

Control Sample of

$$J/\psi \rightarrow \Sigma^+ (\rightarrow p\pi^0) \bar{\Sigma}^- (\rightarrow \bar{p}\pi^0)$$

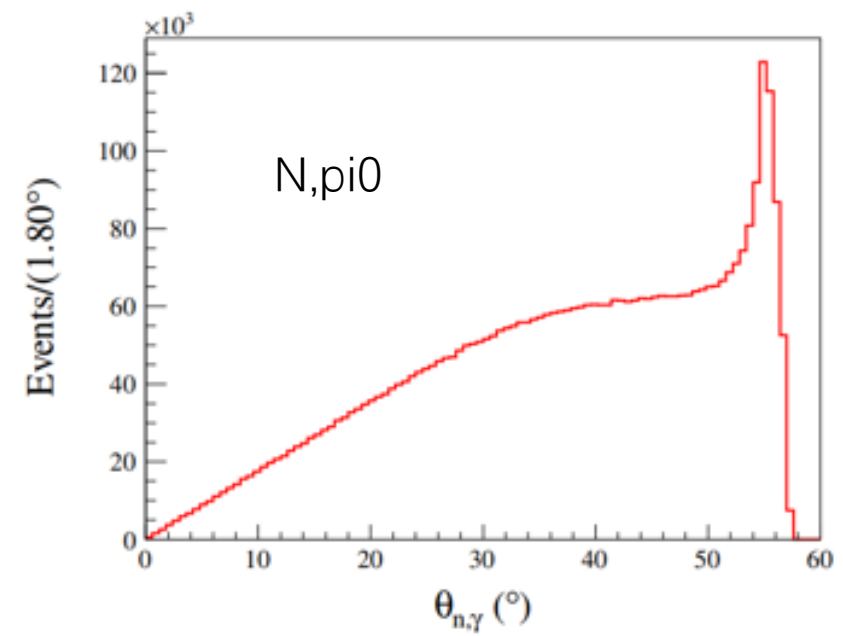
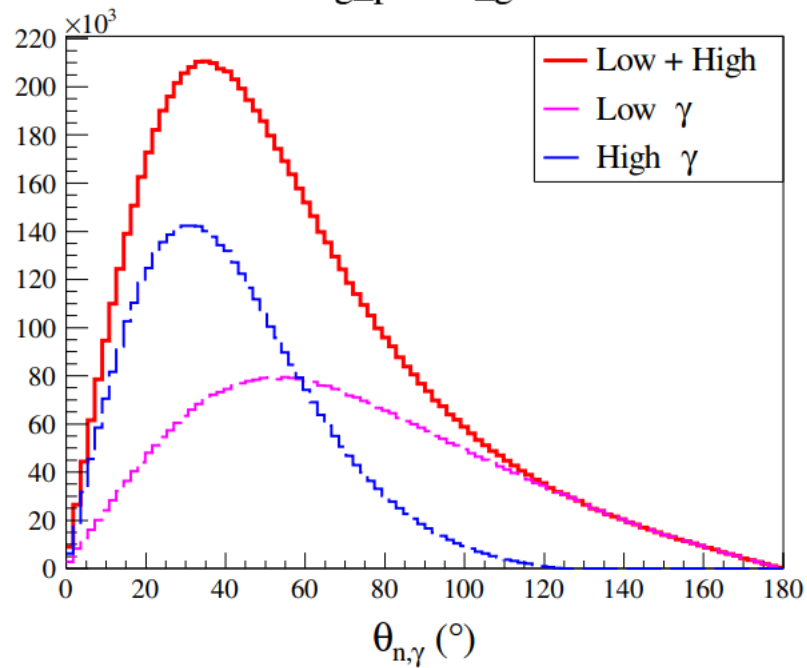
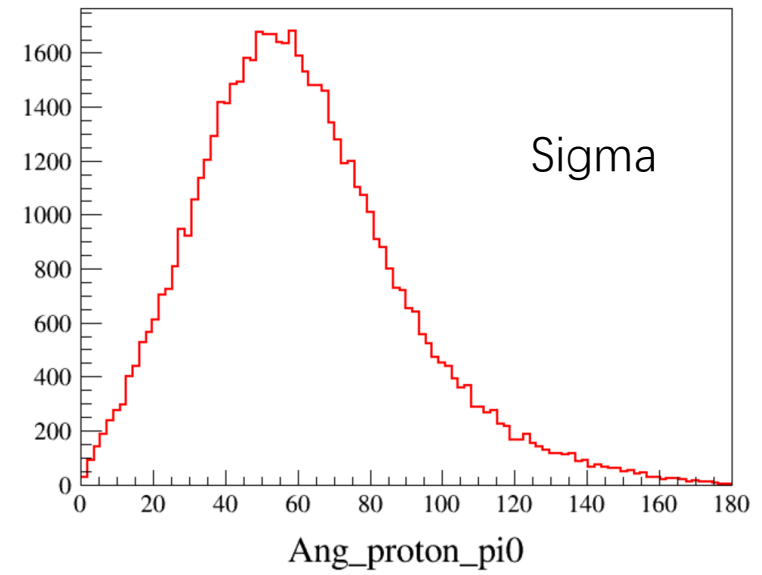
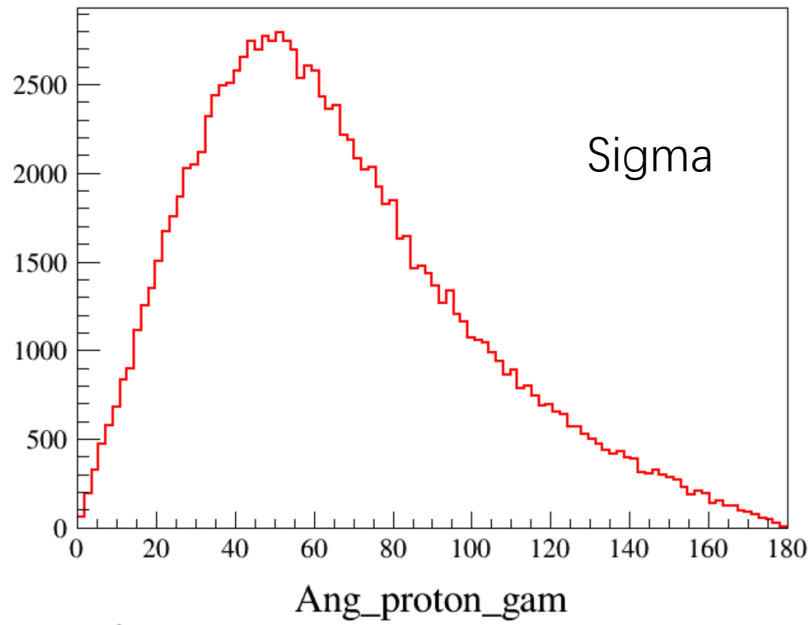
# Compare with Signal process

$$J/\psi \rightarrow \bar{\Lambda}(\rightarrow \bar{p}\pi^+)\Lambda(\rightarrow n\pi^0)$$

