



Contribution ID: 119

Type: Poster

Effect of irradiation and annealing performed with bias voltage applied across the coupling capacitors on the interstrip resistance of ATLAS ITk strip silicon sensors

Tuesday, 24 May 2022 08:39 (1 minute)

In order to cope with the occupancy and radiation doses expected at the High-Luminosity LHC, the ATLAS experiment will replace its Inner Detector with an all-silicon Inner Tracker (ITk), containing pixel and strip subsystems. The strip detector will be built from modules, consisting of one or two n⁺-in-p silicon sensors, PCB hybrids accommodating the front-end electronics, and powerboard providing high voltage, low voltage, and monitoring electronics. The aluminium strips of the silicon sensors developed for the ITk project are AC-coupled with n-type implants in a p-type float-zone silicon bulk. The module powering configuration includes a voltage of up to 0.5 V across the sensor coupling capacitor. However, this voltage is usually not applied in the sensor irradiation studies due to the significant technical and logistical complications. To study the effect of an irradiation and a subsequent beneficial annealing on the ITk strip sensors in real experimental conditions, four prototype ATLAS17LS miniature sensors were irradiated by Co60 source and annealed for 80 minutes at 60°C, both with and without the bias voltage of 0.5 V applied across the coupling capacitors. The values of interstrip resistance measured on irradiated samples before and after annealing indicate that increase of radiation damage caused by the applied voltage can be compensated by the presence of this voltage during annealing.

Collaboration

ATLAS ITk Strip Sensor collaboration

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