Fudan University

Study of Λ semileptonic decay $\Lambda \rightarrow pe^{-}\bar{\nu}_e$

Shun Wang[*,1] , Tao Luo[1], Andrzej Kupsc[2] and Varvara Batozskaya[3]

1.Fudan University, Shanghai, China
2.Uppsala University, Uppsala, Sweden
3.National Centre for Nuclear Research, Warsaw, Poland

*wangshun19@fudan.edu.cn

Cut flow previously determined

Selection Criteria			Events	Absolute Efficiency(%)	Relative Efficiency(%)
	Total events		1,200,000		
Single tag	Reconstruction of $\bar{\Lambda}$		1,042,541	86.88	86.88
	$\|\Delta E\| < 0.02$		824,678	68.72	79.10
	$1.09 < M_{BC} < 1.15$		776,399	55.49	85.76
Double tag	Good tracks		516,926	43.08	66.58
	PID for e	Prob(e)>Prob(π)	217,006	18.08	41.98
		$E^{e}_{EMC}/p > 0.8$	62,721	5.23	28.90
	Reconstruction of Λ		55,563	4.63	88.59
	$\chi^2_{4C} > 60$		44,803	3.73	80.63
Sum			44,803	3.73	

Need to be tested for getting higher efficiency

Table 1: Cut flow previously determined

Comments from Patrik

The mass of the missing π

Dear Tao,

So assume you want to look for Lambda – p mu nu (the same procedure for the opposite secanrio) then
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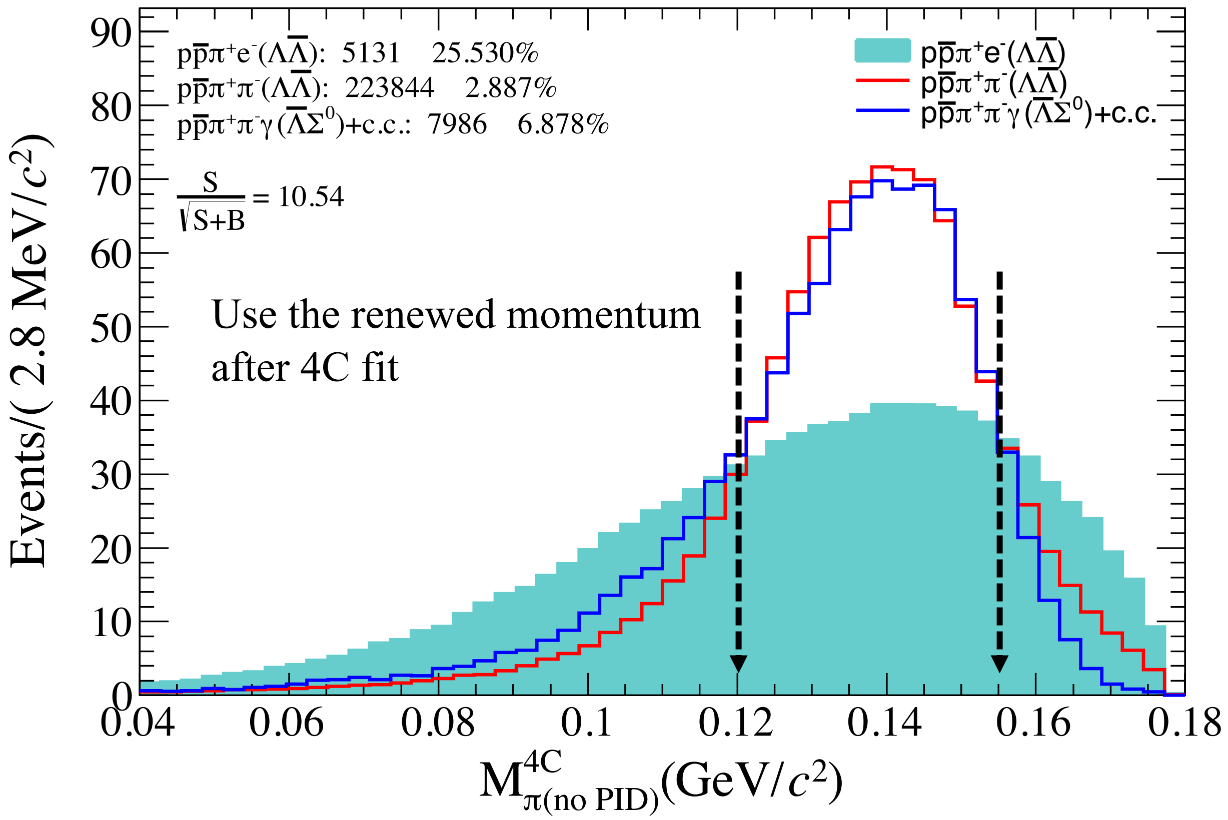

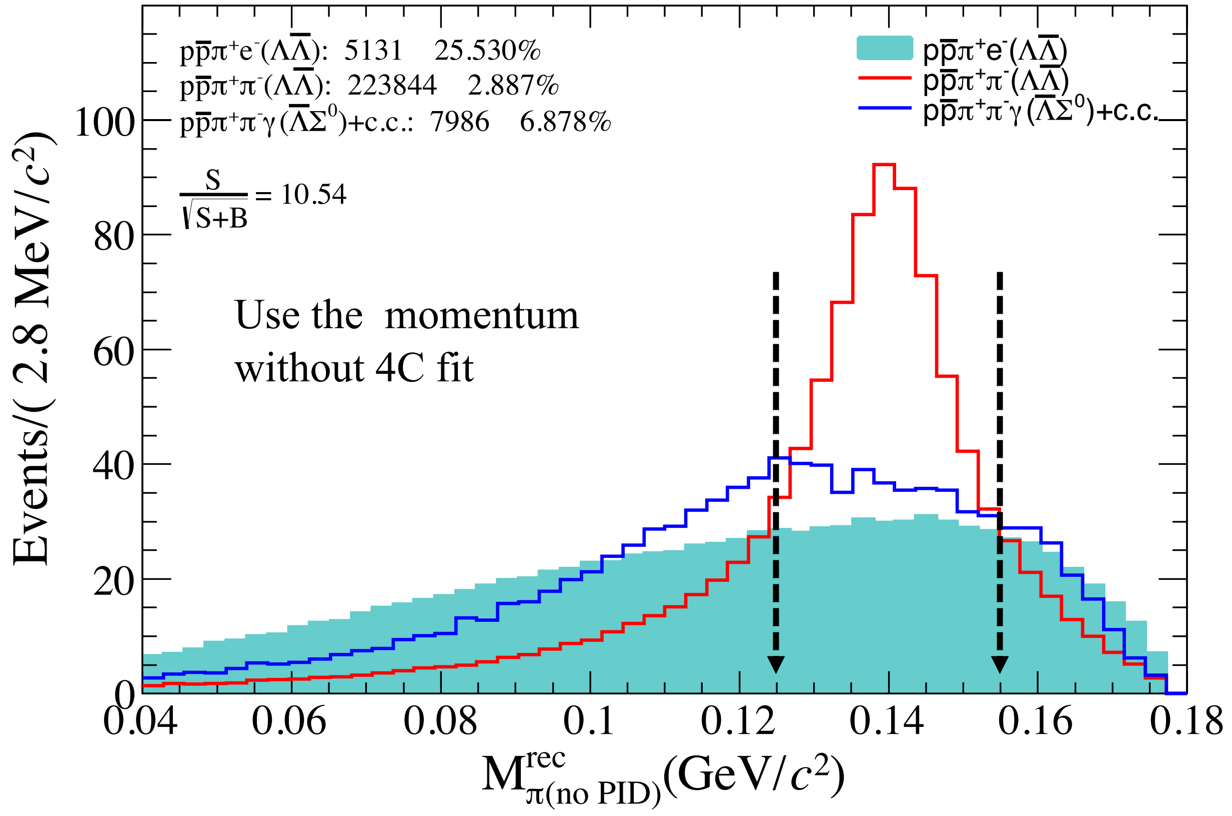

All cuts listed in table 1 except PID are used

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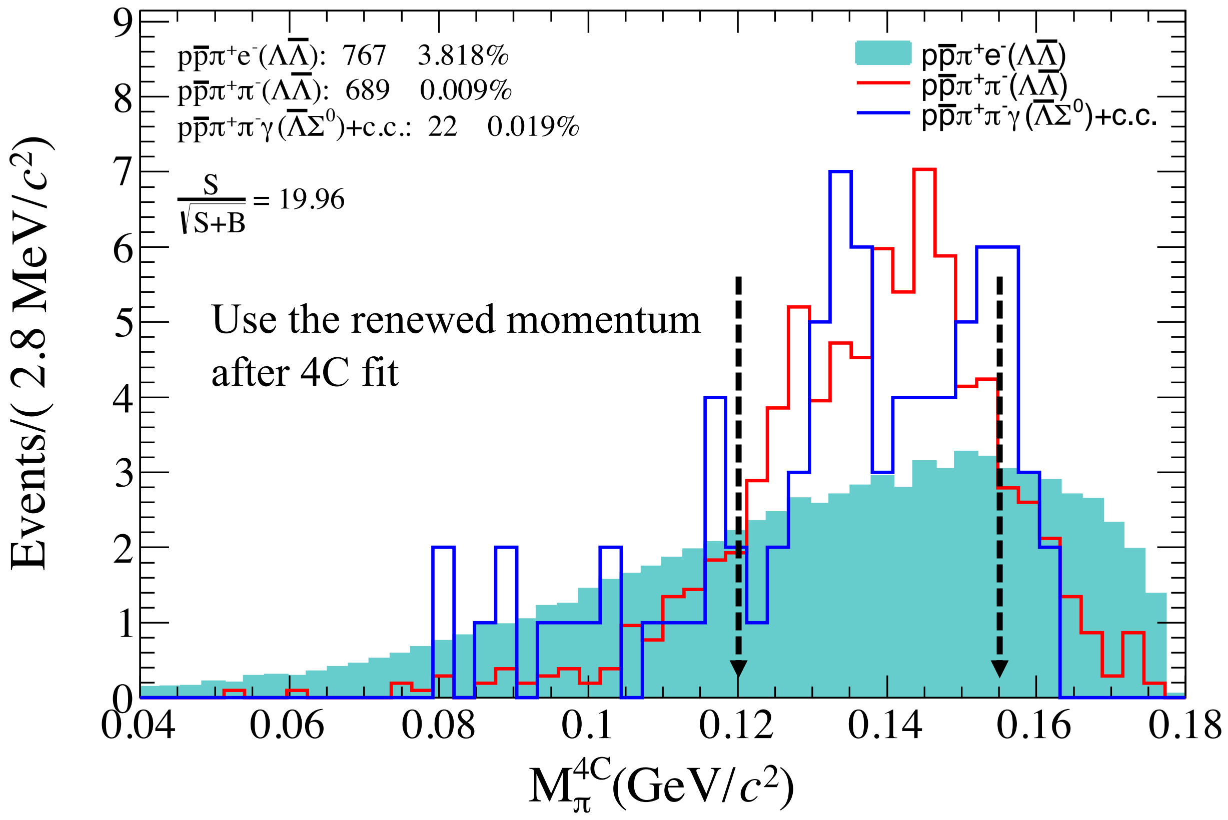

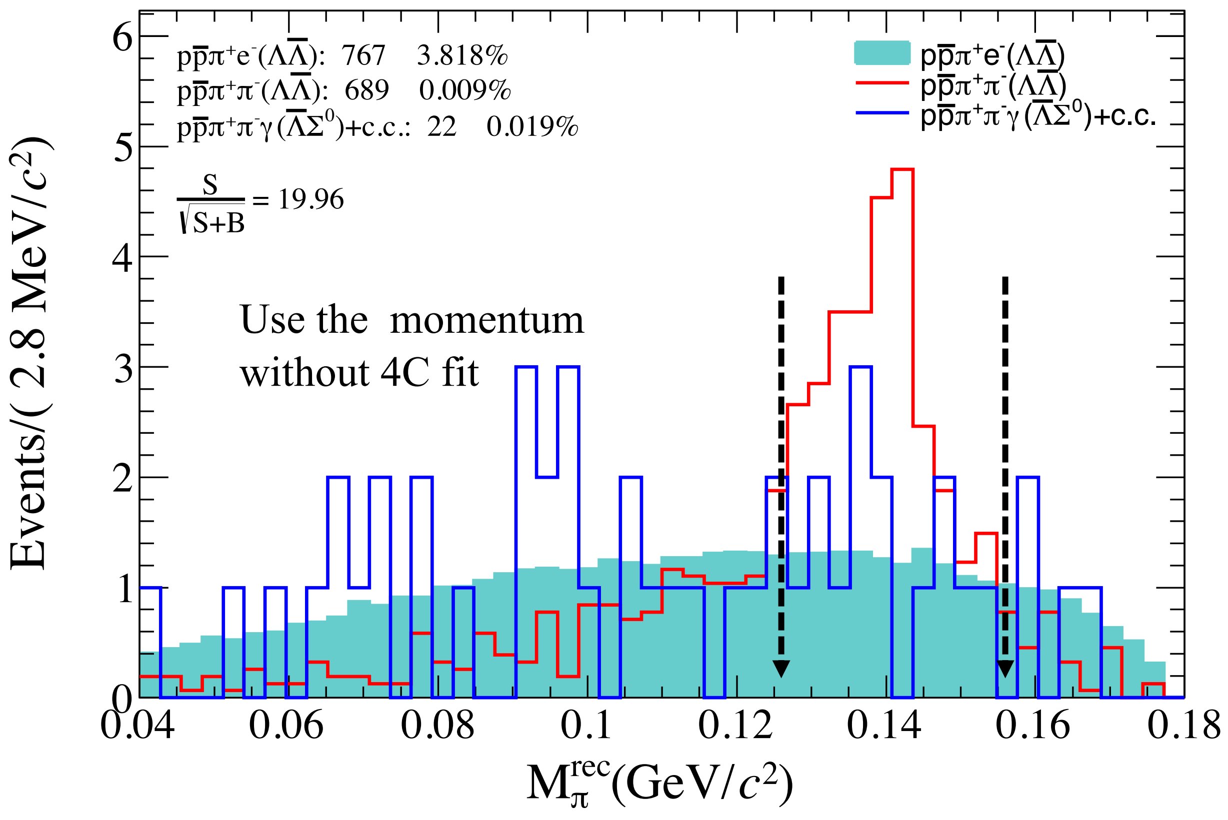

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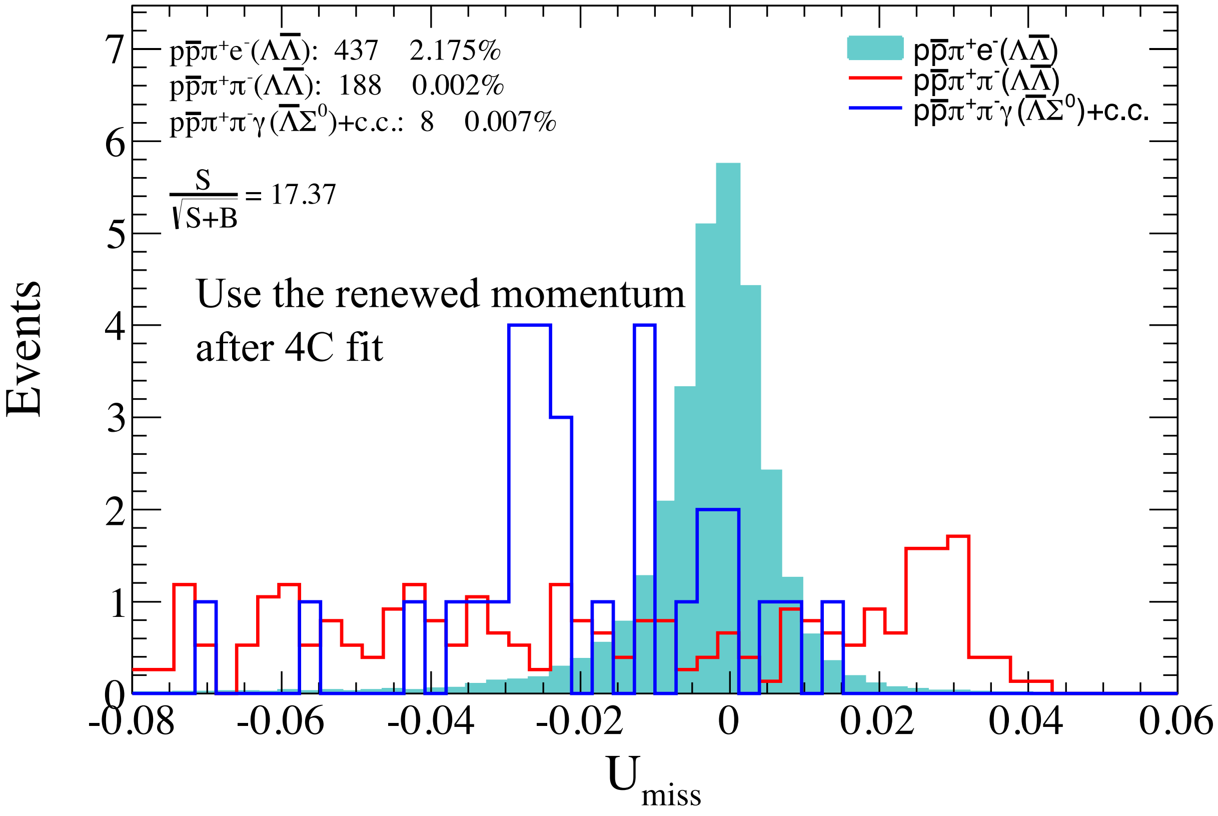
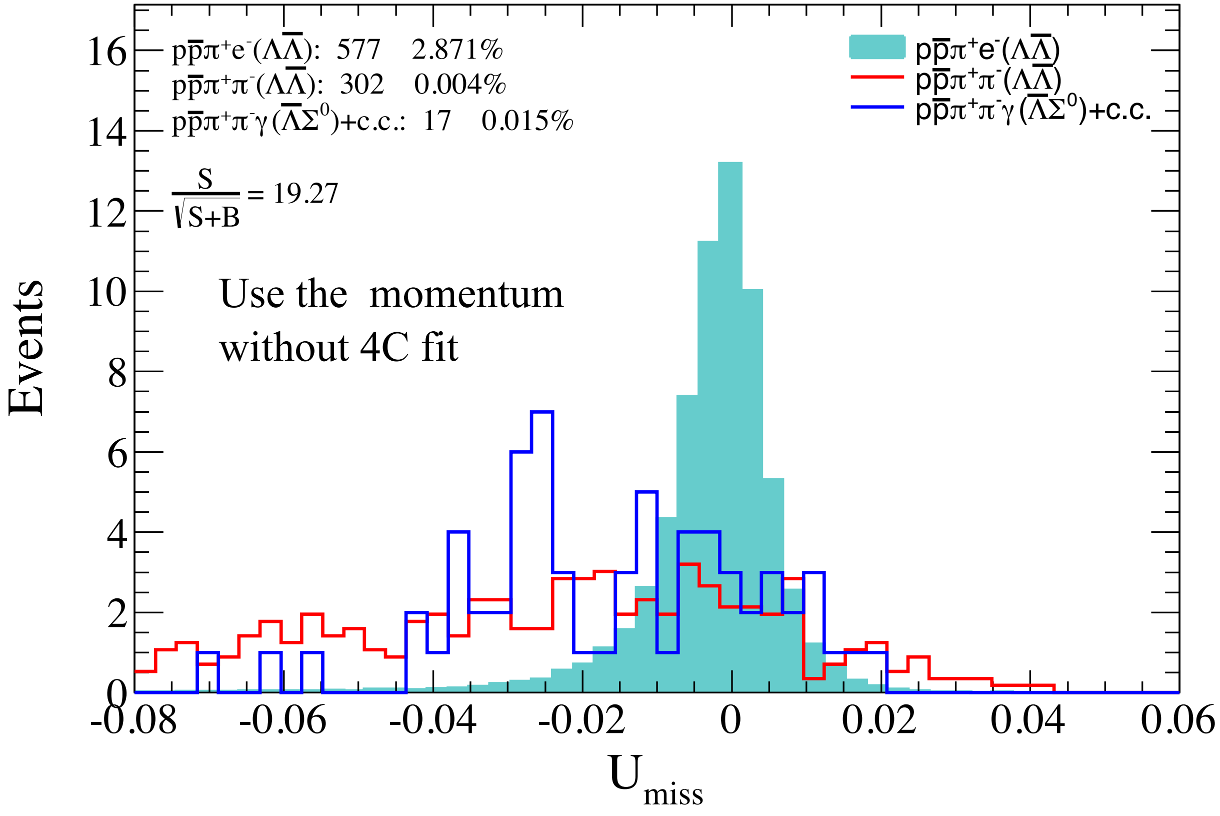


Veto M_{π}^{4C} (0.12, 0.155)



