1 Supplementary material for LHCb-PAPER-2020-033

The $m(K^+K^-)$ shape of B_s^0 tail leaking into B^0 signal region is extracted from an unbinned maximum-likelihood fit to the $B_s^0 \to J/\psi\,\phi$ simulation, as shown in Fig. 1. The $m(K^+K^-)$ shape of $\Lambda_b^0 \to J/\psi\,pK^-$ background is found to be independent on $m(J/\psi\,K^+K^-)$ in simulation, as shown in Fig. 2. The $m(K^+K^-)$ shape of combinatorial backgrpund has been checked to be compatible in different $J/\psi\,K^+K^-$ mass regions and with different BDT requirements, as shown in Fig. 3.

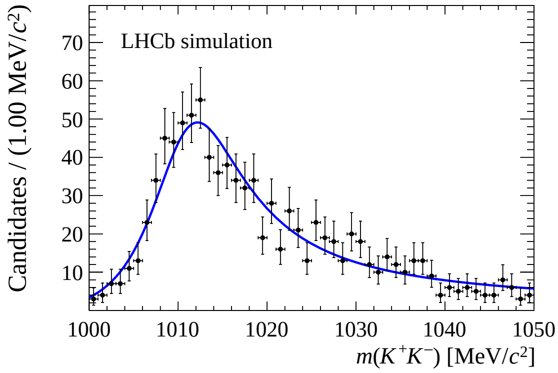

Figure 1: Distribution of $m(K^+K^-)$ in the B^0 region from a $B_s^0 \to J/\psi\,\phi$ simulation sample, superimposed by a fit to the simulation.

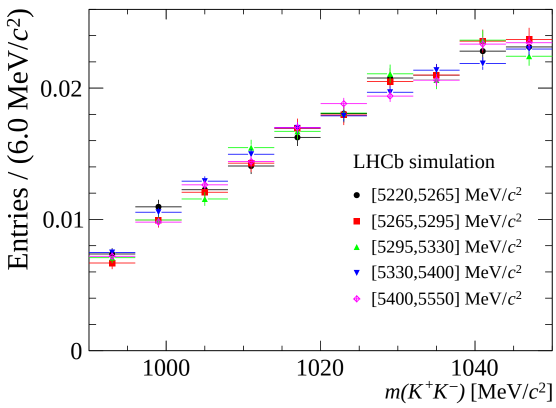

Figure 2: Distributions of the invariant mass $m(K^+K^-)$ in different $m(J/\psi\,K^+K^-)$ intervals with boundaries at 5220, 5265, 5295, 5330, 5400 and 5550 MeV/c^2. They are obtained using simulated $\Lambda_b^0 \to J/\psi\,pK^-$ decays and normalised to unity.

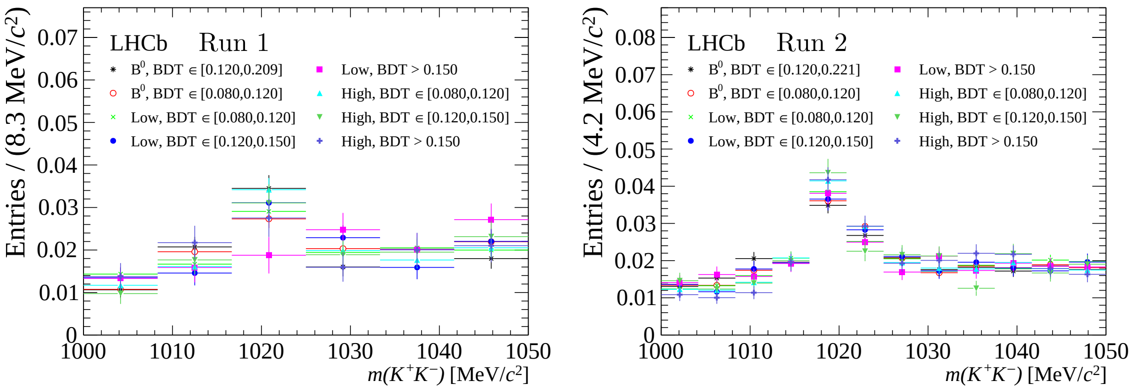

Figure 3: Distributions of the invariant mass $m(K^+K^-)$ in low mass sideband 5220–5250 MeV/c^2, B^0 signal region and high mass sideband 5520–5550 MeV/c^2 with different BDT requirements. They are normalised to unity. The left figure is for Run 1 and the right figure is for Run 2. The $\mathit{\Lambda}_b^0 \to J/\psi\, pK^-$ and $B_s^0 \to J/\psi\, \phi$ contributions are subtracted by injecting simulated events with negative weights.