Geomodels Institute of Research

PROJECTE 150

Reference Guide Version Beta for Windows Vista, 7 and 8
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Contents

Introduction

Contents of Project 150 Reference Guide

This document contains four sections:

1. Presentation

The aim of this software is to provide tools for digitizing geological objects of interest in a 2D image to obtain the 3D object and know their geometric characteristics thanks to his High Density Digital Terrain Model (HDDTM). The software is oriented to digitizing linear features in a outcrop and calculates the geometrical properties as azimuth, dip and trace length. Surface planes can be digitalized as well.

2. Software

2.1 Digitizing Tools in 2D image

The outcrop visualization is achieved with associates 2D images (.jpg, .tif or bmp formats) to a HDDTM (in ASCII or .pf format) where the user can digitize objects of geological interest. Internal algorithms calculated the pixel position in 3D coordinates extracted from the HDDTM.

Feature digitalized:

- *Points*
- *Polylines*
- *Directory Options*

2.2 Attributes features

The 3D results computed from the digitized features are used to calculate a median plane that can be defined with the following eight geometrical properties:

- *3D coordinates position (Of each pixel digitized and the pixels covered between them)*
- *Centroid Position (Coordinate X, Coordinate Y, Coordinate Z)*
- *Azimuth (in Dip Direction format)*
- *Dip*
- *Coplanariety*
- *Collinearity*
- *Number of coordinates extracted*
- *Trace length*

A name is automatically assigned and the user can define the color of the feature and a alphanumeric property in the Set Name.

2.3 Edit Tools

The Interface contains tools to manipulate digitized features:

- *Move Node*
- *Add Node*
- *Delete Node*
- *Delete Feature*
- *Change Feature Color*
- *Split Polyline*
- *Join Polyline*

Related documentation

Contains articles and related information where explain internal functionalities from algorithms or workflow.

- Allmendinger, R. W. 1991. Problem solving in structural geology using vectors and tensors. Cornell University. Ithaca, New York 14853-1504
- Bingham, C., 1964. Distributions on the sphere and on the projective plane, PhD Dissertation, Yale University, New Haven, CT
- Fernández Bellon, Oscar. 2004 *Reconstruction of geological structures in 3D: An example from the southern Pyrenees.* Appendices. PhD Thesis. p.p.3-
- PolyWorks Reference Guide Version 11.0: Appendix E: PIF- Parametric Image Format
- Priest, S.D., 1993. Discontinuity analysis for rock engineering. Chapman and Hall, London, 473
- Woodcook, N.H. 1977. Specification of fabric shapes using an eigenvalue method. Geological Society of American Bulletin 88, 1231-1236.

Technical support

Report any problems, or send your suggestions, can be sent to Geomodels Research Institute or directly to software technical team by e-mail at *dgarcia@ub.edu*

1. Overview

Projecte 150 has been designed to calculate 3D surfaces from lineations or surfaces observed and digitized in 2D images. This process is achieved only if is available a High Density DTM from the image outcrop and the parameters to link the image with the HDDTM.

The link between the images and their HDDTM is achieved in two different ways. One way is thanks to the collinearity equations, where the photogrammetric parameters are necessary to resolve the equations: camera orientation and position, focal length, lens distortion and principal points. On the other hand, if the image is a rectified orthoimage, is only necessary the geographic information file (format .jpw or .tfw).

When a user digitizes a point or the first node of a polyline, pixel position is projected to the nearest HDDTM 3D coordinate with the help of the collinear equation and the photogrammetric parameters or the zenithal projection in an orthoimage. When digitizing the next node of the polyline, all pixels between the digitized pixels are included and are used to calculate the corresponding 3D coordinate. The coordinate number is greater than the nodes. In case of polygons, pixels included within the selected areas are also calculated the 3D coordinates. In this process all irregularities of the HDDTM are incorporated in the digitalized object coordinate with the aim to exploit the high possibilities of lidar, Software from Motion (SfM), or similar technologies.

Fig. 1. Left, Graphic feature digitized with nodes highlight. Right, Results 3D coordinates.

While the feature is digitized, 3D coordinates are processed to know the geometrical characteristics of the feature and the results are displayed on a Stereoplot or are showed in the interface.

The digitized features can be edited to modify or rectified graphically. At the same time, 3D data are re-processed and re-calculated the geometrical attributes to be shown to the user, helping to choose the best digitization option.

Projecte 150 disposes of complementary tools to achieve the best fit planar with a quality control where from each node digitized is calculated the distance at the calculate plane. Results are displayed so that errors can be corrected.

The software can export in different formats the 3D coordinates or in tables with geometric properties for each plane digitized.

