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The surface Resistive Plate Counter: a novel RPC based on MPGD technologies

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The Surface Resistive Plate Counter (sRPC) is a novel RPC based on surface resistivity electrodes, a completely different concept with respect to traditional RPCs that use electrodes characterized by volume resistivity (phenolic-resin or float-glass).
The electrodes of the sRPC exploits the well-established industrial Diamond-Like-Carbon (DLC) sputtering technology on thin (50 μm) polyimide foils, already introduced in the manufacturing of the resistive MPGDs such us micro-RWELL. The DLC foil is then glued on a 2 mm thick glass, characterized by excellent planarity. With this scalable and cost-effective DLC technology it should be possible to realize large area (up to 2x0.5 m2) electrodes with a resistivity spanning over several orders of magnitude (0.01÷10 GOhm/square).
Different sRPC layouts have been tested: symmetric, with both electrodes made of DLC foils, and hybrid, with one electrode made of DLC and the other made of float-glass. With these layouts we measured an efficiency of 95-97% and a time resolution of 1ns. Performance that are quite standard for 2 mm gas gap RPCs.
In addition, exploiting the concept of the high density current evacuation scheme, already introduced for the micro-RWELL, we realized the first prototypes of high-rate electrodes by screen printing a conductive grid onto the DLC film.
With this high-rate layout, with 7 GOhm/square DLC resistivity and 10 mm grounding-pitch, we measured a rate capability of about 1 kHz/cm2 with X-ray, corresponding to about 3 kHz/cm2 with mip. By lowering the DLC resistivity and optimizing the current evacuation scheme, rate capabilities largely exceeding the barrier of the 10 kHz/cm2 seems to be easily achievable.
The sRPC, based on innovative technologies, open the way towards cost-effective high-performance muon devices for applications in large HEP experiments for the future generation of high luminosity colliders.

Collaboration

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