

Physics

at

BESIII

(Beijing Spectrometer III)

Talib Hussain

On behalf of BESIII Collaboration

Centre for High Energy Physics, University of the Punjab,
Lahore, Pakistan

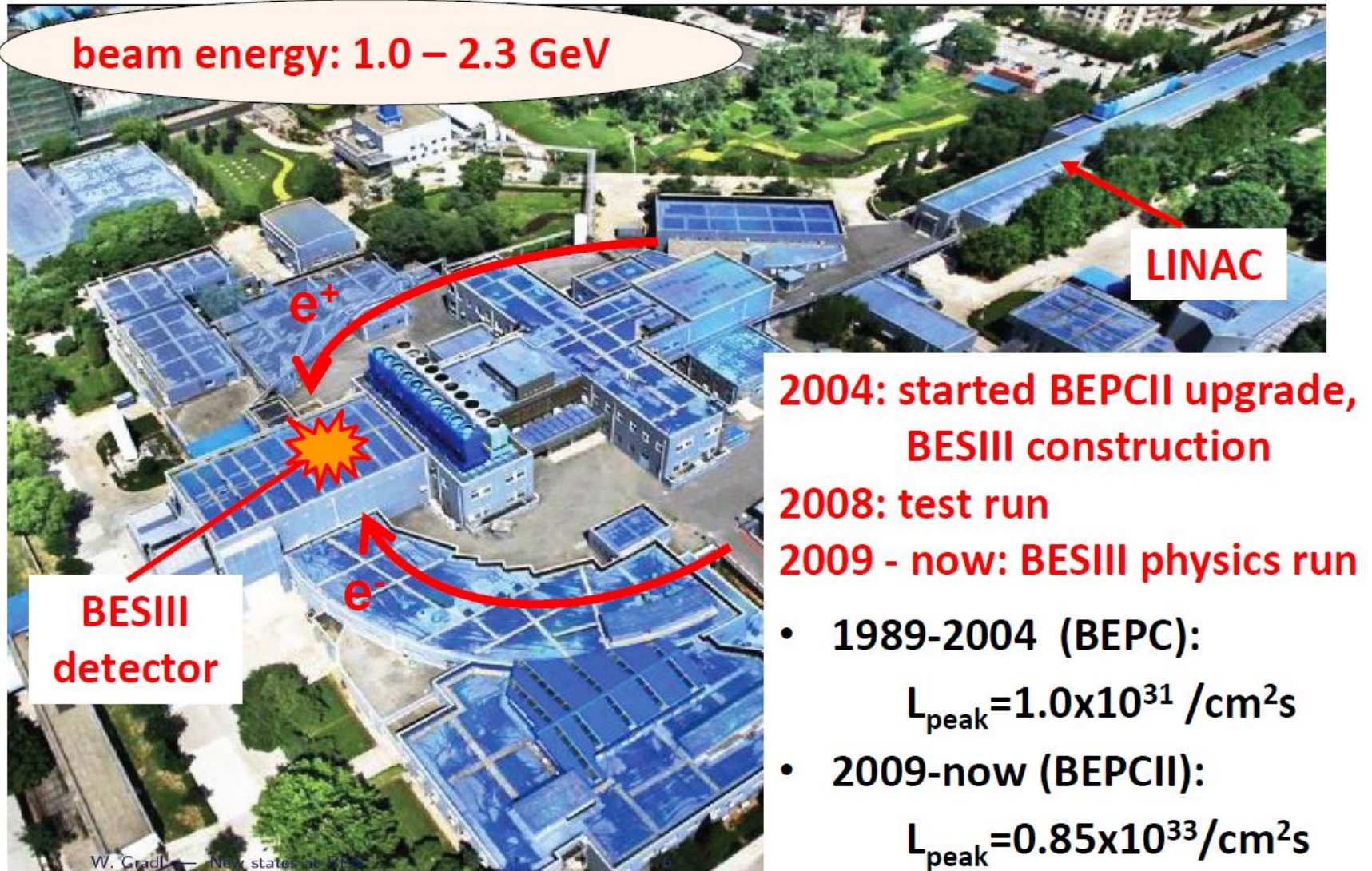
**40th Intl. Nathiagali Summer College, National Center for
Physics, Pakistan**

(03rd - 15th Aug., 2015)

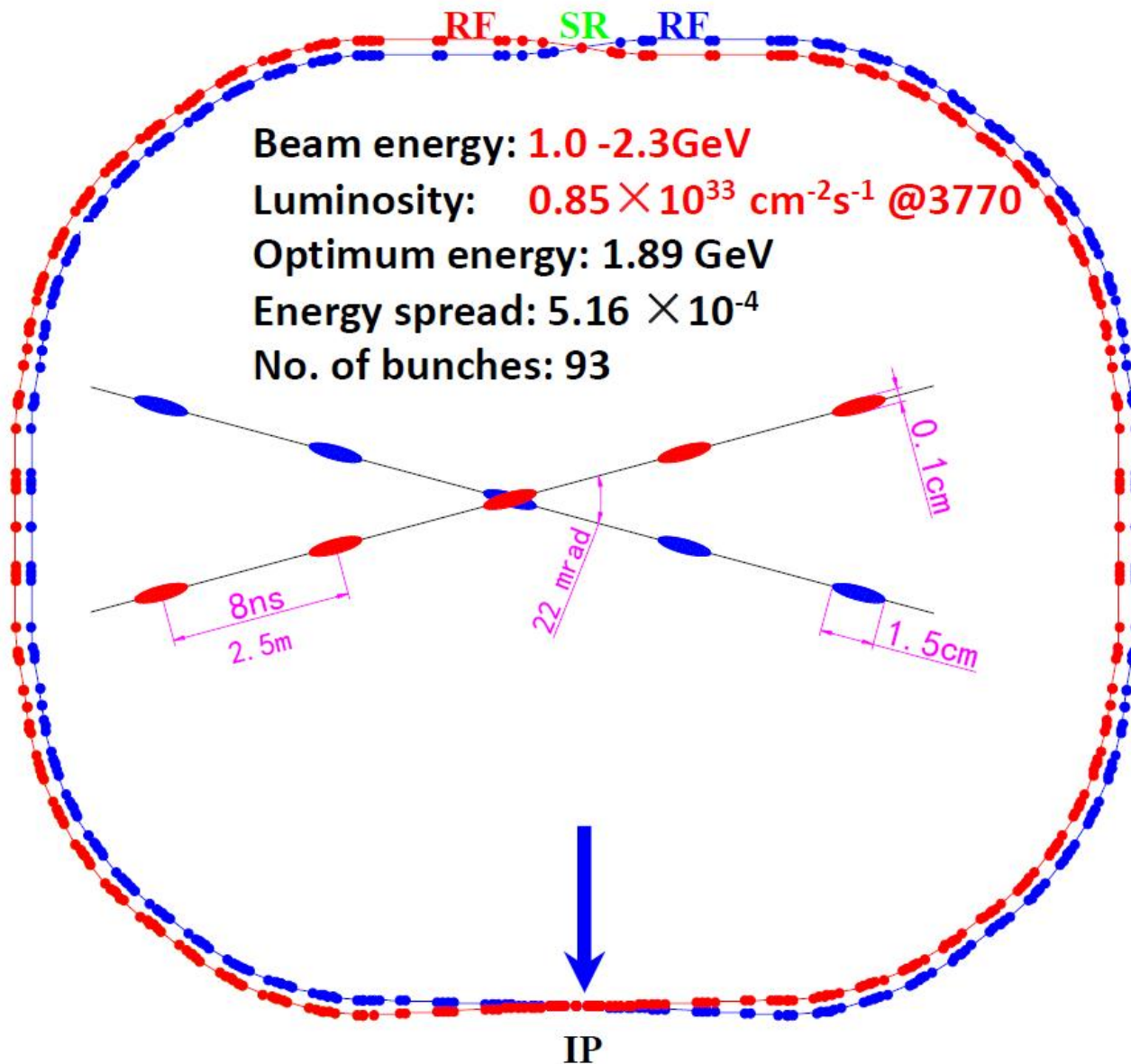
Outline

- Introduction
- BESIII Status
- Light Hadron Physics
- Charmonium and Charmonium-Like Physics
- Charm Physics
- Summary

Beijing Electron Positron Collider (BEPC)



Upgraded BEPC-BEPCII

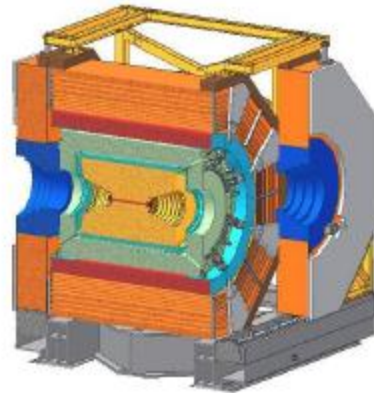


BESIII Detector

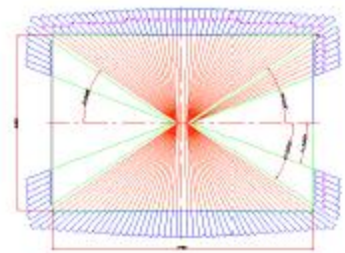
MDC



R inner: 63mm ;
 R outer: 810mm
 Length: 2582 mm
 Layers: 43

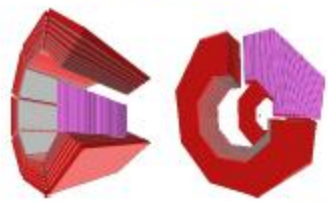


CsI(Tl) EMC



Crystals: 28 cm (15 X_0)
 Barrel: $|\cos\theta| < 0.83$
 Endcap:
 $0.85 < |\cos\theta| < 0.93$

