

Testbeam studies of annealed planar pixel modules and design optimisations of pixel sensors for the ATLAS ITk upgrade employing TCAD simulation

Wednesday 22 November 2017 09:40 (20 minutes)

Facing the high luminosity phase of the LHC (HL-LHC) to start operation around 2026, a major upgrade of the tracker system is in preparation for the ATLAS experiment. Thanks to the small material budget and their high charge collection efficiency after irradiation, thin planar pixel modules are the baseline option to instrument all layers of the pixel system beginning from the second layer.

To optimise the sensor layout towards the decreased pixel cell size of $50 \times 50 \mu\text{m}^2$, TCAD device simulations are being performed before and after irradiation to investigate charge collection efficiency and electrical field properties. Two different common irradiation models will be compared regarding these observables.

In addition, sensors of 100-150 μm thickness, interconnected to FE-I4 read-out chips featuring the previous generation pixel cell size of $50 \times 250 \mu\text{m}^2$, are characterised at testbeams at the CERN-SPS. The performance of sensors irradiated up to a fluence of $1 \times 10^{16} \text{ n}_{\text{eq}}/\text{cm}^2$ is compared in terms of charge collection and hit efficiency before and after annealing. This study aims to reproduce the effects of storage time at room temperature of high energy physics pixel detectors during maintenance periods.

Authors: BEYER, Julien-Christopher (Max-Planck-Institut für Physik (DE)); LA ROSA, Alessandro (Max-Planck-Institute for Physics (D)); MACCHIOLO, Anna (Max-Planck-Institut für Physik (DE)); NISIUS, Richard (Max-Planck-Institut für Physik (DE)); SAVIC, Natascha (Max-Planck-Institut für Physik (DE)); TAIBAH, Reem Hani M (Max-Planck-Institut für Physik (DE))

Presenter: BEYER, Julien-Christopher (Max-Planck-Institut für Physik (DE))

Session Classification: Pixel and strip sensors