Form 8

Research Result Report
ICRR Inter-University Research Program 2023

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

Principal Investigator: MAZIN, Daniel

Participating Researchers: Daniela Hadasch, Koji Noda, Juan Cortina, Carlos Diaz, Thomas Schweizer, Holger Wetteskind, Carlos Delgado, Riccardo Rando, Takayuki Saito, Armand Fiasson, Ievgen Vovk, Marcel Strzys

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 FY2023 the goal was to validate 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 FY2023. In particular, 30% of LST commissioning open items have been closed to increase the safety and reliability of the telescope, most of them related with the control software. On the hardware side, a snow cover has been installed to protect sensitive telescope parts, in particular cables, from ice falling from the mirrors in winter. One of the highlights of FY2023 was an integration test between the control software developed by the CTA ACADA team and the controls software developed by the LST collaboration, involving in total about 30 people from the two projects. The integration took place in La Palma in September and October 2023 and went very well, underlying the robustness of the telescope's software and hardware.

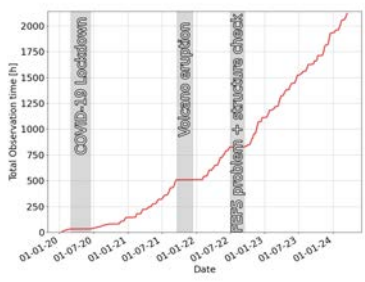

Figure 2: Data taken since Jan 2020

Scientific exploitation: LST1 took regular observations in 2023. The amount of data taken (see Fig. 2) amounts to over 2000 hours since January 2020 underlying that the telescope is working reliably over the last years. In December 2023, a gamma-ray signal from a distant Active Galactic Nuclei OP313 (z=0.997) has been discovered with LST1 (https://www.astronomerstelegram.org/?read=16381) proving that the sensitivity of LST1, even as a stand-alone telescope, is sufficient to produce great scientific results. A corresponding publication on this discovery is in preparation. Several other scientific results are in preparation: RS Oph detection, study of the Crab pulsar, limits of the emission from GRB221009A. Already published in FY 2023 are the following papers: LST1 performance (Abe, H., et al,: ApJ, 956:80 (2023)), LST1-MAGIC performance (Abe, H., et al,: A&A, 680, A66 (2023)), and LHAASO J2108+5157 (Abe, S., et al. A&A, 673, A75 (2023)). 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, is ongoing. In FY2023 the civil works on the three telescopes have been finalized. In the next step, the azimuth rail has been mounted. After that the mechanical structure has been erected and the mirror dish assembled. The status of the works as of the end of FY2023 can be seen in Figure 3. One can see that the works are staged: LST4 (on the left) is the most advanced, followed by LST3 and LST2. The telescope construction works are expected to finish by FY2026 with first light of LST4 in FY2026 followed by LST3 and LST2.

Figure 3: Status of the LSTs in La Palma. From left to right: LST1, LST2, LST3 and LST4

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