2 Software

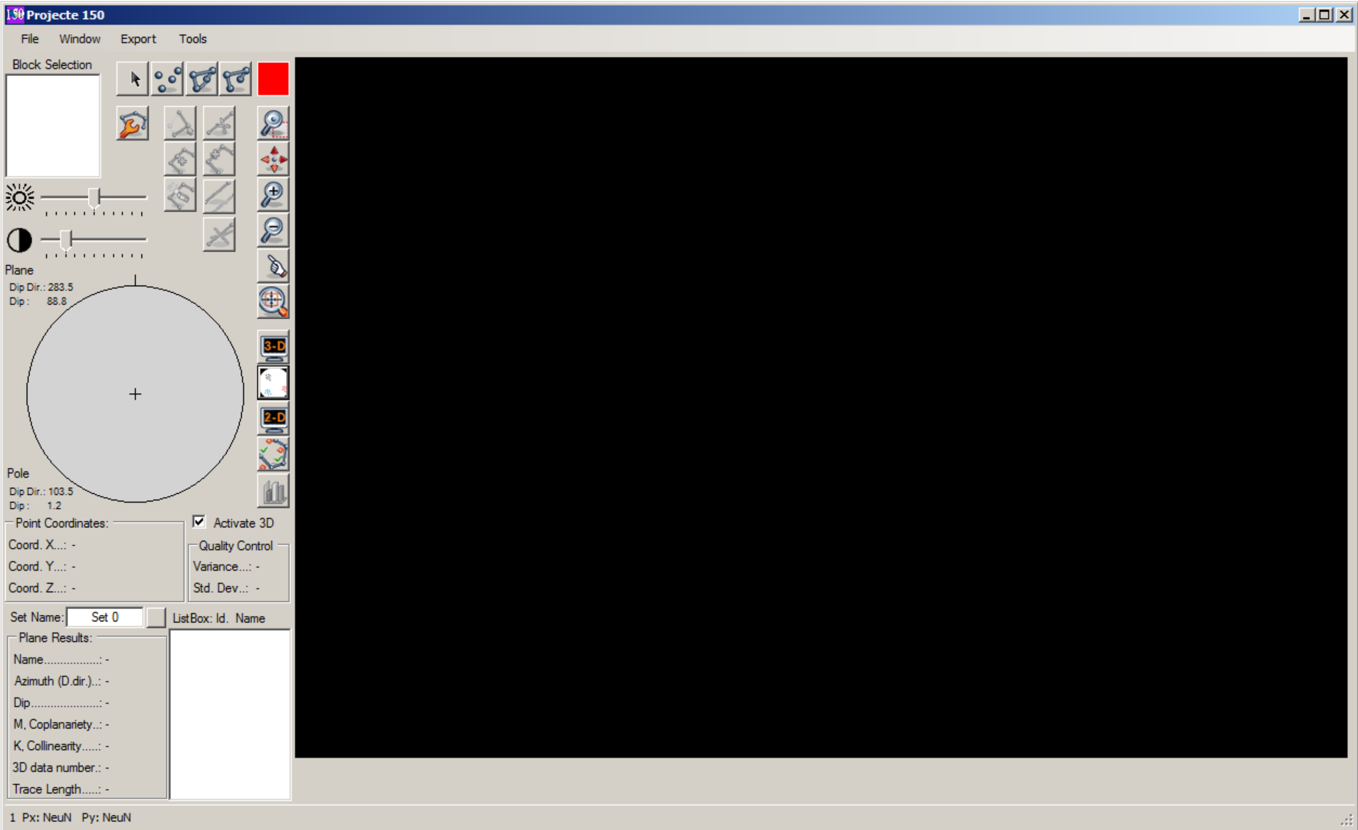


Fig. 2. The Project 150 main interface.

The software is presented by an interface with menu toolbar, an image visualizer, tool buttons and several information labels.

2.1 Load Project

The first step to work with Project 150 consist in load the project file where the directory files are written, select a block and digitize. Features digitized admitted functionalities of edit, analysis and export data.

- Lidar Project
- Agisoft PhotoScan Project
- Orthoimage Project

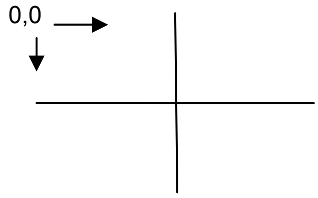
2.1.1 Lidar Project

This option is to load projects created from Laser Scanner data. The required information must include at least one photographic image and the Point Cloud, this association is called as a ***Block*** and additional files are needed. Finally must contain the following files:

- **Point Cloud**. Load the digital model in .pif format (Parametric Image Format). Usually each image corresponds to a laser scanner model.

