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Application of Portable Parallelization Strategies for GPUs on track reconstruction kernels

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Utilizing the computational power of GPUs is one of the key ingredients to meet the computing challenges presented to the next generation of High-Energy Physics (HEP) experiments. Unlike CPUs, developing software for GPUs often involves using architecture-specific programming languages promoted by the GPU vendors and hence limits the platform that the code can run on. Various portability solutions have been developed to achieve portable, performant software across different GPU vendors. Given the rapid evolution of these portability solutions, an early adoption of them in simple HEP testbed applications will help us understand the strengths and weaknesses of respective approaches.

We apply several portability solutions, such as Kokkos, SYCL, std::execution::par and Alpaka, on kernels for track propagation extracted from the mkFit project. We report on the development experience of the same application with different portability solutions, as well as their performance on GPUs, measured as the throughput of the kernels, from different manufacturers such as NVIDIA, AMD and Intel.

Significance

This is a novel result covering application of portability technologies to HEP-centric kernels on the major GPU vendors.

References

Experiment context, if any

Primary authors: STRELCHENKO, Alexei (Fermi National Accelerator Lab. (US)); CERATI, Giuseppe (Fermi National Accelerator Lab. (US)); KWOK, Ka Hei Martin (Fermi National Accelerator Lab. (US)); KORTELAINEN, Matti (Fermi National Accelerator Lab. (US)); GUTSCHE, Oliver (Fermi National Accelerator Lab. (US))

Presenter: KWOK, Ka Hei Martin (Fermi National Accelerator Lab. (US))

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