Cascade Simulations Update

Nathan Sparks

Florida State University, Tallahassee, Florida

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Procedure

Photoproduction of $\Xi^-(1320)$ and $\Xi^0(1315)$ using 9 GeV photons

- t-channel production using the genr8 program
- Reactions and decay chains
  - $\gamma p \rightarrow K^+ Y$ with $Y \rightarrow K^+ \Xi^-$, $\Xi^- \rightarrow \Lambda \pi^-$, $\Lambda \rightarrow \pi^- \mathrm{p}$
  - $\gamma p \rightarrow K^+ Y$ with $Y \rightarrow K_s \Xi^0$, $\Xi^0 \rightarrow \Lambda \pi^0$, $\Lambda \rightarrow \pi^- \mathrm{p}$, $K_s \rightarrow \pi^+ \pi^-$, $\pi^0 \rightarrow \gamma\gamma$
  - $\gamma p \rightarrow K_s Y^+$ with $Y \rightarrow K^+ \Xi^0$, $\Xi^0 \rightarrow \Lambda \pi^0$, $\Lambda \rightarrow \pi^- \mathrm{p}$, $K_s \rightarrow \pi^+ \pi^-$, $\pi^0 \rightarrow \gamma\gamma$
- Excited hyperon parameters:
  m(Y) = 1960 MeV and Γ(Y) = 220 MeV
  from (Guo *et al.*, PRC **76**, 025208 (2007))
- t-channel slope parameter: 5 $(\mathrm{GeV})^{-2}$
- Swim particles through GlueX detectors using HDGeant (minimal control.in file with HADR==0)

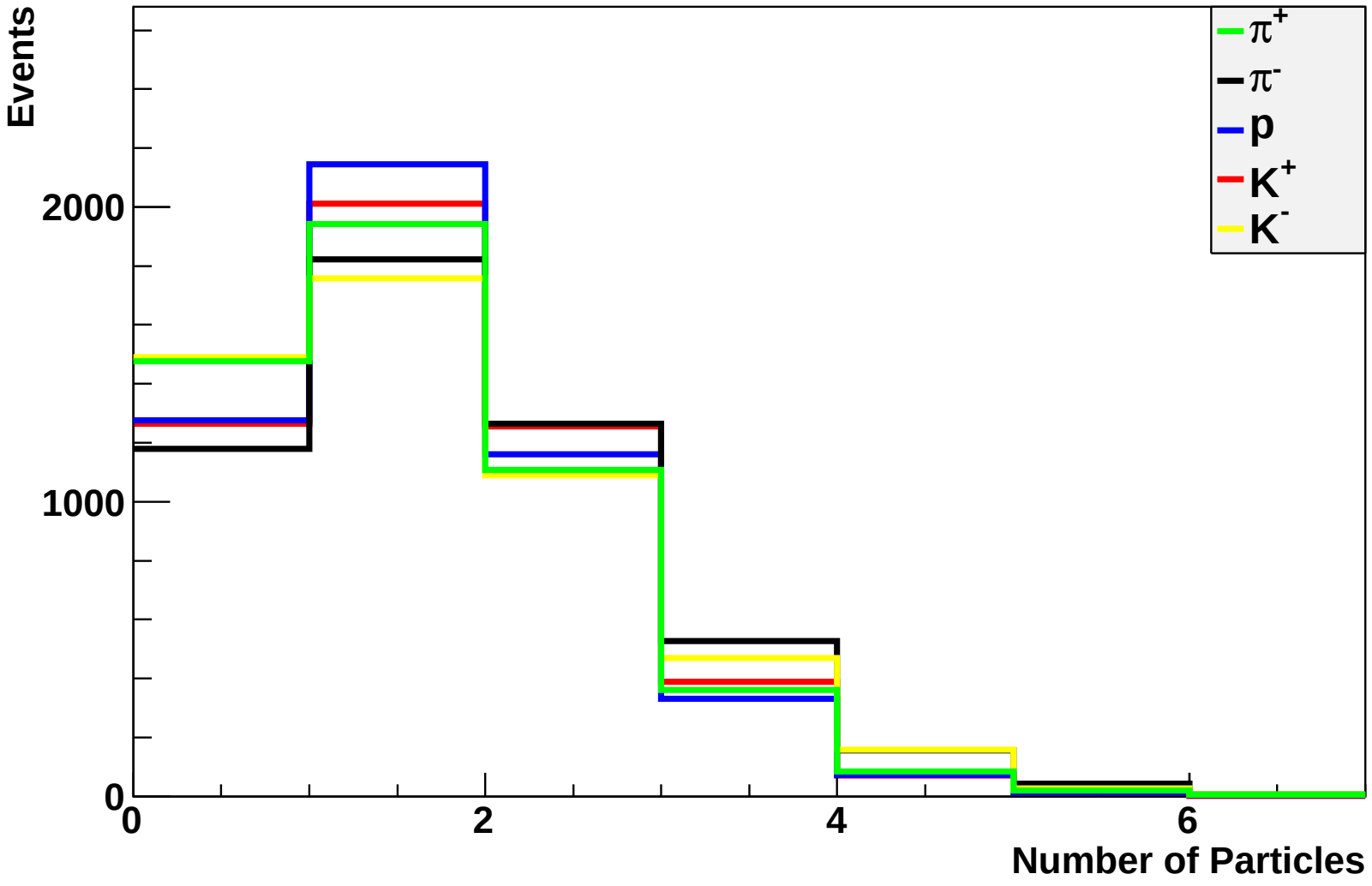
Procedure

- Standard reconstruction and PID from the offline software
- Use hd_root with phys_tree plugin to produce root file with trees
- Determine final state particle combo kinematically
  - If all particles detected, choose combo that best conserves c.m. energy
  - If one particle is missing, choose combo that gives the best missing mass
  - If there are multiple particles of the same type, use mass constraints
  - 3σ mass cut, 750 MeV change in c.m. energy cut (all detected)
- Compare results of normal offline PID to PID_FORCE_TRUTH

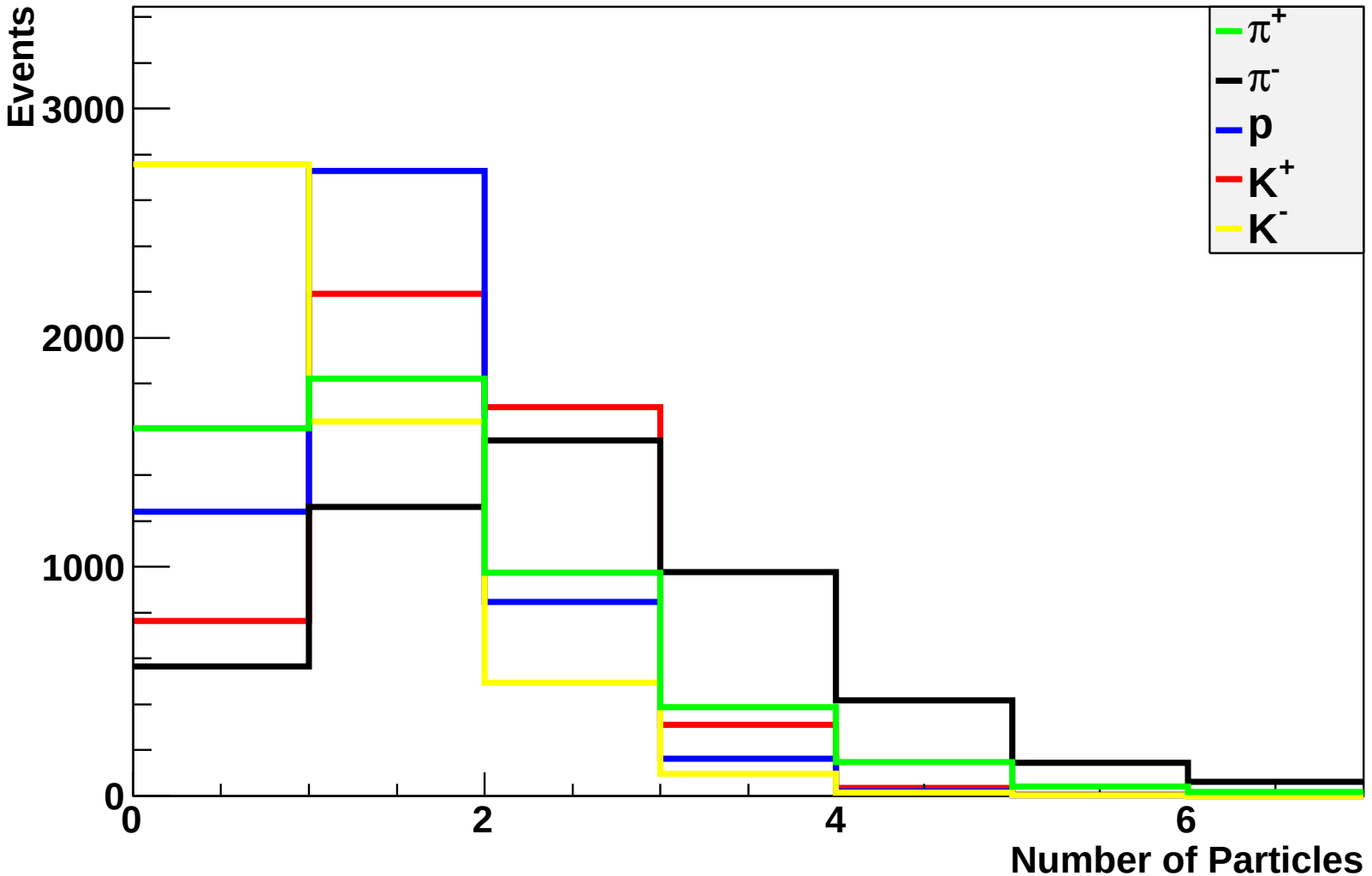
PID_FORCE_TRUTH (configuration parameter)