RPC MUC



BMUC: 9 layers – 72 modules
 EMUC: 8 layers – 64 modules

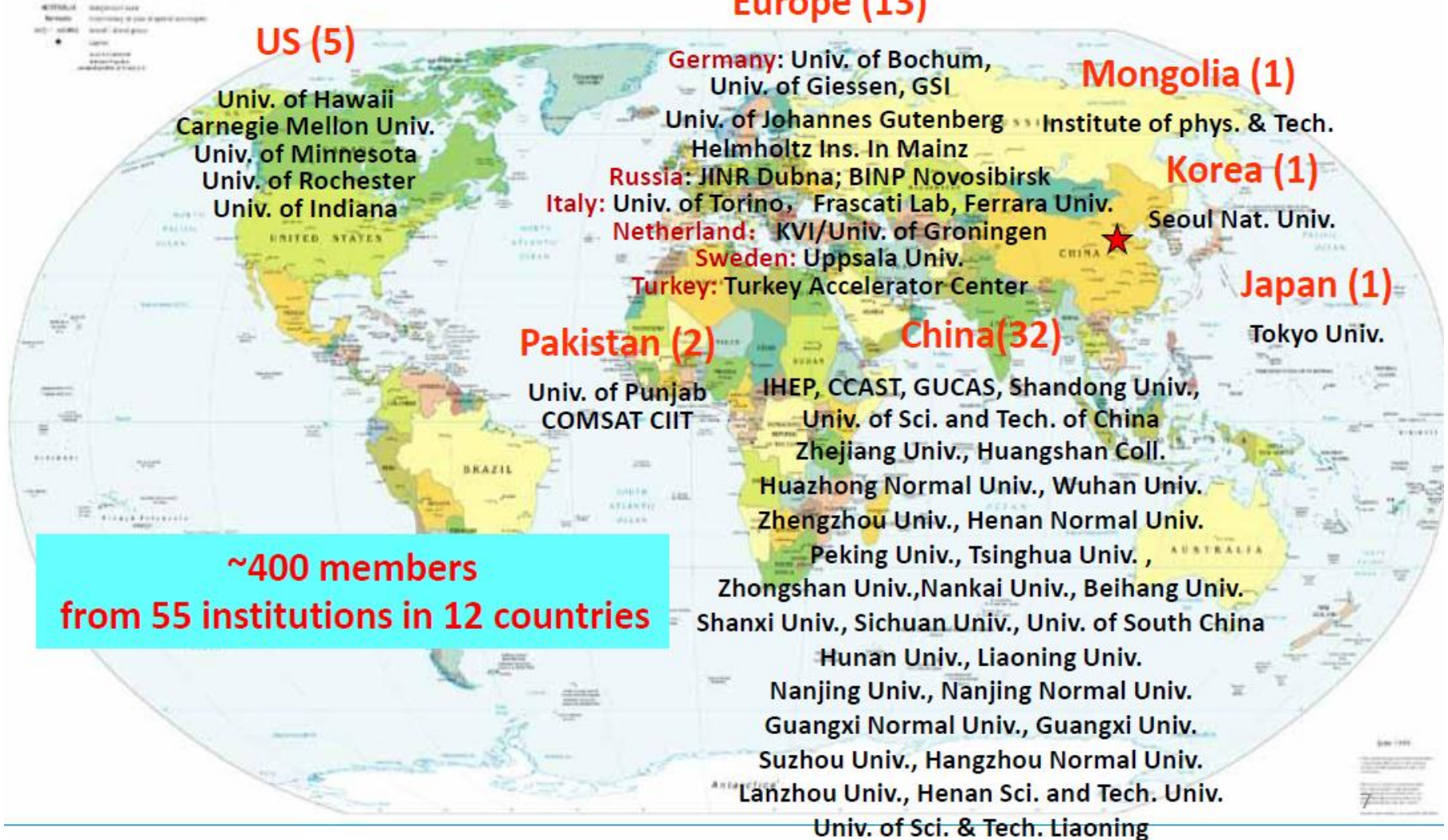
TOF

BTOF: two layers
 ETOF: 48 for each



BESIII Collaboration

Political Map of the World, June 1999

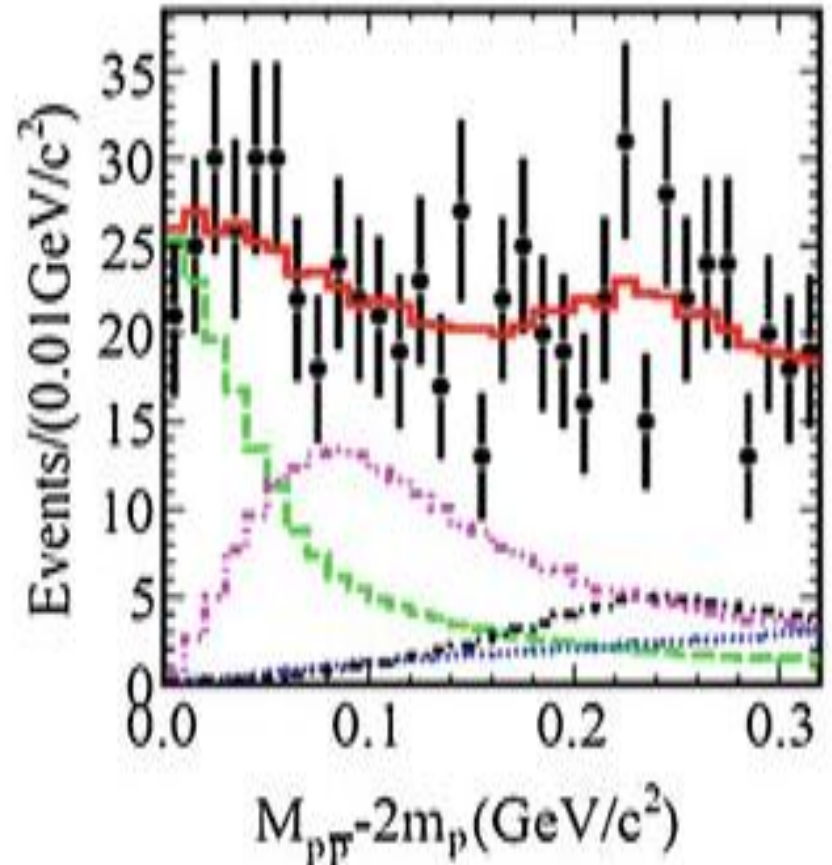
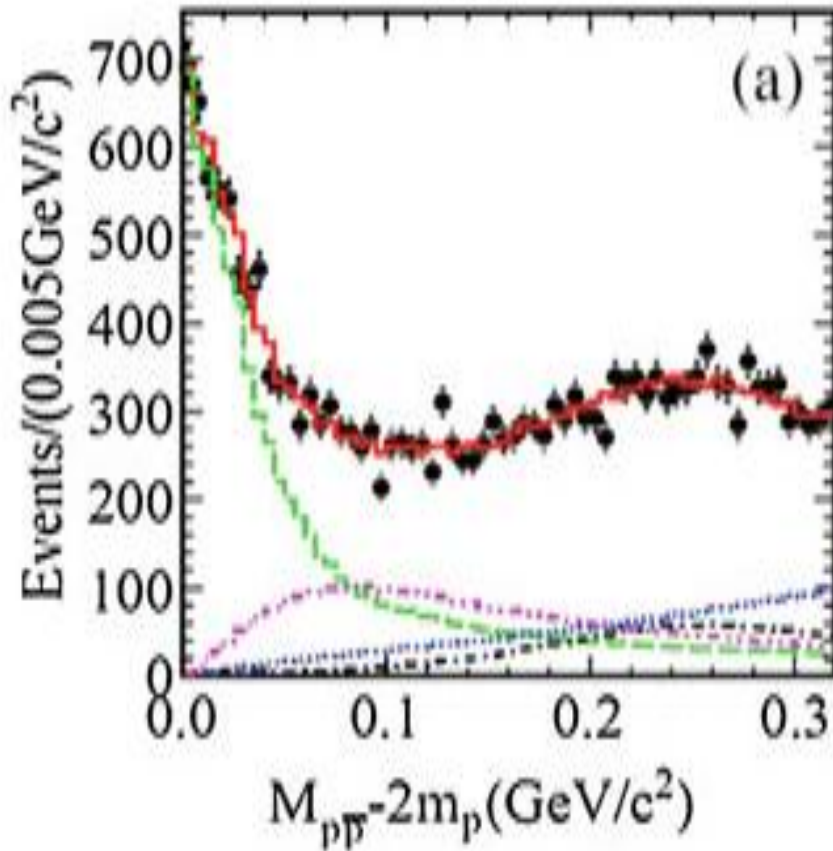


Light Hadron Physics

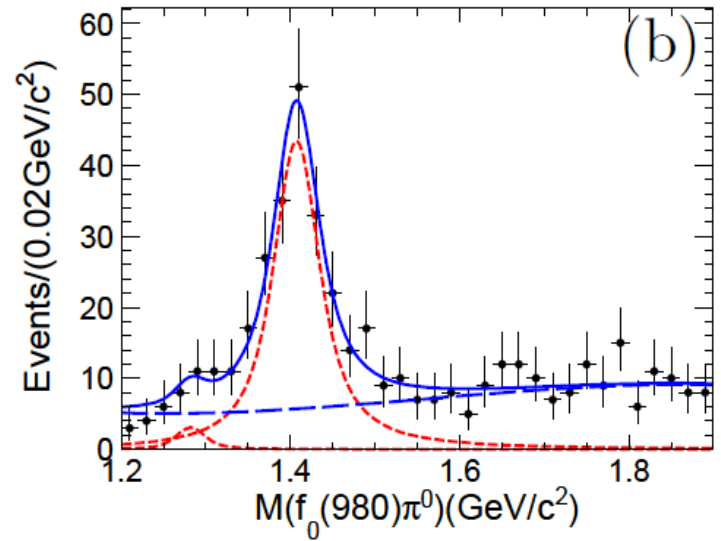
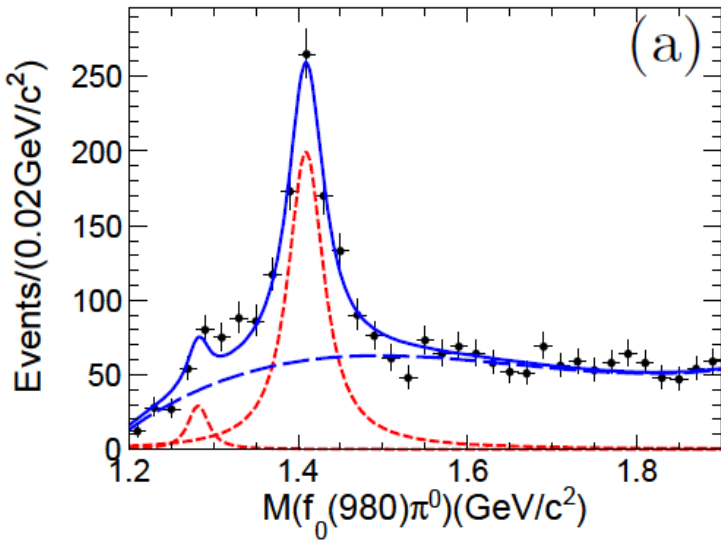
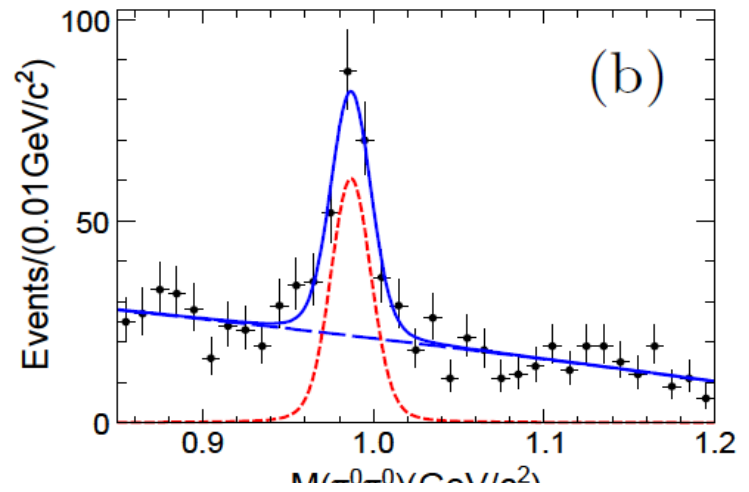
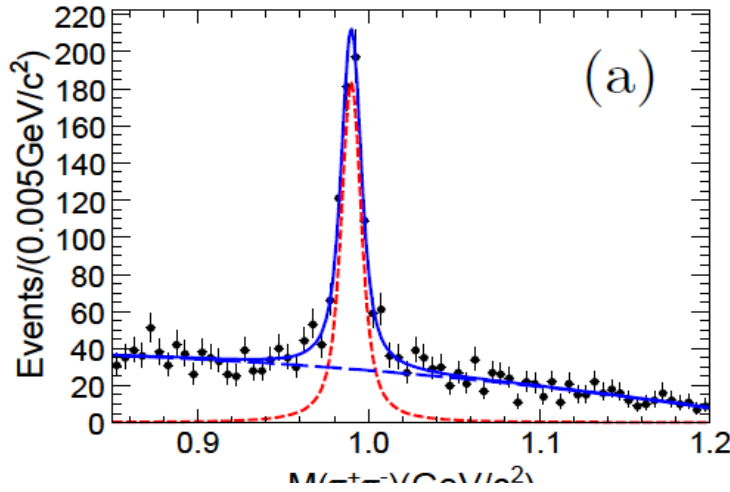
$P\bar{P}$ Enhancements

$$J/\psi \rightarrow \gamma P\bar{P}$$

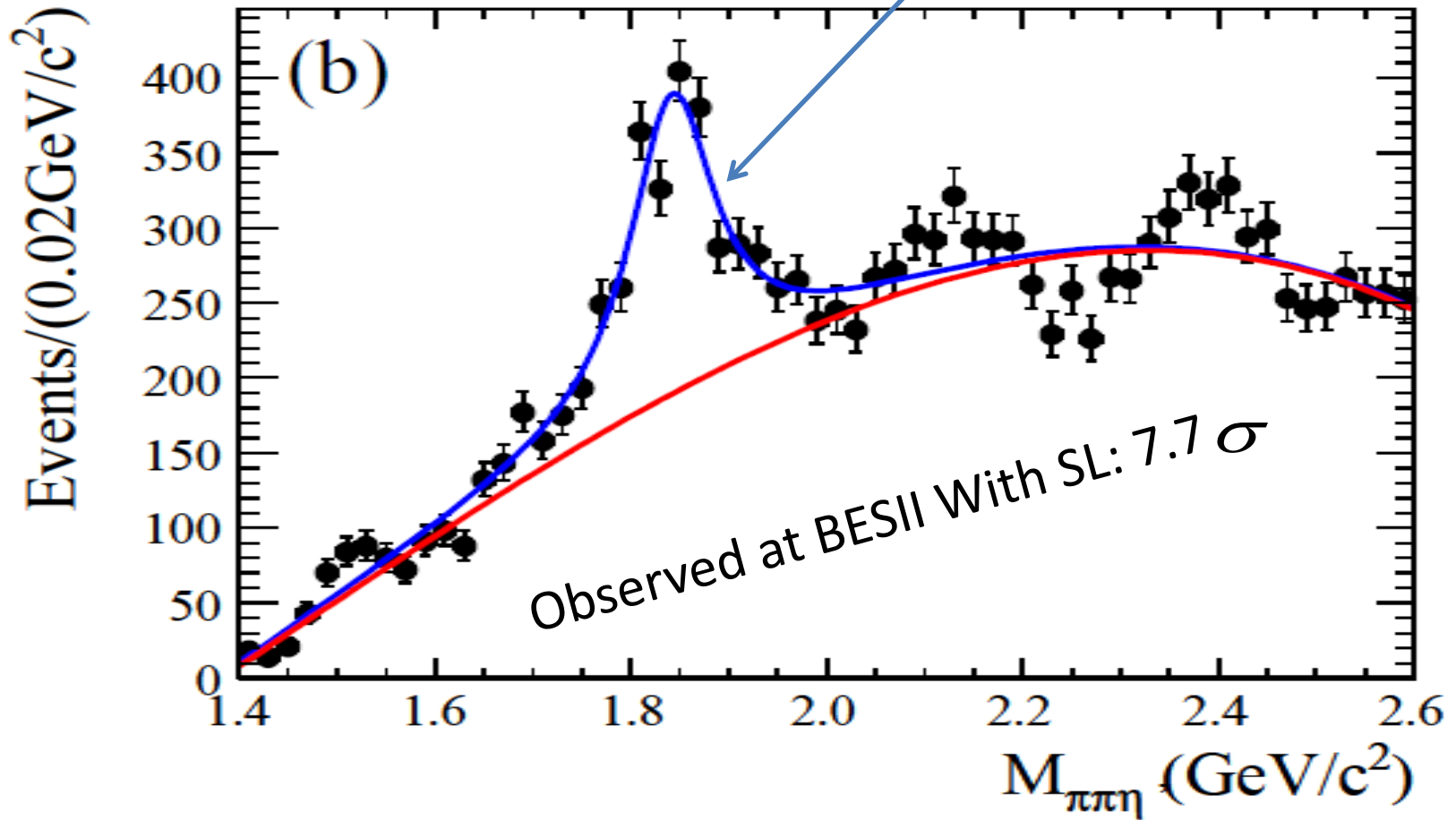
$$\psi(3686) \rightarrow \gamma P\bar{P}$$



