Processing the point cloud with RiscanPro or Riprofile

CyberMapping Lab
UT-Dallas
RiScanPro

Overview of how to import and display scans
Table of Contents Window

Start New Project
Right Click SCANS
New scan position
Import scans (.3dd format)
Select either 2D or 3D for viewing of point cloud
Point cloud with bounding box and scanner location
RiScanPro

Cleaning the image
Why Clean Up the Image?

• A scanned image will include scan points of vegetation, extraneous points between the scanner and the outcrop, and extraneous points beyond the area of interest in the scene.
  – Points outside of the area of interest need to be removed to have a clean model.
  – Vegetation is notorious for creating poor models. The surface is very irregular and the Polyworks Model Builder does not handle this at all well. The removal of as much vegetation as possible without removing rock surface is advisable.

• Both Polyworks and RiScanPro can be used to clean the image.

• Cleaning the model in RiScanPro has the following advantages
  – The response of the computer is much faster in RiScanPro than Polyworks
  – In RiScanPro, points eliminated from the image are eliminated from the data set. Polyworks does not eliminate the deleted points but maintains them in the data set, thus there is no reduction in the size of the data set.
RiScanPro Work Screen

- Project Name
- Scan Position Name
- Scans .3dd files
- Reflector Coordinates
Image Prior to Cleaning
Mouse Button Commands

- The RiScanPro and the Polyworks button commands are very similar. The screenshot below is taken from a Polyworks edit session.
- The left mouse button rotates the image. The point where the mouse is placed defines the pivot point for the rotation.
- The center mouse button moves the image without rotation.
- The right mouse button zooms the images.
- Holding down shift and the right mouse button rotates the image in the plane of the monitor screen but does not rotate the image in 3D mode.
- Holding down shift and the center button forms a zoom window in Polyworks and in RiScanPro it simply repeats the center button move command without the shift key.
Point Deletion Process

- Click the space bar to put the program into edit mode. A cross-hair cursor will appear.
- Left click to select points defining a polygon which will surround the points that you wish to delete.
- Right click on the final point to close the selection action.
- Press the **Del (Delete)** key to complete the deletion.
- If you wish to abandon a selection you can click the space bar and return to navigate mode.
- If you wish to unselect points, click the *Trash Can* icon on the tool bar.
RiScanPro

Extracting Reflectors
(Or, the secret to keeping your interpersonal relationships joyful)
Extraction of Reflectors

• Polyworks has three methods of aligning scans that were made from different locations
  – Point cloud fitting algorithm
  – Control points using N selected points on the two scans, where N is optimally greater than 3, followed by point cloud fitting
  – Defined control point matching

• The first method produces poor results.

• The second method requires the operator to find common points on two scans. This can be difficult, frustrating, infuriating.

• The third method is quick, easy, accurate, and leaves a smile on your face.

• If at all possible, extract reflectors from the RiScan point clouds and use them to align your scans in Polyworks.
Reflector Extraction Process

- Right click a scan in order to open the menu box
- Select **Find Reflectors**
- An option box will open. **Un-select use auto-threshold.** If you do not, you are likely to have numerous invalid reflectors. Start with 0.85 for Threshold detection. If you find no reflectors, lower it. Try lowering in steps of 0.1
- You can name the reflectors (helpful in keeping things straight) and you need to indicate the starting reflector number. (Actually, in Polyworks the names and numbers are not used but you will go crazy trying to keep track of everything if you do not do this.)
Tiepoint Editing Icons

- When you open a tiepoint list, a new window will open. The icons at the top of the window are used to delete, export, and edit the tiepoints.
Delete all points with small **Pixels**
Tie-point (Reflector) List

- The list of reflectors is relative to each scan position. Tie-points from multiple scans at the same scan position will be contained in the same TPL(SOCS) list. Note the Intensity column. Reflectors will have higher values than rock.

