

# Strangeness production at High $Q^2$ at H1

DIS Workshop 2010

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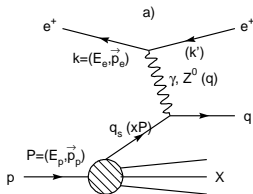
CINVESTAV Mérida

On behalf of H1 Collaboration

- Introduction
- Measurements:  $K_s^0$ ,  $K_s^0/h^\pm$ ,  $K_s^0/DIS$
- Summary



# HERA collider and H1 detector



$$Q^2 = -q^2 = (k - k')^2,$$

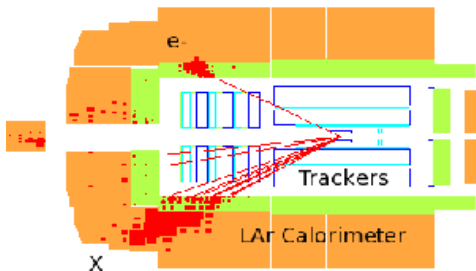
$$y = \frac{q \cdot P}{k \cdot P}, \quad x_{Bj} = \frac{Q^2}{2q \cdot P}$$

The collider provides:

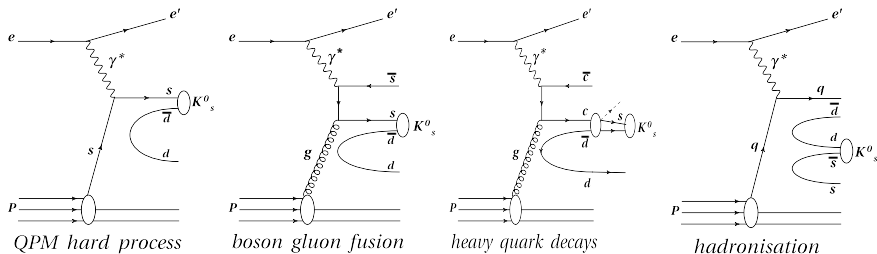
▶  $E_e = 27.6 \text{ GeV}$

▶  $E_p = 920 \text{ GeV}$

$\sqrt{s} = P + k = 319 \text{ GeV}$

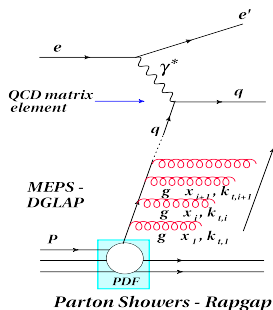


# Strange production mechanism



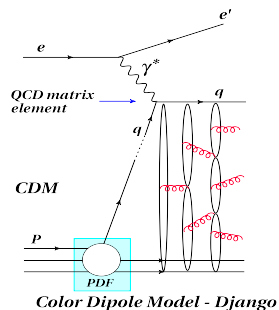
- \* At high  $Q^2$  all mechanisms contribute significantly.
- \* Test of models of fragmentation/hadronisation.
- \* Optimisation of the Monte Carlo parameters.
- \* Test of  $\lambda_s$  universality.

# Simulation programs



**MEPS:** DGLAP evolution equation, strong  $k_T$  ordering for gluon emission.

**CDM:** independent radiation, no ordering in  $k_T$ .



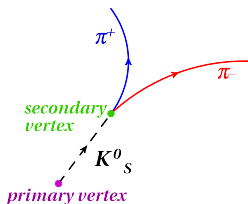
Interfaced to Lund string fragmentation

- ♣ strangeness suppression factor  $\lambda_s = P(s)/P(q)$
- ♣ diquark suppression factor  $\lambda_{qq} = P(qq)/P(q)$
- ♣ strange diquark suppression factor  $\lambda_{sq} = (P(sq)/P(qq))/\lambda_s$
- ♣  $e^+e^-$  ALEPH tuning:  $\lambda_s = 0.286$ ,  $\lambda_{qq} = 0.108$ ,  $\lambda_{sq} = 0.690$

# The $K_S^0$ identification

The decay channel considered is:

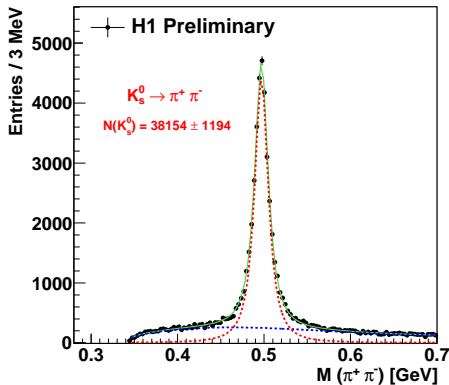
$$K_S^0 \rightarrow \pi^+ \pi^- \text{ with } BR \sim 69.2\%$$



