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Upsilon Results

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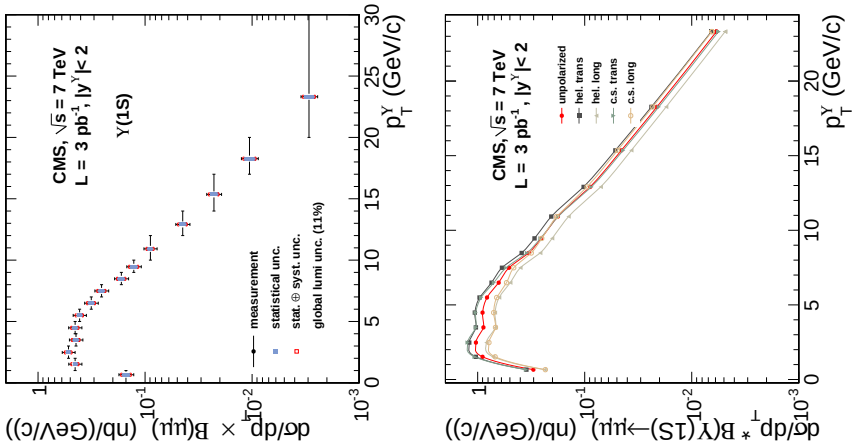
0.1 Cross Rection Results

0.1.1 results for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$

Figure 1: Υ(1S) cross section results, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$



(a) (b)

Table 1: Υ(1S) cross section results, for $d\sigma/dp_{\rm T}$ $|y| < 2$, relative uncertainty in %.

$p_{\rm T}$(GeV/c)	σ	stat./σ	$\sum_{\rm syst.}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0-30$	7.37	1.8	8 (6)	14 (13)	+16	-22	+13	-16
$0-1$	0.30	8	10 (7)	17 (15)	+16	-22	+17	-23
$1-2$	0.90	5	9 (6)	15 (14)	+16	-20	+19	-24
$2-3$	1.04	5	8 (6)	14 (13)	+15	-20	+19	-24
$3-4$	0.88	6	9 (7)	15 (14)	+18	-23	+18	-23
$4-5$	0.90	6	8 (6)	15 (14)	+18	-23	+16	-21
$5-6$	0.82	6	8 (6)	15 (14)	+17	-23	+13	-19
$6-7$	0.64	7	8 (5)	15 (14)	+17	-22	+11	-16
$7-8$	0.51	7	8 (6)	15 (14)	+16	-22	+7	-10
$8-9$	0.33	8	8 (6)	16 (14)	+16	-22	+4	-5
$9-10$	0.25	8	9 (6)	16 (15)	+15	-21	+2	-1
$10-12$	0.36	6	8 (5)	15 (14)	+15	-21	-1	+3
$12-14$	0.18	8	9 (5)	16 (14)	+15	-20	-3	+7
$14-17$	0.14	9	10 (6)	17 (15)	+14	-19	-4	+9
$17-20$	0.06	12	10 (6)	19 (17)	+13	-18	-4	+10
$20-30$	0.06	12	10 (6)	19 (17)	+12	-17	-4	+10

Table 2: Υ(1S) cross section systematics, for $d\sigma/dp_{\rm T}$ $|y| < 2$, relative uncertainty in %.

$p_{\rm T}$	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0-30$	0.5 (0.5)	7.5 (4.6)	0.3 (0.3)	0.6	0.7	0.7	0.0	0.9	0.5	3.0
$0-1$	0.4 (0.4)	8.3 (5.4)	0.1 (0.1)	0.2	1.1	0.8	0.5	0.8	3.4	3.1
$1-2$	0.4 (0.4)	7.8 (5.2)	0.2 (0.2)	0.6	0.6	0.7	0.2	1.1	1.8	3.0
$2-3$	0.5 (0.5)	7.3 (4.7)	0.6 (0.6)	0.3	0.3	0.8	0.1	1.1	1.5	3.0
$3-4$	0.6 (0.6)	7.3 (4.8)	0.6 (0.6)	0.1	0.4	0.8	0.0	1.1	3.7	3.0
$4-5$	0.6 (0.6)	7.4 (4.5)	0.4 (0.3)	0.3	0.7	0.7	0.0	0.9	2.3	3.0
$5-6$	0.6 (0.6)	7.4 (4.3)	0.2 (0.3)	0.5	1.0	0.7	0.0	0.7	0.5	3.0
$6-7$	0.6 (0.6)	7.4 (4.1)	0.2 (0.3)	0.7	1.1	0.6	0.1	0.7	0.4	3.0
$7-8$	0.6 (0.6)	7.7 (4.7)	0.1 (0.1)	1.0	0.7	0.6	0.2	0.8	1.0	3.1
$8-9$	0.6 (0.6)	7.4 (4.2)	0.0 (0.1)	1.2	0.7	0.5	0.0	0.7	1.0	3.0
$9-10$	0.5 (0.5)	7.8 (4.3)	0.1 (0.0)	1.3	0.9	0.5	0.2	0.6	1.9	3.1
$10-12$	0.5 (0.5)	7.4 (3.7)	0.1 (0.1)	1.4	0.8	0.5	0.2	0.6	0.2	3.0
$12-14$	0.5 (0.4)	7.9 (4.0)	0.2 (0.1)	1.6	0.9	0.5	0.1	0.6	0.3	3.1
$14-17$	0.4 (0.4)	8.5 (4.2)	0.1 (0.1)	1.6	0.9	0.5	0.3	0.6	2.2	3.1
$17-20$	0.4 (0.4)	8.9 (4.4)	0.1 (0.1)	1.8	0.8	0.4	0.5	0.7	0.1	3.6
$20-30$	0.3 (0.3)	8.9 (4.3)	0.1 (0.1)	1.6	0.7	0.5	0.3	0.6	0.1	3.5

Table 3: Υ(1S) cross section results, for $d\sigma/dp_{\rm T}$ $|y| < 2$, relative uncertainty in %.

$p_{\rm T}$	σ	stat.	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\rm trk}$	ext.
0: 30	7.37	±1.8	$^{+0.5}_{-0.5}$	$^{+7.5}_{-4.6}$	$^{+0.3}_{-0.3}$	±0.6	±0.7	±0.7	±0.0	±0.9	±0.5	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
0: 1	0.30	±8.1	$^{+0.4}_{-0.4}$	$^{+8.3}_{-5.4}$	$^{+0.1}_{-0.1}$	±0.2	±1.1	±0.8	±0.5	±0.8	±3.4	$^{+0.0}_{-0.1}$	$^{+0.4}_{-0.4}$	±11.4
1: 2	0.90	±4.7	$^{+0.4}_{-0.4}$	$^{+7.8}_{-5.2}$	$^{+0.2}_{-0.2}$	±0.6	±0.6	±0.7	±0.2	±1.1	±1.8	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
2: 3	1.04	±4.6	$^{+0.5}_{-0.5}$	$^{+7.3}_{-4.7}$	$^{+0.6}_{-0.6}$	±0.3	±0.3	±0.8	±0.1	±1.1	±1.5	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
3: 4	0.88	±5.8	$^{+0.6}_{-0.6}$	$^{+7.3}_{-4.8}$	$^{+0.6}_{-0.6}$	±0.1	±0.4	±0.8	±0.0	±1.1	±3.7	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
4: 5	0.90	±5.6	$^{+0.6}_{-0.6}$	$^{+7.4}_{-4.5}$	$^{+0.4}_{-0.3}$	±0.3	±0.7	±0.7	±0.0	±0.9	±2.3	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
5: 6	0.82	±5.8	$^{+0.6}_{-0.6}$	$^{+7.4}_{-4.3}$	$^{+0.2}_{-0.3}$	±0.5	±1.0	±0.7	±0.0	±0.7	±0.5	$^{+0.1}_{-0.1}$	$^{+0.4}_{-0.4}$	±11.4
6: 7	0.64	±6.8	$^{+0.6}_{-0.6}$	$^{+7.4}_{-4.1}$	$^{+0.2}_{-0.3}$	±0.7	±1.1	±0.6	±0.1	±0.7	±0.4	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
7: 8	0.51	±6.9	$^{+0.6}_{-0.6}$	$^{+7.7}_{-4.7}$	$^{+0.1}_{-0.1}$	±1.0	±0.7	±0.6	±0.2	±0.8	±1.0	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
8: 9	0.33	±7.6	$^{+0.6}_{-0.6}$	$^{+7.4}_{-4.2}$	$^{+0.0}_{-0.1}$	±1.2	±0.7	±0.5	±0.0	±0.7	±1.0	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
9:10	0.25	±8.2	$^{+0.5}_{-0.5}$	$^{+7.8}_{-4.3}$	$^{+0.1}_{-0.0}$	±1.3	±0.9	±0.5	±0.2	±0.6	±1.9	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
10:12	0.36	±5.9	$^{+0.5}_{-0.5}$	$^{+7.4}_{-3.7}$	$^{+0.1}_{-0.1}$	±1.4	±0.8	±0.5	±0.2	±0.6	±0.2	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
12:14	0.18	±7.7	$^{+0.5}_{-0.4}$	$^{+7.9}_{-4.0}$	$^{+0.2}_{-0.1}$	±1.6	±0.9	±0.5	±0.1	±0.6	±0.3	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
14:17	0.14	±8.7	$^{+0.4}_{-0.4}$	$^{+8.5}_{-4.2}$	$^{+0.1}_{-0.1}$	±1.6	±0.9	±0.5	±0.3	±0.6	±2.2	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
17:20	0.06	±12.0	$^{+0.4}_{-0.4}$	$^{+8.9}_{-4.4}$	$^{+0.1}_{-0.1}$	±1.8	±0.8	±0.4	±0.5	±0.7	±0.1	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.6
20:30	0.06	±11.7	$^{+0.3}_{-0.3}$	$^{+8.9}_{-4.3}$	$^{+0.1}_{-0.1}$	±1.6	±0.7	±0.5	±0.3	±0.6	±0.1	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.5

Table 4: Υ(1S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y| < 2$, absolute values.

p_{T}(GeV/c)	$\sigma(\Upsilon(1S))$	stat.	$\sum_{\mathrm{syst.}}$	lumi.	$\Delta\sigma$
$0-30$	7.370	$\pm$ 0.131	$^{+0.610}_{-0.419}$	$\pm$ 0.811	$^{+1.023}_{-0.922}$
$0-1$	0.302	$\pm$ 0.024	$^{+0.029}_{-0.022}$	$\pm$ 0.033	$^{+0.050}_{-0.047}$
$1-2$	0.901	$\pm$ 0.043	$^{+0.079}_{-0.058}$	$\pm$ 0.099	$^{+0.133}_{-0.122}$
$2-3$	1.038	$\pm$ 0.048	$^{+0.085}_{-0.062}$	$\pm$ 0.114	$^{+0.150}_{-0.138}$
$3-4$	0.884	$\pm$ 0.051	$^{+0.078}_{-0.062}$	$\pm$ 0.097	$^{+0.135}_{-0.126}$
$4-5$	0.901	$\pm$ 0.050	$^{+0.076}_{-0.055}$	$\pm$ 0.099	$^{+0.135}_{-0.124}$
$5-6$	0.818	$\pm$ 0.048	$^{+0.067}_{-0.045}$	$\pm$ 0.090	$^{+0.122}_{-0.111}$
$6-7$	0.636	$\pm$ 0.043	$^{+0.052}_{-0.035}$	$\pm$ 0.070	$^{+0.097}_{-0.089}$
$7-8$	0.510	$\pm$ 0.035	$^{+0.043}_{-0.030}$	$\pm$ 0.056	$^{+0.079}_{-0.073}$
$8-9$	0.333	$\pm$ 0.025	$^{+0.028}_{-0.019}$	$\pm$ 0.037	$^{+0.052}_{-0.048}$
$9-10$	0.255	$\pm$ 0.021	$^{+0.022}_{-0.015}$	$\pm$ 0.028	$^{+0.042}_{-0.038}$
$10-12$	0.357	$\pm$ 0.021	$^{+0.029}_{-0.018}$	$\pm$ 0.039	$^{+0.053}_{-0.048}$
$12-14$	0.178	$\pm$ 0.014	$^{+0.015}_{-0.010}$	$\pm$ 0.020	$^{+0.028}_{-0.026}$
$14-17$	0.136	$\pm$ 0.012	$^{+0.013}_{-0.008}$	$\pm$ 0.015	$^{+0.023}_{-0.021}$
$17-20$	0.063	$\pm$ 0.008	$^{+0.006}_{-0.004}$	$\pm$ 0.007	$^{+0.012}_{-0.011}$
$20-30$	0.059	$\pm$ 0.007	$^{+0.006}_{-0.003}$	$\pm$ 0.006	$^{+0.011}_{-0.010}$

Table 5: Υ(1S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y| < 2$, absolute values (central±stat.±syst.±lumi.).

p_{T}	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Colli
0: 30	$7.35 \pm 0.13^{+0.61}_{-0.42} \pm 0.81$	$8.56 \pm 0.15^{+0.71}_{-0.49} \pm 0.94$	$5.76 \pm 0.10^{+0.48}_{-0.33} \pm 0.63$	$8.29 \pm 0.15^{+0.69}_{-0.47} \pm 0.91$	6.1
0: 1	$0.30 \pm 0.02^{+0.03}_{-0.02} \pm 0.03$	$0.35 \pm 0.03^{+0.03}_{-0.03} \pm 0.04$	$0.24 \pm 0.02^{+0.02}_{-0.02} \pm 0.03$	$0.35 \pm 0.03^{+0.03}_{-0.03} \pm 0.04$	0.2
1: 2	$0.90 \pm 0.04^{+0.08}_{-0.06} \pm 0.10$	$1.04 \pm 0.05^{+0.09}_{-0.07} \pm 0.11$	$0.72 \pm 0.03^{+0.06}_{-0.05} \pm 0.08$	$1.07 \pm 0.05^{+0.09}_{-0.07} \pm 0.12$	0.6
2: 3	$1.04 \pm 0.05^{+0.08}_{-0.06} \pm 0.11$	$1.20 \pm 0.06^{+0.10}_{-0.07} \pm 0.13$	$0.83 \pm 0.04^{+0.07}_{-0.05} \pm 0.09$	$1.24 \pm 0.06^{+0.10}_{-0.07} \pm 0.14$	0.7
3: 4	$0.88 \pm 0.05^{+0.08}_{-0.06} \pm 0.10$	$1.04 \pm 0.06^{+0.09}_{-0.07} \pm 0.11$	$0.68 \pm 0.04^{+0.06}_{-0.05} \pm 0.07$	$1.04 \pm 0.06^{+0.09}_{-0.07} \pm 0.11$	0.6
4: 5	$0.90 \pm 0.05^{+0.08}_{-0.05} \pm 0.10$	$1.06 \pm 0.06^{+0.09}_{-0.06} \pm 0.12$	$0.69 \pm 0.04^{+0.06}_{-0.04} \pm 0.08$	$1.04 \pm 0.06^{+0.09}_{-0.06} \pm 0.11$	0.7
5: 6	$0.82 \pm 0.05^{+0.07}_{-0.05} \pm 0.09$	$0.96 \pm 0.06^{+0.08}_{-0.05} \pm 0.11$	$0.63 \pm 0.04^{+0.05}_{-0.03} \pm 0.07$	$0.93 \pm 0.05^{+0.08}_{-0.05} \pm 0.10$	0.6
6: 7	$0.64 \pm 0.04^{+0.05}_{-0.03} \pm 0.07$	$0.74 \pm 0.05^{+0.06}_{-0.04} \pm 0.08$	$0.50 \pm 0.03^{+0.04}_{-0.03} \pm 0.05$	$0.71 \pm 0.05^{+0.06}_{-0.04} \pm 0.08$	0.5
7: 8	$0.51 \pm 0.03^{+0.04}_{-0.03} \pm 0.06$	$0.59 \pm 0.04^{+0.05}_{-0.04} \pm 0.07$	$0.40 \pm 0.03^{+0.03}_{-0.02} \pm 0.04$	$0.54 \pm 0.04^{+0.05}_{-0.03} \pm 0.06$	0.4
8: 9	$0.33 \pm 0.03^{+0.03}_{-0.02} \pm 0.04$	$0.39 \pm 0.03^{+0.03}_{-0.02} \pm 0.04$	$0.26 \pm 0.02^{+0.02}_{-0.01} \pm 0.03$	$0.35 \pm 0.03^{+0.03}_{-0.02} \pm 0.04$	0.3
9:10	$0.25 \pm 0.02^{+0.02}_{-0.02} \pm 0.03$	$0.29 \pm 0.02^{+0.03}_{-0.02} \pm 0.03$	$0.20 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.26 \pm 0.02^{+0.02}_{-0.02} \pm 0.03$	0.2
10:12	$0.36 \pm 0.02^{+0.03}_{-0.02} \pm 0.04$	$0.41 \pm 0.02^{+0.03}_{-0.02} \pm 0.05$	$0.28 \pm 0.02^{+0.02}_{-0.01} \pm 0.03$	$0.35 \pm 0.02^{+0.03}_{-0.02} \pm 0.04$	0.3
12:14	$0.18 \pm 0.01^{+0.02}_{-0.01} \pm 0.02$	$0.20 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.14 \pm 0.01^{+0.01}_{-0.01} \pm 0.02$	$0.17 \pm 0.01^{+0.02}_{-0.01} \pm 0.02$	0.1
14:17	$0.14 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.16 \pm 0.01^{+0.01}_{-0.01} \pm 0.02$	$0.11 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.13 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	0.1
17:20	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.07 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.05 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	0.0
20:30	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.07 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.05 \pm 0.01^{+0.00}_{-0.00} \pm 0.01$	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	0.0

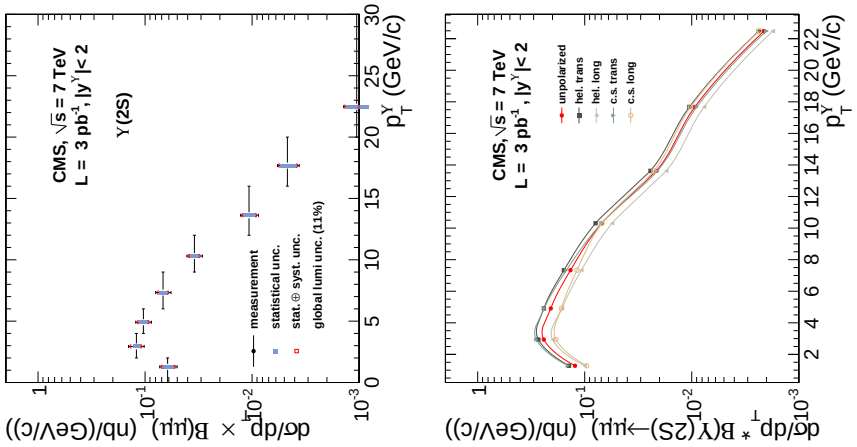
Table 6: Cross section calculation cross check, for Υ(1S) $d\sigma/dp_{\rm T}$ $|y| < 2$

$\Upsilon(1S)$	$p_{\rm T}$ ((GeV/c)			raw fit			weight, w			cros
|rapidity|	range	mean	rms	yield, N	s/e	χ^2/ndf	mean	rms	$\langle w\rangle^{-1}$	$\sigma_{\rm av.} \sim N \cdot \langle w\rangle$
0.0- 2.0	0- 1	0.7	0.2	426 ± 34	12	1.1	2.3	0.4	0.44± 0.09	0.315 ± 0.025
0.0- 2.0	1- 2	1.5	0.3	1153 ± 54	21	1.7	2.4	0.5	0.41± 0.09	0.912 ± 0.044
0.0- 2.0	2- 3	2.5	0.3	1154 ± 53	22	1.1	2.8	0.7	0.36± 0.09	1.048 ± 0.049
0.0- 2.0	3- 4	3.5	0.3	806 ± 46	17	1.3	3.4	0.9	0.30± 0.08	0.894 ± 0.053
0.0- 2.0	4- 5	4.5	0.3	769 ± 43	18	1.0	3.6	1.0	0.28± 0.08	0.913 ± 0.052
0.0- 2.0	5- 6	5.5	0.3	716 ± 40	17	1.1	3.6	0.9	0.28± 0.07	0.852 ± 0.049
0.0- 2.0	6- 7	6.5	0.3	578 ± 37	15	1.2	3.5	0.7	0.28± 0.06	0.666 ± 0.044
0.0- 2.0	7- 8	7.5	0.3	477 ± 33	15	1.3	3.3	0.6	0.30± 0.06	0.513 ± 0.036
0.0- 2.0	8- 9	8.5	0.3	344 ± 26	13	1.1	3.0	0.5	0.34± 0.06	0.334 ± 0.026
0.0- 2.0	9- 10	9.5	0.3	286 ± 24	12	1.1	2.7	0.5	0.37± 0.06	0.255 ± 0.021
0.0- 2.0	10- 12	10.9	0.5	449 ± 27	17	1.1	2.4	0.4	0.41± 0.07	0.359 ± 0.022
0.0- 2.0	12- 14	12.9	0.6	246 ± 19	13	1.3	2.2	0.3	0.45± 0.06	0.178 ± 0.014
0.0- 2.0	14- 17	15.4	0.9	208 ± 18	12	1.2	2.0	0.3	0.50± 0.07	0.138 ± 0.012
0.0- 2.0	17- 20	18.3	0.8	105 ± 13	8	0.8	1.9	0.2	0.54± 0.07	0.064 ± 0.008
0.0- 2.0	20- 30	23.3	2.5	109 ± 13	9	0.8	1.7	0.2	0.60± 0.08	0.059 ± 0.007
0.0- 2.0	0- 30			7825± 133						7.499 ± 1.000

Table 7: Υ(1S) cross section comparison: fit vs sum

$\Upsilon(1S)\,,\ 0 < \lvert y\rvert < 2\ :$	$\sigma = 7.353 \pm 0.132\,,$	$\sum d\sigma = 7.370 \pm 0.131\,,$	$\Delta = 0.2\%$

Figure 2: Υ(2S) cross section results, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$



(a) (b)

Table 8: Υ(2S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y| < 2$, relative uncertainty in %.

p_{T}(GeV/c)	σ	stat./σ	$\sum_{\mathrm{syst.}}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0-30$	1.90	4.2	9 (6)	15 (13)	+14	-19	+12	-15
$0-2$	0.25	12	11 (9)	20 (19)	+14	-19	+17	-22
$2-4$	0.48	8	12 (10)	18 (17)	+12	-17	+18	-23
$4-6$	0.41	10	10 (8)	18 (17)	+16	-22	+15	-20
$6-9$	0.41	9	10 (7)	17 (16)	+15	-21	+9	-13
$9-12$	0.21	10	9 (6)	17 (16)	+14	-20	+1	-0
$12-16$	0.09	13	10 (7)	20 (19)	+14	-19	-2	+6
$16-20$	0.04	18	11 (8)	24 (23)	+12	-18	-4	+9
$20-30$	0.02	23	20 (18)	32 (32)	+12	-17	-5	+11

Table 9: Υ(2S) cross section systematics, for $d\sigma/dp_{\rm T}$ $|y| < 2$, relative uncertainty in %.

$p_{\rm T}$	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0-30$	0.6 (0.6)	8.3 (4.9)	0.3 (0.3)	0.7	0.8	0.8	0.0	1.0	1.9	3.2
$0-2$	0.5 (0.5)	8.3 (5.2)	0.2 (0.2)	0.5	0.6	0.8	0.4	0.6	6.8	3.3
$2-4$	0.7 (0.7)	8.3 (5.4)	0.7 (0.8)	0.2	0.3	1.0	0.1	1.5	8.0	3.3
$4-6$	0.8 (0.7)	7.9 (4.7)	0.4 (0.4)	0.4	1.1	0.8	0.0	0.9	5.2	3.3
$6-9$	0.7 (0.7)	8.6 (4.8)	0.1 (0.1)	1.0	1.2	0.7	0.2	0.9	1.7	3.5
$9-12$	0.5 (0.5)	8.4 (4.2)	0.1 (0.1)	1.5	1.0	0.5	0.2	0.8	0.9	3.6
$12-16$	0.4 (0.5)	8.8 (4.6)	0.1 (0.1)	1.6	0.9	0.5	0.3	0.8	2.0	4.0
$16-20$	0.3 (0.4)	8.3 (4.1)	0.2 (0.1)	1.7	1.0	0.5	0.4	0.5	0.0	6.5
$20-30$	0.3 (0.3)	9.1 (4.4)	0.1 (0.1)	1.7	0.8	0.5	0.2	0.3	0.0	17.3

Table 10: Υ(2S) cross section results, for $d\sigma/dp_{\rm T}$ $|y| < 2$, relative uncertainty in %.

$p_{\rm T}$	σ	stat.	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\rm trk}$	ext.
0: 30	1.90	$\pm$4.2	$^{+0.6}_{-0.6}$	$^{+8.3}_{-4.9}$	$^{+0.3}_{-0.3}$	$\pm$0.7	$\pm$0.8	$\pm$0.8	$\pm$0.0	$\pm$1.0	$\pm$1.9	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5
0: 2	0.25	$\pm$11.8	$^{+0.5}_{-0.5}$	$^{+8.3}_{-5.2}$	$^{+0.2}_{-0.2}$	$\pm$0.5	$\pm$0.6	$\pm$0.8	$\pm$0.4	$\pm$0.6	$\pm$6.8	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5
2: 4	0.48	$\pm$8.5	$^{+0.7}_{-0.7}$	$^{+8.3}_{-5.4}$	$^{+0.7}_{-0.8}$	$\pm$0.2	$\pm$0.3	$\pm$1.0	$\pm$0.1	$\pm$1.5	$\pm$8.0	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$11.5
4: 6	0.41	$\pm$9.8	$^{+0.8}_{-0.7}$	$^{+7.9}_{-4.7}$	$^{+0.4}_{-0.4}$	$\pm$0.4	$\pm$1.1	$\pm$0.8	$\pm$0.0	$\pm$0.9	$\pm$5.2	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$11.5
6: 9	0.41	$\pm$9.4	$^{+0.7}_{-0.7}$	$^{+8.6}_{-4.8}$	$^{+0.1}_{-0.1}$	$\pm$1.0	$\pm$1.2	$\pm$0.7	$\pm$0.2	$\pm$0.9	$\pm$1.7	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5
9:12	0.21	$\pm$9.9	$^{+0.5}_{-0.5}$	$^{+8.4}_{-4.2}$	$^{+0.1}_{-0.1}$	$\pm$1.5	$\pm$1.0	$\pm$0.5	$\pm$0.2	$\pm$0.8	$\pm$0.9	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.6
12:16	0.09	$\pm$13.3	$^{+0.4}_{-0.5}$	$^{+8.8}_{-4.6}$	$^{+0.1}_{-0.1}$	$\pm$1.6	$\pm$0.9	$\pm$0.5	$\pm$0.3	$\pm$0.8	$\pm$2.0	$^{+0.1}_{-0.1}$	$^{+0.4}_{-0.4}$	$\pm$11.7
16:20	0.04	$\pm$18.0	$^{+0.3}_{-0.4}$	$^{+8.3}_{-4.1}$	$^{+0.2}_{-0.1}$	$\pm$1.7	$\pm$1.0	$\pm$0.5	$\pm$0.4	$\pm$0.5	$\pm$0.0	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$12.8
20:30	0.02	$\pm$23.4	$^{+0.3}_{-0.3}$	$^{+9.1}_{-4.4}$	$^{+0.1}_{-0.1}$	$\pm$1.7	$\pm$0.8	$\pm$0.5	$\pm$0.2	$\pm$0.3	$\pm$0.0	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$20.5

Table 11: Υ(2S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y| < 2$, absolute values.

p_{T}(GeV/c)	$\sigma(\Upsilon(2S))$	stat.	$\sum_{\mathrm{syst.}}$	lumi.	$\Delta\sigma$
$0-30$	1.902	$\pm$ 0.079	$^{+0.177}_{-0.122}$	$\pm$ 0.209	$^{+0.286}_{-0.255}$
$0-2$	0.246	$\pm$ 0.029	$^{+0.028}_{-0.023}$	$\pm$ 0.027	$^{+0.049}_{-0.046}$
$2-4$	0.482	$\pm$ 0.041	$^{+0.059}_{-0.050}$	$\pm$ 0.053	$^{+0.089}_{-0.084}$
$4-6$	0.415	$\pm$ 0.041	$^{+0.042}_{-0.033}$	$\pm$ 0.046	$^{+0.074}_{-0.070}$
$6-9$	0.408	$\pm$ 0.038	$^{+0.039}_{-0.027}$	$\pm$ 0.045	$^{+0.071}_{-0.065}$
$9-12$	0.208	$\pm$ 0.020	$^{+0.019}_{-0.012}$	$\pm$ 0.023	$^{+0.036}_{-0.033}$
$12-16$	0.085	$\pm$ 0.011	$^{+0.009}_{-0.006}$	$\pm$ 0.009	$^{+0.017}_{-0.016}$
$16-20$	0.037	$\pm$ 0.007	$^{+0.004}_{-0.003}$	$\pm$ 0.004	$^{+0.009}_{-0.008}$
$20-30$	0.021	$\pm$ 0.005	$^{+0.004}_{-0.004}$	$\pm$ 0.002	$^{+0.007}_{-0.007}$

Table 12: Υ(2S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y| < 2$, absolute values (central$\pm$stat.$\pm$syst.$\pm$lumi.).

p_{T}	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Collin
0: 30	$1.89 \pm 0.08^{+0.18}_{-0.12} \pm 0.21$	$2.16 \pm 0.09^{+0.20}_{-0.14} \pm 0.24$	$1.53 \pm 0.06^{+0.14}_{-0.10} \pm 0.17$	$2.12 \pm 0.09^{+0.20}_{-0.14} \pm 0.23$	1.60
0: 2	$0.25 \pm 0.03^{+0.03}_{-0.02} \pm 0.03$	$0.28 \pm 0.03^{+0.03}_{-0.03} \pm 0.03$	$0.20 \pm 0.02^{+0.02}_{-0.02} \pm 0.02$	$0.29 \pm 0.03^{+0.03}_{-0.03} \pm 0.03$	0.19
2: 4	$0.48 \pm 0.04^{+0.06}_{-0.05} \pm 0.05$	$0.54 \pm 0.05^{+0.07}_{-0.06} \pm 0.06$	$0.40 \pm 0.03^{+0.05}_{-0.04} \pm 0.04$	$0.57 \pm 0.05^{+0.07}_{-0.06} \pm 0.06$	0.37
4: 6	$0.41 \pm 0.04^{+0.04}_{-0.03} \pm 0.05$	$0.48 \pm 0.05^{+0.05}_{-0.04} \pm 0.05$	$0.33 \pm 0.03^{+0.03}_{-0.03} \pm 0.04$	$0.48 \pm 0.05^{+0.05}_{-0.04} \pm 0.05$	0.33
6: 9	$0.41 \pm 0.04^{+0.04}_{-0.03} \pm 0.04$	$0.47 \pm 0.04^{+0.05}_{-0.03} \pm 0.05$	$0.32 \pm 0.03^{+0.03}_{-0.02} \pm 0.04$	$0.45 \pm 0.04^{+0.04}_{-0.03} \pm 0.05$	0.35
9:12	$0.21 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.24 \pm 0.02^{+0.02}_{-0.01} \pm 0.03$	$0.17 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.21 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	0.21
12:16	$0.09 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.10 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.07 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.08 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	0.09
16:20	$0.04 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.04 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.03 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.04 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	0.04
20:30	$0.02 \pm 0.00^{+0.00}_{-0.00} \pm 0.00$	$0.02 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.02 \pm 0.00^{+0.00}_{-0.00} \pm 0.00$	$0.02 \pm 0.00^{+0.00}_{-0.00} \pm 0.00$	0.02

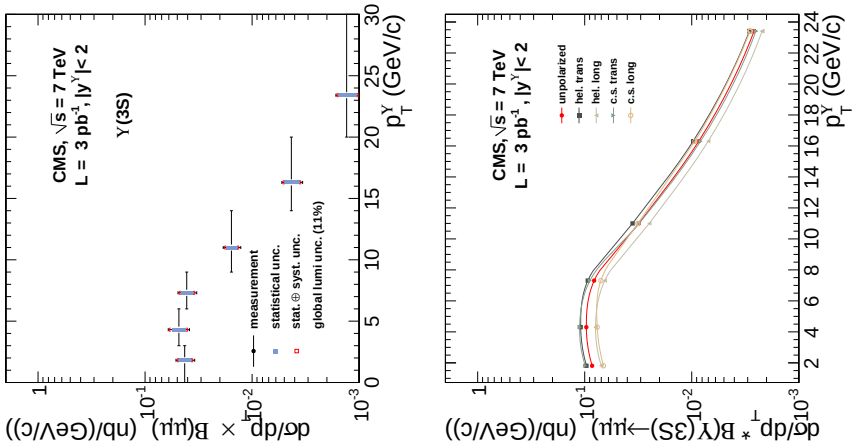
Table 13: Cross section calculation cross check, for Υ(2S) $d\sigma/dp_{\rm T}$ $|y| < 2$

$\Upsilon(2S)$	$p_{\rm T}$ ((GeV/c)			raw fit			weight, w			cross
|rapidity|	range	mean	rms	yield, N	s/e	χ^2/ndf	mean	rms	$\langle w\rangle^{-1}$	$\sigma_{\rm av.} \sim N \cdot \langle w\rangle$	
0.0- 2.0	0- 2	1.3	0.5	368 ± 41	9	1.7	2.3	0.5	0.43± 0.09	0.283 ± 0.033	0
0.0- 2.0	2- 4	2.9	0.6	591 ± 50	12	1.3	3.1	0.9	0.33± 0.09	0.595 ± 0.052	0
0.0- 2.0	4- 6	4.9	0.6	416 ± 40	10	0.9	3.7	1.0	0.27± 0.07	0.503 ± 0.049	0
0.0- 2.0	6- 9	7.3	0.8	424 ± 38	11	1.1	3.3	0.7	0.30± 0.06	0.462 ± 0.043	0
0.0- 2.0	9- 12	10.3	0.8	257 ± 25	10	1.1	2.6	0.5	0.39± 0.07	0.217 ± 0.022	0
0.0- 2.0	12- 16	13.6	1.1	121 ± 16	8	1.3	2.2	0.4	0.46± 0.07	0.087 ± 0.012	0
0.0- 2.0	16- 20	17.7	1.2	63 ± 11	6	1.0	1.9	0.3	0.54± 0.08	0.038 ± 0.007	0
0.0- 2.0	20- 30	22.5	2.1	39 ± 9	4	0.8	1.7	0.1	0.60± 0.05	0.021 ± 0.005	0
0.0- 2.0	0- 30			2279± 91						2.207 ± 0.975	2

Table 14: Υ(2S) cross section comparison: fit vs sum

Υ(2S) , $0 < \|y\| < 2$:	$\sigma = 1.895 \pm 0.080$,	$\sum d\sigma = 1.902 \pm 0.079$,	$\Delta = 0.4\%$

Figure 3: Υ(3S) cross section results, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$



(a) (b)

Table 15: Υ(3S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y| < 2$, relative uncertainty in %.

p_{T}(GeV/c)	σ	stat./σ	$\sum_{\mathrm{syst.}}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0-30$	1.02	6.7	11 (8)	17 (15)	+14	-19	+10	-13
$0-3$	0.26	14	10 (8)	21 (19)	+13	-18	+16	-22
$3-6$	0.29	14	18 (17)	26 (25)	+13	-18	+16	-21
$6-9$	0.24	14	11 (8)	21 (19)	+15	-20	+10	-13
$9-14$	0.16	12	10 (8)	19 (18)	+15	-20	-1	+2
$14-20$	0.05	17	11 (8)	23 (22)	+13	-18	-4	+9
$20-30$	0.03	20	12 (9)	26 (25)	+11	-16	-4	+9

Table 16: Υ(3S) cross section systematics, for $d\sigma/dp_{\rm T}$ $|y| < 2$, relative uncertainty in %.

$p_{\rm T}$	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0-30$	0.7 (0.6)	8.6 (4.7)	0.3 (0.3)	0.8	0.8	0.8	0.1	1.0	3.4	5.4
$0-3$	0.5 (0.5)	8.5 (4.4)	0.4 (0.5)	0.5	0.4	0.9	0.2	0.6	1.7	5.7
$3-6$	0.9 (0.8)	9.1 (5.4)	0.7 (0.7)	0.3	0.9	1.0	0.0	1.7	14.1	7.3
$6-9$	0.7 (0.7)	8.9 (4.8)	0.2 (0.2)	1.1	1.0	0.7	0.0	1.0	2.2	5.6
$9-14$	0.5 (0.5)	7.5 (4.1)	0.1 (0.1)	1.5	0.8	0.5	0.3	0.7	0.4	6.1
$14-20$	0.4 (0.4)	8.8 (4.5)	0.2 (0.1)	1.7	0.8	0.5	0.3	0.6	3.4	5.9
$20-30$	0.3 (0.3)	8.8 (4.1)	0.1 (0.1)	1.6	0.8	0.5	0.5	0.5	0.3	8.3

Table 17: Υ(3S) cross section results, for $d\sigma/dp_{\rm T}$ $|y| < 2$, relative uncertainty in %.

$p_{\rm T}$	σ	stat.	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\rm trk}$	ext.
0: 30	1.02	$\pm$6.7	$^{+0.7}_{-0.6}$	$^{+8.6}_{-4.7}$	$^{+0.3}_{-0.3}$	$\pm$0.8	$\pm$0.8	$\pm$0.8	$\pm$0.1	$\pm$1.0	$\pm$3.4	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$12.2
0: 3	0.26	$\pm$14.0	$^{+0.5}_{-0.5}$	$^{+8.5}_{-4.4}$	$^{+0.4}_{-0.5}$	$\pm$0.5	$\pm$0.4	$\pm$0.9	$\pm$0.2	$\pm$0.6	$\pm$1.7	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$12.4
3: 6	0.29	$\pm$14.3	$^{+0.9}_{-0.8}$	$^{+9.1}_{-5.4}$	$^{+0.7}_{-0.7}$	$\pm$0.3	$\pm$0.9	$\pm$1.0	$\pm$0.0	$\pm$1.7	$\pm$14.1	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$13.2
6: 9	0.24	$\pm$13.9	$^{+0.7}_{-0.7}$	$^{+8.9}_{-4.8}$	$^{+0.2}_{-0.2}$	$\pm$1.1	$\pm$1.0	$\pm$0.7	$\pm$0.0	$\pm$1.0	$\pm$2.2	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$12.3
9:14	0.16	$\pm$12.4	$^{+0.5}_{-0.5}$	$^{+7.5}_{-4.1}$	$^{+0.1}_{-0.1}$	$\pm$1.5	$\pm$0.8	$\pm$0.5	$\pm$0.3	$\pm$0.7	$\pm$0.4	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$12.6
14:20	0.05	$\pm$16.6	$^{+0.4}_{-0.4}$	$^{+8.8}_{-4.5}$	$^{+0.2}_{-0.1}$	$\pm$1.7	$\pm$0.8	$\pm$0.5	$\pm$0.3	$\pm$0.6	$\pm$3.4	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$12.5
20:30	0.03	$\pm$20.1	$^{+0.3}_{-0.3}$	$^{+8.8}_{-4.1}$	$^{+0.1}_{-0.1}$	$\pm$1.6	$\pm$0.8	$\pm$0.5	$\pm$0.5	$\pm$0.5	$\pm$0.3	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$13.8

Table 18: Υ(3S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y| < 2$, absolute values.

p_{T}(GeV/c)	$\sigma(\Upsilon(3S))$	stat.	$\sum_{\mathrm{syst.}}$	lumi.	$\Delta\sigma$
$0-30$	1.024	$\pm$ 0.068	$^{+0.111}_{-0.084}$	$\pm$ 0.113	$^{+0.173}_{-0.156}$
$0-3$	0.256	$\pm$ 0.036	$^{+0.027}_{-0.019}$	$\pm$ 0.028	$^{+0.053}_{-0.050}$
$3-6$	0.290	$\pm$ 0.041	$^{+0.054}_{-0.049}$	$\pm$ 0.032	$^{+0.075}_{-0.072}$
$6-9$	0.245	$\pm$ 0.034	$^{+0.027}_{-0.020}$	$\pm$ 0.027	$^{+0.051}_{-0.048}$
$9-14$	0.156	$\pm$ 0.019	$^{+0.015}_{-0.012}$	$\pm$ 0.017	$^{+0.030}_{-0.029}$
$14-20$	0.052	$\pm$ 0.009	$^{+0.006}_{-0.004}$	$\pm$ 0.006	$^{+0.012}_{-0.011}$
$20-30$	0.026	$\pm$ 0.005	$^{+0.003}_{-0.002}$	$\pm$ 0.003	$^{+0.007}_{-0.006}$

Table 19: Υ(3S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y| < 2$, absolute values (central$\pm$stat.$\pm$syst.$\pm$lumi.).

p_{T}	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Colli
0: 30	$1.02 \pm 0.07^{+0.11}_{-0.08} \pm 0.11$	$1.16 \pm 0.08^{+0.13}_{-0.09} \pm 0.13$	$0.83 \pm 0.06^{+0.09}_{-0.07} \pm 0.09$	$1.12 \pm 0.08^{+0.12}_{-0.09} \pm 0.12$	0.8
0: 3	$0.26 \pm 0.04^{+0.03}_{-0.02} \pm 0.03$	$0.29 \pm 0.04^{+0.03}_{-0.02} \pm 0.03$	$0.21 \pm 0.03^{+0.02}_{-0.02} \pm 0.02$	$0.30 \pm 0.04^{+0.03}_{-0.02} \pm 0.03$	0.2
3: 6	$0.29 \pm 0.04^{+0.05}_{-0.05} \pm 0.03$	$0.33 \pm 0.05^{+0.06}_{-0.06} \pm 0.04$	$0.24 \pm 0.03^{+0.04}_{-0.04} \pm 0.03$	$0.33 \pm 0.05^{+0.06}_{-0.06} \pm 0.04$	0.2
6: 9	$0.24 \pm 0.03^{+0.03}_{-0.02} \pm 0.03$	$0.28 \pm 0.04^{+0.03}_{-0.02} \pm 0.03$	$0.20 \pm 0.03^{+0.02}_{-0.02} \pm 0.02$	$0.27 \pm 0.04^{+0.03}_{-0.02} \pm 0.03$	0.2
9:14	$0.16 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.18 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.12 \pm 0.02^{+0.01}_{-0.01} \pm 0.01$	$0.16 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	0.1
14:20	$0.05 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.04 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.05 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	0.0
20:30	$0.03 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.03 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.02 \pm 0.00^{+0.00}_{-0.00} \pm 0.00$	$0.03 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	0.0

Table 20: Cross section calculation cross check, for Υ(3S) $d\sigma/dp_{\rm T}$ $|y| < 2$

$\Upsilon(3S)$	$p_{\rm T}$ ((GeV/c)			raw fit			weight, w			cross
|rapidity|	range	mean	rms	yield, N	s/e	χ^2/ndf	mean	rms	$\langle w\rangle^{-1}$	$\sigma_{\rm av.} \sim N \cdot \langle w\rangle$	
0.0- 2.0	0- 3	1.8	0.7	396 ± 51	7	1.5	2.5	0.5	0.40± 0.09	0.324 ± 0.043	0
0.0- 2.0	3- 6	4.3	0.9	326 ± 47	7	1.0	3.6	0.9	0.28± 0.07	0.385 ± 0.058	0
0.0- 2.0	6- 9	7.3	0.9	264 ± 36	7	1.1	3.4	0.7	0.30± 0.06	0.290 ± 0.040	0
0.0- 2.0	9- 14	11.0	1.4	207 ± 25	8	1.2	2.5	0.5	0.40± 0.08	0.168 ± 0.021	0
0.0- 2.0	14- 20	16.3	1.7	83 ± 14	6	1.2	2.0	0.3	0.51± 0.08	0.053 ± 0.009	0
0.0- 2.0	20- 30	23.4	2.8	49 ± 10	5	0.8	1.7	0.1	0.60± 0.05	0.027 ± 0.005	0
0.0- 2.0	0- 30			1324± 84						1.247 ± 0.909	1

Table 21: Υ(3S) cross section comparison: fit vs sum

$\Upsilon(3S)$, $0 < \|y\| < 2$:	$\sigma = 1.019 \pm 0.068$,	$\sum d\sigma = 1.024 \pm 0.068$,	$\Delta = 0.5\%$

0.1.2 results for $d\sigma/dp_{\rm T}$ $|y| : (0,1),(1,2)$

Table 22: Υ(1S) cross section results, for $d\sigma/dp_{\rm T}$ $0< |y| <1$, relative uncertainty in %.

$p_{\rm T}$(GeV/c)	σ	stat./σ	$\sum_{\rm syst.}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0-30$	4.03	1.3	8 (6)	14 (12)	+16	-22	+13	-16
$0-2$	0.70	5	9 (7)	15 (14)	+14	-19	+18	-24
$2-5$	1.54	4	10 (9)	15 (15)	+14	-20	+18	-23
$5-8$	1.02	5	7 (6)	14 (13)	+18	-23	+8	-12
$8-11$	0.44	6	7 (5)	15 (14)	+18	-23	-1	+2
$11-15$	0.23	7	8 (5)	15 (14)	+18	-23	-4	+10
$15-30$	0.11	9	8 (6)	16 (15)	+15	-20	-5	+12

Figure 4: Υ(1S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$

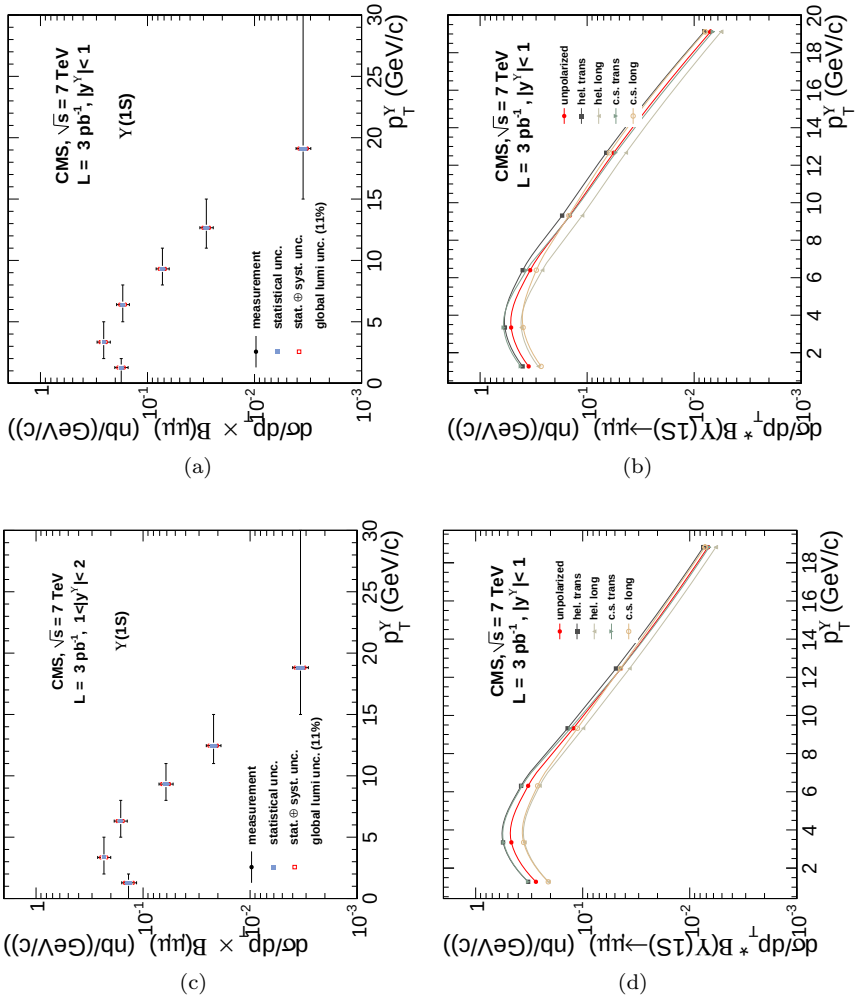


Table 23: Υ(1S) cross section systematics, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, relative uncertainty in %.

$p_{\rm T}$	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0-30$	0.5 (0.5)	7.5 (4.6)	0.3 (0.3)	0.6	0.7	0.7	0.0	0.9	0.5	3.0
$0-2$	0.4 (0.4)	7.7 (5.6)	0.3 (0.3)	0.6	0.5	0.7	0.7	1.3	1.6	3.0
$2-5$	0.6 (0.6)	7.1 (5.2)	0.7 (0.7)	0.2	0.1	0.9	0.3	1.5	6.2	3.0
$5-8$	0.7 (0.7)	6.5 (4.4)	0.3 (0.3)	0.8	0.8	0.7	0.4	1.0	0.3	3.0
$8-11$	0.5 (0.5)	6.4 (3.9)	0.0 (0.0)	1.3	0.5	0.5	0.3	0.7	0.6	3.0
$11-15$	0.5 (0.4)	6.6 (3.8)	0.1 (0.1)	1.5	0.7	0.5	0.3	0.6	0.4	3.0
$15-30$	0.3 (0.4)	7.1 (4.2)	0.1 (0.2)	1.6	0.6	0.5	0.3	0.5	0.9	3.0

Table 24: Υ(1S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, relative uncertainty in %.

$p_{\rm T}$	σ	stat.	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\rm trk}$	ext.	$\sum$
0: 30	4.03	±1.3	$^{+0.5}_{-0.5}$	$^{+7.5}_{-4.6}$	$^{+0.3}_{-0.3}$	±0.6	±0.7	±0.7	±0.0	±0.9	±0.5	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4	
0: 2	0.70	±4.9	$^{+0.4}_{-0.4}$	$^{+7.7}_{-5.6}$	$^{+0.3}_{-0.3}$	±0.6	±0.5	±0.7	±0.7	±1.3	±1.6	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4	
2: 5	1.54	±3.9	$^{+0.6}_{-0.6}$	$^{+7.1}_{-5.2}$	$^{+0.7}_{-0.7}$	±0.2	±0.1	±0.9	±0.3	±1.5	±6.2	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4	
5: 8	1.02	±5.1	$^{+0.7}_{-0.7}$	$^{+6.5}_{-4.4}$	$^{+0.3}_{-0.3}$	±0.8	±0.8	±0.7	±0.4	±1.0	±0.3	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4	
8:11	0.44	±6.1	$^{+0.5}_{-0.5}$	$^{+6.4}_{-3.9}$	$^{+0.0}_{-0.0}$	±1.3	±0.5	±0.5	±0.3	±0.7	±0.6	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4	
11:15	0.23	±6.7	$^{+0.5}_{-0.4}$	$^{+6.6}_{-3.8}$	$^{+0.1}_{-0.1}$	±1.5	±0.7	±0.5	±0.3	±0.6	±0.4	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4	
15:30	0.11	±9.1	$^{+0.3}_{-0.4}$	$^{+7.1}_{-4.2}$	$^{+0.1}_{-0.2}$	±1.6	±0.6	±0.5	±0.3	±0.5	±0.9	$^{+0.1}_{-0.1}$	$^{+0.4}_{-0.5}$	±11.4	

Table 25: Υ(1S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, absolute values.

$p_{\rm T}$(GeV/c)	$\sigma(\Upsilon(1S))$	stat.	$\sum_{\rm syst.}$	lumi.	$\Delta\sigma$
$0-30$	4.031	$\pm$ 0.093	$^{+0.334}_{-0.229}$	$\pm$ 0.443	$^{+0.557}_{-0.502}$
$0-2$	0.704	$\pm$ 0.035	$^{+0.061}_{-0.048}$	$\pm$ 0.077	$^{+0.104}_{-0.098}$
$2-5$	1.539	$\pm$ 0.060	$^{+0.155}_{-0.136}$	$\pm$ 0.169	$^{+0.237}_{-0.226}$
$5-8$	1.021	$\pm$ 0.053	$^{+0.075}_{-0.057}$	$\pm$ 0.112	$^{+0.145}_{-0.137}$
$8-11$	0.435	$\pm$ 0.027	$^{+0.032}_{-0.023}$	$\pm$ 0.048	$^{+0.063}_{-0.059}$
$11-15$	0.226	$\pm$ 0.015	$^{+0.017}_{-0.012}$	$\pm$ 0.025	$^{+0.034}_{-0.031}$
$15-30$	0.106	$\pm$ 0.010	$^{+0.008}_{-0.006}$	$\pm$ 0.012	$^{+0.017}_{-0.016}$

Table 26: Υ(1S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, absolute values (central$\pm$stat.$\pm$syst.$\pm$lumi.).

$p_{\rm T}$	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Collin
0: 30	$7.35 \pm 0.13^{+0.61}_{-0.42} \pm 0.81$	$8.56 \pm 0.15^{+0.71}_{-0.49} \pm 0.94$	$5.76 \pm 0.10^{+0.48}_{-0.33} \pm 0.63$	$8.29 \pm 0.15^{+0.69}_{-0.47} \pm 0.91$	6.15
0: 2	$0.70 \pm 0.03^{+0.06}_{-0.05} \pm 0.08$	$0.80 \pm 0.04^{+0.07}_{-0.05} \pm 0.09$	$0.57 \pm 0.03^{+0.05}_{-0.04} \pm 0.06$	$0.83 \pm 0.04^{+0.07}_{-0.06} \pm 0.09$	0.54
2: 5	$1.54 \pm 0.06^{+0.16}_{-0.14} \pm 0.17$	$1.76 \pm 0.07^{+0.18}_{-0.16} \pm 0.19$	$1.24 \pm 0.05^{+0.12}_{-0.11} \pm 0.14$	$1.81 \pm 0.07^{+0.18}_{-0.16} \pm 0.20$	1.19
5: 8	$1.02 \pm 0.05^{+0.08}_{-0.06} \pm 0.11$	$1.20 \pm 0.06^{+0.09}_{-0.07} \pm 0.13$	$0.79 \pm 0.04^{+0.06}_{-0.04} \pm 0.09$	$1.10 \pm 0.06^{+0.08}_{-0.06} \pm 0.12$	0.89
8:11	$0.44 \pm 0.03^{+0.03}_{-0.02} \pm 0.05$	$0.51 \pm 0.03^{+0.04}_{-0.03} \pm 0.06$	$0.33 \pm 0.02^{+0.02}_{-0.02} \pm 0.04$	$0.43 \pm 0.03^{+0.03}_{-0.02} \pm 0.05$	0.45
11:15	$0.23 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.27 \pm 0.02^{+0.02}_{-0.01} \pm 0.03$	$0.17 \pm 0.01^{+0.01}_{-0.01} \pm 0.02$	$0.22 \pm 0.01^{+0.02}_{-0.01} \pm 0.02$	0.25
15:30	$0.11 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.12 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.08 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.10 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	0.12

Table 27: Cross section calculation cross check, for $\Upsilon(1S)$ $d\sigma/dp_T$ 0< $|y|$ <1

$\Upsilon(1S)$	p_T ((GeV/c)			raw fit			weight, w			cros
|rapidity|	range	mean	rms	yield, N	s/e	χ^2/ndf	mean	rms	$\langle w\rangle^{-1}$	$\sigma_{\text{av.}} \sim N \cdot \langle w\rangle$
0.0- 1.0	0- 2	1.3	0.5	840 ± 42	20	1.3	2.6	0.5	0.38± 0.07	0.719 ± 0.036
0.0- 1.0	2- 5	3.3	0.9	1217 ± 48	26	0.8	3.9	1.0	0.26± 0.06	1.539 ± 0.063
0.0- 1.0	5- 8	6.4	0.9	817 ± 41	19	1.2	3.9	0.8	0.26± 0.05	1.044 ± 0.054
0.0- 1.0	8- 11	9.3	0.8	472 ± 29	16	1.4	2.8	0.5	0.35± 0.06	0.437 ± 0.027
0.0- 1.0	11- 15	12.7	1.2	302 ± 21	15	1.3	2.3	0.3	0.44± 0.07	0.226 ± 0.016
0.0- 1.0	15- 30	19.1	3.6	175 ± 16	11	1.4	1.9	0.3	0.54± 0.08	0.106 ± 0.010
1.0- 2.0	0- 2	1.3	0.5	806 ± 55	14	1.8	2.1	0.3	0.47± 0.07	0.560 ± 0.038
1.0- 2.0	2- 5	3.3	0.9	1615 ± 68	23	1.2	2.7	0.4	0.37± 0.06	1.414 ± 0.060
1.0- 2.0	5- 8	6.3	0.9	970 ± 46	21	0.9	3.1	0.5	0.32± 0.05	0.981 ± 0.047
1.0- 2.0	8- 11	9.3	0.9	416 ± 29	14	1.0	2.7	0.5	0.37± 0.07	0.366 ± 0.026
1.0- 2.0	11- 15	12.5	1.1	243 ± 21	12	1.9	2.2	0.3	0.45± 0.07	0.177 ± 0.015
1.0- 2.0	15- 30	18.8	3.3	175 ± 17	11	1.1	1.8	0.2	0.56± 0.08	0.103 ± 0.010
0.0- 2.0	0- 30			8046± 136						7.673 ± 0.999

Table 28: $\Upsilon(1S)$ cross section results, for $d\sigma/dp_T$ 1< $|y|$ <2, relative uncertainty in %.

p_T(GeV/c)	σ	stat./σ	$\sum_{\text{syst.}}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0-30$	3.55	1.2	8 (6)	14 (12)	+16	-22	+13	-16
$0-2$	0.55	7	11 (9)	17 (16)	+18	-24	+18	-23
$2-5$	1.39	4	9 (7)	15 (14)	+20	-25	+18	-23
$5-8$	0.97	5	9 (5)	15 (13)	+16	-22	+14	-18
$8-11$	0.37	7	10 (6)	16 (14)	+13	-19	+6	-8
$11-15$	0.18	8	10 (6)	17 (15)	+11	-17	-0	+1
$15-30$	0.10	9	11 (6)	18 (16)	+10	-16	-3	+6

Table 29: Υ(1S) cross section systematics, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, relative uncertainty in %.

$p_{\rm T}$	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0-30$	0.5 (0.5)	7.5 (4.6)	0.3 (0.3)	0.6	0.7	0.7	0.0	0.9	0.5	3.0
$0-2$	0.4 (0.4)	8.2 (4.6)	0.0 (0.1)	0.3	1.1	0.6	0.2	0.6	7.3	3.0
$2-5$	0.5 (0.5)	7.7 (4.0)	0.3 (0.3)	0.2	0.9	0.7	0.3	0.5	4.3	3.0
$5-8$	0.6 (0.6)	8.4 (4.2)	0.1 (0.2)	0.7	1.2	0.6	0.5	0.6	0.4	3.0
$8-11$	0.6 (0.5)	8.9 (4.4)	0.0 (0.1)	1.3	1.1	0.5	0.6	0.7	1.7	3.1
$11-15$	0.4 (0.5)	9.1 (4.2)	0.1 (0.2)	1.6	0.9	0.5	0.8	0.6	0.1	3.0
$15-30$	0.4 (0.5)	10.6 (4.3)	0.2 (0.3)	1.7	1.1	0.5	0.9	0.8	2.0	3.1

Table 30: Υ(1S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, relative uncertainty in %.

$p_{\rm T}$	σ	stat.	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\rm trk}$	ext.	$\sum$
0: 30	3.55	$\pm$1.2	$^{+0.5}_{-0.5}$	$^{+7.5}_{-4.6}$	$^{+0.3}_{-0.3}$	$\pm$0.6	$\pm$0.7	$\pm$0.7	$\pm$0.0	$\pm$0.9	$\pm$0.5	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.4	
0: 2	0.55	$\pm$6.9	$^{+0.4}_{-0.4}$	$^{+8.2}_{-4.6}$	$^{+0.0}_{-0.1}$	$\pm$0.3	$\pm$1.1	$\pm$0.6	$\pm$0.2	$\pm$0.6	$\pm$7.3	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.4	
2: 5	1.39	$\pm$4.3	$^{+0.5}_{-0.5}$	$^{+7.7}_{-4.0}$	$^{+0.3}_{-0.3}$	$\pm$0.2	$\pm$0.9	$\pm$0.7	$\pm$0.3	$\pm$0.5	$\pm$4.3	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.4	
5: 8	0.97	$\pm$4.8	$^{+0.6}_{-0.6}$	$^{+8.4}_{-4.2}$	$^{+0.1}_{-0.2}$	$\pm$0.7	$\pm$1.2	$\pm$0.6	$\pm$0.5	$\pm$0.6	$\pm$0.4	$^{+0.1}_{-0.1}$	$^{+0.4}_{-0.4}$	$\pm$11.4	
8:11	0.37	$\pm$7.0	$^{+0.6}_{-0.5}$	$^{+8.9}_{-4.4}$	$^{+0.0}_{-0.1}$	$\pm$1.3	$\pm$1.1	$\pm$0.5	$\pm$0.6	$\pm$0.7	$\pm$1.7	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.4	
11:15	0.18	$\pm$8.3	$^{+0.4}_{-0.5}$	$^{+9.1}_{-4.2}$	$^{+0.1}_{-0.2}$	$\pm$1.6	$\pm$0.9	$\pm$0.5	$\pm$0.8	$\pm$0.6	$\pm$0.1	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.4	
15:30	0.10	$\pm$9.4	$^{+0.4}_{-0.5}$	$^{+10.6}_{-4.3}$	$^{+0.2}_{-0.3}$	$\pm$1.7	$\pm$1.1	$\pm$0.5	$\pm$0.9	$\pm$0.8	$\pm$2.0	$^{+0.1}_{-0.1}$	$^{+0.4}_{-0.4}$	$\pm$11.4	

Table 31: Υ(1S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, absolute values.

$p_{\rm T}$(GeV/c)	$\sigma(\Upsilon(1S))$	stat.	$\sum_{\rm syst.}$	lumi.	$\Delta\sigma$
$0-30$	3.553	$\pm$ 0.090	$^{+0.294}_{-0.202}$	$\pm$ 0.391	$^{+0.491}_{-0.442}$
$0-2$	0.547	$\pm$ 0.038	$^{+0.063}_{-0.051}$	$\pm$ 0.060	$^{+0.095}_{-0.087}$
$2-5$	1.392	$\pm$ 0.059	$^{+0.131}_{-0.094}$	$\pm$ 0.153	$^{+0.210}_{-0.189}$
$5-8$	0.970	$\pm$ 0.046	$^{+0.088}_{-0.053}$	$\pm$ 0.107	$^{+0.146}_{-0.128}$
$8-11$	0.367	$\pm$ 0.026	$^{+0.036}_{-0.022}$	$\pm$ 0.040	$^{+0.060}_{-0.053}$
$11-15$	0.176	$\pm$ 0.015	$^{+0.017}_{-0.010}$	$\pm$ 0.019	$^{+0.030}_{-0.026}$
$15-30$	0.101	$\pm$ 0.009	$^{+0.012}_{-0.006}$	$\pm$ 0.011	$^{+0.019}_{-0.016}$

Table 32: Υ(1S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, absolute values (central$\pm$stat.$\pm$syst.$\pm$lumi.).

$p_{\rm T}$	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Collin
0: 30	$7.35 \pm 0.13^{+0.61}_{-0.42} \pm 0.81$	$8.56 \pm 0.15^{+0.71}_{-0.49} \pm 0.94$	$5.76 \pm 0.10^{+0.48}_{-0.33} \pm 0.63$	$8.29 \pm 0.15^{+0.69}_{-0.47} \pm 0.91$	6.15
0: 2	$0.55 \pm 0.04^{+0.06}_{-0.05} \pm 0.06$	$0.65 \pm 0.05^{+0.07}_{-0.06} \pm 0.07$	$0.42 \pm 0.03^{+0.05}_{-0.04} \pm 0.05$	$0.65 \pm 0.04^{+0.07}_{-0.06} \pm 0.07$	0.42
2: 5	$1.39 \pm 0.06^{+0.13}_{-0.09} \pm 0.15$	$1.67 \pm 0.07^{+0.16}_{-0.11} \pm 0.18$	$1.05 \pm 0.05^{+0.10}_{-0.07} \pm 0.12$	$1.64 \pm 0.07^{+0.15}_{-0.11} \pm 0.18$	1.07
5: 8	$0.97 \pm 0.05^{+0.09}_{-0.05} \pm 0.11$	$1.13 \pm 0.05^{+0.10}_{-0.06} \pm 0.12$	$0.76 \pm 0.04^{+0.07}_{-0.04} \pm 0.08$	$1.10 \pm 0.05^{+0.10}_{-0.06} \pm 0.12$	0.79
8:11	$0.37 \pm 0.03^{+0.04}_{-0.02} \pm 0.04$	$0.42 \pm 0.03^{+0.04}_{-0.02} \pm 0.05$	$0.30 \pm 0.02^{+0.03}_{-0.02} \pm 0.03$	$0.39 \pm 0.03^{+0.04}_{-0.02} \pm 0.04$	0.34
11:15	$0.18 \pm 0.01^{+0.02}_{-0.01} \pm 0.02$	$0.20 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.15 \pm 0.01^{+0.01}_{-0.01} \pm 0.02$	$0.18 \pm 0.01^{+0.02}_{-0.01} \pm 0.02$	0.18
15:30	$0.10 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.11 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.09 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.10 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	0.11

Figure 5: Υ(2S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$

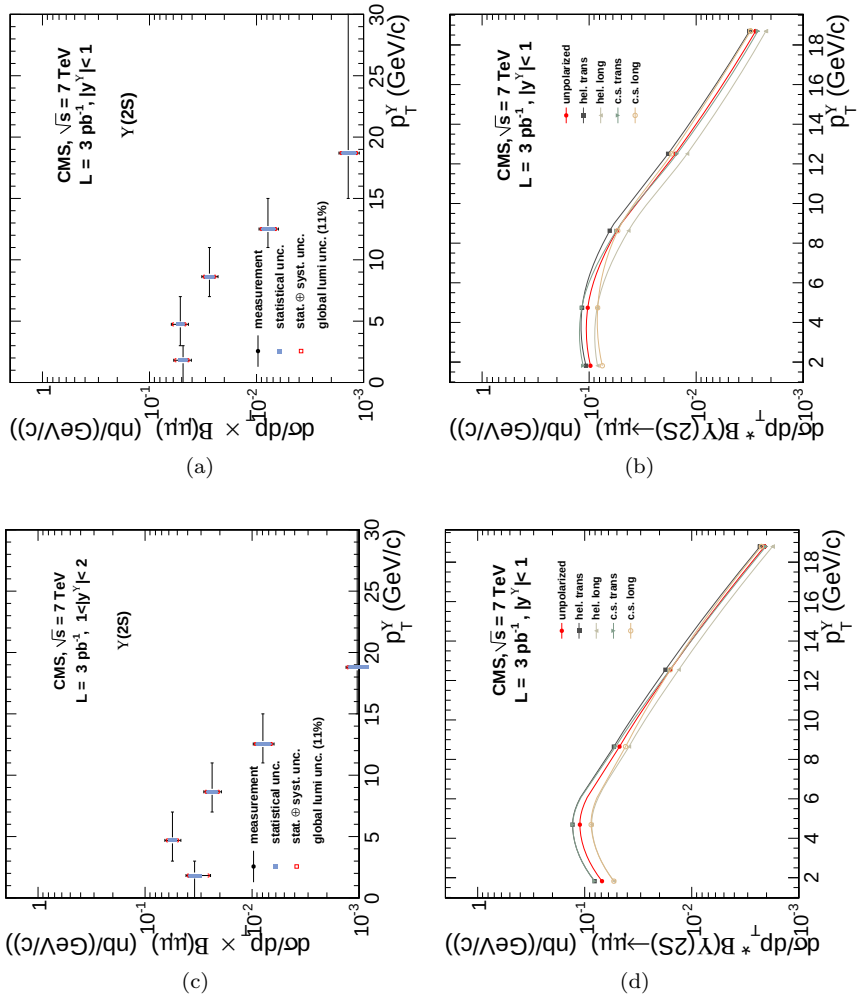


Table 33: Υ(2S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, relative uncertainty in %.

$p_{\rm T}$(GeV/c)	σ	stat./σ	$\sum_{\rm syst.}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0-30$	1.03	2.9	9 (6)	15 (13)	+14	-19	+12	-15
$0-3$	0.29	10	17 (16)	22 (21)	+10	-14	+17	-22
$3-7$	0.41	10	16 (15)	21 (21)	+13	-18	+14	-19
$7-11$	0.22	11	9 (7)	18 (17)	+17	-22	+1	-2
$11-15$	0.06	16	9 (6)	21 (20)	+17	-22	-4	+8
$15-30$	0.04	17	9 (7)	22 (21)	+14	-20	-5	+11

Table 34: Υ(2S) cross section systematics, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, relative uncertainty in %.

$p_{\rm T}$	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0-30$	0.6 (0.6)	8.3 (4.9)	0.3 (0.3)	0.7	0.8	0.8	0.0	1.0	1.9	3.2
$0-3$	0.6 (0.5)	8.2 (6.0)	0.6 (0.6)	0.5	0.1	1.0	0.7	1.4	13.9	3.4
$3-7$	0.8 (0.8)	7.7 (5.2)	0.6 (0.7)	0.4	0.6	1.0	0.4	1.5	13.1	3.4
$7-11$	0.6 (0.6)	7.7 (4.9)	0.1 (0.0)	1.3	0.8	0.6	0.3	1.0	1.7	3.4
$11-15$	0.5 (0.5)	7.3 (4.4)	0.1 (0.1)	1.6	0.8	0.5	0.3	0.7	1.6	3.6
$15-30$	0.3 (0.4)	7.4 (4.3)	0.1 (0.2)	1.7	0.5	0.5	0.2	0.4	1.9	4.2

Table 35: Υ(2S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, relative uncertainty in %.

$p_{\rm T}$	σ	stat.	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\rm trk}$	ext.
0: 30	1.03	±2.9	$^{+0.6}_{-0.6}$	$^{+8.3}_{-4.9}$	$^{+0.3}_{-0.3}$	±0.7	±0.8	±0.8	±0.0	±1.0	±1.9	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.5
0: 3	0.29	±9.8	$^{+0.6}_{-0.5}$	$^{+8.2}_{-6.0}$	$^{+0.6}_{-0.6}$	±0.5	±0.1	±1.0	±0.7	±1.4	±13.9	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	±11.5
3: 7	0.41	±9.5	$^{+0.8}_{-0.8}$	$^{+7.7}_{-5.2}$	$^{+0.6}_{-0.7}$	±0.4	±0.6	±1.0	±0.4	±1.5	±13.1	$^{+0.1}_{-0.1}$	$^{+0.5}_{-0.5}$	±11.5
7:11	0.22	±11.0	$^{+0.6}_{-0.6}$	$^{+7.7}_{-4.9}$	$^{+0.1}_{-0.0}$	±1.3	±0.8	±0.6	±0.3	±1.0	±1.7	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.5
11:15	0.06	±15.9	$^{+0.5}_{-0.5}$	$^{+7.3}_{-4.4}$	$^{+0.1}_{-0.1}$	±1.6	±0.8	±0.5	±0.3	±0.7	±1.6	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.6
15:30	0.04	±16.9	$^{+0.3}_{-0.4}$	$^{+7.4}_{-4.3}$	$^{+0.1}_{-0.2}$	±1.7	±0.5	±0.5	±0.2	±0.4	±1.9	$^{+0.1}_{-0.1}$	$^{+0.4}_{-0.5}$	±11.8

Table 36: Υ(2S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, absolute values.

$p_{\rm T}$(GeV/c)	$\sigma(\Upsilon(2S))$	stat.	$\sum_{\rm syst.}$	lumi.	$\Delta\sigma$
$0-30$	1.028	$\pm$ 0.056	$^{+0.096}_{-0.066}$	$\pm$ 0.113	$^{+0.151}_{-0.134}$
$0-3$	0.291	$\pm$ 0.029	$^{+0.048}_{-0.046}$	$\pm$ 0.032	$^{+0.065}_{-0.063}$
$3-7$	0.412	$\pm$ 0.039	$^{+0.065}_{-0.060}$	$\pm$ 0.045	$^{+0.088}_{-0.085}$
$7-11$	0.220	$\pm$ 0.024	$^{+0.019}_{-0.014}$	$\pm$ 0.024	$^{+0.039}_{-0.037}$
$11-15$	0.063	$\pm$ 0.010	$^{+0.005}_{-0.004}$	$\pm$ 0.007	$^{+0.013}_{-0.013}$
$15-30$	0.042	$\pm$ 0.007	$^{+0.004}_{-0.003}$	$\pm$ 0.005	$^{+0.009}_{-0.009}$

Table 37: Υ(2S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, absolute values (central$\pm$stat.$\pm$syst.$\pm$lumi.).

$p_{\rm T}$	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Colli
0: 30	$1.89 \pm 0.08^{+0.18}_{-0.12} \pm 0.21$	$2.16 \pm 0.09^{+0.20}_{-0.14} \pm 0.24$	$1.53 \pm 0.06^{+0.14}_{-0.10} \pm 0.17$	$2.12 \pm 0.09^{+0.20}_{-0.14} \pm 0.23$	1.60
0: 3	$0.29 \pm 0.03^{+0.05}_{-0.05} \pm 0.03$	$0.32 \pm 0.03^{+0.05}_{-0.05} \pm 0.04$	$0.25 \pm 0.02^{+0.04}_{-0.04} \pm 0.03$	$0.34 \pm 0.03^{+0.06}_{-0.05} \pm 0.04$	0.23
3: 7	$0.41 \pm 0.04^{+0.06}_{-0.06} \pm 0.05$	$0.47 \pm 0.04^{+0.07}_{-0.07} \pm 0.05$	$0.34 \pm 0.03^{+0.05}_{-0.05} \pm 0.04$	$0.47 \pm 0.04^{+0.07}_{-0.07} \pm 0.05$	0.33
7:11	$0.22 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.26 \pm 0.03^{+0.02}_{-0.02} \pm 0.03$	$0.17 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.22 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	0.22
11:15	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.07 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.05 \pm 0.01^{+0.00}_{-0.00} \pm 0.01$	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	0.07
15:30	$0.04 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.05 \pm 0.01^{+0.00}_{-0.00} \pm 0.01$	$0.03 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.04 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	0.05

Table 38: Cross section calculation cross check, for Υ(2S) $d\sigma/dp_{\rm T}$ 0< $|y|$ <1

$\Upsilon(2S)$	$p_{\rm T}$ ((GeV/c)			raw fit			weight, w			cross
|rapidity|	range	mean	rms	yield, N	s/e	χ^2/ndf	mean	rms	$\langle w\rangle^{-1}$	$\sigma_{\rm av.} \sim N \cdot \langle w\rangle$	
0.0- 1.0	0- 3	1.8	0.7	367 ± 36	10	1.2	2.8	0.6	0.35± 0.08	0.341 ± 0.035	0
0.0- 1.0	3- 7	4.7	1.2	373 ± 35	11	1.1	4.2	0.8	0.24± 0.05	0.510 ± 0.049	0
0.0- 1.0	7- 11	8.6	1.1	236 ± 26	9	1.3	3.1	0.6	0.32± 0.07	0.240 ± 0.027	0
0.0- 1.0	11- 15	12.5	1.1	85 ± 14	6	1.3	2.3	0.3	0.44± 0.06	0.064 ± 0.010	0
0.0- 1.0	15- 30	18.7	2.9	69 ± 12	6	1.4	1.9	0.3	0.53± 0.09	0.042 ± 0.007	0
1.0- 2.0	0- 3	1.8	0.7	331 ± 44	7	1.3	2.2	0.4	0.45± 0.08	0.242 ± 0.033	0
1.0- 2.0	3- 7	4.7	1.1	515 ± 48	11	0.9	3.0	0.5	0.34± 0.05	0.504 ± 0.047	0
1.0- 2.0	7- 11	8.6	1.1	221 ± 26	8	1.1	2.8	0.5	0.36± 0.06	0.203 ± 0.025	0
1.0- 2.0	11- 15	12.5	1.1	87 ± 15	6	1.9	2.3	0.4	0.44± 0.08	0.065 ± 0.011	0
1.0- 2.0	15- 30	18.8	3.1	54 ± 12	5	1.1	1.8	0.3	0.56± 0.08	0.032 ± 0.007	0
0.0- 2.0	0- 30			2339± 94						2.242 ± 0.994	2

Table 39: Υ(2S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, relative uncertainty in %.

$p_{\rm T}$(GeV/c)	σ	stat./σ	$\sum_{\rm syst.}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0-30$	0.93	3.0	9 (6)	15 (13)	+14	-19	+12	-15
$0-3$	0.21	15	24 (23)	30 (29)	+17	-23	+17	-23
$3-7$	0.44	9	12 (8)	18 (17)	+17	-22	+17	-22
$7-11$	0.19	12	11 (8)	20 (18)	+13	-18	+9	-12
$11-15$	0.06	17	11 (7)	23 (21)	+11	-17	+1	-0
$15-30$	0.03	21	13 (9)	27 (26)	+10	-16	-3	+7

Table 40: Υ(2S) cross section systematics, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, relative uncertainty in %.

$p_{\rm T}$	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0-30$	0.6 (0.6)	8.3 (4.9)	0.3 (0.3)	0.7	0.8	0.8	0.0	1.0	1.9	3.3
$0-3$	0.5 (0.5)	7.8 (3.8)	0.2 (0.2)	0.3	1.2	0.7	0.2	0.5	21.9	3.8
$3-7$	0.7 (0.7)	9.4 (4.9)	0.3 (0.3)	0.4	1.3	0.8	0.4	0.6	5.4	3.4
$7-11$	0.6 (0.6)	9.6 (4.8)	0.0 (0.0)	1.2	1.1	0.6	0.7	0.8	4.4	3.5
$11-15$	0.5 (0.5)	9.7 (4.8)	0.1 (0.2)	1.6	0.9	0.5	1.1	0.7	1.5	4.6
$15-30$	0.4 (0.4)	9.5 (3.8)	0.2 (0.2)	1.7	1.3	0.4	1.0	0.7	3.4	7.2

Table 41: Υ(2S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, relative uncertainty in %.

$p_{\rm T}$	σ	stat.	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\rm trk}$	ext.
0: 30	0.93	$\pm$3.0	$^{+0.6}_{-0.6}$	$^{+8.3}_{-4.9}$	$^{+0.3}_{-0.3}$	$\pm$0.7	$\pm$0.8	$\pm$0.8	$\pm$0.0	$\pm$1.0	$\pm$1.9	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5
0: 3	0.21	$\pm$14.6	$^{+0.5}_{-0.5}$	$^{+7.8}_{-3.8}$	$^{+0.2}_{-0.2}$	$\pm$0.3	$\pm$1.2	$\pm$0.7	$\pm$0.2	$\pm$0.5	$\pm$21.9	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.6
3: 7	0.44	$\pm$9.3	$^{+0.7}_{-0.7}$	$^{+9.4}_{-4.9}$	$^{+0.3}_{-0.3}$	$\pm$0.4	$\pm$1.3	$\pm$0.8	$\pm$0.4	$\pm$0.6	$\pm$5.4	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5
7:11	0.19	$\pm$12.3	$^{+0.6}_{-0.6}$	$^{+9.6}_{-4.8}$	$^{+0.0}_{-0.0}$	$\pm$1.2	$\pm$1.1	$\pm$0.6	$\pm$0.7	$\pm$0.8	$\pm$4.4	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5
11:15	0.06	$\pm$17.0	$^{+0.5}_{-0.5}$	$^{+9.7}_{-4.8}$	$^{+0.1}_{-0.2}$	$\pm$1.6	$\pm$0.9	$\pm$0.5	$\pm$1.1	$\pm$0.7	$\pm$1.5	$^{+0.1}_{-0.1}$	$^{+0.4}_{-0.4}$	$\pm$11.9
15:30	0.03	$\pm$21.5	$^{+0.4}_{-0.4}$	$^{+9.5}_{-3.8}$	$^{+0.2}_{-0.2}$	$\pm$1.7	$\pm$1.3	$\pm$0.4	$\pm$1.0	$\pm$0.7	$\pm$3.4	$^{+0.1}_{-0.1}$	$^{+0.4}_{-0.5}$	$\pm$13.1

Table 42: Υ(2S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, absolute values.

$p_{\rm T}$(GeV/c)	$\sigma(\Upsilon(2S))$	stat.	$\sum_{\rm syst.}$	lumi.	$\Delta\sigma$
$0-30$	0.934	$\pm$ 0.058	$^{+0.087}_{-0.060}$	$\pm$ 0.103	$^{+0.138}_{-0.122}$
$0-3$	0.207	$\pm$ 0.030	$^{+0.049}_{-0.047}$	$\pm$ 0.023	$^{+0.062}_{-0.060}$
$3-7$	0.444	$\pm$ 0.041	$^{+0.051}_{-0.037}$	$\pm$ 0.049	$^{+0.082}_{-0.074}$
$7-11$	0.189	$\pm$ 0.023	$^{+0.021}_{-0.015}$	$\pm$ 0.021	$^{+0.038}_{-0.034}$
$11-15$	0.063	$\pm$ 0.011	$^{+0.007}_{-0.005}$	$\pm$ 0.007	$^{+0.015}_{-0.014}$
$15-30$	0.031	$\pm$ 0.007	$^{+0.004}_{-0.003}$	$\pm$ 0.003	$^{+0.009}_{-0.008}$

Table 43: Υ(2S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ 1< $|y|$ <2, absolute values (central±stat.±syst.±lumi.).

p_{T}	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Colli
0: 30	$1.89 \pm 0.08^{+0.18}_{-0.12} \pm 0.21$	$2.16 \pm 0.09^{+0.20}_{-0.14} \pm 0.24$	$1.53 \pm 0.06^{+0.14}_{-0.10} \pm 0.17$	$2.12 \pm 0.09^{+0.20}_{-0.14} \pm 0.23$	1.60
0: 3	$0.21 \pm 0.03^{+0.05}_{-0.05} \pm 0.02$	$0.24 \pm 0.04^{+0.06}_{-0.05} \pm 0.03$	$0.16 \pm 0.02^{+0.04}_{-0.04} \pm 0.02$	$0.24 \pm 0.04^{+0.06}_{-0.05} \pm 0.03$	0.16
3: 7	$0.44 \pm 0.04^{+0.05}_{-0.04} \pm 0.05$	$0.52 \pm 0.05^{+0.06}_{-0.04} \pm 0.06$	$0.34 \pm 0.03^{+0.04}_{-0.03} \pm 0.04$	$0.52 \pm 0.05^{+0.06}_{-0.04} \pm 0.06$	0.35
7:11	$0.19 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.21 \pm 0.03^{+0.02}_{-0.02} \pm 0.02$	$0.15 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	$0.21 \pm 0.03^{+0.02}_{-0.02} \pm 0.02$	0.17
11:15	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.07 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.05 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	0.06
15:30	$0.03 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.03 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.03 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	$0.03 \pm 0.01^{+0.00}_{-0.00} \pm 0.00$	0.03

Figure 6: Υ(3S) cross section results, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$

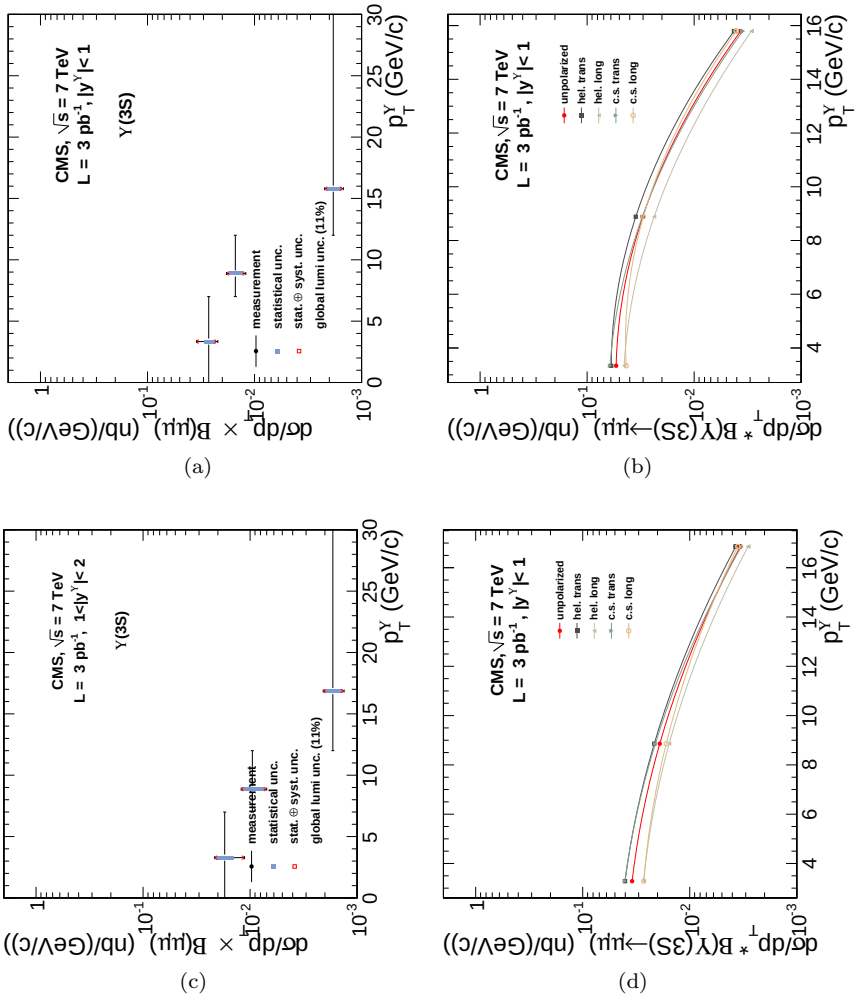


Table 44: Υ(3S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, relative uncertainty in %.

$p_{\rm T}$(GeV/c)	σ	stat./σ	$\sum_{\rm syst.}$ /σ	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0-30$	0.59	4.8	11 (8)	16 (15)	+14	-19	+10	-13
$0-7$	0.38	11	25 (24)	30 (29)	+11	-16	+14	-19
$7-12$	0.15	15	10 (8)	21 (20)	+16	-22	+1	-1
$12-30$	0.07	14	10 (8)	20 (20)	+15	-21	-4	+10

Table 45: Υ(3S) cross section systematics, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, relative uncertainty in %.

$p_{\rm T}$	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0-30$	0.7 (0.6)	8.6 (4.7)	0.3 (0.3)	0.8	0.8	0.8	0.1	1.0	3.4	5.4
$0-7$	0.8 (0.8)	8.8 (5.9)	0.6 (0.7)	0.5	0.5	1.0	0.5	1.7	22.9	5.4
$7-12$	0.6 (0.6)	7.6 (5.0)	0.0 (0.0)	1.4	0.6	0.6	0.1	0.9	2.2	5.7
$12-30$	0.4 (0.4)	7.1 (4.0)	0.2 (0.1)	1.6	0.7	0.5	0.3	0.5	0.2	6.0

Table 46: Υ(3S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, relative uncertainty in %.

$p_{\rm T}$	σ	stat.	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\rm trk}$	ext.
0: 30	0.59	$\pm$4.8	$^{+0.7}_{-0.6}$	$^{+8.6}_{-4.7}$	$^{+0.3}_{-0.3}$	$\pm$0.8	$\pm$0.8	$\pm$0.8	$\pm$0.1	$\pm$1.0	$\pm$3.4	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$12.2
0: 7	0.38	$\pm$11.2	$^{+0.8}_{-0.8}$	$^{+8.8}_{-5.9}$	$^{+0.6}_{-0.7}$	$\pm$0.5	$\pm$0.5	$\pm$1.0	$\pm$0.5	$\pm$1.7	$\pm$22.9	$^{+0.1}_{-0.1}$	$^{+0.5}_{-0.5}$	$\pm$12.2
7:12	0.15	$\pm$14.9	$^{+0.6}_{-0.6}$	$^{+7.6}_{-5.0}$	$^{+0.0}_{-0.0}$	$\pm$1.4	$\pm$0.6	$\pm$0.6	$\pm$0.1	$\pm$0.9	$\pm$2.2	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$12.4
12:30	0.07	$\pm$14.3	$^{+0.4}_{-0.4}$	$^{+7.1}_{-4.0}$	$^{+0.2}_{-0.1}$	$\pm$1.6	$\pm$0.7	$\pm$0.5	$\pm$0.3	$\pm$0.5	$\pm$0.2	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$12.5

Table 47: Υ(3S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, absolute values.

$p_{\rm T}$(GeV/c)	$\sigma(\Upsilon(3S))$	stat.	$\sum_{\rm syst.}$	lumi.	$\Delta\sigma$
$0-30$	0.592	$\pm$ 0.049	$^{+0.064}_{-0.048}$	$\pm$ 0.065	$^{+0.096}_{-0.086}$
$0-7$	0.375	$\pm$ 0.042	$^{+0.095}_{-0.091}$	$\pm$ 0.041	$^{+0.112}_{-0.109}$
$7-12$	0.151	$\pm$ 0.023	$^{+0.015}_{-0.012}$	$\pm$ 0.017	$^{+0.032}_{-0.031}$
$12-30$	0.066	$\pm$ 0.009	$^{+0.006}_{-0.005}$	$\pm$ 0.007	$^{+0.013}_{-0.013}$

Table 48: Υ(3S) cross section results, for $d\sigma/dp_{\rm T}$ 0< $|y|$ <1, absolute values (central$\pm$stat.$\pm$syst.$\pm$lumi.).

$p_{\rm T}$	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Collin
0: 30	$1.02 \pm 0.07^{+0.11}_{-0.08} \pm 0.11$	$1.16 \pm 0.08^{+0.13}_{-0.09} \pm 0.13$	$0.83 \pm 0.06^{+0.09}_{-0.07} \pm 0.09$	$1.12 \pm 0.08^{+0.12}_{-0.09} \pm 0.12$	0.88
0: 7	$0.38 \pm 0.04^{+0.09}_{-0.09} \pm 0.04$	$0.42 \pm 0.05^{+0.11}_{-0.10} \pm 0.05$	$0.32 \pm 0.03^{+0.08}_{-0.08} \pm 0.03$	$0.43 \pm 0.05^{+0.11}_{-0.10} \pm 0.05$	0.30
7:12	$0.15 \pm 0.02^{+0.01}_{-0.01} \pm 0.02$	$0.18 \pm 0.03^{+0.02}_{-0.01} \pm 0.02$	$0.12 \pm 0.02^{+0.01}_{-0.01} \pm 0.01$	$0.15 \pm 0.02^{+0.02}_{-0.01} \pm 0.02$	0.15
12:30	$0.07 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.08 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.05 \pm 0.01^{+0.00}_{-0.00} \pm 0.01$	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	0.07

Table 49: Cross section calculation cross check, for Υ(3S) $d\sigma/dp_{\rm T}$ 0< $|y|$ <1

$\Upsilon(3S)$	$p_{\rm T}$ ((GeV/c)			raw fit			weight, w			cross
|rapidity|	range	mean	rms	yield, N	s/e	χ^2/ndf	mean	rms	$\langle w\rangle^{-1}$	$\sigma_{\rm av.} \sim N \cdot \langle w\rangle$
0.0- 1.0	0- 7	3.3	1.8	444 $\pm$ 48	9	1.0	3.5	1.0	0.29$\pm$ 0.08	0.506 $\pm$ 0.057
0.0- 1.0	7- 12	8.9	1.4	169 $\pm$ 25	7	1.2	3.0	0.6	0.33$\pm$ 0.07	0.168 $\pm$ 0.026
0.0- 1.0	12- 30	15.8	3.7	101 $\pm$ 14	7	1.4	2.1	0.4	0.48$\pm$ 0.09	0.069 $\pm$ 0.010
1.0- 2.0	0- 7	3.3	1.7	353 $\pm$ 59	6	1.4	2.6	0.6	0.38$\pm$ 0.08	0.301 $\pm$ 0.052
1.0- 2.0	7- 12	8.9	1.4	120 $\pm$ 25	5	1.1	2.8	0.5	0.36$\pm$ 0.07	0.110 $\pm$ 0.023
1.0- 2.0	12- 30	16.9	4.3	104 $\pm$ 16	6	1.4	1.9	0.3	0.53$\pm$ 0.08	0.064 $\pm$ 0.010
0.0- 2.0	0- 30			1290$\pm$ 87						1.218 $\pm$ 0.915

Table 50: Υ(3S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, relative uncertainty in %.

