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A GPU-based track reconstruction in the core of high pT jets in CMS

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The Large Hadron Collider is presently undergoing work to increase the centre-of-mass energy to 13 TeV and to reach much higher beam luminosity. It is scheduled to return to operation in early 2015.
With the increasing amount of data delivered by the LHC, the experiments are facing enormous challenges to adapt their computing resources, also in terms of CPU usage. This trend will continue with the planned future upgrade to the High-Luminosity LHC.
Of particular interest is the full reconstruction of the decay products of 3rd generation-quarks in high pT jets that have a crucial role in searches of new physics at the energy frontier.
At high pT, tracks from B-decays become more collimated, hence reducing the track-finding efficiency of generic tracking algorithms in the core of the jet.
The problem of reconstructing high pT tracks in the core of the jet, once a narrow eta-phi region around the jet is defined, was found to be especially beneficial for the application of GPU programming techniques due to the combinatorial complexity of the algorithm.
Our approach to the problem will be described, and particular focus will be given to the partitioning of the problem to map the GPU architecture and improve load balancing.
To conclude, measurements are described, which show the execution speedups achieved via multi-threaded and CUDA code in the context of the object-oriented C++ software framework (CMSSW) used to process data acquired by the CMS detector at the LHC.

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