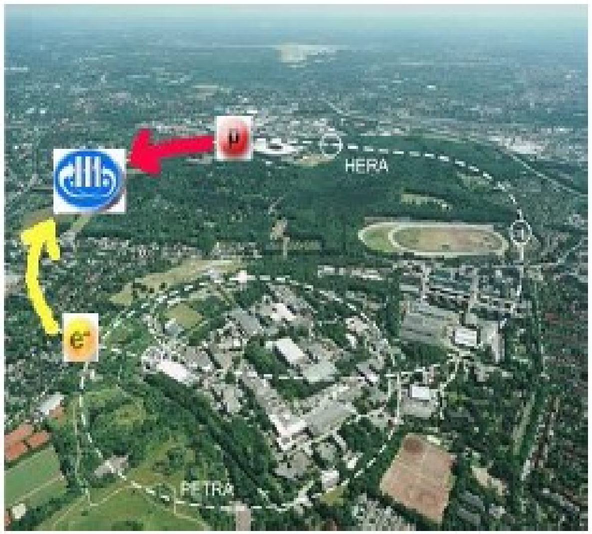
Strangeness Production in Deep-Inelastic ep Scattering at HERA

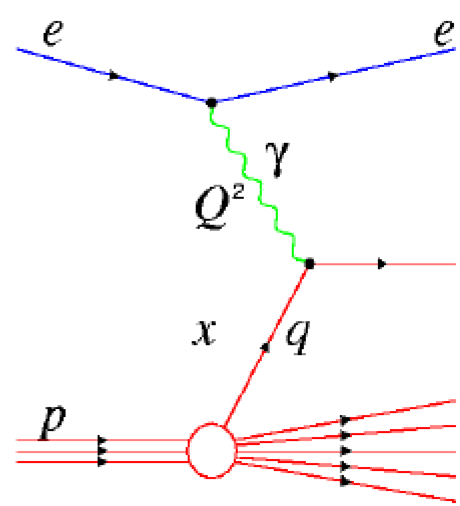
Khurelbaatar Begzsuren, DESY
(on behalf of the H1 collaboration)

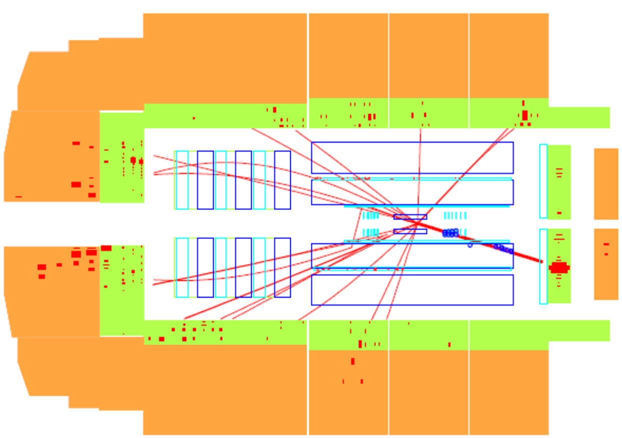
Low X-2013, Rehovot-Eilat, Israel

DIS process at HERA

HERA: $\sqrt{s}$ = *319 GeV*







DIS event at low Q^2

Q^2- photon virtuality

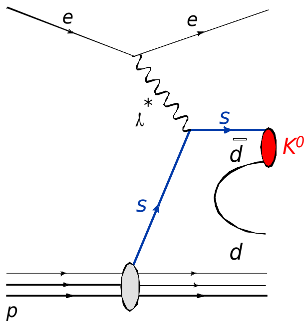
x- Bjorken scaling variable

y- Inelasticity in proton rest frame

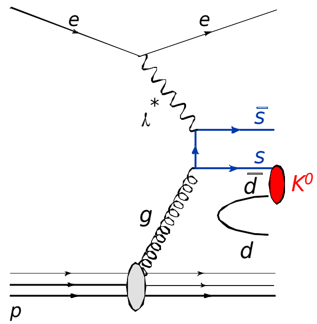
for a fixed center-of-mass energy:

