DVJ/ψP Update:
Exclusive J/ψ Production in *ep*

BACKGROUND CHECK

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ePIC Exclusive, Diffraction, and Tagging Meeting

Residue background Checks

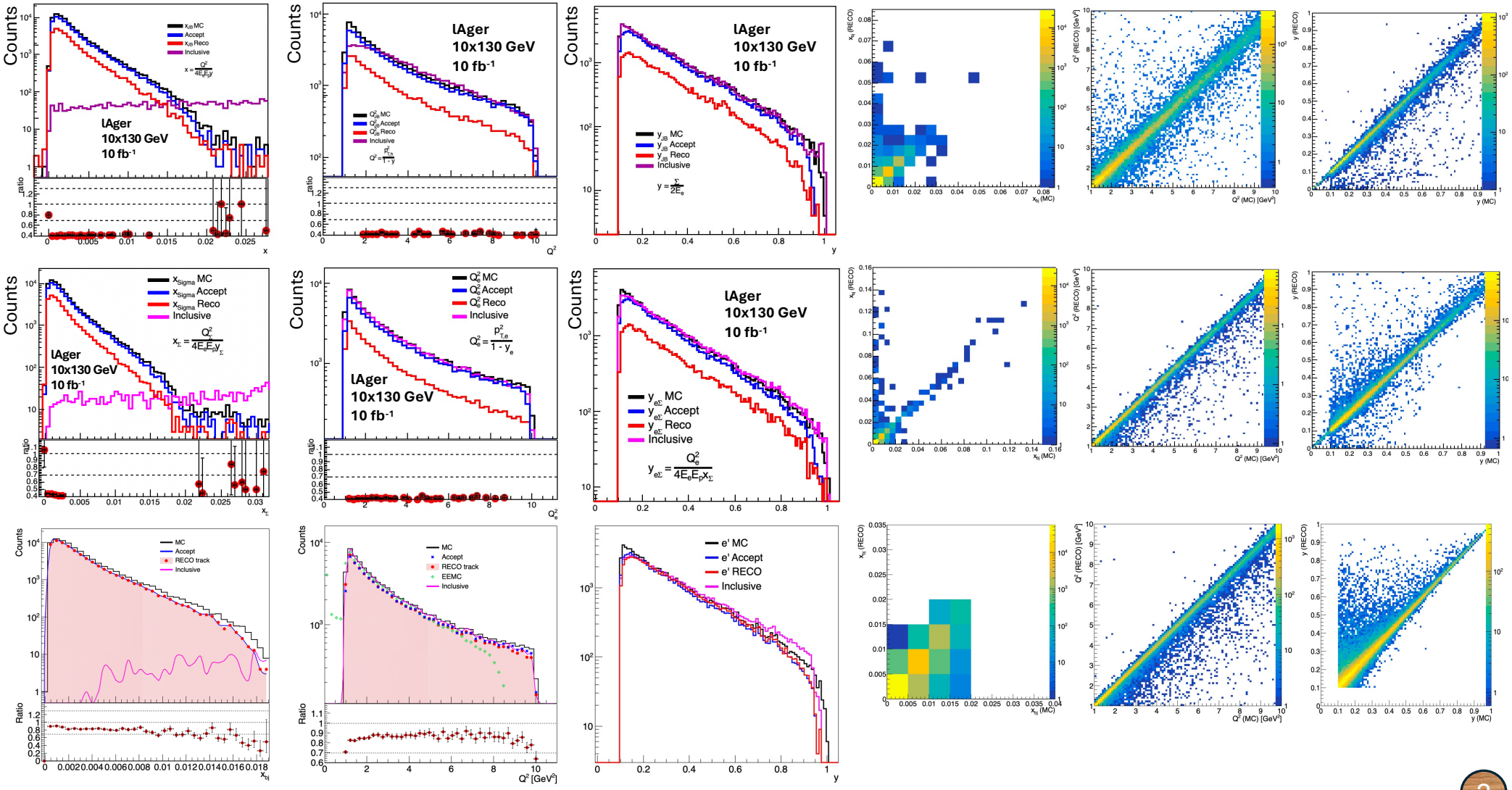
Data for Generation -> $1 < Q^2 < 10$

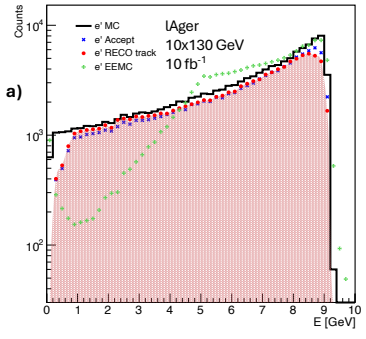
	Background	DVMP Signal
Cross section	0.63928175476836346 μb	1.9943×10^(−2) μb
Luminosity	8x10^(-4) fb^(-1)	10 fb^(-1)
# of Events	500,000	199,430

