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Mapping the CMS inner tracking system with unprecedented precision

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The CMS inner tracking system is a fully silicon-based high precision detector. Accurate knowledge of the positions of inactive elements (such as support structures or shields) is important for simulating the detector, planning detector upgrades, and reconstructing charged particle tracks.

The position of the inactive elements can be determined with a limited precision by the geometrical surveys when the CMS detector is not closed. Nuclear interactions of hadrons with the detector material allow to perform these measurements with a sub-millimeter precision in situ, while the detector is collecting LHC collisions data. With this technique, changes due to the effects of the magnetic field, cryogenic cooling, and irradiation can be taken into account.

Data from proton-proton collisions at a center-of-mass energy of 13 TeV recorded in 2018 at the LHC are used. Results of 2018 data with the upgraded (Phase-1) pixel detector, which was installed at the beginning of 2017 year, have been compared with published 2015 data taken with the original pixel detector.

Primary authors: BARINGER, Philip Shively (The University of Kansas (US)); FLOWERS, Zachary (The University of Kansas (US)); GOUZEVITCH, Maxime (Centre National de la Recherche Scientifique (FR)); KROPIVNITSKAYA, Anna (The University of Kansas (US))

Presenter: KROPIVNITSKAYA, Anna (The University of Kansas (US))

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