- Comments
  - A. Same scan but the reflector was identified as two reflectors, delete one
  - B and C. Same reflector in two different scans, average the results. Theoretically best done by using a weighted average.
Export the Reflectors to be used in Polyworks

- Click the *Export tiepoint list* icon to open the export screen.
- Export the *Name, X, Y, and Z* values. The names are not used in Polyworks but they are helpful in keeping things straight.
- Be sure that the *Column Separator* is *comma,*
- Be sure to give the exported file a descriptive name.
### Exported Reflectors

<table>
<thead>
<tr>
<th>Name</th>
<th>X[m]</th>
<th>Y[m]</th>
<th>Z[m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>RefPos1_004</td>
<td>12.658</td>
<td>-7.503</td>
<td>0.740</td>
</tr>
<tr>
<td>RefPos2_003</td>
<td>-20.137</td>
<td>-2.049</td>
<td>-3.193</td>
</tr>
<tr>
<td>RefPos3_004</td>
<td>-32.349</td>
<td>-16.961</td>
<td>-2.899</td>
</tr>
<tr>
<td>RefPos4_005</td>
<td>6.296</td>
<td>-48.558</td>
<td>-3.500</td>
</tr>
<tr>
<td>RefPos5_005</td>
<td>18.389</td>
<td>-34.180</td>
<td>-3.843</td>
</tr>
</tbody>
</table>
RiScanPro

Export Point Cloud as ASCII File
Export the Point Cloud as an ASCII File

• In order to have maximum flexibility in Polyworks to create the mesh, it is necessary to export the point cloud as an ASCII text file. If the cloud is imported into Polyworks as a .3dd file there is no ability to change the orientation of the mesh that is created. (There is debate at the moment about whether to use the .txt format described here or the .3dd format.)

• Right click the individual scan and select Export in order to activate the menu.
Export the Point Cloud as an ASCII File

- Be sure to enter a file name that is descriptive.
- Be sure that the fields \textbf{X}, \textbf{Y}, \textbf{Z}, and \textbf{Intensity} are selected. None others should be selected and an error will occur in Polyworks if they are.
- The \textbf{Separator} should be \textit{comma}.
- The file will be saved as a \texttt{.txt} file.
Exported Data Format

- The exported text file appears as below
  15.912,11.683,7.269,0.118
  15.805,11.605,7.199,0.125
  15.510,11.388,7.044,0.118
  15.159,11.130,6.864,0.110
  15.251,11.198,6.886,0.125
  15.296,11.231,6.886,0.118
  15.292,11.228,6.864,0.110
  15.321,11.250,6.857,0.133
  15.370,11.285,6.858,0.133
  15.368,11.284,6.837,0.141
  15.451,11.345,6.854,0.149
  15.578,11.438,6.890,0.157
  16.519,12.133,7.285,0.149
  16.497,12.117,7.253,0.141
  16.345,12.005,7.165,0.133
  16.237,11.926,7.096,0.141
  16.328,11.993,7.114,0.133
Building a mesh with Polyworks from text files
Overview of Polywork Interface Platform

Polyworks prior Version 10 interface platform

Polyworks Version 10 and after interface platform
Overview of Polyworks Modules

- **ImAlign:** Used to align two or more different scans.
- **ImMerge:** Used to merge one or more scans and create mesh.
- **ImEdit:** Used to edit 3D models like filling the holes, add and delete triangles.
- **ImCompress:** Used to reduce the amount of triangles in the models.
- **ImInspect:** Used to do analysis for 3D model like measurement and compare between two models.
- **ImTexture:** Used to add and maintain the texture on the models.
- **ImViewer:** Viewer to display the models.
Introducing the Workspace Manager
The PolyWorks/Workspace Manager (WM for short) makes using PolyWorks modules and managing files easy. The WM manages a PolyWorks process from beginning to end, offering simple navigation tools between modules and easy process workflows for new users. The WM contains your input files and PolyWorks Projects, as well as files created as a result of the PolyWorks process. It also offers quick access to PolyWorks modules, Projects, or data.

