Why Interference Fragmentation Functions ?

Rainer Jakob

Fachbereich Physik, Universität Wuppertal, Germany

In this talk the conceptual problems of building explicite models for one-hadron inclusive T_N-odd fragmentation functions (FFs) are discussed. Understanding the basic obstacles in incorporating final state interactions (FSI), exemplified for the case of the spectator model, leads naturally to the consideration of two-hadron interference FFs, for which FSI are much easier to model.

Following the reasons for the failure of attempts to invent simple models for one-hadron T_N-odd FFs is rather illustrative, and may explain why there are only parameterizations, but no explicite model calculations available, for instance, for the Collins function.

The reasoning takes the following steps:

- A classification scheme of transverse momentum dependent FFs with regard to their partonic and hadronic spin/helicity information, their chiral symmetry properties, and their behavior under so-called naive time-reversal (T_N) is briefly discussed (cf. contribution by Piet Mulders and references therein).
- The class of T_N-odd FF which can be non-vanishing only in the presence of FSI is of particular interest. A prominent function is the so-called "Collins function", $H_1^{\perp}(z, \mathbf{k_T})$, which is a potential chiral-odd partner in a measurement of the quark transversity function, h_1, from azimuthal asymmetries in one-hadron inclusive hard scattering processes.
- The modeling of one-hadron T_N-odd FFs faces severe problems which are discussed. Different cases are considered where the observed hadron interacts with
    a. hadrons in the target remnant jet (factorization breaking)
    b. an effective external potential (generally breaks transl./rotational invariance)
    c. hadrons within the same jet (simple ansätze can be redefined into a vertex).

  For the latter class of FSI the technical problems are exemplified in a simple toy model using the general properties of the FFs and the general classification scheme. The example reveals that a phase difference between different reaction channels is necessary, but not sufficient to produce T_N-odd FF.

A more detailed discussion can be found in [1,2]. A calculation of T_N-odd two-hadron interference FFs is presented in an accompanying talk by Marco Radici.

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[1] A. Bianconi, S. Boffi, R. Jakob and M. Radici, Phys. Rev. **D62** (2000) 034008.

[2] A. Bianconi, S. Boffi, R. Jakob and M. Radici, Phys. Rev. **D62** (2000) 034009.