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Process quality control of silicon sensors for the Phase-2 upgrade of the CMS Outer Tracker for the HL-LHC

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After the current running period Run 3 the LHC will undergo a major upgrade with the instantaneous luminosity reaching at $7.5 \times 10^{34}\ cm^{-2}\ s^{-1}$. In order to maintain or improve the physics performance of the CMS detector in this challenging conditions of the HL-LHC, the entire tracking system must be replaced with new detectors with higher radiation tolerance and improved tracking capabilities. The upgraded CMS Outer Tracker will consist of 26592 new silicon sensors. CMS has developed a systematic quality assurance plan in order to have continuous information about the quality of sensors during the long production period and to ensure that the sensors meet the specifications. Process quality control is one of the main procedures for characterizing the sensors along with the sensor quality control and it is performed on dedicated test structures fabricated on the same wafer with the sensor, allowing quick and easy access to the stability of the fabrication procedure and the quality of the materials. The process quality control procedure includes measurements on MOS, diodes, gated diodes, FETs, and Van Der Pauw structures. In this work, the experimental apparatus of the process quality control is described along with the extraction procedure of the relevant process parameters. Examples of experimental results from various wafers are presented as well.

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