

Study of $Y(4260)$ and Observation of Charged Z_c at Belle

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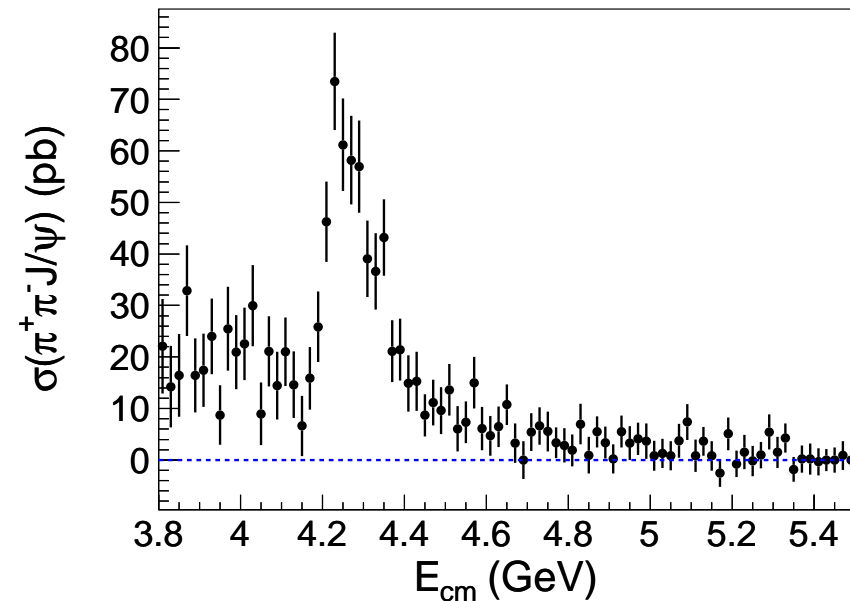
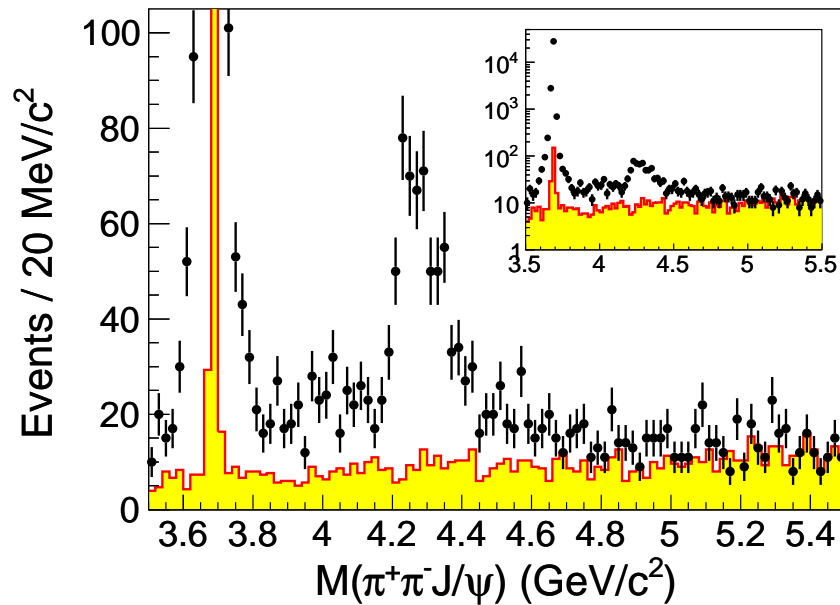
Outline

