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## A SiPM-based 3" LaBr<sub>3</sub> Readout Module for PMTs Replacement in Gamma Spectroscopy

GAMMA is a compact detection module for  $\gamma$ -spectroscopy based on a 3" LaBr<sub>3</sub>(Ce+Sr) co-doped scintillation crystal readout by SiPMs aimed at superseding PMT-based readout of large scintillation crystals in Nuclear Physics experiments maintaining high resolution ( $<3\%$  at 662keV) and high energy dynamic range (100keV – 30MeV), with the benefits of solid-state detectors.

The system is capable of reaching a state-of-the-art energy resolution of 2.6% at 662keV and a dynamic range spanning from few hundreds of keV up to tens of MeV in a single measurement thanks to the custom front-end ASIC, which exploits an automatic and predictive gain switching (AGC, Adaptive Gain Control) to avoid output saturation and thus extend the full-scale range.

The 3" scintillation crystal is coupled to a square matrix of 144 NUV-HD SiPMs from FBK grouped in nine 1"  $\times$  1" tiles; the SiPM tile design is customized specifically for this application and hosts 16 SiPMs with 6mm side (30 $\mu$ m cell, 77% fill factor, 45% PDE).

The detector communicates via USB 2.0 with the host PC to receive the ASIC configuration and to transmit the raw acquisition data up to 70kcps. However, it also has an analog output proportional to the  $\gamma$ -ray energy to mimick the signal of a PMT: this output can be sampled with data acquisition platforms used in PMT-based experiments (like MCAs) to easily integrate the detector in pre-existing setups.

### Primary experiment

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