



#askCERN

# Hangout with CERN: Penguins!

6 June 2013



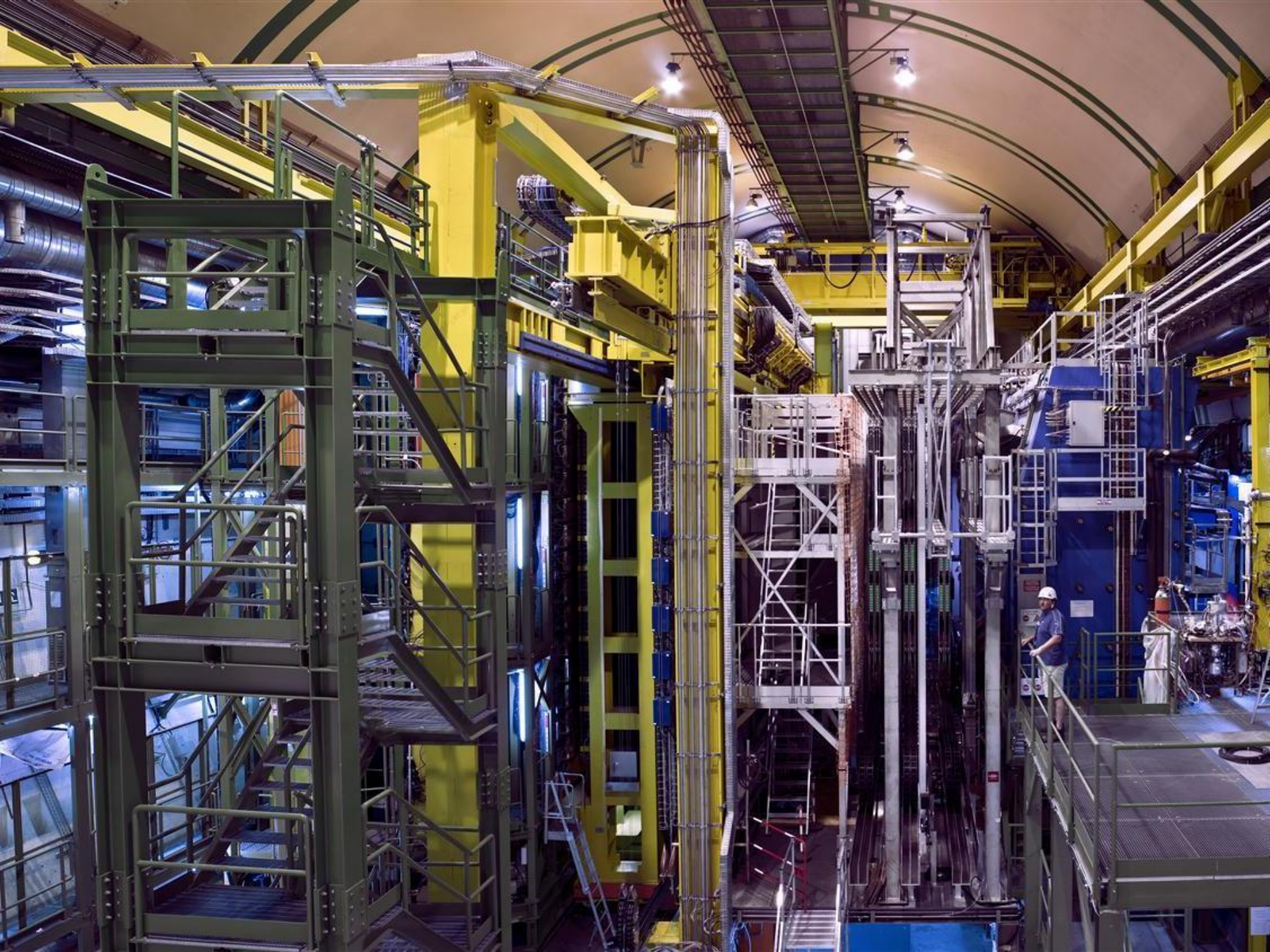


# Today's trivia question

