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Simulation of a Fast Timing Micro-Pattern Gaseous Detector for TOF-PET and future accelerators

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Full MC simulation is a powerful tool for designing new detectors and guide the construction of new prototypes.
Improved micro-structure technology has lead to the rise of Micro-Pattern Gas Detectors (MPGDs), with main features: fexible geometry; high rate capability; excellent spatial resolution; and reduced radiation length. A new detector layout, the Fast Timing MPGD (FTM), could combine both the high spatial resolution (100um) and high rate capability (100MHz/cmˆ2) of the current state-of-the-art MPGDs with a high time resolution of 100ps. Adopting the design of the FTM for the detection of photons can potentially reach sub-millimeter spatial resolution and 100 ps time resolution. Such a detector will allow the development of an affordable TOF-PET scanner with improved image contrast.
This contribution introduces the FTM prototype as an innovative PET imaging detector concept and emphases the importance of full detector simulation to guide the design of the detector geometry.
Interaction of particles with different materials is simulated with the GEANT4 toolkit. Electric fields are calculated with ANSYS and COMSOL, while the simulation of the detector response and detector gain is simulated with Magboltz and Garfield++. Furthermore detector simulations are validated against first measurements of detector prototypes.

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