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On the frequency dependence of the admittance of radiation damaged pad diodes

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The admittance of n+p pad diodes (200 µm thickness, 5×5 mm^2 area) irradiated by 24 GeV/c protons to 1 MeV neutron equivalent fluences Φ_{eq} = 3, 6, 8 and 13×10^{15} cm^{-2} has been measured for reverse voltages Vrev between 1 and 1000 V and for frequencies f between 100 Hz and 2 MHz at temperatures T = −30 ℃ and −20 ℃. A simple model, which assumes that radiation damage causes a position-dependent resistivity ρ only, provides an excellent description of the data. For the position dependence a phenomenological parametri¬sation with 3 parameters for every Φ_{eq}, V_{rev} and T is used. In part of the pad diode a "low ρ"region is obtained, with a ρ value compatible with the intrinsic resistivity ρ_{intr}(T). In the remainder of the pad diode a value ρ ≫ρ_{intr} is found. The "low ρ"region is interpreted as the non-depleted region, and the "high ρ"region as the depleted region. It is con¬cluded that the f dependence of the admittance of irradiated silicon detectors can be described without assumptions about the response time of radiation-induced traps and that dependence of the admittance on f allows determining the depletion depth in irradiated silicon pad diodes

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