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http://gmvcast.uark.edu/scanning/software/polyworks/workflow-polyworks/polyworks-pifedit-cleaning-point-cloud-data/ http://gmvcast.uark.edu/scanning/software/polyworks/workflow-polyworks/polyworks-pifedit-cleaning-point-cloud-data/#comments Mon, 11 Feb 2013 23:25:30 +0000 caitlin
http://gmvcast.uark.edu/?p=12311

This page will show you how to view and 'clean' the data in Polyworks PIFEdit.

Hint: You can click on any image to see a larger version.

POLYWORKS PIFEDIT

Introducing Polyworks PIFEdit:

PIFEdit is a data viewing and editing software available in the PolyWorks suite. It is used to clean scan data of unwanted data/points before importing the data into IMAAlign.

* **Note:** You have to have a full license of Polyworks (w/dongle) to be able to edit and save data out of PIFEdit (otherwise it functions only as a viewer).

Basic Navigation:

Upon opening the PIF file in PIF Edit, view the scan using the appropriate mouse buttons:

Left Button: Rotates the scan

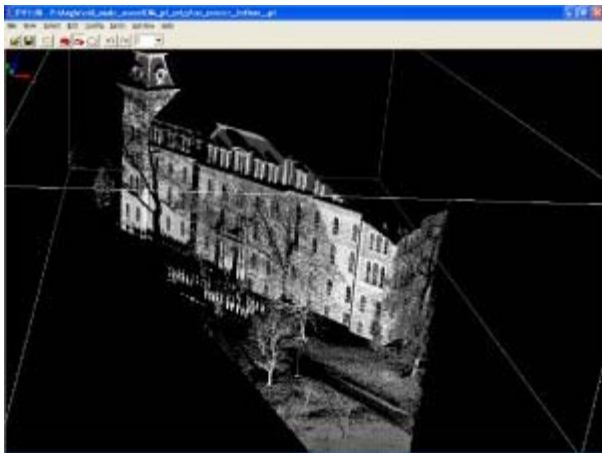
Middle Button: Translates the scan

Right Button: Zooms in and out on the scan

Get accustomed to the use and "feel" of these buttons because they are used in all of the PolyWorks modules.

VIEW DATA

View the data from every angle to identify which data you want to keep and which data can be removed.



In this "un-cleaned" data the trees and people, in this case ROTC soldiers, are

seen

In the image above, a group of ROTC soldiers were included in the scan. Since the focus of the scan is the building, the scan data of the soldiers, the trees, and the ground in front of the building will all be removed.

Notice how the trees and the soldiers (objects in the forefront) cause shadows or holes in the scan data of the structure (object in the rear). This can be remedied by simply acquiring another scan of the same area from another location if access and time permit another scan.

SELECT UNWANTED DATA

To remove the unwanted scan data, press the **space bar**. This activates the Selection dialog box.

Hold down the **Shift and Ctrl keys and use the middle mouse button** to make your selection.

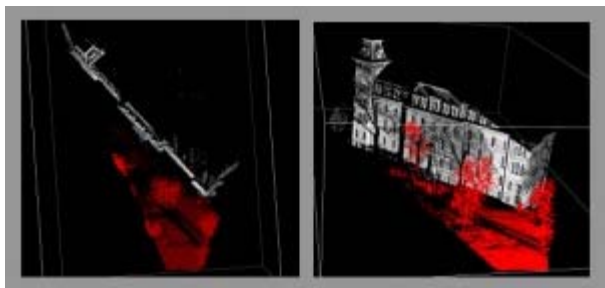
Shift: Enables Volumetric Selection – otherwise it is in Surface Selection mode which is only useful with polygon meshes

Ctrl: Enables Polygonal Selection – otherwise in Freeform Selection mode

CONFIRM SELECTION & DELETE DATA

Because you have to perform a volumetric selection in PIFedit (aka it selects everything in the selection window), it is always good to **double check** the integrity of your selection before you delete any data.

Once you have done so you can go ahead and delete the unwanted data points from the scan. Repeat this operation as many times as needed.



The red indicates data that has been selected. On the left we view the data from above, on the right we view the same selected data in a perspective view

When finished, go to **File – Save As – save as name_cln.pf**.

Note: Our naming convention is to tack a 'cln' onto the scan name or to put the cleaned data into a 'clean' subfolder. **As a rule of thumb – never overwrite the original data.**

CONTINUE TO...

For further processing in the Polyworks Suite, continue on to [Importing Data into IMAlign](#).

]]> <http://gmvcast.uark.edu/scanning/software/polyworks/workflow-polyworks/polyworks-pifedit-cleaning-point-cloud-data/feed/> 0 <http://gmvcast.uark.edu/scanning/hardware/optech-ilris-3d/checklist-optech-ilris->

This page will show you how to process raw scan data from the Optech ILRIS in ILRIS Parser and how to view and 'clean' the data in Polyworks PIFedit.

Hint: You can click on any image to see a larger version.

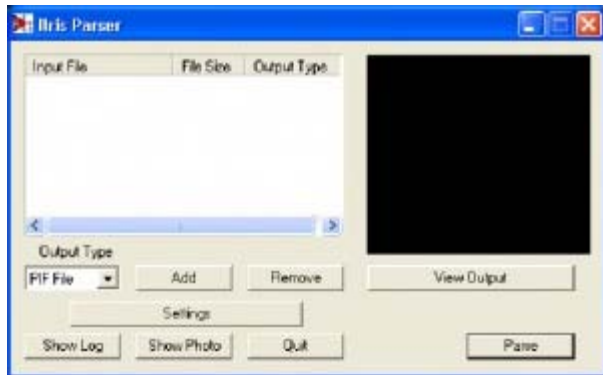
THE OPTECH PARSER

Introducing the Optech ILRIS-3D Parser:

The Parser program processes raw scanner data in a variety of output formats recognized by PolyWorks, GIS softwares, and other 3D modeling suites.

Using ILRIS Parser

Open the Parser program by double-clicking on the icon on your desktop. The Parser window displays as follows:



The Optech Parser window

ADD DATA

Add your data

Add your **.i3d** file by clicking the "Add" button.

Browse to the scan file location and select the desired scan.



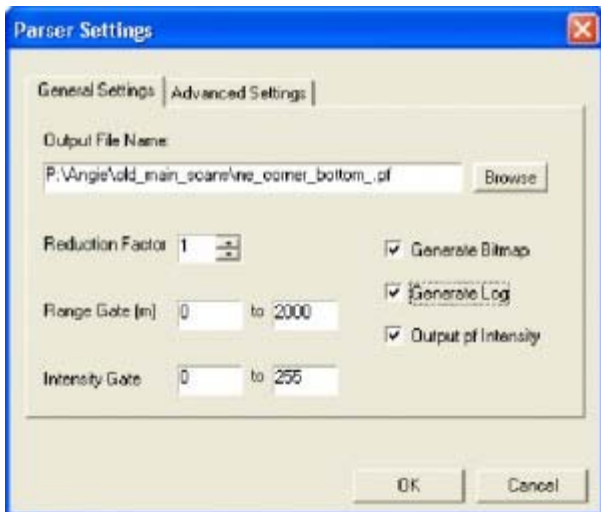
Adding data in Optech Parser

The .i3d file is added to the file window in the Parser. A photograph of the scanned area acquired by the laser scanner is also viewable in the Parser window.

OUTPUT FILES & GENERAL SETTINGS

Next, specify your desired output file type. For more information on output file types and their respective settings, please refer to the ILRIS-3D Operation Manual (Section 9). The PIF file type is the default output file type and is a PolyWorks specific format for use in the Polyworks Suite. The PIF output options are discussed in the following slides.

Click on the “Settings” button.



General settings in Optech Parser

In the Output File Name textbox, specify the name and location for the output PIF file.

The Reduction option allows you to subsample your data (recommended subsampling: 1).

Filtering – You also have the option to “filter” your data by specifying a Range Gate and/or an Intensity gate.

The Range Gate option specifies a desired data range based on distance from the scanner (in meters)

The Intensity Gate option specifies a desired data range based on the intensity readings returned from the scanner. While it is good practice to range grade your data to remove outliers etc..., it is not required because the data can also be edited in the PIFedit software.

MORE GENERAL & ADVANCED SETTINGS

General Settings:

It is recommended to leave the Generate Bitmap, Generate Log, and Output pf Intensity options checked.

Generate Bitmap creates a separate .bmp file of the scan photograph

Generate Log creates a report containing the scan statistics

Output pf Intensity adds the intensity values returned from the scanner to the PIF file.

General Details and Advanced Settings:

For more on these options and those available in the Advanced Settings tab, please refer to the ILRIS-3D Operation Manual (Section 9).

PARSE DATA

When the desired options have been selected in the "Settings" menus, click "Ok," and "Parse" the data. A progress report is displayed to show the steps and completion of the parsing process



The progress window shows as the data is being parsed

CONFIRM PARSING IS SUCCESSFUL

Note that a green check appears beside the file name in the file window indicating that that the file has been parsed.

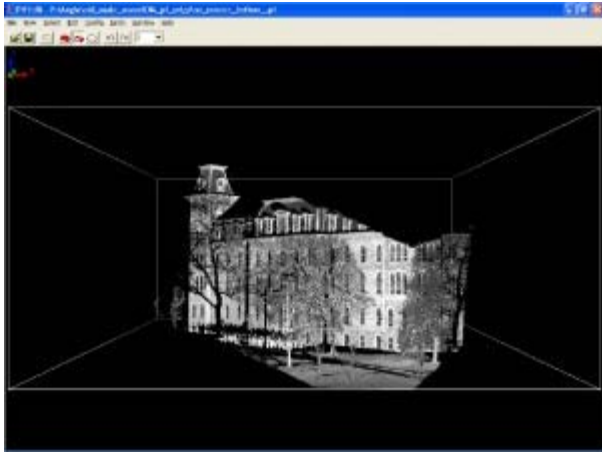
To view the resulting PIF file, click the "View output" button.



Confirm parsing was successful and view output file

VIEW PARSED DATA

Once you click 'View Output' in ILRIS Parser, the PIF file is opened in the PIFedit viewing window



The parsed file can now be viewed in PIFedit

FILES CREATED IN PARSING

Note that a PIF file (.pf), a report log (.txt) and a bitmap of the scan photo (.bmp) are created in the parsing process.



The files created in the parsing process

CONTINUE TO...

Continue to [Polyworks PIFedit: Cleaning Point Cloud Data](http://gmvcast.uark.edu/scanning/hardware/optech-ilris-3d/checklist-optech-ilris-3d/optech-ilris-parser-pre-processing-scan-data/feed/)

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These are basic set-up and operation instructions for operating the Optech ILRIS 3D with a laptop. See the Optech Manual that accompanies the scanner for more detailed information.