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复旦大学 Fudan University

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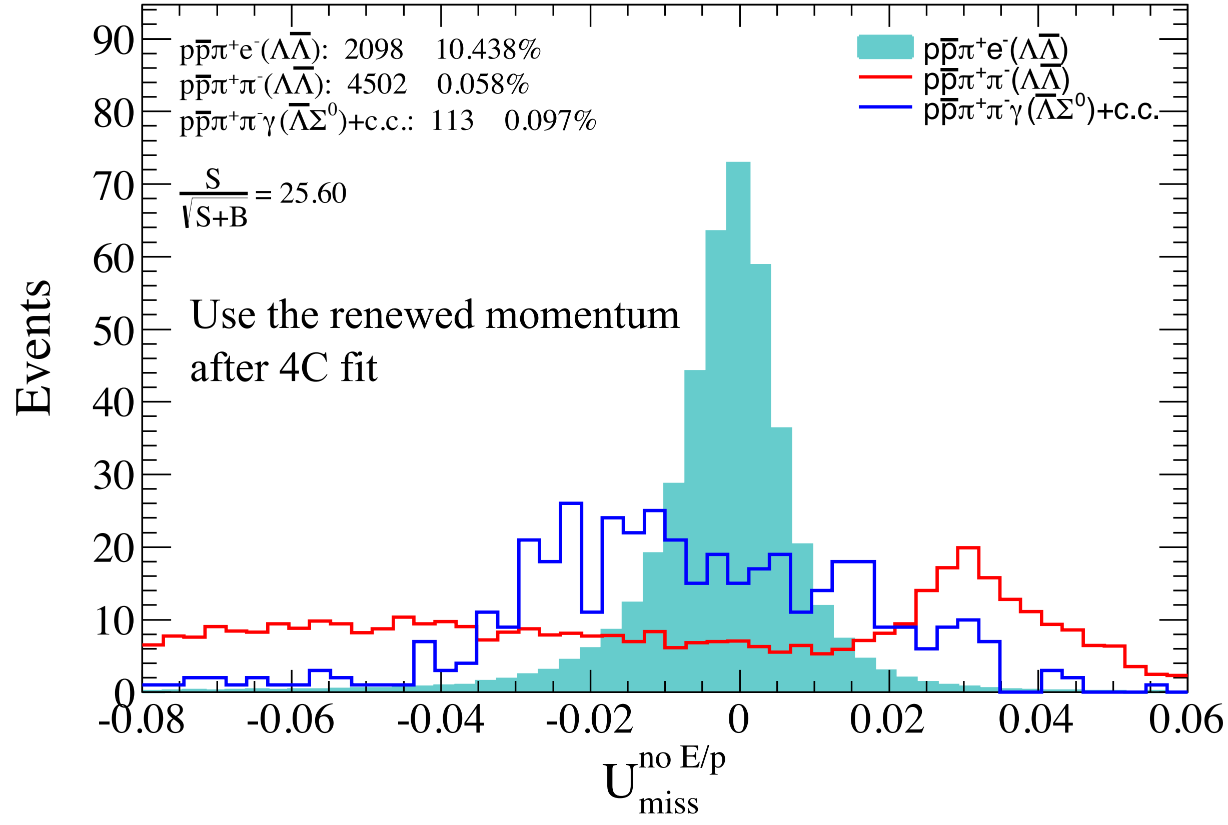

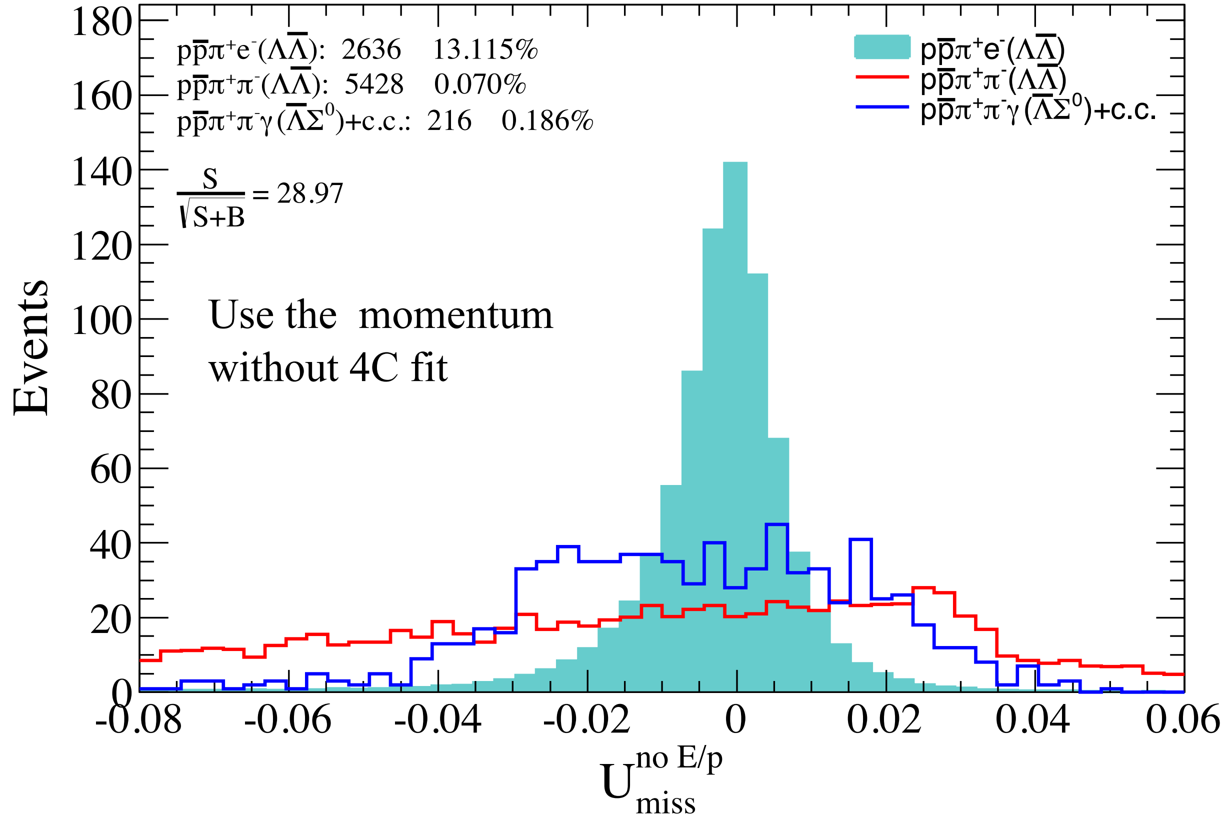

Veto M_{π}^{4C} (0.12, 0.155) without E/p cut for e

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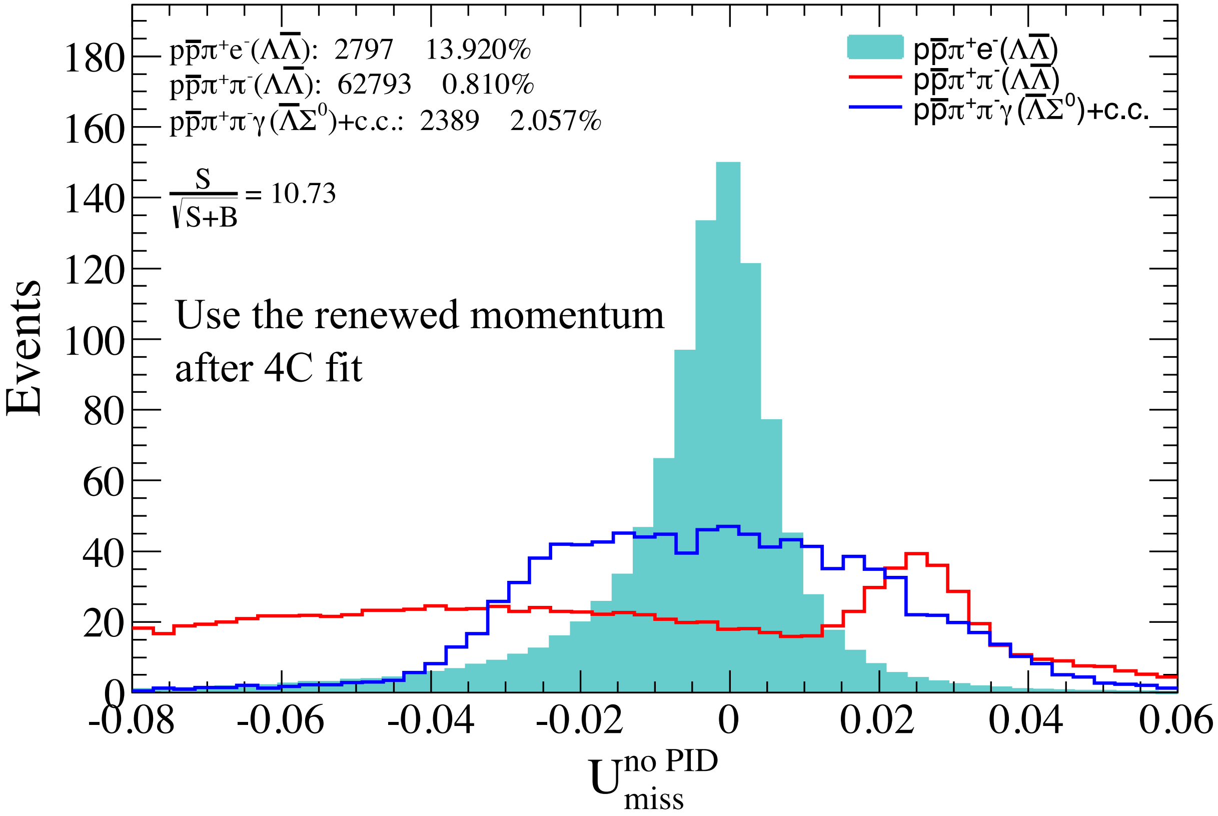

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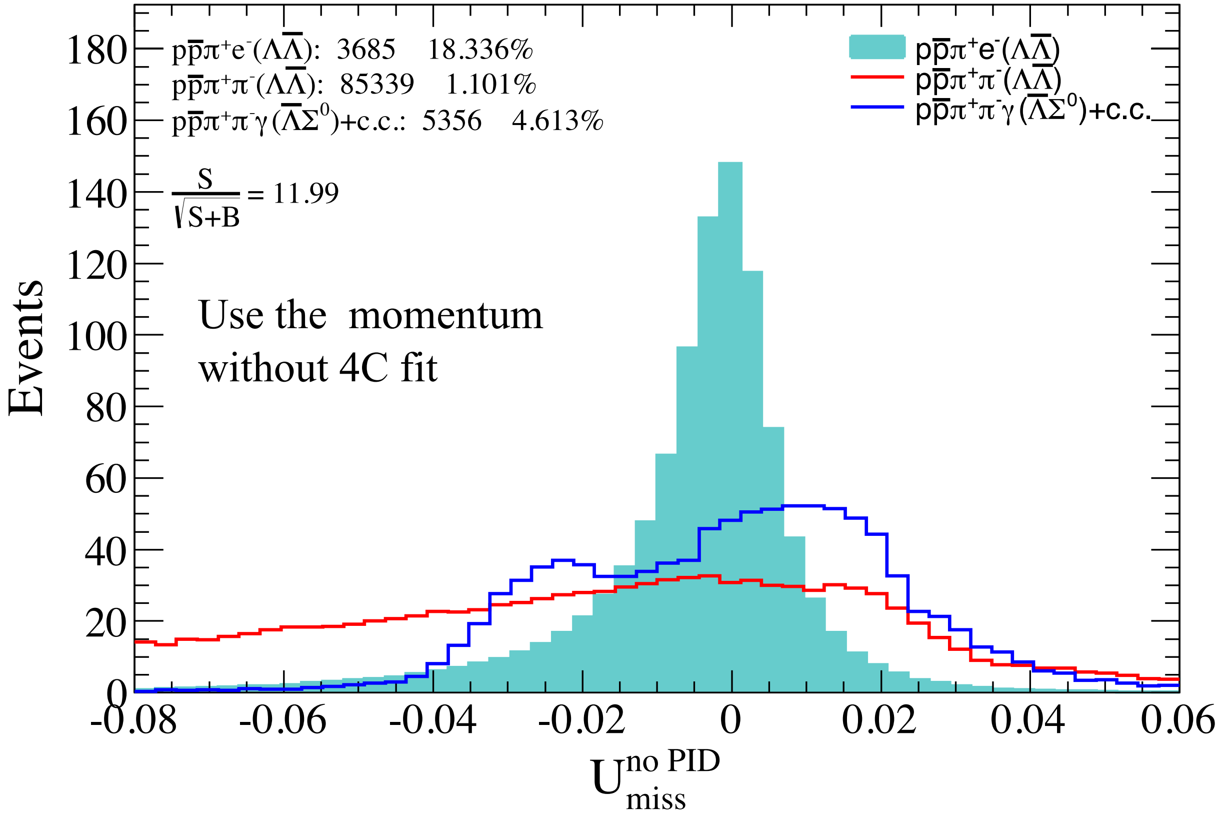

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The momentum of the missing π in the Λ rest frame

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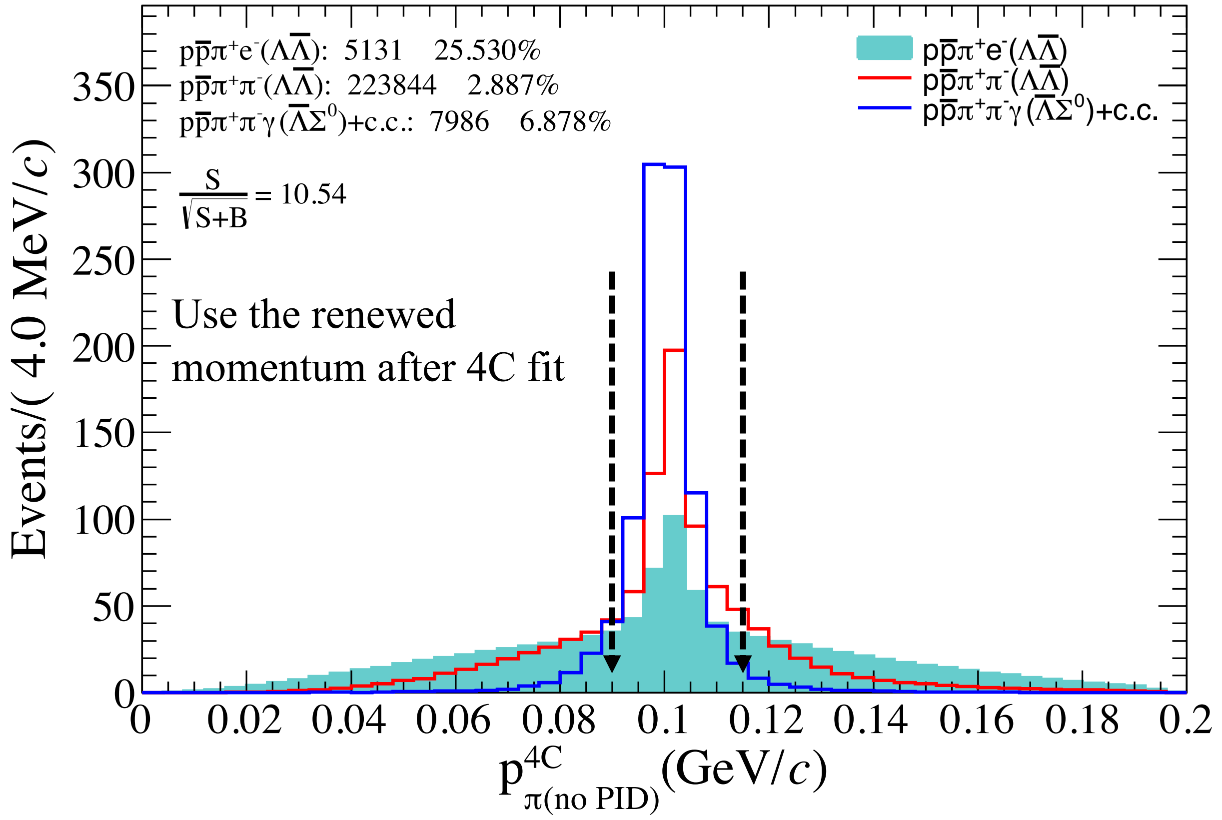

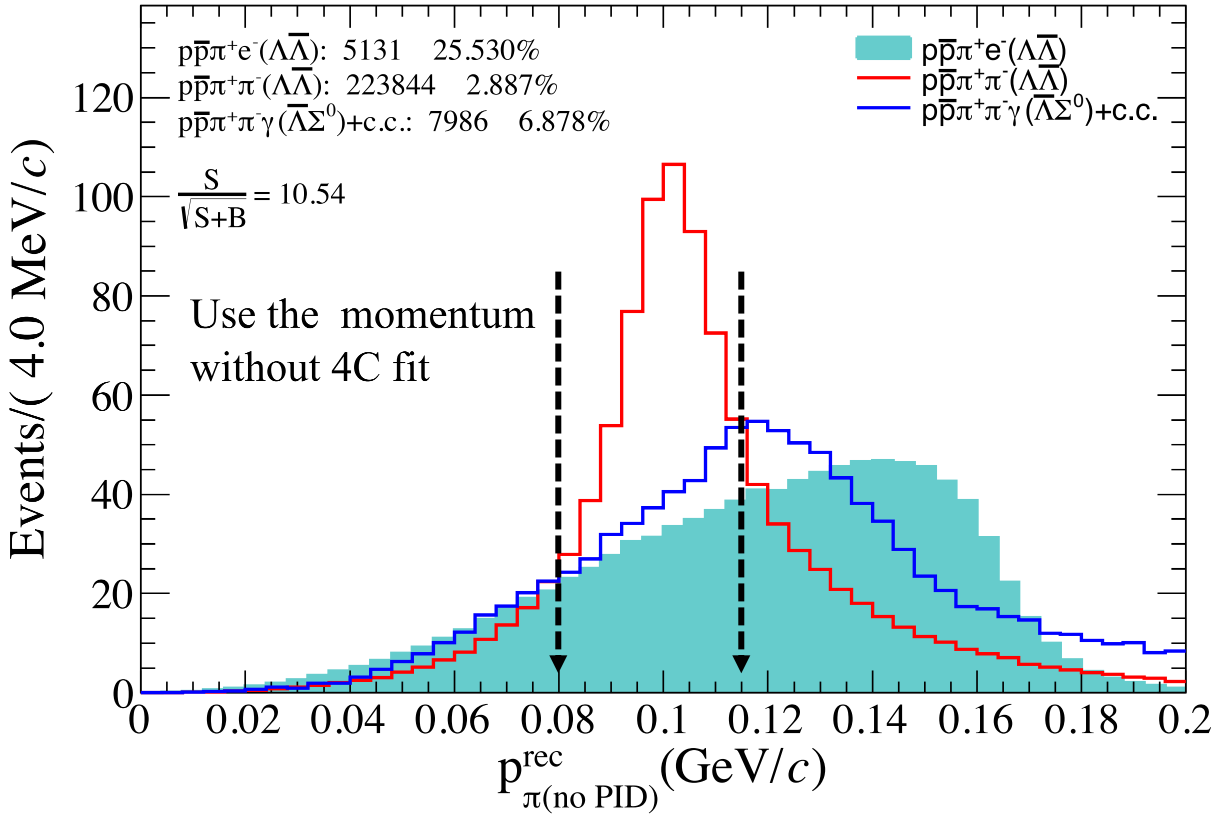

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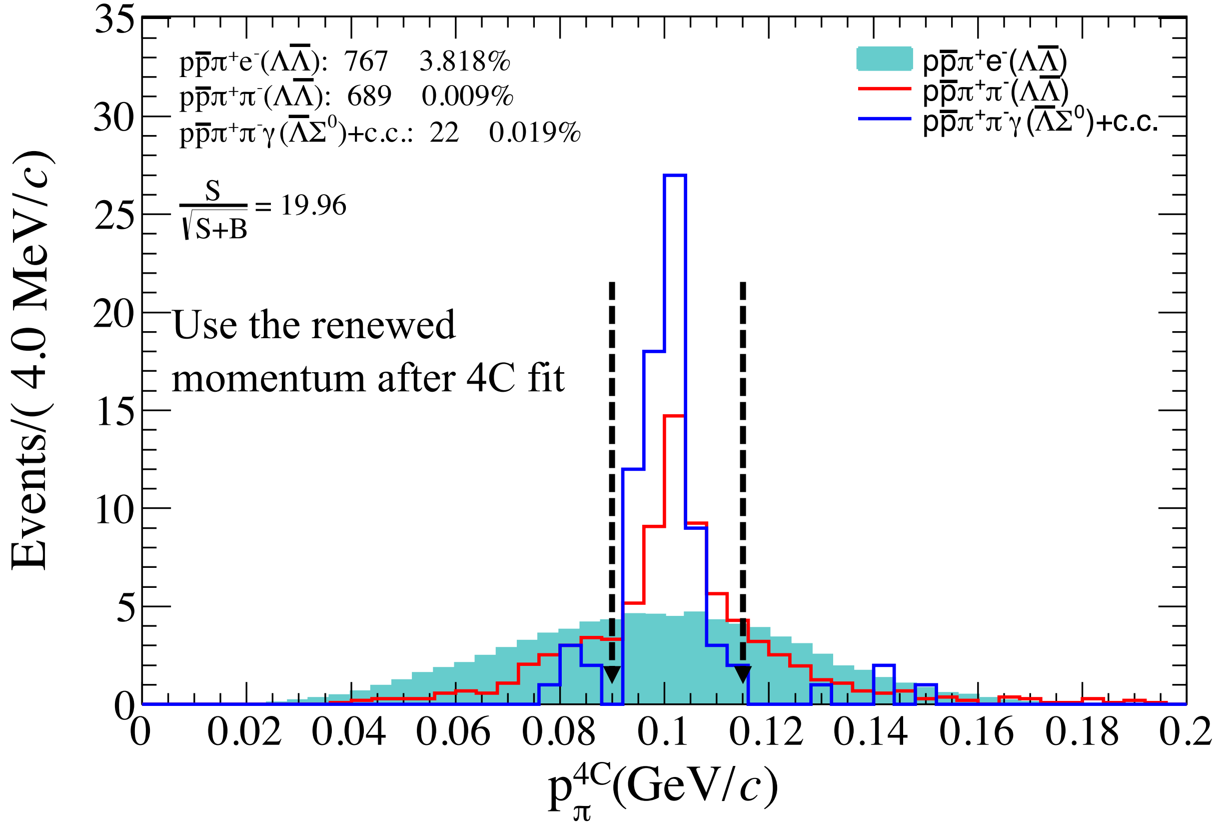