- **Image**. Photo for the laser scanner model. Supports .jpg, .tif or .bmp formats.
- **Calibration**. Photogrammetric file containing information to link each image with his point cloud file with this format:

  - Pitch (Degree) + ← 0 → -
  - Yaw (Degree) - 0 +
  - Roll (Degree) - ↑ 0 ↓ +
  - Zc Position of the camera in the Laser Scanner coordinate system.
  - Yc Position of the camera in the Laser Scanner coordinate system
  - Xc Position of the camera in the Laser Scanner coordinate system
  - Focal length (mm)
  - Xo Principal Point (pixel)
  - Yo Principal Point (pixel)
  - 1rd Radial distortion coefficient
  - 3rd Radial distortion coefficient
  - Pixel Size X
  - Pixel Size Y
  - Skew transformation coefficient
  - 5th Radial distortion coefficient
  - P1 Tangential distortion coefficient
  - P2 Tangential distortion coefficient



  In ASCII format.

- **Matrix**. Data file to translate and rotate changing the Point Cloud reference system. The software can incorporates multiples files in ASCII format.
- **ResultBlock1.** The pixel coordinates results are stored in these files for each block in ASCII format.
- **ResultCoord1.** The resulting 3D coordinates are stored in these files, one for each block in ASCII format.

Files containing this information must be written in ASCII format with the following structure:

Text_File.txt (Example) Legend

```
3                                                            --> Number of blocks
1                                                            --> Start first block ->Number of images (1).
D:\Projectes Digitalitzacio\Lavasar\Fotos\_MG_1804.jpg       --> Address of the first block image
1                                                            --> Number of Point Clouds (1)
D:\Projectes Digitalitzacio\Lavasar\Scan\Scan1_task1.pf      --> Address of the first block Point Cloud.pf
1                                                            --> Number of Calibration files (1)
D:\Projectes Digitalitzacio\Lavasar\Calibracio\Cotiella111foto4.txt --> Address of the first block image Calibration
2                                                            --> Number of Matrix
D:\Projectes Digitalitzacio\Lavasar\Matrius\Scan1_task1_section1.txt --> Address of the first matrix at the first block
D:\Projectes Digitalitzacio\Lavasar\Matrius\UTM.txt          --> Address of the second matrix at the first block
D:\Projectes Digitalitzacio\Lavasar\Projecte150\resultatblock1.txt --> Feature pixels file output address
```

D:\Projectes Digitalitzacio\Lavasar\Projecte150\resultatcoord1.txt	--> Feature coordinates file output address
1	--> Start second block ->Number of images (1).
D:\Projectes Digitalitzacio\Lavasar\Fotos_MG_1809.jpg	--> Address of the second block image
1	--> Number of Point Clouds (1)
D:\Projectes Digitalitzacio\Lavasar\Scan\Scan2_task4.pf	--> Address of the second block Point Cloud.pf
1	--> Number of Calibration files (1)
D:\Projectes Digitalitzacio\Lavasar\Calibracio\Cotiella112foto9.txt	--> Adress of the second block image Calibration
2	--> Number of Matrix
D:\Projectes Digitalitzacio\Lavasar\Matrius\Scan2_task4_section1.txt	--> Adress of the first matrix at the second block
D:\Projectes Digitalitzacio\Lavasar\Matrius\UTM.txt	--> Adress of the second matrix at the second block
D:\Projectes Digitalitzacio\Lavasar\Projecte150\resultatblock2.txt	--> Feature pixels file output address
D:\Projectes Digitalitzacio\Lavasar\Projecte150\resultatcoord2.txt	--> Feature coordinates file output address
1	--> Start second block ->Number of images (1).
D:\Projectes Digitalitzacio\Lavasar\Fotos_MG_1811.jpg	--> Adress of the third block image
1	
D:\Projectes Digitalitzacio\Lavasar\Scan\Scan3_task4.pf	
1	
D:\Projectes Digitalitzacio\Lavasar\Calibracio\Cotiella113foto11.txt	
2	
D:\Projectes Digitalitzacio\Lavasar\Matrius\Scan3_task4_section1.txt	
D:\Projectes Digitalitzacio\Lavasar\Matrius\UTM.txt	
D:\Projectes Digitalitzacio\Lavasar\Projecte150\resultatblock3.txt	
D:\Projectes Digitalitzacio\Lavasar\Projecte150\resultatcoord3.txt	
	--> End block and File

In blue, files with input data, in green, files with output data.

