

The 2007 Europhysics Conference on High Energy Physics

Search for Baryonic Resonances



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On behalf of the H1 Collaboration



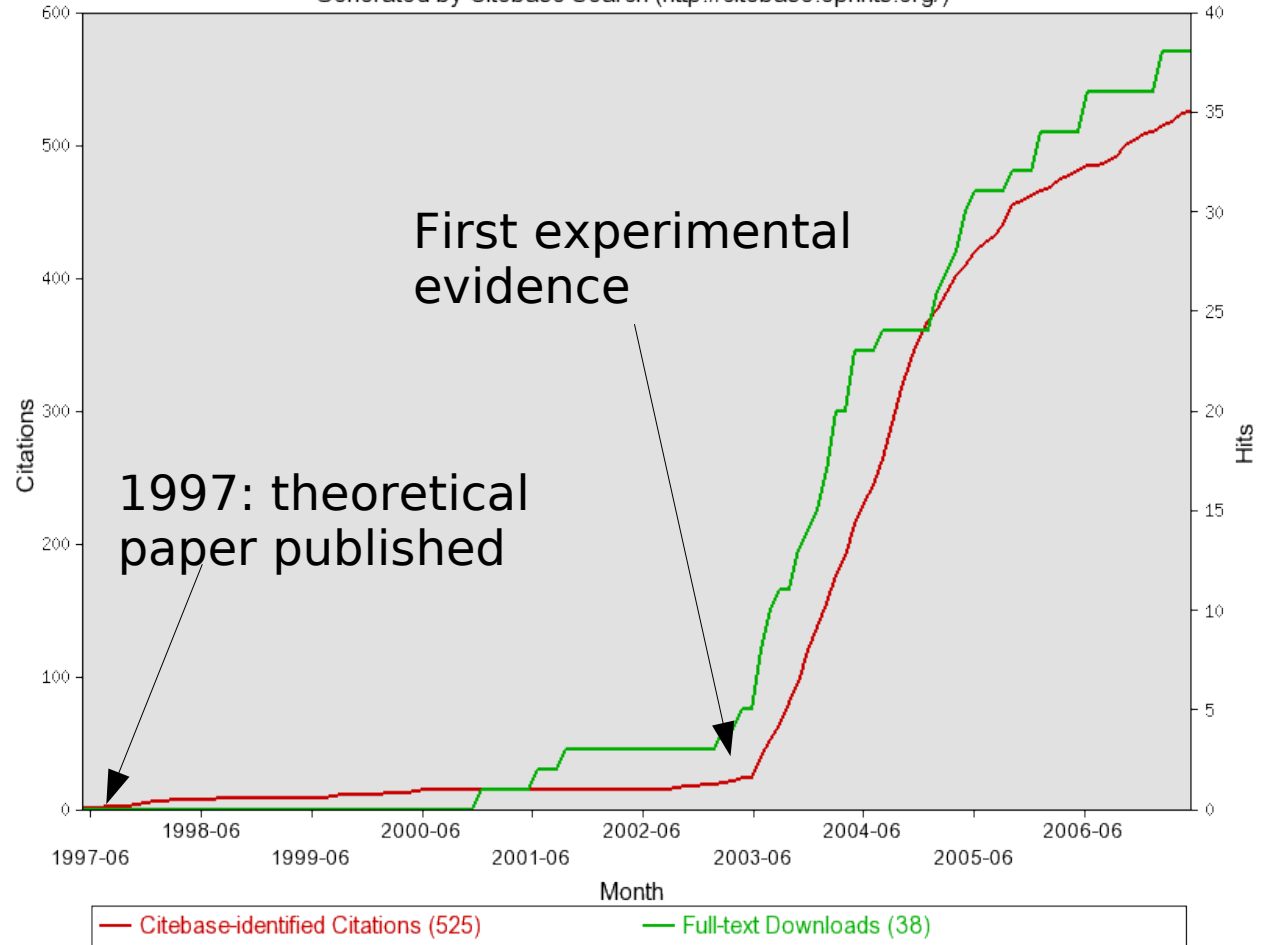
- Introduction
- Search for the strange pentaquark
- Search for the double strange pentaquark
- Summary

Introduction I

Theoretical paper from 1997:
prediction for a 5-quark state
at a certain mass and with a
narrow width.
 $uud d \bar{s}$ -quark state with
possible decays to $K^+ n$
(known strangeness) and $K^0 p$.

