Momentum Resolution

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PHYSICS AT THE TERA SCALE
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Re-collection:

- (x,y) along the trajectory

$$X_t = X_{center} - \left(\frac{1}{\Omega}\right)\sin(\varphi)$$

$$Y_t = Y_{center} + \left(\frac{1}{\Omega}\right)\cos(\varphi)$$

$$Z_t = Z_0 + Zr + S.\tan(\lambda)$$

$$S = \frac{\varphi - \varphi_0}{\Omega}$$

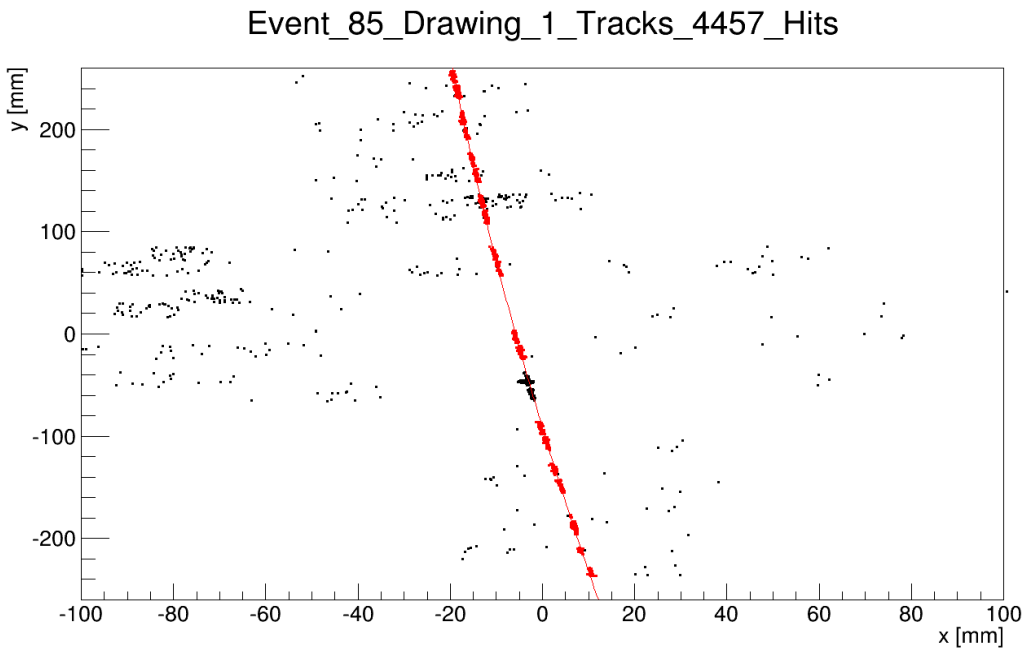
- Collect hits:

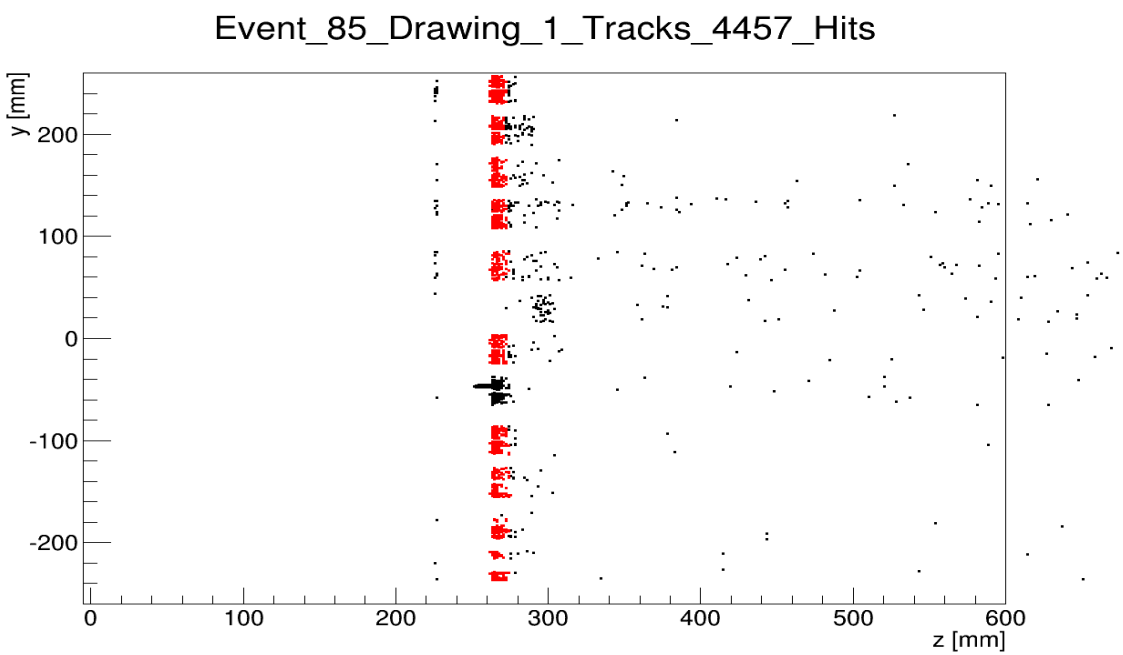
$$\sigma_L = \sqrt{16 + \frac{(T_c v_d)^2}{12} + Z_t D_L^2}$$

$$\sigma_T = \sqrt{\frac{0.055}{\sqrt{12}} + Z_t D_T^2}$$

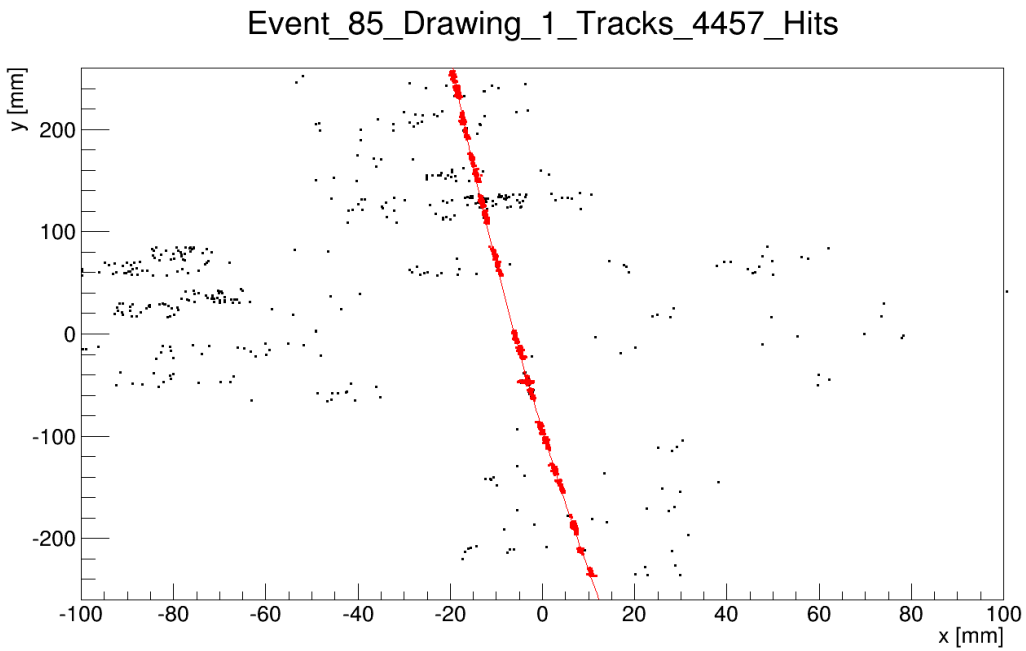
- Hits collected before (BNDHough) + collecting all hits that abs $(Xt-X_{hit}) <= 5\ \sigma_T$, abs $(Yt-Y_{hit}) <= 5\ \sigma_T$ and abs $(Zt-Z_{hit}) <= 5\ \sigma_L$