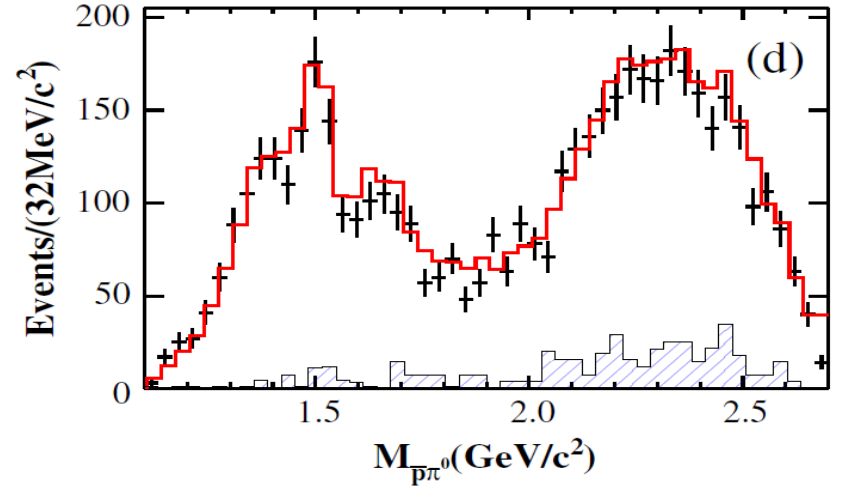
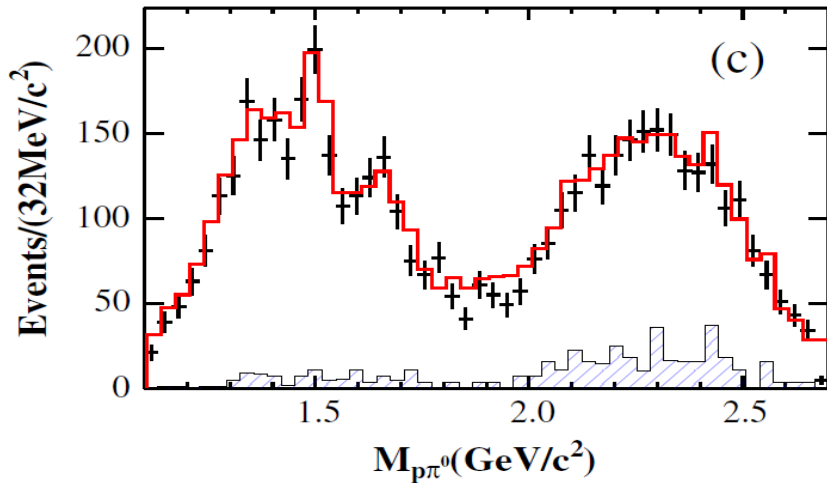
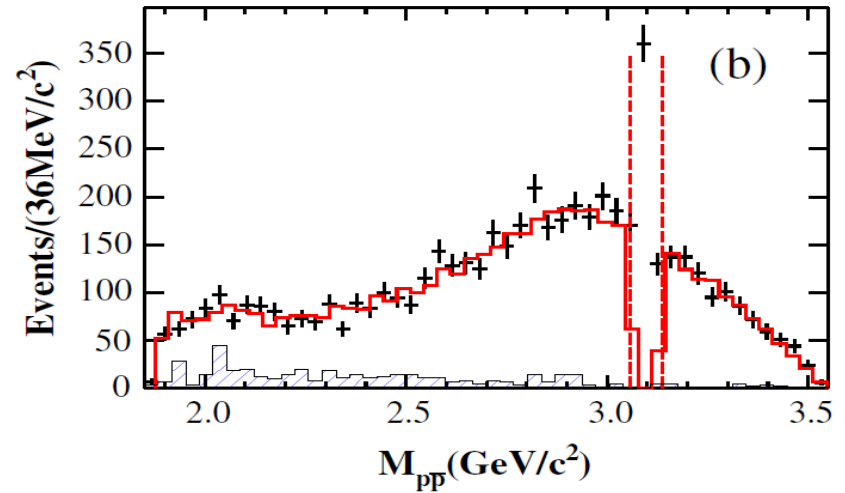
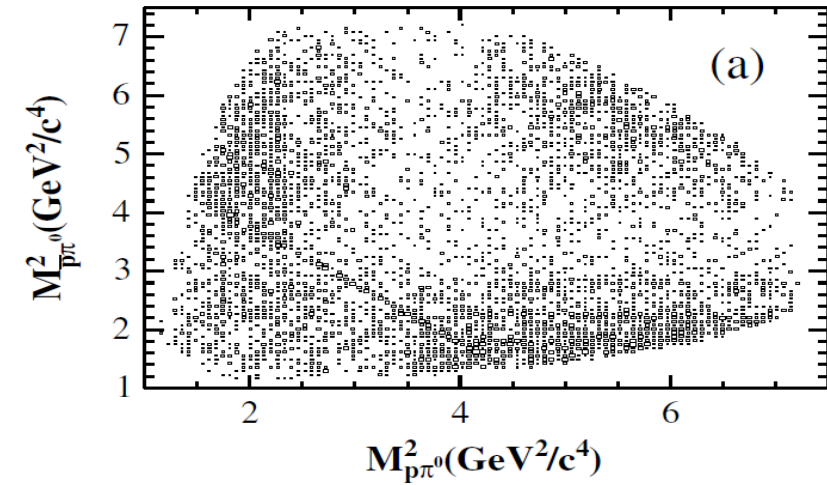
First Observation of $\eta(1405) \rightarrow f_0(980)\pi^0$

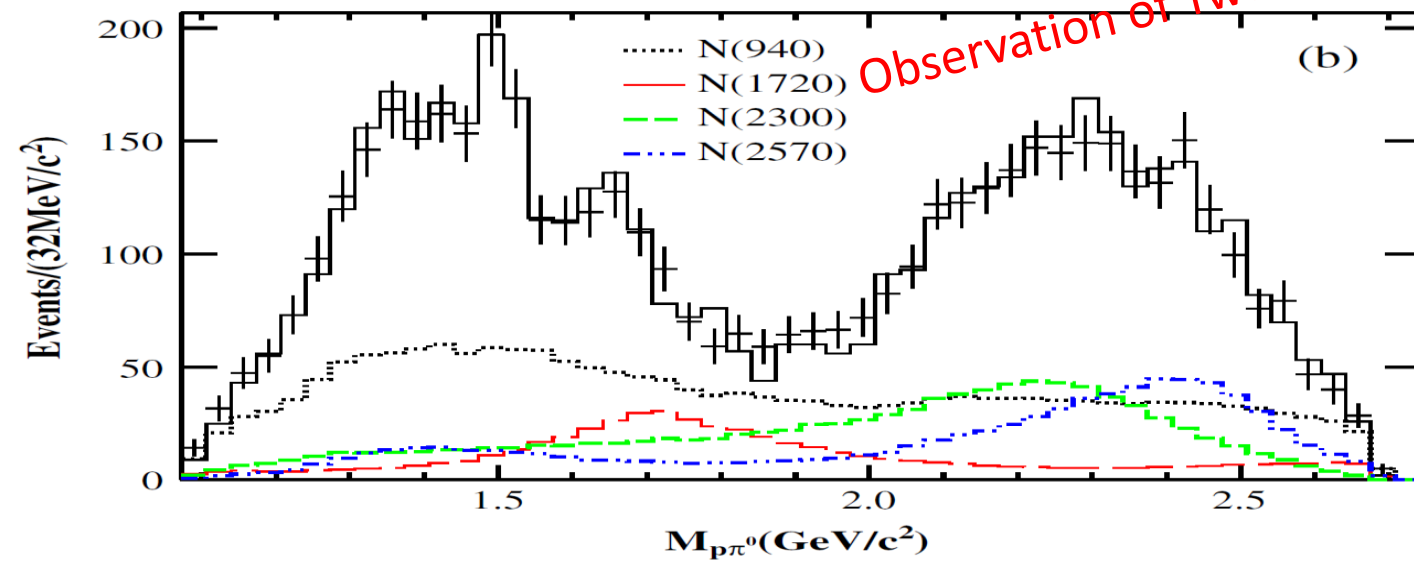
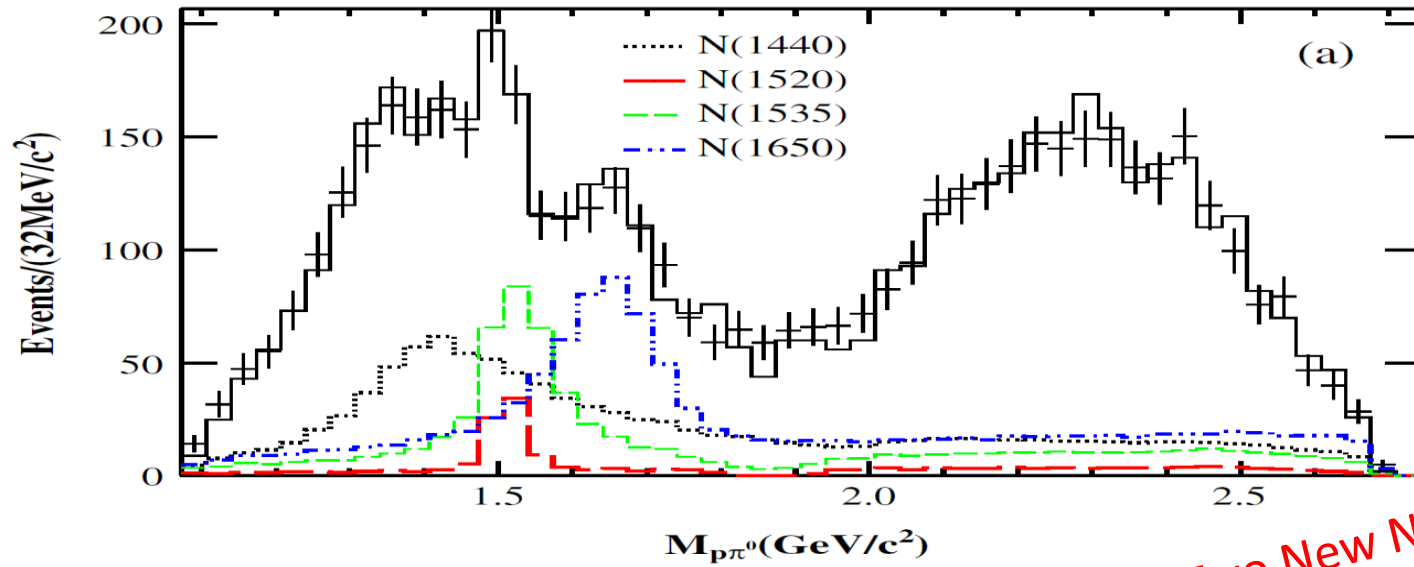


Confirmation of X(1835)

