Supplementary material for LHCb-PAPER-2018-029

Figure 1 shows the full set of 34 angular observables, determined using a moment analysis that combines the long-track and downstream-track $p\pi^-$ candidates in the Run 1 and Run 2 data sets. Figure 2 shows K_1 to K_{10} along with predictions for the observables in the SM and in two new physics scenarios; the first scenario has $C_9^{\rm NP} = -1.0$ and the second scenario has $C_9^{\rm NP} = -C_{10}^{\rm NP} = -0.7$. Figures 3 and 4 show the background-subtracted angular distributions of candidates in the Run 1 and Run 2 datasets, respectively. The long- and downstream-track $p\pi^-$ candidates are combined. Figure 5 shows projections of the six-dimensional efficiency model in the angular variables and q^2. The 2016 data-taking conditions for long-track $p\pi^-$ candidates are used for illustration. Similar features are seen for the other data-taking periods and for downstream-track $p\pi^-$ candidates.

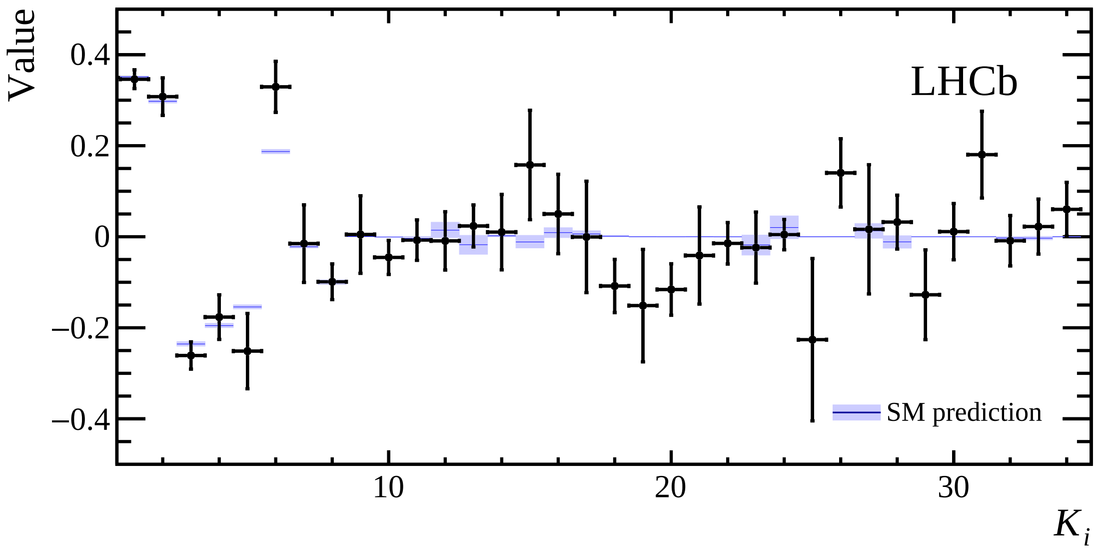

Figure 1: Angular observables combining the results for the moments obtained from Run 1 and Run 2 data, as well as candidates reconstructed in the long- and downstream-track $p\pi^-$ categories. The blue line represents the SM predictions obtained using the EOS software. The light-blue band represents the uncertainty on the SM predictions. The observables K_{11} to K_{34} are computed using the Λ_b^0 production polarisation measurement from Ref. [1].

References

[1] LHCb collaboration, R. Aaij *et al.*, *Measurements of the $\Lambda_b^0 \to J/\psi\Lambda$ decay amplitudes and the Λ_b^0 polarisation in pp collisions at $\sqrt{s} = 7$ TeV*, Phys. Lett. **B724** (2013) 27, arXiv:1302.5578.

[2] W. Altmannshofer, C. Niehoff, P. Stangl, and D. M. Straub, *Status of the $B \to K^*\mu^+\mu^-$ anomaly after Moriond 2017*, Eur. Phys. J. **C77** (2017) 377, arXiv:1703.09189.

[3] M. Ciuchini *et al.*, *On flavourful Easter eggs for new physics hunger and lepton flavour universality violation*, Eur. Phys. J. **C77** (2017) 688, arXiv:1704.05447.

