



Contribution ID: 33

Type: **WG3 Radiation Damage - Extreme Fluence**

Irradiation studies of ATLAS18 mini strip detectors with 23 GeV protons in IRRAD facility

Tuesday 3 June 2025 12:30 (20 minutes)

Several irradiation campaigns using 23 GeV protons were conducted at the IRRAD facility at CERN, employing test structures from ATLAS1 wafers for the ATLAS ITk strip sensors. These campaigns aimed to study charge collection efficiency after irradiation. When irradiating with a narrow beam of high energy protons, various effects must be considered to accurately estimate the actual fluence and interpret detector performance. Secondary particles generated in interactions of the primary protons with material of the support structure, as well as geometrical effects due to shallow incidence angle, can significantly increase the actual fluence to which samples are exposed. These effects were also studied using Geant4 simulation, which showed good agreement with measurements.

Extensive studies of effects of annealing at 60C on CCE were also performed. For detectors irradiated with neutrons or low energy protons the collected charge exhibited a beneficial effect of short-term annealing which was followed by a decrease in charge collection efficiency at longer annealing times. After irradiation with 23 GeV protons to fluences above 1.2×10^{15} n/cm² the collected charge remained unchanged or even decreased significantly after the first few tens of minutes of annealing. Edge-TCT measurements indicated that this unusual annealing behaviour is related to the double-peak electric field profile in the detector. Mixed irradiation with 23 GeV protons and neutrons to fluences matching the expected in the upgraded ATLAS experiment confirmed that this unusual annealing effect will not impact the operation of the ITk strip detector. The results of these studies will be presented in this contribution.

Type of presentation (in-person/online)

in-person presentation

Type of presentation (I. scientific results or II. project proposal)

I. Presentation on scientific results

Author: MANDIC, Igor (Jozef Stefan Institute (SI))

Co-author: ATLAS ITK STRIP SENSOR COMMUNITY

Presenter: MANDIC, Igor (Jozef Stefan Institute (SI))

Session Classification: WG3/WP3 - Extreme fluence and radiation damage characterization