PVDIS Final Results

Data and Error Estimates

Data: Electron PVDIS, proton + deuteron targets
Hadron PVDIS, proton target

Luminosity: 100 fb^{-1} in all three cases
<u>Systematic Errors:</u>
Normalization errors:
- Polarimetry: 1% (2%) for electron (hadron)
- Q^2 determination: 0.2%
- Reconstruction error: 0.2%
- DAQ pile up and dead time: 0.15%
- Luminosity Ratio: Negligible
- Asymmetry from Beam Transverse Polarization: Negligible

Point-to-point (uncorrelated) errors:
- Pion Background: 1%
- Radiative Corrections: 0.2%

(Hanjie Liu)

Observables

$$A_{PV}^{electron} = \frac{G_F Q^2}{2\sqrt{2}\pi\alpha}\left[g_A^e \frac{F_1^{\gamma Z}}{F_1^\gamma} + g_V^e \frac{Y_-}{2Y_+} \frac{F_3^{\gamma Z}}{F_1^\gamma}\right]$$

$$A_{PV}^{hadron} = \frac{G_F Q^2}{2\sqrt{2}\pi\alpha}\left[g_V^e \frac{g_5^{\gamma Z}}{F_1^\gamma} + g_A^e \frac{Y_-}{Y_+} \frac{g_1^{\gamma Z}}{F_1^\gamma}\right]$$

Sensitivity
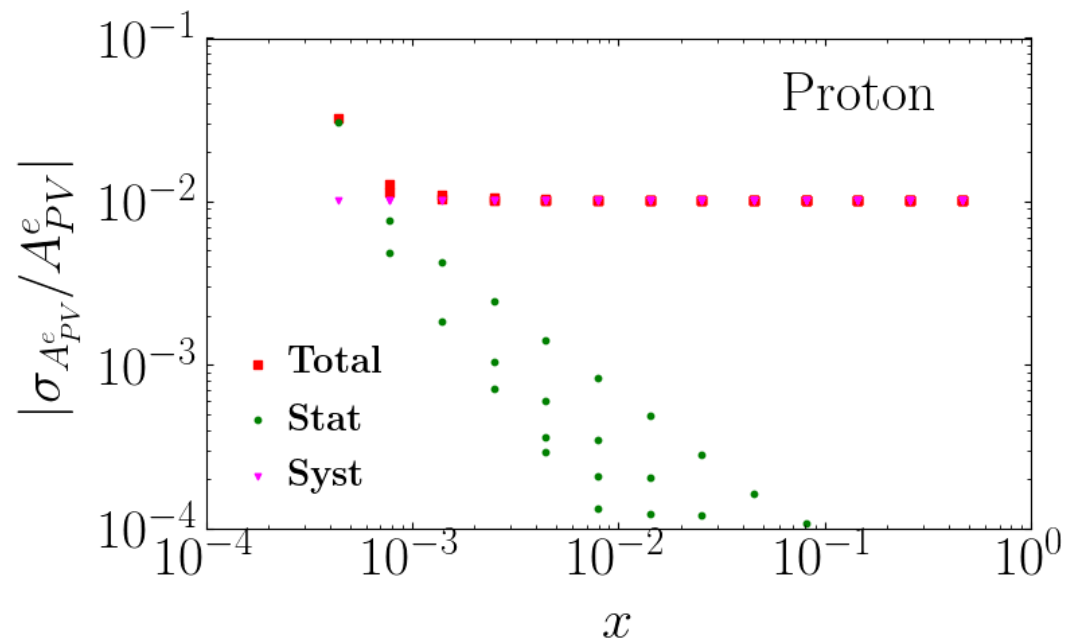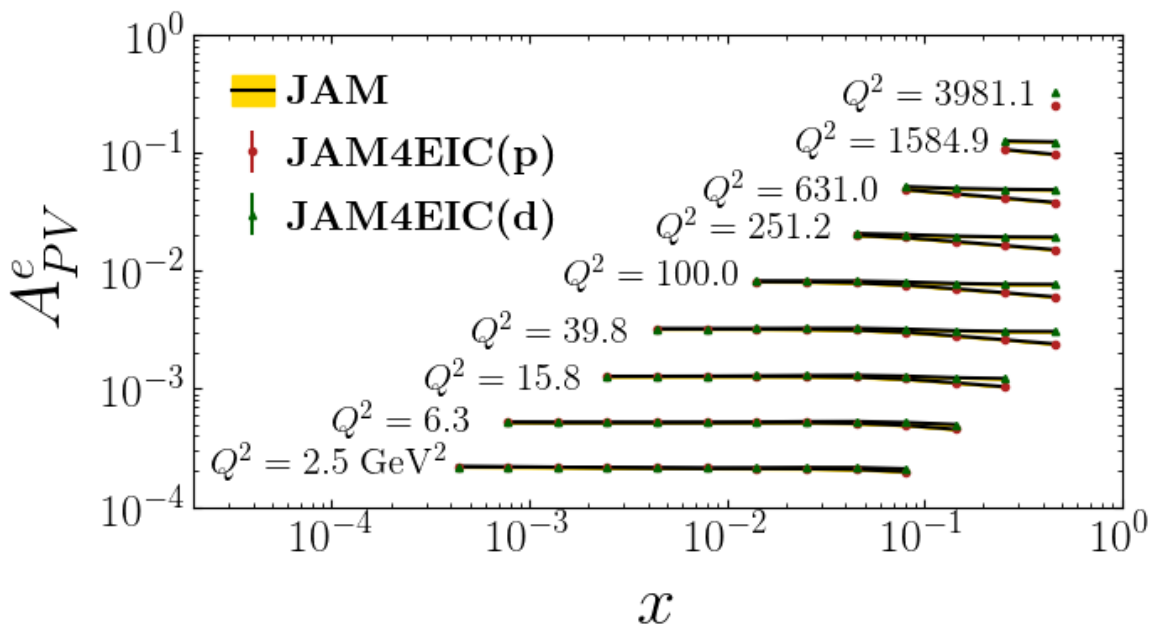
Equal sensitivity to all flavors:

$$F_1^{proton,\ \gamma Z} \approx \frac{1}{9}(u + \bar{u} + d + \bar{d} + s + \bar{s} + c + \bar{c})$$

$$g_1^{proton,\ \gamma Z} \approx \frac{1}{9}(\Delta u + \Delta\bar{u} + \Delta d + \Delta\bar{d} + \Delta s + \Delta\bar{s} + \Delta c + \Delta\bar{c})$$
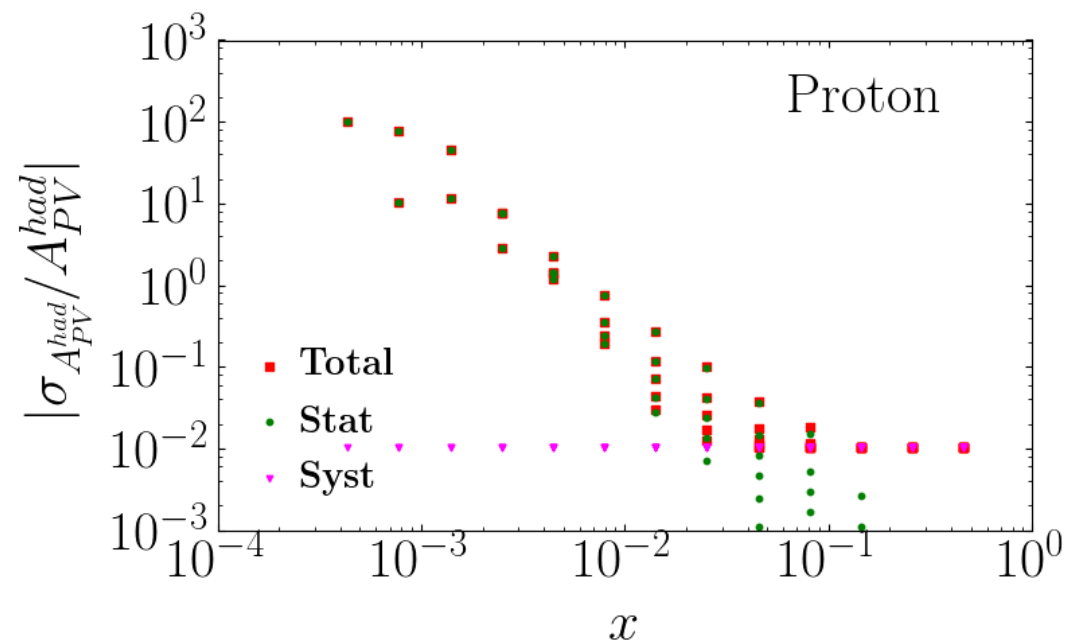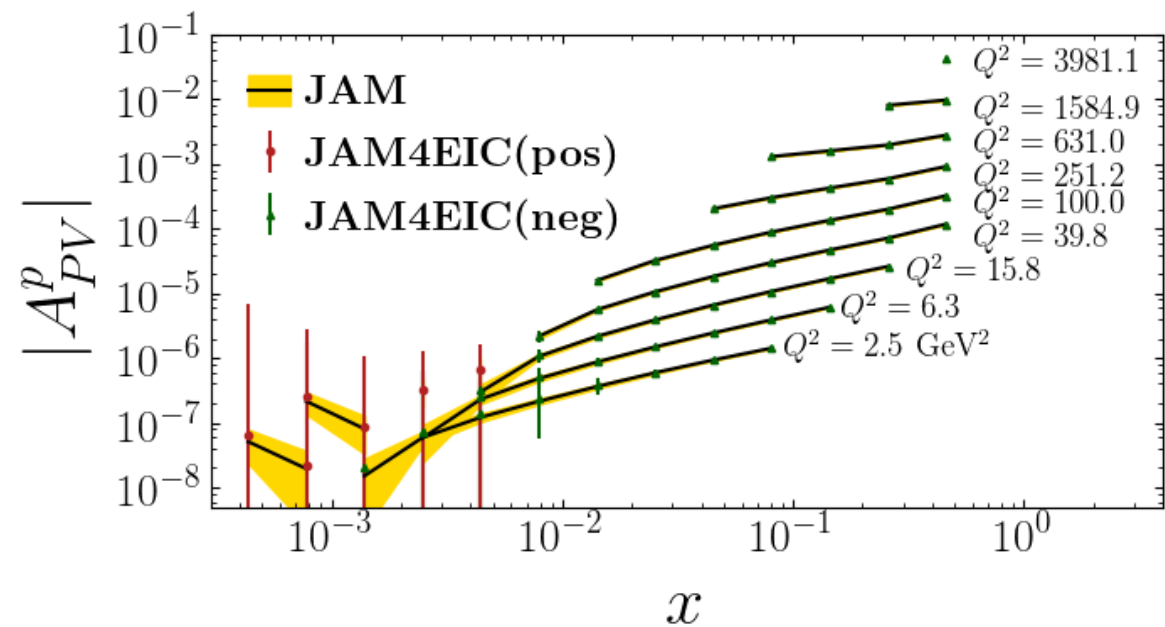
With deuteron target, electron asymmetry proportional to weak mixing angle:
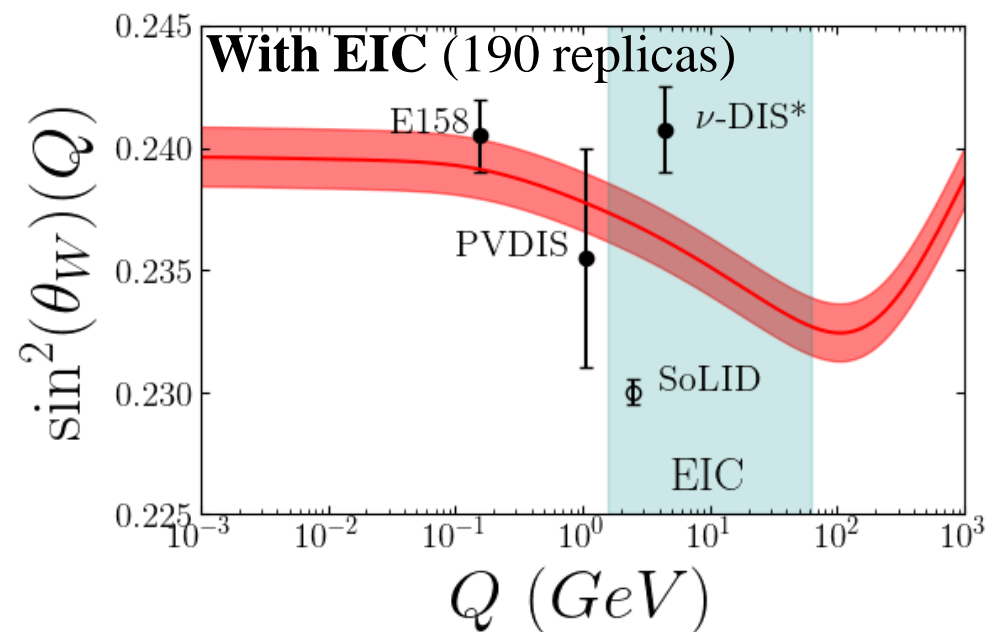
$$A_{PV}^{e(D)} \propto \frac{20}{3}sin^2\theta_W - 1$$

