Measurement of the branching fraction of $\eta_c \to K_S^0 K\pi$

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Overview

Event Selections

Good Charged tracks selections

- $V_{xy} < 1cm$, $|V_z| < 10cm$ (except for the two tracks from K_S^0)
- $|\cos\theta < 0.93|$

Good phton selections($1 \leq N_\gamma \leq 20$)

- $E_\gamma > 25MeV$ for $|\cos\theta| < 0.8$
- $E_\gamma > 50MeV$ for $0.86 < |\cos\theta| < 0.92$
- $0 \leq TDC \leq 14$(in unit of $50ns$)

Event Selections

To improve the efficiency of selections, we assume the following charged tracks as pions

K_S^0 Reconstruction($N_{K_S^0} \geq 1$)

- $L/\sigma_L > 2$(L: decay length; σ_L: error of decay length)
- $|m_{\pi^+\pi^-}^{invariant} - m_{K_S^0}| \leq 20MeV$

$\gamma\pi^+\pi^-$ list

- $3.45 < m_{\pi^+\pi^-}^{recoil} < 3.65GeV$
- $2.8 < m_{\pi^+\pi^-\gamma}^{recoil} < 3.2GeV$

Another π^+K^- or π^-K^+ pair is required
Combination with the minimum $\chi^2 = \chi^2_{4C} + \sum_{i=1}^{N} \chi^2_{PID}(i)$ is kept

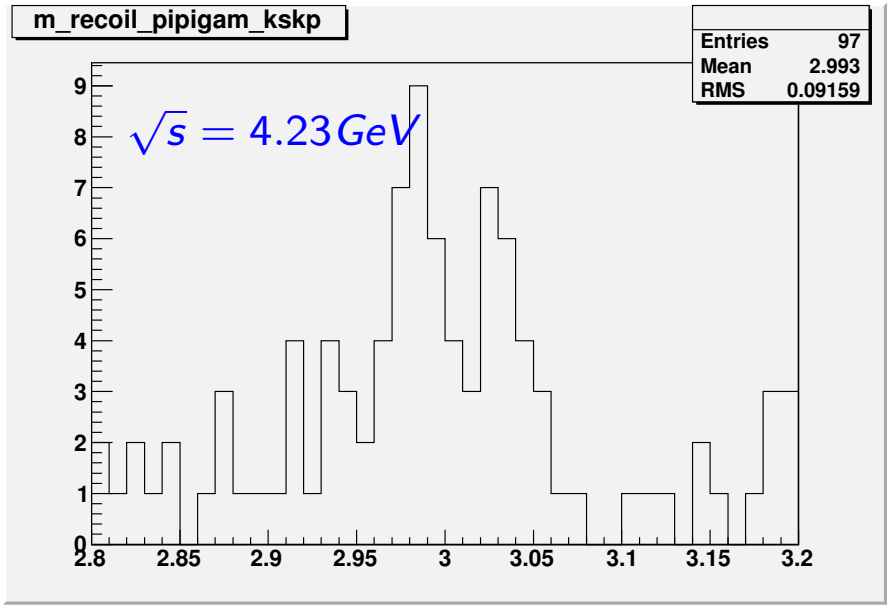
Optimized Selections

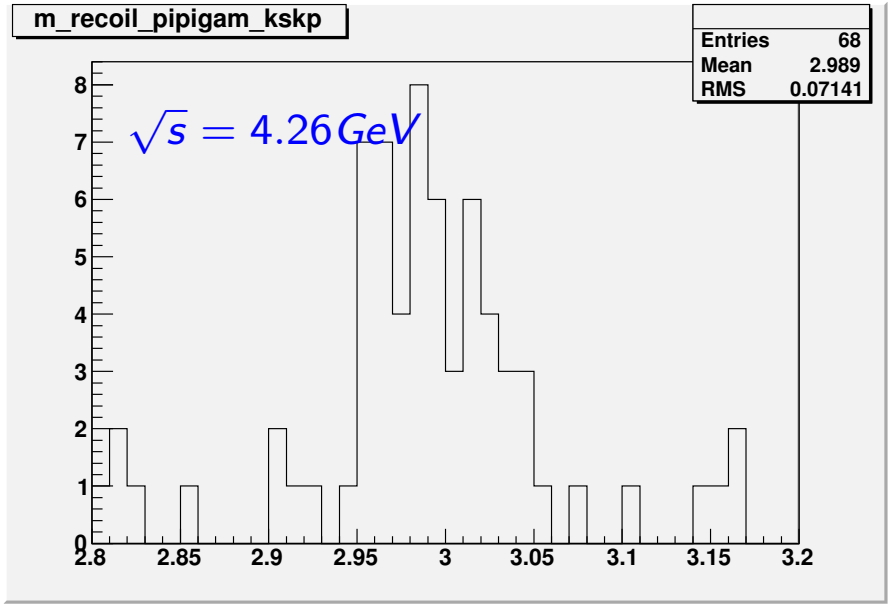
The χ^2_{4C} cut is optimized with the figure of merit(FOM)$\frac{S}{\sqrt{S+B}}$, and the optimized selections are presented below:

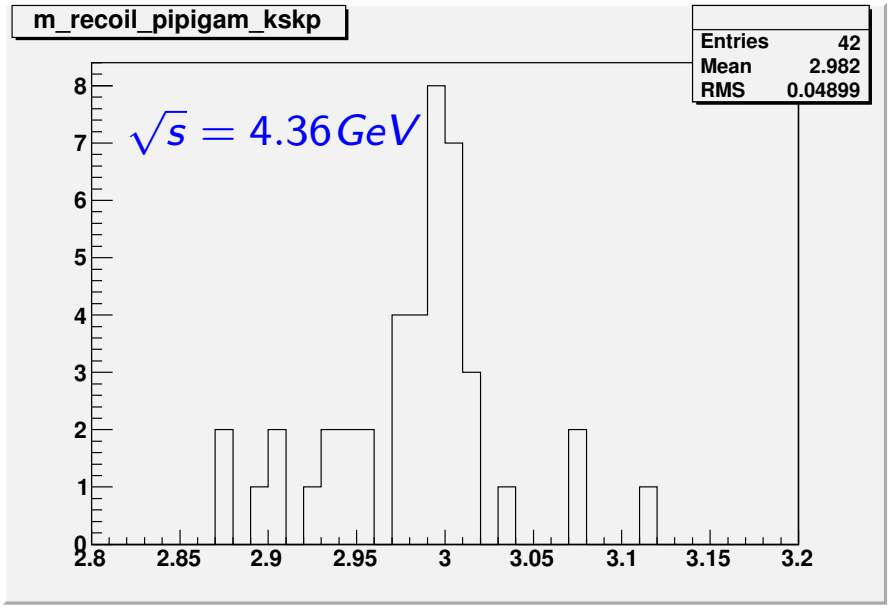
χ^2 Cut ($3.515 < M^{recoil}_{\pi^+\pi^-} < 3.535$)

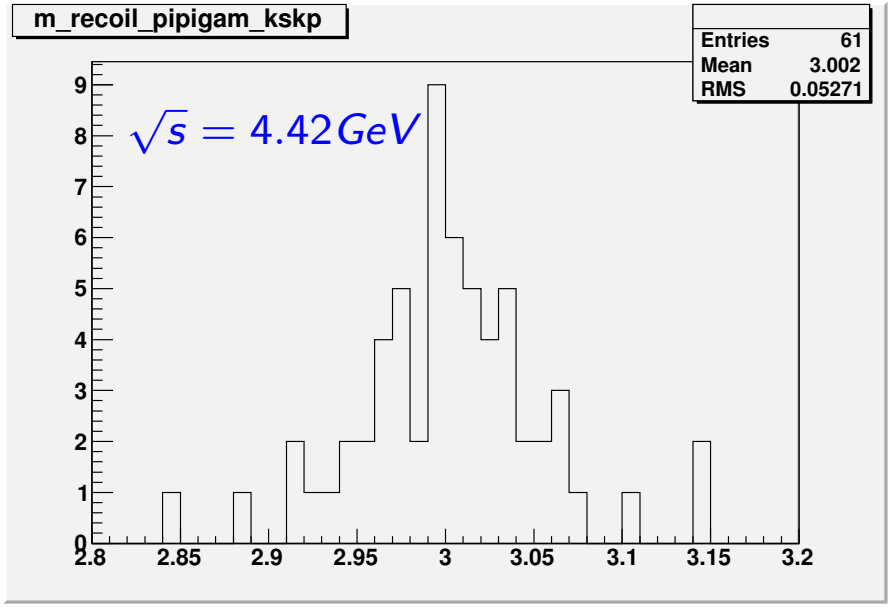
- $\sqrt{s} = 4.23 GeV$: $\chi^2_{4C} < 65$;
- $\sqrt{s} = 4.26 GeV$: $\chi^2_{4C} < 50$;
- $\sqrt{s} = 4.36 GeV$: $\chi^2_{4C} < 25$;
- $\sqrt{s} = 4.42 GeV$: $\chi^2_{4C} < 30$;

Results of $M^{recoil}_{\pi^+\pi^-\gamma}$









Event Selections

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- $0 \leq TDC \leq 14$(in unit of $50ns$)

