

Pion and Kaon Structure Functions – Implications for Pion/Kaon PDFs

Richard Trotta

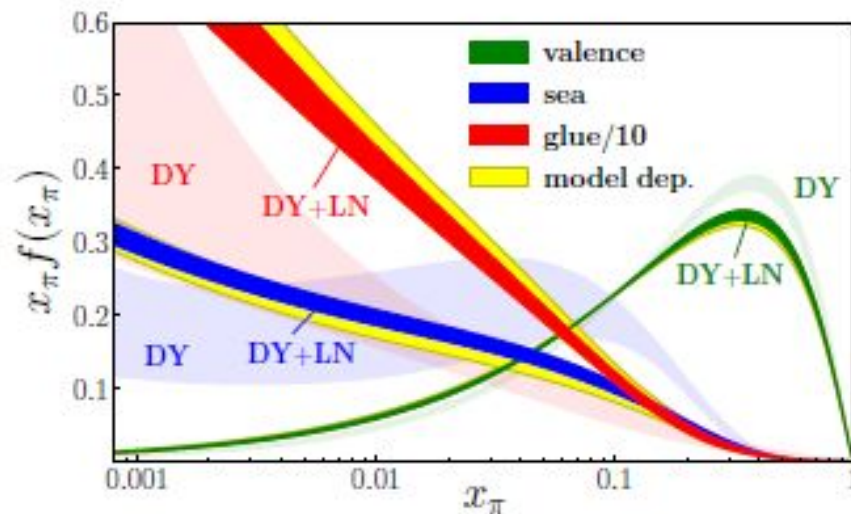
In collaboration with...

Vladimir Berdnikov, Tanja Horn, Nicholas
Mecholsky, Ian Pegg, Nobuo Sato



Pion Global PDF Impact for both DY and LN

- Plot from *Barry et al.* shows that DY has significantly high uncertainty
 - See Nobuo's talk from earlier
- LN will be our focus

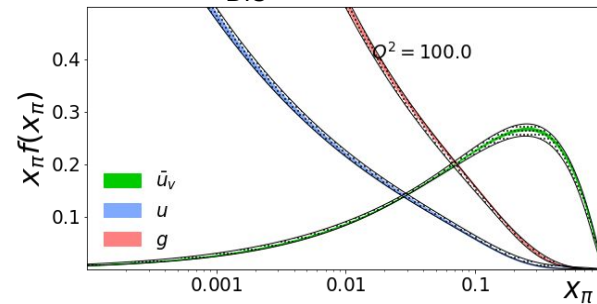
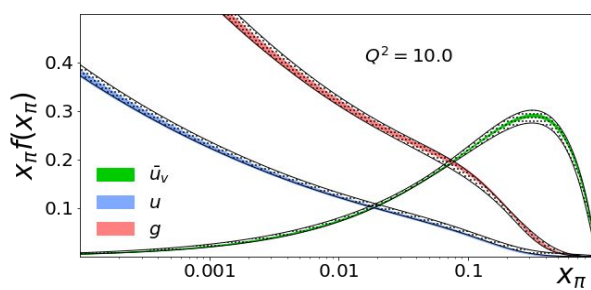


Pion Global PDF Impact Including EIC Projections

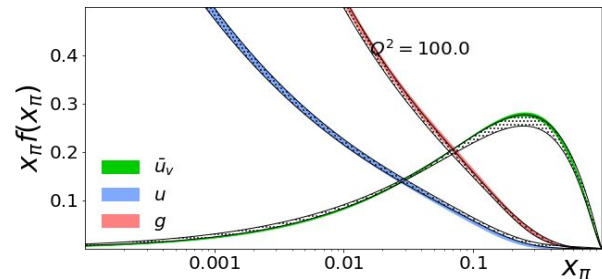
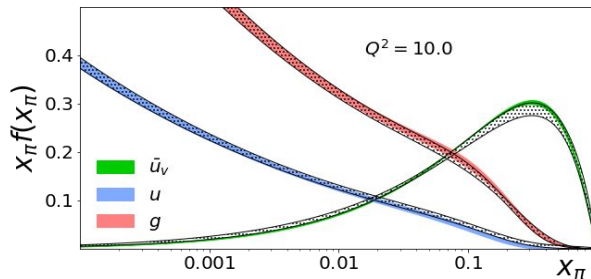
- πN t -exponential splitting function (*McKenney et al.*) with a $y < 0.2$ cut ($y = k^+/p^+$ NOT y_{DIS})
- 1% uncertainty assumed for cross section
- Can create similar plots for kaon by changing the value of the coupling constant

$$\mathcal{F} = \begin{cases} \text{(i)} & \exp((M^2 - s)/\Lambda^2) & s\text{-dep. exponential} \\ \text{(ii)} & \exp(D_{\pi N}/\Lambda^2) & t\text{-dep. exponential} \\ \text{(iii)} & (\Lambda^2 - m_\pi^2)/(\Lambda^2 - t) & t\text{-dep. monopole} \\ \text{(iv)} & \bar{x}_L^{-\alpha_\pi(t)} \exp(D_{\pi N}/\Lambda^2) & \text{Regge} \\ \text{(v)} & [1 - D_{\pi N}^2/(\Lambda^2 - t)^2]^{1/2} & \text{Pauli-Villars} \end{cases}$$

