T 105: Kosmische Strahlung V

Zeit: Donnerstag 16:45–19:00 Raum: VMP9 SR 29

T 105.1 Do 16:45 VMP9 SR 29

Simulation eines abbildenden Luft-Tscherenkow-Teleskops, IceAct, für eine zukünftige IceCube-Gen2 Oberflächenerweiterung — •Bengt Hansmann[1], Jan Auffenberg[1], Thomas Bretz[2], Tim Hansmann[1], Julian Kemp[1,2], Tim Niggemann[2], Leif Rädel[1], Martin Rongen[1], Merlin Schaufel[1], Sebastian Schoenen[1], Johannes Schumacher[2], Martin Stahlberg[1], Ansgar Werhahn[1] und Christopher Wiebusch[1] für die IceCube-Kollaboration — [1]III. Physikalisches Institut B RWTH Aachen, Aachen, Deutschland — [2]III. Physikalisches Institut A RWTH Aachen, Aachen, Deutschland

IceAct ist ein kompaktes abbildendes Luft-Tscherenkow-Teleskop mit Silizium-Photomultipliern, das auf dem Design des Fluoreszenz-Teleskops FAMOUS basiert und für den Einsatz am Südpol optimiert wurde. Ziel ist es, kosmische Luftschauer über dem IceCube Neutrino Observatorium effizient und mit niedriger Energieschwelle zu detektieren. Damit wird es möglich, in IceCube gemessene Signale aus Luftschauern zu identifizieren und von astrophysikalischen Neutrinos zu unterscheiden. Ein erster Prototyp wurde im Dezember 2015 am Südpol installiert. Zur Analyse der in situ Daten und zur Ermittlung des Leistungsvermögens dieses Teleskops, wurde eine CORSIKA-Simulation des Tscherenkowlichts von Luftschauern mit Südpol Bedingungen durchgeführt und Eigenschaften des Teleskops über ein detailliertes GEANT4-Modell evaluiert.

T 105.2 Do 17:00 VMP9 SR 29

HAWC Highlights — •Armelle Jardin-Blicq for the HAWC-Collaboration — Max Planck Institut für Kernphysik

The High-Altitude Water Cherenkov (HAWC) Observatory was completed and began full operation on March 20, 2015. The detector consists of an array of 300 water tanks, each containing 200 tons of purified water and instrumented with 4 PMTs. Located at an elevation of 4100m a.s.l. near the Sierra Negra volcano in central Mexico, HAWC observes gamma rays in the 0.1-100 TeV range and has a sensitivity to TeV-scale gamma-ray sources an order of magnitude better than previous air-shower arrays. It has 2 sr field-of-view and >90% duty cycle make HAWC an ideal instrument for surveying the high-energy sky. We will describe the HAWC detector and its performance characteristics and report initial results from the first months of operation.

T 105.3 Do 17:15 VMP9 SR 29

The upgrade of the HAWC observatory — •Harm Schoorlemmer for the HAWC-Collaboration — Max-Plank-Institut für Kernphysik, Heidelberg, Germany

The High Altitude Water Cherenkov (HAWC) high-energy gamma-ray observatory has recently been completed near the Sierra Negra volcano in central Mexico. HAWC consists of 300 Water Cherenkov Detectors, each containing 200 tons of purified water, that cover a total surface area of 20,000 m^2. HAWC observes gamma rays in the 0.1-100 TeV range and has a sensitivity to TeV-scale gamma-ray sources an order of magnitude better than previous air-shower arrays. The HAWC trigger for the highest energy gamma rays reaches an effective area of 10^5 m^2 but many of them are poorly reconstructed because the shower core falls outside the array. An upgrade that increases the present fraction of well reconstructed showers above 10 TeV by a factor of 3-4 can be done with a sparse outrigger array of small water Cherenkov detectors that pinpoint the core position and by that improve the angular resolution of the reconstructed showers. Such an outrigger array would be of the order of 300 small water Cherenkov detectors of 2.5 m^3 placed over an area four times larger than HAWC. The Max Planck Institute für Kernphysik in Heidelberg just joined the collaboration and will provide the FADC electronics for the readout of the outrigger tanks. Detailed simulations are being performed to optimize the performance of the upgrade.

