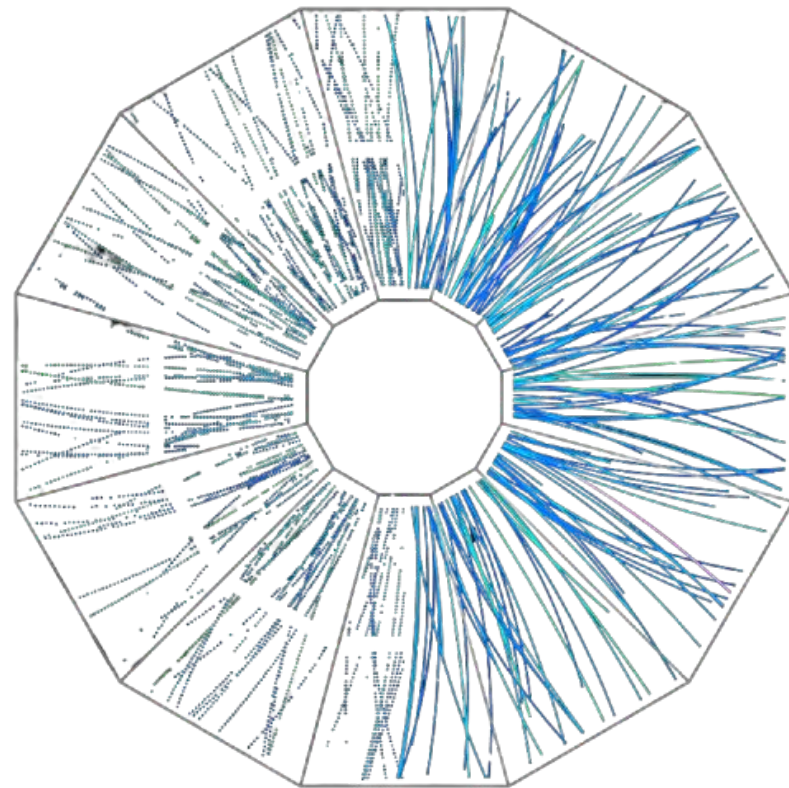


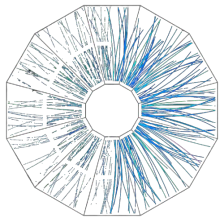
Charged Jet Studies in ep and eA

Dener De Souza Lemos (BNL)

2026 ePIC Collaboration Meeting
Brookhaven National Laboratory, Upton, NY

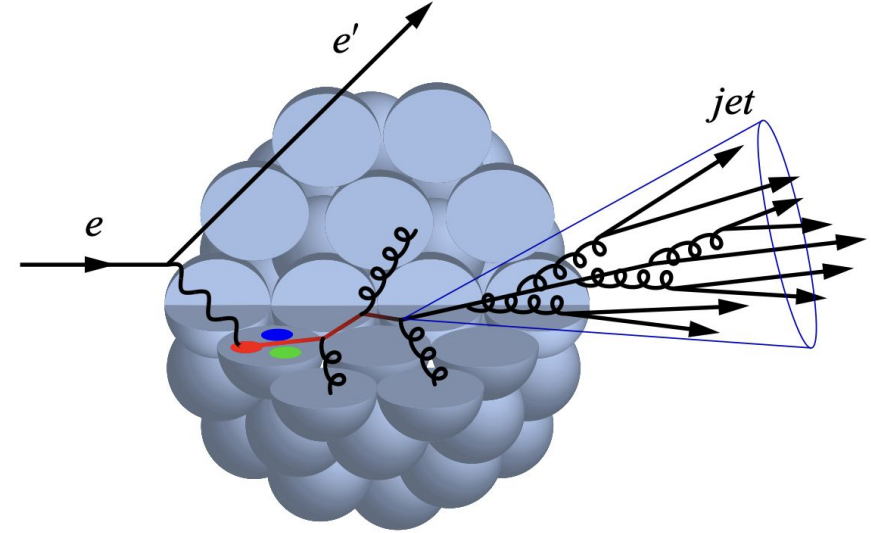


Brookhaven
National Laboratory



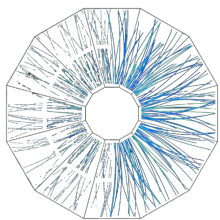
Outline

- Charged Jet Performance (pTDR)
- First Look at Jets with Machine Background
- Physics: Nuclear Modification Factor
- Summary and Outlook



[The Electron-Ion Collider: Assessing the Energy Dependence of Key Measurements](#)





Simulation Details

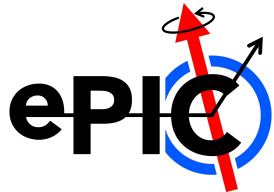
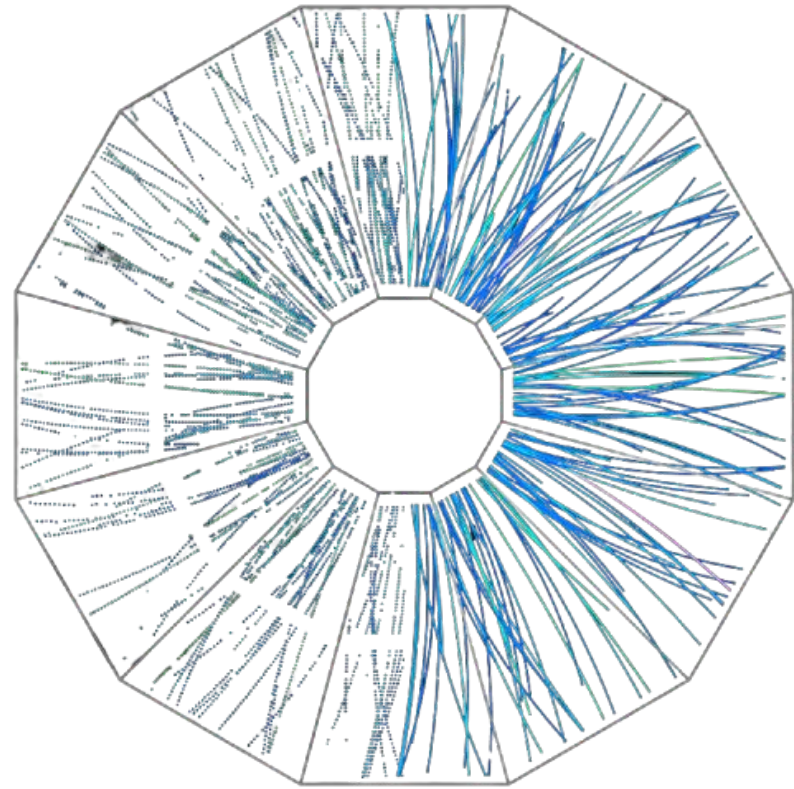
- Energy: 10x100
- Geometry: **25.10**
- ep: official production (NCDIS)
 - PYTHIA8.306
 - $q^2 \text{ min} = 1$ and $q^2 \text{ min} = 10$
- eAu: official production (DIS)
 - BeAGLE103
 - $1 < q^2 < 10$ and $10 < q^2 < 100$

➤ Jet reconstruction

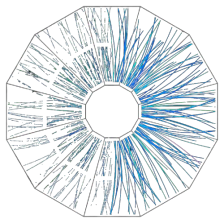
- Charged jets:
 - ReconstructedChargedJets
 - GeneratedChargedJets
 - Remove jets with 1 track inside
 - Cuts in the plots
 - Electron removed using true PID
 - Geometrical matching $\Delta R < 1.0$
- Jet Tree makers (anti- k_T with $R = 1.0$):
 - <https://github.com/denerslemos/CHJetTrees>
 - <https://github.com/denerslemos/CHJetsReCluster>



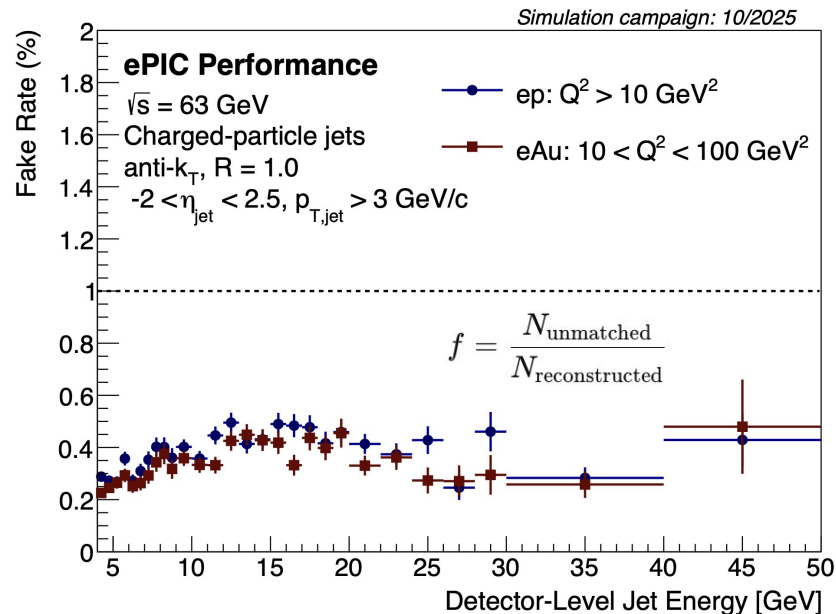
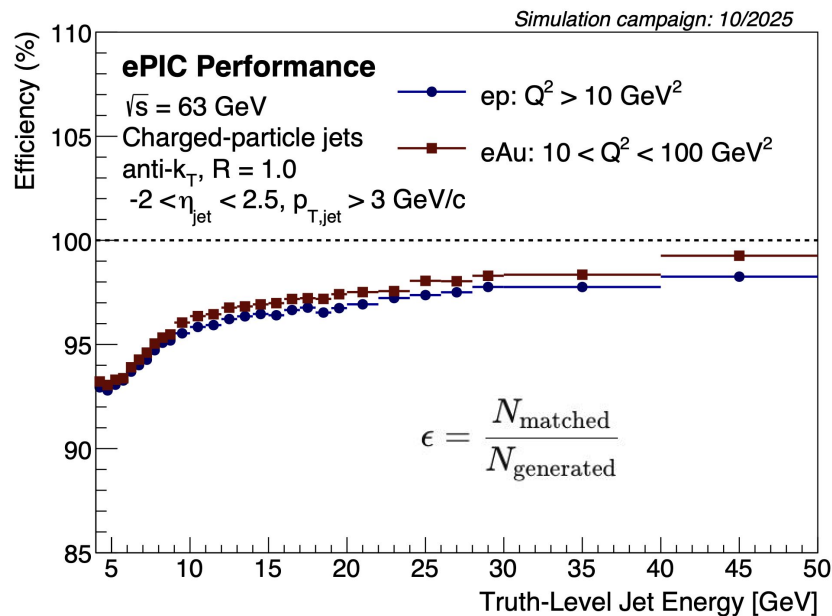
Charged Jet Performance (pTDR)



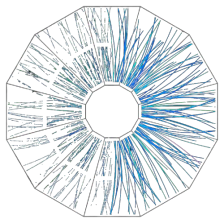
Brookhaven
National Laboratory



Jet finding performance (I)

