



Study of $\bar{p}N$ Interaction between data and MC

Hailin Song

University of Science and Technology of China

Outline

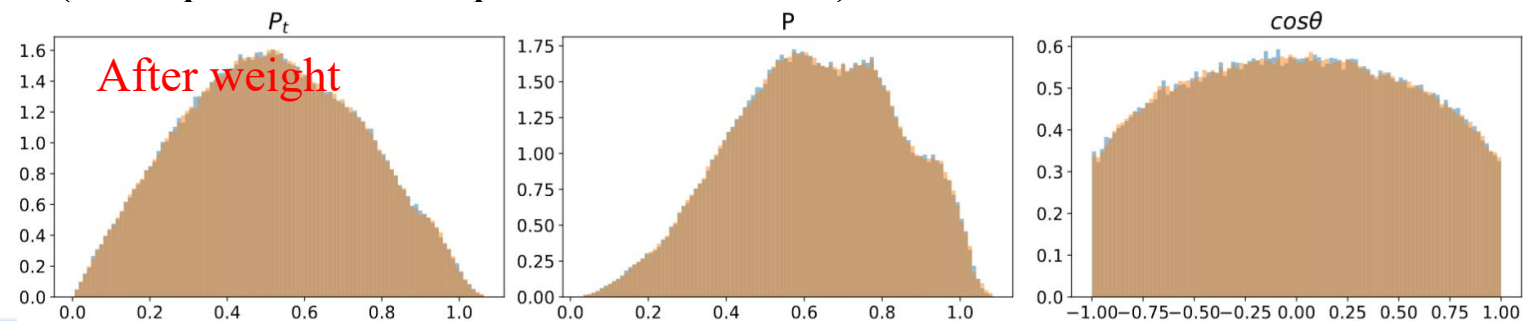
- ◆ **Data sets**
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- ◆ **Data/MC comparison (inclusive)**
- ◆ **Data/MC comparison (exclusive)**
- ◆ **Conclusion**
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\bar{p} control sample: $J/\psi \rightarrow p\bar{p}\pi^+\pi^-$

- J/ψ data (BOSS708): $\text{Br}(J/\psi \rightarrow p\bar{p}\pi^+\pi^-) = (6.0 \pm 0.5) \times 10^{-3}$

Sample type	Ecms (GeV)	Run ID	BOSS Version	Number of event (Int. luminosity)
J/ψ (2009)	3.097	9947-10878	7.0.8	$224.0 \pm 1.3\text{M}$, Ref $(79.63 \pm 0.07 \text{ pb}^{-1})$, Ref
J/ψ (2012)		27255-28236		$1088.5 \pm 4.4\text{M}$, Ref $(315.02 \pm 0.14 \text{ pb}^{-1})$, Ref
J/ψ (2017 – 2019)		52940-54976 55861-56546 56788-59015		$8774.0 \pm 39.4\text{M}$, Ref $(2568.07 \pm 0.40 \text{ pb}^{-1})$, Ref

- Signal MC $J/\psi \rightarrow p\bar{p}\pi^+\pi^-$
 - 4 million with amplitude weighted according to data
 - BOSS version 711 (to implement the updated **GEANT4**)



Event Selection

➤ Good Charged Track:

$$|\cos\theta| \leq 0.93; \quad |V_{xy}| < 0.5 \text{ cm}; \quad |V_z| < 5.0 \text{ cm}; \quad 2 \leq N_{\text{charged}} \leq 12;$$

➤ PID: use dE/dx and TOF information

$$p: \text{prob}(p) > \text{prob}(\pi) \ \& \ \text{prob}(p) > \text{prob}(K)$$

$$\pi: \text{prob}(\pi) > \text{prob}(p) \ \& \ \text{prob}(\pi) > \text{prob}(K)$$

$$K: \text{prob}(K) > \text{prob}(p) \ \& \ \text{prob}(K) > \text{prob}(\pi)$$

$$N_p \geq 1 \ \text{and} \ N_{\pi^+} \geq 1 \ \text{and} \ N_{\pi^-} \geq 1$$

➤ Vertex fit:

Loop all the $p\pi^+\pi^-$ tracks, and select the combination with **minimum** χ_{VF}^2

➤ Kinematic fit:

Missing 3-momenta of \bar{p} , do 1C kinematic fit,

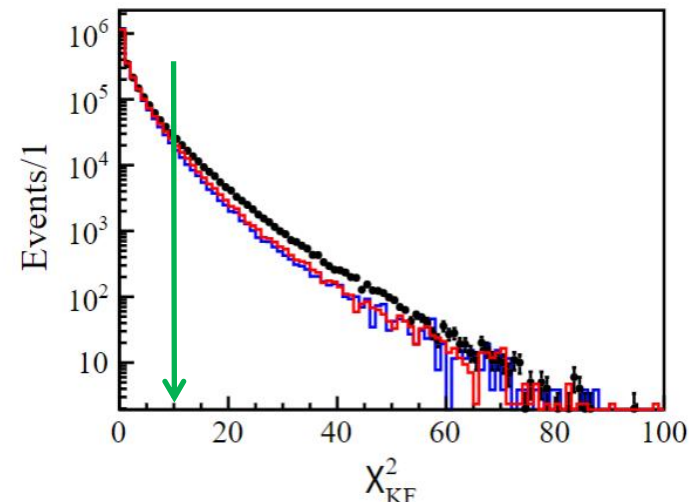
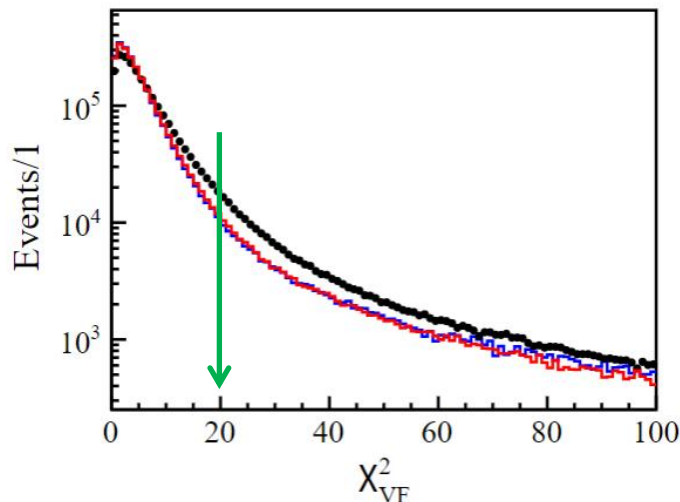
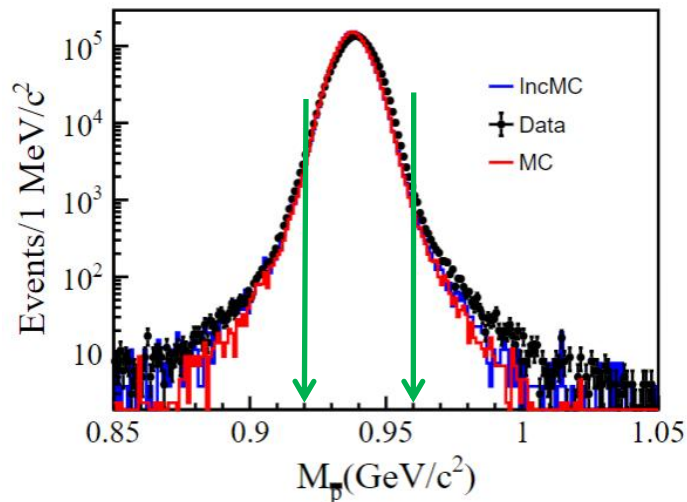
$$\chi_{KF}^2$$

➤ Recoil \bar{p} :

$P_{\bar{p}} = P_{cms} - P_p - P_{\pi^+} - P_{\pi^-}$ with 4-mom before Kinematic fit

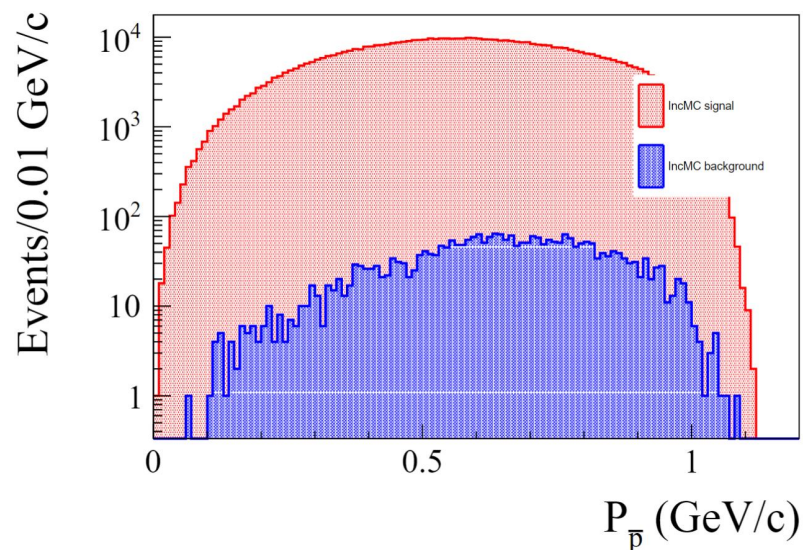
Further selection and Background level

➤ **Further Selection:** $0.92 < m_{\bar{p}} < 0.96 \text{ GeV}/c^2$, $\chi_{VF}^2 < 20$, $\chi_{KF}^2 < 10$.

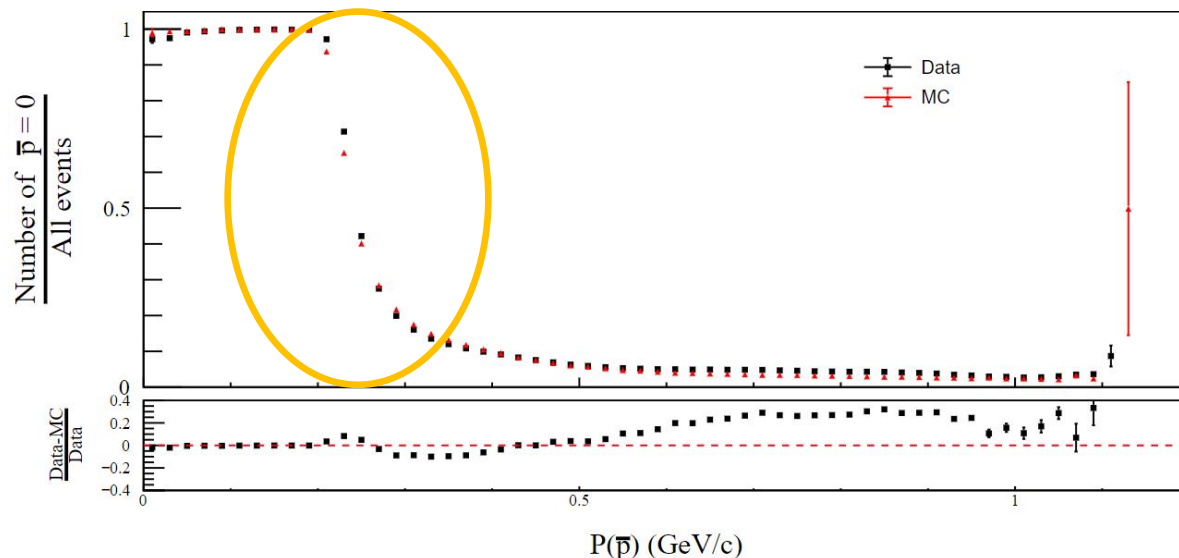
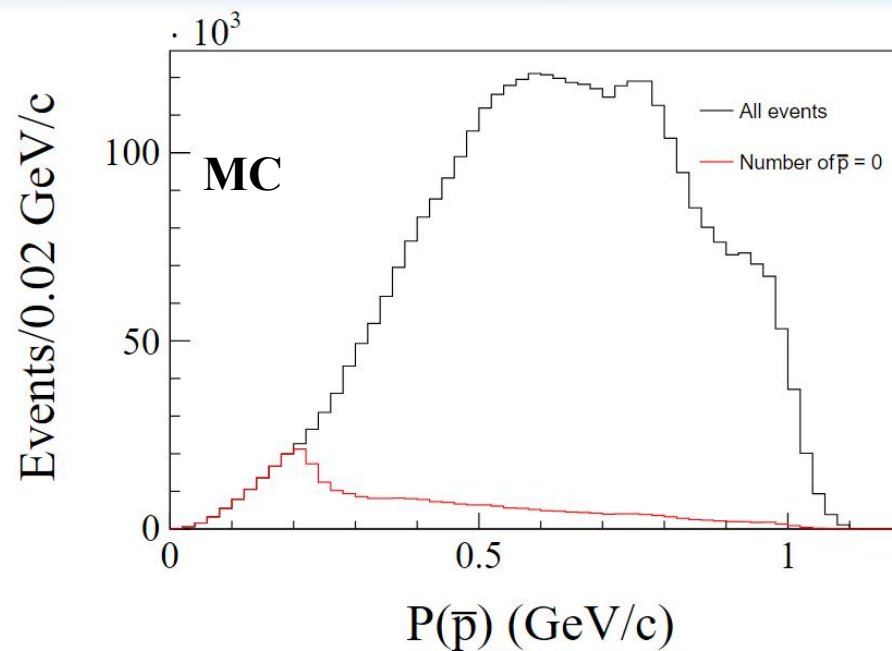
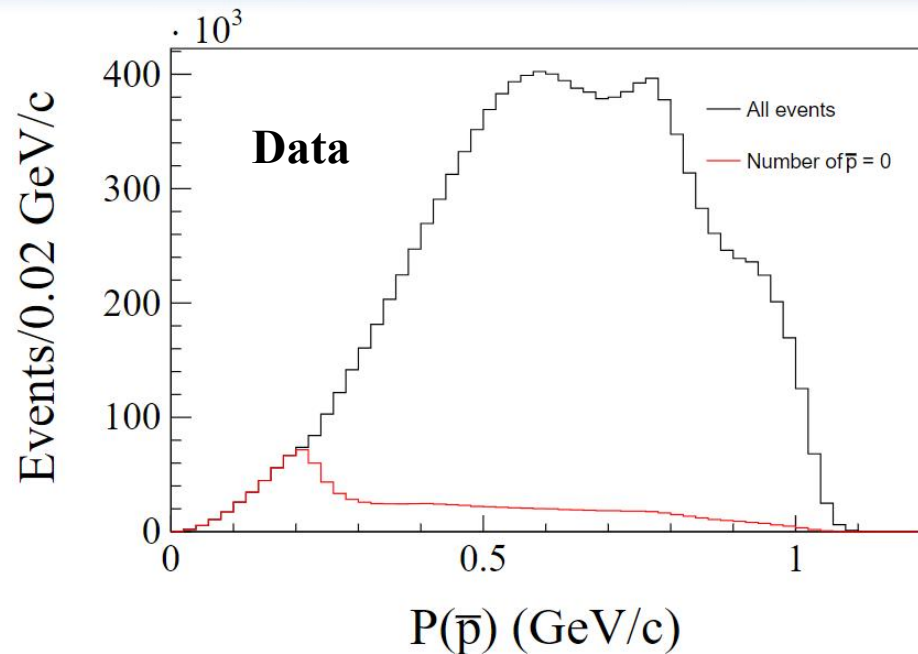