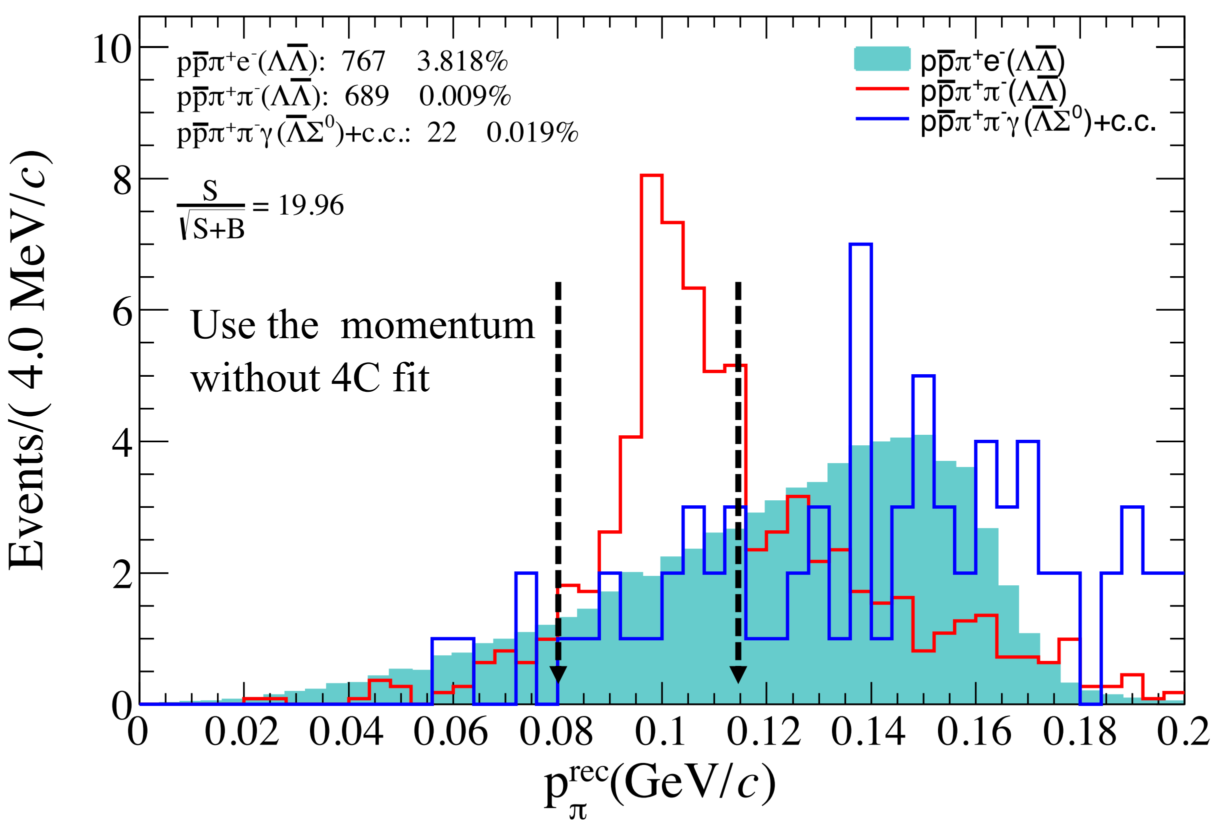

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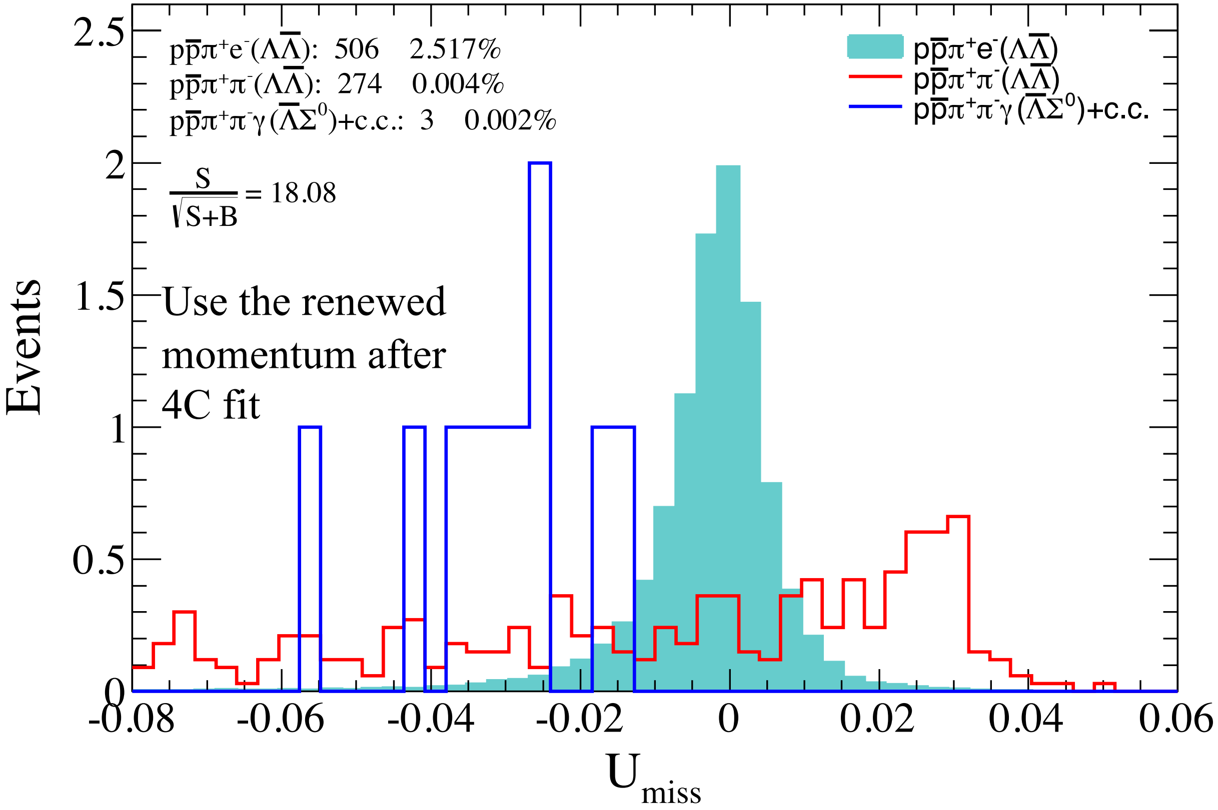

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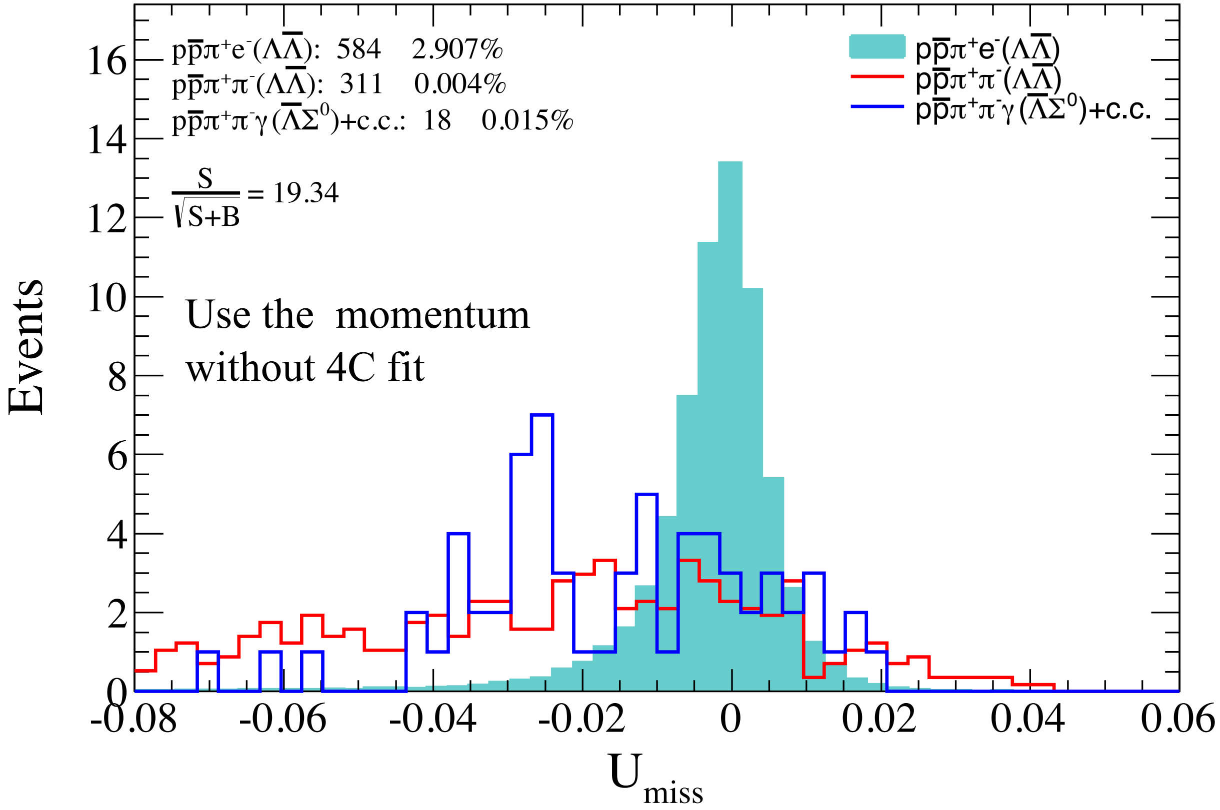

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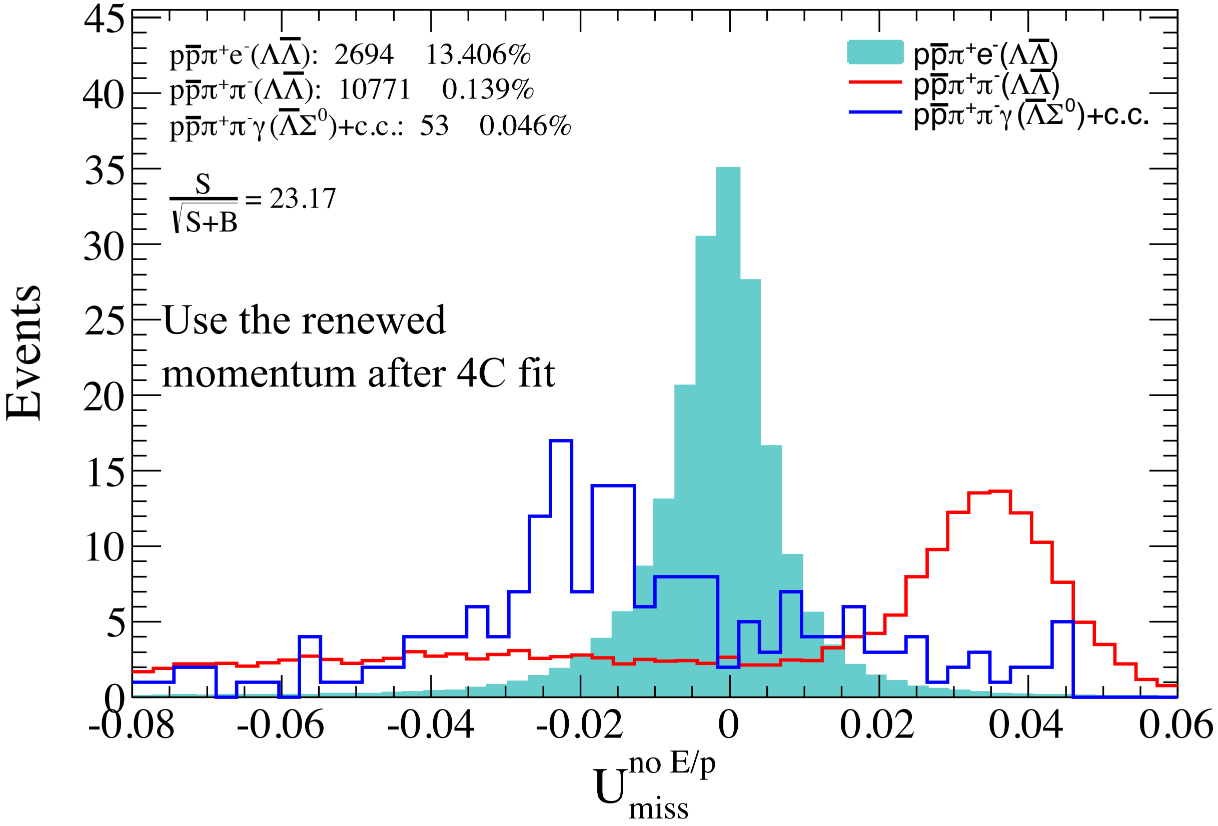

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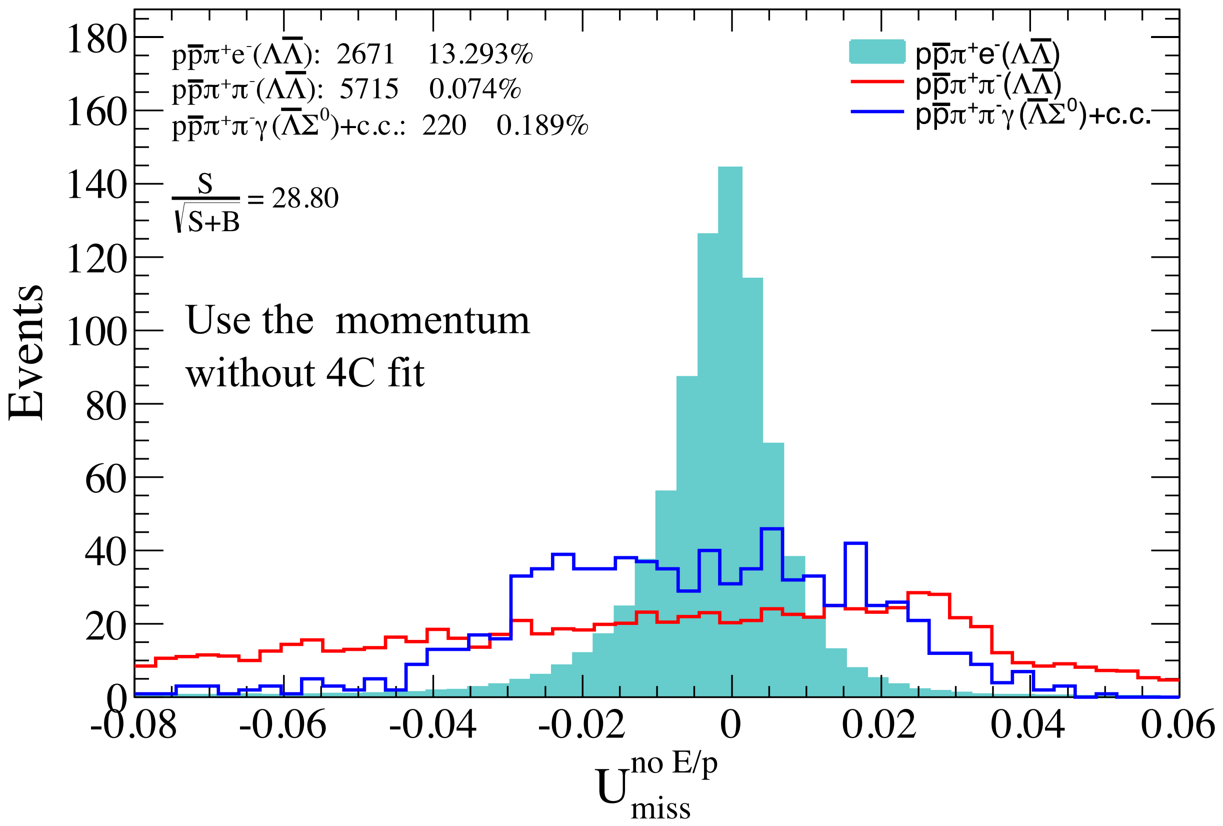

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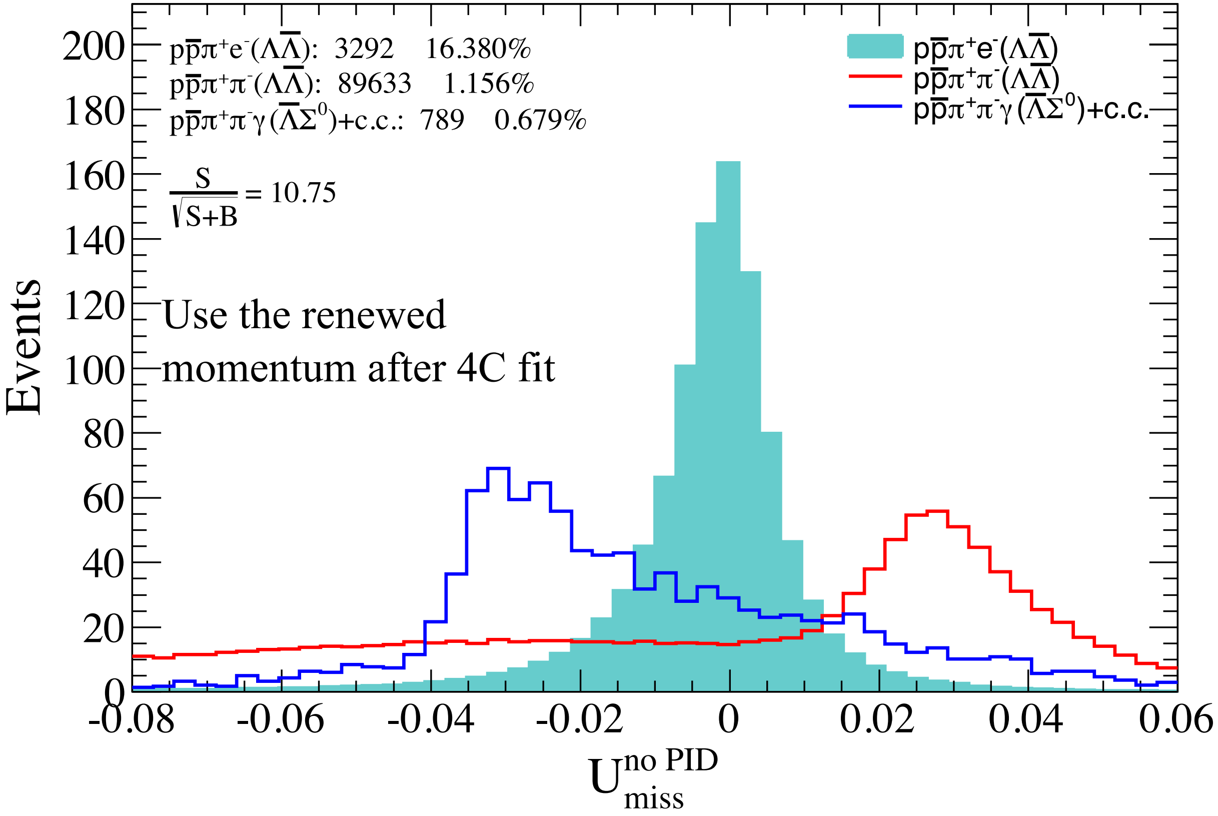

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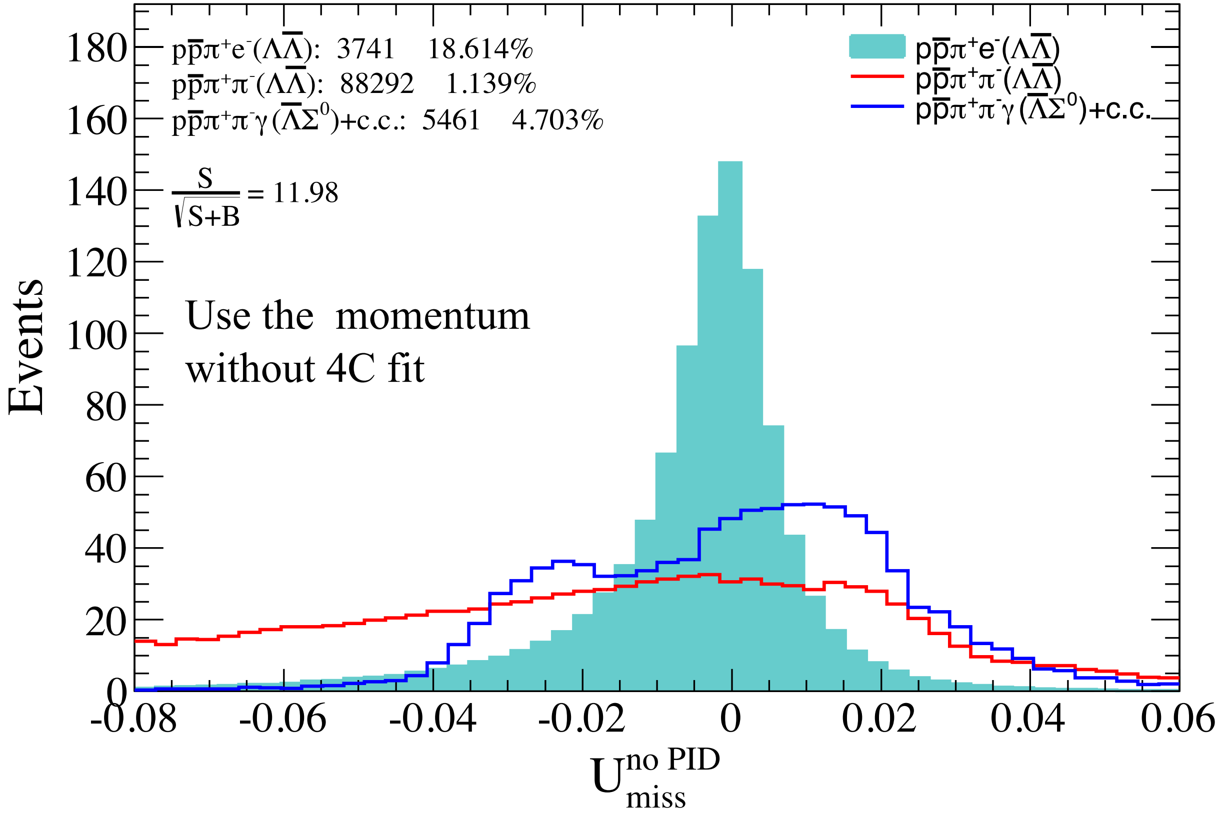