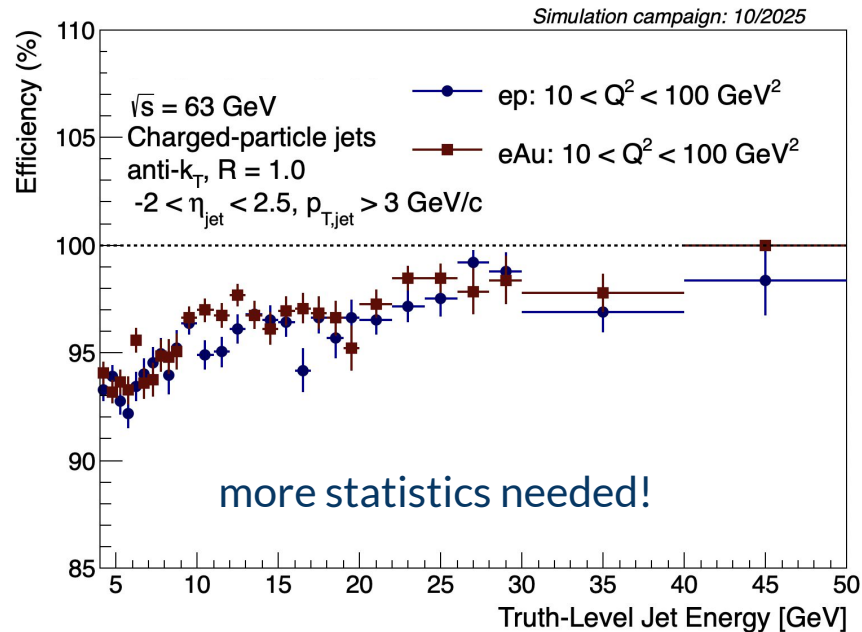
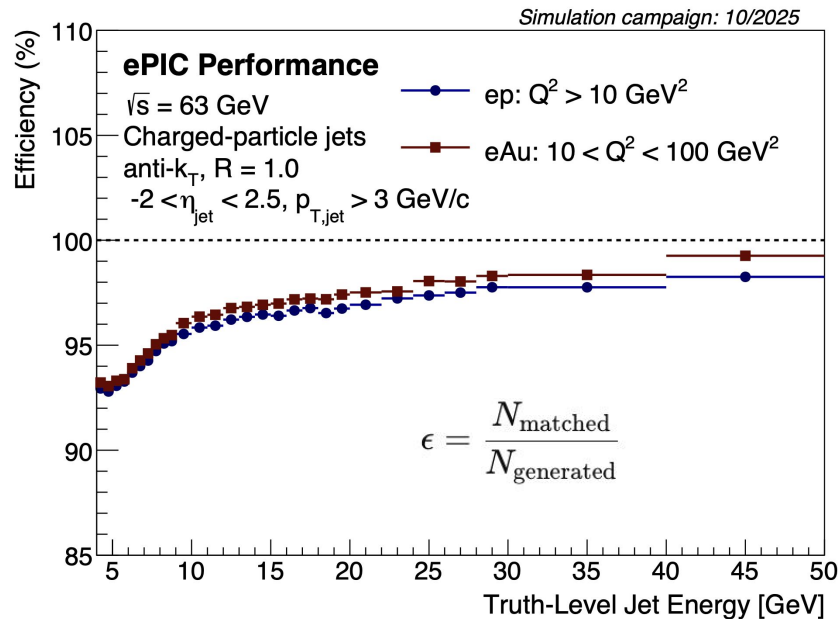


Possible discrepancy due high- Q^2 cut (?)

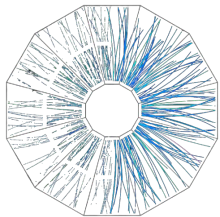


Jet finding performance (II)

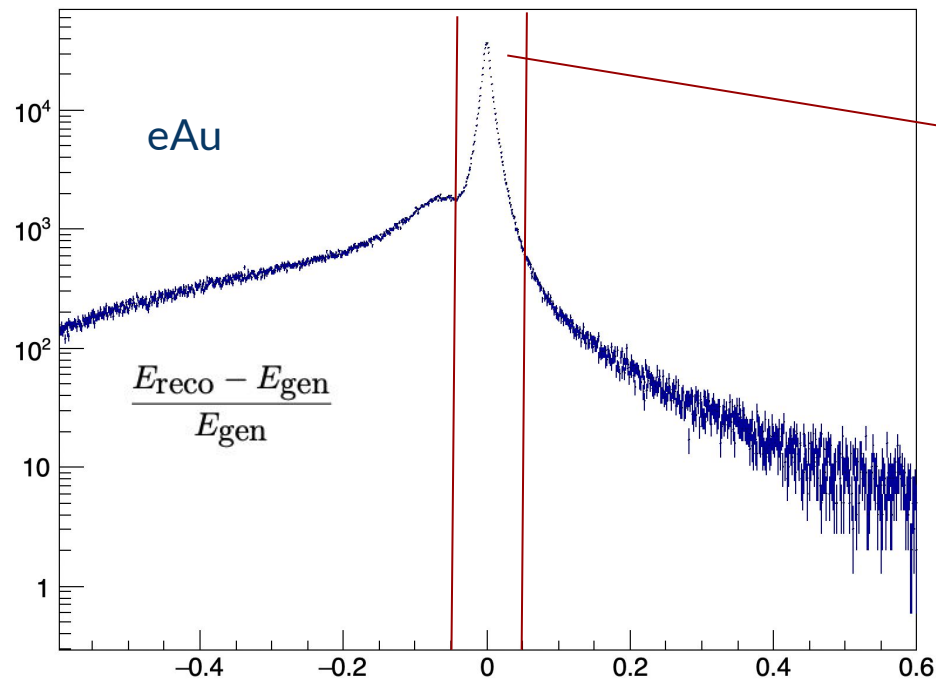
Cut applied in Truth Q^2
(InclusiveKinematicsTruth.Q2)



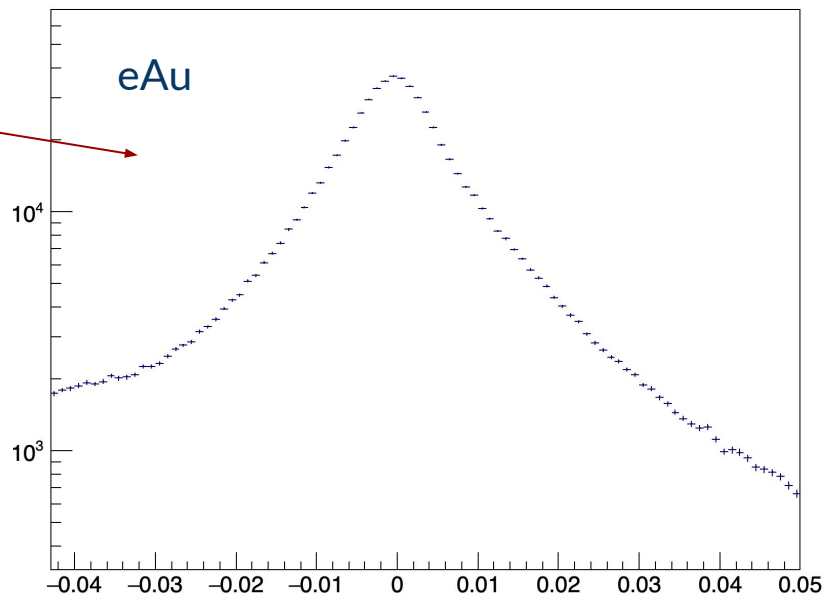
~120k events

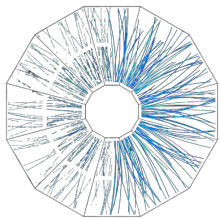


JES/JER Distributions

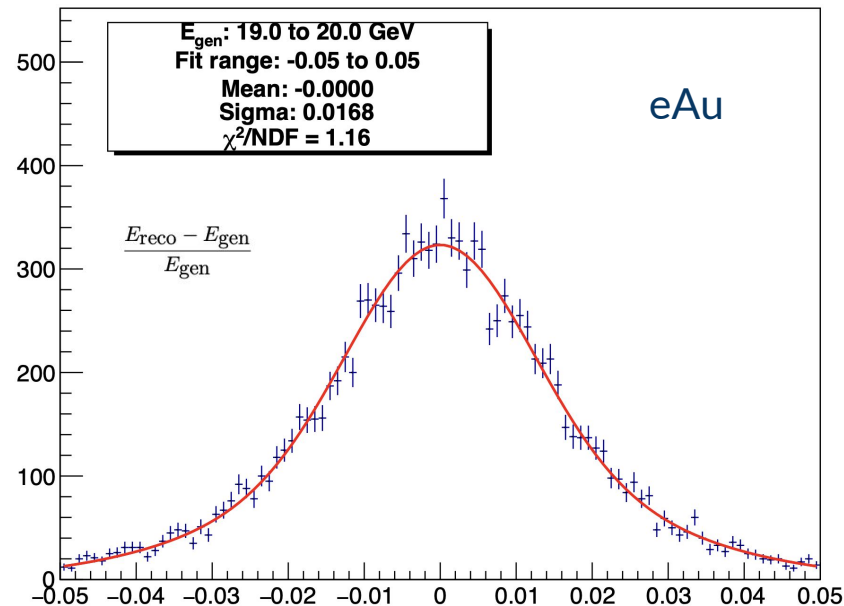
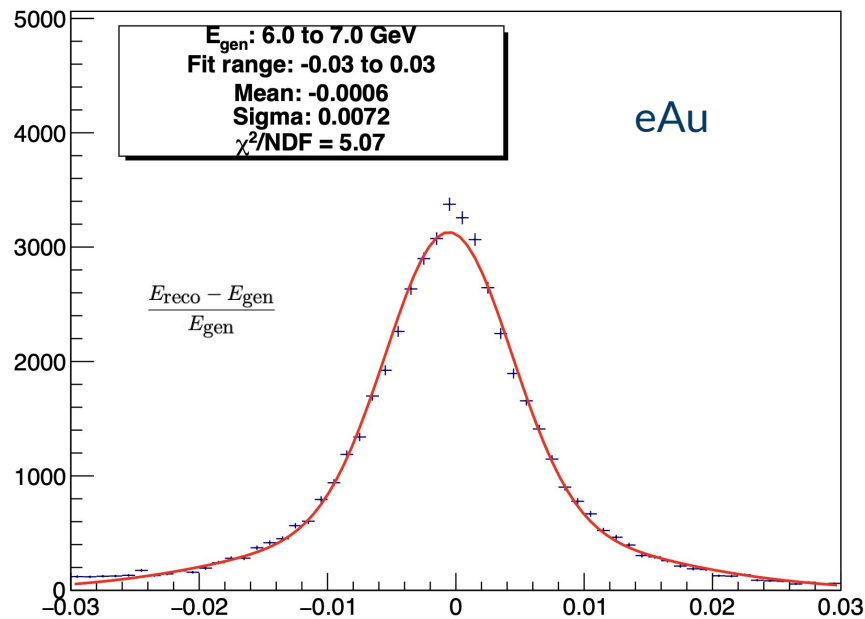


Similar in ep



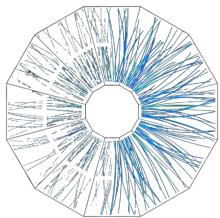


JES/JER Fits

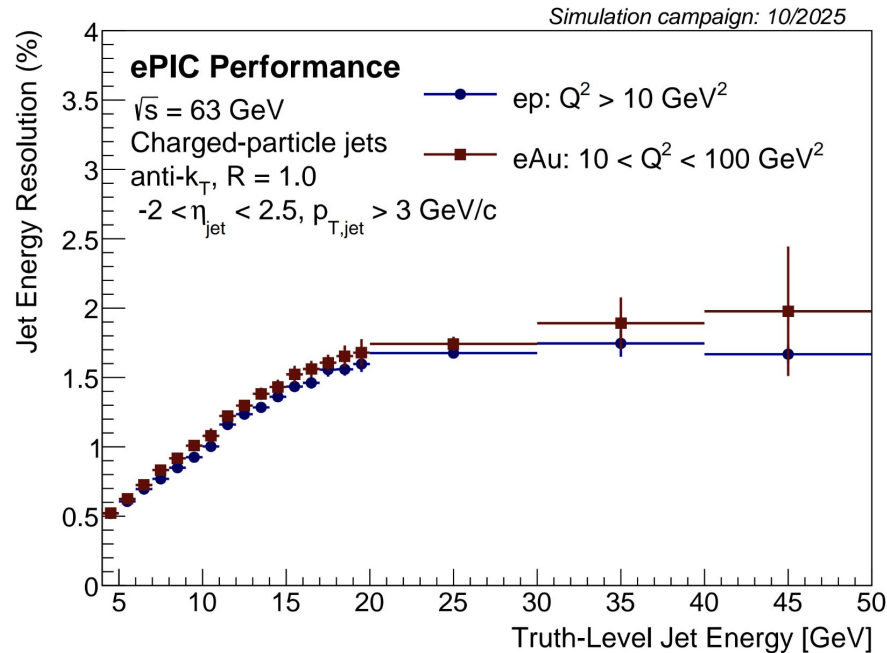


$$f(x) = Y_1 \exp\left(-\frac{(x - \mu)^2}{2\sigma_1^2}\right) + Y_2 \exp\left(-\frac{(x - \mu)^2}{2\sigma_2^2}\right)$$