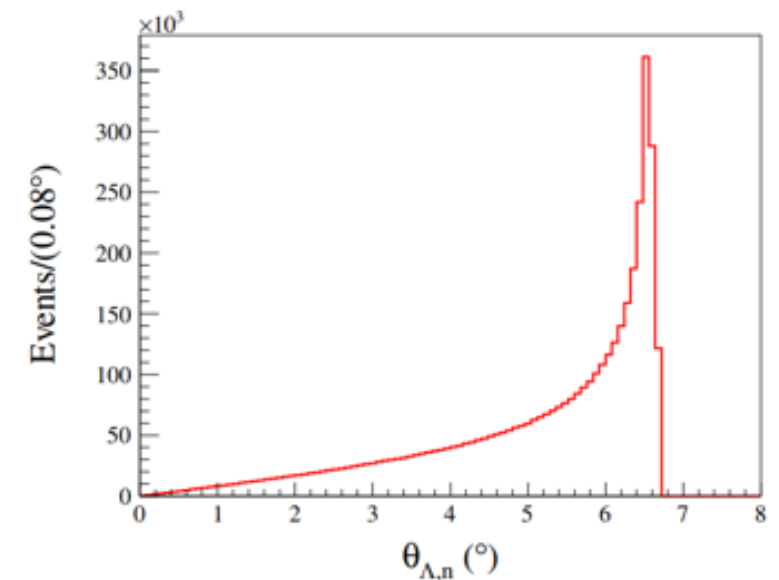
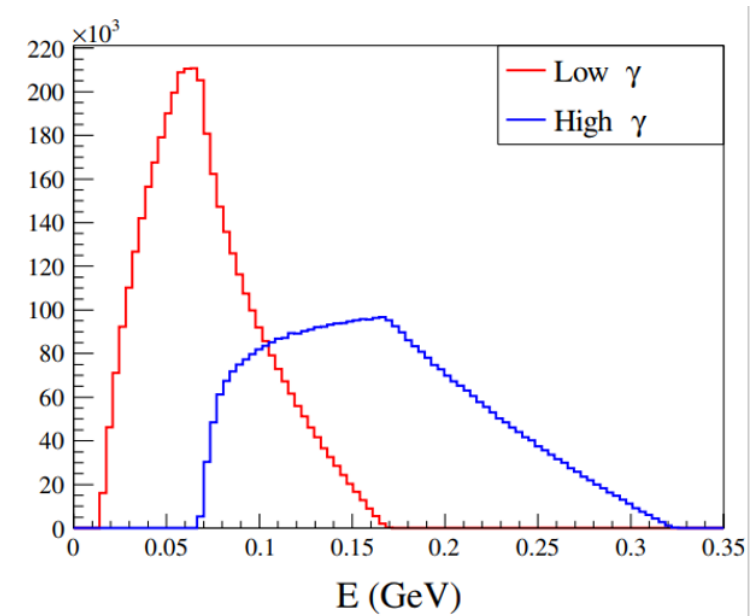
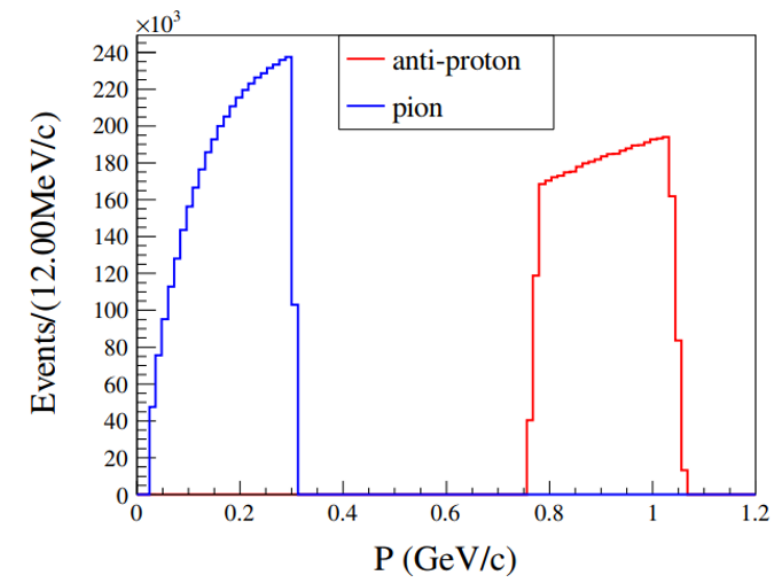
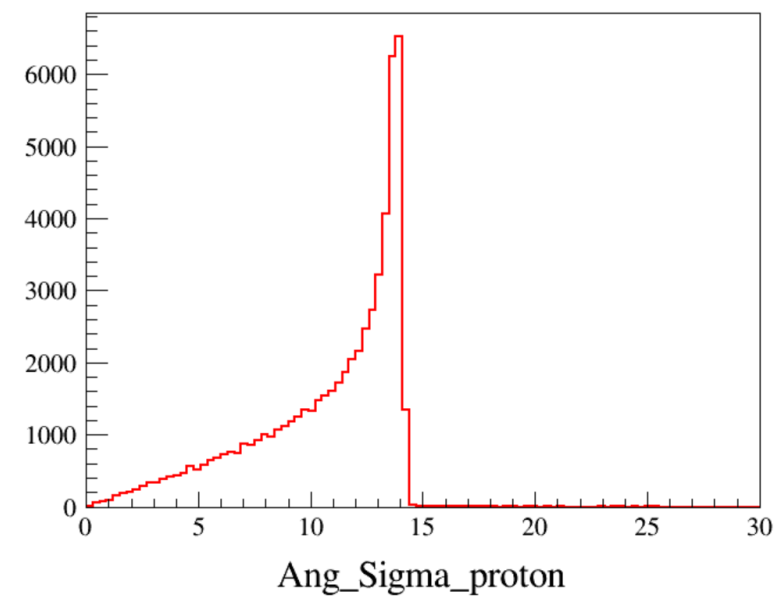
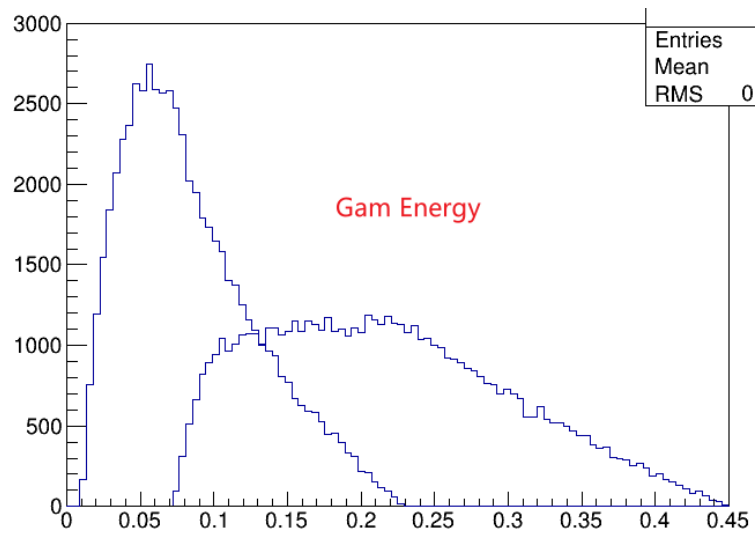
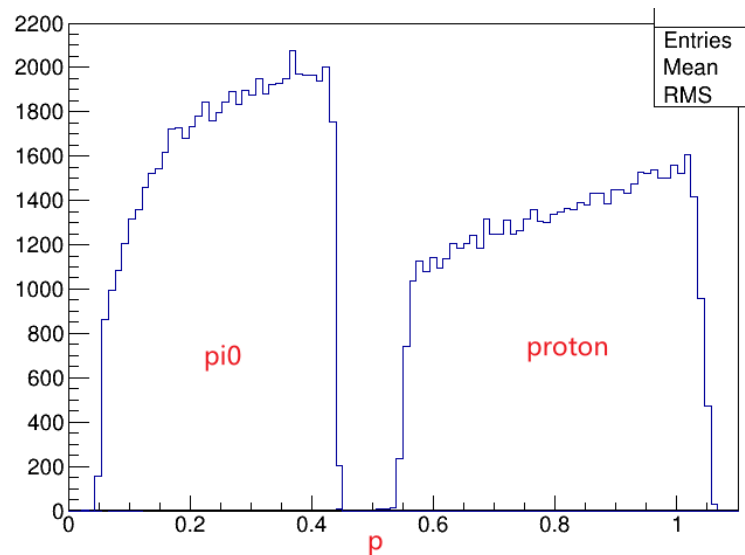
$$J/\psi \rightarrow \Lambda(\rightarrow p\pi^-)\bar{\Lambda}(\rightarrow \bar{n}\pi^0)$$

- 带电径迹数量相同
- Proton与neutron, anti-proton与anti-neutron在EMC中行为相似
- 含有pi0
  
- 选择一个 $\bar{\Sigma}^-$ , 反冲端在 $\Sigma^+$ 区域, N
- 光子选择, 运动学拟合, n
- Proton设置为miss particle

# Truth Dis



# Truth Dis



## ➤ Good Charged Tracks

- $V_r \leq 2cm, |V_z| \leq 10cm$
- $|\cos\theta| < 0.93$

## ➤ PID (Use dedx+TOF)

- **Proton:**  $p > 0.5 \text{ GeV}/c$  && PID:  $\text{Prob}(p) > \text{Prob}(K/\pi)$
- **nProton == 1 && nPbar == 1**

## ➤ Shower Selection

- $|\cos\theta| \leq 0.8, E > 25MeV$
- $0.86 \leq |\cos\theta| \leq 0.92, E > 50MeV$
- $0 \leq TDC \leq 14$
- $Ang_{shower,ChgTrk} \geq 10^\circ$  (for  $\bar{p} \geq 20^\circ$ )
- $N_{shower} \geq 2$

## ➤ $\pi^0$ (from $\bar{\Sigma}^-$ ) Selection

- $116 < M_{\gamma\gamma} < 148 \text{ MeV}/c^2$
- 1C is performed
- $\chi_{1C}^2 < 25$

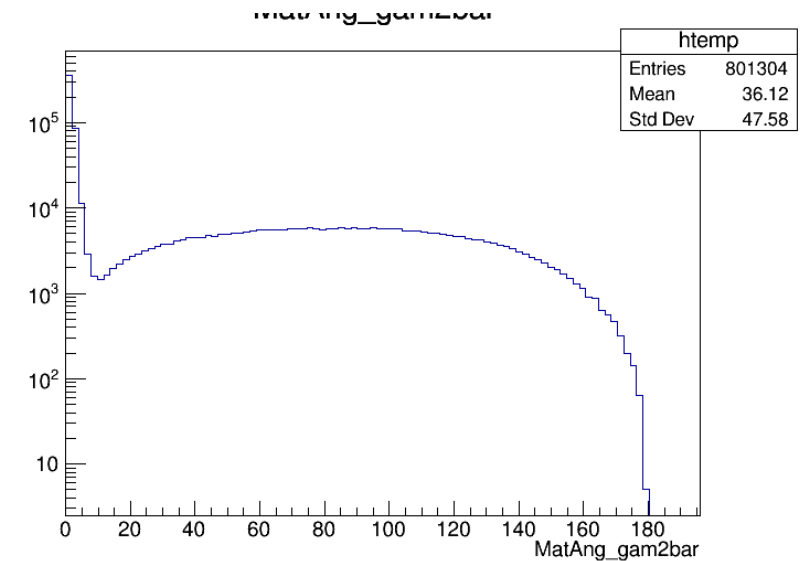
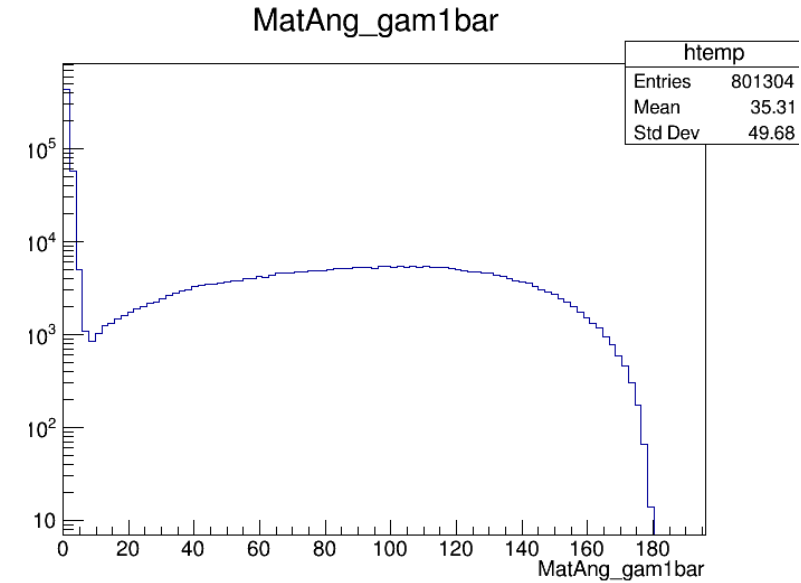
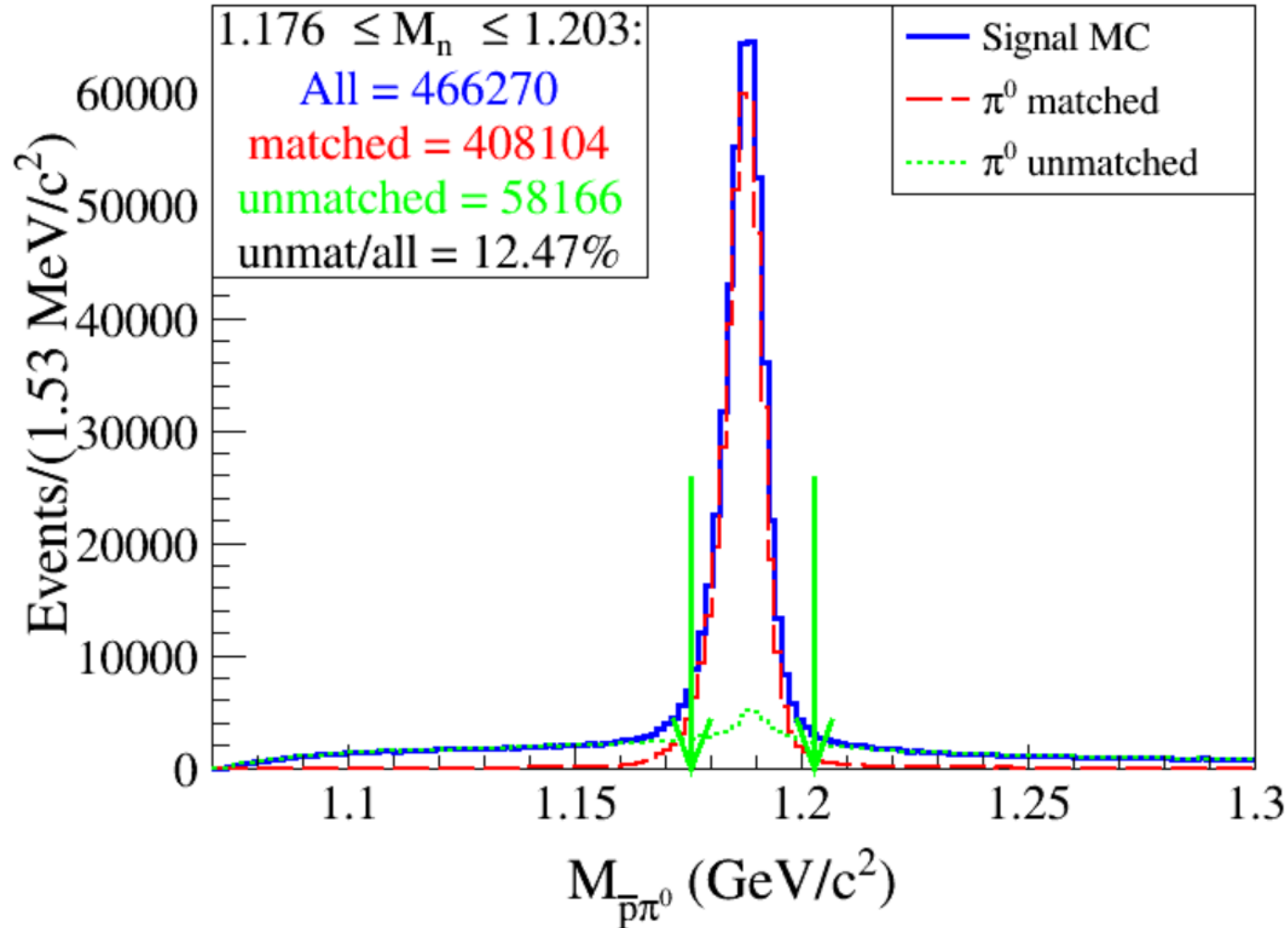
## ➤ $\bar{\Sigma}^-$ Selection

