

Results of a Multi Project Wafer Process of Edgeless Silicon Pixel Detectors

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The edgeless or active edge silicon pixel detectors have been gaining a lot of interest recently due to improved silicon processing and interconnection technology capabilities. VTT has been one of the drivers of the edgeless process technology on 6" (150 mm) wafers. Last year we were able to gather 17 institutions and industrial companies to join for a multi project wafer process of edgeless silicon detectors. These participants come from different fields of applications, such as high energy physics, X-ray imaging, photon science and other medical and spatial applications. Their demands for the detector and design are very diverse and thus the process needed to be carefully designed. In total, 80 pieces of 150 mm wafers were processed to yield a given number of detector variations. The fabricated detector thicknesses were 100, 200, 300 and 500 nm. The polarities of the fabricated detectors on the given thicknesses were p-on-n, n-on-n, n-on-p and p-on-p. The wafer materials were high resistive Float Zone and Magnetic Czochralski silicon with crystal orientation.

The presentation gives an overview of the process and statistically summarizes the electrical characteristics of the edgeless diodes with varied polarities. The characteristics include leakage current, breakdown voltage and capacitance-voltage measurements. The first measurements have indicated reasonable leakage currents of 1-4 nA/cm² at full depletion voltage. Pixel detector characterization results from number of participants are presented with their permission. These include X-ray images, charge collection efficiency and operation of the edgeless detectors after heavy irradiation. Special focus is given on a new edgeless detectors designed for the Timepix and Medipix3 readout ASIC chips.

Primary authors: Dr KALLIOPUSKA, Juha (VTT); Dr WU, Xiaopeng (VTT)

Presenter: Dr KALLIOPUSKA, Juha (VTT)

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