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Radiation hardness studies of n+-in-n planar pixel sensors irradiated to 5E15 n_eq cmˆ-2 and beyond for HLLHC

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ATLAS plans two major upgrades of its pixel detector on the path to HLLHC: First, the insertion of a 4th pixel layer (Insertable B-Layer, IBL) is currently being prepared for 2013. This will enable the ATLAS tracker to cope with an increase of LHC's peak luminosity to about 3E34 cmˆ-2 sˆ-1 which requires a radiation hardness of the sensors of up to 5E15 n_eq cmˆ-2. Towards the end of this decade, a full replacement of the inner tracker is foreseen to cope with luminosities of up to 10E35 cmˆ-2 sˆ-1 at HLLHC. Here, the innermost pixel layer will have to withstand a radiation damage of 2E16 n_eq cmˆ-2.

We have irradiated n+-in-n sensor assemblies based on the current ATLAS pixel read-out chip FE-I3 to IBL as well as HLLHC fluences using thermal neutrons in Ljubljana as well as protons in Karlsruhe and at CERN PS and will present the charge collection efficiency results of lab measurements with a Sr-90 source after irradiation.

Space resolved analysis results such as hit efficiencies from data taken in dedicated CERN SPS and DESY testbeams are going to be shown as well.

Furthermore first results realised with irradiated sensor assemblies based on the new read-out chip FE-I4 will be shown thus enabling a cross-check of results obtained with the FE-I3 system. Data from testbeam measurements with steep angle insertion might be helpful for an improved understanding of charge multiplication.

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oral

Primary authors: Mr RUMMLER, André (TU Dortmund); Prof. GOESSLING, Claus (TU Dortmund); Dr MUENSTERMANN, Daniel (CERN); Mr TROSKA, Georg (TU Dortmund); Ms JENTZSCH, Jennifer (TU Dortmund); Dr KLINGENBERG, Reiner (TU Dortmund); Mrs ALTENHEINER, Silke (TU Dortmund); Mr LAPSIEN, Tobias (TU Dortmund); Mr WITTIG, Tobias (TU Dortmund)

Presenter: Mr RUMMLER, André (TU Dortmund)

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