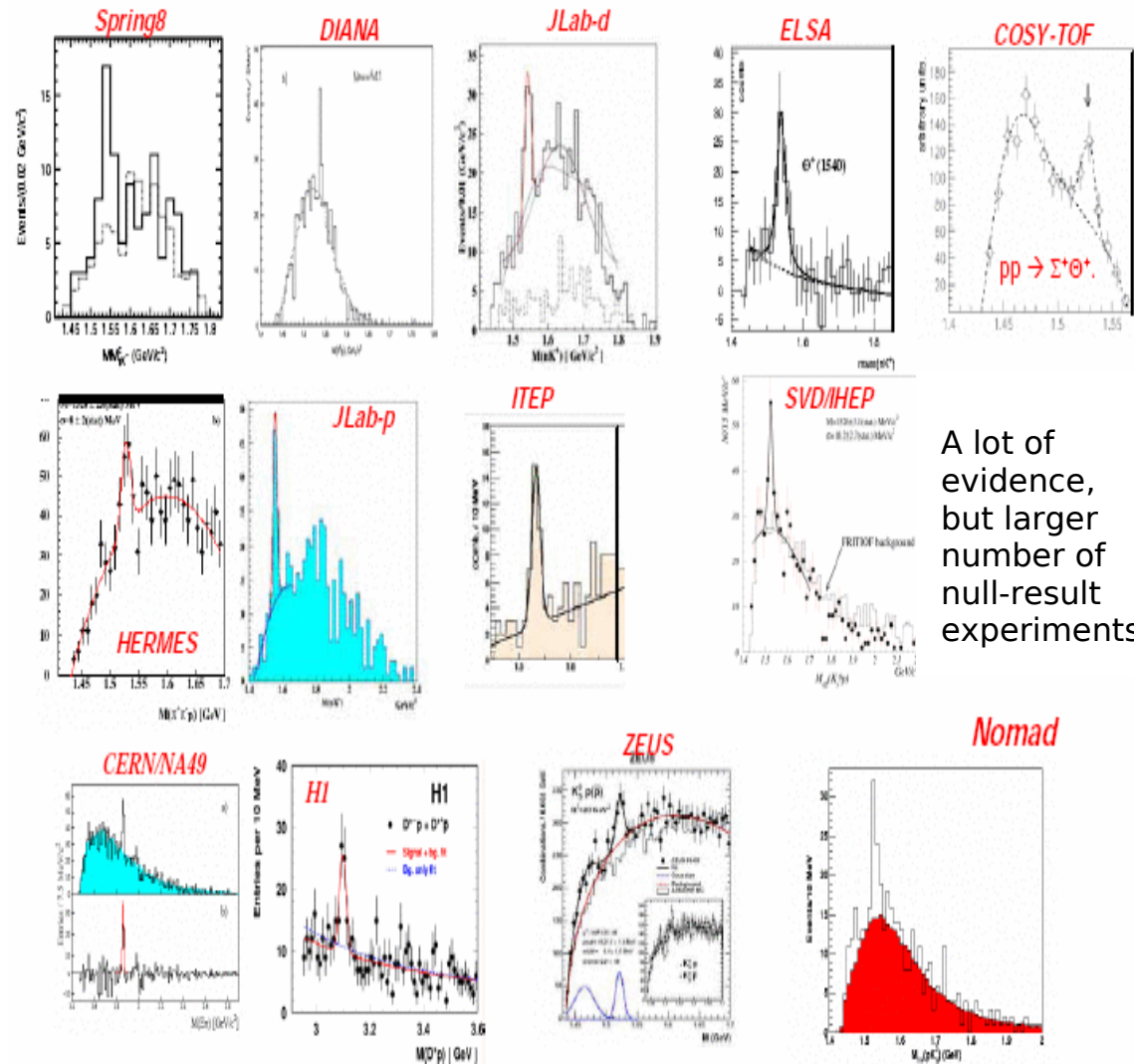
The experimental evidence in
2003 for such a state triggers a
lot of experimental and
theoretical activities.

Diakonov, D. (1997-03-20) "Exotic Anti-Decuplet of Baryons: Prediction from Chiral Solitons"
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Introduction II

- A lot of evidence, but no discovery, since the statistics is low.
- Several similar experiments gave null results.
- High statistics experiments from e^+e^- and hadron accelerators gave null results.



A lot of evidence, but larger number of null-result experiments

The question of existence of pentaquark state is still open.

