Status of a search for the Pc(4450) baryon with HERA data (pentaquark state discovered by LHCb)

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- Last summer the LHCb collaboration reported about pentaquark-charmonium states, seen in Λb0 → J/ψpK- decays

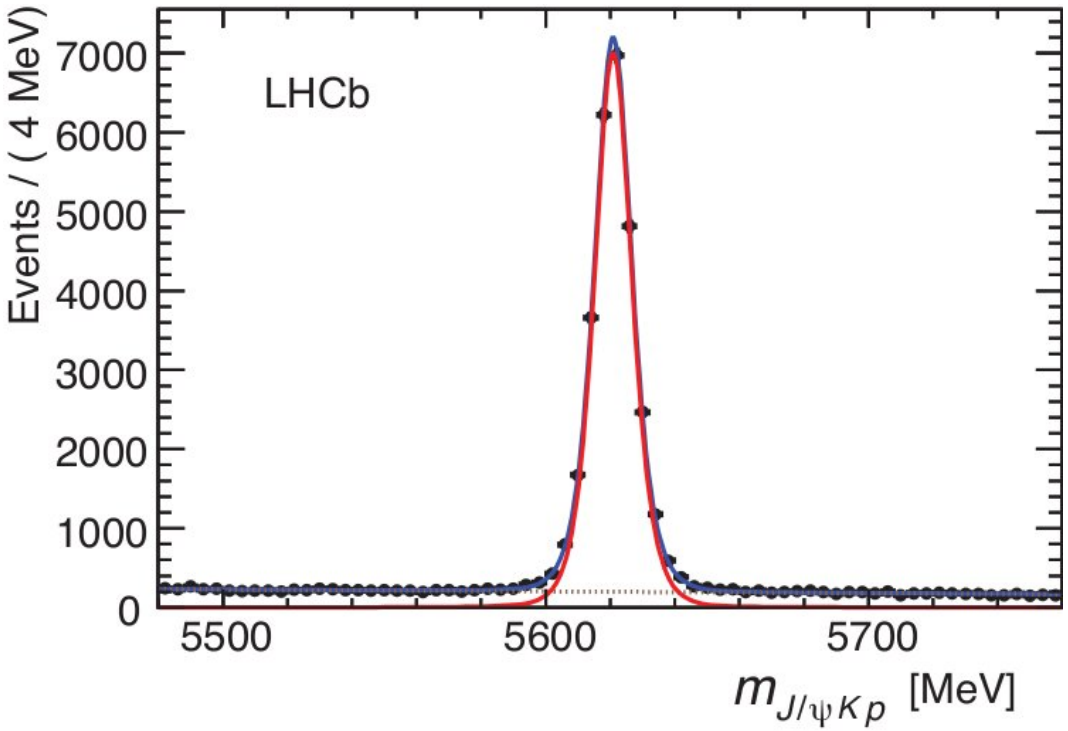
m(Pc+(4450)) = 4449.8±1.7±2.5 MeV, Γ = 39±5±19 MeV
m(Pc+(4380)) = 4380±8±29 MeV, Γ = 205±18±86 MeV

a minimal quark content $c\bar{c}uud$

- Do we able to see Pc(4450) with the ZEUS data?

We'll repeat several plots from the LHCb paper
http://arxiv.org/abs/1507.03414

LHCb: Λ_b^0 in J/Ψ K- p mode

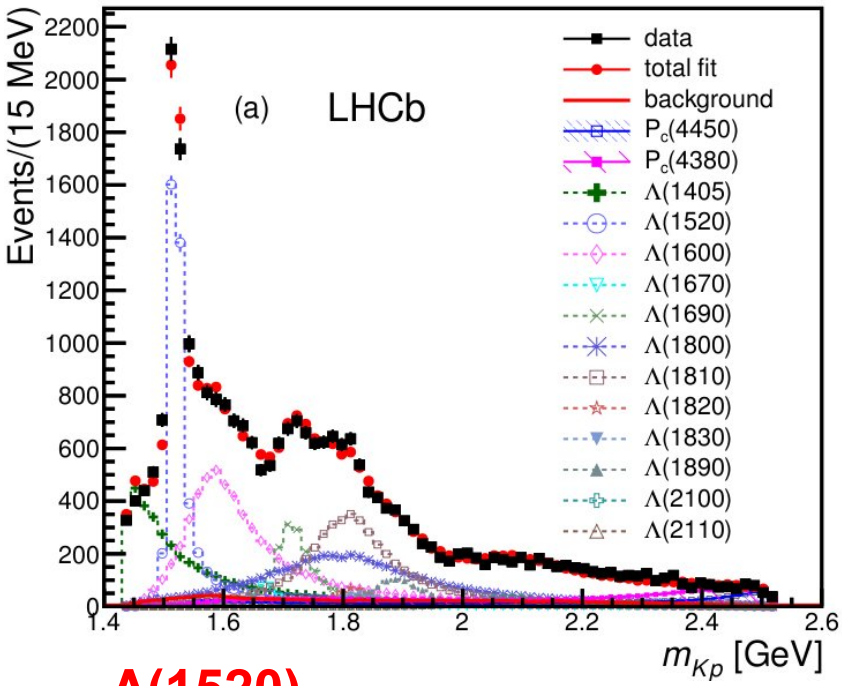


Λ_b^0 window:

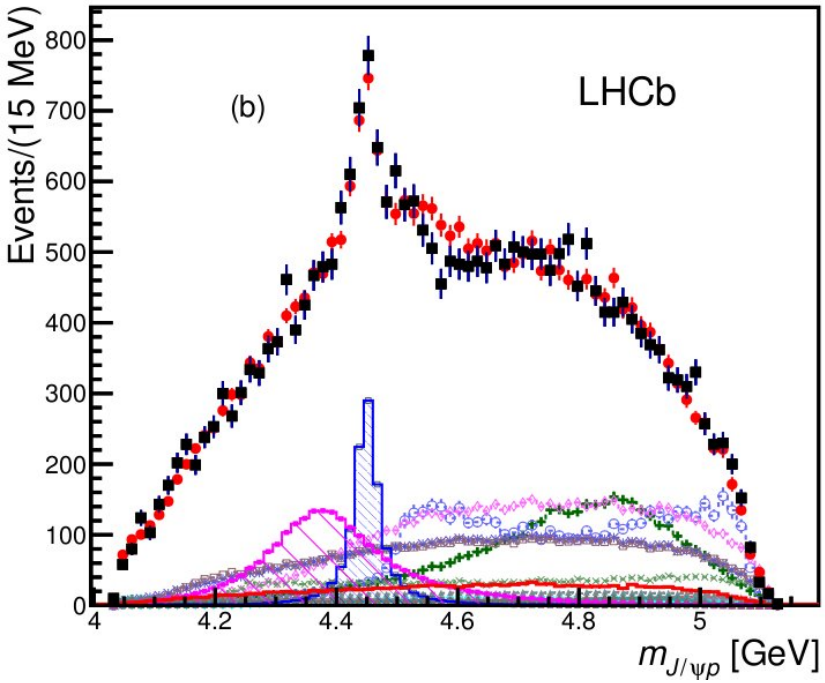
Λb mass ± 15 MeV

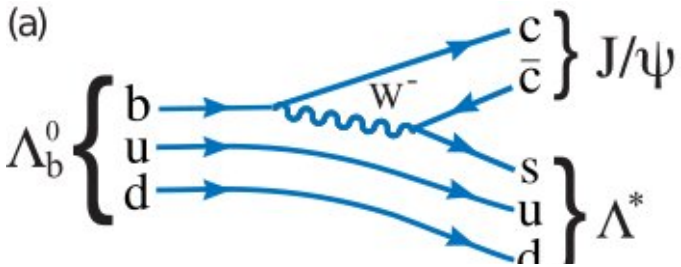
$2 \times 10^6\ \bar{\Lambda}_b^0 \to J/\psi\, \bar{K}^- \bar{p}$ events with $J/\psi \to \mu^+\mu^-$

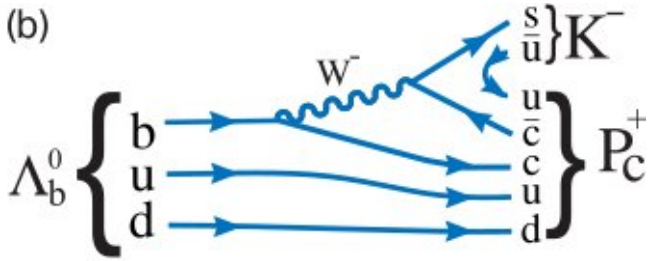
LHCb: (Kp) and (J/Ψp) mass spectra within the Λ_b^0 window



Λ(1520)

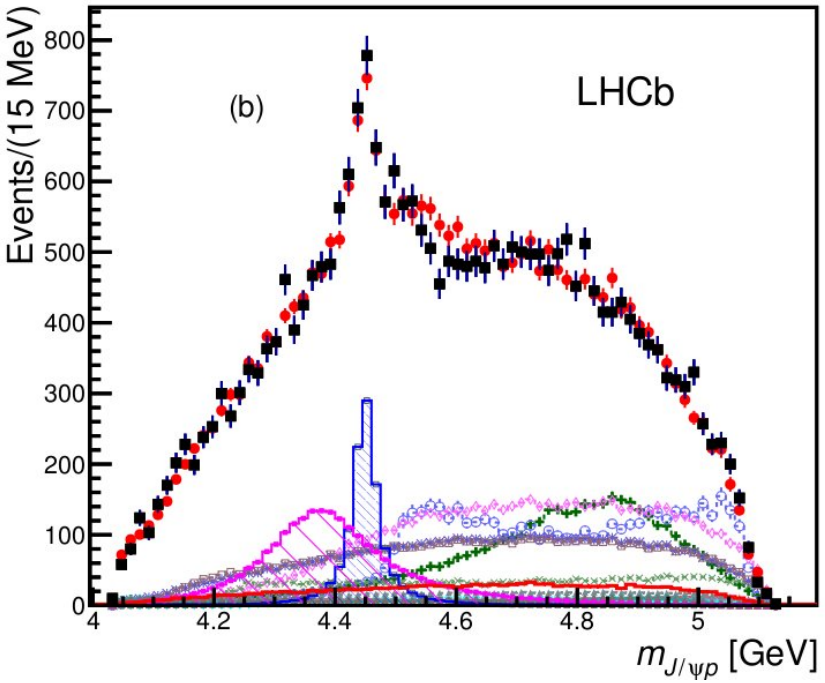






Feynman diagrams for (a) $\Lambda_b^0 \to J/\psi \Lambda^*$ and (b) $\Lambda_b^0 \to P_c^+ K^-$ decay.

