t Reconstruction Using Roman Pot at 2nd Focus

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2024/05/20

t Resolution

Focusing $0.03 < t < 1.6\ GeV^2$

DVCS 18 GeV × 275 GeV Sample

- Data sample was taken from
  - 1 M exclusive coherent events
  - S3/eictest/EPIC/EVGEN/EXCLUSIVE/DVCS/18x275/DVCS.3.18x275.hepmc
  - **No radiative component included**
- Passed through Afterburner to apply **beam effects (angular divergence & momentum spread) and crossing angle**
- **Applied only crossing angle rotation for now, which means only beam effect included**
- Regarding reconstruction of scattered proton
  - Applied 10σ cut based on IR-8 ep 18 GeV × 275 GeV setting (92.5 %)

$$\sigma_{x,y} = \sqrt{\epsilon_{x,y}\beta(z)_{x,y} + (D_{x,y}\frac{\Delta p}{p})^2}$$

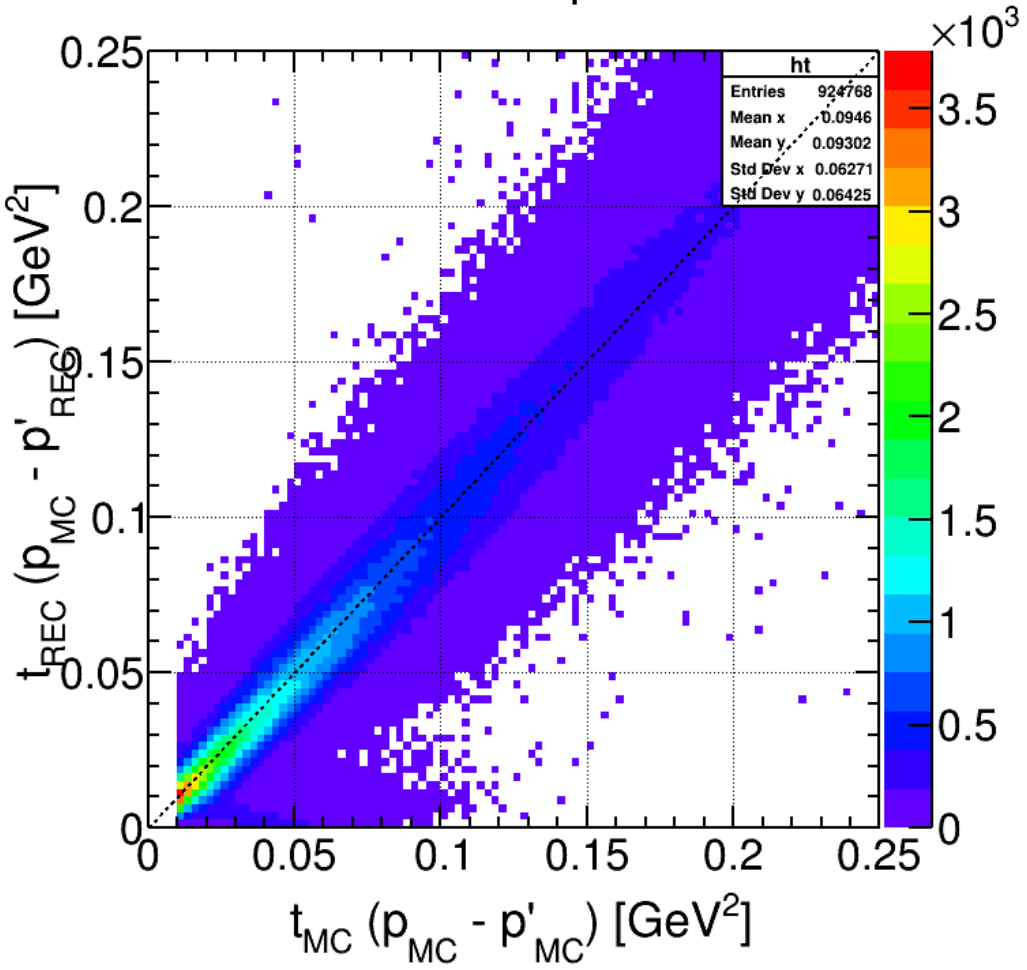
1σ calculation	$1\sigma_x$	$1\sigma_y$
ep β @ IR-8 RPSF (new)	0.146677	0.140271

where ϵ : Emittance at z=0, $\boldsymbol{\beta}$ **: Beta function at z=RPSF**, $\boldsymbol{D}$ **: Momentum dispersion at z=RPSF**, $\frac{\Delta p}{p}$: Momentum spread at z=0

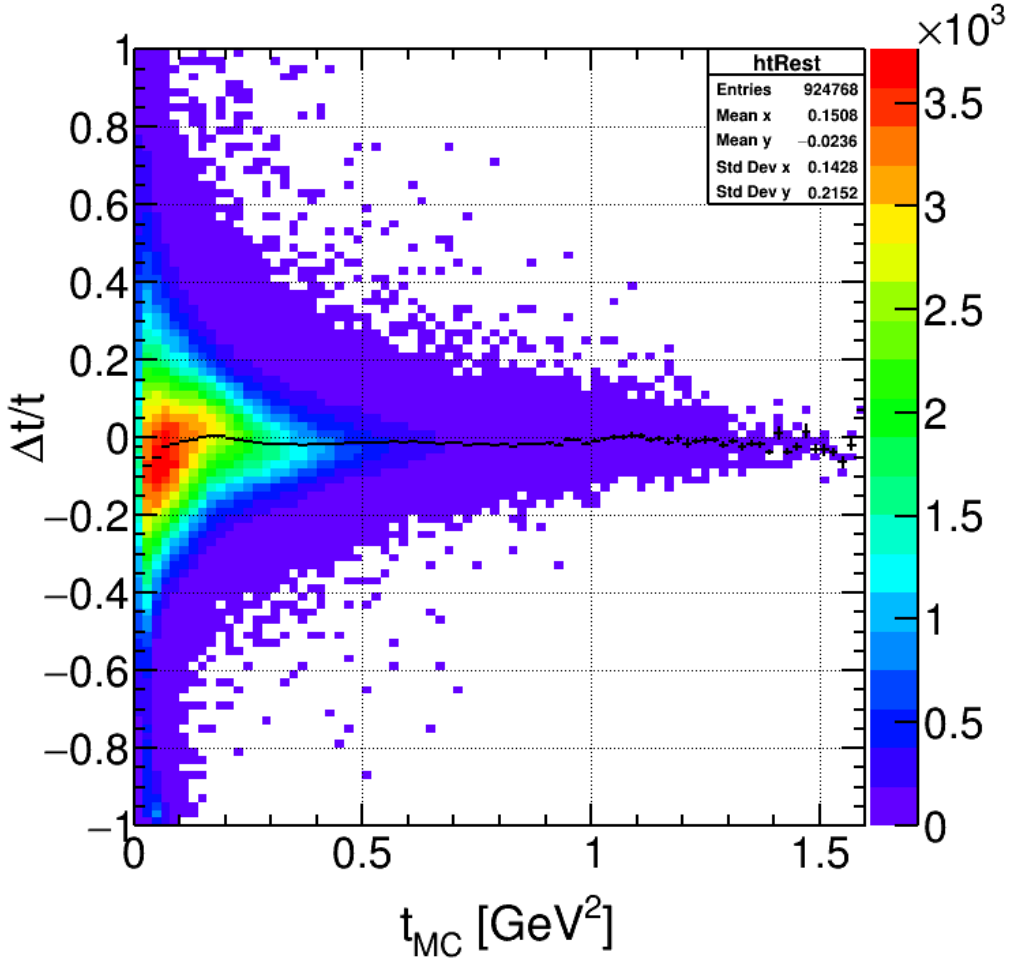
- Used inverse transfer matrices from single particle gun simulation to reconstruct scattered proton momentum and t was calculated from $t = (p' - p)^2$

