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

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

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

## POLYWORKS PIFEDIT

### Introducing Polyworks PIFEdit:

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

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

### Basic Navigation:

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

**Left Button:** Rotates the scan

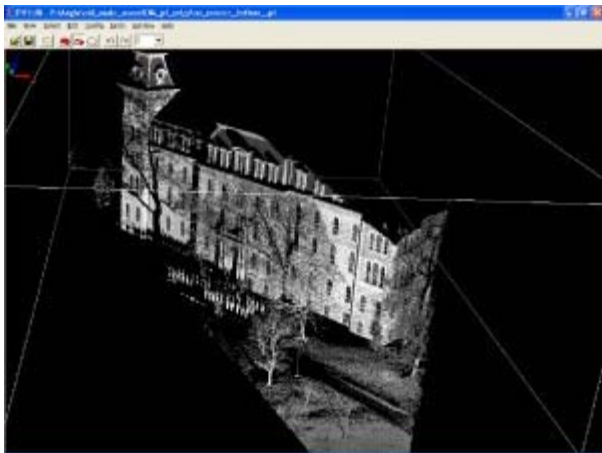
**Middle Button:** Translates the scan

**Right Button:** Zooms in and out on the scan

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

### VIEW DATA

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



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

seen

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

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

## SELECT UNWANTED DATA

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

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

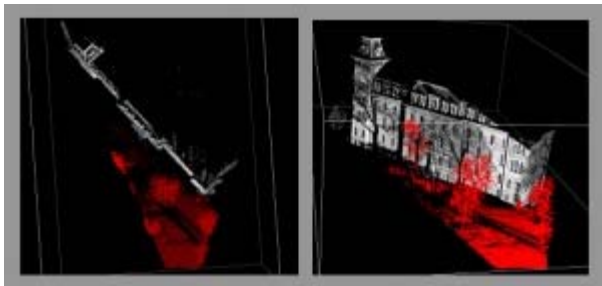
**Shift:** Enables Volumetric Selection – otherwise it is in Surface Selection mode which is only useful with polygon meshes

**Ctrl:** Enables Polygonal Selection – otherwise in Freeform Selection mode

## CONFIRM SELECTION & DELETE DATA

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

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



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

When finished, go to **File – Save As – save as name\_cln.pf**.

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

## CONTINUE TO...

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

]]> <http://gmvcast.uark.edu/scanning/software/polyworks/workflow-polyworks/polyworks-pifedit-cleaning-point-cloud-data/feed/> 0 <http://gmvcast.uark.edu/scanning/software/polyworks/workflow->

polyworks/creating-a-polygonal-mesh-using-immerge/  
http://gmvcast.uark.edu/scanning/software/polyworks/workflow-polyworks/creating-a-polygonal-mesh-using-immerge/#comments Mon, 24 Oct 2011 18:53:31 +0000 Angie  
http://gmvcast.uark.edu/3718/creating-a-polygonal-mesh-using-immerge/ [Continue reading →](#)]]>

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

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

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

Once a point cloud data set has been properly aligned with overlap reduction, it is ready for meshing. IMMerge is the module in Polyworks that creates a mesh from an IMAlign project. *Note* – Only IMAlign projects can be meshed. See below for specifics for IMMerge operations.

## BASIC SETTINGS

In the Polyworks Workspace Manager, select the IMAlign project that you want to mesh and then select **Create a Polygonal Model** in the Workspace Manager.

### IMMerge – Basic Settings

#### **Values Carried over from IMAlign Project (usually do not change)**

**Max Distance:** The maximum distance between two overlapping scans

**Surface Sampling Step:** Average of interpolation step across scans; the resulting mesh density

**Standard Deviation:** Approximate alignment error (In meters for Optech)

**Smoothing Level:** Can be modified. *It is generally recommended to have Low to Med level of smoothing.*

## ADVANCED SETTINGS

### Advanced Settings Explained – (usually do not change)

#### **Reduction Tolerance:**

- Compresses the mesh by reducing the number of triangles (without losing definition)
- Typical Reduction Tolerance =  $1/5 * \text{max standard deviation}$

#### **Smoothing Radius**

- Radius of the spherical filter used to smooth the resultant mesh.
- The greater the smoothing radius, the more the mesh is smoothed.
- Typical Smoothing Radius: 2-4 times the surface sampling step

#### **Smoothing Tolerance**

- Typical Smoothing Tolerance: 3 x's max standard deviation

#### **Common Error returned from IMMerge processing of very large datasets**

**Error 1413:** Block Size too small or Out of memory

- Actually not a function of block size, so DO NOT increase block size. *Recommended block size and compaction is 200 and 20, respectively.* Instead, change the subdivision settings. Change the "# of triangles per job" to "# of Merging jobs" and where it says default, set a value. Start at 1000 then double if the operation still does not merge. If it does not merge in 10000 jobs or less, then the dataset is probably too

large.

