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Determination of precision nuclear decay data for the decay of 153Gd

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In the case of emerging radiopharmaceuticals, the accuracy and precision of the decay data of the radionuclide is crucially important. These data, particularly particle emission probabilities and the half-life, are necessary for the correct quantification of PET images and for dosimetry considerations of practitioners and patient alike.
Often precise nuclear data is determined through a multi-technique measurement campaign in which an absolute standardisation is achieved and decay parameters such as the absolute intensities of gamma-ray emissions and half-life of the nuclide are then measured.
The techniques employed at the National Physical Laboratory to achieve these relevant measurements are described in the context of an improved decay data measurement of ^{153}Gd, with reference to other relevant work. This isotope of gadolinium is used in medicine as a line source for SPECT imaging [2] and has been proposed as a possible in-vitro interstitial rotating shield brachytherapy (I-RSBT) source [3]. In the work presented, the intensities of six gamma-ray emissions in the ^{153}Eu daughter nucleus were measured by HPGe gamma-ray spectroscopy with improved precision than in previous studies. Furthermore, an absolute stardardisation of the source was performed using 4π(LS)-γ digital coincidence counting from which an absolute intensity was derived for the most intense gamma-ray emission, the 97.4 keV de-excitation, of 30.15 (20) per 100 decays [4]. This value is different to the current recommended value by 4 % [5].

[1] Holland et al. Molecular Imaging 2010; 9(1).
[2] Rodriguez et al. J. Nucl. Med. 2016; 57(2):2833
[3] Adams et al. Med. Phys. 2014; 41(5):051703.
[4] Shearman et al. EPJ Web. Conf. 2017; 146:10008
[5] Be et al. Monographie BIPM-5, 2004; 2.

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