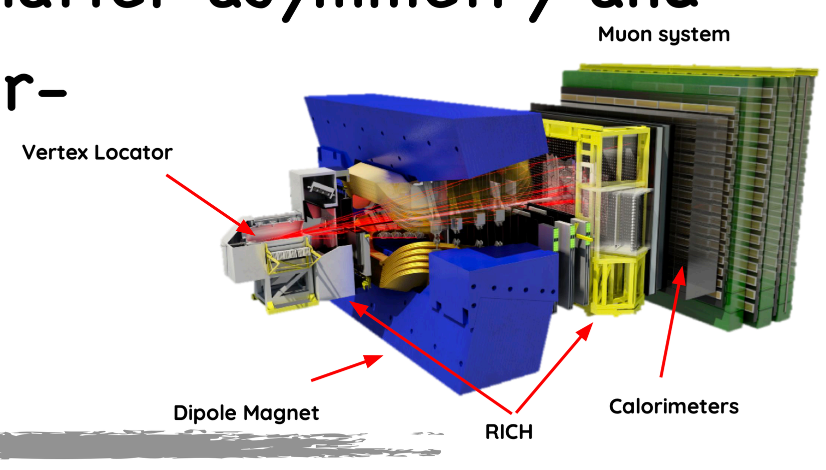
- The 'b' in LHCb stands for beauty!
- As the heavier cousin of the down-quark, it makes studies of many interesting decay modes possible
- $b \to s\ell\ell$ is particularly sensitive to effects from new particles

Analysis of rare beauty at the LHCb Experiment

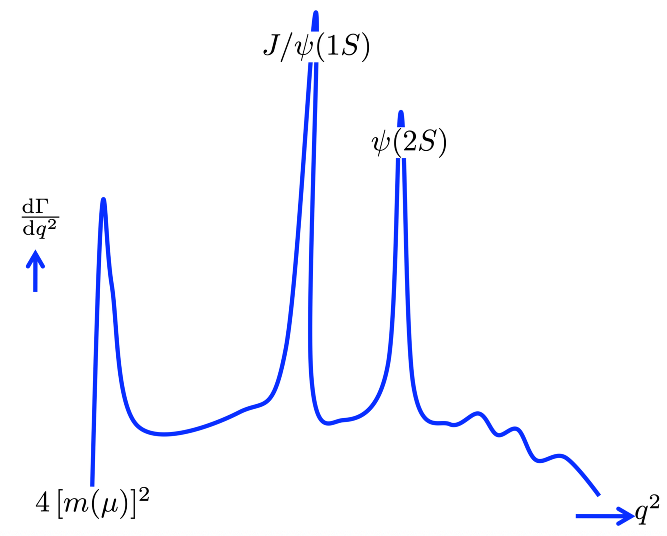
- We study beauty quarks by looking at their decay product inside the LHCb detector
- This helps to shed on light on many mysteries of the Universe, such as matter-antimatter asymmetry and lepton flavour-universality

