Brookhaven National Laboratory

U.S. DEPARTMENT OF ENERGY

ePIC Performance on Coherent J/ψ Diffractive Pattern

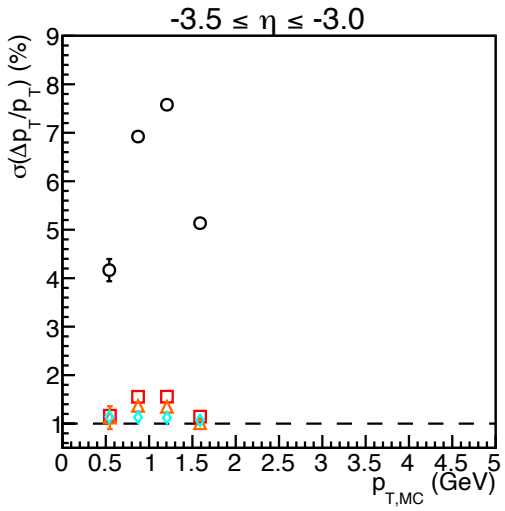
Cheuk-Ping Wong

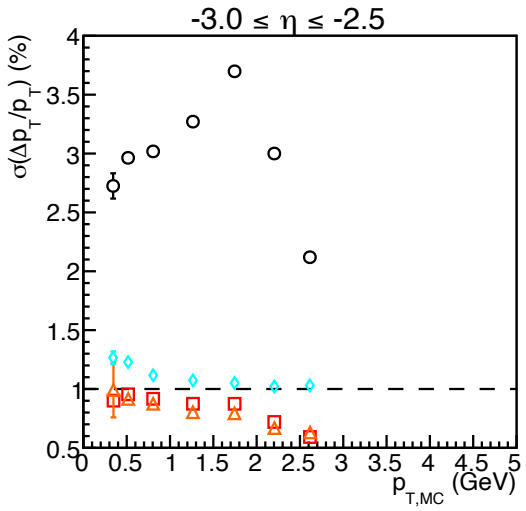
12-11-2023

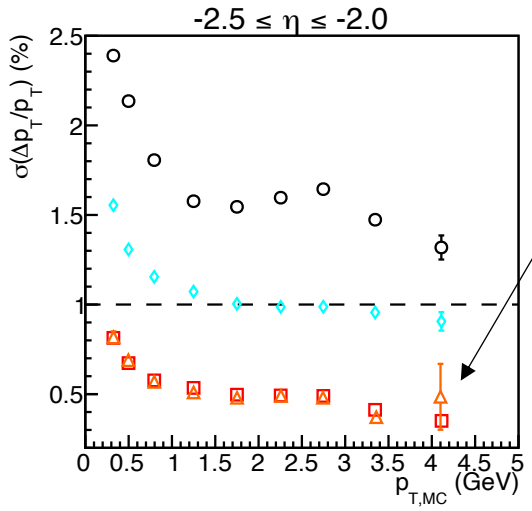
@BrookhavenLab

Detector Simulation Tracking Performance

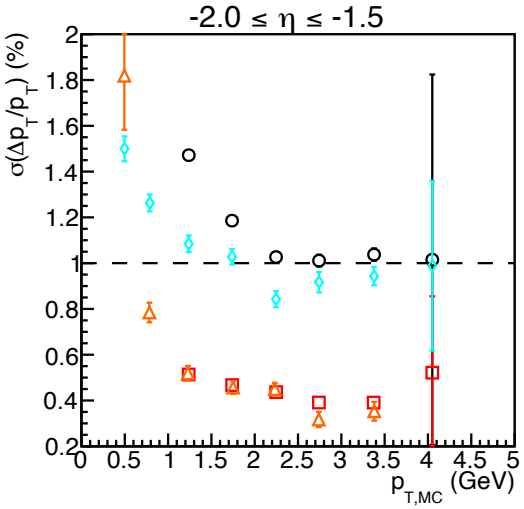
Transverse Momentum Resolutions with e-

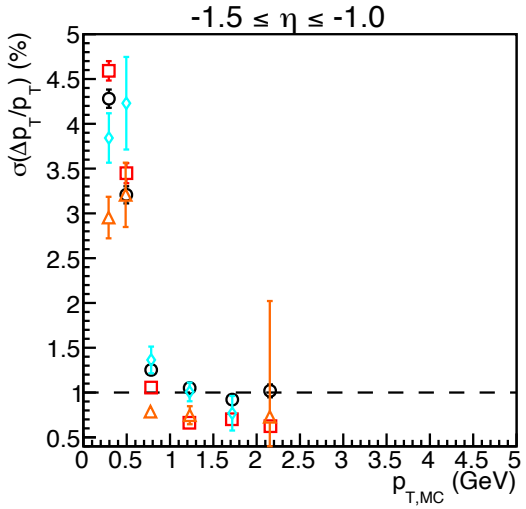






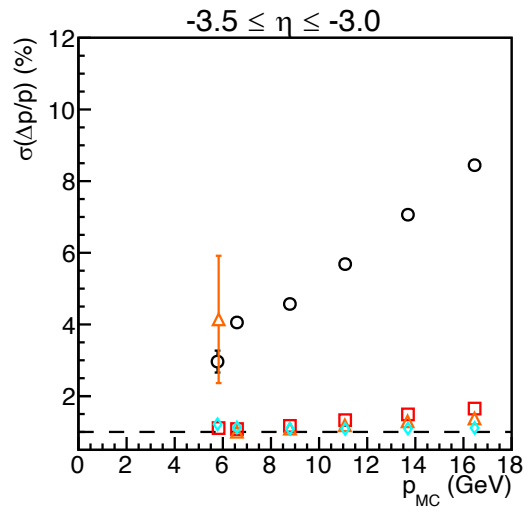
- Flat at high p_T
  → Possibly not a resolution issue, but a material budget issue
- Is it the air?

