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The Particle Flow Algorithm in the Phase II Upgrade of the CMS Level-1 Trigger

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The CMS experiment has greatly benefited from the utilization of the particle-flow (PF) algorithm for the offline reconstruction of the data. The Phase II upgrade of the CMS detector for the High Luminosity upgrade of the LHC (HL-LHC) includes the introduction of tracking in the Level-1 trigger, thus offering the possibility of developing a simplified PF algorithm in the Level-1 trigger. We present the logic of the algorithm, along with its inputs and its firmware implementation. We show that this implementation is capable of operating under the limited timing and processing resources available in the Level-1 trigger environment. The expected performance and physics implications of such an algorithm are shown using Monte Carlo samples with high pile-up, simulating the harsh conditions of the HL-LHC. New calorimeter features allow for better performance under high pileup (PU) to be achieved, provided that careful tuning and selection of the prompt clusters has been made. Additionally, advanced pile-up techniques are needed to preserve the physics performance in the high-intensity environment. We present a method that combines all information yielding PF candidates and performs Pile-Up Per Particle Identification (PUPPI) capable of running in the low latency level-1 trigger environment. Demonstration of the algorithm on dedicated hardware relying on ATCA platform is presented.

In-person participation

Yes

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