Rock-Art Recording

Processing Stereo-Photography using Topcon PI-3000 '*Image Surveying Station*' software

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IMAGING, GRAPHICS AND SURVEY

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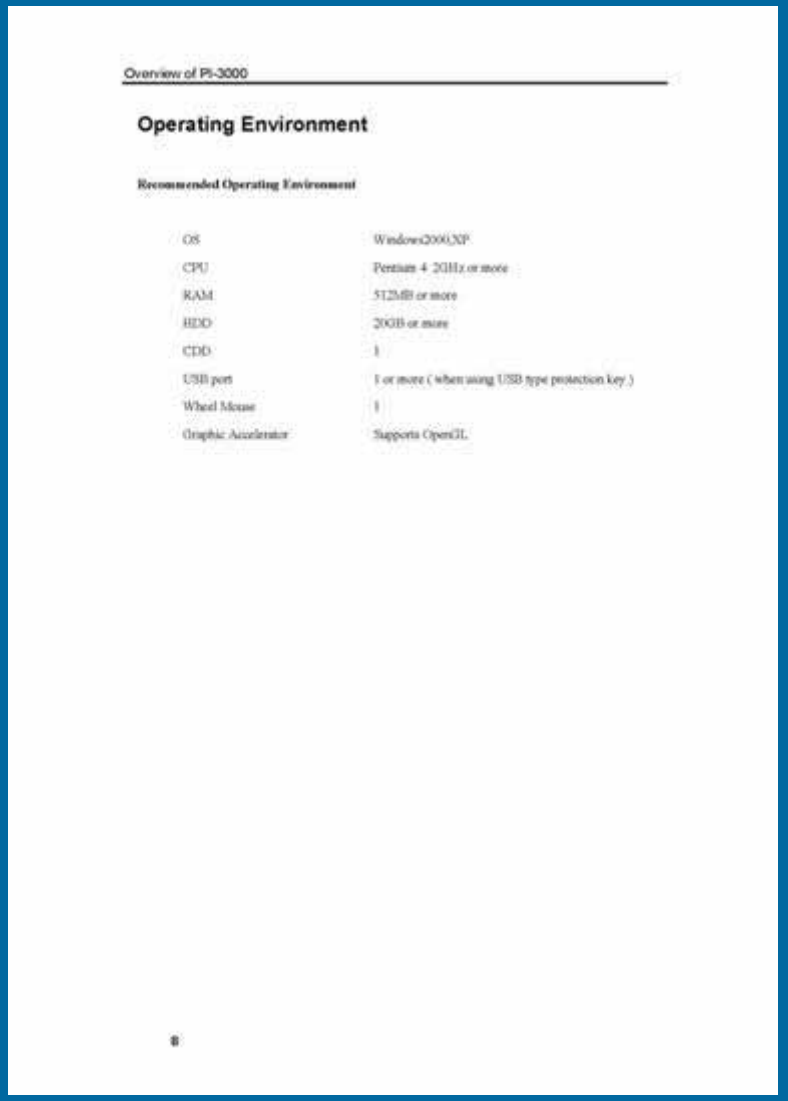
Topcon's PI-3000 'Image Surveying Station – key features

- Can use both metric and standard, non-metric digital cameras
- Includes camera calibration software for non-metric devices
- Uses '*fast and easy*' bundle adjustment to link multiple images together and create 3D model
- Can produce 3D data accurate to ½mm at 10m range – targeted points
- Can also produce 3D data from stereo-pairs using only scaled distances
- Calculation and display of distances, cross sections, contour lines and area calculation
- Can digitise line/vector data either from stereo screen or directly onto 3D model
- Generation and display of ortho-images and 3D models
- Basically all the tools required for photogrammetric processing

PI-3000 computing requirements

- According to page 8 of the manual the computer requirements are as follows:
  - Operating System - Windows 2000 or XP
  - Note, it is not MAC compatible
  - Processor – Pentium 4 (2GHZ) or AMD equivalent or above
  - Memory (RAM) – 512MB or above
  - Hard disk storage – 20GB or above
  - CD drive - should also work in DVD drive
  - USB port – at least one for the ‘dongle’
  - Wheel mouse – essential for 3D analysis
  - Graphics card – should support OpenGL



Overview of PI-3000

Operating Environment

Recommended Operating Environment

OS	Windows2000,XP
CPU	Pentium 4 2GHz or more
RAM	512MB or more
HDD	20GB or more
CDD	1
USB port	1 or more (when using USB type protection key)
Wheel Mouse	1
Graphic Accelerator	Supports OpenGL

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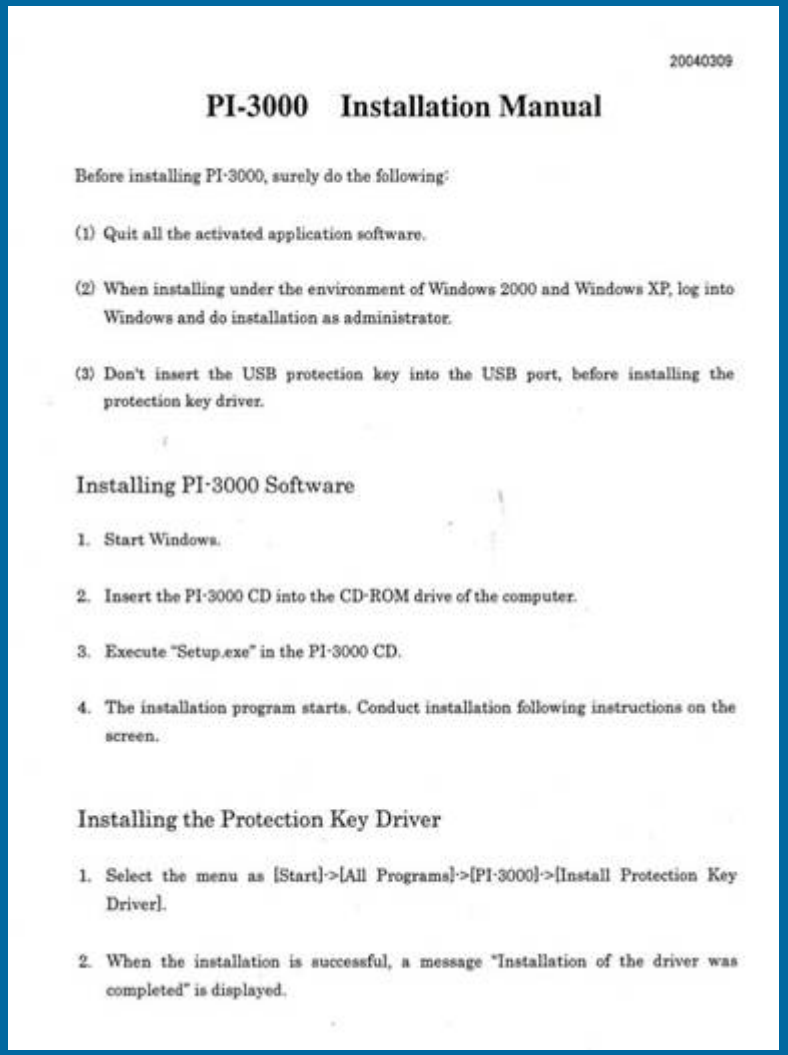
PI-3000 installation

- For temporary licences either downloaded or supplied on CD, follow the installation instructions provided on screen
  - Note the ‘Save Data’ functions have been disabled which means 3D data and ortho images cannot be exported
  - Therefore will need to save project then reload on fully licensed version to allow export of processed data
- For the full licence, follow the installation instructions opposite



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PI-3000 Installation Manual

Before installing PI-3000, surely do the following:

(1) Quit all the activated application software.

(2) When installing under the environment of Windows 2000 and Windows XP, log into Windows and do installation as administrator.

(3) Don't insert the USB protection key into the USB port, before installing the protection key driver.

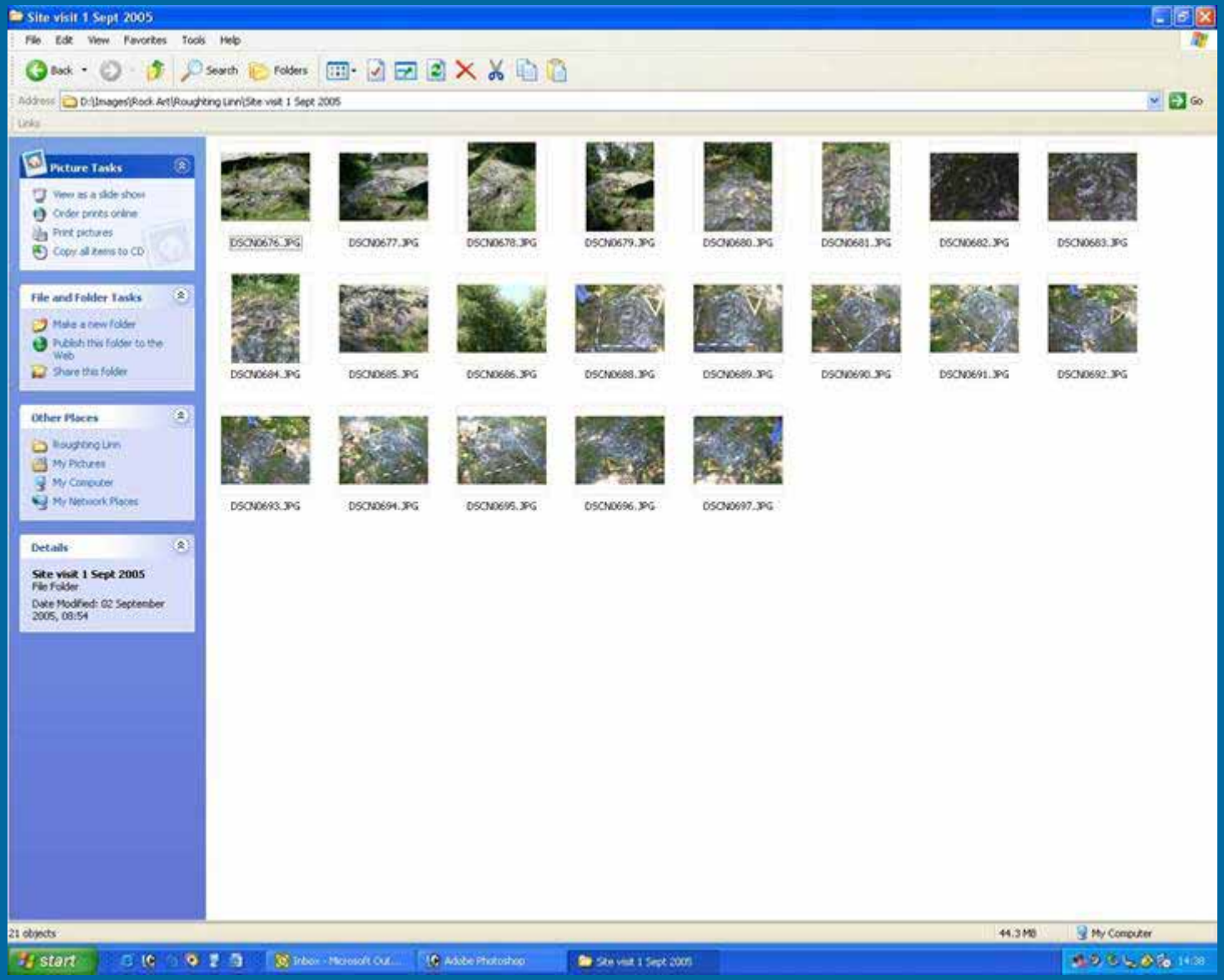
Installing PI-3000 Software

1. Start Windows.
2. Insert the PI-3000 CD into the CD-ROM drive of the computer.
3. Execute "Setup.exe" in the PI-3000 CD.
4. The installation program starts. Conduct installation following instructions on the screen.

Installing the Protection Key Driver

1. Select the menu as [Start]->[All Programs]->[PI-3000]->[Install Protection Key Driver].
2. When the installation is successful, a message "Installation of the driver was completed" is displayed.

1. Place image files in separate folder on computer



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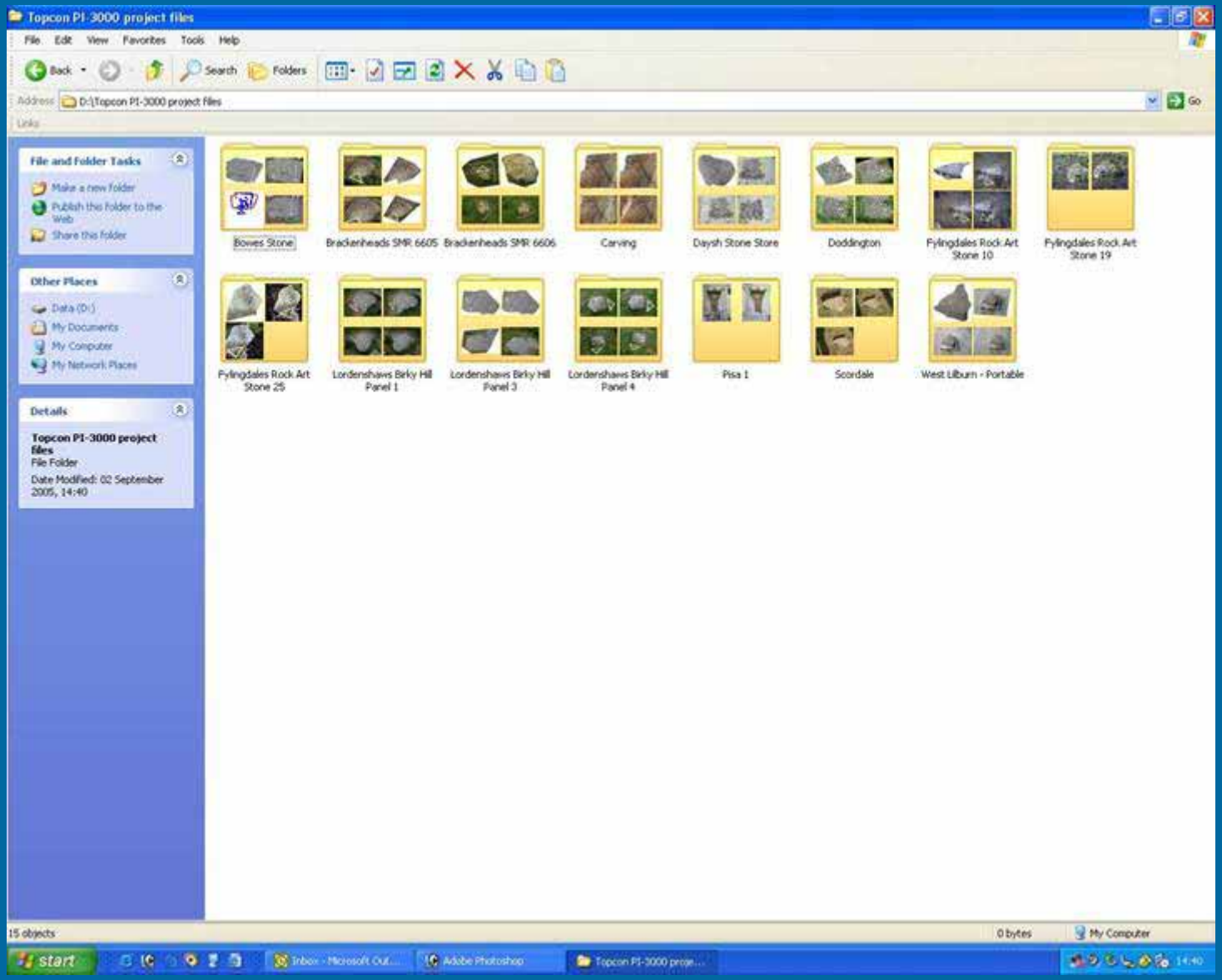
2. Create ‘Topcon PI-3000 project files’ folder



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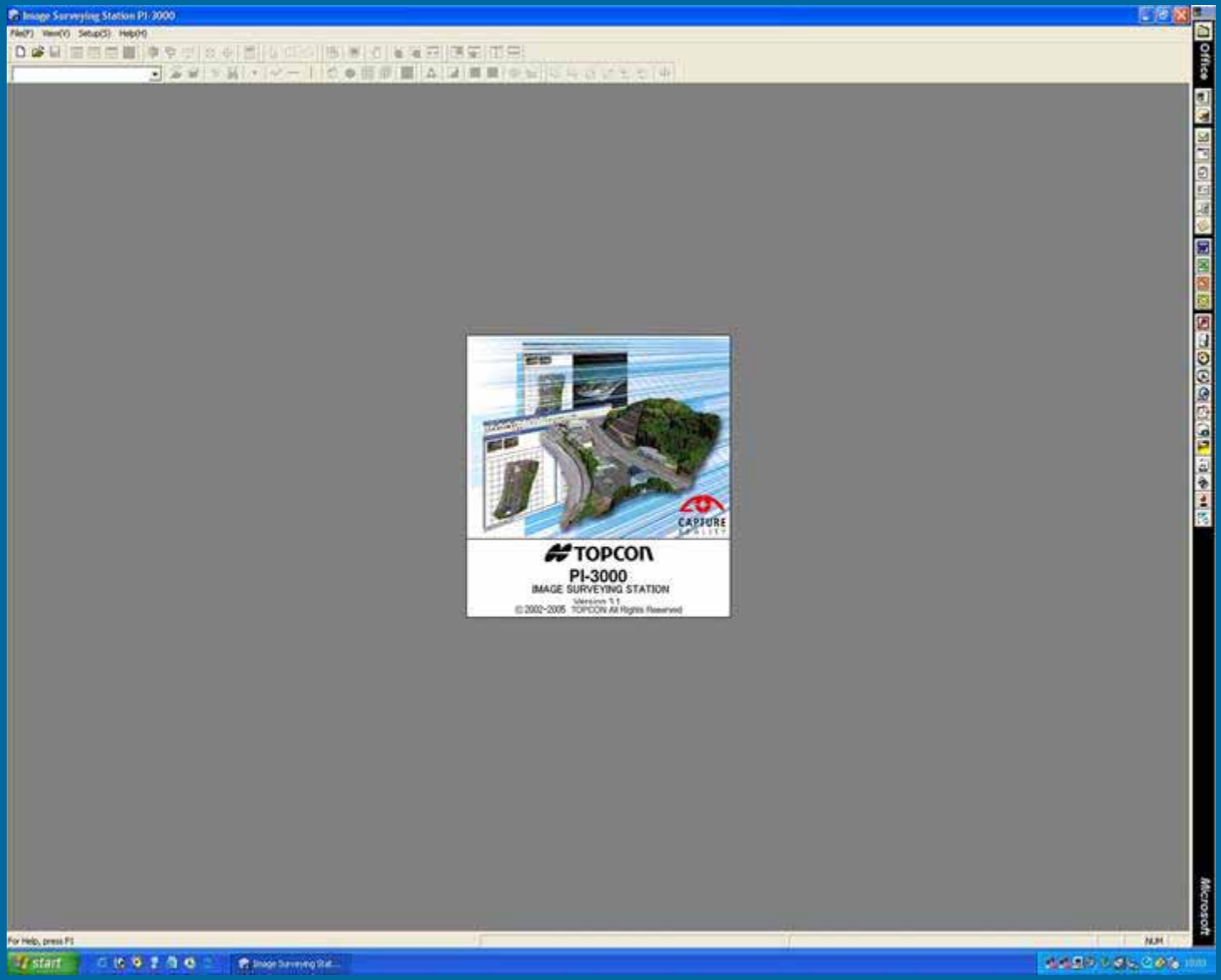
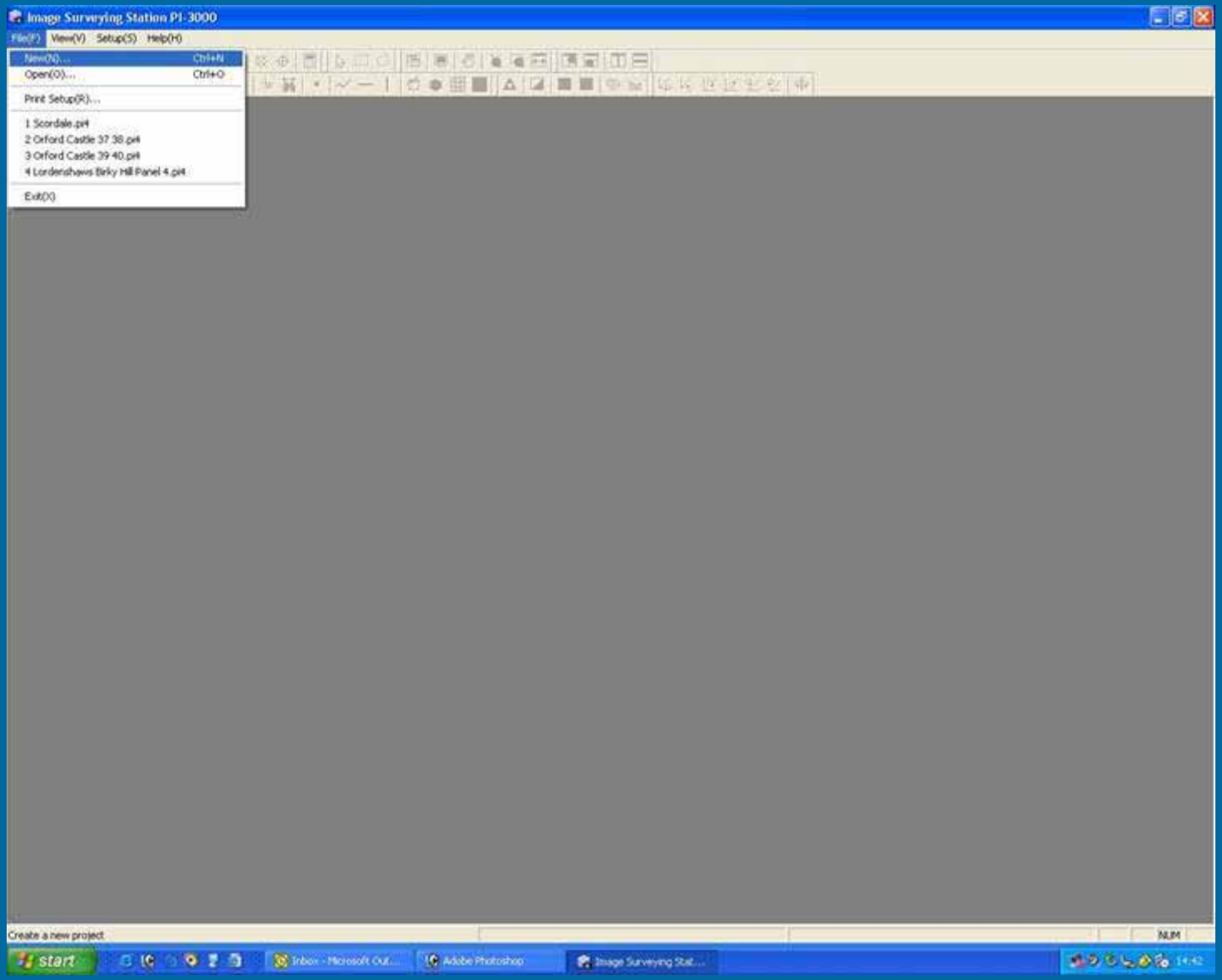
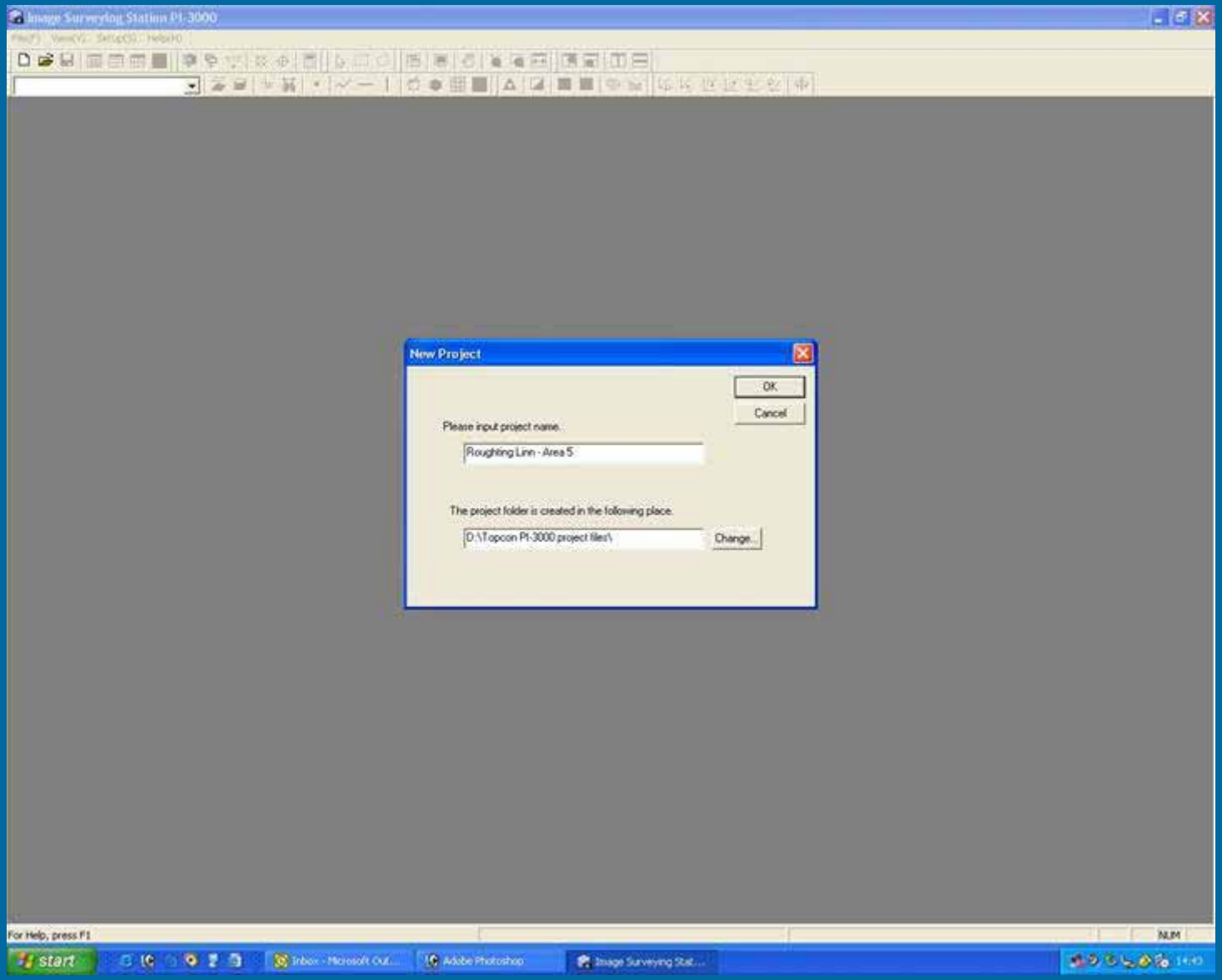
3. Open PI-3000



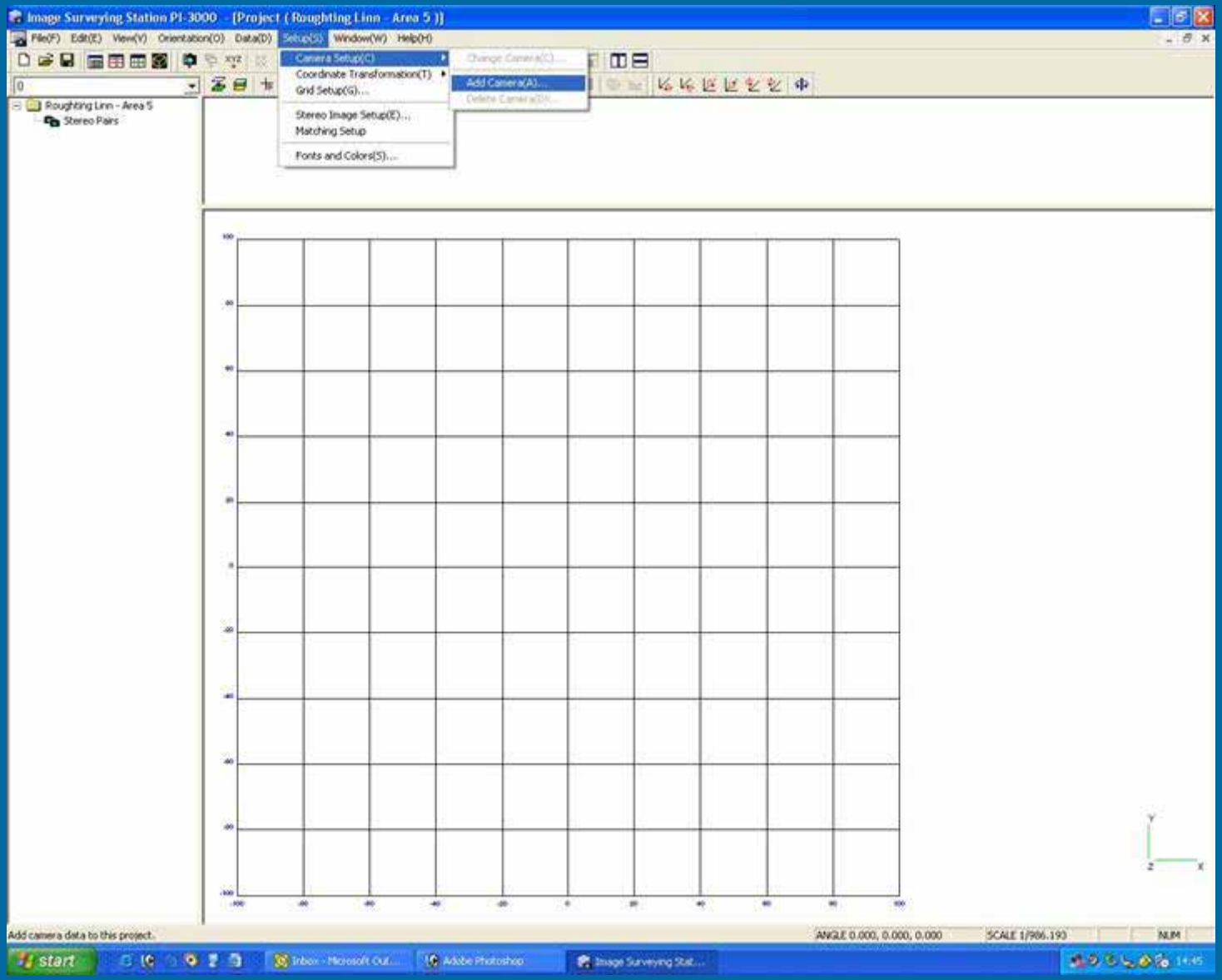
4. Create New project - File, New



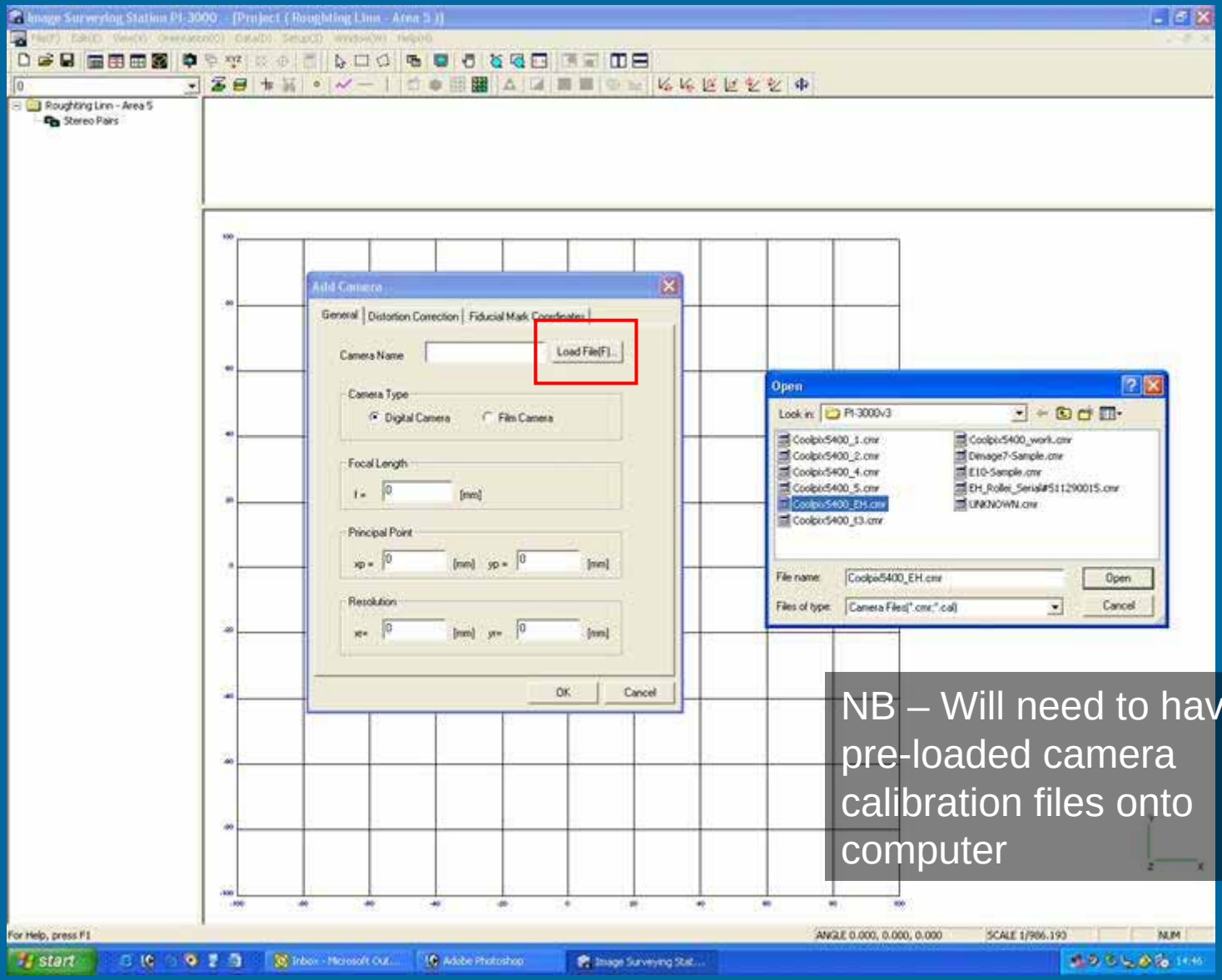
5. Input project name, set project file folder, OK



6. Setup correct camera file - Setup, Camera setup, Add camera



7. Load camera calibration file – Load File, Select correct file, Open



NB – Will need to have pre-loaded camera calibration files onto computer

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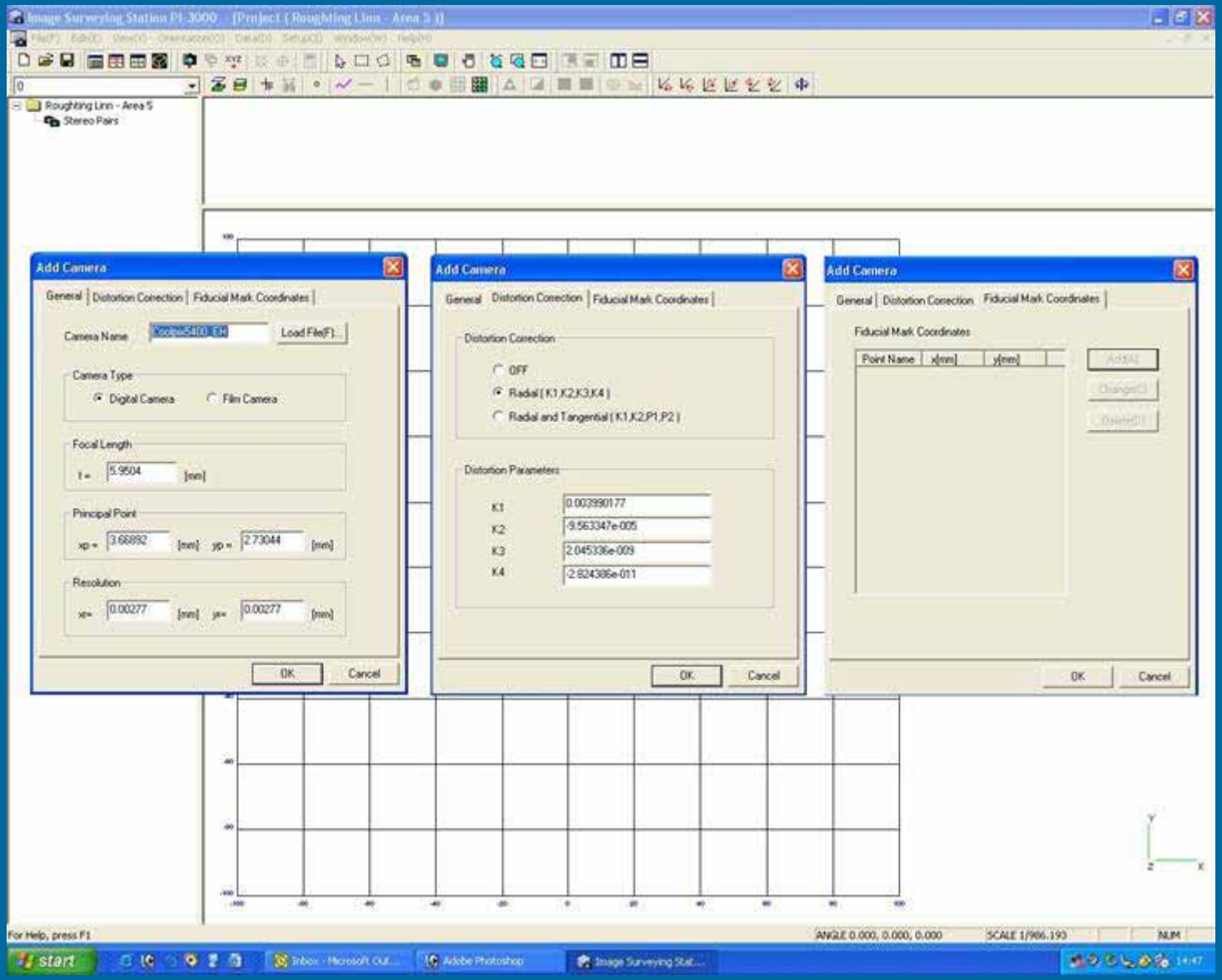
8. Camera calibration data



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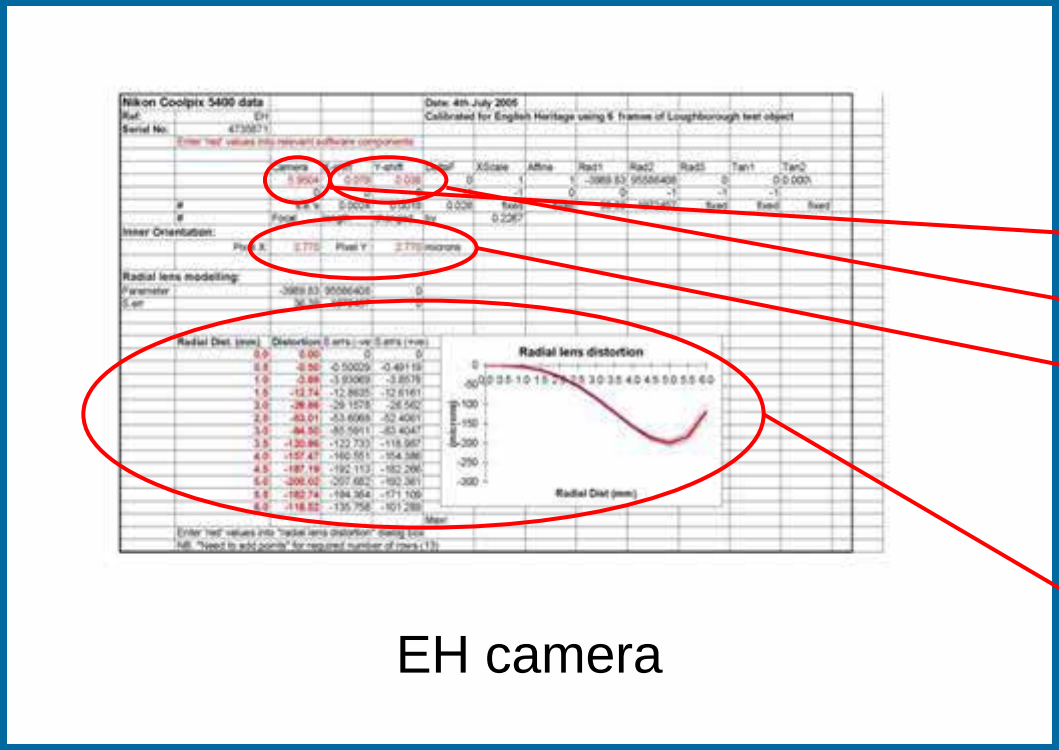
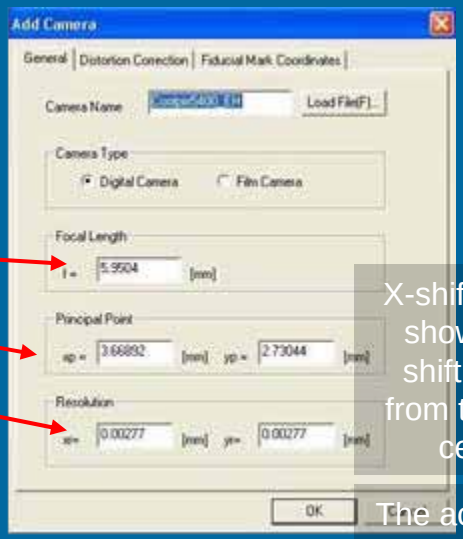
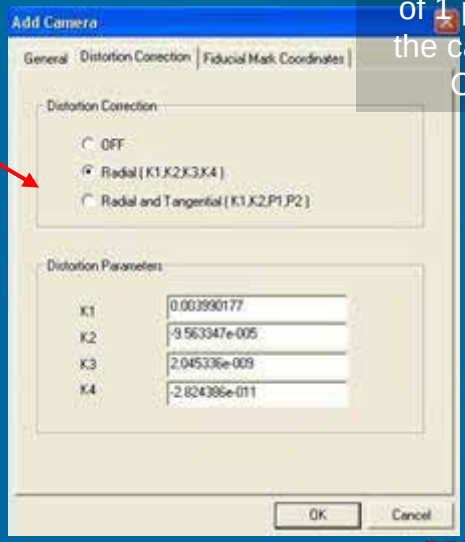
Camera calibration data – what does it mean?



