Response of HADES Electromagnetic calorimeter modules on inclined gamma-beam*

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The electromagnetic calorimeter (ECAL) will soon become a new detector in the HADES spectrometer as a part of the upgrade for experiments with beams from the FAIR facility. The ECAL TDR was approved in 2014 and the production of the ECAL support construction will start in 2015. A module assembly and monitoring system construction is running in parallel. A short ECAL description can be found in [1]. Tests of single ECAL modules using the tagged gamma beam from the MAMI facility at Johannes Gutenberg Universität Mainz were done in the beginning of 2014. A short experiment description and first results on relative energy resolution were presented in [2].

Beside the relative energy resolution, also the response of single detector modules to gamma beams coming close to the module border or under non-zero angles were studied in detail. The response to a non-parallel beam is of high importance as most of the ECAL modules will be under non-zero angle to the incoming particles (see figure 1).

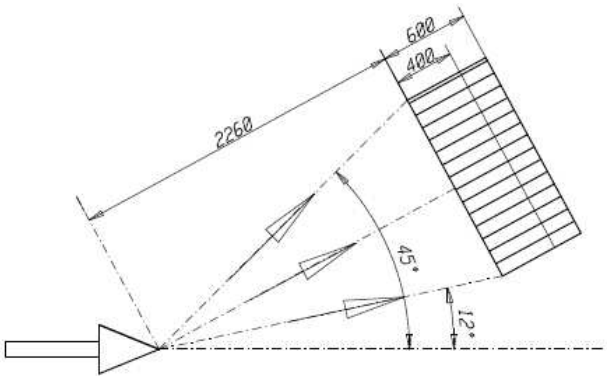

Figure 1: Modules layout in the vertical plane along the beam axis.

Two different inclination angles (6 and 12 degrees) and four hit positions (-2cm, center of module, +2cm, +4cm) were measured and analyzed in detail. As demonstrated on figure 2, the original photon energy can be reconstructed by summing the signal from neighbor modules. This is possible due to a short path length of secondary particles in the non-active volume between the modules.

For parallel beams coming close to the module border, a small part of the total photon energy is lost as the secondary particles are traveling a longer distance in the non-active volume between the modules. This will be eliminated with a calculated correction table.

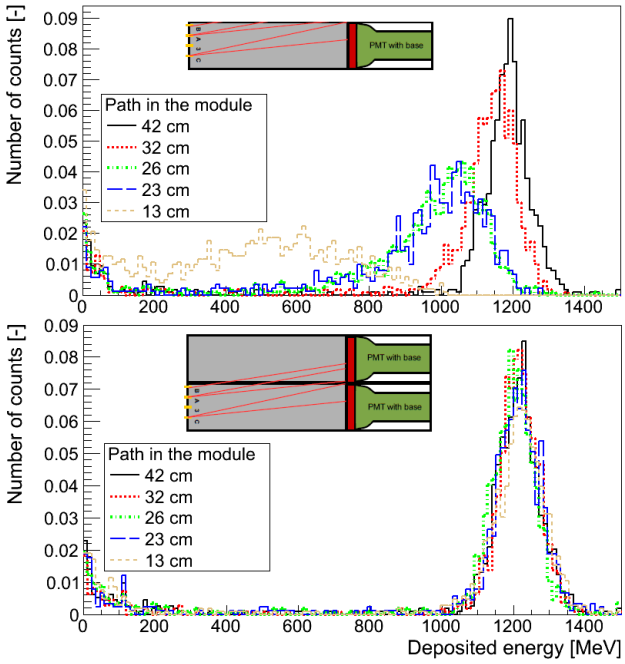

Figure 2: Energy deposited in the primary module (upper histogram) and sum of energies from two neighbouring modules (lower histogram). The energy of primary photons was 1213 MeV, various inclination angles and hit positions resulted in a varying ”path length” in the hit modules.

Simulations are being performed to understand these detector features and to tune the analysis code for first measurements with the detector in 2017.

Acknowledgements

Authors are grateful to A. Thomas and other members of the A2 collaboration for their help with this measurement.

References

[1] O. Svoboda et al., “Electromagnetic calorimeter for the HADES@FAIR experiment”, 2014 JINST 9 C05002

[2] O. Svoboda et al., “Test of the HADES Electromagnetic Calorimeter modules on gamma beam”, GSI Scientific Report 2013 (2014) 12

* Work supported by GSI, HIC for FAIR, EMMI and Czech MSMT LG 12007, GACR 13-067595 and AS CR M100481202 grants, and by European Community FP7 – Capacities, contract HadronPhysics3 n. 283286.

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