T 105.4 Do 17:30 VMP9 SR 29

Photomultipliertests für das AugerPrime Upgrade* — •Sven Querchfeld für die Pierre-Auger-Kollaboration — Bergische Universität Wuppertal, Gaußstr. 20, 42119 Wuppertal

Das Pierre-Auger-Observatorium in Argentinien misst kosmische Strahlung bei den höchsten Energien. Insgesamt 1660 Wasser-Cherenkov-Detektoren und 27 Fluoreszenzteleskope vermessen induzierte Luftschauer. Im Rahmen des AugerPrime Upgrades werden die Bodenstationen mit weiteren Szintillationsdetektoren ausgestattet. Durch die Ergänzung mit einer durch die elektromagnetische Komponente dominierten Messung kann eine genauere Bestimmung des Primärteilchens erfolgen. Die Szintillationszähler besitzen eine Fläche von jeweils 2 m^2 und werden auf den bestehenden Detektoren angebracht. Sie sind mit wellenlängenschiebenden Fasern durchzogen, die über einen Photosensor ausgelesen werden.
In diesem Vortrag wird die Entwicklung und Charakterisierung von Photomultipliern als Auslesesensor der neuen Detektorkomponente vorgestellt. Insbesondere wird die Spannungsteileroptimierung hinsichtlich hoher Linearität, von einzelnen Photonen bis hin zu mehreren 10^5 Photonen pro Ereignis, diskutiert und eine aktive Hochspannungserzeugung mit niedrigem Stromverbrauch gezeigt.

**Gefördert durch die BMBF-Verbundforschung Astroteilchenphysik*

T 105.5 Do 17:45 VMP9 SR 29

Optimierungen des Datensatzes für den Oberflächendetektor des Pierre-Auger-Observatoriums* — •Philipp Papenbreer für die Pierre-Auger-Kollaboration — Bergische Universität Wuppertal

Die Wasser-Cherenkov-Detektoren des Pierre-Auger-Observatoriums werden verwendet, um die Sekundärteilchen der kosmischen Strahlung zu messen. Dabei treten unter den insgesamt 4980 Photoelektronenvervielfachern, während einer Betriebsdauer von mehreren Jahren, immer wieder Perioden auf, in denen einige wenige Detektoren Instabilitäten aufweisen. Für Messungen von bisher nicht nachgewiesenen Primärteilchen, die sehr sensitiv auf die genaue Signalform sind, müssen solche Fehlfunktionen zuverlässig ausgeschlossen werden. Dadurch werden künstliche Ereigniskandidaten vermieden, welche in Abwesenheit eines Signals einen großen Einfluss auf die Ausschlussgrenzen ausüben würden. In diesem Vortrag werden Wege gezeigt instabile Perioden der Detektorkomponenten mithilfe der aufgenommenen Daten ausfindig zu machen, um für die Suche nach Photonen als Primärteilchen der kosmischen Strahlung einen optimalen Datensatz zur Verfügung zu haben.

*Gefördert durch die BMBF-Verbundforschung Astroteilchenphysik

T 105.6 Do 18:00 VMP9 SR 29

Silicon Photomultipliers in AMIGA muon counters — •Ana Martina Botti for the Pierre-Auger-Collaboration — Institut für Kernphysik, Karlsruher Institut für Technologie — Instituto de Tecnologías en Detección y Astropartículas (ITeDA), Argentina.

The project AMIGA (Auger Muons and Infill for the Ground Array) aims to extend the energy range at the Pierre Auger Observatory to observe cosmic rays of lower energies (down to $\sim 10^{17}$ eV) and to study the transition from extragalactic to galactic cosmic rays. AMIGA is compounded by an infill of surface detectors (employing Cherenkov radiation detection in water) and muon counters. The AMIGA muon counters consist of an array of buried modules composed of 64 scintillator bars, a multi-pixel Photo Multiplier Tube (PMT) and the corresponding electronic of acquisition which works along with the surface detector.