- Forces the correct PID, based on hit matching to the truth info., within DTrackTimeBased_factory when there is a correct track available

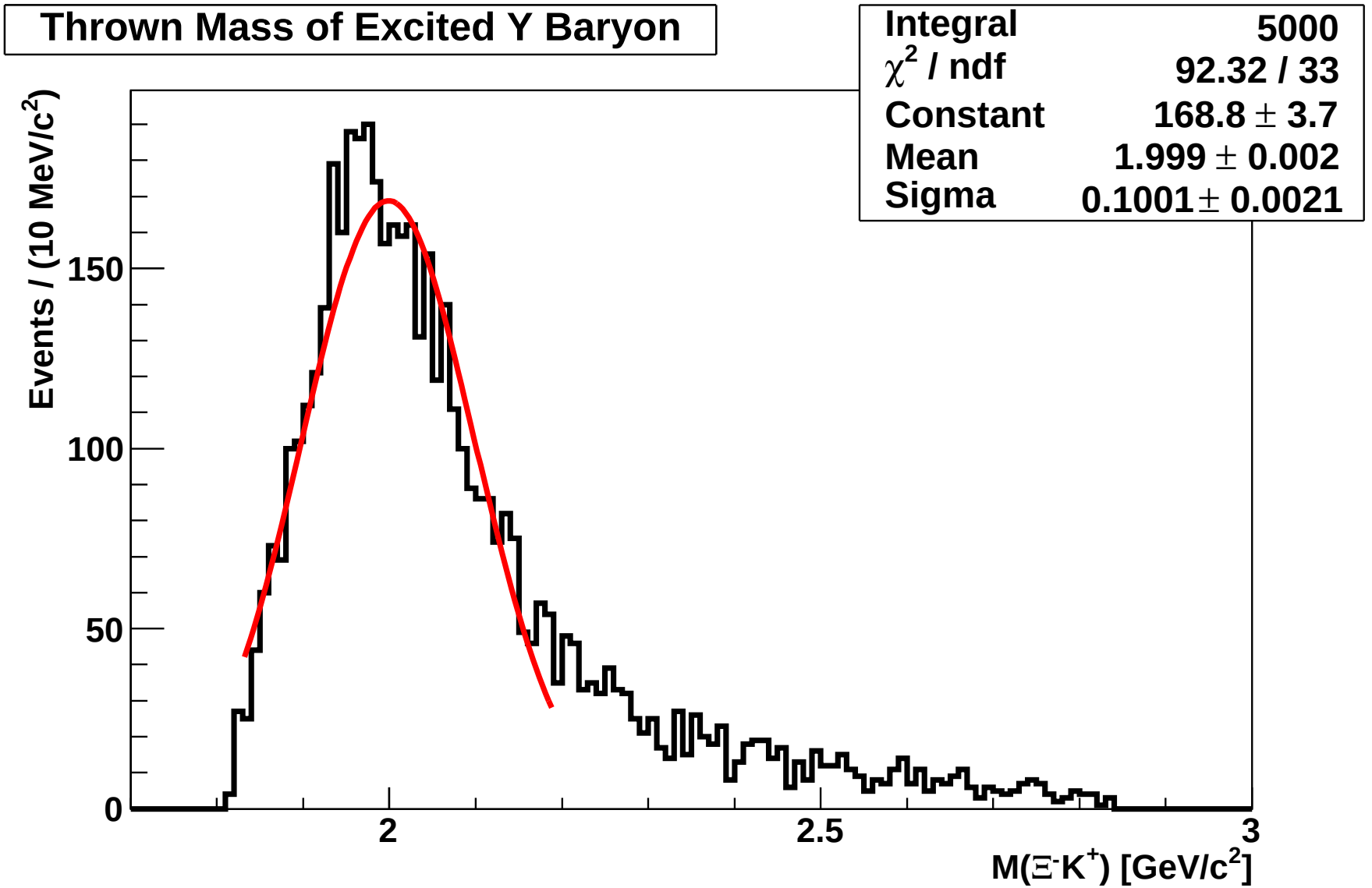
