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Performance verification of the CMS Phase 1 Upgrade pixel detector with collision data

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The Compact Muon Solenoid (CMS) is a multi-purpose detector constructed in order to study high-energy particle collisions in the Large Hadron Collider (LHC) at CERN. The pixel detector is the inner part of the all-silicon charged particle tracking system in CMS. It plays a vital role in the seeding of the track reconstruction algorithms used at CMS, and in the reconstruction of primary interaction and secondary decay vertices. This year, the Phase 1 upgrade detector is replacing its older counterpart that has been used in Run 1 and in the first half of Run 2 with the expectation that the instantaneous luminosity of the LHC would reach $2 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$, well surpassing the rate capabilities of the old detector. The Phase 1 upgrade of the CMS pixel detector was built to operate at such high rate with its new digital readout scheme. Beyond the upgrade of the readout electronics, the detector's new layout will allow for more efficient tracking with smaller fake rate at higher event pile-up by providing more measurement points, first of which is taken at a smaller radius, and reduced material budget due to a light support mechanics and reorganized arrangement of the services. The presentation will describe the design choices which determine the detector's performance parameters, and it will compare the expectations with measurements taken with the first collision data.

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