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Event Building Process for Time streamed data

The Compressed Baryonic Matter (CBM) experiment at the Facility for Anti-Proton and Ion Research (FAIR)in Darmstadt, Germany, is going to produce about 1 TByte per second of raw data at an interaction rate of 10 MHz for the measurement of very rare particles. Until now, all the HEP experiments are based on traditional hardware trigger approach; therefore all simulation and reconstruction software frameworks have been working on the basis of event by event data processing. In contrast, CBM is based on a triggerless DAQ concept. This introduces a real challenge for the online computing process, which has to suppress the raw data volume by three orders of magnitude in real-time. In this respect major work has been going in the direction of changing the software framework such that it produces a continuous, time-sorted stream of digitized data packed in fixed time intervals (”time slice”) which will be similar to the actual raw data output from the different detectors of the experiment. In this time-sliced data there is no event separation; consequently, the available simulation and reconstruction software cannot be straightforwardly used.

As a first step towards the reconstruction of such free-streaming data, we introduced an event-building process which tags physical events based on the time information of the raw data. The process is based on identifying and analyzing dips in the continuous data stream. It was developed on the example of the muon detecton system. The process measures the raw data rate on a nanosecond level; data between two dips indicate event candidates, which are then further analysed with respect to a number of parameters like minimum and maximum number of hits per event, event duration etc. After event definiton in software, all reconstruction algorithms, working on an event-by-event base, can be used without any modification.

In this paper, we will present and discuss the event selection process and its further development like the implementation on heterogeneous platforms using different parallel computing paradigms like OpenMP, MPI, OpenCL and CUDA, as well as its extension to the other CBM detector systems in order to reach at a global event definition.

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