DJANGHO Comparison with HERA

- Energy
  - 27.6 GeV ($e^-$) on 920 GeV (p), $\sqrt{s} = 318.7$ GeV
- 100,000 NC trials
- Cuts
  - Generator: $2 \times 10^{-3} < x < 0.65, 150 GeV^2 < Q^2 < 30000 GeV^2, 2.2 \times 10^{-3} < y < 1.0$,
    - Note: DJANGHO modifies $x_{\text{min}}$ and $y_{\text{min}}$ for consistency with $Q_{\text{min}}^2$
  - Analysis: $W^2 > 225 GeV^2$

- Reduced cross section

$$\frac{d\sigma}{dx dQ^2} = \text{counts}(x, Q^2) \cdot \left( \frac{\sigma_{\text{DJANGHO}}^{\text{tot}}}{\text{trials}} \right)$$

$\Delta x, \Delta Q^2 =$ respective bin widths

$$f = \frac{Q^4 x}{2 \pi \alpha_s^2 (1 + (1 - y)^2)}$$

$C =$ barn conversion constant

$$\sigma_r = f \cdot \left( \frac{d\sigma}{dx dQ^2} \right) \cdot \frac{1}{C}$$
DJANGHO Comparison with Theory

- Energy
  - 18 GeV (e-) on 275 GeV (p), $\sqrt{s} = 140.7 \, GeV$
- 1,000,000 events
- Cuts
  - Generator: $1 \times 10^{-3} < x < 0.99, Q^2 < 1.0 \, GeV^2, 0.01 < y < 0.95, W^2 > 1.96 \, GeV^2$
    - Note: DJANGHO modifies $Q^2_{\text{min, max}}$ for consistency with $W_{\text{min}}, x_{\text{min}}, y_{\text{min}}$
  - Analysis: matches cuts above, lowest x-bin edge is 0.0025 (could go lower)
DJANGHO Comparison with Theory

- Reduced Cross Section
  - See slide 2 for def.

\[ \sigma_{NC} \]
Reduced Cross Section: No Radiative Effects

\[ \sigma_N C - \sigma_T \]

\[ \chi \]

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DJANGHO Comparison with Theory

- Reduced Cross Section: Radiative Effects

\[ \sigma_{NC} - \sigma_T \]

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Summary and Next Steps

Summary
- Good agreement between DJANGHO and theory with HERA data
- Poor agreement between DJANGHO and theory at low $Q^2$
- Good agreement between DJANGHO and theory at mid-to-larger $Q^2$
- Cross sections with no radiative events are in better agreement overall with theory than cross sections with radiative events.

Next Steps
- Apply reweighting to shown DJANGHO results
- Reproducing g1 results from white paper using DJANGHO
  - 18x275: with rad cor. (currently running)
DJANGHO Comparison with Theory

\[
\langle Q^2 \rangle = 937 \text{GeV}^2
\]

\[
\langle Q^2 \rangle = 937 \text{GeV}^2
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\langle Q^2 \rangle = 937 \text{GeV}^2
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\langle Q^2 \rangle = 937 \text{GeV}^2
\]

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DJANGHO Comparison with Theory: Kinematics

$< Q^2 > = 45 \text{ GeV}^2$

$< Q^2 > = 63 \text{ GeV}^2$

$< Q^2 > = 97 \text{ GeV}^2$

$< Q^2 > = 152 \text{ GeV}^2$

$< Q^2 > = 272 \text{ GeV}^2$

$< Q^2 > = 428 \text{ GeV}^2$

$< Q^2 > = 938 \text{ GeV}^2$