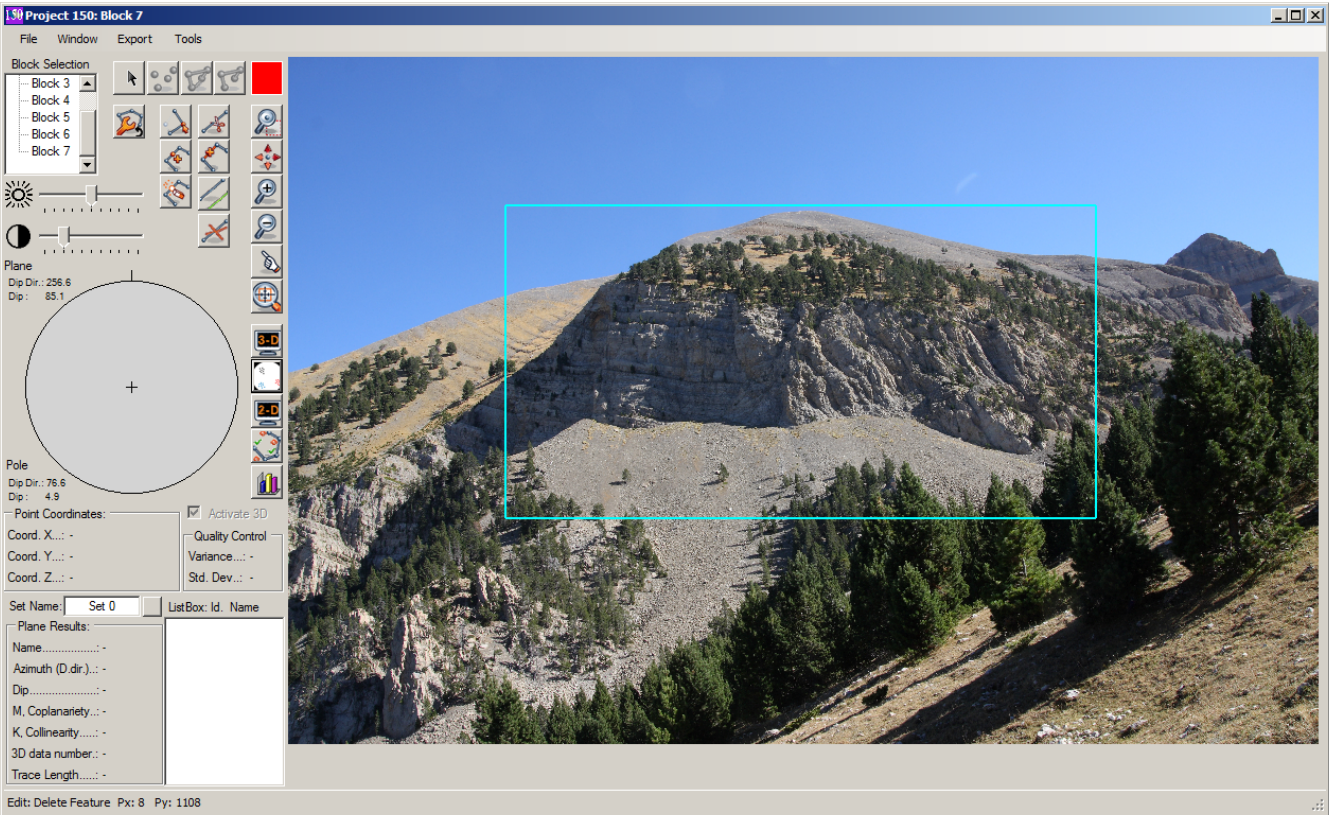


Fig. 3. A laser scanner project block loaded and visulizated with the HGDTM coarse limits displayed.

2.1.4 Unplugged Images

This option is to digitalise images when a point cloud in format .pif is not available. The image can be digitalised to create a file block. File format to digitalise unplugged image have this structure

3	--> Number of images
1	--> Number of the image (1)
D:\Projectes Digitalitzacio\Cotiella_Ortho_mg_3215.tif	--> Address of the first block image
D:\Projectes Digitalitzacio\Cotiella_Ortho \resultatblock1.txt	--> Feature pixels file output address

1	--> Number of the image (1)
D:\Projectes Digitalitzacio\Cotiella_Ortho_mg_3216.tif	--> Address of the first block image
D:\Projectes Digitalitzacio\Cotiella_Ortho \resultatblock2.txt	--> Feature pixels file output address
1	--> Number of the image (1)
D:\Projectes Digitalitzacio\Cotiella_Ortho_mg_3217.tif	--> Address of the second block image
D:\Projectes Digitalitzacio\Cotiella_Ortho \resultatblock3.txt	--> Feature pixels file output address
	--> End block and File

When the point cloud is available, data can be imported. First load a *Lidar Project* and the corresponding number of blocks with the files resultblock#.txt and resultcoord# empty of data. Open the block and *Open Project > Import Lidar.*

2.1.5 Import Lidar

Available Lidar data to construct 3D data from *Open Project > Unplugged Images.* To achieve this process, when the Project Lidar is loaded the file corresponding to resultblock#.txt and resultcoord#.txt must be empty of data.

2.2 Visualization tools

Image visualization can be controlled in three different ways. One way is controlling the window size, other way is through the image resolution and the third option controls the tones range of images.

2.2.1 Window size

From the toolbar *Window* this functionality tries to adapt the window size to the image size. There are four options.

100%: Picture Box is adapted at the full image size, in case of small images.

50%: Picture Box is adapted at the half image size, in case of medium size images.