- If the dataset will not merge, split the IMAAlign project into two pieces and mesh the two pieces separately.

]]> <http://gmv.cast.uark.edu/scanning/software/polyworks/workflow-polyworks/creating-a-polygonal-mesh-using-immerge/feed/0> <http://gmv.cast.uark.edu/scanning/software/polyworks/workflow-polyworks/polyworks-v11-importing-optech-data-into-imalign-2/>  
<http://gmv.cast.uark.edu/scanning/software/polyworks/workflow-polyworks/polyworks-v11-importing-optech-data-into-imalign-2/#comments> Mon, 24 Oct 2011 18:18:34 +0000 Angie  
<http://gmv.cast.uark.edu/3707/polyworks-v11-importing-optech-data-into-imalign/> [Continue reading →](#)]]>

**This workflow will show you how to import Optech data into IMAAlign, part of Polyworks V11**  
*Hint: You can click on any image to see a larger version.*

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

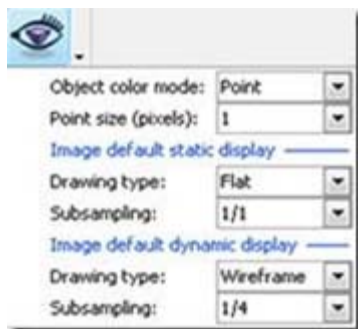
## IMAAlign INTIAL SETUP



**Figure 1: Set IMAAlign options as suggested below prior to importing any data**

IMAAlign is the Polyworks module that allows you to import and align scan data. When you first open IMAAlign, it's good to define a couple of parameters. **Before you import any data**, open IMAAlign options and change the Digitizer from Generic Close Range to Optech ILRIS 3D and change the working units to meters. Also, turn off the Interactive Mode Wizard and the Unknown Units Wizard. Also, under the Alignment section change Subsampling from 1/4 to 1/1 and under the Images section set Max Angle to 85 (see illustration below under Section 4). Next, go to Tools – Save Configuration (to save the new settings).

## DISPLAY PARAMETERS



**Figure 2: The eye icon controls how objects are displayed in the scene**

Object color Mode *Point or Default*

Default Static Display

Drawing Type: *Smooth or Flat*

Subsampling: *1/1*

Default Dynamic Display (*Recommended parameters bolded/italicized*)

Drawing Type: *Point*

Subsampling: *1/16 or 1/64*

## IMPORTING OPTECH DATA

### Importing Optech Data (.pf format)

1. Go to File – Import Images – 3D Digitized Data Sets. Under Spherical Grids, choose Optech PIF. Next, navigate to the file, and select Open. Typically, you will not subsample the data set (choose 1/1), however if file size and/or memory become an issue, **the only place to subsample or decimate a data set in IMAlign is upon import.**

The following is a basic description of the import parameters and additional guidance for modifying parameters.

*Note: Always hit the Reset button before adjusting any import parameters. Previous import settings are retained.*

When Optech data is imported into IMAlign, the data is automatically “gridded” or meshed. For spherical datasets like Optech data, IMAlign does this by subdividing the data by angle and range and then assigning a plane to each data section and then meshing that individual section. Therefore subdividing Optech data by both angle and range (or distance) is recommended. The smaller the angle, the more subscans created. A Subdivision Angle of 20 is generally recommended, however you might want to lower this value to 10 if there is a lot of ground/floor data in a scan.

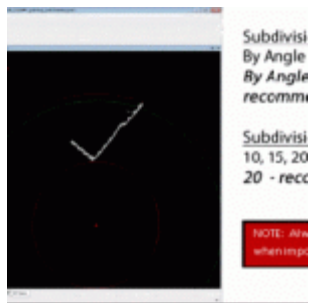


Figure 3: Interface for importing Optech data into IMAlign

## INTERPOLATION OPTIONS – FOCUS

### Interpolation Options

**Focus Distance:** The minimum distance, or the point at which data is first recorded. – Typically leave as is.

**Step at Focus:** The data resolution or point spacing at the focus distance (in meters)

**Max Angle:** The angle from normal for which values are accepted for a scan.

A value of 75 – 85 is good for the Optech.

