12th International "Hiroshima" Symposium on the Development and Application of Semiconductor Tracking Detectors (HSTD12) at Hiroshima, Japan

Contribution ID: **240** Type: **POSTER**

Measurements and simulations of surface and bulk radiation damage effects in silicon detectors for phase II CMS outer tracker

Saturday 14 December 2019 15:04 (1 minute)

Radiation damage effects at High Luminosity LHC (HL-LHC) expected fluences at the outer tracker layers greater than 1×10^{15} n/cm^2 1 MeV equivalent, as well as total ionising doses on the order of 70 Mrad, will impose very stringent constraints in terms of radiation resistance of solid-state detectors, from both silicon substrate and silicon oxide.
In this contribution we address the effects of bulk and surface damage on detectors fabricated on Hamamatsu standard FZ p-type material with an active thickness of 290 μm or thinned to 240 μm.
The planned irradiation and measurement campaigns focuses specifically on disentangling the effects of the two main radiation damage mechanisms, ionization effects and atomic displacement, highlighting any device weak points for improvements, aiming at more radiation resistant solutions.
To this purpose, the interface trap state density and the oxide charge can be extracted from standard test structures for each substrate before and after irradiation with X-rays with doses ranging from 0.05 to 70 Mrad(SiO2), aiming at the surface damage characterization.
Neutron irradiations in the range of $1-10\times10^{14}$ n/cm^2 1 MeV equivalent will be also performed. Measurements on the very same structures will be repeated after both irradiations, allowing the combined surface and bulk damage to be investigated.
TCAD simulation tools will be used to validate a previously developed radiation damage model.
These complementing simulation results could give further insight in the underlying
mechanisms. The model can be also used as a predictive tool to optimize the design and the operation of novel silicon detectors in the HL-LHC scenario.
In this contribution the obtained measurements will be shown and discussed in view of the underlying model of the simulation reproducing these results.

Submission declaration

Original and unpublished

Authors: MARIANI, Valentina (Universita e INFN, Perugia (IT)); Dr MOSCATELLI, Francesco (IOM-CNR and INFN Perugia); PASSERI, Daniele (University & INFN, Perugia (IT)); MOROZZI, Arianna (University and INFN, Perugia (IT)); DIERLAMM, Alexander (KIT - Karlsruhe Institute of Technology (DE)); MATTIAZZO, Serena (Universita e INFN, Padova (IT)); BERGAUER, Thomas (Austrian Academy of Sciences (AT)); DRAGICEVIC, Marko (HEPHY Vienna); HINGER, Viktoria (Austrian Academy of Sciences (AT)); BILEI, Gian Mario (Universita e INFN, Perugia (IT))

Presenter: MARIANI, Valentina (Universita e INFN, Perugia (IT))

Session Classification: POSTER

Track Classification: Radiation damage and radiation tolerant materials