$p_{\rm T}$(GeV/c)	σ	stat./σ	$\sum_{\rm syst.}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0-30$	0.40	4.9	11 (8)	16 (15)	+14	-19	+10	-13
$0-7$	0.24	18	29 (27)	36 (35)	+16	-22	+17	-22
$7-12$	0.10	22	13 (10)	28 (27)	+13	-18	+10	-13
$12-30$	0.06	17	11 (8)	23 (22)	+10	-15	-2	+5

Table 51: Υ(3S) cross section systematics, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, relative uncertainty in %.

$p_{\rm T}$	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0-30$	0.7 (0.6)	8.6 (4.7)	0.3 (0.3)	0.8	0.8	0.8	0.1	1.0	3.4	5.5
$0-7$	0.7 (0.6)	8.6 (2.9)	0.4 (0.4)	0.4	1.1	0.8	0.5	0.3	26.5	6.5
$7-12$	0.7 (0.6)	9.3 (4.1)	0.0 (0.0)	1.3	1.0	0.6	1.1	0.6	6.2	6.7
$12-30$	0.4 (0.4)	9.4 (4.3)	0.1 (0.2)	1.7	1.1	0.5	0.9	0.5	1.5	5.9

Table 52: Υ(3S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, relative uncertainty in %.

$p_{\rm T}$	σ	stat.	A	$\varepsilon_{\rm trig,id}$	S_p	A_{p_T}	$A_{\rm vtx}$	$A_{\rm fsr}$	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\rm trk}$	ext.
0: 30	0.40	±4.9	$^{+0.7}_{-0.6}$	$^{+8.6}_{-4.7}$	$^{+0.3}_{-0.3}$	±0.8	±0.8	±0.8	±0.1	±1.0	±3.4	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	±12.3
0: 7	0.24	±18.3	$^{+0.7}_{-0.6}$	$^{+8.6}_{-2.9}$	$^{+0.4}_{-0.4}$	±0.4	±1.1	±0.8	±0.5	±0.3	±26.5	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	±12.8
7:12	0.10	±22.0	$^{+0.7}_{-0.6}$	$^{+9.3}_{-4.1}$	$^{+0.0}_{-0.0}$	±1.3	±1.0	±0.6	±1.1	±0.6	±6.2	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±12.9
12:30	0.06	±16.8	$^{+0.4}_{-0.4}$	$^{+9.4}_{-4.3}$	$^{+0.1}_{-0.2}$	±1.7	±1.1	±0.5	±0.9	±0.5	±1.5	$^{+0.1}_{-0.1}$	$^{+0.4}_{-0.4}$	±12.5

Table 53: Υ(3S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, absolute values.

$p_{\rm T}$(GeV/c)	$\sigma(\Upsilon(3S))$	stat.	$\sum_{\rm syst.}$	lumi.	$\Delta\sigma$
$0-30$	0.398	$\pm$ 0.050	$^{+0.043}_{-0.033}$	$\pm$ 0.044	$^{+0.065}_{-0.058}$
$0-7$	0.242	$\pm$ 0.044	$^{+0.069}_{-0.066}$	$\pm$ 0.027	$^{+0.086}_{-0.084}$
$7-12$	0.095	$\pm$ 0.021	$^{+0.013}_{-0.010}$	$\pm$ 0.010	$^{+0.027}_{-0.025}$
$12-30$	0.061	$\pm$ 0.010	$^{+0.007}_{-0.005}$	$\pm$ 0.007	$^{+0.014}_{-0.013}$

Table 54: Υ(3S) cross section results, for $d\sigma/dp_{\rm T}$ 1< $|y|$ <2, absolute values (central$\pm$stat.$\pm$syst.$\pm$lumi.).

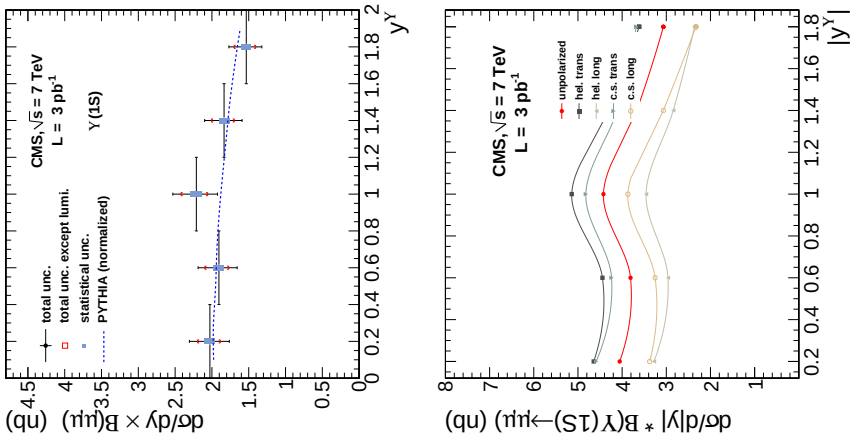
$p_{\rm T}$	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Colli
0: 30	$1.02 \pm 0.07^{+0.11}_{-0.08} \pm 0.11$	$1.16 \pm 0.08^{+0.13}_{-0.10} \pm 0.13$	$0.83 \pm 0.06^{+0.09}_{-0.07} \pm 0.09$	$1.12 \pm 0.08^{+0.12}_{-0.09} \pm 0.12$	0.8
0: 7	$0.24 \pm 0.04^{+0.07}_{-0.07} \pm 0.03$	$0.28 \pm 0.05^{+0.08}_{-0.08} \pm 0.03$	$0.19 \pm 0.03^{+0.05}_{-0.05} \pm 0.02$	$0.28 \pm 0.05^{+0.08}_{-0.08} \pm 0.03$	0.1
7:12	$0.10 \pm 0.02^{+0.01}_{-0.01} \pm 0.01$	$0.11 \pm 0.02^{+0.01}_{-0.01} \pm 0.01$	$0.08 \pm 0.02^{+0.01}_{-0.01} \pm 0.01$	$0.10 \pm 0.02^{+0.01}_{-0.01} \pm 0.01$	0.0
12:30	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.07 \pm 0.01^{+0.01}_{-0.01} \pm 0.01$	$0.05 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	$0.06 \pm 0.01^{+0.01}_{-0.00} \pm 0.01$	0.0

0.1.3 results for $d\sigma/d|y|$

Table 55: Υ(1S) cross section results, for $d\sigma/d|y|$, relative uncertainty in %.

$\|y\|$	σ	stat./σ	$\sum_{\text{syst.}}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0.0-2.0$	7.61	1.8	8 (6)	14 (13)	+16	-22	+13	-16
$0.0-0.4$	1.62	3	8 (6)	14 (13)	+15	-19	+13	-17
$0.4-0.8$	1.52	4	9 (8)	15 (14)	+17	-22	+11	-15
$0.8-1.2$	1.77	4	9 (7)	14 (13)	+16	-22	+9	-12
$1.2-1.6$	1.47	4	9 (7)	15 (13)	+17	-23	+12	-16
$1.6-2.0$	1.23	4	11 (7)	16 (14)	+18	-23	+20	-24

Figure 7: $\Upsilon(1S)$ cross section results, for $d\sigma/d|y|$



(a) (b)

Table 56: $\Upsilon(1S)$ cross section systematics, for $d\sigma/d|y|$, relative uncertainty in %.

$\lvert y\rvert$	A	$\varepsilon_{\text{trig,id}}$	S_p	A_{p_T}	A_{vtx}	A_{fsr}	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0.0-2.0$	0.5 (0.5)	7.5 (4.6)	0.3 (0.3)	0.6	0.7	0.7	0.0	0.9	0.5	3.0
$0.0-0.4$	0.6 (0.6)	6.8 (4.9)	0.4 (0.4)	0.7	0.3	0.7	0.6	1.5	0.1	3.0
$0.4-0.8$	0.6 (0.6)	6.8 (4.7)	0.4 (0.4)	0.6	0.3	0.7	0.3	1.1	5.4	3.0
$0.8-1.2$	0.5 (0.5)	7.5 (4.9)	0.3 (0.3)	0.6	1.0	0.7	0.1	0.7	2.9	3.0
$1.2-1.6$	0.5 (0.5)	7.7 (4.0)	0.2 (0.2)	0.6	1.2	0.6	0.2	0.5	4.0	3.0
$1.6-2.0$	0.6 (0.6)	9.3 (4.0)	0.0 (0.1)	0.6	0.9	0.6	0.9	0.6	5.0	3.0

Table 57: Υ(1S) cross section results, for $d\sigma/d|y|$, relative uncertainty in %.

$\|y\|$	σ	stat.	A	$\varepsilon_{\mathrm{trig,id}}$	S_p	A_{p_T}	A_{vtx}	A_{fsr}	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\mathrm{trk}}$	ext.
0.0: 2.0	7.61	±1.8	$^{+0.5}_{-0.5}$	$^{+7.5}_{-4.6}$	$^{+0.3}_{-0.3}$	±0.6	±0.7	±0.7	±0.0	±0.9	±0.5	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
0.0:0.4	1.62	±3.4	$^{+0.6}_{-0.6}$	$^{+6.8}_{-4.9}$	$^{+0.4}_{-0.4}$	±0.7	±0.3	±0.7	±0.6	±1.5	±0.1	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
0.4:0.8	1.52	±3.9	$^{+0.6}_{-0.6}$	$^{+6.8}_{-4.7}$	$^{+0.4}_{-0.4}$	±0.6	±0.3	±0.7	±0.3	±1.1	±5.4	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
0.8:1.2	1.77	±3.6	$^{+0.5}_{-0.5}$	$^{+7.5}_{-4.9}$	$^{+0.3}_{-0.3}$	±0.6	±1.0	±0.7	±0.1	±0.7	±2.9	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
1.2:1.6	1.47	±3.9	$^{+0.5}_{-0.5}$	$^{+7.7}_{-4.0}$	$^{+0.2}_{-0.2}$	±0.6	±1.2	±0.6	±0.2	±0.5	±4.0	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4
1.6:2.0	1.23	±4.3	$^{+0.6}_{-0.6}$	$^{+9.3}_{-4.0}$	$^{+0.0}_{-0.1}$	±0.6	±0.9	±0.6	±0.9	±0.6	±5.0	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	±11.4

Table 58: Υ(1S) cross section results, for $d\sigma/d|y|$, absolute values.

$\|y\|$	$\sigma(\Upsilon(1S))$	stat.	$\sum_{\mathrm{syst.}}$	lumi.	$\Delta\sigma$
$0.0-2.0$	7.610	± 0.130	$^{+0.630}_{-0.433}$	± 0.837	$^{+1.056}_{-0.952}$
$0.0-0.4$	1.622	± 0.056	$^{+0.125}_{-0.098}$	± 0.178	$^{+0.225}_{-0.211}$
$0.4-0.8$	1.524	± 0.060	$^{+0.142}_{-0.120}$	± 0.168	$^{+0.228}_{-0.215}$
$0.8-1.2$	1.769	± 0.064	$^{+0.154}_{-0.118}$	± 0.195	$^{+0.256}_{-0.236}$
$1.2-1.6$	1.468	± 0.058	$^{+0.137}_{-0.097}$	± 0.161	$^{+0.220}_{-0.197}$
$1.6-2.0$	1.227	± 0.052	$^{+0.137}_{-0.089}$	± 0.135	$^{+0.199}_{-0.170}$

Table 59: Υ(1S) cross section results, for $d\sigma/d|y|$, absolute values (central±stat.±syst.±lumi.).

$\|y\|$	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Co
0.0: 2.0	$7.35 \pm 0.13^{+0.61}_{-0.42} \pm 0.81$	$8.56 \pm 0.15^{+0.71}_{-0.49} \pm 0.94$	$5.76 \pm 0.10^{+0.48}_{-0.33} \pm 0.63$	$8.29 \pm 0.15^{+0.69}_{-0.47} \pm 0.91$	6
0.0:0.4	$1.62 \pm 0.06^{+0.12}_{-0.10} \pm 0.18$	$1.86 \pm 0.06^{+0.14}_{-0.11} \pm 0.20$	$1.31 \pm 0.05^{+0.10}_{-0.08} \pm 0.14$	$1.84 \pm 0.06^{+0.14}_{-0.11} \pm 0.20$	1
0.4:0.8	$1.52 \pm 0.06^{+0.14}_{-0.12} \pm 0.17$	$1.78 \pm 0.07^{+0.17}_{-0.14} \pm 0.20$	$1.18 \pm 0.05^{+0.11}_{-0.09} \pm 0.13$	$1.70 \pm 0.07^{+0.16}_{-0.13} \pm 0.19$	1
0.8:1.2	$1.77 \pm 0.06^{+0.15}_{-0.12} \pm 0.19$	$2.06 \pm 0.07^{+0.18}_{-0.14} \pm 0.23$	$1.38 \pm 0.05^{+0.12}_{-0.09} \pm 0.15$	$1.93 \pm 0.07^{+0.17}_{-0.13} \pm 0.21$	1
1.2:1.6	$1.47 \pm 0.06^{+0.14}_{-0.10} \pm 0.16$	$1.72 \pm 0.07^{+0.16}_{-0.11} \pm 0.19$	$1.14 \pm 0.04^{+0.11}_{-0.08} \pm 0.13$	$1.65 \pm 0.07^{+0.15}_{-0.11} \pm 0.18$	1
1.6:2.0	$1.23 \pm 0.05^{+0.14}_{-0.09} \pm 0.13$	$1.45 \pm 0.06^{+0.16}_{-0.10} \pm 0.16$	$0.94 \pm 0.04^{+0.11}_{-0.07} \pm 0.10$	$1.47 \pm 0.06^{+0.16}_{-0.11} \pm 0.16$	0

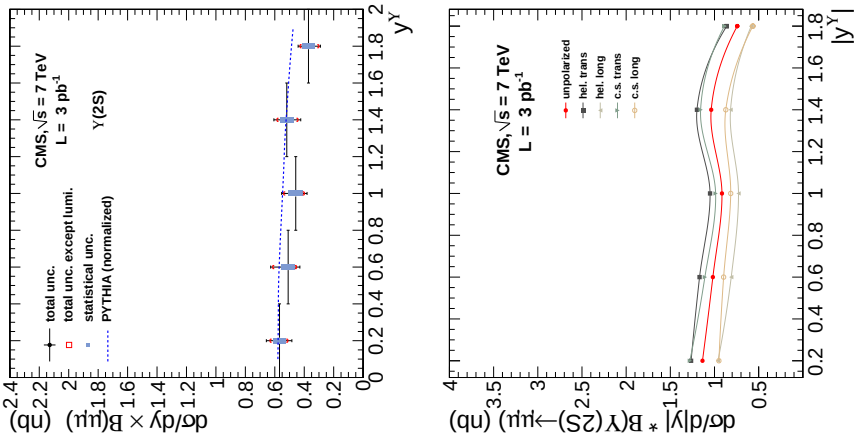
Table 60: Cross section calculation cross check, for Υ(1S) $d\sigma/d|y|$

$\Upsilon(1S)$	$p_{\rm T}$ ((GeV/c)			raw fit			weight, w			cros
|rapidity|	range	mean	rms	yield, N	s/e	χ^2/ndf	mean	rms	$\langle w\rangle^{-1}$	$\sigma_{\rm av.} \sim N \cdot \langle w\rangle$
0.0- 0.4	0- 30	5.6	4.5	1431 ± 48	29	0.8	3.5	1.1	0.28± 0.09	1.664 ± 0.058
0.4- 0.8	0- 30	5.4	4.2	1453 ± 54	26	0.9	3.3	1.0	0.30± 0.09	1.582 ± 0.062
0.8- 1.2	0- 30	5.1	3.9	1949 ± 68	28	1.5	2.8	0.8	0.35± 0.10	1.804 ± 0.066
1.2- 1.6	0- 30	4.9	3.8	1839 ± 70	26	1.1	2.5	0.5	0.40± 0.08	1.497 ± 0.058
1.6- 2.0	0- 30	5.0	4.0	1391 ± 59	24	1.2	2.7	0.5	0.37± 0.07	1.224 ± 0.053
0.0- 2.0	0- 30			8064± 136						7.769 ± 0.845

Table 61: Υ(1S) cross section comparison: fit vs sum

$\Upsilon(1S)\,,\ p_{\rm T} < 30$	:	$\sigma = 7.353 \pm 0.132\,,$	$\sum d\sigma = 7.610 \pm 0.130\,,$ $\quad \Delta = 3.5\%$

Figure 8: Υ(2S) cross section results, for $d\sigma/d|y|$



(a) (b)

Table 62: Υ(2S) cross section results, for $d\sigma/d|y|$, relative uncertainty in %.

$\|y\|$	σ	stat./σ	$\sum_{\text{syst.}}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0.0-2.0$	1.94	4.3	9 (6)	15 (13)	+14	-19	+12	-15
$0.0-0.4$	0.45	7	9 (7)	16 (15)	+11	-15	+13	-16
$0.4-0.8$	0.41	9	19 (18)	23 (23)	+15	-20	+9	-12
$0.8-1.2$	0.37	11	14 (13)	21 (20)	+15	-20	+8	-11
$1.2-1.6$	0.41	9	14 (12)	20 (18)	+16	-21	+12	-16
$1.6-2.0$	0.30	11	18 (15)	24 (22)	+16	-21	+20	-24

Table 63: Υ(2S) cross section systematics, for $d\sigma/d|y|$, relative uncertainty in %.

$\|y\|$	A	$\varepsilon_{\mathrm{trig,id}}$	S_p	A_{p_T}	A_{vtx}	A_{fsr}	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0.0-2.0$	0.6 (0.6)	8.3 (4.9)	0.3 (0.3)	0.7	0.8	0.8	0.0	1.0	1.9	3.2
$0.0-0.4$	0.7 (0.7)	7.7 (5.2)	0.5 (0.5)	0.7	0.3	0.9	0.6	1.5	0.1	3.2
$0.4-0.8$	0.7 (0.6)	7.6 (5.2)	0.4 (0.4)	0.8	0.4	0.8	0.3	1.3	16.4	3.2
$0.8-1.2$	0.6 (0.6)	8.3 (5.7)	0.3 (0.4)	0.7	1.2	0.8	0.1	0.5	10.9	3.2
$1.2-1.6$	0.6 (0.5)	8.5 (4.1)	0.2 (0.2)	0.6	1.4	0.7	0.3	0.6	10.3	3.2
$1.6-2.0$	0.6 (0.7)	10.2 (4.1)	0.0 (0.1)	0.8	1.0	0.6	1.1	0.8	14.3	3.2

Table 64: Υ(2S) cross section results, for $d\sigma/d|y|$, relative uncertainty in %.

$\|y\|$	σ	stat.	A	$\varepsilon_{\mathrm{trig,id}}$	S_p	A_{p_T}	A_{vtx}	A_{fsr}	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\mathrm{trk}}$	ext.
0.0: 2.0	1.94	$\pm$4.3	$^{+0.6}_{-0.6}$	$^{+8.3}_{-4.9}$	$^{+0.3}_{-0.3}$	$\pm$0.7	$\pm$0.8	$\pm$0.8	$\pm$0.0	$\pm$1.0	$\pm$1.9	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5
0.0:0.4	0.45	$\pm$7.5	$^{+0.7}_{-0.7}$	$^{+7.7}_{-5.2}$	$^{+0.5}_{-0.5}$	$\pm$0.7	$\pm$0.3	$\pm$0.9	$\pm$0.6	$\pm$1.5	$\pm$0.1	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$11.5
0.4:0.8	0.41	$\pm$9.1	$^{+0.7}_{-0.6}$	$^{+7.6}_{-5.2}$	$^{+0.4}_{-0.4}$	$\pm$0.8	$\pm$0.4	$\pm$0.8	$\pm$0.3	$\pm$1.3	$\pm$16.4	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$11.5
0.8:1.2	0.37	$\pm$10.8	$^{+0.6}_{-0.6}$	$^{+8.3}_{-5.7}$	$^{+0.3}_{-0.4}$	$\pm$0.7	$\pm$1.2	$\pm$0.8	$\pm$0.1	$\pm$0.5	$\pm$10.9	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5
1.2:1.6	0.41	$\pm$8.9	$^{+0.6}_{-0.5}$	$^{+8.5}_{-4.1}$	$^{+0.2}_{-0.2}$	$\pm$0.6	$\pm$1.4	$\pm$0.7	$\pm$0.3	$\pm$0.6	$\pm$10.3	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5
1.6:2.0	0.30	$\pm$11.1	$^{+0.6}_{-0.7}$	$^{+10.2}_{-4.1}$	$^{+0.0}_{-0.1}$	$\pm$0.8	$\pm$1.0	$\pm$0.6	$\pm$1.1	$\pm$0.8	$\pm$14.3	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$11.5

Table 65: Υ(2S) cross section results, for $d\sigma/d|y|$, absolute values.

$\|y\|$	$\sigma(\Upsilon(2S))$	stat.	$\sum_{\mathrm{syst.}}$	lumi.	$\Delta\sigma$
$0.0-2.0$	1.940	$\pm$ 0.081	$^{+0.181}_{-0.124}$	$\pm$ 0.213	$^{+0.292}_{-0.260}$
$0.0-0.4$	0.454	$\pm$ 0.034	$^{+0.039}_{-0.030}$	$\pm$ 0.050	$^{+0.072}_{-0.067}$
$0.4-0.8$	0.407	$\pm$ 0.037	$^{+0.075}_{-0.072}$	$\pm$ 0.045	$^{+0.095}_{-0.093}$
$0.8-1.2$	0.366	$\pm$ 0.039	$^{+0.052}_{-0.047}$	$\pm$ 0.040	$^{+0.077}_{-0.073}$
$1.2-1.6$	0.415	$\pm$ 0.037	$^{+0.057}_{-0.048}$	$\pm$ 0.046	$^{+0.082}_{-0.076}$
$1.6-2.0$	0.297	$\pm$ 0.033	$^{+0.053}_{-0.046}$	$\pm$ 0.033	$^{+0.071}_{-0.065}$

Table 66: Υ(2S) cross section results, for $d\sigma/d|y|$, absolute values (central±stat.±syst.±lumi.).

$\|y\|$	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Co
0.0: 2.0	$1.89 \pm 0.08^{+0.18}_{-0.12} \pm 0.21$	$2.16 \pm 0.09^{+0.20}_{-0.14} \pm 0.24$	$1.53 \pm 0.06^{+0.14}_{-0.10} \pm 0.17$	$2.12 \pm 0.09^{+0.20}_{-0.14} \pm 0.23$	1
0.0:0.4	$0.45 \pm 0.03^{+0.04}_{-0.03} \pm 0.05$	$0.51 \pm 0.04^{+0.04}_{-0.03} \pm 0.06$	$0.38 \pm 0.03^{+0.03}_{-0.03} \pm 0.04$	$0.51 \pm 0.04^{+0.04}_{-0.03} \pm 0.06$	0
0.4:0.8	$0.41 \pm 0.04^{+0.08}_{-0.07} \pm 0.04$	$0.47 \pm 0.04^{+0.09}_{-0.08} \pm 0.05$	$0.32 \pm 0.03^{+0.06}_{-0.06} \pm 0.04$	$0.44 \pm 0.04^{+0.08}_{-0.08} \pm 0.05$	0
0.8:1.2	$0.37 \pm 0.04^{+0.05}_{-0.05} \pm 0.04$	$0.42 \pm 0.05^{+0.06}_{-0.05} \pm 0.05$	$0.29 \pm 0.03^{+0.04}_{-0.04} \pm 0.03$	$0.39 \pm 0.04^{+0.06}_{-0.05} \pm 0.04$	0
1.2:1.6	$0.41 \pm 0.04^{+0.06}_{-0.05} \pm 0.05$	$0.48 \pm 0.04^{+0.07}_{-0.06} \pm 0.05$	$0.33 \pm 0.03^{+0.05}_{-0.04} \pm 0.04$	$0.46 \pm 0.04^{+0.06}_{-0.05} \pm 0.05$	0
1.6:2.0	$0.30 \pm 0.03^{+0.05}_{-0.05} \pm 0.03$	$0.34 \pm 0.04^{+0.06}_{-0.05} \pm 0.04$	$0.23 \pm 0.03^{+0.04}_{-0.04} \pm 0.03$	$0.36 \pm 0.04^{+0.06}_{-0.05} \pm 0.04$	0

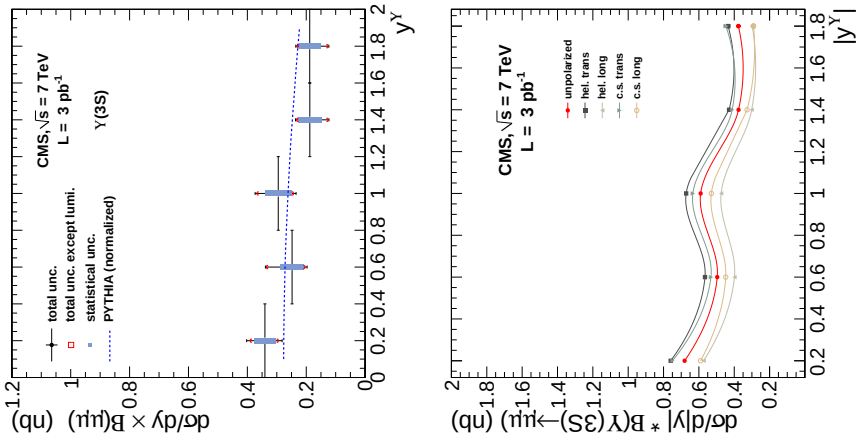
Table 67: Cross section calculation cross check, for Υ(2S) $d\sigma/d|y|$

$\Upsilon(2S)$	$p_{\rm T}$ ((GeV/c)			raw fit			weight, w			cross	
|rapidity|	range	mean	rms	yield, N	s/e	χ^2/ndf	mean	rms	$\langle w\rangle^{-1}$	$\sigma_{\rm av.} \sim N \cdot \langle w\rangle$	
0.0- 0.4	0- 30	5.3	4.0	467 ± 34	13	0.8	3.6	1.0	0.28± 0.08	0.548 ± 0.041	0.
0.4- 0.8	0- 30	5.4	4.0	445 ± 39	11	0.9	3.4	1.0	0.30± 0.09	0.490 ± 0.045	0.
0.8- 1.2	0- 30	5.0	4.0	479 ± 48	9	1.5	2.8	0.8	0.36± 0.10	0.442 ± 0.046	0.
1.2- 1.6	0- 30	4.8	3.8	570 ± 49	11	1.1	2.5	0.5	0.40± 0.08	0.465 ± 0.041	0.
1.6- 2.0	0- 30	4.9	3.7	350 ± 39	9	1.2	2.7	0.5	0.37± 0.07	0.310 ± 0.035	0.
0.0- 2.0	0- 30			2312± 94						2.255 ± 0.824	2.

Table 68: Υ(2S) cross section comparison: fit vs sum

Υ(2S) , $p_{\rm T} < 30$	:	$\sigma = 1.895 \pm 0.080$,	$\sum d\sigma = 1.940 \pm 0.081$, $\Delta = 2.4\%$

Figure 9: Υ(3S) cross section results, for $d\sigma/d|y|$



(a) (b)

Table 69: Υ(3S) cross section results, for $d\sigma/d|y|$, relative uncertainty in %.

$\|y\|$	σ	stat./σ	$\sum_{\text{syst.}}/\sigma$	$\Delta\sigma/\sigma$	HX T	HX L	CS T	CS L
$0.0-2.0$	1.01	6.9	11 (8)	17 (15)	+14	-19	+10	-13
$0.0-0.4$	0.27	11	10 (8)	18 (17)	+12	-16	+10	-13
$0.4-0.8$	0.20	16	31 (30)	37 (36)	+14	-20	+7	-10
$0.8-1.2$	0.24	15	19 (18)	27 (26)	+14	-20	+7	-10
$1.2-1.6$	0.15	21	26 (25)	35 (35)	+14	-20	+10	-13
$1.6-2.0$	0.15	19	28 (26)	36 (35)	+15	-21	+19	-23

Table 70: Υ(3S) cross section systematics, for $d\sigma/d|y|$, relative uncertainty in %.

$\|y\|$	A	$\varepsilon_{\mathrm{trig,id}}$	S_p	A_{p_T}	A_{vtx}	A_{fsr}	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	add.
$0.0-2.0$	0.7 (0.6)	8.6 (4.7)	0.3 (0.3)	0.8	0.8	0.8	0.1	1.0	3.4	5.4
$0.0-0.4$	0.8 (0.7)	8.3 (5.5)	0.4 (0.4)	0.9	0.5	0.9	0.4	1.6	0.3	5.4
$0.4-0.8$	0.7 (0.6)	7.7 (4.5)	0.4 (0.5)	0.9	0.5	0.8	0.6	1.2	29.5	5.4
$0.8-1.2$	0.6 (0.6)	9.0 (6.4)	0.4 (0.4)	0.8	1.1	0.8	0.1	0.8	15.7	5.4
$1.2-1.6$	0.5 (0.5)	7.9 (2.7)	0.2 (0.2)	0.8	1.0	0.7	0.7	0.1	24.2	5.4
$1.6-2.0$	0.7 (0.6)	10.0 (2.9)	0.1 (0.1)	0.7	1.0	0.6	1.2	0.7	25.6	5.4

Table 71: Υ(3S) cross section results, for $d\sigma/d|y|$, relative uncertainty in %.

$\|y\|$	σ	stat.	A	$\varepsilon_{\mathrm{trig,id}}$	S_p	A_{p_T}	A_{vtx}	A_{fsr}	t&p	$\varepsilon_{J/\psi,\Upsilon}$	BG	σ_p	$\varepsilon_{\mathrm{trk}}$	ext.
0.0: 2.0	1.01	$\pm$6.9	$^{+0.7}_{-0.6}$	$^{+8.6}_{-4.7}$	$^{+0.3}_{-0.3}$	$\pm$0.8	$\pm$0.8	$\pm$0.8	$\pm$0.1	$\pm$1.0	$\pm$3.4	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$12.2
0.0:0.4	0.27	$\pm$10.5	$^{+0.8}_{-0.7}$	$^{+8.3}_{-5.5}$	$^{+0.4}_{-0.4}$	$\pm$0.9	$\pm$0.5	$\pm$0.9	$\pm$0.4	$\pm$1.6	$\pm$0.3	$^{+0.1}_{-0.1}$	$^{+0.5}_{-0.5}$	$\pm$12.2
0.4:0.8	0.20	$\pm$15.8	$^{+0.7}_{-0.6}$	$^{+7.7}_{-4.5}$	$^{+0.4}_{-0.5}$	$\pm$0.9	$\pm$0.5	$\pm$0.8	$\pm$0.6	$\pm$1.2	$\pm$29.5	$^{+0.1}_{-0.1}$	$^{+0.5}_{-0.5}$	$\pm$12.2
0.8:1.2	0.24	$\pm$15.1	$^{+0.6}_{-0.6}$	$^{+9.0}_{-6.4}$	$^{+0.4}_{-0.4}$	$\pm$0.8	$\pm$1.1	$\pm$0.8	$\pm$0.1	$\pm$0.8	$\pm$15.7	$^{+0.0}_{-0.0}$	$^{+0.5}_{-0.5}$	$\pm$12.2
1.2:1.6	0.15	$\pm$21.4	$^{+0.5}_{-0.5}$	$^{+7.9}_{-2.7}$	$^{+0.2}_{-0.2}$	$\pm$0.8	$\pm$1.0	$\pm$0.7	$\pm$0.7	$\pm$0.1	$\pm$24.2	$^{+0.0}_{-0.0}$	$^{+0.4}_{-0.4}$	$\pm$12.2
1.6:2.0	0.15	$\pm$19.5	$^{+0.7}_{-0.6}$	$^{+10.0}_{-2.9}$	$^{+0.1}_{-0.1}$	$\pm$0.7	$\pm$1.0	$\pm$0.6	$\pm$1.2	$\pm$0.7	$\pm$25.6	$^{+0.0}_{-0.1}$	$^{+0.5}_{-0.4}$	$\pm$12.2

Table 72: Υ(3S) cross section results, for $d\sigma/d|y|$, absolute values.

$\|y\|$	$\sigma(\Upsilon(3S))$	stat.	$\sum_{\mathrm{syst.}}$	lumi.	$\Delta\sigma$
$0.0-2.0$	1.008	$\pm$ 0.070	$^{+0.109}_{-0.082}$	$\pm$ 0.111	$^{+0.171}_{-0.155}$
$0.0-0.4$	0.272	$\pm$ 0.029	$^{+0.028}_{-0.022}$	$\pm$ 0.030	$^{+0.050}_{-0.047}$
$0.4-0.8$	0.198	$\pm$ 0.031	$^{+0.062}_{-0.060}$	$\pm$ 0.022	$^{+0.073}_{-0.071}$
$0.8-1.2$	0.236	$\pm$ 0.036	$^{+0.045}_{-0.042}$	$\pm$ 0.026	$^{+0.063}_{-0.061}$
$1.2-1.6$	0.150	$\pm$ 0.032	$^{+0.039}_{-0.038}$	$\pm$ 0.017	$^{+0.053}_{-0.052}$
$1.6-2.0$	0.151	$\pm$ 0.029	$^{+0.042}_{-0.040}$	$\pm$ 0.017	$^{+0.054}_{-0.052}$

Table 73: Υ(3S) cross section results, for $d\sigma/d|y|$, absolute values (central±stat.±syst.±lumi.).

$\|y\|$	Unpolarized	Helicity transverse	Helicity longitudinal	Collins-Soper transverse	Co
0.0: 2.0	$1.02 \pm 0.07^{+0.11}_{-0.08} \pm 0.11$	$1.16 \pm 0.08^{+0.13}_{-0.09} \pm 0.13$	$0.83 \pm 0.06^{+0.09}_{-0.07} \pm 0.09$	$1.12 \pm 0.08^{+0.12}_{-0.09} \pm 0.12$	0
0.0:0.4	$0.27 \pm 0.03^{+0.03}_{-0.02} \pm 0.03$	$0.30 \pm 0.03^{+0.03}_{-0.02} \pm 0.03$	$0.23 \pm 0.02^{+0.02}_{-0.02} \pm 0.03$	$0.30 \pm 0.03^{+0.03}_{-0.02} \pm 0.03$	0
0.4:0.8	$0.20 \pm 0.03^{+0.06}_{-0.06} \pm 0.02$	$0.23 \pm 0.04^{+0.07}_{-0.07} \pm 0.02$	$0.16 \pm 0.03^{+0.05}_{-0.05} \pm 0.02$	$0.21 \pm 0.03^{+0.07}_{-0.06} \pm 0.02$	0
0.8:1.2	$0.24 \pm 0.04^{+0.04}_{-0.04} \pm 0.03$	$0.27 \pm 0.04^{+0.05}_{-0.05} \pm 0.03$	$0.19 \pm 0.03^{+0.04}_{-0.03} \pm 0.02$	$0.25 \pm 0.04^{+0.05}_{-0.05} \pm 0.03$	0
1.2:1.6	$0.15 \pm 0.03^{+0.04}_{-0.04} \pm 0.02$	$0.17 \pm 0.04^{+0.04}_{-0.04} \pm 0.02$	$0.12 \pm 0.03^{+0.03}_{-0.03} \pm 0.01$	$0.16 \pm 0.04^{+0.04}_{-0.04} \pm 0.02$	0
1.6:2.0	$0.15 \pm 0.03^{+0.04}_{-0.04} \pm 0.02$	$0.17 \pm 0.03^{+0.05}_{-0.05} \pm 0.02$	$0.12 \pm 0.02^{+0.03}_{-0.03} \pm 0.01$	$0.18 \pm 0.04^{+0.05}_{-0.05} \pm 0.02$	0

Table 74: Cross section calculation cross check, for Υ(3S) $d\sigma/d|y|$

$\Upsilon(3S)$	$p_{\rm T}$ ((GeV/c)			raw fit			weight, w			cross	
|rapidity|	range	mean	rms	yield, N	s/e	χ^2/ndf	mean	rms	$\langle w\rangle^{-1}$	$\sigma_{\rm av.} \sim N \cdot \langle w\rangle$	
0.0- 0.4	0- 30	5.6	4.3	314 ± 31	9	0.8	3.5	1.1	0.29± 0.09	0.361 ± 0.037	0.
0.4- 0.8	0- 30	5.1	3.9	243 ± 36	6	0.9	3.3	1.0	0.30± 0.09	0.265 ± 0.041	0.
0.8- 1.2	0- 30	5.0	3.9	316 ± 46	7	1.5	2.8	0.8	0.35± 0.09	0.295 ± 0.044	0.
1.2- 1.6	0- 30	5.0	4.4	242 ± 44	5	1.1	2.4	0.5	0.41± 0.09	0.194 ± 0.036	0.
1.6- 2.0	0- 30	5.1	4.3	196 ± 36	5	1.2	2.7	0.5	0.37± 0.07	0.172 ± 0.032	0.
0.0- 2.0	0- 30			1310± 87						1.287 ± 0.818	1.

Table 75: Υ(3S) cross section comparison: fit vs sum

Υ(3S) , $p_{\rm T} < 30$	:	$\sigma = 1.019 \pm 0.068$,	$\sum d\sigma = 1.008 \pm 0.070$, $\Delta = 1.1\%$

0.1.4 Cross checks

Table 76: Total cross section: comparison global fit and sum of differential results.

$\Upsilon(1S)$, $0 < \|y\| < 2$:	$\sigma = 7.353 \pm 0.132$,	$\sum d\sigma = 7.370 \pm 0.131$,	$\Delta = 0.2\%$
$\Upsilon(2S)$, $0 < \|y\| < 2$:	$\sigma = 1.895 \pm 0.080$,	$\sum d\sigma = 1.902 \pm 0.079$,	$\Delta = 0.4\%$
$\Upsilon(3S)$, $0 < \|y\| < 2$:	$\sigma = 1.019 \pm 0.068$,	$\sum d\sigma = 1.024 \pm 0.068$,	$\Delta = 0.5\%$
$\Upsilon(1S)$, $0 < \|y\| < 1$:	$\sigma = 7.353 \pm 0.132$,	$\sum d\sigma = 4.031 \pm 0.093$,	$\Delta = 45.2\%$
$\Upsilon(1S)$, $1 < \|y\| < 2$:	$\sigma = 7.353 \pm 0.132$,	$\sum d\sigma = 3.553 \pm 0.090$,	$\Delta = 51.7\%$
$\Upsilon(2S)$, $0 < \|y\| < 1$:	$\sigma = 1.895 \pm 0.080$,	$\sum d\sigma = 1.028 \pm 0.056$,	$\Delta = 45.7\%$
$\Upsilon(2S)$, $1 < \|y\| < 2$:	$\sigma = 1.895 \pm 0.080$,	$\sum d\sigma = 0.934 \pm 0.058$,	$\Delta = 50.7\%$
$\Upsilon(3S)$, $0 < \|y\| < 1$:	$\sigma = 1.019 \pm 0.068$,	$\sum d\sigma = 0.592 \pm 0.049$,	$\Delta = 41.9\%$
$\Upsilon(3S)$, $1 < \|y\| < 2$:	$\sigma = 1.019 \pm 0.068$,	$\sum d\sigma = 0.398 \pm 0.050$,	$\Delta = 61.0\%$
$\Upsilon(1S)$, $p_{\mathrm{T}} < 30$:	$\sigma = 7.353 \pm 0.132$,	$\sum d\sigma = 7.610 \pm 0.130$,	$\Delta = 3.5\%$
$\Upsilon(2S)$, $p_{\mathrm{T}} < 30$:	$\sigma = 1.895 \pm 0.080$,	$\sum d\sigma = 1.940 \pm 0.081$,	$\Delta = 2.4\%$
$\Upsilon(3S)$, $p_{\mathrm{T}} < 30$:	$\sigma = 1.019 \pm 0.068$,	$\sum d\sigma = 1.008 \pm 0.070$,	$\Delta = 1.1\%$

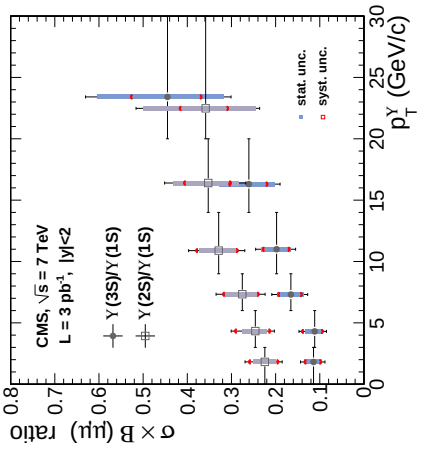
0.2 Other Cross Section Results

0.2.1 Cross section ratios

Table 77: Cross section ratios

$p_{\mathrm{T}}(\,\mathrm{GeV/c}\,)$	$\Upsilon(3\mathrm{S})\,/\Upsilon(1\mathrm{S})$	$\Upsilon(2\mathrm{S})\,/\Upsilon(1\mathrm{S})$
$0-30$	$0.14\,\pm^{0.01}_{0.01}\,\pm^{0.02}_{0.02}$	$0.26\,\pm^{0.02}_{0.02}\,\pm^{0.04}_{0.03}$
$0-3$	$0.11\,\pm^{0.02}_{0.02}\,\pm^{0.02}_{0.02}$	$0.22\,\pm^{0.03}_{0.02}\,\pm^{0.04}_{0.03}$
$3-6$	$0.11\,\pm^{0.02}_{0.02}\,\pm^{0.03}_{0.02}$	$0.25\,\pm^{0.03}_{0.03}\,\pm^{0.05}_{0.03}$
$6-9$	$0.17\,\pm^{0.03}_{0.03}\,\pm^{0.03}_{0.02}$	$0.28\,\pm^{0.04}_{0.04}\,\pm^{0.04}_{0.04}$
$9-14$	$0.20\,\pm^{0.03}_{0.03}\,\pm^{0.03}_{0.03}$	$0.33\,\pm^{0.04}_{0.04}\,\pm^{0.05}_{0.04}$
$14-20$	$0.26\,\pm^{0.07}_{0.06}\,\pm^{0.04}_{0.04}$	$0.35\,\pm^{0.08}_{0.07}\,\pm^{0.05}_{0.05}$
$20-30$	$0.44\,\pm^{0.16}_{0.13}\,\pm^{0.08}_{0.08}$	$0.36\,\pm^{0.14}_{0.11}\,\pm^{0.06}_{0.05}$

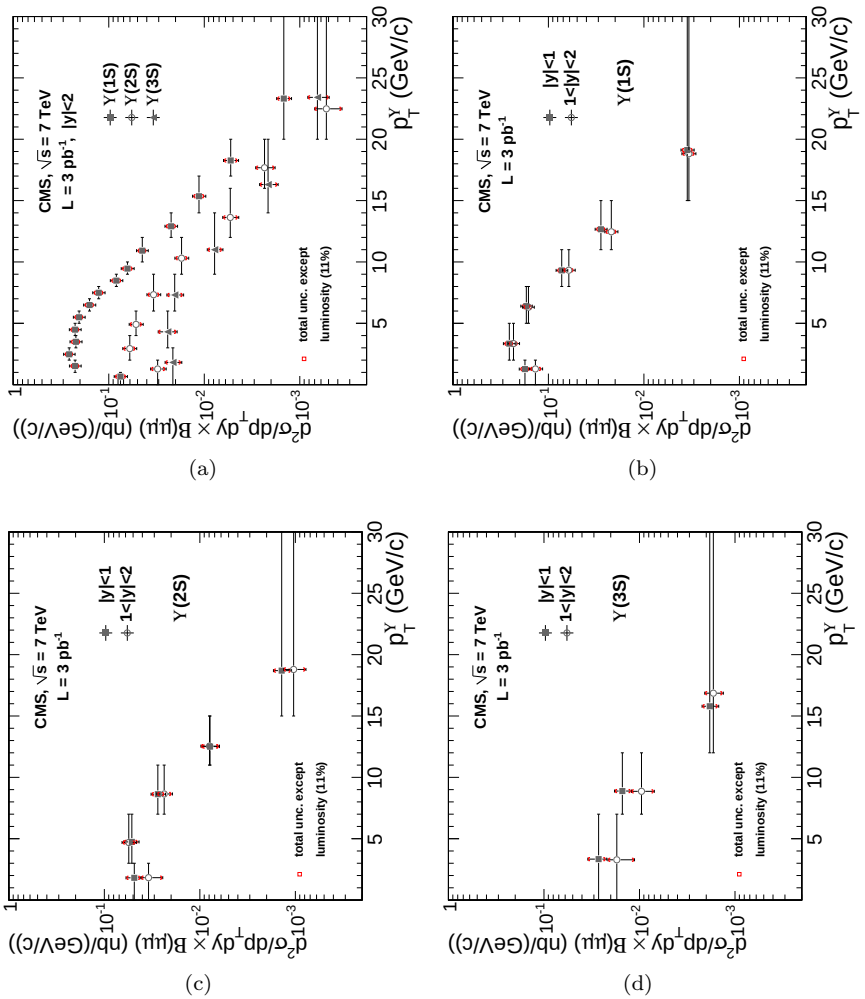
Figure 10: Cross section ratios.



(a)

0.2.2 Cross section overlay

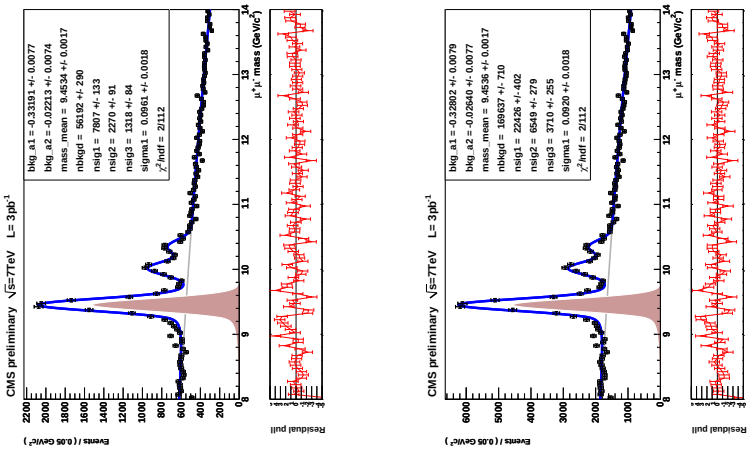
Figure 11: Cross sections overlayed



0.2.3 Comparisons to theory

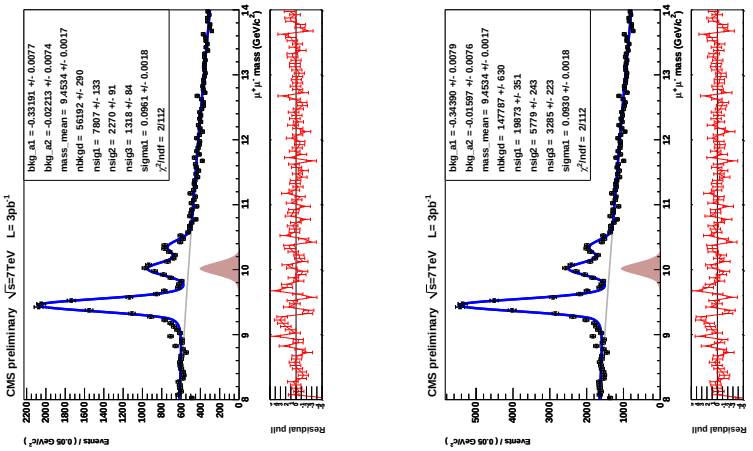
0.3 Nominal Global Mass Fits

Figure 12: Υ(1S) nominal raw (left) and weighted (right) global mass fits.



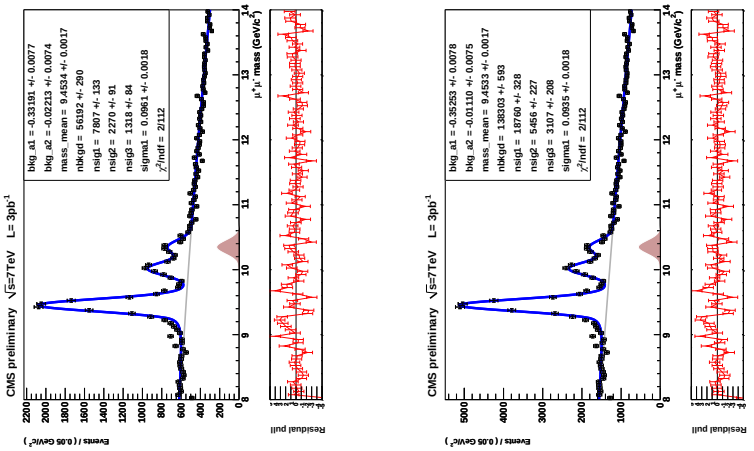
(a) (b)

Figure 13: Υ(2S) nominal raw (left) and weighted (right) global mass fits.



(a) (b)

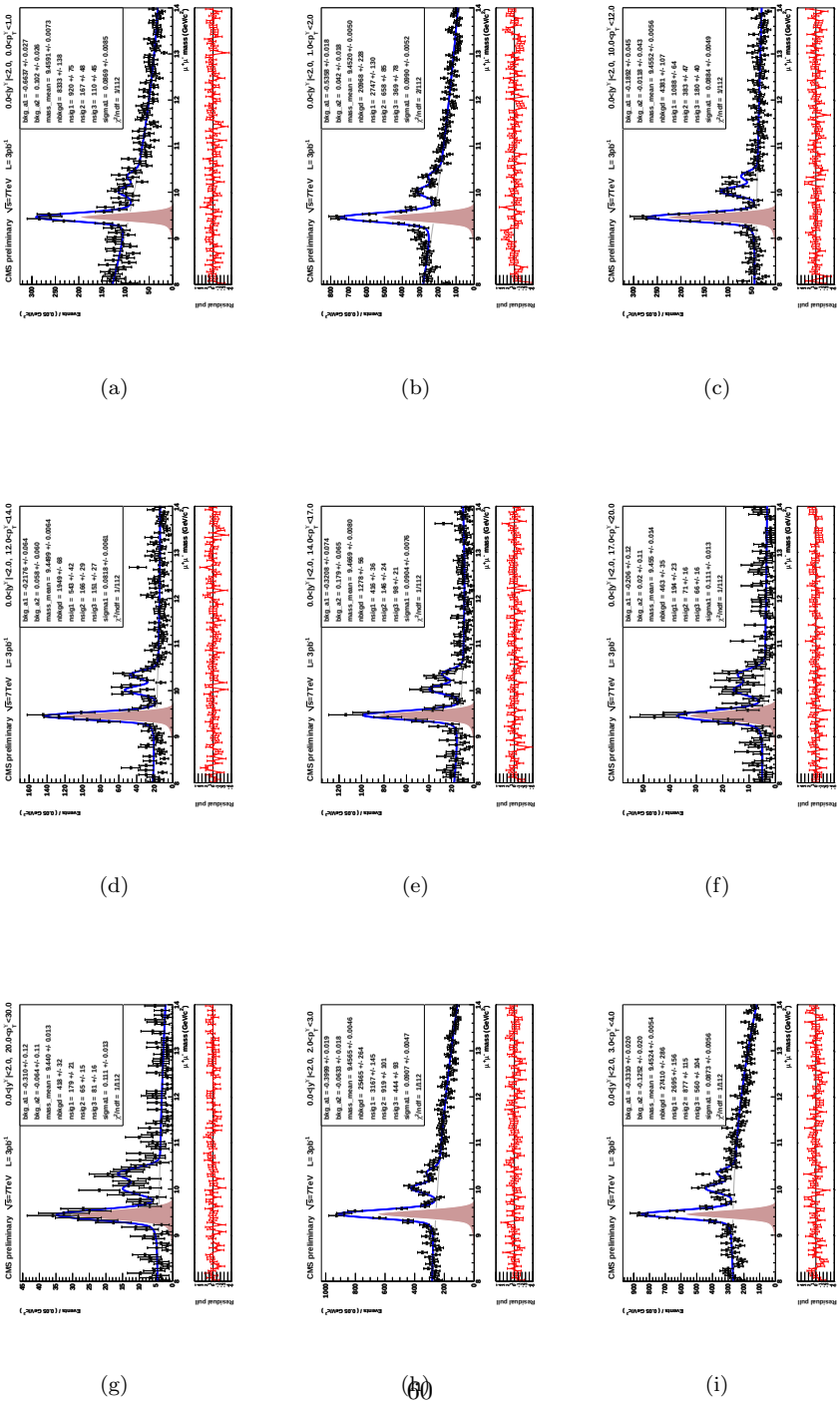
Figure 14: Υ(3S) nominal raw (left) and weighted (right) global mass fits.



(a) (b)

0.4 Nominal Differential Mass Fits

Figure 15: Υ(1S) nominal weighted mass fits, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



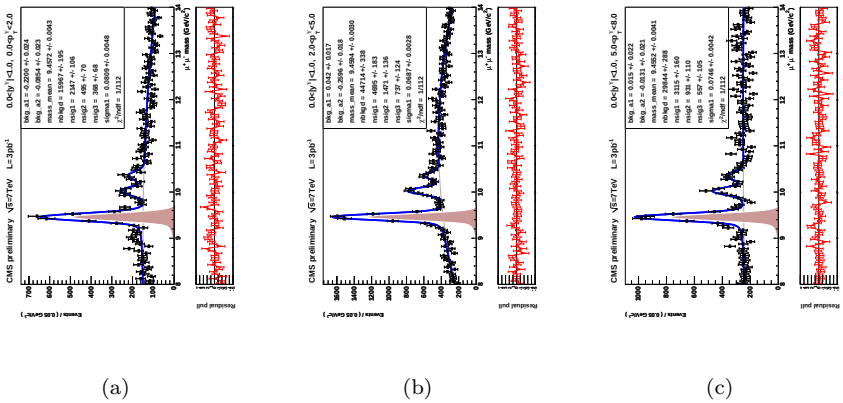
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 16: Υ(1S) nominal weighted mass fits, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

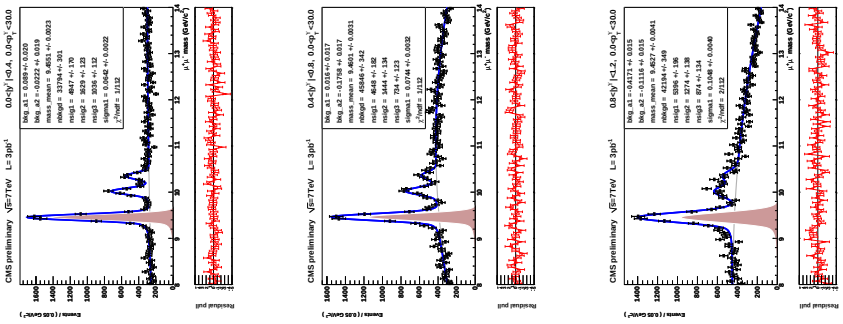


(a) (b) (c)

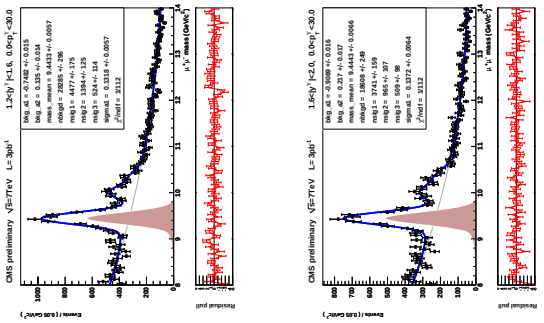
(d) (e) (f)

(g) (h) (i)

Figure 17: $\Upsilon(1S)$ nominal weighted mass fits, for $d\sigma/d|y|$ binning.

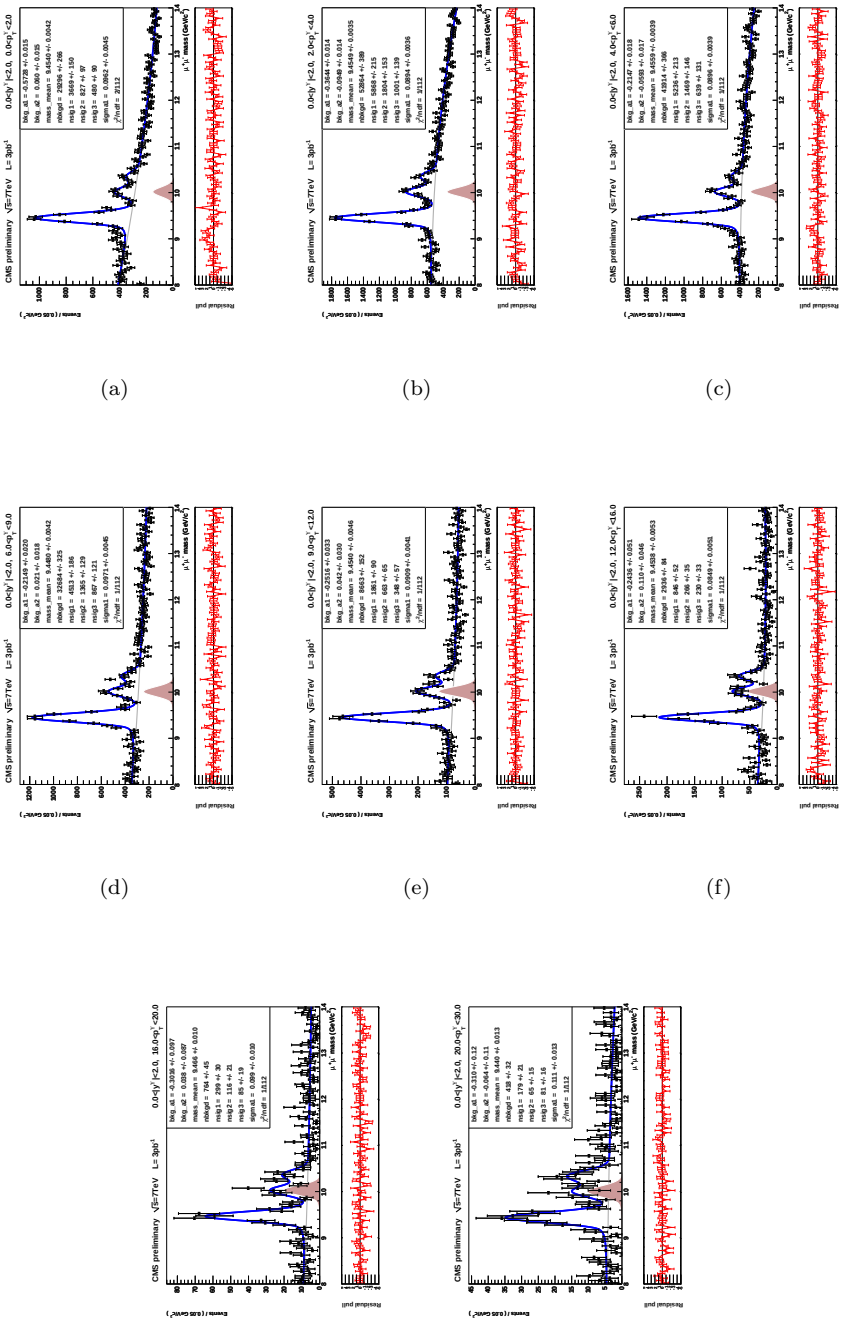


(a) (b) (c)



(d) (e)

Figure 18: Υ(2S) nominal weighted mass fits, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

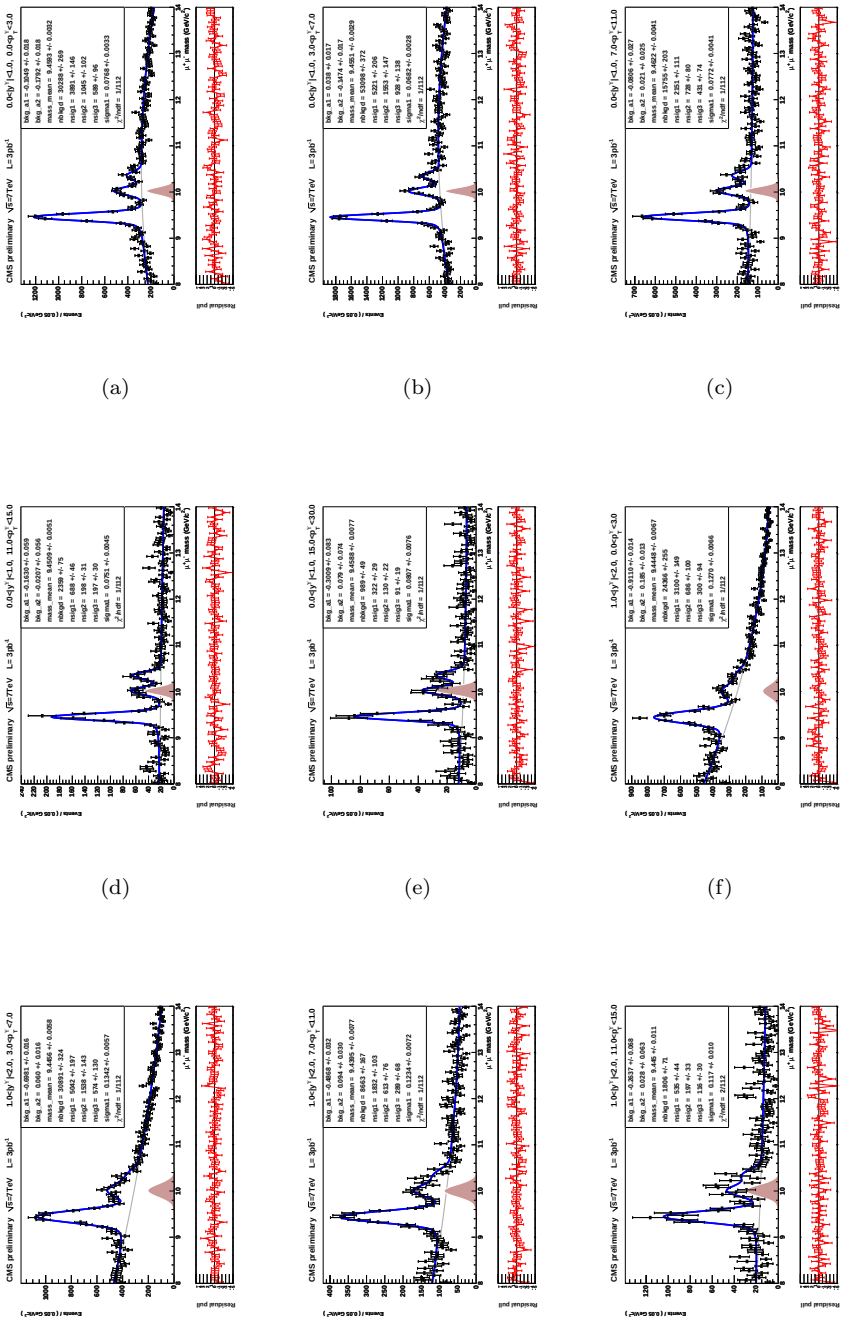


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 19: Υ(2S) nominal weighted mass fits, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

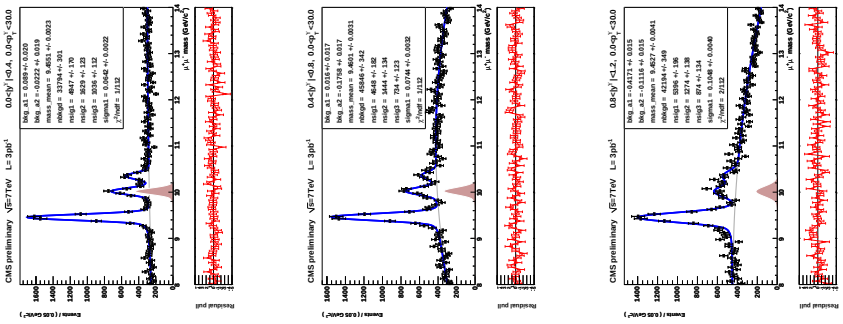


(a) (b) (c)

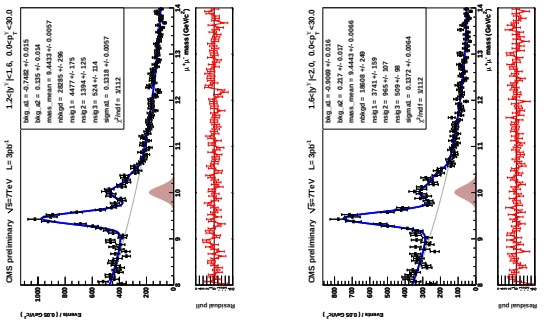
(d) (e) (f)

(g) (h) (i)

Figure 20: $\Upsilon(2S)$ nominal weighted mass fits, for $d\sigma/d|y|$ binning.

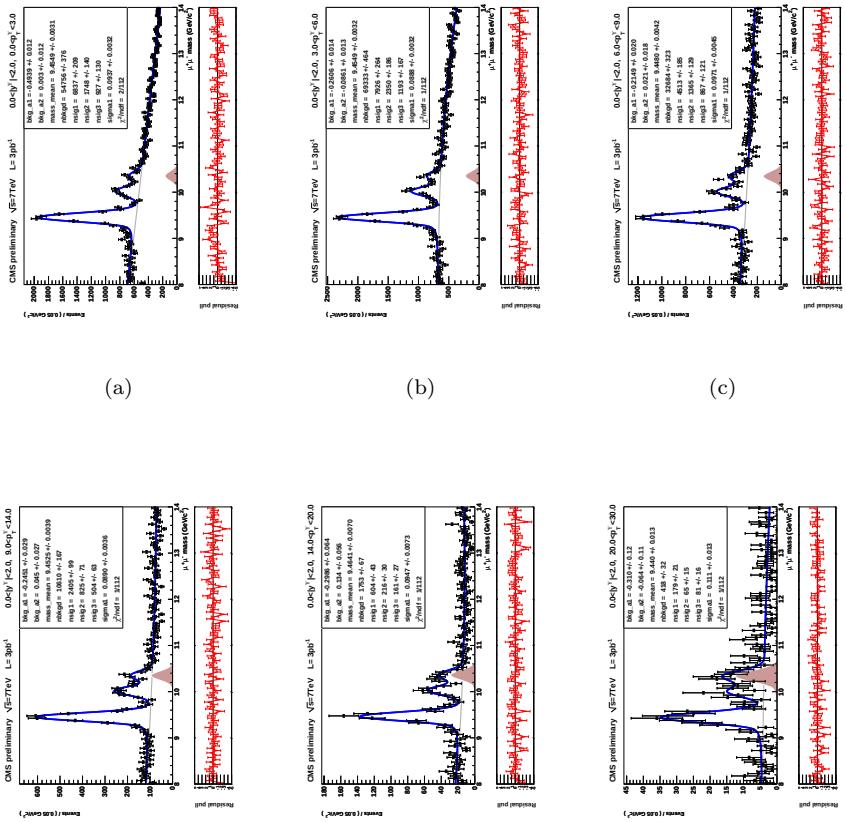


(a) (b) (c)



(d) (e)

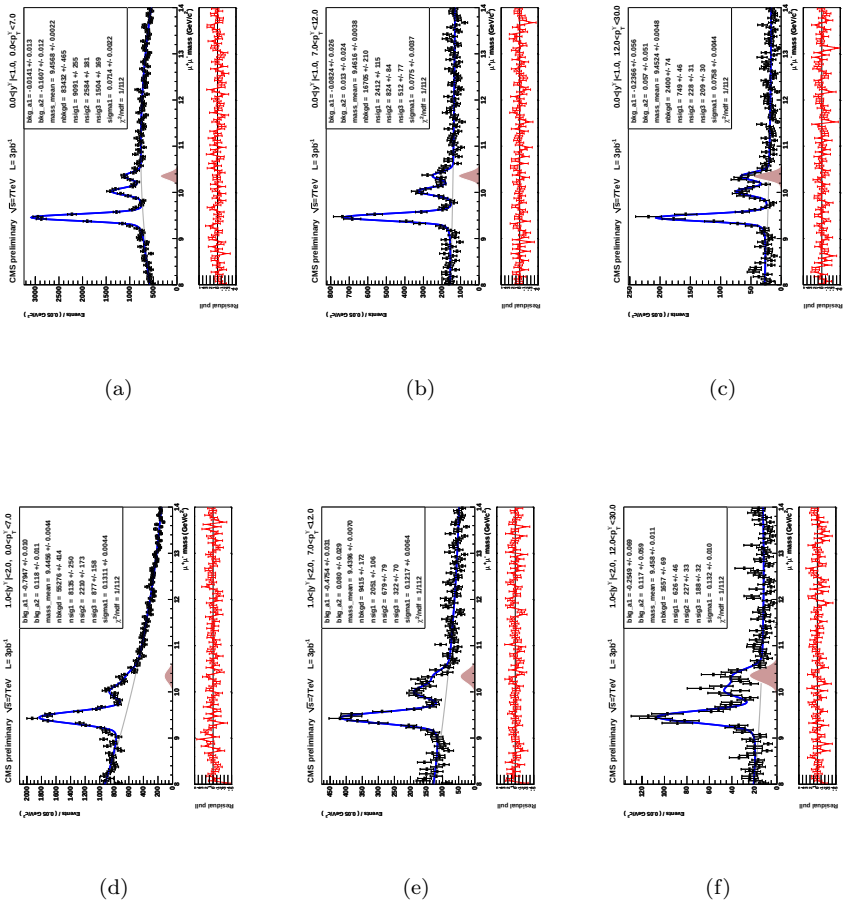
Figure 21: Υ(3S) nominal weighted mass fits, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

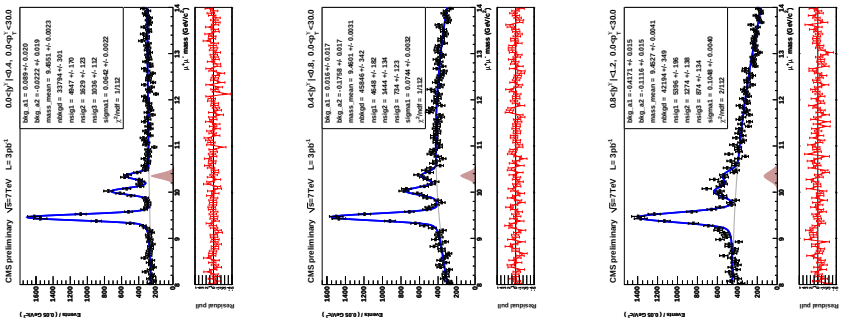
Figure 22: Υ(3S) nominal weighted mass fits, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



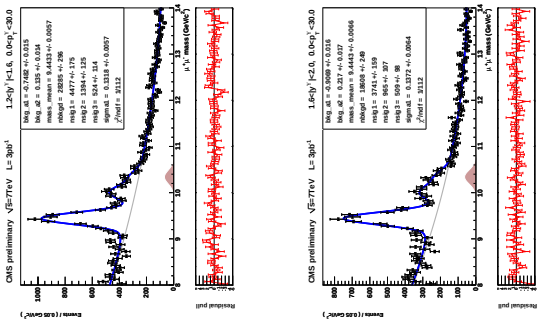
(a) (b) (c)

(d) (e) (f)

Figure 23: Υ(3S) nominal weighted mass fits, for $d\sigma/d|y|$ binning.



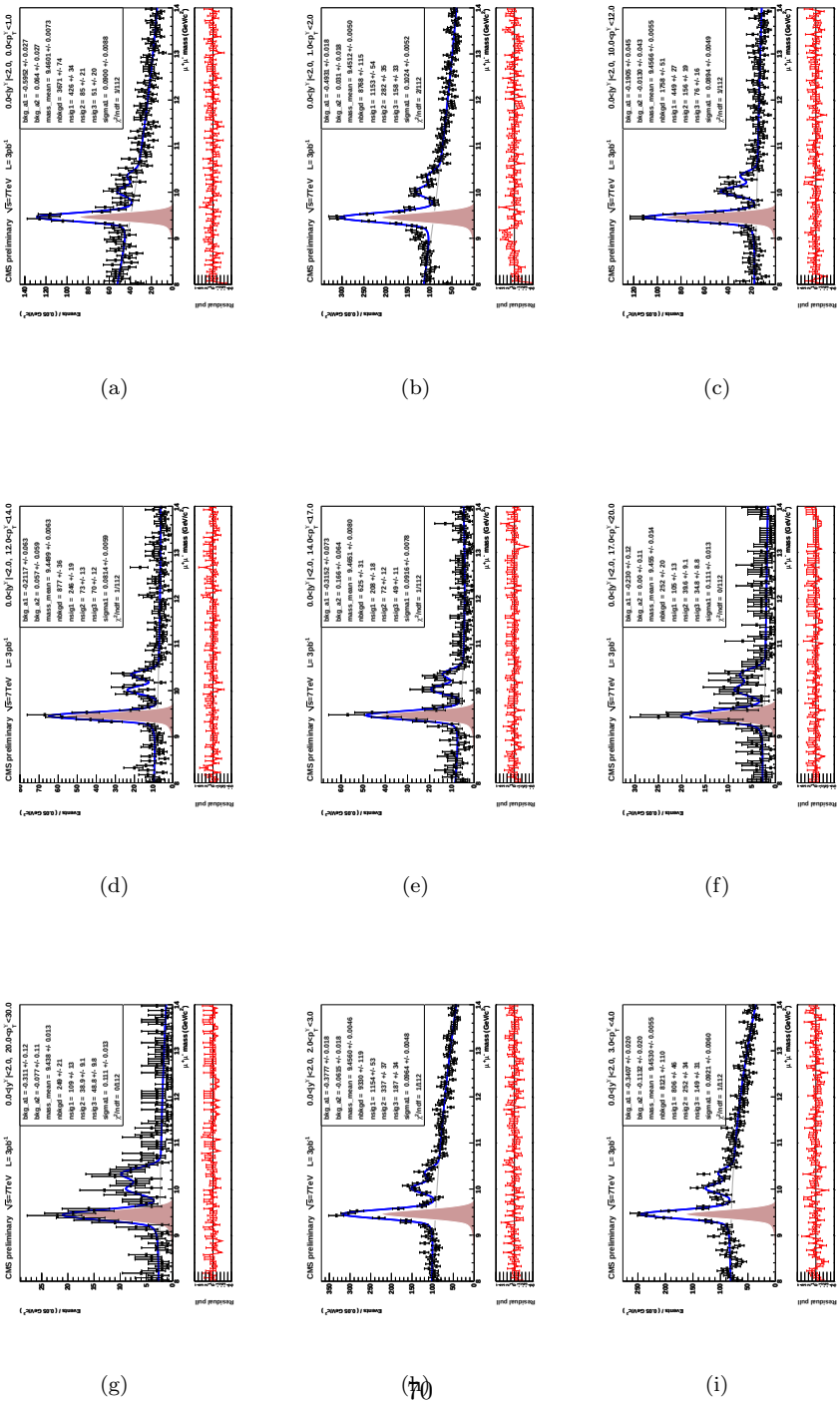
(a) (b) (c)



(d) (e)

0.5 Nominal Differential Mass Fits (RAW)

Figure 24: Υ(1S) nominal raw mass fits, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



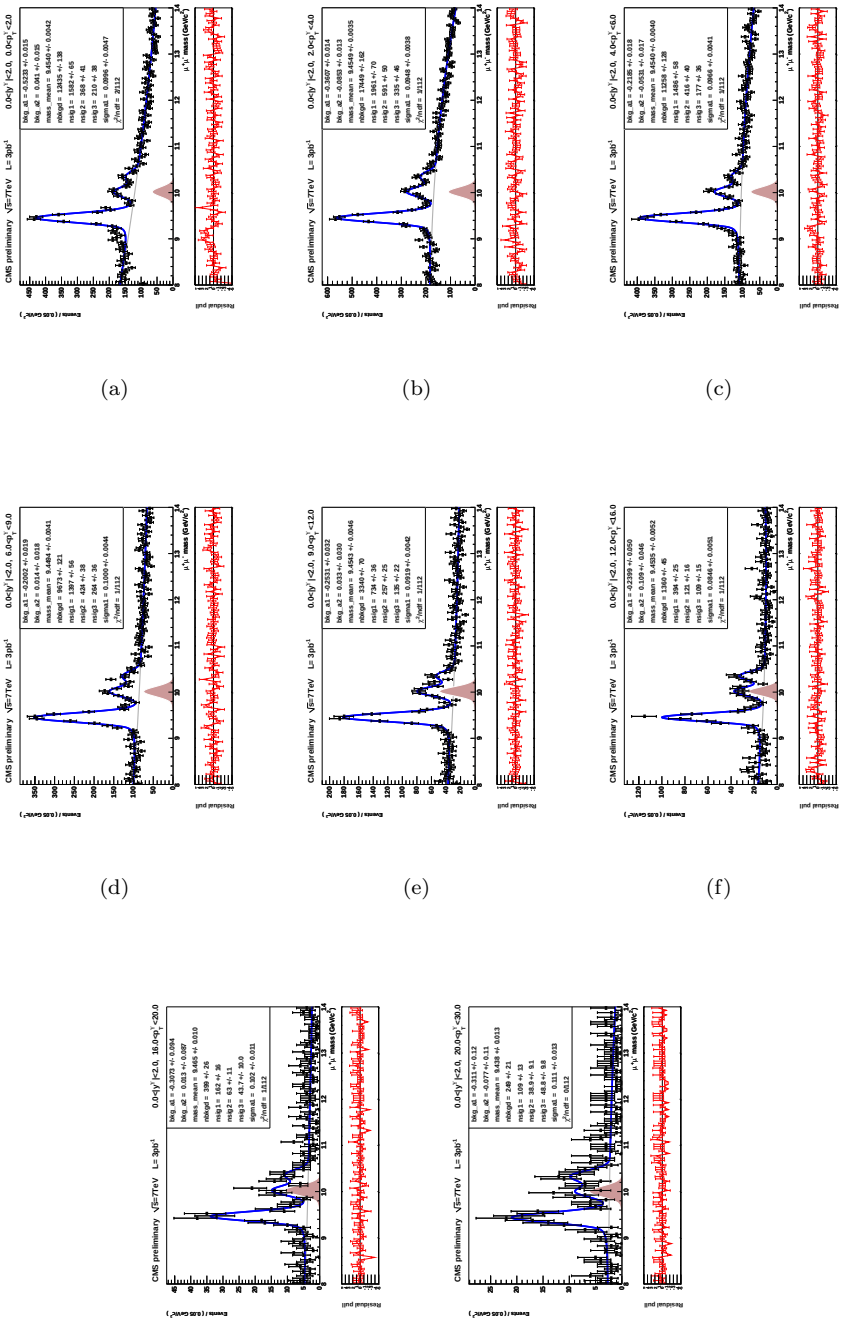
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 25: $\Upsilon(2S)$ nominal raw mass fits, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

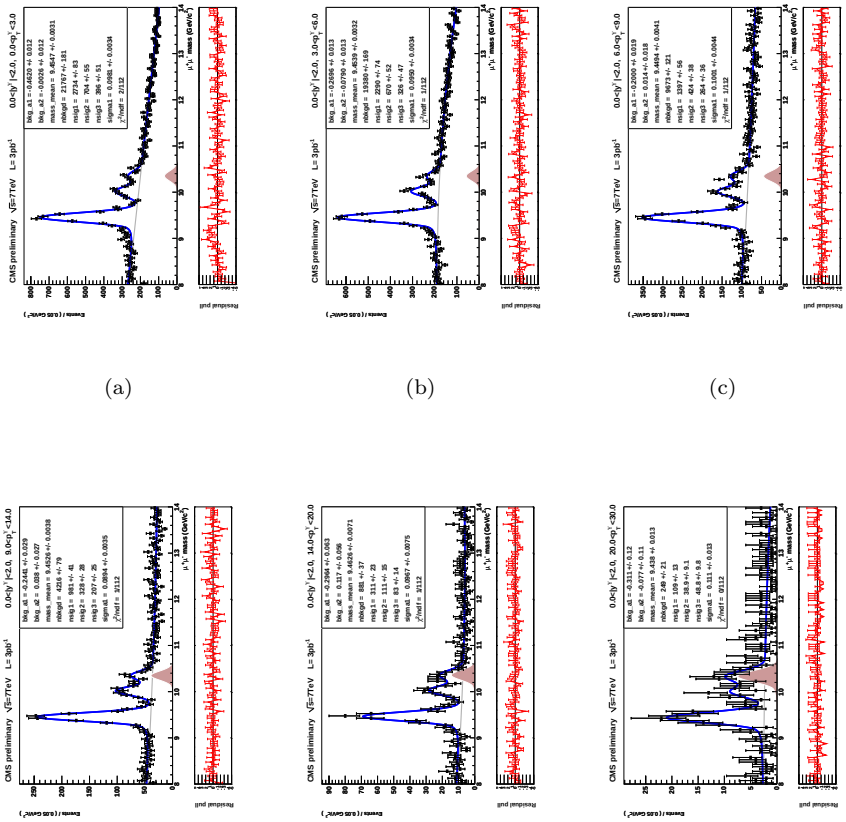


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 26: Υ(3S) nominal raw mass fits, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

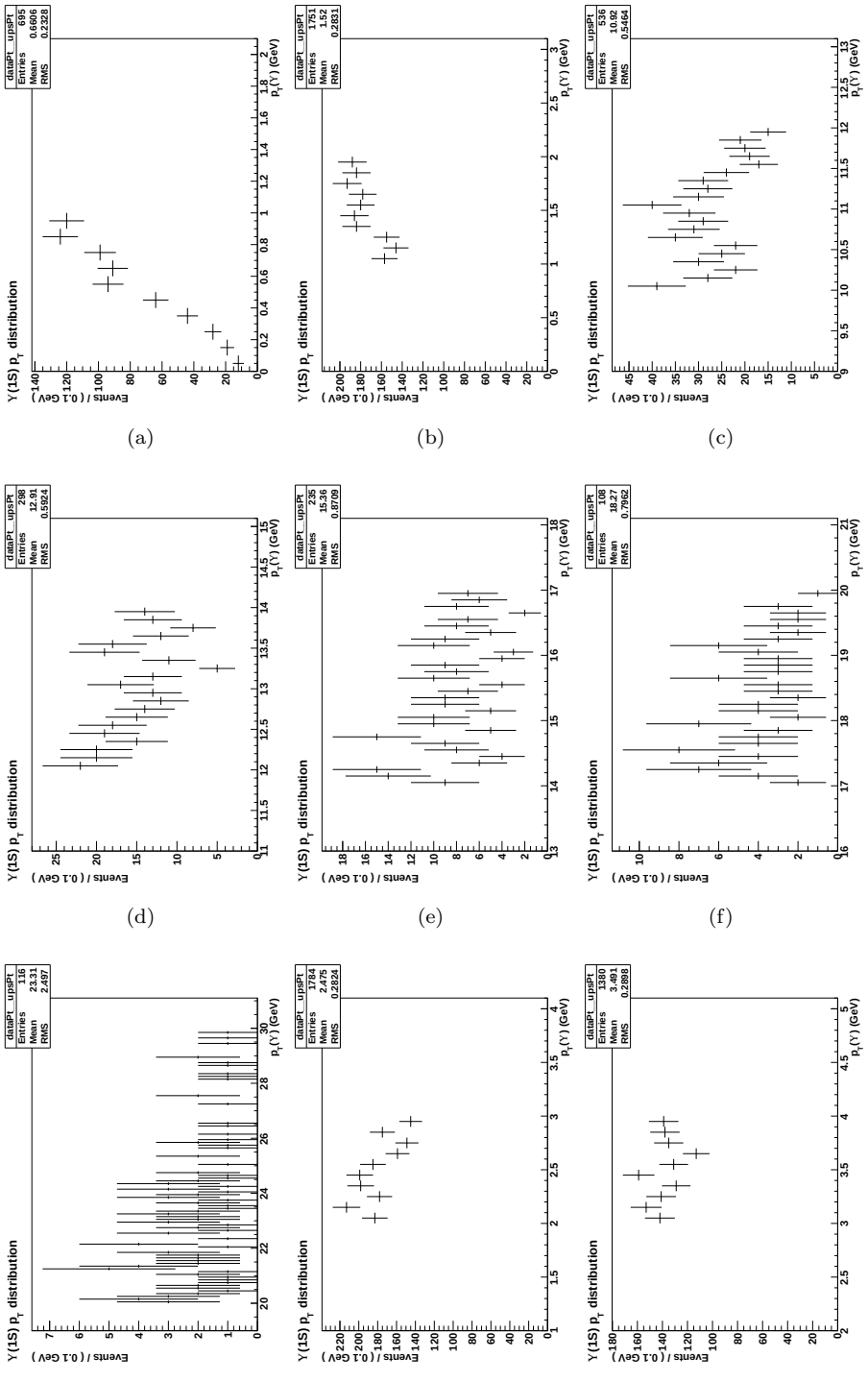


(a) (b) (c)

(d) (e) (f)

0.6 p_{T} Distributions per p_{T} bin

Figure 27: $\Upsilon(1S)$ p_{T} distribution, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$binning.



(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 28: $\Upsilon(2S)$ p_{T} distribution, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$binning.

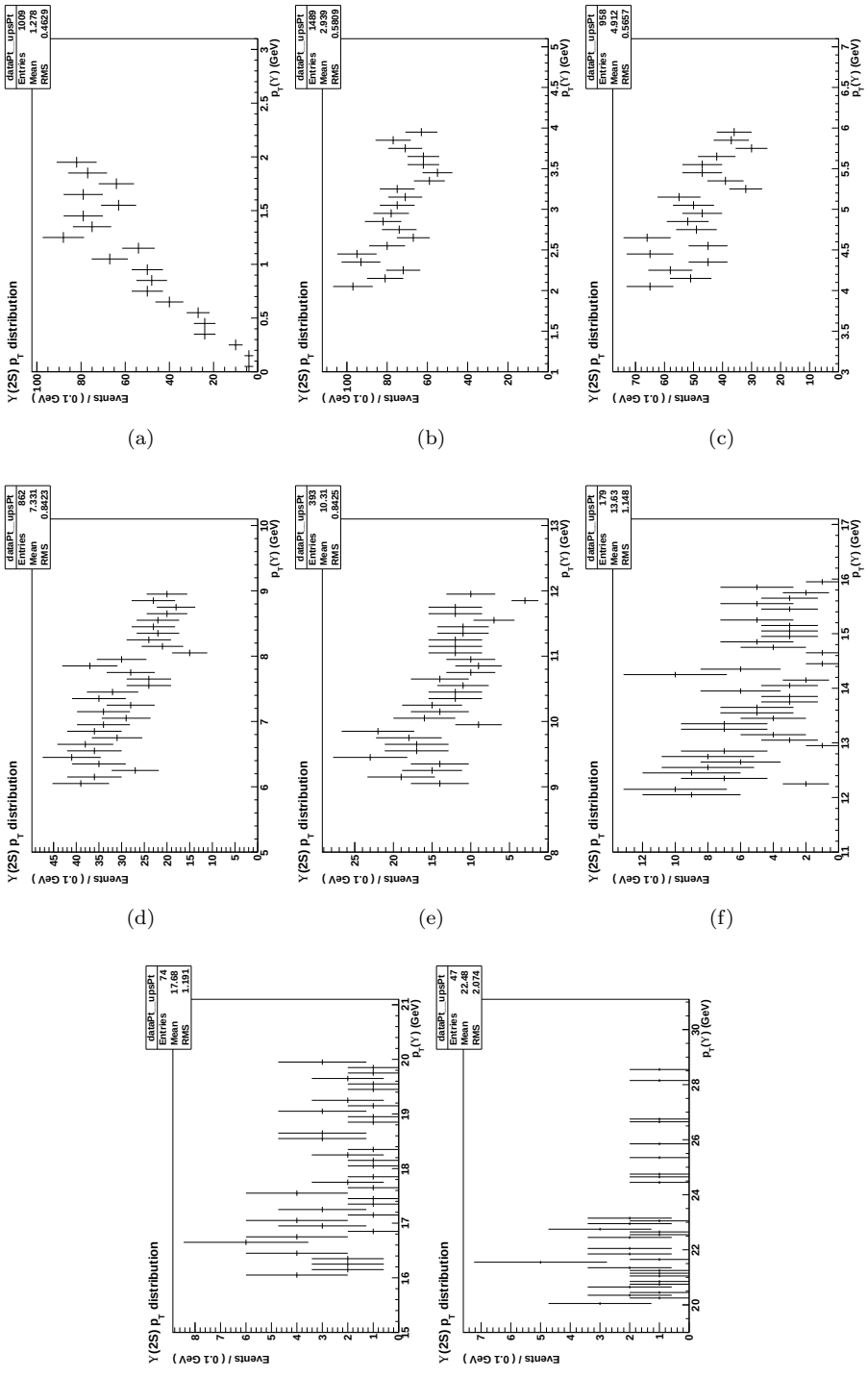


Figure 29: $\Upsilon(3S)$ p_{T} distribution, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$binning.