$Q^2 = xys$

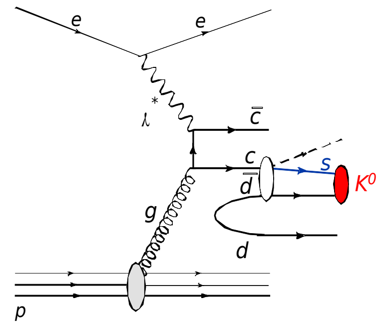
Strange production mechanism



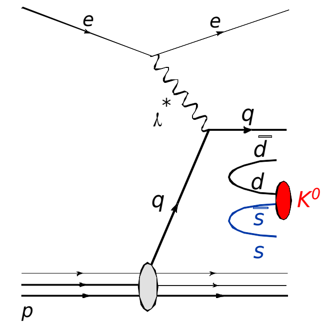
hard process



Boson gluon fusion



Heavy quark decays



hadronisation

All mechanisms contribute significantly

Measurements of strange particle production (K^0_S, Λ):

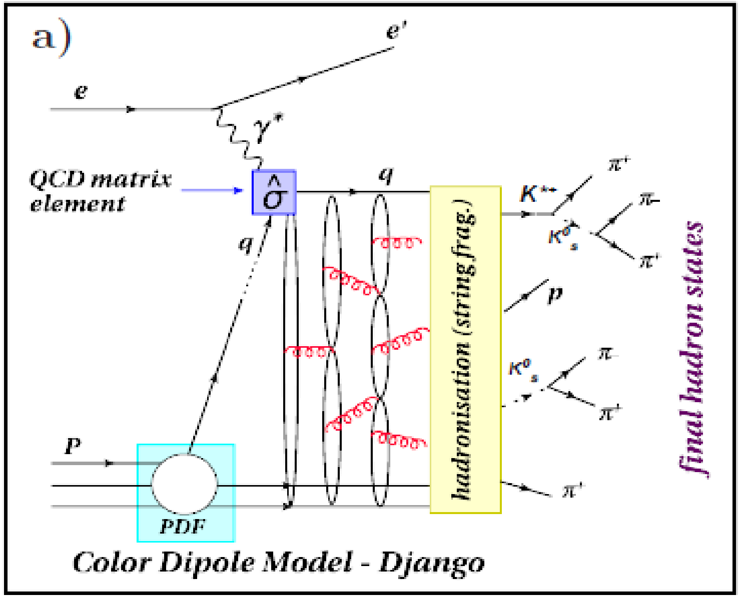
-understanding QCD

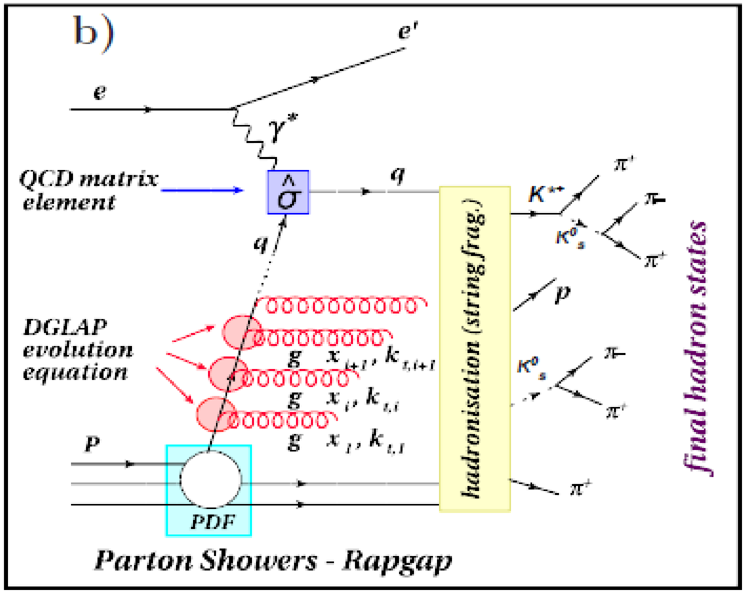
-test of models of fragmentation/hadronisation