1. Set up the tripod as levelly as possible
2. Attach scanner to tripod, be sure to tighten screw securely

3. Turn on laptop and connect it to scanner using either the cable or wireless network. Depending on the desired configuration, please set up accordingly:

Ethernet/Wired Connection

- In Control Panel > Network Connections > Select Internet Protocol (TCP/IP)
- Use the following IP address: 192.9.202.1 and Subnet Mask: 255.255.255.0
- In I3dNet Software > Go to tools > Prefs > Communication > Enter 192.9.202.248
- Polyworks dongle

Wireless Connection

- In Internet Protocol (TCP/IP), enter the following IP address: 192.168.0.6 and Subnet Mask: 255.255.255.0
- In I3dNet Software > Enter IP address 192.168.0.5
- Note that to reset the IP address you can log onto the internet > In Control Panel > Network Connections > (TCP/IP) > Specify 'Obtain IP Address Automatically'

4. Connect batteries to I-Bar in a T-shape. This is the only way that they will provide power to scanner

5. Connect batteries to scanner using battery cable

6. Start the I3DNet Program

7. Go to the Communication Menu > Click 'Connect'

8. Click icon with red outline to place scanning area on screen and re-size red box to define the scan area

9. Click 'Acquire' button to obtain the distance to the object to be scanned

10. Set the parameters of the scan – **First** will return readings from the first object/surface that is encountered while **Last** will return readings from the last object/surface that is encountered. Use Last to scan 'through' objects such as trees, fences, etc.

11. Set point spacing of laser (resolution)

12. Press the apply button

13. Start scan and save the file in the desired location

14. Parse scan to check data quality

15. Continue to [Optech ILRIS Parser: Pre-Processing Scan Data](#)

]]> <http://gmvcast.uark.edu/scanning/hardware/optech-ilris-3d/setup-operations-optech-ilris-3d/optech-ilris-3d-set-up-and-basic-operation/feed/> 0 <http://gmvcast.uark.edu/uncategorized/leica-cyclone-7-0-advanced-guide-for-building-modeling-modeling-and-placing-repeating-features-2/> <http://gmvcast.uark.edu/uncategorized/leica-cyclone-7-0-advanced-guide-for-building-modeling-modeling-and-placing-repeating-features-2/#comments> Tue, 10 Apr 2012 21:19:50 +0000 caitlin 5 meters]]> <http://gmvcast.uark.edu/?p=6348> [Continue reading →](#)]]>

This series will show you advanced modeling building modeling techniques using Leica's Cyclone.

Hint: You can click on any image to see a larger version.

As objects become more complex, using layers (Shift + L) becomes essential to organizing and controlling the model space.

CHOOSE YOUR MODELING METHOD

As noted, it is best to model features in individual ModelSpaces, re-inserting them into the original ModelSpace upon completion. Often features, such as windows, will repeat on structures or sites. Whether each feature is modeled individually or modeled once and then repeated depends on the discretion of the user and the nature of the subject. New, modern structures (such as office buildings) are well-suited to modeling features once and repeating them as they often utilize standardized materials and building methods. Older and/or deteriorating structures/sites are better-suited to modeling features individually as time, movement, and building methods often result in more organic, unique features. As always, the method of modeling depends on the subject and the user's intentions.

COPY WORKING AREA

- 1. Copy working area to new Working ModelSpace** (for example, you may be modeling an entire building but at the current stage, you are inserting a repeating window into a wall; in this case, copy the **wall** to a **Working ModelSpace** and model individual **windows** in a **Feature ModelSpace**. These temporary modeling spaces will be re-inserted into the overall building model later)
- 2. In Working ModelSpace, create base model** in which to insert repeating feature (in this example, create the wall) -> Place on its own layer -> Insert Copy of Object's Points
- 3. Within Feature ModelSpace** (MS where window is modeled) -> Select all objects making up feature -> Edit -> Group -> Copy -> Close Feature MS (**do not** merge into original!)

ASSIGN GROUP TO ITS OWN LAYER

- 4. Within Working ModelSpace** (MS where larger wall has been copied) -> Paste -> Assign Group to its own layer

Note: As long as the coordinate systems have not been altered, the feature will paste into the correct location within the *Working ModelSpace*. This original feature will be the only copy whose location is directly linked to the point cloud data at this point. When the feature is subsequently copied and placed within the working ModelSpace, accuracy to the original data is dependent on how copies are placed by the user and how the points are used/referenced in placement.

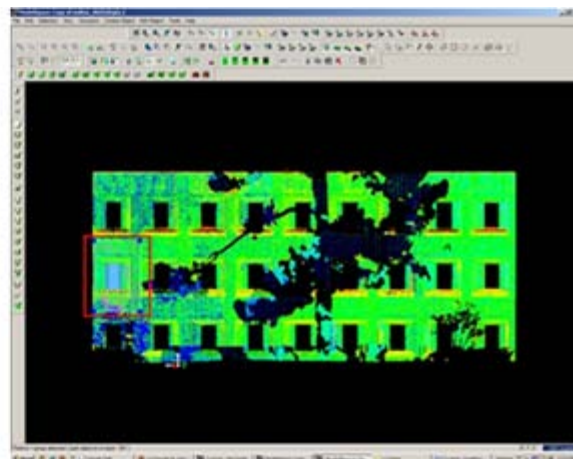
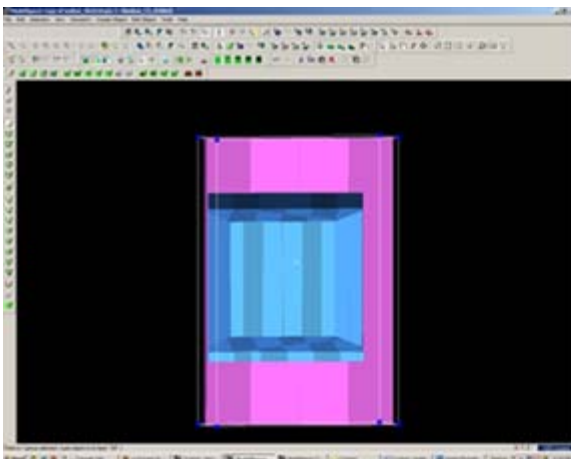


Figure 15 – (Left) Complex feature is grouped and copied (Right) Feature is pasted into the working ModelSpace – note that the feature inserts into the correct position based on the original scan data

DEFINE A “COOKIE CUTTER”

5. If the repeating feature requires a repeating opening, draw a polyline on top of the inserted group to define the opening (this polyline will be used as a “cookie cutter” to make subsequent openings in the wall surface; polyline opening should be **slightly smaller** than the feature to be inserted -> Place cookie cutter polyline on its own layer

6. Use polyline to create opening in primary (wall) patch (follow steps for “Creating Repeating, Identical Openings”) -> this opening now reveals the grouped window within the primary wall surface

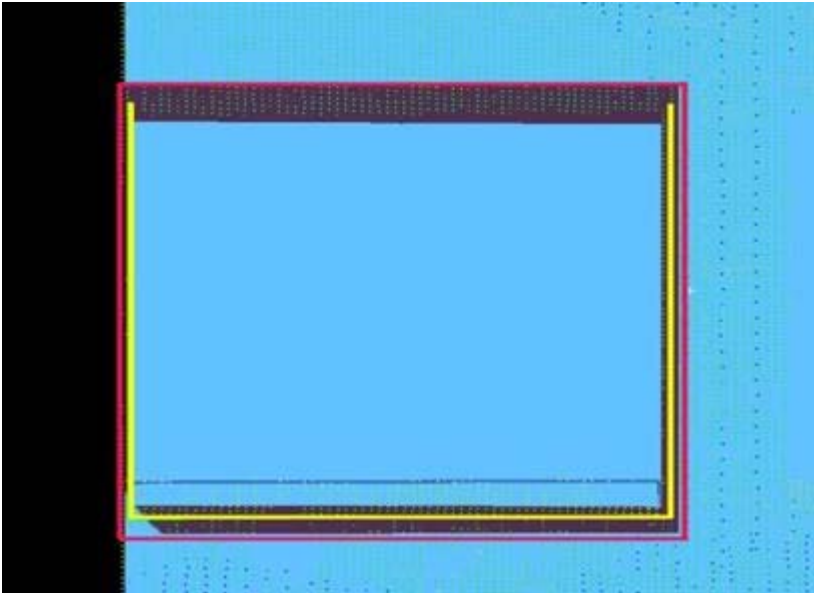


Figure 16 – The large magenta rectangle highlights the entire group; the yellow polyline (representing the “cookie cutter” used to create openings in the primary surface) is slightly smaller than the group

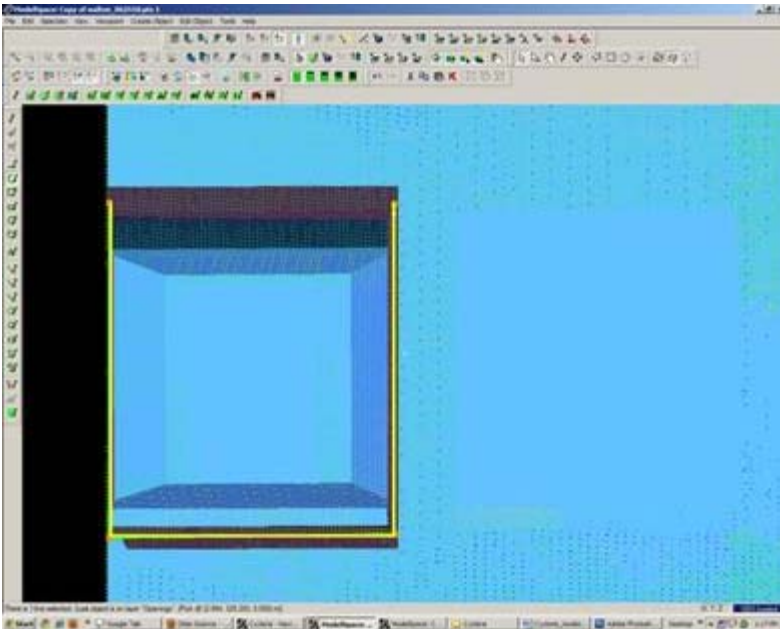


Figure 17 – Opening has been made and the grouped window is revealed – note the yellow polyline “cookie cutter” and the group can be copied and repeated on the primary wall patch

7. Select the Window Group and the “cookie cutter” polyline -> Copy to the next location; there are several methods for placing the repeating feature; two possibilities are outlined below, however different options can be mixed/matched:

7A. Copying and Locating by Pick Points > Multi-select 1st) Group/window 2nd) cookie cutter polyline 3rd) Point representing location where copied object is to be placed -> Create Object -> Copy

7B. Copy dialogue box appears and points that have been chosen are numbered -> Direction of Move, click on blue arrow -> Point to point, define points to use for direction of move and ok -> Distance of move, click on blue arrow -> Point to point, define points to use for distance and ok -> At main dialogue, confirm objects are correctly identified in the “Apply To” pull-down menu -> Copy

Note: If pick points do not show up correctly when copy dialogue box appears, you can re-define pick points while copy command is active; simply multi-select new pick points before defining direction and distance

