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Diffractive structure functions and extraction of PDFs with H1

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In 2004, the H1 Collaboration at HERA installed the Very Forward Proton Spectrometer (VFPS) located at 220m from the interaction point, in the cold section of the proton ring. The spectrometer consists of two Roman Pot stations equipped with scintillating fiber detectors. The device allows the measurement of diffractive proton momentum in the range 0.009 < xpom < 0.025, where xpom is the energy fraction lost by the proton in the interaction, with a very high acceptance (above 90%). The inclusive diffractive deep inelastic scattering, ep -> e gamma* p -> e X p, has been measured with the H1 detector at HERA using VFPS to measure the scattered proton momentum. The cross section is measured differentially in Q2, xpom and beta and compared to previously measured cross section at HERA. A measurement of the longitudinal diffractive structure function F_L^D at low Q2 is also presented. Measurements of the diffractive cross-section at centre of mass energies \sqrt{s} of 225 and 252 GeV in the Q2 range of [2.5; 7] GeV2, using HERA data taken in 2007, are combined with a published measurement at $\sqrt{s}$ of 300 GeV. The structure function F_L^D is extracted from these cross-sections at high values of inelasticity y. Measurements of the cross section for the diffractive process ep -> eXY are also presented, where Y is a proton or a low mass proton excitation carrying a fraction 1-x_IP > 0.95 of the incident proton longitudinal momentum and the squared four-momentum transfer at the proton vertex satisfies |t| < 1.0 GeV2. The cross section is measured for photon virtuality in the range 3.5 < Q2 < 90 GeV2, triple differentially in x_IP , Q2 and beta=x/x_IP , where x is the Bjorken scaling variable. These measurements are done after selecting diffractive events showing a large rapidity interval between the hadronic systems X and Y. Recent H1 measurements of the diffractive DIS cross section based on the reconstruction of a large rapidity gap or the detection of the scattered proton in the FPS or VFPS detectors have been used to extract a new set of diffractive parton distribution functions. The NLO QCD fit fully exploits the possibility that, according to the DDIS factorisation theorem which holds at fixed x_pom, the parton content of the colourless exchange may depend continuously on the x_pom variable. In particular the new fitting strategy does not assume proton vertex factorisation nor inputs from Regge
theory in its x_pom dependence.

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