FLES: Standalone First Level Event Selection Package for CBM*

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The main focus of the CBM experiment is the measurement of very rare probes, that requires interaction rates of up to 10 MHz. Together with the high multiplicity of charged particles (up to 1000) 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.

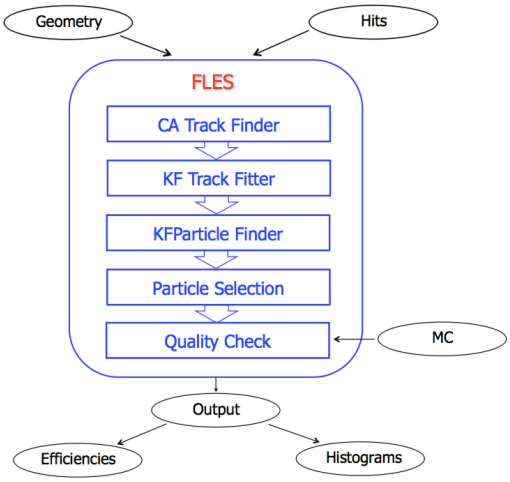

Figure 1: Block diagram of the FLES package.

The First Level Event Selection (FLES) package of the CBM experiment is intended to reconstruct the full event topology including tracks of charged long-lived particles and short-lived particles. The FLES package consists of several modules (see Figure 1): track finder, track fitter, particle finder and physics selection. As an input the FLES package receives the geometry of the tracking detectors and the measurements, which are created by the charged particles crossing the detectors — hits. Tracks of the charged particles are reconstructed by the Cellular Automaton track finder [1]. The Kalman filter based track fitter [2] is used for precise estimation of the track parameters. The KF Particle Finder [3] is used to find short-lived particles. In addition, a module for quality assurance is implemented, that allows to monitor the quality of the reconstruction at all stages.

The package provides the high reconstruction efficiency and the high signal to background (S/B) ratio for the reconstructed decays. For instance, for 240 000 minimum bias Au+Au UrQMD events at 25 AGeV the reconstruction efficiency (normalized on 4π) for the K^0_s meson is 15.3% with the S/B ratio 3.5 and for the Λ hyperon — 17.2% and 5.1 respectively.

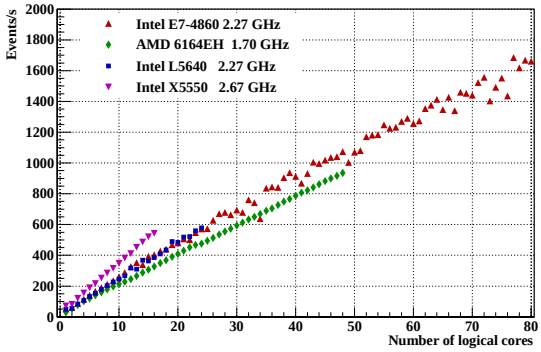

Figure 2: Scalability of the FLES package on many-core servers.

The first version of the FLES package is optimized with respect to speed, intrinsically local and parallel. The implemenation is based on the SIMD instructions and have been parallelized between cores using the Intel Threading Building Blocks package [4], that provides scalable event-level parallelism with respect to the number of hardware threads and CPU cores. Four servers with Intel Xeon and AMD processors have been used for the scalability tests. The most powerful server has 4 processors with 10 physical cores each, that gives 80 logical cores in total. Figure 2 shows a strong scalability for all many-core systems. The achieved reconstruction speed is 1700 events per second on the 80-cores server.

References

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