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Integration and assembly of the CMS phase-2 tracker endcap

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For the high-luminosity LHC (HL-LHC), CMS will install a completely new silicon tracker. The future tracker will consist of two barrel parts and two endcaps (TEDD), one on each side. One endcap is made of five double-disks. One double disk is assembled from four half disks (Dees) on which the detector modules are mounted.

Dees are large and fragile objects, particularly after modules are mounted in the first integration step, thus they need to be supported throughout the whole integration and assembly procedure. A semi-circular arc frame will be used for this purpose. They need to be stiff enough to support the Dees, stress free, and precise to allow merging during double-disk assembly. Various prototypes have been produced and their stiffness and manufacturing precision have been studied. Both features have to be balanced against weight and cost of the arc frames.

The integration and assembly procedure has significantly matured. For integrating modules on the Dees a rotation stand is under development. It also serves as transport tooling and allows to load Dees into the following assembly stations. A first implementation of the disk assembly tooling has been built and tested for the achievable alignment precision. The full assembly procedure is exercised using dummy structures. Two full size Dee prototypes are available, which are used to test the disk assembly procedure and demonstrate the Dee to Dee alignment and connection procedure.

The full TEDD assembly requires not only further tooling design, but also places requirements on the detector mechanics such as metrology and mechanical stability in a non-final load case. The talk will give a complete overview of the full TEDD production procedure. A focus is given on the various toolings, available or in development, needed for the assembly.

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