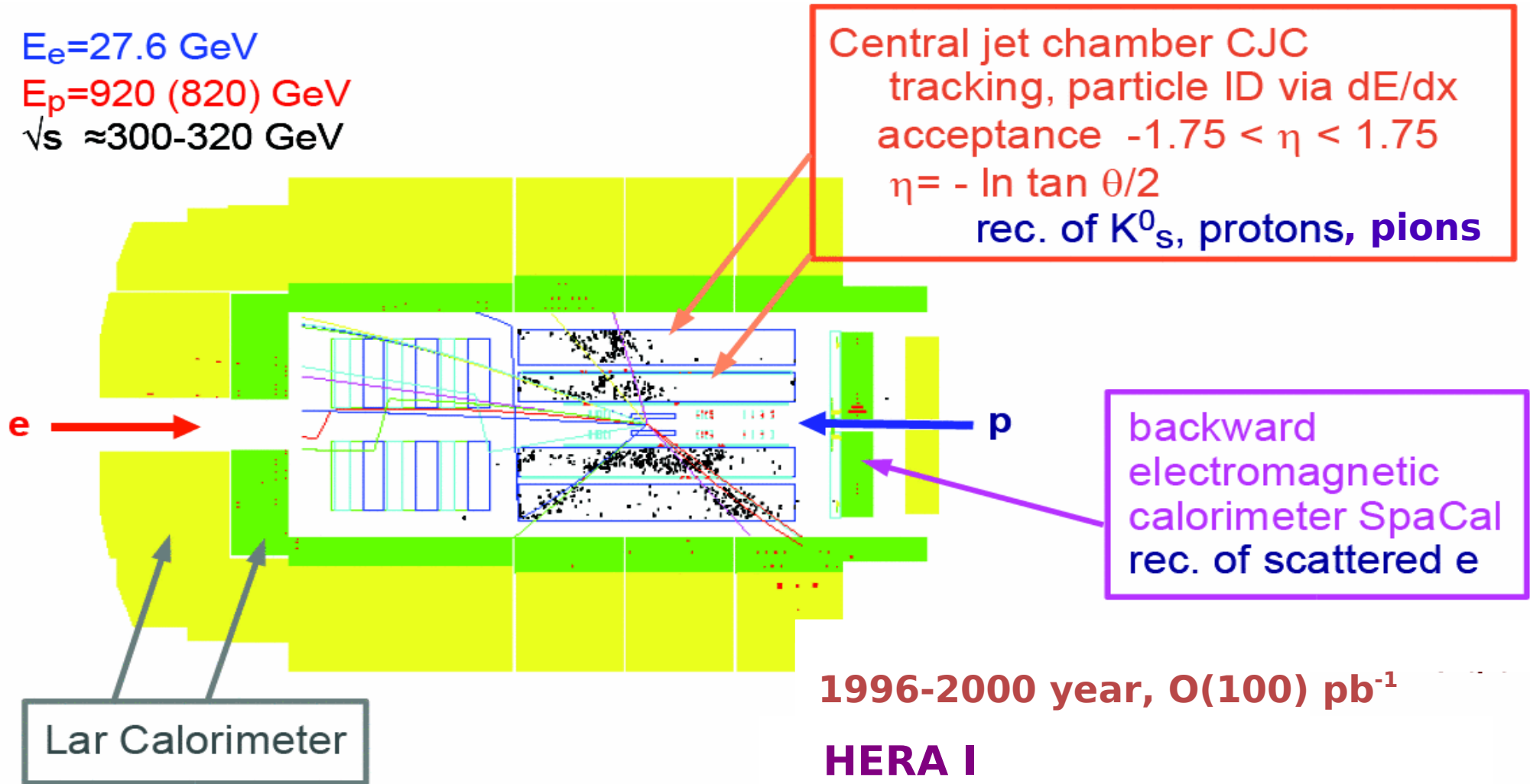


Selection of events with the H1 detector

$E_e = 27.6 \text{ GeV}$

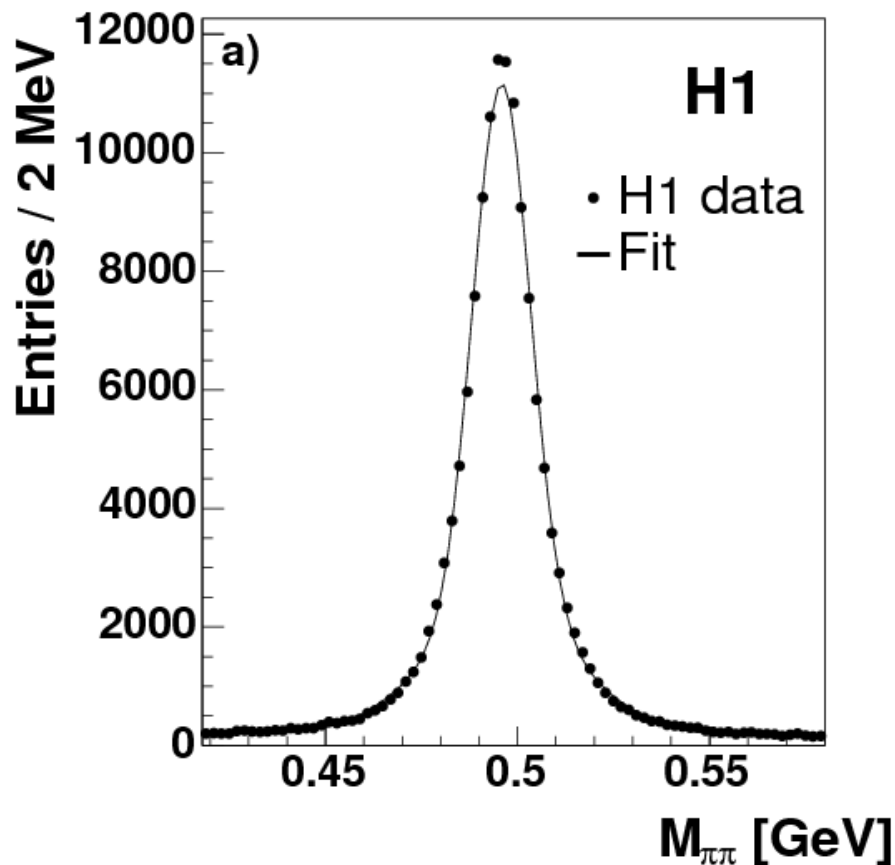
$E_p = 920 \text{ (820) GeV}$

$\sqrt{s} \approx 300\text{-}320 \text{ GeV}$

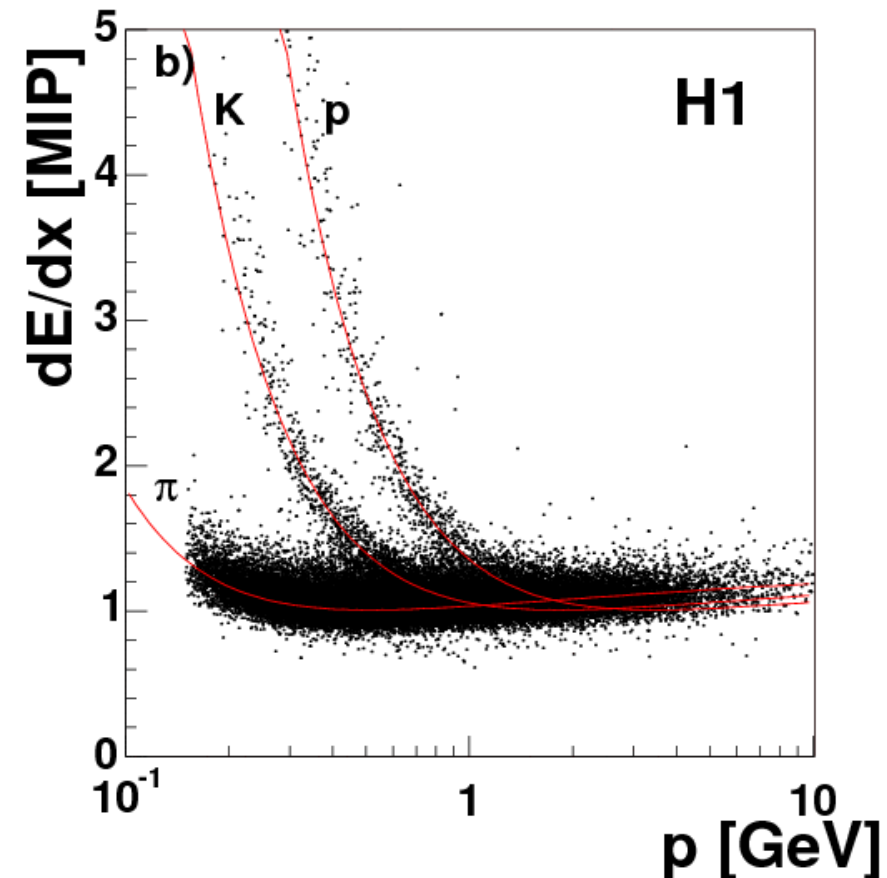


Search for the strange pentaquark: ingredients

Large and clean K_s^0 sample
