

WZGRAD2 Update

LHC EW precision sub-group meeting on 18 December 2020

- Results have now been obtained including higher order corrections (HO) as implemented in WZGRAD (still need to be checked!).
- HO is only based on universal higher-order corrections to the rho parameter (see <https://arxiv.org/pdf/1606.02330.pdf> (section 3.4.5))
- Still working on obtaining results with higher statistics

Table 50: Cross-sections (pb) and ratios: NLO/LO, (NLO+HO)/LO, predictions with different codes in EW scheme $\alpha(0)$ v1. Show are also corrections estimated with TauSpinner+DIZET, needed to match (NLO+HO) predictions calculated in EW $\alpha(0)$ v0 scheme.

Programs	$89 < m_{ee} < 93$ GeV	$60 < m_{ee} < 81$ GeV	$81 < m_{ee} < 101$ GeV	$101 < m_{ee} < 150$ GeV
	$\sigma(LO)$ (pb)			
MCSANC	571.412(5)	43.724(2)	821.414(6)	-
Powheg_ew	571.416(7)	43.724(1)	821.414(9)	-
WZGRAD2	571.409(7)	43.722(4)	821.419(9)	-
RADY(FS)	571.414(1)	43.725(1)	821.420(2)	-
	$\sigma(NLO)/\sigma(LO)$			
MCSANC	1.05117(1)	1.08830(4)	1.05157(1)	-
Powheg_ew	1.05108(1)	1.08814(2)	1.05149(1)	-
WZGRAD2	1.05151(1)	1.08854(9)	1.05191(1)	-
RADY(FS)	1.05101(1)	1.08816(1)	1.05142(1)	-
	$\sigma(NLO + HO)/\sigma(LO)$			
MCSANC	1.06452(1)	1.10004(4)	1.06491(1)	-
Powheg_ew	1.06394(1)	1.09912(2)	1.06433(1)	-
WZGRAD2	1.060039(6)	1.09231(1)	1.06039(2)	-
RADY(FS)	1.06387(1)	1.09979(1)	1.06426(1)	-
TauSpinner+DIZET (estimated)	1.06558(0)	1.09892(0)	1.06613(0)	1.06202

1.08856(1)

Table 51: Cross-sections (pb) and ratios: NLO/LO, (NLO+HO)/LO, predictions with different codes in EW scheme G_μ . Show are also corrections estimated with TauSpinner+DIZET, needed to match (NLO+HO) predictions calculated in EW $\alpha(0)$ v0 scheme.

Programs	$89 < m_{ee} < 93$ GeV	$60 < m_{ee} < 81$ GeV	$81 < m_{ee} < 101$ GeV	$101 < m_{ee} < 150$ GeV
	$\sigma(LO)$ (pb)			
MCSANC	612.531(5)	46.870(2)	880.527(6)	-
Powheg_ew	612.529(8)	46.870(1)	880.513(9)	-
WZGRAD2	612.521(7)	46.868(4)	880.520(10)	-
RADY(FS)	612.526(1)	46.871(1)	880.520(2)	-
	$\sigma(NLO)/\sigma(LO)$			
MCSANC	0.99167(2)	1.02865(7)	0.99206(1)	-
Powheg_ew	0.99155(1)	1.02863(2)	0.99196(1)	-
WZGRAD2	0.99198(1)	1.02913(4)	0.99239(1)	-
RADY(FS)	0.99148(1)	1.02864(4)	0.99189(1)	-
	$\sigma(NLO+HO)/\sigma(LO)$			
MCSANC	0.99232(2)	1.02614(7)	0.99268(1)	-
Powheg_ew	0.99218(1)	1.02592(2)	0.99255(1)	-
WZGRAD2	0.991789(6)	1.0265(9)	0.99214(2)	-
RADY(FS)	0.99179(1)	1.02589(1)	0.99216(1)	-
TauSpinner+DIZET (estimated)	0.99211(0)	1.02321(0)	0.99264(0)	0.98884

Table 52: Forward-backward asymmetry A_{fb} and differences: NLO-LO, (NLO+HO)-LO, predictions with different codes in EW scheme $\alpha(0)$ v1. Show are also corrections estimated with TauSpinner+DIZET, needed to match (NLO+HO) predictions calculated in EW $\alpha(0)$ v0 scheme.

