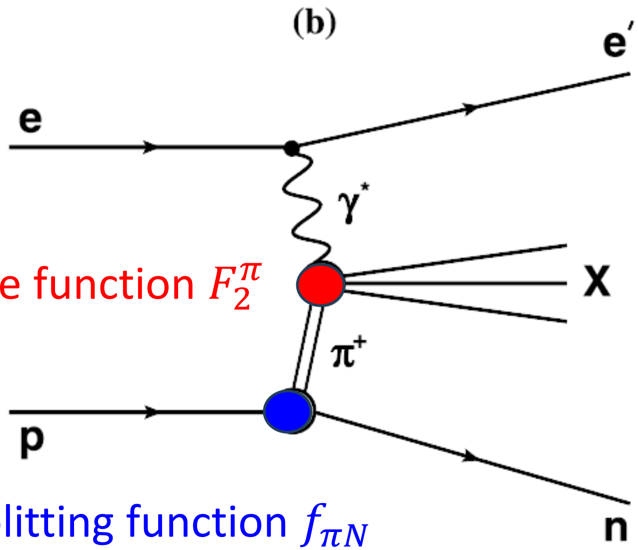
One-pion-exchange model



Pion structure function F_2^{π}

Splitting function $f_{\pi N}$

$$F_2^{\mathrm{LN}(4)}(x, Q^2, y, k_\perp) = 2 f_N^{(\mathrm{on})}(y, k_\perp) F_2^{\pi}(x_\pi, Q^2)$$

$$F_2^{\mathrm{LN}(3)}(x, Q^2, x_L) = 2 f_{\pi N}(\bar{x}_L) F_2^{\pi}(x_\pi, Q^2).$$

$$f_{\pi N}(\bar{x}_L) = \frac{g_A^2 M^2}{(4\pi f_\pi)^2} \int dk_\perp^2 \frac{\bar{x}_L [k_\perp^2 + \bar{x}_L^2 M^2]}{x_L^2 D_{\pi N}^2} |\mathcal{F}|^2,$$

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

F2NLO in the MSbar scheme

For massless DIS in the $\overline{\mathrm{MS}}$ scheme, with the perturbative expansion written as

$$F_2(x,Q^2) = x\sum_q e_q^2\left[(q+\bar{q}) \; + \; \frac{\alpha_s(Q^2)}{4\pi}\left(c_{2,q}^{(1)}\otimes(q+\bar{q}) + c_{2,g}^{(1)}\otimes g\right) + \cdots\right],$$

$$\begin{aligned} x(C_{2q}\otimes f)(x) = C_F\Big\{ & 2\int_x^1 dz\,\frac{\ln(1-z)}{1-z}\left[\hat{f}(x/z)-\hat{f}(x)\right] - \ln^2(1-x)\,\hat{f}(x) \\ & -\frac{3}{2}\int_x^1 dz\,\frac{\hat{f}(x/z)-\hat{f}(x)}{1-z} - \frac{3}{2}\,\hat{f}(x)\ln(1-x) \\ & +\int_x^1 dz\left[3+2z-(1+z)\ln(1-z)-\frac{1+z^2}{1-z}\ln z\right]\hat{f}(x/z) \\ & -\left(\frac{\pi^2}{3}+\frac{9}{2}\right)\hat{f}(x)\Big\}. \end{aligned}$$

$$C_{2g}(z) = T_R\left[\left(z^2+(1-z)^2\right)\ln\frac{1-z}{z} + 8z(1-z) - 1\right].$$

/ention,

$$x(C_{2g}\otimes g)(x) = \int_x^1 dz\, C_{2g}(z)\,\hat{g}\left(\frac{x}{z}\right).$$

