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The SpacePix-D Radiation Monitor Technology demonstrator

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We present a newly developed radiation detector based on ASIC manufactured in a 180nm SoI technology [1]. It serves as a capability demonstration device for the SpacePix ASIC suite, currently under development. The active part of the presented demonstrator SpacePix-D is a monolithic radiation detection ASIC X-Chip03 [2] with an active area of 3.8 ´ 3.8 mm² made of an array of 64 ´ 64 pixels, each with the pulse height measurement capability with a fast 10-bit ADC. The power consumption of the ASIC is 20 mW and it has O(100) Hz imaging capability.

The SpacePix ASICs are novel stand-alone monolithic semiconductor pixel detectors with a non-linear amplifier, allowing them to detect and measure energy deposition of a wide range of ionizing particles. The SoI technology ensures a high degree of SEU and TID tolerance, which makes them attractive for use in demanding environments such as orbital or interplanetary radiation field.

The current SpacePix-D demonstrator is equipped with accumulator, LCD for visualization of hits and cluster analysis as well as with temperature sensor, accelerometer and wireless data connection. With its total power consumption of 1.2 W, the device can be operated for up to 8 hours without the need of an external power supply, thus making it practical for simple measurements and it can be even used as a teaching aid.

One of its main features is easy operation and real-time imaging of ionizing radiation. For a more advanced usage, it can be connected via either USB or Bluetooth to the PC. The operating software, ASPIRE, enables visualization and acquisition of data which can be later processed.

The device has already been successfully tested with various sources of ionizing radiation –ranging from different table-top nuclide sources (55Fe, 241Am) to high energy protons.

[1] M. Havranek et al., MAPS sensor for radiation imaging designed in 180 nm SOI CMOS technology, proceeding from IWORID 2017, submitted to JINST

[2] M. Havranek et al., X-CHIP-03 –SOI MAPS sensor with hit counting and ADC mode, manuscript in preparation

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