Normal PID



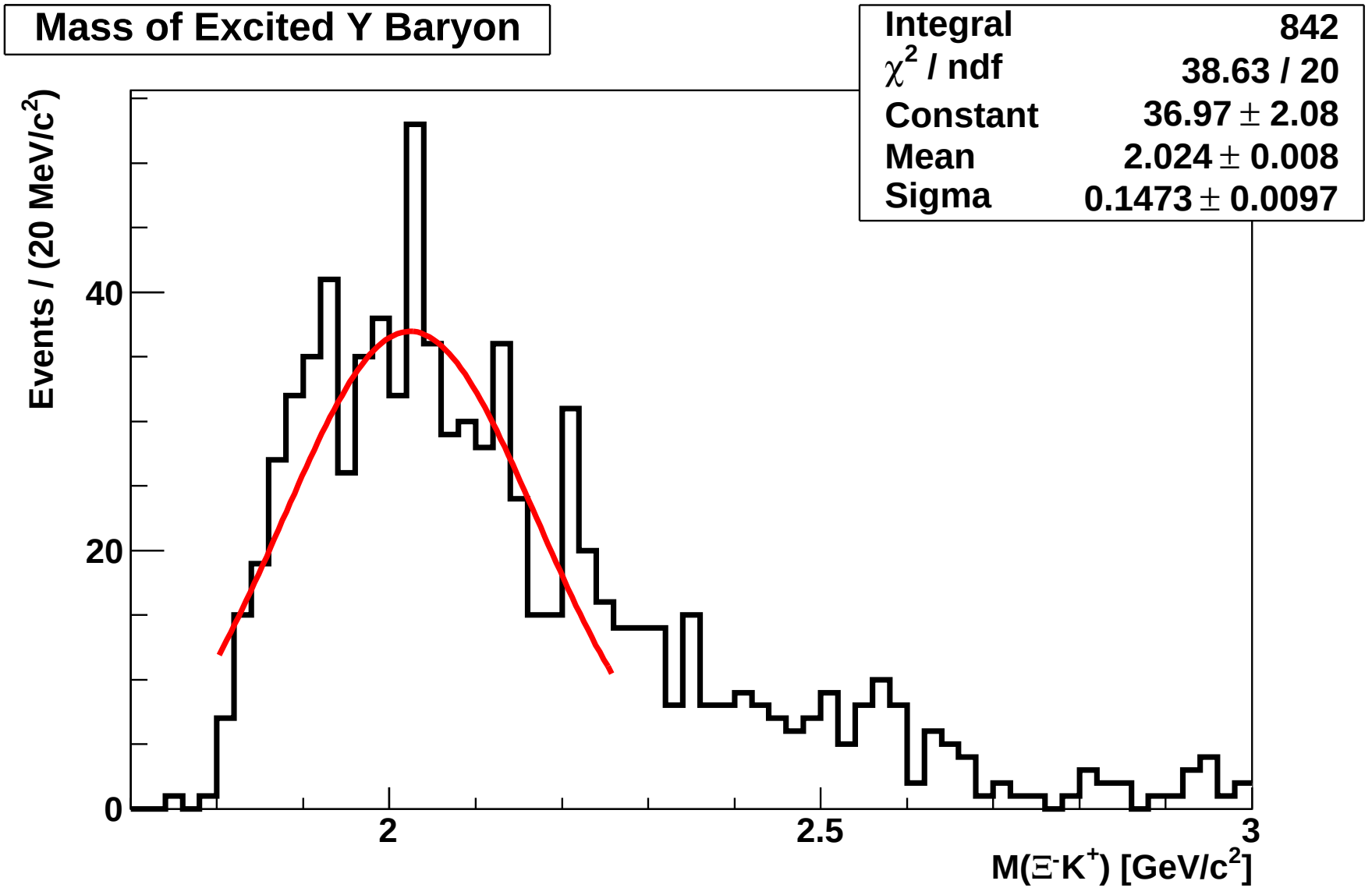
PID Force Truth



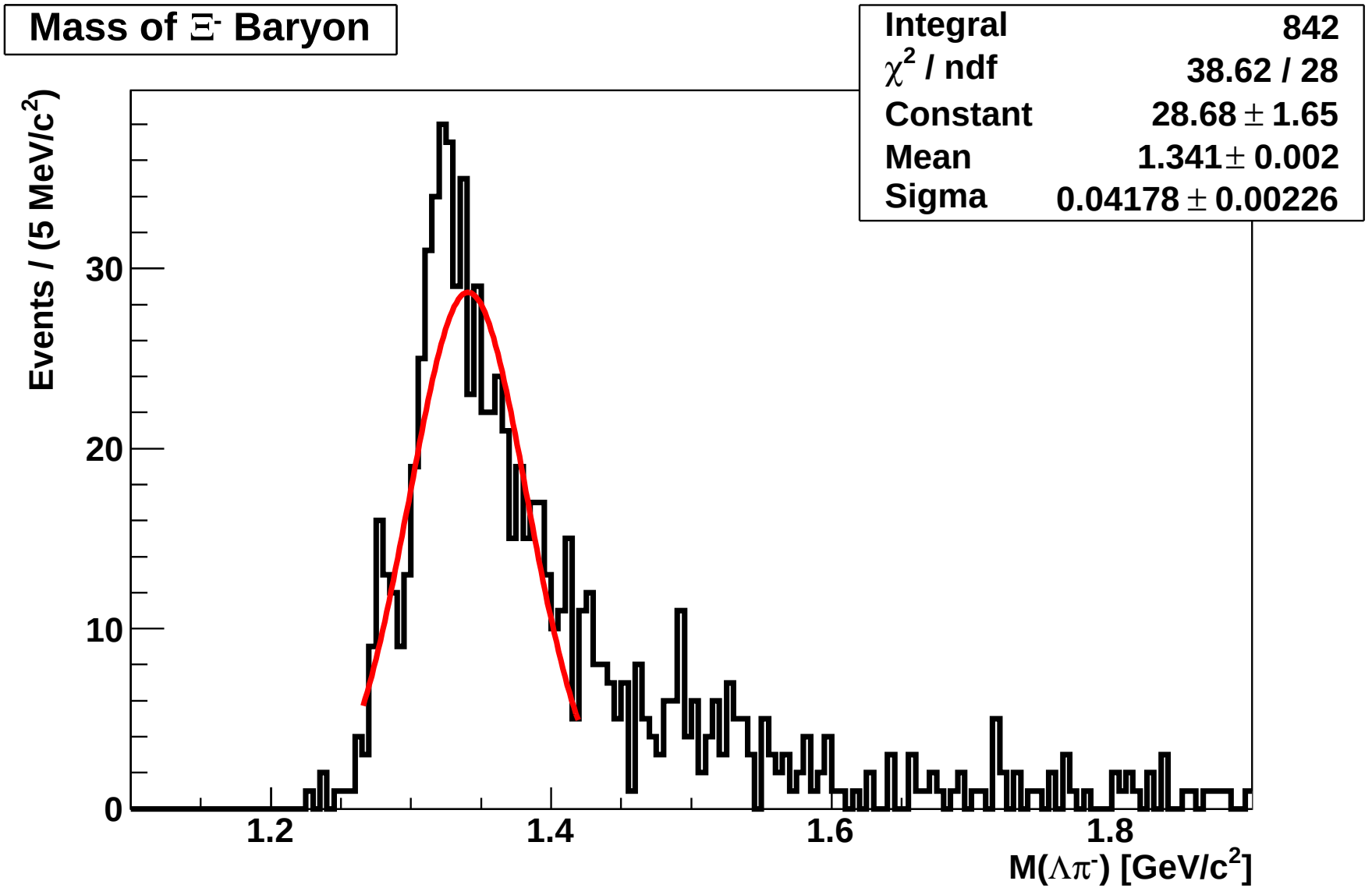
PID Force Truth