F2NLO vs F2LO

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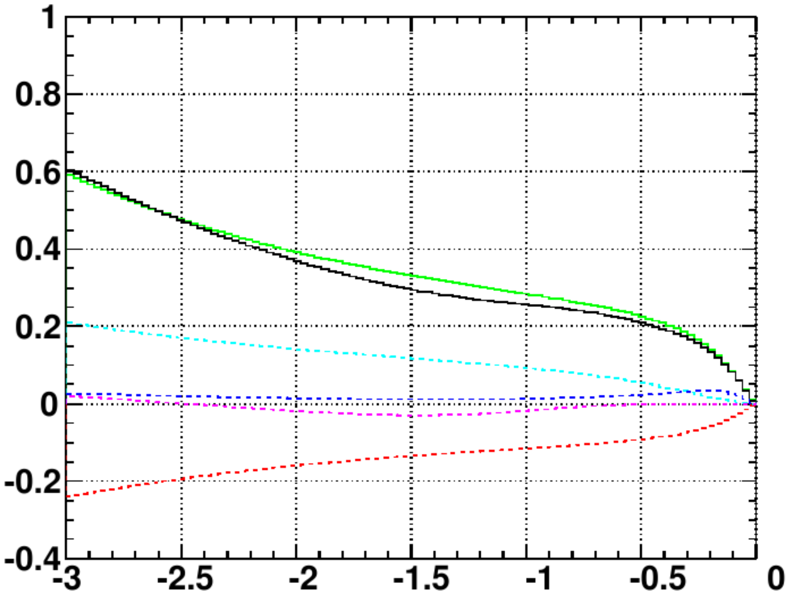
