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P2.23: SpacePix3 - response characterization and total ionising dose testing for space applications

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This work presents SpacePix3, an improved version of the SpacePix2 ASIC [1]. It is a novel MAPS sensor developed for soft advanced space dosimetry fabricated in a 180 nm PDSOI CMOS process. The sensitive area is a matrix of 64×64 pixels with a 60 μm pitch. The detection diode is integrated in a handle wafer, with the depletion depth of approximately 35 μm at -150 V bias. The signal is digitised by 32 column ADCs with 10 bit resolution. The effective dynamic range of the pixel front-end amplifier is 5 to 65 ke⁻, with the possibility of backside pulse digitization of signal 0.25 to 30 Me⁻. The first measurement results using nuclide sources and accelerator ion beams are presented.

This ASIC is suitable for the proposed Czech lunar mission, where it will be exposed to ionising radiation ranging from electrons and protons in the van Allen belts to the heavy ions in the galactic cosmic rays. Therefore, its survivability and response to the TID irradiation was tested according to the relevant standards such as ESCC Basic Specification No. 22900

up to a total dose of 5 kGy in semilogarithmic steps. Results of power consumption and detection response to 238Pu X-ray photons were evaluated before and after irradiation.

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