Energy Correction to the Electron Going into the Forward Tagger

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for the CLAS Collaboration

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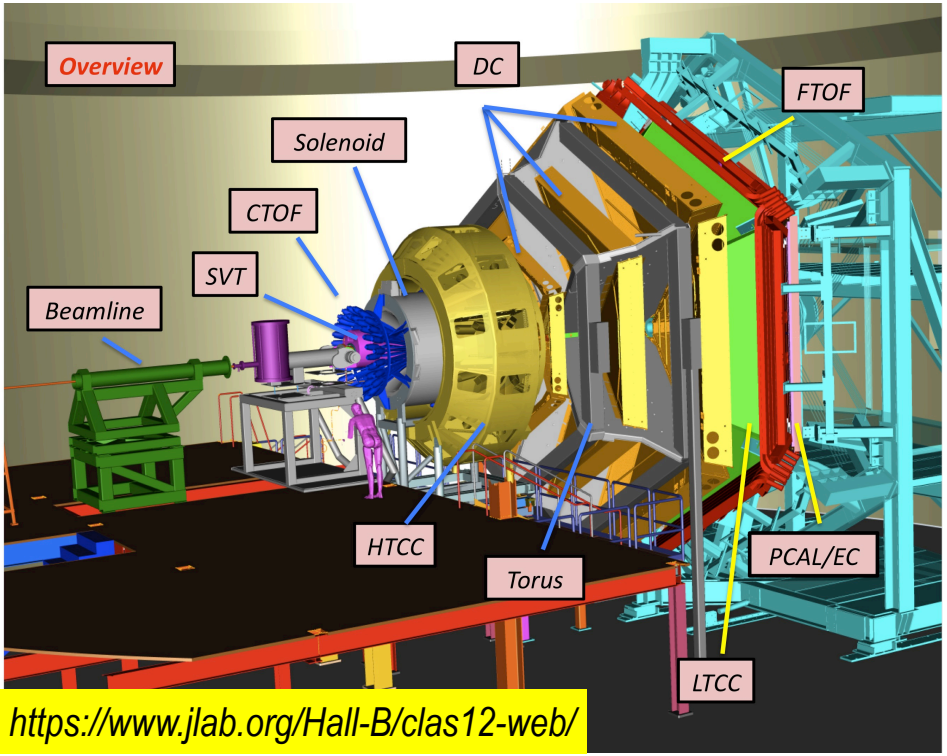
Motivation

