Update the study of $\eta_c \rightarrow \Lambda\bar{\Lambda}$ in J/ψ radiative decay

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Charmonium group meeting

OUTLINE

- Event selection
- Efficiency check
- Background study
- Summary

Event selection

- **Initial selection**

  - **Charged track : $N_p = N_{\bar{p}}=N_{\pi+}=N_{\pi-}$**

    1) No requirements for Vz and Vr

    2) **No PID**(proton and pion are separated by their momentum).

    3) Λ reconstruction: secondary-vertex reconstruction

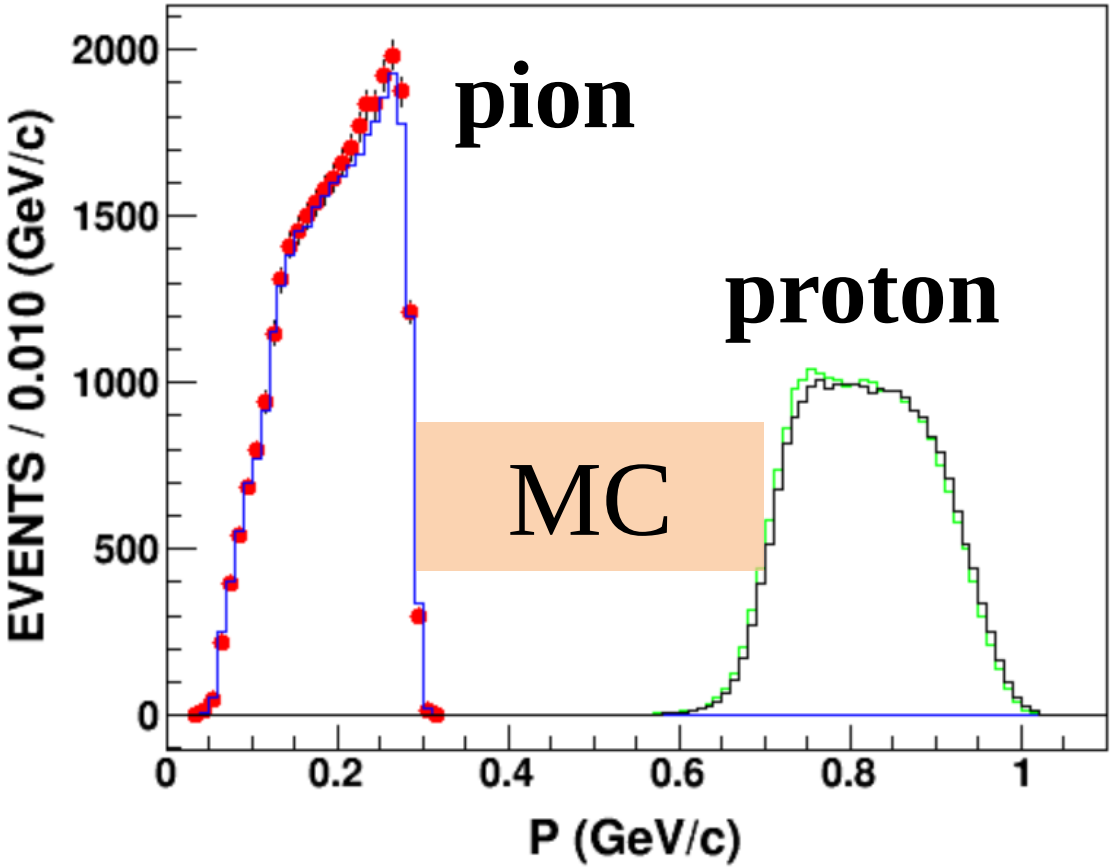
  - **Neutral track: $N_\gamma \geq 1$**

