Leica Cyclone Basic User Manual

September 2017

Contents

Copying Raw Files from the Scanner to the PC

Connect the lemo/ethernet cable into the scanner and PC. Not there are two lemo sockets in the scanner; one with 7 pins and one with 5. Connect to the 7 pin socket.

Open the program “C10 Data Copy” or “Pxx Data Copy”. This can be downloaded from the Leica MyWorld website. The program will automatically find a scanner connected to the Ethernet port. If after 5 minutes the scanner is not found automatically, make sure your network adapter settings in Windows are set to “Obtain an IP address Automatically”. These should be the default settings.

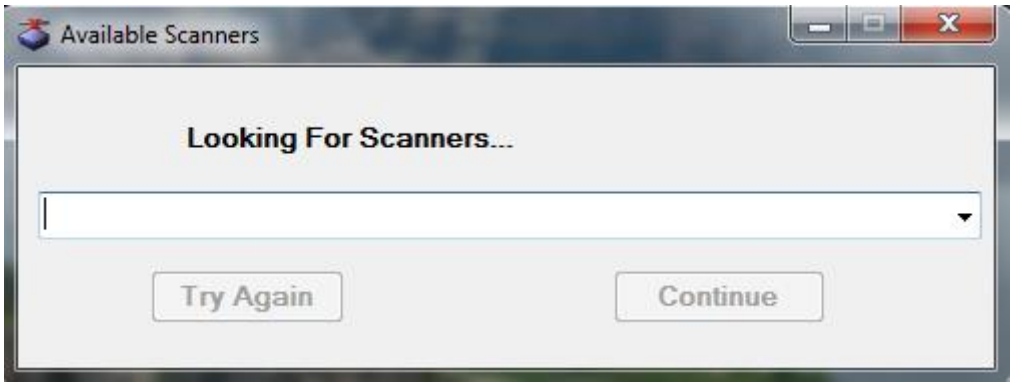


Figure 1. C10 Data Copy program.

Click on **Find Scanners -> Continue**.

A window with two sections will appear. The view on the left is the Scanner’s Hard Drive. The view on the rights is the PC’s hard drive.

Select the Project and the destination folder, click **Copy Projects**. For Ok Tedi the destination folder is D:\laser scans\.

Once finished, close C10DataCopy and shut down the scanner.

Copy Raw files from the USB stick to the PC

If you wrote files directly to the USB stick with the scanner, plug the USB stick into your PC, and copy the raw files to your PC (for OK Tedi, D:\laser scans\).

Opening Cyclone

Open Cyclone by clicking on the **Cyclone** icon on your desktop, or
Start -> All Programs -> Leica Geosystems -> Cyclone 8.0 -> Cyclone.

This will open the Cyclone Navigator.

Figure 2. Leica Cyclone icon.

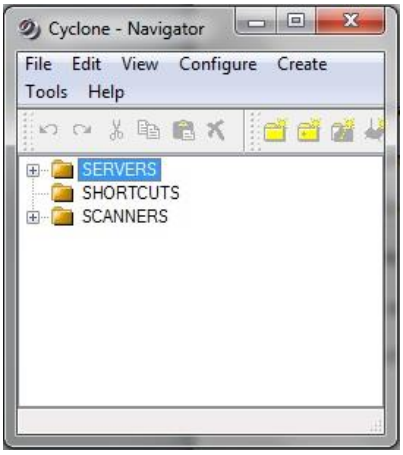


Figure 3. Cyclone Navigator

If you're running Cyclone for the first time, you should turn off Survey mode (it displays the individual scans in their own folders).
Turn Surveyor off mode:
Edit -> Preferences -> Scan -> Survey Mode: No.
Ensure that Level is set to **Default.**

Database definitions

A cyclone database is made up of several modules.

Project Folder - This folder contains all your scan data. You can create new project folder (**Create -> Project)** to re-organise your scan data.

ScanWorld – Each scan position is called a ScanWorld.

ControlSpace – This is a point cloud that contains all the scan data and targets. Only open a ControlSpace if you need to make adjustments to targets. When you combine scans in a registration, Cyclone refers only to the ControlSpace, not the ModelSpace. Normally you never have to access the ControlSpace.

ModelSpace – This is also a point cloud that contains all the scan data and targets. Use the model space for your point cloud work (viewing, modelling, fencing, deleting, meshing, etc). You can create multiple ModelSpaces by copy/paste, or using the fence tool inside a ModelSpace.

Scans – This folder contains all the point cloud data that you acquired whilst scanning, including targets. You only need to access this data to separate scan data into multiple ModelSpaces.

Images – This folder contains the photograph that you took with the scanner. By double clicking on MultiImage, you can see all the photos that were acquired.

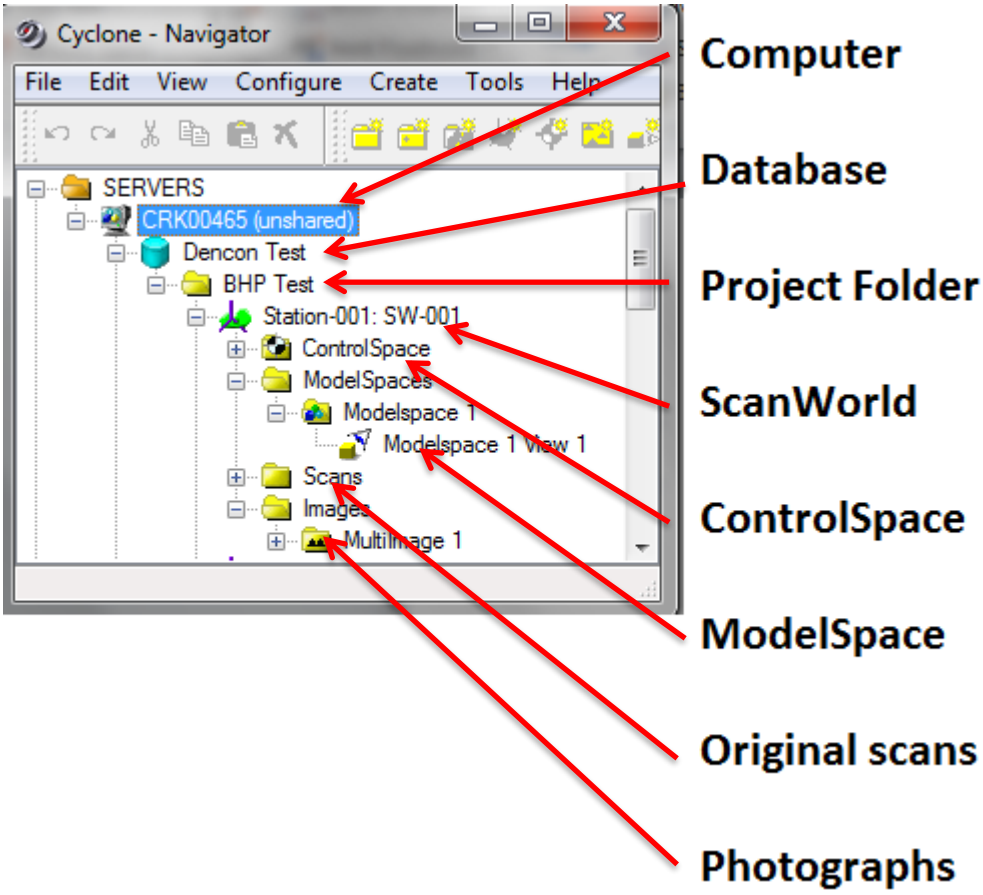


Figure 4. Cyclone navigator definitions.

Database file Structure

To set the folder where Cyclone databases are to be saved on the hard disk drive, in the Cyclone Navigator window, click **Edit -> Preferences**, and select the **SCAN** window.

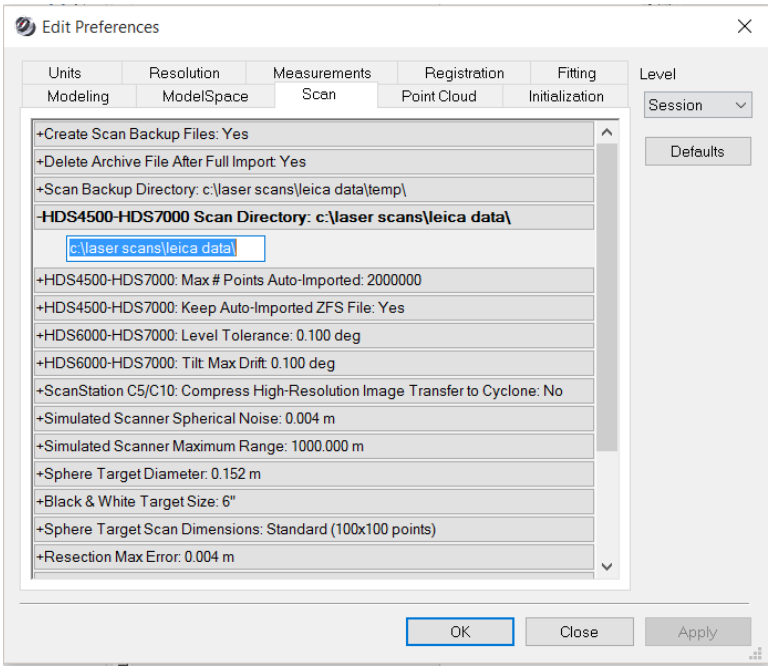


Figure 5. Cyclone Preferences window.

To avoid possible database inconsistencies or corruption, Leica recommends the following:

- Locate each .IMP file in its own folder
- When copying, moving or backing up databases, we recommend backing up the complete database folder, the PCESet folder, and the **eventlog** and **recovery** folders and files
- The **eventlog** records administrative events and critical errors
- The **recovery** file keeps databases consistent, avoiding data corruption that may happen in rare situations
- A warning dialog is displayed if a database's recovery folder cannot be found when it is added to the server. Push the **More Info** button for more information.

Configuring the Server

Using (unshared) will improve Cyclone's performance since the **Shared** folder is meant to prepare the data to flow through a network.

- Right click on **Servers** folder, the menu will appear. See Figure 5.
- Click on **Servers…**
- Uncheck the **Shared** server box if it is checked. See Figure 6.

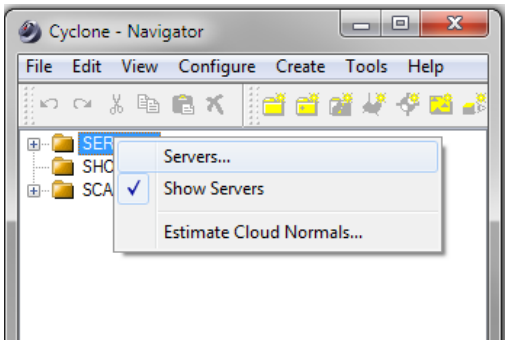


Figure 6. Right click on Servers folder

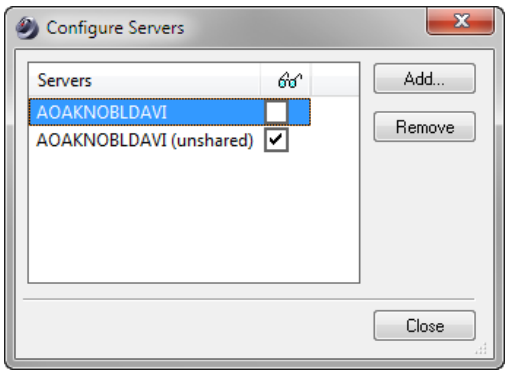


Figure 7. Deactivate shared Server.

Import Raw Scanner Files

When you import raw files from a scanner, you need to first create a Cyclone database.

Cyclone navigator window - **Configure -> Database -> Add**

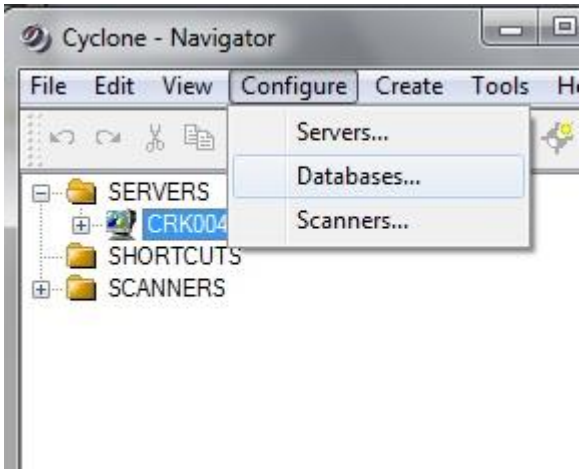


Figure 8. To create a new database.

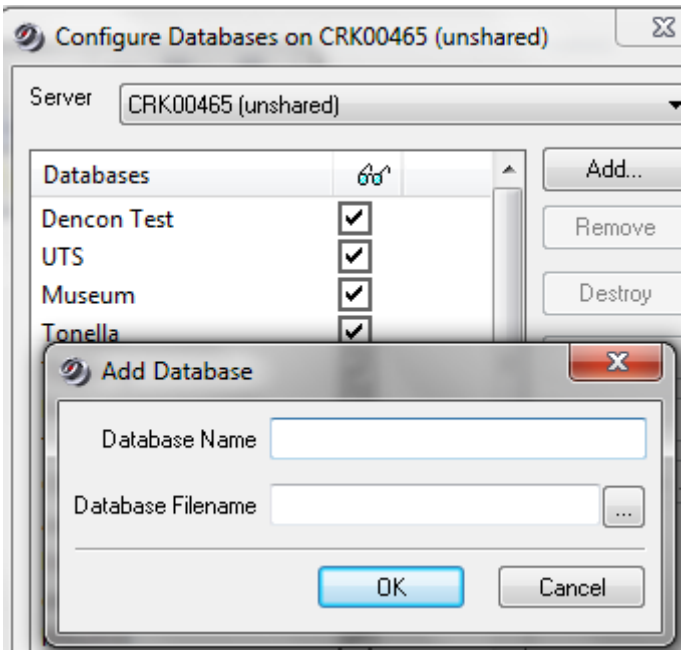


Figure 9. Adding a name to a new database.

Add any filename that you like.

Leave Database Filename field empty (no Cyclone database has been created yet).

The database has been created. Right click on the blue database icon that you just created,

Import ScanStation Data -> Import ScanStation Project.

Use when you're importing raw scan data for a new project.

Import ScanStation Data -> Import ScanStation Partial Project

Use when you're adding raw scan data into an existing project.

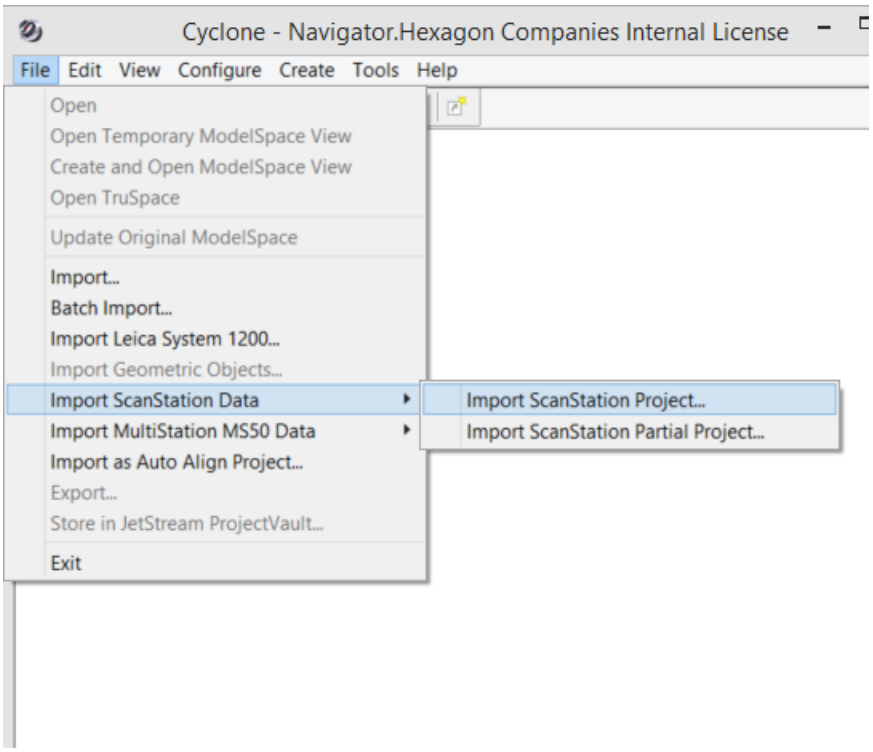


Figure 10. Import ScanStation Data menu.

Select the root folder of the raw files.

Leave all the import setting at default:

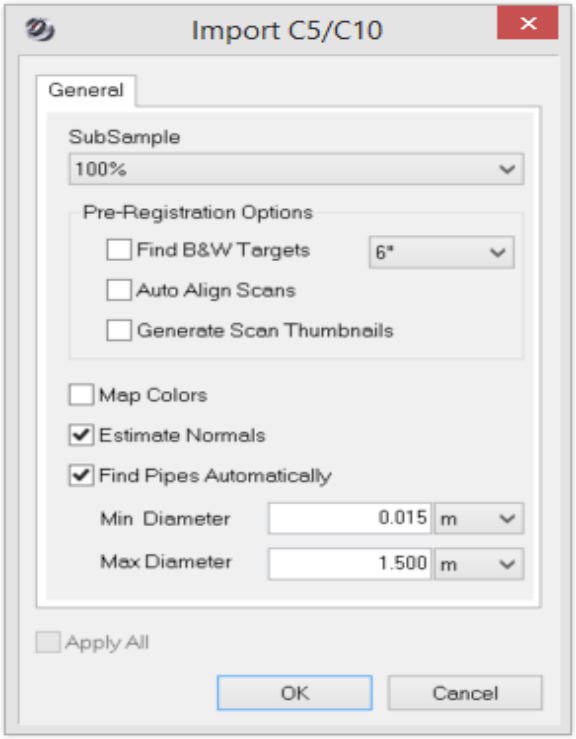


Figure 11. P20 scanner import settings

Sampling – 100% (what percentage of the point cloud density to import)
Find Black & White (B&W) Targets – off (unless you had black & white targets and did not pick them on the scanner)
Auto Align Scans – Will automatically join scans with 25% or more overlap.
Generate Scan Thumbnails – Used for Visual Alignment of scans.
Map Colours – off (applies the photos to the point cloud but does not blend them)
Estimate Normals – on (needed for adding manual Cloud Constraints in Registration)
Find Pipes Automatically – off (unless you have pipes that you want modelled automatically).

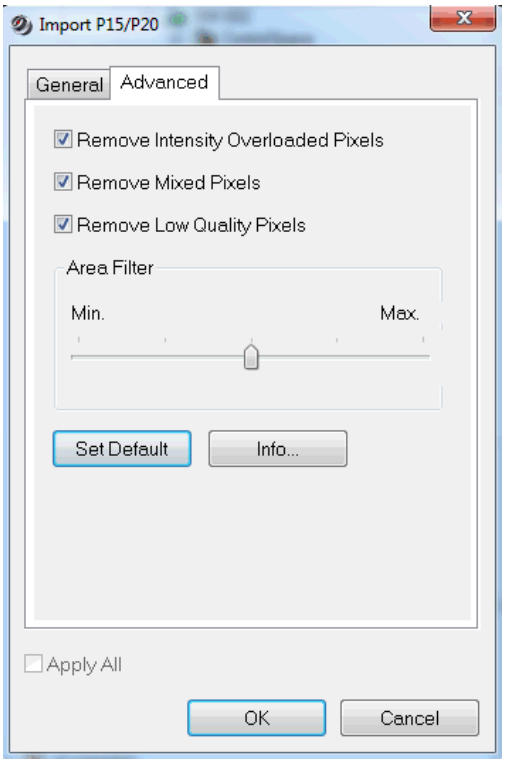


Figure 12. P20 Scanner Import Settings

When importing P20 data into Cyclone, ensure you turn check the 'Remove Mixed Pixels' menu during data import. This will reduce the amount of noise from laser flare in the data.

Importing BLK360 Data Into Cyclone

1. Establish a wireless connection to the BLK360 using the SSID and password found on the inside of the battery compartment door.

Figure 13. Label on BLK360 battery door.

2. From the Cyclone Navigator, select an existing Cyclone database, or let Cyclone create one for you by first selecting the unshared server then selecting the command below.

3. From the Navigator File menu, select File | Import/Manage BLK360…

4. Click on the Find & Connect Device button.

5. The dialog will appear as per Figure 13.

6. You have the option of either deleting setups from the scanner, or importing them. You may select multiple setups to import.

7. The import options dialog will appear as with importing other scanner formats.

8. Specify any of the settings that you want, then press the OK button to import the BLK360 setups.

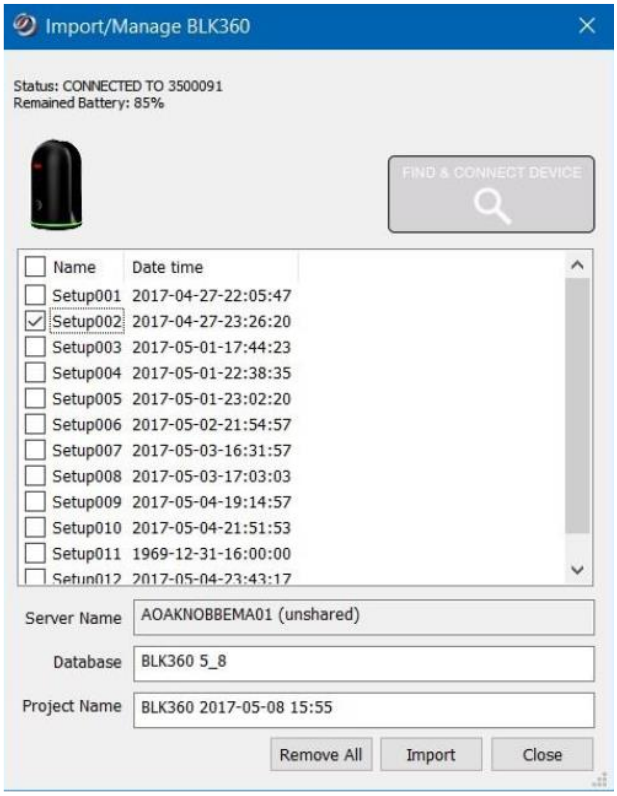


Figure 14. Importing BLK360 Data into Cyclone

Import an Existing Cyclone Database

Cyclone navigator window - **Create -> Database -> Add**

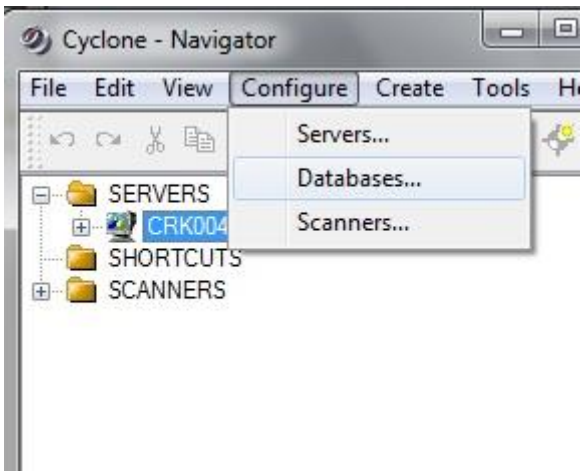


Figure 15. Adding a new database.

Select the Cyclone database .IMP file.

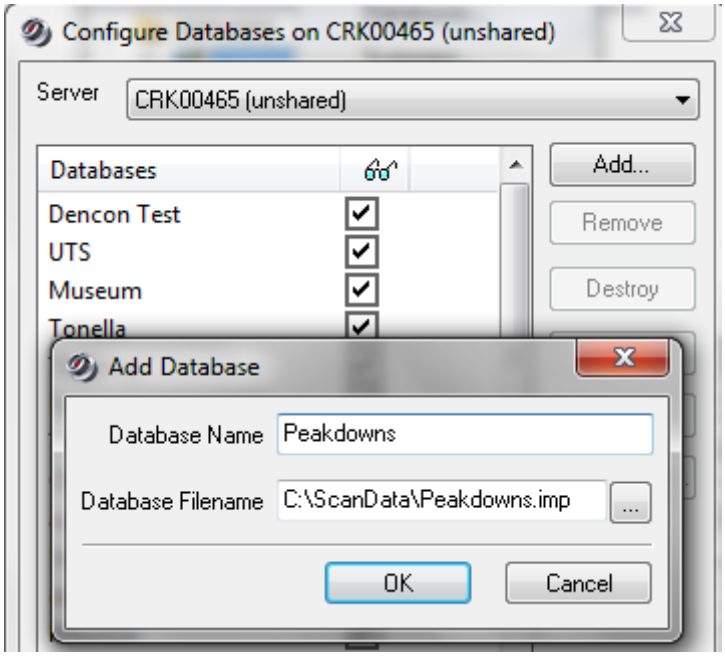


Figure 16. Selecting an existing Cyclone database.

Importing iStar 360 degree Photographs

The Cyclone 9.1.2 release delivers support for the iStar 360 Degree imager. iStar HDR images are generated by a specific camera manufactured by NCTech Ltd. Using this camera, HDR imagery can be captured quickly, and Cyclone can import and automatically map it to any point cloud data. Mapping this data to your point clouds requires no manual mapping of images.

Workflow for importing iStar images into Cyclone:

1. Import your scan data (e57, as well as most all vendor formats are supported) In addition, you must have iSTAR images that match the scans.

2. Either register your data in Cyclone, or import data, like e57 that has already been registered.

3. After importing, select the scanworld icon in the Cyclone hierarchy, then right click and select import.

4. Navigate to the folder that contains the iSTAR files, and select the file named with the .nctri extension. This process will take some time, since image mapping is being done.

5. Once the importing is complete, select the MultiImage node in the Cyclone hierarchy, right click then select Apply MultiImage.

6. Once this process has completed, you may double click on the MultiImage node in the hierarchy to check to make sure the images appear aligned correctly.

7. Finally, open the registered modelspace view, and inspect the mapped images.

Importing Photographs from the Canon external camera

Enable the Auto-Adjust External Camera Images on the Cyclone Preference, and import the data set. The Pose Editor will never appear again during the import.

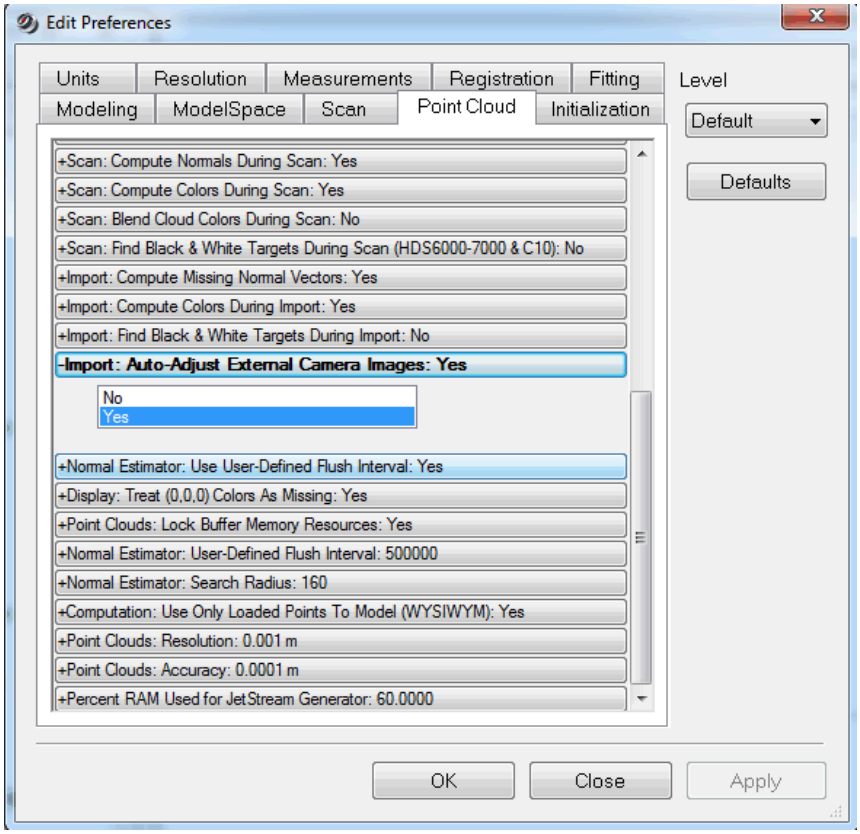


Figure 17. Option to import external camera images.

Points where the field of view of the scanner is greater than the Canon external camera are highlighted in bright green. To change this to a grey colour:

From Cyclone Modelspace, go to Tools | Scanner | ScanWorld Explorer....
Select the station, go to Scanners tab and change the color into grey color or any color - then press Apply ScanWorld Color to Scans...(Ctrl + P).
Once the color change for all, you have to change the color back into the Use Color from Scanner.

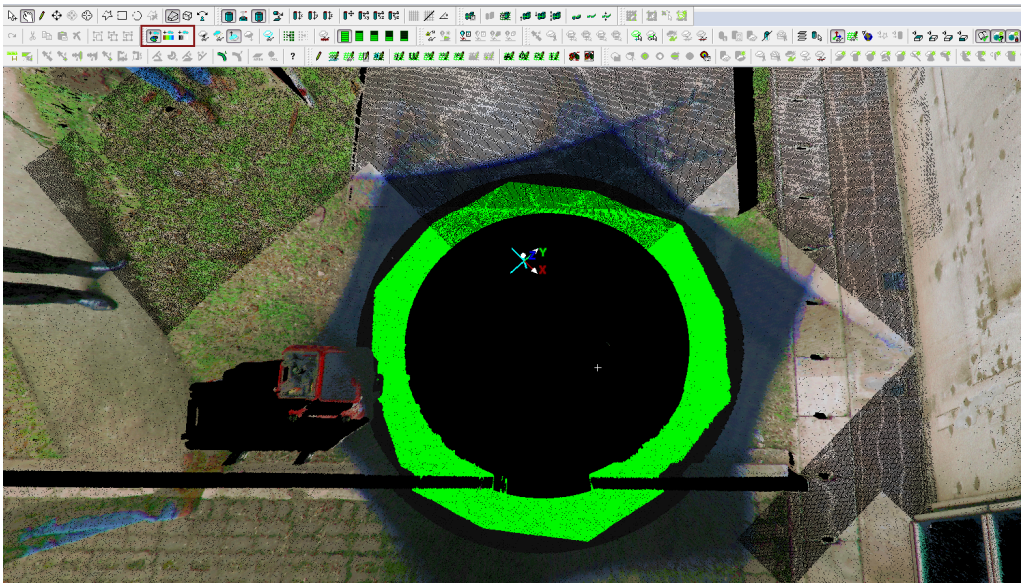


Figure 18. Points where the field of view of the scanner is greater than the Canon external camera are highlighted in bright green.