LHCb: Two states with hidden charm



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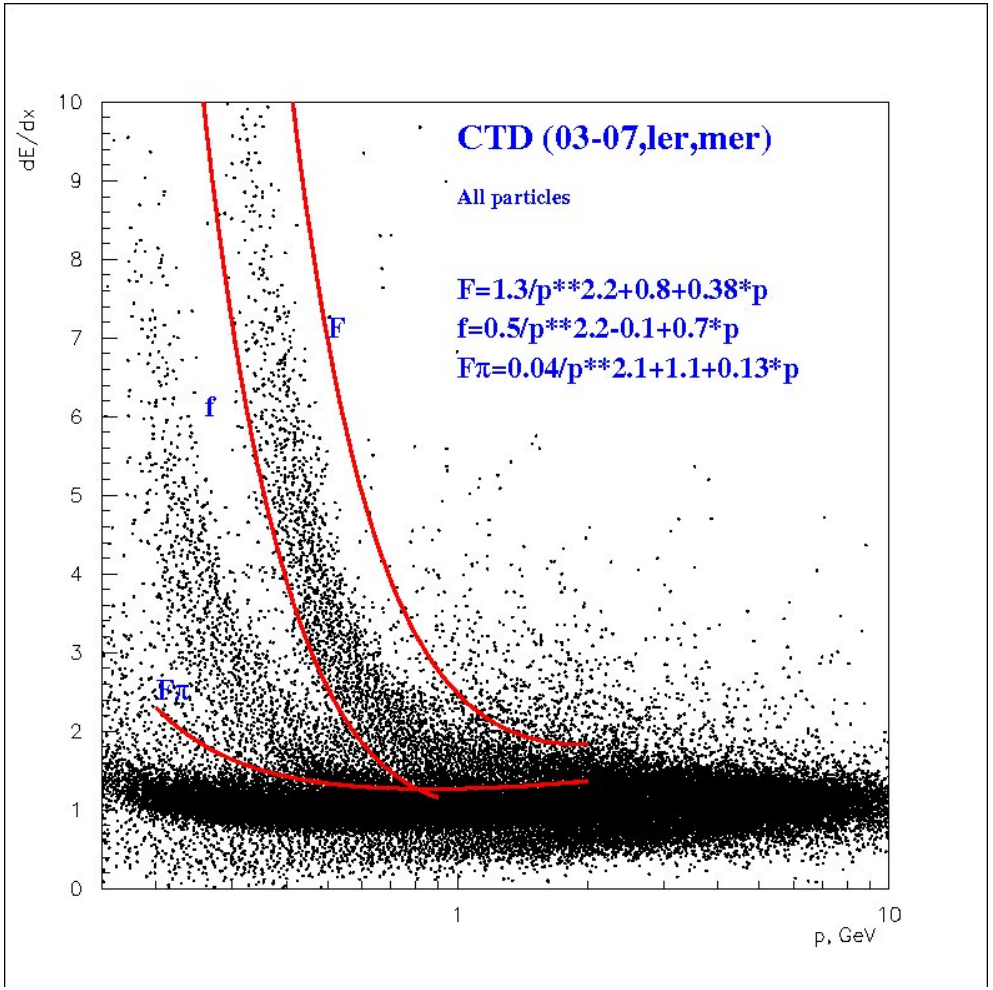
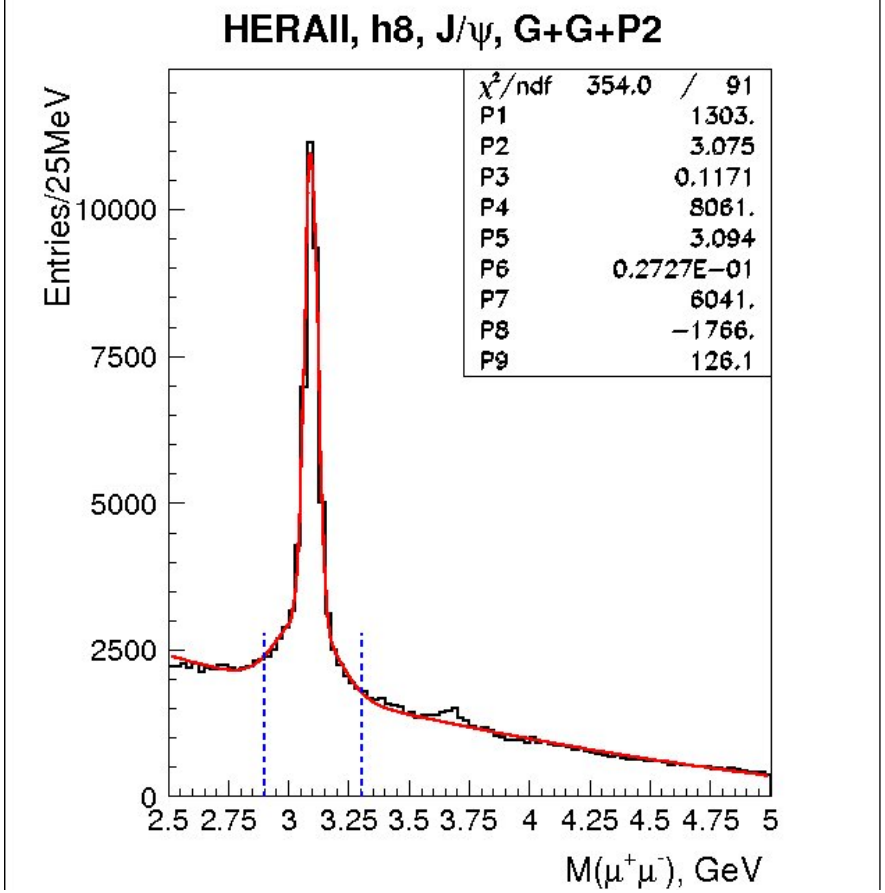
ZEUS CN (paw) HERA2 data: 03-07, ler, mer