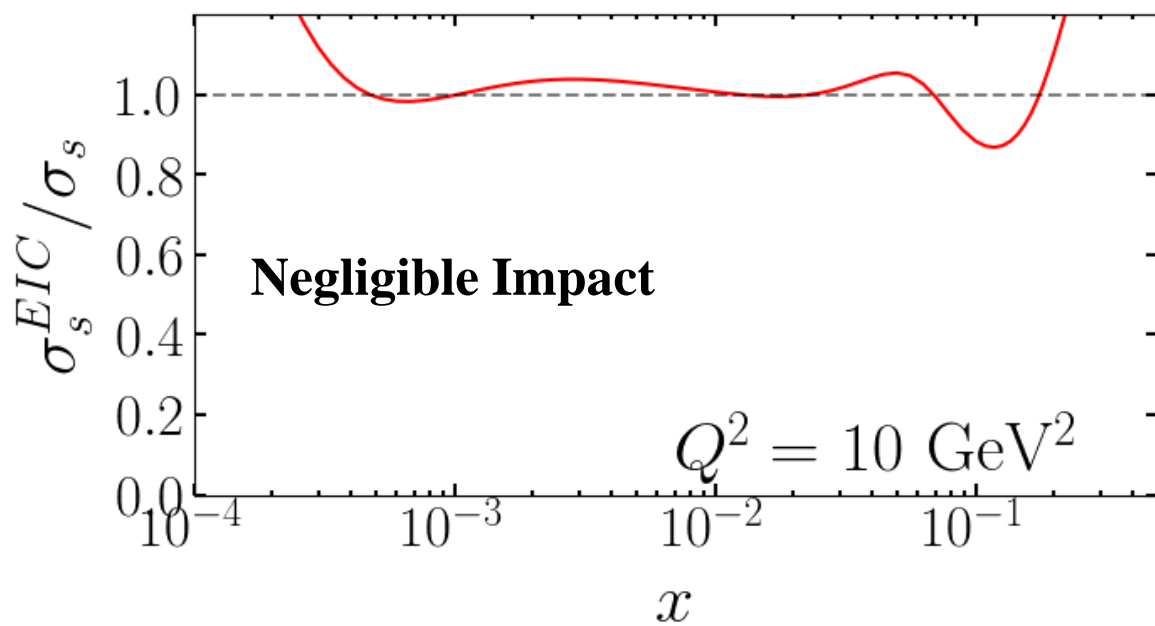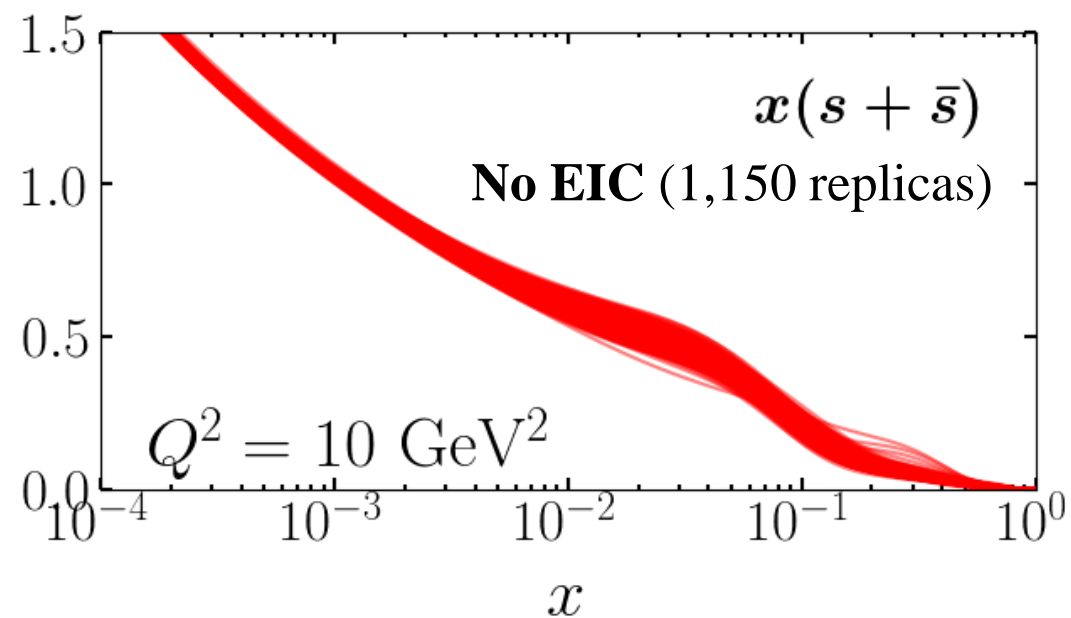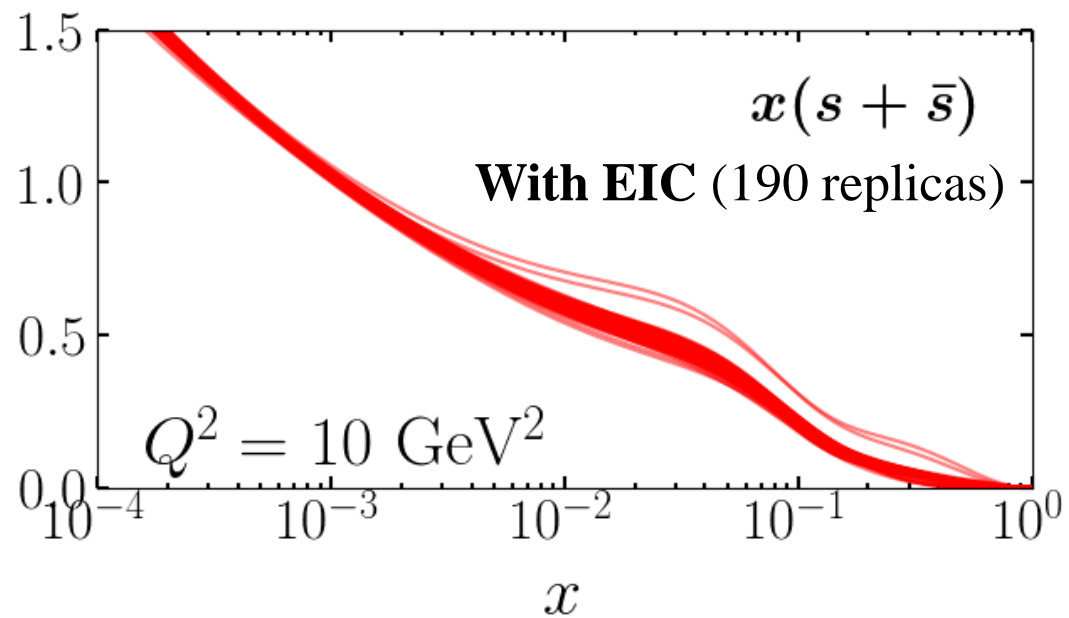(Y.X. Zhao, A. Deshpande, J. Huang, K. S. Kumar, S. Riordan, Eur. Phys. J. A (2017) 53: 55)

