

INVESTIGATION OF ION-BEAM IRRADIATION EFFECTS ON THE ELECTRICAL PROPERTIES OF NOVEL N-TYPE LOW GAIN AVALANCHE DETECTORS

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Low Gain Avalanche Detectors (LGADs) are silicon sensors featuring internal signal amplification and are widely used in High-Energy Physics (HEP) experiments, particularly for precise timing measurements in environments with high particle fluences, such as those at Large Hadron Collider (LHC) at CERN. Conventional p -type LGADs have been optimized for the detection of highly penetrating particles but exhibit reduced gain performance for low penetrating radiation [1]. To address this limitation, n -type Low Gain Avalanche Detectors (nLGADs) have been developed to enhance sensitivity to low penetrating particles in silicon, such as soft X-rays, ultraviolet and visible photons, and low-energy charged particles [2]. Due to electron-initiated avalanche multiplication, nLGADs exhibit enhanced gain for surface-near energy deposition, making them particularly attractive for applications in medical physics, including ion beam cancer therapy, where accurate detection of low-energy charged particles is required [3]. However, the performance of nLGADs can be significantly affected by ionizing radiation through mechanisms such as donor removal, gain suppression, and modifications of the internal electric field [4].

In this work, we present an ongoing investigation of the effects of ion-beam irradiation on the electrical properties of novel n -type LGAD devices fabricated at the *Instituto de Microelectrónica de Barcelona (IMB-CNM)*. A systematic irradiation campaign is combined with pre- and post-irradiation electrical characterization, including current–voltage (I – V) and capacitance–voltage (C – V) measurements, to study changes in leakage current, depletion region behavior, and gain-related parameters. The Transient Current Technique (TCT) is used to further investigate irradiation-induced modifications in charge collection efficiency and gain degradation.

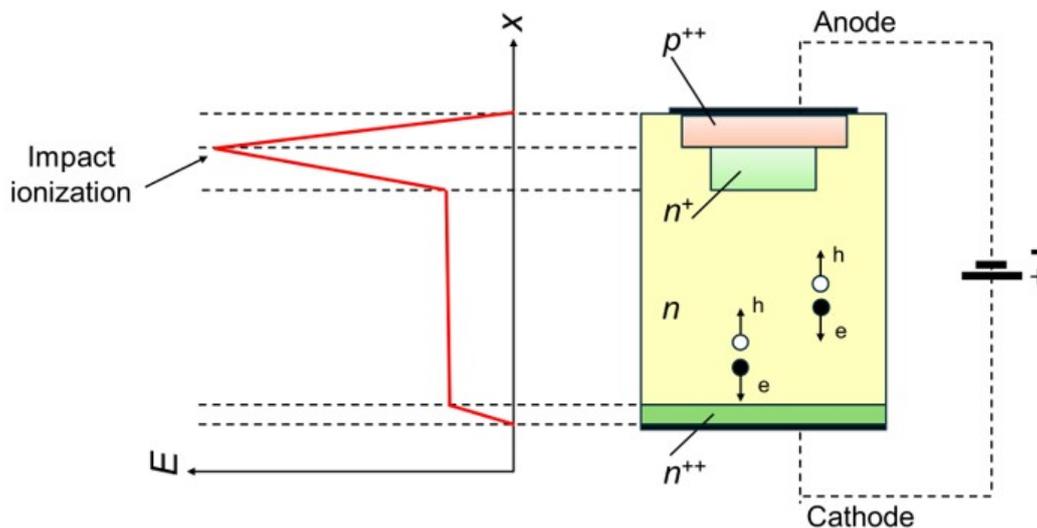


Fig. 1. A schematic representation of the nLGAD structure, implemented as $p^{++}n^+n$. A heavily doped gain layer generates a strong electric field (red solid line), enabling internal signal amplification for the detection of low-penetrating particles.

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