

3D-trench silicon pixels irradiated with neutron fluences up to 10^{18} 1 MeV neq/cm²

Wednesday, 19 March 2025 09:20 (5 minutes)

Future new high luminosity colliders will require exceptionally radiation hard detectors, in particular those that will be closer to the interaction regions, i.e. tracking and vertexing detectors. The TimeSPOT R&D project has developed a new family of 3D silicon pixel sensors with 55 μm pitch that have shown an outstanding time resolution of about 10 ps thanks to their new "trench" design. In these detectors, specially designed vertical (3D) trench junctions within the pixel create a uniform electric field region 25 μm thick, independent of the sensor's thickness, allowing to collect charge carriers created by a crossing charged particle very rapidly. Such geometry minimizes charge carrier losses occurring in radiation damaged detectors and it has been demonstrated that these 3D detectors can still operate efficiently after neutron irradiations up to fluences of $1\text{E}+17$ 1MeVneq/cm². A new irradiation run at the TRIGA Mark II Reactor at the Jožef Stefan Institute has just been concluded, reaching extreme fluences of $1\text{E}+18$ 1MeVneq/cm². Irradiated 3D pixels have been tested at INFN Cagliari laboratories with red and infrared micrometrically focused laser beams allowing to perform a complete mapping of the charge collection efficiency on the pixel area. Such results will be presented at the workshop, showing that these 3D silicon pixels can still operate efficiently under extreme radiation damage conditions.

Primary author: VERDOGLIA, Michele (Istituto Nazionale di Fisica Nucleare)

Presenter: VERDOGLIA, Michele (Istituto Nazionale di Fisica Nucleare)

Session Classification: Solid State Detectors

Track Classification: Solid State Detectors