T 38: Gammaastronomie II

Zeit: Montag 16:45–18:45 Raum: VMP9 SR 27

T 38.1 Mo 16:45 VMP9 SR 27

Konzept zur Messung des Pointings der mittelgroßen CTA-Teleskope mit einer optischen CCD-Kamera — •Domenico Tiziani und Christopher van Eldik — ECAP, Universität Erlangen-Nürnberg

Das Cherenkov Telescope Array (CTA) ist das bodengebundene Experiment der nächsten Generation zur Messung kosmischer Gammastrahlung im Energiebereich von einigen zehn GeV bis zu über 100 TeV. Es wird aus Cherenkov-Teleskopen dreier verschiedener Größen bestehen. Das Projekt befindet sich gerade in der Prototyp-Phase.

Eine wichtige Kalibrierung für CTA ist das sogenannte "Pointing". Darunter versteht man sowohl die genaue Ausrichtung eines Cherenkov-Teleskops als auch die Fähigkeit, eine Position am Himmel in die Ebene der Cherenkov-Kamera zu transformieren und umgekehrt. Eine Methode, das Pointing zu messen, besteht darin, eine optische CCD-Kamera an das Teleskop zu montieren, die gleichzeitig die Positionen der Cherenkov-Kamera und der Sterne am Nachthimmel in einem Bild aufnimmt.

In diesem Vortrag wird die Adaptierung dieser Methode für die mittelgroßen CTA-Teleskope vorgestellt. Es werden Techniken beschreiben, mit denen Aufnahmen einer Pointing-Kamera simuliert und analysiert werden können.

T 38.2 Mo 17:00 VMP9 SR 27

Upgrade of the MAGIC telescopes single wavelength micro power LIDAR system — •Dominik Müller for the MAGIC-Collaboration — Max-Planck-Institut für Physik, München

Since 2011 a single wavelength LIDAR system is operated alongside the observations of the MAGIC telescopes. It is used for real-time monitoring of the atmospheric transmission and for detecting cloud layers within the field of view of MAGIC. The system uses a pulsed Nd:YAG laser with 532nm wavelength and a pulse energy of 5μJ as transmitter. The receiver is mounted to a 60cm spherical single mirror telescope with a F/D ratio of 2.5. To compensate for the low light intensities a sensitive detector with the capability of single photon detection as well as charge integration is needed. For this purpose, a hybrid photo diode with a peak quantum efficiency of 55% an a pulse width of 2.5ns is used in a custom designed detector. The analog signal is recorded by a computer mounted 8-bit FADC with 200MS/s. A signal analysis algorithm converts the LIDAR return signal into a number of single photoelectron counts per range bin. The atmospheric transmission is calculated by fitting a Rayleigh back-scattering model with a sliding window. The resulting transmission profile is used to correct the MAGIC gamma ray data for adverse weather conditions. After five years of data taking the MAGIC LIDAR system is upgraded with a stronger laser and a new detector unit in order to extend the measurement range and to optimize the operation.

T 38.3 Mo 17:15 VMP9 SR 27

FACT - Streamed data analysis and online application of machine learning models — •Kai Arno Brügge and Jens Buss for the FACT-Collaboration — Technische Universität Dortmund, Astroteilchenphysik

Imaging Atmospheric Cherenkov Telescopes (IACTs) like FACT produce a continuous flow of data during measurements. Analyzing the data in near real time is essential for monitoring sources. 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 calculate the flux of an observed source, it is necessary to run an entire data analysis process including calibration, image cleaning, parameterization, signal-background separation and flux estimation. Software built on top of a data streaming framework has been implemented for FACT and generalized to work with the data acquisition framework of the Cherenkov Telescope Array (CTA). We will present how the streams-framework is used to apply supervised machine learning models to an online data stream from the telescope.

T 38.4 Mo 17:30 VMP9 SR 27

Time and charge calibration of Cherenkov telescope data acquired by Domino Ring Sampler 4 chips — •Mario Hörbe[1], Marlene Doert[1], Kai Brügge[2], Jens Buss[2], Christian Bockermann[2], and Alexej Egorov[2] — [1]Ruhr-Universität Bochum — [2]TU Dortmund

Very-high-energy gamma-ray astronomy aims to give an insight into the most energetic phenomena in our Universe. Earthbound Cherenkov telescopes can measure Cherenkov light emitted by atmospheric particle showers which are produced by incoming cosmic particles at high energies. Current Cherenkov telescopes, e.g. operated in the FACT and the MAGIC experiments, utilize Domino Ring Sampler 4 (DRS4) chips for recording signals at high speed coming from the telescopes' cameras. DRS4 chips will also be used in the cameras of the Large-Size telescopes of the projected Cherenkov Telescope Array (CTA). We aim at developing a software solution for the calibration of DRS4 data based on the *streams*-framework, a software tool for streaming analysis which has been developed within the Collaborative Research Center SFB 876. The objectives and the current status of the project will be presented.

