Tracking performance from realistic seeding in J/ψ photo-(electro-) production

California EIC Consortium Collaboration Meeting

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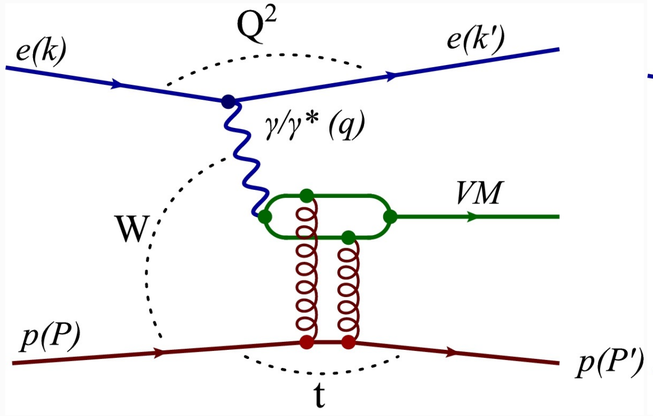
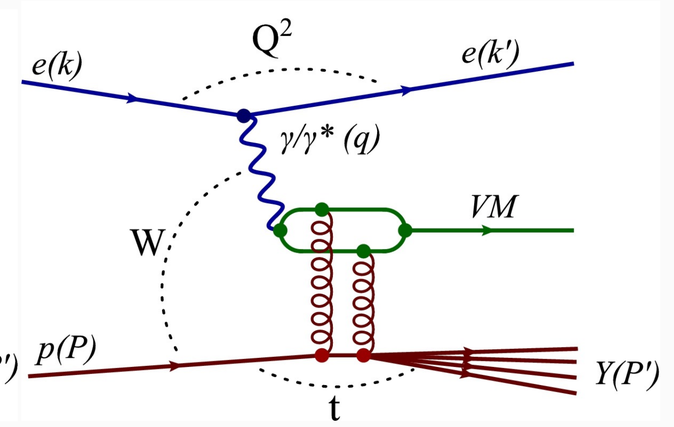
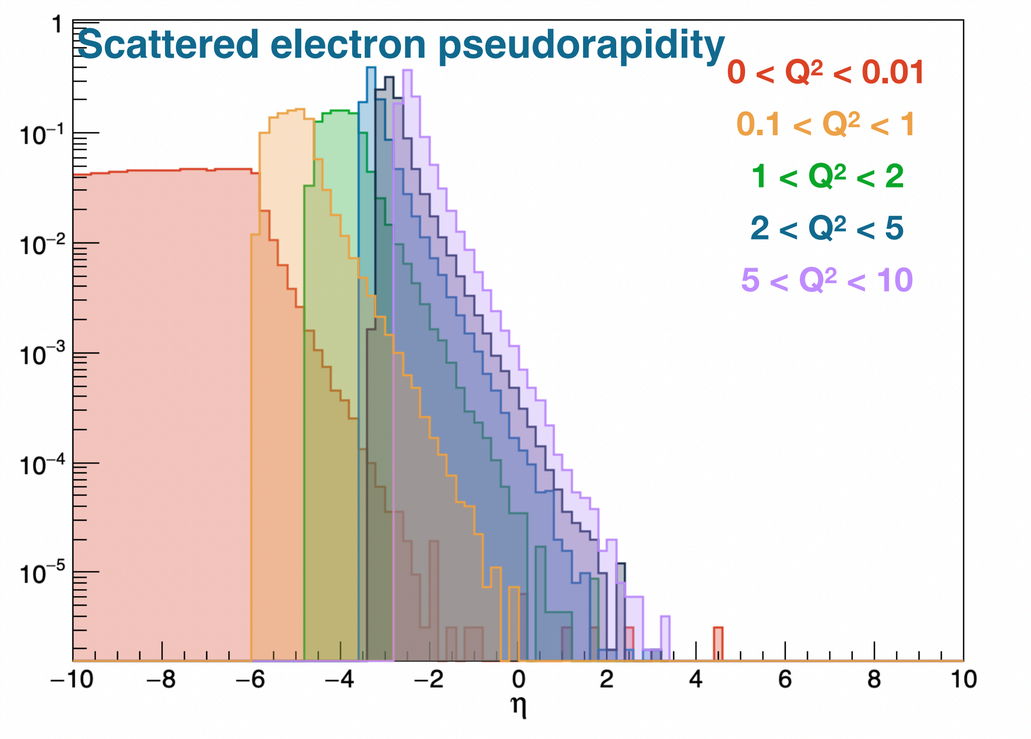
J/ψ photo-(electro-) production

- Coherent production of eA→eA'J/ψ→e(e+e-)A' with eSTARLight
- Electron beam energy of 18 GeV:
  ELECTRON_BEAM_GAMMA = 35295
- Au ion (197, 79) 100 GeV/nucleon:
  TARGET_BEAM_GAMMA = 106.6
- Standard detector simulation under EPIC software framework:
  npsim + eic_recon
- EPIC geometry: epic_craterlake including barrel and endcap mpgd layers
- 0.5 M events per each Q^2 range

