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Surface Distortion Resample

Purpose

The Surface Distortion Resample tool is mainly used to correct the rotational movement distortion with the assistance of checkerboard patterns. It combines "Distortion Correction" and "Resampling" into one tool. The correction is performed in 2D.

Restrictions and Limitations

1. For the checkerboard target to align the system
    a. the checkerboard target must not contain fiducial markers. The tool's corner detection relies on a fully regular alternating black-and-white grid; any embedded marker disrupts this and will cause alignment to fail.



    b. The minimum checkerboard grid requirement (e.g., 5x5 pairs of black-and-white checkers) to calculate 5th-order polynomial functions.

    c. The target must have sufficient dimensions to:

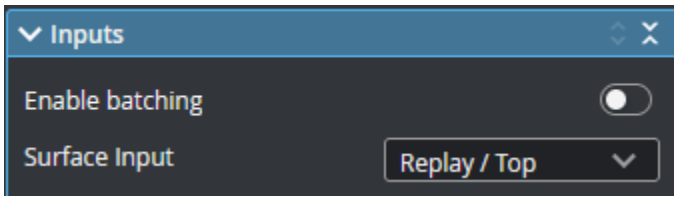
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i. [for the width] Cover the bulk of the sensor's lateral field of view. It is acceptable for the target to be wider than the sensor's X-axis FOV; for example, a 100mm wide checkerboard has been used successfully with a G2610 sensor which has a 10mm FOV.

ii. [for the length] Providing at least 60° of coverage within the rotation scan sector to ensure high-quality alignment. As a guideline, if the perpendicular distance between the sensor center and the rotation axis is 100mm, the checkerboard length should also be at least 100mm.

2. About the scanning
    a. Effective corner detection necessitates a minimum density of 25 scan lines for every checkerboard square.
    b. To prevent blooming around corners, ensure the texture image is not over-exposed or saturated.
3. Current tool functionality is limited to lateral operations and assumes the sensor is mounted vertically with respect to the rotation table, with the optical axis aligned parallel to the rotation axis; adhering to these conditions is essential for minimizing calibration uncertainty.

Inputs



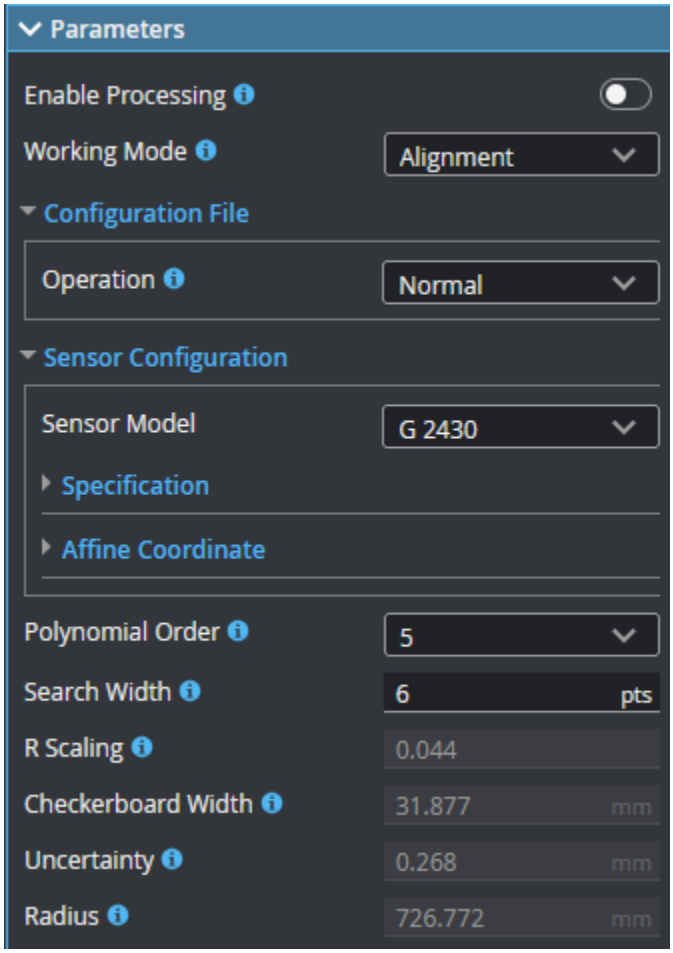
Name	Description
Surface Input	The surface data (both uniform surface and surface point cloud) that the tool will apply calculation and correction to.