rowNo	decay initial-final states	iDcyIFSts	nEtr	nCEtr
1	$J/\psi \rightarrow \pi^+\pi^-p\bar{p}$	0	569168	569168
2	$J/\psi \rightarrow \pi^+\pi^-p\bar{p}\gamma^f$	3	747	569915
3	$J/\psi \rightarrow \pi^+\pi^+\pi^-\pi^-K^+K^-$	5	221	570136
4	$J/\psi \rightarrow \pi^0\pi^+\pi^+\pi^-\pi^-\pi^-$	24	141	570277
5	$J/\psi \rightarrow \pi^0\pi^0\pi^+\pi^-K^+K^-$	22	136	570413
6	$J/\psi \rightarrow \pi^0K_L^0\pi^+\pi^-K^+$	12	114	570527
7	$J/\psi \rightarrow \pi^0\pi^+\pi^+\pi^-\pi^-K^+$	13	96	570623
8	$J/\psi \rightarrow \pi^0\pi^+\pi^-K^+K^-$	27	66	570689
9	$J/\psi \rightarrow \pi^0\pi^+\pi^+\pi^-\pi^-K^+K^-$	10	54	570743
10	$J/\psi \rightarrow \pi^+\pi^-p\bar{p}\gamma^F$	36	53	570796
11	$J/\psi \rightarrow \pi^0\pi^-\bar{n}p$	8	45	570841
12	$J/\psi \rightarrow \pi^0\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$	15	44	570885
13	$J/\psi \rightarrow \pi^0\pi^0\pi^0\pi^+\pi^-K^+$	48	43	570928
14	$J/\psi \rightarrow \pi^0\pi^+\pi^+\pi^-$			9969
15	$J/\psi \rightarrow \pi^0K_L^0\pi^+\pi^-$			1009
16	$J/\psi \rightarrow \pi^0\pi^0\pi^0\pi^+\pi^-$			1044
17	$J/\psi \rightarrow \pi^0\pi^0\pi^+\pi^-\pi^-$	63	34	571078
18	$J/\psi \rightarrow \pi^+\pi^-p\bar{p}\gamma$	81	32	571110

Bkg. level: 0.35%



Features of $\bar{p}N$ interaction (inclusive)

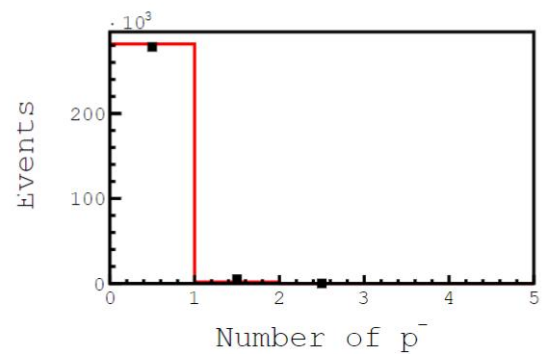
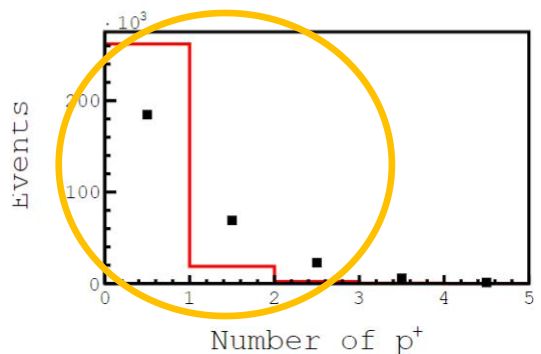
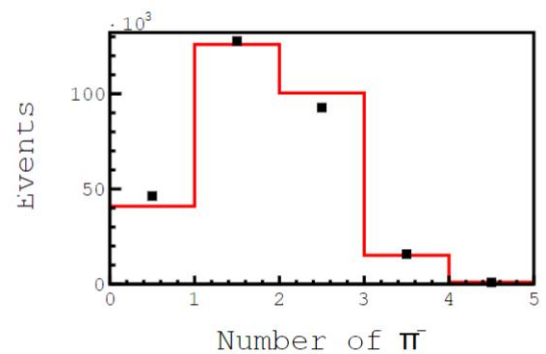
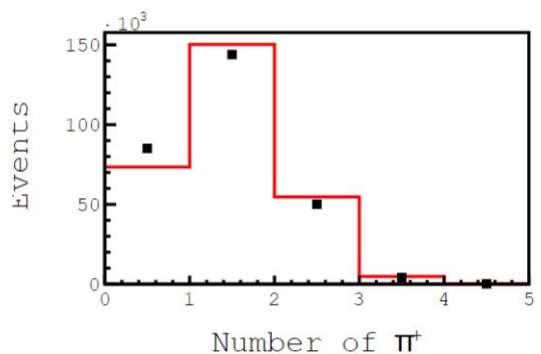
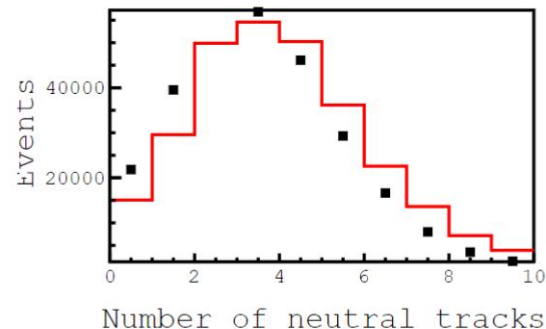
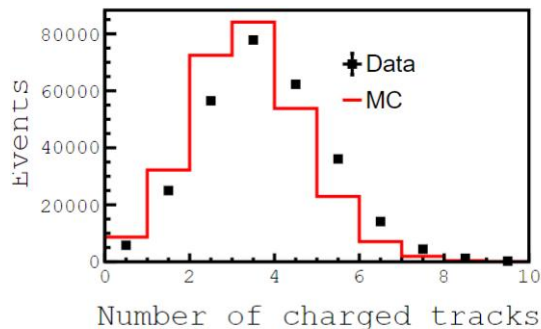


More than **10M \bar{p}** sample within acceptance
 About **1M \bar{p}** didn't been observed \rightarrow interacted
Below 200 MeV, almost **100% \bar{p}** interacted.

We focus on $P(\bar{p}) < 200$ MeV following

Data/MC comparison ($\bar{p}N \rightarrow anything$)

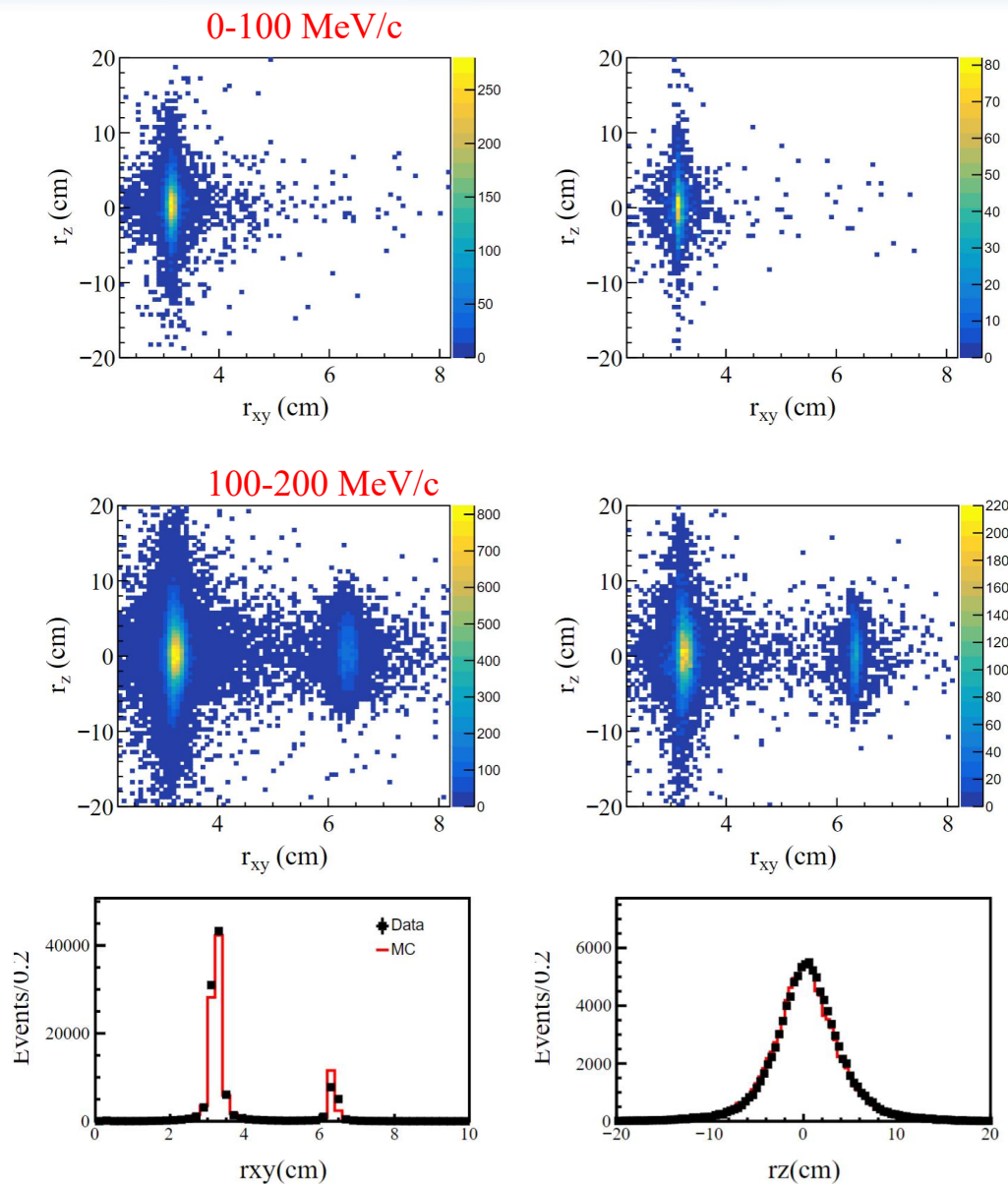
➤ Focus on: 0-200 MeV/c



Multiplicity of the charged tracks, neutral tracks, pions are **consistent** between data and MC.

Multiplicity of **proton** show **large difference** between data and MC → pop out of proton from nucleon?