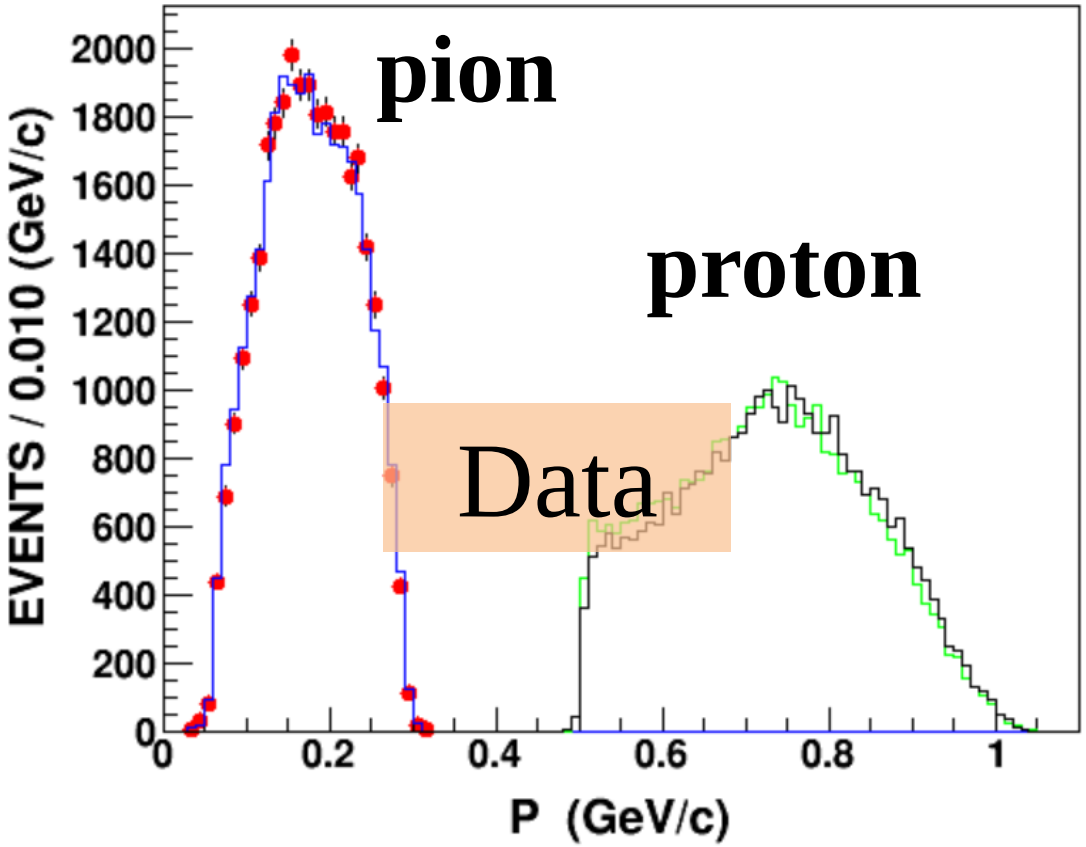
    1) $E_\gamma > 25$ MeV (Barrel), $E_\gamma > 50$ MeV (End cap)

