

gmc_trans VS PYTHIA



Thursday 1st April 2010
EIC Task Force meeting

gmc_trans

- https://wiki.bnl.gov/eic/index.php/Gmc_trans
- Models distributions with transverse spin and transverse momentum.
- With these turned **off** we should obtain normal particle production.
 - ▶ Check plausibility of gmc_trans output.
- Compare with existing PYTHIA events.

To compare with PYTHIA

- Run gmc_trans with:
 - CTEQ 5L (leading order) PDF.
 - Kretzer fragmentation functions.
 - $W^2 > 4 \text{ GeV}^2$.
- Select PYTHIA events with:
 - PYTHIA process 99 = leading order DIS.
 - $Q^2 > 1 \text{ GeV}^2$.
- Electron beam energy 4 GeV
- Proton beam energy 50, 100 and 250 GeV.

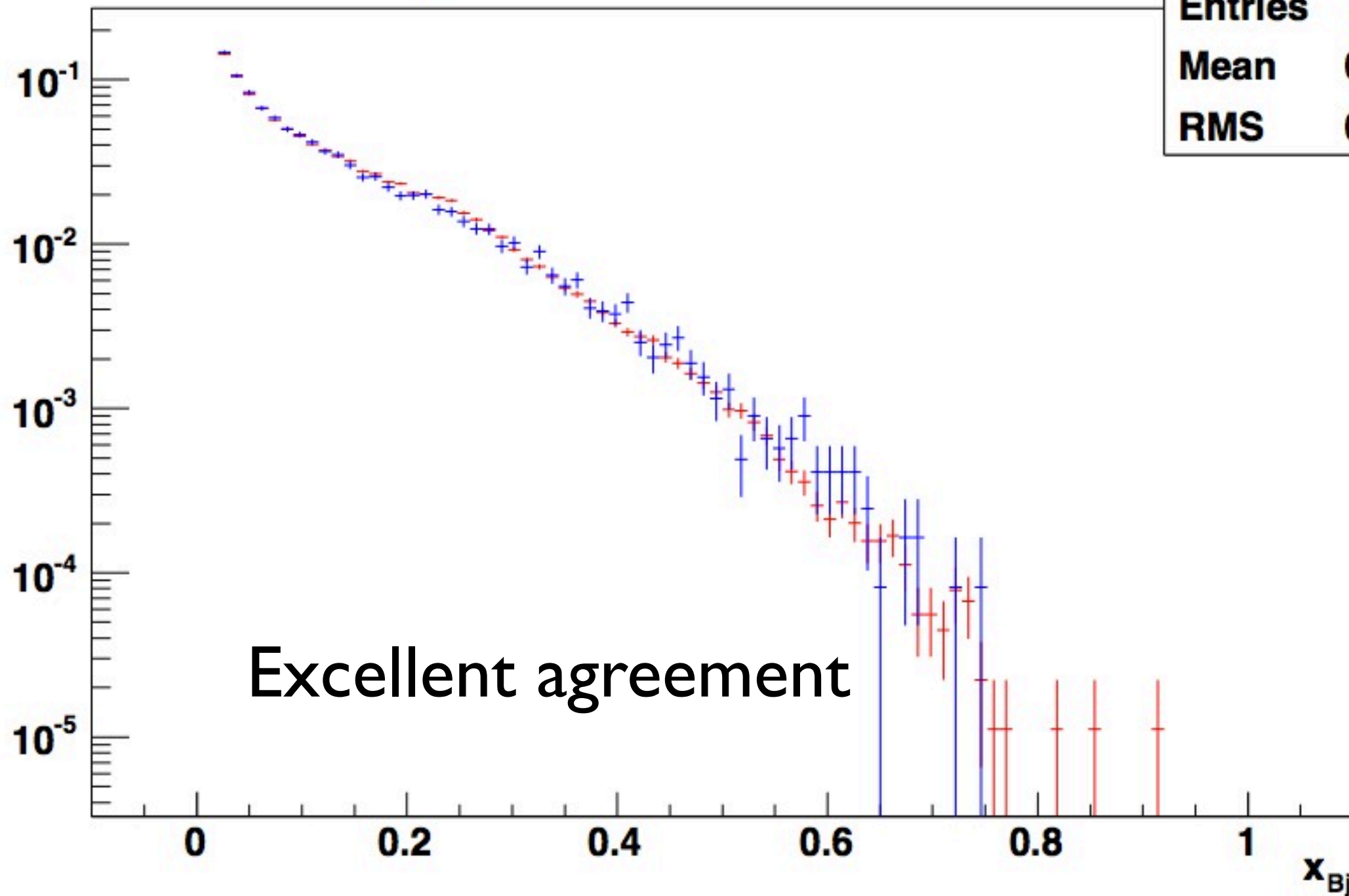
Comparison of kinematic variables

- gmc_trans
 - Numerically integrates $\sigma(x, Q^2, z)$ based on choice of PDF and fragmentation functions.
 - Throws x, Q^2, z based on σ .
 - Calculates W^2, y, v from these.
- Compare Bjorken x, Q^2, W^2, y, v distributions
- **PYTHIA** vs **gmc_trans 4 x 50 GeV**.

