Alignment of the metrology and the starlight beams of the MAM testbed in order to enable the micro-arcsecond level performance needed by SIM.

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Poster presentation

BIOGRAPHY

Dr. Renaud Goullioud has an engineering degree (1994) in electronics from the Institute of Chemistry and Physics of Lyon (France) and a Ph. D. in micro-electronics. He has been working at JPL in the Interferometry Technology Program since 1997, as an optical engineer. He has developed several optical test-beds related to the SIM mission. Since 2000, he has been the lead of the SIM Test-Bed 3. In 2001, he took the additional responsibility of the optical integration of SIM's Macro-Arcsecond Metrology testbed.

ABSTRACT

Future space-based optical interferometers, such as the Space Interferometer Mission, require fringe measurements to the level of picometers in order to produce astrometric data at the micro-arc-second level. To be more specific, it is necessary to measure both the position of the starlight central fringe and the change in the internal optical path of the interferometer to a few tens of picometers. The internal path is measured with a small metrology beam whereas the starlight fringe position is estimated with a CCD sampling a large concentric annular beam. One major challenge for SIM is to align the metrology beam with the starlight beam to keep the consistency between these two sensors.

The Micro-Arcsecond Metrology testbed (MAM) developed at the Jet Propulsion Laboratory features an optical interferometer with a white light source, all major optical components of a stellar interferometer and heterodyne metrology sensors. The setup is installed inside a large vacuum chamber in order to mitigate the atmospheric and thermal disturbances. Both the white light and metrology sensors have been proven to work independently at the required levels. The next step is to integrate them together as a micro-arc-second capable system. A complex alignment sequence has been developed in order to match the absolute tilt and shear of the metrology and starlight paths to 1 microradian and 10 micrometers respectively. This paper describes the MAM optical setup, the alignment process, the contribution of the fine alignment to the final performance and how they relate to SIM.

KEY WORDS: Interferometry, SIM, metrology, alignment.

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