

Radiation-Hard Silicon Detectors for HL-LHC Tracking - RD50 Status Report

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It is foreseen to significantly increase the luminosity of the LHC by upgrading towards the HL-LHC (High Luminosity LHC) in order to harvest the maximum physics potential. Especially the Phase-II-Upgrade foreseen for 2021 will mean unprecedented radiation levels. All-silicon central trackers are being studied in ATLAS, CMS and LHCb, with extremely radiation hard silicon sensors to be employed on the innermost layers. Within the RD50 Collaboration, a massive R&D programme is underway across experimental boundaries to develop silicon sensors with sufficient radiation tolerance. One research topic is to study sensors made from p-type silicon bulk, which have a superior radiation hardness as they collect electrons instead of holes. A further area of activity is the development of advanced sensor types like 3D silicon detectors designed for the extreme radiation levels expected for the inner layers. We will present results of several detector technologies and silicon materials at radiation levels corresponding to HL-LHC fluences. Observations of charge multiplication effects at very high bias voltages in a number of detectors will be reported. In this context, we will show first measurements from a set of dedicated detectors designed in order to better understand the charge multiplication mechanism. Based on our results, we will give recommendations for the silicon detectors to be used for LHC detector upgrades.

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