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#05-114 Monte-Carlo determination of correction factors for the absolute measurement of the activity of solid-state dosimeters using γ- and X-ray spectrometry

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The MADERE platform (Measurement Applied to DosimEtry for REactors) is a metrology facility whose main purpose is to determine the specific activity of solid-state dosimeters irradiated in nuclear reactors, using γ- and X-ray spectrometry. The platform is accredited by the French accreditation Committee (COFRAC) for specific activity measurement of γ- and X-ray emitters.
Analysis methods used at MADERE platform for deriving absolute activities of a dosimeter from the spectrometry measurements induce to take into account several perturbing inherent phenomena of γ and X-ray spectrometry experiments such as self-attenuation inside the dosimeter or escape peak inside the detector. Thus, in order to perform a reliable and accurate analysis, the usual method to determine these correction factors is to use semi-empirical formula and dedicated software. Associated uncertainties are calculated using a Bayesian approach and can reach up to 10 % of the correction value.

In the framework of the continuous improvement of the MADERE platform, an integral Monte-Carlo simulation approach has been initiated to model all the interactions occurring in the whole measurement system (sample, holder device and semiconductor detector).

In order to improve the accuracy on the correction factor determination, a simulation scheme using the combination of the Monte-Carlo codes TRIPOLI-4® (CEA) and GEANT4 (CERN) is developed. In this work the different method developed to determine the correction factors due to the photon interaction inside the detector and inside the dosimeters are presented. Monte-Carlo correction factors are determined for different dosimeters configurations (matrix, geometry) and measurements setup (detector type, dosimeter-detector distance). To validate the results provided by the Monte-Carlo methods, simulations have been compared with the factors routinely applied at the MADERE facility. Then a qualification process of these simulated correction factors will be set up based on the comparison with results of dedicated experiments.

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