2D Micromegas trackers for EIC

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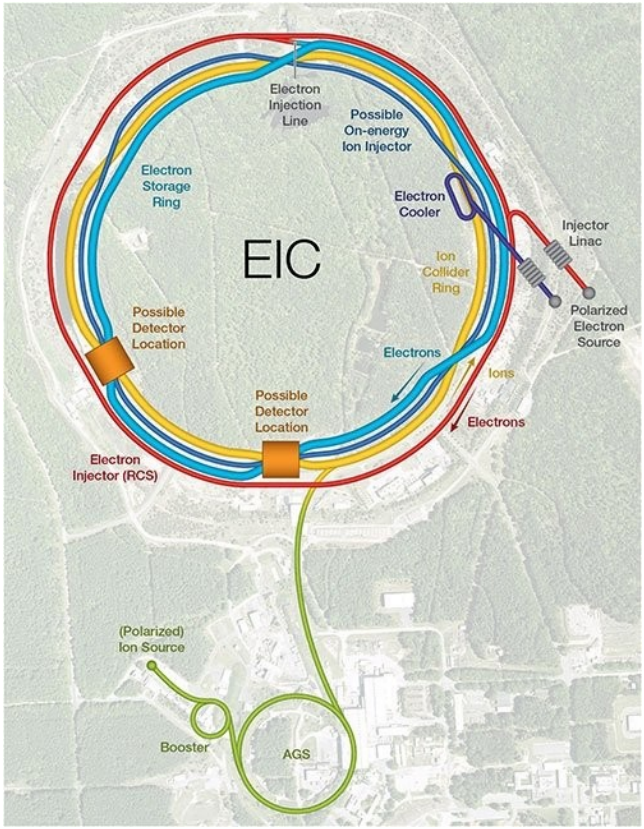
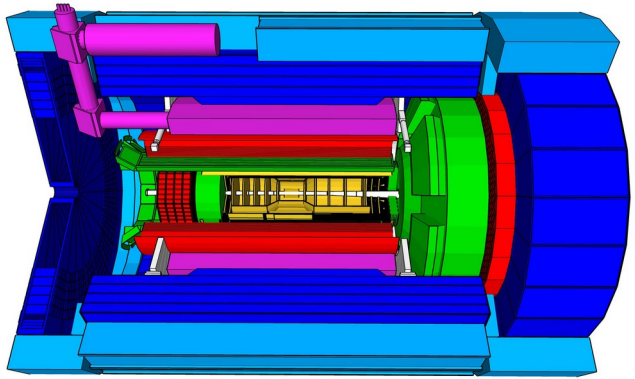
EIC & ePIC

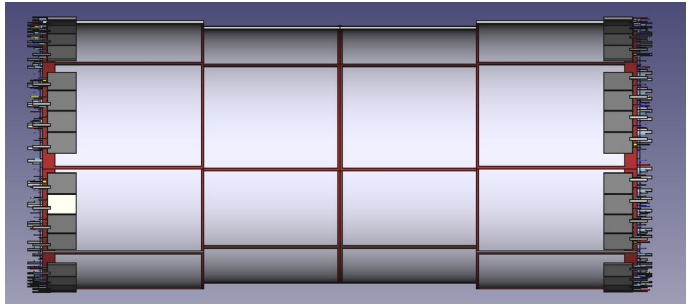


https://www.energy.gov/science/articles/electron-ion-collider-achieves-critical-decision-1-approval

- Electron ion collider: Future collider in Brookhaven, NY, USA. First beam ~2032.
- ePIC will be the first experiment at EIC, the goal is to study how quarks and gluons behave in, interact with, and form hadronic states
- The detector is built around a 1.7T solenoid. Inside the magnet, in the barrel region cylindrical gaseous trackers are needed with:
  - Good resolution ~150µm
  - Low material budget
  - Reduced number of electronic channels

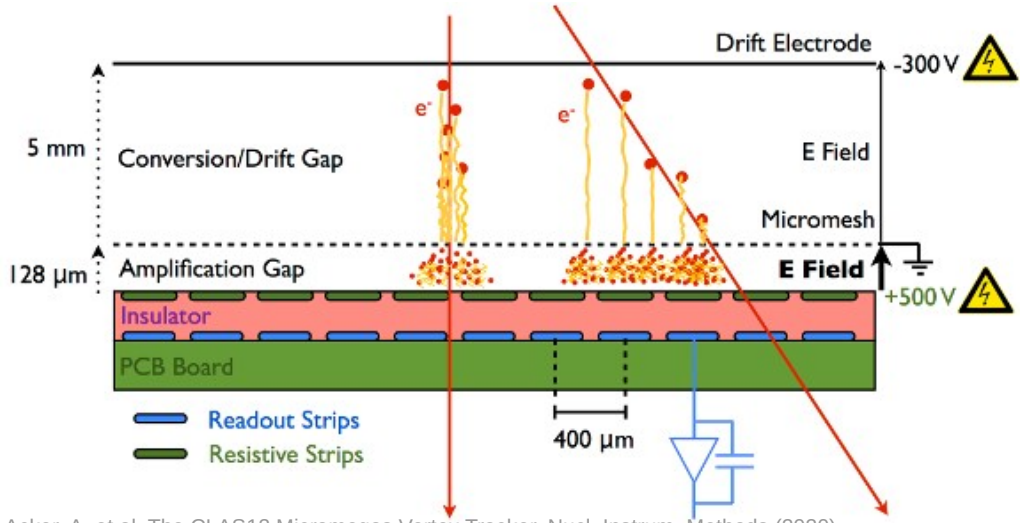


ePIC detector diagram, E. Aschenauer



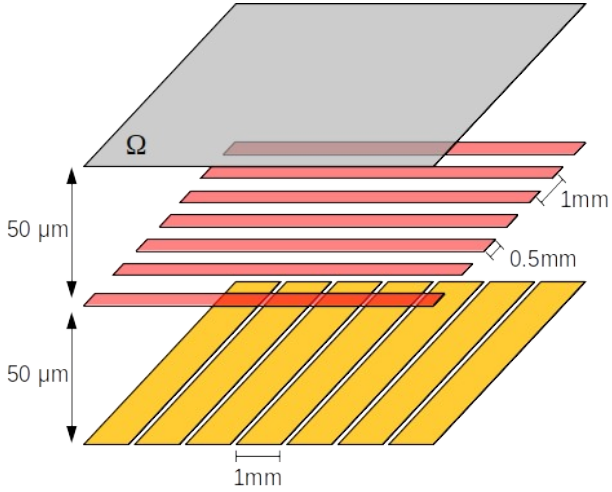
Cylindrical Micromegas diagram, F. Bossù

Micromegas trackers



Acker, A. et al. The CLAS12 Micromegas Vertex Tracker. Nucl. Instrum. Methods (2020).

- A low field region where crossing particles ionize the gas. The electrons created are guided to the mesh.
- High field region below the mesh for amplification.
- The signal is induced on readout strip or pads at the bottom.



- To meet ePIC's needs: 2D trackers with low material budget (~0.05%X0) and strip readout to limit the number of readout channels
  - Resistive layer above the readout.
  - Signal is induced on the resistive and read by strips is both directions through capacitive coupling.

Beam test at MAMI

- In June 2023, beam test on a 880MeV electron beam at MAMI in Mainz.
- We tested prototypes with different variations of readout patterns and resistive patterns.
- Promising results, full resistive layer with 1mm strips fulfills ePIC's requirements but more testing is needed.