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The distribution of missing momentum(neutrino) after PID

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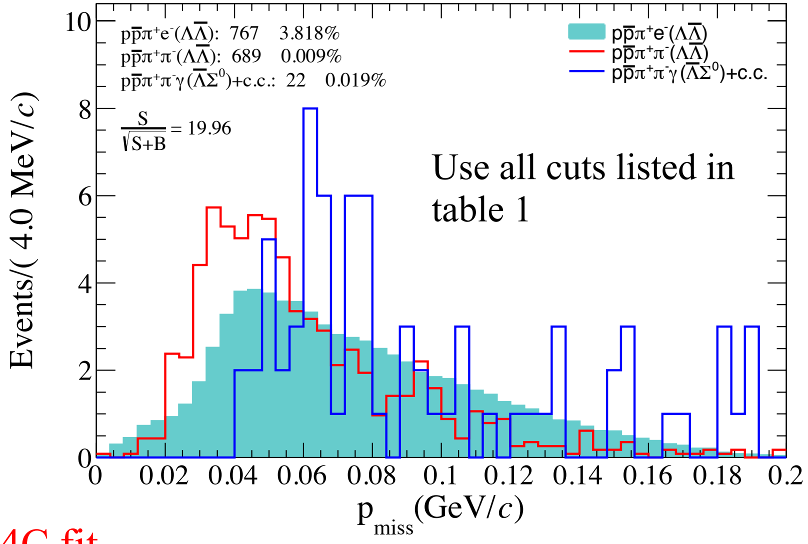

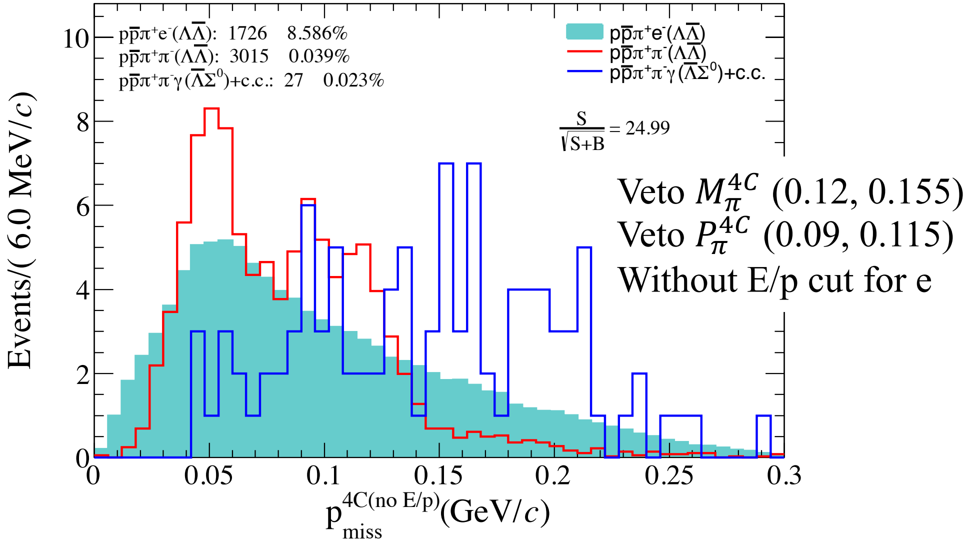

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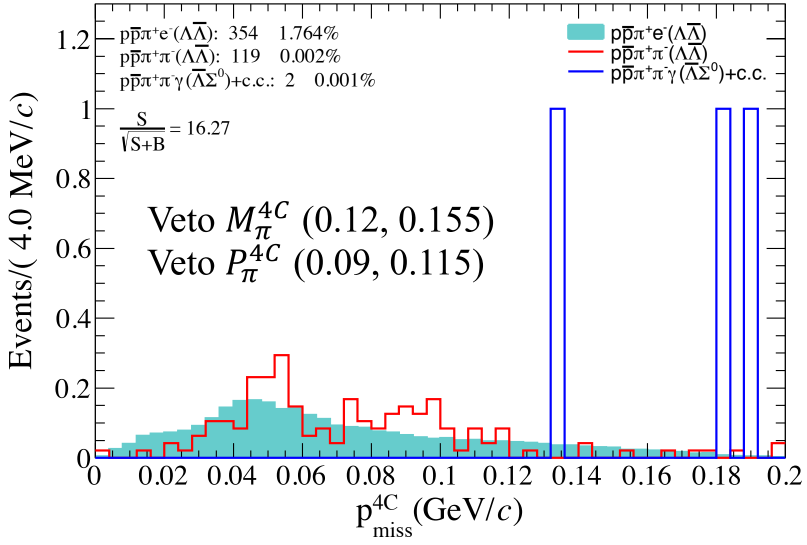

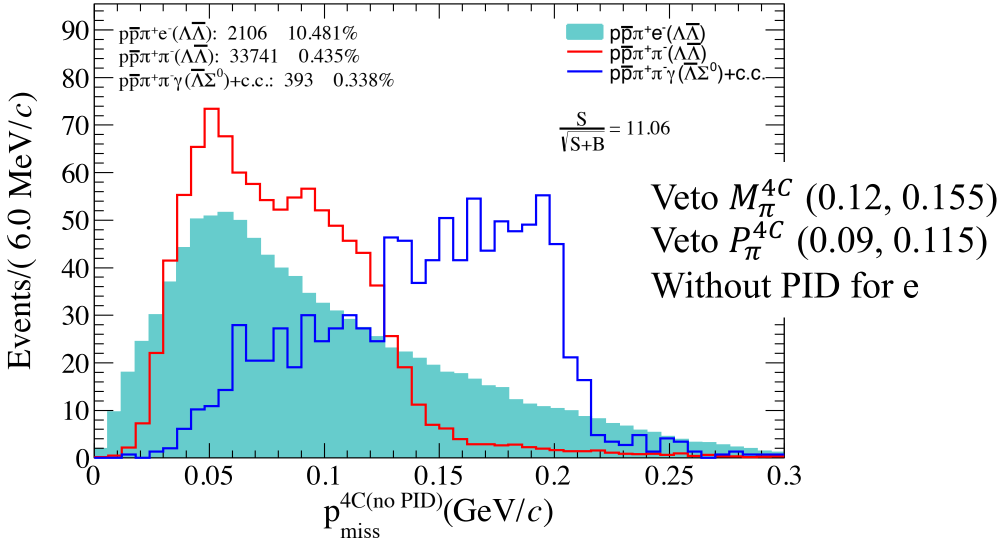

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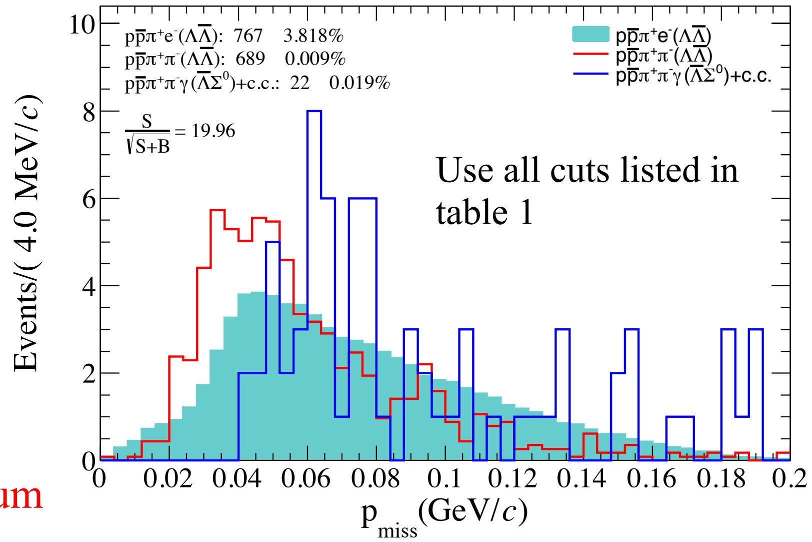

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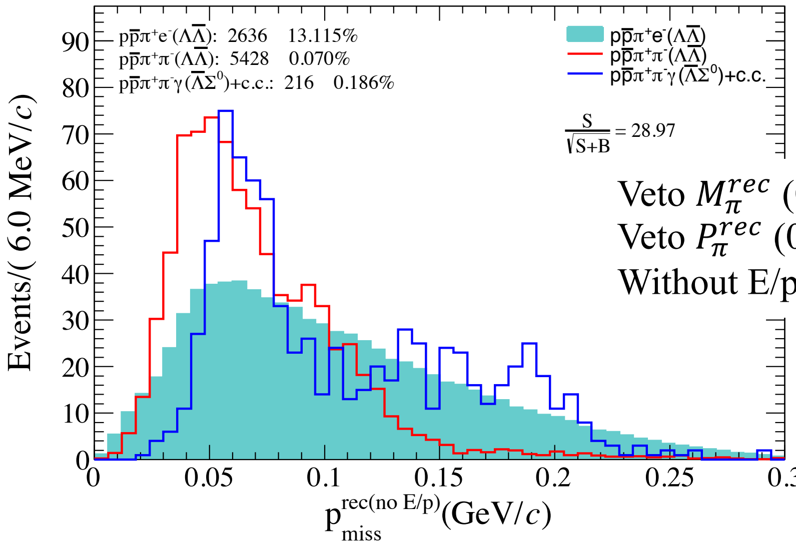

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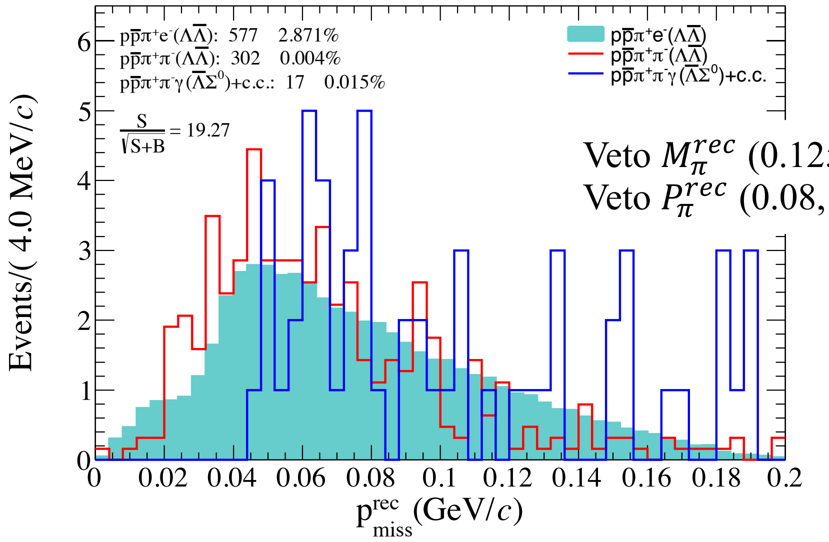

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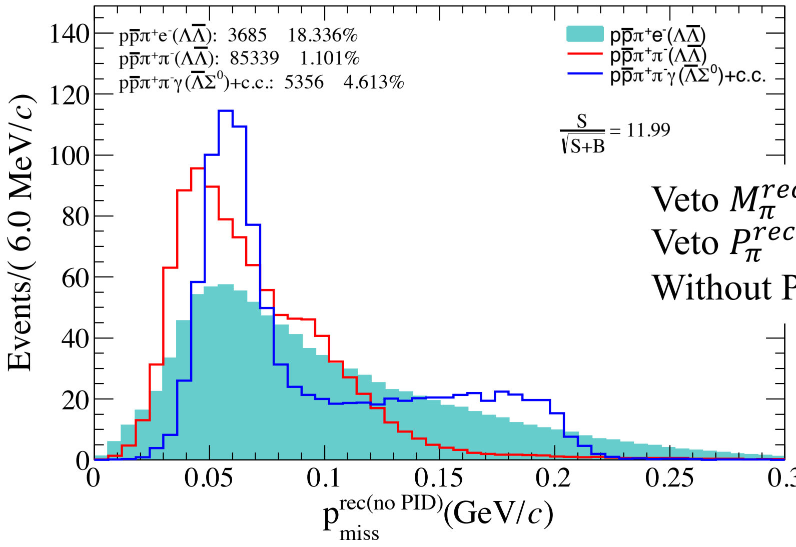

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The distribution of missing momentum(neutrino) after PID

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The energy of γ which comes from Σ^0 in the Σ^0 rest frame

The combination of γ and all charged tracks which has the energy closest to the ECM are selected. And this γ is regarded to from Σ^0.

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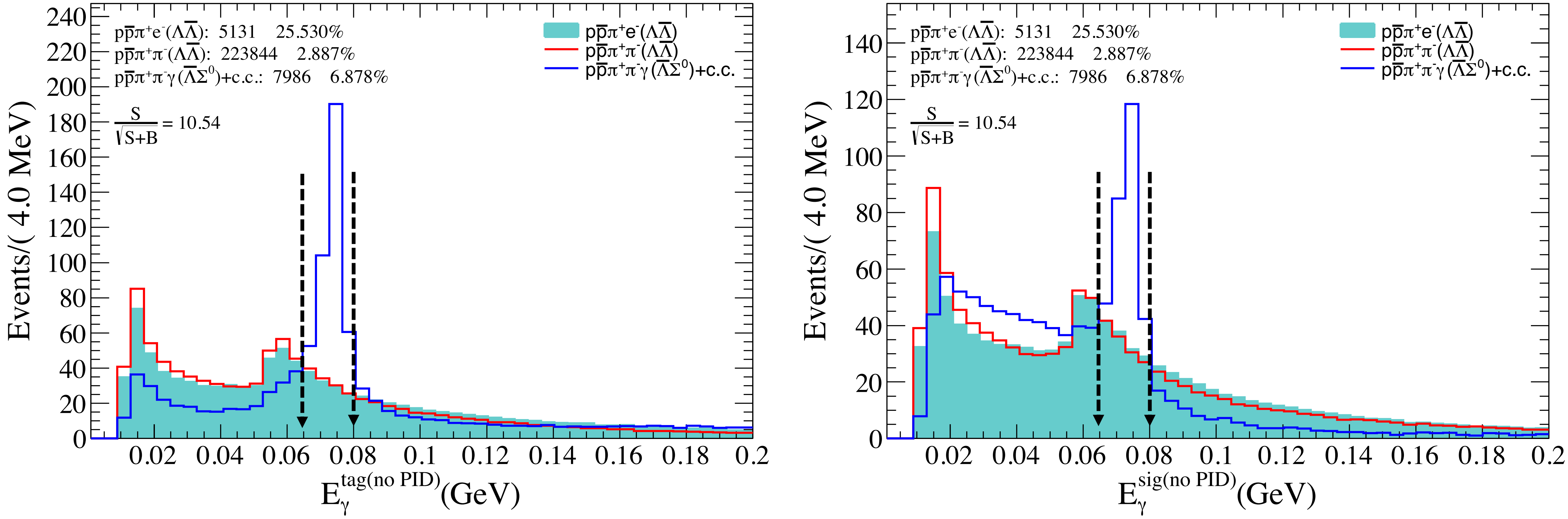

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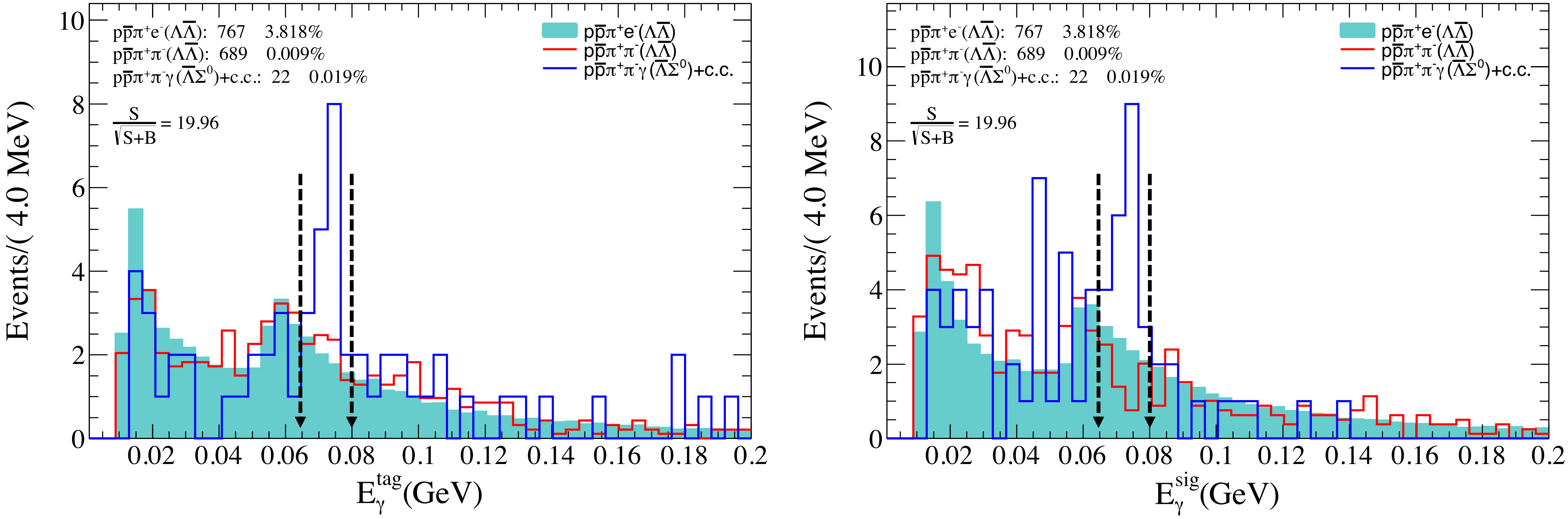

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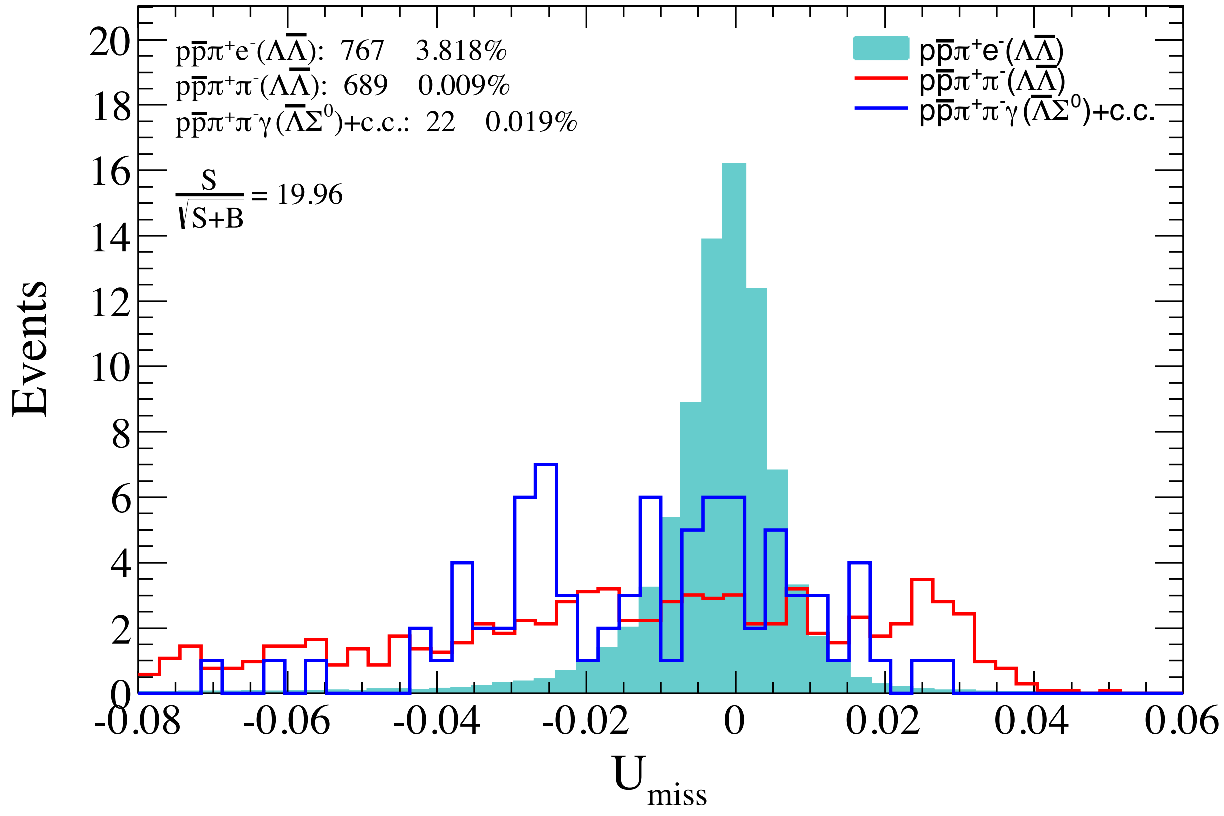

