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Production of GEM-like structures using laser-cutting techniques

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GEM-like charge amplification structures, including FAT GEMs, can find applications in TPCs for dark matter, neutrino and generally rare event search experiments.

A new concept of GEM-like structures was recently proposed. In this concept a double-stack of GEM-like structures is used to optically decouple LAr and GAr regions from a dual-phase TPC. Its core element is a type of GEM structure machined from polyethylene naphthaline (PEN). Due to its intrinsic characteristics, such structure presents several advantages. On the one hand, it will work as self-veto regarding its own background, on the other hand it opens the possibility for doping LAr with dopants with very low ionisation energies (solving one of the main technical challenges related with optical positive feedback by having two layers of mismatched holes) while enabling at the same time the scaling up of such detectors.

In this work, we report the newest developments on the production of GEM-like structures using laser-based techniques, namely the manufacture of a first batch PEN and PMMA-based GEM-like structures. This process allows low-cost, reproducible fabrication of a high volume of such structures. In addition to being a low radioactive technique, we expect that it will allow the scaling up of the production of these structures at a reduced cost. First tests indicate good electrical stability, while the performance assessment is still ongoing.

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