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Tracking cosmics: Recent results from a Micromegas-covered MediPix2 pixel CMOS readout circuit in a mini-TPC

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Conventional readout systems for Time Projection Chambers (TPCs) based on wire chambers have certain limitations concerning counting rate and spatial resolution. We have built a new type of TPC which will not suffer from these limitations.

Our mini-TPC consists of a MediPix chip, a Micromegas and an cathode plane. With the proper gas mixture and voltages it is possible to detect single (primary) electrons left in tracks of minimum ionizing particles. The information we obtain from the measurement has two key components.

First it is possible to measure the position of the track to much higher resolution than with conventional TPCs. Secondly, by analyzing the track-density of primary electrons, the energy loss function (dE/dx) can be measured.

A coincidence setup composed of three scintillator-photomultiplier detectors defines a trigger signal for, in this case, cosmic muons. This signal is used to read out the MediPix chip at the correct time so the muon track can be measured. The data obtained from the cosmic muons has been analyzed for track resolution and energy loss. These results will be presented along with various further developments.

In the near future it will be possible to create a medipix-micromegas combination in a monolithic form using wafer scale post processing. Trials on dummy wafers and their gas amplification tests will be presented.

The combination of a CMOS pixel device, a Micromegas and a thin layer of gas can be used as vertex detector. This Gas On Slimmed Silicon Pixel (GOSSIP) device potentially outperforms Si MAP/strip/pixel detectors in parameters like counting rate, radiation hardness and power dissipation.

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