# 1 Supplementary material for LHCb-PAPER-2021-016

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

Example distributions of the $p\pi^-$ invariant mass of $\Lambda$ candidates and $\pi^+\pi^-$ invariant mass of $K^0_S$ candidates are shown in Fig. 15 with the fit projections overlaid.

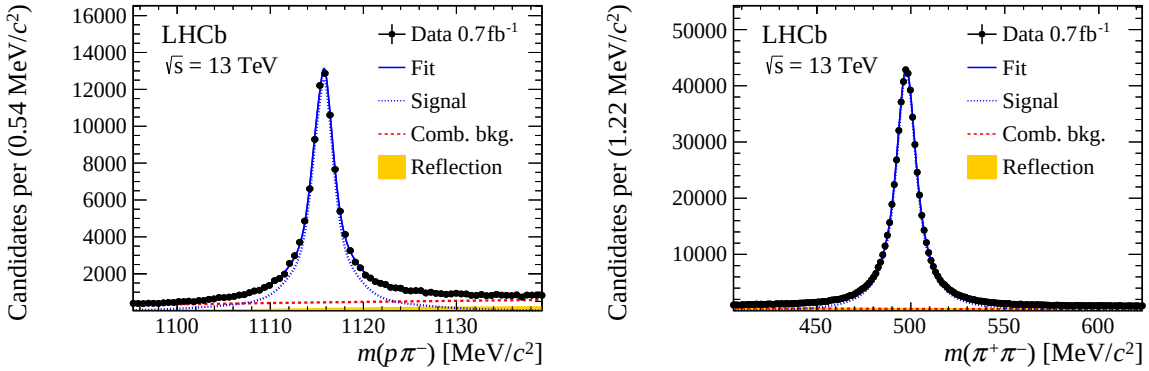


Figure 15: Example distributions of the (left) $p\pi^-$ invariant mass of $\Lambda$ candidates and (right) $\pi^+\pi^-$ invariant mass of $K^0_S$ candidates used in the proton interaction asymmetry measurement. For $\Lambda$ candidates, the proton is only reconstructed with hits in the VELO and its momentum is determined by constraining the $\Lambda$ candidate's momentum vector to a primary vertex. For $K^0_S$ candidates, the $\pi^+$ candidate is only reconstructed with hits in the VELO. Fits to the distributions to determine signal yields are shown as well. The data shown were recorded in 2017 with magnet polarity up.

## 1.1 Detection asymmetry plots

The corrections applied in the $\Lambda^0_b$ production asymmetry measurement at $\sqrt{s} = 7\,\text{TeV}$ and $8\,\text{TeV}$ due to detection asymmetries as a function of $\Lambda^0_b$ rapidity and transverse momentum are shown in Figs. 16, 17, 18 and 19 for the proton PID asymmetry, the muon trigger and PID asymmetry, the proton and muon tracking asymmetry and the kaon-pion detection asymmetry, respectively.

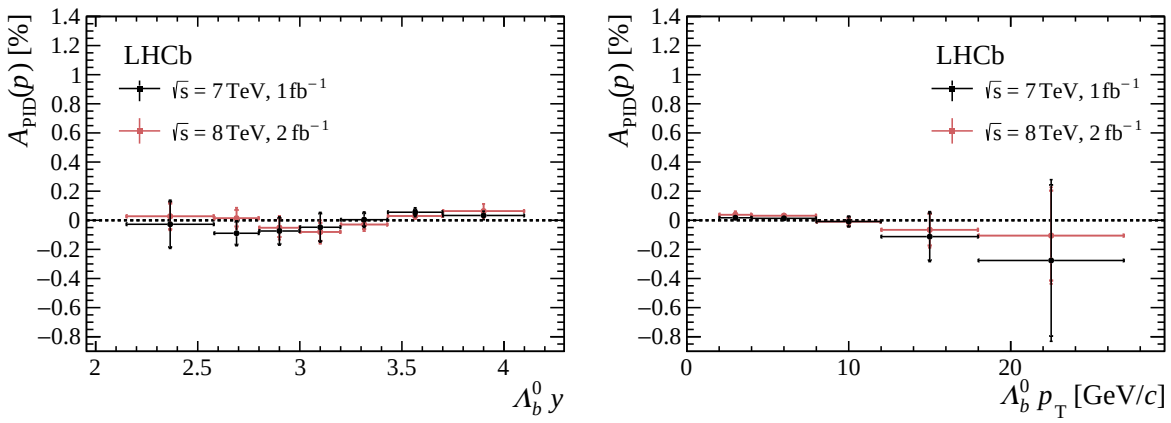


Figure 16: Correction assigned due to the proton PID asymmetry versus $\Lambda_b^0$ (left) rapidity and (right) $p_{\rm T}$ for data recorded at centre-of-mass energies of 7 and 8 TeV. The uncertainties are the quadratic sums of statistical and systematic uncertainties.

