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W and Z production

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Conclusions

## $W^{\pm}, Z^{0}$ and Higgs Boson Production at Hadron Colliders at NNLO

Johannes Blümlein, DESY

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• NNLO predictions are of importance for a series of key cross sections at hadron colliders.

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- NNLO predictions are of importance for a series of key cross sections at hadron colliders.
- This applies to the W, Z, and Higgs boson cross sections in particular.

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- NNLO predictions are of importance for a series of key cross sections at hadron colliders.
- This applies to the W, Z, and Higgs boson cross sections in particular.
- We present detailed NNLO predictions based on all current distributions: ABKM09, ABM10, HERAPDF, JR, MSTW08.

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• We compare to all experimental data having ever been measured.



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- NNLO predictions are of importance for a series of key cross sections at hadron colliders.
- This applies to the W, Z, and Higgs boson cross sections in particular.
- We present detailed NNLO predictions based on all current distributions: ABKM09, ABM10, HERAPDF, JR, MSTW08.
- We compare to all experimental data having ever been measured.
- The study derives realistic theory errors for the use in the present and upcoming measurements at the Tevatron and the LHC.



## $W^{\pm}$ and $Z^0 p\overline{p}$ -cross sections

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$\sqrt{s}$ (TeV)		0.546	0.630	1.8	1.96
ABM10	$W^{\pm}$	$5.632\pm0.092$	$7.045\pm0.111$	$24.441\pm0.235$	$26.740\pm0.259$
$\alpha_s=0.1147\pm 0.0012$	$Z^0$	$1.761\pm0.022$	$2.187\pm0.028$	$7.181\pm0.068$	$7.846\pm0.075$
ABKM09	$W^{\pm}$	$5.804 \pm 0.075$	$7.222 \pm 0.091$	$23.88 \pm 0.243$	$26.09 \pm 0.265$
$\alpha_s=0.1135\pm 0.0014$	$Z^0$	$1.806\pm0.020$	$2.234\pm0.024$	$7.056\pm0.068$	$7.691\pm0.075$
JR	$W^{\pm}$	$5.983 \pm 0.148$	$7.346\pm0.159$	$23.069\pm0.238$	$25.157 \pm 0.251$
$\alpha_s=0.1124\pm 0.0020$		$(5.358\pm0.152)$	$(6.637\pm0.167)$	$(22.121\pm0.274)$	$(24.181\pm0.296)$
	$Z^0$	$1.837\pm0.029$	$2.268\pm0.034$	$6.975\pm0.071$	$7.586\pm0.076$
		$(1.648\pm0.028)$	$(2.047\pm0.033)$	$(6.667\pm0.080)$	$(7.272 \pm 0.087)$
MSTW08	$W^{\pm}$	$5.469\pm0.151$	$6.802\pm0.176$	$23.14 \pm 0.394$	$25.35\pm0.422$
$\alpha_s=0.1171\pm 0.014$	$Z^0$	$1.654\pm0.047$	$2.056\pm0.056$	$6.773 \pm 0.126$	$7.406\pm0.134$
HERAPDF	$W^{\pm}$	6.121	7.519	24.51	26.80
$\alpha_s = 0.1145$	$Z^0$	1.853	2.296	7.319	7.978

Table 1: NNLO predictions for the production cross sections  $a(p\overline{p} \rightarrow V + X) [nb]$ , with  $V = W^{\pm}, Z^{0}$ . The abbreviation  $W^{\pm}$  refers to the sum  $W^{+} + W^{-}$ . Notice that for  $p\overline{p}$  collisions the  $W^{+}$  and  $W^{-}$ cross sections are equal. The errors refer to the  $\pm l\sigma$  pdf uncertainties. The NNLO values of  $\alpha_{s}$  refer to  $\alpha_{s} = \alpha_{s}(M_{Z}^{2})$ . To allow for a comparison with the corrections up to NLO the corresponding cross sections for the JR distributions are also listed as an example in parentheses.

