

Research Result Report ICRR Inter-University Research Program 2022

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 FY2022 the goal was to validate the sensitivity of the instrument and to increase the availability of the telescope to the one required by CTA to be above 95% over a longer period of time.

Status of the commissioning: Several commissioning goals have been achieved in FY2022. In particular, **automatic follow up of Gamma Ray Bursts, without intervention of operators**, has been validated and

is now routinely used. Moreover, an automatic follow up of MAGIC telescopes has been implemented and is successfully used, which increased the duty cycle of the joint MAGIC-LST observations by some 25% because there is no longer a need of manual coordination between the MAGIC and LST shift crews. LST1 is operated from remote and locally onsite thanks to the periodic IT and security upgrades

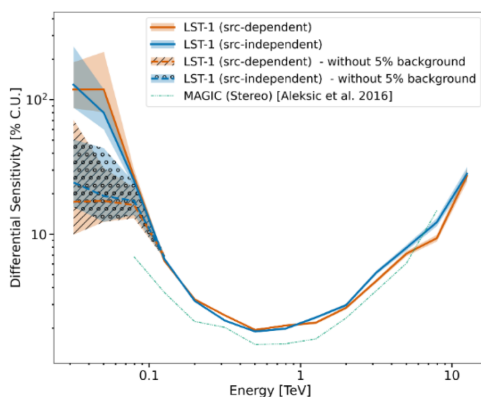


Figure 2: Achieved flux sensitivity of LST-1

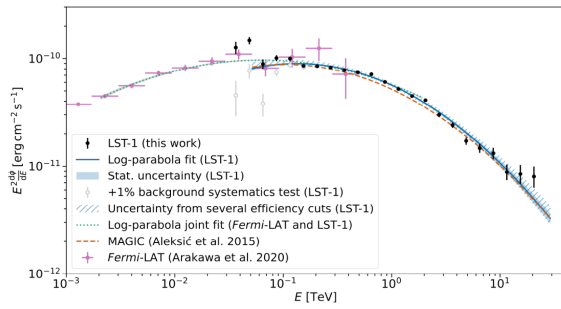


Figure 3: Energy spectrum of Crab Nebula with LST1

performed in FY2022. A new weather station has been installed in LST1, providing vital safety information on the weather conditions during operation. The LST1 performance has been studied in great detail and a publication in *Astrophysical Journal* is under a review process, see some results in Fig 2. and Fig. 3. In the meanwhile, thanks to a focused effort by a task force on the camera control software, the telescope availability increased from 75% to 85%. This is still below the required 95% from CTA, but the team is convinced we are on the right track to achieve this requirement in FY2023.



Figure 4: LST4 status of construction works



Figure 5: cage of the central pin of LST-2

LST2-4 construction status. The construction license for the LST2-4 erection was granted by the local authorities of La Palma in September 2022. Soon after, in November 2022 the civil works started. The progress of the civil works is good and according to our schedule, and we expect that they finish in August 2023. So far, the area

has been cleared, the excavation works completed, the central area compacted and the inner piece of the central pin installed, in all three telescopes, see Fig. 4 and Fig. 5.

Scientific return. LST1 is taking regular data on scientific targets together with the MAGIC telescopes and the live-time of scientific runs with LST1 superseded 1800h since January 2020. The results of this observations start to become public. Observations of LHAASO J2108+5157 are in A&A in press, while two more publications have been submitted for a journal referee process.