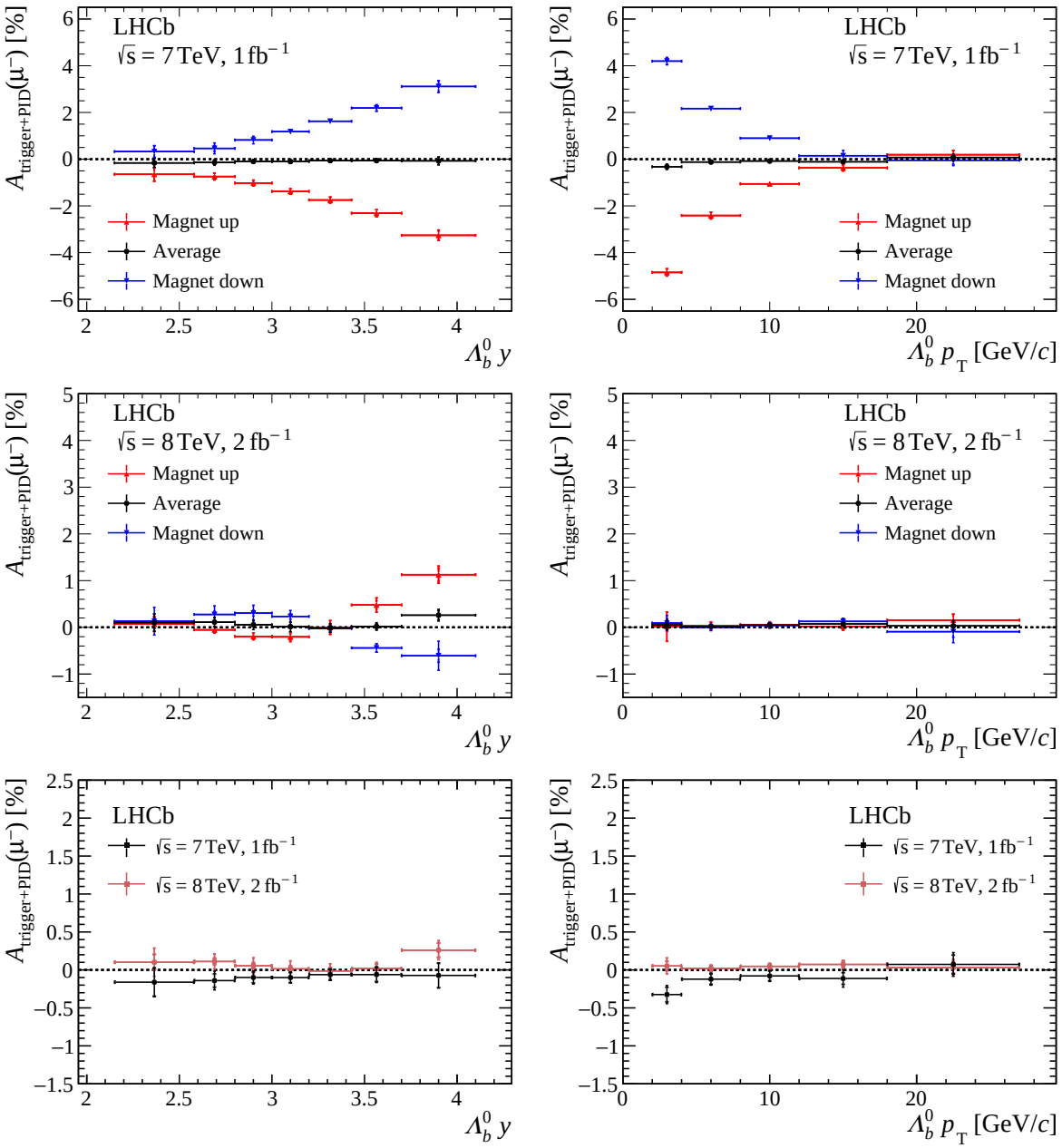


Figure 17: Correction assigned due to the muon trigger and PID asymmetry versus $\Lambda_b^0$ (left) rapidity and (right) $p_{\rm T}$ separately for data recorded at centre-of-mass energies of (top) 7, (middle) 8 TeV and (bottom) combined. The difference between the corrections for magnet up and down is due to a charge-dependent bias in the momentum estimate of muons in the hardware trigger which causes a large detection asymmetry for muons at small transverse momentum. The uncertainties are the quadratic sums of statistical and systematic uncertainties.