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$\sqrt{s}$ (TeV)		0.5	7	10	14
ABM10	$W^+$	$1.236 \pm 0.057$	$59.86 \pm 0.838$	$85.58 \pm 1.267$	$118.4\pm1.891$
	$W^-$	$0.363 \pm 0.092$	$40.28\pm0.535$	$60.28 \pm 0.852$	$86.58\pm1.331$
	$W^{\pm}$	$1.600\pm0.070$	$100.1\pm1.315$	$145.9\pm2.065$	$205.0\pm3.186$
	$Z^0$	$0.305\pm0.015$	$29.01\pm0.391$	$42.77\pm0.633$	$60.69\pm0.963$
ABKM09	$W^+$	$1.160\pm0.046$	$58.86 \pm 0.903$	$85.14 \pm 1.427$	$119.4 \pm 2.072$
	$W^-$	$0.348 \pm 0.014$	$39.43\pm0.614$	$59.56 \pm 0.993$	$86.53 \pm 1.525$
	$W^{\pm}$	$1.509\pm0.058$	$98.27 \pm 1.527$	$144.7 \pm 2.436$	$205.9 \pm 3.658$
	$Z^0$	$0.287 \pm 0.012$	$28.42\pm0.457$	$42.28 \pm 0.743$	$60.70 \pm 0.115$
JR	$W^+$	$1.138\pm 0.061$	$54.57 \pm 1.10$	$78.43 \pm 1.98$	$109.31 \pm 3.13$
		$(1.245\pm0.065)$	$(52.96 \pm 0.99)$	$(76.60 \pm 1.74)$	$(107.58\pm2.95)$
	$W^{-}$	$0.387\pm0.028$	$37.15\pm0.79$	$55.54 \pm 1.44$	$80.02 \pm 2.31$
		$(0.427 \pm 0.030)$	$(36.39 \pm 0.72)$	$(54.67 \pm 1.26)$	$(79.16 \pm 2.12)$
	$W^{\pm}$	$1.525\pm0.052$	$91.72 \pm 1.82$	$133.99\pm3.35$	$189.29\pm5.41$
		$(1.672\pm0.053)$	$(89.36 \pm 1.57)$	$(131.23\pm2.87)$	$(186.74 \pm 4.95)$
	$Z^0$	$0.300\pm0.011$	$27.24\pm0.50$	$40.39 \pm 0.95$	$57.85 \pm 1.56$
		$(0.336\pm0.012)$	$(26.57 \pm 0.43)$	$(39.57 \pm 0.81)$	$(57.00 \pm 1.42)$
MSTW08	$W^+$	$1.221\pm0.0421$	$56.80 \pm 0.971$	$81.83 \pm 1.405$	$114.0\pm1.945$
	$W^-$	$0.416\pm0.017$	$39.63 \pm 0.678$	$59.45\pm1.008$	$85.63 \pm 1.484$
	$W^{\pm}$	$1.637\pm0.052$	$96.41 \pm 1.607$	$141.3\pm2.372$	$199.6\pm3.379$
	$Z^0$	$0.319\pm0.011$	$27.89\pm0.481$	$41.34\pm0.705$	$58.99  \pm  1.012$
HERAPDF	$W^+$	1.219	59.37	85.37	119.0
	$W^{-}$	0.414	40.82	61.06	87.94
	$W^{\pm}$	1.633	100.2	146.4	206.9
1	$Z^0$	0.322	29.08	42.95	61.22

 $W^{\pm}$  and  $Z^0$  *pp*-cross sections

Table 2: NNLO predictions for the production cross sections  $\sigma(pp \rightarrow V + X) [nb]$ , with  $V = W^{\pm}, Z^{0}$ . The abbreviation  $W^{\pm}$  denotes the sum  $W^{+} + W^{-}$ . The errors refer to the  $\pm 1\sigma$  pdf uncertainties. To allow for a comparison with the corrections up to NLO we also listed the corresponding cross sections for the JR distributions as an example in parentheses .



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 $W^{\pm}$  and  $Z^0$  production cross sections

Figure 1: Comparison of different NNLO predictions for the inclusive  $W^+$ ,  $W^-$ ,  $W^+$ , and  $Z^0$  boson production cross sections in  $p\bar{p}$  annihilation and pp scattering ( $\sqrt{S} = 0.5$  TeV) based on the pdfs of recent NNLO analyses, ABM,ABKM,JR,HERAPDF,MSTW08,MSTW10, and the corresponding experimental data by UA1,UA2,PHENIX,CDF,CDF1,D0,ATLAS,CMS. Left panel (a): the lower energy region corresponds to  $\bar{p}\bar{p}$  collisions, except at 0.5 TeV, which refers to pp scattering. For the latter case the predictions refer to (from above)  $W^+ + W^-$ ,  $W^-$  and the ones for  $Z^0$  are given to the right of the ones for  $W^-$ . Right panel (b): LHC energies (pp collisions); the inner error bars refer to ( $\sigma_{\rm stat}^2 + \sigma_{\rm syst}^2$ )<sup>1/2</sup> and the total error is obtained by adding the luminosity error in quadrature.



