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HPS@L1 algorithm for the upgraded CMS level-1 hadronic tau trigger for the HL-LHC

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The High-Luminosity LHC will open an unprecedented window on the weak-scale nature of the universe, providing high-precision measurements of the Standard Model as well as searches for new physics beyond the standard model. The Compact Muon Solenoid (CMS) experiment is planning to replace entirely its trigger and data acquisition system to achieve this ambitious physics program. Efficiently collecting those datasets will be a challenging task, given the harsh environment of 200 proton-proton interactions per LHC bunch crossing. The new Level-1 trigger architecture for the HL-LHC will improve performance with respect to Phase I through the addition of tracking information and updates of the trigger electronics, which will allow to run a simplified particle-flow (PF) event reconstruction on the first trigger level (L1).
In this poster, we present the development of an algorithm to select events containing hadronic tau decays on L1 during LHC Phase II. The algorithm is inspired by the "hadrons-plus-strips"(HPS) algorithm, which has been used for the reconstruction of hadronic taus in offline analyses performed by CMS during LHC Runs 1 and 2. It takes advantage of the capability of the upgraded trigger to perform tracking and PF event reconstruction on L1 and is referred to as the HPS@L1 algorithm. The performance of the algorithm is studied in terms of efficiency and rate expected for a single hadronic tau and for a tau pair (ditau) trigger, using simulated events. For a tau isolation selection that yields a plateau efficiency of 85% per tau, the algorithm achieves a tau pT threshold of about 20 GeV for the ditau trigger, which is lower than the pT threshold achieved by the ditau trigger used by CMS during LHC Phase I.

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