-optimisation of the Monte Carlo parameters

-test of λ_s universality

Monte Carlo simulation





Djangoh, Rapgap- hard partonic processes at the Born level at leading order in α_S

Higher order QCD effects: CDM in Djangoh

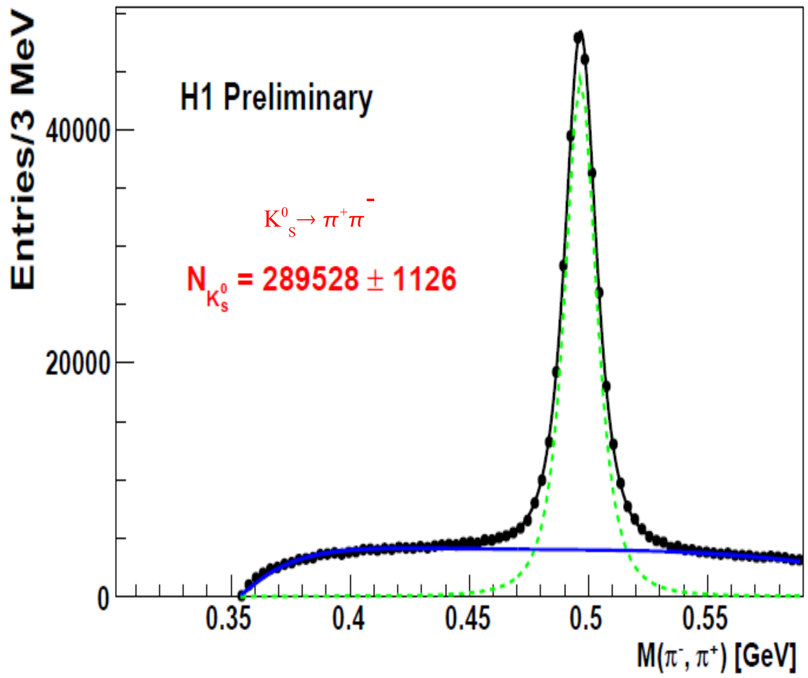
MEPS in Rapgap

JETSET - hadronisation process in the Lund string fragmentation model:

$\lambda_S = 0.286$, $\lambda_{qq} = 0.108$, $\lambda_{sq} = 0.690$ tuned to e^+e^- data (ALEPH)

