T 84: Methods of astroparticle physics V

Time: Thursday 16:30–19:00 Location: L-3.001

T 84.1 Thu 16:30 L-3.001

A new end-to-end calibration of the Fluorescence Detector of the Pierre Auger Observatory — •Christoph Schäfer for the Pierre Auger-Collaboration — Institute for Nuclear Physics, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

One of the crucial parts of the Pierre-Auger-Observatory are fluorescence telescopes. In the past, the absolute calibration of these fluorescence telescopes was performed with a large-diameter light-source, which illuminated the whole aperture of the telescope at once, roughly once every three years, while a relative calibration was performed every night. In this contribution a new technique of an absolute end-to-end calibration of the fluorescence telescopes is presented. This new technique employs a calibrated portable Lambertian light-source which is scanned across the aperture of each telescope. The readout of the PMT camera at each position of the light source in front of the aperture provides an absolute calibration of the telescope. This talk will give a brief overview of the method and its status as well as preliminary results from the fluorescence telescope measurements.

T 84.2 Thu 16:45 L-3.001

Thermal drills for rapid deployment of in-ice instrumentation used for ARIANNA — •Simon Zierke, Dirk Heinen, Lars Steffen Weinstock, and Christopher Wiebusch — RWTH Aachen University, III. Physikalisches Institut

In recent years, access to subglacial regions has become increasingly interesting for terrestrial and extraterrestrial research as well as for large-scale astroparticle physics experiments. Most of the current ice-drilling technologies require a large infrastructure or close supervision. In order to enable a simple and rapid deployment of in-ice instrumentation, within the EnEx-RANGE project thermal drills with a diameter of 8 cm and a length of about 1 m were developed, that reached melting velocities up to 8 m/h. One of these thermal drills was used for the installation of dipole radio antennas for ARIANNA at the Ross Ice Shelf at depths of up to 40 m. For this application, the equipment could be handled by one person, and the drilling could be carried out with minimal remote monitoring. As a next step this drilling technology will be improved within the TRIPLE-IceCraft project, to build a larger melting probe for transporting scientific payloads to a depth of several hundred meters. This melting probe will be demonstrated on the Ekström Ice Shelf near Neumayer-Station-III during the 2021/2022 Antarctic season. We will present the melting probe design, its use for ARIANNA and an outlook on the TRIPLE-IceCraft project.

T 84.3 Thu 17:00 L-3.001

Radio reflections on clouds as a potential background for cosmic ray radio detection — •Carina Kanitz[1], Ilse Plaisier[1,2], and Anna Nelles[1,2] — [1]Friedrich-Alexander-Universität Erlangen-Nürnberg, ECAP, Erwin-Rommel-Str. 1, 91058 Erlangen — [2]DESY, Platanenallee 6, 15738, Zeuthen, Germany

The successful radio-triggered detection of cosmic air showers with measurements at the Owens Valley Radio Observatory Long Wavelength Array (OVRO-LWA) illustrates again the opportunities for cosmic ray detection with radio telescopes.

While several background sources such as airplanes, stationary sources close to the array like A/C units of the data processing shelter and nearby cities were identified, rejected by triggers, and removed from the data, a strong source of radio signals at an elevation angle of 15° could not be identified, as no known emitting objects lie in this direction. An incorrectly reconstructed arrival direction has been excluded.

We investigate the possibility of this signal being caused by radio signals from nearby towns reflected off clouds into the array. This is studied in radio propagation simulations and in a correlation search of measured radio signals with atmospheric data. We will report on first results.

T 84.4 Thu 17:15 L-3.001

Geometry calibration of the KM3NeT neutrino telescope using atmospheric muons — •Daniel Guderian and Alexander Kappes for the KM3NeT-Collaboration — Institut für Kernphysik, Wilhelm-Klemm-Straße 9, Münster

The KM3NeT neutrino telescope consists of a network of large volume Cherenkov detectors at the bottom of the Mediterranean Sea designed to search for neutrino interactions in the water. With its two sites ORCA (optimized for GeV energies) and ARCA (optimized for TeV-PeV energies) under construction, it will allow to determine the neutrino mass hierarchy and detect neutrinos from powerful astrophysical objects. With continuous deployment of sensors and the recent start of data analysis, detector calibration has become a critical task. This contribution reports on the status of a calibration method which uses reconstructed tracks of atmospheric muons to evaluate the detector geometry and timing. In particular, comparisons to time and position calibration methods using dedicated hardware devices will be shown and the added value of this alternative, purely data-driven approach will be discussed.

T 84.5 Thu 17:30 L-3.001

Performance analysis of new PMTs and light guide systems at the Fluorescence Detector of the Pierre Auger Observatory — •Urs Grosse-Rhode for the Pierre Auger-Collaboration — Bergische Universität Wuppertal, Gaußstraße 20, 42119 Wuppertal, Deutschland

The Fluorescence Telescopes at the Auger Observatory are used to detect the fluorescence light produced by extensive air showers. This is done through the use of photomultiplier tubes(PMTs) which are placed in the telescopes camera. The camera consists of 440 PMTs in the focus plane of a $12m*$ mirror. To study the performance of a new generation of PMTs, one camera has been partially equipped with two new PMT types and an new light guide system. The performance can be estimated with the standard and the new PMT types. The bulk of the analysis uses a reference calibration executed at the camera and laser shots which are fired with low inclination, passing by the camera building. Also the recently launched Aeolus satellite introduced a new opportunity, providing a loser shooting into the Auger Oberservatory from space. An overview of the used methods for the performance analysis as well as results from the analysis will also be presented.