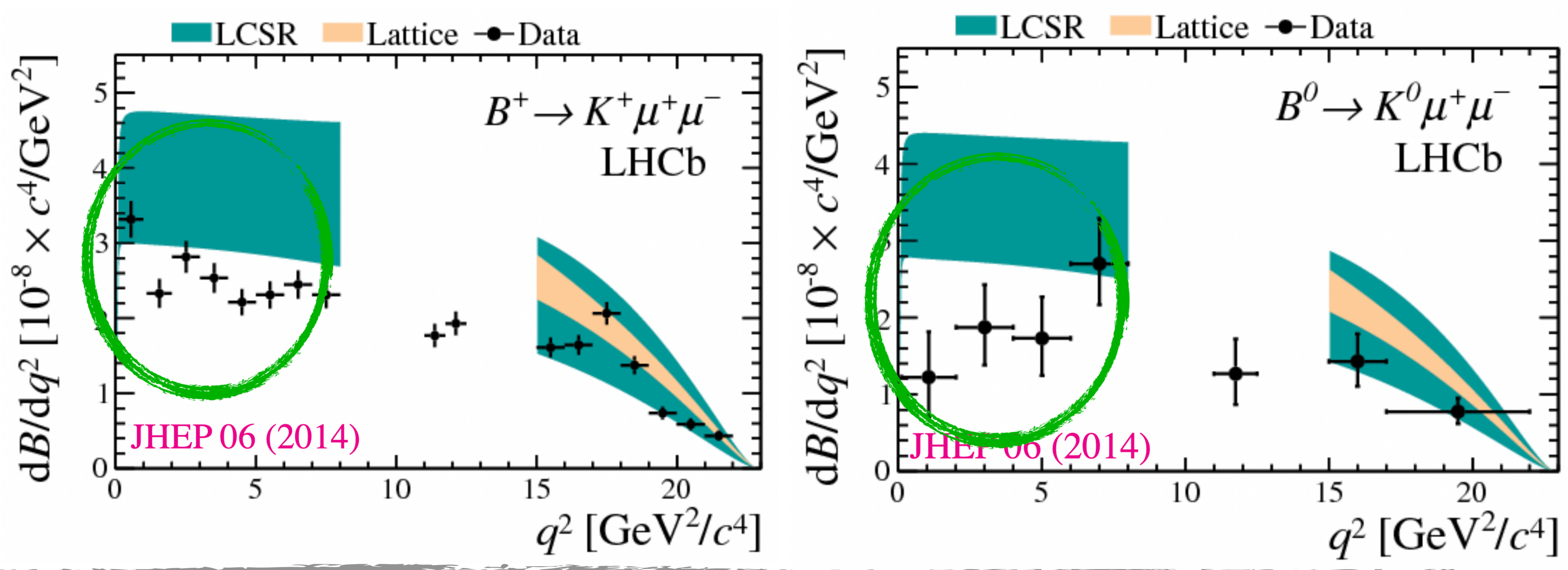


Branching fractions

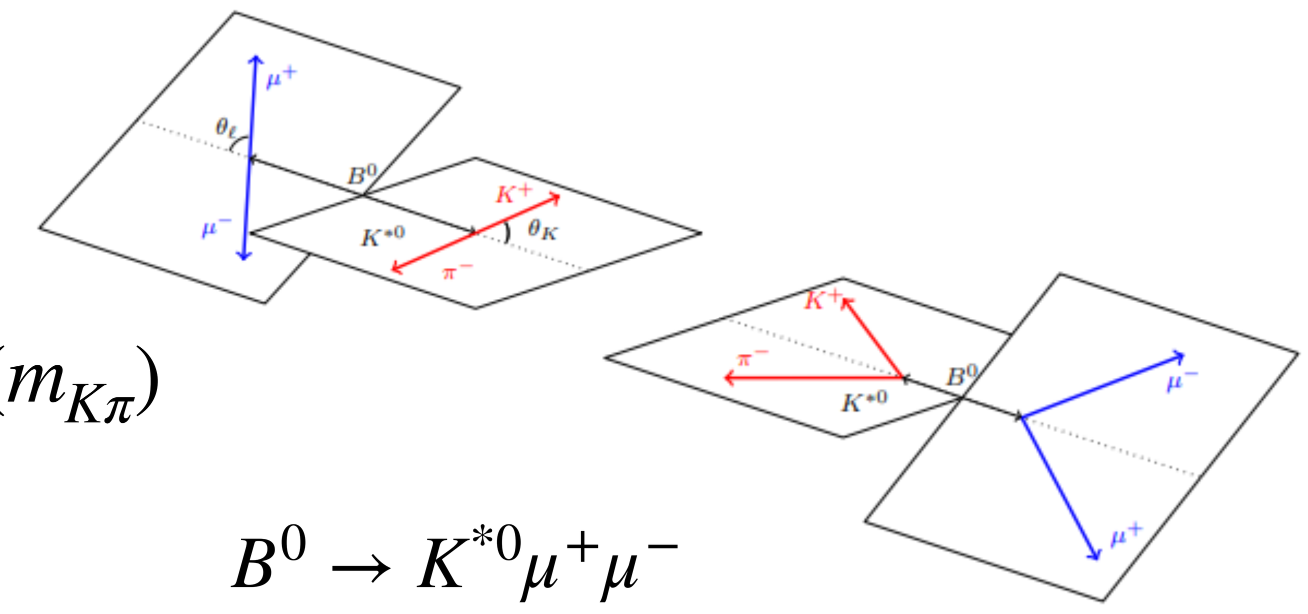
- Decay rate as a function of the dilepton mass squared (q²)
- Branching fraction is the probability to decay to specific state
- By studying the branching fraction we can be sensitive to NP contributions
- These measurements also help improve further analyses!