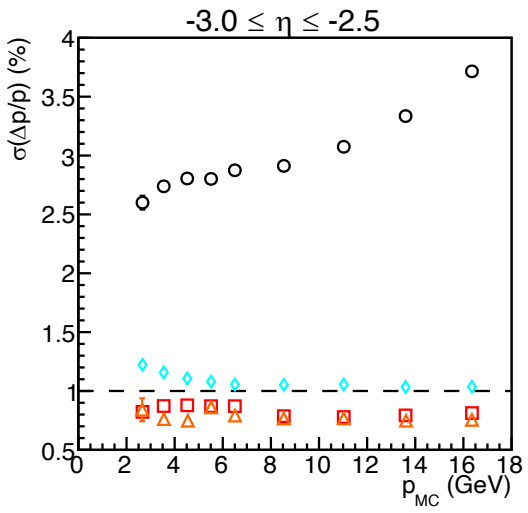


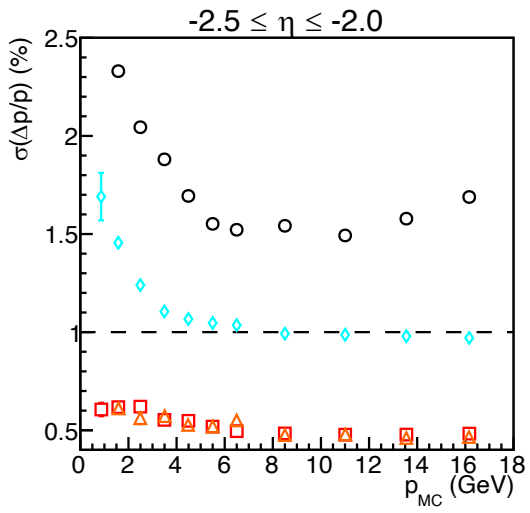


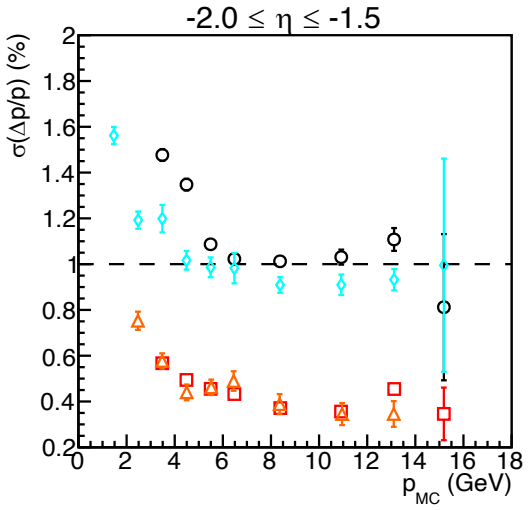
- ePIC
- t_{sup}=0um,7 Si,t_{Si}=5um,pix=10um,B=2T,z_{max}=190cm, no BP
- t_{sup}=0um,8 Si,t_{Si}=5um,pix=10um,B=2T,z_{max}=600cm, no BP
- Ecal e

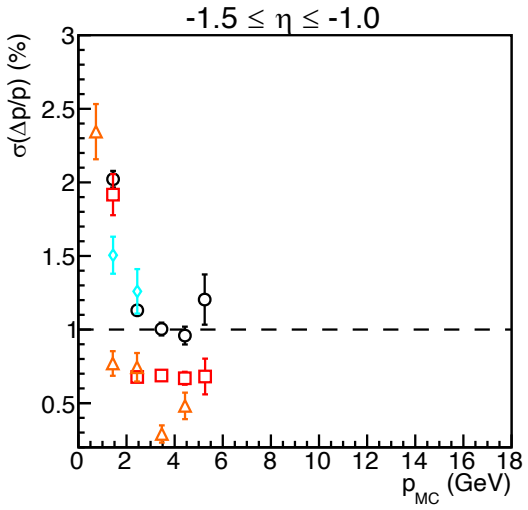
Momentum Resolutions with e^-











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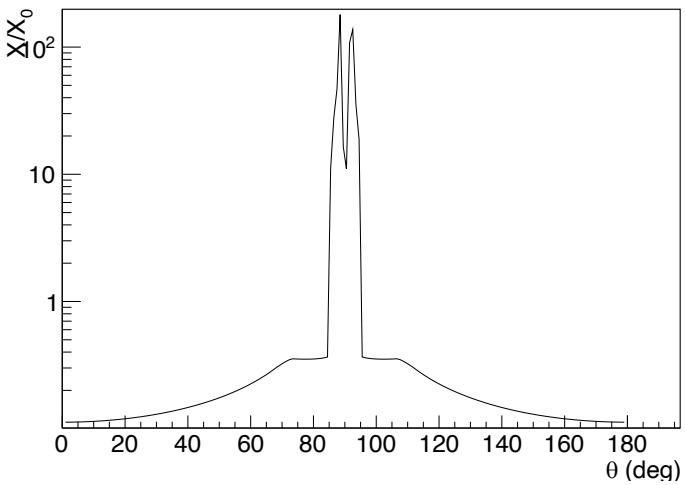
Material Budget



pingwong 9:13 AM

Here the material budget of the central beampipe that I generated. It is clearly wrong. But I am not sure what I did wrong. I did the following.

npsim --runType vis --macroFile run1.mac --compactFile $DETECTOR_PATH/

Inside run1.mac:
/run/initialize
/control/matScan/phi 10 0 360. deg
/control/matScan/theta 180 0 180. deg
/control/matScan/scan

I didn't change the world material from Air to Vacuum, so x/x0 is very high. But the shape is what puzzles me.

mat_BP.pdf
PDF 14KB

Wouter Deconinck (he/him) 9:21 AM

Yeah, that's strange.

shyamkumar 11:22 AM

@pingwong This was an example I given using GEANT4 but I always do using GeoManager and I shared that script with @matt_posik only which is a bit simpler. If @Wouter Deconinck (he/him) want we can upload to epic can be useful for detector implementation. Again GEANT4 and GeoManager uses same approach. *Edited*

If you want I can explain in the next meeting if it can be helpful.

pingwong 11:30 AM

@shyamkumar Can you share the script?

shyamkumar 12:02 PM

Sorry, I forget to tell about script we have already an official script in EICRecon somewhere which can be used for which there is already instructions.

pingwong 3:41 PM

Can you point me to the script in EICRecon?

