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Leica Cyclone 7.1.1: Sub-Dividing Large Point Clouds for Autodesk Applications

This workflow will explain a method of sub-dividing registered, unified point cloud data into more manageably-sized pieces.
Hint: You can click on any image to see a larger version.

INITIAL CLEAN-UP

This workflow may follow "Scanning, and Processing with Targets in Complex Interior Spaces" as a suggested method of sub-dividing registered, unified point cloud data into more manageably-sized pieces. In this example, data is broken up so that it can be imported into AutoCAD and REVIT; as of early 2011, these Autodesk platforms are becoming better at accommodating point clouds, however, currently, only reduced data sets or very small projects can be exported from Cyclone to these software in their entirety due to size limitations. This is a suggested workflow for quickly breaking up data for importation into such Autodesk applications.

I. Initial Clean-Up & Settings – Create MS from registered, unified point cloud > Delete extraneous points and any noise > Save this as Piecing_Base

NOTE: In this example, the original data of a complex interior chilling plant ranged in density from approximately 1cm at the most dense to 10 cm at the least dense. After registration, this data was unified with the medium reduction setting. This resulted in more consistent 2.5 cm spacing in the majority of the data that proved to be manageable in exporting to other formats and software.

II. Set the view to Orthogonal > Viewpoint Tab > Orthogonal

SETTING HORIZONTAL REFERENCE PLANES

III. Setting Horizontal Reference Planes – Once the data is clean a series of reference planes will be created to serve as visual aids to slice the data into smaller pieces. Open the Reference Plane dialogue box and leave it open for the workflow.

A. **Open RP dialogue box** > Tools > Reference Plane > Add/Edit Reference Plane > Click the visibility box to activate the original, default reference plane (RP); this is usually a horizontally oriented plane that is aligned to the X-Y plane of your data

1. If your data needs to be divided up vertically and horizontally (ie: multiple levels of dense data), double click the default RP and rename it Horiz_Level_001 > follow Step III-B

2. If your data does not need to be divided up vertically (ie: single level of data), move to Step IV

B. **Move RF_Horiz_Level_001 to a significant horizontal point in the data** > In this example, a reference plane was set on a point on the floor dividing 2 levels > Zoom into the data so that you can see the floor or significant horizontal feature > use Selection tool to select a point on the feature > Tools > RP > Set Plane Origin at Pick Point

CREATE ADDITIONAL HORIZONTAL RP'S

C. **Create additional horizontal RP's to divide up the data in the vertical direction** > Within the RP dialogue box, left click on

RP_Horiz_Level_001 to select it > Use the copy icon at the top of the dialogue box to Copy Reference Plane > Name the new RP to identify the level (Horiz_Level_002, _003, etc) > LC the new RP > LC the icon at the top of the dialogue box to Set Active Reference Plane > The new RP is now active and can be placed at significant features as outlined in Step III-B (see figures 1 & 2).
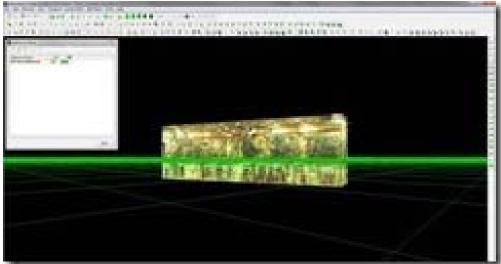

Figure 1 – The Reference Plane dialogue box has been opened and the default reference has been named RP_Horiz_001 and placed on the floor dividing the two levels; Note the main level above the RP and the basement below. This building required only one horizontal plant
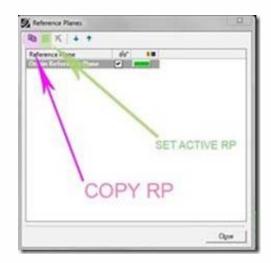

Figure 2 (Left) – A closer view of the dialogue box and the options for copying/adding RP's and for activating the RP

ADDTIONAL REFERENCE PLANES & ESTIMATING DATA SIZE

IV. Additional Reference Planes & Estimating Data Size – Ultimately, how the data is divided depends on the original density and complexity of the point cloud data and the needs of the end-user/end-software. The goal is to balance between creating consistently-sized pieces and using sufficient overlap to allow re-assembly with minimal redundancy. Understanding the complexity within the different areas of your project is essential to understanding how/why you place sectional cuts. 5 square meters of measured space can have more points than 20 square meters of space depending on what is within that volume (ie: a complicated network of pipes versus an empty room).