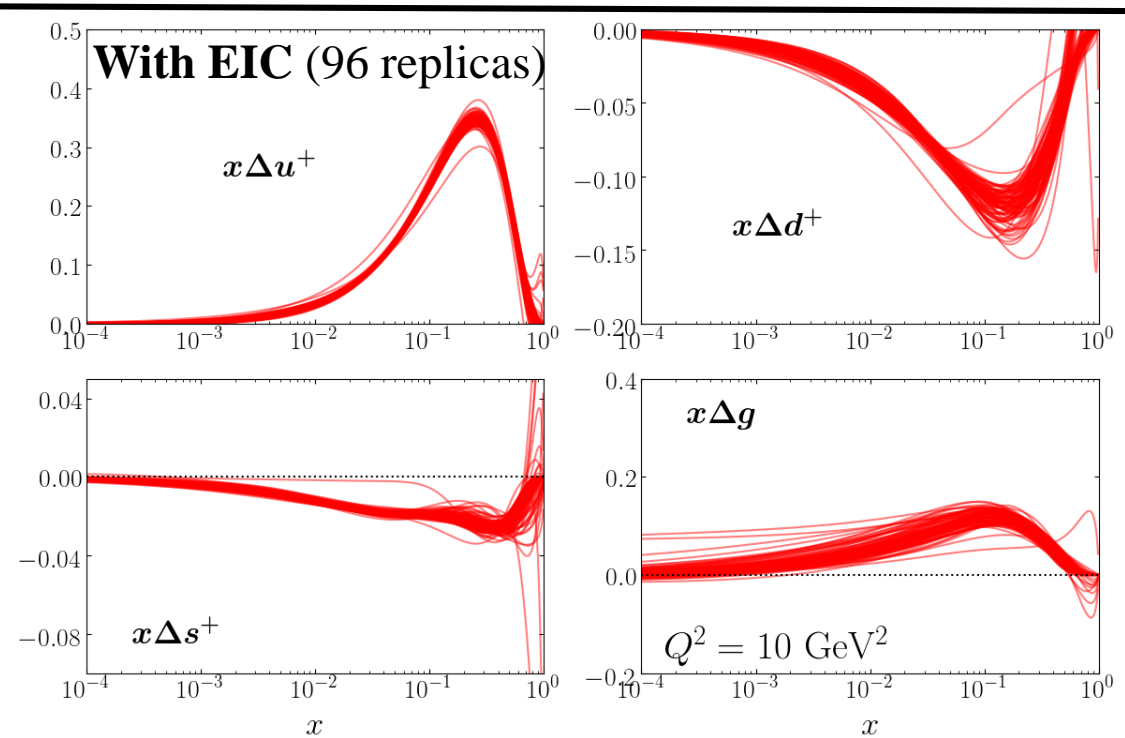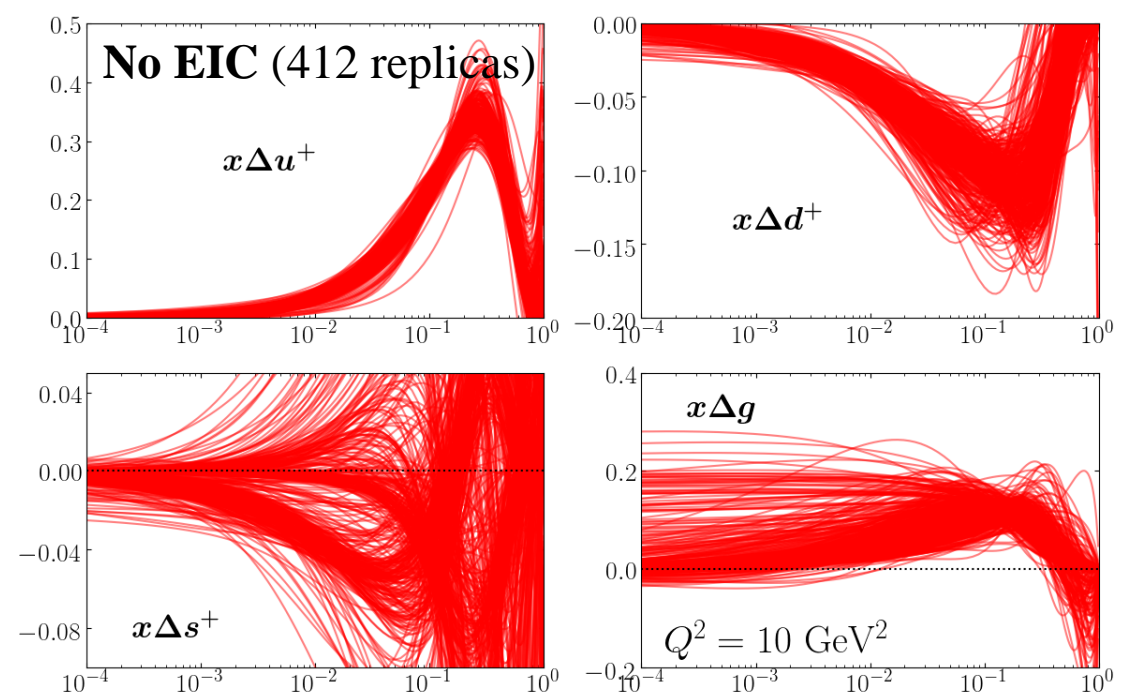**Electron A_{PV}** (Spin-averaged PDFs)

