Jets and α_s Measurements in DIS

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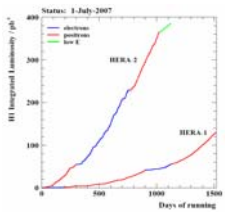
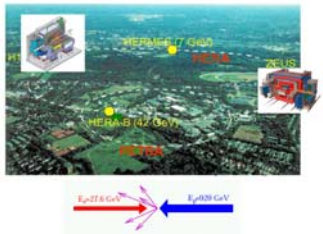
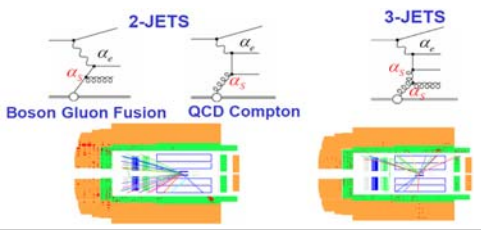


HERA I 1993-2000
integrated luminosity ~120 pb^{-1}

HERA II 2003-2007
integrated luminosity ~380 pb^{-1}

March 2007 Low energy run E_p=460; 575 GeV
integrated luminosity ~ 20 pb^{-1}
June 30 2007 HERA Shut down

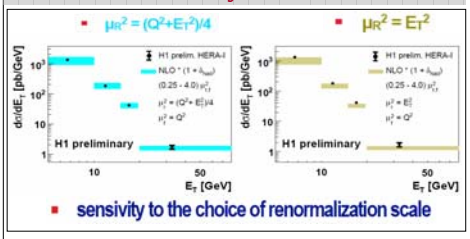




Inclusive and Multi-Jet Production in DIS

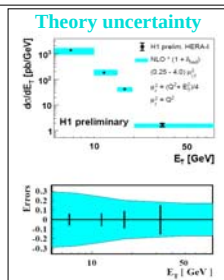
Jet production is investigated in DIS NC events for Low (5 -100GeV^2) and High (150 - 15000GeV^2) negative four momentum transfer squared Q^2.

Low (5 – 100 GeV^2) Q^2 events. $0.2 < y < 0.7$

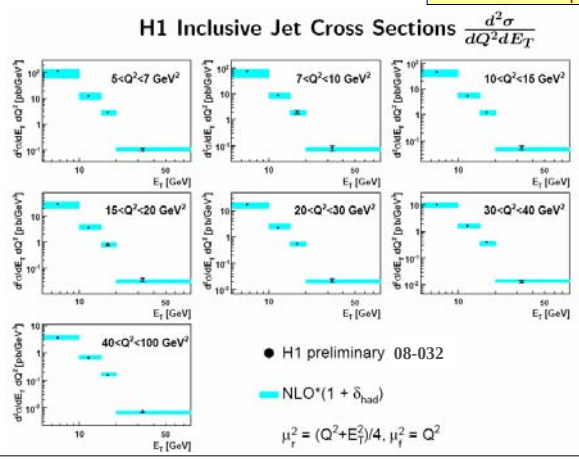


Low Q^2 jet data show that for a reasonable choice of scale μ_r NLO QCD describes the data even for regions with high K factor (NLO/LO) ~ 3, i.e. at Q^2~5 GeV^2 and E_T ~5 GeV (as is shown below)