In this example, the unified point cloud (48,000,000 points) needed to be divided into 300-400 MB pieces in a DXF format to import into REVIT.

Note: Users may find it helpful to adjust the RP's to match the coordinate system or vice versa; this is covered in the *Basic Cyclone Workflow* and is not covered here. In this example, features within the scan data (walls and floors) are used to divide the space instead of defined coordinates. **IMPORTANT TIP: The medium reduction unified cloud creates exports with a clear ratio between the number of points and the size of the resulting DXF file in which 1 million points roughly creates a 1 megabyte DXF file.**

V. Creating Additional Reference Planes

    A. **Create a copy of an existing RP** (see figure 2) > Make the new plane active and name it RP_Vertical_001

    NOTE: turning off the visibility of RP's that you are not actively using helps to understand what you're seeing; this is done in the RP dialogue box

    B. **Tools > RP > set Vertical_001 to the Y-Z Plane or to the Z-Y Plane** depending on the orientation of your data and the direction that you want to grid it > Visually examine the data to see if this standard view aligns to the grid you desire

        1. RC anywhere in the area where the toolbars are located > Enable the Viewing Toolbar > Top view while in Orthographic viewing mode allows you to see if the reference plane is aligned to the feature (an interior wall for example) that you are using to divide the data > If the plane is aligned to your data, move to Step D.

        2. Note that Cyclone toolbars often hide one another and you may need to pull them into the main viewing area to see all of them

CREATING ADDITIONAL REFERENCE PLANES 2

C. **If a standard view or coordinate does not align to the feature**, leave the vertical RP in place:

        1. Create a fence and copy a piece of the data that contain a vertical feature that runs the direction that want to grid/the direction in which you want to divide the data (here the exterior walls running north-south and east-west are used to divide the data so a corner is copied to a new MS)
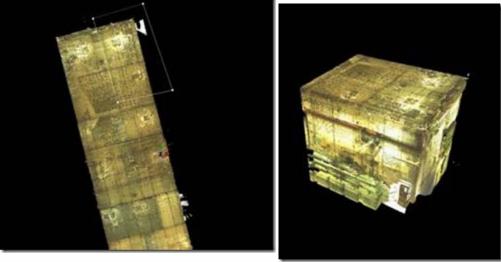

Figure 3 (Left) – Top View, a corner is fenced; Figure 4 (Right) – Perspective View, the corner section copied into its own MS

CREATING ADDITIONAL REFERENCE PLANES 3

2. In the new temporary MS, select a point on the wall > Create Object > Region Grow > Patch > View results in MS before accepting results, adjusting settings as needed to create a small vertical patch on each wall/feature being used to grid and divide the data
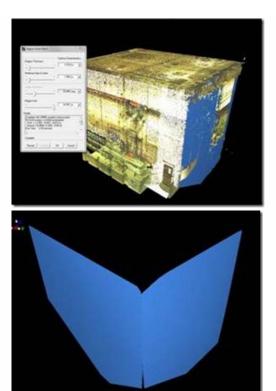
Figure 5 (Left) – A patch is created on each wall/vertical feature; Figure 6 (Right) – The resulting patches with the point cloud hidden
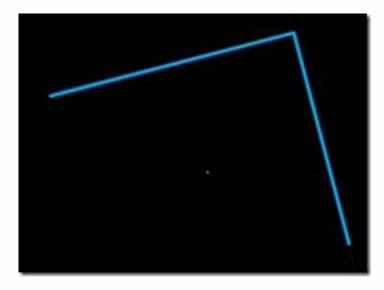

Figure 7 (Left) – Top view in orthographic mode confirms that the planes are perpendicular and have the correct z-direction