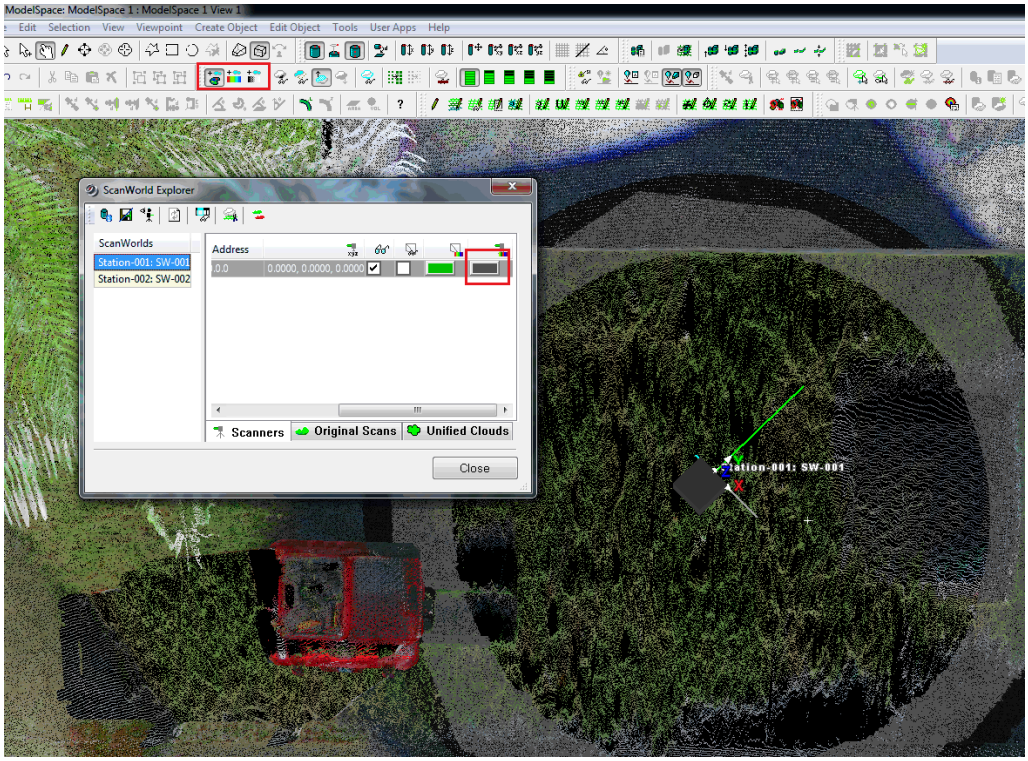


Figure 19. Points where the field of view of the scanner is greater than the Canon external camera are highlighted in grey.

If you have Photographs Captured by the Scanner

When importing raw scanner data with photographs, the photos will need to be blended and applied to the point cloud.

Right click on the project folder under the database icon -> **Batch Blend Multimages**
- This corrects the brightness/contrast of the photographs, to make the images look like one continuous photo.

Right click on the project folder under the database icon -> **Batch Apply MultiImages**
- This colourises the point cloud with images from the camera.

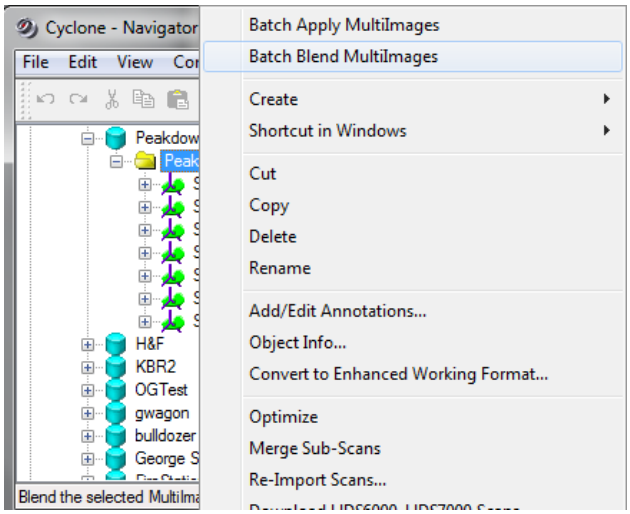


Figure 20. Batch Blend & Apply Images

Importing Control into a Database

Cyclone can import survey coordinates of targets into a database. Surveyors refer to this a importing control, or applying grid coordinates.

Right click on the project folder -> **Create -> Scanworld**. Call it whatever you like, e.g. “Control”.

Right click on the ScanWorld -> **Import**. Select the .txt file containing your control. Note, the control should be in CSV format, but renamed to a .txt file extension. You can have your values separated by commas, spaces, semicolons, or tabs.

Make sure each column has the correct definition. The column containing the target names must be called “Target ID”. The columns for X,Y,Z (or E,N, El) coordinates must also be correctly named. You can change column type by clicking on it.

One done, click **Import**.

Open the control ModelSpace. You will now see only targets, with the coordinates that you’ve imported.

Remember, when you create a registration with control, add the ScanWorlds including the control one, and right Click on the Control ScanWorld -> **Set Home ScanWorld**

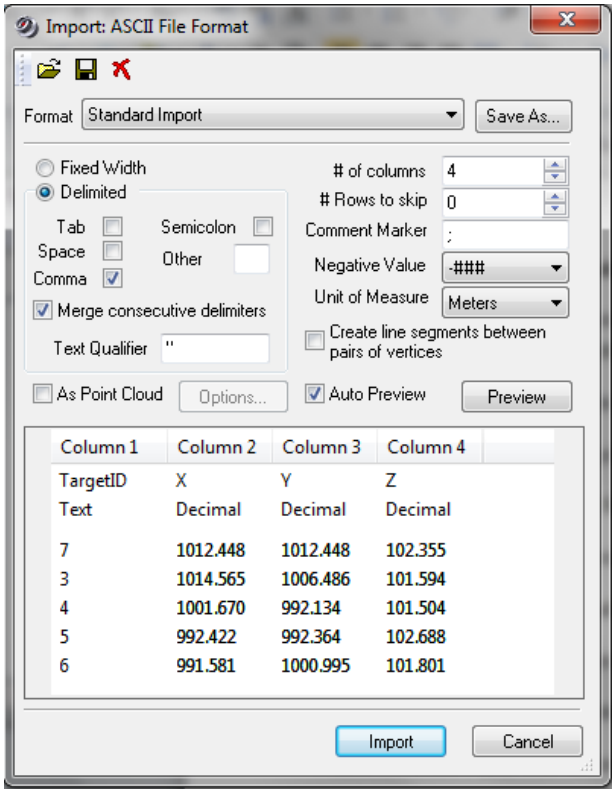


Figure 21. Import control settings.

Registration (Combing Scans Together)

Leica defines a Registration as:

"Registration is the process of integrating a project's ScanWorlds into a single coordinate system as a registered ScanWorld. This integration is derived by a system of constraints, which are pairs of equivalent tie-points or overlapping point clouds that exist in two ScanWorlds. The Registration process computes the optimal overall alignment transformations for each component ScanWorld in the Registration such that the constraints are matched as closely as possible."

Click on your project folder under your database. Click **Create -> Registration**, call it whatever you like. Double click on the registration icon to open it.

Figure 22. Registration icon.

Scans are referred to as *ScanWorlds*. To add your scans into the registration, click **Scan World -> Add Scan World**. Select the scans you wish to combine, and copy them to the registration. If you added control, make sure you select the control ScanWorld as well. Click **OK.**

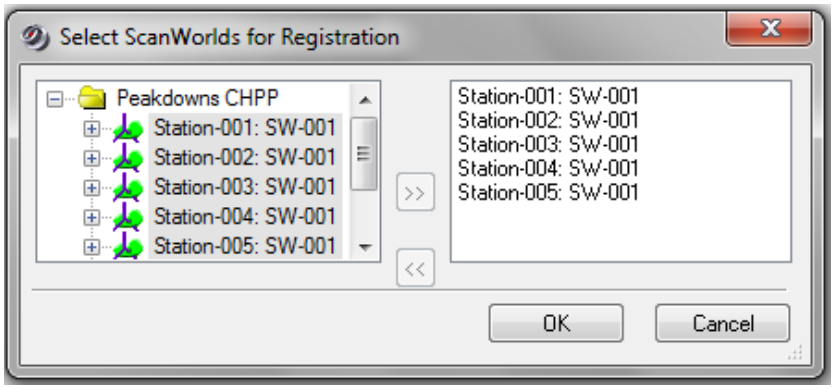


Figure 23. Adding ScanWorlds to a Registration.

You should now see your scans in the "ScanWorlds' Constraints" tab. If you have control, right click on the control ScanWorld -> **Set Home ScanWorld.**

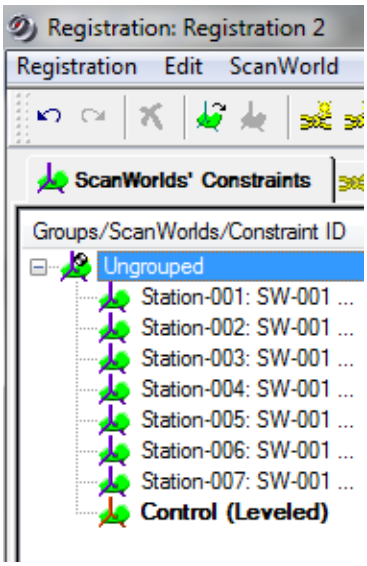


Figure 24. Setting the Control ScanWorld as the home ScanWorld.

Registration ScanWorld Groups

In Cyclone 9.0, ScanWorlds can be automatically grouped together based on common constraints or common overlap.

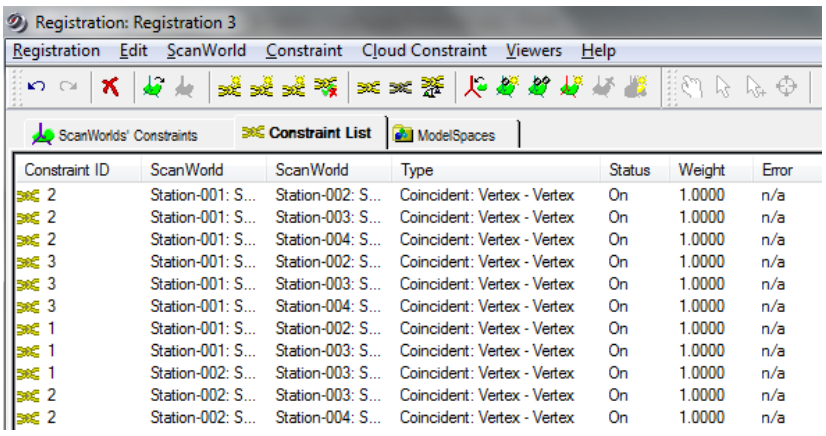
Separate groups of ScanWorlds can be easily joined together using the "Manual Cloud to Cloud" or "Visual Registration" methods, see below.

You can automatically group ScanWorlds together by selecting ScanWorlds in a registration, **right click -> Create ScanWorld Groups ….**

Registration with Targets

Targets are referred to as "Constraints" in Cyclone. To add targets click on **Constraints -> Auto Add Constraints**.

You can see the targets on the **Constraints List** tab.



Constraint ID	ScanWorld	ScanWorld	Type	Status	Weight	Error
2	Station-001: S...	Station-002: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
2	Station-001: S...	Station-003: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
2	Station-001: S...	Station-004: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
3	Station-001: S...	Station-002: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
3	Station-001: S...	Station-003: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
3	Station-001: S...	Station-004: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
1	Station-001: S...	Station-002: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
1	Station-001: S...	Station-003: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
1	Station-002: S...	Station-003: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
2	Station-002: S...	Station-003: S...	Coincident: Vertex - Vertex	On	1.0000	n/a
2	Station-002: S...	Station-004: S...	Coincident: Vertex - Vertex	On	1.0000	n/a

Figure 25. List of constraints on the Constraints List tab.

Notice that the errors have not been computed under the Error column (the value is N/A). To calculate the errors, click **Registration -> Register**.

Sort the errors by value by clicking on the Error column bar. If you have errors above 6mm, I would suggest disabling them (**right click ->Disable**). Then re-calculate the errors by clicking **Registration -> Register**.

Once you're happy with the error values, click **Cloud Constraint -> Auto Add Cloud Constraints**. This feature examines scans that have at least 20% overlap, identifies common objects in the point clouds, and further aligns the scans based on these common objects. The cloud constraints are added to the Constraint List tab as "cloud/mesh".

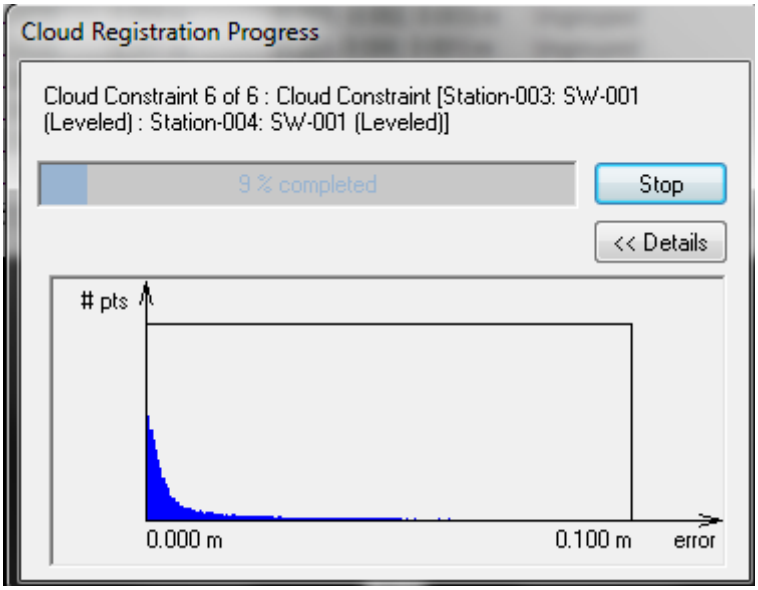


Figure 26. Cloud constraint registration progress

Once done, click **Registration -> Create ScanWorld / Freeze Registration**.
Then to view the data click **Registration -> Create and Open ModelSpace.**

Look at your registration file in the Cyclone Navigator. It now looks like a normal ScanWorld, with all the scans aligned perfectly together.

Registration Without Targets – Manual Cloud to Cloud

If you did not have any targets in a ScanWorld, you will need to manually identify common points between two scans.

Rather than adding constraints automatically like before, we have to add them manually. Click: **Cloud Constraint -> Cloud Constraint Wizard.**

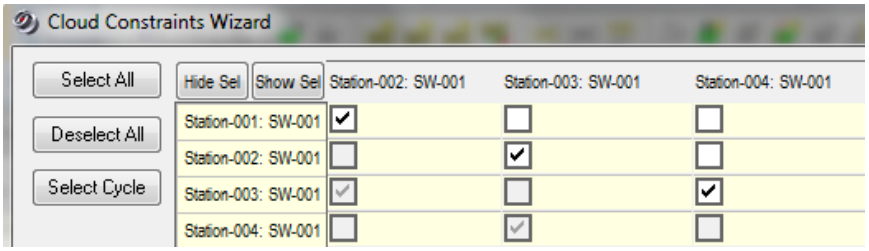


Figure 27. Cloud Constraint Wizard matrix

In the Cloud Constraints Wizard, you have to select which scans are overlapping. In this example, I've selected scans 1 & 2, scans 2 & 3, and scans 3 & 4. Click Update.

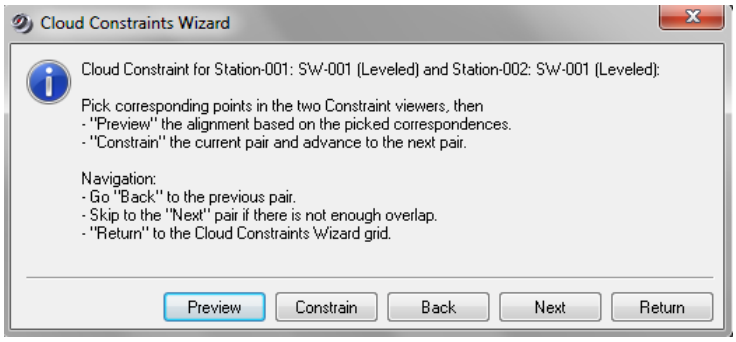


Figure 28. Cloud Constaints Wizard window

Move the Cloud Constraints Wizard window away, but do not close it. You will now see two windows displaying two point clouds on Cyclone. Using the multipack mode, click on at least 3 common points on each scan with at least 100mm accuracy.

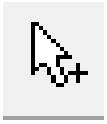


Figure 29. Multi-Pick mode icon

Try and spread the points around as much as possible. Then click on **Preview** in the "Cloud Constraints Wizard" window, and view the combined scans to confirm that they are aligned. If you have you not picked enough points or spaced your points around enough, Cyclone will tell you with an error message. Simply add to the points that you have already picked, and click **Preview** again.

When you click **Preview**, visually check that the scans are aligned. Then close down the ModelSpace preview, and click "**Constrain**" on the Cloud Constraints Wizard. The wizard will automatically progress to the next combination of scans.

Once you have combined all the scans, notice that Cloud/Mesh constraints are now in the Constraints List tab. The errors will need to be calculated; **Registration -> Register.**

Confirm that all the errors are minimal. If not, delete the Constraint and recombine the scans again using the Cloud Constraint Wizard. If you're happy with the errors, click:
Registration -> Create ScanWorld / Freeze Registration, then
Registration -> Create and Open ModelSpace

Look at your registration file in the Cyclone Navigator. It now looks like a normal ScanWorld icon.

Figure 30. ScanWorld icon of a completed registration.

Registration Without Targets – Visual Registration

Registration without targets can also be performed using the **Visual Registration** method in Cyclone 9 onwards. By generating 2D thumbnails of point cloud data, you can visually align two point clouds together much faster than the manual cloud to cloud method.

First, generate the thumb nails. In Cyclone Navigator, select the scans, **right click -> Re-Generate Scan Thumbnails.**

In Cyclone Navigator, create a new registration (**Create -> Registrion)**. Open the Registration (double click). Add the ScanWorlds (**ScanWorlds -> Add ScanWorlds)**. Automatically group the ScanWorlds (**select the ScanWorlds, right click -> Create Scan World Groups with ….**).

Align 2 groups together. **Visual Registration -> 2D Scan Thumbnails.**

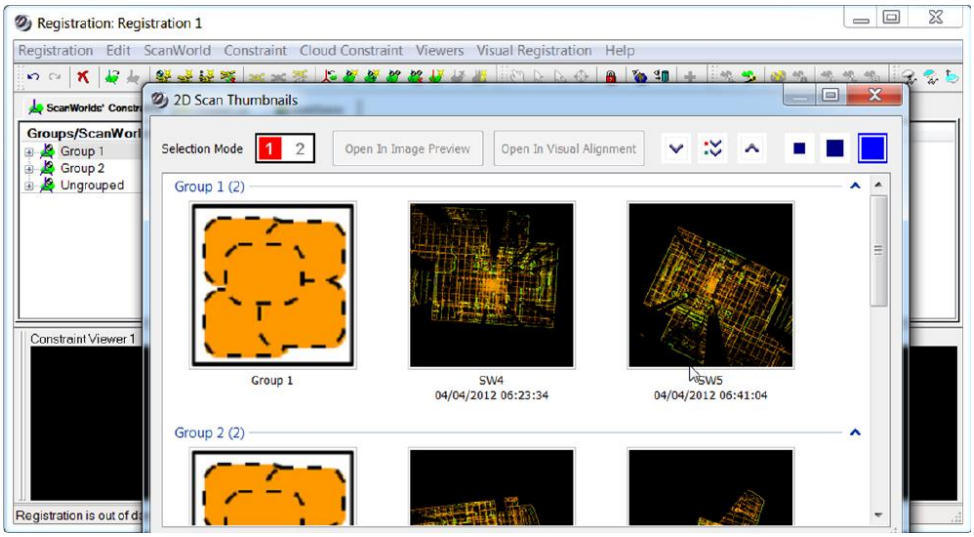


Figure 31. 2D Scan Thumbnails window.

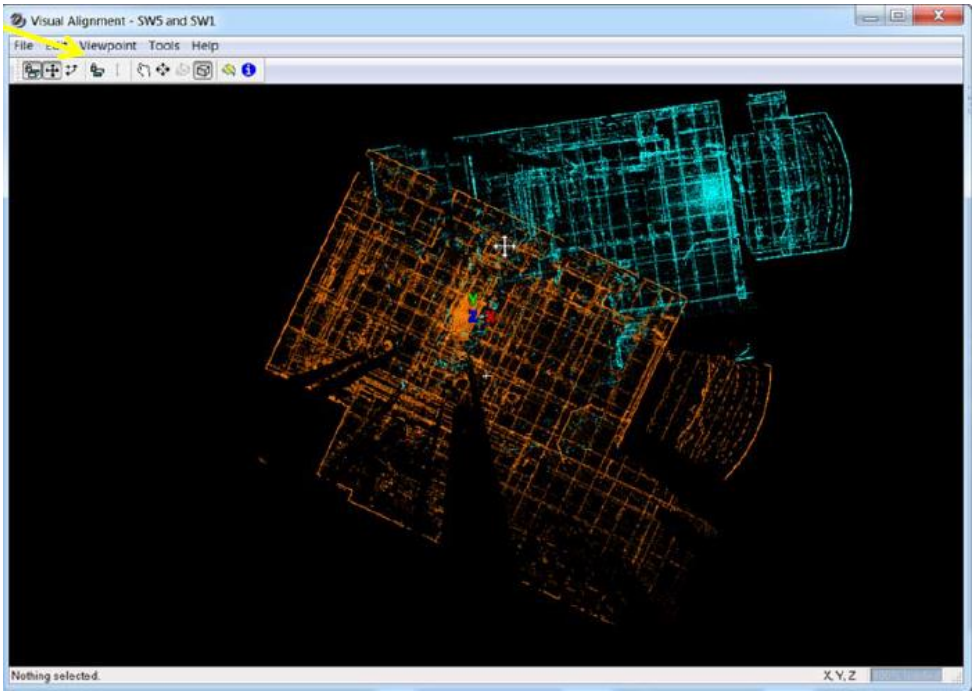
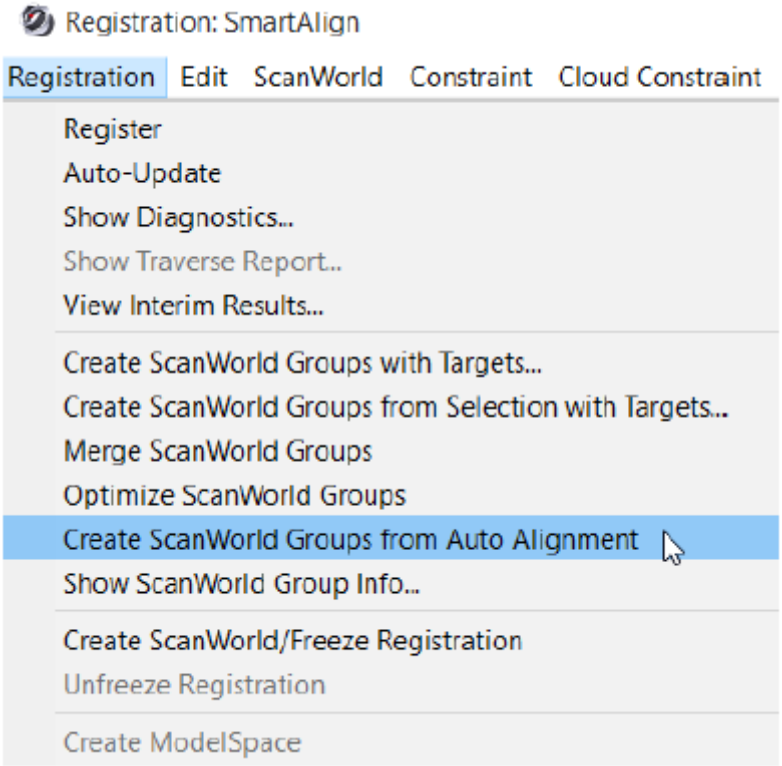


Figure 32. Visually aligning the 2D thumbnails.

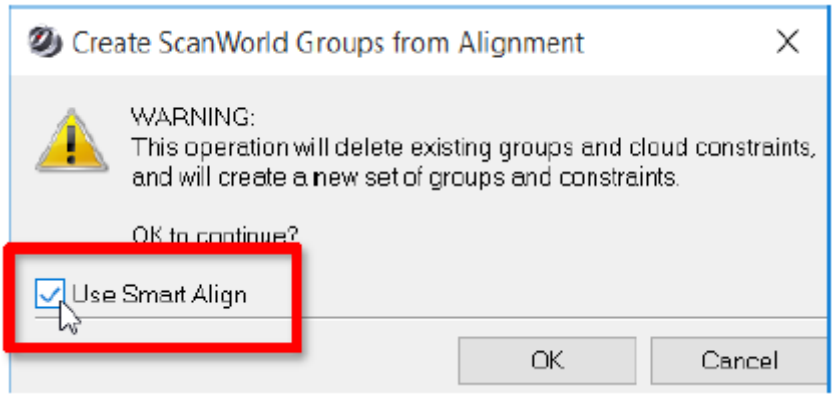
Auto-Align Scans with Previously Imported Scan Data

With Cyclone 9.1.5 a user can now perform an Auto-Align with scan data that has already be imported.

1. Create a new or open an existing registration.



2. From the top menu go to **Registration | Create ScanWorld Groups from Auto Alignment**



3. A dialog will appear asking if you wish to use SmartAlign. Click the check box if want to use SmartAlign. You can run Auto Align without Smart Align by not checking the box. (More on SmartAlign in the next section.

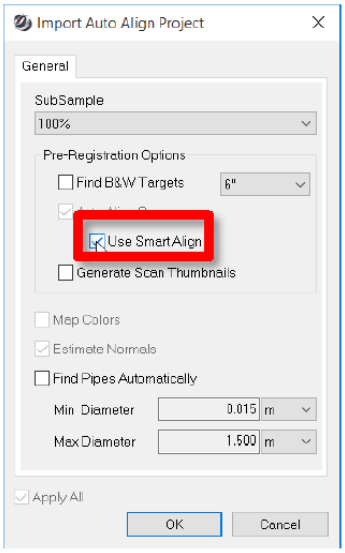
4. If the check box **Use SmartAlign** was checked the SmartAlign window will open with the setups that were in the registration. (More on SmartAlign in the next section.)

5. If the check box to Use SmartAlign was not checked, then Auto Align will run on all setups as normal.

Registration with Smart Align

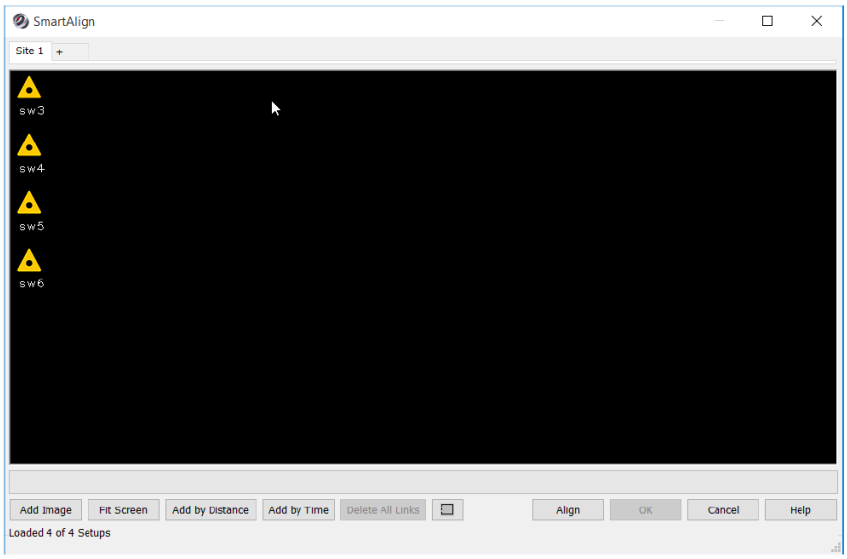
This new tool allows the user to pre-stage the Auto Alignment process via placement of known positons on a map (which is a user imported image). The user then creates links between scan postions by any one or combination of (i) manually created links, (ii) adding links by time, and/or (iii) adding links by distance. Pre-staging the setups to create known links greatly improves the time and quality of the Auto-Align Scans process. SmartAlign is available as an option to Auto-Align at both the data import stage as well as the post-import, Registration stage.