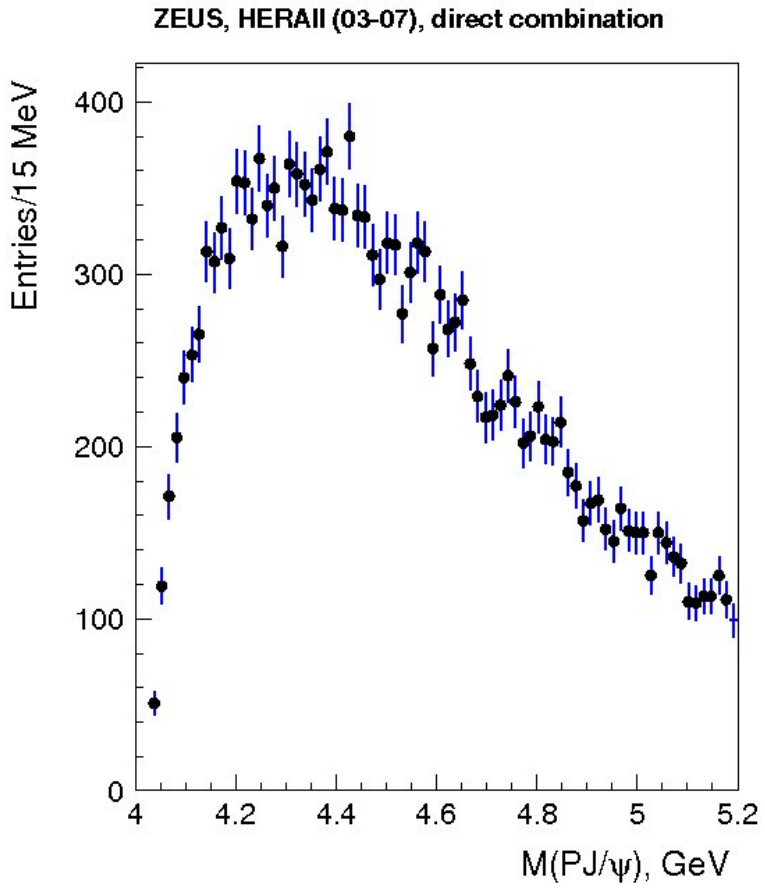
Very modest selection cuts:

- all events (PHP+DIS+ ...)
- Muons from GMUON, Nmu >= 2
- Muqual >= 2,Mupmip >= 0.4 (MV CAL mip probability)
- Muhac2 = 0 or Muhac2 > 3 (cal energy deposit in HAC)
- cos(theta) > -0.9945219
- trk_ntracks >= 3
- Trk_pca not used (1.E-44 problem)
- CTD, CTD + MVD
  pt > 0.15 GeV/c
  Trk_nbr >1 and Trk_nbz >1
  trk_layouter >= 3 and
  trk_naxial >= 15 and
  trk_ndof >= 40
- Cooling pipes
- Super-crack cuts
- Chivtx < 5, Wp > 0.9



First stage : J/Ψ, Ψ' and (p J/Ψ) mass (no K- and Λ_b^0)





Fitted by two Gaussian and a polynomial of 2nd degree. No attempt was made to reduce background

J/Ψ from the window (2.9-3.3) GeV are combined with p±.
No Pc(4450) signal

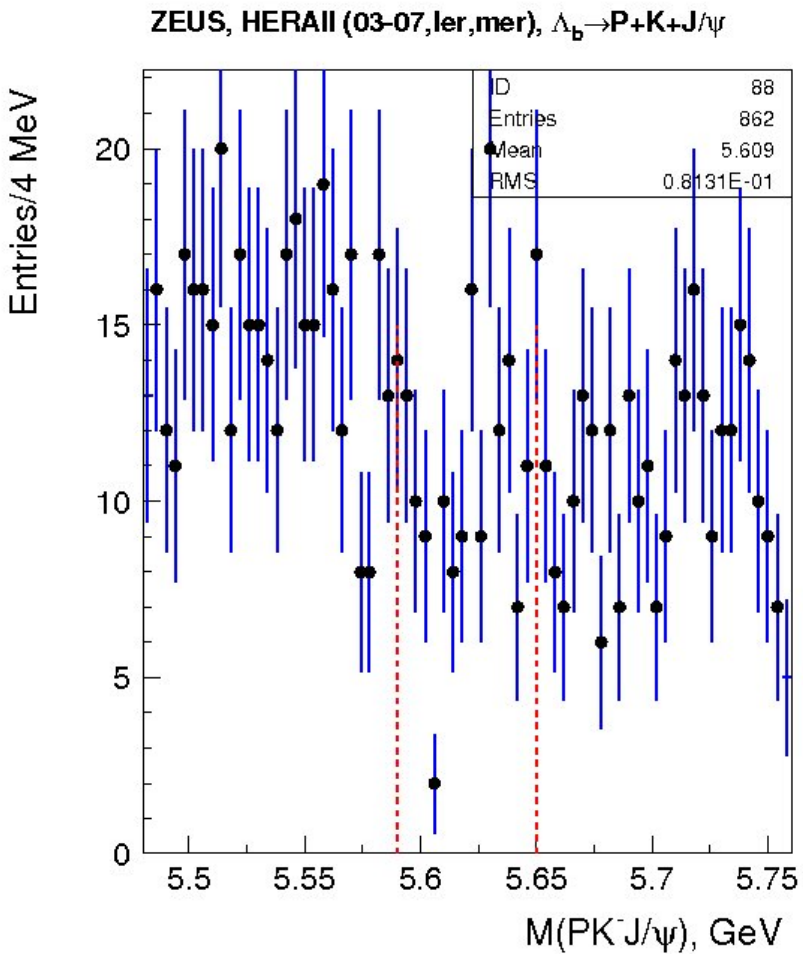
Mass of (p J/Ψ K-)

Hard to see Λb.