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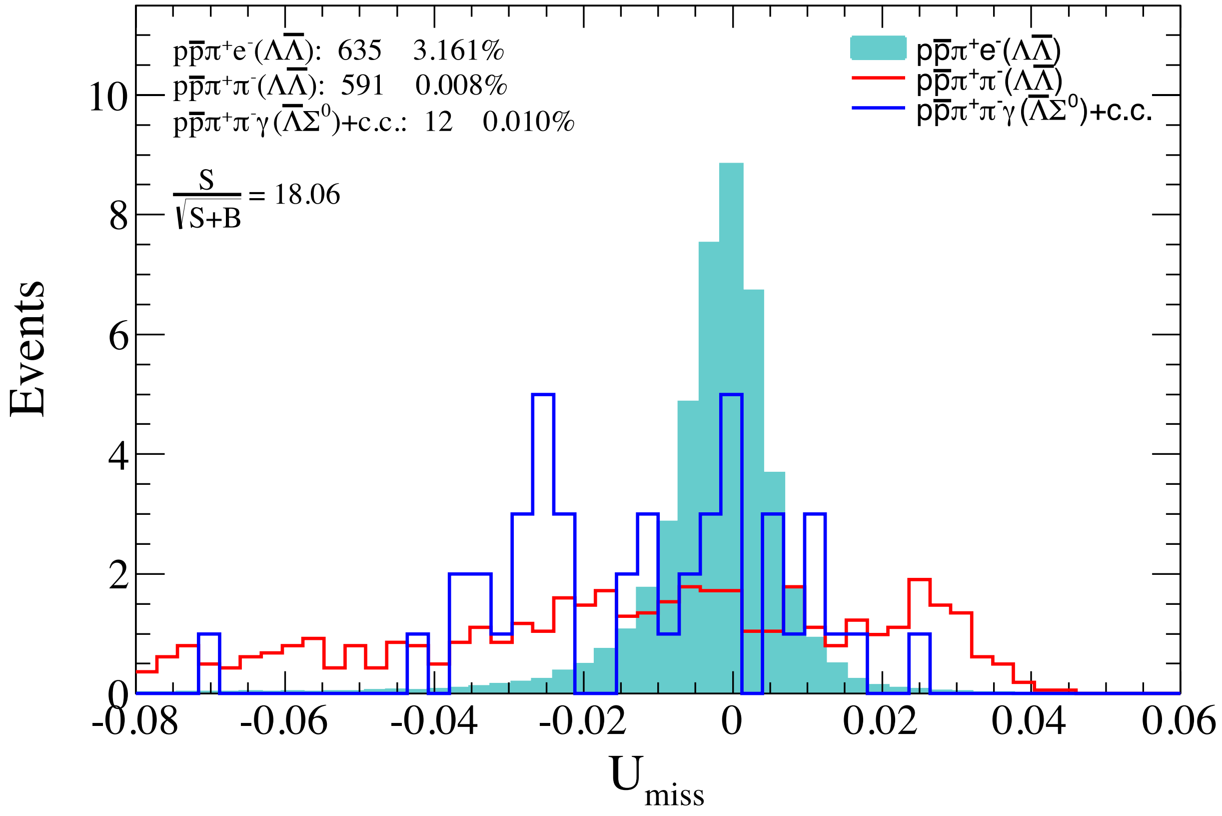
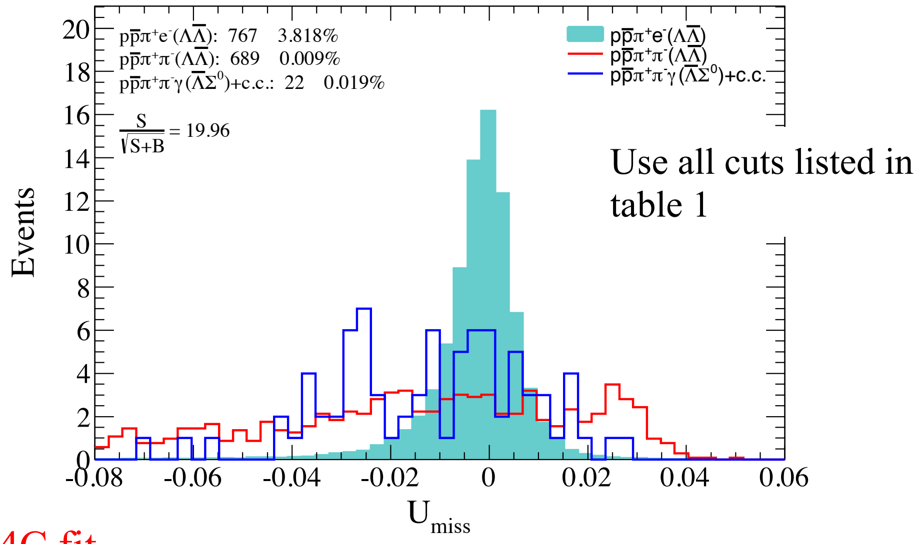


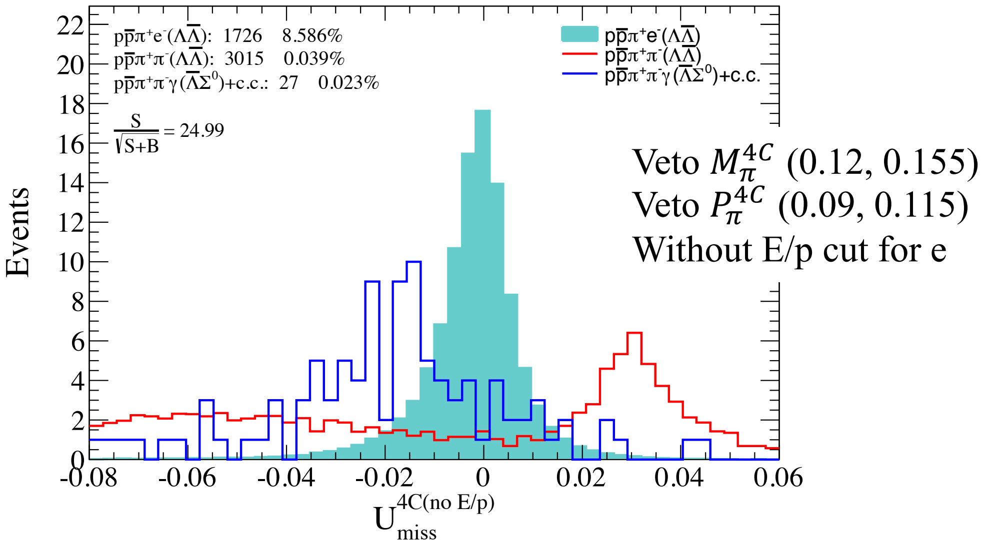
Veto both E_γ^{tag} and E_γ^{sig} (0.065, 0.08)

Comments from Patrik

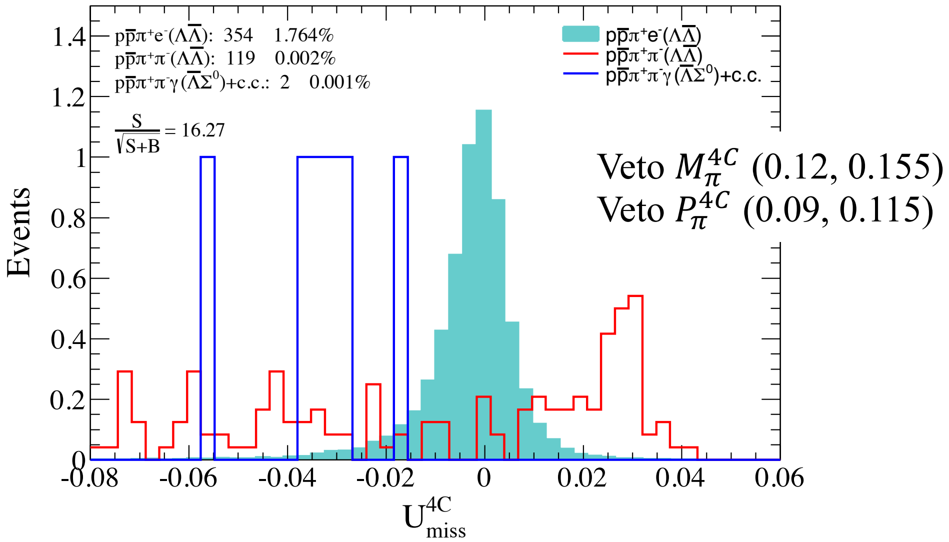
Attempt to use the new cut combinations

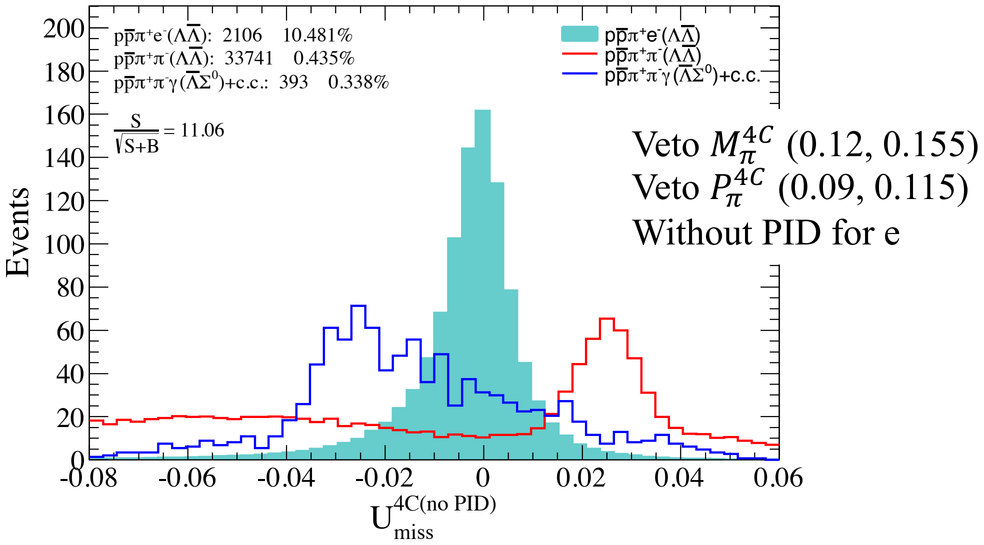
Comments from Patrik





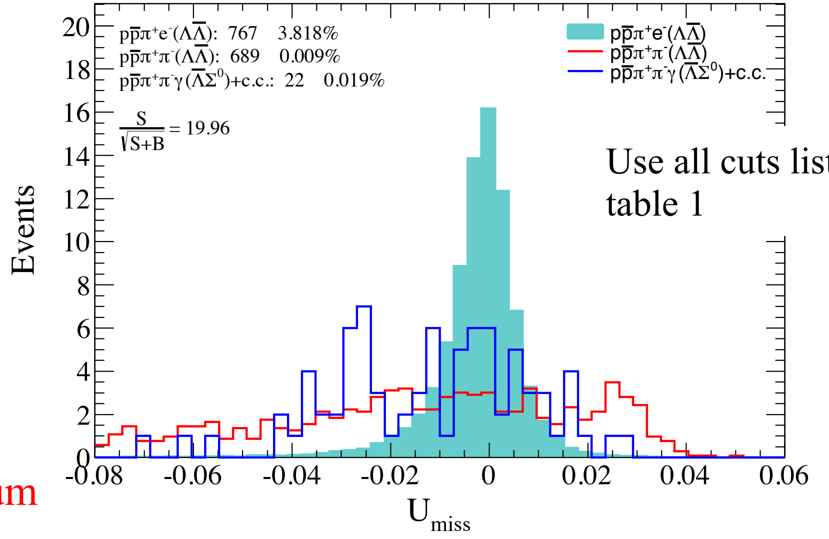
Use the renewed momentum after 4C fit





The distribution of U_miss with new cuts combination

Comments from Patrik



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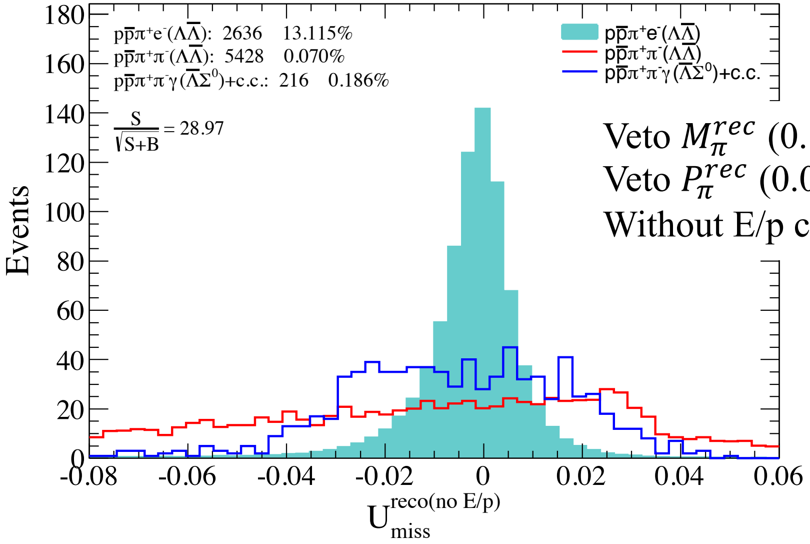

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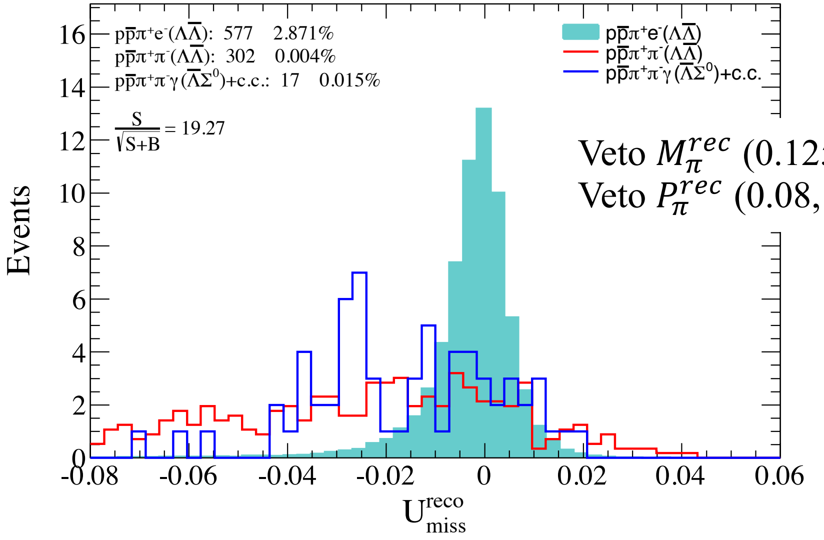
Veto P_π^{rec} (0.08, 0.115)
Without E/p cut for e

Use the momentum without 4C fit



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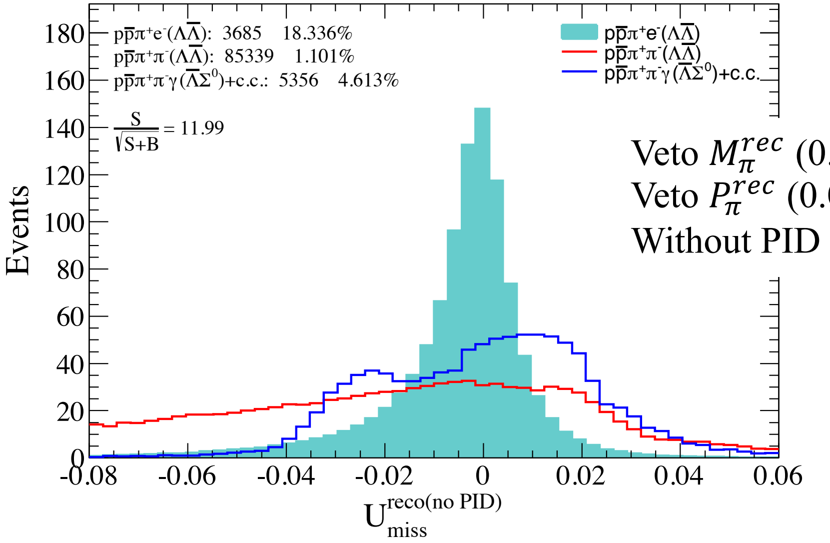

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The momentum of electron in the Λ rest frame

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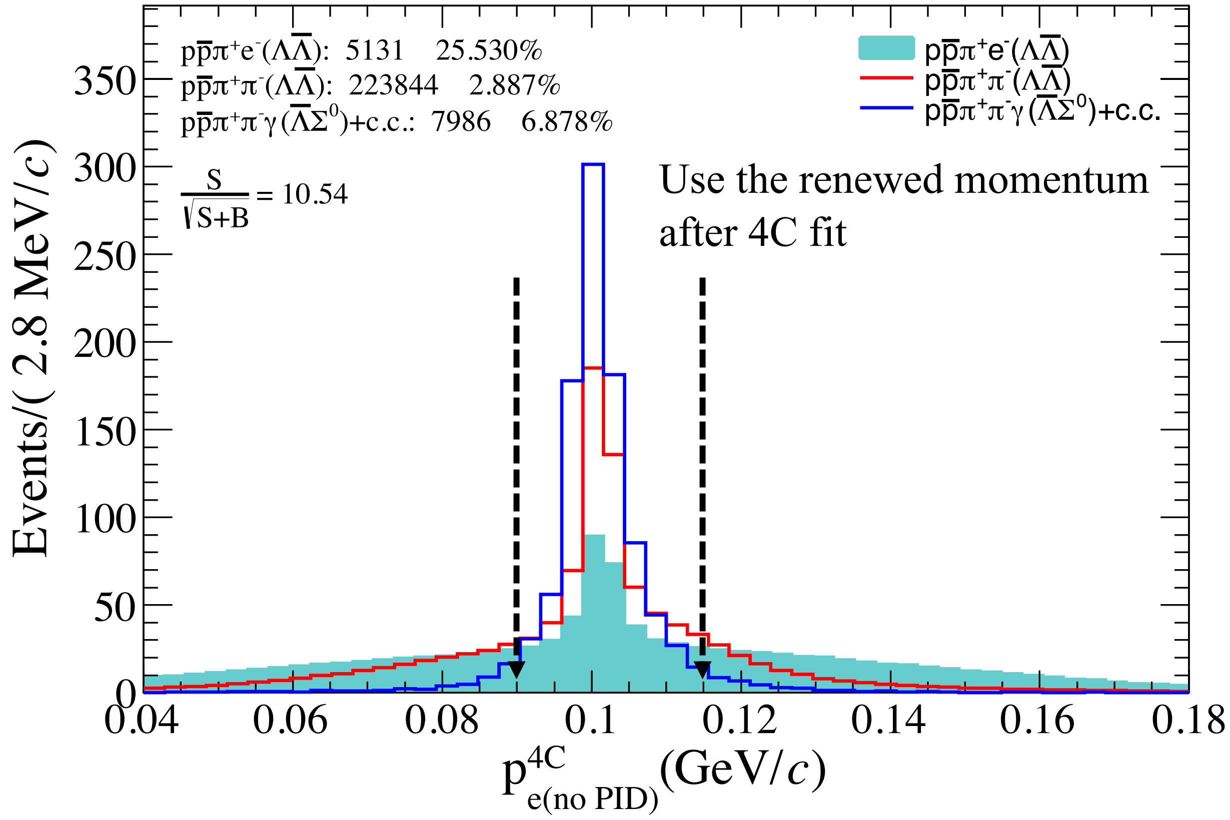