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Parameters

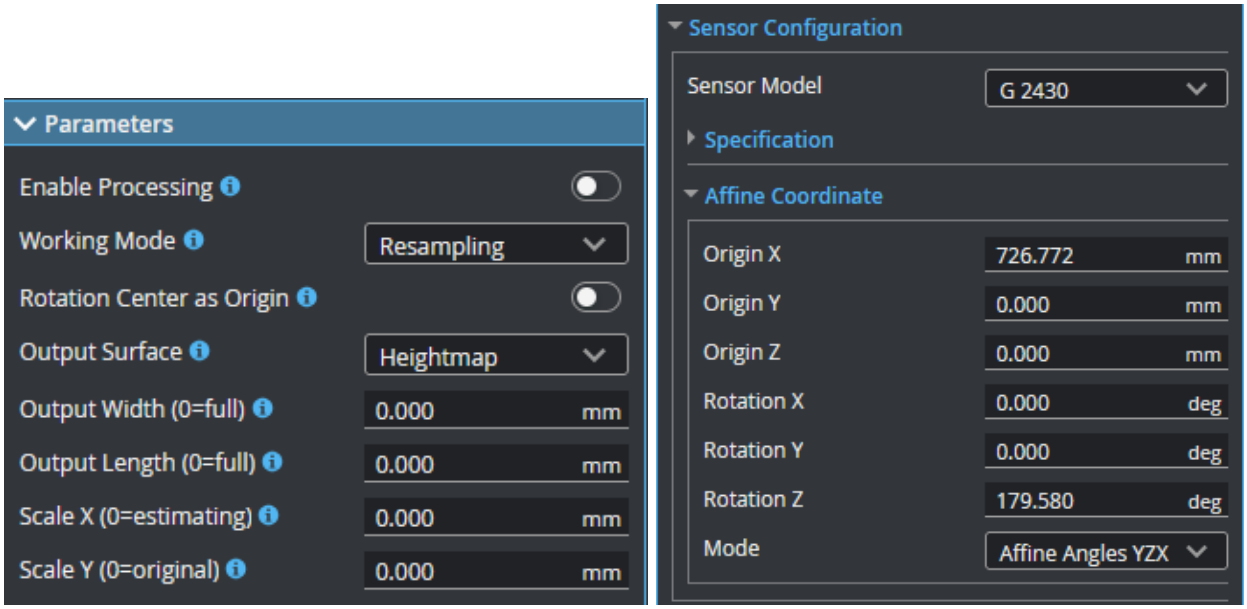
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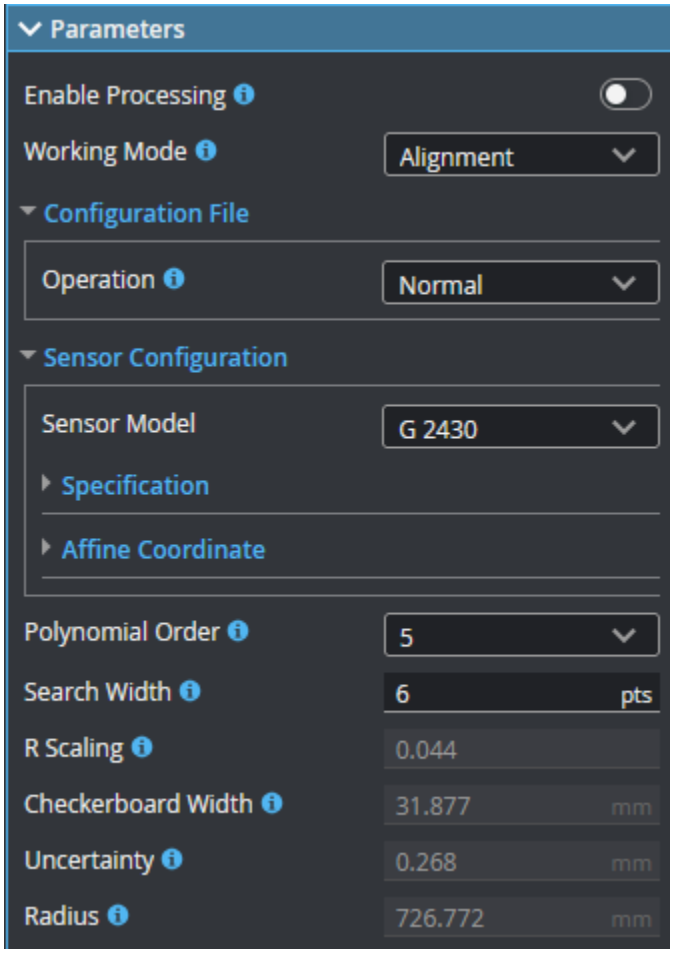
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Name	Description
Enable Processing	When enabled, start the alignment or resample process.
Working Mode	Selects the operation mode. Use \"Alignment\" mode to align the system using a checkerboard target, then switch to \"Resampling\" mode to apply the alignment to live surface data

