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Progress in Room-Temperature and Cryogenic Resistive THGEM-based detectors

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Future experiments in Particle and Astro-particle Physics pose a growing demand for cost-effective large-area imaging detectors, capable of operating stably over a broad range of conditions. Promising candidates are detectors based on the Thick Gas Electron Multiplier (THGEM) principle. Among them are: the cascaded-THGEM, WELL, Resistive-WELL (RWELL) and the recently introduced Resistive-Plate WELL (RPWELL) detector. It is a single-sided THGEM electrode coupled to a segmented readout anode through a sheet of large bulk resistivity. Laboratory and accelerator studies, performed in Ne- and Ar-based gas mixtures at room temperature, have demonstrated the large dynamic range (from one to several thousand electrons) of this few-millimeter thick single-element multiplier, high achievable gains, sub-mm localization resolution and discharge-free operation with high detection efficiency over a broad particle-flux range. Results from new detector prototypes, 500x500 mm2 in size, will be presented.
Originally, the main potential applications focus on particle tracking and sampling elements in digital hadron calorimetry. We will present and discuss new detector concepts for two other potential applications. A large dynamic-range RPWELL-based UV-photon detector, comprising a multiplier coated with a reflective CsI photocathode –with potential applications for RICH and a cryogenic RPWELL-based detector for UV-photon and charge recording in dual-phase noble-gas TPCs –with potential applications in dark-matter searches and neutrino physics. The characteristics of these detectors will be presented.

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