    2) $\theta(\gamma, \bar{p}) > 30°$, $\theta(\gamma, p、\pi^{\pm}) > 20°$

  - **The 4C kinematic fit ($J/\psi \to \gamma\Lambda\bar{\Lambda}$ hypothesis)**

Event selection

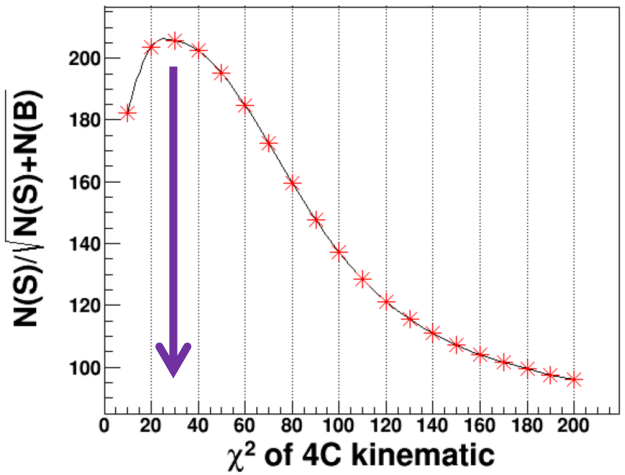


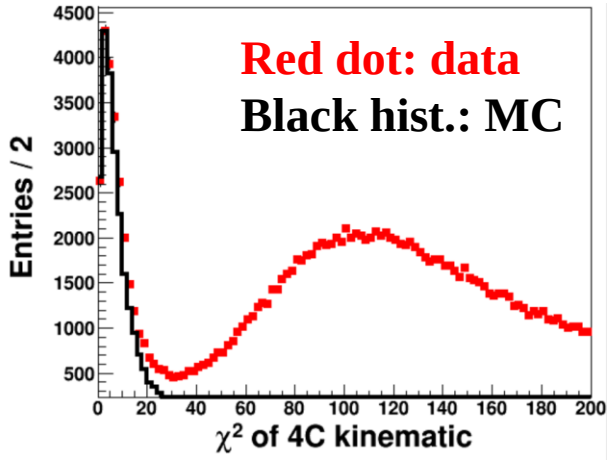


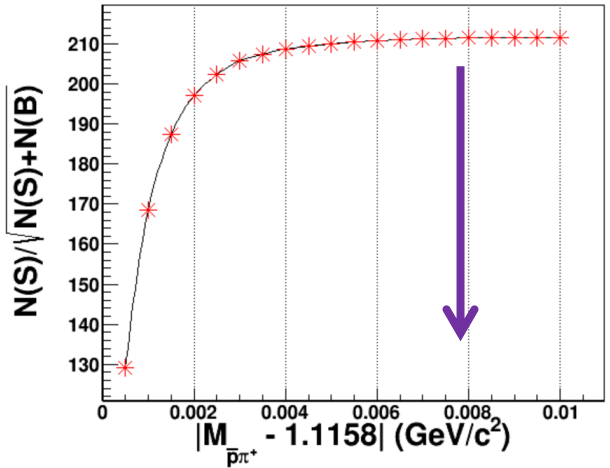
Event selection

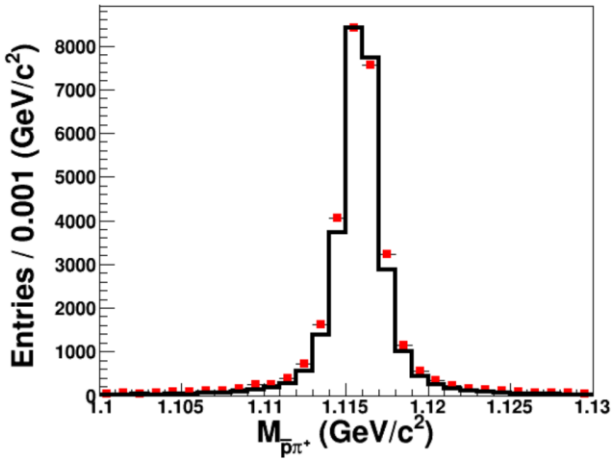
- **Further selection**

$S / \sqrt{S + B}$ **is used to optimize the selection**









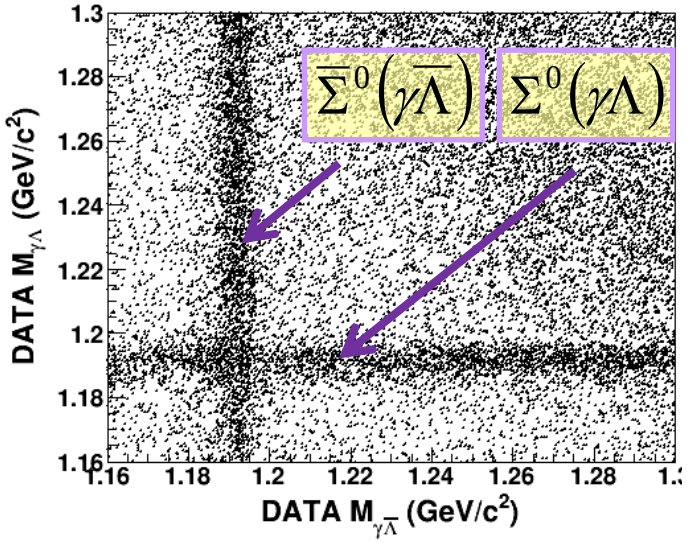
- $\chi^2 < 30$
- $\left| M_{p\pi} - 1.116 \right| < 0.008\ \mathrm{GeV/c^2}$