Bjorken x

Bjorken x of event, x_B

x	
Entries	89444
Mean	0.1256
RMS	0.1044

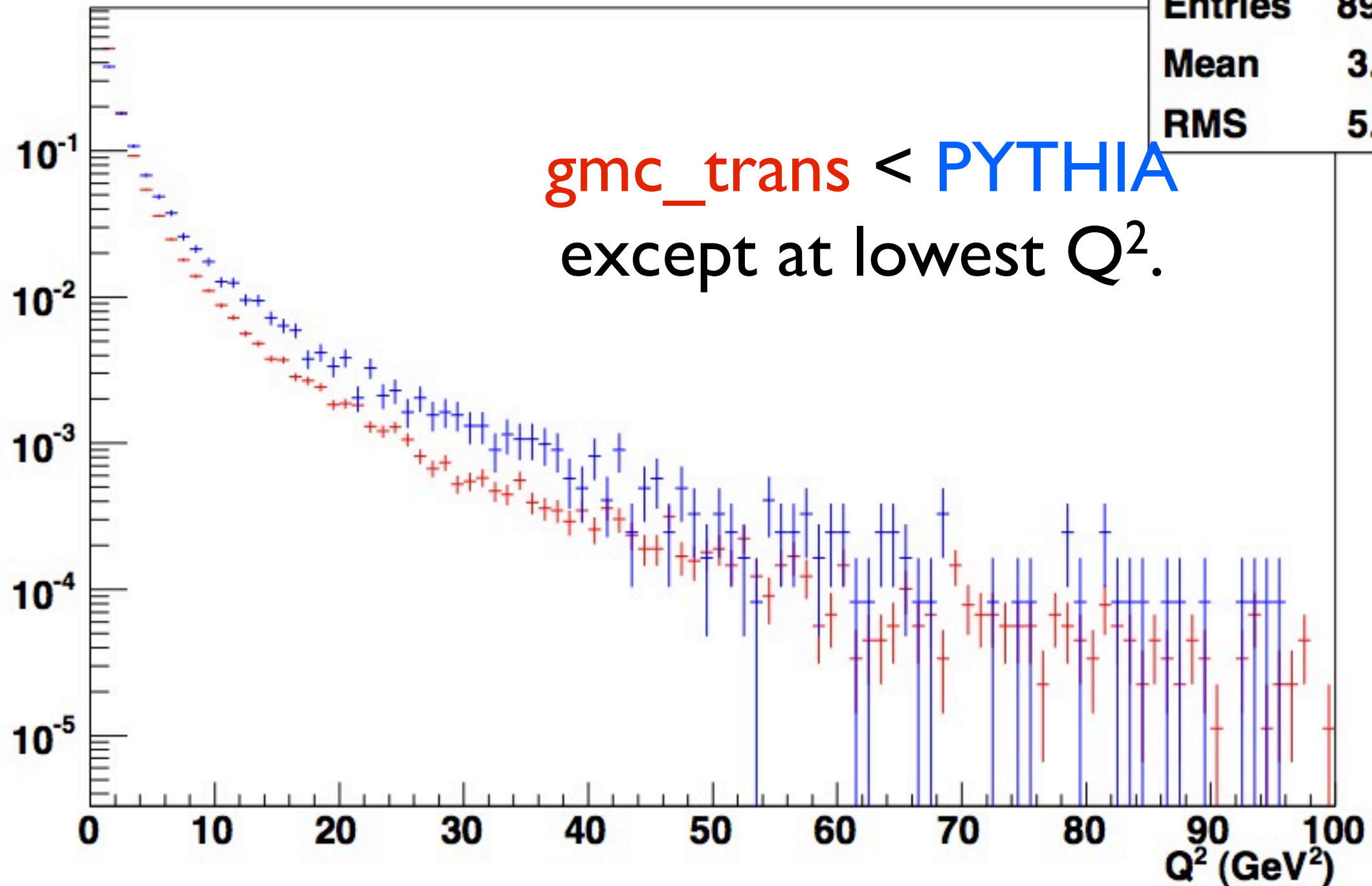


Q^2