- Select the combination of  $\bar{p}, \pi^0$  with minimum  $|M_{\bar{p}\pi^0} - M_{\Sigma^+}|$
- $|M_{\bar{p}\pi^0} - M_{\Sigma^+}| < 13.5MeV$
- $M_{\bar{p}\pi^0}^{recoil}$  is in  $\Sigma^+$  region

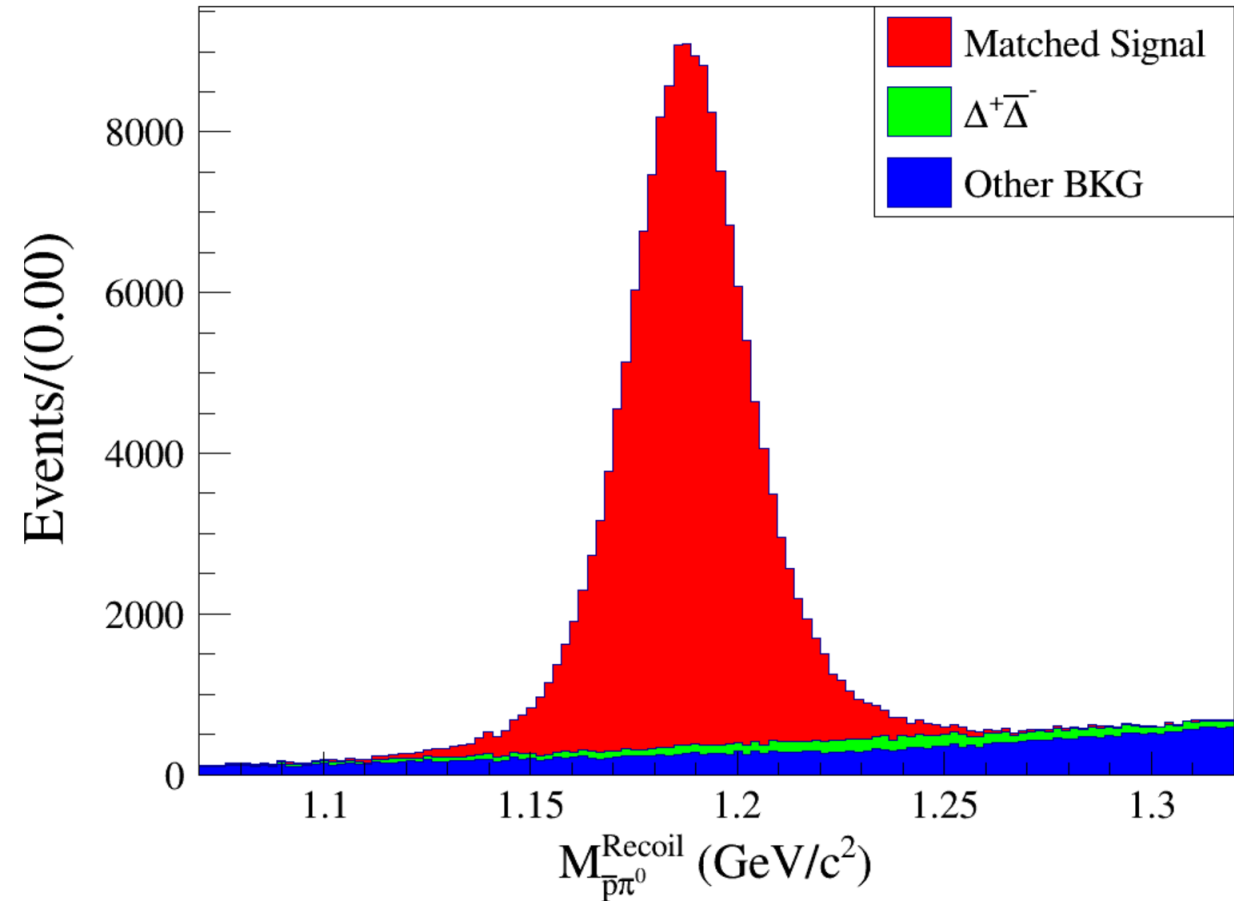
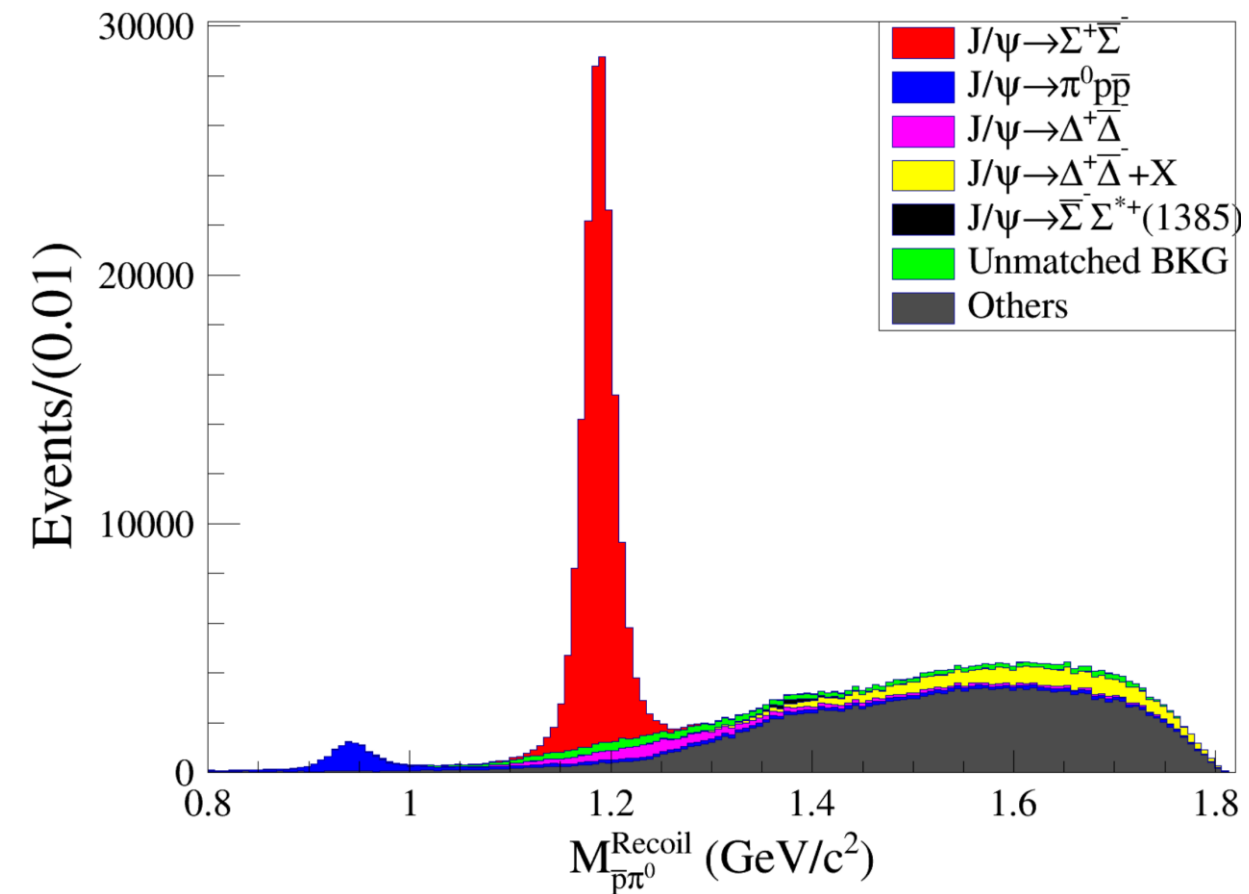
# PHSP Signal MC

Gamma match angle:  $10^\circ$

Mass Window: [1.1758, 1.2028]