K^0_S and Λ visible cross sections

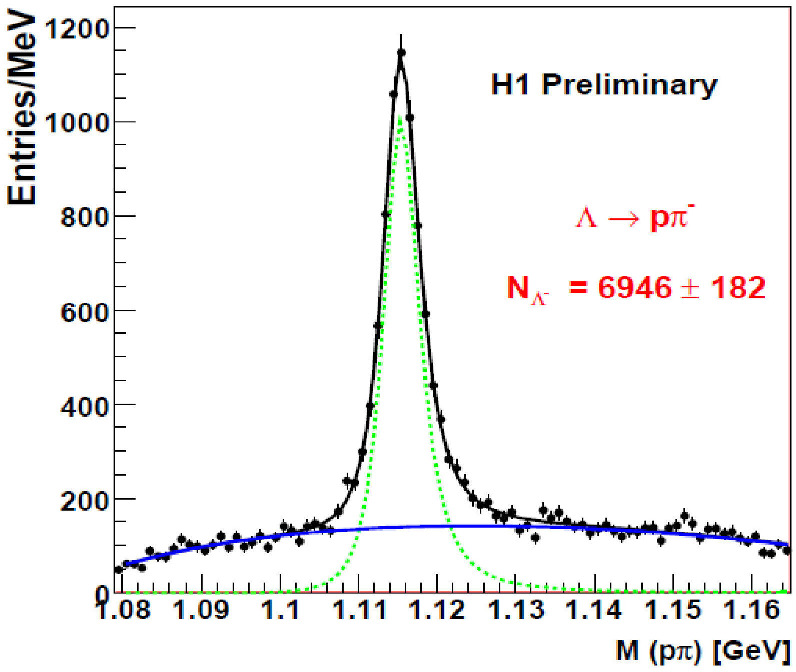
K^0_S at low Q^2



$7 < Q^2 < 100$ GeV^2

$0.1 < y < 0.6$

Λ at high Q^2



$145 < Q^2 < 20000$ GeV^2

$0.2 < y < 0.6$

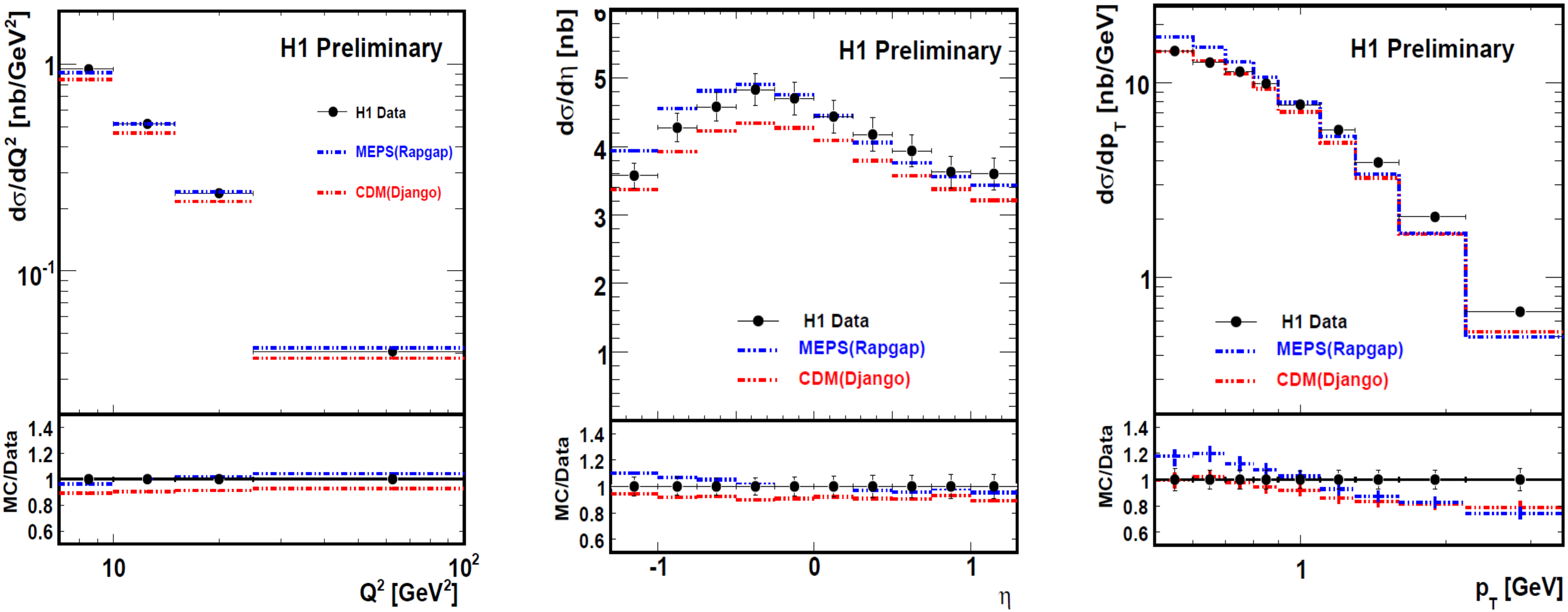
$$\sigma_{vis}(ep\to eK^0X) = 10.66 \pm 0.04(\text{stat.})\,^{+0.50}_{-0.53}(\text{syst.})\text{ nb}$$

$$\sigma_{vis}(ep\to e\Lambda X) = 144.7\pm 4.7(\text{stat.})\,^{+9.4}_{-8.5}(\text{syst.})\text{ pb}$$

