Open Charm Detection: Challenges and Capabilities

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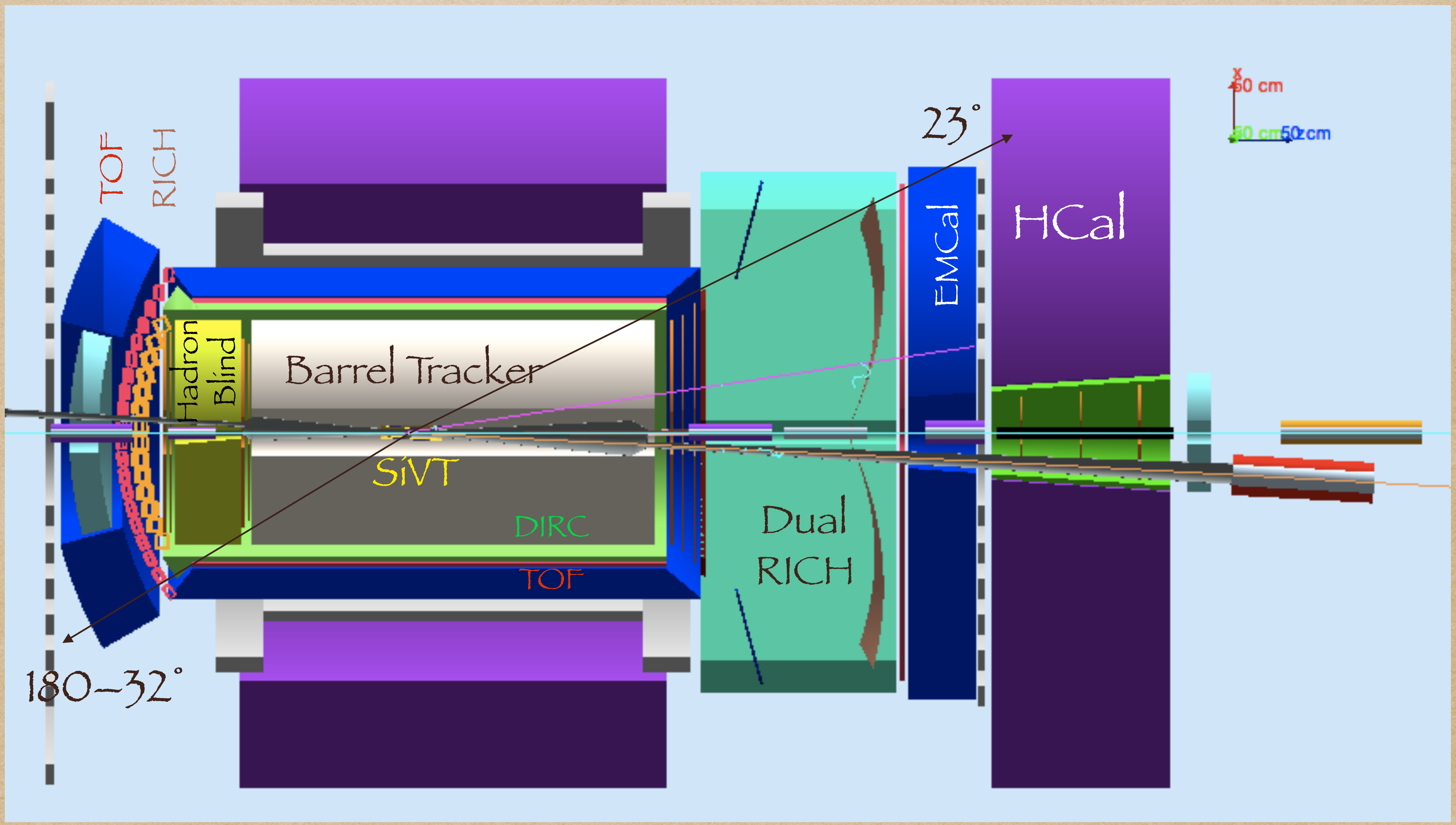
11 May 2016

