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TU Graz

Bachelor Thesis

Institute for Theoretical Physics

Computational Physics

Portal Monitor optimization by applied deconvolution of gamma ray spectra

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Abstract

At the Seibersdorf Laboratories different kinds of radiation detectors are developed and constantly optimized. One of those detectors is the so called YANTAR 2L, a Radiation Portal Monitor placed mainly at junkyards and metal recycling plants all over Europe, consisting of a PVT-scintillation counter and lead shielding. To remain competitive against other companies a better signal to background ratio for the detection system has to be achieved. Since the development of new products is always very expensive the best setup should be found previously using Monte Carlo simulations.

In this work it is shown that different kinds of collimators and more lead shielding at specific locations around the scintillator could theoretically improve the signal to background ratio of YANTAR 2L. This is done by simulating the geometry of the measuring system as also the background radiation and a point source using MCNP 5, a Monte Carlo transport code developed by LANL.

Another aspect of this work is the deconvolution of measured gamma ray spectra to obtain the "real" (theoretical) spectra containing only the photopeaks emitted by the source. Here, the Gold algorithm is used in the unfolding procedure. It is applied to a measured spectrum of the background radiation at the testing site of the YANTAR 2L. The so obtained data is used to improve the simulation and by this reliable results could be achieved. Consequently a theoretically and numerically optimized setup for the detection system and also a reliable unfolding procedure for gamma ray spectra is found.