

External Metrology Truss Technology Demonstration (KITE)

Bijan Nemati, Jet Propulsion Laboratory, Pasadena, CA USA

ABSTRACT

To achieve micro-arcsecond astrometry, SIM's external metrology system must track the relative changes of three baseline vectors with a precision of tens of picometers over a one-hour time scale. The Kite testbed is designed to be the technology demonstration for a picometer-class external metrology truss. Four fiducials, two simple corner cubes and two triple corner cubes, are arranged in a planar parallelogram configuration to allow a redundant measurement of truss deformations by six metrology gauges placed between the fiducials. Each metrology gauge is capable of 20-pm relative metrology accuracy and 10-um absolute metrology accuracy, using a beam launcher capable of self-alignment at the arcsecond level. Besides ultra-precision metrology gauges, this level of precision requires characterization of the corner cubes for dihedral errors at the sub-arcsecond level and reflective coating complex index at the percent level. The Kite demonstration involves the articulation of one of the corner cubes to simulate SIM instrument geometrical changes while various performance metrics are evaluated based on the readings of the individual metrology gauges. The test performance metric compares the direct measurement of length changes by one metrology gauge against the computed estimate for the same based on the other five gauges.

Keywords: metrology, corner cube, truss, interferometry, picometer, heterodyne, SIM