Hadron A_{PV} (Helicity PDFs)

Electron PVDIS Impact (Spin-Averaged Strange and Weak Mixing Angle)

$x(s + \bar{s})$
With EIC (190 replicas)
$Q^2 = 10 \text{ GeV}^2$

$x(s + \bar{s})$
No EIC (1,150 replicas)
$Q^2 = 10 \text{ GeV}^2$

σ_s^{EIC}/σ_s
Negligible Impact
$Q^2 = 10 \text{ GeV}^2$

$\sin^2(\theta_W)(Q)$
With EIC (190 replicas)
E158
ν-DIS*
PVDIS
SoLID
EIC
$Q \ (GeV)$

Hadron PVDIS Results (PDFs)
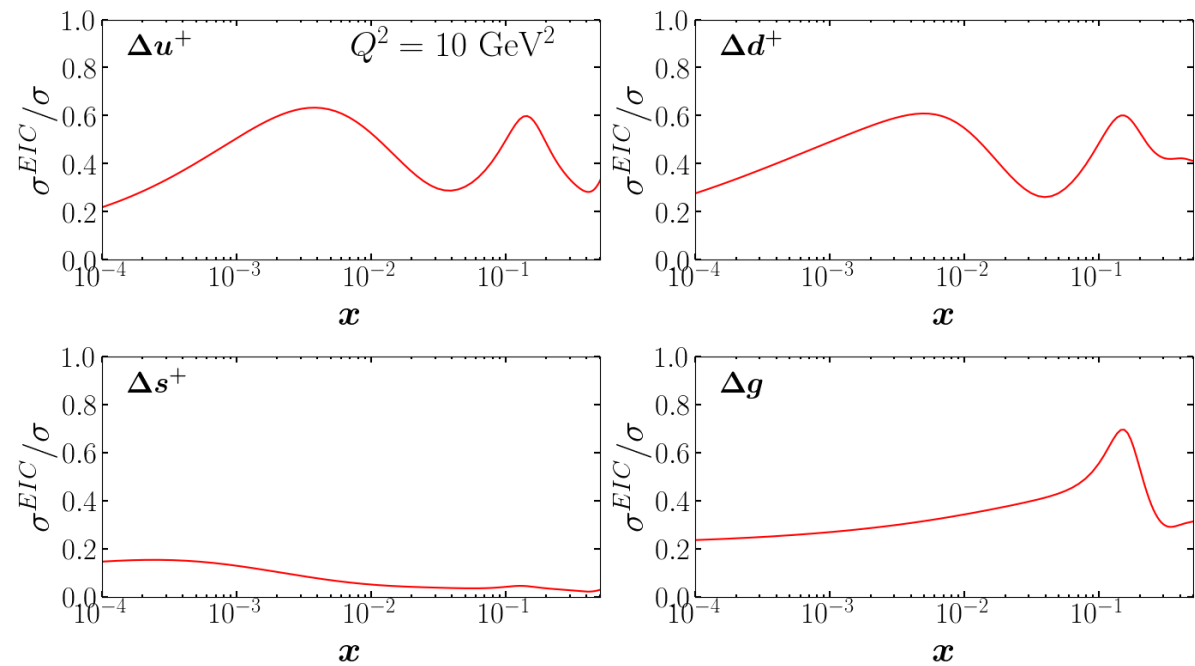
Significant Impact

Conclusions

Electron and hadron PVDIS impact study is complete:

- Spin-Averaged Strange (**Negligible Impact**)

- Weak Mixing Angle (**Significant Constraints**)

- Helicity PDFs (**Significant Impact**)