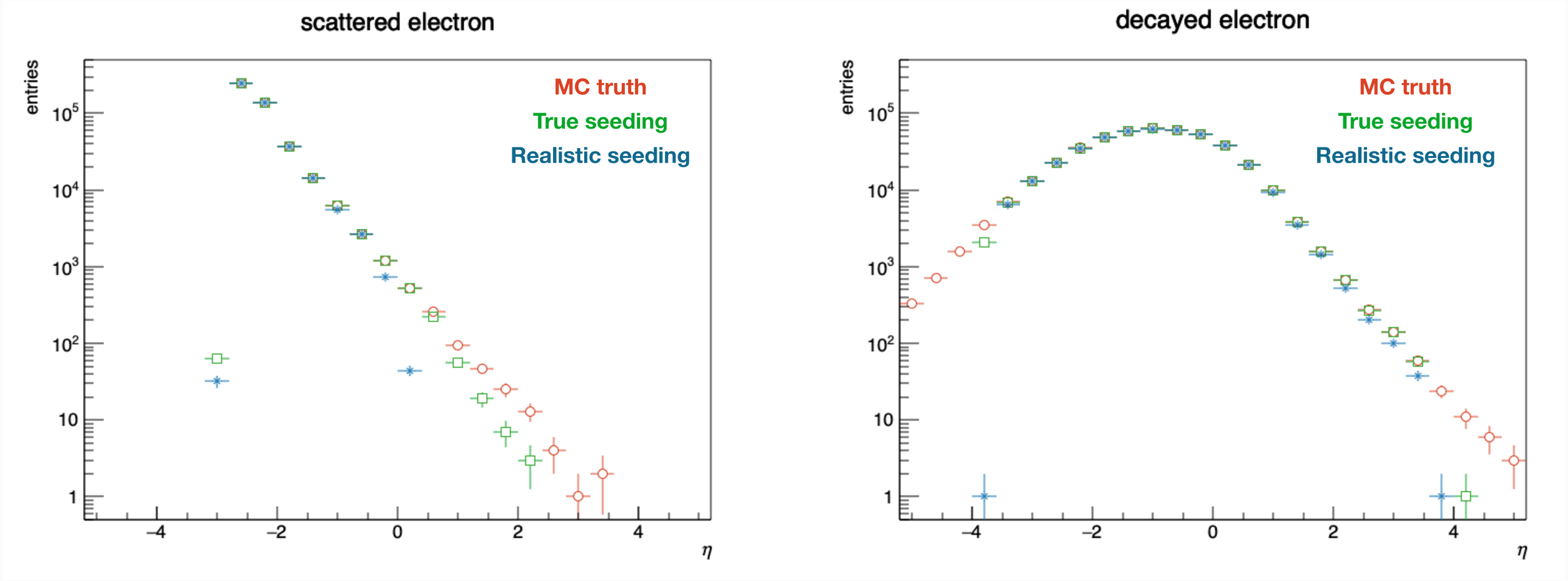






Kinematic acceptance of final state particles

$5 < Q^2 < 10\ (\mathrm{GeV})^2$



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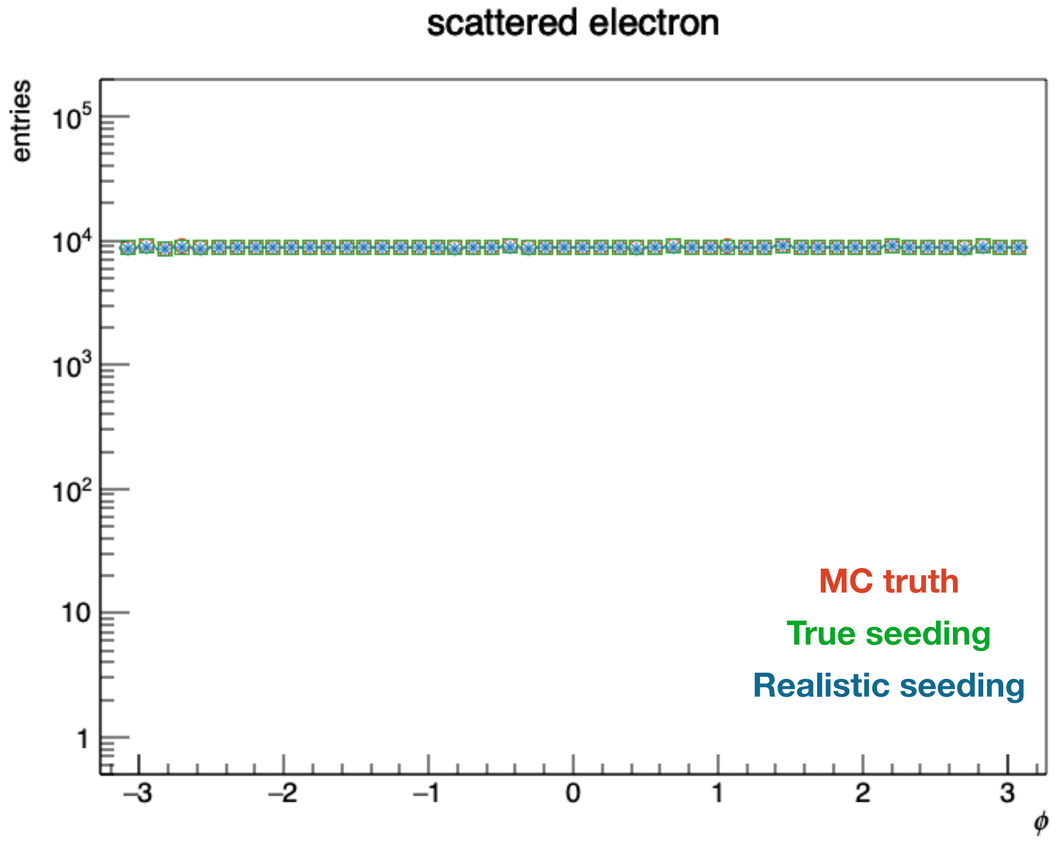
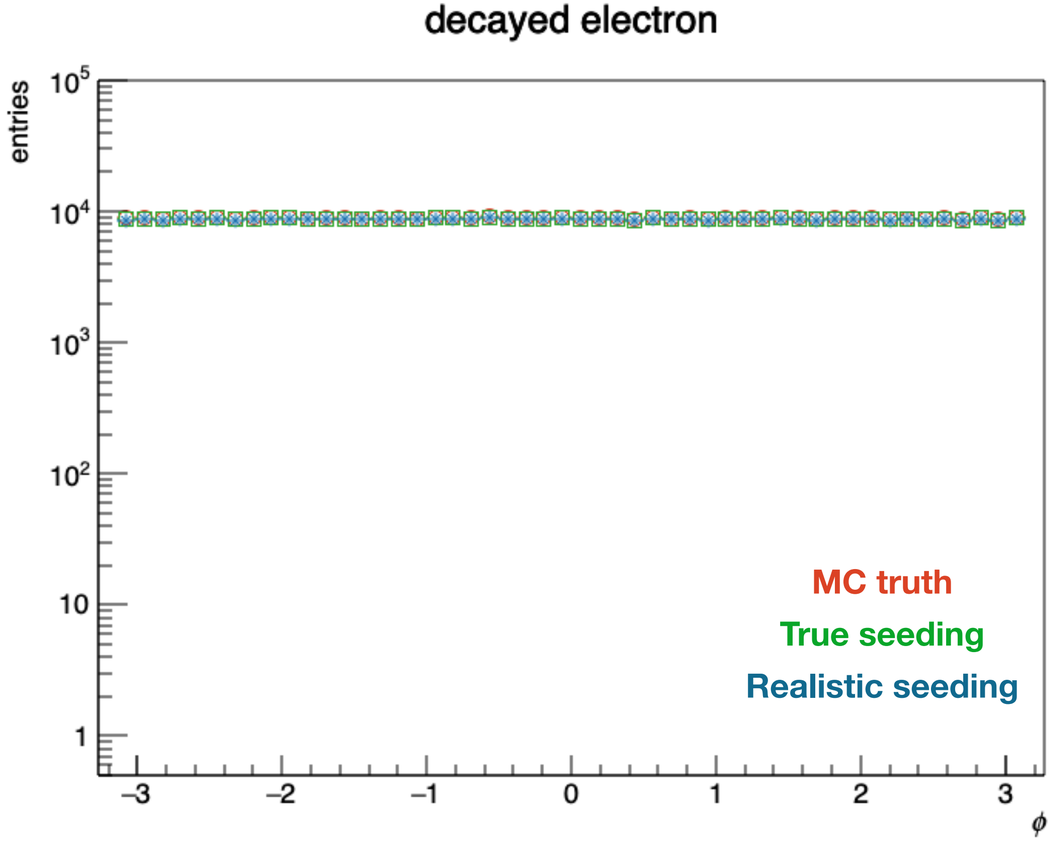
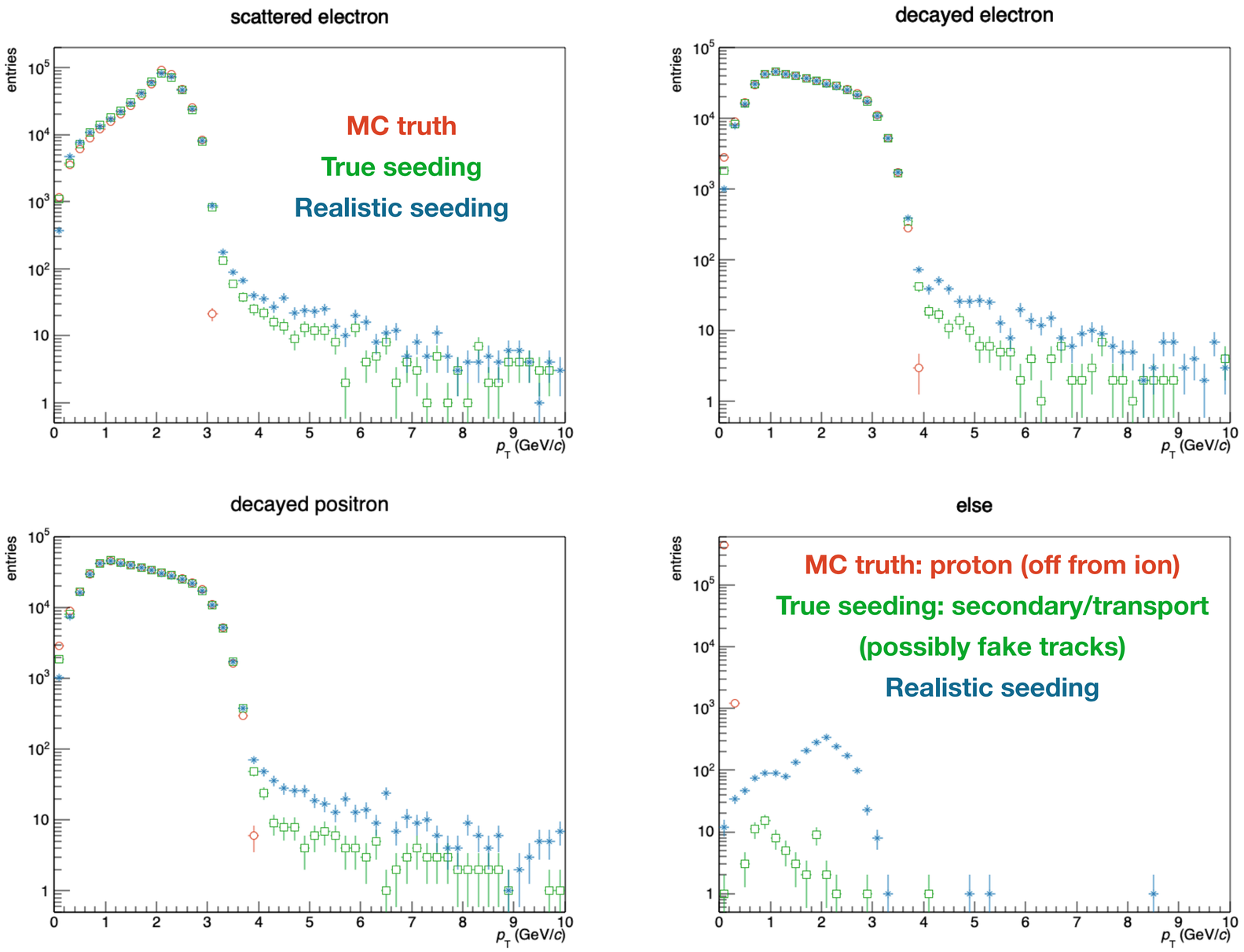