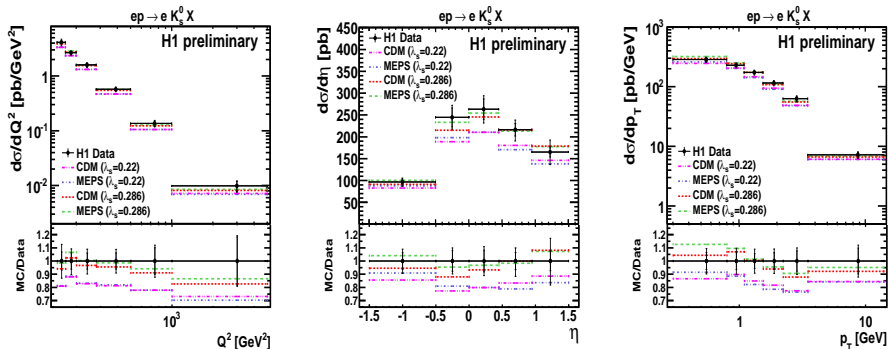
For the measurement:

- $145 < Q^2 < 20000 \text{ GeV}^2$
- $0.2 < y_e < 0.6$
- $p_T(K_S^0) > 0.3 \text{ GeV}$
- $-1.5 < \eta(K_S^0) < 1.5$

38154  $K_S^0$  candidates found in  
 $\mathcal{L} = 340 \text{ pb}^{-1}$



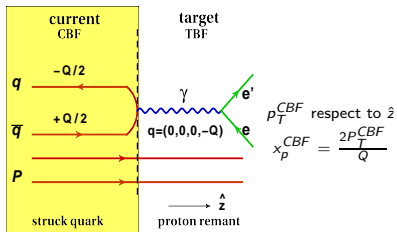
# Cross section measurement in laboratory frame



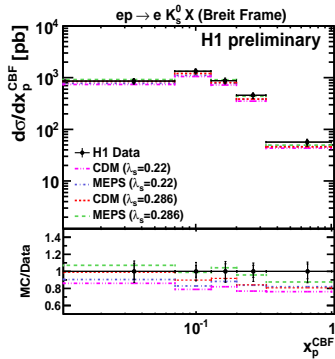
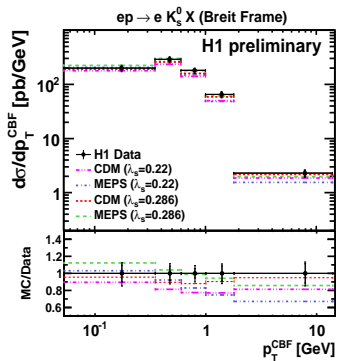
$$\sigma_{vis} = 531 \pm 17(\text{stat.})_{-39}^{+37}(\text{syst.})\text{pb}$$

- ⊗  $\lambda_s = 0.286$  agrees with data in shape and normalization.
- ⊗ MEPS and CDM give similar description of the data.

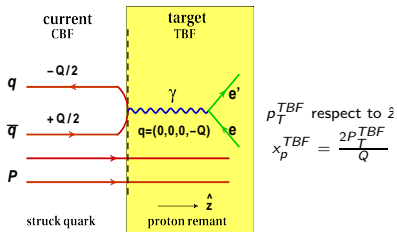
# Cross section in Breit frame - Current region



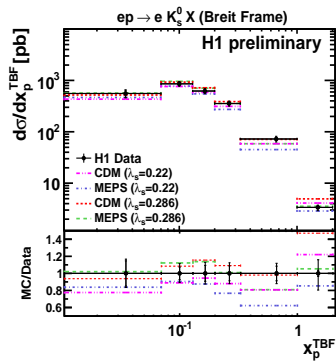
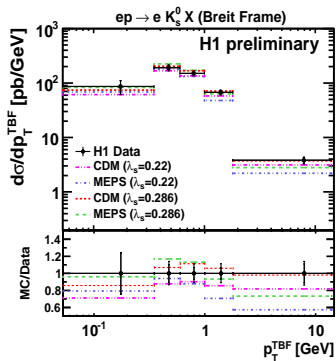
- \* Analogy to  $e^+e^-$  collisions.
- \* QPM hard process preferentially.
- \* Better agreement with  $\lambda_s = 0.286$ .



# Cross section in Breit frame - Target region

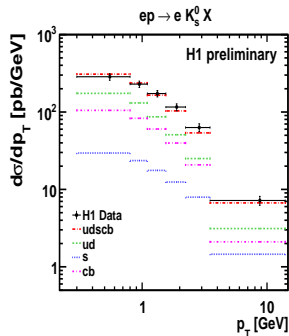
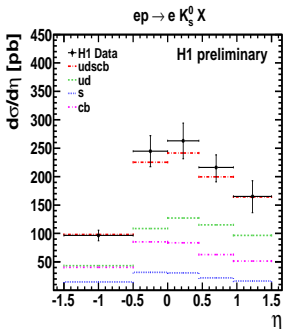
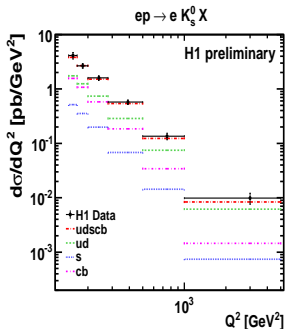


- \* Hadronisation process predominantly.
- \* More sensitivity to  $\lambda_s$ .





