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## Precise timing PICOSEC Micromegas and rapid imaging with gaseous detectors

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Advances in MicroPattern Gaseous Detector (MPGD) technologies and readout devices allow significant improvements of timing resolution as well as novel imaging approaches. This contribution will focus on PICOSEC Micromegas achieving tens of ps timing precision as well as new developments in the optical readout of gaseous detectors taking advantage of state-of-the-art imaging sensors and fast photon detectors.

PICOSEC Micromegas combine a Cherenkov radiator with a semi-transparent photocathode and Micromegas amplification stage to achieve better than 25ps timing precision for Minimum Ionising Particles (MIPs). The latest developments of this technology towards scalable timing systems include optimisations of multi-pad detector modules for robustness and improved timing uniformity and dedicated readout electronics preserving high bandwidth and timing performance.

Recording scintillation light emitted during avalanche multiplication in MPGDs is a powerful readout approach exploiting high-resolution imaging sensors and the high gain and rate capabilities of gaseous detector technologies. Ultra-fast CMOS sensors offer unprecedented frame rates for rapid imaging and can further enable new approaches for 3D track reconstruction in Time Projection Chambers (TPCs). In addition, hybrid readout approaches and fast photon detectors such as SiPMs offer new possibilities for track reconstruction and fast radiation imaging.

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