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Development of a GEM-based TPC for H-dibaryon Search at J-PARC

We have been developing a TPC using GEMs and a gating grid to search for the H-dibaryon at J-PARC with high rate hadron beams up to 10^6 count per second (cps) / cm^2 .

The TPC consists of an octagonal-shape drift cage of 50 cm diameter and 55 cm height, filled with Ar-CH₄ (90:10) gas, and the end cap chamber consisting of a gating grid plane, 3-layer GEMs, and a pad plane. The TPC is operated in dipole magnetic field of 1 T in parallel to the drift electric field. The horizontal position resolution is expected to be better than 300 μm .

We have built a small prototype TPC and performed a beam test. The position shift due to positive-ion feedback was suppressed within ± 0.2 mm both in transverse and longitudinal directions at the beam rate up to 5×10^5 cps/ cm^2 . Detection efficiency was 97 % per pad row at low beam rate (10^3 cps/ cm^2), and 90 % at high beam rate (10^6 cps/ cm^2).

We also performed a laser test of the prototype in magnetic field, and observed expected improvement of the position resolution due to the magnetic field.

We show also the status of the full-size TPC development.

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