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Characterization of B003 AGATA detector in the SALSA setup

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AGATA (Advanced GAmma Tracking Array) is an European collaboration devoted to developing a next-generation γ-ray spectrometer for nuclear structure research at facilities employing both radioactive and stable ion beams. Once completed, AGATA will consist of 180 high-purity germanium (HPGe) detectors, arranged in triple cluster structures (ATCs), providing an overall solid-angle coverage of approximately 82% of 4π. A distinctive feature of AGATA detectors is their electrical segmentation design: each detector comprises 36 isolated segments plus a central contact (core). This segmentation enables γ-ray tracking, i.e., the reconstruction of the γ-ray interaction sequence within the crystal. Tracking significantly reduces background without the need for antiCompton shielding and improves Doppler correction, enhancing, as a result, both system efficiency and energy resolution. The interaction positions and the energies deposited by the photons within the crystal must be determined through pulse shape analysis (PSA) before tracking can be performed. Currently, PSA involves comparing the detector's experimental pulse shapes with simulated responses. Within the collaboration, four research groups are dedicated to the experimental characterization of AGATA detectors, including the LRI-D laboratory at the University of Salamanca (USAL). At USAL, the characterization system under development is based on the SALSA method (SAlamanca Lyso-Based Scanning Array), which enables 3D scanning of AGATA detectors. This R&D technique employs a position-sensitive γ-camera with 256 pixels and an actively collimated γ-ray beam. After performing scans in two different measurement configurations and comparing the resulting electrical pulse shapes (PSC), an experimental database is generated which correlates interaction positions within the crystal to the corresponding electrical responses of the AGATA detector. Nowadays, the University of Salamanca is characterizing the AGATA detector B003. The experimental setup and the measurements performed from two different configurations have been completed, and ongoing efforts focus on developing data-processing algorithms and software. Completed stages include matching between AGATA and the γ-camera events, core pulse-shape comparisons, and filtering and signal treatment of the triggered and neighbouring segments, according to various criteria. Upcoming stages involve analysing transient signals induced in neighbouring segments and reconstructing the γ-ray trajectories to accurately determine the interaction positions within the detector.

Abstract

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