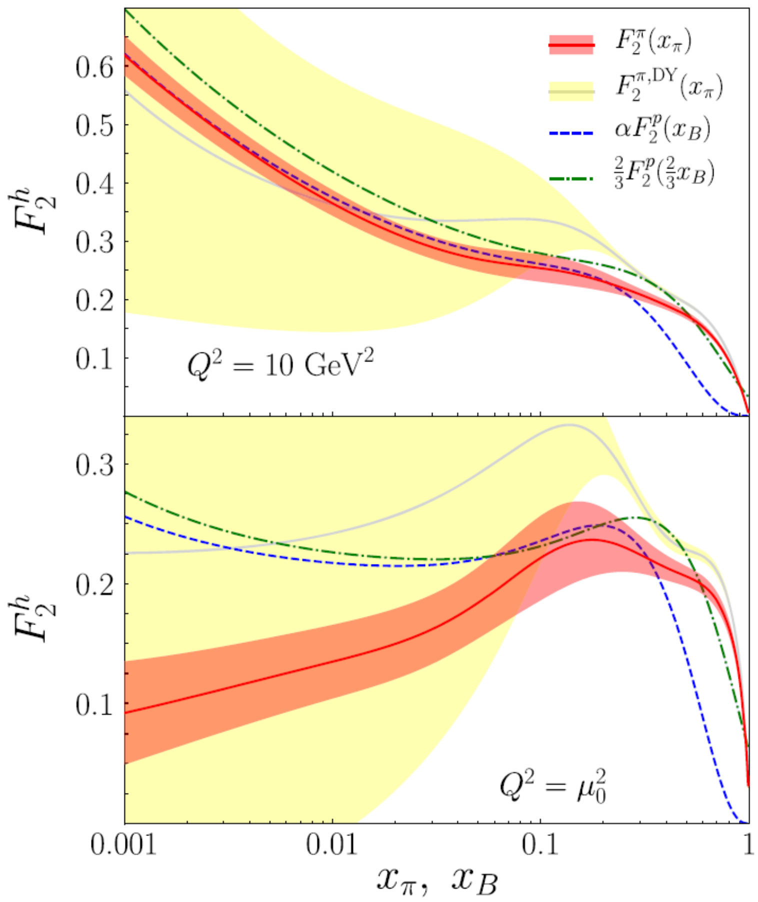
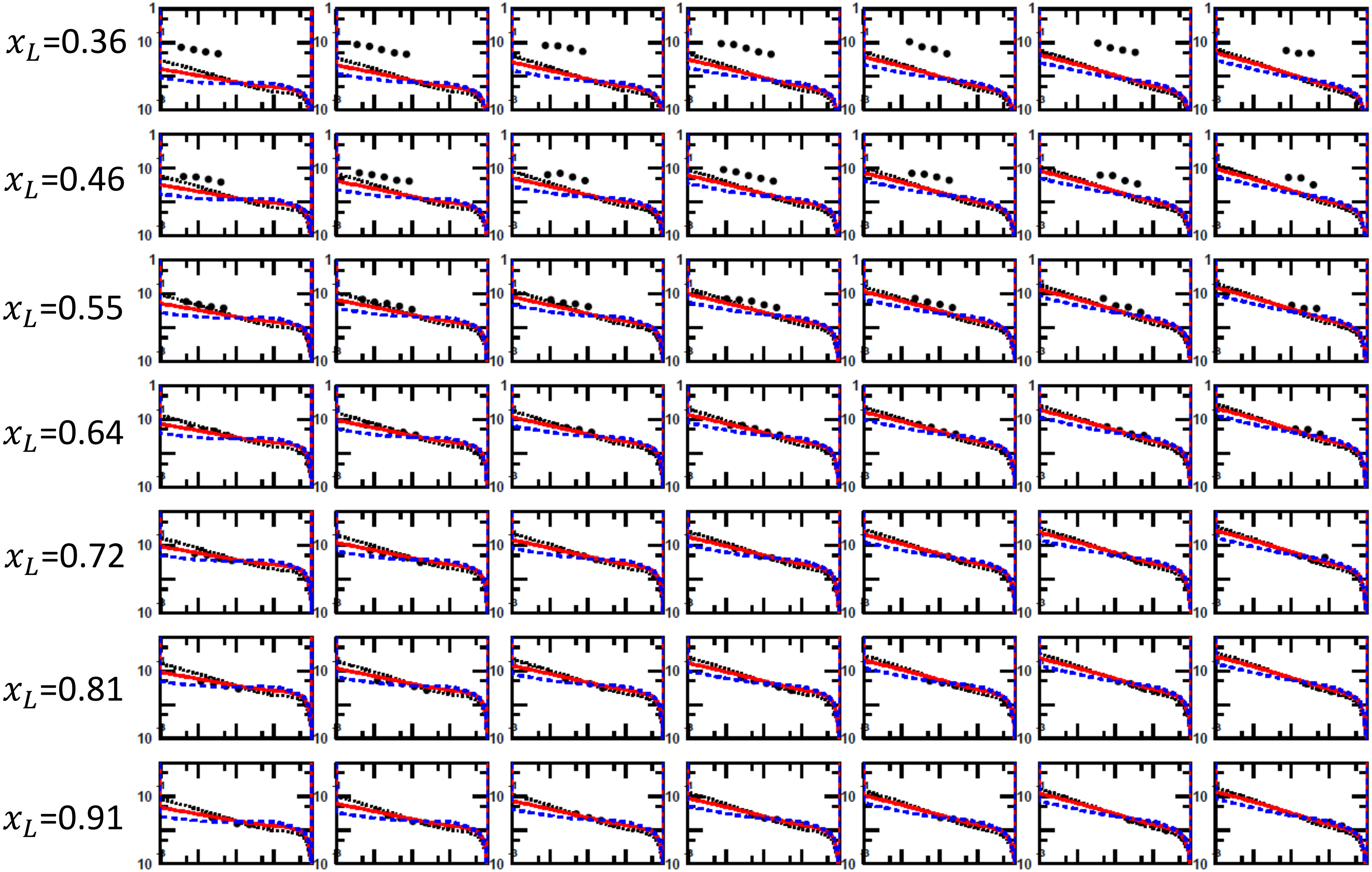