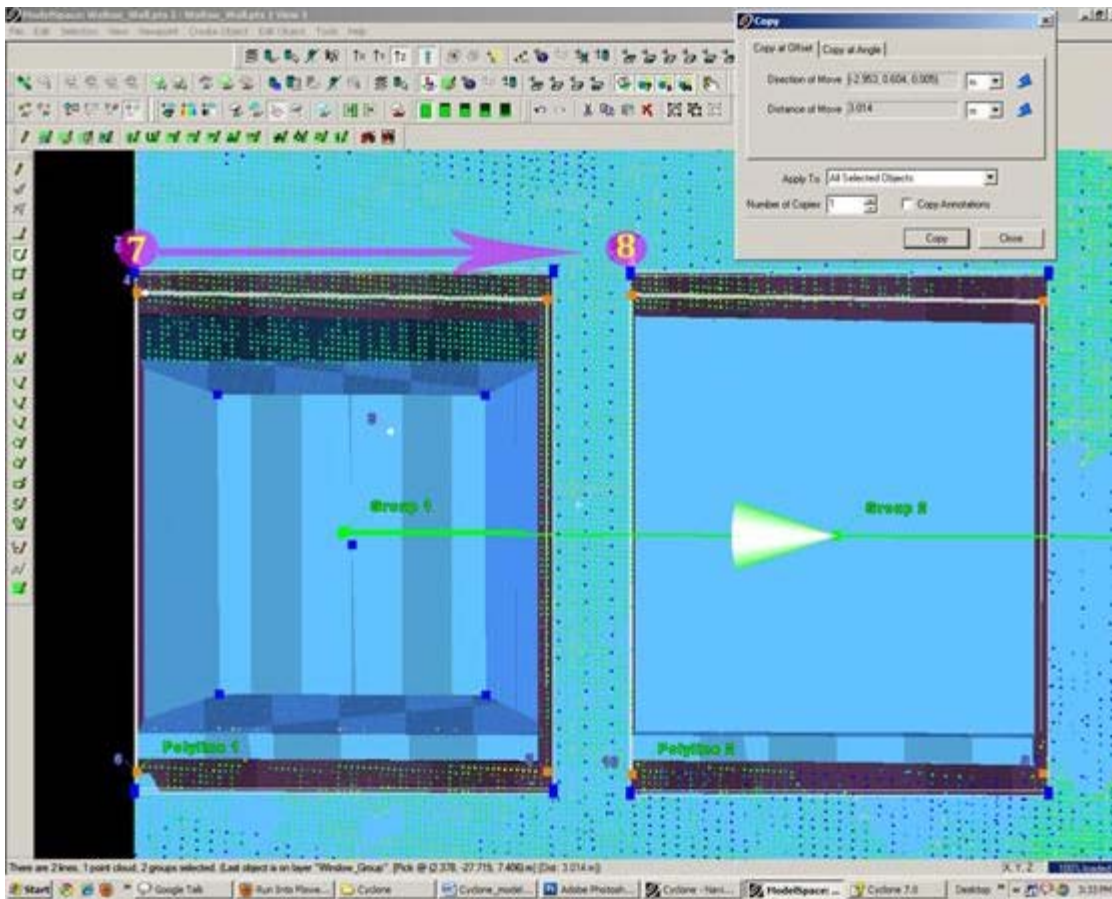


Figure 18 – Window Group and Polyline are copied with Cyclone’s green arrow showing direction of copy – note that in this case, both the direction and the distance of the copy are from Point 7 to Point 8

MULTIPLE COPIES BY DISTANCE AND AXIS

7C. Multiple Copies by Distance and Axis > Multi-select points representing 1st) the starting location of the object to be copied 2nd) the offset distance the object will be copied to -> Tools -> Measure -> Distance -> Point to Point -> Annotation showing distance appears

7D. Continue multi-select command -> Select Object(s) to be copied -> Create Object -> Copy -> Direction of Move -> Choose Axis and ok (arrow appears showing which axis will be used for the copy – note that the direction copy is placed along axis is defined by a positive or negative number in the distance)

7E. Distance of move -> Custom -> Enter amount derived with measure command and ok (a negative or positive possible determines the direction on axis) >Main Copy Dialogue box -> Enter Number of copies – note that copies will be offset from each succeeding copy, NOT from the original start location -> Confirm command applied to objects correctly -> Copy

NOTE: Any error will increase as distance increases; therefore it's important that you examine each copy for accuracy and manually adjust as needed, especially those copies at the greatest distance from the original

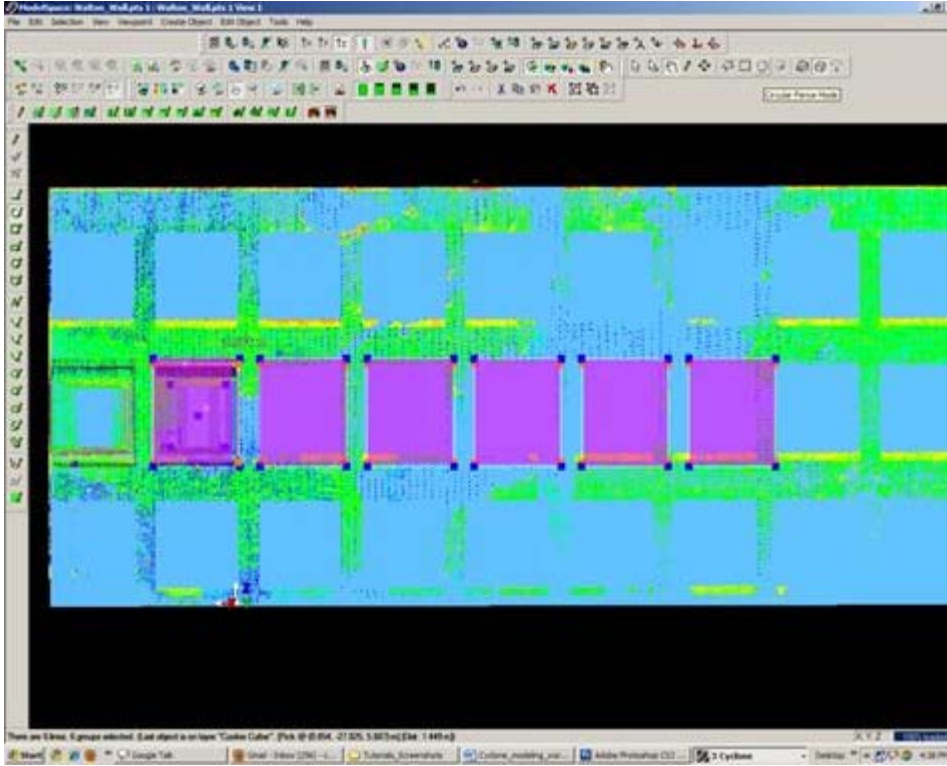


Figure 19 – Multiple copies (highlighted in magenta) are offset from one another; openings can be seen in the green, point cloud data – note that as distance increases from the original left group, the error between the proposed opening/group and the accurate opening in the point data also increases and must be adjusted

REFINING THE PLACEMENT OF REPEATING FEATURES

8. Refining the placement of Repeating Features – as noted, small errors in distance increase with repetition/distance. Using the point cloud and the constraints in Cyclone are essential to accurately placing and locating features. In this example, the primary patch (the wall) is located along the x-axis. As succeeding windows become mis-aligned with the actual point cloud openings, windows are adjusted individually to rectify the model with the point data.

For **distance moved**, specific points are used – in this case the window sill protruded creating a discernible corner to match with the model's sill corner.

Direction moved is restricted to the x-axis – this ensures that (1) the succeeding windows stay horizontally aligned with the original and (2) all windows stay along the same plane (the main wall where original window was placed).

Note: Surfaces are very rarely perfectly orthogonal and flat; rather they usually have fluctuations and they deviate from perfect angles. As such, when comparing a flat surface that has been modeled to the point cloud data, points should appear dispersed on both sides of the plane/patch; all points **should not** be completely located on one side or the other as this indicates the plane is not directly

referencing the points.

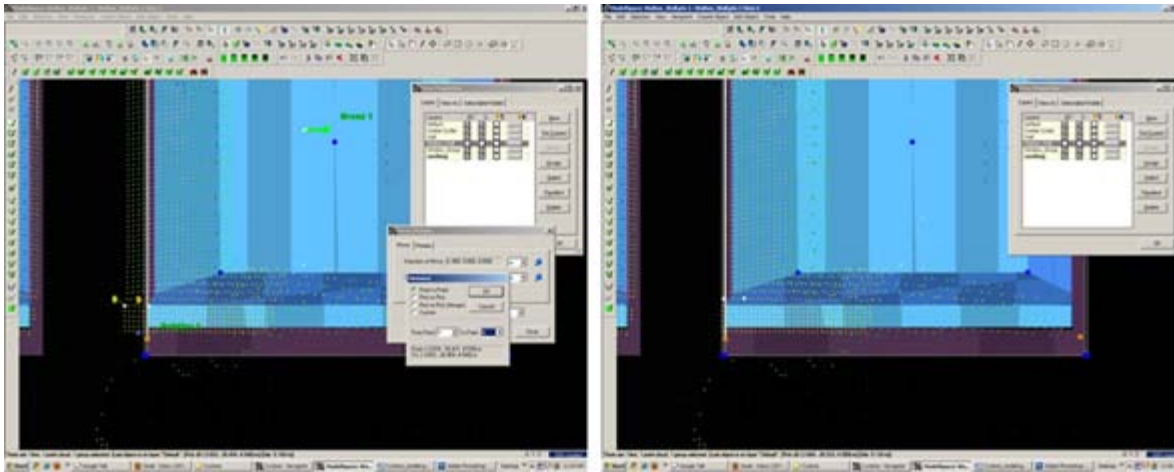


Figure 20 – (Left) A window is misaligned with the point cloud data; zooming in allows the user to use the points very precisely; movement by picking points allows accurate placement of specific features, such as corners, while moving by a standard axis allows orthogonal alignment with other objects, planes, and references (Right) Window is rectified with the x-axis and specific points on the window sill. Note that the visibility of the primary patch (the main wall) has been turned off for clarity of other layers.

MISSING DATA AND COMBINING RESOURCES

9. Missing data and combining resources – While point cloud data and axes help accurately place most features, in some cases data is simply not present. In these cases, utilizing other resources is essential to creating a complete model that is as accurate as possible. In this example, a tree left a large shadow in the wall and placing windows within this shadow becomes difficult with point cloud data alone.

Utilizing measurements – finding the average distance between other windows and placing the windows in shadow at this offset helps place the windows fairly accurately.

Comparing the model with the photographic data collected during scanning further assists in accuracy.

CREATE OPENINGS IN PRIMARY WALL PATCH

10. Once each group has been evaluated and placed accurately -> use the cookie cutter polyline to create openings in the primary wall patch as shown in Step 5 of this section -> Erase or hide the polylines as needed once used (erase if merging back into the original ModelSpace and lines are no longer needed; hidden if copying into original ModelSpace and you want to maintain reference objects in the working ModelSpace).

