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The RPWELL detector –its physics and potential applications

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The Resistive-Plate WELL (RPWELL) detector is a single-element gas-avalanche multiplier, combining a single-faced THGEM electrode coupled to the segmented readout anode through a sheet of large bulk resistivity. Laboratory and accelerator studies, performed in Ne- and Ar-based gas mixtures, have demonstrated its large dynamic range (from one to several thousand electrons), high achievable gains, and discharge-free operation with high detection efficiency over a broad particle-flux range.
In this work, we present recent studies aiming to understand the underlying physics processes governing the operation and performance of the RPWELL detector. The focus is on gain stability, energy and spatial resolutions and edge-related effects. Experimental data are compared to simulation results.

While the main potential applications focus on particle tracking over large areas (at moderate localization resolution), we will also discuss two other topics:

- RPWELL-based UV-photon detectors, comprising one or more amplification stages with a reflective CsI photocathode on the first stage. We show that such detectors offer a high single-photon detection efficiency, exhibiting clear Polya-like spectra at stable operation conditions, also under high primary-charge background.
- A RPWELL detector, investigated for UV-photon and charge recording in dual-phase noble-gas TPCs. Here we will present our first results in cryogenic operation of such devices.

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