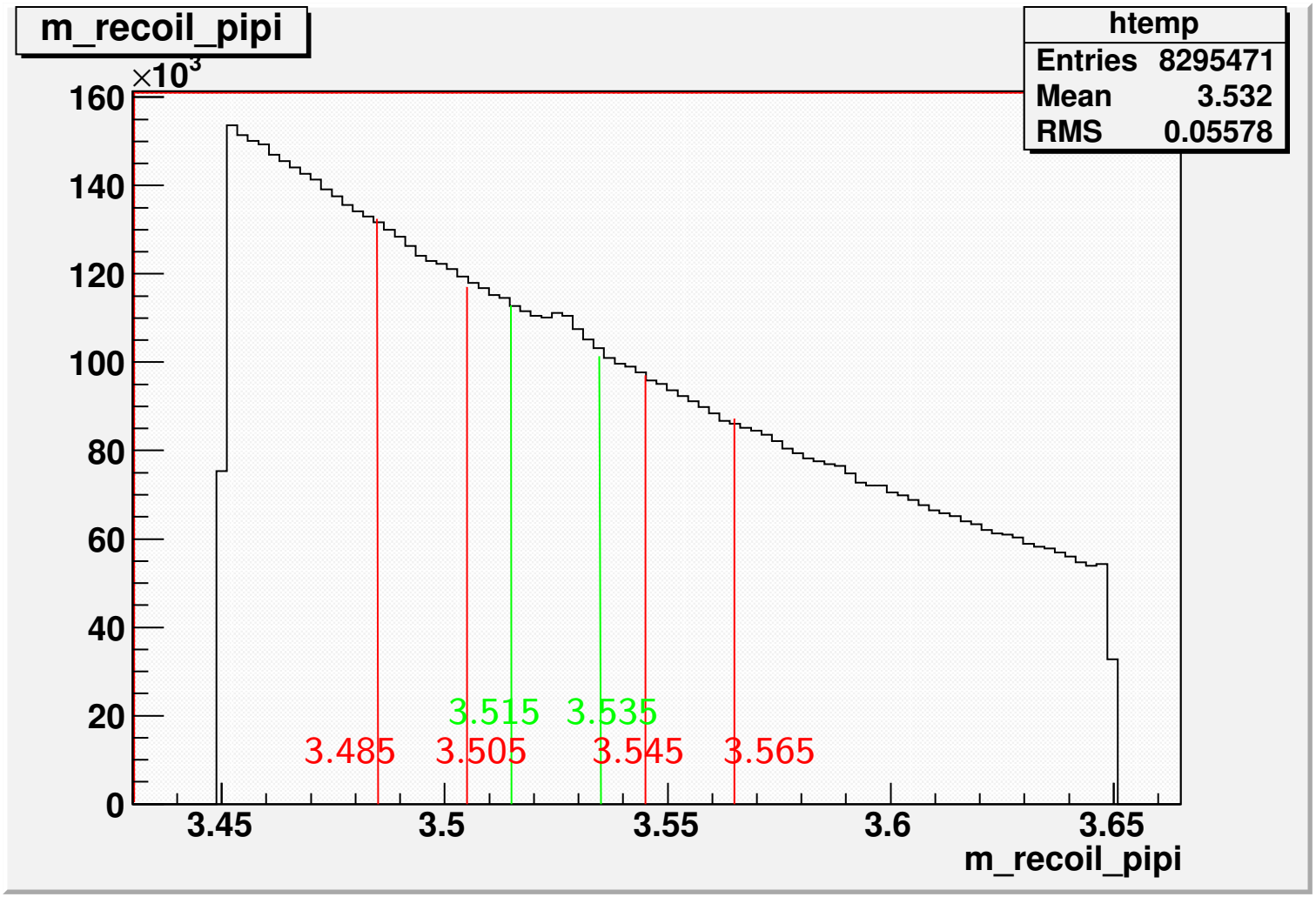
We use the $\gamma\pi^+\pi^-$list to recoil the η_c and h_c signal

$\gamma\pi^+\pi^-$ list

- $3.45 < m^{recoil}_{\pi^+\pi^-} < 3.65GeV$
- $2.8 < m^{recoil}_{\pi^+\pi^-\gamma} < 3.2GeV$

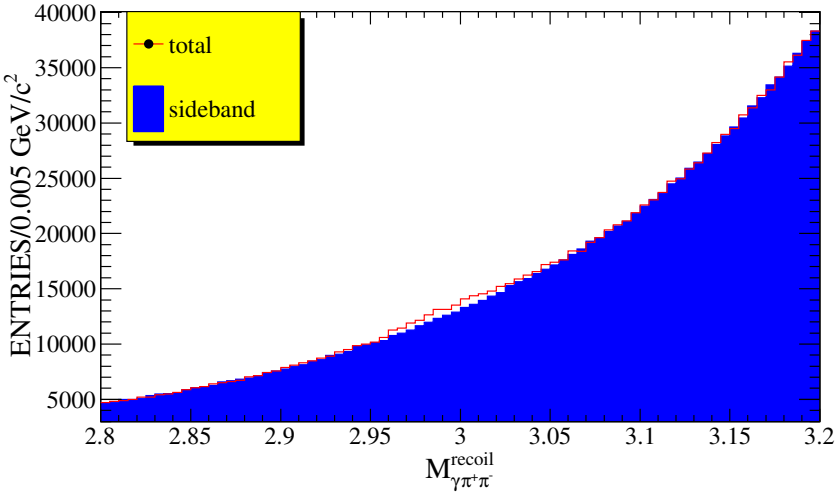
sideband

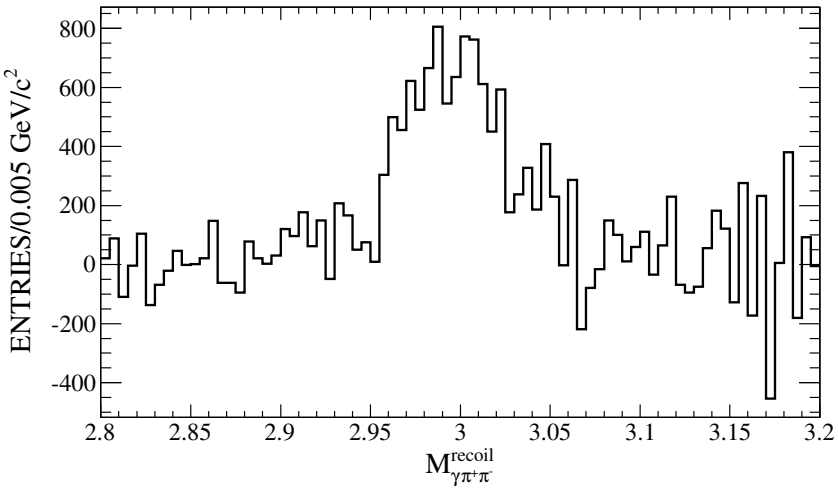
We use the sideband method to analyze the results