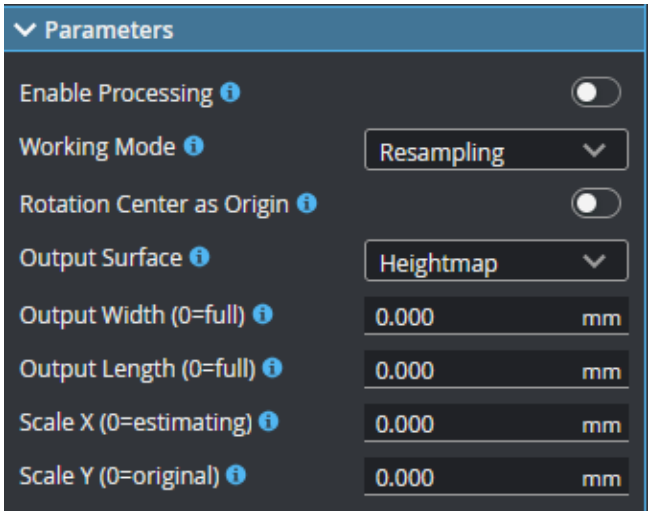
Parameters shown in Alignment mode



Name	Description
Configuration File	Operations relate to the calibration XML files, including • Normal • Load • Save • Delete • Refresh Note that, a Configuration.xml file will be automatically saved right after a successful alignment. On PC, the file is saved “c:/GoTools/SurfaceAlign/Configuration.xml”

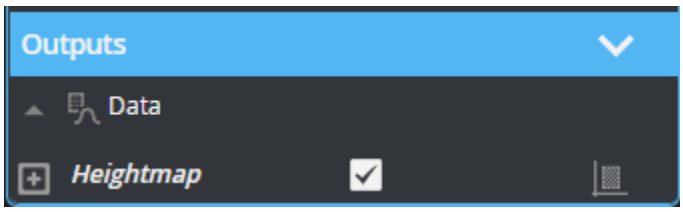
Sensor Configuration	Collapsed section for sensor information, including ● Sensor Model ● Specification ● Affine Coordinate **Notes:** **1. Users usually don't need to specify these parameters.** **2. Once an alignment is done, users MUST NOT edit any Affine Coordinate parameters**
Polynomial Order	Order of the polynomial model to align the system. Higher values capture more complex distortion patterns but may overfit if the calibration data is sparse. The default of 5 suits most setups.
Search Width	Search range in pixel when detecting corners. Increase this value to prevent boundary artifacts from being misidentified as checkerboard corners. Should be at least 1 and never more than 1/5 of the scan line number per square.
R Scaling	These are **read-only** parameters and are updated after a successful alignment. ● R Scaling: Calibrated scale factor of the rotation axis ● Checkerboard Width: Calibrated border width of the detected checkerboard in mm ● Uncertainty: Calibration deviation in mm after Alignment, indicating the residual fitting error. Lower values indicate better calibration quality. ● Radius: Calibrated distance from the rotation axis to the sensor's central axis in mm
Checkerboard Width	
Uncertainty	
Radius	

