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# An FPGA-Based Track Finder for the L1 Trigger of the CMS Experiment at HL-LHC

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A new tracking detector is under development for use by the CMS experiment at the High-Luminosity LHC. This upgrade will allow to reconstruct within a few microseconds charged particle tracks with transverse momentum above 3 GeV, for use in the Level-1 trigger. A concept for an FPGA-based track finder using a fully time-multiplexed architecture is presented, reconstructing tracks using an Hough Transform based algorithm. A hardware demonstrator using MP7 boards has been assembled. It operates on 1/8 of tracker solid angle at a time, processing events taken at 40 MHz with up to 200 superimposed proton-proton interactions, satisfying latency constraints.

## Summary

A new tracking detector is under development for use by the CMS experiment at the High-Luminosity LHC (HL-LHC). A crucial component of this upgrade will be the ability to reconstruct within a few microseconds all charged particle tracks with transverse momentum above 3 GeV, so they can be used in the Level-1 trigger decision. A concept for an FPGA-based track finder using a fully time-multiplexed architecture is presented, where track candidates are reconstructed using a projective binning algorithm based on the Hough Transform. A hardware demonstrator using MP7 processing boards has been assembled to prove the entire system, from the output of the tracker readout boards to the reconstruction of tracks with fitted helix parameters. It successfully operates on one eighth of the tracker solid angle at a time, processing events taken at 40 MHz, each with up to 200 superimposed proton-proton interactions, whilst satisfying latency constraints. The demonstrated track-reconstruction system, the chosen architecture, the achievements to date and future options for such a system will be discussed.

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