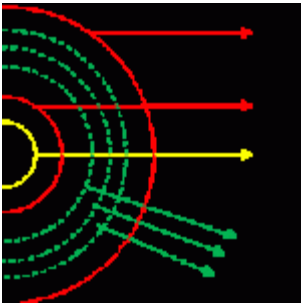


Figure 4: Graphic showing import parameters including the focus distance, number of ranges, and the minimum and maximum distances.

## INTERPOLATION OPTIONS – MAX EDGE LENGTH

**Max Edge Length (Important):** The distance at which points are connected or meshed. Typically 10 x's or less the step or point spacing. A value that is too large can erroneously connect points that should not be connected (Figure 5, left) . Again, this value should be 10's the Step or less. Decreasing will result in less data being imported (Figure 5, Right).

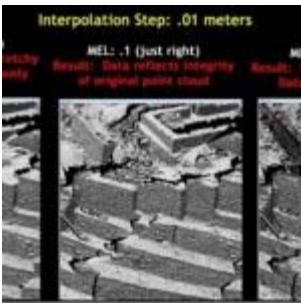


Figure 5: Example of different max edge length values and the effect of these values on data import

## INTERPOLATION OPTIONS – NUMBER OF RANGES

**Number of Ranges:** Self-Explanatory. Adjust as needed. Distance between ranges is based on the focus distance.

**Min Step:** The smallest acceptable step value (typically do not change).

Focus Distance/Ranges	Interpolation Step	MEL
(FD) 10 meters	.01 meter	.1 (or less)
(Rng 1) 20 meters	.02 meters	.2
(Rng 2) 40 meters	.04 meters	.4
(Rng 3) 80 meters	.08 meters	.8

*For each range extending out from the scanner, the interpolation step and max edge length double.*

Remember to always hit the Reset button when importing a new scan. Most of the time, the default import values work well. Occasionally, the max angle or max edge length will need to be adjusted. Once imported, a scan is now comprised as a collection or group of sub scans or images. Note the scans now have "surface information" and are no longer point clouds.

## CONTINUE TO...

Continue to [Registering Scans in Polyworks V11 IMAlign](#)

]]> <http://gmv.cast.uark.edu/scanning/software/polyworks/workflow-polyworks/polyworks-v11-importing-optech-data-into-imalign-2/feed/> 0 <http://gmv.cast.uark.edu/scanning/software/polyworks/workflow-polyworks/registering-aligning-scans-in-polyworks-v11-imalign-2/>  
<http://gmv.cast.uark.edu/scanning/software/polyworks/workflow-polyworks/registering-aligning-scans-in-polyworks-v11-imalign-2/#comments> Mon, 24 Oct 2011 18:11:46 +0000 Angie  
<http://gmv.cast.uark.edu/3700/registering-aligning-scans-in-polyworks-v11-imalign/> [Continue reading →](#)]]>

## This document covers scan registration (alignment) and overlap reduction in Polyworks IMAlign.


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

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

### REGISTRATION – 1

1. Import all scans into IMAlign. Lock (Ctrl + Shift + L or right click – Edit – Lock) the first scan in the table of contents (TOC).

*Note:* To hide a scan's digitizer position, hit the plus next to the scan name in the table of contents, plus next to reference points, then middle click (to hide) the Digitizer Position.

2. Next select a scan in the TOC to align to the first scan and select the Split View Alignment icon  to enter Local Mode.

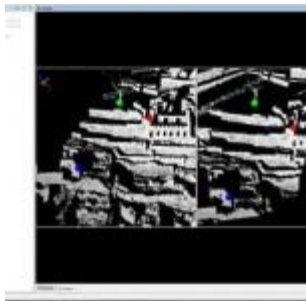
*Note:* The two scans have to have areas of overlap in order to be able to align them together. Also, you can only enter Split View Mode when the unlocked scan is selected.

3. Rotate both views so that they are oriented correctly with respect to one another (see Figure 1 below). This is important for identifying common points between the two scans.


### REGISTRATION – 2

4. Select N Point Pairs Alignment .

5. Match at least 3 pairs of corresponding points between the two views (no more than 5 or so is necessary). Points should be across the entire scan (not concentrated in one area) and multi-planar. Right click when finished.