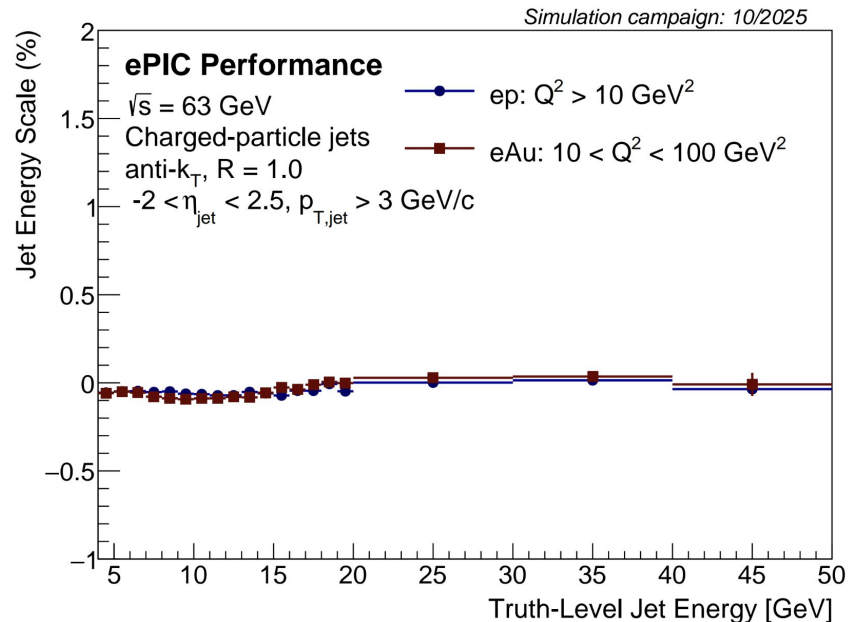
8
$$\sigma = \sqrt{\frac{Y_1}{Y_1 + Y_2} \sigma_1^2 + \frac{Y_2}{Y_1 + Y_2} \sigma_2^2}$$



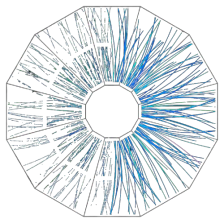
JES/JER pTDR



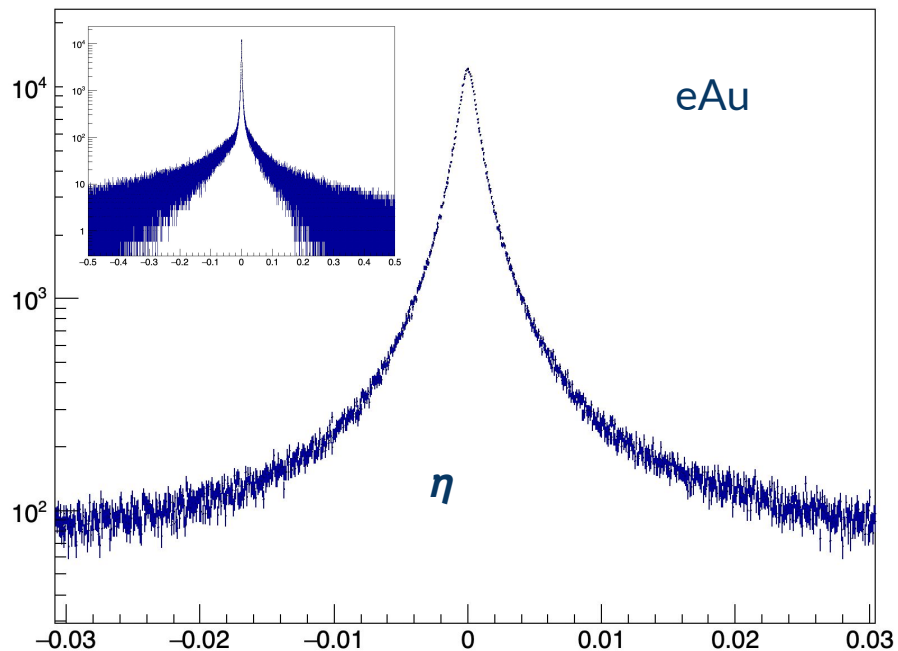
Width



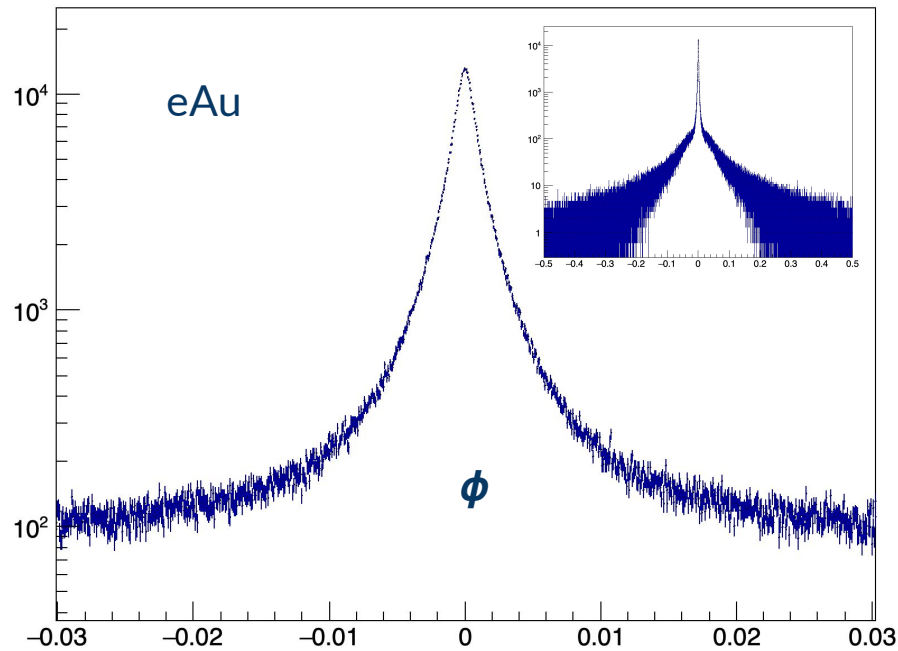
Mean

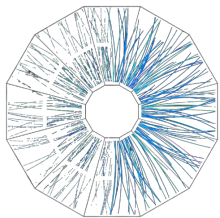


Angular Resolution

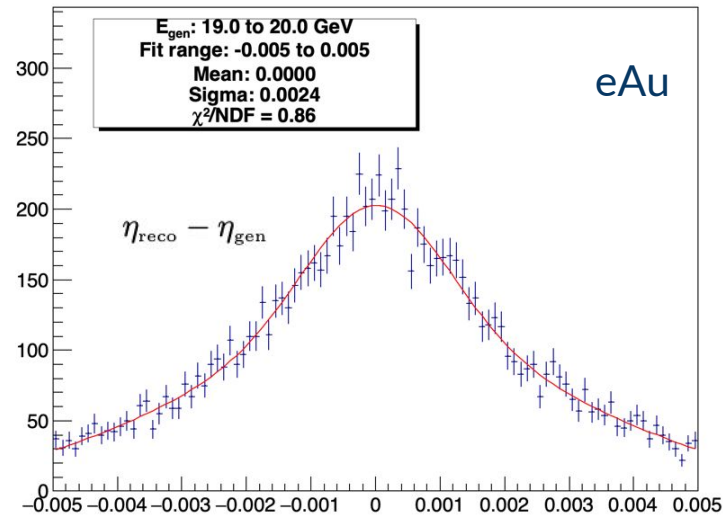
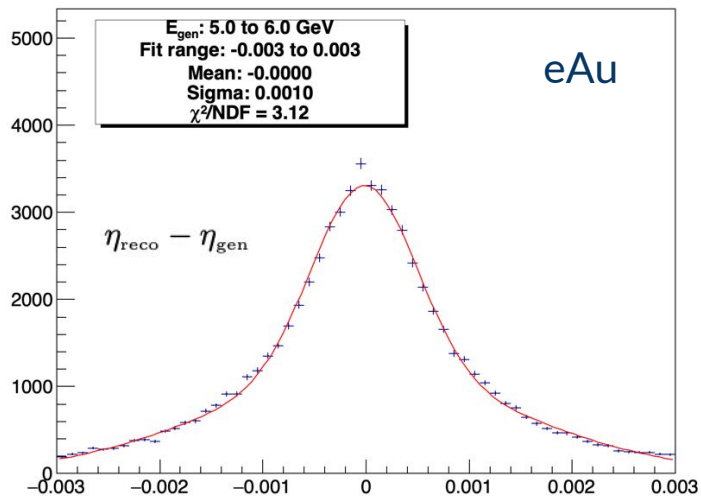


Similar in ep





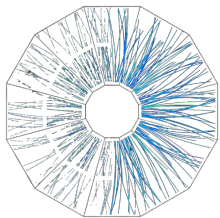
η Fits



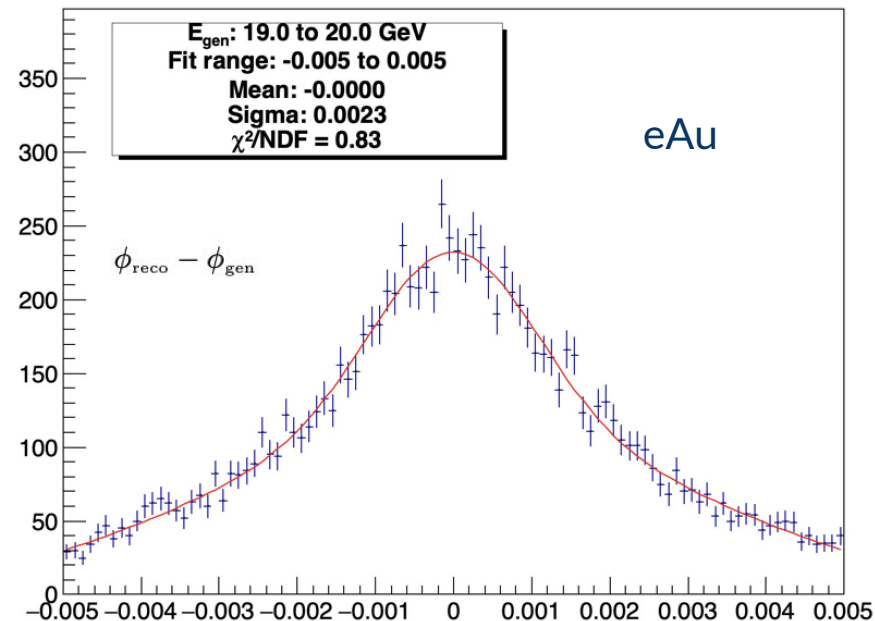
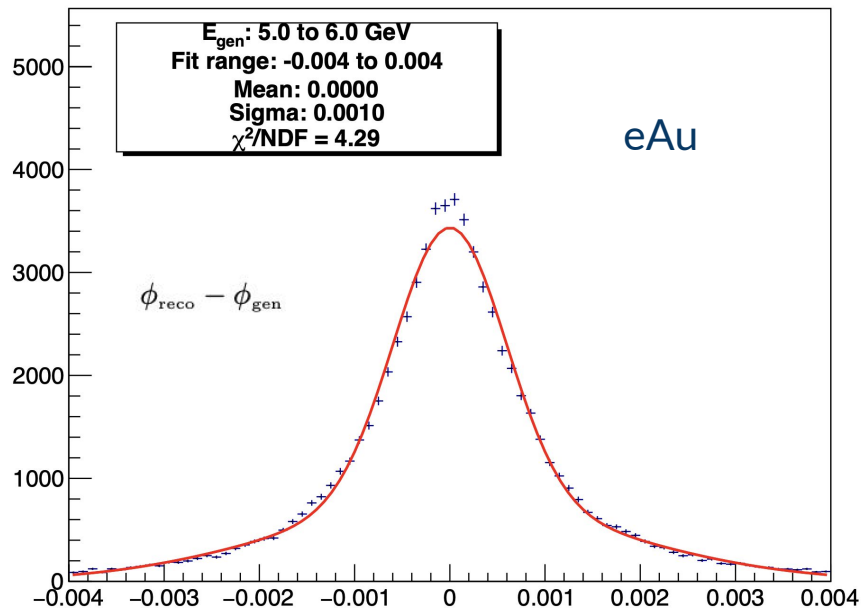
$$f(x) = Y_1 \exp\left(-\frac{(x - \mu)^2}{2\sigma_1^2}\right) + Y_2 \exp\left(-\frac{(x - \mu)^2}{2\sigma_2^2}\right)$$

$$\sigma = \sqrt{\frac{Y_1}{Y_1 + Y_2} \sigma_1^2 + \frac{Y_2}{Y_1 + Y_2} \sigma_2^2}$$





