T 98: Experimental Methods (general) 4

Time: Thursday 16:15–18:05 Location: T-H29

Group Report T 98.1 Thu 16:15 T-H29

High-D: F&E für hochsegmentierte mehrdimensionale Detektoren für zukünftige Experimente — •Erika Garutti für die High-D-Kollaboration — U Hamburg

Zukünftige Experimente für Higgs-Präzisionsmessungen, die Suche nach Physik über das Standardmodell hinaus, sowie für die Untersuchung des Quark-Gluon-Plasmas und die Erforschung des QCD-Phasendiagramms, verlangen eine neue Generation von Hochpräzisionsdetektoren mit beispielloser räumlicher, zeitlicher und energetischer Auflösung. Die Anforderungen an solche 5-dimensionale (5D) Messungen können nur durch die Kombination von Detektoren mit extremer Granularität und neuartigen Rekonstruktionsmethoden erreicht werden. Eine höhere Segmentierung wird durch neu zu entwickelnde mikroelektronische Technologien, Halbleiterdesigns, Segmentierungskonzepte und Ausleseelektronik möglich werden. Diese Forschung auf der Detektorseite muß von neuartigen Algorithmen begleitet werden, die die bereitgestellte 5D-Information effektiv nutzt. Sie geht darin weit über einen einzelnen Detektor hinaus, indem sich alle Komponenten von einem Detektorsystem ergänzen, um eine optimale Rekonstruktionspräzision zu gewährleisten. High-D ist ein neuer vom BMBF geförderter Verbund, in dem die Gemeinschaften der Elementarteilchen-, Kern- und Hadronenphysik erstmalig miteinander gemeinsam an der Entwicklung verschiedener grundlegender Technologien zu solchen 5D-Detektoren zusammenarbeiten. Der Vortrag gibt einen Überblick über die geplanten Arbeiten und Projekte.

T 98.2 Thu 16:35 T-H29

The characterisation of non collisions background events in the ATLAS detector during Run-2 data taking. — •Sergio Grancagnolo — Humboldt-Universität, Berlin, Germany

Understanding events from proton interactions with residual gas in the beam pipe, with collimators, or from cosmic rays is of primary importance to identify potential risk of damage to the accelerator and experiments. In addition, these events represent one of the main background on non-conventional physics signatures based on tracks not pointing to the interaction point, out-of-time energy deposits, or displaced decay vertices might come from signals released by long-living heavy particles. The characteristics of these non-collision backgrounds are illustrated in detail in order to identify, estimate and reject them by using all the ATLAS detector.

T 98.3 Thu 16:50 T-H29

BGNet: A neural network for beam background prediction for SuperKEKB — •Yannik Buch, Ariane Frey, and Benjamin Schwenker — II. Physikalisches Institut, Georg-August-Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Deutschland

In pursuit to understanding the observed CP-violation in our universe, the Belle II detector investigates the b-sector by measuring the decays of the $\Upsilon(4S)$ resonance. These resonances are produced by the SuperKEKB accelerator at KEK in Tsukuba, Japan. The goal of SuperKEKB is to achieve an instantaneous luminosity of $6.5 \times 10^{35}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$. Currently, a luminosity of $5 \times 10^{34}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$ is reached, showing that considerable improvements to the beam focusing and increases of the ring currents are still necessary. A key component to achieve the design luminosity is the nano beam scheme. At the same time, however, the Belle II detector must not be damaged or its performance compromised by extensive radiation and hit rates.

The beam backgrounds at Belle II are mostly composed of storage backgrounds, luminosity-based backgrounds and injection backgrounds of both rings due to the top-up injection scheme. BGNet is trained to predict the overall hit rates and their composition in terms of background source for various Belle II sub-detectors. The input data for BGNet are 1 Hz time series of variables describing the state of the SuperKEKB accelerator. This helps to monitor and mitigate the beam backgrounds during future operation.

T 98.4 Thu 17:05 T-H29

Low-background poly(ethylene naphthalate) as active structural material for the LEGEND-200 $0\nu\beta\beta$ experiment — •Felix Fischer for the PEN-Collaboration — Max-Planck-Institut für Physik, München, Deutschland

Poly(ethylene naphthalate), PEN, is a widely used industrial polyester which intrinsically scintillates blue light and has very good mechanical properties, also at cryogenic temperatures. This makes PEN an ideal candidate for self-vetoing structural materials in the close surrounding of ultra low background detectors for the search of extremely rare events like $0\nu\beta\beta$ decay. The process from procurement of commercially available PEN pellets to an optically active low background support-structure to be used in the next generation $0\nu\beta\beta$-decay search experiment Legend-200 will be presented.

