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4-Dimensional Event Building in the First-Level Event Selection of the CBM Experiment.

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The future heavy-ion experiment CBM (FAIR/GSI, Darmstadt, Germany) will focus on the measurement of very rare probes at interaction rates up to 10 MHz with data flow of up to 1 TB/s. The beam will provide free stream of beam particles without bunch structure. That requires full online event reconstruction and selection not only in space, but also in time, so-called 4D event building and selection. This is a task of the First-Level Event Selection (FLES).

The FLES reconstruction and selection package consists of several modules: track finding, track fitting, short-lived particles finding, event building and event selection. Since all detector measurements contain also time information, the event building is done at all stages of the reconstruction process. The input data are distributed within the FLES farm in a form of so-called time-slices, which time length is proportional to a compute power of a processing node. A time-slice is reconstructed in parallel between cores within a CPU, thus minimizing communication between CPUs. After all tracks of the whole time-slice are found and fitted in 4D, they are collected into clusters of tracks originated from common primary vertices, which then are fitted, thus identifying 4D interaction points registered within the time-slice. Secondary tracks are associated with primary vertices according to their estimated production time. After that short-lived particles are found and the full e
vent building process is finished. The last stage of the FLES package is a selection of events according to the requested trigger signatures.

We describe in details all stages of the FLES package and present results of tests on many-core computer farms with up to 3000 cores, focusing mainly on parallel implementations of the track finding and the event building stages as the most complicated and time consuming parts of the package. The track finding efficiency remains stable and the processing time grows as a polynomial of second order with respect to the number of events in the time-slice. The first results of J/psi selection are presented and discussed.

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