t Calculation Using Proton (p, p')

t Direct Comparison



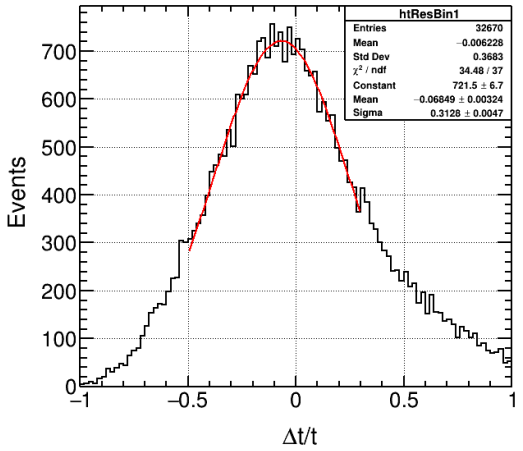
t Resolution vs t



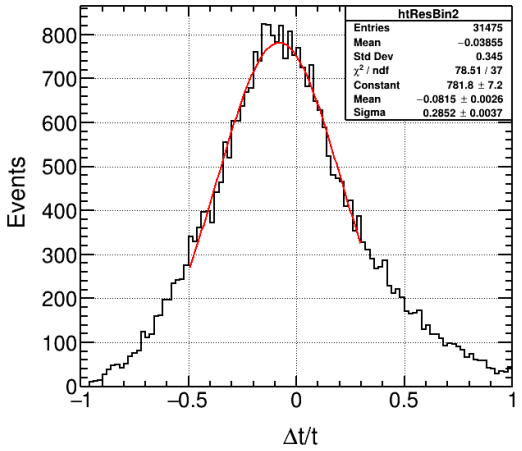
DVCS 18 GeV × 275 GeV Sample **ALL**

t Resolution Bin Using Proton (p, p')

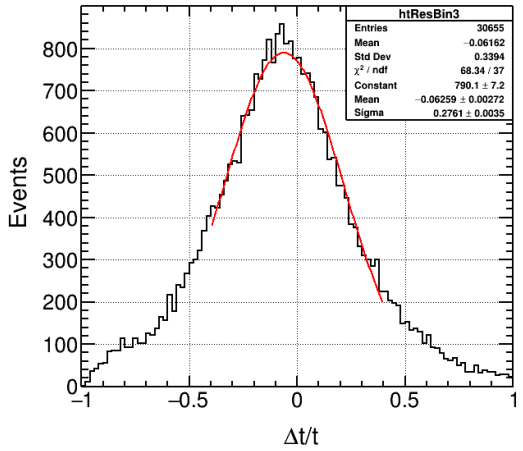
$0.01 \leq t_{MC} < 0.015$



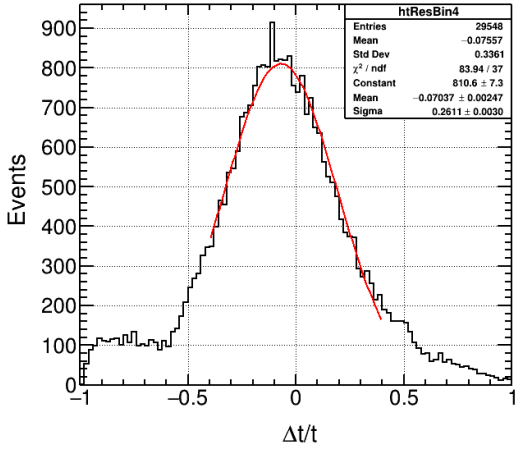
$0.015 \leq t_{MC} < 0.02$



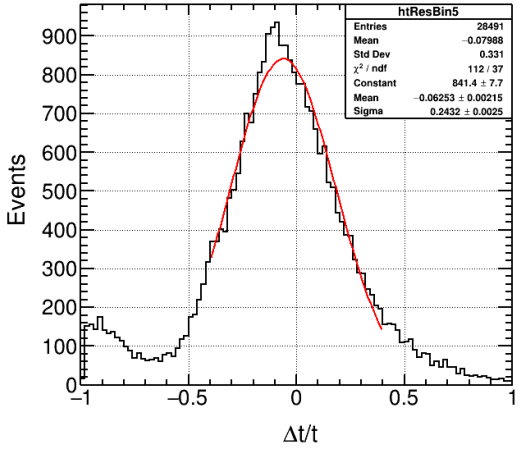
$0.02 \leq t_{MC} < 0.025$



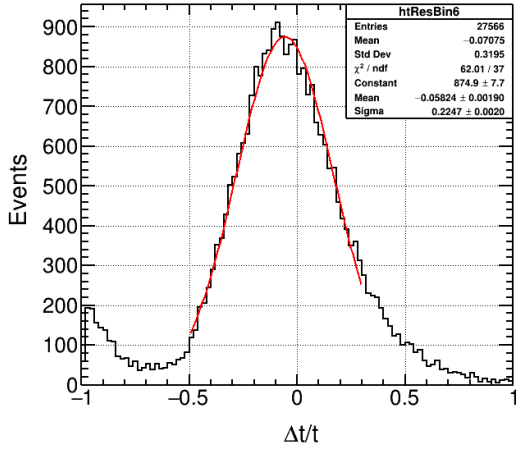
$0.025 \leq t_{MC} < 0.03$



$0.03 \leq t_{MC} < 0.035$



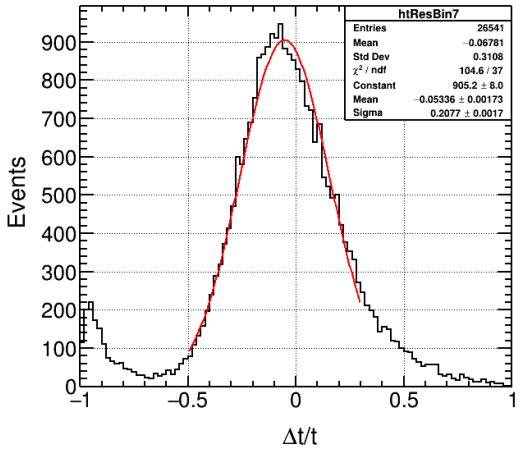
$0.035 \leq t_{MC} < 0.04$



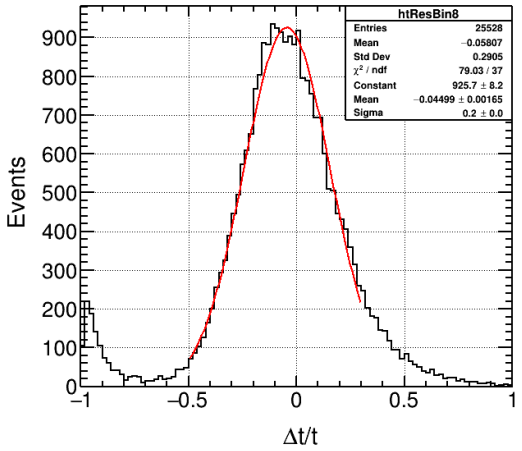
DVCS 18 GeV × 275 GeV Sample **ALL**

t Resolution Bin Using Proton (p, p')