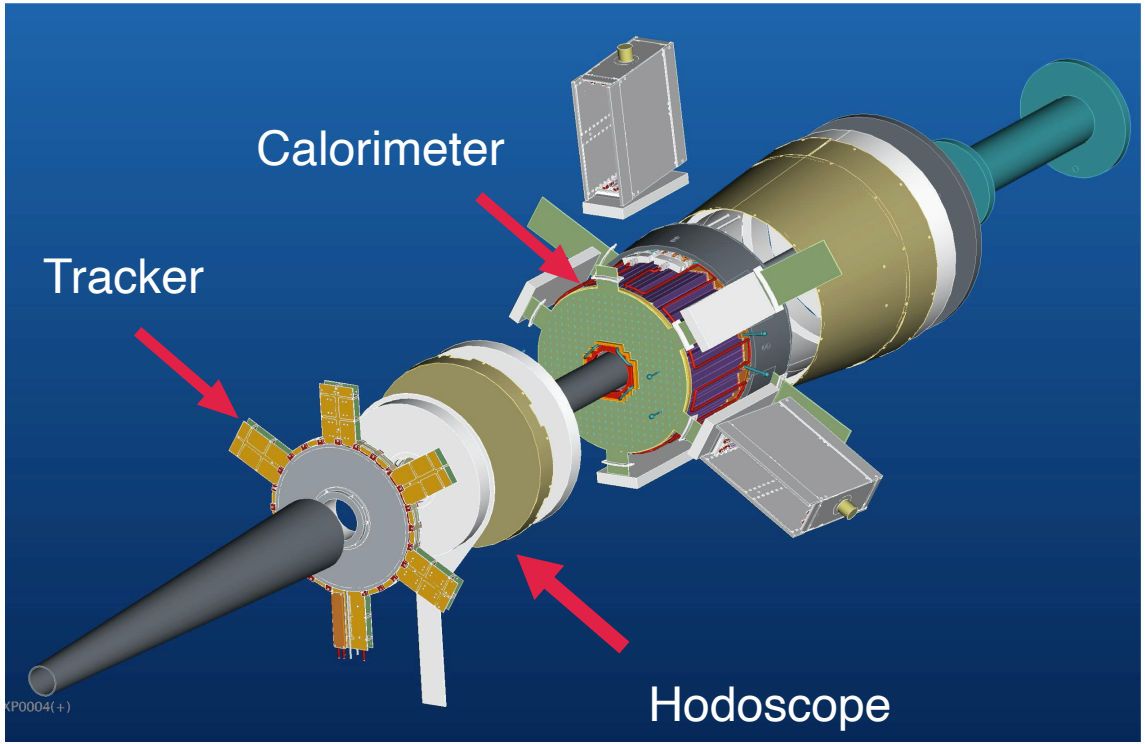
- Reconstruction of reactions multi-final state particles use Missing Mass technique, and it requires a good scattered electron reconstruction, I.e.
  - $ep \rightarrow e'K^+K^+\Xi^-$, where $\Xi^- \rightarrow \pi^-\Lambda$, and $\Lambda \rightarrow p\pi^-$
  - $ep \rightarrow e'K^+K^+K^0\Omega^-$, where $\Omega^- \rightarrow K^-\Lambda, K^0 \rightarrow \pi^+\pi^-$, and $\Lambda \rightarrow p\pi^-$
- Alternative method required to validate the Forward Tagger calibration
- Essential for quasi-real photons experiments

Overview of CLAS12 Detector



- Forward Detector
  - High Threshold Cherenkov Counter (HTCC)
  - Torus Magnet
  - Drift Chambers
  - Low Threshold Cherenkov Counter (LTCC)
  - Forward Time Of Flight (FTOF)
  - Electromagnetic Calorimeters (PCAL & EC)
- Central Detector
  - Silicon Vertex Trackers (SVT)
  - Central Neutron Detector (CND)
  - Central Time Of Flight (CTOF)
  - Solenoid
- Forward Tagger

Forward Tagger



FT-Cal: Homogeneous $PbWO_4$ crystals that identifies electrons, measure the electromagnetic shower energy and provide a fast trigger signal

FT-Hodo: Scintillator counter that provides e/γ separation

FT-Trck: MicroMegas detectors measure the scattering angles with the required accuracy

