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# Novel Two-Dimensional Floating Strip Micromegas Detectors

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Floating strip Micromegas detectors with one-dimensional readout are high-rate capable particle detectors with excellent spatial and temporal resolution, allowing single particle tracking for particle fluxes up to 7\,MHz/cm$^2$. A floating strip Micromegas detector collects the amplified ionization charge on copper anode strips on high voltage, so called floating strips. The charge signal is read out by capacitive coupling to readout strips, separated by a thin layer of insulating FR4 material. This scheme strongly suppresses the sensitivity of the detector to discharges between the micro-mesh and the floating anode strips, triggered by strongly ionizing particles. A two-dimensional readout has been realized with two layers of readout strips, parallel and perpendicular to the floating strips. The localized ionization charge on the floating strips couples differently to the two readout layers. Thus the measured strip pulse duration on the perpendicular readout strips is considerably shorter, significantly improving the time resolution in this layer. We present results from characterization measurements using a 20\,MeV proton beam. Charge signals were recorded with APV25 frontend boards, allowing for single strip readout with pulse height and timing information. To investigate hardware multiplexing schemes, advantageous for large area detector systems, we have interconnected groups of readout strips to single electronics channels, studying the signal pulse height. Additionally inclined detectors allowed for testing \textmu TPC reconstruction in both readout layers. We also report on new designs of the two-dimensional floating strip anode, where readout strip widths and geometric location of both readout layers within the PCB have been varied, and its tests with 5.9\,keV X-rays emitted by a Fe$^{55}$ source.

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