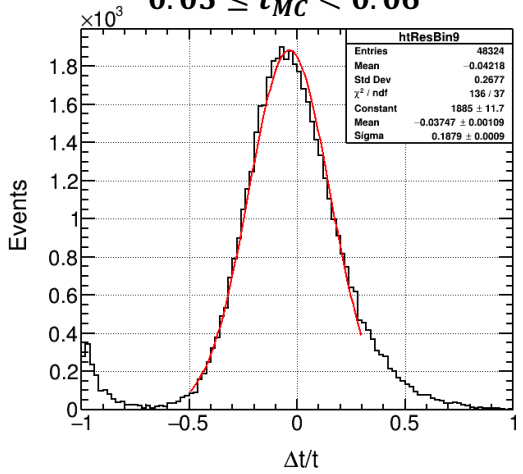
$0.04 \leq t_{MC} < 0.045$



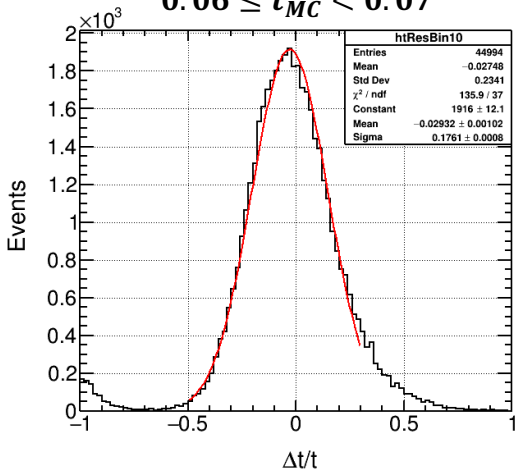
$0.045 \leq t_{MC} < 0.05$



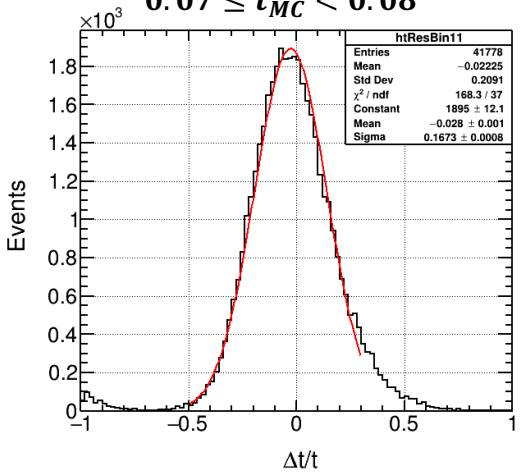
$0.05 \leq t_{MC} < 0.06$



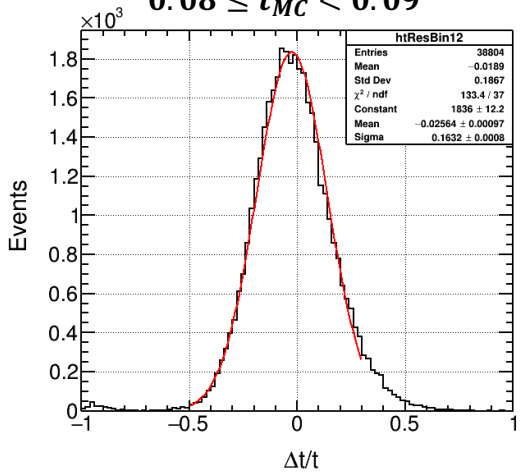
$0.06 \leq t_{MC} < 0.07$



$0.07 \leq t_{MC} < 0.08$



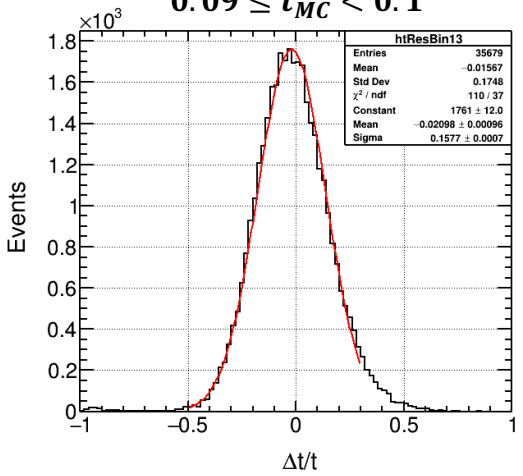
$0.08 \leq t_{MC} < 0.09$



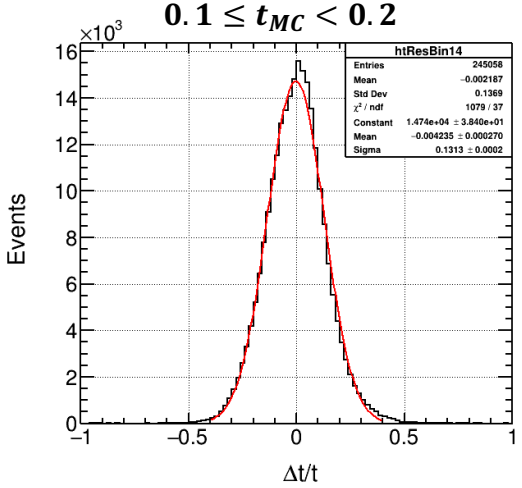
DVCS 18 GeV × 275 GeV Sample **ALL**

t Resolution Bin Using Proton (p, p')