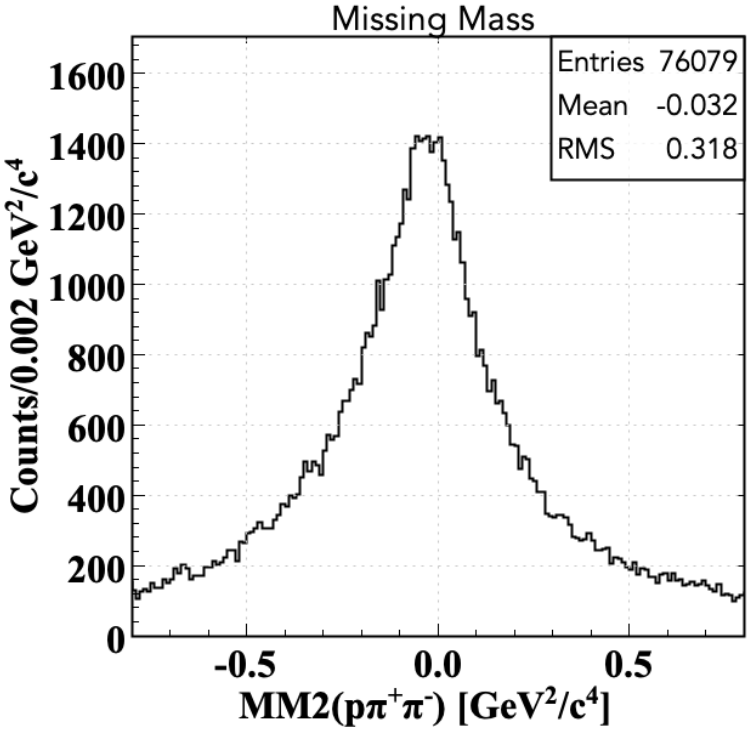
Forward Tagger

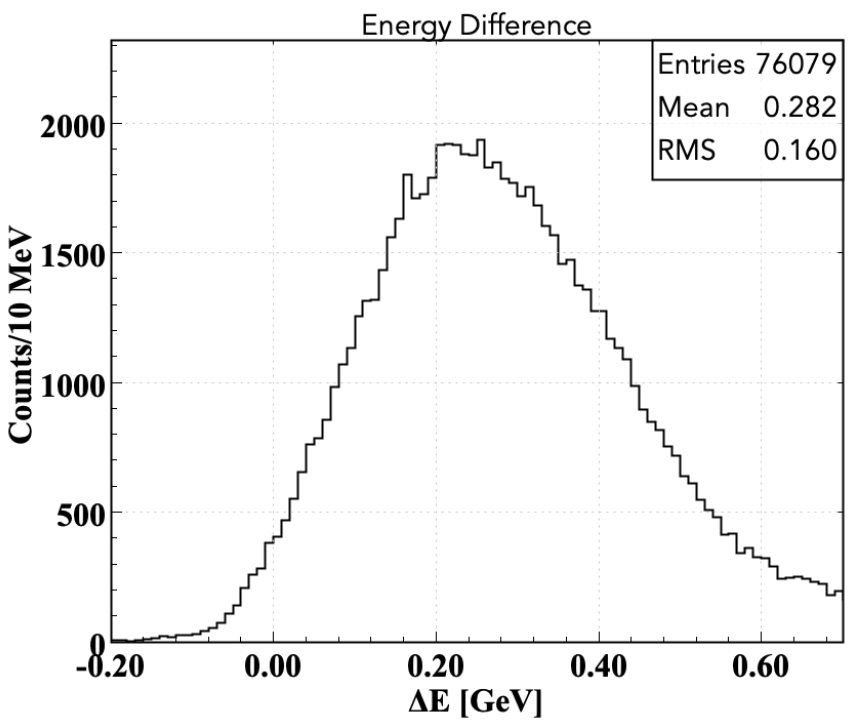
- Detects electron and photons at small angles ($2.5 < \theta_{lab} < 4.5$ degrees)
- Enables experiments at low-Q^2 ($10^{-2} - 10^{-1} GeV^2$) by providing:
  - Energy-tagged electron
  - Plane of polarization

Event Selection and Methodology

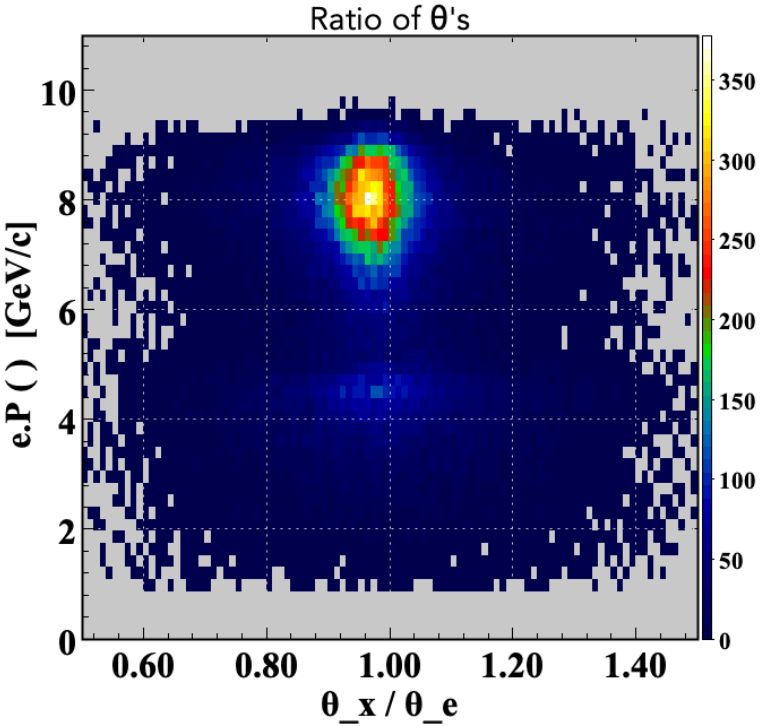
- Simple reaction with the scattered electron in FT
  - $ep \rightarrow e'p\pi^+\pi^-$
- Treat the scattered electron as a missed particle I.e.
- Using the four-momentum of the missing particle to calibrate the detected electron