# BKG Ana



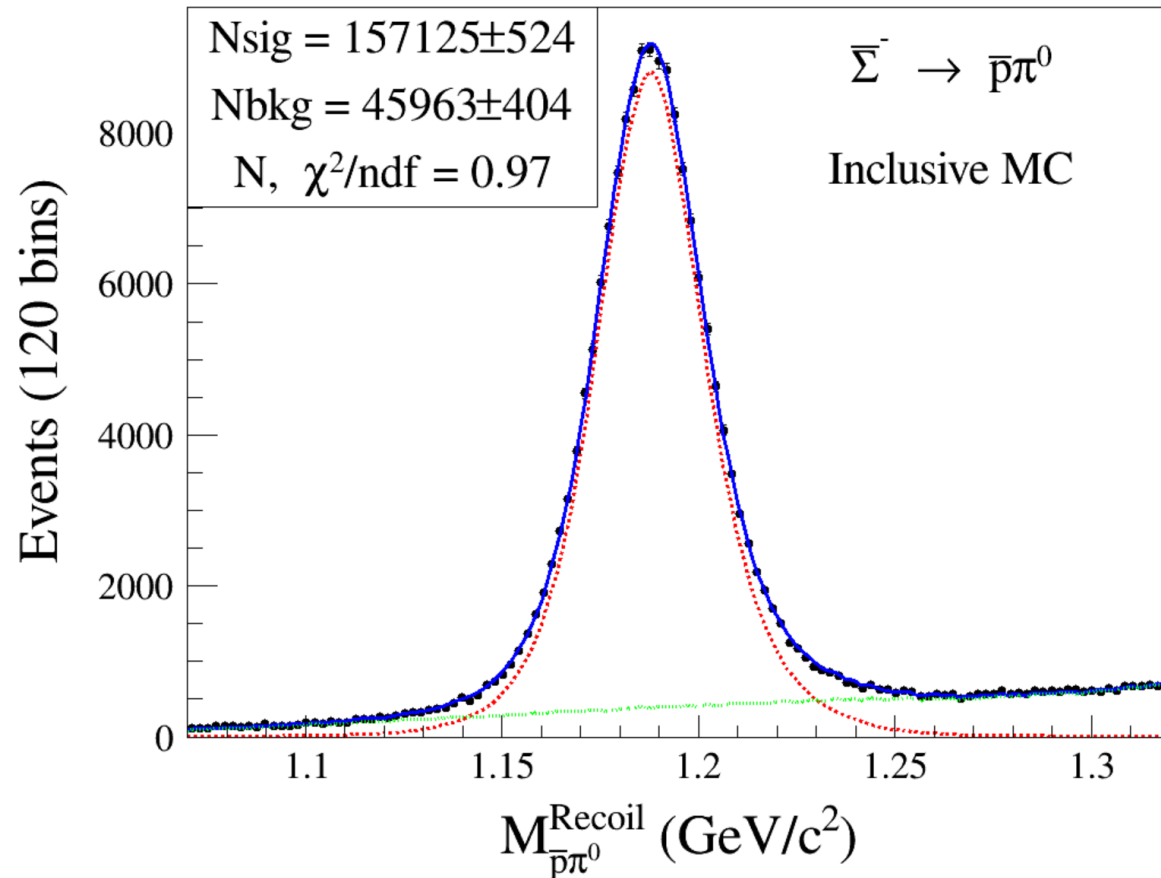
# Yield Extraction of $\bar{\Sigma}^-$

**Signal Shape:** truth matched signal MC convolve a Gaussian function

**$J/\psi \rightarrow \Delta^+ \bar{\Delta}^-$  BKG Shape:** PHSP MC from incMC convolve a Gaussian function

**Residual BKG:** 3<sup>rd</sup> Chebychev polynomial

**Fit Range:**  $1.07 < M_{\bar{p}\pi^0}^{\text{Recoil}} < 1.32 \text{ GeV}$



	Signal	BKG
Input	156975	46113
Output	$157125 \pm 524$	$45963 \pm 404$
Diff( $\times \sigma$ )	0.29	0.37



# Event Selection of $\Sigma^+ \rightarrow p\pi^0$

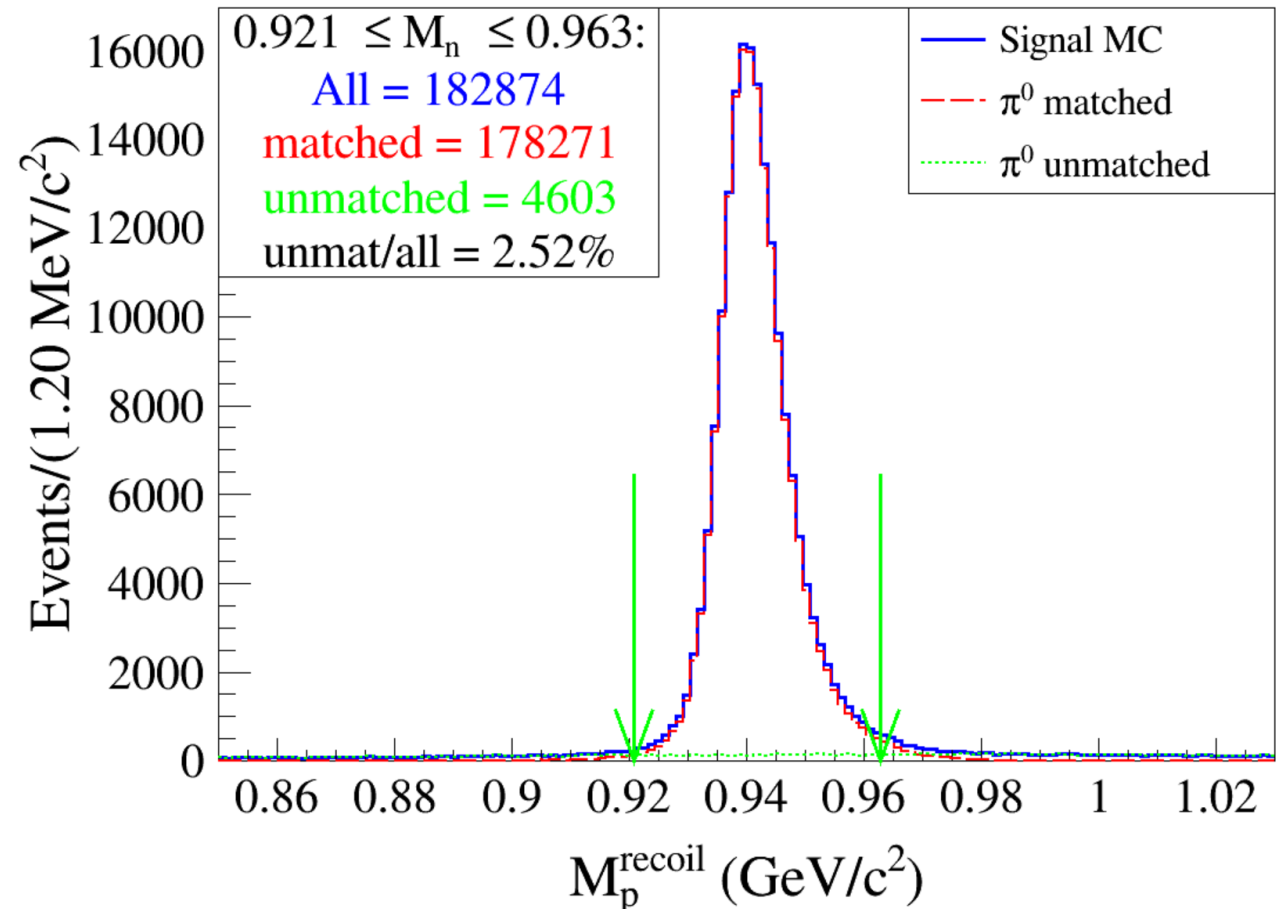
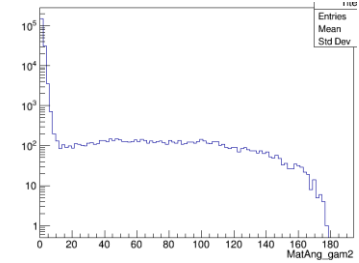
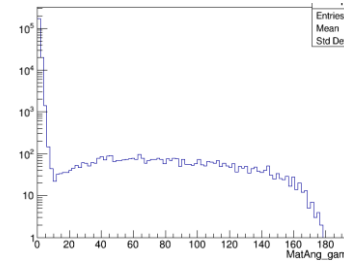
## ➤ $\bar{\Sigma}^-$ Selection

