

1) Title and spokesperson

Measurement of 15 MeV g-rays with the AGATA cluster detectors

Spokesperson: Fabio Crespi

2) Main objectives

The performance of AGATA detectors in the range up to 10-20 MeV has never been studied in detail. With this purpose in mind we performed a measurement of the response to 15.1 MeV gamma rays using two HPGe triple clusters of the AGATA Demonstrator array, operating at LNL. This study represents a crucial test of the AGATA detectors for the measurement of high-energy gamma rays, in terms of detection efficiency, linearity, energy resolution, tracking and performance of the pulse shape analysis (PSA) algorithms.

3) Short statement on the run itself and how AGATA operated.

The experiment was performed 1st-3rd December 2010, using 2 AGATA triple clusters (i.e. the only available in that period). We had 3 days of Tandem beam time (11B at 45 MeV) and 1 day for performing Am-Be-Fe calibration measurement. There were no significant problems during the experiment related to the AGATA detectors. The beam was very stable and the current was 1pA.

4) Status of the analysis.

Data Analysis is in its final status, actually we are preparing a NIMA paper that describes the obtained results.

5) Any results

A measurement of 15.1 MeV gamma rays for studying the response to high energy gamma rays of the AGATA segmented HPGe detectors was performed at LNL-INFN. The reaction used was $d(11B,ng)12C$ at $E_{beam} = 19.1$ MeV. In addition an Am-Be-Fe source measurement, providing gamma lines up to 9 MeV, was performed. Some results:

Energy resolution scales as expected up to 9 MeV (15 MeV gamma line cannot be used to test intrinsic resolution due to Doppler broadening) .

Linearity has been studied, the pulse height to energy conversion resulted to be very linear up to 15 MeV.

Experimental interaction multiplicity distributions were compared with the results of GEANT4 simulations finding good agreement.

Doppler correction quality @ 15 MeV was verified to be significantly improved using detector segmentation and Pulse Shape Analysis as compared to the case of using only HPGe crystal centers for Doppler Correction (non-segmented detectors case) and segment centers (36-fold segmented detectors but not using information from PSA).

Nice agreement was found between the line shape of the experimental spectrum in the 15 MeV region and the spectrum obtained with a Geant4 simulation of the experiment.

6) Publications or talks (or an indication if there will be any)

Publications:

1)"Measurement of 15 MeV g-rays with the AGATA cluster detectors" - LNL Annual Report 2010, page 58.

2)Conference Record of Poster Presentation at 2011 Nuclear Science Symposium IEEE 23-29 October 2011 Valencia Digital Object Identifier : 10.1109/NSSMIC.2011.6154591

3)NIMA paper will be sent soon to Johan Nyberg (contact person on issues of AGATA technical and instrumentation publications) prior to submission to NIMA.

Talks:

1) F.Crespi - EGAN 2011 Workshop, 26-30 June 2011, Padova (Italy)

2) "Response of AGATA Segmented HPGe Detectors to Gamma-Rays up to 15.1 MeV"

Invited Seminar at the Laboratori Nazionali di Legnaro (LNL-INFN), November 10th 2011, Legnaro, Italy

3) "Study of high-lying collective modes with AGATA"

Invited talk at the 3rd Workshop on Level Density and Gamma Strength, May 23-27, 2011, Oslo, Norway.

7) Any problems

-All technical problems related to the replay and presorting of the data have been solved through the help of local LNL team. The procedure is now rather well established.