Use of commercial CMOS-sensors in radiation detection and measurement

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Radiation detection has numerous practical applications across many academic and commercial fields, including medical imaging, radiation safety, and material sciences. However, even entry-level radiation detectors typically cost hundreds of euros. The wide range of applications and public interest make the development of an economical detector highly desirable.

Among the different approaches to radiation detection, one of the most studied in recent decades is the use of semiconductor-based solid-state detectors. This trend has been driven by continuous advancements in the semiconductor industry. Various detector types, such as Charge-Coupled Devices and Silicon Drift Detectors have been developed for this purpose. In particular, the widespread adoption of Complementary Metal-Oxide-Semiconductor (CMOS) imaging sensors in consumer electronics has made them an attractive candidate for radiation detection applications.

This study investigates the feasibility of using a low-cost, commercially available CMOS image sensor as a radiation dosimeter. For this task we selected the Raspberry Pi HQ Camera due to its out-of-the-box usability and extensive code libraries. The sensor was tested by placing different radioactive isotopes, namely Am-241, Ba-133 and Cs-137, directly on top of the sensor inside a dark box. The image data was captured using picamera2 Python library and processed with OpenCV. Our results successfully demonstrated the detection of gamma rays and beta (electron) particles emitted by these sources.

Additionally, we are investigating whether the sensor’s image-sensing capability can be used to determine not only the type and energy of the radiation but also its point of origin within the camera's field of view. This capability could be particularly useful in medical imaging applications.