25%: Picture Box is adapted at the quarter image size, in case of medium-great size images. Is the option default

12.5%: Picture Box is adapted at the eighth image size, for the greater size images.

2.2.2 Image resolution

Main interface disposes of five button tools for control the resolution image.

**Subset image**: After select *Subset image*, the pointer cursor is activated over the image. Press the left button mouse and drag over the image to define a rectangle and liberate the left button pressed.

 **Move** : Select *Move* to move the screen window over the image. With this option activated press the left button mouse and drag over the image.

 **Zoom in** : Click left button over the image to increase the image resolution.

Zoom out : Click left button over the image to reduce the image resolution.

Reset view : Click button return the image at the original resolution.

2.2.3 Tone range

Two sliding buttons to control brightness and contrast of the image.

Brightness: Sliding the control image light is increases or decrease.

Contrast: Sliding the control contrast light is increases or decrease.

2.3 Digitizing tools

This section explains the three options to digitize graphical features on the image. The color attribute is maintained and can be used as an attribute or for geological features classification (bedding, set joints or faults).

Activate 3D check box facilitate the deactivation to calculate 3D coordinate between digitized nodes. If the user consider is not necessary take coordinates 3D in a segment of the polyline, can disable the check box.

2.3.1 Point

Is the most simple feature graphic to digitize. One click for point and the 3D point coordinates are shown. Points are not possible to edit.

2.3.2 Polygon

Select the *polygon tool* to activate the digitizing tool on the image. User must digitize point by point as a polyline and ending with double-click left button mouse then, the event close automatically the polygon and calculates the 3D coordinates into the area .

Fig. 4. Left, polygon digitized with node highlight. Right, Results 3D surface coordinates.

2.3.3 Polyline

 Selecting *polyline tool* active the digitizing tool on the image. User must digitize point by point and ending with double-click left button mouse, the tool closed automatically the polygon**.**

2.4 Attribute features

They correspond to the properties associated to the graphic features as color feature, of nomenclature as Name and Set Name and the geometric characteristics computed to the 3D results and derived from calculate the planar regression.

- **Identification Name:** Attribute automatically assigned as point, polyline or polygon and correlative number.
- **Color:** User can select a color to digitize the graphic feature and with this color will be represented on the stereoplot and used like to classify features.
- **Set Name:** Value default is 0. It is a alphanumeric attribute and can be modified by the user. Is applied to classify digitized features.
- **Azimuth (D. dir.):**. The obtained coordinates are used to make the best fit to a plane with methodology based in calculate eigenvalues of the inertial moment (Related documents, Bingham 1964, Woodcook 1977). Azimuth plane expressed in Dip direction is stored for each polyline and polygon digitized. Interface display a stereoplot with the pole planes in dip direction and Dip and the same color that the graphic feature attribute.
- **Dip.** Dip value obtained from the best fit to a plane calculated with the 3D coordinates.
- **M, Coplanariety:** Planar regression degree of fit. Good fit have higher index value (Related documents, Fernandez 2004).
- **K, Collinearity:** Planar regression degree of fit. Good fit have lower value. Feature values highest that 0.8 are highlight (Related documents, Fernandez 2004).
- **3D data number:** Number of 3D coordinates extracted from the HDDTM to represent the digitized feature.
- **Trace length:** In meters, correspond at the real distance digitized for polyline features.
- **Point Coordinate:** for point feature correspond at the coordinate digitized, for polyline and polygon correspond to the centroid plane.

2.5 Edit tools

Edit tools are created to modify feature digitized. Point features don't accept edit. Edit actions performed over the graphic features digitized affect directly over the 3D coordinates results producing changes in the same way. Editing actions can be produced at node, at features or at attributes. Any node or any feature must be selected before take action of be edited.

 Press this button active the edit tools  and another press deactivate the edit tools.

2.5.1 Select feature

There are three ways to select a feature, is not accepted multi select. Only work over the action that is selected.

-  **Select - Deselect feature:** Select this button and click with left button mouse over the node of a graphic feature, then the feature with the must closest node selected will be activated. Is visible through the red highlight nodes. At the same time the listbox of identification names (Id. Name) is highlighted the name of the selected feature and in the stereoplot the plane pole change to black color and list in Plane Results shows the attributes.
- **Stereoplot:** Click left button mouse over a pole plane, the graphic feature is highlight, the ListBox Name highlight the name of the selected feature and in the stereoplot the plane pole change to black color and list in Plane Results shows the attributes.
- **ListBox Identification Name:** Selecting the name of one feature, the graphic feature is highlight, showing the pole in black and displayed in red highlight mode the feature graphic if press *Select-Deselect Feature.*

2.5.2 Node actions

Selecting this tools, all nodes of the graphic features are highlighted and ready to be edited.

 **Move node:** Clicking and holding the left-mouse button on the most closest node and dragging the pointer to the new position will be defined the new node position when the left-button is released.

