Approved plots for $B \rightarrow \tau \nu$ study with 34.6 fb$^{-1}$ of Phase III data

The Belle II Collaboration

Abstract

This note contains approved plots of $B \rightarrow \tau \nu$, analysis with ICHEP 2020 dataset, corresponding to an integrated luminosity of 34.6 fb$^{-1}$. Details of the analysis are documented in the supporting physics note BELLE2-NOTE-PH-2020-024.
FIG. 1: $M_{bc}$ distribution of the tag B candidate for the electron channel. We require a reconstructed tag B with a FEI discriminant output $p_{FEI} > 0.01$ and only one charged track on the signal side. The track is required to have momentum in the lab frame $p_{trk} > 0.5$ GeV/c and to be identified as electron requiring $eid > 0.9$. A continuum suppression is applied requiring $\cos \Delta \theta_{\text{thrust}} < 0.8$. MC distributions are scaled to data luminosity.
FIG. 2: Distribution of the residual energy in the ECL, $E_{\text{ECL}}$, for the electron channel. $E_{\text{ECL}}$ is the sum of the energy deposited in the ECL by all neutral objects in the event that are not used to make the tag B candidate or the signal side. Energy deposits greater than 55 MeV are considered. We require a reconstructed tag B with a FEI discriminant output $p_{\text{FEI}} > 0.01$, $M_{bc} > 5.27 \text{GeV}/c^2$ and only one charged track on the signal side. The track is required to have momentum in the lab frame $p_{\text{trk}} > 0.5 \text{GeV}/c$ and to be identified as electron requiring $e_{\text{id}} > 0.9$. A continuum suppression is applied requiring $\cos \Delta \theta_{\text{thrust}} < 0.8$. MC distributions are scaled to data luminosity except for the signal which is enhanced by a factor of 100.
FIG. 3: Distribution of the sum of missing energy and missing momentum in the center-of-mass frame, $E_{\text{miss}}^* + cp_{\text{miss}}^*$, for the electron channel. We require a reconstructed tag B with a FEI discriminant output $p_{\text{FEI}} > 0.01$, $M_{bc} > 5.27 \text{GeV}/c^2$ and only one charged track on the signal side. The track is required to have momentum in the lab frame $p_{\text{trk}} > 0.5 \text{GeV}/c$ and to be identified as electron requiring $eid > 0.9$. A continuum suppression is applied requiring $\cos\Delta\theta_{\text{thrust}} < 0.8$. MC distributions are scaled to data luminosity except for the signal which is enhanced by a factor of 100.
FIG. 4: Monte Carlo distribution of the residual energy in the ECL, \(E_{\text{ECL}}\), for the electron channel in the range \([0,2]\) GeV. \(E_{\text{ECL}}\) is the sum of the energy deposited in the ECL by all neutral objects in the event that are not used to make the tag \(B\) candidate or the signal side. Energy deposits greater than 55 MeV are considered. We require a reconstructed tag \(B\) with a FEI discriminant output \(p_{\text{FEI}} > 0.01\), \(M_{bc} > 5.27\, \text{GeV}/c^2\) and only one charged track on the signal side. The track is required to have momentum in the lab frame \(p_{\text{trk}} > 0.5\, \text{GeV}/c\) and to be identified as electron requiring \(eid > 0.9\). A continuum suppression is applied requiring \(\cos \Delta \theta_{\text{thrust}} < 0.8\).