Virtuality of exchanged γ , Q^2

QSquared

Entries	89444
Mean	3.759
RMS	5.943

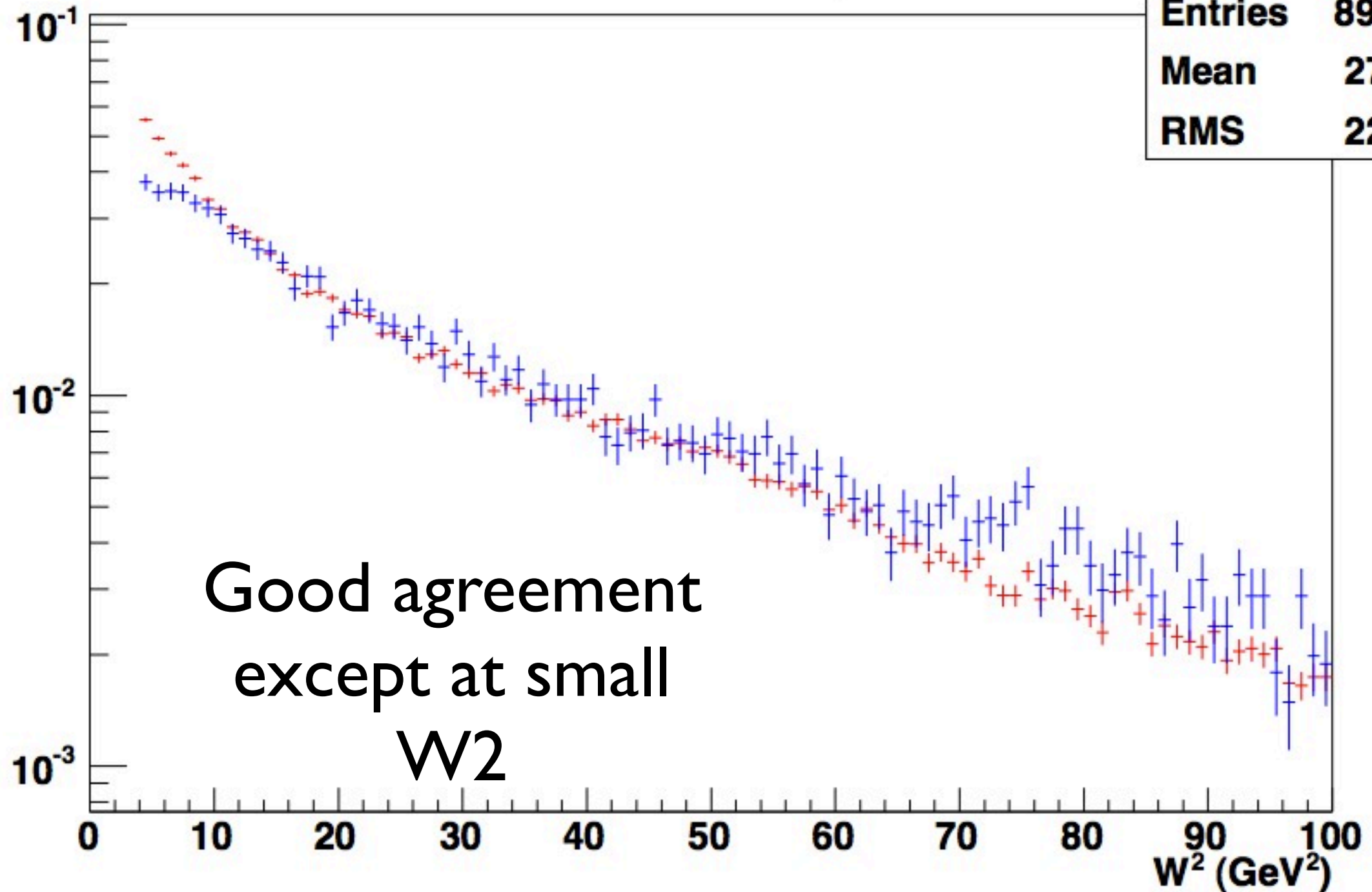