Transverse momentum of final state particles

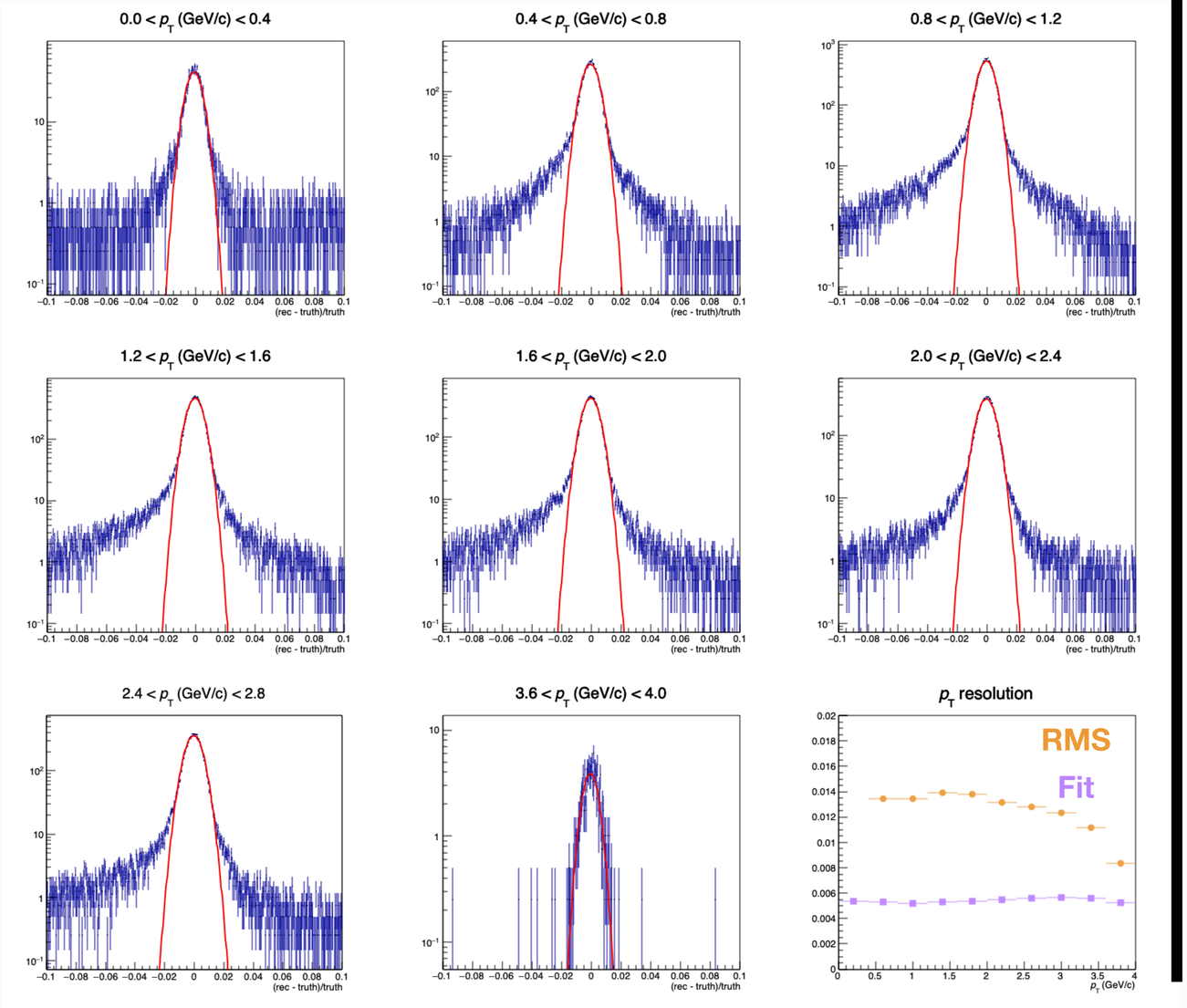
$5 < Q^2 < 10\ (GeV)^2$

- Both scattered electron and decay products are mostly in EPIC acceptance!
- Reconstructed pT from realistic seeding not too far from the one from true seeding (and MC truth)
- Secondary fraction is different in true/ realistic seeding