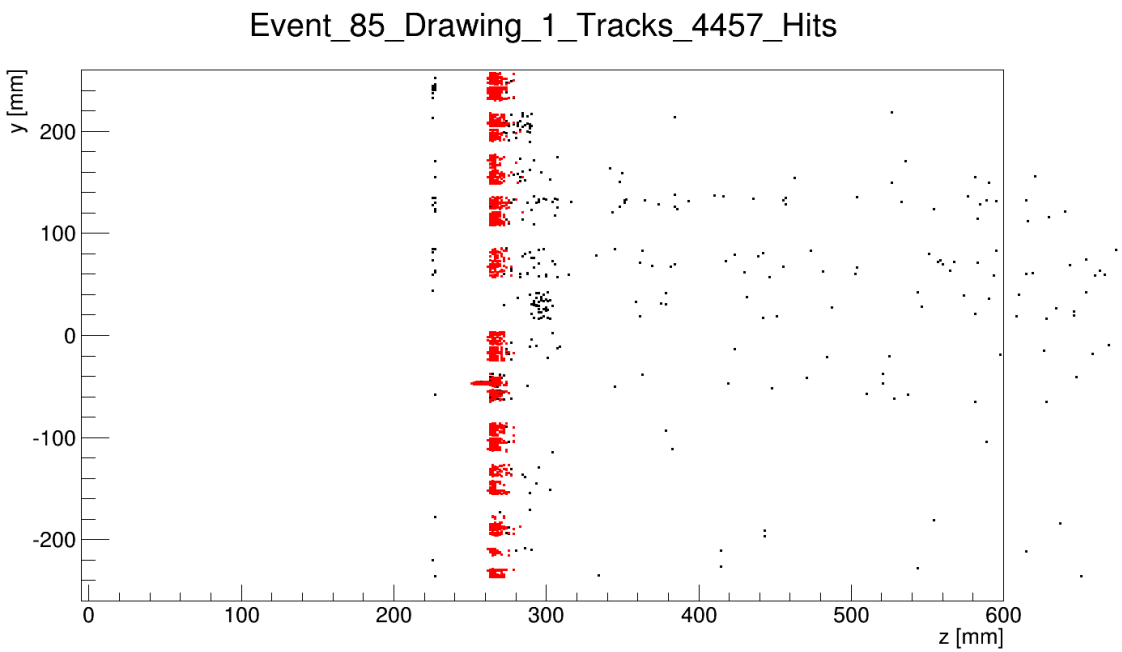
Before collection





After collection





- Transverse Momentum Resolution: $\frac{\sigma_{P_t}}{P_t^2}$
  - Transverse Momentum for Real data
  - Each run: **10000** events

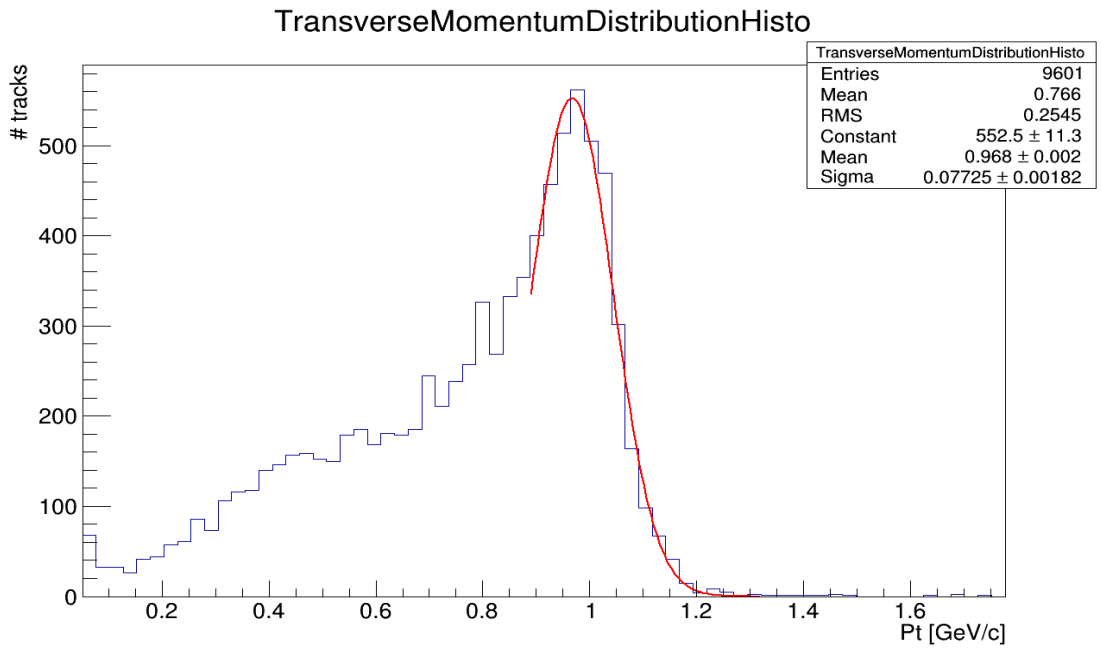
Run	Energy (GeV)	Pt	σPt	Momentum Resolution $(GeV)^{-1}$
140	1	0.968	0.07726	**0.08245**
139	2	1.92	0.1065	**0.02889**
138	3	2.674	0.2607	**0.03646**
137	4	3.425	0.2855	**0.02434**
136	5	4.255	0.3121	**0.01724**

