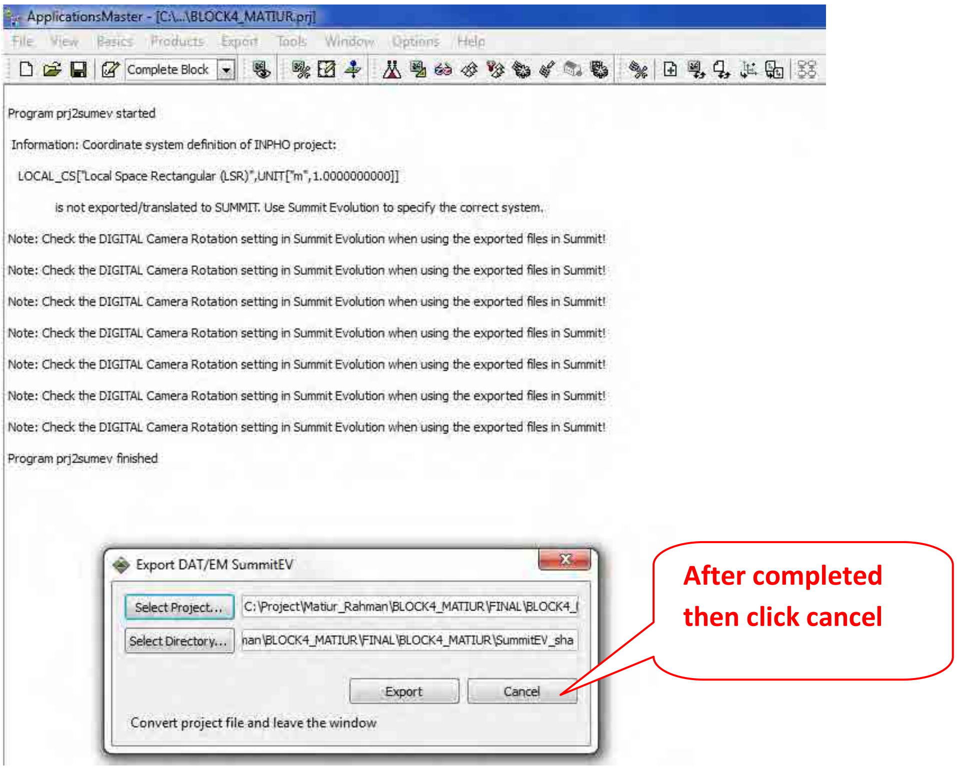



Select INPHO project file
C:\Project\Matiur_Rahman\BLOCK4_MATIUR\FINAL\BLOCK4_MA
Search BLOCK4_MATIUR
Organize
New folder
Favorites
Desktop
Downloads
Recent Places
Libraries
Documents
Music
Pictures
Videos
Computer
Network
Name
Date modified
Type
Size
SummitEV 7/17/2011 11:35 AM File folder
SummitEV_0 7/21/2011 3:10 PM File folder
SummitEV_1 7/21/2011 3:08 PM File folder
_cont.xpf 6/1/2011 11:34 AM XPF File 23 KB
aat 7/20/2011 2:15 PM HTML Document 242 KB
aat 7/4/2011 11:54 AM Text Document 240 KB
BLOCK4_MATIUR.cnt 7/4/2011 11:54 AM CNT File 3 KB
BLOCK4_MATIUR.prj 7/4/2011 11:54 AM PRJ File 389 KB
BLOCK4_MATIUR.prj.bak 7/4/2011 11:54 AM BAK File 389 KB
BLOCK4_MATIUR.sta 7/4/2011 11:54 AM STA File 52,806 KB
BLOCK4_MATIUR.sta.bak 7/3/2011 12:18 PM BAK File 52,806 KB
BLOCK4_MATIUR 7/4/2011 11:48 AM XML Document 49 KB
BLOCK4_MATIUR.xpf 7/4/2011 11:54 AM XPF File 12,941 KB
BLOCK4_MATIUR.xpf.bak 7/4/2011 11:48 AM BAK File 12,941 KB
BLOCK4_MATIUR_0.isd 6/2/2011 9:34 AM ISD File 524,750 KB
BLOCK4_MATIUR_1.isd 6/27/2011 9:37 AM ISD File 524,751 KB
BLOCK4_MATIUR_2.isd 6/27/2011 9:43 AM ISD File 422,266 KB
Click
Click
File name:
All Files (*.*)
Open
Cancel


Export DAT/EM SummitEV
Select Project...
C:\Project\Matiur_Rahman\BLOCK4_MATIUR\FINAL\BLOCK4_
Select Directory...
C:\Project\Matiur_Rahman\BLOCK4_MATIUR\FINAL\BLOCK4_
Export
Cancel
Select output directory
Select Directory if necessary and indicate the place where export file will save.


