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Genetic multiplexing for MPGD: how to read more than 1,000 strips with 64 channels

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Modern particle physics experiments frequently require the detection of particles on large areas, with an excellent spatial resolution. The resulting detectors usually contain thousands of readout elements –strips, pixels, pads –and consequently the same number of electronic channels. In most cases, the electronics budget therefore becomes significant in the total cost of the project. It also leads to delicate issues on integration, cooling, power consumption, cabling, which can be prohibitive for some applications. Very often, however, the incident flux per readout element is not critical. For one particular event, the signal is localized on a few electronic channels, the others being useless. Even in high luminosity experiments, the spatial resolution is a stronger constraint for fine granularity in some parts of the acceptance. For this reason, the possibility to connect several readout elements to a single channel appears as a promising tool to optimize a given ! setup, providing that the resulting pattern allows the localization of a particle without ambiguities. In this presentation, I will describe a recent idea developed at the CEA-Saclay for MPGD detectors, called genetic multiplexing. Assuming a signal is deposited on at least 2 neighbouring strips, spatial resolution of the order of 100 microns can be achieved with meter size detectors equipped with only 64 channels. With this technique, the degree of multiplexing can be easily adjusted to the incident flux of particles to solve the ambiguities. This concept could be used in a wide range of applications, like particle physics, tomography, astrophysics, or homeland security. A 50x50 cm² Micromegas detector has been successfully tested with cosmics, and its performance will be presented.

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