

MRST'2004 QED PDF's and W mass calculations

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Upon reading the paper introducing MRST'2004 PDFs (hep-ph/0411040), I believe they do not offer practical advantages compared to the regular PDF's, when predicting contributions to W boson production due to initial-state electroweak radiation.

1. Both standard and QED versions of MRST'2004 PDFs are outdated and should not be used, as acknowledged by the MSTW authors themselves (arXiv:0901.0002).
2. MRST'2004 QED PDFs do not provide an estimate of PDF uncertainties.
3. The NLO-QED initial-state brehmstralung contribution $q + \bar{q} \rightarrow W + \gamma$ is of the same order in electroweak coupling as the NLO-QED $q + \gamma^* \rightarrow q + \gamma$ Compton scattering contribution to neutral-current DIS cross sections. The latter EW contribution to the DIS hard cross section does not seem to be included in the MRST'2004 QED global analysis, which evaluates the photon radiative contributions in the PDF evolution, but not in the hard cross sections for the fitted processes (at Born level in the QED coupling). Therefore, the MRST'2004 QED PDFs do not provide the NLO-QED accuracy for the initial-state contribution in the W production process.
4. Inclusion of photon radiation into the PDF evolution introduces isospin violation due to the difference in electric charges of up-type and down-type quarks. Therefore, the u -quark PDF in the proton and d -quark PDF in the neutron are two different functions. A QED fit must introduce additional nonperturbative PDFs for the photon and for isospin breaking for both valence quarks and sea (anti)quarks (at least three additional nonperturbative functions). The initial parametrization of these functions at $Q \approx 1$ GeV is very uncertain, nor the experimental data exist which can constrain them reliably. This makes the MRST'2004 QED fit a representative parametrization at best, without a credible estimate of the associated theoretical uncertainty.