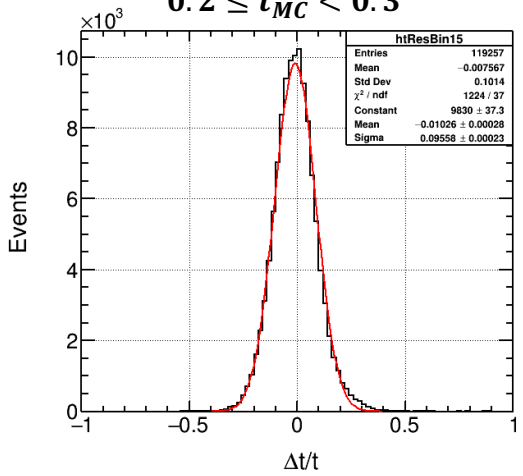
$0.09 \leq t_{MC} < 0.1$



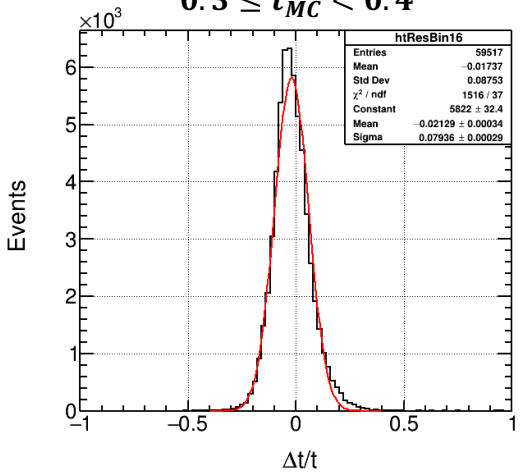
$0.1 \leq t_{MC} < 0.2$



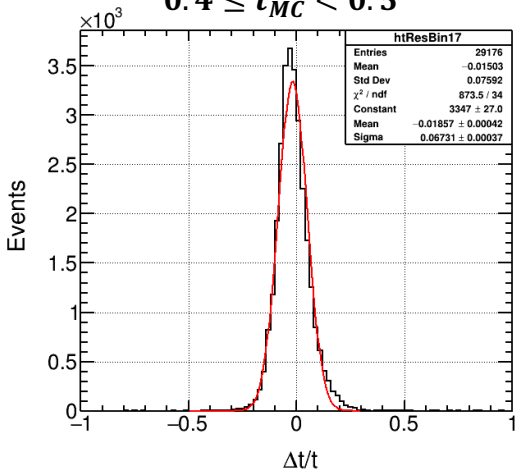
$0.2 \leq t_{MC} < 0.3$



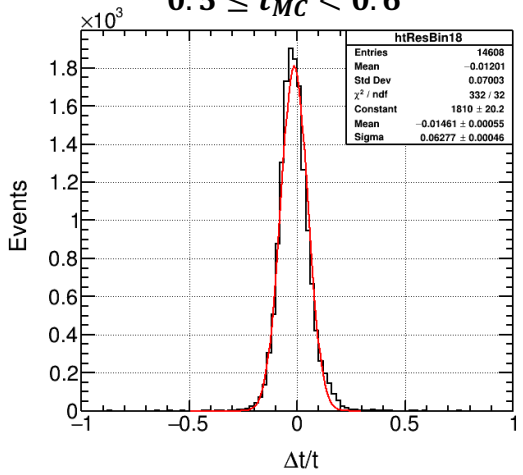
$0.3 \leq t_{MC} < 0.4$



$0.4 \leq t_{MC} < 0.5$



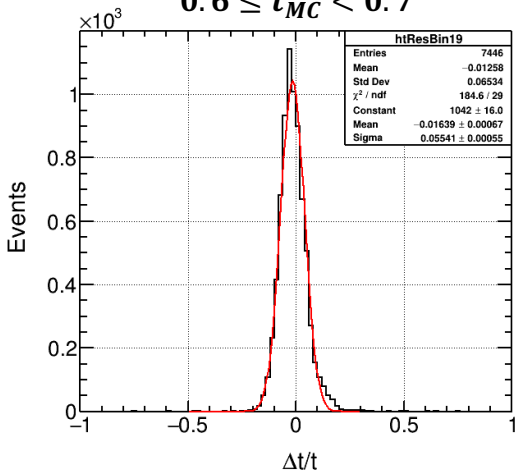
$0.5 \leq t_{MC} < 0.6$



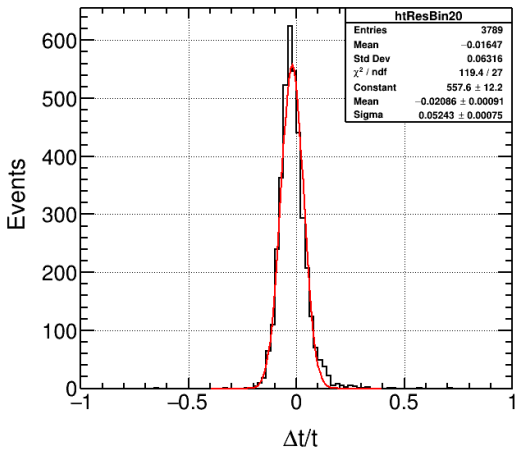
DVCS 18 GeV × 275 GeV Sample **ALL**

t Resolution Bin Using Proton (p, p')

