

# CyberGage360 Accuracy Specification

## Introduction

CyberGage30 System Accuracy is measured to ISO10360 Standards adapted to 3D Scanning System XYZ data from NIST Traceable Ball Plate artifacts measuring Ball Sphericity and Ball to Ball Center Distances. The error of each of the measurements is recorded with Total Range Error determining the System Uncertainty for Work Volume and Feature Precision. The error for length relates to System Volumetric Accuracy = MPEe and is a function of the length measured between Ball Centers and is expressed as  $A + L/b$ , where A is the MPE of a measurement of 0 length, L is the measured length within the Work Volume of the Scanner and b is a constant determining the slope of the MPEe function.

**System Volumetric Accuracy =  $0.007\text{mm} + L/10000\text{mm}$  (MPEe)**

**System Repeatability = 0.005mm**

## Procedure

1. Use a predefined Polyworks project that has been created for doing a Gage R&R on the ball plate to be used for the certification.
  - a. The ball plate has been certified per a NIST Traceable measurement system.
  - b. The CG360 is currently Field Calibrated using a designated ball plate.
  - c. The reference model for the Polyworks project was created from the certified data from the designated ball plate.
2. Using the CG360 UI, run the ball plate inspection 5 times.
3. When finished, open the polyworks project and run SPC on the last 5 pieces.
4. Report the Overall Statistics for the Sphere Measurements.
5. Report the Overall Statistics and Values Per Piece for the Ball to Ball Distance measurements.
6. Export the 3 tables to CSV from the report viewer.
7. Import the 3 data sets from above into the Spec Worksheet.xlsx file and copy to the proper worksheets.
8. Verify the data meets specification.

## Data

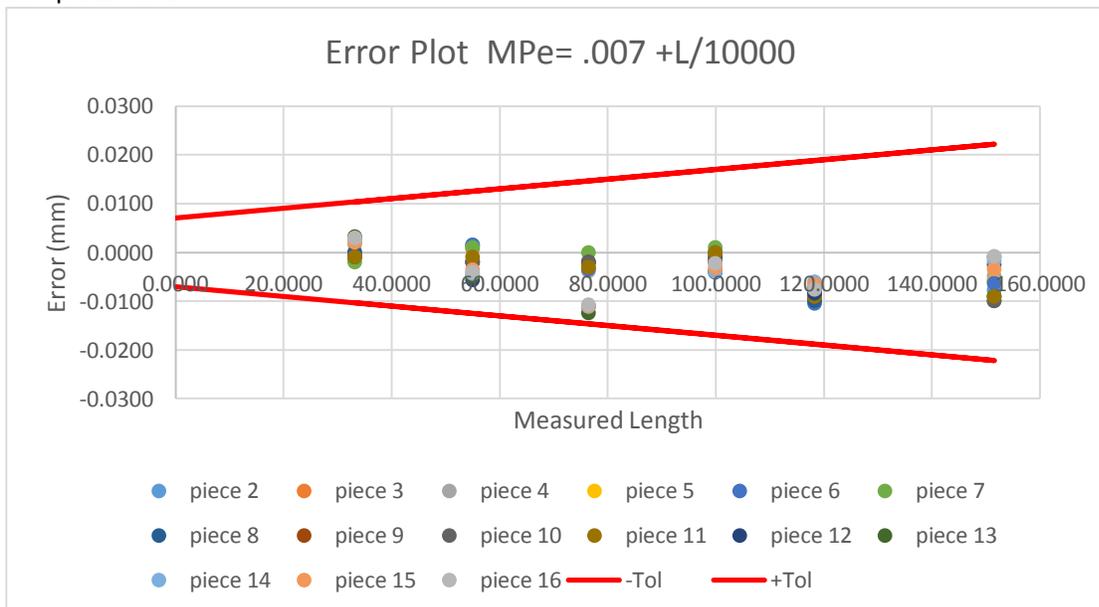
### MPE<sub>p</sub>

For MPE<sub>p</sub> we are measuring the 3 datum spheres on the ball plate that are used to align the plate to the CAD. These are all 1" spheres. Using 3 of these spheres gives us 15 measurements per machine to use for MPE<sub>p</sub> calculation. The maximum absolute value of the error for each sphere and machine is shown below:

System	Sphere	Radial Error
3	datum sphere A	0.0015
3	datum sphere B	0.0074
3	datum sphere C	0.0058
5	datum sphere A	0.005
5	datum sphere B	0.004
5	datum sphere C	0.011
8	datum sphere A	0.0103
8	datum sphere B	0.0057
8	datum sphere C	0.0091
	<b>Max Error</b>	<b>0.011</b>

### MPE<sub>E</sub>

The chart below shows the MPE<sub>E</sub> results obtained from three CG360 machines, systems 3, 5, and 8 using ball plate 1019.



The 2 red lines represent the MPE<sub>E</sub> Tolerance. Each point is a single measurement, and the vertically stacked points represent measurements of the same ball to ball distance. For this chart we have set the tolerance,  $MPE_E = 0.007 + L/10000$ . So at 0 length, we should see a maximum error of 7 microns. there are 35 ball to ball distances times 5 repetitions per machine times 3 machines represented on the chart.

## Repeatability

Working from the same data sets as above, the repeatability of each measurement can be calculated. For both the Sphere Form and Distance measurements, the repeatability will be calculated as 3 Sigma of each measurement, per machine. So in both cases below, each line represents data from 1 machine.

