

# Large-area gas-avalanche Resistive-Plate WELL detectors: potential sampling elements for digital hadron calorimetry

Thursday 5 October 2017 10:20 (20 minutes)

Future digital and semi-digital hadron calorimeters, will consist of 40-50 layers of thin sampling elements interposed between absorber planes. The total area coverage of such elements could reach a few thousands of square meters, thus requiring robust, cost-effective solutions. The thin, single-element Resistive Plate WELL (RPWELL) detector concept could be an effective solution for DHCAL, SDHCAL and for other applications requiring particle tracking at moderate, sub-mm spatial resolutions.

The RPWELL comprises of a single-sided Thick Gas Electron Multiplier (THGEM) electrode, coupled to a segmented readout anode through a resistive plate ( $\sim 10^9 - 10^{11} \Omega\text{cm}$ ). The properties of the RPWELL have been demonstrated, on series of small- and medium-size prototypes, with Semitron ESD225 plastic or doped silicate glass resistive plates. Beam tests with relativistic muons and pions of a 300x300 mm<sup>2</sup> RPWELL detector prototype, with SRS-APV25 readout electronics were recently carried out; they have demonstrated its potential applicability to DHCAL & SDHCAL: high detection efficiency at low average pad multiplicity, under discharge-free operation, in both neon and argon-based gas mixtures. Argon based mixtures are economic and allow reducing the drift gap and hence the design of few-millimeter thick detectors.

On the basis of the knowledge accumulated, a thin, self-supporting 500x500 mm<sup>2</sup> glass-RPWELL detector prototype with anode-strips readout was designed and built for the first time; it was assembled using a gluing technique under vacuum, with the resistive plate coupled to the anode through a resistive-layer/epoxy film.

This large-area detector prototype, with SRS/APV25 electronics, yielded good performance at the laboratory. It will undergo extensive test-beam investigations in July 2017, at CERN-SPS.

In the near future, new detector modules will be assembled with dedicated MICROROC embedded electronics, developed for SDHCAL applications. This would be a crucial step towards the integration of RPWELL sampling elements into a full SDHCAL prototype.

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**Session Classification:** Prototypes, upgrades and concepts