ϕ Fits



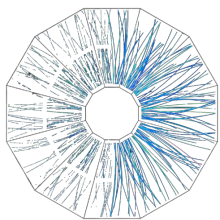
$$f(x) = Y_1 \exp\left(-\frac{(x - \mu)^2}{2\sigma_1^2}\right) + Y_2 \exp\left(-\frac{(x - \mu)^2}{2\sigma_2^2}\right)$$

12

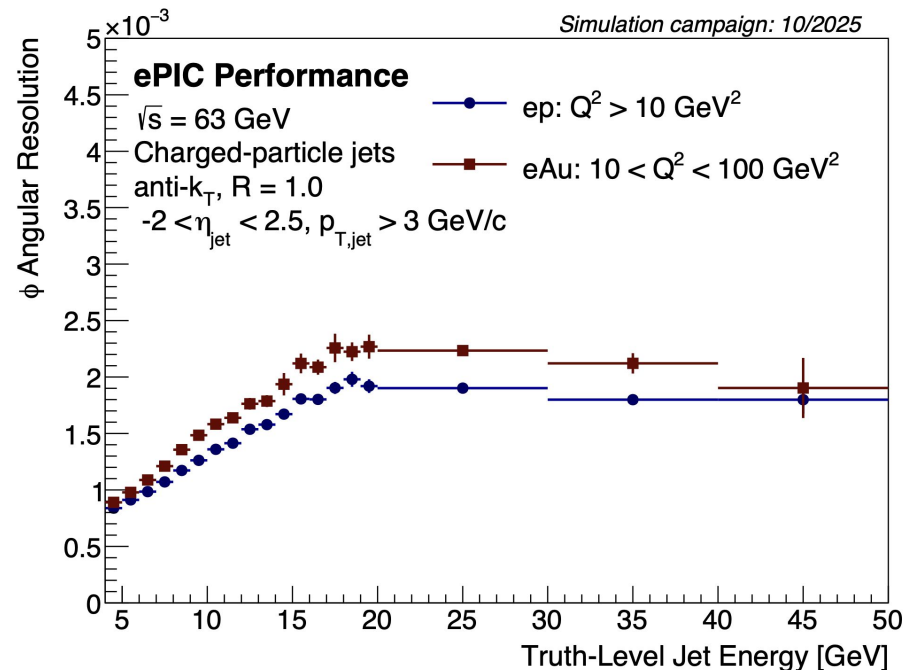
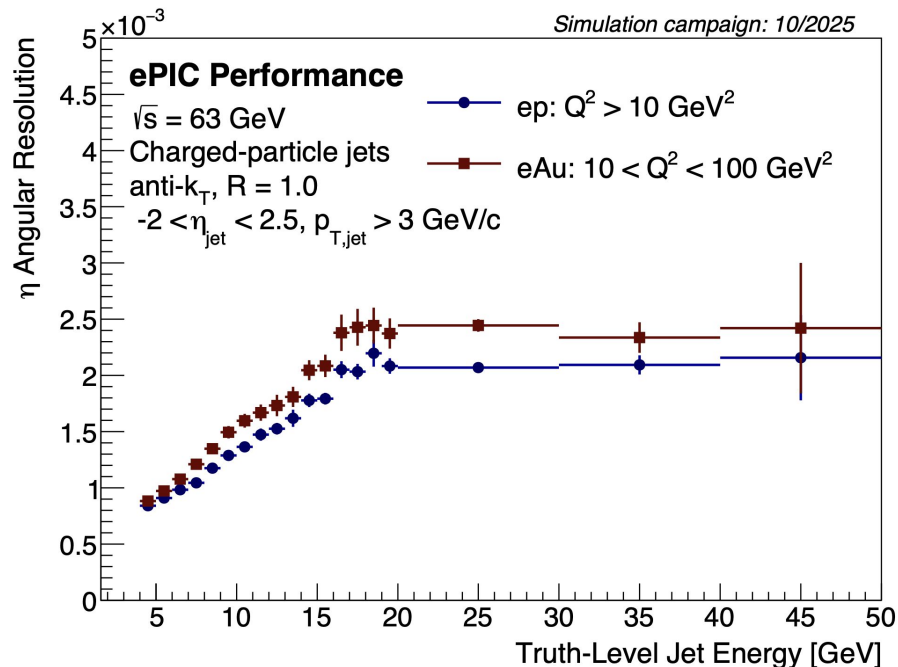
$$\sigma = \sqrt{\frac{Y_1}{Y_1 + Y_2} \sigma_1^2 + \frac{Y_2}{Y_1 + Y_2} \sigma_2^2}$$



Brookhaven
National Laboratory

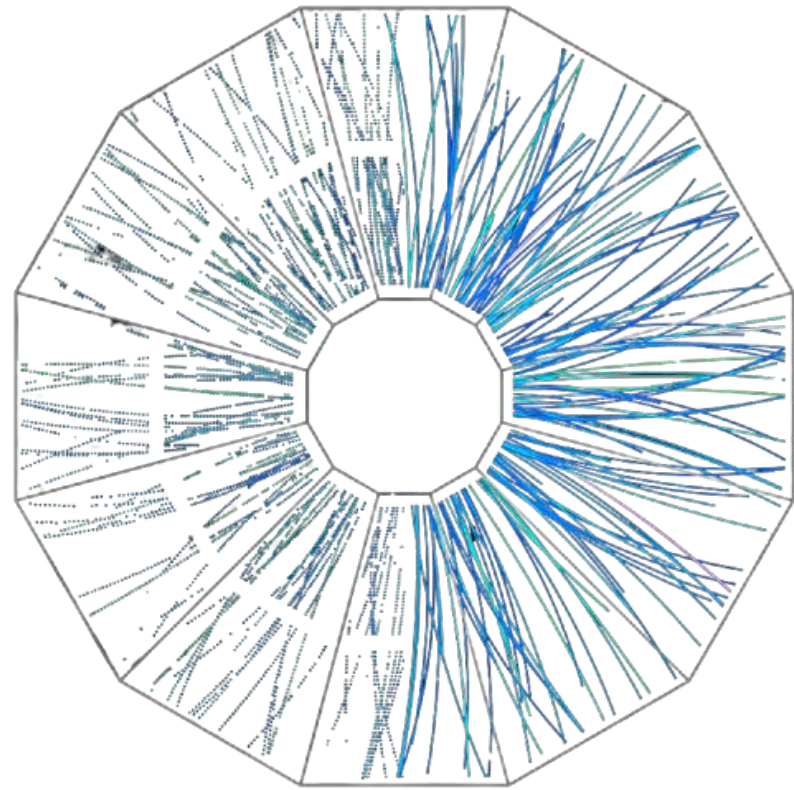
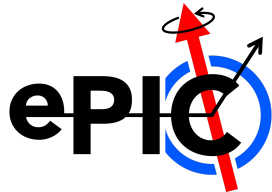


Angular resolution pTDR



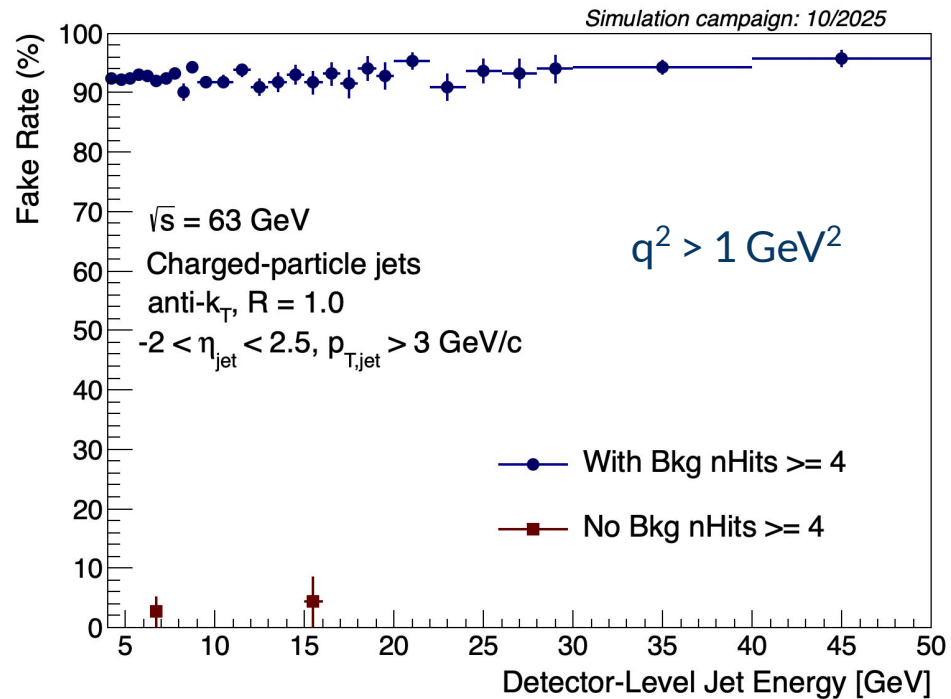
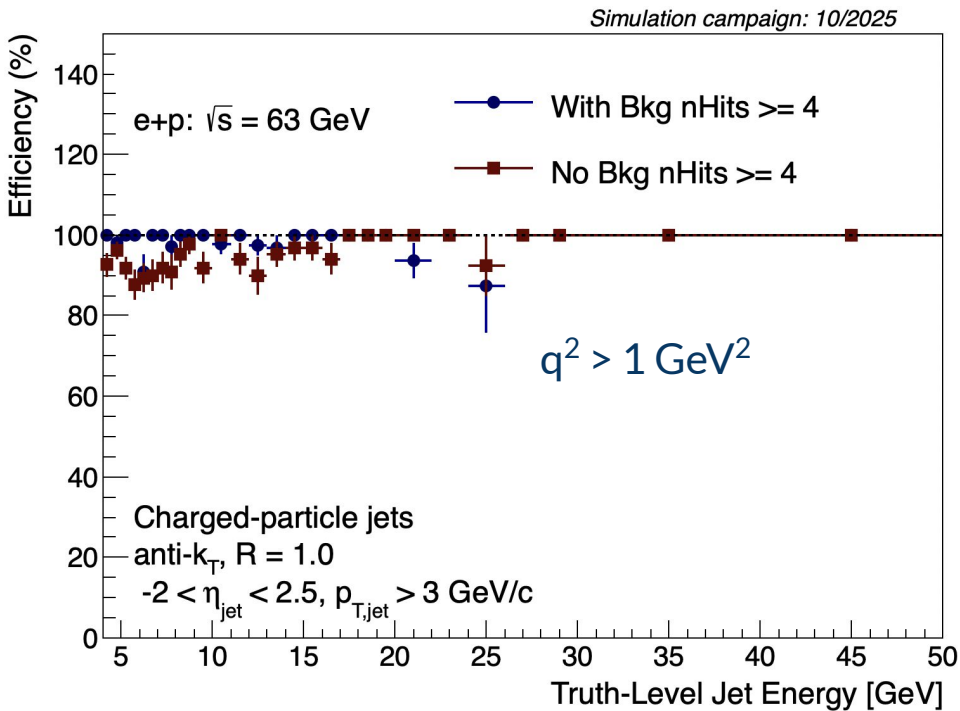
Compatible with our tracking resolution (ep)