### ➤ Good Shower Selection

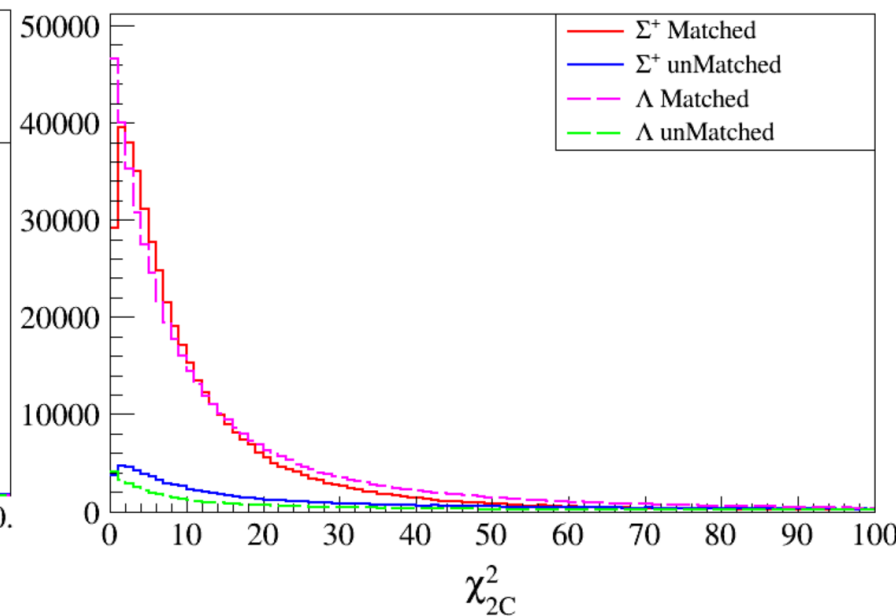
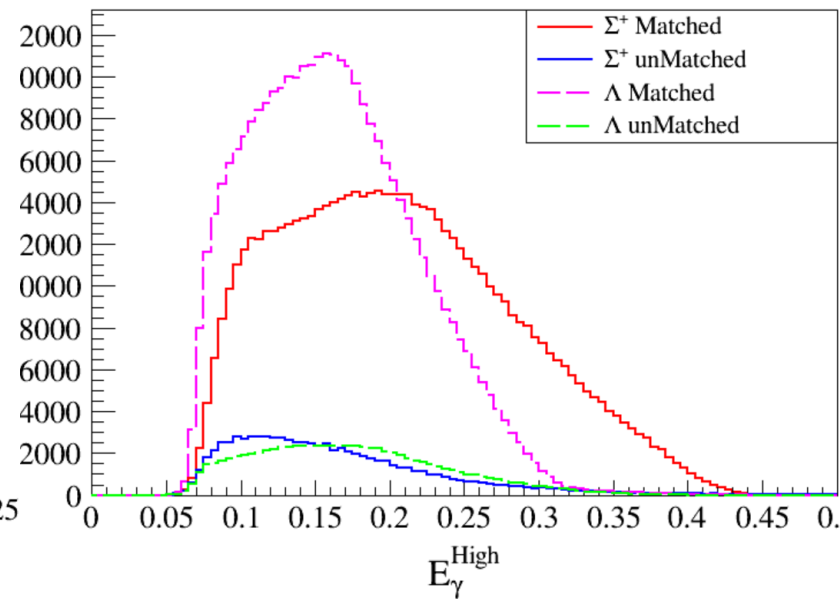
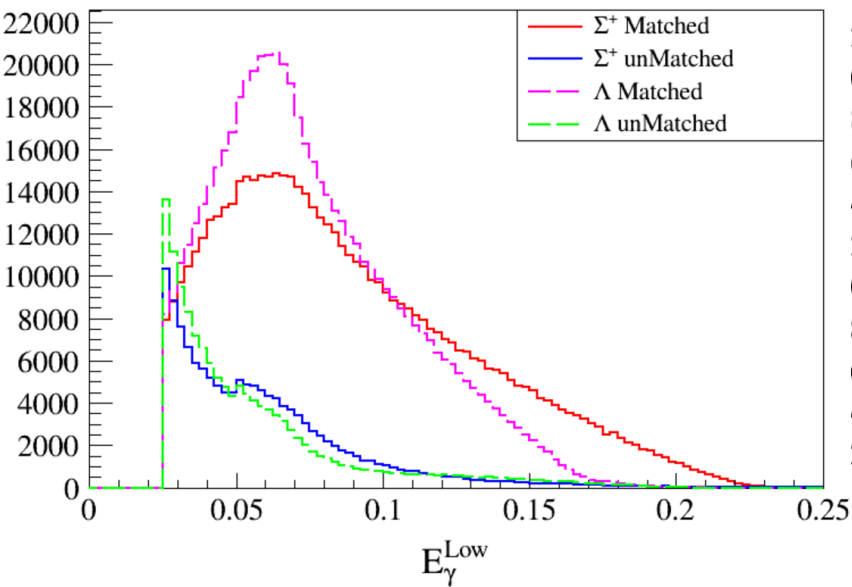
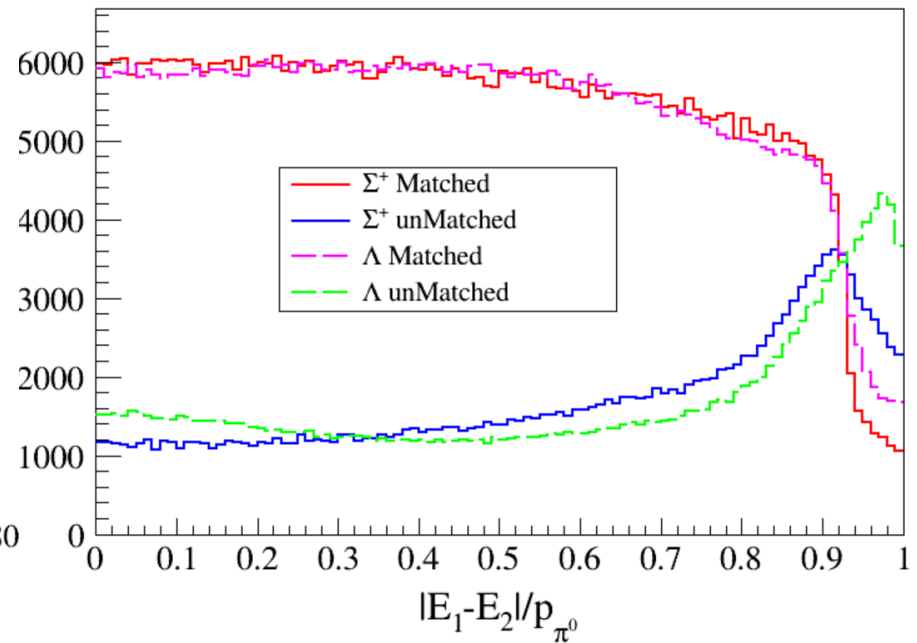
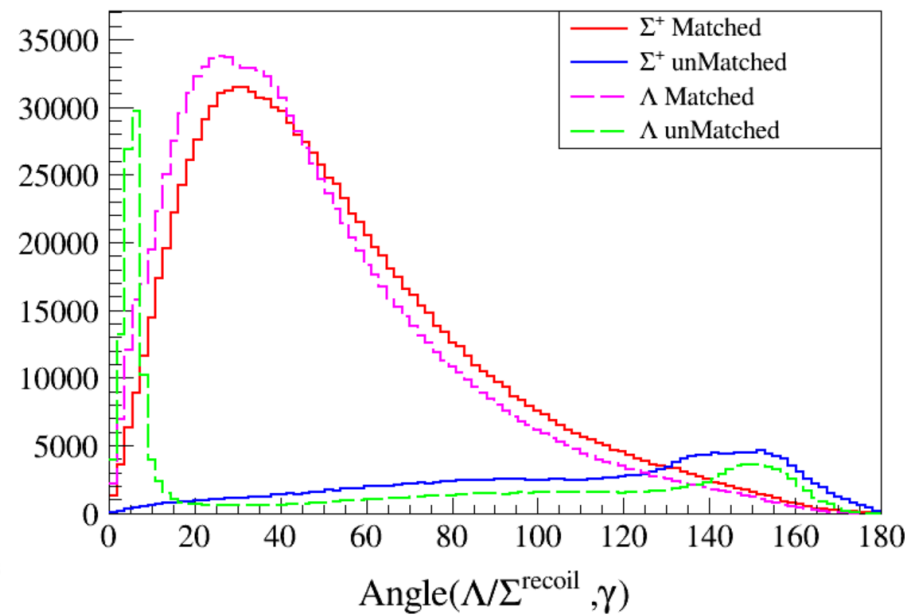
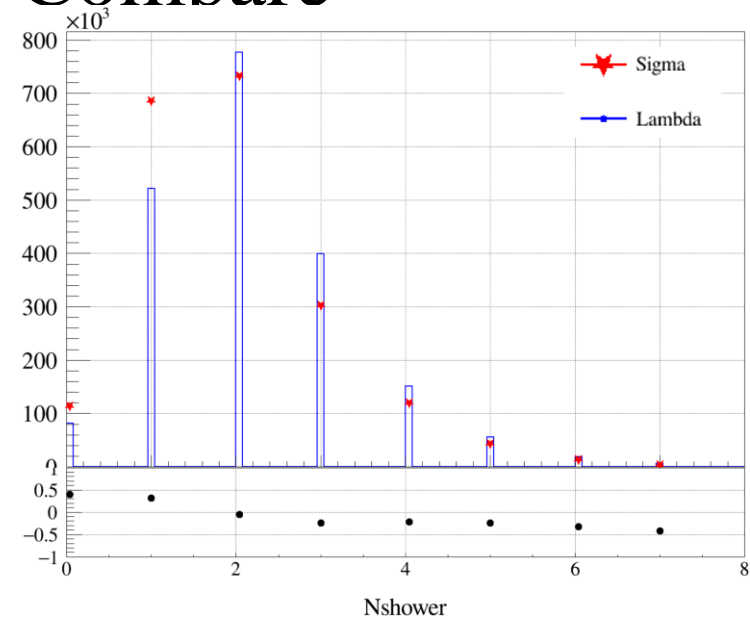
- No contain the  $\gamma$  from above  $\pi^0$  (from  $\bar{\Sigma}^- \rightarrow \bar{p}\pi^0$ )
- Common Selection
- $Ang_{shower,ChgTrk} \geq 10^\circ$  (for  $\bar{p} \geq 20^\circ$ )
- $N_{shower} \geq 2$

### ➤ 2C Kinematic fit

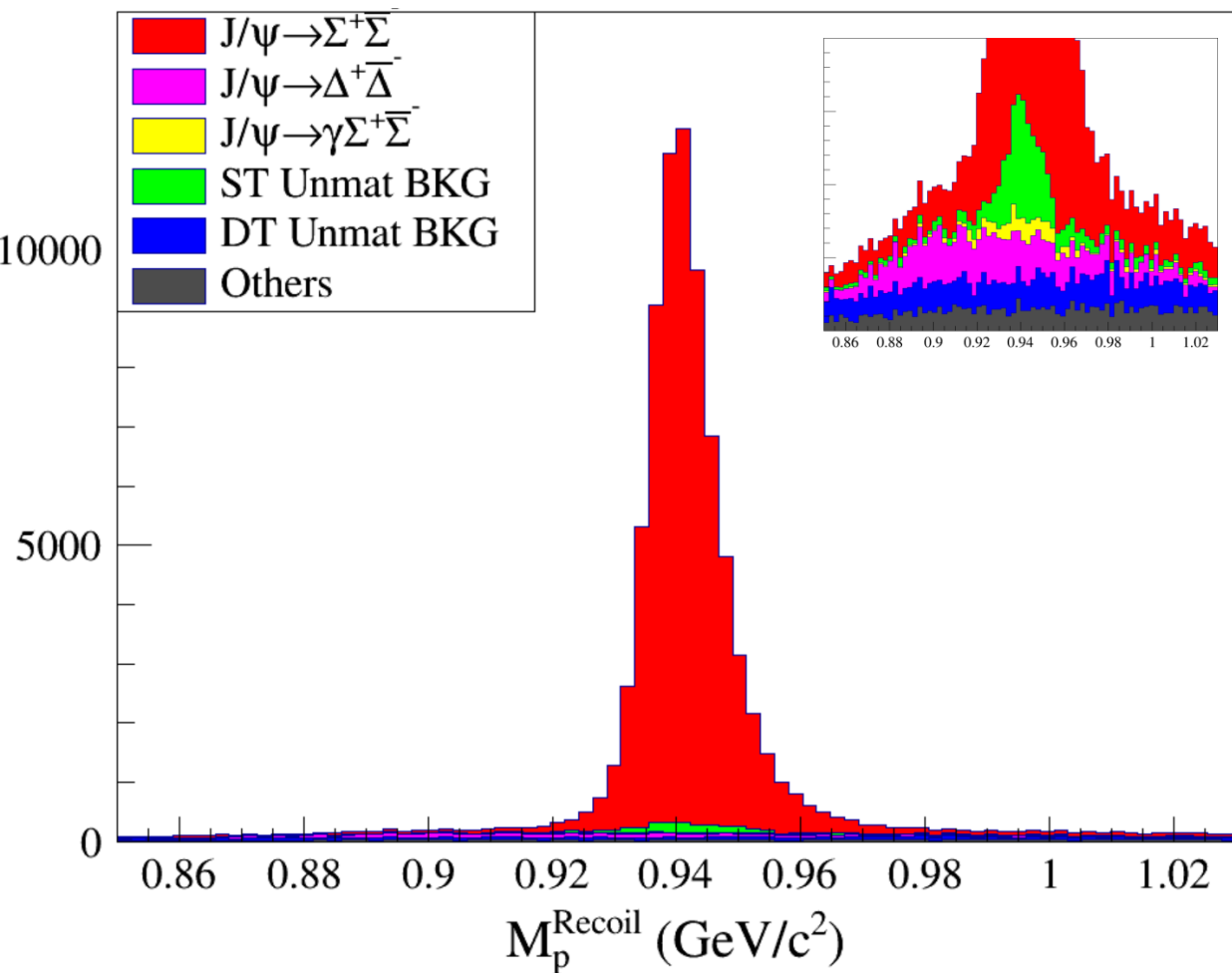
- On the hypothesis of  $\bar{p}\pi^0 p\gamma\gamma$
- Loop all  $\gamma$  pairs, perform:
  - $\frac{|E_1 - E_2|}{p_{\pi^0}} < 0.9$
  - $\theta_{\gamma, A} > 10^\circ$ , A direction is recoiled from  $\bar{A}$
  - BDT Response  $> 0.15$
- Proton is treated as a missing particle
- Constrain  $M_{p\gamma\gamma} = M_{\Sigma^-}^{PDG}$  and  $M_{\gamma\gamma} = M_{\pi^0}^{PDG}$
- $\chi_{2c}^2 < 50$
- $M_p^{recoil} \in [0.85, 1.03] GeV$