Data/MC comparison ($\bar{p}N \rightarrow anything$)



- **Good consistent** of the interaction vertex with respect of R_{xy} and R_z
- Below 100 MeV/c, all are interacted at the beam-pipe
- Above 100 MeV/c, some are interacted at inner MDC

Event Selection (exclusive process)

- Good Charged Track:

$$|\cos\theta| \leq 0.93; \quad 2 \leq N_{\text{charged}} \leq 9;$$

- Good Photon:

$$E_{\text{barrel}} \geq 25 \text{ MeV for } |\cos\theta| < 0.80;$$

$$E_{\text{endcap}} \geq 50 \text{ MeV for } 0.86 < |\cos\theta| < 0.92;$$

$$0 \leq TDC \leq 700 \text{ ns};$$

- Only use dE/dx

$$p: \text{prob}(p) > 0.001 \text{ and } \text{prob}(p) > \text{prob}(\pi, K, e)$$

$$K: \text{prob}(K) > 0.001 \text{ and } \text{prob}(K) > \text{prob}(p, \pi, e)$$

$$\pi: \text{prob}(\pi) > 0.001 \text{ and } \text{prob}(\pi) > \text{prob}(p, K, e)$$

$$e: \text{prob}(e) > 0.001 \text{ and } \text{prob}(e) > \text{prob}(p, K, \pi)$$

- Further Selection:

$$2.2 < R_{xy} < 8.2 \text{ cm}, \quad |R_z| < 10 \text{ cm}$$

$$0.10 < M_{\gamma\gamma} < 0.16 \text{ GeV}/c^2 \text{ for one } \pi^0; \quad M_{\gamma\gamma} < 0.05 \text{ GeV}/c^2 \text{ for no } \pi^0.$$

Decay Chain:

$$\bar{p}p \rightarrow \pi^+\pi^+\pi^-\pi^-\pi^0 \text{ or } \pi^+\pi^+\pi^-\pi^-, \pi^+\pi^-$$

$$\bar{p}n \rightarrow \pi^+\pi^-\pi^-\pi^0 \text{ or } \pi^+\pi^-\pi^-$$

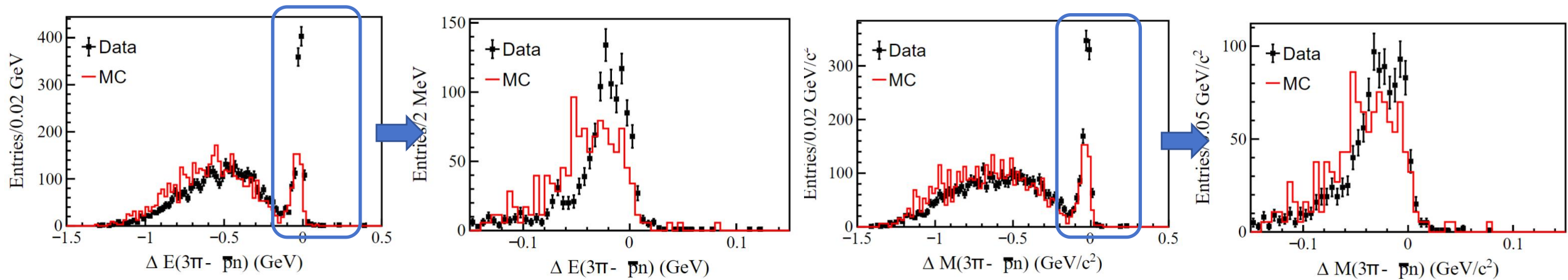
- π^0 Reconstruction:

Select the photon pair with invariant mass closest to π^0

- Vertex fit:

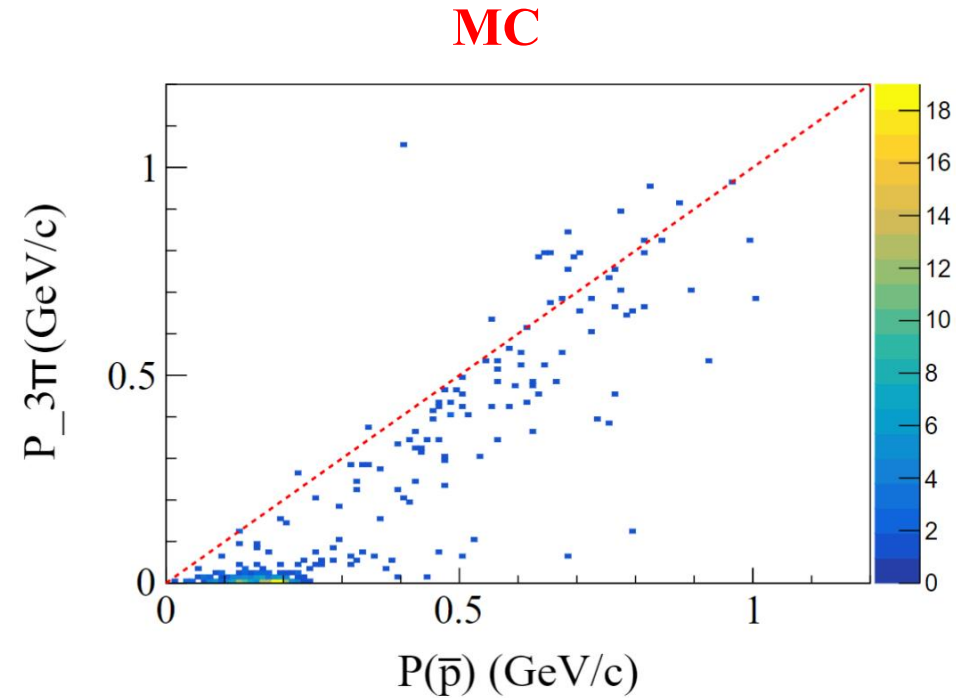
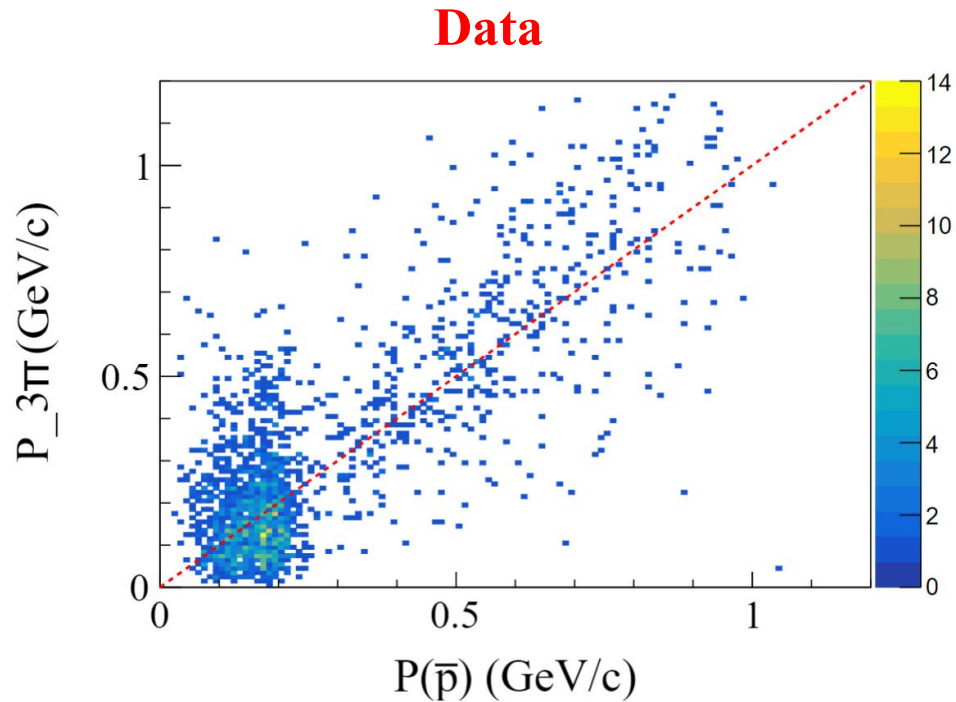
A vertex fit is performed and $\chi^2 < 200$

$$\bar{p}n \rightarrow \pi^+ \pi^- \pi^-$$



- No **Fermi energy** or **\bar{p} momentum** considered for **$\bar{p}n$ system** now
- Clear peaks observed at $E(\pi^+ \pi^- \pi^-) = 1.877$ GeV and $M(\pi^+ \pi^- \pi^-) = 1.877$ GeV, which come from **$\bar{p}n \rightarrow \pi^+ \pi^- \pi^-$** , **with worse resolution for MC than data**
- Besides, both data and MC are not peaked at $E(\pi^+ \pi^- \pi^- - \bar{p}n) = 0$, but **shifted to the left**, with slightly difference

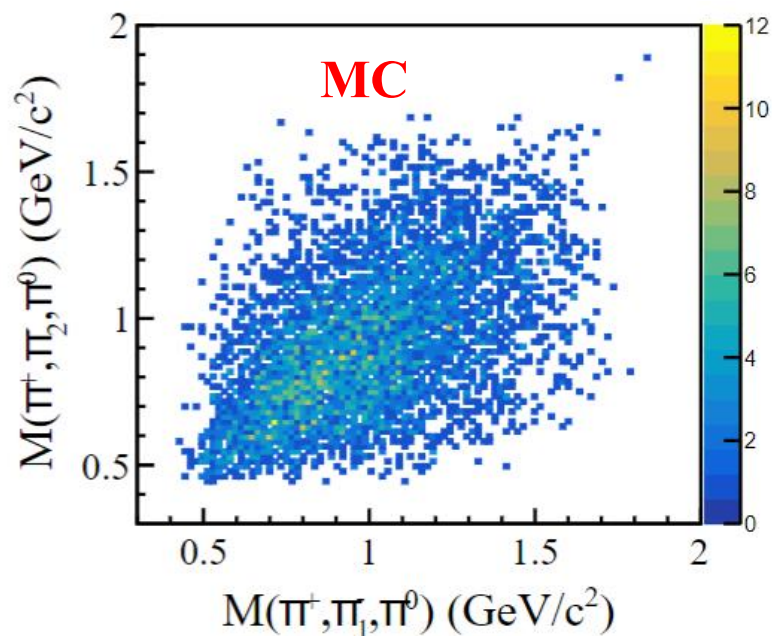
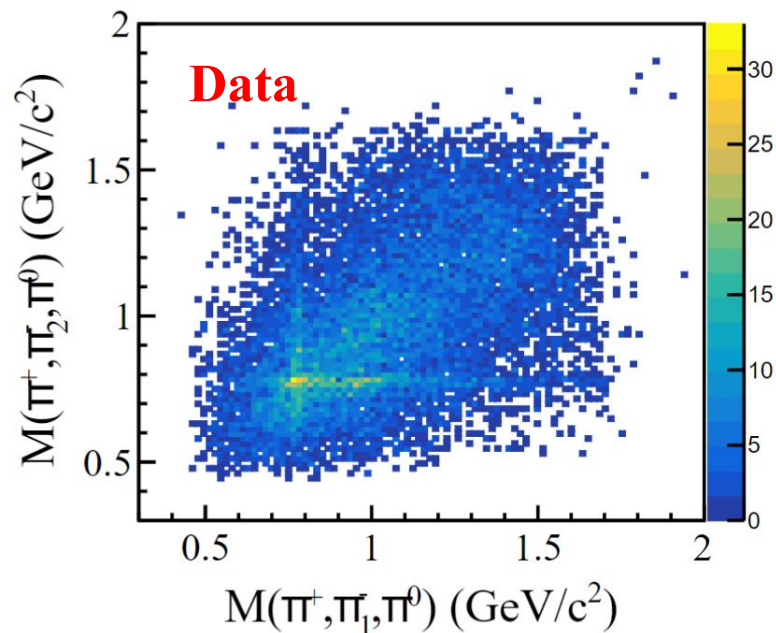
$$\bar{p}n \rightarrow \pi^+ \pi^- \pi^-$$



Inconsistence in the momentum of $P(\pi^+ \pi^- \pi^-)$

- In MC, indeed, no **Fermi energy** or **\bar{p} momentum** are considered in **$\bar{p}n$ interaction**, **$P(\pi^+ \pi^- \pi^-) \sim 0$**
- However, in data, both Fermi energy and \bar{p} momentum will contribute a **non-zero momentum** to $\bar{p}n$ interaction

$$\bar{p}n \rightarrow \pi^+ \pi^- \pi^- \pi^0$$

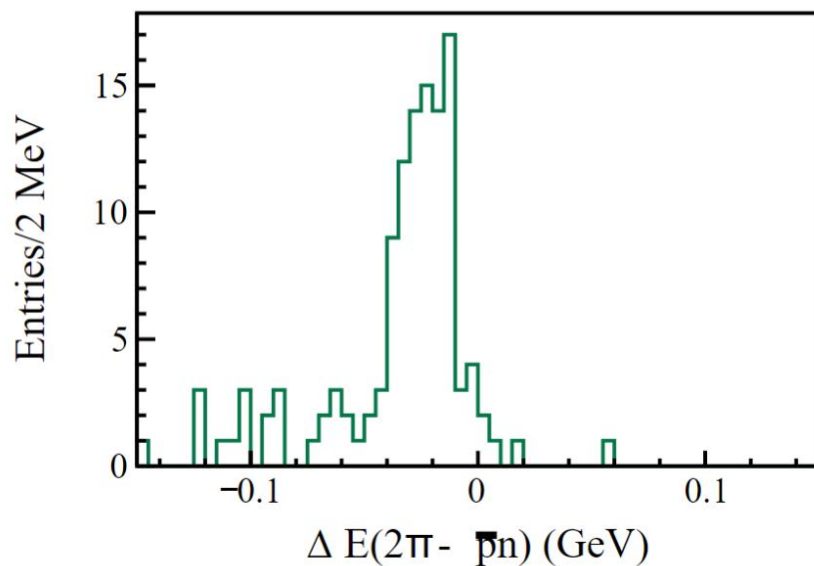


Inconsistence in the amplitude in 3pi mass spectrum

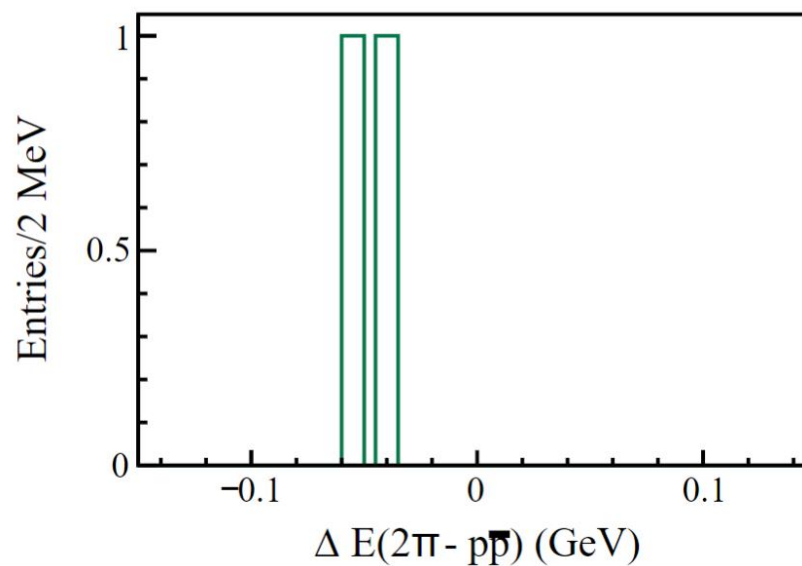
- Clear ω signal observed in data while no such structure considered in MC

$$\bar{p}p \rightarrow \pi^+ \pi^-$$

Data



MC



Inconsistence in the production rate between data and MC

➤ Clear $\bar{p}p \rightarrow \pi^+ \pi^-$ signal but not significantly in MC

Reconstructed events (preliminary)