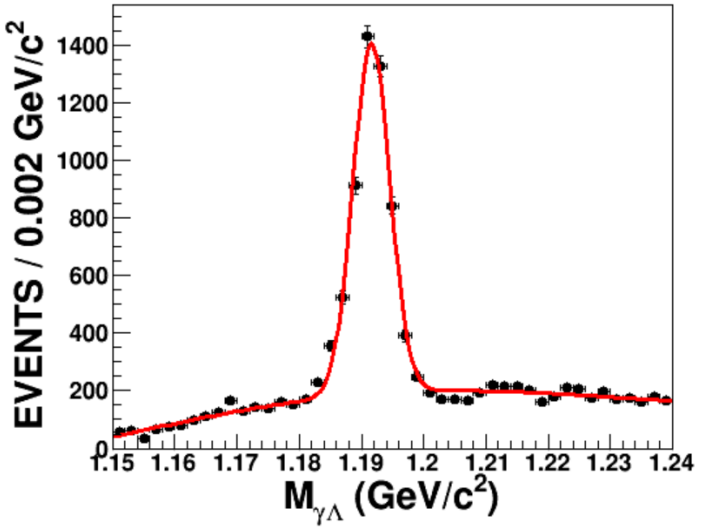
Event selection

- **Further selection**

  $S / \sqrt{S + B}$ **is used to optimize the selection**

  Σ^0 and $\bar{\Sigma}^0$ should be suppressed.





- $\chi^2 < 30$
- $\left|M_{p\pi} - 1.116\right| < 0.008$ GeV/c^2
- $\left|M_{\gamma\Lambda(\bar{\Lambda})} - 1.192\right| > 0.009$ GeV/c^2

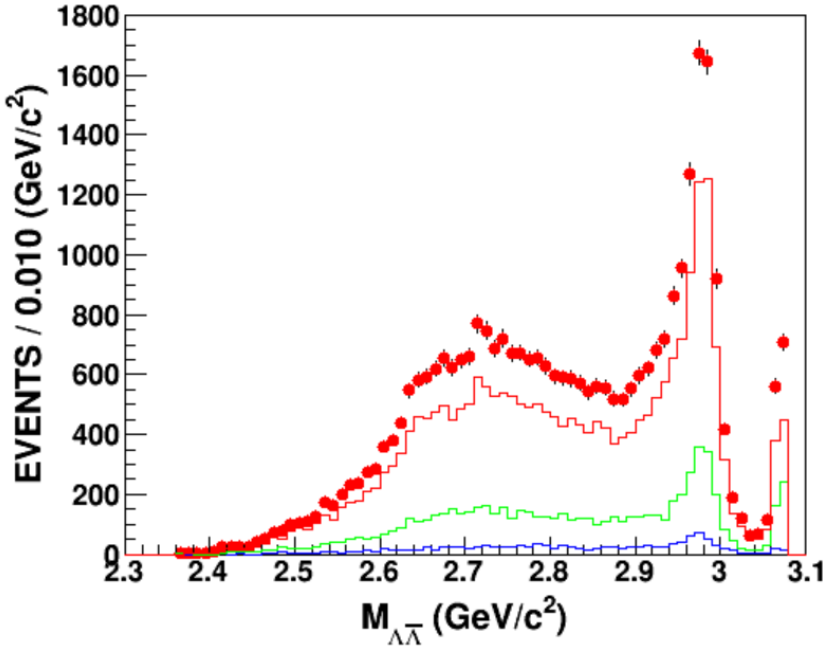
$M_{\gamma\Lambda} = 1191.61 \pm 0.06$ MeV/c^2

$\sigma_{\gamma\Lambda} = 2.98 \pm 0.08$ MeV/c^2

Efficiency check

Date	09	12	17 and 18
MC (10^7) Efficiency(%)	12.76	14.39	12.48
Data sample	223.7×10^6 [1]	1086.9×10^6 [1]	4600×10^6 [2]
	1177	6840	24410

Red dots : all
Blue hist. : 09
Green hist. 12
Red hist. 17 and 18



[1] M. Ablikim, et. al, Chin. Phys. C, Vol.41, No.1(2007).
[2]http://english.ihep.cas.cn/bes/doc/2250.html?tdsourcetag=s_pcqq_aiomsg