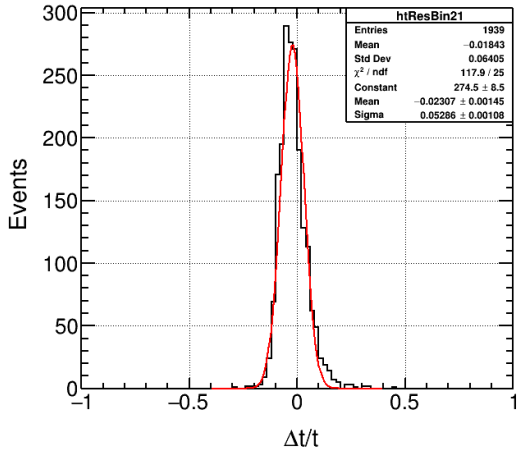
$0.6 \leq t_{MC} < 0.7$



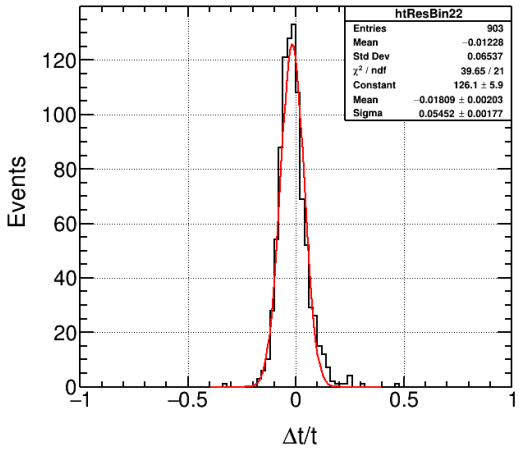
$0.7 \leq t_{MC} < 0.8$



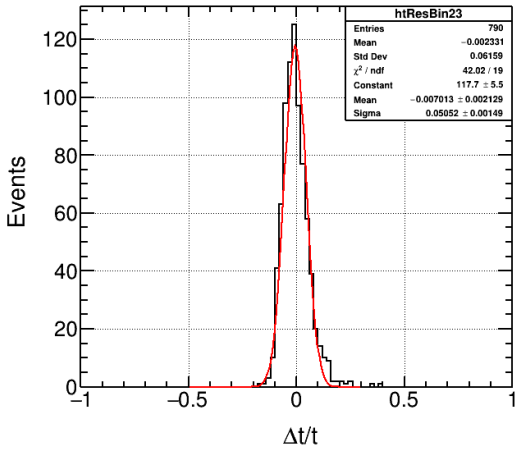
$0.8 \leq t_{MC} < 0.9$



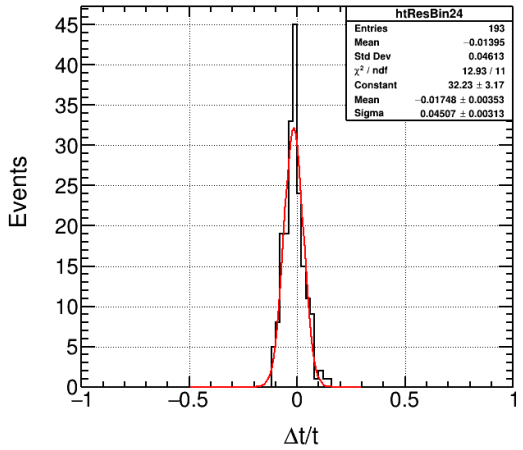
$0.9 \leq t_{MC} < 1.0$



$1.0 \leq t_{MC} < 1.2$

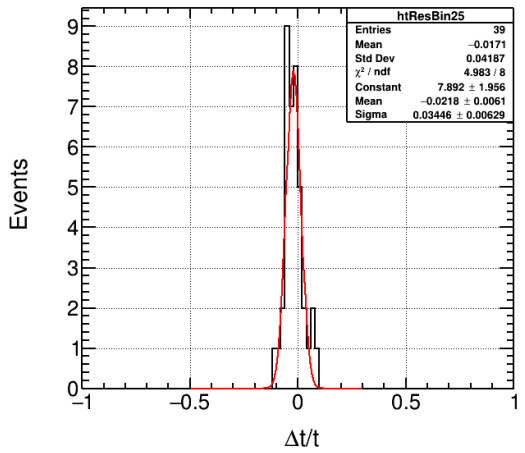


$1.2 \leq t_{MC} < 1.4$

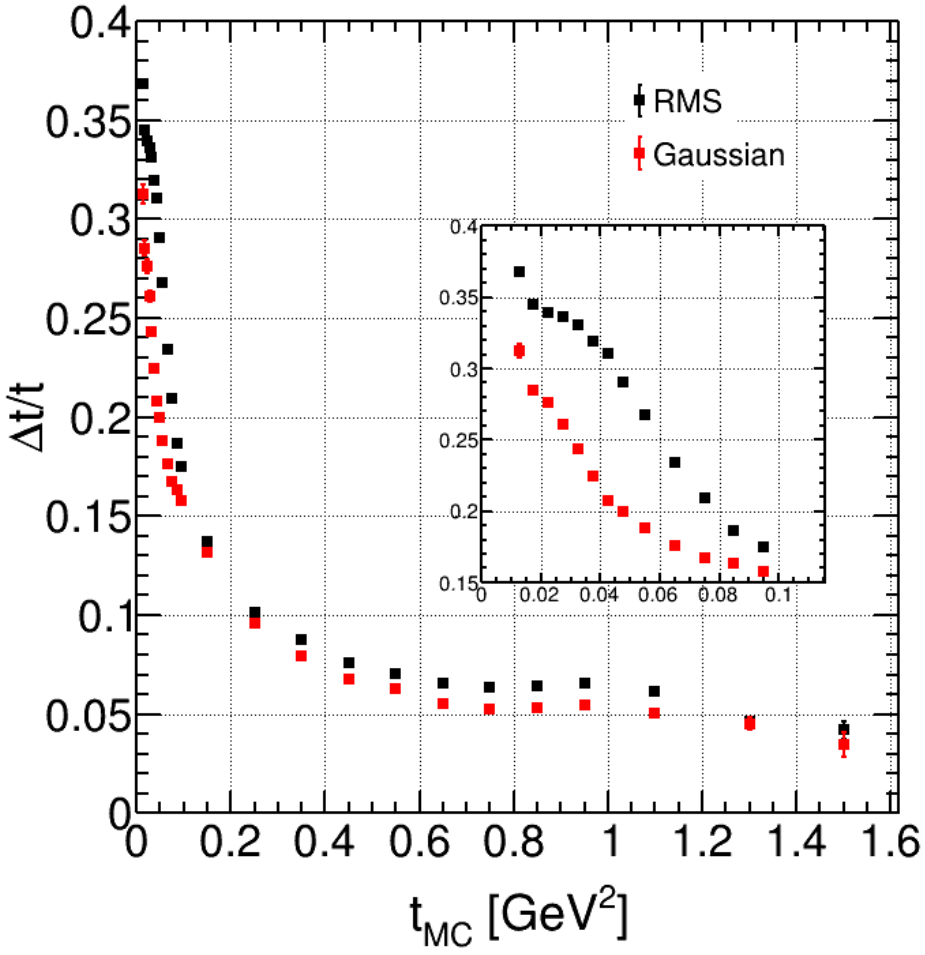


t Resolution Bin Using Proton (p, p')

$1.4 \leq t_{MC} < 1.6$



t Resolution Using Proton (p, p')



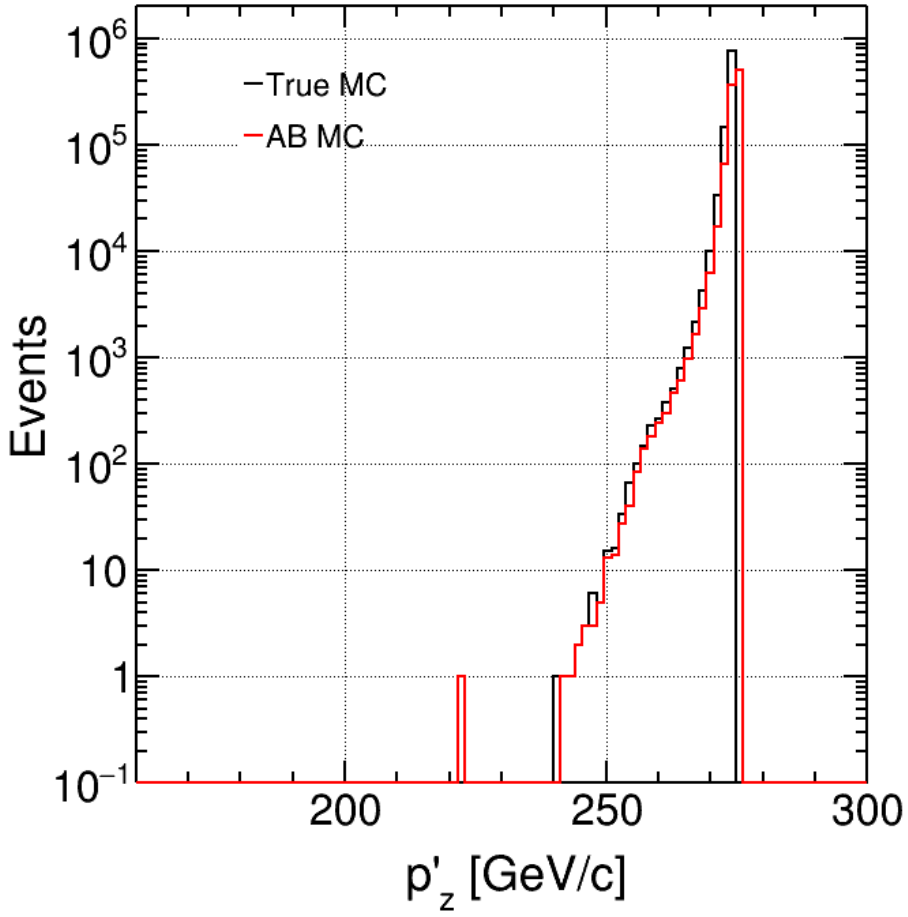
Assume $p_{T\,\mathrm{min}}$ ~ 0.18 GeV, then t ~ 0.03

