Supplementary material for LHCb-PAPER-2019-023

This appendix contains supplementary material that will be posted on the public CDS record but will not appear in the paper.

Comparison of the branching fraction ratios with analogous results obtained in B-meson decays

The result of this analysis is consistent with analogous measurements in neutral and charged B-meson decays to the J/ψ, χ_{c1}, and ψ(2S) final states [1]. The ratios are defined as

$$
\begin{aligned}
R_{\mathrm{J/\psi}} &\equiv \frac{\mathcal{B}(\mathrm{X_b} \to \chi_{c1}(3872) + \mathrm{X})}{\mathcal{B}(\mathrm{X_b} \to \mathrm{J/\psi} + \mathrm{X})} \times \mathcal{B}(\chi_{c1}(3872) \to \mathrm{J/\psi}\,\pi^+\pi^-)\,, \\
R_{\chi_{c1}} &\equiv \frac{\mathcal{B}(\mathrm{X_b} \to \chi_{c1}(3872) + \mathrm{X})}{\mathcal{B}(\mathrm{X_b} \to \chi_{c1} + \mathrm{X})} \times \mathcal{B}(\chi_{c1}(3872) \to \mathrm{J/\psi}\,\pi^+\pi^-)\,, \\
R_{\psi(2S)} &\equiv \frac{\mathcal{B}(\mathrm{X_b} \to \chi_{c1}(3872) + \mathrm{X})}{\mathcal{B}(\mathrm{X_b} \to \psi(2S) + \mathrm{X})} \times \frac{\mathcal{B}(\chi_{c1}(3872) \to \mathrm{J/\psi}\,\pi^+\pi^-)}{\mathcal{B}(\psi(2S) \to \mathrm{J/\psi}\,\pi^+\pi^-)}\,,
\end{aligned}
$$

where $\mathrm{X_b}$ denotes a beauty hadron, and X denotes $\mathrm{K}^{*0}, \mathrm{K}^0, \pi^+, \mathrm{K}^0\pi^+$ or pK^-.