- **Simulation** but only **1000** events

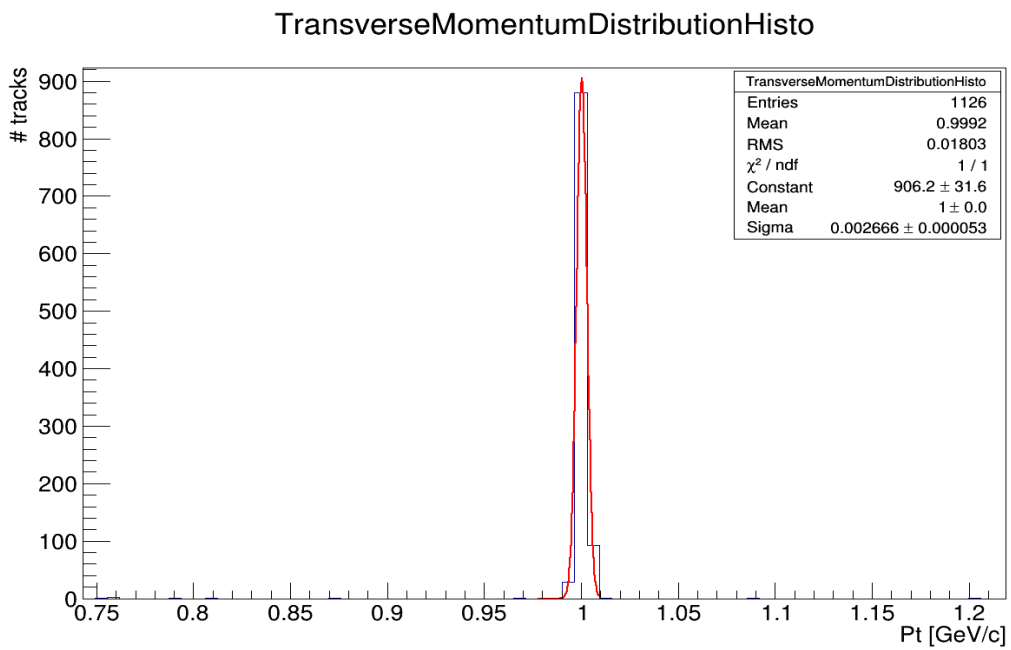
Run	Energy (GeV)	Pt	σPt	Momentum Resolution $(GeV)^{-1}$
140	1	1.001	0.00266	**0.00267**
139	2	2.004	0.00768	**0.00191**
138	3	3.013	0.0162	**0.00178**
137	4	4.005	0.02917	**0.00182**
136	5	5.013	0.0429	**0.00171**

