LMI TECHNOLOGIES

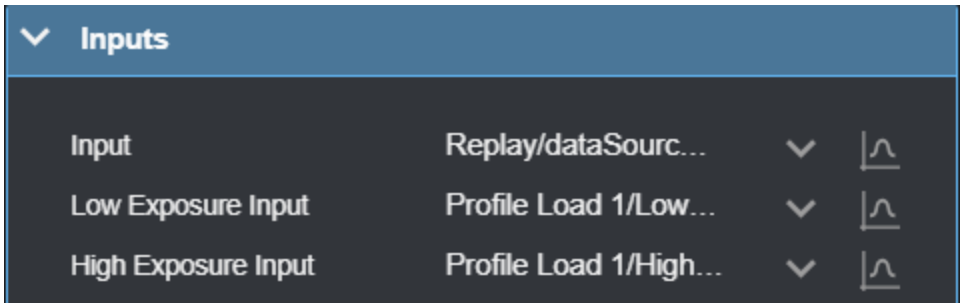
Profile Sort

Purpose

The tool outputs a uniform surface by sorting out the required points from a bundle of unmerged raw profiles scanned with the following conditions met or a .sot file saved by the GoPxL tool named “Profile Sort”.

- Raw profile scanning mode with "Spot Selection" as "None"
- [Optional] Enable "Acquire Intensity"
- Support only single/double exposures raw profiles

Inputs



Name	Description
Input	The profile data that the tool will apply the processing to.
Low Exposure Input (Enabled in the Running Mode **Replay**)	The profile data captured with the low exposure setting.
High Exposure Input (Enabled in the Running Mode **Replay**)	The profile data captured with the high exposure setting.

Parameters

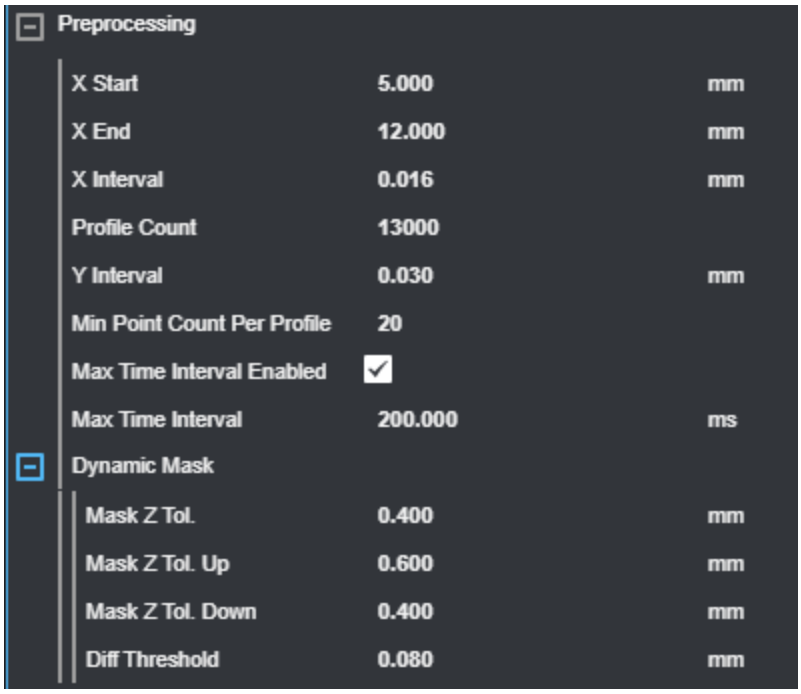
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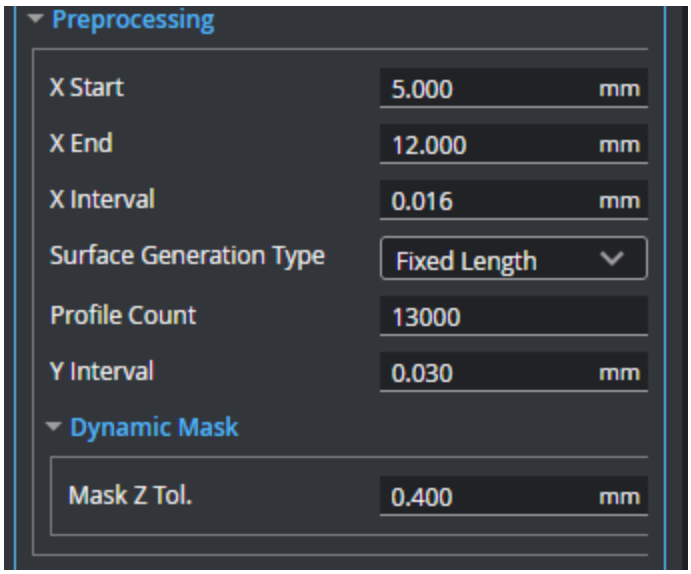


