HK 12: Instrumentation IV

Zeit: Montag 16:30–18:30 Raum: Audimax H1

Gruppenbericht HK 12.1 Mo 16:30 Audimax H1

Status of the Transition Radiation Detector for the CBM Experiment — •Philipp Kähler for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Transition Radiation Detector (TRD) will be part of the Compressed Baryonic Matter (CBM) experiment at FAIR. Multi-Wire Proportional Chambers (MWPCs) for this detector are challenged to record interaction rates up to 10 MHz in heavy-ion collisions, which will result in particle rates at the TRD plane of up to 120 kHz cm^{-2}: the MWPCs will therefore be built in a fast design with signal collection times below 300 ns.

The physics case, the finalised technical detector design and the latest evolution of the self-triggered read-out chain will be summarised. In 2017, testbeam measurements have been performed in DESY II electron beam and in the high-rate environment of the Gamma Irradiation Facility (GIF^{++}) at CERN. Results from these tests will be presented and their implications discussed. This work is supported by BMBF.

HK 12.2 Mo 17:00 Audimax H1

Track reconstruction on CBM-TRD testbeam data — •Felix Fidorra for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Compressed Baryonic Matter (CBM) experiment is a fixed-target heavy-ion experiment at the SIS100 accelerator at FAIR. The CBM Transition Radiation Detector (TRD) is one of the key detectors to provide electron as well as charged fragment identification and tracking. Some Detector prototypes were tested on several testbeam campaigns at the SPS accelerator at CERN and other accelerator facilities. In the testbeam campaigns at the SPS in 2016, Multi-Wire Proportional Chambers (MWPC) with outer dimensions of 95 cm x 95 cm have been used to record the generated particles in a Pb–Pb fixed-target setup. This type of chamber was developed for usage in the outer region of the detector at the final experiment. The testbeam data will be discussed with respect to track reconstruction, incident angles and detector efficiency. This work is supported by BMBF.

HK 12.3 Mo 17:15 Audimax H1

Automated gaintable measurements for the CBM-TRD — •Johannes Beckhoff for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Transition Radiation Detector (TRD) is a part of the Compressed Baryonic Matter (CBM) experiment at FAIR. Multi-Wire Proportional Chambers (MWPCs) with a PE foam foil radiator are contributing to particle identification and overall tracking performance. The chambers will be operated for PID with Xenon, while for calibration measurements also Argon is of interest. Measurements with Argon and Xenon will be compared and discussed regarding gas gain and the choice of the amplification voltage.
In this talk an automated chamber calibration stand for gaintable determination is presented. First results and comparisons from the gas measurements will be presented. This work is supported by BMBF.

HK 12.4 Mo 17:30 Audimax H1

Test beam results of prototypes for the CBM-TRD at DESY and GIF++ — •Florian Roether for the CBM-Collaboration — Institut für Kernphysik, Frankfurt, Deutschland

The Compressed Baryonic Matter (CBM) experiment at the Facility for Antiproton and Ion Research (FAIR) will explore the QCD phase-diagram in the region of high net-baryon densities. The Transition Radiation Detector (TRD) with its multi-layer-design will provide electron identification and contribute to particle tracking as well as the identification of light nuclei.

The TRD will be constructed from modules of two sizes. Each TRD module consists of a radiator, a thin Multiwire Proportional Chamber (MWPC) and the coresponding Front-End Electronics (FEE).

The evaluation of the performance of these detectors at suitable facilities is a crucial part of the research and development process. The latest large prototypes which were build in a joint effort in Frankfurt and Münster, have been tested in 2017 at DESY and GIF++ (CERN). In this talk we will present results from these testbeam campaigns.

This work is supported by BMBF-grant 05P15RFFC1

HK 12.5 Mo 17:45 Audimax H1

Status of the Readout Chain for the CBM-TRD Experiment — •Cruz de Jesus Garcia Chavez for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Transition Radiation Detector (TRD) is part of the Compressed Baryonic Matter (CBM) experiment at FAIR. During 2017, the TRD readout chain featured important upgrades such as the introduction of the new Self-triggered Pulse Amplification and Digitization asIC (SPADIC) version 2.0, which implements the STS-HCTSP protocol for data transmission to the Data Processing Board (DPB), developed on the AMC FMC Carrier Kintex (AFCK) FPGA. This later implements a FLIM data transmission protocol to the FLES Interface Board (FLIB). The slow control and configuration for the DPB as well as for the front-ends is based on the (IPbus) protocol.

Results and evaluation of the readout chain during testbeam measurements performed in 2017 using Multi-Wire Proportional Chambers (MWPCs) at DESY II electron beam and on the Gamma Irradiation Facility (GIF^{++}) at CERN will be presented together with an overview of the new SPADIC 2.1 protocol and the commissioning status. This work is supported by BMBF.

HK 12.6 Mo 18:00 Audimax H1

Implementation of the ALICE TRD triggers — •Guido Willems for the ALICE-Collaboration — Westfälische Wilhelms-Universität Münster and CERN

The Transition Radiation Detector (TRD) of ALICE is operated at high event inspection rates around 10 kHz and allows for processing the data of all particles detected in a collision event within a time window shorter than $6\,\mu$s. The processing involves the reconstruction of all particle tracks as well as the generation of trigger signals which are used to trigger the readout of other detectors in ALICE. A large number of Xilinx Virtex-4 FX100 FPGAs are combined and process the incoming data in parallel in order to achieve this performance.

This talk outlines how the detector with its online data processing infrastructure works and focuses on the trigger decision unit. Recently, it has been extended by a new trigger on light nuclei which is now already being used in production data taking. It significantly enhances the sample of events containing deuterons, tritons, $Z = 2$ particles like helium and alpha as well as their corresponding antiparticles. The trigger is operated in pPb and pp collisions where these events are generally very rare.

HK 12.7 Mo 18:15 Audimax H1

Feasibility Studies on a Nuclei Trigger using the ALICE-TRD — •Benjamin Brudnyj — Institut für Kernphysik, Goethe-Universität Frankfurt, Frankfurt am Main

At the Large Hadron Collider (LHC) at CERN significant production rates of light (anti-)(hyper-)nuclei have been measured in Pb–Pb collisions. The production of such nuclei has recently become a topic of high interest. For instance the measured lifetime of the lightest hypernucleus, the hypertriton (a bound state of a proton, a neutron and a Λ hyperon), is significantly below the expectation of state-of-the-art theory calculations which expect the lifetime to be very close to the Λ lifetime. Therefore, it is important to also measure these rare nuclei in p–p collisions.

Due to their short lifetime, only its decay products can be measured, e.g. the charged two body decay channel ${}^{3}_{\Lambda}\mathrm{H} \rightarrow {}^{3}\mathrm{He} + \pi^{-}$. In order to be able to measure these rare (anti-)fragments also in p–p and p–Pb collisions, it is essential to increase the statistics by employing a trigger on nuclei. Using the data on Pb–Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV it turned out that particles with $Z > 1$ in the TRD show a behavior that can be used to implement such a nuclei trigger.

In this talk the physics case of a nuclei trigger will be elaborated as well as the exctracted efficiencies and purities for the different light nuclei. In addition, first results of triggered data on p–Pb collisions at $\sqrt{s_{NN}} = 8.16$ TeV and on pp collisions at $\sqrt{s} = 13$ TeV will be presented.