Run 140 – 1 GeV

Real data

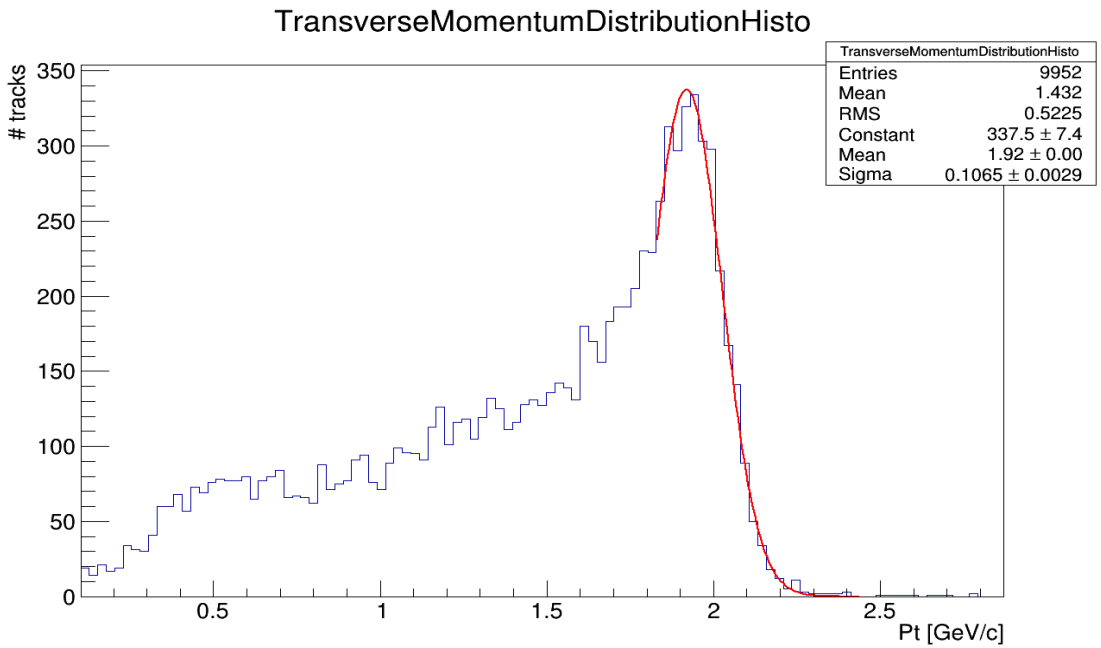


Simulation

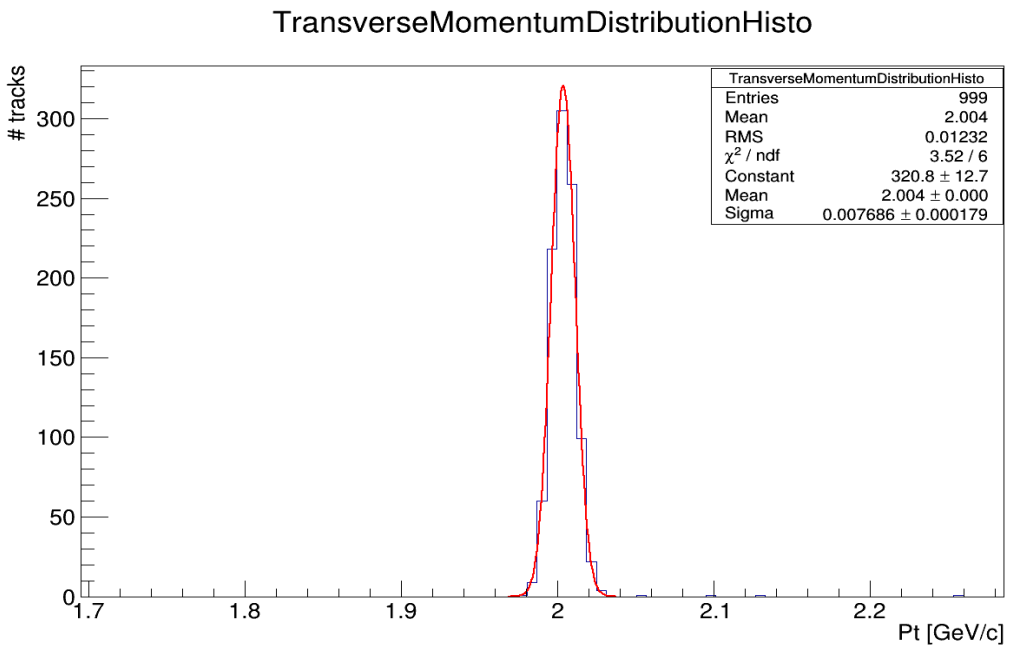


Run 139 – 2 GeV

Real data

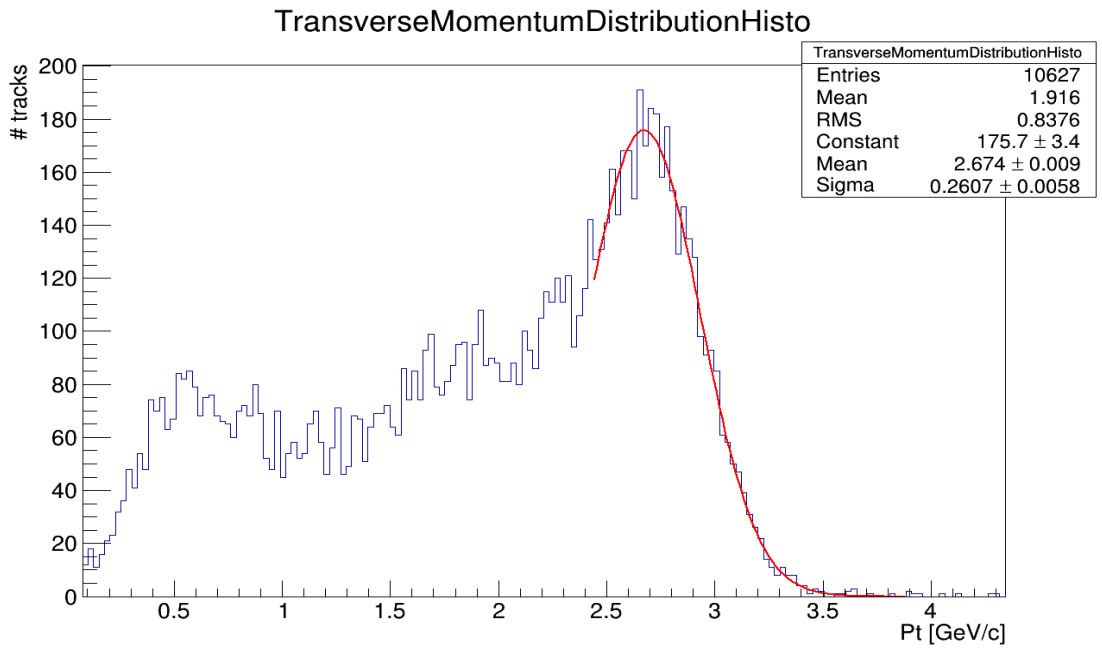


Simulation

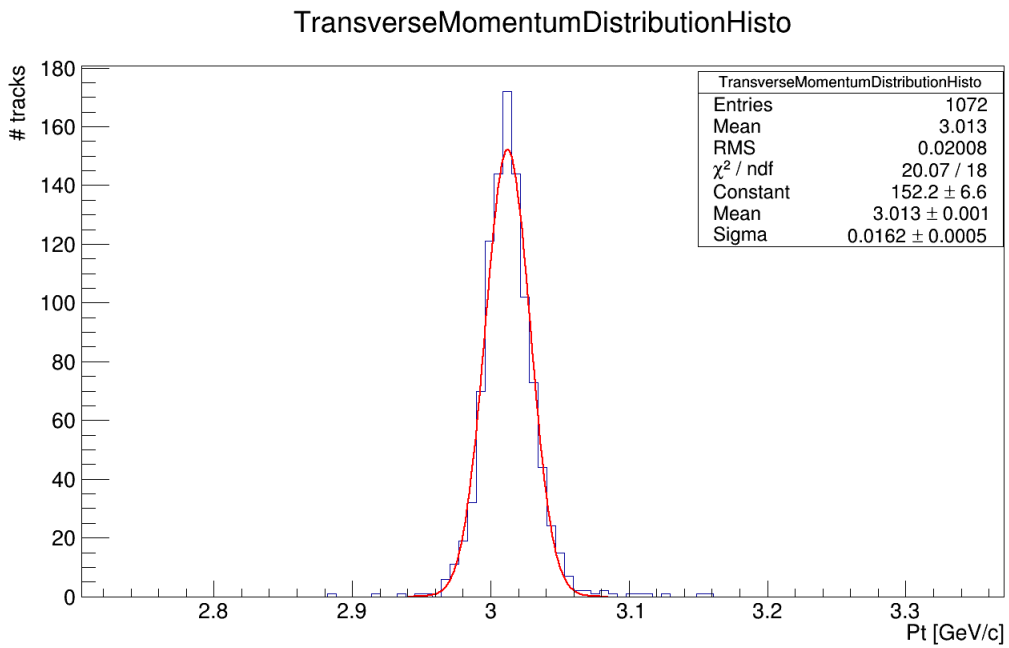


Run 138 – 3 GeV

Real data