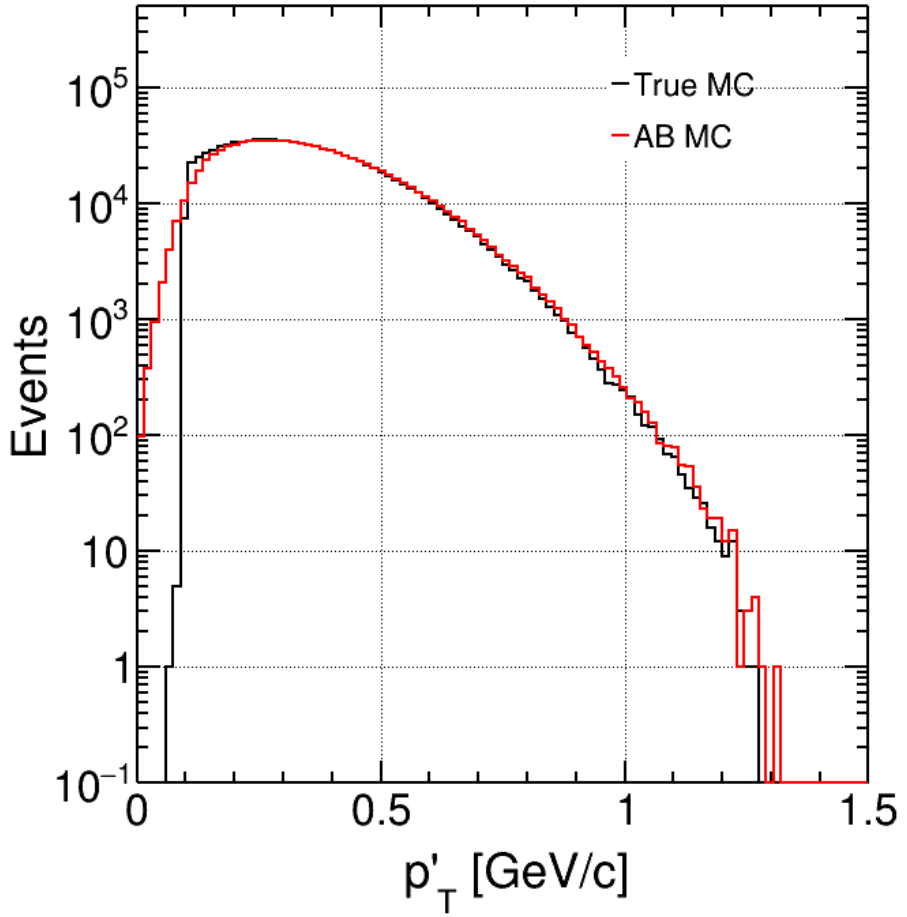
t range focus
0.03 < t < 1.6 GeV^2

Comparison between True MC and Afterburn MC

*__True MC__: particle information from event generator
*__Afterburn (AB) MC__: particles being __boosted__ and __rotated in afterburner__, but
__un-rotated by crossing angle afterwards + still beam effects included__