(132,000 K_s^0 from the fit with
3% background)



Proton identification by dE/dx
(8% resolution). Efficiency varies
between 65% and 100%.

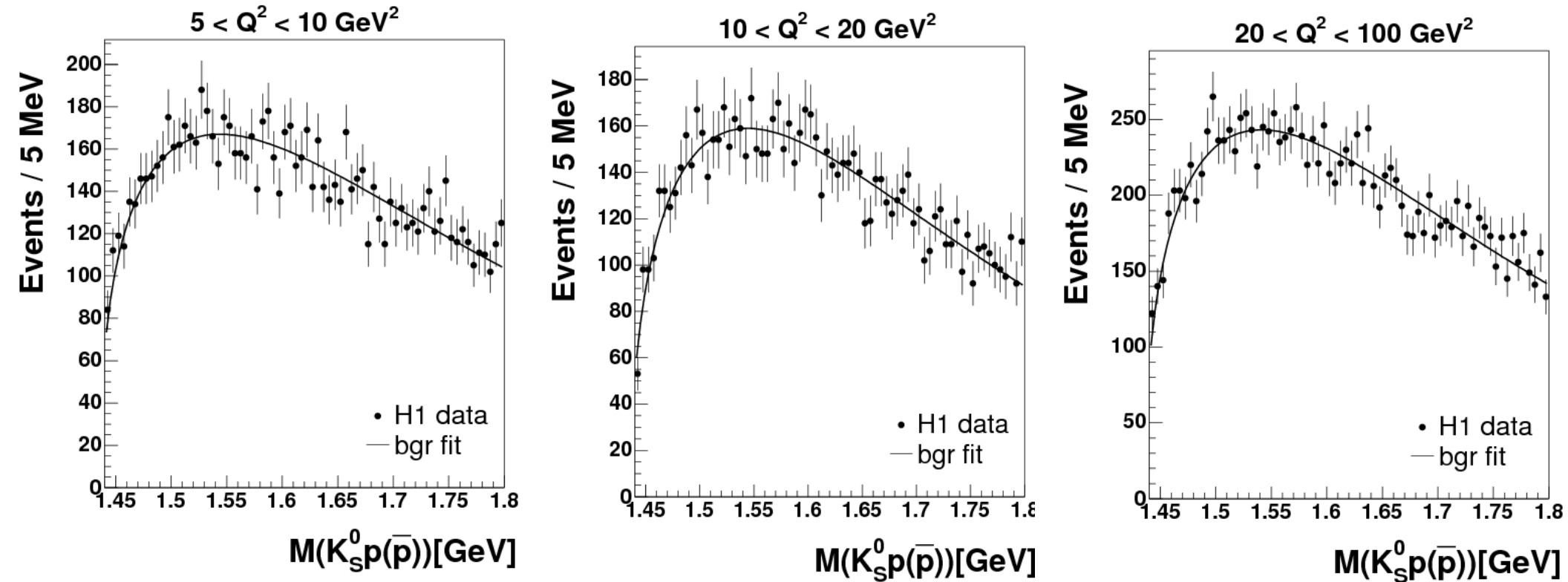


Search for the strange pentaquark:

Invariant $K_s^0 p (K_s^0 \bar{p})$ mass

$P_T(K_s^0 p) > 0.3 \text{ GeV}$, $|\eta| < 1.5$, $5 < Q^2 < 100 \text{ GeV}^2$, $0.1 < y < 0.6$

