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Planar Pixel Sensors for the ATLAS tracker upgrade at HL-LHC

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The ATLAS Planar Pixel Sensor (PPS) R&D Project is a collaboration of 17 institutes and more than 80 scientists, started to explore the feasibility of employing planar pixel sensors for the upgraded tracker at HL-LHC. Different pixel concepts are investigated for the inner and outer layers. In the first case the focus is on extreme radiation hardness, with the use of very thin pixel sensors (with an active thickness in the range of 75-150 μm), and the achievement of slim and active edges to provide low geometrical inefficiency.

In the case of the outer layers, different approaches are being investigated to face the challenge of instrumenting an increased surface with respect to the present pixel system:

production on 6" instead of 4" wafers, more cost-efficient and industrialised interconnection techniques and establishing the n-in-p technology which as a single-sided process requires less production steps.

New results will be presented, illustrating the performance of FE-I3 and FE-I4 pixel modules, irradiated up to a fluence of $2 \times 10^{16} \text{ n}_{eq}/\text{cm}^2$. The focus will be on charge collection and noise measurements performed with radioactive sources in the laboratory and tracking efficiencies of the different planar technologies extracted from beam tests with pions at CERN SPS. With these studies tracking efficiencies of 97% after a fluence of $2 \times 10^{16} \text{ n}_{eq}/\text{cm}^2$ have been demonstrated with n-in-n FE-I3 modules as well as efficiencies of 98-99% at a fluence of $5 \times 10^{15} \text{ n}_{eq}/\text{cm}^2$ for n-in-p modules.

for the collaboration

ATLAS Planar Pixel Sensor (PPS) R&D Project

Presenter: Mr GALLRAPP, Christian (CERN)

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