EH camera



X-shift, Y-shift shows lens shift values from the CCD centre



The actual size of 1 pixel on the camera's CCD

Camera calibration information provided by Dr Jim Chandler, Loughborough University

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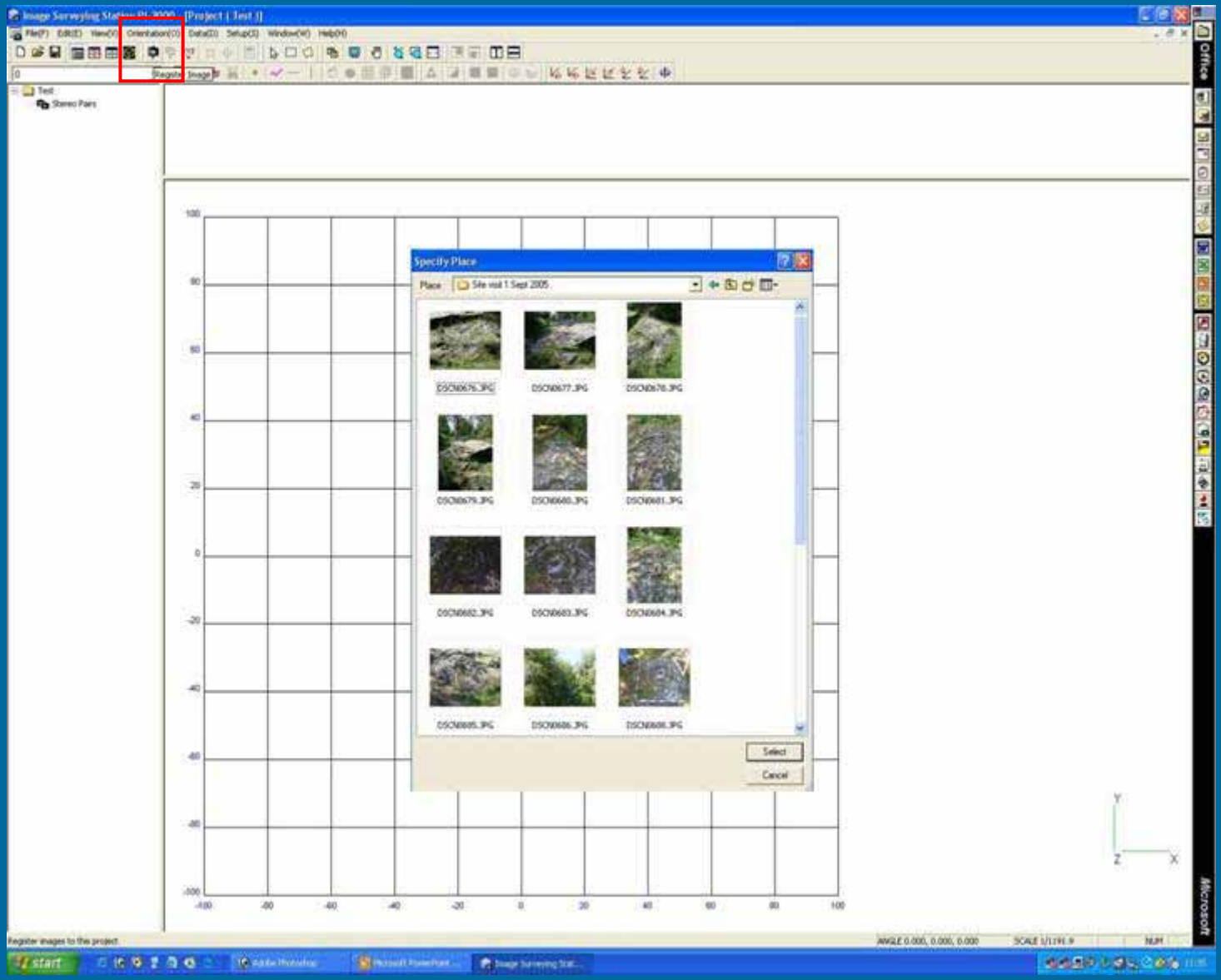
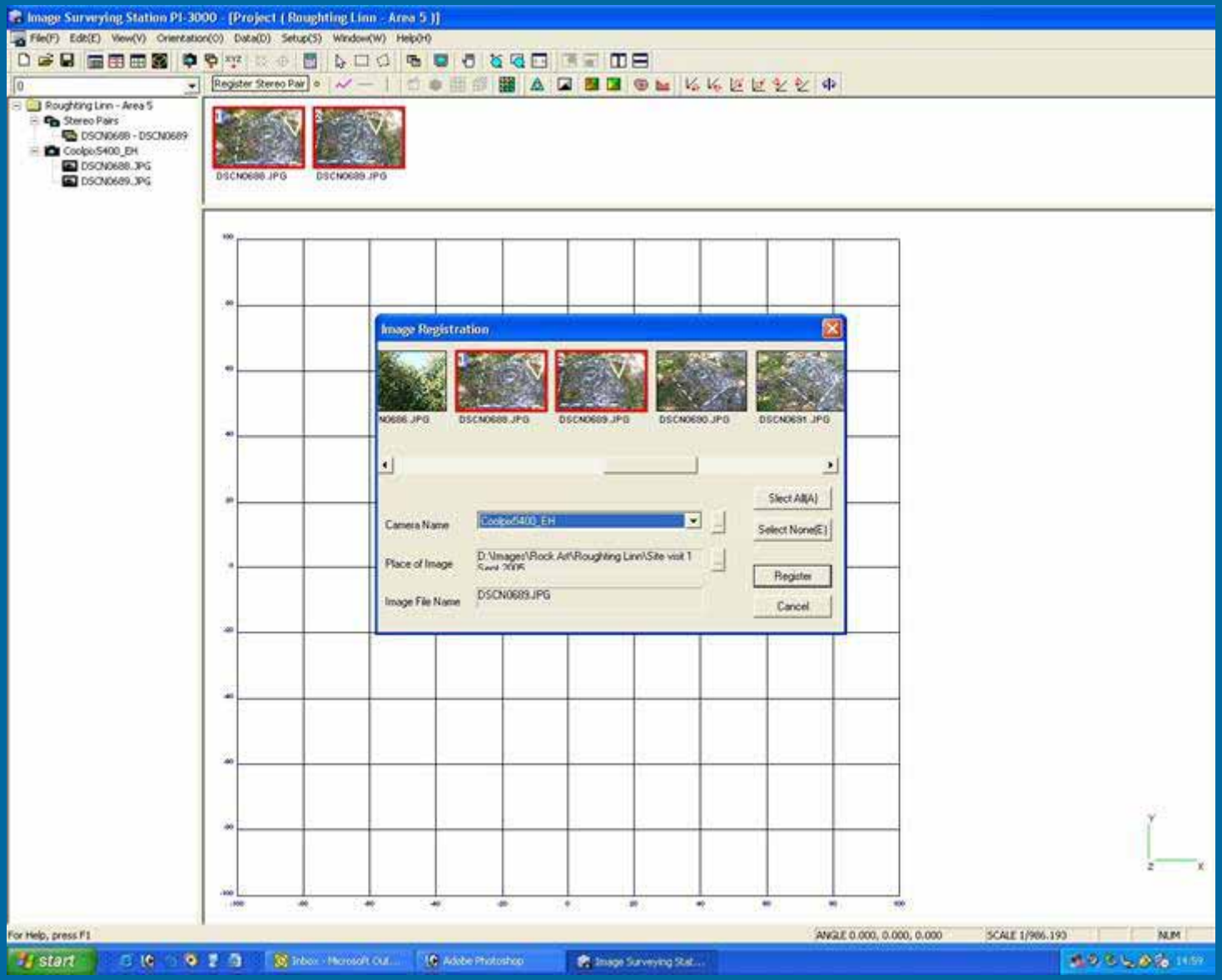
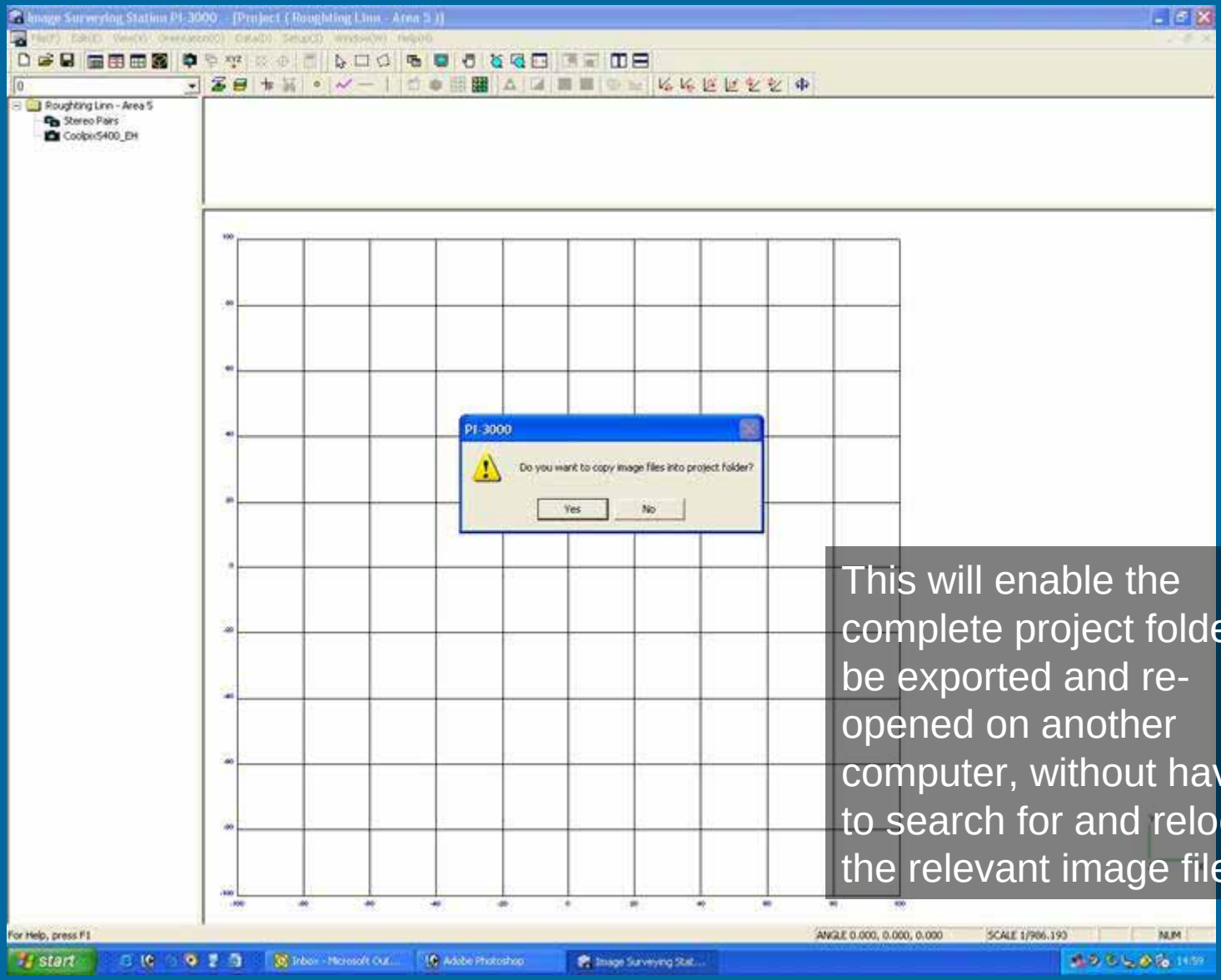
9. Register Image, Specify Place (folder), Select



10. Image Registration, Highlight Stereo Pair, Register

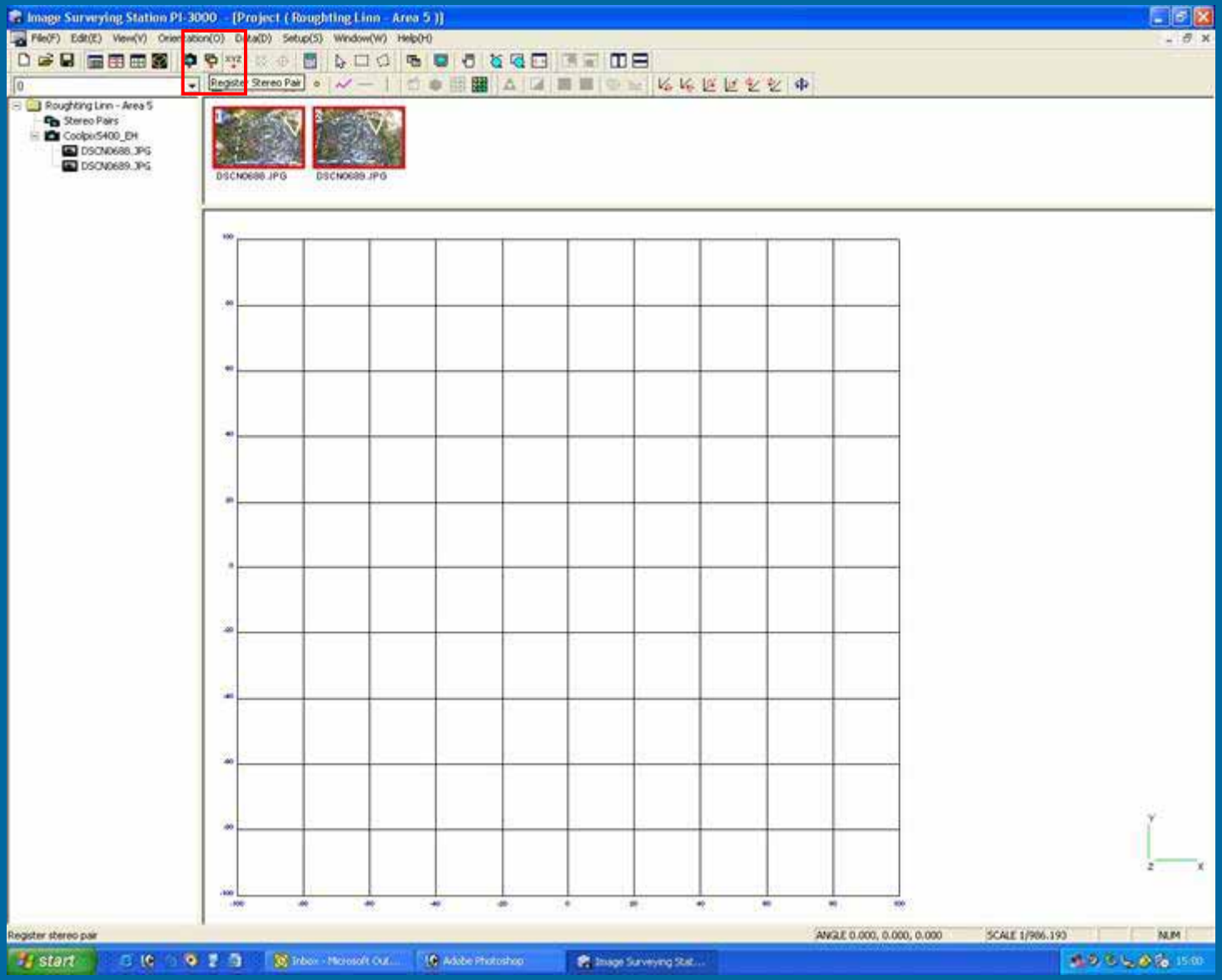


11. Copy image files, Yes

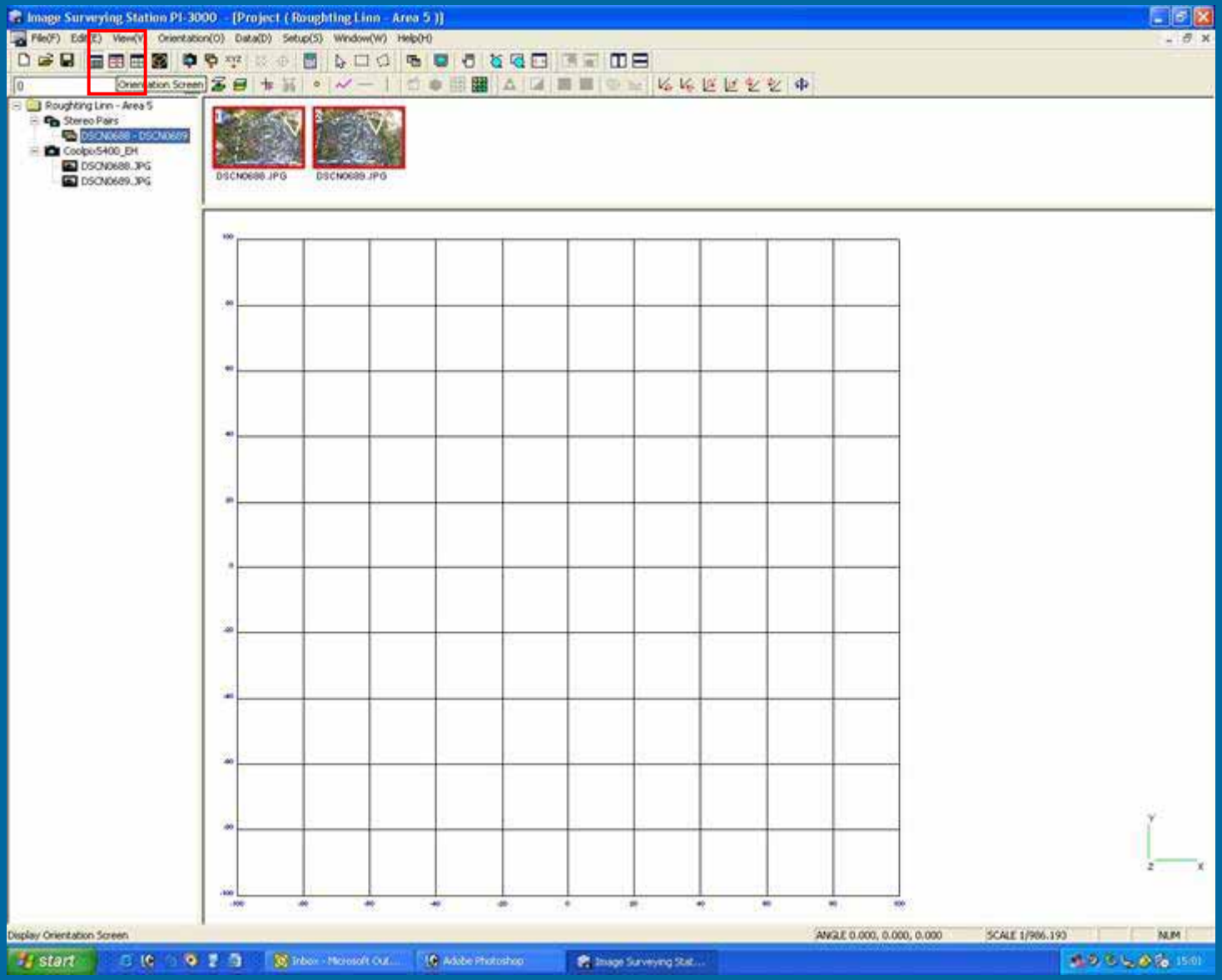


This will enable the complete project folder to be exported and re-opened on another computer, without having to search for and relocate the relevant image files

12. Highlight in correct left/right order, Register Stereo Pair



13. Highlight registered pair, Orientation screen



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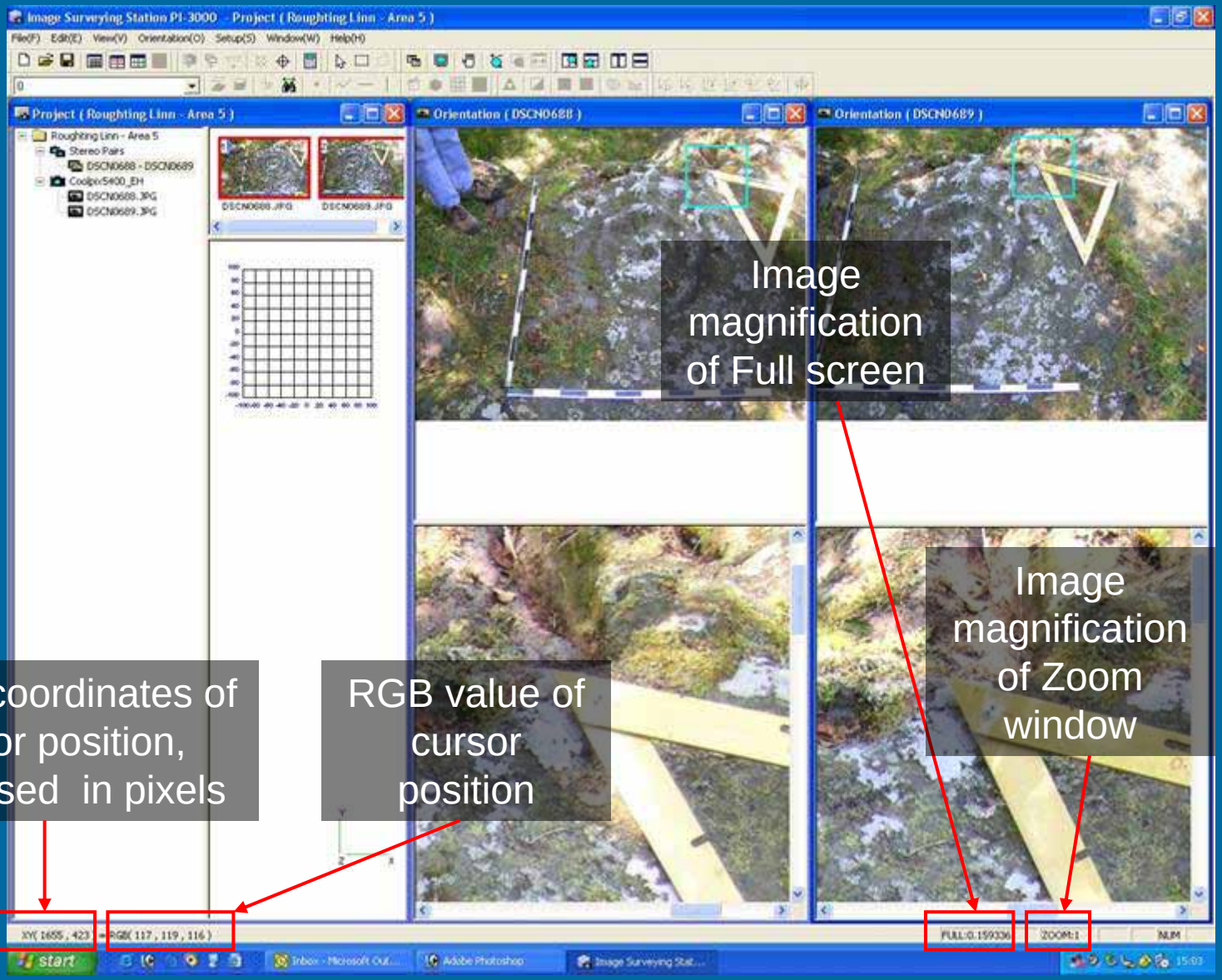
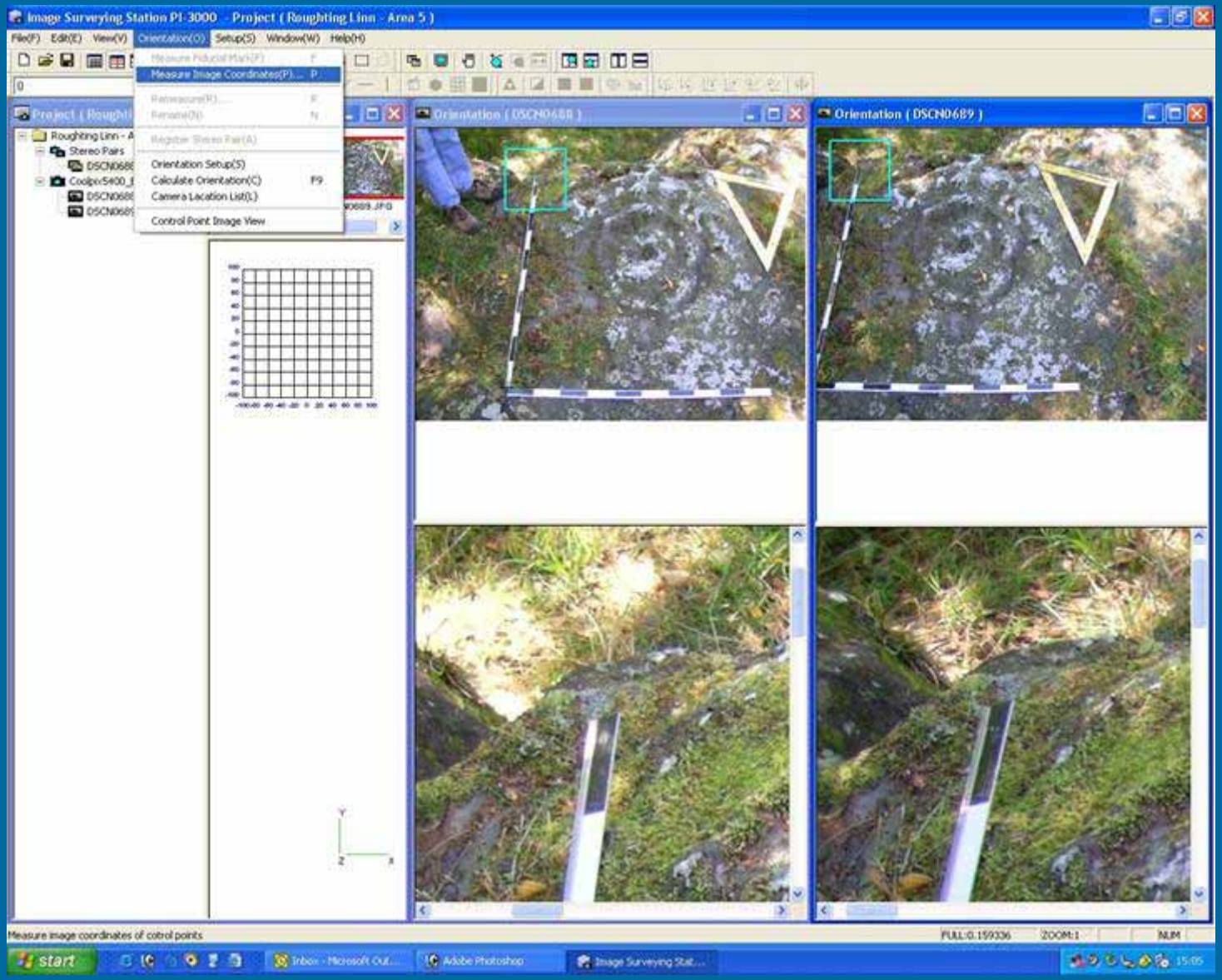
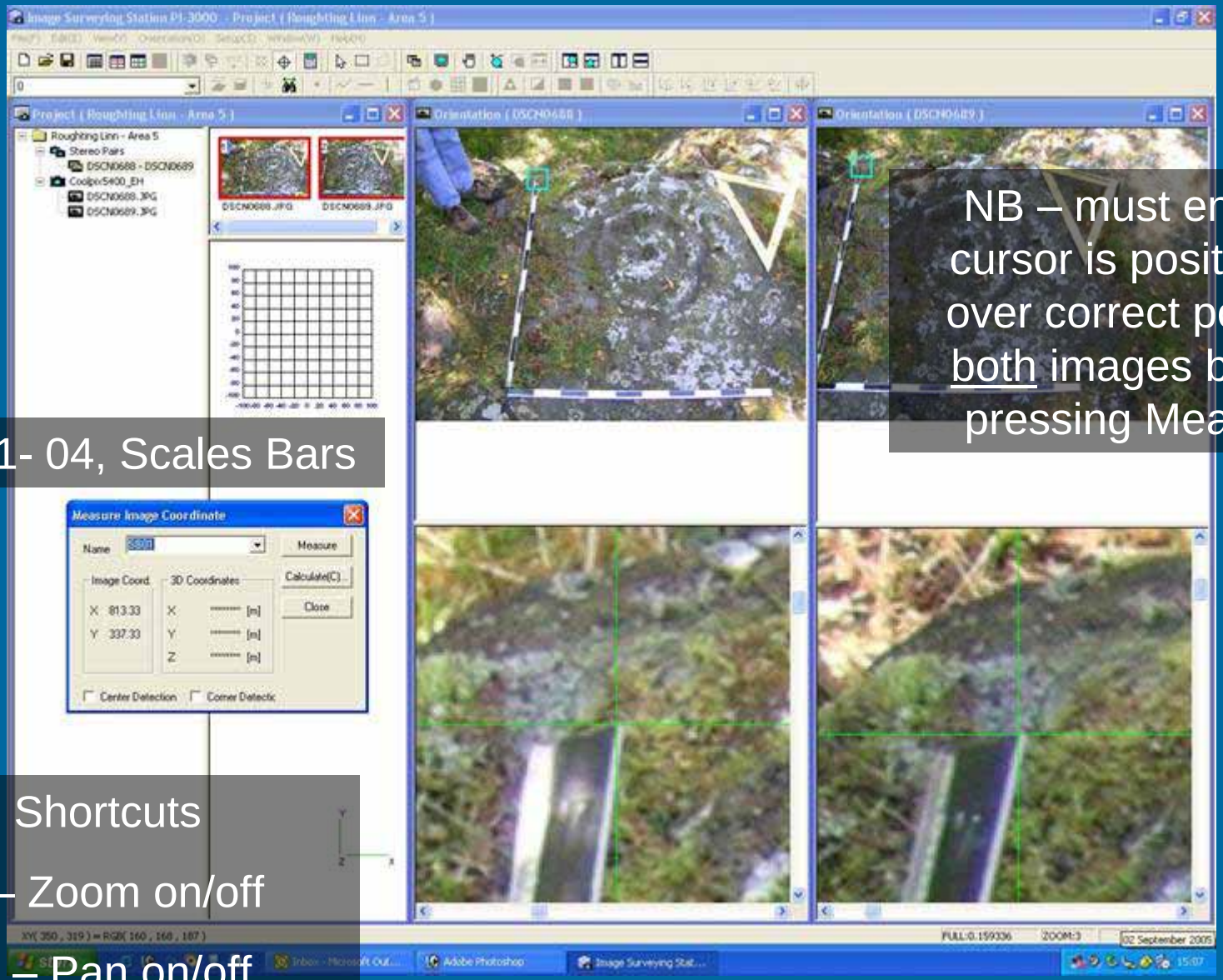
14. Orientation screen



15. Orientation, Measure Image Co-ordinates



16. Measure Image Coordinate – SB01, Set cursor on point, Measure



SB01- 04, Scales Bars

NB – must ensure cursor is positioned over correct point in both images before pressing Measure

Shortcuts

Z – Zoom on/off

M – Pan on/off

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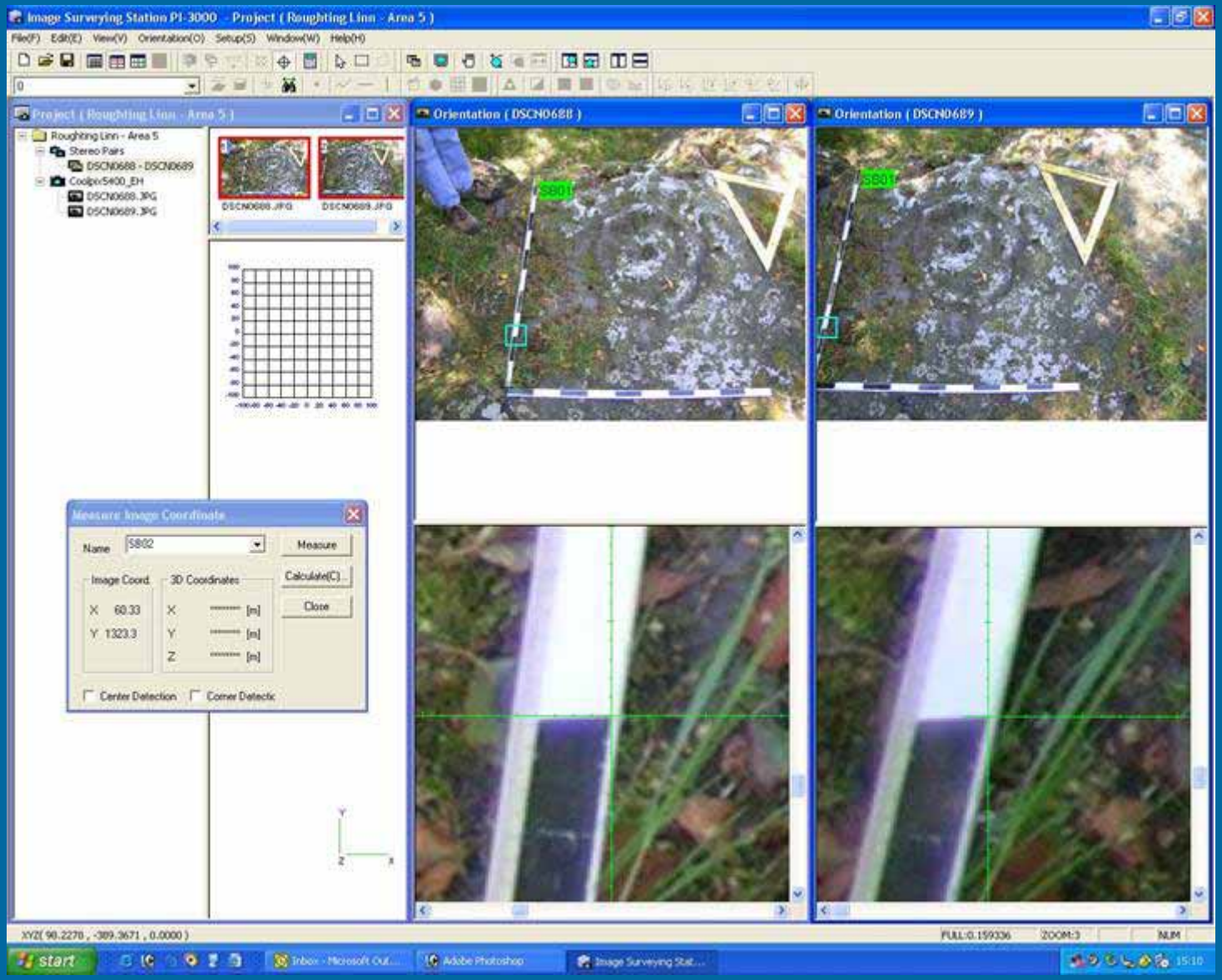
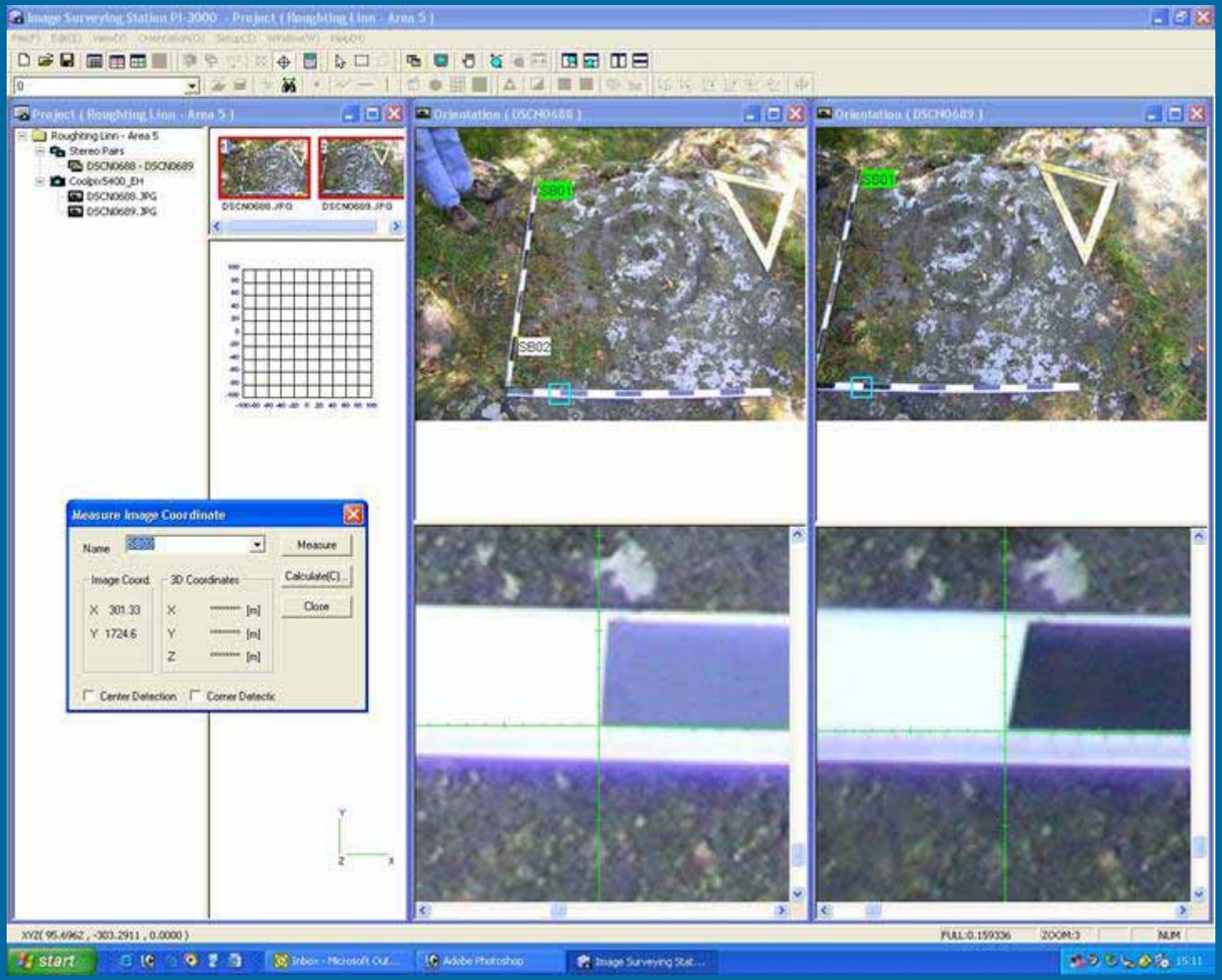
17. Measure Image Coordinate – SB02, Set cursor on point, Measure