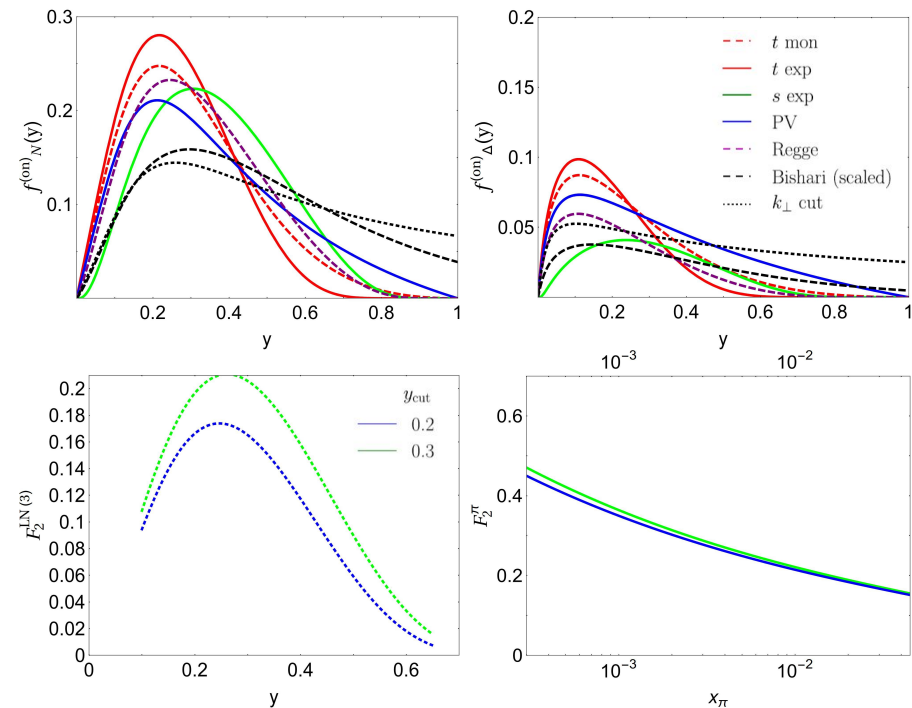
Kinematics: $\{0.01 < x < 0.08, 1.25 < Q^2 < 80.0, 0.1 < y_{\text{DIS}} < 0.8\}$



Kinematics: $\{0.1 < x < 0.8, 12.5 < Q^2 < 800, 0.1 < y_{\text{DIS}} < 0.8\}$



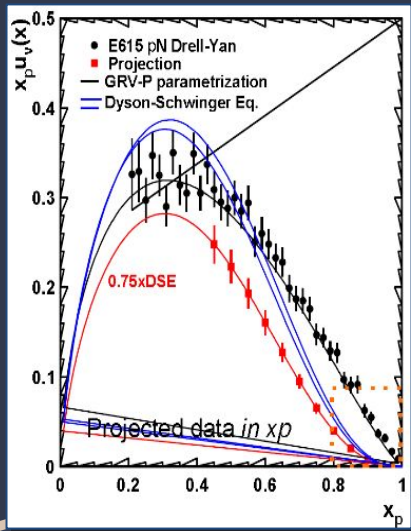
Recreation of Tagged Neutron Structure Function



- Recreated from *McKenney et al.* by Nick Mecholsky
- N & Δ splitting functions look good, as does the S.F. but the tagged neutron S.F. is off
- Goal is to parameterize the kaon in a similar global impact plot of EIC data on PDFs

$$F_2^{LN(3)}(x, Q^2, y) = 2f_N^{(on)}(y)F_2^{\pi}(x_{\pi}, Q^2)$$

Conclusion



- Global impact of pion is well documented with good projections for EIC data at low to moderate x .
- Kaon global impact is scarce.
- There are two approaches for obtaining EIC projections for kaon...
 - Global PDF Impact plot similar to pion with a change in the coupling constant
 - More rigorously through parameterization similar to *McKenney et al.* did for the pion
- Both methods will provide crucial analysis for the impact of EIC accessible kinematics and projected uncertainties on global PDF fits.
- See talks by Rachel, Rik, and Vladimir

Extra Slides

