METIS SCAO - implementing AO for ELT

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Abstract

METIS, the Mid-infrared ELT Imager and Spectrograph is among the first-generation instruments for ESO's 39m Extremely Large Telescope (ELT). It will provide diffraction-limited spectroscopy and imaging, including coronagraphic capabilities, in the thermal/mid-infrared wavelength domain (3 μm – 13.3 μm). Its Single Conjugate Adaptive Optics (SCAO) system will be used for all observing modes, with High Contrast Imaging imposing the most demanding requirements on its performance.

The final design review of METIS took place in fall of 2022; the development of the instrument, including its SCAO system, has since entered the Manufacturing, Assembly, Integration and Testing (MAIT) phase. Numerous challenging aspects of an ELT AO system are addressed in the mature designs for the SCAO Control System and the SCAO Hardware Module: the complex interaction with the telescope entities that participate in the AO control, wavefront reconstruction with a fragmented and moving pupil, secondary control tasks to deal with differential image motion, non-common path aberrations and mis-registration. A K-band pyramid wavefront sensor and a GPU based real-time computer, tailored to needs of METIS at the ELT, are core components. The implementation of the METIS SCAO system includes thorough testing at several levels before the installation at the telescope. These tests require elaborate setups to mimic the conditions at the telescope.

This presentation provides an overview of the design of METIS SCAO as it will be implemented, the main results of the extensive analyses performed to support the final design, and the next steps on the path towards commissioning.

Keywords: METIS, SCAO, ELT

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