T 35: Gammaastronomie 2

Zeit: Dienstag 11:00–12:30 Raum: H 2

T 35.1 Di 11:00 H 2

Readout calibration of Cherenkov telescope data acquired by Domino Ring Sampler v.4 chips - a status report after one year of research — •Mario Hörbe — Ruhr-Universität Bochum, Germany

Very-high-energy gamma-ray astronomy aims to give insights into the most energetic phenomena in our Universe. Earthbound Cherenkov telescopes measure Cherenkov light emitted by constituents in atmospheric showers which are initiated by primary high-energy particles. Current Cherenkov telescope cameras, e.g. operated in the MAGIC and FACT experiments, utilize the fourth generation of Domino Ring Sampler (DRS4) chips to acquire data at a high pace. The future Cherenkov Telescope Array (CTA) will implement this technology and acquire vast amounts of DSR4-based data, requiring precise calibration. We aim at developing readout data calibration techniques between the requirements of calibration precision and computational resource consumption, to be operated in CTA. The status as well as the challenges and objectives of the project will be presented.

T 35.2 Di 11:15 H 2

Measurement of aspherical mirrors with PMD — •Andreas Specovius, Christopher Van Eldik, André Wörnlein, and Alexander Ziegler — Friedrich–Alexander–Universität Erlangen–Nürnberg

The future Cherenkov Telescope Array (CTA) will consist of about 100 single telescopes with a total reflecting surface of $\sim 10.000\,\mathrm{m}^2$ made of numerous mirror facets. An efficient way to reliably reconstruct the surface of specular free–forms is Phase Measuring Deflectometry (PMD). PMD is routinely used to characterize the focal distance and point spread function of spherical CTA prototype mirrors. To investigate the possibility to measure the surface properties of aspherical mirrors, the standard PMD evaluation used for spherical telescope mirrors has been applied to one type of the aspherical mirror facets of the medium–sized prototype Schwarzschild–Couder Telescope (SCT). Experiences, implemented improvements and first results of this analysis are shown.

T 35.3 Di 11:30 H 2

The Photon Stream, a Novel IACT Event Representation — •Sebastian A. Mueller[1] and Jens Buss[2] for the FACT-Collaboration — [1]ETH Zuerich — [2]TU Dortmund

Imaging Atmospheric Cherenkov Telescopes (IACTs) observe extensive air showers during the night to probe the very high energetic gamma ray sky on an event to event basis. Both a Cherenkov photon and a Night Sky Background (NSB) photon generates an indistinguishable electric pulse in IACT cameras. However, the separation of Cherenkov photons from the pool of NSB photons is crucial for the air shower reconstruction. Using silicon sensors, the single photon performance of the First G-APD Cherenkov Telescope (FACT) is stable enough that at least in dark nights a single photon reconstruction can be applied. This results in a list of photon arrival times for each pixel in contrast to the common main-pulse amplitude and main-pulse arrival time for each pixel. In this contribution, we first present our single photon extractor for FACT and evaluate its performance, second we introduce an IACT event representation which stores only the arrival times of the individual photons in each pixel (Photon Stream). Finally, we give a brief outlook into possible improvements in air shower reconstruction and show why the Photon Stream is a very natural IACT event format and why it has potential to be very compact, efficient and interchangeable.

T 35.4 Di 11:45 H 2

FACT – Towards Robotic Operation — •Maximilian Nöthe[1] and Dominik Neise[2] for the FACT-Collaboration — [1]TU Dortmund, Dortmund, Deutschland — [2]ETH Zürich, Zürich, Schweiz

Situated on the Canary Island of La Palma at the Observatorio del Roque de los Muchachos, the First G-APD Cherenkov Telescope (FACT) continuously monitors bright gamma-ray sources.

IACTs usually need a crew of two to five shifters on site to operate. One of the major goals of the FACT collaboration is robotic operation. Since first light in October 2011, great progress has been made towards this goal. A first step, remote operation without shifters on site, was implemented in summer 2012. Since then, streamlined web interfaces replaced more complicated or unreliable ones via ssh or VNC and VNP. At this point, shifters were only required to startup the telescope in the evening, shut it down in the morning and monitor telescope state and environmental conditions in between. These efforts lead to a data taking efficiency of ~95 % and a total of over 2300 hours of physics data in the past twelve months.

In this talk, the current effort to go to full robotic operation will be presented. A new software was introduced, to go to a mode of operation where the telescope takes data completely on its own, only notifying a shifter if and when human interaction is necessary. It can reach to a shifter via phone, text messages and even send plots and images. The software continuously monitors the telescope status, environmental conditions and quick look analysis results.

T 35.5 Di 12:00 H 2

FACT - Machine Learning Analysis — •Kai Brügge, Jens Buss, and Maximilian Nöthe for the FACT-Collaboration — TU Dortmund, Dortmund, Deutschlands

Imaging Atmospheric Cherenkov Telescopes like FACT (First G-APD Cherenkov Telescope) produce a continuous flow of data during observation. One major task of a monitoring system is to detect changes in the gamma-ray flux of a source, and to alert other experiments if some predefined limit is reached in order to possibly trigger multi wavelength observations. Thus analyzing the data with low latency is essential for understanding the acceleration mechanisms in bright gamma-ray sources like active galactic nuclei.

In order to calculate the fluxes of an observed source, it is necessary to calculate the instrument response function (IRF) and effectively minimize background noise. This analysis relies heavily on the usage of machine learning methods to perform background suppression and energy estimation. We describe how multi-variate models are applied to FACT's data stream with low latency, show IRFs, present fluxes and compare results to an existing analysis which does not use machine learning.

T 35.6 Di 12:15 H 2

FACT - DRS Temperature Calibration — •Florian Schulz for the FACT-Collaboration — TU-Dortmund, Germany

The camera of the first G-APD Cherenkov Telescope (FACT) is comprised of 1440 individual pixels which are equipped with a silicon based photosensor (SiPM) each. The readout electronics is based on the Domino Ring Sampler 4 (DRS4-Chip). Every chip comprises 9*1024 capacitors and operates with a sampling frequency of 2 GHz during standard data acquisition. In standard operation, 300 samples (150ns), the so-called region of interest (RoI) are read out for each triggered event. It is necessary to calibrate the properties of all the capacitors of the 160 DRS4-Chips.

Taking drs calibration runs is one way to determine values like Baseline and Gain for every capacitor. The temperature dependence of the calibration parameters is studied. The final goal is to be able to calculate the required calibration constants based on the temperature measurement and reduce the recording of calibration runs to a minimum during the night. The effect on the data is studied.