

GPU-accelerated track reconstruction in the ALICE High Level Trigger

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ALICE (A Large Heavy Ion Experiment) is one of the four major experiments at the Large Hadron Collider (LHC) at CERN.

The High Level Trigger (HLT) is an online compute farm which reconstructs events measured by the ALICE detector in real-time.

The most compute-intensive part is the reconstruction of particle trajectories called tracking and the most important detector for tracking is the Time Projection Chamber (TPC).

The HLT uses a GPU-accelerated algorithm for TPC tracking that is based on the Cellular Automaton principle and on the Kalman filter.

The GPU tracking has been running in 24/7 operation since 2012 in LHC Run 1 and now in Run 2.

In order to better leverage the potential of the GPUs, and speed up the overall HLT reconstruction, we plan to bring more reconstruction steps (e.g. the tracking for other detectors) onto the GPUs.

There are several tasks running so far on the CPU that could benefit from cooperation with the tracking, which is hardly feasible at the moment due to the delay of the PCI Express transfers.

Moving more steps onto the GPU, and processing them on the GPU at once, will reduce PCI Express transfers and free up CPU resources.

On top of that, modern GPUs and GPU programming APIs provide new features which are not yet exploited by the TPC tracking.

We present our new developments for GPU reconstruction, both with a focus on the online reconstruction on GPU for O2 in ALICE during LHC Run 3, and also taking into account how the current HLT in Run 2 can profit from these improvements.

Tertiary Keyword (Optional)

Parallelization

Secondary Keyword (Optional)

Reconstruction

Primary Keyword (Mandatory)

High performance computing

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