First Look at Charged Jets with Machine Background

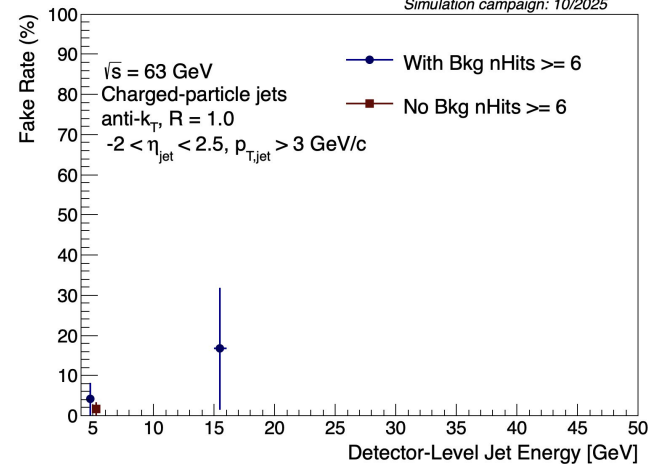
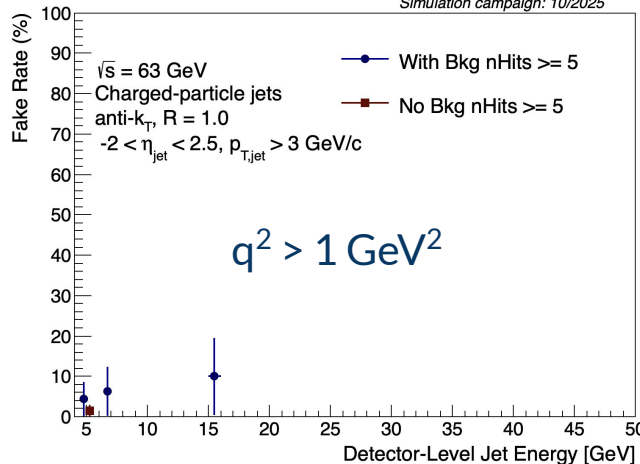
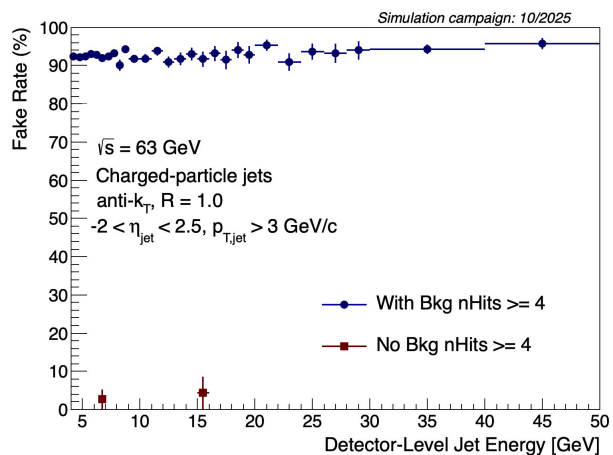
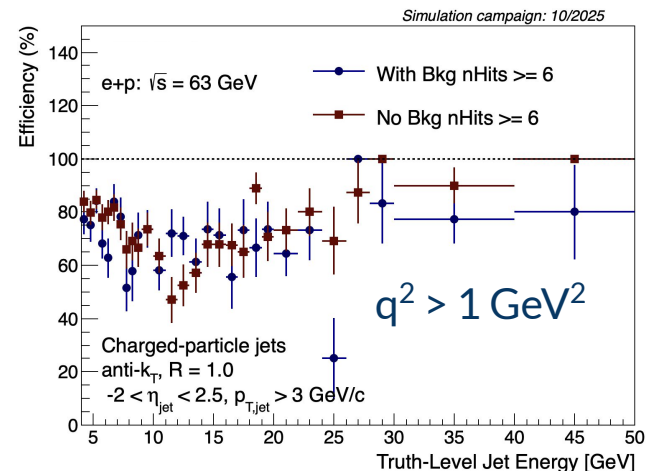
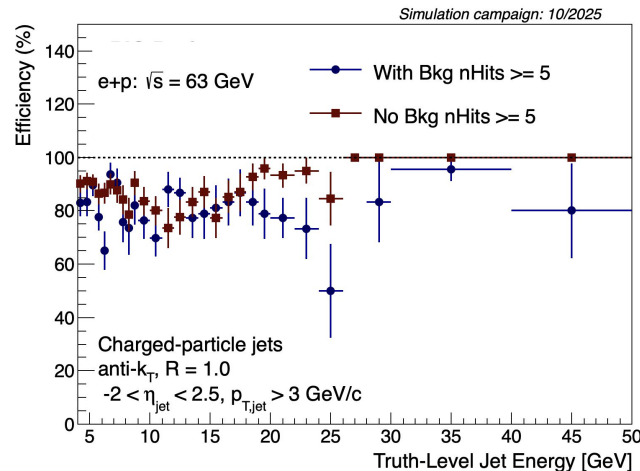
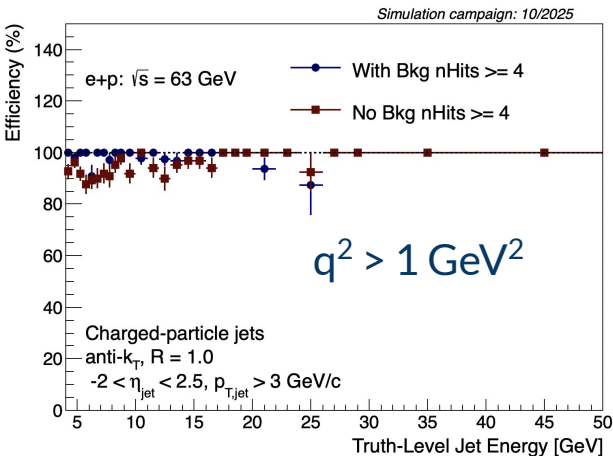


Brookhaven
National Laboratory

~30k events



/volatile/eic/EPIC/RECO/25.10.4/epic_craterlake/Bkg_1SignalPer2usFrame/DIS/NC/10x100/minQ2=1/



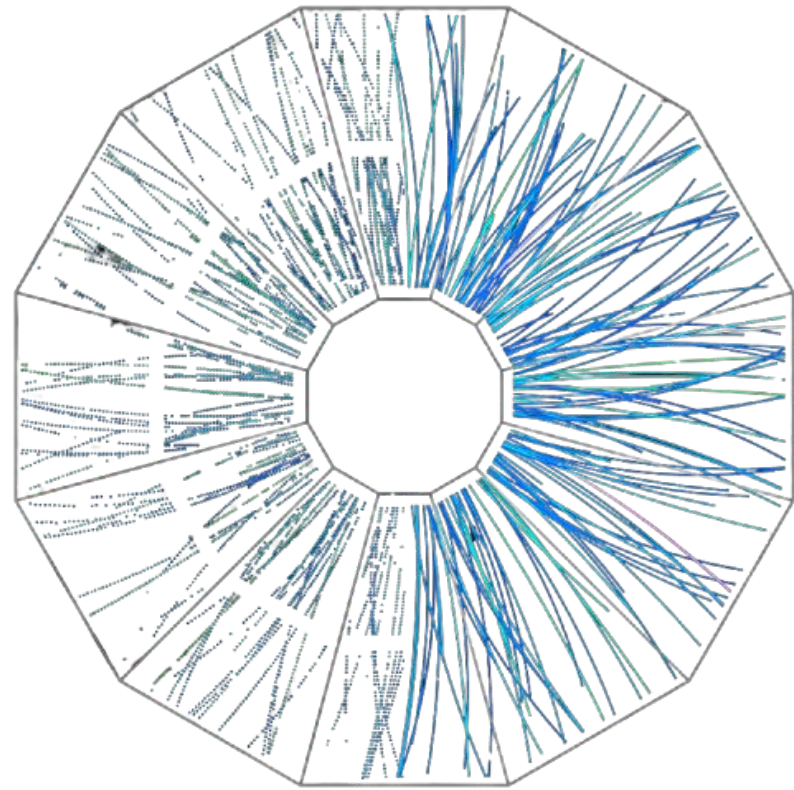
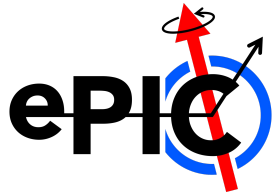
NMeasurements: ≥ 4

16

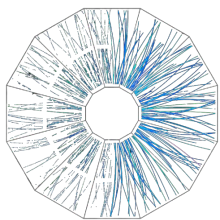
NMeasurements: ≥ 5

NMeasurements: ≥ 6

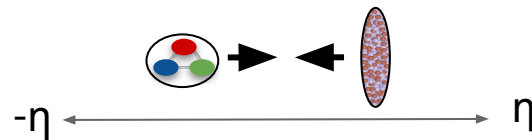
Physics: Nuclear Modification Factor



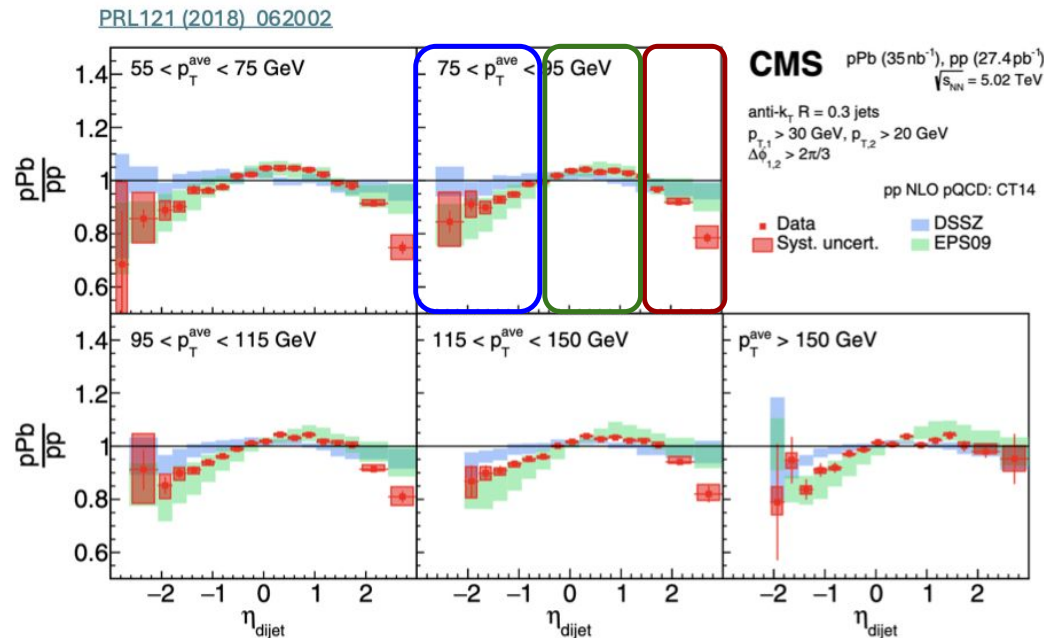
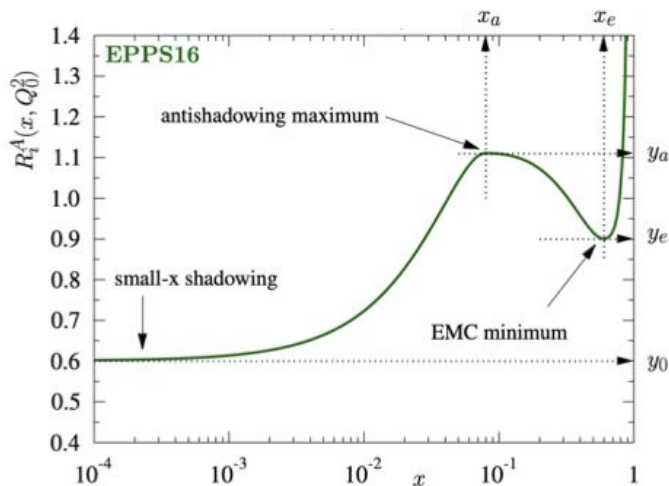
Brookhaven
National Laboratory



