HK 12: Heavy Ion Collisions and QCD Phases III

Zeit: Dienstag 11:00–12:30 Raum: F 1

Gruppenbericht HK 12.1 Di 11:00 F 1

Event reconstruction and selection in high-rate heavy-ion reactions in the CBM experiment at FAIR — •Maksym Zyzak for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung

The CBM experiment at FAIR is being designed for the study of the QCD phase diagram in the region of the high baryon chemical potential at relatively moderate temperatures, where a complex structure is predicted by modern theories. The physics program of CBM includes precision measurements of a wide set of observables that contains very rare particles like charmed hadrons, dileptons, multi-strange (anti-) hyperons, and hypernuclei. The comprehensive and systematic study of these particles including their phase-space distributions requires extremely high interaction rates of up to 10^7 collisions per second. The complicated decay topologies of these observables prevent the use of simple hardware triggers. Therefore, the CBM collaboration is developing a free-streaming data read-out system, where each single detector signal will be provided with a time stamp, and then send to a high-performance computing farm. There, a full online (4-D) event reconstruction will be performed based on the signals from the various detector systems. Fast algorithms then will online select those events which contain candidates of particles under investigation. The status of the CBM online event reconstruction and selection procedures will be discussed.

HK 12.2 Di 11:30 F 1

Geometry independent Kalman filter based track fit — •Artemiy Belousov[1,2], Ivan Kisel[1,2,3], and Maksym Zyzak[3] for the CBM-Collaboration — [1]Goethe-Universität Frankfurt — [2]Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH

Modern experiments in High Energy Physics are tend to increase the amount of data to be processed, thus, the speed of the algorithms become crucial. However, the efficiency and precision of the applied procedures can not be compromised. Therefore, the Kalman filter method is usually used as the core for the reconstruction of collision, as it satisfies all the requirements.

Current implementations of the Kalman filter method to the reconstruction of charged particle trajectories are based on the assumption of the 2D measurements with the third coordinate fixed. Such an approach leads to the strong dependency of the fitting procedure on the geometry of the experiment.

In the current work the 3D Kalman filter based track fit is developed, which operates with 3D measurements of 3 independent coordinates. The algorithm shows correct results with pulls of unity width and flat distribution of the prob-function.

HK 12.3 Di 11:45 F 1

Transverse-momentum distributions of charged particles in p-Pb collisions with ALICE at the LHC — •Michael Habib for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

The inclusive charged particle spectra in proton-lead collisions is used to quantify initial state effects and provides a reference measurement for the studies of deconfined matter created in nucleus-nucleus collision.

The ALICE experiment at the LHC recorded p-Pb collisions at a center of mass energy of $\sqrt{s_{\rm NN}} = 5.02$ TeV in the years 2013 and 2016.

In this talk the transverse-momentum spectrum in p-Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$ TeV measured with the ALICE detector and the corresponding nuclear modification factor $R_{\rm pPb}$, given by the ratio of the $p_{\rm T}$ spectrum in proton-lead to that in proton-proton collisions scaled by the number of binary collisions, will be presented. The primary charged particle transverse-momentum ($p_{\rm T}$) distribution of the 2013 dataset was reanalyzed with improved analysis methods, leading to significant reduced systematic uncertainties. The ALICE pp reference spectrum at a collision energy of $\sqrt{s} = 5$ has been used for $R_{\rm pPb}$ factor calculations.

HK 12.4 Di 12:00 F 1

Determination of secondary particles contamination in charged particle spectra measured with ALICE at LHC — •Federica Sozzi for the ALICE-Collaboration — GSI, Darmstadt, and Universität Heidelberg

Transverse-momentum distributions for primary charged particles and corresponding nuclear modification factor R_{AA} have been measured by the ALICE Collaboration for different collision systems and energies, comprising newer data sets collected in Run 2 and re-analysed data sets from Run 1.

The systematic uncertainties are largely reduced with respect to similar past ALICE measurements, due to improvements in the analysis procedure. One of the systematic contribution that has been studied is the contamination of secondary particles in the sample, originating from the interaction of particles with material and, to a larger extent, from the weak decay of neutral strange particles, K^0 and Λ. The fraction of secondaries after the track selection cuts is of the order of few percent and depends on the transverse-momentum. Since the yield of the strange particles is known to be underestimated in event generators, the determination of this fraction from MC leads to a corresponding large uncertainty. Therefore the fractions of secondaries have been determined through fits of the experimentally-measured distributions of the distance to closest approach of tracks to vertex. In this contribution the fitting method, the results and their impact on the transverse-momentum distribution measurement will be described.

HK 12.5 Di 12:15 F 1

Performance of 4-Dimensional Cellular Automaton Track Finder in CBM — •Valentina Akishina[1,3,4] and Ivan Kisel[1,2,3] for the CBM-Collaboration — [1]Goethe- Universitat Frankfurt am Main — [2]Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum fur Schwerionenforschung GmbH — [4]Joint Institute for Nuclear Research

The CBM experiment will focus on the measurement of rare probes at interaction rates up to 10 MHz with data flow of up to 1 TB/s. In this case resolving different collisions, which may overlap in time, is a non-trivial task. Event building requires full online event reconstruction and selection taking into account not only space coordinates, but also time measurements, so-called 4D reconstruction. The algorithms must be fast, precise and suitable for online data processing in order to use the full potential of modern many-core computer architectures.

For the most time-consuming part of the reconstruction procedure the Cellular Automaton track finder is used. The event-based CA track finder was adapted for time-slice-based 4D track reconstruction, which is a requirement in case of CBM. The 4D CA track finder is both vectorized and parallelized. The algorithm shows strong scalability on many-core systems. The speed-up factor of 10.1 was achieved on a CPU with 10 hyper-threaded cores. The algorithm performance is compared with event-based approach event-wise with the help of ideal event-builder. The 4D CA track finder is able to reproduce the efficiency and the speed performance of the event-based CA track finder. The algorithm was included into the CBMROOT framework.