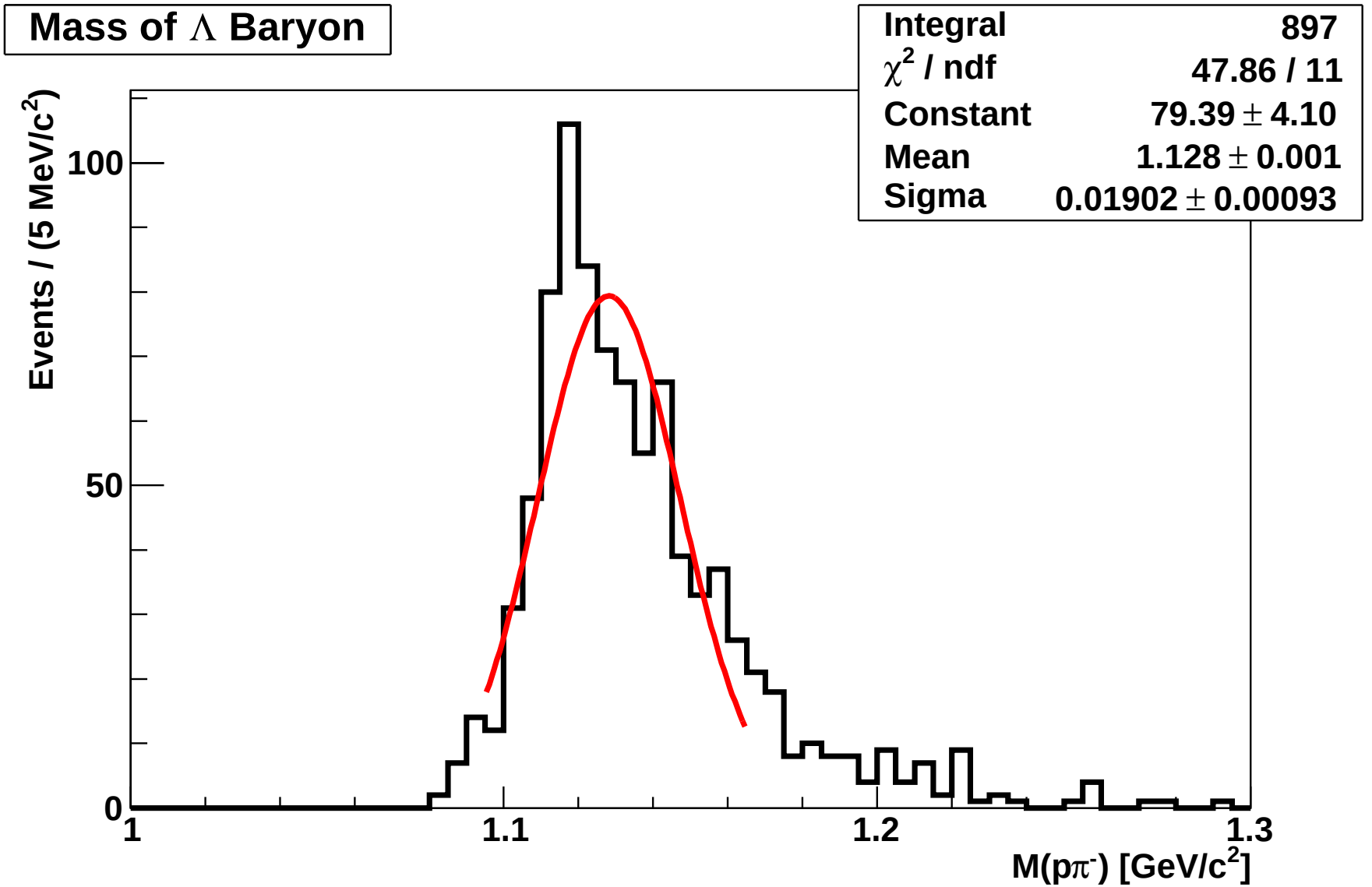
PID Force Truth



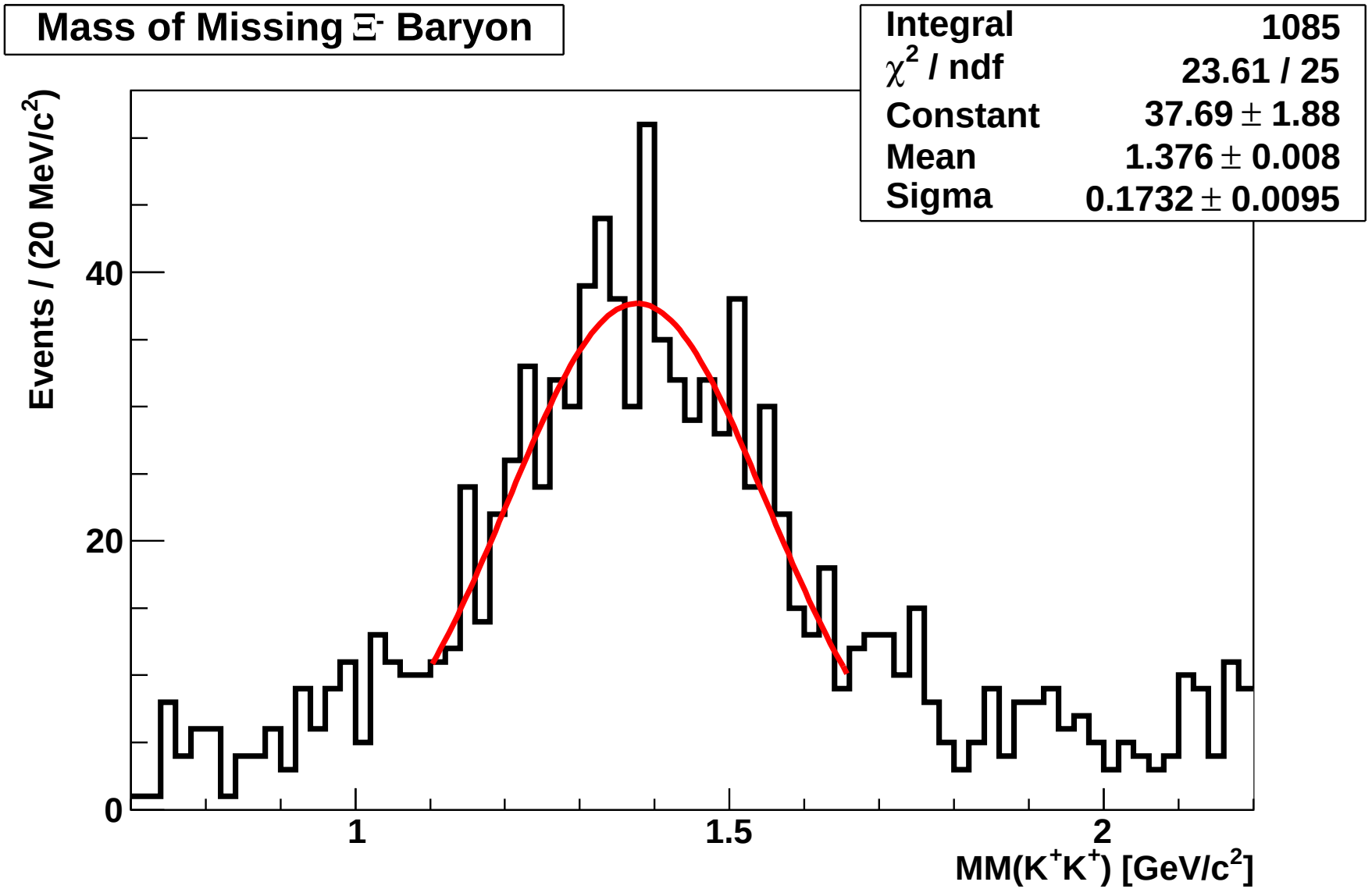
PID Force Truth



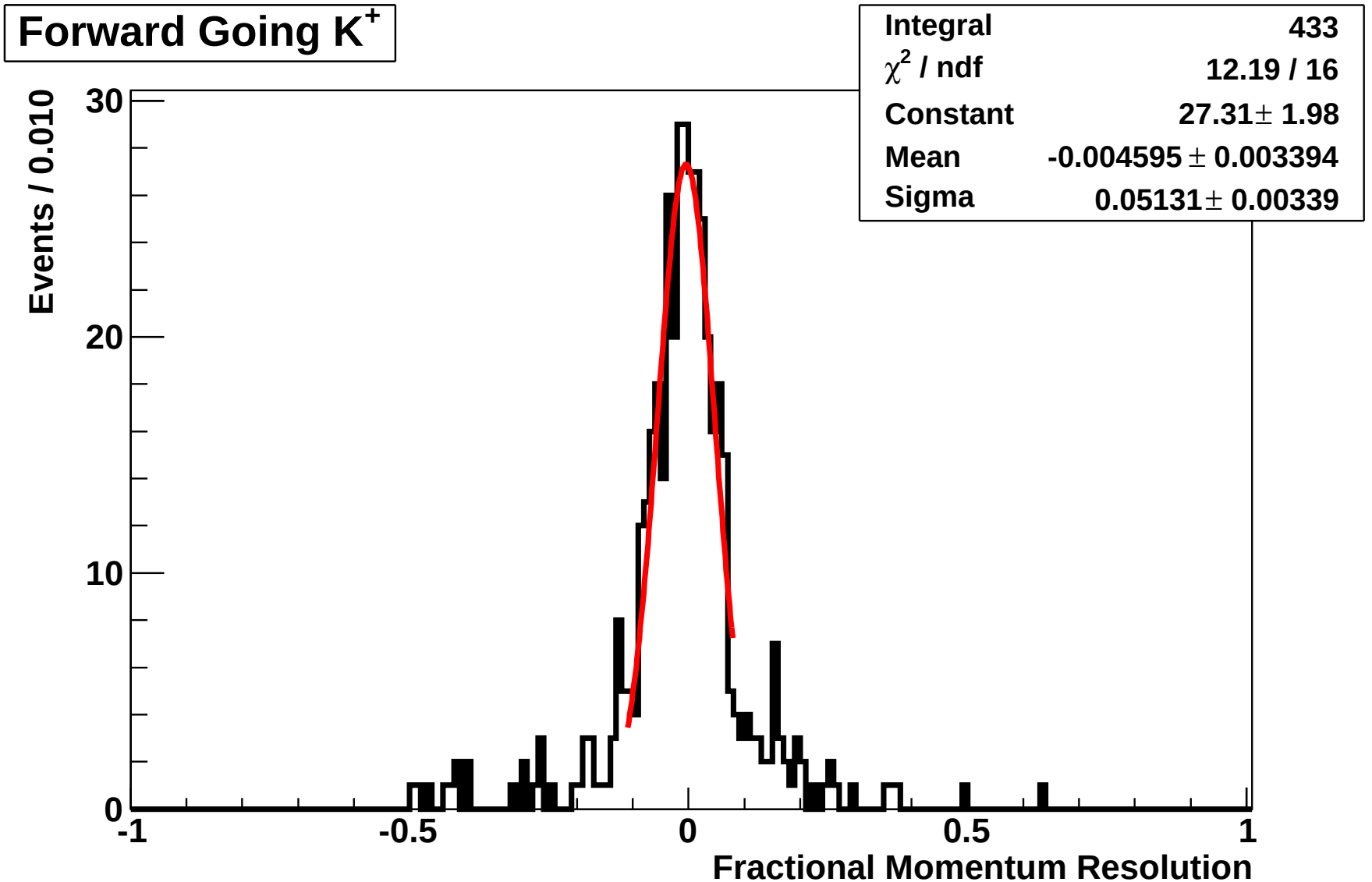
PID Force Truth