P_T and P_z Distribution



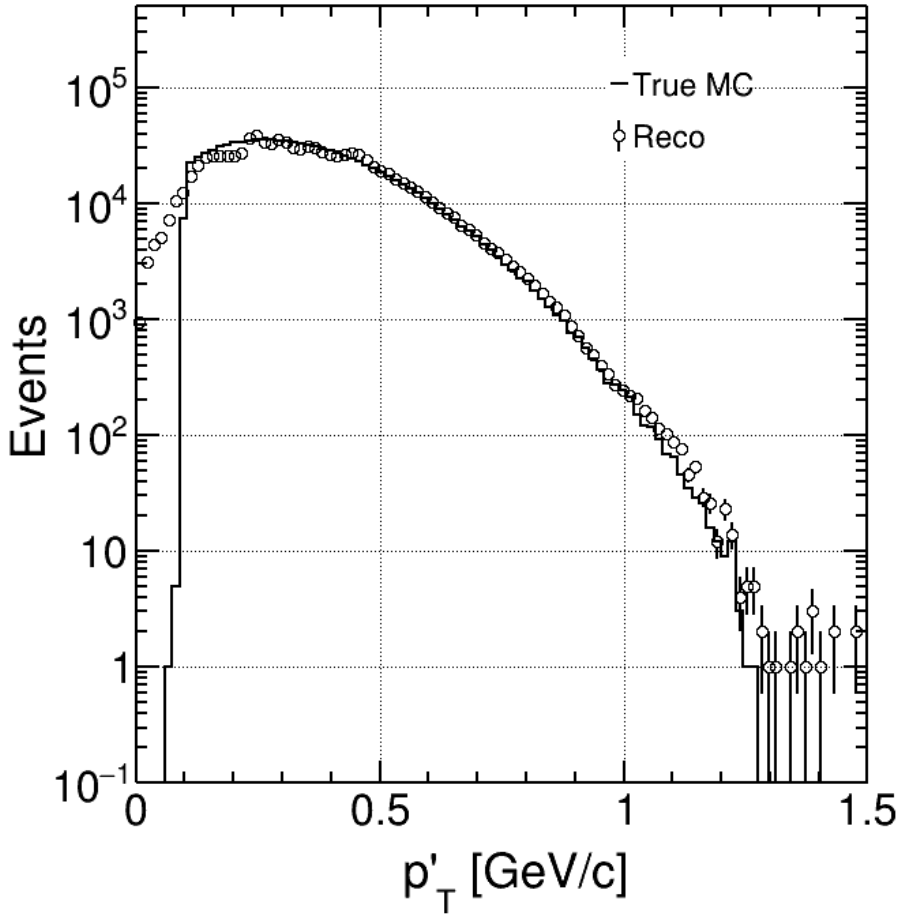


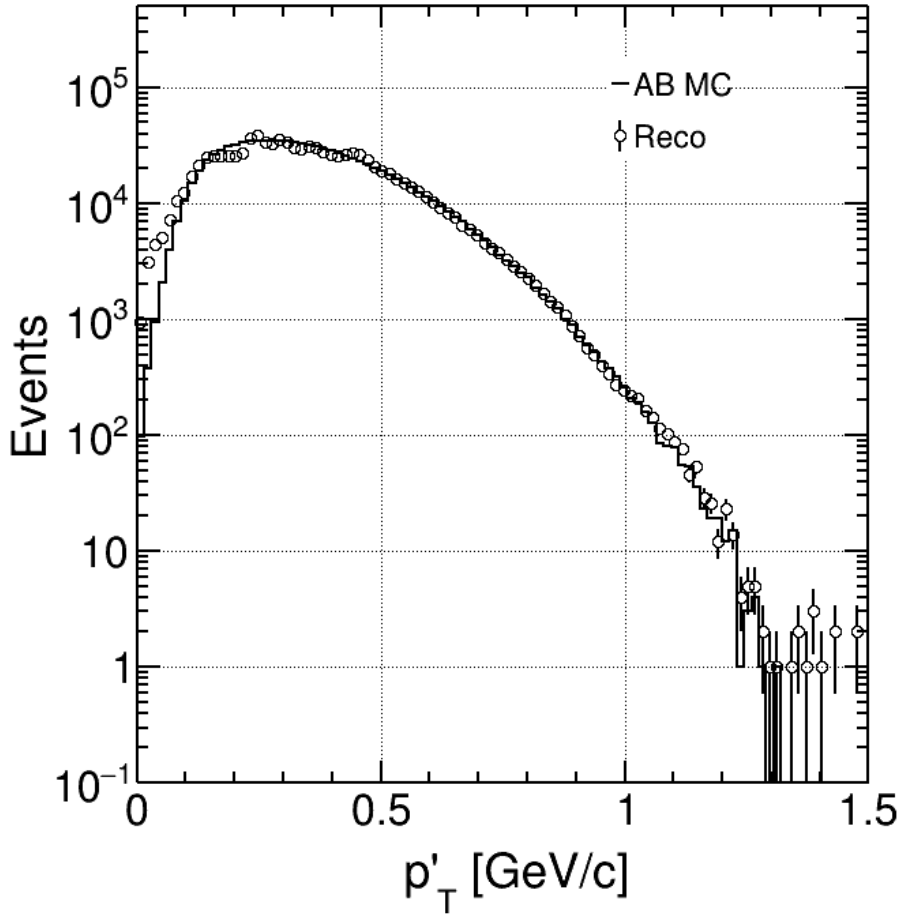
AB MC (red) driven by **beam effects only** from **True MC (black)**

Comparison between True MC/Afterburn MC and Reconstructed

*__True MC__: particle information from event generator
*__Afterburn (AB) MC__: particles being __boosted__ and __rotated in afterburner__, but __un-rotated by crossing angle afterwards + still beam effects included__
*__Reconstructed (Reco)__: particles being reconstructed by transport matrices

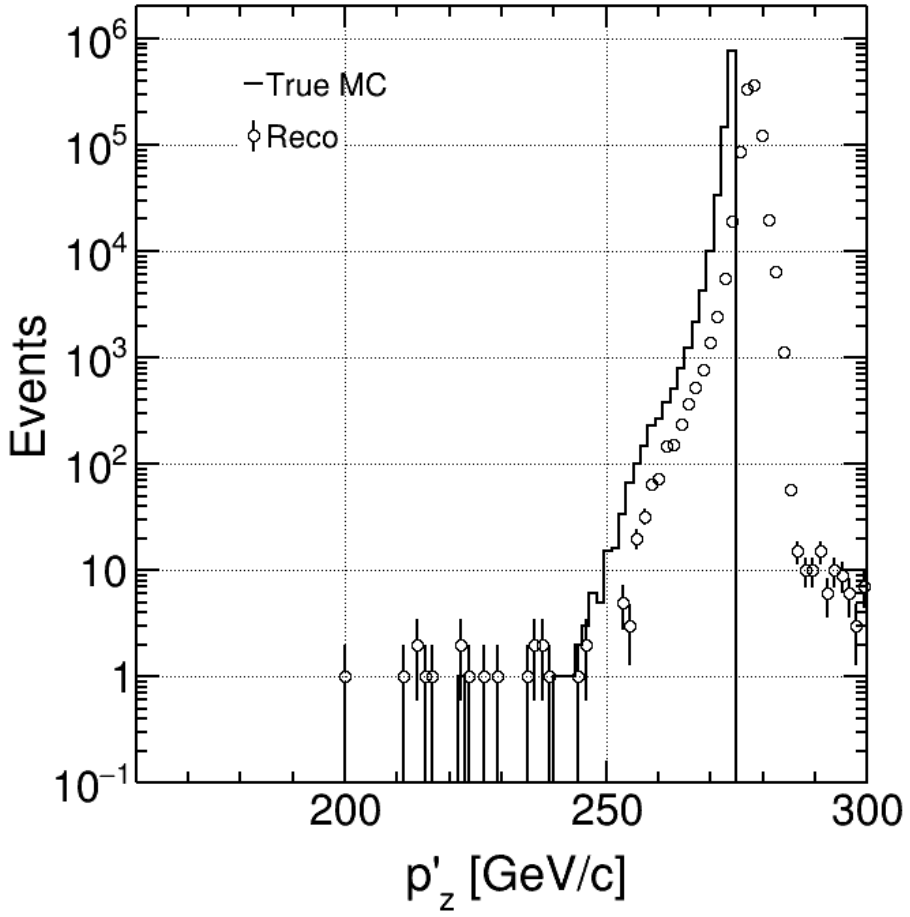
P_T Distribution

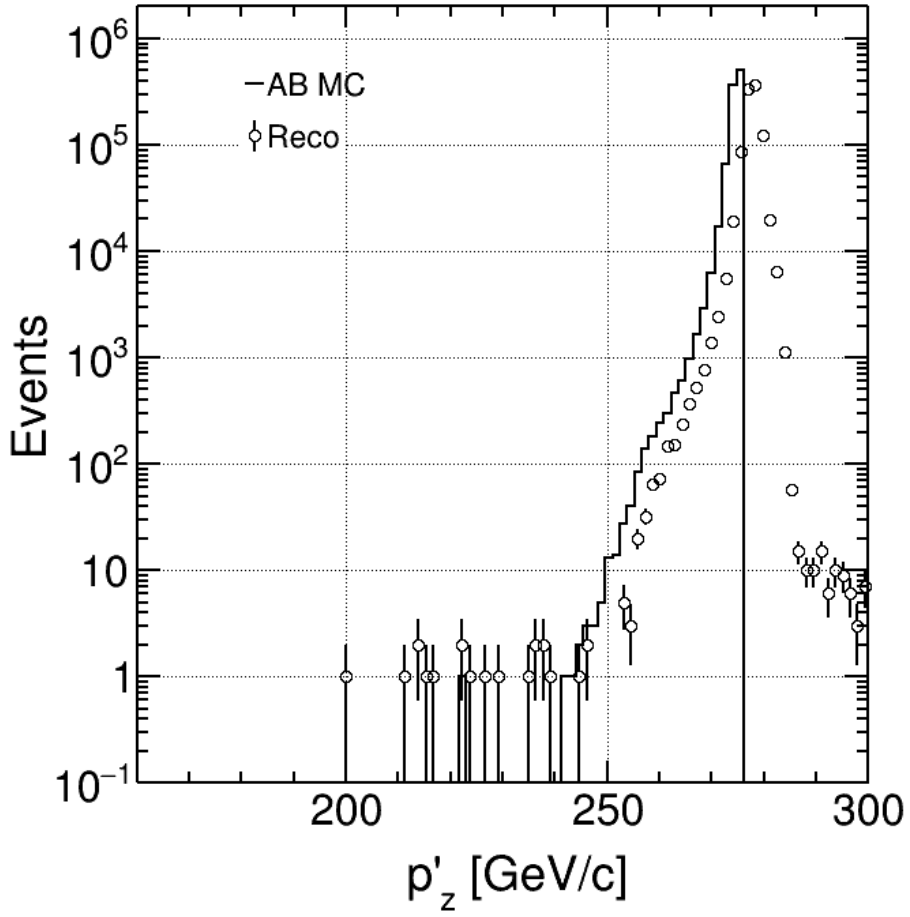




AB MC (solid right) smeared from **True MC (solid left)** at **low p_T**, in particular