Browse For Folder
Choose a directory to write exported file(s).
Program Files
Program Files (x86)
Project
Block_4_Sha
Matiur_Rahman
BK_BLOCK4_Test
BLOCK4_MATIUR
BK_BLOCK4(With GNSS)
BLOCK4_(With GNSS)
FINAL
BLOCK4_MATIUR
New Folder
OK
1. Make a new folder if necessary.
2. Click
Export DAT/EM SummitEV
Select Project...
C:\Project\Matiur_Rahman\BLOCK4_MATIUR\FINAL\BLOCK4_
Select Directory...
nan\BLOCK4_MATIUR\FINAL\BLOCK4_MATIUR\SummitEV_sha
Export
Cancel
Convert project file and leave the window
Click "Export"
Warning
Output directory does not exist!
Do you want to create the directory?
Yes
No
Click "Yes"


Export DAT/EM SummitEV
Select Project...
Select Directory...
Export
Cancel
Convert project file and leave the window
Select how models are created from image Ids
Select <Yes> to generate models along strips in ascending and decsending order
Select <No> to generate models in acsending order only
Yes
No
Click "No"
Define what EO SUMMIT Evolution should use per defualt for model setup
Do you want to use directly MATCH-AT's computed EO parameters by default for model setup in SUMMIT EVOLUTION
and NOT
SUMMIT EVOLUTION's recomputation from the exported Tie Point Measurements?
Yes
No
Click No


ApplicationsMaster - [C:\...\BLOCK4_MATIUR.prj]
File View Basics Products Export Tools Window Options Help
Complete Block
Program prj2sumev started
Information: Coordinate system definition of INPHO project:
LOCAL_CS["Local Space Rectangular (LSR)",UNIT["m",1.0000000000]]
is not exported/translated to SUMMIT. Use Summit Evolution to specify the correct system.
Note: Check the DIGITAL Camera Rotation setting in Summit Evolution when using the exported files in Summit!
Note: Check the DIGITAL Camera Rotation setting in Summit Evolution when using the exported files in Summit!
Note: Check the DIGITAL Camera Rotation setting in Summit Evolution when using the exported files in Summit!
Note: Check the DIGITAL Camera Rotation setting in Summit Evolution when using the exported files in Summit!
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Note: Check the DIGITAL Camera Rotation setting in Summit Evolution when using the exported files in Summit!
Note: Check the DIGITAL Camera Rotation setting in Summit Evolution when using the exported files in Summit!
Program prj2sumev finished
Export DAT/EM SummitEV
Select Project...
C:\Project\Matiur_Rahman\BLOCK4_MATIUR\FINAL\BLOCK4_
Select Directory...
nan\BLOCK4_MATIUR\FINAL\BLOCK4_MATIUR\SummitEV_sha
Export
Cancel
Convert project file and leave the window
After completed then click cancel

Appendix

(Example of Trouble Shooting)

Example of Trouble Shooting

for

The result of Aerial Triangulation

on

IDMS project

This Appendix shows the examples of trouble shooting done during the generation of the result of Aerial Triangulation. Actually the AT group completed BLOCK4 right now and adjusted the result solution of troubles met during the works done. The trouble shooting, may happen to individual BLOCK, must be added here in this chapter as APPENDICES for further trouble shooting.

July 2011

Aerial Triangulation Group

Survey of Bangladesh

BLOCK 4

When the Aerial Triangulation is implemented on Block 4, the height error more than tolerated encountered. Following are the one of solution to eliminate errors and make this method guideline for further actual Aerial Triangulation works to be carried out.

```
Active Block                                              : complete Block
    Number of photos                                      : 560
    Number of strips                                      : 19
    Photo scale                                           : 1:82348
    Mean terrain height [m]                               : 15
    Automatic blunder detection                           : OFF
    Use all adjusted points in project file
    as control (absolute mode)                            : OFF
Control parameter for block adjustment:    (Start Post Processing: Sun Jun 19 12:52:44 2011)
    ----------------------------------------
    Self-calibration                                      : OFF
    GNSS-Mode                                             : OFF
    Drift-Mode                                            : OFF
    IMU-Mode                                              : OFF
    Earth's curvature correction                          : ON
    Atmospheric correction                                : ON
    Do not eliminate manual points                        : OFF
    Standard deviations (a-priori) :
    --------------------------------
    Ground control (planimetry) [m] Set
            0 (=default)                                  :   0.098
    Ground control (height) [m] Set
            0 (=default)                                  :   0.364
    Automatic image points [mm] Set
            0 (=default)                                  :   0.002
    Image points of ground control and manual measurements [mm] :   0.002
```

