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CMS Inner Tracker Upgrade

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The LHC is preparing an upgrade, which will bring the luminosity of the machine to $5-7 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$ reaching an integrated luminosity of 3000 by the end of 2037. This High Luminosity LHC scenario, HL-LHC, will require extensive upgrades to the experiments to fully exploit the physics potential of the accelerator. In this so-called Phase-2 upgrade, CMS detector will require improved radiation hardness, higher detector granularity to reduce occupancy, increased bandwidth to accommodate higher data rates, and an improved trigger capability in order to maintain an acceptable trigger rate. Thus, the entire tracking system will need to be replaced to deal with the HL-LHC environment and to maintain the excellent performance of the current CMS detector.

The Phase-2 Inner Tracker (IT) is designed to maintain or even improve the tracking and vertexing capabilities under the high pileup (140 - 200 collisions per bunch crossing) conditions of the HL-LHC. The detectors should have the required radiation tolerance and capability of delivering the desired performance in terms of detector resolution, occupancy, and track separation. IT will be built from thin silicon pixel detectors segmented into pixel sizes of $25 \times 100 \mu\text{m}^2$ or $50 \times 50 \mu\text{m}^2$. IT is composed of a barrel part with four cylindrical layers and eight small and four large disc-like structures in each forward direction. The design also includes the possibility to extract and replace the degraded parts of the detector without removing the beam pipe. The Tracker Endcap Pixel detector (TEPX), installed within the extended space, will enable the measurement of real-time instantaneous luminosity as an added functionality. The extended geometrical coverage of up to $\eta < 4.0$ provides large forward acceptance to mitigate the pileup especially in the endcap calorimeters.

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