P_z Distribution



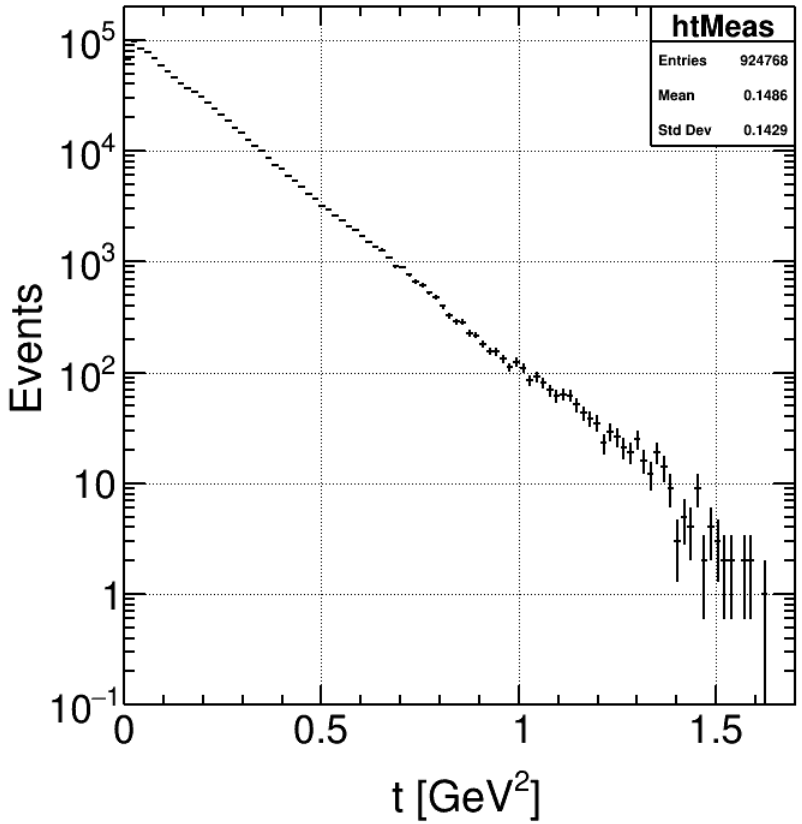


AB MC (solid right) smeared from **True MC (solid left)**

Next Steps

- Investigate an offset in P_z distribution
  - By switching off vertex smearing in z in afterburner
  - Transport matrices were calculated under assumption of (0, 0, 0) at IP-8

- Check t distribution in
  - Nominal, afterburned, and post-burned

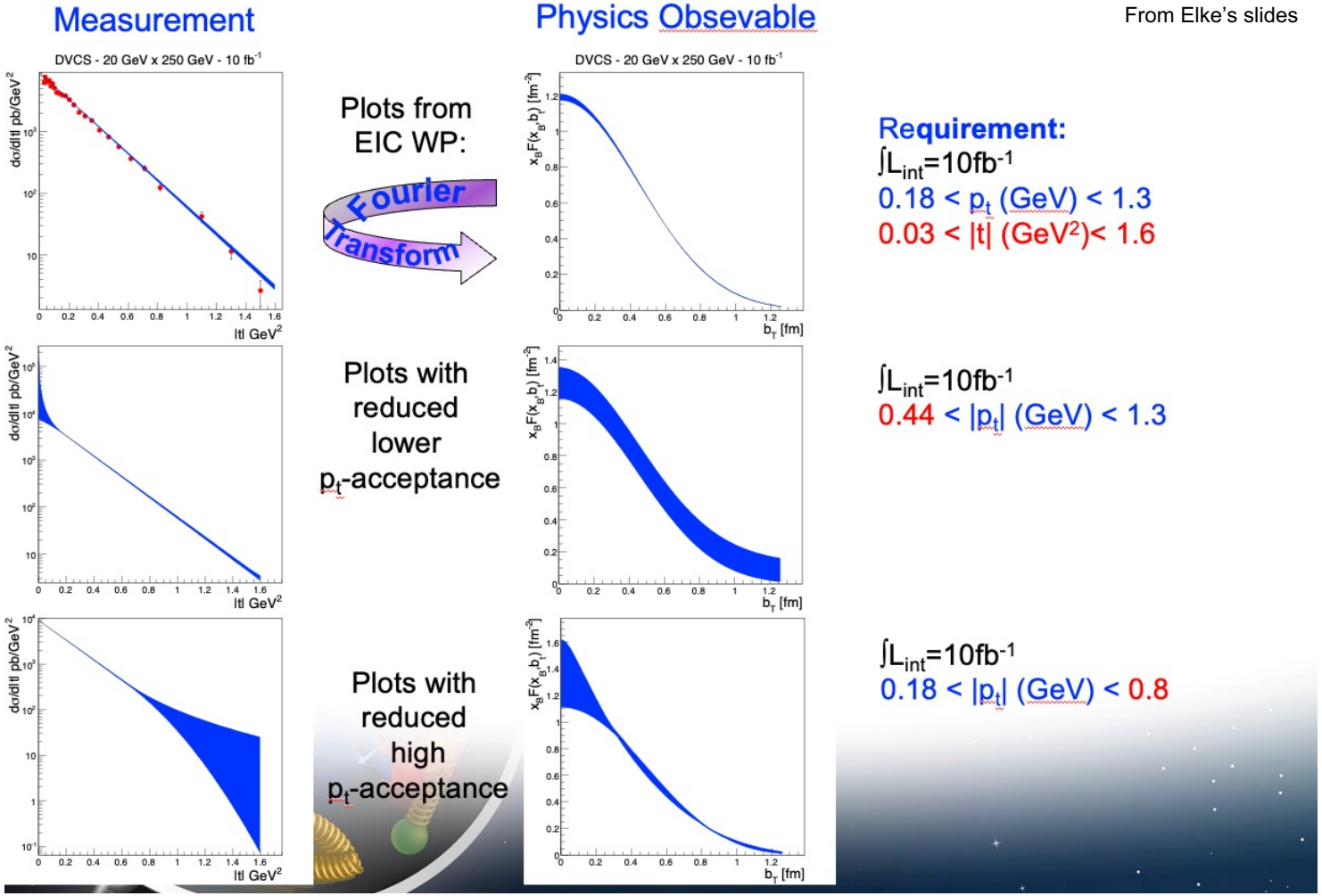


Backup Slides

Spatial Imaging of Nucleon – Approach

Impact of reduced scattered proton acceptance

From Elke's slides



IR-8 2nd focus greatly improves **forward acceptance**

- **Excellent low-p_T acceptance** for protons and light nuclei from exclusive reactions at very small t
- **Detection of target fragments**

Opportunity to **probe large b** (outside nucleon's primary volume: not related to internal nucleon structure)

t Resolution