Currently, ITeDA is evaluating the feasibility of replacing PMTs with silicon photomultipliers (SiPM) without performing any substantial modification in the digital readout nor in the mechanical design. I present calibration results of a prototype module associated to the surface detector Toune of the Pierre Auger Observatory using a SiPM Hamamatsu S1257-100C plugged to the standard AMIGA front-end electronics. In addition, a study concerning gain stability and temperature variation has also been performed and will be reported. I finally discuss a comparison between traces measured by both photo detectors (PMT and SiPM) for modules associated to the surface detector Toune.

T 105.7 Do 18:15 VMP9 SR 29

Optimization of the coupling of optical fibers to an SiPM for a scintillator upgrade of the Pierre Auger Observatory — •Julian Kemp, Thomas Bretz, Thomas Hebbeker, Rebecca Meissner, Lukas Middendorf, Tim Niggemann, Christine Peters, and Johannes Schumacher for the Pierre-Auger-Collaboration — III. Physikalisches Institut A, RWTH Aachen University

The Pierre Auger Observatory successfully measures cosmic-ray air-showers at the highest energies by detecting both the fluorescence light produced in the atmosphere and the particle density of the shower at the ground. Nevertheless, this procedure does not allow for a precise measurement of the muon to electron ratio of a single shower. As this quantity is connected to the mass of the primary particle, it allows for a cosmic-ray mass composition measurement. To improve the ability of separating muons from the electromagnetic component, scintillator based detectors will be added to each surface detector station. The basic design will consist of several scintillator bars feeding the produced light into a bundle of wavelength shifting fibers. The light can be detected by photomultipliers (PMTs) or by silicon photomultipliers (SiPMs). The latter benefit from their higher photon detection efficiency and robustness. Due to the smaller area of the SiPMs compared to a PMT, the light detection efficiency of this system strongly depends on the quality of the optical coupling of the fiber bundle to the SiPM. Possible solutions are compared.

T 105.8 Do 18:30 VMP9 SR 29

A SiPM-based scintillator prototype for the Upgrade of the Pierre Auger Observatory — •Johannes Schumacher, Thomas Bretz, Thomas Hebbeker, Julian Kemp, Rebecca Meissner, Lukas Middendorf, Tim Niggemann, and Christine Peters for the Pierre-Auger-Collaboration — III. Physikalisches Institut A, RWTH Aachen University, Germany

Plastic scintillator-based detectors are simple and yet powerful instruments, commonly used in particle physics experiments. These detectors are also planned to be installed at the Pierre Auger Observatory as part of the upgrade called AugerPrime. Here, a single detector module will consist of several large-sized scintillator bars. Embedded wavelength shifting fibres read out the scintillation light and are coupled to a single photo-sensitive device.

We investigate the application of silicon photomultipliers (SiPMs) in this scope, which benefits from high photon detection efficiency and stability. We show the performance of a SiPM-based prototype device installed in the 2 m^2 detector ASCII - an early prototype of the scintillating detector planned for AugerPrime. We focus on the electronics, the optical coupling and the in situ calibration. As ASCII has been operating with SiPMs for several months now, we also highlight first high-energy events seen in coincidence with the Surface Detector of the Pierre Auger Observatory.

T 105.9 Do 18:45 VMP9 SR 29

Calibrating the Auger Engineering Radio Array at the Pierre Auger Observatory using an Octocopter — •Florian Briechle, Martin Erdmann, and Raphael Krause — III. Physikalisches Institut A, RWTH Aachen University, Germany

With the Auger Engineering Radio Array (AERA) at the Pierre Auger Observatory radio emission of extensive air showers induced by ultra high energy cosmic rays is observed. Characteristics of the primary cosmic ray, e.g., arrival direction, mass or energy, can be measured this way. To produce high quality data, the detector needs to be well understood and calibrated. A useful tool for calibration campaigns is an octocopter. With it, a calibration source can be placed above the array, which makes this a very flexible method useful for different types of calibrations. Special focus is put on the position reconstruction and the position accuracy of the octocopter during the calibration flights. A new optical method using two cameras for these position reconstructions is presented. Results of a measurement campaign in spring 2015 are presented. In this campaign, the sensitivity of the AERA stations as well as timing characteristics were measured. The results of the sensitivity measurement are compared to simulations.