1. To use SmartAlign, begin a regular import of scan data and then select the **Auto Align Scans** option in the import dialog and then select **Use SmartAlign.**



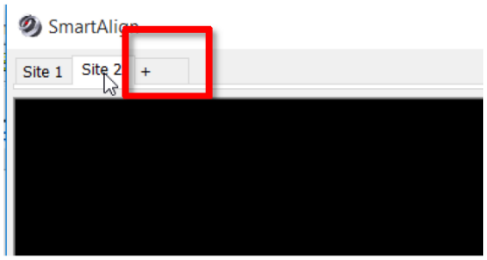
Or, if in a Registration, after choosing **Create ScanWorld Groups from Auto Alignment** from the top **Registration** menu,

2. The scan data will go through the normal import process; at the end of import, the SmartAlign dialog will appear. In the following example, four (4) scans were imported for SmartAlign:



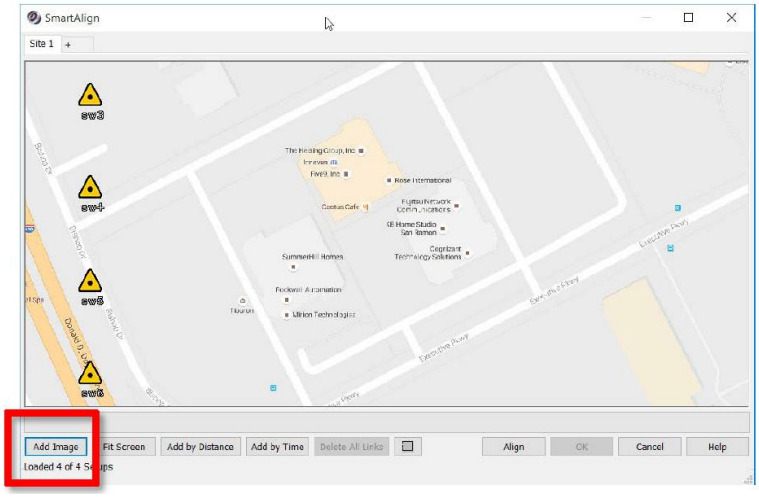
3.
(Optional) At this point you can add another Site by clicking the + sign on the tab bar at the top. Adding another Site will allow you to transfer setups to another area. You may want to do this if you need Auto Align to consider groups of setups separately. For example, all setups on Floor 1 go into Site 1 and all setups on Floor 2 go into Site 2.

a. To create another Site simply click on the + sign in the Tab area at the top.



b. To move setups to another site select the setup icons with a single left mouse click; hold the control key to multi-select other setups. You can also use the selection fence by clicking the button at the bottom of the window. After you have a group of selected setups, right click. You will see options to send the setups to a particular Site. Click the desired Site and the setups will move to the selected Site.

4. Next select the **Add Image** button to add a background image to the dialog. Browse for an image and click OK to view image in SmartAlign dialog:



5. Move the setup icons to their relative positions on the map. Using a single left mouse click and hold, drag the icons. Field notes works great for this part!

6. Next, add links between setups. *Adding links will allow Auto Align to only consider the links added, thereby saving a great deal of time*. You have multiple options for adding the links: a. Drag one icon over another then back to the original position. A link will appear between them.

b. Click the **Add by Time** button. This will add links by the time stamp on the scanner file. This is a great way to add links according to the time if scans were captured in a sequential and chronological way.

c. Click the **Add by Distance** button. This will add links based on pixel spacing between the icons on the map.

7. You can edit links by deleting them; simply left click to select the link and then press the keyboard delete key.

8. When all links are established, click the **Align** button to begin the Auto Align process.

9. During the Auto Align process links will turn red while they are being analysed.

10. At the end of the Auto Align process the links will turn colors based on the status of the link: a. Green = Good link. Link will be used to form the group.

b. Yellow =Good link, but not necessary to form a group. You may decide to add this link latter in the registration process.

c. Red =Bad link. Link will not be used to form the group.

11. At this stage, you can edit the links again by deleting them and creating new links in order to try the Align process again until you get to a desirable result.
Note: You can have more than one group in one site if Auto Align finds more than one group in a particular site.
12. In the below example, Auto Align found 3 green (good) links and 2 red (bad) links. However the green links are enough in this situation to form a group as the green links connect all the setups in this site. You do not need to delete red links when you are ready to accept the results and continue with the Auto Align process.

13. Click the OK button to finish the process. In this example, one group was formed and a registration was created with the grouped setups in one group.

14. You can then continue with the completion of the registration as normal.

Registration Diagnostics

A full report on a registrations diagnostics can be easily generated. Open the registration, and click **Registration -> Show Diagnostics.** The report will display the errors of each constraint used.

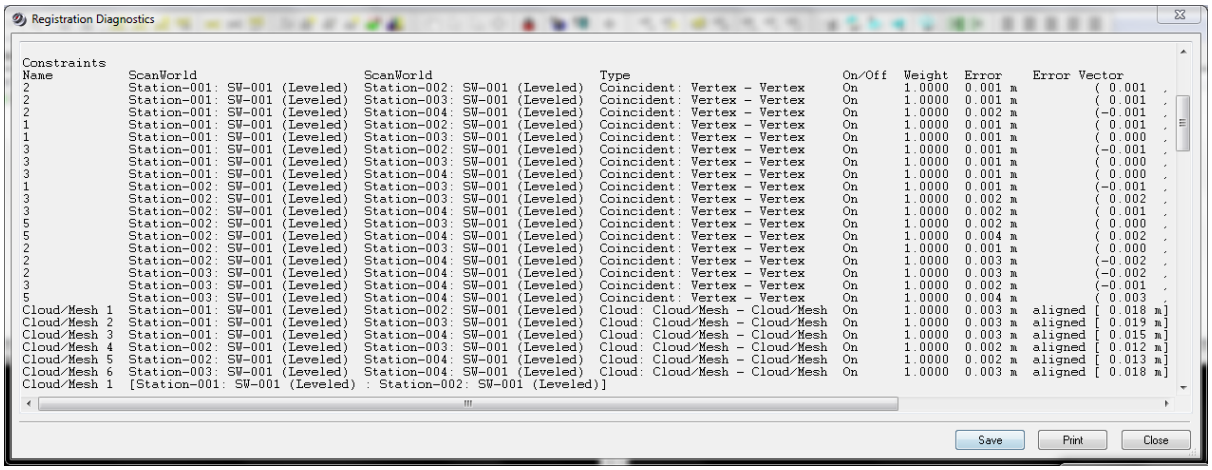


Figure 33. Registration diagnostics report.

Unifying a ModelSpace

Before you start modelling or do any further changes to the registration, unify the registration that you have done. Even though the registered ScanWorlds look like one single point cloud, they are still treated as separate point clouds in a ModelSpace. Unifying results in better resource allocation of your PC's memory.

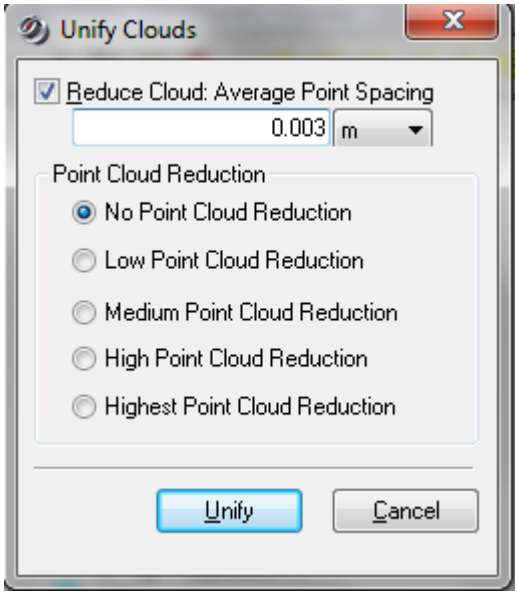


Figure 34. Unify cloud options.

Once you unify a ModelSpace, you cannot un-unify it. So it's a good idea to a make a copy first.

To make a copy of a ModelSpace, **right click -> Copy,** then under the ModelSpace folder, **right click -> Paste**.

To unify, **right click** on the new ModelSpace -> **Unify ModelSpace**.

You have the option to reduce the point cloud density. This is useful, as it reduces the number of points in the cloud, improving performance in Cyclone. I recommend a 3mm reduction in points for modelling purposes. Once done, click **Unfiy**.

Adding / Renaming Targets

To add a target:

Click on the centre of target with the Pick Mode, and then **Create Object -> Fit to Cloud -> HDS Target** or **Black/White Target.**

Figure 35. Pick Mode icon.

To name or rename a target

Click on the centre of target with the Pick Mode, and then **Tools -> Registration -> Add/Edit Registration Label.**

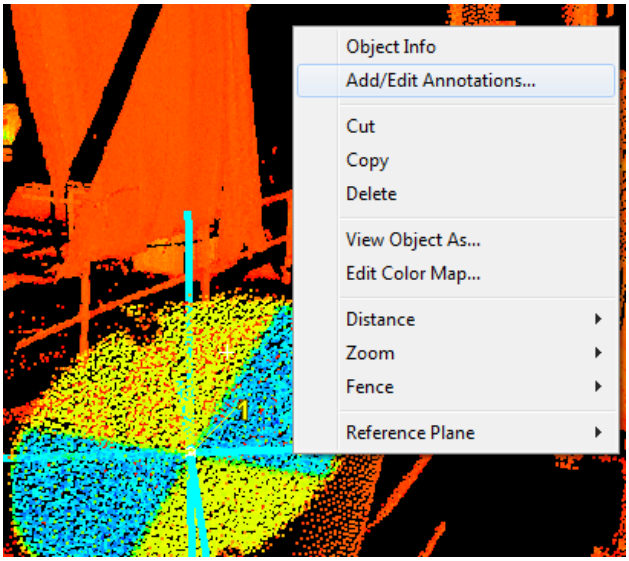


Figure 36. Naming/renaming a target.

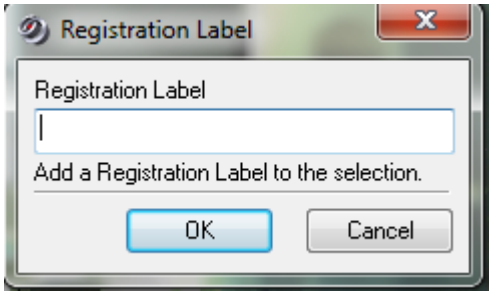


Figure 37. Changing a targets value (name).

Using modelled objects as targets

Cyclone can use modelled objects as targets. For example, you can use a modelled pipe as object. Select the pipe, and click **Tools -> Registration -> Add/Edit registration label**

A 3 plane corner (i.e. in a room where the ceiling and two walls intersect), can be very accurately defined by Cyclone and can be used as a target. **Create Object -> Fit Fenced -> Corner** (vertex added automatically). Click on the vertex, then **Tools -> Registration -> Add/Edit registration label**.

ScanWorld Explorer

The ScanWorld Explorer is a useful tool to turn on/off point clouds in a registration. You cannot do this once you have unified the cloud.

To access the ScanWorld Explorer open the ModelSpace of a registration, and click **Tools -> Scanner -> ScanWorld Explorer**.

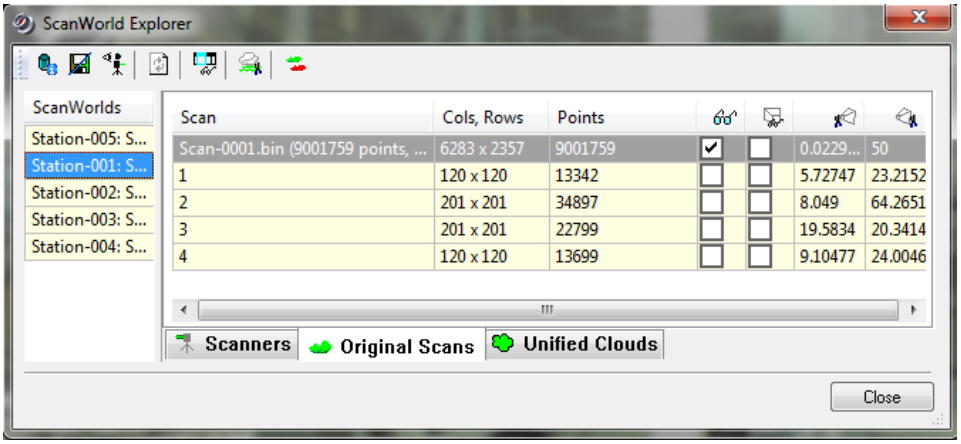


Figure 38. ScanWorld Explorer window.

In the ScanWorld Explorer, you can hide or show clouds that are part of the existing registration by un-ticking the viewable icon:

Figure 39. Viewable icon.

Segment scan by distance. You can apply delete data beyond a certain range from your scans.

Figure 40. Segment scan by distance icon.

Allign View. This function puts you into the perspective of the scanner in a particular scan. NB: A short cut to this view is to select the point cloud with the pick-mode, and press “a” on the keyboard.

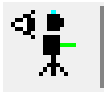


Figure 41. Align view icon.

Note that the align view mode is set to the **panoramic view**. This locks your view in a 360° bubble view.

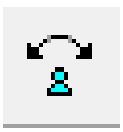


Figure 42. Panoramic View icon.

View Properties

This option allows you to turn on/off visibility and selectability, as well as segment cloud or objects into different layers.

Figure 43. View Properties icons.

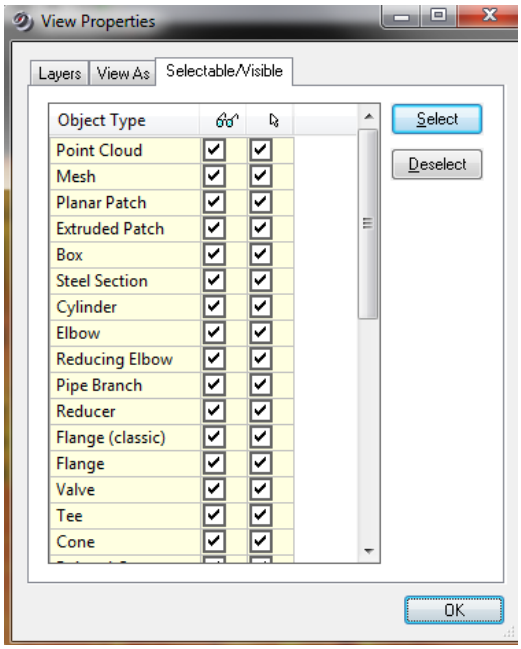


Figure 44. View Properties window.

Notice that there are three main tabs: Layers, View As, and Selectable/Visible.

Layers

You can select points, meshes, or modelled objects, and assign them to a layer of their own. This is useful if you wish to hide certain objects, or group the same objects together (e.g. assign all cylinders to their own layer).

View As

You can set the resolution of object in the View As tab.

For example, a mesh can be viewed in high resolution (LOD – Full Range) or as a wireframe.

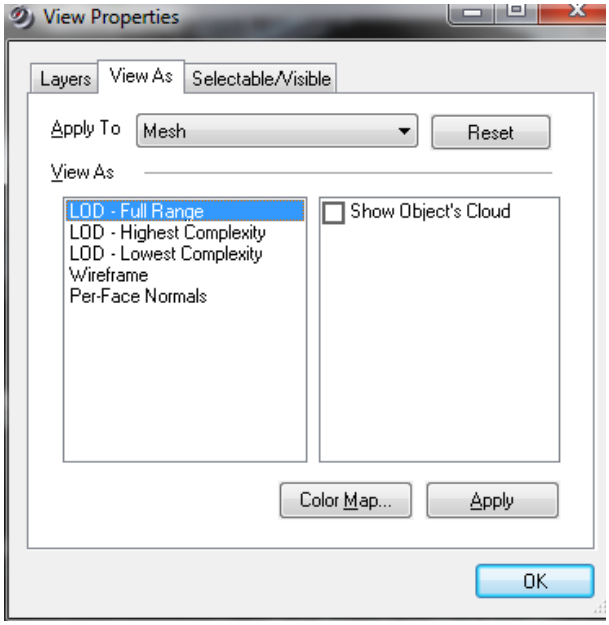


Figure 45. View Properties - View As tab.

Select/Visible Tab

This tab gives you the option allowing an object to be visible, and also selectable with the pick mode.

3D Modelling

Cyclone is a very powerful tool for modelling pipes, steel beams, valves, boxes, patches and other objects. When modelling pipes and steel beams, Cyclone can model to standard sizes. To activate this mode, click **Create Object -> Use Parts Table.**
You can choose the database to use by clicking **Edit -> Object Preference.**

There are five ways to model: Region Grow, Fit to Cloud, Fit to Fence, 2D Draw and Insert Object.

When modelling objects from the point cloud using **Region Grow** commands, the objects point cloud will be made invisible. At any time you can show the objects cloud by selecting the modelled object, and clicking **Create Object -> Insert Copy of Objects Points.**

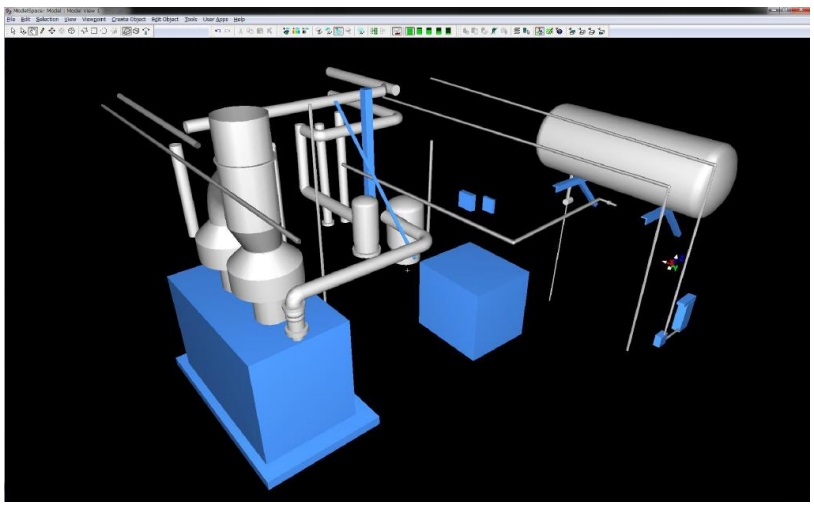


Figure 46. Plant objects can easily be modelling Cyclone.

Modelling Cylinders/Pipes from the Cloud

You can model pipes in your original ModelSpace. To model a single pipe, select the pipe with the pick mode, click

Create Object -> Region Grow -> Cylinder.

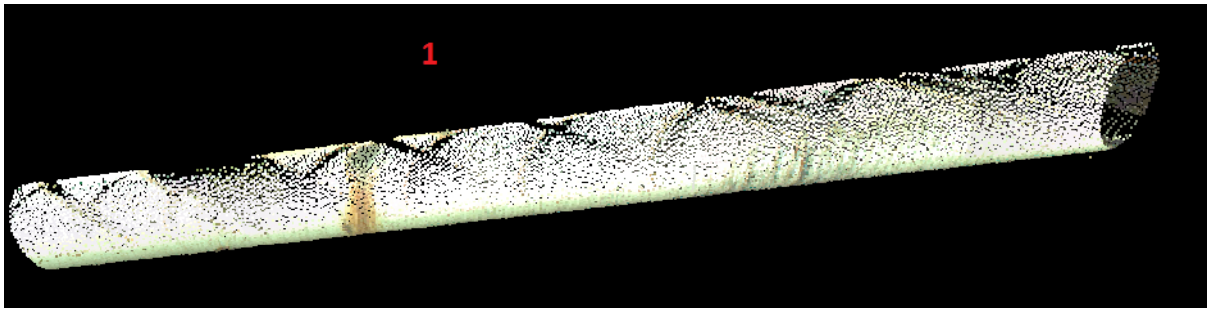


Figure 47. Modelling a single pipe.

To model a pipe run, click on the separate parts of the pipe with the multi pick mode, click **Create Object -> Region Grow -> Pipe Run**.

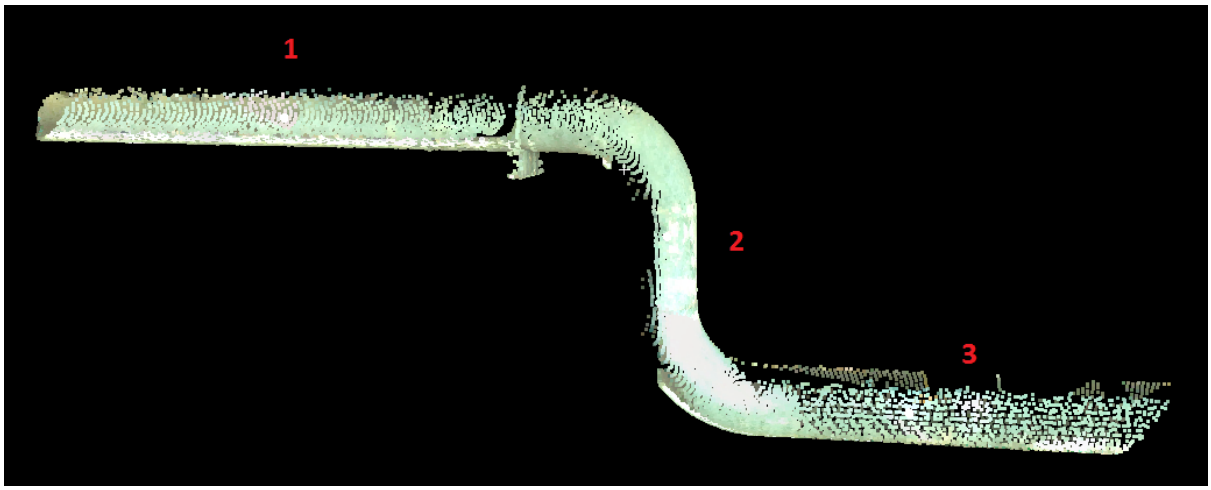


Figure 48. Modelling a Pipe Run of 3 sections.

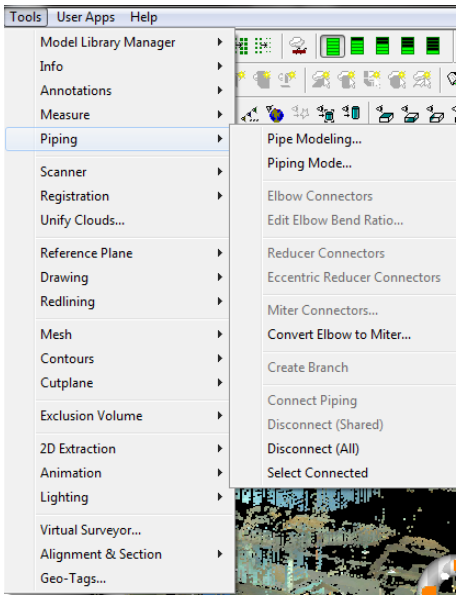


Figure 49. Piping Menu

Pipes can also be modelled automatically, **Create Object -> Find Pipes Automatically.** The function will not work on a unified pipe cloud, and will not add pipe elbows, only straight pipes.

Pipes can be connected with elbow or mitre connections, or reducers can be added to the end of pipes.

These functions can all be found in the Piping menu, under **Tools -> Piping.**

Modelling Cylinders Automatically

Cyclone 8.0 onwards can scan the point cloud and model pipes automatically. Note, this cannot be done on unified points clouds. To begin the process, select the point cloud (**Selection -> Select All**), and click: **Create Object -> Find Pipes Automatically**

You may wish to colourise the cylinders different colours. To do so, click: **Edit Objects -> Appearance -> Create Objects from Random Colours**

You can filter cylinders by size by clicking: **Create Objects -> Filter Pipes**

Modelling Cylinder Components

There are several other options with pipes. Valves, blind flanges, wielding neck flanges, reducers, and tee joins must be fitted by eye. You cannot “region grow” or “fit to cloud” a valve. Using the handles, adjust the size to best match the cloud. To add these objects, click on the end handle of a pipe, then **Create Object -> Insert -> ….**

Elbow Join

An elbow join is a continuous smooth pipe join. Note, pipe runs will add elbow joins between pipes automatically.

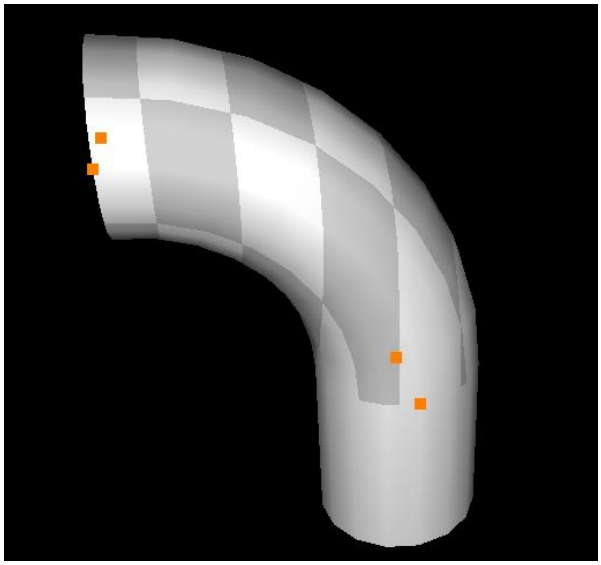


Figure 50. A pipe join

Mitres Join

A mitre join is made of multiple pipe cross sections. It is not a smooth continuous join like an elbow.

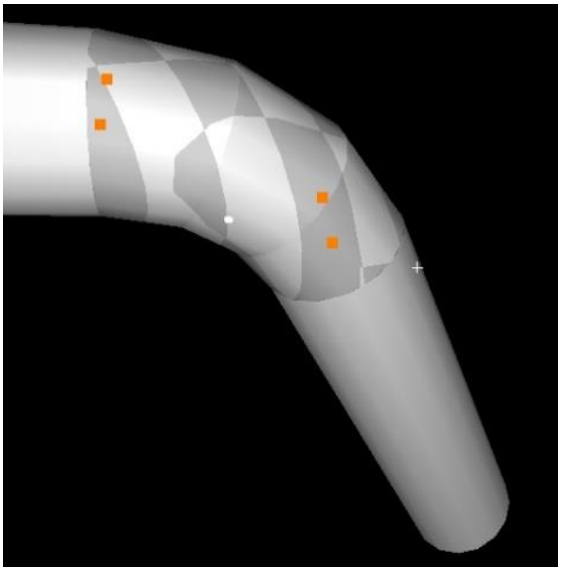
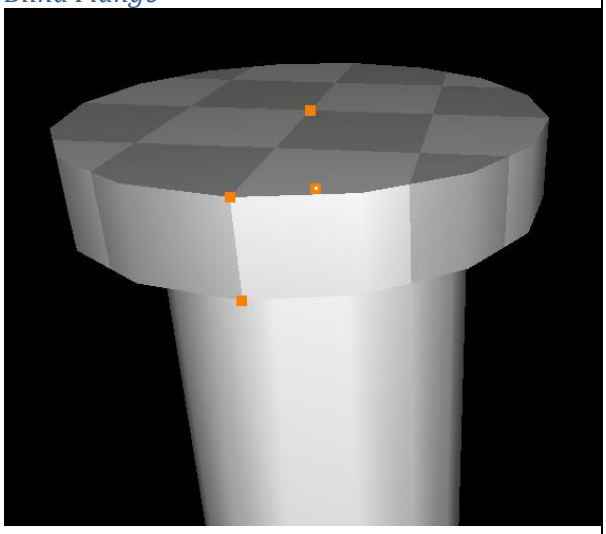
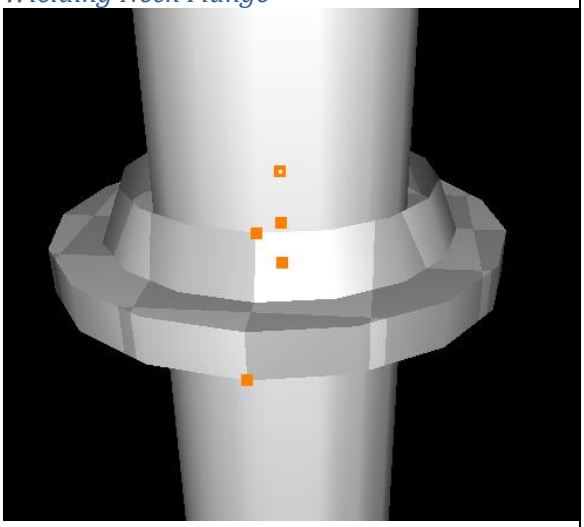


Figure 51. A 3 section mitre join.

Blind Flange



Wielding Neck Flange



Concentric Reducer

2 Cylinders of different diameter joined together with a Concentric Reducer.

Eccentric Reducer

2 Cylinders of different diameter joined together with an Eccentric Reducer.

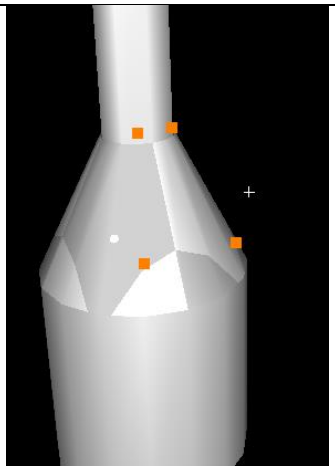


Figure 52. Concentric Reducer.

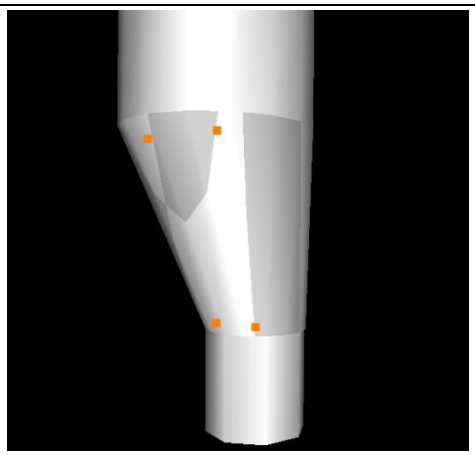


Figure 53. Eccentric Reducer.

Valves

Create Object -> Insert -> Valve.

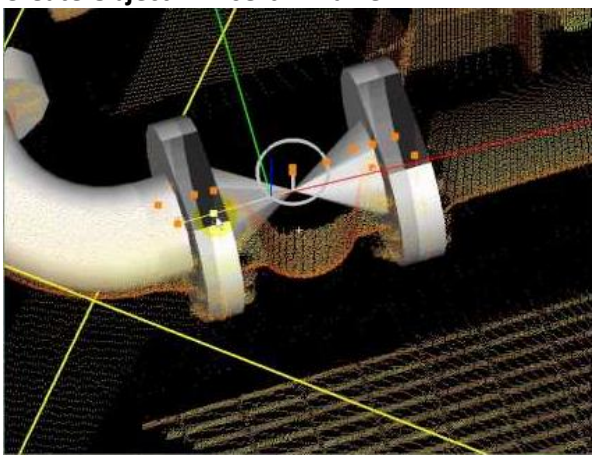


Figure 54. Modelled valve.

Tee Joins:

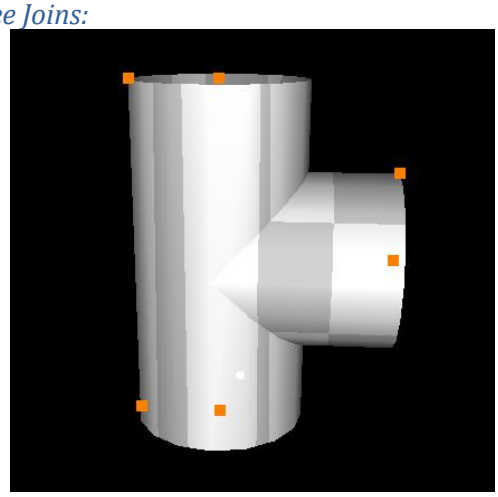


Figure 55. Modelled Tee join.

