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CMS reconstruction improvements for the tracking in large pile-up events

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The CMS tracking code is organized in several levels, known as 'iterative steps', each optimized to reconstruct a class of particle trajectories, as the ones of particles originating from the primary vertex or displaced tracks from particles resulting from secondary vertices. Each iterative step consists of seeding, pattern recognition and fitting by a kalman filter, and a final filtering and cleaning. Each subsequent step works on hits not yet associated to a reconstructed particle trajectory.

The CMS tracking code is continuously evolving to make the reconstruction computing load compatible with the increasing instantaneous luminosity of LHC, resulting in a large number of primary vertices and tracks per bunch crossing.

The major upgrade put in place during the present LHC Long Shutdown will allow the tracking code to comply with the conditions expected during Run2 and the much larger pile-up. In particular, new algorithms that are intrinsically more robust in high occupancy conditions have been developed, iterations have been re-designed (including a new one, dedicated to specific physics objects), code optimizations have been deployed and new software techniques have been used. The speed improvement has been achieved without significant reduction in term of physics performance.

The methods and the results are presented and the prospects for future applications are discussed.

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