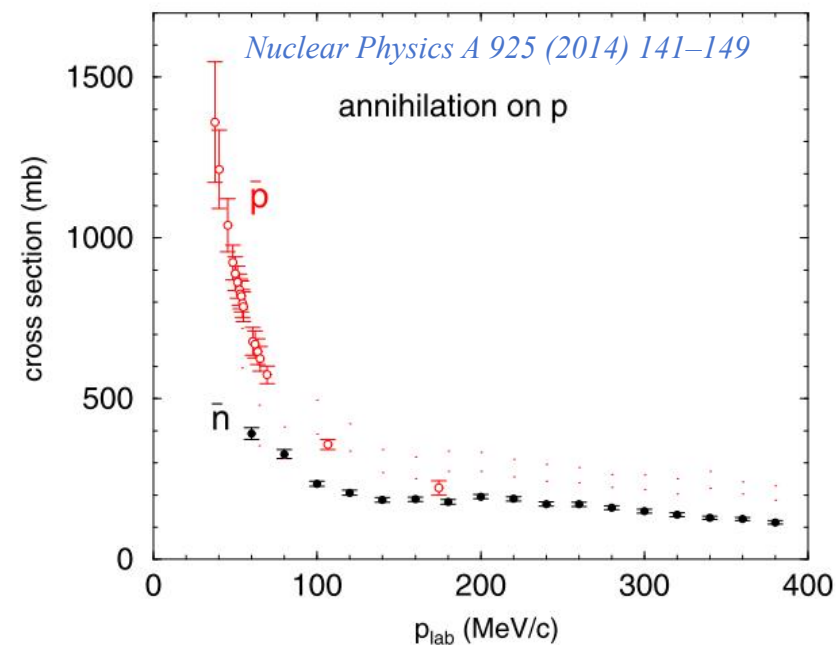
- Production rates of different channels.

Differences between data and MC

Process	0<P<0.2 GeV/c		P>0.2 GeV/c	
	Data	MC	Data	MC
$\bar{p}n \rightarrow \pi^+ \pi^- \pi^-$	774 (10.1%)	209 (9.2%)	751 (11.2%)	134 (7.2%)
$\bar{p}n \rightarrow \pi^+ \pi^- \pi^- \pi^0$	3361 (43.7%)	825 (36.2%)	2049 (30.5%)	796 (42.6%)
$\bar{p}p \rightarrow \pi^+ \pi^-$	78 (1.0%)	4 (0.2%)	146 (2.2%)	15 (0.8%)
$\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$	1529 (19.9%)	270 (11.9%)	1299(19.3%)	264 (14.1%)
$\bar{p}p \rightarrow \pi^+ \pi^+ \pi^- \pi^-$	833 (10.8%)	409 (18.0%)	1035 (15.4%)	246 (13.2%)
$\bar{p}p \rightarrow \pi^+ \pi^+ \pi^- \pi^- \pi^0$	1117 (14.5%)	561 (24.6%)	1447 (21.5%)	415 (22.2%)

Conclusion

- Overall, the simulation of antiproton interactions is considered to be good. By analyzing the inclusive and exclusive distributions, some differences have been found:
 - Multiplicity of **proton** show **large difference** between data and MC.
 - Inconsistence in the **momentum of final states** between data and MC.
 - Inconsistence in the amplitude in **3pi mass spectrum**.
 - Inconsistence in the **production rate** between data and MC.



Back Up:

● $\bar{p}p \rightarrow \text{Anything}$

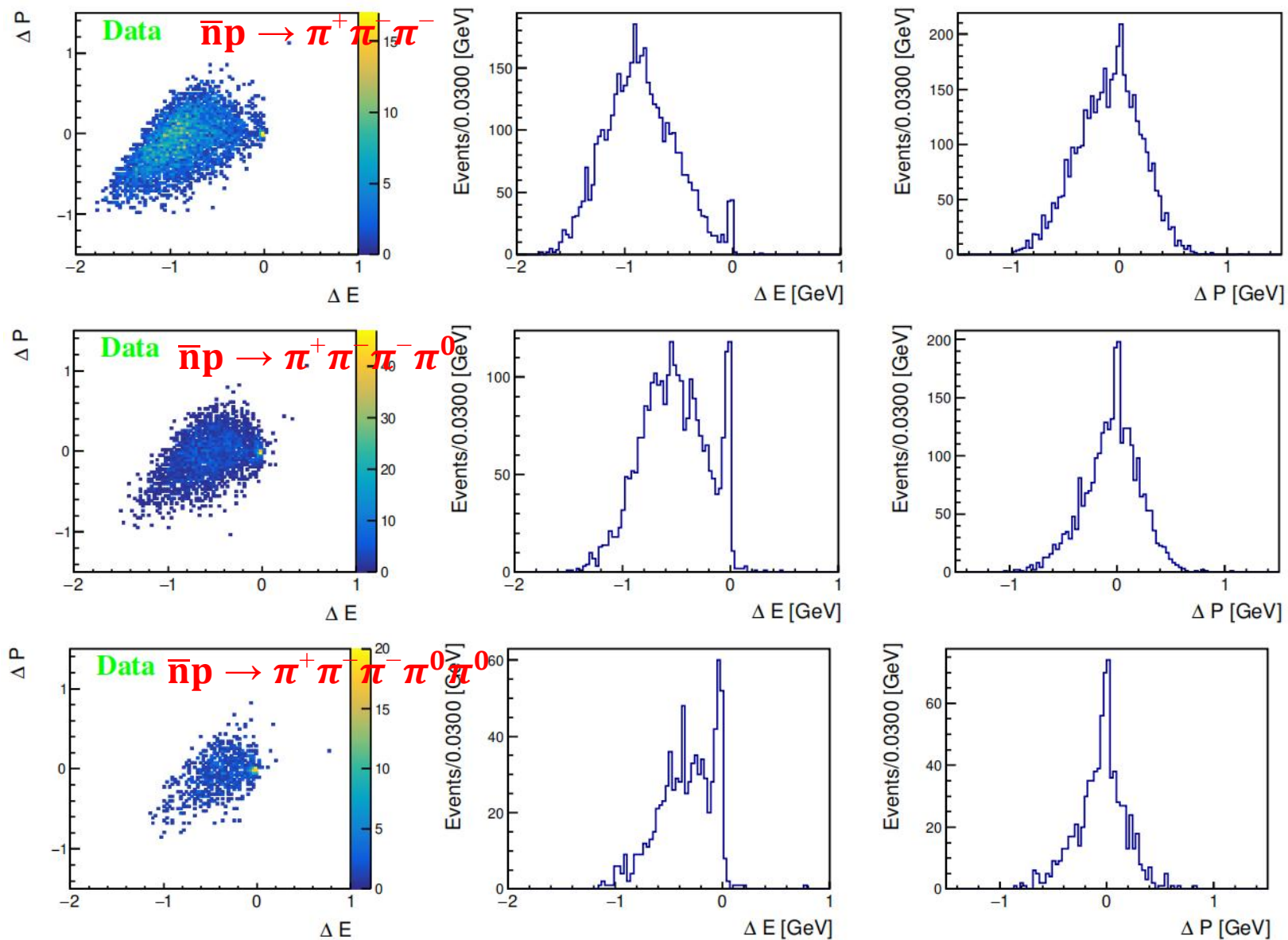
Annihilation frequencies of $\bar{p}p$ annihilation at rest in liquid H₂ into pionic final states (in units of 10⁻³), from [2,48,216]

Final state	BNL	CERN	Crystal Barrel
All neutral	32 ± 5	41 ⁺² ₋₆	35 ± 3
2π ⁰			0.65 ± 0.03
3π ⁰			7.0 ± 0.4
4π ⁰			3.1 ± 0.2
5π ⁰			9.2 ± 0.4
6π ⁰ (1)			0.12 ± 0.01
7π ⁰ (1)			1.3 ± 0.1
8π ⁰ (2)			0.012 ± 0.001
9π ⁰ (2)			0.025 ± 0.003
Non-multipion			15 ± 5
π ⁺ π ⁻	3.2 ± 0.3	3.33 ± 0.17	3.14 ± 0.12
π ⁺ π ⁻ π ⁰	78 ± 9	69.0 ± 3.5	67 ± 10
π ⁺ π ⁻ 2π ⁰			122 ± 18
π ⁺ π ⁻ 3π ⁰			133 ± 20
π ⁺ π ⁻ 4π ⁰			36 ± 5
π ⁺ π ⁻ 5π ⁰ (1)			13 ± 2
π ⁺ π ⁻ MM	345 ± 12	358 ± 8	65 ± 20*
2π ⁺ 2π ⁻	58 ± 3	69 ± 6	56 ± 9
2π ⁺ 2π ⁻ π ⁰	187 ± 7	196 ± 6	210 ± 32
2π ⁺ 2π ⁻ 2π ⁰			177 ± 27
2π ⁺ 2π ⁻ 3π ⁰			6 ± 2
2π ⁺ 2π ⁻ MM	213 ± 11	208 ± 7	30 ± 15*
3π ⁺ 3π ⁻	19 ± 2	21.0 ± 2.5	40 ± 3 ^a
3π ⁺ 3π ⁻ π ⁰	16 ± 3	8.5 ± 1.5	
3π ⁺ 3π ⁻ MM	16 ± 3	3 ± 1	
Sum	954 ± 18	986 ± 6	970 ± 58

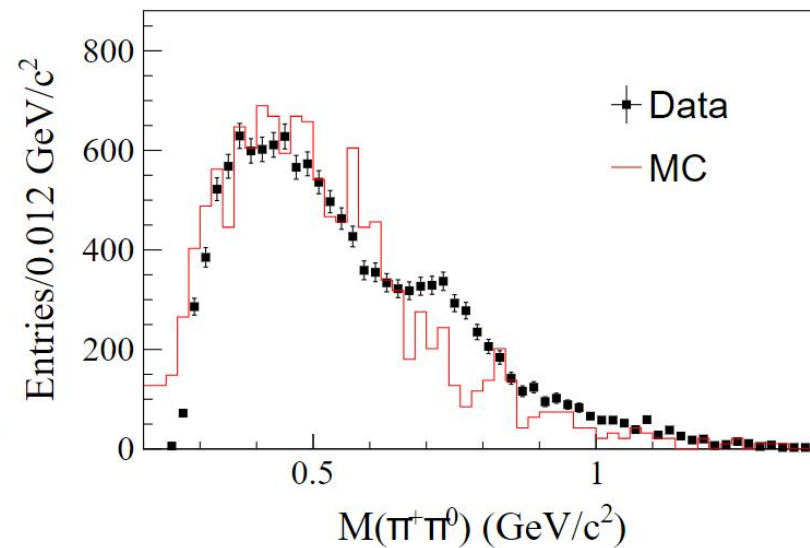
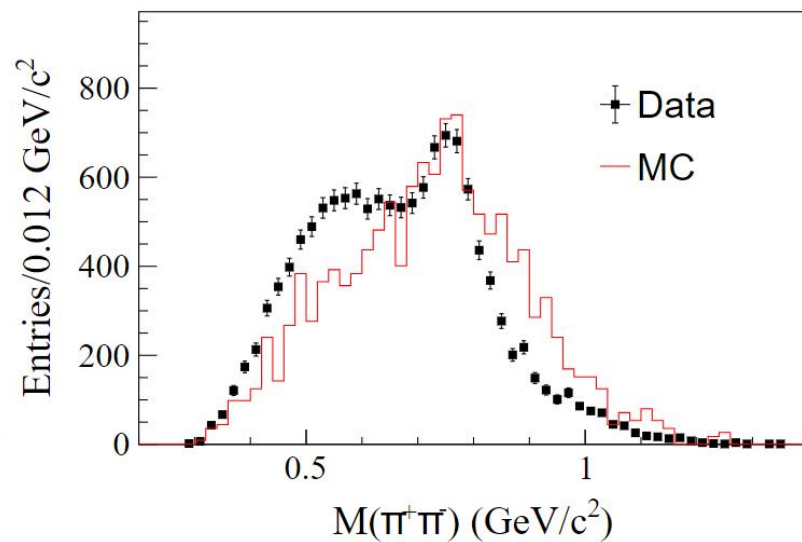
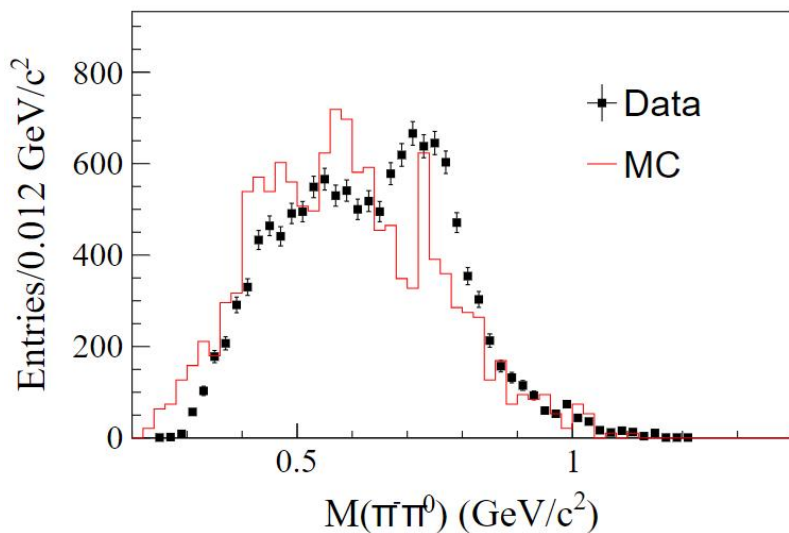
● $\bar{p}n \rightarrow \text{Anything}$