End Caps

You can add end caps to cylinders: **Edit Object -> End Caps ->**

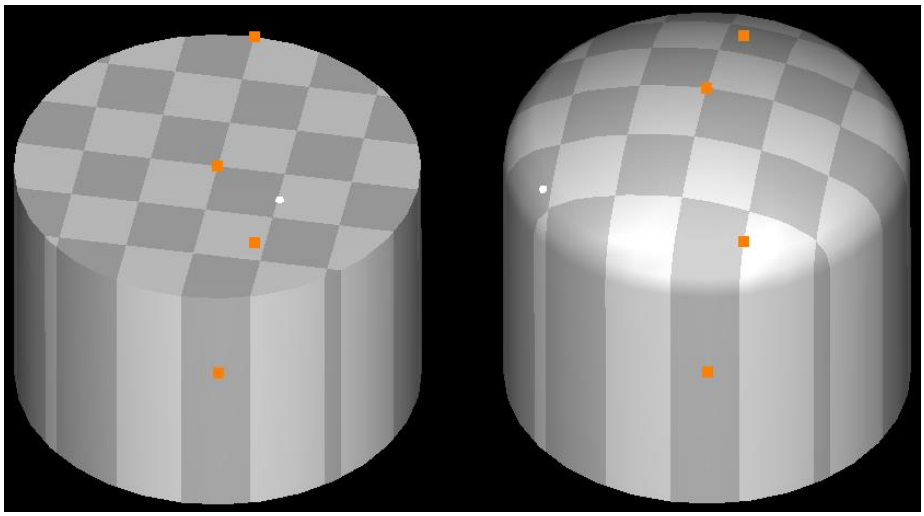


Figure 56. Flat (left) and Semi Elliptical (right) Caps.

Modelling Pipe Objects without the Point Cloud

Pipe objects (pipes, elbows, flanges, etc), that have not been scanned or do not yet exist can be modelled from within Cyclone. For example, a new pipe run can be added into the pipe cloud, and point cloud collisions can be ran to determine the pipe will fit correctly.

Tools -> Piping -> Pipe Modelling

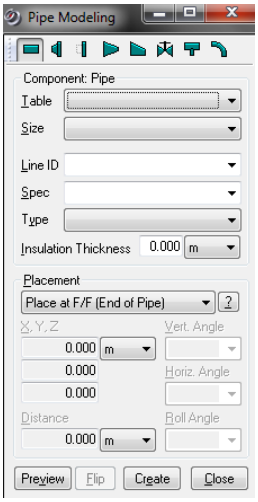


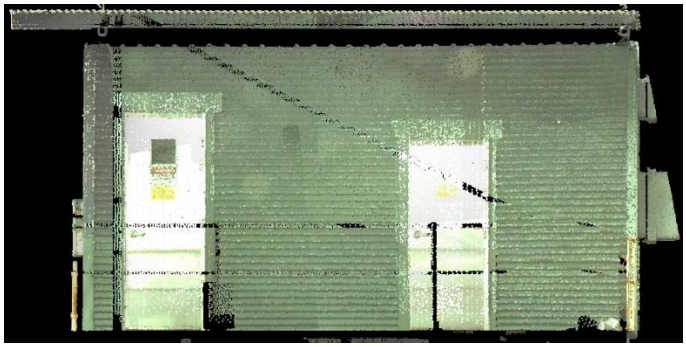
Figure 57. Modelling objects not in the point cloud.

Modelling Patches

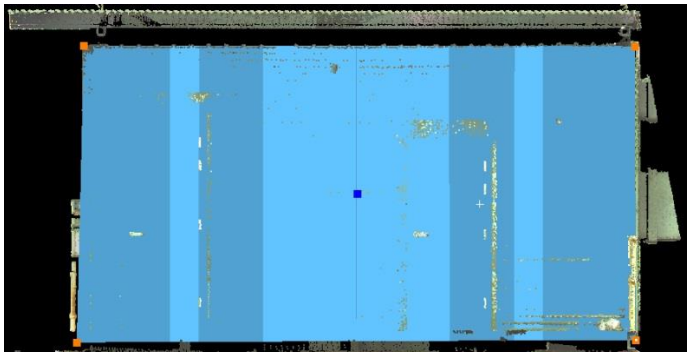
A patch is a 2 dimensional plane. Patches can be used to model flat objects, such as walls, ceiling, floors, etc.

Holes can be cut into patches, so long as they do not cut through the perimeter.

Patches can be extruded to become 3 dimensional objects. Once extruded, holes cannot be cut into them.



Select a point on the surface with the pick mode, then click **Create Object -> Region Grow -> Patch.**



Normally there will be numerous handles and corners. The patch can be made rectangular by selecting the patch, then **Edit Object -> Patch -> Make Rectangular.**

NB: In the above example, a patch could also be created using by drawing a 2D polygon against the XY reference plan.

Cutting fences from a Patch

Objects such as doors and windows can be cut out of the patch using the fence tool. It is best to view the patch in orthographic mode when making cuts. NB: A fence cannot be cut beyond the perimeter of the patch.

Create Object -> Insert Copy of Objects Points

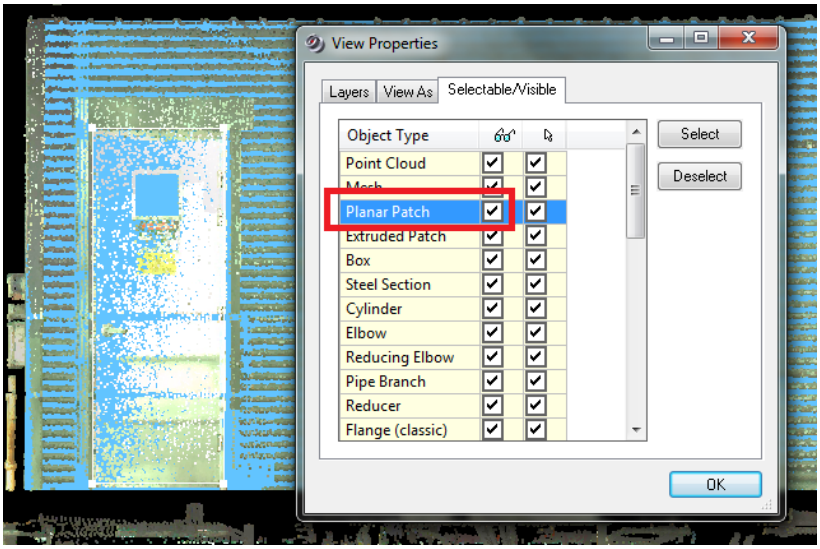


Figure 58. Changing the visibility of the patch. Note the rectangular fence over the doorway.

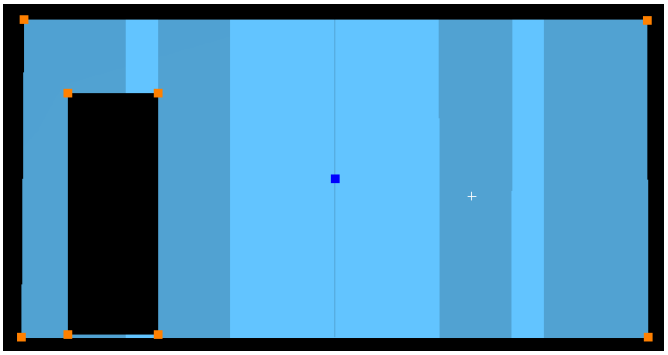


Figure 59. Patch with fenced area removed.

Extruding Patches

Extruding a patch give it depth and becomes a 3D object. A patch is only a 2D flat surface. Once a patch has been extruded, fences can no longer be cut from it.

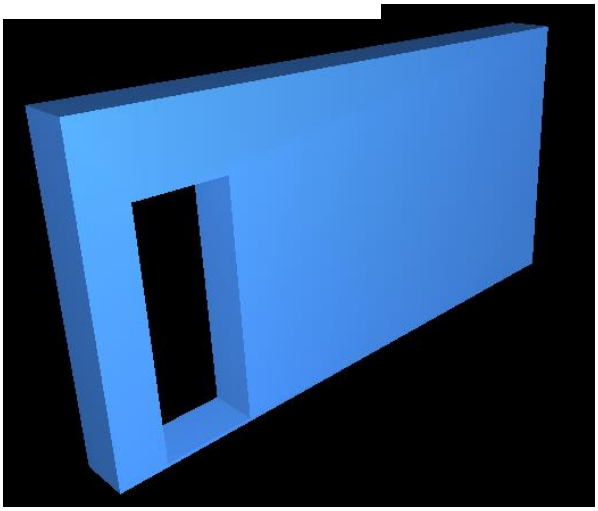


Figure 60. An extruded patch with depth.

Extending Patches

Select the patches, and select **Edit Object -> Extend -> Extend All Objects**.

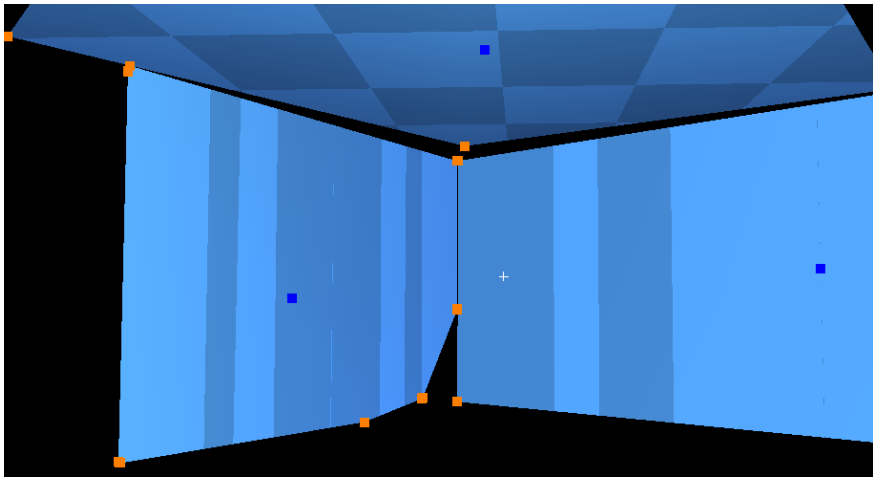


Figure 61. 3 Patches before extension.

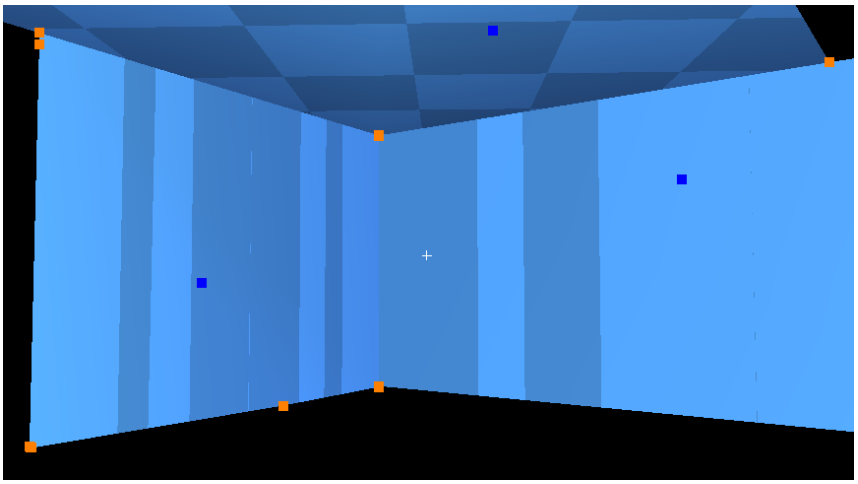


Figure 62. 3 patches after extension. Note the corner.

Modelling Steel Beams – Fit to Cloud Method

With Steel Beams, you must copy the beam to a new ModelSpace. Fence out a steel beam using the fence tool, **right click -> Copy Fenced to New ModelSpace**.

Clean up the steel beam by using the polygonal fence tool, and **right click -> Fence -> Delete Outside** or **Delete Inside**. The steel beam point cloud should look like the below figures.

Figure 64. Top down view of cleaned up steel beam. Note that the view is in orthographic mode, not perspective mode.

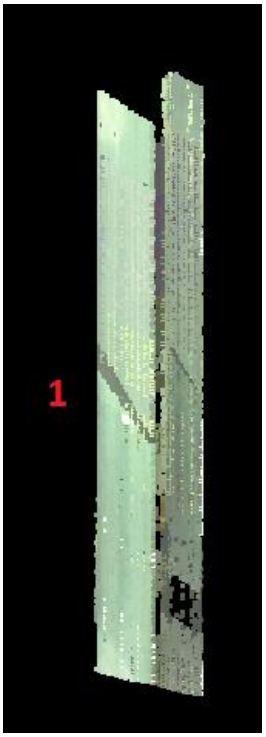


Figure 63. Side view of steel beam.

To model a steel beam, click on the beam with the pick mode, and then **Create Object -> Fit To Cloud -> Steel Section -> Wide Flange**

NB: You can also fence the beam, **right click -> Fit Fence -> Steel Section -> Wide Flange.**

Steel beam Angle, channel, Tee, rectangular tube, and wide flange (I-beams) steel beams can all be modelled in Cyclone using the above method.

Angle:

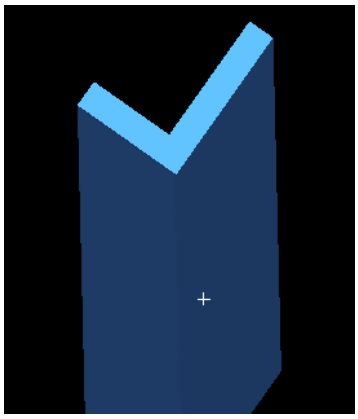


Figure 65. Steel Angle Beam

Channel:

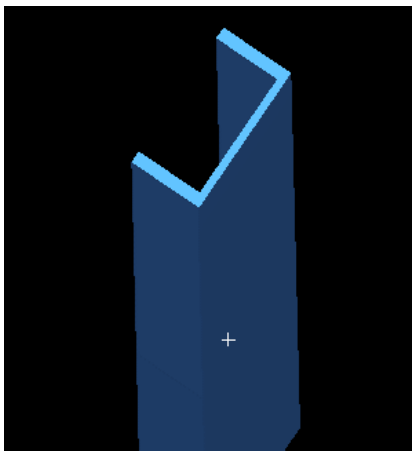


Figure 66. Steel Channel Beam.

Tee:

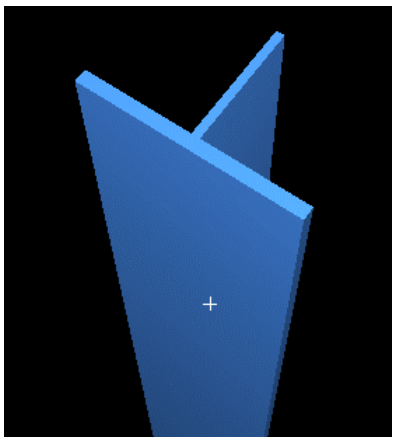


Figure 67. Tee Steel Beam.

Rectangular Tube

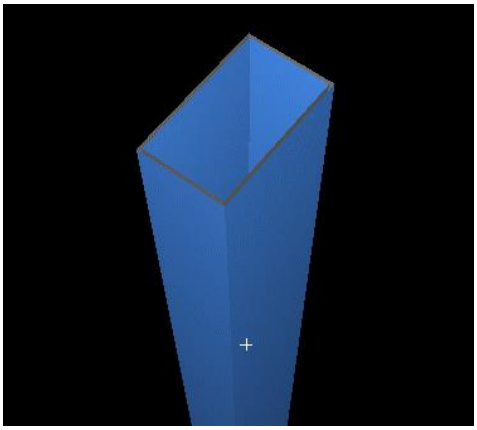


Figure 68. Rectangular Steel Beam.

Wide Flange (I-Beam or H-Beam):

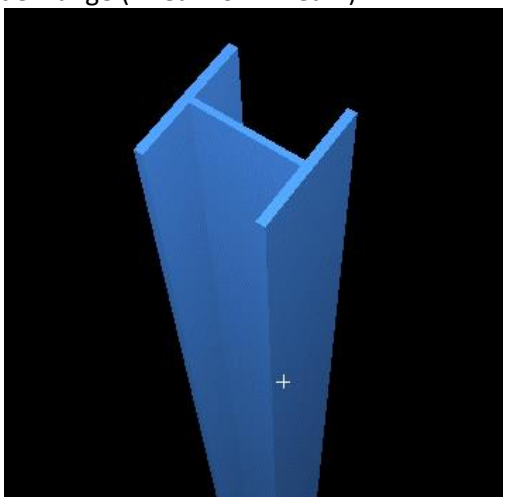


Figure 69. Wide Flange Steel Beam.

Modelling Steel Beams – Extrude Shape Method (Cyclone 9.0)

In Cyclone 9.0, steel beams can modelled from 2 picks without having to clean the cloud. Using the multi-pick tool, pick two points on a steel beam. **Create Object -> Extrude Shape (2 picks) -> Wide Flange.**

NB: This function will only model to dimensions in the database. **Create Object -> Use Parts Table** must be ticked and enabled.

NB: The area around the cross section of the picks on the steel must be clean of noise for 20mm on each side of pick see image.

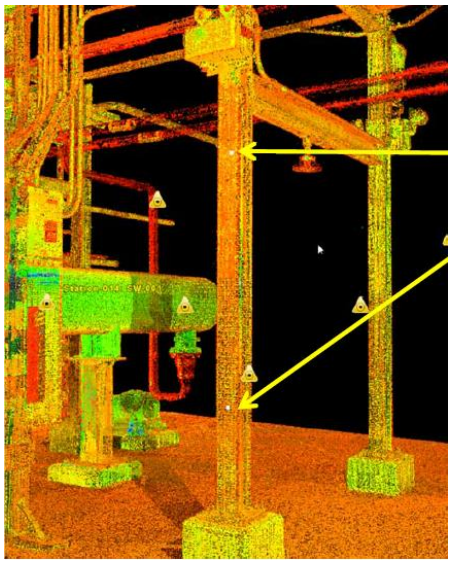


Figure 70. Cyclone 9.0 can model steel beams using the multi-pick method.

Modelling Boxes (Cuboids)

Like steel beams, boxes can only be modelled from point clouds using the Fit to Cloud command. Therefore, you must first fence and copy a box to a new model space, isolate the box point cloud data, then **Create Object -> Fit to Cloud -> Box.**

Modelling Spheres

Like steel beams, spheres can only be modelled from point clouds using the Fit to Cloud command. Therefore, you must first fence and copy a sphere to a new model space, isolate the sphere's point cloud data, then **Create Object -> Fit to Cloud -> Sphere.**

Modelling Targets

Scanner targets (HDS target, black/white target, or sphere target) can be modelled in Cyclone.

Select the target with the pick mode. You do not have to select the centre of the target.

Create Object -> Fit to Cloud ->

Note, you do not have to isolate the target. If there is enough point data on the target, Cyclone will automatically add a vertex in the centre of the target.

Modelling to standard sizes

In Leica Cyclone, you can create modelled objects to sizes in a database. To do this, click **Edit -> Object Preferences**, and select the Object Type. When you next model this object, Cyclone will best fit the dimensions to a list of standard sizes from a database.

Databases are located in the directory:
C:\Program Files\Leica Geosystems\Cyclone\Lib\Tables

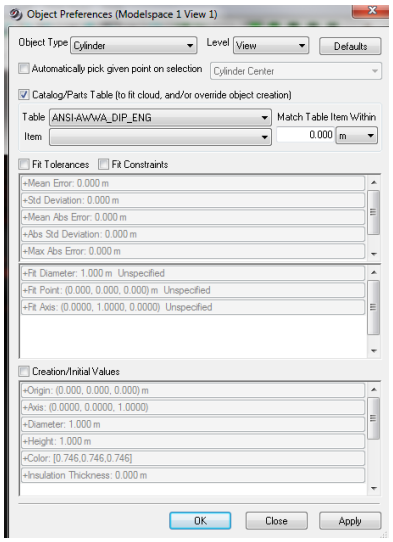


Figure 71. Object Preferences Window.

Merging models back into the original Model Space

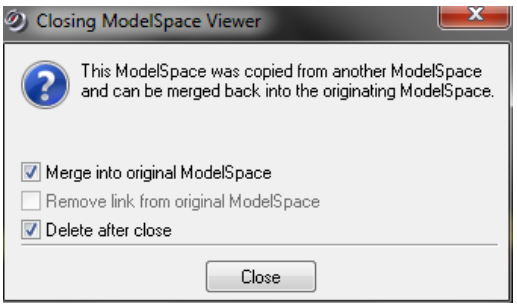


Figure 72. Closing ModelSpace View.

Once the model has been made, close down the ModelSpace windows, and check “Merge into original ModelSpace” and “Delete after close”.

Object Handles

Handles are contained in objects within Cyclone that are used to adjust the object’s position, orientation, and size. **Handles** are **colour coded** to indicate the movement type.

- **Red** – Rotate
- **Orange** – Resize, translate, and snap
- **Blue** – Translate and snap

You can move objects in Cyclone, and restrict the movement to a 2 dimensional plane.
Edit Object -> Handles -> Constrain Motion To -> …..

Left click on an orange handle, and hold **Ctrl** to move an object.

Left click on an orange handle, and hold **Shift** to will snap handles to each other.

Holding **Alt** allows the object to move.

Quick Move

A modelled object can be moved easily with the **Quick Move** command. Select 2 points on the model (click on the blue handles) with the multi-pick mode, then select two corresponding points on the point cloud, and **Edit Object -> Quick Move.** This is much faster than manually dragging an object.

Copying Multiple Models

A modelled object can be copied multiple times. This is useful, for example, if you wish to copy a steel beam every 5 metres in the X-axis directions. Select the object with the pick mode, then click **Create object -> Copy.**

Changing the Appearance of Modelled Objects

Modelled objects can have their appearance (e.g. colour, transparency, etc) customised in Cyclone.

Select the object with the pick mode, then click
Edit Object -> Edit Colour/Material

Grouping Modelled Objects

Multiple objects can be grouped together as a single objects. This makes it easier to move the objects together, or to assign them all to a layer.

Select all objects with the Multi Pick mode, then
Edit -> Group -> Group

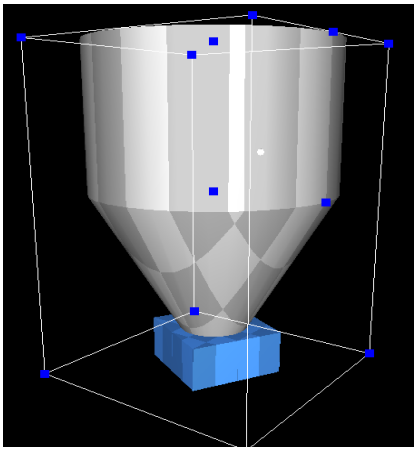


Figure 73. 3 modelled objects grouped.

Fit Edge Tool

The Fit Edge tool is used for creating a polyline the follows an edge.

Create Object -> Fit Edge

Figure 74. Point cloud of a step.

A cross section view point of the edge should appear in the Fit Edge window, along with a vertex. If not, rotate the point cloud manually and add a vertex on the edge. Multiple vertexes can be added if required. The nodal point indicates the position where a polyline will be created.

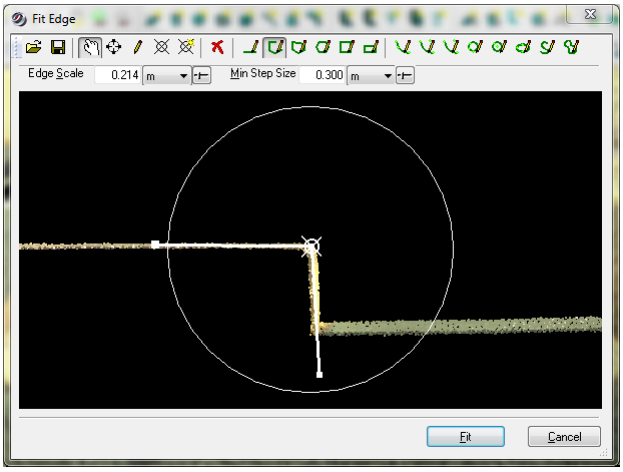


Figure 75. Fit Edge window with cross section view on point cloud.

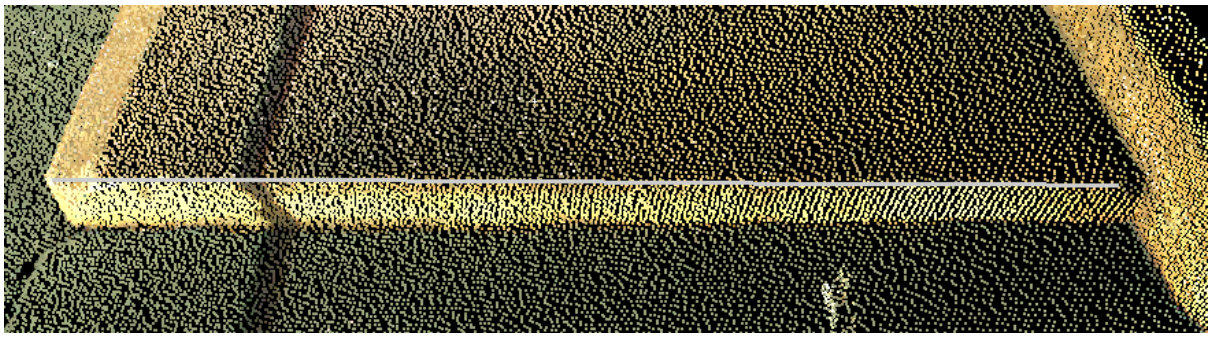


Figure 76. Point cloud with added polyline (in grey).

Import/Export DXF files with Cyclone

Modelled objects in Cyclone can be exported as a DXF, and viewed in 3rd party CAD programs (such as AutoCAD or MicroStation).

To export a model from Cyclone, select the item(s), and click File -> Export, and selected AutoCAD DXF R12 Format (*.dxf).

Cyclone can only import COE (Cyclone Object Exchange) objects. It cannot import DXF objects directly. To import DXF models into Cyclone, you have to convert them into COE files using the Leica COE data transfer plugin for AutoCAD or MicroStation.

Model Library

Cyclone has a model library for commonly used objects. You can add or load models to/from the library easily.

To Import a Model from the Model Library

Tools -> Model Library Manager -> Insert Model

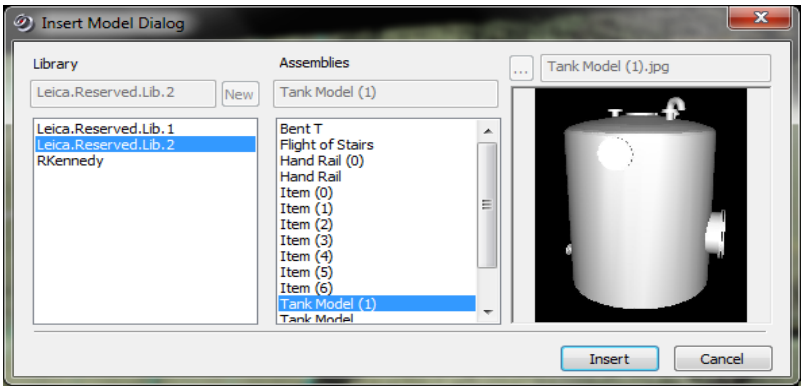


Figure 77. Insert Model window.

To Save a Model to the Model Library

Take a screenshot of your model and save it as .jpg file. Copy the model into a new Model Space. Select All, then click **Tools -> Model Library Manager -> Save Model.**

Create a new name for a Library, Assembly and load the screenshot of the model.

Geo Tags

A Geo Tag allows you to add additional meta data to the point cloud in Cyclone. Geo Tags will be automatically saved into a Leica TruView when created.

Tools -> Geo Tags

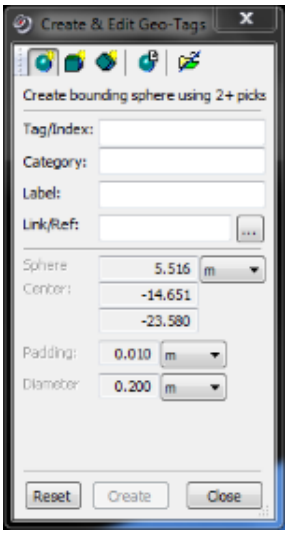


Figure 78. Geo Tags window.

Creating a TruView

A TruView allows to you share the scan data in internet explorer. You will first need to download and install a plugin for internet explorer. Google the term “Leica TruView download”, and download the link.

To create the TruView, open the ModelSpace that you wish to share. Zoom out so that you can see all the scan station positions. This will be the site map of your TrueView.

Once done click **File -> Publish Site Map**.
Create a folder where you want the TrueView to be -> **OK**.
Select your ScanWorld -> **OK**.
Click **TruView Settings** button.
Click **Color Map Settings**.

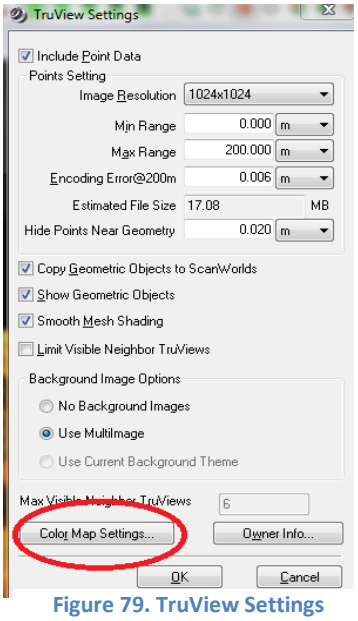


Figure 79. TruView Settings

If you have photographs, set the mode to “Colours from Scanner”. If you do not have photographs, set the mode to “Intensity Map.”

For “Intensity Map” mode, you set the scheme to either greyscale or Multi-Hue/Rainbow. In Grayscale mode, you can adjust the darkness with the Gamma setting.

