Measurements of K^0_s and Λ spectra and B-E correlations between Kaons in DIS

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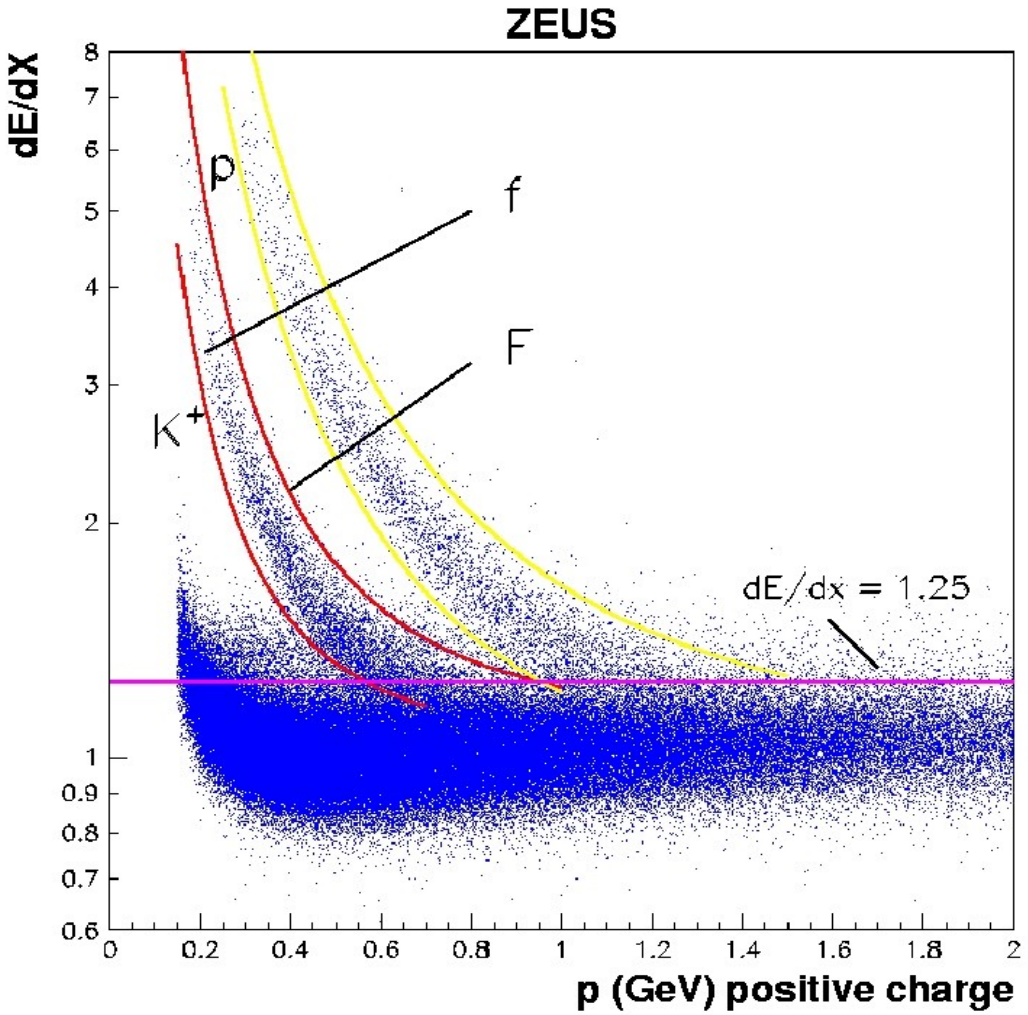
On behalf of the ZEUS Collaboration

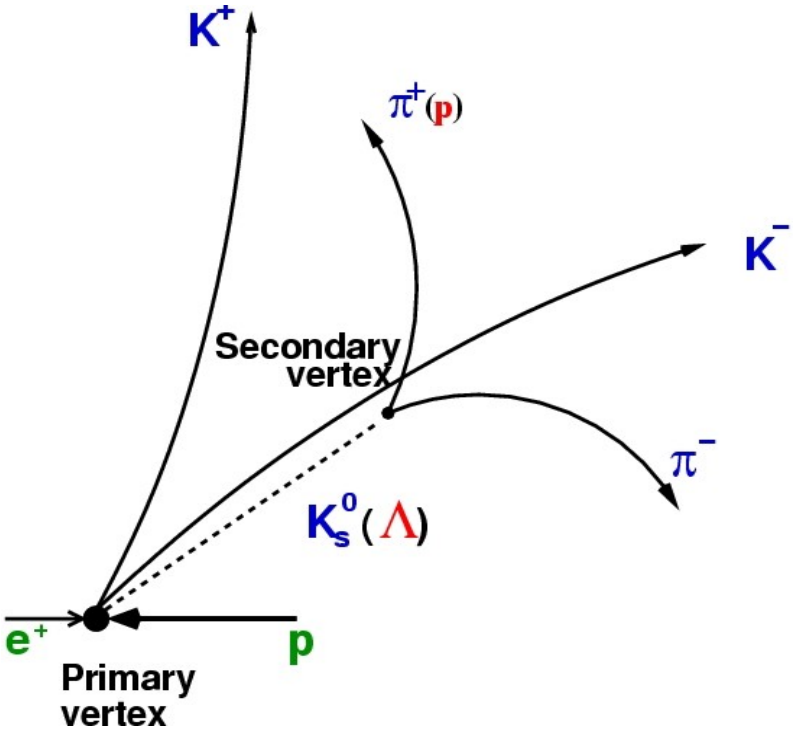
- Identification of $K^{\pm}$, K^0_s and Λ
- Differential cross-sections in $p_T^{lab}, \eta^{lab}, x_{Bj}, Q^2$
- Baryon-antibaryon asymmetry
- Baryon-to-meson ratio
- Bose-Einstein correlations between $K^{\pm}K^{\pm}$, $K^0_s K^0_s$