Name	Description
Running Mode	There are three modes 1. Fastest: Process the input unmerged stream and generate the surface without saving any file 2. Save All Profiles: Save all raw profiles of each stitched surface into a .sot file. This mode only works for the PC platform and the saving path is “C:\GoTools\ProfileSort” 3. Replay: Take the two raw profile outputs from Profile Load as inputs to generate the stitched surface (Default Mode)
Preprocessing (Parameters Group)	The group of parameters used in the preprocessing process.
Template Creation (Parameters Group)	The group of parameters used in the template creating process.
Cluster (Parameters Group)	The group of parameters used in the points clustering process.
Postprocessing (Parameters Group)	The group of parameters used in the postprocessing process.

Special Handling (Parameters Group)	The group of parameters used in the special handling process.
Object Length	The fixed object length. If it's equal to 0, this tool will detect the object length automatically and output the result.
Show Advanced Parameters	If enabled, some additional parameters which are used for some advanced functions will show up.
Enable Diagnostics	If enabled, some diagnostics will show up for debugging purposes together with some additional measurements and data outputs. It is recommended to disable it after users fine tune the parameters to achieve better speed performance.
Profile To Compare	Show which kind of profile to check the extraction result of profiles. It supports the following options: • Base: The initial base profile • Multi: The profile after picking the best point from each bin with multiple candidates • Remove Noises: The profile after using point set clustering to remove possible noise points • Final: The profile after gap filling • Last Valid: The last valid profile used be a mask for the following profiles
Segment Start Y	The whole stitched surface could be very long in Y direction. If user only cares about a segment of the stitched surface, he can specify the segment range in Y direction and check the segment in an additional surface output named "Segment Surface"
Segment End Y	
Show Dynamic Mask	Show the dynamic mask in the graphic of the first measurement
Disable All Filters	Disable the filtering processes which are controlled by the following parameters: • **Large Gap Filling X Size Min, Large Gap Filling X Size Max** • **Gap Fill X Size, Gap Fill Y Size** • **Smoothing X Size, Smoothing Y Size** • **Enable Reprocessing** Please check the individual parameter's description to see the detailed process

Preprocessing Parameters





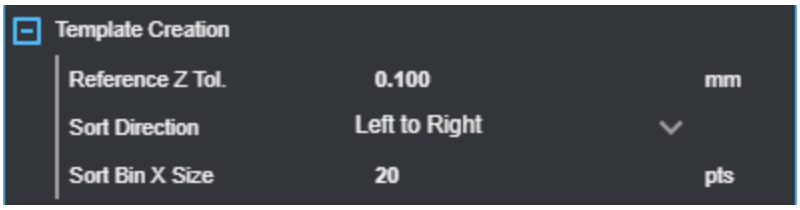
Name	Description
X Start	They define processing range (in mm) along the X axis on each profile
X End	

X Interval	Profile binning / resampling interval in mm
Surface Generation Type	Determines how the tool decides when a surface is complete and ready for output. Three modes are available: - **Fixed Length**: The surface is output when exactly Profile Count profiles have been collected. This is the classic behavior. - **Variable Length – Valid Profiles**: The tool accumulates profiles as long as the part is present. When Empty Profile Count consecutive empty (invalid) profiles are detected, the tool treats the gap as the end of the part, outputs the accumulated surface (trimming the trailing empty profiles), and resets for the next part. This allows parts of varying length to be measured without knowing the profile count in advance. - **Variable Length – External Gating**: The surface acquisition is controlled by an external digital signal (gate). Collection begins when the gate goes high and ends when it goes low, at which point the surface is output. The profile buffer grows dynamically up to Max Profiles Count.
Empty Profile Count	(Available only in Variable Length – Valid Profiles mode) Number of consecutive empty profiles required to trigger end-of-part detection. When this many profiles in a row contain no valid points, the tool considers the part scan complete, outputs the surface, and resets the buffer for the next part.
Max Profiles Count	(Variable Length modes) Upper bound on the number of profiles that can be buffered for a single surface. If this limit is reached before an end-of-part condition is detected, the buffer is forcibly reset and the incomplete surface is discarded. Acts as a safety cap to prevent unbounded memory growth.
Profile Count	Number of profiles used to form a surface
Y Interval	Define the Y interval in mm of the output surface
Min Point Count Per Profile	A profile is a valid profile if its valid point count isn't less than this parameter.
Max Time Interval Enabled	Whether to check the time difference between the two adjacent frames
Max Time Interval	If the time interval of two adjacent frames exceeds this threshold, they are considered to belong to two different stitched surface outputs. Thus, previously cached profiles will be cleared. It works like an automatic Stop/Start to clear the current cached data.