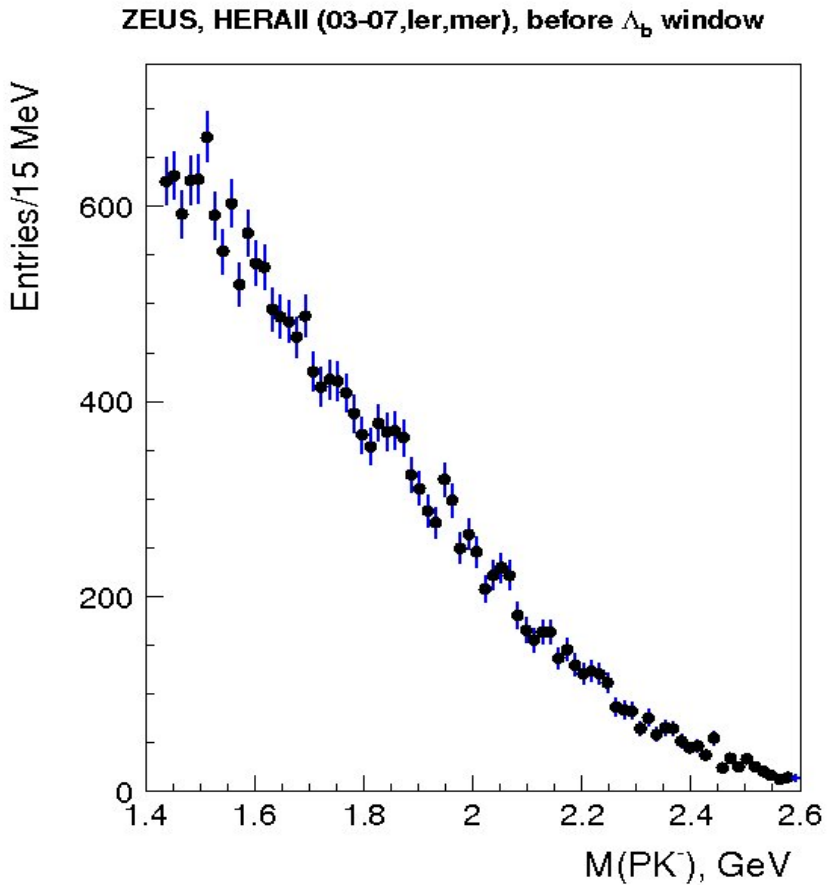
Mass window :
5.59-5.65 GeV

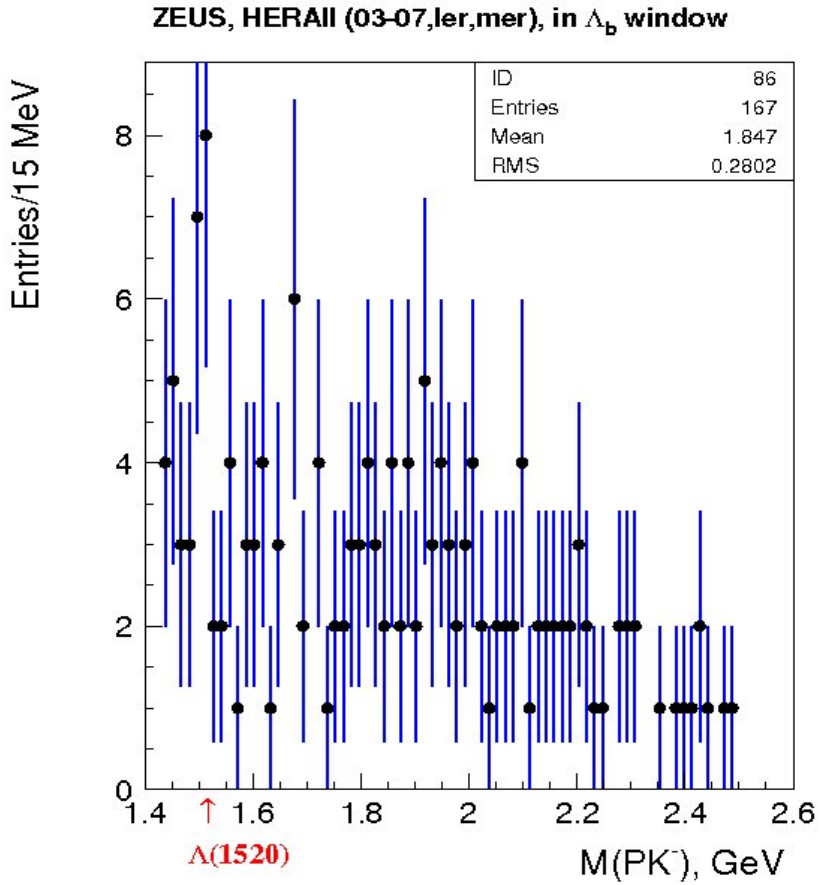
(Λb mass ± 30 MeV)

We do not used impact parameter, δ.
(defined as the distance of closest approach of the muon with respect to the beam position.)