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T 84.6 Thu 17:45 L-3.001

The Acoustic Calibration Modules of the IceCube Upgrade — •Max Scharf, Dirk Heinen, Moritz Kellermann, Martin Rongen, Shefali Shefali, Lars Steffen Weinstock, Christopher Wiebusch, and Simon Zierke for the IceCube-Collaboration — III. Physikalisches Institut B, RWTH Aachen University

The IceCube Upgrade will expand the current IceCube Neutrino Observatory with seven additional strings of instrumentation. These will include an acoustic calibration system. This calibration system consists of ten acoustic modules, which are distributed along the new strings and can receive and emit acoustic signals over distances of up to several hundred meters. Using acoustic trilateration these modules are able to determine their positions and improve the overall quality of positioning in IceCube. Furthermore, the system will allow for glaciological measurements and will be an important demonstration of acoustic geometry calibration for the future IceCube Gen2 detector. Within the EnEx-RANGE project autonomous melting probes with acoustic instrumentation for positioning have been developed and successfully demonstrated. Based on this experience, acoustic modules are currently being developed and planned to be ready for production by late 2020. This talk will present the current status of the hardware development and results from test measurements.

T 84.7 Thu 18:00 L-3.001

Entwicklung von Sensoren eines akustischen Kalibrierungssystems für das IceCube Upgrade — •Moritz Kellermann, Dirk Heinen, Martin Rongen, Max Scharf, Shefali Shefali, Lars Steffen Weinstock, Christopher Wiebusch und Simon Zierke für die IceCube-Kollaboration — III. Physikalisches Institut B, RWTH Aachen University

Das IceCube Upgrade wird das derzeitige IceCube Neutrino Observatorium um sieben Kabelstränge mit optischen Modulen und Kalibrierungsgeräten erweitern. Darunter befindet sich ein Kalibrierungssystem mit zehn Modulen, die akustische Signale über mehrere hundert Meter senden und empfangen können. Zusätzlich sollen in eini-

gen optischen Modulen akustische Sensoren integriert werden. Mittels Trilateration akustischer Laufzeiten kann die Position der Module bestimmt und die Qualität bisheriger Positionsbestimmungen verbessert werden. Außerdem ermöglicht das System glaziologische Messungen und ist eine wichtige Demonstration für eine akustische Kalibrierung der Geometrie des zukünftigen IceCube-Gen2 Detektors. Der Vortrag präsentiert das aktuelle Design, sowie die elektronischen und mechanischen Eigenschaften der akustischen Sensoren.

T 84.8 Thu 18:15 L-3.001

The POCAM as self-calibrating light source for the IceCube Upgrade — •Felix Schmuckermaier, Felix Henningsen, and Christian Spannfellner — Technische Universität München, Germany

The IceCube Neutrino Observatory will be upgraded until the South Pole season of 2022/23. This IceCube Upgrade will consist of seven new instrumentation strings containing optical sensors and calibration devices. Besides extending the detector's science capabilities towards lower energies, the goal is to improve the knowledge of the Antarctic ice properties as well as the detector response. In order to achieve these calibration goals, the strings will be equipped with different calibration devices, including 21 Precision Optical Calibration Modules (POCAM). In this talk we present the motivation for the POCAM and its properties as a novel self-calibrating and isotropic light source, emitting light pulses of adjustable intensity and pulse width. The POCAM's primary goals are the improvement of South Pole ice systematic uncertainties down to a few percent as well as the study of detector instrumentation efficiencies and linearities. In the scope of the latter, it will further aim to verify the detector energy scale and its calibrations.

T 84.9 Thu 18:30 L-3.001

PeeEmTee: A python/numpy-based package for analyses of PMT characterisation measurements — •Jonas Reubelt, Tamás Gál, and Johannes Schumann — ECAP, Universität Erlangen-Nürnberg, Erwin-Rommel-Str. 1, 91058 Erlangen

Photomultiplier tubes (PMTs) are frequently used as high-sensitivity light sensors in modern physics detectors. Precision measurements employing PMTs require a detailed understanding of the sensors' behaviour in low light-level environments. The PeeEmTee package (https://github.com/JonasReubelt/PeeEmTee) provides functionalities fundamental for PMT characterisation under such conditions, like a routine for fitting PMT response functions to charge distributions. The physical modelling of PMTs that went into PeeEmTee, as well as the concept and base functionality of the package will be presented.

T 84.10 Thu 18:45 L-3.001

Development of a standard test and calibration procedure for the hardware of the Radio Neutrino Detector RNO-G — •Nora Feigl for the RNO-G-Collaboration — ECAP, Friedrich-Alexander-Universität Erlangen-Nürnberg

The Radio Neutrino Observatory in Greenland (RNO-G) will be able to detect the radio emission of neutrinos with energies above 100 PeV in the Greenland ice. RNO-G will not only observe as the first ultra-high-energy neutrino detector the Northern sky but also works as a pathfinder for the radio component of the next-generation neutrino detector IceCube-Gen2.

Starting summer 2020, 5 of the overall 35 stations of RNO-G will be installed. The hardware of these first stations is tested in spring 2020. On the basis of the experiences of these 5 stations, the second generation of hardware will be improved and IceCube-Gen2 will be designed with the knowledge and experience gained in the RNO-G project.

Reproducible and exact testing and calibration procedures are essential to evaluate the performance of the stations and make RNO-G a success. The same holds for a well-designed calibration database and suitable interfaces to store the calibration data.

In this talk the used methods and the current status of the hardware testing are presented.