Once the TruView is created, open the folder, and click SiteMap.htm.

NB: The TruView plugin will only work with Microsoft Internet Explorer. You can download the TruView plugin from the Leica website:
http://hds.leica-geosystems.com/en/Leica-TruView_63960.htm

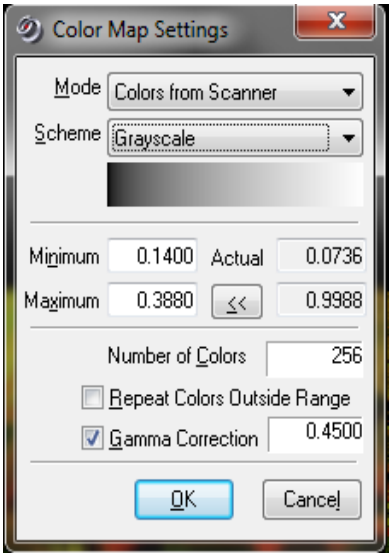


Figure 80. TruView Colour Map Settings

Key Plans

A key plan allows you to easily share point cloud data locked into the perspective of the scanner, with anyone that has Cyclone installed. It is very similar to a TruView, except a Key Plan must be ran in Cyclone. Cyclone can be installed without a license and used as a viewer.

File -> Create KeyPlan

A background image (e.g. from Google Maps) can be imported. Select 2 scanner setups to align it.

Limit Boxes

Limit boxes are a useful way to view a small volume of data in a large point cloud.
Open a ModelSpace, click

View -> Set Limit Box by Cursor, or
View -> Set Limit Box by Fence.

Notice that now the data is limited to just the box. To turn off the limit box, click **View -> Limit Box**.

You can increase the size of the limit box with the multipack mode. Click on the limit box, and then drag the handles (the orange squares).

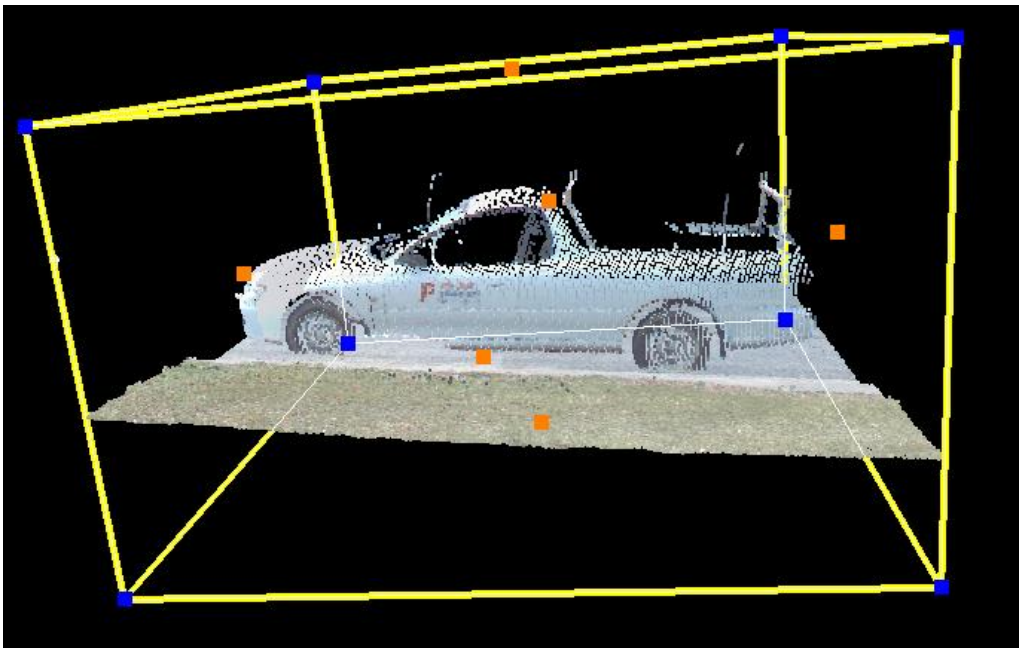


Figure 81. A car in a limit box.

Limit Boxes can also be saved and loaded in the Limit Box Manager: **View -> Add/Edit Limit Boxes.** The saved Limit Boxes in Cyclone can also be viewed in AutoCAD Cloudworx with the Clipping Manager tool.

Limit boxes can also be aligned to an axis. Select the limit box, then click **Edit Object -> Align -> Align to Axis -> XYZ Axis.**

Fences

Fences are another useful way of isolating or deleting points from the point cloud. There are 3 fence modes: Polygonal Fence, Rectangular Fence and Circular Fence.

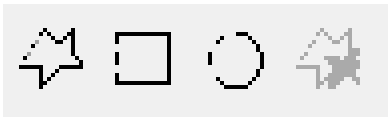
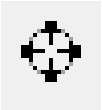
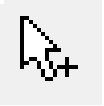
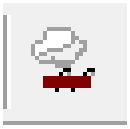


Figure 82. Fence tools (polygonal, square, circular, and cancel).

Viewing Modes

Perspective view: Shows the point cloud with depth of field.  Figure 83. Perspective icon.	**Orthographic view**: Shows the point cloud with no depth of view.  Figure 84. Orthographic icon.
Seek : Focuses the view on a point in the point cloud. The shortcut is **S** on the keyboard.  Figure 85. Seek icon	**View Mode**: Allows you to zoom, rotate and pan around a point that you selected with **Seek**.  Figure 86. View Mode icon
Pick Mode: Allows you to pick a point in the point cloud. The co-ordinates will be displayed at the bottom of the screen. Hold down **Shift** to pick multiple points.  Figure 87. Pick Mode icon.	**Multi-pick Mode**: Same as the pick mode, but allows you to pick multiple points without holding down **Shift.**  Figure 88. Multi-pick Mode icon.
Hide the Point Cloud: This icon depicts a pair of crossed out glasses looking at a cloud. This function is useful if you wish to hide the point cloud and only show modelled objects.  Figure 89. Hide the point cloud	**Fly Mode** 1. Click the Fly Mode icon to activate. 2. Hold down the left mouse button to fly forward. 3. Hold the right mouse button down to fly backward 4. Use the mouse wheel to control the speed of flight.  Figure 90. Fly Mode icon.

Changing the coordinate system

Cyclone allows you to easily transform the coordinate system of a point cloud. You may want to move the origin, or align a wall or object with the X or Y-axis. New coordinate systems can be saved, and the point cloud can easily switch between different coordinate systems.

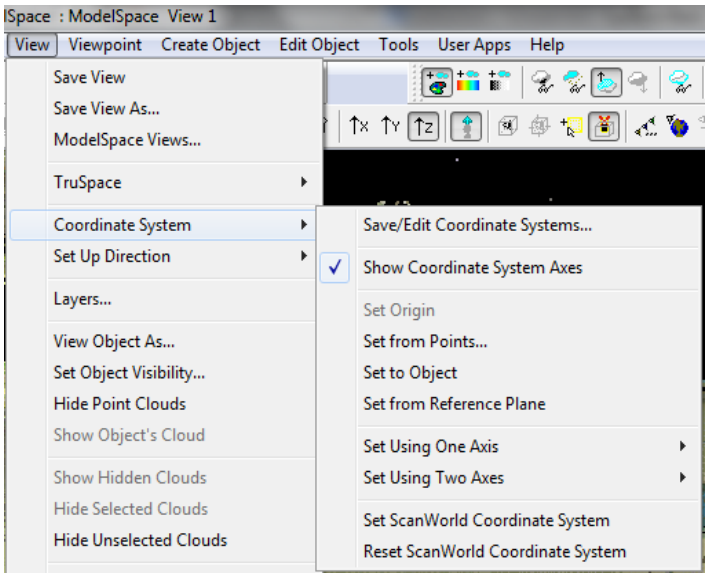


Figure 91. Changing the Coordinate System.

Interfering Points

This function is useful for clash detection (i.e interference or collision of points) of a modelled object against the point cloud. For example, one could import a modelled pipe run for a new pipe, and confirm if the new pipe will fit against the existing cloud.

Select the point cloud and the model (**Selection -> Select All**).

Tools -> Measure -> Interfering Points

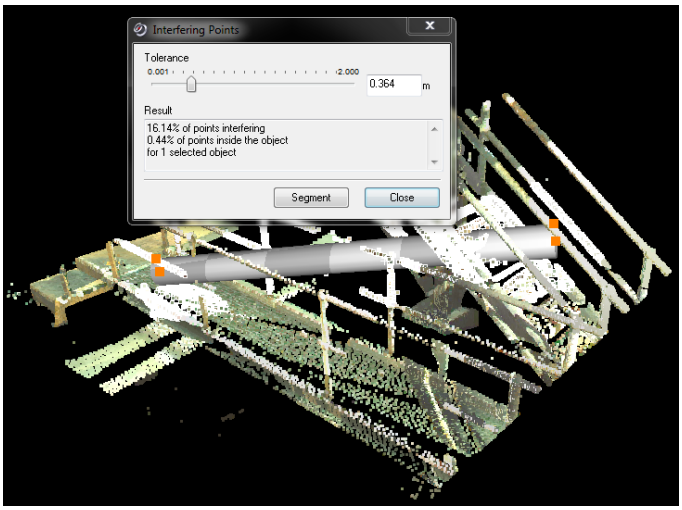


Figure 92. Interfering/collision Points are highlighted in white.

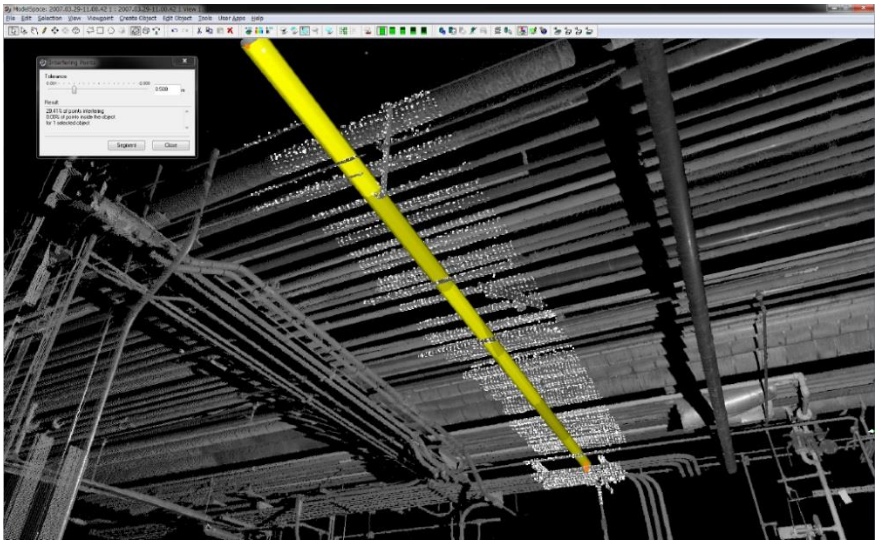


Figure 93. Interfering / collision points are highlighted in white.

Measurements

Measurements can easily be made in Cyclone. Using the multi-pick tool, select tool points on a point cloud, and select:

Tools -> Measure -> Distance -> Point to Point

Tools -> Measure -> Edit Measurements

You can add additional columns by right clicking on the top of a column, and selecting **Customise.**

Distance – Slope distance (hypotenuse)
dX – Change in X values
dY – change in Y values
dZ – Change in Z values.
dH – Horizontal value
dV – Vertical value (should be same as dZ)

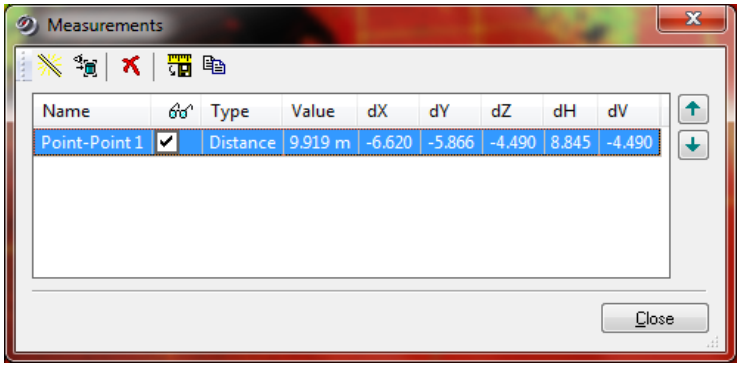
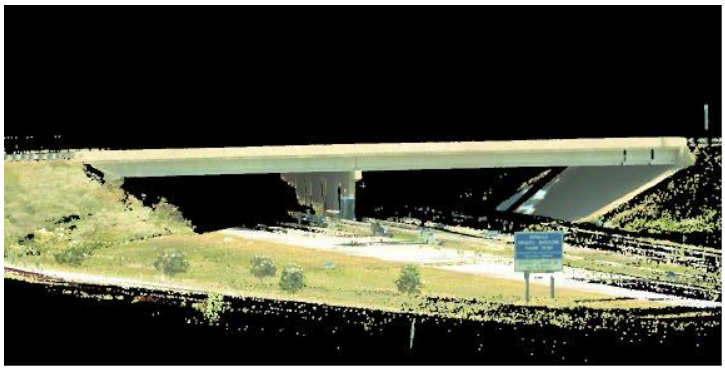


Figure 94. Saved Measurements' window.

Measuring Clearances using Patches

This function is used to calculate the clearance height. For example, to calculate the minimum clearance height of a bridge over a road.

Tools -> Measure -> Clearances



In this example, a bridge is scanned from over 100m away using the Leica C10 whilst traffic was continually flowing. om a single point, we can see the bridge clearance is 17.4 ft, we can measure the entire length quickly.

Figure 95. A point cloud of a bridge and freeway.

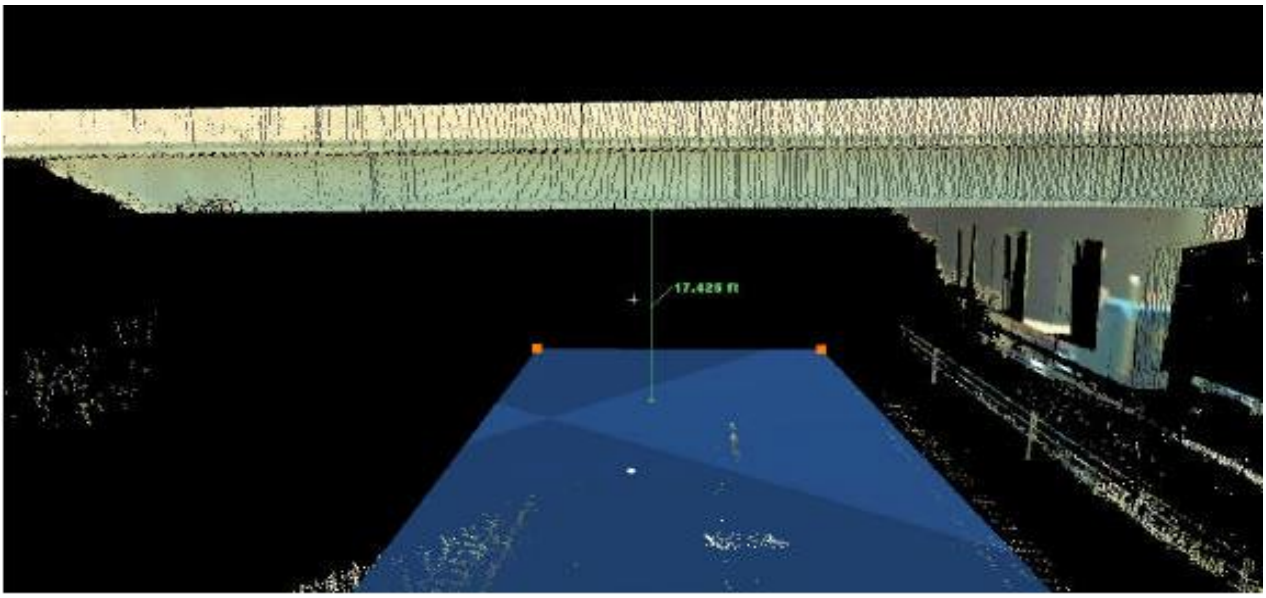


Figure 96 Patch on the road surface under the bridge.

Use the “Fit Edge” tool to place a polyline along the edge of the bridge. Select the edge with the pick mode, then click **Create Object -> Fit Edge**

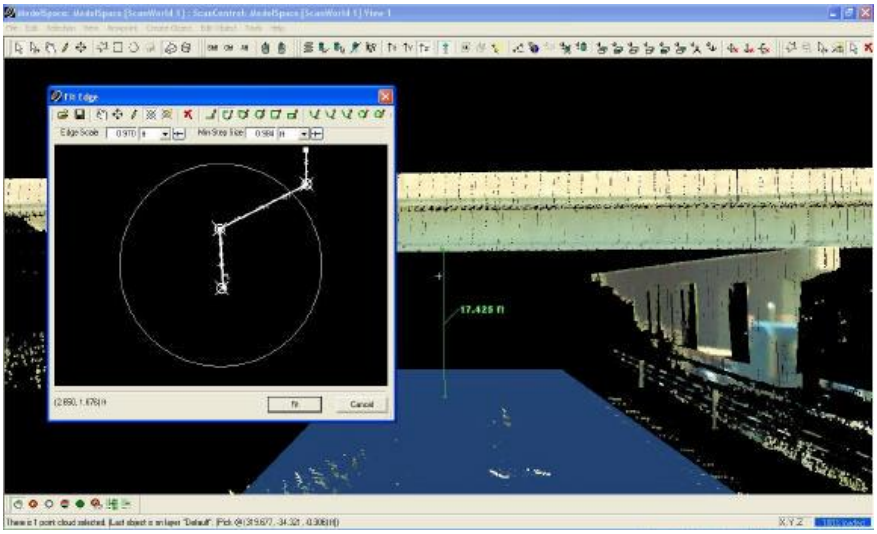


Figure 97. Fit Edge tool.

Tools -> Measure -> Point to Unbounded Surface (gives the true vertical distance to a patch).

In this example, a different height is found in each lane. By using the “Fit Edge” tool, you can calculate better clearance values then picking points in the field by eye.

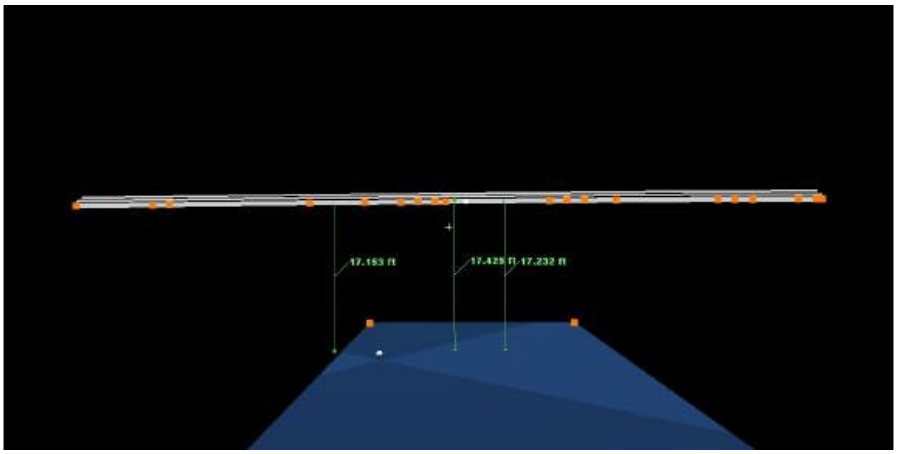


Figure 98. Clearance height distances from patch to polyline.

Measuring Clearances using Clearance Command

Bridges clearances can also be calculated using the Clearance command without modelling patches or edges.

First, you will need to use the multipick to pick a two point on the road, and then two more points above the road on the underside of the bridge.

Tools -> Measure -> Clearances

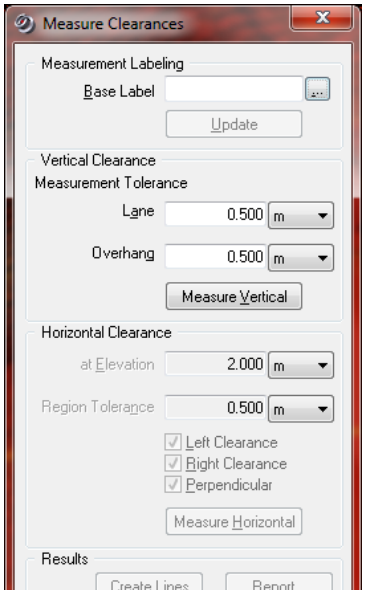


Figure 99. Measure Clearances' window

Filtering noise from a flat/smooth surface

To filter noise (such as cars, people, etc) from a flat/smooth surface (such as a road), we can run a Smooth Surface filter in Cyclone. First, fence the area interest out, and copy to a new model space.

Next, unify the point cloud (**Tools -> Unify Clouds**).

Select the ground surface with the single pick tool.

Create Object -> Region Grow -> Smooth Surface.

The point cloud will now be split into 2 separate clouds; the smooth surface (e.g. road), and the noise above the roads (e.g. cars, people, etc). Select the noise above the road with the single pick mode, and press delete.

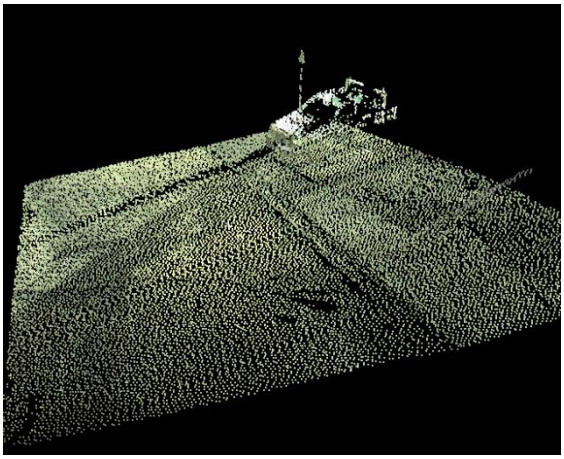


Figure 100. Road before Smooth Surface

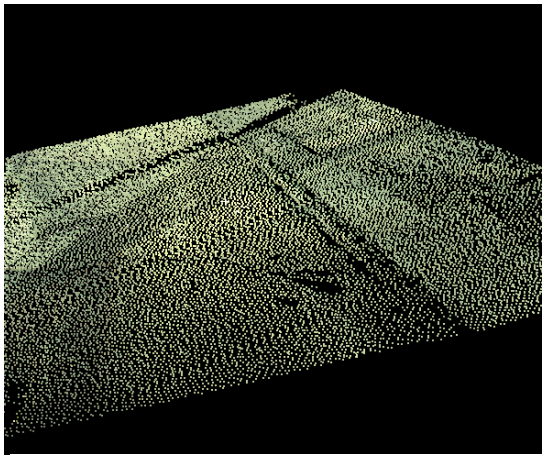


Figure 101. Road after Smooth Surface

Alignment & Sections – Cyclone 8.0

An alignment on a road can be easily created in Cyclone, and broken into sections. The individual sections can be modelled with a poly line automatically. Note, Cyclone cannot perform tunnel alignments. Technodigit 3D Reshaper software is required for tunnel alignments.

Fence an area of a road. Select two points on a road surface with the Multi-Pick tool, and click **Create Object -> From Pick Points -> Alignment.** If the road surface is curved, you can create a polyline. If you need to filter the noise, see the previous chapter "Filtering noise from a flat/smooth surface".

Next, create the alignment; **Tools -> Alignment & Sections -> Create Alignment**, then create sections; **Tools -> Alignment & Sections -> Create Sections.**

A list of sections will be displayed. The individual sections can be inspected by click on the station in the Station column.

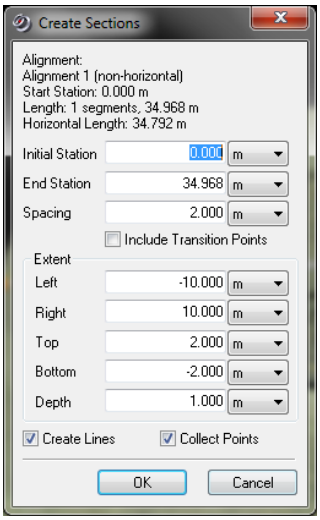


Figure 103. Alignment Create Sections window.

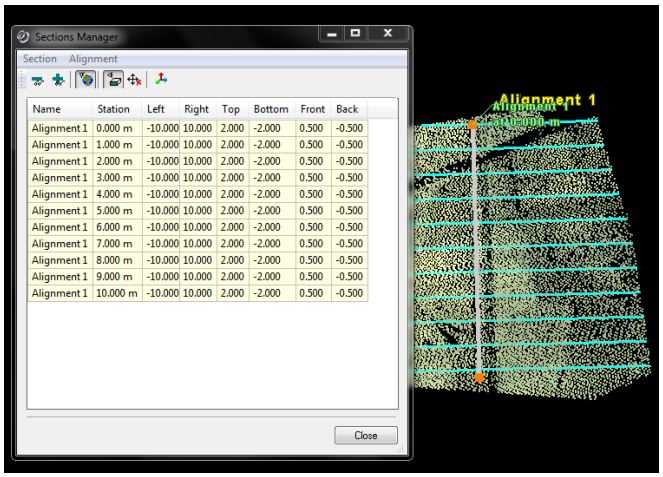


Figure 103. Alignment Section Manager

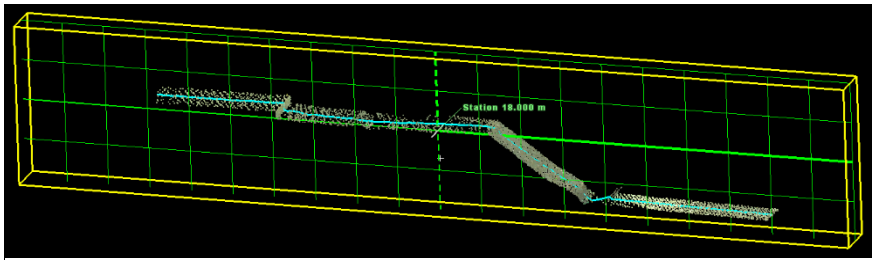


Figure 104. Note that the polyline will follow the alignment.

The handles of the polyline can be manually adjusted to better follow the point cloud if needed.

Point cloud data can be copied with the alignment by selecting "collect points" in the "Create Sections" window.

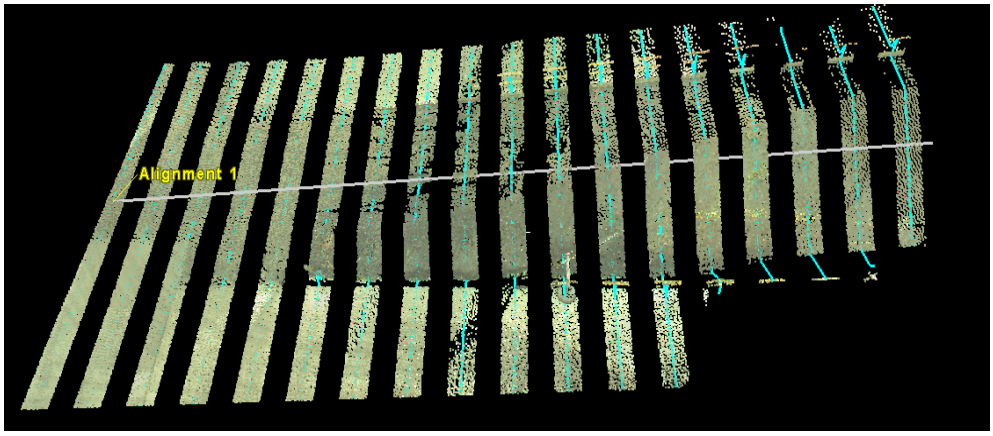


Figure 105. Alignment sections with point cloud.

The polyline alignment and centre line can be exported as a DXF file. **File -> Export -> (select AutoCAD DX R12 format).**

Alignment & Sections – Cyclone 9.0

In Cyclone 9.0, a new Alignment tool was released that includes a plan view window.

Cyclone 9 introduces a new tool for Topo feature extraction.
Tools -> Roadway Alignment & Section -> Create Alignment -> Alignment Section Manager

This tool allows you to quickly break an alignment into sections, and draw string lines of features down an alignment (e.g. top of curb, edge of curb, bottom of curb, etc).

First, an alignment must be drawn. Select two points using the multipick tool, then click **Create Object -> From Pick Points -> Line Segment.**

Next, turn your line segment into an alignment. With the line segment selected, click **Tools -> Roadway Alignment & Station -> Create Alignment**

Then open the Alignment / Station manager:
Tools -> Roadway Alignment & Station -> Alignment / Station Manager

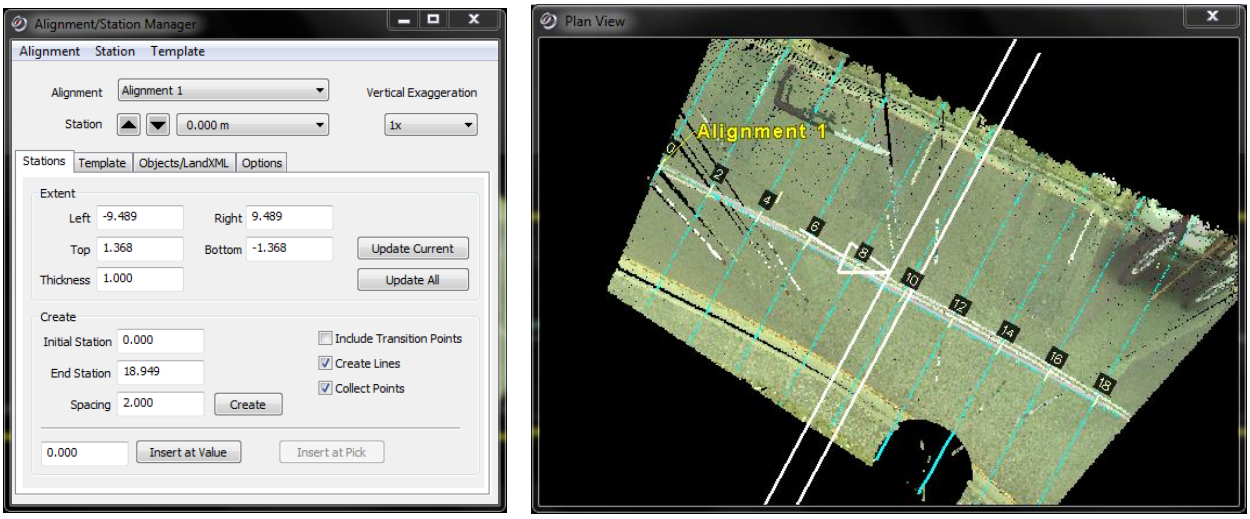


Figure 106. Alignment Section Manger & Plan View in Cyclone 9.0.