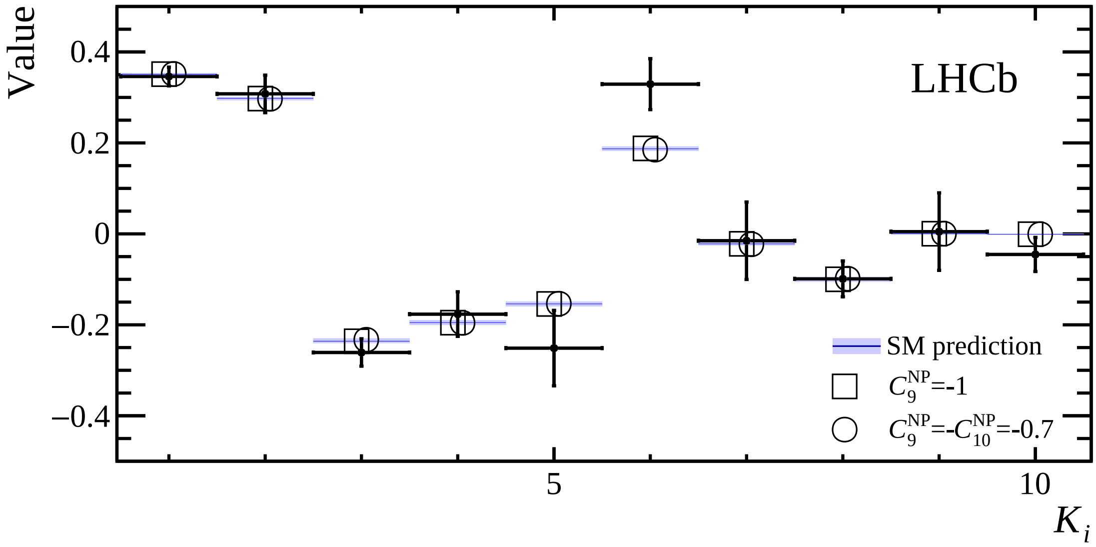

Figure 2: Angular observables combining the results for the moments obtained from Run 1 and Run 2 data, as well as candidates reconstructed in the long- and downstream-track $p\pi^-$ categories. The blue line represents the SM predictions obtained using the EOS software. The light-blue band represents the uncertainty on the SM predictions. The squares represent the prediction of a new physics scenario with $C_9^{\rm NP} = -1.0$ and the circles represent the prediction of a new physics scenario with $C_9^{\rm NP} = -C_{10}^{\rm NP} = -0.7$. These new physics scenarios, favoured by the global fits to the b to s quark data [2–6], result in only a small change of K_1 to K_{10} in the low-recoil region. For illustration purposes the central values for the two new physics scenarios are shifted in the horizontal axis.

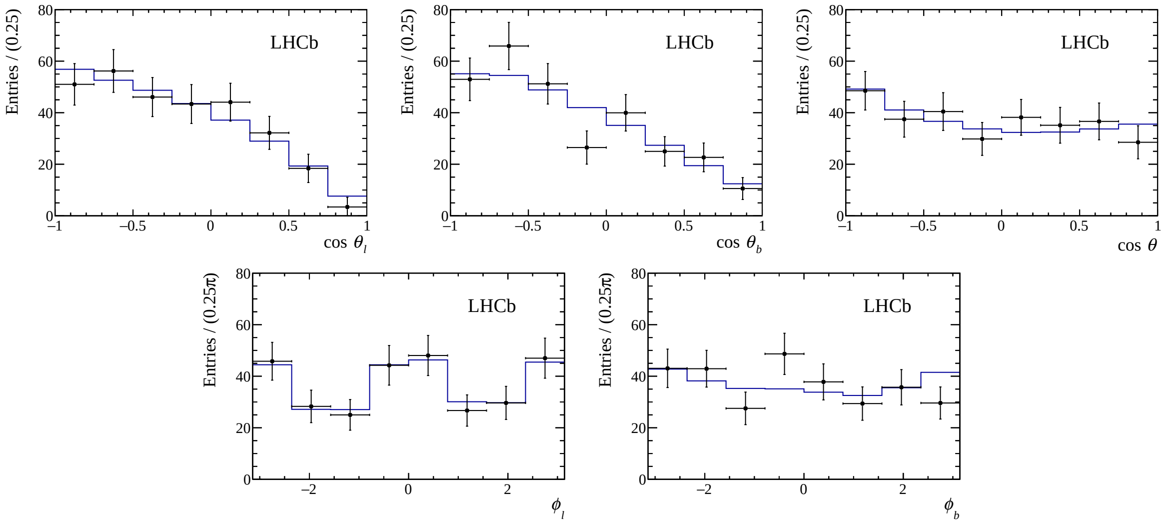

Figure 3: One-dimensional projections of the angular distribution of the candidates in the long- and downstream-track $p\pi^-$ categories in the Run 1 data set (black points). Background is subtracted from data but no correction is applied for the efficiency. The projection of the angular distribution obtained from the moment analysis multiplied by the efficiency distribution is overlaid. The large variation in ϕ_l is primarily due to the angular acceptance.

