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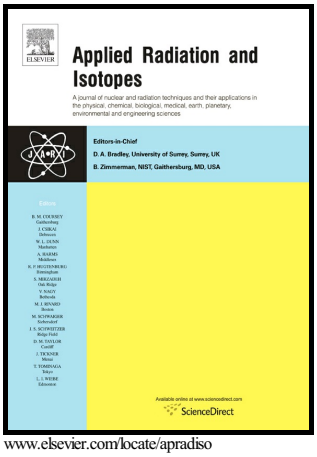

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An Improved OSEM Iterative Reconstruction Algorithm for Transmission Tomographic Gamma Scanning☆

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Abstract

As one of the most advanced non-destructive analytical techniques for nuclear wastes, tomographic Gamma Scanning (TGS) is able to give accurate quantitative and qualitative measurements of nuclear waste barrels. OSEM (Ordered Subsets Expectation Maximization) has been used in transmission TGS image reconstruction on account of its good reconstruction quality and ideal convergence rate. In this paper, an improved method—NMO-OSEM (Non-minimization optimization OSEM) was proposed, it's an iterative algorithm with corrected initial values optimized by non-minimization optimization method. To evaluate its performance, a TGS system is used to perform transmission measurements on barreled nuclear wastes. The results show: ①Compared with the reconstructed images by traditional OSEM under 6 transmission energies (122keV、344keV、779keV、964 keV、1112 keV、1408 keV), the improved NMO-OSEM has a great advantage in reducing the artifacts and effectively improving the quality of the reconstructed images. ②the attenuation coefficients values of 72 voxels under 3 emission energies (662keV、1173keV and 1332keV) reconstructed by the proposed algorithm are more accurate (range of error: 0.22%～13.83%) than reconstructed by traditional OSEM (range of error: 1.31%～32.21%), which proves this method has more stable reconstruction precision and could be regarded as an ideal option for real applications.

Keywords: OSEM, TGS, image reconstruction, non-minimization optimization, transmission measurement, attenuation coefficient

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