

Measurement of Radiation Damage through Leakage Current Monitoring of the ATLAS Pixel Detector

Monday 25 February 2019 16:30 (20 minutes)

Radiation damage incurred by the silicon modules in the ATLAS Pixel Detector B-Layer, Layer-1, Layer-2, and disks from the beginning of 2011 through November 2018 has been monitored through measurement of the leakage current. The measurement makes use of the fact that leakage current changes by an amount proportional to the received hadronic fluence. The data are compared to predictions made with the Hamburg Model which is scaled to match their average magnitude. Comparisons of fluence predictions by PYTHIA8+FLUKA to the fluence determined from leakage current data combined with the Hamburg Model are also made for each barrel layer and disk. Projections of the lifetime of the Pixel Detector are made using several scenarios for expected future temperatures and fluence rates and extrapolating from the present leakage current data and Hamburg Model predictions, through year 2023 and 500 fb^{-1} of total collected luminosity.

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Session Classification: Session 3: Radiation effects in HEP experiments