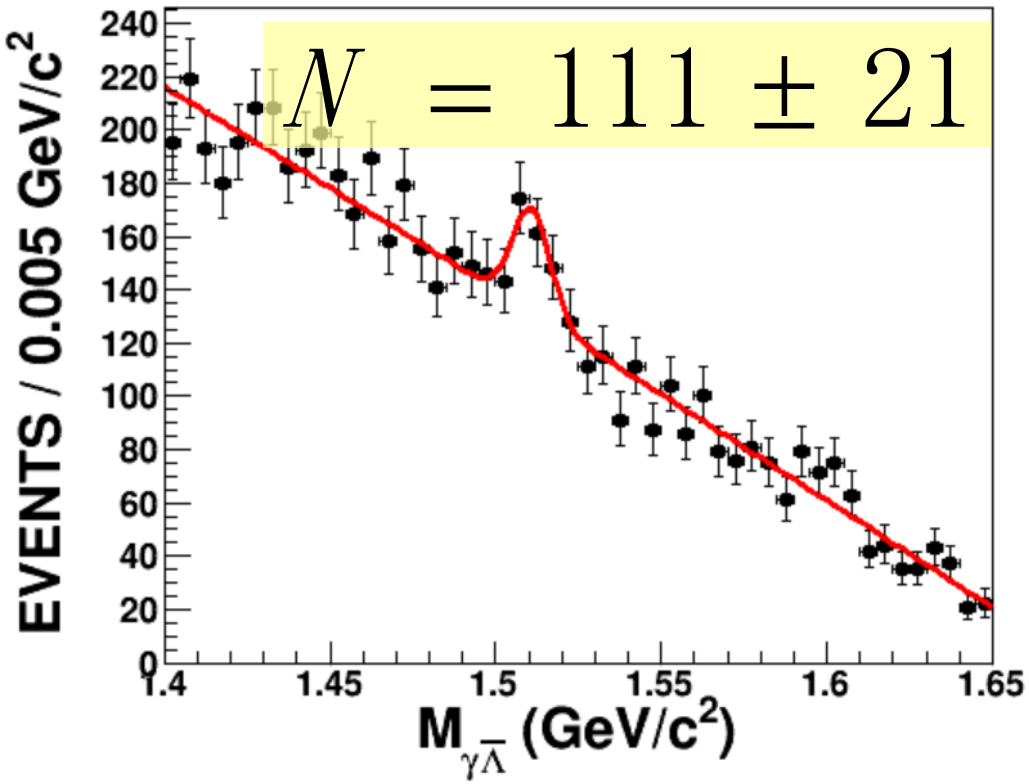
Efficiency check

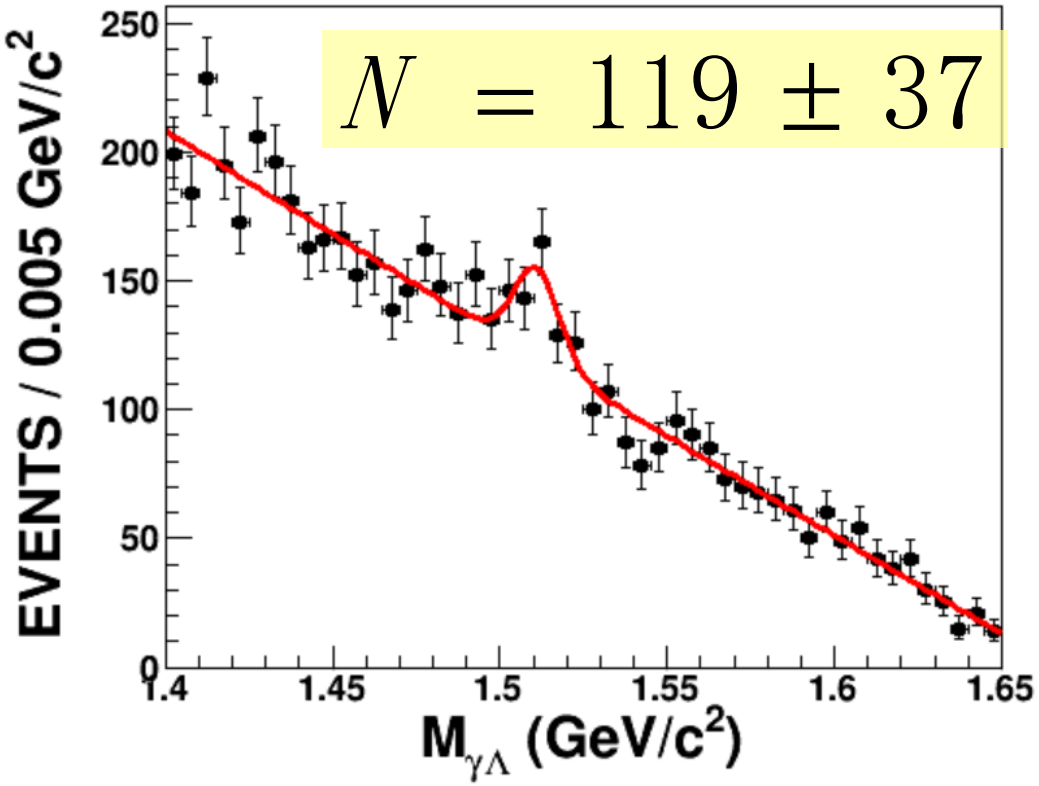
MC sample : 10^7

cut / data	Good track	Good photon	Vertex fit	4C	Mass of $p\pi$	Mass of $\gamma\Lambda/\bar{\Lambda}$
09	498037	470640	438243	162446	155869	127649
12	515885	487373	457567	183238	175653	143904
17 and 18	486800	460283	426917	158307	151867	124823

The difference of detection efficiency between these data samples maybe caused by the intensity of magnetic field.

