

Research Result Report

ICRR Inter-University Research Program 2024

Research Subject: Development of the CTA/LST telescope control system

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Summary of Research Result :

This project is dedicated to the development of the high-level telescope control system (TCS) for the Large Size Telescopes (LSTs) of the next-generation CTA Observatory. TCS developed here in FY2020-2023 automates telescope operations and allows Observatory personnel to treat it like a “black box”, responding to the predefined high-level commands. The system also enables robotic operations, including remote control from the partner institutions in Japan.

In FY2024 developers from ICRR and the University of Geneva enhanced automatic TCS reactions to abnormal operational conditions and performed another round of successful integration tests with the CTA array control and data acquisition (ACADA) system. Corresponding LST/TCS team achievements in FY2024 are summarized below.

Telescope automation

- automatic fault handling logic was extended and stabilized in order to require human intervention only in case of critical problems with telescope subsystems. TCS also gained a new automatic recovery logic active also during inactivity periods, aimed at reducing the time needed for recovery in case of problems in-between the scientific observations.
- TCS was also extended to actively protect the telescope from harsh external conditions. In a particular case of a sunrise, it gradually switches off affected telescope camera subsystems before sunlight triggers their own safety routines.

- remaining auxiliary subsystems were integrated and can be controlled via TCS when necessary

Integration with ACADA

- dedicated continuous integration pipeline has been set up to perform automatic and reproducible TCS compilation and testing. The pipeline runs few hundreds of different tests covering around 90% of all camera-related TCS code and upon success provides the pre-built TCS version that is ready for the deployment on-site independently or as a part of ACADA. Both TCS builds and pipeline code are shared with the ACADA team for the eventual integration that will ensure the automatic compliance of the prepared TCS and ACADA releases.
- configuration files data base format and access API has been agreed between the LST/TCS and CTA/ACADA teams
- regular integration tests between LST/TCS and CTA/ACADA teams have been organized to ensure the coherency of the on-going control software development on both sides. The performed tests revealed no TCS critical issues, re-enforcing an earlier conclusion of TCS compliance with CTA requirements.

Adaptation to subsequent LSTs and joint observations with MAGIC

- dedicated trigger delay tables for joint observations with the neighboring MAGIC telescopes have been added to LST/TCS. Such “stereo” observations allow for an improved telescope sensitivity and are regularly planned between the LST and MAGIC collaborations.
- TCU and its web-interface eGUI have been prepared to be installed on the control servers of the currently being built LST telescopes 2-4. Also the control software (including TCS) deployment scheme for multiple LSTs, essential for their coherent setup, has been prepared.

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