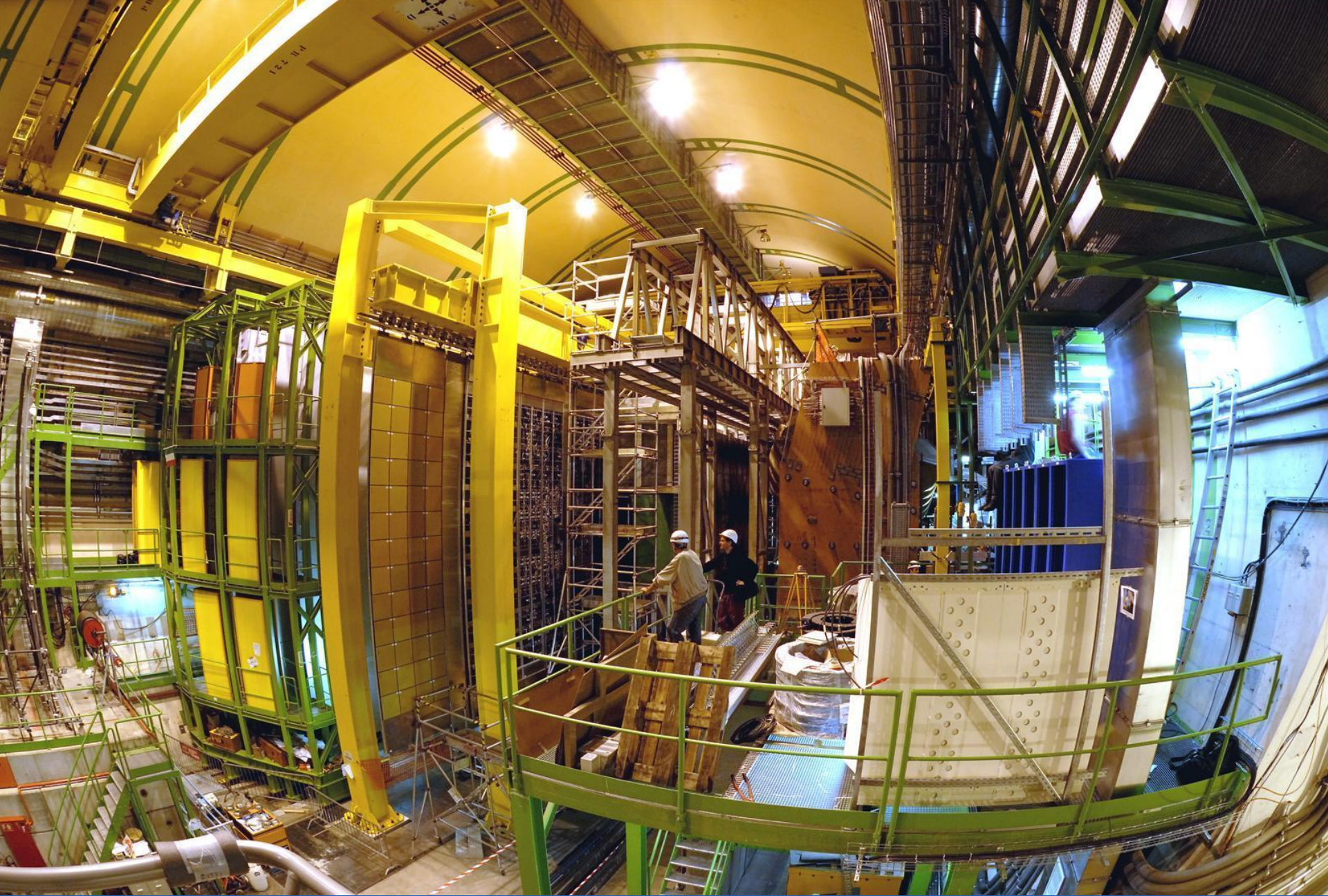
The idea of a “Penguin Diagram” came to John Ellis after he lost a bet with a fellow physicist.