3. Select the patches (here there are 2 patches representing the north-south and east-west directions) > Copy > Close/delete the temporary MS
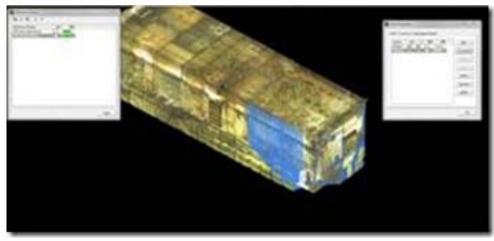
CREATING ADDITIONAL REFERENCE PLANES 4

4. In the original MS (Piecing_Base), open the Layers dialogue box (Shift + L) > Create a layer called Patches > Make the new layer current > Paste the patches into the base MS

Note: The use of a temporary MS to create the patches allows the unified point cloud in the base to remain as a single cloud; when an object such as a patch is created, the points are automatically deleted and if you choose to insert a copy of the deleted points, they are individual sub-set point clouds resulting in undesired multiple clouds in the base.
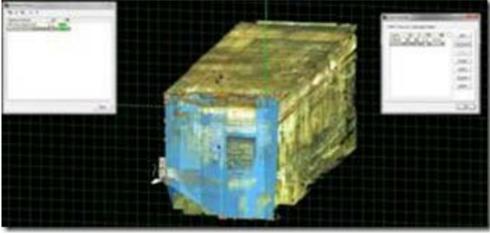
5. Select a patch > Confirm that RP_Vertical is active and visible > Tools > RP > Set on object > Activate the top view to

confirm that the RP is now aligned to the wall/feature

6. Copy/add a vertical RP for each patch/direction > Turn off the visibility of the layer Patches

Figure 8 – Two patches representing the two walls are pasted into the base MS

Figure 9 – The vertical reference plane is aligned to the wall/patch

CREATING ADDITIONAL REFERENCE PLANES 5

D. **Once you have a vertical RP that is aligned to each wall/patch > Create copies of the RP's and move them to significant points/features in the project that will allow consistently sized pieces** (You are basically placing guides by which you will cut the data into pieces)

1. Choose the first direction to grid > Select the vertical RP (RP_Vertical_001) > Confirm it is visible and turn off the visibility of the other RP's

2. Copy Vertical_001 > Name the new RP Vertical_002 > Make Vertical_002 active

3. Select a point along the direction you are gridding to define the location for Vertical_002

    a. Look for regularly occurring features (such as panels on the roof or interior walls/features) to begin placing the RP guides

    b. Use the measure tool (Multi-Select 2 points > Tools > Measure > Distance > Point to Point) to further examine the distance between divisions you are considering

4. Note the information regarding number of points and data size at the beginning of this section

       a. The complexity of the data within the section affects the file size of each piece tremendously. It's a matter of testing and evaluating until you become familiar with the density of your data and find what division/grid size will work

       b. NOTE: the goal is to have consistently-sized data evaluated by the number of points/resulting megs; this does not always mean pieces have similarly-sized physical dimensions.

5. Once the point is selected > Tools > RP > Set Plane Origin at Pick Point

CREATING ADDITIONAL REFERENCE PLANES 7

You have set up the guides for the first sectional piece to be copied out and exported > It is recommended that you place the vertical RP guides one at a time, checking the size of the resulting point cloud and export files until you have a good understanding of how to divide up the data consistently > Going through the export process is the only way to verify the resulting file size and to confirm that your grid dimensions are appropriate to the complexity and density of each area.
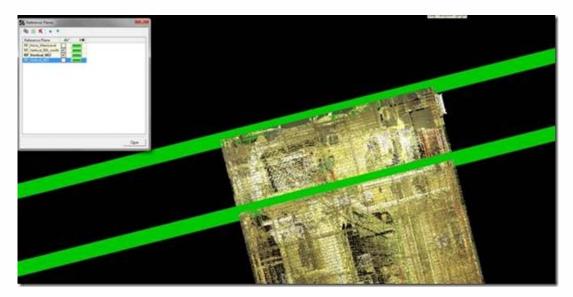

Figure 10 – Top view of the north end of the building; the visibility of the horizontal RP's has been turned off for clarity. The top green line is the first vertical reference plane (Vertical_001) that was created from the wall/patch. The bottom green line is Vertical_002 that has been moved by selecting a point on the seam between metal panels on the roof. The area between the two RP's represents Piece_001. This piece/sectional slice will be copied and exported to see if the estimated location for the RP results in an appropriate file size.

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