APR12-2012-000520

Abstract for an Invited Paper
for the APR12 Meeting of
the American Physical Society

GPUs in experimental particle physics

NIKLAUS BERGER, Heidelberg University

Many applications in particle and nuclear physics demand vast computational power with high throughput and low latency. Graphics Processing Units (GPUs) provide such massively parallel floating point computing power at low cost. Indeed many problems are easily parallelized and can be sped up by orders of magnitude by the use of GPUs. The talk will discuss two very different examples, namely the use of GPUs for partial wave analysis and on-line track reconstruction. Partial wave analysis is a key tool in hadron spectroscopy. The unbinned likelihood fits employed are an almost perfect match for the architecture of GPUs. GPU based partial wave analysis was pioneered at the Beijing Spectrometer III experiment in order to deal with world's largest datasets from electron-positron collisions in the charm threshold energy region and is now employed by many groups in the field. The presentation will describe the challenges for implementing a GPU based partial wave analysis and how they were overcome. Usually the most time consuming part of analysing particle physics events is the reconstruction of tracks of charged particles. A new generation of high rate experiments running without a hardware trigger (e.g. the LHCb upgrade, PANDA, a proposed $\mu \rightarrow eee$ search) will be relying on very fast on-line event reconstruction, including tracking. This in turn requires massive amounts of computing power, which is currently best provided by GPUs. The talk will describe the state of GPU based tracking efforts.