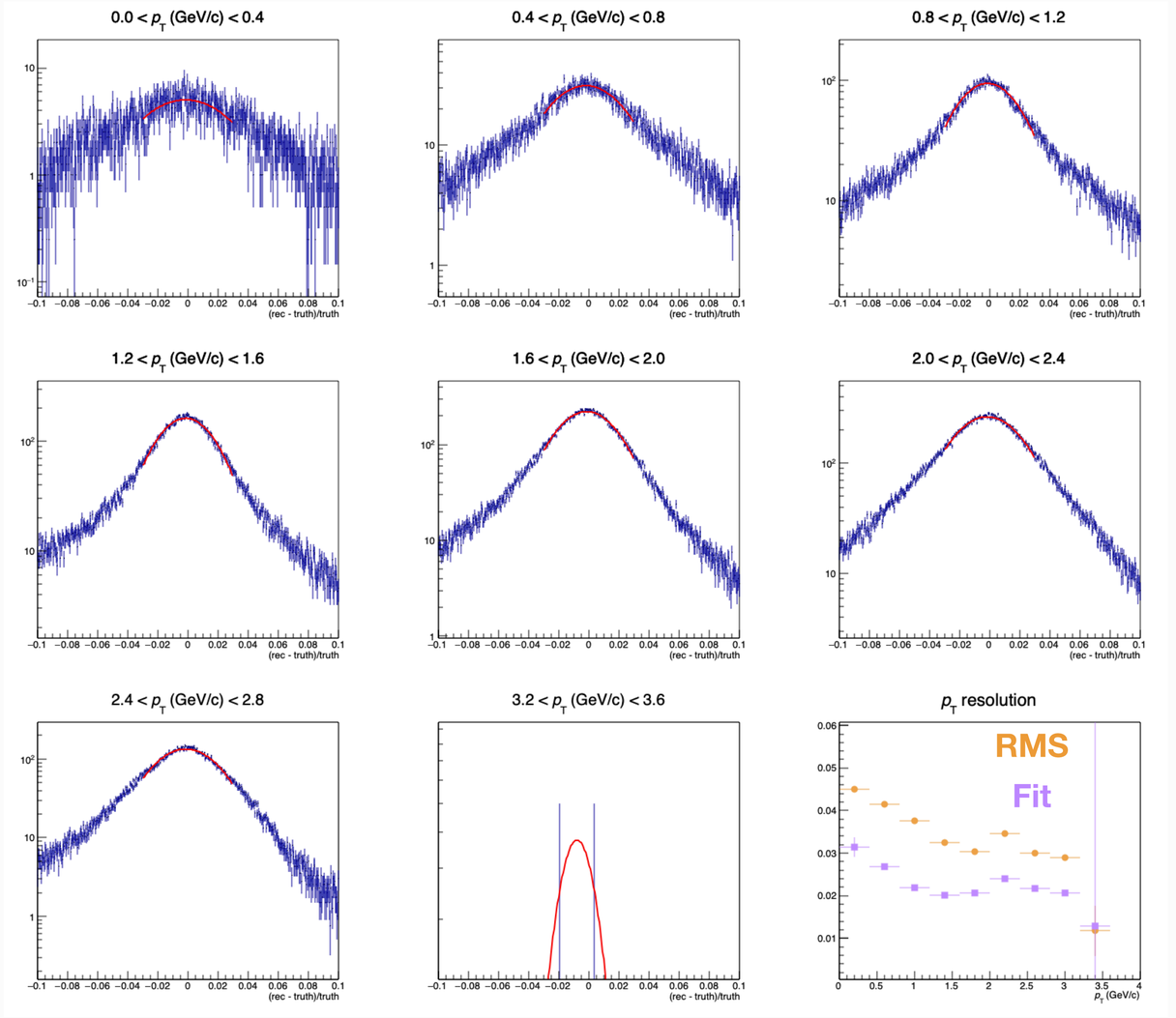


Transverse momentum resolution from true seeding

-1 < η < 1

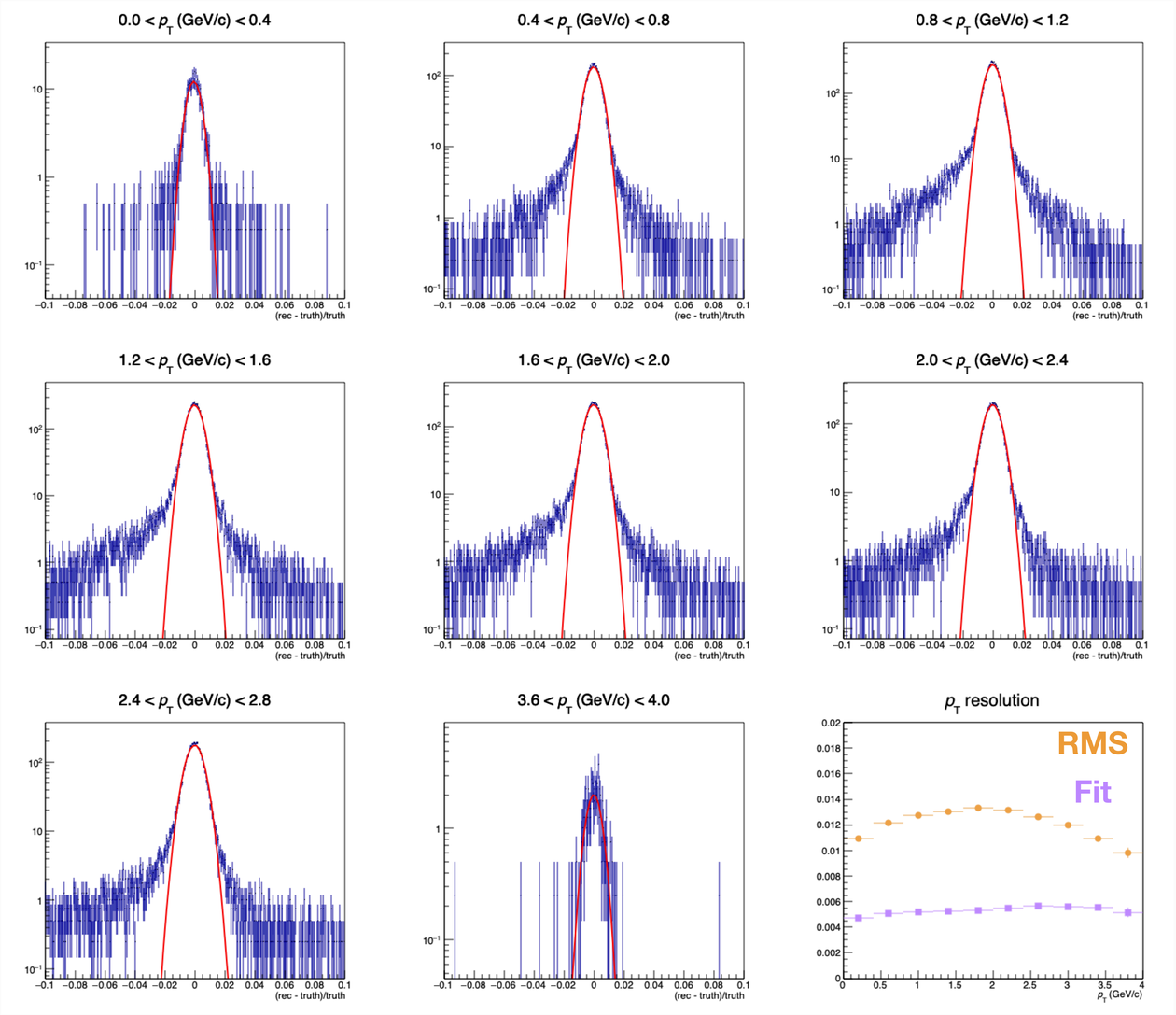


-3.5 < η < -1.5



Transverse momentum resolution from realistic seeding

$-1 < \eta < 1$



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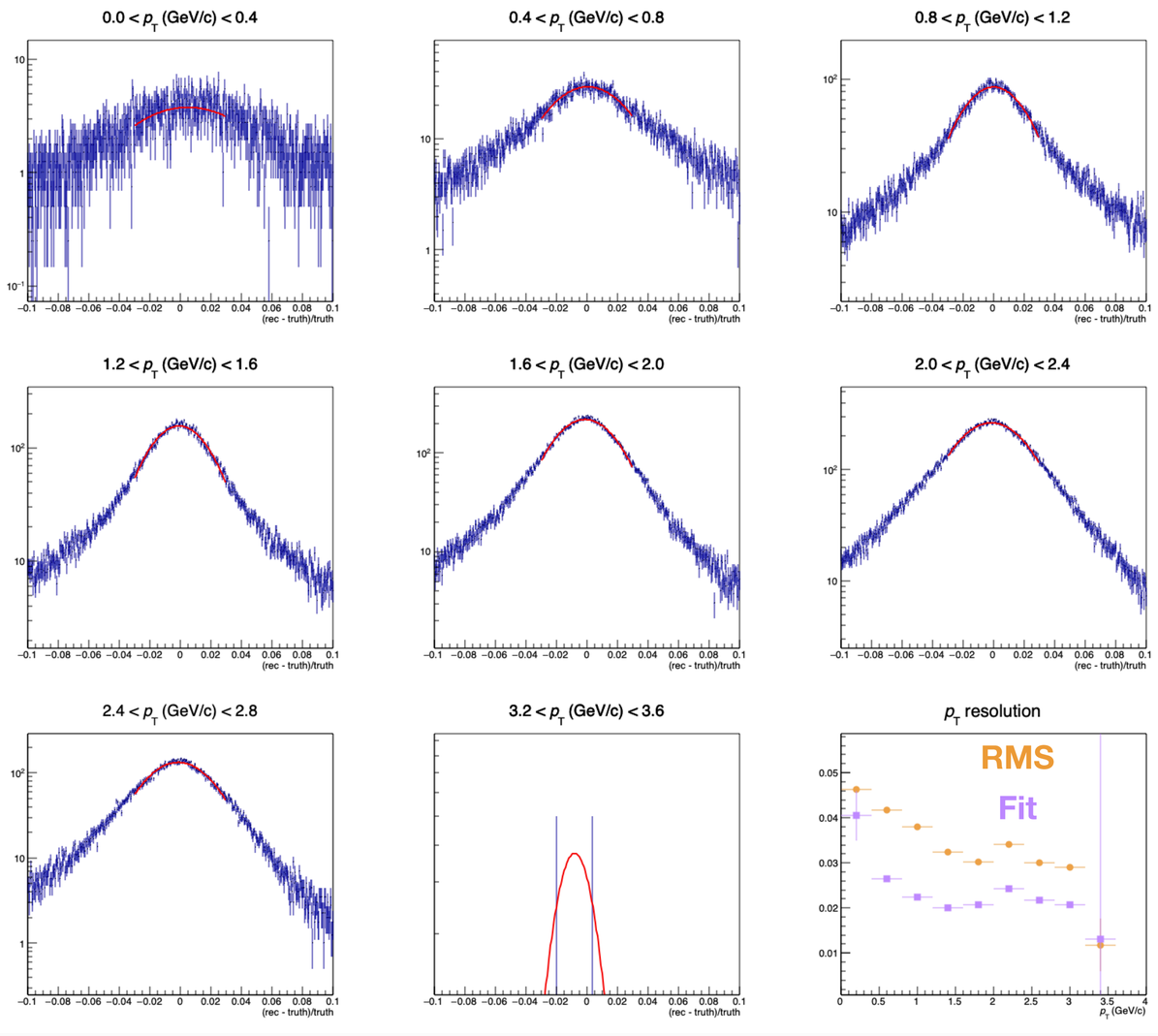
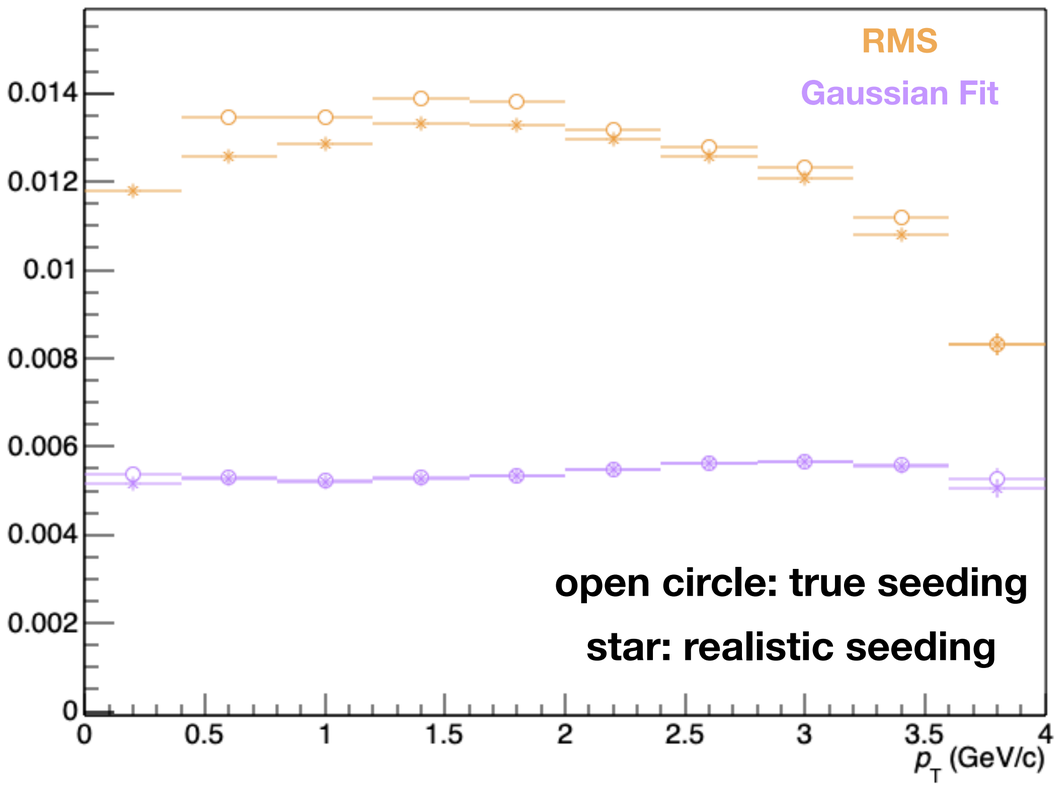


