T 51: Experimental Techniques in Astroparticle Physics 2

Time: Tuesday 16:15–18:20 Location: T-H36

T 51.1 Tue 16:15 T-H36

Comparison of Sky Models of the Galactic Radio Background for the Calibration of Radio Arrays — •Max Büsken for the Pierre Auger-Collaboration — Institut für ExperimentelleTeilchenphysik, Karlsruher Institut für Technologie, Karlsruhe, Deutschland

The Pierre Auger Observatory is the largest ground-based experiment for the detection of ultra-high energy cosmic rays. New radio antennas will be installed on each of the surface detector stations as part of the AugerPrime upgrade. This will allow to study the mass composition of cosmic rays arriving with large inclination angles.

Performing an accurate calibration and having a good understanding of its uncertainties is crucial for any physics analysis. Conducting a calibration campaign in the field with a reference antenna is not feasible on this large scale. Therefore the absolute calibration of the radio antennas will be performed using the diffuse galactic radio emission as an absolute reference, as it is the most dominant source of background. I will present a comparison of sky models that predict the galactic emission received from the whole sky. I will show how large the uncertanties on these predictions are and illustrate, what this means for radio experiments relying on this calibration method.

T 51.2 Tue 16:30 T-H36

Verbesserung des externen Triggers von AERA für ausgedehnte Luftschauer am Pierre-Auger-Observatorium — •Rukije Uzeiroska für die Pierre Auger-Kollaboration — Bergische Universität Wuppertal

Das Pierre-Auger-Observatorium ist das größte Observatorium für kosmische Strahlung der Welt. Sein Auger Engineering Radio Array (AERA) besteht aus mehr als 150 Antennenstationen, die eine Fläche von etwa 17 km^2 abdecken, und dient der Erfassung von Radiosignalen, die von ausgedehnten Luftschauern emittiert werden. Diese Messungen werden verwendet, um die Eigenschaften der primären kosmischen Strahlung zu rekonstruieren, die die Luftschauer verursacht. Die Datennahme von AERA wird insbesondere extern durch die zentrale Datennahme des Observatoriums getriggert. Seine Funktionsweise führt dazu, dass viele Ereignisse getriggert werden, die für AERA nicht relevant sind. Zudem werden nicht alle interessanten Ereignisse als solche erkannt. Um den externen Trigger zu verbessern wird eine neue, vereinfachte Rekonstruktionsmethode für die Bestimmung der Richtung eines ausgedehnten Luftschauers vorgestellt. Die Zuverlässigkeit dieser Methode wird anhand von rekonstruierten Luftschauern getestet. Auf Basis der entwickelten Rekonstruktionsmethode werden verschiedene Trigger-Bedingungen definiert und getestet. Die optimale Trigger-Bedingung erreicht eine Effizienz von 99,87 % für relevante AERA-Ereignisse, während sie die Gesamt-Datenrate um 49,98 % reduziert. Dies stellt eine substantielle Verbesserung gegenüber dem aktuellen AERA-Trigger dar.

T 51.3 Tue 16:45 T-H36

Depth of Maximum of Air-Shower Profiles at the Pierre Auger Observatory — •Thomas Fitoussi for the Pierre Auger-Collaboration — Karlsruhe Institute of Technology, Institute for Astroparticle Physics, Karlsruhe, Germany

The Pierre Auger Observatory is the largest ultra-high energy cosmic rays observatory in the world. Using a hybrid technique (fluorescence telescopes and surface detectors) it is possible to estimate the mass composition of cosmic rays. The main mass-sensitive observable measured with fluorescence telescopes is the depth of maximum of air-shower profiles called $X_{\rm max}$.

In this presentation, we will present the analysis of the most recent dataset with a special focus on results at low energies down to $\sim 10^{17}$ eV. These low energy measurements are preformed with the High Elevation Auger Telescope (HEAT) and they allow to study the energy region where the transition between Galactic and extragalactic cosmic rays is expected.

T 51.4 Tue 17:00 T-H36

Separation of muonic and electromagnetic signals using the upgraded detectors of the Pierre Auger Observatory — •Allan Machado Payeras[1,2], Anderson Campos Fauth[2], Darko Veberic[1], and David Schmidt[1] — [1]Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]University of Campinas, Campinas, Brazil

The Pierre Auger Observatory detects extensive air showers (EAS), produced by high-energy cosmic rays. Its surface detector (SD) is composed of 1660 water-Cherenkov detectors (WCD) disposed in a triangular grid with a spacing of 1500 m between nearest neighbours. At the moment, the Observatory is being upgraded with the main addition of a surface scintillation detector (SSD), which will be installed on top of each WCD. The main goal of the upgrade is to obtain data sensitive to the composition of the primary cosmic rays, which is necessary to understand the astrophysical origin of these particles. In this work, we have studied a method to obtain a separation of signals due to the electromagnetic and muonic components of EAS, using the responses of the WCD and SSD. Such separation is the key to obtain composition-sensitive information from the new dataset. The signals of each of the components were modelled for the detectors and, using Monte Carlo simulation of both EASs and of the detector responses, we studied the reconstruction of the components for different distances to the shower axis, energies and zenith angles of the primaries. We assessed the reconstruction precision of the different components not only for the total signal, but also for its time structure.

