Semi-Analytic Model of Particle ID in JLEIC Full Acceptance Detector

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Progress Report: 11 January 2017

Open Charm LDRD

Basic model of Particle ID as a function of p, ϑ, ϕ

- Analytic Tracking in uniform B-field
  - Could be replaced with GEMC look-up table
  - Momentum and angle resolution required for PID detectors (DIRC, RICH…)
- Use resolution estimates of each detector to generate PID cuts/spectra.
- Central
  - DIRC / TOF / Shashlyk EMCal
- Ion Endcap
  - Dual RICH / TOF / Shashlyk EMCal.
- Forward Dipole

Sample Parameters

- Central Tracker
  - X/X0 = 1%/sinθ
  - Sagitta resolution = 200 μm
- Barrel PID
  - DIRC $\delta\theta_C$ = 1mrad $\oplus$ $\delta\theta_{Track}$
  - TOF resolution = 40 psec
- EndCap
  - Dual RICH, parameters tbd (A. Deldotto)
  - TOF resolution = 40 psec
- Forward Tracker (Dipole 1 only)
  - 10 mrad < θ < 80 mrad
  - Sagitta resolution = 100 μm (GEM Trackers)

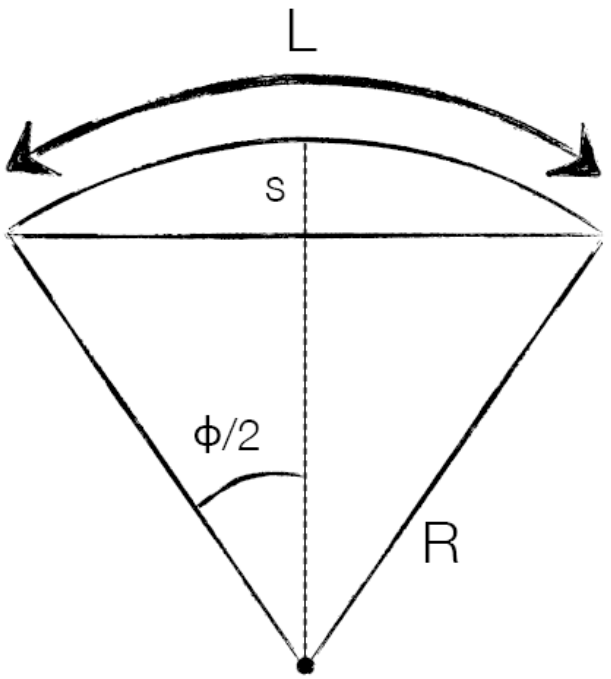
Prototype c/root modules

- For a given initial p,θ,ϕ, compute:
  - Path Length to PID detectors
  - Initial/Final angle resolution
  - Momentum resolution
  - PID detectors impacted
  - PID performance