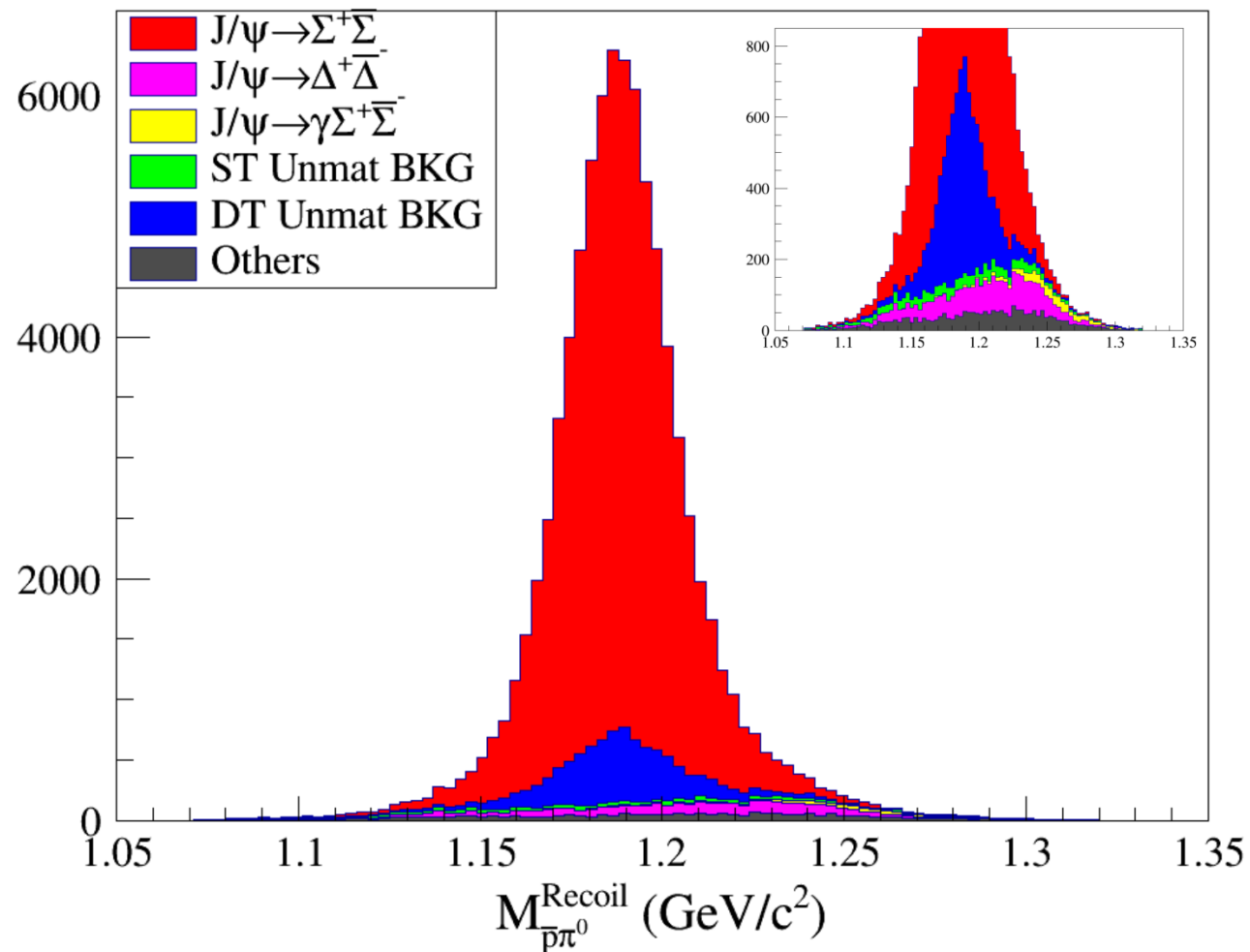
# Compare



# BKG Ana

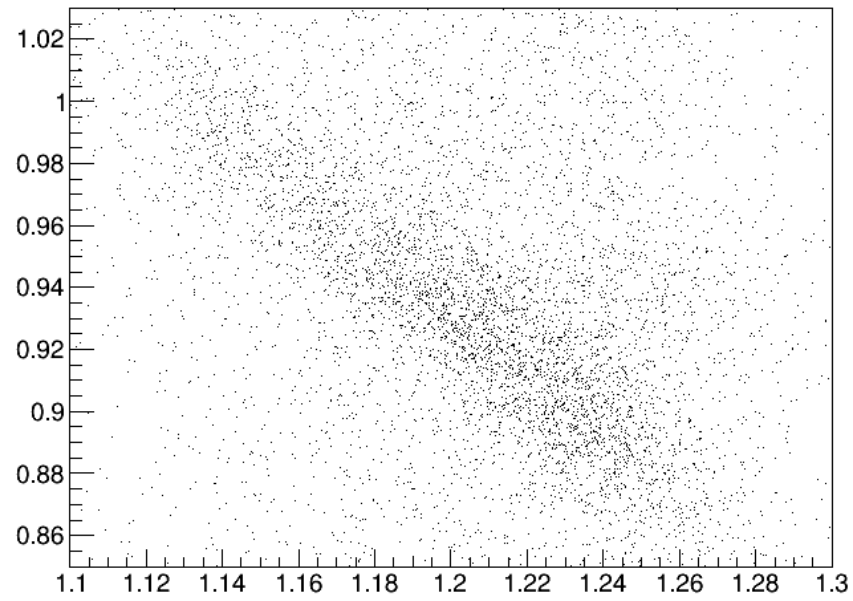


运动学拟合后的proton反冲谱

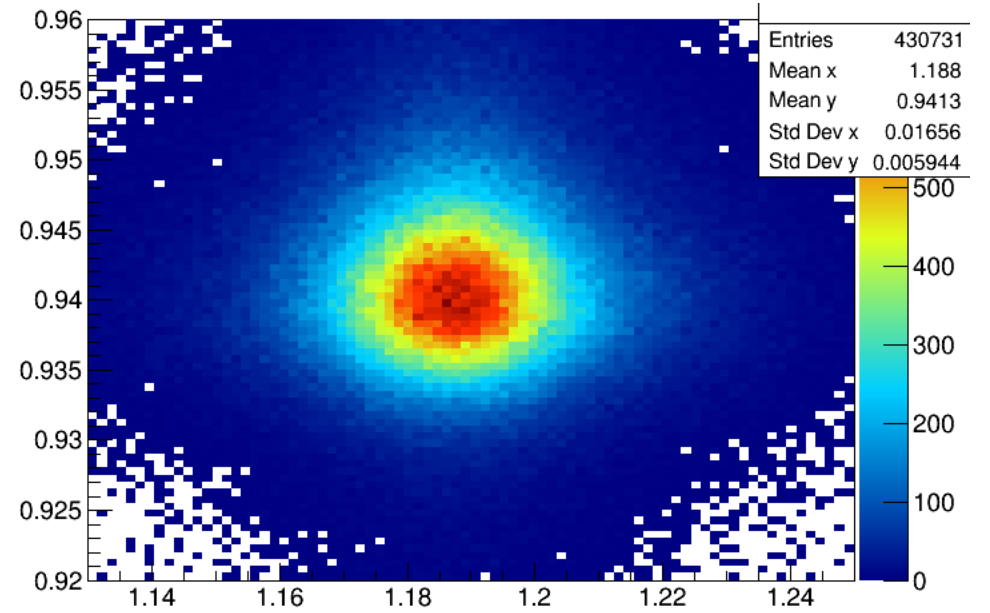


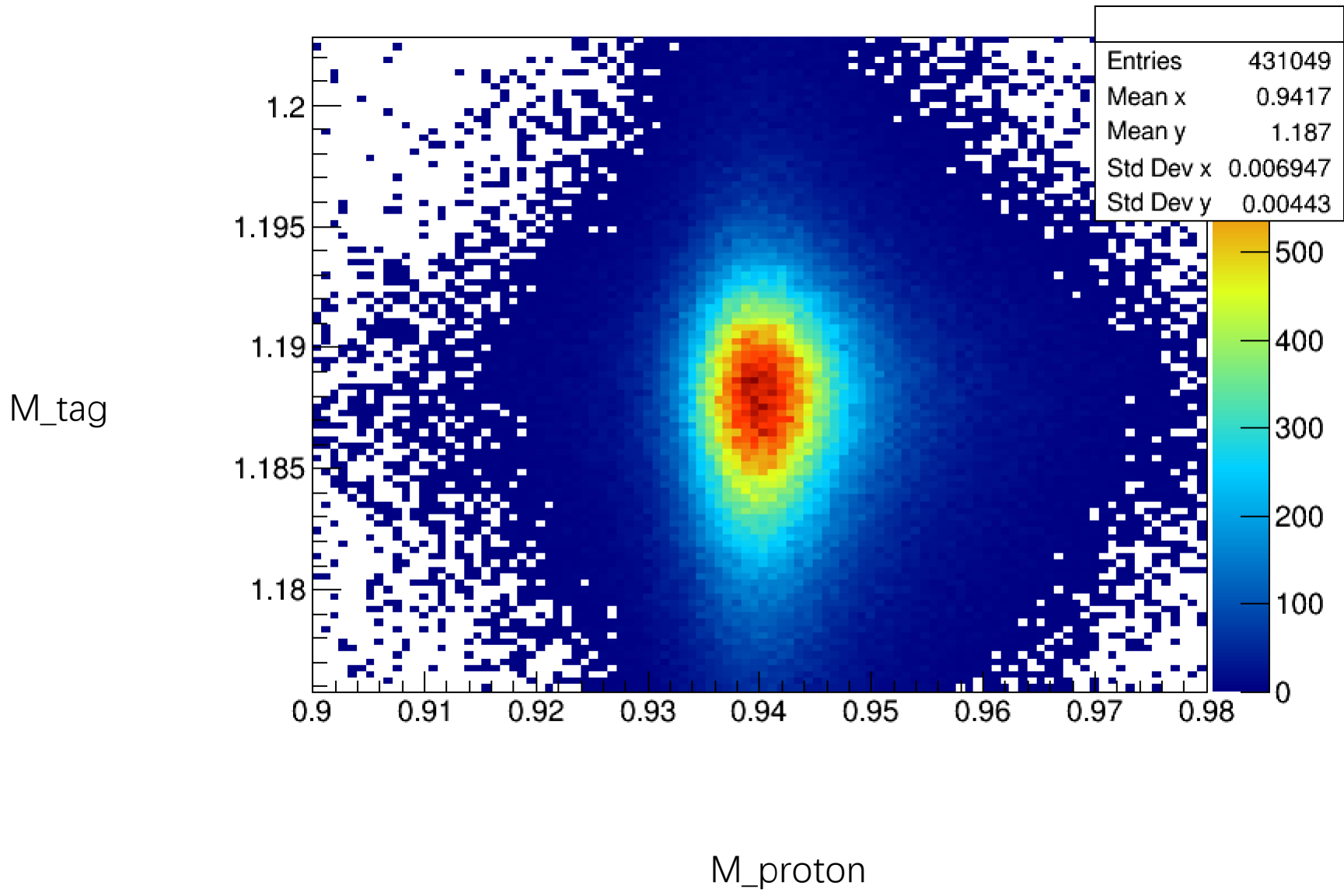
