



Contribution ID: 117

Type: **Poster**

P1.68: A low-noise read-out electronics for high energy resolution X-ray strip detectors

Monday, June 26, 2023 3:59PM (1 minute)

Semiconductor strip sensors are widely applied for X-ray imaging applications such as spectroscopy. X-ray imaging devices are required to provide good position resolution and spectroscopic features, which implies very tight noise level requirements too [1]–[3]. This work presents a design and simulations of the front-end electronics designed to work with 1D silicon strip sensors with a 75 μm pitch and 1 cm length, exhibiting around 1.5 pF capacitance. The detector is DC-coupled to a read-out ASIC built of 16 read-out channels. The detector read-out system is expected to operate with an X-ray energy range from 4 to 10 keV.

The charge processing chain comprises a CSA, a shaping amplifier with a selectable peaking time value, a discriminator, and some supporting circuits. It provides various modes of operation: a continuous read-out with a pole-zero canceling circuit and a mode with digitally-assisted pulsed reset of the charge-sensitive amplifier (CSA) as well as the active baseline restorer. The presented front-end is designed in the CMOS 180 nm process and occupies an area equal to 1525 x 1525 μm^2 . Each channel dissipates the power of around 6 mW and the total noise is below 20 e⁻ rms. In the fast operation mode with a digital reset, the front-end can process the incoming hits at a rate of 50 kps/ch. The analysis of the designed ASIC including reliability and PVT test results will be presented.

[1] P. O'Connor and G. De Geronimo, "Prospects for charge sensitive amplifiers in scaled CMOS," *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 480, no. 2–3, pp. 713–725, 2002, doi: 10.1016/S0168-9002(01)01212-8.

[2] M. Campbell et al., "Towards a new generation of pixel detector readout chips," *J. Instrum.*, vol. 11, no. 01, p. C01007, 2016, [Online]. Available: <http://stacks.iop.org/1748-0221/11/i=01/a=C01007>.

[3] P. Wiącek et al., "Position sensitive and energy dispersive x-ray detector based on silicon strip detector technology," *J. Instrum.*, vol. 10, no. 4, pp. P04002–P04002, 2015, doi: 10.1088/1748-0221/10/04/P04002.

The authors acknowledge funding from the National Science Centre (Research Project 2020/37/N/ST7/01546).

Primary author: ZUBRZYCKA, Weronika

Co-author: GRYBOS, Pawel

Presenter: ZUBRZYCKA, Weronika

Session Classification: Poster (incl. coffee)