In short, the WM lets you:
- **manage** the contents of a workspace
- **navigate** within the PolyWorks process easily via the Wizard window
- **contain** your input files, your Projects and the PolyWorks-generated files
- **document** workspace objects by adding notes and images
- **share** information with your colleagues quickly
Polyworks Help Guides

For more information, use help guides in the main polyworks window.
Importing ASCII File to ImAlign
Open or create workspace window popup each time polyworks program startup. Create a new workspace for your work or select an existing workspace if you already have one. For quick work or test that you don’t need to save any work you may select cancel.
Import Scan Data to ImAlign

I Want To...

- Import a 3D digitized dataset using IMAlign
- Import a 3D digitized dataset using IMInspect
You should get it from here for the first time then it will appear in the recent formats.
Select Point data file

Look in: file path

Files of type: Point Cloud Files (*.*)
Template: Points Only

File name: scan1.det.txt

Open
Cancel

Then click open
Instructions:
1- Using the mouse, give the data the desired orientation.
2- Click on "Anchor" anytime to define a new viewpoint facing the current orientation.
3- Check "Use plane" to enable a plane that can be used for clipping points. Use the slider to translate the clipping plane along the current viewpoint.

Hint: point selections can be performed by pressing Spacebar. Several operations can be performed on the selected points using the dialog box's menu.

Hint: the point cloud can be subsampled by specifying a subsampling value and clicking on "Subsample".

4- Click on "Next" or press Tab to go to the next step.
5- In the dialog box that appears, specify a new value for the maximum edge length to preview the resulting triangulation.

Hint: experiment with several values for this parameter, as it can be used to clean up undesired triangles.

6- Specify the interpolation step and/or the maximum angle.
7- Click on "OK" to create the image using the current values, or click on "Cancel" to cancel the operation.

Hints:
* For some formats, it is possible to bypass most of the steps above and perform an automatic generation of images. To use this feature use the dialog box's menu "Edit->Auto organize".

Shortcuts:
* Press Escape to exit the mode.
Clean the data by pressing the space bar once then press middle button of the mouse and press shift + control button in the same time, then select the point that you want to delete then release all buttons and just press right button of the mouse the selected data will be in red color. Press delete button in keyboard the point data will delete.
When you finish from cleaning hit the space bar again to get the mouse arrow again, and then stretch the model by zoom to the data to be perpendicular to the data. Click on Use clipping plane. Then click on Anchor. Then next tab.
Zoom tell you see the triangle mesh

Then change the values in the import image window

change to 0.5

change 0.05

After finish click OK

Leave it as it is
Press TAB to go to the next step.

2- Then click Yes

Are you sure you wish to leave the Point Cloud Organizer? Leaving the Organizer removes the point cloud from memory.

Yes  
No

1- When you finish click Done
Clean the data if necessary with the same previous procedure.  
Hit space bar → shift + ctrl + middle mouse button  
Select the unwanted points then click right mouse button  
Then delete the red points.
Then import ASCII point cloud then do the same as you did before.
Importing 3DD File to ImAlign
Import Scan Data to ImAlign (3DD Format)
you can select Multiple scans in one time
Select OK
Change from 75 to 89
Close Wizard
1- Change these values
Each model has different value

2- Click update then zoom to the outcrop to see the changes

3- Click OK when you finish
Focus distance
A text box that specifies a distance from the scan origin. This distance is used for two purposes. At focus distance it identifies a circular zone of data points in the middle of the first range. Its value is then doubled to calculate the upper limit of the first range. Note that each time a value is specified, the **Step at focus** value is automatically calculated.

**Step at focus**
A text box that specifies the point-to-point spacing calculated by IMAlign at the **Focus distance**. Since it is calculated in the middle of the first range, it provides a good average interpolation step for that range. Its value is doubled for each subsequent range, and used as the interpolation step for the range when it is larger than the **Min. interpolation step**. You may also enter your own base value in the text box.

Max edge length
A text box that specifies the base value used to limit the maximum triangle edge length for each range. The default value is **1000**. It is recommended to change this value. This value is used for the first range and doubled for each subsequent range. Note that to see the bridging in the 3D rendering window, the drawing type of the Static display mode should be set to **Flat** (View > Image Default Static > Flat).
Subdivided files and this case there are 70 files