18. Measure Image Coordinate – SB03, Set cursor on point, Measure



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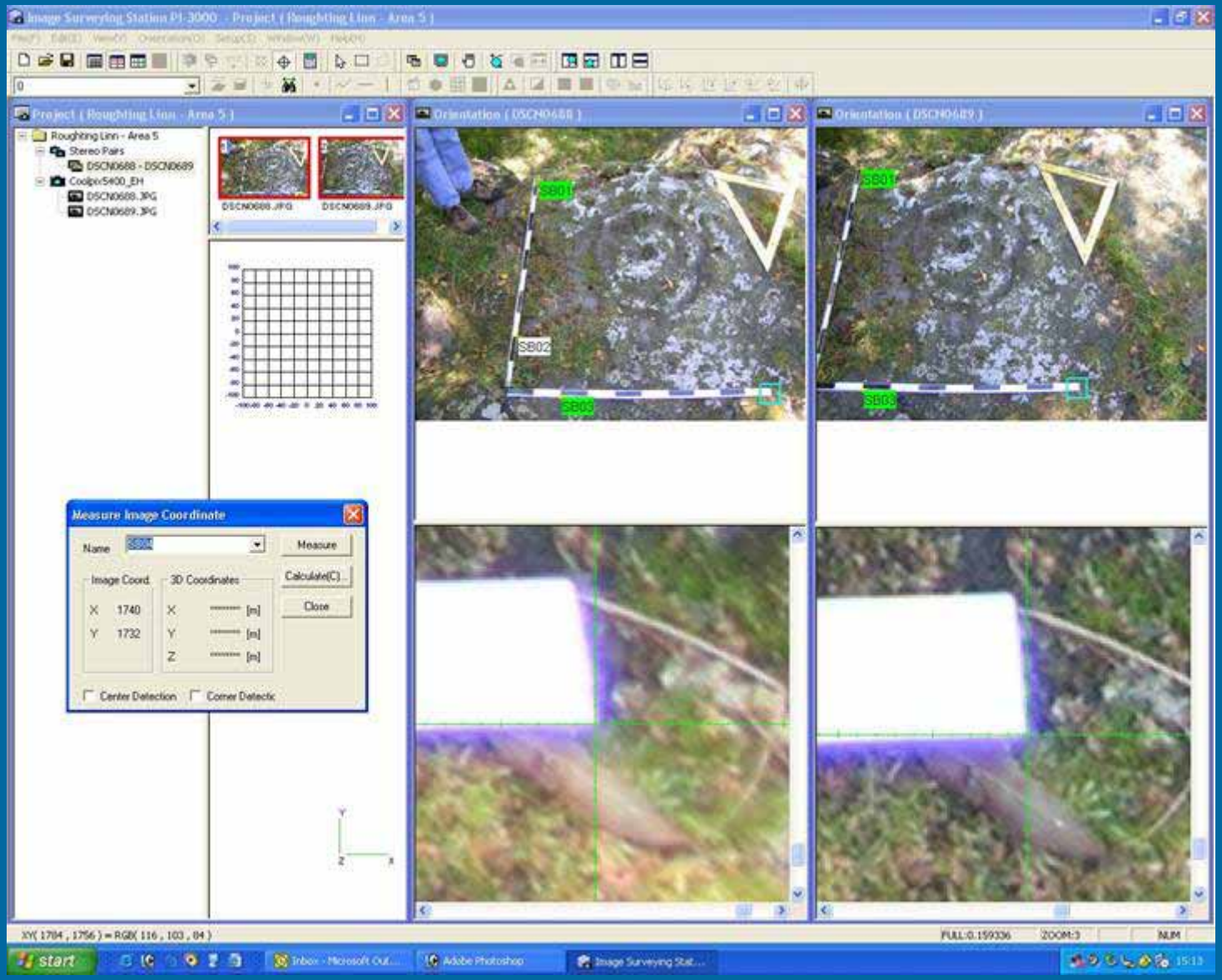
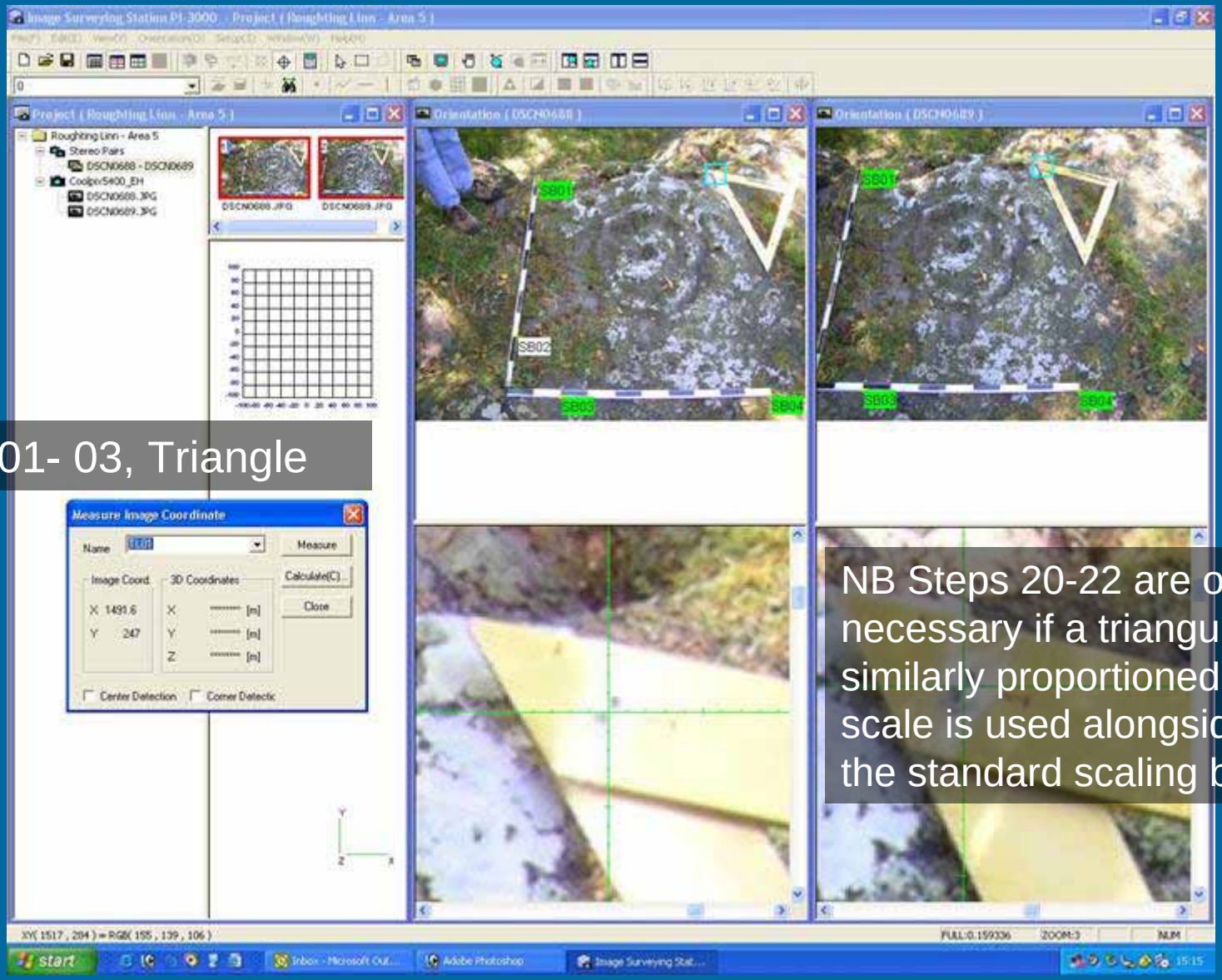
19. Measure Image Coordinate – SB04, Set cursor on point, Measure



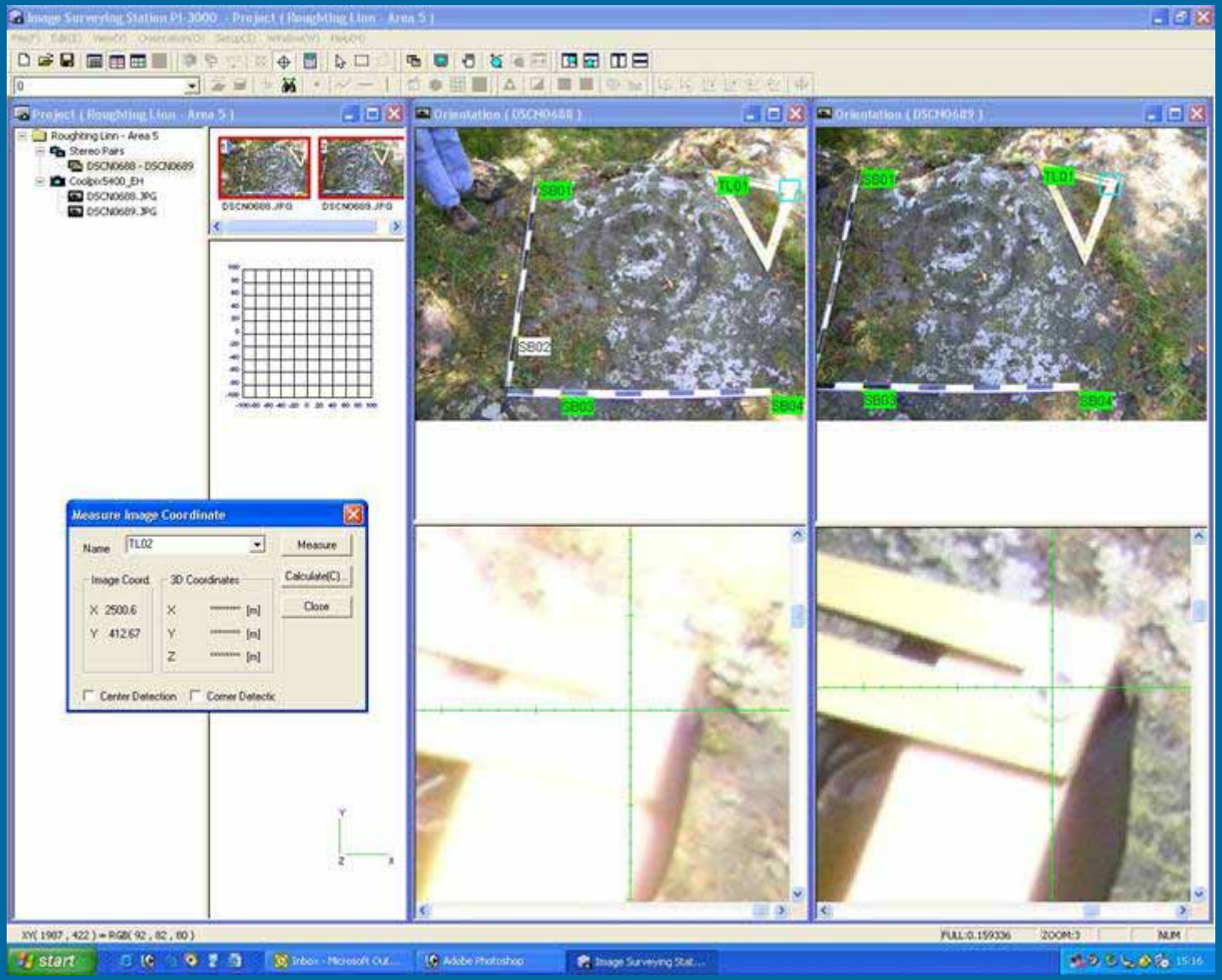
20. Measure Image Coordinate – TL01, Set cursor on point, Measure



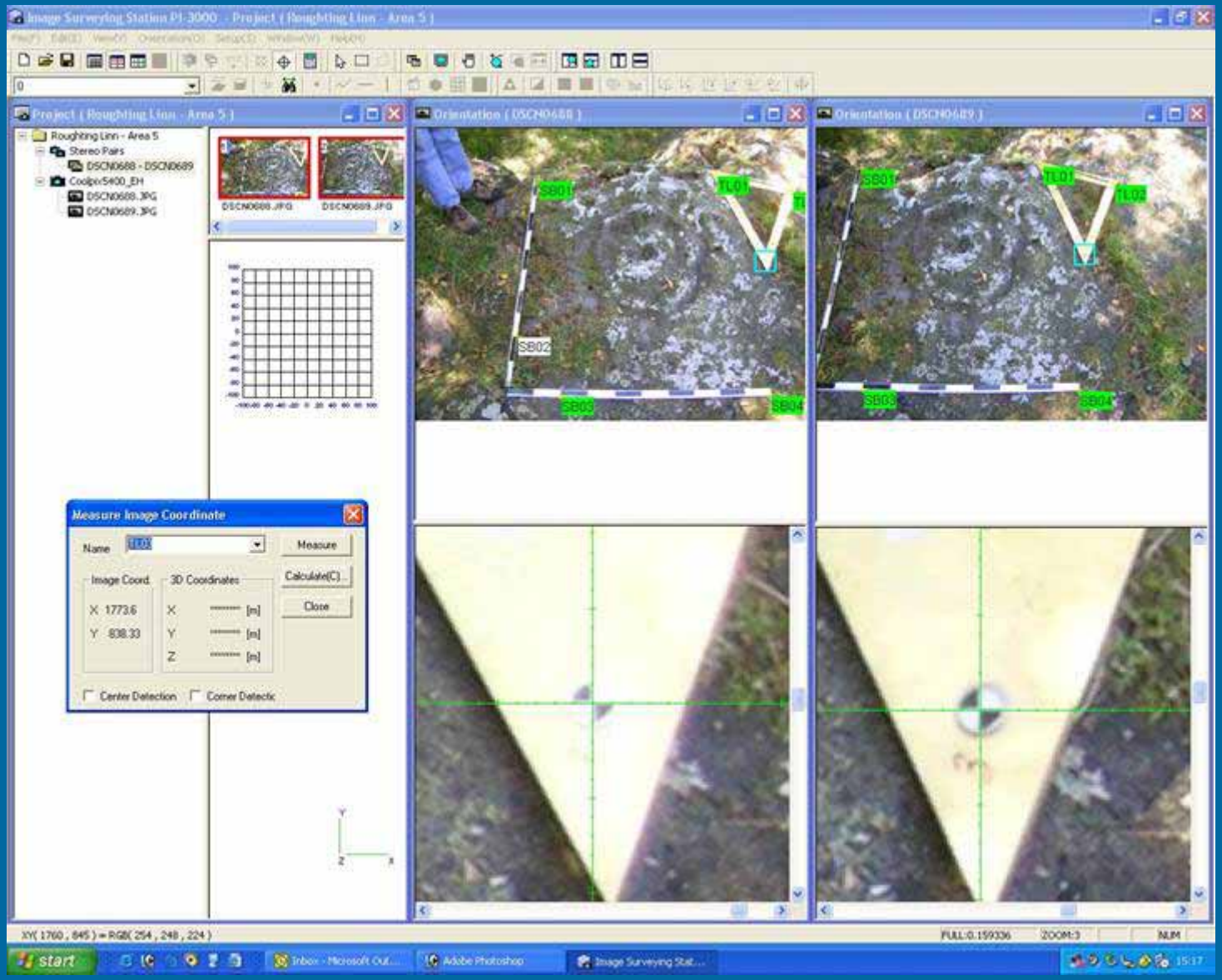
TL01- 03, Triangle

NB Steps 20-22 are only necessary if a triangular or similarly proportioned scale is used alongside the standard scaling bars

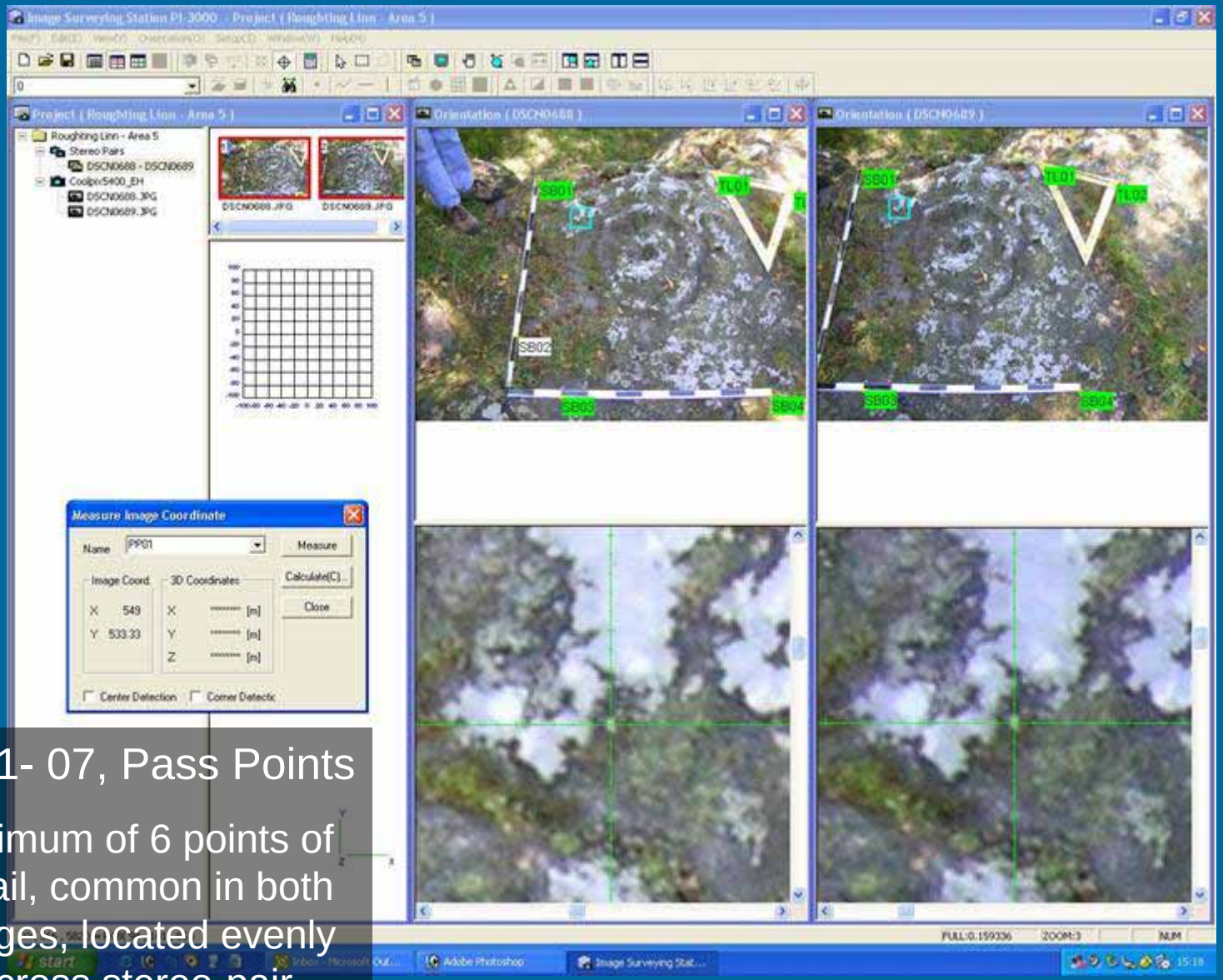
21. Measure Image Coordinate – TL02, Set cursor on point, Measure



22. Measure Image Coordinate – TL03, Set cursor on point, Measure



23. Measure Image Coordinate – PP01, Set cursor on point, Measure



PP01- 07, Pass Points

Minimum of 6 points of detail, common in both images, located evenly across stereo-pair

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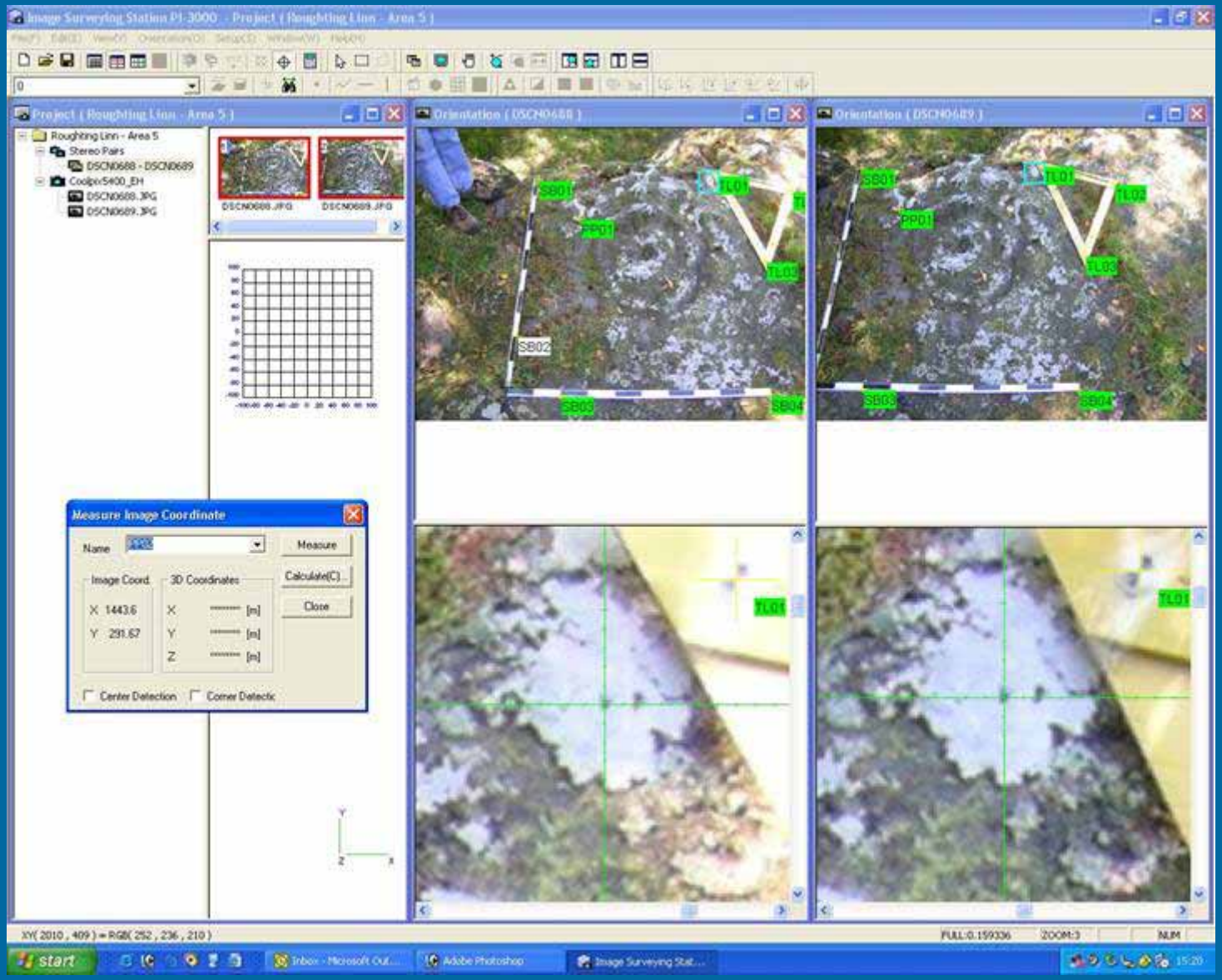
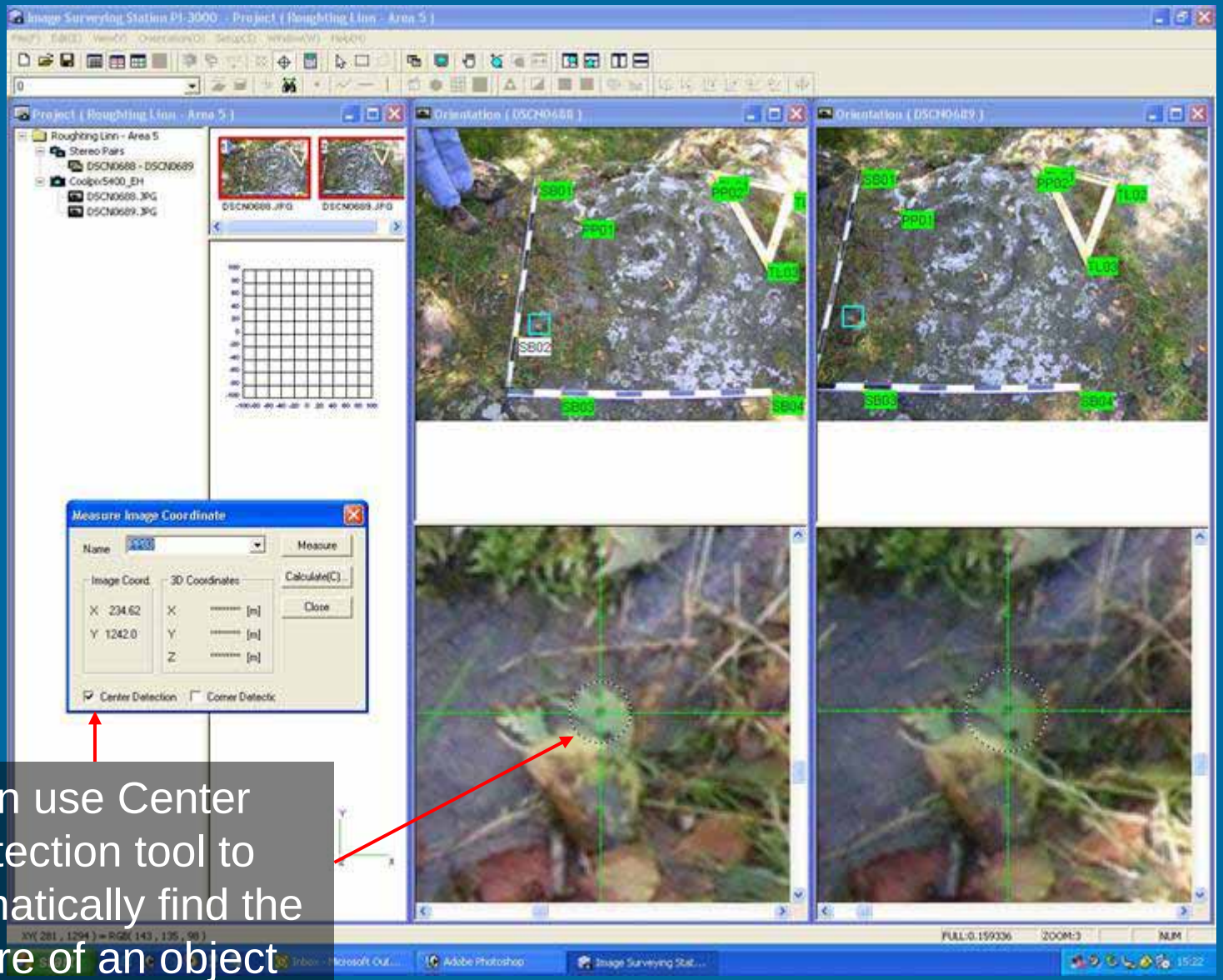
24. Measure Image Coordinate – PP02, Set cursor on point, Measure

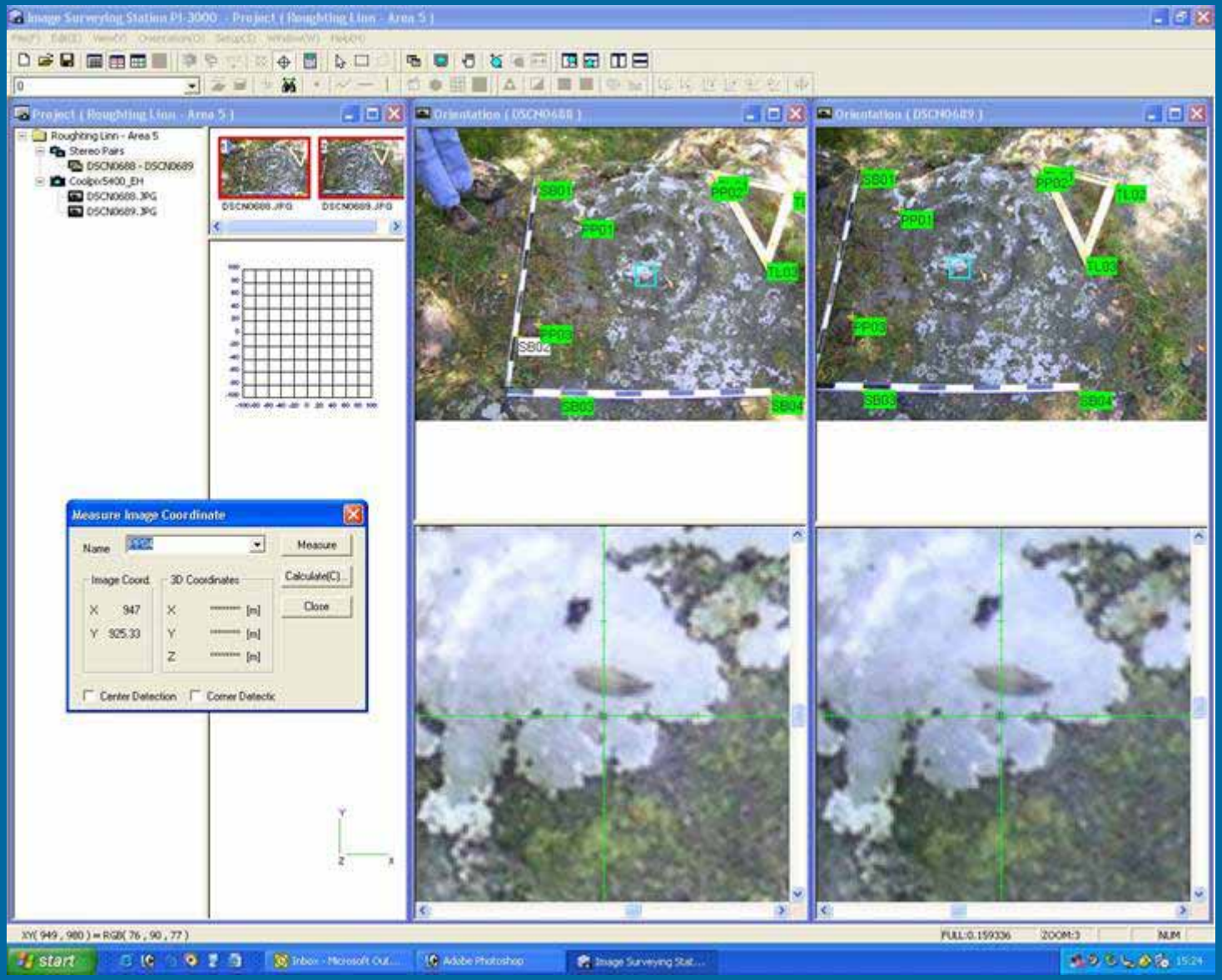


25. Measure Image Coordinate – PP03, Set cursor on point, Measure

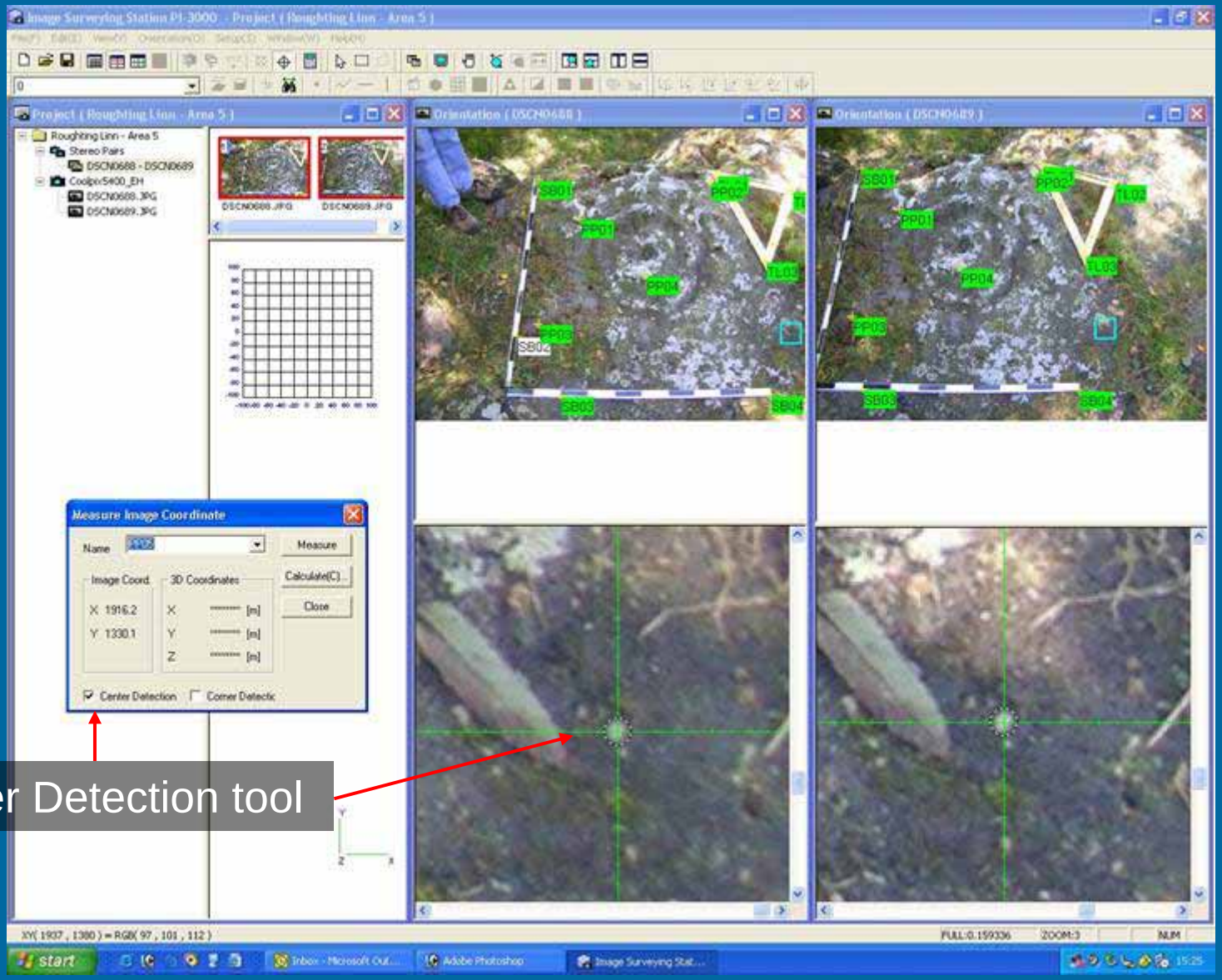


Can use Center Detection tool to automatically find the centre of an object

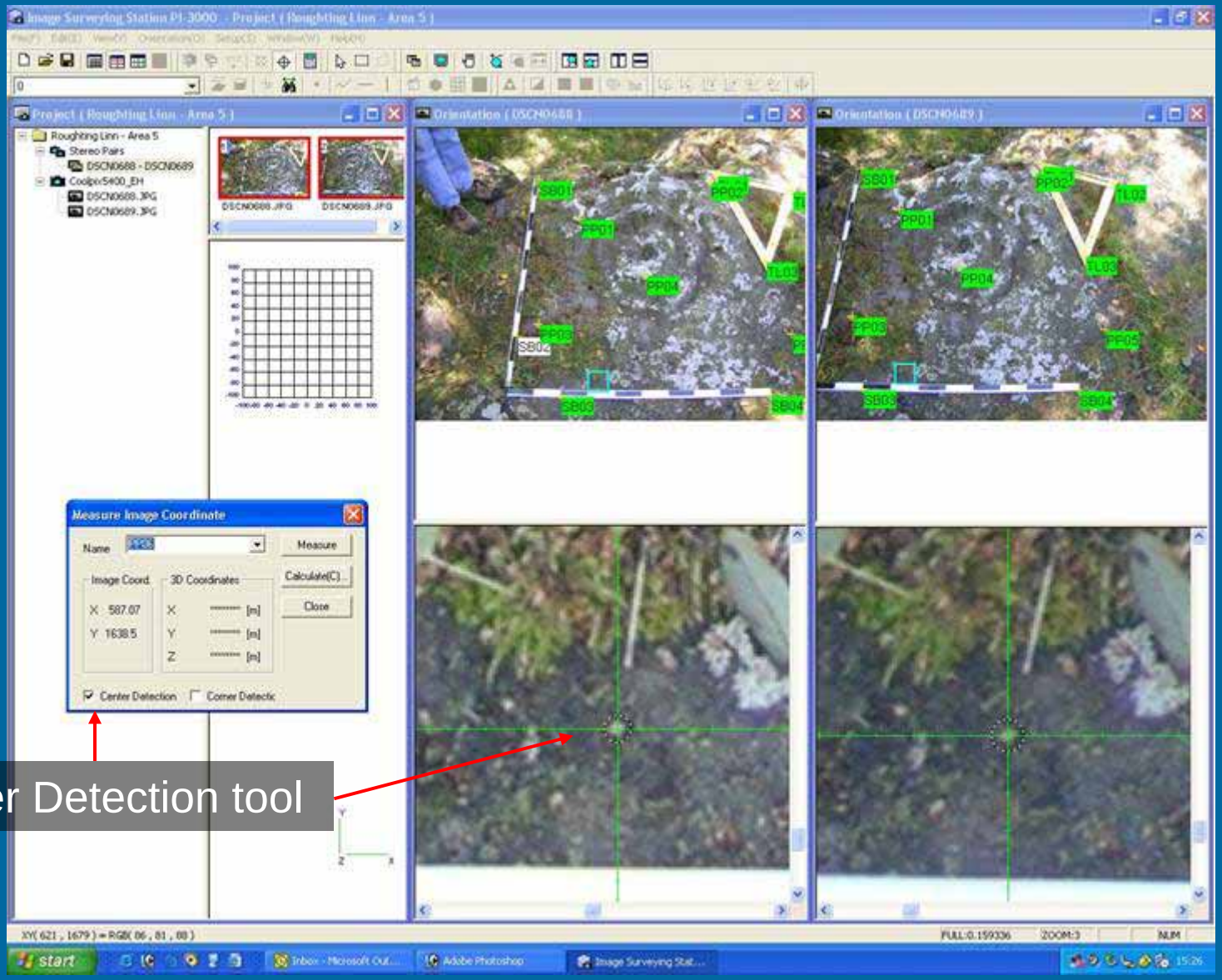
26. Measure Image Coordinate – PP04, Set cursor on point, Measure



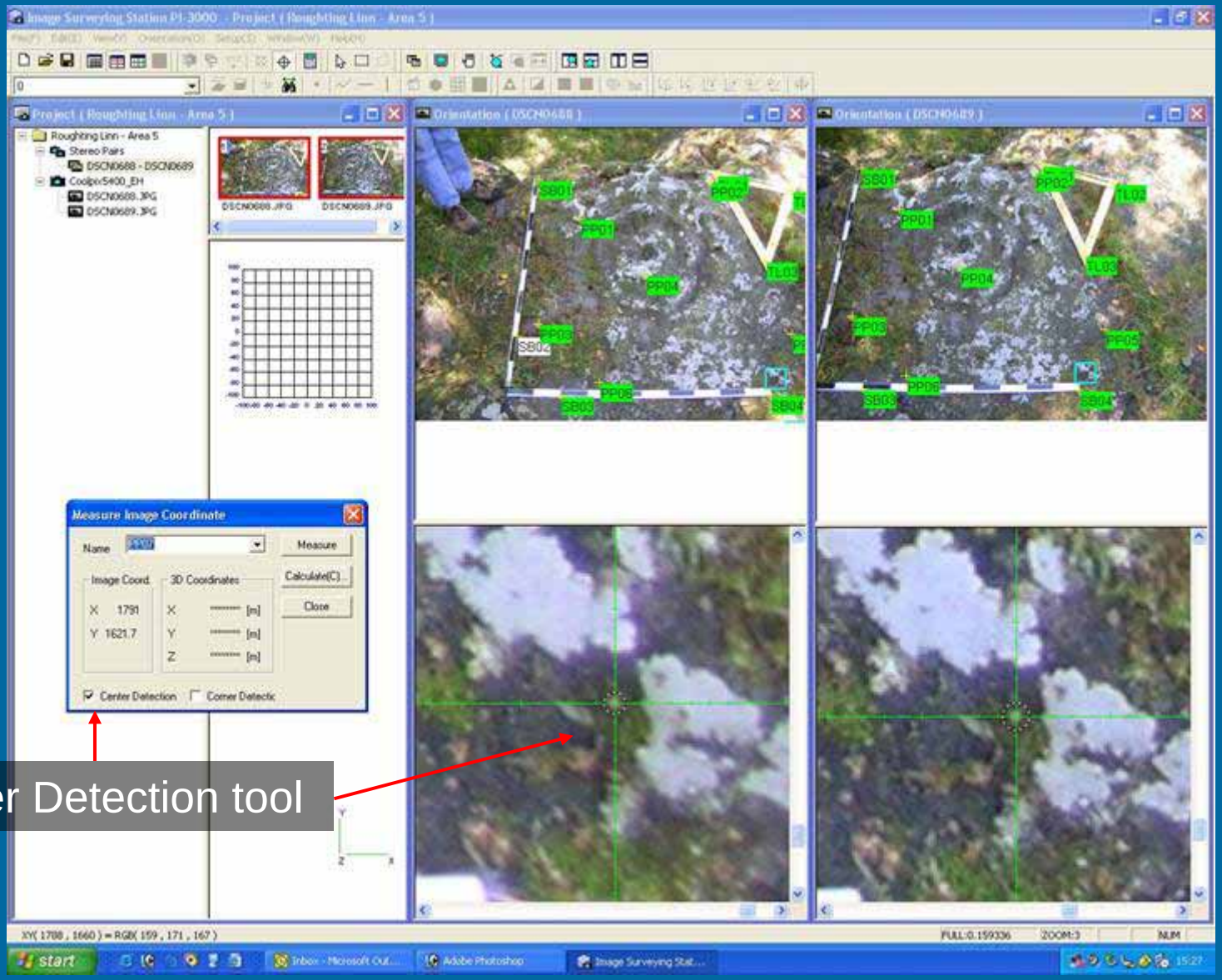
27. Measure Image Coordinate – PP05, Set cursor on point, Measure



