Available online at www.sciencedirect.com
ScienceDirect
Nuclear Physics B Proceedings Supplement 00 (2014) 1–2
Nuclear Physics B Proceedings Supplement

# Tests of the Electroweak Interactions at Hadron Colliders

Jeffrey Berryhill, on behalf of the ATLAS, CDF, CMS, D0, and LHCb collaborations

*Fermi National Accelerator Laboratory (FNAL), Batavia, IL 60510, USA*

**Abstract**

*Keywords:*

## 1. *W* boson physics

ATLAS [1] CDF [2] CMS [3] D0 [4] LHCb [5]

ATLAS high-mass Drell–Yan [6] ATLAS low-mass Drell-Yan [7] ATLAS Z PT [8] ATLAS Z phistar [9] ATLAS Wgamma Zgamma [10] ATLAS WW 7 TeV [11] ATLAS WW 8 TeV [12]

CDF Z asymmetry muon [13] CDF Z asymmetry electron [14] CDF W mass PRD [15] CDF W mass PRL [16]

CMS Drell–Yan 7 TeV [17] CMS W asymmetry muon [18] CMS W asymmetry electron [19] CMS W+charm [20] CMS ZZ4l 8 TeV [21] CMS ZZ4l 7 TeV [22] CMS WW/ZZ 8 TeV [23] CMS WW2l2n 7 TeV [24] CMS WWlnjj 7 TeV [25] CMS WVgamma 8 TeV [26] CMS Wgamma/Zgamma 7 TeV [27] CMS Znngamma 7 TeV [28] CMS WWexcl 7 TeV [29] CMS VBF Z 7 TeV [30] CMS SSWW 8 TeV [31]

D0 W asymmetry electron [32] D0 W asymmetry muon [33] D0 W mass PRD [34] D0 W mass PRL [35]

CDF+D0 W mass combination [36]

Snowmass electroweak [37]

Wmass PDF [38]

ATLAS WW scattering [39] ATLAS VBF Z [40]

## 2. *Z* boson and Drell-Yan production physics

## 3. Triple gauge couplings

## 4. Quartic gauge couplings

## References

[1] G. Aad, et al., The ATLAS Experiment at the CERN Large Hadron Collider, JINST 3 (2008) S08003. doi:10.1088/1748-0221/3/08/S08003.

[2] A. Abulencia, et al., Measurements of inclusive W and Z cross sections in p anti-p collisions at s**(1/2) = 1.96-TeV, J.Phys. G34 (2007) 2457–2544. arXiv:hep-ex/0508029, doi:10.1088/0954-3899/34/12/001.

[3] S. Chatrchyan, et al., The CMS experiment at the CERN LHC, JINST 3 (2008) S08004. doi:10.1088/1748-0221/3/08/S08004.

[4] V. Abazov, et al., The Upgraded D0 detector, Nucl.Instrum.Meth. A565 (2006) 463–537. arXiv:physics/0507191, doi:10.1016/j.nima.2006.05.248.

[5] J. Alves, A. Augusto, et al., The LHCb Detector at the LHC, JINST 3 (2008) S08005. doi:10.1088/1748-0221/3/08/S08005.

[6] G. Aad, et al., Measurement of the high-mass Drell–Yan differential cross-section in pp collisions at sqrt(s)=7 TeV with the ATLAS detector, Phys.Lett. B725 (2013) 223–242. arXiv:1305.4192, doi:10.1016/j.physletb.2013.07.049.

[7] G. Aad, et al., Measurement of the low-mass Drell-Yan differential cross section at $\sqrt{s}$ = 7 TeV using the ATLAS detector, JHEP 1406 (2014) 112. arXiv:1404.1212, doi:10.1007/JHEP06(2014)112.

[8] G. Aad, et al., Measurement of the $Z/\gamma^*$ boson transverse momentum distribution in $pp$ collisions at $\sqrt{s}$ = 7 TeV with the ATLAS detectorarXiv:1406.3660.

[9] G. Aad, et al., Measurement of angular correlations in Drell-Yan lepton pairs to probe Z/gamma* boson transverse momentum at sqrt(s)=7 TeV with the ATLAS detector, Phys.Lett. B720 (2013) 32–51. arXiv:1211.6899, doi:10.1016/j.physletb.2013.01.054.

[10] G. Aad, et al., Measurements of W and Z production in pp collisions at $\sqrt{s}$=7TeV with the ATLAS detector at the

LHC, Phys.Rev. D87 (11) (2013) 112003. arXiv:1302.1283, doi:10.1103/PhysRevD.87.112003.

