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SMART Detector Project: recent results from the SMART experiment

A growing interest is recently focusing on Czochralski and Epitaxial Silicon as potentially radiation-hard materials.
We report on the processing and characterization of microstrip sensors and pad detectors produced on n- and p-type Magnetic Czochralski, Epitaxial and Float Zone silicon. The aim of this work is the development of radiation hard detectors for very high luminosity colliders. The activity is funded by INFN within the SMART project, in the framework of the RD50 Collaboration. The devices have been produced by ITC-IRST; each wafer hosts ten microstrip sensors with different geometries, several diodes and test structures.
The isolation in the strip detectors produced on p-type material has been achieved by means of a uniform p-spray implantation, with doping of $3x10^{12}$ cm^{-2} (low dose p-spray) and $5x10^{12}$ cm^{-2} (high dose p-spray).
The samples have undergone various irradiation campaigns, using 24 GeV/c protons (CERN-Geneva), 26 MeV protons (FZK-Karlsruhe) and reactor neutrons (JSI Ljubljana), up to ~10^{16} cm^{-2} 1 MeV neutrons eq. (n_{eq}/cm^2), and have been completely characterized before and after irradiation. Their radiation hardness as a function of the irradiation fluence has been established in terms of breakdown voltage, depletion voltage, leakage current, Charge Collection Efficiency and evaluating the more relevant mini-sensors parameters variation. Moreover, the time evolution of depletion voltage, leakage current and interstrip capacitance has been followed in order to study their annealing behavior and Space Charge Sign Inversion effects.