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Annealing effects on highly n-doped layers in Resistive AC-coupled Silicon Detectors (RSD/AC-LGAD)

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Resistive AC-coupled Silicon Detectors (RSD/AC-LGAD) are novel silicon sensors that provide both precise spatial and temporal resolution, making them a key technology for the next generation of collider experiments (HL-LHC, FCC, CEPC). Like all silicon devices, these sensors suffer from irradiation damage which create additional states in the silicon band gap that lead to macroscopic changes, such as increased leakage current or changes in effective donor concentration. Annealing studies of irradiated sensors allow for detailed analysis of the defects created inside of silicon during irradiation. Traditionally, annealing studies focus on studying the sensor bulk with detailed IV, CV, and Charge Collection measurements. However, this study focuses on the resistive n+ layer, which is a thin, highly n-doped layer crucial for the charge spread (spatial reconstruction) in RSDs/AC-LGADs. The donor doping is monitored with sheet resistivity measurements via dedicated test structures. As the structures are irradiated, the sheet resistance increases due to donor removal. This study focuses on understanding the mechanism of donor removal by observing how the sheet resistance changes with annealing at low and high temperatures. It is important to assess how irradiation and annealing accumulated during a technical stop at a collider experiment, affect the sheet resistance and the charge sharing mechanism in these devices. The results of this study also demonstrate that simple sheet resistance measurements are a powerful tool for defect analysis in thin, highly n-doped silicon layers.

Type of presentation (in-person/online)

in-person presentation

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

I. Presentation on scientific results

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