1. General
2. Study of $Y(4260)$
3. Z_c
4. Conclusions

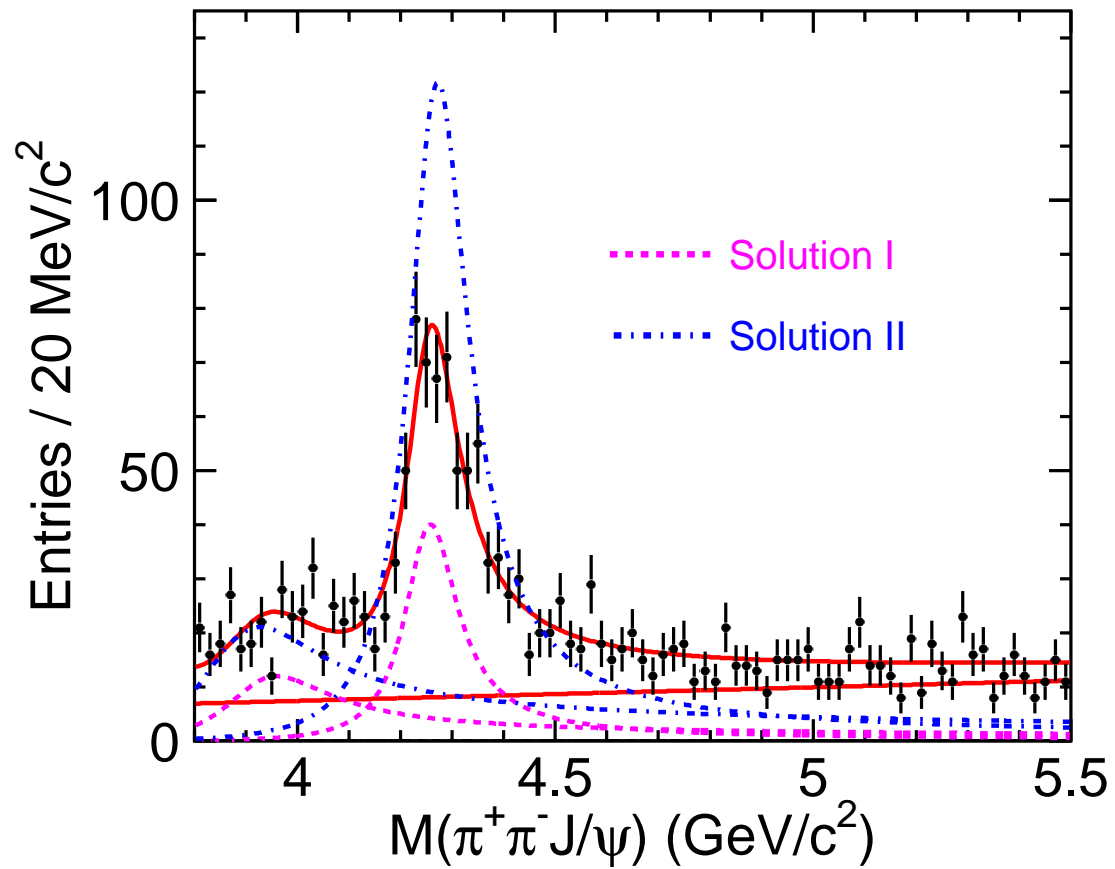
General

- Belle uses ISR to study $e^+e^- \rightarrow J/\psi\pi^+\pi^-$ from 3.8 to 5.5 GeV
- A sample of 967 fb^{-1} was collected at $\Upsilon(nS)$, $n = 1, 2, \dots, 5$
- We require 4 tracks from IR with net charge 0, two pions and two leptons ($J/\psi \rightarrow e^+e^-, \mu^+\mu^-$), recoil mass $|M_{\text{rec}}^2| < 2 \text{ GeV}^2$
- arXiv:1301.0121, submitted to Phys. Rev. Lett.