To create an alignment, enter in the desired values and click **Create.** The point cloud will now be split into sections, and a top down Plan View window be shown.

A new feature in Cyclone 9.0 is the ability to create templates. Click on the **Template** tab.

TIN Meshes

Cyclone has a very powerful TIN mesh function. A TIN (Triangulated Irregular Network) is particular type of Digital Terrain Model (DTM) used to emulate surfaces. It should not be used for complex surfaces (e.g. people, statues, buildings, trees), but more simple surfaces such as a road or a stockpile.

Creating a TIN Mesh

Select the surface with the pick mode, click **Tools -> Mesh -> Create Mesh -> TIN Meshing.** You can view the mesh as a wireframe. Highlight the mesh (**Ctrl + A), View -> View Object As -> Wireframe**

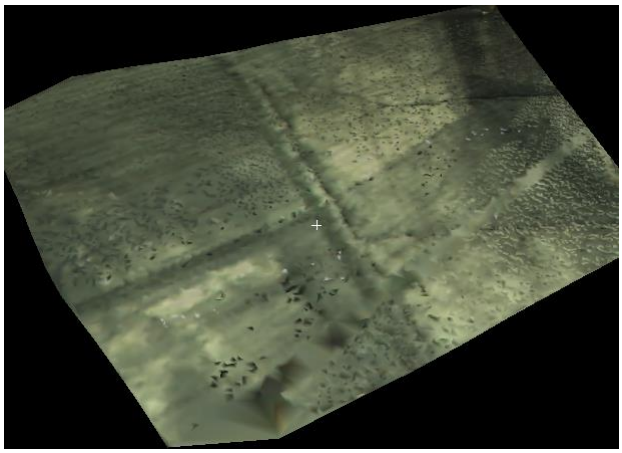


Figure 108. A TIN mesh when viewed as a solid

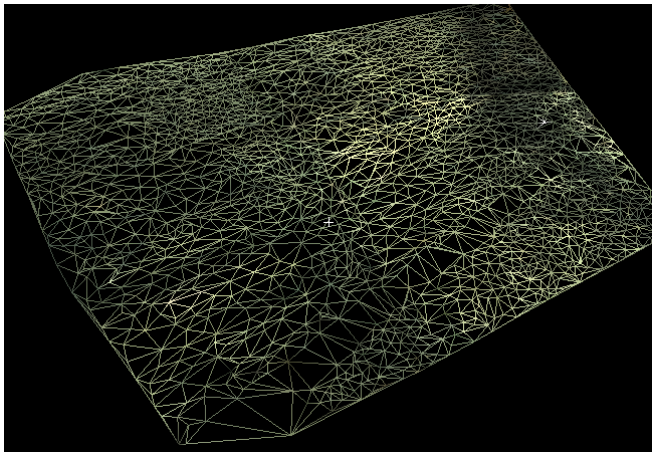


Figure 108. A TIN mesh when viewed as a wireframe.

Removing Spikes from a Mesh

When you mesh a surface, occasionally random spikes will appear due to point cloud noise. To remove the spikes fence the spike using one of the fence tools. Right click, **Fence -> Delete Inside**.

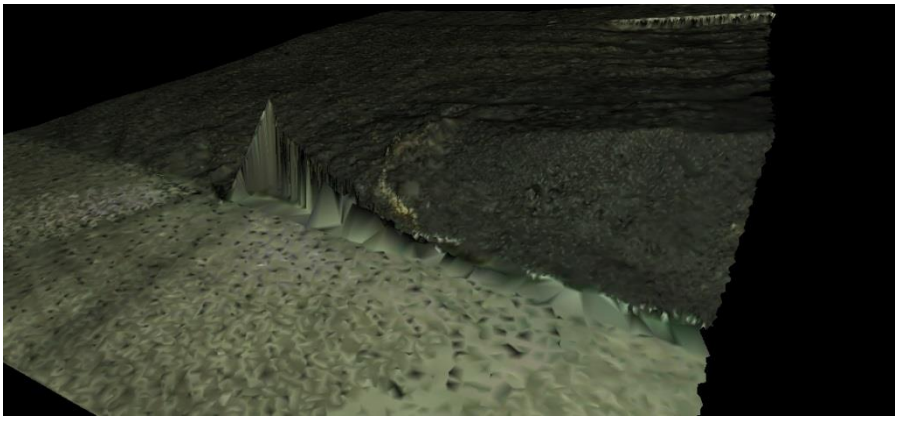


Figure 109 Mesh with spike.

Filling in hols in a Mesh

Select the perimeter of the whole using the pick mode.

Tools -> Mesh -> Fill Selected Hole

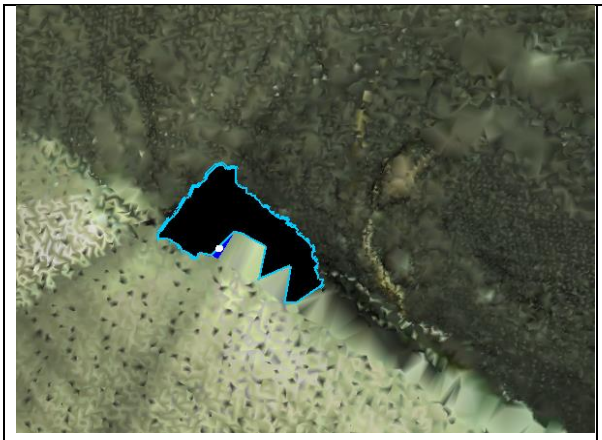


Figure 110. Mesh with hole's perimeter selected.

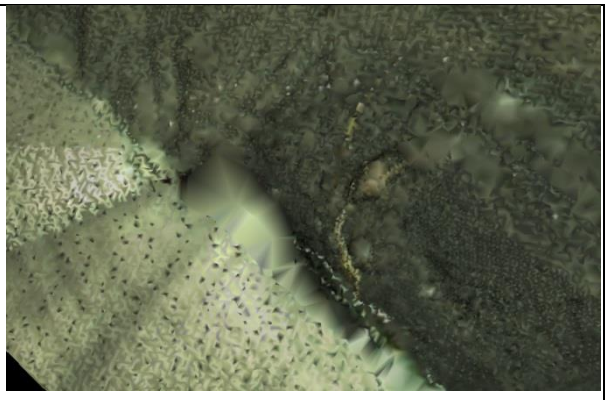


Figure 111 Mesh with spike removed.

Sampling a TIN Mesh

Note: Cyclone 9 has introduced a "Points on a Grid" tool that is similar to this function.

A TIN mesh can be sampled against the reference plane to create a grid of points, vertexes, or as another mesh.

First, add the reference plane. **Tools -> Reference Plane -> Show Active Plane.** Move the plane's origin to the mesh. **Tools -> Reference Plane -> Set Plane Origin at Pick Point**

Align the plan to the mesh. **Tools -> Reference Plane -> Rotate**

Sample the mesh against the plane. **Tools -> Mesh -> Sample Grid**

Hide the reference plane. **Tools -> Reference Plane -> Show Active Plane**

Hide the Mesh. **View -> Set Object Visibility**

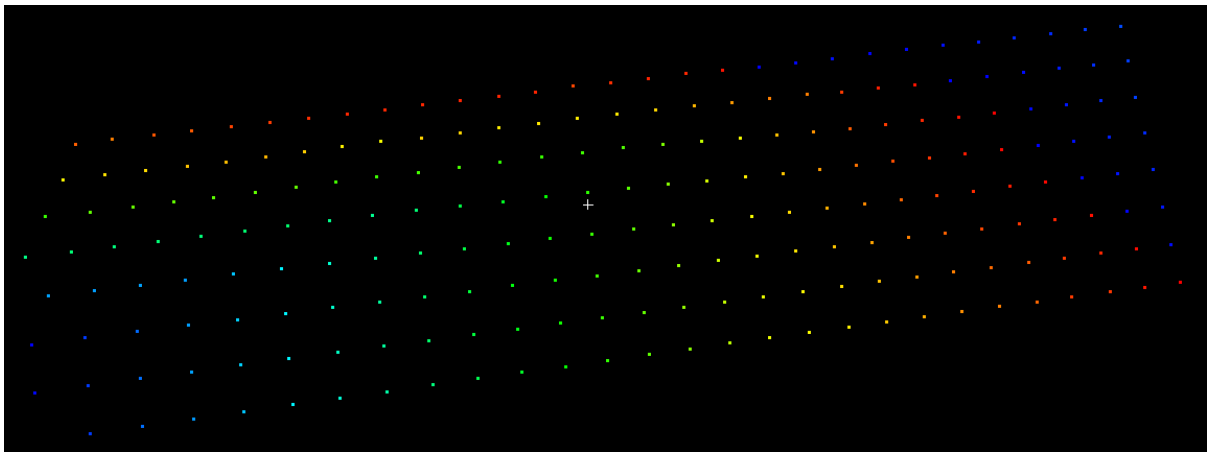


Figure 112. A grid of points, sampled from a mesh.

Creating Contours on a Mesh

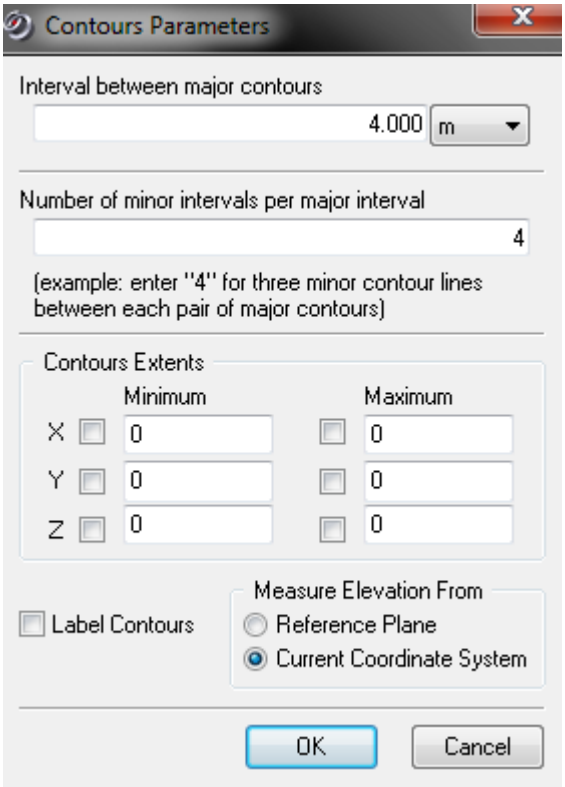


Figure 113. Contours Parameters windows.

Select the mesh (**selection -> select all)**, and click **Tools -> Contour -> Create Mesh**

Colouring the mesh based on elevation

Edit Object -> Appearance -> Edit Global Colour Map. Under Mode, select **Elevation Map**.

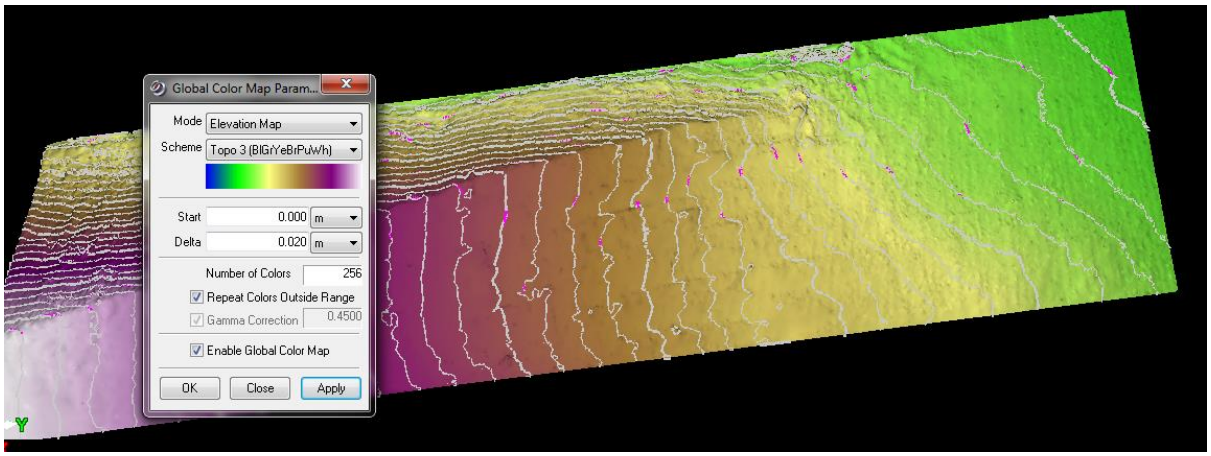


Figure 114. Mesh with contours and coloured based on elevation.

Calculating Volumes with Mesh

You may have a need to calculate the volume of a stockpile. To do this:

1.) Isolate the point cloud that wish to calculate the volume of with the fence tool, and **right click -> Copy To New Model Space.**
2.) Select the isolated point cloud with the pick mode.
3.) Create the Mesh:
Tools -> Mesh -> Create Mesh -> Tin.
4.) Click on the bottom of the mesh with the pick mode.
5.) Add the Reference Plane:
Tools -> Reference Plane -> Set Plane Origin at Pick Point.
6.) Calculate the Volume:
Tools -> Measure -> Mesh Volume -> Above Ref Plane.
The volume area is now calculated

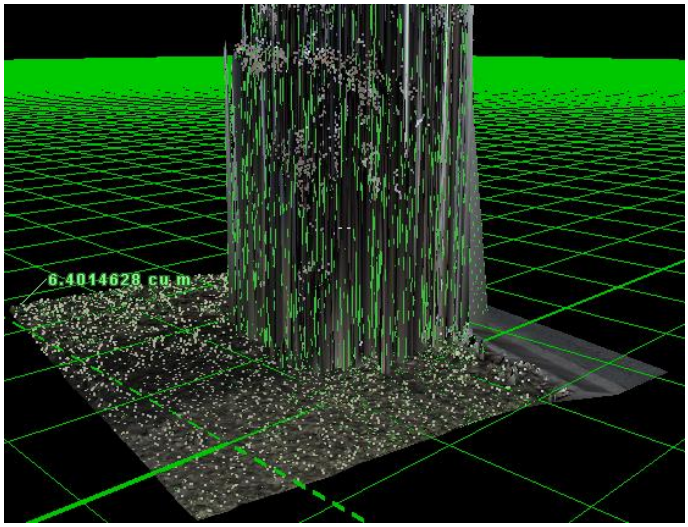


Figure 115. Using a Mesh and Reference Plane to calculate a volume.

Decimating a Mesh

Often the mesh may be of higher resolution than needed. To reduce the number of triangles in the mesh, and hence the resolution, select the mesh (**Selection -> Select All**), and then click **Tools -> Mesh -> Decimate Mesh.** Usually a 10% reduction is sufficient.

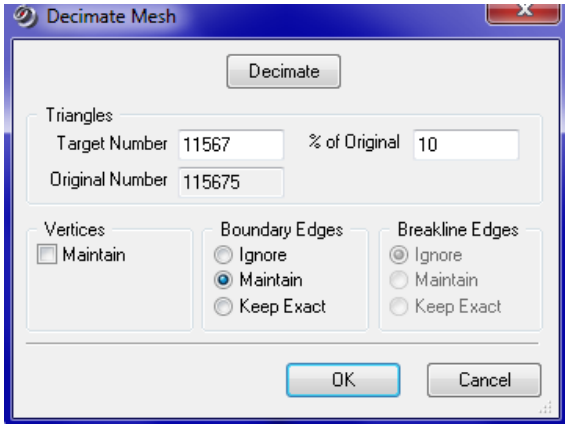


Figure 116. Decimate mesh parameters

Extending a TIN Mesh to Break lines

By creating a polyline along an edge (e.g. top of curb), the mesh can be extended to the breakline to create a sharp edge.

First, create the break line. Pick a polyline along an edge, and click **Create Object -> From Picked Points -> Polyline.** Do the same for the bottom of curb. You could also use the **Fit Edge** tool to perform this.

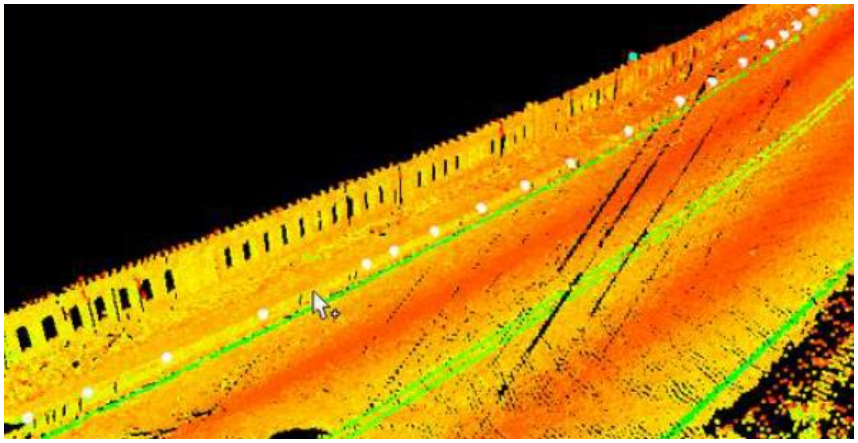


Figure 117. Edge of curb selected with multi-pick.

Tools -> Mesh -> Breaklines -> Extend TIN to Polyline

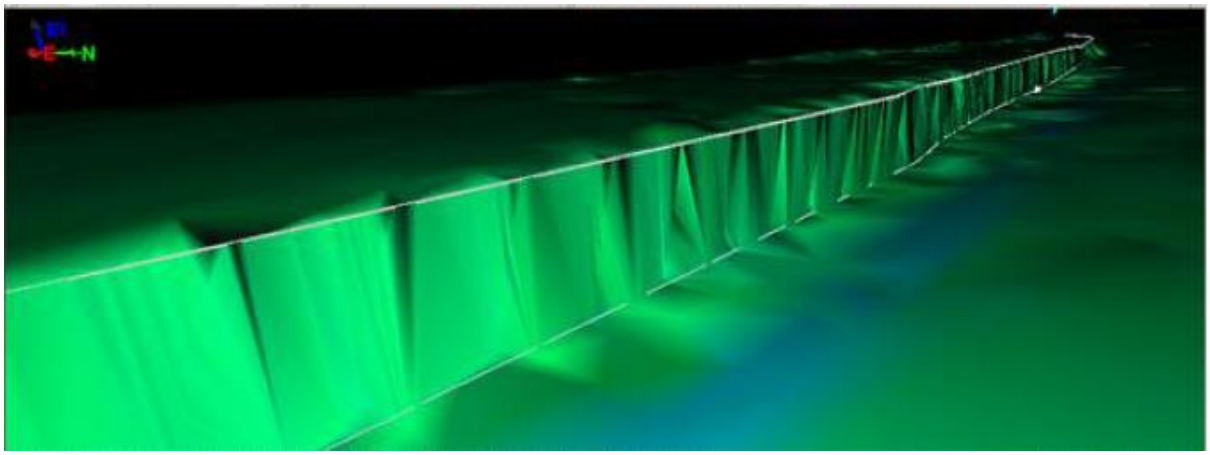


Figure 118. Edge of curb when meshed.

Animation

A fly through animation through a point cloud can be created from within Cyclone. It may take some trial and error to achieve the correct frame rate.

1.) Add the cameras at intervals along your cloud: **Create Object -> Insert -> Camera**
2.) Create a path for the fly through by joining the cameras up: **Tools -> Animation -> Create Path**
3.) **Tools -> Animation -> Set Path**
4.) Hide the cameras and the path so they don't show up in the animation.
View -> Set Object Visibility -> Untick **Camera** and **Polyline**
5.) **Tools -> Animation -> Animation Editor**
6.) **Tools -> Animation -> Animate**

Set frame rate around 50 and the resolution at 800 by 600. The animation will render quickly and you will be able to preview the product. Once animation is perfected, increase the frame rate to desired level and increase resolution to 1200 by 900.

Floor Flatness/Floor Levelness Analysis and ASTM 1155 Reporting

With Cyclone 9.1.6 onwards, users can now perform Floor Flatness (FF) and Floor Levelness (FL) analysis with automatic report generation according to the ASTM 1155 standard. FF and FL numbers determine whether a floor is sufficiently smooth and level, respectively, as constructed. This test method covers a quantitative method of measuring floor surface profiles to obtain estimates of the floor's characteristic FF/FL Face Floor Profile numbers.

1. Within a ModelSpace View

2. From the top menu go to **Tools -> Floor Flatness/Floor Levelness.** The window "Floor Flatness / Floor Levelness" will open.

3. Go to Define Test Area, select a fence type option, and define the Test Area. Then pick two points with the Multipick tool to define the first path of the Test Template. Then select Draw Template.

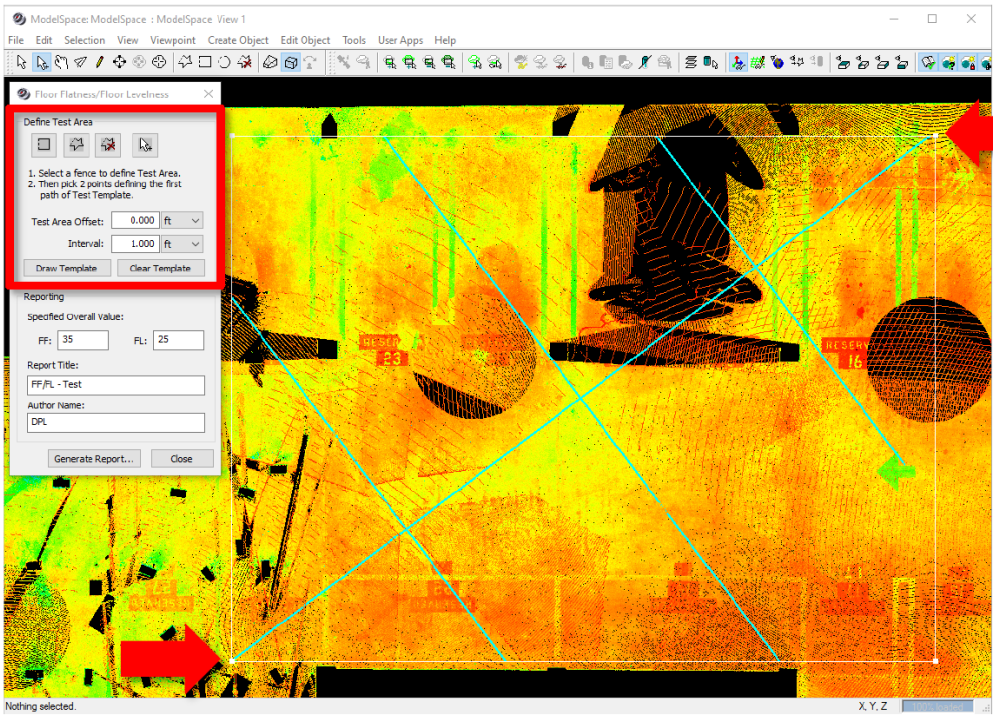


Figure 119. Drawing the test area for Floor Flatness / Floor Levelness.

4. Next determine the Specified Overall Values, the Report Title, and Author Name. The information entered will be used for the report.

5. With the information entered, click Generate Report…

6. Choose a file location, file name, and save.

Note: When generating this report, the tool will generate an elevation point along the four lines using the user specified interval (1 foot by default according to the ASTM 1155 standard). These points will be calculated using the Ground SmartPick tool to gather an elevation. The tool will then use the area and the elevation points to calculate the report according to the ASTM standard.

8. Once the report is open, you will see all the elements needed in the report per the ASTM 1155 standard.

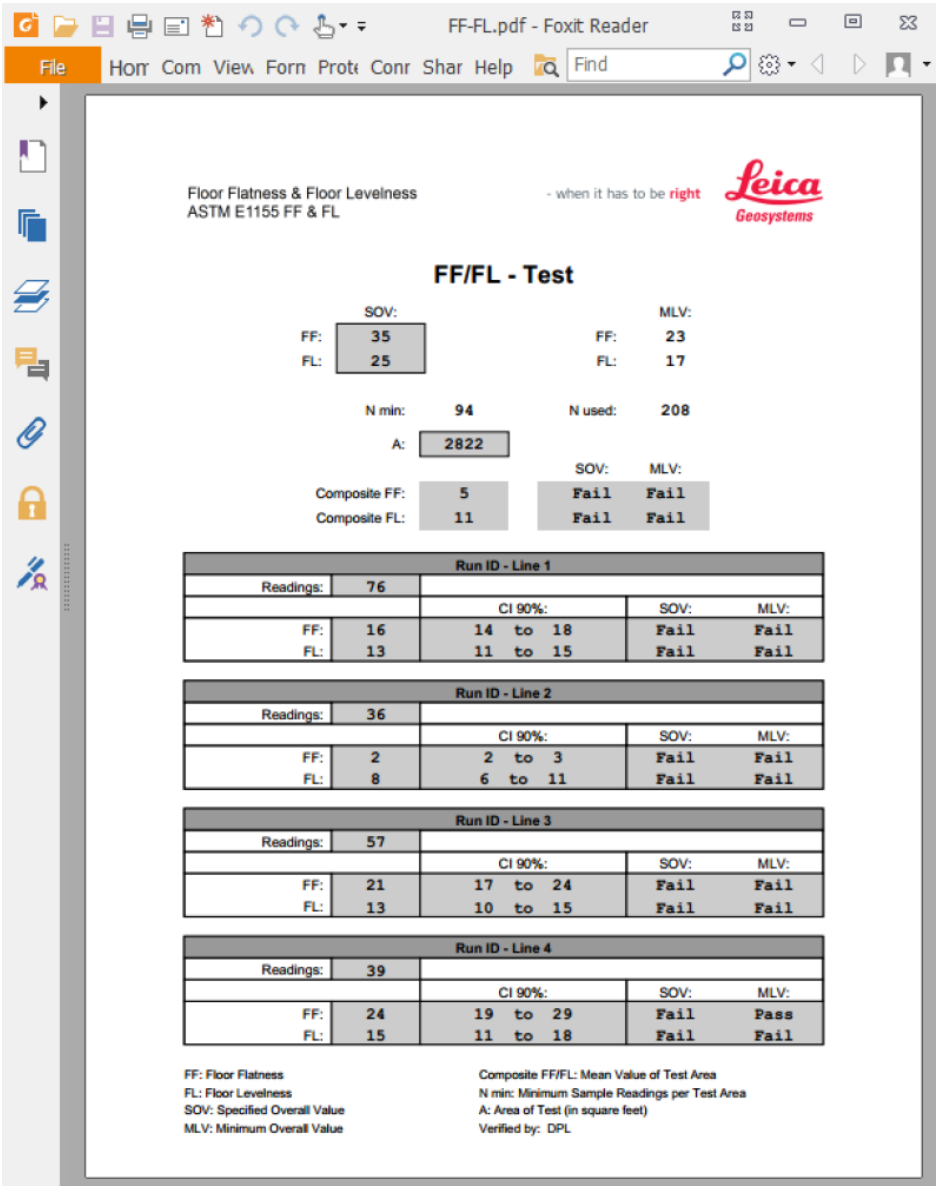


Figure 120. Floor Levelness PDF Report

Cut Planes

Cut planes are useful if only wish to see a slice of the point cloud parallel to the X, Y or Z plane.

I find it easier to use the icons of the Cut Plane toolbar. The Cut Plane menu is located under **Tools -> Cut Planes**.

The easiest method is to first align the cut plane to a reference plane. Remember, reference planes can be on the XY, XZ, or YZ planes.

First, adjust your coordinate system to be aligned with the object you want to slice. In the below example, the X axis is parallel to the front of the building (see the previous section "Changing the Coordinate System"). Next, show the reference plane you want. **Tools -> Reference Plane -> Set to XY/XZ/YZ Plane.** Click on the **View Slice** icon in the Cutplane toolbar. You can also set the thickness of the slice, and progress through sections on the point cloud. Using a single pick point with Quick Slice will result in a 1 meter slice thickness.

Figure 121. Cutplane Toolbar

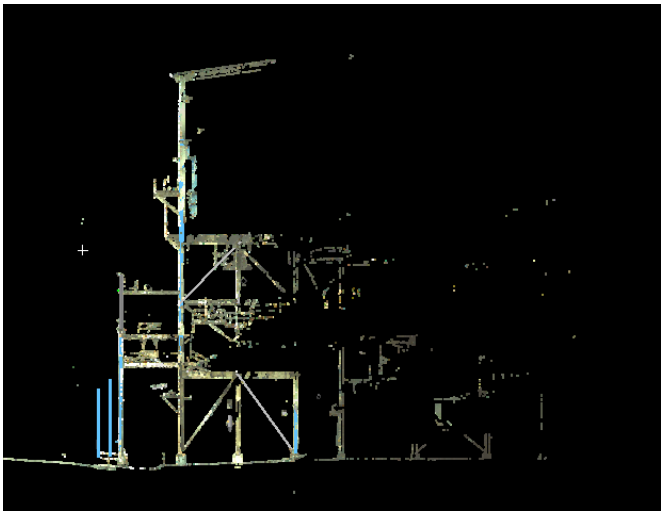


Figure 122. Cut plane side view of a coal treatment plant.

Point Cloud Density

If you PC is lagging, you can reduce the number of points that are being displayed.
View -> Point Cloud Density -> No Reduction / Low Reduction / High Reduction.

Figure 123. Point cloud density Toolbar.

Depending on the power of your PC, you can increase the number of points that your computer loads and displays to produce a denser point cloud.
Edit -> Preferences -> Point Cloud -> Load: Max Points / Display: Max Points

Point Cloud Rendering

View -> Point Cloud Rendering ->
- Shaded
- One-Sided: This mode will remove the points on a plane closes to the viewer. This is very useful when viewing a closed room.
- Front
- Back
- Silhouette: The points closest to the viewer will be darkened, whilst the points furthest will be highlighted. This gives the impression of seeing through walls.