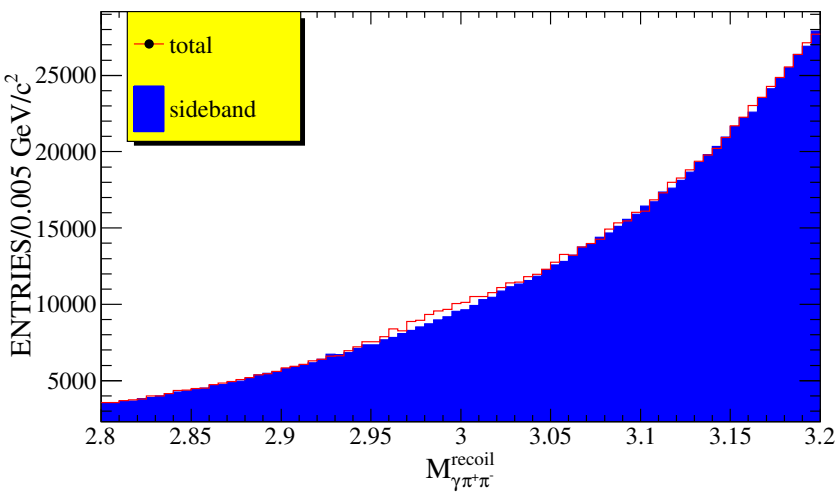
results of sideband $M^{recoil}_{\pi^+\pi^-\gamma}$