Study of $Y(4260) \rightarrow J/\psi\pi^+\pi^-$ – I



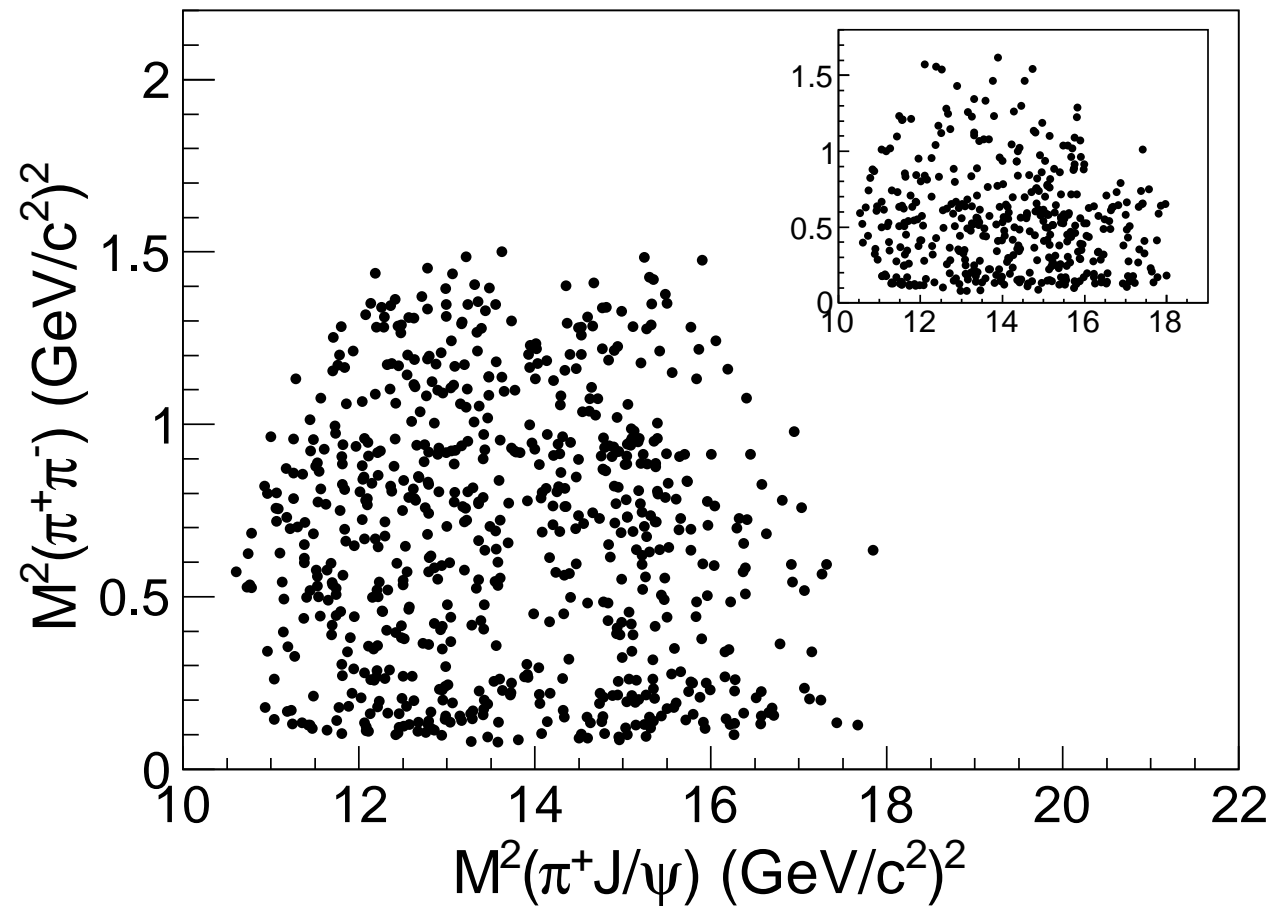
We observe a clear signal of $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$,
and at higher masses some structure around 4 GeV and $Y(4260)$

Study of $Y(4260) \rightarrow J/\psi\pi^+\pi^-$ – II

Study of $Y(4260) \rightarrow J/\psi\pi^+\pi^-$ – III

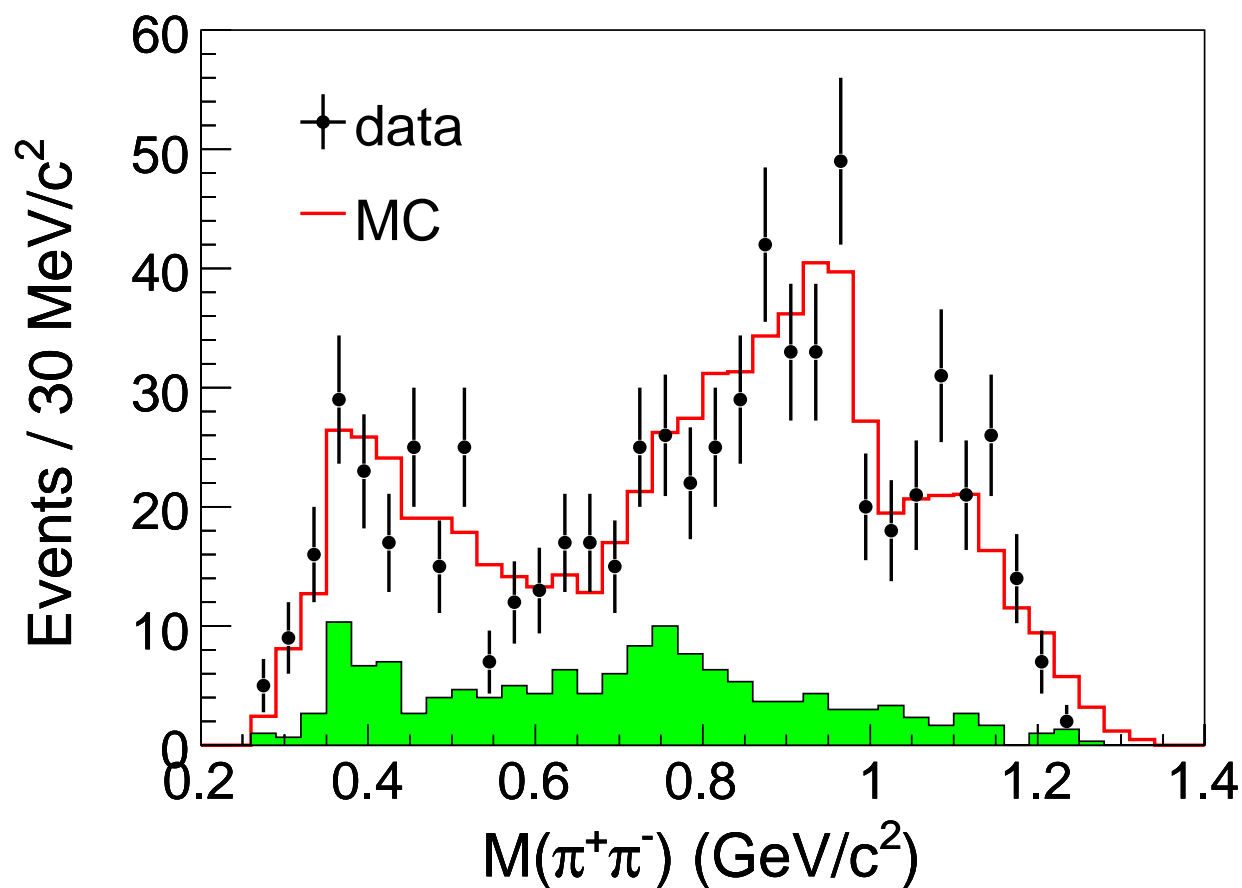
Parameters	Solution I	Solution II
$M(R_1)$	$3890.8 \pm 40.5 \pm 11.5$	
$\Gamma_{\text{tot}}(R_1)$	$254.5 \pm 39.5 \pm 13.6$	
$\Gamma_{ee}\mathcal{B}(R_1)$	$(3.8 \pm 0.6 \pm 0.4)$	$(8.4 \pm 1.2 \pm 1.1)$
$M(R_2)$	$4258.6 \pm 8.3 \pm 12.1$	
$\Gamma_{\text{tot}}(R_2)$	$134.1 \pm 16.4 \pm 5.5$	
$\Gamma_{ee}\mathcal{B}(R_2)$	$(6.4 \pm 0.8 \pm 0.6)$	$(20.5 \pm 1.4 \pm 2.0)$
ϕ	$59 \pm 17 \pm 11$	$-116 \pm 6 \pm 11$

