Contribution ID: **186** Type: **Poster**

P1.48: A prototype Radiation Energy Measuring Integrated Circuit with an asynchronous current-pulse reset block providing analog-to-digital conversion in 28 nm CMOS

Monday, 26 June 2023 15:38 (1 minute)

In this work, we present a prototype Radiation Energy Measuring Integrated Circuit (REMIC). This chip has been fabricated in 28 nm CMOS node, works in single photon counting mode and consists of 100 pixels of size 50 µm × 50 µm (Fig. 1). Each pixel is equipped with a cascoded-inverter-based charge sensitive amplifier (CSA) with Krummenacher feedback [1], and three reset circuits: switch-based [2], click-clack [3] and current-pulse reset [4].

The working principle of the latter is to discharge the CSA feedback capacitor after a pulse by injecting small current pulses, each of which is counted by the pixel logic. Importantly, the number of pulses required do return the CSA output to baseline is proportional to the amplitude of the CSA output pulse and hence to the particle energy. The amount of the injected current can be regulated by a digital-to-analog converter (DAC), allowing a trade-off between speed of operation and resolution of energy measurement (Fig. 2).

Having 12-bit pixel counters responsible for current-pulses counting, REMIC enables fast and precise colorful imaging. Simulated static power consumption per pixel is 7 µW, whereas dynamic power consumption depends on current-pulse reset configuration and may be about 60 µW or less. The chip is currently under measurements, and in the contribution, we will present the most recent results, possibilities and conclusions.

[1] F. Krummenacher, Nucl. Instrum. Meth. A 305 (1991) 527
[2] H.-S. Kim et al., IEEE J. Solid-State Circuits 48 (2013) 541
[3] R. Kłeczek et al., ESSCIRC 2019—IEEE 45th Eur. Solid State Circuits Conf. (ESSCIRC), 85
[4] P. Kaczmarczyk and P. Kmon, 2023 JINST 18 C03010

The authors acknowledge funding from the Ministry of Education and Science of Poland for the research project under the 'Diamond Grant'program (0071/DIA/2018/47).

Primary authors: KACZMARCZYK, Piotr (AGH University of Science and Technology); KMON, Piotr (AGH University of Science and Technology)

Presenter: KMON, Piotr (AGH University of Science and Technology)

Session Classification: Poster (incl. coffee)