Supplementary material for LHCb-PAPER-2016-006
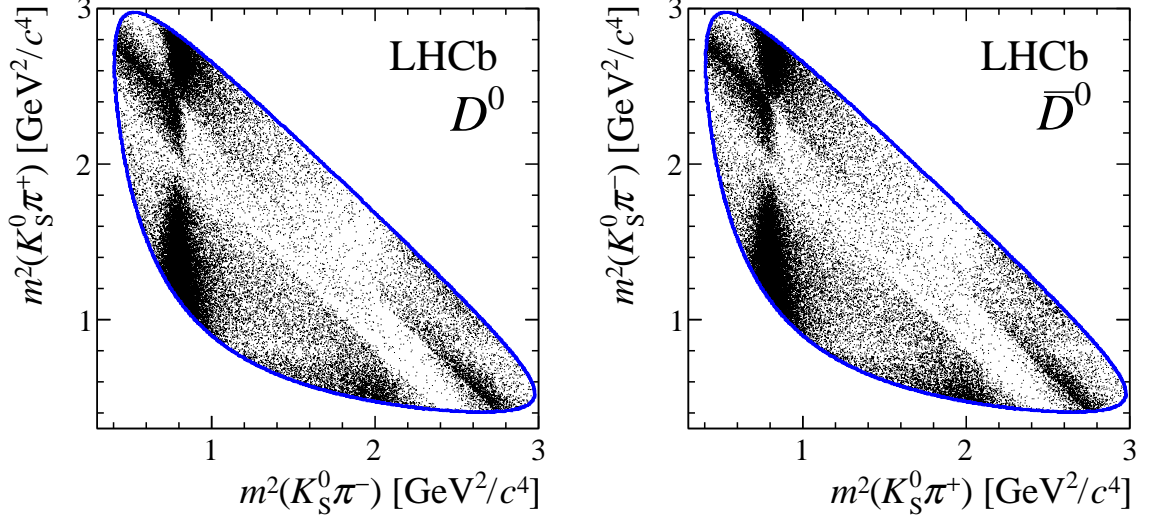

Figure 1: Dalitz plots of candidates in the signal region for $D \to K_S^0 \pi^+ \pi^-$ from (left) $\overline{B}^0 \to (D^{*+} \to D^0 \pi^+)\mu^- \overline{\nu}_\mu X$ and (right) $B^0 \to (D^{*-} \to \overline{D}^0 \pi^-)\mu^+ \nu_\mu X$ decays. The solid blue line indicates the kinematic boundary.