Intermediate Dynamics – I



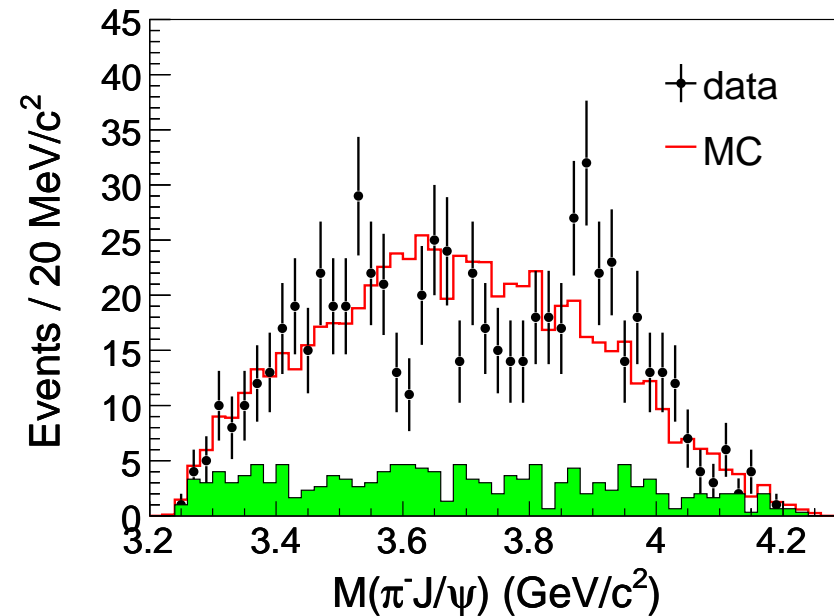
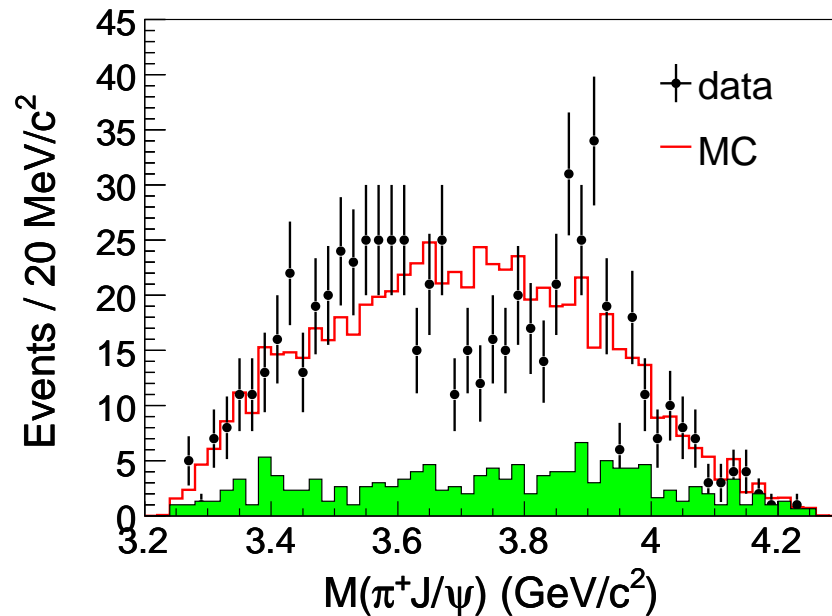
$$4.15 < M(J/\psi\pi^+\pi^-) < 4.45 \text{ GeV}$$

