
The RTC for METIS SCAO

Thomas Bertram¹, Florian Briegel¹, Hugo Coppejans^{*†1}, Carlos Correia², Martin Kulas^{‡1}, Horst Steuer^{*§1}, and Philip Neureuther

¹Max Planck Institute for Astronomy – Germany

²Space ODT Porto – Portugal

Abstract

METIS, the Mid-infrared Imager and Spectrograph for the ELT, is one of three first generation science instruments and has recently completed its final design phase. Its Single Conjugate Adaptive Optics (SCAO) system will provide the performance of an Extreme Adaptive Optics system which enables high contrast imaging observations in the thermal/mid-infrared wavelength domain ($3\ \mu\text{m} - 13.3\ \mu\text{m}$).

The real-time computer (RTC) is the central component of the SCAO real-time control system. It executes the time critical wavefront control loop as well as associated control tasks by processing the data from the pyramid wavefront sensor and controlling the set of ELT actuators dedicated to Adaptive Optics. A total of 4868 commands to be computed at a loop rate of up to 1 kHz impose a number of demanding constraints in terms of memory throughput and computing power on the Hard Real-Time Core (HRTC), which employs GPU acceleration for the bulk of computations.

Several auxiliary functions need to be in place to establish and maintain the quality of the wavefront correction. Among them are the control of the pupil position, the compensation of misregistration and of non-common path aberration, and the adaption of the temporal control parameters.

The main wavefront control loop and many of the auxiliary functions have been prototyped to verify timing requirements and to identify the most suitable algorithms. A median RTC computation time of $382\ \mu\text{s}$ was achieved for a 300k samples (5 minutes) run. The results are presented in this paper together with the foreseen RTC hardware and the software deployment within the SCAO Control System.

Keywords: AO, Control System, NCPA, PSI, QACITS, RTC, HRTC, SRTC, COMPASS, GPU, METIS, ELT

*Speaker

†Corresponding author: coppejans@mpia.de

‡Corresponding author: kulas@mpia.de

§Corresponding author: steuer@mpia.de