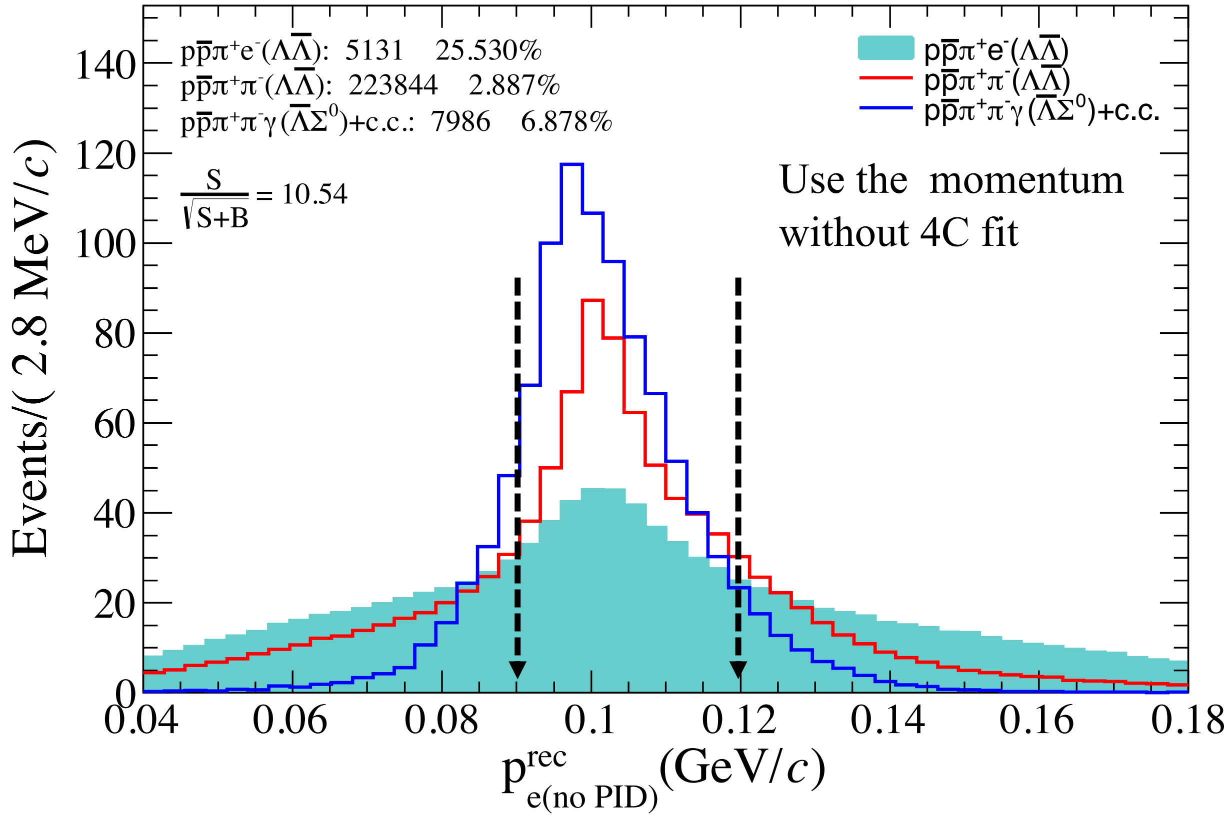

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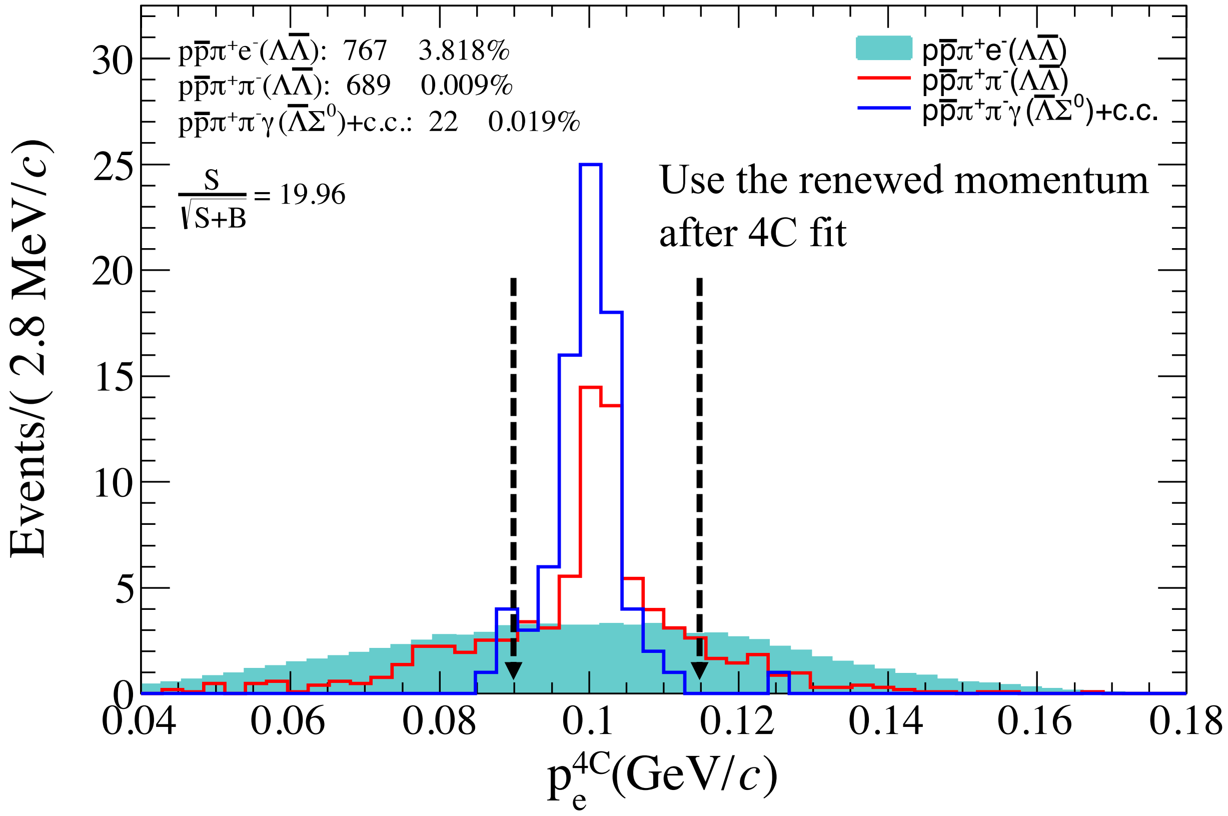

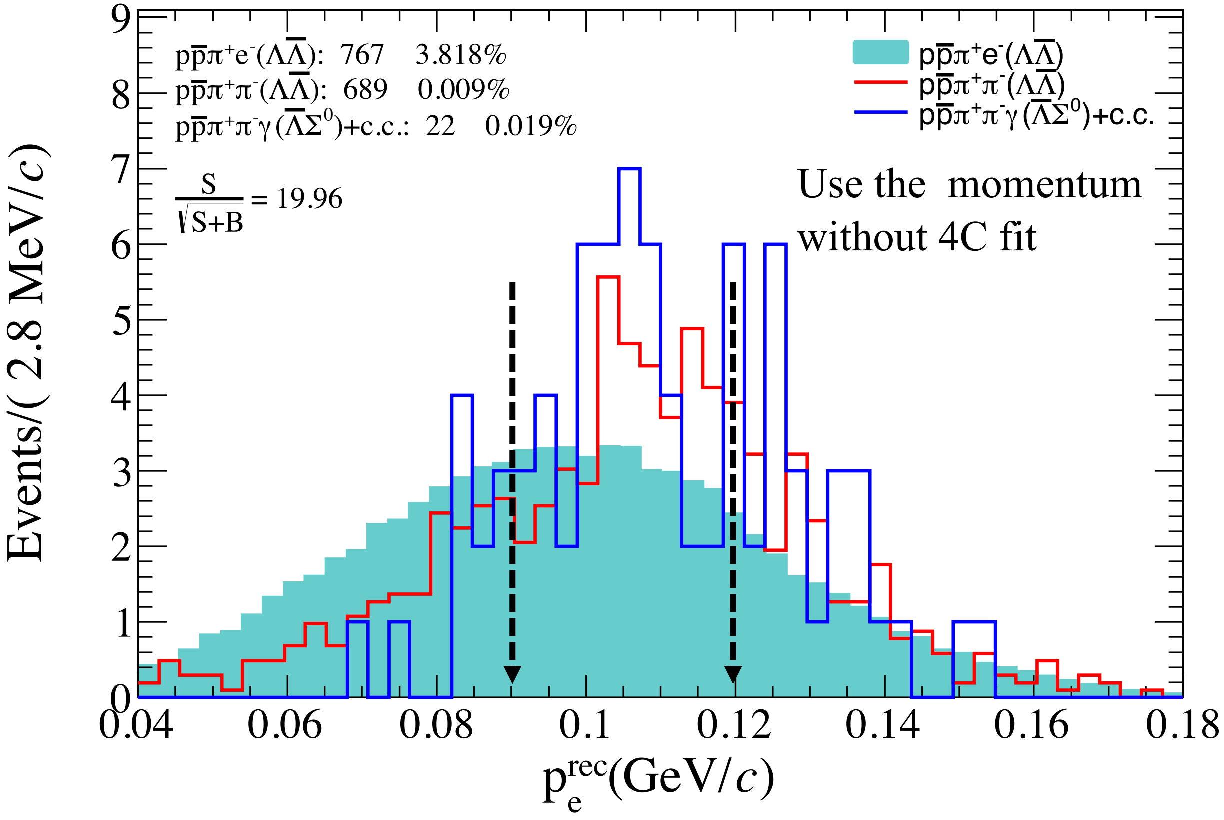

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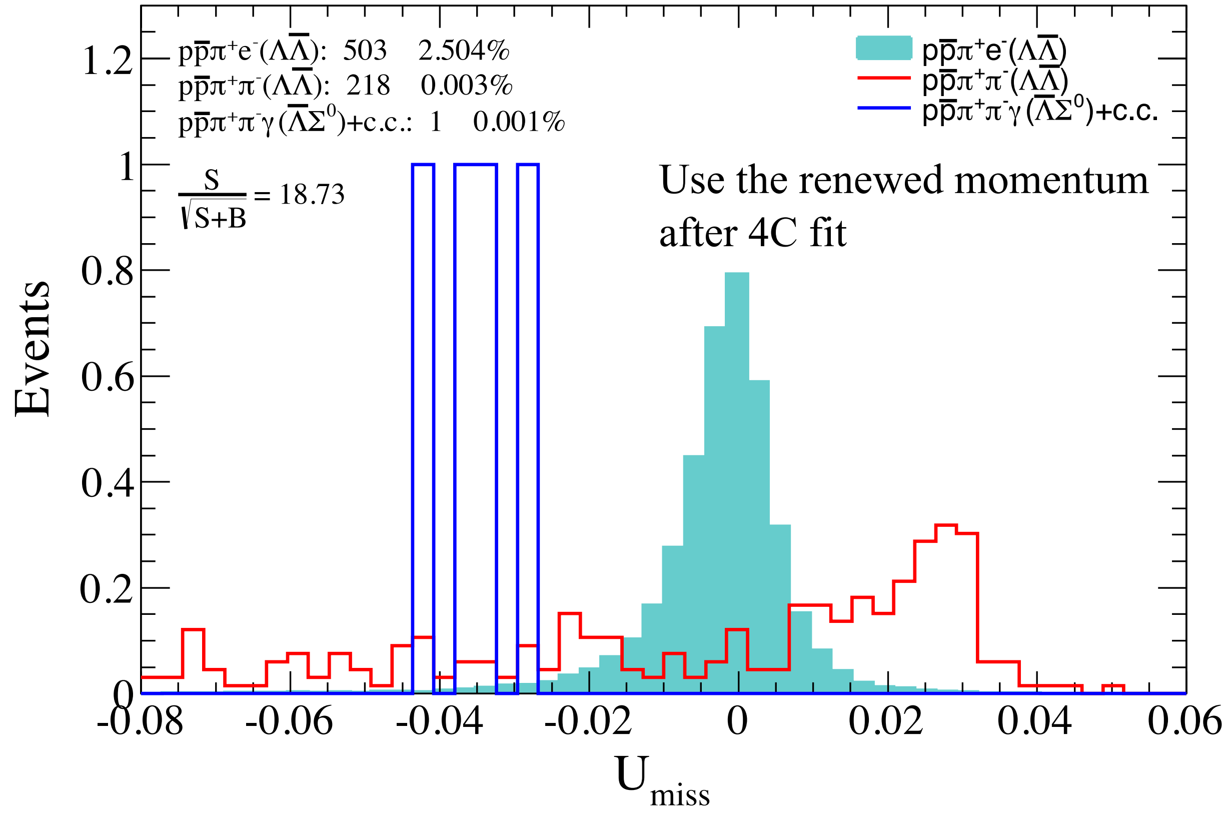

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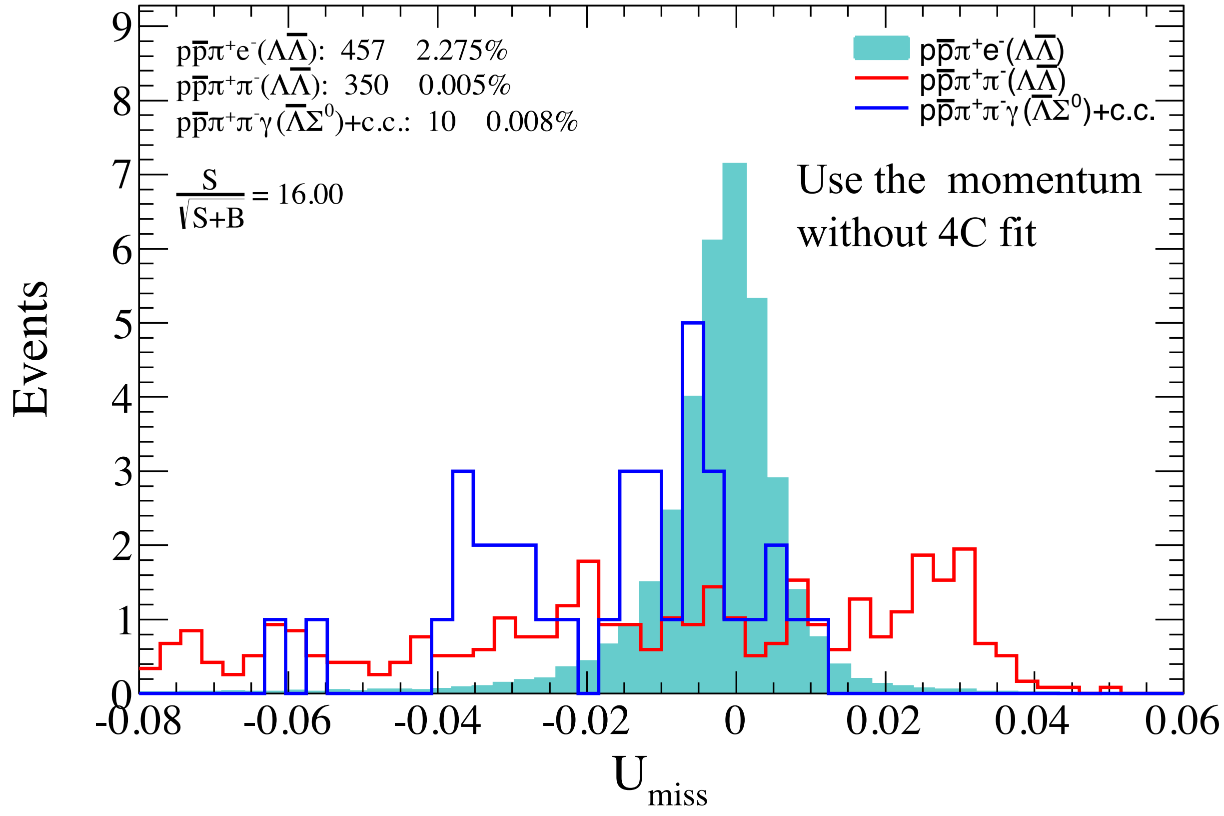

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復旦大學 Fudan University

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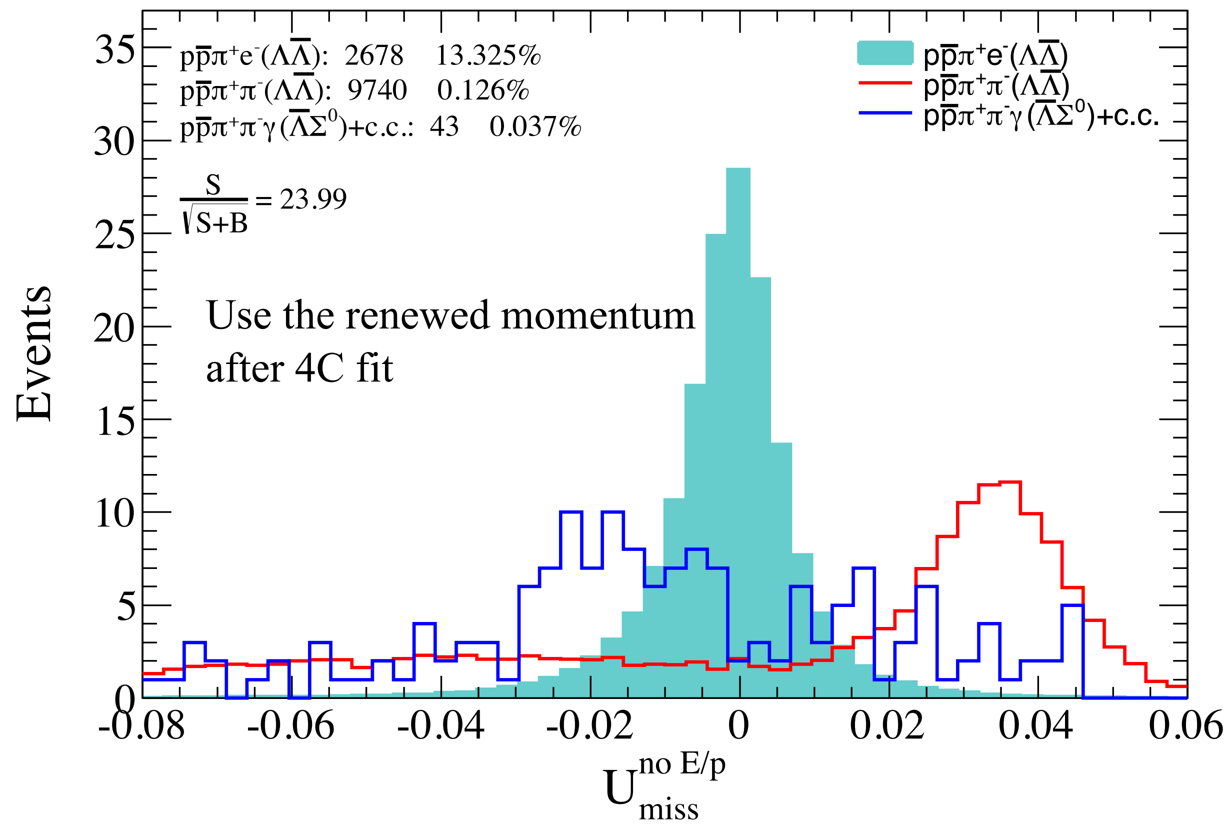
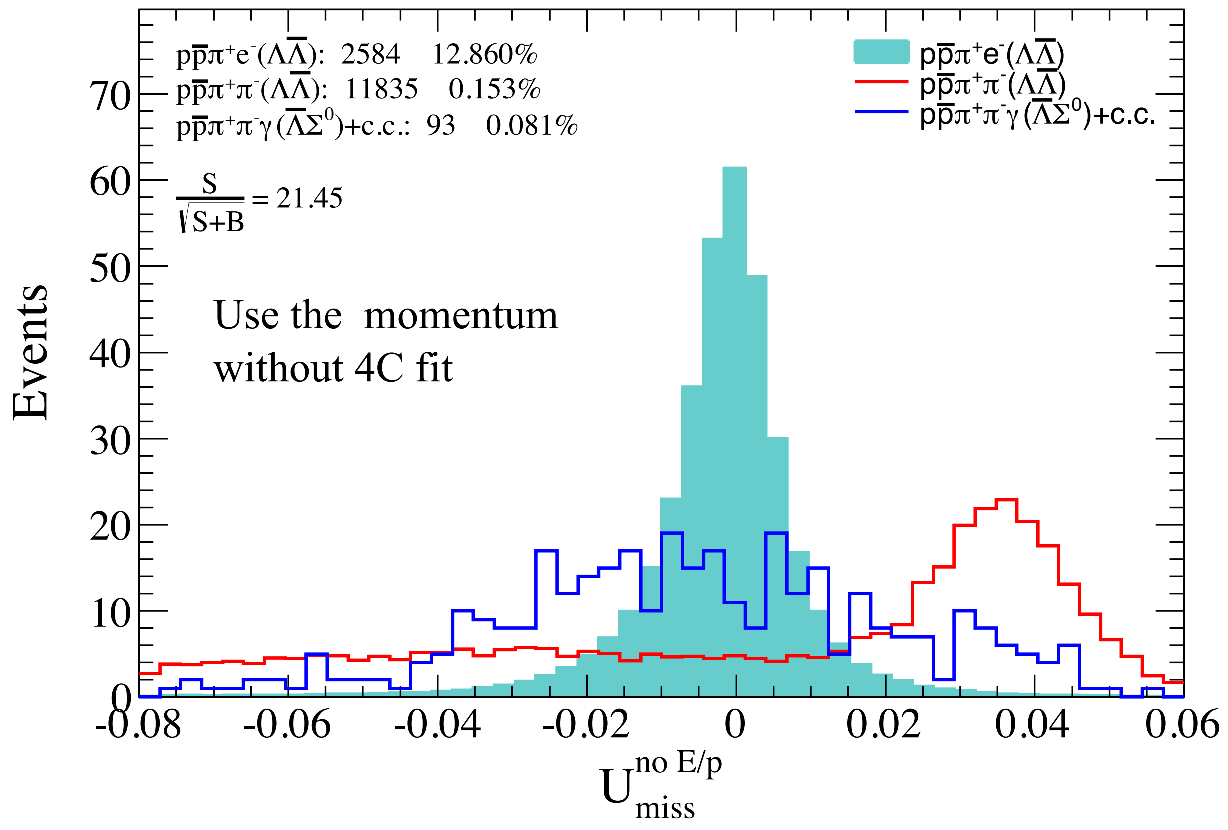
The momentum of electron in the Λ rest frame



