Reconstruction of $B^0 \to J/\psi K_S^0$ and $B^+ \to J/\psi K^+$

Y. Yusa[*]

Niigata University, Niigata, Japan

(The Belle II Collaboration)

CONTENTS

---

[*] yusa@hep.sc.niigata-u.ac.jp
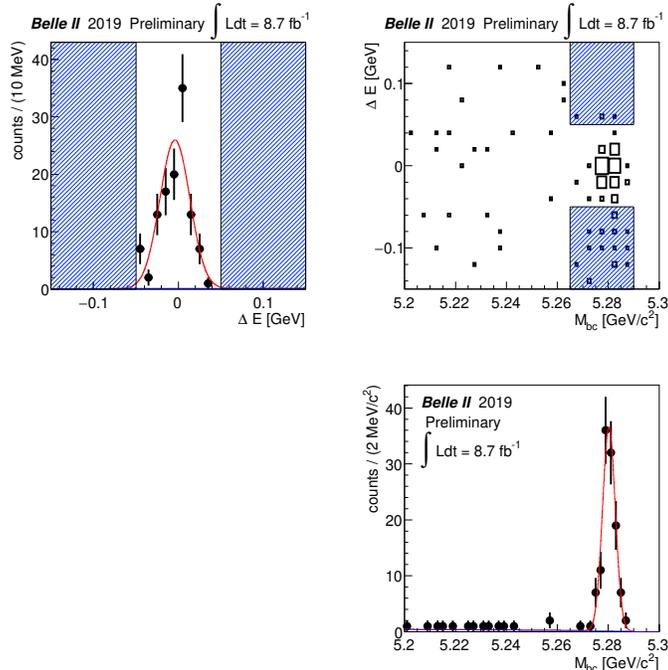
FIG. 1. ΔE (left top), $M_{\rm bc}$ (right bottom) and 2-dimensional plot of reconstructed $B^0 \to J/\psi K_S^0, J/\psi \to \ell^+\ell^-$ candidates from the data samples taken in 2019. Fit results are shown with solid lines in 1-dimensional plots. Signal-enhanced selections $M_{\rm bc} > 5.27$ GeV/c^2 and $|\Delta E| <$ 40 MeV are applied except for the variables displayed. Shaded regions are excluded from the fit.

TABLE I. $B^0 \to J/\psi K_S^0$ yields extracted from 2-dimensional fit to the $M_{\rm bc}$ and ΔE distributions from the data samples taken in 2019 together with the expectation from signal reconstruction efficiencies. Errors of the expected signal includes statistical uncertainty of the MC samples and systematics of the analysis.

Mode	Signal	Background	Expected signal
$B^0 \to J/\psi K_S^0,\ J/\psi \to e^+e^-$	38.4 ± 6.3	1.9 ± 0.5	38.5 ± 3.1
$B^0 \to J/\psi K_S^0,\ J/\psi \to \mu^+\mu^-$	74.8 ± 8.5	0.5 ± 0.2	64.6 ± 4.5
$B^0 \to J/\psi K_S^0,\ J/\psi \to \ell^+\ell^-$	113.9 ± 11.1	1.3 ± 0.3	103.1 ± 5.5

1. PUBLIC PLOTS AND YIELDS

We reconstruct the decay $B^0 \to J/\psi K_S^0$ which is a "golden mode" of the $\sin 2\phi_1$ measurement, and its reference decay $B^+ \to J/\psi K^+$ using 8.7 fb^{-1} of the data taken in the 2019 runs of the Belle II. We perform the fit to the reconstructed kinematic variables and obtain yields of the signal and background as shown in Tables I and II. These numbers are used as the signal-background fractions as one of the input parameters for the $\sin 2\phi_1$ measurement.
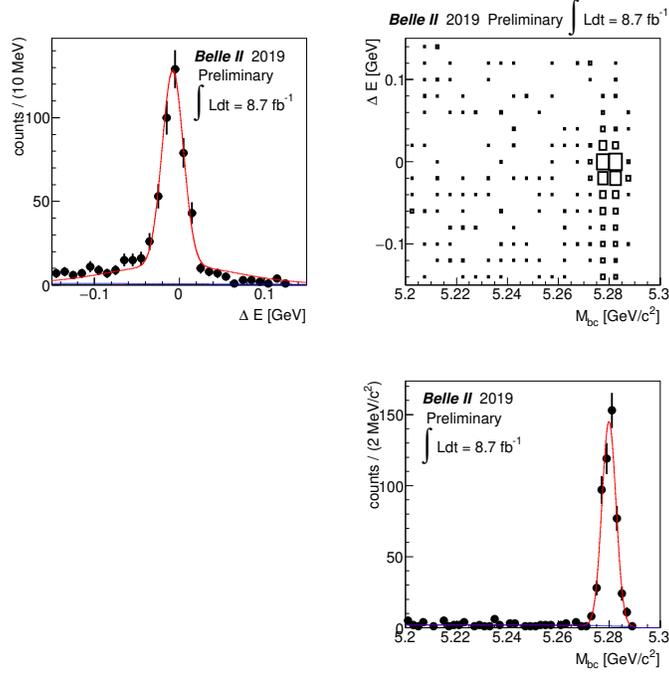
FIG. 2. ΔE (left top), $M_{\rm bc}$ (right bottom) and 2-dimensional plot of reconstructed $B^0 \to J/\psi K^+, J/\psi \to \ell^+\ell^-$ candidates from the data samples taken in 2019. Fit results are shown with solid lines in 1-dimensional plots. Signal-enhanced selections $M_{\rm bc} > 5.27$ GeV/c^2 and $|\Delta E| < 40$ MeV are applied except for the variables displayed.

TABLE II. $B^+ \to J/\psi K^+$ yields extracted from 2-dimensional fit to the $M_{\rm bc}$ and ΔE distributions from the data samples taken in 2019 together with the expectation from signal reconstruction efficiencies. Errors of the expected signal includes statistical uncertainty of the MC samples and systematics of the analysis.

Mode	Signal	Background	Expected signal
$B^+ \to J/\psi K^+,\ J/\psi \to e^+e^-$	175.7 ± 13.2	7.2 ± 0.9	190.0 ± 10.0
$B^+ \to J/\psi K^+,\ J/\psi \to \mu^+\mu^-$	322.0 ± 17.4	4.2 ± 0.6	290.3 ± 18.1
$B^+ \to J/\psi K^+,\ J/\psi \to \ell^+\ell^-$	495.5 ± 21.6	11.3 ± 1.0	480.3 ± 20.7

3