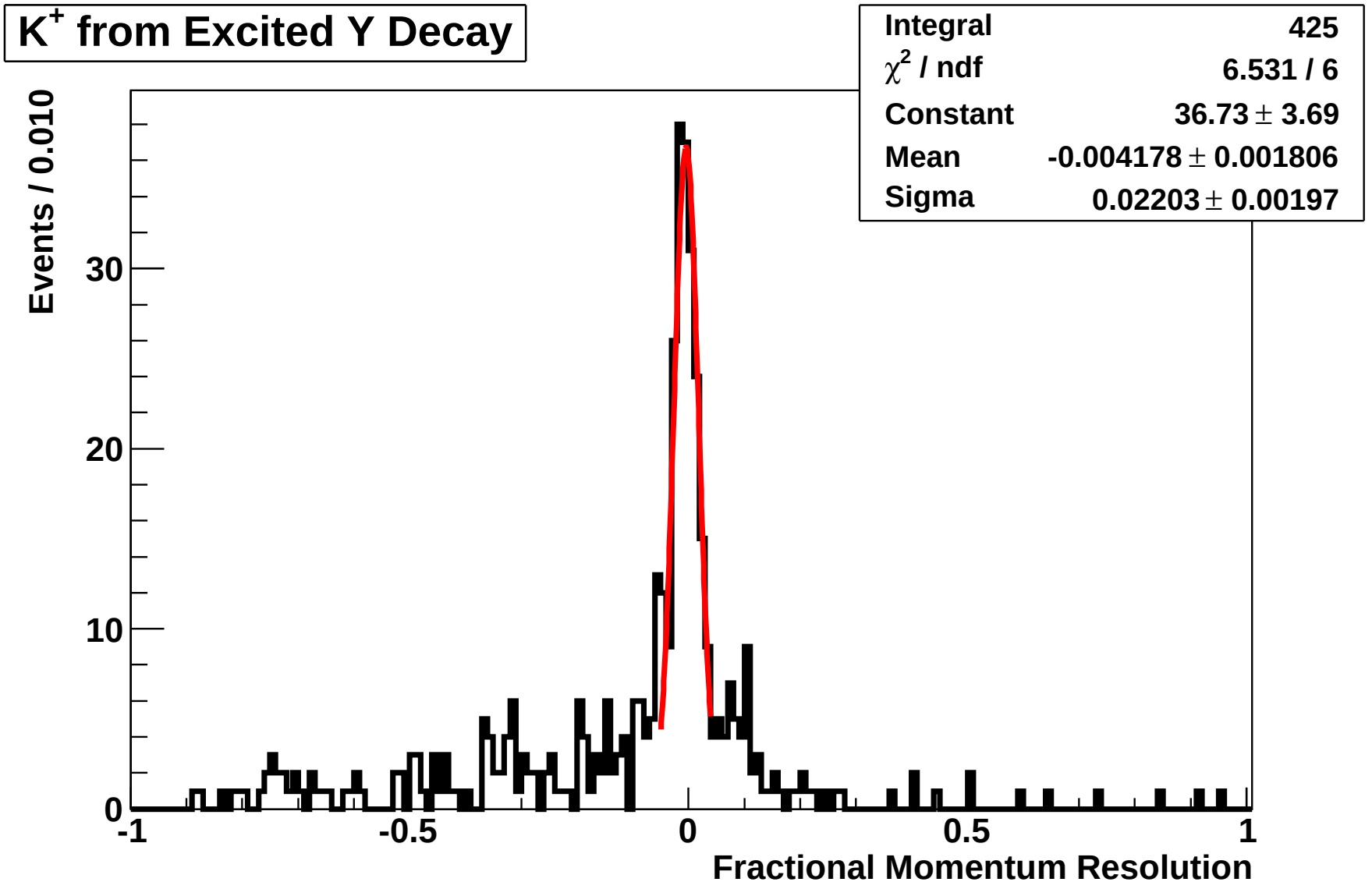
PID Force Truth



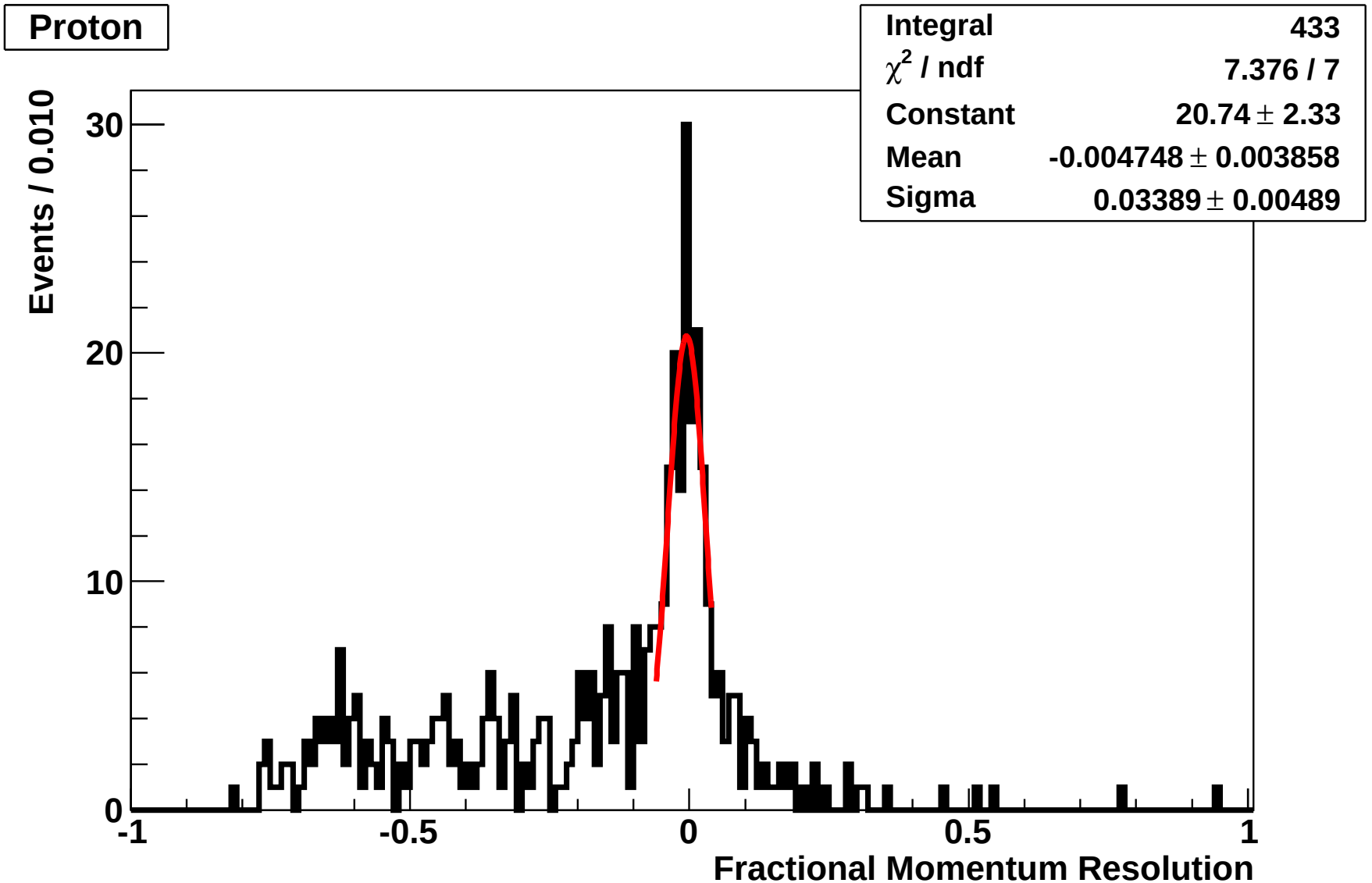
PID Force Truth



PID Force Truth



PID Force Truth



