

Reanalysis of $\pi^- N$ data including NLL threshold resummed contributions

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CERN, 26. 04. 2010



Pionic Parton Distributions

Hadronic cross section given as a convolution

$$\sigma = f^\pi(x_1, \mu^2) \otimes \hat{\sigma}(x_1, x_2, M^2, \mu^2) \otimes f^p(x_2, \mu^2)$$

- f^p very well determined by global analysis of proton data (CTEQ, MRST)
- $\hat{\sigma}$ full NLO (NNLO) calculations + NLL (NNLL) threshold resummed contributions available
- f^π poorly known, lack of data
 - NLO analysis of $\pi^- N$ Drell-Yan data: [Stirling et al. 1991](#)
 - Sea and gluon distributions from constituent quark model: [Gluck et al. 1999](#)

Reanalysis of $\pi^- N$ data including NLL resummed contributions

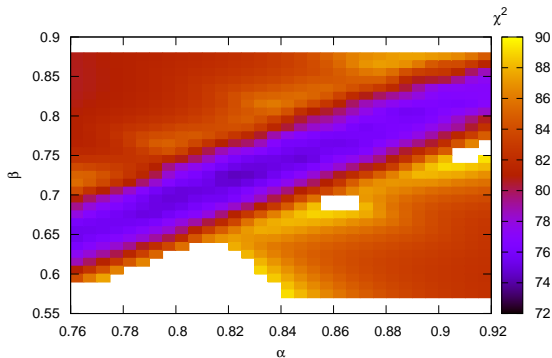
- Assume simple structure of pionic valence distribution at very low input scale $\mu_0^2 = 0.4 \text{ GeV}^2$

$$x f_V^\pi(x) = N_V x^\alpha (1-x)^\beta$$

- Fit to available Drell-Yan data

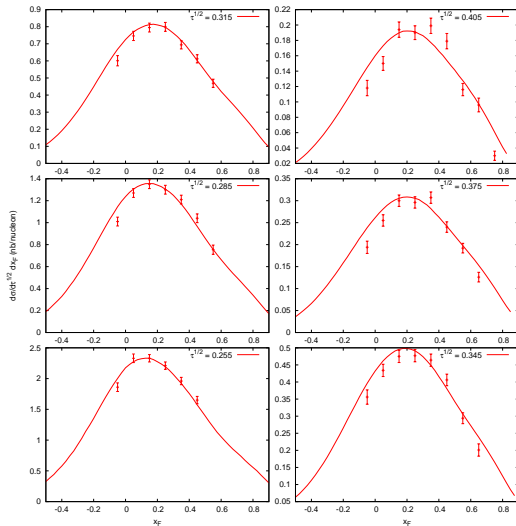
Matching to full NLO cross section

$$\begin{aligned} \sigma = & \text{NLL resummed } \sigma_{NLL} - 1. \text{ order expansion of } \sigma_{NLL} \\ & + \text{full NLO } \sigma_{NLO} \end{aligned}$$

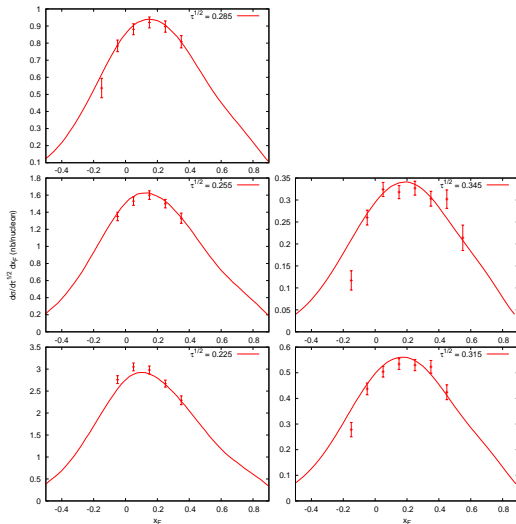
χ^2 -fit to Drell-Yan data from CERN-NA10 1985

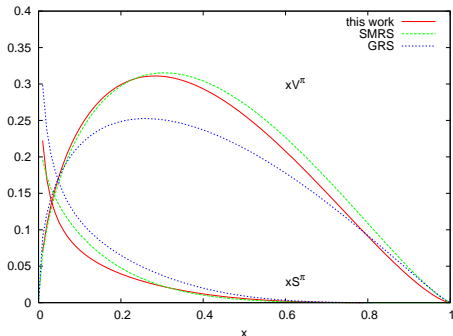
Best fit: $\alpha = 0.82$, $\beta = 0.72$, $\chi^2/\text{d.o.f.} = 73/61$, $K = 1.15$

π^- beam on a W target, $\sqrt{S} = 19.1$ GeV (CERN-NA10 1985)



π^- beam on a W target, $\sqrt{S} = 23.2$ GeV (CERN-NA10 1985)



χ^2 -fit to Drell-Yan data from CERN-NA10 1985

Pionic parton distribution functions at $\mu = 6$ GeV

- peak of the valence distribution slightly shifted to smaller x
- steeper decline of the valence distribution at high x

Cosistency check: Comparison with prompt photon data

$$\pi^- N \rightarrow \gamma + X$$

NLO: [Aurenche et al. 1988](#)

NLL resummation: [Catani et al. 1999](#)

500 GeV π^- beam on a Be target (Fermilab-E706 1993)