New Messages

shyamkumar 4:53 AM

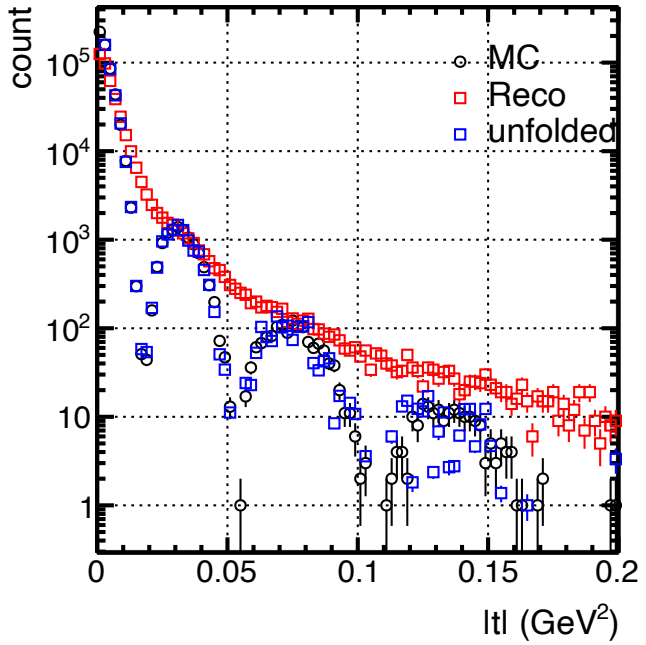
May be @Shujie Li can tell this?

Unfolding

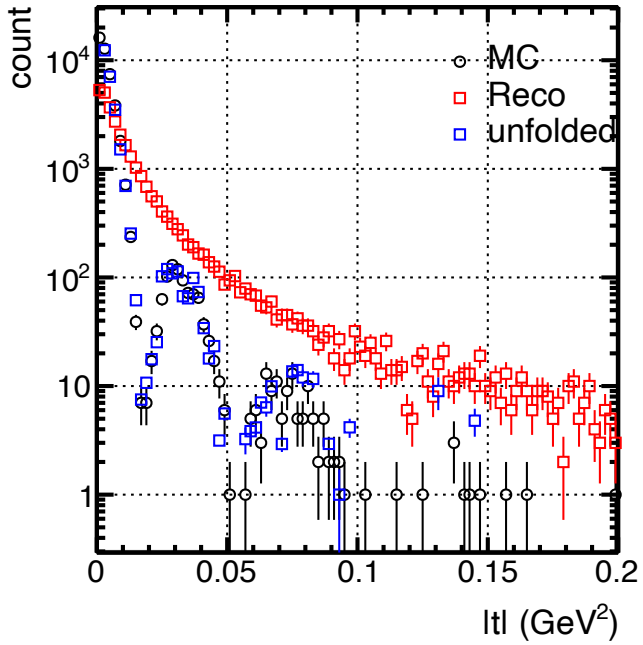
Unfolded t Distributions

- No muon ID
- Bayesian unfolding, 1 iteration
- Training sample of 200k events
- Unfolded histogram with 1.6M events
- Too good. Way too good

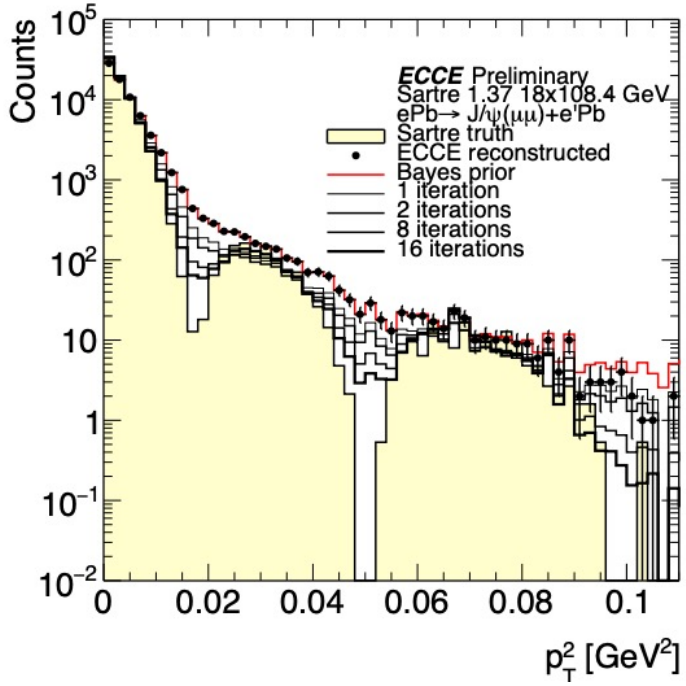
$1 < Q^2 < 10\ GeV^2$



$10 < Q^2 < 100\ GeV^2$



Peter Steinburg, ECCE



https://indico.bnl.gov/event/18385/contributions/73101/attachments/46047/77833/Steinberg_EICUG20230216.pdf

Summary

- Momentum resolution shows minimal changes with a long tracking disks distance (6m)
- Trying to generate material budgets
- First look at unfolding: possibly over-trained

Backup

Simulation Setup

Sartre

- eAu at 18x110 GeV
- $Q^2 \geq 1$ GeV^2
- Coherent events only
- Forced $J/\psi \rightarrow l^+ l^-$
- No background