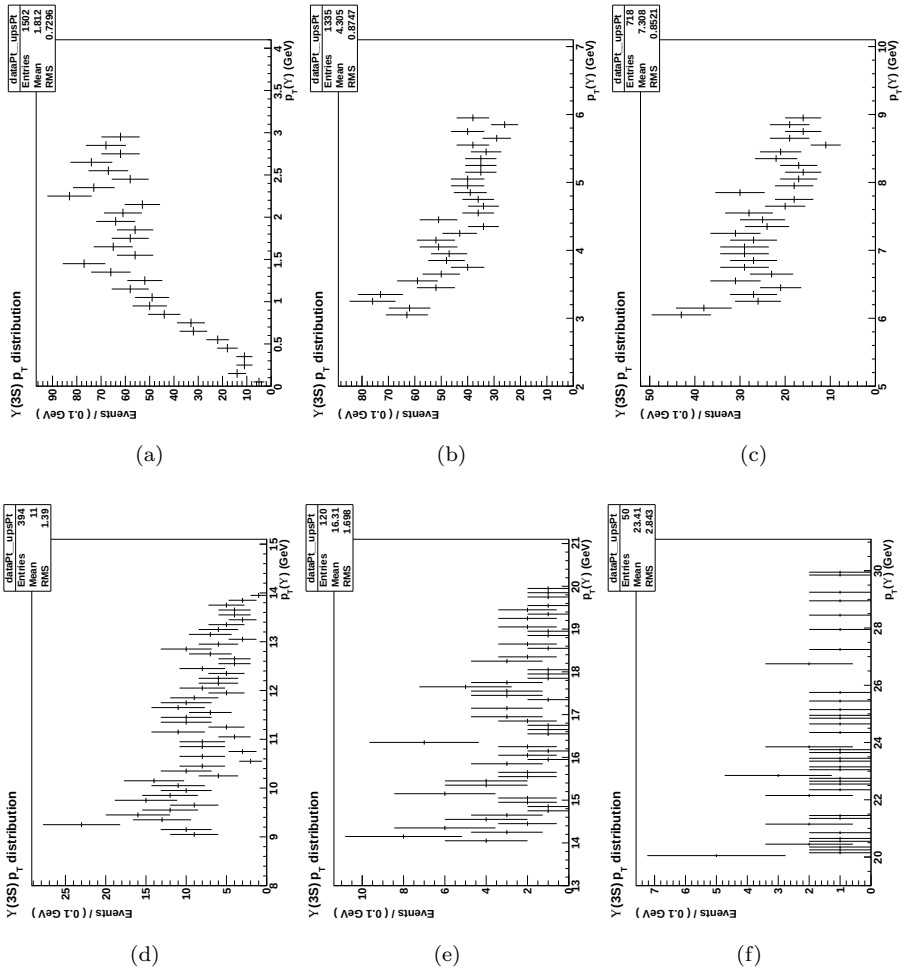
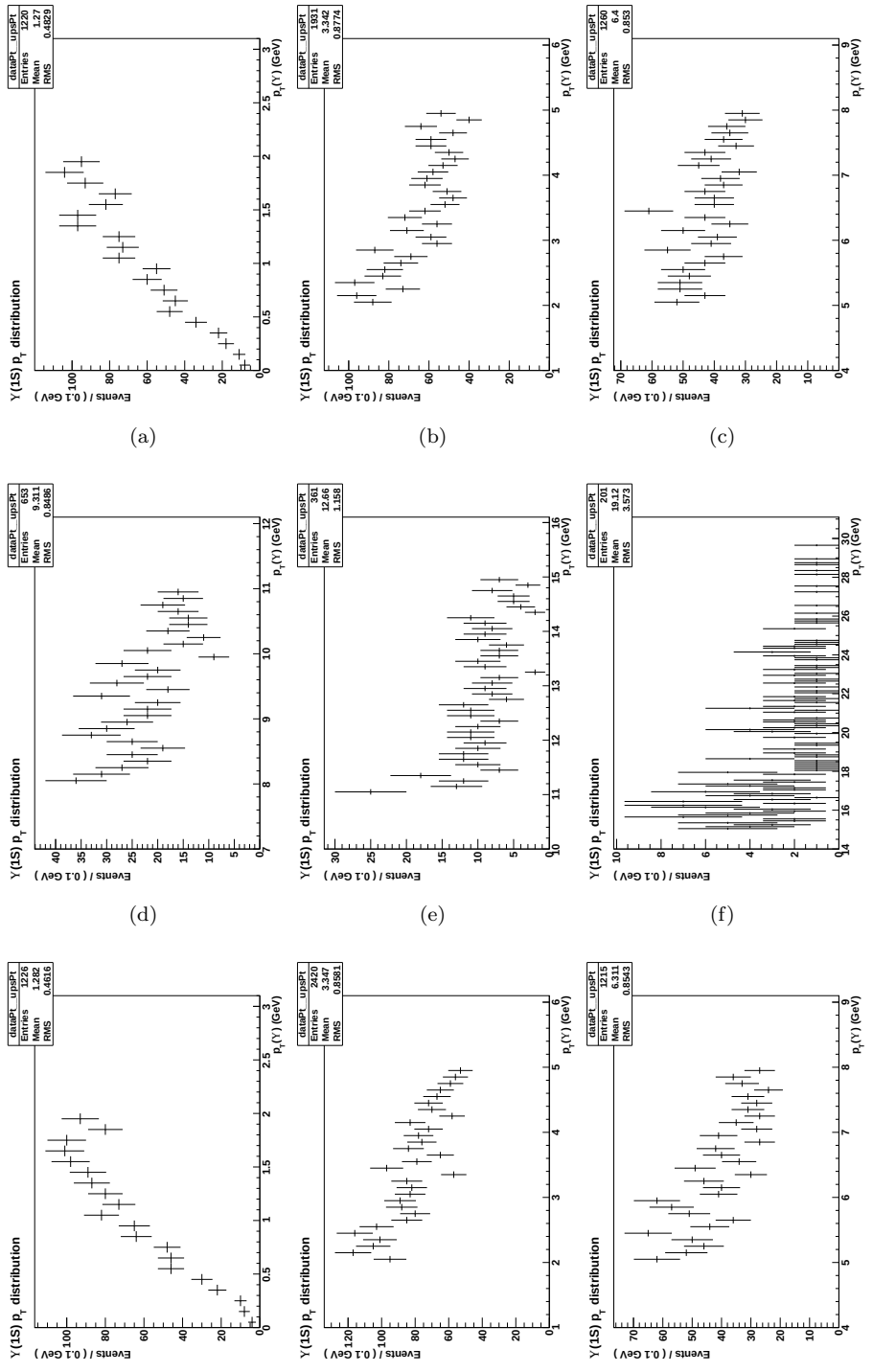


Figure 30: $\Upsilon(1S)$ p_{T} distribution, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$binning.



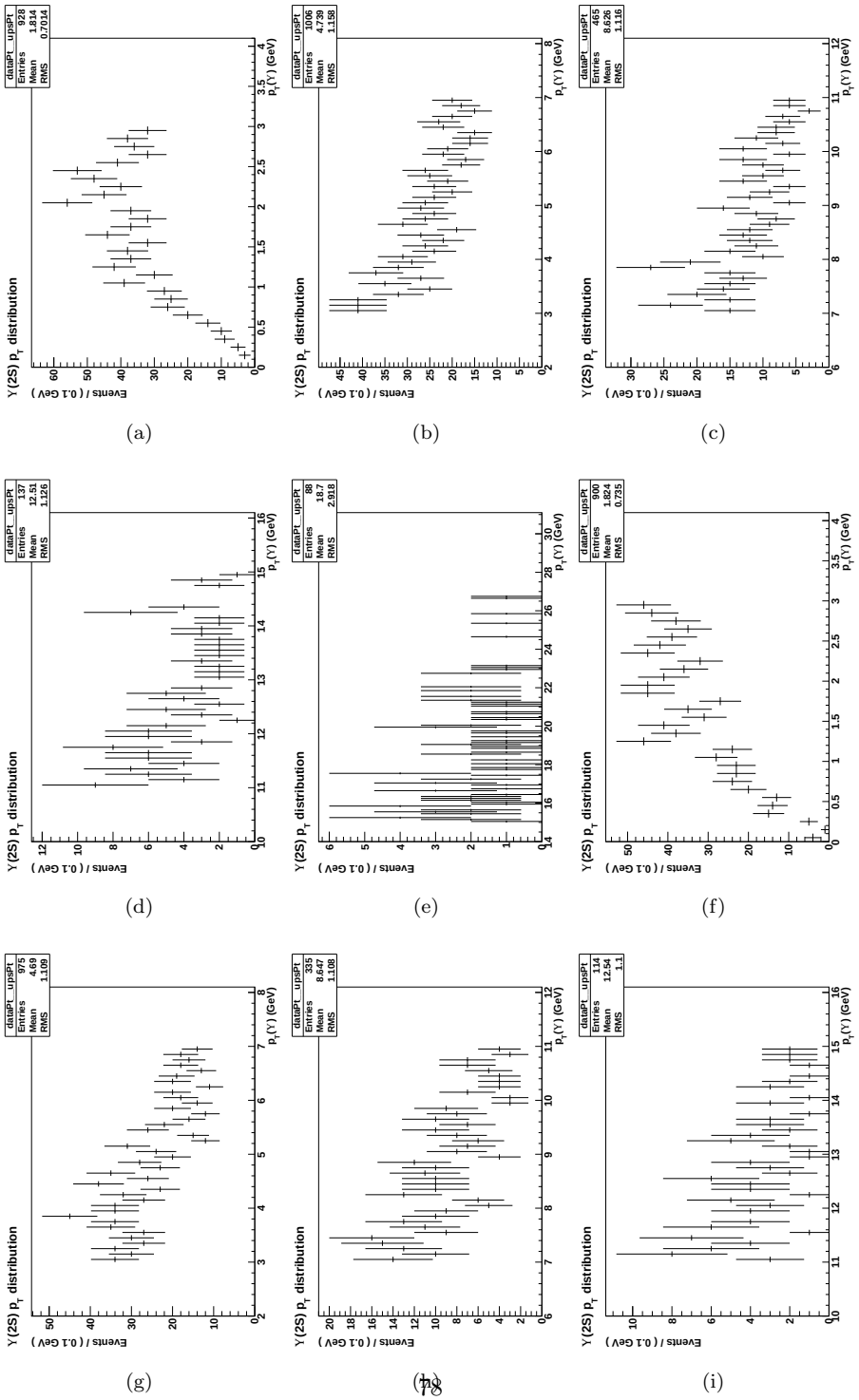
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 31: $\Upsilon(2S)$ p_{T} distribution, for $d\sigma/dp_{\mathrm{T}}$ $|y| : (0,1),(1,2)$binning.



(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j)

Figure 32: $\Upsilon(3S)$ p_{T} distribution, for $d\sigma/dp_{\mathrm{T}}$ $|y| : (0,1),(1,2)$binning.

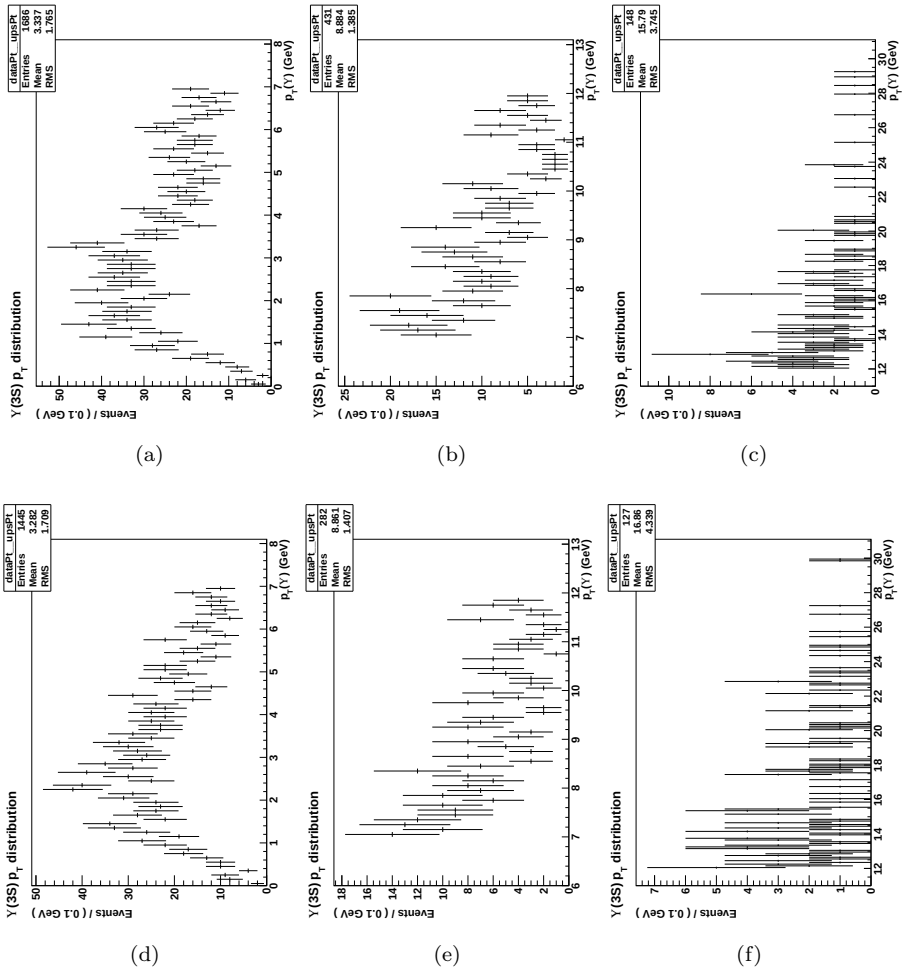


Figure 33: Υ(1S) p_{T} distribution, for $d\sigma/d|y|$binning.

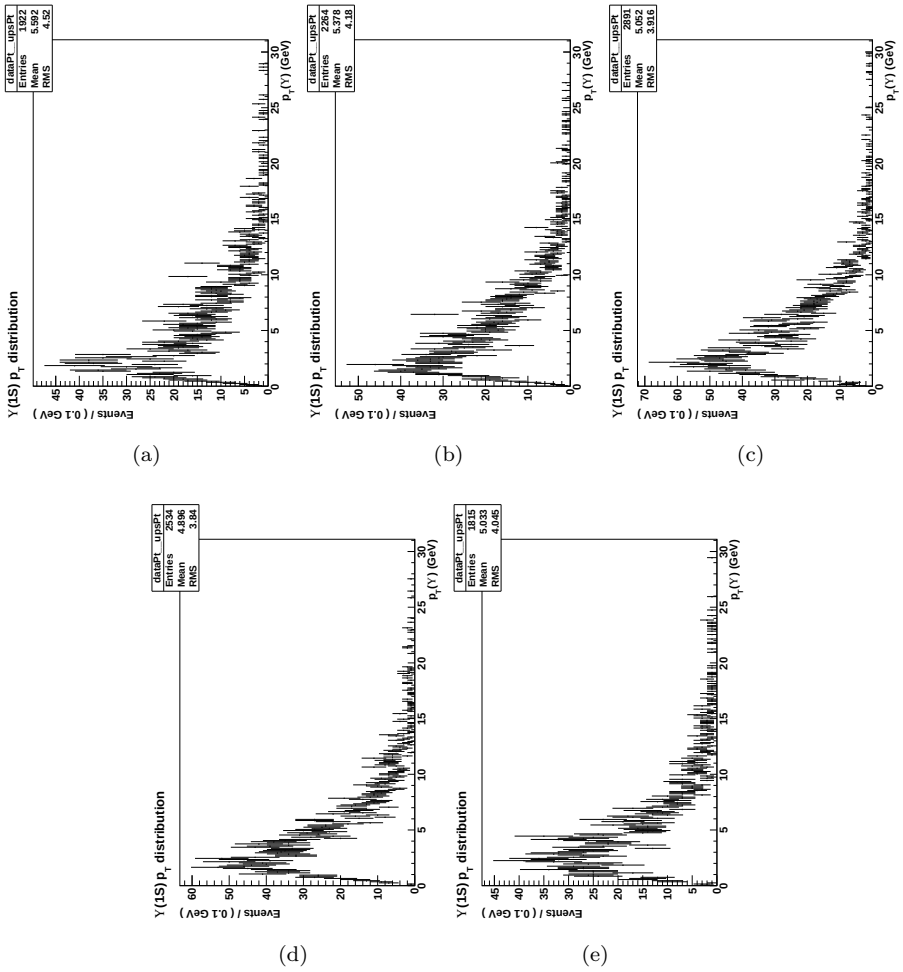


Figure 34: Υ(2S) p_{T} distribution, for $d\sigma/d|y|$binning.

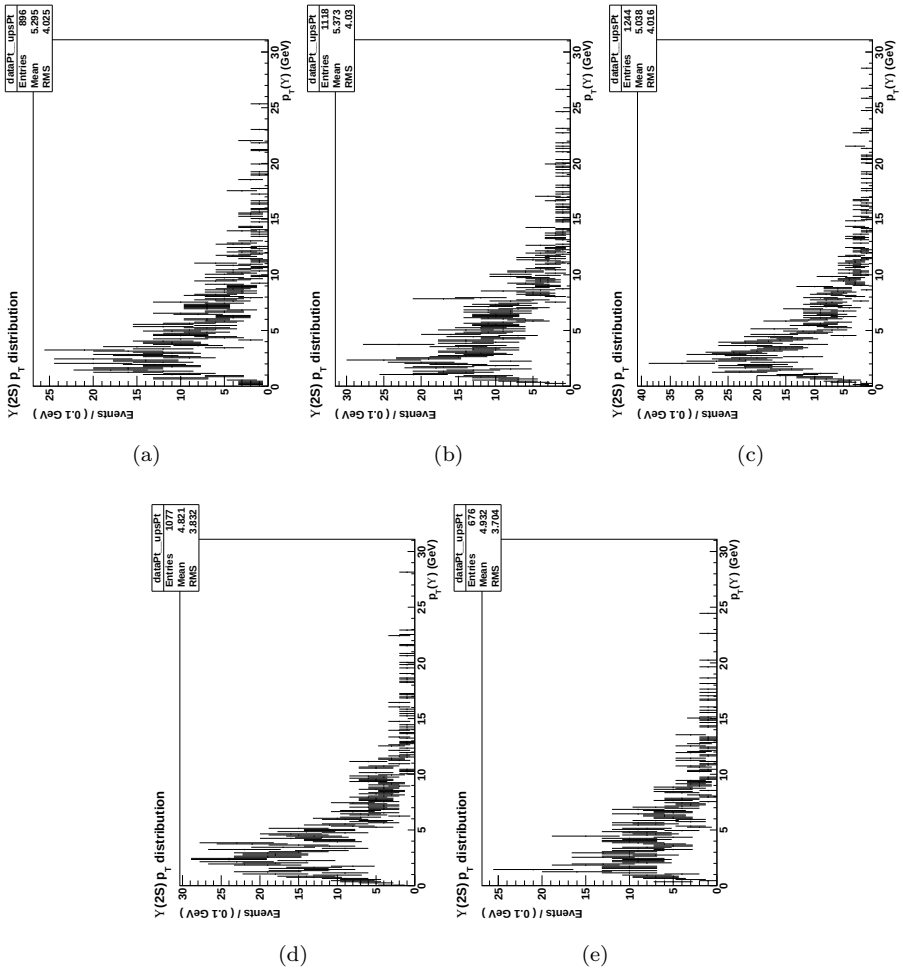
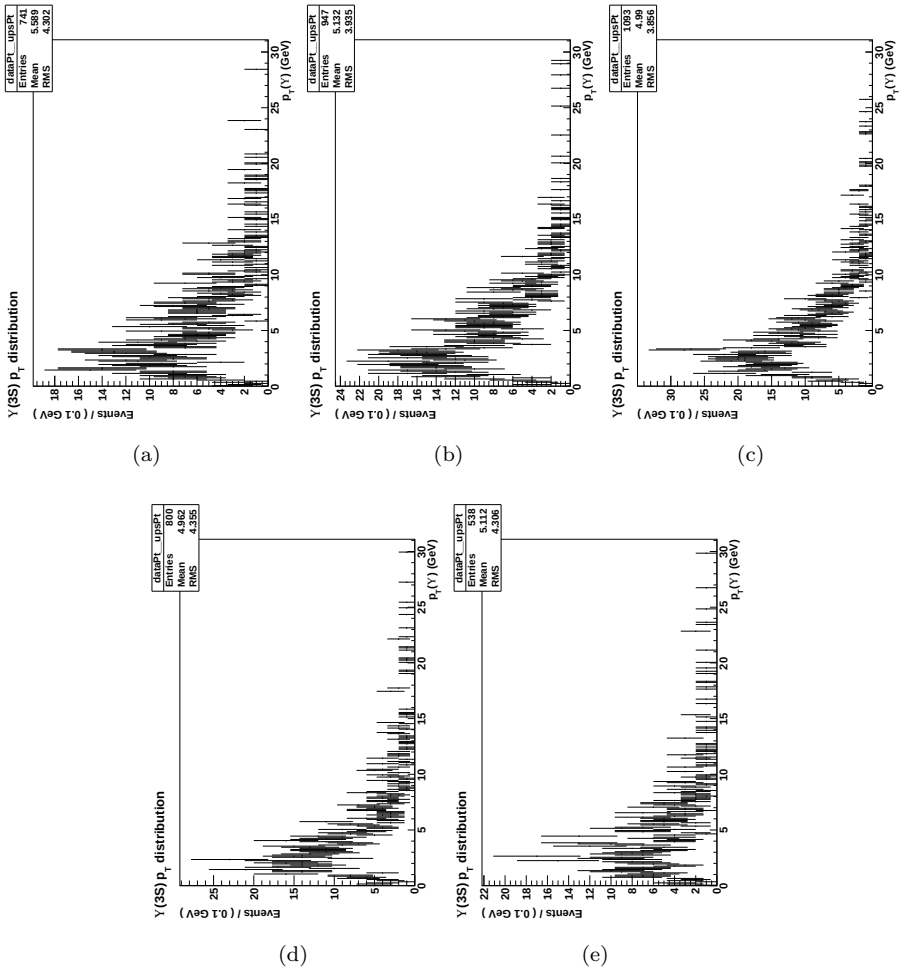
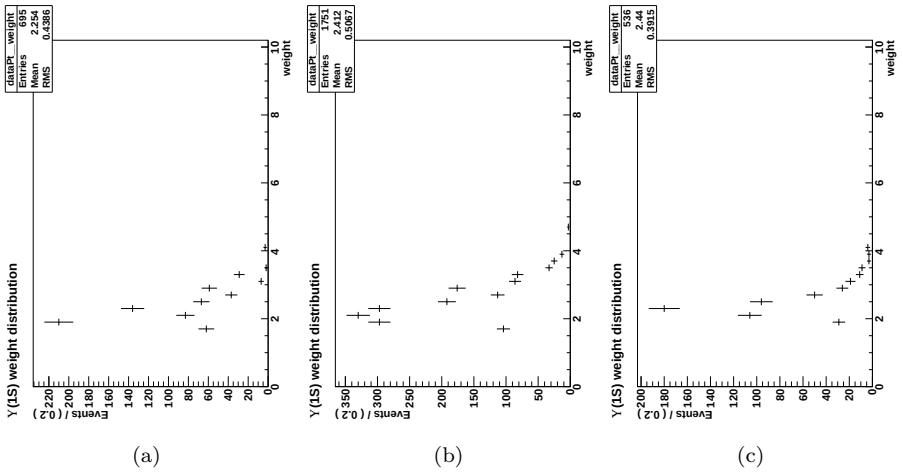


Figure 35: $\Upsilon(3S)$ p_{T} distribution, for $d\sigma/d|y|$binning.



0.7 Weight distributions per bin

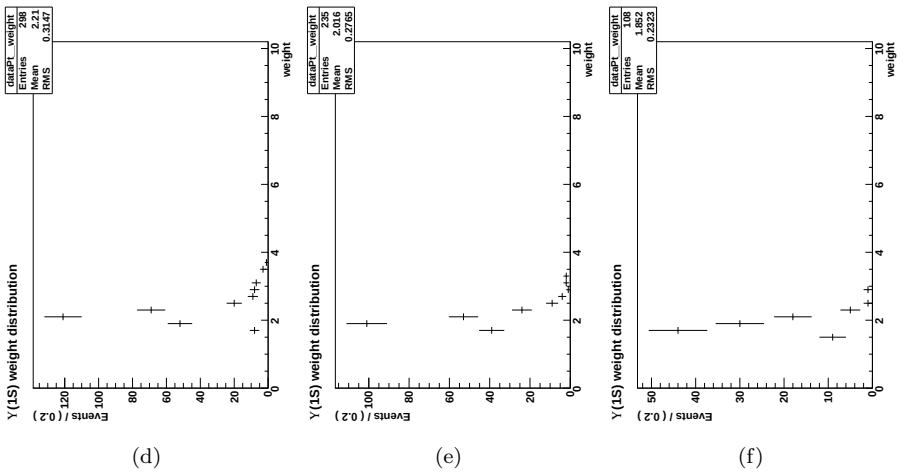
Figure 36: Υ(1S) weight distribution, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$binning.



(a)

(b)

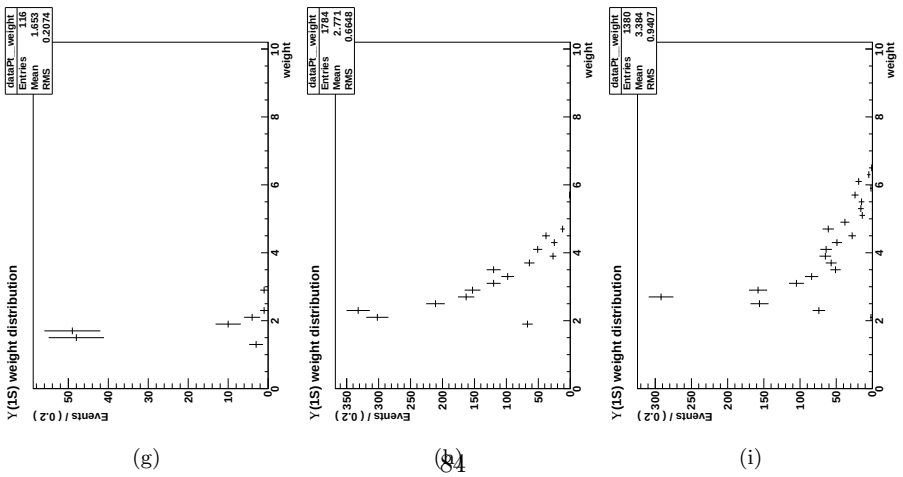
(c)



(d)

(e)

(f)



(g)

(h)

(i)

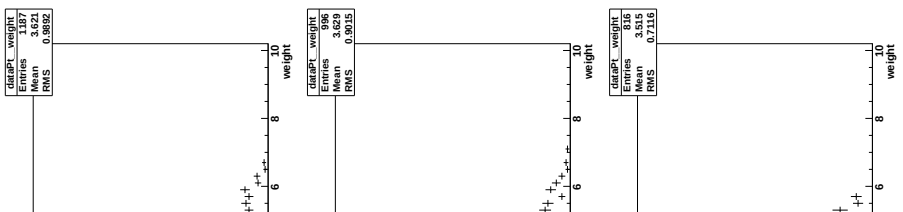


Figure 37: Υ(2S) weight distribution, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$binning.

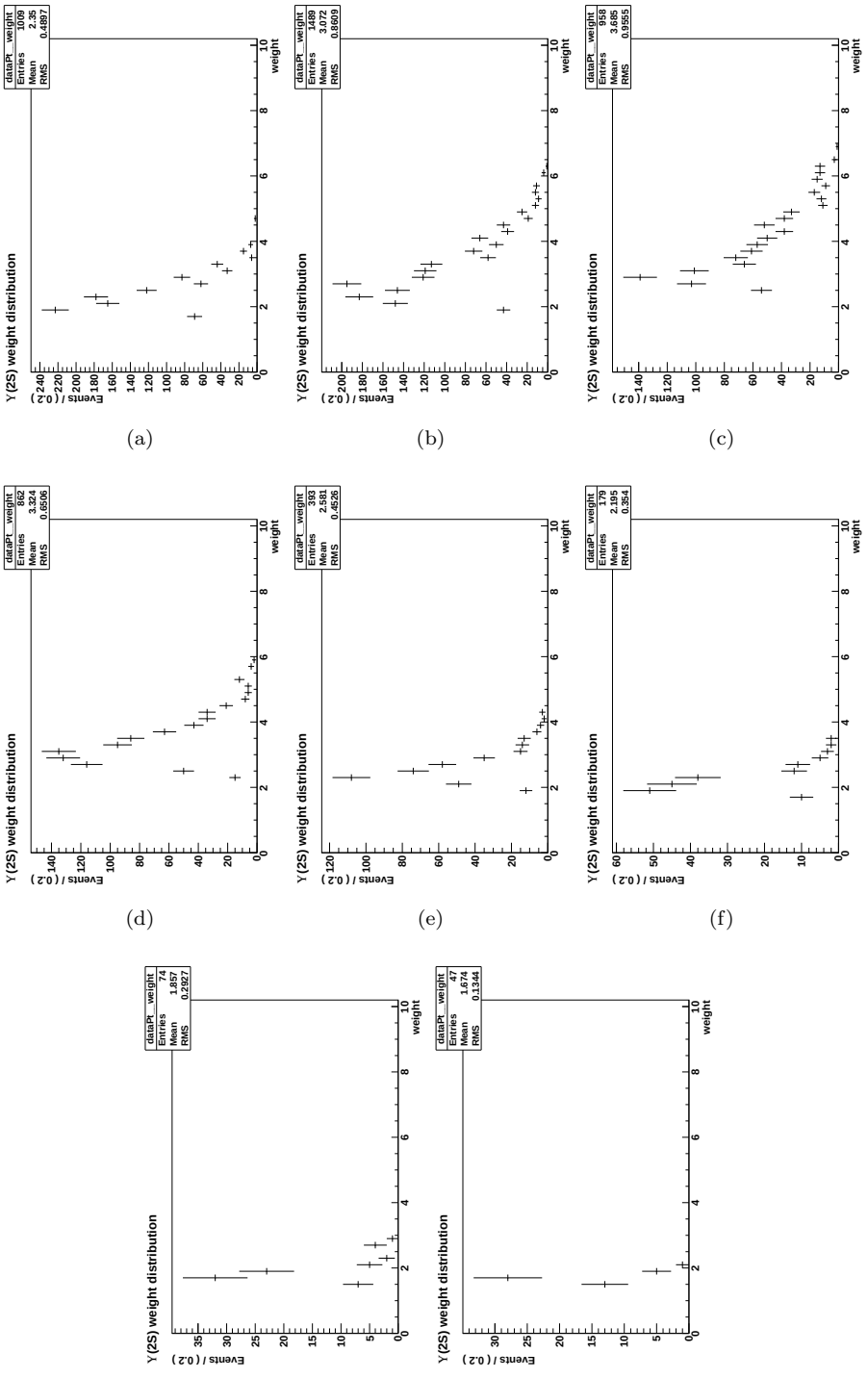


Figure 38: Υ(3S) weight distribution, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$binning.

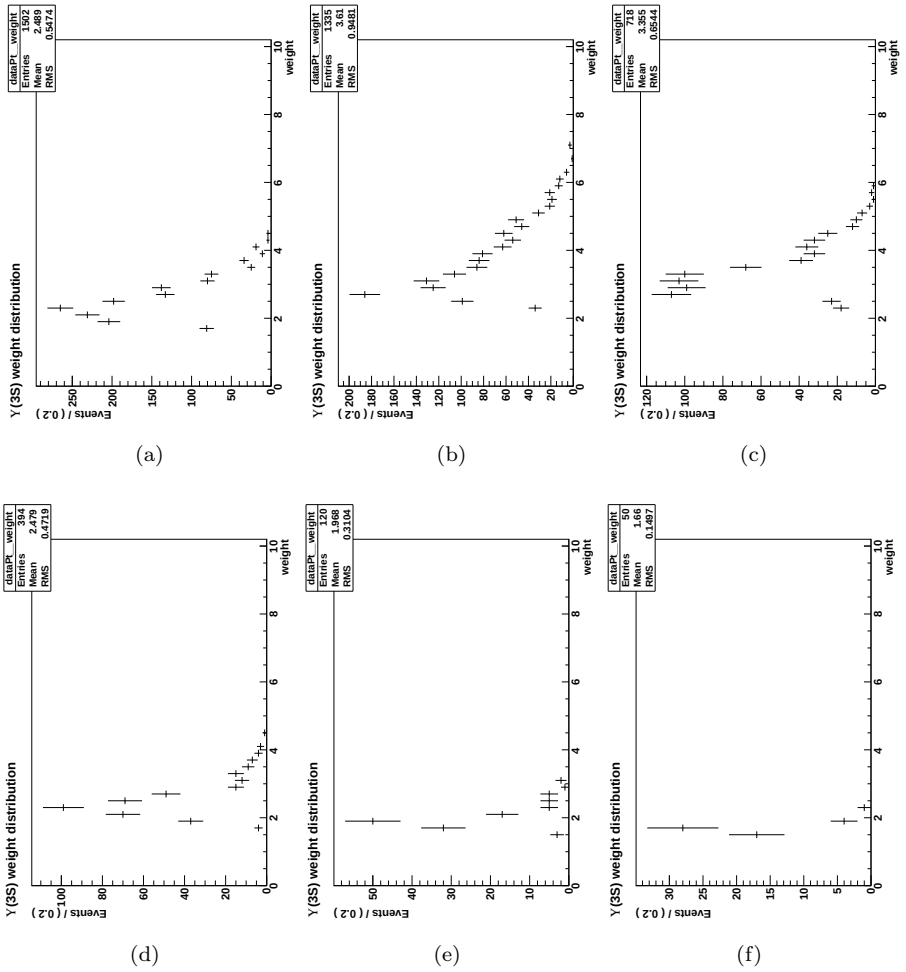


Figure 39: Υ(1S) weight distribution, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$binning.

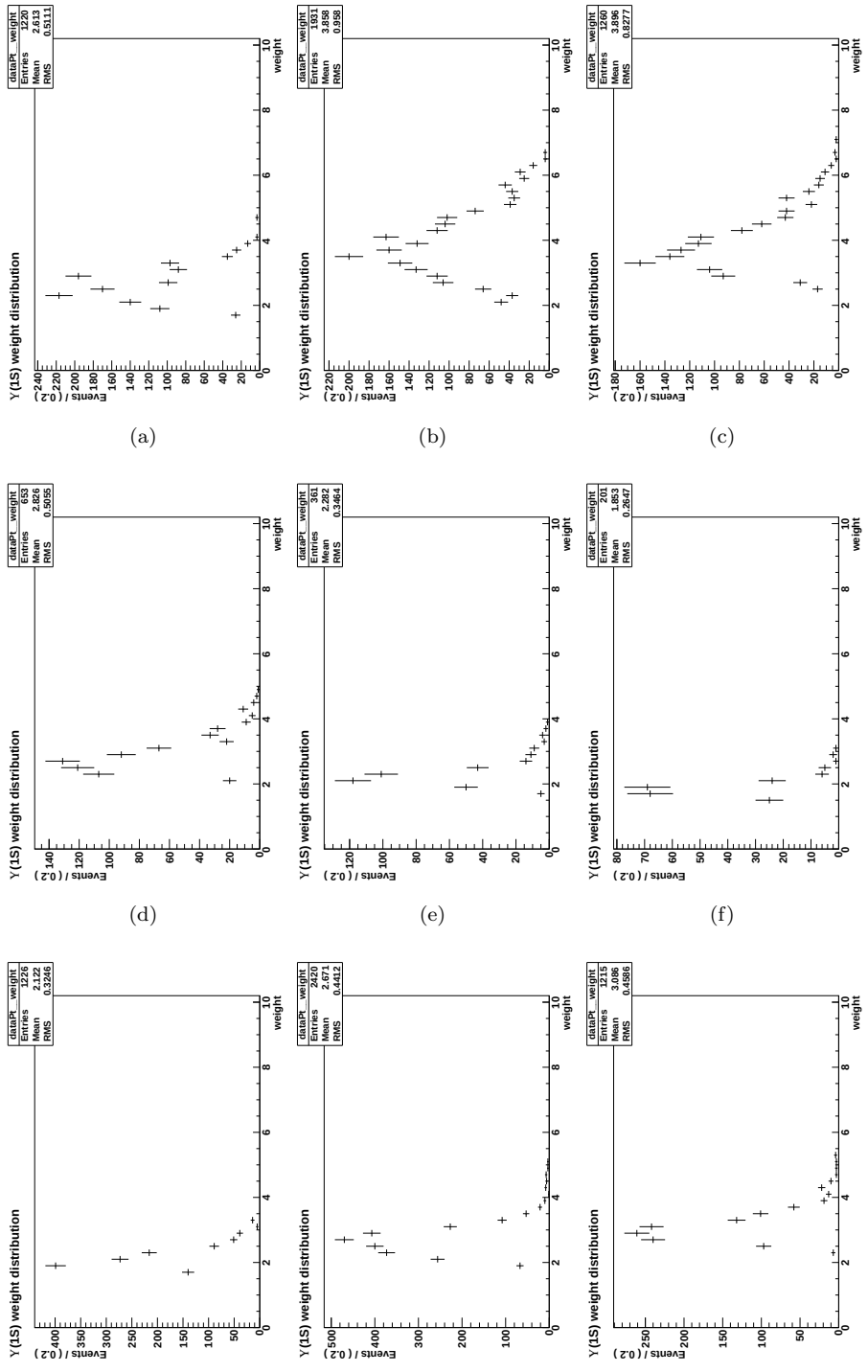


Figure 40: $\Upsilon(2S)$ weight distribution, for $d\sigma/dp_{\mathrm{T}}$ $|y| : (0,1),(1,2)$binning.

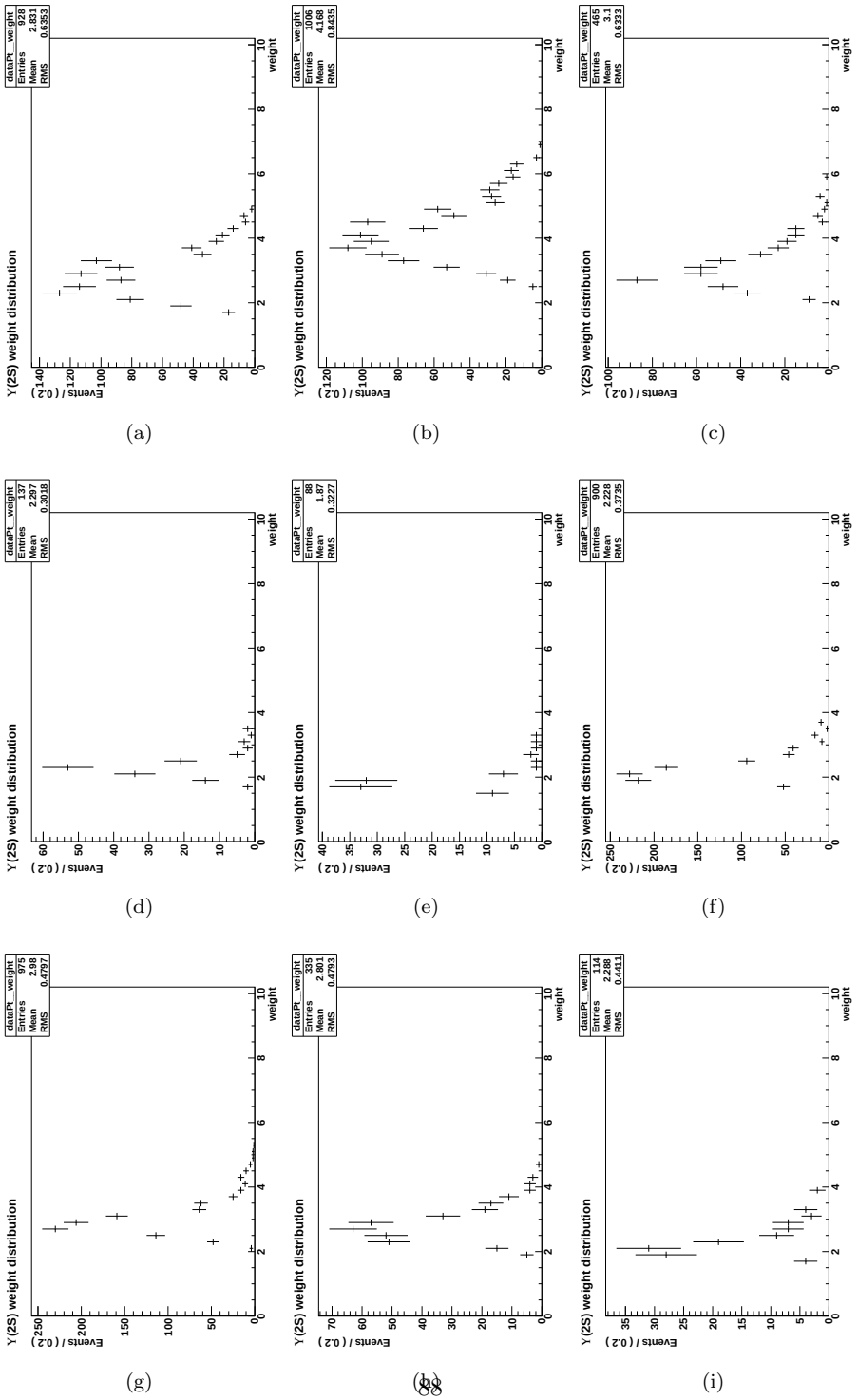


Figure 41: Υ(3S) weight distribution, for $d\sigma/dp_{\mathrm{T}}$ $|y| : (0,1),(1,2)$binning.

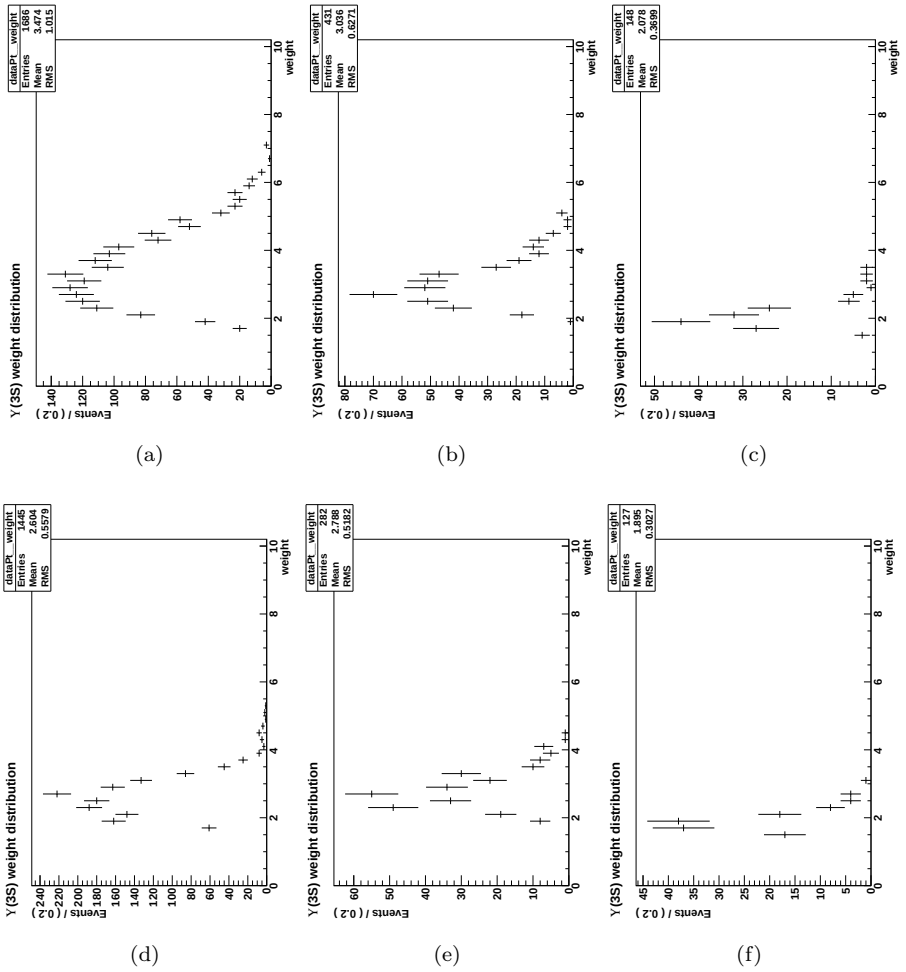


Figure 42: Υ(1S) weight distribution, for $d\sigma/d|y|$binning.

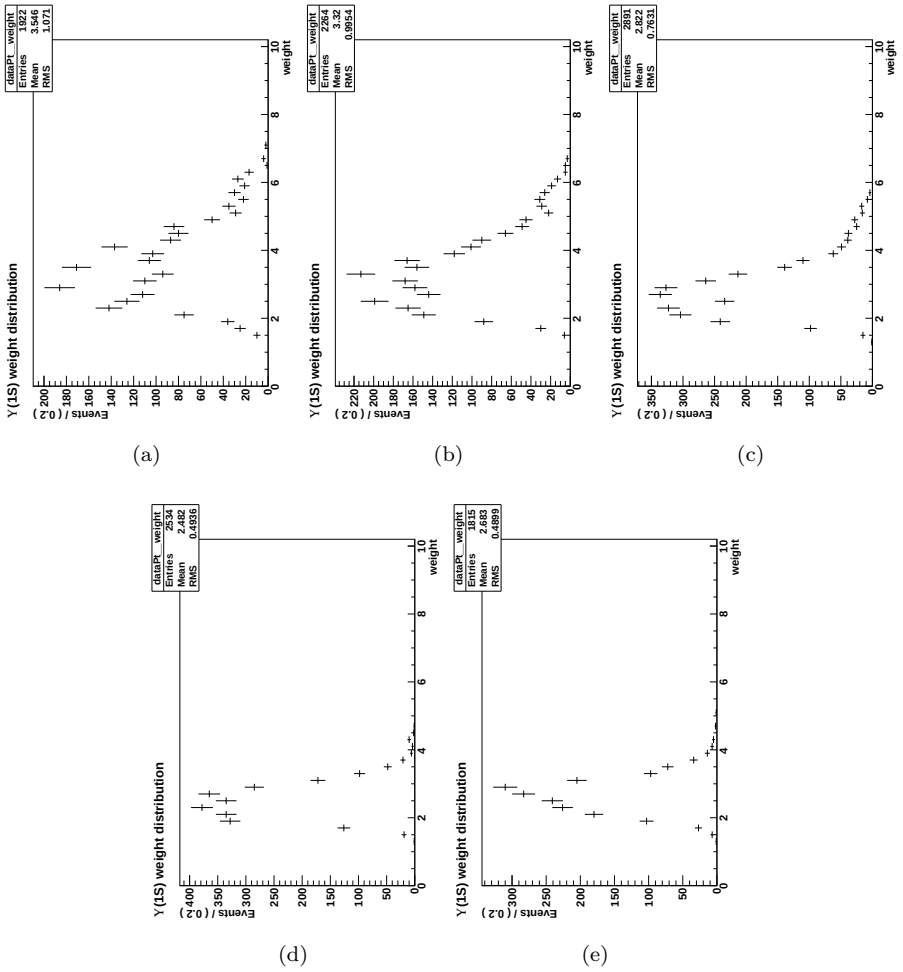
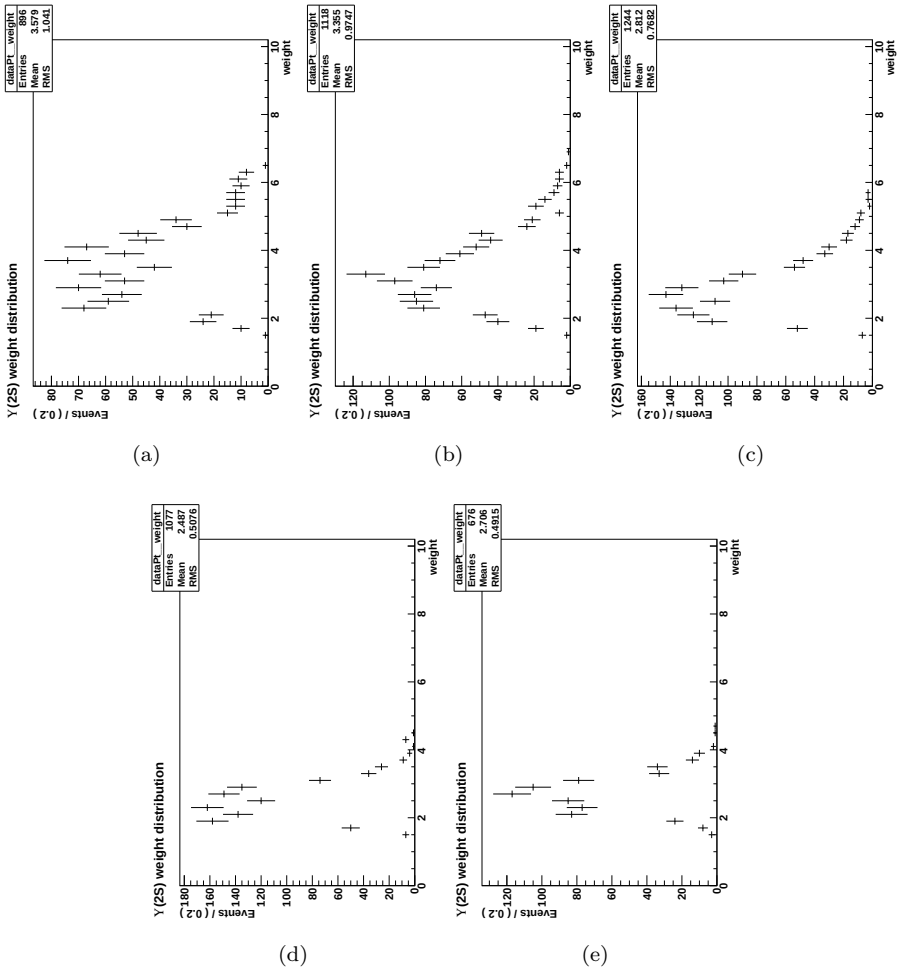


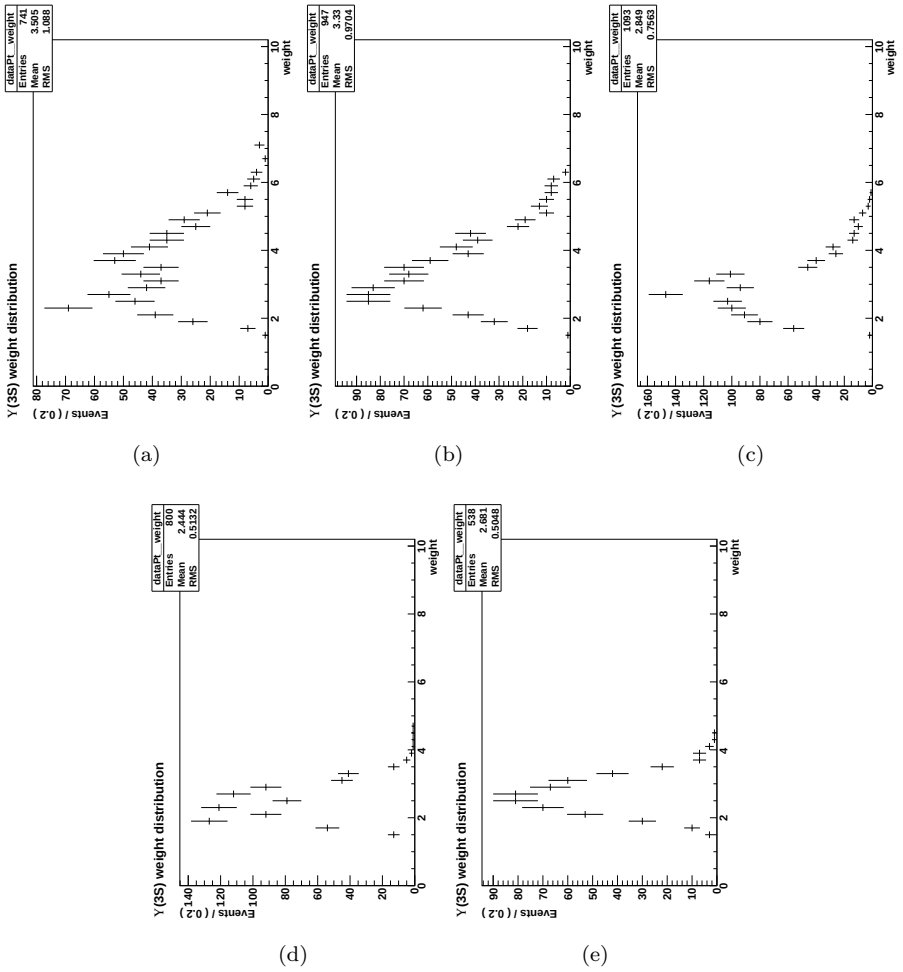
Figure 43: Υ(2S) weight distribution, for $d\sigma/d|y|$binning.



(a) (b) (c)

(d) (e)

Figure 44: Υ(3S) weight distribution, for $d\sigma/d|y|$binning.

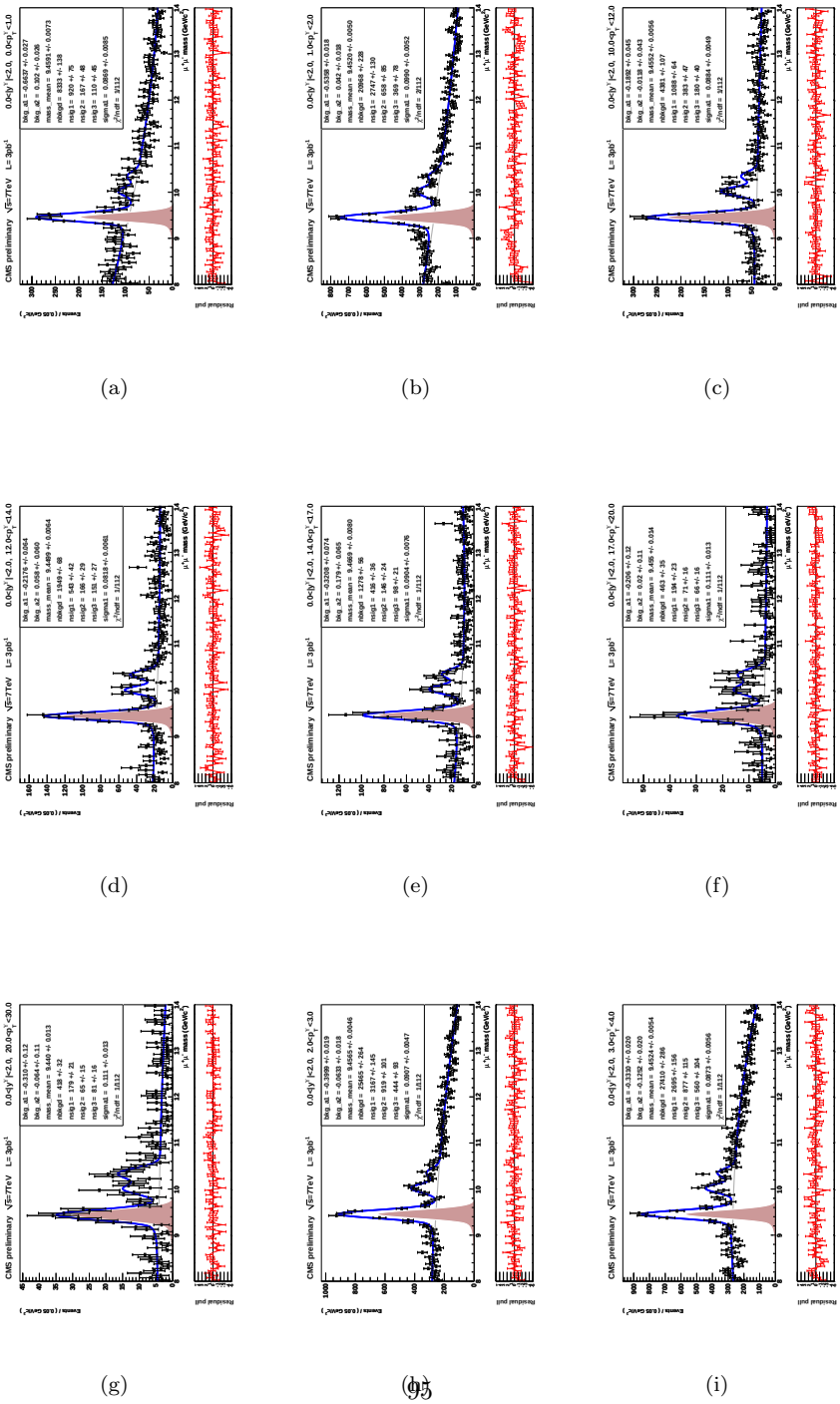


0.8 Systematic Differential Mass Fits

0.8.1 systematics source: nominal

Systematics contribution from nominal reference

Figure 45: Υ(1S) systematic mass fits:nominal, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



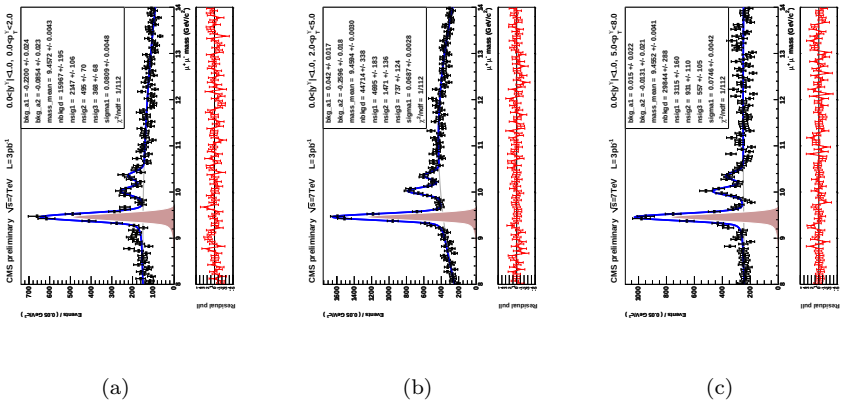
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 46: Υ(1S) systematic mass fits:nominal, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

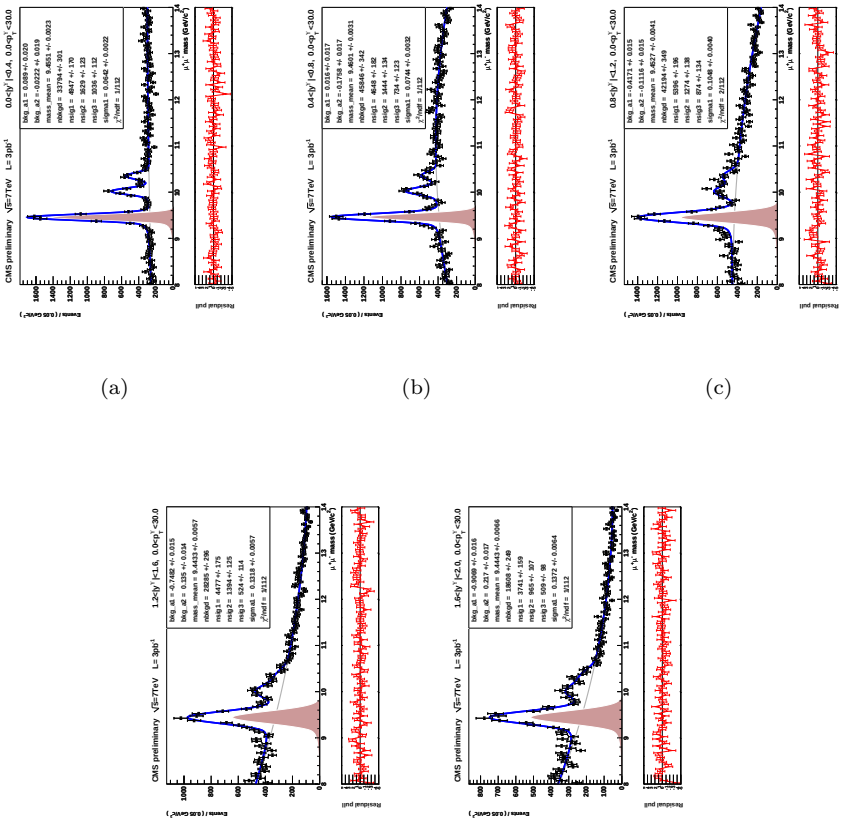


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

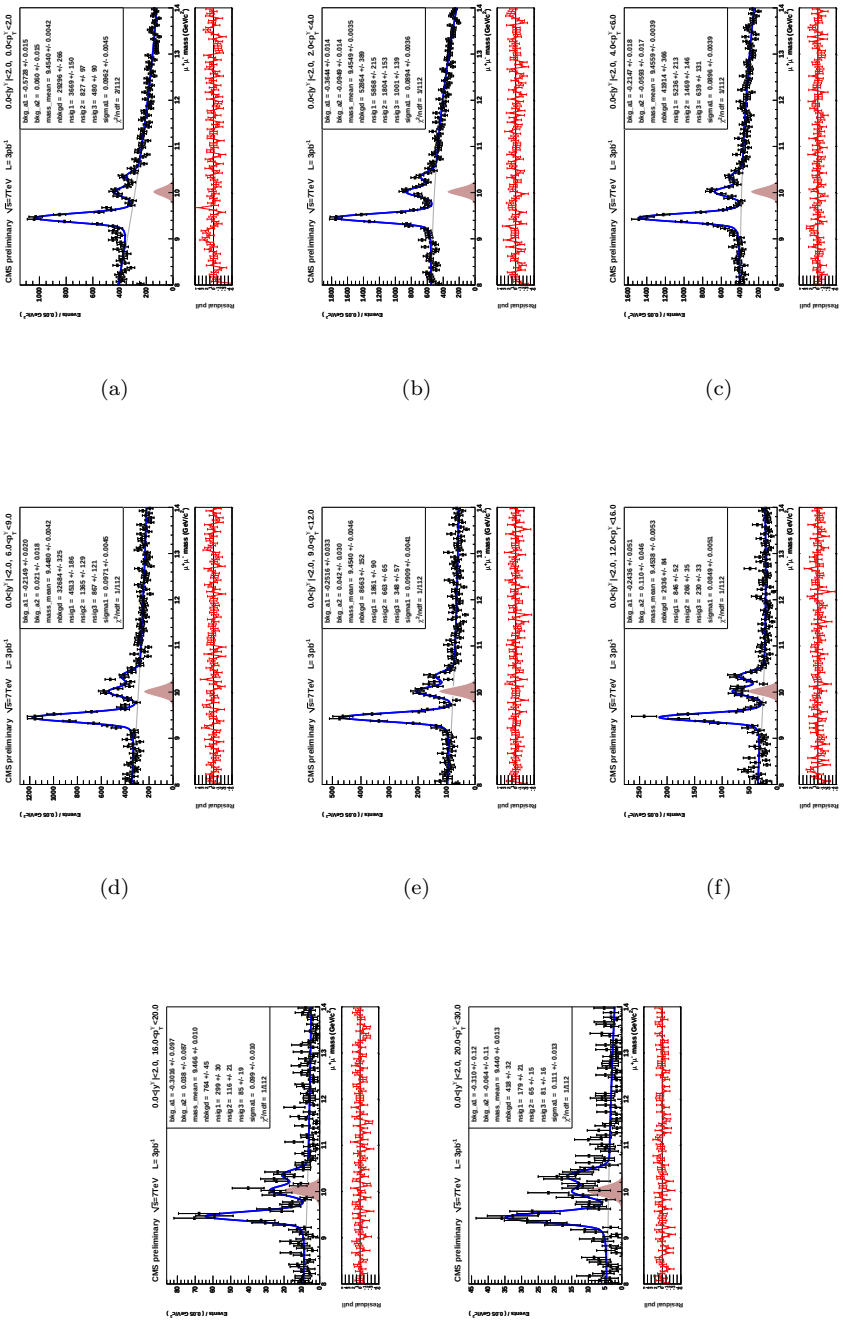
Figure 47: Υ(1S) systematic mass fits:nominal, for $d\sigma/d|y|$ binning.



(a) (b) (c)

(d) (e)

Figure 48: $\Upsilon(2S)$ systematic mass fits:nominal, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

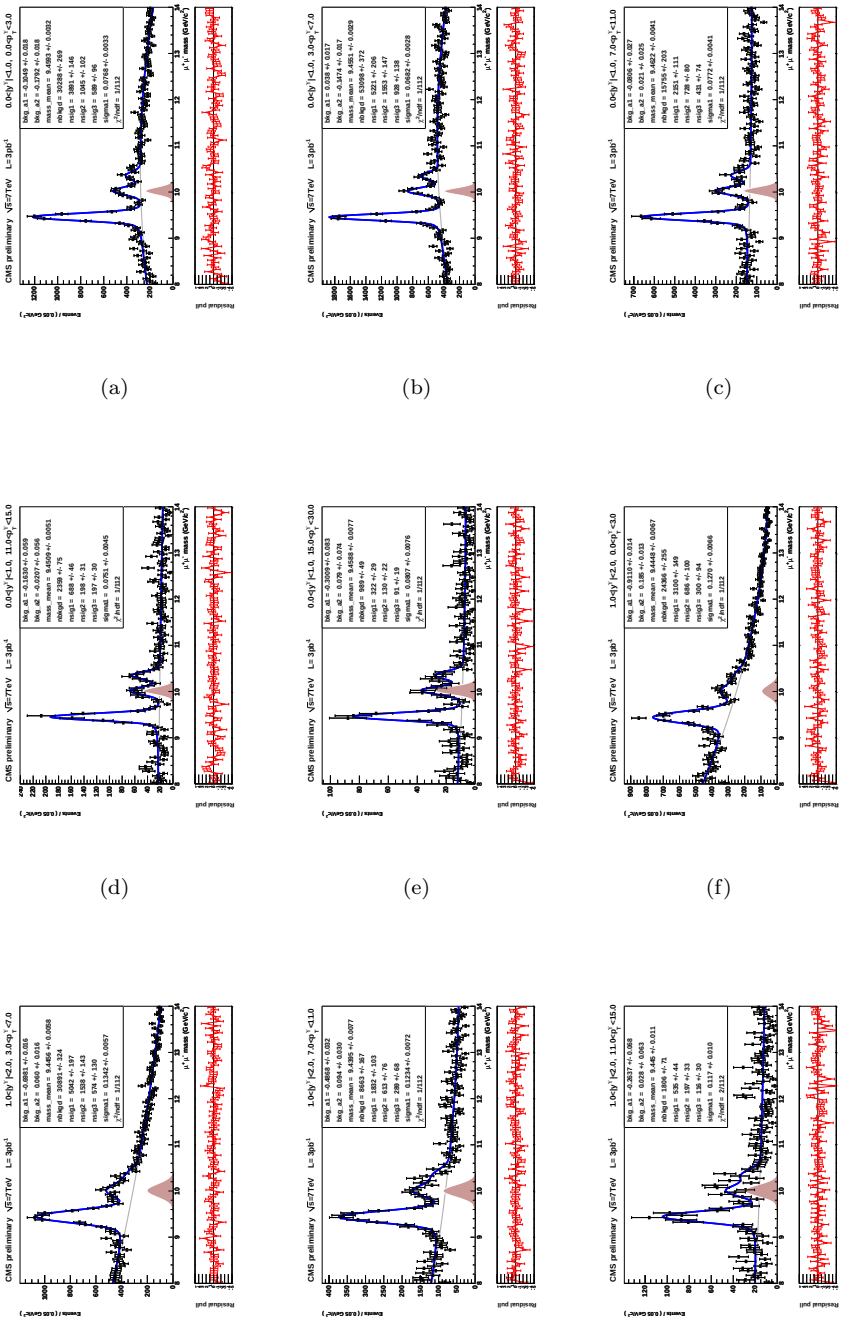


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 49: Υ(2S) systematic mass fits:nominal, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

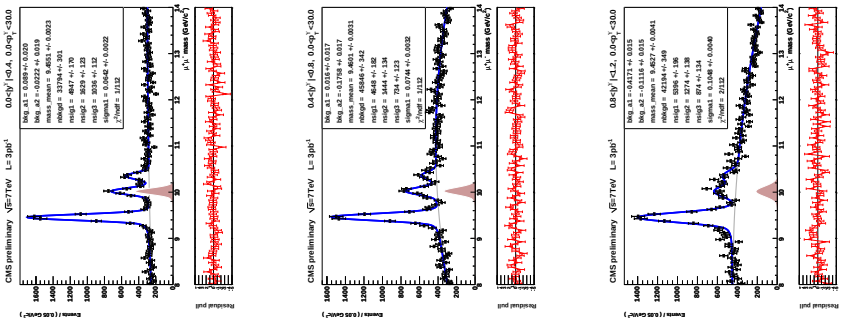


(a) (b) (c)

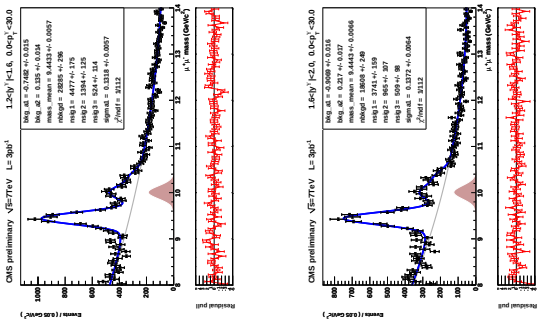
(d) (e) (f)

(g) (h) (i)

Figure 50: $\Upsilon(2S)$ systematic mass fits:nominal, for $d\sigma/d|y|$ binning.

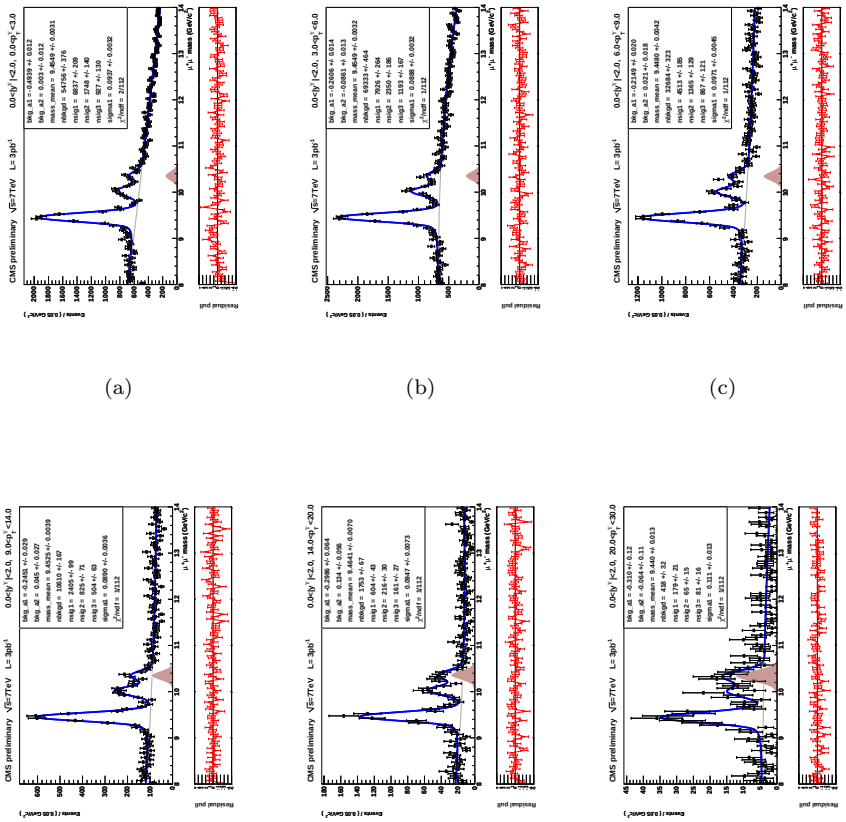


(a) (b) (c)



(d) (e)

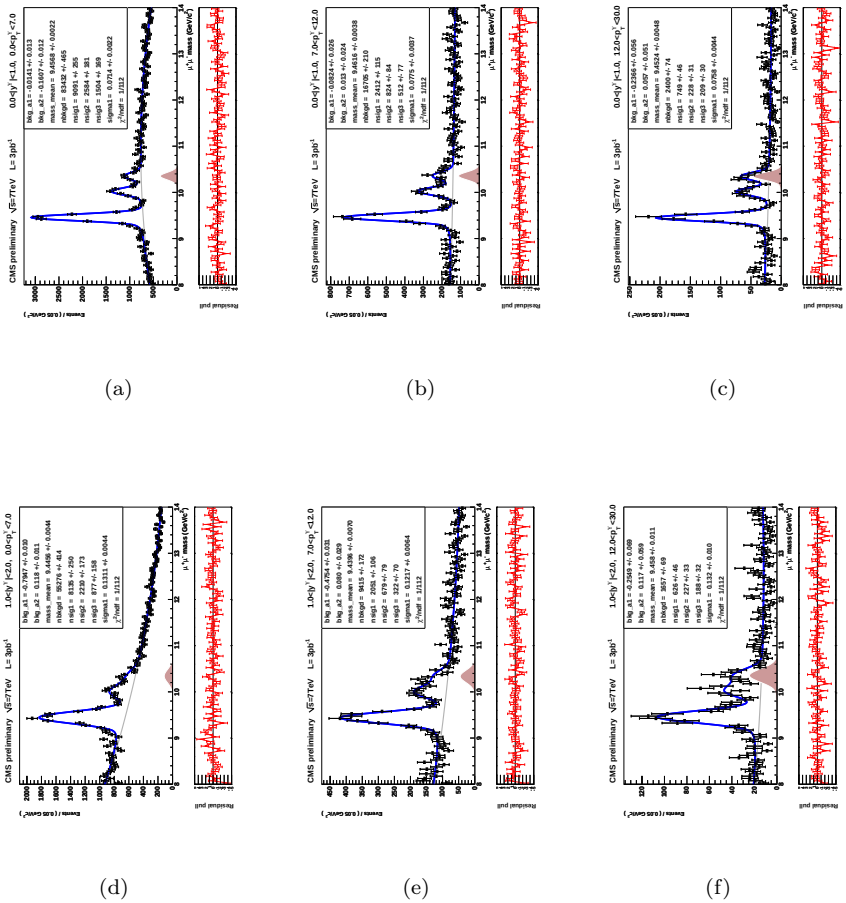
Figure 51: Υ(3S) systematic mass fits:nominal, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

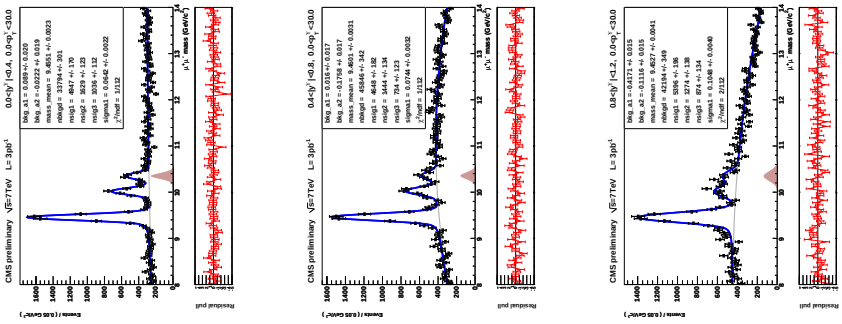
Figure 52: Υ(3S) systematic mass fits:nominal, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



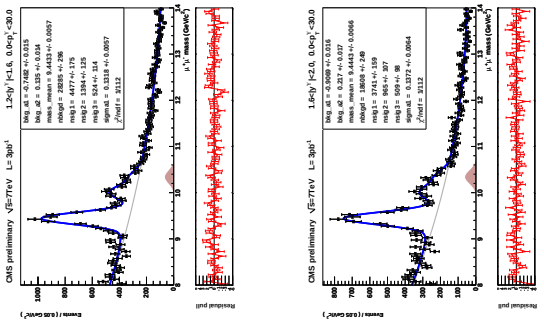
(a) (b) (c)

(d) (e) (f)

Figure 53: Υ(3S) systematic mass fits:nominal, for $d\sigma/d|y|$ binning.



(a) (b) (c)

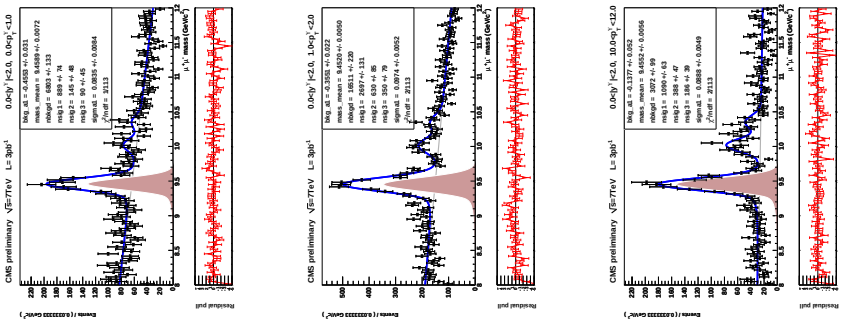


(d) (e)

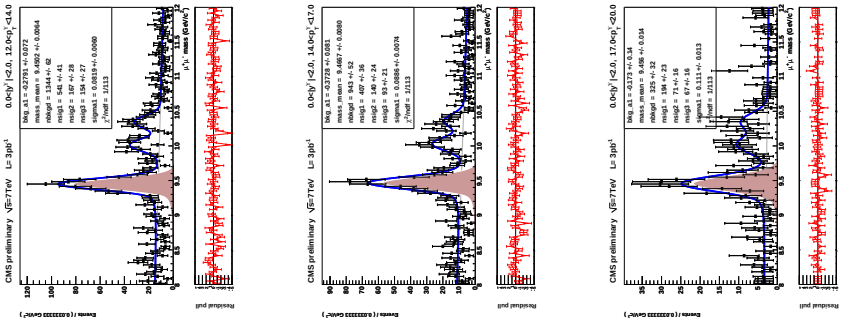
0.8.2 systematics source: linear812

Systematics contribution from linear background mass shape in 8-12 $\mathrm{GeV/c^2}$

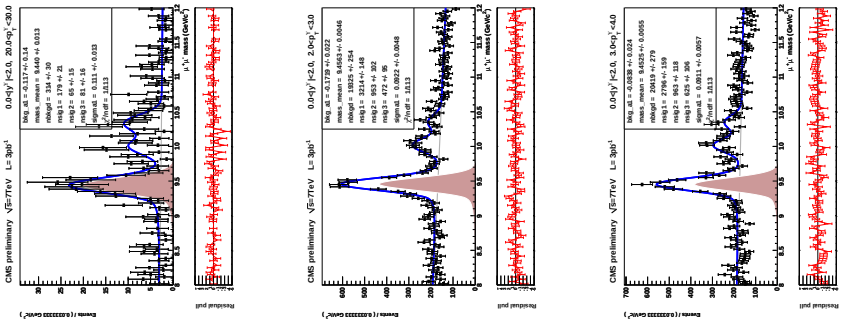
Figure 54: Υ(1S) systematic mass fits:linear812, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

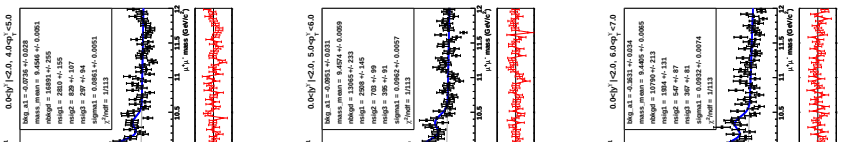
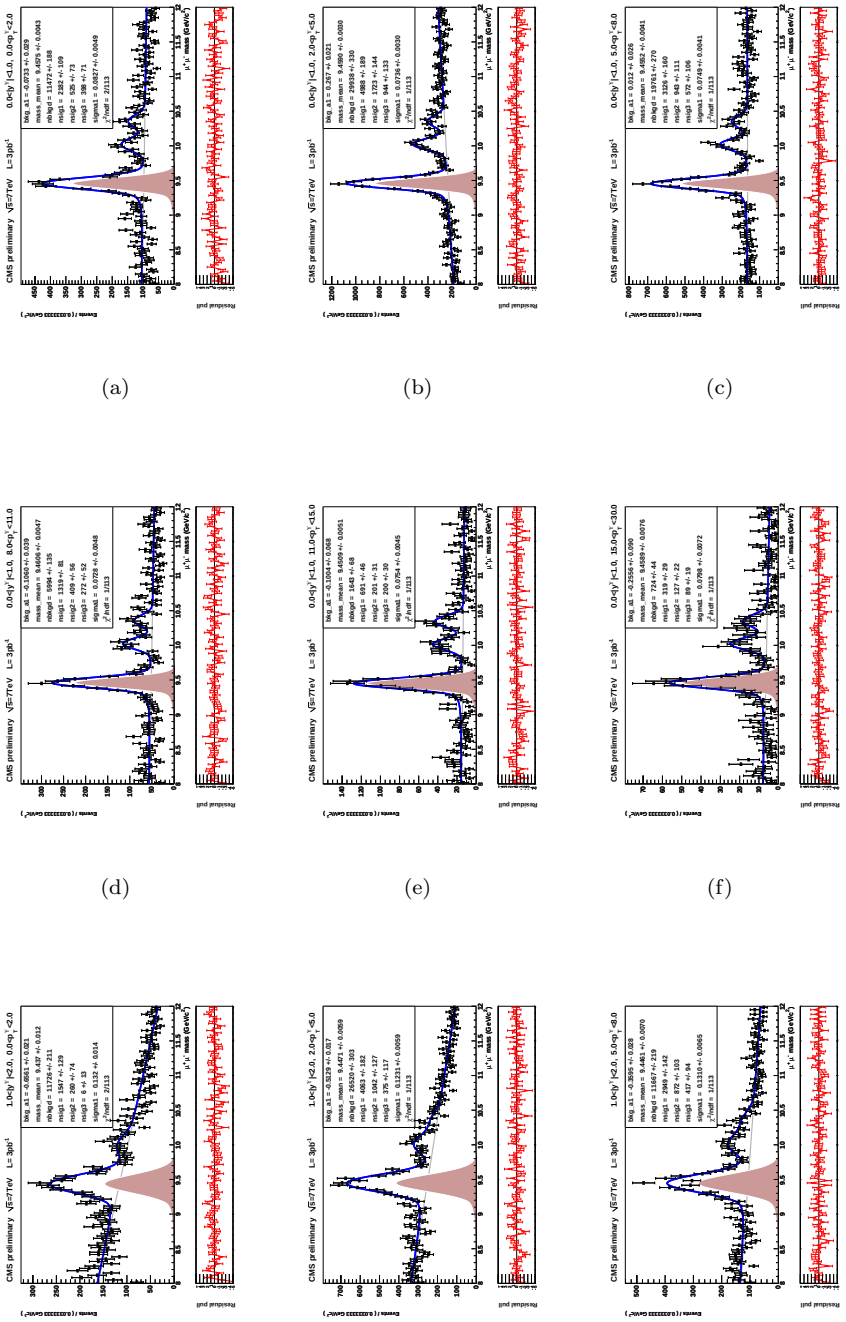


Figure 55: Υ(1S) systematic mass fits:linear812, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

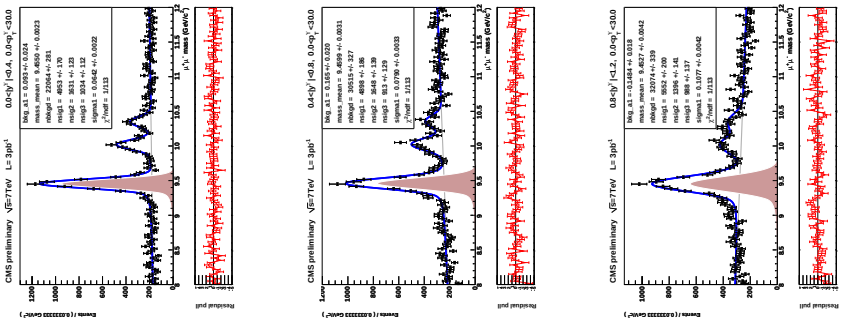


(a) (b) (c)

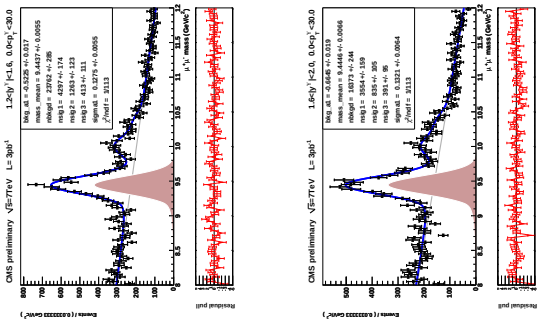
(d) (e) (f)

(g) (h) (i)

Figure 56: $\Upsilon(1S)$ systematic mass fits:linear812, for $d\sigma/d|y|$ binning.

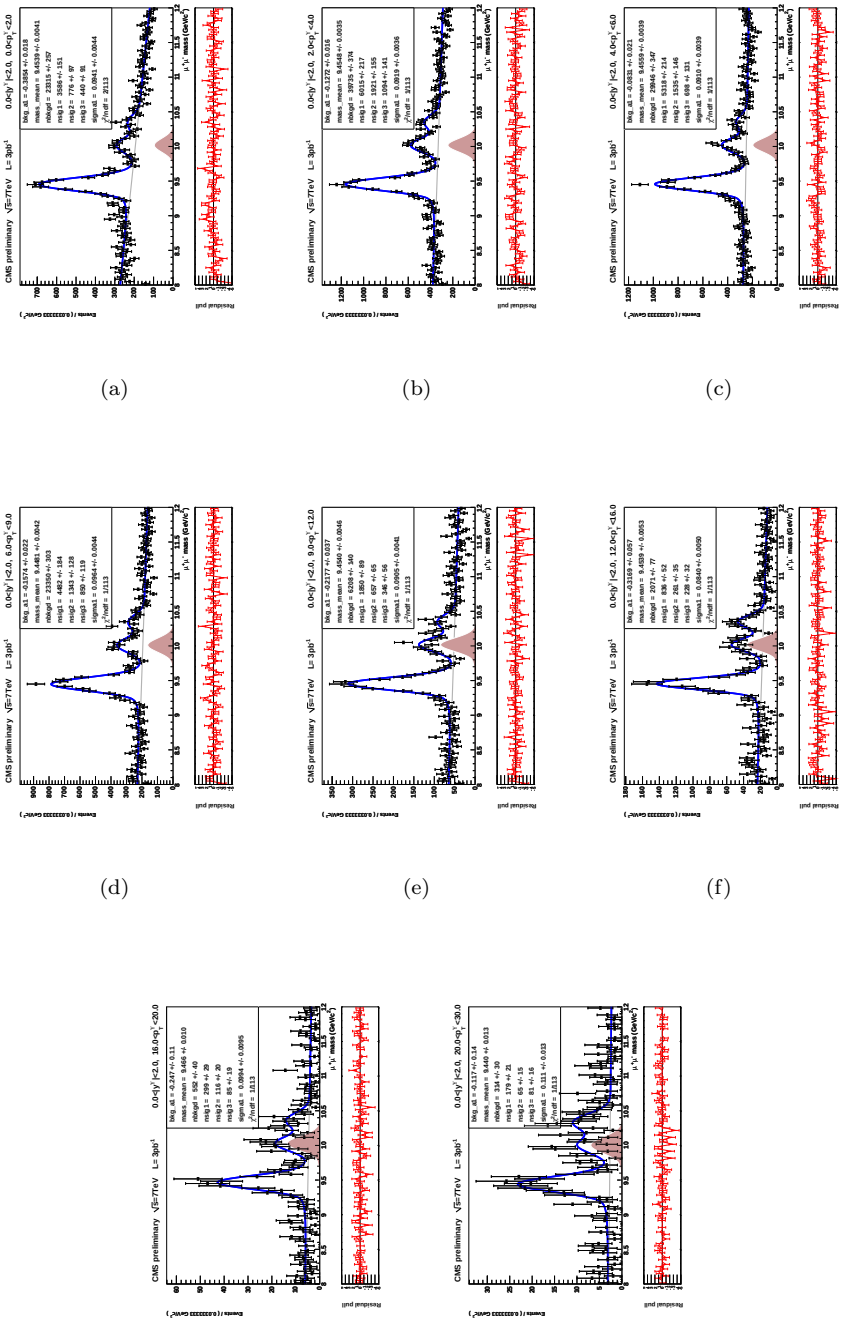


(a) (b) (c)



(d) (e)

Figure 57: $\Upsilon(2S)$ systematic mass fits:linear812, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

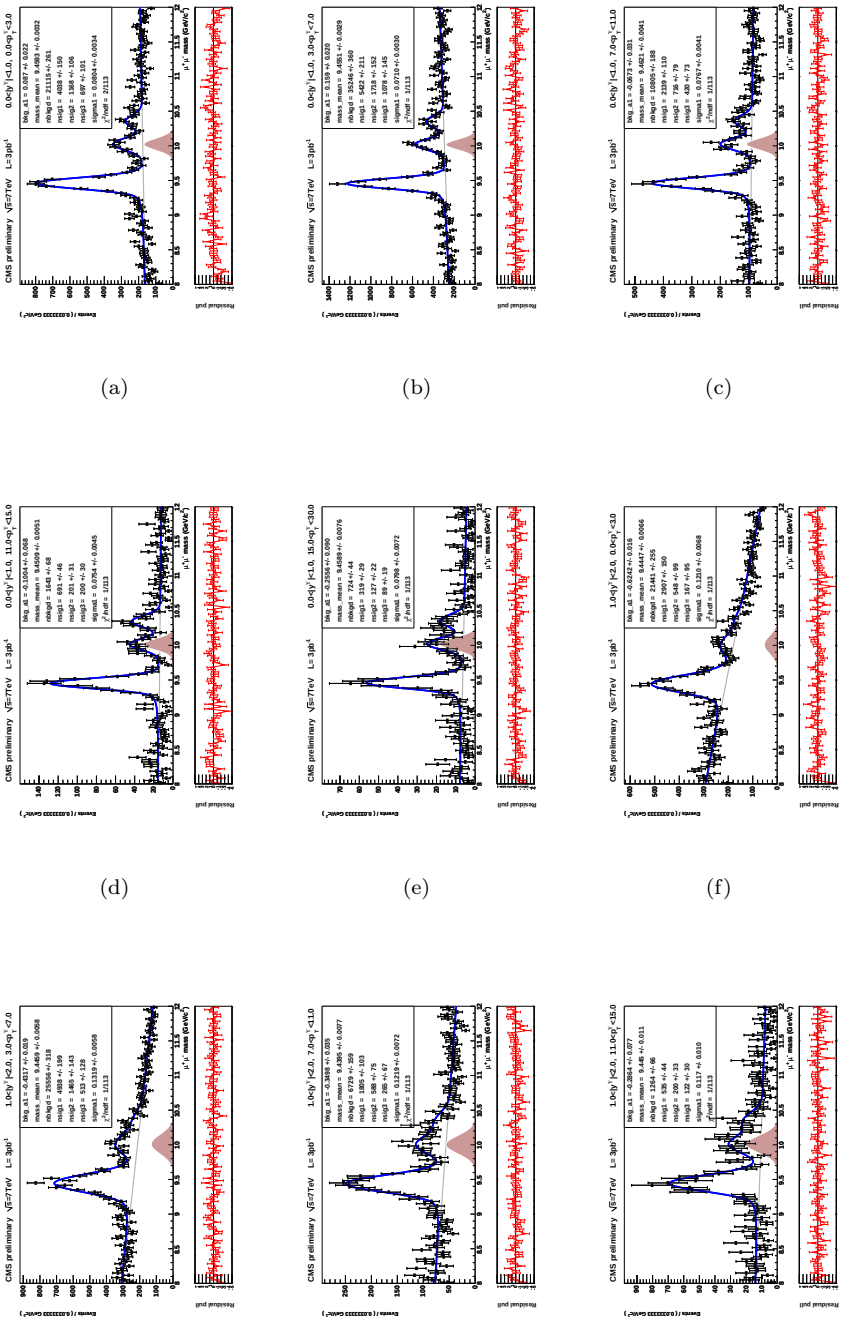


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 58: Υ(2S) systematic mass fits:linear812, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

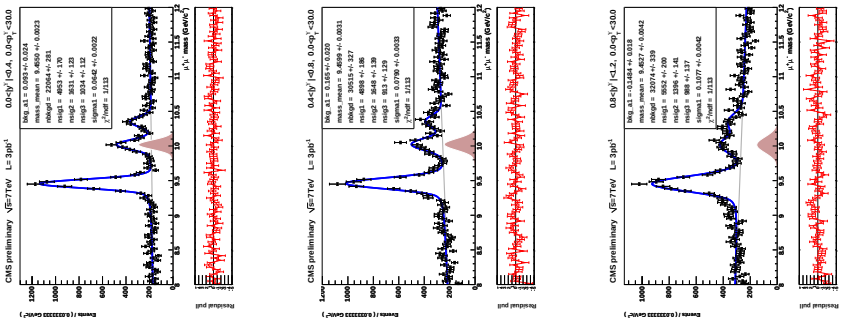


(a) (b) (c)

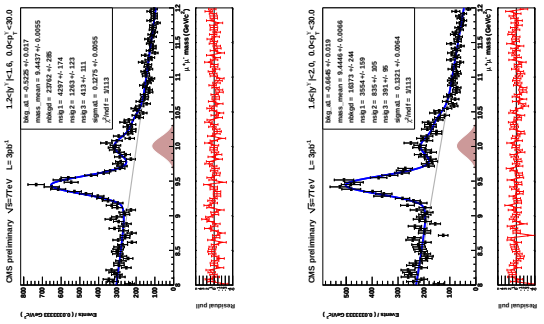
(d) (e) (f)

(g) (h) (i)

Figure 59: $\Upsilon(2S)$ systematic mass fits:linear812, for $d\sigma/d|y|$ binning.