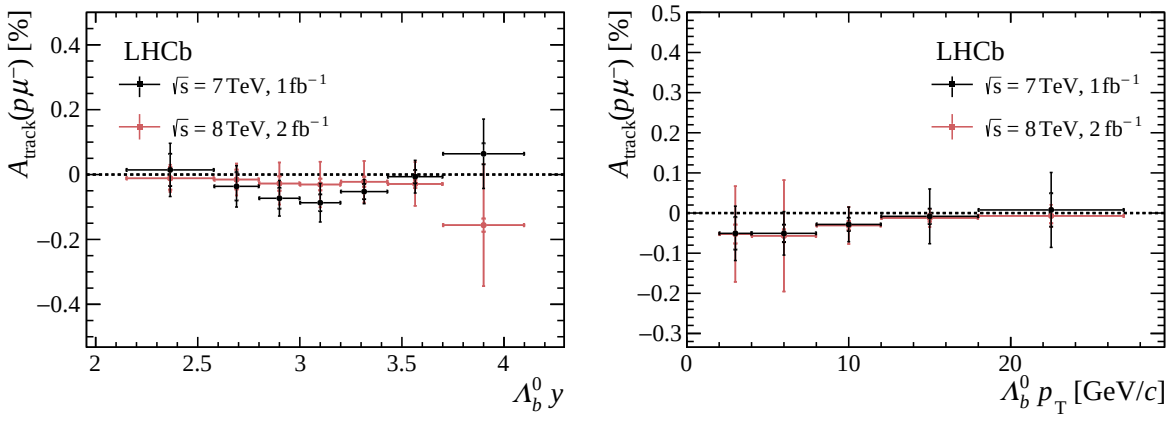


Figure 18: Correction assigned due to the combined track reconstruction asymmetry of protons and muon versus $\Lambda_b^0$ (left) rapidity and (right) $p_{\text{T}}$ for data recorded at centre-of-mass energies of 7 and 8 TeV. The uncertainties are the quadratic sums of statistical and systematic uncertainties.

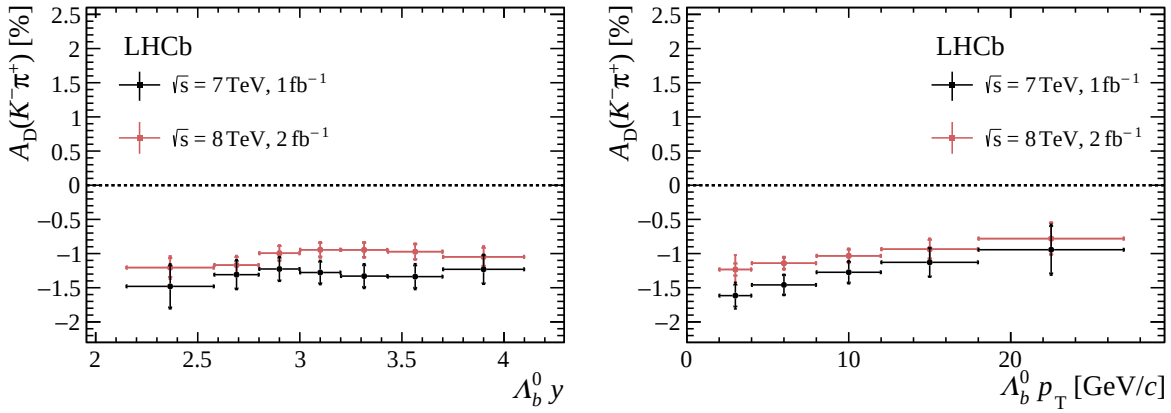


Figure 19: Correction assigned due to the kaon-pion detection asymmetry versus $\Lambda_b^0$ (left) rapidity and (right) $p_{\text{T}}$ for data recorded at centre-of-mass energies of 7 and 8 TeV. The uncertainties are the quadratic sums of statistical and systematic uncertainties.