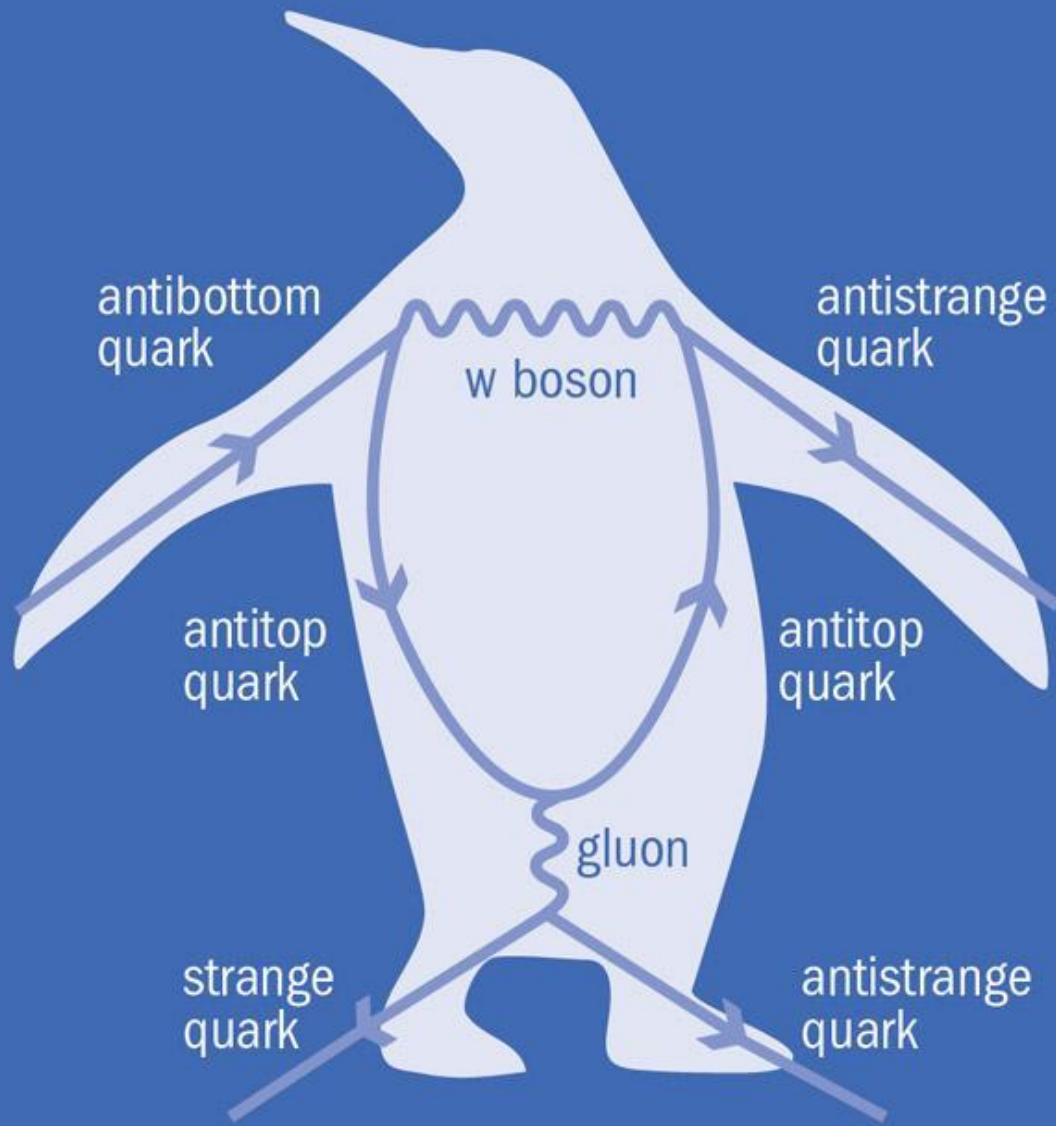
What was the bet and what game were they playing?

Respond in YouTube comments or on Twitter using #askCERN.

