

# First evidence for the two-body charmless baryonic decay $B^0 \rightarrow p\bar{p}$

Beauty 2014, Edinburgh University

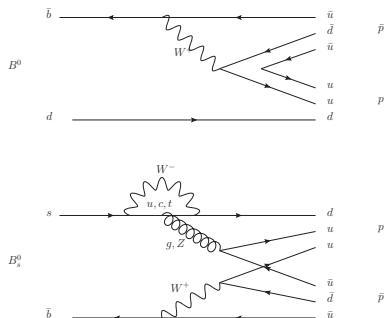
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On behalf of the LHCb collaboration

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# Search for the decays $B^0 \rightarrow p\bar{p}$ and $B_s^0 \rightarrow p\bar{p}$

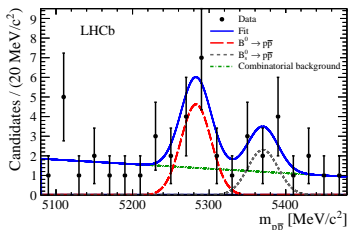


Results published in JHEP  
(doi:10.1007/JHEP10(2013)005)

- ▶ Only one 2-body charmless baryonic  $B$ -decay mode observed,  $B^+ \rightarrow p\Lambda(1520)$  (Phys. Rev. D 88, 052015)
- ▶  $B_{(s)}^0 \rightarrow p\bar{p}$  predicted to be the simplest modes to search for
- ▶ Previous searches had probed down to BFs  $\sim 10^{-7}$  (CLEO, SLAC, KEK-B)
- ▶ Relative BF measurement with  $B^0 \rightarrow K^+\pi^-$  as normalisation channel
- ▶ Analysis uses  $0.92 \text{ fb}^{-1}$  of proton-proton collision data at CoM energy of 7 TeV, 90% of the full 2011 data set

# Results

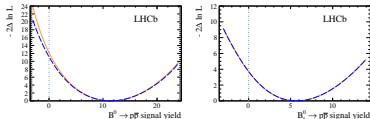
Event selection and signal optimisation applied followed by unbinned maximum likelihood fits to the invariant mass spectra.  $B_{(s)}^0 \rightarrow p\bar{p}$  yields extracted:



- ▶  $N(B^0 \rightarrow p\bar{p}) = 11.42 \pm 4.25$  (stat) events  
→ **3.3 $\sigma$  significance**
- ▶  $N(B_s^0 \rightarrow p\bar{p}) = 5.70 \pm 3.38$  (stat) events  
→ 1.9 $\sigma$  significance
- ▶ First evidence for a two-body charmless baryonic  $B^0$  decay

Construct confidence level intervals on BFs using Feldman Cousins method (@ 68.3% CL)

- ▶  $\mathcal{B}(B^0 \rightarrow p\bar{p}) = (1.47^{+0.62}_{-0.51} \text{ } ^{+0.35}_{-0.14}) \times 10^{-8}$
- ▶  $\mathcal{B}(B_s^0 \rightarrow p\bar{p}) = (2.84^{+2.03}_{-1.68} \text{ } ^{+0.85}_{-0.18}) \times 10^{-8}$



- ▶ Two-sided confidence limits applied to  $B^0 \rightarrow p\bar{p}$  and  $B_s^0 \rightarrow p\bar{p}$  BFs for the first time
- ▶ Upper limit on  $B_s^0 \rightarrow p\bar{p}$  BF improves previous result by 3 orders of magnitude
- ▶ Measured  $B^0 \rightarrow p\bar{p}$  BF excludes all existing theoretical predictions!

## Follow-up Analyses

Full 2011+2012 dataset  $B_{(s)}^0 \rightarrow p\bar{p}$  analysis

- ▶ Work underway on updated  $B_{(s)}^0 \rightarrow p\bar{p}$  search using full  $3\text{ fb}^{-1}$  run 1 dataset
- ▶ Suite of improvements planned following the 2011 analysis

Search for  $B^+ \rightarrow p\bar{\Lambda}$

- ▶ Analysis within LHCb to search for  $B^+ \rightarrow p\bar{\Lambda}$ , the next simplest two-body baryonic mode after  $B_{(s)}^0 \rightarrow p\bar{p}$
- ▶ Analysis on full run 1 data set
- ▶ Relative BF measurement, with  $B^+ \rightarrow \pi^+ K_S^0$  as normalisation channel