HK 26: Instrumentation VII

Time: Tuesday 16:00–17:30 Location: HK-H3

HK 26.1 Tue 16:00 HK-H3

Performance and quality testing of frontend electronics for the CBM RICH detector * — •Pavish Subramani for the CBM-Collaboration — University of Wuppertal

The CBM experiment is a high collision rate rate experiment, producing estimated single Cherenkov photon rates of up to $\sim$ 300 kHz per pixel in its Ring Imaging Cherenkov Detector (RICH). Signals of the 8×8 pixel Multianode Photomultiplier Tubes (MAPMT) are digitized using the FPGA-TDC based DIRICH frontend readout chain, providing excellent timing precision. A dedicated lab setup producing realistic detector signals using a pulsed laser light source was set up in order to validate the high rate capability of the DIRICH readout. It is found that individual readout channels can withstand photon rates up to 2.2 MHz/pixel, limited only by maximum data rate capability and buffer size on the frontend board. In addition, also effects of high photon occupancy on the MAPMTs were investigated, which might cause additional signals due to capacitive cross talk within the MAPMT or readout chain. Occupancies of up to 55 % (simultaneous photon hits on more than half of the MAPMT pixels) were investigated, indicating that in the expected occupancy range of 10–15 % the readout works flawlessly with very low crosstalk. The talk will focus on the laboratory test setup and qualification measurements of the readout chain obtained herewith.

* supported by BMBF (05P19PXFCA, 05P21PXFC1) and GSI.

HK 26.2 Tue 16:15 HK-H3

Precursor of the NOVEC-649 based cooling system for the CBM Micro Vertex Detector — •Franz A. Matejcek — Goethe-Universität Frankfurt

The Micro Vertex Detector of the Compressed Baryonic Matter Experiment (CBM) is placed 5 cm behind the target. The pixel detector with low material budget operates in vacuum. It consists of four stations equipped with 288 thin and large area CMOS sensors which produce a total of around 70 W of heat. To ensure their radiation hardness and detecting efficiency they have to be operated below -10 °C. The material budget-optimized cooling concept relies on efficient conductive cooling of the sensors, glued onto TPG carriers, providing very high thermal conductivity in the geomatrical acceptance. Actively cooled heat sinks outside the acceptance transfer the heat to the dedicated high-tech coolant NOVEC-649 (3M), featuring low viscosity in the temperature range of interest and good radiation hardness. This contribution will focus on the steps towards routine operation with NOVEC-649 and the evaluation of the thermal performance of a MVD prototype. This work has been supported by BMBF (05P19RFFC1), CremlinPLUS, GSI and HIC for FAIR.

HK 26.3 Tue 16:30 HK-H3

Study of the material budget and data rates for the STS detector system of the CBM experiment — •Mehulkumar Shiroya for the CBM-Collaboration — Goethe University Frankfurt, Frankfurt am Main, Germany

The Compressed Baryonic Matter (CBM), a fixed target experiment is under development at the Facility for Anti-Proton and Ion Research (FAIR) in Darmstadt(Germany). The aim of the experiment is to study the QCD phase diagram of strongly interacting matter at high density and moderate temperature employing heavy-ion beams in the energy range between 2 AGeV-11 AGeV.

The experiment is designed to run with beam intensities up to 10^9 Au + Au particles/sec and an interaction rate of up to 10^7 collisions/sec. Therefore, fast and free streaming electronics is needed for read-out and data transfer. The read-out electronics are connected to the silicon micro-strips sensors via polyimide-Al micro-cables and are placed outside the active region of STS to minimize the material budget. Detailed realistic knowledge of the detector geometry, including both active and passive material, is necessary to estimate the material budget of the detector which has a large impact on the absorption of delta electrons created in beam-target interaction, as well as in nuclear interaction of particles created in the heavy-ion collision with the active and passive materials. We present the status of the simulations of the STS detector geometry and its impact on the expected signal rates.

