

Microelectronic Test Structures for the Development of a Strip Sensor Technology for High Energy Physics Experiments

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The planned upgrade of the Large Hadron Collider (HL-LHC) requires the development of new tracking silicon sensors for the future ATLAS detector. These new devices must fulfil the specifications established by the ATLAS collaboration, in order to guarantee the proper performance of the tracking system during the life time of the experiment. A prototype strip sensor layout have been designed at IMB-CNM using a new python-based layout tool, and fabricated in 6-inches substrates by the semiconductor manufacturing company Infineon Technologies AG.

This work presents a set of test structures, capable to evaluate key device elements as the implant and metal resistivity, the bias resistance, the coupling capacitance between strip implant and strip metal, the study of the surface leakage current, or the influence of the sensor edge design in the device breakdown voltage. A complete analysis of these parameters pre-irradiation and after a proton and gamma irradiations, up to doses similar to the ones expected in the future ATLAS Inner-Tracker (ITk), is presented. This study shows the relevance of microelectronic test structures to monitor and improve the technology of tracking silicon sensors for High Energy Physics Experiments.

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