K and Λ identification

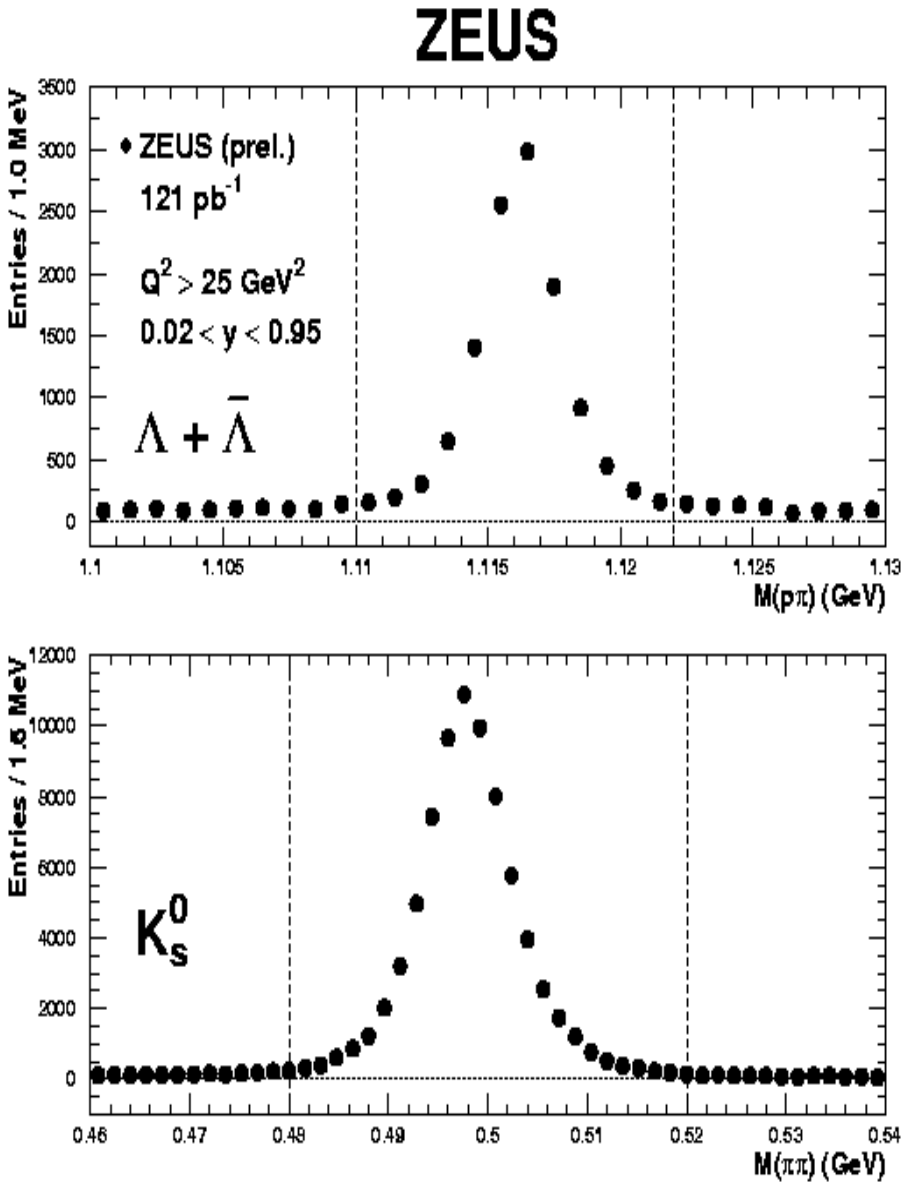
$K^{\pm}$ by energy-loss, dE/dx



K^0_s and Λ by displaced secondary vertex



K^0_s and Λ reconstruction



Background at the level of ~ 6% in Λ and ~3% in the K^0_s sample

- strangeness suppression factor

Motivation

Based on about 100 times larger data sample of 121 pb^{-1} collected by the ZEUS experiment in a wide kinematic range of ep interactions at HERA

- How well MC generators model s-quark production with λ_s=const
- Origin of the low momentum (0.5-5 GeV) baryons in the central region, $|\eta|<1.5$: $B - \bar{B}$ asymmetry, baryon charge transport
- Bose-Einstein correlations between pure states of $\pi^{\pm}$, $K^{\pm}$ in comparison with a mixed state $K^0_S = (K^0 + \bar{K}^0)/\sqrt{2}$

Event and Particle Selection

ep: 300 GeV, 39 pb^{-1} $\oplus$ 318 GeV, 82 pb^{-1}

ZEUS 1996-2000 data 121 pb^{-1}

PHP:

Q^2<1 GeV^2;

0.2<y<0.85

DIS:

5<Q^2<25 and Q^2>25 GeV^2;

0.02<y<0.95

2 jets with E_t^{jet} > 5 GeV

Particle selection: - Secondary vertex, V^0 ;

- $0.6 < P_T(K_S^0, \Lambda) < 2.5$
- $|\eta(K_S^0, \Lambda)| < 1.2$

MC generators

To study physics,
determine the response of
the detector and obtain
the correction factors

