Test of the HADES Electromagnetic Calorimeter modules on photon beam*

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Development of the electromagnetic calorimeter (ECAL) for the HADES experiment is coming to its final stage. A dedicated measurement using secondary gamma beam from MAMI facility at Johannes Gutenberg Universität Mainz was employed to verify the selected technical solutions.

The ECAL will allow the HADES experiment to measure data on neutral meson production in heavy ion collisions in the energy range of 2-10 AGeV with the beam of the future accelerator SIS100@FAIR. The detector is a lead glass calorimeter read out by photomultipliers connected to a novel electronic. A detailed description of the ECAL can be found in [1, 2].

Beam tests of single ECAL modules were performed to measure energy resolution, test the two new front-end boards ("Cracow" and PaDiWa AMPS) and measure detector response on beam inclined with respect to the module axis.

The tagger detector from MAMI was used to select eight different gamma energies ranging from 81 up to 1399 MeV (eight different triggers were used). Modules were exposed to collimated gamma beam of approx. 6 mm diameter at a 5 kHz load. The CAEN DT5742 and GSI made MA8000 shaper was used as a referential read out system to be able to compare with the two tested front-end boards. Stored pulse shapes were compared with the pulses measured using cosmic muons and LED monitoring system, see figure 1. Results measured with PaDiWa AMPS front-end board can be found in [3].

Energy resolution was studied to be able to decide which size of photomultiplier is the most suitable in terms of in terms of the price-performance ratio. Resolution of modules with a photomultiplier with 1" diameter seems to be significantly worse than that one with 1.5" and 3" diameter, see figure 2. These measurements are in a good agreement with the measurements done with the two new front-end boards.

Measurements with inclined modules confirmed the results of our simulations, namely that we are able with a good precission to detect particles hitting more than one module or placed close to module border.

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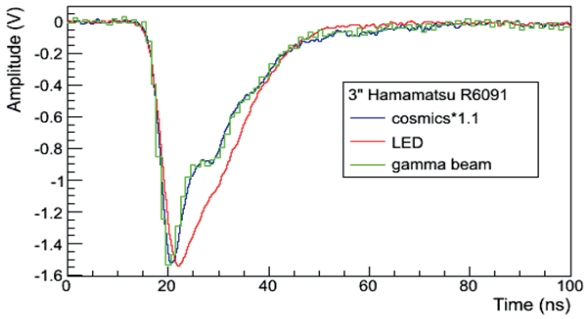

Figure 1: Pulse shapes induced by photons with energy of 1399 MeV, cosmic muons passing the full module length and by light from a LED diode.

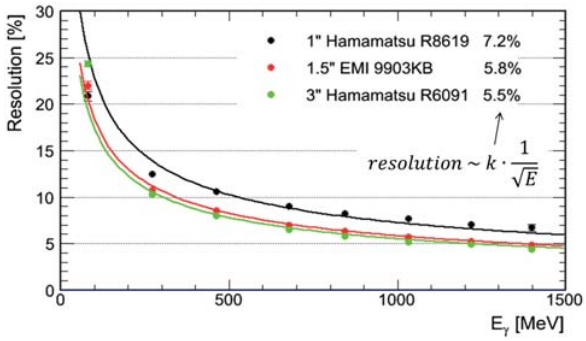

Figure 2: Energy resolution of ECAL modules with different PMTs. Numbers behind the PMT type show energy resolution at 1 GeV.

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