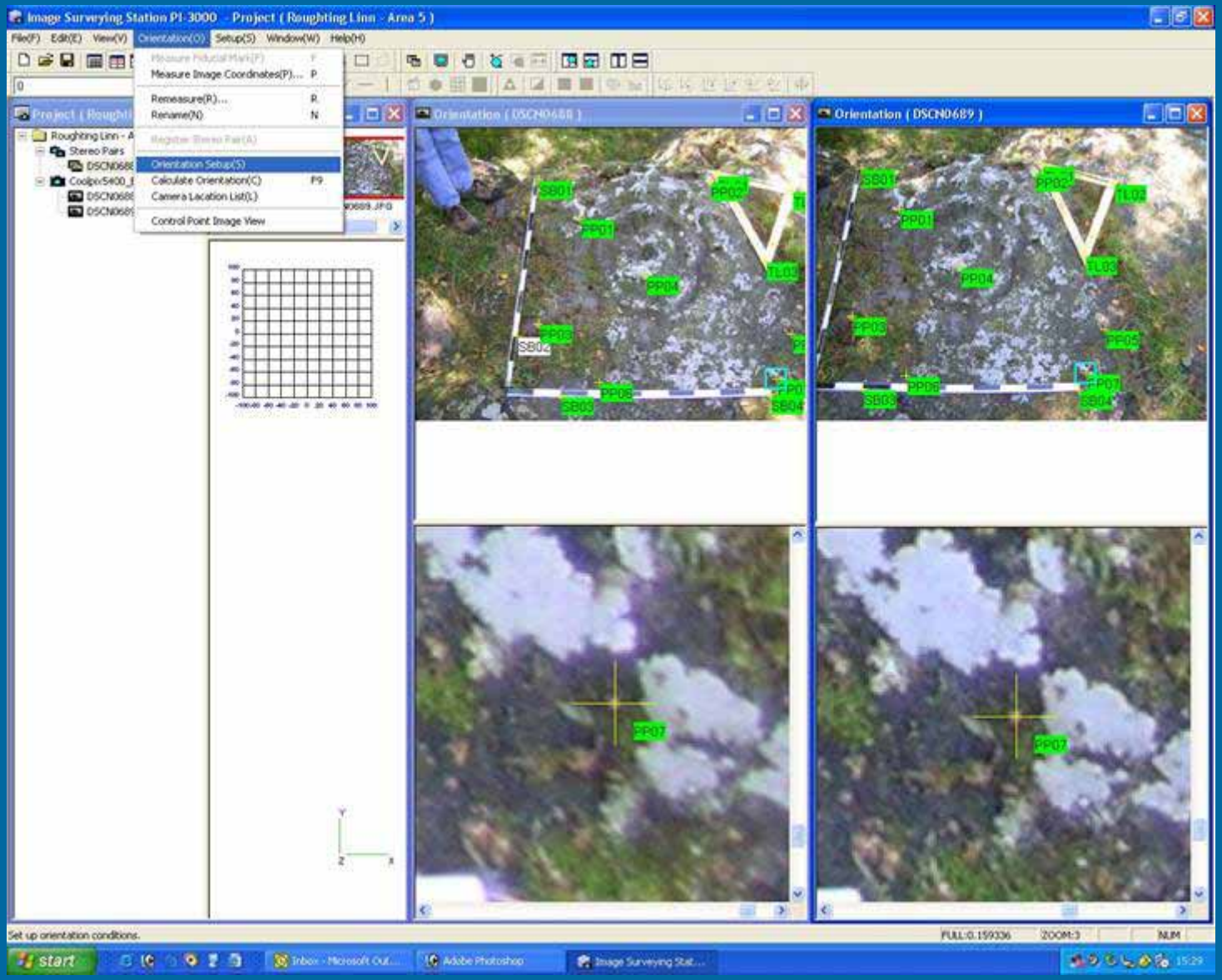
28. Measure Image Coordinate – PP06, Set cursor on point, Measure



29. Measure Image Coordinate – PP07, Set cursor on point, Measure



30. Orientation, Orientation Setup



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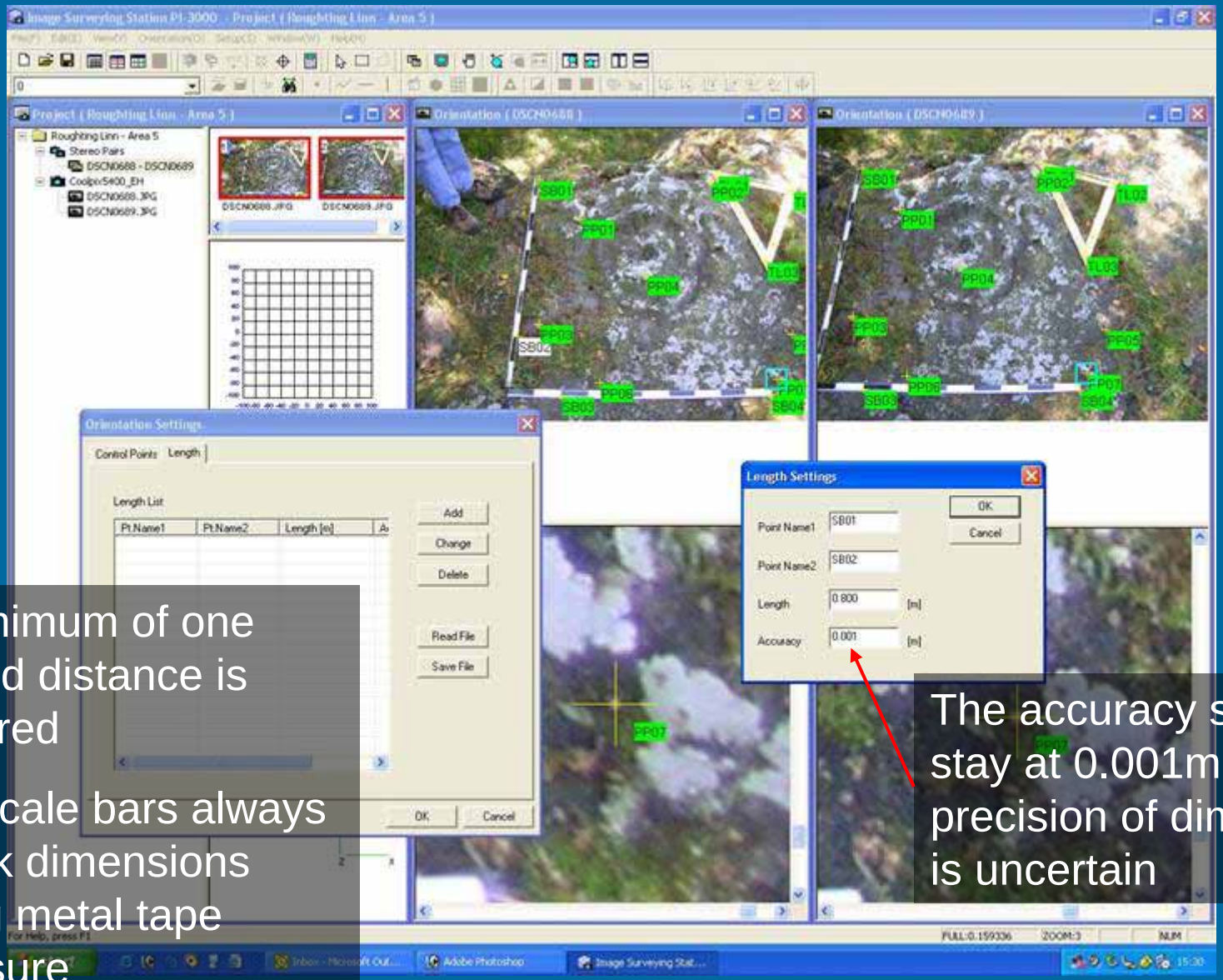
31. Orientation Settings, Length, Add, SB01, SB02, ‘Input length’, OK

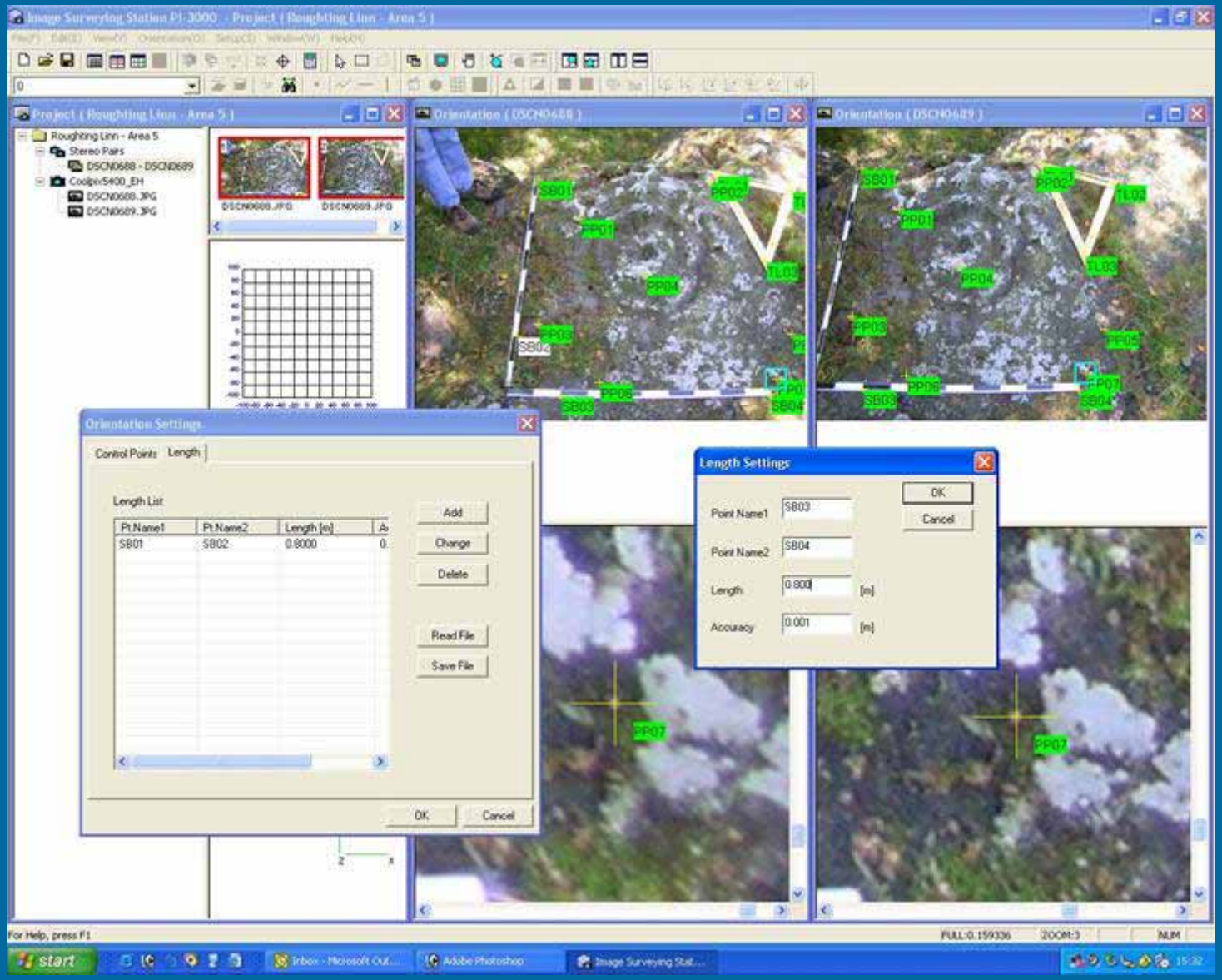


A minimum of one scaled distance is required

For scale bars always check dimensions using metal tape measure

The accuracy should stay at 0.001m unless precision of dimension is uncertain

32. Orientation Settings, Length, Add, SB03, SB04, ‘Input length’, OK



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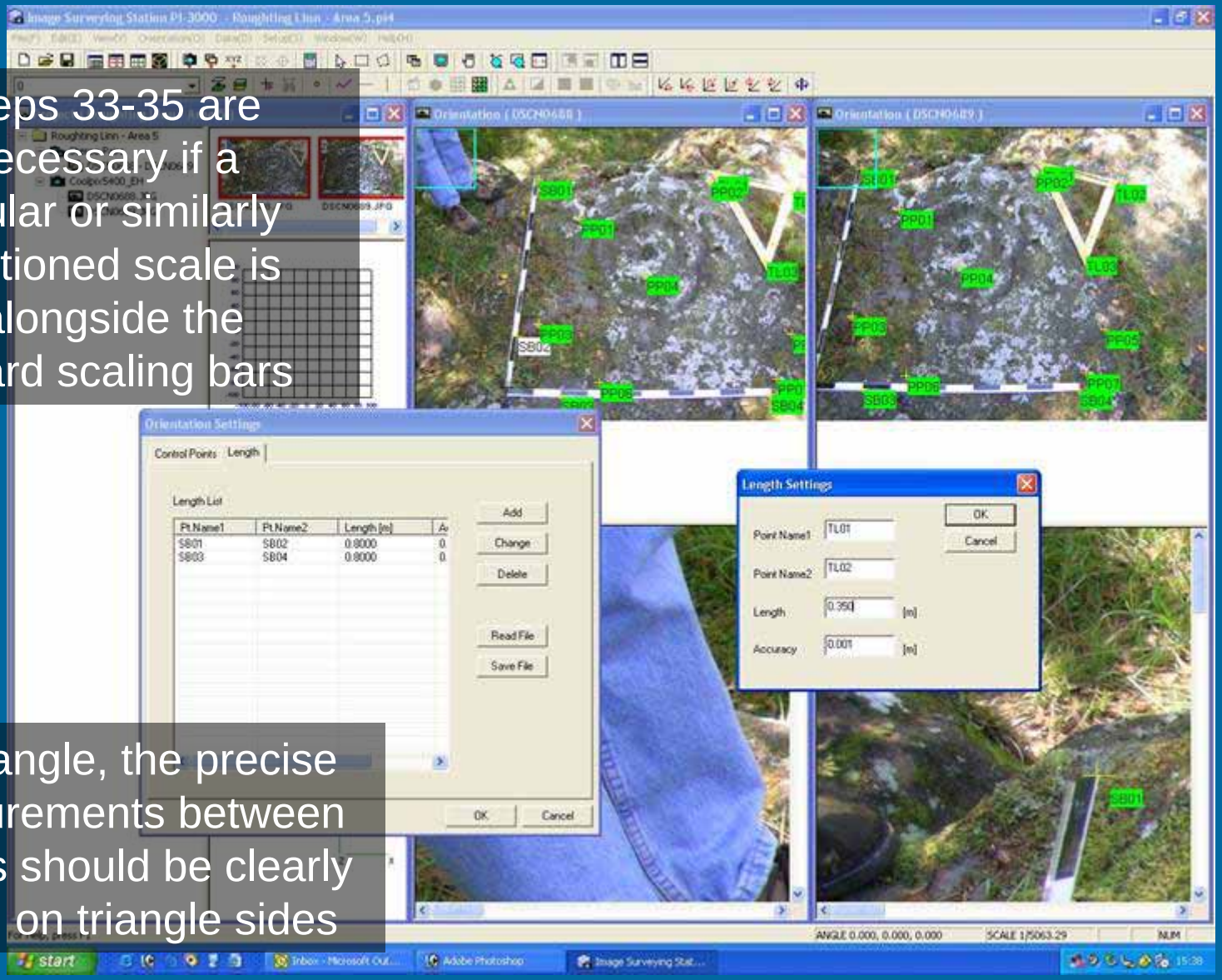
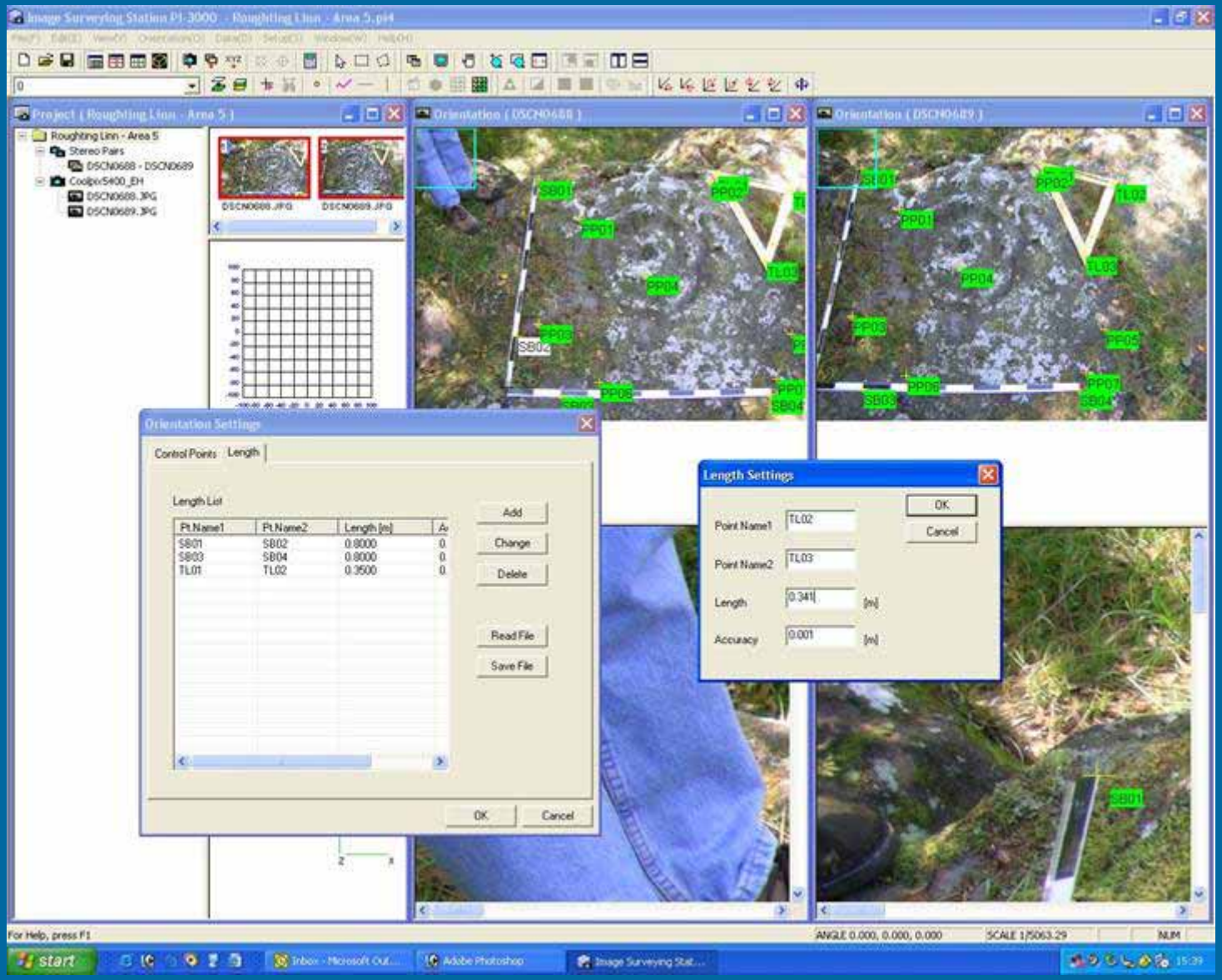
33. Orientation Settings, Length, Add, TL01, TL02, ‘Input length’, OK

NB Steps 33-35 are only necessary if a triangular or similarly proportioned scale is used alongside the standard scaling bars

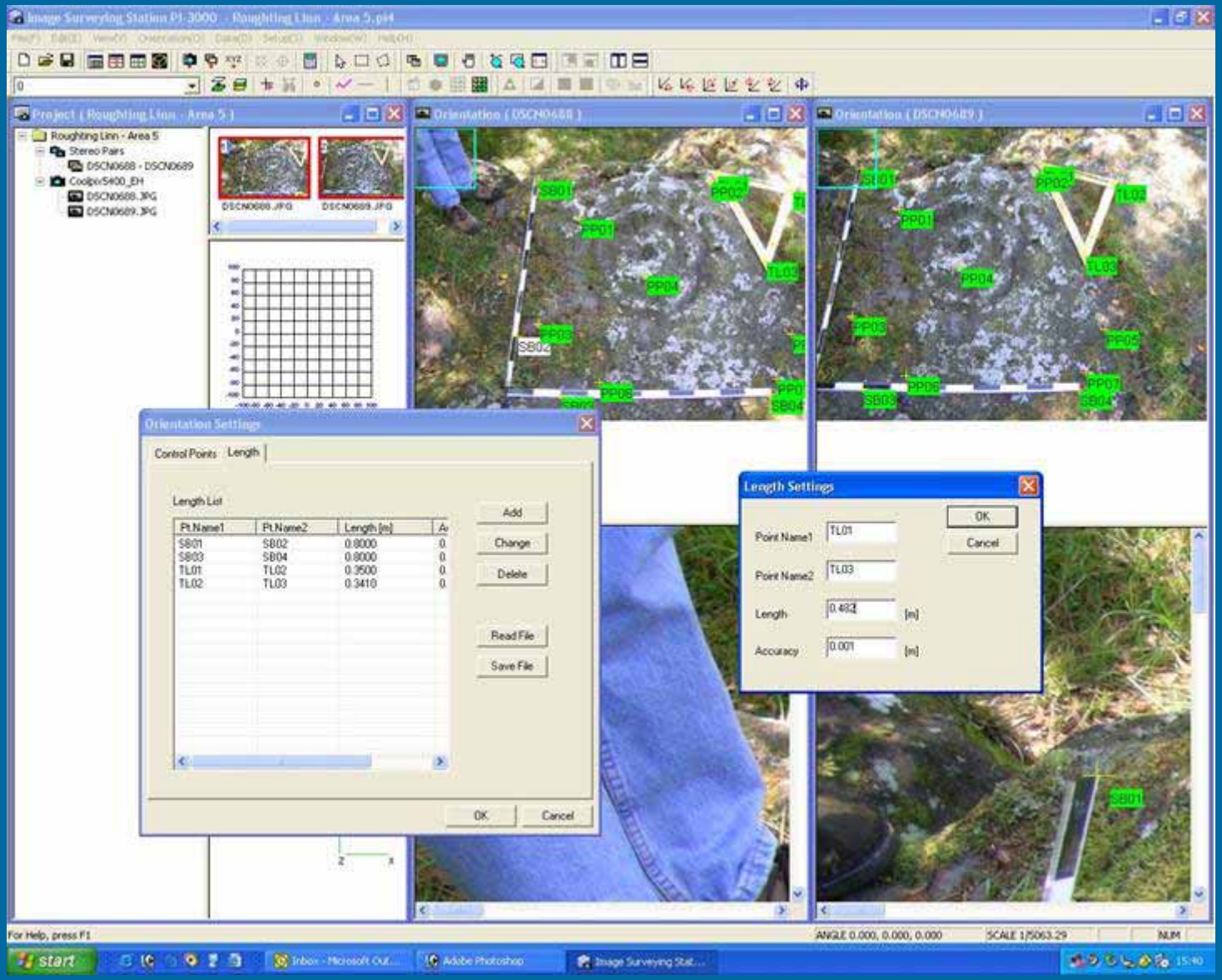


For triangle, the precise measurements between targets should be clearly written on triangle sides

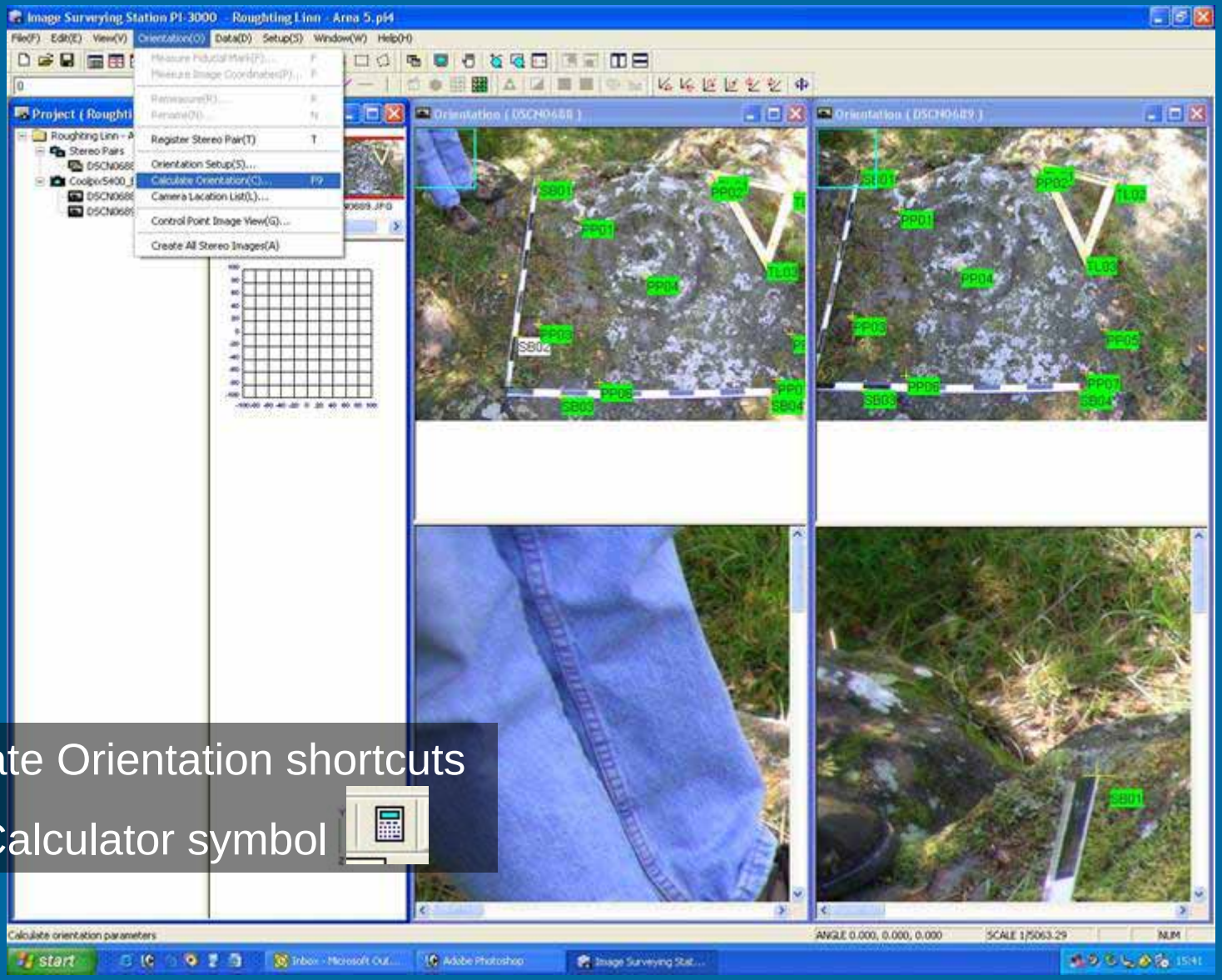
34. Orientation Settings, Length, Add, TL02, TL03, ‘Input length’, OK



35. Orientation Settings, Length, Add, TL01, TL03, ‘Input length’, OK



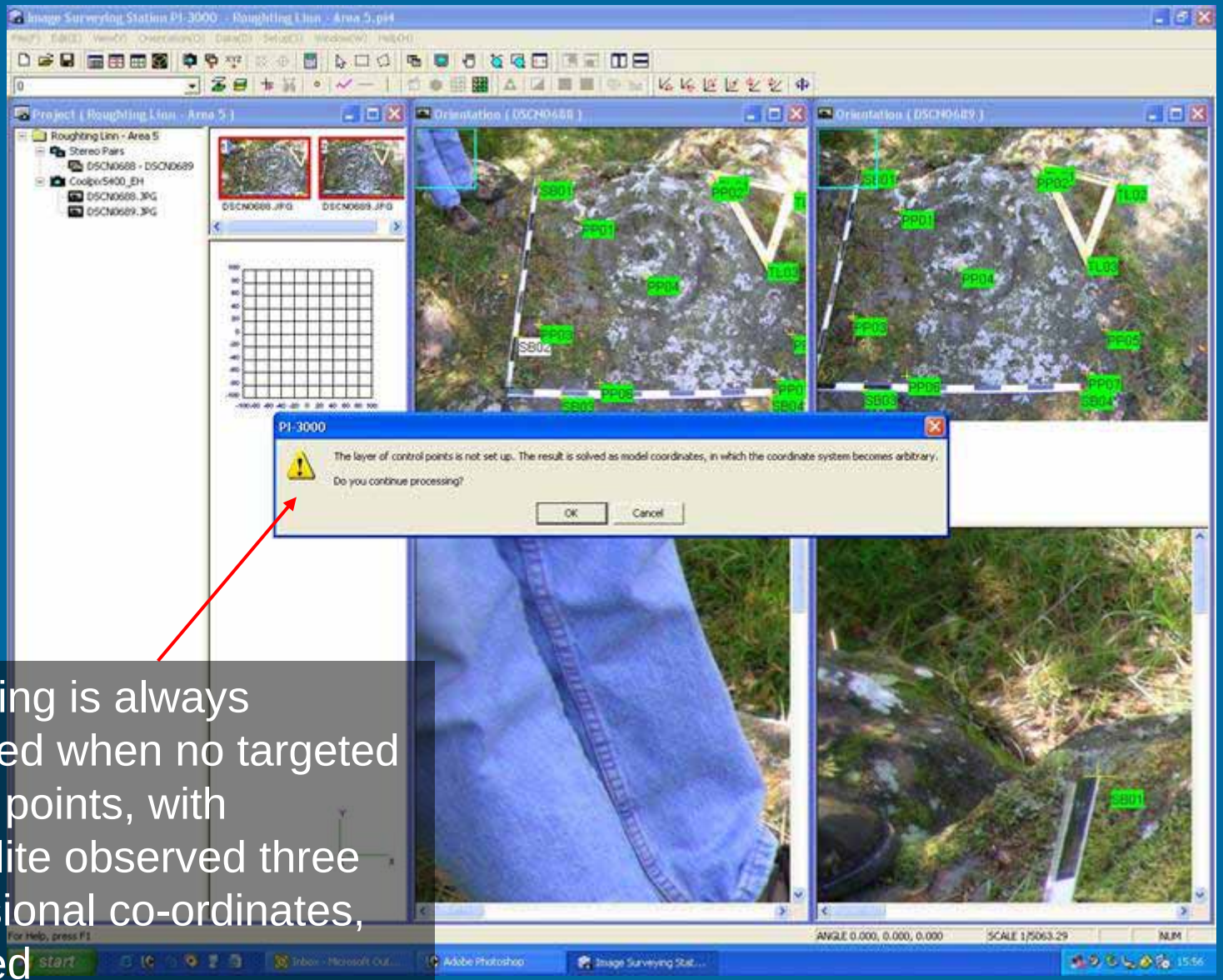
36. Orientation, Calculate Orientation



Calculate Orientation shortcuts

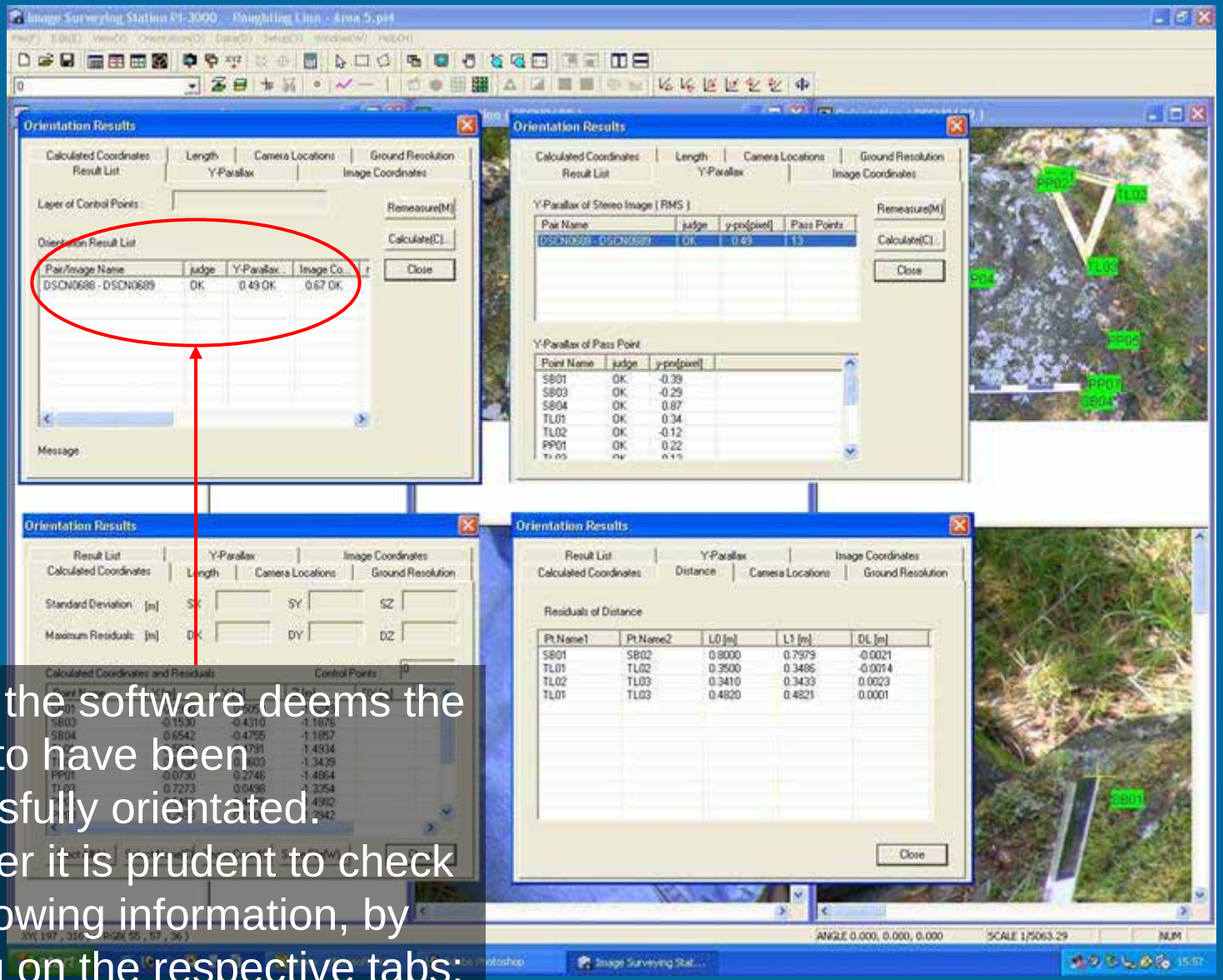
F9 or Calculator symbol

37. Do you continue processing?, OK



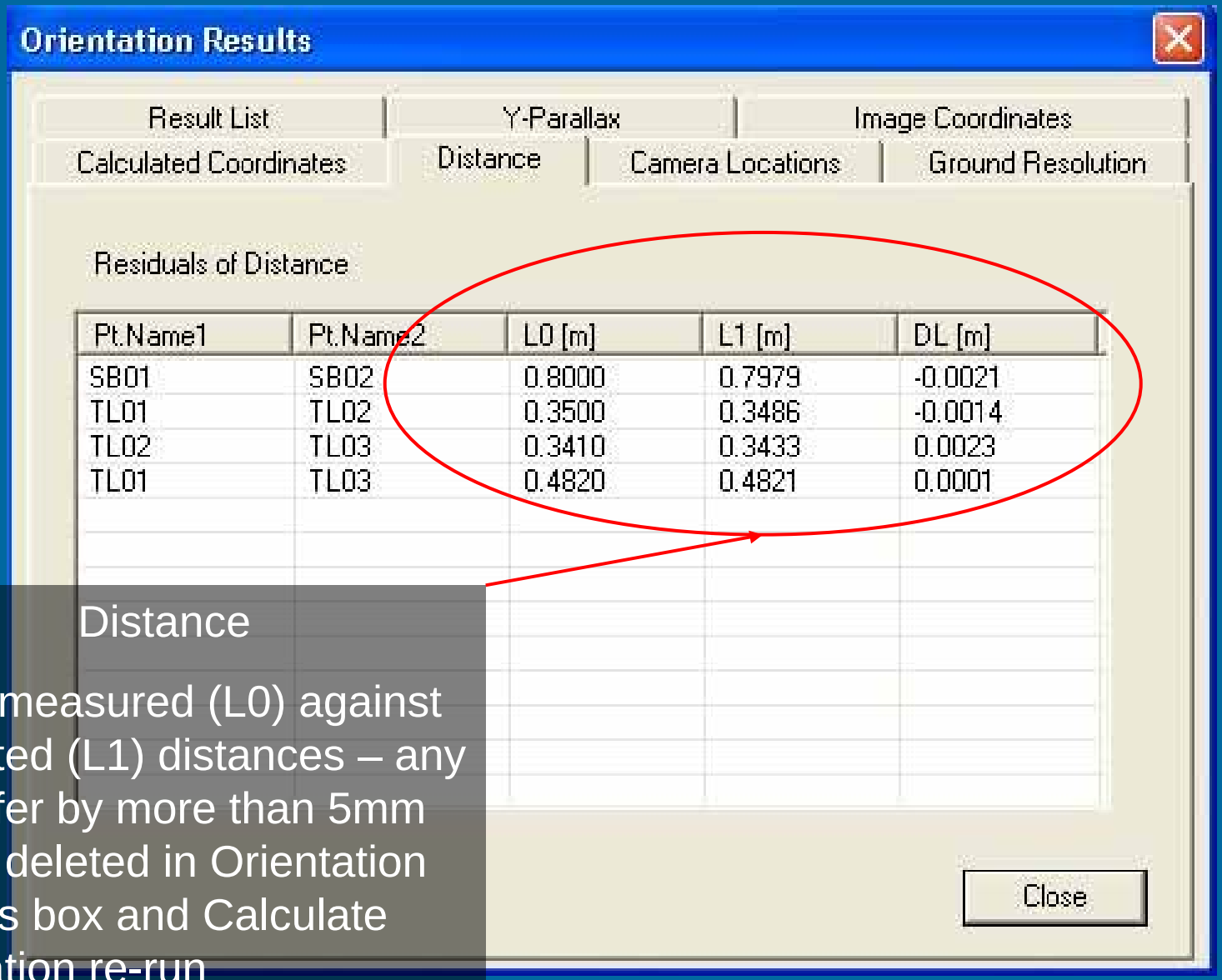
A warning is always produced when no targeted control points, with theodolite observed three dimensional co-ordinates, are used

38. Orientation Results



If ‘OK’, the software deems the model to have been successfully orientated. However it is prudent to check the following information, by clicking on the respective tabs:

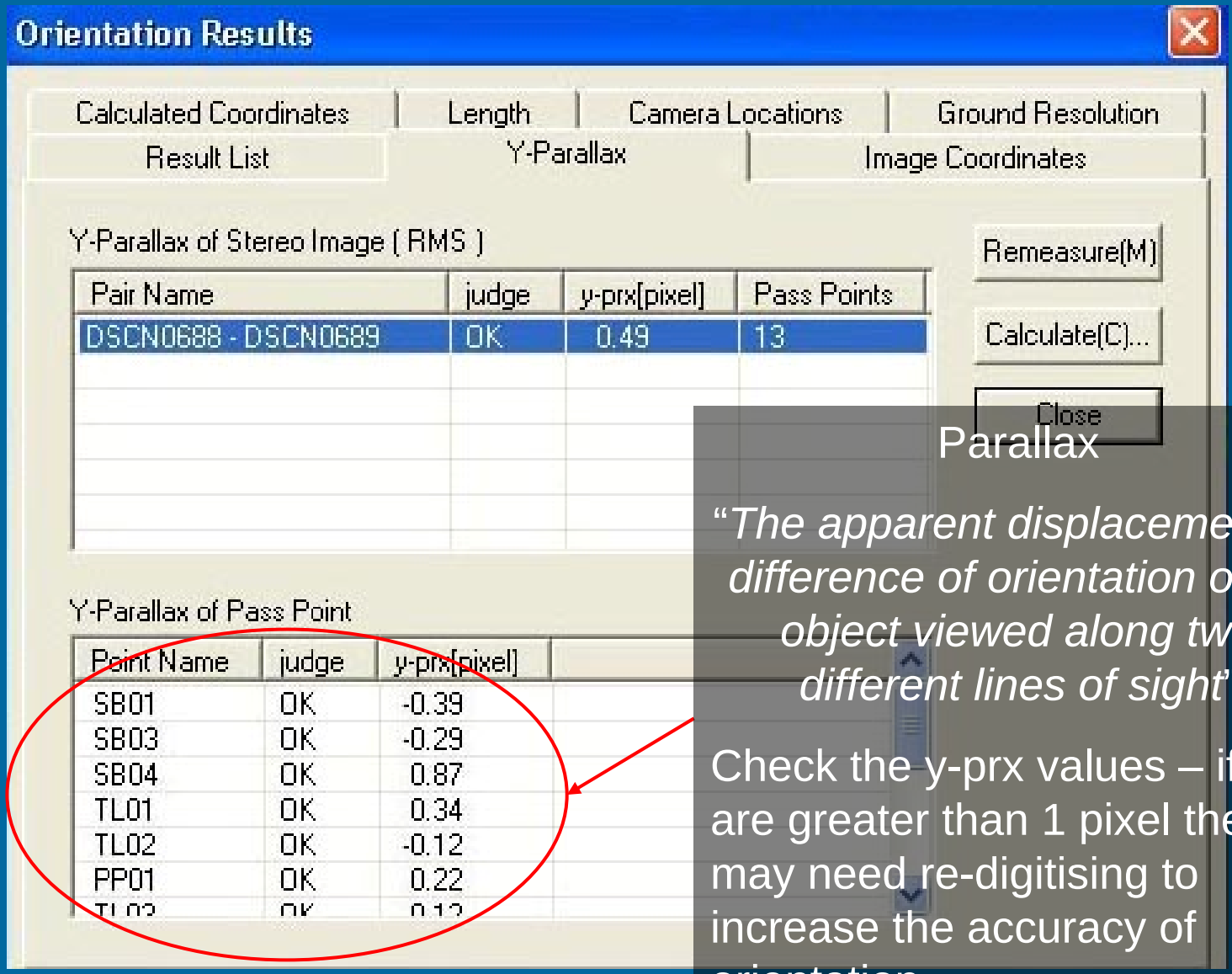
39. Orientation Results - Distance



Distance

Check measured (L0) against computed (L1) distances – any that differ by more than 5mm can be deleted in Orientation Settings box and Calculate Orientation re-run