W^2

Invariant mass of hadronic system, W^2

WSquared

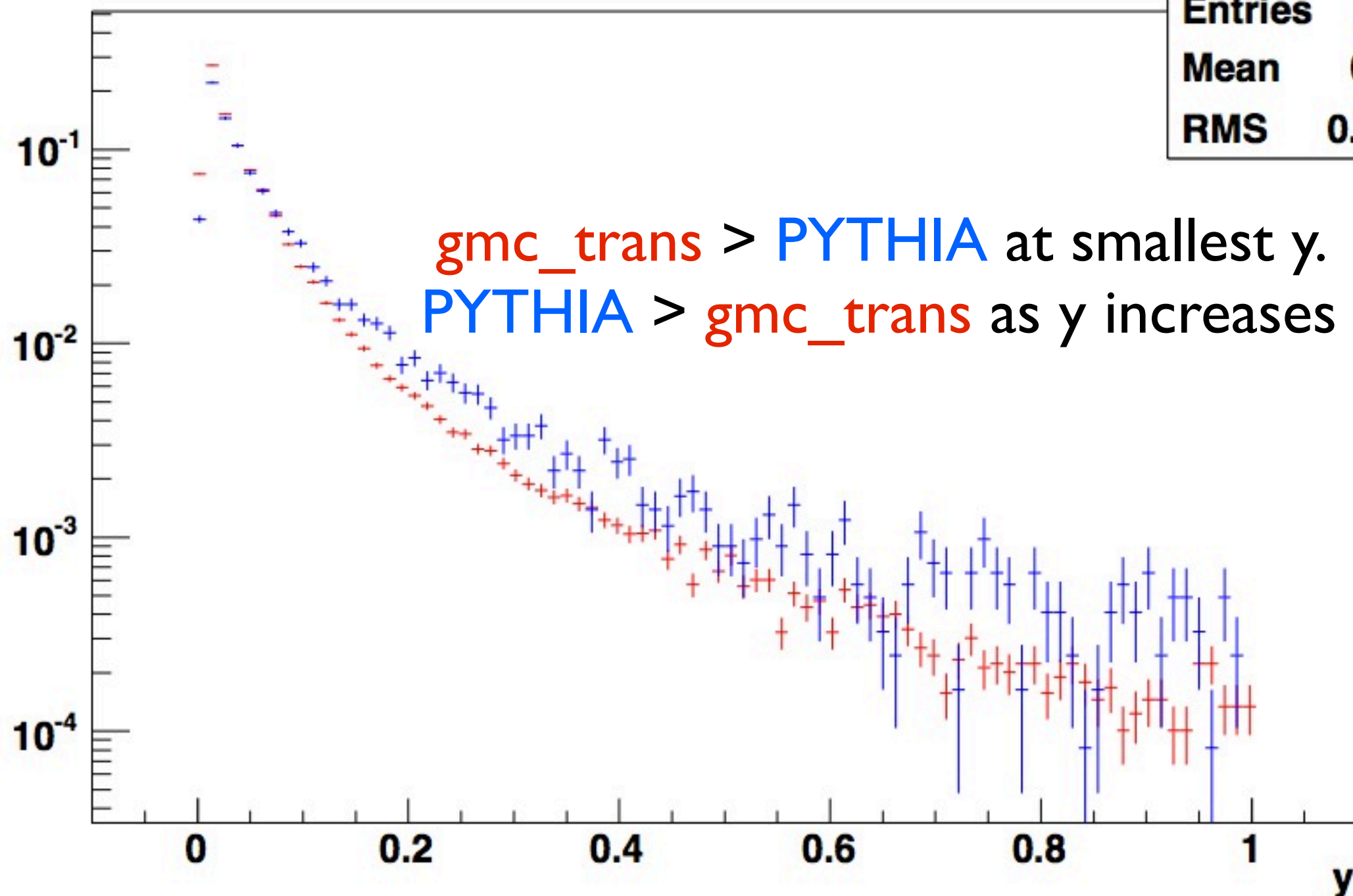
Entries	89444
Mean	27.94