74 pb^{-1}

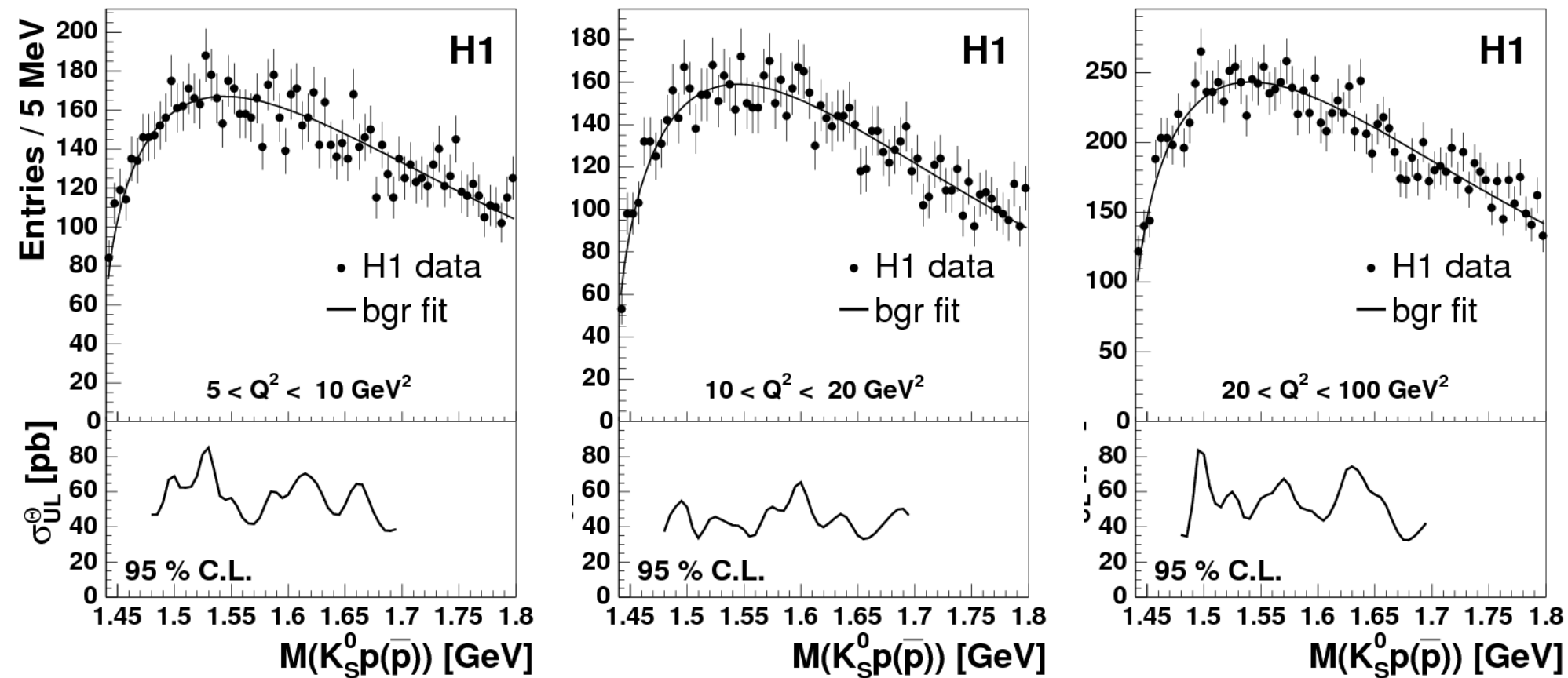


$$\text{background} = \alpha (M - M_{thr})^\beta \exp(-(M - M_{thr})\gamma), \quad M_{thr} = M_p + M_{K_s^0}$$

No significant signal is observed in any of the Q^2 bins



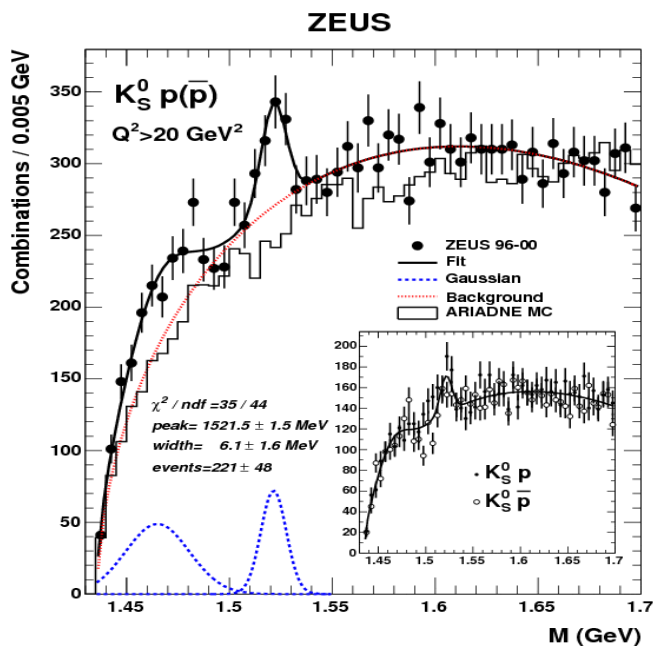
Search for the strange pentaquark: upper limit on the cross section



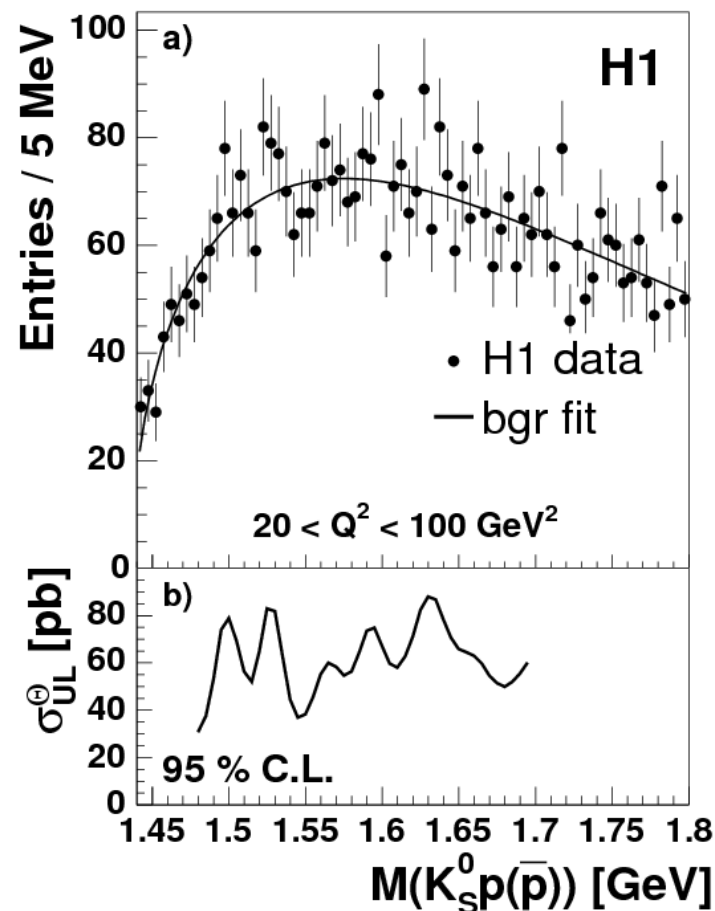
No fluctuation at the same mass in different Q^2 bins



