HK 60: Instrumentation XVI

Time: Thursday 14:00–15:30 Location: HK-H5

HK 60.1 Thu 14:00 HK-H5

Monte-Carlo simulations of low-energy X-ray interactions in the ALICE TPC — •Ankur Yadav, Philip Hauer, Philipp Bielefeldt, and Bernhard Ketzer for the ALICE-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

The ALICE Time Projection Chamber (TPC) was recently upgraded with a Gas Electron Multiplier (GEM) based readout in order to cope with the high Pb-Pb interaction rate of 50 kHz planned for Run 3 of the LHC. In the scope of an extensive commissioning program, several measurements were already conducted without the beam. This included the injection of the meta-stable radioactive isotope Kr-83m into the gas volume of the TPC as well as the irradiation of the TPC with an X-ray source.

In order to better understand and cross-check the measured data, the MC methods provided by the Geant4 toolkit were used to simulate the interaction of low energy X-rays and associated secondary particles in the TPC. A complete detector simulation chain was developed which includes drift, diffusion, gas amplification as well as the effects of electron attachment.

In this talk, the comparison between the simulations and the measured data will be presented.

Supported by BMBF

HK 60.2 Thu 14:15 HK-H5

Quality Control of the upgraded ALICE TPC — •Stefan Heckel for the ALICE-Collaboration — Technische Universität München

About three years ago, in December 2018, the LHC and concomitant the ALICE experiment went into a long shutdown. ALICE has used this time for major upgrades including new readout chambers for the Time Projection Chamber (TPC). The TPC can now be operated in continuous read-out mode, enabling much higher data-taking rates than before. Going along with the detector upgrades, the entire software framework for data taking, reconstruction and analysis is developed anew. Within this framework, the Quality Control (QC) of the detectors plays a crucial role to guarantee a successful data-taking campaing in the upcomming LHC Run 3.

In this talk, the development of the QC for the upgraded ALICE TPC will be summarised. Given the challenging data-taking conditions, the QC has to be able to assess the quality of the data synchronously during data taking. For this purpose, the data will be analysed online with trendings of important quantities as a function of time and automatic checking procedures raising alarms in case of any outlier behaviour observed. The QC results will be visulized using different tools for the ALICE shift crew in the ALICE control room and for the TPC experts. In October 2021, the upgraded ALICE has taken physics data for the first time during a pilot-beam test of the LHC. First results of these data from the TPC-QC point of view will be shown.

HK 60.3 Thu 14:30 HK-H5

Optimization of the calibration parameters for the font-end electronics of the Silicon Tracking System of the CBM experiment — •Dairon Rodriguez Garces for the CBM-Collaboration — GSI Helmholtzzentrum, Darmstadt, Germany

The CBM is a next-generation experiment to be operated at FAIR facility. Its goal is to investigate the phase diagram of strongly interacting matter in the region of high baryon-net densities. To achieve the high rate capability CBM will be equipped with fast and radiation hard detectors employing free-streaming readout electronics. The Silicon Tracking System (STS) is the main detector for charged particle measurements and momentum determination. It is designed as eight tracking layers built from 876 modules. The custom-designed front-end electronics for reading out the double-sided silicon sensors is the STS-XYTER ASIC: analog front-end for signal processing and digital part with hit generation and readout. The characterization of the chip is an extensive procedure that includes multiple functional tests such as proper amplitude and time calibration. These are necessary steps to correctly interpret the collected data. The design of the analog front-end, with a double processing path for independent time and energy measurements, implies that the calibration should consider not only the ADC linearity aspects but also a homogeneous time response among all channels, and a well-known correlation of the threshold in both measuring paths. This work describes the characterization of the timing discriminator of the ASIC, the optimization of other-related chip parameters, and their effect on the measured data.

HK 60.4 Thu 14:45 HK-H5

Towards pre-series production: Quality control of the Silicon Tracking System module and components — •Adrian Rodríguez Rodríguez for the CBM-Collaboration — GSI Helmholtzzentrum

The Silicon Tracking System (STS) is the main tracking detector of the future CBM experiment. It is designed to reconstruct trajectories of charged particles with high efficiency and to achieve a momentum resolution better than 2% inside a 1 Tm magnetic field. The STS comprises 876 modules arranged in 8 tracking stations, where 1.8 million channels are read out with self-triggering electronics matching the experiment's data streaming and online event analysis concept. Currently, the STS project is entering the pre-series production phase, in which more than 30 modules are expected to be assembled with the final components and procedures. This is an essential task for proving the assembly concept of the final detector and requires a thorough quality control procedure in order to ensure the reliable performance of the modules and high production yield. For this purpose, multiple quality control steps have been implemented before and during the assembly of the components and the necessary hardware and software have been developed. This work will present the results of systematic testing of the STS modules and components, the steps to optimize the quality control concept, and the most significant challenges towards series production.

HK 60.5 Thu 15:00 HK-H5

Measurements of the Timing Characteristics of Silicon Photomultipliers
— •Christopher Wenzel — Ruhr-Universität Bochum, Institut für Experimentalphysik I

Silicon Photomultipliers (SiPMs) are solid-state detectors with single-photon sensitivity. Samples of the latest generation combine high gain with low noise and have an improved detection efficiency for blue and near-UV light. Due to short rise times below a few hundred picoseconds SiPMs are well suited for fast timing applications such as Time-of-Flight PET.
Within the UFaCal project, various SiPMs are being tested for possible application in a calorimeter prototype that will provide precise timing information in addition to energy.
To compare the timing performance of different SiPMs, the Single Photon Time Resolution (SPTR) was measured. The intrinsic time resolution of the photodetector can be extracted by deconvolving the measured SPTR value and the different contributions of the measurement setup. A limiting factor of the measurable SPTR is given by the pulse width of the used laser system.
This talk presents a setup for SPTR measurements using a femtosecond laser in combination with an optical trigger. Femtosecond pulses grant the ability to neglect the contribution of the laser pulse width to the measured SPTR value. The timing characteristics of a large selection of commercially available SiPMs will be presented.
Funded by BMBF

HK 60.6 Thu 15:15 HK-H5

Development of an Endcap Disc DIRC for PANDA and SCTF — •Simon Bodenschatz, Lisa Brück, Michael Düren, Jan Niclas Hofmann, Sophie Kegel, Jhonatan Pereira de Lira, Mustafa Schmidt, Marc Strickert, Chis Takatsch, Leonard Welde und Vincent Wettig — 2. Physikalisches Institut Justus Liebig Universität Gießen

The Endcap Disc DIRC has been designed for the PANDA experiment at FAIR. The design is currently being iterated on for the future high luminosity Super Charm Tau Factory (SCTF) in Russia where not only pion/kaon separation, but also muon/pion separation is required in a broad momentum range. The DIRC prototypes are tested in the Gießen Cosmic Station, which provides track information of relativistic atmospheric muons and enables performance measurements of MCP-PMT and SiPMs based designs. Prototypes and teststand are readout by a free running DAQ system using TOFPET ASICs as digitizers.