1. Generation status of troubles (discrepancy)

Following table shows the discrepancy of height error more than tolerance on GCP. (Red color)

Residuals, vertical control points in [meter]

ID	rz	ID	rz	ID	rz	ID	rz
A-1	-0.319	Z-5	-0.069	AN-2	-0.179	AH-14	0.080
A-2	-0.008	Z-6	0.334	AN-5	-0.253	AH-16	-0.172
A-3	-0.040	A-12	-0.496	AN-6	0.262	AH-18	-0.072
A-4	0.017	A-13	0.059	AS-1	-0.173	AH-19	-0.776
A-5	0.018	A-14	-0.170	AS-2	-0.849	AH-20	-0.250
A-6	-0.235	A-15	0.114	AS-3	-0.221	AH-21	-0.083
A-7	-0.077	A-16	0.335	AS-4	-0.102	AH-22	-0.143
A-8	-0.012	A-18	0.744	AS-5	-0.073	AN-13	0.503
A-9	0.299	A-20	-0.149	AS-6	-0.212	AN-14	0.881
E-1	-0.205	A-21	-0.055	AS-9	0.284	AN-31	0.168
E-2	0.060	A-22	-0.073	B4_1	0.363	AS-10	-0.224
E-4	0.049	A-23	-0.718	B4_2	-0.032	AS-22	0.633
E-5	-0.050	A-24	-0.131	B4_3	0.604	AS-35	-0.349
E-6	-0.111	A-25	-0.089	B4_4	-0.384	AS-36	0.151
E-7	0.044	A-26	-0.070	B4_5	0.903	AS-37	0.514
E-8	0.053	A-27	-0.113	B4_6	-0.116	AS-38	0.308
E-9	0.275	A-28	0.178	B4_7	-0.594	AS-40	0.354
S_1	0.186	A-29	-0.226	B4_8	0.164	B4_9	0.437
S_2	**-1.473** check point	A-30	-0.116	E-10	-0.135	B4_10	-0.291
S_3	**-1.224** check point	A-31	0.028	E-11	-0.520	B4_11	0.099
S_4	-0.193	A-32	-0.026	**SK-6**	**1.144**	B4_12	0.188
S_5	-0.060	A-34	-0.275	S_10	-0.223	B4_14	-0.532
S_6	-0.041	AH-4	-0.404	S_11	-0.147	B4_15	0.129
S_7	-0.120	**AH-5**	**1.018** check point	S_12	-0.387	B4_17	0.670
S_8	0.048	AH-6	-0.193	Z-15	-0.131	B4_19	0.688
S_9	-0.323	AH-7	0.041	**Z-16**	**4.945** check point	B4_20	0.912
Z-1	0.542	AH-8	-0.303	AH-11	-0.199	B4_21	-0.437
Z-2	0.007	AH-9	-0.084	AH-12	0.484 check point	B4_22	-0.332
Z-4	0.443	AN-1	-0.163				

Based on the above mentioned matters, data checking and following trouble shooting 1 were implemented.

2. Causes of troubles and its trouble shooting (Elimination of errors No.1)

For the trouble shooting, resurvey of GCP (Ground Control Point) with errors exceed tolerance was conducted in the field and also checking of existence of parallax at each GCP in the spatial models was carried out. Results of each checking item are following.

- **Cause 1: Automatic processing of each GCP observation**

  Observation of GCP had been implemented automatically. As a result, point measurement wasn't carried our identically, information error exists in GCP (including post pointing point) description and etc were found as causes.

- **As a trouble shooting;**
  - Reconfirmation of the position of post pointing points in the point description by field surveying team
  - Reconfirmation of the position of reconfirmed post pointing points in the spatial models
  - Implementation of manual re-observation of GCP for re-confirmation of observation position

- **Cause 2: Existence of duplicate aerial photograph in flight line**

  AS there are several duplicate spatial models in each flight line such as L22, L24, L30, L125, L126, it became clear that result of automatic observation of Tie-points was not suitable. It seems that the cause of such result is from the different photography timing.