DIS

CDM ARIADNE 4.1

MEPS LEPTO 6.5

PHP

PYTHIA 6.1

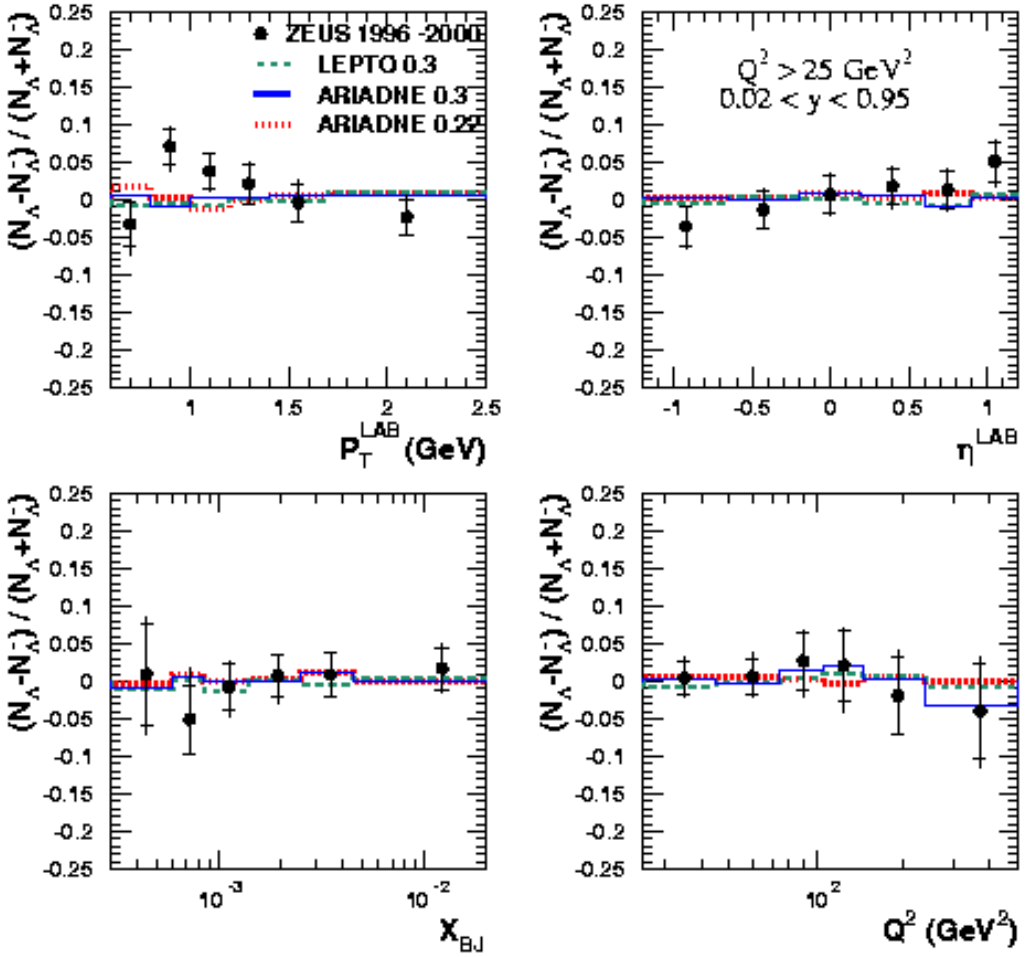
$$\lambda_s = P(s)/P(u)$$

- strangeness suppression factor

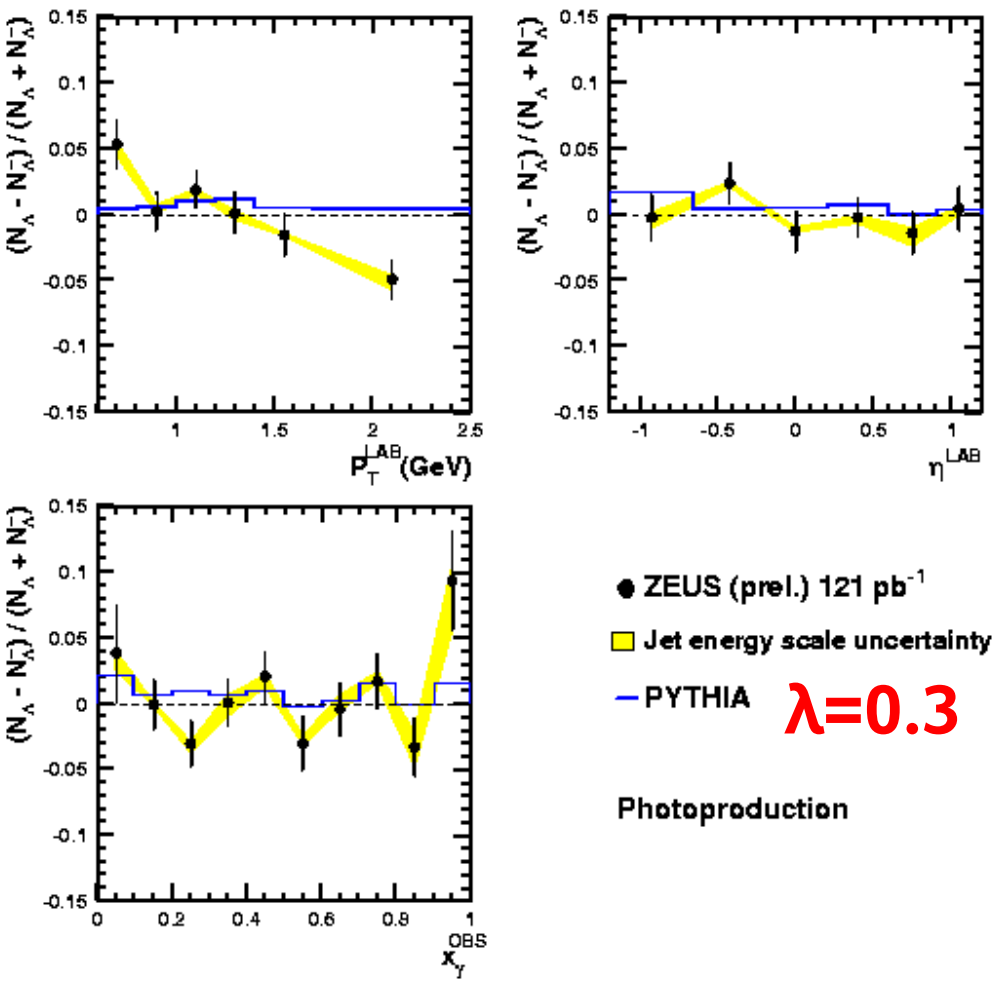
Baryon-antibaryon asymmetry

$$\frac{N_\Lambda - N_{\bar{\Lambda}}}{N_\Lambda + N_{\bar{\Lambda}}}$$

DIS ZEUS

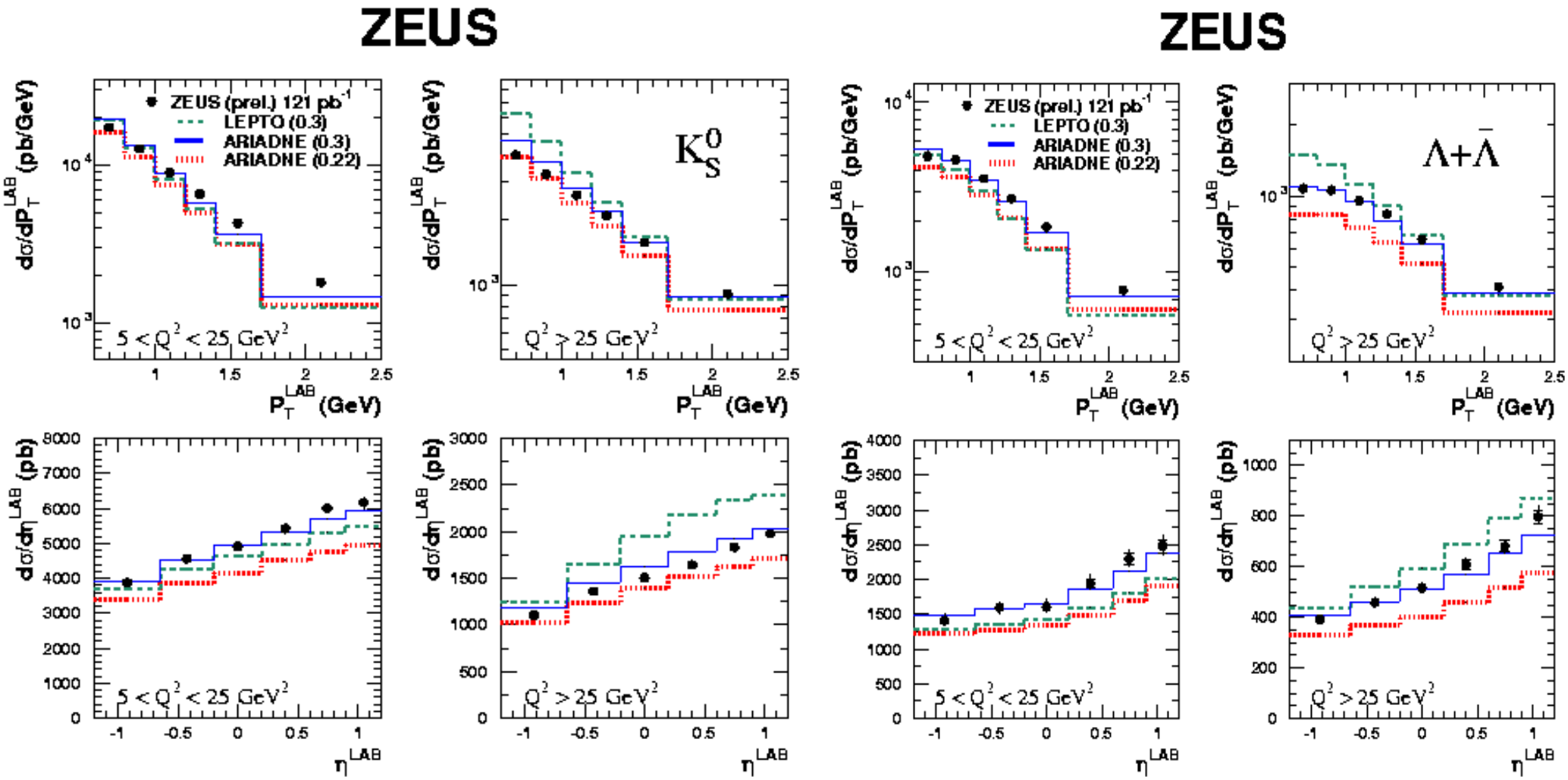


PHP ZEUS



Ratios are statistically consistent with 0
No evidence for B-$\bar{B}$ asymmetry and the string junction mechanism

DIS cross-sections: Differential features



K^0_s: All model predicts steeper p_T slopes

Λ: ARIADNE with λ_s=0.3 describes data well, 0.22 less satisfactory

LEPTO fails to describe the data (too fast growth of dσ/dη with Q^2)

