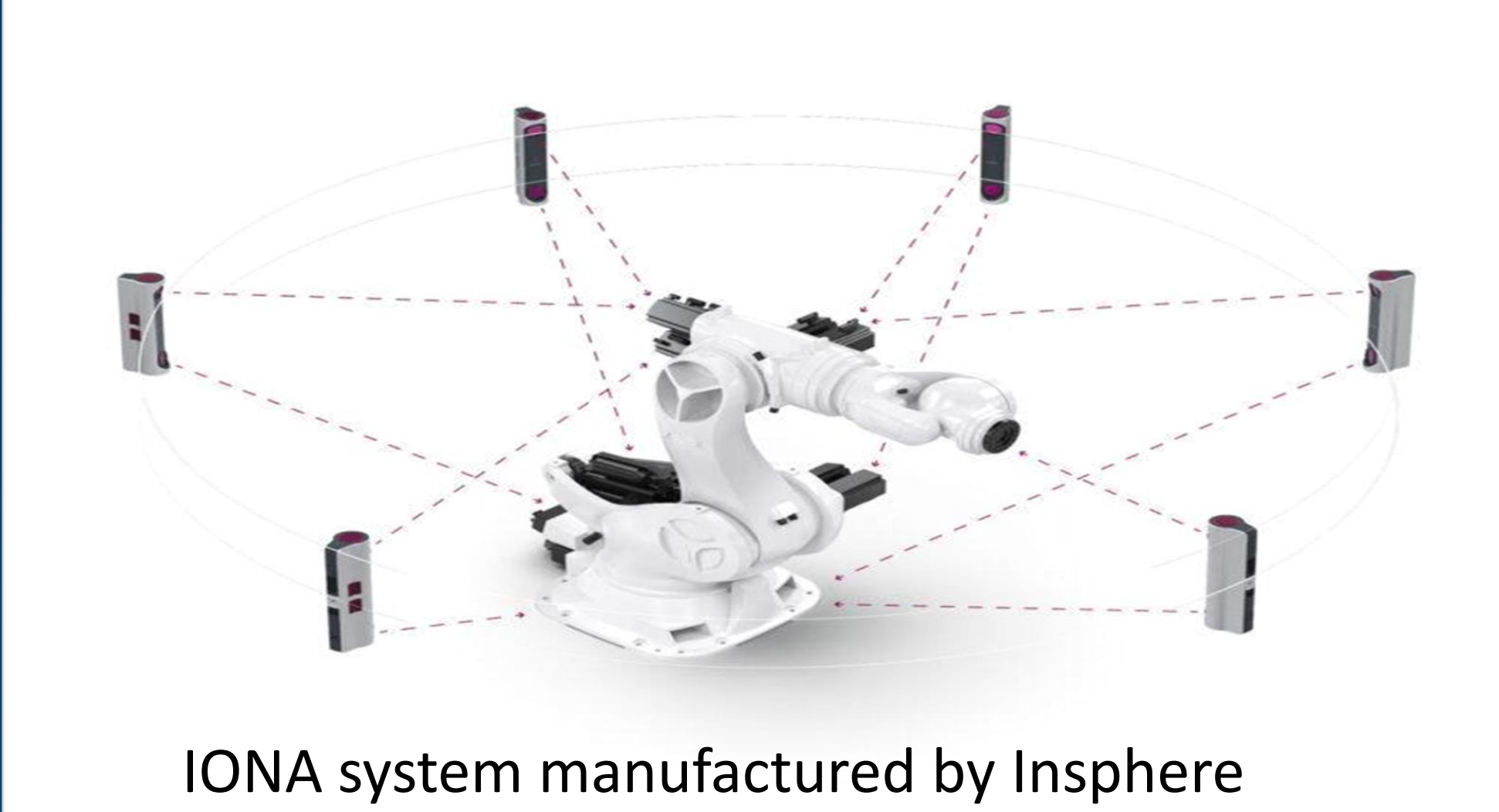