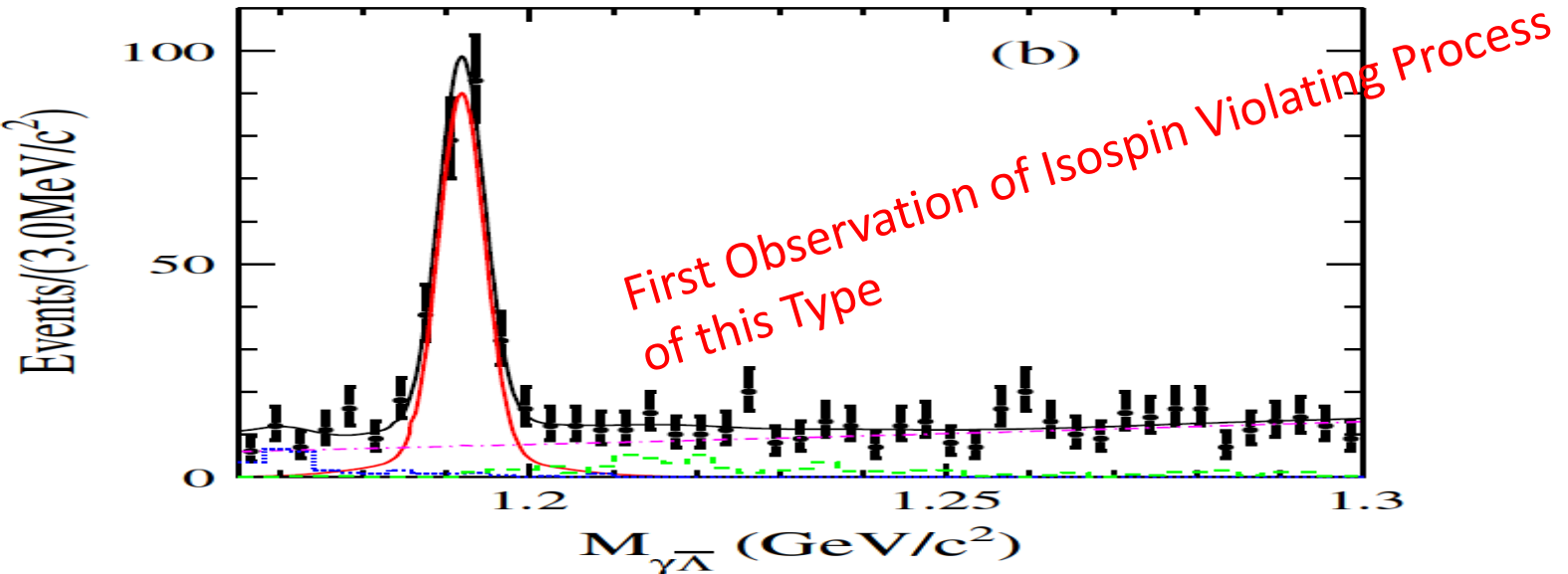
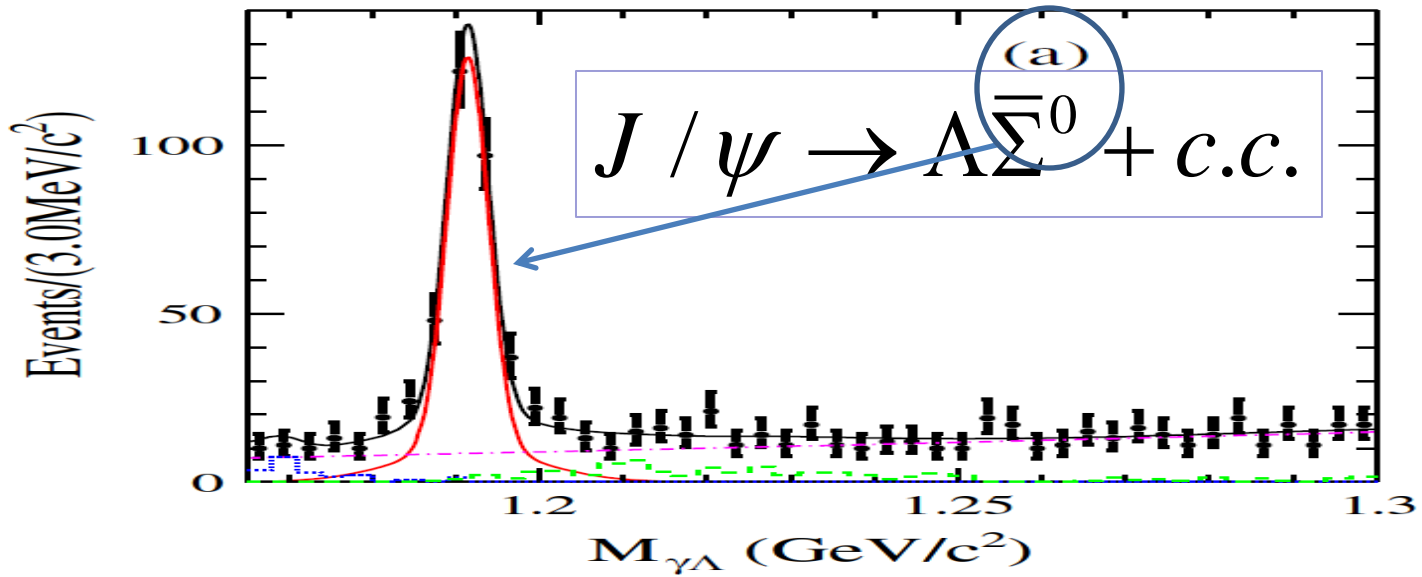


Dalitz Plot Analysis of $\psi(3686) \rightarrow P\bar{P}\pi^0$



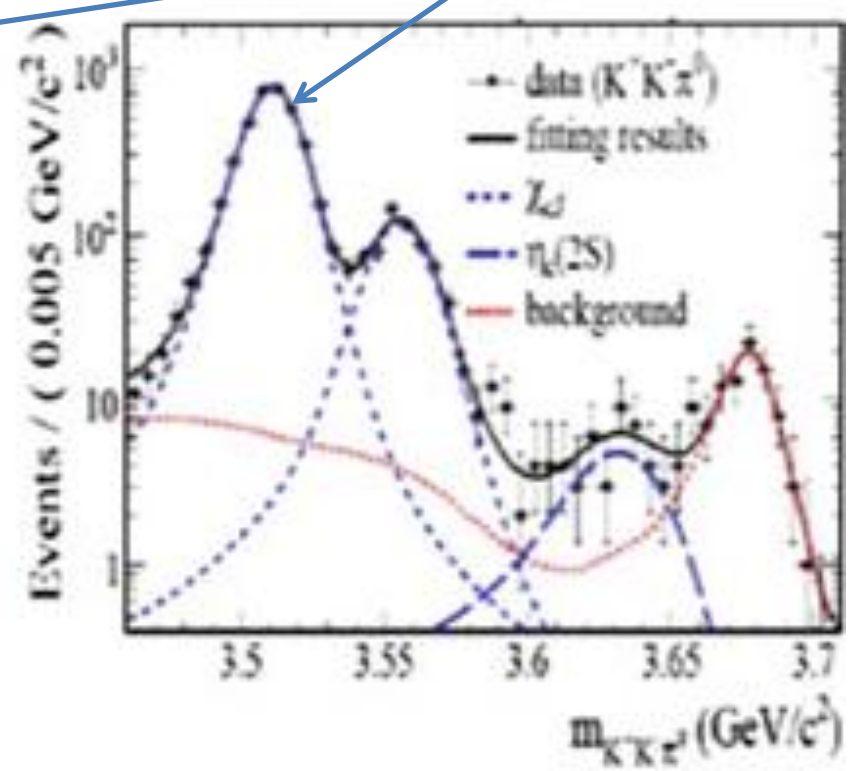
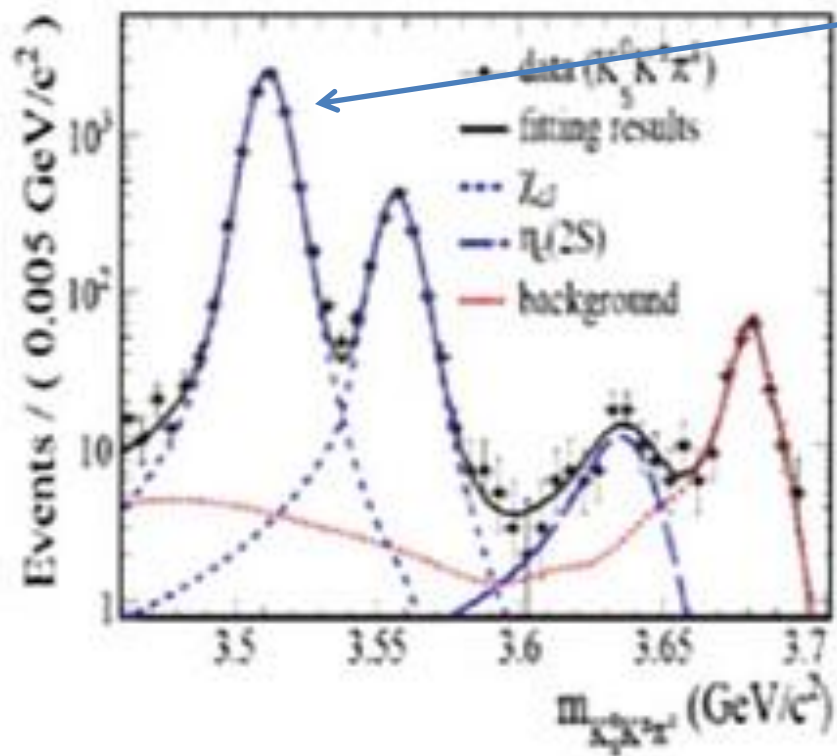


