Contribution ID: **768** Type: **Talk**

Radiation characterization of two large and fully depleted CMOS pixel matrices fabricated in 150 nm and 180 nm technologies

Thursday, 21 February 2019 16:55 (20 minutes)

Two different design concepts of the depleted monolithic CMOS active sensor (DMAPS) are realized in the large scale pixel matrixes, named LF-Monopix and TJ-Monopix. They are realized in so-called large and small electrode design in a pixel. In the large electrode DMAPS, a high bias voltage of 300 V is applied to the highly resistive wafer without damaging the readout electronics. Full depletion of the sensor was observed at 20 V and at 120 V for 100 μm or 200 μm thinned wafer, respectively. In contrast, the small fill factor DMAPS has analog front end circuit that achieves low noise (19 e-) and low power (110 mW/cm^2) thanks to its small detector capacitance. The sensing volume is modified 25 μm p-epi layer, and it is also fully depleted. Both of prototypes are fully monolithic DMAPS equipped with a fast readout in column drain architecture. To investigate the radiation hardness of both pixel matrixes, they are irradiated with neutrons and protons up to the fluence of $1\times10^15\mathrm{n}_{eq}/\mathrm{cm}^2$. Results of electrical and beam tests performed on un-irradiated and irradiated chips will be shown in this presentation.

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Session Classification: Semiconductor Detectors

Track Classification: Semiconductor Detectors