T 116: Detektorsysteme 4

Zeit: Donnerstag 16:45–19:05 Raum: VSH 17

Gruppenbericht T 116.1 Do 16:45 VSH 17

Track reconstruction for the Mu3e experiment — •Alexandr Kozlinskiy — Kernphysik Institut, Johannes Gutenberg-Universität Mainz

The *Mu3e* experiment is designed to search for the lepton flavour violating decay $\mu^+ \to e^+e^-e^+$. To reach phase I sensitivity of $5 \cdot 10^{-15}$, the experiment will be performed at the πE5 beam line at the Paul-Scherrer Institute (Switzerland) providing 10^8 muons per second. The muons with a momentum of about 28 MeV/c are stopped and decay at rest on a target that is placed inside two double layers of 50 μm thin pixel sensors with a pixel size of 80×80 μm^2. Timing information is provided by three layers of scintillating fibres, placed just before the outer double layers, and a scintillating tile detector. To improve momentum resolution, the detector geometry allows to record hits when particles bend back in the 1 T magnetic field. A fast track reconstruction is needed to cope with the high occupancy environment, reaching 100 tracks per reconstruction frame of 50 ns. The track reconstruction uses a novel fit algorithm that only takes into account the multiple scattering uncertainty and neglects detector resolution, allowing fast online reconstruction on a graphics processor (GPU) based filter farm. The implementation and performance of offline track reconstruction and the use of timing information from fibre and tile detector are presented.

T 116.2 Do 17:05 VSH 17

Jet reconstruction and performance using a Particle Flow algorithm in ATLAS — Ian Brock, Irina Cioara, Maike Hansen, •Regina Moles-Valls, and Rui Zhang — University of Bonn

Jets are a key ingredient in many ATLAS physics analyses. Therefore, a good jet reconstruction and calibration is essential to improve the measurements of the properties of the known particles, as well as to facilitate the search of new particles.

During the Run 1 of the LHC, the ATLAS analyses used jets built only from topological clusters of calorimeter cells (topo-cluters) or only from tracks. The particle flow algorithm introduces a new approach by combining tracking and calorimeter information. This algorithm replaces the calorimeter topo-clusters associated to charged hadrons by their momenta measured in the inner detector.

The performance of particle flow jets compared with those jets reconstructed from calorimeter energy deposits alone, shows improvements in the transverse momentum and angular resolution, as well as a reduction of the pile-up contribution. The particle flow algorithm is one of the jet collections in ATLAS for the LHC Run 2 analyses.

T 116.3 Do 17:20 VSH 17

Computertomographie mit einem CMS Phase I Pixeldetektor — Erika Garutti[1], Matteo Centis Vignali[2], Milan Zvolsky[1] und •Severin Diederichs[1] — [1]Universität Hamburg, Institut für Experimentalphysik, Luruper Chaussee 149, 22761 Hamburg — [2]CERN

Ein CMS Phase I Einzelchip Pixeldetektor und eine PHYWE XR 4.0 Röntgenmaschine wurden verwendet, um einen Mikro-Computertomographen zu entwickeln. Der hybride Silizium-Pixeldetektor ermöglicht es, sowohl die Intensität, als auch die Energie der einfallenden Röntgenphotonen zu messen. Die gemessene Photonenenergie ermöglicht es, Algorithmen für spektrale Computertomographie zu studieren. Ein Programm wurde entwickelt, welches tomografische Bilder aus den aufgenommenen Daten rekonstruiert. Die Parameter des Systems, wie z.B. die Spannung und der Strom der Röntgenröhre, sowie die Messzeit, wurden optimiert und mehrere Korrekturen wurden angewandt, um die Bildqualität zu verbessern. Die Qualität der rekonstruierten tomographische Bilder wurde durch einfache Phantome abgeschätzt. Die Leistungsfähigkeit des Systems wurde durch die Aufnahmen von Bildern kleiner Insekten validiert.