Detector

- epic-2023.10.0
- epic_craterlake_18x110_Au.xml

Data Selections and Reconstructions

Single electron selection

If the electron $\eta < -2.5$, use Ecal energy instead of momentum from tracking

$\boldsymbol{J/\psi}$ reconstruction

- |pid| = 11
- Opposite charges cut on dilepton pair

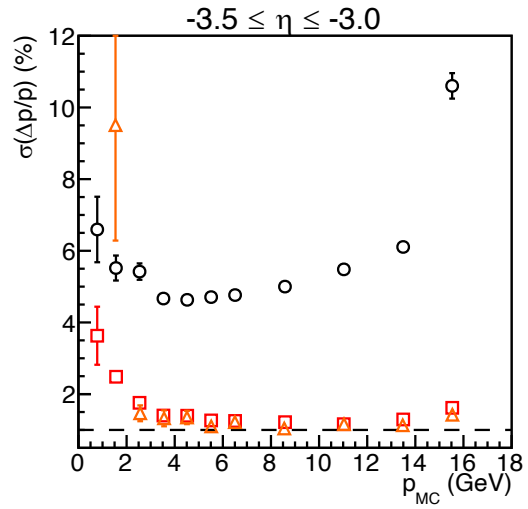
Q^2

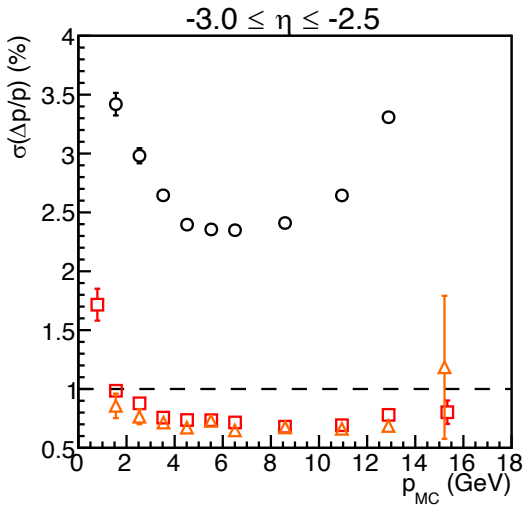
- Scattered electrons must be negatively charged
- $Q^2 = -(e_{beam} - e_{scattered}).M2()$

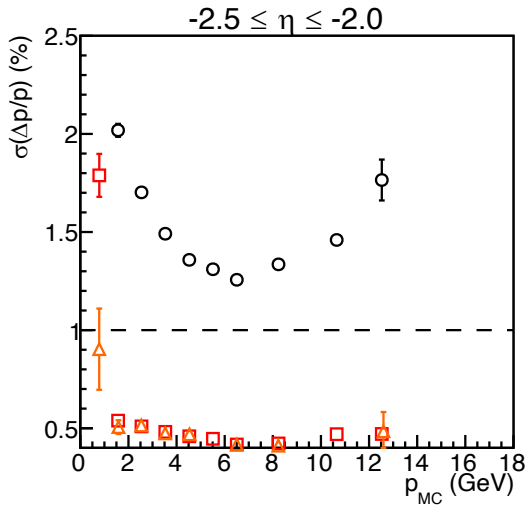
t from method L

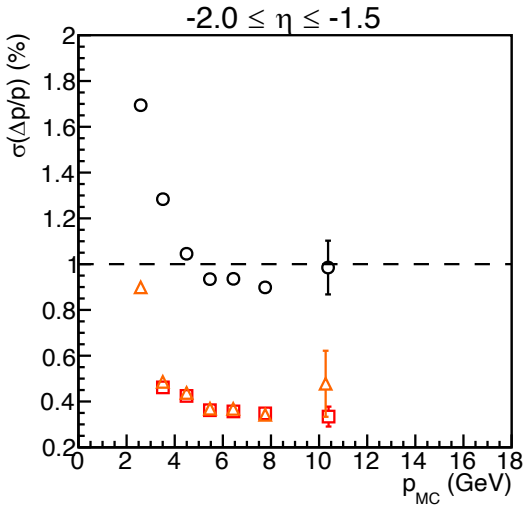
- Removed events with a mis-reconstructed $Q^2 < 1$ GeV^2
- Reconstructed $\boldsymbol{J/\psi}$ $|\eta| < 1.5$
- Require information of the proton beam
- Better t resolutions

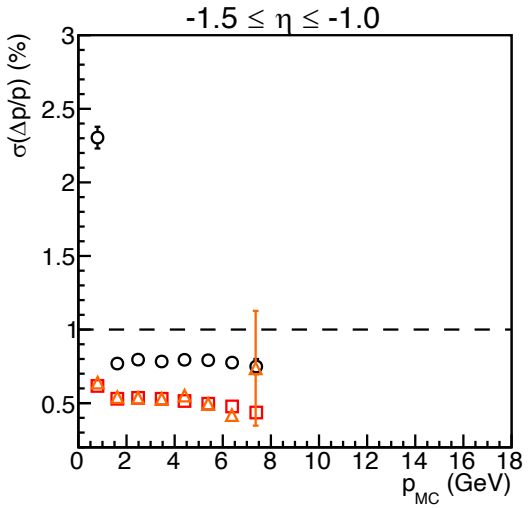
Backward Momentum Resolution ($\mu^{+/-}$)









