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A Dedicated Electronics-Based Pixel Tracking System for CMS for HL-LHC Luminosities

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Addressing challenges of triggering in the High Luminosity LHC environment require development of fast and efficient track-based triggering methods. We consider a dedicated electronics-based system, which could be used as a co-processor performing fast tracking using data from the pixel detector for events passing the CMS Level-1 trigger. In this scenario, a list of tracks above a certain threshold will be made available for use at the very early stages of the software-based CMS High Level trigger allowing fast and efficient reduction in the rate of events necessary to allow performing more complex and time-consuming reconstruction methods on surviving events. While primarily targeted for later stages of "Phase I" upgrades, the same system can be utilized in the Phase II luminosity regime as part of the Level-1 trigger logic. In this case, the system will take advantage of the increased Level-1 trigger latency to perform tracking in regions of interest identified by the Level-1 calorimeter or muon triggers. In this scenario, the system will either confirm or deny presence of an energetic track and relay that information back to the Level-1 trigger decision logic before the final Level-1 decision to accept or reject an event is made.

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