Hot Keys

Hot keys are keyboard shortcuts that can be saved for nearly all commands in Cyclone. They're ideal for saving time and reducing mouse clicks for commonly used features. All functions on Cyclone can have a hotkey assigned to them.

Customise Hot Keys

Edit -> Customise Hot Keys

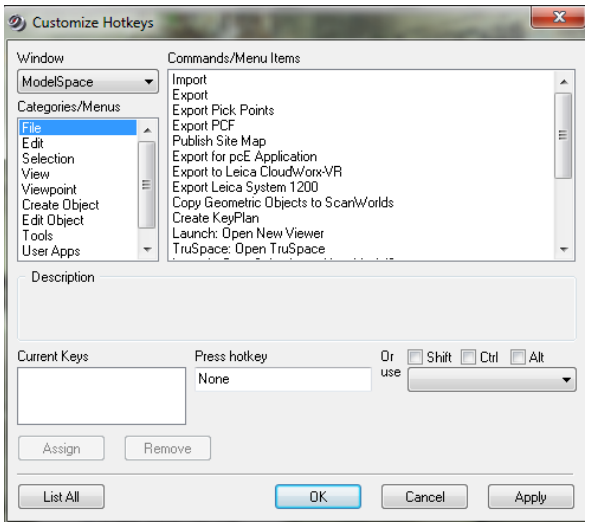


Figure 124. Hotkeys menu.

Default Hot Keys

Some hot keys that are assigned by default are:
Left Mouse – Rotate around the point of focus (use seek to reset the point of focus)

Righ Mouse – Pan (moves the point of focus)

Left + Right Mouse – Zoom

Scroll wheel button down on Mouse - Zoom

Ctrl + Left Mouse – Turns the viewpoint around (i.e. “Look around”).

Alt + Left Mouse – While in view mode, rotate slowly around focal.

Spacebar – Deselect All
s – Seek
Seek Mode + Shift – Click on a point. The view will be shifted to the scanner’s perspective.
i - Information (with an object selected)
c – Coordinate system menu
~ - Toggle between Pick mode and View mode.
d – Distance (measure distance between two points).
f – Segment by fence

Shift + i – Delete inside fence
Shift + o – Delete outside fence
C – Clear fence

Shift + s – Set selectable
Shift + l - layers

TruSpaces

A TruSpace is useful for viewing the point cloud from the perspective of the scanner. It’s a useful tool to manually add targets that were missed.

View -> TruSpace -> Show TruSpaces

Select a TruSpace with the pick mode, and click **View -> TruSpace -> Open TruSpace.**

To link the TruSpace to the main ModelSpace, click **View -> TruSpace -> Link TruSpace.**

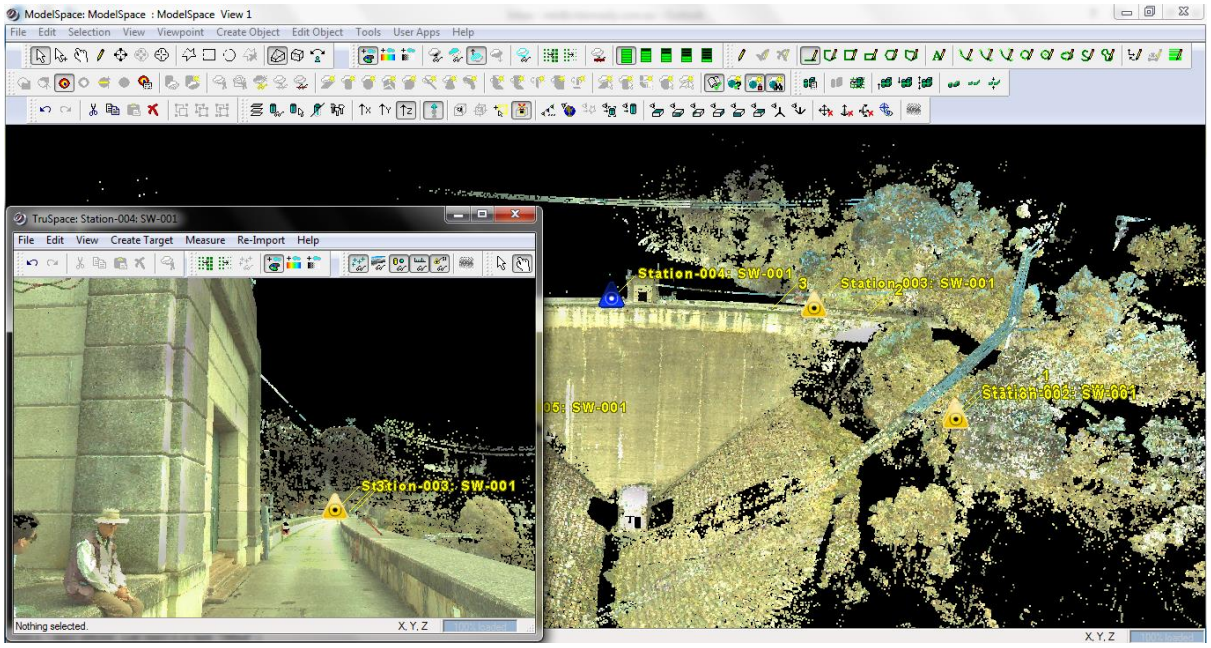


Figure 125. Truspace window (small).

Exporting Point Clouds

Point clouds can be exported in several formats. With the ModelSpace open, **File -> Export,** and select the format. The most common formats for point clouds are .pts, .ptx, and .txt. The easiest way to share a point cloud is to copy the Cyclone .imp database, and view the point cloud within Cyclone. Cyclone is free to use as a viewer.

Importing Point Clouds

Point clouds and raw scanner data (Leica, Z+F, Riegl and Faro scanners), can be imported directly into Cyclone. In the Cyclone Navigator, create a new database (**Configure -> Database -> Add**), enter a name. Once created, right click on the database -> **Import**. Some of the common formats are: Riegl (3dd, rxp, rsp), Z+F (zfs, zfc), Faro (fls, fpr, fws).

Drawing

You can use Cyclone to draw objects in 2D against the reference plane. This is useful if you wish to trace the outline of an object and then extrude it.

Select a point with the pick mode that you wish to draw on against a plane, then
Tools -> Reference Plane -> Set to…..

Tools -> Drawing -> Draw Polyline

Tools -> Drawing -> Create Drawing

Create Object -> From Curves -> Patch

NB: The reference plane can viewed as a XY, YZ, or XY plane. It can also be rotated and tilted to suit the object that you're drawing to.

Turn the drawing to a 3D object, **Edit Object -> Extrude**

Global Colour Map

The colour representation of the point cloud can be changed in Cyclone.

Edit Object -> Appearance -> Edit Global Colour Map

This is useful if you wish to change the representation of reflectivity.

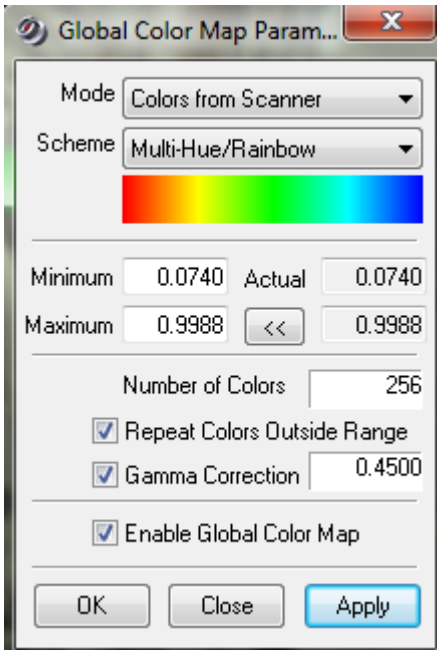


Figure 126. Global colour map parameters.

Reducing Point Cloud Density

Using the pick tool, select the point cloud and click, **Tools -> Reduce Point Cloud.**

NB: This function can only be used on point clouds that have not been unified. To reduce the point cloud density of unified point clouds, you can use the unify tool again (**Tools -> Unify Clouds**).

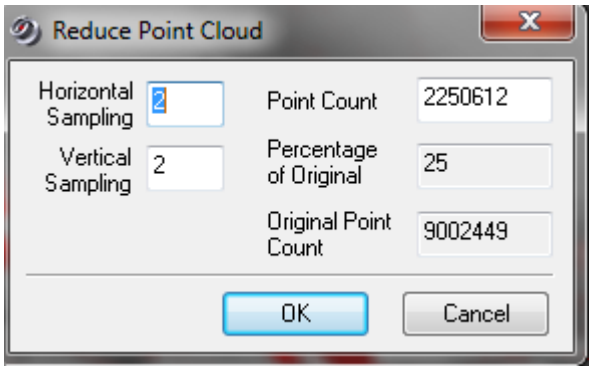


Figure 127. Reduce Point Cloud Density.

Segment Cloud

It can be useful to separate a point cloud into small sections.

Create Object -> Segment Cloud -> …

- Cut Sub-Selection

- Cut by Fence

- Cut by Intensity… (Useful for cutting out noise from the scanner).

- Cut by Distance from Point

- Cut by Offset from Plane

- Cut Near Ref Plane…

- Trim Edges

Virtual Surveyor (VS)

With Virtual Survey, you can extract features (points and 3D line data with point codes, line connecting codes, and comments) directly from point cloud in Cyclone, and then export these feature codes as a standard ASCII format into the surveying software of your choice. If you are using AutoCAD- or MicroStation-based platforms, the original raw point cloud can also be brought in (via CloudWorx) to verify the feature extractions and add detail to the existing topographic representation.

Tools -> Virtual Surveyor

When prompted, "Opening Existing VS File?", click the **Skip** button to start a new **VS** file. A new **VS** window will appear.

In the **VS** window, create a **New Layer** by clicking the Layers button, to put in the linework and give it a colour (optional). See Figure 1. Then click **Set Current** in the **View Properties** box, then click **OK**. Repeat this step for additional linework.

- Enter or select a **Feature Code** (optional). See Figure 2.
- Turn **OFF** the **Automatic Candidate Features** button. See Figure 3.
- **Multi-Select** points. See Figure 3.
- Click **Start** to create Polyline. See Figure 3.
- Turn **ON** the **Feature Code** button. See Figure 3.
- **Check** in candidate picks at the bottom of the **VS** dialog box.

You can use the SmartPick tool by clicking **View -> SmartPick Viewport**.

The SmartPick tool allow you to pick points within a defined radius of the cursor. The options are:

1. Closest Point (i.e. the closes point cloud point to the cursor.

2. Highest Point (i.e. the highest point within the cursor. E.g. the top of a tree).

3. Lowest Point. (i.e. the lowest point within the search radius. E.g. the bottom of a tree).

4. Ground Point. The SmartPick will interpret where the ground point by searching within a radius, even if there are no points directly where picked.

NB: Clicking in the bottom right hand corner of the SmartPick View window will rotate the view.

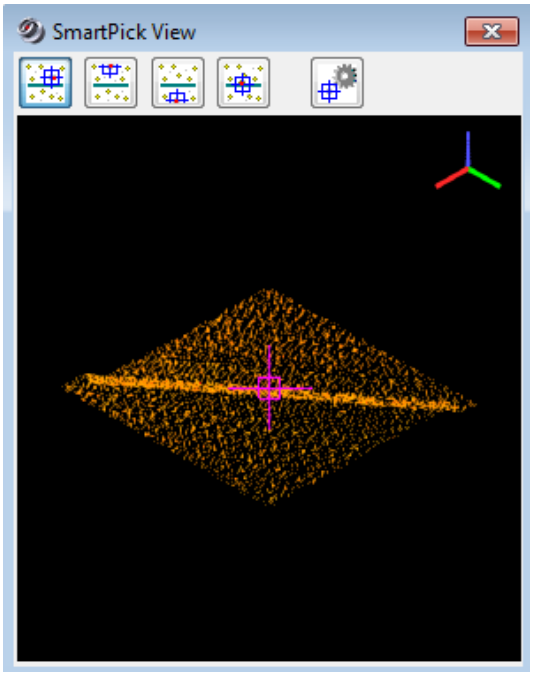


Figure 128. SmartPick View Window

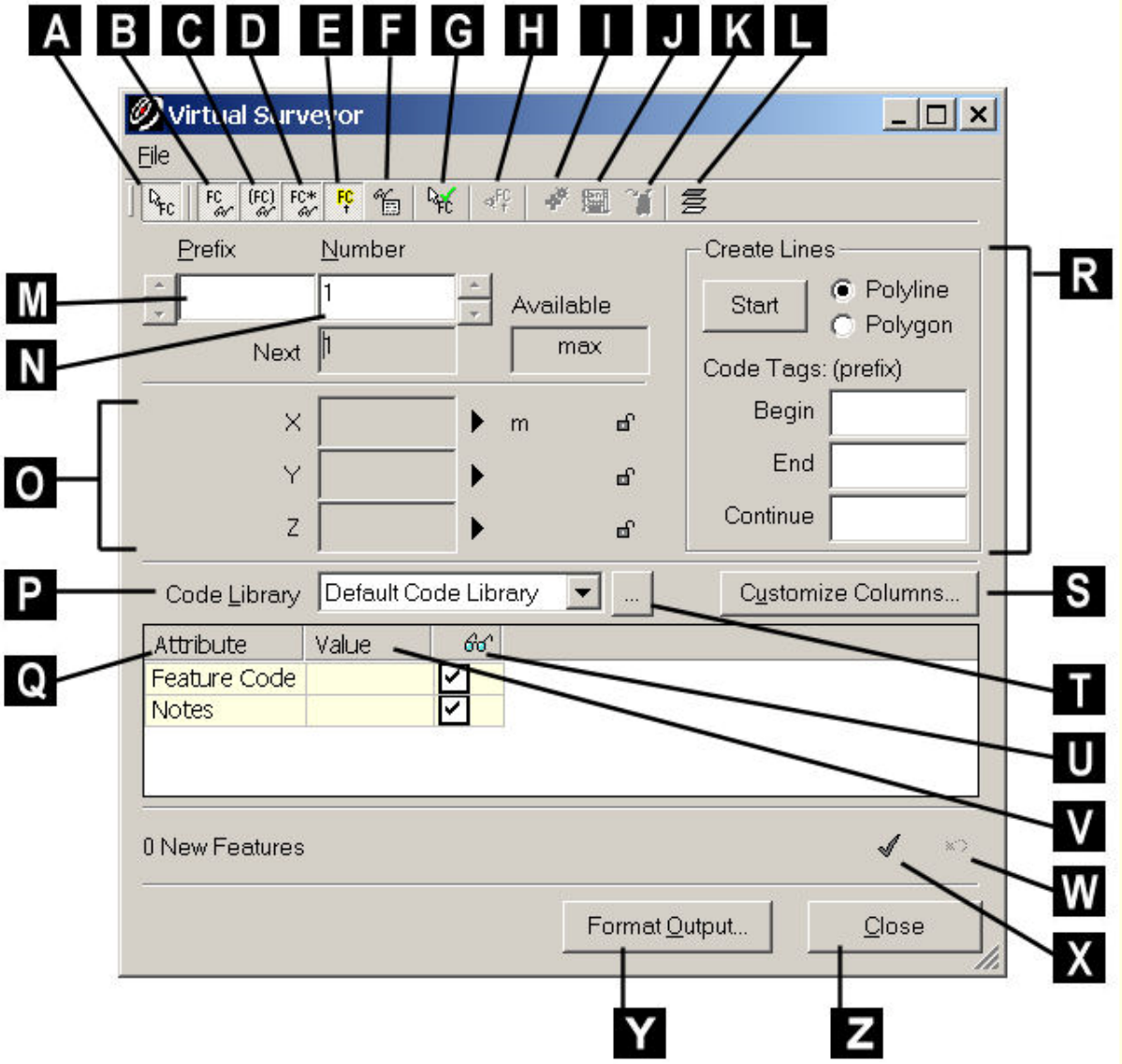


Figure 129. Virtual Surveyor Menu

A. Click to add a candidate feature with each pick.
B. Show features in the ModelSpace viewer.
C. Show candidate features in the ModelSpace viewer.
D. Show unsaved features in the ModelSpace viewer.
E. Highlight the current feature in the ModelSpace viewer.
F. Show features options, which affect how features are displayed.
G. Select to add a feature with each pick.
H. Change the viewpoint to view the current feature.
I. Adds one vertex to the ModelSpace for each feature.
J. Exports the features directly to LandXML.
K. Exports the features directly to the Leica System 1200 format.
L. Invokes the **Layers** command.
M. The prefix of the current feature.
N. The point number that will be assigned to the candidate feature created from the next pick.

O. Displays coordinate data for the current feature. Click the arrow icon to edit the coordinate data. Click the lock icon to keep that value constant..
P. Select a feature code library.
Q. List of values for the available attributes.
R. The **Create Lines** area. Select the creation of a polyline or polygon, supply the **Code Tags** that will be prepended to each corresponding feature, then click the **Start** button.
S. Click to customize the attributes displayed.
T. Invokes the Customize Lookup Lists command. See **Customize Lookup Lists** for information on managing the libraries.
U. Visibility of each attribute in the graphical window.
V. Click to select or enter a value for the desired attribute.
W. Undo last add features.
X. Commit the candidate features.
Y. Click to export current added features.
Z. Click to close the Virtual Surveyor.

Points on a Grid

Cyclone can place points within a fenced region by sampling the reference plane. This is very similar to sampling a mesh against the reference plane.

Click **Tools -> Points on a Grid**.

View the point cloud top down.

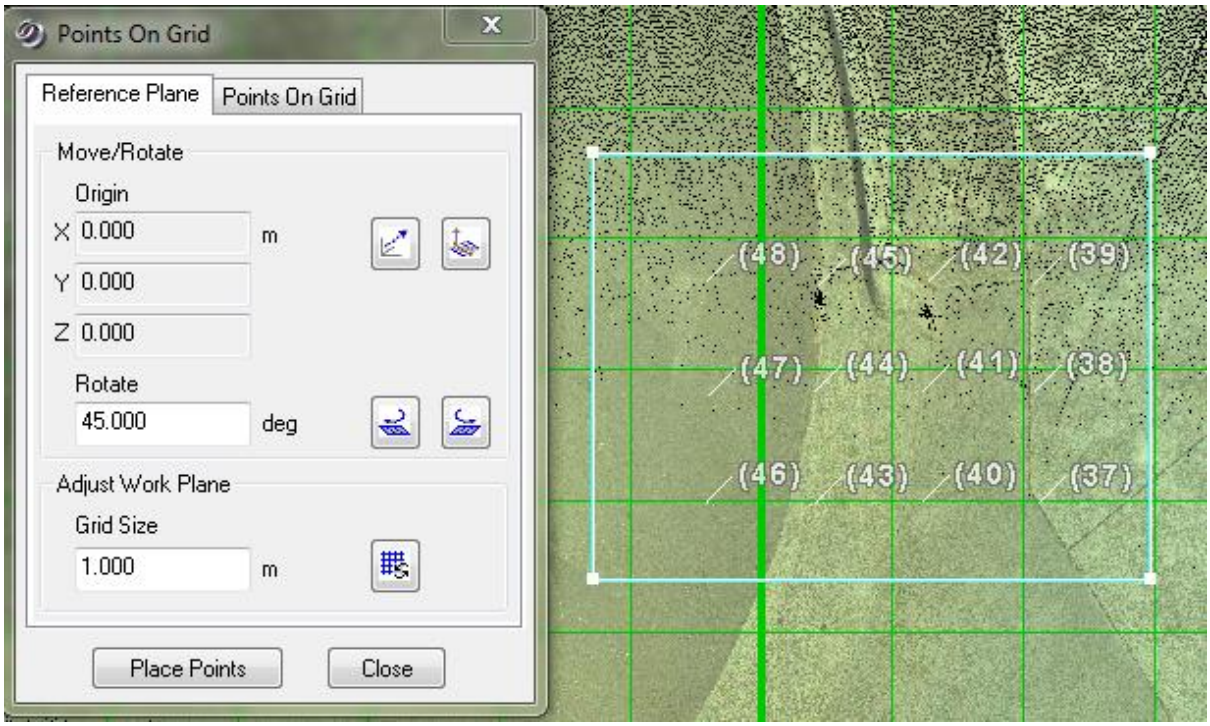


Figure 130. Placing ground points on a grid.

Separating Overlapping Scans

In a Free Station scanning mode, if a user forgets to hit Standard Setup (StdStp) between scan positions, the data from two different positions will end up in the same ScanWorld. The scan data can be separated into their designated ScanWorlds. There is only one image saved per ScanWorld so the images for the overlapping data could be lost.

1. From Cyclone Navigator, highlight the project folder and from the drop down menu, **Create Station**. Highlight the Station and create a ScanWorld. This creates a blank ScanWorld structure.

2. Expand the Scans folder under the position with the duplicate data. The scans are symbolized with turquoise clouds. Identify the scans that need to be moved. Drag and drop the scans into the Scan folder of newly created Scanworld. The scans can also be copied and pasted into the new ScanWorld. Cyclone will prompt you that your are attempting to move data. Click OK. Highlight the target scans, select copy and paste the associated target scans into the new Scan folder. Delete any duplicate target data in the original ScanWorld. Create the ModelSpace and ModelSpace View.

3. Open the ScanWorld with the duplicate data and turn off the point cloud under **View, Hide Point Clouds**. With multi-pick, select the vertices of the targets that need to be separated and copied into the new ScanWorld. Select **Edit, Copy**. Open the ModelSpace of the new ScanWorld and go to **Edit,**

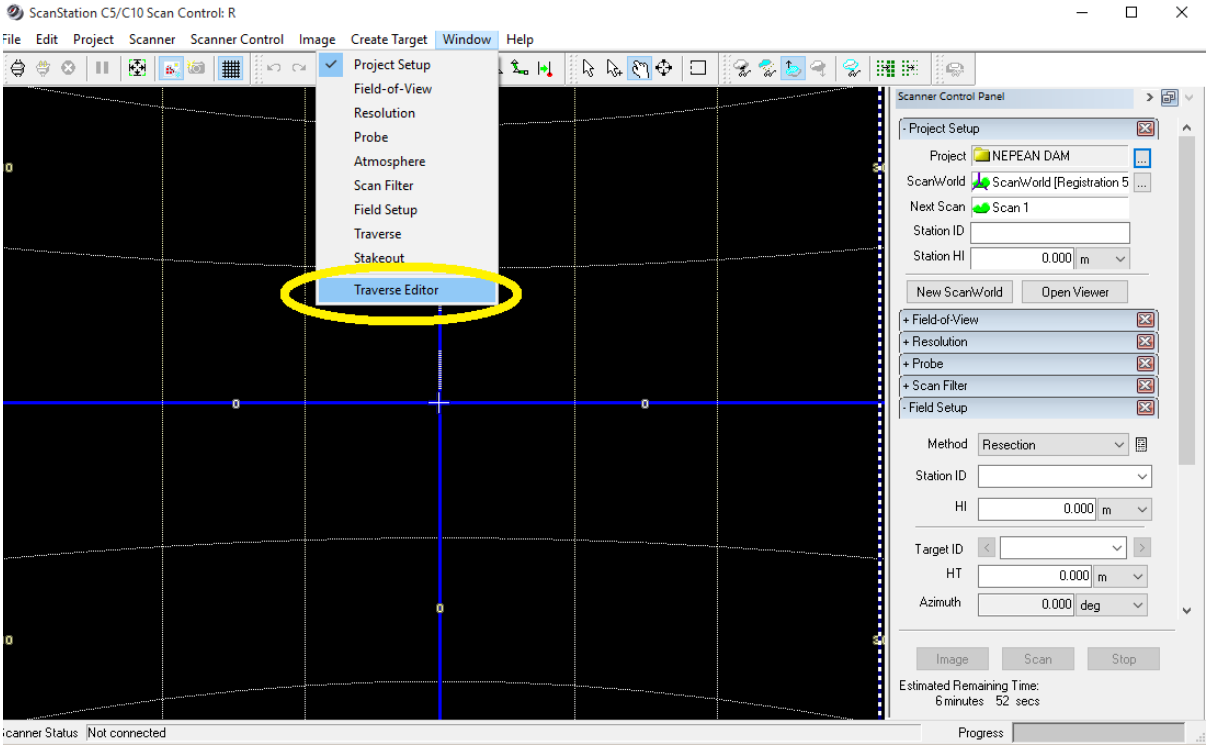
Paste to put the vertices into the new ScanWorld. Select the vertices in the new ModelSpace and go to **Tools, Registration, Copy to Control Space**.

4. Return to the ScanWorld with the duplicate data. Multi-pick the extra targets and delete them. Turn on the point cloud under View and uncheck Hide Point Clouds.

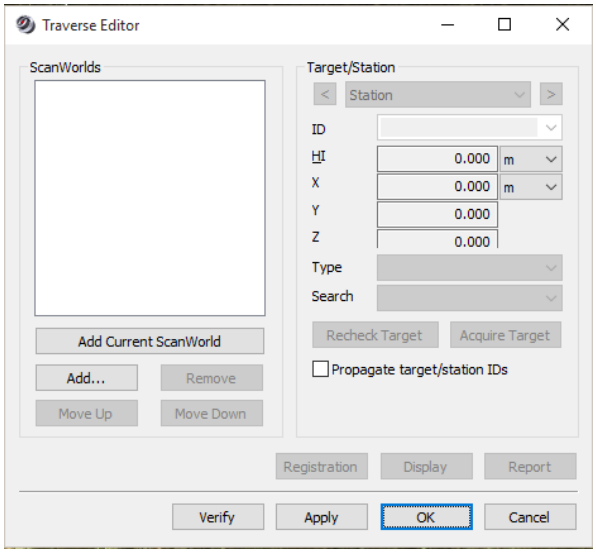
Traverse Editor

If you have traverse with a Leica Cxx or Pxx scanner, and have made a mistake with the vertical heights, backsight or resection, you can manually correct these values in the traverse settings in the Traverse Editor.

1.) In the Cyclone Navigator menu, click **Configure -> Scanners -> Add**. Add a new scanner. The name and IP address can be anything you like.
2.) In the Cyclone Navigator, open the Scanners folder, and double click on the Scanner icon.
3.) Select your project folder from your existing data.
4.) Click **Windows -> Traverse Editor**, to open the Traverse Editor.



5.) Select all the ScanWorlds you wish to assemble and Click the ok button
6.) If all the fields were entered with correct information during field collection then all you need to do to complete the Traverse is click the Verify button. If good then just click the Registration button and you are done. No more manual entry of traverse data.



If a target height mistake has been made, this can be corrected inside Cyclone.

1) After the import, delete the "Registered ScanWorld" in Cyclone Navigator, just to avoid any confusion regarding ControlSpaces.

2) Open the ControlSpace of the first and the last position and add the name of the Station to the scanner position.*
Tools - Registration - Add/Edit Registration Label

* Since the traverse is open, Cyclone will only find one constraint for the first and last position, which is not enough.
One needs to have 2 constraint if all ScanWorld are leveled. When you add the name of the scanner position, Cyclone will use the scanner position as a constraint.
Thus one has enough constraint to register the ScanWorlds.

3) Open the ControlSpace of the position where the target height is incorrect and change it.
Tools - Registration - Add/Edit Registration - Set Target Height

4) Open a new registration and add all ScanWorlds, include ScanWorld: "Known Coordinates".

For the detailed workflow, please have a look at the video link below:
https://sendit.hexagon.com/message/npOZSp6LV2YKC9JM5tjBvu

Python Scripting

Cyclone allows users to create scripts using the Python language. In a model space, click **User Apps -> ....**

CloudWorx for AutoCAD

Cloudworx for AutoCAD is a plugin that allows the user to import Cyclone databases directly into AutoCAD. Cloudworx allows AutoCAD to display very large point clouds, whilst maintaining full AutoCAD functionality.

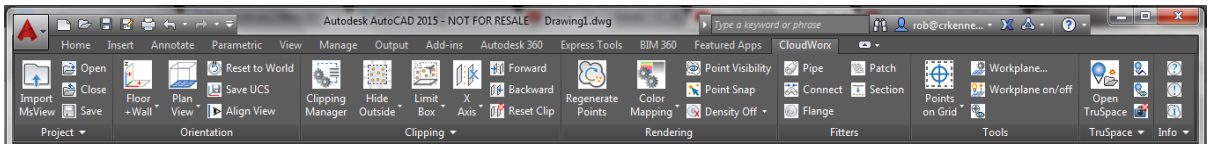
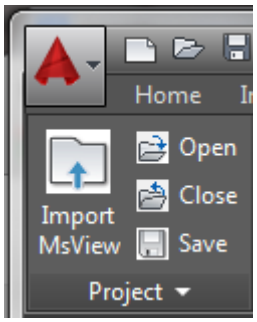
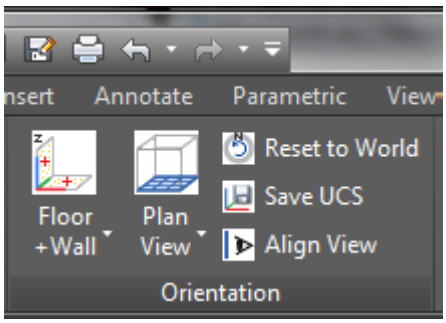
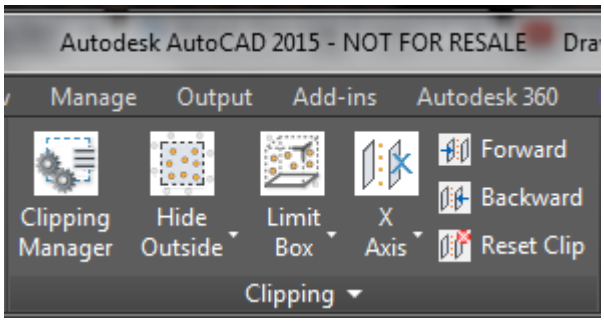
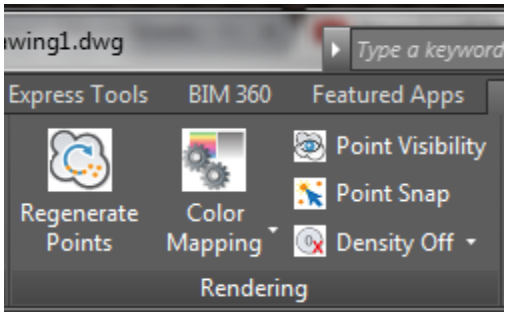


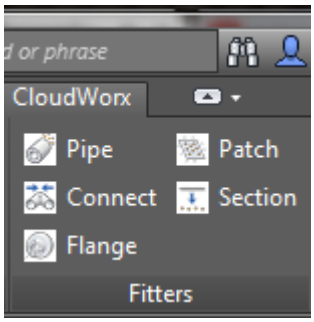
Figure 131. CloudWorx for AutoCAD ribbon.