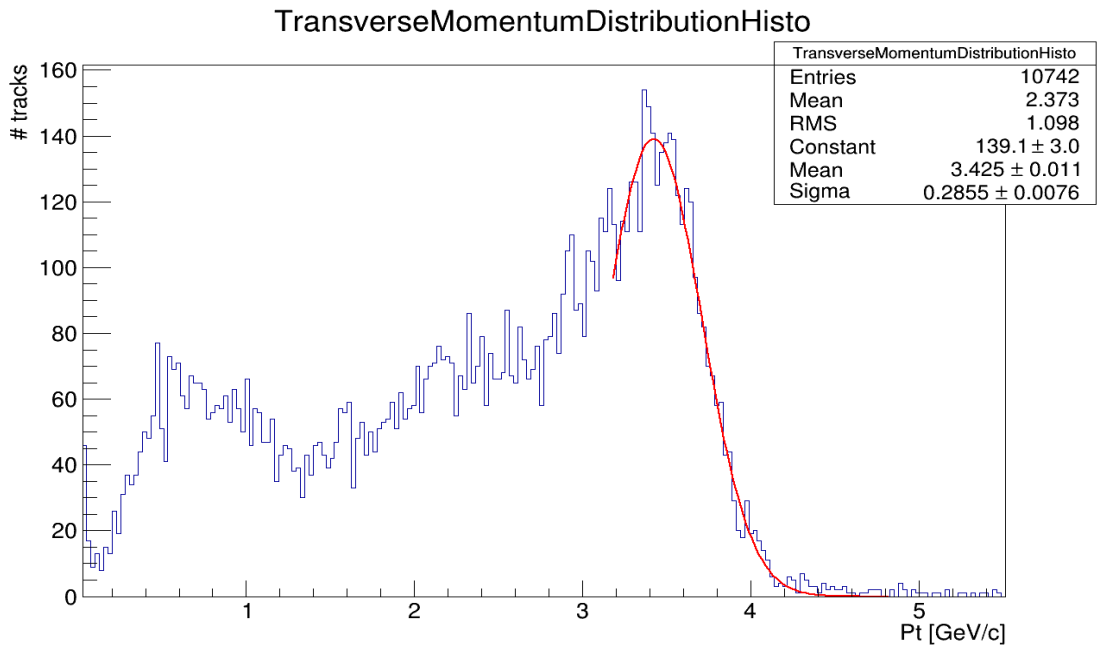


Simulation

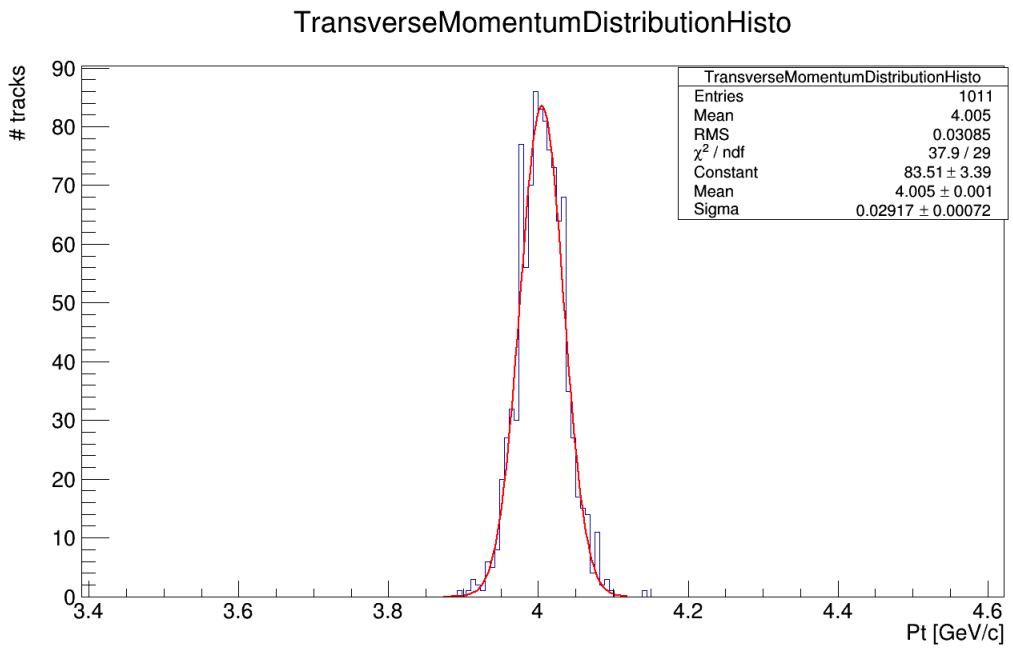


Run 137 – 4 GeV

Real data

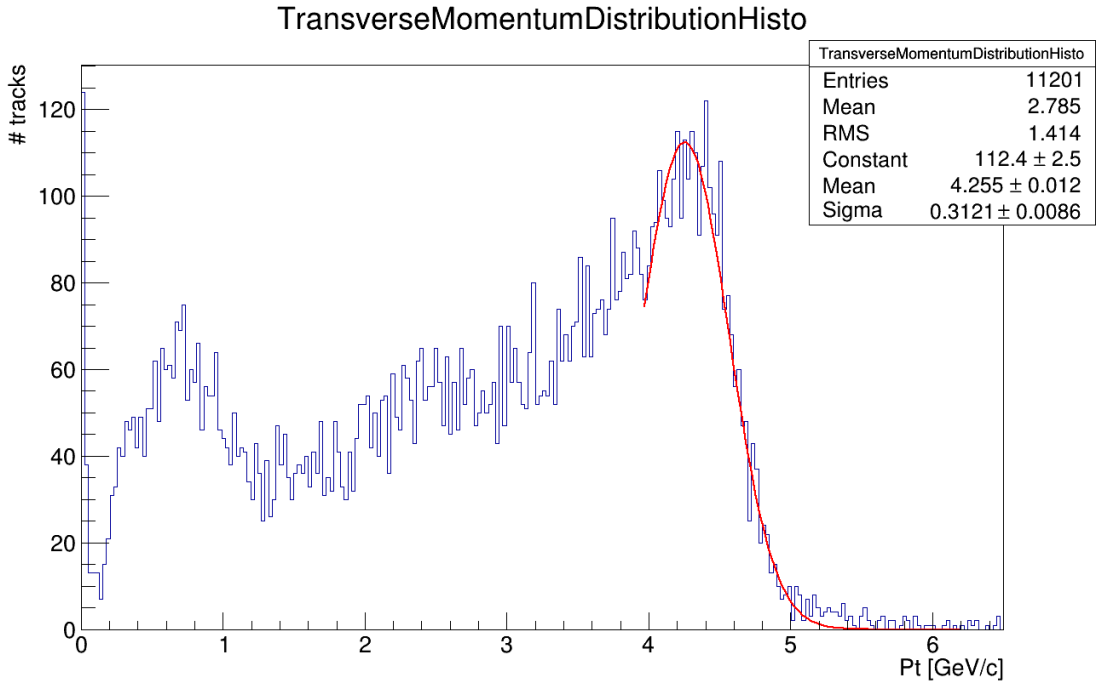


Simulation

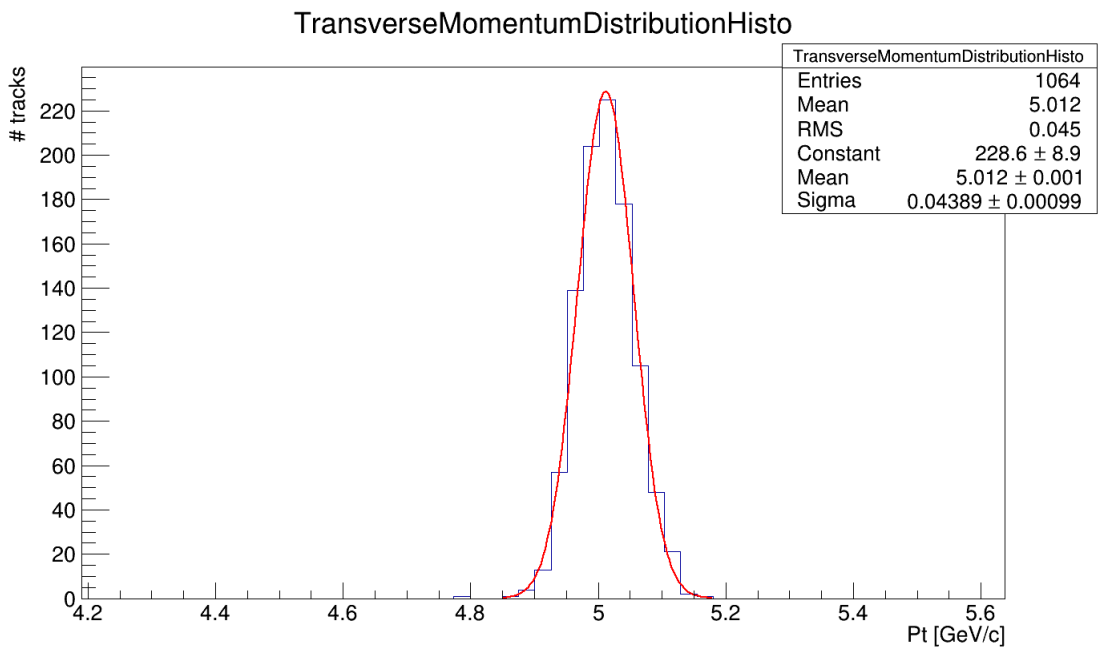


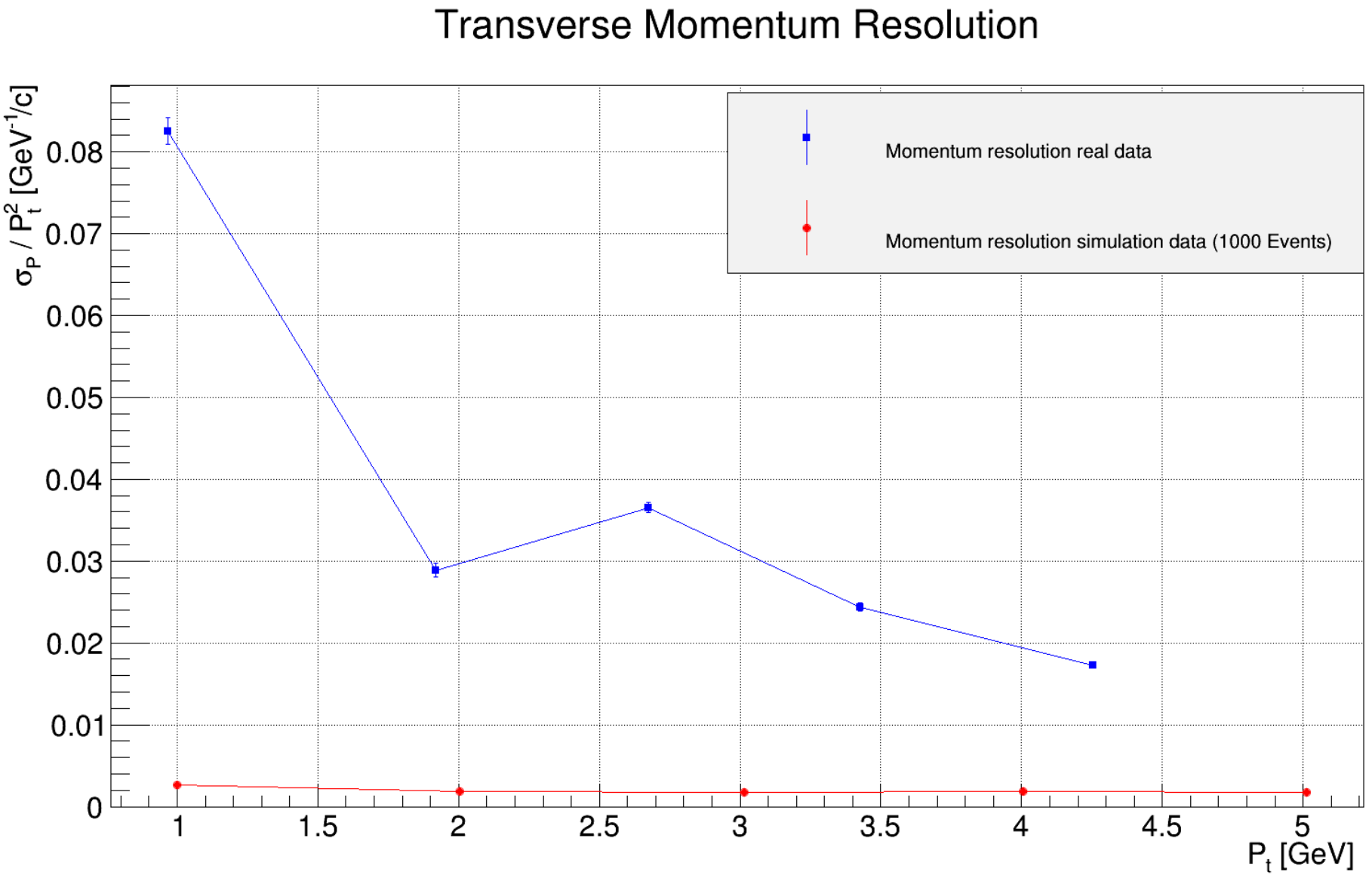
Run 136 – 5 GeV

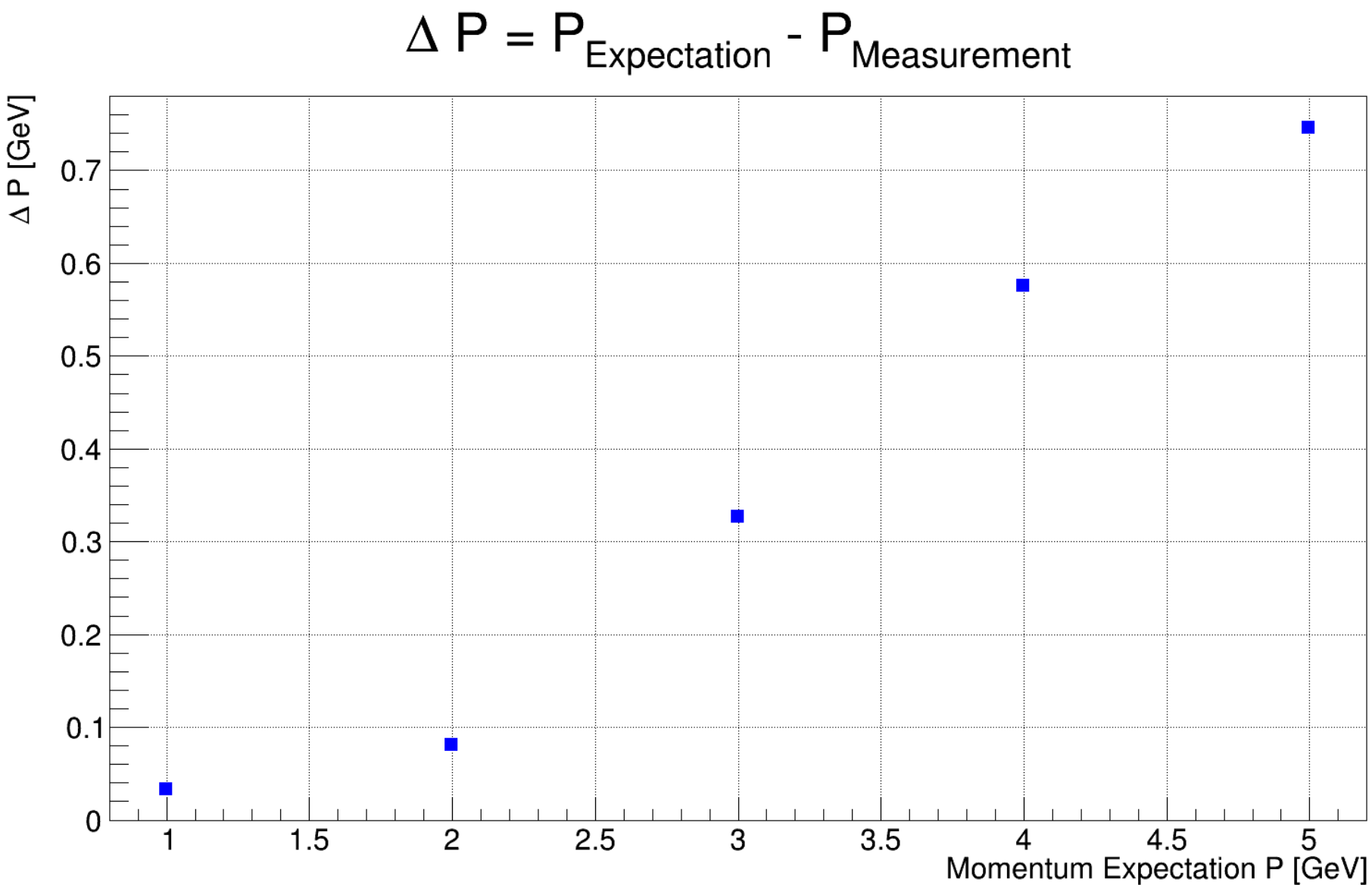
