Supplementary material for PAPER-2020-012

This appendix contains supplementary material to be sent to CDS, but not to the journal. Figure 1 shows the invariant-mass spectra of the pK^- system of the signal and normalization modes, obtained from background-subtracted data and from the simulation based on a uniform phase-space model. Figure 2 shows the one-dimensional fit projection of $m(p\bar{p})$ on a linear scale. Figure 3 shows the one-dimensional projections of $m(p\bar{p}pK^-)$ for the selected candidates with $m(p\bar{p})$ in the η_c or J/ψ signal region. Figure 4 shows the one-dimensional fit projection of $m(p\bar{p})$ for the selected candidates with $m(p\bar{p}pK^-)$ in the Λ_b^0 signal region. Figure 5 shows the background-subtracted $\eta_c p$ mass spectrum and the fit projection which includes the contribution from a $P_c(4312)^+$ resonance. Figure 6 shows the profile likelihood ratio, which is used to estimate the upper limit on the $P_c(4312)^+$ yield in the background-subtracted data displayed in Fig. 5.
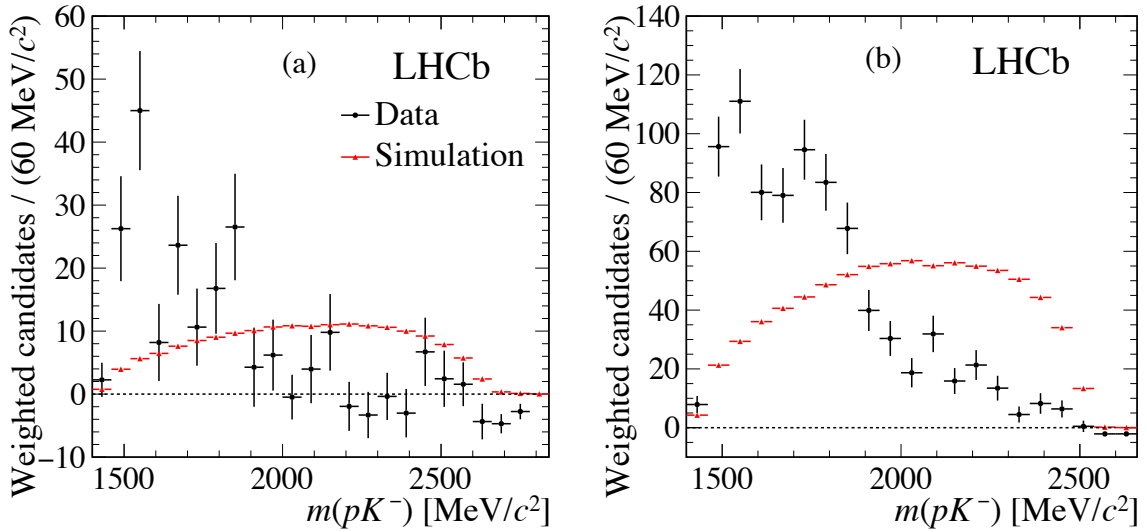

Figure 1: The invariant-mass spectra of the pK^- system of (a) the $\Lambda_b^0 \to \eta_c pK^-$ decays , and of (b) the $\Lambda_b^0 \to J/\psi\, pK^-$ decays . The black points represent the background-subtracted data and the red points correspond to the expectation from a simulation generated according to a uniform phase-space model.
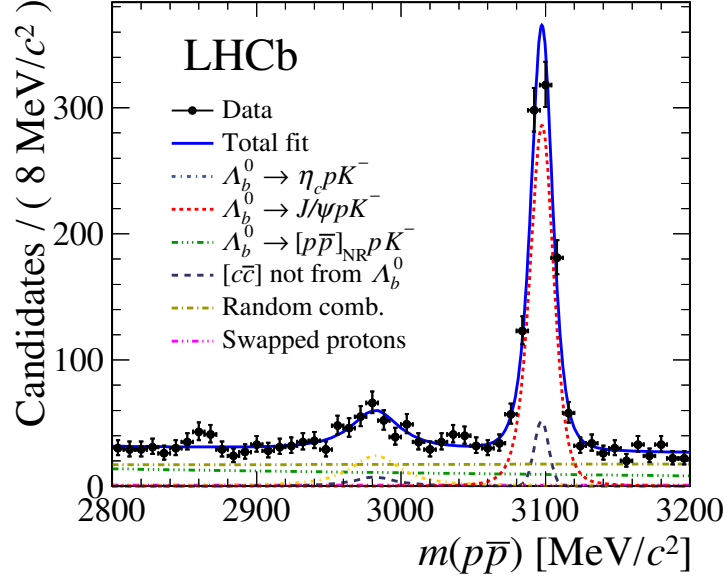
Figure 2: Distribution of $m(p\overline{p})$ for the selected candidates. The data are shown as black circles, while the blue solid line shows the fit result. Individual components are given in the legend.
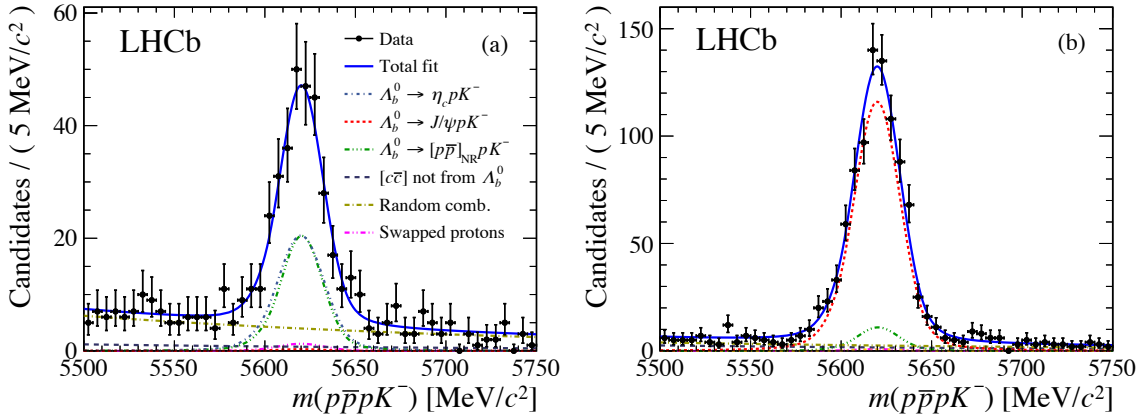

