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Thick GEM: a fast growing MPGD technology

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Thick-GEMs (THGEMs) are robust gaseous multipliers, derived from the GEM design and introduced in the early 2000s. They are proposed for large-scale applications in several fields. THGEMs consist of Printed Circuit Boards (PCBs) with a regular pattern of holes obtained by drilling; they are manufactured in large series and large size. Mass production of THGEMs has already started in collaboration with Italian industry. THGEMs with different geometrical parameters have been extensively studied and the main results are presented. The special role of the rim (a clearance around the hole) is illustrated. The challenge of achieving high (0.1 to 1 million), stable gain in THGEM-based detectors is discussed. Different substrates (ceramic, glass, PTFE, etc.) and various production procedures (laser drilling, chemical etching, capillary plate techniques) have been used with promising results. Different design options, like the highly segmented electrode, called THCOBRA, and different architectures, in particular those based on blind THGEMs (Thick-WELL) are presented and their applications are discussed. THGEMs are used as gaseous multipliers and as reflective photocathodes for VUV photons when coated with a CsI layer. THGEM-based Photon Detectors have been proposed for RICH upgrades at CERN LHC (ALICE) and SPS (COMPASS); a hybrid MPGD architecture consisting of two THGEM layers and a Micromegas has been chosen and implemented in 2016 on COMPASS RICH-1 for a total active area of 1.4 square meters. Applications of the THGEM (also called LEM) technology in the field of cryogenic detectors, in particular for double-phase large volume Ar ones, where they represent the best candidate for large area coverage, are presented. Other important cryogenic applications (LXe) are discussed. A proposal to exploit the recently discovered “local dual phase” configuration for cryogenic THGEMs is illustrated. The detection of X-rays and that of neutrons using THGEM-based devices is discussed and very promising results recently obtained using THGEMs for imaging applications are shown. The perspectives of this fast growing innovative technology are then summarized.

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