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P2.2: Imaging and spectrometric performance of SiC Timepix3 radiation camera

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Silicon carbide belongs to the wide band gap semiconductor materials, and it is very perspective in the detection of various types of radiation. Another advantage is the commercial availability of high-quality crystalline material required for the preparation of radiation detectors. The 4H-SiC has the band gap energy of 3.23 eV at room temperature, breakdown voltage of 3-5E6 V/cm, carriers saturation velocity of 2×E7 cm/s and excellent physical and chemical stability. A large band gap energy is advantageous for low leakage current and high radiation tolerance.
We developed first prototype of Timepix3 camera based on 4H-SiC sensor depicted in Fig. 1. [1]. First results show high quality X-ray imaging performance. The active volume of the SiC sensor consists of an 80 um thick epitaxial layer that is grown on a 350 um SiC substrate and depleted to 65 um under 200 V applied. The used bias is 200 V. The SiC Timepix3 radiation camera has great potential in tracking of heavy ions and neutrons as SiC radiation hard material. In this work we concentrated on spectrometric performance of SiC Timepix3 radiation camera using X-rays and gamma-photons. We compared the results with standardly used Silicon Timpex3 camera of 300 um thick sensor. We evaluated several X-ray fluorescence peaks generated by X-ray tube irradiation of different high purity materials and also various radioisotopes (241-Am, 133-Ba, 57-Co). Following we evaluated X-ray imaging performance where we used various types testing object. Also obtained images and data images we compared with Silicon camera to consider of SiC Timepix3 radiation camera quality and stability.

[1] Zaťko B., Šagátová A., Gál N., Novák A., Osvald J., Boháček P. Polansky Š., Jakůbek J., Kováčová E.: From a single silicon carbide detector to pixelated structure for radiation imaging camera. In Journal of Instrumentation, 2022, vol. 17, no. C12005.

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