运动学拟合前pbar pi0反冲谱

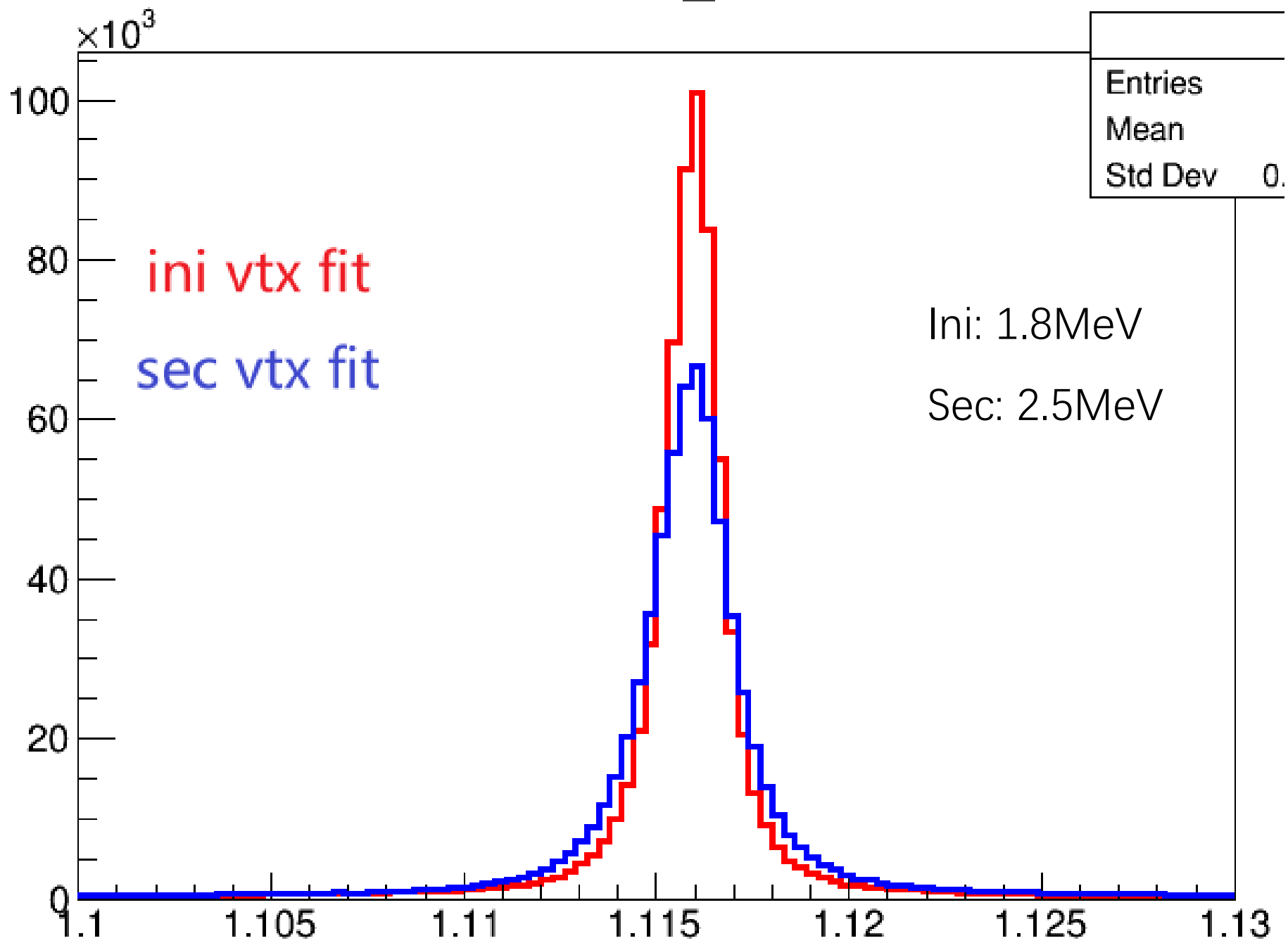
Residual BKG



Signal



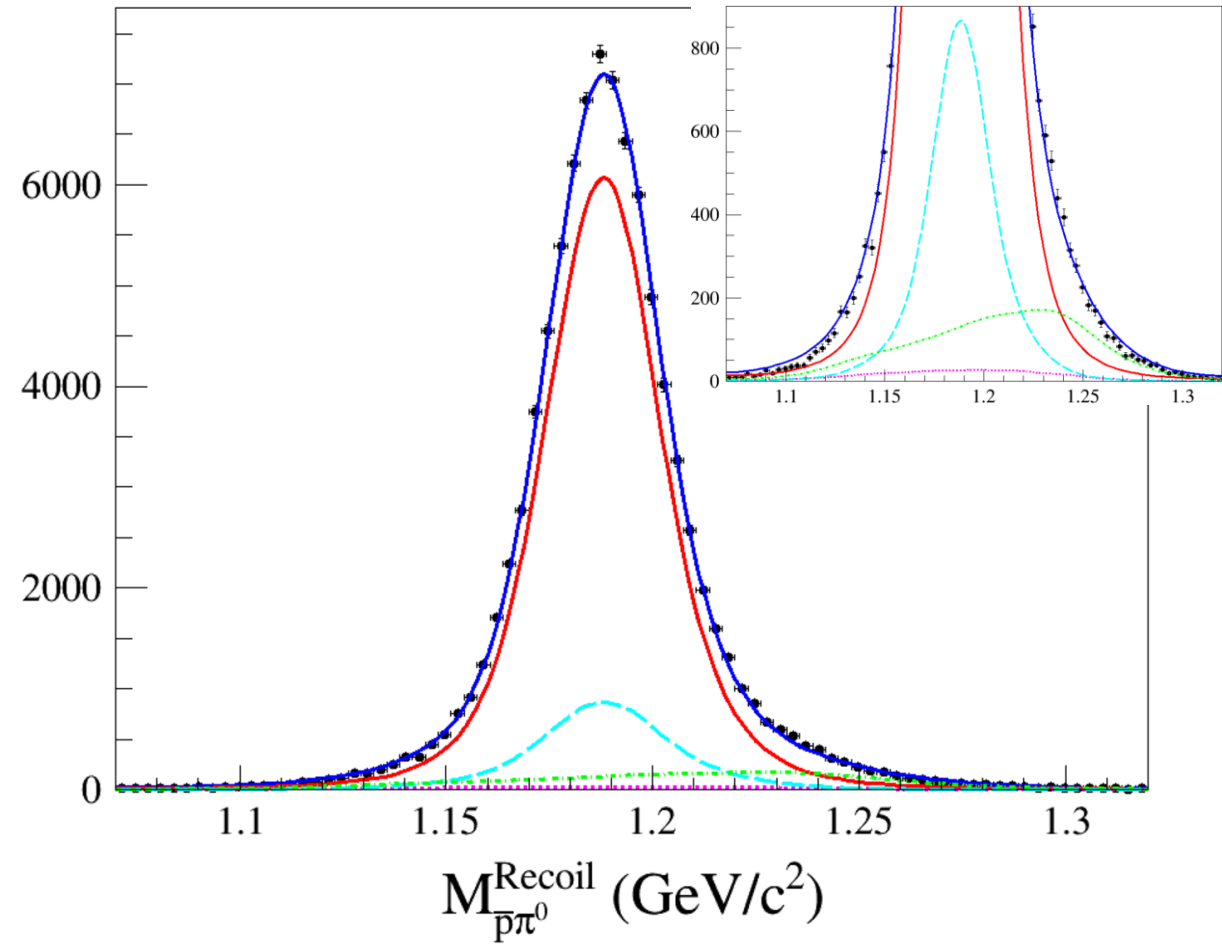
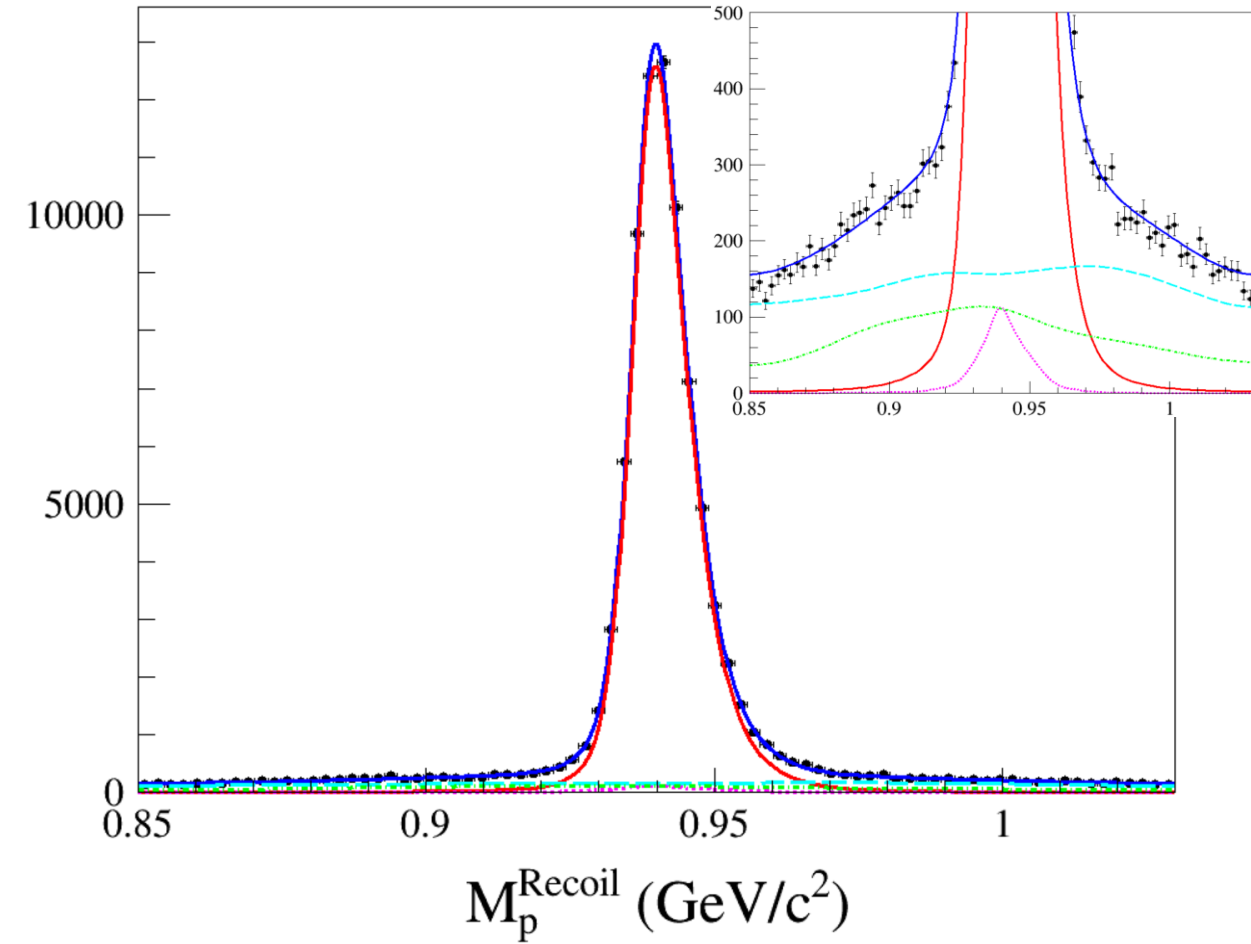


