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Longitudinal structure function F_L at small x extracted from the Berger–Block–Tan parametrization of F_2

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The longitudinal structure function $F_L(x,Q^2)$ is extracted at low values of the Bjorken variable x from the Berger–Block–Tan (BBT) parametrization [1–4] of $F_2(x,Q^2)$, which describes fairly well the available experimental data on the reduced cross sections and, at asymptotically low x, provides a behaviour of the cross sections $\sim \ln^2 1/x$, in accordance with the Froissart predictions [5]. In order to maintain the correct asymptotical behaviour of the longitudinal structure function $F_L(x,Q^2)$, it is sought in the same form as the BBT parametrization of $F_2(x,Q^2)$. To facilitate our calculations, the corresponding parametrizations of $F_2(x,Q^2)$ and $F_L(x,Q^2)$ are considered in space of Mellin momenta. This allows to find the parameters of $F_L(x,Q^2)$ in an explicit analytical form. The extracted longitudinal structure function is in a reasonable good agreement with the available experimental data.

In Figure 1 we present an example of the extracted SF $F_L^{\rm BBT}(x,Q^2)$ at a fixed value of the invariant mass $W^2=(p+q)^2$ in comparison with the available experimental data of the H1-collaboration [6]. The shaded area represents the uncertainties in the BBT parameters obtained in [4]. It can be seen that the suggested extraction procedure describes fairly well the data, especially in the interval $Q^2 > 5\,\mathrm{GeV}^2$. At lower values of the momentum transfer $Q^2 < 5\,\mathrm{GeV}^2$ the next-to-leading (NLO) corrections and their resummation (see, e.g. [7]) become rather important. An analogous analysis of the $F_L^{\rm BBT}(x,Q^2)$ at low x and Q^2 with NLO taken into account will be presented elsewhere.

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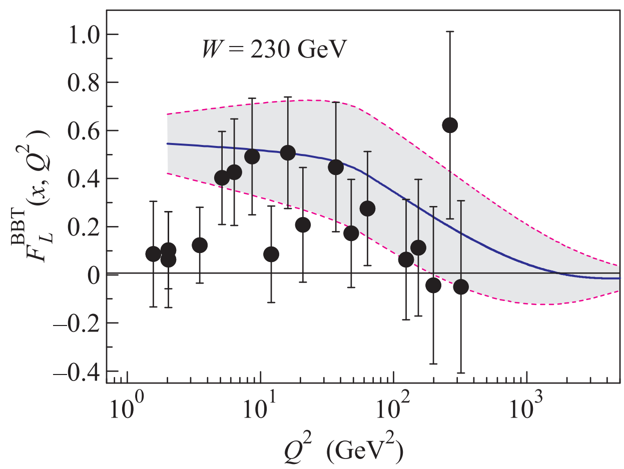

Fig. 1. (Color online) Q^2 dependence of the extracted longitudinal SF $F_L^{\rm BBT}(x,Q^2)$ at fixed value of the invariant mass $W = 230\,\mathrm{GeV}$, solid curve. The shaded area corresponds to uncertainties of the BBT parameters in [4]. Experimental data by the H1 Collaboration are taken from [6]

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