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High rate performance of Small-pad Resistive Micromegas. Results of different resistive protection concepts

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Micromegas resistive detectors have already proven to be suitable for precision tracking at rates up to few kHz/cm^2. Rate capability up to few MHz/cm^2 and low occupancy can be achieved by using few mm2 readout pads. Such a rate capability will be required in upgrades of forward muon detectors of LHC experiments as well as in experiments at future colliders.

We present the development of resistive micromegas with O(mm^2) pad readout aiming at precision tracking without efficiency loss up to several MHz/cm^2. To achieve this goal the miniaturization of the readout elements is a key element of the project.

A series of small-pad micromegas detectors have been built with the spark protection resistive layer realised with different techniques: a pad-patterned embedded resistor with screen printing, and a uniform DLC (Diamond Like Carbon structure) layer by sputtering. All detectors consist of a matrix of 48x16 pads. Each pad has a rectangular shape with a pitch of 1 and 3 mm in the two coordinates. The active surface is 48x48 mm^2 with a total number of 768 channels, routed off-detector for readout.

Characterization and performance studies of the detectors have been carried out by means of radioactive sources, X-Rays guns, cosmic rays and high energy particle beam. The response under high irradiation, high rate exposure, is compared with low irradiation performances. A comparison of performance with different resistivity values will be presented.

A new prototype with integrated electronics readout, with front-end IC chip mounted (or bonded) on the back side of the readout plane, is currently under assembly. Such a configuration guarantee full scalability to large size detectors, overcoming the challenging problem (unsolvable for large size) of routing off detector the pad readout lines. The design, the construction and preliminary data of this new detector, will also be reported.

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