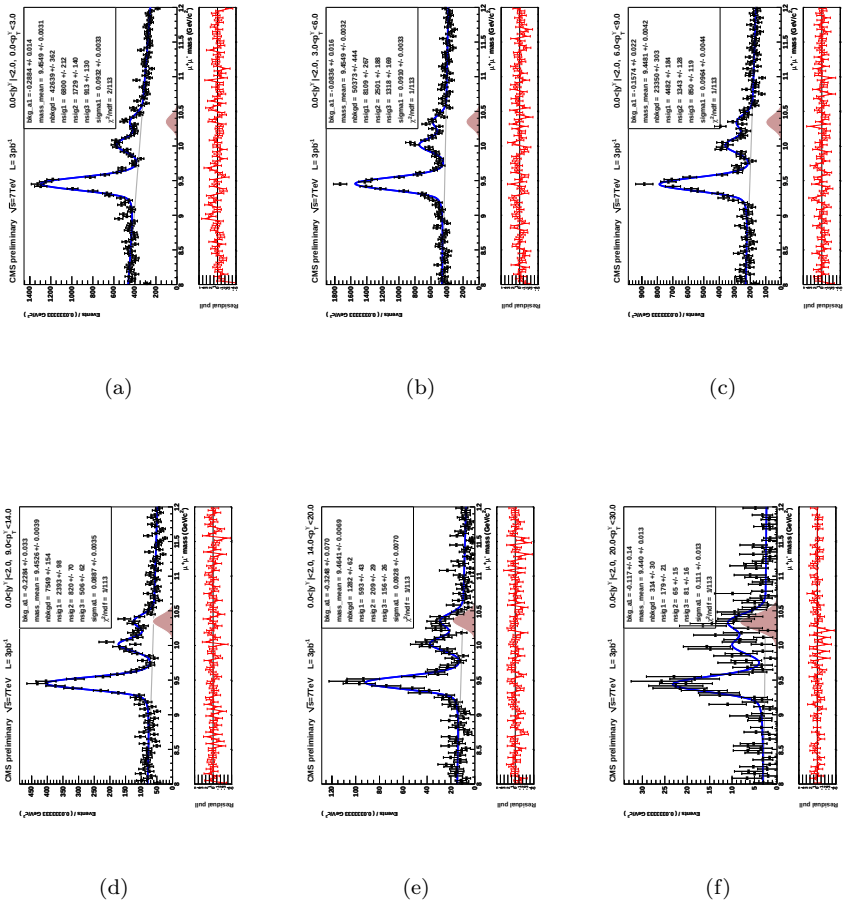


(a) (b) (c)



(d) (e)

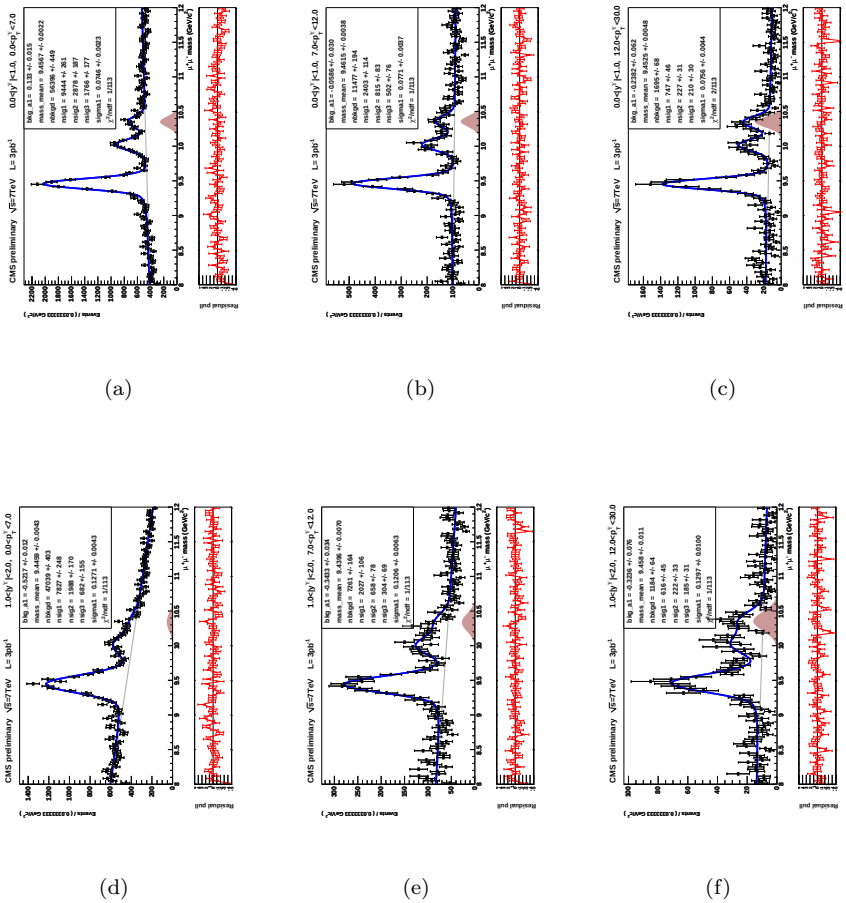
Figure 60: Υ(3S) systematic mass fits:linear812, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

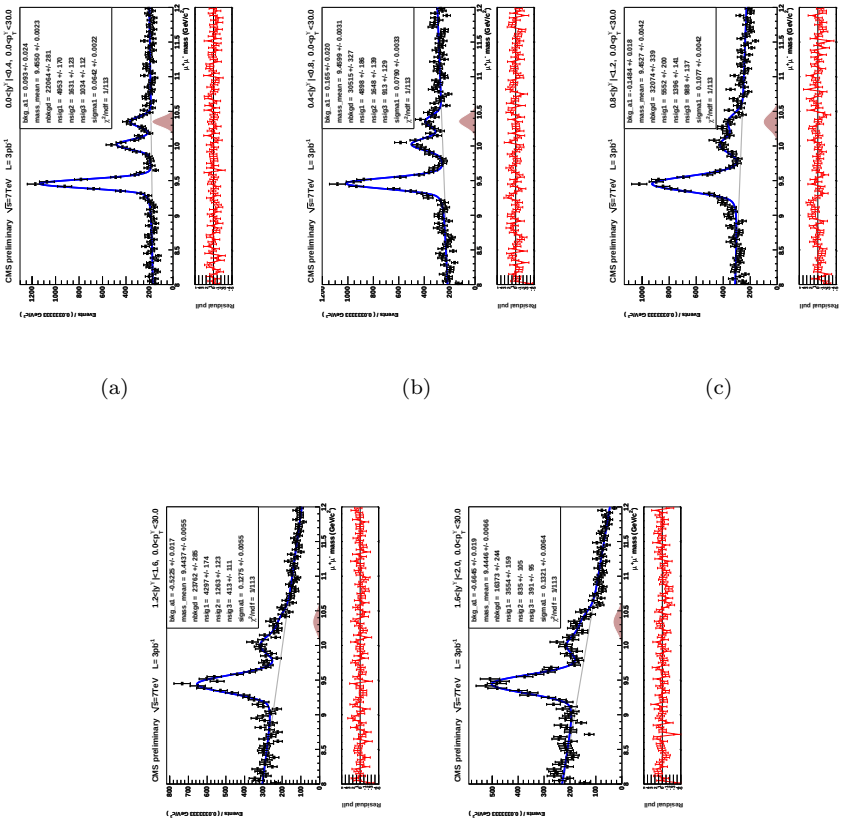
Figure 61: Υ(3S) systematic mass fits:linear812, for $d\sigma/dp_{\rm T}$ $|y|$: $(0,1),(1,2)$ binning.



(a) (b) (c)

(d) (e) (f)

Figure 62: $\Upsilon(3S)$ systematic mass fits:linear812, for $d\sigma/d|y|$ binning.



(a) (b) (c)

(d) (e)

0.8.3 systematics source: tnpmc

Systematics contribution from tnp from J/Ψ MC, for muon id and trigger efficiency

Figure 63: Υ(1S) systematic mass fits:tnpmc, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

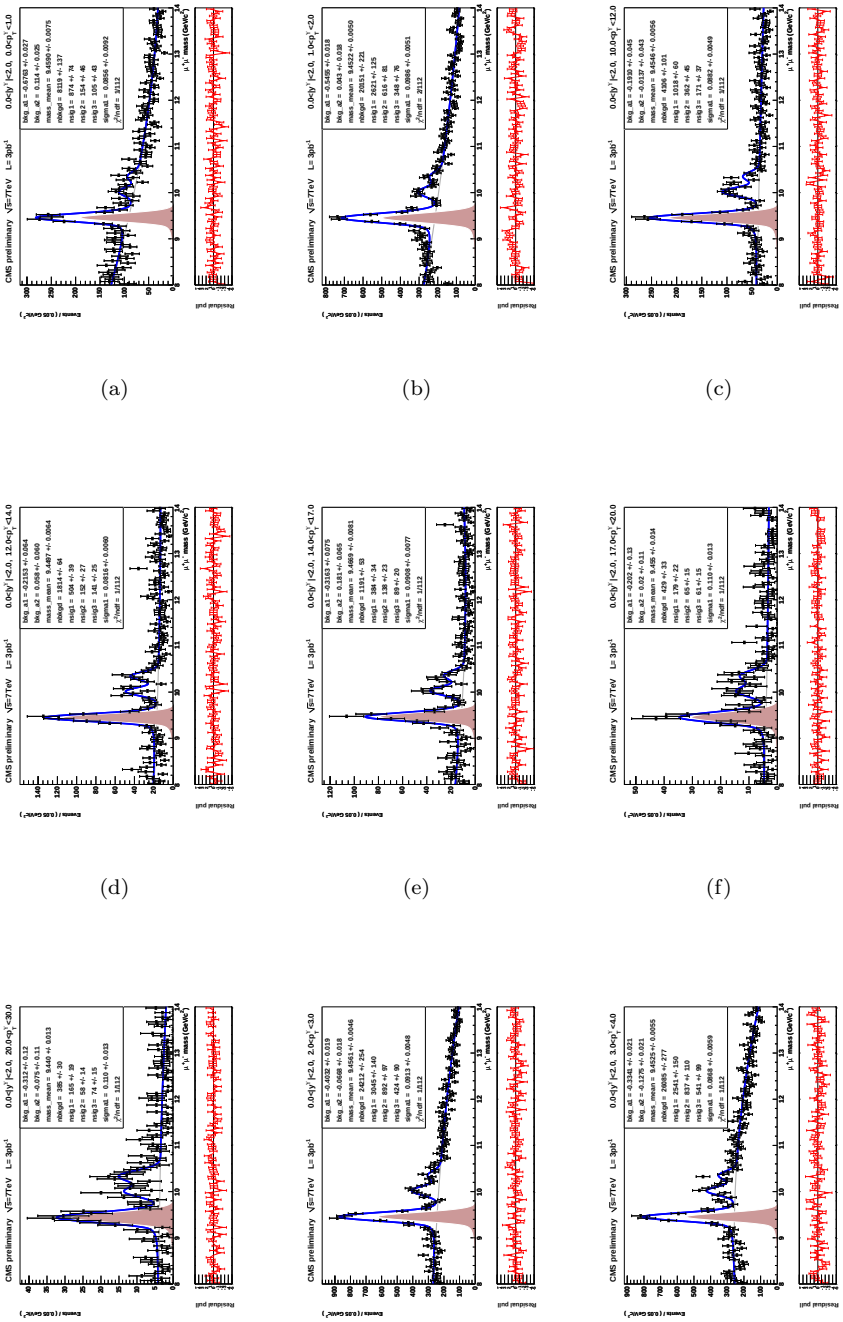
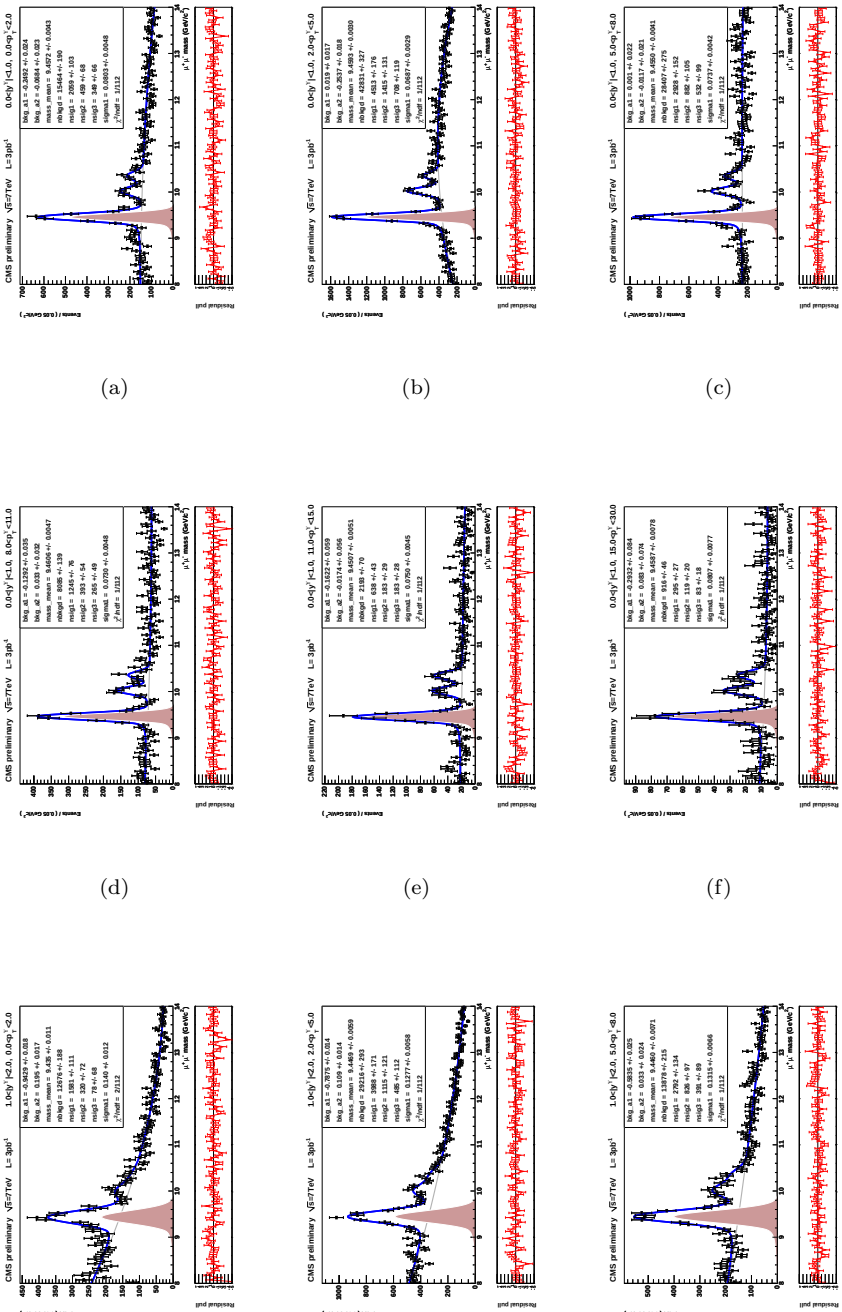


Figure 64: Υ(1S) systematic mass fits:tnpmc, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

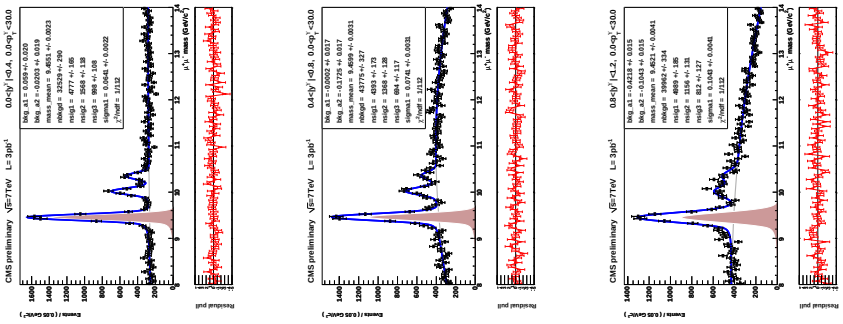


(a) (b) (c)

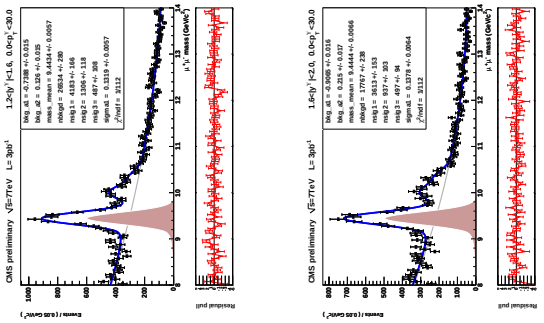
(d) (e) (f)

(g) (h) (i)

Figure 65: $\Upsilon(1S)$ systematic mass fits:tnpmc, for $d\sigma/d|y|$ binning.

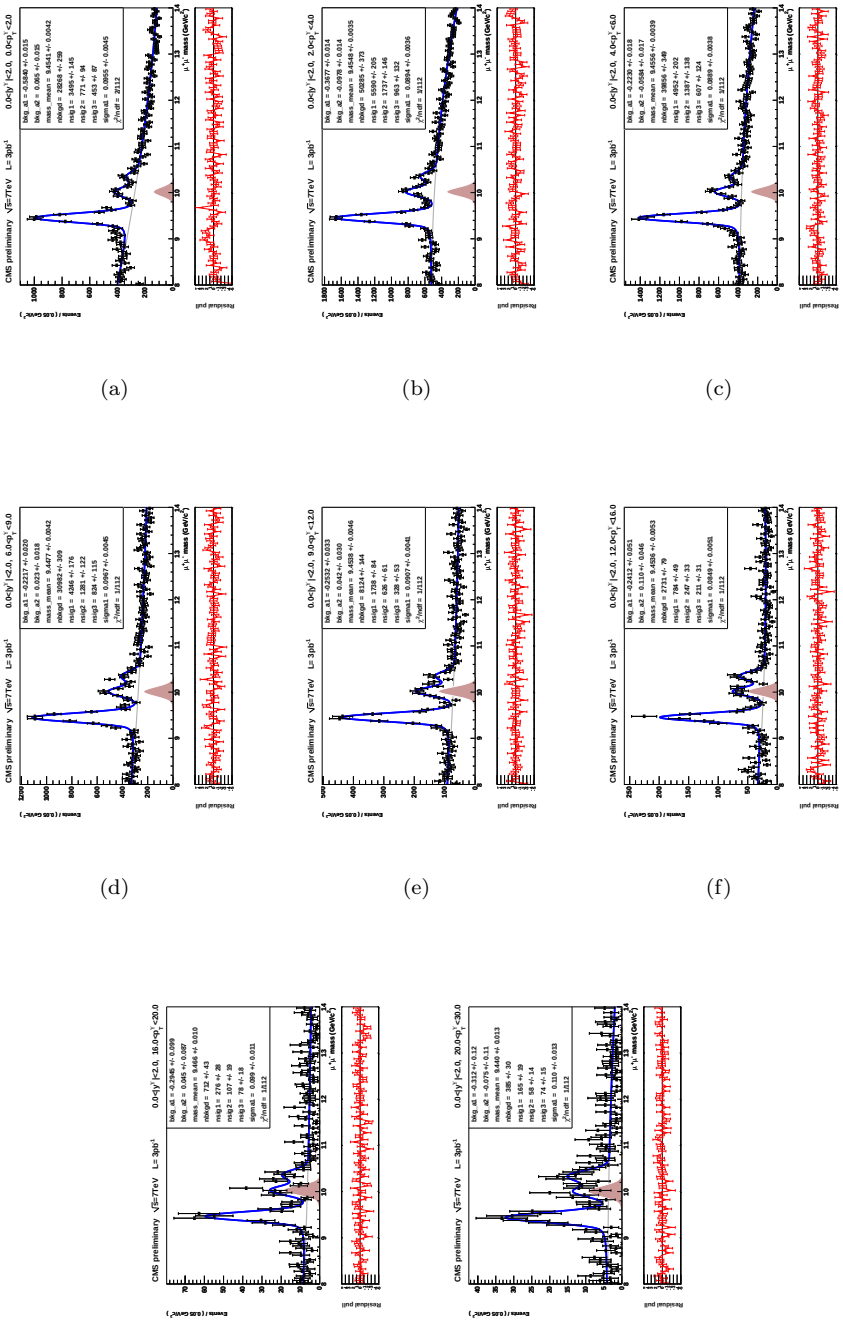


(a) (b) (c)



(d) (e)

Figure 66: Υ(2S) systematic mass fits:tnpmc, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

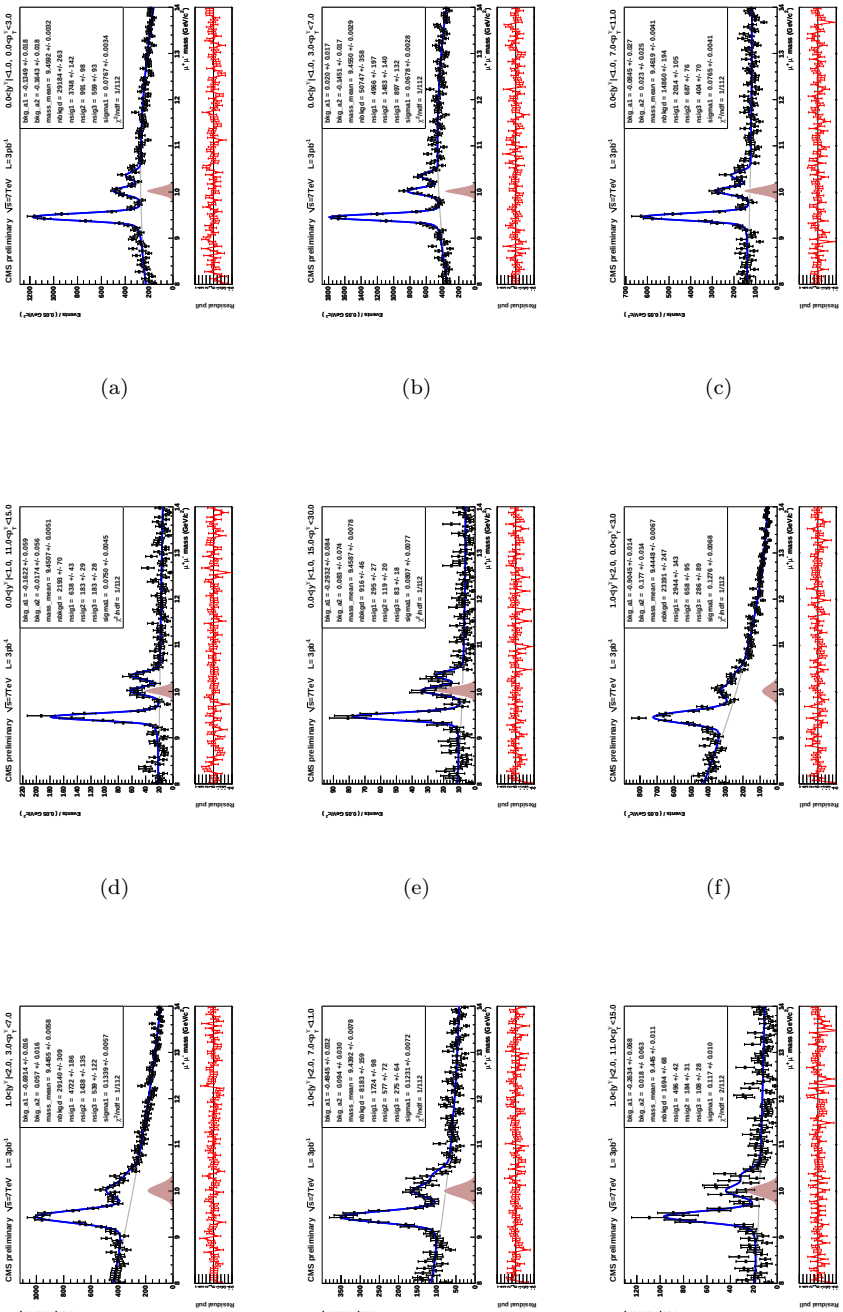


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 67: Υ(2S) systematic mass fits:tnpmc, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

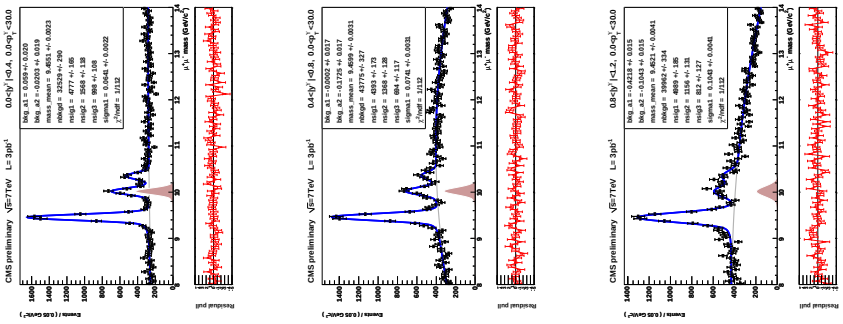


(a) (b) (c)

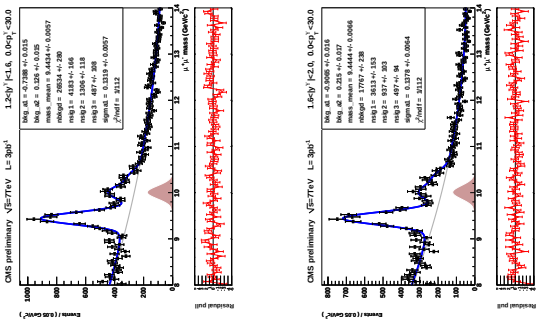
(d) (e) (f)

(g) (h) (i)

Figure 68: Υ(2S) systematic mass fits:tnpmc, for $d\sigma/d|y|$ binning.

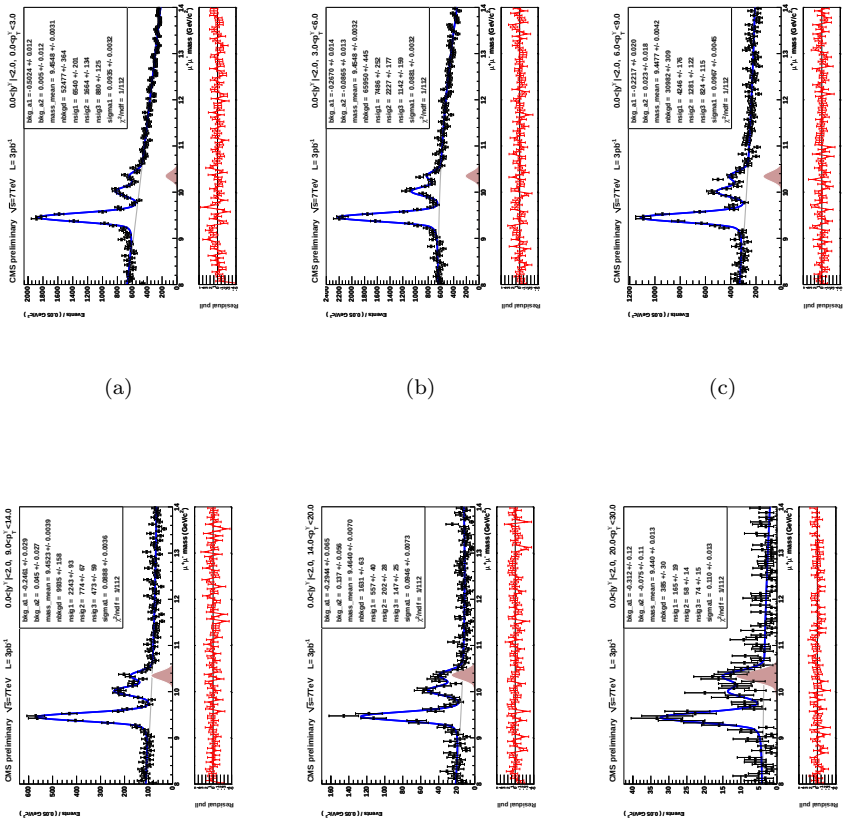


(a) (b) (c)



(d) (e)

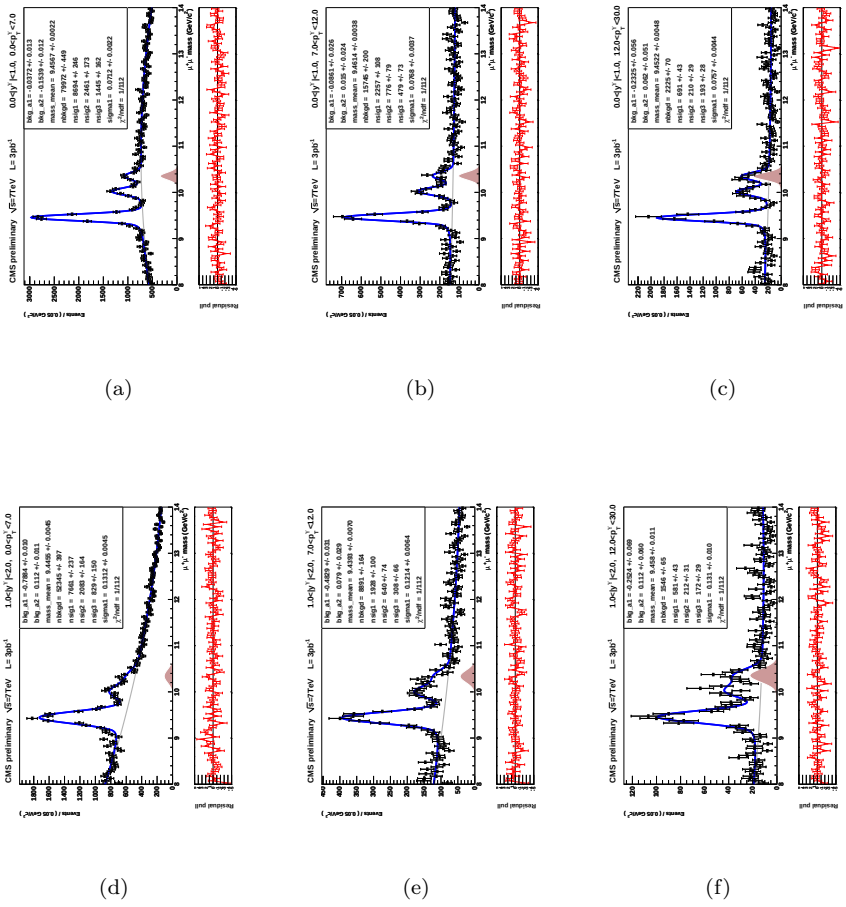
Figure 69: Υ(3S) systematic mass fits:tnpmc, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

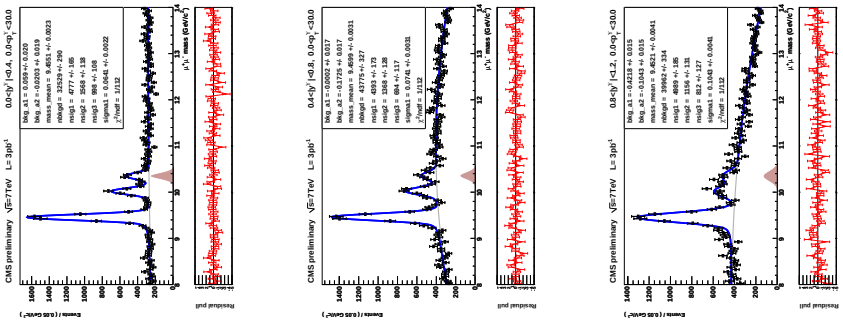
Figure 70: Υ(3S) systematic mass fits:tnpmc, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



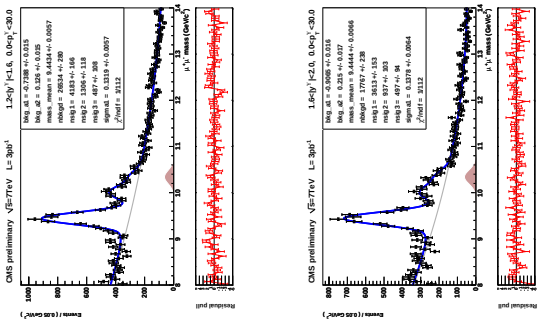
(a) (b) (c)

(d) (e) (f)

Figure 71: Υ(3S) systematic mass fits:tnpmc, for $d\sigma/d|y|$ binning.



(a) (b) (c)

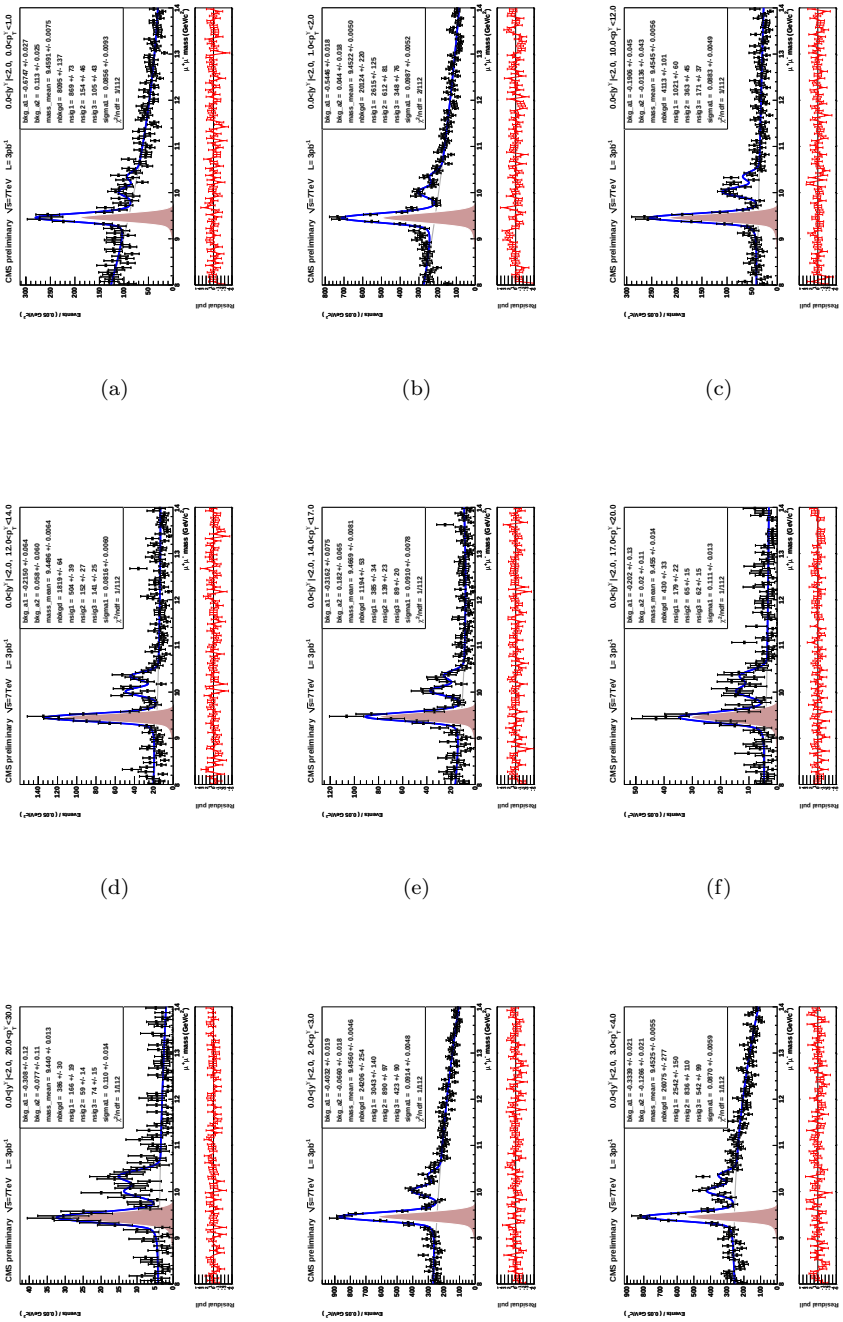


(d) (e)

0.8.4 systematics source: mctrue

Systematics contribution from tnp from J/Ψ MC truth, for muon id and trigger efficiencies

Figure 72: Υ(1S) systematic mass fits:mctrue, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



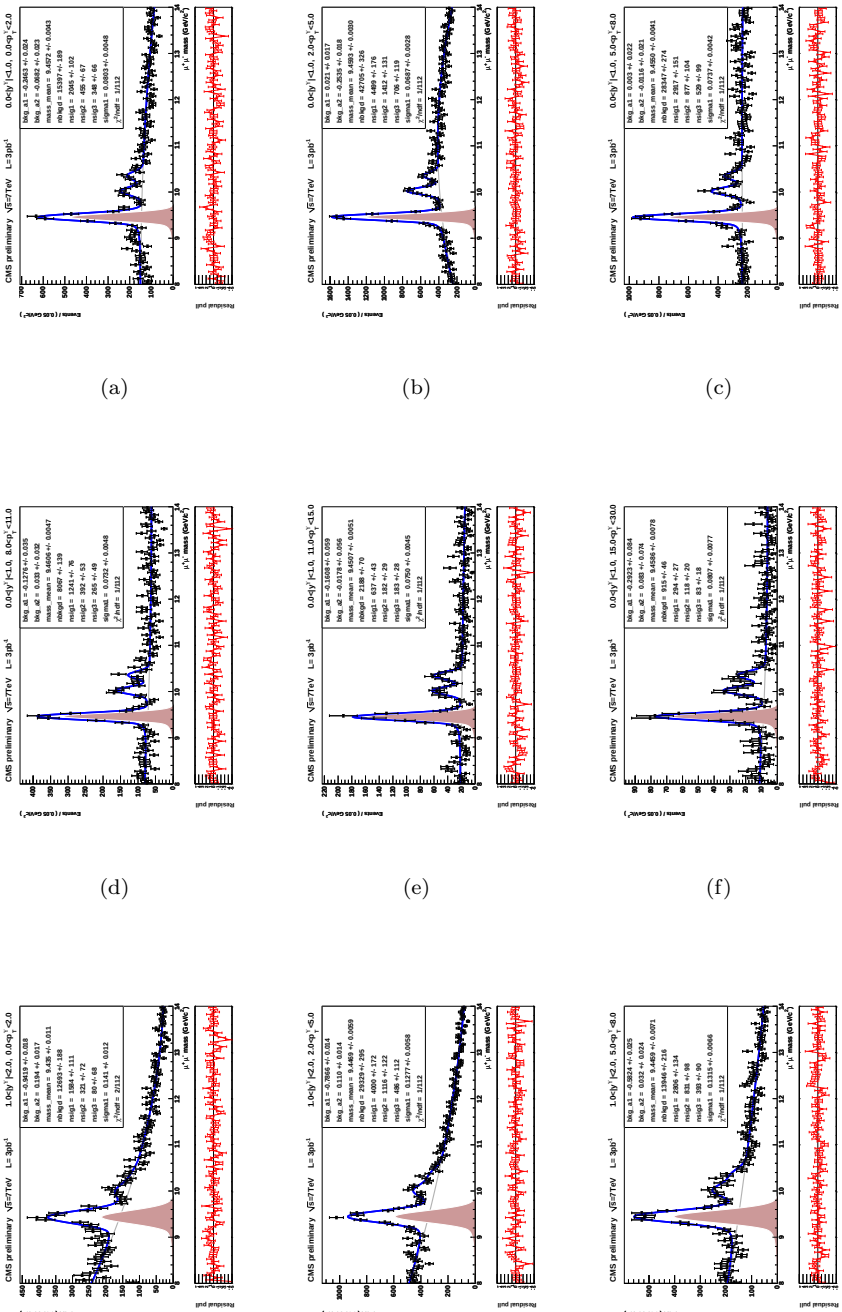
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 73: Υ(1S) systematic mass fits:mctrue, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

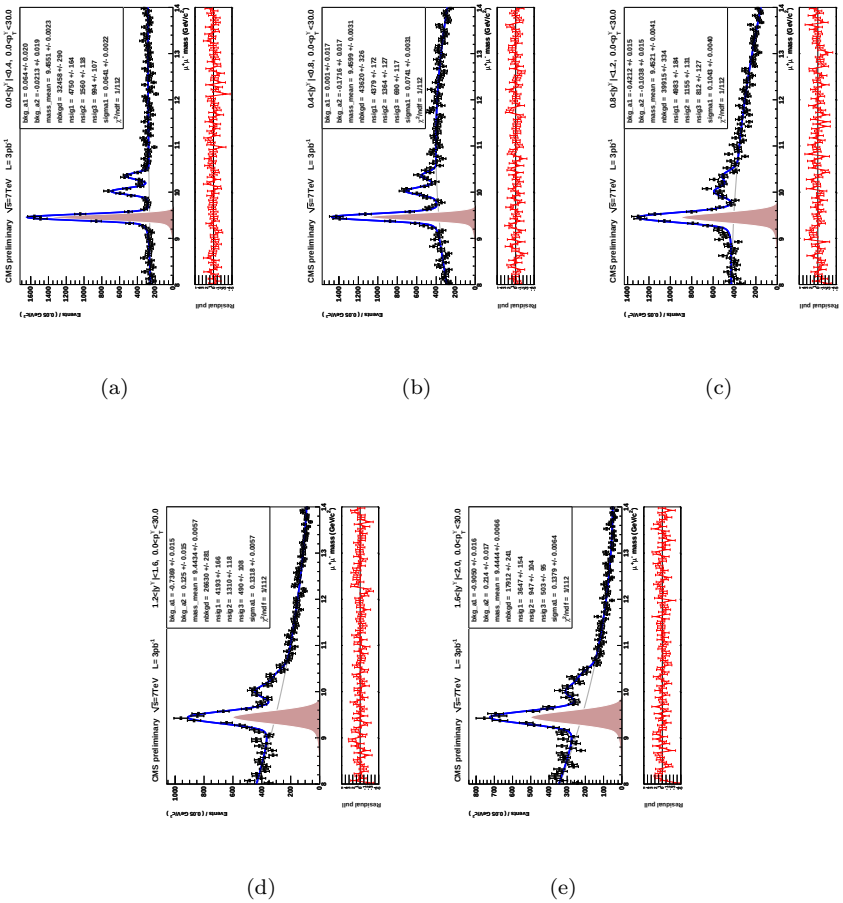


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

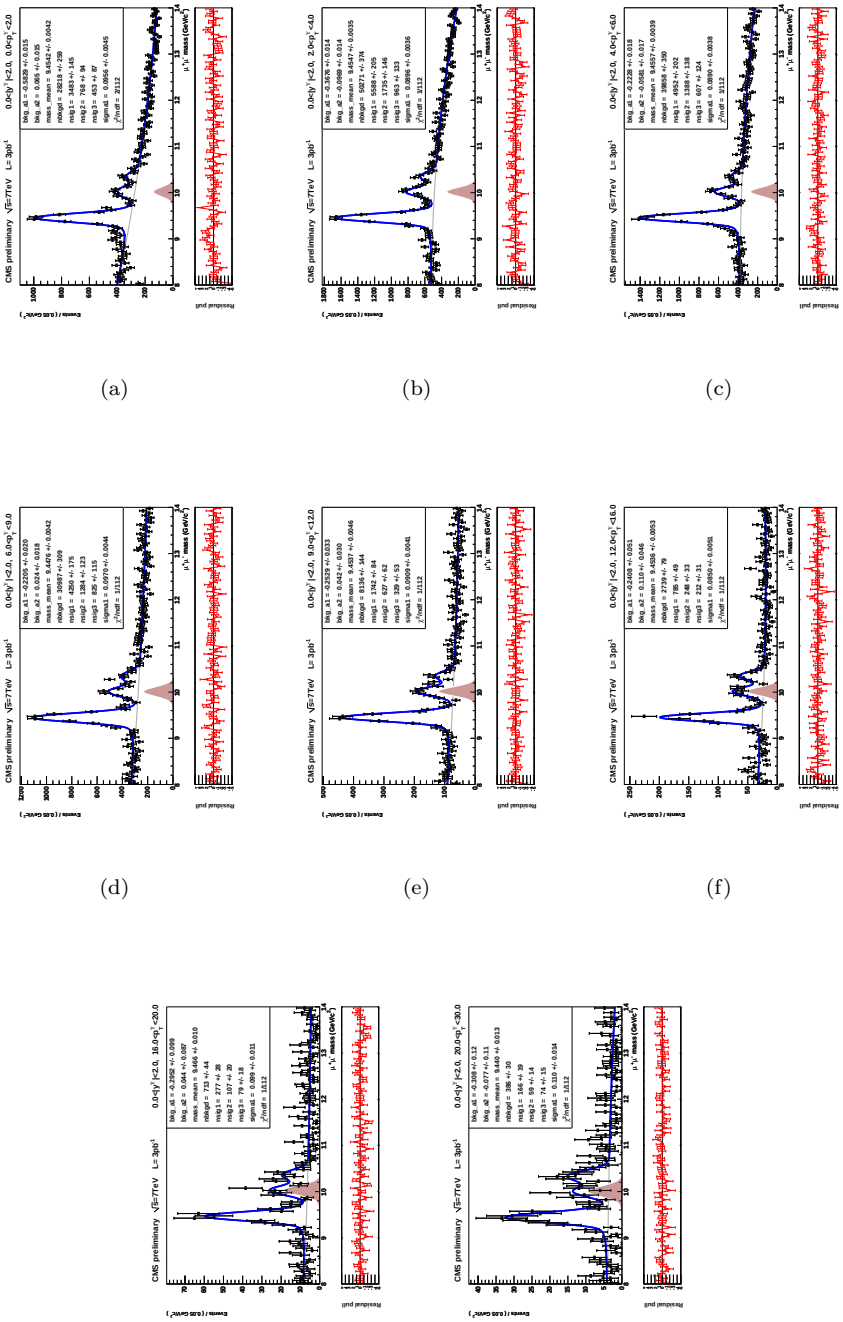
Figure 74: $\Upsilon(1S)$ systematic mass fits:mctrue, for $d\sigma/d|y|$ binning.



(a) (b) (c)

(d) (e)

Figure 75: Υ(2S) systematic mass fits:mctrue, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

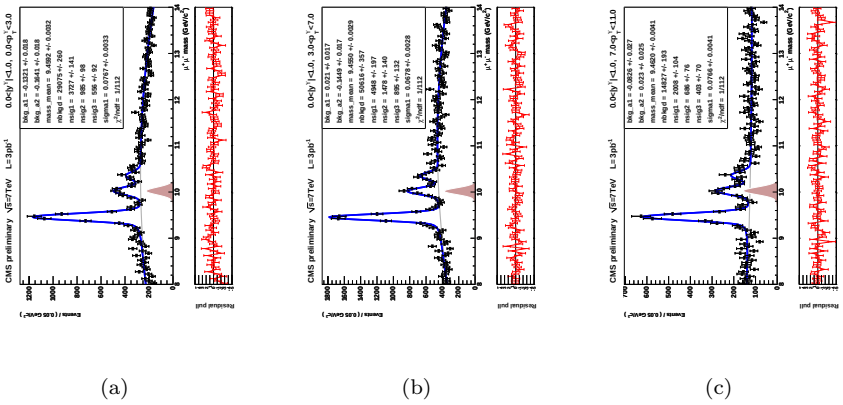


(a) (b) (c)

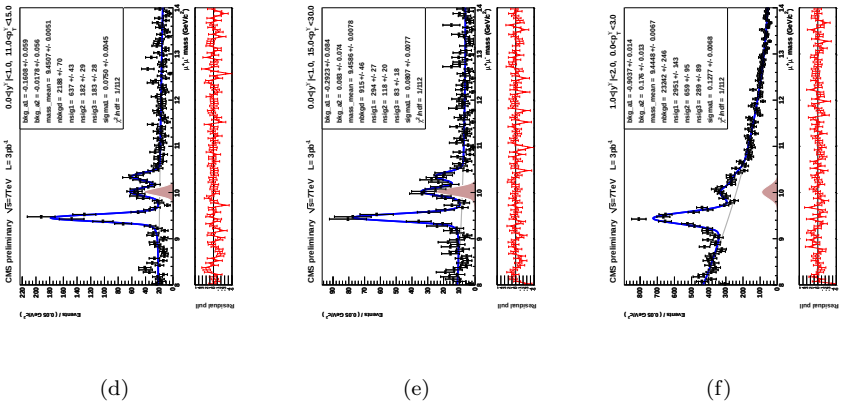
(d) (e) (f)

(g) (h)

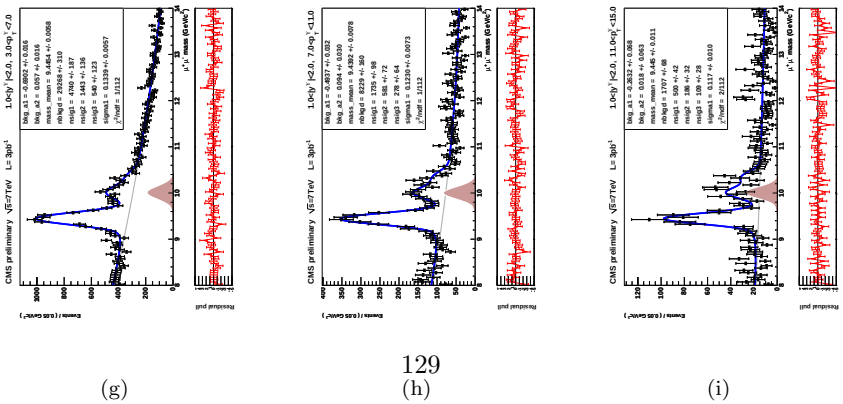
Figure 76: Υ(2S) systematic mass fits:mctrue, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

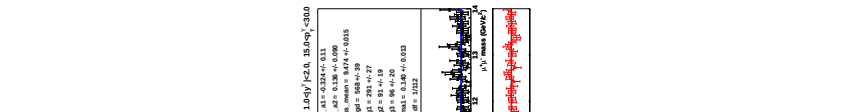
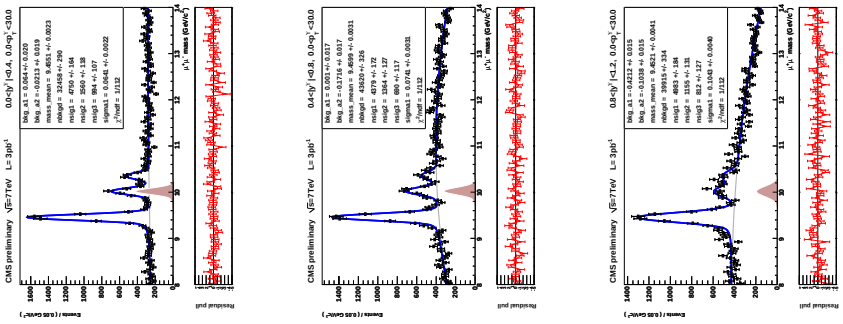
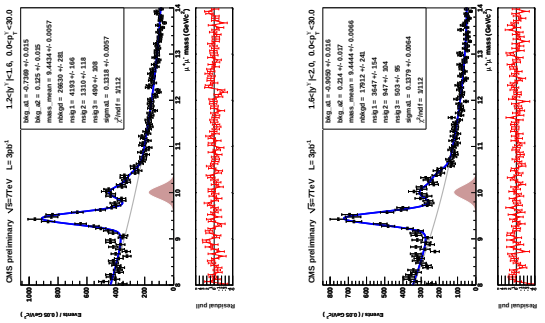


Figure 77: $\Upsilon(2S)$ systematic mass fits:mctrue, for $d\sigma/d|y|$ binning.

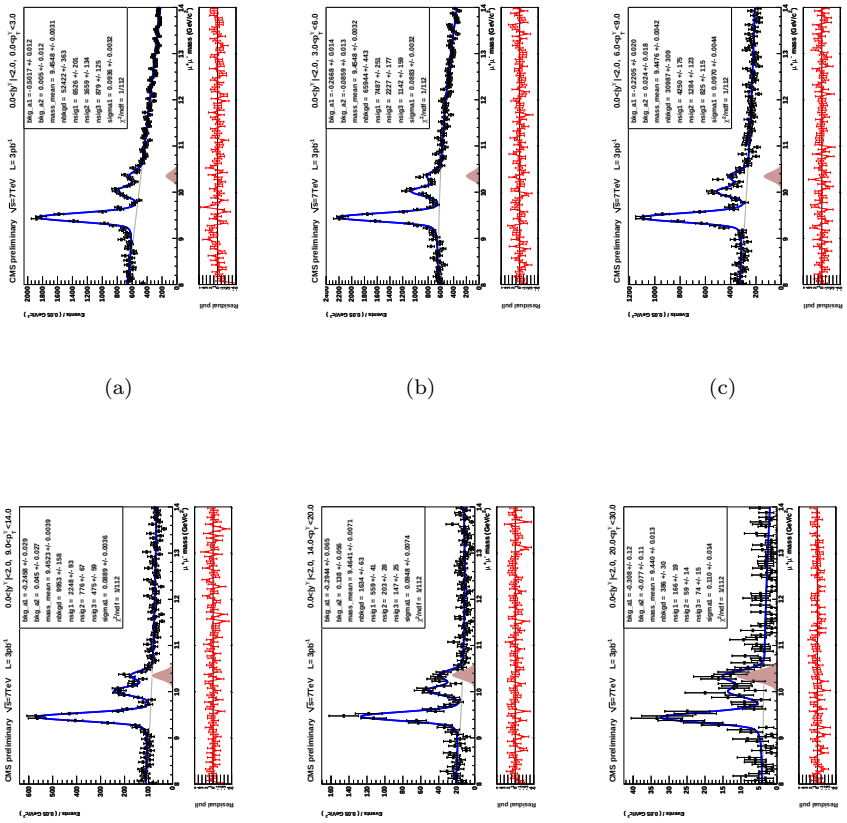


(a) (b) (c)



(d) (e)

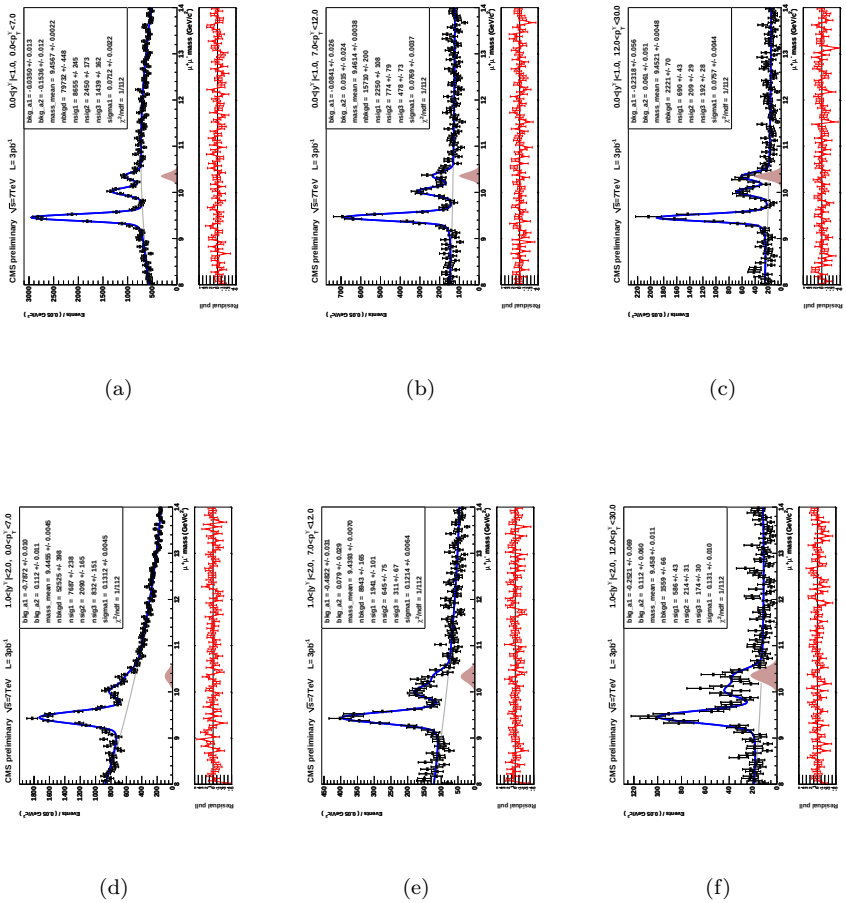
Figure 78: $\Upsilon(3S)$ systematic mass fits:mctrue, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

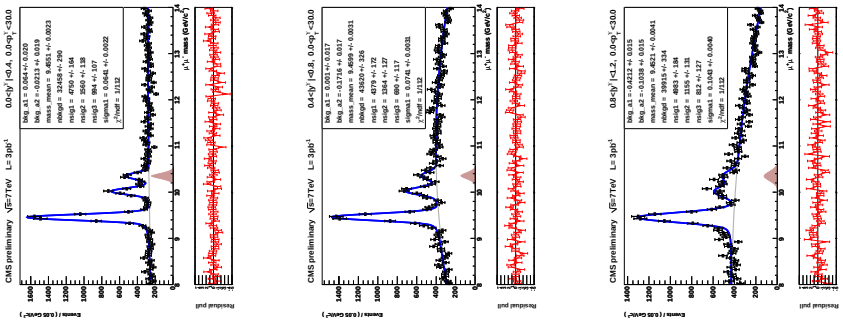
Figure 79: Υ(3S) systematic mass fits:mctrue, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



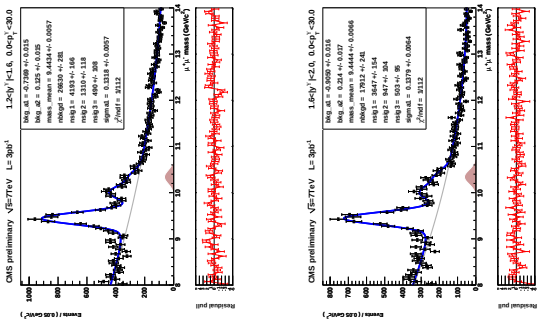
(a) (b) (c)

(d) (e) (f)

Figure 80: Υ(3S) systematic mass fits:mctrue, for $d\sigma/d|y|$ binning.



(a) (b) (c)

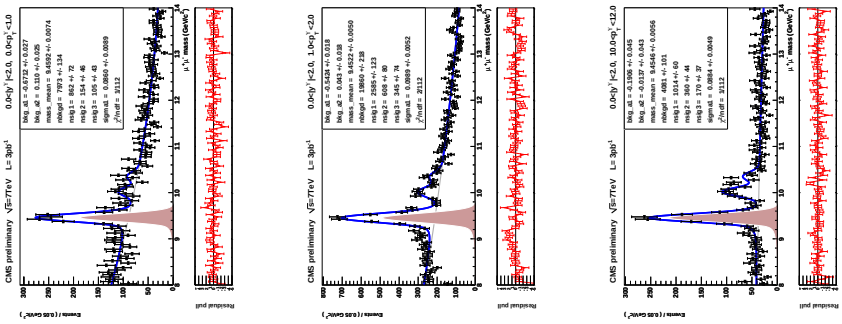


(d) (e)

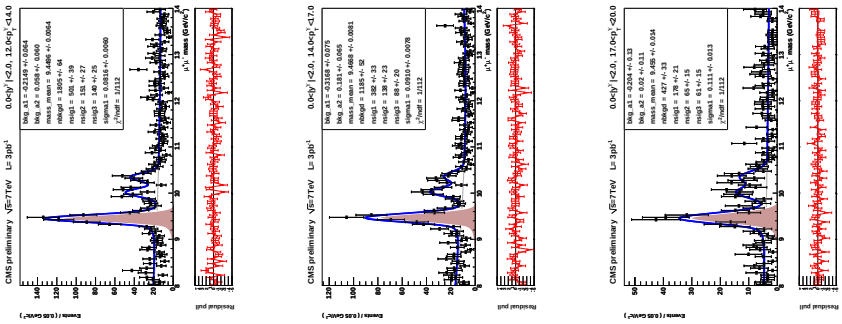
0.8.5 systematics source: tnpmcUps

Systematics contribution from tnp from Υ MC truth, for muon id and trigger efficiencies

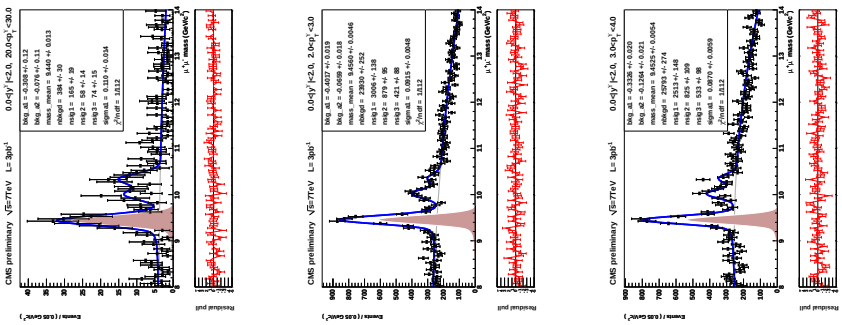
Figure 81: $\Upsilon(1S)$ systematic mass fits:tnpmcUps, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

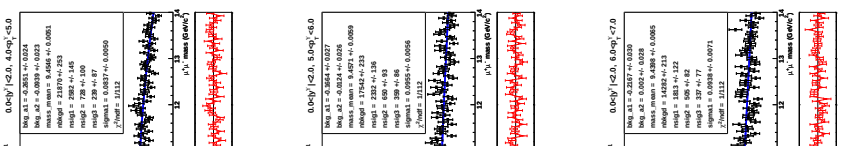
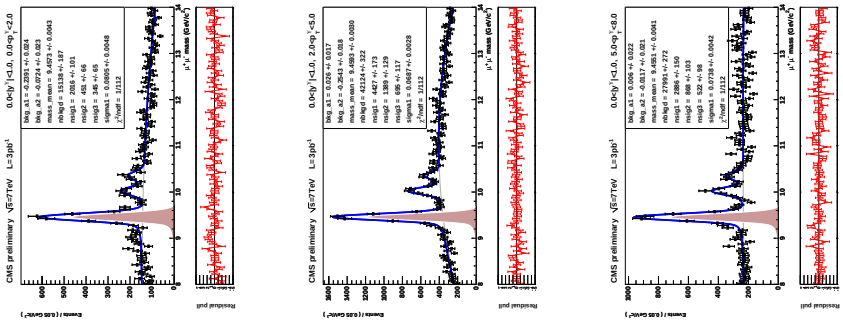
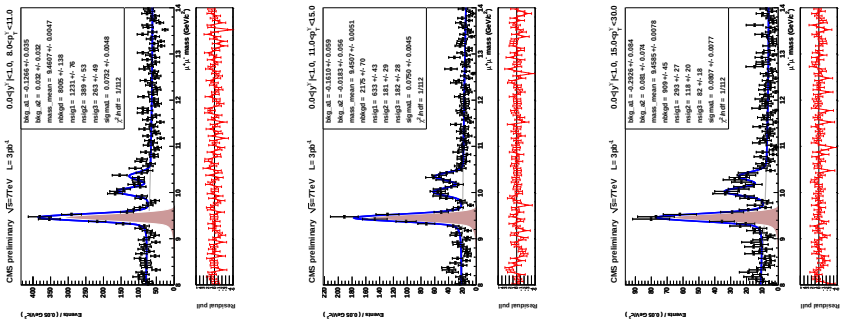


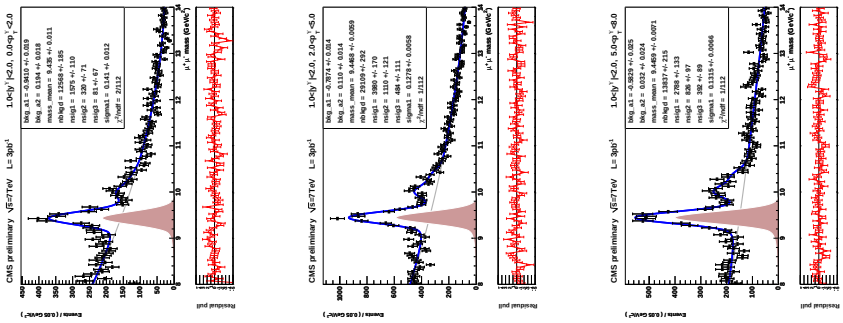
Figure 82: Υ(1S) systematic mass fits:tnpmcUps, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

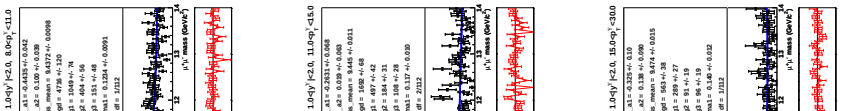
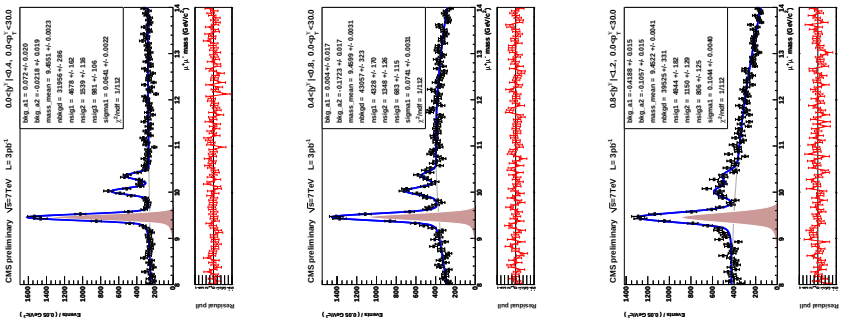
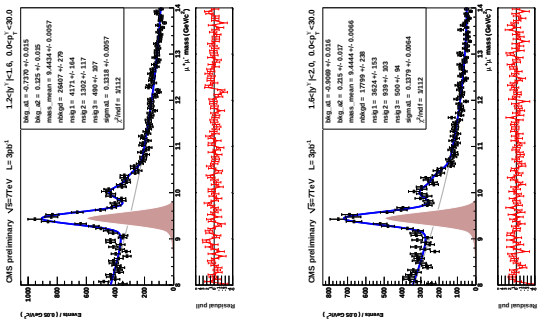


Figure 83: Υ(1S) systematic mass fits:tnpmcUps, for $d\sigma/d|y|$ binning.

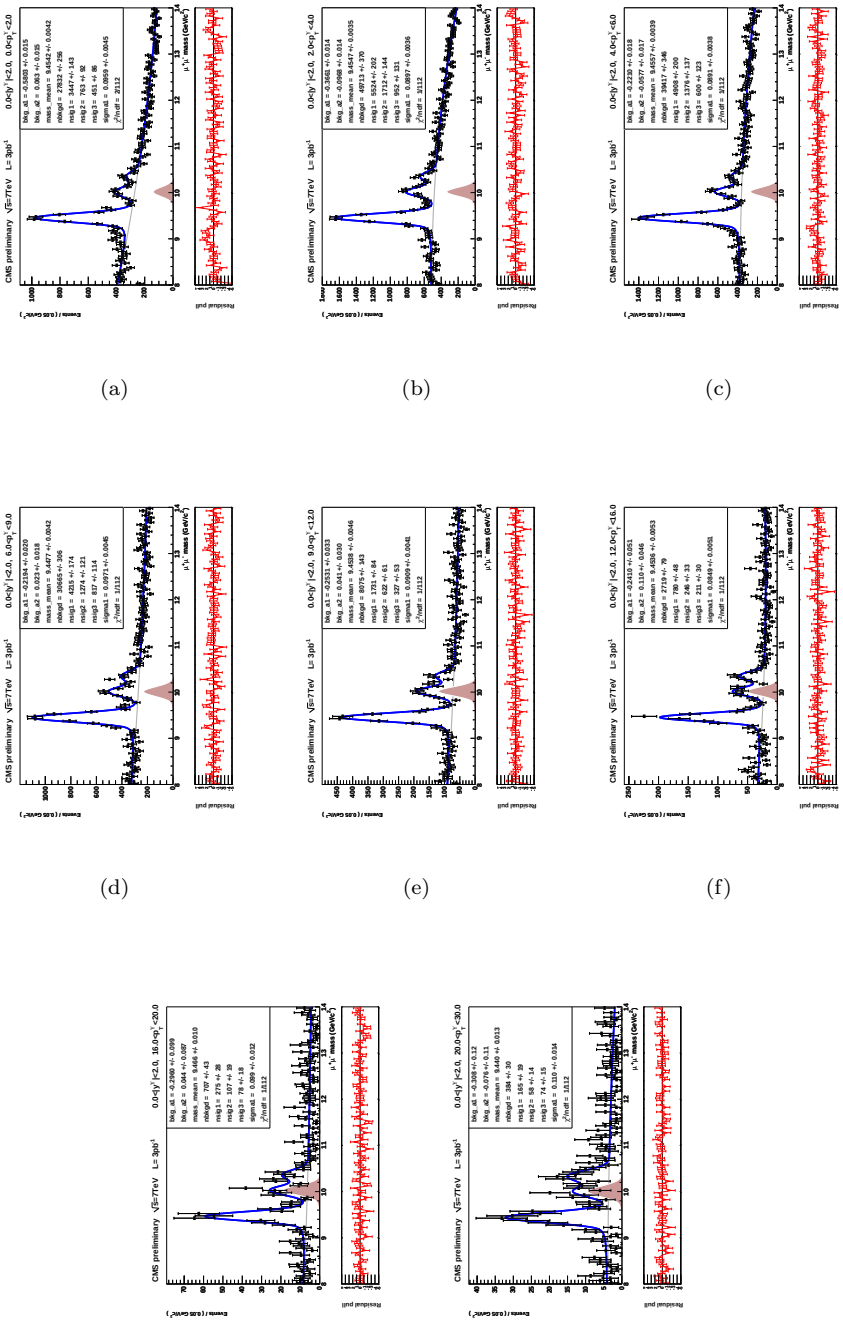


(a) (b) (c)



(d) (e)

Figure 84: $\Upsilon(2S)$ systematic mass fits:tnpmcUps, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

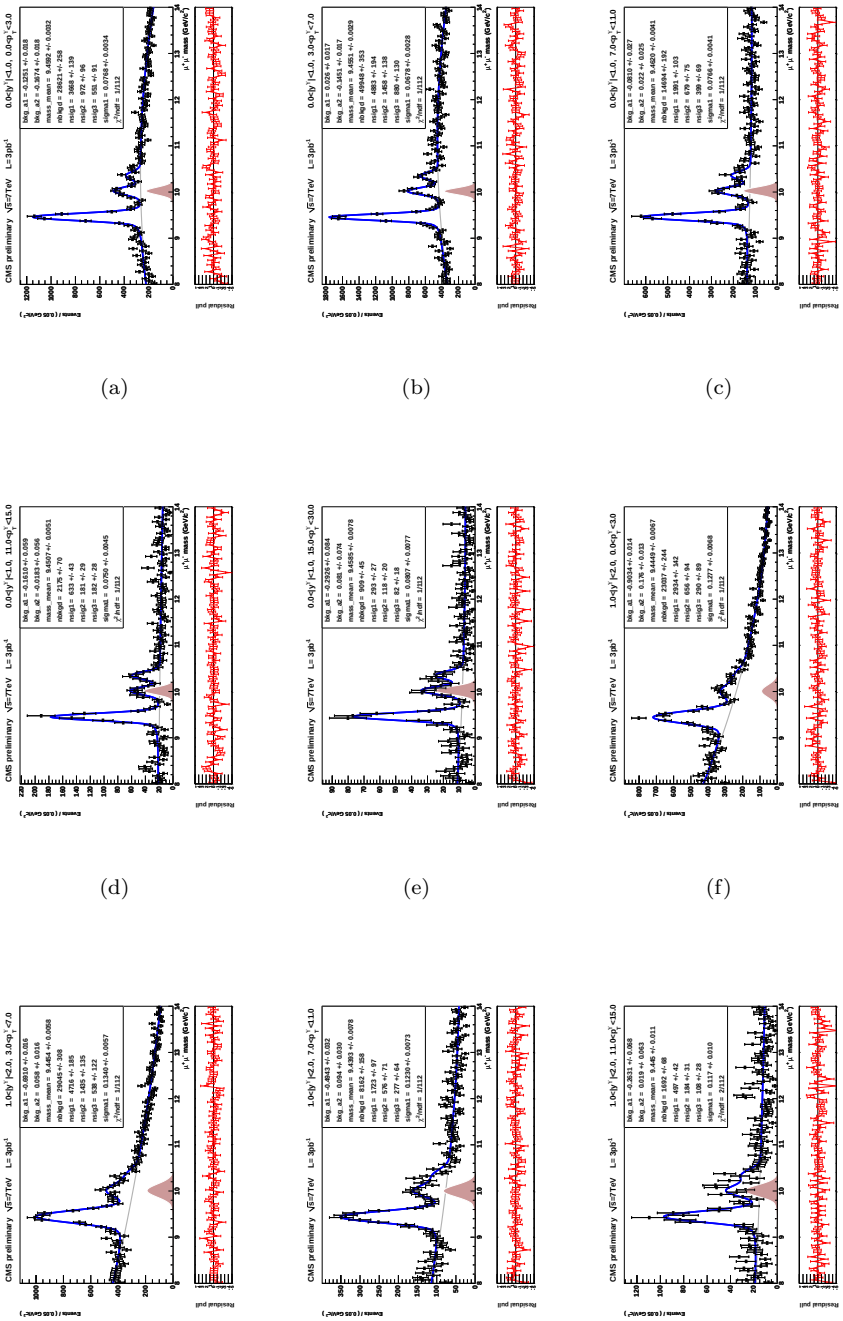


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 85: Υ(2S) systematic mass fits:tnpmcUps, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

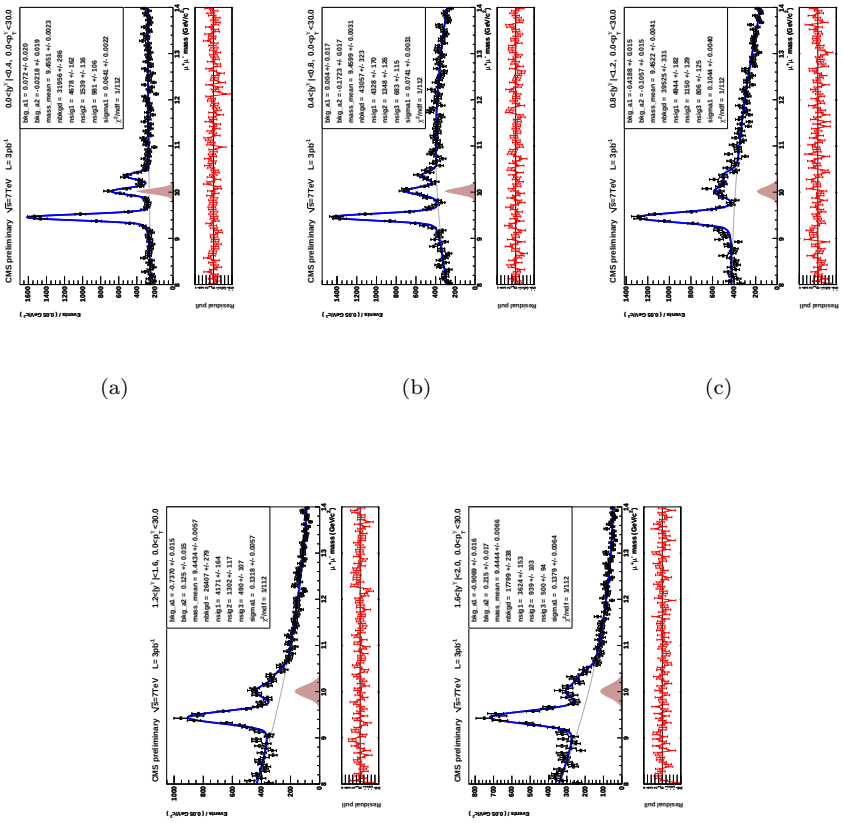


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

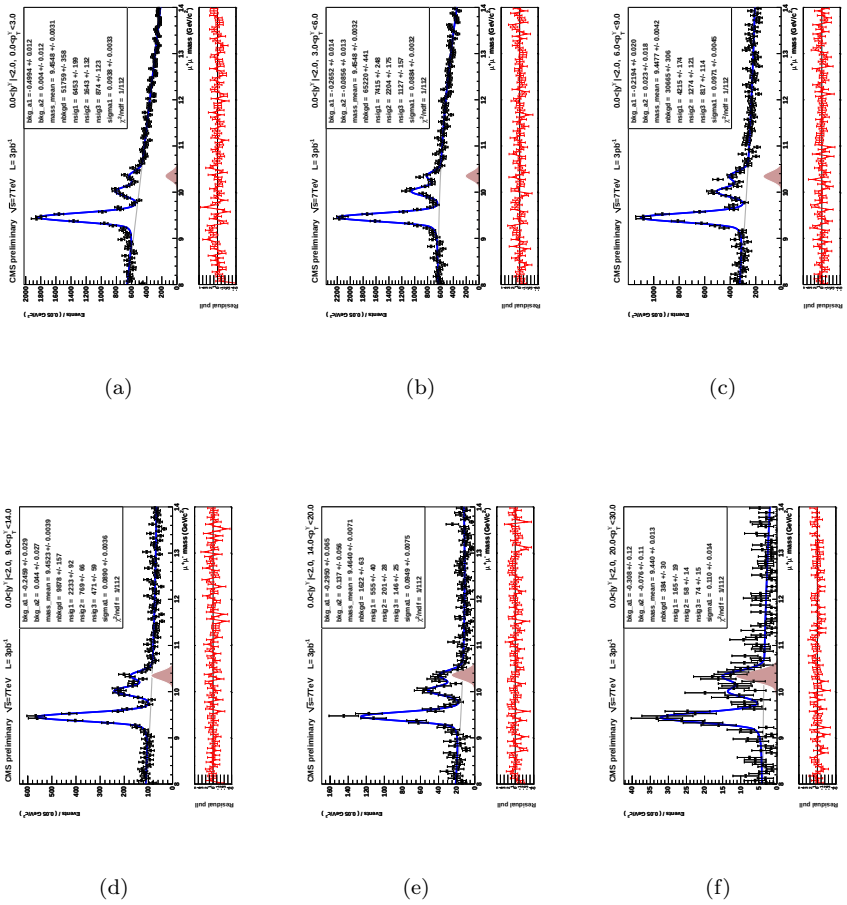
Figure 86: $\Upsilon(2S)$ systematic mass fits:tnpmcUps, for $d\sigma/d|y|$ binning.



(a) (b) (c)

(d) (e)

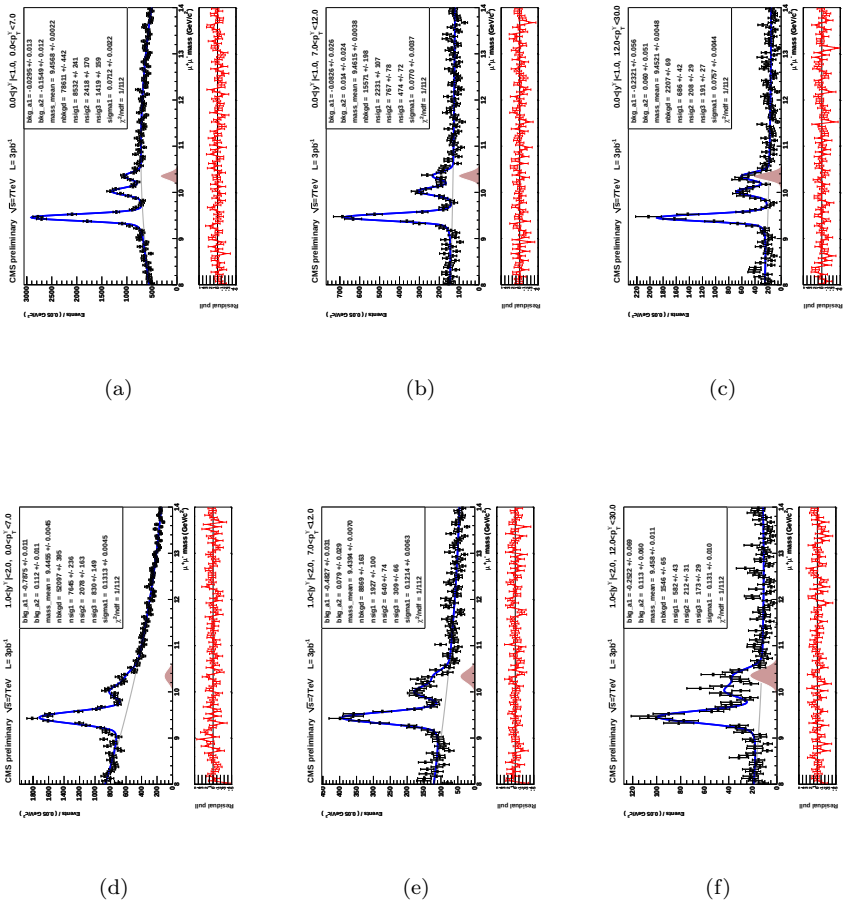
Figure 87: $\Upsilon(3S)$ systematic mass fits:tnpmcUps, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

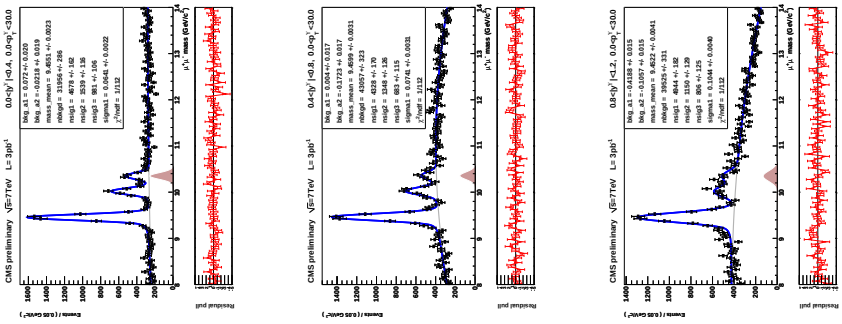
Figure 88: Υ(3S) systematic mass fits:tnpmcUps, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



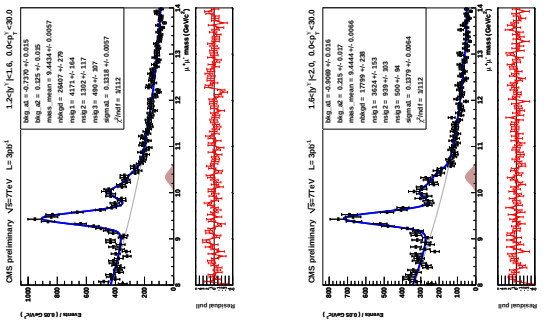
(a) (b) (c)

(d) (e) (f)

Figure 89: Υ(3S) systematic mass fits:tnpmcUps, for $d\sigma/d|y|$ binning.



(a) (b) (c)

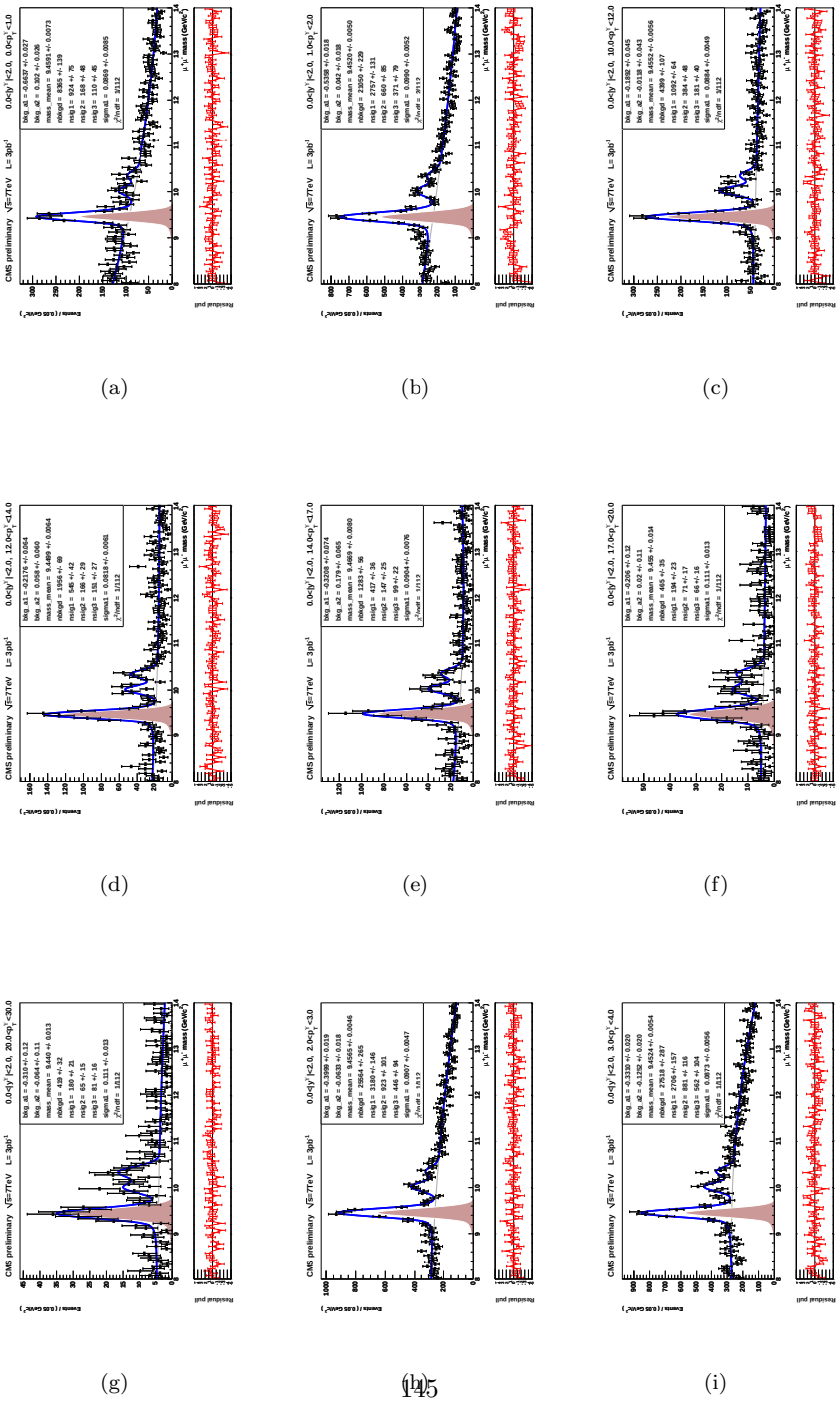


(d) (e)

0.8.6 systematics source: EtrkLo

Systematics contribution from tracking, quality, vertex efficiency stat unc ($+1\sigma$)

Figure 90: $\Upsilon(1S)$ systematic mass fits:EtrkLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



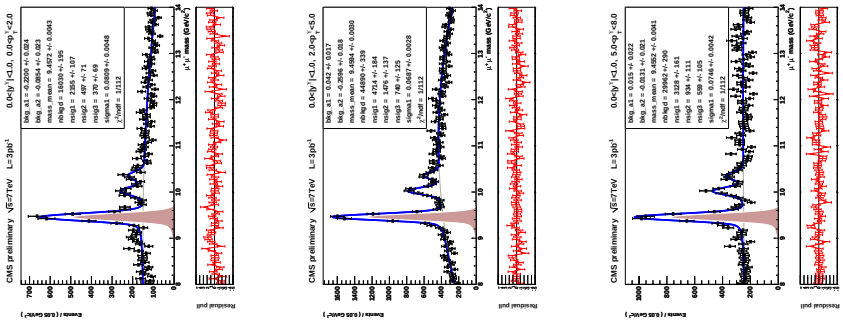
(a) (b) (c)

(d) (e) (f)

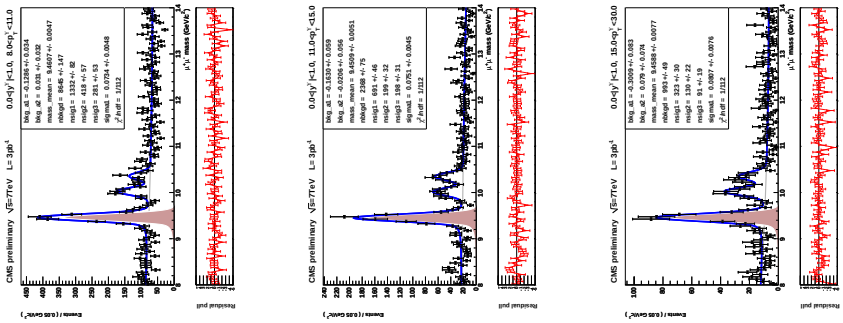
(g) (h) (i)

(j) (k) (l)

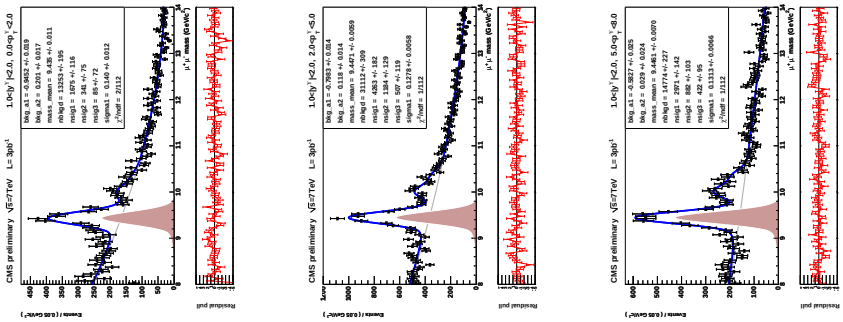
Figure 91: Υ(1S) systematic mass fits:EtrkLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

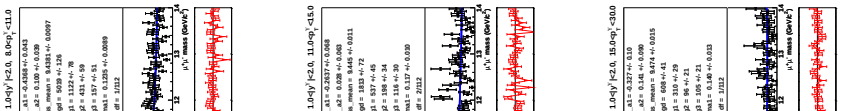
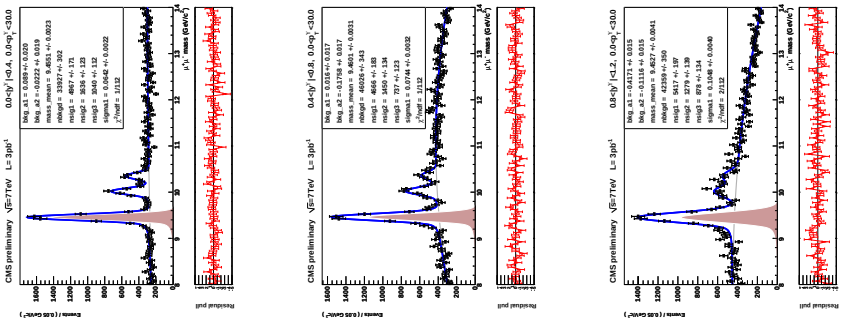
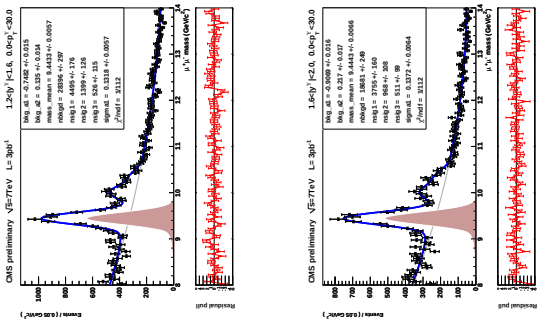


Figure 92: $\Upsilon(1S)$ systematic mass fits:EtrkLo, for $d\sigma/d|y|$ binning.