Search for the strange pentaquark: Comparison with the ZEUS signal



H1:
 $20.0 < Q^2 < 100.0 \text{ GeV}^2$
 $0.1 < y < 0.6$
 $\sigma(M = 1.52) < 72 \text{ pb} (95 \text{ C.L.})$
 (extrapolated to ZEUS
 y-region):
 $\sigma(M = 1.52) < 100 \text{ pb} (95 \text{ C.L.})$



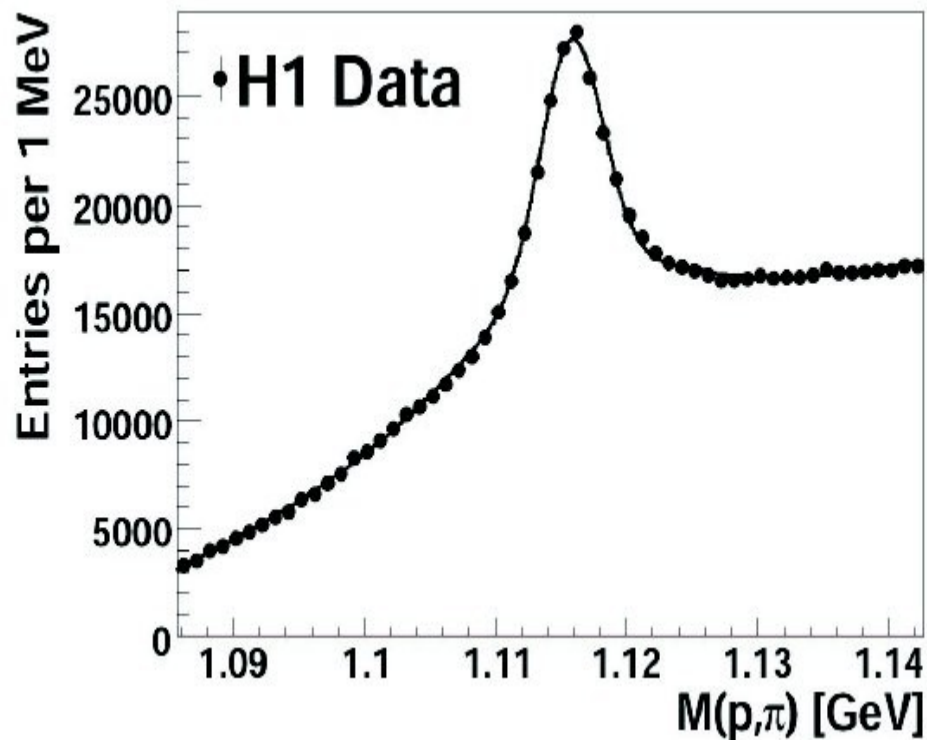
ZEUS : preliminary result (DIS 2005)

