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Precision Measurement and QCD Analysis of the Inclusive Deep Inelastic *ep* Scattering Cross Section at Low Q^2

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A measurement of the deep inelastic scattering cross section is reported for momentum transfers squared $2 \leq Q^2 \leq 120$ GeV^2 and for Bjorken-x values $3 \cdot 10^{-5} < x < 0.1$. The data were collected by the HERA experiment H1 in the years 1996 and 1997, with a luminosity of 20 pb^{-1} for $Q^2 > 10$ GeV^2, of 2 pb^{-1}, taken in a dedicated run, for Q^2 below 10 GeV^2 and of 5 pb^{-1} using a special trigger to access the region of high inelasticity up to $y \simeq 0.9$. This measurement is by about a factor of two more accurate than results published previously, and it uses in the lower Q^2 region the new Backward Silicon Tracker of the H1 experiment. A QCD analysis of the cross section data, combined with fixed target experiments, shows theory to NLO to be in very good agreement with the new data. A rather precise measurement is obtained of the gluon distribution $xg(x, Q^2)$ in the proton. A novel technique has been developed to determine the longitudinal structure function $F_L(x, Q^2)$ using the measured derivative $\partial\sigma/\partial \log y$. This permitted the range of access to F_L to be extended down to low Q^2 values of 3 GeV^2.