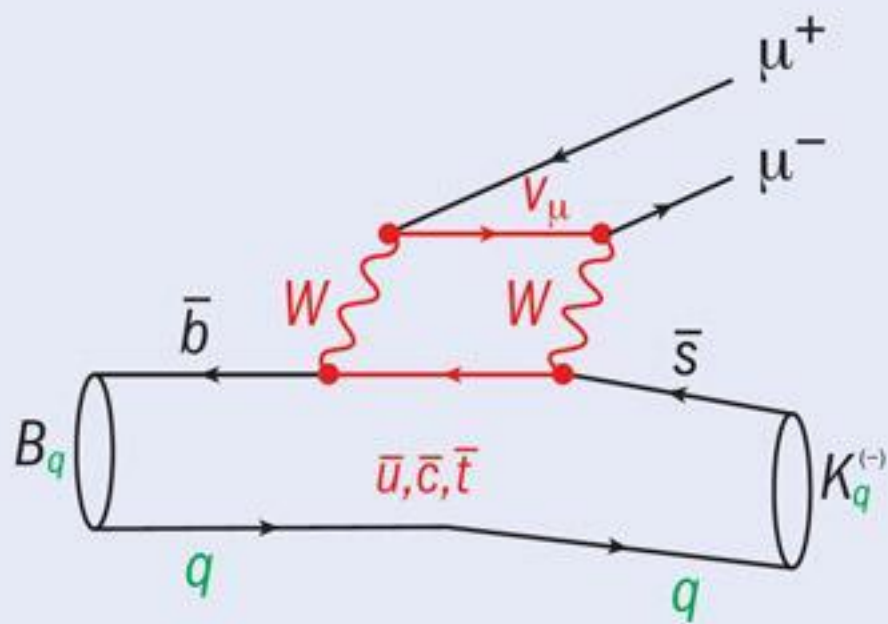
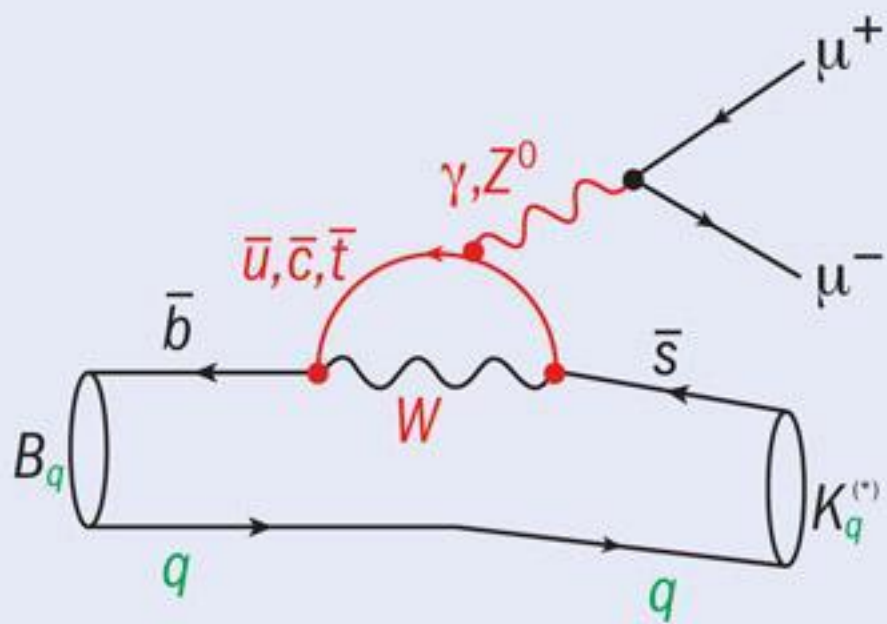