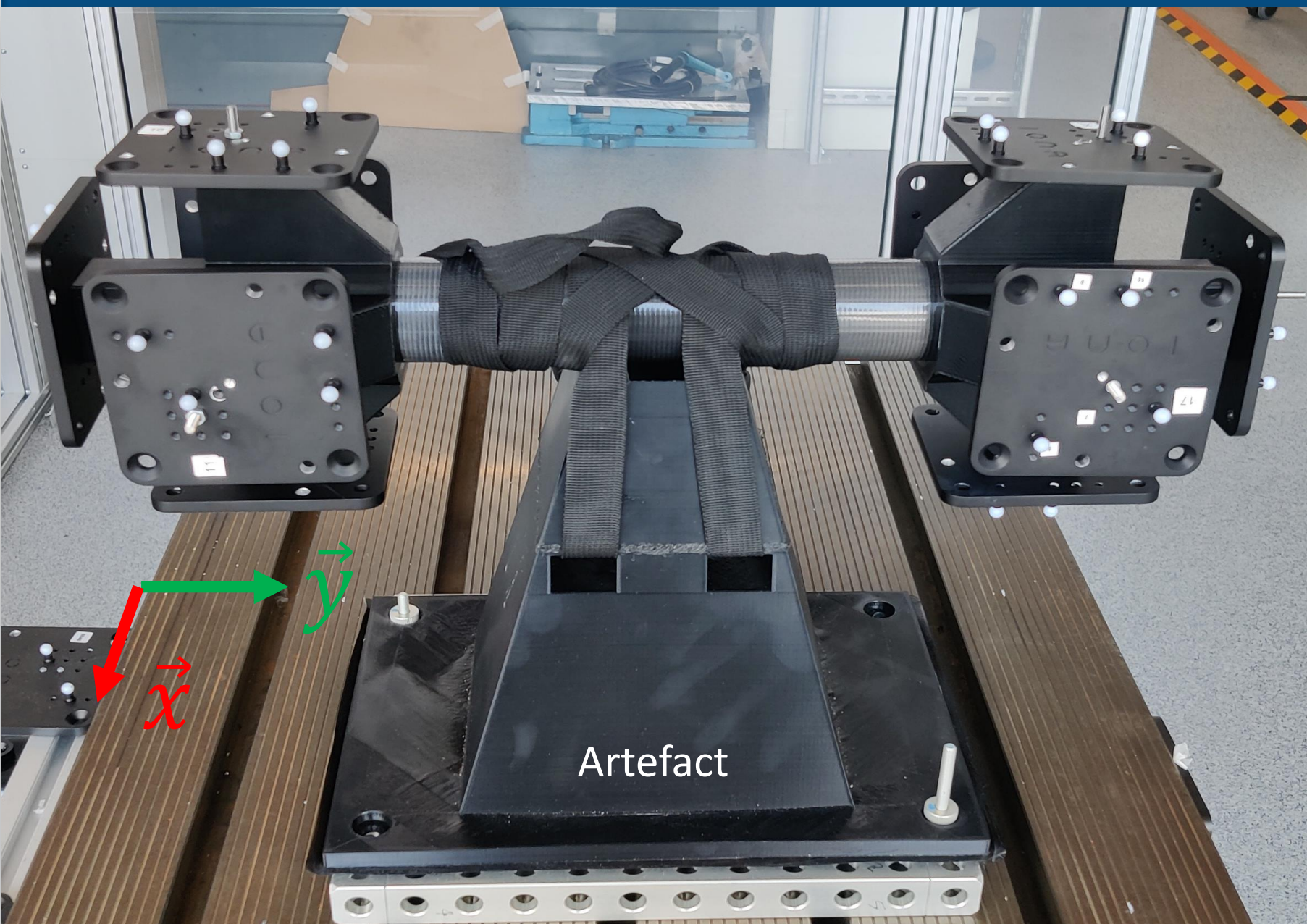