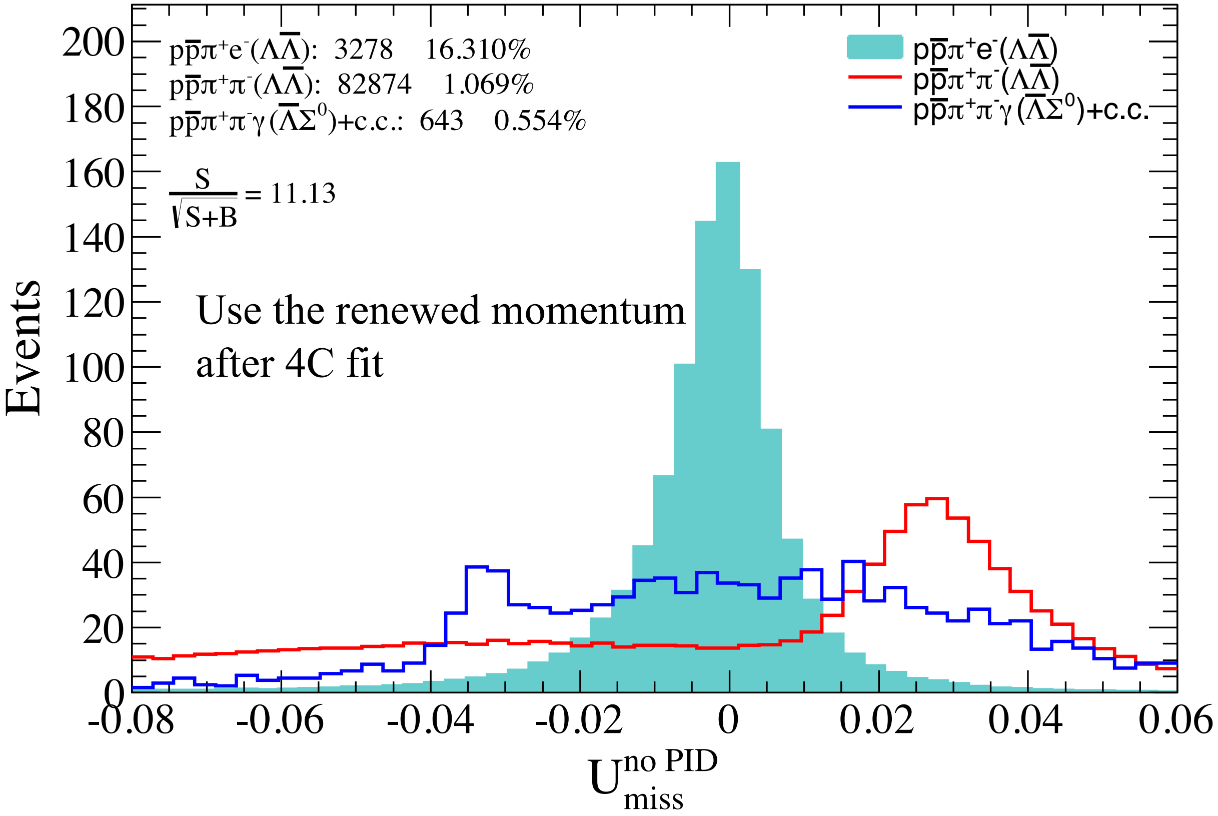


Veto P_e^{4C} (0.09, 0.115) without E/p cut for e

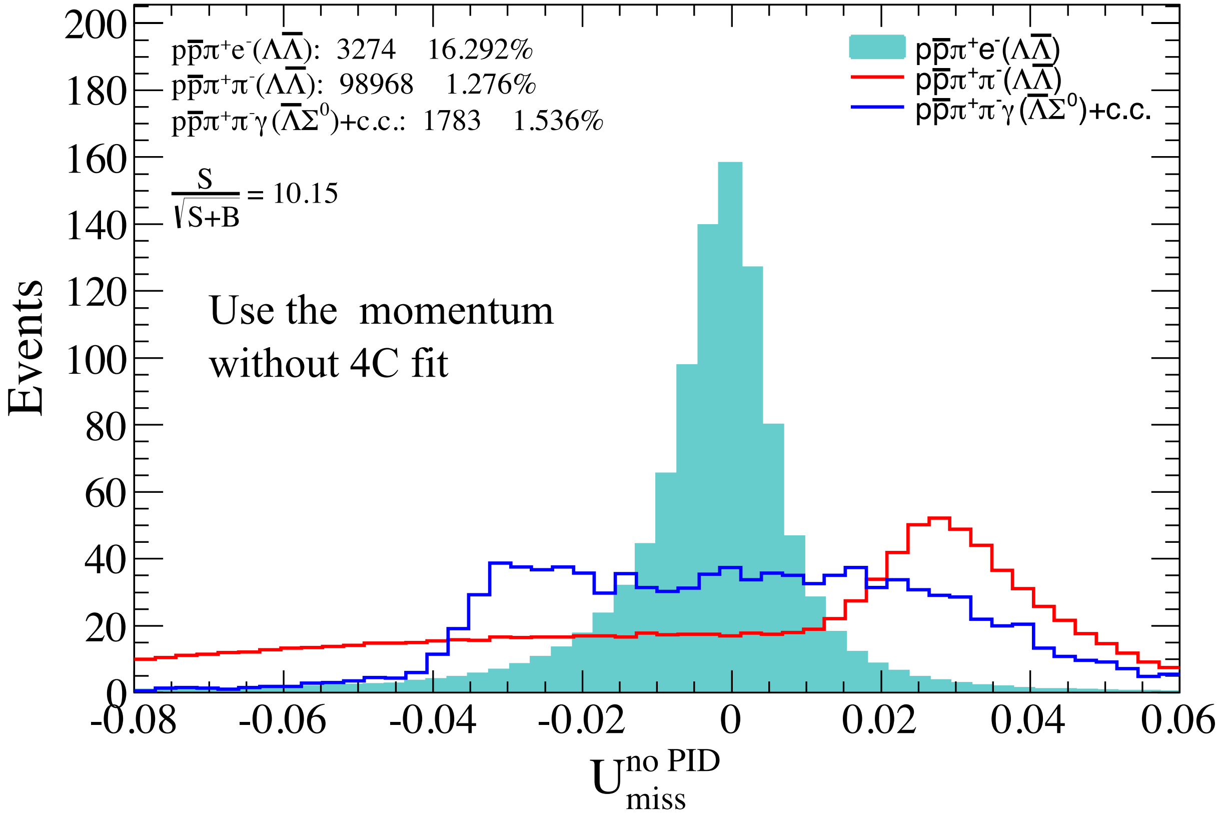
Veto P_e^{rec} (0.09, 0.12) without E/p cut for e

Comments from Hai-Bo Li

The momentum of electron in the Λ rest frame



Veto P_e^{4C} (0.09, 0.115) without PID for e



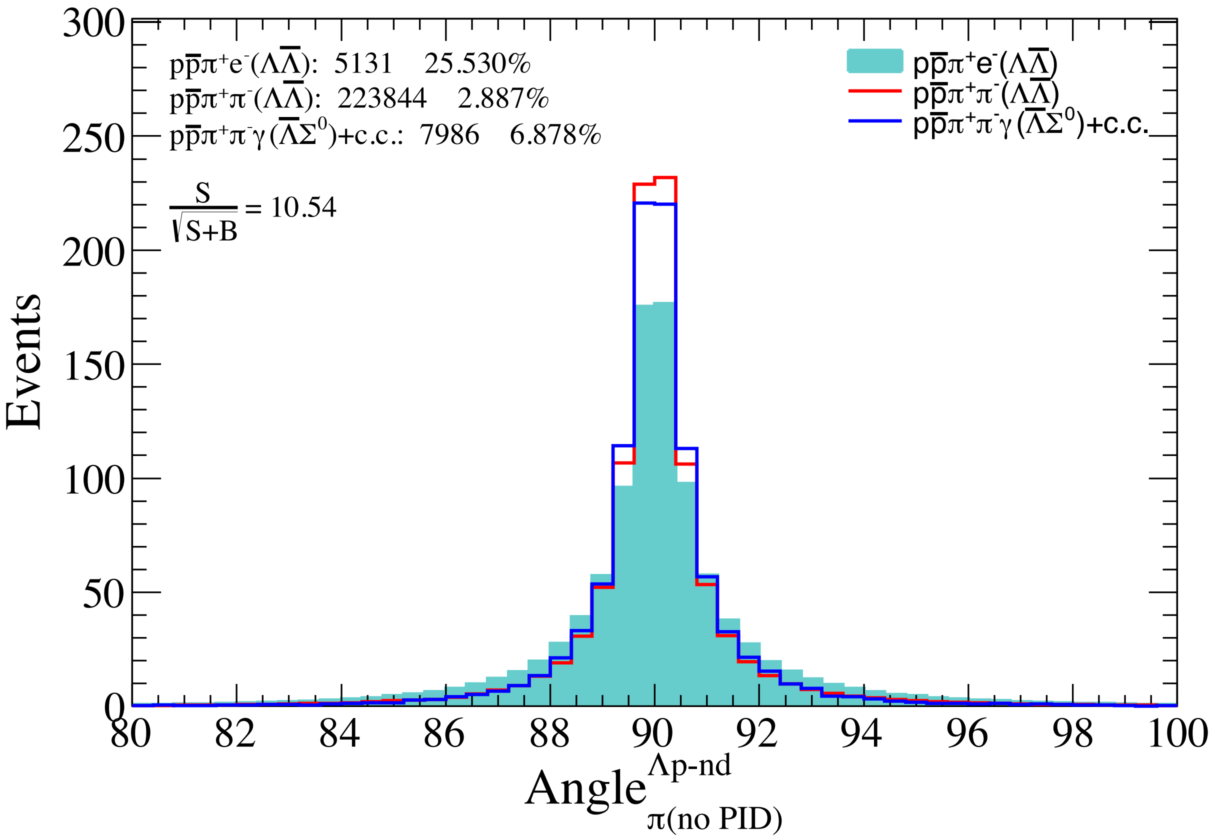
Veto P_e^{rec} (0.09, 0.12) without PID for e

Comments from Hai-Bo Li

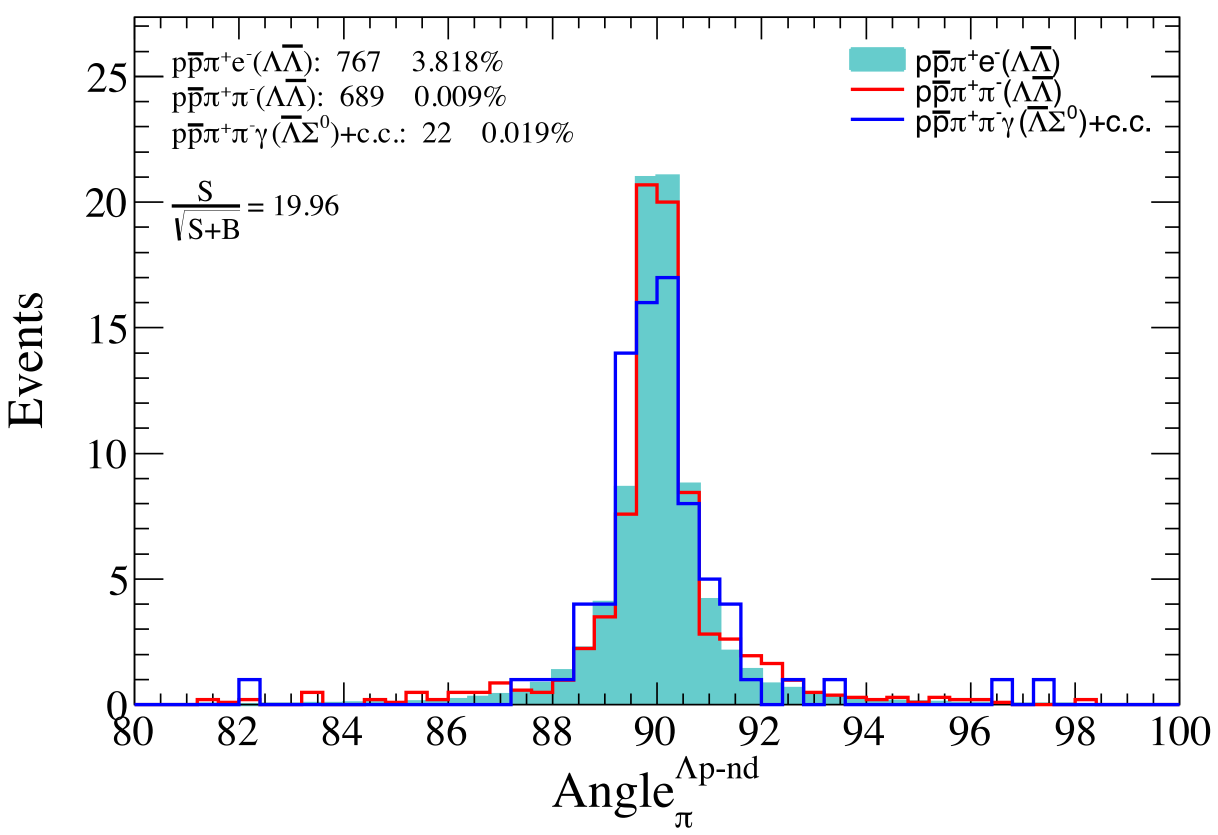
The angle between electron and the normal dirction of Λ-proton plane

Comments from Hai-Bo Li

The angle between electron and the normal dirction of Λ-p plane



All cuts listed in table 1 except PID are used



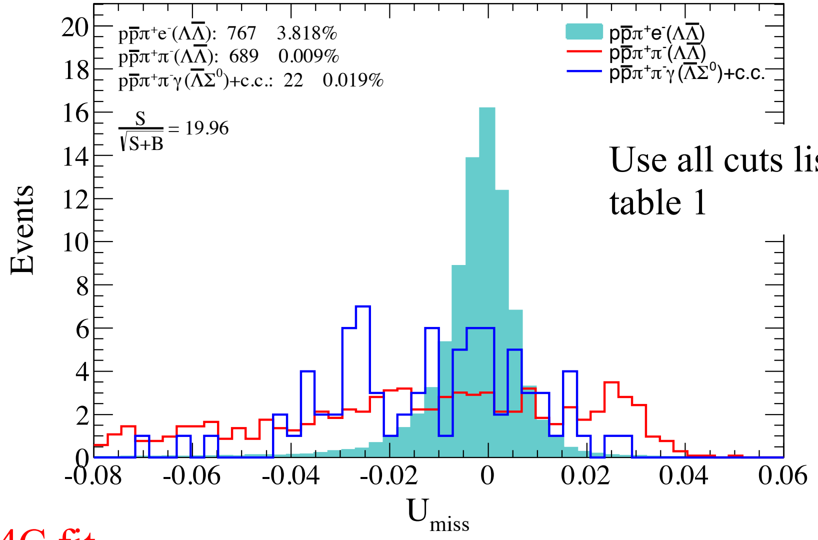
All cuts listed in table 1 are used

Comments from Hai-Bo Li

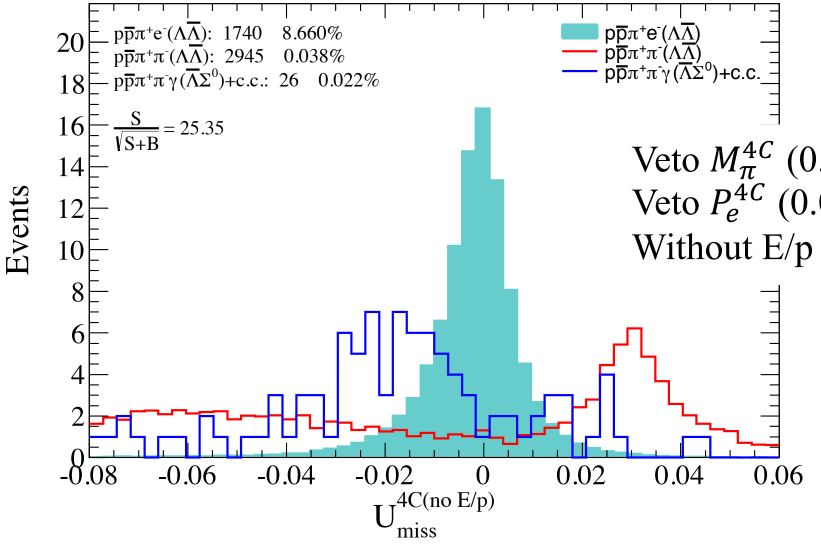
Attempt to use the new cut combinations

Comments from Hai-Bo Li

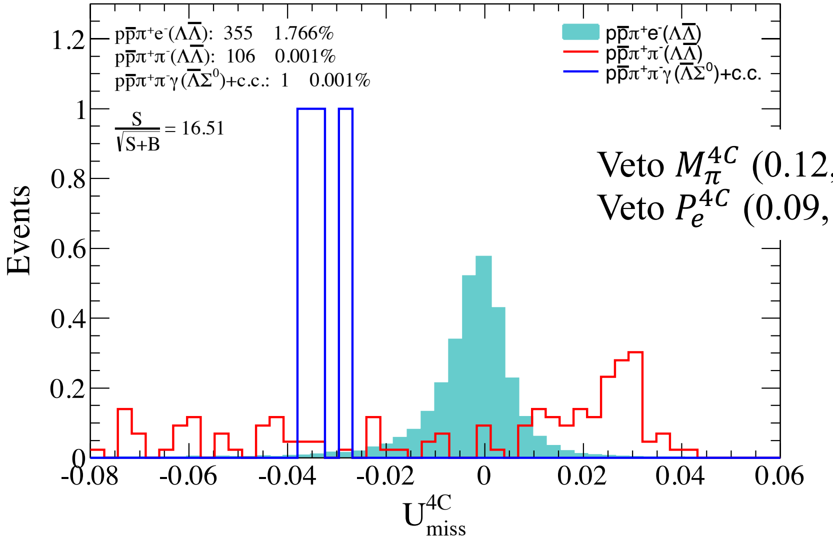
Use the renewed momentum after 4C fit



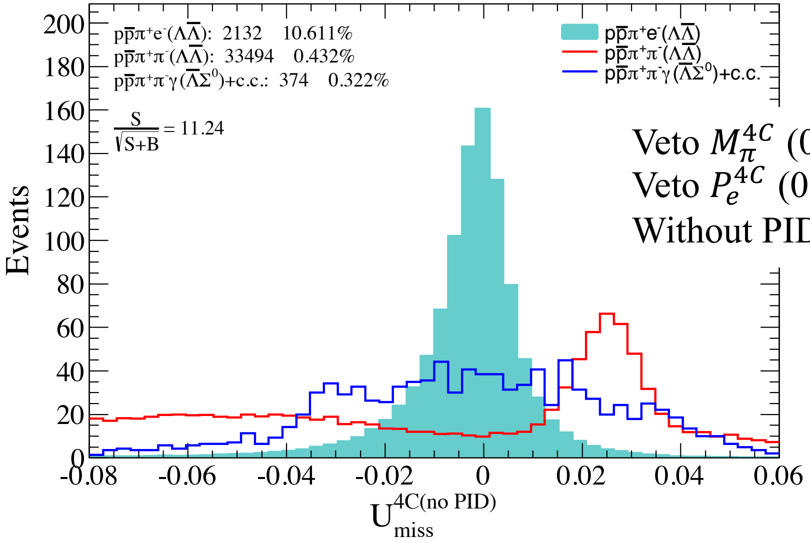
Use all cuts listed in table 1



Veto M_π^{4C} (0.12, 0.155)
Veto P_e^{4C} (0.09, 0.115)
Without E/p cut for e



Veto M_π^{4C} (0.12, 0.155)
Veto P_e^{4C} (0.09, 0.115)

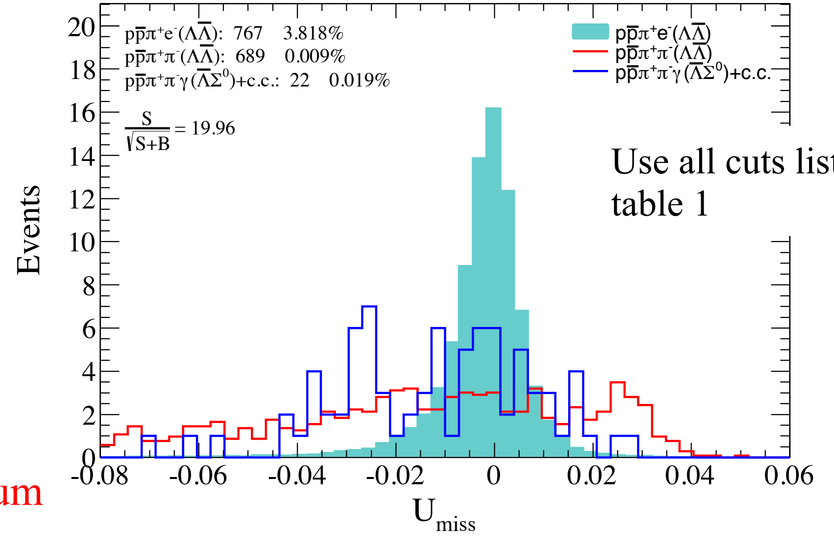


Veto M_π^{4C} (0.12, 0.155)
Veto P_e^{4C} (0.09, 0.115)
Without PID for e

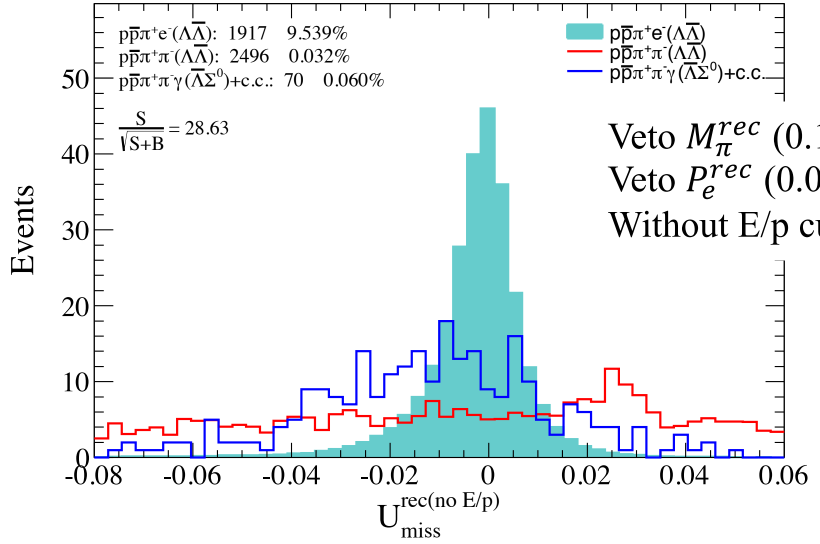
The distribution of U_miss with new cuts combination

