Role of the $\mathbf{k}_T$ - dependant transversely polarized parton distributions in $p\,p\uparrow\longrightarrow\pi+X$

X. Artru

Institut de Physique Nucléaire de Lyon, IN2P3-CNRS & Université Claude-Bernard, F-69622 Villeurbanne cedex, France.
e-mail: x.artru@ipnl.in2p3.fr

Single spin asymmetries A_N in inclusive meson production from polarized protons can be *qualitatively* explained [1] as a product of the ordinary ($\mathbf{k}_T$ - averaged) transversity distribution $\delta q(x)$ and the (Collins) asymmetry $\delta D(z,\mathbf{r}_T)$ of the polarized quark fragmentation function. *Quantitatively*, however, the positivity constraint (Soffer inequality) [2] imposed on the first factor makes it difficult to reproduce the large size of the observed asymmetry [3]. This difficulty can be avoided [4] by taking into account the trigger bias in $\mathbf{k}_T$ and the $\mathbf{k}_T$ - dependent tranversity distribution [5], which depends on the azimuth of $\mathbf{k}_T$ and obeys the weaker positivity constraint [6] $|\delta_{\hat{\mathbf{x}}}q(x,\mathbf{k}_T)\pm\delta_{\hat{\mathbf{y}}}q(x,\mathbf{k}_T)|\leq 2q^{\pm}(x,\mathbf{k}_T)$, where the $\hat{\mathbf{x}}$ (resp. $\hat{\mathbf{y}}$) subsript refers to the transfer of transversity along the $\hat{\mathbf{x}}$ (resp. $\hat{\mathbf{y}}$) axis. These inequalities are saturated by a simple (quark + scalar-diquark) model of the nucleon [7]. Taking this model, we have made an analytic calculation of the single spin asymmetry in inclusive meson production, fixing x and z and assuming gaussian dependances in $\mathbf{k}_T$ and $\mathbf{r}_T$ for the polarized quark distribution and fragmentation functions. The unpolarized and polarized inclusive $\mathbf{p}_T$ distributions of the meson (normalized to unity), σ and $\sigma+\delta\sigma$, as well as the asymmetry $A_N(x_F,\mathbf{p}_T)\equiv\delta\sigma/\sigma$ are displayed. The comparison between the curves without and with the inclusion of the $\mathbf{k}_T$ dependance of the quark transversity shows that the latter enhances A_N by a factor two at least, the maximum asymmetry being obtained at twice larger $\mathbf{p}_T$.

- [1] X. Artru, J. Czyzewski, H. Yabuki, Z. Phys. C73 (1997) 527; M. Anselmino, M. Boglione, F. Murgia, Phys. Rev. D60 (1999) 054027; M. Boglione and E. Leader, Phys. Rev. D61 (2000) 61.

- [2] J. Soffer, Phys. Rev. Lett. 74 (1995) 1292.
- [3] M. Boglione and E. Leader, Phys. Rev. D61 (2000) 61.
- [4] X. Artru, RIKEN-BNL workshop "Future Transversity Measurements", Brookhaven 18-20 sept. 2000.
- [5] A. Kotzinian, Nucl. Phys. B 441 (1995) 234; R.D. Tangerman, P. Mulders, Phys. Lett. B 352 (1995) 129.
- [6] A. Bachetta, M. Boglione, A. Henneman, P.J. Mulders, Phys. Rev. Lett. 85 (2000) 712.
- [7] X. Artru, M. Mekhfi, Z. Phys. C45 (1990) 669; H. Meyer, P.J. Mulders, Nucl. Phys. A 528 (1991) 589.