Intermediate Dynamics – II



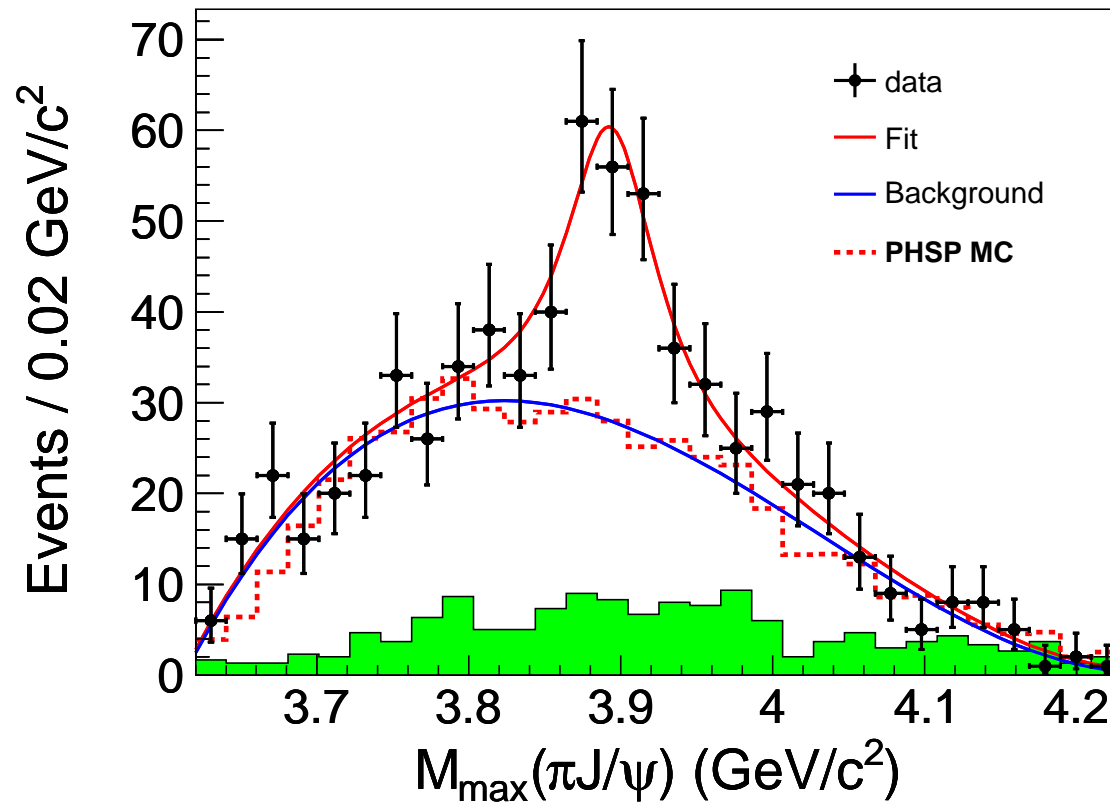
We observe $f_0(500)$, $f_0(980)$ and non-resonant S-wave $\pi^+\pi^-$

Intermediate Dynamics – III



Phase space model does not describe the data,
there is an obvious structure at 3.9 GeV

Observation of a Charged Charmonium-like State



$M = (3894.5 \pm 6.6 \pm 4.5) \text{ MeV}$, $\Gamma = (63 \pm 24 \pm 26) \text{ MeV}$,
 $159 \pm 49 \pm 7$ events, 5.2σ significance, produced in $(29.8 \pm 8.9)\%$ $Y(4260)$ decays