Figure 2: Dalitz plots of candidates in the signal region for $D \to K_S^0 K^+ K^-$ from (left) $\overline{B}^0 \to (D^{*+} \to D^0 \pi^+)\mu^- \overline{\nu}_\mu X$ and (right) $B^0 \to (D^{*-} \to \overline{D}^0 \pi^-)\mu^+ \nu_\mu X$ decays. The solid blue line indicates the kinematic boundary.
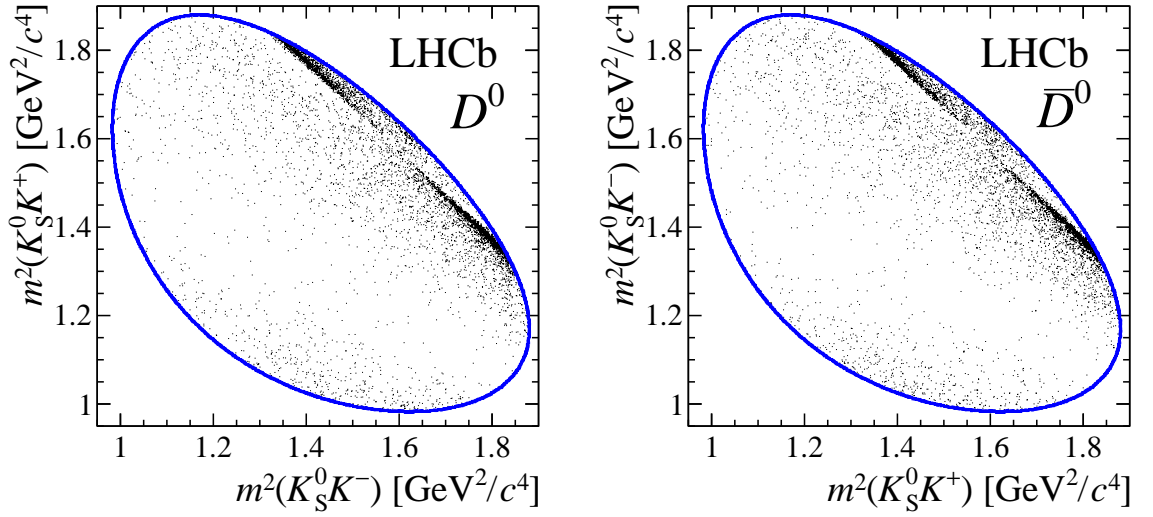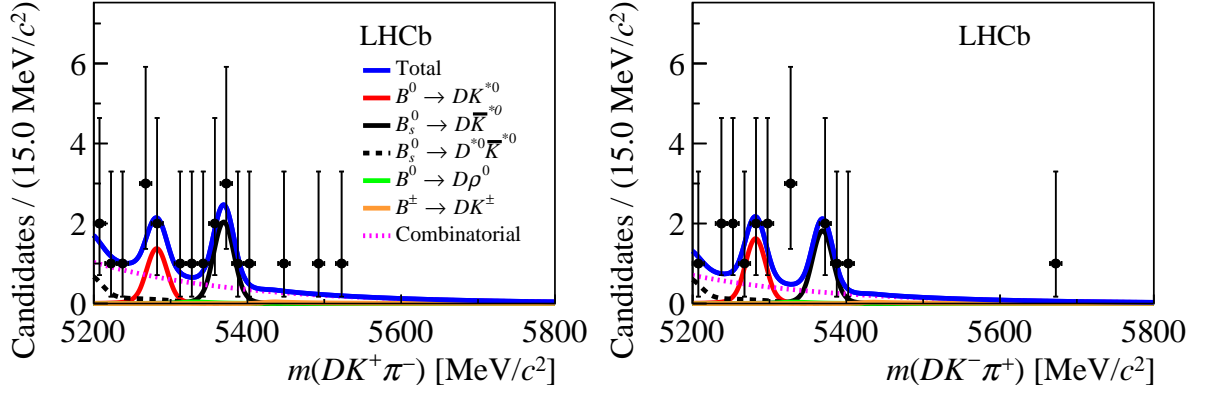
Figure 3: Result of the Dalitz plot fit in an example bin containing $D \to K_S^0 \pi^+ \pi^-$ candidates from (left) $B^0 \to DK^{*0}$ and (right) $\overline{B}^0 \to D\overline{K}^{*0}$. The (blue) fit result is superimposed, including the (red) signal, (solid black) $B_s^0 \to D\overline{K}^{*0}$, (dashed black) $B_s^0 \to D^{*0}\overline{K}^{*0}$, (green) $B^0 \to D\rho^0$, (orange) $B \to DK$ and (dashed magenta) combinatorial background components.
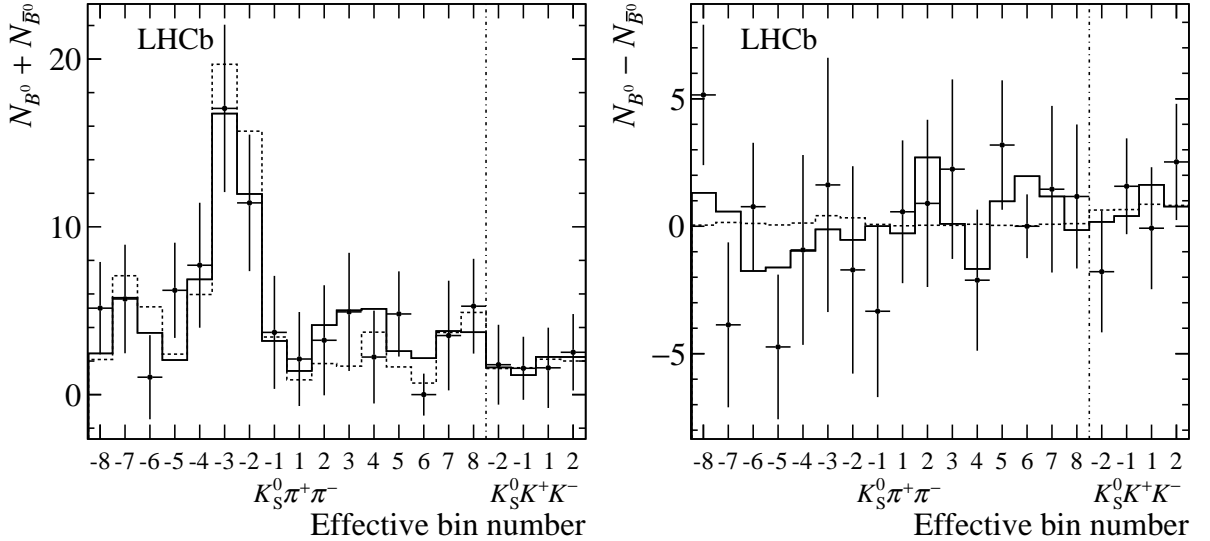

Figure 4: The values of (left) $N_{B^0} + N_{\overline{B}^0}$ and (right) $N_{B^0} - N_{\overline{B}^0}$ from two fit methods are shown. The data points show the result of fitting the B yields directly while the solid histogram indicates the expected yield calculated from the best fit values of $x_\pm, y_\pm$. On the right-hand plot, the dashed histogram shows the expectation for $x_\pm = y_\pm = 0$.

The signal yield in each Dalitz plot bin is fitted directly and compared with the distribution for the yields predicted by the fitted values of $x_\pm$ and $y_\pm$. Figure 4 shows the results separately for the sum of B^0 and $\overline{B}^0$ and their difference. The effective bin number is used, where the yields in bin i in B^0 decays and bin $-i$ in $\overline{B}^0$ decays are combined. The agreement confirms that the fit provides a good description of the data. The difference between the B^0 and $\overline{B}^0$ yields is also shown and includes the expected difference for $x_\pm =$

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$y_\pm = 0$. The expectations for this hypothesis are not exactly at zero in each bin as they are calculated using the total B^0 and $\overline{B}^0$ yields, which are different. While these yields also show consistency with the fitted values of $x_\pm$ and $y_\pm$, the uncertainties are large and hence there is also consistency with the hypothesis of no CP violation.