EIC@JLab Detector Overview

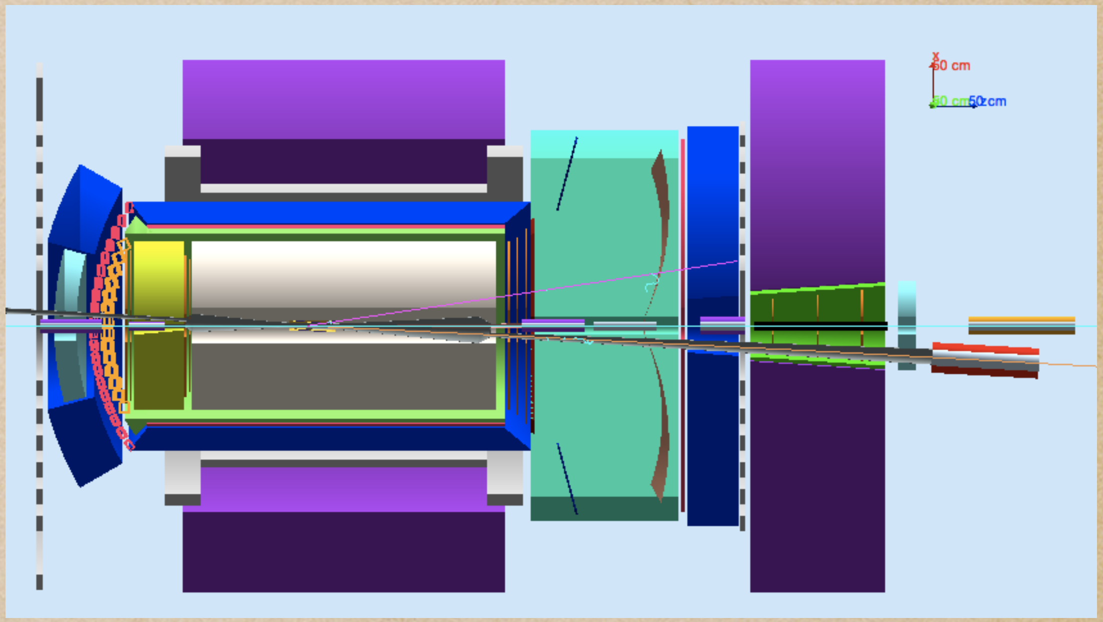
- Full Acceptance
  - Full Particle ID
  - High resolution tracking in 3 Tesla field, 1m radial volume
  - Endcap Hadronic Calorimetry
  - Small angle dipole
- GEMC simulation framework: Options for
  - GEANT4
  - Fast Monte-Carlo
  - But, no Analysis framework in place for EIC yet

