

Connecting The Dots 2023



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Track reconstruction with mkFit and developments towards HL-LHC

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MkFit is a Kalman filter-based track reconstruction algorithm that uses both thread- and data-level parallelism. It has been deployed in the Run-3 offline workflow of the CMS experiment. The CMS tracking performs a series of iterations to reconstruct tracks of increasing difficulty. MkFit has been adopted for several of these iterations, which contribute to the majority of reconstructed tracks. When tested in the standard conditions for production jobs, MkFit has been shown to speed up track pattern recognition by an average of 3.5x. This speedup is due to a number of factors, including vectorization, a lightweight geometry description, improved memory management, and single precision. Efficient vectorization is achieved with several compilers and relies on a dedicated library for small matrix operations, Matriplex, which has recently been released in a public repository. The mkFit geometry and material description has been generalized to support the Phase-2 upgraded tracker geometry for the HL-LHC and potentially other detector configurations. The implementation strategy and preliminary results with the HL-LHC geometry are presented. Speedups in track building from mkFit imply that track fitting becomes a comparably time consuming step of the tracking chain. Prospects for an mkFit implementation of the track fit are also discussed.

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