RMS	22.99



y

Inelasticity of event, y

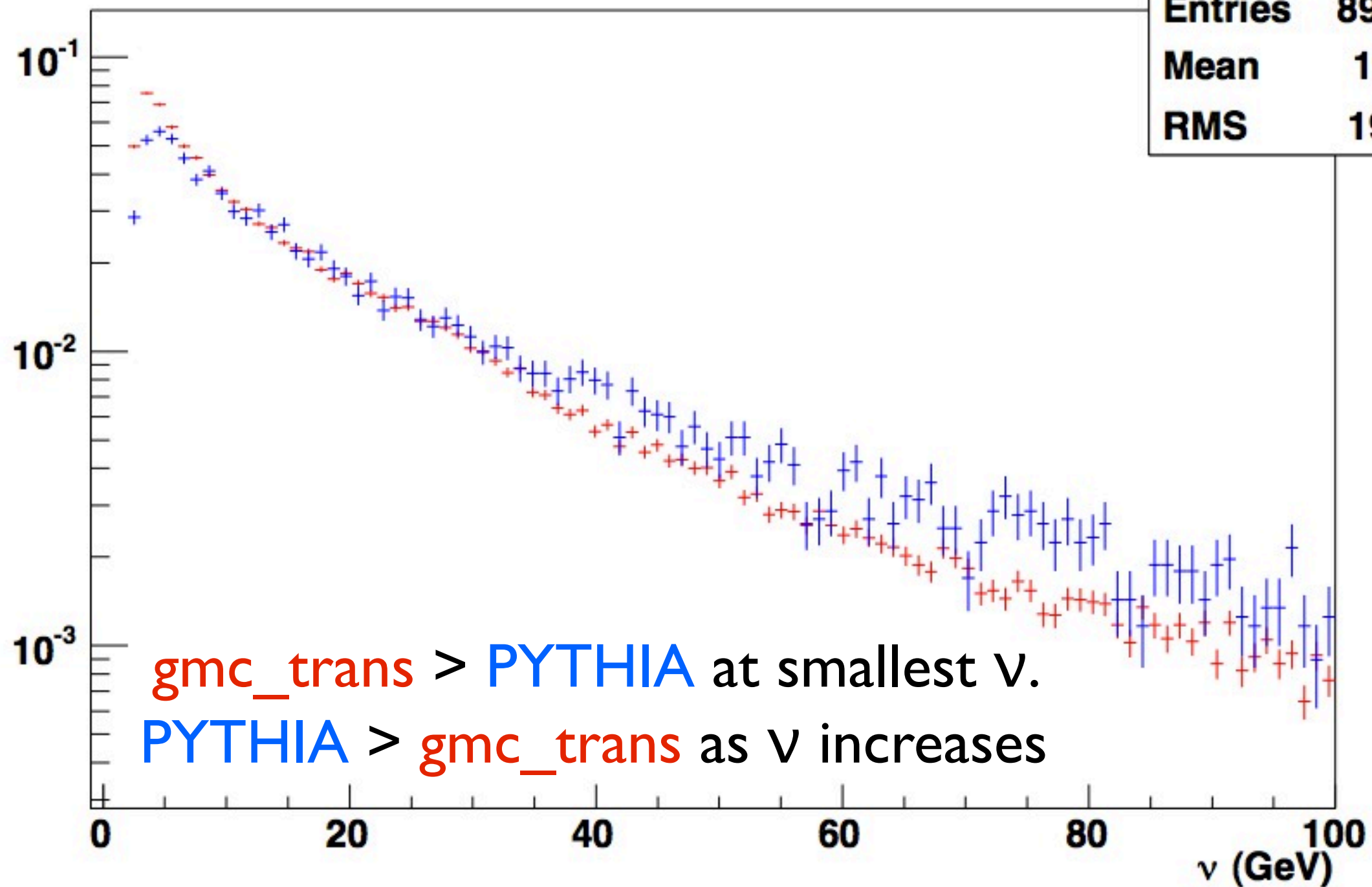
y	
Entries	89444
Mean	0.0643
RMS	0.09917