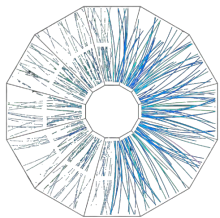
Exploring CNM with Jets



- Jets are useful tools to explore CNM and to constrain nPDFs
 - Shadowing, antishadowing, EMC

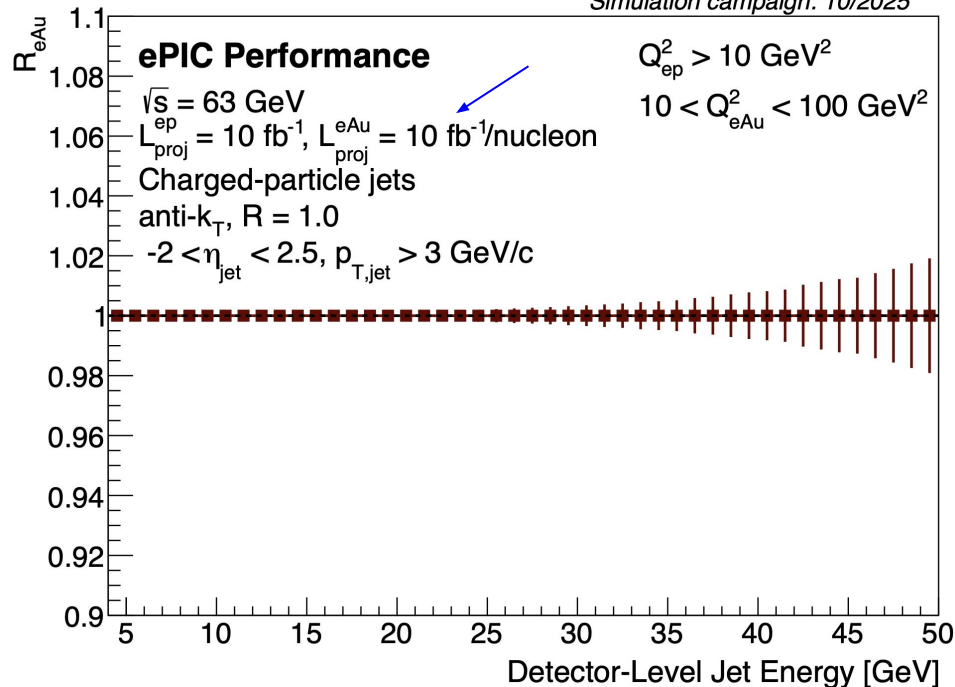


Map: $(x, Q) \leftrightarrow (\eta_{dijet}, p_T^{ave})$

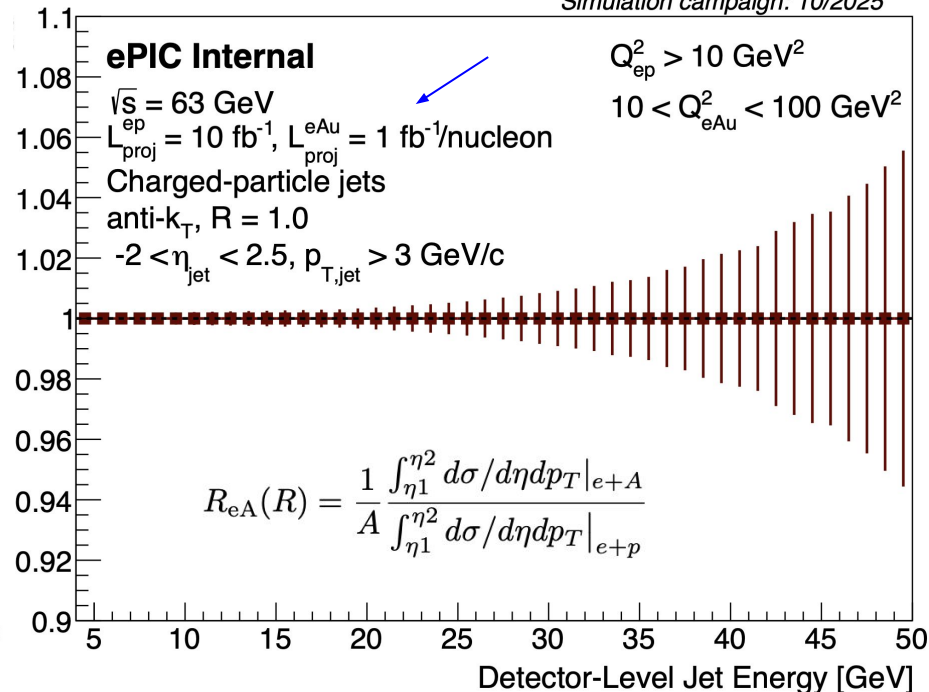


Nuclear Modification Factor: R_{eAu}

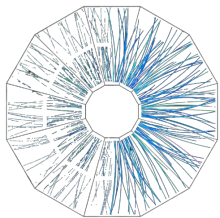
Simulation campaign: 10/2025



Simulation campaign: 10/2025

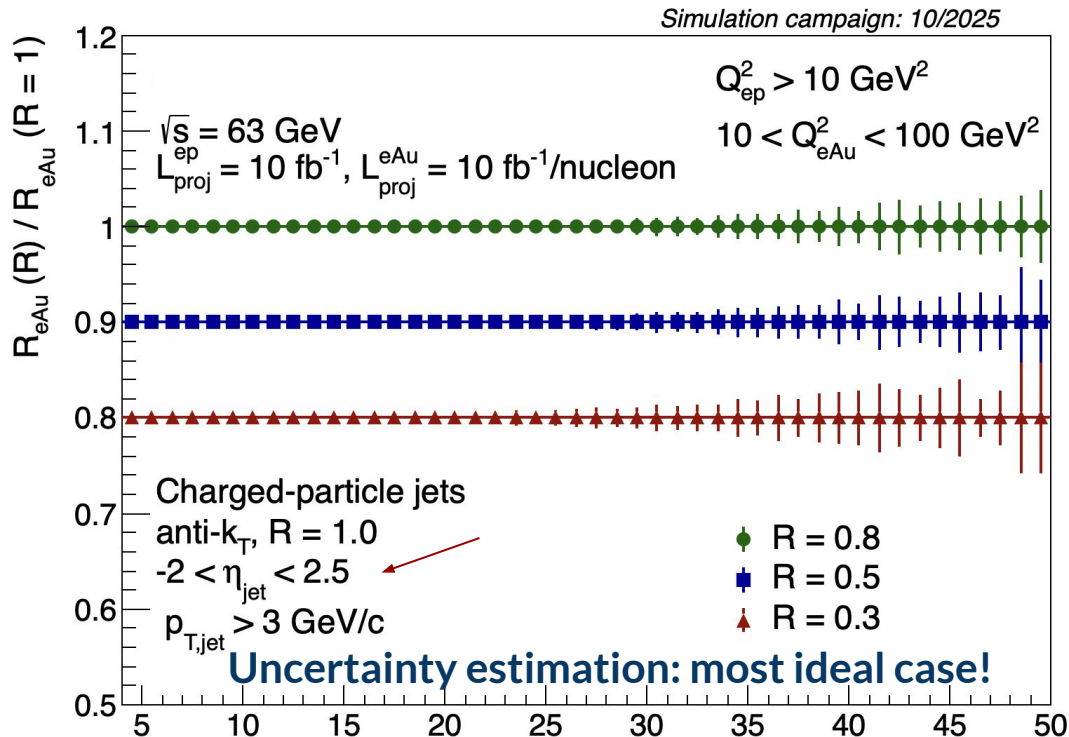
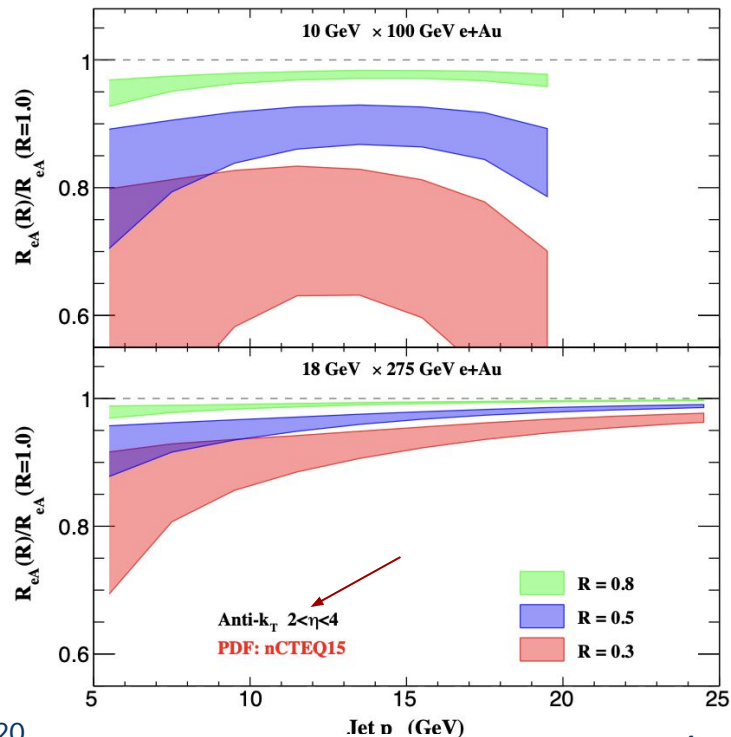


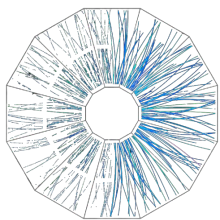
Uncertainty estimation: most ideal case!