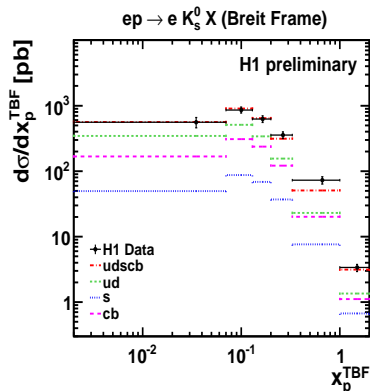
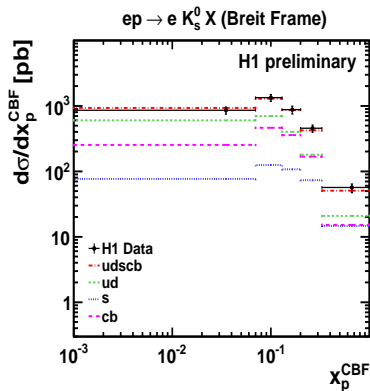
# Flavour contribution in laboratory frame



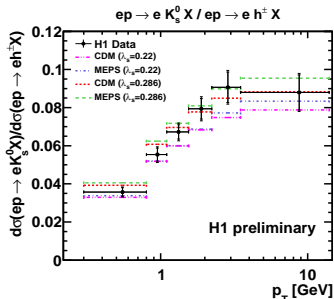
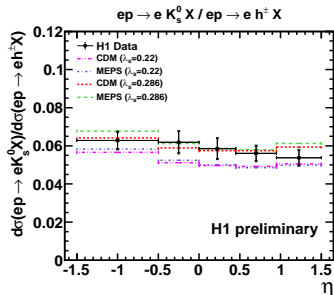
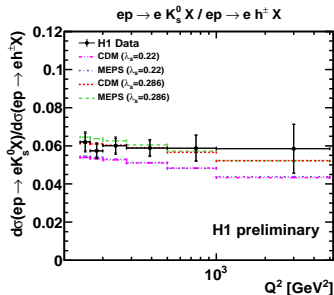
- The contribution of  $ud$  light quarks dominates.
- Heavy  $cb$  quarks as second dominant contribution.
- The  $s$  quark contribution becomes more important at high  $p_T$ .

# Flavour contribution in Breit frame

- The contribution of  $s$  quark equals the heavy  $cb$  quarks contribution at high  $x_p$  in current region.



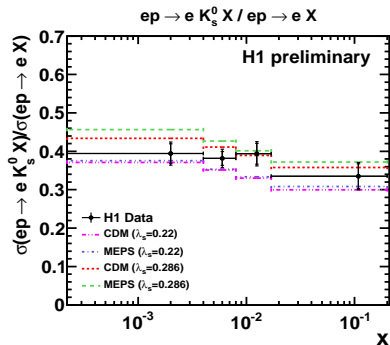
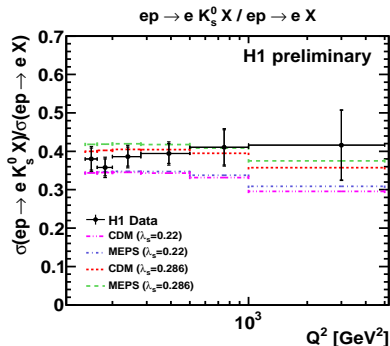
# The ratio of $K_S^0$ over charged particle production



$$\sigma(ep \rightarrow eK_S^0 X) / \sigma(ep \rightarrow eh^\pm X)$$

- Ratio almost flat as function of  $Q^2$ .
- Ratio rises in  $p_T$ .
- $\lambda_S = 0.286$  describes data.

# The $K_s^0$ density measurement



$$\text{Density} = \sigma(ep \rightarrow eK_s^0 X) / \sigma(ep \rightarrow eX)$$

- \* The density average at 0.4 independently of  $Q^2$  and  $x$ .
- \* Both models predict small falling in  $x$ .



# Summary

- The  $K_s^0$  production is measured as first time at high  $Q^2$  by H1 collaboration.
- Production ratio of  $K_s^0$  over charged particle and  $K_s^0$  to DIS events give flat behavior.
- The production is dominated by hadronisation.
- The  $\lambda_s = 0.286$  describes the measurements.