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$M_H$ (GeV)	ABM10	ABKM09	JR	MSTW08	HERAPDF
100	$1.438 \pm 0.066$	$1.380\pm0.076$	$1.593\pm0.091$	$1.682\pm0.046$	1.417
110	$1.051\pm0.052$	$1.022\pm0.061$	$1.209\pm0.078$	$1.265\pm0.038$	1.055
115	$0.904\pm0.047$	$0.885\pm0.055$	$1.060\pm0.072$	$1.104\pm0.034$	0.917
120	$0.781\pm0.042$	$0.770\pm0.050$	$0.933\pm0.067$	$0.968 \pm 0.031$	0.800
125	$0.677 \pm 0.038$	$0.672\pm0.045$	$0.823\pm0.062$	$0.851\pm0.029$	0.700
130	$0.588\pm0.034$	$0.589\pm0.041$	$0.729\pm0.058$	$0.752 \pm 0.026$	0.615
135	$0.513\pm0.031$	$0.518\pm0.037$	$0.647 \pm 0.054$	$0.666 \pm 0.024$	0.541
140	$0.449\pm0.028$	$0.456\pm0.034$	$0.576\pm0.050$	$0.591\pm0.022$	0.479
145	$0.394\pm0.025$	$0.403\pm0.031$	$0.514\pm0.047$	$0.527 \pm 0.020$	0.424
150	$0.347\pm0.023$	$0.358\pm0.028$	$0.461\pm0.044$	$0.471 \pm 0.018$	0.377
155	$0.306\pm0.020$	$0.318\pm0.026$	$0.413\pm0.041$	$0.421 \pm 0.017$	0.336
160	$0.271\pm0.019$	$0.283\pm0.024$	$0.371\pm0.039$	$0.378 \pm 0.016$	0.300
165	$0.240\pm0.017$	$0.253\pm0.022$	$0.335\pm0.036$	$0.341 \pm 0.014$	0.269
170	$0.213\pm0.015$	$0.226\pm0.020$	$0.302\pm0.034$	$0.307 \pm 0.013$	0.241
175	$0.190\pm0.014$	$0.203\pm0.019$	$0.274\pm0.032$	$0.278 \pm 0.012$	0.217
180	$0.169\pm0.013$	$0.182\pm0.017$	$0.248\pm0.030$	$0.251\pm0.012$	0.195
185	$0.151\pm0.012$	$0.164\pm0.016$	$0.225 \pm 0.028$	$0.228 \pm 0.011$	0.176
190	$0.136\pm0.011$	$0.148\pm0.015$	$0.205\pm0.027$	$0.207 \pm 0.010$	0.159
200	$0.109 \pm 0.009$	$0.121 \pm 0.013$	$0.170 \pm 0.024$	$0.172 \pm 0.009$	0.131

Table 3: NNLO predictions for the production cross sections  $\sigma(p\overline{p} \rightarrow H^0 + X)$  [pb] at  $\sqrt{S} = 1.96$  TeV. The errors refer to the  $\pm 1\sigma$  pdf uncertainties.