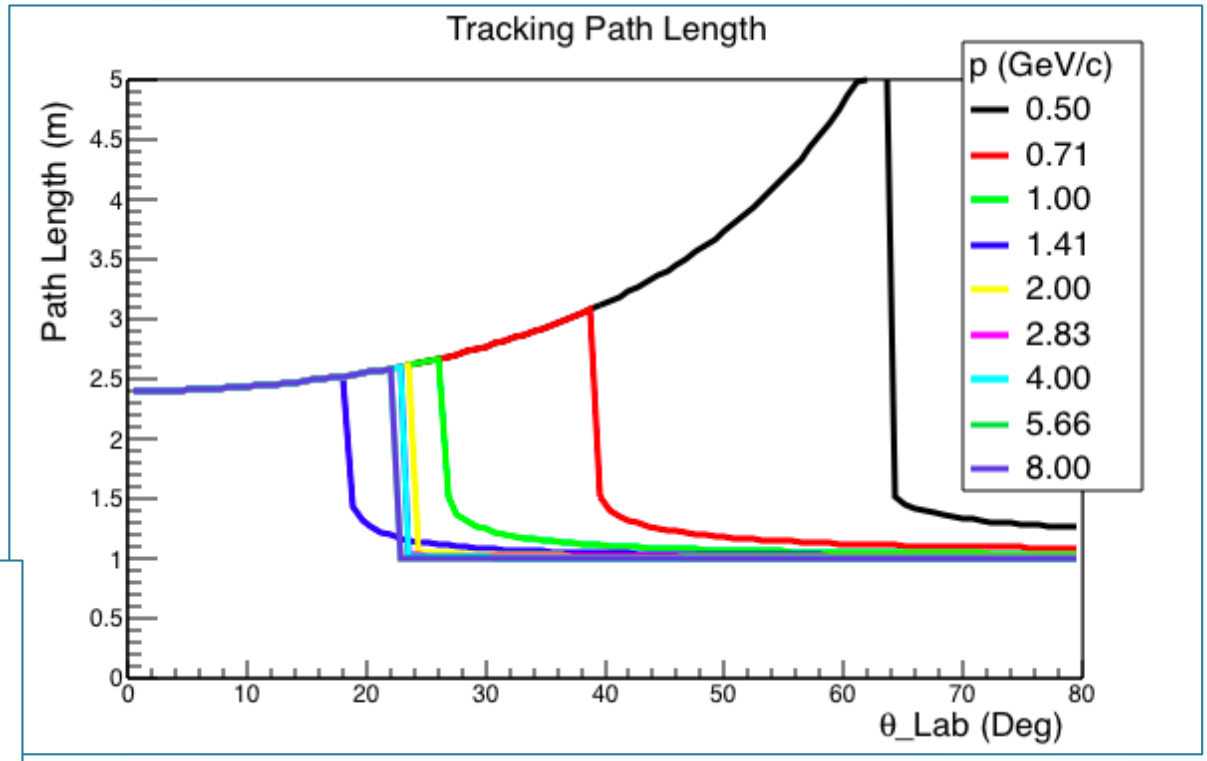
Currently Implemented

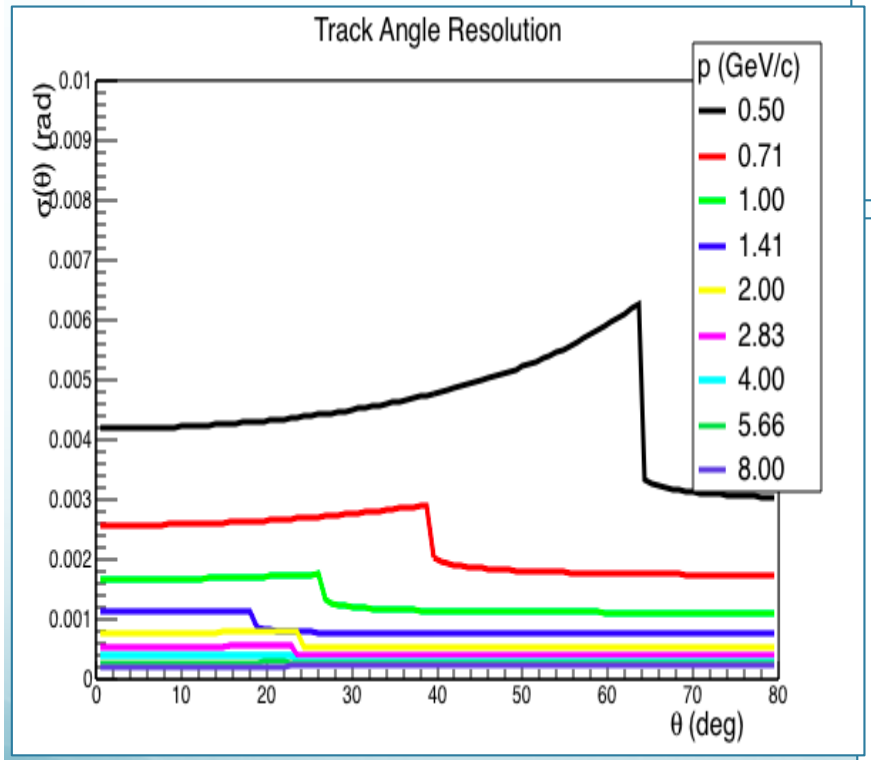
- A simple driver to evaluate modules
  - Tracking, Central and Forward
    - $\sigma_p/p = \sigma_{sagitta}/s$
    - Tracking should use Gluckstern:
    - I am currently using a fixed $\sigma_{sagitta}$
  - Barrel DIRC PID
  - TOF