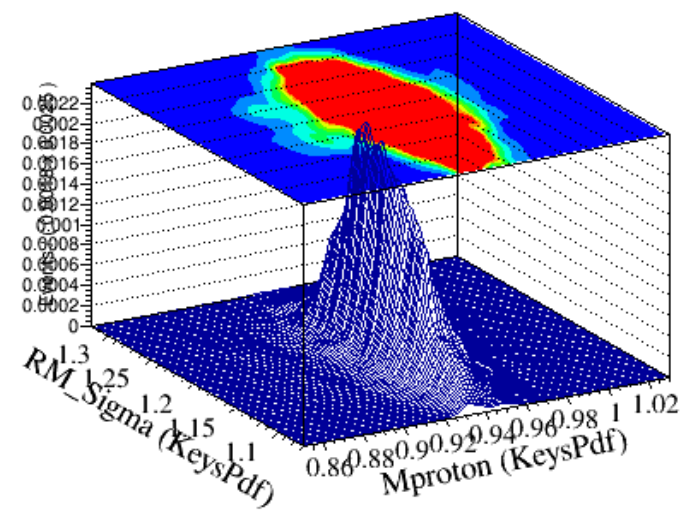
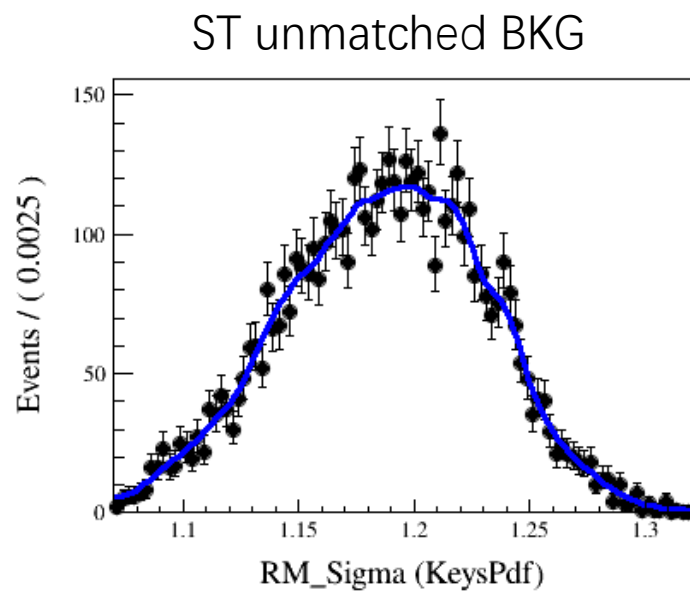
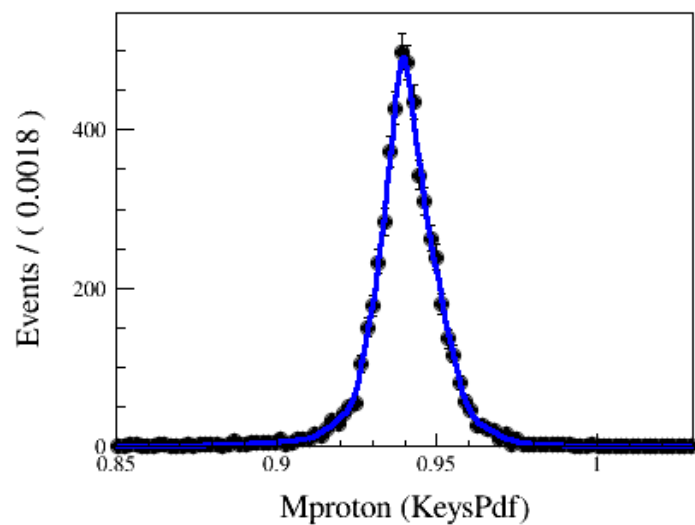
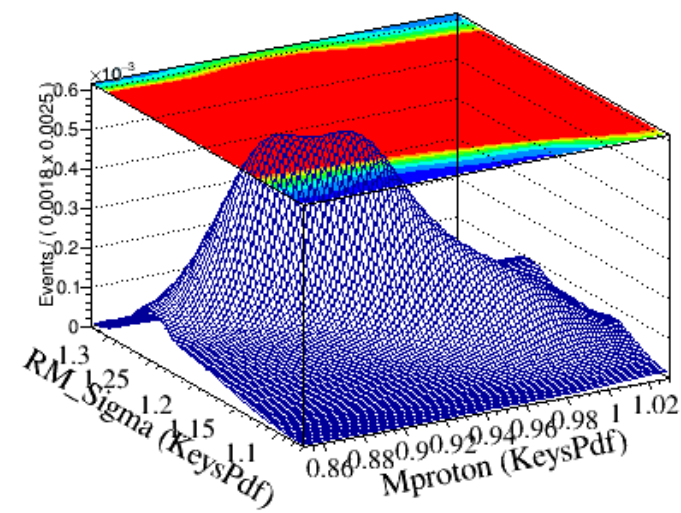
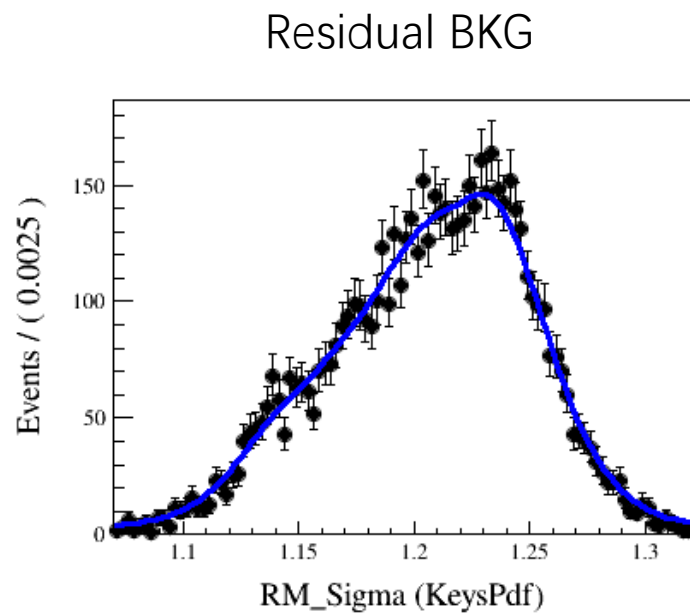
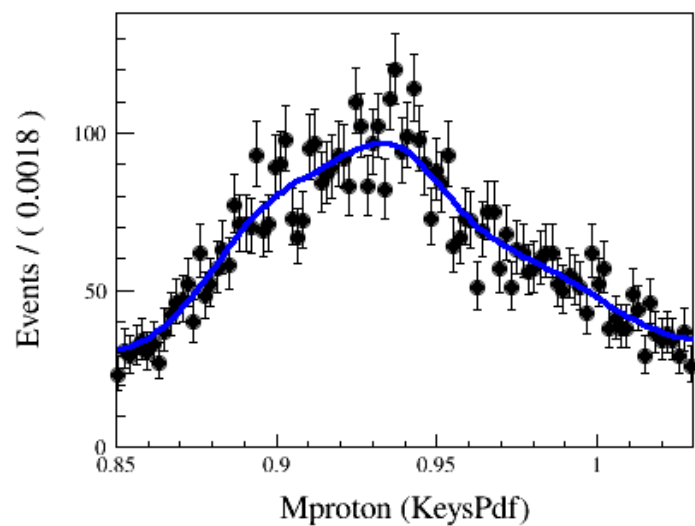


# Yield Extraction of DT (2D-Fit)

- **Signal Shape:** MC Shape  $\otimes$  Gaussian
- **ST unmatched BKG, DT unmatched, Residual BKG :** MC Shape using RooNDKeysPdf. The ratio of  $\frac{N_{sig}}{N_{STunm}+N_{DTunm}}$  is fixed.
- **Fit Range:**  $[0.85 < M_{\bar{p}}^{Recoil} < 1.03] \times [1.07 < M_{\bar{p}\pi^0}^{Recoil} < 1.32 \text{ GeV}]$

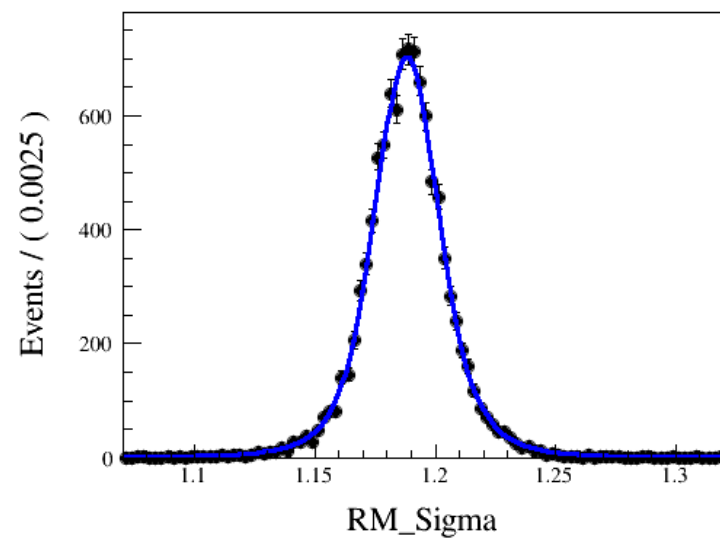
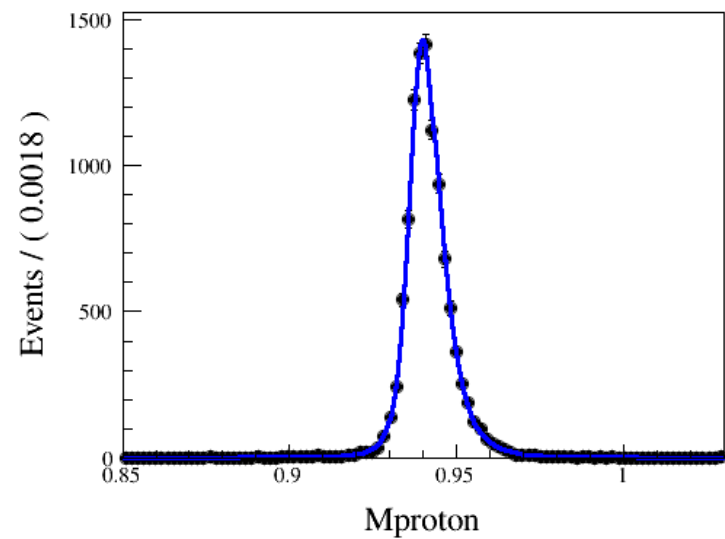
	Signal	BKG
Input	73430	18871
Output	$73766 \pm 262$	$18544 \pm 127$
Diff( $\times \sigma$ )	1.29	2.57







Check Pdf



Signal KeysPdf

DT unmatched BKG