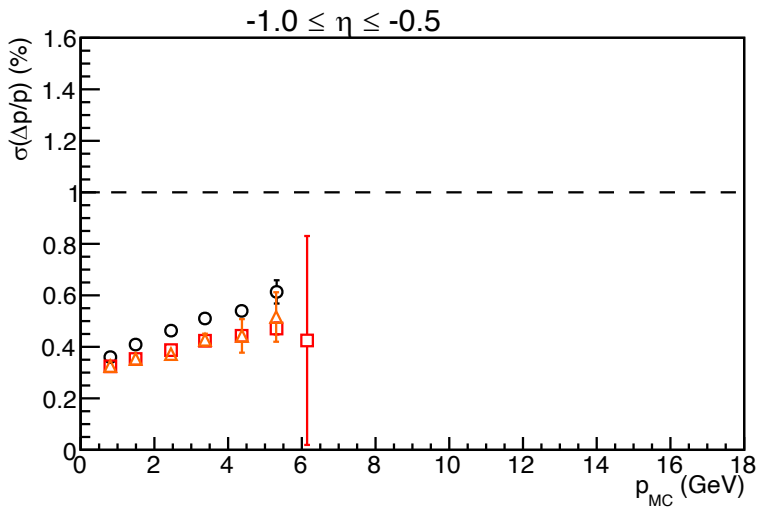


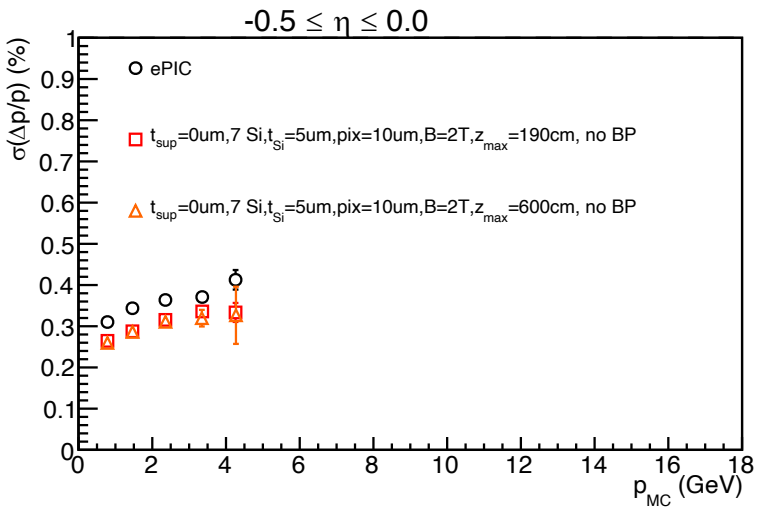
ePIC

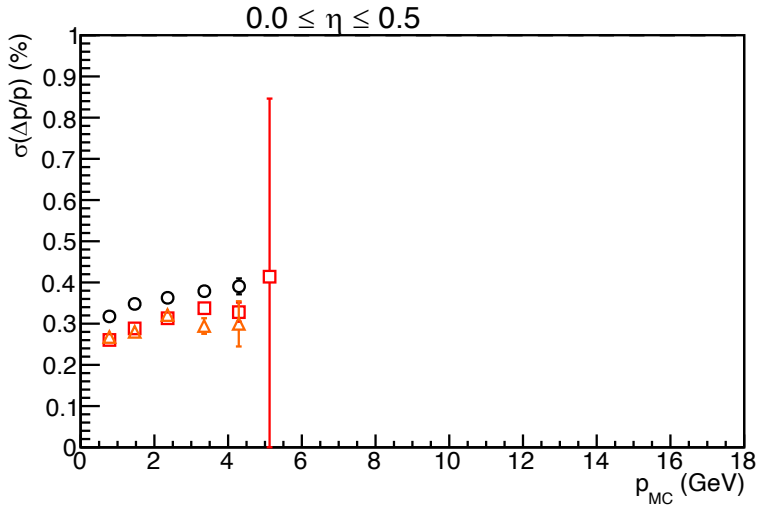
t_{sup}=0um,7 Si,t_{Si}=5um,pix=10um,B=2T,z_{max}=190cm, no BP

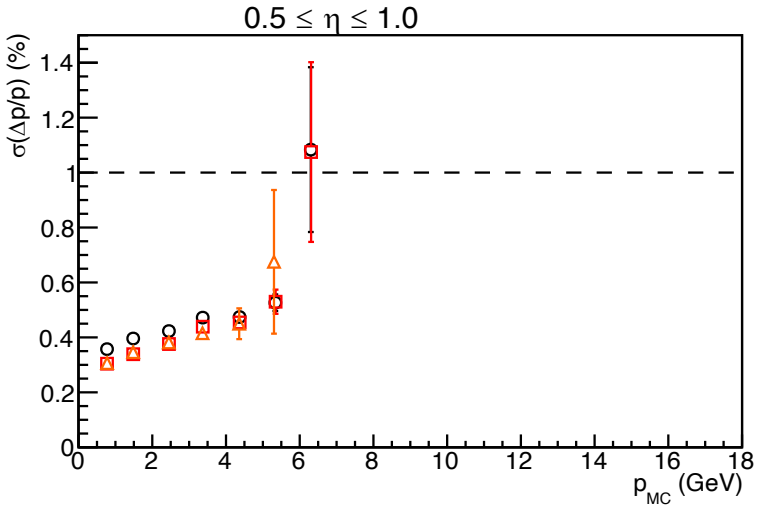
t_{sup}=0um,7 Si,t_{Si}=5um,pix=10um,B=2T,z_{max}=600cm, no BP

Barrel Momentum Resolution ($\mu^{+/-}$)

