Implementation of the Goloskokov-Kroll model pseudoscalar meson leptoproduction in PARTONS

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Leptoproduction of mesons

- Factorization for electroproduction of mesons, only for longitidunally polarized photons, has been proven [Collins-Frankfurt-Strikman '97]
- For transversely polarized photons, cross section is power suppressed by $1/Q$ [Collins-Frankfurt-Strikman '97]
- But in some kinematics, it is apparent that transversely polarized photons contributes substantially [HERMES Collaboration, arXiv:0907.2596]

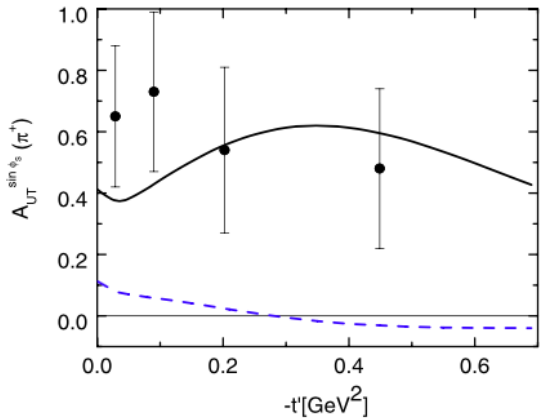

Fig. 2 (Color online) The $\sin\phi_s$ moment for a transversely polarized target at $Q^2 \simeq 2.45$ GeV^2 and $W = 3.99$ GeV. The prediction from our handbag approach is shown as a *solid line*. The *dashed line* is obtained disregarding the twist-3 contribution. Data are taken from [10]

Figure: [Goloskokov-Kroll '10, arXiv:0906.0460]

Goloskokov-Kroll model

- Goloskokov-Kroll(GK) model for pseudoscalar meson production considers the region of small ξ and small $-t$, but large Q^2 and W
- Contributions from transversely polarized photons can be computed as a twist-3 effect in the handbag mechanism
- In pseudoscalar meson production, the following amplitudes are relevant [Goloskokov-Kroll '11, arXiv:1106.4897]

$$\mathcal{M}_{0+,0+} = \sqrt{1-\xi^2}\frac{e}{Q}[\langle\tilde{H}\rangle - \frac{\xi^2}{1-\xi^2}\langle\tilde{E}\rangle]$$

$$\mathcal{M}_{0-,0+} = \frac{e}{Q}\frac{-t'}{2m}[\xi\langle\tilde{E}\rangle]]$$

$$\mathcal{M}_{0-,++} = \sqrt{1-\xi^2}e\,\langle H_T\rangle$$

$$\mathcal{M}_{0+,\mu+} = -\frac{e}{4m}\sqrt{-t'}\langle\bar{E}_T\rangle$$

Goloskokov-Kroll model

- Generically, $\langle F \rangle$ represents a convolution of a GPD F with an appropriate subprocess amplitude

$$\langle F \rangle = \sum_{\lambda} \int_{-1}^{1} dx \, \mathcal{H}_{\mu'\lambda,\mu\lambda}(x, \xi, Q^2) \, F(x, \xi, t)$$

  where λ denotes unobserved helicities of the partons.
- Subprocesses are calculated in the so-called modified perturbative approach: Transverse momenta of the quark and the anti-quark in the meson are kept and gluon radiations are taken into account through Sudakov factor
- In impact parameter space

$$\mathcal{H}_{\pi} = \int d\tau d^2\vec{b} \, \hat{\Psi}_{\pi}(\tau, -\vec{b}) \hat{\mathcal{F}}^{i}_{\pi}(\bar{x}, \xi, \tau, Q^2, \vec{b}) \alpha_s(\mu_R) \, exp\big(- S(\tau, \vec{b}, Q^2)\big)$$

Goloskokov-Kroll model

- Goloskokov-Kroll model works reasonable well at COMPASS kinematics [COMPASS Collaboration, arXiv:1903.12030]

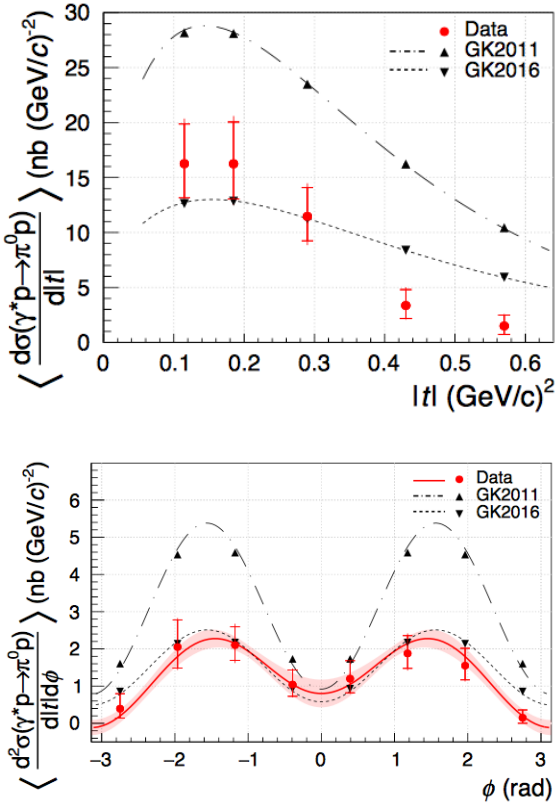

Figure: $|t|$ and ϕ dependence of exclusive π^0 leptoproduction at kinematics $< Q^2 > = 2GeV^2$, $< x_{Bj} > = 0.093$.

PARTONS

B. Berthou et al., Eur.Phys.J. C78 (2018) 6, 478

- PARtonic Tomography Of Nucleon Software (PARTONS) is a software framework dedicated to the phenomenology of GPDs
- Bridge between models of GPDs and experimental data
- Website: http://partons.cea.fr

Final remarks

- Why are we interested in π^0?
  - access to the chiral-odd GPDs
  - background to DVCS
  - important for detector studies
- PARTONS is flexible to accommodate other models and channels
- Implementation of the code in PARTONS is ongoing
- Up-to-date parameters from P. Kroll
- Several cross checks have been performed in Mathematica