T 22: Experimentelle Techniken der Astroteilchenphysik 1

Zeit: Montag 16:45–18:50 Raum: S 9

Gruppenbericht T 22.1 Mo 16:45 S 9

Integration of a TARGET-based Readout Module into GCT — •Peter Deiml[1], Adrian Zink[1], Manuel Kraus[1], David Jankowsky[1], Stefan Funk[1], Justus Zorn[2], Maurice Stephan[3], Arnim Balzer[3], and the CTA Consortium[4] for the GCT-Collaboration — [1]Erlangen Centre for Astroparticle Physics (ECAP), Friedrich-Alexander-Universität Erlangen-Nürnberg, Erwin-Rommel-Str. 1, D-91058 Erlangen, Germany — [2]Max-Planck-Institut für Kernphysik, Heidelberg — [3]GRAPPA, University of Amsterdam — [4]Full consortium author list at http://cta-observatory.org

TARGET is an Application Specific Integrated Circuit (ASIC) designed for digitisation and readout of different photosensors in various types of experiments. One application is the next generation ground-based observatory for gamma-rays, the Cherenkov Telescope Array (CTA). There, it is integrated into the camera of the Gamma Cherenkov Telescope (GCT), one proposed candidate for the small size telescopes (SSTs). To be affordable while meeting the demands made to CTA, the camera consists of 32 readout modules with four TARGET-ASICs each. Key features are a high sampling frequency of 1 GSa/s, a deep analog buffer, a compact design, a dynamic range of >10 bits, a moderate power consumption and affordability. We give an overview of the GCT architecture and its operating principle and how the TARGET-based readout modules are integrated. Finally, we discuss performance tests measured with TARGET-C modules, the newest generation of TARGET-based readout modules.

T 22.2 Mo 17:05 S 9

The FlashCam cameras for the medium-sized telescopes of the Cherenkov Telescope Array — •Marc Pfeifer for the FlashCam-Collaboration — ECAP, Friedrich-Alexander Universität Erlangen-Nürnberg, Erwin-Rommel-Str. 1, D 91058 Erlangen, Germany

The Cherenkov Telescope Array (CTA) will be the next generation of ground-based gamma-ray observatory. It will be formed of several dozens of telescopes of different sizes. For the success of such an observatory, cost-efficient cameras with high reliability and a superior performance are mandatory. FlashCam is a camera system that has been developed for this purpose and is proposed for the medium-sized telescopes of CTA.

The design of FlashCam follows a horizontal architecture. A fully-digital signal processing chain is implemented in the readout electronics, based on commercially available parts only. The FlashCam team has built a full-size camera prototype which has been equipped with the complete readout system during 2016.

Our contribution will give an overview of the architecture of FlashCam and will show results from the performance verification of the camera.

T 22.3 Mo 17:20 S 9

IceAct, Imaging Air Cherenkov Telescopes with SiPMs at the South Pole for IceCube-Gen2 — Jan Audehm, •Jan Auffenberg, Thomas Bretz, Erik Ganster, Maurice Günder, Lasse Halve, Thomas Hebbeker, Jan Paul Koschinsky, Lukas Middendorf, Tim Niggemann, Leif Rädel, Martin Rongen, Tobias Sälzer, Merlin Schaufel, Sebastian Schoenen, Johannes Schumacher, Aatif Waza, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut, RWTH Aachen University

IceCube-Gen2 is planned to extend the IceCube Neutrino Observatory at the geographic South Pole. For neutrino astronomy, a large background-free sample of well-reconstructed astrophysical neutrinos is essential. The main background for this signal are muons and neutrinos which are produced in cosmic-ray air showers in the Earth's atmosphere. The coincident detection of these air showers by the surface detector IceTop has been proven to be a powerful veto for atmospheric neutrinos and muons in the field of view of the Southern Hemisphere. This motivates a large extension of IceTop to more efficiently detect cosmic rays. Part of these extension plans is IceAct, small imaging air cherenkov telescopes based on SiPM cameras and optimized for harsh environments. Compared to IceTop stations, these telescopes potentially lower the detection threshold for air showers. The South Pole environment promises a very good duty cycle. We will present the progress and future plans of the IceAct project including first coincident data of IceAct with IceCube.

T 22.4 Mo 17:35 S 9

Development of a 61-Pixel Camera for the IceAct Imaging Air Cherenkov Telescope — •Jan Paul Koschinsky, Jan Audehm, Jan Auffenberg, Thomas Bretz, Lasse Halve, Thomas Hebbeker, Tim Niggemann, Martin Rongen, Tobias Sälzer, Merlin Schaufel, Johannes Schumacher, Aatif Waza, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut, RWTH Aachen University, D-52056 Aachen, Germany

Part of the Gen2 extension of the IceCube Neutrino Observatory at the geographic South Pole is a surface air shower detector. Primary goal is to veto atmospheric muons and neutrinos as background for the measurement of astrophysical neutrinos. One possible technology are compact imaging air Cherenkov telescopes, IceAct, that exhibit a lower energy threshold compared to surface particle detectors. The IceAct telescope design is adapted from the FAMOUS fluorescence telescope which achieves a large field of view. It consists of a Fresnel lens allowing for an enclosed optical system protecting the camera from the harsh environment. The camera is based on light collecting Winston cones and SiPMs allowing a high duty cycle. Here we will present the development of a new 61-pixel camera that is intended to replace the 7-pixel camera, currently operating with an IceAct prototype at the South Pole.