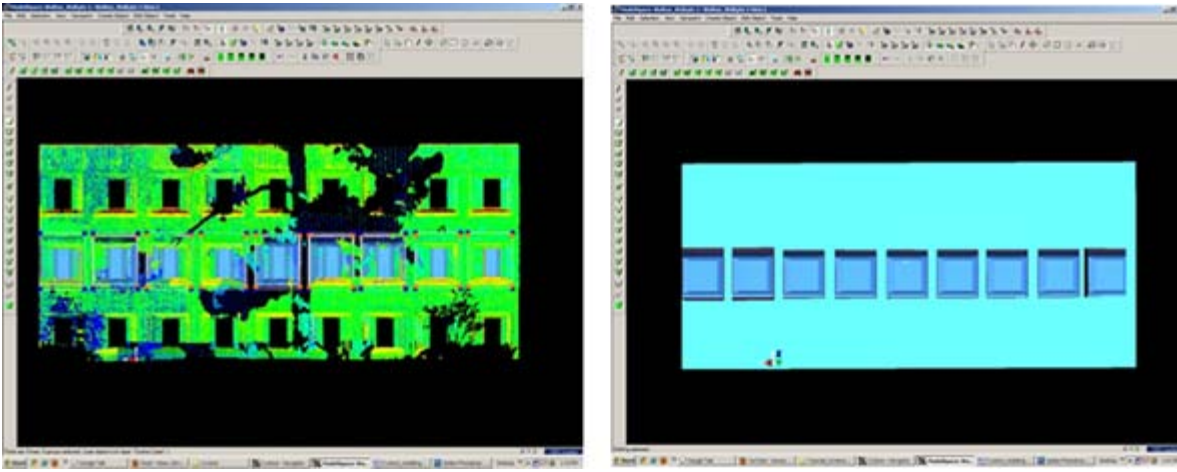


Figure 21 – (Left) Windows, in dark blue, have been individually analyzed and adjusted for accuracy with the point cloud, in green (Right) Openings have been made in the primary wall patch, in light blue; the dark blue window groups are revealed.

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<http://gmvcast.uark.edu/uncategorized/leica-cyclone-7-0-advanced-guide-for-building-modeling-modeling-a-complex-shape-2/#comments> Tue, 10 Apr 2012 20:42:34 +0000 caitlin 5 meters]]>
<http://gmvcast.uark.edu/?p=6322> [Continue reading →](#)]]>

This series will show you advanced modeling building modeling techniques using Leica's Cyclone.

Hint: You can click on any image to see a larger version.

As objects become more complex, using layers (Shift + L) becomes essential to organizing and controlling the model space.

MODELING AN ANGLED WINDOW OPENING

A. Modeling a Complex Shape – An Angled Window Opening

1. **Copy area to be modeled** into new, working ModelSpace
2. **Familiarize yourself with the object** and the different layers/depths in space that you are working with; when angles are involved it's good to understand where each angle terminates.



Figure 8 (Left) Complex window to be modeled (Right) Familiarize yourself with the layers of space to be modeled – here yellow represents the farthest plane (the glass) and orange represents the closest plane (the wall in which the window is set)

DIVIDE INTO SUB-SELECTIONS IF NESSCEARY

3. It may be useful to divide the point cloud into sub-selections based on their depth in space or on separate areas to model – Rotate the object to view it from the side or top view -> fence the area to be subselected -> RC -> Point Cloud Subselection -> Add Inside Fence

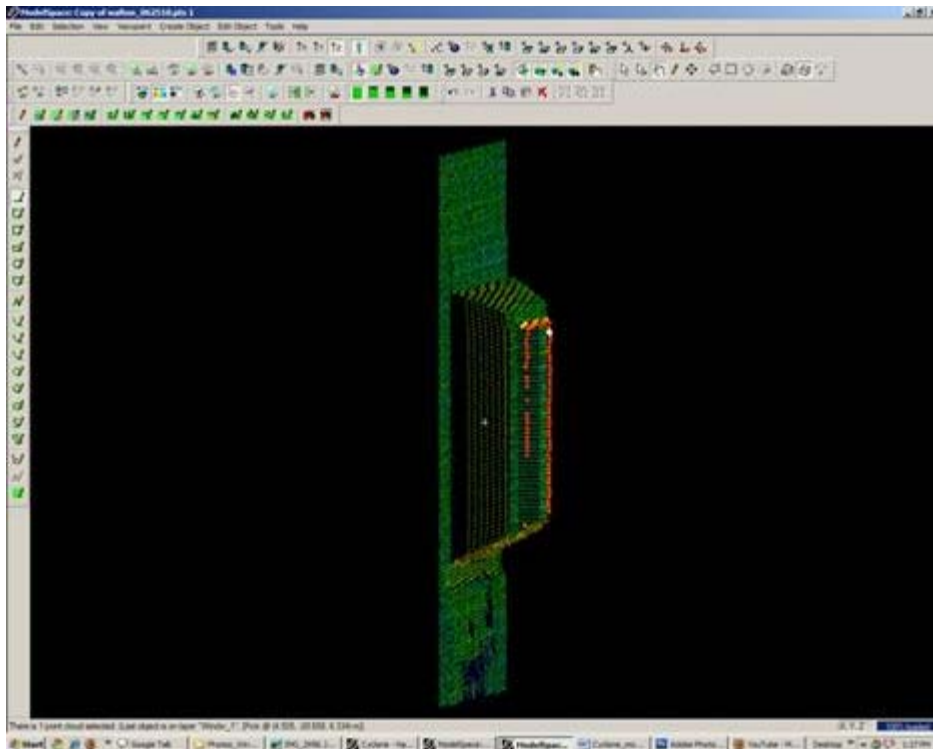


Figure 9 – Point cloud is sub-selected into several clouds based on their depth in space

MODEL THE OBJECT

4. Model the object using patches, extensions and extrusions as previously outlined – when

modeling angled or complex surfaces, patches can be created several ways. When fencing an area and fitting a patch, fence the area that best represents the surface – exclude areas where the surface becomes skewed or extreme near boundaries, curves, etc.

5. While snapping adjacent patches together and extending them, extra handles are often created. It's best to clean up the patches as you go of any extra handles/geometries to maintain simple, clean lines where possible: Select Patch -> ALT + RC on extra handle -> handle removed

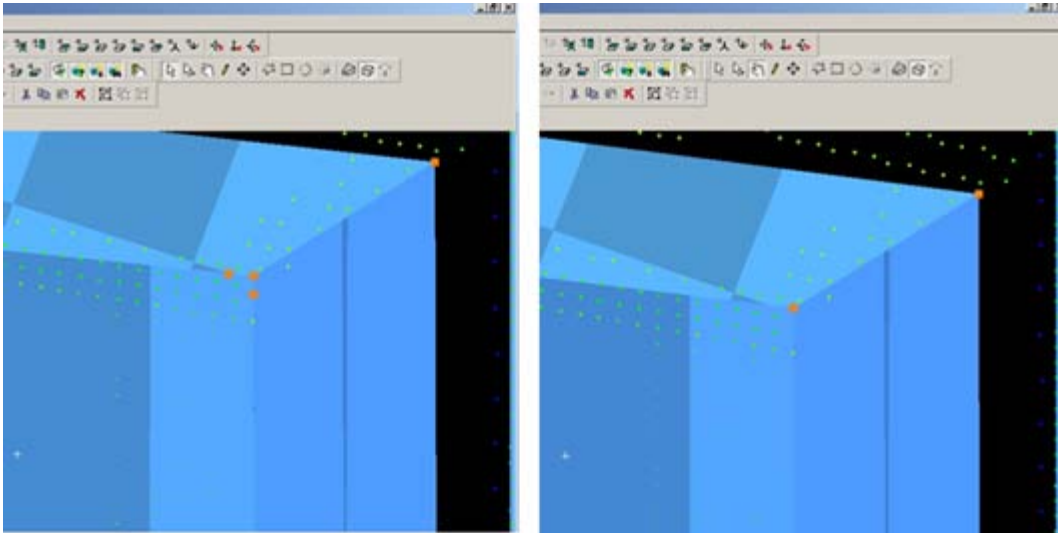


Figure 10 – (Left) Extra handles have been created where the patches intersect (Right) Extra handles deleted, leaving the cleanest, simplest geometry possible

MODELING TIPS

6. As objects become more complex and angles become more complicated, it may be helpful to visually clarify and define the objects. This can be done several ways, including editing object colors and creating lines along the edges of objects that are intersecting. Lines create crisp edges and create wireframe objects for export later.

6A. Change Object Color -> Select Object -> Edit Object -> Appearance -> Choose color

6B. Creating Lines where objects intersect: Once the patches/objects have been extended to one another > Mult-select 2 intersecting patches -> Create Object -> From Intersections -> Curve (Note that in Cyclone, a curve here is a line. Also note that sometimes lines will extend beyond the object. Select the line -> slide the handles so beginning and end of line is within the object -> use handles or extend command to make the lines form corners) **NOTE: It's recommended to place lines/polylines on their own layer to aid in their selection and visibility later.**

MORE MODELING TIPS

7. While modeling complex objects, you will encounter areas where surfaces exist but there is no point cloud data to model directly from. Extruding and extending will often produce these surfaces but sometimes creating polylines and customized patches may be the best way to model these areas. Using the handles of previously modeled objects helps maintain the accuracy of the scan data.

7A. Align view to see the vertices of existing objects to use as guides for the edges of the proposed patch.

7B. Choose handles/points to create the new patch – select the points in the order you wish to draw the polyline that will define the edges for the patch. Do not close the polyline, leaving the last line segment open.

7C. Create Object -> From Pick Points -> Polyline -> Assign Polyline to its own layer

7D. Create Object -> From Curves -> Patch

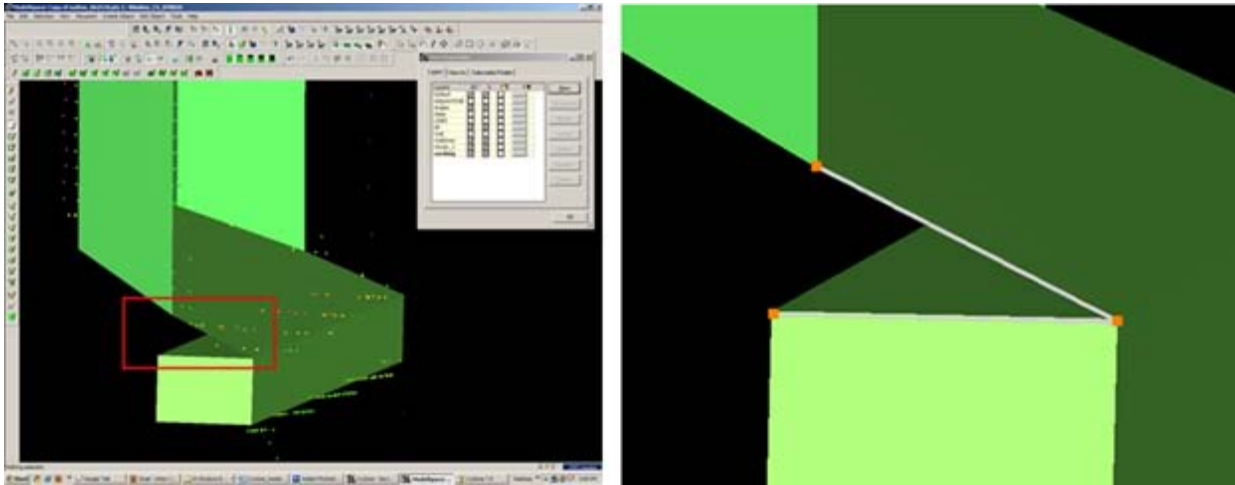


Figure 11 – (Left) Objects have been created from point cloud however no data exists for the area inside the red rectangle (Right) Handles of the previously modeled objects are used as pick points to define the edges of the custom patch – note that the final side of the polygon is left open

