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The path toward HEP High Performance Computing

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High Energy Physics code has been known for making poor use of high performance computing architectures. Efforts in optimising HEP code on vector and RISC architectures have yield limited results and recent studies have shown that, on modern architectures, it achieves a performance between 10% and 50% of the peak one. Although several successful attempts have been made to port selected codes on GPUs, no major HEP code suite has a "High Performance" implementation. With LHC undergoing a major upgrade and a number of challenging experiments on the drawing board, HEP cannot any longer neglect the less-than-optimal performance of its code and it has to try making the best usage of the hardware. This activity is one of the foci of the SFT group at CERN, which hosts, among others, the Root and Geant 4 projects. The activity of the experiments is shared and coordinated via a Concurrency Forum, where the experience in optimising HEP code is presented and discussed. Another activity is centred on the development of a high-performance prototype for particle transport. Achieving a good concurrency level on the emerging parallel architectures without a complete redesign of the framework can be done only by parallelizing at the event level, or with a much larger effort at the track level. Apart from the shareable data structures, this typically implies a multiplication factor in terms of memory consumption compared to the single threaded version, together with sub-optimal handling of event processing tails. Besides this, the low level instruction pipelining of modern processors cannot be used efficiently to speedup the program. We have implemented a framework that allows scheduling vectors of particles on an arbitrary number of computing resources in a fine grain parallel approach. The talk will review the current optimisation activities within the SFT group with a particular emphasis on the development perspectives towards a simulation framework able to profit best from the recent technology evolution in computing.

Primary author: Dr CARMINATI, Federico (CERN)

Co-authors: GHEATA, Andrei (CERN); APOSTOLAKIS, John (CERN); Dr BRUN, Rene (CERN)

Presenter: Dr CARMINATI, Federico (CERN)

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