[11] G. Aad, et al., Measurement of $W^+W^-$ production in pp collisions at $\sqrt{s}$=7TeV with the ATLAS detector and limits on anomalous WWZ and WW couplings, Phys.Rev. D87 (11) (2013) 112001. arXiv:1210.2979, doi:10.1103/PhysRevD.87.112001, 10.1103/PhysRevD.88.079906.

[12] Measurement of the $W^+W^-$ production cross section in proton-proton collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector, Tech. Rep. ATLAS-CONF-2014-033, CERN, Geneva (Jul 2014).

[13] T. A. Aaltonen, et al., Indirect measurement of $\sin^2\theta_W$ (or $M_W$) using $\mu^+\mu^-$ pairs from $\gamma^*/Z$ bosons produced in $p\bar{p}$ collisions at a center-of-momentum energy of 1.96 TeV, Phys.Rev. D89 (2014) 072005. arXiv:1402.2239, doi:10.1103/PhysRevD.89.072005.

[14] T. Aaltonen, et al., Indirect measurement of $\sin^2\theta_W$ ($M_W$) using $e^+e^-$ pairs in the Z-boson region with $p\bar{p}$ collisions at a center-of-momentum energy of 1.96 TeV, Phys.Rev. D88 (7) (2013) 072002. arXiv:1307.0770, doi:10.1103/PhysRevD.88.072002, 10.1103/PhysRevD.88.079905.

[15] T. A. Aaltonen, et al., A precise measurement of the $W$-boson mass with the Collider Detector at Fermilab, Phys.Rev. D89 (2014) 072003. arXiv:1311.0894, doi:10.1103/PhysRevD.89.072003.

[16] T. Aaltonen, et al., Precise measurement of the $W$-boson mass with the CDF II detector, Phys.Rev.Lett. 108 (2012) 151803. arXiv:1203.0275, doi:10.1103/PhysRevLett.108.151803.

[17] S. Chatrchyan, et al., Measurement of the differential and double-differential Drell-Yan cross sections in proton-proton collisions at $\sqrt{s}$ = 7 TeV, JHEP 1312 (2013) 030. arXiv:1310.7291, doi:10.1007/JHEP12(2013)030.

[18] S. Chatrchyan, et al., Measurement of the muon charge asymmetry in inclusive pp → W + X production at $\sqrt{s}$=7 TeV and an improved determination of light parton distribution functionsarXiv:1312.6283.

[19] S. Chatrchyan, et al., Measurement of the electron charge asymmetry in inclusive $W$ production in $pp$ collisions at $\sqrt{s}$ = 7 TeV, Phys.Rev.Lett. 109 (2012) 111806. arXiv:1206.2598, doi:10.1103/PhysRevLett.109.111806.

[20] S. Chatrchyan, et al., Measurement of associated W + charm production in pp collisions at $\sqrt{s}$ = 7 TeV, JHEP 1402 (2014) 013. arXiv:1310.1138, doi:10.1007/JHEP02(2014)013.

[21] V. Khachatryan, et al., Measurement of the pp to ZZ production cross section and constraints on anomalous triple gauge couplings in four-lepton final states at $\sqrt{s}$ = 8 TeVarXiv:1406.0113.

[22] S. Chatrchyan, et al., Measurement of the $ZZ$ production cross section and search for anomalous couplings in 2 l2l ' final states in $pp$ collisions at $\sqrt{s}$ = 7 TeV, JHEP 1301 (2013) 063. arXiv:1211.4890, doi:10.1007/JHEP01(2013)063.

[23] S. Chatrchyan, et al., Measurement of W+W- and ZZ production cross sections in pp collisions at sqrt(s) = 8 TeV, Phys.Lett. B721 (2013) 190–211. arXiv:1301.4698, doi:10.1016/j.physletb.2013.03.027.

[24] S. Chatrchyan, et al., Measurement of the $W^+W^-$ Cross section in $pp$ Collisions at $\sqrt{s}$ = 7 TeV and Limits on Anomalous $WW\gamma$ and $WWZ$ couplings, Eur.Phys.J. C73 (2013) 2610. arXiv:1306.1126, doi:10.1140/epjc/s10052-013-2610-8.

[25] S. Chatrchyan, et al., Measurement of the sum of $WW$ and $WZ$ production with $W$+dijet events in $pp$ collisions at $\sqrt{s}$ = 7 TeV, Eur.Phys.J. C73 (2013) 2283. arXiv:1210.7544, doi:10.1140/epjc/s10052-013-2283-3.

[26] S. Chatrchyan, et al., A search for WW$\gamma$ and WZ$\gamma$ production and constraints on anomalous quartic gauge couplings in pp collisions at $\sqrt{s}$ = 8 TeVarXiv:1404.4619.