T 51.5 Tue 17:15 T-H36

Pointing accuracy of the roving laser system for the energy calibration of the Pierre Auger Observatory* — •Alina Nasr Esfahani — Bergische Universität Wuppertal, Gaußstr. 20, Wuppertal, Germany

The Fluorescence Detector (FD) of the Pierre Auger Observatory provides a nearly model independent measurement of the energy of primary cosmic rays. This FD energy measurement sets the energy scale of the Surface Detector, its precision thereby factors into the systematic uncertainties of practically all scientific results from the Observatory. By firing a laser with known energy output in front of the FD telescopes the energy calibration obtained from other methods can be cross-checked independently. The camera response to the laser closely resembles its response to a real cosmic ray shower providing a valuable end-to-end calibration. The laser system includes components to expand and depolarize the laser beam to optimize the scattering in the atmosphere and detection by the FD camera. We built the roving laser system by utilizing a telescope mount as a carrier for the laser. Angular precision measurements show that this greatly improves the pointing accuracy, which has been a significant source of uncertainty in previous campaigns. The precision requirements for a sufficient reduction of systematic uncertainties compared to previous systems are based on the analysis of laser simulations.

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T 51.6 Tue 17:30 T-H36

Applications of the high-energy lepton and photon propagator PROPOSAL — •Jean-Marco Alameddine[1], Jan Soedingrekso[1], and Alexander Sandrock[2] — [1]Astroparticle Physics WG Rhode, TU Dortmund University, Germany — [2]University of Wuppertal, Germany

PROPOSAL is a simulation library, usable in both C++ and Python, which provides 3D Monte Carlo simulations of charged leptons and high-energy photons. One key concept of PROPOSAL is to offer a trade-off between simulation precision and performance for each individual use case. Due to its customizable and modular structure, PROPOSAL is used for a wide range of applications, for example in the simulation chain of the IceCube Neutrino Observatory or as an electromagnetic interaction model in the shower simulation framework CORSIKA 8.

In this contribution, an introduction to the simulation framework as well as an overview of its current and possible future applications, including muography, are presented.

T 51.7 Tue 17:45 T-H36

Effects of unresolved particles in the counts estimated by a segmented detector — •Flavia Gesualdi[1,2] and Daniel Supanitsky[1] — [1]Instituto de Tecnologías en Detección y Astropartículas (CNEA, CONICET, UNSAM), Centro Atómico Constituyentes, B1650KNA San Martín, Buenos Aires, Argentina —

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Segmented particle counters are part of many astroparticle physics detectors and are used to estimate particle densities. For instance, measuring the density of muons in air showers is key for composition analyses, which in turn help to elucidate the origin of cosmic rays. Technically, the goal of a segmented particle counter is to provide an accurate estimate of the impinging number of particles from the measured number of hit segments. If two particles hit a same segment within a time interval smaller than the time resolution, the two particles are counted as one. This undercounting effect, referred to as pile-up, is larger when the number of segments is small with respect to the number of impinging particles, and when the time resolution is poor compared to the characteristic duration of a single-particle signal. In this work, we develop a new pile-up-correction method that makes use of the whole temporal structure of the signal. We compare its performance against methods in literature. We show that the method of this work performs well when considering typical air-shower signals, and that it is also the only one that extends well to long or double-bump-like signals.

Group Report T 51.8 Tue 18:00 T-H36

Intensity interferometry campaign at the H.E.S.S. telescopes — •Naomi Vogel, Andreas Zmija, Gisela Anton, Stefan Funk, Dmitry Malyshev, Thilo Michel, Frederik Wohlleben, and Adrian Zink — Friedrich-Alexander-Universität Erlangen-Nürnberg, ECAP

Intensity interferometry (II) enables high angular resolution (~milliarcsecond) astronomical observations in the optical band by measuring the photon fluxes of at least two telescopes with varying baselines and correlating them. It has already been applied by VERITAS and MAGIC with excellent results. Imaging Atmospheric Cherenkov Telescopes are suitable for performing intensity correlations because of their very large collecting areas. We are planning an upcoming II campaign at the H.E.S.S. telescopes in Namibia. Our developed II setup, which includes a 2nm interference filter, is designed to fit on the lid of the telescopes and to handle the high photon count rates expected from the stars. This is achieved by photomultipliers whose photo currents are measured and then correlated. As preparation for our campaign lab measurements were carried out to achieve low background and good signal-to-noise ratios. In this contribution we will present our technical setup and results from our lab measurements as precursor for II at the H.E.S.S. telescopes.