T 116.4 Do 17:35 VSH 17

Signal Characterization in Two-Dimensional Floating Strip Micromegas Detectors — •Felix Klitzner, Otmar Biebel, Jonathan Bortfeldt, Bernhard Flierl, Philipp Loesel, Ralph Mueller, Maximilian Herrmann, and Ralf Hertenberger — Ludwigs-Maximilians-Universität München

Floating strip Micromegas detectors with one-dimensional readout strips are high-rate capable particle detectors with excellent spatial and temporal resolution, allowing single particle tracking for particle fluxes up to 7 MHz/cm^2. A floating strip Micromegas detector collects the amplified ionization charge on copper anode strips with high ohmic contact to high voltage, so called floating strips. The charge signal is read out by readout strips, separated by a thin Kapton layer from the anode strips. This scheme makes the detector robust against discharges between the micro-mesh and the floating anode strips, induced by strongly ionizing particles. A novel two-dimensional readout has been realized with two layers of readout strips, parallel and perpendicular to the floating strips. Different designs of the two-dimensional floating strip anode have been investigated, where readout strip width and order of both readout layers on the PCB have been varied. We present results from characterizing measurements using a 20 MeV proton beam and 5.9 keV photons from an ^{55}Fe-source, recorded with APV25 front-end boards. Detailed simulations have been set up to understand the signal formation on the two readout layers, as differences with respect to the signal polarity, duration and height are observed on the parallel and perpendicular strip layer.

T 116.5 Do 17:50 VSH 17

Reducing the systematic uncertainty of the integrated luminosity at the CMS experiment — •Joscha Knolle and Andreas B. Meyer — DESY, Hamburg, Germany

The integrated luminosity for a given dataset of the CMS experiment is computed from the event rate measurements of certain detectors, the luminosity monitors. Its uncertainty is a dominant systematic uncertainty in many cross section measurements.

A series of Van der Meer (VdM) scans is performed to calibrate the luminosity monitors. During a VdM scan, the colliding beams are scanned in steps across one another in opposite directions in the transverse plane of the detector. From the measurement of event rates in the luminosity monitors, the calibration constants for the conversion of the measured event rate to instantaneous luminosity can be determined.

In my talk, I will present studies towards the reduction of the systematic uncertainty of the integrated luminosity for the data collected in 2015 and 2016 at the CMS experiment.

T 116.6 Do 18:05 VSH 17

FANGS, A radiation monitoring detector system for the Beast II experiment of Belle II — Patrick Ahlburg, Jochen Dingfelder, Andreas Eyring, Viacheslav Filimonov, •Nandita Khetan, Hans Kruger, Carlos Marinas, Laura Mari, David .L Pohl, and Norbert Wermes — University of Bonn

The upgrade from KEKB to SuperKEKB is expected to lead to an increase of a factor of 40 in luminosity compared with KEKB. This requires the Belle II detector components, in particular the vertex detector close to the interaction point, to be sufficiently radiation-tolerant to cope with the higher event rates and background radiation. BEAST II, a dedicated detector system to study background radiation and also help in machine commissioning will be employed in Phase 2, which is expected to start at the beginning of 2018. This experiment will measure the expected radiation dose for the inner detectors and therefore ensure a radiation safe environment for the final vertex detector system.

FANGS (FE-I4 ATLAS Near Gamma Sensors), a part of the BEAST II detector system dedicated to radiation monitoring, based on ATLAS-IBL front-end electronics and planar silicon sensors is currently being developed and characterized for this purpose. FANGS is sensitive to low KeV X-rays and can operate at high particle rates. This talk will discuss the development of the FANGS modules and their integration in the BEAST II experiment.

T 116.7 Do 18:20 VSH 17

CLAWS Phase 2: Beam background monitoring in the commissioning of SuperKEKB — •Daniel Heuchel, Miroslav Gabriel, Hendrik Windel, Naomi van der Kolk, and Frank Simon — Max Planck Institute for Physics

The SuperKEKB accelerator in Tsukuba, Japan, is currently undergoing an extensive commissioning campaign, split in three phases. During the second phase, which is starting at the end of 2017, the inner part of Belle II will be replaced by a detector system called Beam Exorcism for a Stable ExperimenT II(BEAST II), specifically designed to

measure background levels at the interaction point (IP) for different operation parameters of the accelerator.

