Contribution ID: **212** Type: **poster**

Development of a Compact Electronics System for a Drone-Mounted Gamma Radiation Detector Aiming at Aerial Mapping and Surveillance

This project presents a specialized gamma radiation detector electronics system optimized for aerial mapping, surveillance, and radiation safety applications. The drone-mounted design effectively addresses radiation safety requirements across challenging terrains and sensitive locations. We discuss the main features of the detector electronics, starting from powering the detector up to data output to the onboard computer (OBC). The detector integrates four high-resolution scintillation crystals read by photomultiplier tubes (PMTs) and surrounded by a plastic scintillator veto system employing silicon photomultipliers (SiPMs). The custom electronics architecture emphasizes compactness, miniaturization, and low power consumption. It features analog front-end processing, digitally-controlled high-voltage bias modules, high-speed digitization (50 MHz, 16-bit ADC), and advanced FPGA-based digital signal processing, including trapezoidal finite impulse response (FIR) filtering, precise peak detection, and robust coincidence/anticoincidence trigger logic. Processed data are stored in onboard histogram memories, providing detailed gamma-ray spectra with adjustable resolution and dynamic range, complemented by integrated temperature and pressure sensors for environmental corrections. An STM32 microcontroller interfaces these subsystems with a Raspberry Pi acting as the onboard computer, facilitating data acquisition, storage, analysis, and real-time control using a 4G/LTE cellular modem kit, which also provides GPS tagging capabilities.

Keywords: Gamma-ray detection, Radiation mapping, Drone-mounted detector, FPGA signal processing.

Workshop topics

Front-end electronics and readout

Author: DOS SANTOS, Joaquim Marques Ferreira (University of Coimbra)

Co-authors: ARNEODO, Francesco (New York University Abu Dhabi); FRANCHI (AGE Scientific srl, Capezzano Pianore, Lucca, Italy); FAWWAZ, Osama; PERILLO (AGE Scientific srl, Capezzano Pianore, Lucca, Italy)

Presenter: DOS SANTOS, Joaquim Marques Ferreira (University of Coimbra)