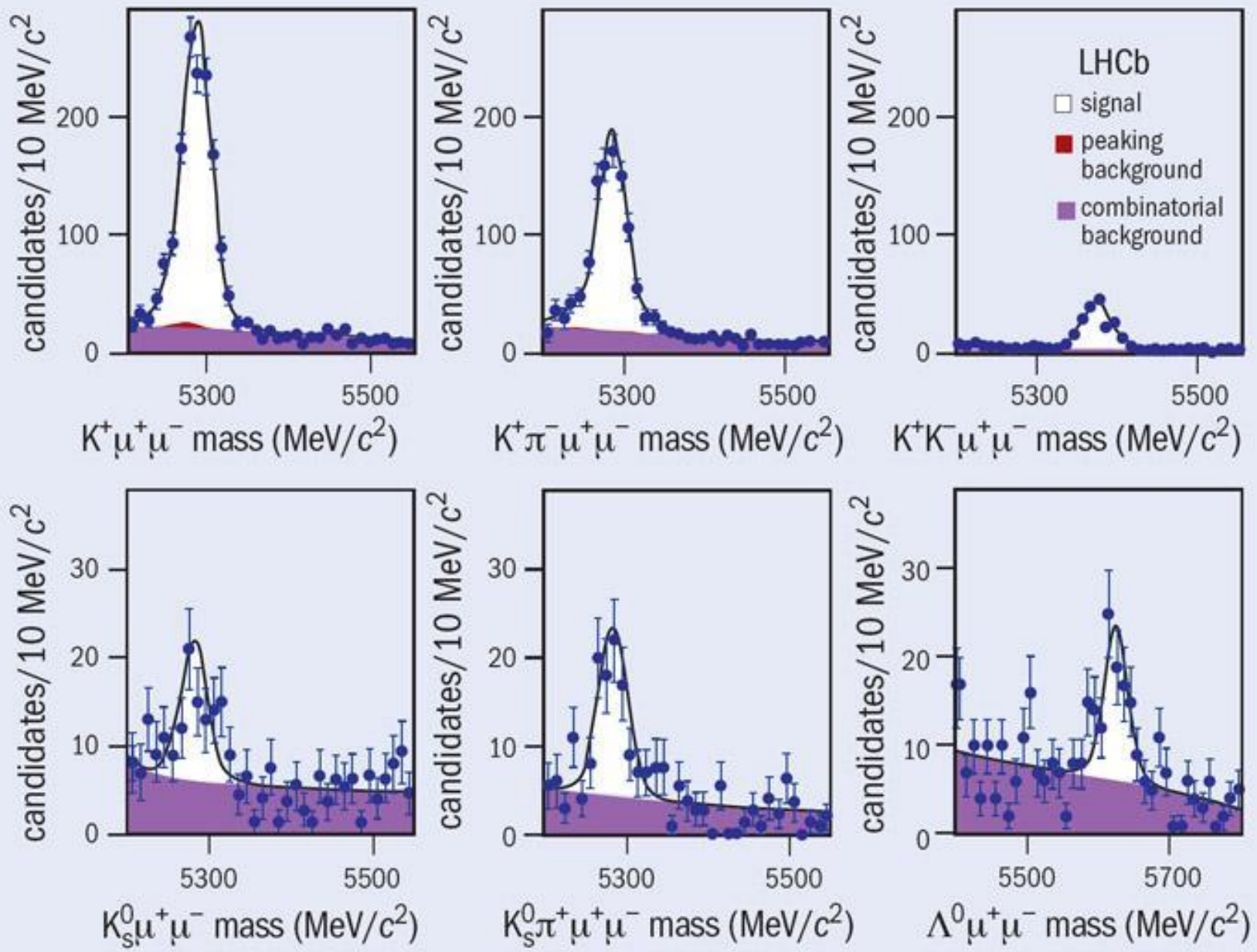




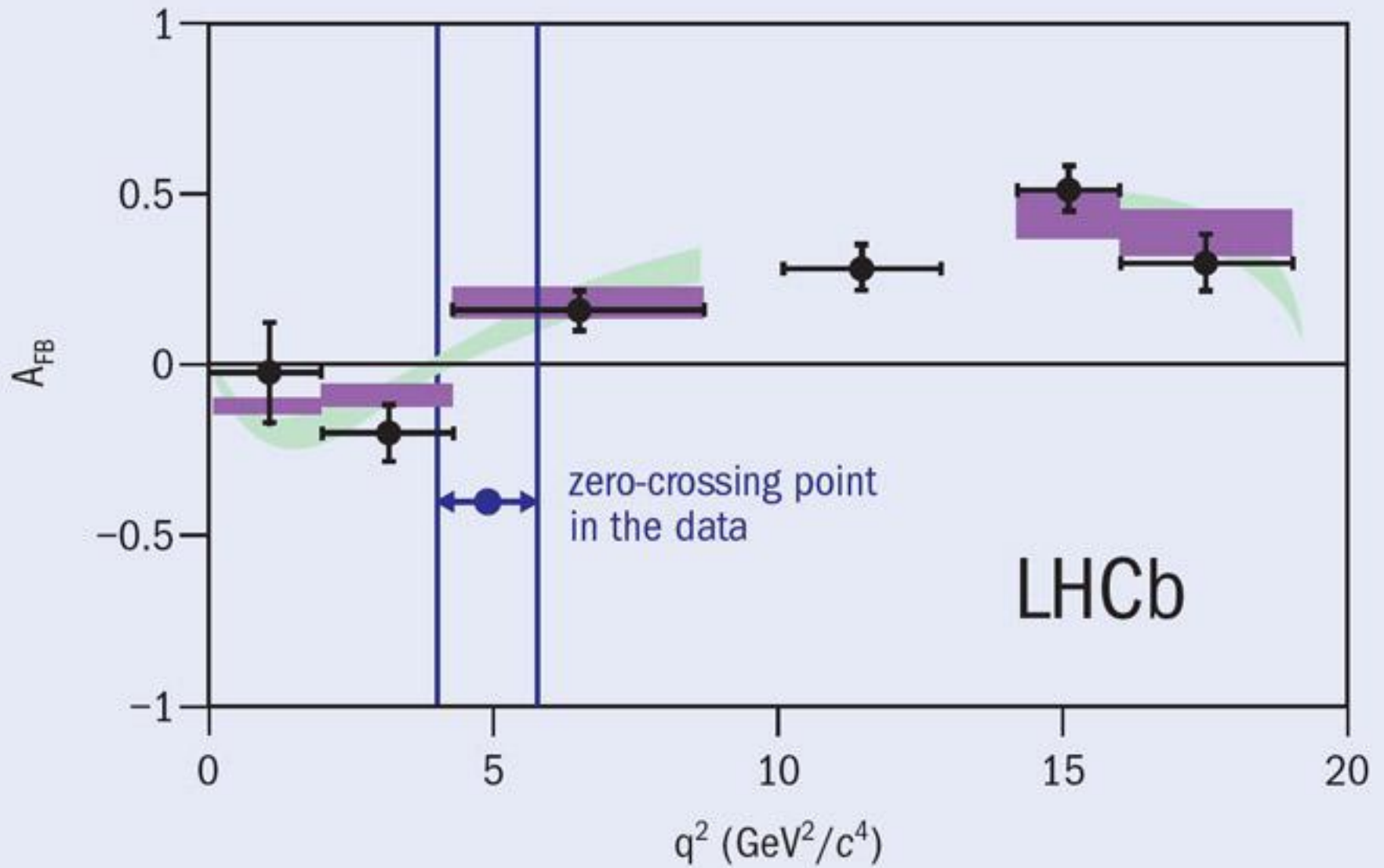


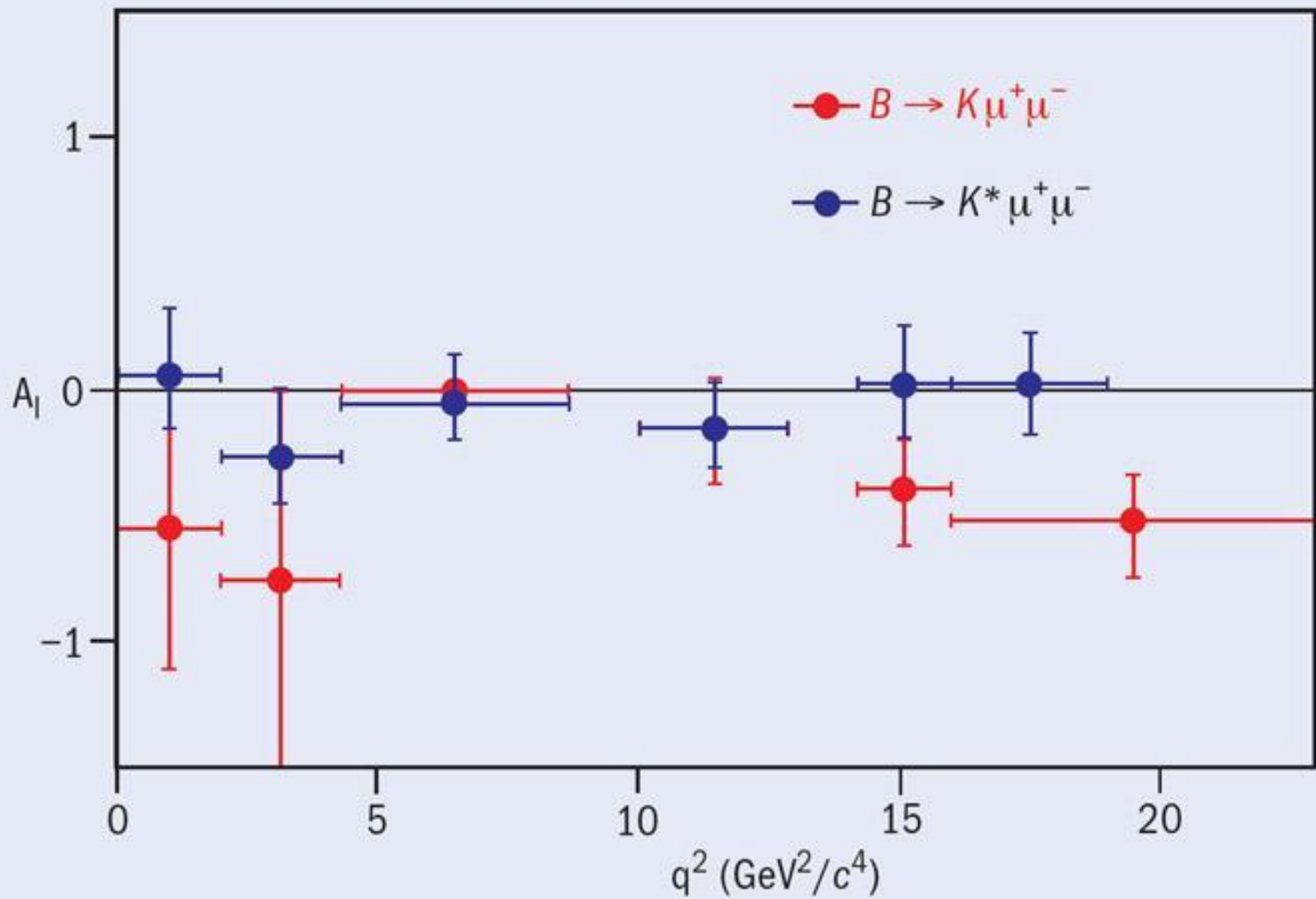


