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FLES: First Level Event Selection package for the CBM experiment

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The CBM (Compressed Baryonic Matter) experiment is an experiment being prepared to operate at the future Facility for Anti-Proton and Ion Research (FAIR, Darmstadt, Germany). Its main focus is the measurement of very rare probes, which requires interaction rates of up to 10 MHz. Together with the high multiplicity of charged tracks produced in heavy-ion collisions, this leads to huge data rates of up to 1 TB/s. Most trigger signatures are complex (short-lived particles, e.g. open charm decays) and require information from several detector sub-systems.
First Level Event Selection (FLES) in the CBM experiment will be performed on-line on a dedicated processor farm. This requires the development of fast and precise reconstruction algorithms suitable for on-line data processing. The algorithms have to be intrinsically local and parallel and thus require a fundamental redesign of traditional approaches to event data processing in order to use the full potential of modern many-core CPU/Phi/GPU architectures. Massive hardware parallelization has to be reflected in mathematical and computational optimization of the algorithms.
An overview of the on-line FLES processor farm concept, different levels of parallel data processing in the farm from the supervisor down to the multi-threading and the SIMD vectorization, implementation of the algorithms in single precision, memory optimization, scalability with respect to number of cores, efficiency, precision and speed of the FLES algorithms are presented and discussed.

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