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Automating the assembly of PS modules for the CMS Phase II Tracker

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For the start of the High-Luminosity phase of the LHC, the CMS tracker will be replaced by a new tracking detector; this and other upgrades will allow the experiment to both cope with the increased instantaneous luminosity and, at the same time, enhance its overall physics reach.

A key aspect of the upgraded CMS tracker is the use of double-sided pixel-strip (PS) and strip-strip (2S) modules capable of local stub reconstruction. This new hardware capability will be exploited to identify stubs from high-pT charged particles and transmit tracking information to the L1 trigger for every LHC bunch crossing. The need to correlate hits across the two sensors of a module for local stub reconstruction leads to stringent requirements on their relative alignment; for example, the two sensors of a PS module must be assembled to a relative rotational alignment of 800 microradians.

We present a method to partially automate the assembly of PS modules for the CMS Phase II Tracker. The method is based on the integration of a high-precision motion stage with a vacuum handling tool and a high-definition camera, all controlled via a dedicated software interface. The positions of the two sensors are deduced using a pattern recognition algorithm on images acquired by the camera and, based on these measurements, the two sensors are brought into alignment for the module assembly. The current status of the automated assembly procedure is discussed, including results on the first mechanical prototypes.

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