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Experience in SYCL/oneAPI for event reconstruction at the CMS experiment

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The CMS software framework (CMSSW) has been recently extended to perform part of the physics reconstruction with NVIDIA GPUs. To avoid writing a different implementations of the code for each back-end the decision was to use a performance portability library and so Alpaka has been chosen as the solution for Run-3.

In the meantime different studies have been performed to test the track reconstruction and clustering algorithms on different back-ends like CUDA and Alpaka.

With the idea of exploring new solutions, INTEL GPUs have been considered as a new possible back-end and their implementation is currently under development.

This is achieved using SYCL, that is a cross-platform abstraction C++ programming model for heterogeneous computing. It allows developers to reuse code across different hardware and also perform custom tuning for a specific accelerator. The SYCL implementation used is the Data Parallel C++ library (DPC++) in the Intel oneAPI Toolkit.

In this work, we will present the performance of physics reconstruction algorithms on different hardware. Strengths and weaknesses of this heterogeneous programming model will also be presented.

Significance

Heterogeneous Computing is becoming more and more popular, so is very important to find solutions to avoid code-duplication, like the use of abstraction layers or performance portability libraries.

For this reason is also essential to explore new solutions and one, among the others, is the use of Intel GPUs and the Intel oneAPI Toolkit that provides the portability library DPC++.

This work extends a study performed on other portability libraries and aims at testing these new solutions in order to compare their performance and to be able to converge on the best choice in the end.

References

Experiment context, if any

This is one of the studies within the Patatrack project that aim at exploring innovative software and hardware technologies for the CMS experiment at CERN

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