Programs	$89 < m_{ee} < 93$ GeV	$60 < m_{ee} < 81$ GeV	$81 < m_{ee} < 101$ GeV	$101 < m_{ee} < 150$ GeV
$A_{fb}(LO)$				
MCSANC	0.04655(1)	-0.20304(4)	0.04482(1)	-
Powheg_ew	0.04655(1)	-0.20298(2)	0.04481(1)	-
WZGRAD2	0.04654(1)	-0.20299(8)	0.04482(1)	-
RADY(FS)	0.04655(1)	-0.20295(1)	0.04481(1)	-
$A_{fb}(NLO) - A_{fb}(LO)$				
MCSANC	-0.01596(1)	-0.01103(6)	-0.01595(1)	-
Powheg_ew	-0.01641(2)	-0.01148(3)	-0.01640(2)	-
WZGRAD2	-0.01619(2)	-0.01121(12)	-0.01617(2)	-
RADY(FS)	-0.01620(1)	-0.01133(1)	-0.01619(1)	-
$A_{fb}(NLO + HO) - A_{fb}(NLO)$				
MCSANC	0.00077(1)	0.00068(6)	0.00078(1)	-
Powheg_ew	0.00077(1)	0.00074(3)	0.00078(2)	-
WZGRAD2	0.00184(1)	0.00132(3)	0.00185(4)	-
RADY(FS)	0.00078(1)	0.00066(1)	0.00078(1)	-
$A_{fb}(NLO + HO) - A_{fb}(LO)$				
MCSANC	-0.01519(1)	-0.01035(6)	-0.01517(1)	-
Powheg_ew	-0.01564(2)	-0.01074(2)	-0.01562(2)	-
WZGRAD2	-0.01434(1)	-0.00989(2)	-0.01434(4)	-
RADY(FS)	-0.01542(1)	-0.01067(1)	-0.01541(1)	-
TauSpinner+DIZET (estimated)	-0.01508(0)	-0.01104(0)	-0.01515(0)	-0.00684

-0.01122(2)

Table 53: Forward-backward asymmetry A_{fb} and differences: NLO/LO, (NLO+HO)/LO, predictions with different codes in EW scheme G_μ . Show are also corrections estimated with TauSpinner+DIZET, needed to match (NLO+HO) predictions calculated in EW $\alpha(0)$ v0 scheme.

Programs	$89 < m_{ee} < 93$ GeV	$60 < m_{ee} < 81$ GeV	$81 < m_{ee} < 101$ GeV	$101 < m_{ee} < 150$ GeV
	$A_{fb}(LO)$			
MCSANC	0.04654(1)	-0.20299(4)	0.04481(1)	-
Powheg_ew	0.04655(1)	-0.20298(2)	0.04481(1)	-
WZGRAD2	0.04654(1)	-0.20299(8)	0.04482(1)	-
RADY(FS)	0.04655(1)	-0.20295(1)	0.04481(1)	-
	$A_{fb}(NLO) - A_{fb}(LO)$			
MCSANC	-0.01688(2)	-0.01170(8)	-0.01688(2)	-
Powheg_ew	-0.01740(2)	-0.01214(3)	-0.01738(2)	-
WZGRAD2	-0.01716(2)	-0.01186(11)	-0.01715(2)	-
RADY(FS)	-0.01717(1)	-0.01199(1)	-0.01716(1)	-
	$A_{fb}(NLO + HO) - A_{fb}(NLO)$			
MCSANC	0.00137(2)	0.00111(8)	0.00137(2)	-
Powheg_ew	0.00137(2)	0.00112(3)	0.00136(2)	-
WZGRAD2	0.00183(1)	0.00131(3)	0.00183(5)	-
RADY(FS)	0.00122(1)	0.00103(1)	0.00122(1)	-
	$A_{fb}(NLO + HO) - A_{fb}(LO)$			
MCSANC	-0.01551(2)	-0.01059(8)	-0.01551(1)	-
Powheg_ew	-0.01603(2)	-0.01102(3)	-0.01602(2)	-
WZGRAD2	-0.01533(1)	-0.01056(2)	-0.01532(5)	-
RADY(FS)	-0.01595(1)	-0.01096(1)	-0.01594(1)	-
TauSpinner+DIZET (estimated)	-0.01597(0)	-0.01104(0)	-0.01514(0)	0.00684

-0.01186(3)