SUPPLEMENTARY INFORMATION

Kinematics			
	DIS#1	Left DIS#2	Right DIS#2
E_b (GeV)	6.067	6.067	
θ_0	12.9°	20.0°	
E_0' (GeV)	3.66	2.63	
$\langle Q^2\rangle_{\rm data}$ [(GeV/c)^2]	1.085	1.901	
$\langle x\rangle$	0.241	0.295	
$\langle W\rangle$ (GeV)	2.073	2.330	
$A_{\rm raw}^{\rm bc}$ (ppm)	-78.45	-140.30	-139.84
(stat.)	±2.68	±10.43	±6.58
(syst.)	±0.07	±0.16	±0.46
Corrections with systematic uncertainties			
P_b	88.18%	89.29	88.73%
ΔP_b	±1.76%	±1.19%	±1.50%
$1+\bar{f}_{\rm depol}$	1.0010	1.0021	
(syst.)	$<10^{-4}$	$<10^{-4}$	
$1+\bar{f}_{\rm Al}$	0.9999	0.9999	0.9999
(syst.)	±0.0024	±0.0024	±0.0024
$1+\bar{f}_{\rm dt}$	1.0147	1.0049	1.0093
(syst.)	±0.0009	±0.0004	±0.0013
$1+\bar{f}_{\rm rc}$	1.015	1.019	
(syst.)	±0.020	±0.004	
$1+\bar{f}_{\gamma\gamma{\rm box}}$	0.998	0.997	
(syst.)	±0.002	±0.003	
Other systematic uncertainties in $\Delta A_{\rm exp}/A_{\rm exp}$			
$\Delta\bar{f}_{\pi^-}$	±0.009%	±0.006%	±0.003%
$\Delta\bar{f}_{\rm pair}$	±0.04%	±0.3%	±0.3%
$\Delta\bar{f}_{A_n}$	±2.5%	±2.5%	±2.5%
ΔQ^2	±0.85%	±0.64%	±0.65%
rescattering background	$\ll 0.2$%	$\ll 0.2$%	$\ll 0.2$%
target impurity	±0.06%	±0.06%	±0.06%
Asymmetry Results			
$A_{\rm exp}$ (ppm)	-91.10	-160.80	
(stat.)	±3.11	±6.39	
(syst.)	±2.97	±3.12	
(total)	±4.30	±7.12	

TABLE I: Asymmetry results on $\vec{e}-^2$H parity-violating scattering from the PVDIS experiment at JLab. The kinematics shown include the beam energy E_b, central angle and momentum settings of the spectrometer θ_0, E_0', and the actual kinematics averaged from the data $\langle Q^2\rangle$ and $\langle x\rangle$. The electron asymmetries obtained from the narrow trigger of the DAQ with beam-related corrections, $A_{\rm raw}^{\rm bc}$, were corrected for the effects from the beam polarization P_b and other systematic effects including: the beam depolarization effect $\bar{f}_{\rm depol}$, the target aluminum endcap $\bar{f}_{\rm Al}$, the DAQ deadtime $\bar{f}_{\rm dt}$ [1], the radiative correction $\bar{f}_{\rm rc}$ that includes effects from energy losses of incoming and scattered electrons as well as the spectrometer acceptance and detector efficiencies, and the box-diagram correction $\bar{f}_{\gamma\gamma{\rm box}}$. Other systematic uncertainties that affected the asymmetries include: the charged pion and the pair production background $\bar{f}_{\pi^-}$ and $\bar{f}_{\rm pair}$, the beam normal asymmetry $\bar{f}_{A_n}$, the uncertainty in the determination of Q^2, the re-scattering background, and the target impurity. Final results on the physics asymmetries $A_{\rm exp}$ are shown with their statistical, systematic, and total uncertainties. Reference: [1] Subedi, R. *et al.*, A Scaler-Based Data Acquisition System for Measuring Parity Violation Asymmetry in Deep Inelastic Scattering, Nucl. Instrum. Meth. A. **724**, 90 (2013).

	$\langle Q^2\rangle = 1.085$, $\langle x\rangle = 0.241$	$\langle Q^2\rangle = 1.901$, $\langle x\rangle = 0.295$
Physical couplings used in the Calculation		
$\alpha_{EM}(Q^2)$	1/134.45	1/134.20
$C_{1u}^{\rm SM} = -0.1887 - 0.0011 \times \frac{2}{3}\ln(\langle Q^2\rangle/0.14{\rm GeV}^2)$	−0.1902	−0.1906
$C_{1d}^{\rm SM} = 0.3419 - 0.0011 \times \frac{-1}{3}\ln(\langle Q^2\rangle/0.14{\rm GeV}^2)$	0.3427	0.3429
$2C_{1u}^{\rm SM} - C_{1d}^{\rm SM}$	−0.7231	−0.7241
$C_{2u}^{\rm SM} = -0.0351 - 0.0009\ln(\langle Q^2\rangle/0.078\ {\rm GeV}^2)$	−0.0375	−0.0380
$C_{2d}^{\rm SM} = 0.0248 + 0.0007\ln(\langle Q^2\rangle/0.021\ {\rm GeV}^2)$	0.0276	0.0280
$2C_{2u}^{\rm SM} - C_{2d}^{\rm SM}$	−0.1025	−0.1039
a_1, a_3 terms in $A_{\rm SM}$, in ppm		
CTEQ/JLab (CJ) full fit, mid	NA	−147.37, −12.12
min		−147.41, −12.99
max		−147.40, −13.07
"PDF+QPM" MSTW2008 LO	−83.61, −4.13	−146.43, −12.48
"PDF+QPM" CT10 (NLO)	−84.06, −4.35	−146.64, −12.89
coefficients for $2C_{1u} - C_{1d}$, $2C_{2u} - C_{2d}$ in $A_{\rm SM}$, in ppm		
CTEQ/JLab (CJ) full fit, mid	NA	203.52, 116.68
min		203.58, 125.01
max		203.56, 125.78
"PDF+QPM" MSTW2008 LO	115.63, 40.26	202.22, 120.08
"PDF+QPM" CT10 (NLO)	116.25, 42.41	202.51, 124.08

TABLE II: Comparison of standard-model (SM) prediction for the asymmetry, $A_{\rm SM}$, using different structure functions: MSTW2008 [2], CT10 [3], and the CTEQ/JLab (CJ) [4] fits. The CJ fits include 3 sets – middle, minimal, and maximal – to provide the nominal value of the asymmetry and the uncertainties. Values for $\alpha_{EM}(Q^2)$ were calculated using $\alpha_{EM}(Q^2 = 0) = 1/137.036$. The weak couplings at the measured Q^2 values, $C_{1,2}^{\rm SM}(Q^2)$, were based on Table 7 and Eq. (114-115) of [5]. References: [2] Martin, A.D., Stirling, W.J., Thorne, R.S. and Watt, G., Parton distributions for the LHC, Eur. Phys. J. C **63**, 189 (2009). [3] H.-L. Lai *et al.*, New parton distributions for collider physics, Phys. Rev. D **82**, 074024 (2010). [4] Owens, J.F., Accardi, A. and Melnitchouk, W., Global parton distributions with nuclear and finite-Q^2 corrections, Phys. Rev. D **87**, 094012 (2013). [5] Erler, J. and Su, S., The Weak Neutral Current, Prog. Part. Nucl. Phys. **71**, 119 (2013).