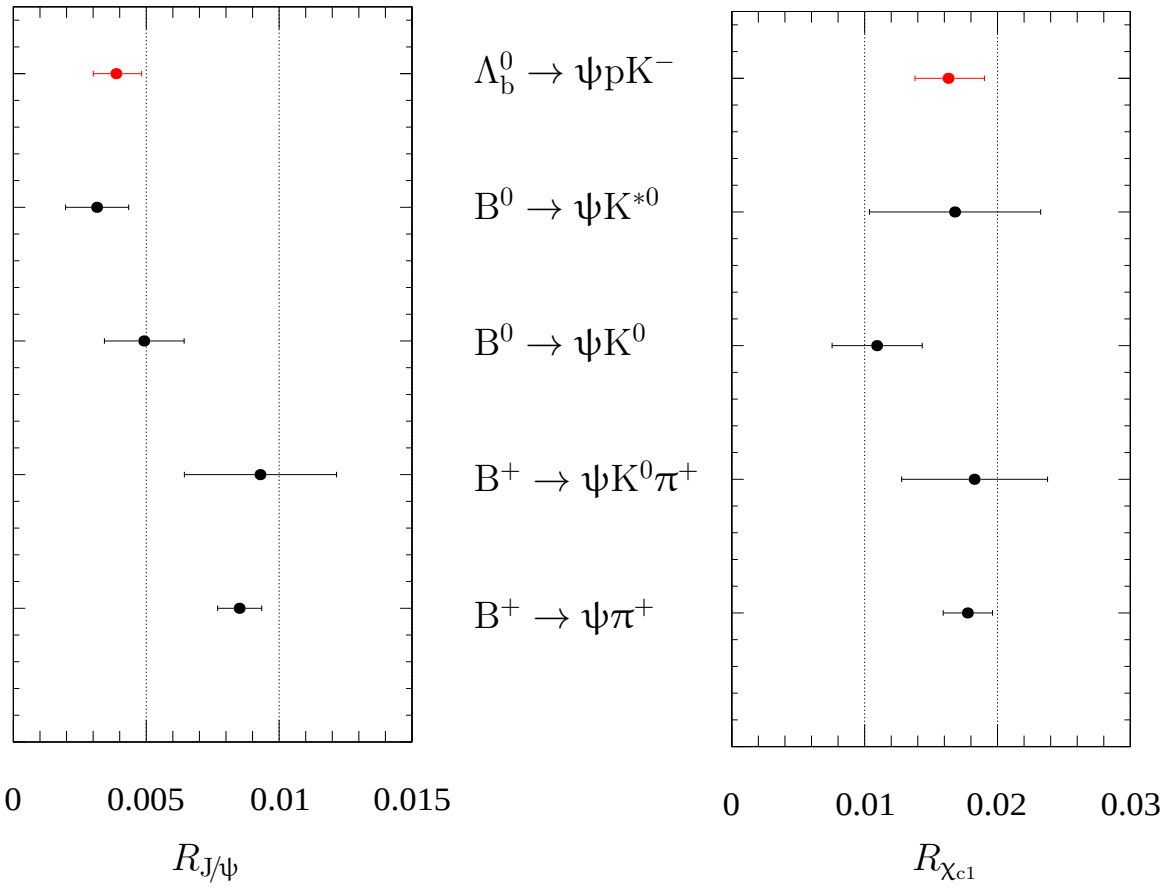

Figure 1: Comparison of the branching fraction ratios measured in this analysis (red dot) with analogous results obtained in neutral and charged B-meson decays [1] to (left) the J/ψ and (right) χ_{c1} final-state. The symbol ψ in decay chains denotes a J/ψ, χ_{c1} or $\chi_{c1}(3872)$ meson.

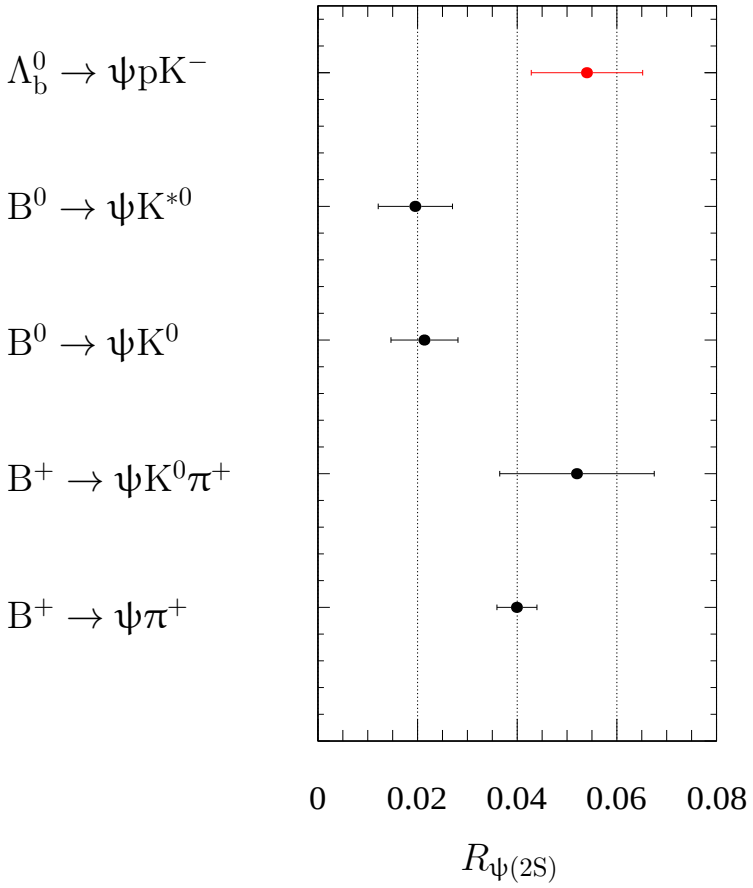

Figure 2: Comparison of the branching fraction ratios measured in this analysis (red dot) with analogous results obtained in neutral and charged B-meson decays [1] to the $\psi(2S)$ final-state. The symbol ψ in decay chains denotes a $\psi(2S)$ or $\chi_{c1}(3872)$ meson.

Dipion mass spectra comparison

Background-subtracted mass distribution of the $\pi^+\pi^-$ combinations is shown in Fig. 3.