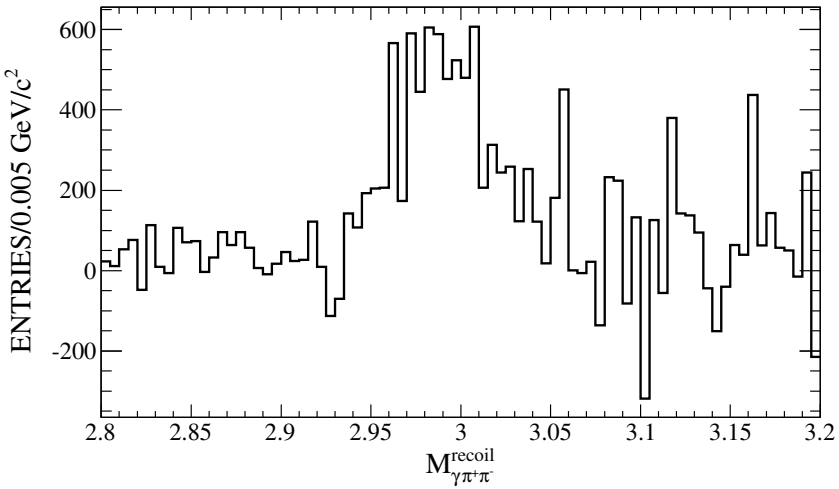
$\sqrt{s} = 4.23 GeV$





$\sqrt{s} = 4.26 GeV$

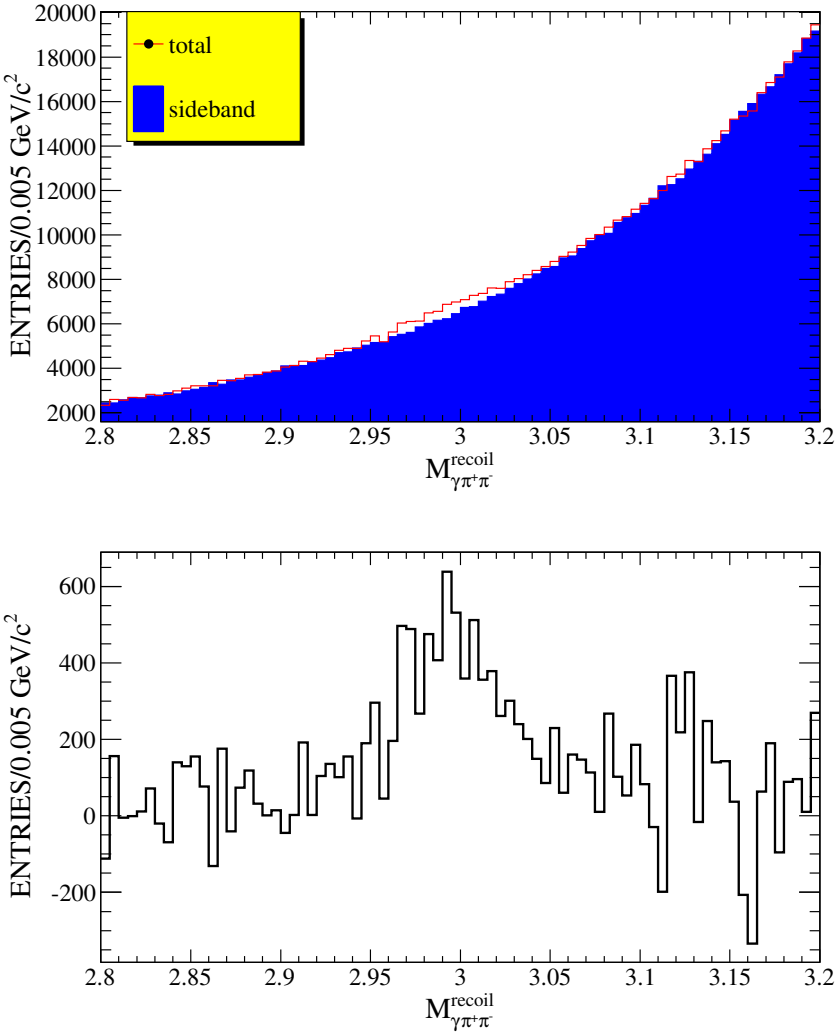




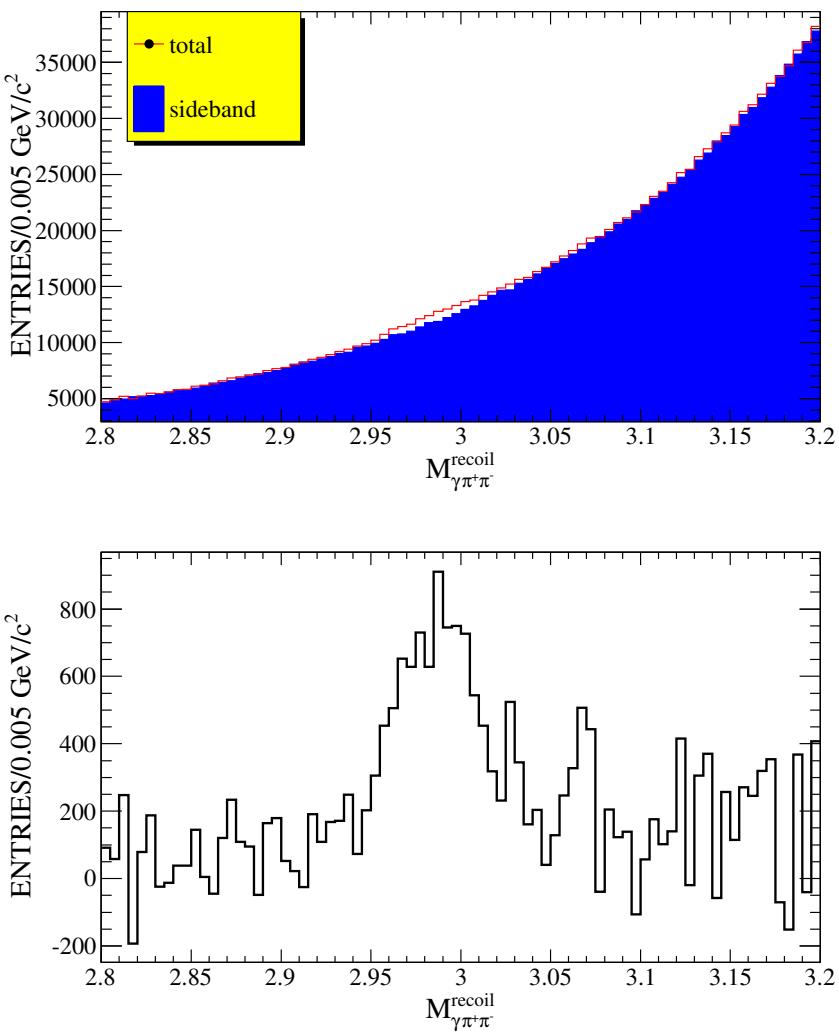
The upper ones draw the sideband and signal regions together, while the lower ones draw net events

results of sideband $M^{recoil}_{\pi^+\pi^-\gamma}$

$\sqrt{s} = 4.36 GeV$



$\sqrt{s} = 4.42 GeV$



The upper ones draw the sideband and signal regions together, while the lower ones draw net events

