

# Resolution study

## GEMC, Data, Kinematic Fit

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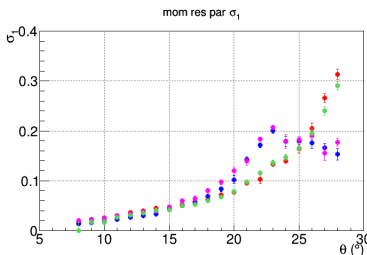
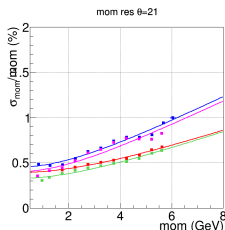
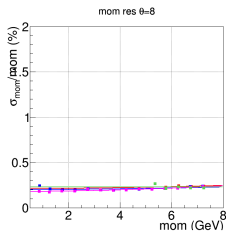
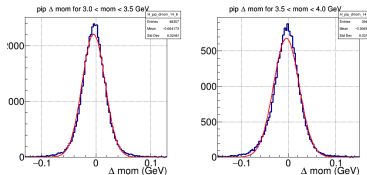
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Nov 14<sup>th</sup> 2019



# GEMC Resolutions for $e$ , $p$ , $\pi^+$ , and $\pi^-$

- Step 1: fit  $\sigma_p = p_{rec} - p_{gen}$ ,  $\sigma_\theta$ , and  $\sigma_\phi$  in bins of  $\theta$  and  $p$
- Step 2: fit the gaussian width parameter vs  $p$  for each  $\theta$  bin
- Step 3: obtain resolution parameterization vs  $p$  and  $\theta$

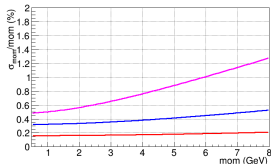


Parameterizations:  $\frac{\sigma_p}{p} = \sqrt{\sigma_1^2 p^2 + \left(\frac{\sigma_2}{\beta}\right)^2}$ ,  $\sigma_{\theta, \phi} = \sqrt{\sigma_1^2 + \left(\frac{\sigma_2}{p\beta}\right)^2}$

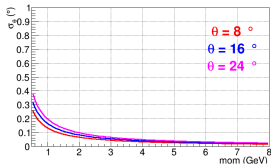


# GEMC Resolutions for $e$ , $p$ , $\pi^+$ , and $\pi^-$

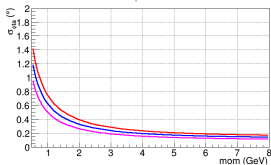
DC momentum resolutions



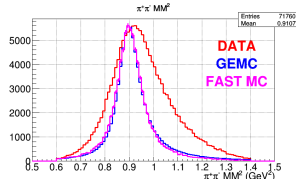
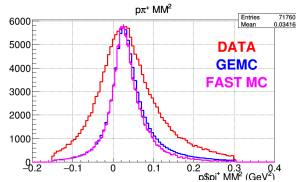
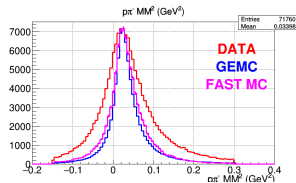
DC  $\theta$  resolutions



DC  $\phi$  resolutions

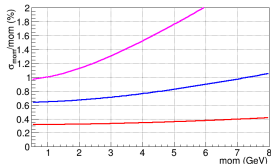


- Input resolution functionals into fast MC
- Simulate exclusive two pions production in fast MC
- Exclusive resolutions GEMC matches fast MC
- GEMC hadron energy loss  $\approx 5$  to 8 MeV, depends on angle

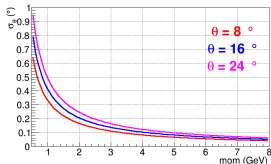


# Data Resolutions for $e$ , $p$ , $\pi^+$ , and $\pi^-$

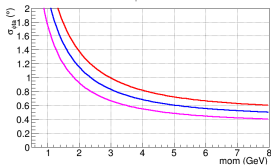
DC momentum resolutions



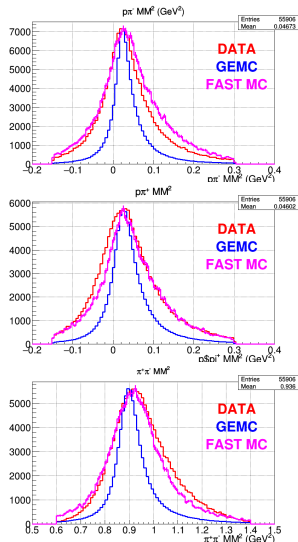
DC  $\theta$  resolutions



DC  $\phi$  resolutions



- Use resolution functionals with a smear factor into fast MC
- Adjust fast MC exclusive reaction resolutions onto data
- Momentum resolution twice worse, angle smear factor  $\approx 3$
- Data hadron energy loss  $\approx 15$  MeV, depends on angle

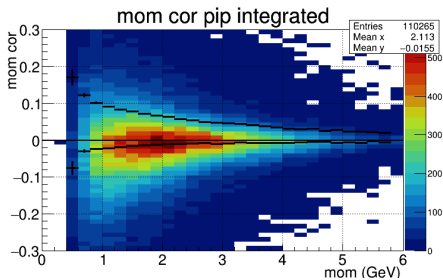


# Resolutions and Kinematic Fit

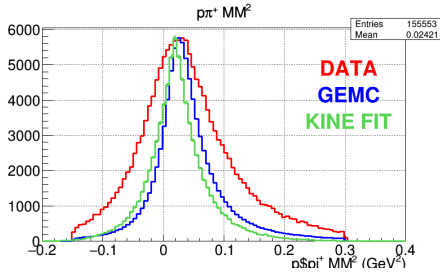
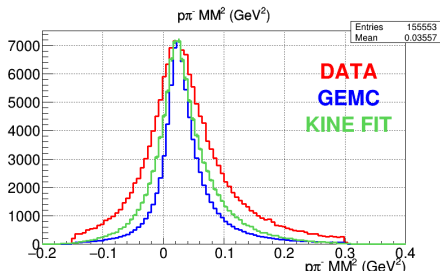
- Input resolutions into Fast MC
- Ad-hoc factors to adjust Fast MC to data
- Perform kinematic fit

Evidence for hadron energy loss:

$$\text{mom cor} = \delta = \frac{p_{\text{prec}} - p_{\text{fit}}}{p_{\text{prec}}}$$



Next step: cross-check results with other reaction: radiative elastic, neutron  $\pi^+$ , ... (?)



# Summary, prospect

- Resolutions for electrons, protons, positive and negative pions
- Resolutions for momenta, polar and azimuthal angles
- Parameterized as functionals of momenta, angles, and mass
  
- Fast MC able to reproduce GEMC resolutions on exclusive reaction
- Data resolutions smear factors two to three times worse
- Kinematic fit can bring data resolution close to GEMC
- Evidence for energy losses of hadrons
  
- Extend kinematic fitting: other reactions, other methods, cross-check findings
- Make use of tracking error matrix into kinematic fitting
- Make use of actual energy loss and multiple scattering formalism
  
- Apparently duplication of efforts: better coordination?