Central Detector



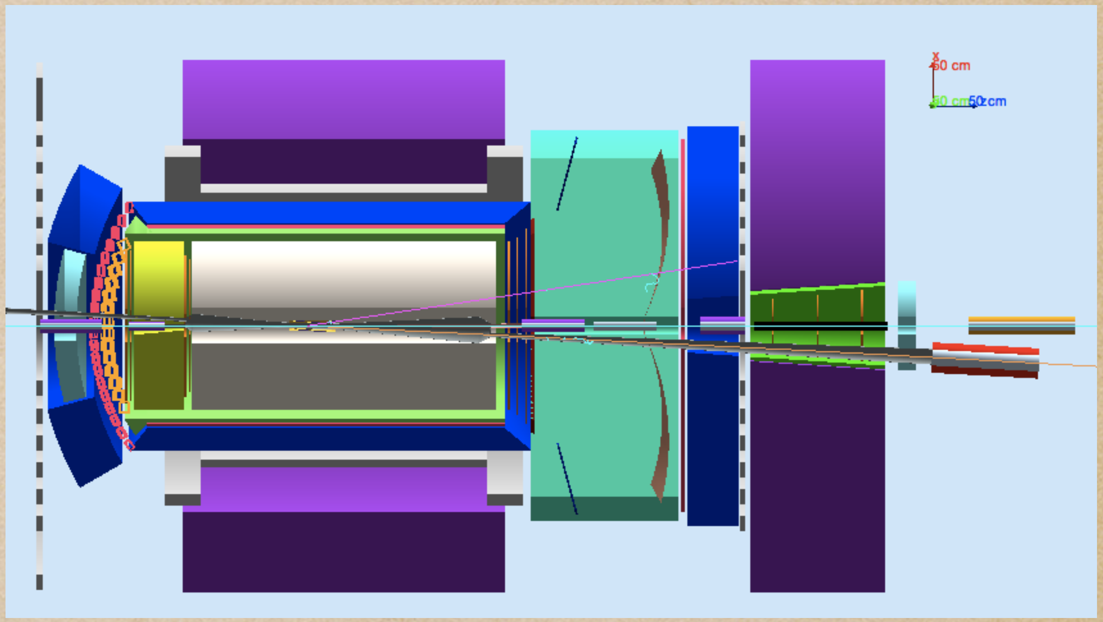
Hadron ID

- e-EndCap: 180°–32° < θ < 179°
  - pi/K/p up to ~10 GeV/c (e-beam limit)
  - Aerogel RICH + TOF
- Barrel 23° < θ < 148°
  - pi/K/p up to ~6 GeV/c
  - DIRC (1 mrad)
    + TOF (<50ps)
- i-EndCap 3° < θ < 23°
  - pi/K/p up to ~50 GeV/c
  - TOF + Dual (Aerogel+CF_4) RICH