T 98.5 Thu 17:20 T-H29

Setup for a ground parameter measurement for the radio detection at the Pierre Auger Observatory* — •Jannis Pawlowsky for the Pierre Auger-Collaboration — Bergische Universität Wuppertal, Gaußstraße 20, 42119 Wuppertal, Deutschland

The Pierre Auger Observatory is the largest observatory in the world measuring ultra high energy cosmic rays (UHECR). With the on-going AugerPrime upgrade, the hybrid detection of the 27 Fluorescence Telescopes and 1660 Water Cherenkov Detectors (WCD) is complemented by the Radio Detector (RD) on top of each WCD. The mounted antenna detects the radio emission of the air shower.

The reconstruction of the UHECR properties with radio signals is dependent on environmental parameters like atmospheric (weather) conditions and soil composition. The ground conditions are especially important for inclined air showers, where a non-negligible fraction of the radio signal is reflected off ground prior to being measured by the antenna. Knowledge of the ground parameters, namely permittivity, ε, and conductivity, σ, is therefore essential for a precise reconstruction.

The usage of constant reference values for ε and σ is not applicable for the extended RD grid. With an area of approximately $3000\,\mathrm{km}^2$ it consists of many different soil types and has distinct weather conditions. In this talk we present a campaign for a measurement of the different soil types and a permanent stable and cost efficient setup in order to detect relative changes due to varying weather conditions.

**Gefördert durch die BMBF Verbundforschung Astroteilchenphysik (Vorhaben 05A20PX1)*

T 98.6 Thu 17:35 T-H29

Rydberg Background reduction in KATRIN experiment using THz Radiation* — •Shivani Ramachandran and Enrico Ellinger for the KATRIN-Collaboration — Bergische Universitaet Wuppertal, Germany

One of the key requirement for the KATRIN experiment to reach its goal sensitivity in measuring the neutrino mass is minimal background. In order to achieve this and eliminate some known contributors, several background suppression methods have already been implemented. Presently the most prominent contribution to the background in the measured signal are electrons produced by thermal ionization of Rydberg atoms which originate from the walls of the main spectrometer.

A plausible method is using THz and microwave radiation which can lead to a reduced lifetime of Rydberg atoms and allow for dedicated stimulated de-excitation. The influence of THz light source in the main spectrometer along with the state and spatial evolution of the Rydberg atoms is studied via simulations. The transition and ionization rates due a light source depend mainly on its frequency, intensity and spectral width. A range of frequencies in the THz regime with different intensities are tested for background reduction. Influence of currently available broadband and narrowband THz sources are also studied. The results show important parameters namely the radiative power, frequency range and number of sources required for effective background reduction with this method. *Gefördert durch die BMBF-Verbundforschung Astroteilchenphysik

T 98.7 Thu 17:50 T-H29

Geometry Calibration of IceCube - A new Likelihood-based Multilateration Approach — •Saskia Philippen, Christoph Günther, and Christopher Wiebusch for the IceCube-Collaboration — RWTH Aachen University - Physics Institute III B, Aachen, Germany

The IceCube Neutrino Observatory consists of 5160 Digital Optical Modules (DOMs), attached to 86 cable strings, which are embedded in the Antarctic ice in a depth between 1.5 to 2.5 kilometers. The reconstruction of neutrino events is based on the arrival times of Cherenkov

light at the position of these DOMs. Currently, these positions are only known with a precision of about one meter, because of the uncertainty during the hole drilling process. For several calibration purposes IceCube has produced data-sets in which flashes from LEDs installed inside the DOMs are detected by the surrounding DOMs. The transit times of these signals can be converted into distances between each pair of DOMs. We have developed a multilateration algorithm which fits the positions of all DOMs to these distances in a global maximum-likelihood analysis. The here presented algorithm can be applied beyond IceCube also to the acoustic calibration systems that are foreseen in the IceCube Upgrade and IceCube-Gen2.