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Recent results on the beta decay of 152Tb and its relevance in theranostics

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The use of radionuclides for cancer diagnostics and therapy is extensively recognized and employed across various techniques. The effectiveness of these techniques, along with the minimisation of the doses to healthy tissue in both, therapy and diagnostics, hinges on several factors, one of which is the decay properties of the specific radionuclide used. Specifically, the types of particles, radiation emitted, energies, and their emission probabilities, play a crucial role in accurately calculating the dose administered to patients when using radioisotopes.

High quality/accuracy nuclear decay data is essential for the aforementioned calculations of dose administered to patients. In this case in particular, beta plus-decay data, as positron emission is the preferred decay process when we come to medical imaging (PET). However, one of the main physical quantities relevant to this process is the beta-intensity distribution, which is not easy to measure in medium-mass or heavy nuclei.

A recent report by the IAEA explicitly mentioned the need for measurement of specific isotopes for their relevance in theranostics using Total Absorption Spectroscopy (TAS). Among them, 152Tb, proposed as a theranostic partner of 161Tb and 149Tb, is recommended for a TAS measurement.

In this presentation, we report on the TAS measurement of the beta decay of 152Tb recently carried out at ISOLDE (CERN). The results show clear discrepancies between the measured TAS spectrum and the Geant4 simulation using the ENSDF database. We observed discrepancies in the region from 1.8 MeV to the Q_EC value.

We will present results on the newly measured beta-intensity distribution for this decay, as well as its relevance in the dose administered to different regions of a potential patient undergoing a PET scan with 152Tb.

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