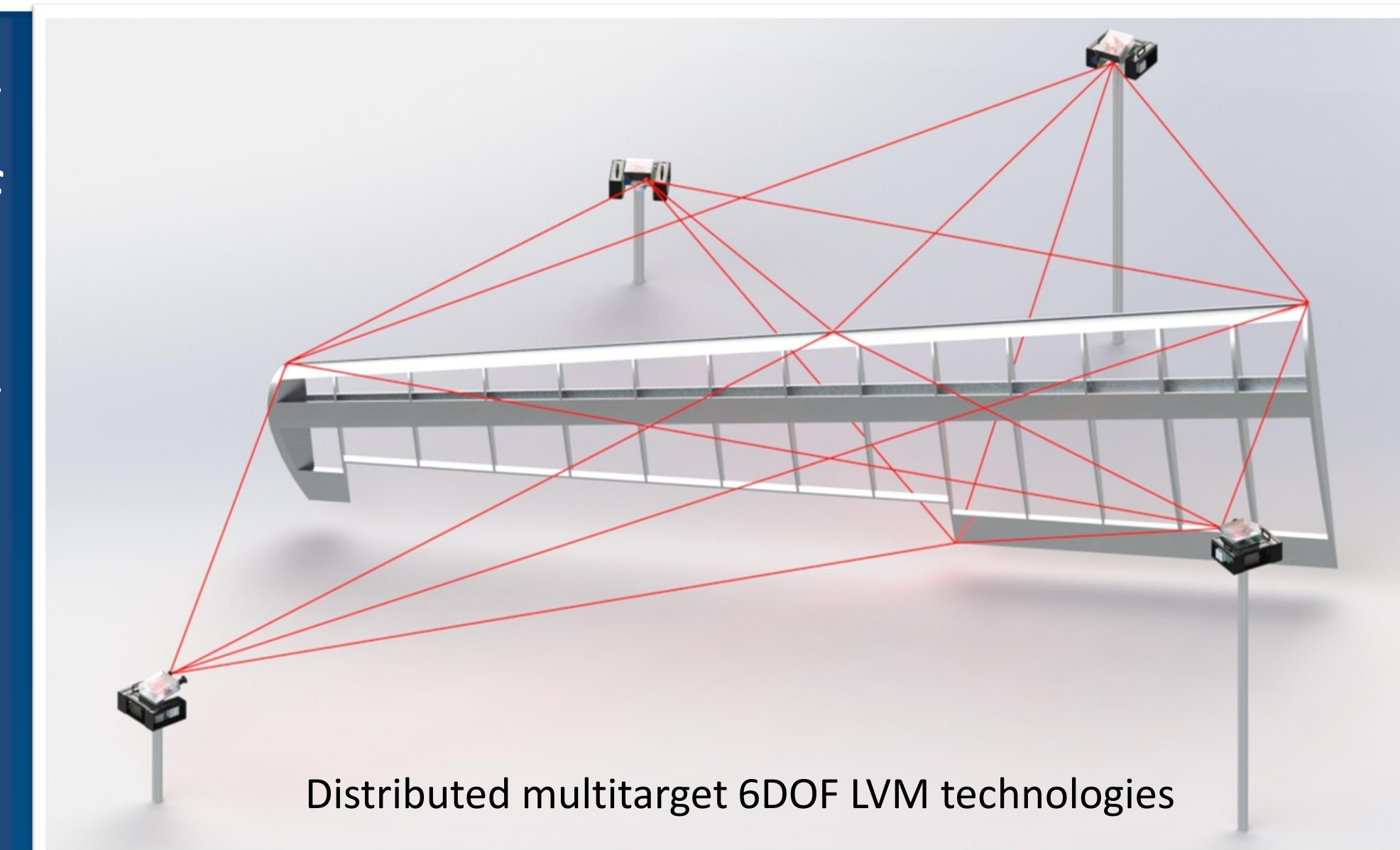


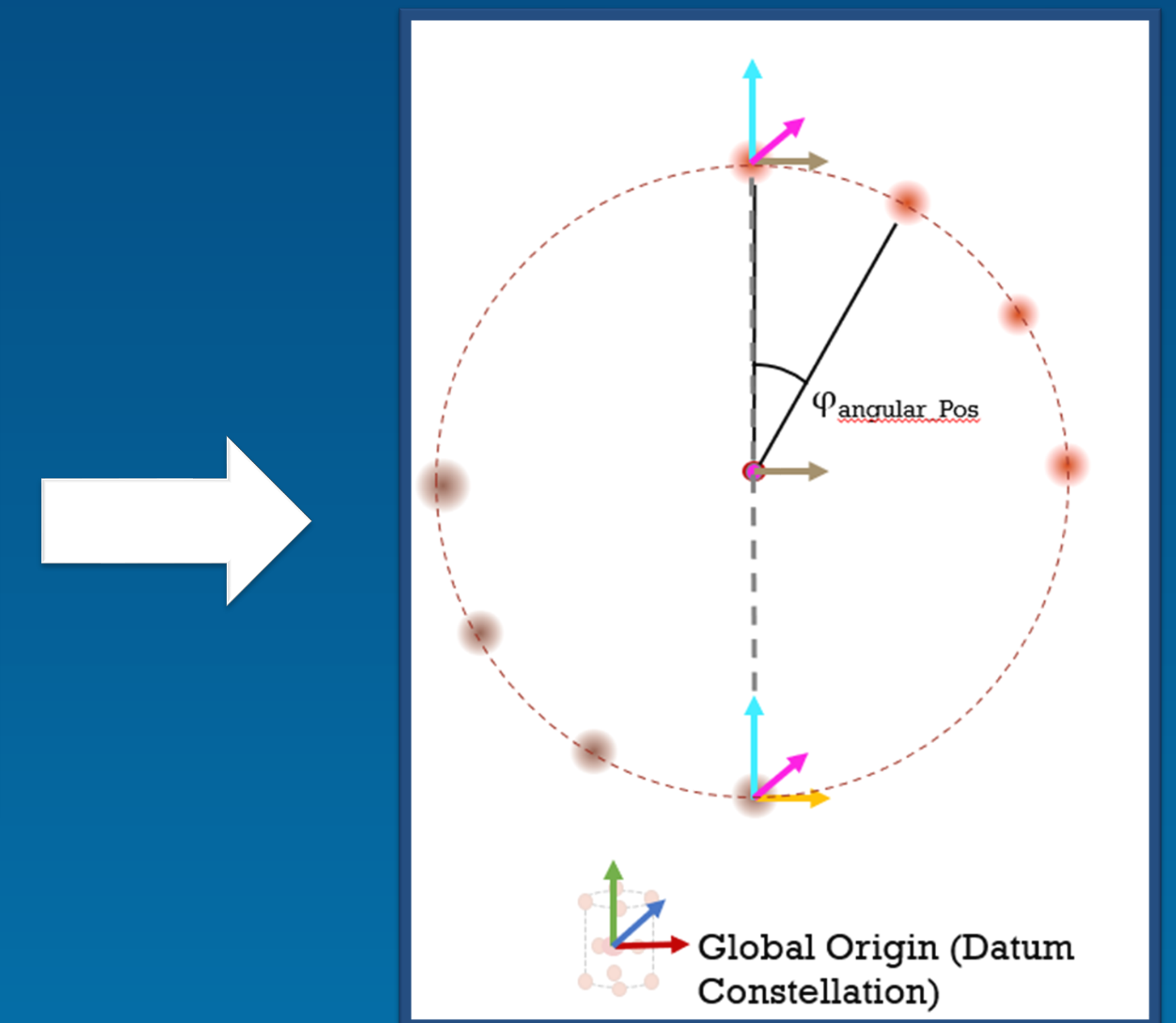
Robots are subject to multiple sources of error that can result in low absolute accuracy which imposes limitations on their application. Distributed multitarget six degrees of freedom (6DOF) large volume metrology (LVM) technologies have been proposed as a potential solution to improve robot guidance and enable more intelligent automation by tracking multiple objects over large working volumes. However, their adoption is hindered by the lack of dynamic test methods in current LVM standards to quantify measurement system performance. **The aim of this project is to develop a generalised test method to quantify the dynamic performance of LVM technologies.**



