Application of a Simple PSA Algorithm for HPGe Segmented Detectors to in-Beam Data

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γ-ray Tracking Detectors

- Large volume (240 cm³), Highly segmented HPGe detectors
- Digital electronics to record and process signals from segment
- Pulse Shape Analysis (PSA) to decompose recorded signals
- Reconstruction of tracks evaluating permutations of Interaction Points (IPs)

PSA with Recursive Subtraction (RS) Algorithm

ISSUE: determination of the Number Of Interactions in a segment and their radial coordinate, processing the net-charge signal

1. It exploits the fact that in small window around the Current Pulse maximum the shape of the signal is mainly determined by the characteristics (x,y,z,E) of the most energetic interaction

2. The signal of the set that fits best is subtracted from the detector signal

3. Step 1 and 2 are iterated until an energetic weight of 100% is reached

Maximum Position and The Gamma Interaction Position

- Signals are calculated using MGS code.
- (P. Medina, et al., A simple method for the characterization of HPGe detectors, IMTC, Como, Italy, 2004)

A Direct Relation Exists Between The Current Pulse Maximum Position and The Gamma Interaction Position

Execution Time Performances

RS algorithm execution time scales linearly with the number of interactions to distinguish (not exponentially like in brute force algorithms)

Execution time can be tuned by changing NIT parameter (number of iterations) to represent the first decomposed interaction

In-beam experiments

Comparing the radial distribution of the experimental signals with that resulting from GEANT simulations

- Same effect found with a different PSA method
- Most probably due to miss correspondence between calculated and real detector position response

Excellent agreement between the experimental and calculated Distributions!

Comparing the number of interactions per segment distribution of the experimental signals with that resulting from GEANT simulations

Excellent agreement between the experimental and calculated Distributions!