$Q^2 > 20.0 \text{ GeV}^2, 0.04 < y < 0.95$

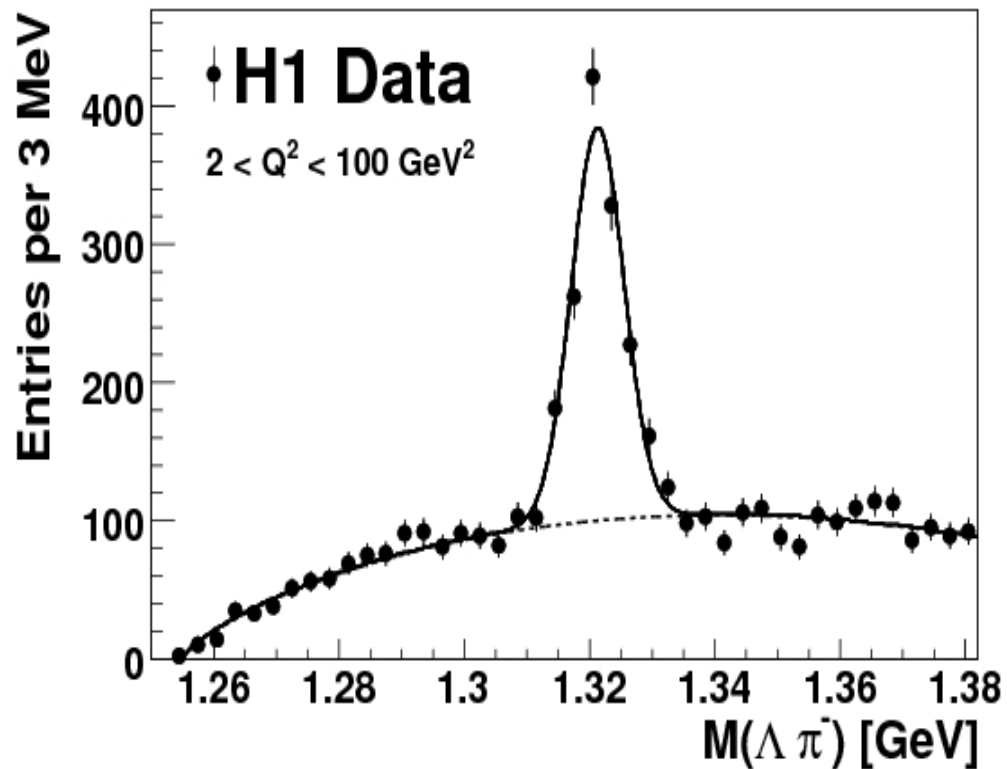
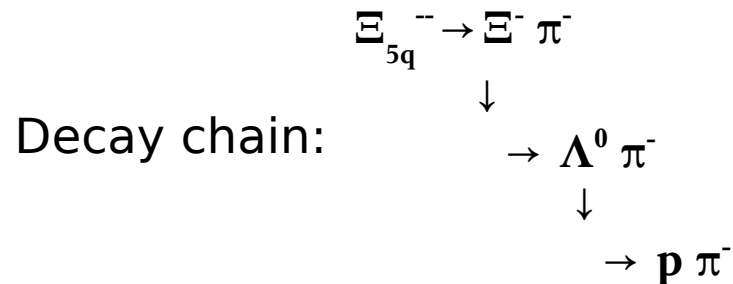
$$\sigma(e p \rightarrow e \theta X \rightarrow e K^0 p X) = 125 \pm 27 (\text{stat})_{-28}^{+38} (\text{syst}) \text{ pb}$$



Search for the double strange pentaquark: Ingredients



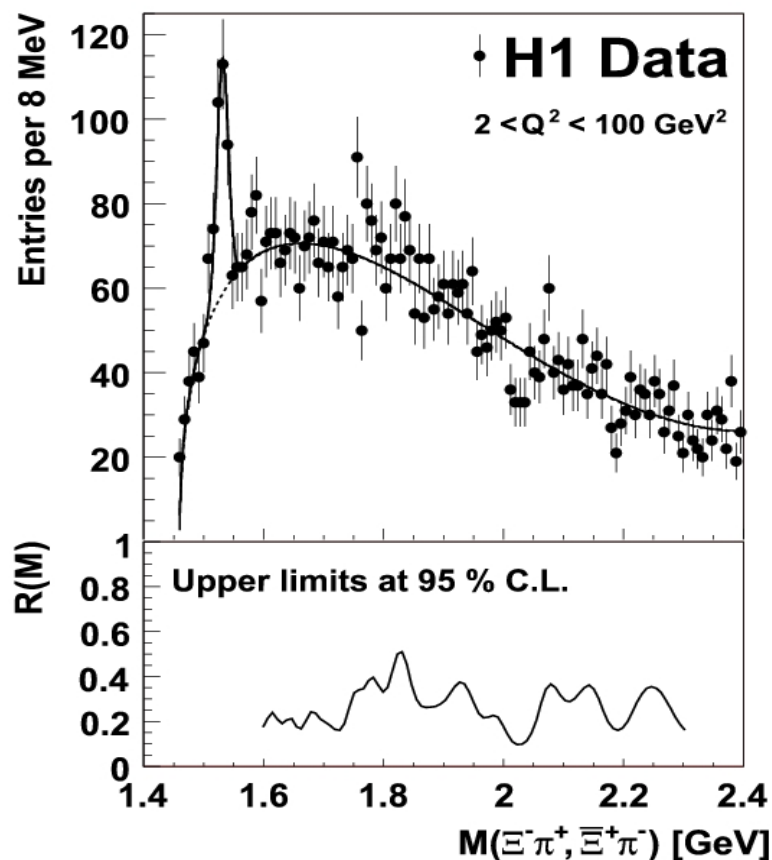
150,000 reconstructed Λ 's
1870 reconstructed Ξ 's



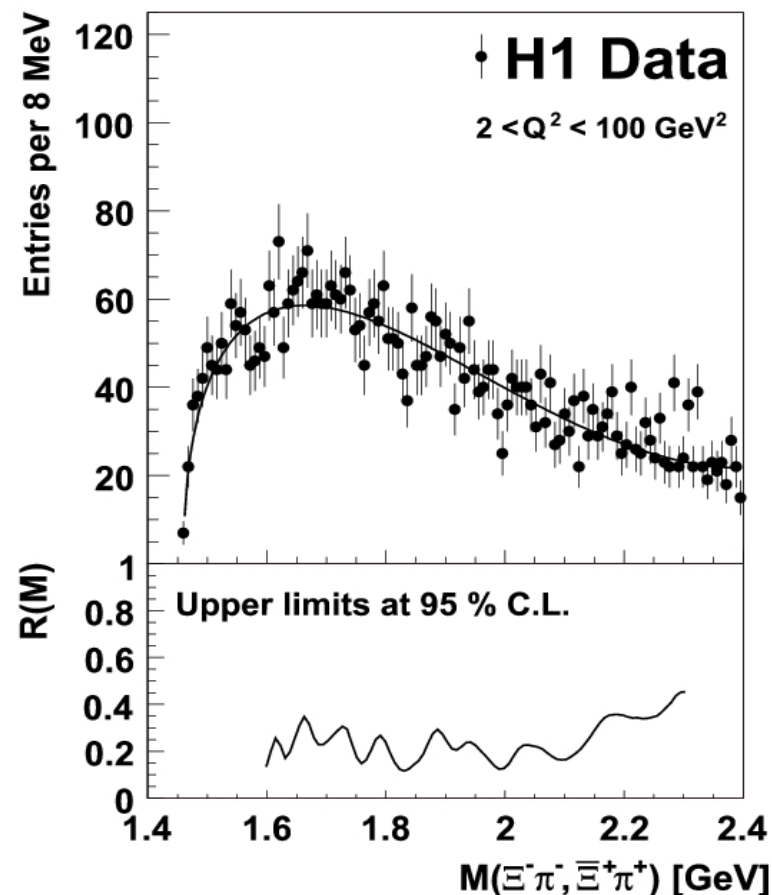
Search for the double strange pentaquark: Results

