Efficiency Stability in HPGe Detectors

Pedro Henrique de Almeida Mascarenhas, Frederico Antonio Genezini,Guilherme Soares Zahn
Instituto de Pesquisas Energéticas e Nucleares - IPEN-CNEN/SP

HPGe detectors are one of the most widely used tools in nuclear physics research, and several applications of gamma-ray spectroscopy rely on the stability of the efficiency of the detectors over the duration of the experiment. This is true for absolute measurements, where an efficiency calibration is usually performed either in the beginning or in the end of an experiment, and also in comparative measurements, when a given sample's activity is compared to that of a well-known standard, measured either before or after it. In all these cases, the detection efficiency for a given energy is assumed to be absolutely constant over time.
In this work the reprodutibility of the efficiency of two different HPGe detectors, one plugged to a regular analogic amplifier and the other to a digital signal processing (DSP) device, were inspected by performing a long series of sequential measurements with different standard calibration sources of diverse activities, and comparing the standard deviation of the number of counts per second in each series to the uncertanty of the individual measurements. The results allow a discussion on the stability of the detector's efficiency over a few days, its possible dependence with the count rate, and the estimation of the uncertainty related to the efficiency variation.