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Simulation study of the n+-n- Si sensors having p-spray/p-stop implant for the SiD detector

Silicon Detector (SiD) is one of the proposed detector for future e+-e- Linear colliders, like International Linear Collider (ILC). The estimated neutron background for ILC is around 1 - 1.6 x 10^10 1-MeV equivalent neutrons cm-2 year-1 for the Si micro strip sensors to be used in the innermost vertex detector. The p+n-n+ double-sided Si strip sensors are supposed to be used as position sensitive sensors for SiD. On the n+n- side of these sensors, shorting due to electron accumulation leads to uniform spreading of signal over all the n+ strips. Hence inter-strip isolation becomes one of the major technological challenges. One of the attractive methods to achieve the inter-strip isolation is the use of uniform p-type implant on the silicon surface (p-spray). Another alternative is the use of floating
p-type implants that surround the n-strips (p-stops). However, the high electric fields at the edge of the p-spray/p-stop have been shown to induce pre-breakdown micro-discharge. An optimization of the implant dose profile of the p-spray and p-stop is required to achieve good electrical isolation while ensuring satisfactory breakdown performance of the Si sensors. In the present work, we report the preliminary results of simulation study performed on the n+n- Si sensors, equipped with p-spray and p-stops, using SILVACO tools.

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