11th International "Hiroshima" Symposium on the Development and Application of Semiconductor Tracking Detectors (HSTD11) in conjunction with 2nd Workshop on SOI Pixel Detectors (SOIPIX2017) at OIST, Okinawa, Japan

Contribution ID: **2** Type: **POSTER**

3D-Si single sided sensors for the innermost layer of the ATLAS pixel upgrade

Sunday 10 December 2017 20:11 (1 minute)

The LHC is expected to reach luminosities up to 3000 fb−1 and the innermost layer of the ATLAS upgrade plans to cope with higher occupancy and to decrease the pixel size. 3D-Si sensors are a good candidate for the innermost layer of the ATLAS pixel upgrade since they exhibit good performance under high fluences and the new designs will have smaller pixel size to fulfil the electronics expectations. Detectors located at large η angles, far from the interaction point, will receive the particles almost perpendicularly to the column. In order to have a more precise detection at those positions, thinner 3D detectors are proposed. In order to test different configurations, two possible types of wafers are proposed: a 150 µm p-type SOI wafer and 150 µm p-type SOI wafer with a p-type backside implant. The thickness of the active wafer can be reduced according to the requirement of the experiment.
In this poster, the Sentaurus TCAd simulation and the preliminary electrical results of 3D thin detectors fabricated at CNM will be presented. The simulations of new geometries with smaller pixel sizes show a good response without irradiation and their collected charge will decrease to less than half when they are irradiated with the expected fluences of 2 × 1016 neq /cm2. The 50 µm×50 µm geometry shows higher CCE than 100 µm×25 µm (1E) after irradiation, since the distance to the electrodes is smaller and therefore the drifting distances are shorter and the generated electron–hole pairs have less probability of trapping

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Session Classification: POSTER

Track Classification: Pixel sensors for tracking