T 89: Detektorsysteme III

Zeit: Donnerstag 16:30–19:00 Raum: Z6 - SR 2.007

T 89.1 Do 16:30 Z6 - SR 2.007

Particle track reconstruction at BelleII using a Combinatorial Kalman Filter — •Miriam Künzel — DESY Hamburg — LMU Munich

This talk presents implementations of a Combinatorial Kalman Filter approach for the track reconstruction in the BelleII detector. After shortly presenting main features of the BelleII tracking framework, the general concept of a Kalman filter is described and why it is useful for tracking algorithms. To go into more detail, the workflow of one of the current Kalman filter implementations is presented. Current results and impact on to the BelleII physics are shown as well.

T 89.2 Do 16:45 Z6 - SR 2.007

Validierung eines auf tiefen neuronalen Netzen basierenden Flavor Tagging Algorithmus am Belle und Belle II-Experiment — Florian Bernlochner, Michael Feindt, Thomas Hauth, Martin Heck, •Jochen Gemmler und Pablo Goldenzweig — KIT

Das Belle II-Experiment am SuperKEKB Speicherring in Japan befindet sich derzeit im Aufbau und wird Anfang 2019 B-Mesonen-Paare in einer noch nie dagewesenen instantanen Luminosität erzeugen. Messungen zur CP-verletzenden Asymmetrie beim Zerfall eines $B^0\bar{B}^0$-Paares in einen CP-Eigenzustand f_{CP} und den Endzustand f_{tag} sind ein wichtiges Forschungsvorhaben des Experiments. Zur Bestimmung der zeitabhängigen CP-Asymmetrie wird der Flavor des zu f_{tag} gehörigen B-Mesons aus einem flavor-spezifischen Zerfallskanal von den Endzustandsteilchen abgeleitet. Dieser Prozess wird als Flavor Tagging bezeichnet und nutzt bestimmte Attribute der jeweiligen Zerfallstopologie. Der Einsatz eines tiefen neuronalen Netzes bietet eine Alternative zu dem bisherigen, auf Boosted Decision Trees basierenden, Ansatz bei dem Eingangsvariablen konstruiert werden müssen, die über den grundlegenden Ereignisinhalt wie Spuren und Cluster hinausgehen.

In diesem Vortrag wird eine erstmalige Validierung des auf neuronalen Netzen basierenden Ansatzes auf dem vollen Datensatz des Belle Experiments, der 772 Millionen B-Mesonpaare beinhaltet, vorgestellt.

T 89.3 Do 17:00 Z6 - SR 2.007

Pileup effect removal in shower shape of photon ID — •Binish Batool, Ivor Fleck, and Yichen Li — University of Siegen, Siegen, Germany

In this presentation the shower shapes of photons in the calorimeter of the ATLAS detector are investigated. The presence of in-time pile up causes some deviation in the distribution of the shower shapes of photons. This deviation is studied by using an efficient estimator i.e. average energy density in eta regions; $|\eta| < 1.5$ (central energy density) and $1.5 < |\eta| < 3.0$ (forward energy density). The choice of this estimator depends on its correlation with shower shapes. The correction of shower shapes employs a subtraction method at derivation level, to remove the pile up effect. For this, an eta dependent energy density and area of corresponding cells are used, which results in a removal of the pile-up effect.

T 89.4 Do 17:15 Z6 - SR 2.007

Track-based Mulitple Scattering Tomography — •Paul Schütze and Hendrik Jansen — Deutsches Elektronen-Synchrotron DESY, Hamburg, Deutschland

In detectors for particle physics experiments, not only the minimization, but also the determination and localization of the material budget is crucial due to its large impact on simulation and event reconstruction. Using a charged particle beam in the GeV-range and a high-resolution beam telescope, the material budget of any device can be determined and localized precisely by measuring the position-resolved scattering angle distribution of the particle beam. Illuminating the sample from various directions and using an inverse radon transform, this method furthermore enables three-dimensional, tomographic imaging.