40. Orientation Results – Y-Parallax



Parallax

"*The apparent displacement or difference of orientation of an object viewed along two different lines of sight*"

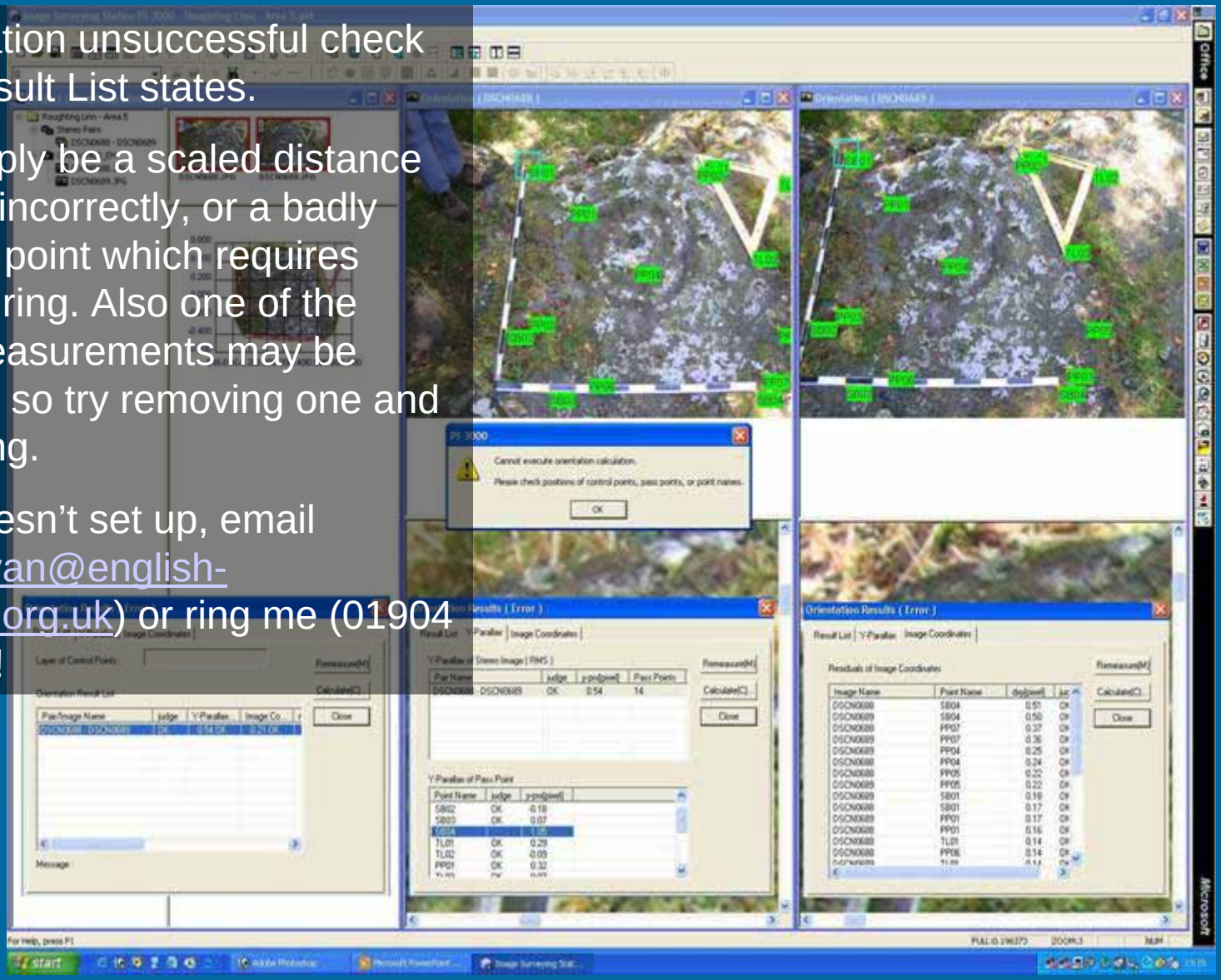
Check the y-prx values – if any are greater than 1 pixel they may need re-digitising to increase the accuracy of orientation

41. Orientation Results - unsuccessful

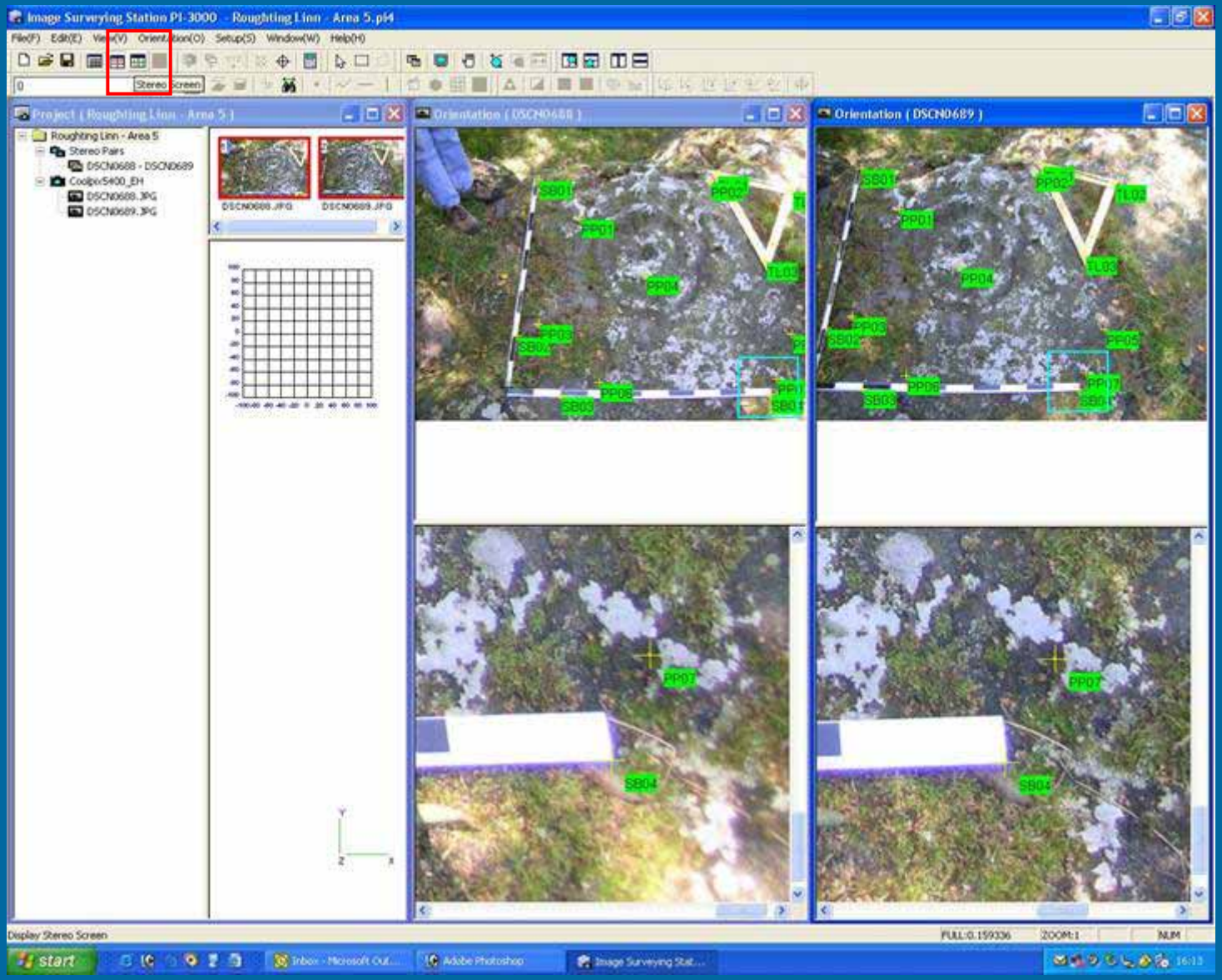
If orientation unsuccessful check what Result List states.

May simply be a scaled distance typed in incorrectly, or a badly digitised point which requires remeasuring. Also one of the scale measurements may be incorrect so try removing one and re-running.

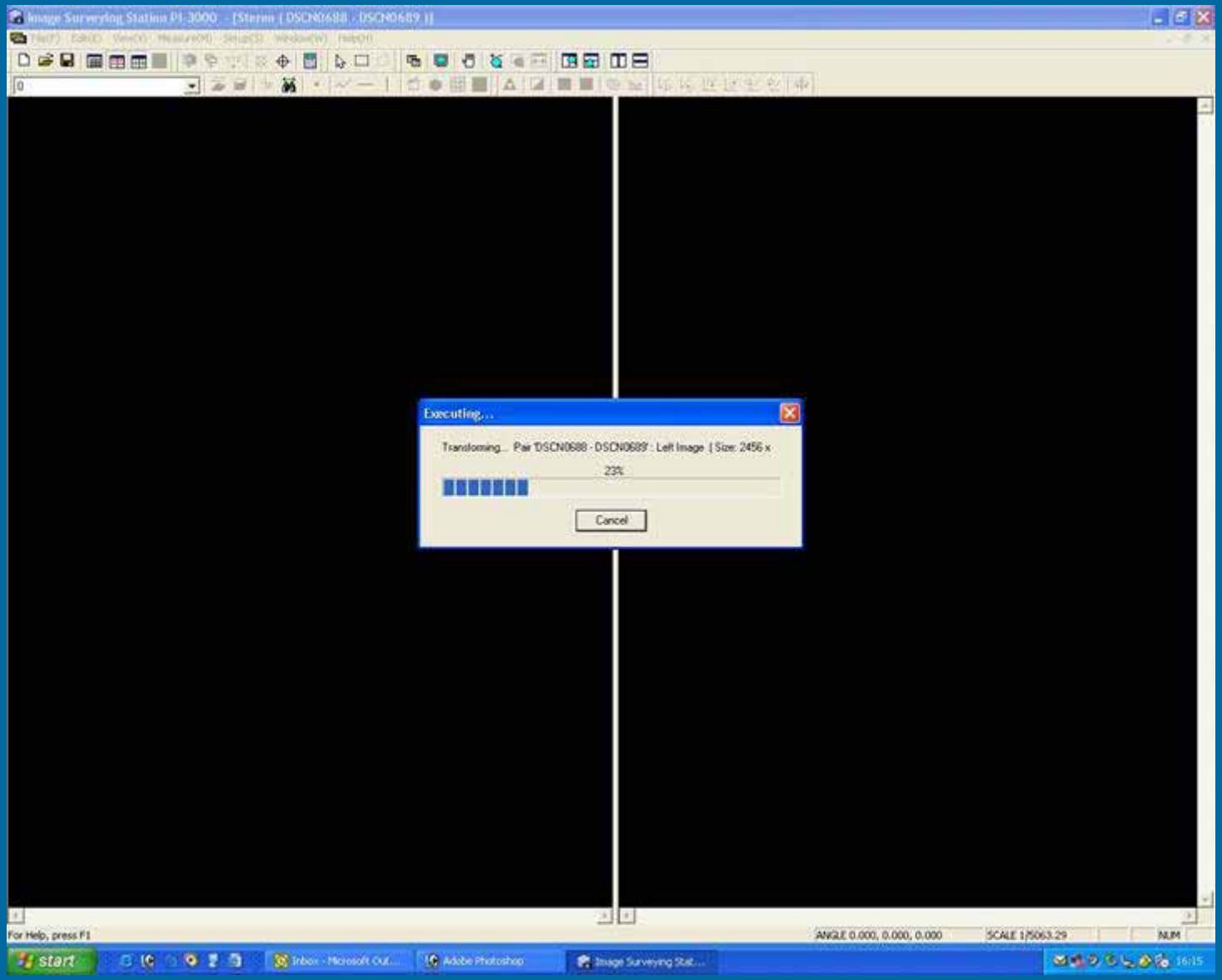
If still doesn't set up, email (paul.bryan@english-heritage.org.uk) or ring me (01904 601959)!



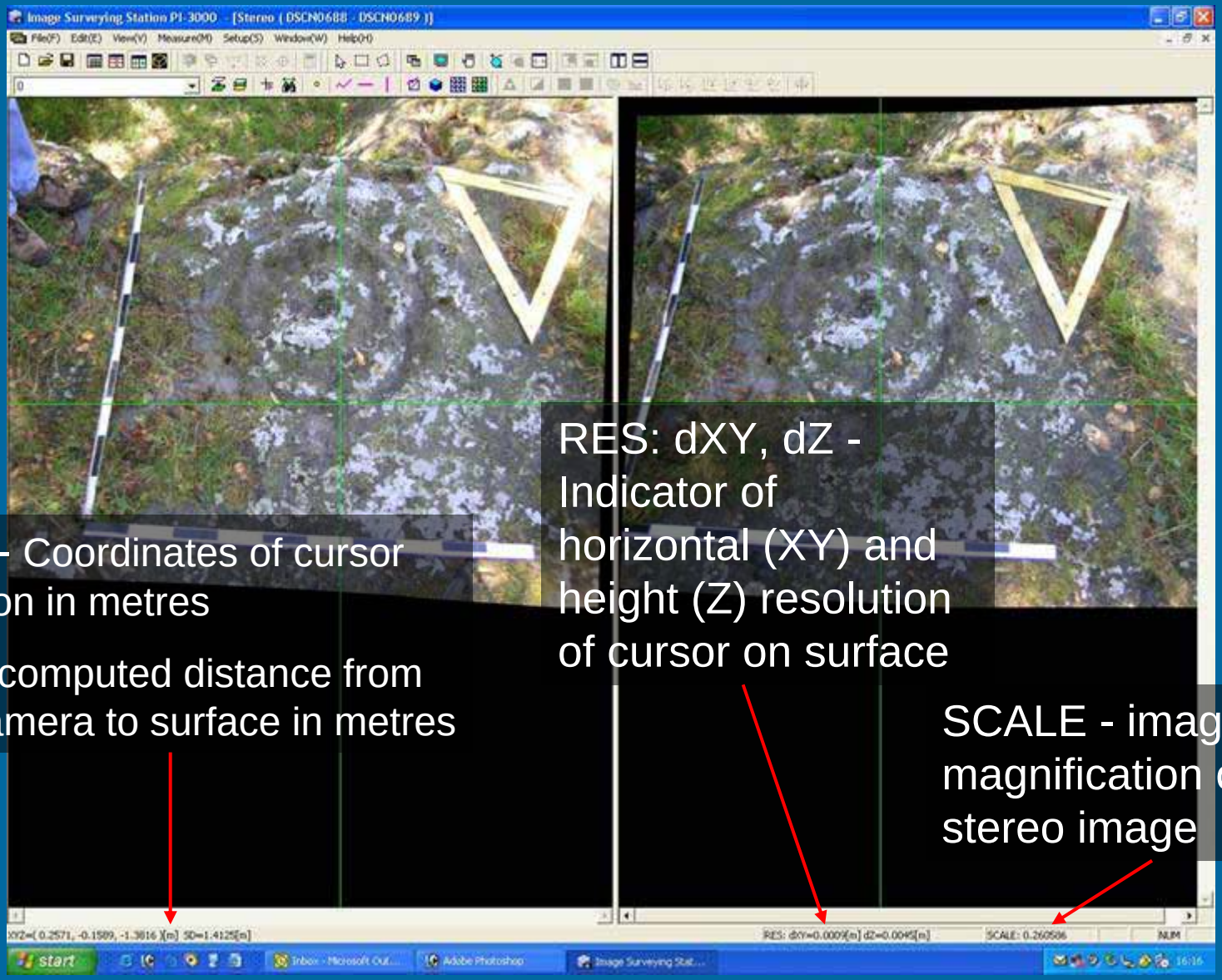
42. Stereo Screen



43. Stereo Screen, Transforming images



44. Stereo Screen



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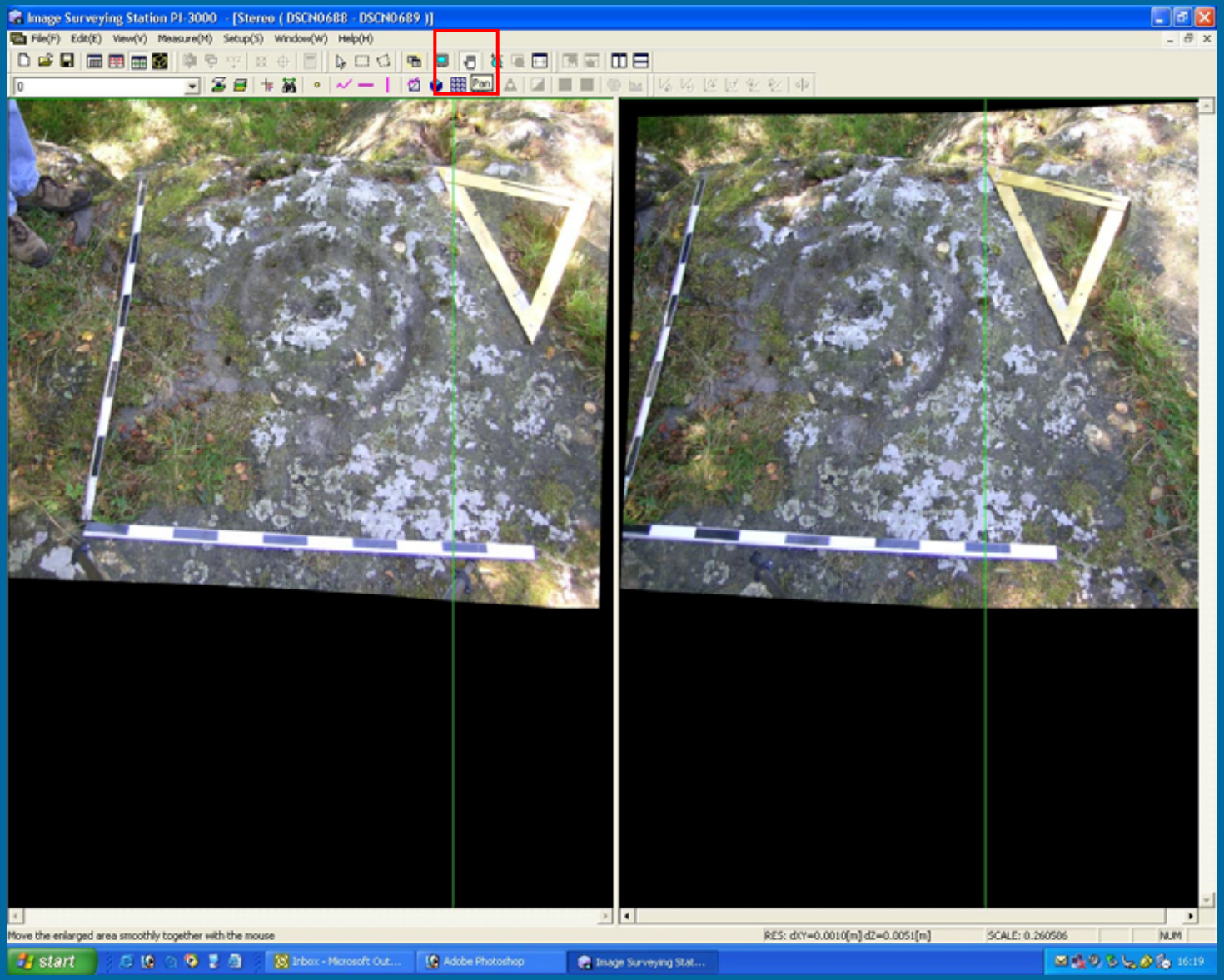
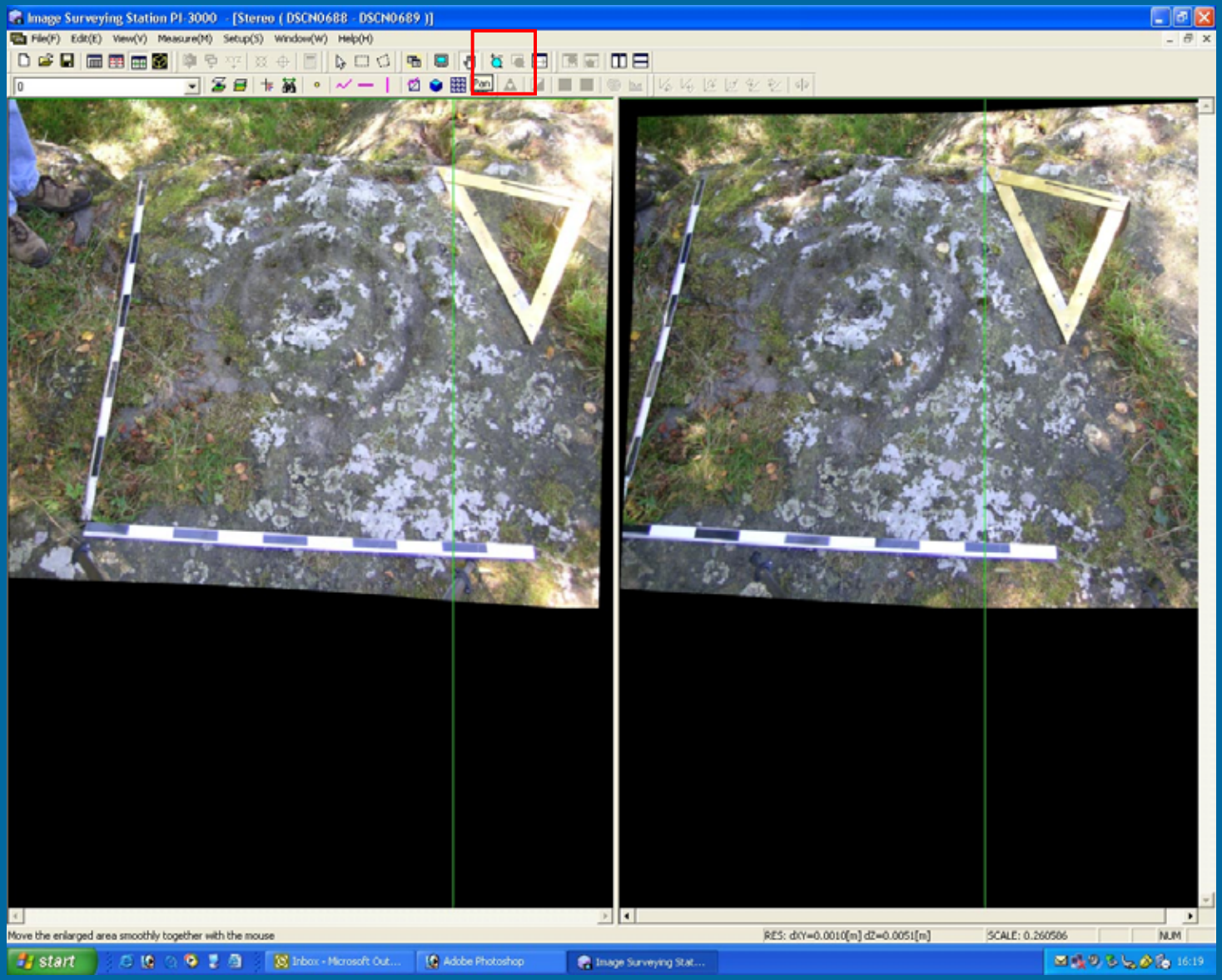
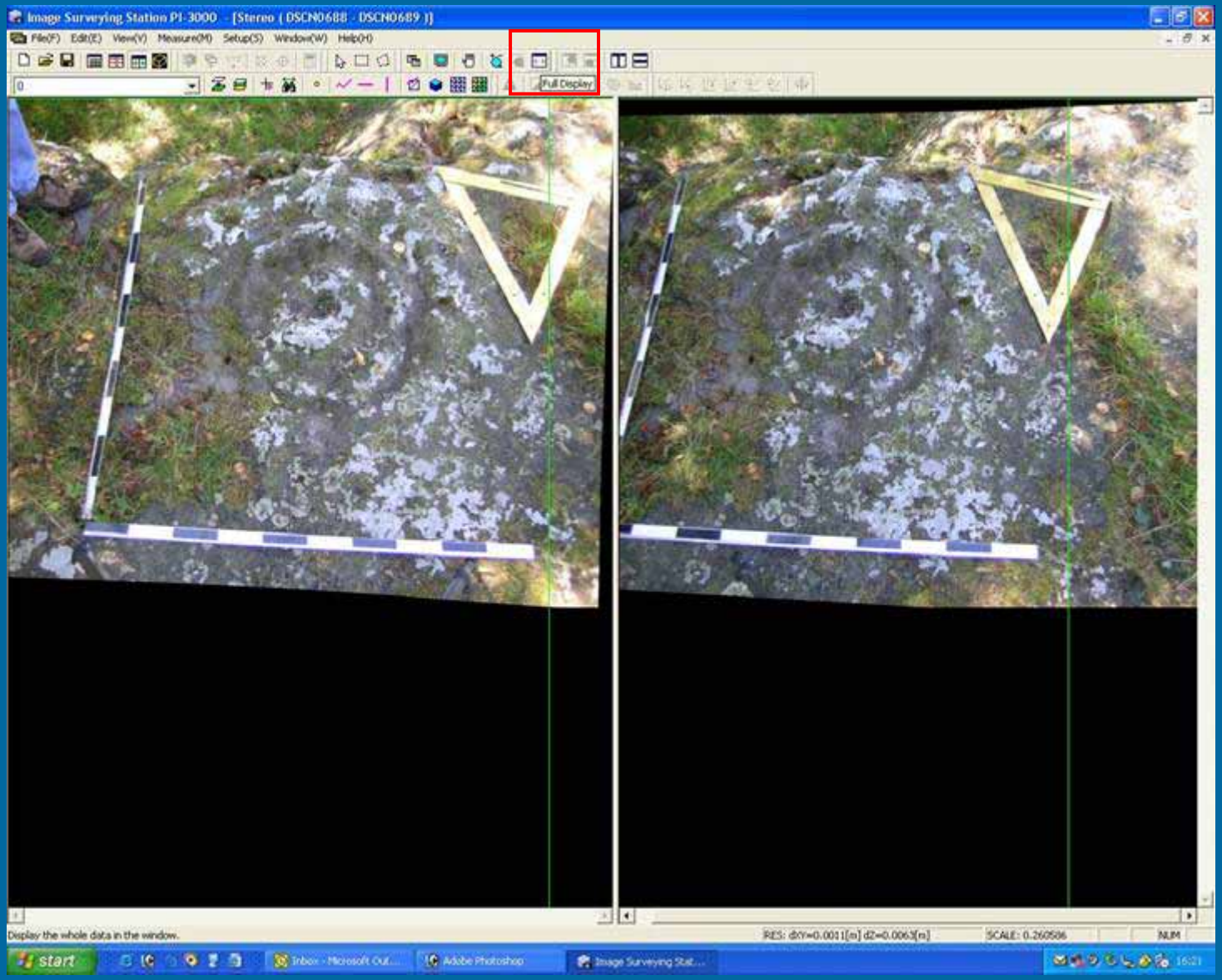
45. Pan , Shortcut M



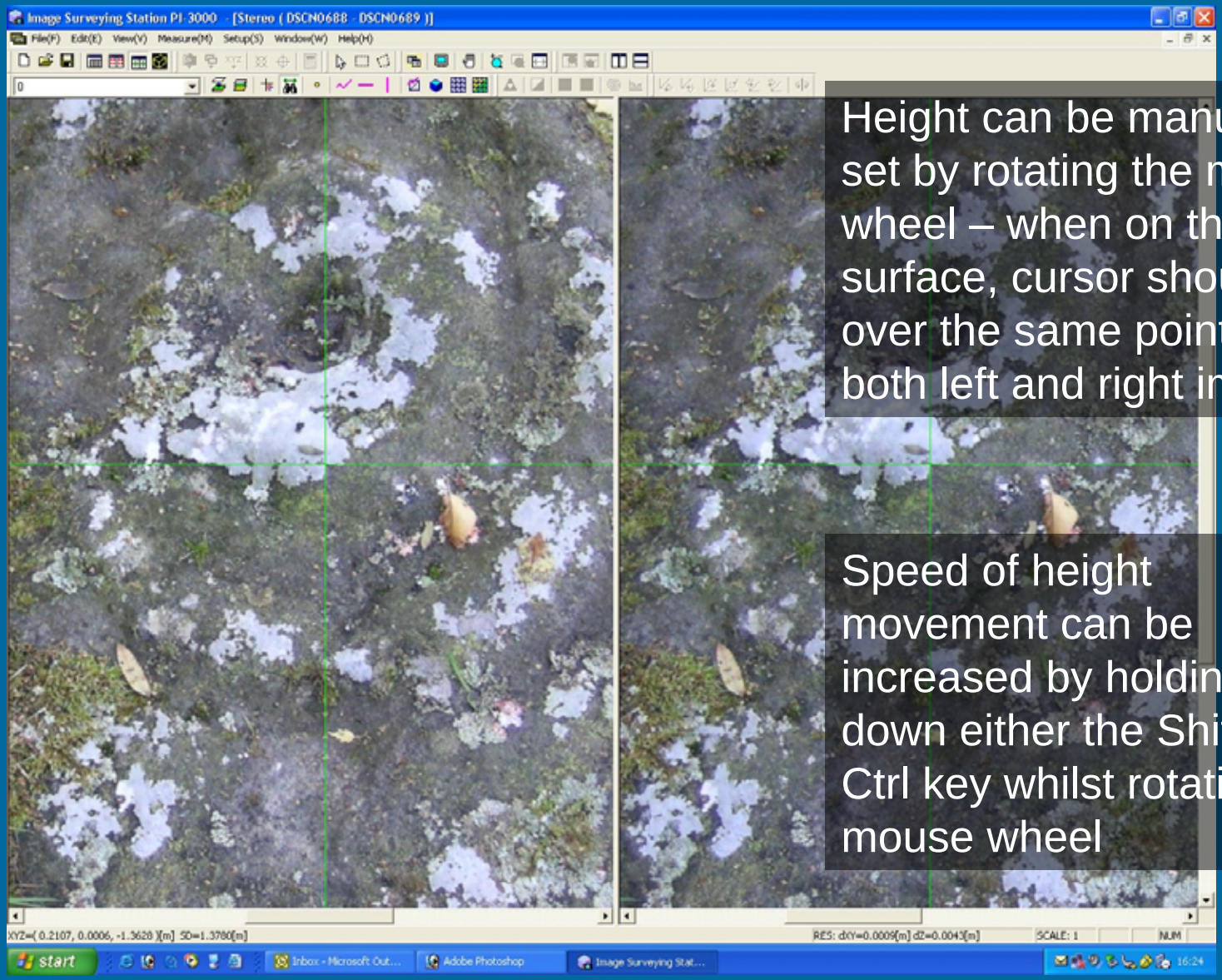
46. Zoom , Shortcut Z



47. Full Display, Shortcut W



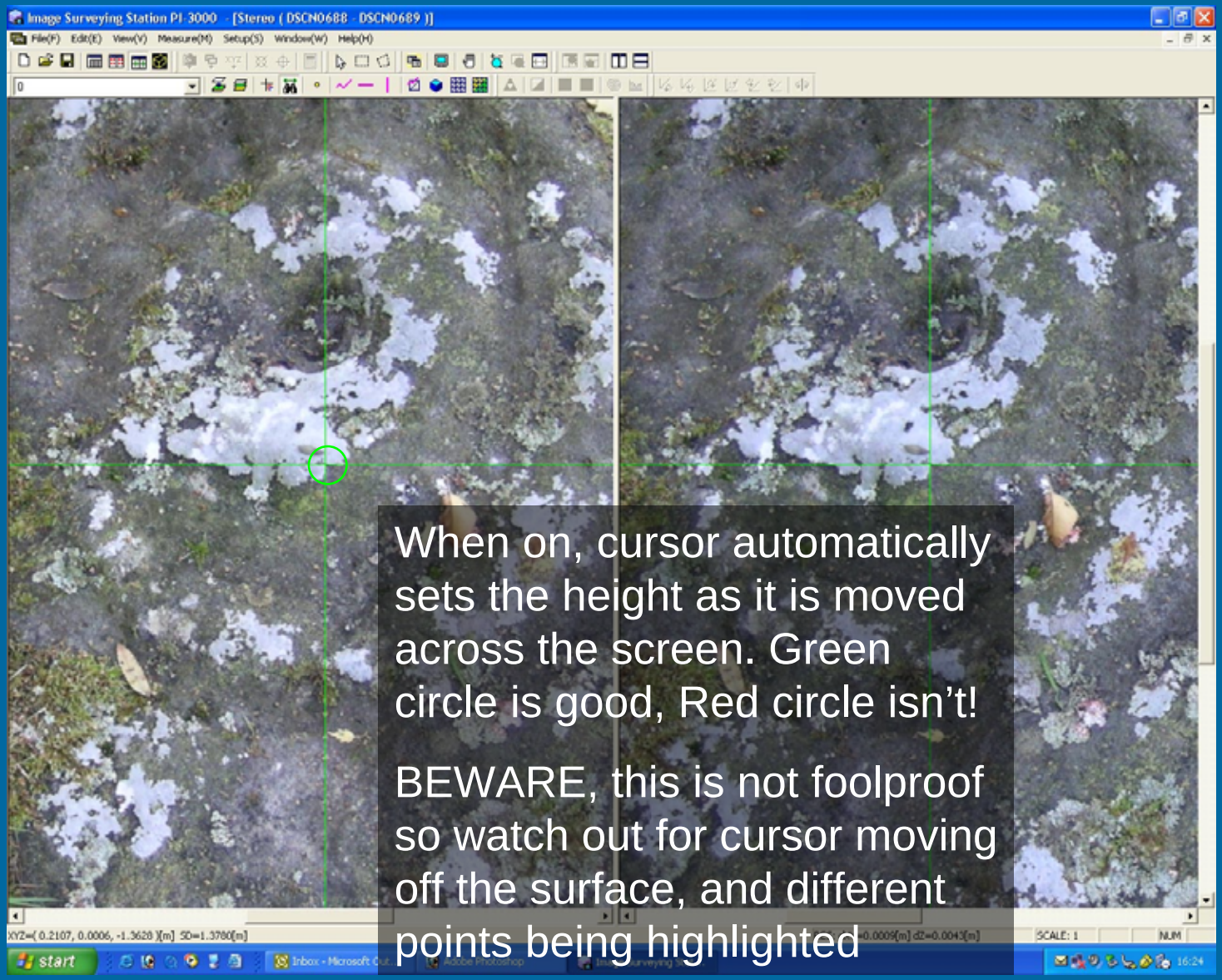
48. Setting height with cursor



Height can be manually set by rotating the mouse wheel – when on the surface, cursor should be over the same point in both left and right image

Speed of height movement can be increased by holding down either the Shift or Ctrl key whilst rotating the mouse wheel

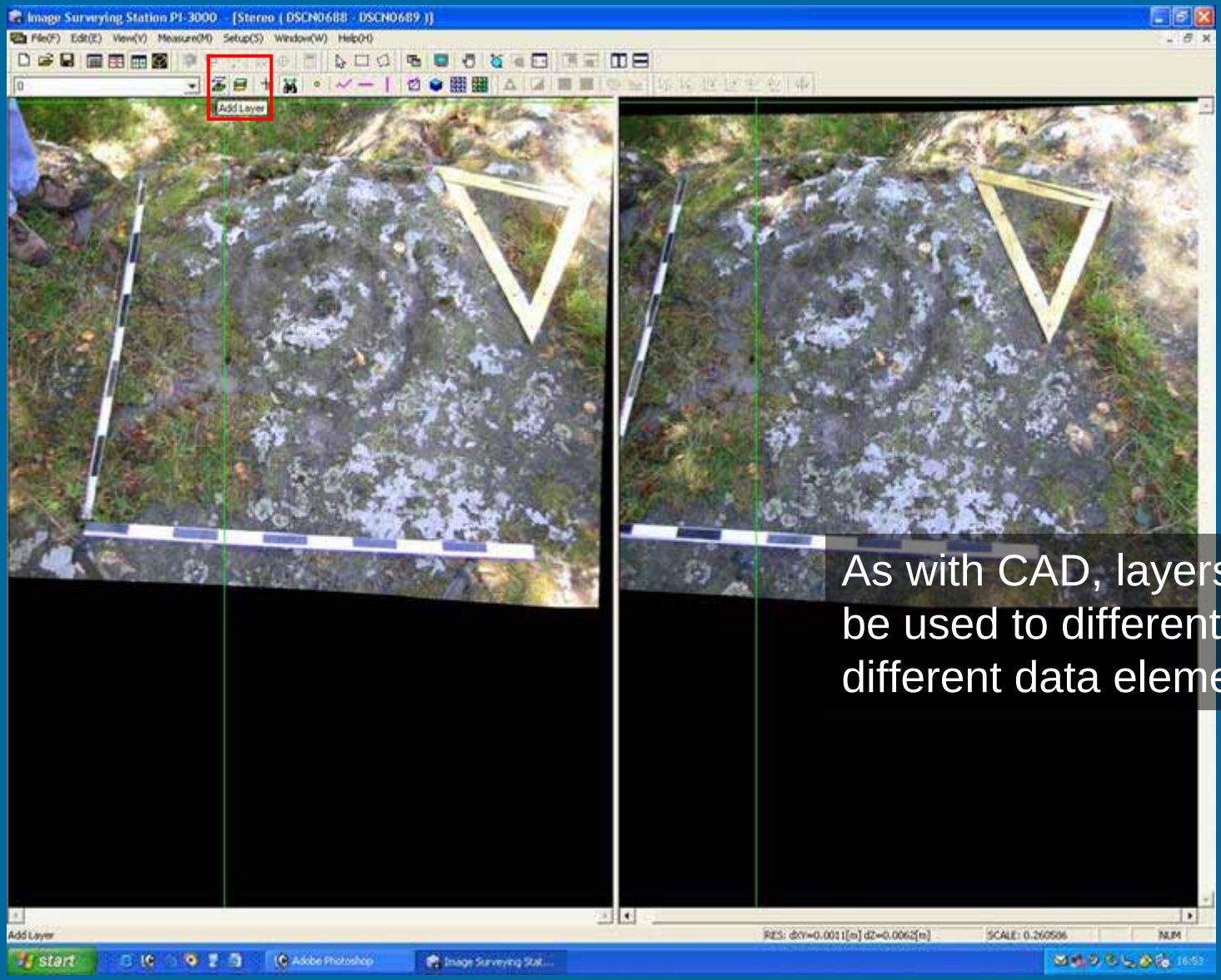
49. Auto correlate On/Off, A+spacebar or middle mouse button



When on, cursor automatically sets the height as it is moved across the screen. Green circle is good, Red circle isn't!