Intriguing discrepancy with predictions!





Angular analysis



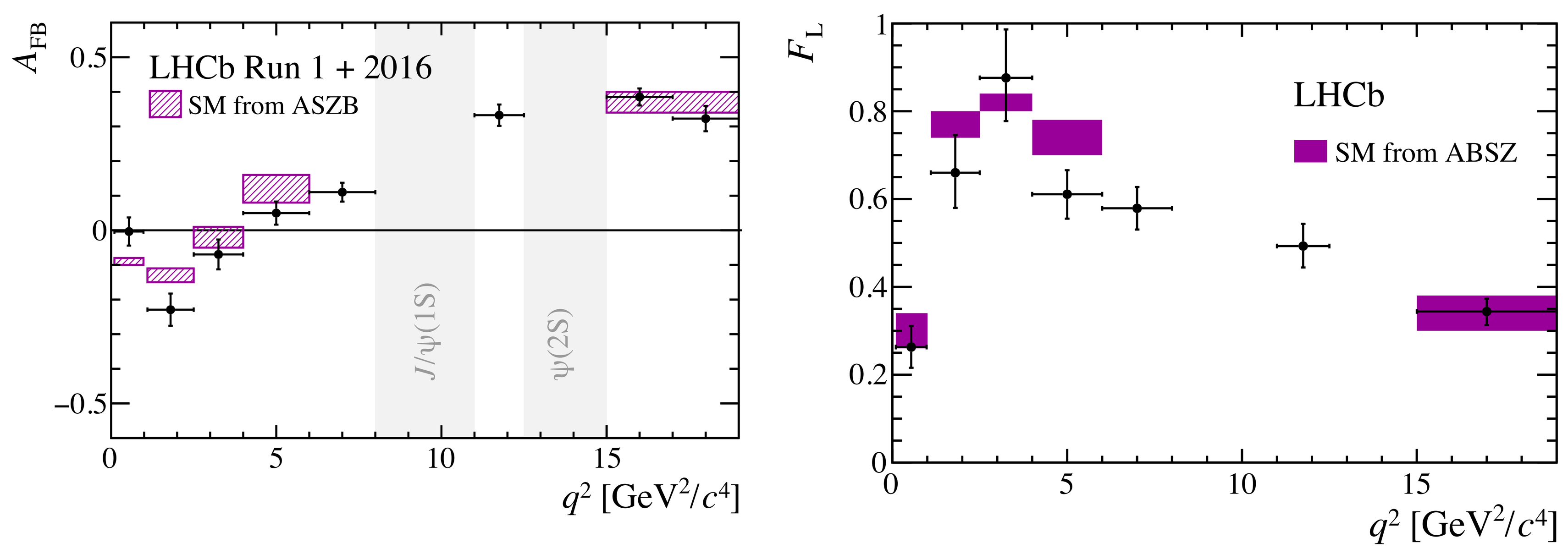
- Decay rate as a function of q² and decay angles

$$\frac{d\Gamma[B^0 \to K^{*0}\mu^+\mu^-]}{dq^2 d\vec{\Omega} dm^2_{K\pi}} = \frac{9}{32\pi} \sum_i J_i(q^2) f_i(\cos\theta_\ell, \cos\theta_K, \phi) g_i(m_{K\pi})$$

Angular observables — Angular distributions

- Construction of observables with reduced hadronic uncertainties
- A_{FB}: Charge asymmetry between muons going forward and backward in the B rest frame
- F_L: Fraction of longitudinally polarised mesons in the final state

