HK 48: Instrumentation X

Time: Thursday 14:00–16:00 Location: J-HS C

Group Report HK 48.1 Thu 14:00 J-HS C

Upgrade of the ALICE TPC — •Tariq Mahmoud for the ALICE-Collaboration — University of Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

After the Long Shutdown 2 (2019 − 2020), the LHC will deliver Pb-Pb-collisions with a minimum-bias interaction rate of 50 kHz. In order to make full use of the increased luminosity, the TPC, which is the main tracking and particle identification device of ALICE, is currently being upgraded with readout chambers (ROC) based on Gas Electron Multipliers (GEM). These avoid the long dead-time of the order of 200 μs generated by the ion gate and hence allow for continuous operation and readout. In summer 2019 the TPC was equipped with new GEM ROCs that had been constructed and tested in a collaborative effort of 9 European and 4 US institutions. The HV system was also upgraded for the safe operation of GEM detectors. In order to meet the new readout conditions, a new ASIC called SAMPA was developed, which contains an internal Pre-Amp, a Shaper, and a 10-bit ADC (sampling rate of 5 MHz) with 32 channels. First successful pre-commissioning tests using ionization tracks generated by cosmic rays and a UV-laser system were carried out around mid-November 2019 with the upgraded TPC. A systematic commissioning program will be taking place throughout December 2019 till February 2020. The status of the upgraded TPC will be presented as well as the results of the commissioning program. Supported by BMBF.

HK 48.2 Thu 14:30 J-HS C

A photoelectric-effect-based field calibration system for the Time Projection Chamber at the CBELSA/TAPS experiment — •Dimitri Schaab, Fabian Metzger, Markus Ball, Reinhard Beck, and Bernhard Ketzer — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

The performance of a Time Projection Chamber (TPC) relies on a very good knowledge of the electric field inside the sensitive volume. This is crucial since deviations from a perfectly homogeneous drift field deteriorate the spatial resolution of the detector if they remain uncorrected. Reasons for these deviations are, on the one hand, static imperfections of the detector structure and, on the other hand, dynamic changes of the space charge inside the sensitive volume which mainly originate from fluctuations of the event rate.
For the new TPC for the CBELSA/TAPS experiment, a calibration system based on the one of the T2K experiment is being set up. With the help of a UV-laser, electrons are released via the photoelectric effect at well-known positions on the cathode. By the electric field, these electrons are guided towards the readout plane and show the integrated spatial distortions. The UV laser light is introduced into the TPC from the anode side through fibre bundles. Care was taken to achieve a uniform illumination of the cathode surface. In this scope, a small TPC (sTPC) has been designed and built in order to test the calibration system. The setup and first measurements will be presented.

Group Report HK 48.3 Thu 14:45 J-HS C

The CBM Time-of-Flight FAIR Phase 0 program — •Ingo Deppner and Norbert Herrmann for the CBM-Collaboration — Pysikalisches Institut, Uni. Heidelberg

In order to provide particle identification (PID) of charged hadrons at the future high-rate Compressed Baryonic Matter (CBM) experiment the TOF group has developed a large-area Time-of-Flight (ToF) wall equipped with high rate capable multi-gap resistive plate chambers (MRPC). Prior to its destined operation at the Facility for Antiproton and Ion Research (FAIR) - starting in 2025 - this high-rate timing MRPC technology will be used for physics research at two scientific pillars of the FAIR Phase-0 program: the end-cap TOF upgrade of the STAR experiment at RHIC and the mTOF wall of the mCBM experiment at SIS18. At STAR, the fixed- target program of the Beam Energy Scan II (BES-II) will rely on 108 CBM MRPC detectors for forward PID at trigger rates of up to 2 kHz. At mCBM, high-performance benchmark runs of Λ-baryon production at top SIS18 energies and CBM design interaction rates of 10 MHz will become feasible with a PID backbone consisting of 25 CBM MRPC detectors. Apart from the physics perspective, these pre-FAIR involvements will help gathering experience in operating the final CBM TOF wall comprising about 1500 MRPC detectors and 110,000 readout channels. The status of the FAIR phase 0 program will be discussed. The project is partially funded by BMBF 05P15VHFC1.

HK 48.4 Thu 15:15 J-HS C

mini-TOF performance during mini-CBM beam time at SIS18 — •Qiunan Zhang for the CBM-Collaboration — Tsinghua University Beijing

The Compressed Baryonic Matter (CBM) experiment is one of the main pillars at FAIR. It aims to study the QCD phase diagram at high baryon densities with unprecedented interaction rate up to 10 MHz. This requires new free-streaming data acquisition methods, new data analysis concepts and radiation hard and high-rate capable detectors. The CBM Time of Flight wall (CBM-TOF) covers the task of charged particle identification. Muitl-gap Resistive Plate Chambers (MRPCs) with different rate capabilities will be used at their corresponding regions. To reduce the commissioning time for CBM, a CBM full system test-setup called mini-CBM (mCBM) has been installed and tested with various beams at GSI SIS18 facility. The high-rate MRPC prototypes developed at Tsinghua University, called MRPC3a, were selected to be implemented in mTOF modules for mCBM. Additional thin float glass MRPCs from USTC, foreseen for the low rate region, were also tested in mCBM experiment. Performance results from these prototypes regarding efficiency, time and spacial resolution and cluster size analyzed by the so called tracking method will be discussed during this talk. The project is partially founded by BMBF 05P15VHFC1.

Group Report HK 48.5 Thu 15:30 J-HS C

Status of the CBM-TRD — •Philipp Kähler for the CBM-Collaboration — Institut für Kernphysik, Universität Münster

The Transition Radiation Detector (TRD) of the Compressed Baryonic Matter experiment (CBM) will be based on four layers of irregular foam foil radiator and MWPC. It is designed to provide electron/positron identification for di-electron measurements, light-nuclei identification relevant for hyper-nuclei analyses and charged-particle tracking.

The general status of the CBM-TRD project will be presented. This includes studies on the high-rate performance at the CERN-GIF and results from electron beam measurements at DESY. The self-triggered readout, based on the SPADIC-ASIC, and its usage in the FAIR Phase 0 programme will be covered, and the overall system construction status will be summarised.

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