Different radii R_{eAu}

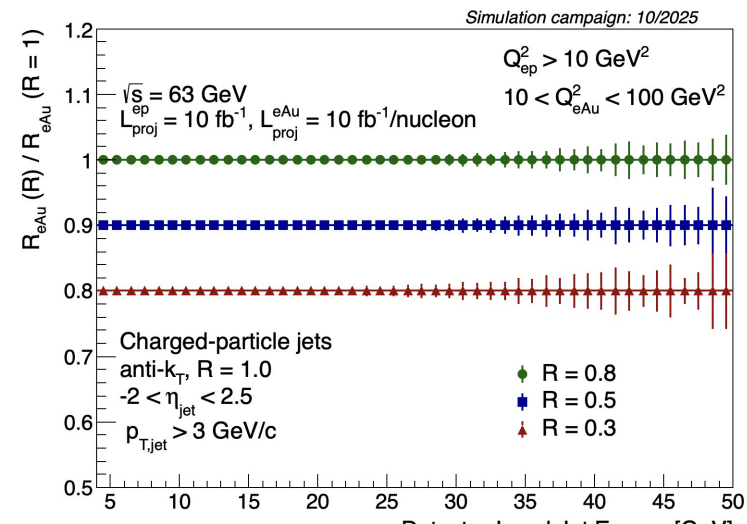
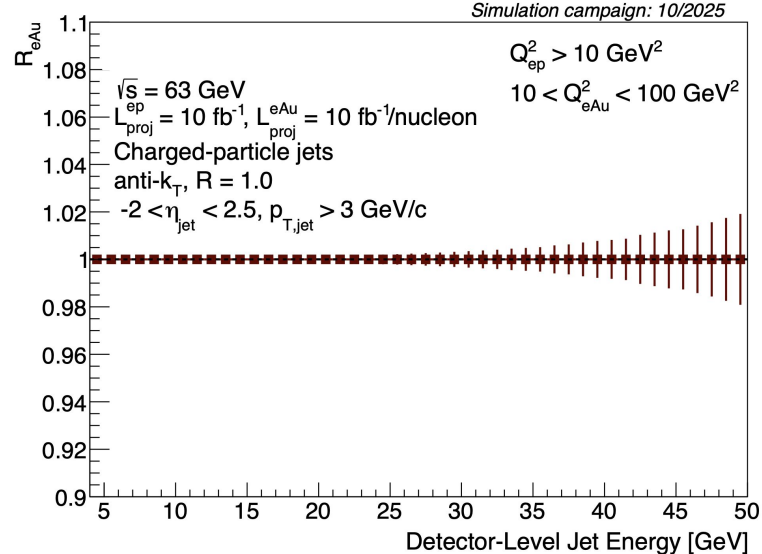
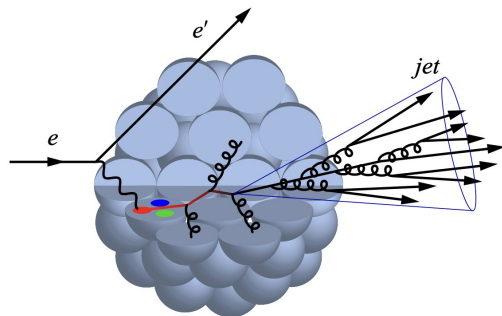
~120k events





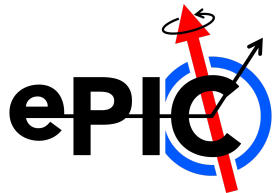
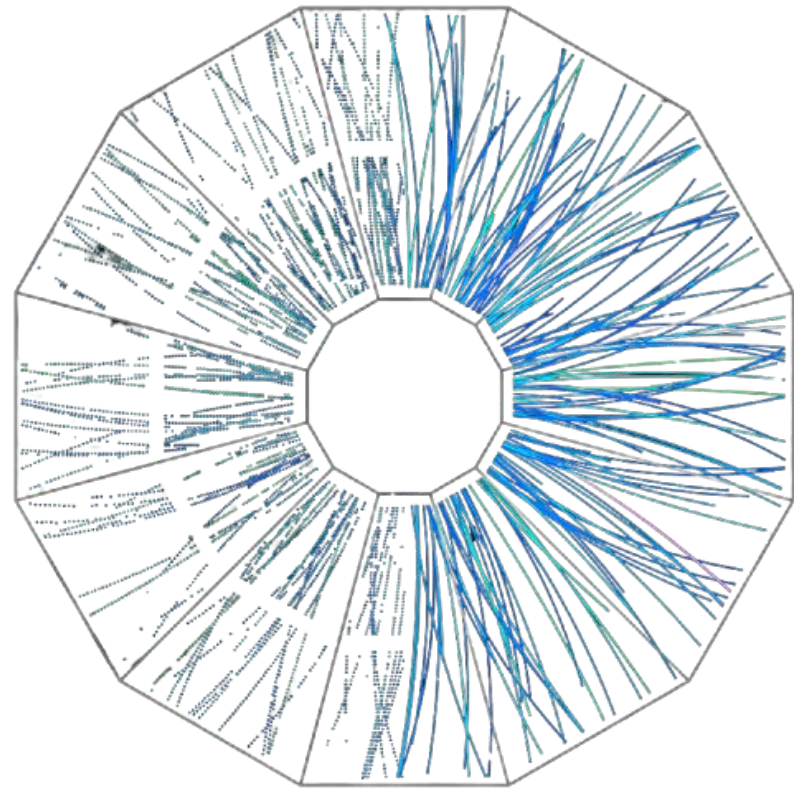
Summary and outlook

- Jets are flexible tools that can be used to explore CNM in different ways
- Would be good to also have dijet samples in both ep and eAu simulations
 - $\gamma+g$ fusion
 - Azimuthal asymmetries

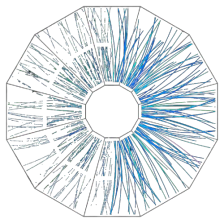


[illegible]

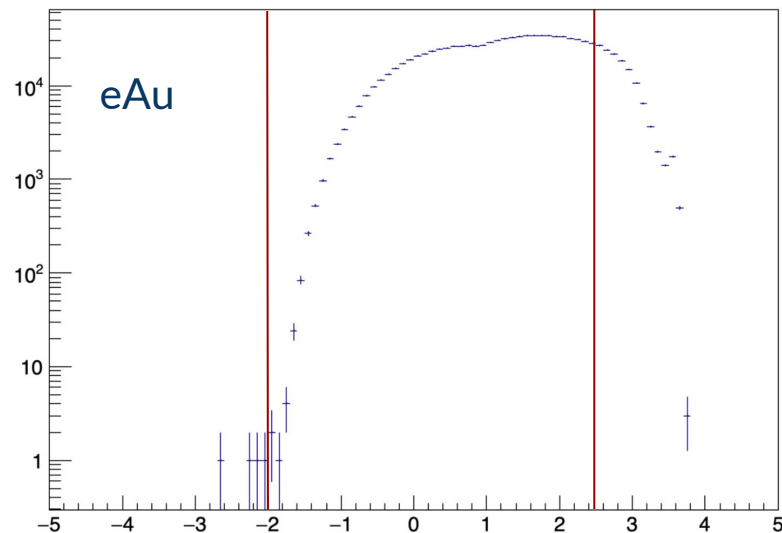
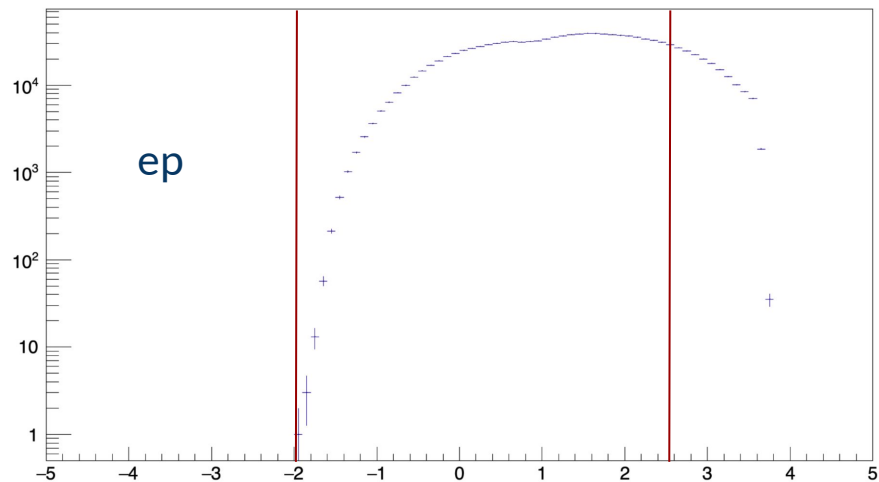
Backup