Second stage: Inclusion of K± and Λ_b^0

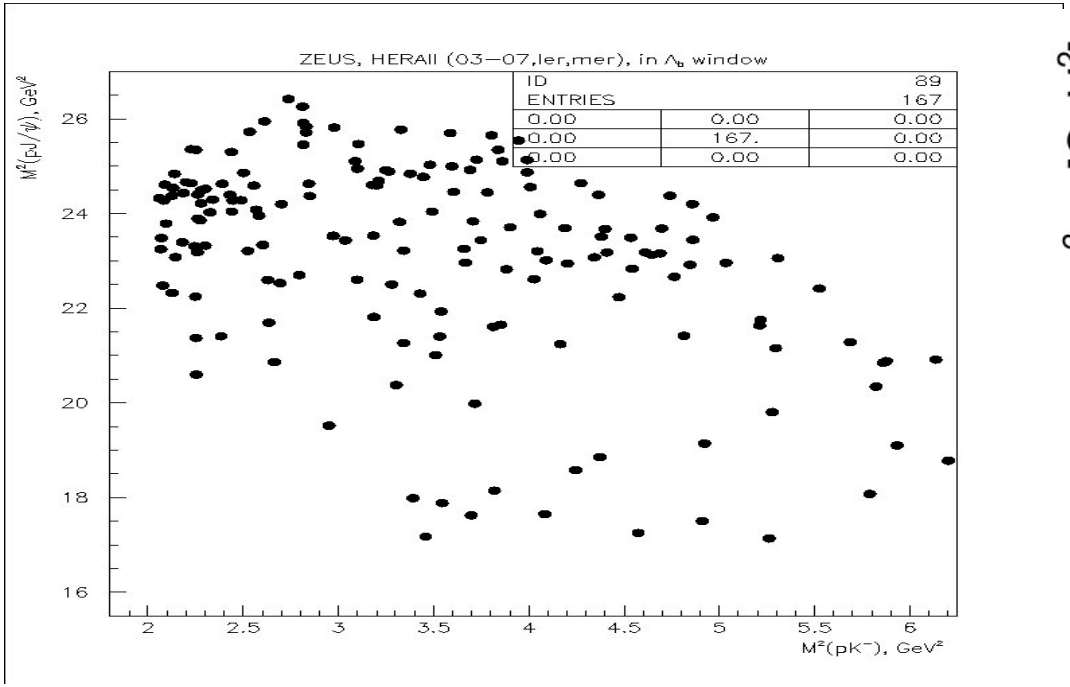


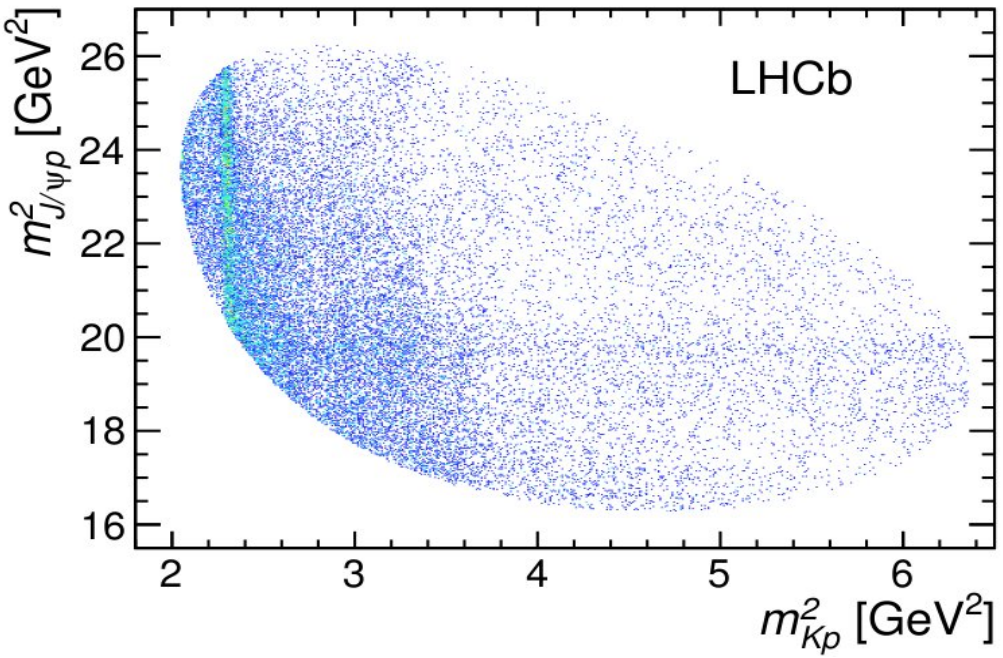


Before the Λ_b^0 window cut.
No indication of Λ(1520)

