Contribution ID: **48** Type: **Poster**

New high-Z organic scintillators for total-body SPECT and theranostic dosimetry

Tuesday 18 February 2025 16:10 (20 minutes)

SPECT (Single-Photon Emission Computed Tomography) is a nuclear imaging diagnostic exam that involves the administration of a radiopharmaceutical that specifically links to the tumor cells while emitting gamma rays, allowing for cancer detection. Typical SPECT detectors involve monolithic inorganic crystals combined with PMT matrices for the readout.

In this contribution we present a new total-body SPECT gamma detector that exploits organic scintillators enriched with high-Z impurities with concentrations up to 10%, to profit from an extremely fast scintillation signal, low cost and ease of manipulation while ensuring the photoelectric interaction probability needed for good diagnostic efficiency. The reSPECT detection system will consist of a 3D-printed tungsten collimator that also serves as a container for the scintillator segments organized in a grid geometry. A custom readout based on the CMOS technology and tuned for fast scintillation events, with an independent channel for each scintillator, will be designed to handle the high event rate, allowing for possible applications in advanced theragnostic. Multiple FPGA-based modules will pre-process the data in real-time. Additionally, the Silicon-based readout guarantees the compliance with MRI scans.

In this contribution we will show the expected performances of the reSPECT detection system, evaluated with Monte Carlo simulations, and the results of the experimental tests carried out with the scintillator prototypes.

Primary experiment

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Session Classification: Coffee & Posters A

Track Classification: Medical Applications