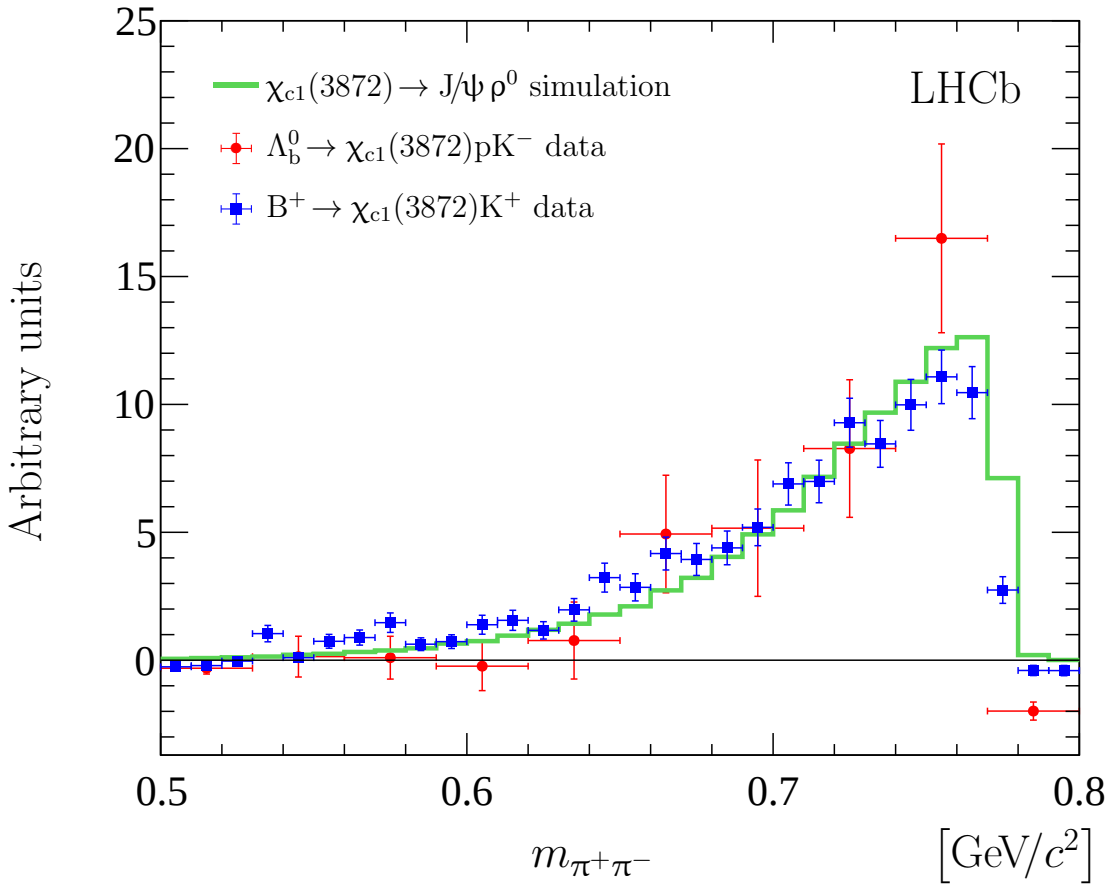

Figure 3: Background-subtracted mass distribution of the $\pi^+\pi^-$ combinations in (red) $\Lambda_b^0 \to \chi_{c1}(3872)pK^-$ and (blue) $B^+ \to \chi_{c1}(3872)K^+$ [2] decays. The distributions are normalized to equal area.

Mass spectra for the $\chi_{c1}(3872)K^-$ and $\chi_{c1}(3872)p$ combinations from $\Lambda_b^0 \to \chi_{c1}(3872)pK^-$ decays

Background-subtracted mass distributions for the $\chi_{c1}(3872)K^-$and $\chi_{c1}(3872)p$ systems are shown in Fig. 4.

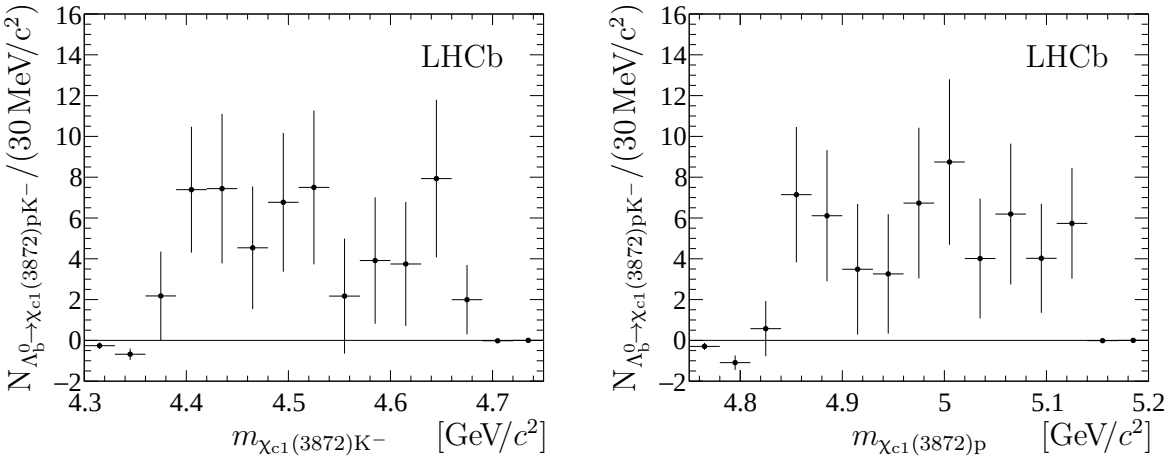

Figure 4: Background-subtracted mass distributions for (left) the $\chi_{c1}(3872)K^-$and (right) $\chi_{c1}(3872)p$ systems in $\Lambda_b^0 \to \chi_{c1}(3872)pK^-$ decays.

References

[1] Particle Data Group, M. Tanabashi *et al.*, *Review of particle physics*, Phys. Rev. **D98** (2018) 030001.

[2] LHCb collaboration, R. Aaij *et al.*, *Quantum numbers of the* X(3872) *state and orbital angular momentum in its* $\rho^0 J/\psi$ *decay*, Phys. Rev. **D92** (2015) 011102(R), `arXiv:1504.06339`.