ν

ν

nu	
Entries	89444
Mean	19.71
RMS	19.19



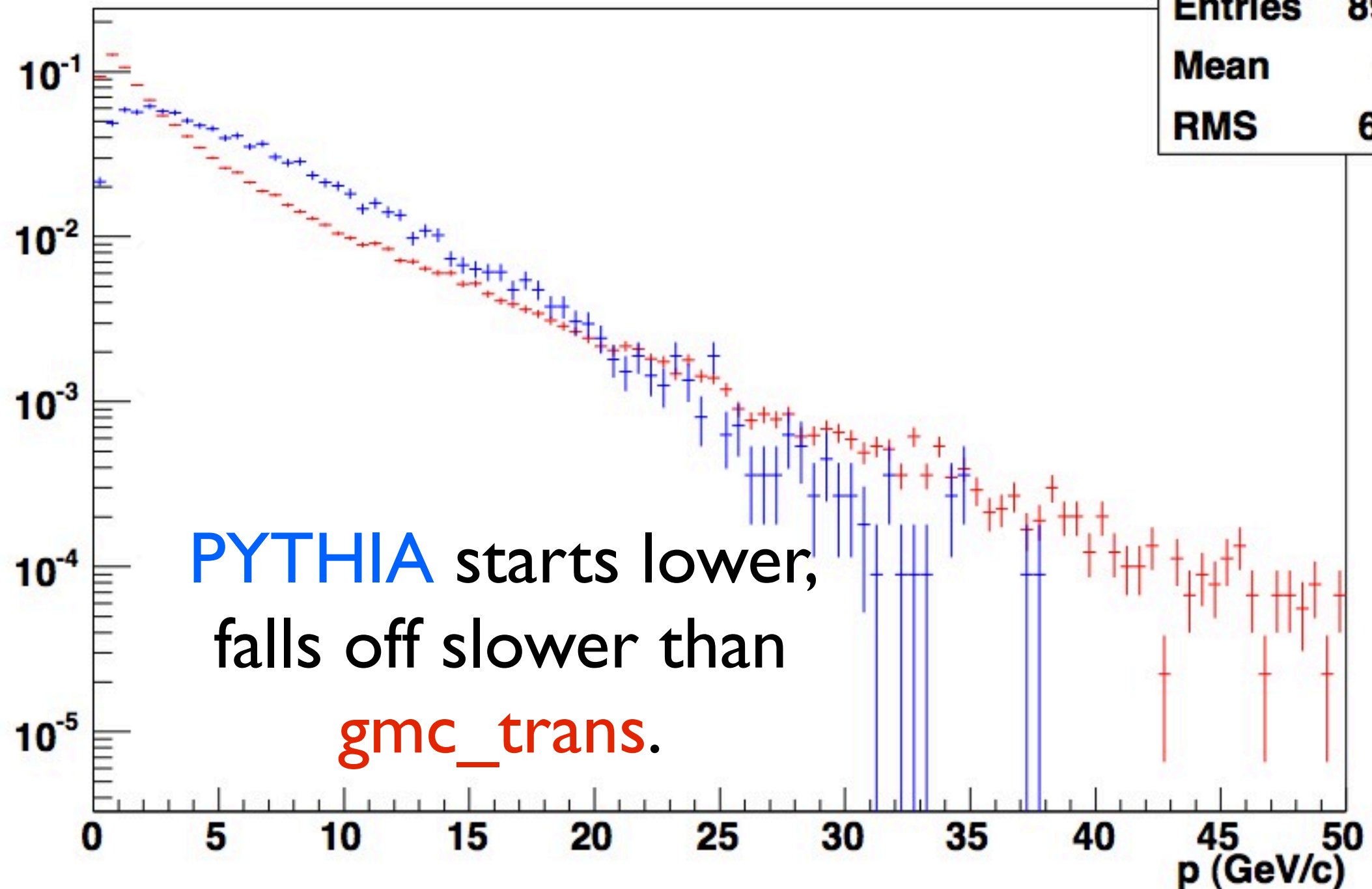
π^+ production

- gmc_trans produces only one particle (in this case π^+): $e + p \rightarrow e' + \pi^+$.
- Generates π^+ p_T^2 according to an exponential p_T^2 distribution.
- To compare, select leading (highest-momentum) π^+ from PYTHIA event.

