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on the algorithm of characterization limits of the net count calculation method for low counts of IMS beta-gamma coincidence noble gas samples

The beta/gamma coincidence spectra are analyzed at the International Data Centre (IDC) using the so called net count calculation (NCC) method based on a number of Region of Interest (ROI) and interference ratios between isotopes and ROIs. The gross counts in each ROI follows Poisson distribution. Therefore, the true value and variance of the gross counts are estimated as the gross counts of a single measurement. That works fine for the samples with high counts. However, it could be a problem when the samples are on the detector background level. The critical level could be under-estimated in case there is a negative value of the net counts, therefore probably resulting in false positive. The net counts with a negative value are replaced as 0 based on the prior knowledge that the true value of the amount of radioactivity is non-negative. For the samples on the detector background level, characterization limits of the net count are estimated based on the detector background measurement instead of the single measurement itself. This paper presents results of the new algorithm compared with the current NCC method for noble gas samples from IMS beta-gamma coincidence systems and Monte-Carlo simulated samples on the detector background level.

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