With these techniques, samples of high density can be investigated, exceeding the corresponding limits of X-ray imaging by far. Therefore, the method of material budget imaging has the potential of becoming a highly valuable tool also for applications outside of high-energy physics.

In this contribution, we will present the method of material budget imaging and its potential and limits and show first results of track-based multiple scattering tomography measurements performed at the DESY Test Beam Facility.

T 89.5 Do 17:30 Z6 - SR 2.007

Simulationsstudien zur Abschirmung eines Germanium-Detektors — Marcel Gerhardt, Claus Gössling, Kevin Kröninger, Christian Nitsch und •Hannah Rullkötter — TU Dortmund, Lehrstuhl für Experimentelle Physik IV, Otto-Hahn-Straße 4a, 44227 Dortmund

Die Dortmund Low Background Facility (DLB) besteht aus einem hochreinen Germanium-Detektor, welcher von einer inneren Abschirmung bestehend aus Blei, Polyethylen und Elektrolytkupfer und einer massiven äußeren Abschirmung bestehend aus Barytbeton und Gusseisen umgeben ist. Die äußere Abschirmung entspricht 10 Meter Wasseräquivalent. Aufgrund dieser Abschirmungen erreicht die DLB eine hohe Untergrundreduktion im Vergleich zu Systemen mit kleinerer Abschirmung.

Ziel des Projektes ist es auch für Systeme mit einer weniger aufwendigen Abschirmung einen möglichst geringen Untergrund und damit eine hohe Sensitivität zu erreichen. Dazu wird ein Untergrundspektrum simuliert und dessen Reduktion durch geeignete Variation von Abschirmungen quantifiziert. Der Einfluss der Umgebungsradioaktivität lässt sich zum Beispiel mit einer Bleischicht stark reduzieren. Allerdings leisten auch intrinsische Effekte in der Abschirmung einen Beitrag zum Untergrund. Um die intrinsische Radioaktivität abzuschirmen werden weitere Materialschichten benötigt, welche in den Simulationen berücksichtigt werden.

T 89.6 Do 17:45 Z6 - SR 2.007

Tracking of charged particles using an FE-I4B pixel telescope and moving emulsion films — Markus Cristinziani, Fabian Hügging, Jens Janssen, Vadim Kostyukhin, •Nikolaus Owtscharenko, and David-Leon Pohl — Physikalisches Institut der Universität Bonn

The SHiP collaboration plans a general purpose fixed-target experiment to search for hidden particles at a new beam-dump facility at the CERN SPS. To estimate the total charm cross-section in the final experiment, which includes hadronic cascade production, a dedicated measurement will be performed in 2018. Protons from the SPS interact with a multilayer target, that is interleaved with tracking emulsion films. Silicon pixel detectors behind the target will complement the high spatial resolution of emulsions with a high timing resolution.

In order to develop this tracking system, a telescope with five planes of ATLAS IBL modules has been operated in the SPS beam together with two emulsion films moving perpendicularly to the beam. This talk reports on the combined operation and first results of the 2017 test beam.

T 89.7 Do 18:00 Z6 - SR 2.007

The Mu3eGamma upgrade to the Mu3e experiment — •Hendrik Leuschner for the Mu3e-Collaboration — Physikalisches Institut, Universität Heidelberg

The Mu3e experiment investigates the potential LFV decay $\mu \to eee$ with a final target sensitivity of 1 in 10^{16} at the Paul Scherrer Institute. Muons from a high intensity beam are stopped on a hollow double cone-shaped target. The primary setup consists of four thin silicon detector layers built from high-voltage monolithic active pixel sensors (HV-MAPS). Due to the low momentum of the decay particles, the resolution is mainly determined by multiple scattering. The reconstruction is therefore based on a fast 3-dimensional multiple scattering fit with high performance of up to 100 tracks per 50ns readout frame. Different LFV decay channels can be searched for in addition to $\mu \to eee$. With a potential upgrade called *Mu3eGamma*, the channel $\mu \to e\gamma$ and subsequent $\gamma \to ee$ can be investigated.

