Search for the decay $\Xi_b^-(\Omega_b^-)\to\Lambda_c^+h^-h'^-$ at LHCb

Bhagyashree Pagare[1], Timothy Gershon[1], Thomas Latham[1], Mark Whitehead[2]
[1]University of Warwick, [2]University of Glasgow

Why do we search ?

- CP violation phenomenon that relates to matter and antimatter asymmetry has never been observed in b baryons
- Studies of b baryons are limited
- Necessary to know the production properties to be able to determine CP asymmetries in future studies
- Provide new insights into charm baryon spectroscopy

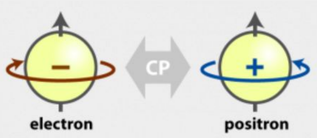


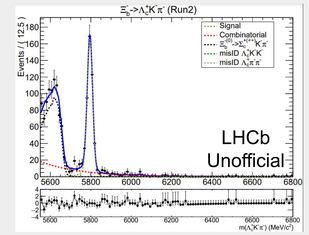
Fig 1. Charge Parity transformation

How do we measure?

- Use $B^-\to\Lambda_c^+ph^-$ as the control mode and $\Xi_b^-(\Omega_b^-)\to\Lambda_c^+h^-h'^-$ as signal modes where h,h' can be K or π
- Simultaneous fit separately for signal modes and control modes
- Blind analysis for signal modes
- Yields for misID background are constrained depending upon the yield of correctly identified signal

What do we observe and study?

- Resonances in the control mode channel corresponding to $\Sigma_c(2455)$, $\Sigma_c(2520)$, $\Sigma_c(2840)$
- Variation of the production asymmetry with respect to transverse momentum which is consistent with zero as expected for B



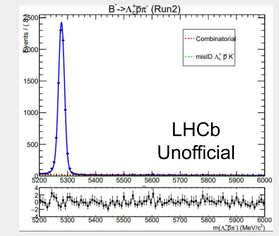


Fig 2. Invariant mass of signal mode and control mode candidates

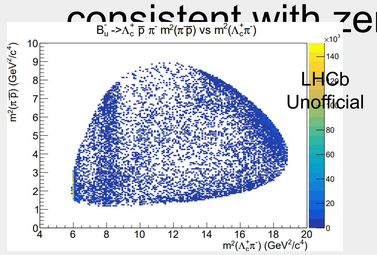


Fig 3. Dalitz plot

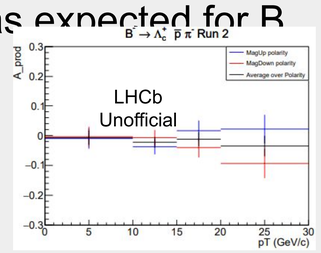
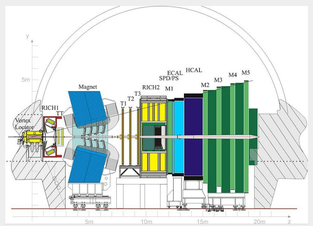
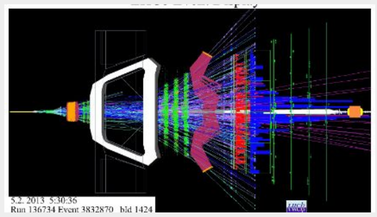


Fig 4. Production asymmetry vs transverse momentum

Where do we search and why ?

- We search for it at LHCb
- Designed to study the unprecedented amounts of b baryons from the LHC p-p collisions of $9fb^{-1}$
- Excellent vertex, mass and time resolution
- Precise particle identification





Source *https://cds.cern.ch/record/1520167*

References

- *Phys. Rev. D, 78:112003, 2008*
- *T Gershon and V V Gligorov. CP Violation in the b system. Reports on Progress in Physics, 80(4):046201, Feb 2017*
- *LHCb-PAPER-2020-005,CERN-EP-2020-051,arXiv:2004:10563*

What do we compute and measure?

- We measure the relative branching fraction from fit yields and efficiency

$$\frac{\mathcal{B}(\Xi_b^-\to\Lambda_c^+h^-h'^-)}{\mathcal{B}(B_u^-\to\Lambda_c^+\bar{p}h^-)}\times\frac{f_{\Xi_b^-(\Omega_b^-)}}{f_{B_u^-}}=\frac{\mathcal{N}_{\Xi_b^-(\Omega_b^-)}/\epsilon_{\Xi_b^-(\Omega_b^-)}}{\mathcal{N}_{B_u^-}/\epsilon_{B_u^-}}$$

- The efficiencies are computed from MC
- The result of the relative branching fraction of the two control modes is given as

LHCb Unofficial

$$\frac{\mathcal{B}(B^-\to\Lambda_c^+\bar{p}K^-)}{\mathcal{B}(B^-\to\Lambda_c^+\bar{p}\pi^-)}=0.0398\pm0.0023\,(\text{stat})\pm0.0012\,(\text{syst})$$

- Most precise measurement.
- Results for signal modes are in preparation