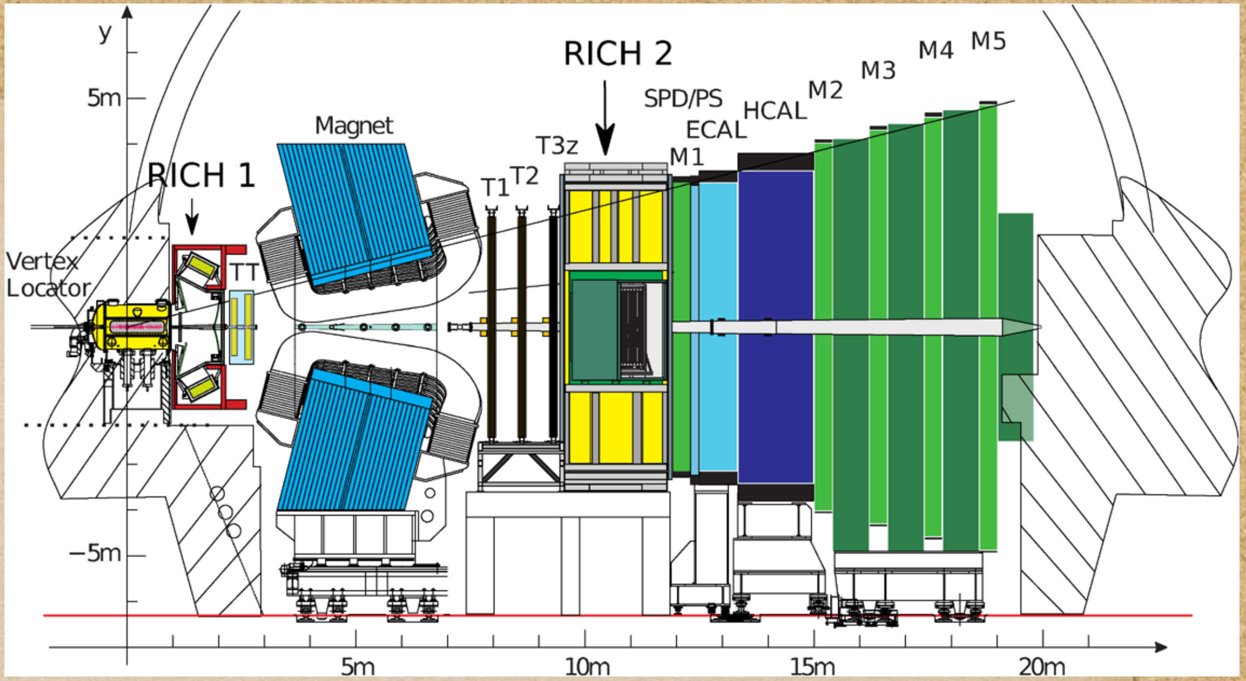


Lepton ID

- e-EndCap: $180^\circ - 32^\circ < \theta < 179^\circ$
    - e/pi: EMCal + Hadron-Blind (Cerenkov)
    - Transition Radiation option
- Barrel $23^\circ < \theta < 148^\circ$
    - e/pi:
        - EMCal
        - DIRC (0.5<p<1 GeV)
        - TRad?
- i-EndCap $3^\circ < \theta < 23^\circ$
    - e/pi: EMCal (+TRad?)
    - mu/pi: HCal (muon tracker needed?)



LHCb: PID



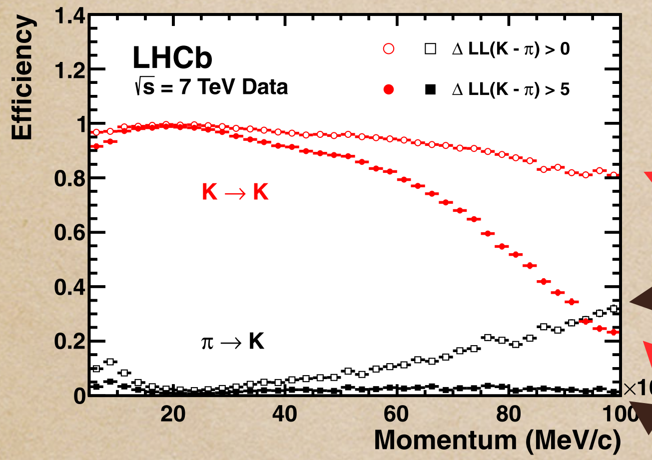


Fig. 17 Kaon identification efficiency and pion misidentification rate measured on data as a function of track momentum. Two different $\Delta \log \mathcal{L}(K - \pi)$ requirements have been imposed on the samples, resulting in the open and filled marker distributions, respectively