Observation of Two New N^* Resonances



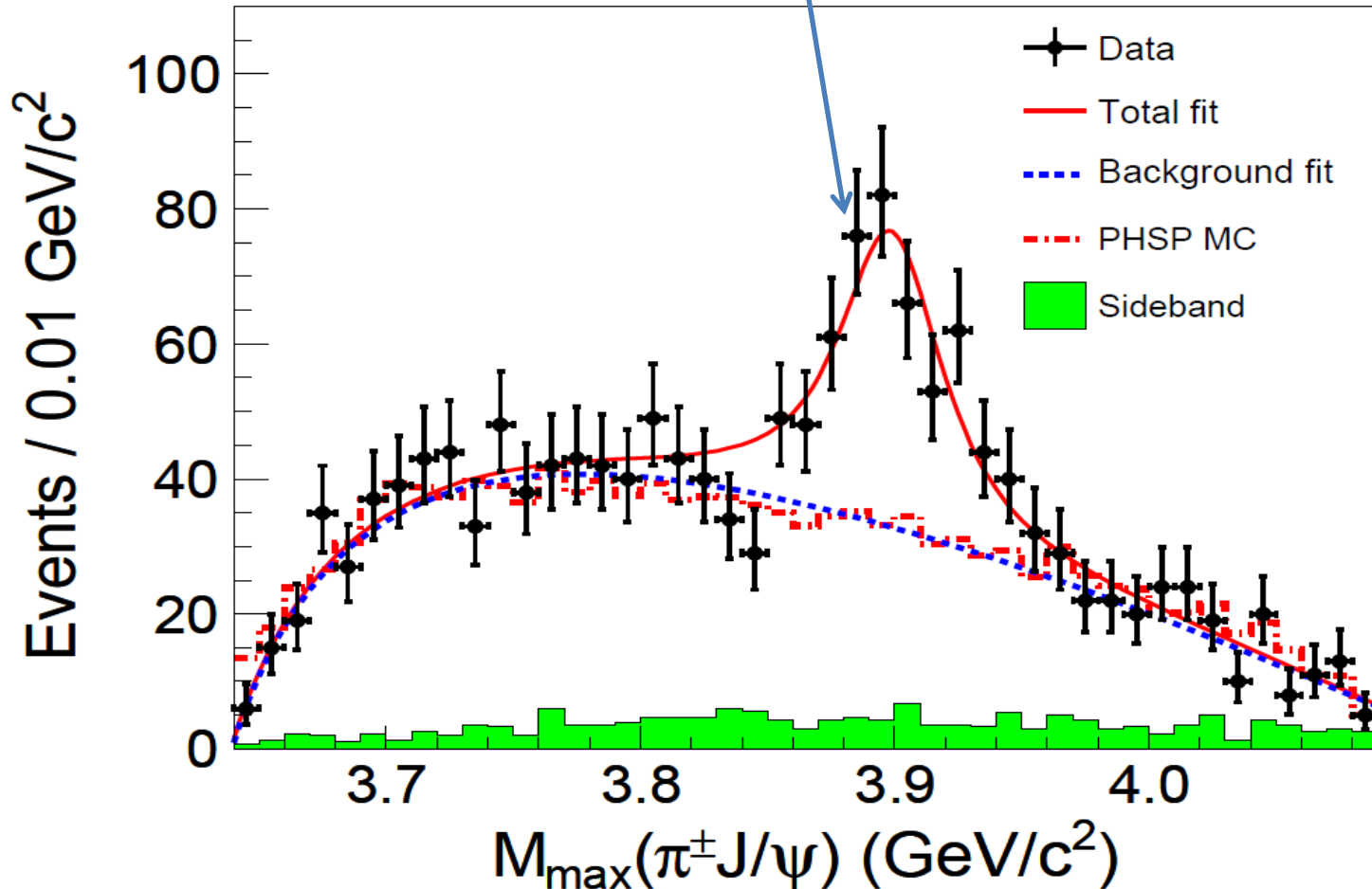
Charmonium Spectroscopy

First Observation of $\psi(2S) \rightarrow \gamma\eta_c(2S)$

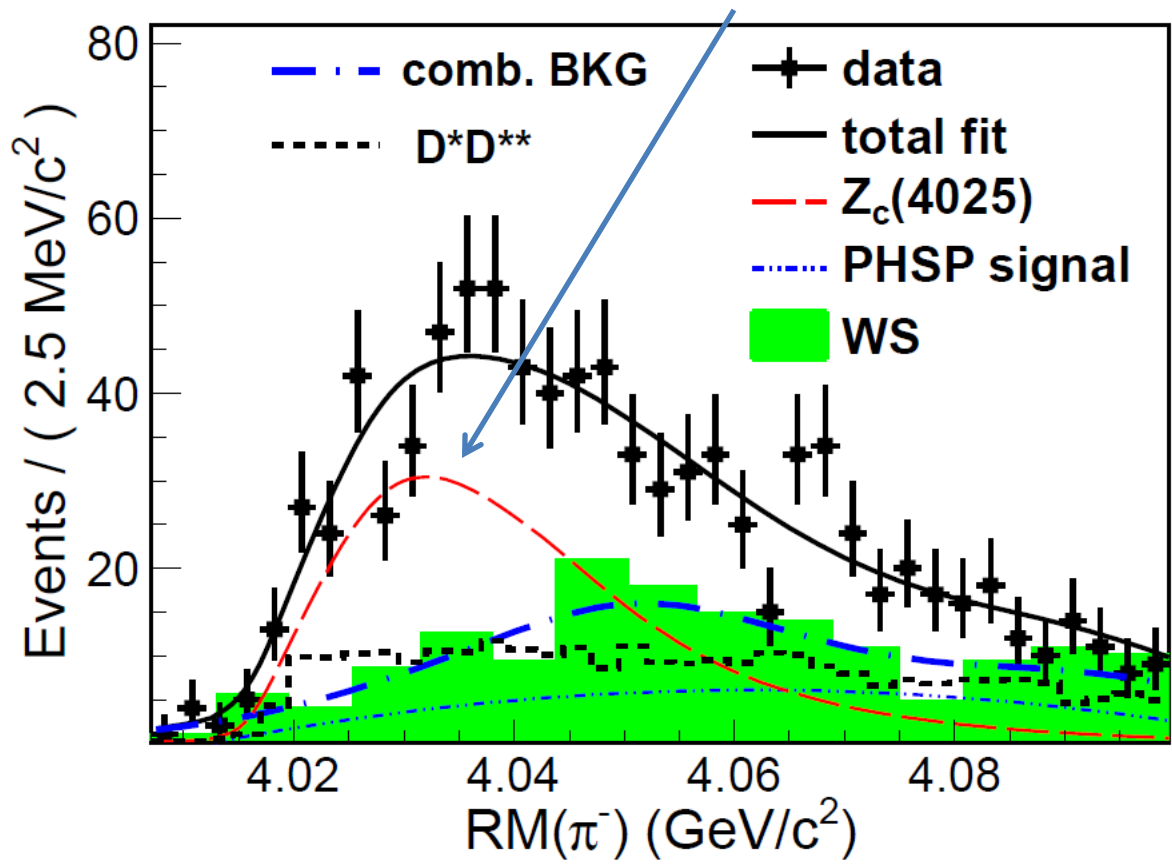


Observation of Charged Charmoniumlike Structures

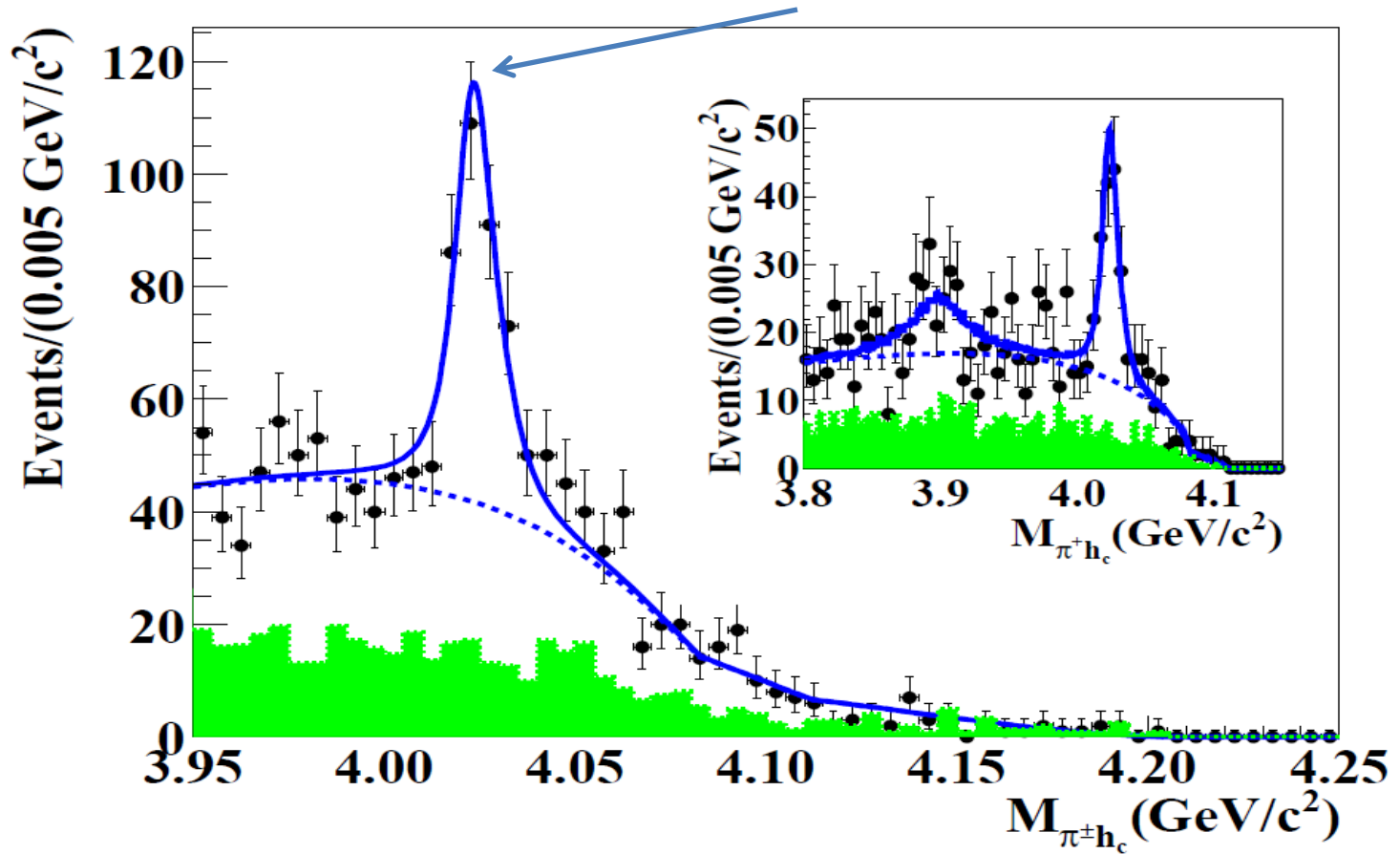
$$(i) e^+e^- \rightarrow \pi^\pm Z_c(3900)^\mp$$



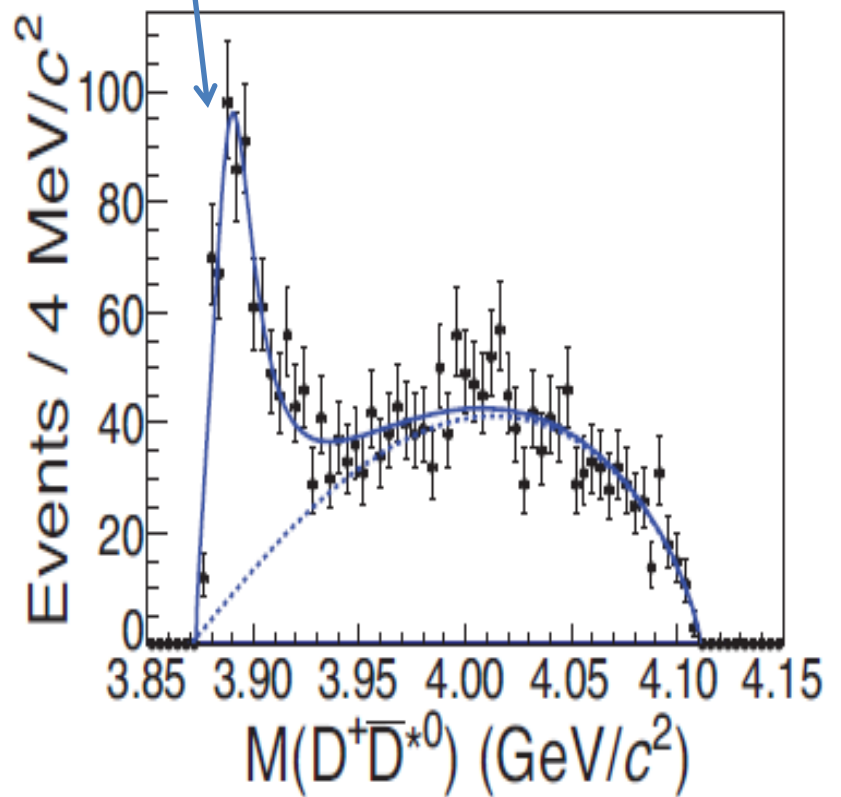
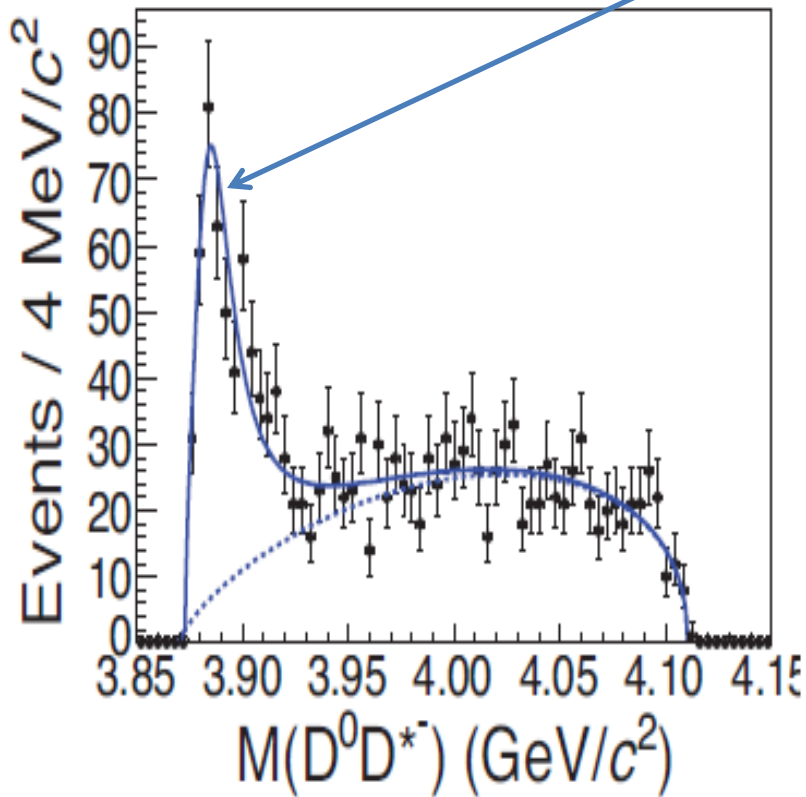
$$(ii) e^+ e^- \rightarrow \pi^\pm Z_c(4025)^\mp$$



