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Alignment of the upgraded CMS pixel detector

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The all-silicon tracking system of the CMS experiment provided excellent resolution for charged tracks and an efficient tagging of heavy flavor jets during Run1 and Run2 of the LHC. After a new pixel detector has been installed during the LHC technical stop at the beginning of 2017, the positions, orientations, and surface curvatures of the sensors needed to be determined with a precision at the order of few micrometers to ensure the required physics performance. This is far beyond the mechanical mounting precision but can be achieved using an in-situ track-based alignment procedure that minimises the track-hit residuals of reconstructed tracks. During operation, the alignment also needs to be quickly recalculated each time the state of the CMS magnet is changed between 0T and 3.8T. The geometries are carefully validated with data-driven methods.

We present latest results of the CMS tracker alignment in 2017 from the early detector-commissioning phase and the later operation, that were derived using several million reconstructed tracks from collisions and cosmic-rays data. Special emphasis is put on the alignment of the new pixel detector.

Primary author: SCHROEDER, Matthias (KIT - Karlsruhe Institute of Technology (DE))

Presenter: SCHROEDER, Matthias (KIT - Karlsruhe Institute of Technology (DE))

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