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Dynamic Mask (Parameters Group)	The group of parameters used in the dynamic mask
Mask Z Tol.	DTM is enabled internally to ensure continuity in the Y direction. The method filters out outliers of the current frame before any other processes based on the uniform profile output of the last frame plus/minus this parameter. While it is back scanning, It will filter out outliers whose relative z coordinate doesn't belong to [Mask Z Tol. (Up), Mask Z Tol. (Down)]. If a bin/column value of the last output is invalid, that bin/column won't remove any points from the current frame
Mask Z Tol. (Up)	These two parameters are used in the process of filtering out outliers. Please see the previous parameter's description whose name is Mask Z Tol.
Mask Z Tol. (Down)	
Diff Threshold	Calculate one diff surface after we have got the final uniform surface output. The diff surface is calculated by subtracting the uniform surface from itself with "Diff Offset Y" shift along Y axis, if the difference of one pixel is larger that "Diff Thresh", invalidate it from the "Diff Surface" data output.

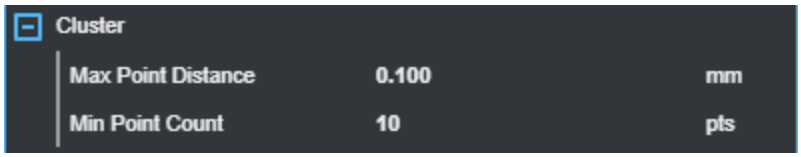
Template Creation Parameters



Name	Description
Reference Z Tol.	If all the points within the column (bin) is less than Z tolerance distance away, takes the average of the points and add to base profile
Sort Direction	Points of the current frame can be sorted in one of the two orders • Right to Left • Left to Right It is better to sort the points from a good data side, e.g., if there are serious secondary reflections on the left side, select Right to Left is a good way to go

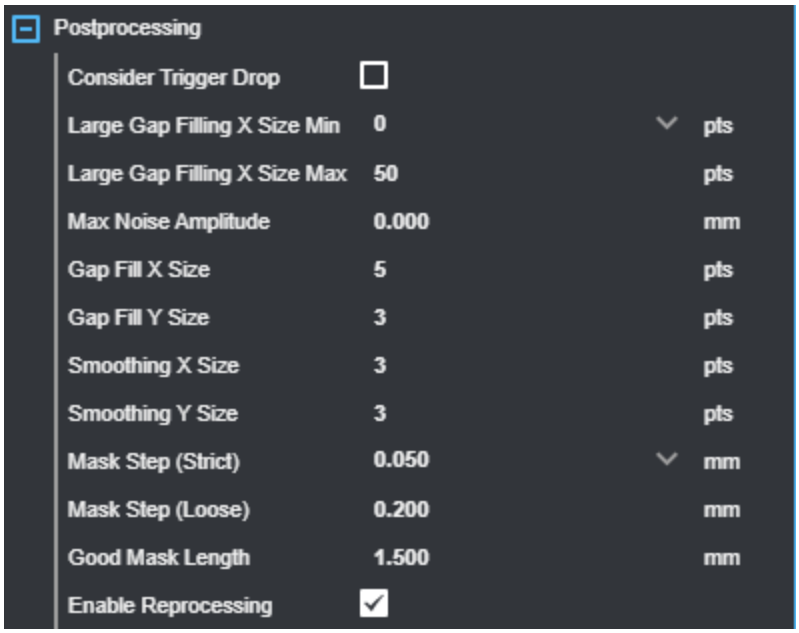
Sort Bin X Size	Number of data bins used to create the fitting curve