True seeding vs. Realistic seeding

-1 < η < 1



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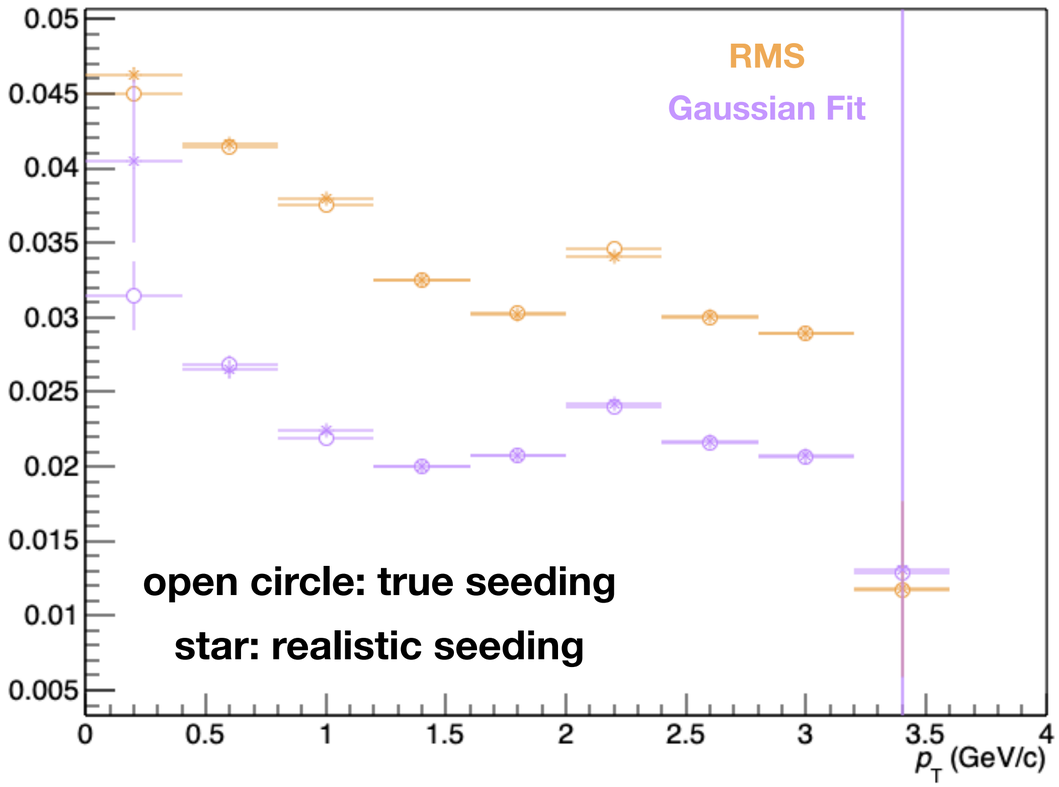
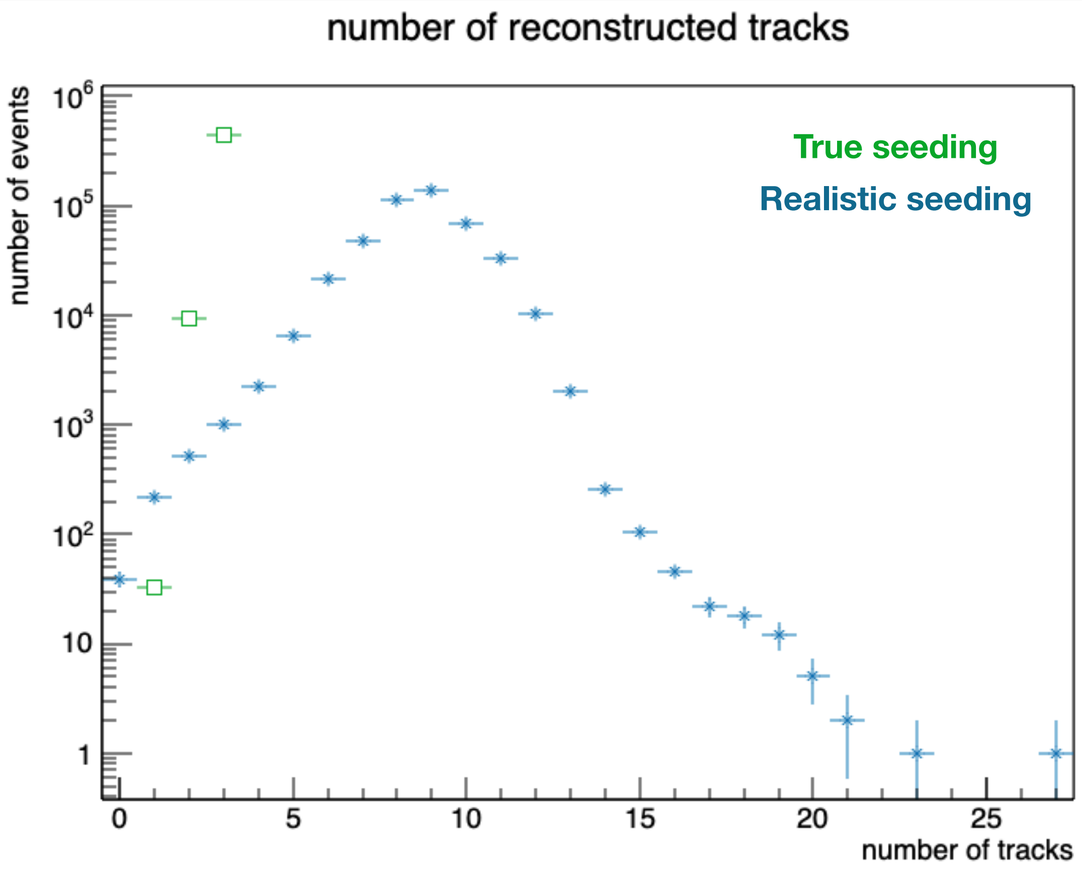
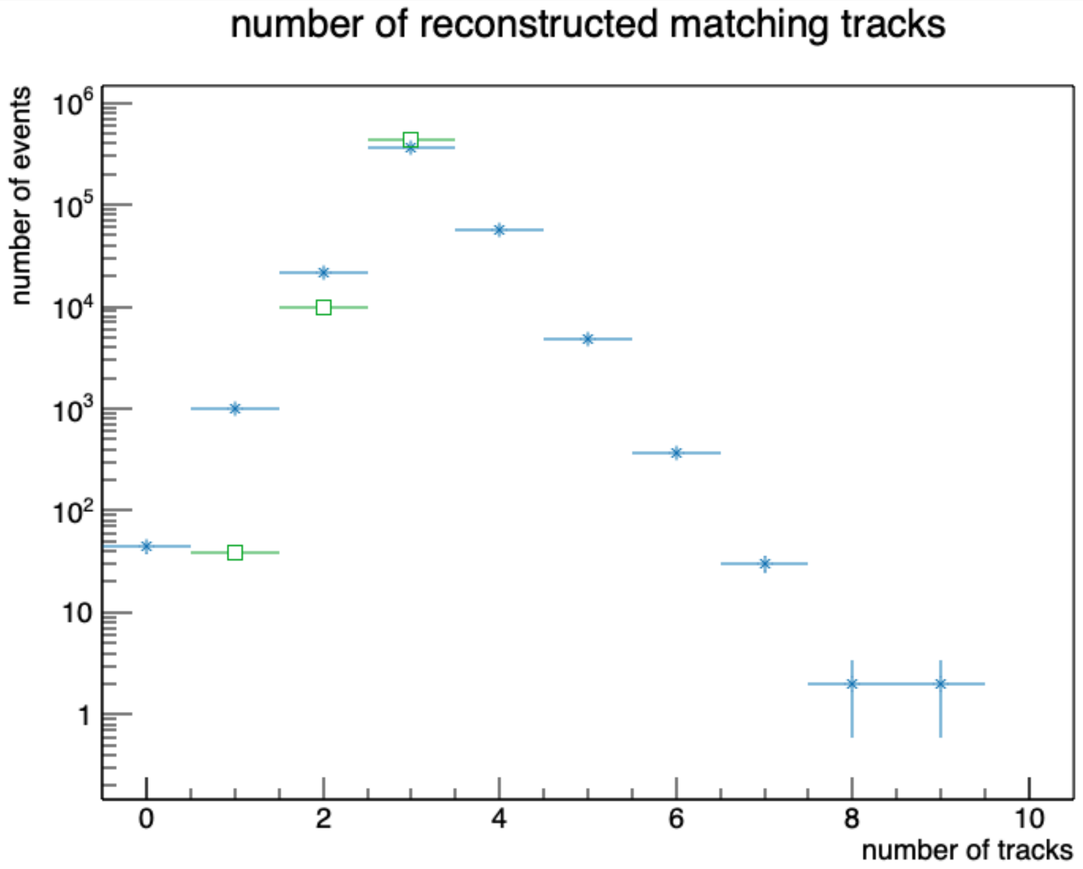