## $H^0 p\overline{p}$ -production cross section at Tevatron

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$M_H$ (GeV)	ABM10	ABKM09	JR	MSTW08	HERAPDF
100	$22.82\pm0.53$	$21.18\pm0.60$	$20.48 \pm 0.70$	$22.95\pm0.31$	20.90
110	$18.65\pm0.44$	$17.30\pm0.49$	$16.92\pm0.56$	$18.84\pm0.26$	17.12
115	$16.95\pm0.40$	$15.72\pm0.45$	$15.46\pm0.50$	$17.16\pm0.23$	15.58
120	$15.45\pm0.37$	$14.34\pm0.41$	$14.17 \pm 0.45$	$15.69\pm0.22$	14.22
125	$14.14\pm0.35$	$13.12\pm0.38$	$13.03\pm0.41$	$14.39\pm0.20$	13.03
130	$12.96\pm0.32$	$12.03\pm0.35$	$12.01\pm0.37$	$13.23\pm0.19$	11.97
135	$11.92\pm0.29$	$11.07\pm0.33$	$11.10\pm0.34$	$12.20\pm0.17$	11.02
140	$10.99\pm0.27$	$10.21\pm0.31$	$10.29\pm0.32$	$11.28\pm0.16$	10.18
145	$10.15\pm0.26$	$9.44\pm0.29$	$9.55\pm0.29$	$10.45\pm0.15$	9.42
150	$9.40\pm0.24$	$8.75\pm0.27$	$8.89 \pm 0.27$	$9.71 \pm 0.14$	8.74
155	$8.73\pm0.23$	$8.13\pm0.25$	$8.30\pm0.25$	$9.04\pm0.14$	8.13
160	$8.12\pm0.21$	$7.56\pm0.24$	$7.75 \pm 0.24$	$8.43\pm0.13$	7.57
165	$7.56\pm0.20$	$7.05\pm0.23$	$7.26 \pm 0.23$	$7.88\pm0.12$	7.07
170	$7.06\pm0.19$	$6.59\pm0.21$	$6.82 \pm 0.21$	$7.38\pm0.12$	6.62
175	$6.60\pm0.18$	$6.17\pm0.20$	$6.41\pm0.20$	$6.92\pm0.11$	6.20
180	$6.19\pm0.17$	$5.79\pm0.19$	$6.04\pm0.19$	$6.51\pm0.11$	5.83
185	$5.80\pm0.16$	$5.43 \pm 0.18$	$5.70\pm0.18$	$6.13\pm0.10$	5.48
190	$5.46\pm0.15$	$5.11\pm0.17$	$5.39\pm0.18$	$5.78\pm0.10$	5.16
200	$4.84 \pm 0.14$	$4.55\pm0.16$	$4.83\pm0.16$	$5.16\pm0.09$	4.60
220	$3.88\pm0.12$	$3.67\pm0.14$	$3.96\pm0.14$	$4.20\pm0.08$	3.73
240	$3.18\pm0.10$	$3.02\pm0.12$	$3.32\pm0.13$	$3.49\pm0.07$	3.09
260	$2.66\pm0.09$	$2.55\pm0.10$	$2.84 \pm 0.12$	$2.96 \pm 0.06$	2.61
280	$2.28\pm0.08$	$2.19\pm0.09$	$2.48\pm0.11$	$2.58 \pm 0.06$	2.26
300	$2.00 \pm 0.08$	$1.94 \pm 0.09$	$2.23 \pm 0.11$	$2.29 \pm 0.06$	2.00

H<sup>0</sup> pp-production at LHC  $\sqrt{S} = 7$  TeV

Table 4: NNLO predictions for the production cross sections  $\sigma(pp \rightarrow H^0 + X)$  [pb] at LHC for  $\sqrt{S} = 7$  TeV. The errors refer to the  $\pm 1\sigma$  pdf uncertainties.



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$M_H$ (GeV)	ABM10	ABKM09	JR	MSTW08	HERAPDF
100	$28.81\pm0.65$	$26.81\pm0.74$	$25.66\pm0.91$	$28.85\pm0.38$	26.38
110	$23.71\pm0.54$	$22.04\pm0.61$	$21.31\pm0.72$	$23.83\pm0.32$	21.74
115	$21.62\pm0.49$	$20.09\pm0.56$	$19.53\pm0.65$	$21.77\pm0.29$	19.85
120	$19.78\pm0.46$	$18.38\pm0.51$	$17.95\pm0.59$	$19.96\pm0.27$	18.18
125	$18.15\pm0.42$	$16.86\pm0.48$	$16.55\pm0.53$	$18.35\pm0.25$	16.70
130	$16.70\pm0.39$	$15.52\pm0.44$	$15.29\pm0.49$	$16.93\pm0.23$	15.39
135	$15.41\pm0.36$	$14.32\pm0.40$	$14.17 \pm 0.44$	$15.65\pm0.21$	14.21
140	$14.25\pm0.34$	$13.24\pm0.38$	$13.16\pm0.41$	$14.51\pm0.20$	13.16
145	$13.21\pm0.32$	$12.28\pm0.36$	$12.26\pm0.37$	$13.48\pm0.19$	12.22
150	$12.27\pm0.30$	$11.41\pm0.33$	$11.44\pm0.35$	$12.55\pm0.18$	11.37
155	$11.42\pm0.28$	$10.63\pm0.31$	$10.69\pm0.32$	$11.71\pm0.17$	10.60
160	$10.66\pm0.26$	$9.92\pm0.29$	$10.02\pm0.30$	$10.96\pm0.16$	9.90
165	$9.96\pm0.25$	$9.28\pm0.27$	$9.41 \pm 0.28$	$10.27\pm0.15$	9.27
170	$9.33\pm0.23$	$8.69\pm0.26$	$8.85 \pm 0.27$	$9.64\pm0.14$	8.69
175	$8.75\pm0.22$	$8.15\pm0.25$	$8.34 \pm 0.25$	$9.06 \pm 0.14$	8.17
180	$8.22\pm0.21$	$7.67\pm0.24$	$7.88\pm0.24$	$8.54\pm0.13$	7.69
185	$7.73\pm0.20$	$7.22\pm0.23$	$7.45\pm0.23$	$8.06\pm0.12$	7.25
190	$7.29\pm0.19$	$6.81\pm0.21$	$7.06\pm0.22$	$7.62\pm0.12$	6.85
200	$6.51\pm0.18$	$6.09\pm0.20$	$6.36\pm0.20$	$6.84\pm0.11$	6.14
220	$5.28\pm0.15$	$4.96\pm0.17$	$5.26 \pm 0.17$	$5.61\pm0.10$	5.02
240	$4.37\pm0.13$	$4.13\pm0.15$	$4.44\pm0.15$	$4.70\pm0.09$	4.19
260	$3.70\pm0.12$	$3.51\pm0.13$	$3.83\pm0.14$	$4.03\pm0.08$	3.58
280	$3.20\pm0.10$	$3.05\pm0.12$	$3.38\pm0.14$	$3.53\pm0.07$	3.13
300	$2.83 \pm 0.10$	$2.72 \pm 0.11$	$3.05 \pm 0.13$	$3.17 \pm 0.07$	2.79

