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High space resolution µ-RWELL for high rate applications

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The micro-Resistive-WELL (µ-RWELL) is a compact, simple and robust Micro-Pattern Gaseous Detector (MPGD) developed for large area HEP applications requiring the operation in harsh environment.
The detector amplification stage, similar to a GEM foil, is realized with a polyimide structure micro-patterned with a blind-hole matrix, embedded through a thin Diamond Like Carbon (DLC) resistive layer with the readout PCB. The introduction of a resistive layer (ρ˜50÷200 MΩ/square) mitigating the transition from streamer to spark gives the possibility to achieve large gains (>10ˆ4), while affecting the detector performance in terms of rate capability. Different detector layouts have been studied: the most simple one based on a single-resistive layer with edge grounding has been designed for low-rate applications (few tens of kHz/cm2); more sophisticated schemes are under study for high-rate purposes (O(MHz/cm2)).
The single-resistive layer scheme, extensively tested and validated, it is mature for the technology transfer towards the industry working into the rigid and flexible PCB photolithography.
The high-rate version of the detector has been developed in the framework of the phase-2 upgrade of the LHCB muon system, where strong requirements on the robustness and rate capability are required.
An overview of the different architectures studied for the high-rate version of the detector, together with their performance measured at the high intensity PiM1 beam of the PSI will be presented.
The presence of the resistive layer also affects the charge spread on the strips and consequently the spatial resolution of the detector: the results of a systematic study of the spatial resolution obtained with the charge centroid (CC) method for orthogonal tracks as a function of the DLC resistivity will be discussed.
For non-orthogonal tracks the spatial resolution with CC method is compared with the performance obtained with the micro-TPC mode: a readout approach that exploiting the combined measurement of the time of arrival and the amplitude of the signals on the strips allows a fine estimation of the position of the track for a wide incident angular range.
The excellent performance together with the high flexibility of the technology suggests the use of such a detector as a high space resolution inner tracker in HEP. The possibility to exploit the µ-RWELL technology to build a full Cylindrical detector will be eventually discussed.

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