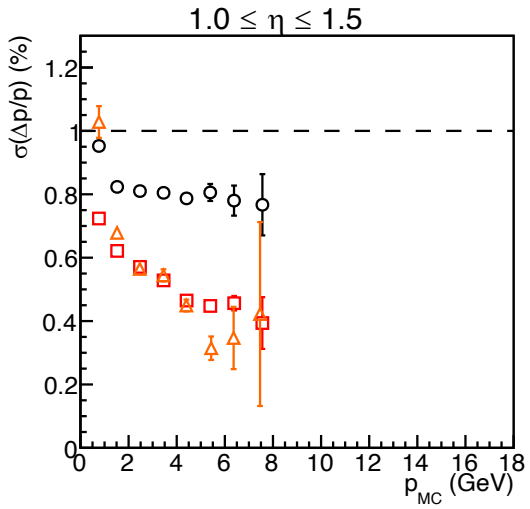


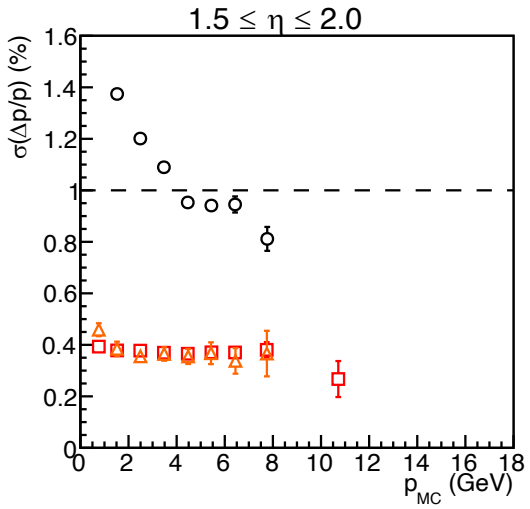


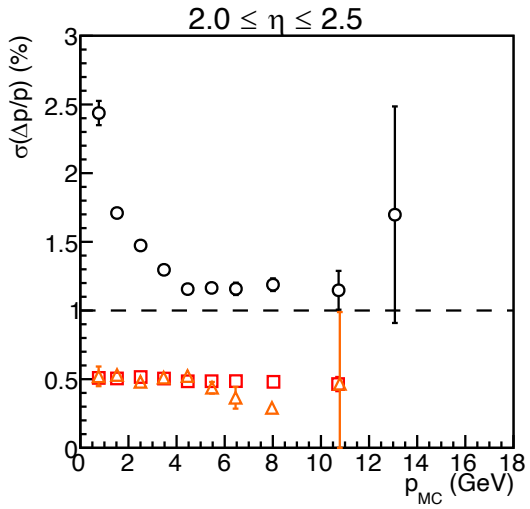


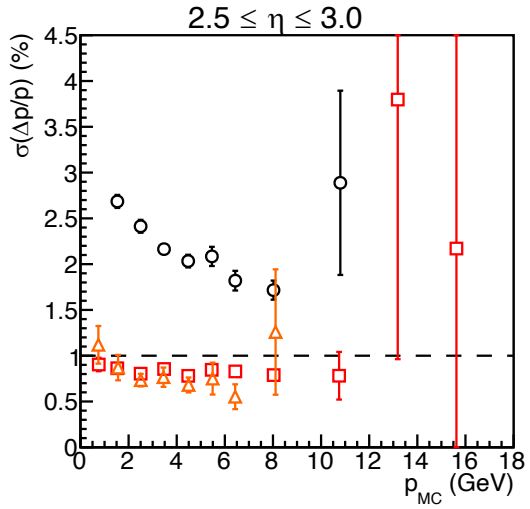


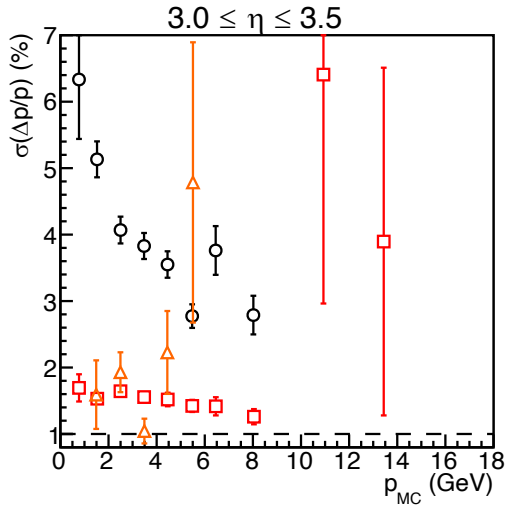
Forward Momentum Resolution ($\mu^{+/-}$)











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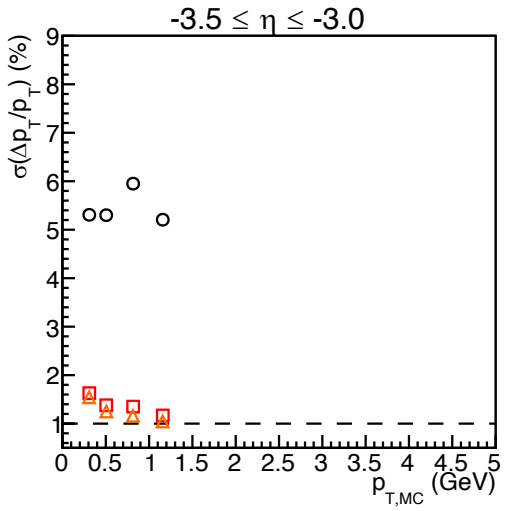
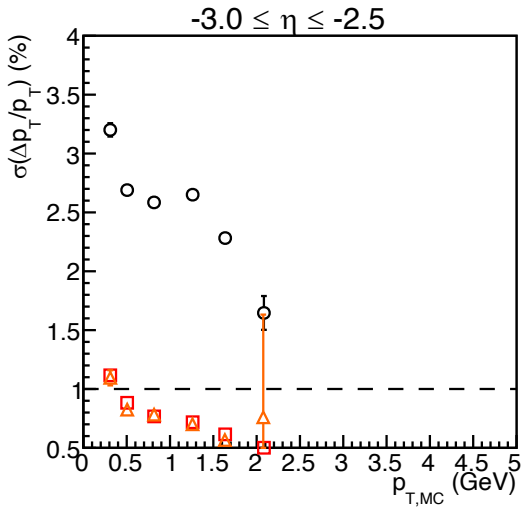
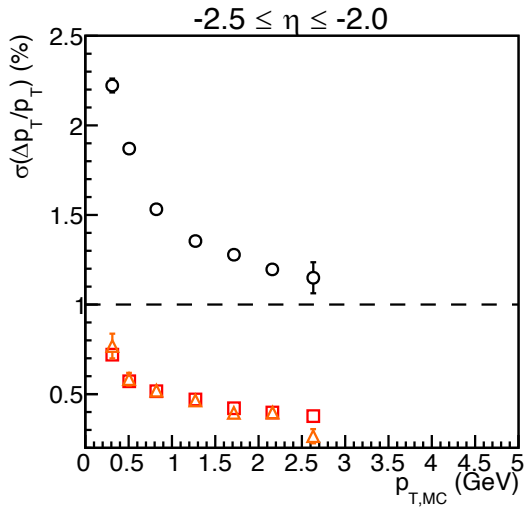
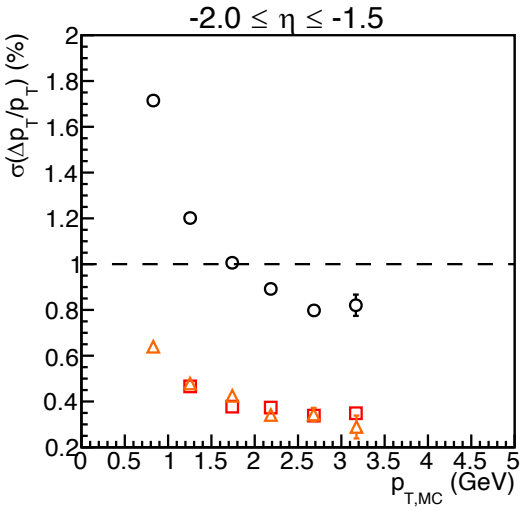
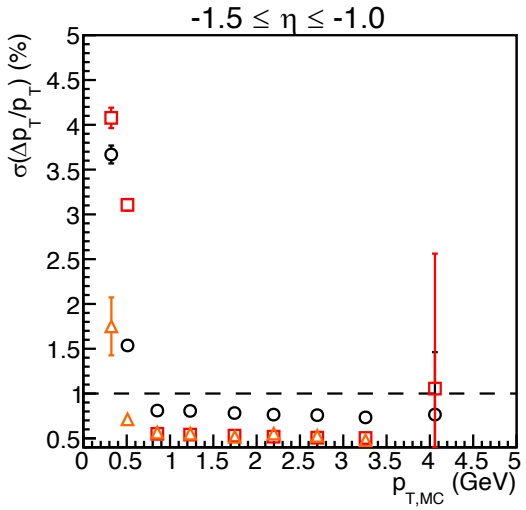
Backward Transverse Momentum Resolution ($\mu^{+/-}$)