Final state	Frequency (in %)
π ⁻ nπ ⁰	16.4 ± 0.5
π ⁻ π ⁰	0.40 ± 0.04
π ⁻ 2π ⁰	0.68 ± 0.07
π ⁻ 4π ⁰	1.32 ± 0.20
2π ⁻ π ⁺ nπ ⁰	59.7 ± 1.2
2π ⁻ π ⁺	1.57 ± 0.21
2π ⁻ π ⁺ π ⁰	21.8 ± 2.2
2π ⁻ π ⁺ 2π ⁰	6.3 ± 1.1
3π ⁻ 2π ⁺ nπ ⁰	23.4 ± 0.7
3π ⁻ 2π ⁺	5.15 ± 0.47
3π ⁻ 2π ⁺ π ⁰	15.1 ± 1.0
4π ⁻ 3π ⁺ nπ ⁰	0.39 ± 0.07
Sum	95.5 ± 1.5%
Final state	Frequency (in 10 ⁻⁴)
K ⁰ K ⁻	14.7 ± 2.1
K ⁰ K ⁺ π ⁻ π ⁻	36.0 ± 4.2
K _S K _S π ⁻	14.7 ± 2.0
K _S K _L π ⁻	21.2 ± 3.6
K ⁰ K ⁺ π ⁻ π ⁻	24.8 ± 2.6
K ⁰ K ⁻ π ⁺ π ⁻	34.2 ± 3.5
K _S K _S π ⁻ π ⁰	25.6 ± 2.8
K ⁰ K ⁺ π ⁻ π ⁻ π ⁰	1.6 ± 0.9
K _S K ⁻ π ⁺ π ⁻ π ⁰	33.6 ± 3.8
K _S K ⁻ ω	35.0 ± 5.2
K _S K _S π ⁺ π ⁻ π ⁻	2.8 ± 1.2
K _S K _L π ⁺ π ⁻ π ⁻	1.9 ± 1.2
Sum	2.5 ± 0.1%

Back Up: From ZZL's Memo



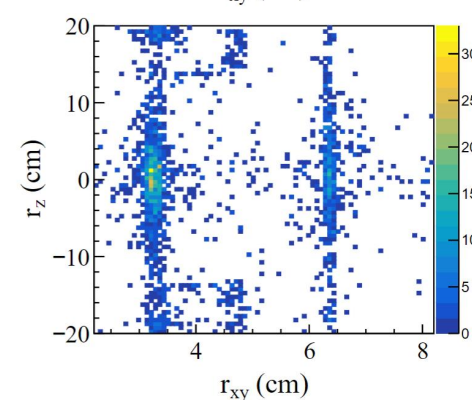
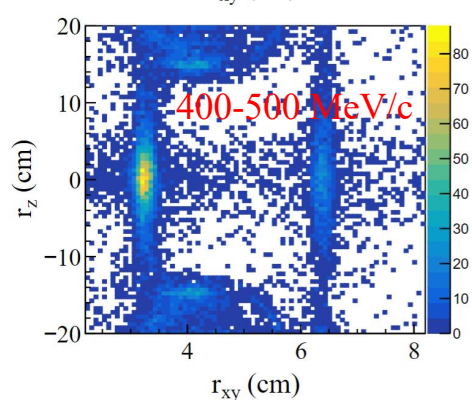
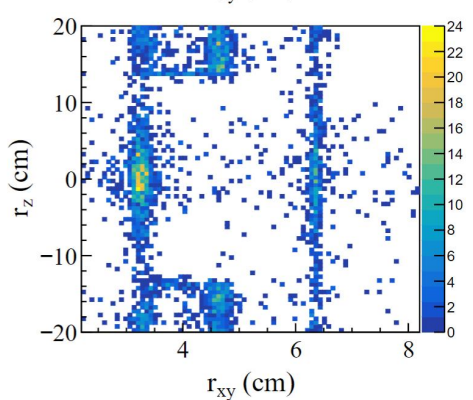
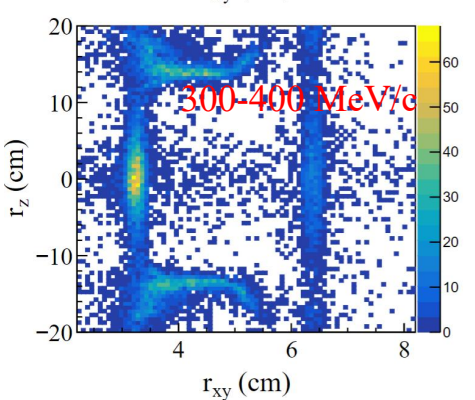
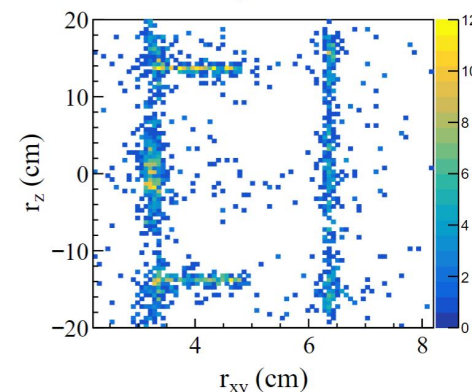
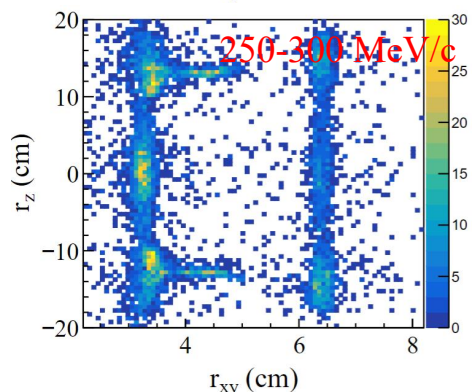
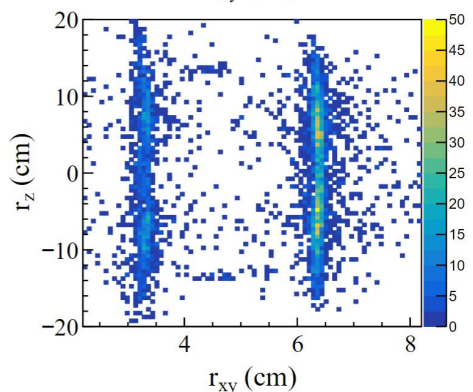
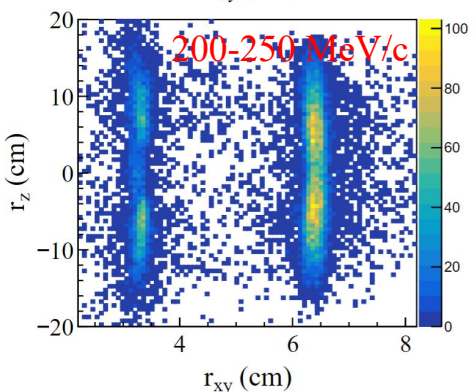
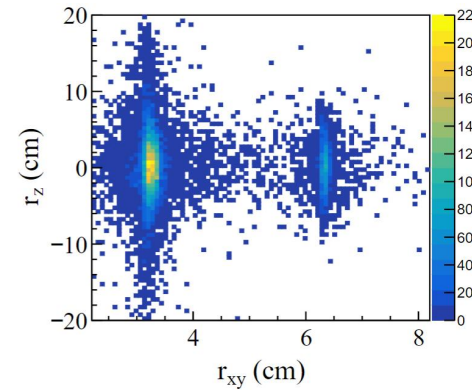
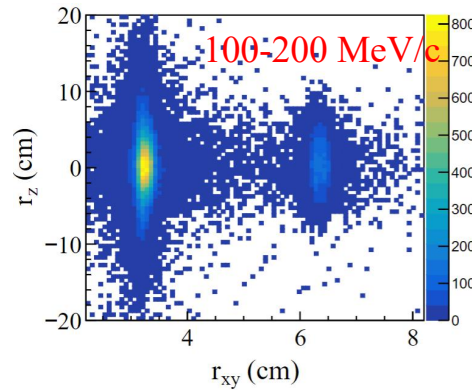
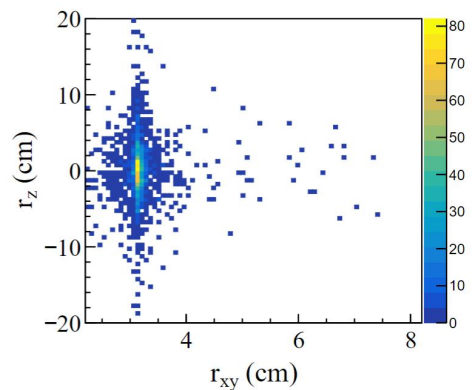
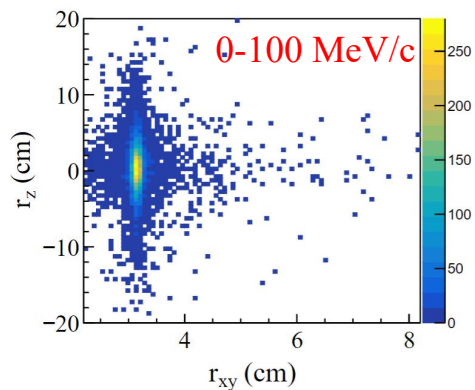
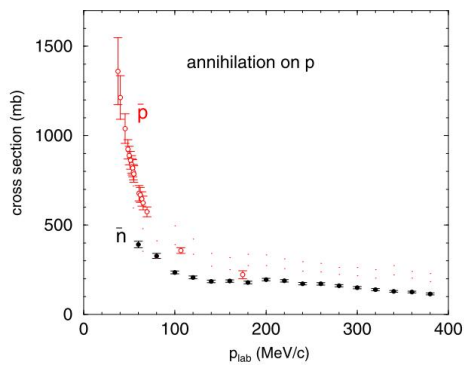
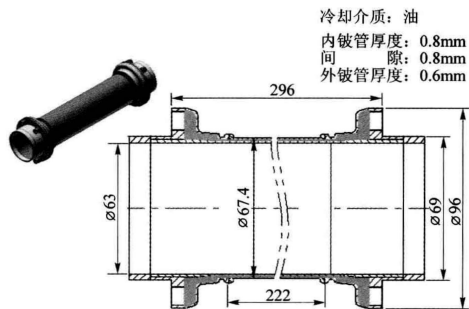
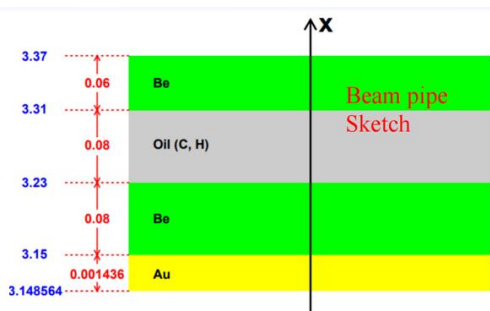
$$\bar{p}n \rightarrow \pi^+ \pi^- \pi^- \pi^0$$



