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Evolution of data structures for heterogeneous reconstruction in CMSSW

The Next Generation Trigger project aims to improve the computational efficiency of the CMS reconstruction software (CMSSW) to increase the data processing throughput at the High-Luminosity Large Hadron Collider. As part of this project, this work focuses on improving the common Structure of Arrays (SoA) used in CMSSW for running both on CPUs and GPUs. We introduce a new SoA feature that allows users to selectively prune and combine columns across one or more existing SoAs into a new view, while preserving a user-friendly interface. It is also possible to consolidate these columns into a new SoA object, performing heterogeneous memory copies as needed. This process uses the Alpaka library for optimizing data transfer across different computing architectures, reducing overhead, and improving efficiency. Another new feature introduces the possibility of generating custom methods for SoA elements, enhancing flexibility and expressiveness in data manipulation. The design prioritizes ease of use, allowing users to interact with the data intuitively while benefiting from an efficient underlying implementation. The impact of these optimizations, along with performance measurements, will be presented.

Significance

References

Experiment context, if any

CMS experiment

Author: CMS COLLABORATION

Presenter: CMS COLLABORATION

Session Classification: Poster session with coffee break

Track Classification: Track 1: Computing Technology for Physics Research