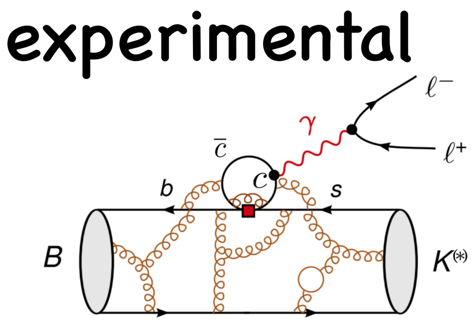
$B^0 \to K^{*0}\mu^+\mu^-$



Hadronic cleanliness

LFU tests

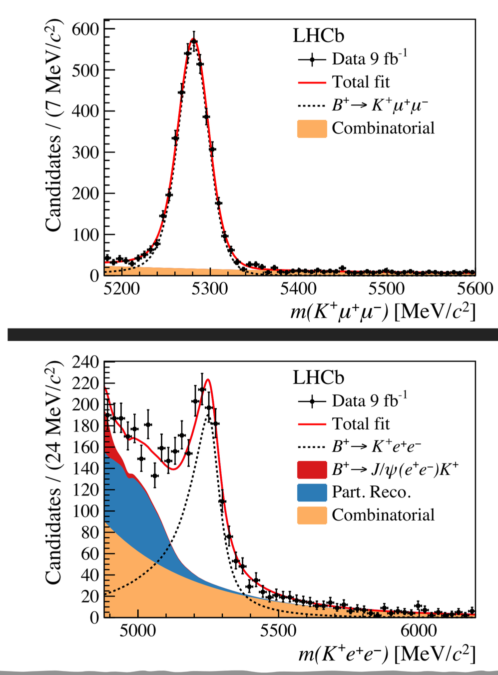
- Large parts of the hadronic and experimental uncertainties cancel



$$R_H = \frac{\mathscr{B}(B \to H\mu^+\mu^-)}{\mathscr{B}(B \to He^+e^-)}$$

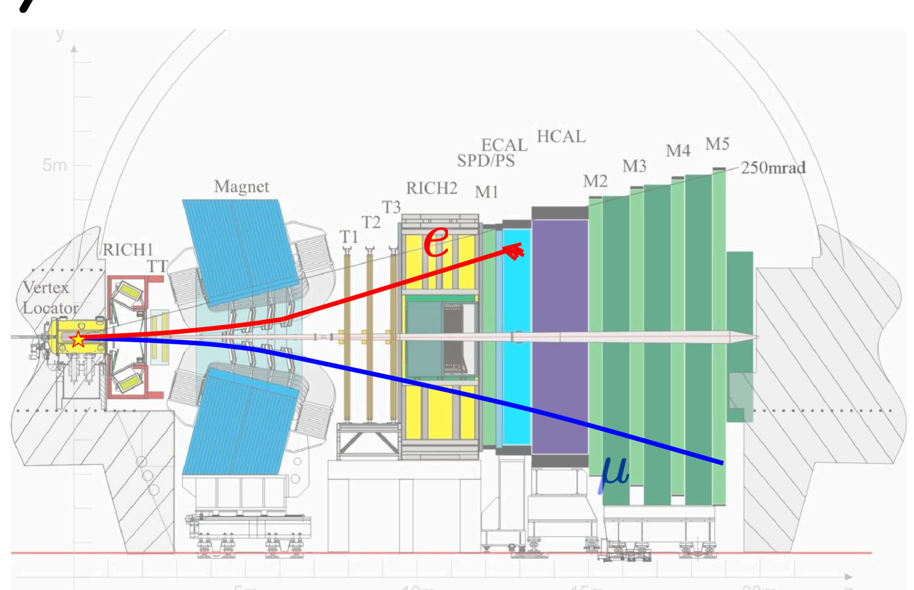
- Two main experimental ingredients

$$R_H = \frac{N(B \to H\mu^+\mu^-)}{N(B \to He^+e^-)} \frac{\epsilon(B \to He^+e^-)}{\epsilon(B \to H\mu^+\mu^-)} =$$



- Yields and Efficiencies!

- Different interactions with the detector
  - Muons go through almost undisturbed
  - Electrons lose significant energy and are are way more difficult to reconstruct



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Interested in the search for New Physics?

Come and join the effort!

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References
[1] https://arxiv.org/pdf/2103.11769.pdf
[2] https://arxiv.org/pdf/1512.04442.pdf

Martin Andersson