λ_S	0.286
$\sigma_{vis}(ep\to eK^0_sX)$ CDM	9.88 nb
$\sigma_{vis}(ep\to eK^0_sX)$ MEPS	10.93 nb

λ_S	0.220	0.286
$\sigma_{vis}(ep\to e\Lambda X)$ CDM	136 pb	161 pb
$\sigma_{vis}(ep\to e\Lambda X)$ MEPS	120 pb	144 pb

K^0_S differential cross-sections at low Q^2



MEPS(Rapgap) describes Q^2 and η

CDM(Djangoh) slightly below the data

Both models fail to describe the P_T dependence

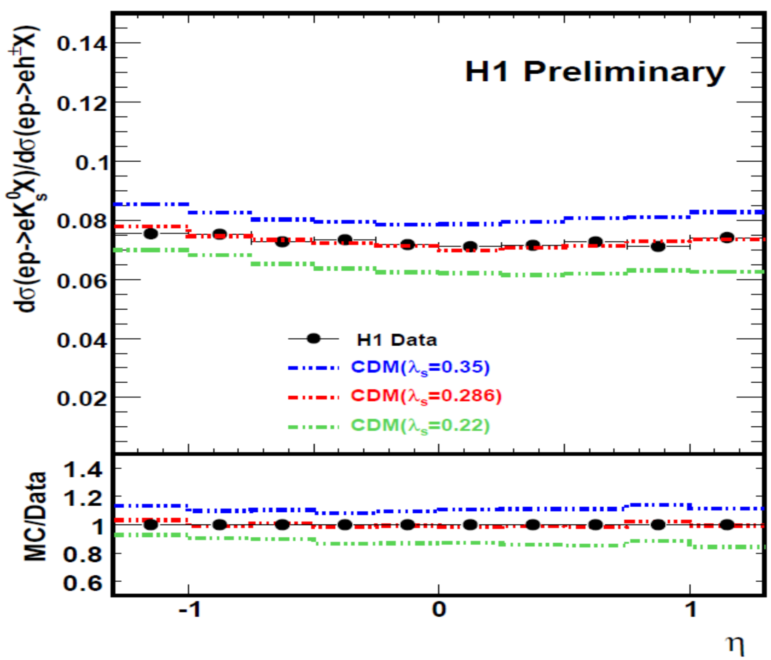
Ratio of K^0_s to charged particles

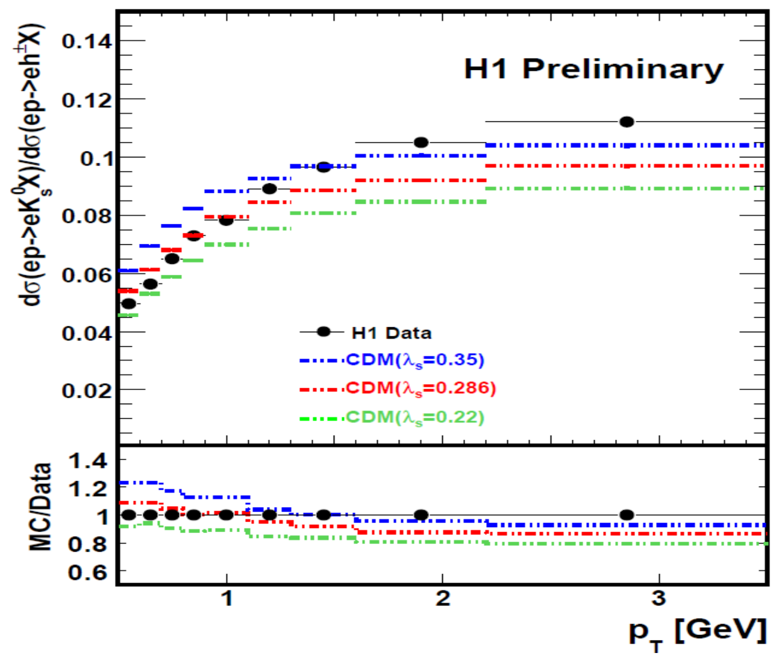
$$R = \frac{\sigma_{vis}(ep \to e' K^0_s X)}{\sigma_{vis}(ep \to e' h^\pm X)} = 0.0721 \pm 0.0003(\text{stat.})\,{}^{+0.0019}_{-0.0024}(\text{syst.})$$

