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TFPX-TBPX adjustable mechanical connection tests for the Phase II integration of the CMS Inner Tracker

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During LHC Phase II, the CMS tracker will be updated to increase its performance given by the higher luminosity. One of the goals of this upgrade is to cover the maximum surface and to not leave gaps around the interaction point, to increase the global performance of the detector. In order to reach it, TBPX (Tracker Barrel Pixel) design is divided into four halves. The halves are staggered layer by layer around the beam pipe, to cover the whole area around the interaction point with sensors. Due to the high precision required for the position of the sensors, the connection between separate parts becomes critical. Indeed TBPX, the closest structure to the interaction point, is connected to TFPX (Tracker Forward Pixel), a longer system which reaches its final position sliding on rails, supporting TBPX in cantilevered way. TFPX support system, even if adjustable, is not precise enough to guarantee a safe installation. To avoid collision between layers of different halves of TBPX, a tunable connection has been implemented. Such connection allows TBPX positioning with respect to a precise reference system defined by ITST rails, within a certain range independently from the TFPX position. This talks presents the design solution to manage the position and orientation regulation, the connection details to reach the proper required precision, and to solve many constraints due to lack of space, high rigidity and low mass, radiation hard and low thermal expansion materials. Furthermore, it would be showed the results of the Integration test run in Purdue in January 2024, where this connection was tested for the first time by mounting and inserting half Inner Tracker mockup inside half section of ITST. Finally, it would be explained the continuation of this test run in Pisa, to solve the criticalities found during the insertion test, to fine tune the installation procedure and it's positioning accuracy.

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