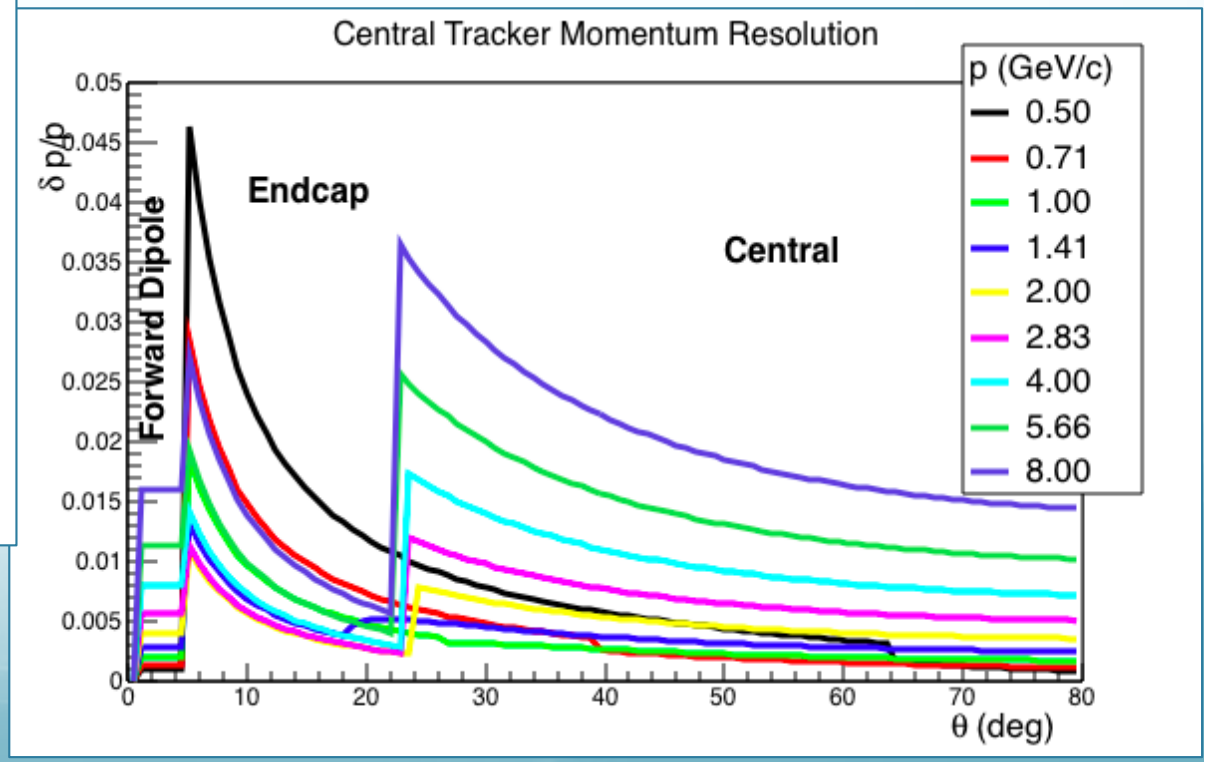
$$\sigma_s = \frac{\sigma_{r\phi}}{8}\sqrt{\frac{720}{N+5}} \quad s$$



