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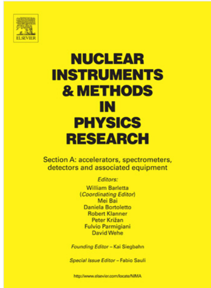

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Ciara Sivels, Shaun Clarke, Enrico Padovani, Amanda Prinke, Justin McIntyre, S.A. Pozzi

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Validation of MCNPX-PoliMi code for simulations of radioxenon beta-gamma coincidence detection

Ciara Sivels[1], Shaun Clarke[1], Enrico Padovani[2], Amanda Prinke[3], Justin McIntyre[3], S. A. Pozzi[1]

[1]University of Michigan, Department of Nuclear Engineering and Radiological Sciences, Ann Arbor, MI, USA, [2]Politecnico di Milano, Department of Energy, Milan, Italy, [3]Pacific Northwest National Laboratory, Richland, WA, USA

Abstract

Radioxenon detection is an important component of the verification regime for the Comprehensive Nuclear-Test-Ban Treaty. We developed and validated a new model in MCNPX-PoliMi to simulate the decay of various radioxenon isotopes and the detector response of a variety of detector types. The model was validated using calibration data from a plastic and NaI(Tl) beta-gamma coincidence detector and the results are presented. The results of this validation show that this model can also be used as a tool to produce training spectra and as a method to calibrate radioxenon detection systems.

Keywords

MCNPX-PoliMi, beta-gamma, radioxenon, coincidence simulation

1 Introduction

The Comprehensive Nuclear-Test-Ban Treaty Organization established the International Monitoring System (IMS) which consists of four technologies: infrasound, hydroacoustic, radionuclide and seismic monitoring. Radioxenon monitoring is a major component of the verification regime due to its ability to characterize an event as containing fissile material. Over the years, many detectors have been developed and tested to improve radioxenon detection capabilities [1]. A common technique for measuring radioxenon is beta-gamma coincidence detection. The detectors currently deployed in the IMS typically use a plastic scintillating cell as the beta detector and sample container, and a well-type NaI(Tl) detector as the gamma detector [2-4]. These systems have proven to be capable of measuring radioxenon from a variety of sources [5-8]. However, these systems also have limitations requiring the development of alternative detection methods. The use of coincidence detection requires advanced calibration techniques typically involving the measurement of each of the radioxenon isotopes of interest. From this calibration, the resolution of the detectors are measured and regions of interest (ROIs) are established. The ROIs are used to quantify detection efficiencies, interference ratios, and convert the beta-gamma spectra into radioxenon activities.