

**Title:** The dependence of the Micro-arcsecond Metrology (MAM) Testbed performance prediction on white light algorithm approach

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**Brief Description:**

MAM (Micro-arcsecond Metrology Testbed), is a dedicated systems-level testbed that combines the major SIM (Space Interferometry Mission) subsystems including laser metrology, pointing, and pathlength control. The testbed is configured as a modified Michelson interferometer for the purpose of studying the white-light (science or guide stars) fringe measurement processes.

This paper will compare the performance of various algorithms using the MAM data, and will aid in our recommendation of how the SIM flight system should process the science and guide interferometer data.

The experiment measures the pathlengths via the white-light phase and IR laser metrology. The variance of phase differences between white light and metrology is directly related to our accuracy in relative pathlength measurements.

The full aperture He-Ne laser light is a substitute for the sub-aperture metrology light prior to the installation of SAVV (Sub-Aperture Vertex-to-Vertex) 1.3 um laser metrology as the optical path reference for white light in the system. The analysis of the white-light detected on the CCD and the He-Ne light detected on the photodiode will provide us with the phase differences between the two. Our noise floor in phase (or pathlength) difference measurements is determined by both the full aperture laser light and white light fringe data detected on the CCD.

MAM data are subject to random noise and systematic noise, e.g. drifts and cyclic errors, from instruments. Several fringe estimation algorithms have been developed and validated with the MAM data. Preprocessing procedures for fringe data have also developed in conjunction with estimation algorithms to further enhance the fidelity of data. The performance improvements are quantified with respect to a baseline algorithm, which is the least-squares fitting solution. The adopted performance metrics are long-time Allan variance and short-time chop variance. The algorithms recommended to SIM are based on the improvements and sensitivity studies from MAM data analysis.