HK 27: Heavy-Ion Collisions and QCD Phases V

Time: Wednesday 14:00–15:30 Location: SCH/A216

Group Report HK 27.1 Wed 14:00 SCH/A216

The CBM Experiment at FAIR - towards commissioning in 2027 — •Christian Sturm for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The Compressed Baryonic Matter experiment (CBM) is under construction at the Facility for Antiproton and Ion Research (FAIR). It aims to explore the phase structure of strongly interacting (QCD) matter at large net-baryon densities and moderate temperatures by means of heavy-ion collisions. The CBM experiment is designed as a fixed-target experiment, being equipped with fast and radiation-tolerant detector systems read out by a free-streaming data acquisition system. Performing online 4D reconstruction and selection CBM will measure with unprecedented interaction rates of up to 10 MHz. Hence, rare and penetrating probes like multi-strange hadrons, ΛΛ-hypernuclei, di-electrons/muons as well as charm production will be measured with high statistics in this region of the QCD phase diagram for the first time. This opens the opportunity to search for structures in the excitation functions and thus obtain experimental evidence for a first order phase transition and critical end point recently predicted to be present in the FAIR (SIS100) energy range. The presentation will summarize the preparation status of the CBM experiment on the way towards commissioning in 2027 including latest results of the mCBM experiment, a CBM demonstrator and full-system test-setup running within the FAIR phase-0 program.

HK 27.2 Wed 14:30 SCH/A216

Improving the CBM RICH lepton reconstruction — •Pavish Subramani, Christian Pauly, and Karl-Heinz Kampert — Bergische Universität Wuppertal

The Compressed Baryonic Matter experiment (CBM) is a heavy ion fixed target experiment, designed to probe the QCD phase diagram near the critical point at high μ_B and medium temperatures. The Ring Imaging Cherenkov Detector (RICH), situated directly behind the Micro Vertex Detector (MVD) and Silicon Tracking System (STS), is designed to distinguish electrons from pions, being the most abundantly produced particles in heavy ion collisions in the momentum range up to 10 GeV/c. One major source of background in the dilepton analysis is contamination by pions arising from false ring track matching in the RICH. Moreover, electrons from photon conversion inside the target and detector material are partly undetected by the STS tracking system, but cause additional Cherenkov rings in the RICH. If these rings are falsely matched to pion tracks they lead to electron misidentification, and thus can increase the combinatorial background and reduce the signal-to-background ratio.

This talk will focus on possible improvements in the efficiency of primary electron identification and pion suppression, for example by using additional information from the Transition Radiation Detector (TRD) situated directly behind the RICH.

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HK 27.3 Wed 14:45 SCH/A216

CBM performance for the measurement of (multi)strange hadrons' anisotropic flow in Au+Au collisions at FAIR — •Oleksii Lubynets[1,2] and Ilya Selyuzhenkov[1] for the CBM-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung — [2]Goethe-Universität Frankfurt am Main

The main goal of the CBM experiment is to study highly compressed baryonic matter produced in collisions of heavy ions. The SIS-100 accelerator at FAIR will enable investigation of the QCD matter at temperatures up to about 120 MeV and net baryon densities 5-6 times larger than that of the normal nuclear matter. Hyperons produced during the dense phase of a heavy-ion collision provide information about the equation of state of the QCD matter. The measurement of (multi)strange hyperons' anisotropic flow is important for understanding the dynamics and evolution of the QCD matter created in the collision.

Performance studies for strange hadrons anisotropic flow measurement with the CBM experiment at FAIR will be presented. Strange hadrons are reconstructed via their decay topology using Kalman Filter algorithm methods. Directed flow of strange hadrons is calculated as a function of rapidity, transverse momentum and collision centrality. The effects due to non-uniformity of the CBM detector response in the azimuthal angle, transverse momentum and rapidity are corrected using the QnTools analysis package. The CBM performance is compared with that of the STAR experiment and projections for statistical uncertainties with high statistics data at CBM are presented.

HK 27.4 Wed 15:00 SCH/A216

Σ^0 reconstruction in Ag+Ag collisions at $\sqrt{s_{NN}}$ = 2.55 GeV with HADES — •Marten Becker for the HADES-Collaboration — Justus-Liebig-University Giessen

The HADES experiment at GSI investigates the moderate temperature and high density regime of the QCD phase diagram created by A+A collisions at a few AGeV kinetic beam energy. Besides leptons and photons, strangeness directly transports measurable information of the created dense matter to the laboratory. In 2019 HADES collected Ag+Ag collisions at 2.55 GeV center of mass energy which is of great interest since the energy is right at the strangeness production threshold. For the first time, the newly installed electromagnetic calorimeter allows direct photon detection. The RICH detector was upgraded in addition, which strongly improves electron identification and the detection of conversion-pairs.

This contribution shows work in progress results on the Σ^0 baryon reconstruction, decaying electromagnetically into $\Lambda + \gamma$. Feasibility studies in simulations prove the reconstruction methods in the $\Lambda + \gamma$ channel as well as the Λ+lepton channel where the photon converted and at least one low energetic $e^{\pm}$ is identified in the RICH. The Σ^0 yield is extracted and the resulting Λ/Σ^0 ratio is compared to statistical-thermal model calculations.

HK 27.5 Wed 15:15 SCH/A216

First measurements of Σ^+ and $\bar{\Sigma}^-$ with ALICE — •Benedict Heybeck for the ALICE Germany-Collaboration — Institut für Kernphysik, Johann Wolfgang Goethe-Universität Frankfurt, Frankfurt, Germany

The first measurements of Σ^+- and $\bar{\Sigma}^-$-baryons with ALICE in pp collisions at $\sqrt{s}$ = 13 TeV will be presented.
Σ^+ baryons decay into a proton and a neutral pion via the weak interaction with a branching ratio of 51.57%. The neutral pion decays electromagnetically almost exclusively into two photons which are challenging to measure with the ALICE apparatus. In particular, since these photons have low momenta. However, Σ baryons are an important probe to study the strangeness production in pp collisions. Furthermore, the reconstructed Σ baryons can be used for correlation measurements with protons to improve the understanding of the interaction between nucleons and hyperons.