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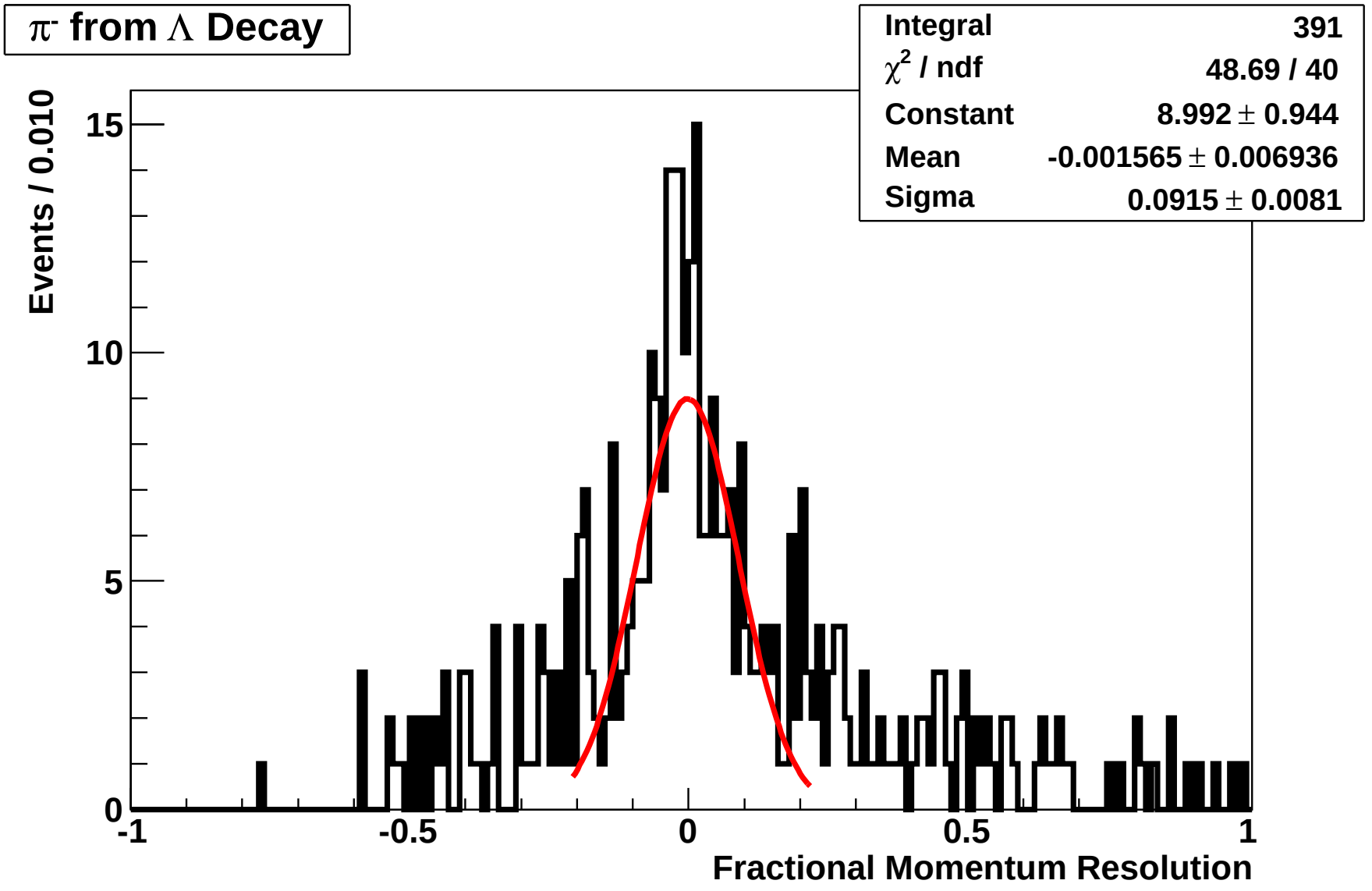
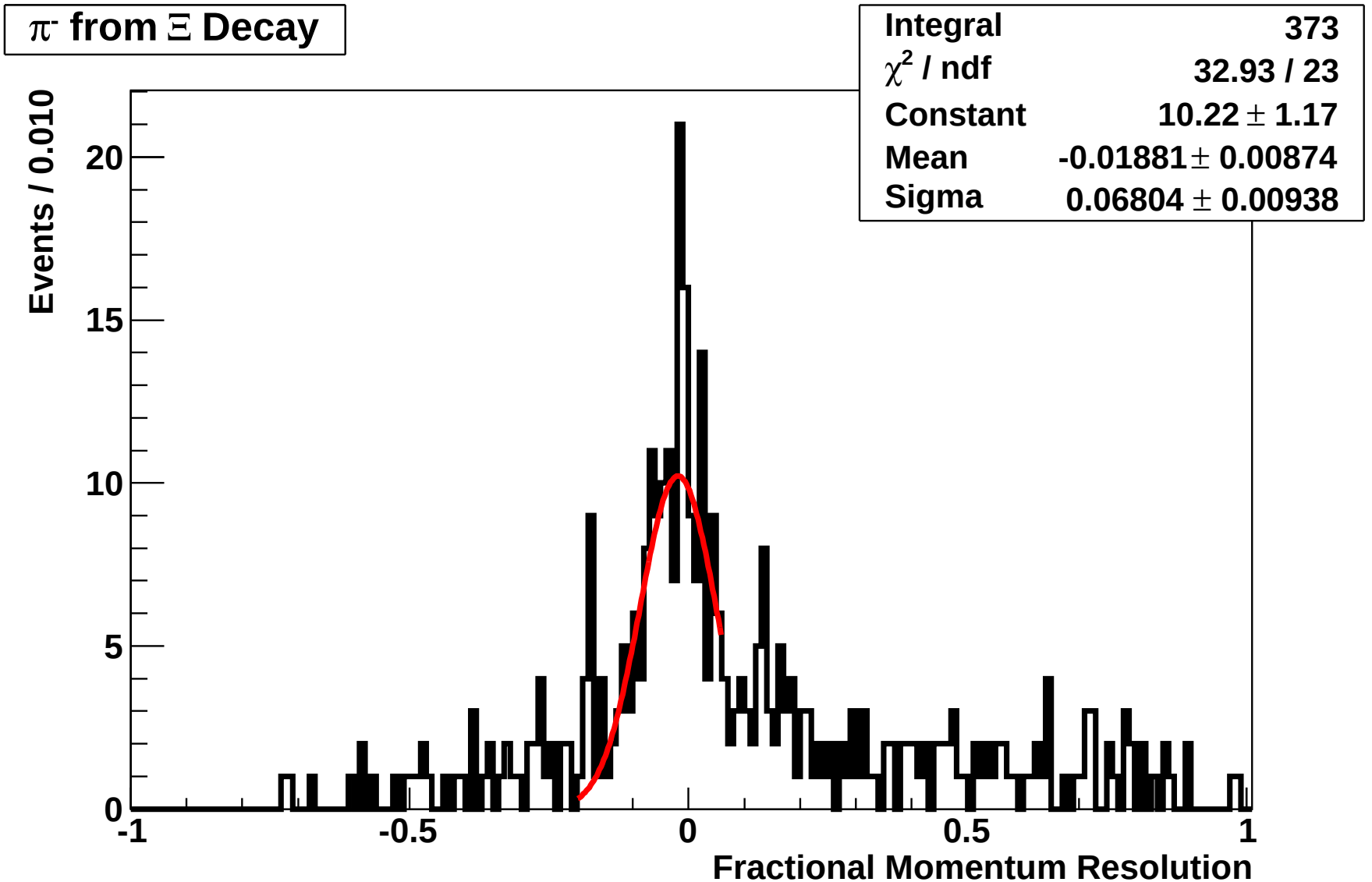
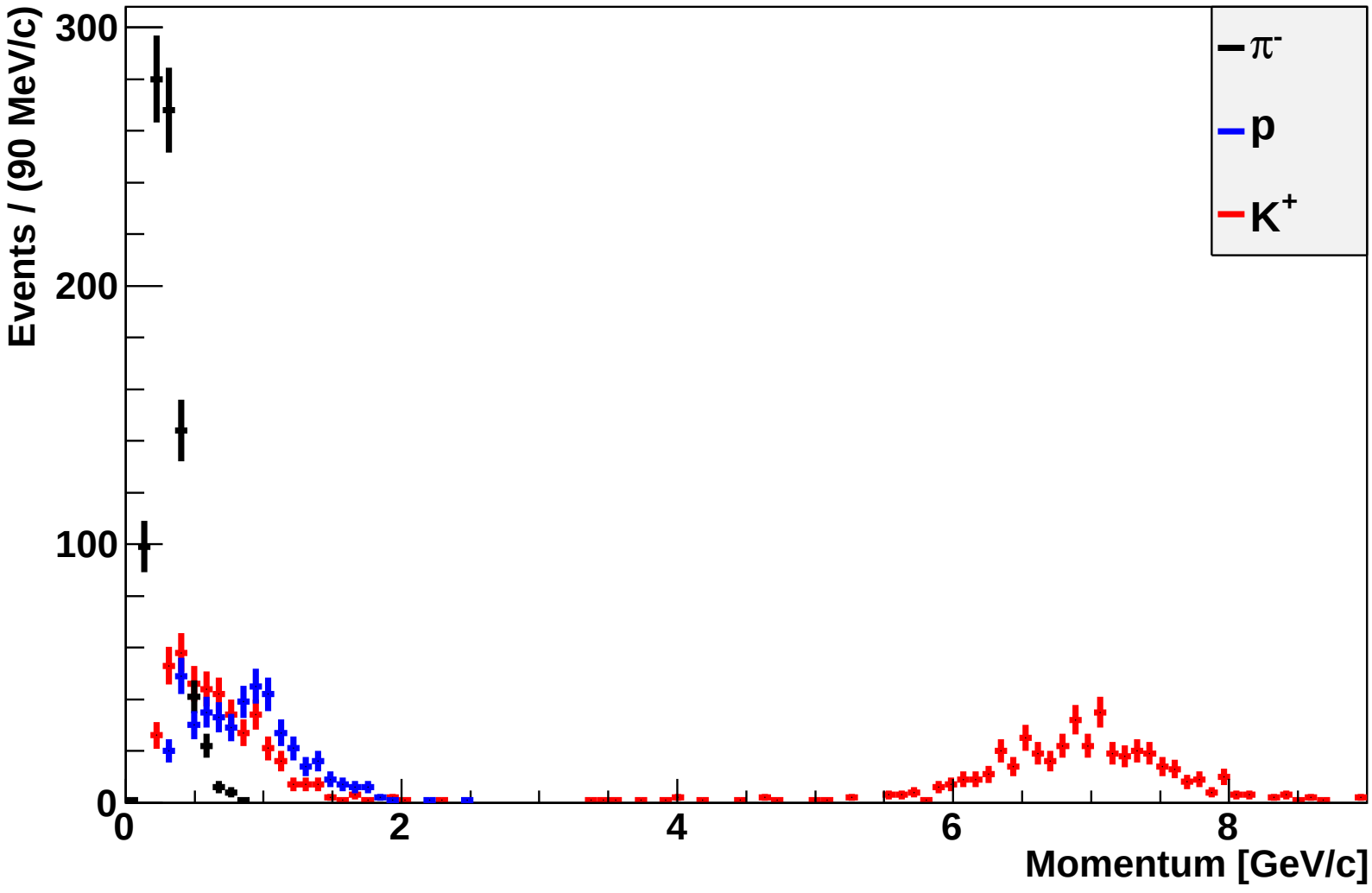