Within the Λ_b^0 window

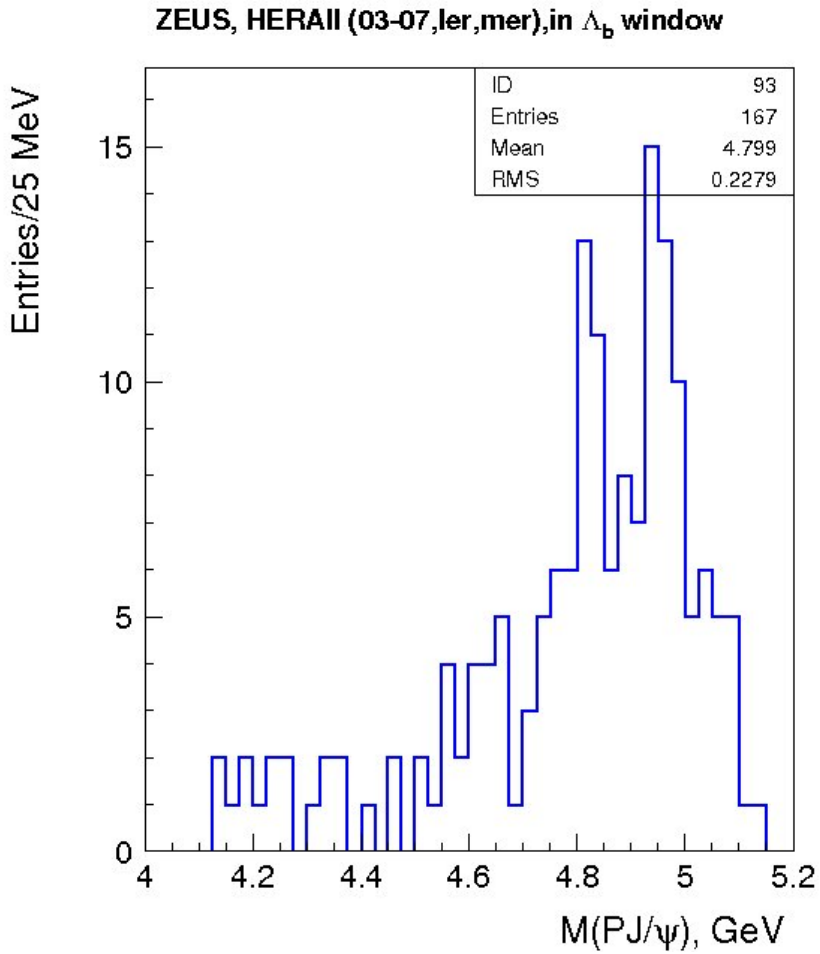
More comparison with LHCb: the Dalitz plot

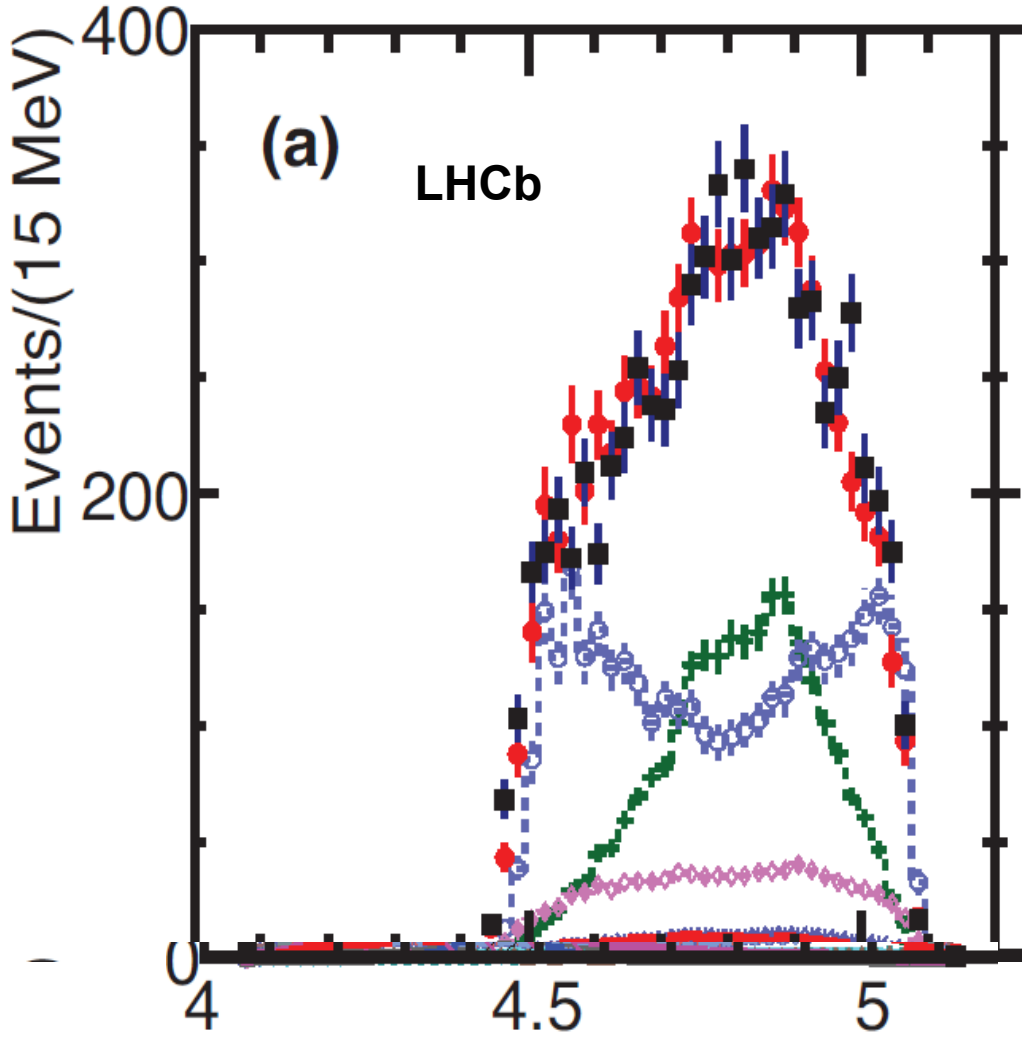




Invariant mass squared of K^-p versus $J/\psi p$ for candidates within ± 15 MeV of the Λ_b^0