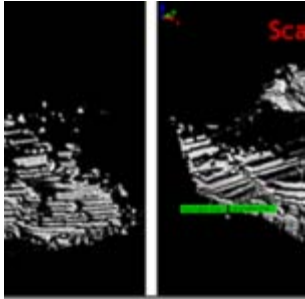
**Figure 1: Identifying common tie points between two scans**

6. Next, run a best fit alignment  between the scans. This is an iterative alignment that fine tunes the NtoN alignment. Subsampling should be 1/1; optionally you can choose to Show slipping color map. In the statistics tab, the Standard Deviation reflects the accuracy of the alignment. Ideally (though it doesn't always happen) you want the standard deviation to be less than the accuracy of the scanner. For the

Optech, this is approximately 1 centimeter (.01). For the Minolta VIVID 9i, this varies based on the lense that you use (tele = 200 microns (.2mm), mid = 400 microns (.4mm). If the best fit alignment is taking too long to run but the alignment is close enough (the standard deviation is less than or equal to the accuracy of the digitizer and the Convergence value and mean are very close to 0), then the alignment can be stopped. This accepts the best fit alignment computed up to that point.

## REGISTRATION – 3

7. Once the best fit alignment is complete, lock the second scan. Select the next scan to align and repeat Steps 2-6.



8. Once all of the data has been aligned, compute one final Global or Best Fit Alignment. This adjusts the alignment across the entire dataset. To do this, select a single scan that has good coverage across the entire dataset and lock it then unlock all remaining scans. Run the Best Fit Alignment one final time. Once all alignments have been completed, save your IMAAlign Project. A recommended naming convention is *project\_name\_GR* (*GR* = *Global Registration*).

**TIP:** Scans can also be grouped together allowing you to hide, select and perform numerous operations on a group of scans at the same time.

## OVERLAP REDUCTION – 1

Overlap reduction is performed to remove the overlapping or redundant data between scans. This is recommended prior to meshing and/or to reduce the size of the dataset. Make sure and save a copy of your dataset prior to overlap reduction. Next, select Image – Reduce Overlap.

The Overlap Reduction parameters are discussed more below:

**Max Distance:** Determined by scanner

**Max # of overlapping images:** Recommended 5

**Number of overlap layers:** Recommended 3

**Best Data (Std)** –Default (when all scans are the same resolution) – typically use this option

**Best Data (Extreme)** – Used when you have scans of multiple resolutions.

This ensures that high resolution data will not be replaced by overlapping lower resolution data. Select all high resolution scans in TOC and then run operation.

*Suggested Setting: Best Data Standard*

## OVERLAP REDUCTION – 2

**Data Quality:**

**Viewing Angle:** Accepts points that are orthogonal to the scan direction (directly in front of the scanner) rather than those that are more oblique.

**Point-to-Digitizer Distance:** Accepts points that are closer to the scanner rather than those that are further away.

*Suggested Setting: Viewing Angle*



Sometimes manual overlap reduction is required in addition to the automatic reduction in order to visually clean-up the data. The best way to go about this is by systematically selecting using the Select scan on



Screen Tool and toggling scans (using the Hide and Keep commands) and deleting the redundant data. This is done primarily for visual purposes.

Once overlap reduction is completed on your project, save your project with a different file name. A recommended naming convention is *project\_name\_GRE* (*GRE = Global Registration with additional edits/overlap reduction*). It is best to save projects with different names at key processing steps, in case one wants to return to a specific processing point.

For more on meshing, see Meshing using Polyworks IMMerge V11.

## ALIGNING MULTIPLE IMAlign PROJECTS

### Aligning Multiple IMAlign Projects

Multiple IMAlign projects can also be aligned to one another. This allows for users to work on different sections of the site and then merge those sections together into one project. A global alignment and overlap reduction should be completed on each individual project before the projects are brought together. When an IMAlign project is imported to an existing project, the screen goes straight into a split view alignment. Align the 2 datasets using N Point pairs and then compute a Best Fit Alignment. Repeat for multiple projects. Multiple datasets can also be aligned in IMInspect if necessary.

