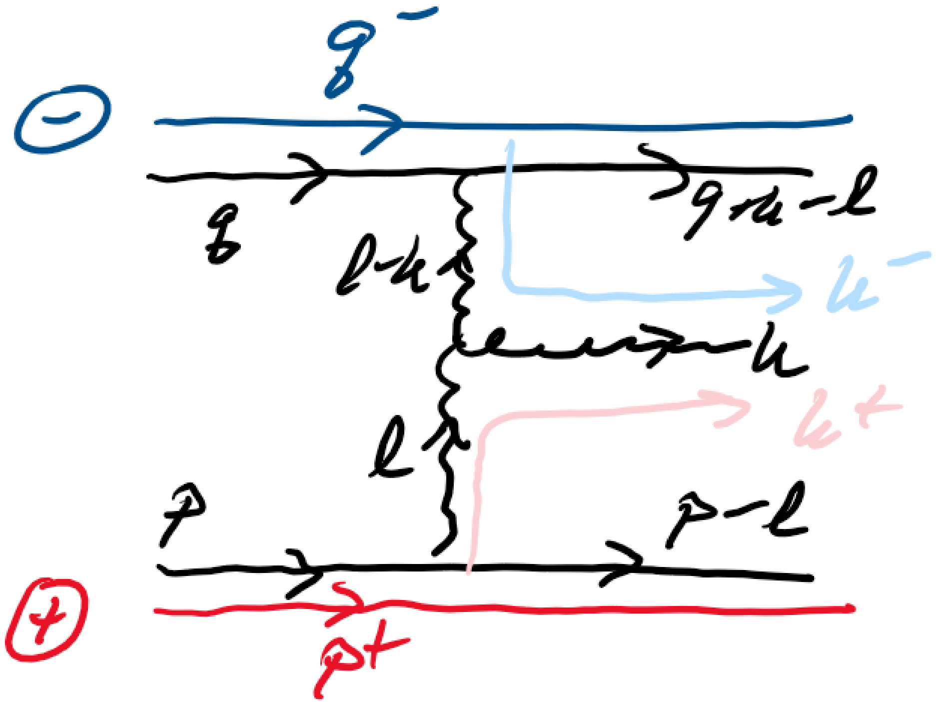
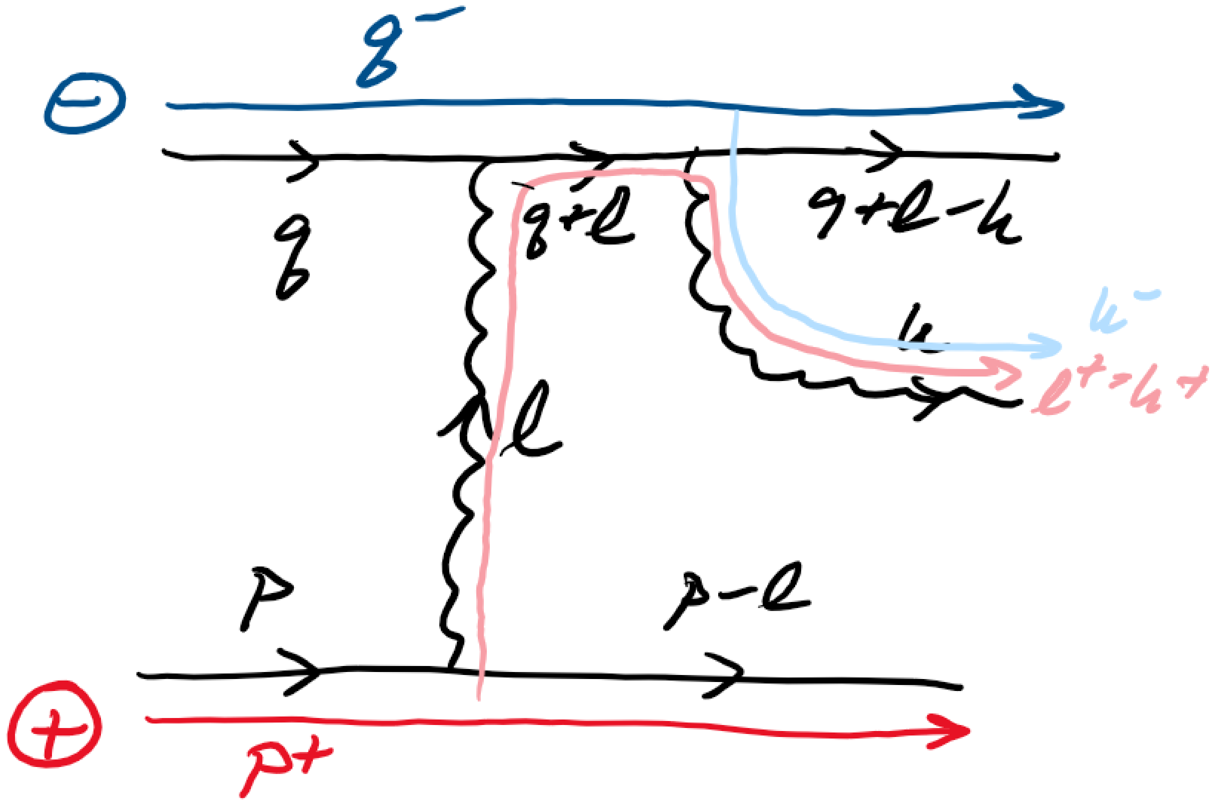
$$
\begin{cases}
p^\mu = \left(p^+, 0^-, \vec{0}_T\right) \\
q^\mu = \left(0^+, q^-, \vec{0}_T\right) \\
k^\mu = \left(k^+, \frac{k_T^2}{2k^+}, \vec{k}_T\right) \\
l^\mu \approx \left(k^+, 0^-, l_T\right)
\end{cases}
$$