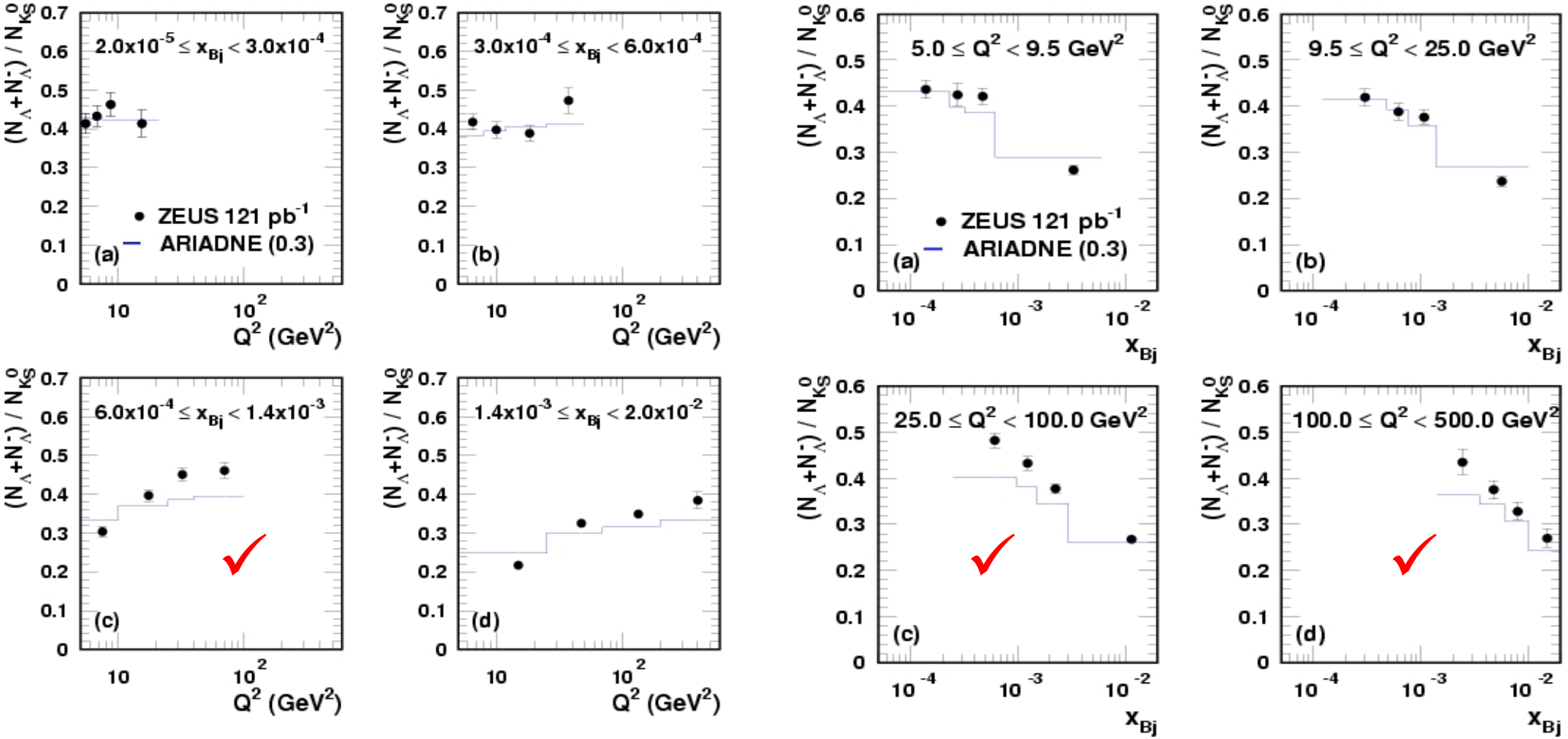
Baryon - to - meson ratio

$$\frac{N_{\Lambda}+N_{\bar{\Lambda}}}{N_{K^0_s}}$$

ZEUS

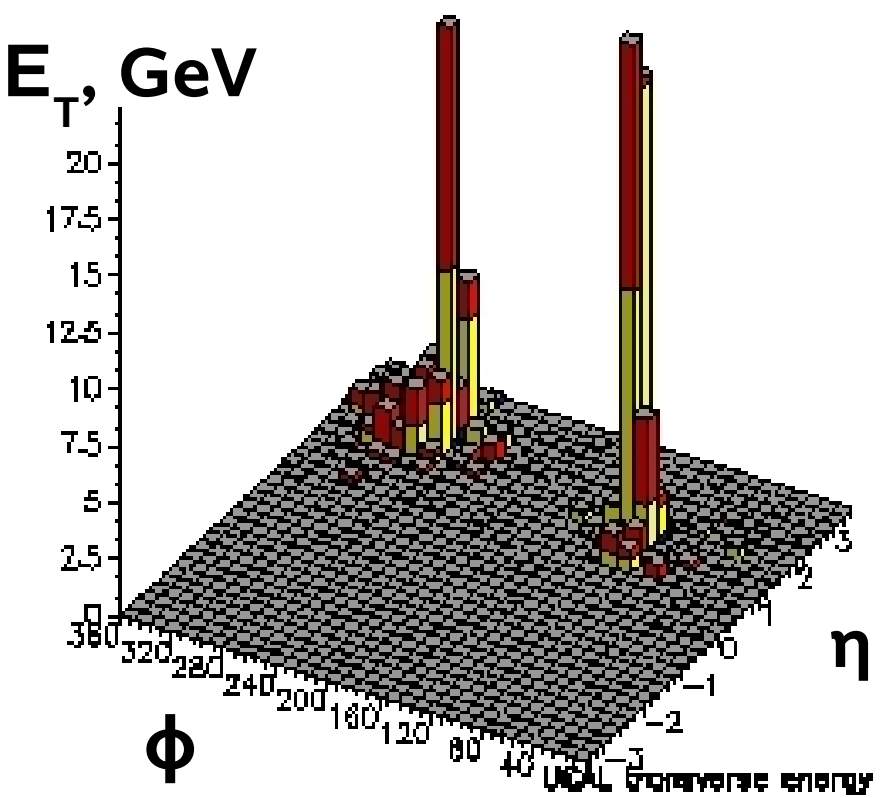
Fixed bins in x ,Q^2

ZEUS

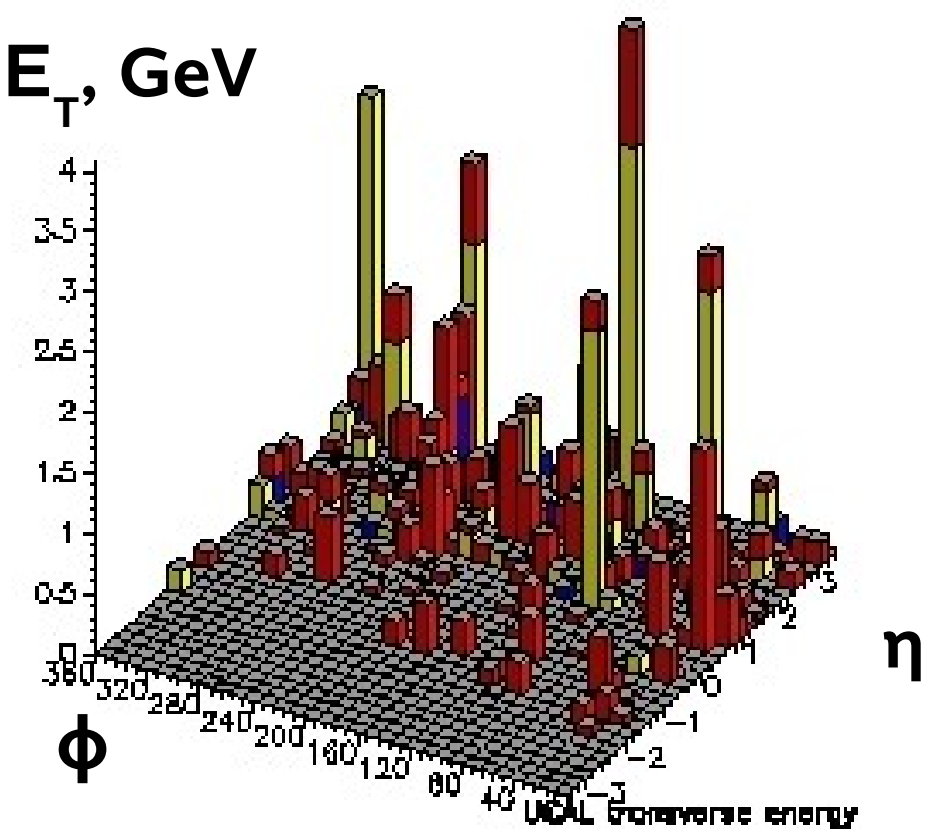


✓ **ARIADNE underestimates the data at high Q^2 by up to 20%; Ratios are similar to those from *ee* and *pp*.**