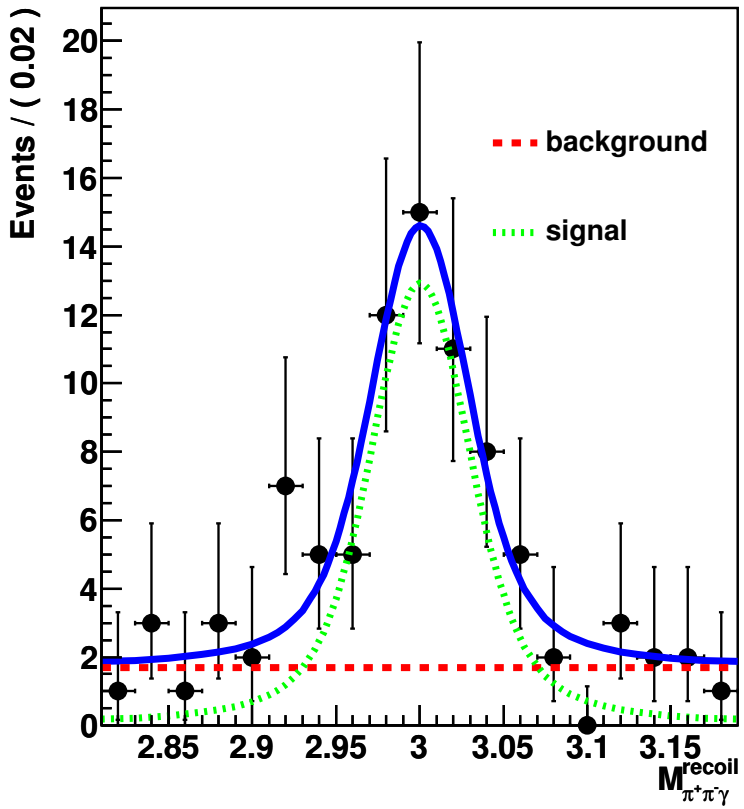
Fit Simultaneously

We use as signal a p.d.f. of Breit-Wigner convolved with a Gaussian distribution
And we use a zero-order Polynomial to describe the background of the Exclusive Process
While we use the sideband shape as the background of the Inclusive Process

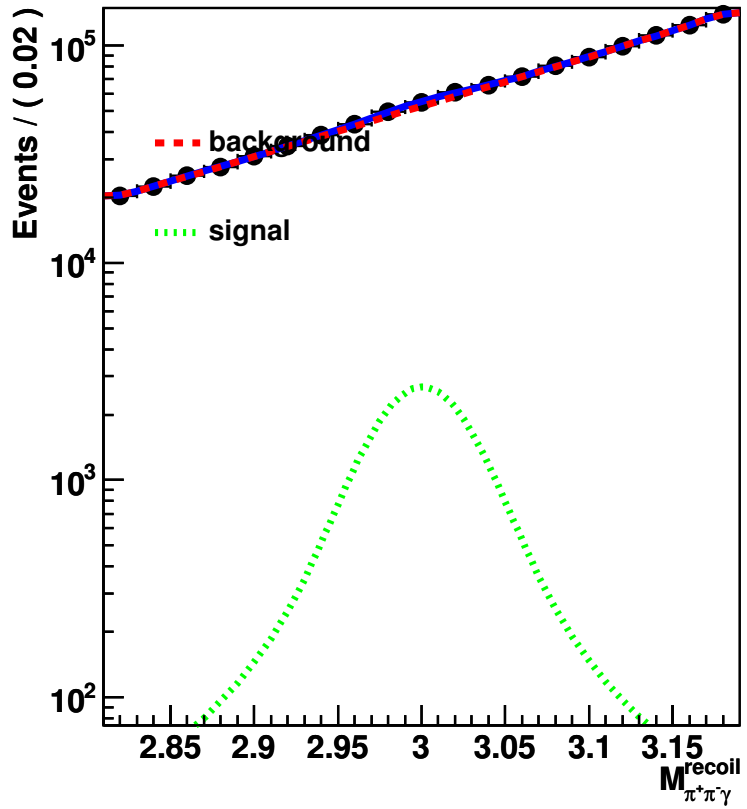
And we fixed the width of the signal to be $32.2 Mev$ same as in the PDG booklet

$\sqrt{s} = 4.23 Gev$

Exclusive



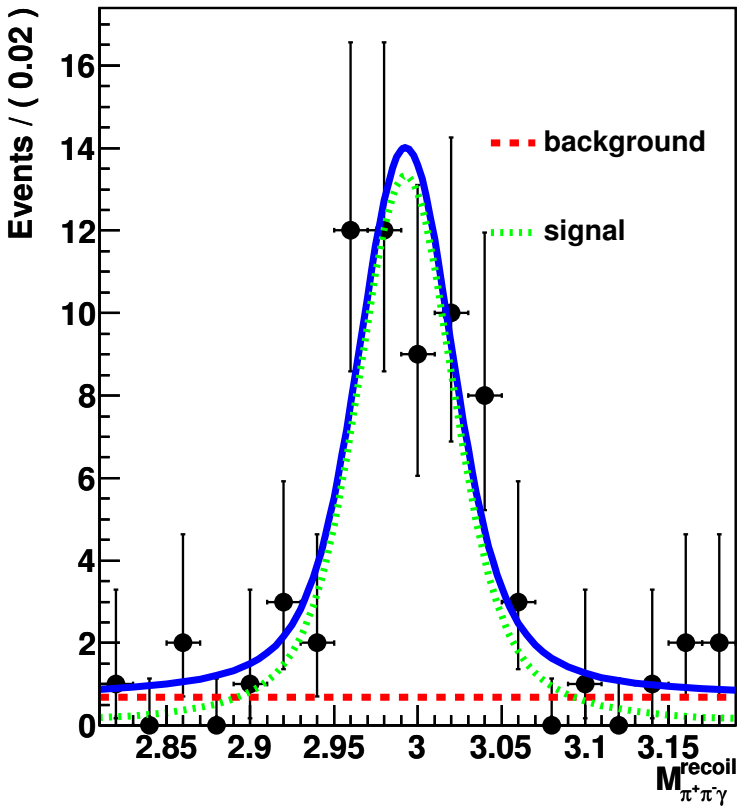
Inclusive



	N_{signal}	$N_{background}$
Exclusive Process	56 ± 10	32 ± 8
Inclusive Process	11622 ± 887	1177290 ± 1298

