Contribution ID: **337** Type: **ORAL**

3D Trenched-Electrode Pixel Sensors: design, technology and initial results

Monday 16 December 2019 10:00 (20 minutes)

As the luminosities produced by particle collider experiments increase in the next few years, increasing the pile up, the tracking detectors in these experiments will require improved spatial and timing resolution to distinguish between different tracks as well as having the required radiation hardness to survive for the duration of the experiment. 3D sensors have already been proven as a viable and inherently radiation hard technology. While encouraging timing results have been obtained from small-pitch 3D test structure, new approaches are also being being investigated to meet the challenges of the coming years.

One such approach, pursued in the framework of the INFN TIMESPOT project, is the development of 3D sensors with trench electrodes. The trench geometry will provide more uniform electric and weighting fields than in current devices, allowing for good timing resolution, while also maintaining or improving upon the usual advantages of a 3D geometry.

The fabrication of the first batch of devices, designed with input from TCAD simulations, consisting of TIMEPIX compatible pixel sensors, as well as a number of test devices to study the performance of different pixel geometries, was carried out at FBK (Trento, Italy) on 6-inch diameter, p-type, Si-Si Direct Wafer Bonded substrates having a 150-μm thick FZ active layer. Initial I-V measurements of the TIMEPIX-compatible sensors and other small pixel arrays was performed making use of a temporary metal layer. Results highlighted good intrinsic properties, with leakage current density of the order of a few pA per pixel and breakdown voltage in excess of the measurement limit of 50V. However, a non-negligible density of process defects was also observed, that makes the yield of the large area sensors quite low.

This presentation will report on the design and technological aspects, and report results from the electrical characterization of pixels and test structures.

Submission declaration

Original and unpublished

Primary author: FORCOLIN, Giulio Tiziano (Universita degli Studi di Trento è INFN (IT))

Co-authors: DALLA BETTA, Gian-Franco (INFN and University of Trento); MENDICINO, Roberto (Universita della Calabria (IT)); FICORELLA, Francesco (FBK Trento); RONCHIN, Sabina (FBK); BOSCARDIN, Maurizio (FBK Trento); LOI, Angelo (INFN - National Institute for Nuclear Physics); LAI, Adriano (Universita e INFN, Cagliari (IT))

Presenter: FORCOLIN, Giulio Tiziano (Universita degli Studi di Trento è INFN (IT))

Session Classification: Session5

Track Classification: Pixel sensors for tracking