- **As a trouble shooting;**
  - Implementation of post processing excluding the duplicate photograph data of L22, L24, L30, L125, L126
  - Implementation of re-observation of tie-point of target photographs

Result of resurvey of GCP was inserted and re-computation the post-processing (Without EO data) was carried out. The result is following table as below.

Residuals, vertical control points in [meter]

ID	rz	ID	rz	ID	rz	ID	rz
A-1	-0.318	Z-4	0.460	AH-9	-0.075	AH-12	0.504
A-2	-0.008	Z-5	-0.066	AN-1	-0.190	AH-11	-0.180
A-3	-0.037	Z-6	0.342	AN-2	-0.180	AH-14	0.088
A-4	0.026	A-12	-0.469	AN-5	-0.289	AH-16	-0.181
A-5	0.027	A-13	0.050	AN-6	0.239	AH-18	-0.064
A-6	-0.224	A-14	-0.113	AS-1	-0.172	AH-19	-0.732
A-7	-0.070	A-16	0.283	AS-2	-0.845	AH-20	-0.162
A-8	-0.006	A-18	0.658	AS-3	-0.217	AH-21	-0.096
A-9	0.318	A-20	-0.155	AS-4	-0.101	AH-22	-0.164
E-1	-0.198	A-21	-0.084	AS-5	-0.071	AN-13	0.496
E-2	0.072	A-22	-0.076	AS-6	-0.208	AN-14	0.881
E-4	0.079	A-23	-0.729	AS-9	0.286	AN-31	0.173
E-5	-0.045	A-24	-0.138	B4_1	0.313	AS-10	-0.217
E-6	-0.101	A-25	-0.086	B4_2	-0.403	AS-22	0.677
E-7	0.051	A-26	-0.069	B4_3	0.269	AS-35	-0.326
E-8	0.044	A-27	-0.112	B4_4	-0.350	AS-36	0.223
E-9	0.197	A-28	0.145	B4_6	-0.227	AS-37	0.525
S_1	0.201	A-29	-0.240	B4_7	-0.562	AS-38	0.219
S_2	-1.482 check point	A-30	-0.119	B4_8	0.168	AS-40	0.084
S_3	-1.223 check point	A-31	0.047	B4_9	0.441	B4_10	-0.285
S_4	-0.199	A-32	-0.006	E-10	-0.179	B4_11	0.101
S_5	-0.065	A-34	-0.328	E-11	-0.541	B4_12	0.205
S_6	-0.032	AH-4	-0.380	SK-6	1.095	B4_14	-0.524
S_7	-0.117	AH-5	1.041 check point	S_10	-0.223	B4_15	0.128
S_8	0.052	AH-6	-0.198	S_11	-0.131	B4_19	0.592
S_9	-0.321	AH-7	0.056	S_12	-0.391	B4_20	0.709
TBM	0.433	AH-8	-0.311	Z-15	-0.440	B4_21	-0.431
Z-1	0.522	Z-16	1.207 check point	B4_22	-0.324		
Z-2	0.004						

Based on the above mentioned result, checking of GCP and Post-Pointing point were checked in the actual spatial models of SAMIT Evolution (Digital plotting software) was carried out and it became clear the computed value had discrepancy of 2m comparing with rz of computation result of aerial triangulation.

As a trouble shooting;

- Change the standard deviation of GCP for post-processing
- Reviewing the post processing with “with EO file” and “without EO file”

- **The case of Without EO file**

Control parameter for block adjustment: Start Post Processing: Tue Jun 28 14:09:36 2011

Ground control (planimetry) [m] Set			
0 (=default)			: 0.098
1			**: 0.050**
Ground control (height) [m] Set			
0 (=default)			: 0.150
1			**: 0.100**
Automatic image points [mm] Set			
0 (=default)			: 0.002
Image points of ground control and manual measurements [mm]			: 0.002
Max standard deviations of terrain points			
x	0.291 [meter] at point	30000077	
y	0.308 [meter] at point	30000248	
z	0.818 [meter] at point	90000337	
Mean standard deviations of terrain points			
x	0.072		
y	0.081		
z	0.262		

