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Novel Mobile Radioxenon Detector for On-Site Gas Sample Counting

Many Radioxenon detector systems used in the International Monitoring System (IMS) and in other applications employ beta/gamma coincidence detection to achieve high sensitivity. While very sensitive to small amounts of radioxenon, the existing systems require careful calibration and gain matching of several detectors and photomultiplier tubes and their organic scintillators show a memory effect from previous measurements. We present in this paper a novel detector designed for field measurements such as those performed during On-Site Inspections (OSI). The design is based on a simple phoswich geometry, where beta/gamma coincidences are detected by digital pulse shape analysis. Size, weight, and complexity have been reduced and the memory effect has been mitigated while still achieving the minimum detectable concentration required by IMS stations. Since a single photodetector is used to read the combined beta and gamma detector signal, this configuration also simplifies the calibration processes. Built-in gain stabilization addresses varying environmental field conditions such as temperature changes. This in turn reduces the instrument setup time and maximizes the identification of short lived radioxenon isotope. The detector design is studied by both GEANT4 and MCNPX modeling, and preliminary measurement results are reported. Sponsored by the National Nuclear Security Administration, Award No. DE-NA0001522.

Primary author: FALLU, Anthony (Mirion Technologies (MGPI) SA)

Presenter: FALLU, Anthony (Mirion Technologies (MGPI) SA)

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