The simulated modifications include an additional photon conversion layer and two silicon detector layers with larger radii. The implementation in the Geant4 simulation setup is presented and studies on reconstruction performance and optimization are shown.

T 89.8 Do 18:15 Z6 - SR 2.007

Helium Cooling System for the Mu3e Experiment —

•Constantin Tormann for the Mu3e-Collaboration — Physikalisches Institut, Universität Heidelberg

The Mu3e experiment will search for the charged lepton flavour violating decay $\mu \to eee$ with a target sensitivity of one in 10^{16} decays. To reach this sensitivity the Mu3e detector is based on a combination of a silicon pixel tracking system, a scintillating fibre detector and a scintillating tile detector. In order to minimize the effects of multiple coulomb scattering the detector and its cooling system require an ultra low material budget. Cooling with gaseous helium has been chosen as it offers a reasonable compromise between radiation length and cooling potential. For a maximum heat load of 400 mW/cm^2 dissipated by the pixel modules, the cooling system needs to be capable of keeping the temperature below 70°C and temperature gradients as low as possible.

Computational fluid dynamics (CFD) simulations have been used to study the cooling system. This method provides many insights into the temperature and pressure distribution, making it possible to optimize the design. To verify the computational results on the one hand and test the system for mechanical and thermal stress on the other hand, an experimental test stand has been designed.

After a general overview of the cooling system, this talk will focus on the results of the CFD simulations and present the latest progress on the experimental tests.

T 89.9 Do 18:30 Z6 - SR 2.007

Simulation studies of the technical prototype for the Mu3e Tile Detector — •Hannah Klingenmeyer for the Mu3e-Collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg

The goal of the Mu3e experiment is to search for the decay $\mu \to eee$, which violates lepton flavour conservation, with a sensitivity of 10^{-16}. To determine the vertex of the three decay electrons, precise spatial and timing measurements are necessary. One of the detector systems which will determine the time information of the electrons is the Tile Detector, which is based on plastic scintillator tiles read out by Silicon PhotoMultipliers (SiPMs).

In this talk, the status of the technical prototype of the Tile Detector, which is currently under development, will be presented. The design of the prototype has been implemented in a 3D-CAD software, which can be used for simulation studies, e.g. of the heat flow in the detector. These simulations are of particular importance for the optimisation of the mechanical design of the detector, which is constrained by the limited space available within the planned setup of the Mu3e experiment. The simulation results, which will be used to determine the final detector design, will be shown and compared to first measurements taken with the prototype in a laboratory setup.

T 89.10 Do 18:45 Z6 - SR 2.007

Dezentrales Synchronisationsystem für ein Sensornetzwerk — •Simon Zierke, Dirk Heinen, Peter Linder, Lars Steffen Weinstock und Christopher Wiebusch — III. Physikalisches Institut B, RWTH Aachen University

Für eine synchronisierte Datenerfassung von räumlich verteilten Detektorsystemen, müssen die einzelnen Einheiten mit einer gemeinsamen Zeitbasis arbeiten. Eine solche Zeitbasis kann durch eine dedizierte Synchronisationsleitung verteilt werden. Um diese zusätzliche Leitung zu vermeiden, können weitere Signale wie z.B. GPS oder eine gemeinsame AC-Spannungsversorgung genutzt werden. Das hier vorgestellte Synchronisationssystem nutzt die Nulldurchgänge einer gemeinsamen AC-Spannungsversorgung als zeitliche Referenz und kann einen Trigger mit einem Jitter < 50 ns generieren. Dieses System wurde im Rahmen des EnEx-RANGE Projekts für ein Netzwerk von akustisch-instrumentierten Eisschmelzsonden zur Navigation in Gletschereis entwickelt. Es kann jedoch auch Verwendung in anderen verteilten Detektorsystemen finden. In diesem Vortrag wird das hierfür entwickelte dezentrale Synchronisationssystem und Resultate aus verschiedenen Testszenarien präsentiert.