$\sqrt{s} = 4.26\,Gev$

Exclusive



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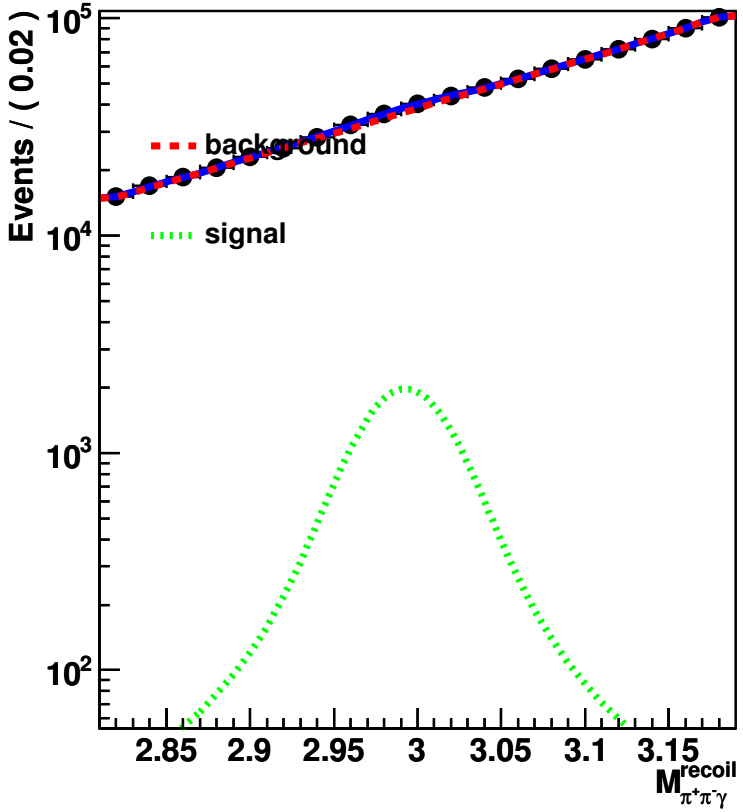
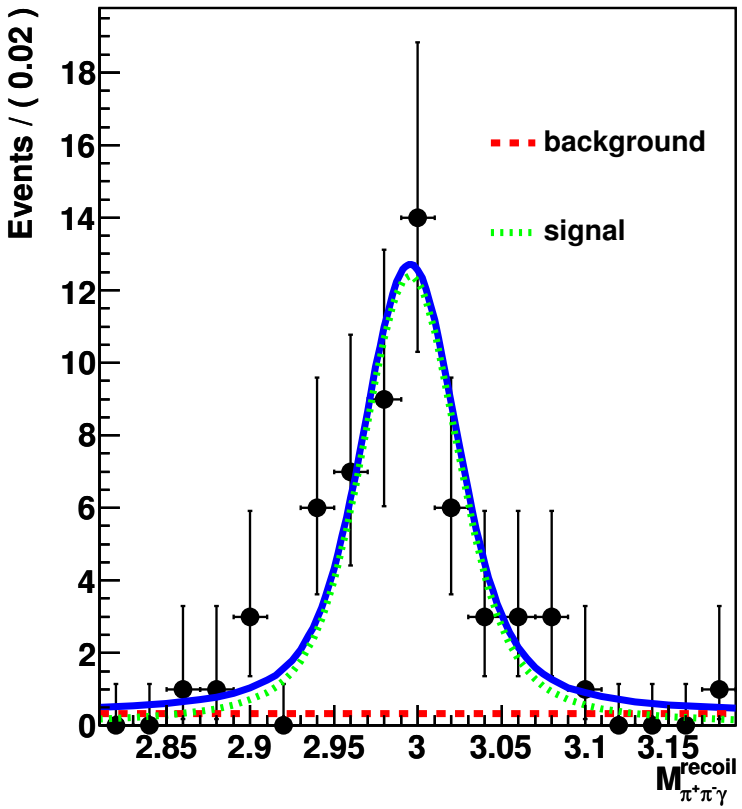


	N_{signal}	$N_{background}$
Exclusive Process	56 ± 9	13 ± 6
Inclusive Process	8266 ± 700	861403 ± 1160