π^+ momentum

p of π^+

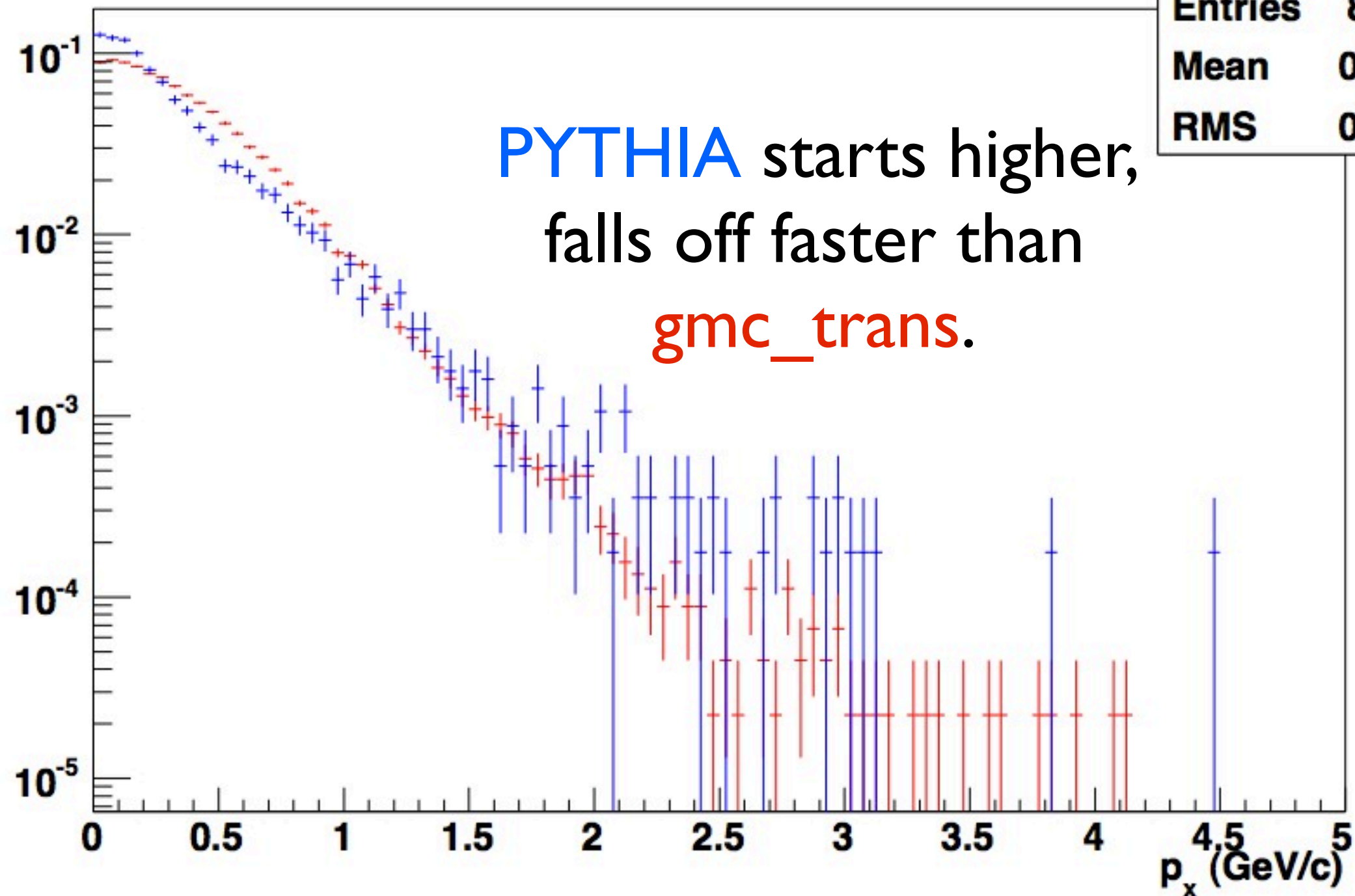
pLeadingParticle	
Entries	89444
Mean	4.97
RMS	6.007