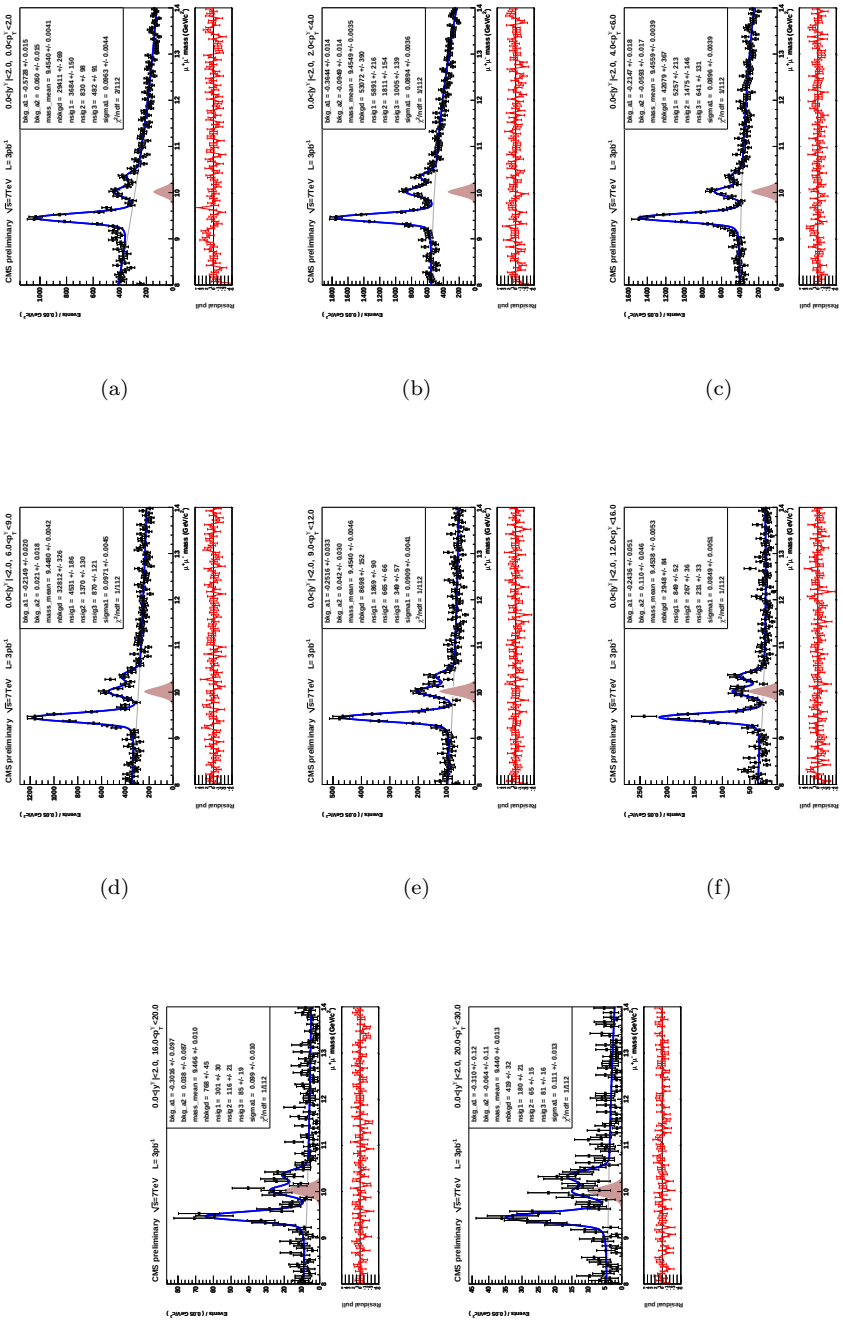


(a) (b) (c)



(d) (e)

Figure 93: $\Upsilon(2S)$ systematic mass fits:EtrkLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

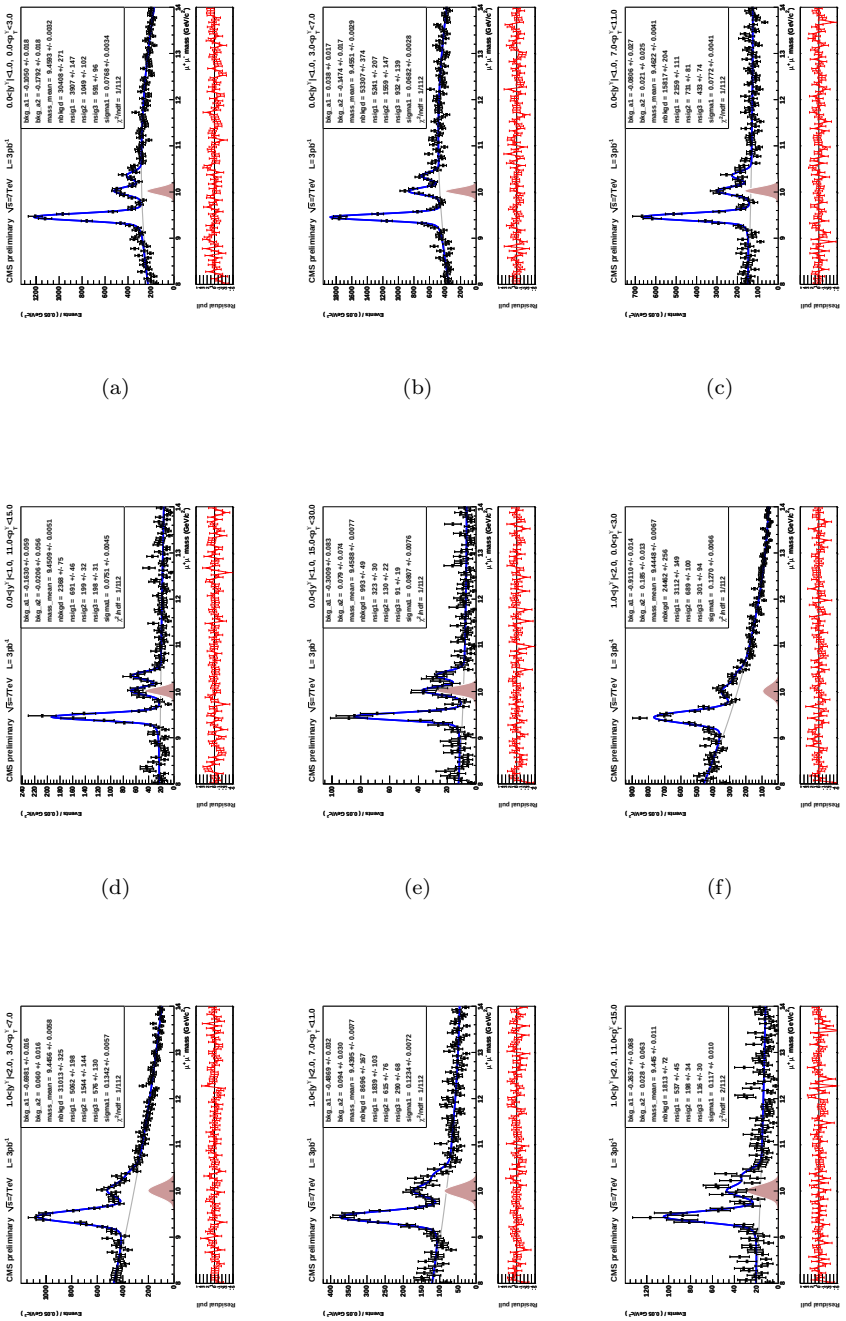


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 94: Υ(2S) systematic mass fits:EtrkLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

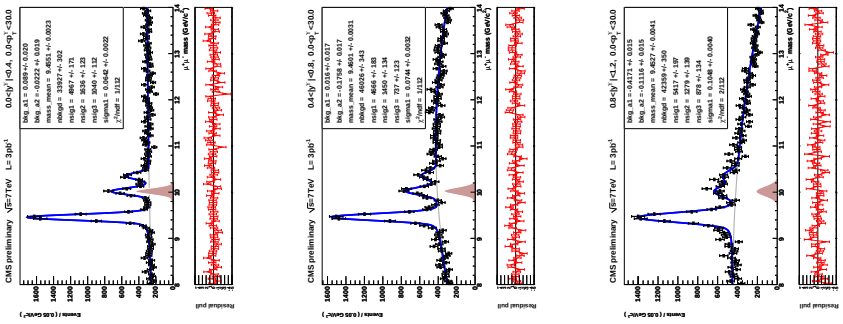


(a) (b) (c)

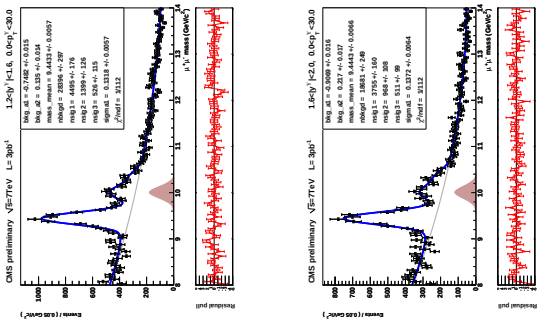
(d) (e) (f)

(g) (h) (i)

Figure 95: $\Upsilon(2S)$ systematic mass fits:EtrkLo, for $d\sigma/d|y|$ binning.

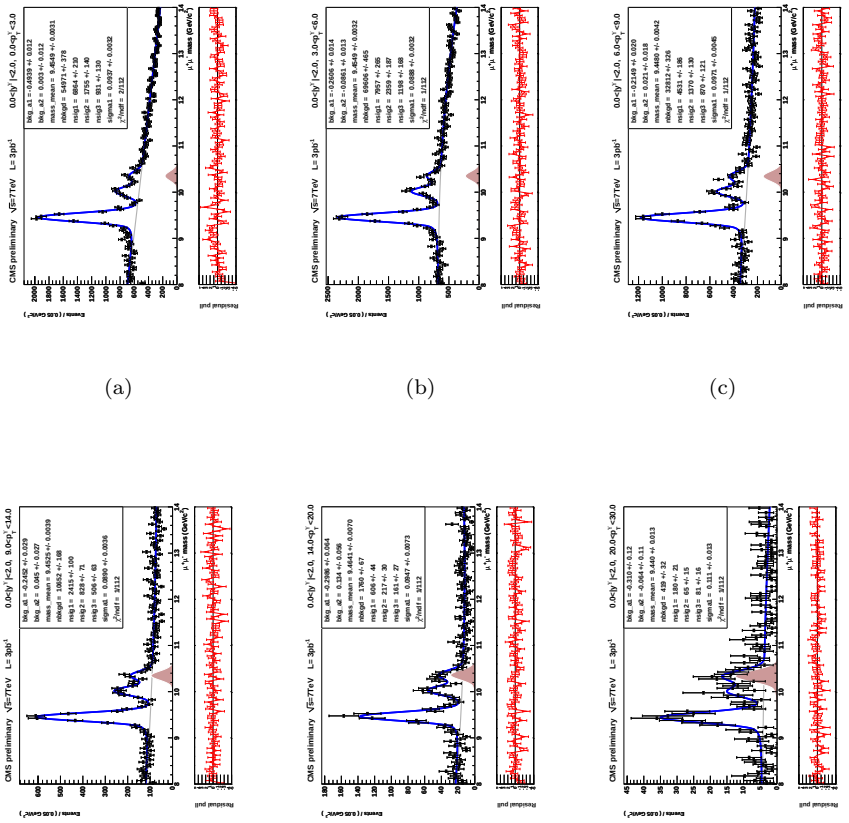


(a) (b) (c)



(d) (e)

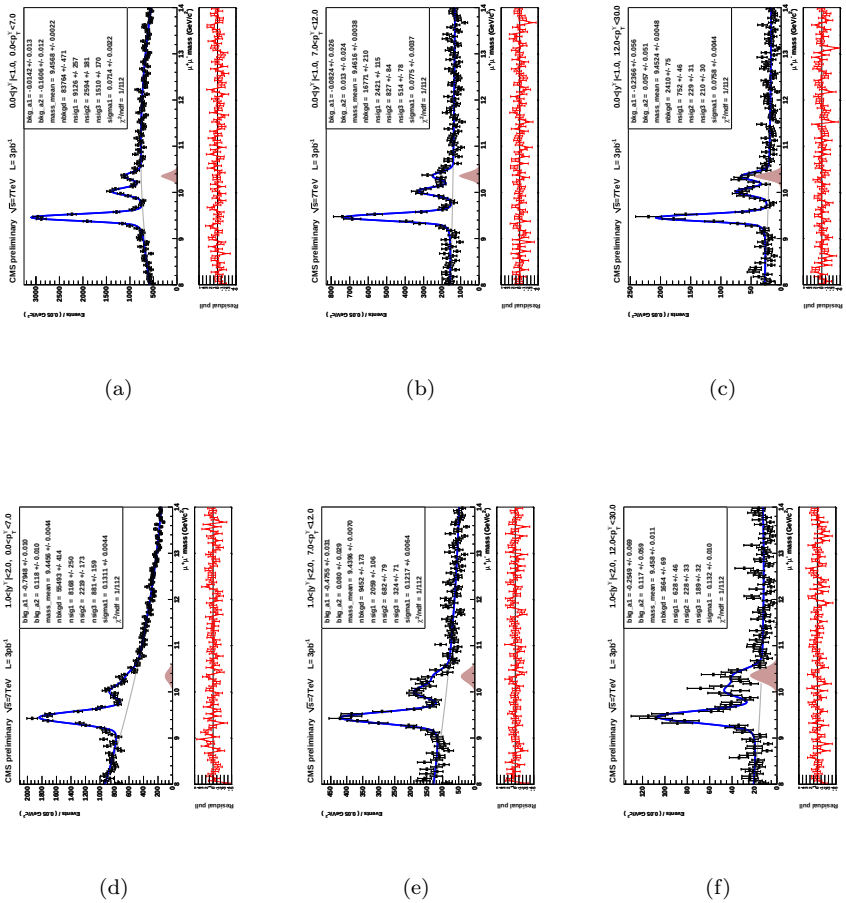
Figure 96: $\Upsilon(3S)$ systematic mass fits:EtrkLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

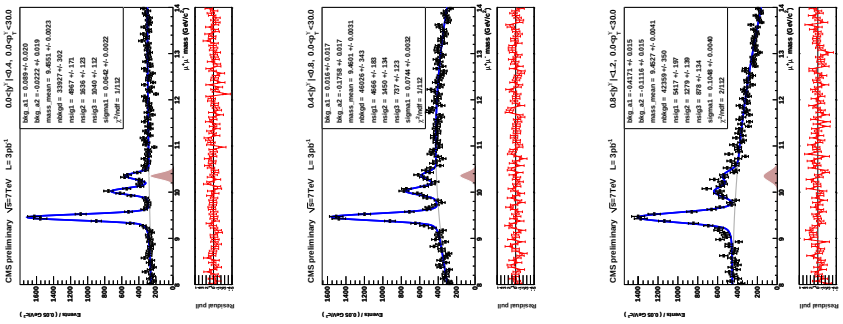
Figure 97: Υ(3S) systematic mass fits:EtrkLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



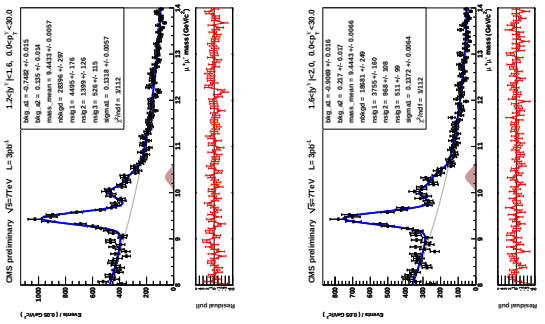
(a) (b) (c)

(d) (e) (f)

Figure 98: Υ(3S) systematic mass fits:EtrkLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

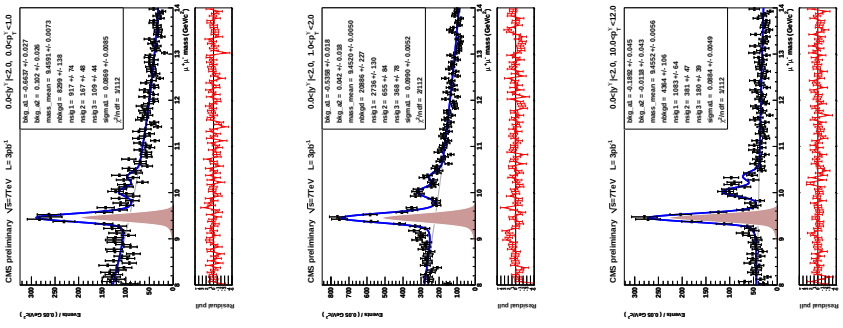


(d) (e)

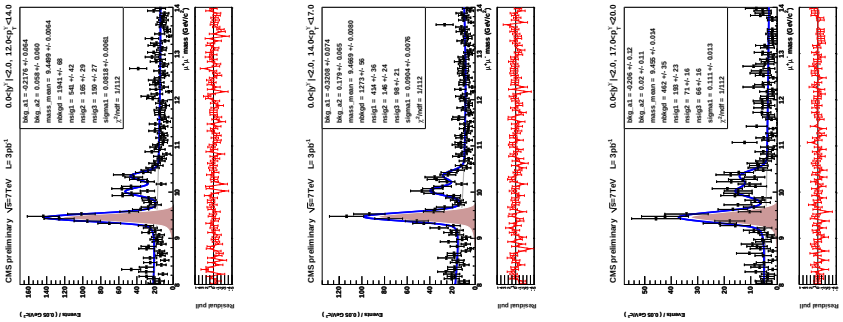
0.8.7 systematics source: EtrkHi

Systematics contribution from tracking, quality, vertex efficiency
stat unc (-1σ)

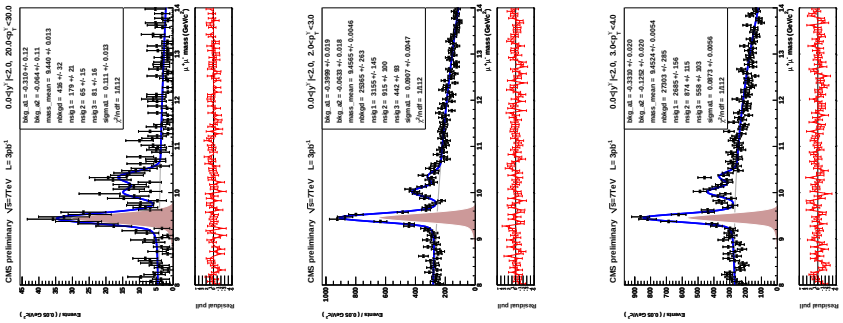
Figure 99: Υ(1S) systematic mass fits:EtrkHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

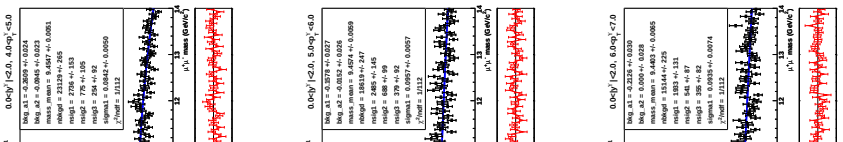
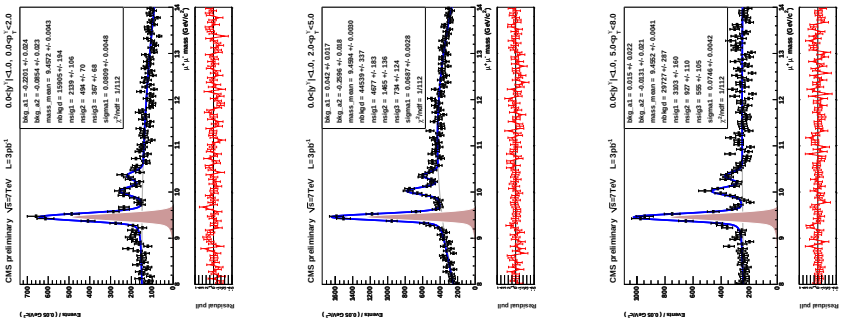
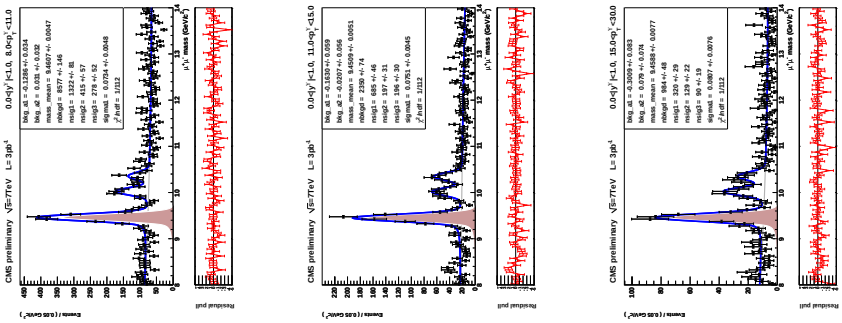


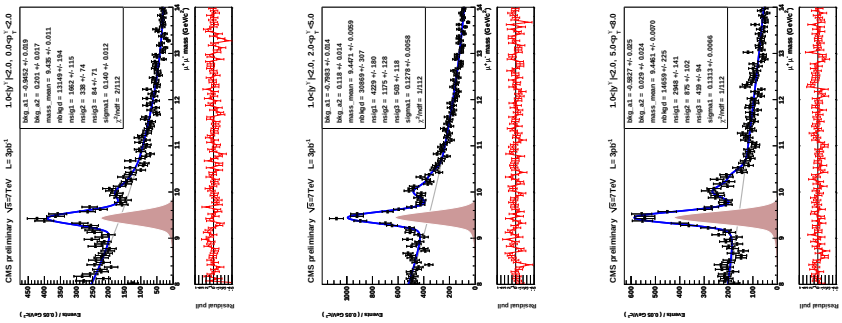
Figure 100: $\Upsilon(1S)$ systematic mass fits:EtrkHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

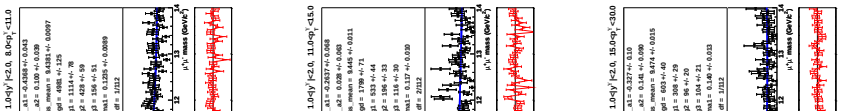
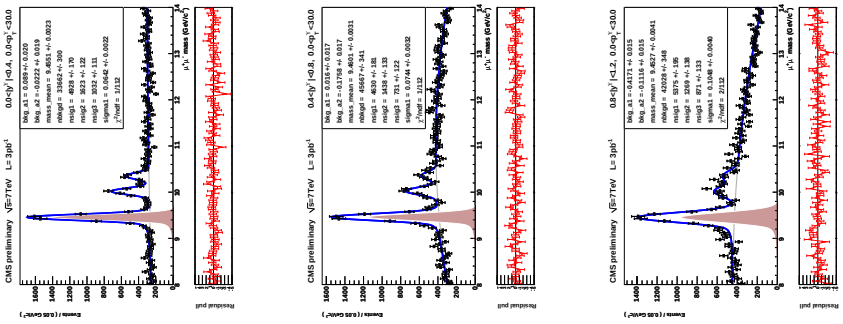
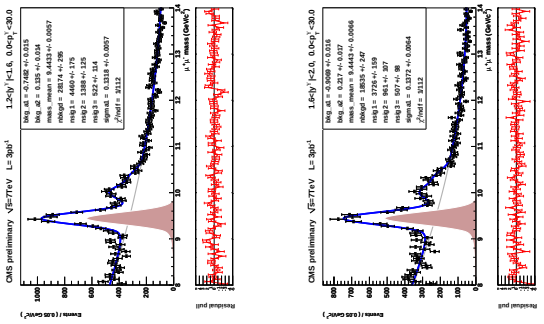


Figure 101: $\Upsilon(1S)$ systematic mass fits:EtrkHi, for $d\sigma/d|y|$ binning.

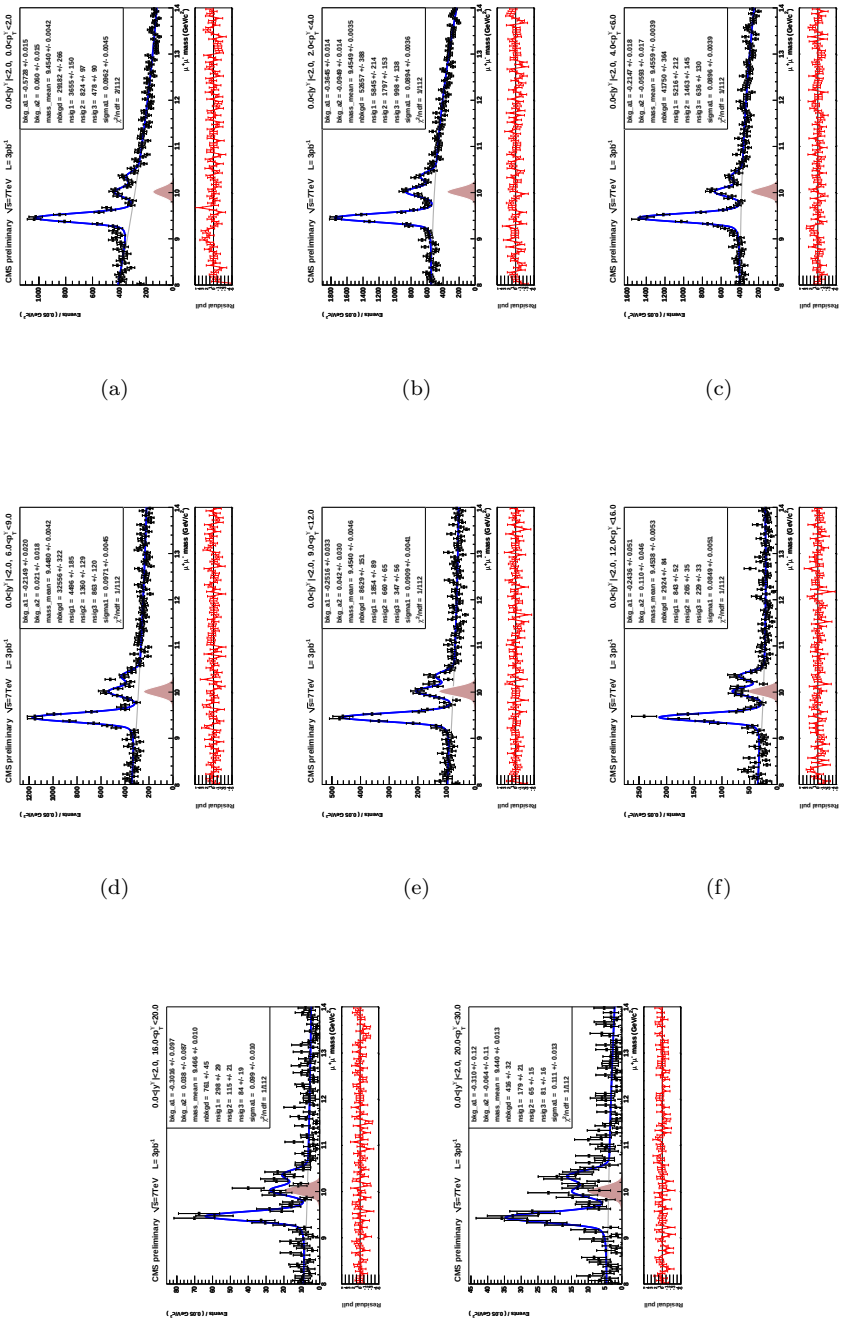


(a) (b) (c)



(d) (e)

Figure 102: Υ(2S) systematic mass fits:EtrkHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

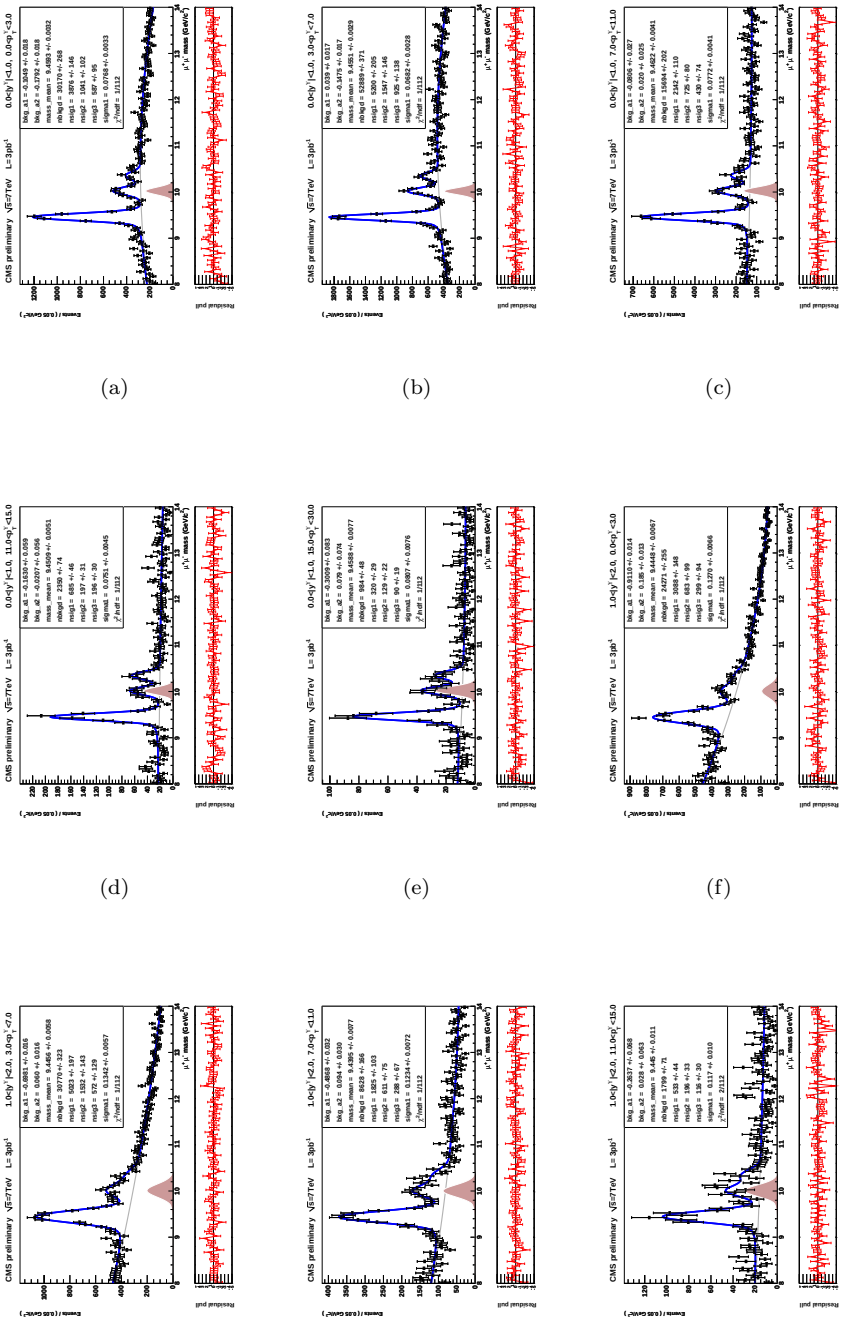


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 103: $\Upsilon(2S)$ systematic mass fits:EtrkHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

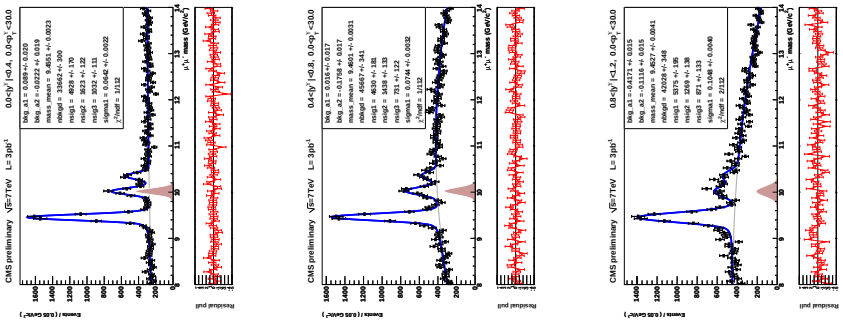


(a) (b) (c)

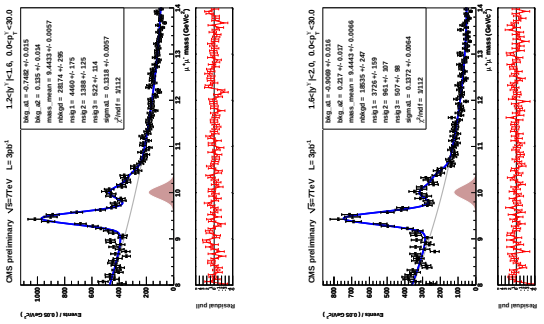
(d) (e) (f)

(g) (h) (i)

Figure 104: $\Upsilon(2S)$ systematic mass fits:EtrkHi, for $d\sigma/d|y|$ binning.

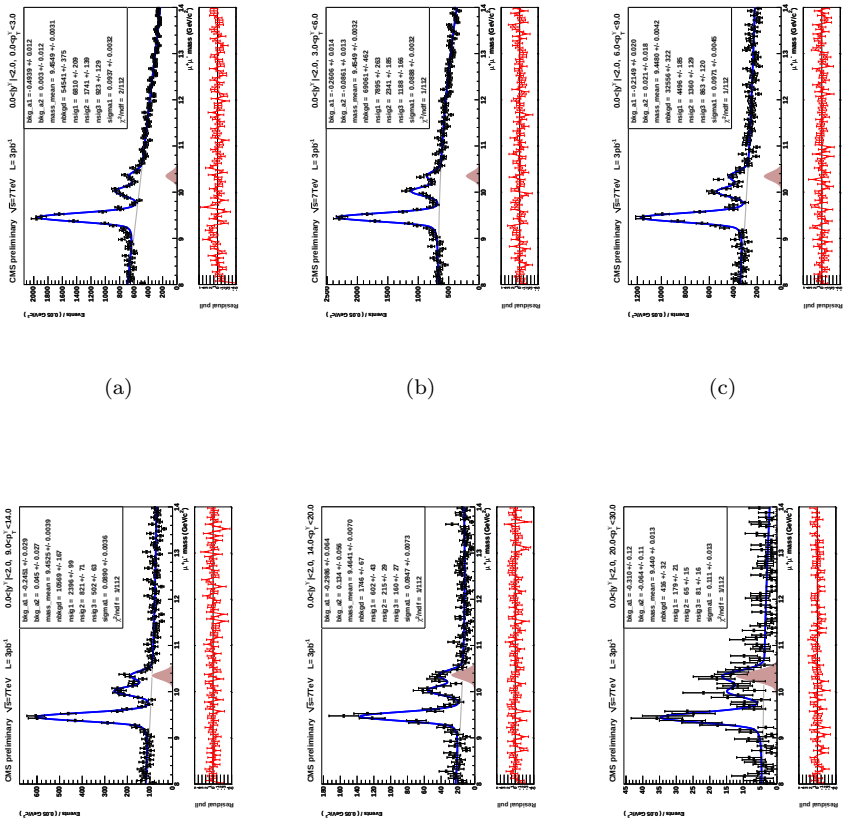


(a) (b) (c)



(d) (e)

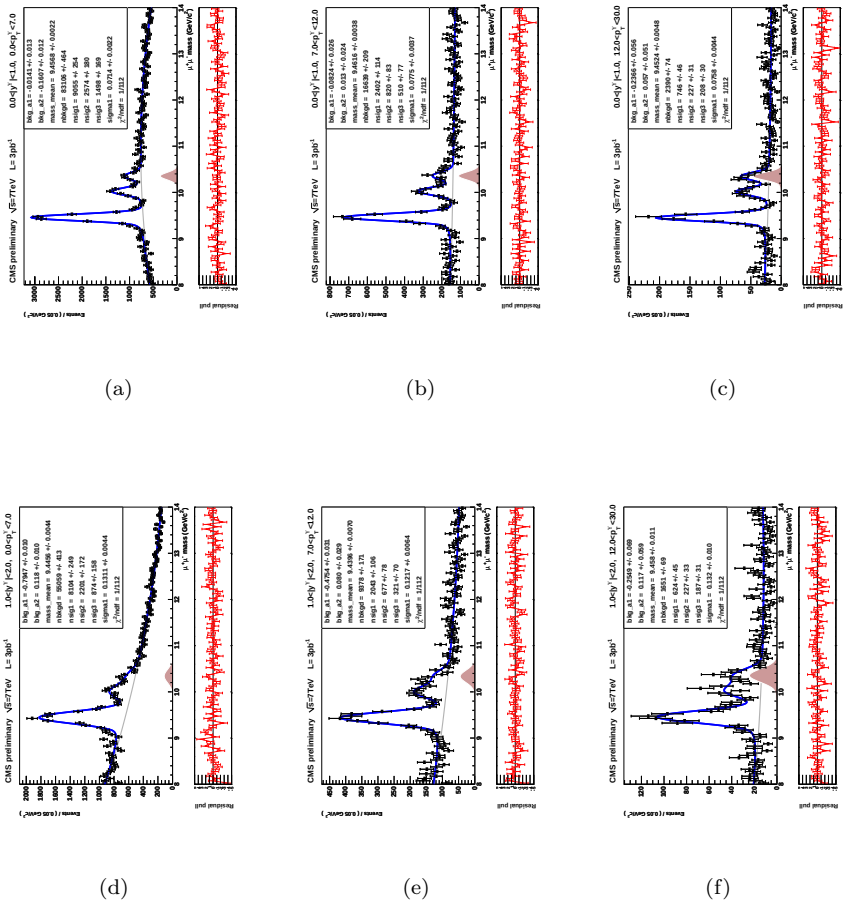
Figure 105: Υ(3S) systematic mass fits:EtrkHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

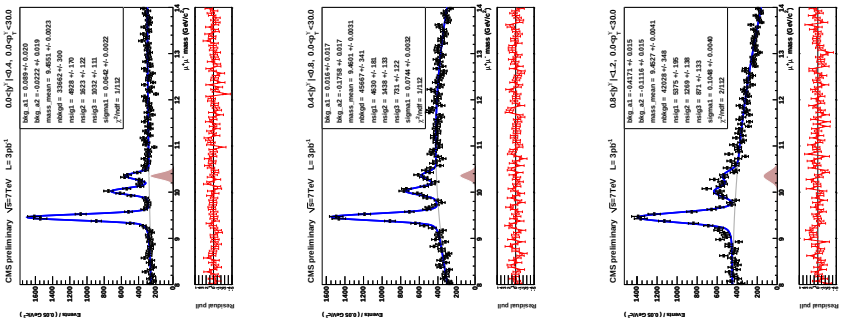
Figure 106: $\Upsilon(3S)$ systematic mass fits:EtrkHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



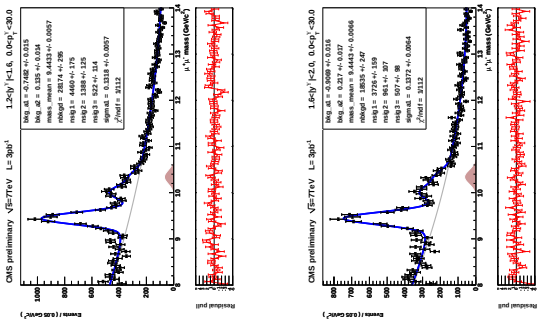
(a) (b) (c)

(d) (e) (f)

Figure 107: Υ(3S) systematic mass fits:EtrkHi, for $d\sigma/d|y|$ binning.



(a) (b) (c)

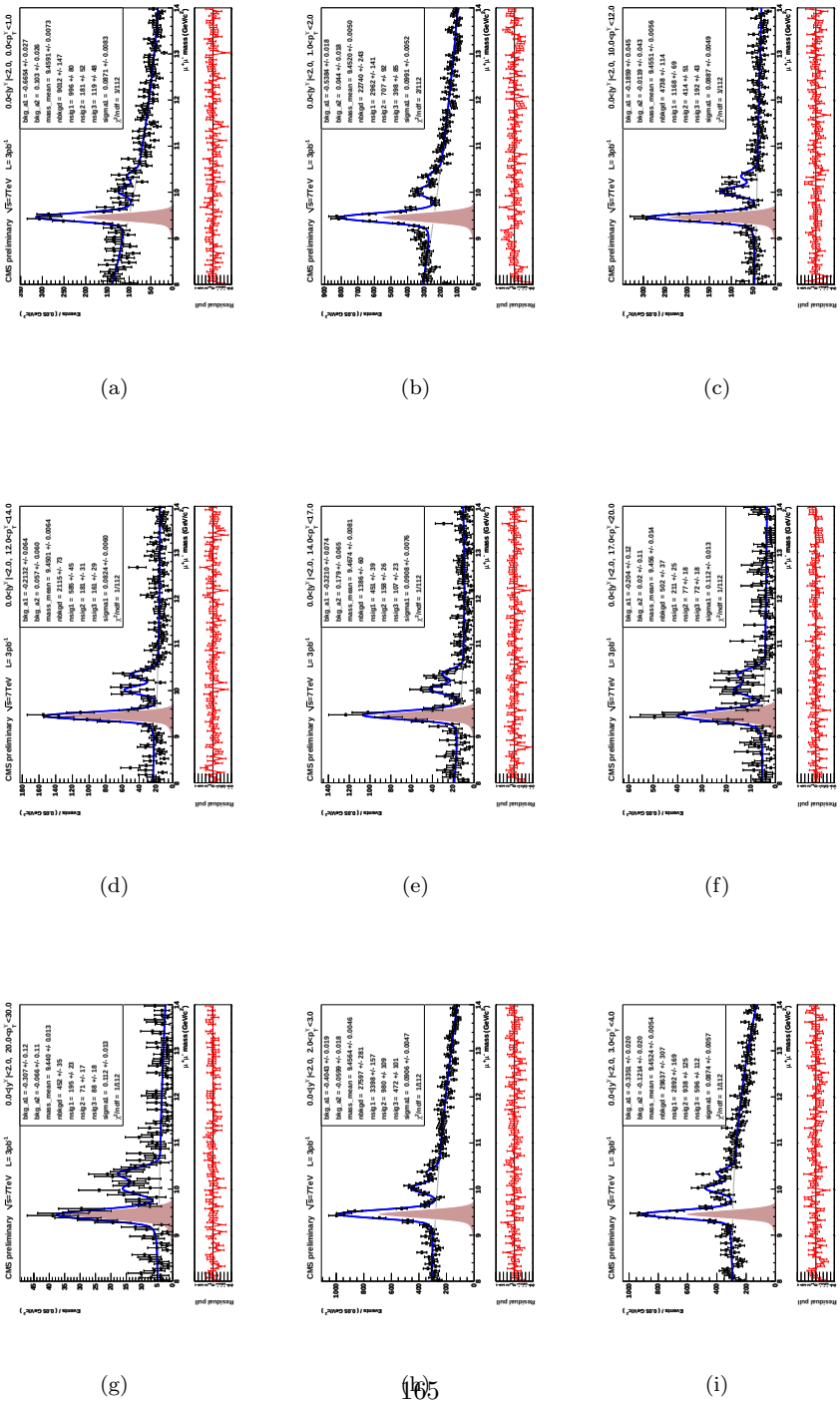


(d) (e)

0.8.8 systematics source: EtrecoHi

Systematics contribution from muon id and trigger stat uncertainty (-1σ)

Figure 108: Υ(1S) systematic mass fits:EtrecoHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



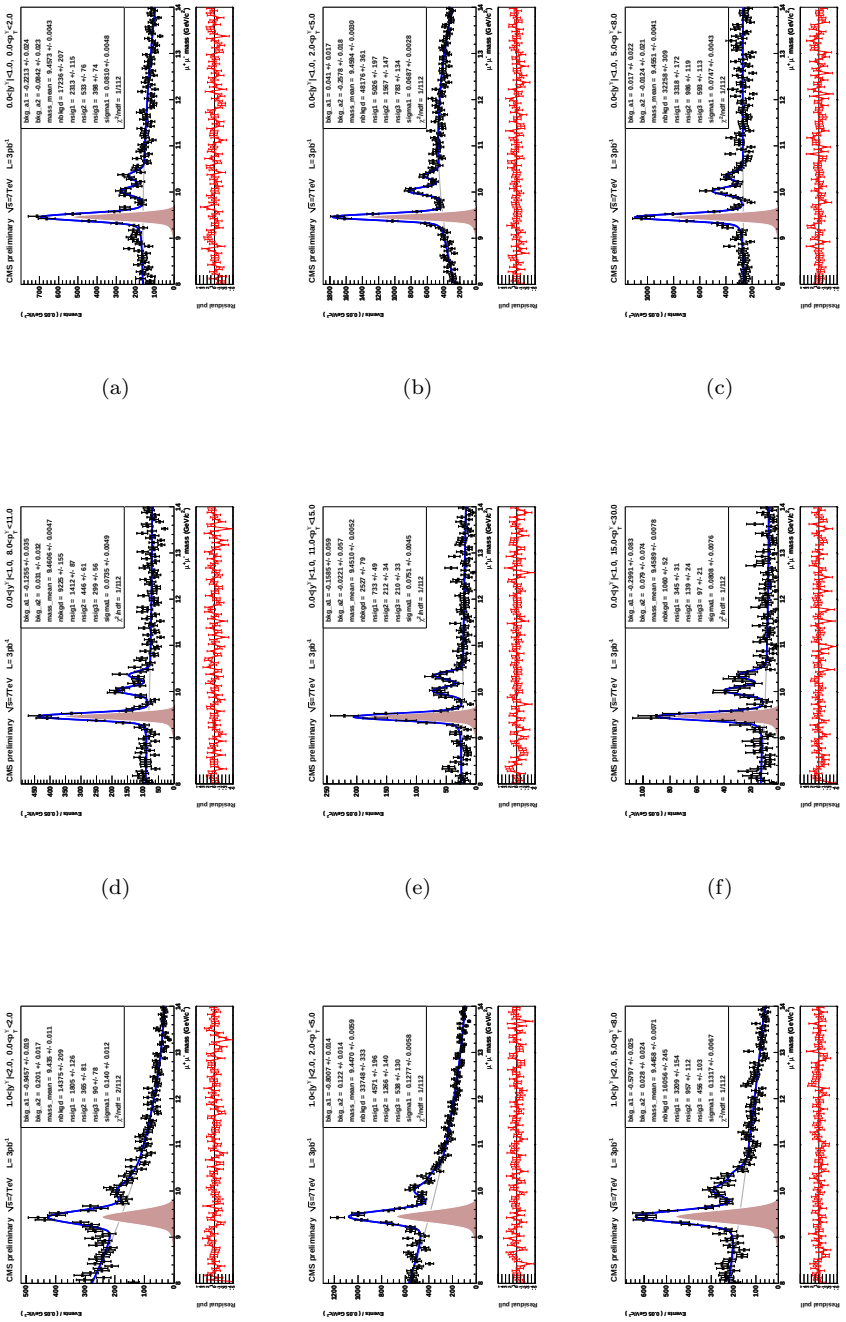
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 109: Υ(1S) systematic mass fits:EtrecoHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

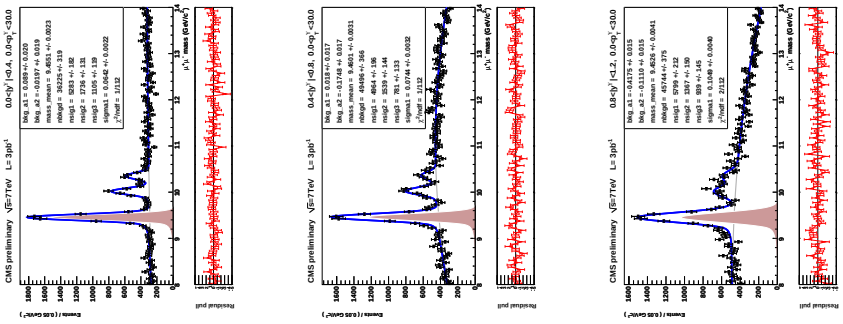


(a) (b) (c)

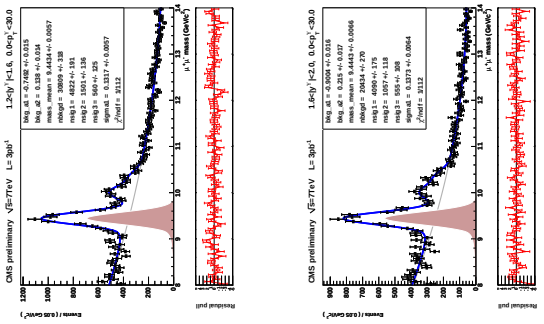
(d) (e) (f)

(g) (h) (i)

Figure 110: Υ(1S) systematic mass fits:EtrecoHi, for $d\sigma/d|y|$ binning.

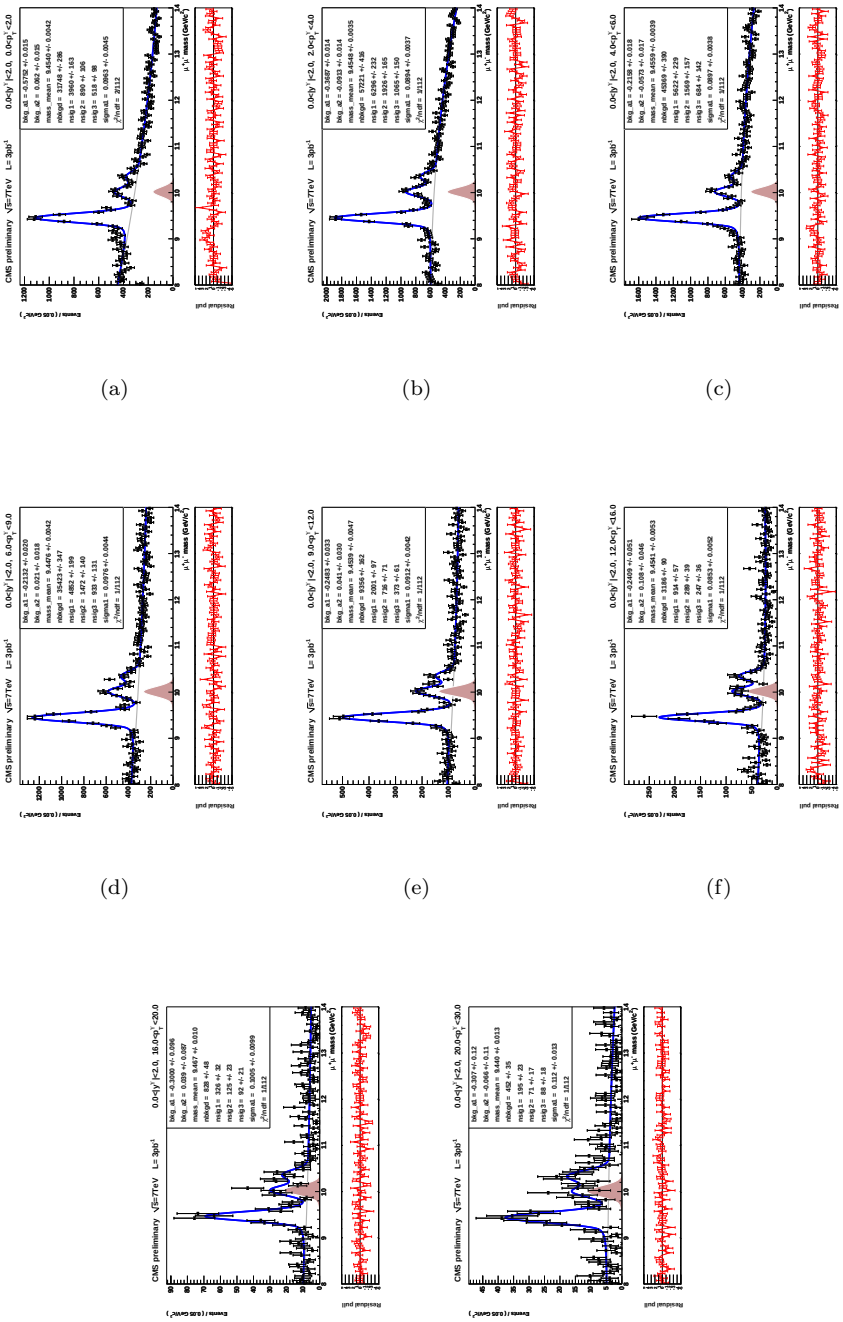


(a) (b) (c)



(d) (e)

Figure 111: Υ(2S) systematic mass fits:EtrecoHi, for $d\sigma/dp_{\mathrm{T}}, |y|$: $(0, 2)$ binning.

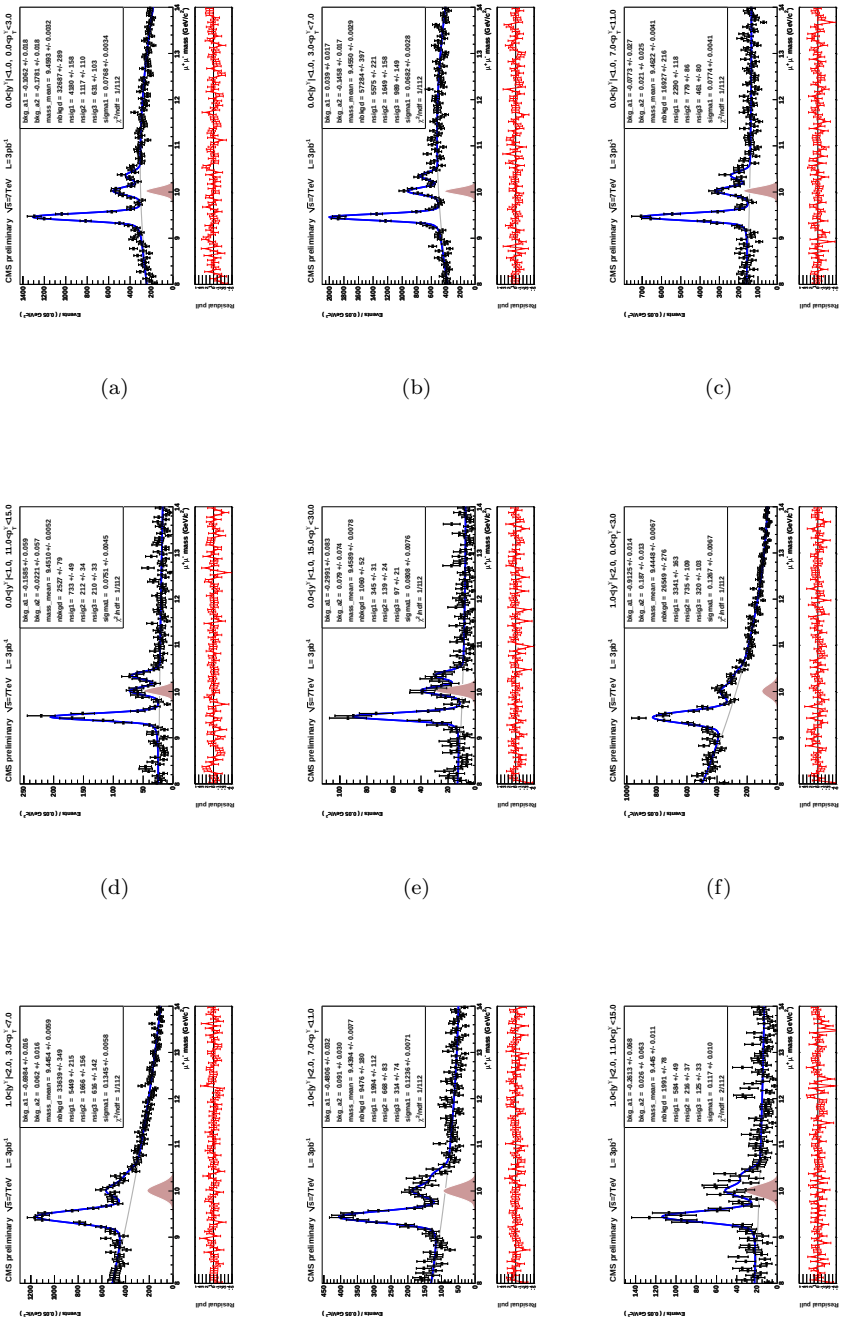


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 112: Υ(2S) systematic mass fits:EtrecoHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

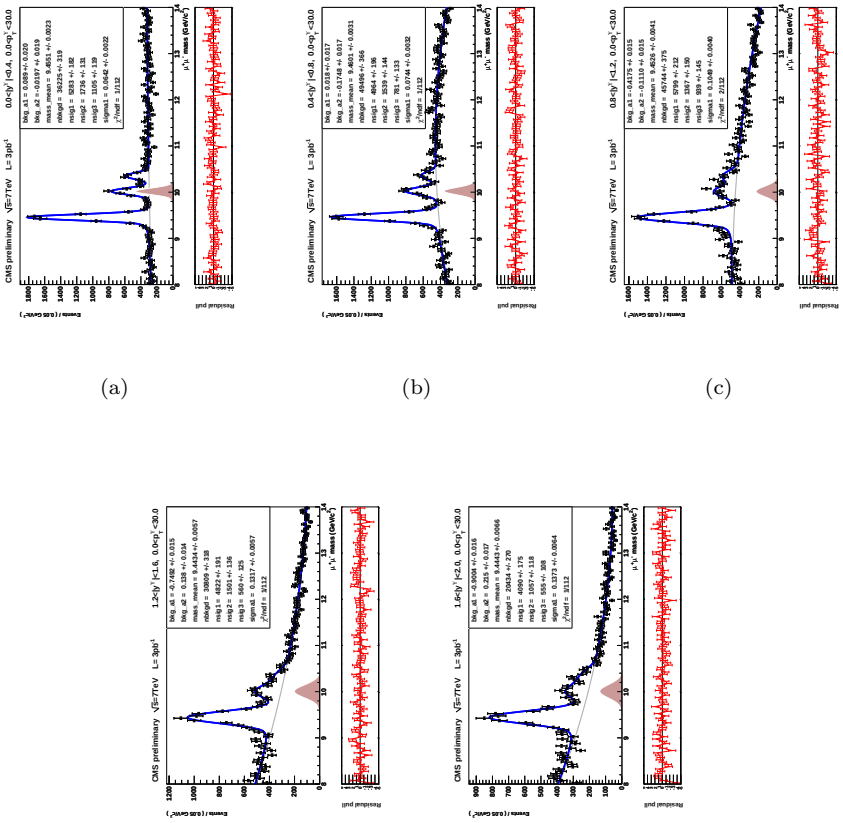


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

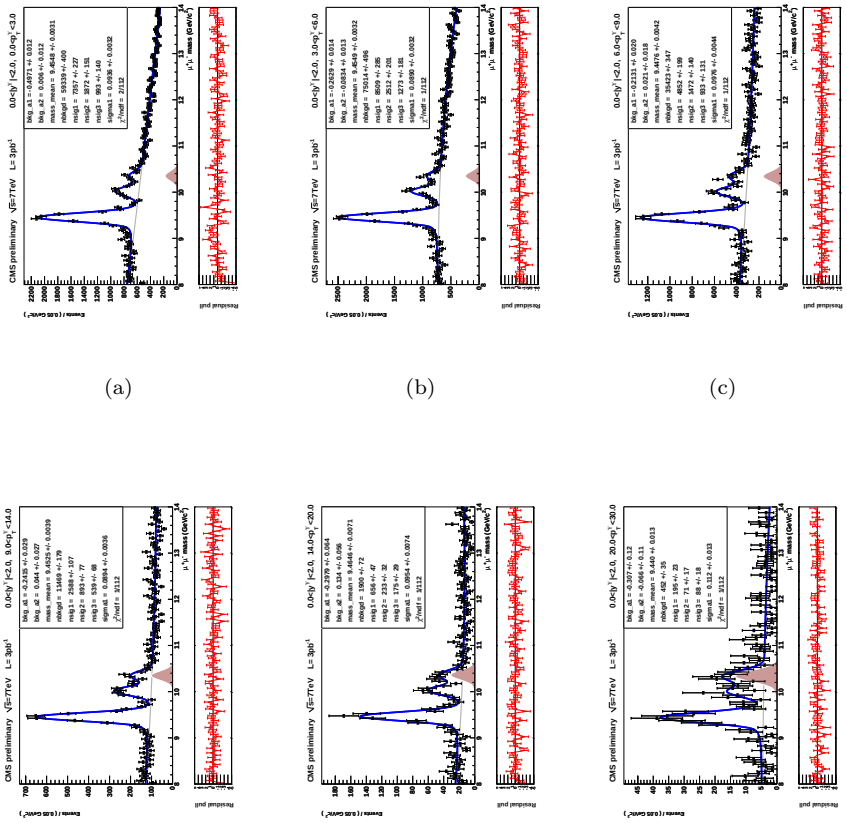
Figure 113: Υ(2S) systematic mass fits:EtrecoHi, for $d\sigma/d|y|$ binning.



(a) (b) (c)

(d) (e)

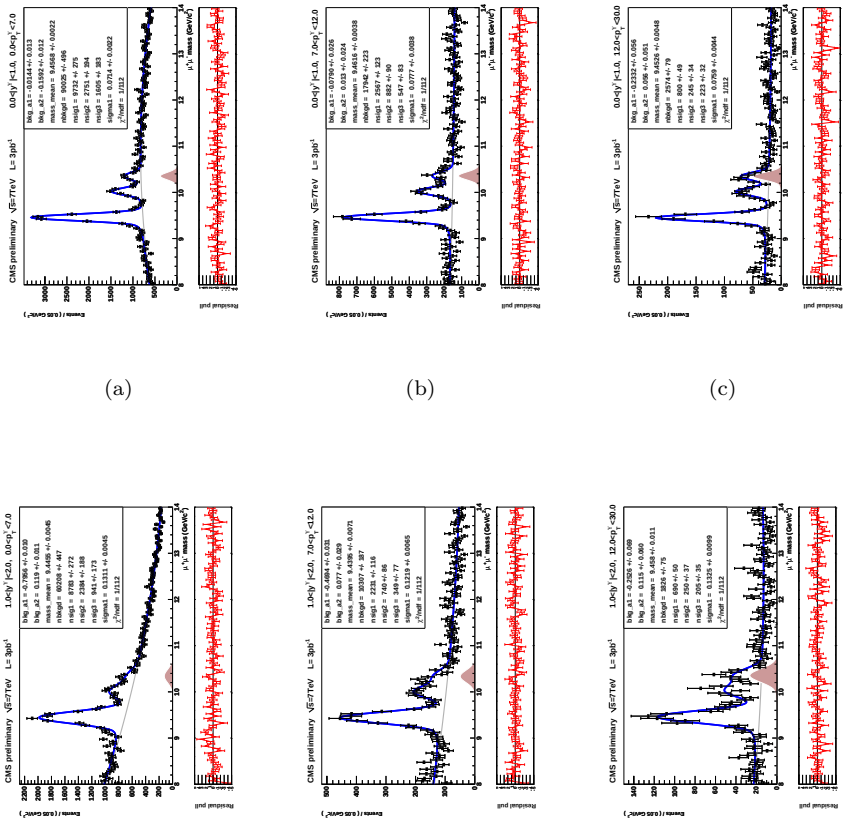
Figure 114: $\Upsilon(3S)$ systematic mass fits:EtrecoHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

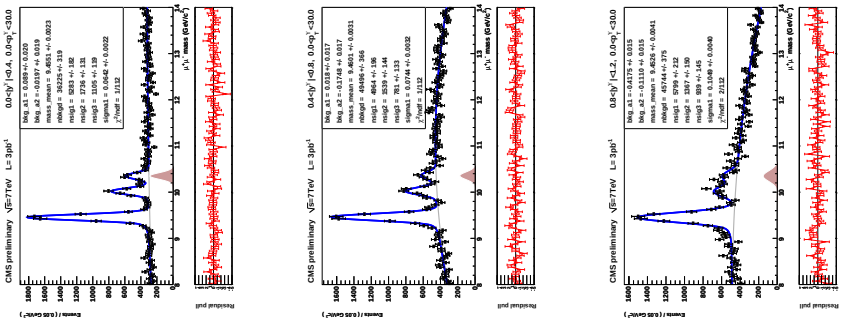
Figure 115: Υ(3S) systematic mass fits:EtrecoHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



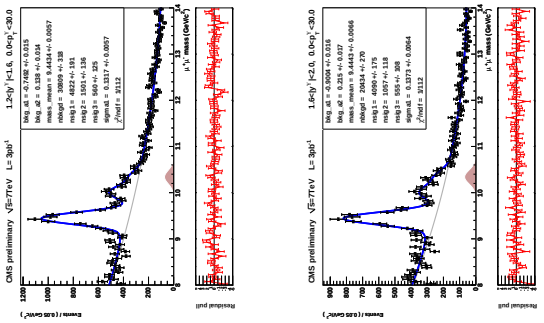
(a) (b) (c)

(d) (e) (f)

Figure 116: Υ(3S) systematic mass fits:EtrecoHi, for $d\sigma/d|y|$ binning.



(a) (b) (c)

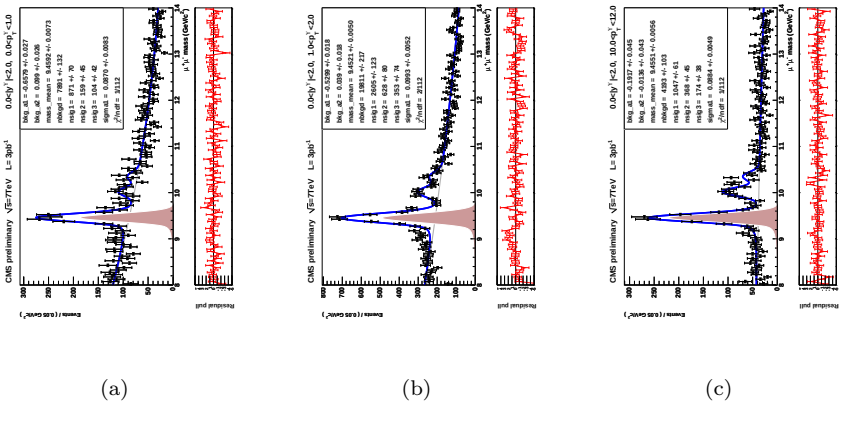


(d) (e)

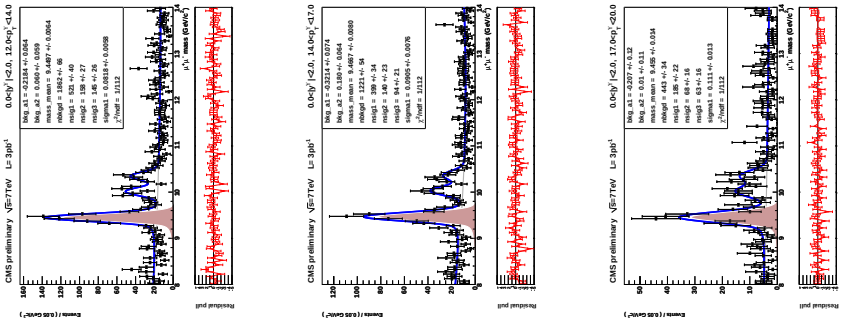
0.8.9 systematics source: EtrecoLo

Systematics contribution from muon id and trigger stat uncertainty ($+1\sigma$)

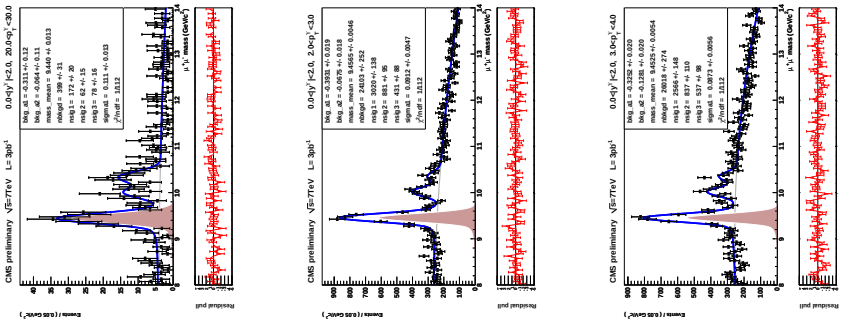
Figure 117: $\Upsilon(1S)$ systematic mass fits:EtrecoLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

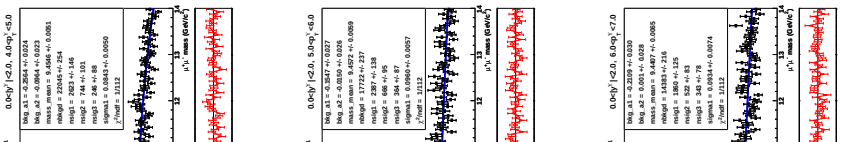
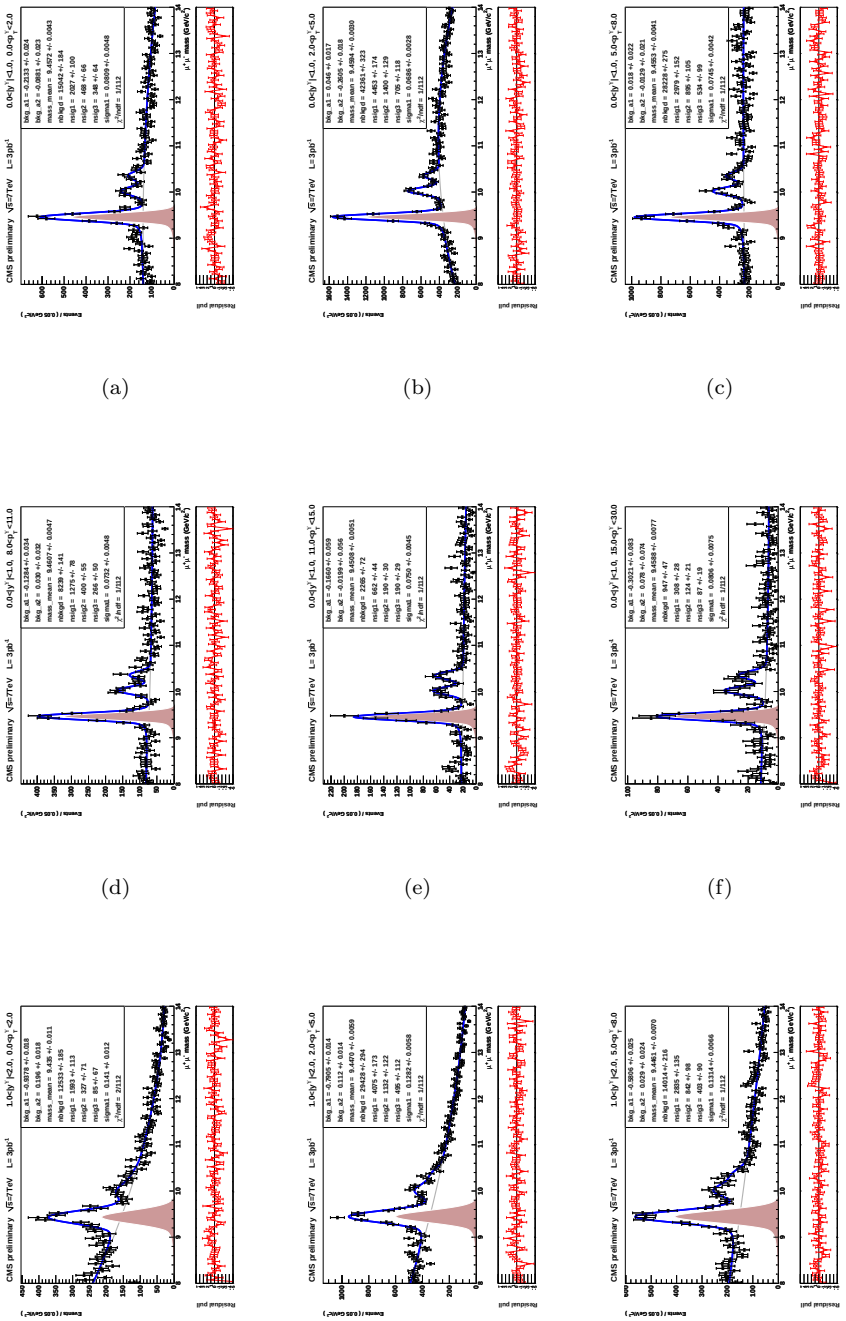


Figure 118: Υ(1S) systematic mass fits:EtrecoLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

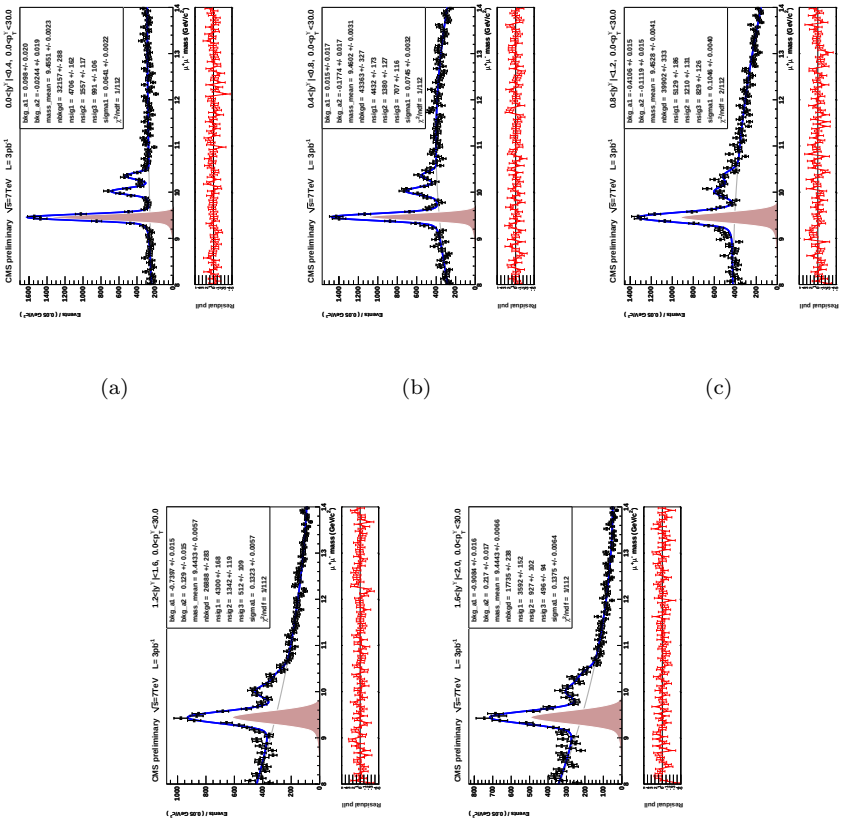


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

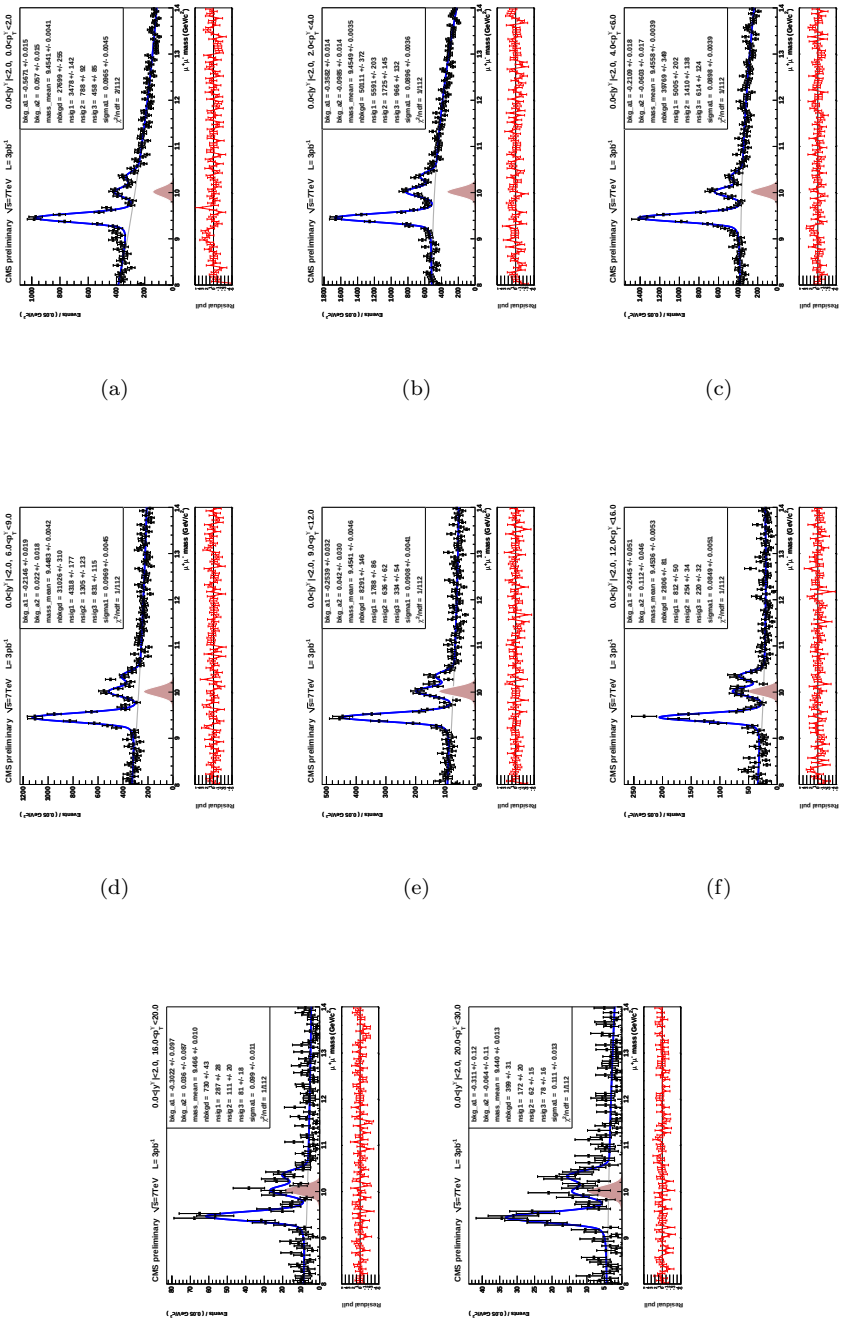
Figure 119: Υ(1S) systematic mass fits:EtrecoLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

(d) (e)

Figure 120: Υ(2S) systematic mass fits:EtrecoLo, for $d\sigma/dp_{\mathrm{T}}, |y|$: $(0, 2)$ binning.

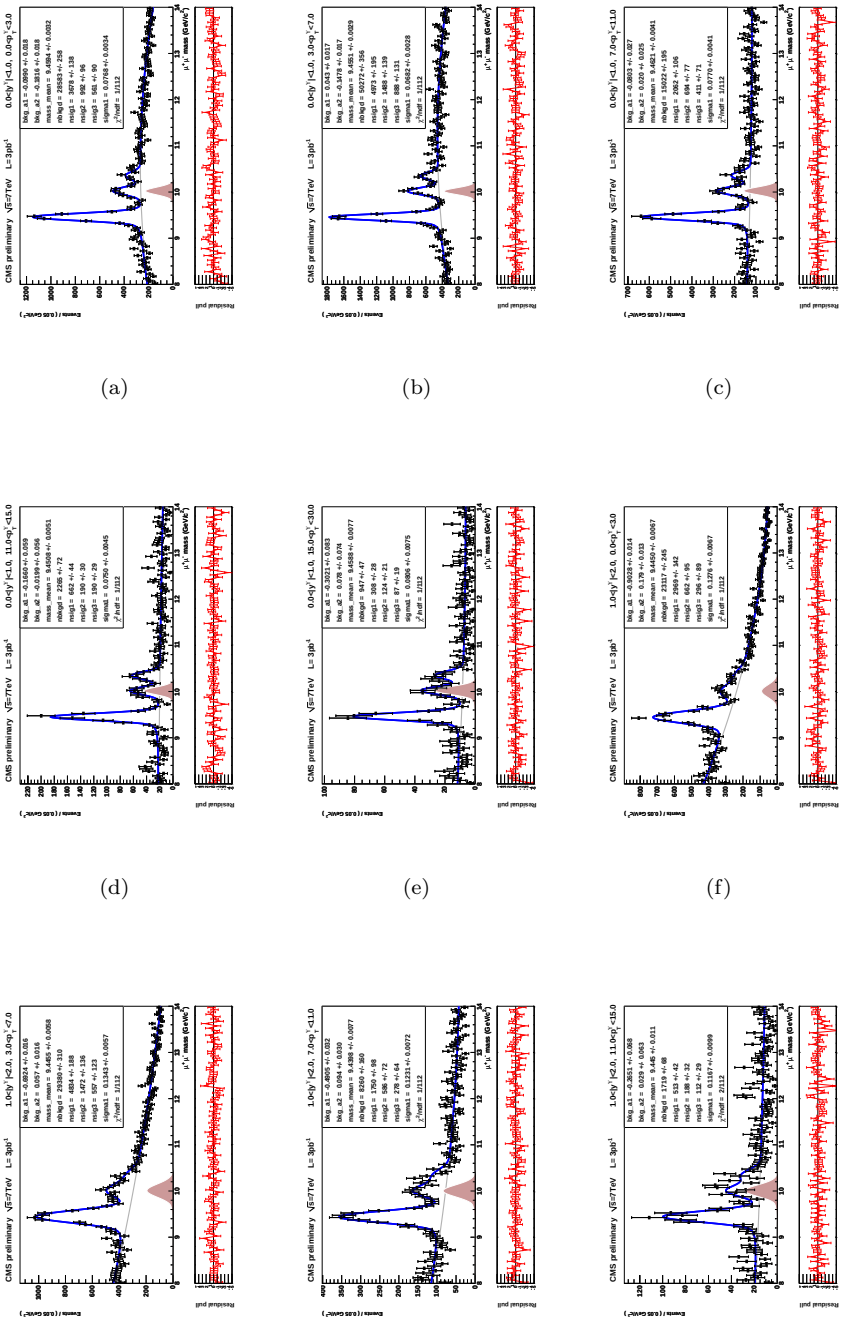


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 121: Υ(2S) systematic mass fits:EtrecoLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

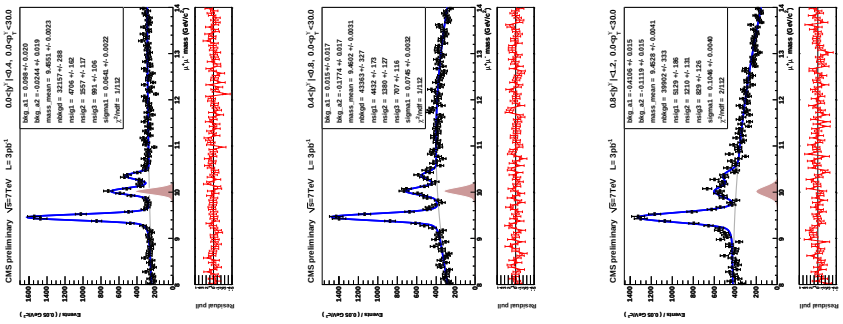


(a) (b) (c)

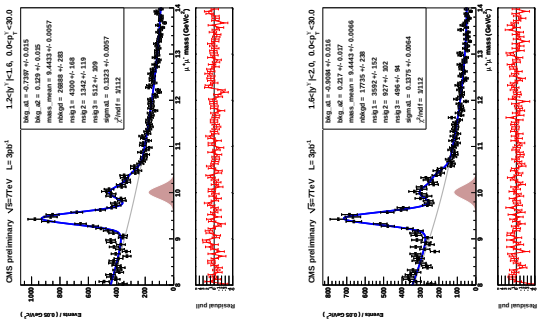
(d) (e) (f)

(g) (h) (i)

Figure 122: Υ(2S) systematic mass fits:EtrecoLo, for $d\sigma/d|y|$ binning.

