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Effect of Birks Constant and Defocusing Parameter on Triple-to-Double Coincidence Ratio Parameter in Monte Carlo Simulation-GEANT4

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Abstract : This project concerns with the detection efficiency of the portable triple-to-double coincidence ratio (TDCR) at the National Institute of Metrology of Ionizing Radiation (INMRI-ENEA) which allows direct activity measurement and radionuclide standardization for pure-beta emitter or pure electron capture radionuclides. The dependency of the simulated detection efficiency of the TDCR, by using Monte Carlo simulation Geant4 code, on the Birks factor (kB) and defocusing parameter has been examined especially for low energy beta-emitter radionuclides such as 3H and 14C, for which this dependency is relevant. The results achieved in this analysis can be used for selecting the best kB factor and the defocusing parameter for computing theoretical TDCR parameter value. The theoretical results were compared with the available ones, measured by the ENEA TDCR portable detector, for some pure-beta emitter radionuclides. This analysis allowed to improve the knowledge of the characteristics of the ENEA TDCR detector that can be used as a traveling instrument for in-situ measurements with particular benefits in many applications in the field of nuclear medicine and in the nuclear energy industry.

Keywords : Birks constant, defocusing parameter, GEANT4 code, TDCR parameter
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