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Charge collection and field profile studies in heavily irradiated silicon strip sensors for the ATLAS Inner Tracker Upgrade

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The ATLAS group has evaluated the charge collection in silicon microstrip sensors irradiated up to fluence of 1×10^{16} n_{eq}/cm^2, exceeding the 1.6×10^{15} n_{eq}/cm^2 maximum expected during the HL-LHC period including a safety factor of 2. The ATLAS12, n^+-on-p type sensors fabricated by HPK on FZ substrates, is the latest barrel sensor design.
The charge collection out of irradiated 1×1 cm2 barrel test sensors has been evaluated systematically using penetrating -rays and Alivaba readout systems. The obtained data are compared among various measurement sites and with previous ATLAS07 design. The results are very consistent particularly when the sensor thicknesses are normalized with the active thickness derived from CV and edge-TCT (Transient Current Technique) measurements.
The edge-TCT is also effective in evaluation of the field profiles across the depth and differences have been examined between irradiated ATLAS07 and ATLAS12 samples and among the samples irradiated with different radiation sources, neutrons, protons and pions.
The studies of the bulk properties of the devices show that they can yield sufficiently large signal for the expected range of fluence in the HL-LHC to remain precision tracking sensors.

The presentation is on behalf of the ATLAS ITK Strip Sensor Collaboration

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