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FAT-GEM detectors for operation in noble elements

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We introduced in 2019 a new concept for electroluminescence in noble elements, based on very-thick acrylic-based perforated structures (Field-Assisted Transparent Gas Electroluminescence Multipliers, or FAT-GEMs in short). Although the structure had the potential for increased light collection thanks to its transparent substrate, such a possibility was not exploited and efforts were put on demonstrating that the technology was already competitive off-the-shelf. In this work we will present our latest results for wavelength-shifting FAT-GEMs made on substrates based on PEN as well as PMMA with TPB-coated holes. In the same configuration, we measured for our FAT-GEMs up to 70% of the light collected with meshes, and we will show how, even if counter- intuitive, it is in principle possible to overcome the 100% physical limit. Measured yields in xenon gas are well in excess of 3 phe/e/bar up to 3.6 kV/cm/bar, with energy resolutions extrapolating to below the values reported by leading experiments. Operated in argon at around the gas density of dual-phase argon detectors, an encouraging value of 1.4 phe/e was obtained. We will present these results comprehensively, together with simulations of the structure response.

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