Form 8

Research Result Report
ICRR Inter-University Research Program 2025

Research Subject: Engineering runs of the first Large Size Telescope of CTA and construction of LST2-4 in La Palma Canary Islands, Spain

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Summary of Research Result :

Figure 1: Completed LST1 in La Palma in October 2018.

The purpose of the project is to commission the first Large Size Telescope (LST, see Figure 1) of the CTA project in La Palma, Canary Islands, Spain. In FY2024 the goal was to finalize the validation of the LST1 telescope and the interface between the LST telescope and the central control system of the CTA observatory called ACADA.

Status of the commissioning: Several commissioning goals have been achieved in FY2025. In particular, the telescope control software has been upgraded from Linux CentOS 7 to AlmaLinux 9 as required by CTAO. Also, the camera control software has been upgraded to use Java 17 instead of outdated Java 8 version as well as gradle 8.7 instead of gradle 5.6. Migration of all control software to CTAO gitlab has been completed. Moreover, we completed implementation of authentication at a lower control software level (so-called MOS), which is an essential safety feature to prevent unauthorized telescope control and make sure that telescope cannot be commanded when there are people working inside the telescope. From the operation point of view we started to implement a system with at least one professional operator onsite during observations, which is expected to improve the stability of operation in FY2026 after the training period of the operators is completed. We also agreed with CTAO on a short list of items to be solved before the telescope can be accepted by CTAO, and to close the list in FY2026.

Scientific exploitation: LST1 took regular observations in 2025. The amount of data taken amounts to over 3300 hours since January 2020 underlying that the telescope is working reliably over the last years. Detailed studies of a BL Lac flare, detection of recurrent nova RS Ophiuchi, constraints on emission from magnetar SGR 1935+2154 and constraints on TeV gamma-ray emission from supernova SN 2024bcn have been published in FY2025, proving the excellent sensitivity and energy resolution of a single LST at lowest energy gamma rays. Also, a hint from a very bright GRB GRB221009A has been published contributing to our understanding of jet structure inside long gamma-ray bursts. Some 10 more scientific publications are in preparation.

LST2-4 construction: In parallel with the LST1 operation, the construction of the three further LSTs in La Palma, LST2-4, continued. In FY2025 the camera supporting arch of LST-2 has been installed. Following the arch installation the telescopes have been brought to the park position towards North and all 198 mirrors have been installed in LST2. In Autumn 2025 the camera of the LST4 telescope has been successfully installed. Due to manufacturing mistakes, moving elements inside the camera access platforms of LST2-4 had to be significantly redone. This work has been completed in FY 2025. The status of the installation at the end of FY2025 can be seen in Figure 3. Next steps in the installation will be camera installation of LST-3 (April 2026), camera installation in LST-2 (June 2026). LST-4 first light is approaching, only missing a few calibration devices to be installed and drive system of the telescope to be validated. LST-3 and LST-2 will follow in FY 2027.

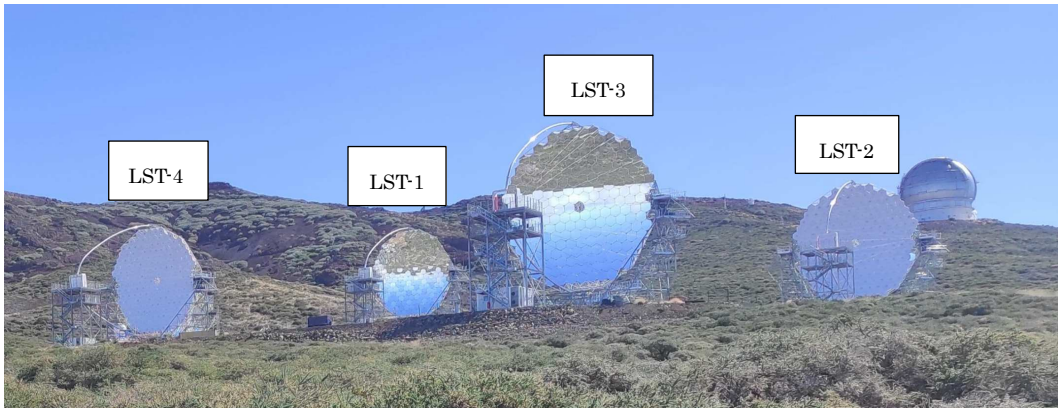

Figure 3: Status of the LSTs in La Palma in FY2025.