Clustering Parameters



Name	Description
Max Point Distance	The max distance to determine if two adjacent points belong to the same category. Suppose P1 and P2 are two adjacent points in the bins, they are considered to belong to the same category if the two below conditions are satisfied 1. Abs(P1.x - P2.x) < Max Point Distance 2. Abs(P1.z - P2.z) < Max Point Distance To speed up the performance, it is intentional to not use euclidean distance
Min Point Count	A category whose point count is less than this specified threshold will be removed from the final output

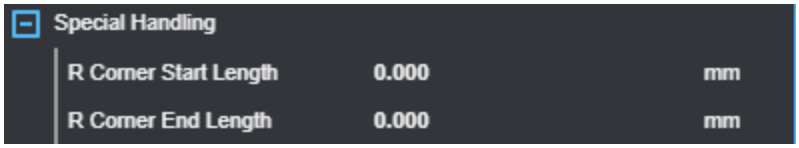
Post Processing Parameters



Name	Description
Consider Trigger Drop	When enabled, show up the following two editable parameters. The tool will insert blank rows to the position where there are frame drops
Encoder Nominal Interval (ENI)	Parameters to check if there are drops happening between two adjacent captured frames. Suppose E0 and E1 are encoder values of two adjacent frames, and dE = abs(E0 - E1). If 1. abs(dE-ENI) < EIT, no frame drops occurs between the two captured frames 2. abs(dE-ENI) > EIT, there will be round(dE/ENI-1) frames drops
Encoder Interval Tolerance (EIT)	
Large Gap Filling X Size Min	There are some missing points on some frames due to laser power. If the gap width is between [Large Gap Filling X Size Min, Large Gap Filling X Size Max], the tool will fill them with the 3 order polynomial fitting method.
Large Gap Filling X Size Max	
Max Noise Amplitude	Add uniform noise to the above fitting value, this parameter sets the noise amplitude.
Gap Fill X Size	Number of data bins used to create the fitting curve for gap filling along the X axis.

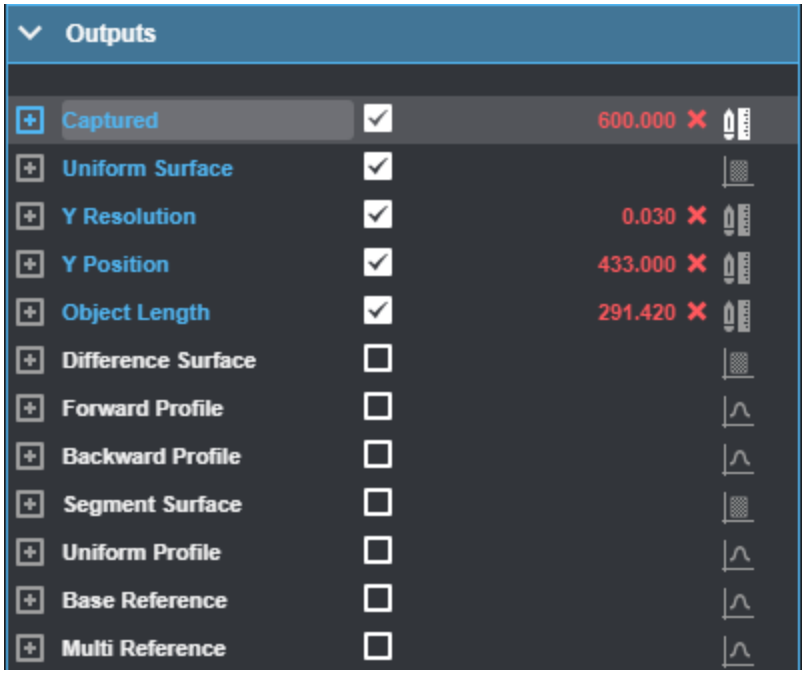
Gap Fill Y Size	Number of data bins used to create the fitting curve for gap filling along the Y axis.
Smoothing X Size	Number of data bins for profile averaging (along the X axis).
Smoothing Y Size	Number of data bins for surface averaging (along the Y axis).
Mask Step (Strict)	These two parameters are used to calculate an average step which is used to judge whether a profile is a good mask for the following frames when the mask length exceeds **Good Mask Length.** The formula is “step = (Loose - Strict) / ValidProfileCount”.
Mask Step (Loose)	
Good Mask Length	The valid length that a good mask could be used for. When over this length, the backward scanning will be used if enabled.
Enable Back Scan	Whether to use back scanning to get a better profile.