Photoproduction



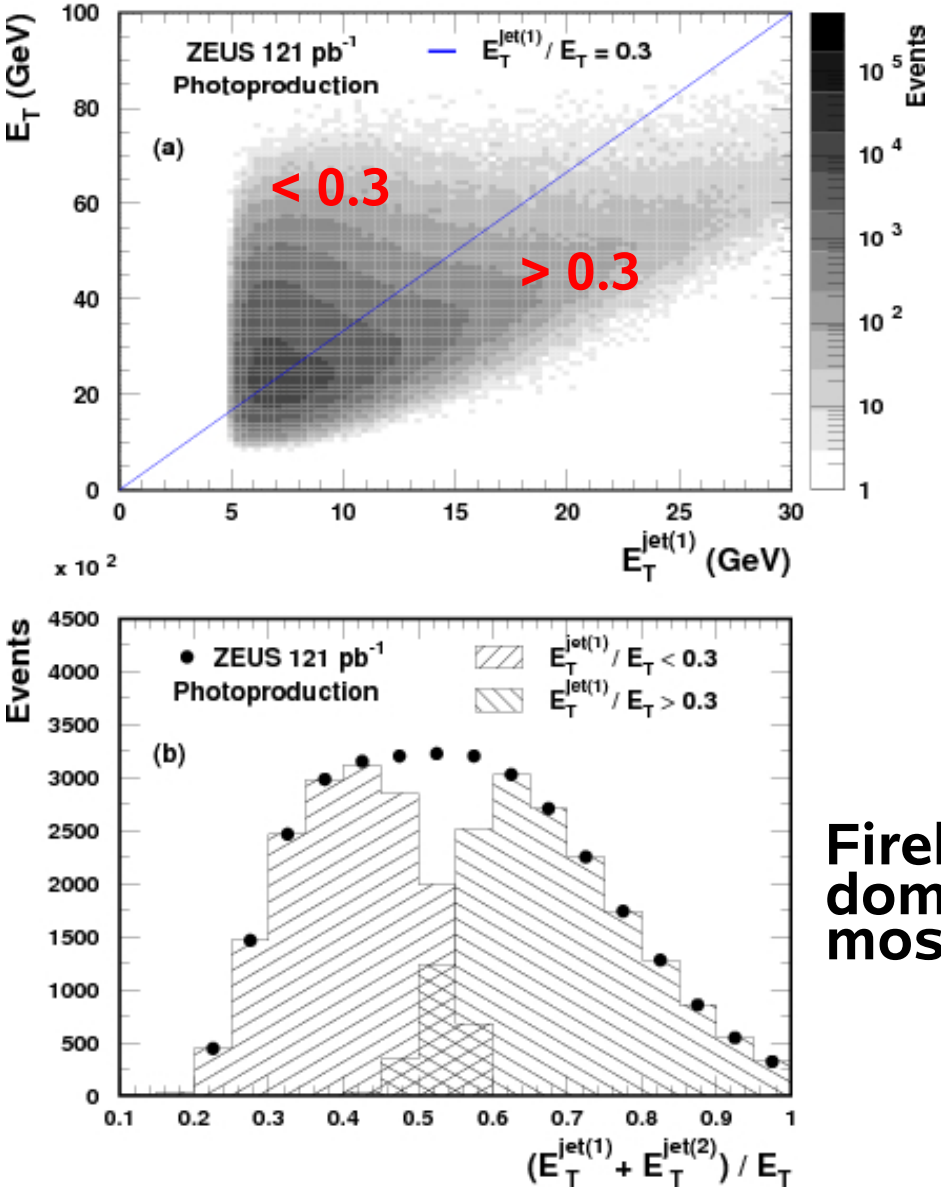
event with 2 jets



fireball-like event

Fireball sample selection in PHP

Total transverse energy



Highest transverse energy jet

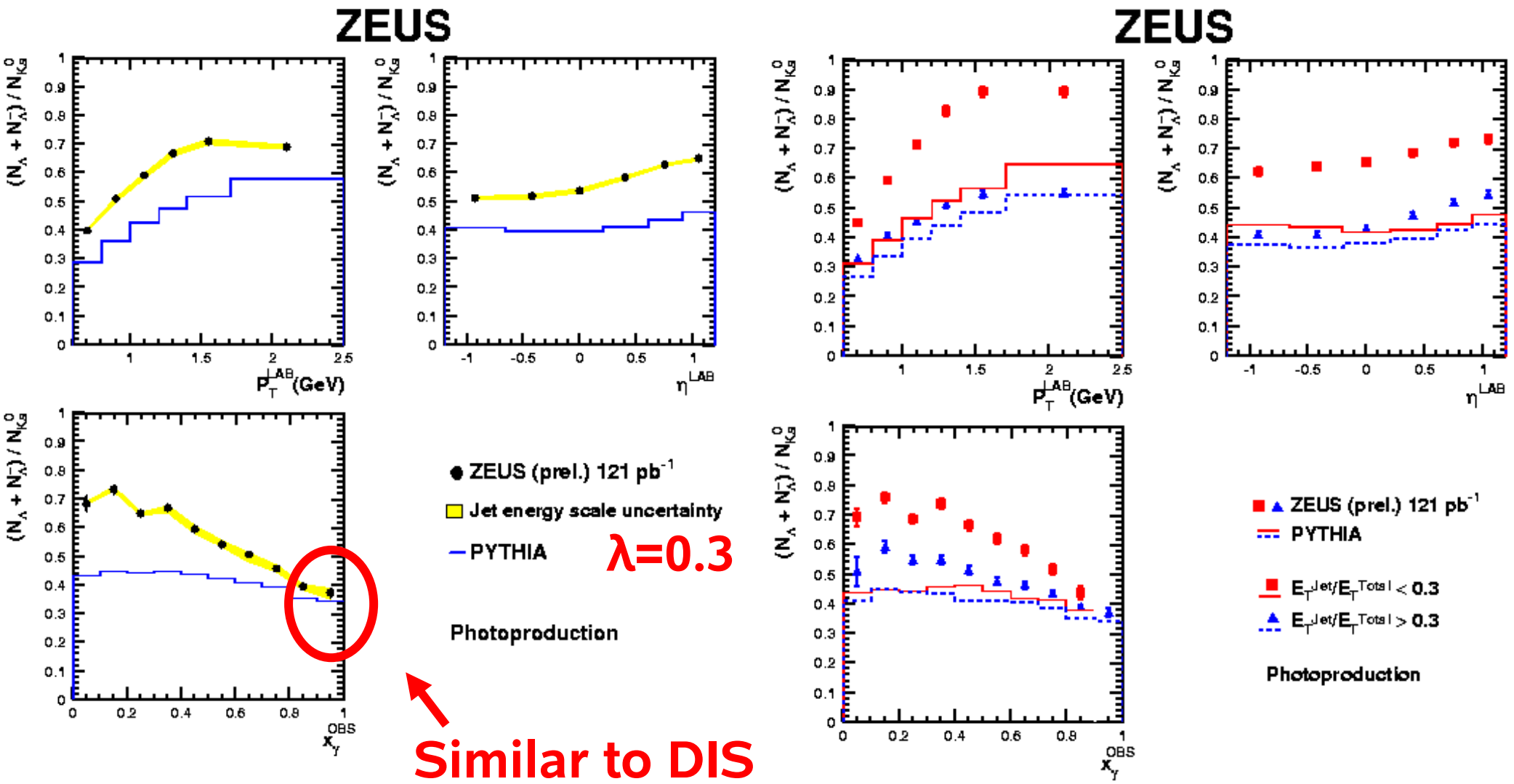
Fireball-enriched

$E_T^{jet(1)}/E_T < 0.3$

Fireball-depleted events dominated by jj carrying most of E_T

PHP: Baryon-to-meson ratio

$$\frac{N_{\Lambda}+N_{\bar{\Lambda}}}{N_{K^0_s}}$$



Similar to DIS

PYTHIA fails to describe the data

MI makes several independent jets

Bose-Einstein correlations between $K^{\pm}K^{\pm}$

Double ratio method

$$R(Q_{12}) = \frac{P(Q_{12})^{data}}{P_{mix}(Q_{12})^{data}} / \frac{P(Q_{12})^{MC,nBEC}}{P_{mix}(Q_{12})^{MC,nBEC}}$$

