

Determining the absolute fraction of emitted Ps by GEANT4 supported analysis of gamma spectra

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Experiments using positronium (Ps) often perform a spectrometer calibration with a germanium single crystal at high temperature in order to obtain a 100% Ps formation reference spectrum. However, the actual determination of the absolute Ps fraction remains demanding due to systematic influences.

Using GEANT4-simulated detector responses to 2γ and 3γ radiation sources inside the (coincidence) Doppler-broadening spectrometer at NEPOMUC, FRM II, we derived a reliable value for the Ps fraction reemitted from a Ge(100) target heated close to its melting point at low positron implantation energies.

By fitting the simulated spectra to the measured spectra we find an absolute value of $72 \pm 4\%$ maximum Ps formation, contradicting the 100% assumption.