H<sup>0</sup> pp-production at LHC  $\sqrt{S} = 8$  TeV

Table 5: NNLO predictions for the production cross sections  $\sigma(pp \rightarrow H^0 + X)$  [pb] at LHC for  $\sqrt{S} = 8$  TeV. The errors refer to the  $\pm 1\sigma$  pdf uncertainties.



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$M_H$ (GeV)	ABM10	ABKM09	JR	MSTW08	HERAPDF
100	$71.16 \pm 1.53$	$67.27 \pm 1.78$	$62.24 \pm 2.62$	$70.73\pm0.98$	65.54
110	$60.05 \pm 1.27$	$56.60 \pm 1.48$	$52.77 \pm 2.11$	$59.73\pm0.81$	55.28
115	$55.42 \pm 1.17$	$52.17 \pm 1.36$	$48.82 \pm 1.92$	$55.16\pm0.73$	51.01
120	$51.32 \pm 1.10$	$48.25 \pm 1.24$	$45.32\pm1.74$	$51.10\pm0.69$	47.23
125	$47.63 \pm 1.00$	$44.73 \pm 1.16$	$42.16\pm1.59$	$47.46\pm0.62$	43.83
130	$44.33\pm0.94$	$41.59 \pm 1.08$	$39.32 \pm 1.45$	$44.19\pm0.57$	40.80
135	$41.36\pm0.87$	$38.77 \pm 1.00$	$36.77 \pm 1.33$	$41.26\pm0.53$	38.07
140	$38.67\pm0.81$	$36.22\pm0.93$	$34.45\pm1.23$	$38.60\pm0.49$	35.60
145	$36.23\pm0.77$	$33.92\pm0.87$	$32.36\pm1.13$	$36.21\pm0.46$	33.37
150	$34.02\pm0.71$	$31.83\pm0.81$	$30.46\pm1.04$	$34.03\pm0.43$	31.34
155	$32.00\pm0.67$	$29.93\pm0.77$	$28.72\pm0.97$	$32.04\pm0.40$	29.49
160	$30.16\pm0.64$	$28.20\pm0.72$	$27.14\pm0.90$	$30.22\pm0.38$	27.81
165	$28.48\pm0.62$	$26.62\pm0.68$	$25.70\pm0.83$	$28.58\pm0.36$	26.28
170	$26.93\pm0.57$	$25.16\pm0.65$	$24.37 \pm 0.78$	$27.05\pm0.34$	24.87
175	$25.52\pm0.54$	$23.83\pm0.61$	$23.15\pm0.73$	$25.65\pm0.32$	23.58
180	$24.21\pm0.52$	$22.61\pm0.58$	$22.03\pm0.69$	$24.37\pm0.31$	22.39
185	$23.00\pm0.49$	$21.48\pm0.56$	$20.99\pm0.64$	$23.18\pm0.29$	21.30
190	$21.90\pm0.47$	$20.44\pm0.53$	$20.04 \pm 0.61$	$22.09\pm0.28$	20.29
200	$19.91\pm0.43$	$18.59\pm0.49$	$18.33\pm0.55$	$20.14\pm0.26$	18.49
220	$16.75\pm0.37$	$15.64\pm0.41$	$15.59\pm0.45$	$17.03\pm0.22$	15.62
240	$14.38\pm0.33$	$13.44\pm0.36$	$13.54\pm0.38$	$14.70\pm0.19$	13.46
260	$12.60\pm0.29$	$11.79\pm0.33$	$12.01\pm0.34$	$12.96\pm0.18$	11.85
280	$11.27\pm0.27$	$10.56\pm0.30$	$10.86\pm0.30$	$11.66\pm0.17$	10.64
300	$10.32 \pm 0.25$	$9.69\pm0.28$	$10.07\pm0.29$	$10.75\pm0.16$	9.80