λ_s	0.220	0.286	0.350
CDM	0.064	0.073	0.081

$7 < Q^2 < 100$ GeV^2

$0.1 < y < 0.6$



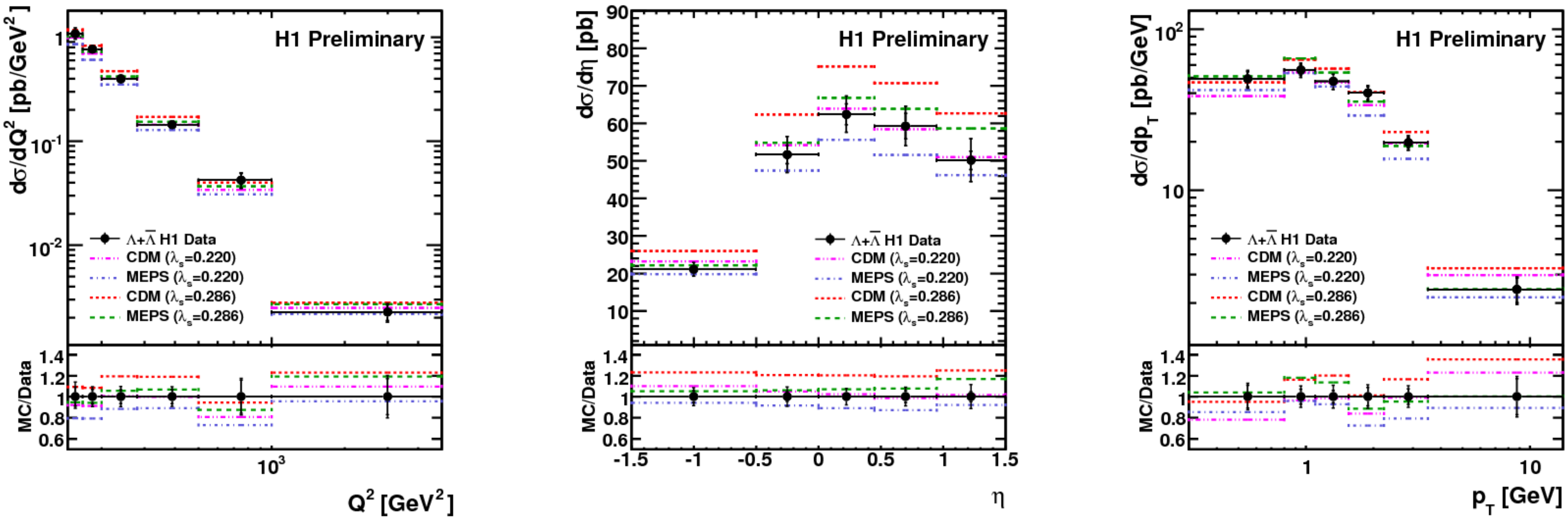


Best description is obtained for $\lambda_s = 0.286$

p_T shape of the ratio is not described

Large sensitivity on λ_s

Λ differential measurement at high Q^2

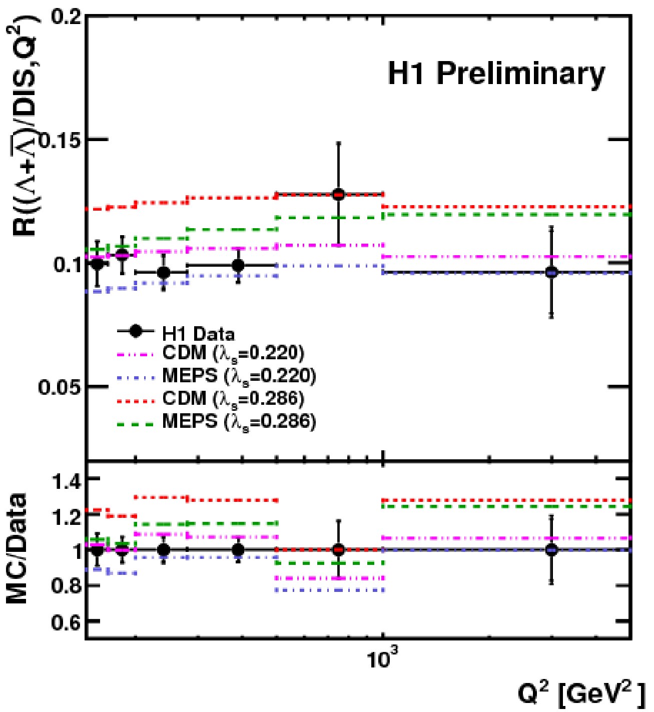


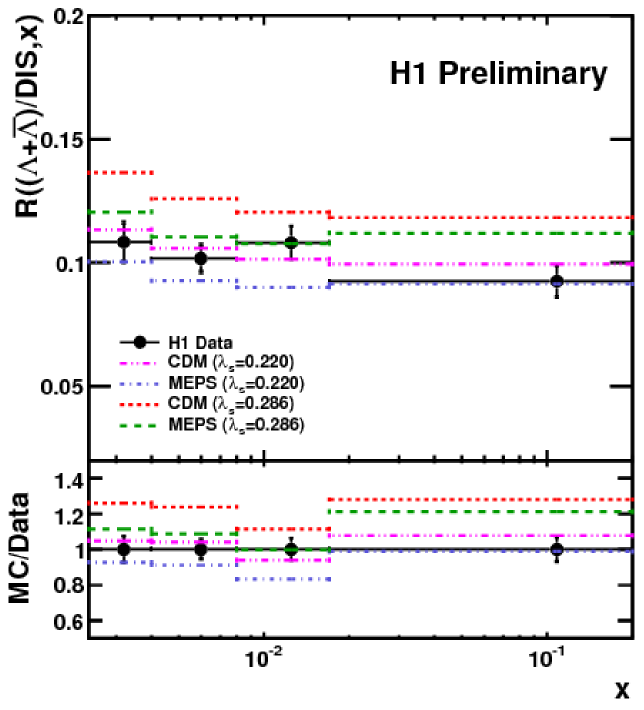