Control point ID rz

ID	rz	ID	rz	ID	rz	ID	rz
A-1	-0.014	Z-6	0.060	AS-1	-0.021	AH-18	-0.006
A-2	-0.016	A-12	-0.088	AS-2	-0.210	AH-19	-0.179
A-3	-0.005	A-13	0.036	AS-3	-0.044	AH-20	-0.006
A-4	0.005	A-15	0.019	AS-4	-0.019	AH-21	-0.013
A-5	0.005	A-16	0.075	AS-5	-0.018	AH-22	-0.023
A-6	-0.020	A-18	0.062	AS-6	-0.066	AN-13	0.133
A-7	-0.011	A-20	-0.033	AS-9	0.049	AN-14	0.202
A-8	-0.003	A-21	-0.064	B4_2	-0.057	AN-31	0.023
A-9	0.070	A-23	-0.231	B4_3	0.028	AS-10	-0.067
E-1	-0.086	A-24	-0.017	B4_4	-0.052	AS-22	0.139
E-2	0.034	A-25	0.010	B4_5	0.075	AS-35	-0.058
E-4	0.054	A-26	-0.010	B4_6	-0.022	AS-36	0.150
E-5	-0.009	A-27	0.010	B4_7	-0.069	AS-37	0.036
E-6	-0.031	A-28	0.120	B4_8	0.025	AS-38	0.002
E-7	0.010	A-29	-0.040	B4_9	0.060	AS-40	-0.004
E-8	0.007	A-30	-0.012	E-10	-0.031	B4_10	-0.034
E-9	0.055	A-32	0.056	E-11	-0.116	B4_11	0.017
S_4	-0.030	A-34	-0.148	**SK-6**	**0.207**	B4_12	0.026
S_5	-0.027	AH-4	-0.131	S_10	-0.042	B4_14	-0.142
S_6	0.001	AH-6	-0.033	S_11	0.018	B4_15	0.022
S_7	-0.022	AH-7	0.050	S_12	-0.090	B4_19	0.066
S_8	0.015	AH-8	-0.066	Z-15	-0.120	B4_20	0.061
S_9	-0.054	AH-9	-0.010	**Z-16**	**0.194**	B4_21	-0.051
TBM	0.049	AN-1	-0.030	AH-11	-0.200	B4_22	-0.041
Z-1	0.204	AN-2	-0.030	AH-12	0.166	B4_1_1	0.088
Z-2	-0.000	AN-5	-0.061	AH-14	0.012	SK_6_1	0.193
Z-4	0.161	AN-6	0.031	**AH-16**	**-0.049**	Z-16-1	0.125
Z-5	-0.020						

- **The case of With EO file**

The computation result of with EO file is shown in following table.

Residuals, vertical control points in [meter] **Start Post Processing: Tue Jun 28 15:09:37 2011**

ID	rz	ID	rz	ID	rz	ID	rz
A-1	0.047	Z-5	-0.016	Z-16-1	-0.035	AH-12	0.193
A-2	0.000	Z-6	0.079	AN-5	0.052	AH-14	-0.033
A-3	0.022	A-12	-0.016	AN-6	0.002	**AH-16**	**-0.056**
A-4	0.023	A-13	0.281	AS-1	0.009	AH-18	0.011
A-5	0.027	A-15	0.293	AS-2	0.134	AH-19	0.008
A-6	0.012	A-16	0.099	AS-3	0.027	AH-20	-0.156
A-7	0.030	A-18	0.006	AS-4	-0.001	AH-21	0.019
A-8	0.037	A-20	-0.044	AS-5	-0.005	AH-22	0.005
A-9	0.157	A-21	-0.135	AS-6	-0.004	AN-13	0.175
E-1	0.201	A-23	-0.305	AS-9	0.064	AN-14	0.045
E-2	0.286	A-24	-0.013	B4_2	-0.064	AN-31	-0.043
E-4	0.196	A-25	-0.027	B4_3	-0.068	AS-10	0.014
E-5	0.002	A-26	-0.017	B4_4	-0.075	AS-22	-0.143
E-6	0.042	A-27	-0.128	B4_5	0.003	AS-35	-0.064
E-7	0.029	A-28	-0.004	B4_6	0.026	AS-36	-0.089
E-8	0.016	A-29	-0.022	B4_7	-0.063	AS-37	-0.102
E-9	-0.018	A-30	-0.005	B4_8	0.068	AS-38	-0.518
S_4	-0.013	A-32	-0.231	B4_9	0.099	AS-40	-0.152
S_5	-0.005	A-34	-0.106	E-10	-0.009	B4_10	-0.020
S_6	0.183	AH-4	0.005	E-11	0.018	B4_11	0.015
S_7	-0.005	AH-6	-0.058	**SK-6**	**-0.024**	B4_12	0.060
S_8	0.029	AH-7	0.151	S_10	-0.022	B4_14	-0.357
S_9	-0.032	AH-8	0.003	S_11	0.209	B4_15	0.014
TBM	-0.036	AH-9	-0.005	S_12	-0.044	B4_19	0.074
Z-1	0.089	AN-1	-0.007	Z-15	-0.088	B4_20	0.019
Z-2	**0.003**	AN-2	-0.011	**Z-16**	**-0.036**	B4_21	-0.015
Z-4	0.421	B4_1_1	0.051	AH-11	-0.290	B4_22	-0.005
		SK_6_1	-0.047				

Based on the above mentioned result, the residuals of computation result with EO file become so small comparing with previous result. But it seems that the EO file accuracy is not suitable for the tolerable due to the fact that the z value of "mean standard deviations of terrain points" become worse.