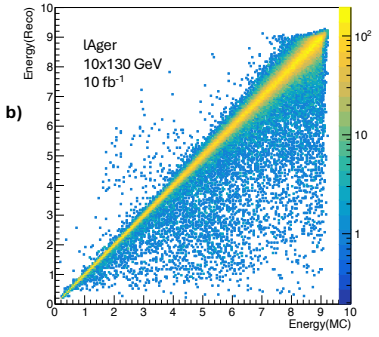
Data for Analysis -> $1 < Q^2 < 10$

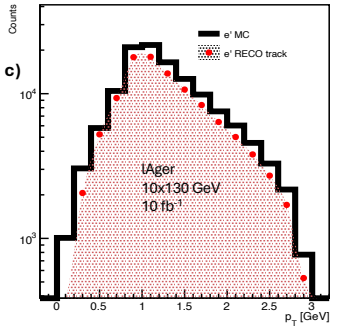
	Background	DVMP Signal
Cross section	0.63928175476836346 μb	1.9943×10^(−2) μb
# of Events	280,000	125,812

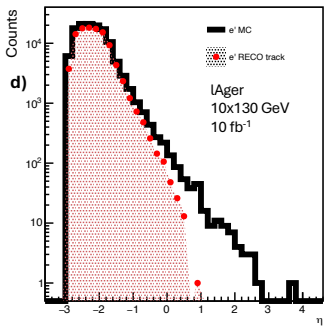
I reduced the number of events used to safe runtime.

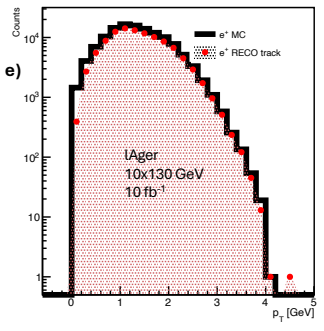

Counts
lAger
10x130 GeV
10 fb-1
Accept
Inclusive
Reco
MC
RECO track
EEMC
ratio

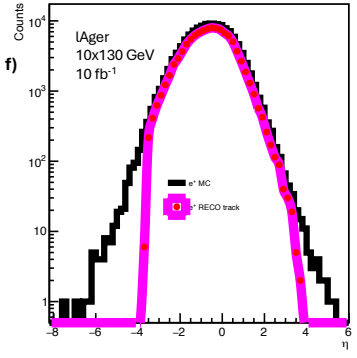

a)
e' MC
e' Accept
e' RECO track
e' EEMC
lAger
10x130 GeV
10 fb-1
Counts
E [GeV]

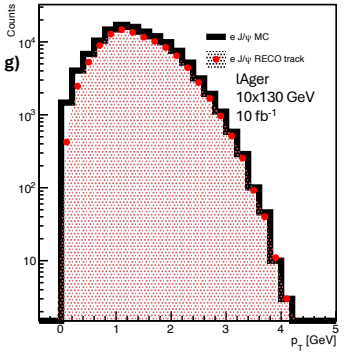

b)
lAger
10x130 GeV
10 fb-1
Energy(Reco)
Energy(MC)

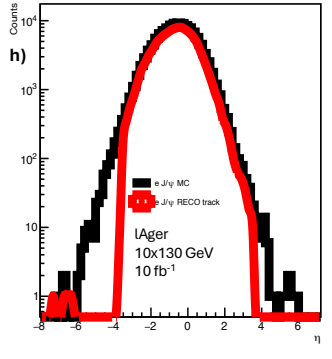

c)
e' MC
e' RECO track
lAger
10x130 GeV
10 fb-1
Counts
pT [GeV]