Real data



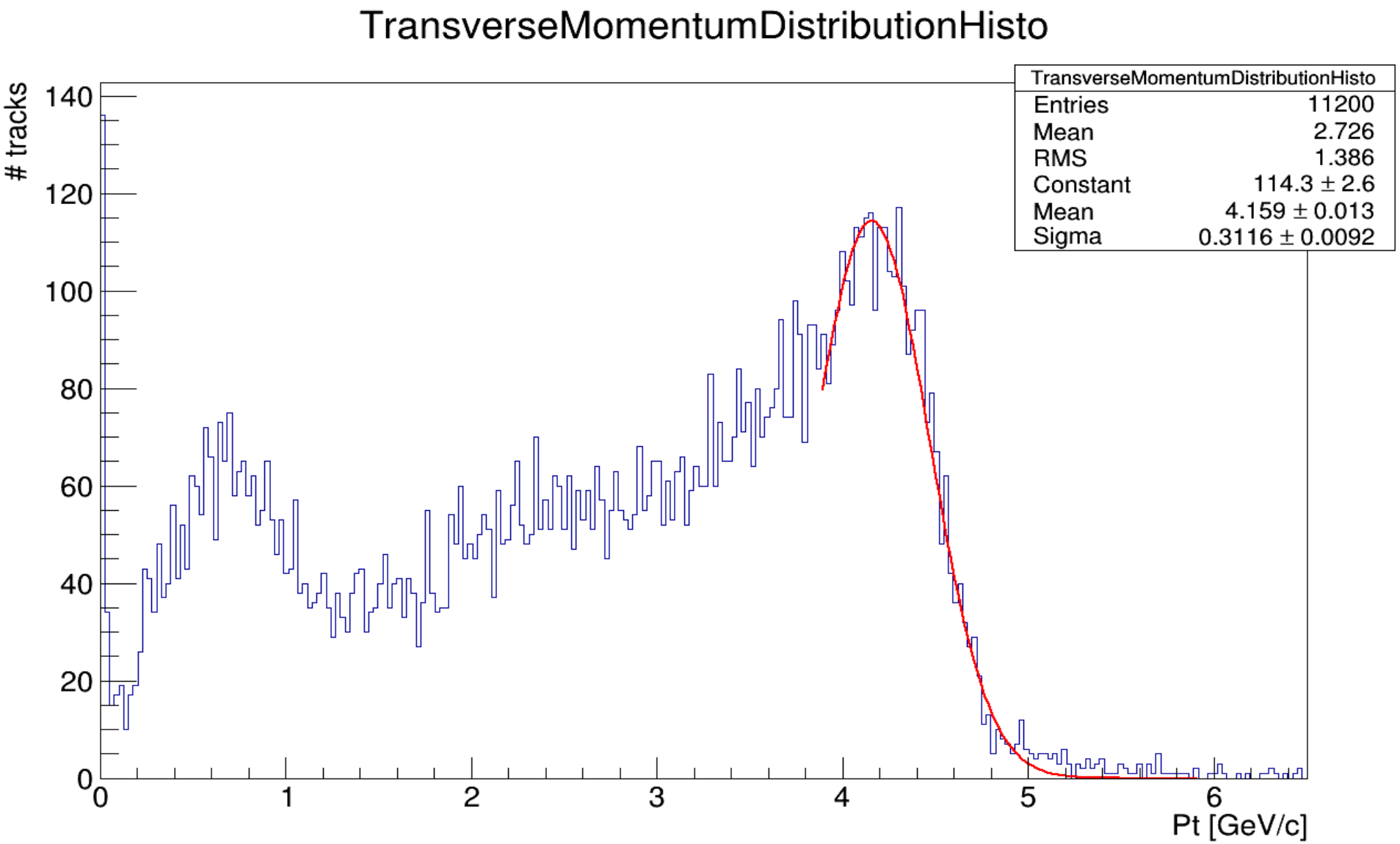
Simulation



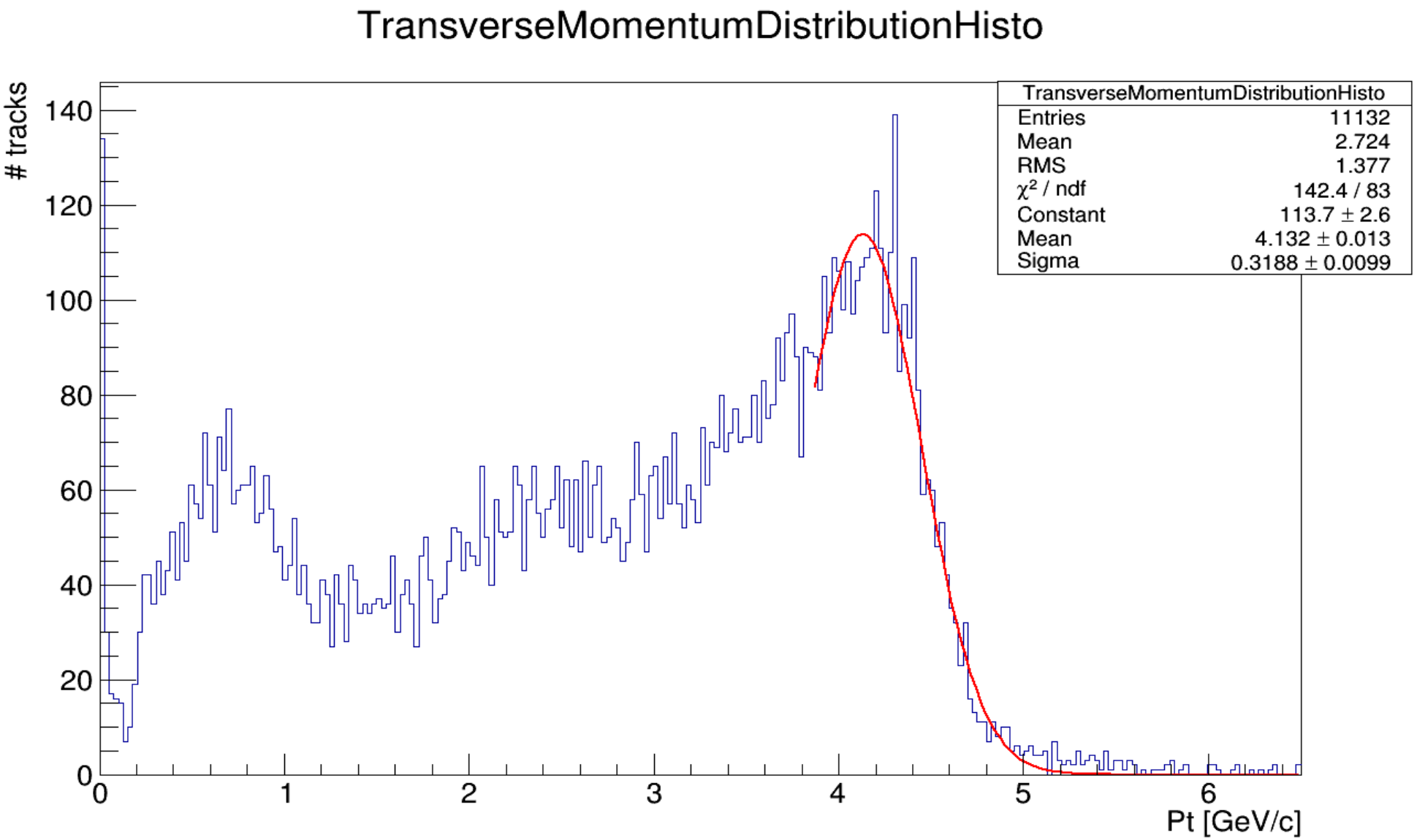

Transverse Momentum Resolution
Momentum resolution real data
Momentum resolution simulation data (1000 Events)
σ_P / P_t^2 [GeV^{-1}/c]
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