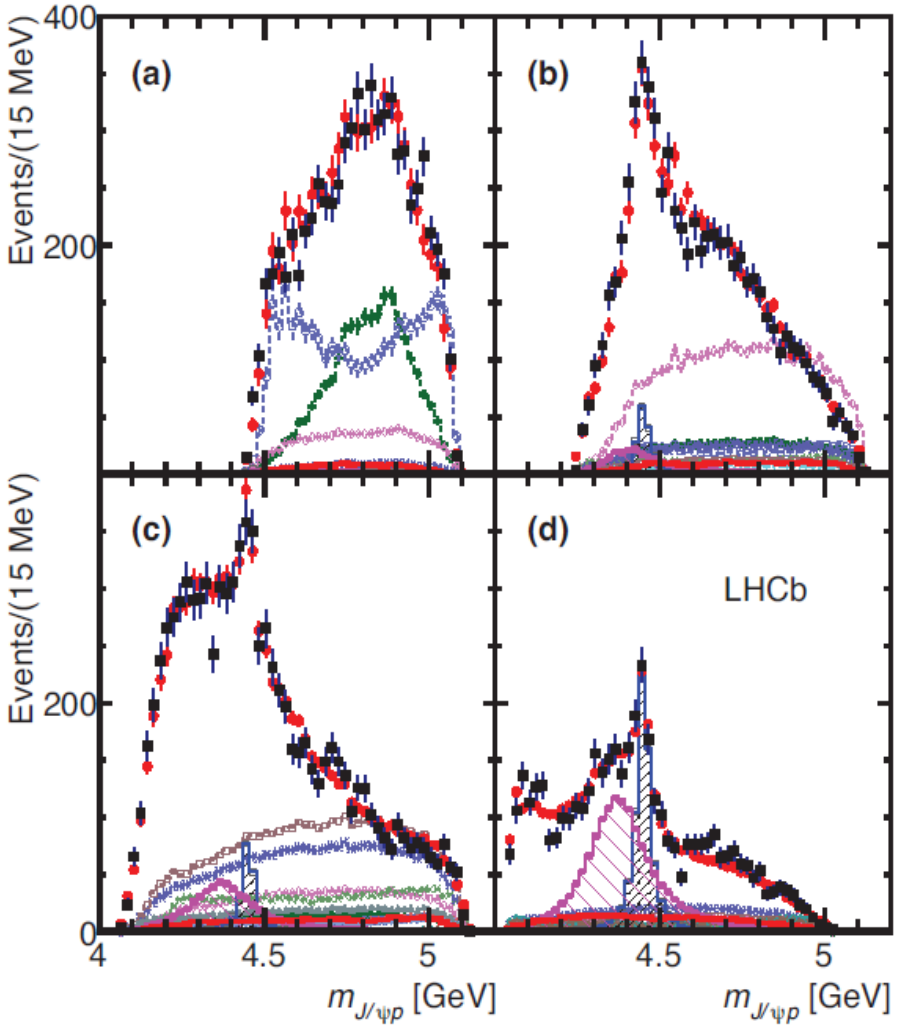
(J/Ψp) mass spectra within the Λ_b^0 window





Quite different from LHCb.

However there is such interesting plot ..



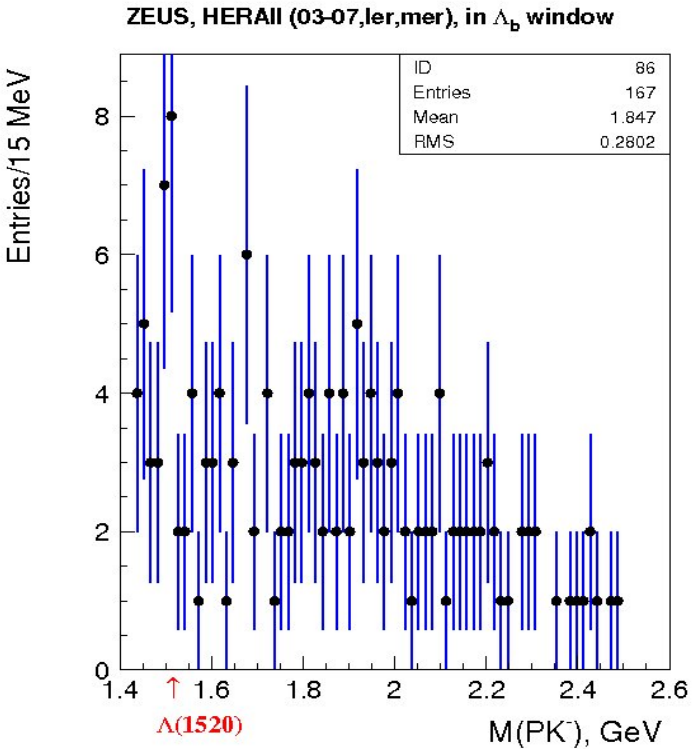


Figure 8: $m_{J/\psi p}$ in various intervals of m_{Kp} for the fit with two P_c^+ states: (a) $m_{Kp} < 1.55$ GeV, (b) $1.55 < m_{Kp} < 1.70$ GeV, (c) $1.70 < m_{Kp} < 2.00$ GeV, and (d) $m_{Kp} > 2.00$ GeV. The data are shown as (black) squares with error bars, while the (red) circles show the results of the fit.

Conclusions

- We do not see so far any trace of Pc baryon in the ZEUS HERA2 data

- We plan to refine the analysis and include the HERA1 data