

Online reconstruction of the collision topology in the CBM experiment

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The CBM experiment is a future fixed-target experiment at FAIR/GSI (Darmstadt, Germany). It is being designed to study heavy-ion collisions at extremely high interaction rates of up to 10 MHz. Therefore, the experiment will use a very novel concept of data processing based on free streaming triggerless front-end electronics. In CBM time-stamped data will be collected into a readout buffer in a form of continuous time-slices and delivered to a large computer farm to be reconstructed and selected online. Therefore the full online reconstruction of the event topology is required already at the First Level Event Selection (FLES) stage. In this case both the efficiency and speed of the reconstruction algorithms are crucial.

The task of reconstructing individual collisions out of continuous time-stamped data, where information on different events overlaps in time, must be performed in software and requires so-called 4-dimensional (4D) reconstruction: both in space and time. The FLES reconstruction package consists of several modules: track finding, track fitting, event building, short-lived particles finding, and event selection. The package is optimised with respect to speed and parallelised both at the data (using the SIMD instruction set) and the task (using OpenMP and Pthreads) levels.

The input data are distributed within the FLES farm in a form of a time-slice, which is processed in parallel. The particle trajectories, reconstructed with the 4D Cellular Automaton track finder and fitted with the 4D Kalman Filter method and combined into event-corresponding clusters according to the estimated production time. Such track clusters are given as an event input to the KF Particle Finder package for short-lived particle reconstruction. The last stage of the FLES package is a selection of events according to the requested trigger signatures. The reconstruction procedure and the results of its application to simulated collisions for the CBM detector setup are presented.

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