Contribution ID: **49** Type: **not specified**

UKRI-MPW0: A proof-of-concept, backside biased only High Voltage CMOS pixel chip

Friday 2 December 2022 11:50 (20 minutes)

High Voltage CMOS (HV-CMOS) sensors are thin, radiation tolerant and cost-effective position sensitive detectors that have the potential to be the prime candidate for particle tracking applications in the next generation of high energy colliders. The high bias voltage typical of these sensors (˜60 V) allows for fast charge collection times, by drift, and good radiation tolerance; combined with integrated readout electronics, these sensors can be made monolithic and therefore thin avoiding expensive bump-bonding. However, further research and development is needed to reach the time resolution, pixel size, and radiation tolerance requirements put forth by the likes of the High Luminosity-LHC (HL-LHC) and Future Circular Collider (FCC).

UKRI-MPW0 is a proof-of-concept, backside biased only HV-CMOS pixel chip. It was designed with the goal of improving the radiation tolerance of this technology. The chip implements a dedicated sensor cross-section which omits any topside p-wells in direct contact with the substrate. A breakdown voltage of 600 V is achieved before irradiation. The chip is designed in the LFoundry 150 nm HV-CMOS process with a substrate resistivity of 1.9 kΩ·ohm cm and a total thickness of 280 µm.

In this contribution we will present the dedicated sensor cross-section of UKRI-MPW0 and give details of the backside processing methods used. We will also show the edge-TCT evaluation of the test structures, included on the edge of the chip, irradiated with neutrons up to $1{\cdot}10^{16}$ n_{eq}/cm^2 fluence. We will summarise steps currently planned to further develop this sensor technology.

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Session Classification: Monolithic Devices