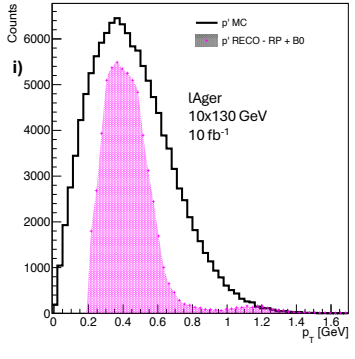

d)
e' MC
e' RECO track
lAger
10x130 GeV
10 fb-1
Counts
η

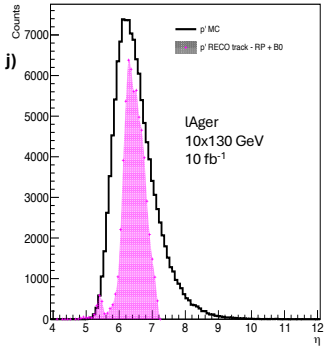

e)
e' MC
e' RECO track
lAger
10x130 GeV
10 fb-1
Counts
pT [GeV]

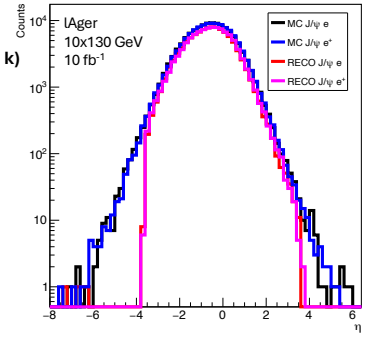

f)
lAger
10x130 GeV
10 fb-1
e' MC
e' RECO track
Counts
η

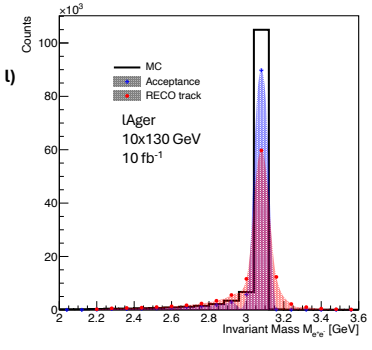

g)
e J/ψ MC
e J/ψ RECO track
lAger
10x130 GeV
10 fb-1
Counts
pT [GeV]

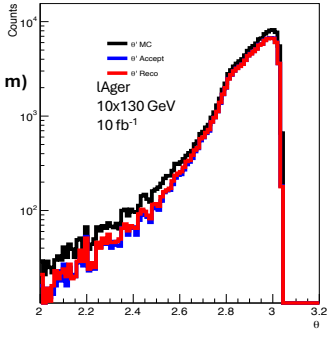

h)
e J/ψ MC
e J/ψ RECO track
lAger
10x130 GeV
10 fb-1
Counts
η

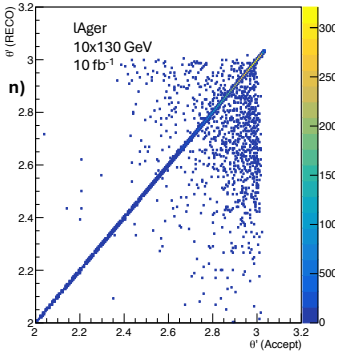

i)
p' MC
p' RECO - RP + B0
lAger
10x130 GeV
10 fb-1
Counts
pT [GeV]

