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Si-PIN radiation detectors with low leakage current, thin incident window and large active area for Nuclear Physics applications.

Silicon PIN-type radiation detectors with high resistive substrate were simulated, designed and fabricated for nuclear physics applications. The main design considerations of the Si PIN-type radiation detector were a low leakage current and thin incident window of the p+ and n+ layers. Two technologies have been used to fabricate thin and thick substrates (from 200 μm to 1mm).
The first technology incorporates one extracting ring and a floating guard ring around the active area of the detector in order to obtain leakage current density values of the order of 2 nA/cm2·100μm at full depletion and at room temperature for devices with an active area with hexagonal shape and large about 9 cm2 .
In the second technology three floating guard electrodes and an edge protection structure were incorporated to increase the breakdown voltage (>1000V) and to minimize the leakage current density to values lower than 2 nA/cm2·100μm for devices with active area of the order of 4 cm2.
Shallow p+ and n+ layers and thin metal/passivation layers were also incorporated to minimize particles/ions energy loss. The doping profile of the p+ and n+ layers were measured by means of SIMS technique and the detectors have been electrically characterized.
Experimental results will be presented and discussed.

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