Experimental investigation of the conversion electrons from medical radioisotope ^{125}I

B. Tee,[1] T. Kibédi,[1] M. Alotiby,[2] M. Vos,[2] and I. Gregoric[3]

[1]*Department of Nuclear Physics, The Australian National University, ACT 2601, Australia*

[2]*Electronics Materials Engineering, The Australian National University, ACT 2601, Australia*

[3]*Australian Nuclear Science and Technology Organisation, Lucas Heights, NSW, Australia*

^{125}I has potential to be used in a highly-targeted cancer therapy due to its specific decay characteristics, including the high number (up to 21) mainly low energy Auger electrons emitted following a single nuclear decay. These low energy electrons have a high linear energy transfer (LET) to the biological medium, and thus are suitable tools for such cancer treatment. However, in order to use the emitted Auger electrons for cancer tratment, the precise knowledge of the full energy spectrum of ^{125}I medical isotope is required. This knowledge is crucial to evaluate the radiation dose accurately.

^{125}I decays via electron capture to the 35.5 keV excited state in ^{125}Te. Due to its low energy, 93% of the time this excited state will decay via internal conversion to the ground state of ^{125}Te. In an internal conversion process, a core-hole electron is emitted from the radioactive atom, this electron is known as a conversion electron. Both the electron capture and the internal conversion will create atomic vacancies. The absolute number and distribution of these vacancies will control the Auger electron radiations. The 35.5 keV transition is known to be a mixed M1+E2 (magnetic dipole plus electric quadrupole) transition. Previous studies also indicated, that the M1 decay could also be affected by the so-called nuclear penetration effect.

Here we report on a new high resolution conversion electron measurement aiming to determine the degree of multipole mixing $\delta(E2/M1)$, as well as the penetration parameter λ, with precision. The measurements have been carried out using the ANU Electron Momentum Spectrometer (EMS) [1], operated at 5 eV energy resolution, which is more than an order of magnitude better, than any previous measurement of this decay. The monolayer ^{125}I source was prepared at ANSTO on a gold substrate, following the procedures described by Pronschinske et al. [2].

In this talk we will report on the new measurements and examine their impact on the Auger electron yield from the ^{125}I electron capture decay.

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[1] M.R. Went, M. Vos, J. Elect. Spec. and Rel. Phenom. **148** (2005) 107

[2] A. Pronschinske, et al., Nature Mater **14** (2015) 904