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Performance of a 64-channel, 3.2x3.2cm² SiPM tile for TOF-PET application

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We present the first results of timing and energy resolution of a newly developed 64-channels tile with FBK SiPMs. The tile has dimensions of 32x32 mm² and it is composed of an array of 8x8 SiPMs, having a regular pitch along the x and y directions of 4 mm. The fill factor at the tile level is 85%. We designed two versions: one with single-ended and the other with differential readout.

The first prototypes are equipped with RGB-HD SiPMs with a cell size of 25 μm . We tested a tile with single ended readout with a scintillator array, manufactured to perfectly match the tile pitch and composed of 8x8 LYSO crystals with dimensions of 4x4x22 mm³. We used a single-channel setup, based on a fast, discrete amplifier, a digital oscilloscope and a PC, and read one SiPM at a time. We irradiated the detector with 511 keV gamma photons, emitted by a Na²² radioactive source. At 20 °C, we measured an energy resolution of 10.7% FWHM, corrected for saturation. The timing measurements were performed against a known reference detector, whose contribution was subtracted. We compared two conditions: when only one SiPM was biased and read, and when all the 64 SiPMs were biased but only one was read. At 20 °C, we measured a timing resolution of 200 ps FWHM in the first case, and 220 ps FWHM in the second case.

Measurements on a second tile production equipped with NUV SiPMs, having a cell size of 40 μm , are ongoing and will be presented at the conference.

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