- Good match between True seeding and Realistic seeding

True seeding vs. Realistic seeding: multiplicity





- known issue: duplicated tracks realistic seeding; resulting large track multiplicity
- Next step: Track reduction in realistic sending and matching between particle and track

Summary and outlook

- Simulation full chain is ready for vector meson photoproduction using eSTARLight
- Validate tracking performance
  - Matching between MC particle and track
  - Fake/duplicate track study
  - Effect of MPGD layers
  - Add quality reflected variables into streaming output
- Update the projection in Yellow Report including |t| distribution
- Extend to other quarkonium states: ψ(2S), Υ(nS)

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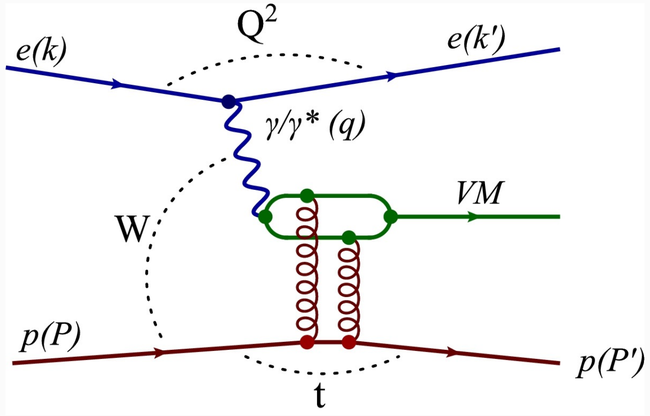
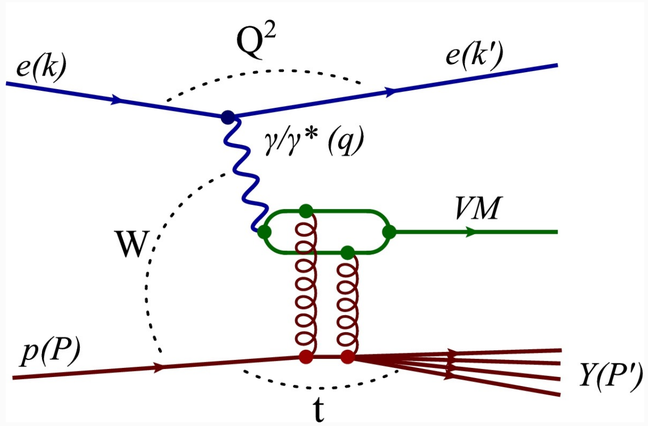
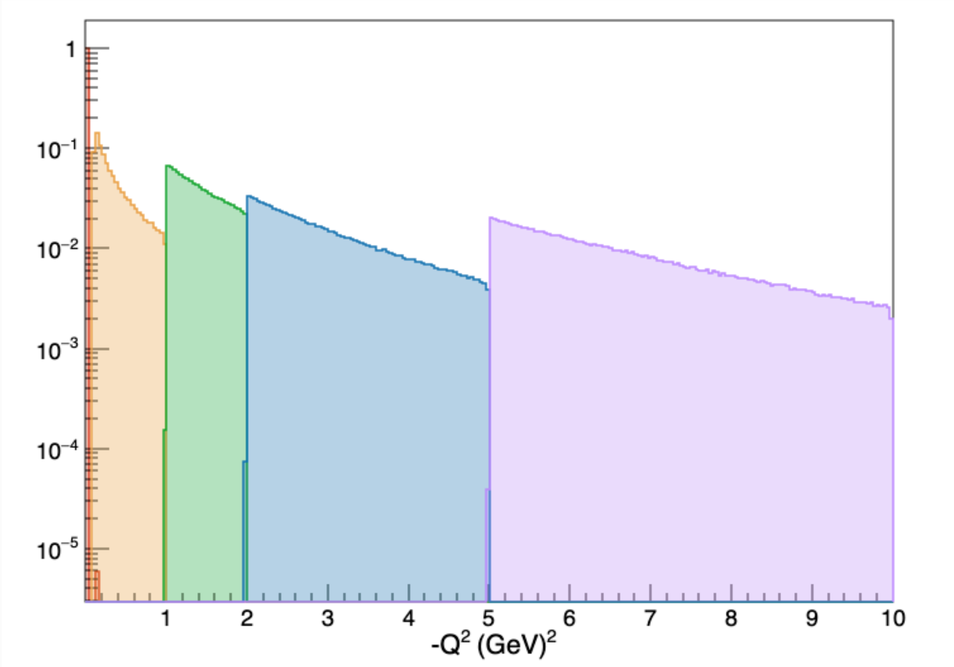