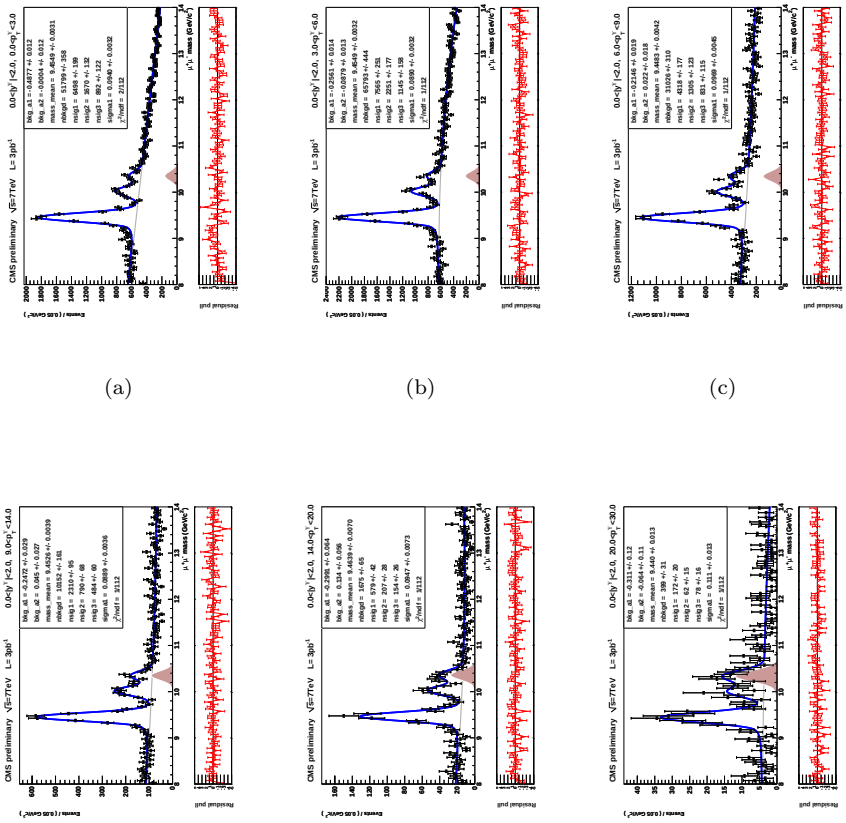


(a) (b) (c)



(d) (e)

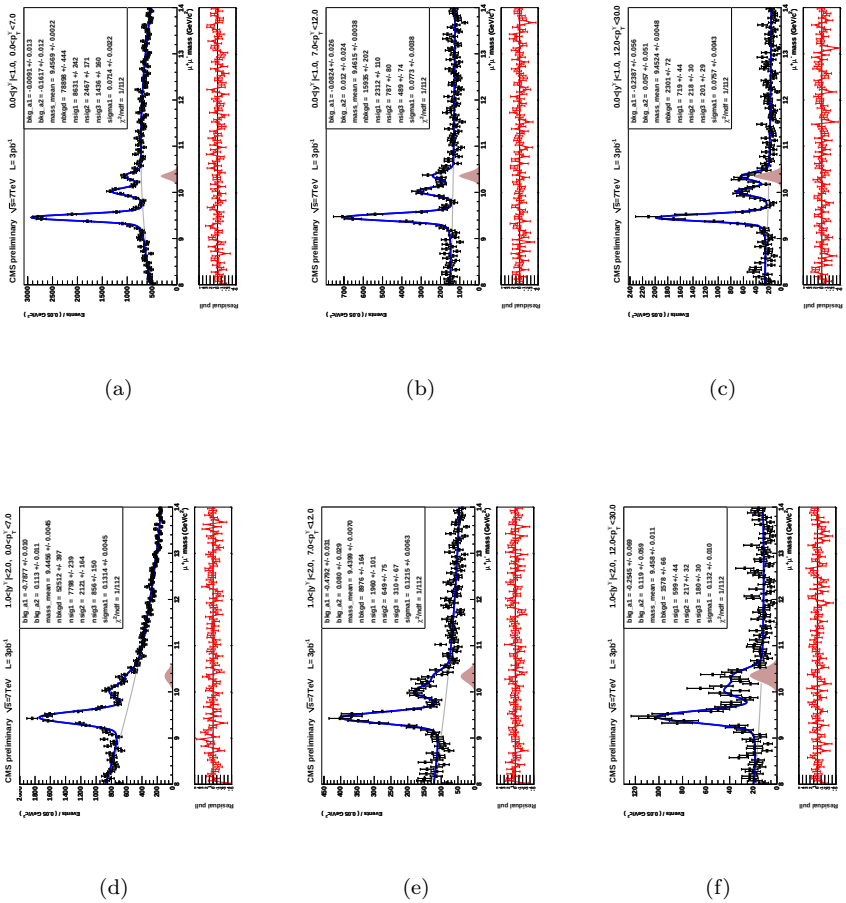
Figure 123: $\Upsilon(3S)$ systematic mass fits:EtrecoLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

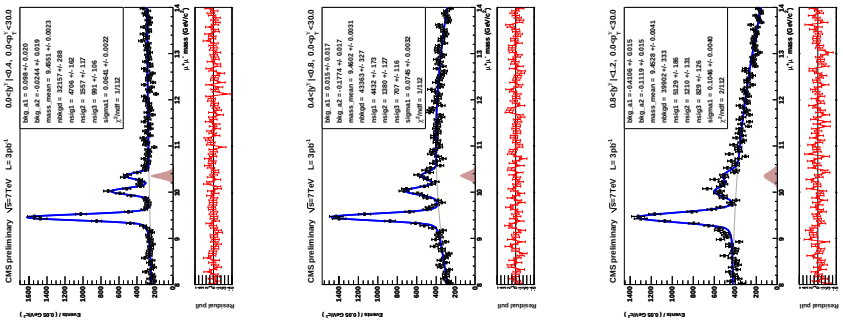
Figure 124: Υ(3S) systematic mass fits:EtrecoLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



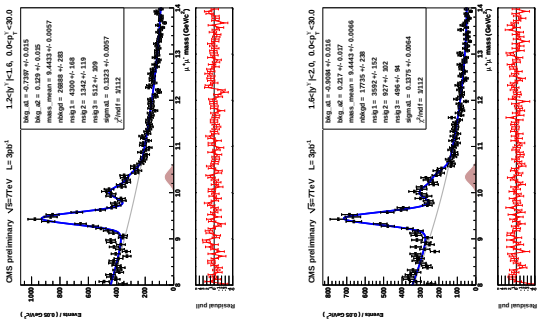
(a) (b) (c)

(d) (e) (f)

Figure 125: Υ(3S) systematic mass fits:EtrecoLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

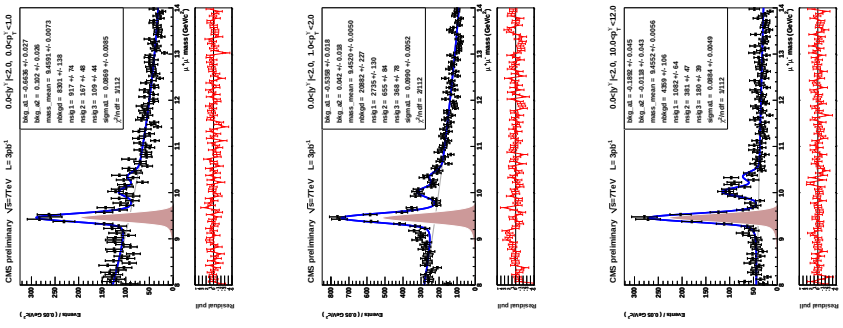


(d) (e)

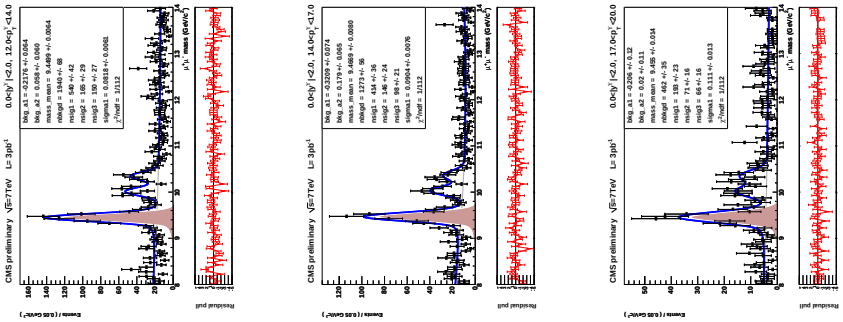
0.8.10 systematics source: AccLo

Systematics contribution from acceptance stat uncertainty ($+1\sigma$)

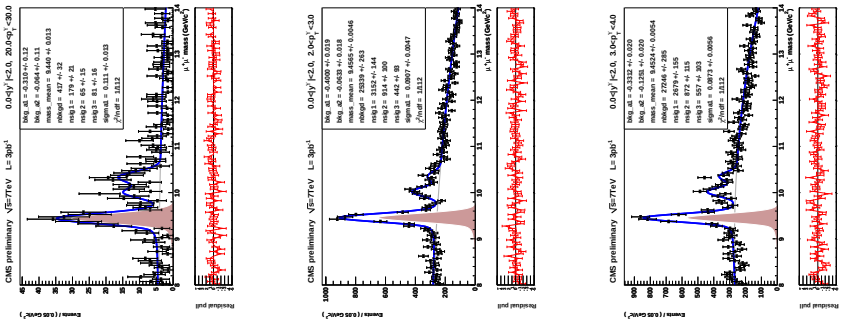
Figure 126: $\Upsilon(1S)$ systematic mass fits:AccLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

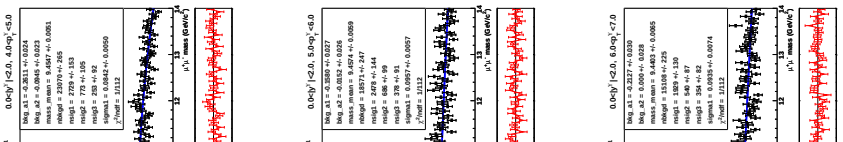
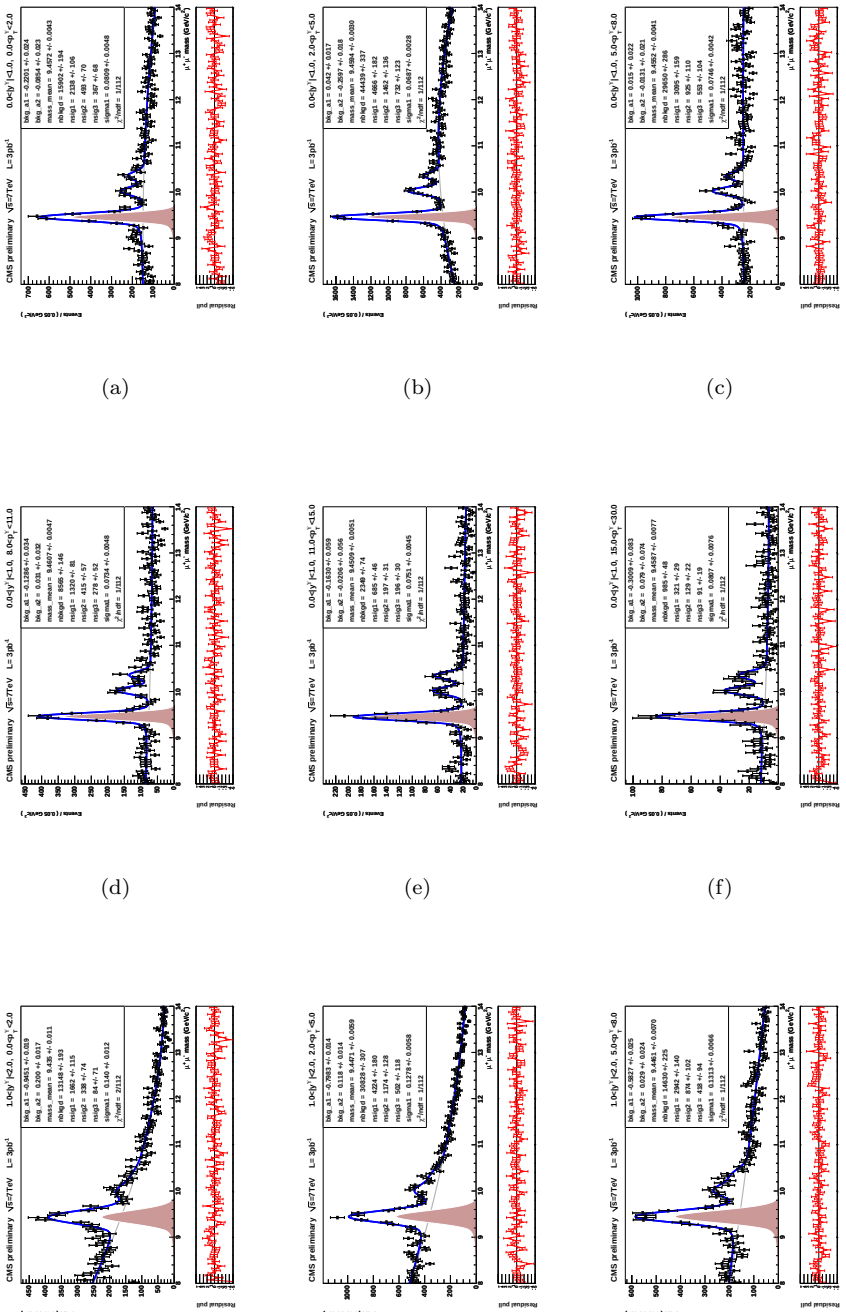


Figure 127: $\Upsilon(1S)$ systematic mass fits:AccLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

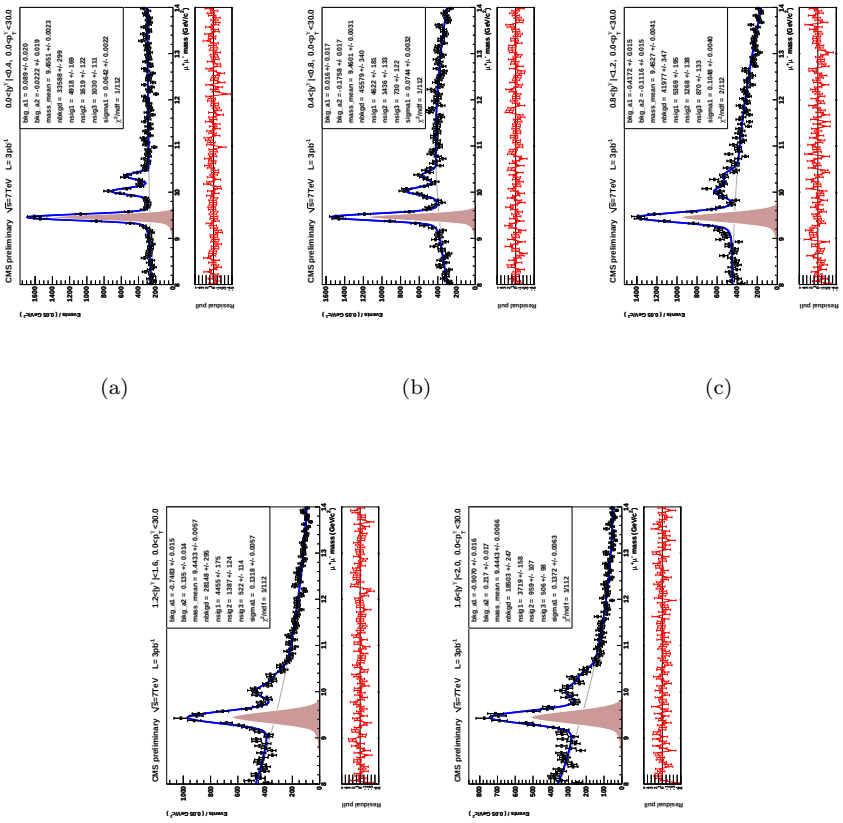


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

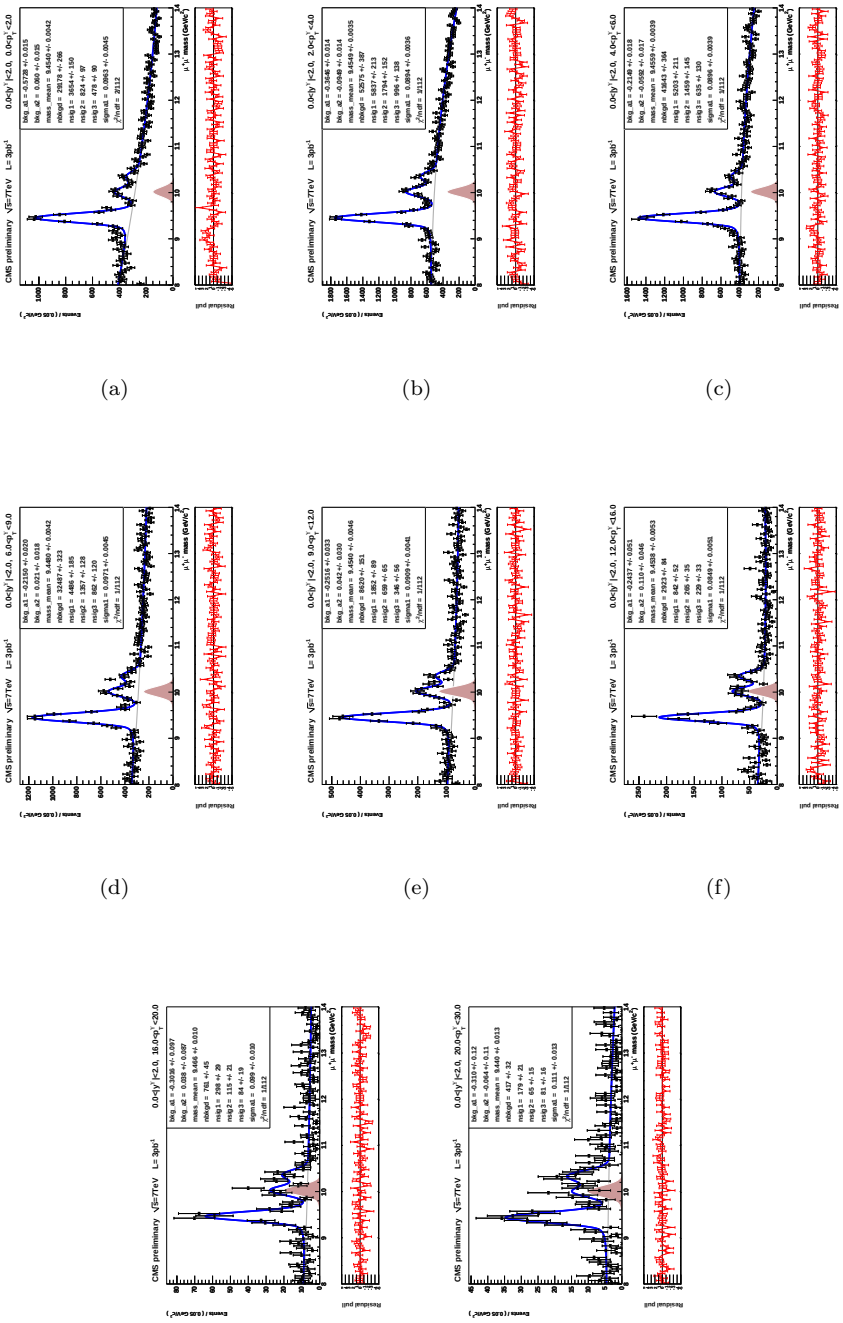
Figure 128: Υ(1S) systematic mass fits:AccLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

(d) (e)

Figure 129: Υ(2S) systematic mass fits:AccLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

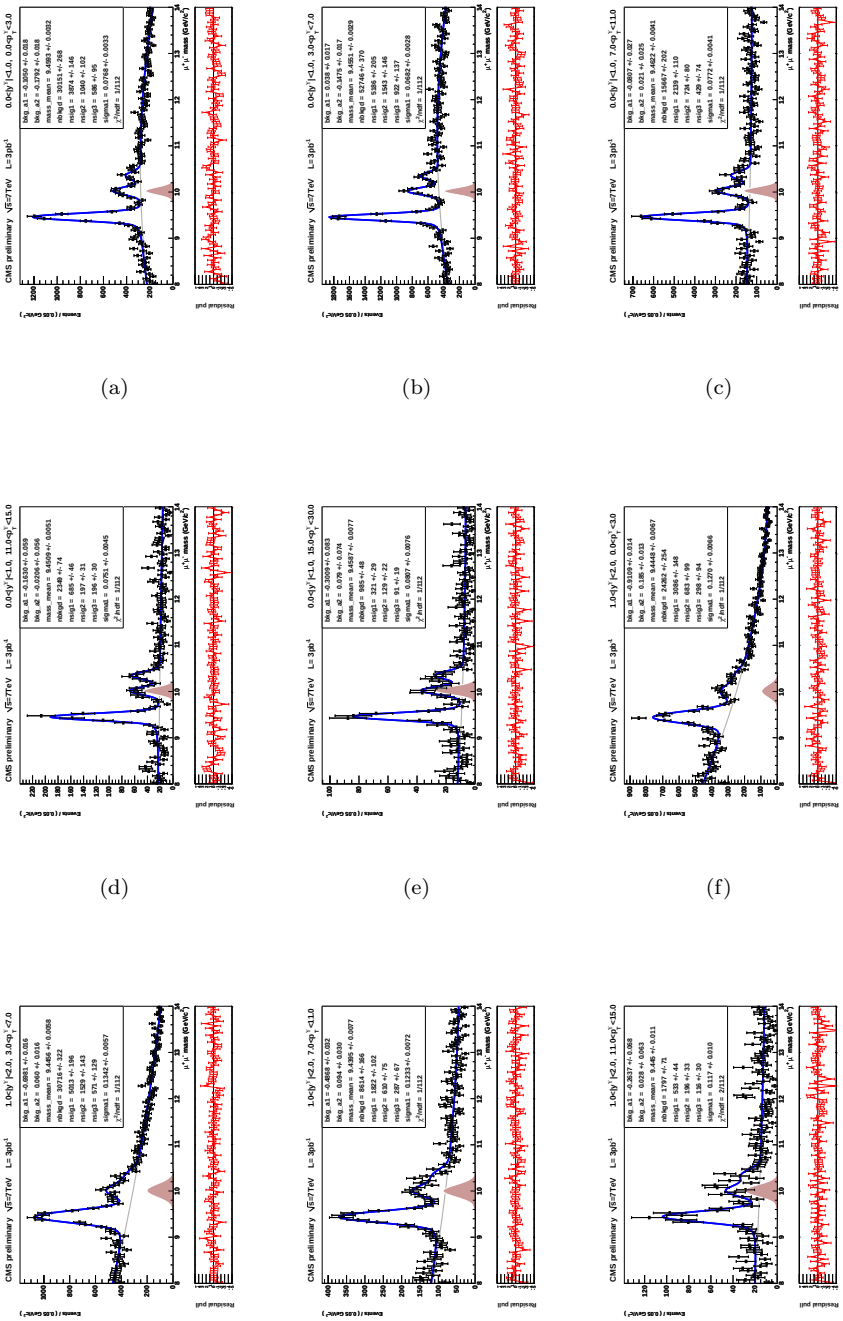


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 130: Υ(2S) systematic mass fits:AccLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

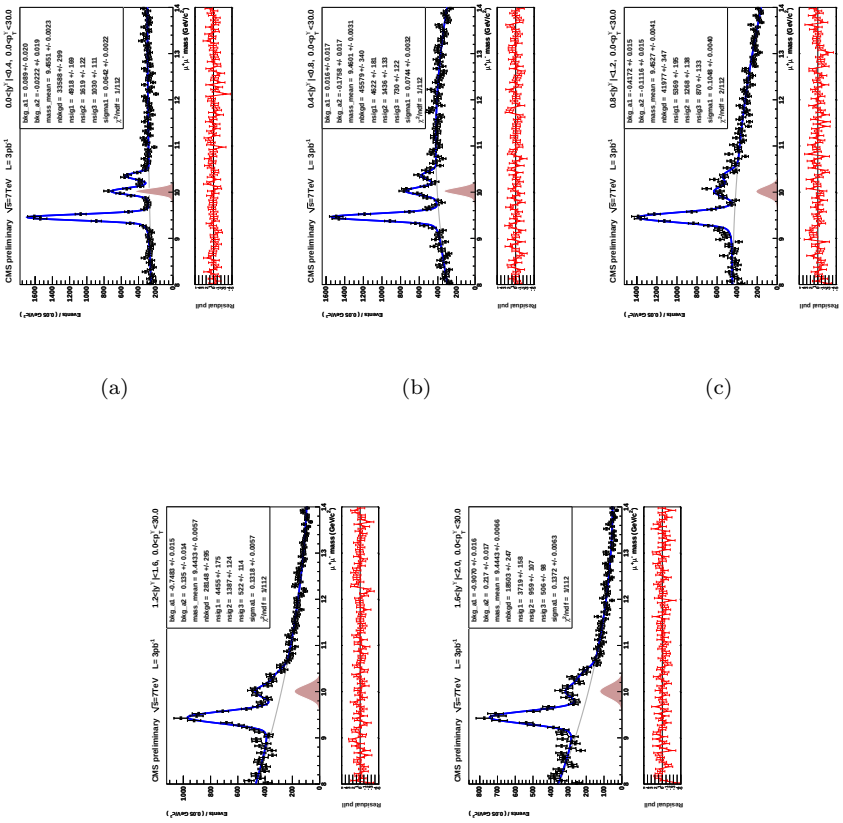


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

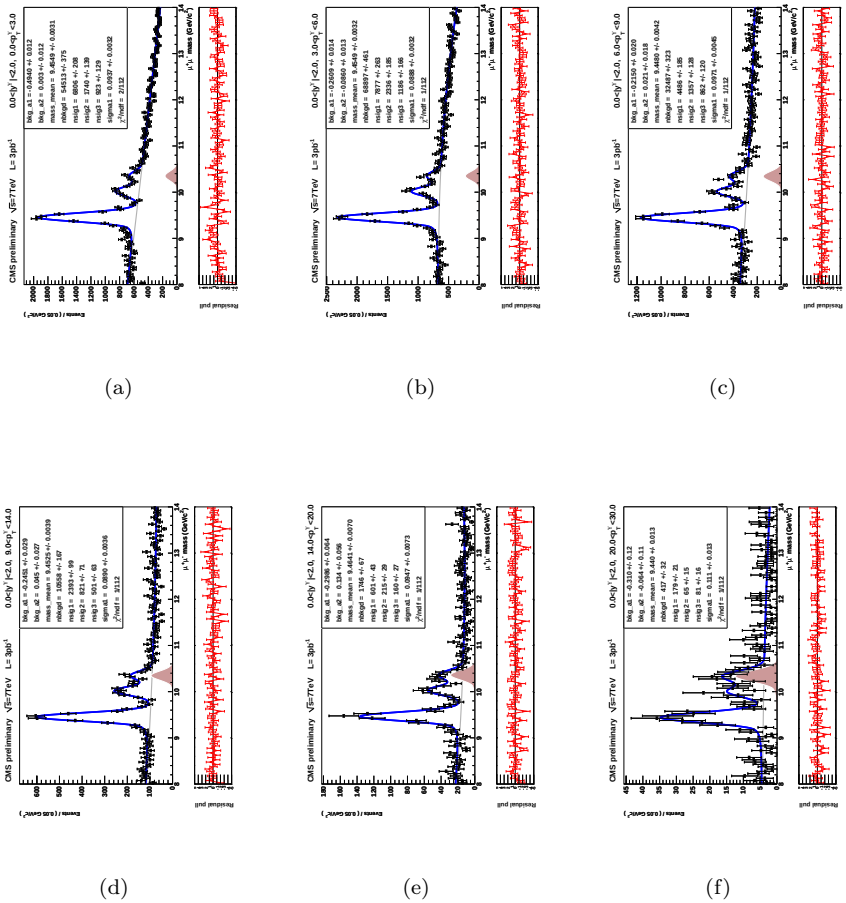
Figure 131: Υ(2S) systematic mass fits:AccLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

(d) (e)

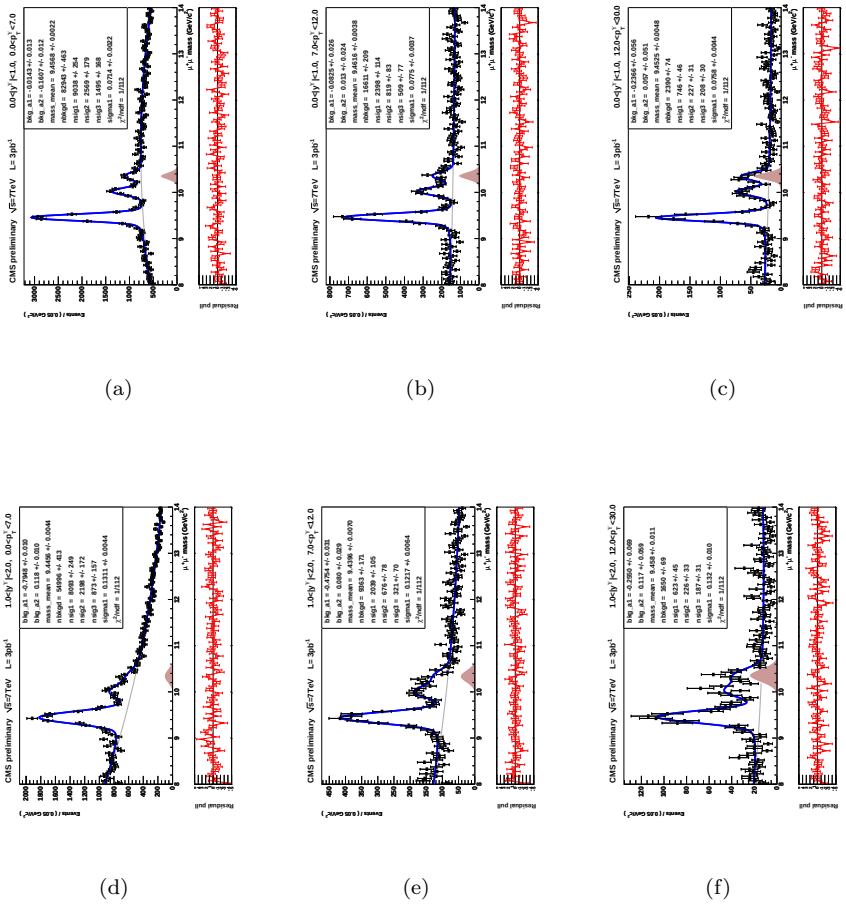
Figure 132: Υ(3S) systematic mass fits:AccLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

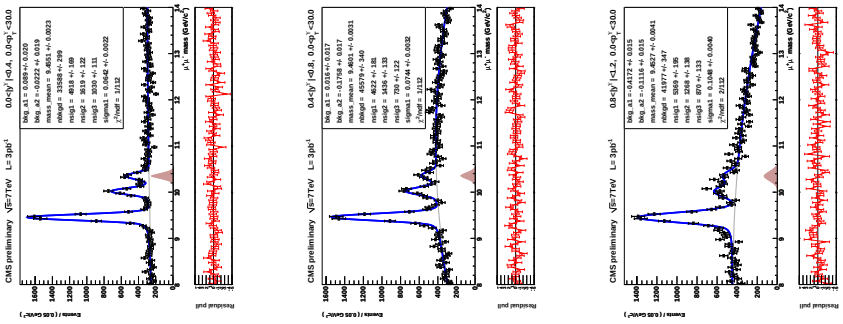
Figure 133: $\Upsilon(3S)$ systematic mass fits:AccLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



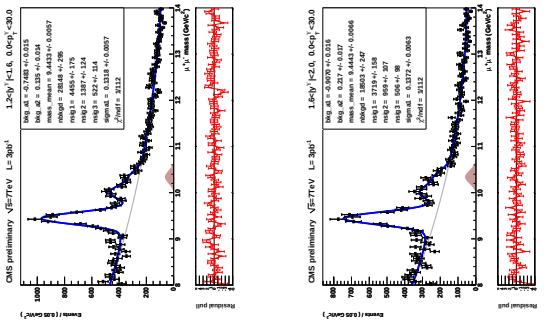
(a) (b) (c)

(d) (e) (f)

Figure 134: Υ(3S) systematic mass fits:AccLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

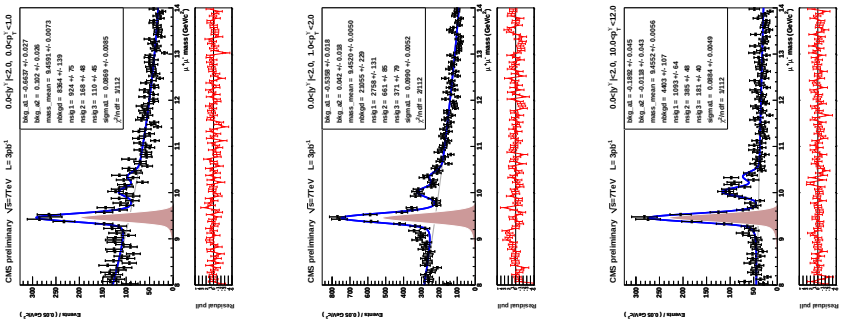


(d) (e)

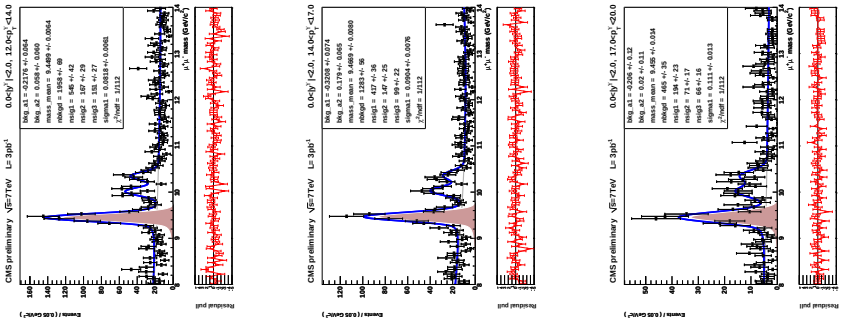
0.8.11 systematics source: AccHi

Systematics contribution from acceptance stat uncertainty (-1σ)

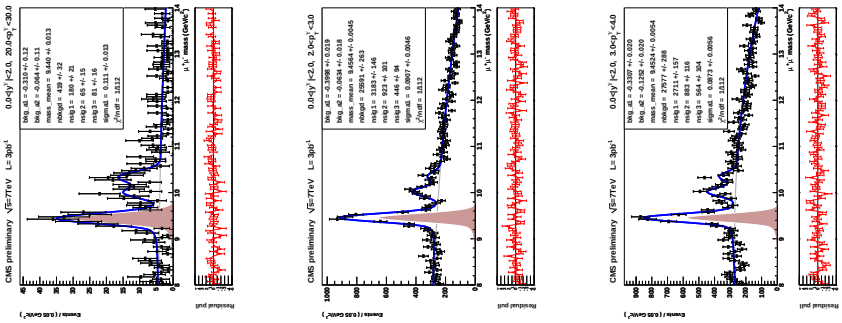
Figure 135: $\Upsilon(1S)$ systematic mass fits:AccHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



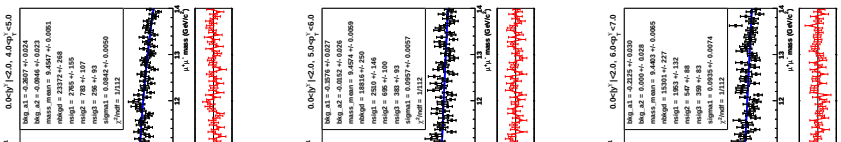
(a) (b) (c)



(d) (e) (f)

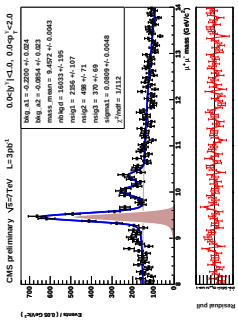


(g) (h) (i)

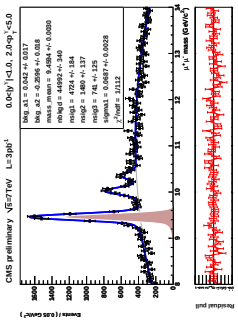


(j) (k) (l)

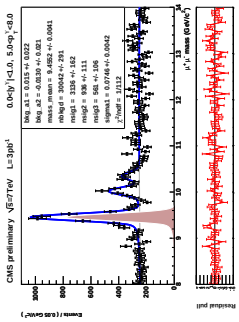
Figure 136: $\Upsilon(1S)$ systematic mass fits:AccHi, for $d\sigma/dp_{\rm T}$ $|y|$: $(0,1),(1,2)$ binning.



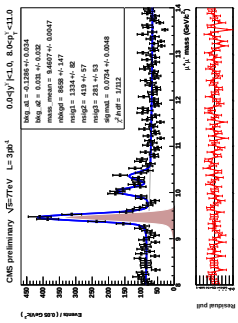
(a)



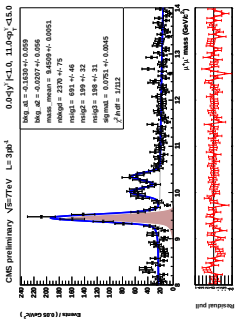
(b)



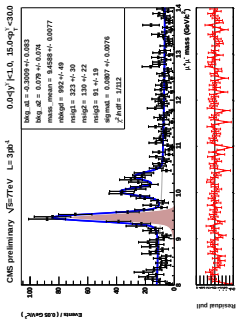
(c)



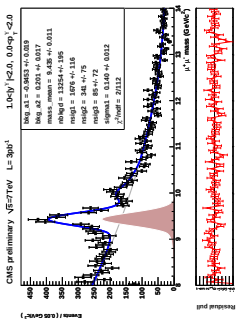
(d)



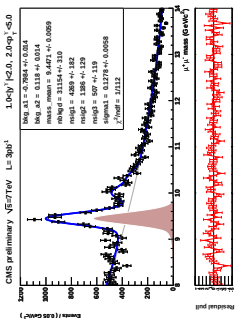
(e)



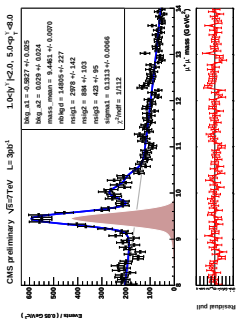
(f)



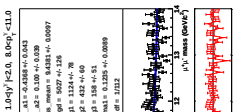
(g)

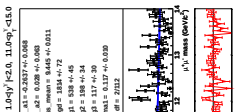


(h)



(i)





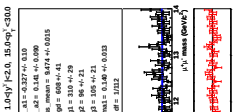
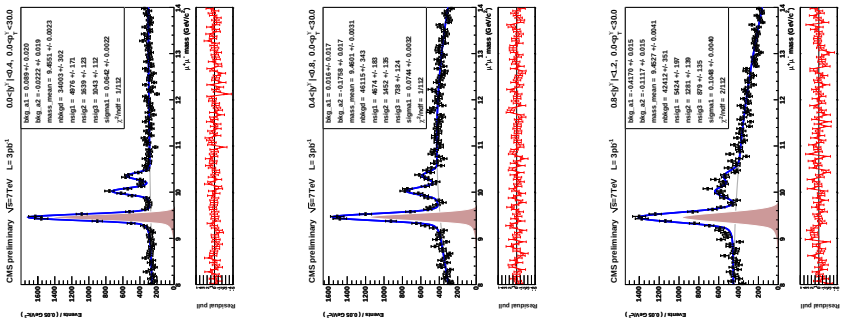
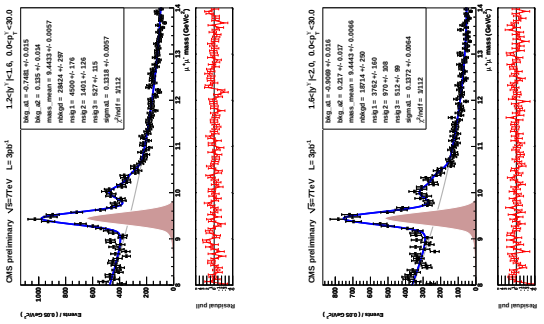


Figure 137: Υ(1S) systematic mass fits:AccHi, for $d\sigma/d|y|$ binning.

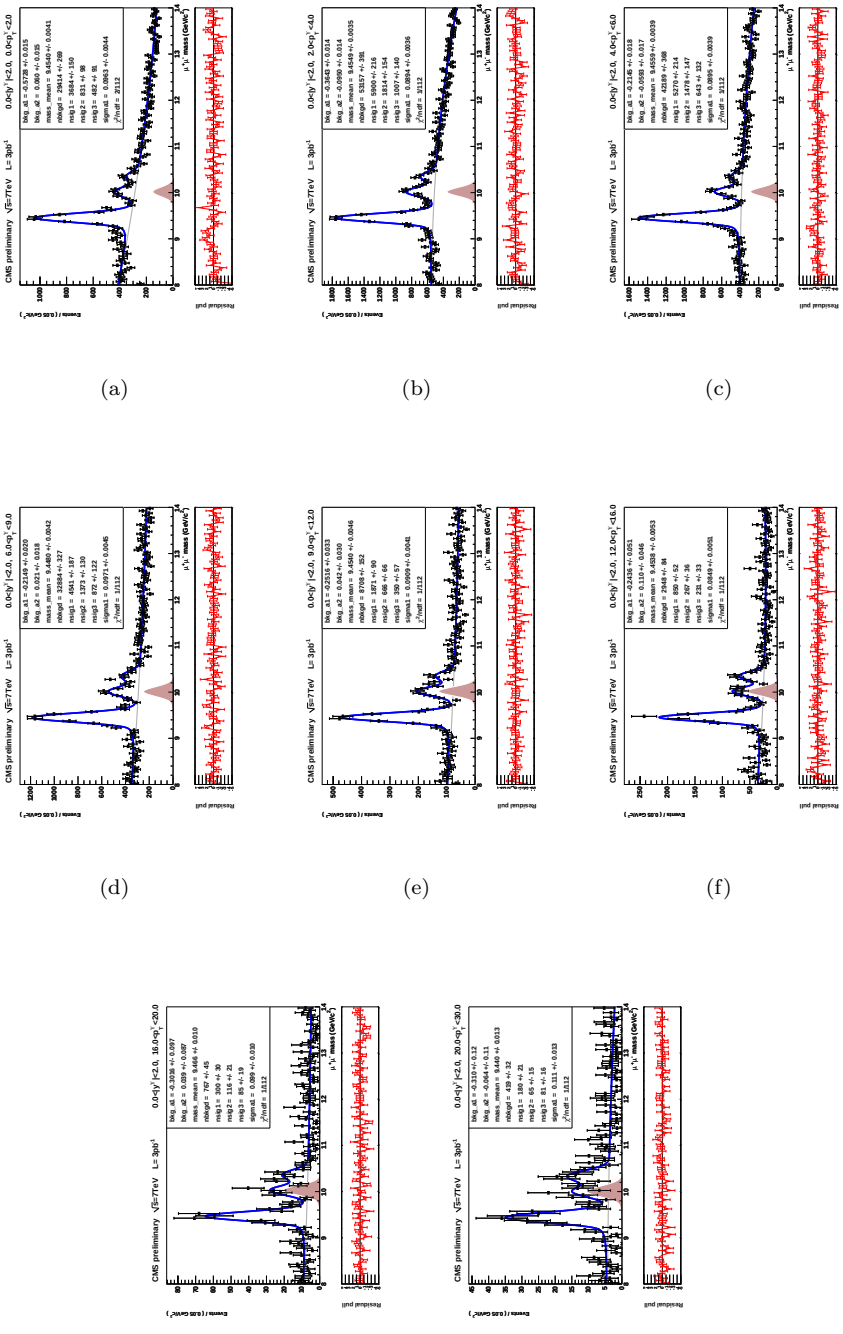


(a) (b) (c)



(d) (e)

Figure 138: $\Upsilon(2S)$ systematic mass fits:AccHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

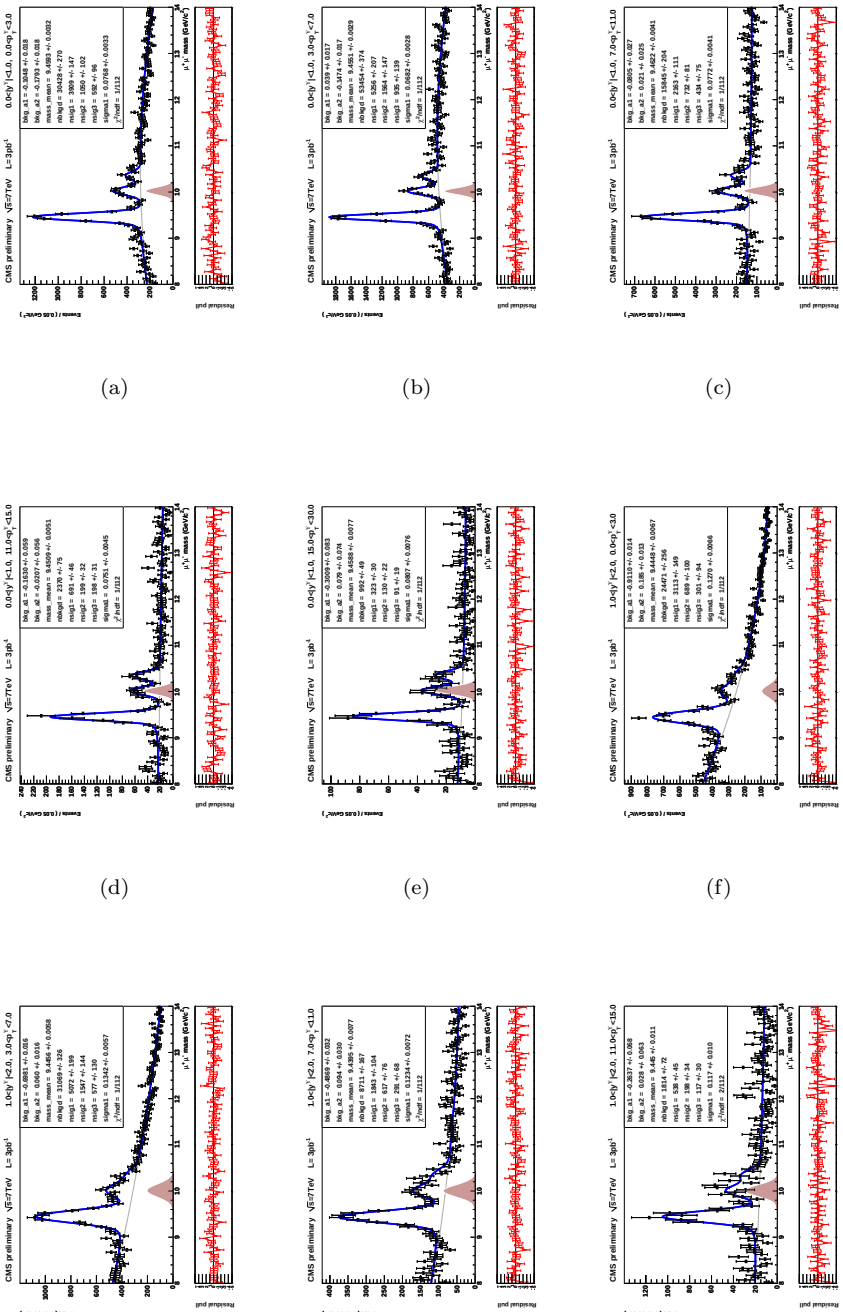


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 139: Υ(2S) systematic mass fits:AccHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

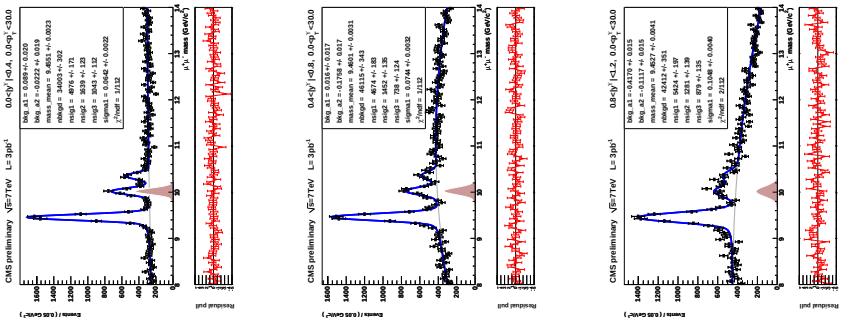


(a) (b) (c)

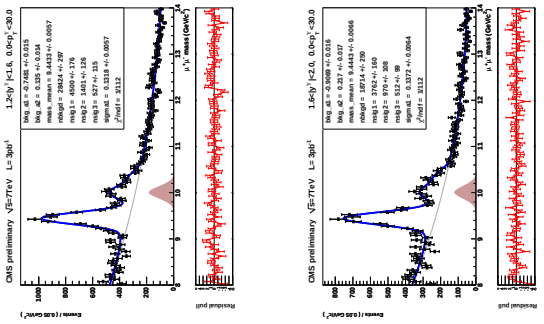
(d) (e) (f)

(g) (h) (i)

Figure 140: Υ(2S) systematic mass fits:AccHi, for $d\sigma/d|y|$ binning.

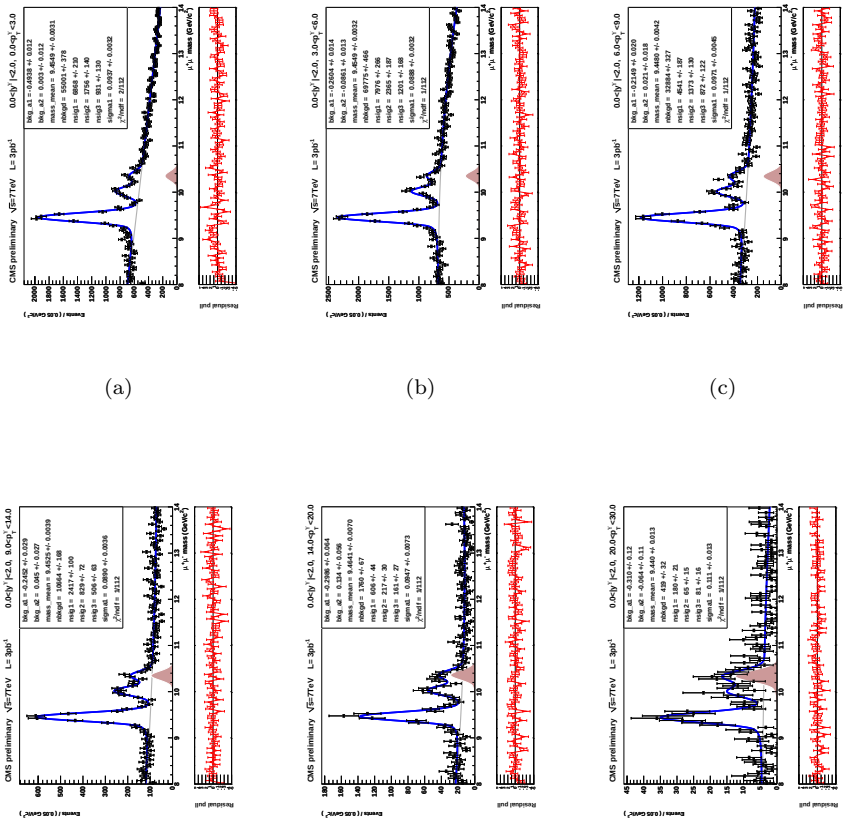


(a) (b) (c)



(d) (e)

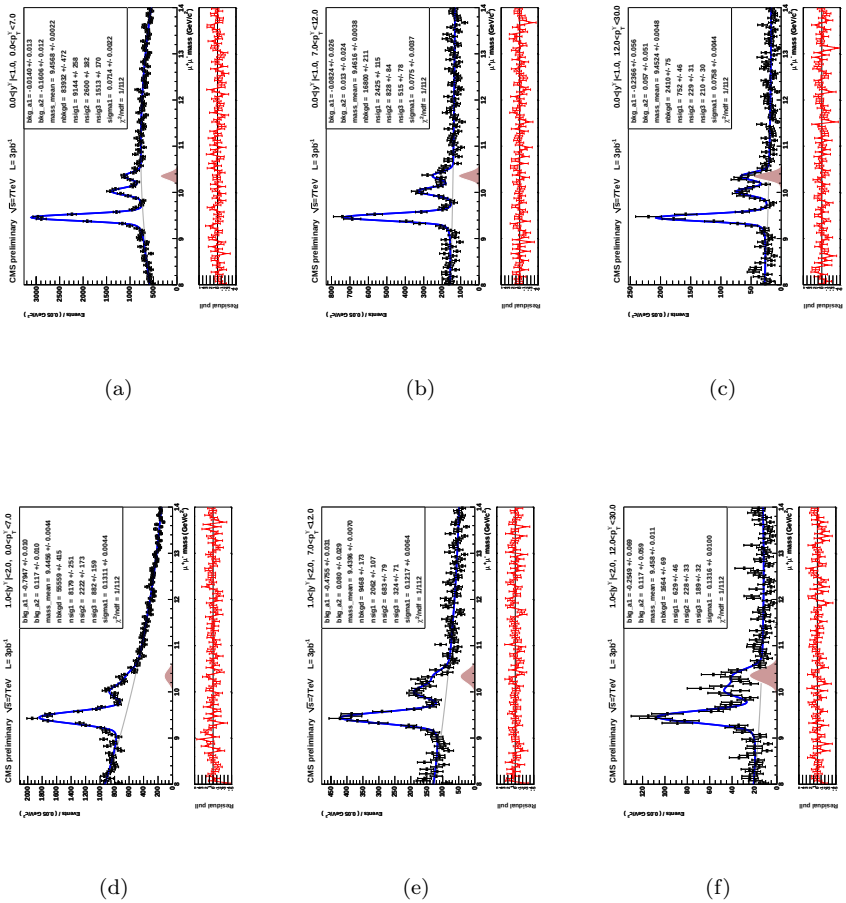
Figure 141: Υ(3S) systematic mass fits:AccHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

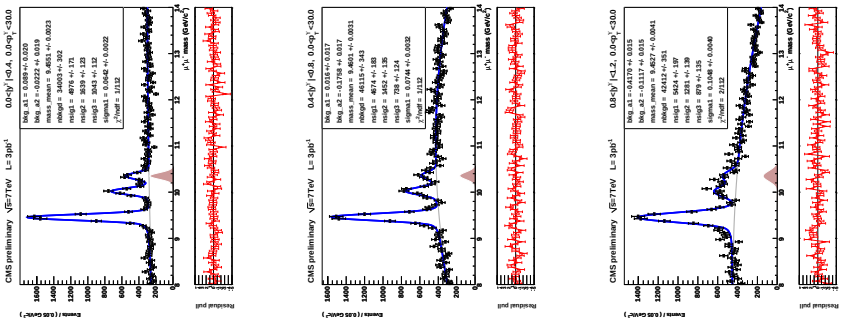
Figure 142: $\Upsilon(3S)$ systematic mass fits:AccHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



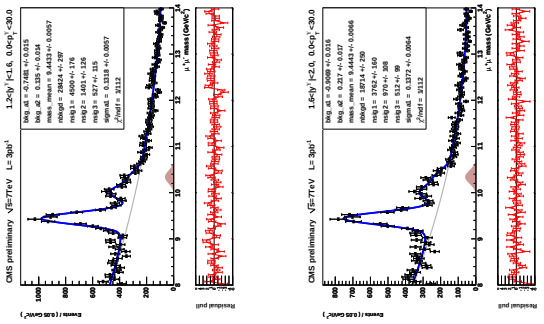
(a) (b) (c)

(d) (e) (f)

Figure 143: Υ(3S) systematic mass fits:AccHi, for $d\sigma/d|y|$ binning.



(a) (b) (c)

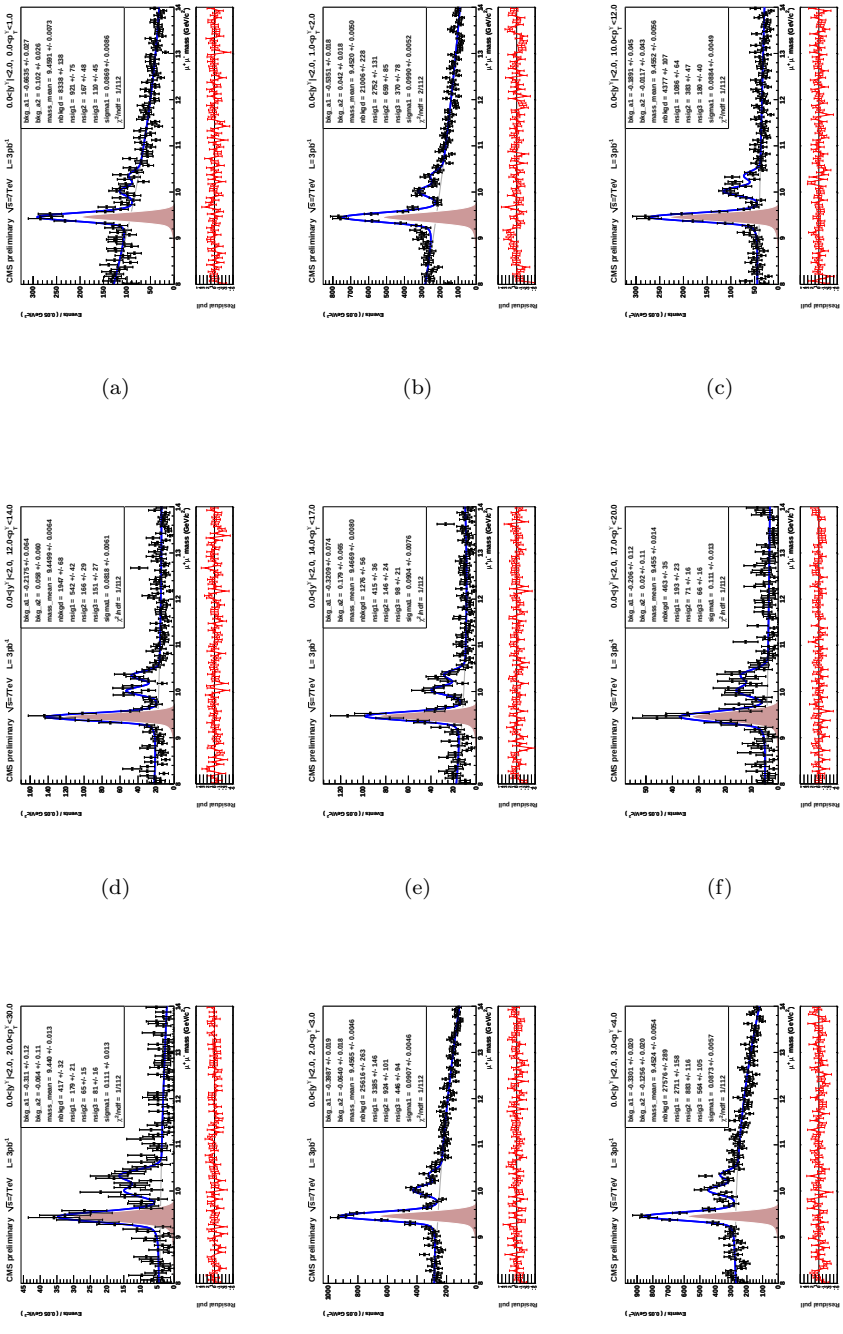


(d) (e)

0.8.12 systematics source: ptscaleLo

Systematics contribution from acceptance p_{T} scale (-1σ)

Figure 144: Υ(1S) systematic mass fits:ptscaleLo, for $d\sigma/dp_{\mathrm{T}}, |y|$: $(0, 2)$ binning.

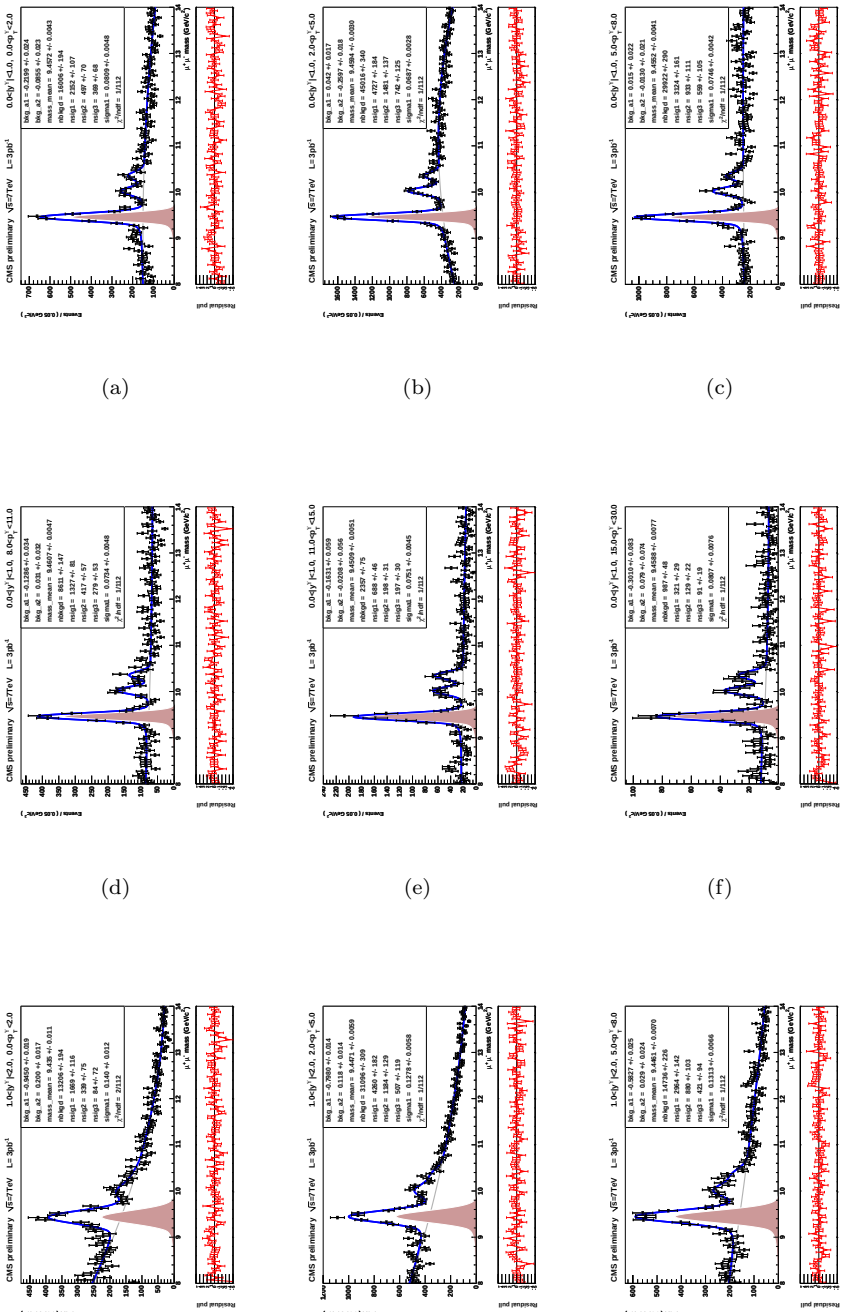


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure 145: Υ(1S) systematic mass fits:ptscaleLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

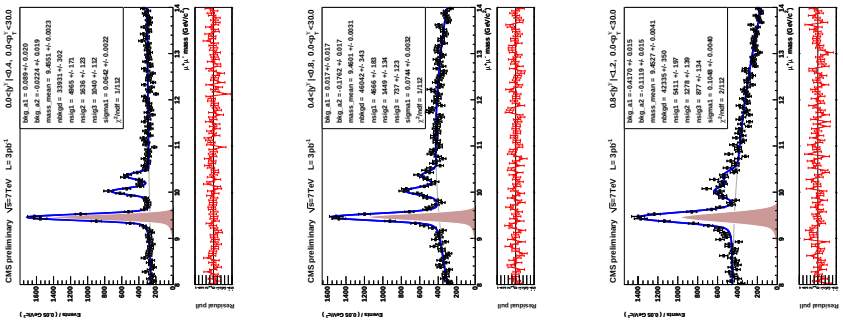


(a) (b) (c)

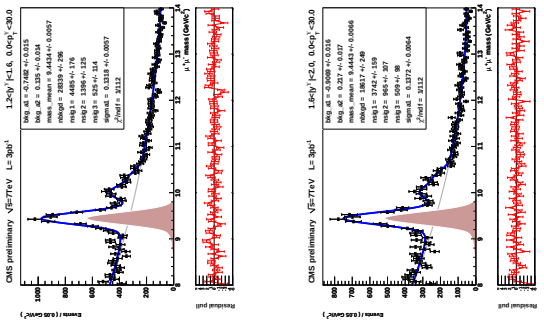
(d) (e) (f)

(g) (h) (i)

Figure 146: Υ(1S) systematic mass fits:ptscaleLo, for $d\sigma/d|y|$ binning.

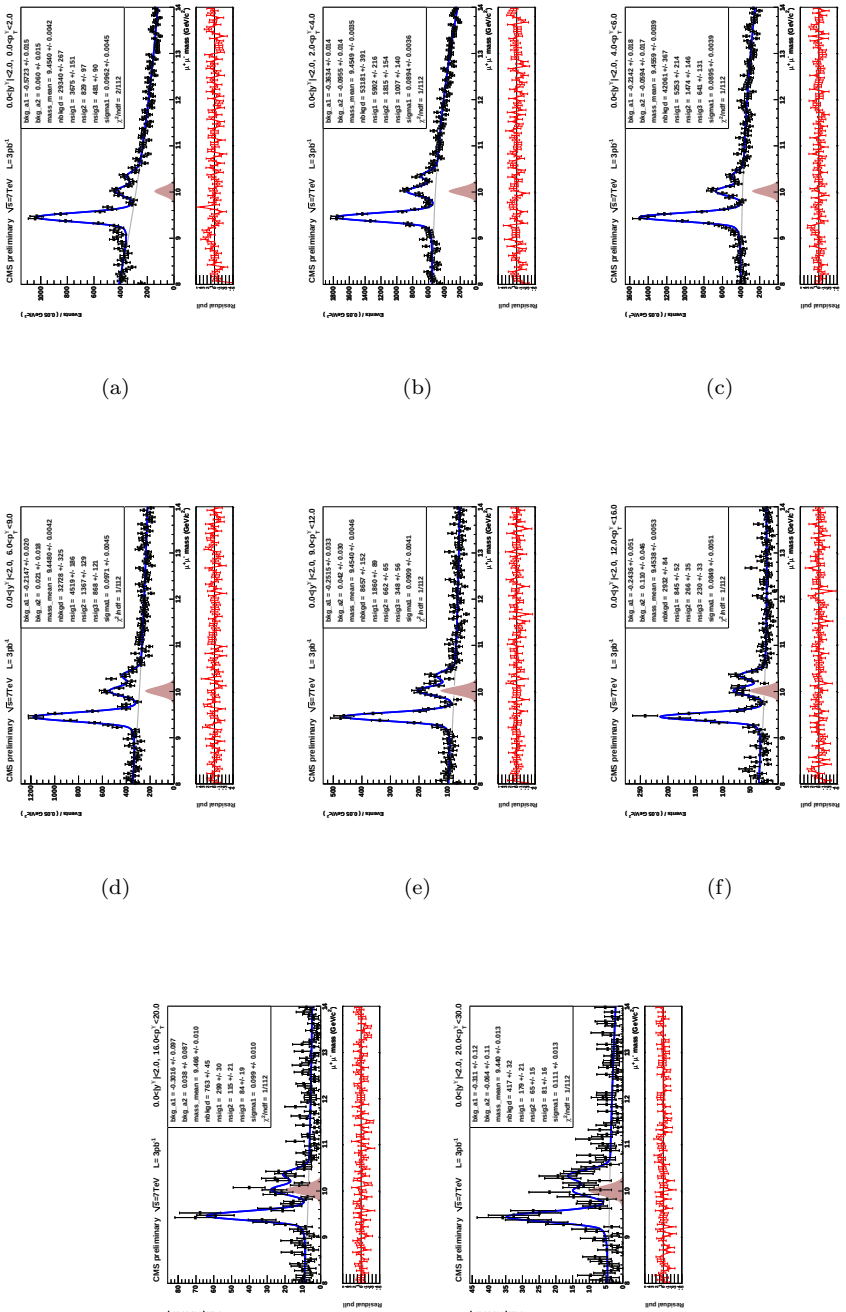


(a) (b) (c)



(d) (e)

Figure 147: Υ(2S) systematic mass fits:ptscaleLo, for $d\sigma/dp_{\mathrm{T}}, |y|$: $(0, 2)$ binning.

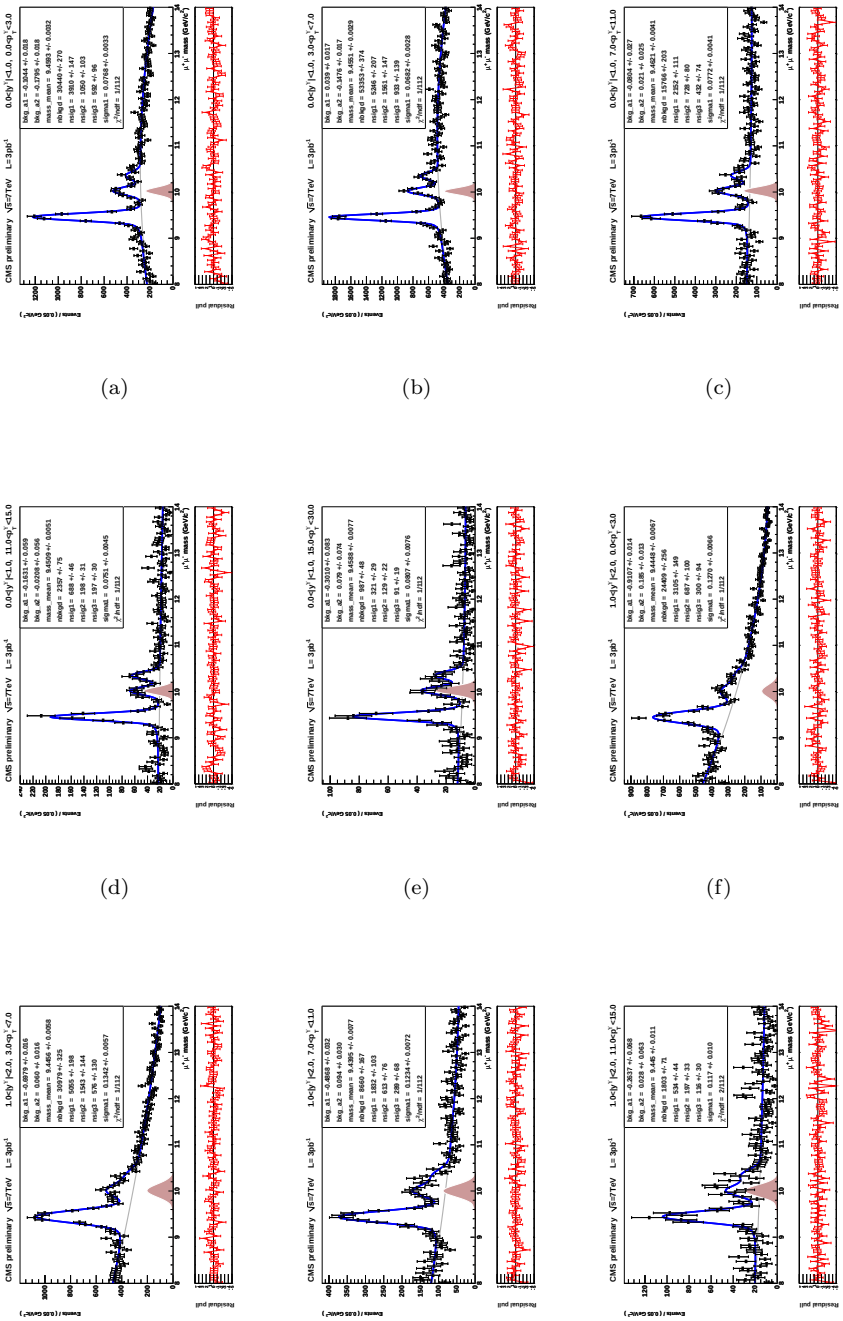


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 148: Υ(2S) systematic mass fits:ptscaleLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

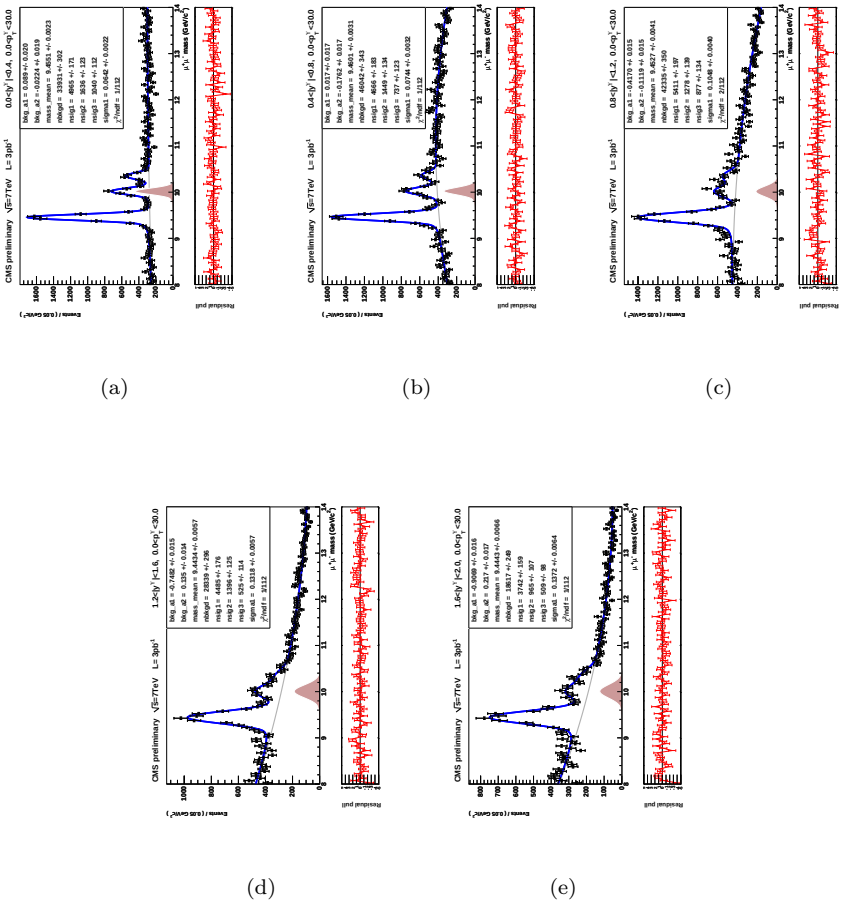


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

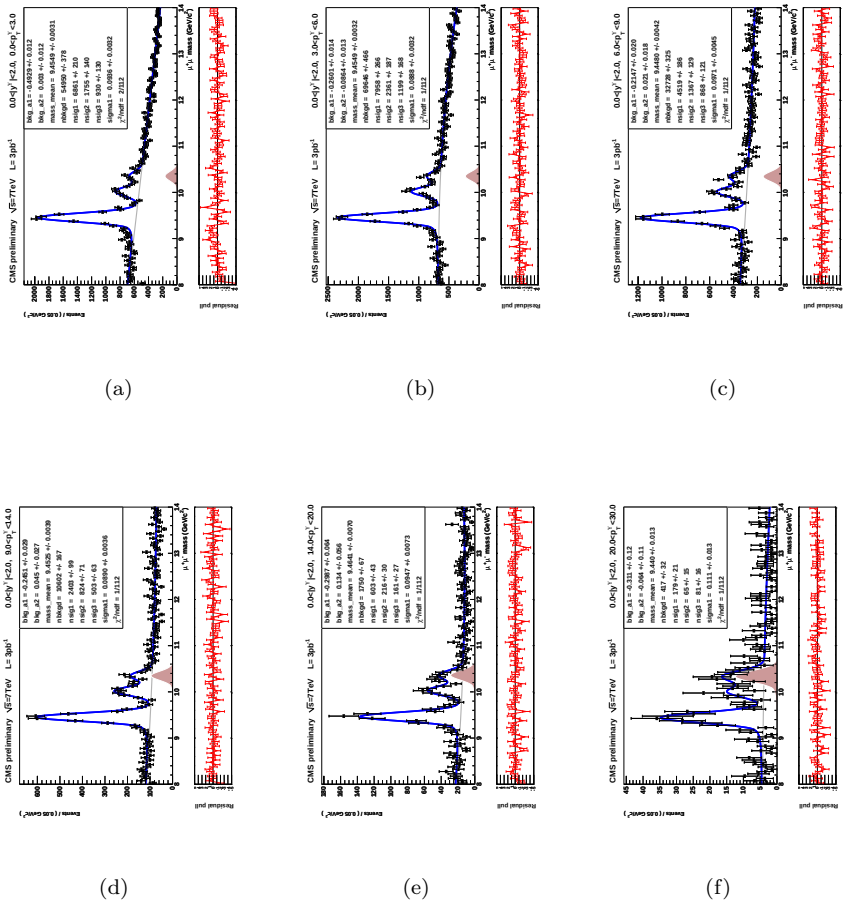
Figure 149: $\Upsilon(2S)$ systematic mass fits:ptscaleLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

(d) (e)

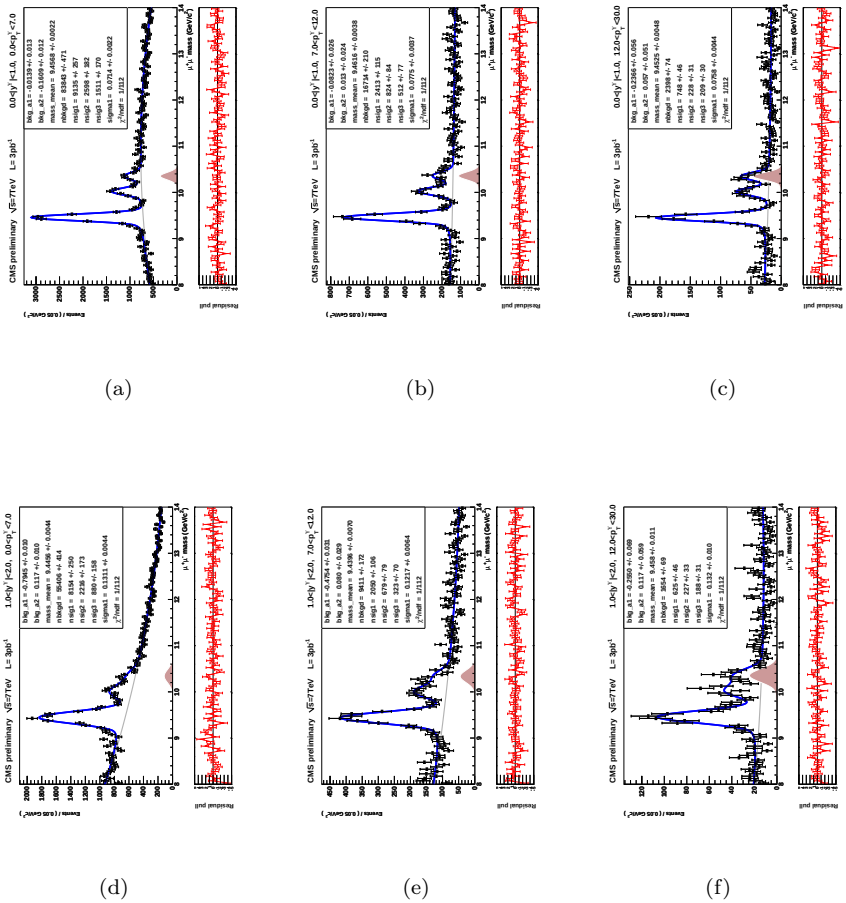
Figure 150: Υ(3S) systematic mass fits:ptscaleLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

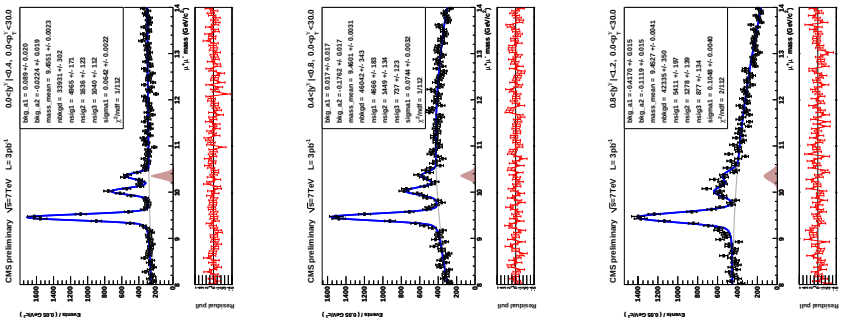
Figure 151: Υ(3S) systematic mass fits:ptscaleLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



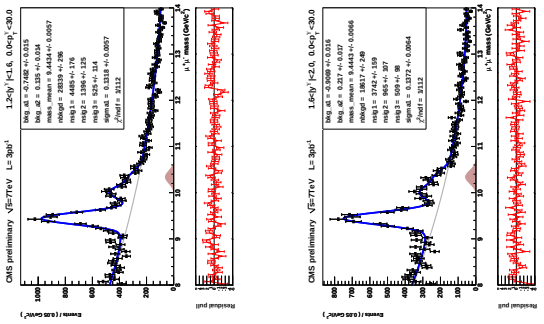
(a) (b) (c)

(d) (e) (f)

Figure 152: Υ(3S) systematic mass fits:ptscaleLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

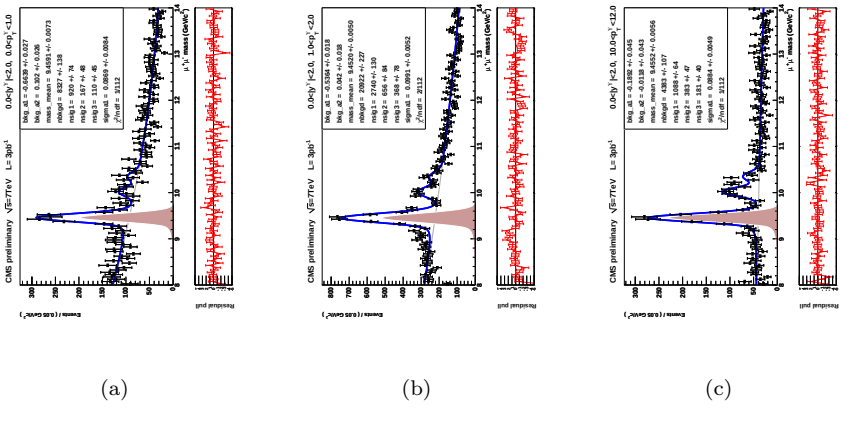


(d) (e)

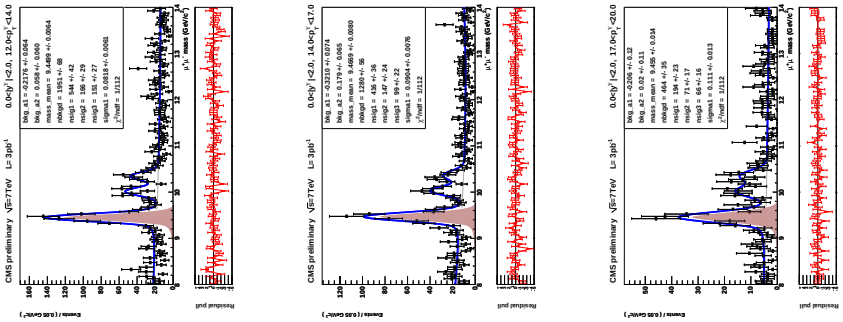
0.8.13 systematics source: ptscaleHi

Systematics contribution from acceptance p_{T} scale ($+1\sigma$)

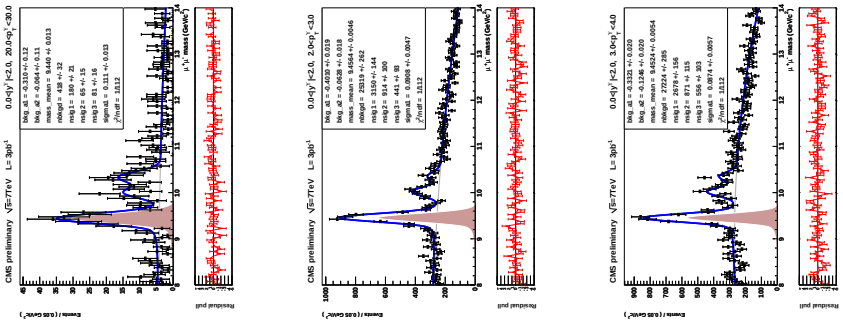
Figure 153: $\Upsilon(1S)$ systematic mass fits:ptscaleHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

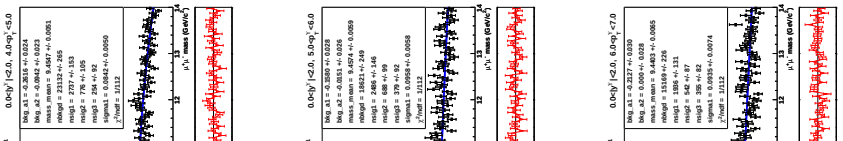
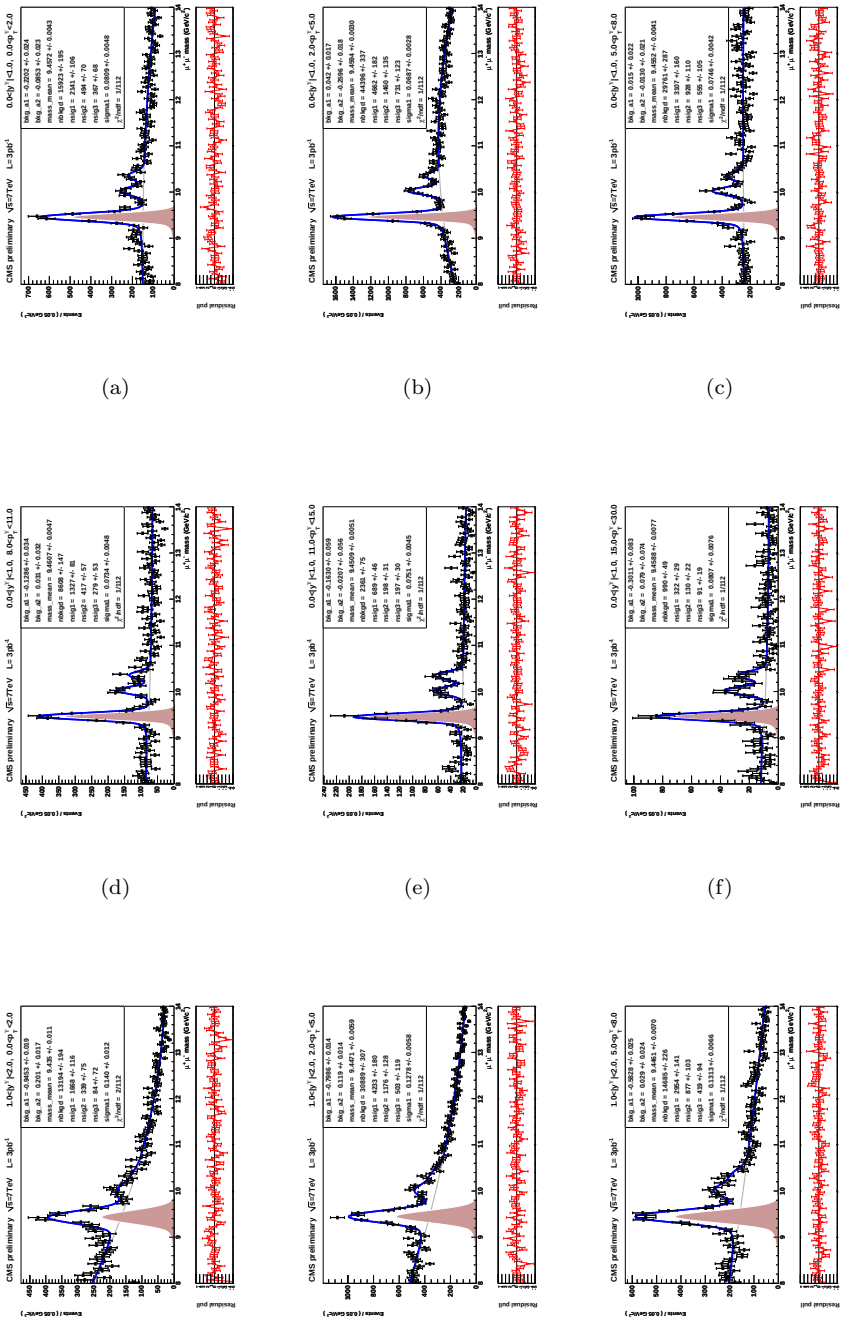


Figure 154: Υ(1S) systematic mass fits:ptscaleHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

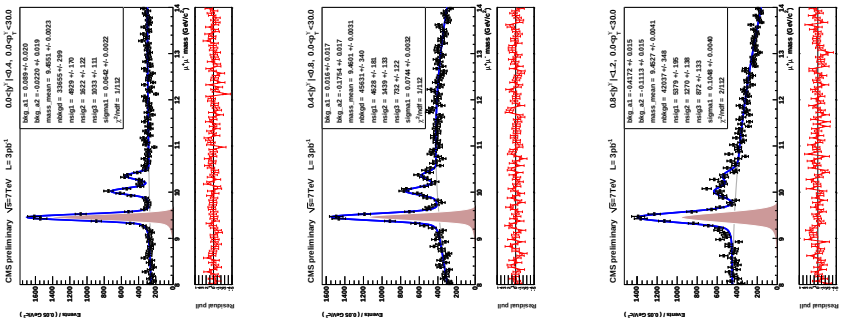


(a) (b) (c)

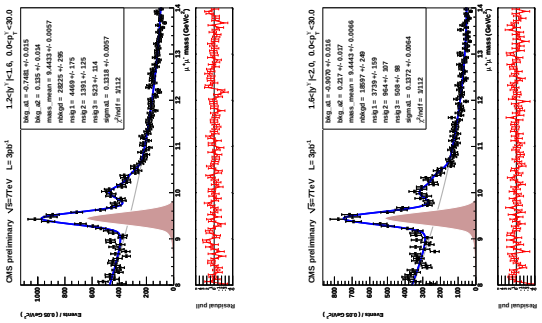
(d) (e) (f)

(g) (h) (i)

Figure 155: Υ(1S) systematic mass fits:ptscaleHi, for $d\sigma/d|y|$ binning.

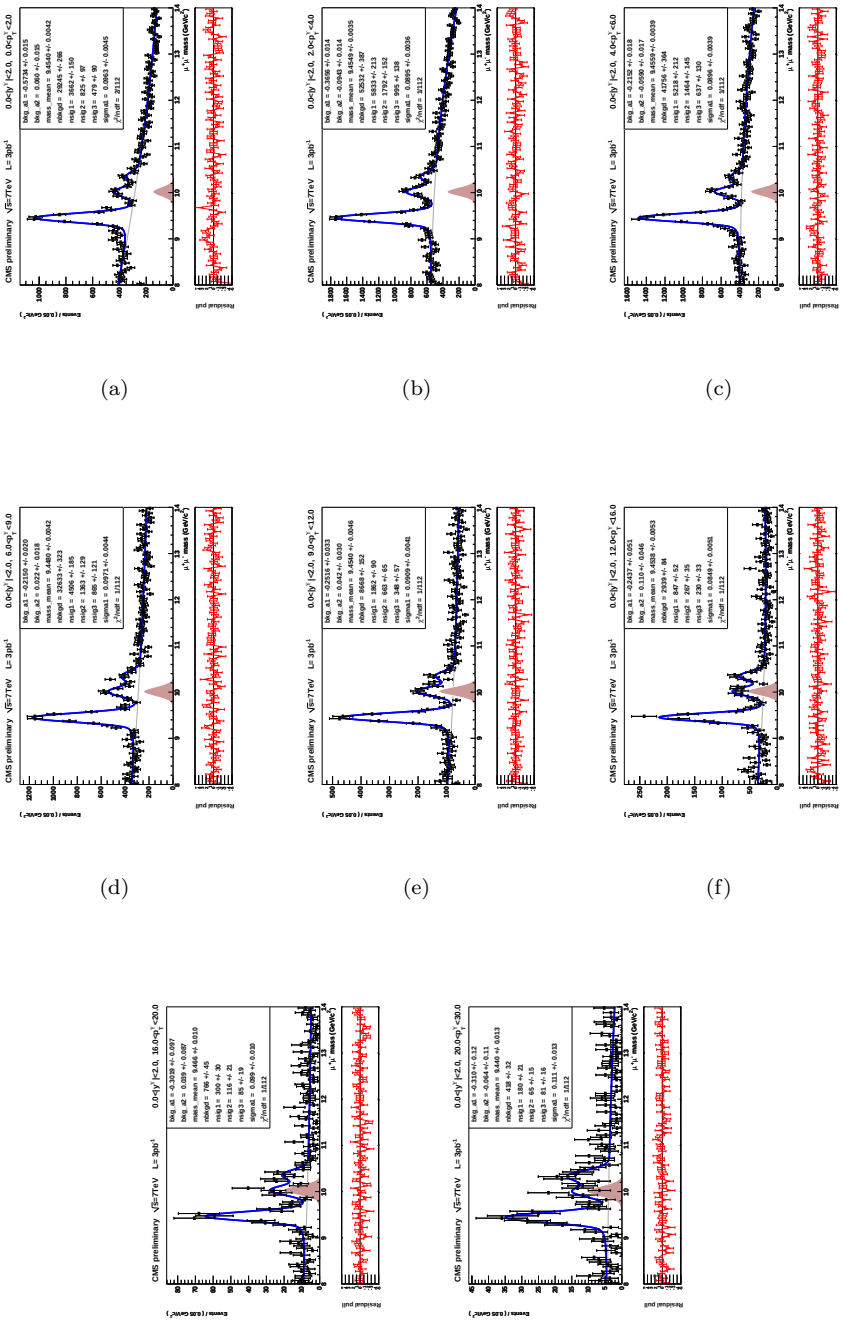


(a) (b) (c)



(d) (e)

Figure 156: $\Upsilon(2S)$ systematic mass fits:ptscaleHi, for $d\sigma/dp_{\mathrm{T}}, |y|$: $(0, 2)$ binning.

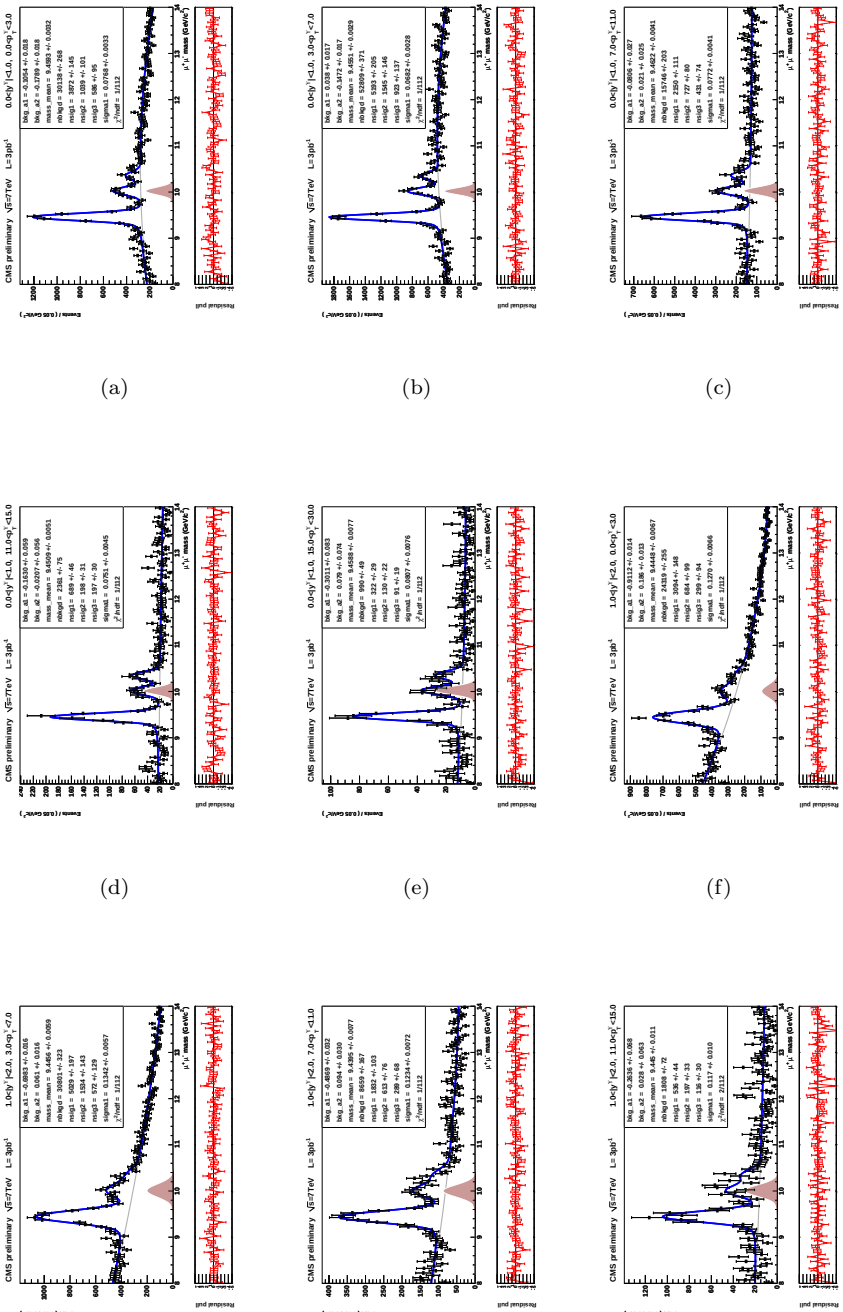


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 157: Υ(2S) systematic mass fits:ptscaleHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

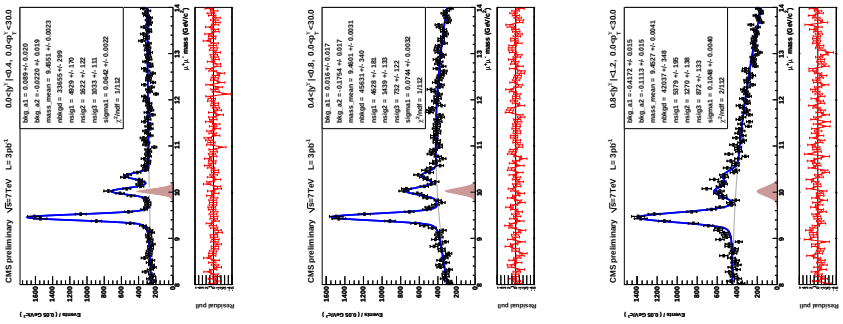


(a) (b) (c)

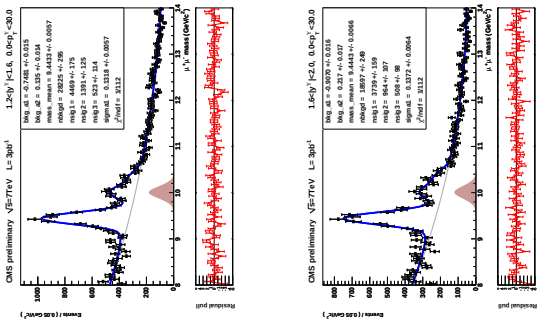
(d) (e) (f)

(g) (h) (i)

Figure 158: Υ(2S) systematic mass fits:ptscaleHi, for $d\sigma/d|y|$ binning.