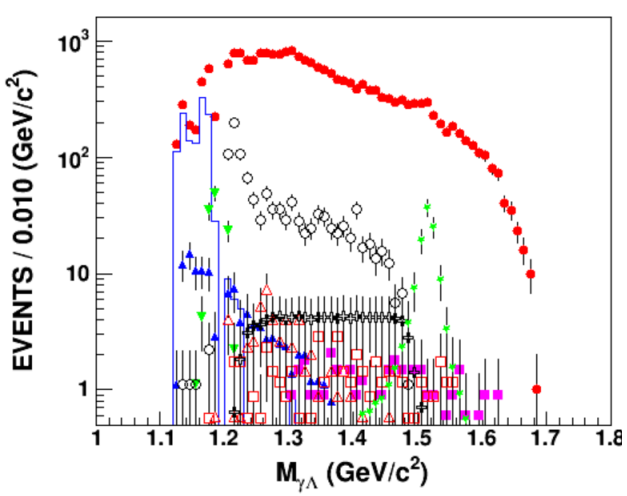
Background study

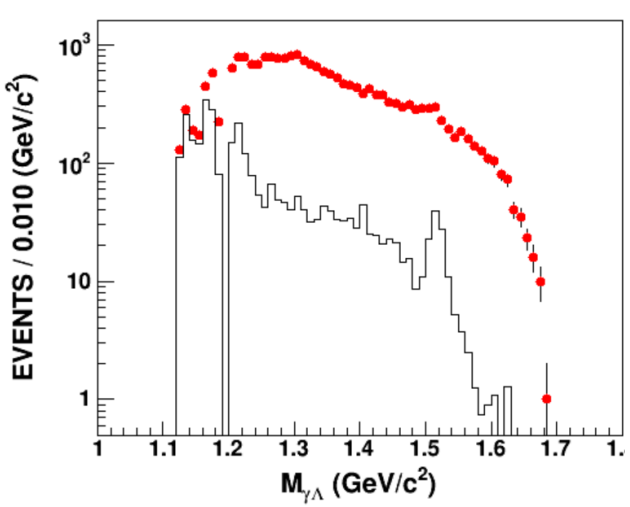


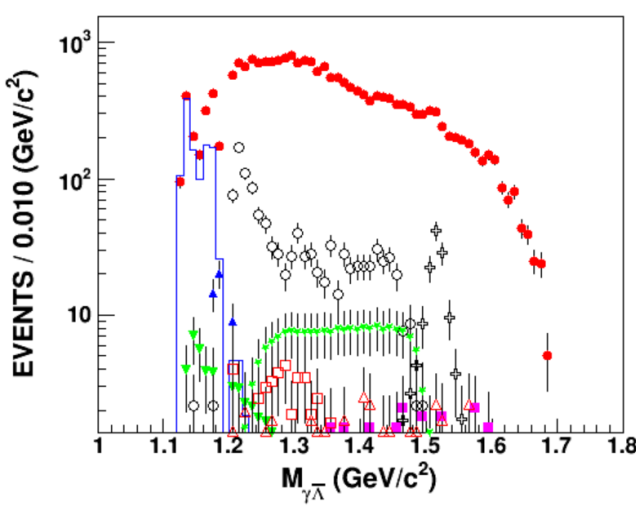


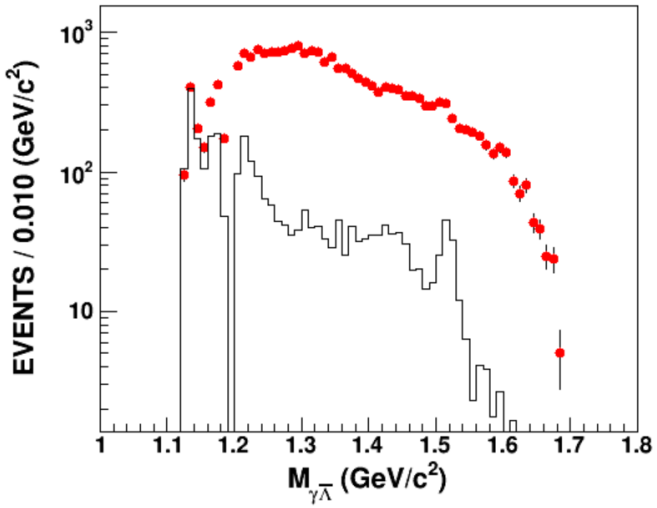
Estimation of $J/\psi \to \Lambda(1520)\overline{\Lambda} + c.c.$

Background study









