### Reconstruction accuracy and resolution comparison using exclusive reactions between data and simulation

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November 14, 2019





### Objective

- Studies of tracking accuracy and resolution for the inbending 10.6 GeV data from DNP cooking compared to GEMC simulations for the following exclusive channels:
  - ep -> ep
  - ep -> e p π<sup>0</sup>
  - ep -> e n π<sup>+</sup>

- ep -> e p π<sup>+</sup> π<sup>-</sup>
- ep -> e p K<sup>+</sup> K<sup>-</sup>
- UConn group: David Riser, Andrey Kim, Stefan Diehl,
  F.X. Girod, Brandon Clary.



### **Elastic Scattering**

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If you know two of these, you can calculate the other three.



Data Run Period	RG-A F18, <b>10.6 GeV</b>
Total Runs	64
Torus Field	Electron Inbending (full strength)
Location	/work/clas12/rg-a/trains/v16_v2/skim4_inclusive/

Event Generator	Elastic + Radiative Effects (ESEPP)
Total Events Gen	20M
Torus Field	Electron Inbending (full strength)
Torus Field	Electron Inbending (full strength)





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### **Elastic Scattering - W spectrum**





### Elastic Scattering - W spectrum after $\phi_e - \phi_p$ cut





### Elastic Scattering - $\phi_e - \phi_p$ spectrum after W cut





## Elastic Scattering - $p_e$ and $\theta_e$ spectra from data and simulaton





## Elastic Scattering - $p_p$ and $\theta_p$ spectra from data and simulaton



class

#### Elastic Scattering - $\theta_e vs p_e$ spectra from data and simulaton





## Elastic Scattering - - $\phi_e - \phi_p$ spectra from data and simulaton



#### Elastic Scattering - W spectra from data and simulaton



# Elastic Scattering - W peak and resolution from data and simulaton





#### Elastic Scattering - $\Delta \theta_e$ spectrum from simulations



class

#### Elastic Scattering - $\Delta p_e$ spectrum from simulations



#### Elastic Scattering - $\Delta p_e$ spectra using electron angle from data and simulation



#### Elastic Scattering - $\Delta \theta_p$ spectrum from simulations



## Elastic Scattering - $\Delta \theta_{p}$ spectra using electron angle from data and simulation





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# Elastic Scattering - $\Delta E_{beam}$ spectra using two angles ( $\theta_e$ , $\theta_p$ ) from data and simulation



#### Elastic Scattering - $\Delta p_p$ spectrum from simulations





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## Elastic Scattering - $\Delta p_p$ spectra using electron angle from data and simulation



#### ep -> e p $\pi^0$ - MM<sup>2</sup> spectra from data and simulation



### ep -> e p $\pi^0$ - MM<sup>2</sup> vs $\theta_p$ spectra from data and simulation



#### ep -> e p $\pi^0$ - MM<sup>2</sup> spectra from data and simulation





MM2(GeV<sup>2</sup>)

#### ep -> e p $\pi^0$ - MM<sup>2</sup> spectra from data and simulation



25

#### ep -> e p $\pi^+ \pi^-$ MM<sup>2</sup> spectra from data and simulation



#### ep -> e p $K^+K^-$ - MM<sup>2</sup> spectra from data and simulation





## Summary

- Extensive tracking accuracy and resolution studies are under way using various exclusive channels.
- The momentum corrections for electrons and hadrons using exclusive channels are under way.
- Next step would be resolution matching between Data and simulations for missing mass, angular and momentum resolutions using DOCA smearing in GEMC.
- GPP type program could be developed if needed, which could save time since the procedure requires many trial and errors.
- Smearing factors could be applied to other analyses such as SIDIS or Inclusive analyses
- The above steps should be repeated as software improves and new cooking data come up.
- Kinematic fitter may be used for exclusive channels: the program is ready but requires accurate covariance matrix elements, which is also essential for alignments.