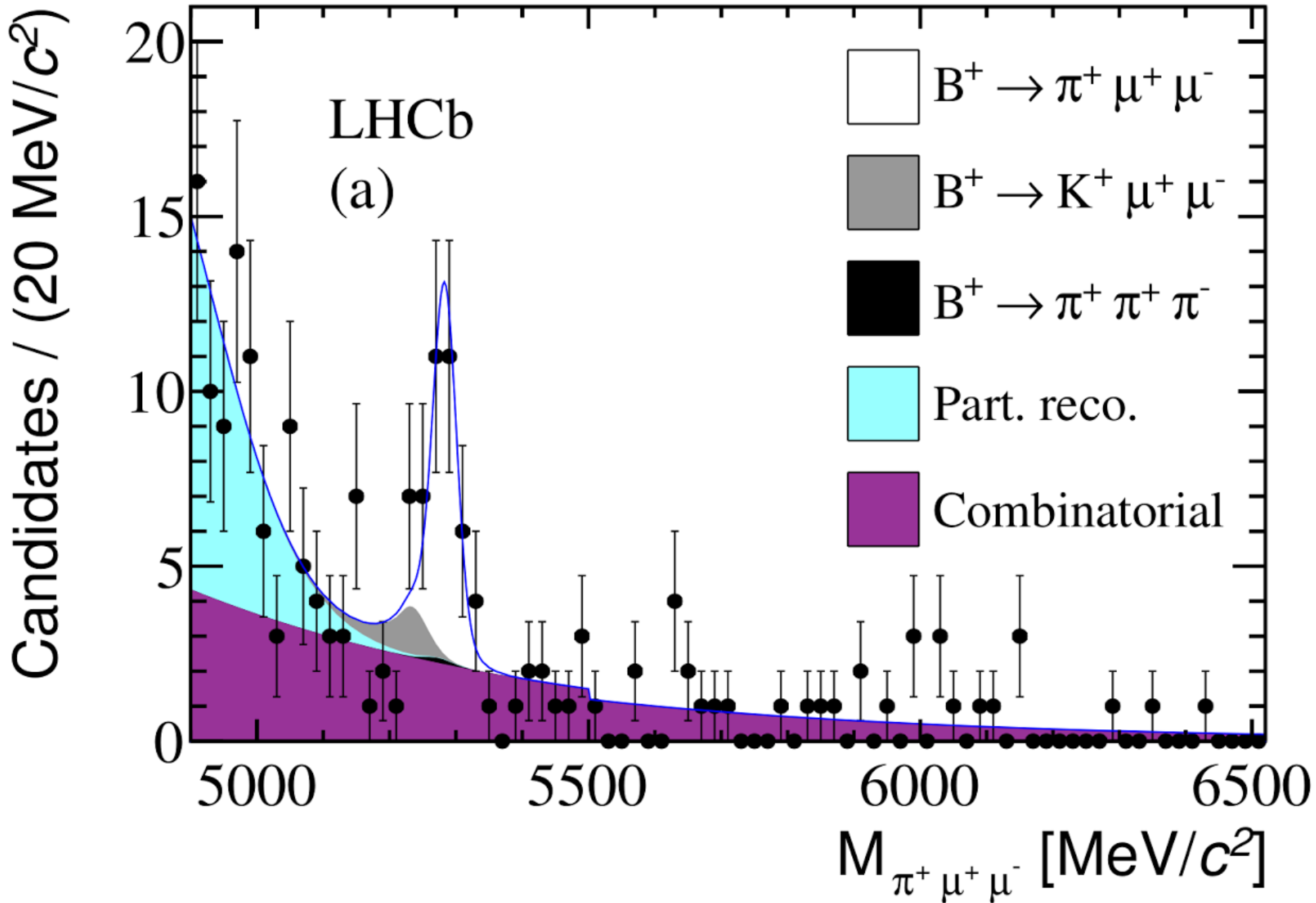




theory    binned    LHCb data points







# Today's trivia answer


Q. The idea of a “Penguin Diagram” came to John Ellis after he lost a bet with a fellow physicist.

What was the bet and what game were they playing?