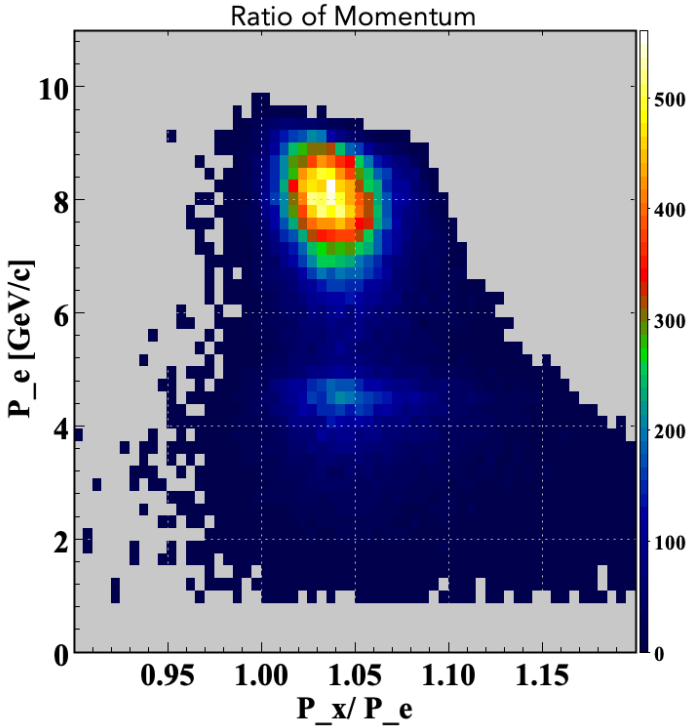
Event Selection and Methodology



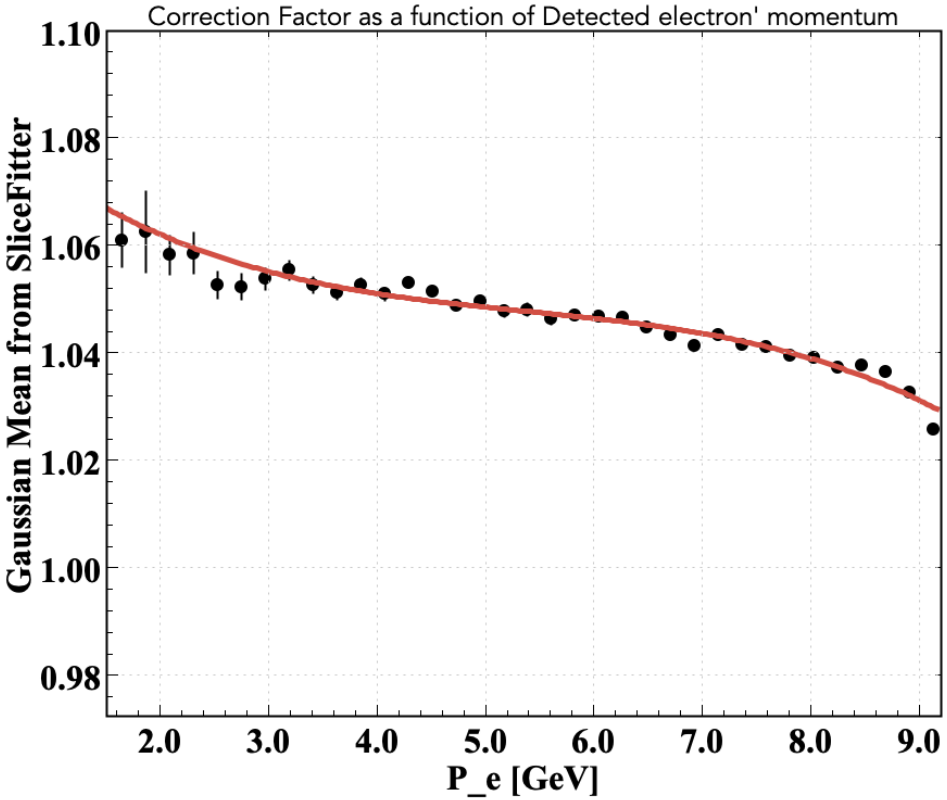


Event Selection and Methodology





Correction Factors

