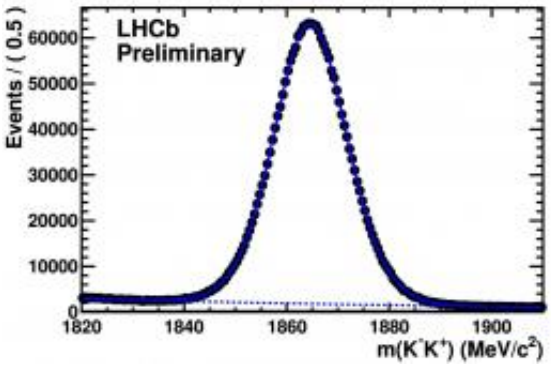
Charming surprise: First evidence for CP violation in charm decays

15 November 2011, by Antonella Del Rosso



The LHCb Collaboration has presented today at the Hadron Collider Particle Symposium in Paris possible first evidence for CP violation, the difference between behaviour of matter (particles) and antimatter (antiparticles), in charm decays.

The CP violation in charm quarks has always been thought to be extremely small. So, looking at particle decays involving matter and antimatter, the LHCb experiment has recently been surprised to observe that things might be different. Theorists are on the case.

The study of the physics of the charm quark was not in the initial plans of the LHCb experiment, whose letter "b" stands for "beauty quark". However, already one year ago, the Collaboration decided to look into a wider spectrum of processes that involve charm quarks among other things.

The LHCb trigger allows a lot of these processes to be selected, and, among them, one has recently shown interesting features. Other experiments at b-factories have already performed the same measurement but this is the first time that it has been possible to achieve such high precision, thanks to the huge amount of data provided by the very high luminosity of the LHC.

"We have observed the decay modes of the D^0, a particle made up of a charm quark plus a u antiquark", explains Pierluigi Campana, LHCb Spokesperson. "In particular, we have studied and combined the decay rates of the D^0 and its antiparticle. According to the theory of the Standard Model, we should have measured a very small value of a parameter known as *Delta* A_{CP} that is calculated using these decay rates and is related to the properties of matter and antimatter. We found that *Delta* A_{CP} is around 0.8% instead of the predicted 1‰ (or less). Although making precise evaluations in processes involving charm quarks is difficult, the Delta ACP parameter appears to be much higher than expected".

And while theorists have already started looking into the unexpected result to check possible explanations or find completely new causes, the LHCb scientists are putting all their energy into pushing their analysis even further. "So far we have analysed only about 60% of the data available from the 2011 run", says Pierluigi Campana. "We plan to complete the analysis but also to perform independent checks using different approaches and strategies".

The LHCb Collaboration and the theorists held a joint meeting at CERN on 10 and 11 November to discuss the impact of LHCb results on the current theories and how we should now look at the properties of the charm quark. The improved measurement and the independent checks planned by the Collaboration will certainly contribute to clarifying the situation. The new results should be available by early next year.

More information:
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