The performance of large-volume metrology (LVM) systems is often quantified using static tests, such as those described in ISO 10360 or ASME B89.4.19, even though they are used to track people and objects that are in motion. Few standards target dynamic measurements, such as ASTM E3064-16, but to what extent do they allow the dynamic performance of these systems to be measured?

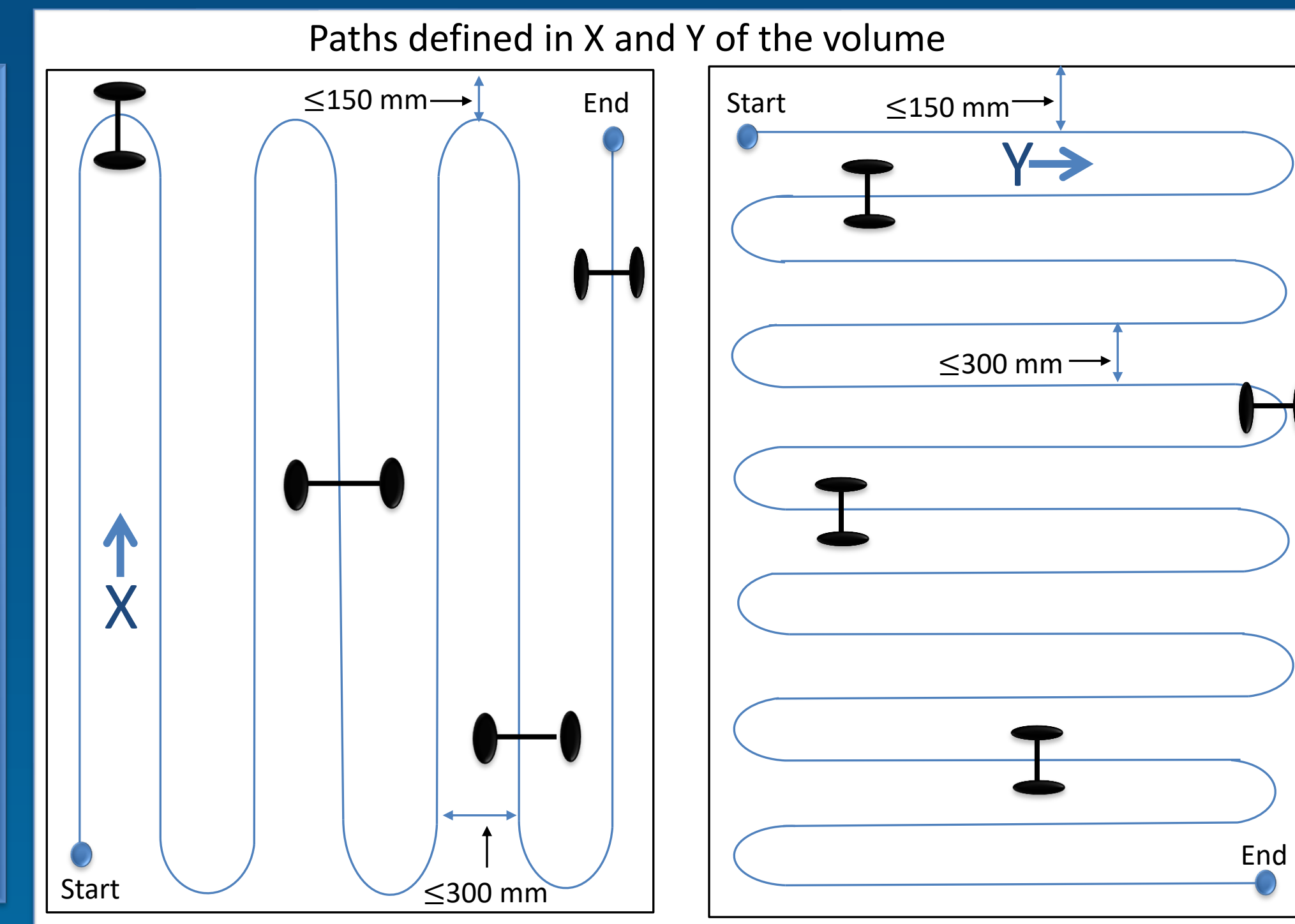
The objective of this work is to reproduce and evaluate the ASTM E3064-16 standard using a multi-nodal distance camera system and explore potential limitations.



ASTM E3060-16



- Volumetric test
- Gauge length with two marker sets attached at each extremity moving at approximately constant speed and maintained in 3 orientations relative to the trajectory of movement: parallel, perpendicular and normal.
- Evaluate relative pose error between marker sets.
- Results are reported in RMS, maximum deviation from mean, and percentile errors in position & orientation.



Standard metric results (Repeatability without reference system):

