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Approved Plots: Study of $B^+ \to K^+\ell^+\ell^-$ at Belle II

The Belle II Collaboration

Abstract

We report a study of flavor-changing neutral current mediated decays $B^+ \to K^+\ell^+\ell^-$, where ℓ is an electron or a muon. The analysis is performed using $62.8\,\text{fb}^{-1}$ data recorded near the $\Upsilon(4S)$ resonance by the Belle II experiment.

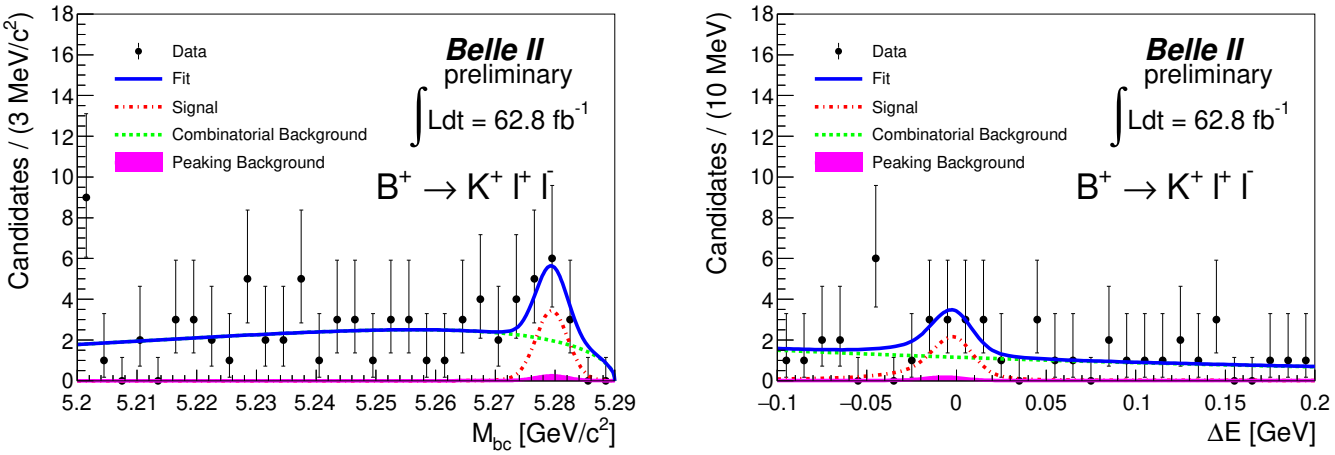

FIG. 1: Signal enhanced projection for a fit to the distributions of beam-energy-constrained mass $M_{\rm bc}$ and energy difference ΔE of $B^+ \to K^+\ell^+\ell^-$ candidates, where ℓ is an electron or muon. The $M_{\rm bc}$ projection is obtained in a window $-0.06 < \Delta E < 0.04$ GeV whereas the ΔE projection is obtained for $M_{\rm bc} > 5.27$ GeV/c^2. The fit model for $M_{\rm bc}$ contains the following three components: a Crystall Ball function for the signal (red dot-dash line), another Crystall Ball function for the peaking background from $B^+ \to K^+\pi^+\pi^-$ decays (magenta filled area), and an ARGUS function for the combinatorial background from $q\bar{q}$ continuum and other B decays (green dashed line). Similarly, the fit model for ΔE contains the following three components: a double-sided Crystal Ball summed with a Gaussian function for the signal (red dot-dash line), another double-sided Crystal Ball summed with a Gaussian function for the peaking background from $B^+ \to K^+\pi^+\pi^-$ decays (magenta filled area), and an exponential function for the combinatorial background from $q\bar{q}$ continuum and other B decays (green dashed line). Black markers with error bars are data. The signal shape parameters obtained from correctly reconstructed simulated events are kept fixed in the fit. The ARGUS endpoint is fixed to the kinematic threshold of 5.29 GeV/c^2 and the second parameter is determined from the fit to data. We also determine the parameter of the exponential from the fit to data. The number of peaking background events is fixed to the value 0.7, which is estimated from simulated events. The signal component has an overall significance of 2.7 standard deviations, with a yield of $8.6^{+4.3}_{-3.9} \pm 0.4$, where the quoted uncertainties are statistical and systematic, respectively.