One of the subsystems of this commissioning detector are the sCintillation Light And Waveform Sensors (CLAWS), consisting of two ladders with 8 small scintillator tiles, each individually read out by a silicon photomultiplier. The main focus of CLAWS is to study the time evolution of background originating from the continuous top-off injection of the accelerator. Thus, the system features sub-ns time resolution combined with continuous sampling over millisecond time scales. In this contribution, we will present the overall setup and design of the CLAWS phase 2 modules and discuss the performance of the detector elements. Furthermore, first results from a common integration and beam test, scheduled for February 2017 at DESY, will be discussed.

T 116.8 Do 18:35 VSH 17

Leistungsfähigkeit der Spurfindung mit dem Siliziumstreifendetektor des Belle II–Experiments — Thomas Hauth[1], Martin Heck[1], Jakob Lettenbicher[2], Felix Metzner[1], Eugenio Paoloni[3] und •Jonas Wagner[1] — [1]IEKP, KIT, Karlsruhe — [2]HEPHY, Wien — [3]INFN, Pisa

Das sich momentan in Tsukuba, Japan im Bau befindliche Belle II–Experiment wird einen modernen Siliziumstreifendetektor aufweisen, welcher eine eigenständige Spurrekonstruktion erlauben wird. Diese wird ergänzend zur Spurrekonstruktion auf Basis der Driftkammer des Belle II–Detektors eingesetzt werden. Insbesondere wird es möglich sein niederenergetische Teilchen, welche die Driftkammer nicht erreichen und eine besondere Beeinflussung durch Vielfachstreuung im Material erfahren, zu vermessen. Diese Streuung und die komplexe Geomtrie des vierlagigen Siliziumstreifendetektors, sowie die erhöhte Ereignisrate und der hohe Untergrund erschweren die Spurrekonstruktion.

In diesem Vortrag sollen erste Einblicke in die Leistungsfähigkeit des Spurfindungsalgorithmuses geliefert werden, der diese Aufgabe für ein breites Impulsspektrum mit einer hohen Effizienz und angemessener Laufzeit bewältigt.

T 116.9 Do 18:50 VSH 17

Spurfindung mit dem Siliziumstreifendetektor des Belle II–Experiments — Thomas Hauth[1], Martin Heck[1], Jakob Lettenbichler[2], •Felix Metzner[1], Eugenio Paoloni[3] und Jonas Wagner[1] — [1]IEKP, KIT, Karlsruhe — [2]HEPHY, Wien — [3]INFN, Pisa

Das sich momentan in Tsukuba, Japan im Bau befindliche Belle II–Experiment wird einen modernen Siliziumstreifendetektor mit einer komplexen Geometrie aufweisen. Dieser erlaubt eine eigenständige Spurrekonstruktion, welche ergänzend zur Spurrekonstruktion auf Basis der Driftkammer des Belle II–Detektors eingesetzt werden kann. Weiterhin wird die Vermessung niederenergetischer Teilchen, welche die Driftkammer nicht erreichen, ermöglicht.

Der für diesen Siliziumstreifendetektor entwickelte Spurfindungsalgorithmus muss die Spuren physikalisch interssanter Teilchen auch unter den Umständen der im Vergleich zum Vorgängerexperiment erhöhten Ereignis– und Untergrundsrate mit hoher Effizienz identifizieren können. Eine besondere Herausvorderung ergibt sich hierbei aus der vierlagigen Detektorgeometrie, die keinerlei Symmetrien aufweist. Für niederenergetische Teilchen wird die Spurrekonstruktion zusätzlich durch die Vielfachstreuung die diese im Material erfahren erschwert.

In diesem Vortrag wird eine knappe Übersicht dieses Spurfindungsalgorithmus gegeben. Im Speziellen wird die Simulationsdatengetriebene Lösung für die Miteinbeziehung der unregelmäßigen Detektorgeometrie erläutert.