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Calibration Procedure of Beta-Gamma Coincidence Measurements in the International Monitoring System Network Using four Radioxenon Spikes

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Activity ratios of CTBT-relevant isotopes can be used to discriminate nuclear explosion sources from releases of nuclear facilities and to determine the detonation time under assumed scenarios. The net signals of radioxenon isotopes and their associated uncertainties are estimated by the net count calculation (NCC) method. An alternative approach is the regression analysis such as the least squares fitting, enabling the deconvolution of X ray contributions from radioxenon isotopes and radon, especially for complicated spectra and low count level. The determination of the concentrations of these isotopes relies on a robust calibration method. This paper outlines a combined calibration procedure based on four radioxenon spikes. The output of the beta-gamma detector system can be read out as three measurement channels: beta-gamma coincidences, beta singles and gamma singles. All three channels detect the same number of radioactive decays in 4π measurement geometry. The detection efficiencies are determined by comparison among the numbers of counts from three measurement channels, without the need for a reference value of radioxenon activity. In this work, the activity values of radioxenon standard sources are estimated based on the NCC method first, then used for calibration of the regression analysis method.

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Promotional text

The determination of the xenon concentrations in noble gas samples relies on a robust calibration method. A new method for determining calibration values needed for regression analysis is introduced.

Oral preference format

in-person

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