HK 26.4 Tue 16:45 HK-H3

Proof-of-Principle of Collinear Laser Spectroscopy on Neutral Atoms following Photodetachment — •Laura Renth[1], Bernhard Maass[1,4], Dag Hanstorp[3], Phillip Imgram[1], Daniel Koestel[2], Di Lu[3], Wilfried Nörtershäuser[1], and Thomas Walther[2] — [1]IKP, TU Darmstadt — [2]IAP, TU Darmstadt — [3]University of Gothenburg — [4]Argonne National Laboritory, Chicago, USA

At the Collinear Apparatus for Laser Spectroscopy and Applied Physics (COALA) [1] in Darmstadt a new experimental approach was tested to perform collinear laser spectroscopy on boron atoms produced from a negative ion sputtering source.

An ion sputtering source produced negatively charged boron ions which where then guided into the COALA beamline. From this ion beam an atomic beam was created by photodetachement with a pulsed laser. Then, collinear laser spectroscopy was performed for the $2p\ ^2P_{1/2} \rightarrow 3s\ ^2S_{1/2}$ and for the $2p\ ^2P_{3/2} \rightarrow 3s\ ^2S_{1/2}$ transitions of ^{11}B and on the the $2p\ ^2P_{3/2} \rightarrow^3 s\ ^2S_{1/2}$ transition of ^{10}B. The resonance was only observed after implementing new diagnostic tools at COALA, namely a Wien filter and the generation of short ion pulses to perform time-of-flight (TOF) spectrometry. First results will be presented and the potential of this approach are discussed.

[1] K. König, J. Krämer, C. Geppert, P. Imgram, B. Maaß, T. Ratajczyk, W. Nörtershäuser. A New Collinear Apparatus for Laser Spectroscopy and Applied Science (COALA). Rev. Sci. Instr. 91, 081301 (2020).

HK 26.5 Tue 17:00 HK-H3

Integration of a Resistive Plate Chamber for Precise Measurement of High-Momentum Protons in Short Range Correlations — •Manuel Xarepe[1,2], Thomas Aumann[1,4], Alberto Blanco[3], Daniel Galaviz[2], Luis Lopes[3], Andrea Jedele[1,4], João Saraiva[3], Hans Törnqvist[1,4], Bastian Löher[4], and Håkan Johansson[5] for the R3B-Collaboration — [1]TU-Darmstadt — [2]LIP-Lisbon — [3]LIP-Coimbra — [4]GSI — [5]Chalmers-UT

Within the framework of the FAIR Phase-0 experimental program, that will study for the first time of Short Range Correlations (SRC) in radioactive nuclei at the R3B (Reactions with Relativistic Radioactive Beams) experiment of the FAIR laboratory, by measuring the breakup reaction of 16C on a proton target in inverse kinematics, an innovative approach based on Resistive Plate Chambers (RPC) as a proton Time-of-Flight (ToF) is presented. The excellent time resolution properties of the RPC (about 50 ps) will allow for a precise measurement of the momentum of the forward emitted protons from high-momentum correlated pairs. In this work the RPC detector will be introduced, the characteristics of the integration of the detector in the R3B experiment will be presented, and first results from calibrations using cosmic rays, radioactive sources and a test beam time after installation in the experimental cave will be shown.

HK 26.6 Tue 17:15 HK-H3

Characterization of plastic scintillators with radioactive sources for the DarkMESA experiment — •Matteo Lauss for the MAGIX-Collaboration — Institute for Nuclear Physics, Mainz University, German

At the Institute for Nuclear Physics in Mainz the new electron accelerator MESA will go into operation within the next years. In the extracted beam operation (150 MeV, 150 μA) the P2 experiment will measure the weak mixing angle in electron-proton scattering in 10,000 hours operation time. The beam dump of this experiment is ideally suited for a parasitic dark sector experiment - the DarkMESA experiment. It is designed for the detection of Light Dark Matter (LDM) which in the simplest model couples to a massive vector particle, the dark photon γ'.

A highly efficient veto detector surrounding the calorimeter hermetically is essential to probe the target parameter space of DarkMESA successfully. The veto detector will mainly consist of plastic scintillation counters. A detector prototype is currently under construction using 2 cm thick plastic scintillators of type EJ-200 and a matrix of 5×5 lead fluoride crystal bars for the calorimeter. The measurement of the scintillation light is accomplished by silicon photomultipliers (SiPM) mounted on a specially designed electronic board. Systematic studies

with a selection of commonly used radioactive sources were conducted to determine the homogeneity of the light yield across the scintillators. The light yield was determined by extracting the Compton edge for gamma emitters with an appropriate response function.