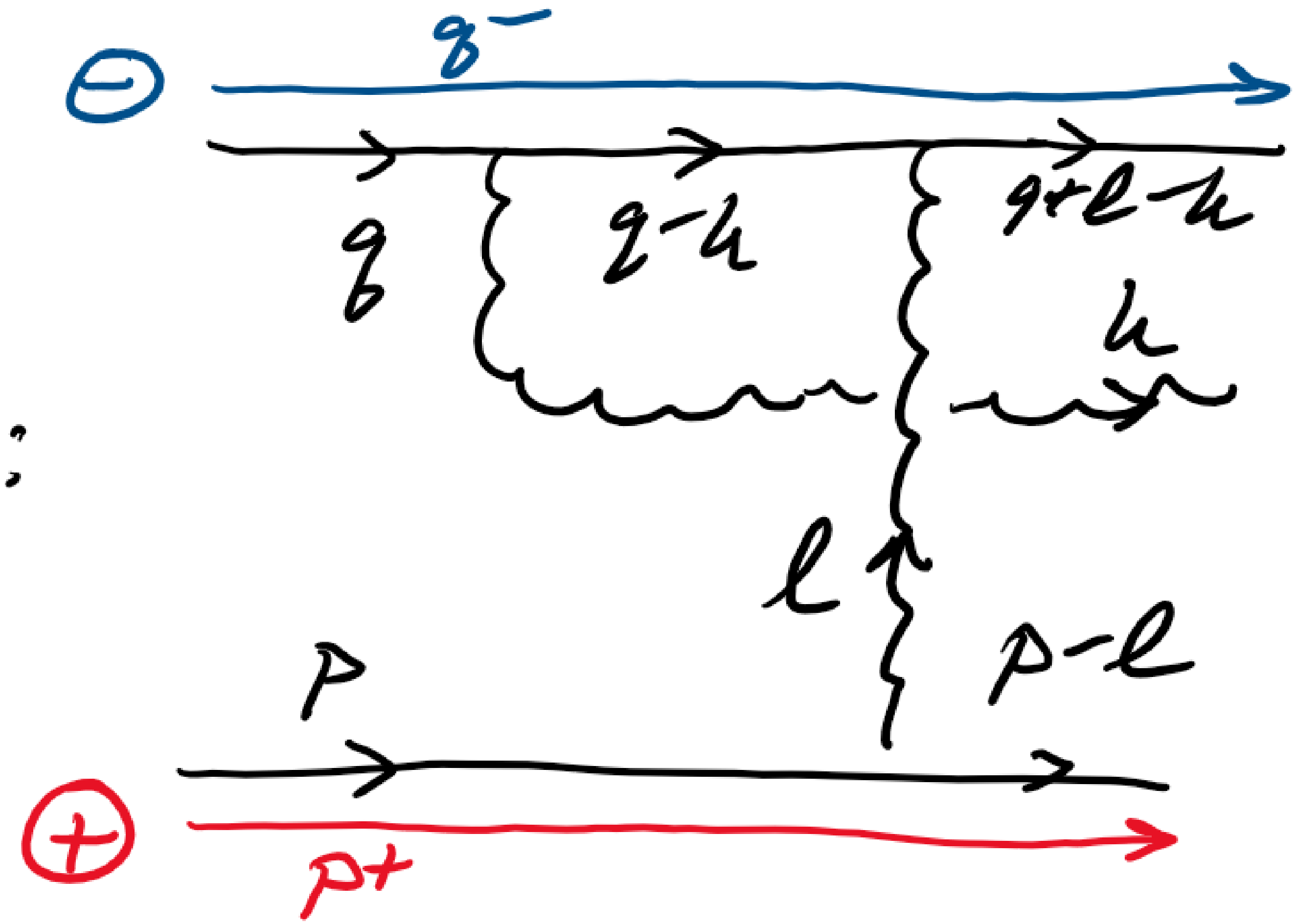


$\underline{A}$:



$$A = -\left(\frac{4s}{\ell_T^2}\right)\left(\frac{k^- \varepsilon^{\mu +} |k|}{k_T^2}\right) \times \text{coeff}$$

$\underline{B}$:



$$B = \frac{4s}{l_T^2 k_T^2}\, k^- \left(\varepsilon^*(k)\right)^+ \times \text{coeff}$$

For QED:

In both A & B

coeff $= (-ie)^3 (i)(-i) = ie^3$

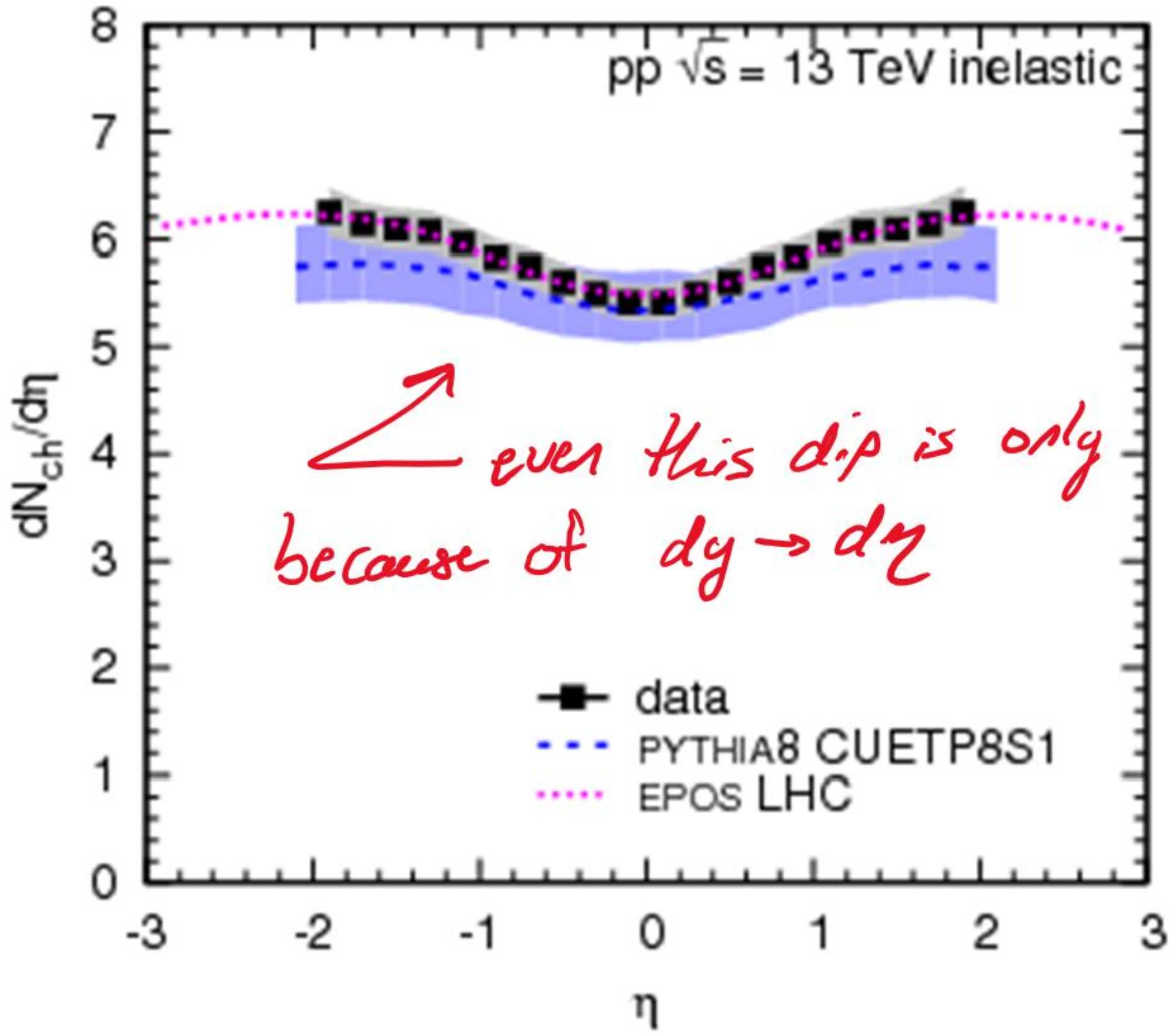
$$A + B = 0$$

For QCD:

$$A + B = -4 g^3 f^{abc} [t^c] \otimes [t^b] \frac{s}{l_T^2 k_T^2} \left[k^- \varepsilon^{+*} l_k s \right]$$

$$\left\langle \left| \frac{\mathcal{M}}{2s} \right|^2 \right\rangle = 2 (4\pi \alpha_s)^3 C_F \, \frac{1}{l_T^2 \, k_T^2 \, (k-l)_T^2}$$

$$\frac{d\sigma}{d^2k \, d^2l \, dy} = \frac{2 \alpha_s^3 C_F}{\pi^2} \, \frac{1}{l_T^2 \, k_T^2 \, (k-l)_T^2}$$


pp $\sqrt{s}$ = 13 TeV inelastic
$dN_{ch}/d\eta$
η
data
PYTHIA8 CUETP8S1
EPOS LHC
even this dip is only because of $dy \to d\eta$

At weak coupling: $\alpha_s \ll 1$ and $\rho \sim O(1)$

$$\rho(y) = \rho(y=0) \cdot e^{\alpha_s \cdot c \cdot y}$$

In the full nonlinear case

$$\rho(y) = \frac{\left(\frac{a}{b}\frac{Q^2}{\alpha_s}\right)\rho_0}{\rho_0 + \left(\frac{a}{b}\frac{Q^2}{\alpha_s} - \rho_s\right)e^{-a\alpha_s y}}$$

$p(y)/p_{max}$