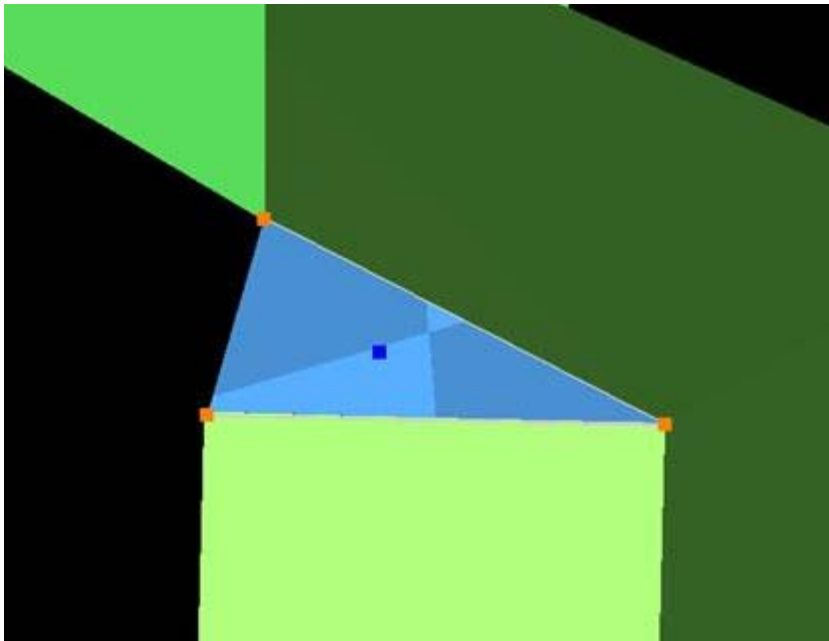


Figure 12 – Polyline that was formed from pick points is used to create new custom patch

GROUPING

Helpful Hints -

Grouping: Whether repeating a complex feature or using it only once, it's a good idea to group the various objects together to maintain the integrity of the individual objects and their intersections. Both small and large ScanWorlds can be best controlled through:

(1) **Copying specific areas to a new ModelSpace** to model individually > Fence > RC > Copy to new MS

(2) **Grouping complex features** after they are modeled > Select All Objects that compose complex feature -> Edit -> Group

NOTE: Select all objects, NOT points in the grouping; Items may be ungrouped and removed from groups through the same command

HINT – VISIBILITY AND SELECTABILITY

Hints

Visibility and Selectability – As complexity increases the use of layers becomes crucial. You can control which layers are visible and selectable in the layers dialogue box during an active command; this becomes very useful as points, objects, and lines become placed on top of one another)

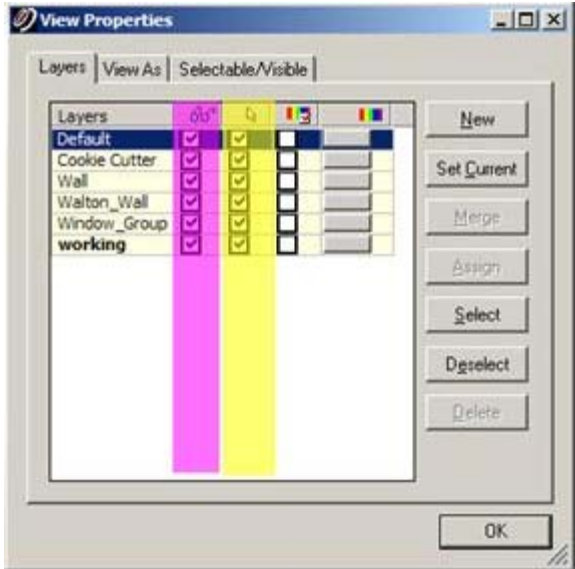


Figure 13 – Magenta highlights the column showing whether layer is visible; yellow highlights the column showing whether layer is selectable – these attributes can be toggled as needed during active commands

HINT – ACTIVE COMMAND

Hints

Active Command Dialogue – The command dialogue at the bottom of the screen is also very useful as models become more complex. It lists everything that is selected (line, point cloud, group, etc), and as each item is selected, the dialogue shows the layer of and the specific coordinates of each

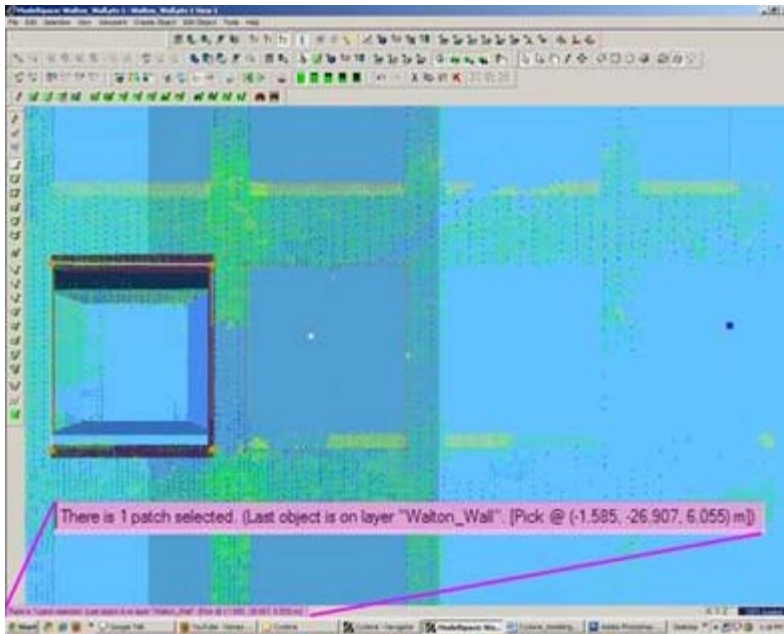


Figure 14 – The dialogue line at the bottom, left of the screen shows information about the items that are actively selected.

HINT – EXPLODE COMMAND

Hints

Explode Command - When a volumetric object is used or when a patch is exploded, it may be necessary to break the volume into individual planes -> Select Object -> Create Object -> Explode

CONTINUE TO...

Continue to [Modeling and Placing Repeating Features](#)

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This series will show you advanced modeling building modeling techniques using Leica's Cyclone.

Hint: You can click on any image to see a larger version.

SELECT OBJECT

Note that restoring the original points that are removed when an object is created is essential to placing openings or to creating more complex features within an object.

I. Select Object –> Right Click –> Insert Copy of Object's Points. Also note that if/when the working ModelSpace is merged back into the original ModelSpace upon closing, all objects and points are merged so any re-inserted points should be considered (most likely deleted) before merging into the original MS.

II. Once the points have been inserted, Align View so that object being modeled is perpendicular to screen (see GMV Guide 'Model a Non Rectangular Patch'). There are several methods to creating openings, depending on their geometry and whether the opening is repeated:

CREATING A SINGLE OPENING

A. Creating A Single Opening:

1. **Create primary patch/wall** in which hole is to to be made
2. **Select Object** -> Right Click -> Insert Copy of Object's Points.
3. **Create Fence** that is completely inside intended opening
4. **Select the primary patch** -> Edit Object -> Patch -> Subtract

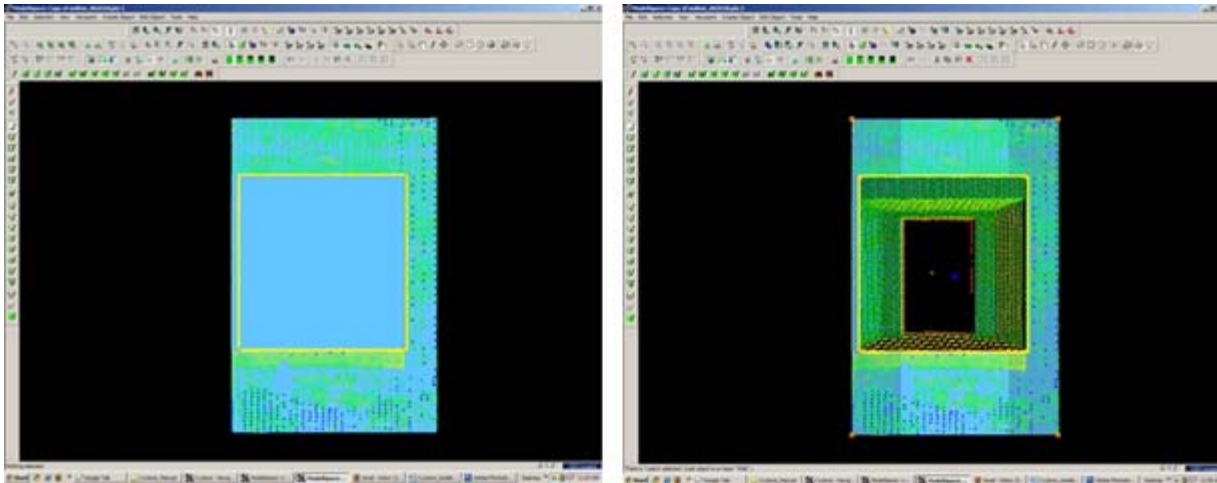


Figure 5 (Left) Primary Patch with copy of points inserted and fence drawn- note the fence for the proposed opening is completely within the patch; (Right) Fenced area subtracted from primary patch

CREATING AND REPEATING IDENTICAL OPENINGS

B. Workflow for Creating Repeating, Identical Openings:

1. **Create primary patch/wall** in which opening is to to be made
2. **Select Object** -> Right Click -> Insert Copy of Object's Points.
3. **Multi-select points to outline the intended opening** -> Create Objects -> From Pick Points -> Polyline (Recommendation: Assign this polyline to a new layer to make it easier to use later)
4. **RC** -> **Fence** -> From Selection
5. **Select Primary Patch** -> Edit Object -> Patch -> Subtract
6. **Select Polyline** -> Select handle + CTRL to move to next location -> Repeat Steps 1-6 (Note the polyline can be edited by using the handles if succeeding openings differ)

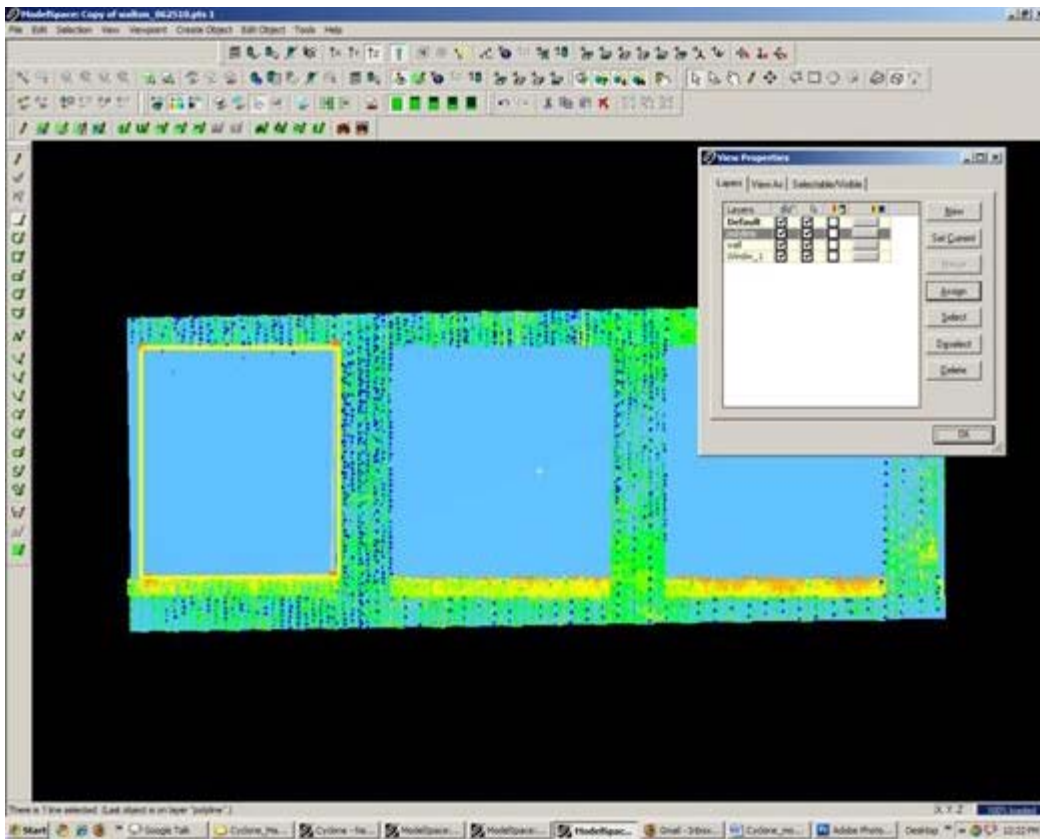


Figure 6 Polyline is created from points and placed on its own layer on the first of a series of identical openings

