



Contribution ID: 400

Type: Oral

GPU-based Offline Clustering Algorithm for the CMS High Granularity Calorimeter

Monday 4 November 2019 15:15 (15 minutes)

The future upgraded High Luminosity LHC (HL-LHC) is expected to deliver about 5 times higher instantaneous luminosity than the present LHC, producing pile-up up to 200 interactions per bunch crossing. As a part of its phase-II upgrade program, the CMS collaboration is developing a new end-cap calorimeter system, the High Granularity Calorimeter (HGCAL), featuring highly-segmented hexagonal silicon sensors (0.5-1.1 cm²) and scintillators (4-30 cm²), totalling more than 6 million channels in comparison to about 200k channels for the present CMS endcap calorimeters. For each event, the HGCAL clustering algorithm needs to reduce more than 100k hits into \sim 10k clusters, while keeping the fine shower structure. The same algorithm must reject pileup for further shower reconstruction. Due to the high pileup in the HL-LHC and high granularity, HGCAL clustering is confronted with an unprecedented surge of computation load. This motivates the concept of high-throughput heterogeneous computing in HGCAL offline clustering. Here we introduce a fully-parallelizable density-based clustering algorithm running on GPUs. It uses a tile-based data structure as input for a fast query of neighbouring cells and achieves an $O(n)$ computational complexity. Within the CMS reconstruction framework, clustering on GPUs demonstrates at least a 10x throughput increase compared to current CPU-based clustering.

Consider for promotion

Yes

Authors: CMS COLLABORATION; Mr CHEN, Ziheng (Northwestern University); Dr PANTALEO, Felice (CERN); Dr ROVERE, Marco (CERN); Mr DI PILATO, Antonio (University of Bari & INFN)

Presenter: Mr CHEN, Ziheng (Northwestern University)

Session Classification: Track 5 –Software Development

Track Classification: Track 5 –Software Development