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Parallelizing the unpacking and clustering of detector data for reconstruction of charged particle tracks on multi-core CPUs and many-core GPUs

Wednesday, 22 April 2020 21:25 (10 minutes)

Charged particle tracking is the most computationally intensive step of event reconstruction at the LHC. Due to the computational cost, the current CMS online High Level Trigger only performs track reconstruction in detector regions of interest identified by the hardware trigger or other detector elements. We have made significant progress towards developing a parallelized and vectorized implementation of the combinatoric Kalman filter algorithm for track building that would allow efficient global reconstruction of the entire event within the projected online CPU budget. Global reconstruction necessarily entails the unpacking and clustering of the hit information from all the silicon strip tracker modules; however, currently only modules selected by the regional reconstruction are processed. Therefore, we have recently begun to investigate improving the efficiency of the unpacking and clustering steps.

In this talk, we report recent progress in the integration of the Kalman filter track builder mkFit with the CMS data processing framework, and improvements in its track building physics performance. We present results from parallelizing the unpacking and clustering steps of the raw data from the silicon strip modules so that all the required hit information for global reconstruction can be produced efficiently. We include performance evaluations of the new unpacking and clustering algorithms on Intel Xeon and NVIDIA GPU architectures, along with updated track building performance results on Intel Xeon.

Consider for young scientist forum (Student or postdoc speaker)

No

Second most appropriate track (if necessary)

Enhanced performance of tracking algorithms

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