A Pulse Shape Analysis Algorithm for HPGe detectors

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In recent years the possibility of accelerating radioactive nuclei has allowed the investigation of nuclear structure properties far away from the stability valley. As a counter part, high resolution γ-spectroscopy measurements with radioactive beams at relativistic energies are extremely difficult, especially due to the low beam intensity, the high background radiation and the large Doppler effect. This require the development of high-purity Ge detectors able not only to cover the largest fraction of solid angle around the target but also allowing the reconstruction of the trajectory of each γ-ray interacting into the array. The AGATA project is a European collaboration aiming at the development of a 4π array of high purity segmented Ge detectors of the newest generation, which will allow us to perform a tracking of the interacting γ-rays, with a precision in the interaction position of the order of few mm. Since such a precision is far beyond the level that can be reached segmenting the detector electrode, this position information has to be obtained through an analysis of the shape of the electronic impulse from the Ge detector (Pulse Shape Analysis). A simple PSA method that allows the identification of the number of interactions inside a detector segment and their radial localization will be presented. The algorithm is based on the assumption that is possible to find regions in the detector current pulse in witch its shape is with good approximation, determined by the characteristics of only one interaction (x,y,z,E) also in the case of a multiple interaction event. This procedure allows the computing time which is required to analyze one event to scale linearly with the number of interactions that have to be disentangled, and not exponentially like it does in brute force PSA approach; the algorithm doesn't need to process the induced signals of the neighbouring segments. The algorithm has been tested on a set of simulated events, the signals are calculated taking into account electrical noise and the preamplifier response. The efficiency of the algorithm for the correct identification of the number of interaction points and their radial position ranges between 65% to 95% depending on the complexity of the analyzed event.