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An FPGA based track finder at Level 1 for CMS at the High Luminosity LHC

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"A new tracking detector is under development for the Compact Muon Solenoid (CMS) experiment at the High-Luminosity LHC (HL-LHC). It includes an outer tracker that will construct stubs, built from clusters reconstructed in two closely-spaced layers, for the rejection of hits from low transverse momentum tracks and transmit them off-detector at 40MHz. If tracker data is to contribute to keeping the Level-1 trigger rate at around 750 kHz under increased luminosity, a crucial component of the upgrade will be the ability to identify tracks with transverse momentum above 3 GeV/c by building tracks out of stubs. A concept for an FPGA-based track finder using a fully time-multiplexed architecture is presented, where track candidates are identified using a projective binning algorithm based on the Hough Transform. A complete hardware demonstrator based on the MP7 processing board has been assembled to prove the entire system from the input to the tracker readout boards to producing tracks with fitted helix parameters. This has been achieved within the latency constraints with existing technology in 1/8th of the tracker solid angle at up to 200 proton-proton interactions per event. The track reconstruction system demonstrated, the architecture chosen, the achievements to date and future options for such a system will be discussed."

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Track Classification: 9 : Real Time Pattern Recognition