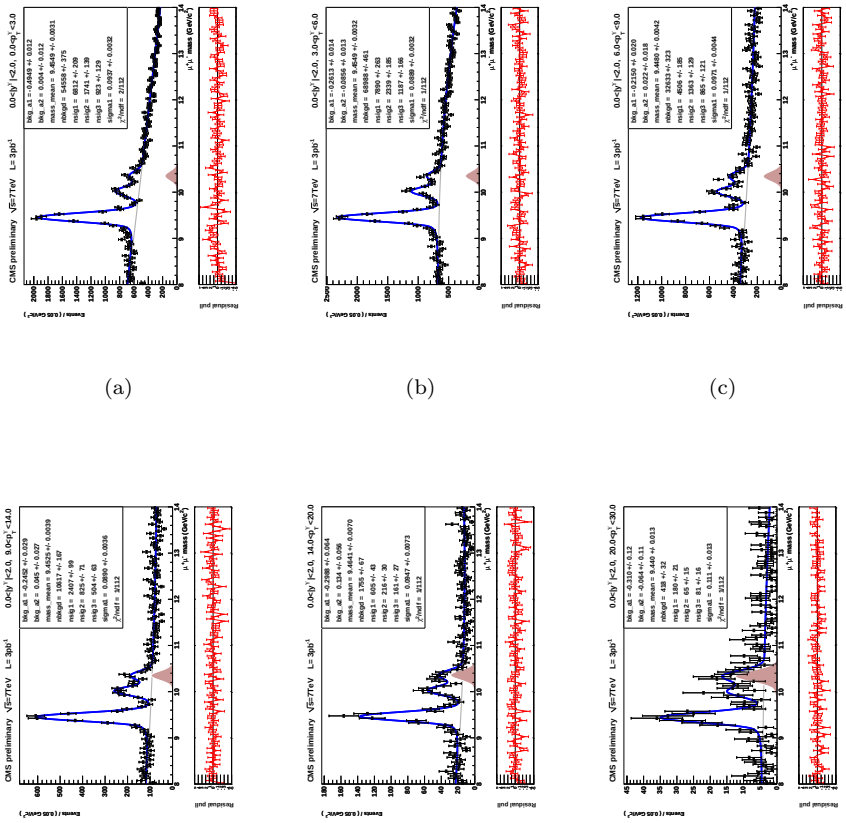


(a) (b) (c)



(d) (e)

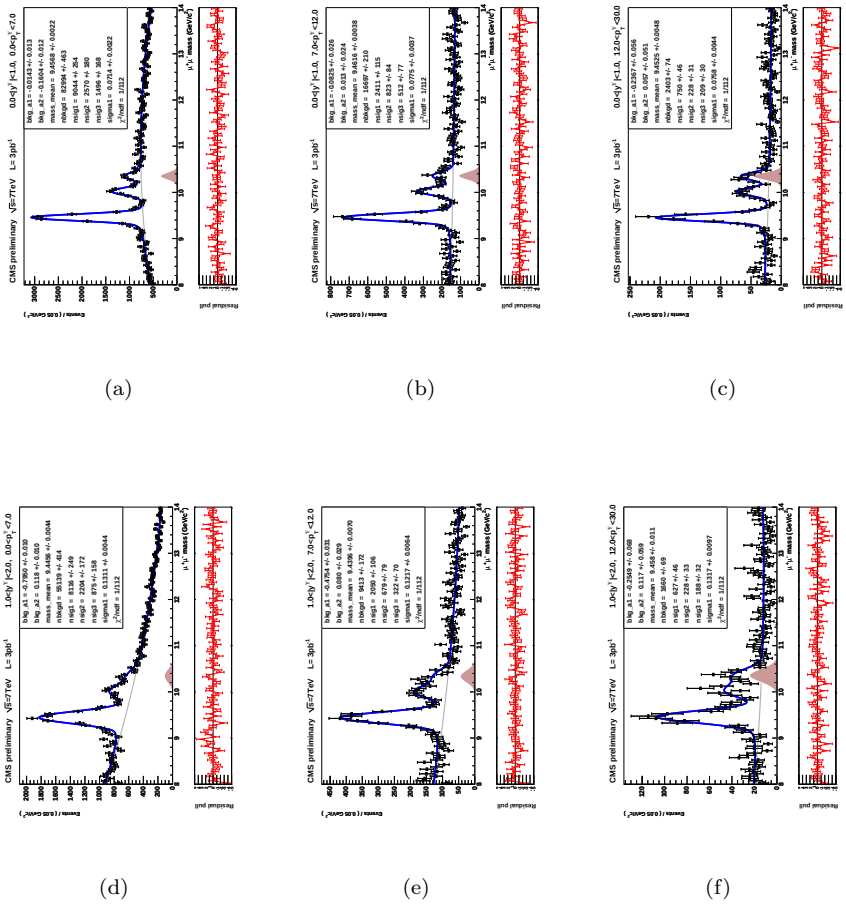
Figure 159: $\Upsilon(3S)$ systematic mass fits:ptscaleHi, for $d\sigma/dp_{\mathrm{T}}$, $|y|$: $(0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

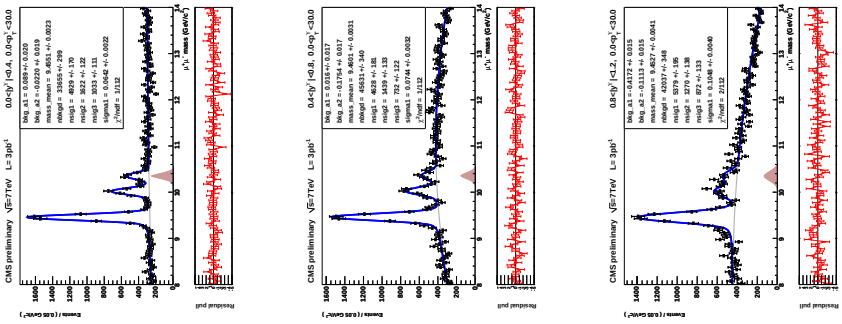
Figure 160: Υ(3S) systematic mass fits:ptscaleHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



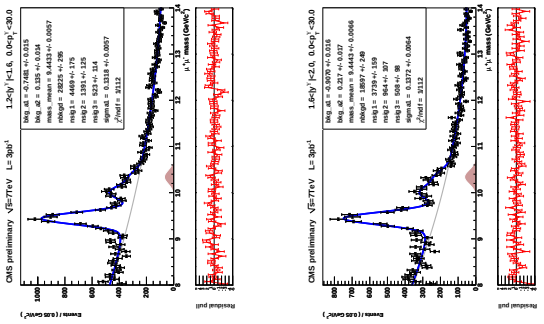
(a) (b) (c)

(d) (e) (f)

Figure 161: Υ(3S) systematic mass fits:ptscaleHi, for $d\sigma/d|y|$ binning.



(a) (b) (c)

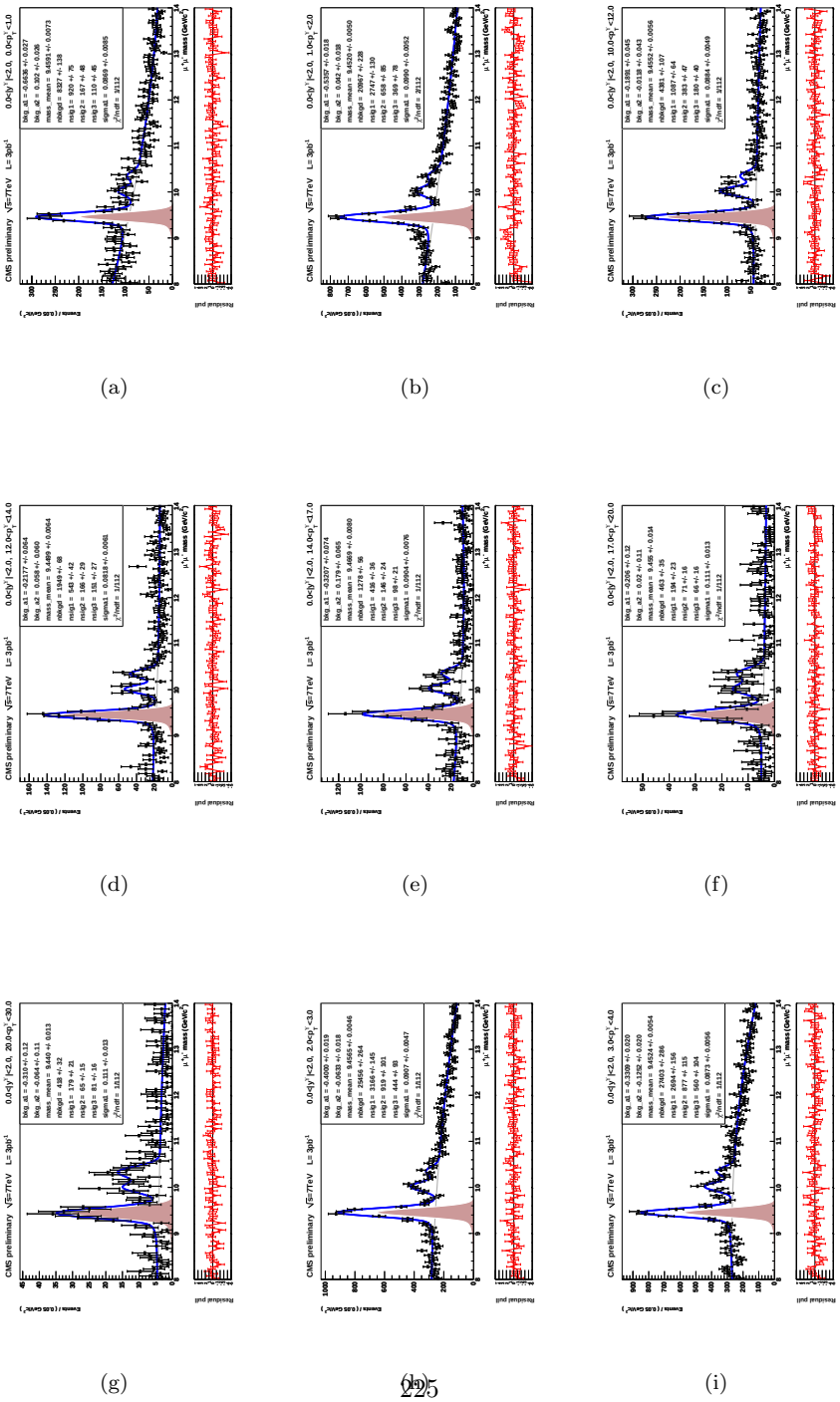


(d) (e)

0.8.14 systematics source: ptresoLo

Systematics contribution from acceptance p_{T} resolution (-1σ)

Figure 162: $\Upsilon(1S)$ systematic mass fits:ptresoLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



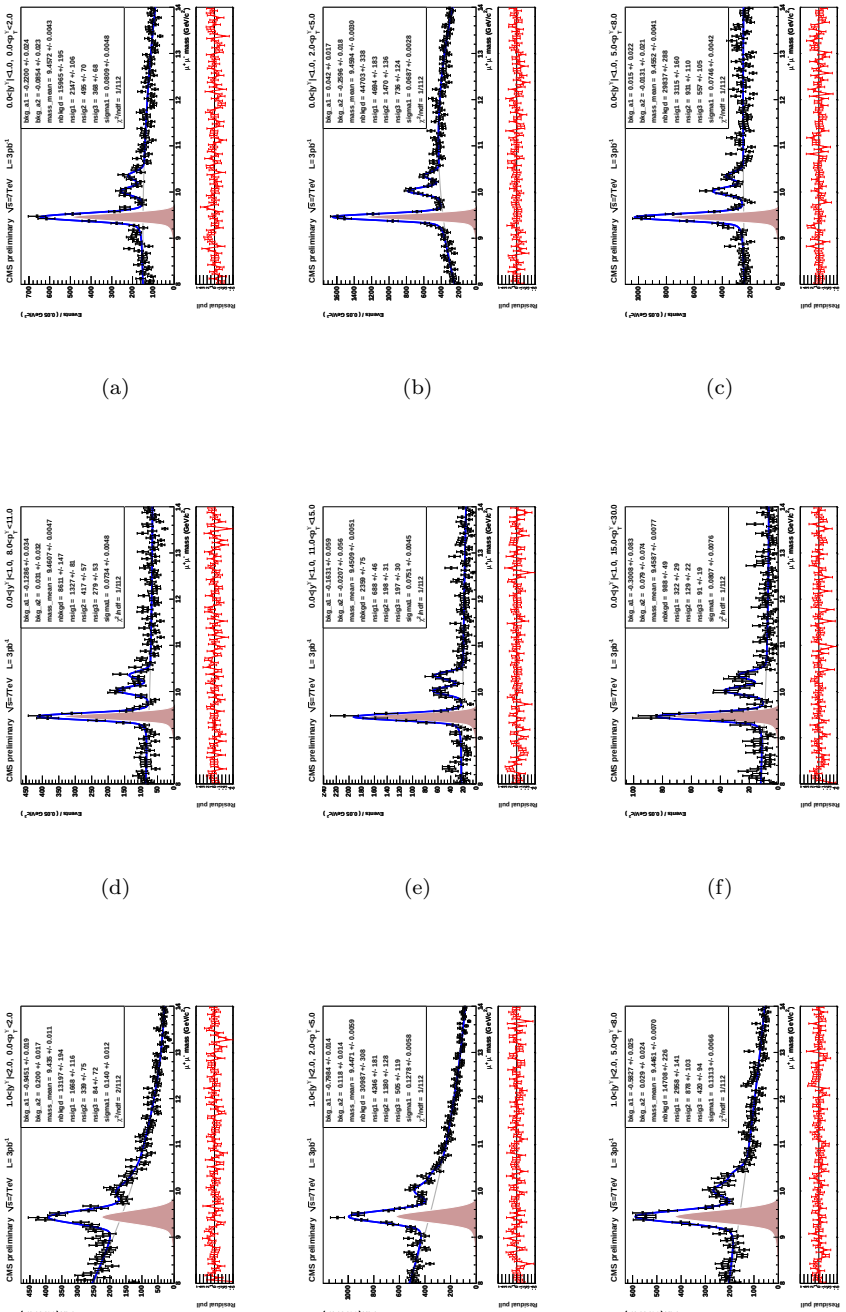
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 163: Υ(1S) systematic mass fits:ptresoLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

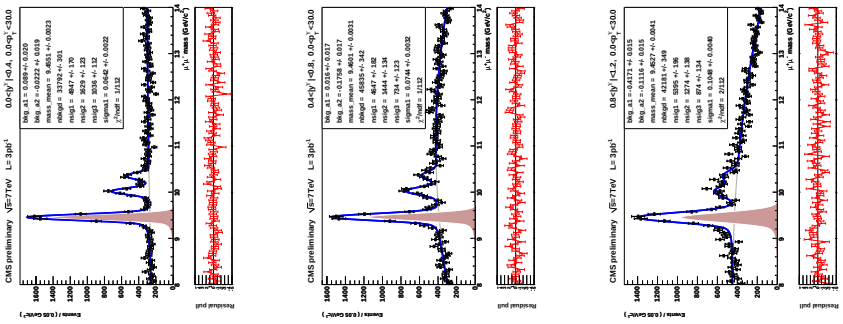


(a) (b) (c)

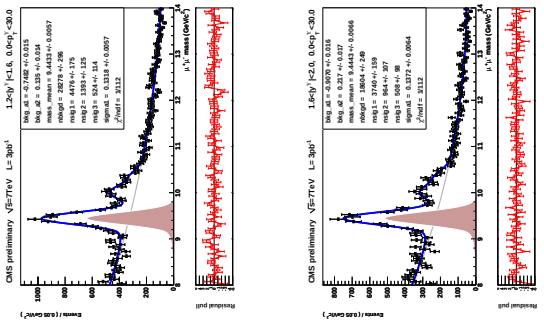
(d) (e) (f)

(g) (h) (i)

Figure 164: Υ(1S) systematic mass fits:ptresoLo, for $d\sigma/d|y|$ binning.

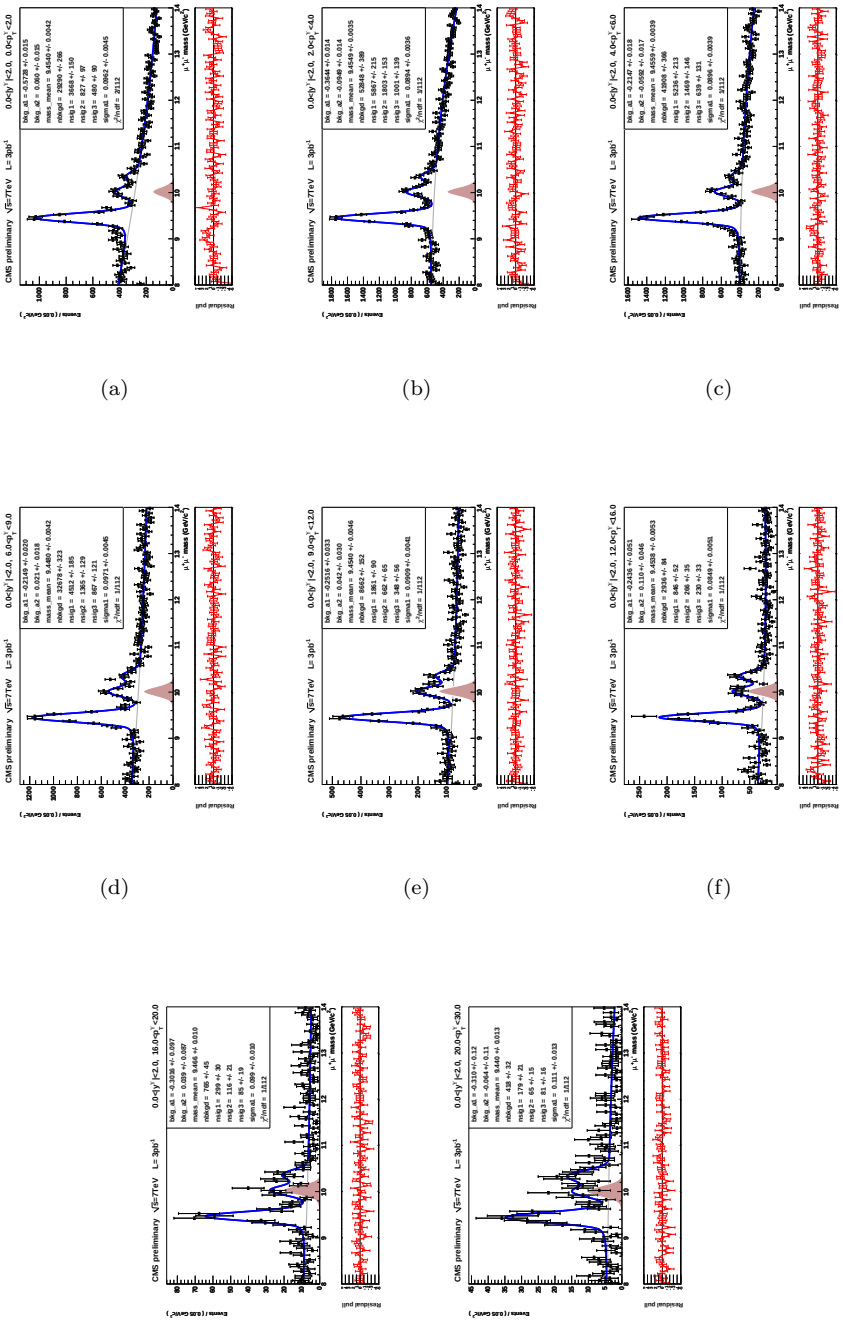


(a) (b) (c)



(d) (e)

Figure 165: Υ(2S) systematic mass fits:ptresoLo, for $d\sigma/dp_{\mathrm{T}}, |y|$: $(0, 2)$ binning.

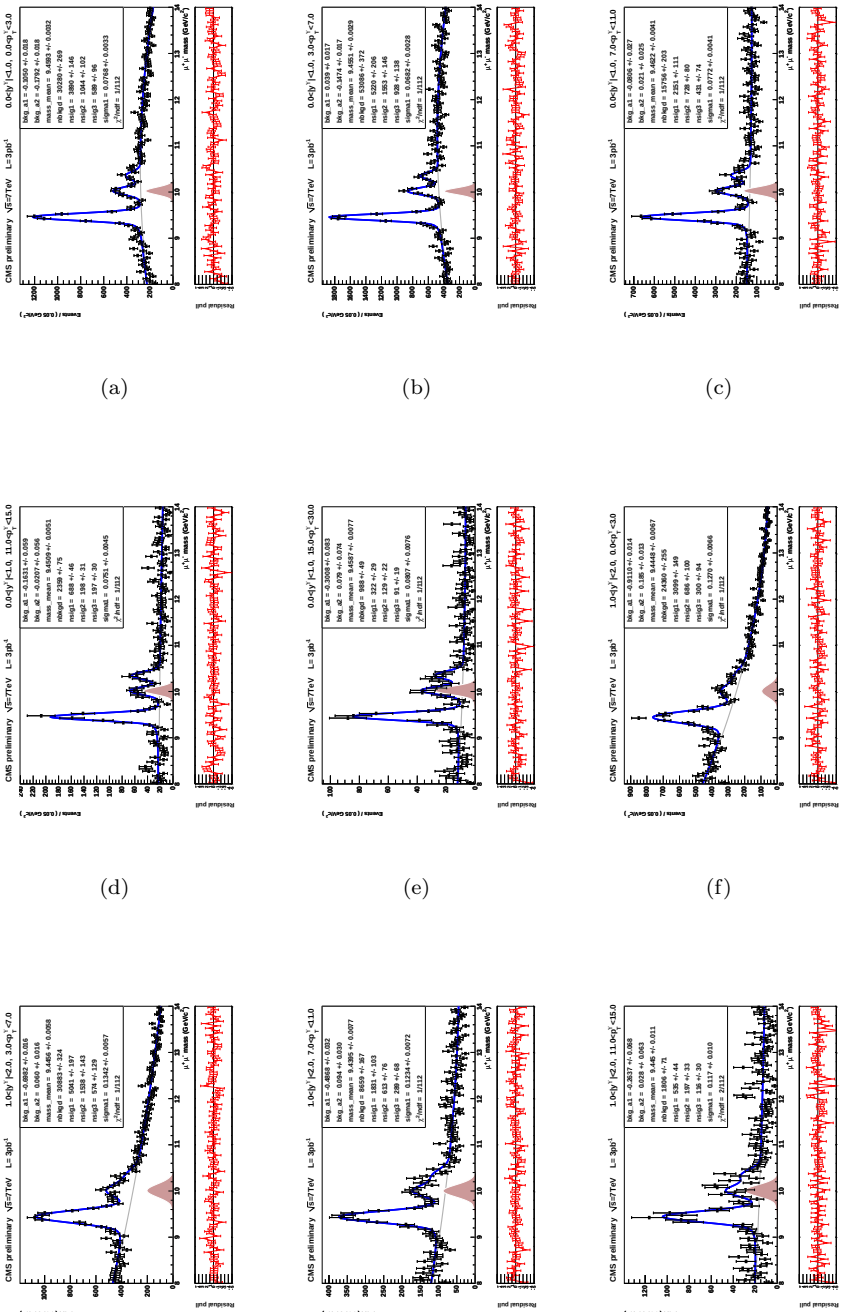


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 166: Υ(2S) systematic mass fits:ptresoLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

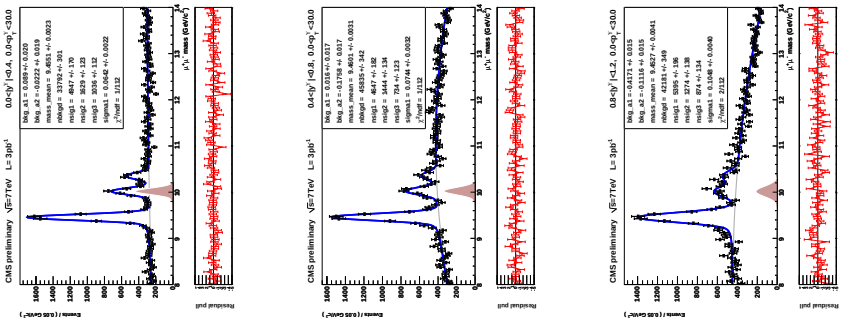


(a) (b) (c)

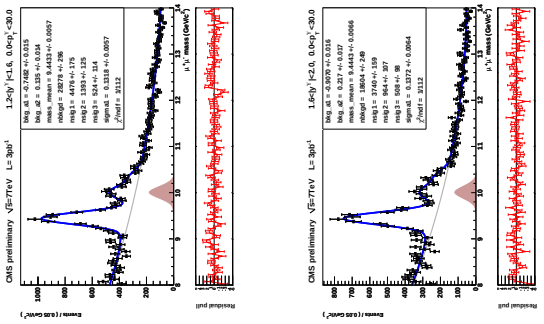
(d) (e) (f)

(g) (h) (i)

Figure 167: Υ(2S) systematic mass fits:ptresoLo, for $d\sigma/d|y|$ binning.

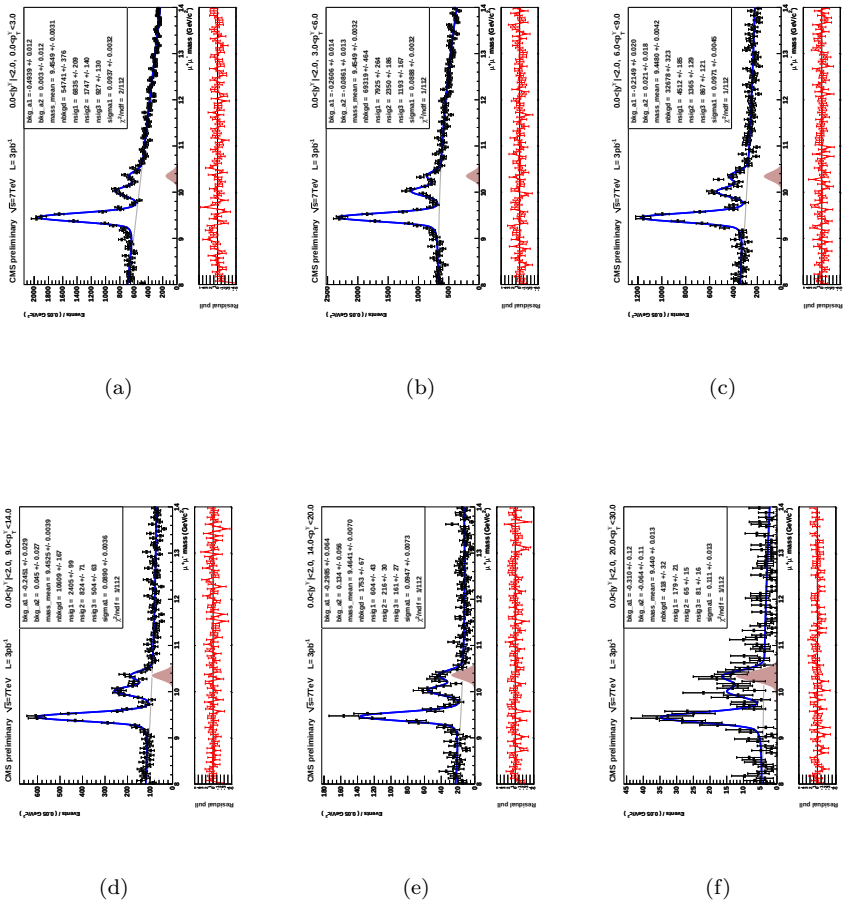


(a) (b) (c)



(d) (e)

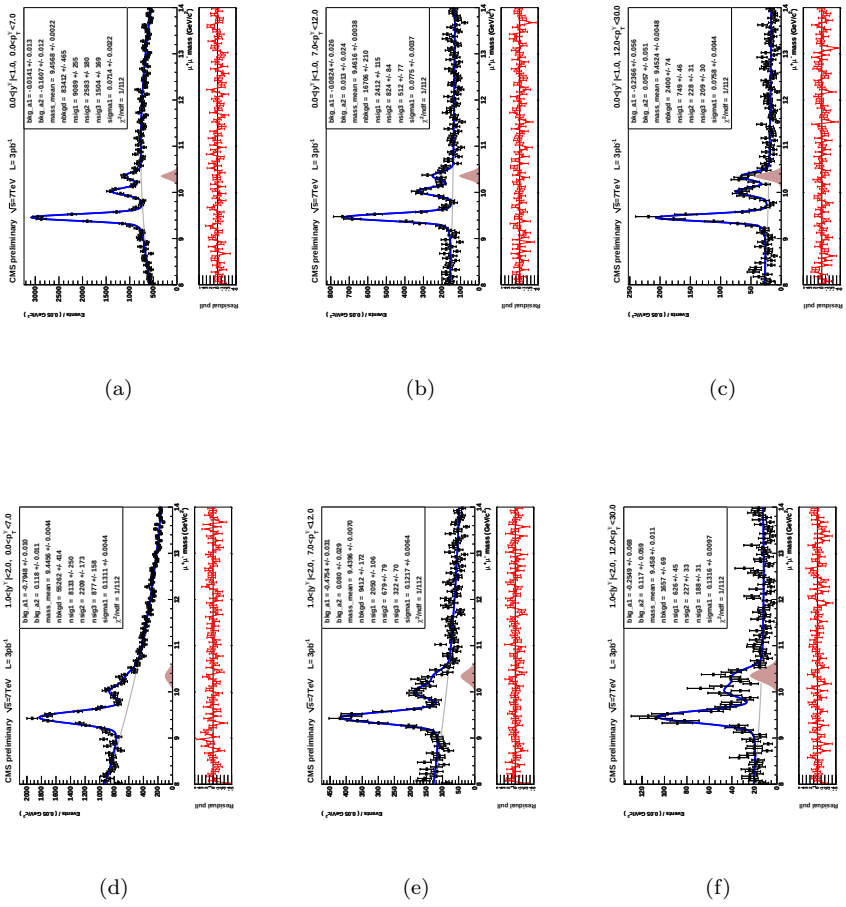
Figure 168: $\Upsilon(3S)$ systematic mass fits:ptresoLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

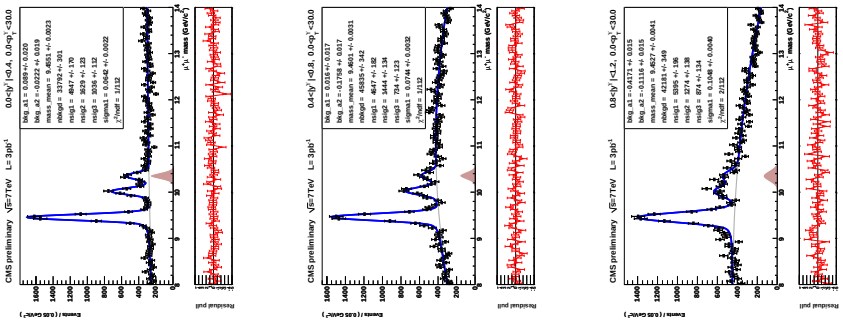
Figure 169: Υ(3S) systematic mass fits:ptresoLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



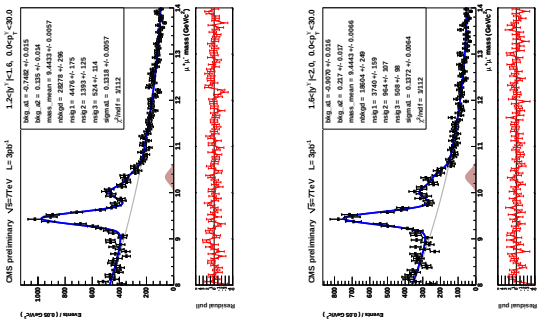
(a) (b) (c)

(d) (e) (f)

Figure 170: Υ(3S) systematic mass fits:ptresoLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

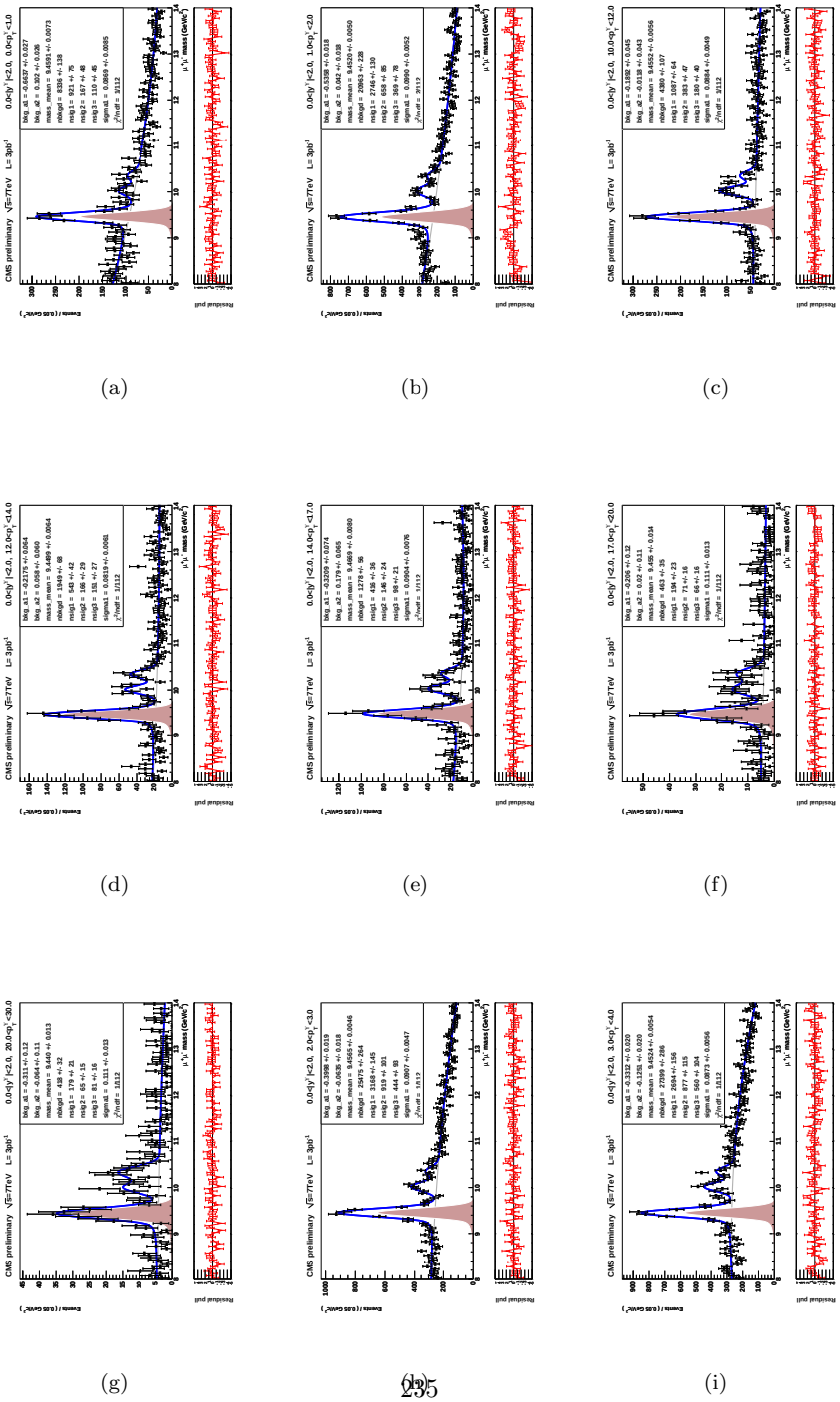


(d) (e)

0.8.15 systematics source: ptresoHi

Systematics contribution from acceptance p_{T} resolution $(+1\sigma)$

Figure 171: Υ(1S) systematic mass fits:ptresoHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



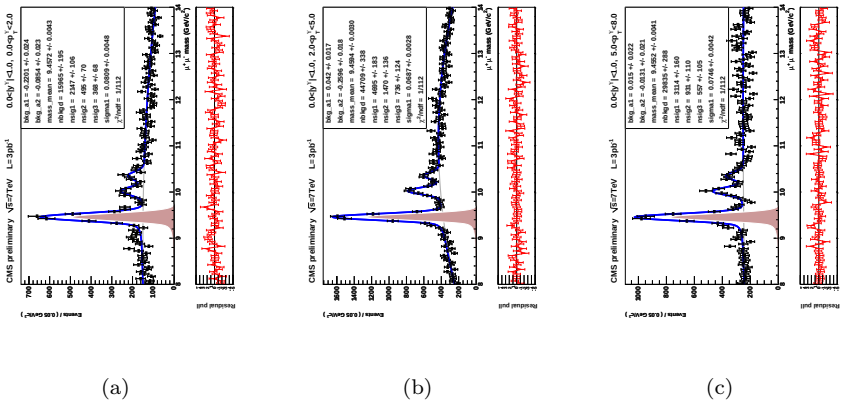
(a) (b) (c)

(d) (e) (f)

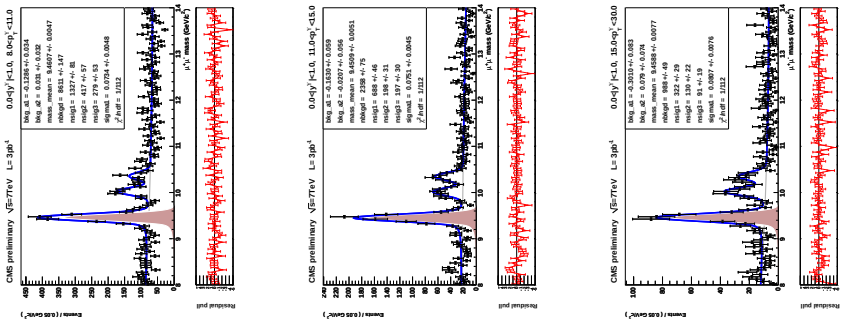
(g) (h) (i)

(j) (k) (l)

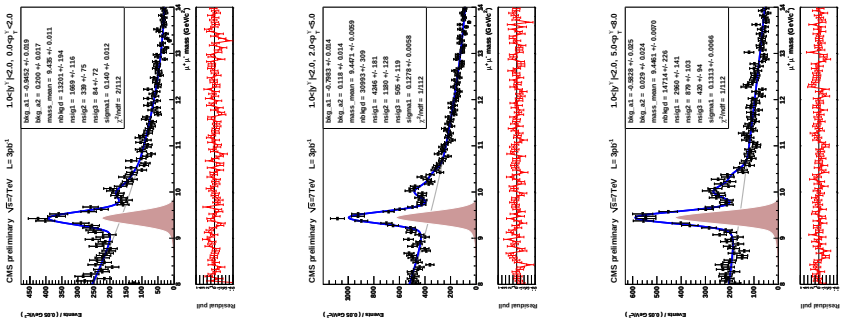
Figure 172: Υ(1S) systematic mass fits:ptresoHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

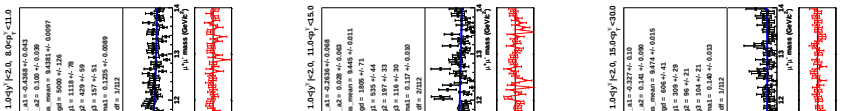
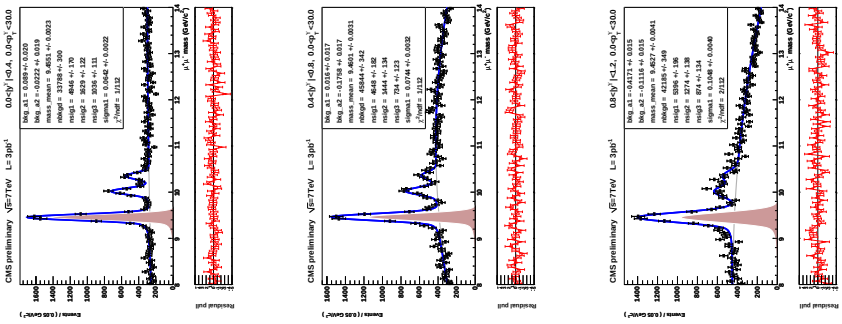
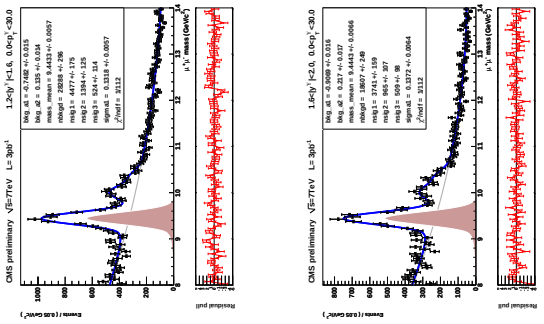


Figure 173: Υ(1S) systematic mass fits:ptresoHi, for $d\sigma/d|y|$ binning.

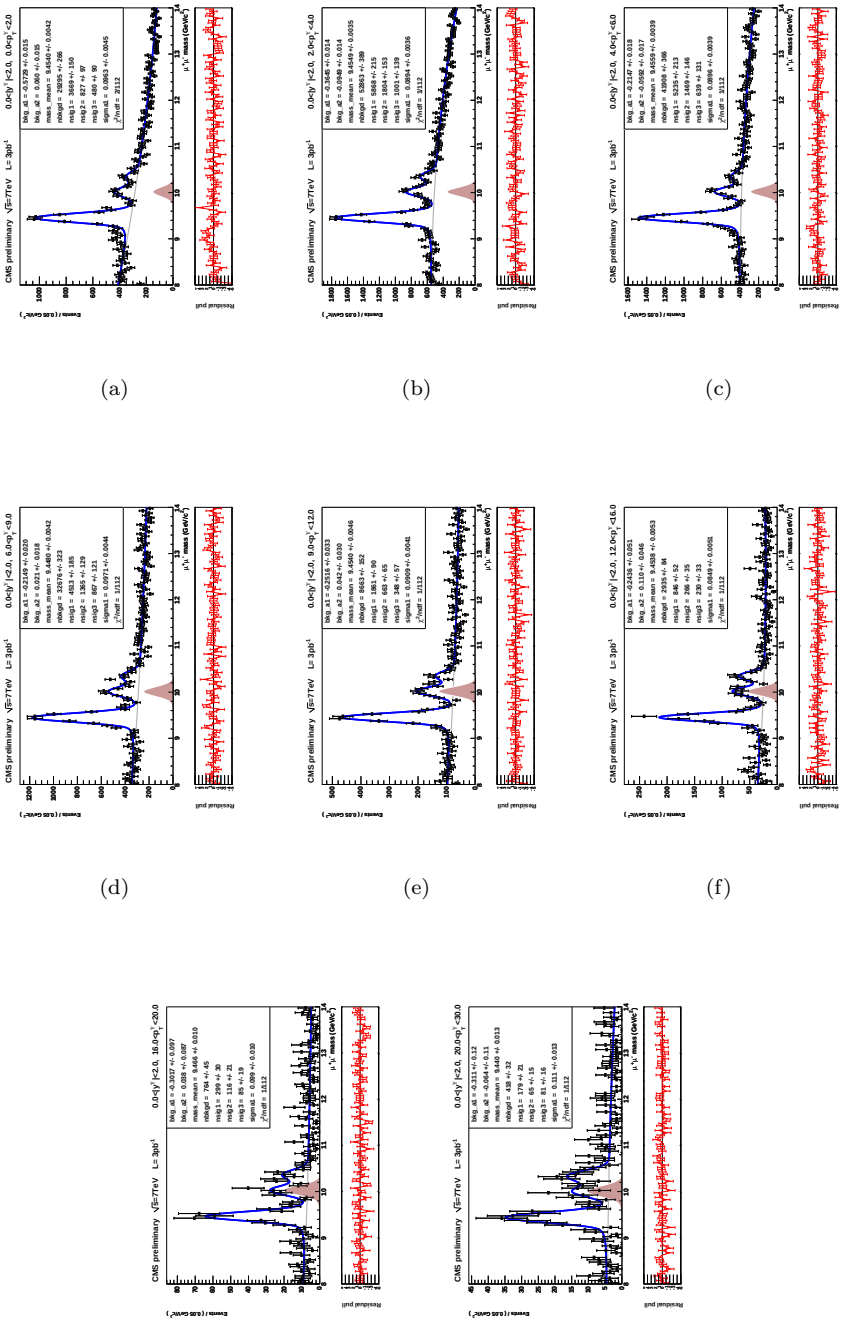


(a) (b) (c)



(d) (e)

Figure 174: Υ(2S) systematic mass fits:ptresoHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

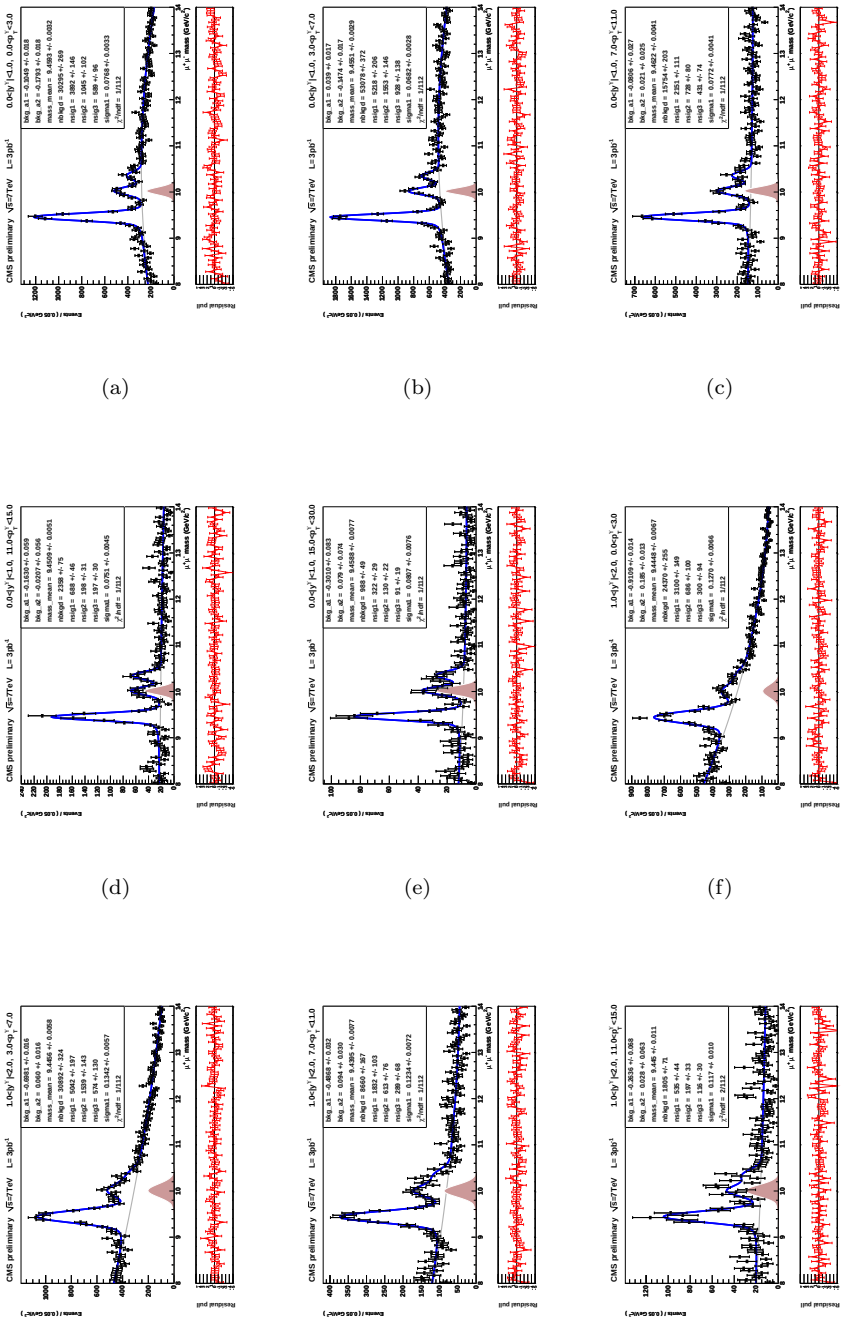


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 175: Υ(2S) systematic mass fits:ptresoHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

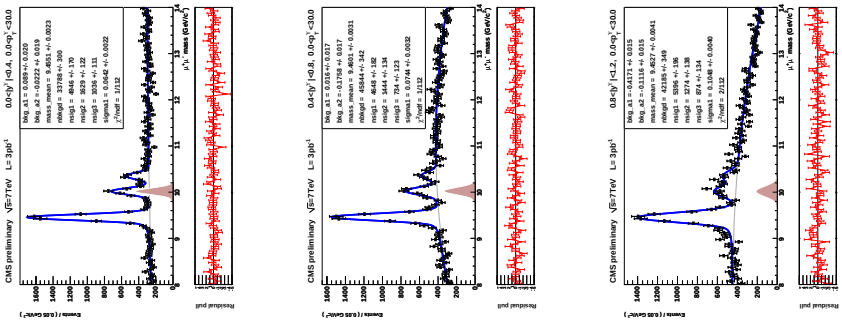


(a) (b) (c)

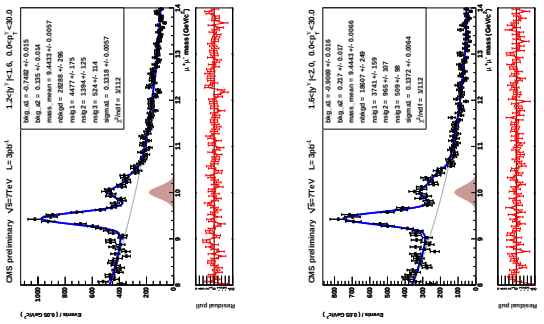
(d) (e) (f)

(g) (h) (i)

Figure 176: Υ(2S) systematic mass fits:ptresoHi, for $d\sigma/d|y|$ binning.

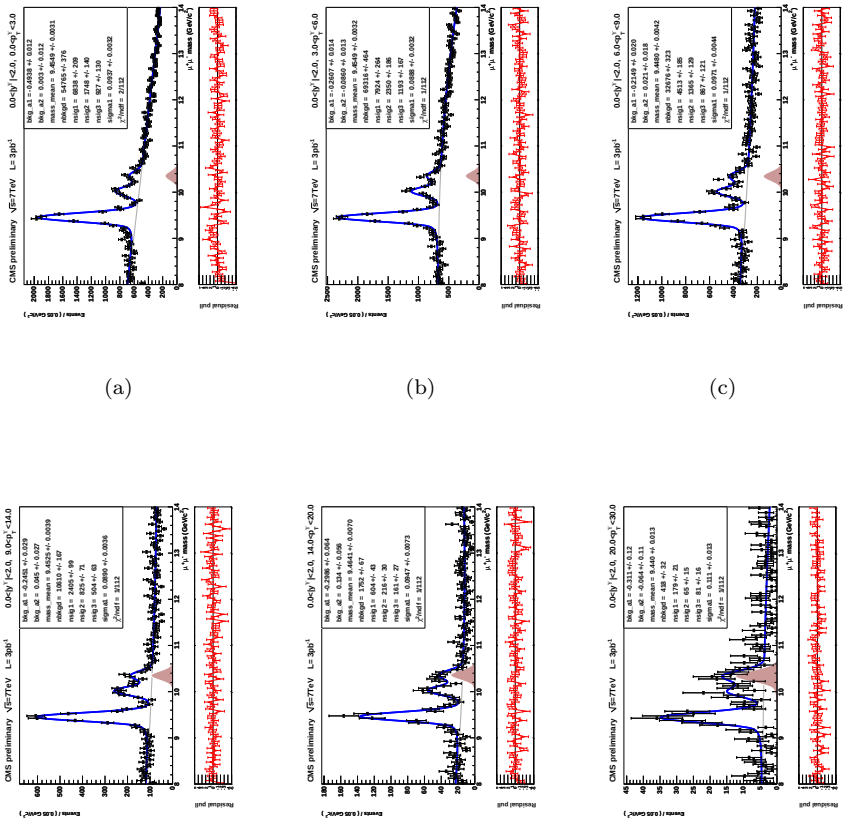


(a) (b) (c)



(d) (e)

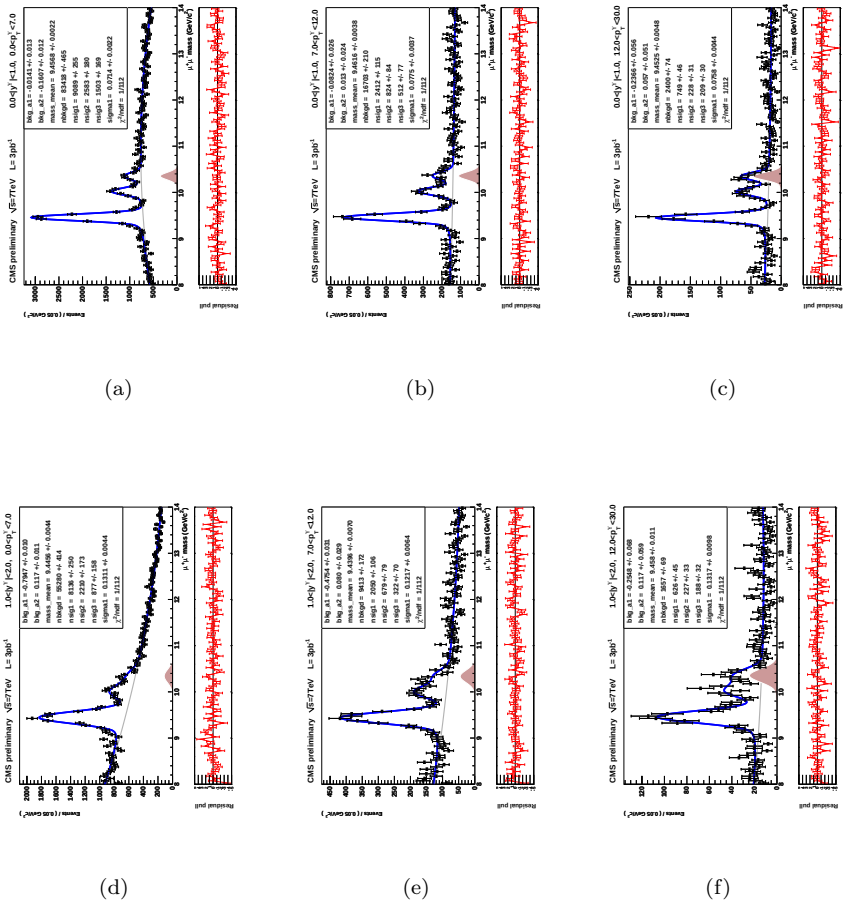
Figure 177: Υ(3S) systematic mass fits:ptresoHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

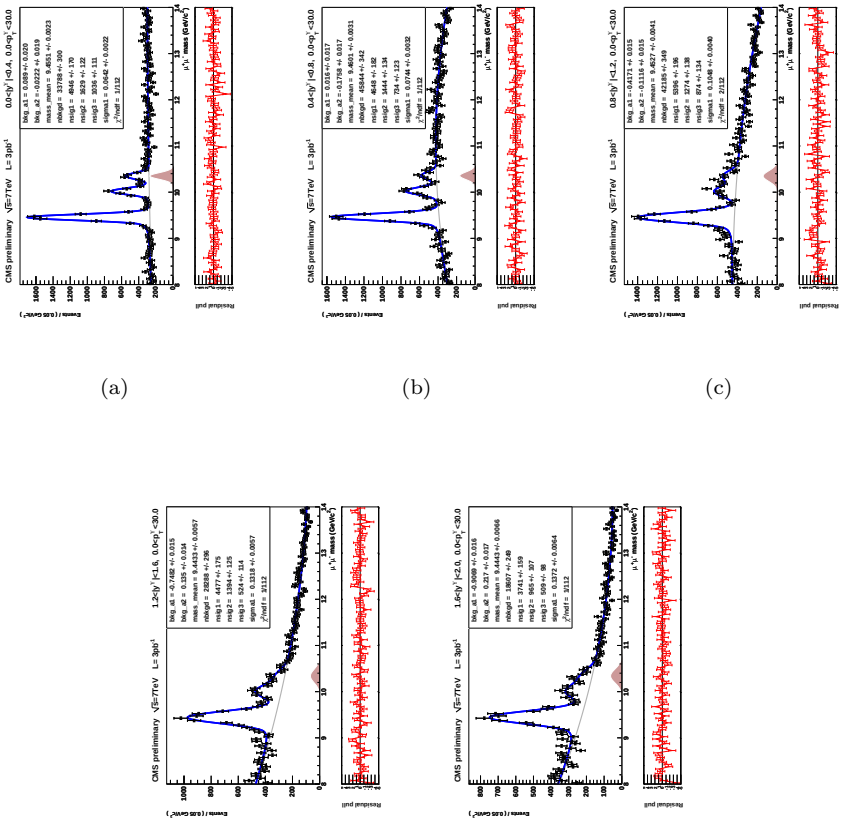
Figure 178: Υ(3S) systematic mass fits:ptresoHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



(a) (b) (c)

(d) (e) (f)

Figure 179: Υ(3S) systematic mass fits:ptresoHi, for $d\sigma/d|y|$ binning.



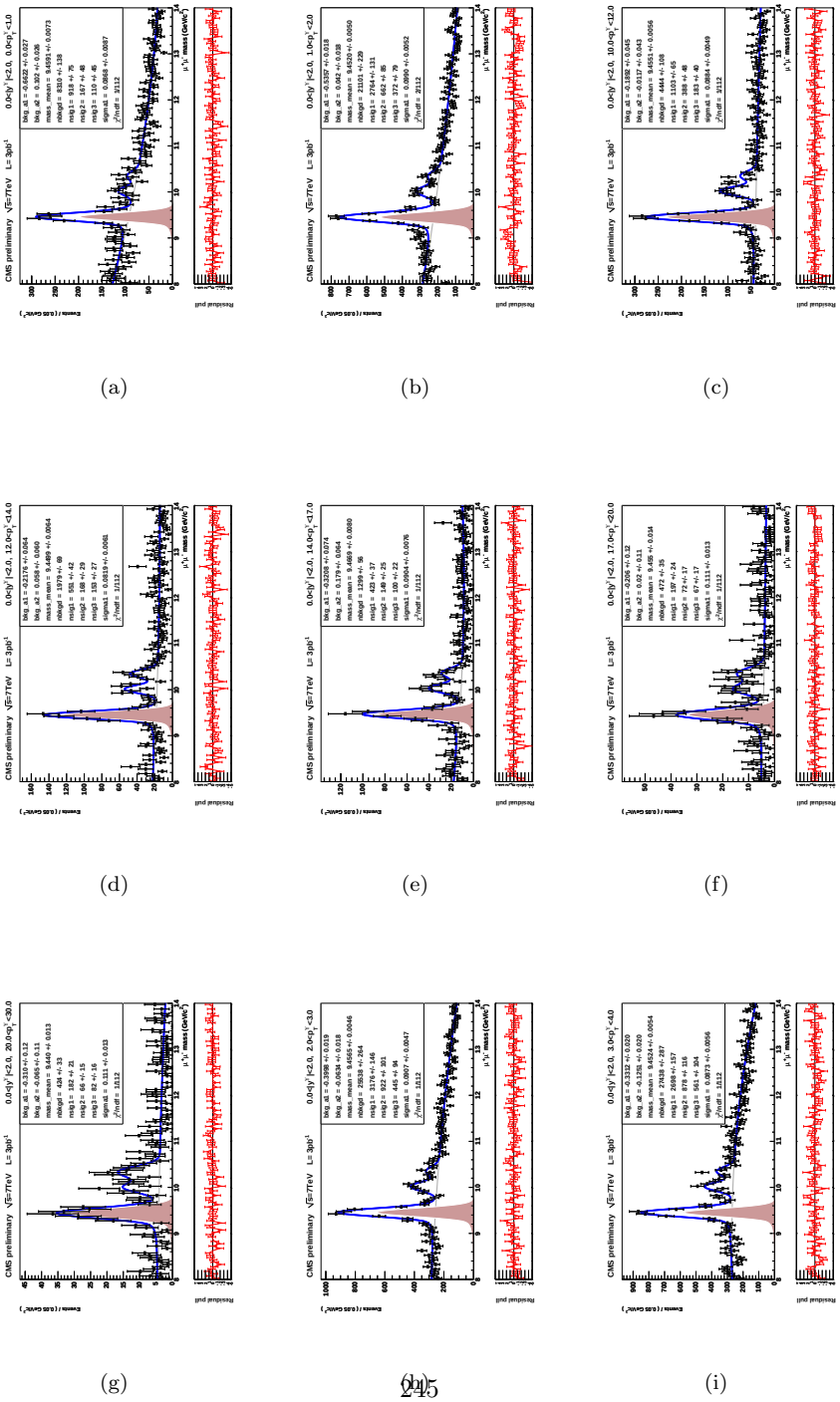
(a) (b) (c)

(d) (e)

0.8.16 systematics source: ptspec

Systematics contribution from acceptance p_{T} spectrum (pythia reweighted)

Figure 180: $\Upsilon(1S)$ systematic mass fits:ptspec, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



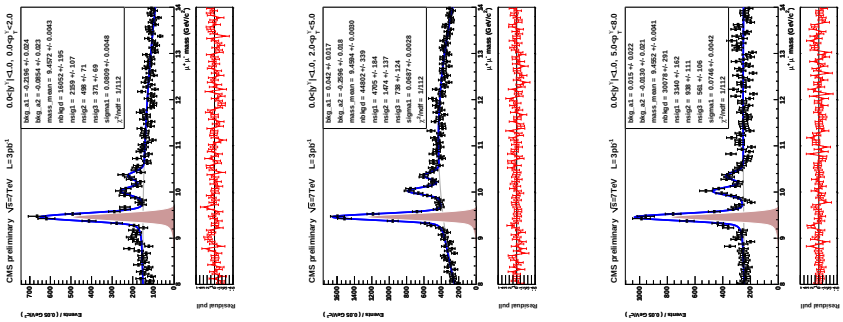
(a) (b) (c)

(d) (e) (f)

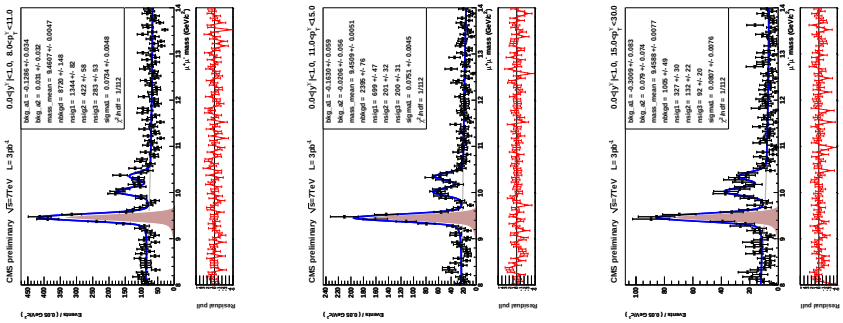
(g) (h) (i)

(j) (k) (l)

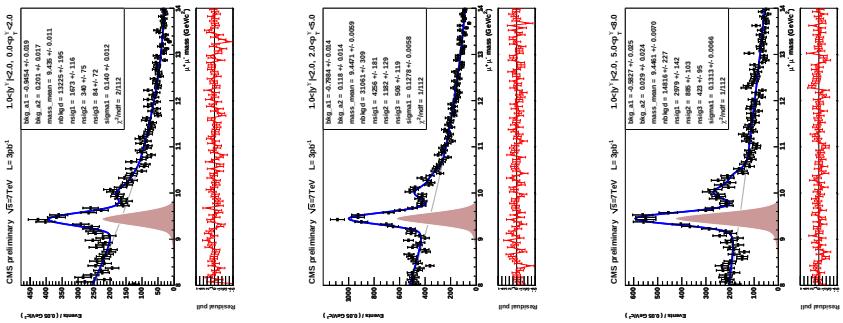
Figure 181: $\Upsilon(1S)$ systematic mass fits:ptspec, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

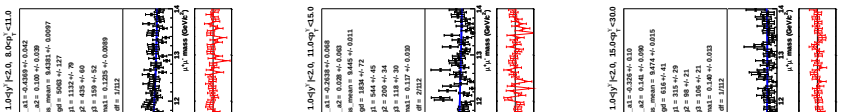
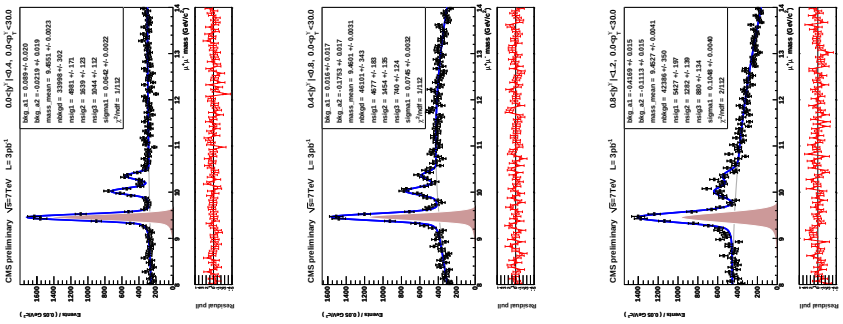
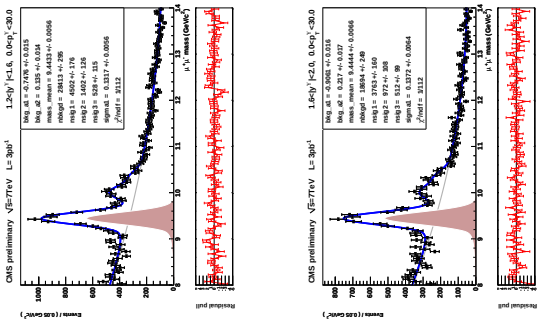


Figure 182: Υ(1S) systematic mass fits:ptspec, for $d\sigma/d|y|$ binning.

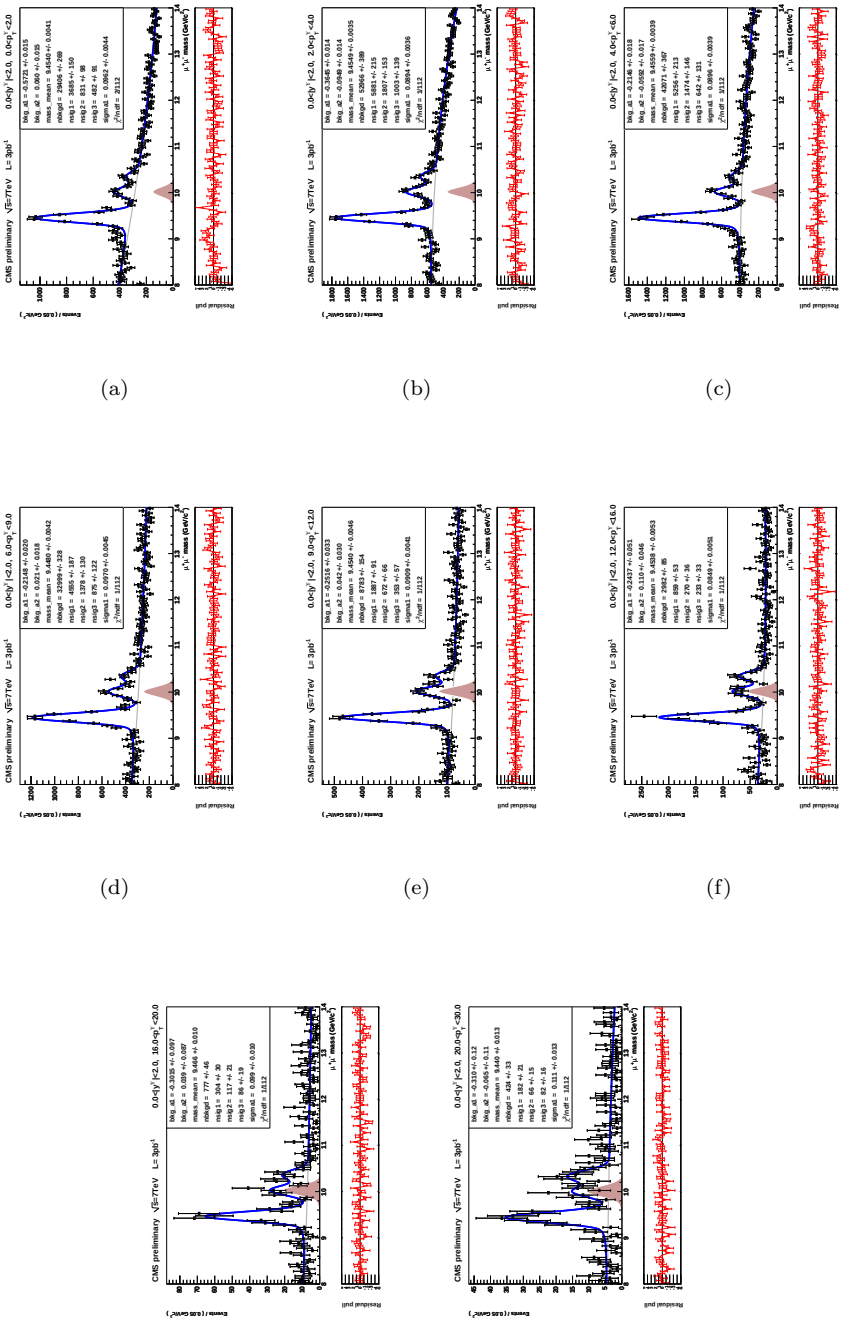


(a) (b) (c)



(d) (e)

Figure 183: Υ(2S) systematic mass fits:ptspec, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

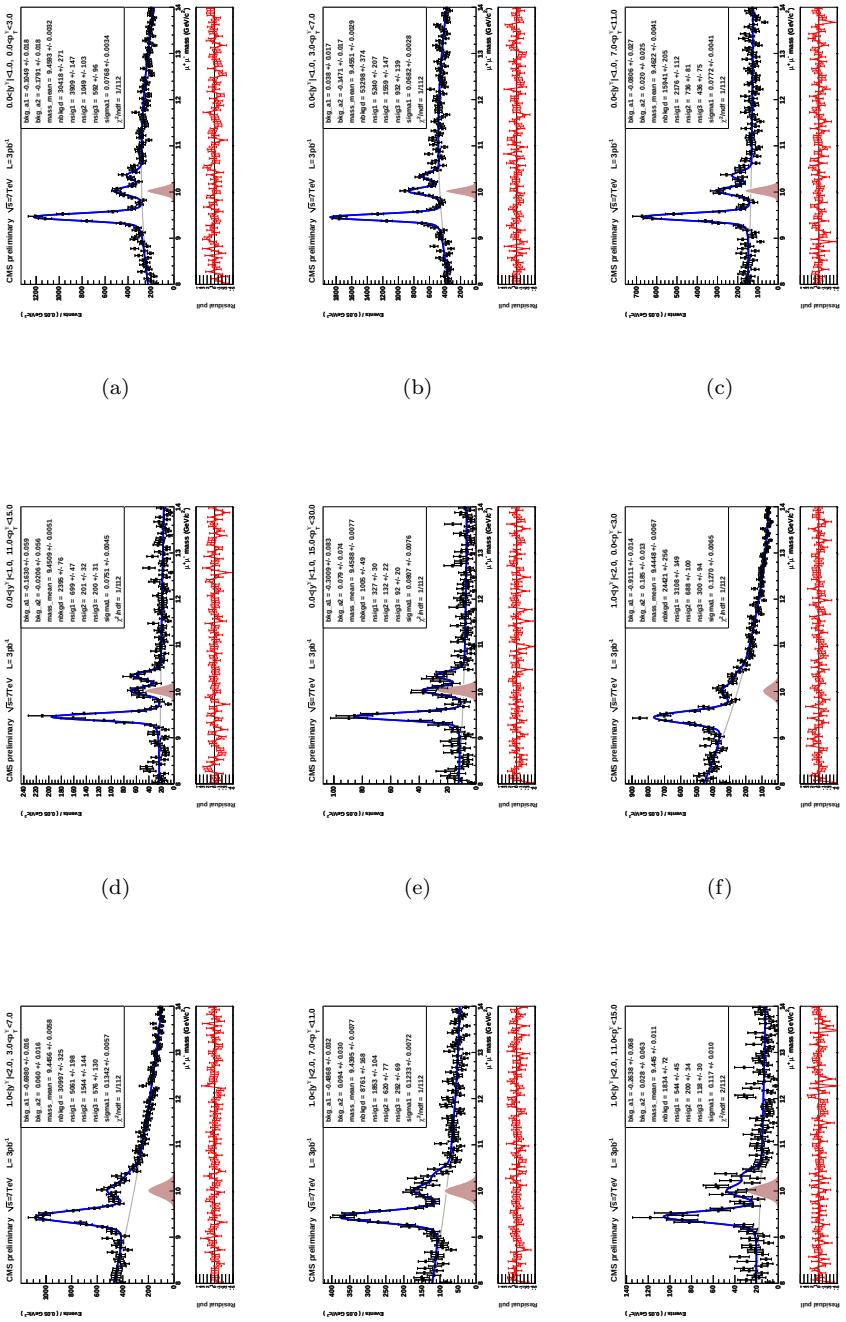


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 184: $\Upsilon(2S)$ systematic mass fits:ptspec, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

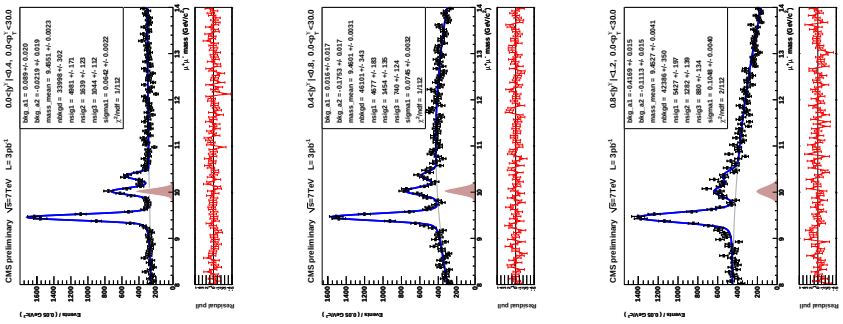


(a) (b) (c)

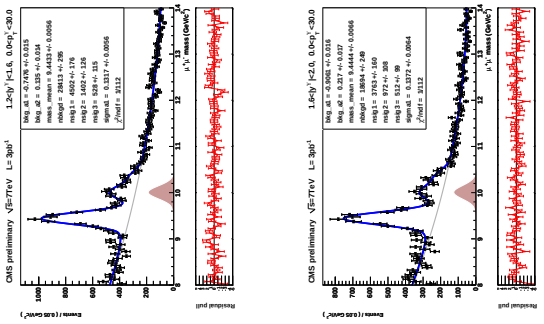
(d) (e) (f)

(g) (h) (i)

Figure 185: Υ(2S) systematic mass fits:ptspec, for $d\sigma/d|y|$ binning.

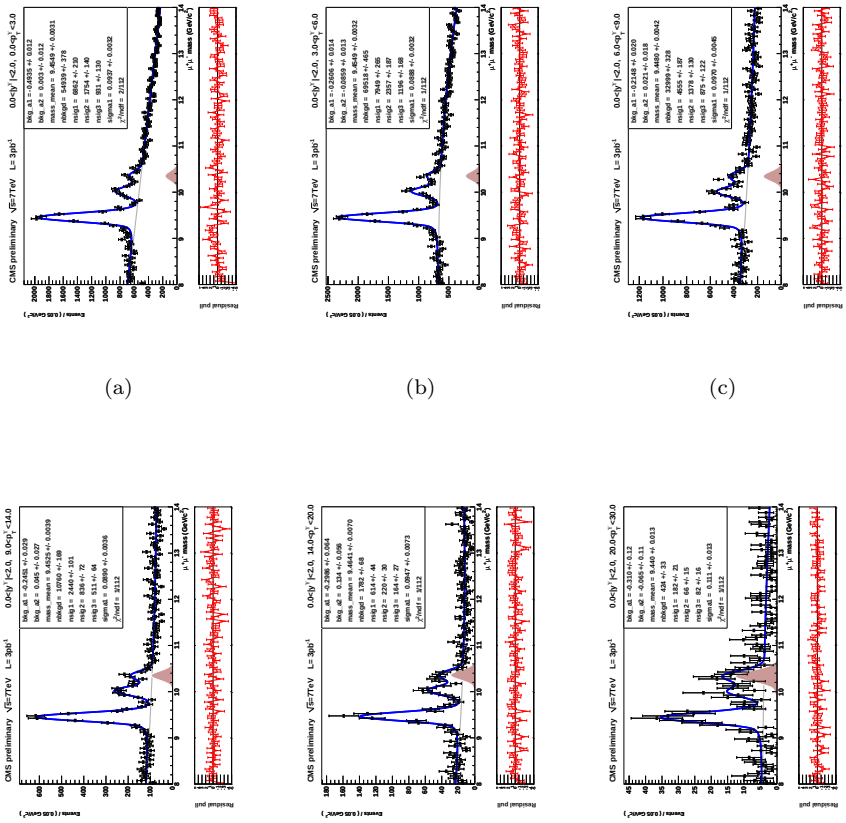


(a) (b) (c)



(d) (e)

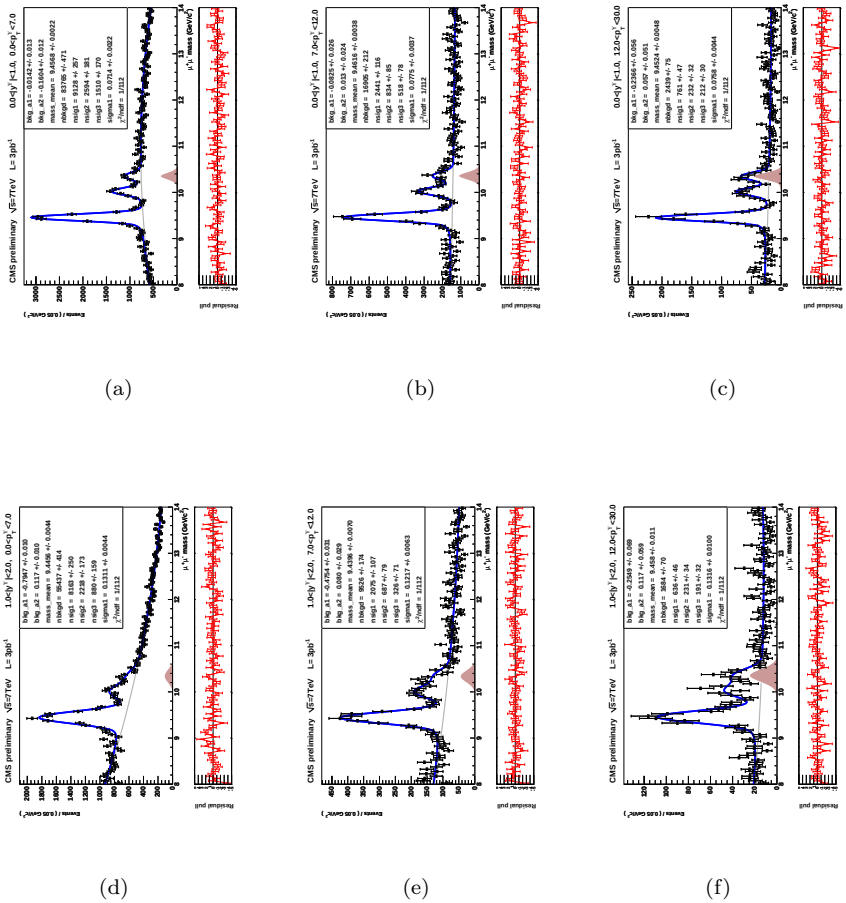
Figure 186: Υ(3S) systematic mass fits:ptspec, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

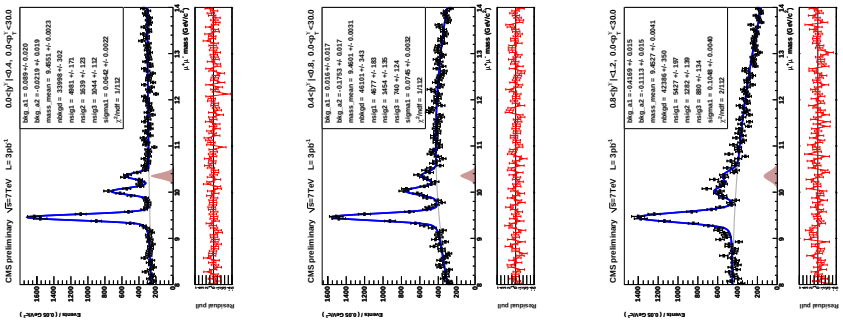
Figure 187: $\Upsilon(3S)$ systematic mass fits:ptspec, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



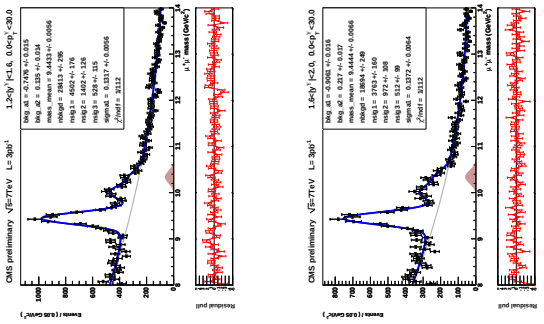
(a) (b) (c)

(d) (e) (f)

Figure 188: Υ(3S) systematic mass fits:ptspec, for $d\sigma/d|y|$ binning.



(a) (b) (c)

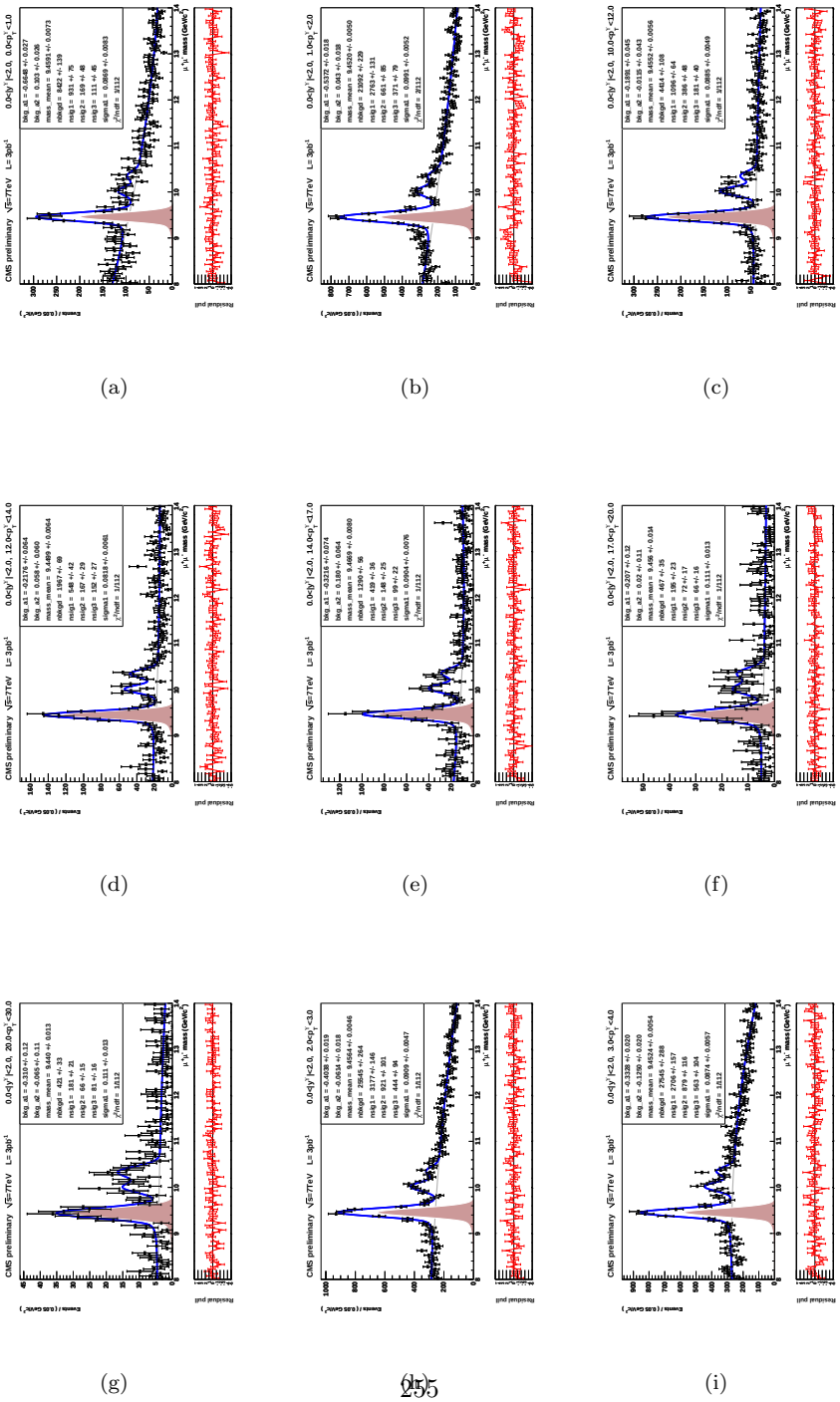


(d) (e)

0.8.17 systematics source: vtxpos

Systematics contribution from acceptance vertex position (luminous region)

Figure 189: $\Upsilon(1S)$ systematic mass fits:vtxpos, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



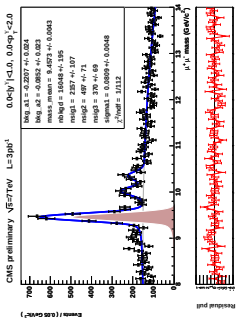
(a) (b) (c)

(d) (e) (f)

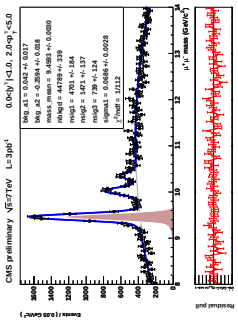
(g) (h) (i)

(j) (k) (l)

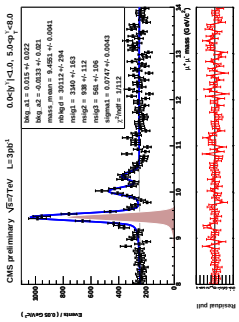
Figure 190: $\Upsilon(1S)$ systematic mass fits:vtxpos, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



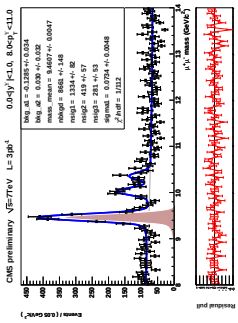
(a)



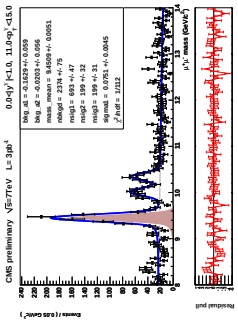
(b)



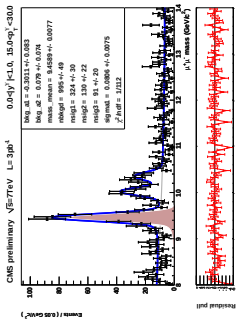
(c)



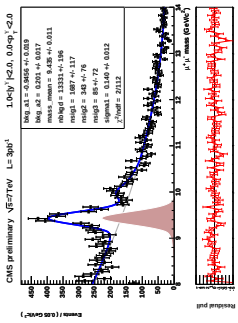
(d)



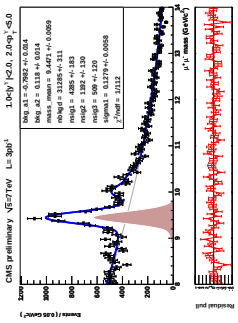
(e)



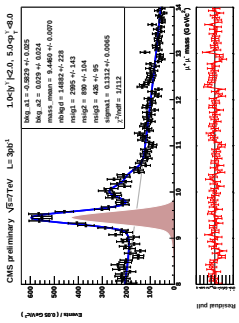
(f)



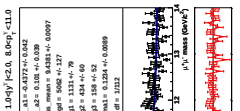
(g)

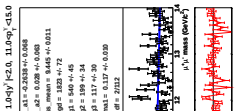


(h)



(i)





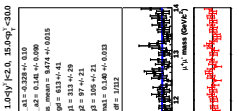
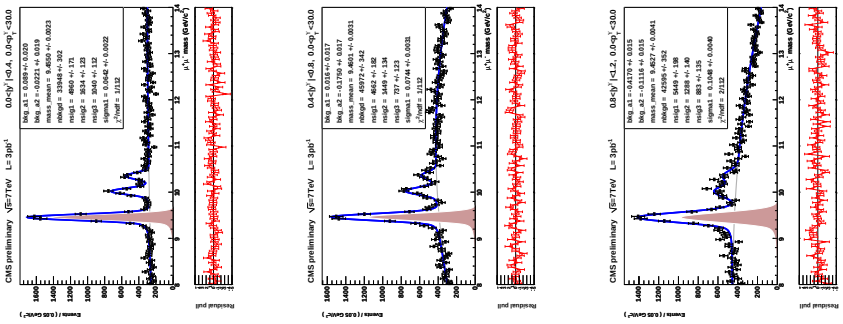
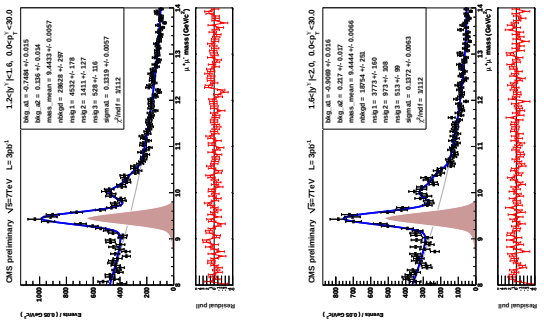


Figure 191: Υ(1S) systematic mass fits:vtxpos, for $d\sigma/d|y|$ binning.