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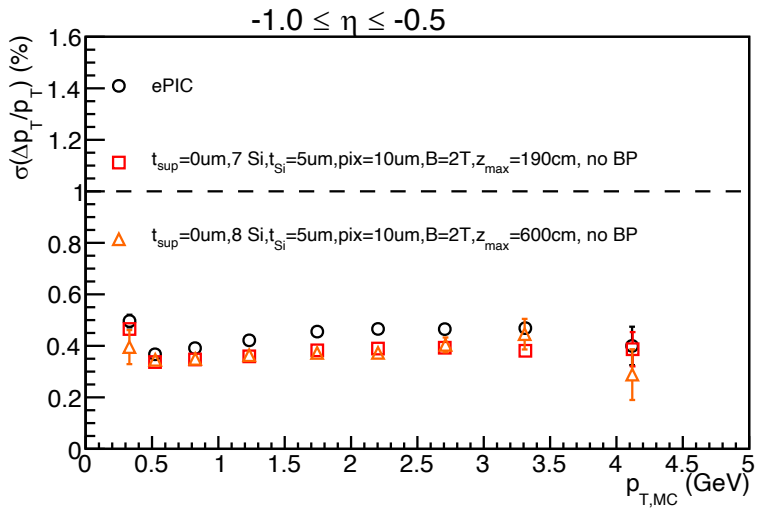
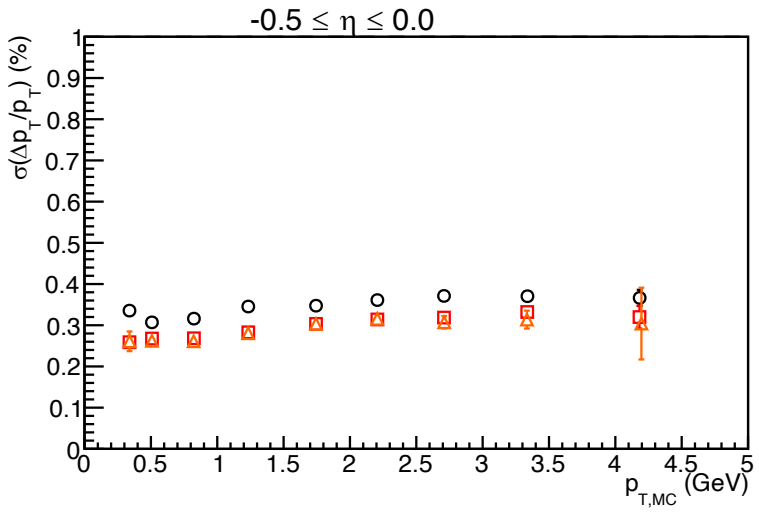
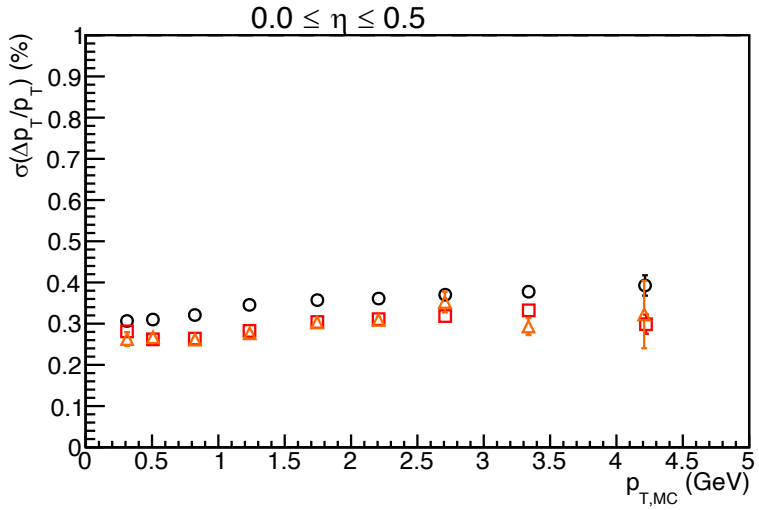
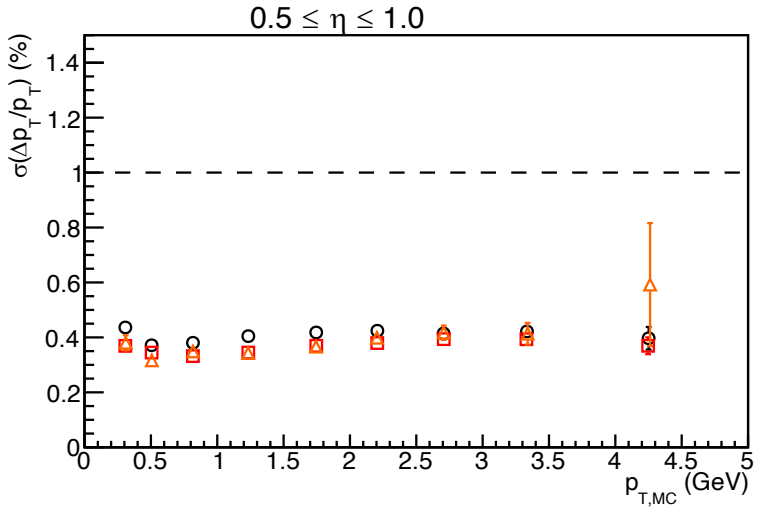
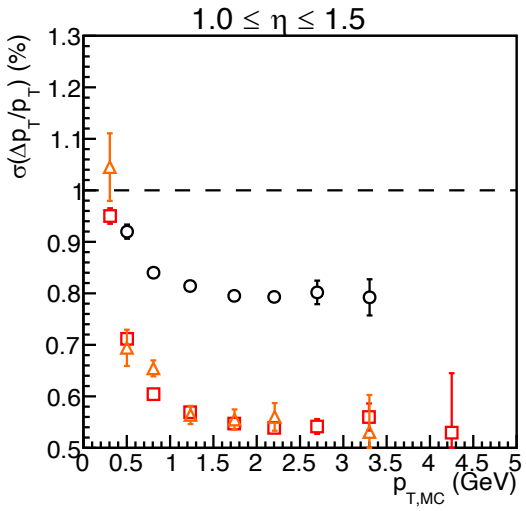


