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Study of spatial resolution of low-material GEM tracking detectors

Spatial resolution of GEM based tracking detectors is simulated and measured. The simulation includes GEANT4 based transport of high energy electrons with careful accounting of atomic relaxation processes including emission of fluorescent photons and Auger electrons and custom post-processing, including accounting of diffusion, gas amplification fluctuations, distribution of signals on readout electrodes, electronics noise and particular algorithm of final coordinate calculation (center of gravity). The simulation demonstrates that the minimum of spatial resolution of about 10 μm can be achieved at a strips pitch of 250 μm to 300 μm with the gas mixture of Ar-CO_2 (75%-25%). At a larger pitch the resolution is quickly degrading reaching 80-100 μm at a pitch of 500 μm. Spatial resolution of low-material triple-GEM detectors for the DEUTRON facility at VEPP-3 storage ring is measured at the extracted beam facility of VEPP-4M collider. These detectors are made of light components and the amount of material in the sensitive area is about 2.4x10^{-3} X0. The resolution of one DEUTRON detector was measured with 500 MeV electrons and the measured value is equal to 35 μm for orthogonal tracks. More results of simulations and measurements with different gas mixture and higher energy beam will be presented.

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Track Classification: Gaseous Detectors