$\sqrt{s} = 4.36\,Gev$

Exclusive



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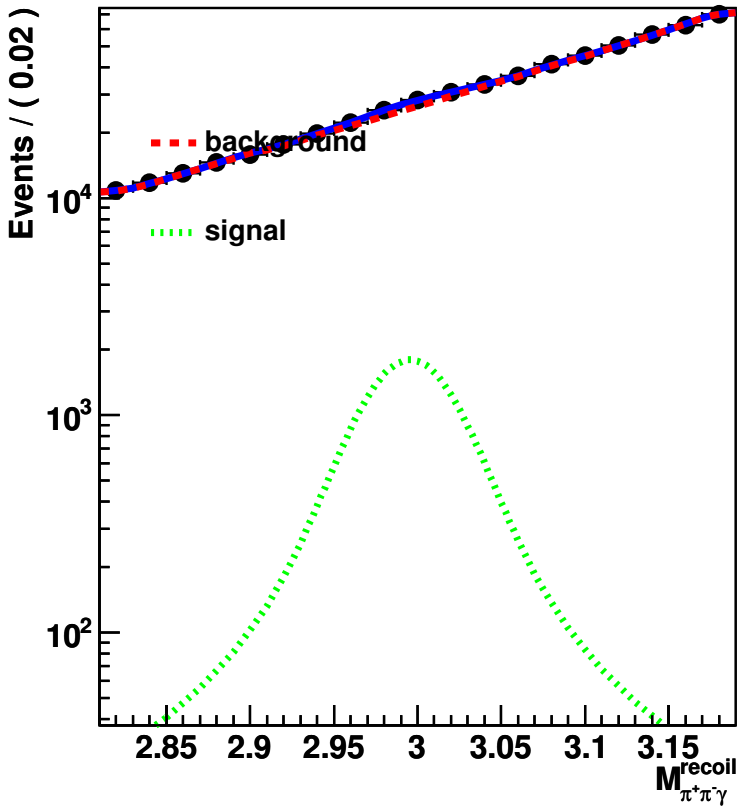
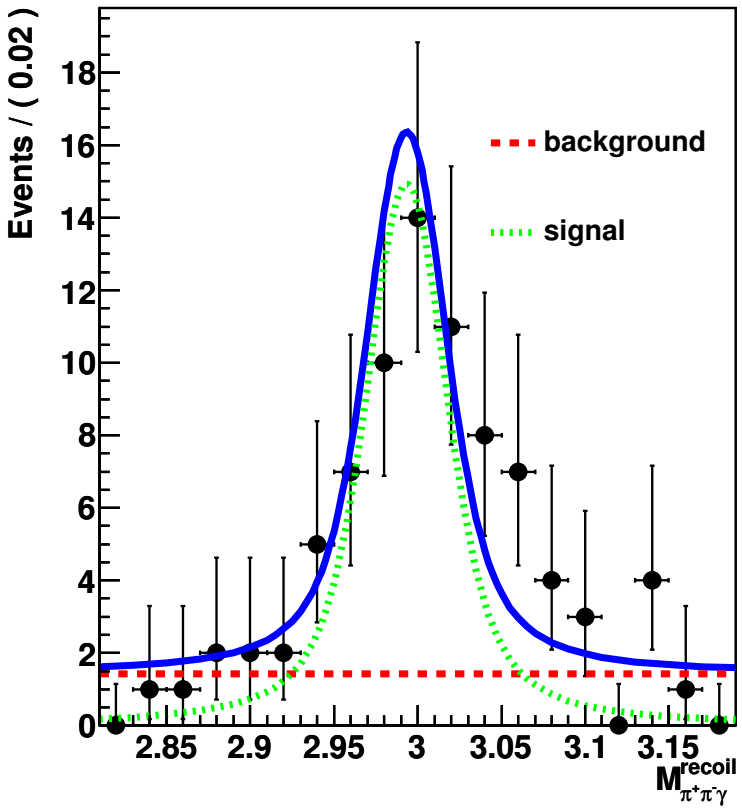


	N_{signal}	$N_{background}$
Exclusive Process	52 ± 9	6 ± 5
Inclusive Process	7517 ± 620	597960 ± 987

$\sqrt{s} = 4.42 Gev$

Exclusive



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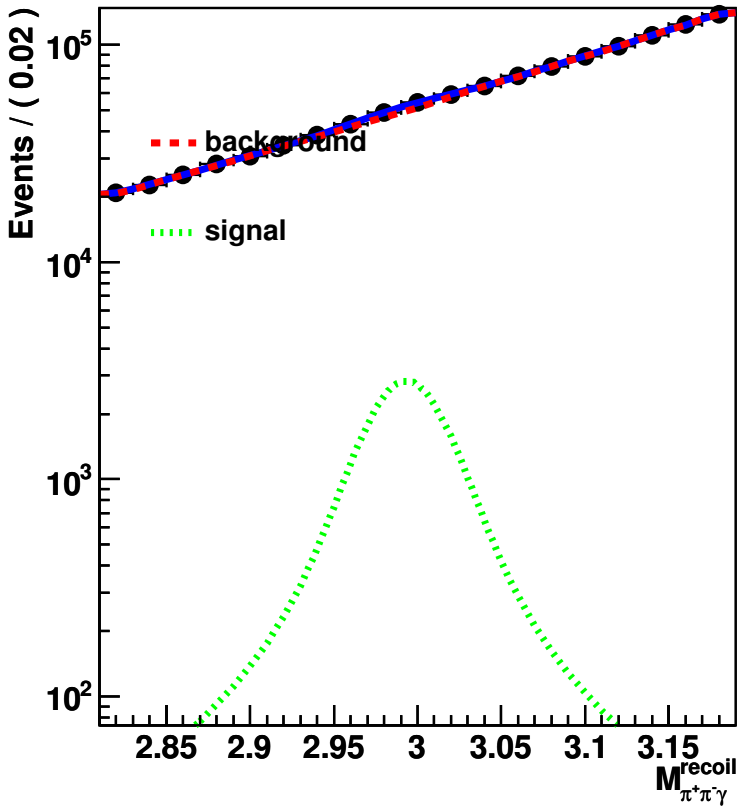

	N_{signal}	$N_{background}$
Exclusive Process	55 ± 10	27 ± 9
Inclusive Process	10382 ± 822	1170480 ± 1357

If the fit is reasonable, we want to get the efficiency next, so that we can get the preliminary results of the branching fraction