

## Decay Spectroscopy of Medical Imaging Isotope Terbium-152

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Terbium-152, decaying by electron capture and  $\beta^+$  emission to  $^{152}\text{Gd}$  with  $Q_{\text{EC}} = 3990(40)$  keV and  $T_{1/2} = 17.8784(95)$  h, shows promise in nuclear medicine. First-in-human trials have demonstrated its suitability for positron emission tomography (PET) imaging, with potential applications in personalised cancer treatments through its membership of the terbium theragnostic quartet. Routine use of this radionuclide requires improved nuclear data for patient dosimetry, involving precision measurements of gamma-ray emission probabilities and the calculation of beta feeding strengths. Results of a decay spectroscopy study of  $^{152}\text{Tb}$  are presented, using sources prepared using spallation of a 1.4 GeV proton beam on a tantalum target, and mass-separated using the ISOL method at CERN-ISOLDE. Gamma-ray coincidences were measured using the Fission Product Prompt  $\gamma$ -ray Spectrometer (FIPPS) at the Institut Laue-Langevin, Grenoble, supported by measurements taken using the PN1 Si(Li)-HPGe conversion electron spectroscopy setup using sources created in the same ISOLDE production run. Over 100 previously unreported excited states in  $^{152}\text{Gd}$  up to excitation energies of 3.7 MeV are presented, placed in a level scheme of over 1000 gamma-ray transitions. Angular correlation and electron-gamma coincidence analysis provide multipolarity and mixing ratio assignments to transitions, allowing the inference of level spins and parities. The updated level scheme results in revised gamma-ray and  $\beta^+$  intensities, showing a reduced dose to patients compared to the previous expected values.