Figure 3: Distributions of selected candidates for $m(p\overline{p}pK^-)$ with (a) $m(p\overline{p}) \in [2935, 3031]$ MeV/c^2 and (b) $m(p\overline{p}) \in [3066, 3126]$ MeV/c^2. The data are shown as black circles, while the blue solid line shows the fit result. Individual components are given in the legend.

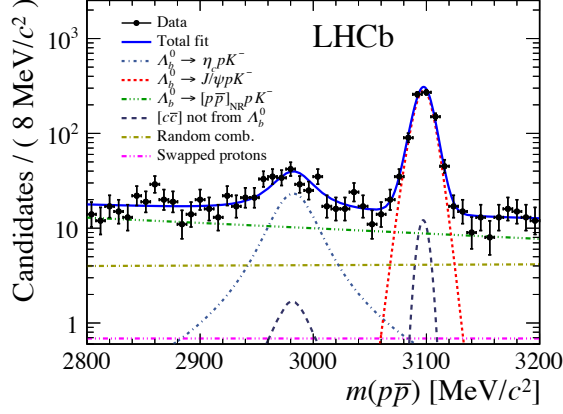Figure 4: Distribution of selected candidates for $m(p\overline{p})$ with $m(p\overline{p}pK^-) \in [5590, 5650]\,\text{MeV}/c^2$. The data are shown as black circles, while the blue solid line shows the fit result. Individual components are given in the legend.
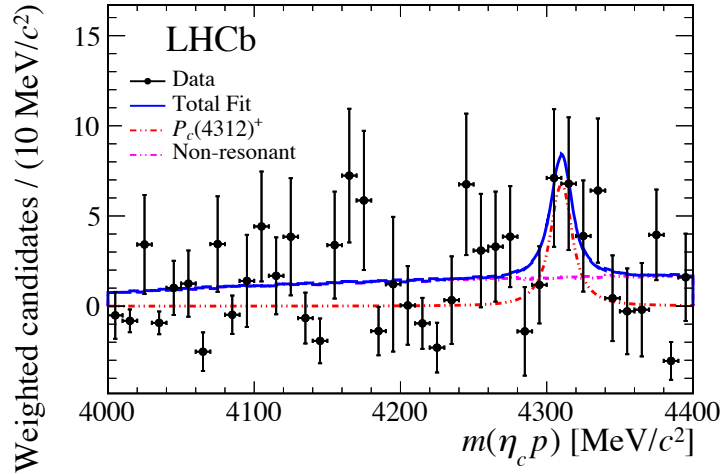

Figure 5: Fit projection of $m(\eta_c p)$ including the contribution from a $P_c(4312)^+$ resonance, compared to the distribution of the background-subtracted data. The data are shown as black circles, while the blue solid line shows the fit result. The red dashed line line shows the contribution from the $P_c(4312)^+$ resonance, and the magenta dashed line shows the contribution from $\Lambda_b^0 \to \eta_c pK^-$ decays without the $P_c(4312)^+$ intermediate state.
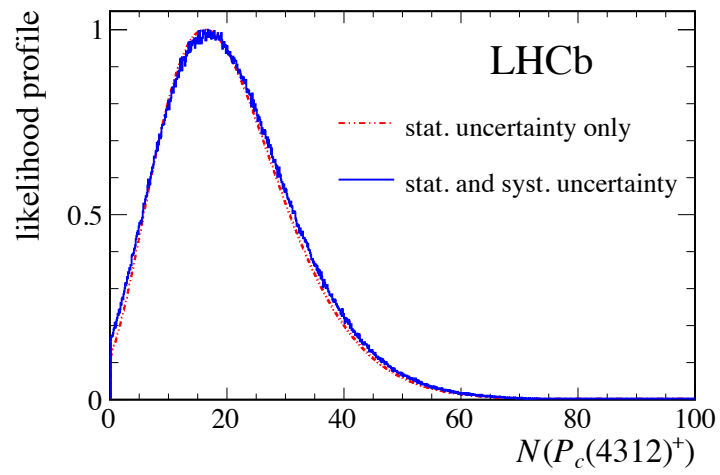
Figure 6: The profile likelihood ratio as a function of the yield of the $P_c(4312)^+$ resonance. The red dashed line indicates the ratio as determined from the fit to the data. The blue line indicates the ratio after it has been convolved with a Gaussian function to account for systematic uncertainties on the yield.