1.Red dot: data

2.Blue Hsit. : $J/\psi \to \Lambda\bar{\Lambda}$

3.Green Hist. : $J/\psi \to \gamma\Lambda\bar{\Lambda}$

4.Purple Squre: $J/\psi \to \pi^0\Lambda\bar{\Lambda}$

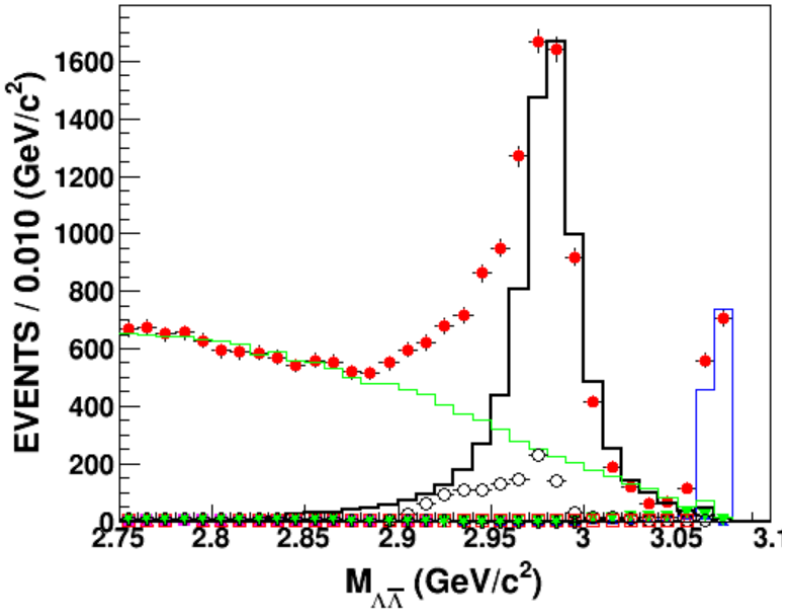
5.Blue Triangle: $J/\psi \to \Sigma^0\bar{\Lambda}$

