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Tests of 50 µm thick silicon micro-strip sensors after extreme fluences up to 3x10^{16} neq cm^{-2}

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The development of silicon detectors tolerant to extreme fluences for future high energy and high luminosity hadron colliders (like the upgrade of the present Large Hadron Collider to high luminosity at CERN) is demanded not only for instrumenting the innermost layers (where pixel sensors will be deployed) but also for particle flow calorimetry. The anticipated fluence levels range from 2x10^{16} neq in the inner pixel layers to possibly 1x10^{17} neq cm^{-2} in the forward calorimeter region. The challenge is daunting, because of the large increase of the reverse current and the severe decrease of the signal recorder by the irradiated devices. The use of thin silicon detectors in charge multiplication regime could take the tolerance of silicon detectors further towards satisfying this requirement.
We show here the experimental result obtained with silicon micro-strip sensors with a thickness of 50 µm irradiated to various fluences up to 3x10^{16} neq cm^{-2}. After irradiation the signal is studied with fast electrons from a radioactive source, to mimic the signal of minimum ionising particles. Additional IV measurements show the current of highly irradiated silicon sensors.

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