

Title: Generic Programming and Performance Comparison for CPUs and GPUs

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Abstract:

Today, GPUs are widely used in scientific computing in general, and have applications in high energy physics. We employ GPUs for reconstructing particle trajectories at the ALICE High Level Trigger at the CERN LHC particle accelerator. For the upcoming ALICE online offline computing upgrade, we plan to perform the backbone of all track reconstruction on GPUs. In order to stay independent from single vendors, we do not want to rely exclusively on proprietary APIs like CUDA. Instead, we use generic C++ code and small wrappers to execute the same code on traditional processors with OpenMP, on NVIDIA GPUs with CUDA, and on AMD GPUs via OpenCL with AMD C++ extensions. To evaluate potential hardware for the new online computing farm, an architecture survey with a fair comparison of GPUs and CPUs is required, which takes all aspects into account: cost and feasibility of porting the various reconstruction tasks on GPU, total cost of ownership, energy and rackspace limits, stability, scalability, and applicability of the software on other compute farms. The talk will give an overview over these topics with a focus on reconstruction software for the ALICE experiment and briefly cover some other projects where we dealt with similar considerations.