Comments from Hai-Bo Li

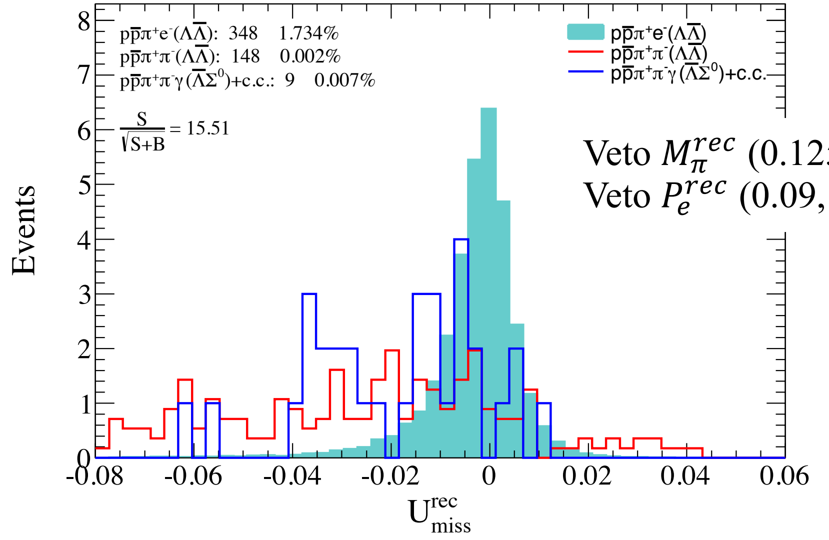
Use the momentum without 4C fit



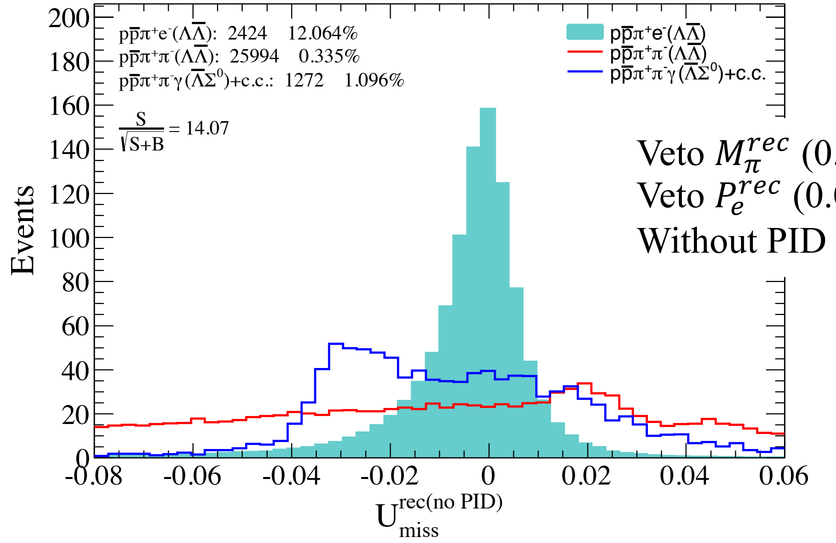
Use all cuts listed in table 1



Veto M_π^{rec} (0.125, 0.155)
Veto P_e^{rec} (0.09, 0.12)
Without E/p cut e



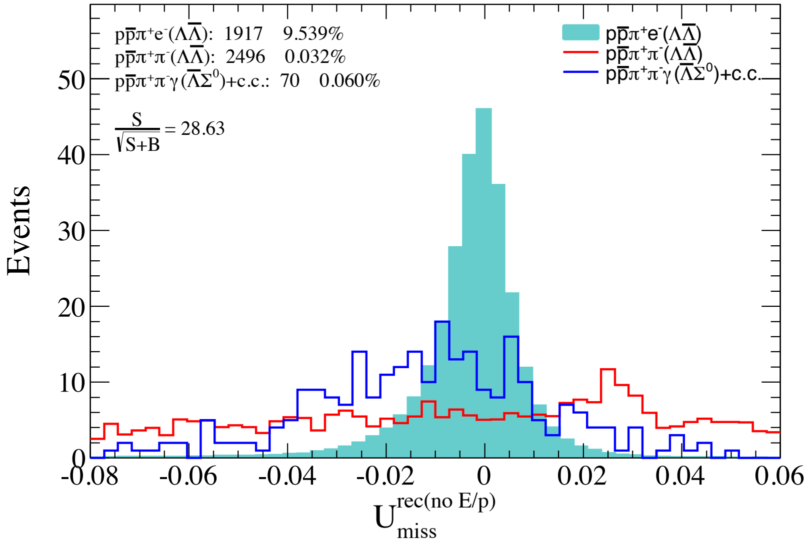
Veto M_π^{rec} (0.125, 0.155)
Veto P_e^{rec} (0.09, 0.12)



Veto M_π^{rec} (0.125, 0.155)
Veto P_e^{rec} (0.09, 0.12)
Without PID for e

The distribution of U_miss with new cuts combination

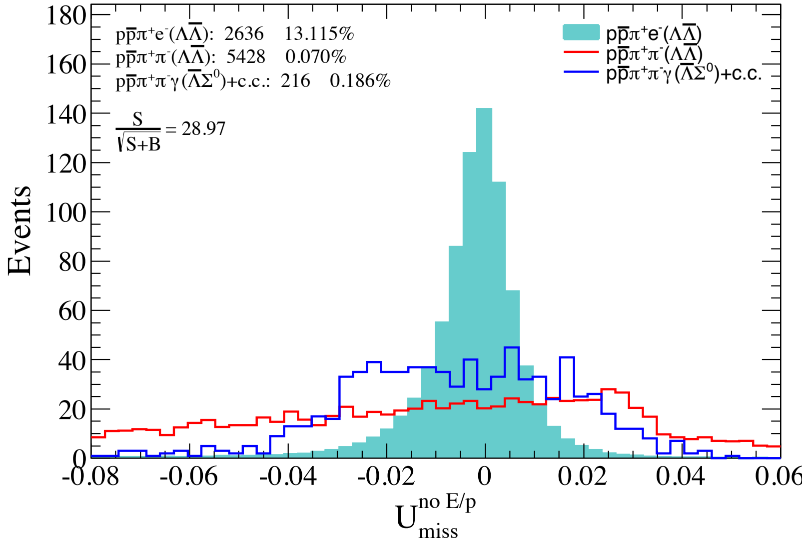
Result of these tests

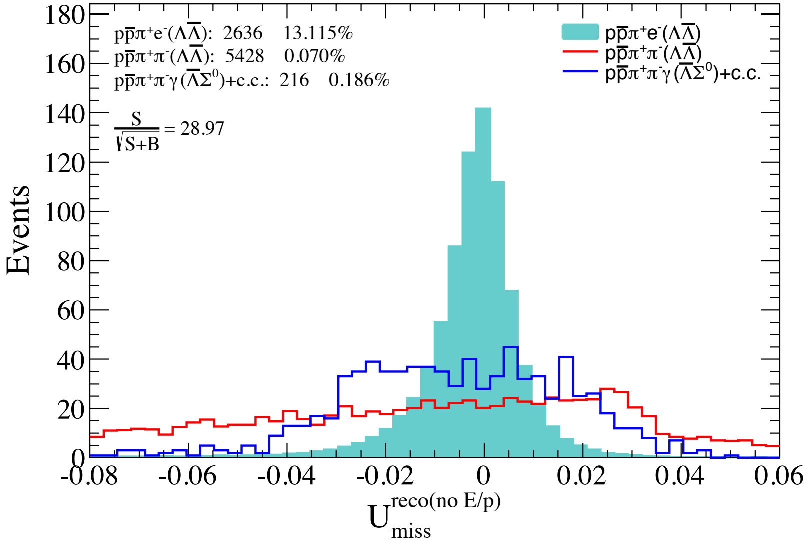


1. Use the following cuts to replace E/p:

Veto $M_{missing\ \pi}^{recoil}$ (0.125, 0.155)

Veto P_{e}^{recoil} (0.09, 0.12)





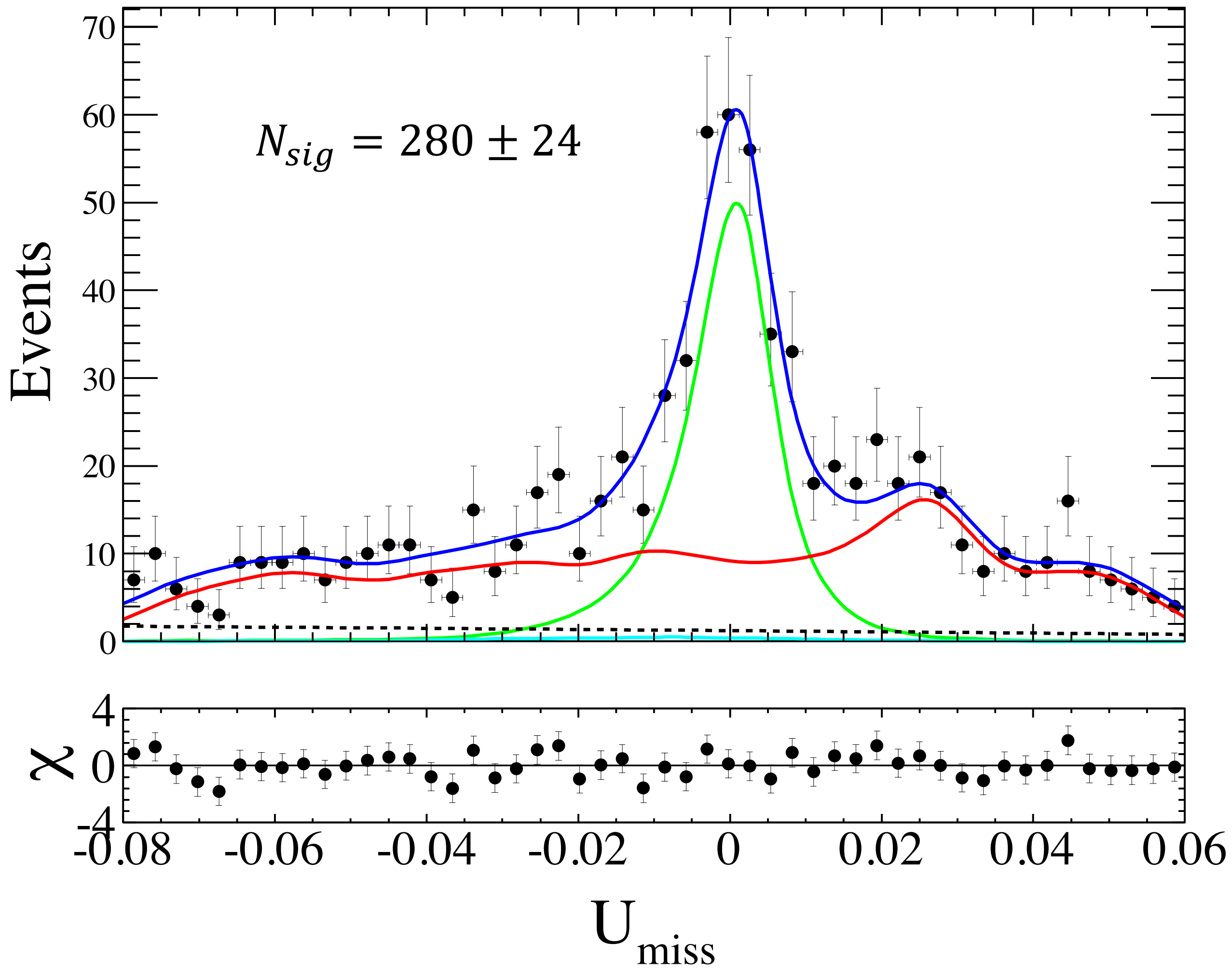
2. Use the following cuts to replace E/p:

Veto $M_{missing\ \pi}^{recoil}$ (0.125, 0.155)
(Both used in the two plots)

Veto $P_{missing\ \pi}^{recoil}$ (0.08, 0.115)
(Only used in the right plot)

All of the momentum we used to get the plots in this slide is without 4C

Fitting result obtained by using new cuts instead of E/p

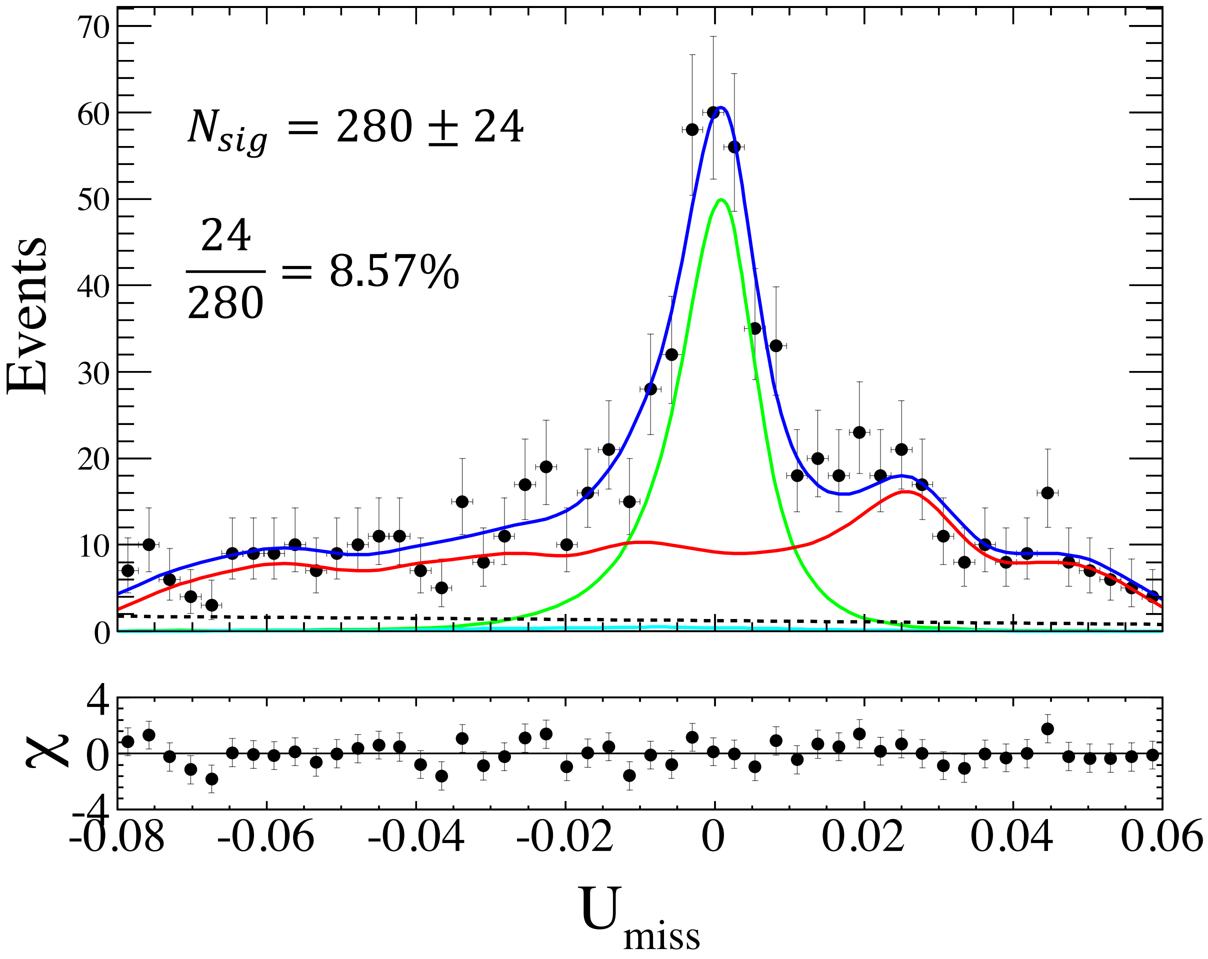


- ✓ **Signal:** MC matched shape $\otimes$ a Gaussian
- ✓ **Main Background:** MC shape from $J/\psi \to \Lambda\bar{\Lambda}$, $\Lambda \to p\pi^-, \bar{\Lambda} \to \bar{p}\pi^+$
- ✓ Peaking background: MC shape (fixed) from $J/\psi \to \Lambda\bar{\Sigma}^0, \Lambda \to p\pi^-, \bar{\Sigma}^0 \to \gamma\bar{\Lambda}, \bar{\Lambda} \to \bar{p}\pi^+$ +c.c.
- ✓ Other background: 2^{nd} order polynomial

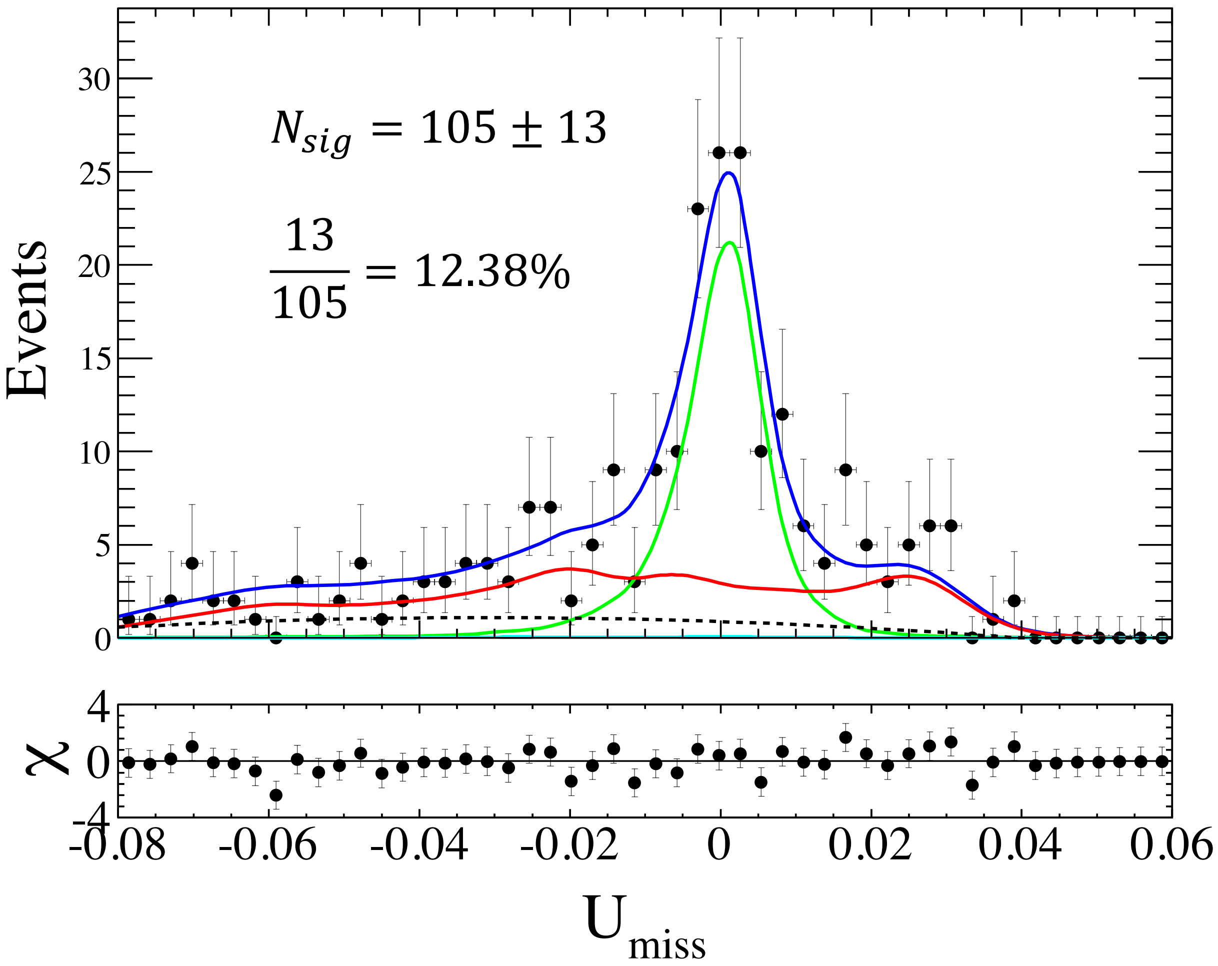
There is only 1.3 billion J/psi data.

For 10 billion data, according to this result, the expected yield is 2,154 which is about 3 times the value of the previous result.

Comparison between the new result and the previous one



New result with 1.3 billion J/psi data



Previous result with1.3 billion J/psi data

Back Up

Momentum distributions