[27] S. Chatrchyan, et al., Measurement of the W gamma and Z gamma inclusive cross sections in pp collisions at $\sqrt{s}$ = 7 TeV and limits on anomalous triple gauge boson couplings, Phys.Rev. D89 (2014) 092005. arXiv:1308.6832, doi:10.1103/PhysRevD.89.092005.

[28] S. Chatrchyan, et al., Measurement of the production cross section for $Z\gamma \to \nu\bar{\nu}\gamma$ in pp collisions at $\sqrt{s}$ = 7 TeV and limits on $ZZ\gamma$ and $Z\gamma\gamma$ triple gauge boson couplings, JHEP 1310 (2013) 164. arXiv:1309.1117, doi:10.1007/JHEP10(2013)164.

[29] S. Chatrchyan, et al., Study of exclusive two-photon production of $W^+W^-$ in $pp$ collisions at $\sqrt{s}$ = 7 TeV and constraints on anomalous quartic gauge couplings, JHEP 1307 (2013) 116. arXiv:1305.5596, doi:10.1007/JHEP07(2013)116.

[30] S. Chatrchyan, et al., Measurement of the hadronic activity in events with a Z and two jets and extraction of the cross section for the electroweak production of a Z with two jets in pp collisions at $\sqrt{s}$ = 7 TeV, JHEP 1310 (2013) 062. arXiv:1305.7389, doi:10.1007/JHEP10(2013)062.

[31] Vector boson scattering in a final state with two jets and two same-sign leptons, Tech. Rep. CMS-PAS-SMP-13-015, CERN, Geneva (2014).

[32] V. M. Abazov, et al., Measurement of the $W$ Boson Production Charge Asymmetry in $p\bar{p} \to W + X \to e\nu + X$ Events at $\sqrt{s}$ = 1.96 TeV, Phys.Rev.Lett. 112 (2014) 151803. arXiv:1312.2895, doi:10.1103/PhysRevLett.112.151803.

[33] V. M. Abazov, et al., Measurement of the muon charge asymmetry in $p\bar{p} \to$ W+X $\to \mu\nu$ + X events at $\sqrt{s}$=1.96TeV, Phys.Rev. D88 (2013) 091102. arXiv:1309.2591, doi:10.1103/PhysRevD.88.091102.

[34] V. M. Abazov, et al., Measurement of the $W$ boson mass with the D0 detector, Phys.Rev. D89 (1) (2014) 012005. arXiv:1310.8628, doi:10.1103/PhysRevD.89.012005.

[35] V. M. Abazov, et al., Measurement of the W Boson Mass with the D0 Detector, Phys.Rev.Lett. 108 (2012) 151804. arXiv:1203.0293, doi:10.1103/PhysRevLett.108.151804.

[36] T. A. Aaltonen, et al., Combination of CDF and D0 $W$-Boson Mass Measurements, Phys.Rev. D88 (5) (2013) 052018. arXiv:1307.7627, doi:10.1103/PhysRevD.88.052018.

[37] M. Baak, A. Blondel, A. Bodek, R. Caputo, T. Corbett, et al., Working Group Report: Precision Study of Electroweak InteractionsarXiv:1310.6708.

[38] G. Bozzi, J. Rojo, A. Vicini, The Impact of PDF uncertainties on the measurement of the W boson mass at the Tevatron and the LHC, Phys.Rev. D83 (2011) 113008. arXiv:1104.2056, doi:10.1103/PhysRevD.83.113008.

[39] G. Aad, et al., Evidence for Electroweak Production of $W^\pm W^\pm jj$ in $pp$ Collisions at $\sqrt{s}$ = 8 TeV with the ATLAS DetectorarXiv:1405.6241.

[40] G. Aad, et al., Measurement of the electroweak production of dijets in association with a Z-boson and distributions sensitive to vector boson fusion in proton-proton collisions at $\sqrt{s}$ = 8 TeV using the ATLAS detector, JHEP 1404 (2014) 031. arXiv:1401.7610, doi:10.1007/JHEP04(2014)031.

[41] G. Aad, Erratum: Measurement of $W^+W^-$ production in $pp$ collisions at $\sqrt{s}$ = 7TeV with the atlas detector and limits on anomalous $wwz$ and $ww\gamma$ couplings [phys. rev. d 87, 112001 (2013)], Phys. Rev. D 88 (2013) 079906. doi:10.1103/PhysRevD.88.079906.
URL http://link.aps.org/doi/10.1103/PhysRevD.88.079906