-  **Add node:** Press and hold the left-button mouse between two nodes of a line and dragged until the new position node.
-  **Delete node:** Click left-button mouse over the node selected to be deleted.

2.5.3 Feature Actions

The graphic feature to be edited must be selected only with the button  Select-Deselect feature.

- **Delete Feature:** Select the graphic feature and press this button, the feature will be deleted from the register and the numbers of the identification name will subtracts one position.
- **Change color:** Select the graphic feature and press this button, a color menu will be open to choose a new color and change the pole color in the stereoplot.
- **Split Feature:** Select the graphic feature and press this button to split the polyline in two new polylines. Click left-button mouse on the section line (and near to one node) and the action is completed. New polylines are computed to create the attributes and displayed the new poles in the stereoplot.
- **Join Feature:** To join two different polylines is necessary press this button and select the headers or ending nodes of the both polylines. Attributes are automatically update.

2.5.4 Attribute Edit

- **Set Name:** Selecting from the identification names listbox *Set Name* the *set name* is activated to be edit and change text by default.

2.6 Export Data

Project 150 can export best-fit to a plane data and associate parameters in different formats. Export only can export by blocks, not by project.

2.6.1 Fracture

This export option create a ASCII file with the following parameters:

- Id_name
- Plane Centroid (Coordinates X, Y, Z)
- Azimuth (Dip Direction)
- Dip
- Coplanariety, M
- Collinearity, K
- 3D Data Number
- Trace length
- Set Name

2.6.2 Morphology

This export option create a ASCII file with the following parameters:

- Plane Centroid (Coordinates X, Y, Z)
- Vector orientation: Components of the normal plane vector (u,v,w)
- Azimuth (Dip Direction)
- Dip
- Coplanariety, M
- Collinearity, K
- 3d Data Number
- Number identification: Internal export correlative number.
- Roughness index: Is calculated for polylines and polygons, but only in polygons have real significated.
- Wide: Approach to geometric dimensions of the feature in meters.
- Long: Approach to geometric dimensions of the feature in meters.
- Area: Approach to geometric dimensions of the feature in meters.
- Set Name.

Output file Morphology.txt is created at default folder. Into the dialog box there are parameters filters to control the number of planes:

- Minimum number of points: The number threshold, under this 3D Data number the features are not exported.
- Minimum area: The area threshold, under this square meters for each feature the features are not exported. Notice: For polyline features is not a good quality parameter.
- Minimum M: Limit value for collinearity index, calculated at the best-fit to a plane.
- Minimum K: Limit value for coplanariety index calculated at the best-fit to a plane. .
- Offset Coordinate: To translate centroid points.

2.6.3 Polyworks polylines

The Project 150 exports format files that can be incorporated as a polyline in Polyworks Module Inspector, but *color* and *Set Name* and *id_name* is lost. With this export format, the polyline structure is conserved. Is possible to import as a *Data > Point Cloud from Text File*.

2.6.4 To surface Gocad .ts

Files created in **Export > Morphology** can be exported to Gocad (Paradigm) as surfaces. Gocad software showing each plane with the area and wide and long attributes, with the orientation of dip direction and Dip in the position of the centroid. Input file is “Morphology.txt” and output file is “ExportCluster.ts”.

2.7 Scanline statistics

A digitized line can be used to define a scanline (Related documents, Priest 1993). Attributes calculated for each feature are incorporated in the process of scanline to be used to compute statistical data as the spacing between planes. The average orientation of planes used is calculated too. The process is divided in some steps:

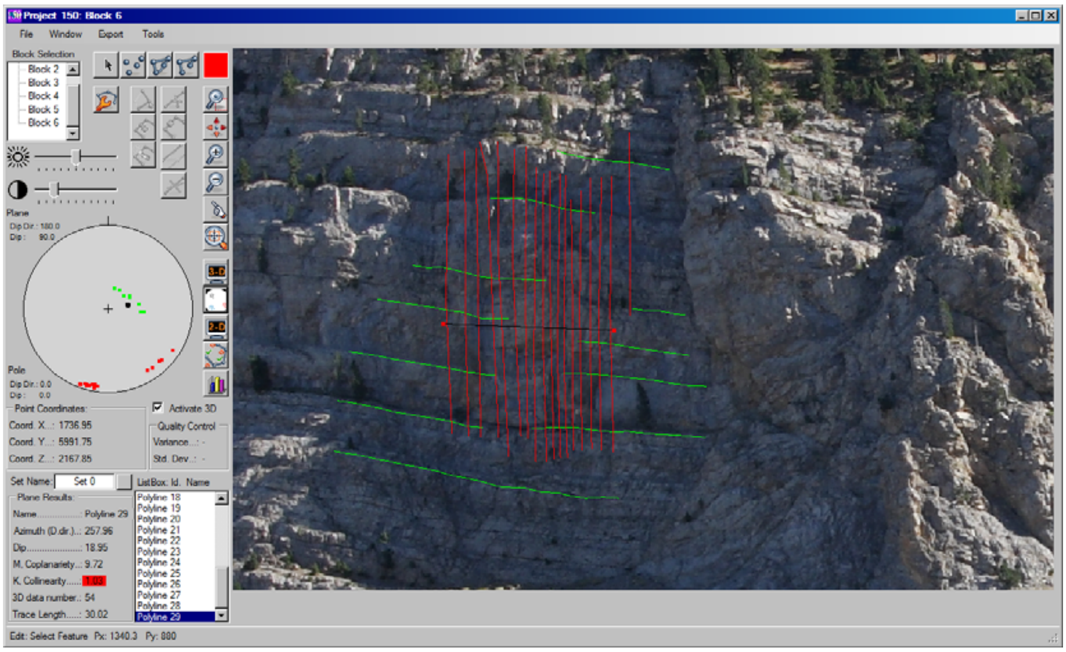


Fig. 5. Configuration scanline example. Bedding (green), joint (red), scanline(black).

2.7.1 Select features

 The scanline functionality starts when the user selects a polyline and press this button, then is displayed the *Select planes* sub-menu from the *Scanline* menu.

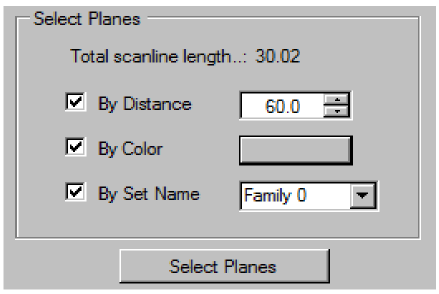


Fig. 6. *Select plane* sub-menu from *Scanline* menu.

The submenu shows the trace length of the scanline feature to have a reference distance so that the user can filter the uninterest features with three checkbox options according to the following attributes:

- *Distance*: Is defined from the centroid feature to the most close point of the scan line. User can activate the filter with a maximum distance threshold.
- *Color*: The selected color will used to limit the features with this color.
- *Set name*: This attribute restrict the select features with this *Set name*.

The process starts pressing *Select Planes* button.

2.7.2 Orientation Set

The orientation Set box displays results from *Select Planes* process with the following statistical values:

- Number of Features: Number of features accepted. In the nearby list are displayed the id. Name of each selected feature
- Mean Resultant Direction: The selected features are grouped in a set and are calculated the Resultant of vector data, is a appropriate statistical method if polar data have a fisher distribution (with a single polarity).
- Preferred Mean Orientation. Eigenvector method. Based in matrices (Bingham statistics) and on the concept of moments of inertia. The minimum moment of inertia is obtained for an axis passing through the "average" orientation and the maximum moment is obtained 90º away from the minimum, along an axis corresponding to the pole of the best-fit girdle. In the matrix of sums directions cosine products are obtained these axes, mutually with perpendicular directions, the eigenvectors, these eigenvalues are properties of the matrix. Eigenvector1 is the largest moment of inertia, and Eigenvector3 is the smallest moment of inertia, and estimates the centre of the densest cluster, similar to a mean direction. Eigenvector2 is the emptiest part. They give as indication of the type of concentration in the distribution. $E_1 < E_2 < E_3$. If $E_1 = E_2 << E_3$ is a pure cluster. If $E_1 << E_2 = E_3$ pure girdle. This method is the better to a Bingham distribution (bi-modal) or poles to folded surfaces. The process produce more information :
  - Normalized Eigenvalues. (Related documents, Allmendinger 1991). The best result for a bipolar distribution set is two short values and one very long and two values of equal length and one much shorter will define a girdle distribution. Three values of nearly equal result define a random distribution.
  - Shape parameter. $\ln(\tau_3/\tau_2)/\ln(\tau_2/\tau_1)$
  - Strength parameter: : $\ln(\tau_3/\tau_1)$

If no mean method is selected, the *Intensity* process uses the own orientation of each angle. There are the possibility to chose one of two mean methods and the *Intensity* process replaces the own orientation of each plane by the mean selected method as mean orientation.

2.7.3 Density

In accordance with the orientation method selected *Intensity* the process computes the following parameters:

- Scanline-Mean Resultant Set Angle. Is the angle between the scanline and the feature set calculated by the vector addition method.
- Scanline-Mean Principal Orientation Set Angle: Is the angle between the scanline and the feature set calculated by the Eigenvalues and Eigenvectors method.
- Mean Spacing: Is the mean distance value between the features along the scanline.
- Standard deviation: Statistical value from the spacing values.

With *Save File* activated, the process creates a file with results of features attributes and intensity values.