$$(iii) e^+ e^- \rightarrow \pi^\pm Z_c(4020)^\mp$$

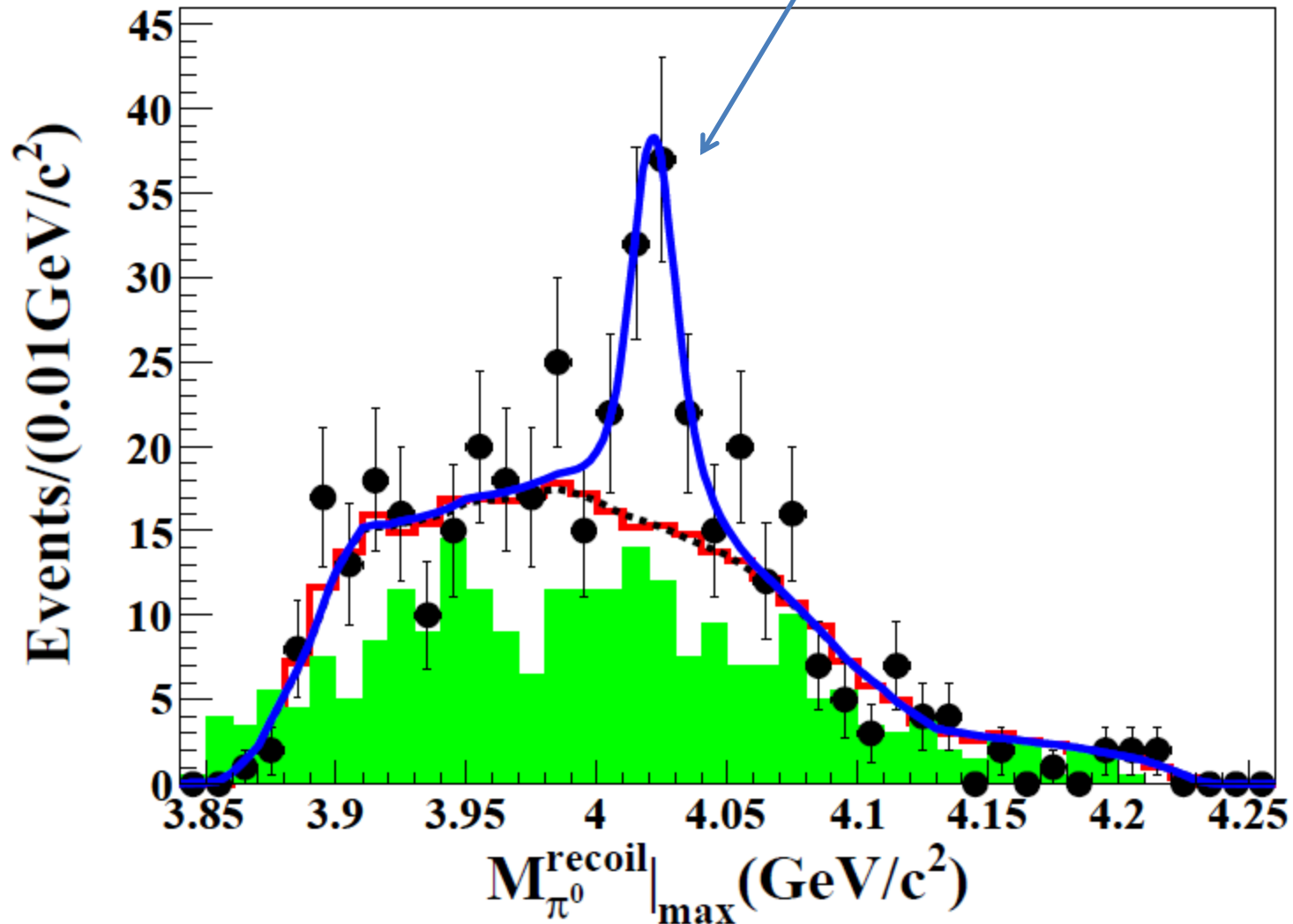


$$(iv) e^+e^- \rightarrow \pi^\pm Z_c(3885)^\mp$$

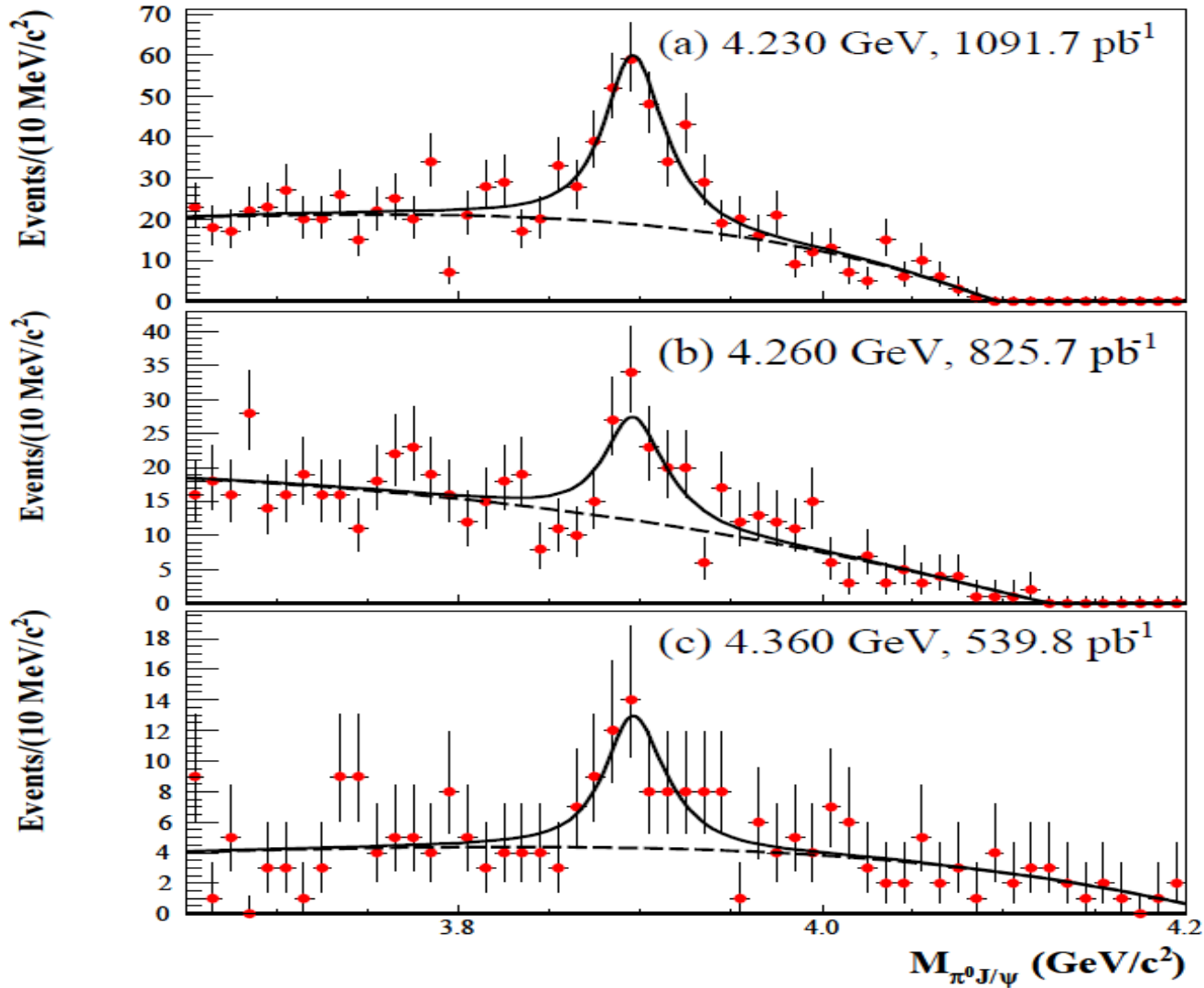


Observation of Neutral Charmoniumlike Structures

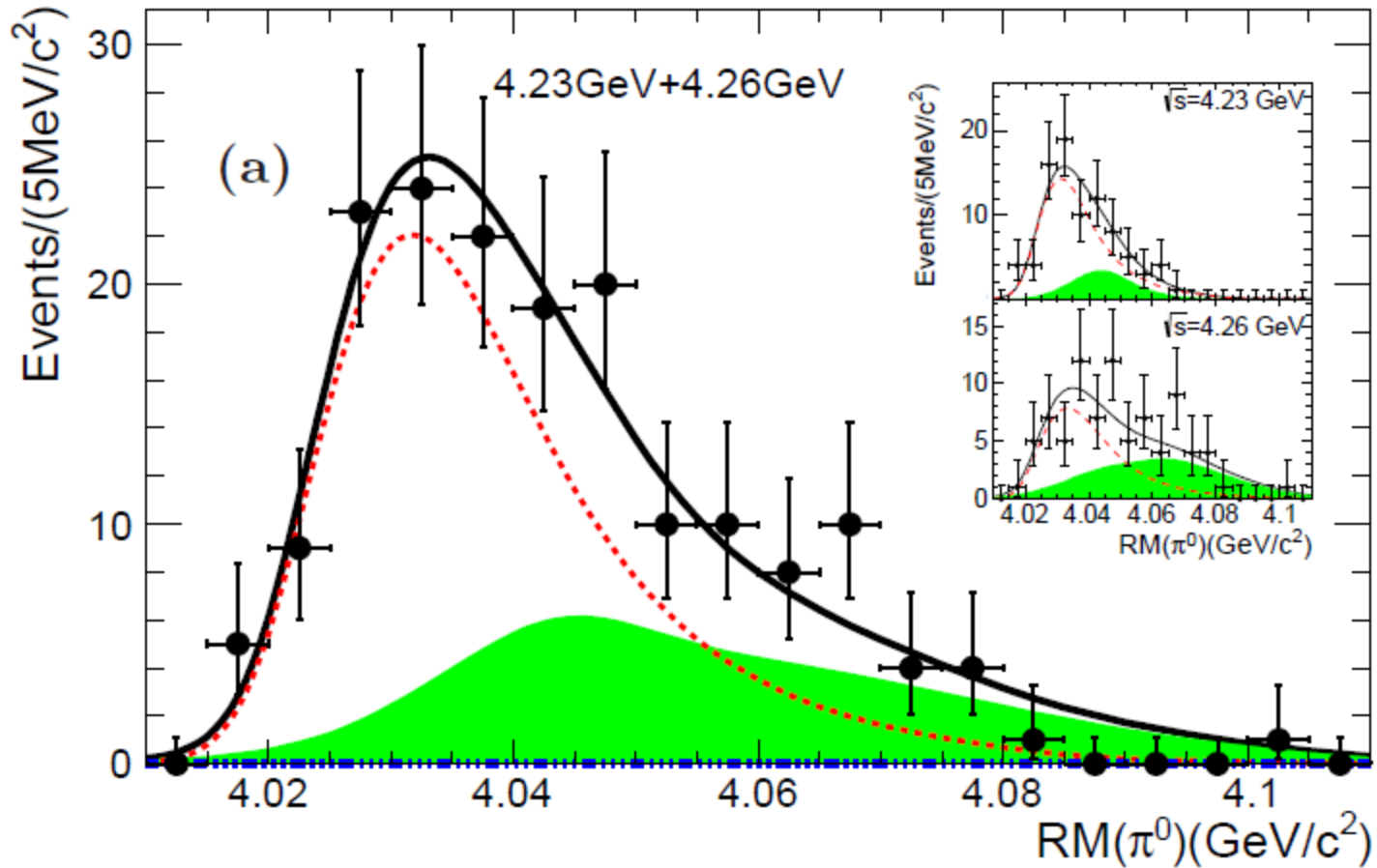
$$(i) e^+e^- \rightarrow \pi^0 Z_c(4020)^0$$



