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A Low-Material Time Projection Chamber for MAGIX

The MAinz Gas Injection Target EXperiment (MAGIX) will be operated at the Mainz Energy-Recovering Superconducting Accelerator (MESA), performing high-precision electron scattering experiments on a variety of targets, ranging from hydrogen to argon.

The setup includes a windowless gas jet target, followed by two high-resolution magnetic spectrometers that focus the scattered electrons onto their focal plane. Due to the significant impact of background effects, such as multiple scattering at low energies, a low-material Time Projection Chamber (TPC) has been developed to achieve a momentum resolution of $\Delta p/p < 10^{-4}$. Underneath sits a Trigger Veto System, which will be presented by an additional poster.

To eliminate material in the particle path, an innovative open field cage design has been developed, ensuring that the only material in the particles' trajectory is a 75 µm thin Kapton foil. This design minimizes the material budget and preserves track quality.

These features make the TPC an essential component for realizing the physics program of MAGIX, which spans from studies of nucleon form factors to astrophysical S-factor measurements. This contribution focuses on the design considerations and the performance of the low-material TPC, highlighting its role within the MAGIX setup.

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