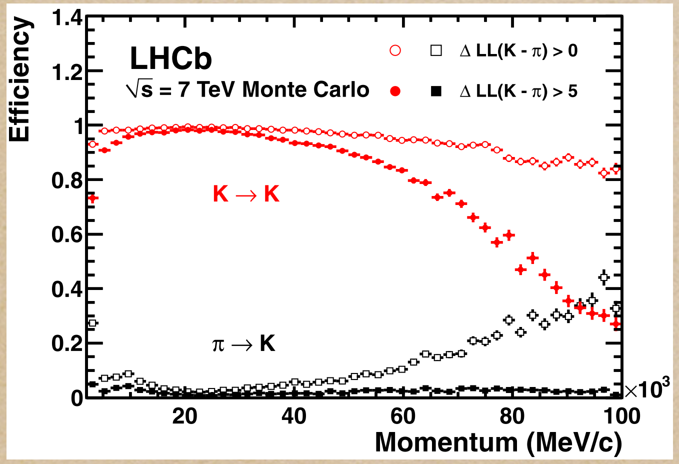
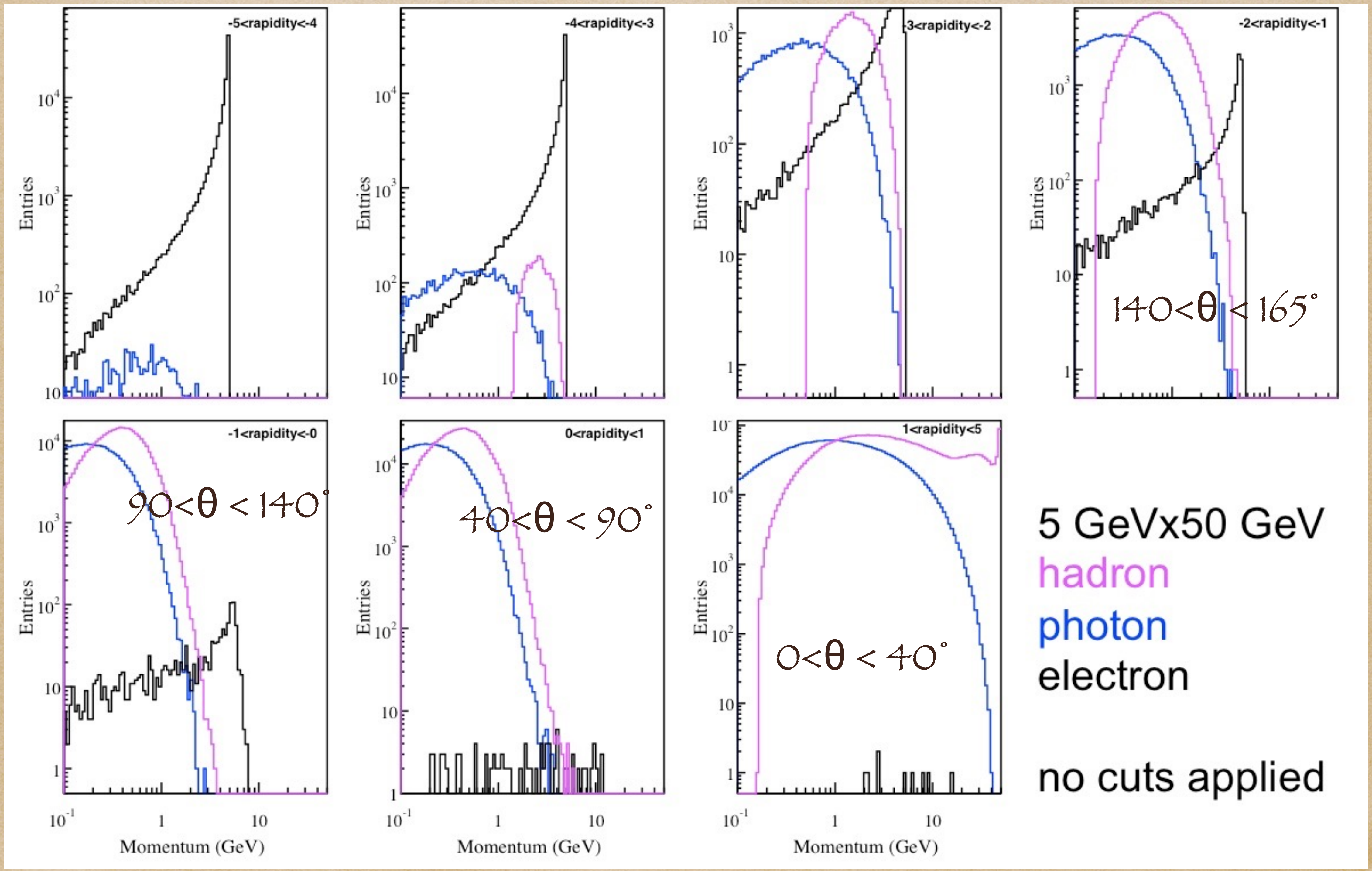


Fig. 18 Kaon identification efficiency and pion misidentification rate measured using simulated events as a function of track momentum. Two different $\Delta \log \mathcal{L}(K - \pi)$ requirements have been imposed on the samples, resulting in the open and filled marker distributions, respectively

- Open symbols:
  - High Efficiency, low purity
- Solid symbols:
  - Low Efficiency, High purity

Particle Fluxes



Short-Term Goals

- Apply GEMC acceptance to Open Charm events
  - Focus on $x_B > 0.05$
- Develop Fast Monte-Carlo parameterizations of Tracking Resolution, PID, Acceptance