T 38.5 Mo 17:45 VMP9 SR 27

FACT - New Image Parameters Based on the Watershed-Algorithm — •Lena Linhoff, Kai Arno Bruegge, and Jens Buss for the FACT-Collaboration — TU Dortmund, Dortmund, Deutschland, Experimentelle Physik 5b

FACT, the First G-APD Cherenkov Telescope, is the first imaging atmospheric Cherenkov telescope that is using Geiger-mode avalanche photodiodes (G-APDs) as photo sensors. The raw data produced by this telescope are processed in an analysis chain, which leads to a classification of the primary particle that induce a shower and to an estimation of its energy. One important step in this analysis chain is the parameter extraction from shower images. By the application of a watershed algorithm to the camera image, new parameters are computed. Perceiving the brightness of a pixel as height, a set of pixels can be seen as 'landscape' with hills and valleys. A watershed algorithm groups all pixels to a cluster that belongs to the same hill. From the emerging segmented image, one can find new parameters for later analysis steps, e.g. number of clusters, their shape and containing photon charge. For FACT data, the FellWalker algorithm was chosen from the class of watershed algorithms, because it was designed to work on discrete distributions, in this case the pixels of a camera image. The FellWalker algorithm is implemented in FACT-tools, which provides the low level analysis framework for FACT. This talk will focus on the computation of new, FellWalker based, image parameters, which can be used for the gamma-hadron separation. Additionally, their distributions concerning real and Monte Carlo Data are compared.

T 38.6 Mo 18:00 VMP9 SR 27

Active learning for Corsika — •Dominik Baack, Fabian Temme, Jens Buss, Max Nöthe, and Kai Brügge for the FACT-Collaboration — TU Dortmund, Dortmund, Deutschland

Modern Cosmic-Ray experiments need a huge amount of simulated data. In many cases, only a portion of the data is actually needed for following steps in the analysis chain,for example training of different machine learning algorithms. The other parts are thrown away by the trigger simulation of the experiment or so not increase the quality of following analysis steps.

In this talk, I present a new developed package for the air shower simulation software corsika. This extension includes different approaches to reduce the amount of unnecessary computation. One approach is a new internal particle stack implementation that allows to priorice the processing of special intermediate shower paricles and the removal of not needed shower particles.

The second approach is the possibility to sent various information of the initial particle and parameters of the status of the partial simulated event to an external application to approximate the information gain of the current simulator event. If the information gain is to low, the current event simulation gets terminated and all information get stored into a central database. For the Simulation - Server communication a simple network protocol has been developed.

T 38.7 Mo 18:15 VMP9 SR 27

FACT - More than four Years of Blazar Monitoring — •Daniela Dorner for the FACT-Collaboration — Universität Würzburg, Deutschland

Since October 2011, the First G-APD Cherenkov Telescope (FACT) has been collecting more than 5500 hours of physics data. Thanks to the silicon based photosensors (SiPMs, aka G-APDs), observations during bright ambient light like full moon can be carried out without degradation of the sensors. Keeping the gain of the SiPMs stable using an online feedback system, a stable and homogeneous detector performance is achieved. Based on this and an automatic data taking procedure, an unbiased longterm data sample is collected. An automatic quick look analysis provides results shortly after the data are taken allowing to send flare alerts within the same night. The main targets for FACT are the bright TeV blazars Mrk 421 and Mrk 501 which are monitored since January 2012. In addition, several other sources like for example the Crab Nebula, 1ES 1959+650, 1ES 2344+54.1 are observed. In this presentation, the results from more than four years of monitoring will be summarized. Several flares from Mrk 501 and Mrk 421 will be discussed in the multi-wavelength (MWL) context. Mrk 501 underwent major outbursts in June 2012 and June 2014 during the yearly MWL campaigns. Mrk 421 showed a bright flare in April 2013 where also MWL observations are available. 1ES 1959+650 showed enhanced flux in autumn 2015. Results from these observations will be discussed.

T 38.8 Mo 18:30 VMP9 SR 27

FACT - Energy Spectrum of the Crab Nebula — •Fabian Temme, Sabrina Einecke, and Jens Buss for the FACT-Collaboration — TU Dortmund, Experimental Physics 5, Otto-Hahn-Str.4, 44221 Dortmund, Germany

The First G-APD Cherenkov Telescope is the first Imaging Air Cherenkov Telescope which uses silicon photon detectors (G-APDs aka SiPM) as photo sensors. With more than four years of operation, FACT proved an application of SiPMs is suitable for the field of ground-based gamma-ray astronomy. Due to the stable flux at TeV energies, the Crab Nebula is handled as a "standard candle" in Cherenkov astronomy. The analysis of its energy spectrum and comparison with other experiments, allows to evaluate the performance of FACT. A modern analysis chain, based on data stream handling and multivariate analysis methods was developed in close cooperation with the department of computer science at the TU Dortmund. In this talk, this analysis chain and its application will be presented. Further to this, results, including the energy spectrum of the Crab Nebula, measured with FACT, will be shown.