Contribution ID: **228** Type: **Poster**

TCAD investigation of Compensated LGAD Sensors for extreme fluence

Tuesday, 28 May 2024 15:45 (1 minute)

Future frontier accelerators envisage the use of silicon sensors in environments with fluences exceeding 1×10^{17} 1 MeV n_{eq}/cm^2. Presently available silicon sensors can operate efficiently up to fluences of 2×10^{16} 1 MeV n_{eq}/cm^2, while the gain mechanism of Low-Gain Avalanche Diode (LGAD) sensors under irradiation is maintained up to a fluence of about 5×10^{15} 1 MeV n_{eq}/cm^2.
To extend the operational range of silicon detectors by more than one order of magnitude, an innovative approach has been employed in designing the implant responsible for signal multiplication, engineering a well-calibrated compensation of p and n dopants.
The new design, called Compensated LGAD, is devised to be more resilient to radiation. Both acceptor and donor atoms will undergo removal with irradiation, but if adequately engineered, their difference will remain constant, ensuring the gain multiplication mechanism even at extreme fluences. Therefore, the Compensated LGADs will empower the 4D tracking ability to a fluence of 1×10^{17} 1 MeV n_{eq}/cm^2 and above.
The FBK foundry released the first production of Compensated LGAD sensors at the end of 2022. In this work, the simulation outcomes of non-irradiated and irradiated Compensated LGAD devices will be presented. State-of-the-art Synopsys Sentaurus TCAD tools have been adopted for the purpose at hand, accounting for the radiation damage effects by means of the "New University of Perugia"numerical model. The comparison between measured and simulated I-V and C-V characteristics obtained before and after neutron irradiation represents the strategy to assess the acceptor and donor removal coefficient of compensated sensors. The forthcoming stages of Compensated LGAD design evolution will also be envisaged.

Collaboration

Role of Submitter

I am the presenter

Primary authors: FONDACCI, Alessandro (IOM-CNR / INFN - Perugia); CROCI, Tommaso (Istituto Nazionale di Fisica Nucleare); PASSERI, Daniele (University and INFN Perugia); MOROZZI, Arianna (INFN - Perugia); WHITE, Robert Stephen (INFN - Torino); HANNA, Cecilia (Istituto Nazionale di Fisica Nucleare); SIVIERO, Federico (Istituto Nazionale di Fisica Nucleare); MENZIO, Luca (Istituto Nazionale di Fisica Nucleare); LANTERI, Leonardo (INFN - Torino); MULARGIA, Roberto (Istituto Nazionale di Fisica Nucleare); FERRERO, Marco (Istituto Nazionale di Fisica Nucleare); ARCIDIACONO, Roberta (Istituto Nazionale di Fisica Nucleare); CARTIGLIA, Nicolo' (Istituto Nazionale di Fisica Nucleare); SOLA, Valentina (Istituto Nazionale di Fisica Nucleare); MOSCATELLI, Francesco (Istituto Nazionale di Fisica Nucleare)

Presenter: FONDACCI, Alessandro (IOM-CNR / INFN - Perugia)

Session Classification: Solid State Detectors - Poster session

Track Classification: T3 - Solid State Detectors