- Id. Name.
- Centroid Feature coordinates.
- Orientation Feature (Dip direction and Dip).
- Quality orientation features (collinearity and coplanariety).
- Number of 3D points.
- Trace length.
- Set name.
- Intersection Point feature with scanline.
- Spacing.
- Apparent distance from scanline initial point.
- Real distance from scanline initial point

2.8 Complementary tools

There are a number of complementary tools to created with the aim to facilitate tasks of data manipulation.

2.8.1 Visualization 3D-2D

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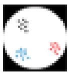
Tool 3D open a new screen of visualization the resultant coordinates in 3D. There are four visualization options to control point of view (Zoom, Rotate (axes X, Y), Move, rotate (axe Z)). Is necessary close the screen when we return to work with the digitalize menu or press button *2D*.

2.8.2 Refresh Stereoplot

 Some times stereoplot display may present problems, in these cases, this option refresh the stereoplot display and resolve the problem.

2.8.3 Control Quality Feature

 This application encodes the adjust degree of each node with the best fit regression plane. Selecting a feature graphic and pressing this option, for each 3D coordinate resulting from a node is calculated the distance to the best plane and applied a statistical process, part of this information is shown by the descriptive parameters, *variance* and *standard deviation*. Other part is displayed with a color-coded for each node representing at the distance quartile (Q.) which belong, providing information on the quality of the fit:

Violet	Blue	Cyan	Median	Green	Yellow	Red
-3,4Q	-2Q	-1Q	0Q	1Q.	2Q.	3, 4 Q

2.8.4 Join Polylines from Blocks

This tool have place in **Menu-->Tools**. The functionality has the aim of join features polylines from different blocks, is designed for a long polylines that are not represented in an only block.

In the main toolbar Open Project open a project and select the blocks with polylines to join with a maximum of three blocks.

Load the blocks, select one polyline from each list block and press *Join Polyline*, in the list New Polylines will be adding a new polyline and visualized the attributes. The new polylines can be exported from the Join Polylines.

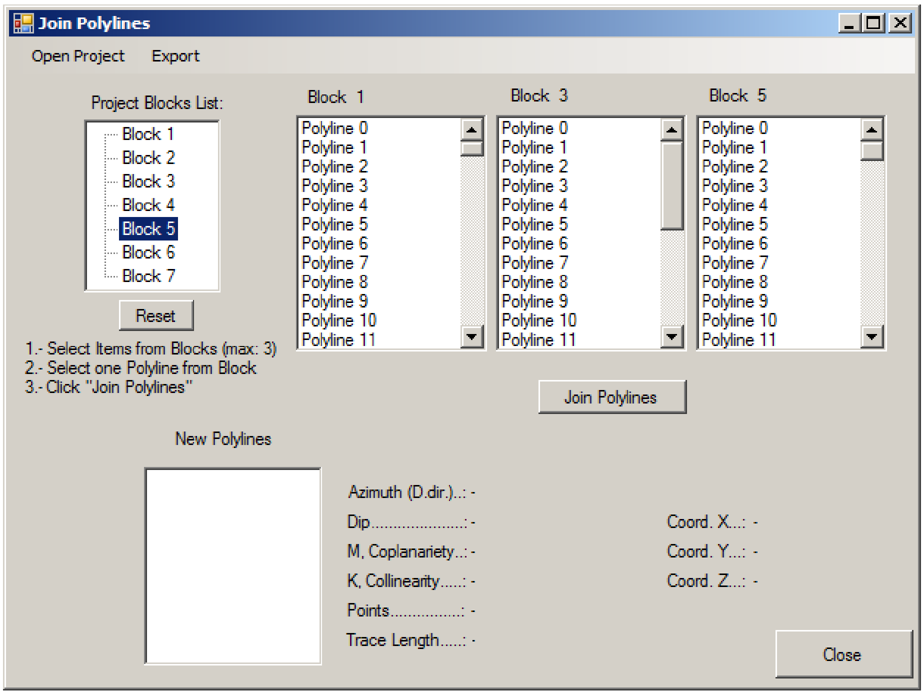


Fig. 7. Join Polylines menu interface.

2.8.5 Import 3D Coordinates

Project 150 can calculate a pixel position from a well-known 3D position coordinate and therefore draw a graphic feature on the image.

There are two ways to incorporate data:

- Manually: Only accept point features. User introduces manually each coordinates in his box and press "*Find Out Pixel Coordinates*" to start the process. Results are displayed. Pressing "*Incorporate*", data is incorporated in the block and the point is drawing over the image.

- From File: To incorporate Points, Polygons and Polylines is necessary a file with the 3D coordinates and with this format.

point

CoordinateX CoordinateY CoordinateZ

polyline

CoordinateX CoordinateY CoordinateZ

CoordinateX CoordinateY CoordinateZ

CoordinateX CoordinateY CoordinateZ

polygon

CoordinateX CoordinateY CoordinateZ

CoordinateX CoordinateY CoordinateZ

CoordinateX CoordinateY CoordinateZ