HK 18: HK+T Joint Session IV: Pixel Detectors

Zeit: Dienstag 11:00–12:20 Raum: F 073

HK 18.1 Di 11:00 F 073

MuPix8 - a large HV-MAPS prototype — •Heiko Augustin for the Mu3e-Collaboration — Physikalisches Institut, Universität Heidelberg

The Mu3e experiment is dedicated to the search for the lepton flavour violating decay $\mu^+ \rightarrow e^+e^-e^+$ with an unprecedented sensitivity of one in 10^{16} decays. In the Standard Model this decay is suppressed to a branching ratio below 10^{-54}. Thus, any observation of a signal is a clear sign for New Physics. To reach the sensitivity goal a pixel tracker with low material budget and high rate capability is required. The technology of choice are High Voltage Monolithic Active Pixel Sensors (HV-MAPS) produced in an AMS $180nm$ HV-CMOS process.

The MuPix7 prototype showed the tremendous possibilities of this technology to build fast, monolithic pixel sensors of $50\mu m$ thickness.

In this talk the architecture of the first large $2 \times 1cm^2$ prototype MuPix8 is presented. It houses three 1.25 Gbit/s data links and tests circuits for timewalk suppression, aiming to improve the time resolution below $10ns$.

Further the road map for the characterisation and future R&D towards the final pixel sensor for the Mu3e pixel tracker is depicted.

HK 18.2 Di 11:15 F 073

Large Area Monolithic Pixel Detectors for HL-LHC & Future High Rate Experiments — •Tamasi Rameshchandra Kar, Adrian Herkert, and André Schöning — Physikalisches Institut, Universität Heidelberg, Germany

The high luminosity upgrade of the LHC (HL-LHC) aims to increase the luminosity to five times the designed luminosity to explore and better understand several interesting physics processes. This poses several challenges to the present design of the detector due to increased occupancy, very high pileup ($\sim$ 200) and radiation dense environment.
Recent advancements in HV-CMOS technology gave birth to thin, radiation hard monolithic pixel detectors at a cost per unit area comparable to traditional strip detectors. This opens up the possibilities unthinkable in the past, e.g. it is possible to construct large area pixel detectors for experiments like ATLAS, CMS and other future collider experiments.
Track triggers are on the wish-list for many experiments as a key trigger to harvest interesting physics. A track trigger based on a triplet design comprising of three layers of monolithic pixel sensors is proposed for the ATLAS inner tracker. The feasibility of such a track trigger operated at the first level at 40 MHz is exploited based on a full Geant4 simulation. In addition a design proposal for such a triplet trigger using Mupix8, a first large High Voltage Monolithic Active Pixel Sensor (HV-MAPS) prototype will be presented.

Gruppenbericht HK 18.3 Di 11:30 F 073

The vertex detector of NA61/SHINE* — •Michael Deveaux for the NA61/SHINE-Collaboration — Goethe Universität Frankfurt

The vertex detector of NA61/SHINE at the CERN SPS aims to collect open charm data in Pb+Pb collisions at high SPS energies. In a first phase, the so-called Small Acceptance Vertex Detector (SAVD) was developed and installed. It consists of four layers of 50 μm thin MIMOSA-26AHR CMOS sensors providing a spatial resolution of ~ 3.5 μm. The sensors are integrated on the new ultra-lightweight support and cooling carbon fiber structures developed for the ALICE ITS upgrade. The readout of the detector and the techniques for integrating the sensors were derived from the prototype of the CBM Micro Vertex Detector.

We discuss the concept and design of the detector and show first results on the detector performance as obtained from a beam test with a $150A$ GeV/c Pb+Pb beam carried out in December 2016. Moreover, we give an outlook toward the construction of a full vertex detector.

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HK 18.4 Di 11:50 F 073

Performance Studies of Belle II DEPFET Pixel Ladders in Test Beams — •Philipp Wieduwilt, Ulf Stolzenberg, Harrison Schreeck, Benjamin Schwenker, and Ariane Frey — Georg-August-Universität Göttingen

The construction of the new e^+e^--accelerator at the Japanese Flavour Factory (KEKB) has been finalized and the commissioning of its detector experiment (Belle II) is planned to be finished early 2017. The improved e^+e^- collider "SuperKEKB" will deliver an instantaneous luminosity of $8 \cdot 10^{35}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$, which is 40 times higher than the world record set by KEKB. In order to be able to fully exploit the increased number of collision events, and to provide high precision measurements of the decay vertices of the B meson systems in such a harsh environment, the Belle II detector will be equipped with a newly developed silicon vertex detector, which is based on the DEPFET technology. The DEPFET pixels are field effect transistors on a fully depleted silicon bulk and they combine signal detection and amplification per pixel. The new pixel detector is located closest to the interaction point and consists of two layers of active pixel sensors. Belle II will use DEPFET sensors thinned to 75 μm with low power consumption and low intrinsic noise. Beam test campaigns were conducted in order to study the performance of the pixel sensor modules. This talk will present the collected results of the April 2016 beam test and performance studies of the latest front-end read-out ASIC designs.

HK 18.5 Di 12:05 F 073

Evaluation of Innovative Cooling Concepts with High Performance Carbon Material for Vertex Detectors operated in Vacuum — •Daniela Mijatovic for the CBM-MVD-Collaboration — Goethe-Universität Frankfurt

Vertex detectors operating in vacuum have to feature, besides a low material budget, also an excellent cooling performance to ensure the efficiency of the sensors. High-performance, carbon-based materials allow to resolve this contradiction, following the concept of heat conduction to guide the heat dissipated by the sensors to heat converters located outside the detector acceptance.

Sensor carrier materials based on graphite (e.g. low-cost Thermal Pyrolythic Graphite (TPG)) and Chemical Vapor Deposited (CVD) diamond were systematically studied. To do so, IR thermography is employed supplemented by PT100 sensors to quantitatively examine the thermal performance of MVD detector modules in vacuum. In addition, we compare the results with dedicated simulations (Autodesk CFD Motion) on the heat load of detector modules.

This contribution presents our work in designing and testing innovative carrier material assemblies to efficiently cool ultra-thin vertex detectors in the context of constructing the Micro-Vertex-Detector (MVD) for CBM at the future FAIR facility.

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