]]> <http://gmvcast.uark.edu/scanning/software/polyworks/workflow-polyworks/registering-aligning-scans-in-polyworks-v11-imalign-2/feed/> 0 <http://gmvcast.uark.edu/scanning/software/polyworks/shortcut-guide-polyworks/polyworks-interface-basics-2/> <http://gmvcast.uark.edu/scanning/software/polyworks/shortcut-guide-polyworks/polyworks-interface-basics-2/#comments> Tue, 10 May 2011 21:54:25 +0000 Angie <http://gmvcast.uark.edu/2304/polyworks-interface-basics/>

**This document will introduce you to the interface basics of Polyworks.**

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

## INTRODUCTION TO WORKSPACE MANAGER

Polyworks is a modularized package that offers a centralized workspace for organizing component parts of 3D data processing from scan alignment to meshing to inspection. Users can access any of the main modules from the Polyworks Workspace Manager as well as individually from the Start Menu. The principal modules and their functionality are listed in Figure 1 below:

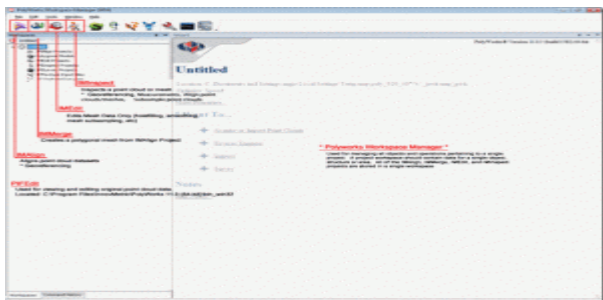


Figure 1: Polyworks Workspace Manager showing principal software modules

The Polyworks Workspace is meant to house all processing components related to a project. Therefore it is best to create workspaces that are specific to a given project. For example with object scanning projects where multiple objects of a collection are scanned and process, a workspace should ideally be created for each individual object.

When a Polyworks Workspace is saved, a .pwk file is created (*sample.pwk*) along with an associated workspace file structure (*sample\_Files*). The associated file structure (shown in Figure 2 below) manages all of the projects from the internal modules (IMAlign, IMEdit, etc...) as well as the data imported and exported from those modules.



Figure 2: Polyworks Workspace file (PWK) and additional workspace files

When moving files from one location to another, it is recommended to first zip a workspace to ensure that the workspace data structure and organization are retained. For more on the Polyworks Workspace Manager, please reference the Workspace Manger Basics.pdf from the Help menu in Polyworks.

## DESCRIPTION OF PRIMARY MODULES

### IMAlign

IMAlign supports scan alignment of 3D digitized datasets. IMAlign offers direct interaction with a list of different digitizers as well as import support for a range of point cloud and mesh formats. Here users can align different datasets and prepare them for subsequent meshing.



Figure 3: List of import formats for IMAlign

### IMMerge

IMMerge is the meshing utility of Polyworks that produces a polygonal model directly from an IMAlign project. Note – Only point clouds can be meshed in IMMerge.

### IMEdit

IMEdit is the mesh editing module of Polyworks. Here a number of mesh cleanup operations are available including hole filling and smoothing. Curve Creation and NURBS Surfacing options are also available in IMEdit.

### IMInspect

IMInspect offers product inspection, measurement, and comparison capabilities. Here users can import original 3D point clouds, polygonal meshes, and CAD datasets and perform a range of different measurements and comparisons. Primitive fitting as well as feature extraction is performed in IMInspect.

## DESCRIPTION OF LESSER MODULES

## **IMCompress**

IMCompress is a module completely dedicated to model reduction or decimation. The same capabilities are available from inside IMEdit.

## **IMTexture (Add-On)**

IMTexture is an optional module available that generates texture maps from vertex colors for reduced models. It is currently available from Innovmetric for – Academic pricing.

## **IMView**

IMView is the free viewing software provided by Innovmetric. It is available in the main product sweet and also standalone from the Innovmetric website.

## **IMKey**

IMKey is the licensing utility for the entire Polyworks suite. License borrowing capabilities are available here.

## **MOUSE BUTTON FUNCTIONALITY**

# **Polyworks Mouse Button Functionality**

<b>Left:</b> Rotate	<b>Shift + Middle:</b> Boxed Zoom In
<b>Middle:</b> Pan	<b>Shift + Right:</b> Rotate about Viewing Axis
<b>Right:</b> Zoom	

In addition to the basic mouse functionality listed above, there are also options for single button controls available in each of the modules. These controls are shown below in Figure 4.

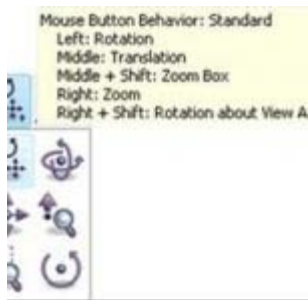


Figure 4: Mouse Button Behavior Options in Polyworks modules

## **SCENE DISPLAY OPTIONS**

# **Scene Display Options (all modules)**

The main display options in Polyworks are available by clicking on two highlighted icons in Figure 5. These icons are available in all of the main modules and may vary slightly between the different modules.



