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First Irradiation Studies of the novel nLGAD Concept

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Low Gain Avalanche Detectors (LGADs) show excellent precision timing performance for high-energy physics (HEP) particle detection and will therefore be employed in detector upgrades for the High-Luminosity LHC ATLAS and CMS. However, traditional p-type LGADs face limitations in detecting low-penetrating particles, such as soft X-rays and low-energy protons. To address this, n-type LGADs (nLGADs) have been developed by IMB-CNM. This study shall give an overview of the efforts to characterize nLGADs, focusing on their performance after 23 GeV proton irradiation at PS-IRRAD (CERN). Step-by-step irradiation with low fluences and high-fluence exposures were conducted to explore the impact on the device performance. Investigations cover the electrical characterization of the devices before and after irradiation. Further techniques like the 3D resolving Two Photon Absorption - Transient Current Technique (TPA-TCT) and red as well as UV TCT were used to study electric field distributions and the reduction of gain after irradiation. Compared to the well-studied acceptor removal effects in p-type LGADs, the obtained results show that it is more complex to investigate the irradiation induced degradation of the nLGAD gain layer, since the characteristics are strongly influenced by complicated field structures after type-inversion. Combined with the research on acceptor removal in standard pLGADs, this work can offer input not only for advancing the LGAD technology in general, but also the evelopment of future HEP detector concepts, such as the compensated LGAD.

Type of presentation (in-person/online)

in-person presentation

Type of presentation (I. scientific results or II. project proposal)

I. Presentation on scientific results

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