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CMS barrel timing detector assembly

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The High Luminosity LHC (HL-LHC) phase, scheduled to start in 2030 and deliver 3000 fb-1 in 10 years, will offer unique potential for precision measurements and searches for rare processes. However, it will also pose significant challenges for the detectors due to extremely high radiation levels and the large number of simultaneous interactions per bunch crossing (up to 200). To mitigate pile-up, CMS will install the MIP Timing Detector (MTD), capable of measuring charged-particle arrival times with 30–60 ps precision. Its central component, the Barrel Timing Layer (BTL), consists of about 166,000 LYSO:Ce crystal bars with double-ended SiPM readout. After successful design optimisation and prototype validation in test beams, the BTL has entered the construction phase.

Peking University is one of the key assembly centers of the MTD BTL, responsible for completing one quarter of the overall detector assembly together with Tsinghua University and Beihang University. At each assembly center, SiPMs are coupled to LYSO:Ce crystals to form Sensor Modules, which are then integrated with the front-end electronics boards to form Detector Modules, and subsequently assembled into complete detector Trays. The assembly work started in the autumn of 2024 and has since been progressing smoothly.

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