Contribution ID: **5** Type: **Oral**

Simulation of the depletion voltage evolution of the ATLAS Pixel Detector

Monday 20 February 2017 14:00 (20 minutes)

The ATLAS Pixel detector has been operating since 2010 and consists of hybrid pixel modules where the sensitive elements are planar n-in-n sensors.
In order to investigate and predict the evolution of the depletion voltage and of the leakage current in the different layers, a fully analytical implementation of the Hamburg model was derived. The parameters of the model, describing the dependence of the depletion voltage (U_depl) on fluence, temperature and time were tuned with a fit to the available measurements of Udepl in the last years of operation.
A particular emphasis is put on the B-Layer, where the highest fluence has been accumulated up to now. A precise input of temperature and radiation dose is generated from the on-module temperature monitoring and the luminosity data. The analysis is then also extended to the Insertable B-Layer (IBL), installed at the end of Run-1, where we expect the fastest evolution of the radiation damage with luminosity, due to its closer position to the interaction point. Different detector temperatures and luminosity scenarios are simulated to investigate the impact of maintenance periods at room temperature and of the accumulated fluence for the future data taking in Run-2.

TRACK

Simulations

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Session Classification: Session 2: Planar Sensors (1)