0 < Q^2 < 0.01

0.1 < Q^2 < 1

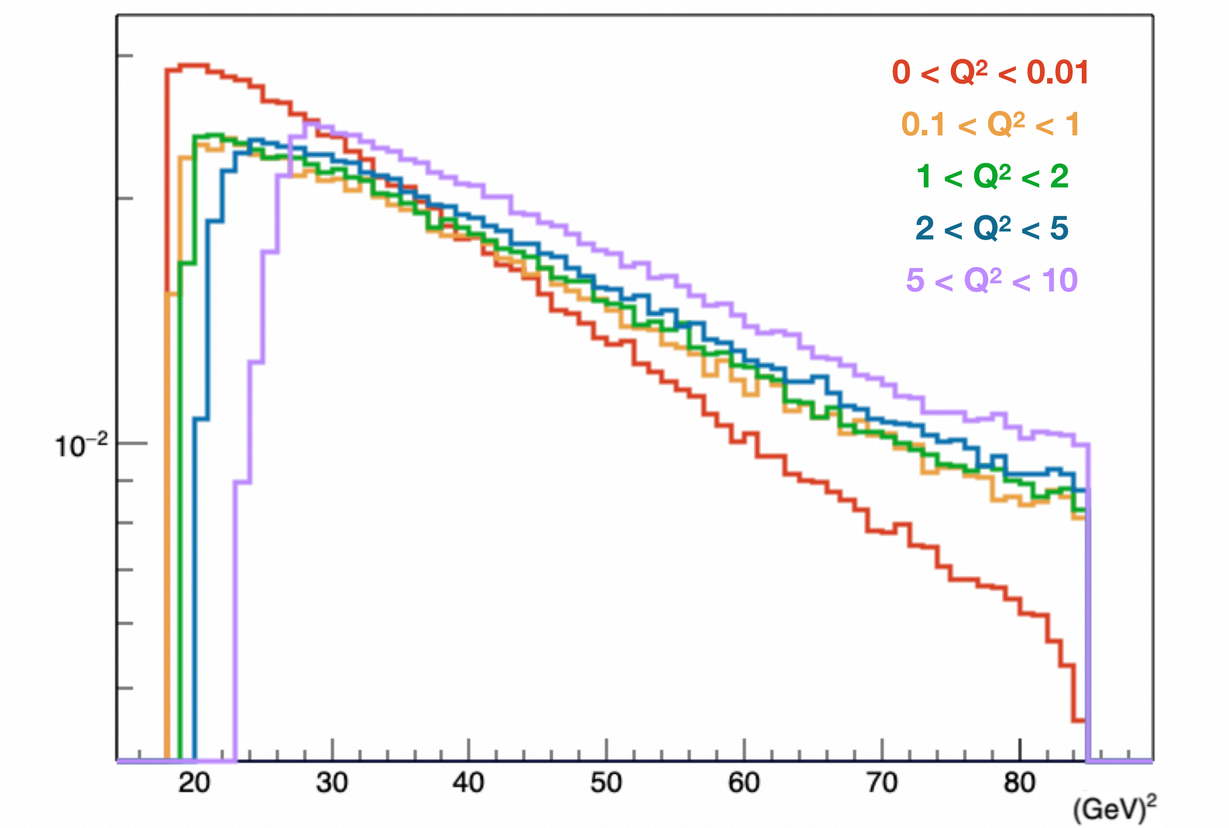
1 < Q^2 < 2

2 < Q^2 < 5

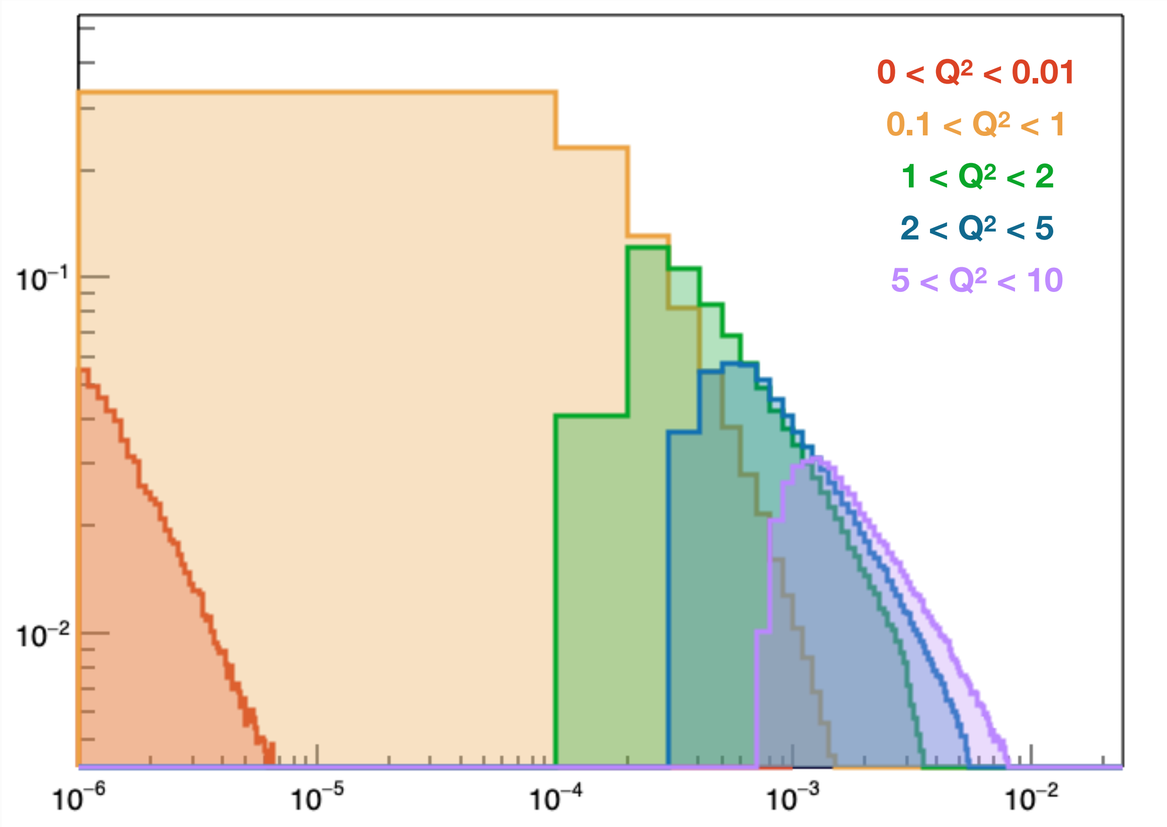
5 < Q^2 < 10

Event characteristics

$W_{\gamma p}$

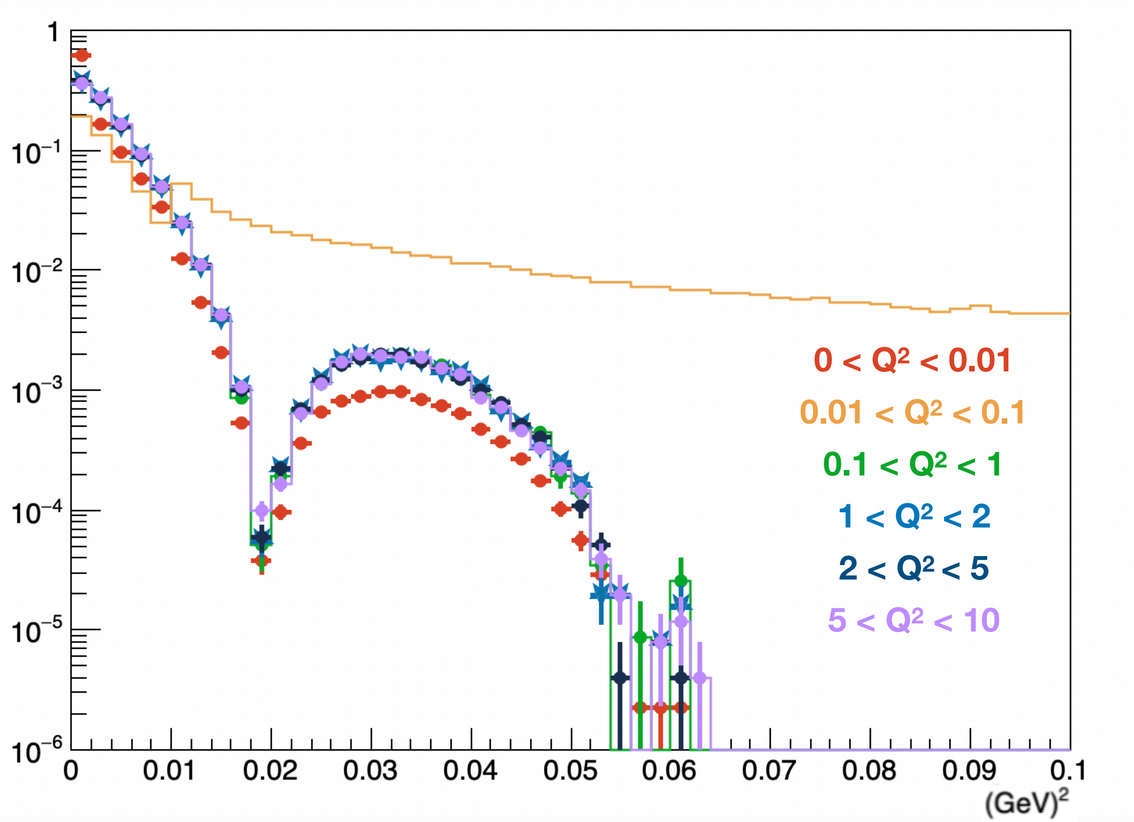


Bjorken x

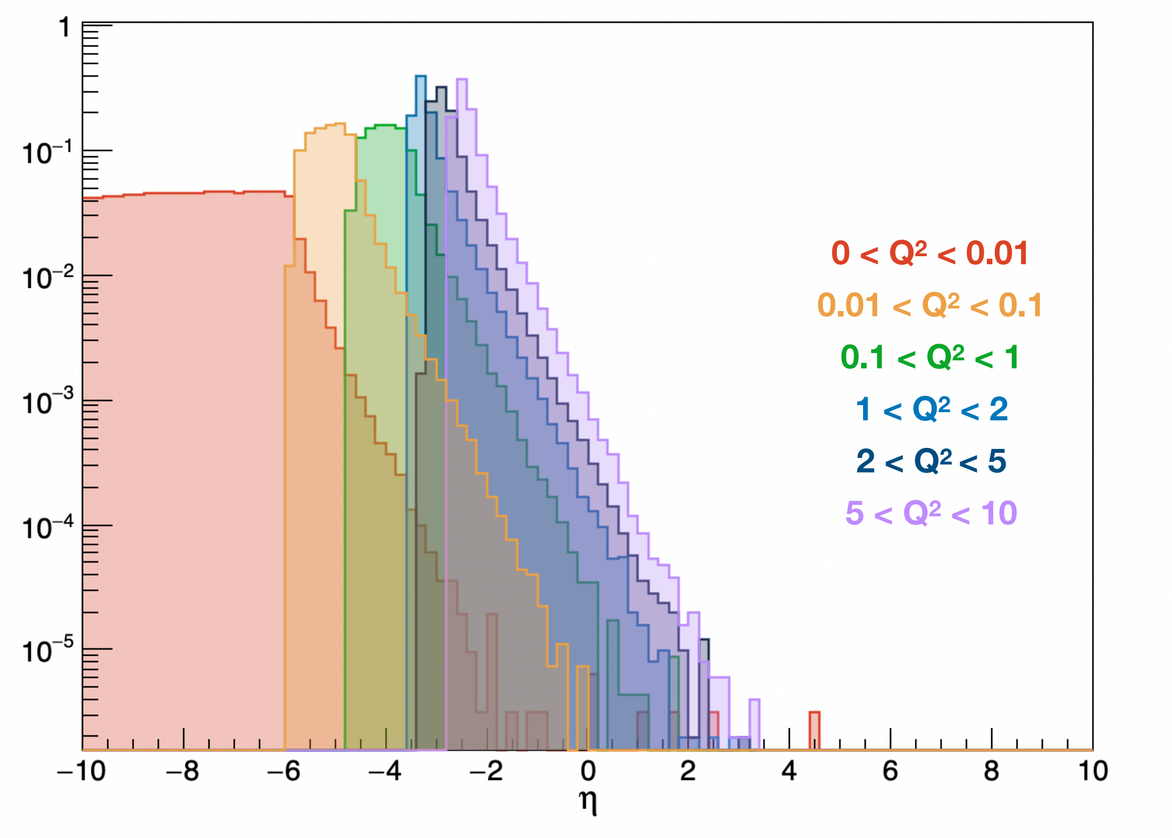


Event characteristics

ltl distribution

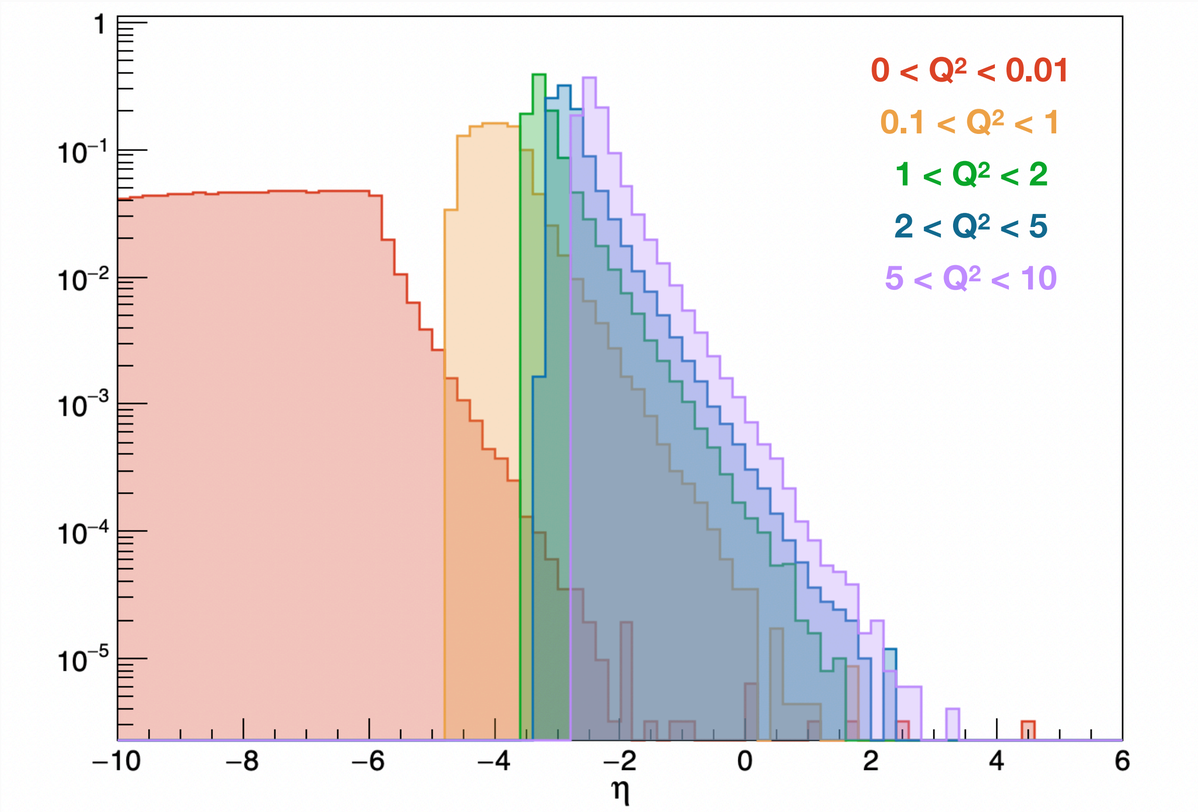


Scattered electron pseudorapidity