A. He would simply have to use the word “penguin” in his next conference talk. They were playing darts.

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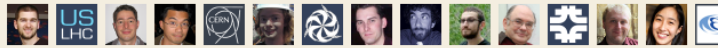
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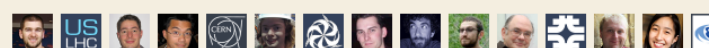
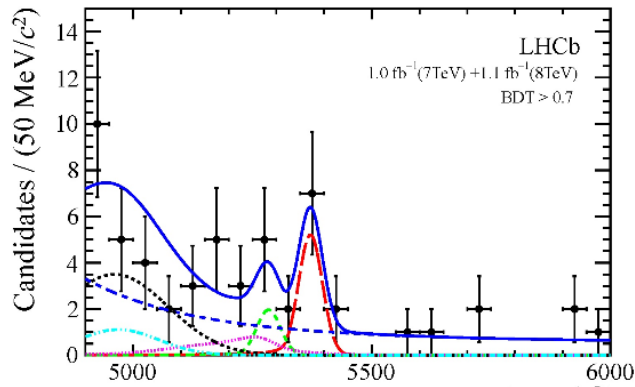


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## Huge impact from a tiny decay

The [Hadron Collider Physics Symposium](#) opened on November 12 in Kyoto on a grand note. For the first time, the [LHCb](#) collaboration operating at the [Large Hadron Collider](#) (LHC) at [CERN](#) showed evidence for an extremely rare type of events, namely the decay of a  $B_s$  meson into a pair of muons (a particle very similar to the electron but 200 times heavier). A meson is a composite class of particles formed from a quark and an antiquark. The  $B_s$  meson is made of a bottom [quark](#)  $b$  and a strange quark  $s$ . This particle is very unstable and decays in about a picosecond (a millionth of a millionth of a second) into lighter particles.

Decays into two muons are predicted by the theory, the [Standard Model of particle physics](#), that states it should occur only about 3 times in a billionth of decays. In scientific notation, we write  $(3.54 \pm 0.30) \times 10^{-9}$  where the value of 0.30 represents the error margin on this theoretical calculation. Now, the LHCb collaboration proudly announced that they observed it at a rate of  $(3.2^{+1.5}_{-1.2}) \times 10^{-9}$ , a value very close to the theoretically predicted value, at least within the experimental error.



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## The mystery remains on the Higgs boson

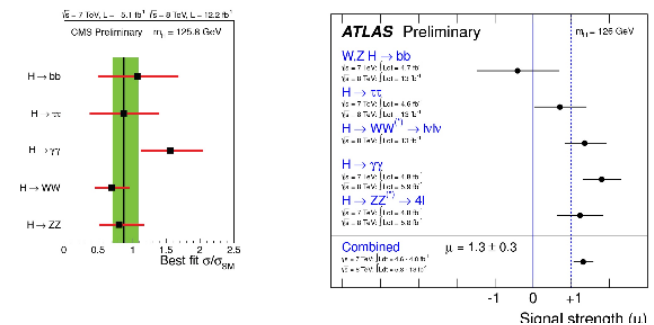
Ever since the discovery of what might be the [Higgs boson last July](#), physicists from the [CMS](#) and [ATLAS](#) experiments have been trying to pinpoint its true identity. Is this the Higgs boson expected by the [Standard Model of particle physics](#) or some "Higgs-like boson" befitting a different theoretical model?

To tell the difference, we must check all its properties, like how often this boson decays into different types of particles, and determine its spin and parity, two properties of fundamental particles.

Since the new boson has a short lifetime, it breaks apart immediately after being created. There are five ways a Standard Model Higgs boson should decay that we can study at the [Large Hadron Collider](#) (LHC): breaking into two photons, two W or two Z bosons, two b quarks or two tau leptons in well defined proportions. We must check both the presence of and the rate at which each decay mode occurs.

Last summer, just after the discovery of the new boson, both experiments reported unambiguous observations in only three channels. Unfortunately, the data sample was still too small to really be able to check if the new boson could decay into a pair of b quarks or tau leptons.

With more data available, the two experiments have just shown results for all channels today at a [conference](#) held in Kyoto as shown on the two figures below.





# Next week's Hangout with CERN

- Thursday 13 June, same time 17:00 CEST
  - You've Got TALENT!

# Participants

Nico Serra, LHCb Experiment

Tom Blake, LHCb Experiment

Gilad Perez, Theorist

# Credits

Steven Goldfarb — Host

Freya Blekman — Q&A from Social Media

Kate Kahle and Achintya Rao — Production

Thank you for watching!



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