T 140: Gamma Astronomy VI

Time: Thursday 17:30–19:00 Location: POT/0151

T 140.1 Thu 17:30 POT/0151

Signal extraction of raw simulated and laboratory data with the FlashCam camera for Medium Sized Telescopes in CTA. — •Clara Escanuela, Felix Werner, and Jim Hinton — Max-Planck Institut fuer Kernphysik, Saupfercheckweg 1, 69117 Heidelberg

The Cherenkov Telescope Array (CTA) is the next generation observatory for very high energy (VHE) gamma rays. The southern CTA site will consist of large, medium (MST), and small size telescopes to cover a wide range of photon energies. The FlashCam will be used for the southern site MSTs, and is a photomultiplier-tube based camera with a fully digital readout system. A FlashCam MST is expected to start taking data in Chile in 2024. This requires deep laboratory testing which includes the reproduction of shower-like illumination patterns and time profiles with an LED array, laser calibration, and night sky background simulation. We present first results from testing the signal extraction algorithm and performance verification in the laboratory.

T 140.2 Thu 17:45 POT/0151

Influence of varying pulse shapes on the response of FlashCam — •Fabian Leuschner for the CTA FlashCam-Collaboration — IAAT, 72076 Tübingen, Germany

FlashCam is a fully digital camera for Imaging Air Cherenkov Telescopes (IACTs) and is foreseen to be used for the Medium-Sized Telescopes (MSTs) at the southern site of the upcoming CTA Observatory. Since 2019, a fully functional advanced prototype is installed to CT5, the world's largest IACT that is part of the H.E.S.S. array in Namibia. Accurate reconstruction of the input light intensity in each individual pixel is key for correctly reconstructing air showers and consecutively for observations of very high energetic gamma rays. Extensive measurements with tuneable light-pulses from two pulsed lasers have been used to assess the performance of the reconstruction algorithms. The setup provides dual pulses, each with less than a nanosecond duration. Pulses are emitted either synchronously or with an adjustable time delay of multiples of 0.5 ns between each pulse.

After a short introduction into the FlashCam concept, I will discuss the influence of such pulses with varying length, shape, and intensity on the camera response. The results show that FlashCam is able to reconstruct the intensity of incoming light pulses over the required dynamic range with accuracies on the percent scale and meets the requirements for use in the CTA Observatory.

T 140.3 Thu 18:00 POT/0151

Muon Calibration of Dual-Mirror-Telescopes — •Henning Ptaszyk, Rune M. Dominik, and Maximilian Linhoff for the CTA-Collaboration — Astroparticle Physics, TU Dortmund University, D-44227 Dortmund, Germany

The Cherenkov Telescope Array (CTA) is being built at two sites on the northern and southern hemisphere respectively and will be the next generation ground- based very-high-energy gamma-ray observatory. Both arrays will consist of multiple Imaging Atmospheric Cherenkov Telescopes (IACT) in different sizes, built for the observation of gamma-ray induced air showers within different energy ranges. The southern array, currently being constructed in Chile, will include Small-Sized Telescopes (SSTs) utilizing a Schwarzschild-Couder design, that feature two reflectors instead of one. This optical design, which is also proposed for some of the MSTs, not only allows for a more compact construction, but also counteracts optical aberration.

To ensure precise reconstruction of the incoming gamma-ray's properties, calibra- tion methods are required. As for previous IACT experiments, ringlike images, generated by atmospheric muons, present an important calibration source for CTA. Since the aforementioned dual-mirror telescopes pose a novel introduction to IACT observatories, it is necessary to study the muon calibration process for Schwarzschild-Couder telescopes. The status and further proceeding of this research are the subject of this talk.

T 140.4 Thu 18:15 POT/0151

Reproducible Analysis of MAGIC Data with the Database-Driven Framework AutoMAGIC and the Open-Source Python Package Gammapy — •Simone Mender and Jan Lukas Schubert for the MAGIC-Collaboration — TU Dortmund University

The open-source Python package Gammapy is mainly developed for the high-level analysis of gamma-ray data of the future Cherenkov Telescope Array Observatory. It can also be used to analyze data from existing imaging air Cherenkov telescopes like MAGIC. Gammapy requires event-based data combined with the corresponding instrument response functions. In order to process this science-ready data (so-called DL3) for MAGIC, the new database-driven framework AutoMAGIC is developed. With AutoMAGIC it is possible to create DL3 data in an automated and reproducible way. It enables the possibility to perform very cumbersome analyses automatically, e.g. the low-level data reprocessing that is needed for observations with moderate to strong moonlight. In this talk, we present the analysis chain and its validation. For this, we analyzed Crab Nebula data, which was taken under different observational conditions.

T 140.5 Thu 18:30 POT/0151

Automatized Analysis of MAGIC Sum-Trigger-II Pulsar Data — •Jan Lukas Schubert and Simone Mender for the MAGIC-Collaboration — TU Dortmund University, Dortmund, Germany

The MAGIC telescopes are a stereoscopic system of Imaging Air Cherenkov Telescopes which is used for gamma-ray detection in the GeV to TeV range. Thanks to an analogue trigger system, dubbed Sum-Trigger-II, low-energy data with a threshold as low as ~25 GeV can be recorded, enabling the MAGIC telescopes to perform comparably low energetic analyses such as pulsar analyses.

This data requires a dedicated treatment adapted to the low energies. Since the analysis structure is complex, it is reasonable to automatize the analysis to save time for an analyzer and to deliver entirely reproducible results. The automatization of the analysis of Sum-Trigger-II data was implemented in the autoMAGIC project which aims to automatize the entire MAGIC analysis chain.

A workflow for the pulsar timing and the pulsar analysis based on the autoMAGIC output is currently designed and implemented. It delivers results comparable to manual pulsar analyses.

In the future, the automatization of the analysis of Sum-Trigger-II data could be used for further optimizations of the low-energy analysis as well as for comparisons of low-energy data from MAGIC and the LST. In combination with the automatic pulsar analysis, this will enable the possibility to perform long-term pulsar analyses with a comparably small amount of work.

T 140.6 Thu 18:45 POT/0151

Towards an automatic mode of operation of the MAM subsystem of MAGIC — •Angela Bautista for the MAGIC-Collaboration — Max Planck Institute for Physics, Munich, Germany

The MAGIC telescope system is sensitive to gamma rays in the very high energy range 20 GeV-100 TeV. Cherenkov light produced in extensive air showers is collected and used to estimate the primary gamma-ray energy. The atmosphere absorbs part of the Cherenkov light and the MAGIC LIDAR system is used to correct observations with zenith angles up to 60°. MAGIC observes sources above 60° using the Very Large Zenith Angle (VLZA) observation technique. The increased collection area during VLZA observations enables the study of PeVatron candidates with steep spectra extending to 100 TeV and beyond. At such large zenith angles, the column density of air exceeds the range covered by the LIDAR and a different atmospheric calibration technique is needed. The MAGIC Atmospheric Minion (MAM) was installed at the MAGIC site to correct for the atmospheric effects during VLZA observations. The task of MAM is to measure the atmospheric transmission in real-time either by using aperture photometry or spectroscopy of stars within the same sky region as the gamma-ray source of interest. Currently, a manual procedure for photometric calibration is already in place. This talk presents recent progress along with the next steps to advance towards an automatic mode of operation of the MAM subsystem.