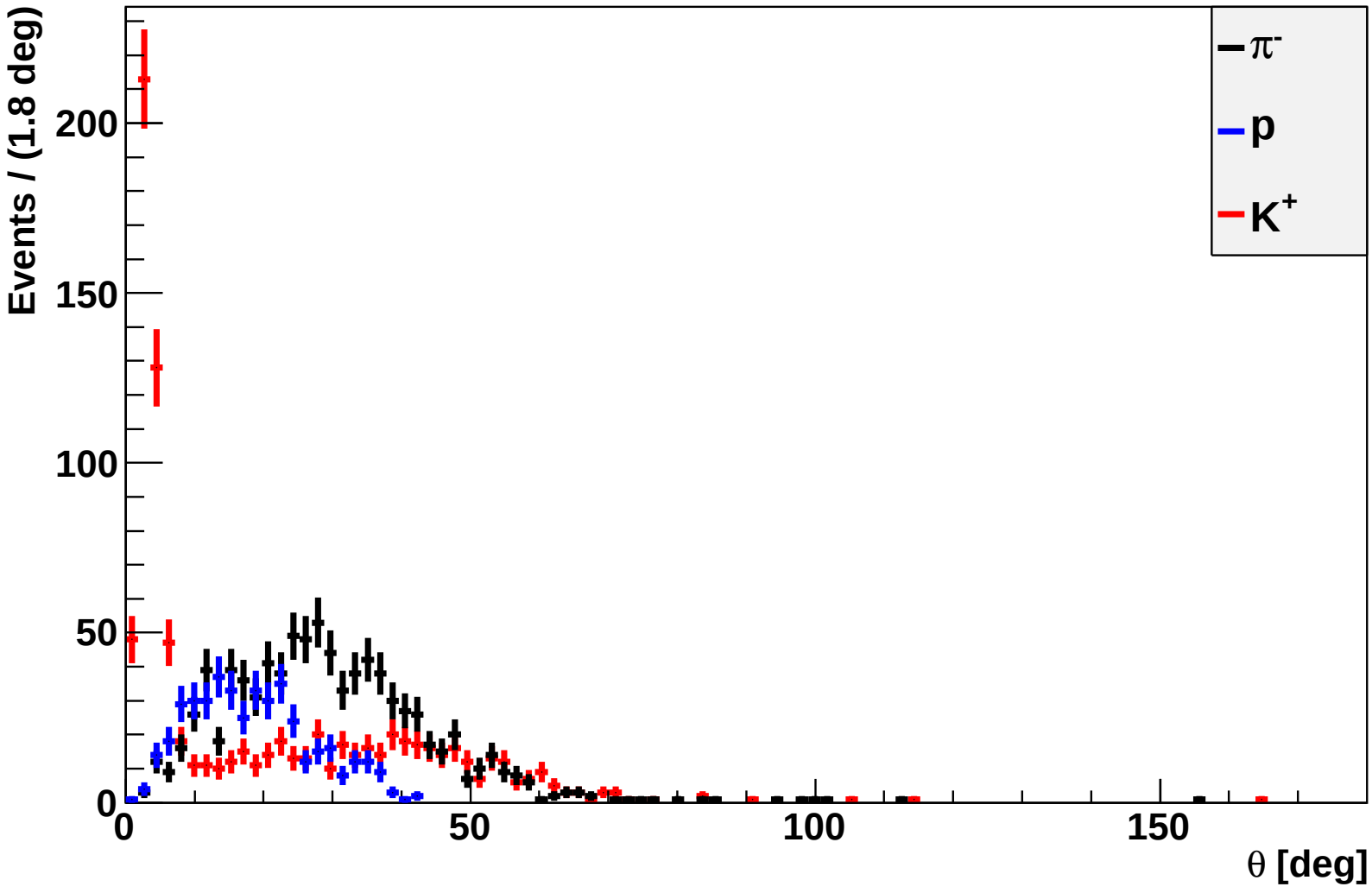
PID Force Truth



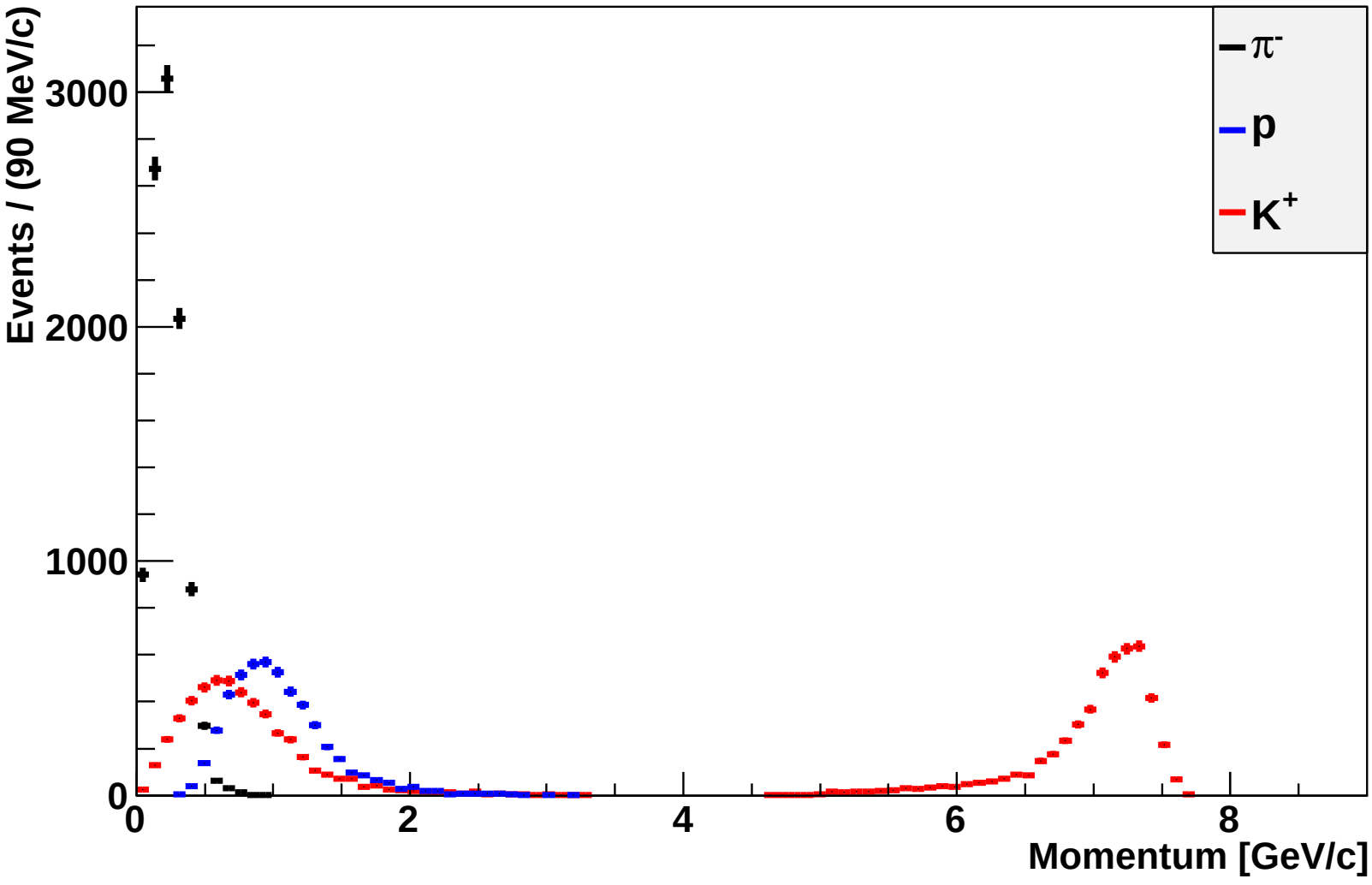
PID Force Truth: Accepted Momentum Dist.



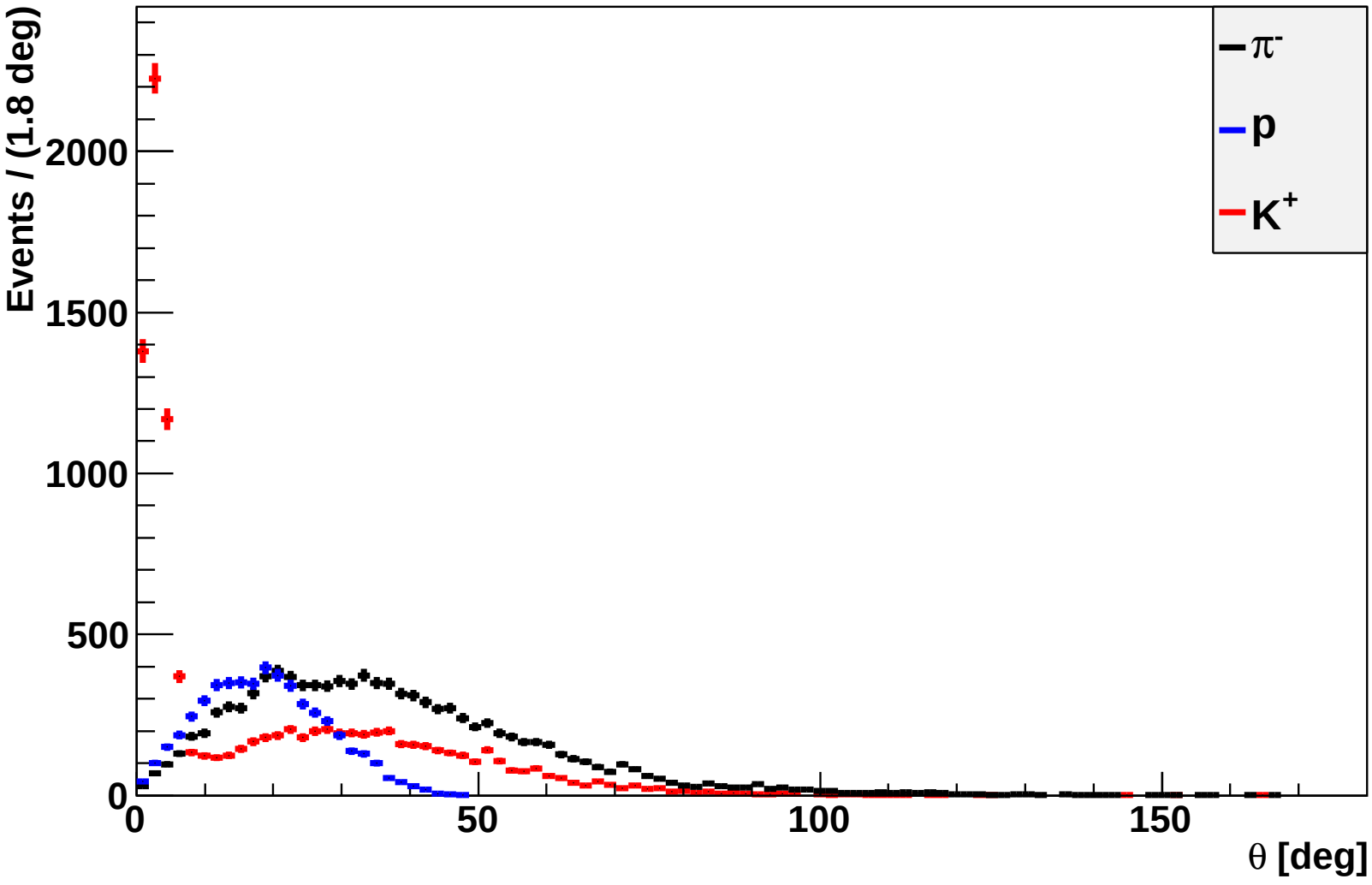
PID Force Truth: Accepted Theta Dist.