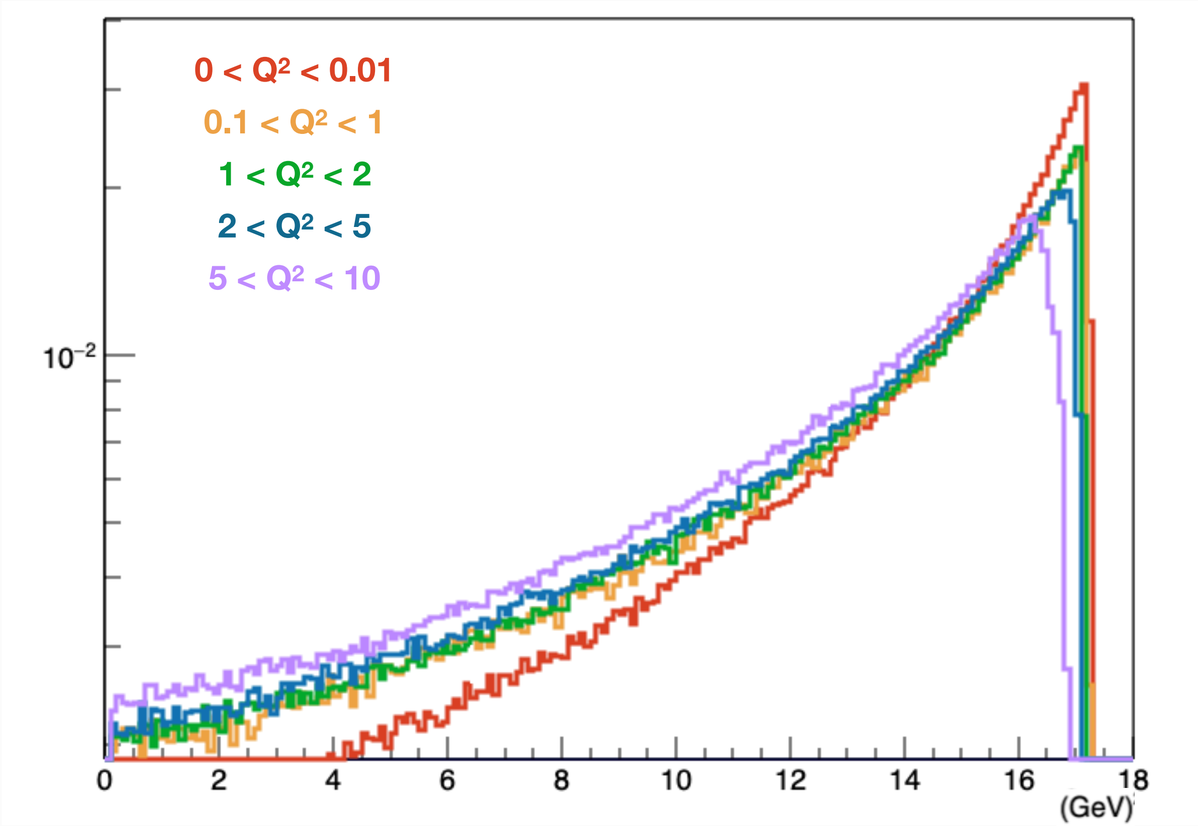


Scattered electrons in MC

Scattered electron pseudorapidity



Scattered electron energy



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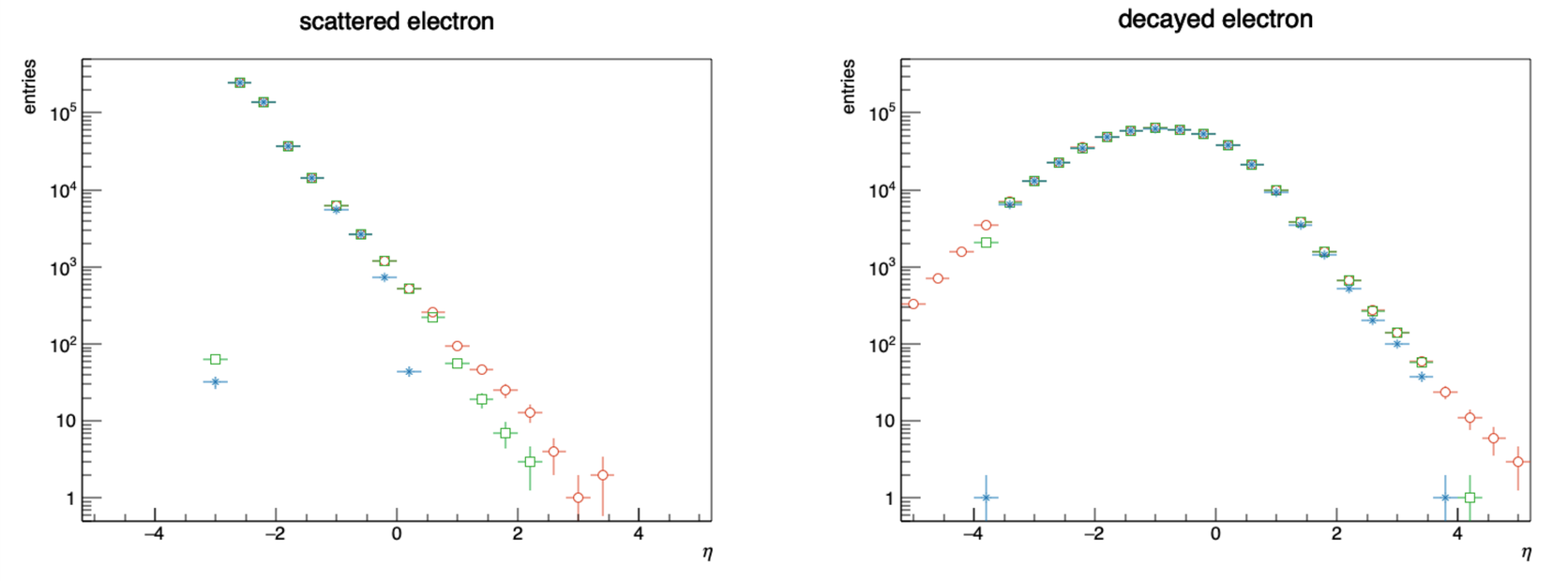

MC truth: proton (off from ion)

True seeding: secondary/transport

Realistic seeding: secondary/transport

MC truth

True seeding

Realistic seeding