p_x

p_x of π^+

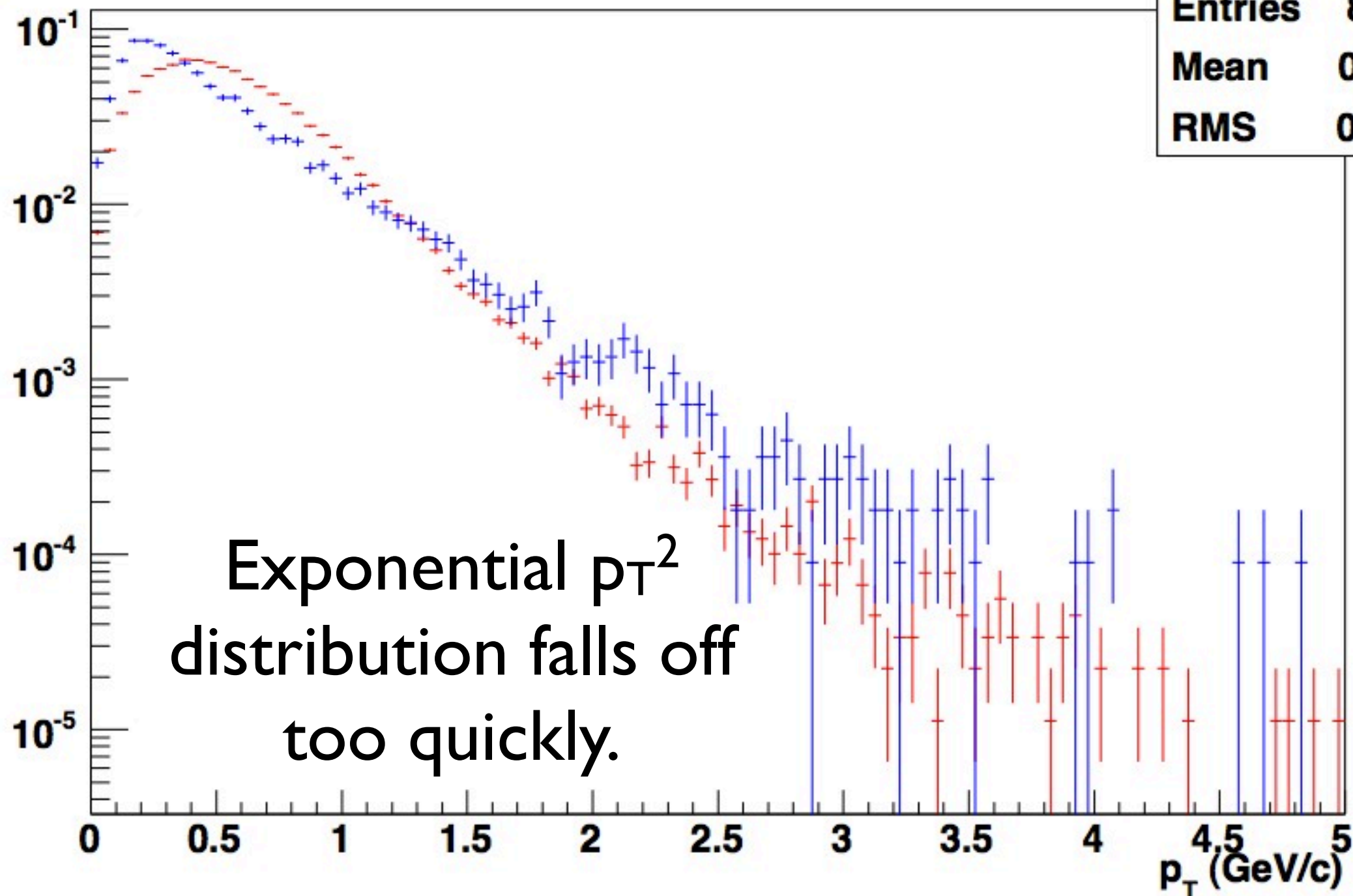
pxLeadingParticle	
Entries	89444
Mean	0.3737
RMS	0.3212



p_T

p_T of π^+

ptLeadingParticle	
Entries	89444
Mean	0.5858
RMS	0.3725



Summary

- Kinematics:
 - Bjorken x matches very well.
 - Other match in certain regions but not in others
 - agreement typically with a factor ≤ 2 .
- π^+ momentum distributions differ; again factor ≤ 2 .
- Mean p_T^2 is an adjustable quantity.

p_z

p_z of π^+

pzLeadingParticle	
Entries	89444
Mean	5.004
RMS	6.084