Figure 5: (Left) Polyworks Viewing Options and (Right) Scene Options as shown in IMAlign

The object display  options (shown bottom left in Figure 5 above) are covered here in more detail.

### **Object color Mode**

**Point:** Displays image texture data

**Default:** Displays all scans with default gray material

**Object:** Displays each scan with unique color

**Image Subgroup:** Displays each image subgroup with unique color

**Error Map:** Displays error map from best fit alignment (if option is selected during alignment operation)

### **Default Static Display**

#### **Drawing Type**

**Flat:** Displays as mesh data set with flat shading (allows you to see individual facets)

**Point:** Display as point cloud

**Smooth:** Displays as mesh data set with smooth shading

**Wireframe:** Displays wireframe of mesh

### **Subsampling**

**1/1**

**1/4:** One point is displayed for every 4 points

**1/16**

**1/64**

## **SELECTION TOOLS**

## **Selection Tools**

The user activates selection in Polyworks by tapping the *space bar*. Tapping the space bar again also deactivates selection and switches to view manipulation/scene navigation.

*To perform a selection the user must:*

*(Hold) Shift:* Allows Volumetric Selection – necessary for selecting within point clouds

*(Optional Hold) Ctrl:* Allows Polygonal Outline of Selection.

*No Ctrl:* Freeform selection

*(Hold) Middle Mouse button-* to trace the selection

The Selection Menu shown in Figure 6 below is available in all PW modules. The default selection mode is set to toggle, therefore to append a selection or deselect – the user must change the selection mode to mark or deselect respectively.



Figure 6: Selection Modes in Polyworks

## SHORTCUT KEYS

### Shortcut Keys

Keys	Function
Ctrl + Shft + A	Select All
Ctrl + Shft + D	Hide Scans Can also middle click on scan name in TOC
Ctrl + Shft + R	Restore Scans
Ctrl + Shft + E	Ignore Scans (ignored for most operations)
Ctrl + Shft + U	Use Scans
Ctrl + Shft + K	Keep Scan (Keeps selected scan – hides all others)
Ctrl + Shft + L	Lock Scan
Ctrl + Shft + O	Unlock Scan

## IMALIGN BASICS

### IMAlign Basics (Getting Started)



Figure 7: Remember to set IMAlign options as suggested below prior to importing any data

IMAlign is the Polyworks module that allows you to import and align scan data. When you first open IMAlign, it's good to define a couple of parameters.

*Before you import any data, open IMAlign options and change the Digitizer from Generic Close Range to the scanner you are working with and change the working units to the digitizer units. Also, turn off the Interactive Mode Wizard and the Unknown Units Wizard. Also, under Alignment change Subsampling from 1/4 to 1/1 and under images, Max Angle choose 85. Next, go to Tools – Save Configuration (to save the new settings).*

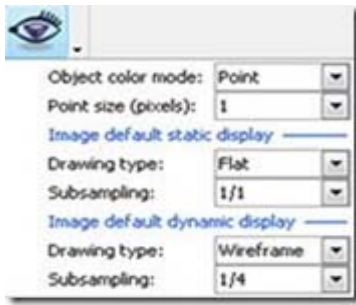


Figure 8: The highlighted icon controls how the scan data will be displayed in the scene.

## RECOMMENDED VIEWING OPTIONS

Below are the recommended settings for the Viewing Options

Object color Mode *Recommended parameters are bolded/italicized*

*Point*: Displays image texture data (Intensity (I) data for Optech; RGB data for Leica)

*Default*: Displays all scans with default gray material

*Object*: Displays each scan with unique color

*Image Subgroup*: Displays each image subgroup with unique color

*Error Map*: Displays error map from best fit alignment (if option is selected during alignment operation)

Default Static Display *Recommended parameters are bolded/italicized*

Drawing Type

*Flat*: Displays as mesh data set with flat shading (allows you to see individual facets)

*Point*: Display as point cloud

*Smooth*: Displays as mesh data set with smooth shading

*Wireframe*: Displays wireframe of mesh

Subsampling

**1/1**

1/4 : One point is displayed for every 4 points

1/16

1/64

Default Dynamic Display *(Recommended parameters bolded/italicized)*

Drawing Type

*Point*

Subsampling

*1/16 or 1/64*

You are now ready to begin importing scan data into your IMAAlign Project!

]]> <http://gmv.cast.uark.edu/scanning/software/polyworks/shortcut-guide-polyworks/polyworks-interface-basics-2/feed/> 0