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R&D on a novel fast timing micro pattern gaseous detector (FTM)

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We would like to describe a novel class of Micro Pattern Gas Detectors, dedicated to fast time applications: the Fast Timing MPGD (FTM).

Time resolution in gas detectors is dominated by fluctuations in the drift region of the nearest distance of the primary ionisation to amplification region. In order to improve their time resolution, we propose a new configuration, in which we split the conventional drift region in several ones, each of them coupled to its multiplication stage.
The timing of the ionisation processes in the respective drift volumes will then compete leading to a decrease of the arrival time to any multiplication volume and consequently, a decrease of the fluctuations and an improvement of the time resolution.
The reduction of the time resolution is proportional to the number of drift layers employed.

The architecture of the proposed new device is then based on a stack of several layers where drift and multiplication stages alternate in the structure.
The signal from each amplification region can be read out through the capacitive couplings at both sides of the stack; in order to do that, the entire structure is realized by fully resistive materials. This allows also a spark protection for the device.

We have built the first working prototype and we are on the way of building the second one. The two detectors are based on two different MPGD structures. The first one is made by two layers of resistive micro-well, while the second one will be formed by four amplification stages of resistive Micromegas.
In both cases each of the drift regions is kept at 250 um thickness and the readout electrodes are placed at both ends of the stacks and are made of copper.
Both detectors were designed and built at the CERN Micro Pattern Technology workshop; all the polarized layers were manufactured using resistive kapton or resistive coatings, taking advantage from the expertize acquired by the workshop in the recent years in the use of resistive material to build compact spark-protected MPGD.

We have demonstrated the construction feasibility with small prototypes, but we believe that those detectors can be fabricated also in large area and that this technique can be exploited for applications in high energy physics experiments and also in medicine and astronomy.

We will present preliminary results of both prototypes, under test at CERN, together with the detailed description of the applied production techniques.

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