
First on-sky demonstration of the C-BLUE One camera and the HEART RTC platform on REVOLT

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Abstract

REVOLT (the Research, Experiment, and Validation of Adaptive Optics with a Legacy Telescope) is an experimental AO test bench aimed at validating on-sky new critical AO technologies. It is designed for the Coudé focus of the Dominion Astrophysical Observatory 1.2m McKellar Telescope, in Victoria BC, Canada, which is part of the National Research Council Herzberg Astronomy and Astrophysics (NRC-HAA) Research Center.

REVOLT currently integrates a 277-element ALPAO deformable mirror (DM), a 17x17 sub-aperture Shack-Hartmann wavefront sensor (WFS) and an InGaS science camera in a single conjugate AO (SCAO) configuration. Visible light is sent to the WFS, which is based on a C-BLUE One camera purchased from First Light Imaging, while near-infrared light is directed to the science camera. The AO system is driven by a Real-Time Controller (RTC) based on HEART, an RTC software framework and toolkit developed at NRC-HAA. HEART-based RTCs are currently being implemented in NFIRAOS for the Thirty Meter Telescope, as well as GPI 2.0, GNAO and GIRMOS for the Gemini North Telescope.

REVOLT has been successfully tested on sky during one night in August 2022, and two more nights in September 2022. These were the first ever on-sky tests for the C-BLUE One camera and for HEART. In this paper, we report on the preliminary results obtained during these observing nights. We demonstrated very stable AO correction on various targets at a frame rate of 1 kHz with minimal lag (1.4 ms from end of WFS exposure to DM update), consistently achieving significant image quality improvements, with H-band Strehl ratios between 20% and 35% on bright targets, depending on conditions. Better system calibrations will likely allow further performance improvements in the future.

We also successfully tested stable injection of the REVOLT-corrected light into a mono-mode fiber, in preparation for testing a new photonic spectrograph developed at the NRC-AEP (Advanced Electronic and Photonic) Research Centre during fall 2022.

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