Inconsistence in the amplitude in 2pi mass spectrum

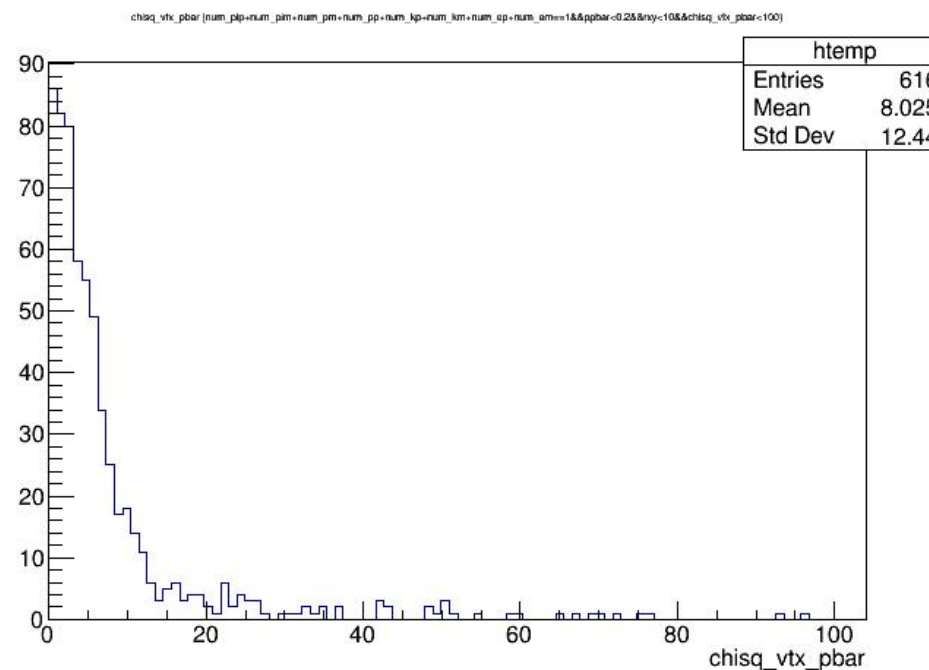
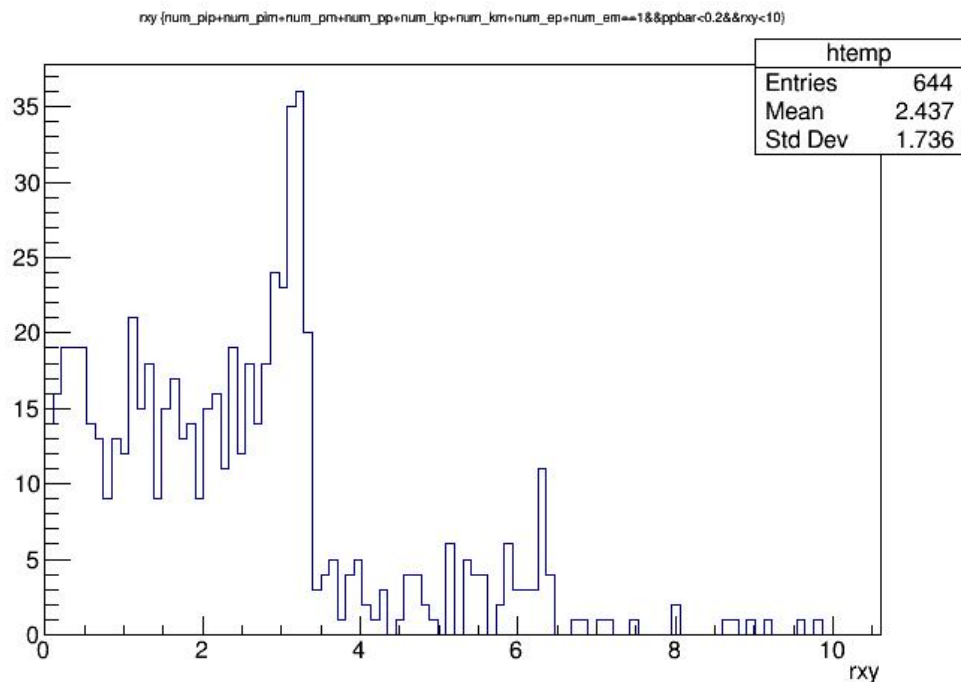
- Clear ρ signal observed in data, also in MC?

Back Up: Rxy and Rz from Vertexfit



Back Up: Vertexfit for one track

- When fitting with only one charged track in the vertex fit, it seems that rxy directly comes from the POCA point before fitting.
- The chisq value has not been set with a protection value, but the output appears to be normal.



Back Up: MC Truth From G4

```
***** currentTrack->GetTrackStatus() == fStopAndKill && current
particle = anti_proton
ParticleID = 4
*****Pre ProcessName : hIoni
*****Post ProcessName : hFritiofCaptureAtRest
particle = anti_proton nSeco = 18 processName : hFritiofCaptureAtRest
initialMomentum = 106.64635478233 82.389525140197 -126.49583464384
Momentum = 184.83147736094 MeV
Current Position: 33.33209804948 mm, -31.340794565386 mm
-----HAILIN SONG-----
*****sectrk->GetParentID() == pbarTrackID*****
*****Don't cout the hIoni process*****
ProcessName = hFritiofCaptureAtRest
sectrk Name = e-
Particle Total Energy: 0.51122561100725 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = e-
Particle Total Energy: 0.51103512850412 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = e-
Particle Total Energy: 0.5110445557485 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = e-
Particle Total Energy: 0.51105756290064 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = gamma
Particle Total Energy: 7.7115813705462e-05 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = gamma
Particle Total Energy: 0.00010422648777711 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = gamma
Particle Total Energy: 0.0001457113727147 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = gamma
Particle Total Energy: 0.0042427723231634 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = gamma
Particle Total Energy: 0.0061713051973286 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = gamma
Particle Total Energy: 0.031891650644808 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = pi-
Particle Total Energy: 505.9142822882 MeV
```

```
-----
Hadronic Processes for anti_proton

Process: hadElastic
  Model: hElasticLHEP: 0 eV ---> 100.1 MeV
  Model: AntiAElastic: 100 MeV ---> 100 TeV
  Cr_sctns: AntiAGlauber: 0 eV ---> 25.6 PeV

Process: anti_protonInelastic
  Model: FTFP: 0 eV ---> 100 TeV
  Cr_sctns: AntiAGlauber: 0 eV ---> 25.6 PeV

Process: hFritiofCaptureAtRest
```

```
ProcessName = hFritiofCaptureAtRest
sectrk Name = pi+
Particle Total Energy: 395.42849798255 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = pi+
Particle Total Energy: 219.19919866795 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = pi-
Particle Total Energy: 286.70372439695 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = pi0
Particle Total Energy: 446.20149843121 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = neutron
Particle Total Energy: 944.63849020808 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = Li7
Particle Total Energy: 6535.8661967691 MeV
ProcessName = hFritiofCaptureAtRest
sectrk Name = gamma
Particle Total Energy: 0.48262972300109 MeV
num_pp = 0 num_pm = 0 num_pip = 2 num_pim = 2 num_pi0 = 1 num_ep = 0 num_em = 4
num_kp = 0 num_km = 0 num_gam = 7 num_neu = 1 num_antineu = 0 num_others = 1
```

Back Up: MC Truth From G4

```
particle = anti_proton nSeco = 10 processName : anti_protonInelastic
initialMomentum = -201.95065483568 -100.80757319353 -173.14407134911
Momentum = 284.47337879857 MeV
Current Position: 31.493584740201 mm, -15.388123437615 mm
-----HAILIN SONG-----
*****sectrk->GetParentID() == pbarTrackID*****
*****Don't cout the hIoni process*****
ProcessName = anti_protonInelastic
sectrk Name = eta
Particle Total Energy: 674.66462378914 MeV
ProcessName = anti_protonInelastic
sectrk Name = pi-
Particle Total Energy: 167.45148121246 MeV
ProcessName = anti_protonInelastic
sectrk Name = pi0
Particle Total Energy: 309.83198907407 MeV
ProcessName = anti_protonInelastic
sectrk Name = pi+
Particle Total Energy: 434.34401256222 MeV
ProcessName = anti_protonInelastic
sectrk Name = pi-
Particle Total Energy: 305.09854529972 MeV
ProcessName = anti_protonInelastic
sectrk Name = neutron
Particle Total Energy: 943.61355852983 MeV
ProcessName = anti_protonInelastic
sectrk Name = gamma
Particle Total Energy: 6.801792755401 MeV
ProcessName = anti_protonInelastic
sectrk Name = gamma
Particle Total Energy: 0.55163622953274 MeV
ProcessName = anti_protonInelastic
sectrk Name = gamma
Particle Total Energy: 0.2610939520787 MeV
ProcessName = anti_protonInelastic
sectrk Name = Au195[1979.490]
Particle Total Energy: 181571.0536617 MeV
num_pp = 0 num_pm = 0 num_pip = 1 num_pim = 2 num_pi0 = 1 num_ep = 0 num_em = 0
num_kp = 0 num_km = 0 num_gam = 3 num_neu = 1 num_antineu = 0 num_others = 2
```

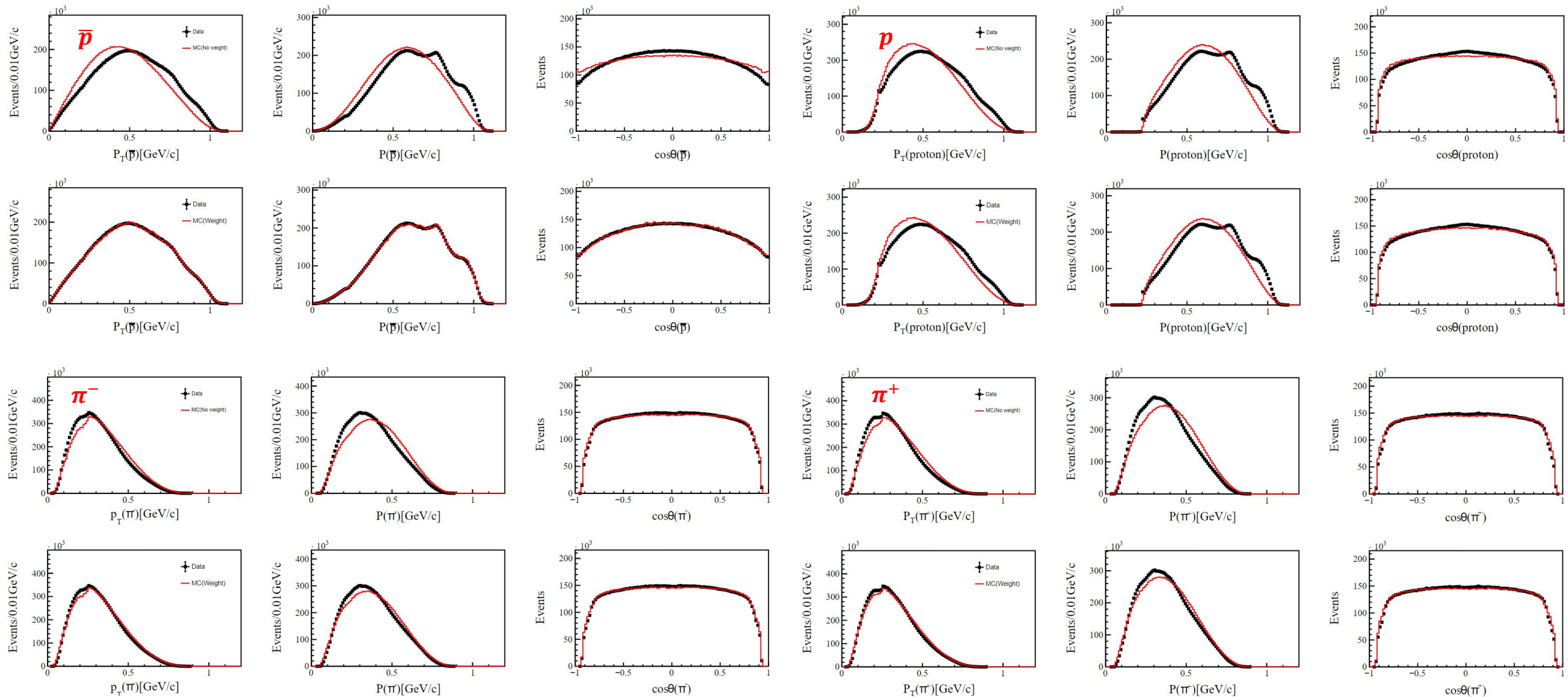
```
-----
Hadronic Processes for anti_proton

Process: hadElastic
  Model: hElasticLHEP: 0 eV ---> 100.1 MeV
  Model: AntiAElastic: 100 MeV ---> 100 TeV
  Cr_sctns: AntiAGlauber: 0 eV ---> 25.6 PeV

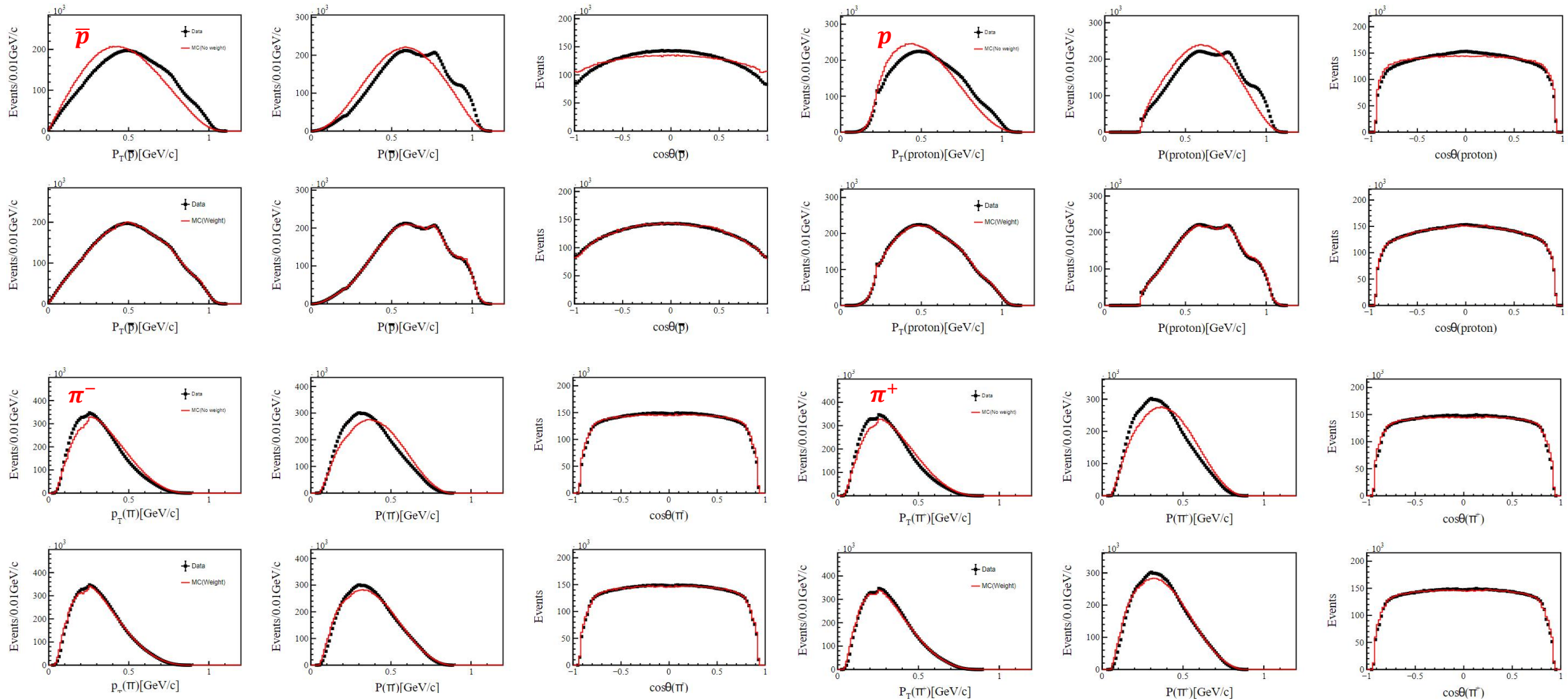
Process: anti_protonInelastic
  Model: FTFP: 0 eV ---> 100 TeV
  Cr_sctns: AntiAGlauber: 0 eV ---> 25.6 PeV

Process: hFritiofCaptureAtRest
```