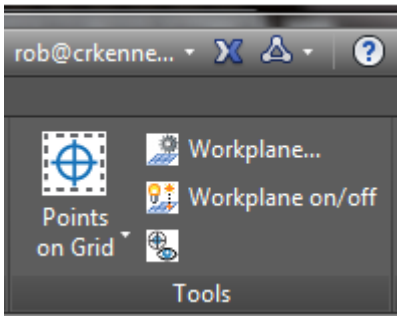


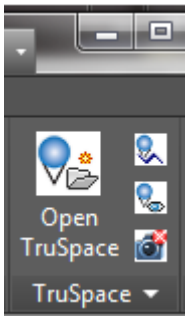












1. Setting Up CloudWorx for AutoCAD
2. CloudWorx Toolbar Definitions
3. Configuring a Database
4. Opening a ModelSpace in CloudWorx
5. Point Rendering
6. Aligning AutoCAD View for Mapping
7. Restoring Saved UCS
8. Digitize the Point Cloud
9. Hiding a Point Cloud
10. Aligning AutoCAD View for Buildings Common AutoCAD commands: UCS
11. Additional Option to Align AutoCAD View
12. Hiding Regions Toolbar Definitions
13. Using Fit Section Tool

14. Using Fit Pipe to Cloud Tool
15. Drawing Completed
16. Clash detection

Turn off SNAP visibility. Turn on OSNAP.

- OSNAP
- UCS
- Line
- Polyline
- Offset
- Hatch
- Symbols
- Text

Client License Manager

Leica Cyclone and Cloudworx uses a Flex LM license program called Client License Manger. Licenses are not issued on a hardware USB dongle. They are issued with an entitlement identification (EID) number.

Activating a License

To activate the licenses on the Server, open the License Administrator Server (**Start -> Programs -> Leica Geosystems -> Client License Manager -> Administrator Server** or **CLM For Floating Licenses**). Click on Activate New Licenses, copy and paste the EID number, then click "Check for Activatable Licenses", then "Activate License".

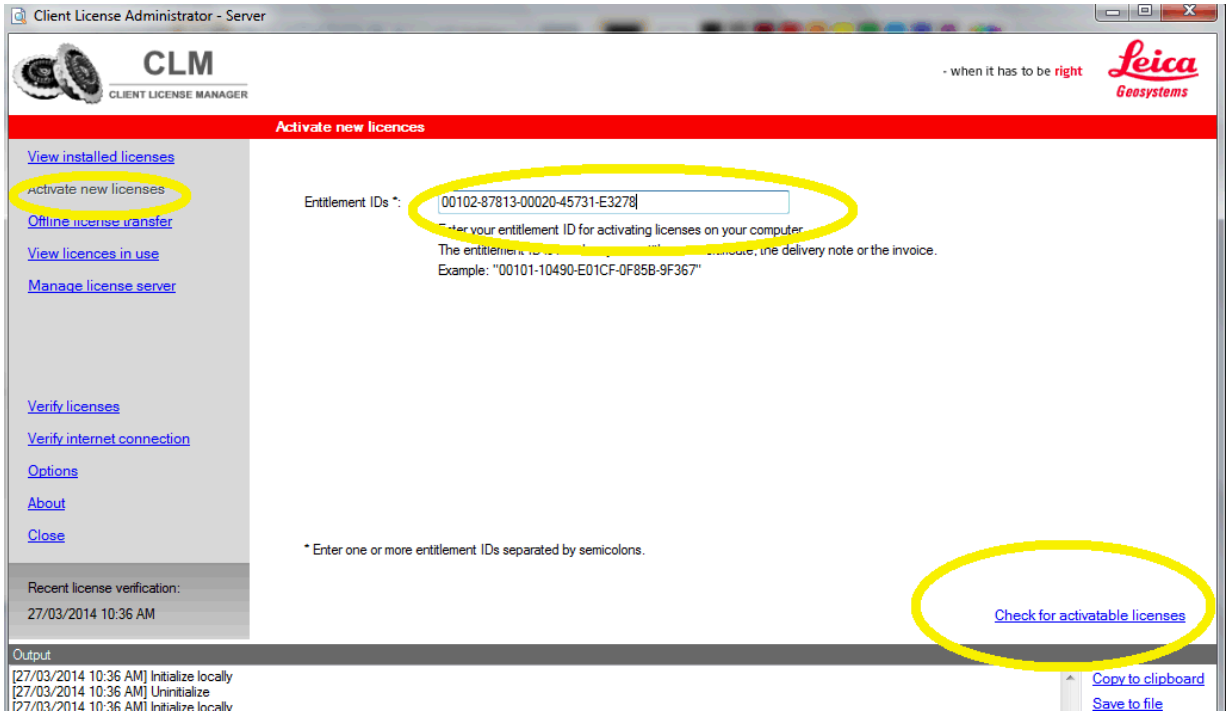


Figure 132. Activating a new license on CLM.

Returning a License to Rehost

Note, you can only do this 3 times before the license will be locked.

If you need to rehost the license on a new server or PC, you have to first return the license.

Start -> Programs -> Leica Geosystems -> Client License Manager -> Administrator Server or **CLM For Floating Licenses**).

Click **View Installed Licenses ->** Check the license **-> Return Licenses (rehost)**

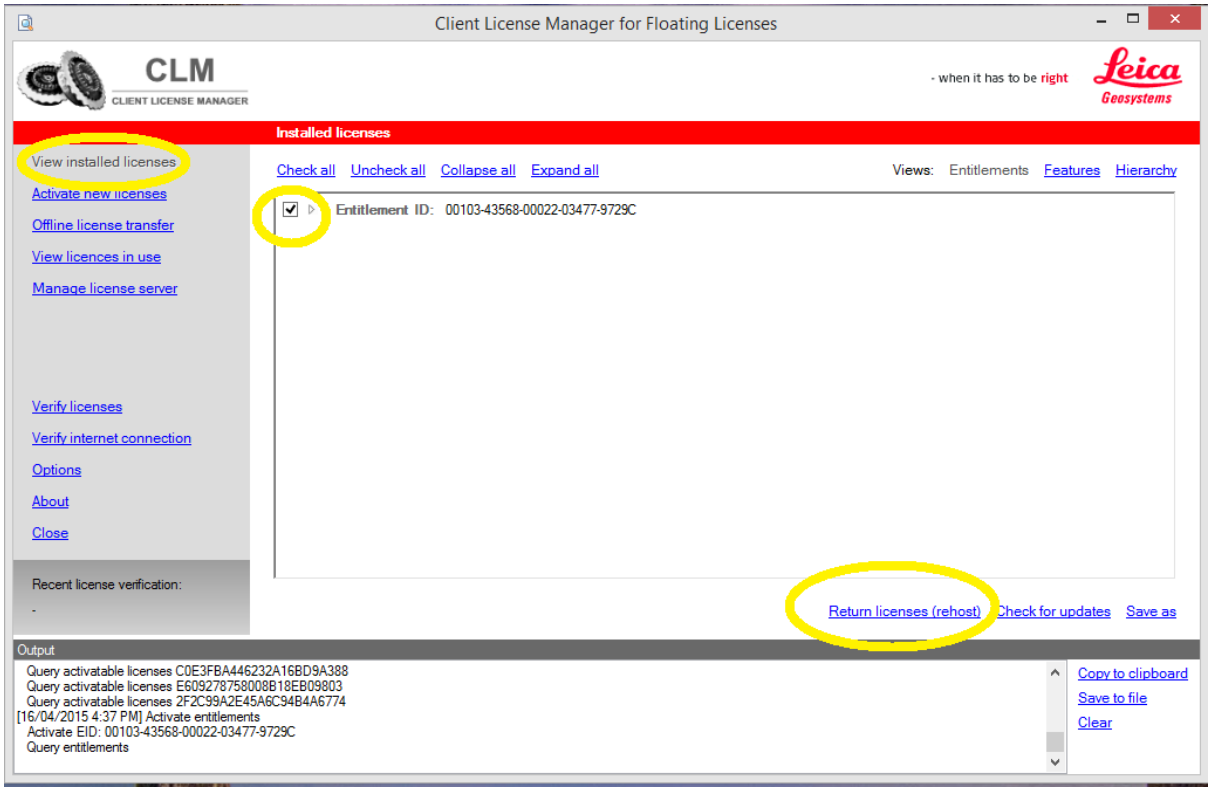


Figure 133. Rehosting a license on CLM.

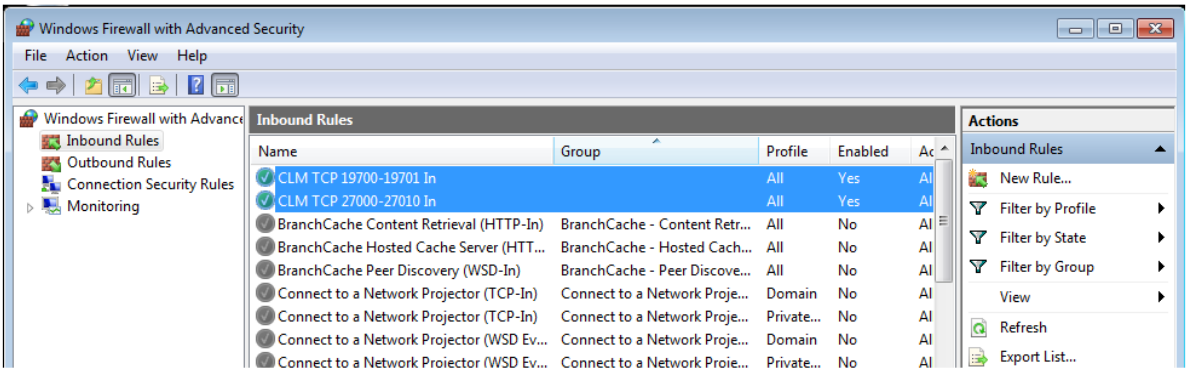
Ports that need to be opened on a network

The following ports are required to be opened on a network to allow Cyclone's client license manager (CLM) to work.

To enable clients to check-out or borrow licenses from a server in your LAN you have to create inbound rules to open TCP ports:

- For the application `lmgrd.exe` open a local TCP port in the range from `27000...27009`. (The default is 27000)
- For the application 'LGS.exe' open any unused TCP port, e.g. 27010
- For the application 'clmrdsvr.exe' open the local TCP port 19701

With CLM 1.3 or higher they have already been predefined and do not have to be entered manually.



These ports also have to be defined in the file 'svr_lgs.lic'. This file is installed in the license server installation folder, which by default is: C:\Program Files\Common Files\Leica Geosystems\License-Server

- add the server port number to the first line: SERVER this_host ANY 27000 (possible between '27000…27009')
- add the vendor daemon port to the second line:VENDOR LGS port=27010 (any port e.g. 27010)

SERVER this_host ANY (means the first free will be used)

VENDOR LGS PORT=27010

AutoCAD & Cyclone license conflict

Change the first line of svr_lgs.lic in C:\Program Files (x86)\Common Files\Leica Geosystems\License-Server - to add 27001 to the end of the first line so that it read 'SERVER this host ANY 27001'

Client License Manger over a VPN

Cyclone/ CloudWorx licenses can be used with a VPN. In this case it is also necessary to specify the ports to be used in this network.

By default CLM chooses ports 27000-27010
This is defined and can also be changed if required in "svr_lgs.lic" under C:\Program Files (x86)\Common Files\Leica Geosystems\License-Server.
Tip: Check the port status via "Start – cmd – netstat"or:
http://technet.microsoft.com/enus/sysinternals/bb897437.aspx

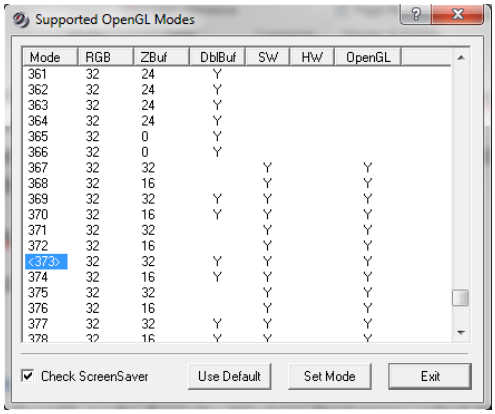
Client License Manager Proxy Error

Make sure you do not the "connect remotely to CLM service" box ticked and set to local server.

Cyclone Graphics Options

Launch the OpenGL modes from the Windows Start menu, select All Programs, Leica Geosystems, Cyclone, Utilities, OpenGL Modes.

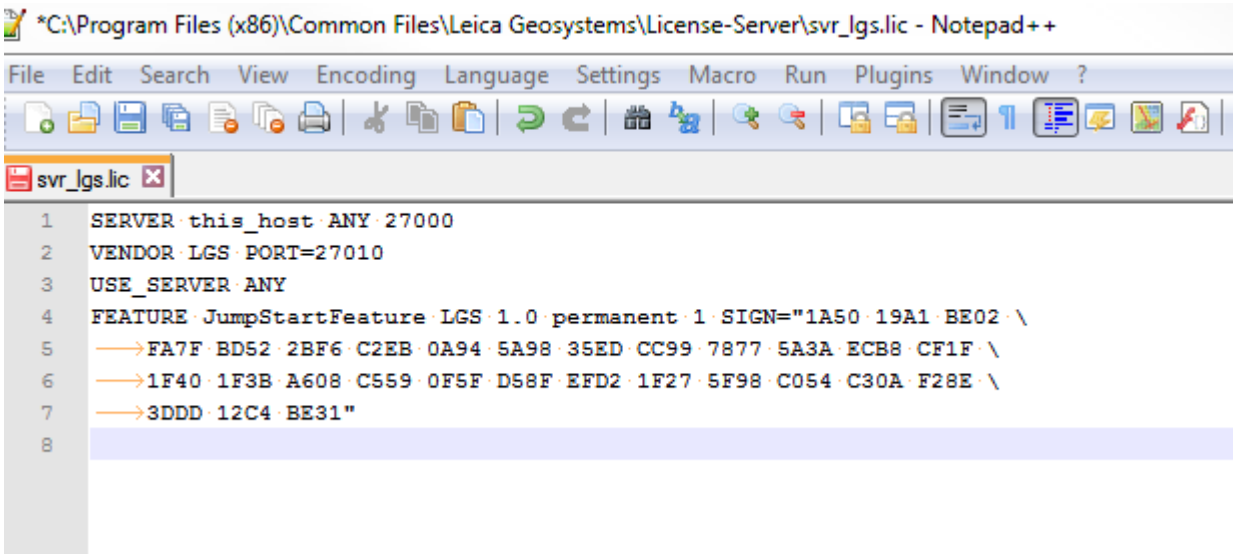
A combination of 32 (RBG) 32 (ZBuf) Y (DblBuf) Y (SW) Y (OpenGL) works best for Cyclone on most computers.



Cyclone cannot find or verify the license server (either on my own computer or on a server).

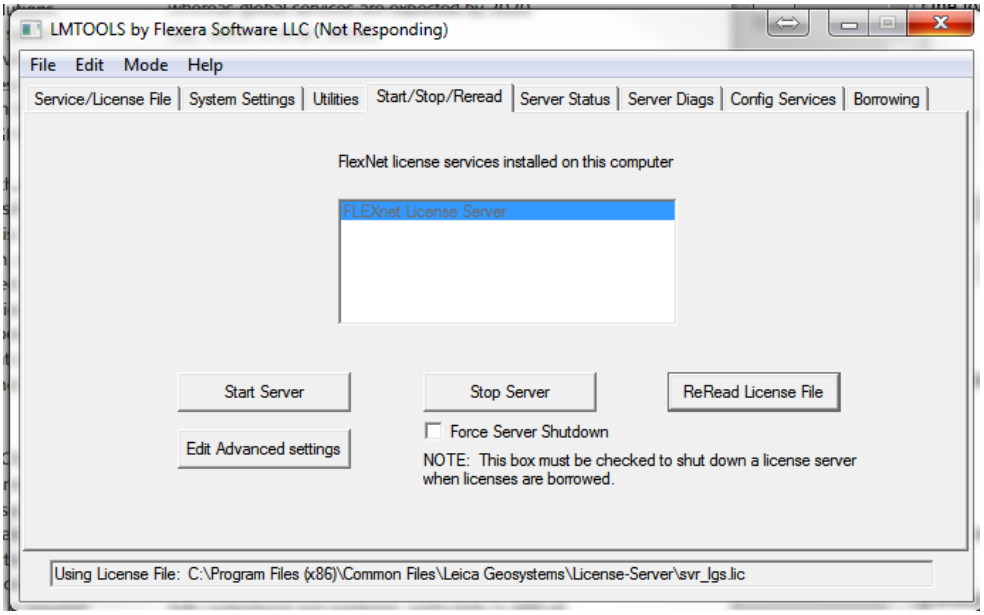
It is either that part of the program is not running properly or is blocked by anti-virus software or a firewall.

1. Upgrade CLM to 1.4.1.002 or later (available on myWorld)
2. Make sure the ports are not being tied up by another program.
    a. Navigate to here: C:\Program Files (x86)\Common Files\Leica Geosystems\License-Server
    b. Change the properties of the svr_lgs.lic so they are not 'read-only'
    - Open svr_lgs.lic in notepad (or similar) add the server port number to the first line: SERVER this host ANY 27000 (possible between '27000…27009')
    - add the vendor daemon port to the second line: VENDOR LGS port=27010 (any port e.g. 27010)
      SERVER this host ANY (means the first free will be used)
      VENDOR LGS PORT=27010



3. Within C:\Program Files (x86)\Common Files\Leica Geosystems\License-Server Run lmtools.exe
4. Go to the tab Start/Stop/Reread and click on ReRead License File. Check that the message bar at the bottom of the screen says license file reread. Reread Server License File Completed.

5. Click on Server Status tab, click on Perform Status Enquiry – check the result to see if any servers are down. If they are go to Step 6.
   If the lic file cannot be read go to step 6.



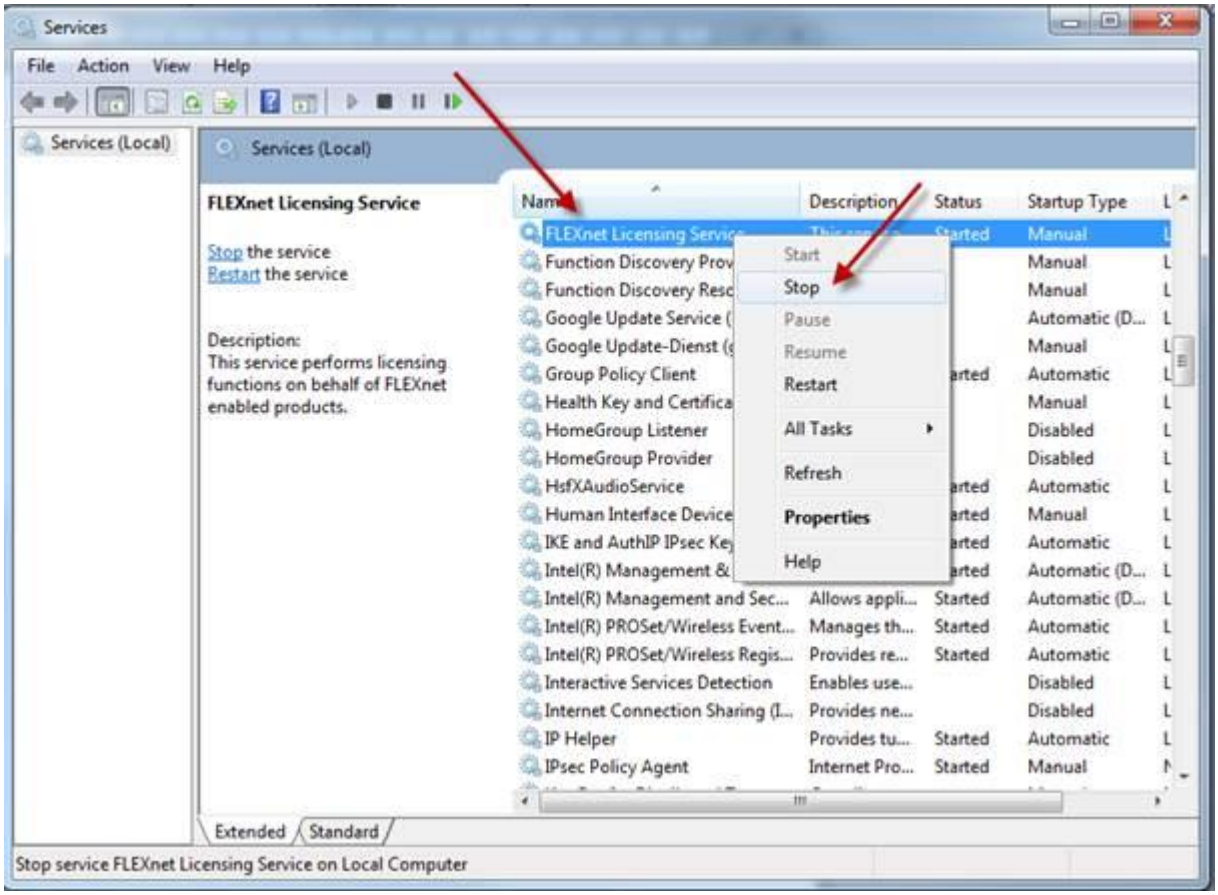
6. Open Cyclone & re-check your licenses, it should now work.
7. If you still cannot connect to your license server then check to see if your anti-virus is blocking your servers if it is the server will be seen as 'down'? If you cannot find anything then Stop CLM and Flexnet SERVICES then go to Add/Remove programs and Uninstall all your Flexnet and CLM activation wizard programs from this list. Then re-run CLMN 1.4.1.002.exe install and **WATCH FOR A POP UP WARNING FROM YOUR ANTI-VIRUS SOFTWARE** – choose to allow software through the anti-virus software. Go to Step 5.
8. If you still cannot open the server go to Windows Firewall settings with Advanced security and check that there are Inbound rules for CLM TCP 19700-19701 and CLM TCP 2700-27010. For the application lmgrd.exe open TCP port for 27000-27009 for LGS.exe open any unused TCP port and for clmrdsvr.exe open port 19701. Go to step 5.

Cyclone has a trusted storage error message

Please do the following:

1.) WRITE DOWN OR TAKE A SCREEN SHOT OF ALL YOUR CLM EID NUMBERS
2.) Close INFINITY/LGO or CYCLONE and close CLM software if open
3.) Go to Control Panel /Administrative Tools /Services (or type ***services*** into your windows search area & it takes you here)

One by one click on the 3 services which start with Flexnet and choose to STOP the service. If you have a floating license also stop the CLM Remote Daemon (svr). If you are not sure look for it and stop it if you find one.

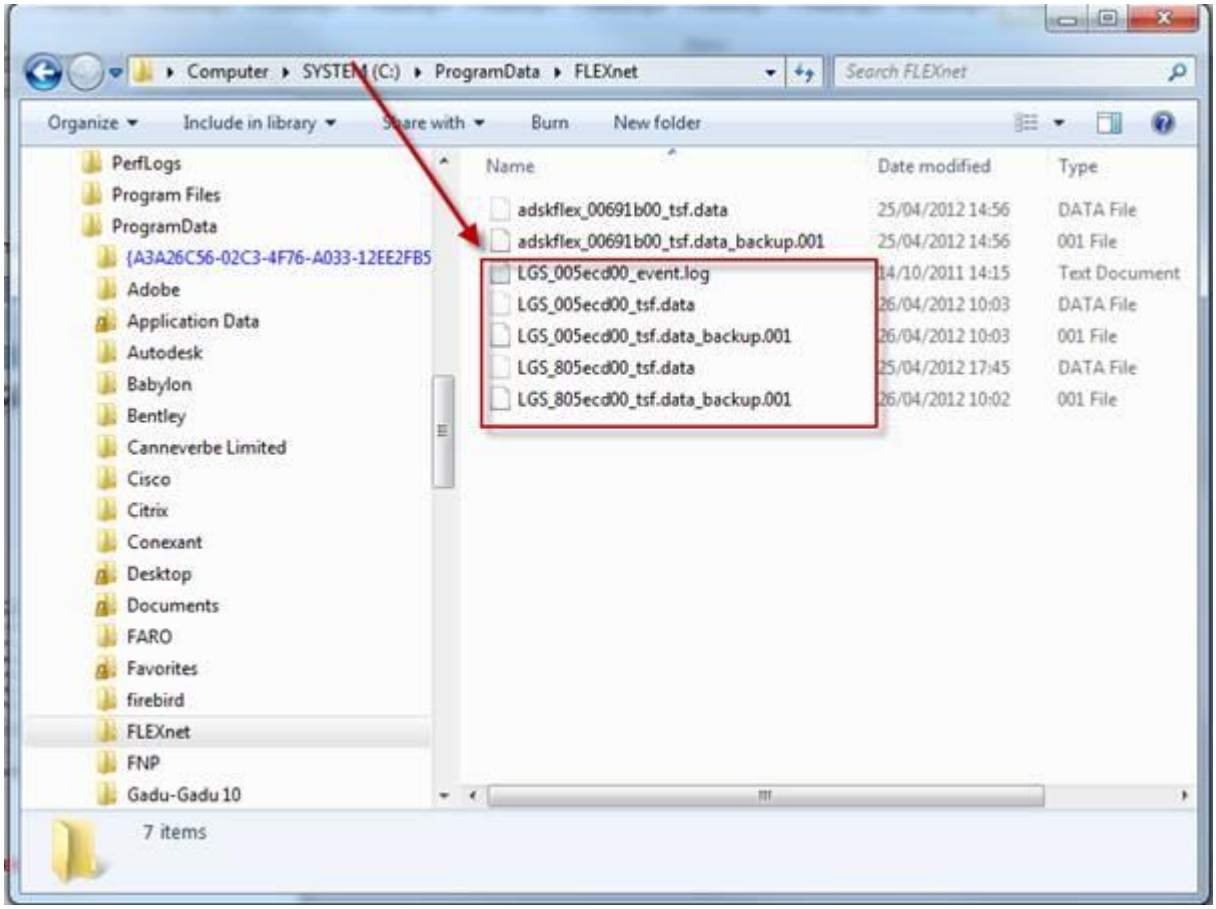


4.) Go to the path (it is hidden folder):

c:\Documents and Settings\All Users\Application Data\FLEXnet\ (winXP)

OR

c:\ProgramData\FlexNet



5.) DELETE only files starting with LGS and nothing else

6.) Start the FLEX NET service from point 3 (and CLM Remote Daemon)

7.) Go to CLM and re-activate the licenses. After that Infinity/LGO or Cyclone will work

Uninstall Leica Cyclone (including registry keys)

1. Uninstall Cyclone
Using the Installer

2. Delete folders manually:
Window XP (32bit):
C:\Program Files\Leica Geosystems\Cyclone
C:\Documents and Settings\User\My Documents\Cyclone
C:\Documents and Settings\User\Application Data\Leica Geosystems\Cyclone
Windows Vista and Windows 7 (64bit)
C:\Program Files\Leica Geosystems\Cyclone
C:\Users\User\Documents\Cyclone
C:\Users\User\AppData\Roaming\Leica Geosystems\Cyclone

3. Delete registry keys manually
Start Regedit (Start – Run – Enter Regedit – Press OK)
Delete following registry keys:
HKEY_CURRENT_USER – Software – Cyra Technologies
HKEY_CURRENT_USER – Software – Leica Geosystems – Cyclone*
HKEY_CURRENT_USER – Software – Leica Geosystems – CadPlugins
HKEY_LOCAL_MACHINE – Software – Leica Geosystems – Cyclone*
HKEY_LOCAL_MACHINE – Software – Leica Geosystems – CadPlugins
On 64bit machines additionally:
HKEY_LOCAL_MACHINE – Software – Wow6432Node – Cyra Technologies
HKEY_LOCAL_MACHINE – Software – Wow6432Node – Leica Geosystems – Cyclone*

4. Restart the PC

5. Clear Windows Temp folder

Useful Websites

Laser Scanning Forum -
http://laserscanning.org.uk

The Centre for Advanced Spatial Technologies -
http://gmv.cast.uark.edu/category/scanning/software/leica-software/leica-cyclone/cyclone-workflows/

Turning Point Systems Group -
http://turningpointsystemsgroup.com/HDS%20Support.html

Leica HDS Blog UK -
http://hdsblog.co.uk/blog/

Leica HDS Demonstrations -
http://software.lgshds.com/public/cyclone/demo/cyclone6.0.html

Technodigit 3D Reshaper

3D Reshaper is an advanced point cloud software for creating meshes, tunnel alignments, and deformation analysis.

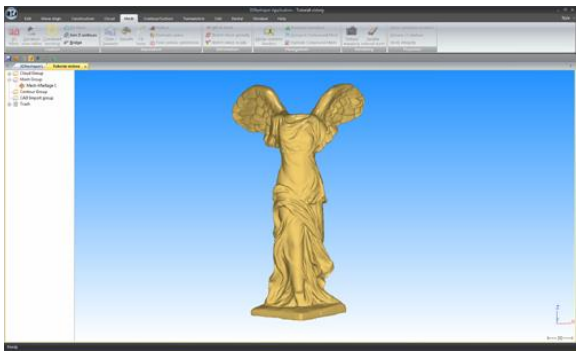


Figure 134. 3D Reshaper Screenshot

To find information about the use of 3D Reshaper, please refer to the following :

1. Beginner's guide (from the Windows Start Menu or in your "My documents" folder)
2. Help files (from Reshaper Help Menu)
3. Videos: http://www.3dreshaper.com/en1/En_Videos.htm
4. Exercises: http://www.3dreshaper.com/en1/En_Practicalsdownload.htm
   -> **Login:** NurbsSurface
   -> **Password:** Reconstruction
5. 3D Reshaper forum http://www.3dreshaper.com/en1/En_forum.htm

Table of Figures