SUPPLEMENTARY INFORMATION

Kinematics			
	DIS#1	Left DIS#2	Right DIS#2
E [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	
Measured Asymmetries with Beam Corrections			
$A^{\rm bc}_{\rm raw}$ [ppm]	-78.45 ± 2.68(stat.)± 0.07(syst.)	-140.30 ± 10.43(stat.)± 0.16(syst.)	-139.84 ± 6.58(stat.)± 0.46(syst.)
Corrections with systematic uncertainties			
P_b	$(88.18 \pm 1.76)\%$	$(89.29 \pm 1.19)\%$	$(88.73 \pm 1.50)\%$
$1 + \bar{f}_{\rm depol}$	$1.0010 \pm (< 10^{-4})$	$1.0021 \pm (< 10^{-4})$	
$1 + \bar{f}_{\rm Al}$	0.9999 ± 0.0024	0.9999 ± 0.0024	0.9999 ± 0.0024
$1 + \bar{f}_{\rm dt}$	1.0147 ± 0.0009	1.0049 ± 0.0004	1.0093 ± 0.0013
$1 + \bar{f}_{\rm rc}$	1.015 ± 0.020	1.019 ± 0.004	
$1 + \bar{f}_{\gamma\gamma{\rm box}}$	0.998 ± 0.002	0.997 ± 0.003	
Other systematic uncertainties in $\Delta A_{\rm exp}/A_{\rm exp}$			
$\Delta \bar{f}_{\pi^-}$	$\pm 0.009\%$	$\pm 0.006\%$	$\pm 0.003\%$
$\Delta \bar{f}_{\rm pair}$	$\pm 0.04\%$	$\pm 0.3\%$	$\pm 0.3\%$
$\Delta \bar{f}_{A_n}$	$\pm 2.5\%$	$\pm 2.5\%$	$\pm 2.5\%$
ΔQ^2	$\pm 0.85\%$	$\pm 0.64\%$	$\pm 0.65\%$
rescattering background	$\ll 0.2\%$	$\ll 0.2\%$	$\ll 0.2\%$
target impurity	$\pm 0.06\%$	$\pm 0.06\%$	$\pm 0.06\%$
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 for $\vec{e}-{}^2$H parity-violating scattering from the PVDIS experiment at JLab. The kinematics shown include the beam energy E, the 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, $A^{\rm bc}_{\rm raw}$, were corrected for the effects from the beam polarization P_b and other systematic effects including: the beam depolarization effect $\bar{f}_{\rm depol}$, scattering from the target aluminum endcaps $\bar{f}_{\rm Al}$, 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 PDF 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).