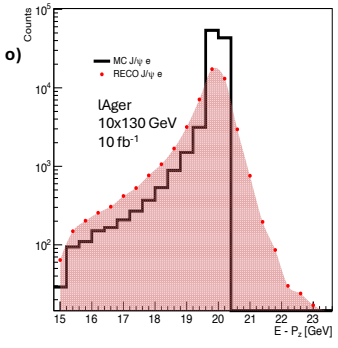

j)
p' MC
p' RECO track - RP + B0
lAger
10x130 GeV
10 fb-1
Counts
η

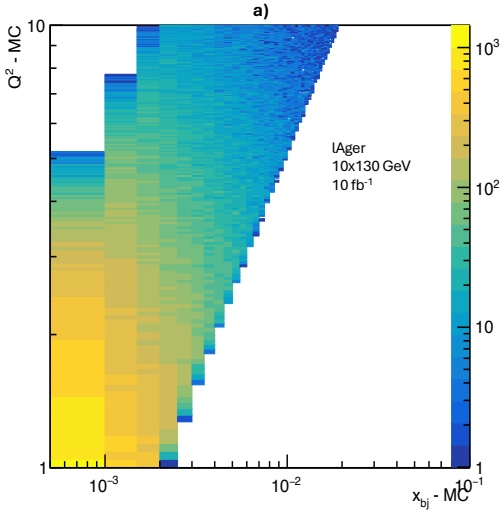

k)
lAger
10x130 GeV
10 fb-1
MC J/ψ e
MC J/ψ e+
RECO J/ψ e
RECO J/ψ e+
Counts
η

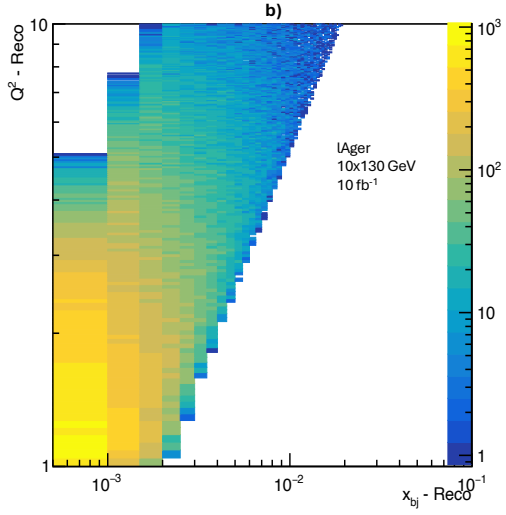

l)
MC
Acceptance
RECO track
lAger
10x130 GeV
10 fb-1
Counts
Invariant Mass Me'e- [GeV]

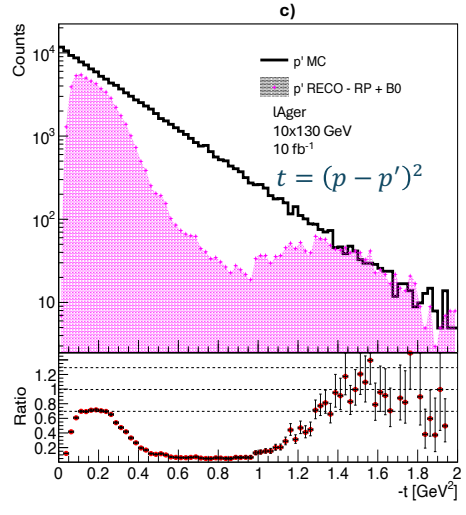

m)
e' MC
e' Accept
e' Reco
lAger
10x130 GeV
10 fb-1
Counts
θ

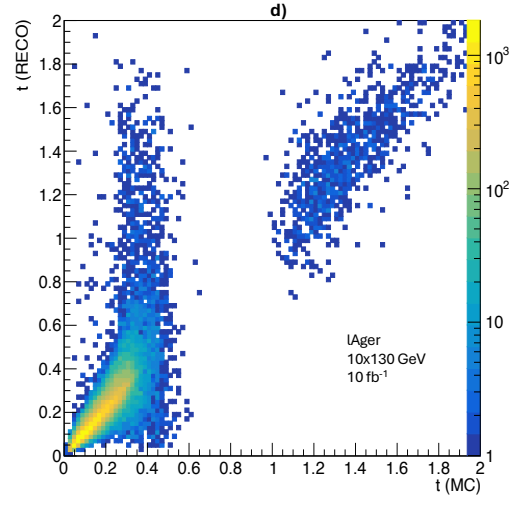

n)
lAger
10x130 GeV
10 fb-1
θ' (RECO)
θ' (Accept)

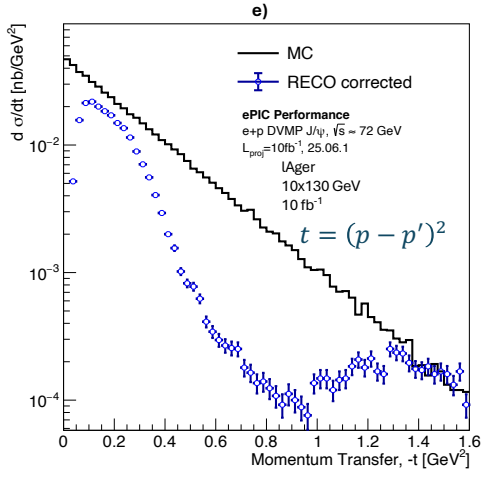

o)
MC J/ψ e
RECO J/ψ e
lAger
10x130 GeV
10 fb-1
Counts
E - Pz [GeV]