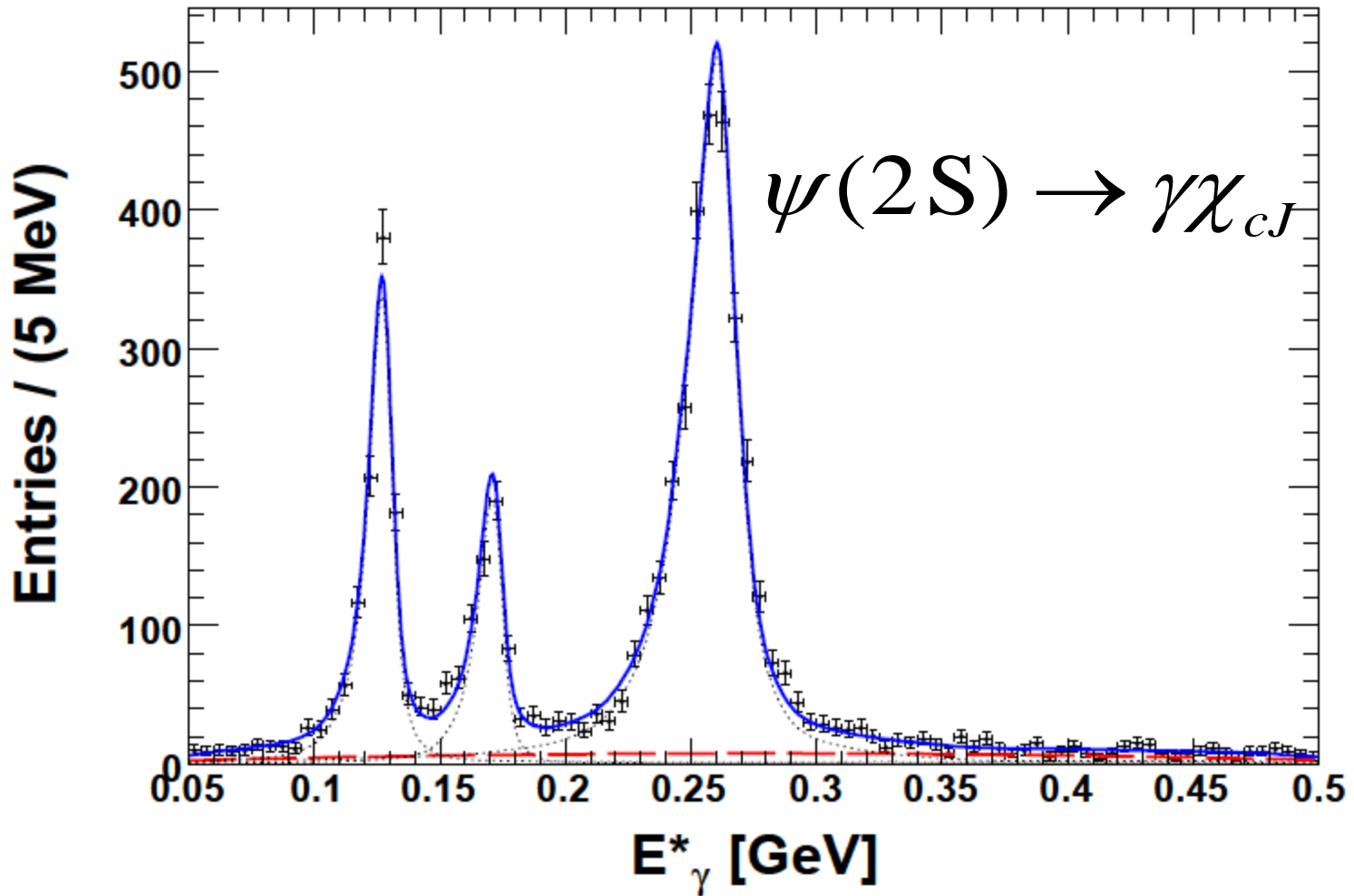
$$(ii) e^+e^- \rightarrow \pi^0 Z_c(3900)^0$$



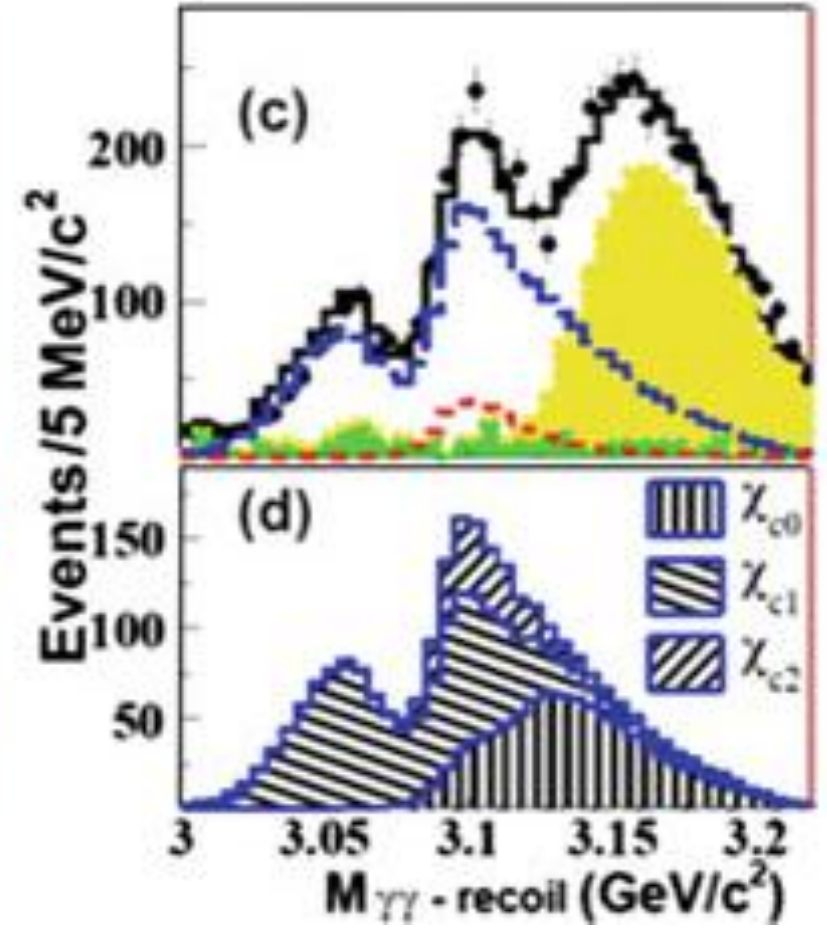
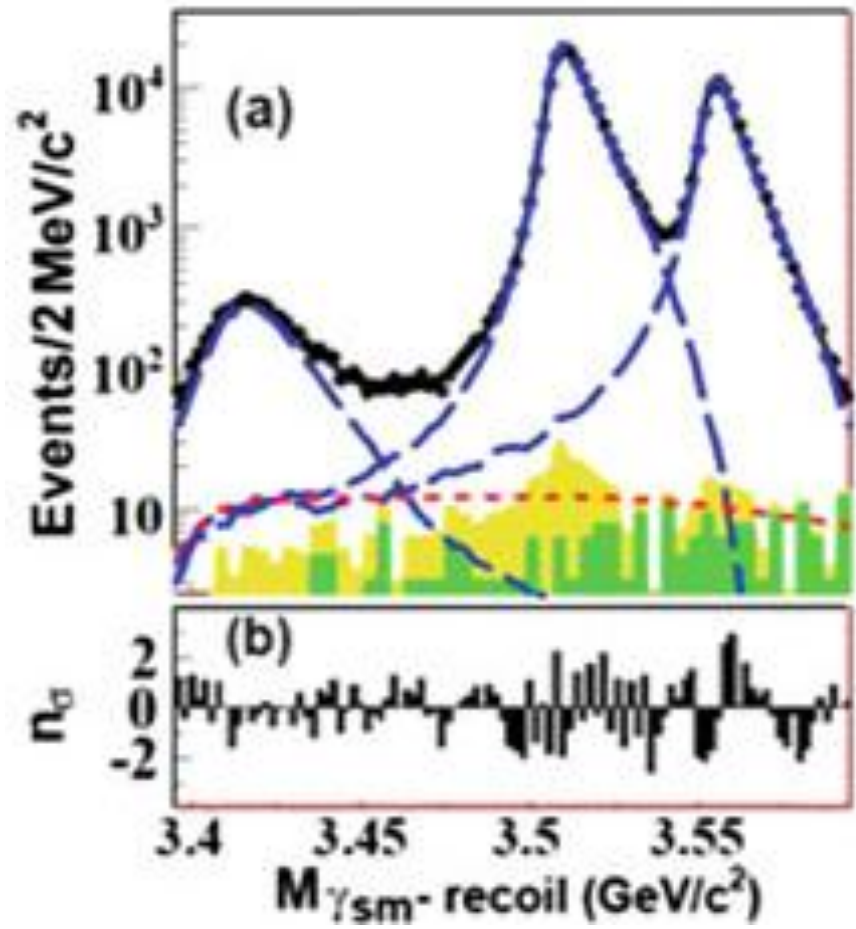
$$(iii) e^+e^- \rightarrow \pi^0 Z_c(4025)^0$$



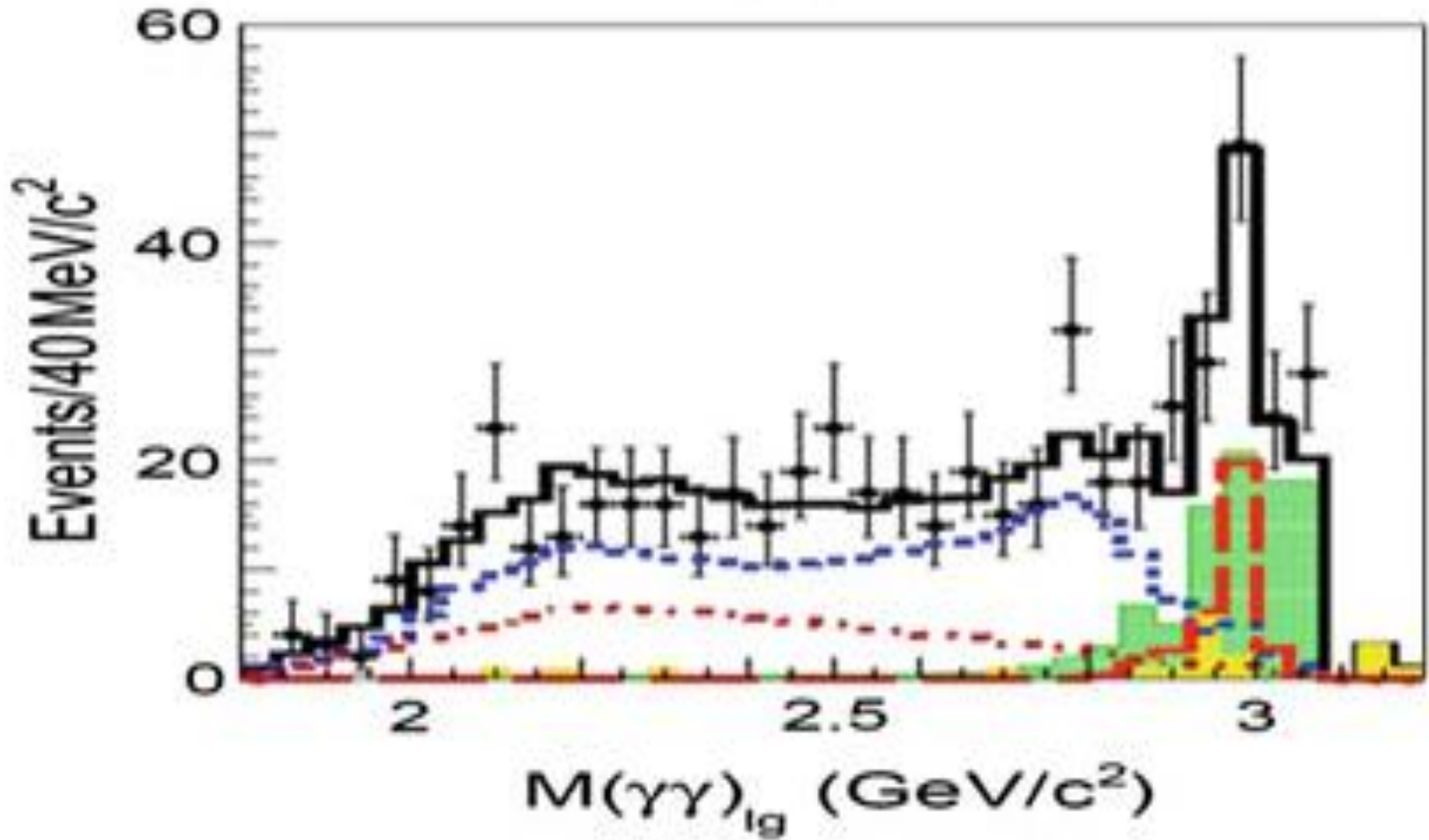
First Observation of $\chi_{cJ} \rightarrow \pi^0 \pi^0 \pi^0 \pi^0$