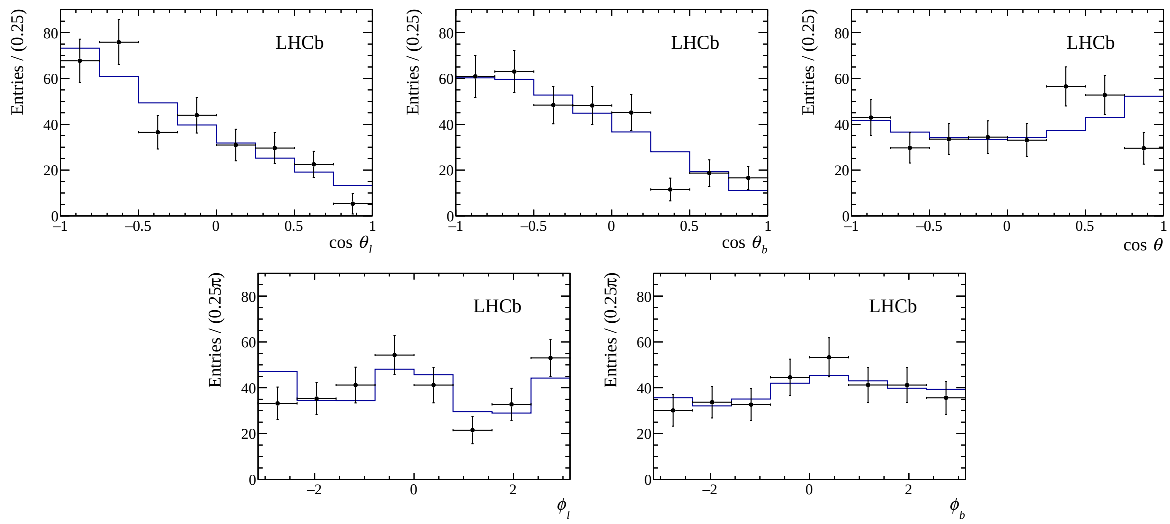

Figure 4: One-dimensional projections of the angular distribution of the candidates in the long- and downstream-track $p\pi^-$ categories in the Run 2 data set (black points). Background is subtracted from data but no correction is applied for the efficiency. The projection of the angular distribution obtained from the moment analysis multiplied by the efficiency distribution is overlaid. The large variation in ϕ_l is primarily due to the angular acceptance.

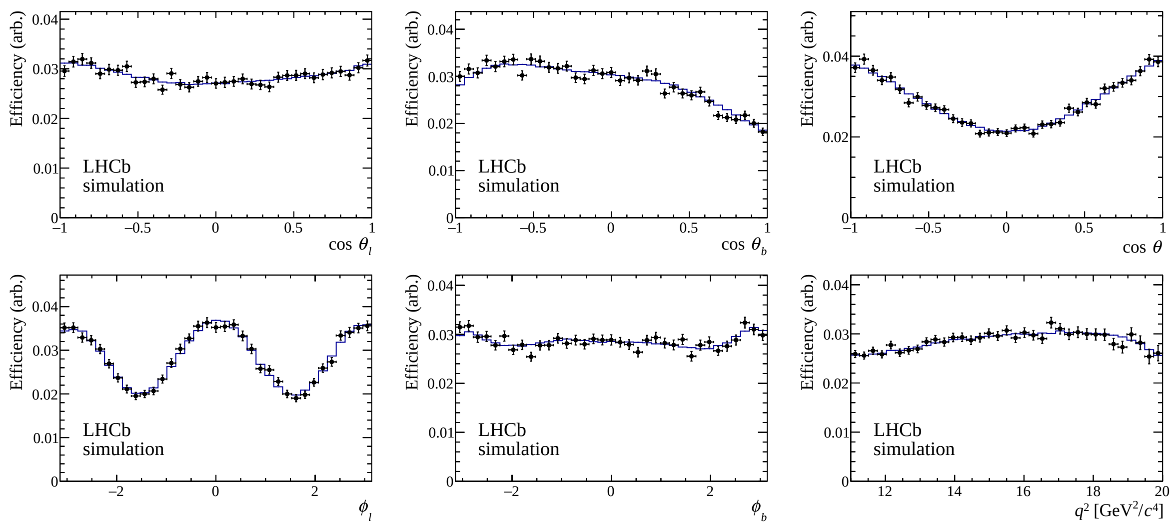

Figure 5: One-dimensional projections of the six-dimensional efficiency model for using long-track $p\pi^-$ combinations in the 2016 data in the range $11 < q^2 < 20\,\mathrm{GeV}^2/c^4$. The points correspond to simulated $\Lambda_b^0 \to \Lambda\mu^+\mu^-$ phase space decays that are selected by the same selection process as the data.

[4] V. G. Chobanova *et al.*, *Large hadronic power corrections or new physics in the rare decay* $B \to K^*\mu^+\mu^-$*?*, JHEP **07** (2017) 025, arXiv:1702.02234.

[5] L.-S. Geng *et al.*, *Towards the discovery of new physics with lepton-universality ratios of* $b \to s\ell\ell$ *decays*, Phys. Rev. **D96** (2017) 093006, arXiv:1704.05446.

[6] B. Capdevila *et al.*, *Patterns of new physics in* $b \to s\ell^+\ell^-$ *transitions in the light of recent data*, JHEP **01** (2018) 093, arXiv:1704.05340.