1
1.5
2
2.5
3
3.5
4
4.5
5
P_t [GeV]


Δ P = P_Expectation - P_Measurement
Δ P [GeV]
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1
1.5
2
2.5
3
3.5
4
4.5
5
Momentum Expectation P [GeV]

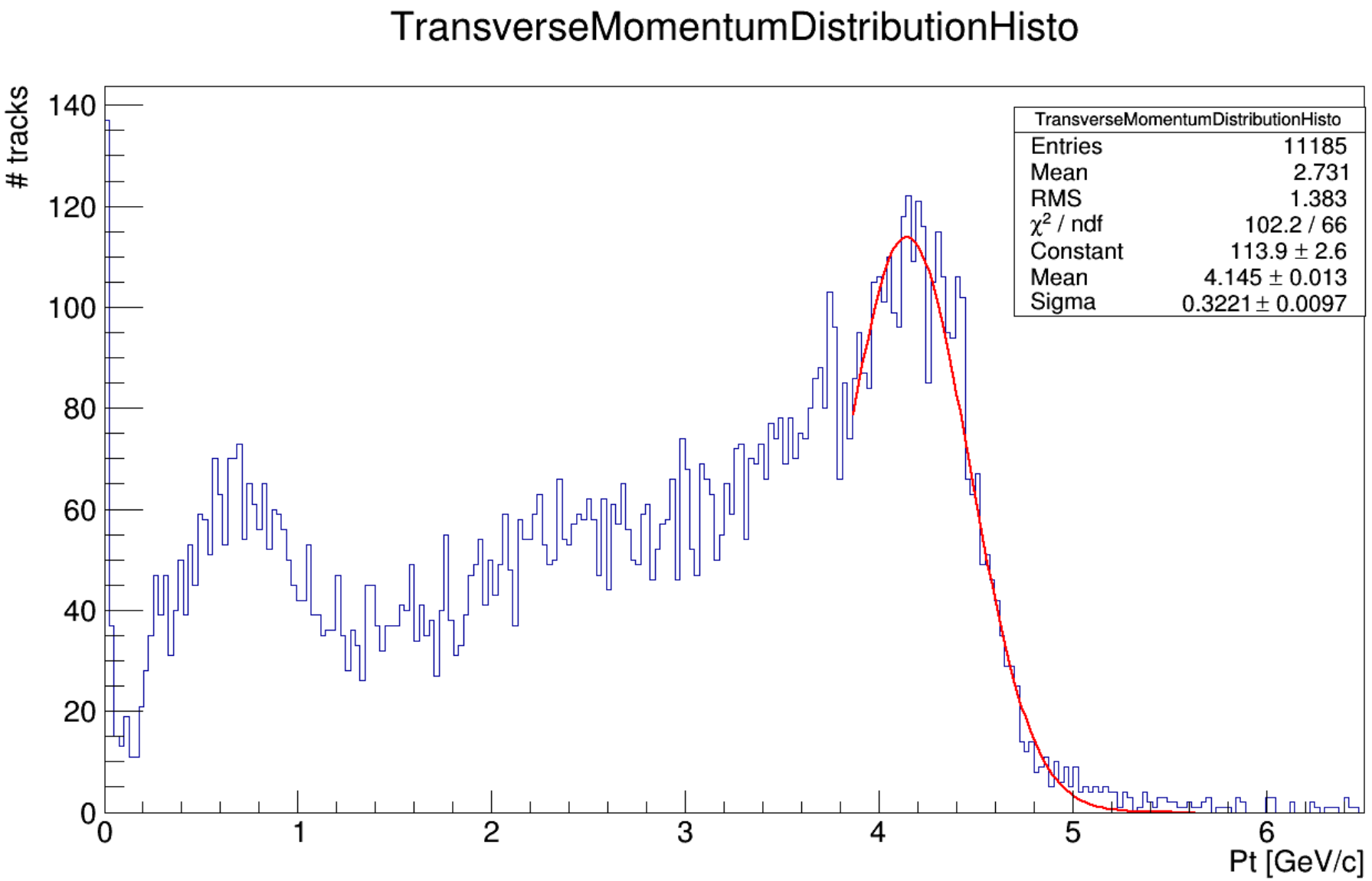
Run 136: 5 GeV, 1mm moved the upper 32 chips **up** and the lower 32 chips **down (stretch)**



Run 136: 5 GeV, 5mm moved the upper 32 chips **down** and the lower 32 chips **up (shrinkage)**



Run 136: 5 GeV, 5mm moved the upper 32 chips **up** and the lower 32 chips **down (Stretch)**



Run 136: 5 GeV, Only middle Module (without upper and lower 32 chips)