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Measurements of Low Gain Avalanche Detectors (LGAD) for High Energy Physics applications

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This work introduce a new concept of silicon radiation detector with intrinsic multiplication of the charge called Low Gain Avalanche Detectors (LGAD). These new detectors are based on the standard Avalanche Photo Diodes (APD) normally used for optical and X-ray detection applications. The main difference to standard APD detectors is the low gain requested to detect high energy charged particles and the possibility to have fine segmentation pitches in order to create microstrip or pixel devices which do not suffer from the limitations normally found in avalanche detectors.

The gain implemented in the non-irradiated devices must retain some effect also after irradiation, with a higher multiplication factor with respect to standard structures in order to be used in harsh envairoments such as expected in colliders experiments.

The investigation of these detectors provides important indications on the ability of this modified electrode geometry to control and optimise the charge multiplication effect, in order to fully recover the collection efficiency of heavily irradiated silicon detectors, at reasonable bias voltage compatible with the voltage feed limitation of the CERN HL-LHC experiments.

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