EPS YEPP Prize

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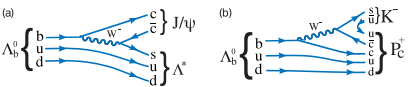
Preface

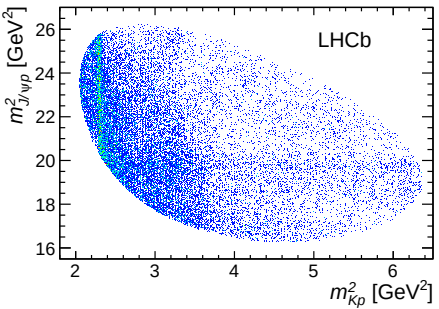
- Bulk of the work done with LHCb data, and with the support of the collaboration.
  - It goes without saying that it wouldn't have been possible without them.
- I am extremely grateful to them for making this possible!

Pentaquarks

- "Conventional" hadrons made out of three quarks (baryons) or a quark and an anti-quark (mesons).
  - Other combinations mentioned as possible in original quark model papers, now referred to as "exotic" hadrons

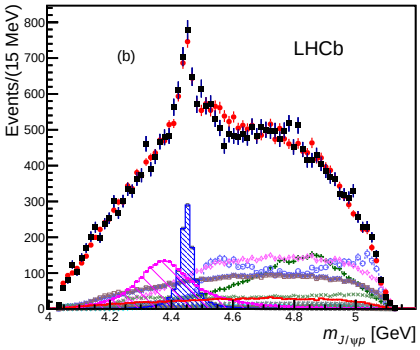
- Long sought after, with several false alarms.
- Finally: observation of pentaquark candidates in decays of $\Lambda_b^0 \to J/\psi p K$ decays.

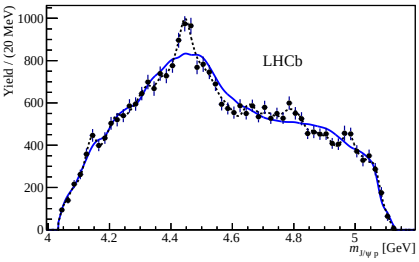




Observation of pentaquarks

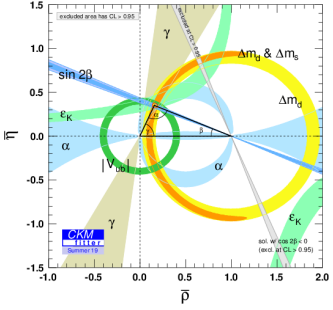
- Two candidates observed in six-dimensional amplitude analysis.
- Inability for conventional resonances to describe data demonstrated using studies of Legendre moments of angular distribution.

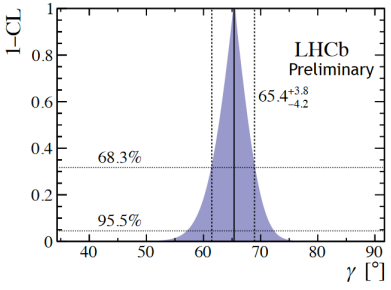




Measurements of CKM angle γ

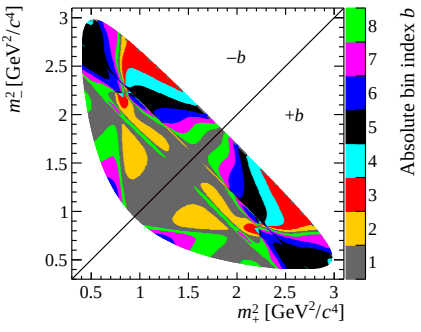
- Testing Standard Model description of CP violation with precision measurements of CKM angle γ.
- Combination of LHCb measurements yields $\gamma = (65.4^{+3.8}_{-4.2})^\circ$
- Dominates world average, so far consistent with indirect determinations
  - UT Fit: $(65.8 \pm 2.1)^\circ$
  - CKMFitter: $(65.55^{+0.90}_{-2.65})^\circ$

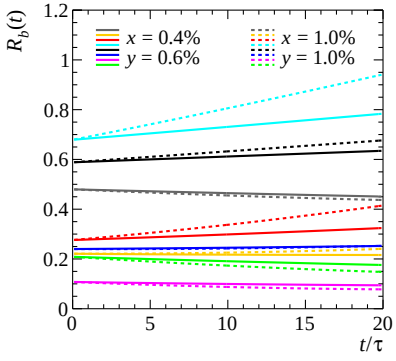




Mixing and CP violation in charm

- Development of new methods for analysing LHCb's massive but experimentally challenging samples of "multi-body" charm decays.

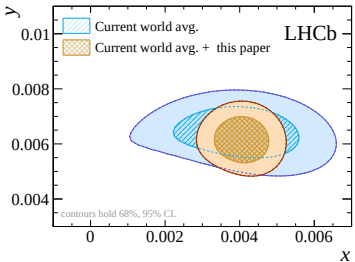


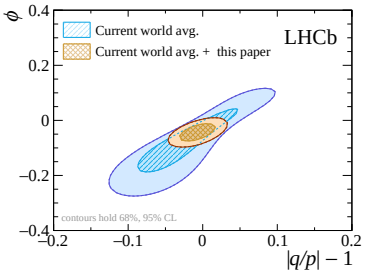


- Application to Run 1 $D \to K^0_S \pi^+ \pi^-$ data lead to world's most precise measurement of mass difference of neutral charm meson eigenstates x

Mixing and CP violation in charm

- Latest news with Run II data: First observation of mass difference x and dramatic improvements on CP violation parameters.





Summary

- I have been fortunate to have performed many exciting analyses:
  - Observation of long searched for pentaquark candidates
  - Significant improvements in precision of mixing and CP violation parameters in beauty and charm decays.
- Thanks again to all of LHCb!
- Special thanks to everyone at Syracuse, Oxford, and CERN who has provided invaluable help to me along the way.