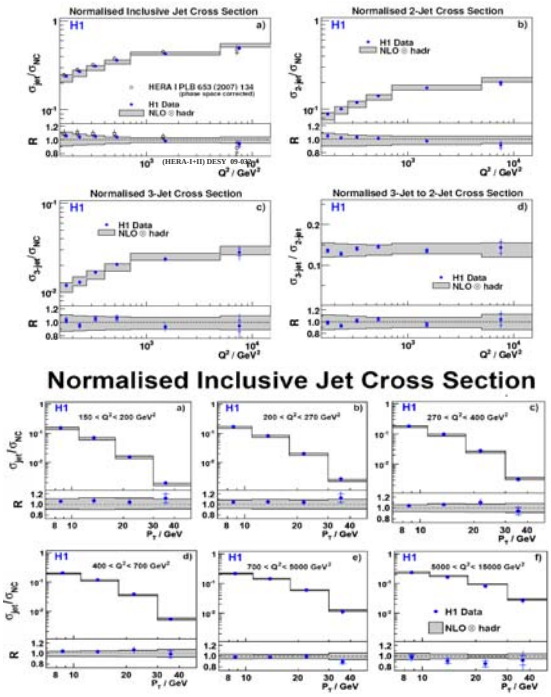
Theory uncertainty



Theory uncertainty (mainly renormalization scale) **dominates over the experimental one and increases with decreasing Q^2 and E_T**



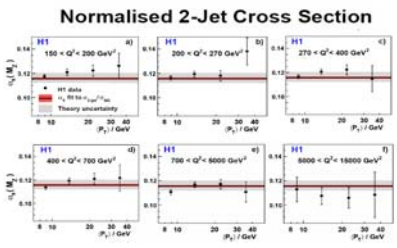
High (150 – 15000 GeV^2) Q^2 events. $0.2 < y < 0.7$



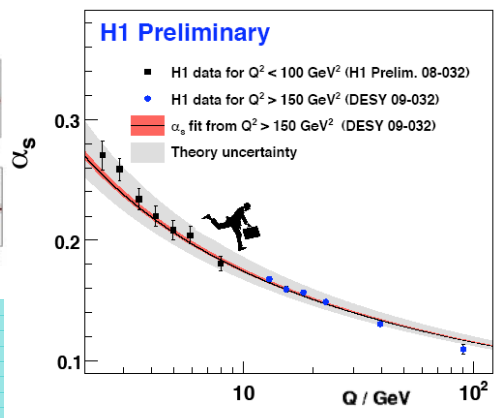
The normalized jet cross sections have significantly reduced experimental uncertainties. Data are well described by NLO QCD within the experimental uncertainties (2-6%). Theory uncertainty (5-10%) dominates.

Experimentally the most precise extraction of α_s

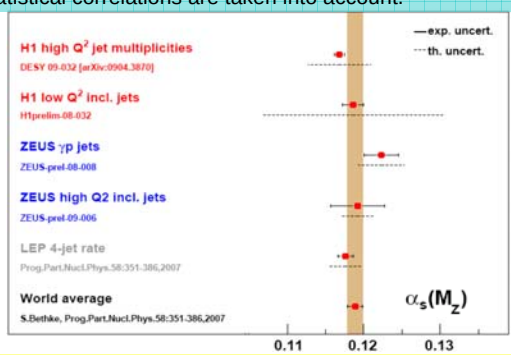
The strong coupling $\alpha_s(M_Z)$ is extracted by fitting NLO QCD predictions to the normalized inclusive, 2-jet, 3-jet cross sections at high Q^2 and for inclusive jet cross sections at low Q^2 separately using the "Hessian" method. The statistical correlations are taken into account.



Comparison of $\alpha_s(M_Z)$ value extracted from normalized 2-jet cross section with $\alpha_s(M_Z)$ determined from each (Q^2, P_T) bin (*black dots*). This comparison as well as comparisons with normalized inclusive and 3-jet cross sections (for high Q^2) and inclusive jet cross sections (for low Q^2) show that $\alpha_s(M_Z)$ extraction is self consistent.



$\alpha_s(Q)$ running over 2 orders of magnitude in Q



The experimentally most precise determination of $\alpha_s(M_Z)$

$$\alpha_s(M_Z) = 0.1168 + 0.0007(\text{exp})\ ^{+\ 0.0046}_{-\ 0.0030}\ (\text{th}) + 0.0016\ (\text{PDF})$$

is derived at high Q^2 from a common fit to the normalized jet cross sections. It agrees well with the world average.

The relative experimental error is below 1%, four times smaller than the theoretical uncertainties.