Best description is obtained for MEPS with $\lambda_S = 0.220$

The cross sections fall rapidly with Q^2 and p_T

The models follow the general behaviour of data, but some differences are seen

Λ production to DIS cross-section ratio





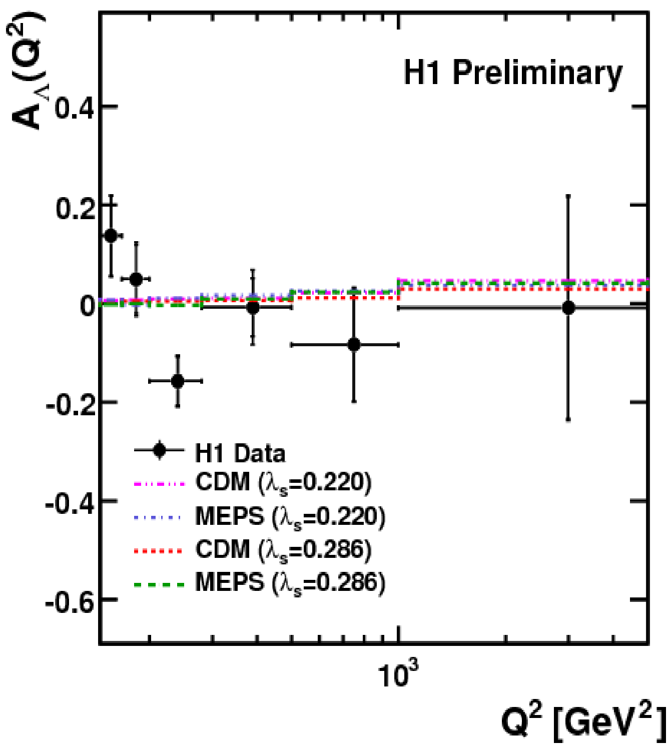
Best description is obtained by CDM(Djangoh) for $\lambda_S = 0.220$