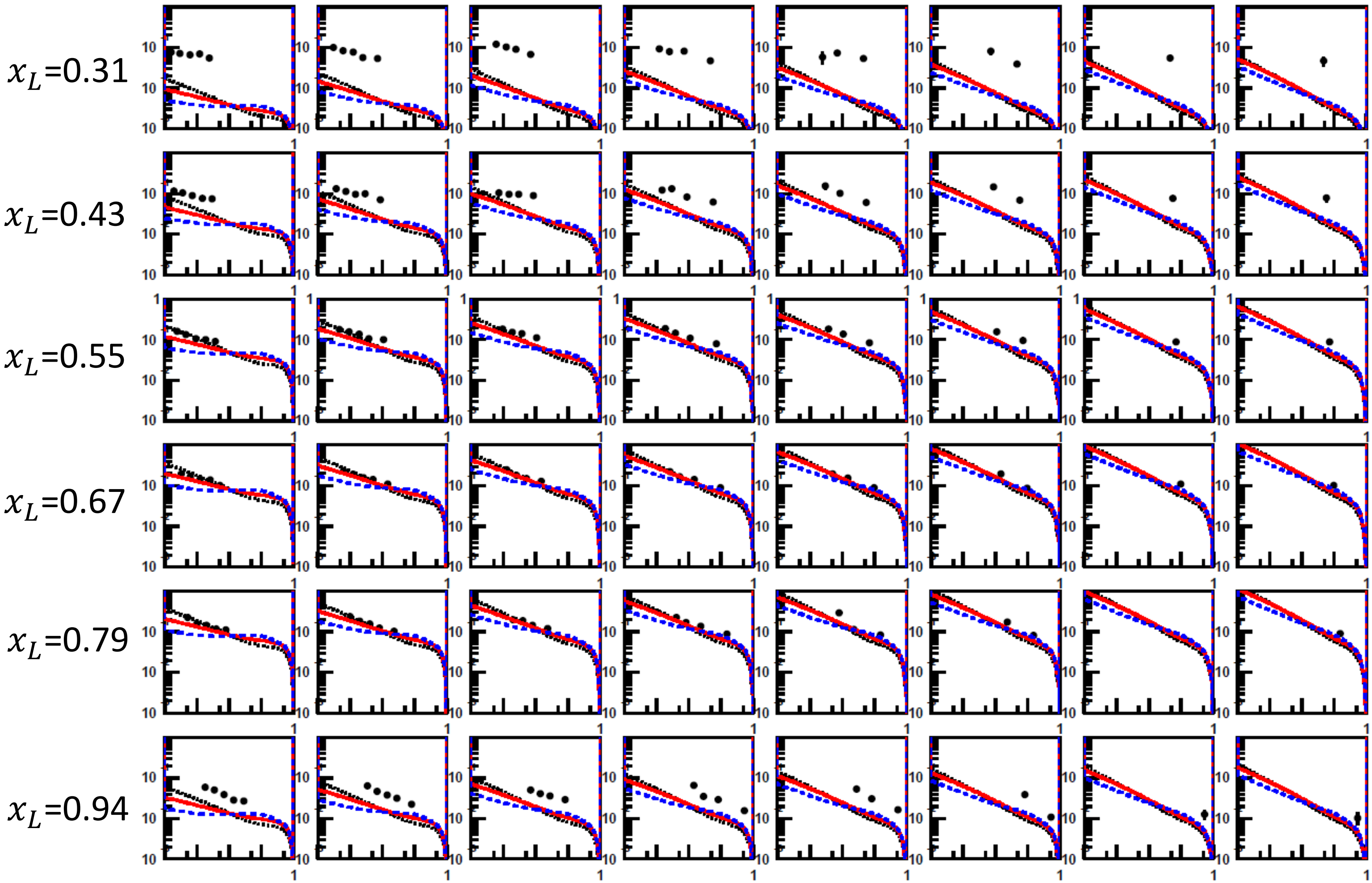
H1

Q2 vs. xL, F2LN(xpi)



ZEUS

Q2 vs. xL, F2LN(xpi)



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