EXAMPLE

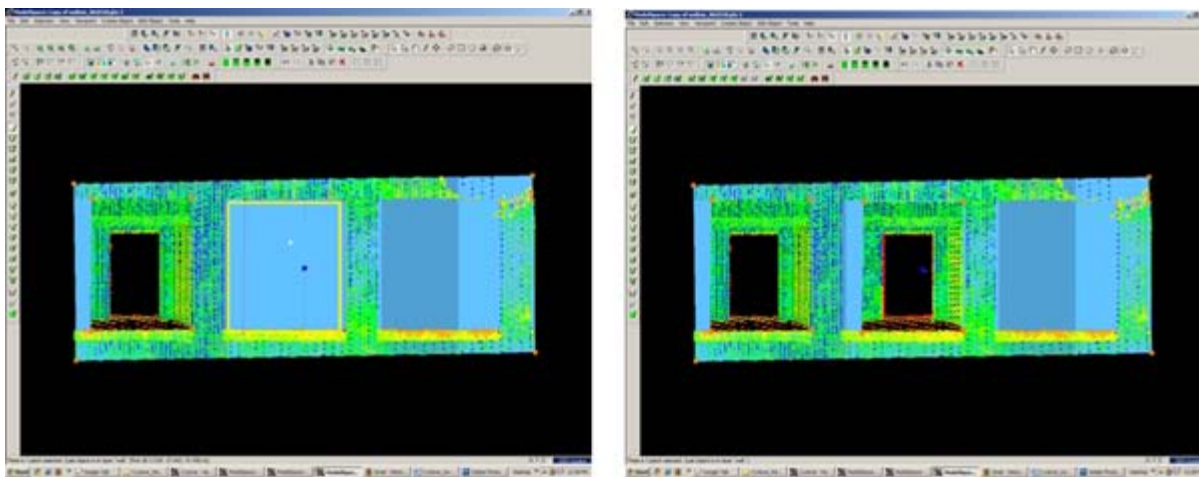


Figure 7 (Left) First opening has been subtracted from the primary patch and the polyline has been moved to the second proposed opening; (Right) Identical second opening has been subtracted

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<http://gmvcast.uark.edu/?p=6186>

This series will show you how create a mesh and model surface topography in Leica's

Cyclone

Hint: You can click on any image to see a larger version.

SELECT POINTS

9. Select Points (when dealing with large areas, selecting several points results in more surface points being sampled in the surface growing process) -> Create Object -> Region Grow -> Smooth Surface -> Cyclone runs the region grow by default settings to show the initial view and the dialogue box – Adjust Surface Characteristics and click 'Restart' to preview results -> Click OK when satisfied with preview:

Hardtop Surface (this is generally chosen for fairly uniform areas with paved or hard surfaces; if dealing with rolling unpaved terrain, uncheck this option). Viewing the point cloud with color from scanner or hue intensity is recommended for this process Per Cyclone 7.0 Glossary: *"This command is used to segment a selected smooth surface in a point cloud. The points representing the smooth surface are merely segmented from the point cloud; no object is inserted. This command is not available for use with a pcE file (pcE cloud)."*

DECIMATE AND SUBDIVIDE

10. Decimate Mesh (per Leica Trainer July 2010 current bug in meshing command) -> Select Mesh -> Tools -> Mesh -> Decimate -> Maintain 100% of original triangles, vertices, and exact boundary edges -> Decimate allows pre-view -> OK to accept

11. Subdivide areas by breaklines -> Select Boundary Breaklines and Mesh -> Tools -> Breaklines -> Extend Polylines to TIN -> (NOTE: This command extends a polyline onto a TIN object, creating edges in the mesh based on the projection of the polyline vertically onto the mesh – although polyline itself does not change. The edges are stretched vertically to conform to the polyline's shape – If select command through Breaklines submenu, polyline will be converted to breakline on the mesh; if select command through polyline submenu, resulting line will be a geometric object

NOTE: If errors appear 😞 1) Select Mesh -> Tools -> Mesh -> Verify TIN -> If TIN is not valid, the number of invalid faces will be listed and the faces will be selected -> Tools -> Mesh -> Delete Selection -> Repeat this verification and deletion process until TIN successfully verified; (2) If errors regarding polylines overlapping -> Select Polylines -> Tools -> Drawing -> Align vertices to axes

ADDITIONAL STEPS

12. Re-insert break lines (copied in Step V) -> Copy from temporary location -> Paste into working mesh MS

13. Editing Triangles and Spikes -> In layers dialogue box -> View As tab -> Apply to **Mesh** -> **Wireframe** -> **Apply & OK** ->

14. In top view, fence in problematic triangle(s) causing spike -> Fence -> Delete Inside -> Select hole (highlights cyan) -> RC -> Mesh -> Fill selected hole

EXPORTING

15. Exporting 3D Lines, Mesh, Point Cloud -> There are several options for exporting topographic features. The objects created through tracing and meshing can be exported or the point cloud itself can be exported.

A. Export the lines, polylines, arcs -> Use the properties manager (Shift + L) to turn off the visibility/selectability of the point cloud -> Select All -> File -> Export

DXF R12 Format –This retains 3D information (in this case the z-coordinate for the lines); Do not select 2D DXF R12 Format

Objects may also be exported as ASCII or XML file types here

Once exported, the .dxf file can be opened in CAD, imported into Sketchup, or converted for use in multiple software.

B. Export the mesh -> Select mesh -> File -> Export -> Select file type for destination software

C. Export the Point Cloud -> Newer versions of Autodesk products (2009 and beyond) support point clouds. If you do not have Cyclone but you do have CAD, use Cyclone to export the points and then trace/model in CAD software much as we have done in Cyclone. The main issue is file size when importing into CAD; in general, point clouds must be broken into smaller pieces to allow them to be imported. See the CAST workflow, 'Reducing Point Clouds for Autodesk **Applications**' for more details.

NOTE: In general, a .PTS file with a maximum size of 4mb will import into CAD

Create new layers for the breaklines and features (Shift + L) -> Review the area to be modeled identifying where the surface changes and/or where the user wants a clean break or difference between adjacent surfaces. Create layers for primary and secondary features as needed.

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This workflow will show you how to use Leica's COE plug-in to import and export objects and points in Cyclone.

Hint: You can click on any image to see a larger version.

IMPORTING & EXPORTING

Importing & Exporting Objects and Points in Cyclone with COE Files

I. Importing files into Cyclone is done through the Navigator window, where a new MS is created with the imported file -> Open Cyclone Navigator -> Select Database/ModelSpaces Folder -> RC -> Import -> browse to COE file -> Open -> MS View appears named by default with the COE file location

NOTE: You cannot import a COE into a MS view, rather it must be imported into the overall "ModelSpaces" project folder at which time a new MS view is created for editing. While most objects can be imported into Cyclone, complex objects (ie: beveled edges, rounded corners, notches) may be translated into a collection of lines and arcs versus objects when imported

MANAGING THE COE-MS

II. Managing the COE-MS -> Open the COE ModelSpace that has automatically been created -> It is recommended that you group objects and place them on individual layers as needed in this original COE MS (to group -> Select Objects -> Edit -> Group -> Group -> Objects can be ungrouped at any time with this command as well) -> Copy all objects -> Close COE MS

PASTING COE OBJECTS INTO ORIGINAL MS

III. Pasting COE objects into Original MS -> Its highly recommended to copy and paste the original MS as a copied/working MS in Cyclone Navigator; use this copied MS to insert objects, updating the original MS only as a final step -> Open copied MS -> Paste objects that were copied from COE file in Step II -> NOTE: if coordinates were maintained and referenced throughout the modeling and export process, the object should automatically paste into the correct position. If references/links have been lost, the imported objects may need to be moved/rotated (select objects -> RC -> move/rotate)

NOTE: When moving grouped or multiple objects, faces and lines may appear to remain in their original position or become displaced during manipulation; as long as all objects are selected or grouped/selected, this is only a refreshing issue -> View Properties (Shift + L) -> Selectable/Visible Tab -> toggle the visibility of the object type off (ie: mesh or patch, etc) and when toggled back on, the view of all objects should be refreshed.

COMPARING MODELED OBJECTS WITH ORIGINAL POINTS

Comparing Modeled Objects with Original Points in Cyclone

I. Import the COE file into Cyclone Navigator

II. Upon importing, the COE creates its own MS that loses many of the editing/manipulation options -> Open the COE MS -> Select All -> Copy -> Open Working MS (containing points to compare/analyze) -> Paste COE object(s) into Working MS; NOTE: Pay attention to the layers in Cyclone: all ACAD layers accompany the object when imported however when copied/pasted objects are placed on a layer named 'default~'; Manually assign the correct layer to the object in the Working MS and delete unnecessary layers.

CALCULATE MESH TO POINT CLOUD DEVIATION

III. Calculate Mesh to Point Cloud Deviation -> Multi-select the object mesh and the point cloud (Its recommended to view the mesh in "per-face normals" setting > Shift + L for Layers > View As tab) -> Tools -> Measure -> Mesh to Points Deviation -> Dialogue Box Options:

- Slider bar allows user to adjust and preview deviations on the mesh faces above a user-set limit; minimum and maximum boxes are read-only
- Distance computation – user decides whether those faces that are highlighted are based on maximum or average deviation and Absolute (no positive/negative distances) or Signed Distance
- Details – displays total mesh faces, # of faces deviating, what percentage of the whole that represents, and total # of points

CALCULATING DEVIATION – CONT.

