

Temperature Dependent Measurements of n-in-n Pixel Sensors

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The innermost tracking detector of the ATLAS experiment at CERN-LHC consists of planar n-in-n pixel sensors with FE-I3 front-end electronics as hybrid. The 2013/14 newly to be installed insertable b-layer (IBL) at the ATLAS experiment will consist of pixel sensors with a revised design layout and an improved FE-I4 front-end electronics. The envisaged radiation dose in the forthcoming data taking period of the innermost sensors will be a few 10^{15} Neutrons (1 MeV equivalent) cm^{-2} . For future collider and detector upgrades like the high luminosity LHC (HL-LHC) pixel sensors in environments exceeding doses well above 10^{16} cm^{-2} are considered.

In this contribution various aspects of R&D laboratory investigations employing radioactive source scans and electric analogue and digital measurements of unirradiated and irradiated (partly up to IBL fluences and partly up to HL-LHC fluences) n-in-n pixel sensor structures are discussed. Main focus are the dependencies and correlations between the sensor operation temperature and observables including leakage currents and charge collection. Some of the investigations are not only performed on single chip sensor+electronic assemblies using several thousands of pixels but also include smaller pixel clusters down to single pixels.

Design studies to improve the temperature monitoring of pixel sensors of the IBL design as well as for the foreseen prototyping sensor productions for HL-LHC upgrade studies are presented.

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