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Operation, calibration and performance of the CMS silicon tracker

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The CMS tracker is the largest silicon detector ever built, covering an area close to 200 m2 and consisting of 15 148 silicon strip and 1440 silicon pixel modules. The use of tracker data in physics analysis requires fine-grained monitoring and calibration procedures. Results from timing studies, threshold optimization, calibration of gains and Lorentz angle determination are shown and the impact on resolution and dE/dx measurements is discussed. In order to achieve an optimal track-parameter resolution, the position and orientation of its modules need to be determined with a precision of few micrometers and an accurate representation of the distribution of material in the tracker is needed. Results of the alignment of the full tracker are presented, based on the analysis of several million reconstructed tracks recorded during the commissioning of the CMS experiment with cosmic rays and the first proton-proton collisions. They have been validated by several data-driven studies and compared with predictions obtained from a detailed detector simulation. Reconstructed photon conversions and nuclear interactions have been used for a first estimate of the tracker material.

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