INCLUSIVE CHARGED PARTICLE SPECTRA IN PHOTOPRODUCTION AT H1

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Inclusive charged particle spectra are measured in photoproduction with the H1 detector at HERA, using an integrated luminosity of $\mathcal{L} \simeq 1.3\ \mathrm{pb}^{-1}$. The transverse momentum (p_T) distribution extends to 12 GeV/c, and agrees with a LO QCD calculation. The pseudo-rapidity (η) distribution is shown to be sensitive to the partonic content of the photon.

1 Introduction

At HERA, photoproduction processes allow to study the hadronic structure of the photon. Complementarily to the usual jet analysis [1], inclusive charged particle distributions suffer less from both theoretical and experimental ambiguities, and, even if the information gained is more of indirect nature, can also provide precise checks of the QCD description of the photon [2].

2 Detector and data analysis

The data used here were taken with the H1 detector [3] in 1994 at HERA, colliding beams of e^+ and p with energies of 27.5 GeV and 820 GeV respectively. They represent an integrated luminosity $\mathcal{L} \simeq 1.3\ \mathrm{pb}^{-1}$. Events are first selected online by asking for the positron scattered at low angles to be detected in the e-tagger (which restricts y and Q^2, the fractional energy and the virtuality of the photon in the range $0.3 < y < 0.7$, $Q^2 < 0.01\ \mathrm{GeV}^2$) in coincidence with a track in the central tracker with $p_T > 0.4$ GeV/c. Final event and track selection requires at least one well measured track, originating from a vertex in the expected interaction region, with $p_T > 2$ GeV/c and in the central region $|\eta| < 1$. For these tracks, the resolution in p_T is $\sigma(p_T)/p_T \simeq 0.8\%.p_T$ (p_T in GeV/c). Data have been fully corrected for all known detector effects, such as trigger efficiency, e-tagger acceptance, track reconstruction and selection efficiency, and finally migrations in p_T. Details on the correction procedure and the estimation of systematic errors can be found elsewhere [4].

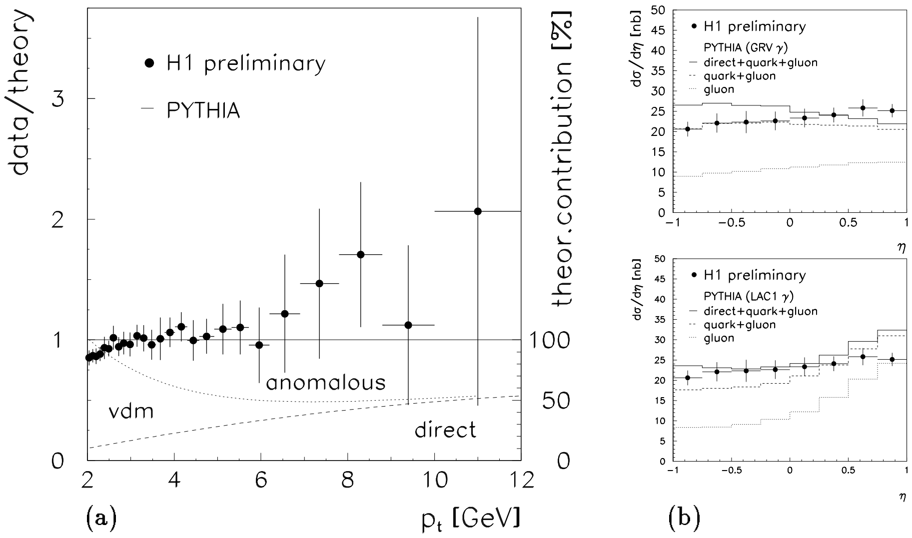

Figure 1: (a) Ratio of the inclusive charged particle cross-section in photoproduction measured in H1 at HERA and a LO QCD calculation from PYTHIA, as a function of p_T. The three areas between the curves represent the contributions to this calculation from the direct, VDM and anomalous components of the photon. (b) Inclusive charged particle cross-section $d\sigma/d\eta$ measured in H1 as a function of η for $p_T > 2$ GeV/c, and compared with a LO QCD calculation (full lines) from PYTHIA using the parton distributions of the photon GRV (top) and LAC1 (bottom). Also shown are the resolved component (dashed lines) and the gluon part (dotted lines) of this resolved contribution.

3 Results and interpretation

The double differential cross-section $d^2\sigma/d(p_T^2)d\eta$ averaged over $|\eta| < 1$ and divided by LO QCD calculation from PYTHIA [5] is presented in figure 1(a) as a function of p_T in the range $2 < p_T < 12$ GeV/c. Details on the parameters used in Monte-Carlo calculations can be found elsewhere [6]. The theoretical prediction overshoots the data by 20% at $p_T \sim 2$ GeV/c, in a region where multiple parton interactions are still expected to contribute. Above $p_T = 2.5$ GeV/c there is a good agreement between data and theory. On the same figure, one can see the relative contributions of the direct, VDM and anomalous components of the photon. As expected, when going to high p_T, only the anomalous and direct component contribute each for half of the cross-section.

The differential cross-section $d\sigma/d\eta$ as a function of η is presented in figure 1(b) together with the PYTHIA [5] predictions (full line) using two different parton distributions of the photon, GRV [7] (top) and LAC1 [8] (bottom). Also shown are the contributions of the resolved component of the photon (dashed line) and of the gluon part of this resolved component (dotted line). Since the η interval used corresponds on average to a parton energy fraction between $x_\gamma \sim 0.05$ ($\eta = 1$) and $x_\gamma \sim 0.4$ ($\eta = -1$), one can see the sensitivity of the data to the parton distributions as function of x_γ : for example, a steep rise of the gluon distribution at low x_γ, as predicted by the LAC1 parameterization, is not supported by the data.

4 Conclusion

A new measurement of inclusive charged particle distributions in photoproduction at H1 has been presented. It allows to check the validity of the QCD description of (quasi-real) photon-proton interactions, and to put constraints on the partonic content of the photon.

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