Back Up: only weight \bar{p}

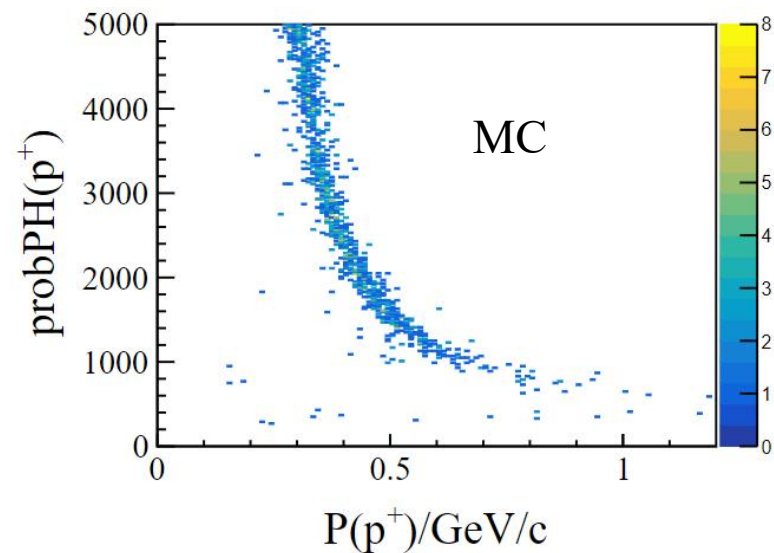
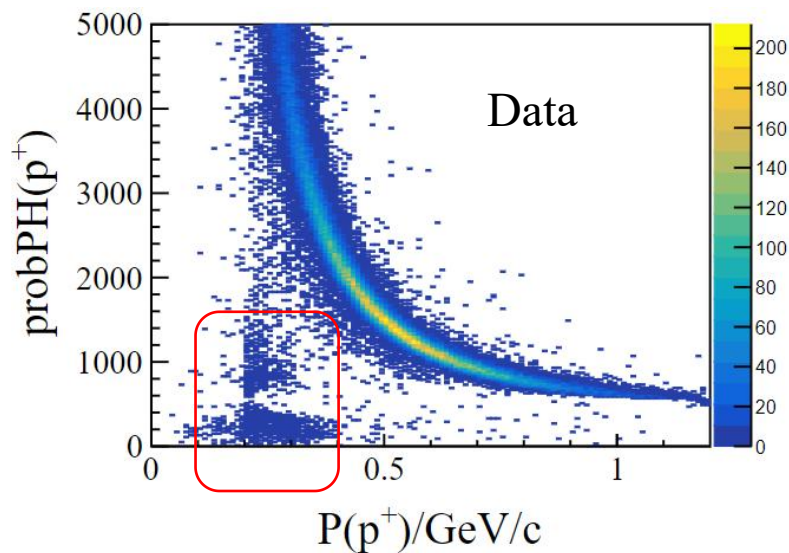
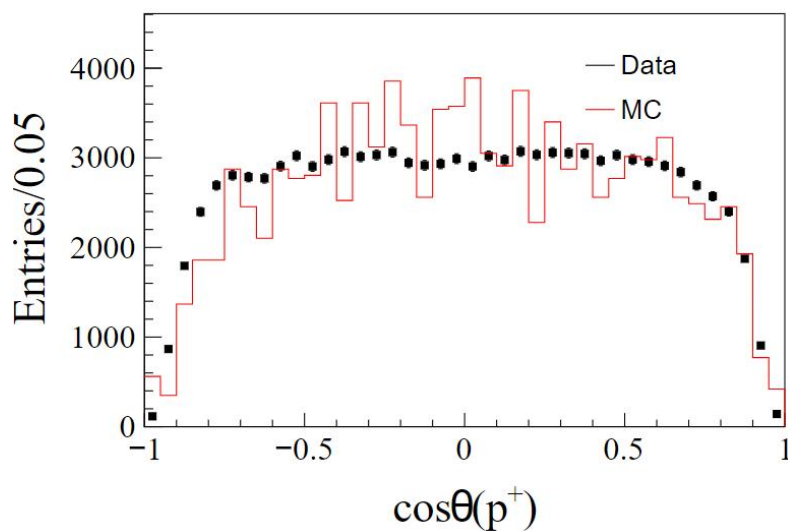
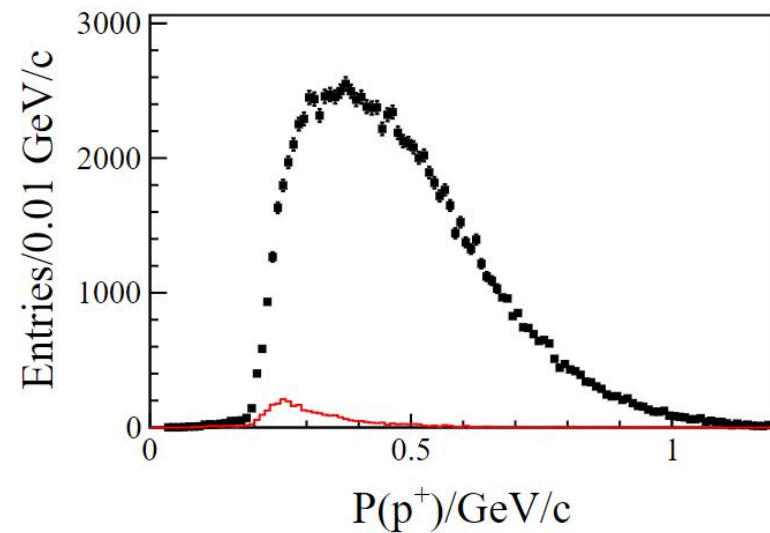
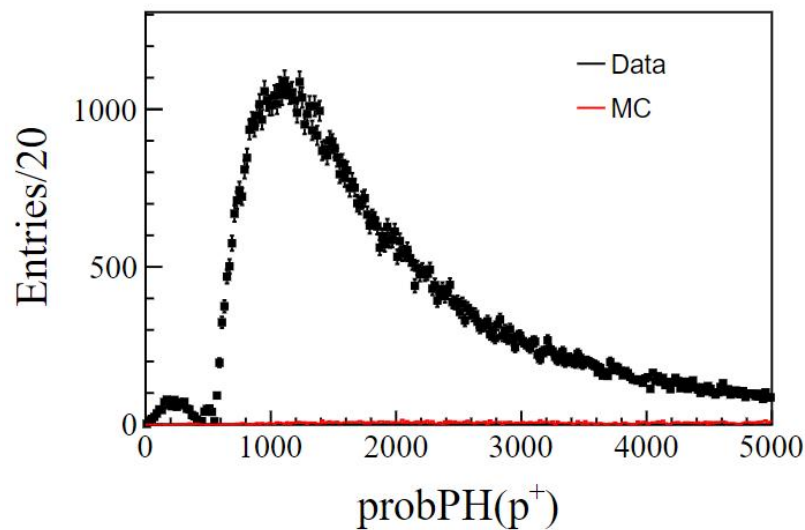


Back Up: only weight \bar{p} and p

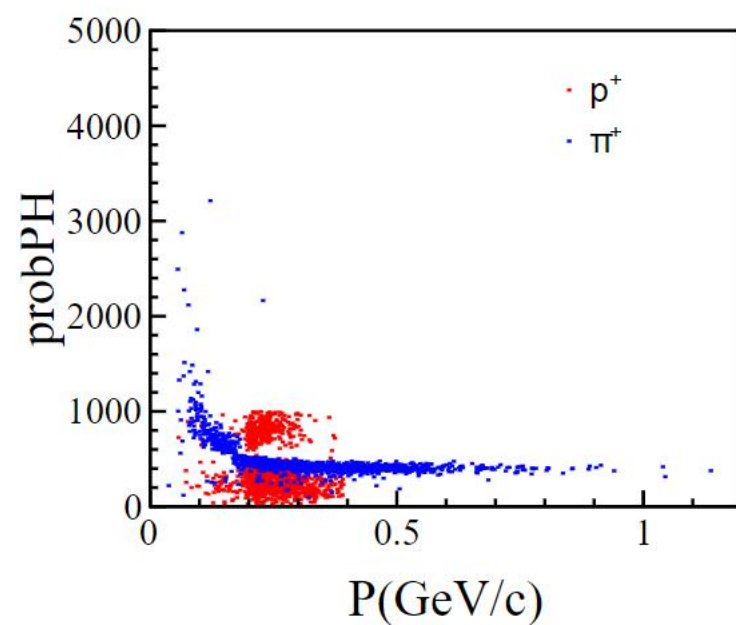
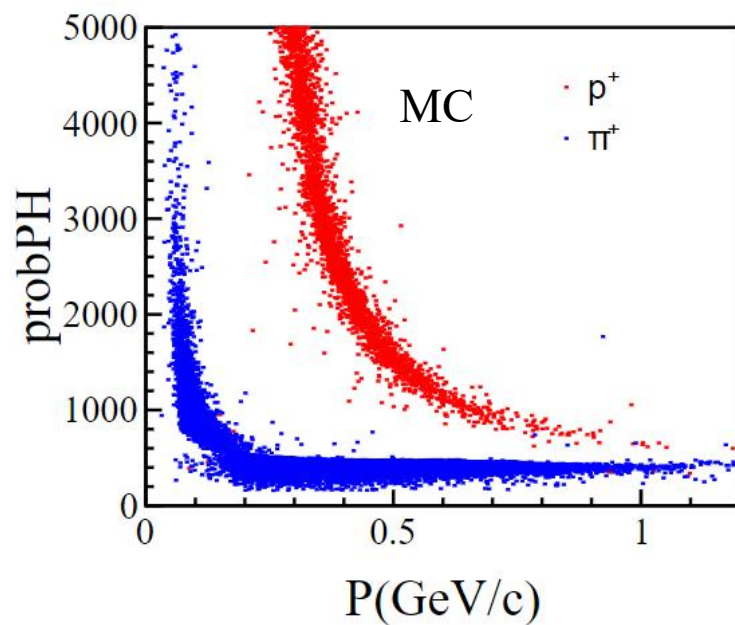
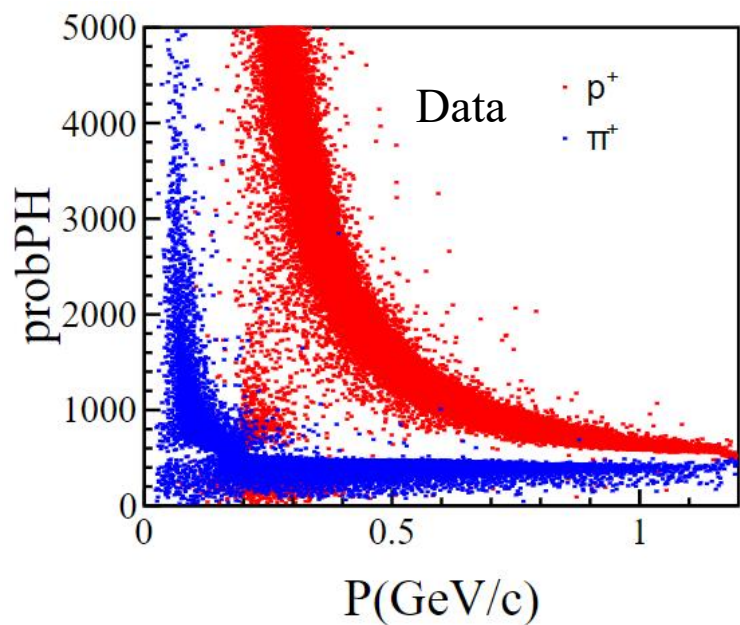


Back Up: Study of p^+

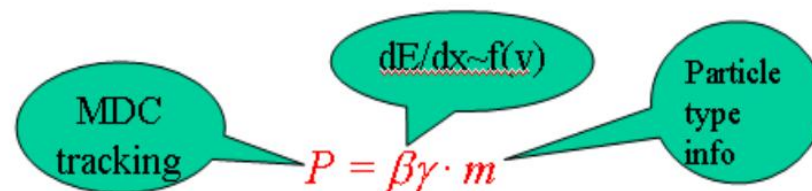
- Select the p^+ with the highest energy for at least one p^+ event.



