

# Global QCD Analysis of Polarized Semi-Inclusive DIS Data and Fragmentation Functions

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We have set up a global perturbative QCD analysis framework to LO or NLO for deep-inelastic lepton-nucleon scattering (DIS), hadron reactions, and  $e^+e^-$  reaction. Parton distribution functions and fragmentation functions are both analyzed with QCD  $Q^2$  evolution.

Many of DIS experiments nowadays employ semi-inclusive measurement of DIS where hadrons in the final states are detected. So, a simple analysis of inclusive scattering is insufficient. The fragmentation process needs to be included for analyses of semi-inclusive data to extract parton distribution functions.

Hadron production in proton-proton collision such as RHIC contains both parton distribution functions and fragmentation functions, but prompt photon production at RHIC includes only parton distribution functions.

Hadron production in  $e^+e^-$  annihilation is one of the solid methods to study fragmentation functions.

The double spin asymmetry in  $\pi^{+-}$  or  $K^{+-}$  production in polarized DIS was analyzed together with inclusive DIS data. Unlike the analysis of inclusive data alone,  $u$ bar,  $d$ bar, and  $s$  quarks can be handled separately with semi-inclusive data.

We will present our recent results of the QCD analysis, including the following points:

- QCD analysis of polarized DIS, with both inclusive and semi-inclusive data,
- Estimation of possible uncertainties of fragmentation functions,
- Study of effects of these uncertainties on the calculation of spin asymmetry in semi-inclusive DIS,
- Study of impacts of these uncertainties on the extraction of quark helicity distribution functions.

