Contribution ID: **347** Type: **Plenary reports**

Real-time event reconstruction and analysis in the CBM experiment at FAIR using HPC

Thursday 13 September 2018 09:30 (30 minutes)

CBM is a future heavy-ion experiment at FAIR, Darmstadt. It is characterised by up to 10 MHz collision rates, a large amount of produced particles, non-homogeneous magnetic fields and a very complex detector system. Event reconstruction is the most complicated and time consuming task of the data analysis in the CBM experiment with up to one thousand particles per central collision. An additional complication is a continuous data stream represented in form of time slices. All of the above mentioned makes it necessary to develop fast and efficient reconstruction algorithms and to optimise them for running on heterogeneous many-core HPC clusters. The First-Level Event Selection (FLES) package is intended to reconstruct online the full event topology including trajectories (tracks) of charged particles and short-lived particles without low-level hardware triggers. The FLES package consists of several modules: Cellular Automaton (CA) track finder, Kalman Filter (KF) based track fitter, KF based short-lived particle finder and physics selection. The FLES package is platform and operating system independent. It is portable to different many-core CPU architectures. The package is vectorised using SIMD instructions and parallelised between CPU cores. All algorithms are optimised with respect to the memory usage and the speed. The CA track finder takes 10 ms per minimum bias event on a single CPU core. The KF track fitter estimates parameters of about 400 particles in a μs on a GPU card. Decays of short-lived particles in more than 100 channels are searched and analysed in about 2 ms. The whole FLES package shows a strong scalability many-core CPU systems achieving the reconstruction speed of 1700 events/s on a 80-cores server and 2.2·105 events/s on an HPC cluster with 100 nodes. The developed FLES algorithms can be of interest for other HEP experiments as well.

Author: Prof. KISEL, Ivan (for the CBM collaboration) (Goethe University Frankfurt, Frankfurt am Main, Hesse, Germany, Frankfurt Institute for Advanced Studies, Frankfurt am Main, Hesse, Germany GSI Helmholtz Centre for Heavy Ion Research, Darmstadt, Germany)

Presenter: Prof. KISEL, Ivan (for the CBM collaboration) (Goethe University Frankfurt, Frankfurt am Main, Hesse, Germany, Frankfurt Institute for Advanced Studies, Frankfurt am Main, Hesse, Germany GSI Helmholtz Centre for Heavy Ion Research, Darmstadt, Germany)

Session Classification: Plenary reports