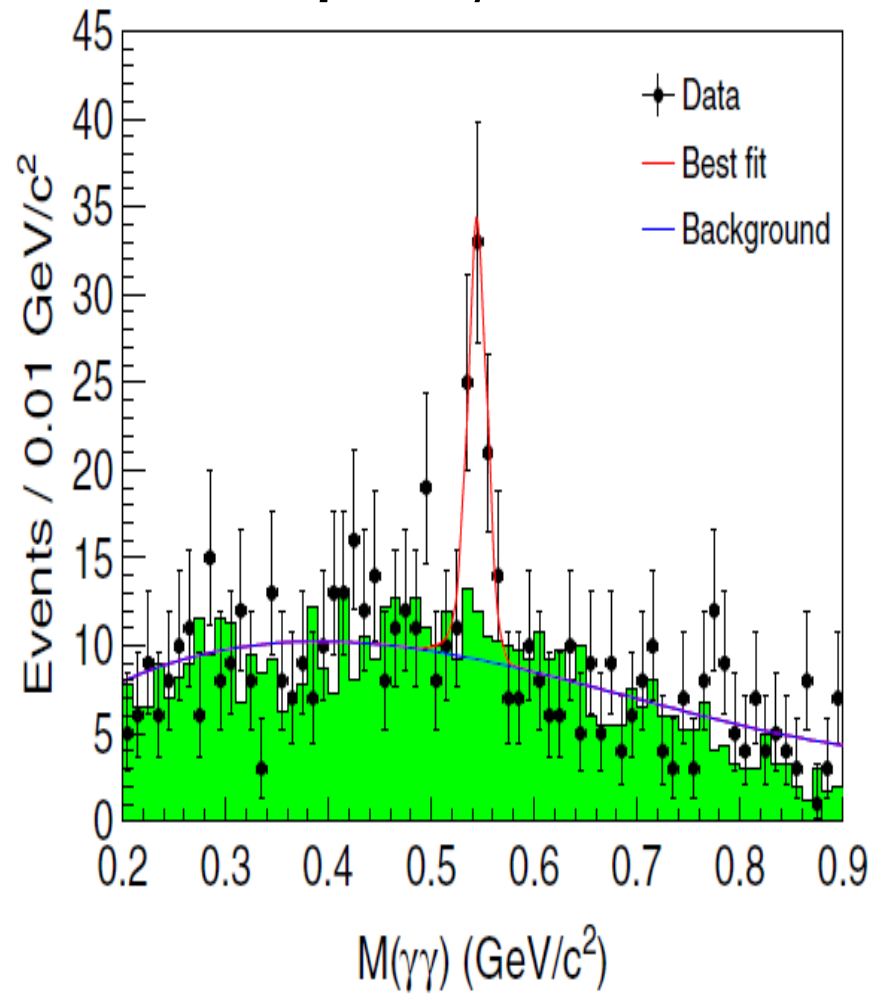
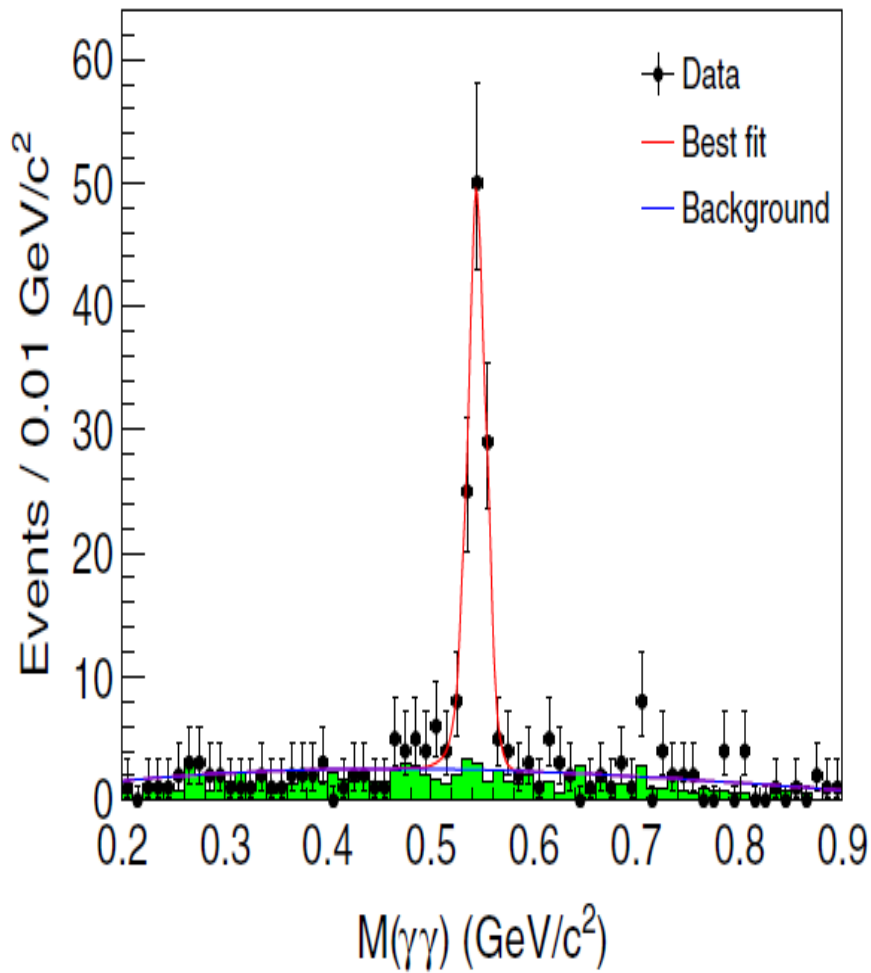
First Evidence of $\psi(2S) \rightarrow \gamma\gamma J/\psi$



First Evidence of $\eta_c(1S) \rightarrow \gamma\gamma$

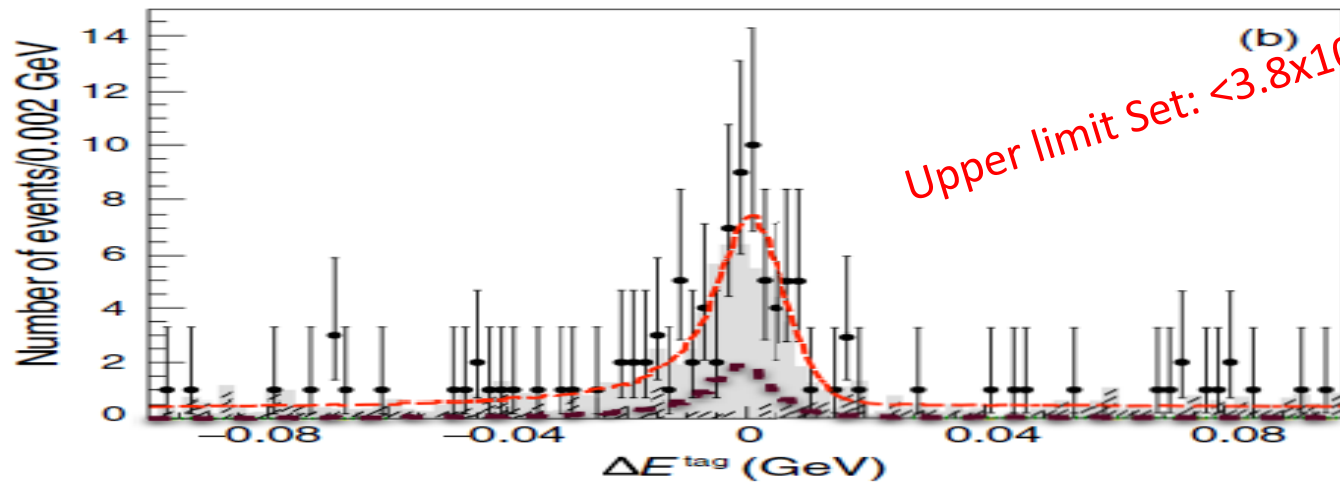
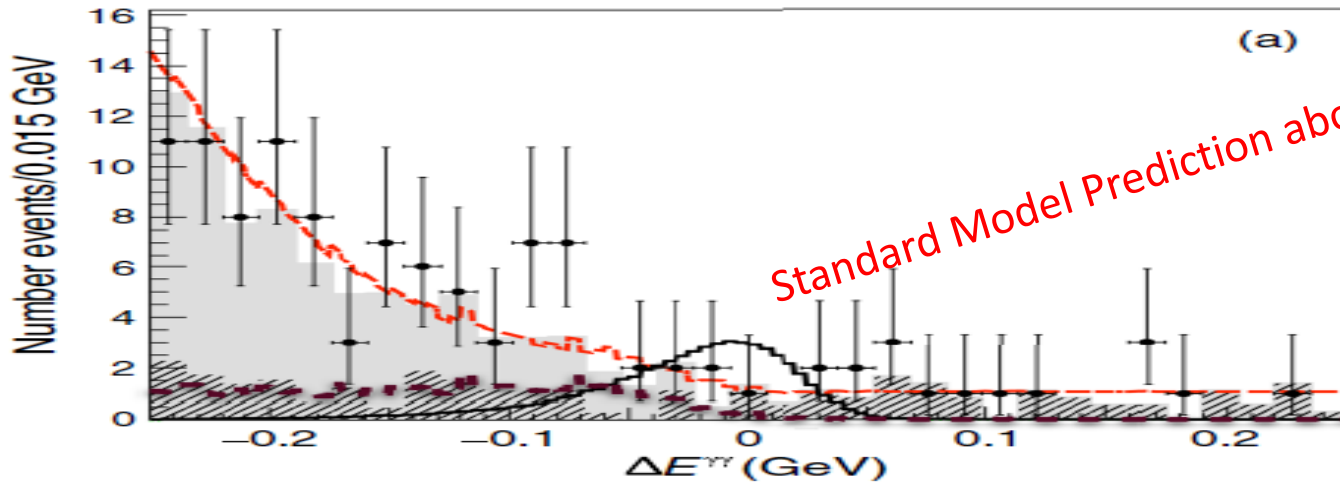


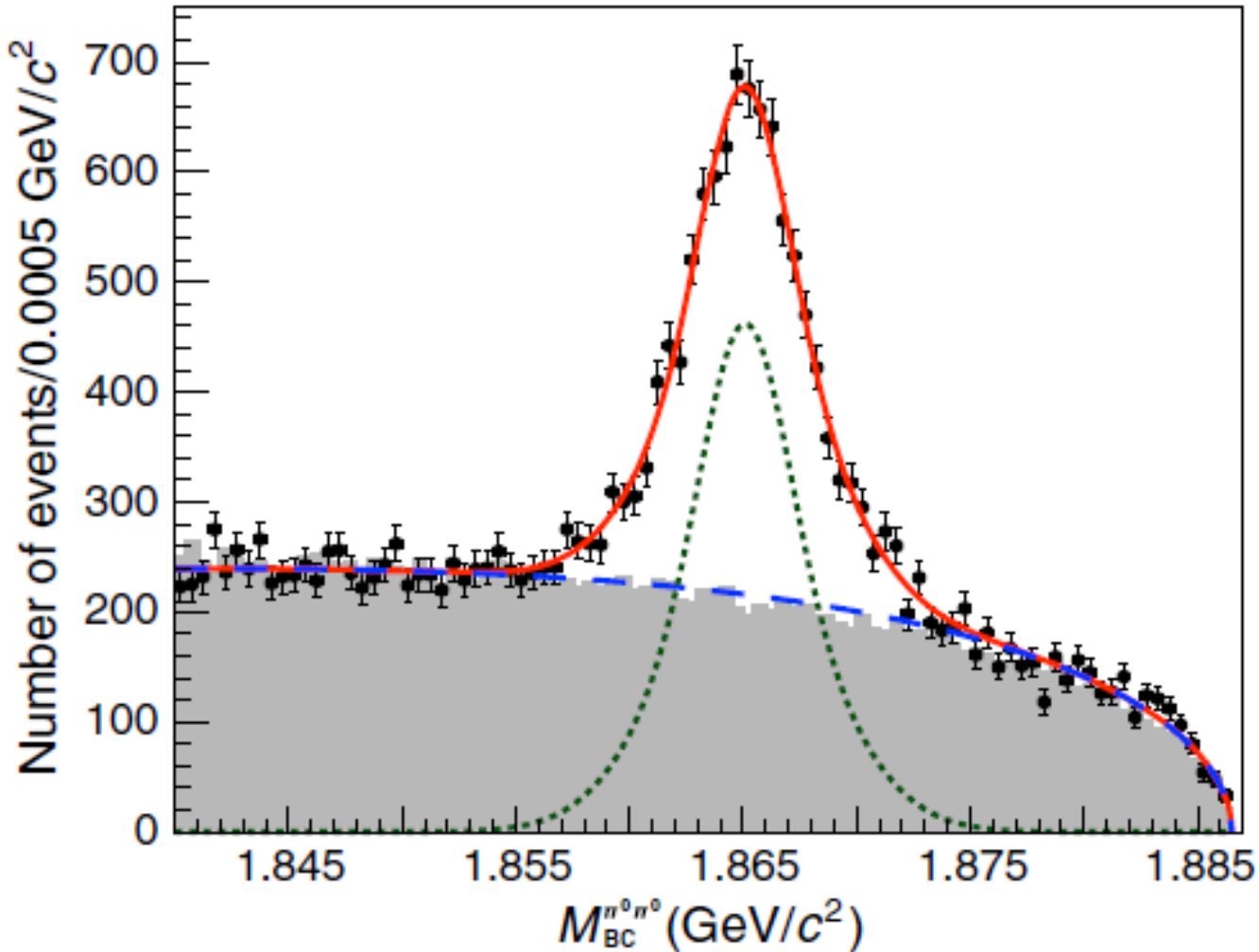
Observation of $e^+e^- \rightarrow \eta J / \psi$



Charm Physics

Study of $D^0 \rightarrow \gamma\gamma$



Improved Study of $D^0 \rightarrow \pi^0 \pi^0$ 

Summary

- BESIII probes excellently and successfully the Light Hadrons, Charmonia, Charmoniumlike Structures, Charmed Hadrons, etc.
- BESIII tests many many predictions successfully, yielding first/new observations/evidences, etc.
- BESIII on its way: Yet to come many interesting and significant results
- Charmoniumlike structures; an interesting domain of physics: Looking ahead to explore their properties
- Open charm needs more statistics based study from several angles, to prototype its physics clearly...

Thanks