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P2.64: Design and simulation studies of the micro-pattern gaseous beam monitor of the CSR external-target experiment

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A micro-pattern gaseous detector with pixel readout is being developed for the beam monitoring for the CSR external-target experiment (CEE) at HIRFL. Demanded by the physics program of the CEE experiment, it not only monitors the lateral beam density distribution, but also measures the lateral position of each beam particle with a spatial resolution better than $50 \mu\text{m}$ and with a rate up to 10^6 pps. The beam monitor mainly consists of two field cages inside a gas vessel with electrical fields orthogonal to each other, and four custom-designed charge sensing and readout chips on the anode of each field cage. The gas electron multiplier (GEM) is adopted for some beams with less ionizing power. The simulation of the drift electric field, gas properties, signal induction and spatial resolution of the detector has been carried out to optimize the geometrical set-up, to evaluate the expected performance, and to calculate the requirements on the chip characteristics. In particular, as the beam intensity increases, the ion back flow (IBF) from electron avalanches inside the GEM and the ions produced by the beam particles leads to sizable electric field distortion in the drift region, which worsens the spatial resolution of the detector. In this poster, the design and simulation studies of the beam monitor, especially the modelling and the correction of the space charge effect, are presented

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