IV. Calculate Object to Point Cloud Deviation when Object is created in Cyclone > Object (ie: cylinder, primitives) -> after creation, select object and RC -> Info dialogue tells Fit Quality including Error Mean, Error Std. Deviation, and Absolute Errors; Interfering Points may also be calculated

V. Calculate Object to Point Cloud Deviation when Object is created outside of Cyclone ->

Interfering Points -> Multi-select object and point cloud -> Tools -> Measure -> Interfering Points -> Dialogue box appears in which user can adjust the tolerance to calculate -> all cloud points that are within the user-specified distance of the selected object are highlighted and can be segmented from the rest of the cloud (See Cyclone help 'How to Segment interfering points' for more details) and dialogue box displays the percentage of points interfering and the percentage of points inside the object (useful in volumes); this analysis is limited in many modeling applications as accurately modeled objects rarely lie completely on one side of the points referenced

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In this series, columns in a deteriorating colonnade will be modeled by several methods.
Hint: You can click on any image to see a larger version.

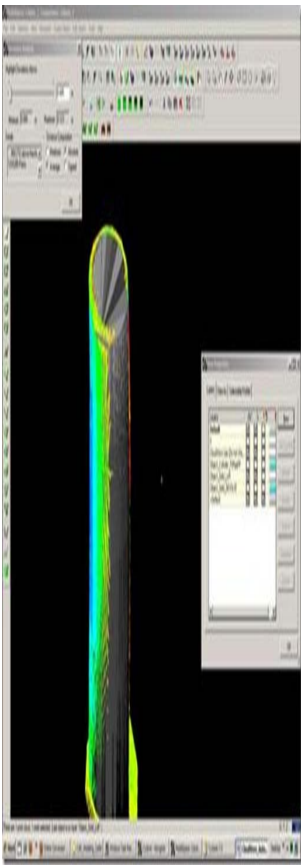
CLOUDWORX

Comparing Modeled Objects to Original Points in this example

(analyzed at .005 m (.5 cm) / average distance of deviation/ absolute value)

I. CloudWorx – three section cuts in the x or y direction – lofted in the z (up) direction to create 3D solid column:

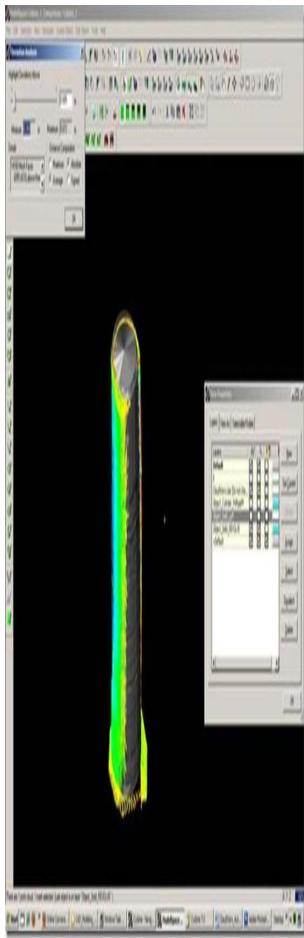
- 7% of the mesh faces (ie: 484 of 6,914) were above .5 cm deviation from point cloud



CLOUDWORX 2

II. Cloudworx – 1 section cut in the z direction (representing 1/2 the column from outside edge to center) – revolved around center axis to create 3D solid column

- 43% of the mesh faces (ie: 6,055 of 14,160) were above the .5 cm deviation from point cloud



CYCLONE

III. Cyclone – Mesh created in Cyclone from point cloud

- < 1% of the mesh faces (ie: 977 of 334,133) were above the .5 cm deviation from point cloud



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In this series, columns in a deteriorating colonnade will be modeled by several methods.
Hint: You can click on any image to see a larger version.

USE THE CLOUDWORX SLICE TOOLBAR

Method 2: Slicing Single Cross Section and Revolving the Profile Around Center – Similar to the first method, the column will be sliced and traced; however here, a single profile will be traced and revolved around the center, creating a solid or surface object. Follow steps in Method 1, Section I for setting up the ACAD model space and isolating the colonnade.

I. Use the CloudWorx Slice Toolbar to slice the point cloud from the top view (or whichever view allows you to see the entire diameter of the column/feature); this will be the only section profile that will be traced and we will only be tracing half of it; choosing the most complete/intact slice possible is recommended. See Method 1 for details on slicing

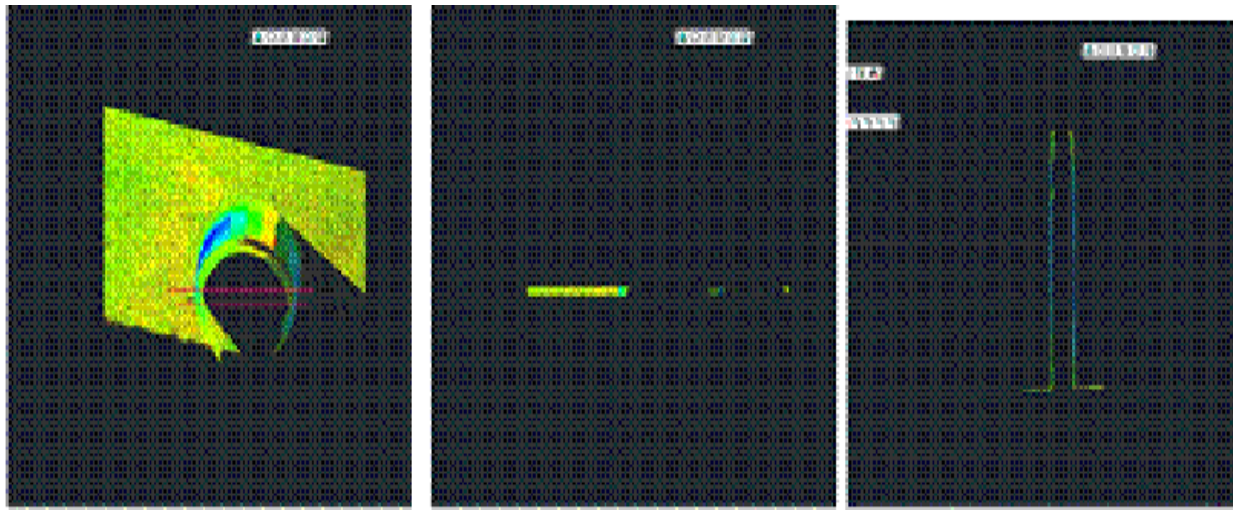



Figure 7 (Left) Top view of the column; magenta lines highlight the slicing boundaries – (Center) Top view of the column profile slice – (Right) Front view of the column profile slice

TRACE THE PROFILE AND SNAP TO POINT CLOUD

II. Trace the profile of the section cut, snapping directly to point cloud > Front or Side View
> Make correct layer current > Zoom in to view points comfortably and refresh point cloud to confirm

all points visible  (do this periodically, especially when zooming in/out) > Command Line: PL or POLYLINE and begin to trace the profile/outline the profile of the section cut

REMEMBER: (1) Enable OSNAP “NODE” to snap to points (2) At command line: type “U” during active polyline command to undo vertices/go back without ending the command (3) At command line: PEDIT allows polyline(s) to be edited, joined, etc. (4) See ACAD Help: Drawing and Editing Polylines for more information

DETERMINE CENTER AROUND WHICH TO ROTATE

III. Determine the center around which to rotate > NOTE: there are a variety of ways to determine the center of a feature; one is outlined here. Also see the “fit pipe to cloud” method (following section), which determines the center directly from the point cloud and places a polyline along the centerline >

A. After half of the profile has been traced turn on ORTHO mode, which restricts drawing to a 90-degree vertical and horizontal direction to ensure clean angles for the

rotation later 

B. OSNAPS – enable ENDPOINT and MIDPOINT -> Use OSNAPS to draw a line that is perpendicular to the column’s profile polyline: the start point snaps to the endpoint of the top of the column and the end point snaps to the point cloud on the opposite edge of the section cut – this line represents the full diameter of the column. Draw another line in the same way at the bottom of the column (See Figures 12 & 13)

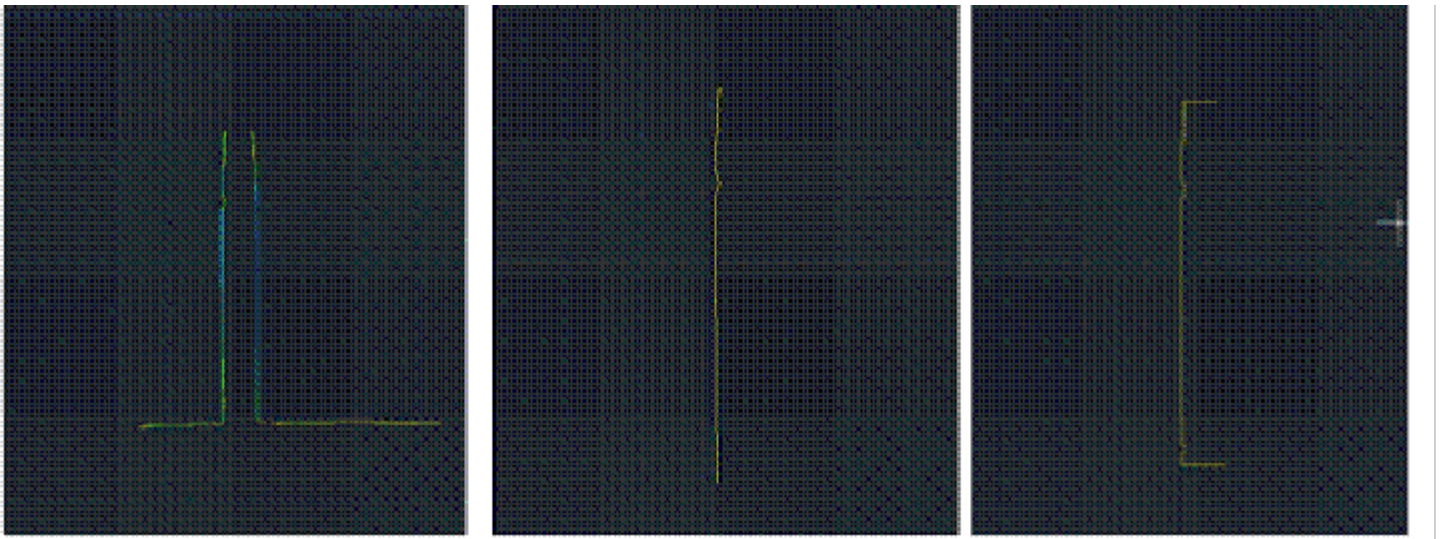


Figure 8 (Left) Front view of point cloud and polyline representing left profile of the column – (Center) Front view with the point cloud hidden – (Right) Original polyline with perpendicular lines drawn at the top and bottom representing the diameter of the column