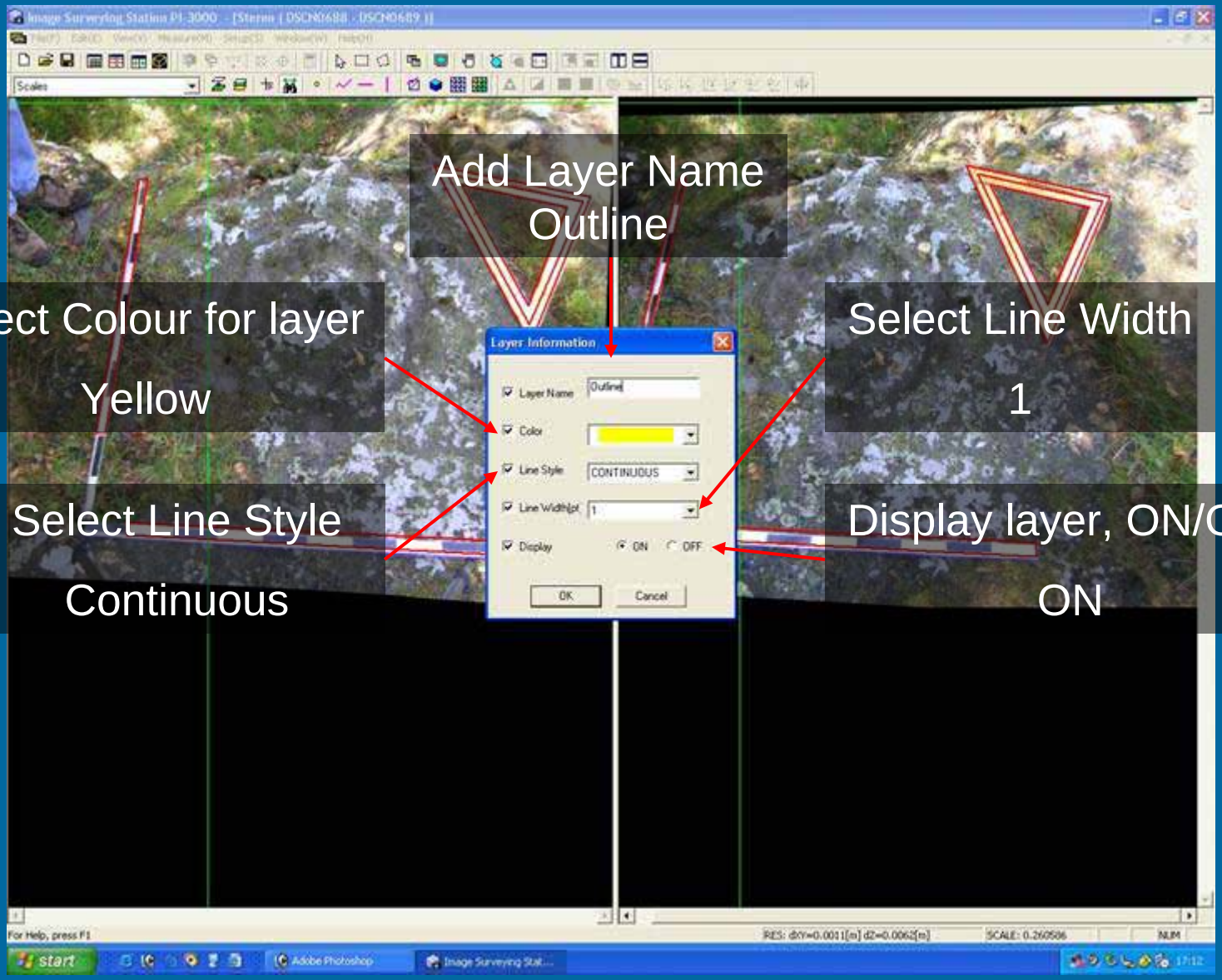
BEWARE, this is not foolproof so watch out for cursor moving off the surface, and different points being highlighted

50. Add Layer

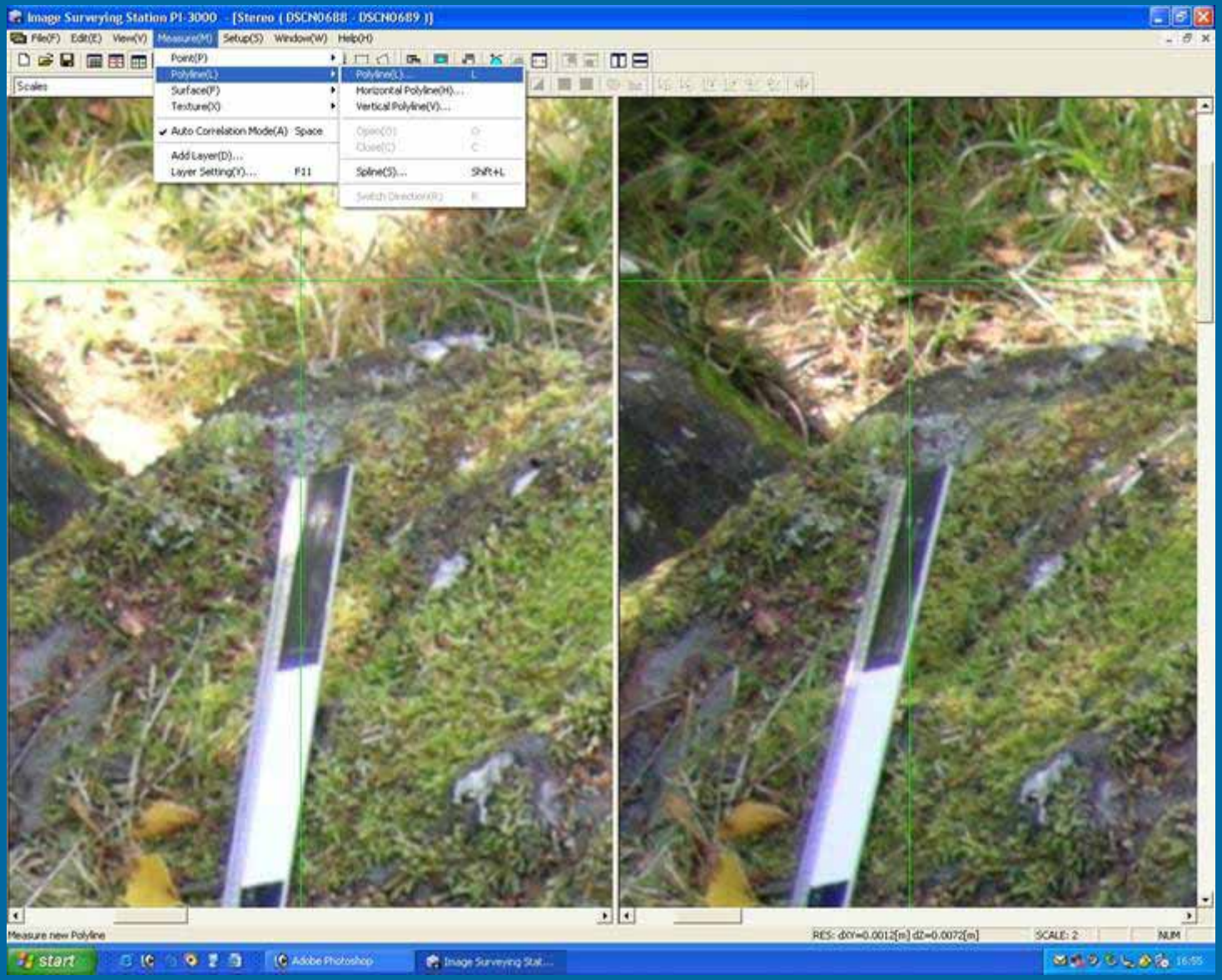


As with CAD, layers can be used to differentiate different data elements

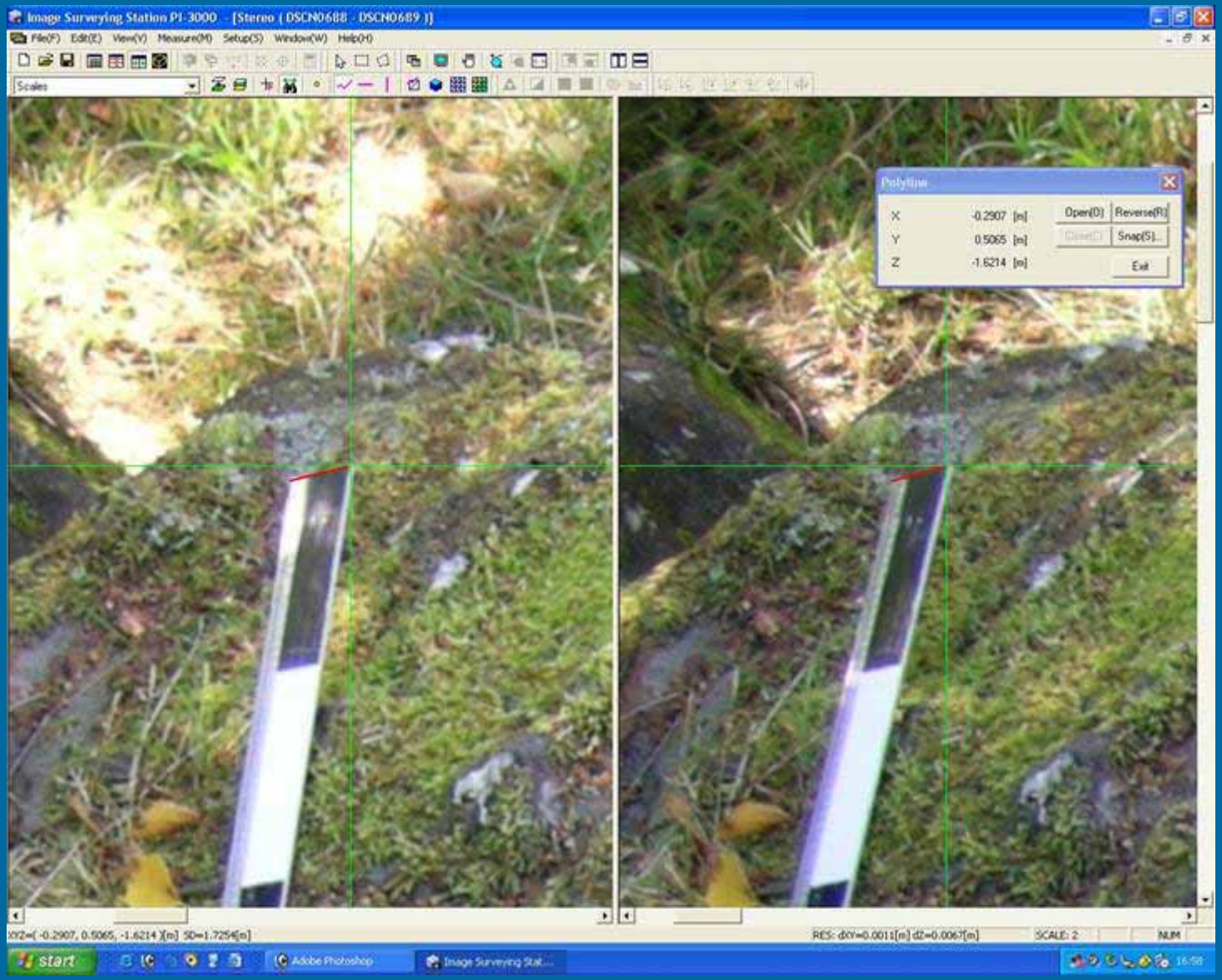
51. Layer Information, Outline, OK



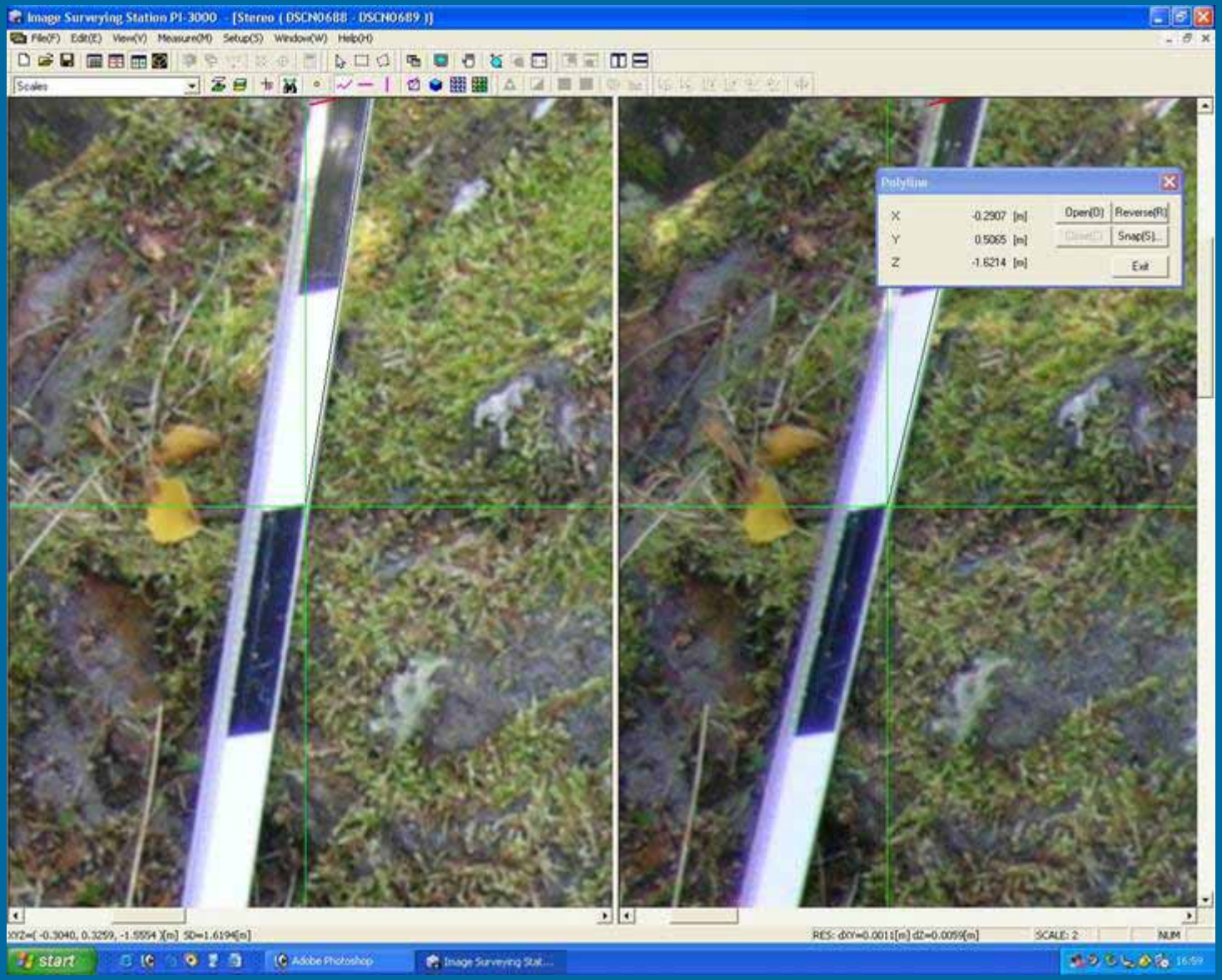
52. Measure, Polyline, Polyline



53. Digitising Polyline



54. Use S to centre each image when Digitising



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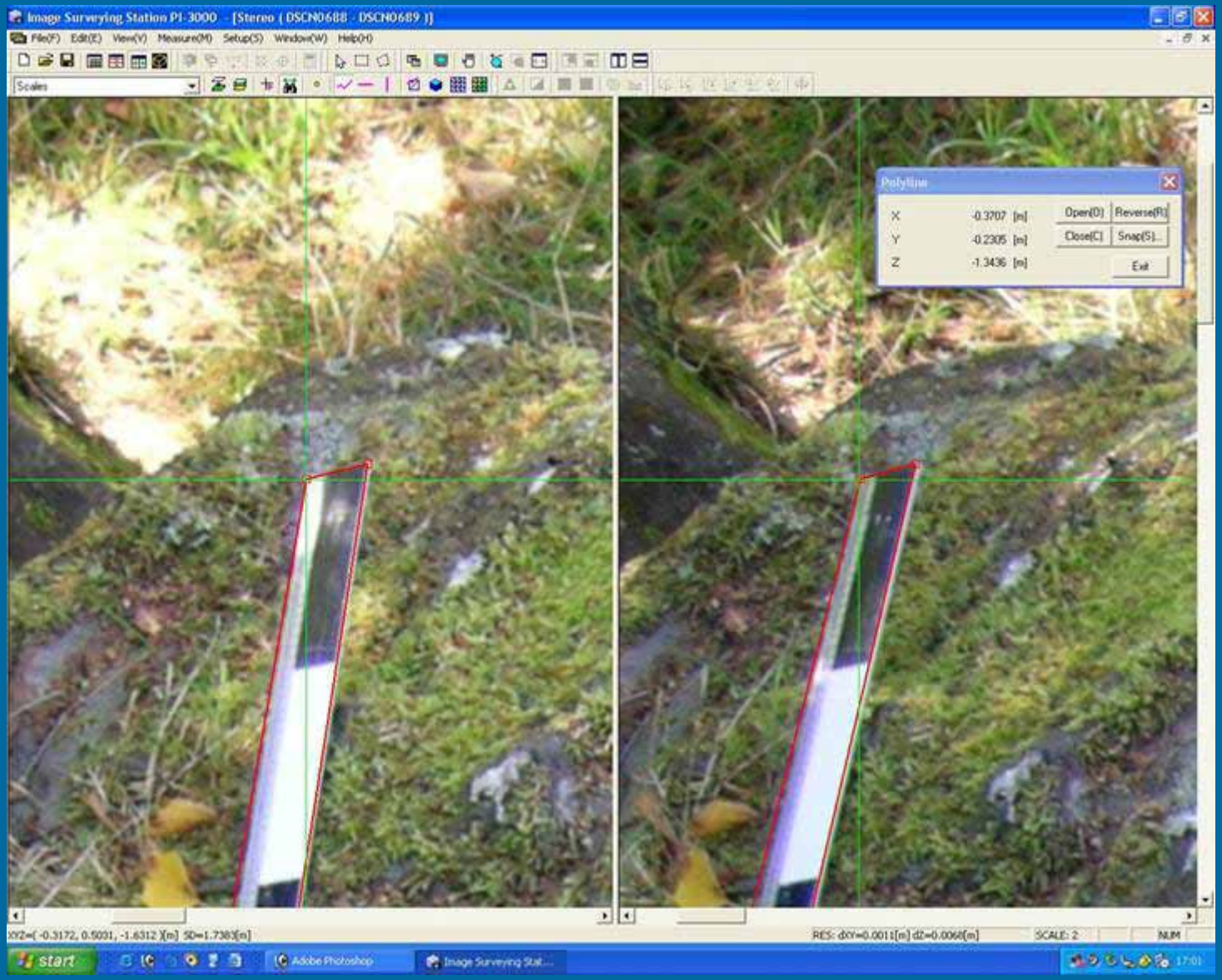
55. Use C to Close each polyline when Digitising



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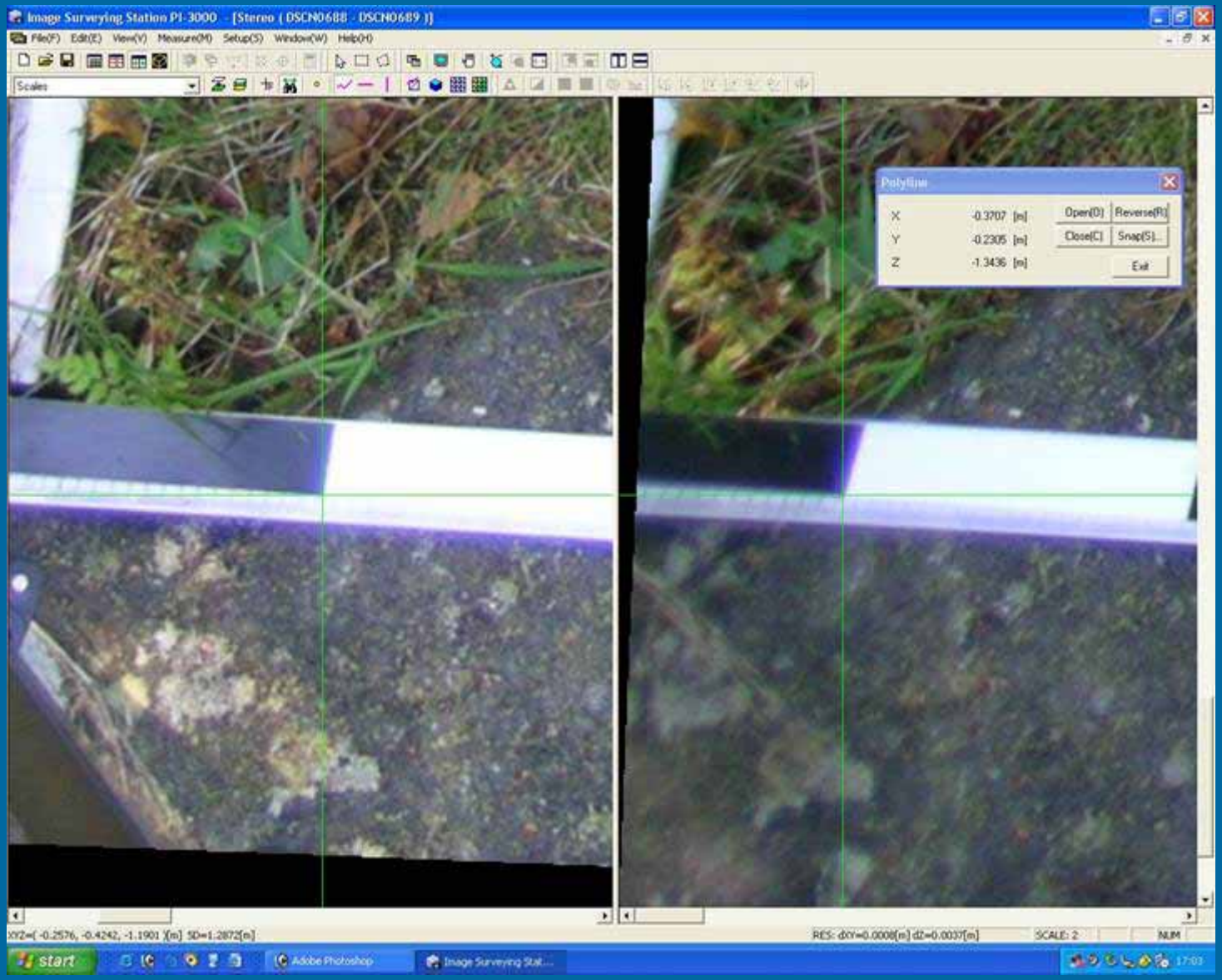
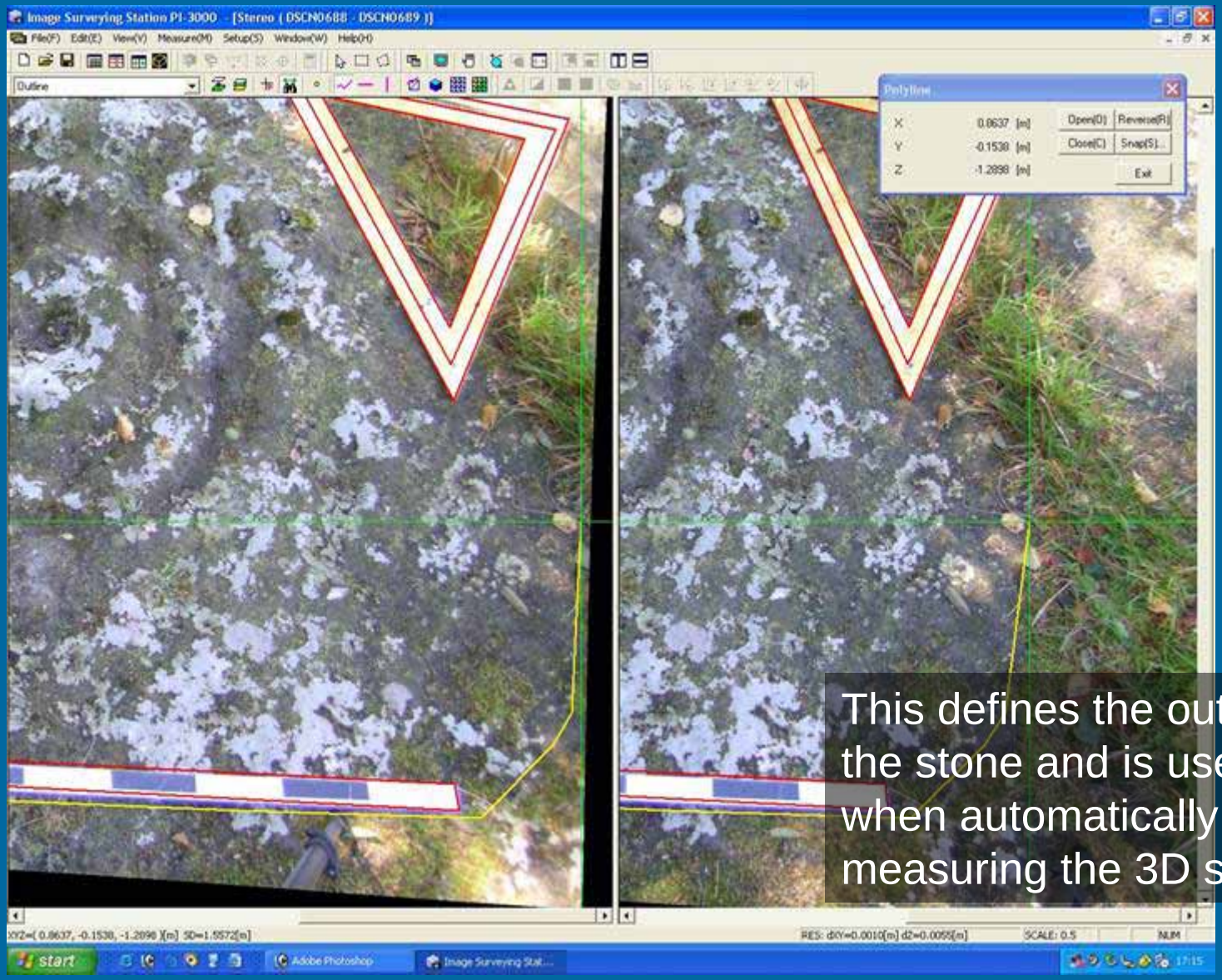
56. Use O to Open a new polyline when Digitising



57. Digitising Polyline, outline



This defines the outline of the stone and is used when automatically measuring the 3D surface

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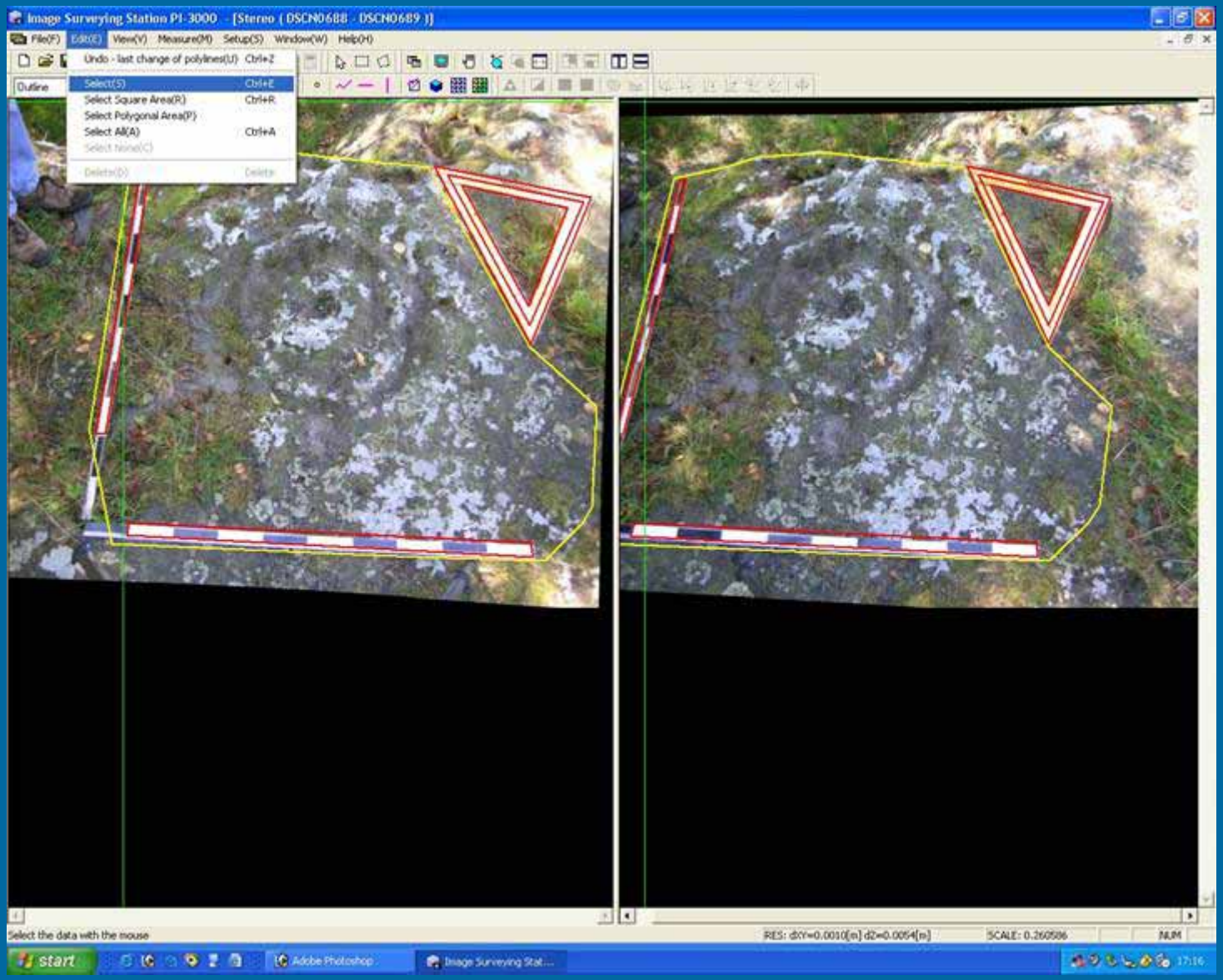
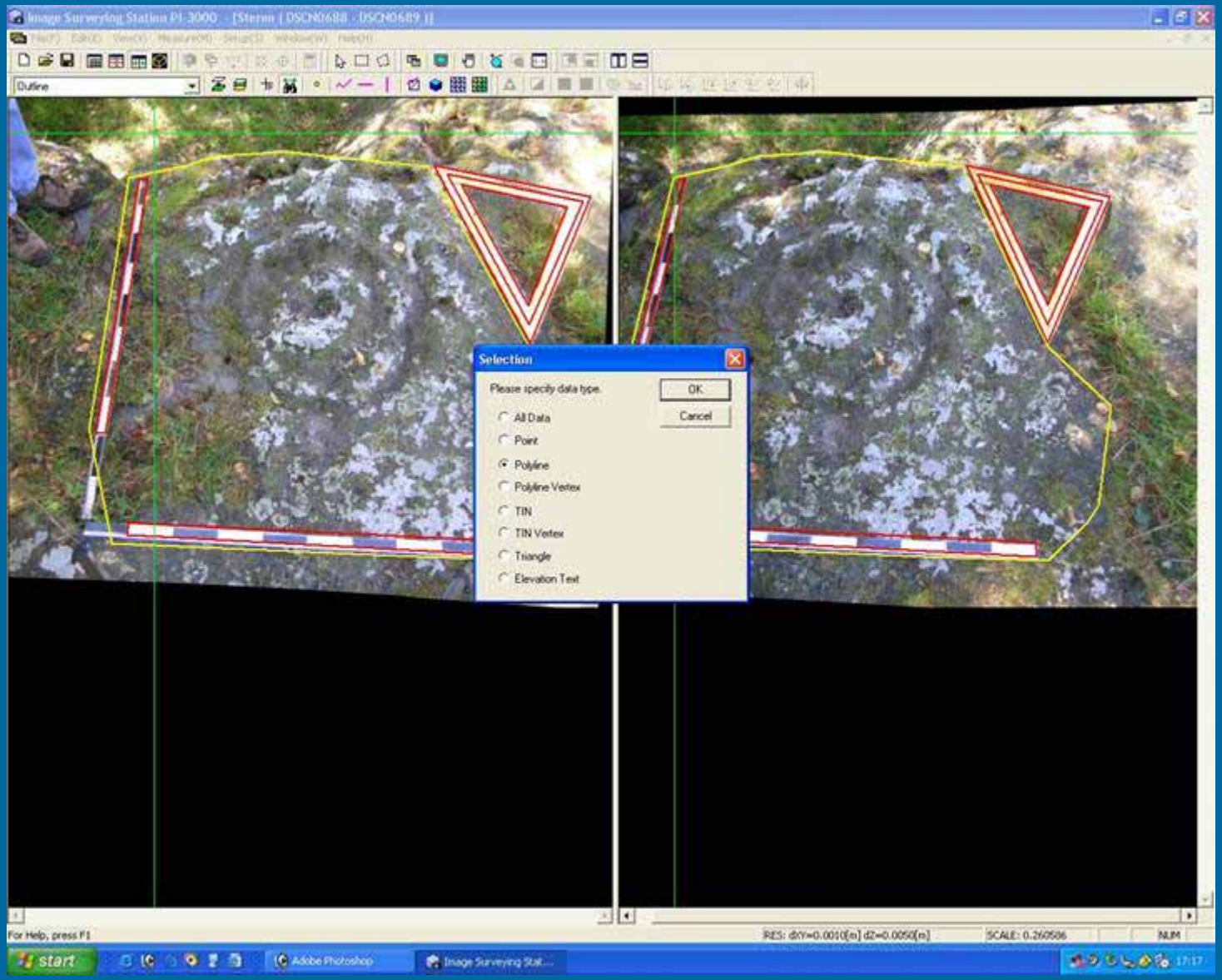
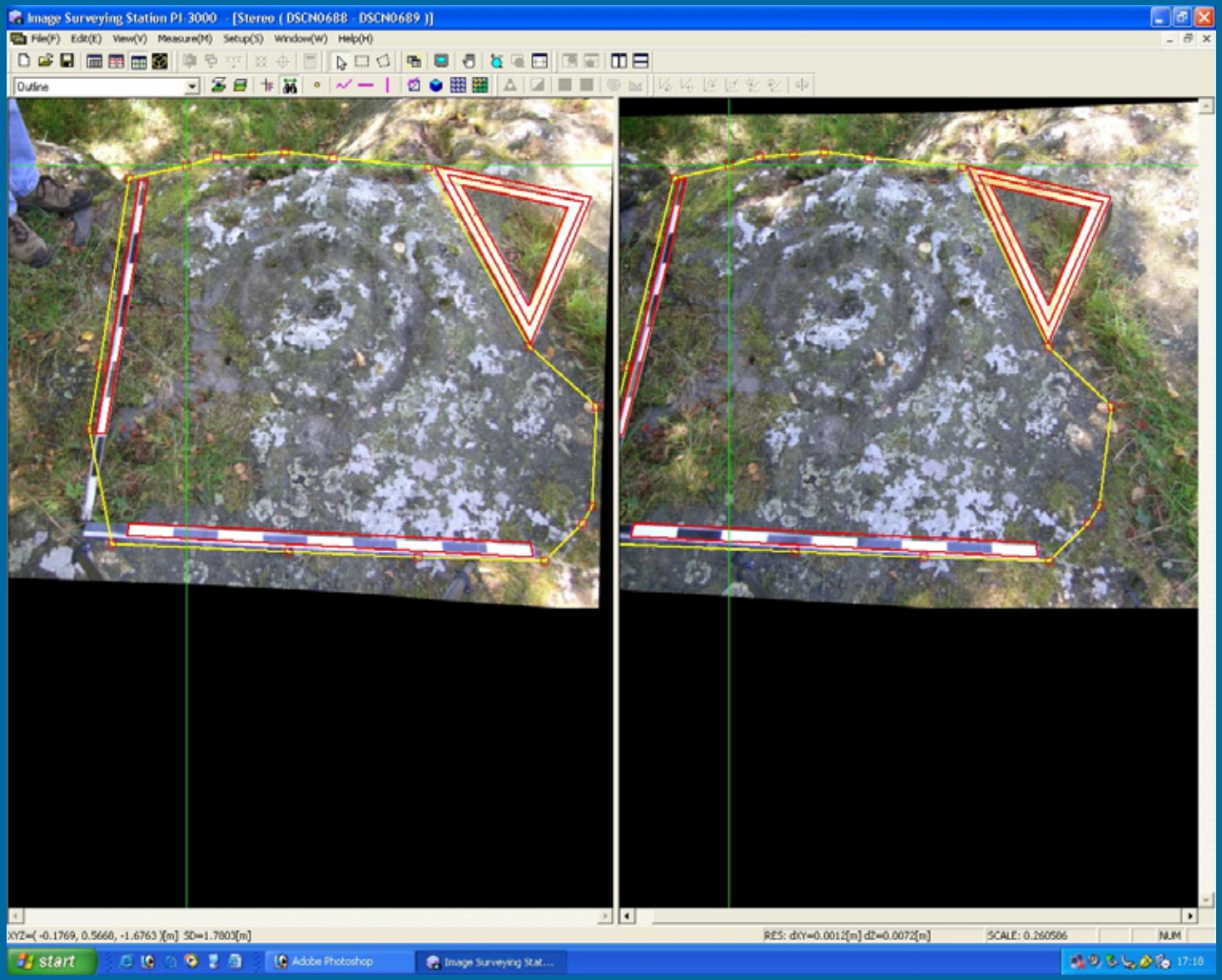
58. Selecting Outline polyline - Edit, Select



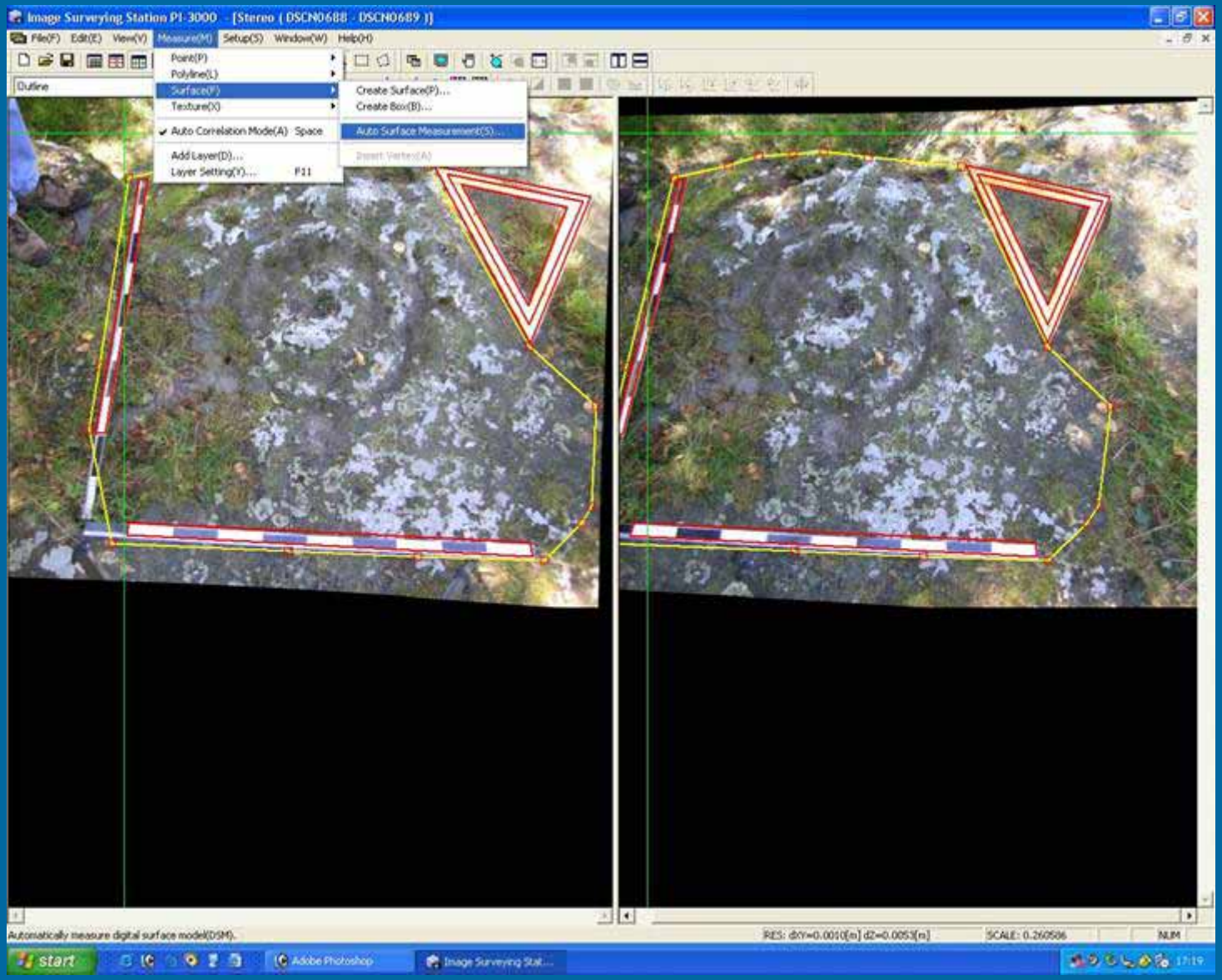
59. Polyline, OK



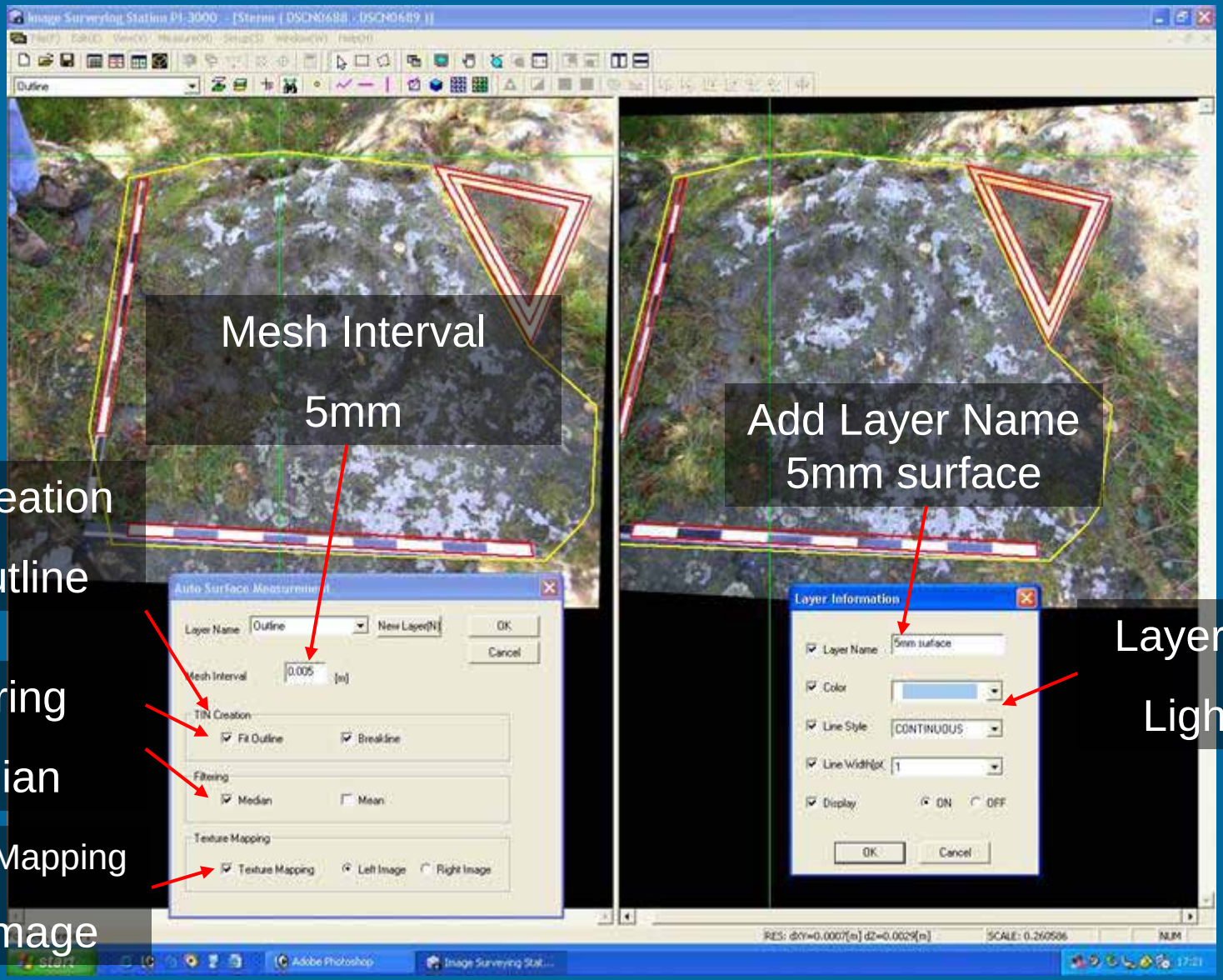
60. Hold cursor over outline, press left mouse button to select polyline