Special Handling Parameters



Name	Description
R Corner Start Length	The length of the fillet area at the start position of the battery surface in the scanning direction
R Corner End Length	The length of the fillet area at the end position of the battery surface in the scanning direction

Outputs



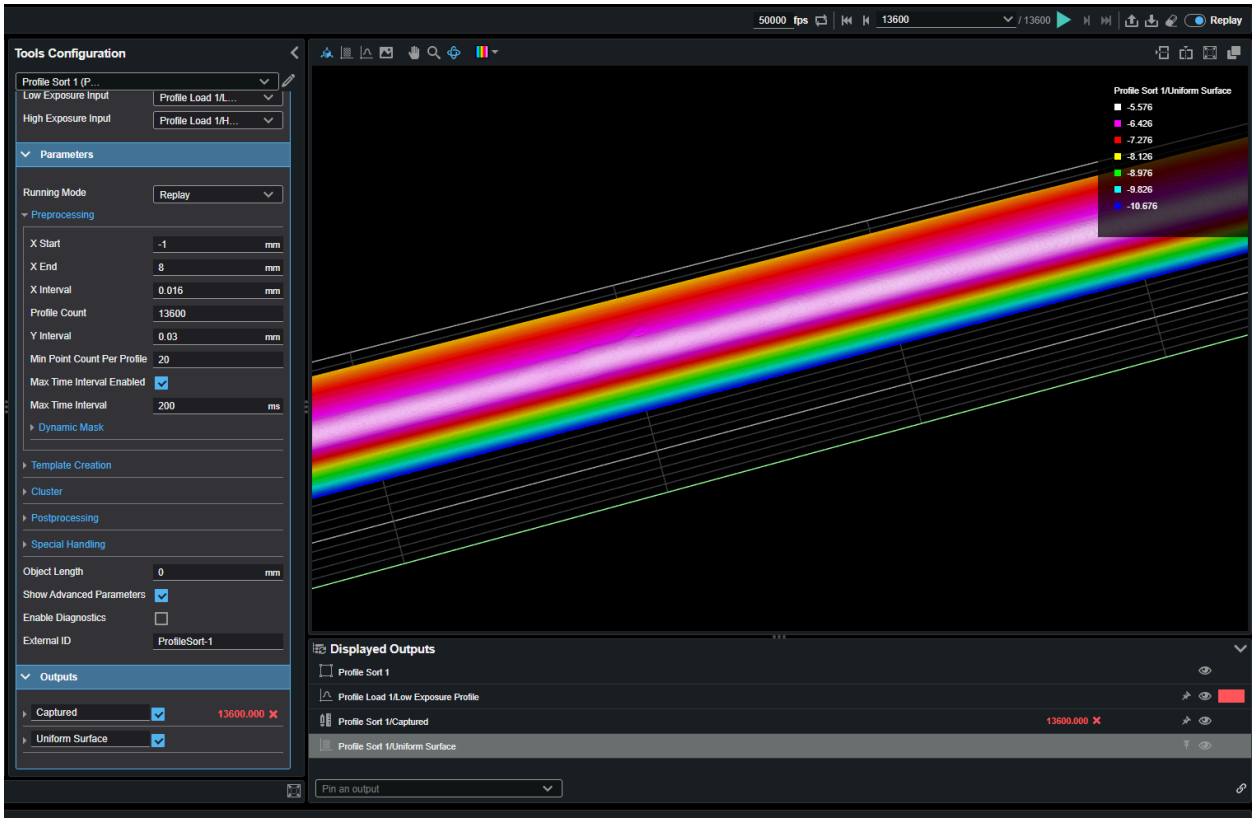
Type	Name	Description
Measurement	Captured	Indicates the number of frames successfully added to the combined surface
Measurement	Y Resolution	Indicates the Y resolution of the stitched surface. It is useful to determine which profiles cause problems in a certain part of the stitched surface. Show up when “Enable Diagnostics” is enabled.
Measurement	Y Position	Y index position relates to the “Segment Start Y” value Show up when “Enable Diagnostics” is enabled.
Measurement	Object Length	The scanned object’s length along the Y axis. Show up when “Enable Diagnostics” is enabled.
Data Output	Uniform Surface	The stitched surface output

