# Approved plots: $X(3872)$ rediscovery from $B$ decay with 62.8 fb$^{-1}$ of Phase 3 data at Belle II

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## Abstract

The decay of $B \to J/\psi \pi^+ \pi^- K$ is studied using 62.8 fb$^{-1}$ data collected at the $\Upsilon(4S)$ resonance. Evidence for $B \to X(3872)K$ with a statistical significance of $4.6\sigma$ is found. This note contains the public plots associated with the internal note BELLE2-NOTE-PH-2020-025.
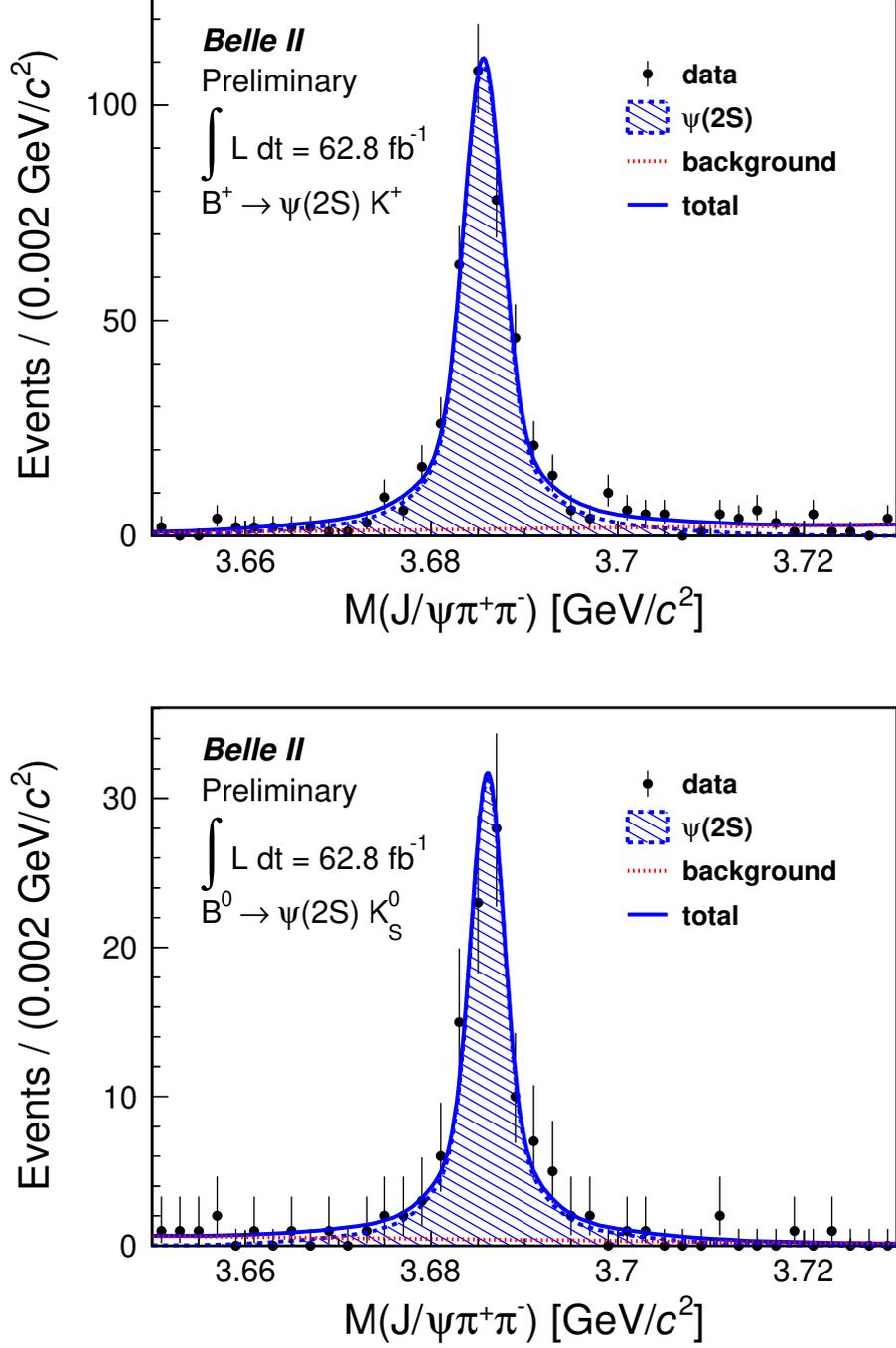
FIG. 1: The $M_{J/\psi\pi^+\pi^-}$ distributions on the $\psi(2S)$ signal region with the real data. Here, blue solid line shows total fit result. A triple Gaussian with a common mean are used as a probability density function (PDF) for the signal component, where parameters except the mean and scaling factor of the sigmas are detemrined with the signal Monte-Carlo (MC) samples. A first-order Chebyshev function is used as a PDF for the background component.
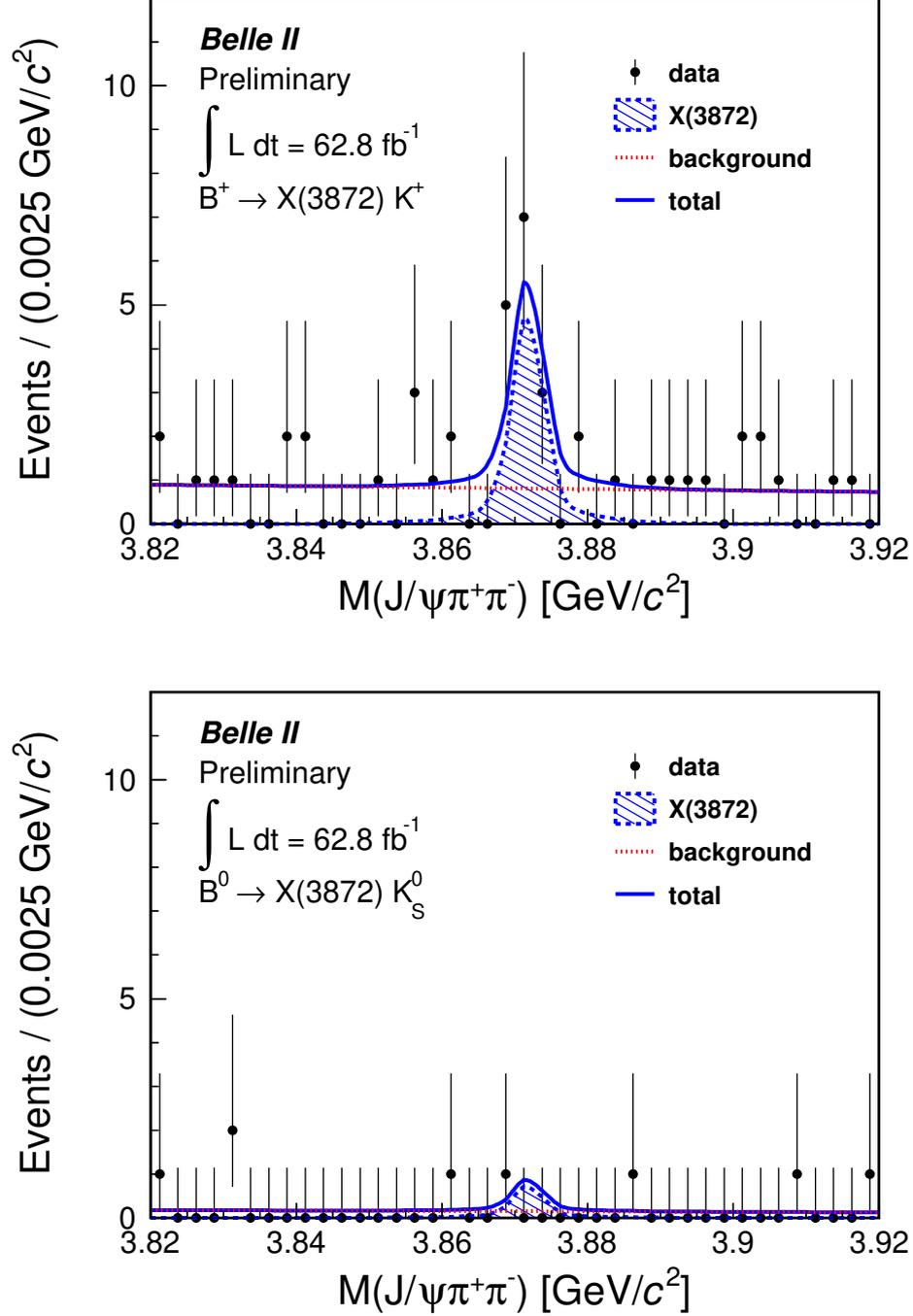
FIG. 2: The $M_{J/\psi\pi^+\pi^-}$ distributions on the $X(3872)$ signal region with the real data. Here, blue solid line shows total fit result. A histogram PDF generated with signal MC samples assuming the world average mass of $X(3872)$ [1] and the Breit-Wigner width of the LHCb measurement [2] is used as a PDF for the signal component. A first-order Chebyshev function is used as a PDF for the background component. A simultaneous fit is performed so as to combine the distribution for $B^0$ decay and that for $B^+$ decay, where a ratio of the expected signal yields is constraint. Here, $\mathcal{B}(B^0 \rightarrow X(3872)K^0)/\mathcal{B}(B^+ \rightarrow X(3872)K^+) = 0.50$ is assumed [3], and the signal efficiency is determined with the signal MC samples. The $X(3872)$ signal yields is $14.4 \pm 4.6$, and the statistical significance is $4.6\sigma$.

[1] M. Tanabashi *et al.* (Particle Data Group), Phys. Rev. D **98**, 030001 (2018).

[2] R. Aaij *et al.* (LHCb collaboration), J. High Energ. Phys. **2020**, 123 (2020).

[3] S.-K. Choi *et al.* (Belle Collaboration), Phys. Rev. D **84** 052004 (2011) .