61. Measure, Surface, Auto Surface Measurements



62. Auto Surface Measurement, New Layer, Layer Information



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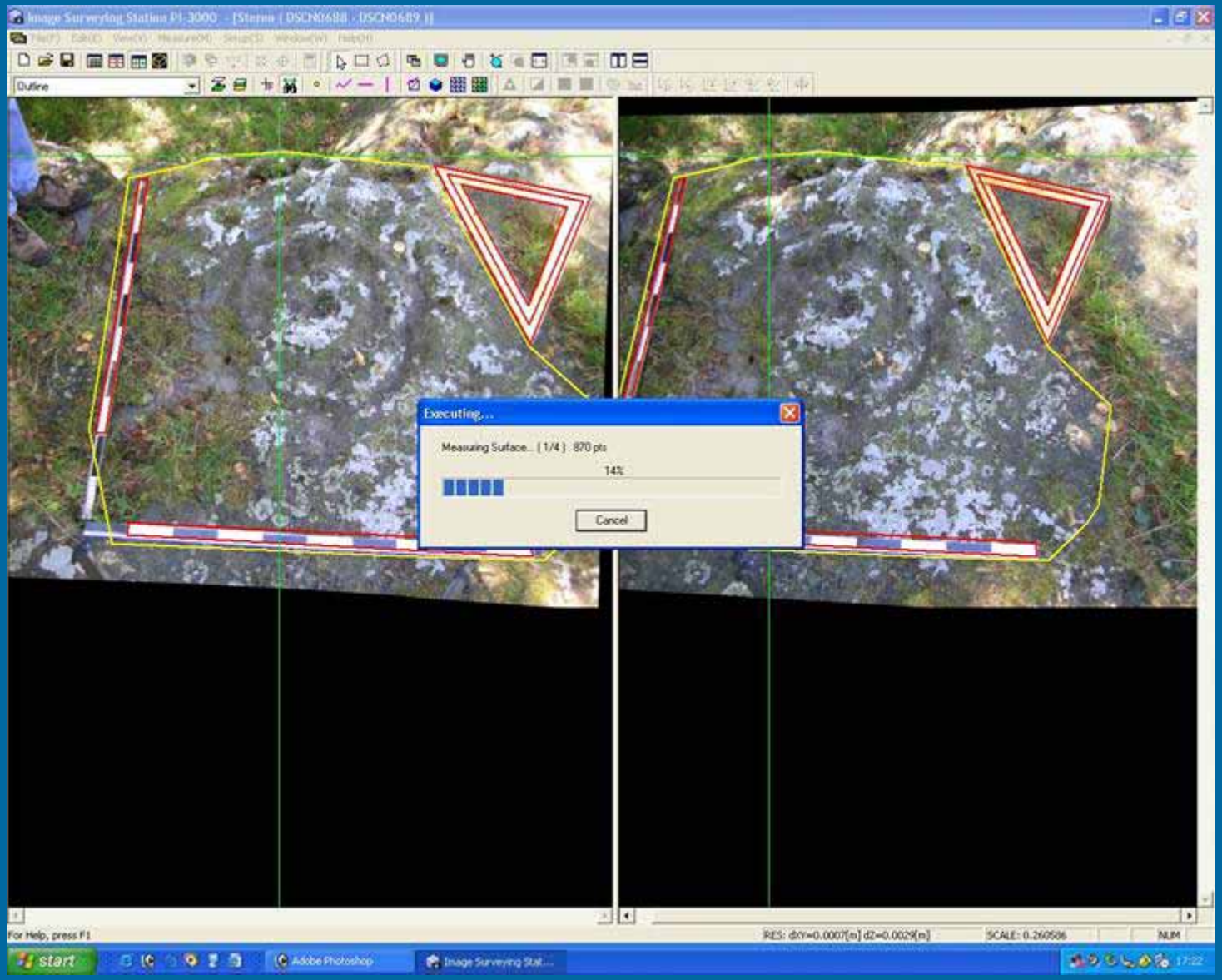
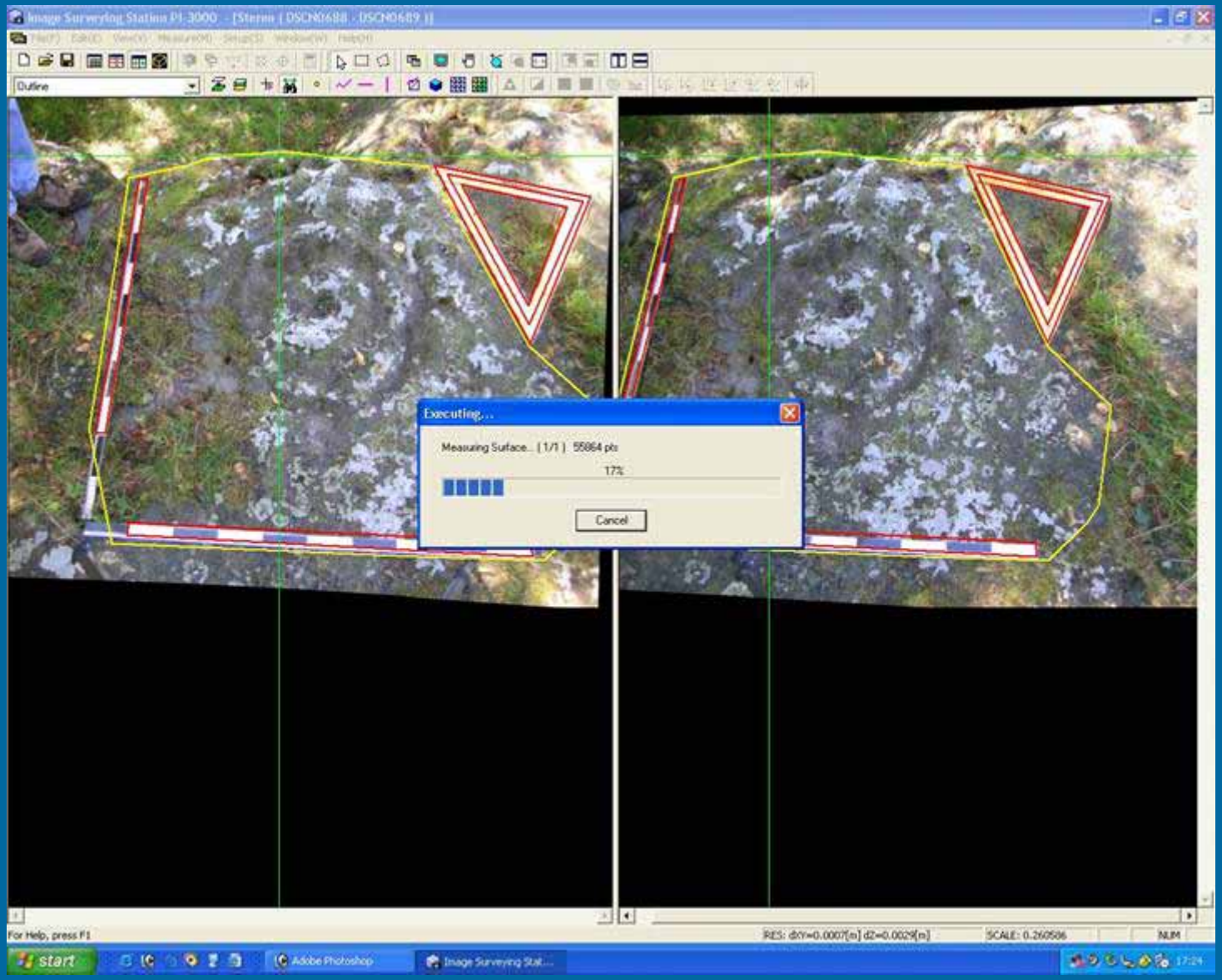
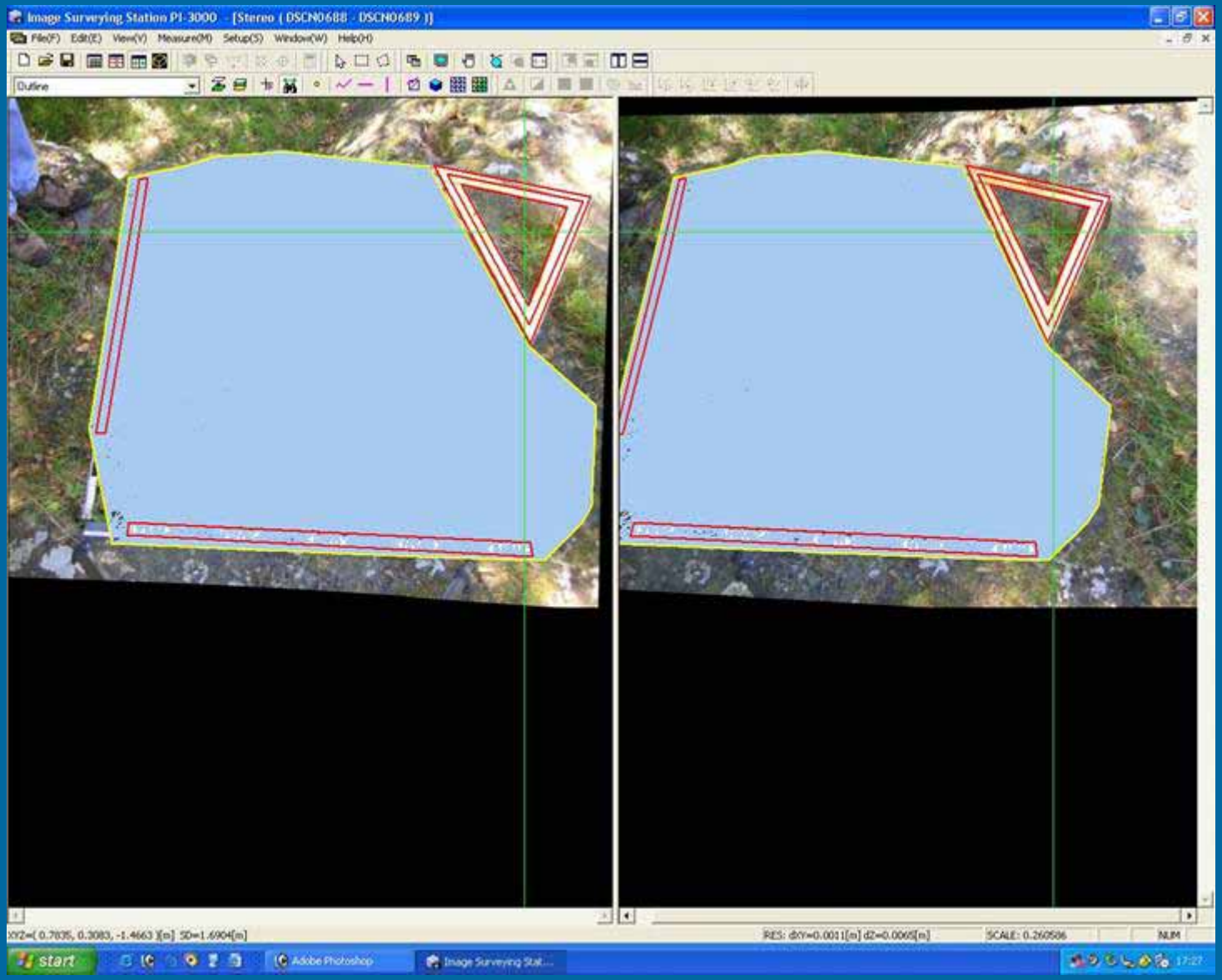
63. Measuring Surface



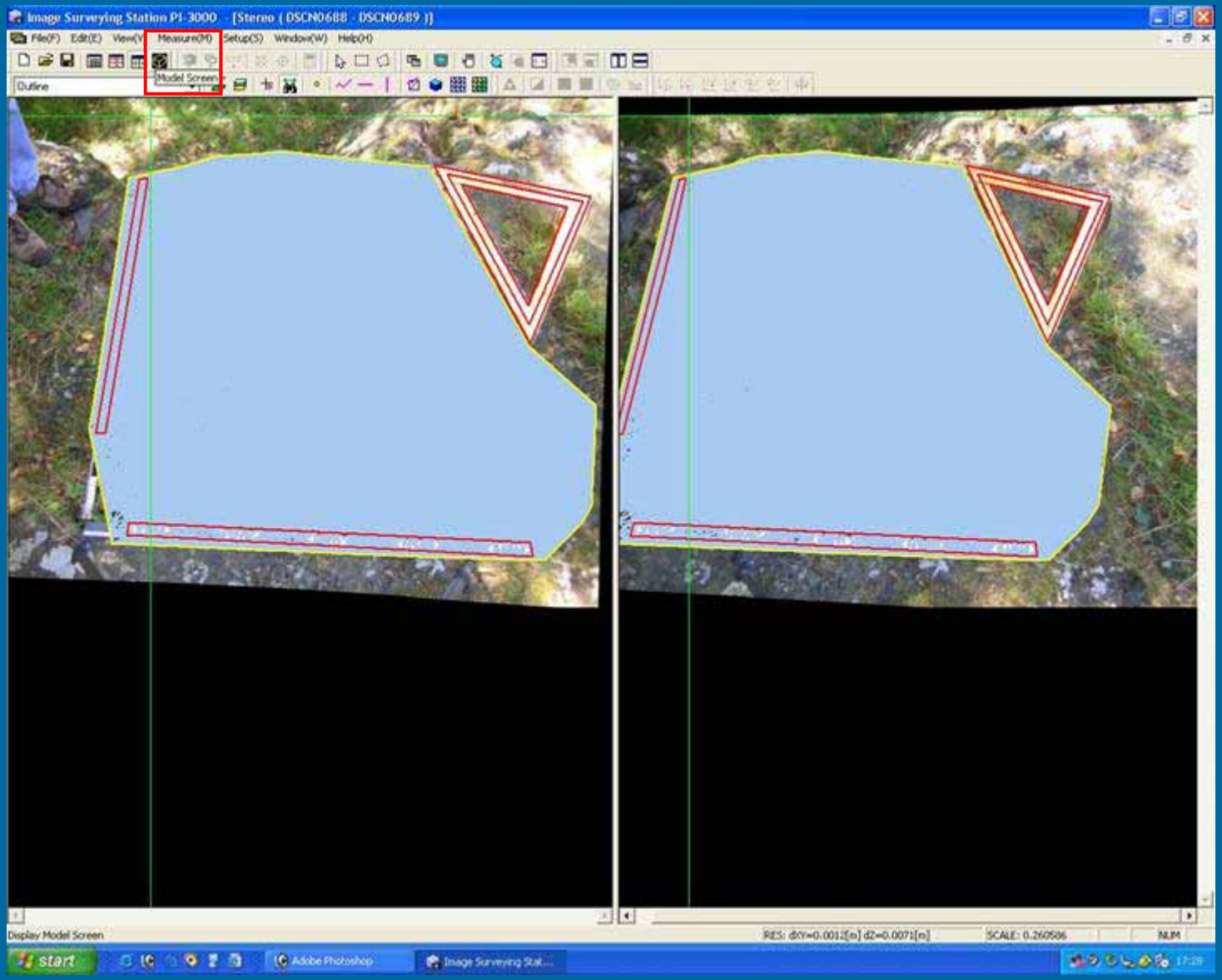
64. Measuring Surface – several passes to achieve result



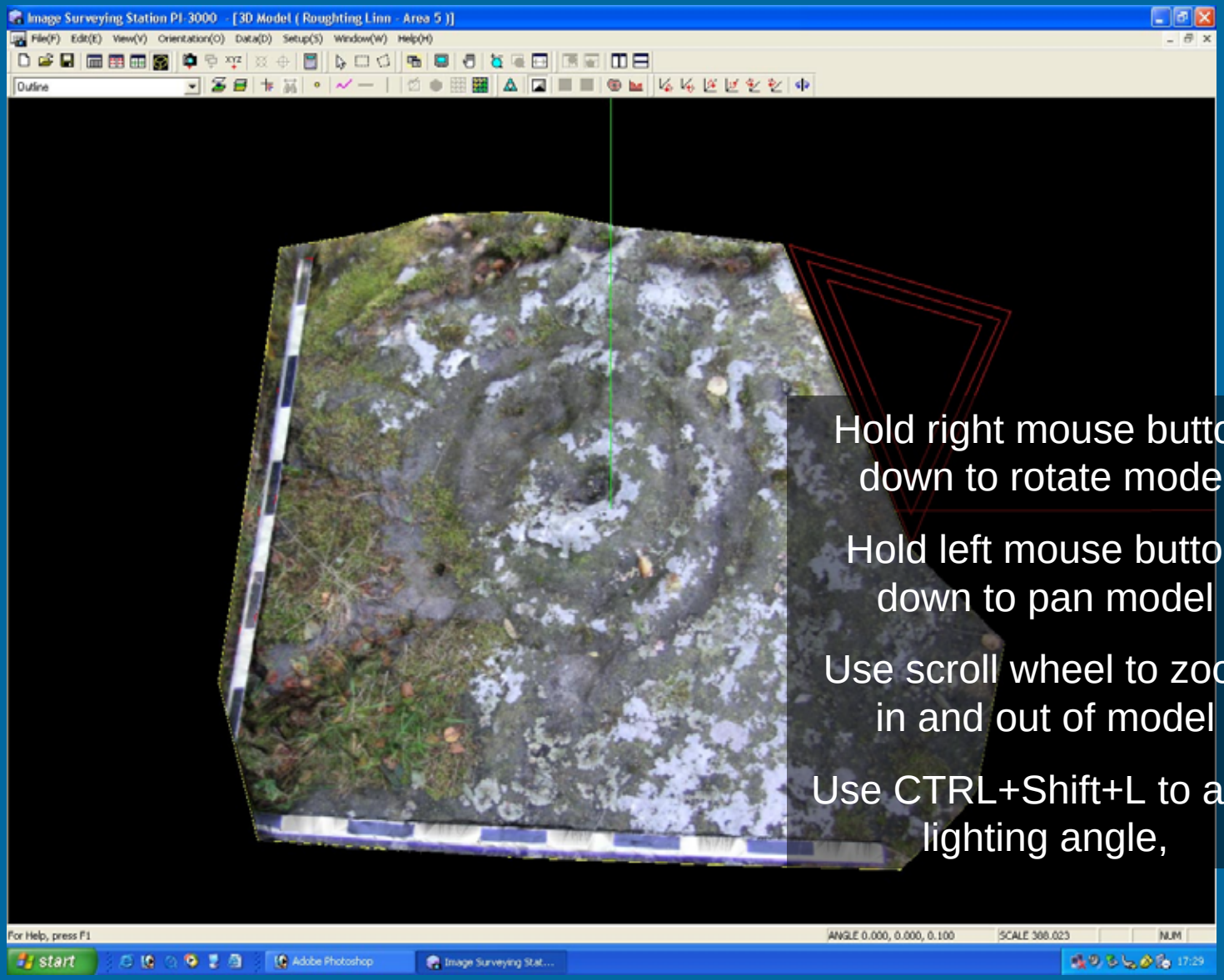
65. Measured Surface



66. Model Screen



67. Model Screen , 3D model displayed



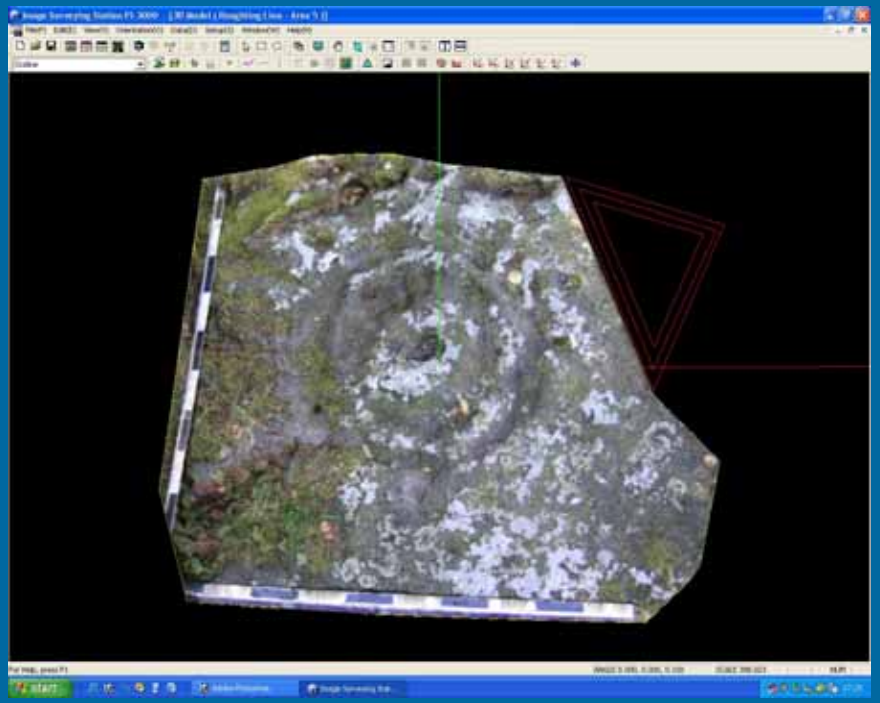
Hold right mouse button down to rotate model

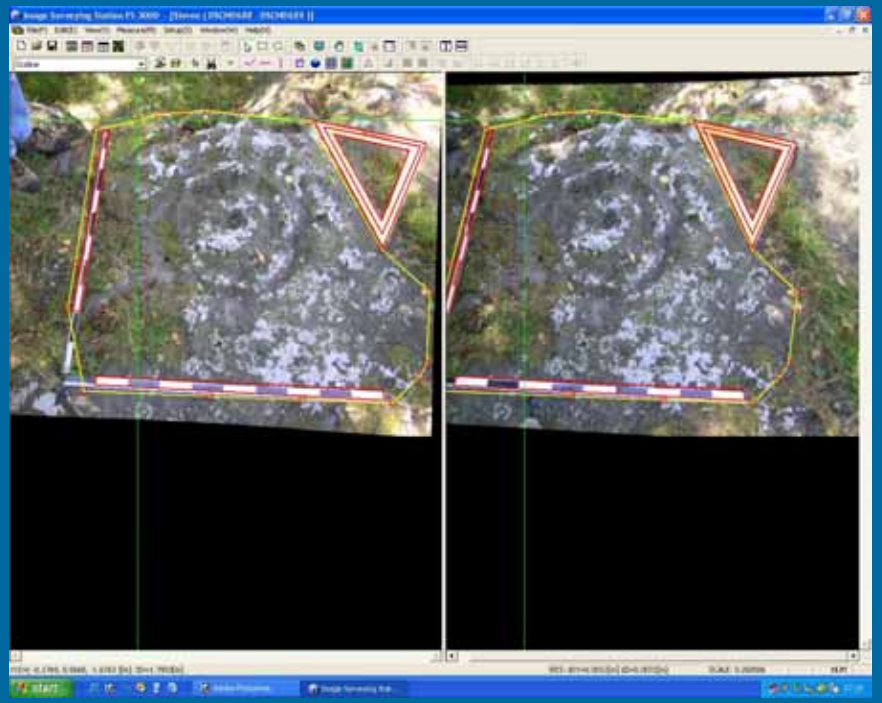
Hold left mouse button down to pan model

Use scroll wheel to zoom in and out of model

Use CTRL+Shift+L to alter lighting angle,

68. Digitising carved detail



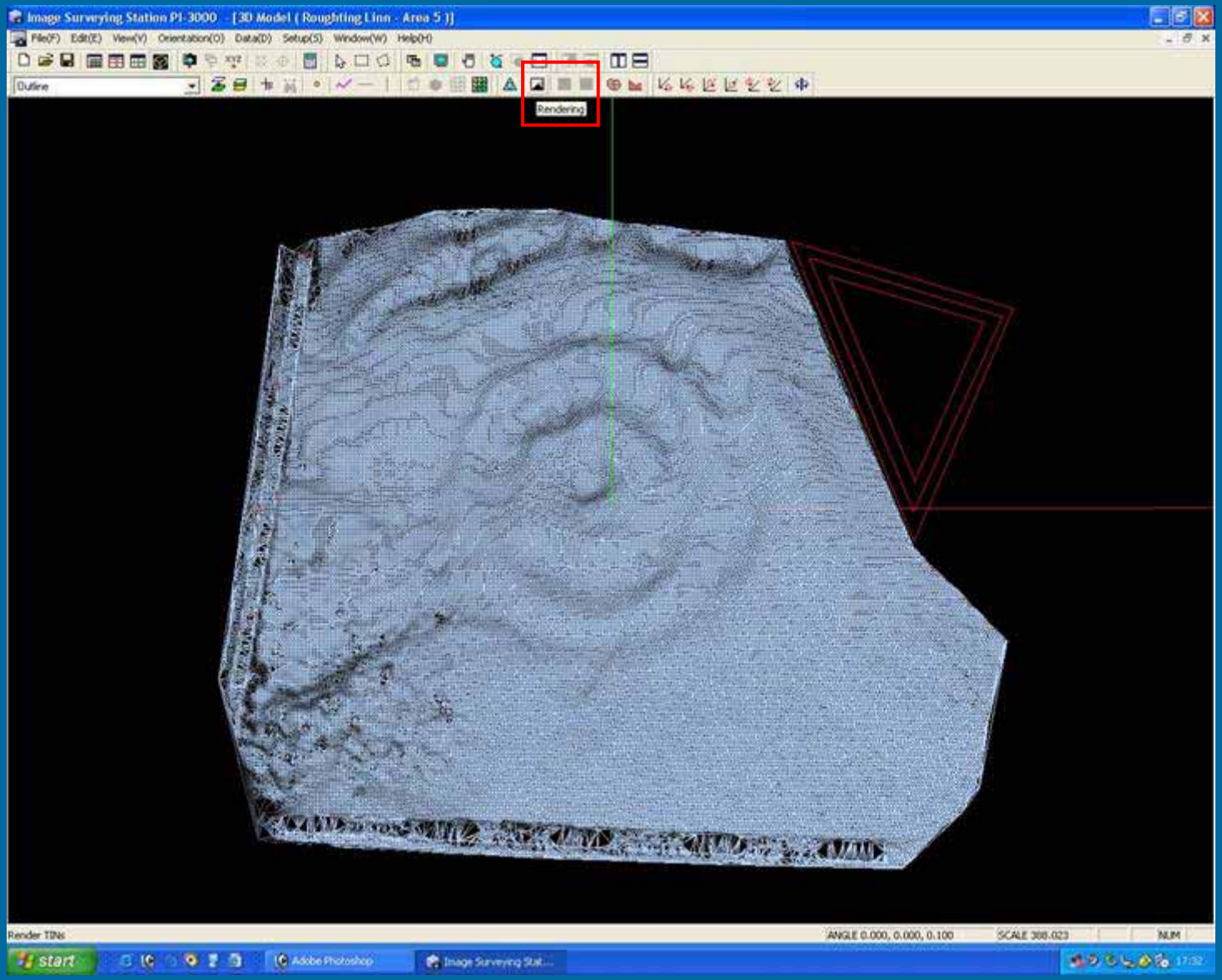


Drawings of the carved detail can be digitised in two ways:

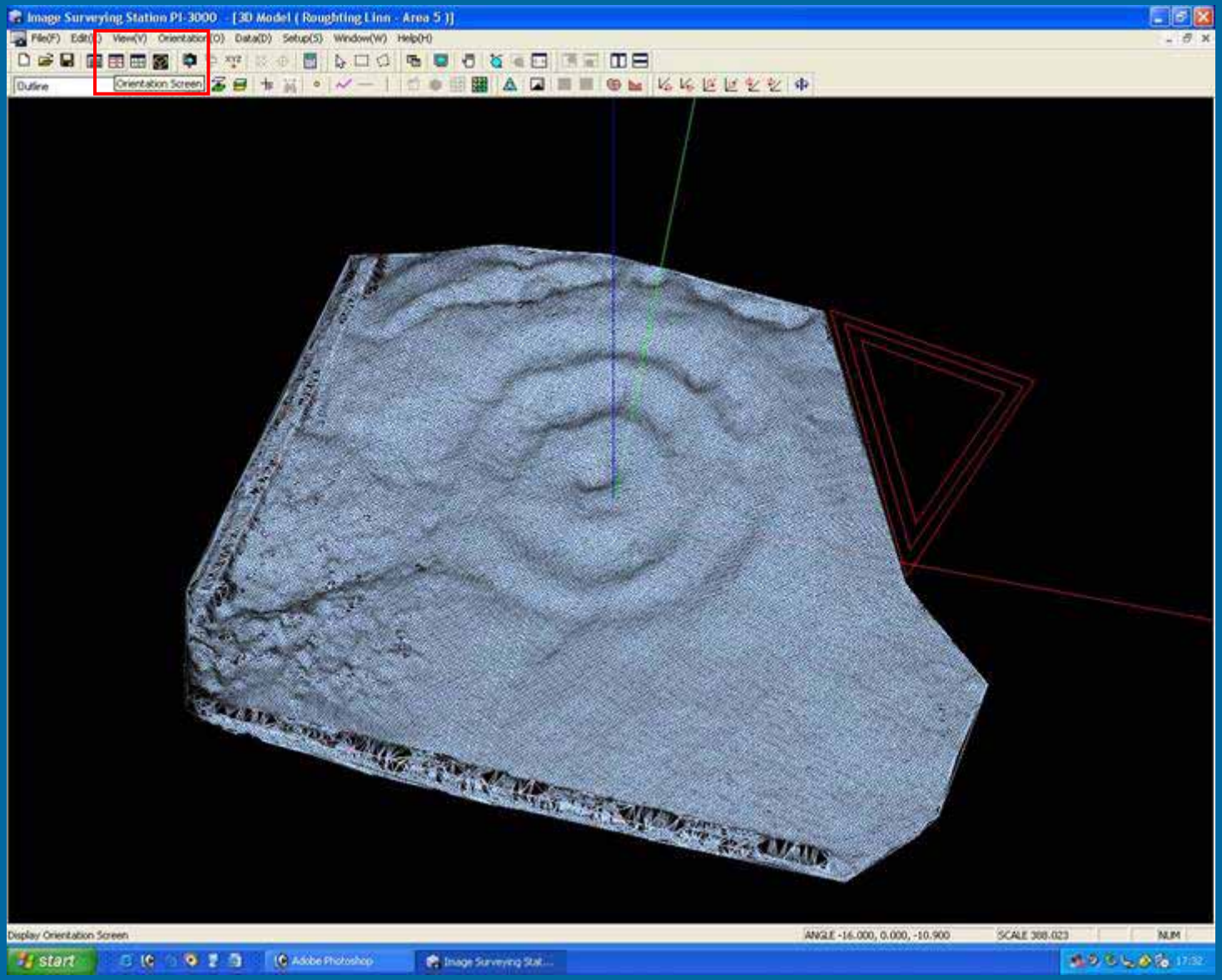
- Directly on top of the 3D model
- Off the stereo-pair using the Stereo Screen

Both use the same digitising workflow previously used for outline generation

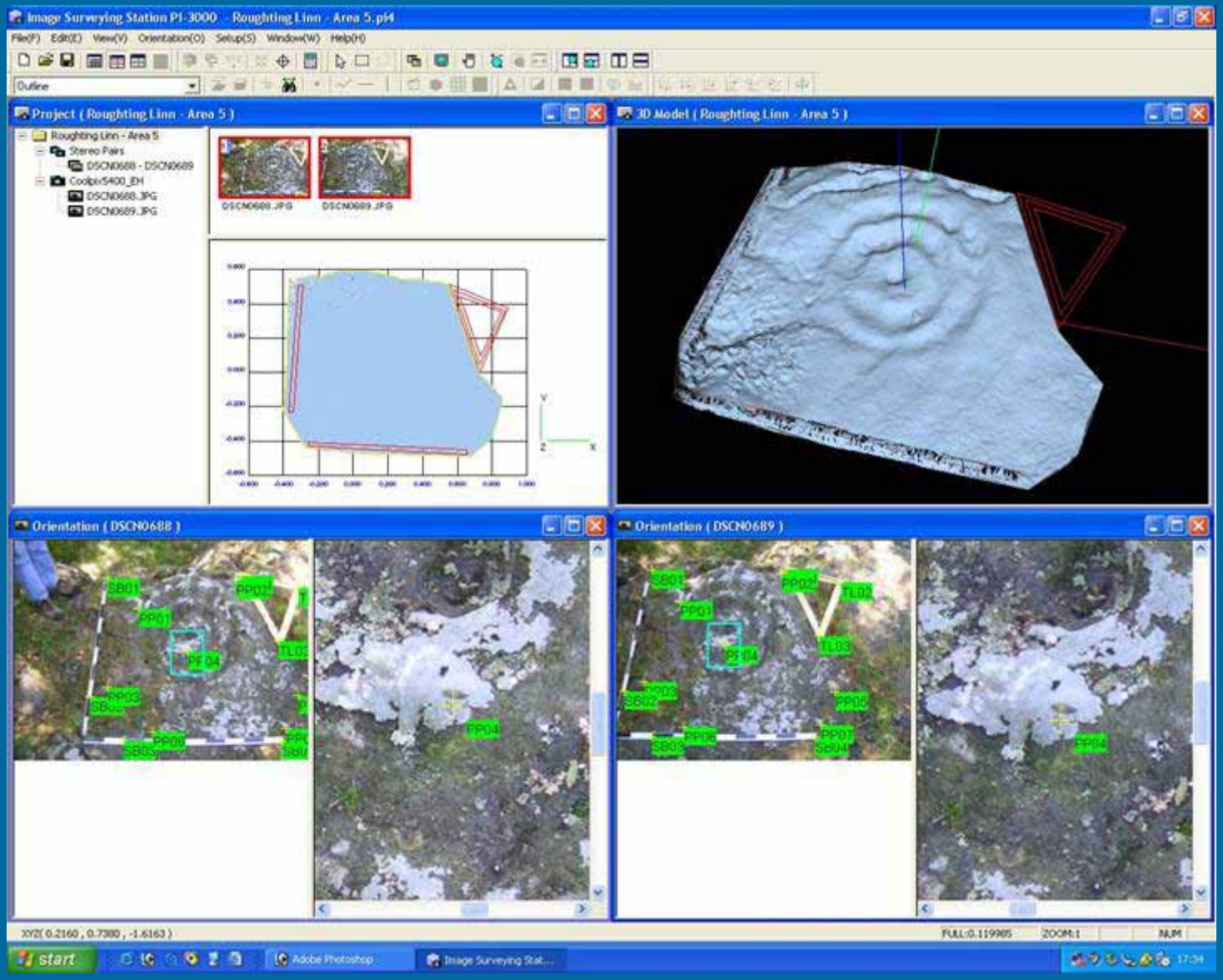
69. To view model without textured Render,