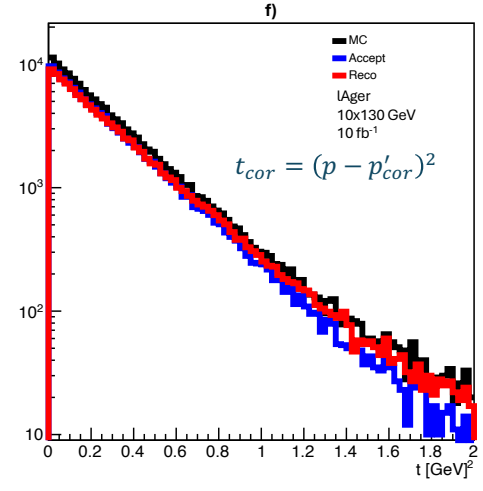

a)
Q² - MC
x_bj - MC
lAger
10x130 GeV
10 fb⁻¹

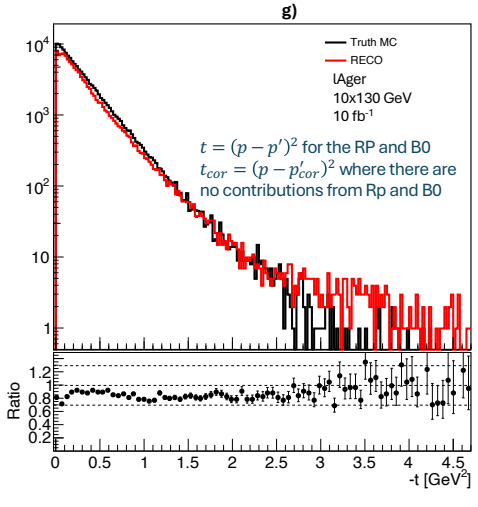

b)
Q² - Reco
x_bj - Reco
lAger
10x130 GeV
10 fb⁻¹

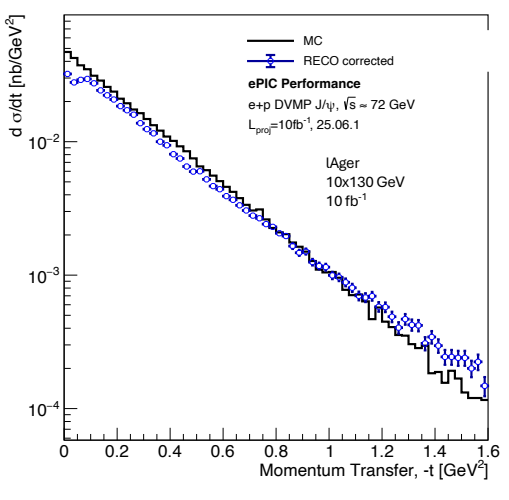

c)
Counts
p' MC
p' RECO - RP + B0
lAger
10x130 GeV
10 fb⁻¹
$t = (p - p')^2$
Ratio
-t [GeV²]


d)
t (RECO)
t (MC)
lAger
10x130 GeV
10 fb⁻¹

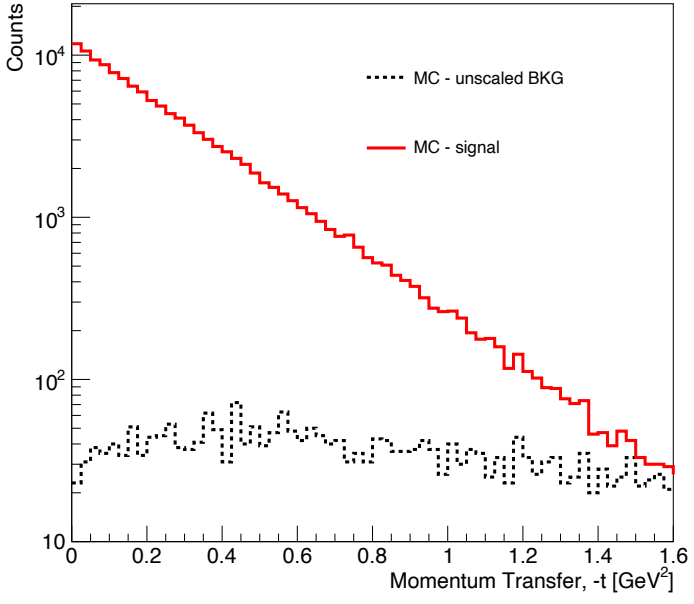

e)
d σ/dt [nb/GeV²]
MC
RECO corrected
ePIC Performance
e+p DVMP J/ψ, √s ≈ 72 GeV
L_proj=10fb⁻¹, 25.06.1
lAger
10x130 GeV
10 fb⁻¹
$t = (p - p')^2$
Momentum Transfer, -t [GeV²]