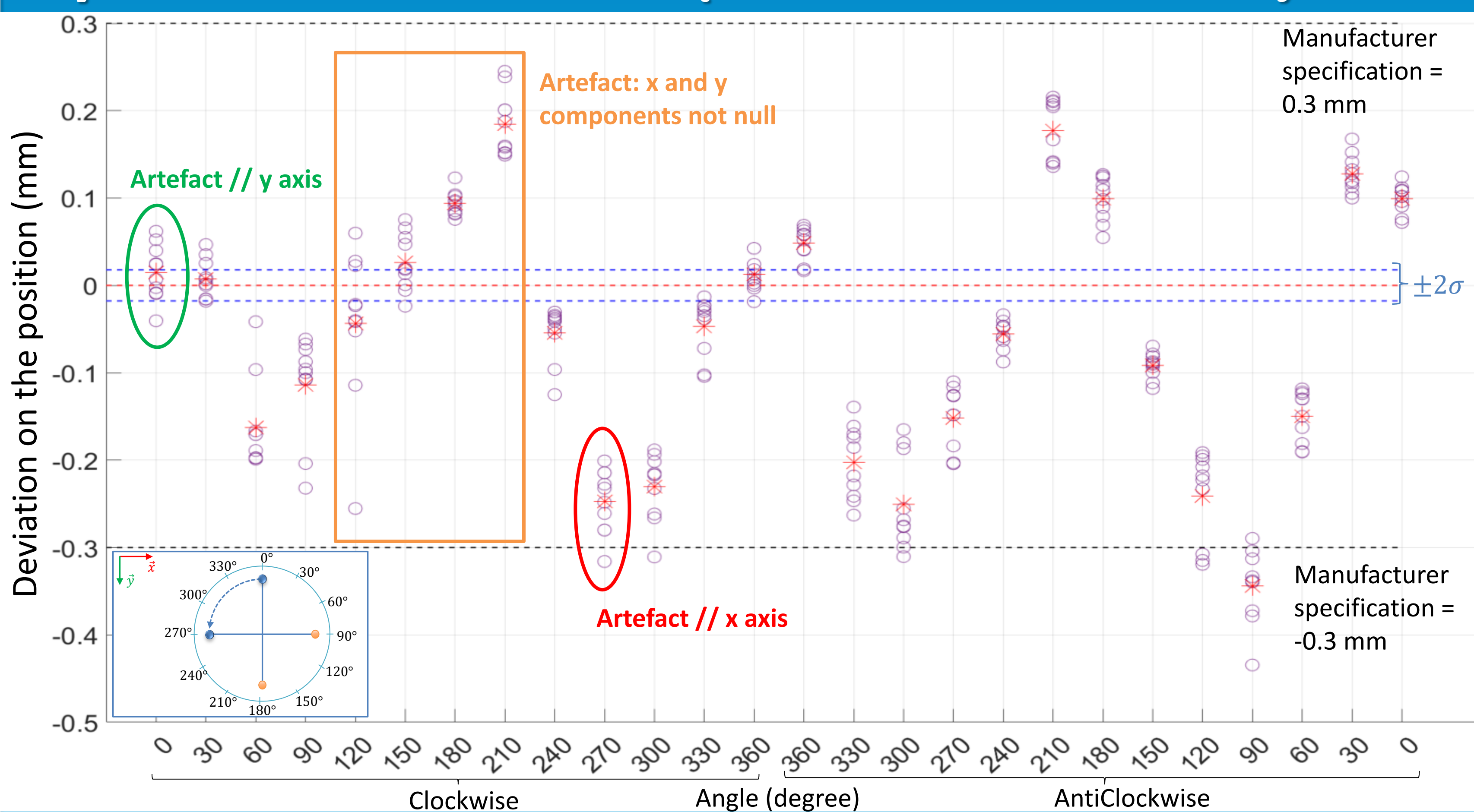
	RMS	Max deviation	Percentile 99.7%	Percentile 95%	Percentile 50%	
Position	0.1870	0.2014	0.2014	0.2014	0.0027	Path in x
	0.0870	0.1199	0.1199	0.1199	0.0323	Path in y
Orientation	0.7417	0.9947	0.9947	0.9947	0.6454	Path in x
	0.9431	0.9992	0.9992	0.9992	0.9532	Path in y

Marker set orientation had a greater influence on relative pose error than position within the field of view.

However:

- Summary statistics give only a single number, and don't provide a detail analyse of the data (example which orientation contribute the most to the error).
- The method is insensitive to temporal effects and is unsuitable to test dynamic performance.
- The method does not capture error on the global coordinate frame which is most relevant to systems that determine this on a frame-by-frame bases.

Expanded tests result (10 measurements):



An expanded data collection protocol has been proposed to enhance the quality of the results:

- Twisting the artefact around its x-axis altering which tiles were in view of difference nodes without altering position in real space.
- Rotating the artefact around the axes perpendicular to the plane of motion (Z axes).
- Varying the speed of motion.

The extended test indicates a greater sensitivity to target orientation and target configuration than absolute position within the working volume. The results indicate that the standard test does not adequately sample orientation. However, the method is insensitive to consistence bias present on both marker sets.

Further Work

Future work will focus on error mapping using a robotic actuator, extending the current standard to include rotation, twisting, and velocity, in addition to the orientation and position already covered. Speed control and latency measurements will also be explored.

Like it?
Scan me please!