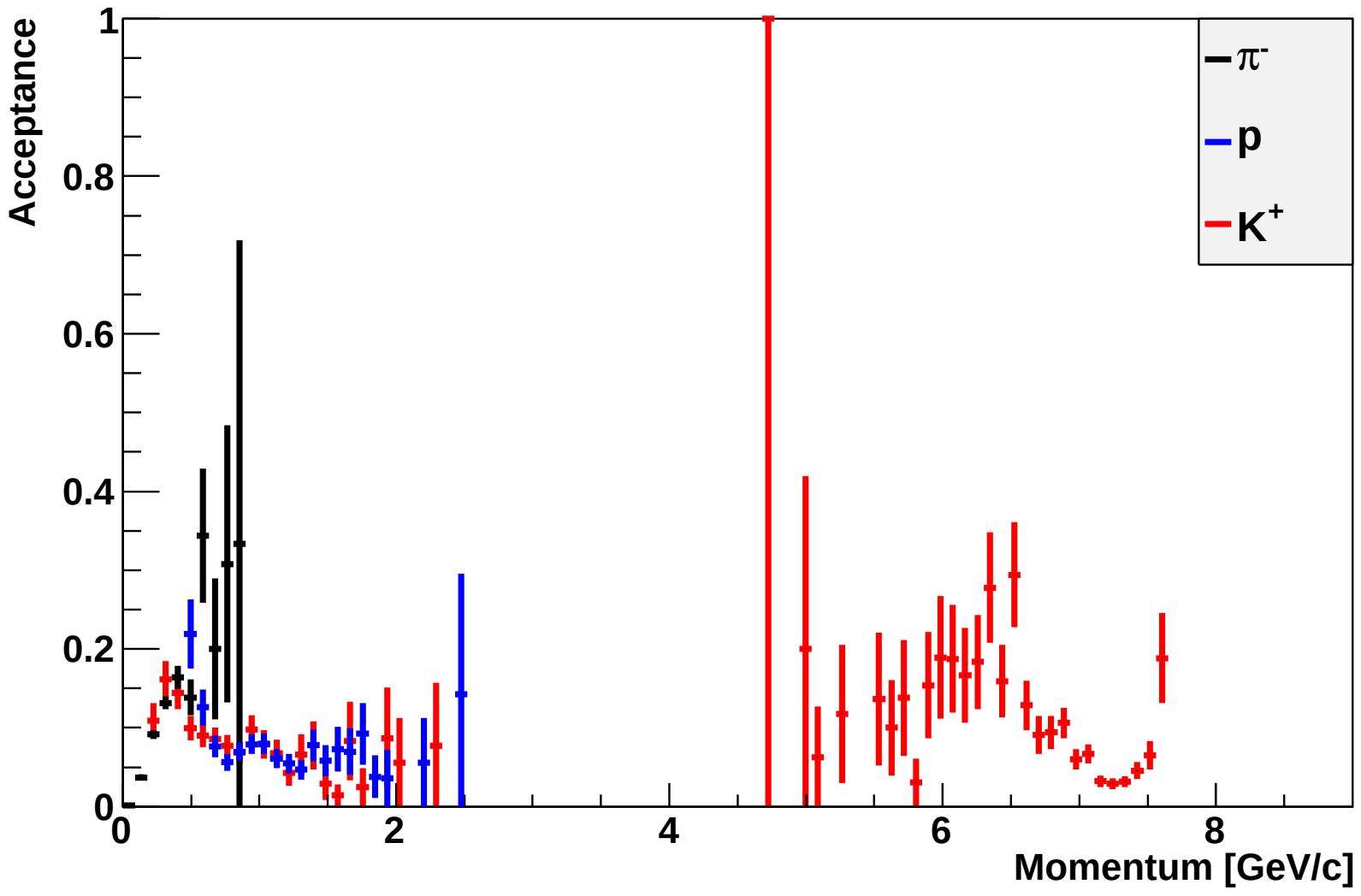
PID Force Truth: Generated Momentum Dist.



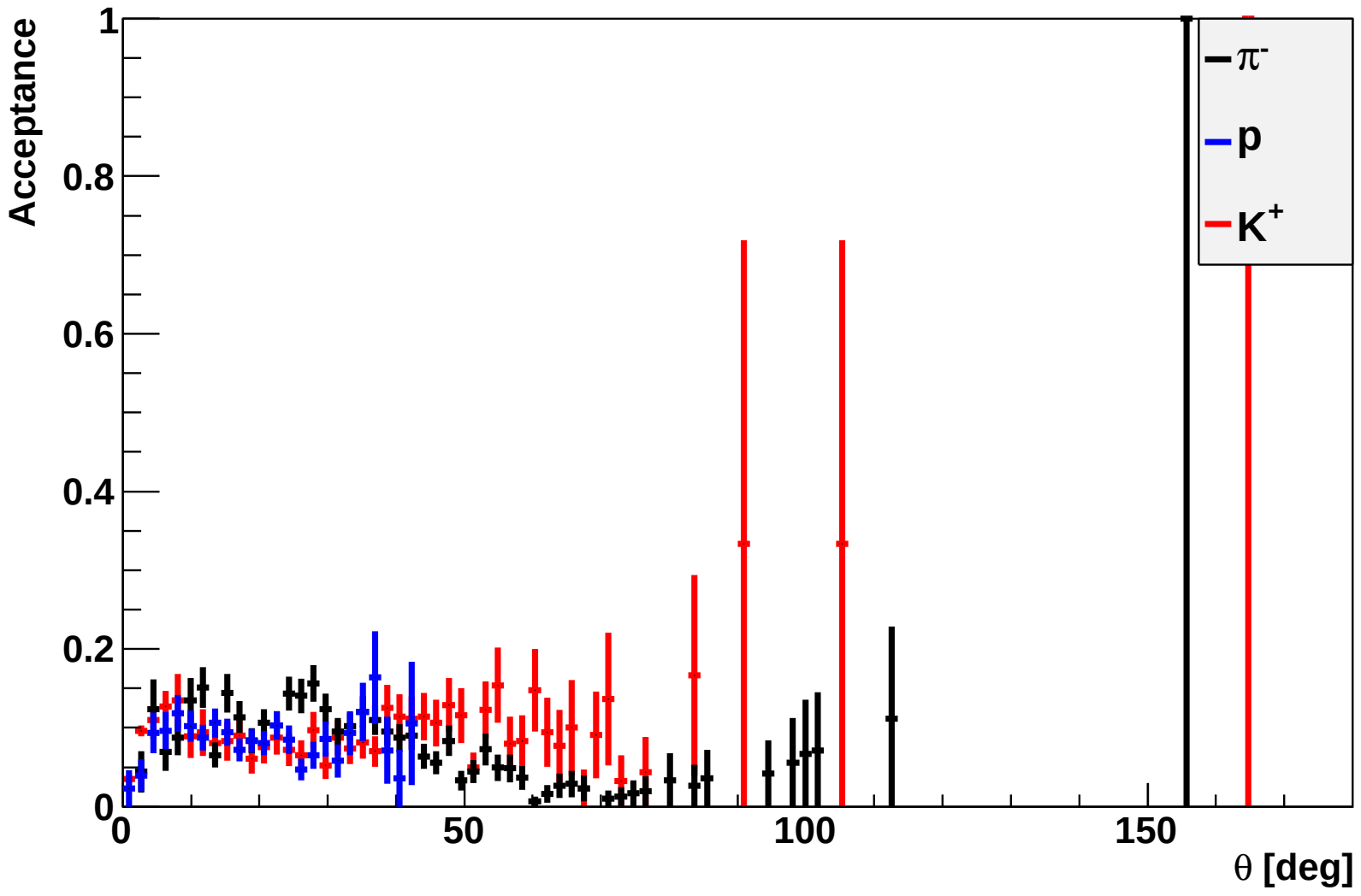
PID Force Truth: Generated Theta Dist.



PID Force Truth: Acceptance in Momentum



PID Force Truth: Acceptance in Theta



Comparison of momentum resolutions (PID Force Truth, all detected)

Final State	R(p)	R(K^+)	R(K^+(Y))	R($\pi^-(\Xi)$)	R($\pi^-(\Lambda)$)
$K^+K^+\pi^-\pi^-$p	3.4	5.1	2.2	6.8	9.2
			R($\pi^+(K_s)$)	R($\pi^-(K_s)$)	
$K^+K_s\pi^-\pi^0$p	2.9	4.3	2.5	1.7	2.7
		R(K^+(Y))			
$K_sK^+\pi^-\pi^0$p	3.2	2.3	3.3	2.7	4.8
		R($\pi^+(b_1)$)	R($\pi^+(\rho)$)	R($\pi^-(\rho)$)	R(π^-(X))
b1 pi	3.7	2.3	2.4	2.5	2.4

R: momentum resolution in %

b1 pi: $\pi^+\pi^+\pi^-\pi^-\pi^0$p final state

Comparison of mass resolutions (PID Force Truth, all detected)

Final State	$\Gamma(m\Xi)$	$\Gamma(\Xi)$	$\Gamma(Y^*)$	$\Gamma(\Lambda)$	$\Gamma(\pi^0)$
$K^+K^+\pi^-\pi^-$p	173	42	150	19	
	$\Gamma(K_s)$				
$K^+K_s\pi^-\pi^0$p	23	67	196	10	17
$K_sK^+\pi^-\pi^0$p	13	66	142	10	17
	$\Gamma(mb_1)$	$\Gamma(b_1)$	$\Gamma(X)$	$\Gamma(\omega)$	
b1 pi	151	104	168	43	12

Γ: mass resolution in MeV/c^2

mΞ: missing Ξ

Comparison of reconstruction efficiencies

Final State	f1	f2	f3	f4	f5	f6
$K^+K^+\pi^-\pi^-$p	8.4	2.2	17.1	8.7		
$K^+K_s\pi^-\pi^0$p	3.1	1.0	10.9	4.8		
$K_sK^+\pi^-\pi^0$p		2.5		8.2		
b1 pi	19.3	12.7	51.2	38.1	43.2	31.9

f1: percent recon. with one particle missing and using normal PID
f2: percent recon. requiring all particles and using normal PID
f3: percent recon. with one particle missing and using PID Force Truth
f4: percent recon. requiring all particles and using PID Force Truth
f5: percent recon. with one particle missing and using normal PID, but without kaon mass hypotheses
f6: percent recon. requiring all particles and using normal PID, but without kaon mass hypotheses