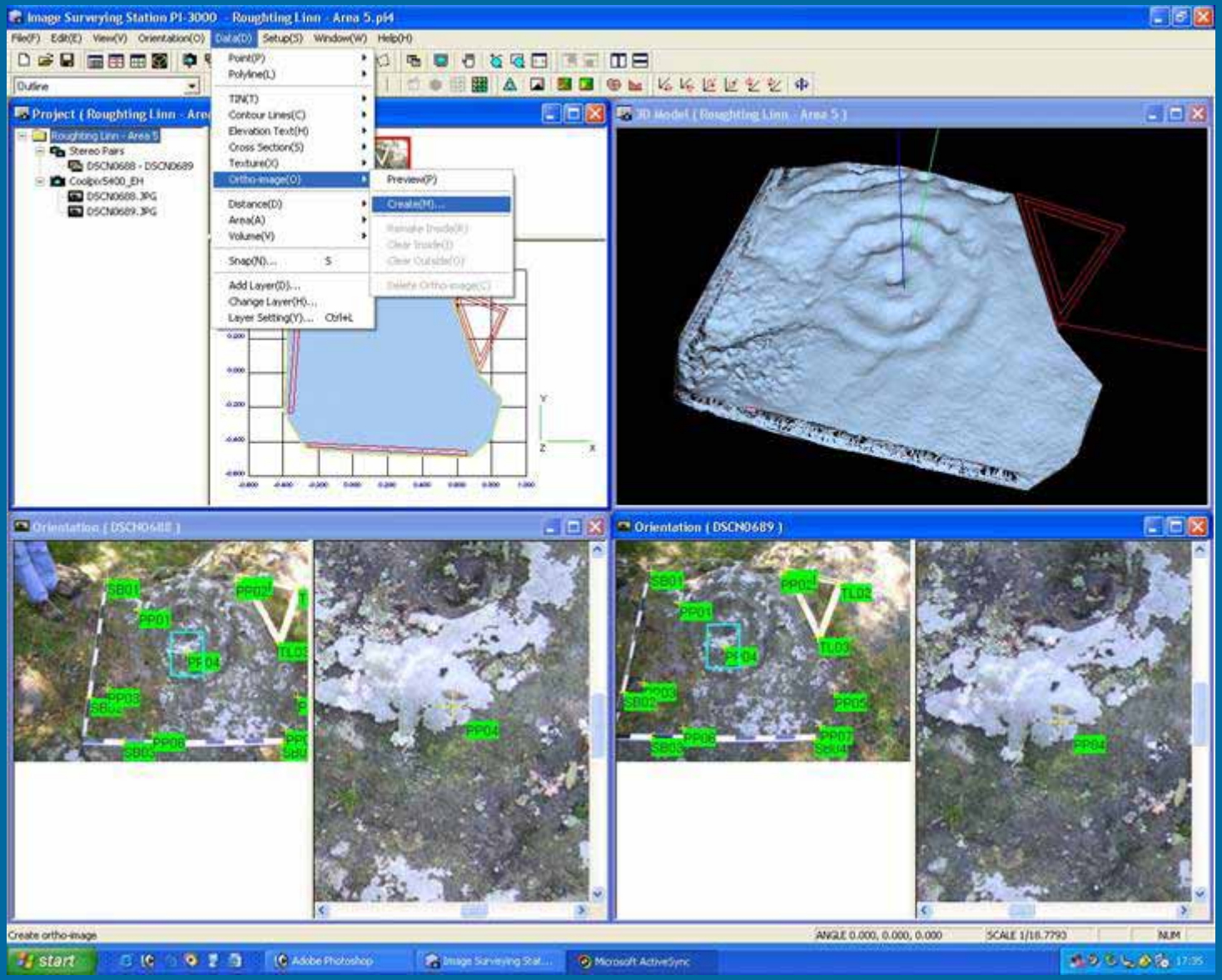
70. Orientation Screen,



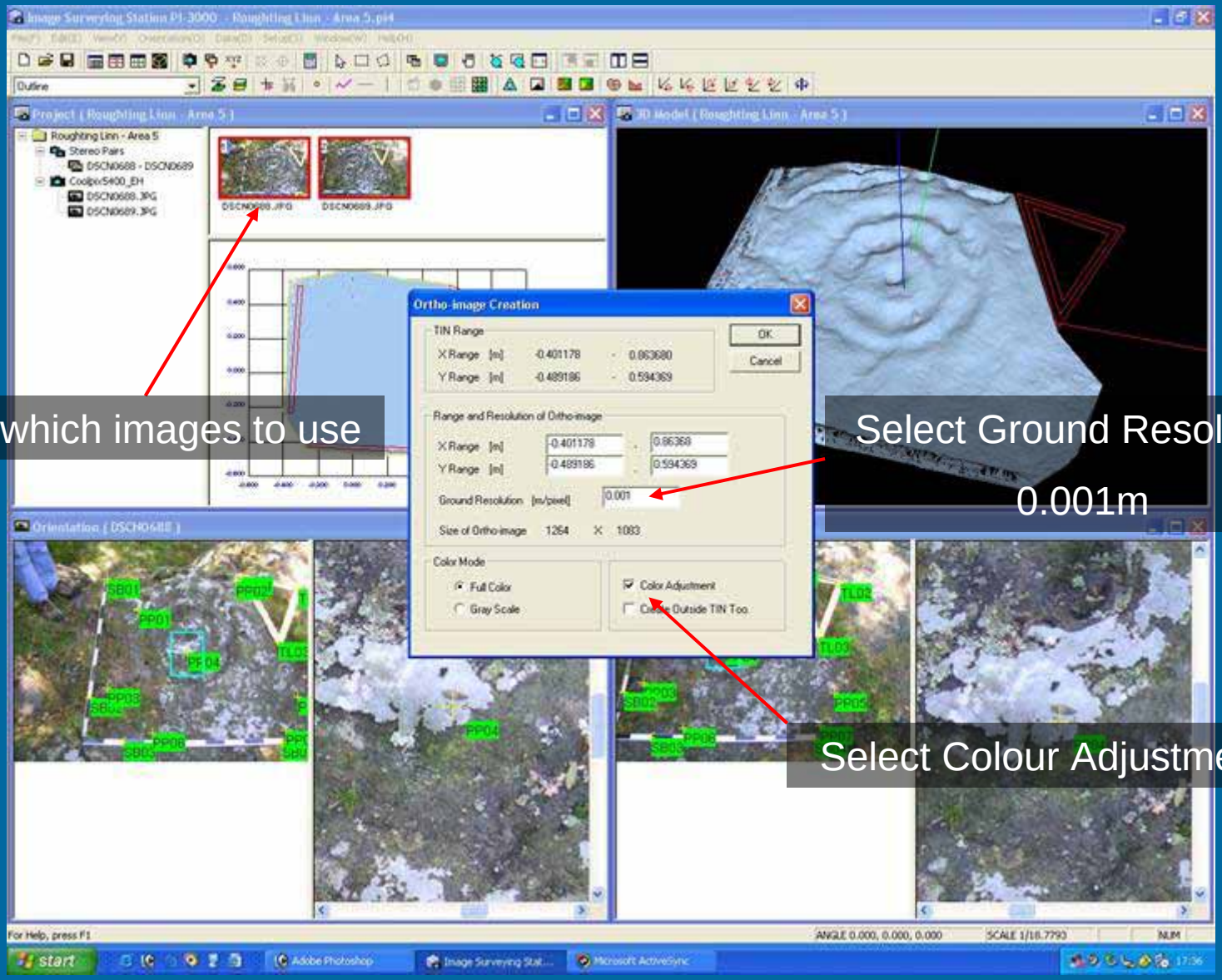
71. Multiple view ports



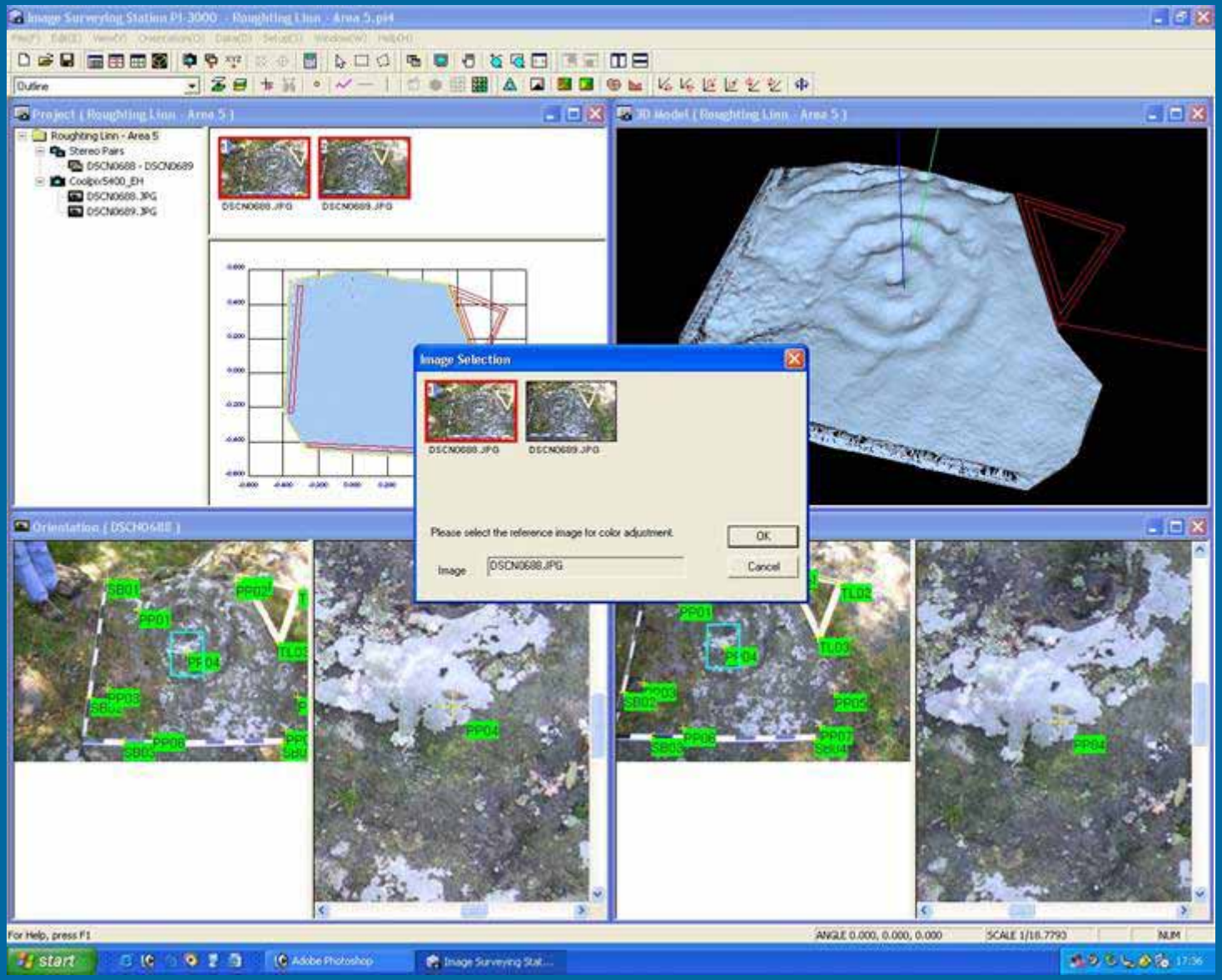
72. Data, Ortho-image, Create



73. Ortho-image Creation



74. Image Selection – reference image for colour adjustment



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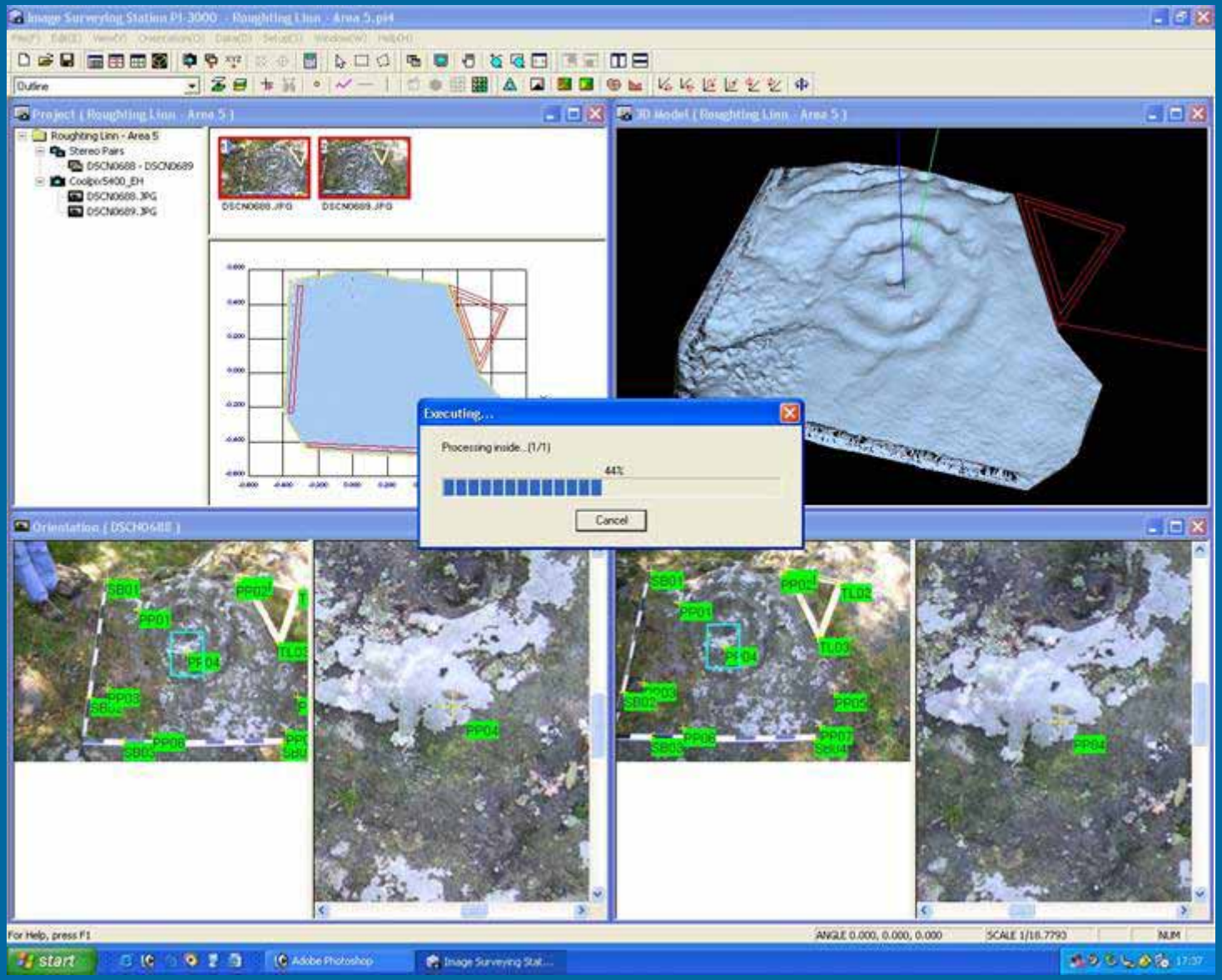
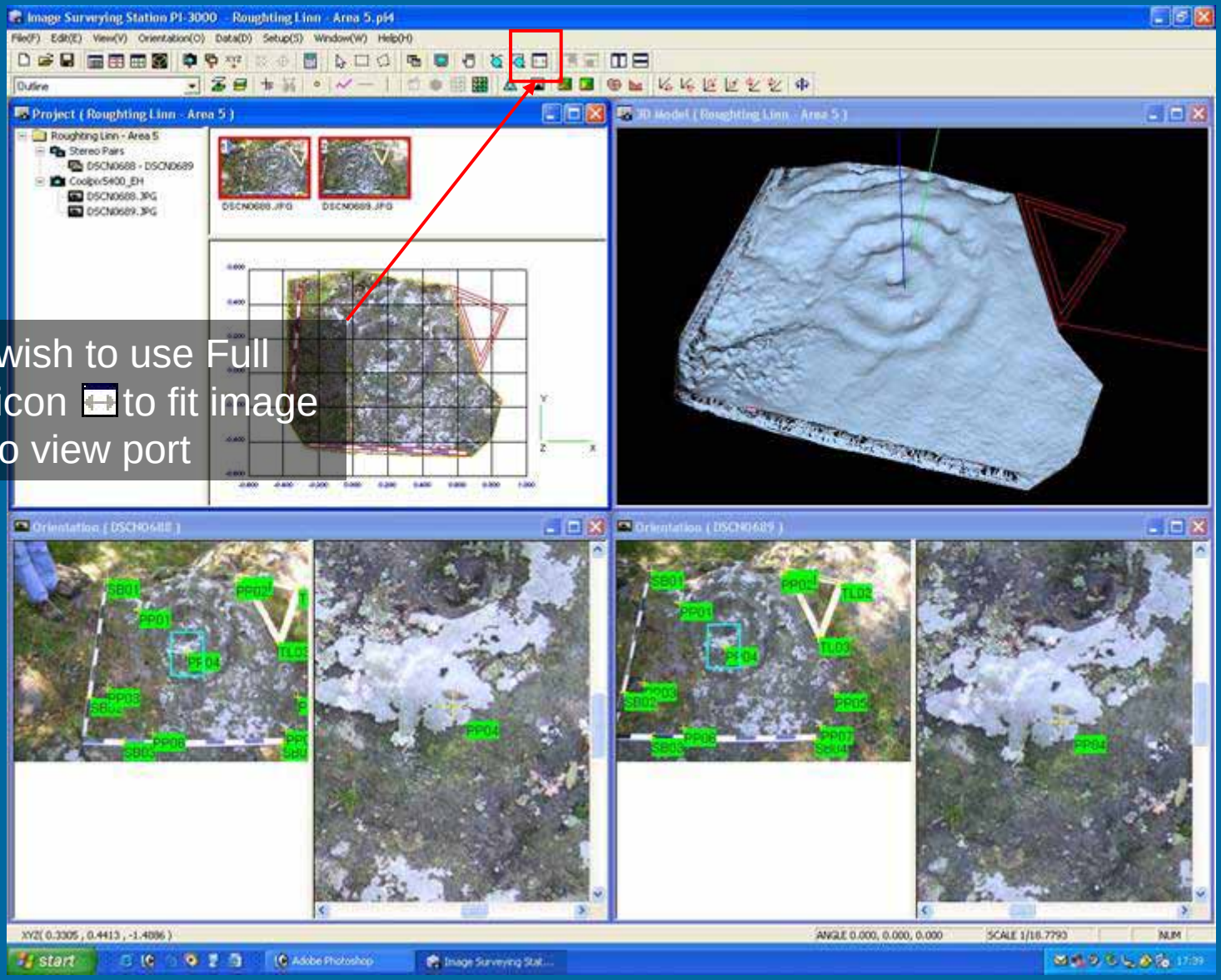
75. Ortho-image Creation - Processing

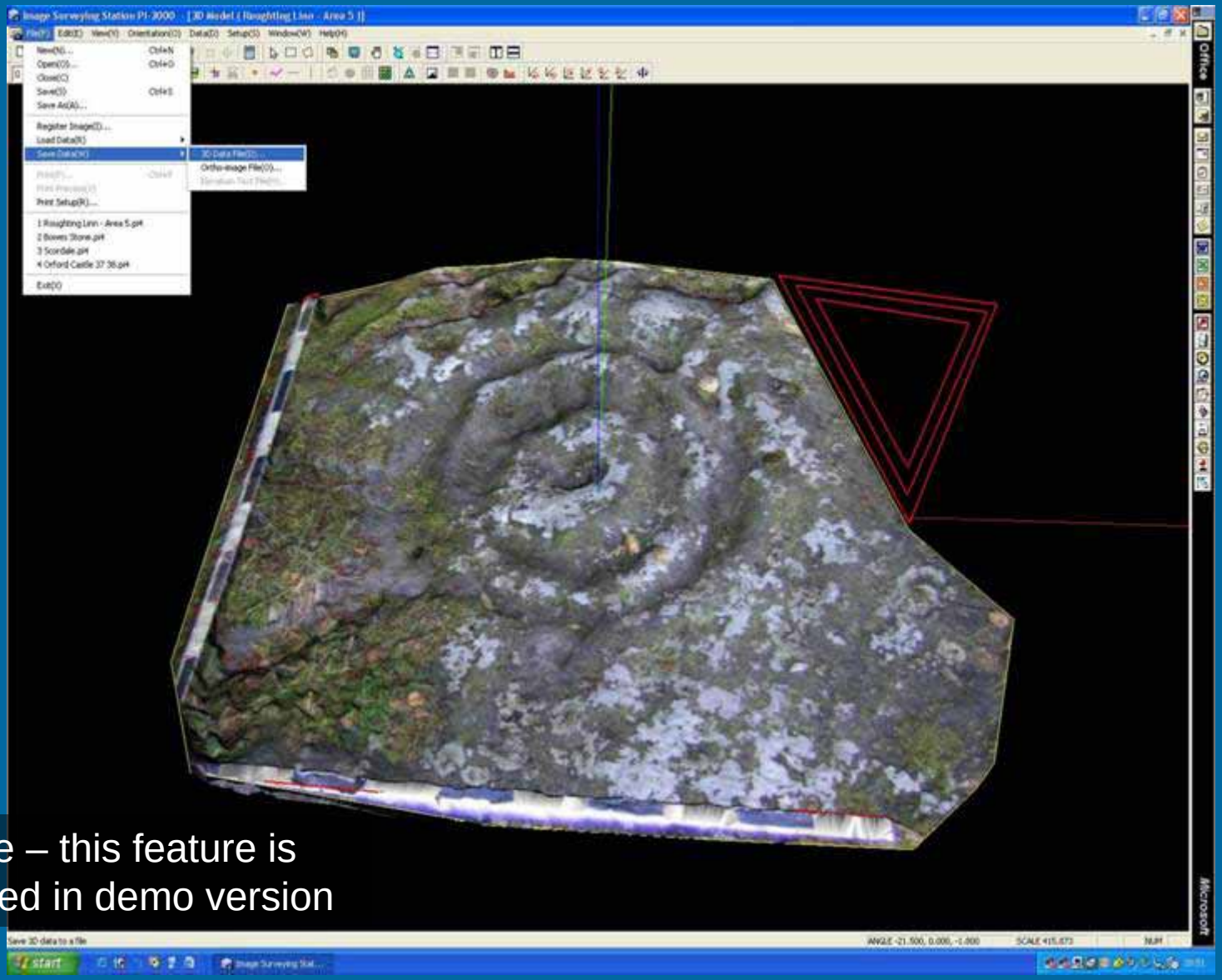


76. Ortho-image Creation – Processing complete



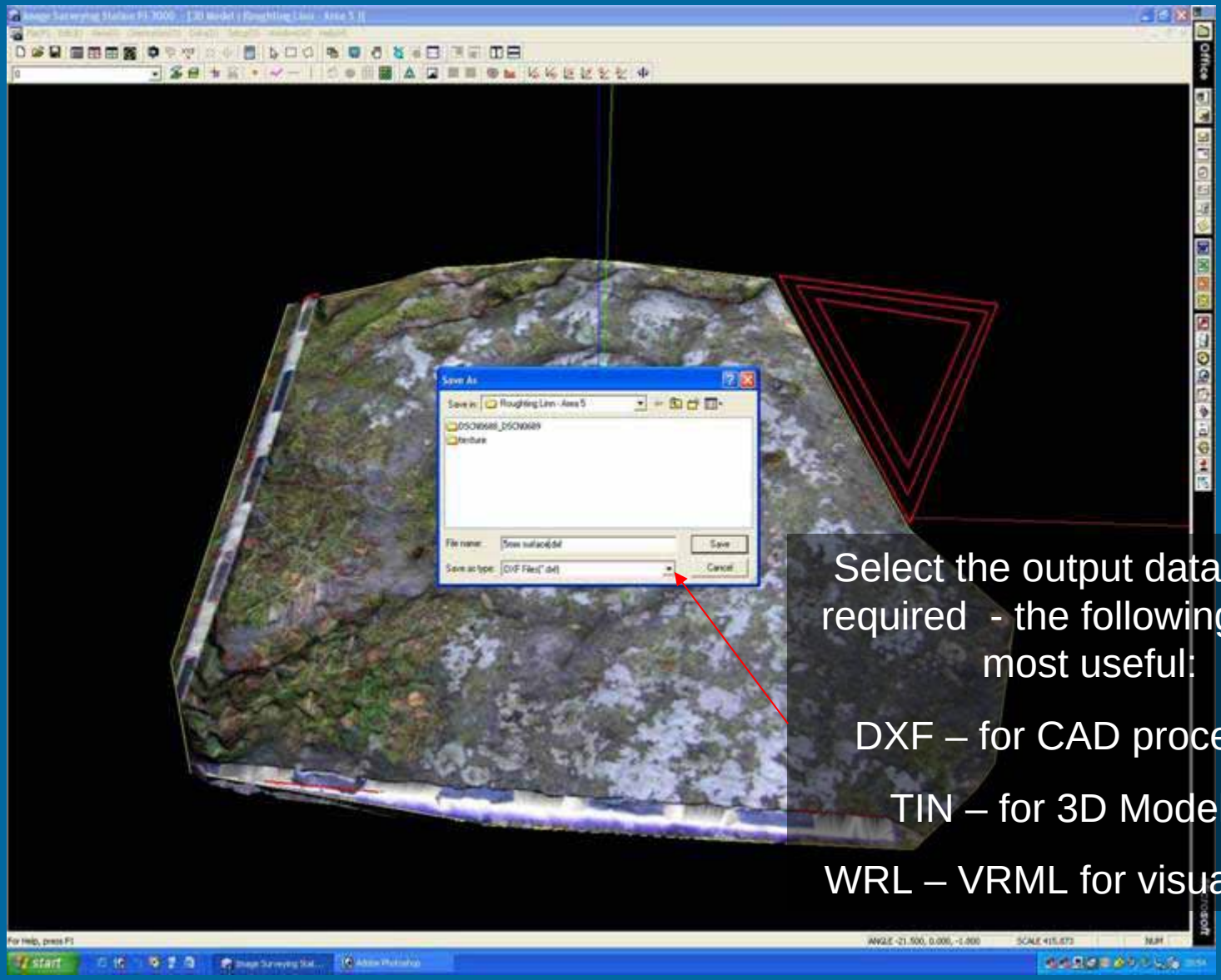
May wish to use Full display icon to fit image to view port

77. Model Screen, File, Save Data, 3D Data File



Note – this feature is disabled in demo version

78. Save As, WRL (VRML) File, Save



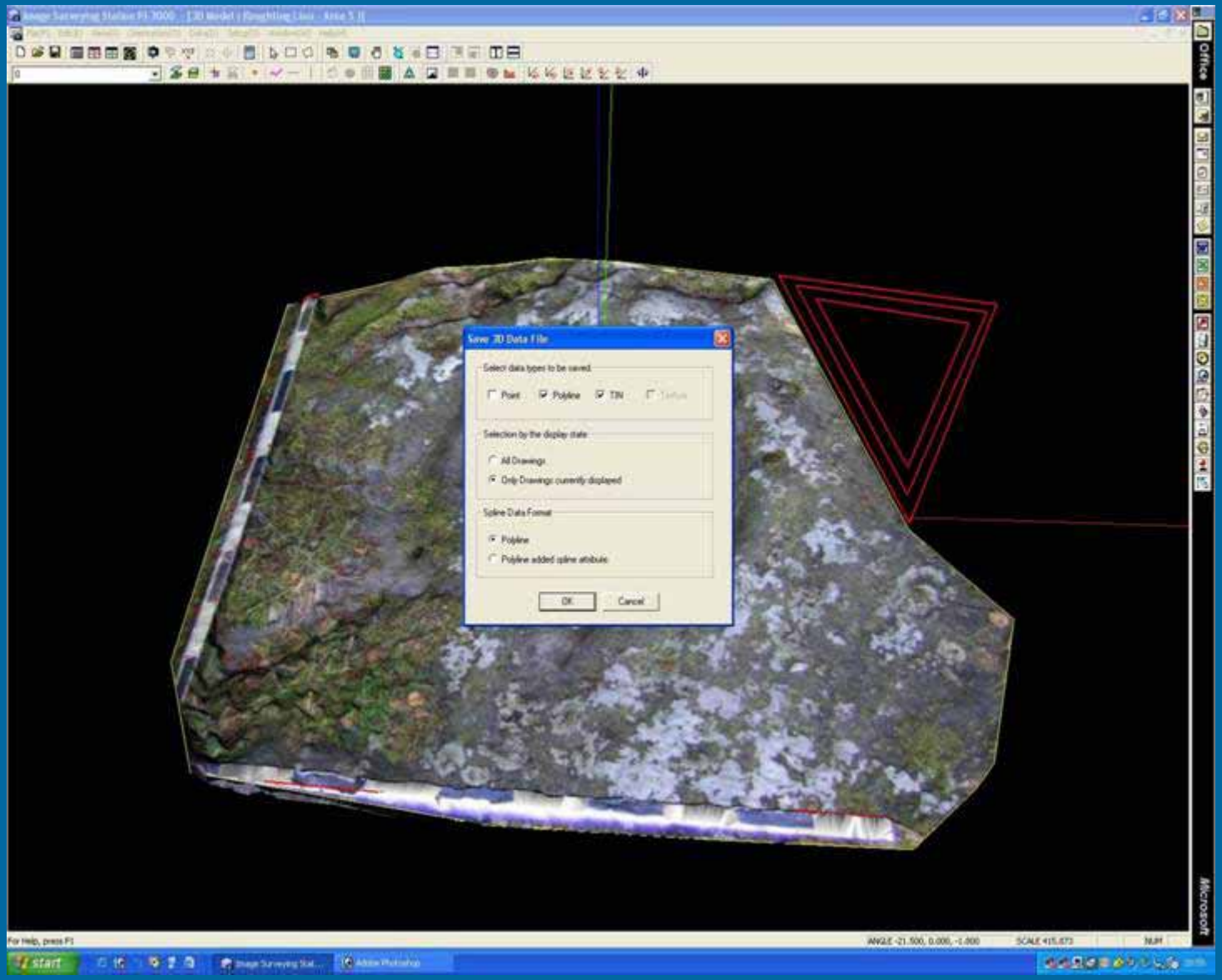
Select the output data format required - the following will be most useful:

DXF – for CAD processing

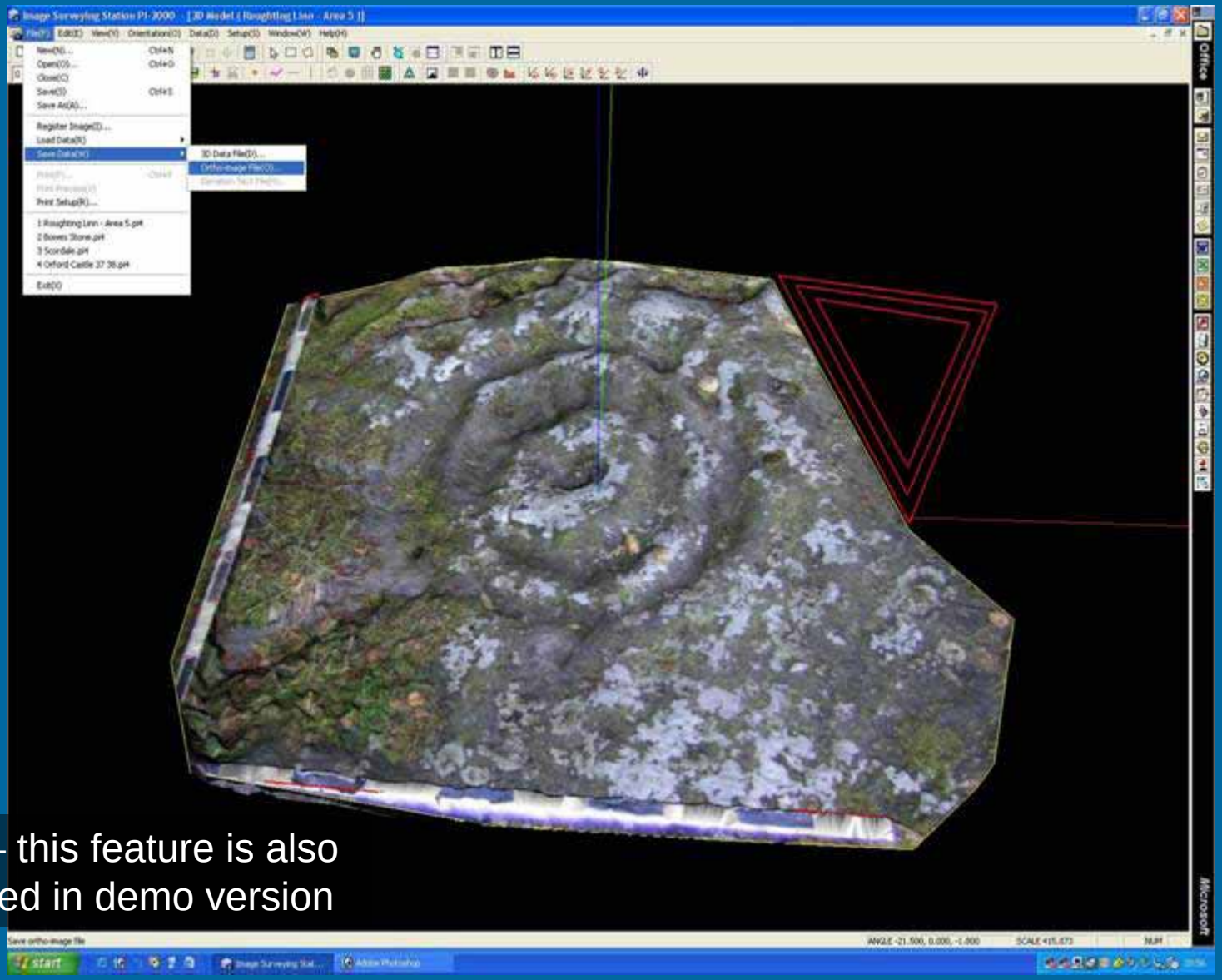
TIN – for 3D Modelling

WRL – VRML for visualisation

79. Save 3D Data File, OK

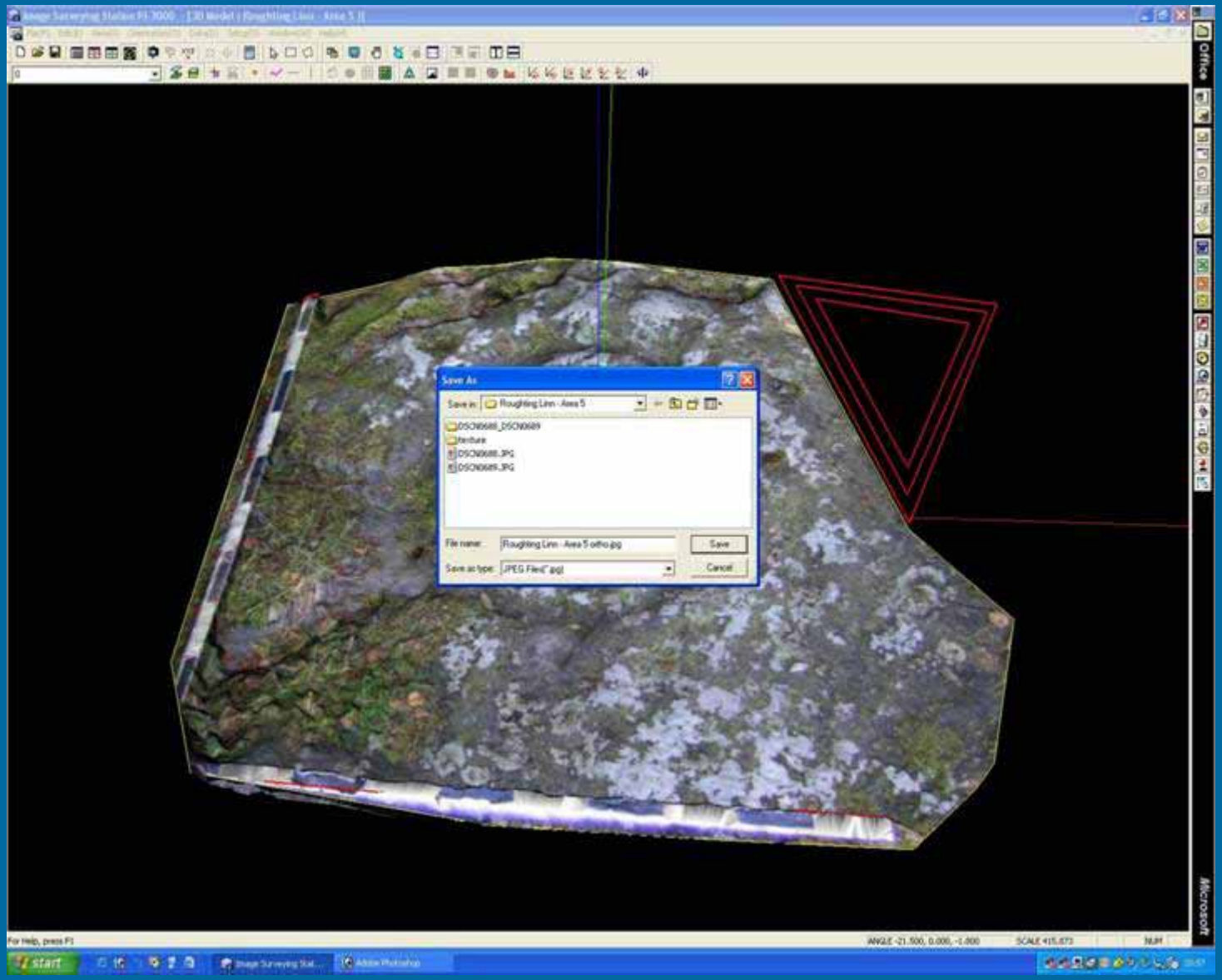


80. File, Save Data, Ortho-image

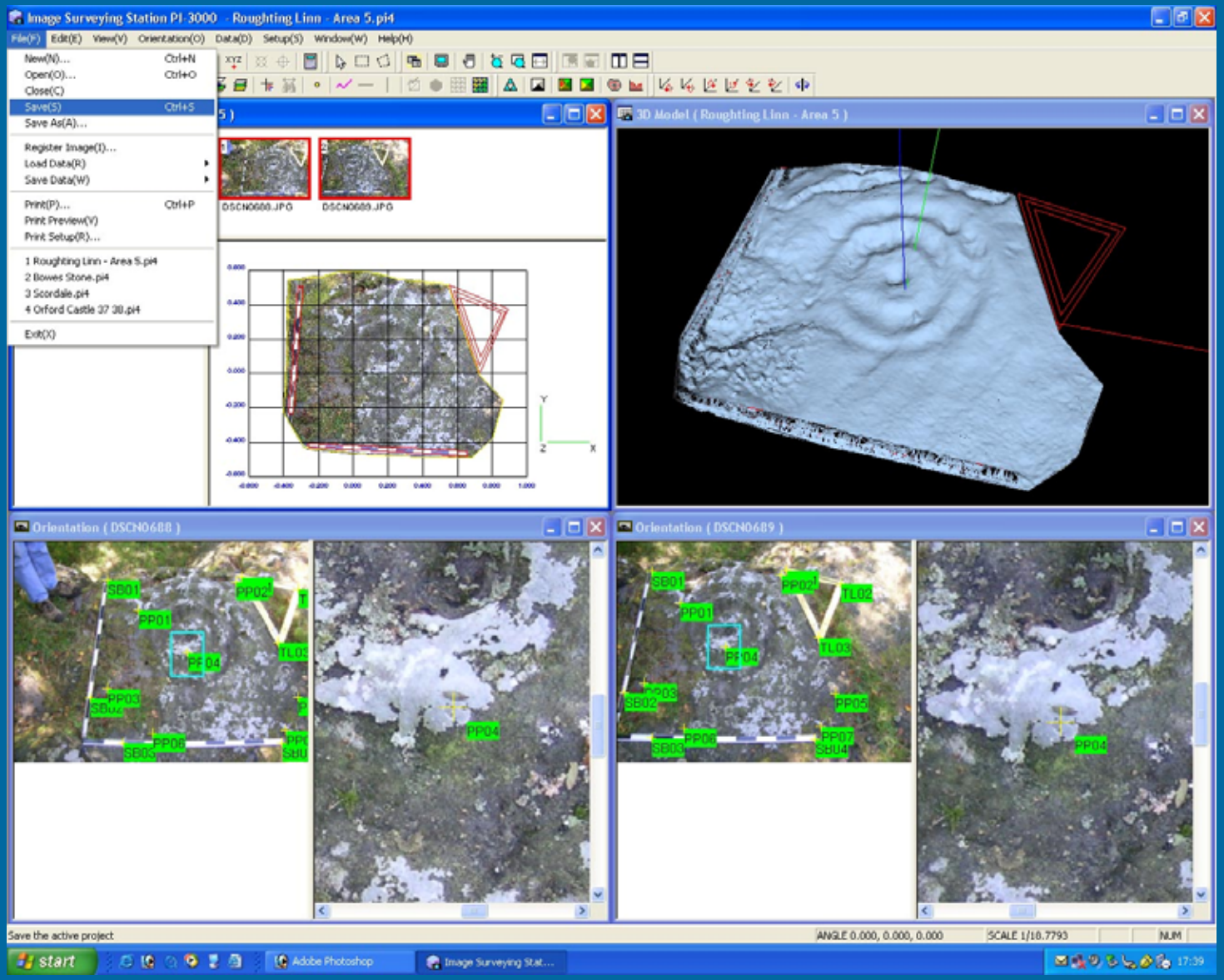


Note – this feature is also disabled in demo version

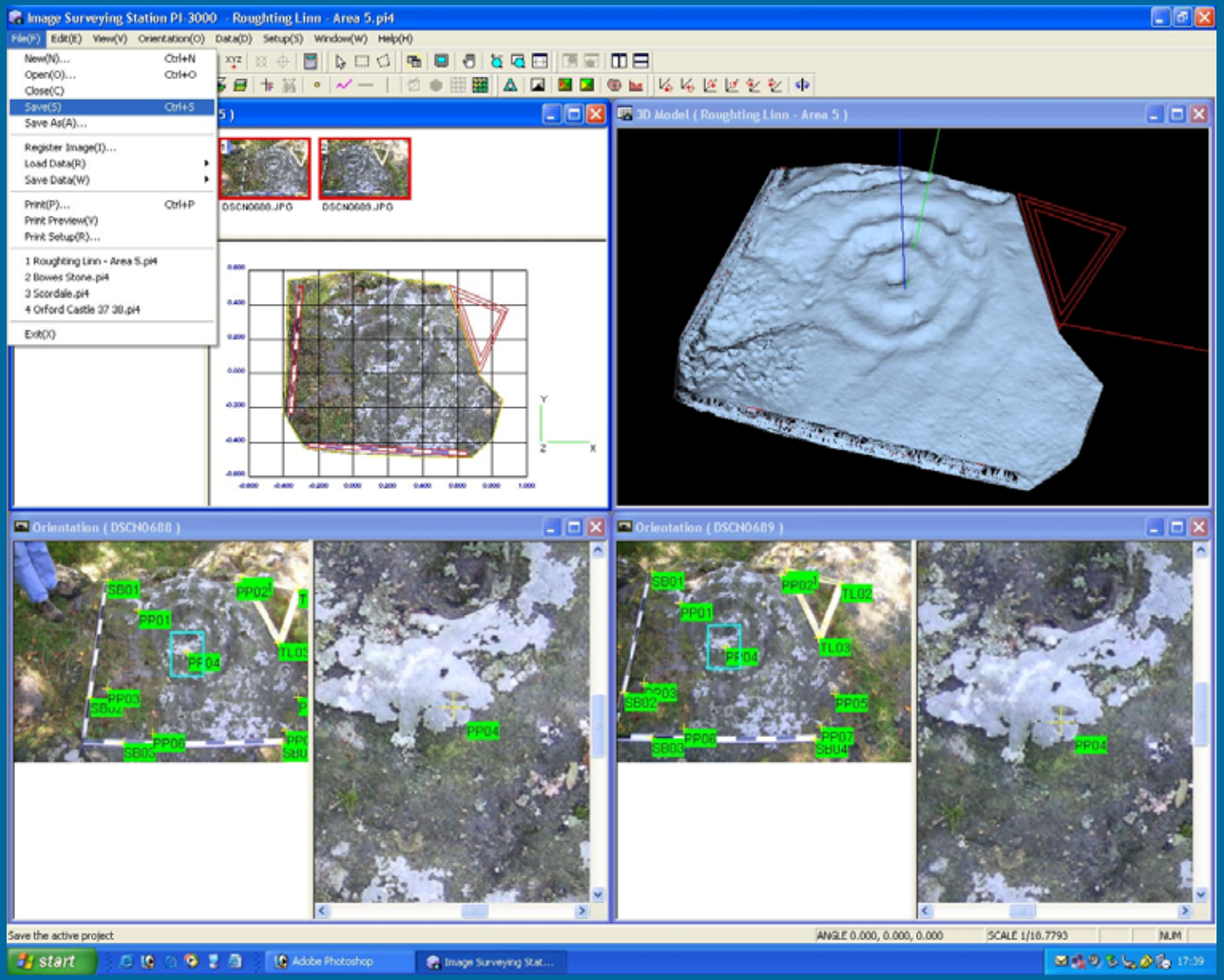
81. Save As, JPEG File, Save



82. File, Save – to save project



83. File, Close then Exit - to exit software



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