$P_T(\Xi \pi) > 1 \text{ GeV}$, $|\eta| < 1.5$, $2 < Q^2 < 100 \text{ GeV}^2$, $0.05 < y < 0.7$

101 pb^{-1}



Clear signal of $\Xi(1530)$:
 $N = 163 \pm 24(\text{stat.})$



No signal of narrow resonance
above $\Xi(1530)$

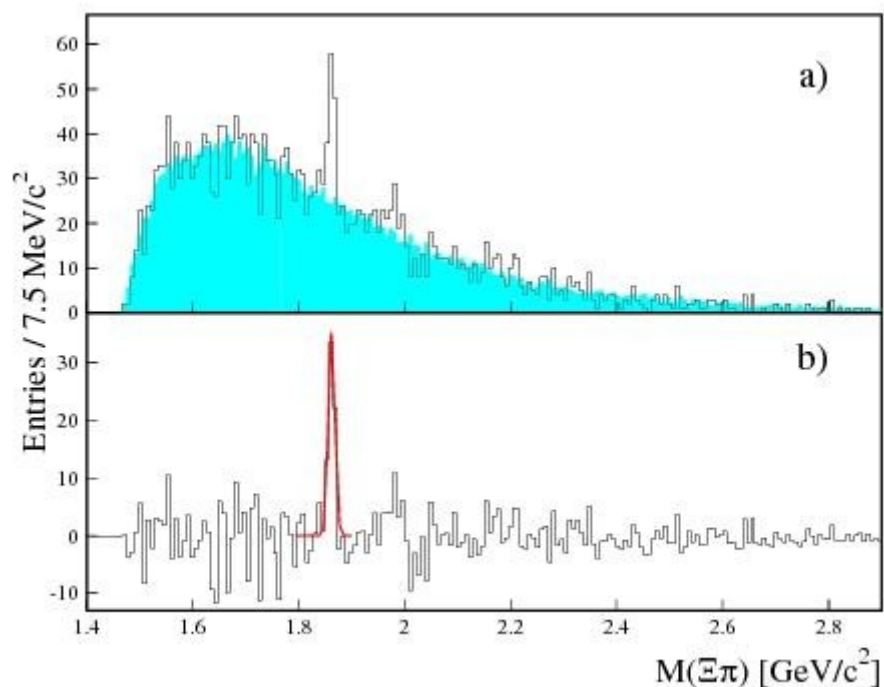


Search for the double strange pentaquark: Summary of searches

NA49 results :

$$m = 1860 \text{ MeV}$$

$$\text{width} < 18 \text{ MeV}$$



H1 results :

neutral combinations

$$0.1 < R_{\text{u.l.}} < 0.5$$

Charged combinations

$$0.12 < R_{\text{u.l.}} < 0.45$$

Similar upper limits from ZEUS









No signal :

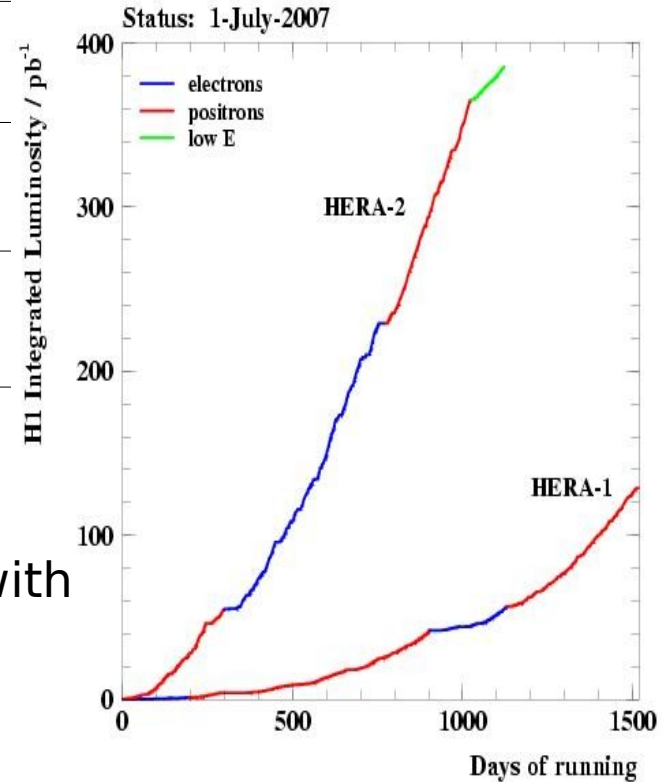
FOCUS, COMPASS, CDF....



Summary

- Complete HERA I data was analysed with the following results from H1 & ZEUS:

		
strange pentaquark ($K_s^0 p$)		
double strange pentaquark ($\Xi \pi$)		
charm pentaquark ($D^* p$)		



This controversial situation will be possible to resolve with high statistics HERA II data