EXAMPLES

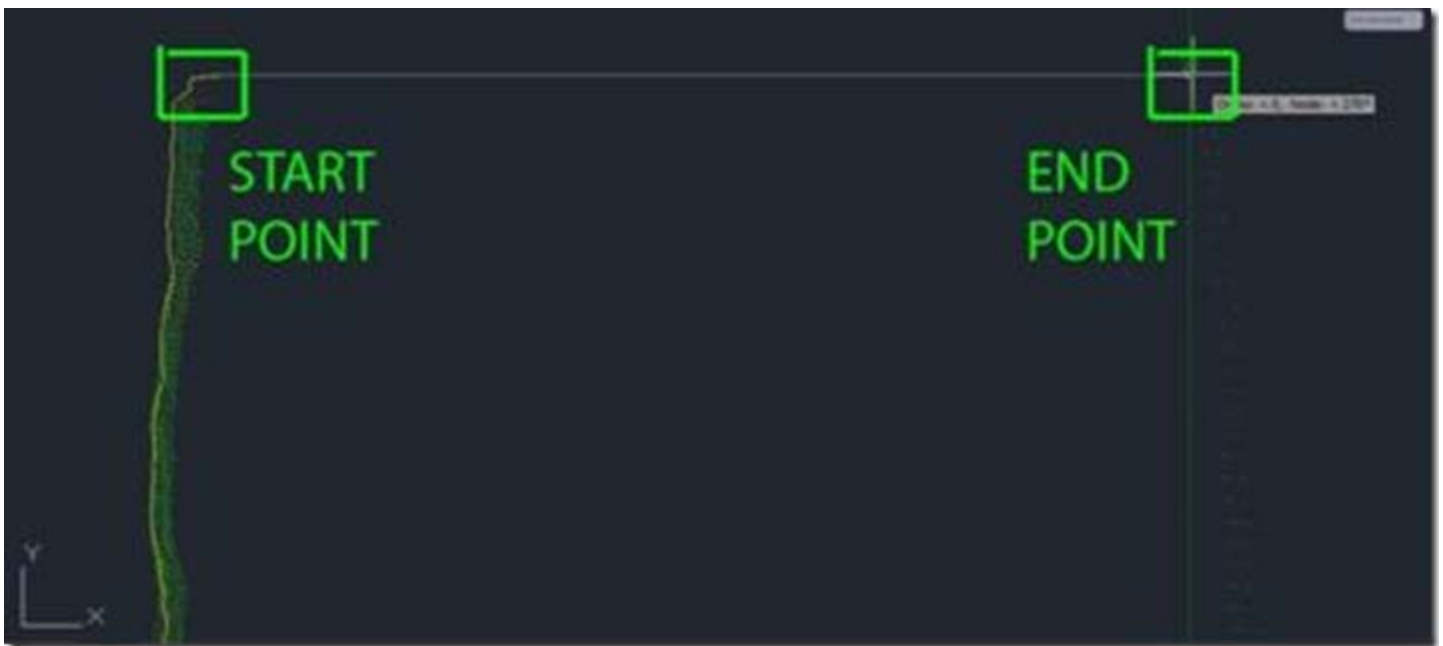


Figure 9 - Front view, close-up of the top of the column; on the left of the image, the yellow polyline is the original line tracing the point cloud profile (dense green points). With osnaps, draw a line snapping to the end point of the original polyline. Ortho Mode ensures a perpendicular line to the opposite edge of the point cloud/column (less dense green dots on the right side of the image). Repeat this process at the bottom to achieve the 3 lines shown in Figure 8.

USING OSNAPS

C. Use OSNAPS to snap to the **midpoint** of the line at the top of the column to the **midpoint** of the line at the bottom of the column – this line represents the center of the column (**TIP**: When snapping to midpoint, a triangle and the word “midpoint” appears near the cursor) -> Use grips or the TRIM command to trim the ends of the lines that protrude past the center line

NOTE: This method finds the center based on the diameter of the column at the top and bottom at the point of the slice, accounting for any leaning/tilting along the z-direction; For generally upright features, drawing a line in the center and restricting it to the z-axis will result in more regularized features with identical “up directions”

IV. Command line: PEDIT to edit the polylines and join them into a single closed polyline > PEDIT > Select original polyline > JOIN > Select centerline, top line, and bottom line > ENTER 2X > Clicking on the polyline should confirm that it is now a single object (if it does not join, check to confirm no endpoints are snapped to one another but they are NOT overlapping).

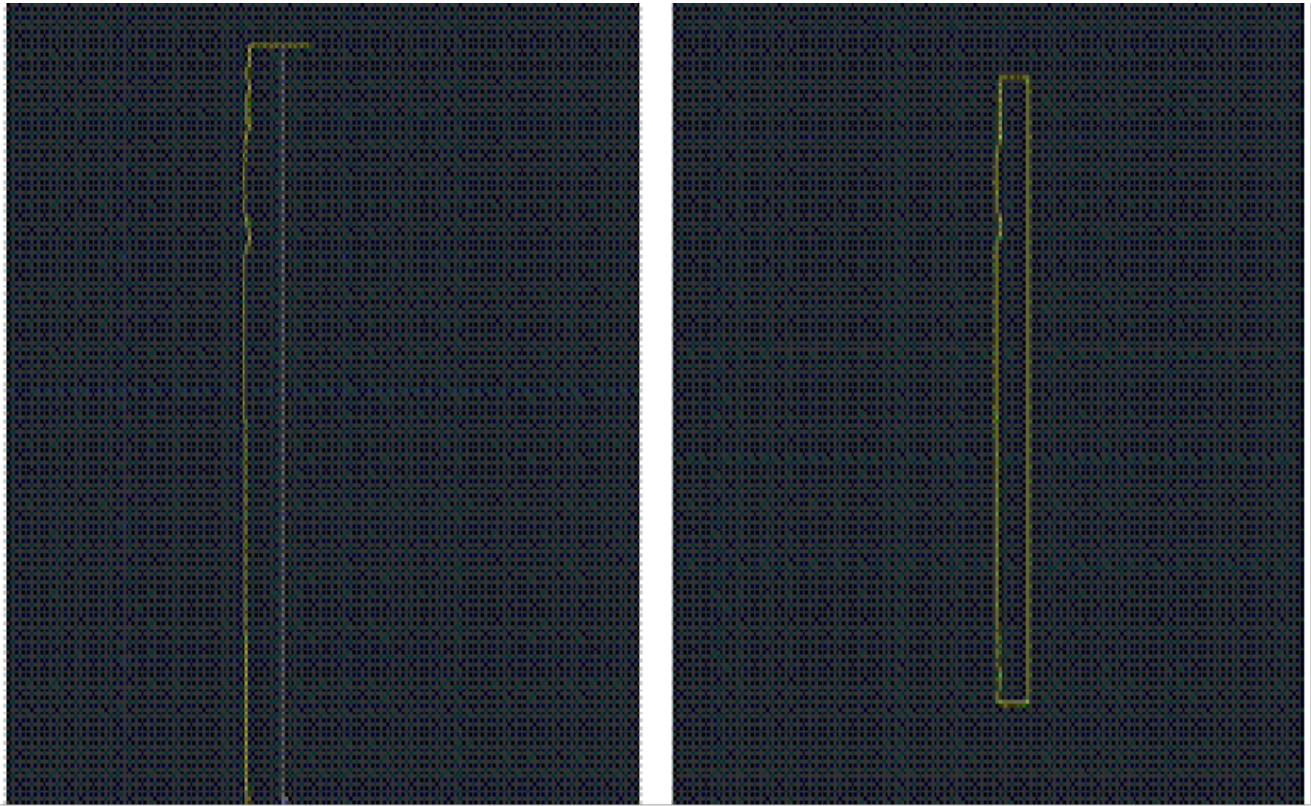


Figure 10 (Left) Draw a polyline from the midpoint of the top line to the midpoint of the bottom line – note the yellow triangle and ‘midpoint’ showing the OSNAP constraint is active (Right) Polylines have been drawn, trimmed, and joined to form a single polyline representing the profile of the column from the center to the edge

ROTATE PROFILE TO FORM 3D OBJECT

V. Rotate profile to form 3D object > Create and make a separate layer for the 3D object and make it active > 3D Modeling main toolbar > EXTRUDE tab pulls down to REVOLVE (see figure 4) or at command line: REVOLVE > select profile polyline > ENTER > “Specify Start point or define axis” > Select endpoint at the bottom of the centerline > “Specify axis endpoint” > Select endpoint at the top of the centerline > “Specify angle of revolution” > ENTER to accept default of 360-degrees

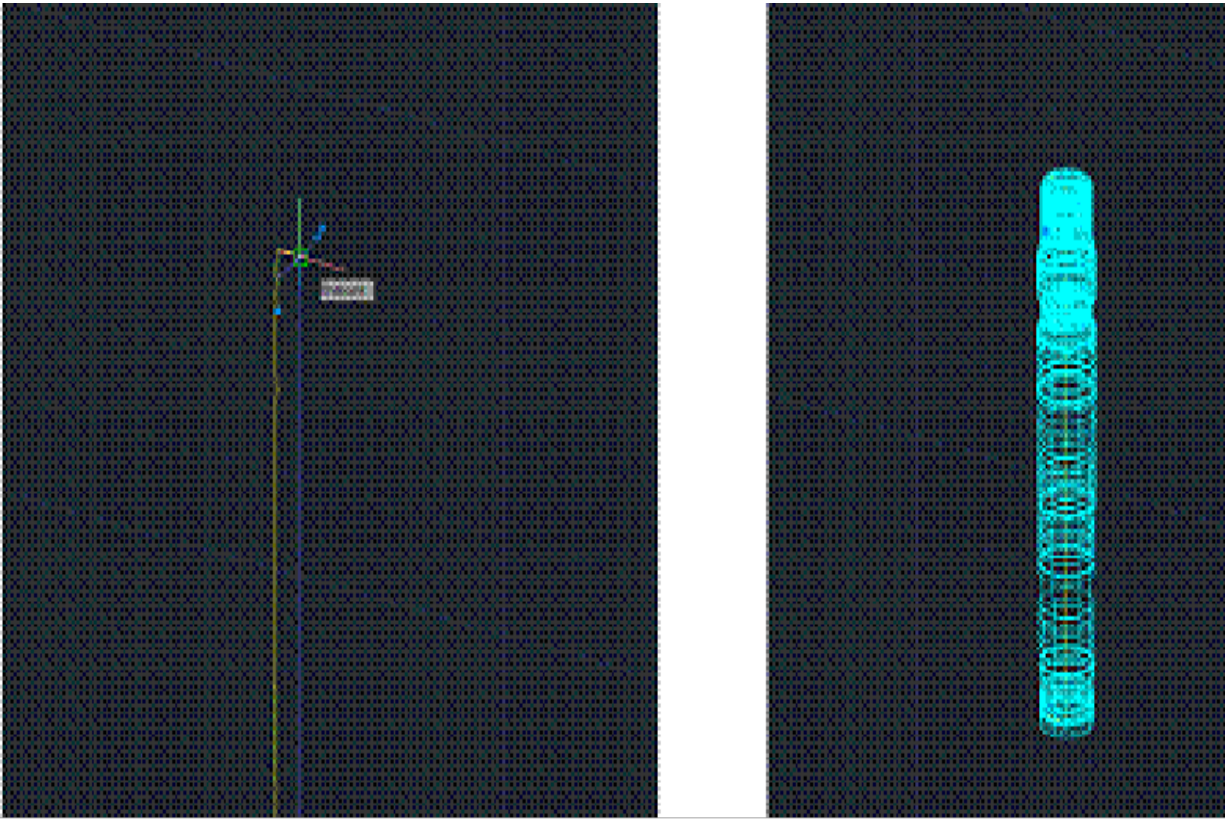


Figure 11 (Left) The centerline of the column is drawn by snapping from the midpoint of the bottom polyline to the midpoint of the top polyline (Right) 2D tracing of the point cloud section cut is revolved around the centerline creating 3D object

6. Modeled object can now be edited or exported as desired.

[wptitle]CONTINUE TO...

Continue to [Comparing Modeled Objects to Original Points](#)

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