* Reference data 1

- In case the only result GCP and BM are used.

Table **A**

Quality Control Sheet

BLOCK4 GCP&LEVEL 20-Jun-11

	Average			Max						RMS			
Line	EASTING	NORTHING	HEIGHT	MAX de(m)	MAX dn(m)	MAX dh(m)	d-OMEGA	d-PHI	d-KAPPA	De(m)	Dn(m)	Dz(m)	Ds
124	5.0	−0.1	3.2	6.3	4.5	7.0	−0.052	0.037	−0.032	5.0	2.0	3.4	6.4
125	0.4	−0.6	3.7	1.2	4.0	4.6	−0.030	−0.015	0.012	0.6	1.7	3.7	4.1
126	−0.6	−2.7	3.9	−1.9	−4.7	5.5	−0.062	−0.026	0.032	0.7	2.1	3.8	4.4
20	−1.4	0.0	0.0	−5.7	−1.3	−4.2	−0.035	0.043	−0.012	2.8	0.6	1.9	3.4
21	0.4	2.4	−0.1	7.1	4.6	−5.7	−0.040	−0.048	−0.043	1.8	2.9	1.5	3.7
22	0.6	2.0	2.0	7.8	2.8	3.7	−0.032	−0.058	−0.046	2.1	2.0	2.3	3.7
22−1	−2.4	1.3	−0.6	−5.8	2.2	−6.3	−0.020	0.035	0.113	3.0	1.4	2.4	4.1
23	−0.6	1.4	0.6	5.7	2.5	−7.1	−0.013	0.048	−0.023	1.7	1.5	2.1	3.1
24	0.2	0.2	1.1	3.1	2.5	2.8	−0.037	−0.027	−0.032	0.9	0.7	1.4	1.8
24−1	−4.1	1.8	−1.2	−7.7	2.4	−4.4	−0.018	0.057	−0.025	4.7	1.9	2.2	5.5
25	−0.2	−0.2	0.7	6.6	0.9	3.2	−0.030	0.047	−0.042	1.8	0.4	1.4	2.3
26	−0.7	1.0	0.6	−7.0	1.9	−4.6	−0.023	0.057	−0.030	1.9	1.2	1.4	2.6
27	0.1	0.3	0.1	−6.9	−1.0	−6.1	−0.031	0.048	−0.038	1.6	0.5	1.5	2.3
28	−1.2	−0.3	2.0	−7.9	−1.5	−4.3	−0.024	0.053	−0.028	2.2	0.5	2.4	3.3
29	−0.1	−0.8	0.5	−8.0	−1.5	−7.9	−0.036	0.057	−0.046	1.9	0.9	2.1	3.0
30	−0.8	−3.6	−0.5	2.6	−4.5	−2.2	−0.042	−0.025	−0.035	1.3	3.6	0.8	3.9
30−1	−5.6	−2.7	−5.3	−7.4	−2.8	−8.7	−0.040	0.057	−0.013	5.5	2.7	5.7	8.4