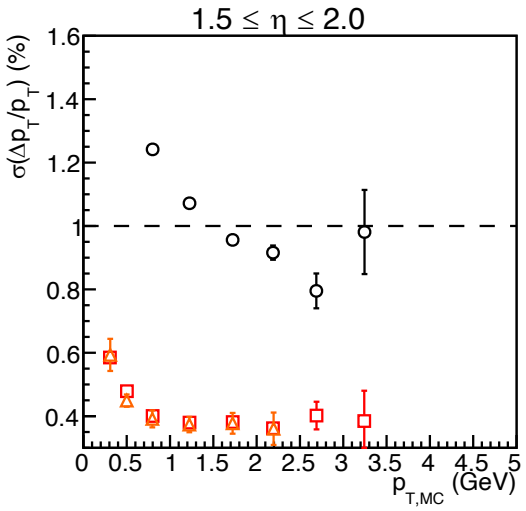


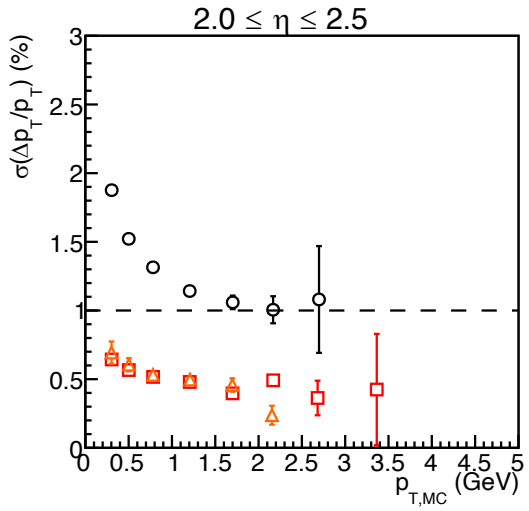


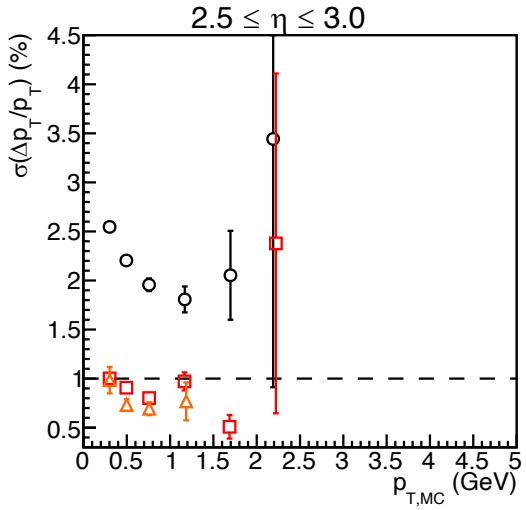


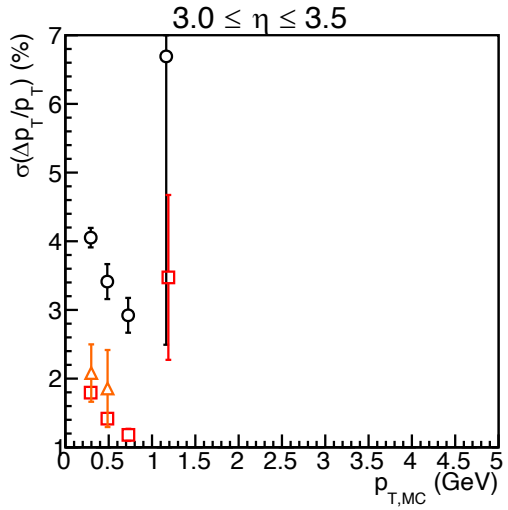
Forward Transverse Momentum Resolution ($\mu^{+/-}$)











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