H<sup>0</sup> pp-production at LHC  $\sqrt{S} = 14$  TeV

Table 6: NNLO predictions for the production cross sections  $\sigma(pp \rightarrow H^0 + X)$  [pb] at LHC for  $\sqrt{S} =$ 14 TeV. The errors refer to the  $\pm 1\sigma$  pdf uncertainties.



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## Comparison of the current NNLO gluon densities



Figure 2: Comparison of the NNLO gluon distributions at  $Q^2 = 4$  GeV<sup>2</sup> and  $Q^2 = (160 \text{ GeV})^2$  for the ratio  $xg(x, Q^2)/xg(x, Q^2)_{ABKA}$  for ABKM09 (full line), (dashed line), MSTW08 (dotted line), and HERAPDF(dash-dotted line, without error band).

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Figure 3: Predictions of the inclusive Higgs–boson production cross sections at NNLO for different energies at the LHC for the parton distributions ABM10, JR, HERAPDF, MSTW08. For the ABM10 and JR distributions the scale variation errors corresponding to the range  $M_H/2 \le \mu_F = \mu_R \le 2M_H$ are included. The inner error bars refer to the pdf–errors only.

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• The combined HERA data are essential for the prediction of the Standard Candels and Higgs boson production at Tavatron and LHC at NNLO.



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- The combined HERA data are essential for the prediction of the Standard Candels and Higgs boson production at Tavatron and LHC at NNLO.
- W<sup>±</sup> and Z<sup>0</sup> boson production at LHC is currently predicted with an accuracy of 10%, mainly due to the present differences in the sea quark densities .



# Johannes

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- The combined HERA data are essential for the prediction of the Standard Candels and Higgs boson production at Tavatron and LHC at NNLO.
- $W^{\pm}$  and  $Z^0$  boson production at LHC is currently predicted with an accuracy of 10%, mainly due to the present differences in the sea quark densities .
- The Higgs boson production cross section at Tevatron has a current error of  $\sim 40\%.$



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- The combined HERA data are essential for the prediction of the Standard Candels and Higgs boson production at Tavatron and LHC at NNLO.
- $W^{\pm}$  and  $Z^0$  boson production at LHC is currently predicted with an accuracy of 10%, mainly due to the present differences in the sea quark densities .
- The Higgs boson production cross section at Tevatron has a current error of  $\sim 40\%.$

• Here the reference to MSTW08 only may lead to wrong exculsion bounds.



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Conclusions

- The combined HERA data are essential for the prediction of the Standard Candels and Higgs boson production at Tavatron and LHC at NNLO.
- $W^{\pm}$  and  $Z^0$  boson production at LHC is currently predicted with an accuracy of 10%, mainly due to the present differences in the sea quark densities .
- $\bullet\,$  The Higgs boson production cross section at Tevatron has a current error of  $\sim 40\%.$
- Here the reference to MSTW08 only may lead to wrong exculsion bounds.

 $\bullet\,$  At LHC an accuracy of 10-17 % is obtained.



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• An essential limiting factor for the accuracy of the Higgs boson production cross section is the present knowledge of  $\alpha_s(M_Z^2)$ .

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## Conclusions

- An essential limiting factor for the accuracy of the Higgs boson production cross section is the present knowledge of  $\alpha_s(M_Z^2)$ .
- The theoretical error on the W,Z and Higgs boson production cross sections at NNLO are given by the cover of the ABM10, HERAPDF, JR, and MSTW08 predictions.