Average = ((MATCH−AT Value) − (POS−EO Value))/Photos

RMS = Standord Deviation

Table **B**

Quality Control Sheet

BLOCK4 With GNSS-IMU 20-Jun-11

	Average			Max						RMS			
Line	EASTING	NORTHING	HEIGHT	MAX de(m)	MAX dn(m)	MAX dh(m)	d-OMEGA	d-PHI	d-KAPPA	De(m)	Dn(m)	Dz(m)	Ds
124	0.5	−1.4	0.3	0.8	−2.7	2.0	−0.027	−0.012	−0.031	0.6	1.6	0.9	2.0
125	−0.6	−0.6	3.1	−0.8	−1.3	3.7	−0.020	−0.006	0.012	0.6	0.8	3.1	3.3
126	−0.8	0.4	5.9	−1.1	0.6	6.1	−0.027	−0.032	0.032	0.7	0.7	4.1	4.2
20	0.3	2.3	−1.1	0.5	2.6	−1.9	−0.018	0.006	−0.014	0.4	2.3	1.2	2.6
21	0.4	2.6	−0.3	0.6	2.9	−2.0	−0.024	−0.009	−0.042	0.5	2.6	1.1	2.8
22	0.1	1.8	1.5	0.4	2.0	2.8	−0.028	−0.007	−0.046	0.2	1.8	1.7	2.5
22−1	−1.1	1.8	0.0	−1.4	2.0	−0.8	−0.016	0.006	0.113	1.1	1.8	0.5	2.2
23	−0.2	1.0	0.2	−0.9	1.3	1.7	−0.017	0.015	−0.023	0.4	1.0	0.9	1.4
24	0.1	1.4	0.4	0.4	1.8	1.9	−0.029	−0.010	−0.031	0.2	1.4	0.9	1.7
24−1	−0.4	1.1	0.7	−1.6	1.4	1.0	−0.023	0.015	−0.024	0.9	1.2	0.7	1.6
25	−0.2	0.2	0.8	0.9	1.2	2.2	−0.027	0.018	−0.042	0.6	0.3	1.2	1.3
26	−0.5	0.5	0.6	−0.9	0.7	1.9	−0.020	0.016	−0.030	0.6	0.5	0.9	1.2
27	0.5	0.7	−0.1	0.9	1.1	−1.4	−0.026	−0.018	−0.038	0.5	0.7	0.8	1.2
28	−0.9	−0.1	1.9	−1.1	−0.5	3.2	−0.021	0.013	−0.028	0.9	0.2	2.1	2.3
29	0.2	0.7	0.9	0.6	1.1	2.6	−0.024	0.007	−0.046	0.3	0.7	1.4	1.6
30	−1.1	−0.1	1.4	−1.4	−0.5	2.6	−0.018	0.011	−0.036	1.1	0.3	1.6	1.9
30−1	−0.7	0.8	−0.1	−1.0	0.9	−0.3	−0.018	0.007	−0.010	0.6	0.8	0.2	1.0

Average = ((MATCH−AT Value) − (POS−EO Value))/Photos

RMS = Standerd Deviation

Table **C**

Quality Control Sheet

BLOCK4 Mod EO file 30-Jun-11

	Average			Max						RMS			
Line	EASTING	NORTHING	HEIGHT	MAX de(m)	MAX dn(m)	MAX dh(m)	d-OMEGA	d-PHI	d-KAPPA	De(m)	Dn(m)	Dz(m)	Ds
124	2.0	-1.0	1.3	3.5	-2.6	2.2	-0.032	0.016	-0.031	2.1	1.5	1.4	3.0
125	-0.4	-0.6	3.2	-0.7	-1.4	3.7	-0.020	-0.007	0.012	0.4	0.8	3.2	3.3
126	-0.7	-1.0	5.1	-2.0	-2.4	5.7	-0.047	-0.030	0.033	0.6	0.9	3.8	4.0
20	-0.9	2.6	-0.4	-1.2	3.2	-2.7	-0.015	0.013	-0.016	1.0	2.6	1.3	3.1
21	0.5	2.1	0.1	6.4	3.1	-3.6	-0.032	-0.045	-0.042	1.6	2.2	1.0	2.9
22	0.2	1.6	1.6	0.6	2.5	2.5	-0.036	-0.008	-0.046	0.2	1.7	1.7	2.4
22-1	-1.4	1.2	0.0	-2.0	2.2	-1.6	-0.026	0.009	0.008	1.4	1.4	0.9	2.2
23	-0.3	0.9	0.1	-0.8	1.2	-2.2	-0.016	0.017	-0.023	0.4	0.9	1.1	1.5
24	0.1	1.5	0.5	-0.4	2.1	2.0	-0.028	-0.010	-0.032	0.2	1.6	1.0	1.9
24-1	-1.0	1.0	0.3	-2.4	1.5	1.0	-0.023	0.020	-0.025	1.4	1.1	0.6	1.8
25	-0.3	0.3	1.0	-0.9	1.1	2.4	-0.027	0.018	-0.042	0.5	0.4	1.2	1.4
26	-0.6	0.8	0.9	-0.9	1.2	2.1	-0.018	0.016	-0.030	0.6	0.8	1.1	1.5
27	0.3	0.1	0.1	-5.5	-0.9	-3.9	-0.032	0.039	-0.038	1.2	0.4	1.1	1.7
28	-1.0	0.1	2.1	-1.7	0.4	3.1	-0.020	0.016	-0.028	1.0	0.1	2.2	2.4
29	0.1	-0.1	0.8	-7.0	1.7	-6.0	0.033	0.050	-0.046	1.6	0.4	1.8	2.4
30	-1.0	-0.8	0.9	-1.5	-1.5	1.9	-0.025	0.010	-0.036	1.0	0.9	1.1	1.7
30-1	-3.6	1.0	-2.4	-4.0	1.3	-4.4	-0.018	0.031	-0.010	3.6	1.0	2.8	4.6

