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Characterization and Calibration of the RD53B CMS Chip

The High-Luminosity LHC is expected to start its operation in 2029. All the detector experiments around the LHC will also have significant improvements (the so-called Phase-2 upgrade) to ensure optimal performance with 10 times higher than nominal instantaneous luminosity. The innermost layers of the upgraded detectors must have higher granularity with more readout channels, and be significantly more radiation-hard than the current ones.

The CMS experiment is preparing a completely new silicon tracker unit, consisting of two separate parts: the Inner and the Outer Tracker. The Inner Tracker will feature pixel detectors with 6 times smaller pixels, compared to the current ones, and will have 12 forward disks instead of the current 3, making the total number of pixels reach around 2 billion. It will feature a radiation-hard readout chip, developed by the RD53 collaboration for both CMS and ATLAS experiments, and will be able to provide the necessary data transmission rates. The preparation works for the CMS Inner Tracker upgrade are well underway and the 2nd generation chip prototypes, the RD53B CMS (also called CMS ReadOut Chip or CROC for short), are already being tested and optimized. A dedicated data acquisition and control framework is used for chip calibration and testing. The most recent chip characterization and calibration results will be presented during the talk.

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