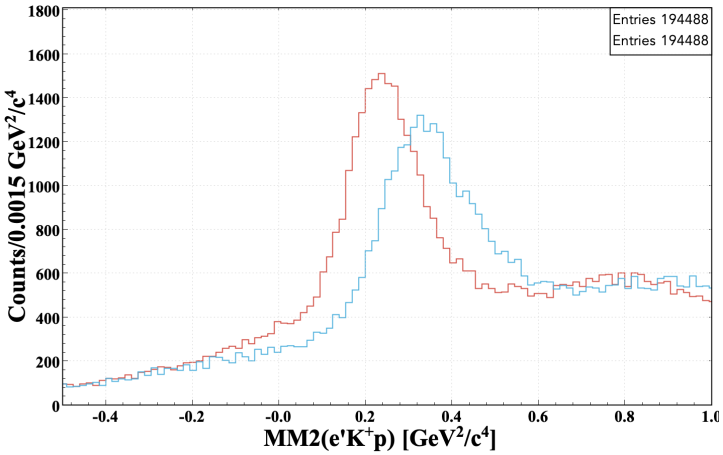


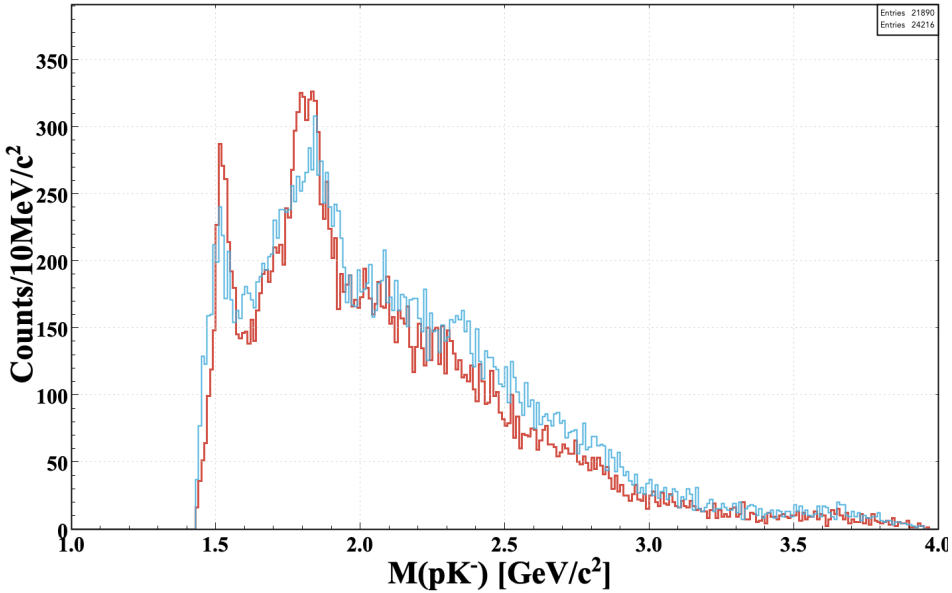
- Fit (any) empirical Function
  - Constant
  - Linear
  - Higher Order Polynomials
  - Rational
  - Etc