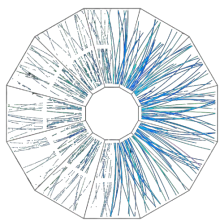


Brookhaven
National Laboratory



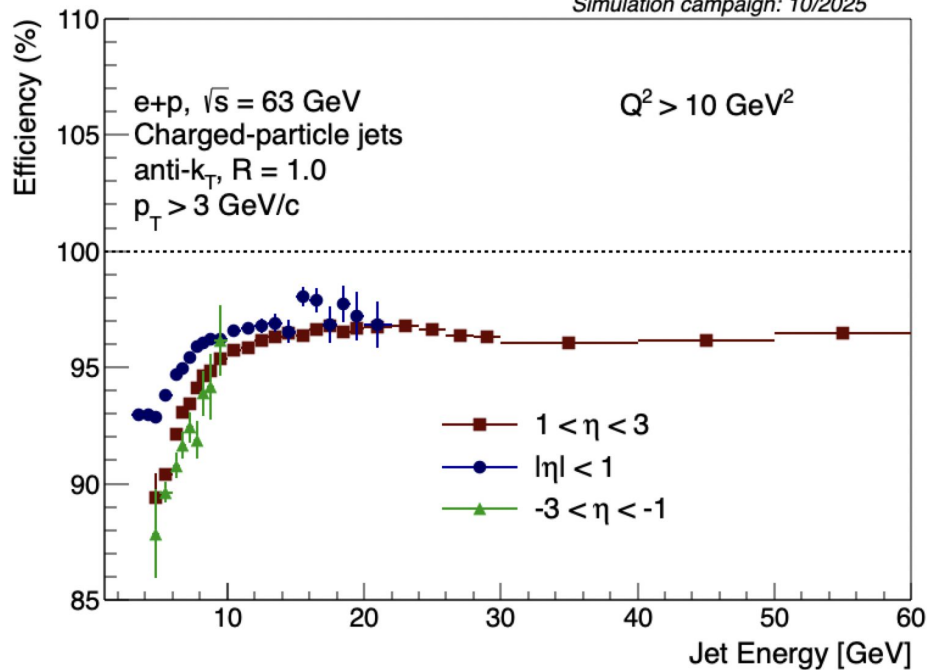
η distributions



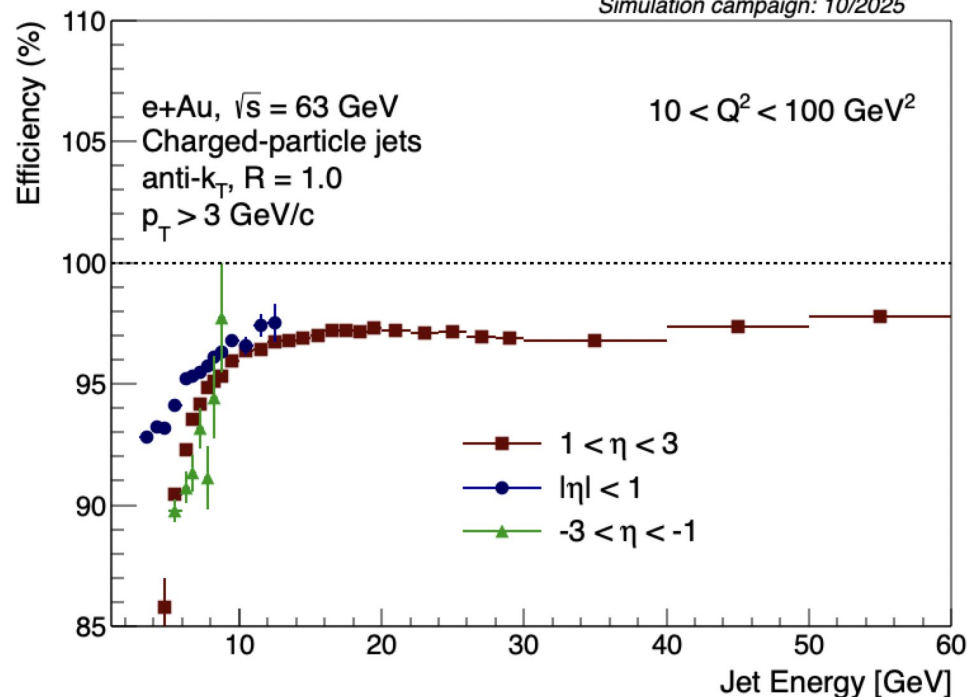


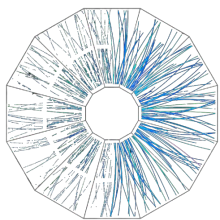
η dependency: efficiency

Simulation campaign: 10/2025

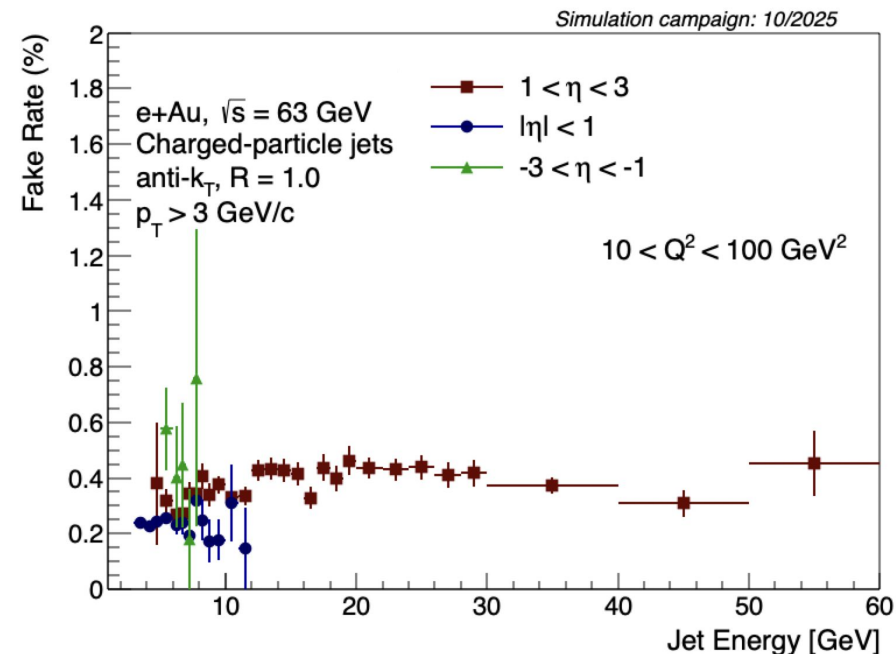
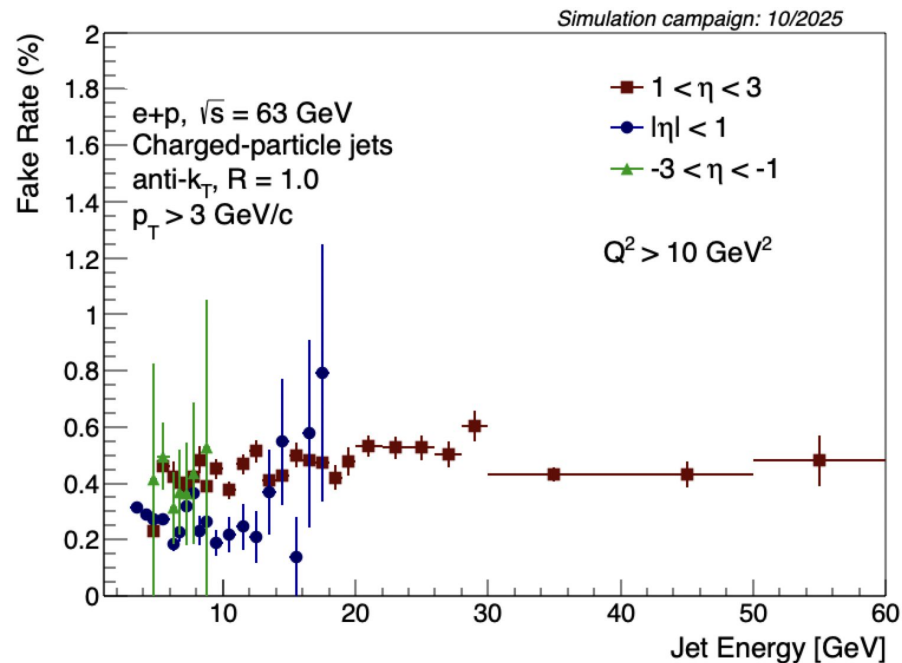


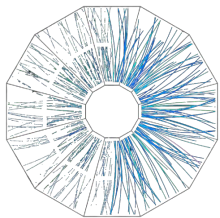
Simulation campaign: 10/2025



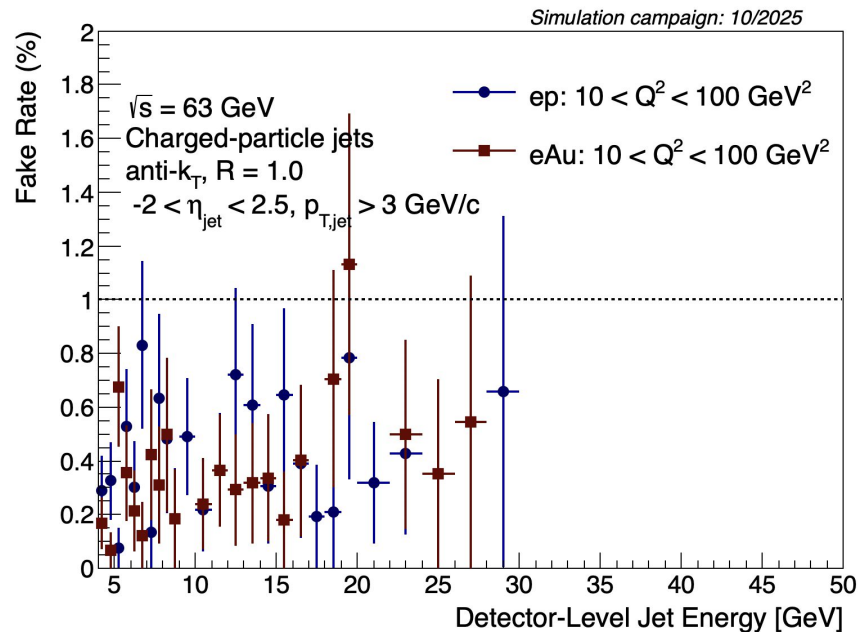
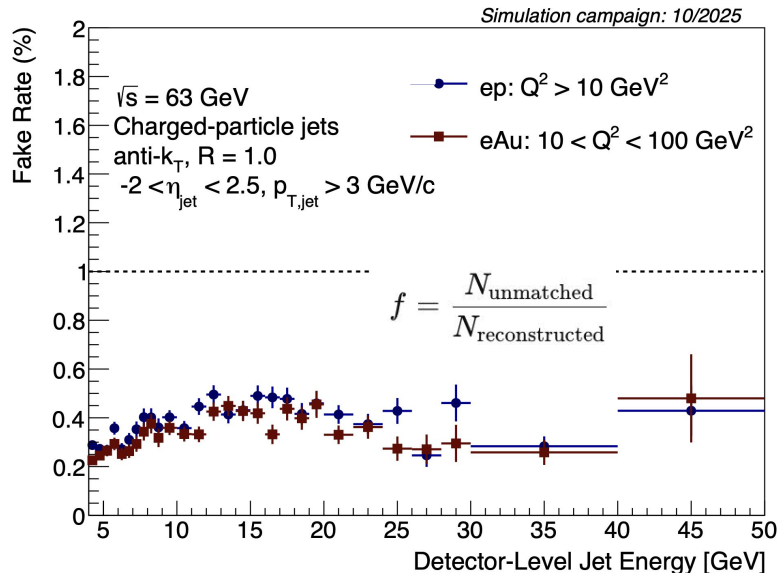


η dependency: fake rate

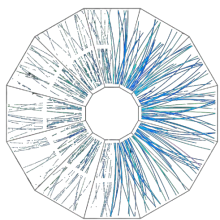




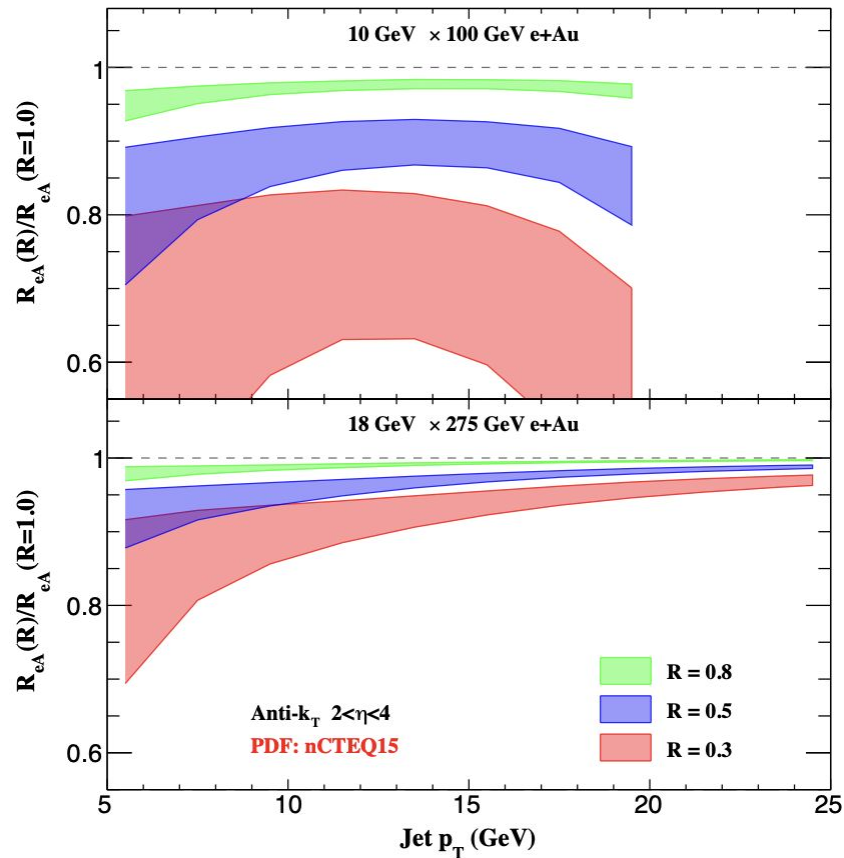
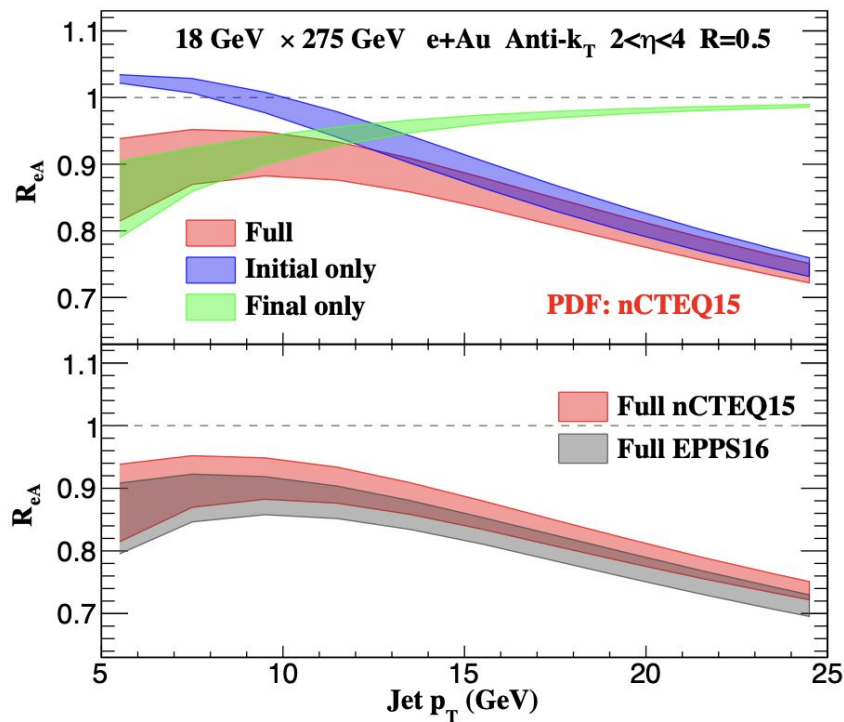
Jet finding performance (III)



Possible discrepancy due high- Q^2 cut (?)



Different radii R_{eAu}



[Phys. Rev. Lett. 126, 252001 \(2021\)](#)