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ABSTRACT:

The stellar interferometry mission (SIM), and particularly one of its testbeds [the Micro-Arc-Second Metrology Testbed (MAMTB)] require compund optical pieces the construction and qualification of which, in turn, require very high precision absolute surface metrology gauges.

There are many designs examined in the literature for absolute surface metrology gauges. Some of these use a standard surface gauge and perform repeated measurements in various piece orientations to measure and calibrate several optical pieces simultaneously. As the pieces get flatter and flatter, these suffer from more and more of accumulating subtraction errors. These can not absolutely measure pieces that has a retro-reflector mounted on them.

There is another class of surface metrology gauges that avoid most of these problems. These gauges use a 3-fiber, laser-light + white-light, fiber-tip interferometer to calibrate a flat absolutely without subtraction and use this flat in a split-beam single-fiber, fiber interferometer to measure and calibrate compound optical pieces, like flat mirrors with retro-reflectors embedded in them.

We have been building a system as described above. Our 3-fiber interferometer is in initial alignment and displaying the first fringes. The split-beam, single-fiber interferometer is under construction. Both interferometers are designed to operate in vacuum, mounted on one top of another in a mezzanine-type arrangement in our 4 ft. vacuum chamber. In addition, another smaller white light interferometer has been built to manufacture some of the compound optics while the main gauges are being developed.

In this paper, the details of the design, construction and performance

of these pair of interferometers, both in air and in vacuum will be discussed. We expect the system to be fully functional and making measurements at the time of this conference.

The research described is performed at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

KEY WORDS: Spaceborne interferometry, high precision metrology

BRIEF BIOGRAPHY:

The author is a member of the technical staff in the Interferometry Metrology and Optics group of the Interferometry and Large Optical Systems section at JPL. After getting his Ph. D. from Caltech, he has worked in the Gravitational Physics Group at Caltech, in the Artificial Intelligence Laboratory at MIT and in the LIGO Project at Caltech as a Staff Scientist.