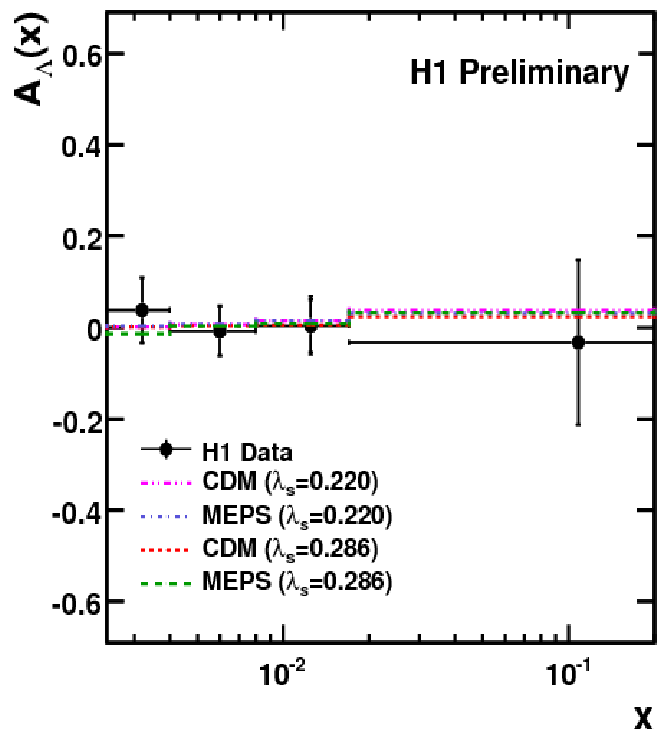
Λ-$\bar{\Lambda}$ Asymmetry

$145 < Q^2 < 20000$ GeV^2
$0.2 < y < 0.6$

$$A_\Lambda = \frac{\sigma_{vis}(ep \to e'\Lambda X) - \sigma_{vis}(ep \to e'\bar{\Lambda} X)}{\sigma_{vis}(ep \to e'\Lambda X) + \sigma_{vis}(ep \to e'\bar{\Lambda} X)}$$

$$A_\Lambda = 0.002 \pm 0.022(\text{stat.}) \pm 0.018(\text{syst.})$$





Data do not show any evidence for a non-vanishing asymmetry in the Λ phase space region investigated

Conclusions

K^0_s production at low Q^2:

-MEPS(Rapgap) gives a reasonable description of the data in Q^2, η but predicts a softer spectrum in Pt

-CDM(Django) reasonable in shape, but below the data

$K^0_s/h^\pm$ ratio:

-CDM(Django) good description in $K^0_s/h^\pm$ yield for $\lambda_s = 0.286$

-good description at small Pt, but fails at higher Pt

-$K^0_s/h^\pm$ shows large sensitivity for determining λ_s

Λ Production at high Q^2:

-The measured visible Λ cross section is found to be described best by CDM using $\lambda_s = 0.220$ and the MEPS model using $\lambda_s = 0.286$

- When investigating the Λ production to DIS cross section ratio the best agreement is observed for the CDM with $\lambda_s = 0.220$

-Λ-$\overline{\Lambda}$ Asymmetry is found to be consistent with zero