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Towards Large Size Pixelized Micromegas for operation beyond 1 MHz/cm2

Friday 16 December 2022 09:00 (20 minutes)

In recent years, an R&D project has been conducted to consolidate resistive Micromegas technology for operations well beyond the current ones in HEP experiments, with the aim of a stable, reliable, and high gain operation up to particle rates above 1 MHz/cm2, on large surfaces. To achieve this goal, while maintaining a low occupancy on the readout elements, a configuration with small pads readout (only few mm2) has been adopted, which requires innovative solutions for the spark protection resistive scheme. Two main resistive patterns were investigated, expanding the scope of the developments made in previous projects. The main difference between the adopted technical solutions is that in one case (embedded resistors) the charge evacuates through independent pads in a pad patterned layout, while in the other case a continuous and uniform double DLC resistive layer has been adopted and the charge evacuates through vertical dot-connections, several mm apart. A detailed performance comparison will be reported, showing the optimisations and benefits of this latest configuration. More recently, this year, moving towards a larger scale, a new detector with an active area of 400 cm2 has been built, implementing a double layer of DLC foils with a surface resistivity around 30 MOhm/square. The first results will be reported on rate capability, robustness, dependence on the irradiated area, tracking efficiency and energy and spatial resolution following laboratory measurements and the next tests at CERN SPS with high energy particle beams. With the proven high performance of this large area detector, and with the construction of even larger small-pad resistive micromegas next year, our R&D is reaching the goal of establishing the technology for future use under hard and high-rate employment in the field of particle physics and other applications.

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