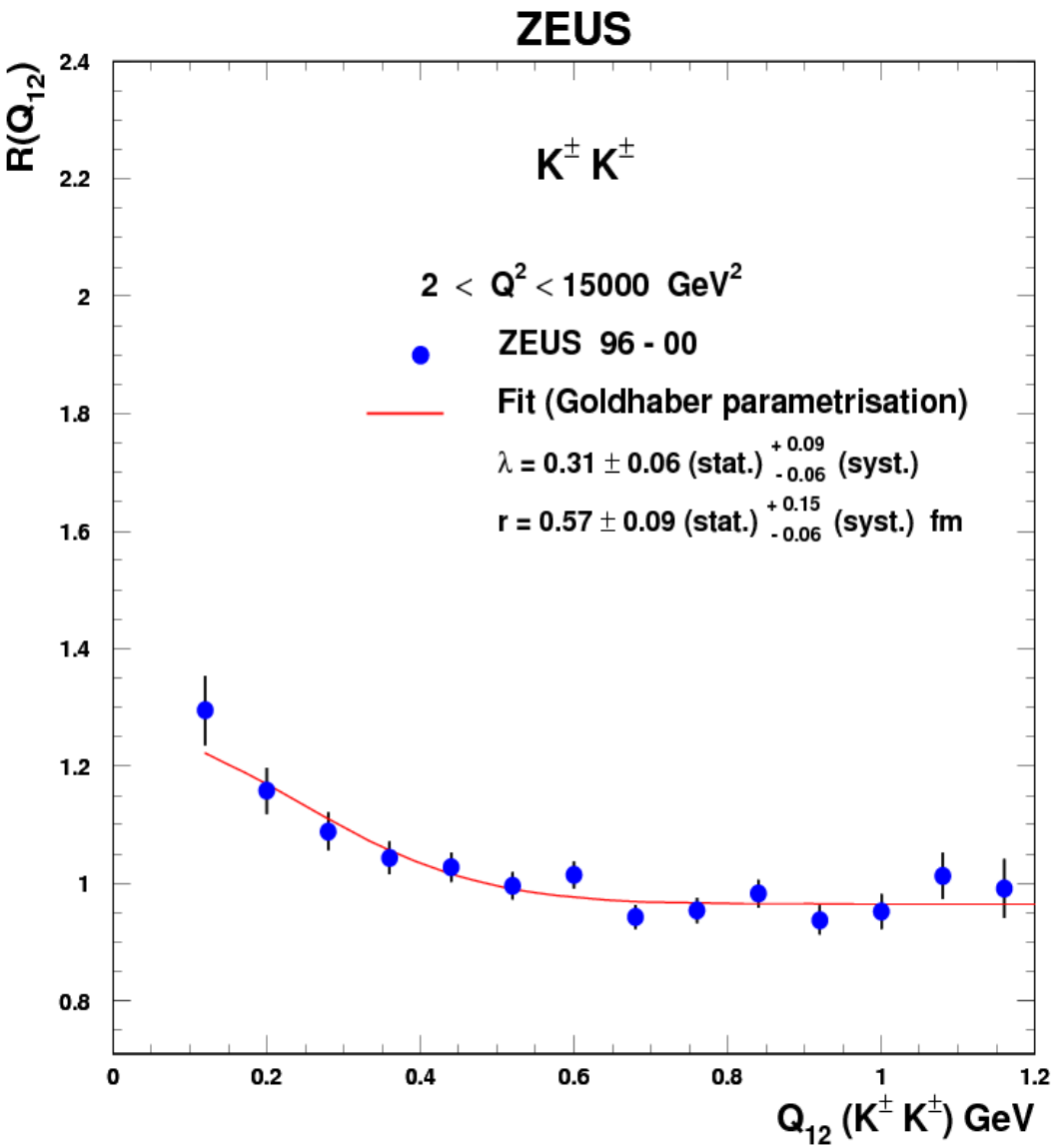
$$Q_{12} = \sqrt{-(p_1 - p_2)^2}$$

55522 $K^{\pm}K^{\pm}$, p < 0.9 GeV

Goldhaber form

$$R(Q_{12}) = 1 + \lambda \exp(-r^2 Q_{12}^2)$$

Parameters (r, λ) are consistent with the H1 result

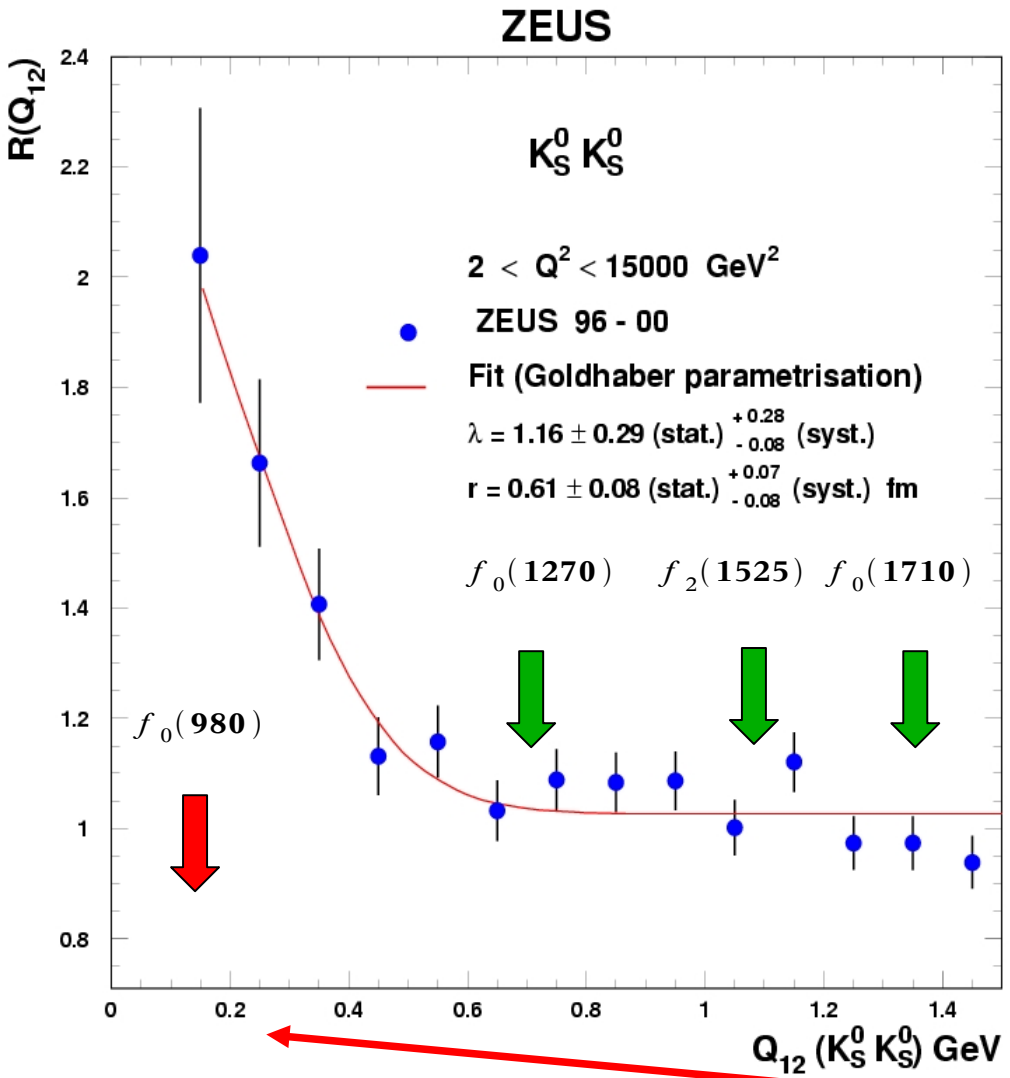


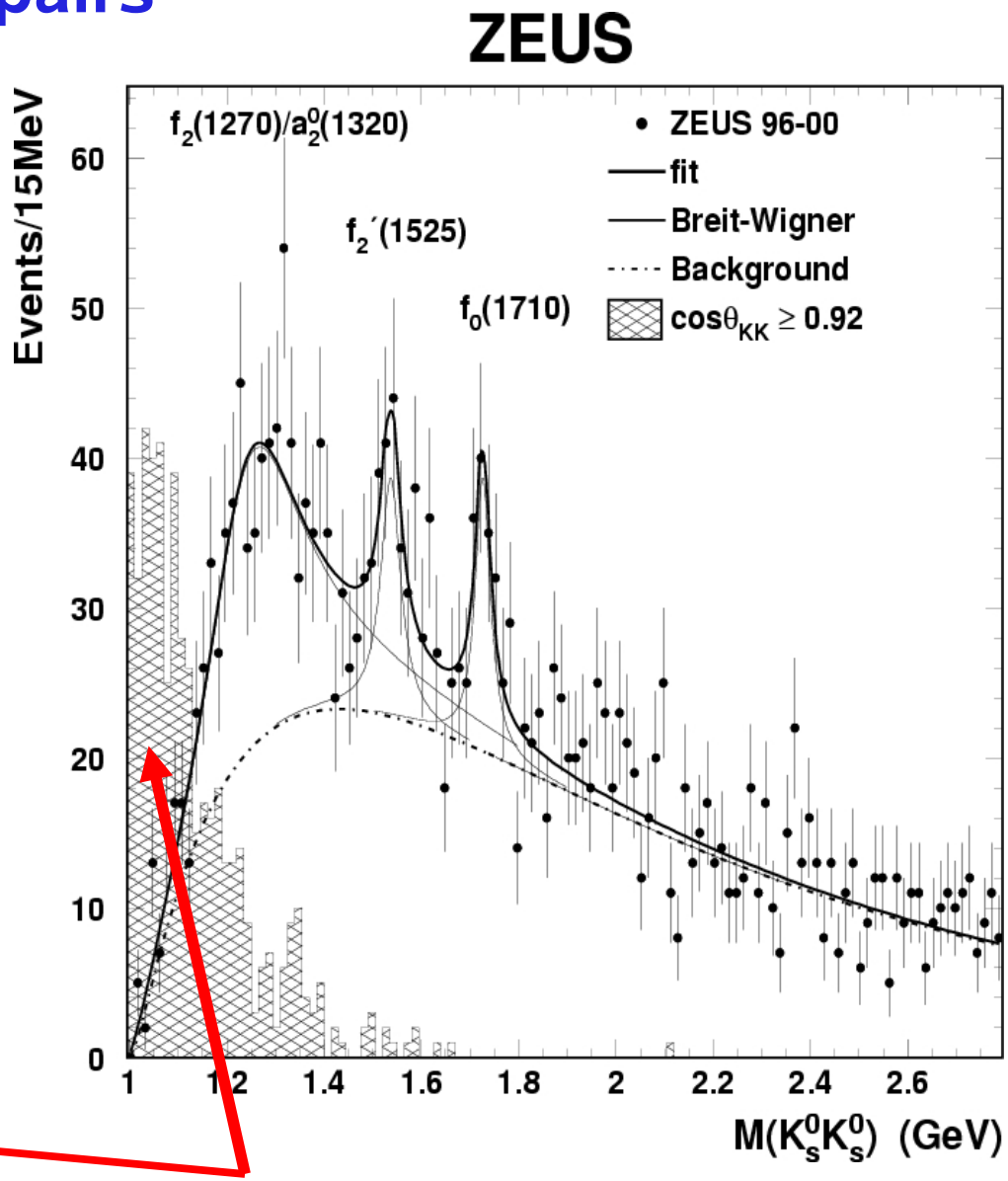
Bose-Einstein correlations between $K^0_S K^0_S$

75% at low Q_{12}

$K^0 K^0, \bar{K}^0 \bar{K}^0, \underline{K^0 \bar{K}^0} \rightarrow K^0_s K^0_s$

18405 pairs





subthreshold $f_0(980)$ decays

Comparison of DIS and LEP results

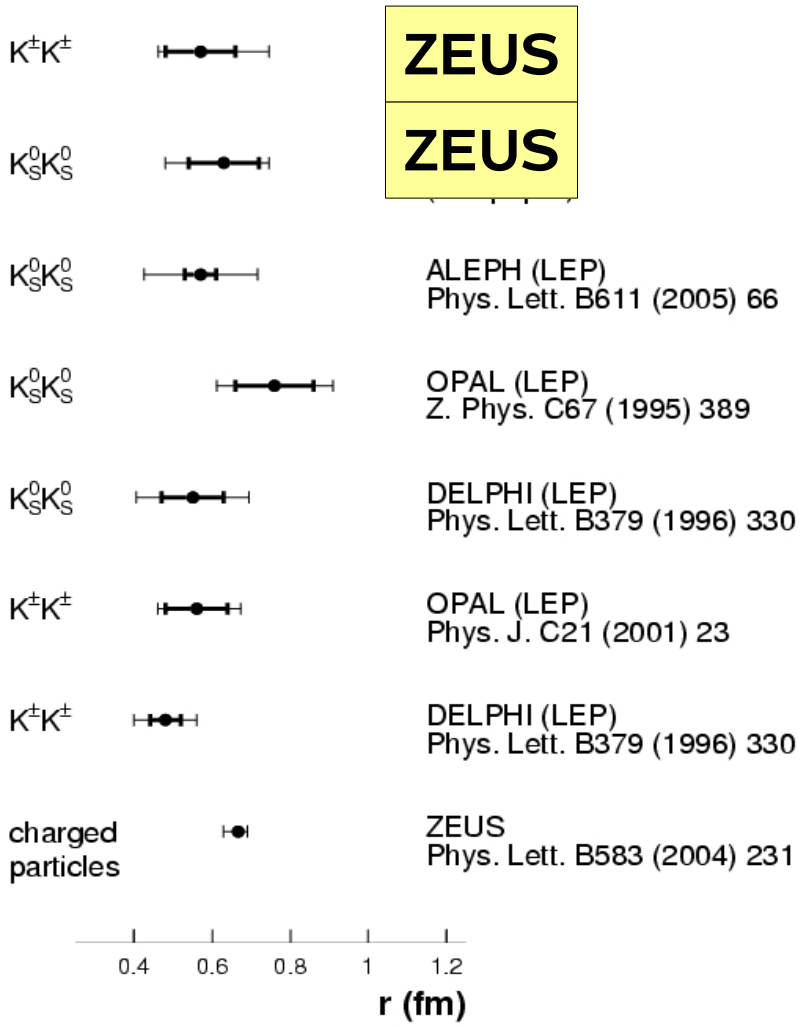
Fraction of c_f = 4%

λ = 1.16±0.29

→ $\lambda(c_f)$ = 0.70±0.19

r = 0.61± 0.08 fm

→ $r(c_f)$ = 0.63±0.09 fm



Summary

Measurements of $K^{\pm}$,K^0_S, Λ's production have been made at ZEUS using 121 pb^{-1} integrated luminosity:

- No sizeable baryon-antibaryon asymmetry is observed ;
- ARIADNE and PYTHIA satisfactorily describe some of the distributions with **λ** in the range [0.22-0.3], however **λ** value depends on $\mathbf{Q^2}$, $\mathbf{x_{Bj}}$, $\mathbf{p_T}$ and **η**;
- The ratio of baryons to mesons is large in the PHP resolved region and in the fireball PHP region, much larger than in e+e- and is not described by PYTHIA ;
- The values of **(r, λ)** from Bose-Einstein correlations between $\mathbf{K^{\pm}K^{\pm}}$ and $\mathbf{K^0_SK^0_S}$ agrees and consistent with e+e- data.
- The **f(980)**->$\mathbf{K^0_SK^0_S}$ decay can significantly affect the **λ** value.