f)
MC
Accept
Reco
lAger
10x130 GeV
10 fb⁻¹
$t_{cor} = (p - p'_{cor})^2$
t [GeV]²

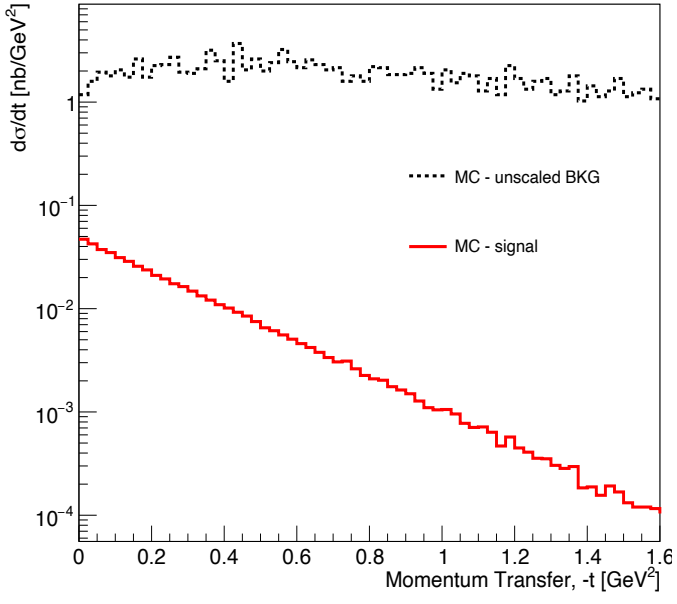

g)
Truth MC
RECO
lAger
10x130 GeV
10 fb⁻¹
$t = (p - p')^2$ for the RP and B0
$t_{cor} = (p - p'_{cor})^2$ where there are no contributions from Rp and B0
Ratio
-t [GeV²]


h)
d σ/dt [nb/GeV²]
MC
RECO corrected
ePIC Performance
e+p DVMP J/ψ, √s ≈ 72 GeV
L_proj=10fb⁻¹, 25.06.1
lAger
10x130 GeV
10 fb⁻¹
Momentum Transfer, -t [GeV²]

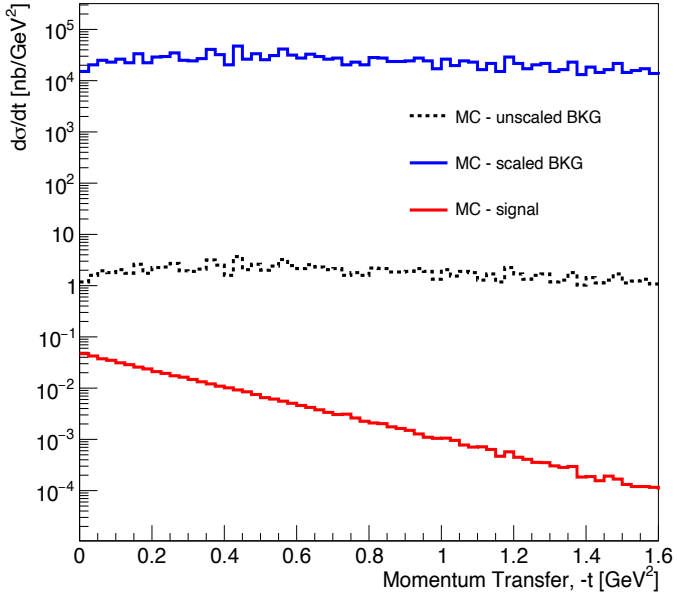
Residue background Checks



The black dashed line is the background counts and red is the lAger signal counts



The cross section before scaling the background



The black dashed line is the background, scaled from 7.8×10^{-4} fb^{-1} to the same 10 fb^{-1}, so it rises by about 1.28205128×10^{4} times.

Even though the background was simulated with ~$10^4\times$ less luminosity, its raw counts (before scaling) were already only about one order of magnitude below the signal.

This means that once the normalization of both datasets to the same luminosity is done, the background becomes huge relative to the signal — which would dominate.

Residue background Checks

Quantity	**Signal**	**Background**
Luminosity (fb^{-1})	10	7.8×10^{-4}
Raw counts	Similar	Slightly lower
After scaling	Moderate yield	Grows ×13,000
Dominance	---	Overwhelming
Meaning	Exclusive σ is small	Inclusive σ is huge