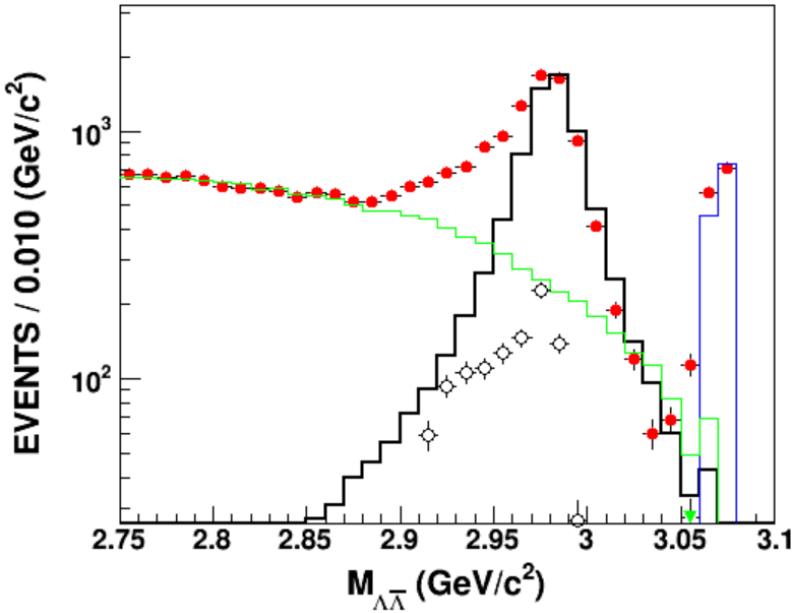
6.Green Anti-triangle: $J/\psi \to \Sigma^0\bar{\Lambda}$

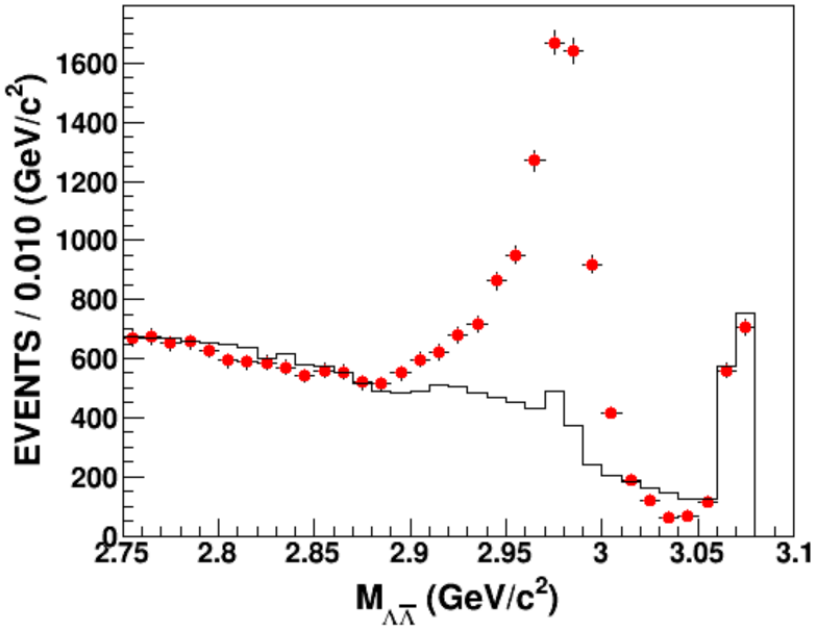
7.Black Circle: $J/\psi \to \Sigma^0\bar{\Sigma}^0$

8.Green star: $J/\psi \to \Lambda(1520)\,\bar{\Lambda}$+*c.c.*

Background study







1.Red dot: data

2.Black hist.: $\eta_c \to \Lambda\bar{\Lambda}$

3.Blue Hsit. : $J/\psi \to \Lambda\bar{\Lambda}$

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6.Blue Triangle: $J/\psi \to \bar{\Sigma}^0\Lambda$

7.Green Anti-triangle: $J/\psi \to \Sigma^0\bar{\Lambda}$

8.Black Circle: $J/\psi \to \bar{\Sigma}^0\Sigma^0$

9.Green star: $J/\psi \to \Lambda(1520)\,\bar{\Lambda}$+*c.c.*

Summary

- Preliminary study of $\eta_c \to \Lambda\bar{\Lambda}$

1)Proton and pion can be separated by their momentum for the channel;

2) Efficiency of different data samples are not same;

3) Background study:

Contribution of $J/\psi \to \Lambda(1520)\bar{\Lambda}$+*c.c.* is estimated by fitting data, and other backgrounds are estimated according to their branching fractions.

- Next work:

1) Fixed the selection;

2) Analyze the mass spectrum of $\Lambda\bar{\Lambda}$ with all J/ψ sample.