Methodology

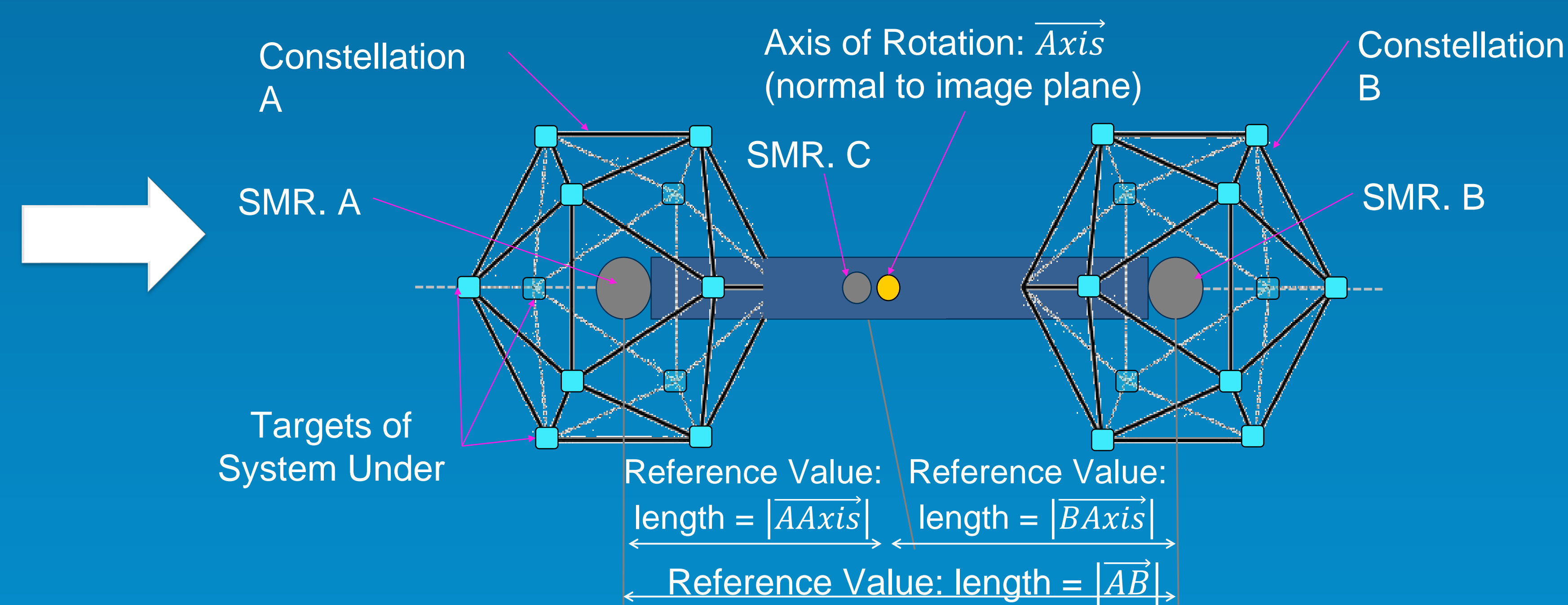
1. Two rotating marker constellations defined a calibrated length gauge.
2. The path is parameterised by the angular position of a synchronised rotational actuator and the absolute pose of the axis of rotation.
3. The orientation can be determined on a per-frame basis in relation to the position vector that describes the length gauge and the normal of the circular path described by the two constellations.

Errors are reported within the intrinsic coordinate system of the path described by the two constellations. This methodology works in a static (stop start) and dynamic mode.



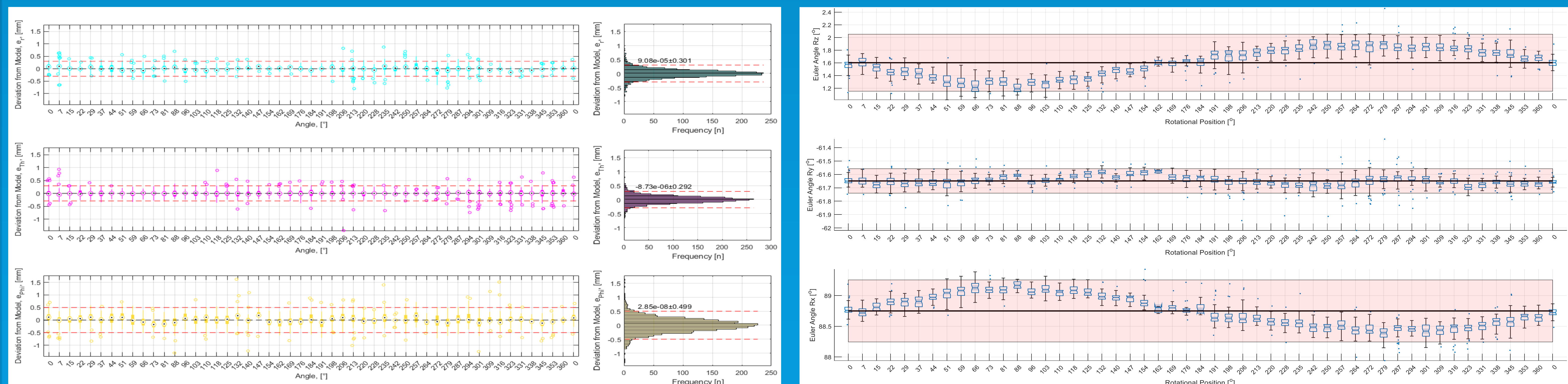
Artefact design

- Ultra-rigid, low thermal expansion, chemically stable body and target constellation frame.
- Well-sampled, homogeneously distributed, Constellation centroid coincident with SMR.A and SMR.B, respectively.
- Collinearity of constellation centroids and the axis of rotation.
- Coplanarity of constellation centroids and SMR.C.
- Perpendicularity of the position vector between the constellation centroids, \overline{AB} , and the axis of rotation, \overline{Axis} .



Results:

Precision of 6DOF measurement as a function of position and orientation through a 360° rotation



Summary and Further Work

The methodology shows promise quantifying 6DOF performance in both a static and dynamic case. The artefact, however, requires further development to ensure rigidity. Additional work is also necessary to synchronise measurement data with the mode of actuation to quantify temporal effects.

Alignment to AMP Institute Technical Themes:

Key words: Automation, Machine tools, Metrology and sensing.