T 22.5 Mo 17:50 S 9

First evaluation of the prototype 19-modules camera for the Large Size Telescope of the CTA — •Tsutomu Nagayoshi for the CTA-Japan-Collaboration — Saitama Univ., Saitama-shi, Japan — Max-Planck-Inst. fuer Phys., Munich, Germany

The Cherenkov Telescope Array (CTA) represents the next generation of ground based observatory for very high energy gamma rays. This observatory will be an array of about 100 Cherenkov telescopes of three different sizes, will be ten times more sensitive than the current generation telescopes, and will expand the energy coverage to be from 20 GeV to more than 300 TeV. The Large Size Telescope (LST), which has 23 m diameter mirror dish, dominates the sensitivity of CTA below 200 GeV, which is the energy range with the largest discovery potential, including the detection of many pulsars or distant (z>1) blazars or GRBs. The LST camera consists of 265 photo sensor modules, each of them containing seven photomultiplier tubes (PMTs), a slow control board, a readout board, and a 2-level trigger logic. The PMTs (R11920, Hamamatsu Photonics) have 1.5 inch size photo-cathode and 8 stages of dynodes. In addition, for each PMT, Cockcroft*Walton type DC-DC converter and a preamplifier ASIC are assembled. We carried out the quality control of all PMTs, and constructed the first prototype mini-camera consisting of 19 PMT modules. In this talk I will present the results of the quality control and the first evaluation of the integration tests of the 19-modules camera prototype.

T 22.6 Mo 18:05 S 9

FAMOUS/HAWC - A small size air-Cherenkov telescope for a ground detector array - a possible future extension? — •Merlin Schaufel — RWTH Aachen, Germany

The fluorescence telescope FAMOUS turned out to be a versatile and multi-use instrument. After the successful measurement of Cherenkov light originating from air showers with the 7-pixel prototype and the commissioning of the FAMOUS-type IceAct at the South Pole, the new 61 pixel telescope is now operational.
A joint measurement of the FAMOUS telescope, in sync with the gamma ray observatory HAWC (Serra Negra, Mexico), will allow a detailed characterization of the telescope performance using the additional reconstruction information from the array with real events. Furthermore, it will test the technology of small IACTs as a possible extension of array type detectors to improve i.a. the energy resolution for the high energy range. In this talk, I present the current status of the integration of an external detector system into the HAWC DAQ and the possible opportunities of such a combination.

T 22.7 Mo 18:20 S 9

First Observation of Coincident Air Showers with IceAct and IceCube — •Tobias Sälzer, Jan Auffenberg, Thomas Bretz, Erik Ganster, Maurice Günder, Lasse Halve, Thomas Hebbeker, Jan Paul Koschinsky, Lukas Middendorf, Tim Niggemann, Leif Rädel, Martin Rongen, Merlin Schaufel, Sebastian Schoenen, Johannes Schumacher, Aatif Waza, and Christopher Wiebusch — III. Physikalisches Institut, RWTH Aachen University, D-52056 Aachen, Germany

One planned component of the IceCube-Gen2 Neutrino Observatory is an array of compact imaging air Cherenkov telescopes called IceAct. The goal is to reduce the atmospheric background for astrophysical neutrino searches by identifying air showers above the detector. A prototype of an IceAct telescope featuring a seven-pixel SiPM camera has been installed at the South Pole and operated over the course of 2016. The acquired data is synchronized with IceCube and analyzed. We present results on the performance of the prototype based on events observed in coincidence with the other detectors of the observatory.

T 22.8 Mo 18:35 S 9

Investigation of the potential of composition measurements with IceTop and IceAct — •Aatif Waza, Jan Auffenberg, Thomas Bretz, Thomas Hebbeker, Jan Paul Koschinsky, Tim Niggemann, Martin Rongen, Tobias Sälzer, Merlin Schaufel, and Johannes Schumacher for the IceCube-Collaboration — III. Physikalisches Institut, RWTH Aachen University, D-52056 Aachen, Germany

IceAct is planned as an array of SiPM-based Imaging Air Cherenkov Telescopes as one surface component of IceCube-Gen2. Goal of this array would be to efficiently detect cosmic rays below the threshold of IceTop and improve composition measurements of the IceCube Neutrino Observatory. Within the hybrid measurement of cosmic rays by IceTop, IceCube, and IceAct, IceTop mainly provides the direction and energy of the shower, IceCube a measurement of the high-energy muon component, and IceAct the particle density along the air shower axis. We present first results from CORSIKA-based simulations of air showers with proton and iron primary particles.