Parameters shown in Resamping mode



Name	Description
Rotation Center as Origin	If checked, use the rotation center as the origin of output data.
Output Surface	Format of output surface, including • Heightmap • Point Cloud
Output Width (0=full)	These 4 parameters are only shown when “Output Surface” is set to Heightmap Usually keep them as the defaults (all 0s), unless users need a fixed output dimension and/or a fixed resolution of the output uniform surface
Output Length (0=full)	
Scale X (0=estimating)	
Scale Y (0=original)	

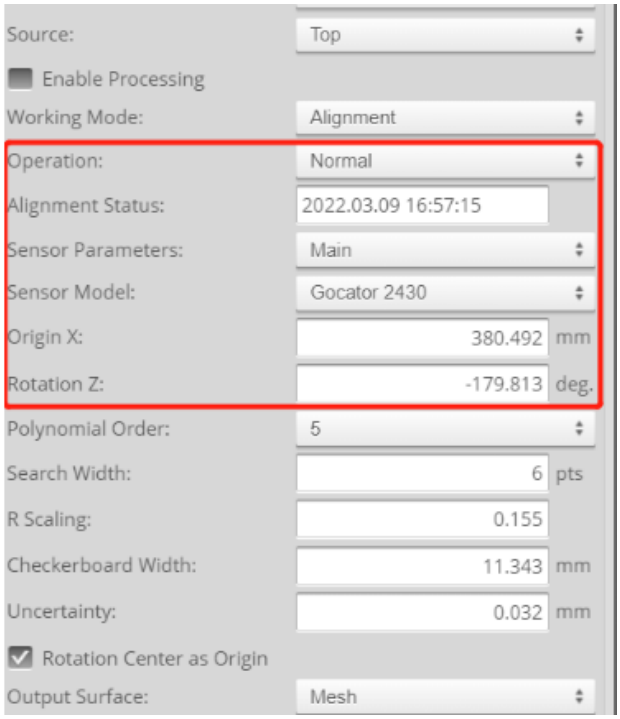
Outputs

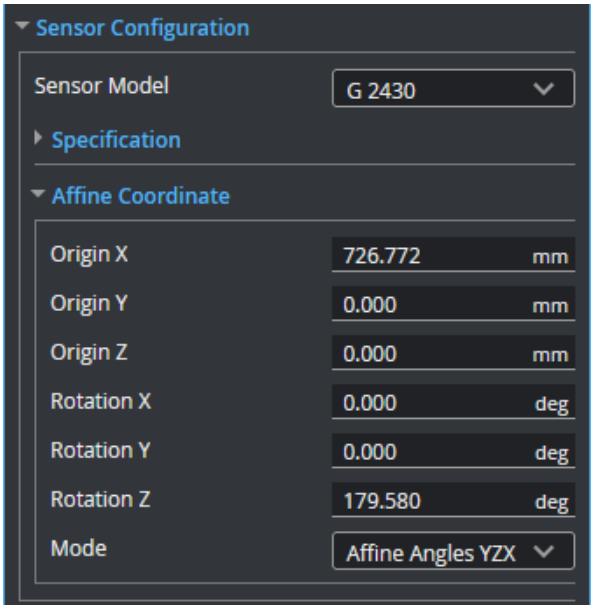


Type	Name	Description
Surface	Heightmap Point Cloud	The corrected surface.

Major Revisions

- Parameters aren't exactly the same any more. For example, Classic's sensor parameters only have Origin X and Rotation Z, while GoPxL shows more (though all the others are unused in this tool)





- Remove the measurement “Processing Time” from GoPxL.
- Classic has the Mesh option for the Output Surface parameter, but GoPxL doesn’t have it any more, as we think it is rarely used