Space Interferometry Mission System Testbed 3: Architecture

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Abstract

The Space Interferometry Mission (SIM) System Testbed-3 has been integrated in JPL's new Optical & Interferometry Development Laboratory. The testbed consists of a three baseline astrometric interferometer whose optical layout is functionally equal to SIM's current flight layout. The main testbed objective is to demonstrate nanometer class stability of fringes in the dim star, or science, interferometer while using path length & angle feed-forward control, and while the instrument is integrated atop a flight-like structure. This work marks the first time an astrometric 3-baseline interferometer is tested on a flight-like structure rather than on rigid optical tables. The path length & angle feed-forward control signal is synthesized using data from two guide interferometers and the external metrology systems. Each interferometer is fitted with an internal metrology system, a delay line for fringe tracking, and a star tracking system. In addition, the external metrology system is used to monitor changes in the length & direction of the science baseline vector. The instrument is mounted on a flexible structure similar in scale and dynamic response to the flight article. This flexible structure is supported by a ½ Hz class isolation system to simulate a quasi-free-free condition. A structure similar to the spacecraft "backpack" currently planned for SIM is connected to the instrument's flexible structure using a passive isolation system. This system and individual reaction-wheel-actuator-isolators are part of a dual isolation scheme to reduce instrument jitter. This paper describes instrument architecture, preliminary measurements, and a brief review of the instrument's theory of operation.