Back Up: Study of p^+

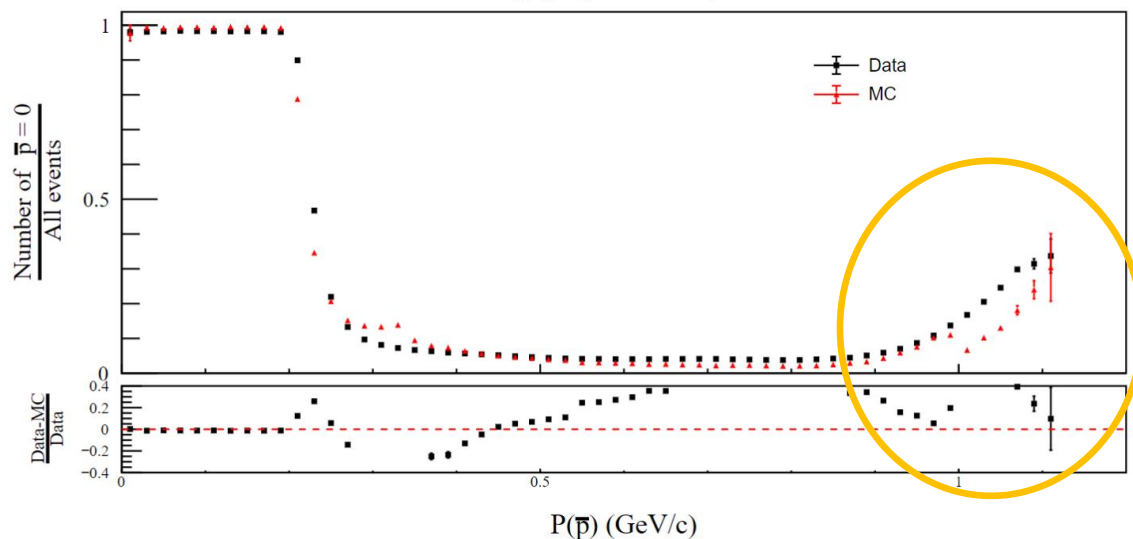
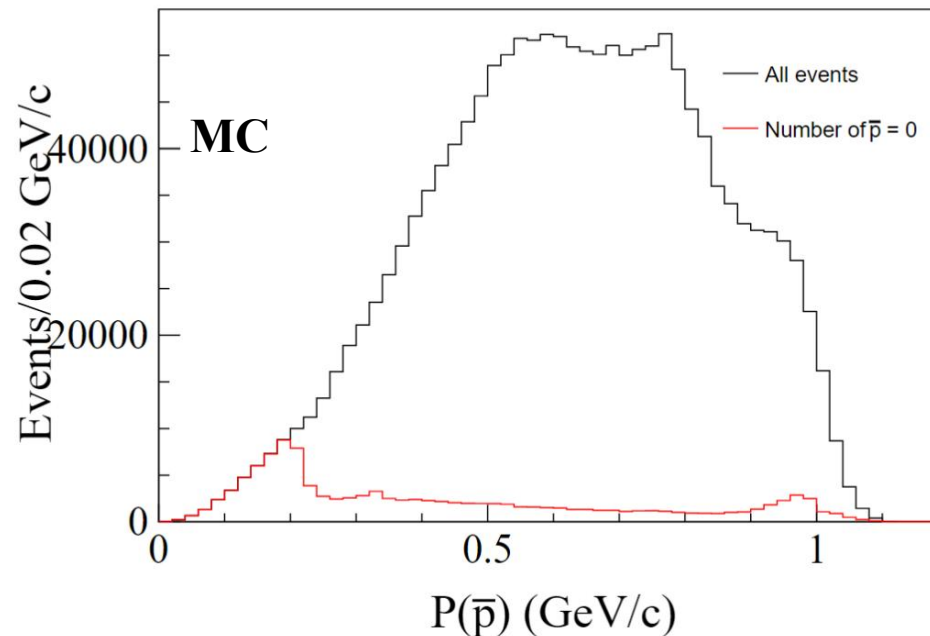
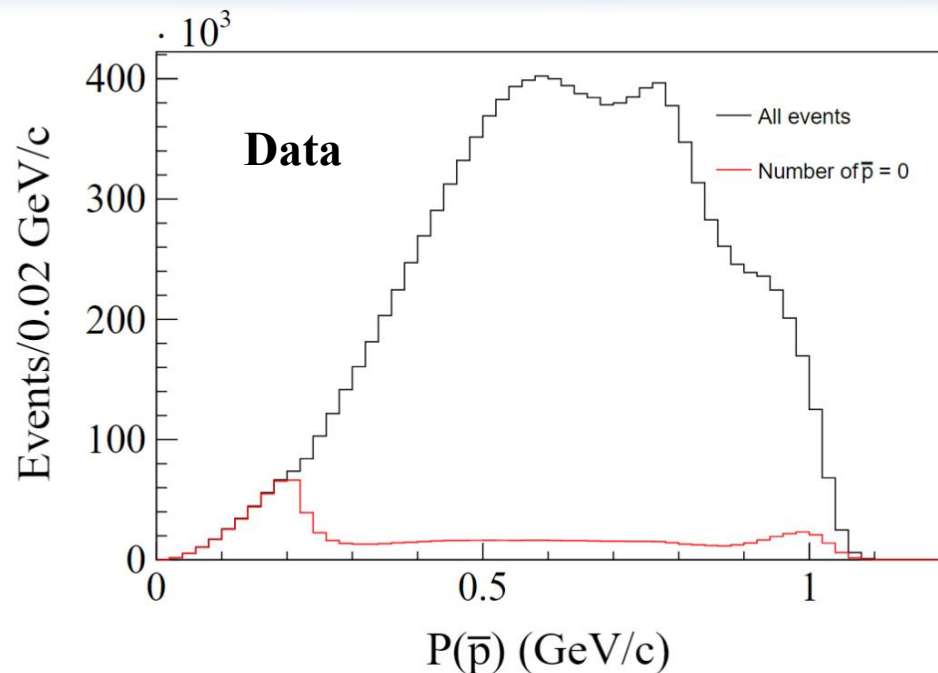


$$\chi = \frac{dE/dx(\text{测量}) - dE/dx(\text{期望})}{\sigma(dE/dx)}$$



- 根据不同粒子的假设得到不同的 χ 值，比较 χ 值大小，可以得到该粒子属于某种粒子的几率，从而实现粒子鉴别

Back Up: Features of $\bar{p}N$ interaction (inclusive)

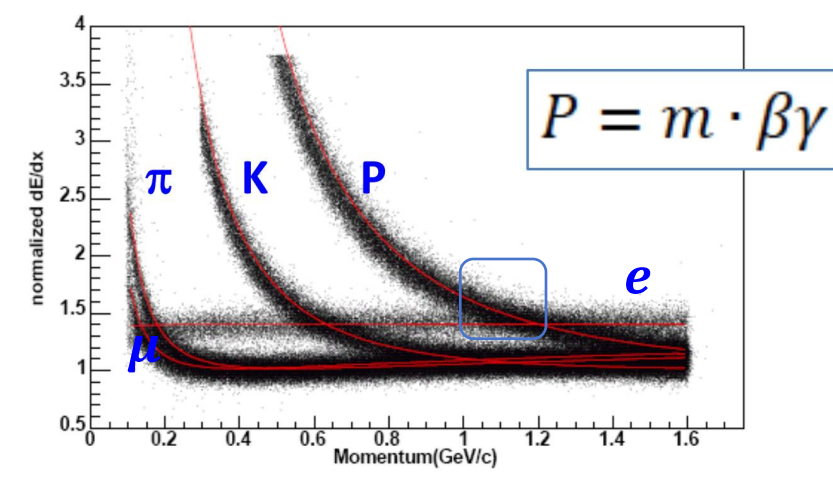
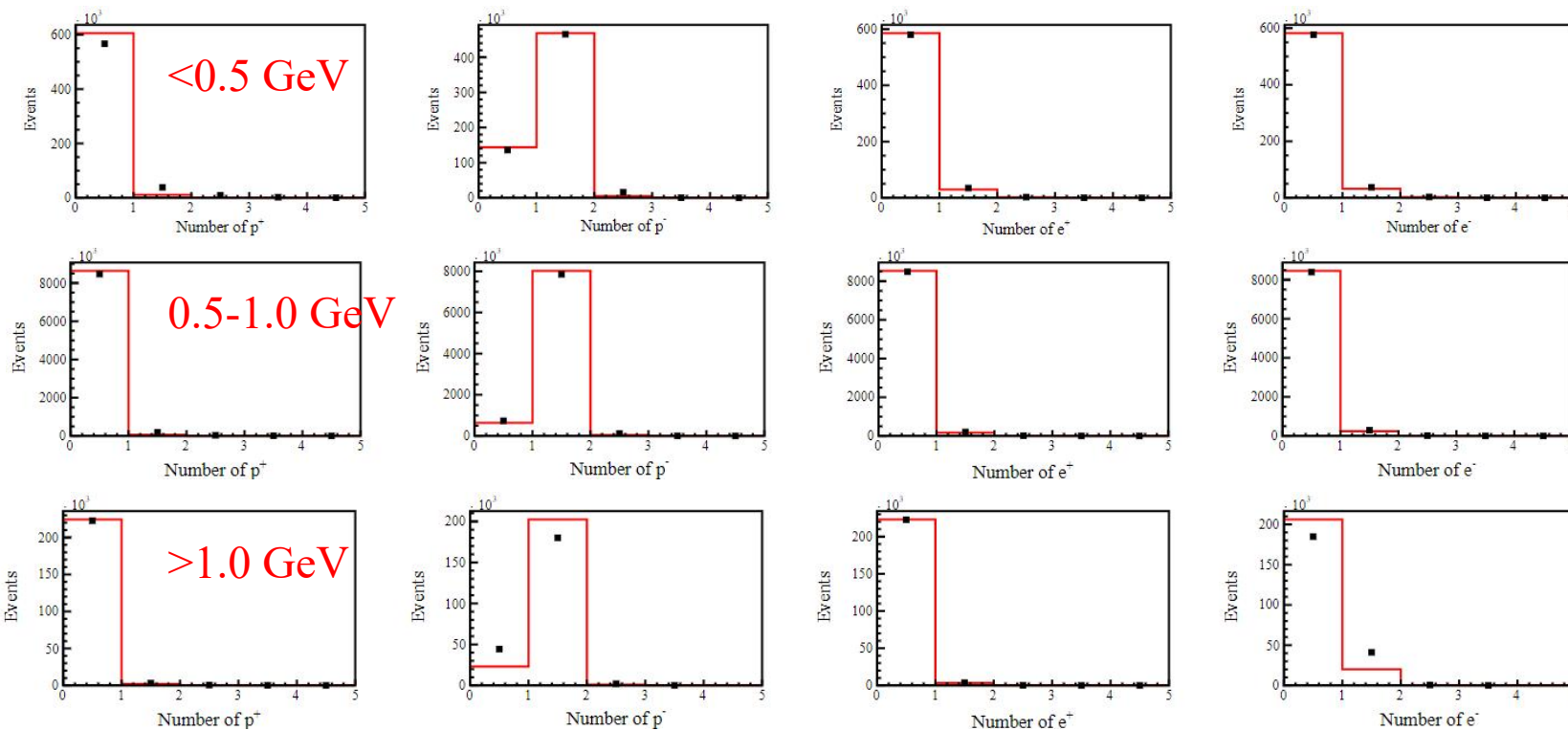


More than **10M \bar{p}** sample within acceptance
 About **1M \bar{p}** didn't been observed \rightarrow interacted
Below 200 MeV, almost **100% \bar{p}** interacted.

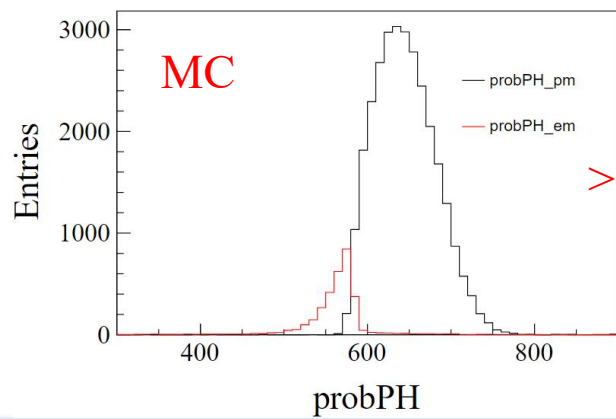
Abnormal increasing interaction ratio with $P(\bar{p}) > 1\text{GeV}$

We focus on $P(\bar{p}) < 200\text{ MeV}$ following

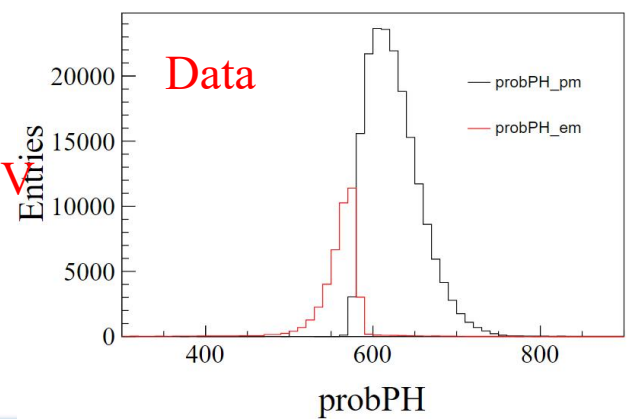
Back Up: Abnormal increasing interaction ratio



- Just use dedx info for PID, when $P(\bar{p}) > 1 \text{ GeV}/c$, **more antiproton will be misidentified to be electron.**



>1.0 GeV



Back Up: Abnormal increasing interaction ratio

