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Novel Resistive-Plate WELL sampling elements for (S)DHCAL

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Digital and Semi-Digital Hadronic Calorimeters (S)DHCAL were suggested for future Colliders as part of the particle-flow concept. Though studied mostly with RPC-based techniques, studies have shown that MPGD-based sampling elements could outperform. An attractive, industry-produced, robust, particle-tracking detector for large-area coverage, e.g. in (S)DHCAL, could be the novel single-stage Resistive Plate WELL (RPWELL). It is a single-sided THGEM coupled to the segmented readout electrode through a sheet of large bulk resistivity. Past laboratory and accelerator studies were performed in moderate-size RPWELL prototypes in Ne- and Ar-based gas mixtures. These demonstrated large dynamic range (from single electrons to thousand-times MIPS), stable operation under high gains (> 105) also in hadronic beams; MIP detection efficiency>98% was reached at <1.2 pad multiplicity. We will present recent studies carried out with 6.5 mm thick (incl. electronics) 50x50 cm2 RPWELL-based sampling elements, equipped with a Semi Digital readout electronics based on the MICROROC chip. They were performed at the CERN-SPS with 150 GeV muons and high-rate pions. Results will be shown on detection efficiency, pad multiplicity, gain and efficiency uniformity and detector stability. We will further present the preliminary performance of an RPWELL-based (S)DHCAL small prototype exposed to low-energy electrons at CERN-PS. Other applications in noble-liquid and UV detectors will be discussed.

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