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Development of n-in-p large-area silicon microstrip sensors for very high radiation environments

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We have developed a novel and radiation-tolerant n-in-p silicon microstrip sensors for very high radiation environments such as high-luminosity LHC. The sensors are designed to be operable to the end-of-life fluence of ≥1×10ˆ15 1-MeV neutron-equivalent/cmˆ2. The sensors are fabricated in p-type, float-zone, 6 in. wafers where we lay out two designs of large-area, 9.75 cm × 9.75 cm, strip sensors, together with a number of miniature sensors. The large-area sensors have four blocks of short strips, 2.4 cm long each. One design is made with all "axial"segments (ATLAS12A) and the other with two "axial"and two "stereo"strip segments (ATLAS12M). Each design has (1) two edge-widths: standard (˜900 μm) and slim (˜450 μm), and (2) punch-through protection (PTP) structures at the end of each strips. The miniature sensors are implemented with variations of the PTP structure, and the "wedge"designs for the endcap sensors with stereo strips or the "skewed"layout. A "ganging"of stray stereo strips to the readout strips is designed in a stereo-strip segment of the ATLAS12M sensor and in the "wedge"miniature sensors. We report the design and the initial performance of the large area and the miniature sensors with the standard or the slim edge dicing.

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