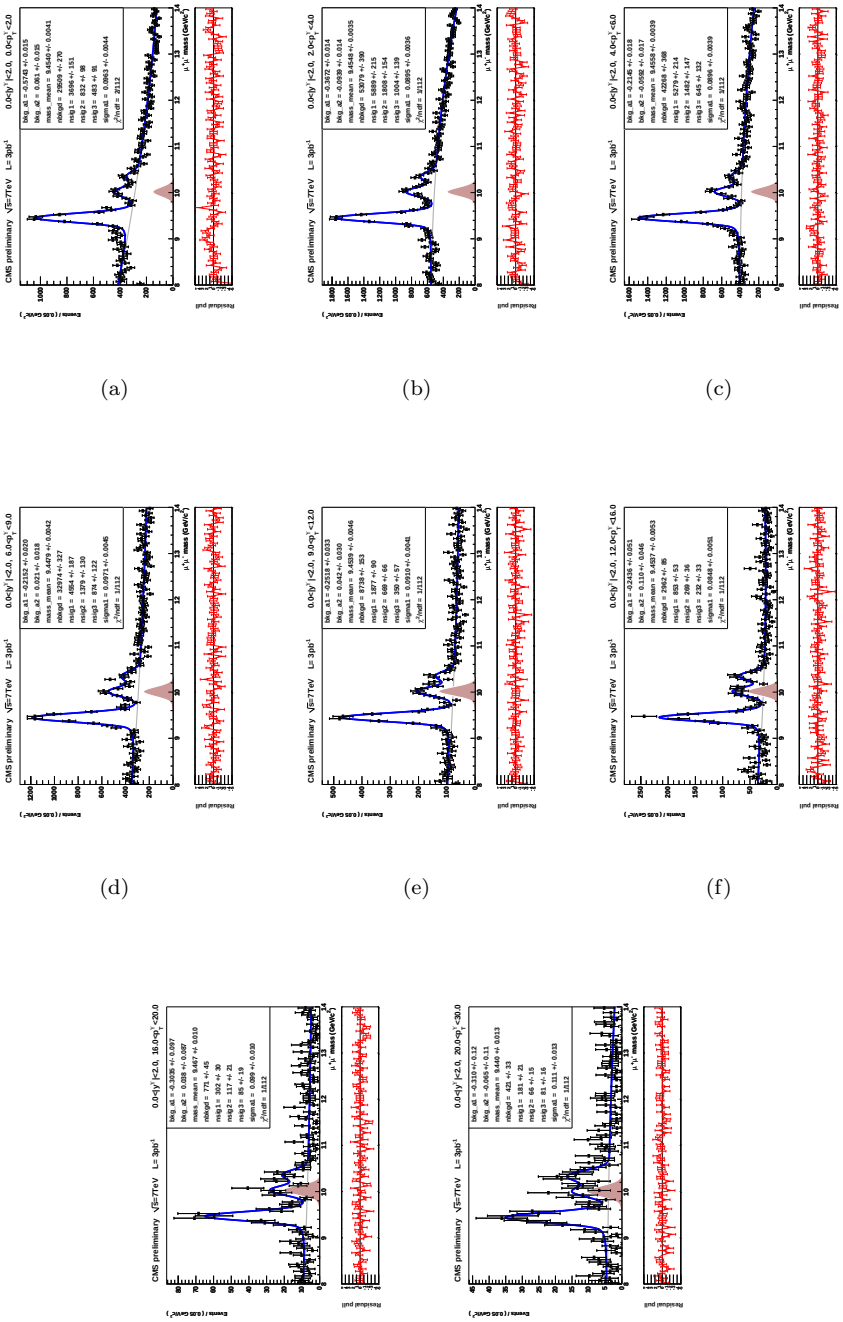


(a) (b) (c)



(d) (e)

Figure 192: $\Upsilon(2S)$ systematic mass fits:vtxpos, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

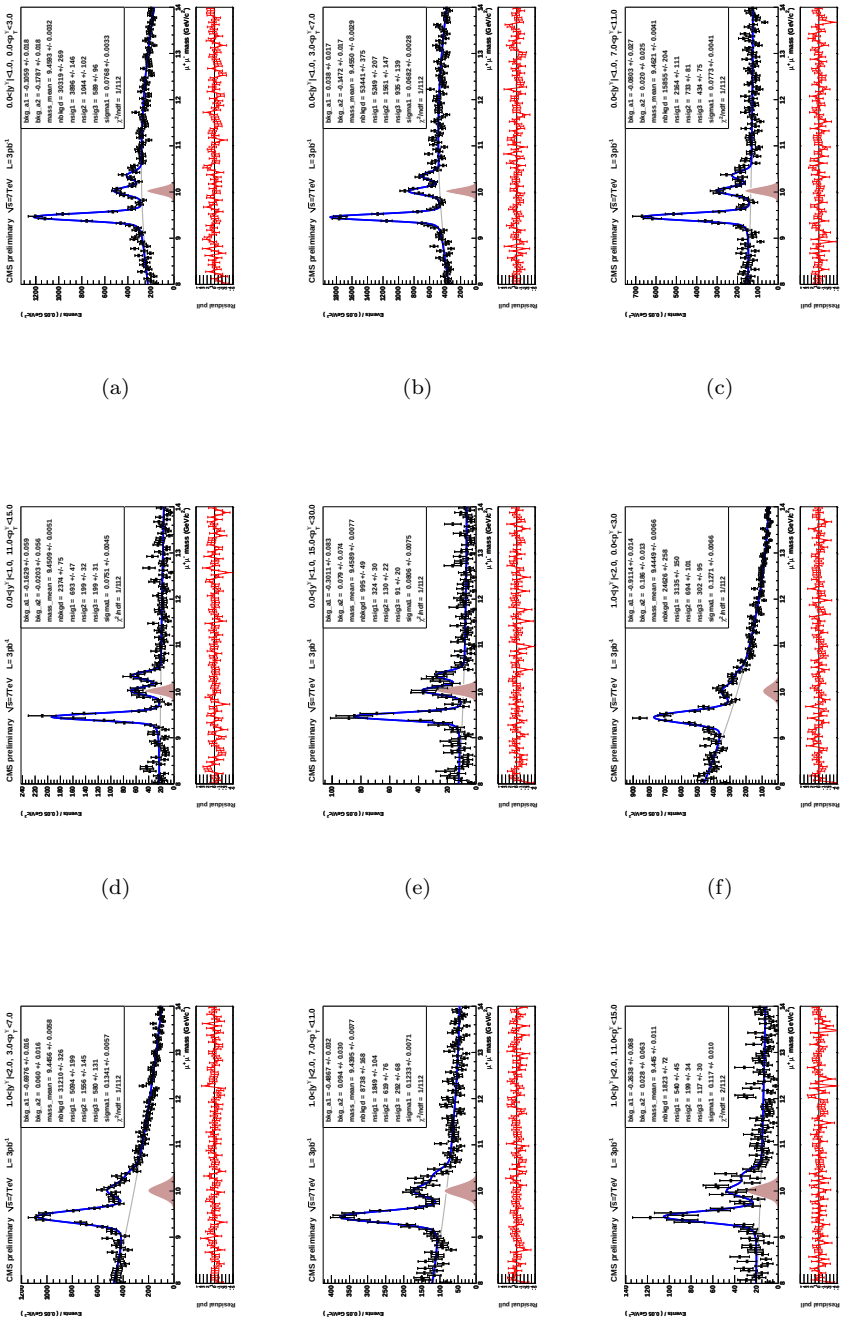


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 193: $\Upsilon(2S)$ systematic mass fits:vtxpos, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

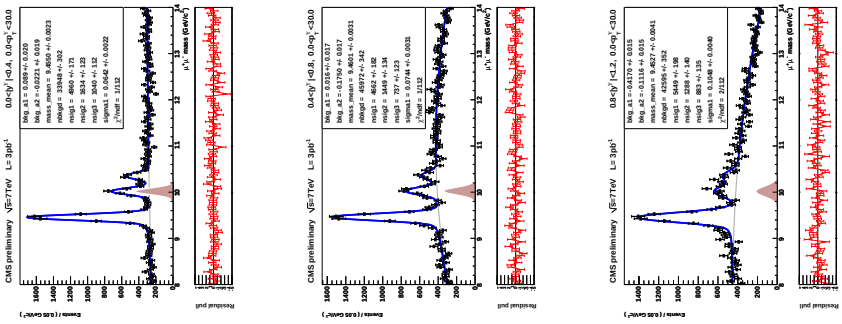


(a) (b) (c)

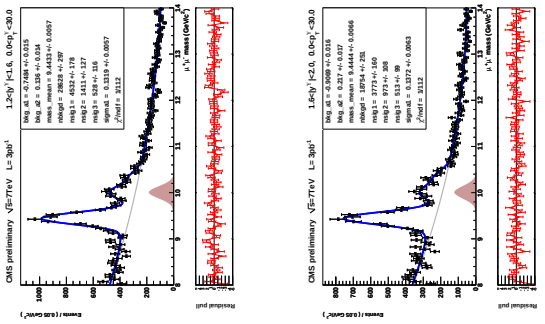
(d) (e) (f)

(g) (h) (i)

Figure 194: $\Upsilon(2S)$ systematic mass fits:vtxpos, for $d\sigma/d|y|$ binning.

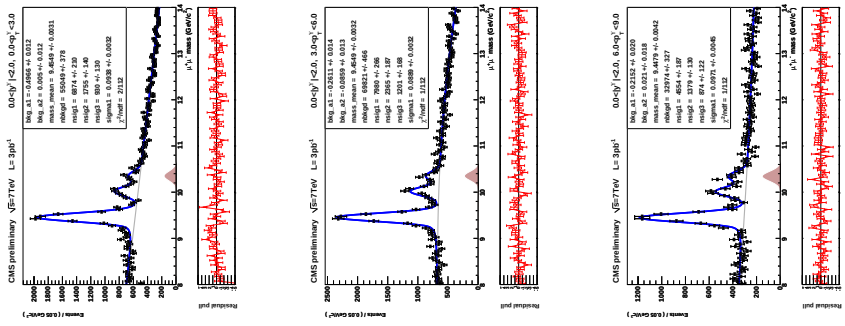


(a) (b) (c)

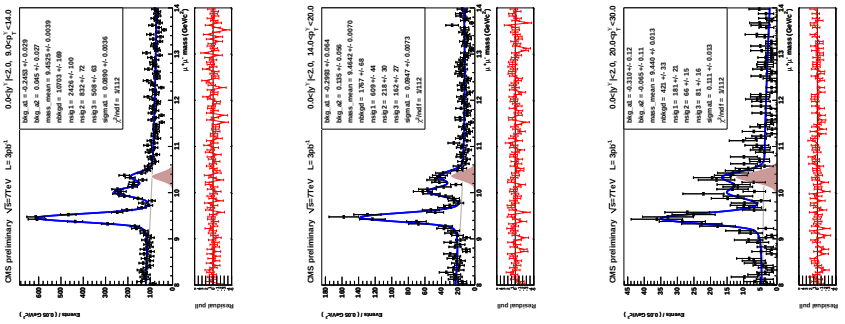


(d) (e)

Figure 195: Υ(3S) systematic mass fits:vtxpos, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

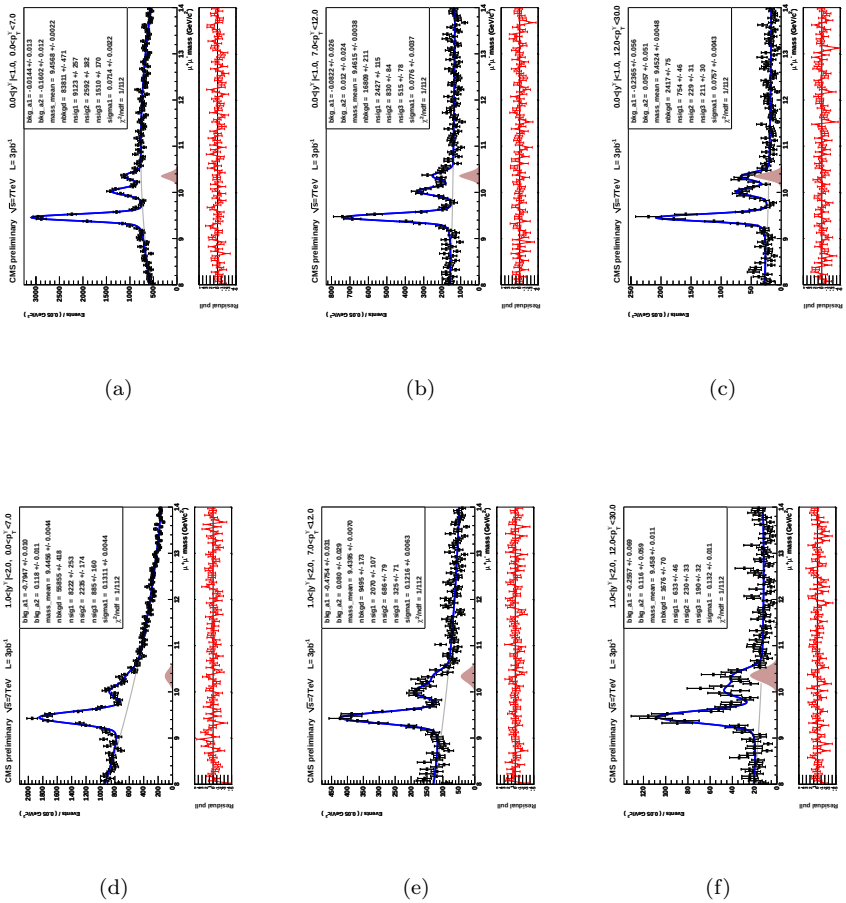


(a) (b) (c)



(d) (e) (f)

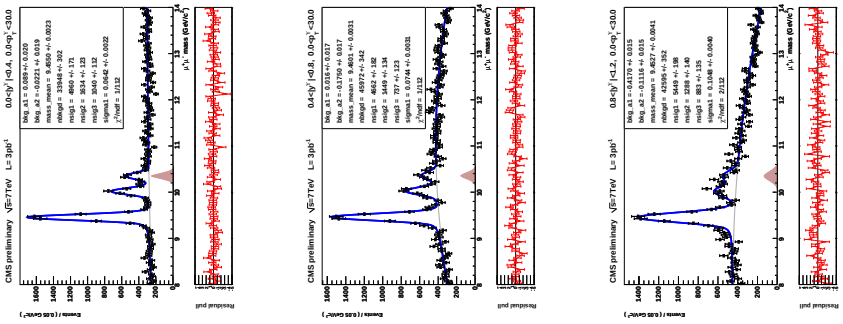
Figure 196: $\Upsilon(3S)$ systematic mass fits:vtxpos, for $d\sigma/dp_{\rm T}$ $|y|$: $(0,1),(1,2)$ binning.



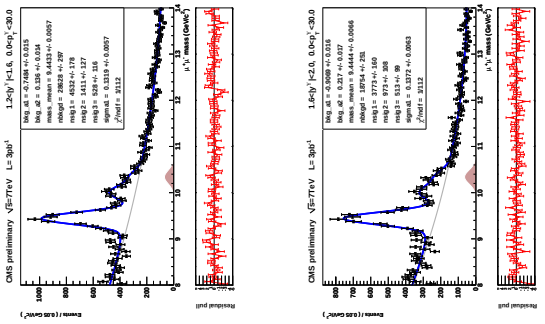
(a) (b) (c)

(d) (e) (f)

Figure 197: Υ(3S) systematic mass fits:vtxpos, for $d\sigma/d|y|$ binning.



(a) (b) (c)

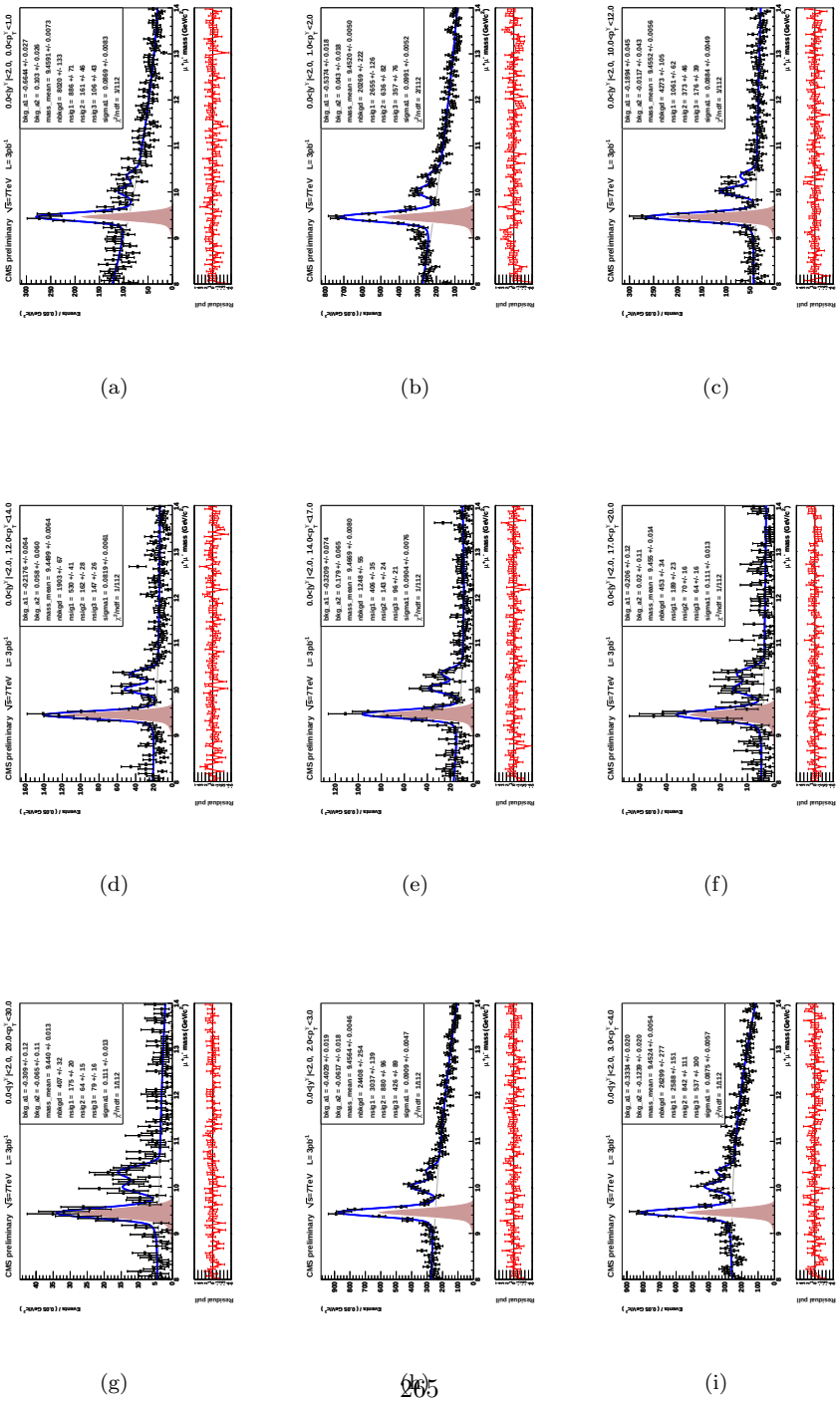


(d) (e)

0.8.18 systematics source: nofsr

Systematics contribution from acceptance with no fsr

Figure 198: Υ(1S) systematic mass fits:nofsr, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



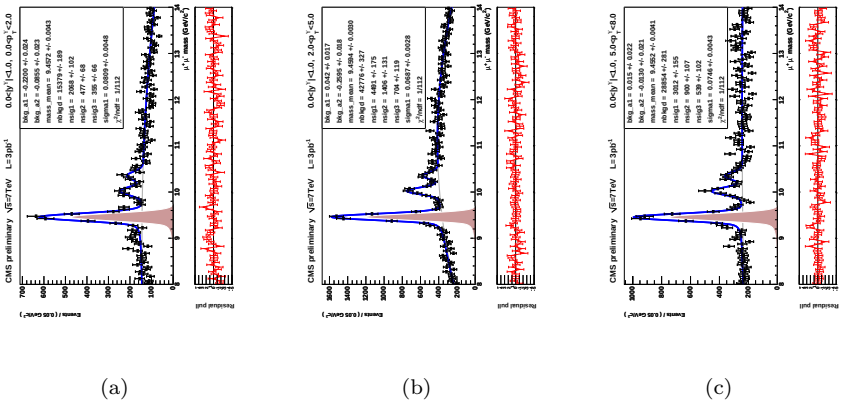
(a) (b) (c)

(d) (e) (f)

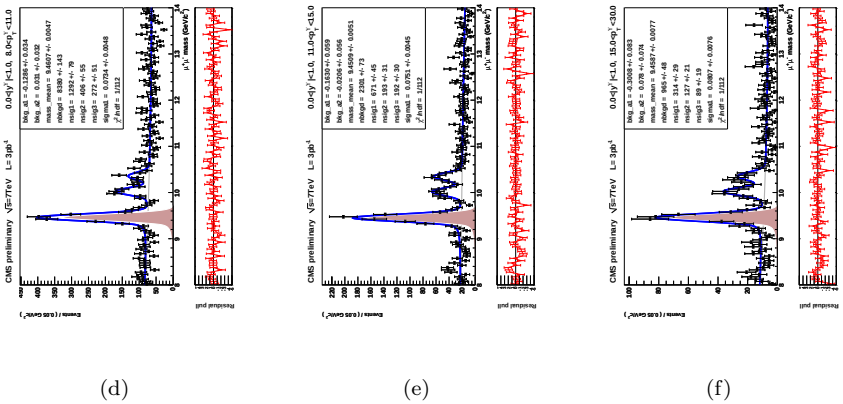
(g) (h) (i)

(j) (k) (l)

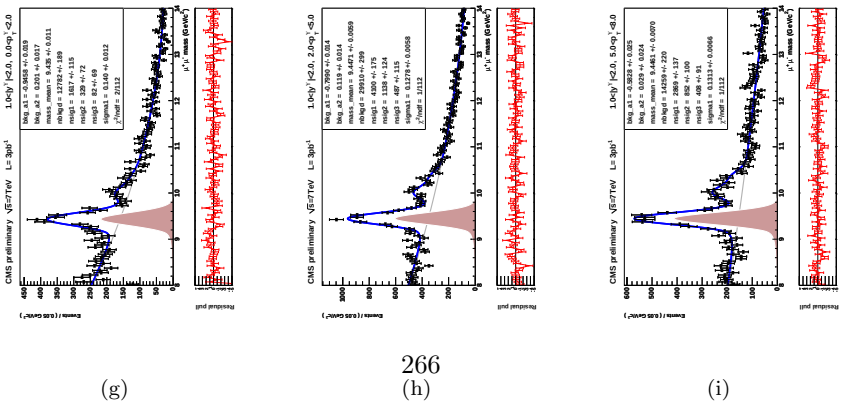
Figure 199: Υ(1S) systematic mass fits:nofsr, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



(a) (b) (c)



(d) (e) (f)



(g) (h) (i)

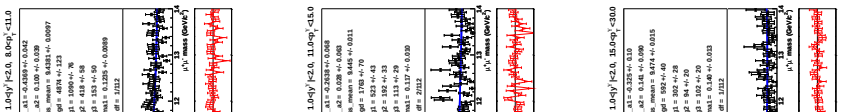
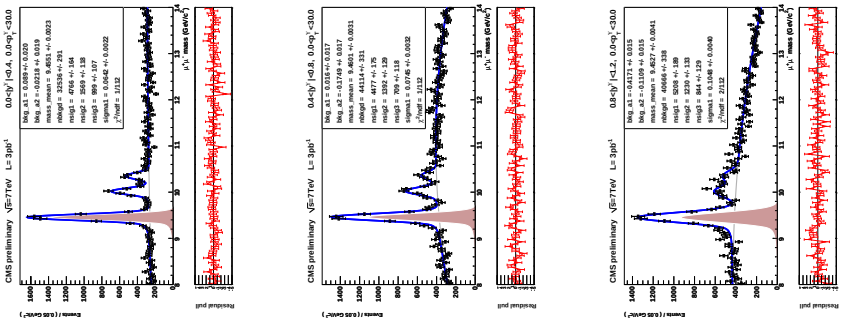
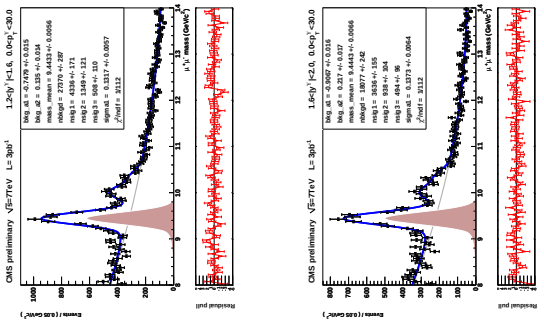


Figure 200: Υ(1S) systematic mass fits:nofsr, for $d\sigma/d|y|$ binning.

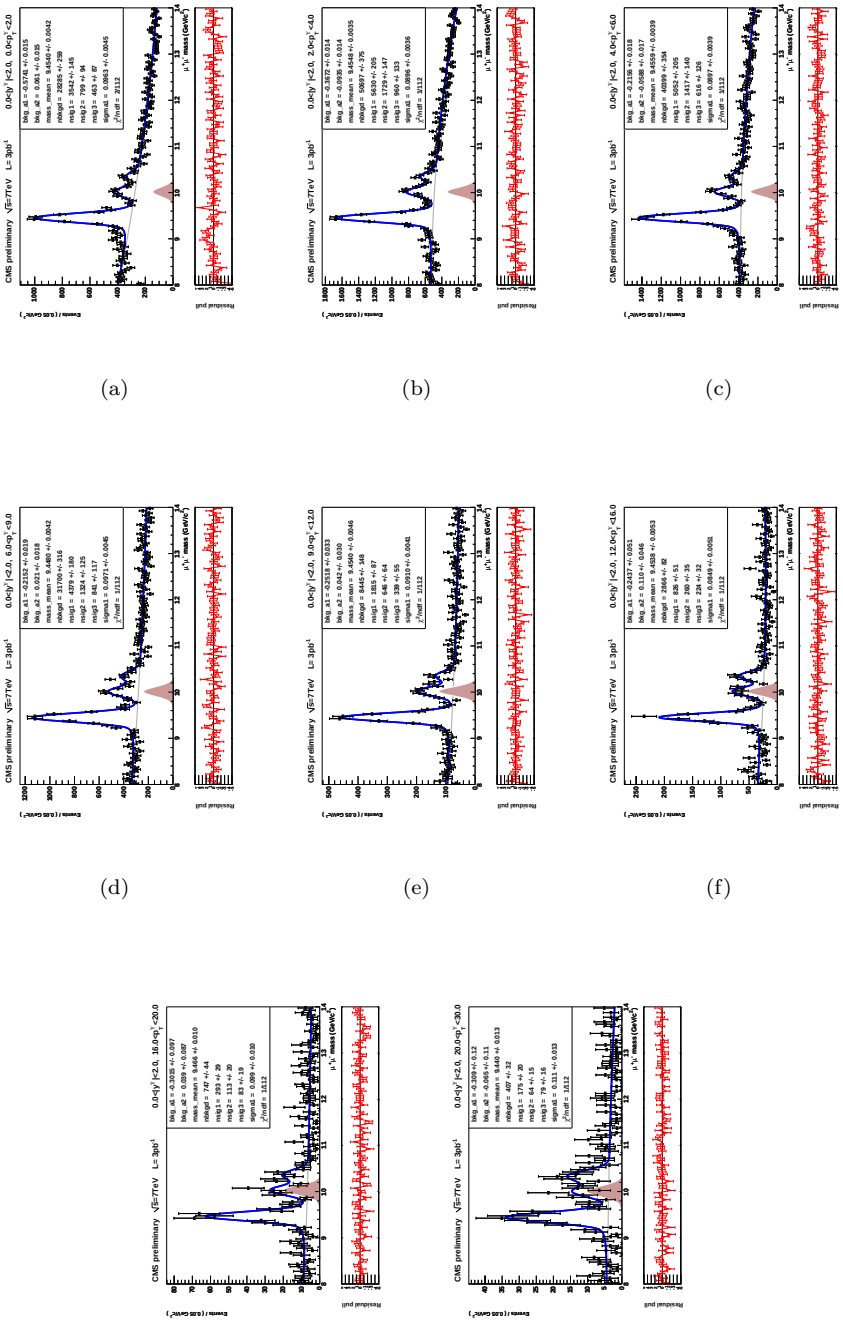


(a) (b) (c)



(d) (e)

Figure 201: Υ(2S) systematic mass fits:nofsr, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

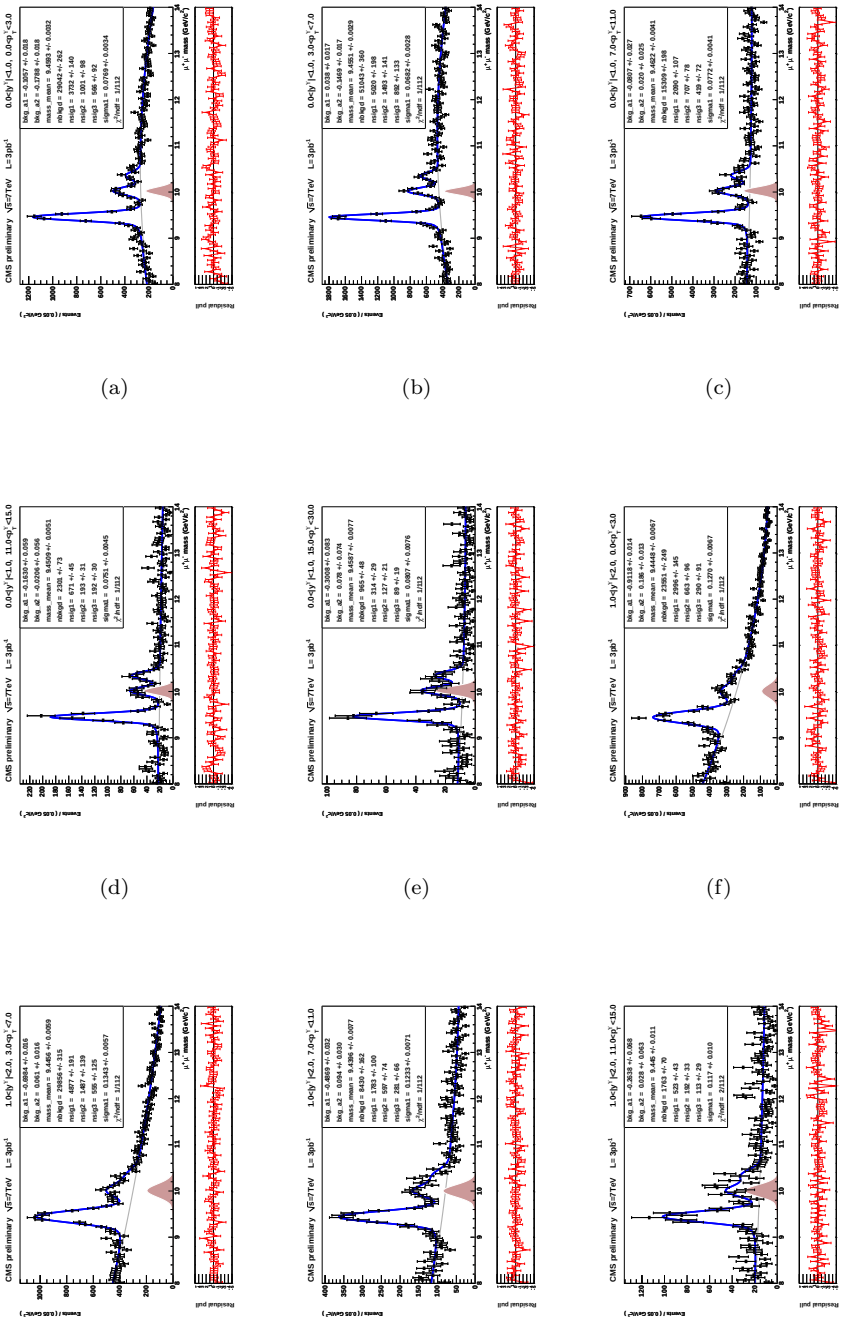


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 202: Υ(2S) systematic mass fits:nofsr, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

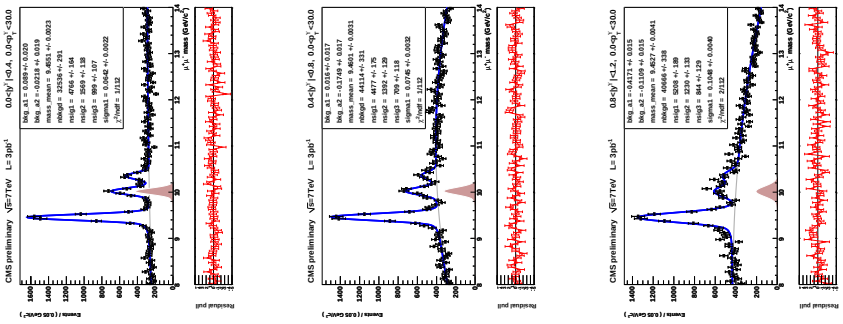


(a) (b) (c)

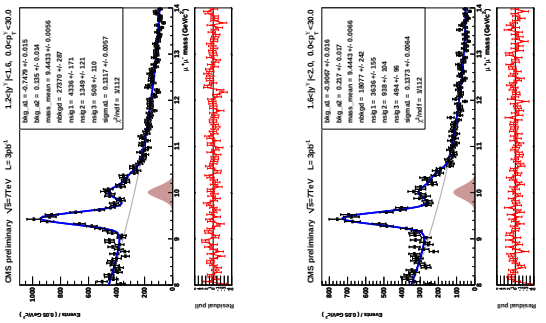
(d) (e) (f)

(g) (h) (i)

Figure 203: Υ(2S) systematic mass fits:nofsr, for $d\sigma/d|y|$ binning.

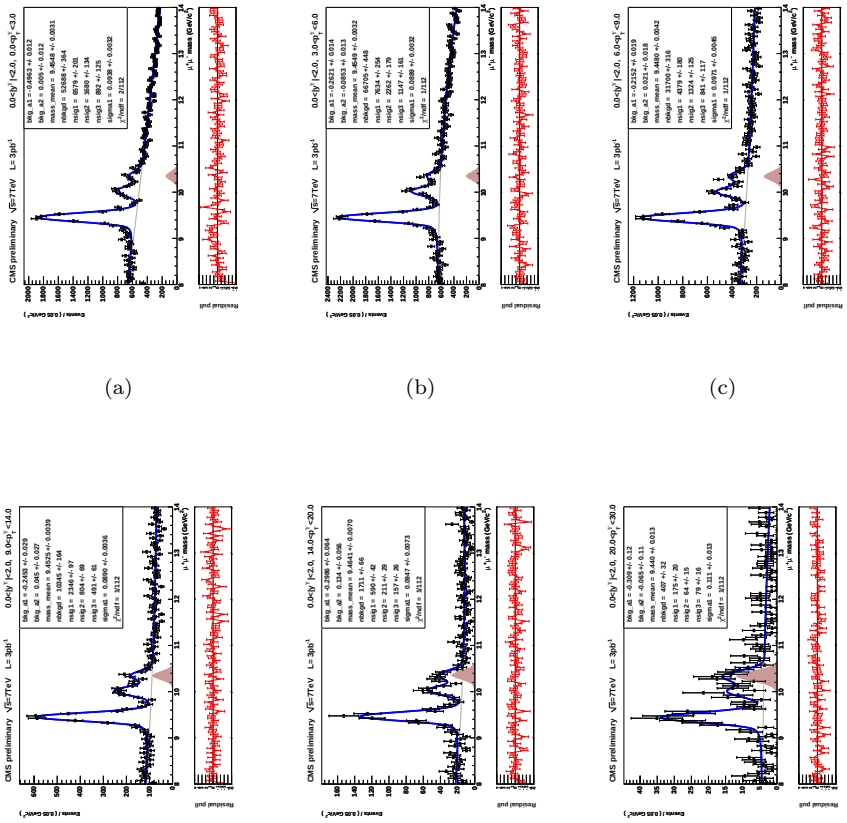


(a) (b) (c)



(d) (e)

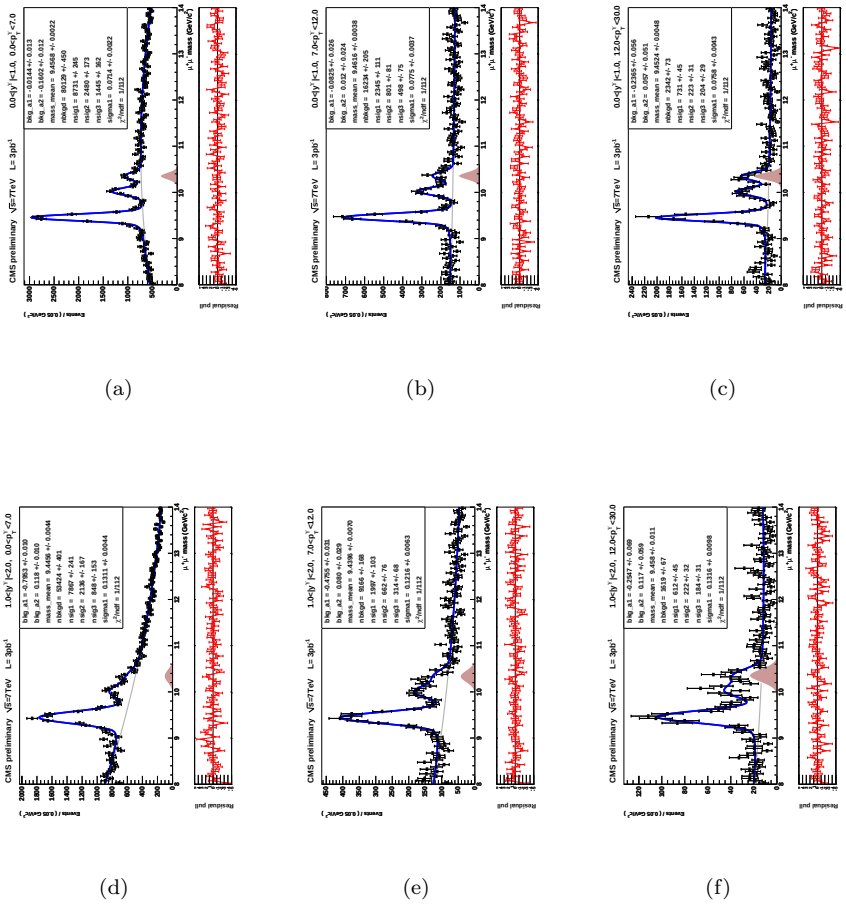
Figure 204: $\Upsilon(3S)$ systematic mass fits:nofsr, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

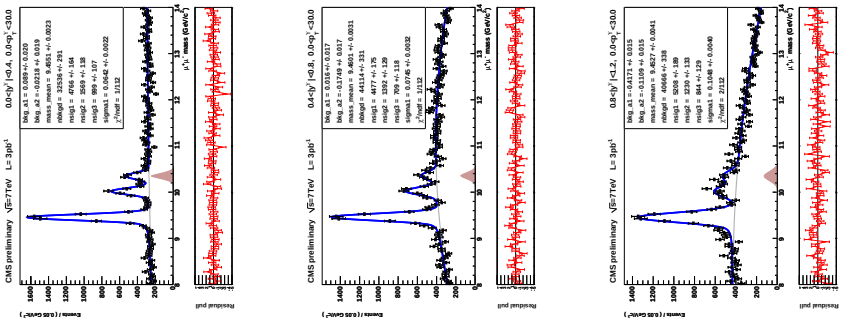
Figure 205: Υ(3S) systematic mass fits:nofsr, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



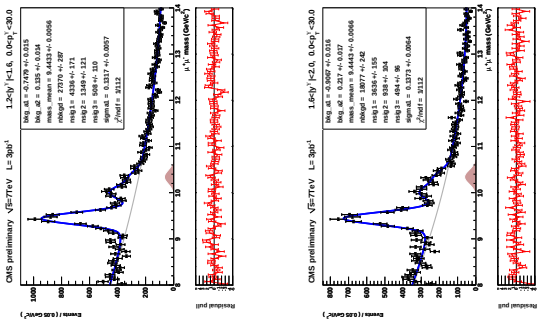
(a) (b) (c)

(d) (e) (f)

Figure 206: Υ(3S) systematic mass fits:nofsr, for $d\sigma/d|y|$ binning.



(a) (b) (c)

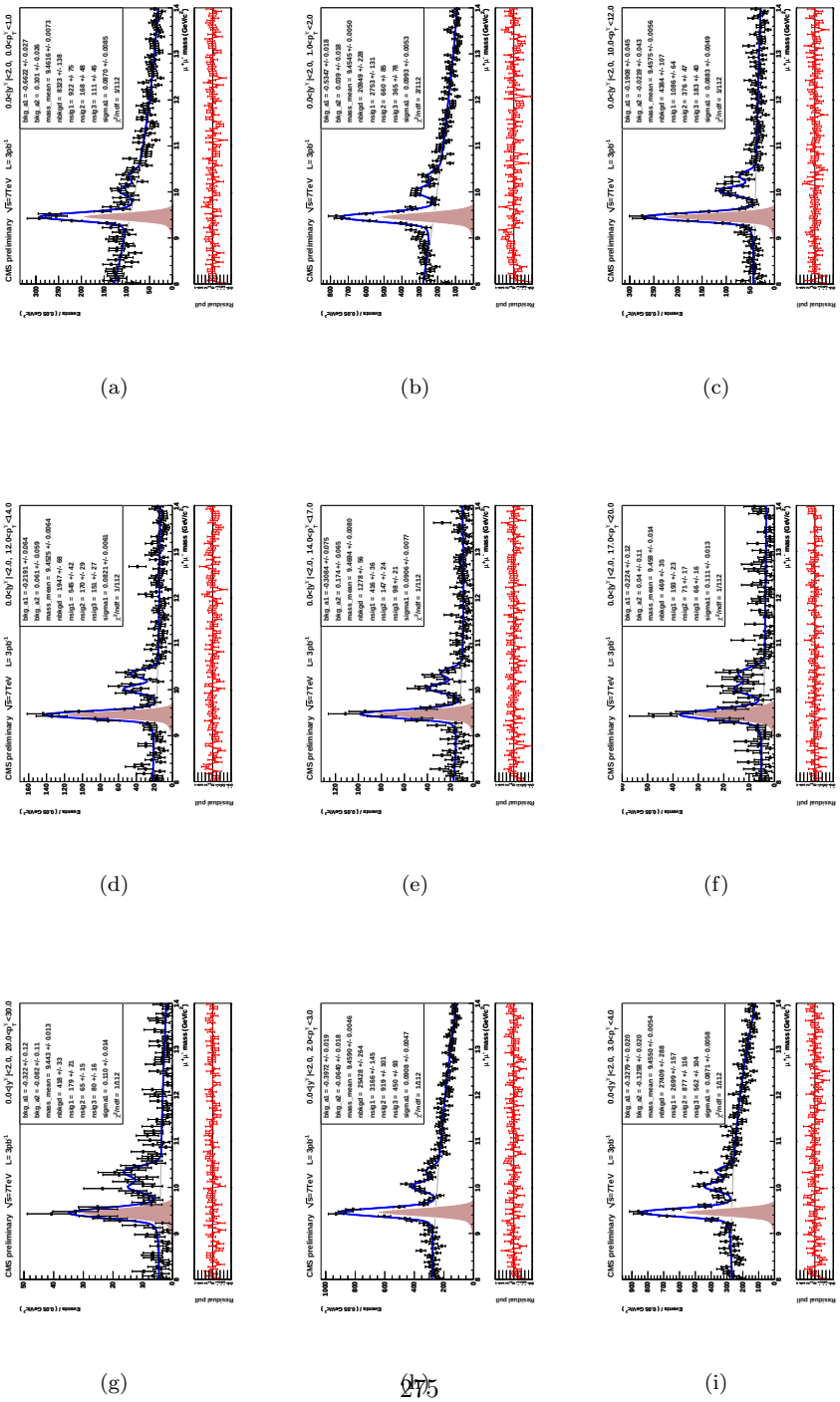


(d) (e)

0.8.19 systematics source: otherLo

Systematics contribution from mass scale uncertainty on mass reconstruction (-1σ)

Figure 207: Υ(1S) systematic mass fits:otherLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



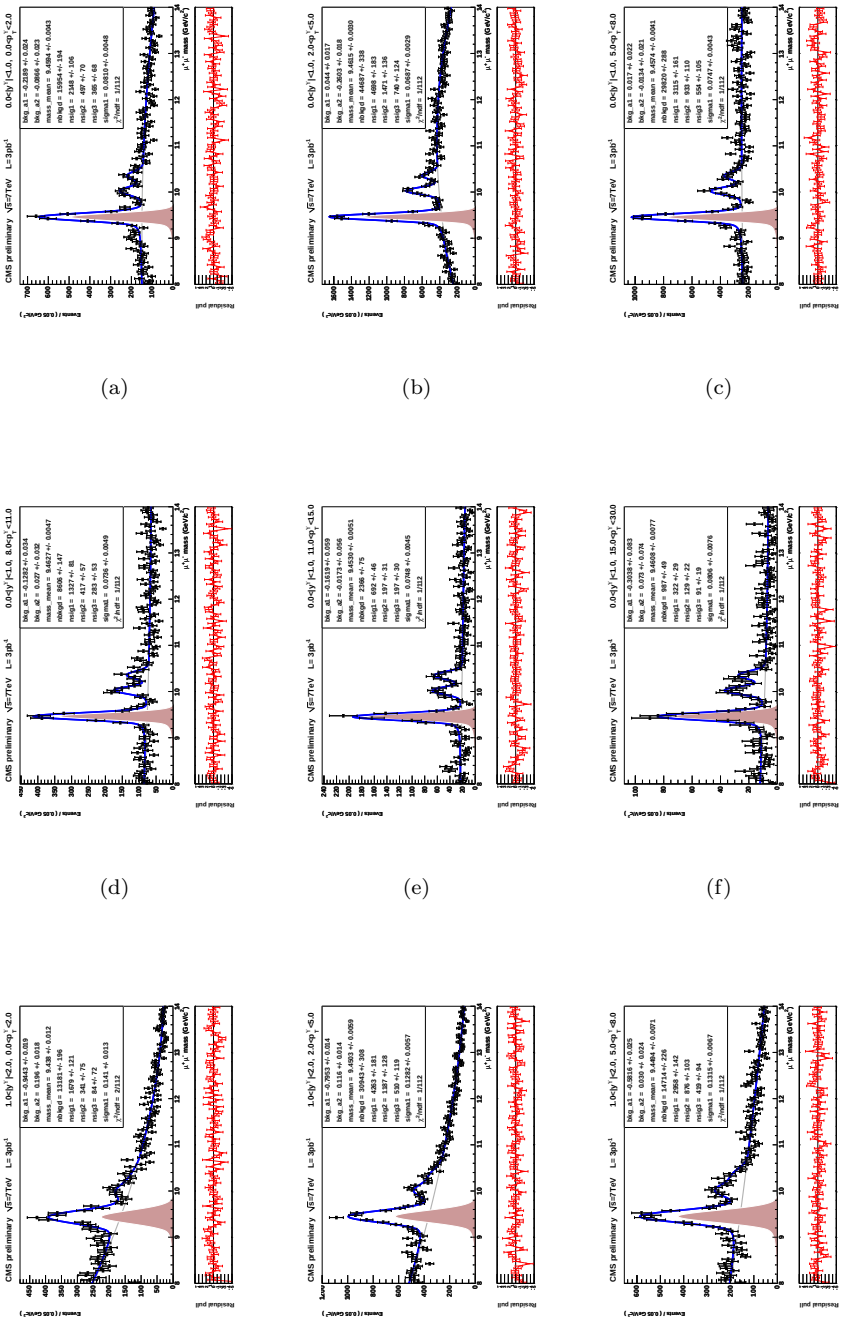
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 208: Υ(1S) systematic mass fits:otherLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

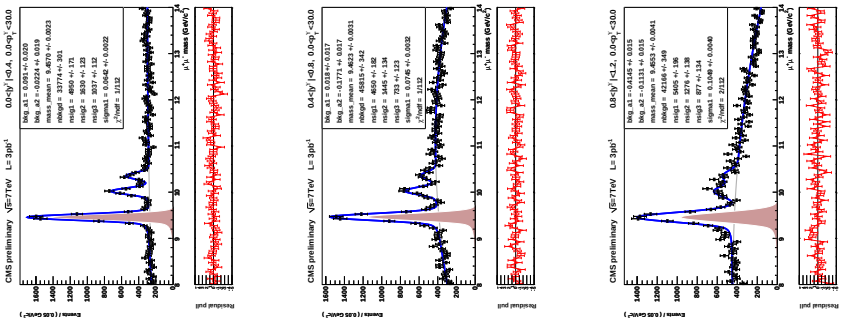


(a) (b) (c)

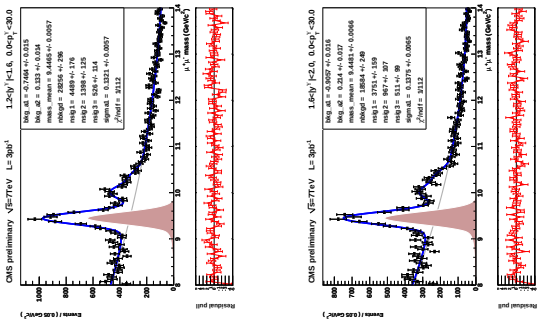
(d) (e) (f)

(g) (h) (i)

Figure 209: $\Upsilon(1S)$ systematic mass fits:otherLo, for $d\sigma/d|y|$ binning.

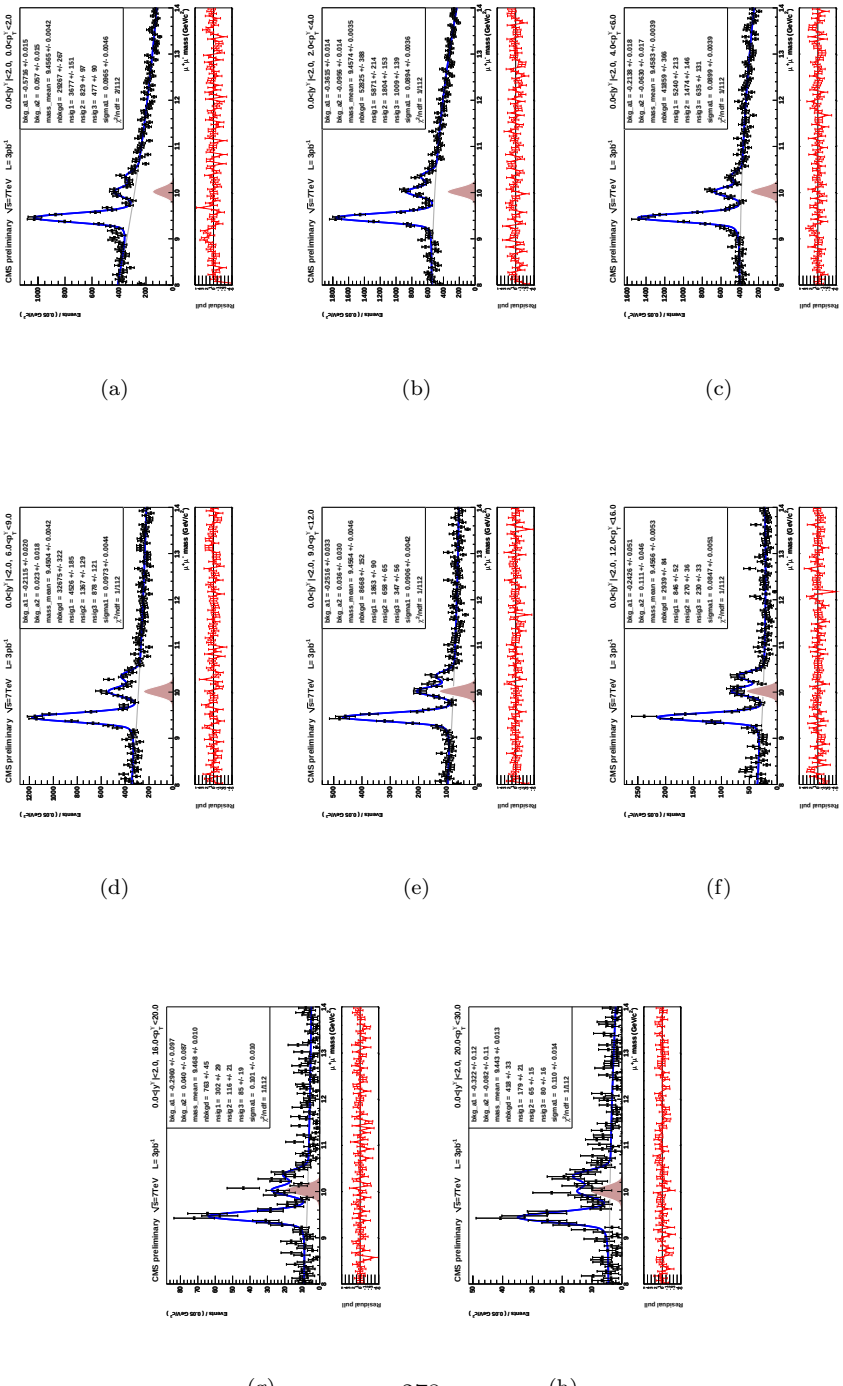


(a) (b) (c)



(d) (e)

Figure 210: Υ(2S) systematic mass fits:otherLo, for $d\sigma/dp_{\mathrm{T}}, |y|$: $(0, 2)$ binning.

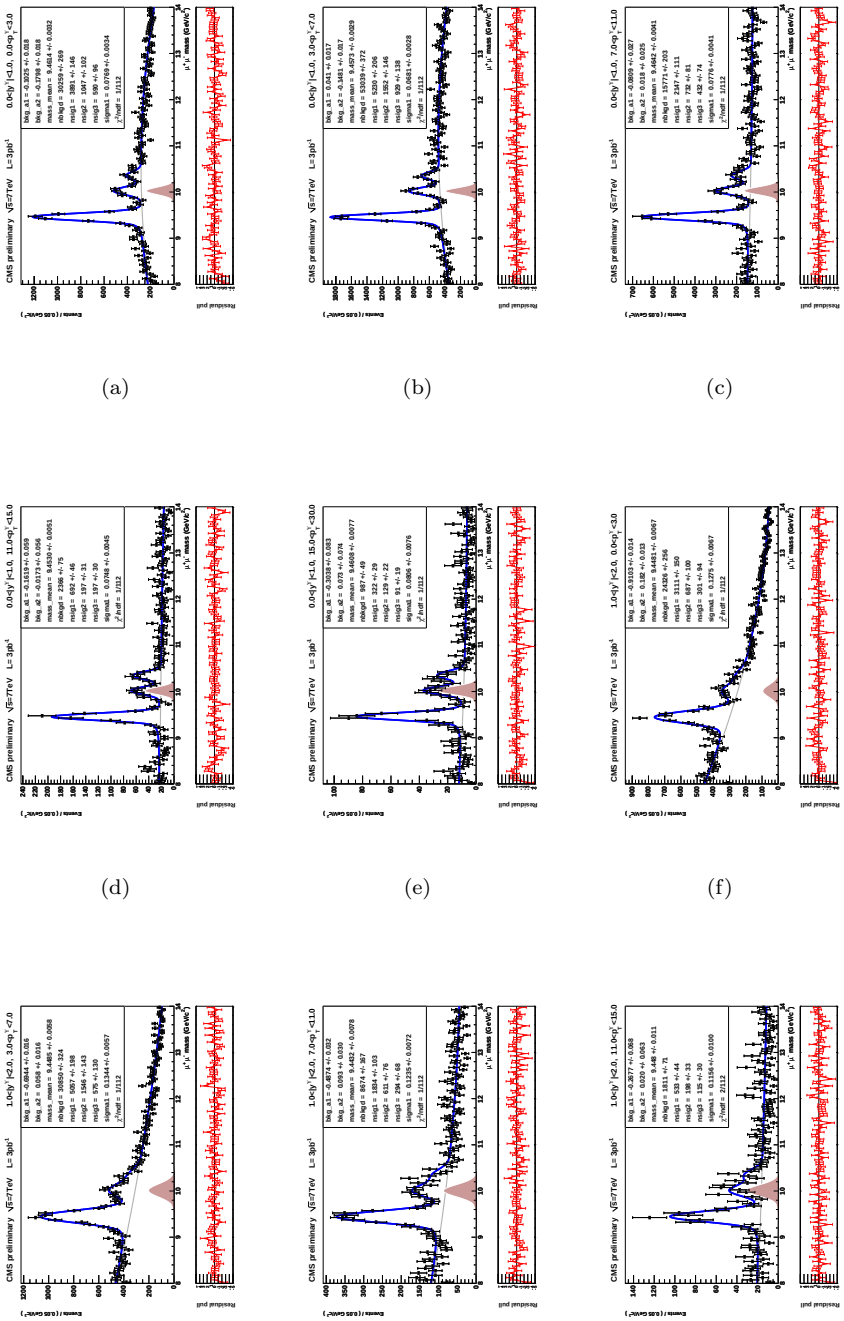


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 211: Υ(2S) systematic mass fits:otherLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

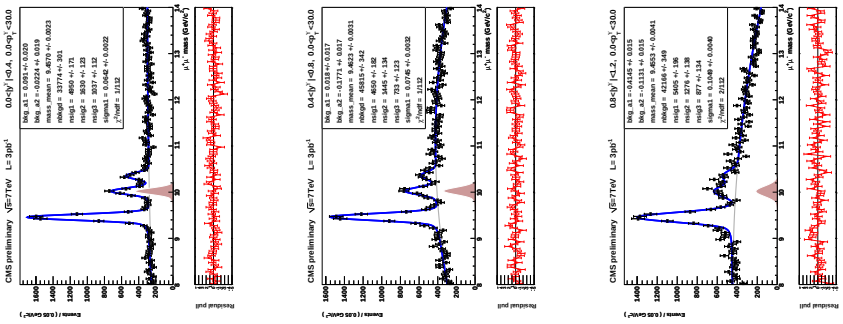


(a) (b) (c)

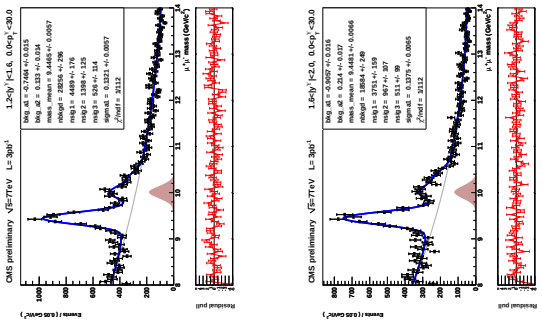
(d) (e) (f)

(g) (h) (i)

Figure 212: $\Upsilon(2S)$ systematic mass fits:otherLo, for $d\sigma/d|y|$ binning.

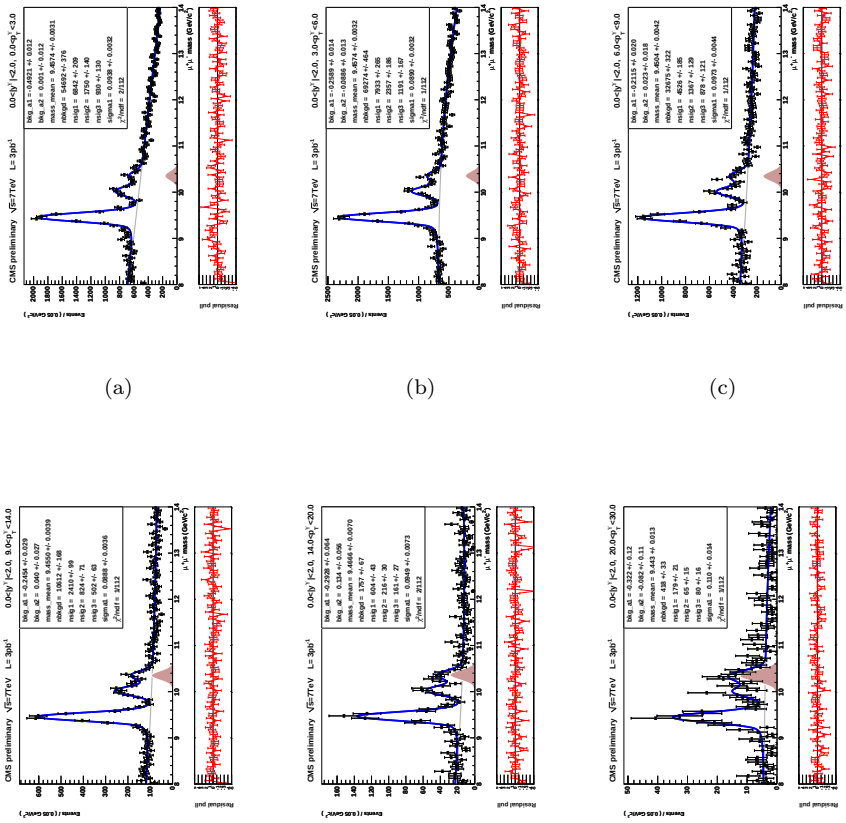


(a) (b) (c)



(d) (e)

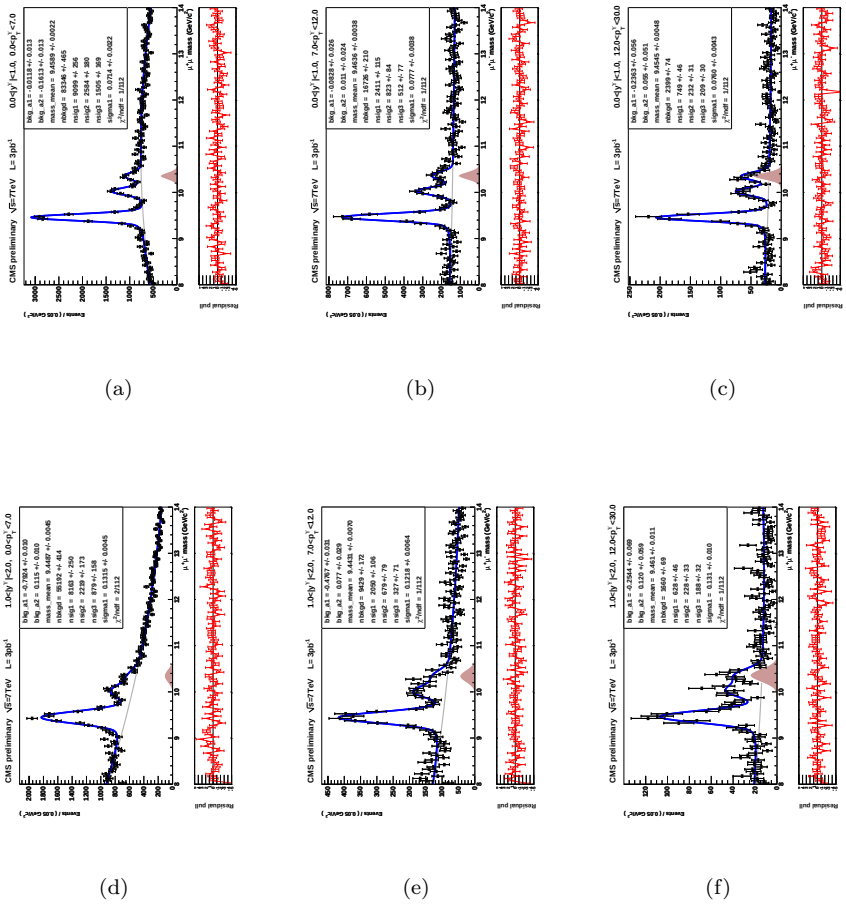
Figure 213: Υ(3S) systematic mass fits:otherLo, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

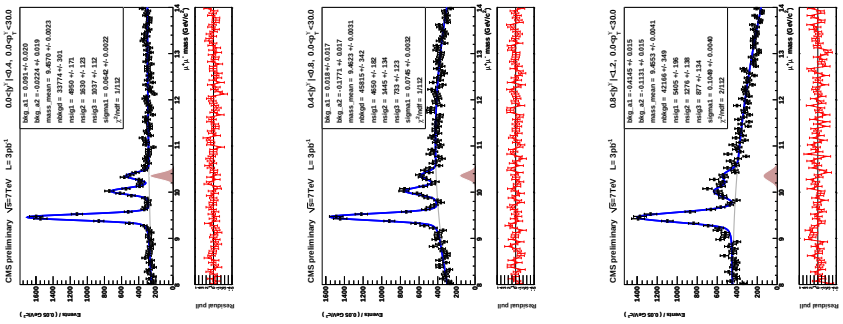
Figure 214: $\Upsilon(3S)$ systematic mass fits:otherLo, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



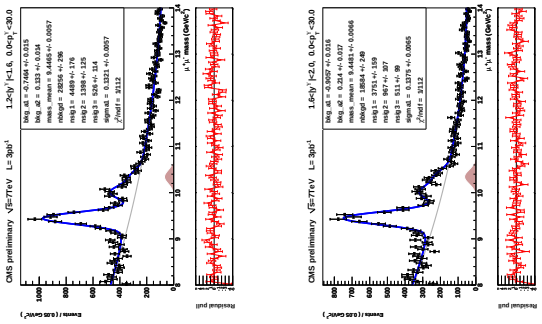
(a) (b) (c)

(d) (e) (f)

Figure 215: Υ(3S) systematic mass fits:otherLo, for $d\sigma/d|y|$ binning.



(a) (b) (c)

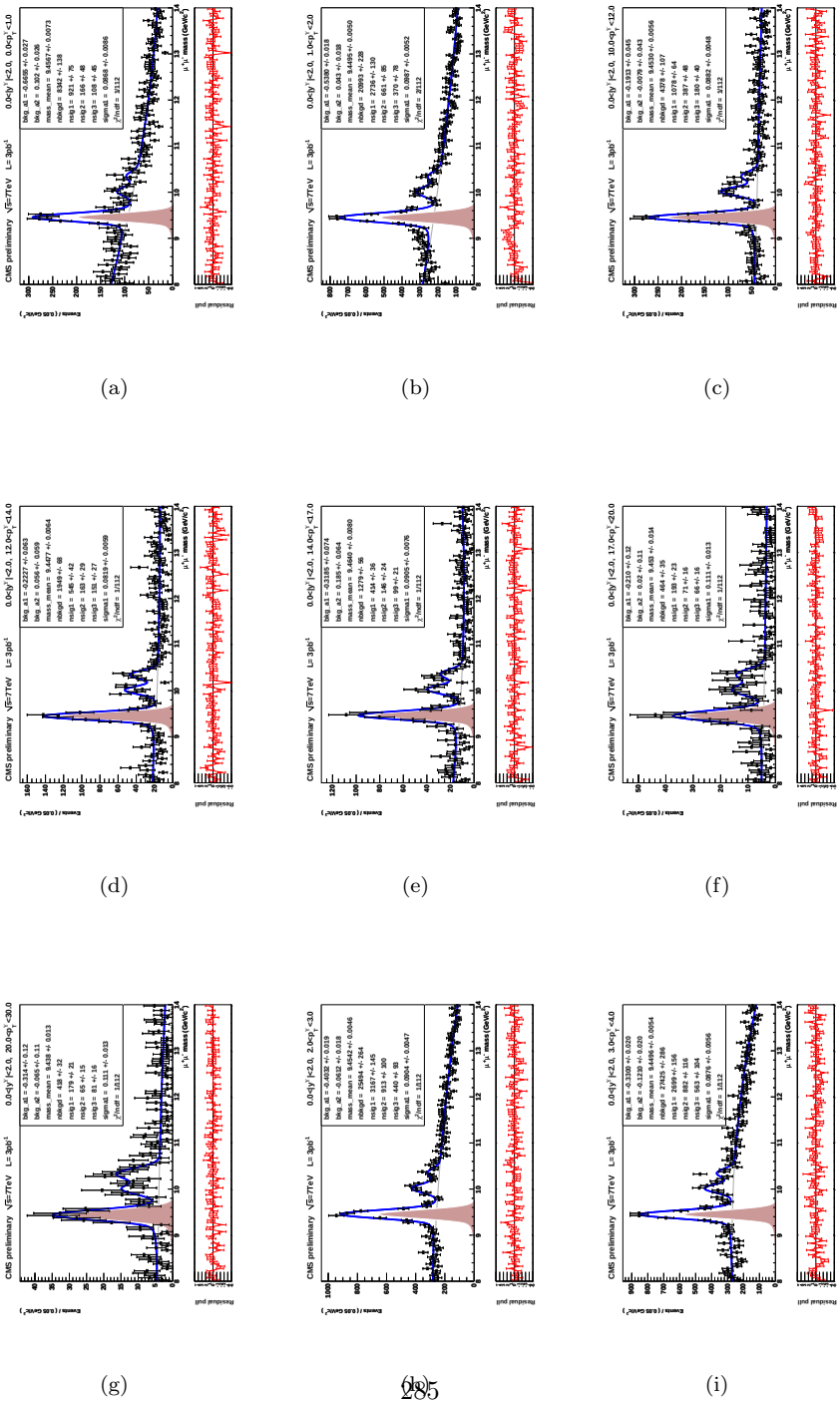


(d) (e)

0.8.20 systematics source: otherHi

Systematics contribution from mass scale uncertainty on mass reconstruction ($+1\sigma$)

Figure 216: $\Upsilon(1S)$ systematic mass fits:otherHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



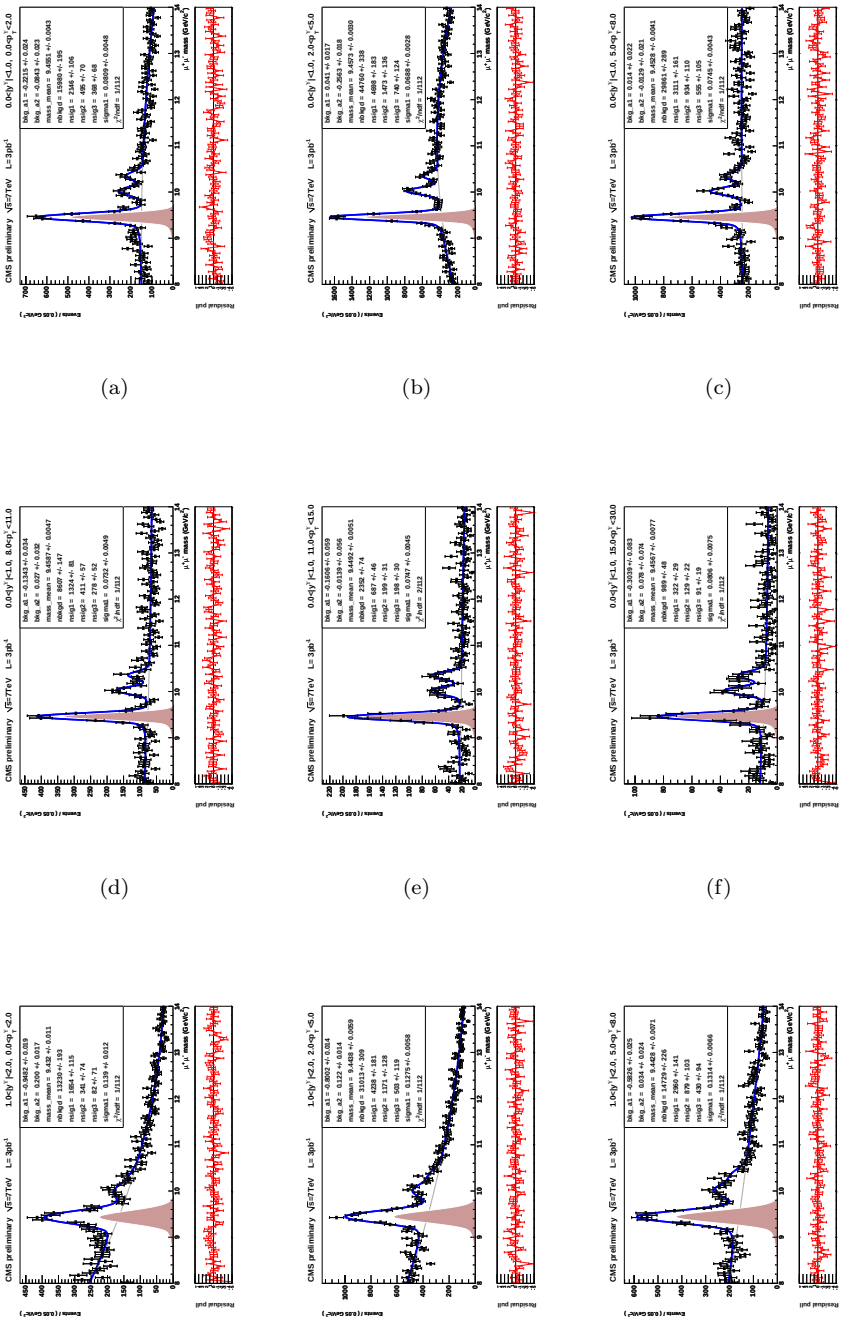
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (l)

Figure 217: Υ(1S) systematic mass fits:otherHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

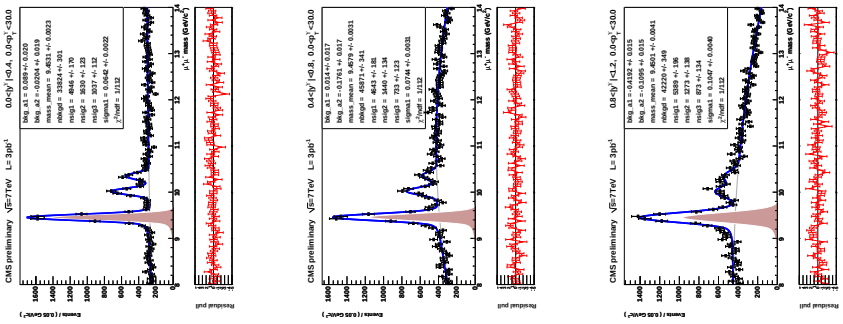


(a) (b) (c)

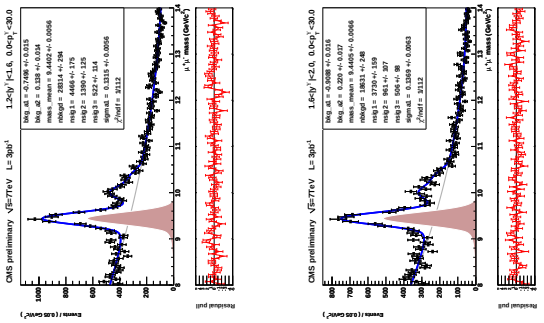
(d) (e) (f)

(g) (h) (i)

Figure 218: $\Upsilon(1S)$ systematic mass fits:otherHi, for $d\sigma/d|y|$ binning.

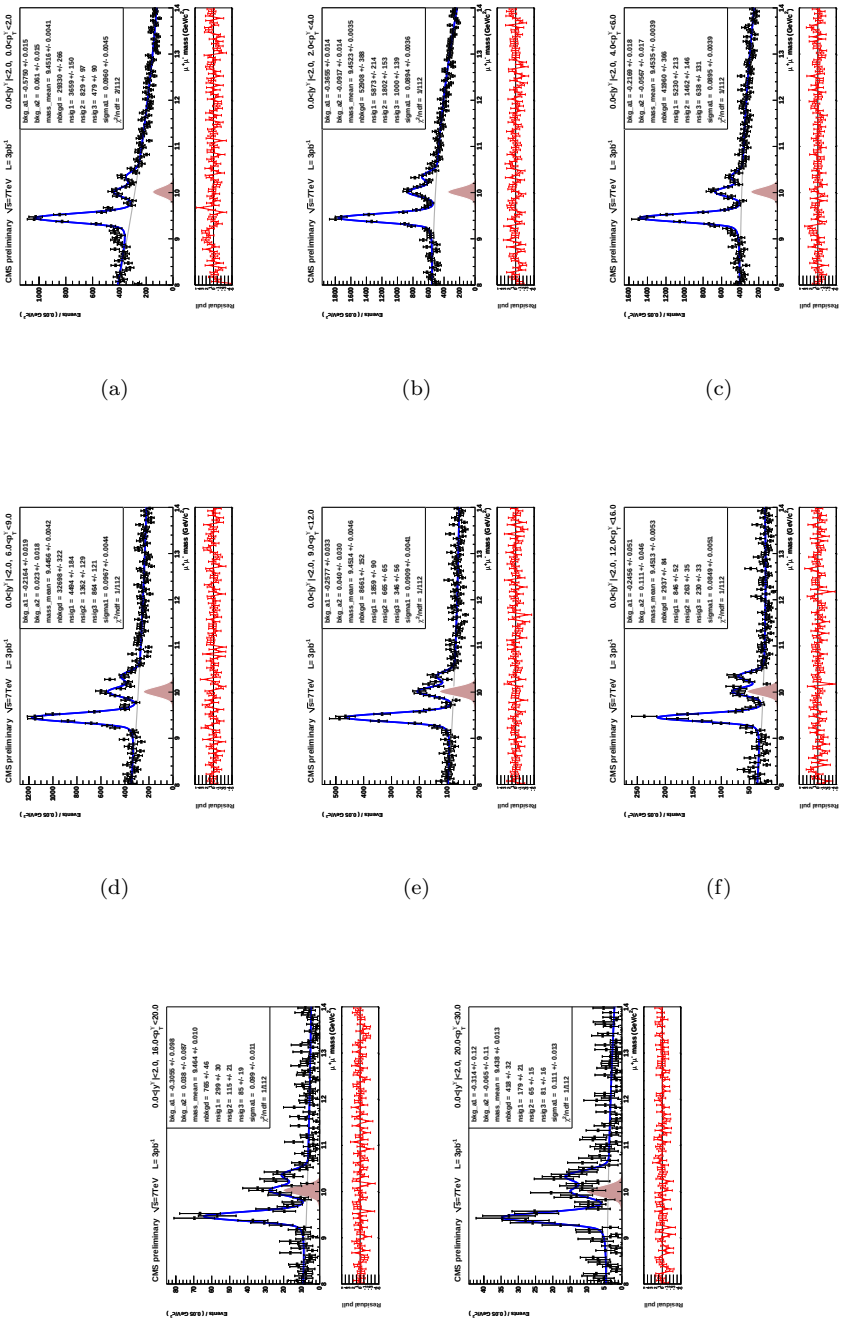


(a) (b) (c)



(d) (e)

Figure 219: Υ(2S) systematic mass fits:otherHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.

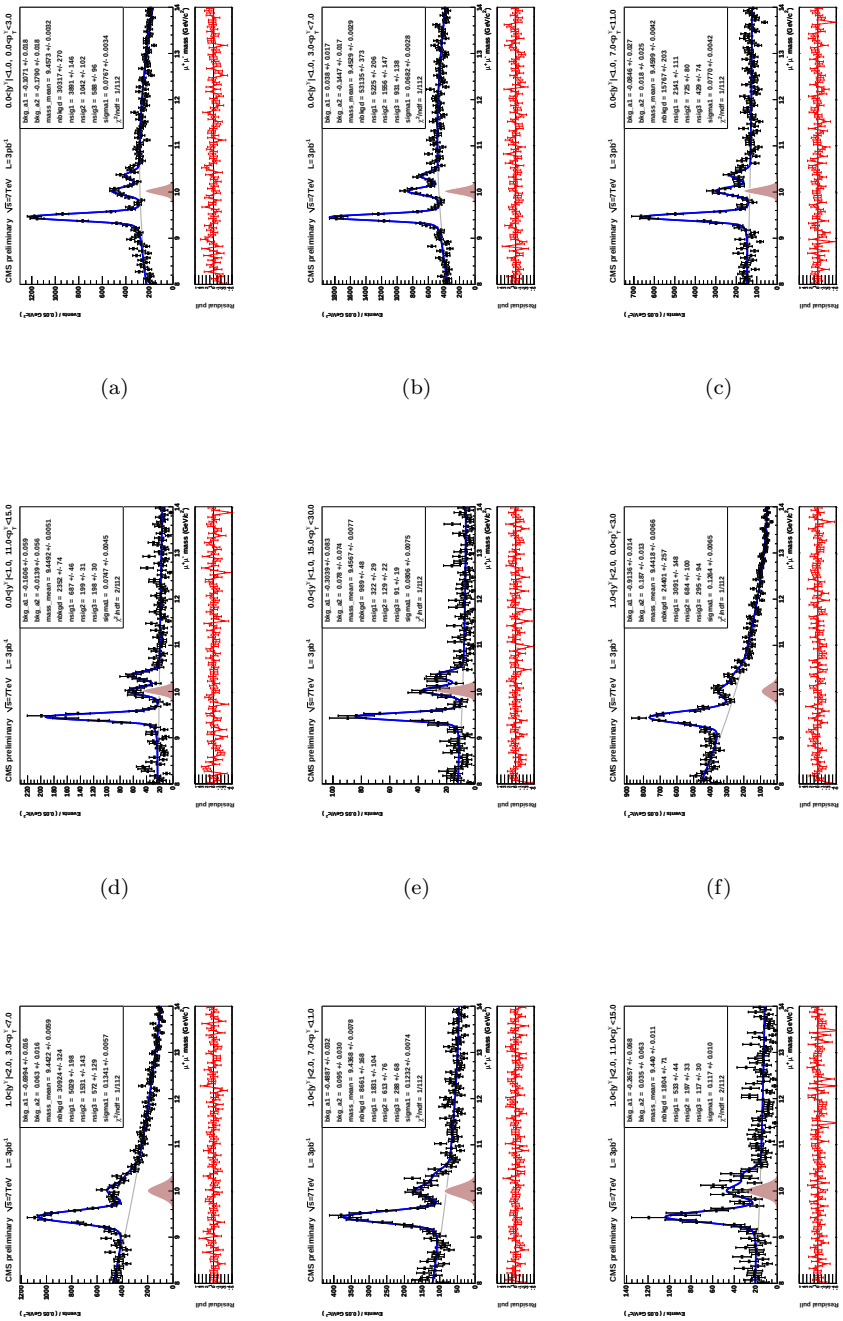


(a) (b) (c)

(d) (e) (f)

(g) (h)

Figure 220: Υ(2S) systematic mass fits:otherHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.

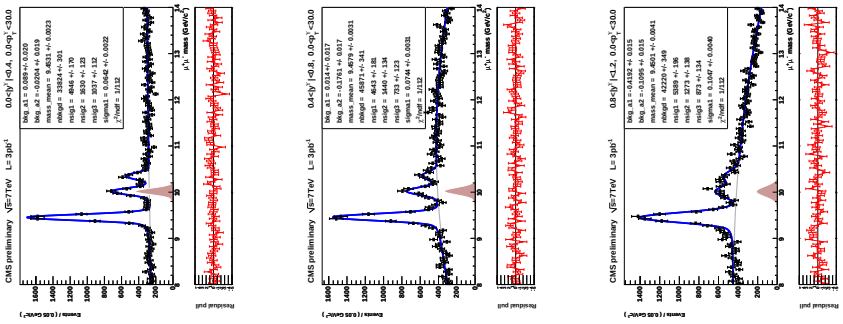


(a) (b) (c)

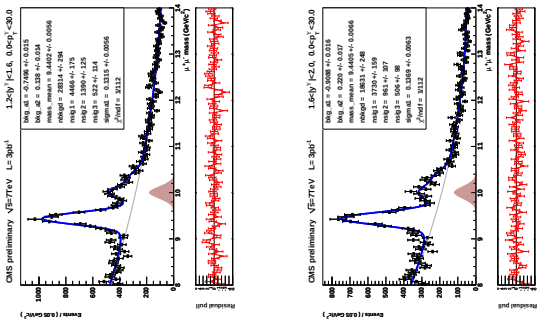
(d) (e) (f)

(g) (h) (i)

Figure 221: Υ(2S) systematic mass fits:otherHi, for $d\sigma/d|y|$ binning.

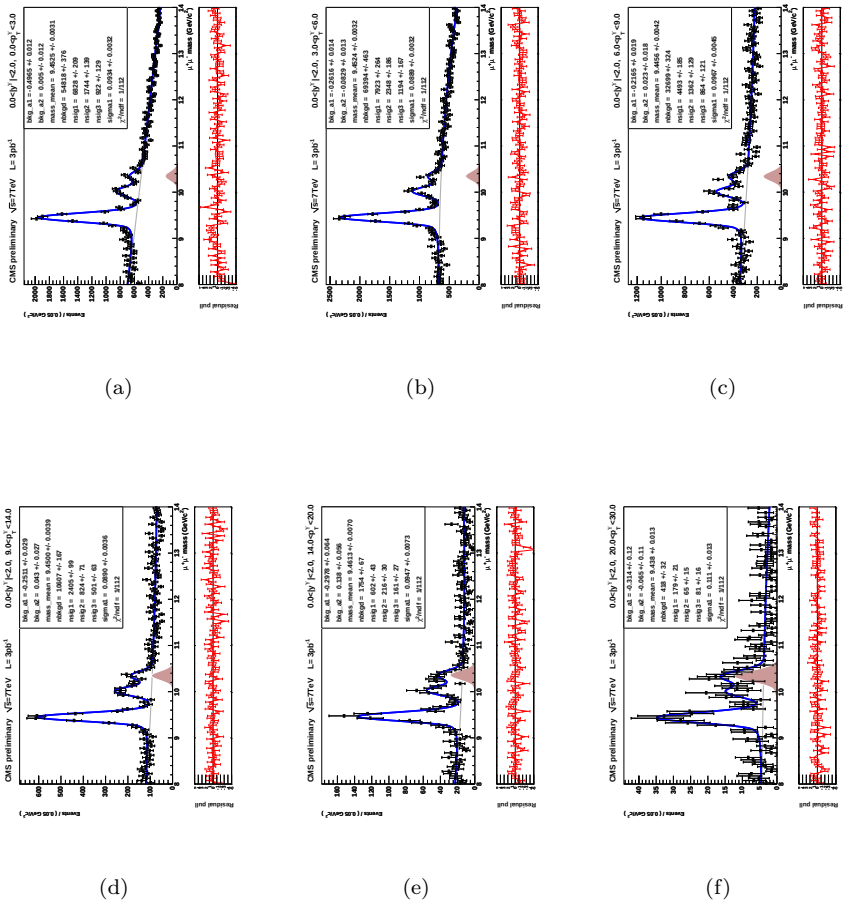


(a) (b) (c)



(d) (e)

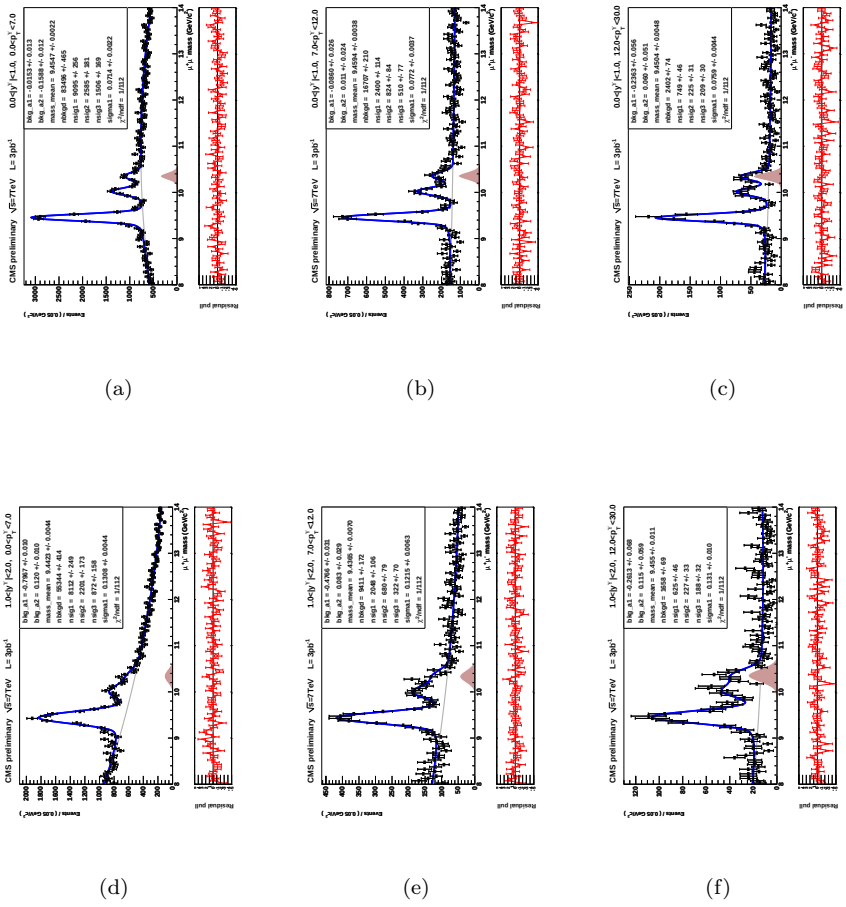
Figure 222: Υ(3S) systematic mass fits:otherHi, for $d\sigma/dp_{\mathrm{T}}, |y| : (0, 2)$ binning.



(a) (b) (c)

(d) (e) (f)

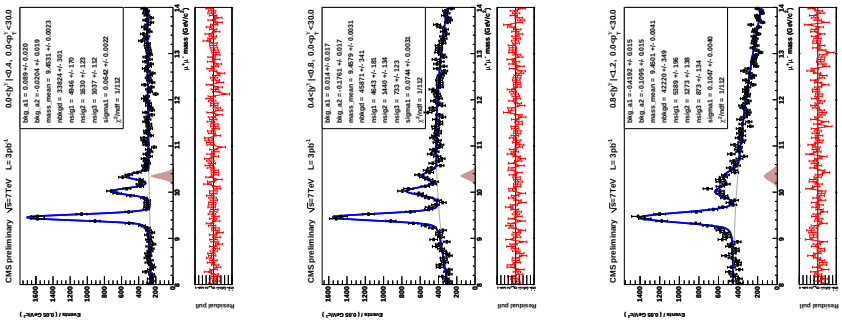
Figure 223: Υ(3S) systematic mass fits:otherHi, for $d\sigma/dp_{\mathrm{T}}$ $|y|$: $(0,1),(1,2)$ binning.



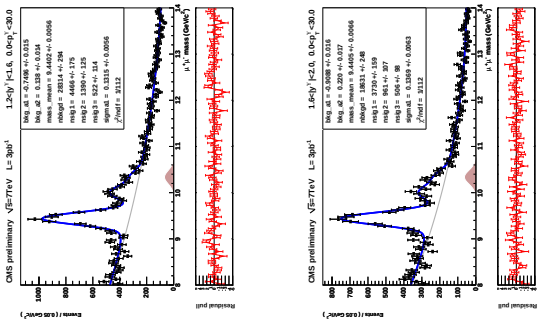
(a) (b) (c)

(d) (e) (f)

Figure 224: Υ(3S) systematic mass fits:otherHi, for $d\sigma/d|y|$ binning.



(a) (b) (c)



(d) (e)