$$CF = 1.0888 - 0.0189 * P_e + 0.0031 * P_e^2 - 0.0002 * P_e^3$$

Applying Correction (RGA Data; Beam Energy 10.6 GeV)

$$ep \rightarrow e'\Lambda^{*}K^{+} \rightarrow e'K^{+}p(K^{-})$$

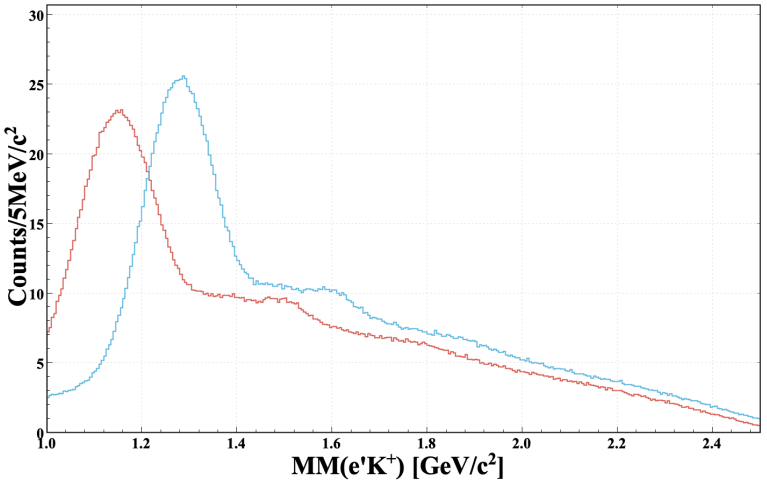


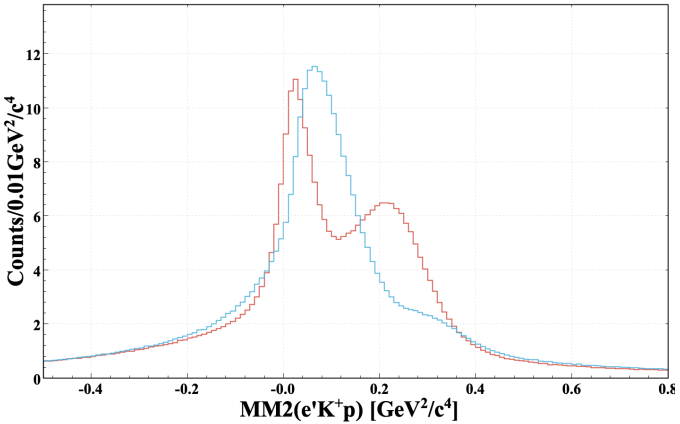


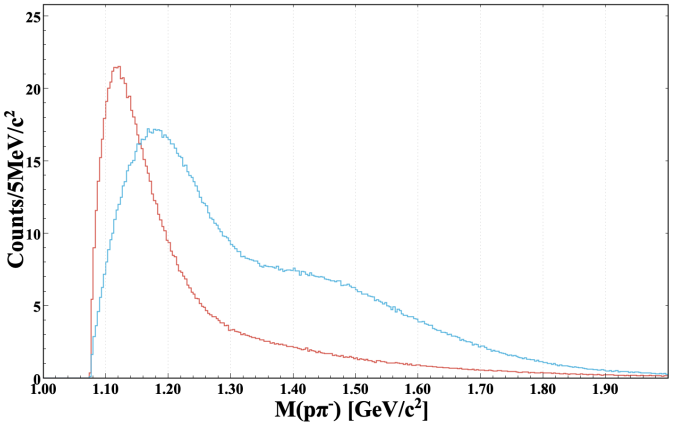
— Before correction
— After correction

Applying Correction (RGK Data; Beam Energy 7.5 GeV)

$$ep \rightarrow e'\Lambda K^+ \rightarrow e'pK^+X$$







— Before correction
— After correction

Conclusions

- The correction improves the momentum resolution of the scattered electron
- Can be used to validate Calibrations in the Forward Tagger
- This is still a work in progress
  - θ correction should be the next step