T 18: Exp. Methods, CTA, others

Time: Monday 16:30–18:00 Location: POT/0351

T 18.1 Mon 16:30 POT/0351

Characterization of PMTs for the FlashCam project — •Oleg Kalekin for the CTA FlashCam-Collaboration — Erlangen Centre for Astroparticle Physics, FAU Erlangen-Nürnberg, Nikolaus-Fiebiger-Str. 2, 91058 Erlangen, Germany

High quantum efficiency PMTs of type R12199-100-5 from Hamamatsu have been selected for the cameras of telescopes of the Cherenkov Telescope Array (CTA). The FlashCam group has developed a camera design suitable for installation in Medium-Sized Telescopes of CTA.

Using PMTs delivered in 2017, an advanced FlashCam prototype was produced and installed in the central CT5 telescope of the H.E.S.S. experiment in Namibia in fall 2019. Since then the PMTs are in field operation for more than 2 years already, and provide very stable performance. To control the quality of the PMTs, sub-samples delivered in 2017 and 2021-2022 have been characterized in laboratory for timing parameters, gain, afterpulsing and Quantum Efficiency (QE). The results on spectral shape of QE and homogeneity of QE over photocathode area as well as an evolution of these parameters with time will be presented.

T 18.2 Mon 16:45 POT/0351

Performance of SiPM test pixel operation in the MAGIC IACT PMT camera — •Alexander Hahn[1], Razmik Mirzoyan[1], Antonios Dettlaff[1], David Fink[1], Daniel Mazin[1,2], and Masahiro Teshima[1,2] — [1]Max Planck Institute for Physics, Munich, Germany — [2]Institute for Cosmic Ray Research, The University of Tokyo, Kashiwa City, Japan

All currently operating large Imaging Atmospheric Cherenkov Telescopes (IACTs), such as MAGIC, H.E.S.S., or VERITAS, or such as CTA's LST presently being commissioned, use photomultiplier tubes (PMTs) as primary light detectors. It has been shown that smaller IACTs such as FACT and ASTRI can operate with Silicon photomultipliers (SiPMs) instead. However, it is an open research question whether SiPMs may also be suitable as light detectors for large-scale IACTs. To address this question, we have built several SiPM-based prototype detector modules at the Max Planck Institute for Physics. The first module, based on SiPMs from Excelitas, was installed in the PMT-based MAGIC-I imaging camera in May 2015, while two more modules, one using SiPMs from Hamamatsu and another one from SensL, were installed in 2017. Since then, all these modules have been operated in parallel with the PMT camera. Here we present a multi-year in situ study of SiPMs and PMTs in an operational IACT and present a direct performance comparison between the two detector types.

T 18.3 Mon 17:00 POT/0351

nsb2: an open source tool for simulating Imaging Atmospheric Cherenkov Telescope Night Sky Background — •Gerrit Roellinghoff[1], Samuel Spencer[2,1], and Stefan Funk[1] for the H.E.S.S.-Collaboration — [1]Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen Centre for Astroparticle Physics, Nikolaus-Fiebiger-Str. 2, 91058 Erlangen, Germany — [2]Department of Physics, University of Oxford, Keble Rd, Oxford OX1 3RH, United Kingdom

As a result of being exposed to the night sky, Imaging Atmospheric Cherenkov Telescopes (IACTs) are sensitive to background illumination; all sources of illumination that are not Cherenkov light. This Night Sky Background (NSB) limits the operational time of IACTs, introduces systematic uncertainty and is a source of Data/Monte-Carlo mismatch. Building on software previously developed for H.E.S.S., we present an open source tool for the pixel-wise prediction of NSB in IACTs, simulating contributions from a variety of sources, such as starlight, moonlight and atmospheric glow. It allows for the computationally efficient prediction of NSB rates for a variety of IACT types, thus improving on Data/Simulation mismatch and enabling users to plan observations for IACTs during partial moonlight observations.

T 18.4 Mon 17:15 POT/0351

IceCube-Gen2: Optical module prototyping and performance studies — •Markus Dittmer and Alexander Kappes for the IceCube-Collaboration — Westfälische Wilhelms-Universität Münster

As the progression of IceCube continues, a novel optical module (OM) for IceCube-Gen2 is being developed, that incorporates lessons learned from the development of modules for IceCube Upgrade while adapting to the reduced borehole diameter. The presentation will provide a brief introduction to four (of many) aspects involved in the development of the Gen2OM prototype: The gel pad concept, which is key for performance and integrity, and related prototyping; photomultiplier studies; simulation studies for OM performance; and a method for estimating the module background caused by radioactive scintillation in the pressure vessel.

T 18.5 Mon 17:30 POT/0351

Acceptance Tests of 10,200 Photomultiplier Tubes for the mDOMs of the IceCube Upgrade — •Lasse Halve[1], Philipp Behrens[1], Erik Büchau[1], Maja Freienhofer[2], Tara Haji Azim[1], Joëlle Savelberg[1], Lars Schmidt[1], Lydia von der Weiden[2], Johannes Werthebach[2], and Christopher Wiebusch[1] for the IceCube-Collaboration — [1]RWTH Aachen University - Physics Institute III B, Aachen, Germany — [2]Astroparticle Physics WG Rhode, TU Dortmund University, Germany

More than 10,000 3-inch Photomultiplier Tubes (PMT) will be deployed in multi-PMT Digital Optical Modules (mDOM) of the IceCube Upgrade. Prior to integration of the PMTs into the modules, they need to be tested for compliance with specifications agreed upon with the manufacturer. For this purpose, two dedicated testing facilities have been constructed at RWTH Aachen University and TU Dortmund University. These facilities have been optimized for a large throughput of PMTs using highly automized and parallelized testing routines. All PMTs have undergone extensive acceptance tests including single-photon response and detection efficiency, time-resolution, background rates, high-voltage dependence and more. During testing, several deviations from the specifications were identified and could be mitigated prior to the mDOM production. We describe the design of the facilities, testing procedures, and results of the acceptance tests.

T 18.6 Mon 17:45 POT/0351

Validation Tests of 10,200 Photomultiplier Tubes for the IceCube Upgrade — •Tara Haji Azim, Philipp Behrens, Erik Büchau, Lasse Halve, Joëlle Savelberg, Lars Schmidt, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut B, RWTH Aachen University

The Upgrade of the IceCube Neutrino Observatory incorporates the installation of Photomultiplier Tubes (PMTs) as parts of advanced multi-PMT Digital Optical Modules (mDOMs). For this purpose, 10,200 of 3-inch PMTs were quality controlled prior to the commissioning phase at two facility sites, one at RWTH Aachen University and the other one at TU Dortmund University. All PMTs have undergone extensive acceptance tests including single-photon response, detection efficiency, time-resolution, background rates, high-voltage dependence, and more. In this talk, we will review selected results of the survey.