Data Output	Difference Surface	The difference surface by subtracting the uniform surface from a shifting copy of itself. Show up when “Enable Diagnostics” is enabled.
Data Output	Forward Profile	The mask profile while forward scanning. Show up when “Enable Diagnostics” is enabled.
Data Output	Backward Profile	The mask profile while backward scanning. Show up when “Enable Diagnostics” is enabled.
Data Output	Segment Surface	Crop the stitched surface based on “Segment Start Y” and “Segment End Y” Show up when “Enable Diagnostics” is enabled.
Data Output	Uniform Profile	The final profile output of the current frame Show up when “Enable Diagnostics” is enabled.
Data Output	Base Reference	The base reference of the current frame. Its bin value is determined by one of the two ways below 1. There is only one point (hence clear winners) 2. If all the points within the column (bin) is less than Z tolerance distance away, takes the average of the points and add to base profile Show up when “Enable Diagnostics” is enabled.
Data Output	Multi Reference	It is generated by adding more points to Base Reference based on fitting Show up when “Enable Diagnostics” is enabled.

Major Revisions

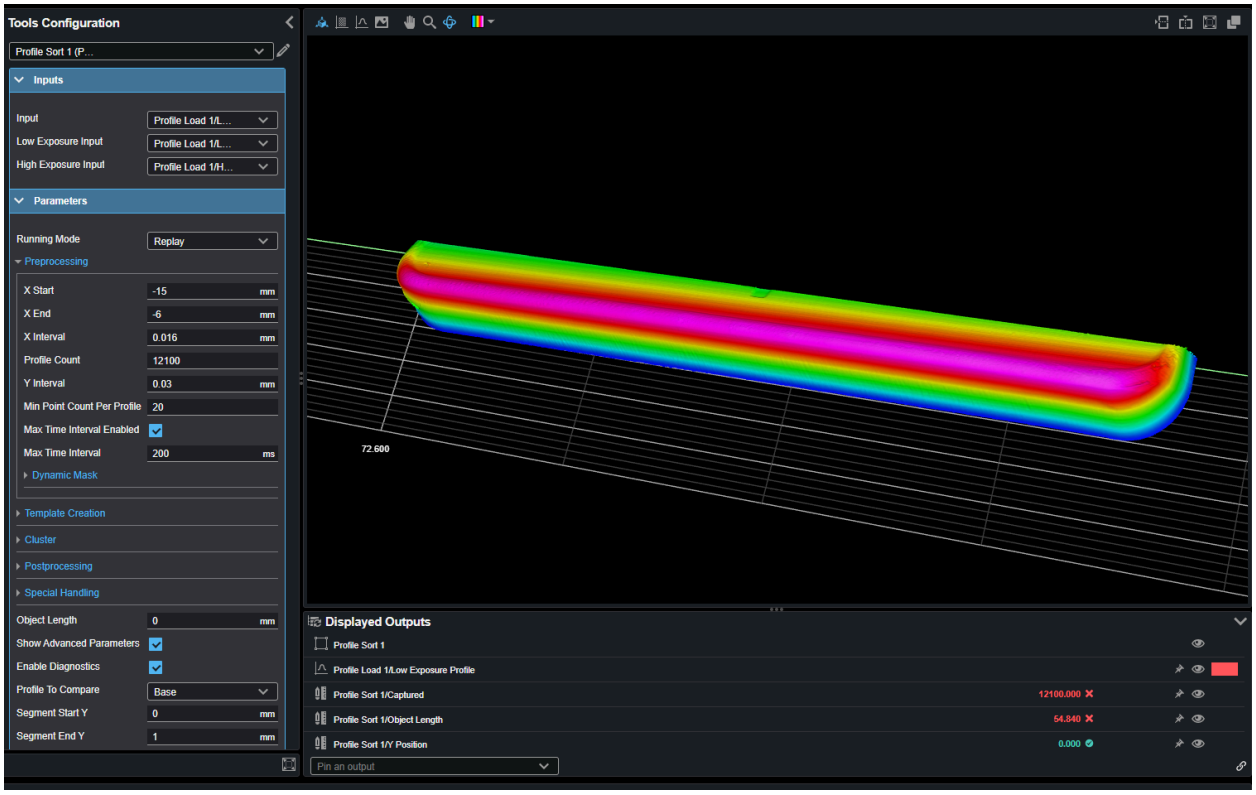
Application Examples

Example 1



Example 2

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