Detector Paralysis Factor and Dead-time Measurements

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Characterization of detector dead-time for high intensity environment (e.g., spent fuel monitoring) has been a topic of interest for years. Modeling attempts have been made but none seems to describe the phenomenon accurately. The idealized one parameter models do not describe the detector behavior completely. A two parameter model would be more suitable to describe the count loss in high intensity environment. A new experimental technique is developed to determine the required parameters for two parameter model making use of the rise and fall of the counts obtained from a fast decaying source.
Short lived isotopes were produced by irradiation at Missouri S&T Reactor. High Purity Germanium (HPGe) detector was tested in this study. Initially, due to very high source intensity, the detector becomes completely dead and as the source decays the count rate begins to increase. A normalized plot of this rise and fall of the observed count rate is used in conjunction with a graphical solution to obtain the required parameters; namely Paralysis factor and Detector deadtime.
This technique does not require any idealized assumption about the paralysis nature of the detector. s. These results are consistent with the belief that HPGe detectors are more paralyzing in nature as compared to Geiger Mueller (GM) detectors.µHPGe detector was tested using Mn-56 and V-52 isotopes. Based on the data collected, HPGe was found to have a paralysis factor in the rage of 50-77% and the dead-time was approximately 10.