Tracking Results

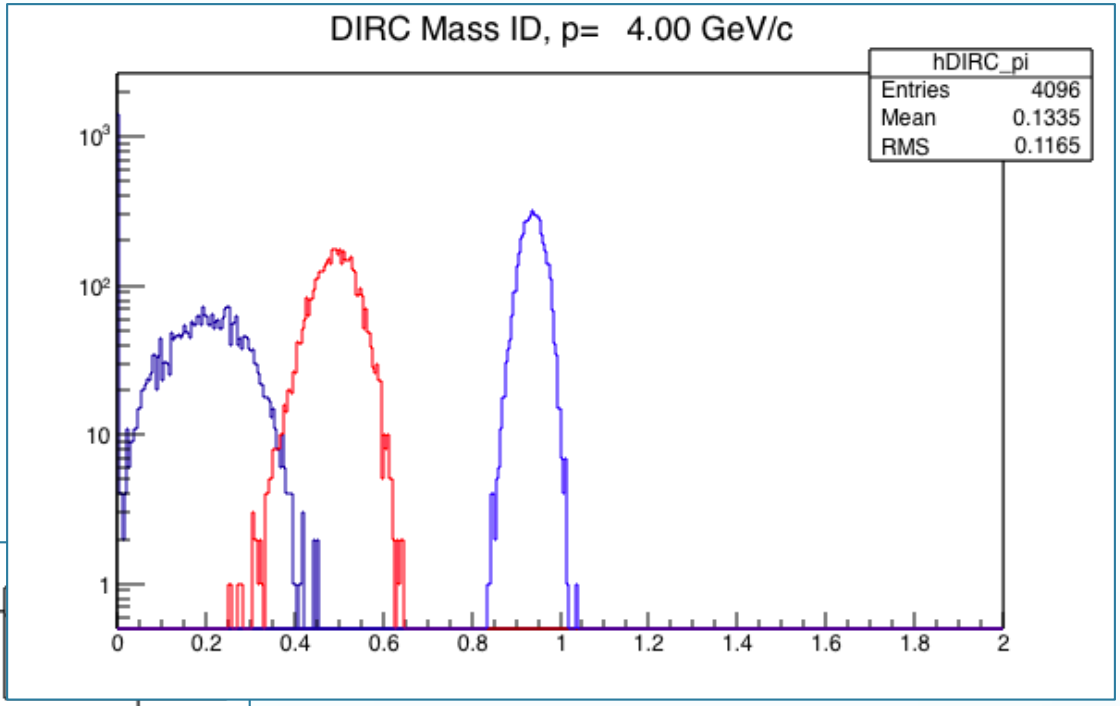


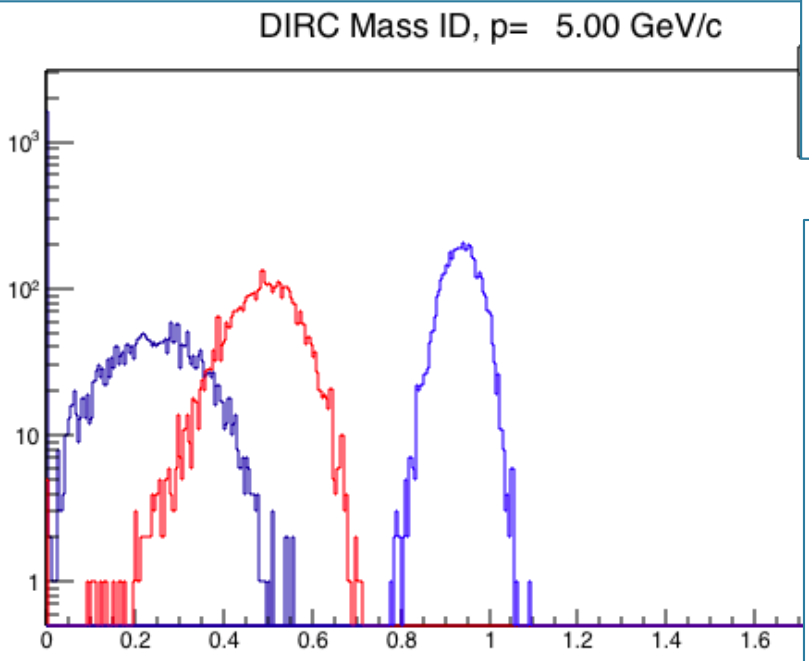


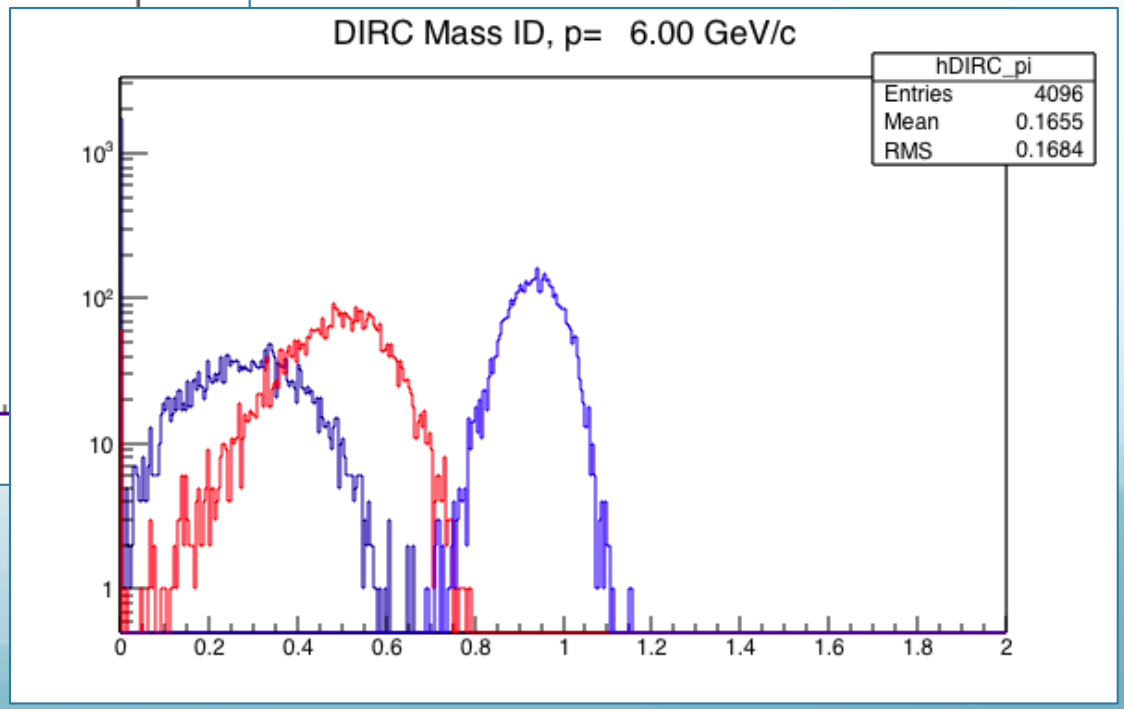


DIRC Performance

- $1 \oplus 1$ mrad θ_C resolution

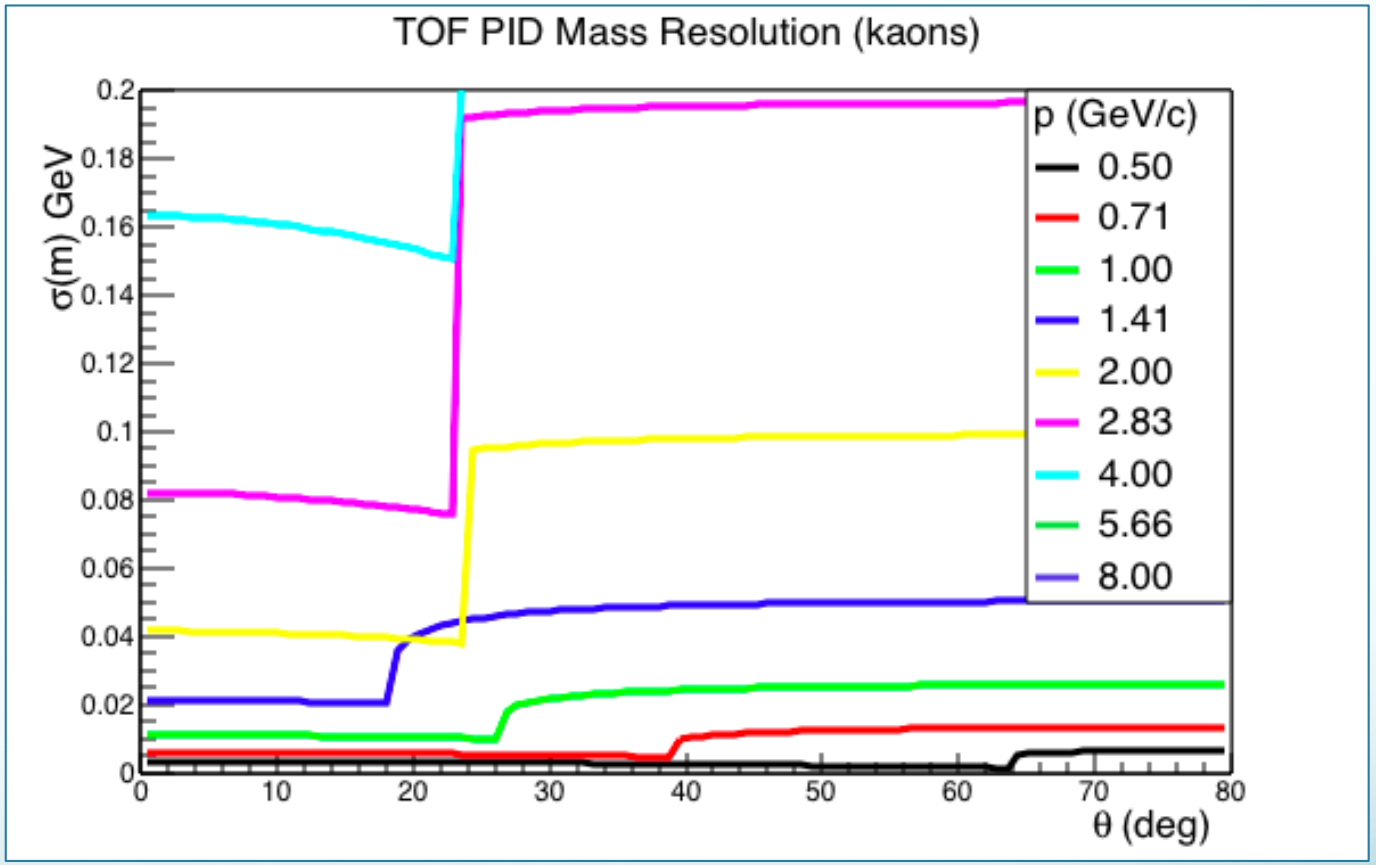






TOF Performance: Kaons

- Barrel & Endcap
- Next:
  - Make PID plot like DIRC plot
  - Combine mass ID from multiple detectors



Outlook

- Detailed write-up available on wiki
- Refine tracking analysis
- Use look-up tables for detector acceptance (detector is not azimuthally symmetric)
- Include Dual RICH performance
- e/h ID?
- Convert to stand-alone modules