Average = ((MATCH-AT Value) - (POS-EO Value))/Photos

RMS = Standerd Deviation

: Improvement value

- Positional data of principal point of photographs of the final result in 21, 27, 29, 126 of each flight line acquired in table A were replaced with existing EO file value and re-computed.
- The final result is shown as following table

Start Post Processing: Thu Jun 30 12:26:30 2011

Active Block	: complete Block
Number of photos	: 560
Number of strips	: 19
Photo scale	: 1:82347
Mean terrain height [m]	: 15
Automatic blunder detection	: OFF
Use all adjusted points in project file as control (absolute mode)	: OFF
Control parameter for block adjustment :	
--	
Self-calibration	: OFF
GNSS-Mode	: ON
Drift-Mode	: ON
drift per strip	: ON
drift for X,Y,Z	: ON,ON,ON
enable shifts only	: OFF
IMU-Mode	: ON
IMU-Bore-sight	: OFF
Earth's curvature correction	: ON
Atmospheric correction	: ON
Do not eliminate manual points	: OFF
Standard deviations (a-priori) :	

Ground control (planimetry) [m] Set	
0 (=default)	: 0.098
1	: 0.050
Ground control (height) [m] Set	
0 (=default)	: 0.150
1	: 0.100
Automatic image points [mm] Set	
0 (=default)	: 0.002

Residuals vertical control points in [meter]

ID	rz	ID	rz	ID	rz	ID	rz
A-1	0.044	Z-6	0.055	AS-1	0.008	AH-18	-0.005
A-2	-0.000	A-12	-0.066	AS-2	0.124	AH-19	-0.206
A-3	0.023	A-13	0.014	AS-3	0.026	AH-20	-0.154
A-4	-0.002	A-14	0.117	AS-4	-0.002	AH-21	-0.010
A-5	0.002	A-15	0.190	AS-5	-0.028	AH-22	-0.014
A-6	-0.017	A-16	0.124	AS-6	-0.063	AN-13	0.102
A-7	-0.011	A-18	0.054	AS-9	0.037	AN-14	0.075
A-8	-0.007	A-20	-0.053	B4_2	-0.039	AN-31	-0.001
A-9	0.074	A-21	-0.158	B4_3	-0.029	AS-10	-0.060
E-1	0.202	A-23	-0.201	B4_4	-0.089	AS-22	-0.026
E-2	0.281	A-24	-0.012	B4_5	0.048	AS-35	-0.091
E-4	0.209	A-25	-0.010	B4_6	0.010	AS-36	-0.141
E-5	0.004	A-26	-0.016	B4_7	-0.094	AS-37	-0.000
E-6	0.046	A-27	-0.007	B4_8	0.032	AS-38	-0.262
E-7	0.011	A-28	0.097	B4_9	0.089	AS-40	-0.069
E-8	0.013	A-29	-0.021	E-10	-0.019	B4_10	-0.013
E-9	-0.193	A-30	-0.007	E-11	0.033	B4_11	0.010
S_4	-0.015	A-32	-0.040	SK-6	0.105	B4_12	0.049
S_5	-0.011	A-34	-0.168	S_10	-0.023	B4_14	-0.254
S_6	0.179	AH-4	-0.203	S_11	0.213	B4_15	0.020
S_7	-0.006	AH-6	-0.013	S_12	-0.049	B4_19	0.067
S_8	0.029	AH-7	-0.022	Z-15	-0.081	B4_20	0.016
S_9	-0.033	AH-8	-0.078	Z-16	0.052	B4_21	-0.021
TBM	-0.036	AH-9	-0.015	AH-11	-0.269	B4_22	-0.005
Z-1	0.045	AN-1	-0.019	AH-12	0.200	B4_1_1	0.054
Z-2	0.001	AN-2	-0.002	AH-14	0.013	SK_6_1	0.085
Z-4	0.359	AN-5	0.044	AH-16	-0.065	Z-16-1	0.016
Z-5	-0.020	AN-6	0.001				