

WAL Updates

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Key Points

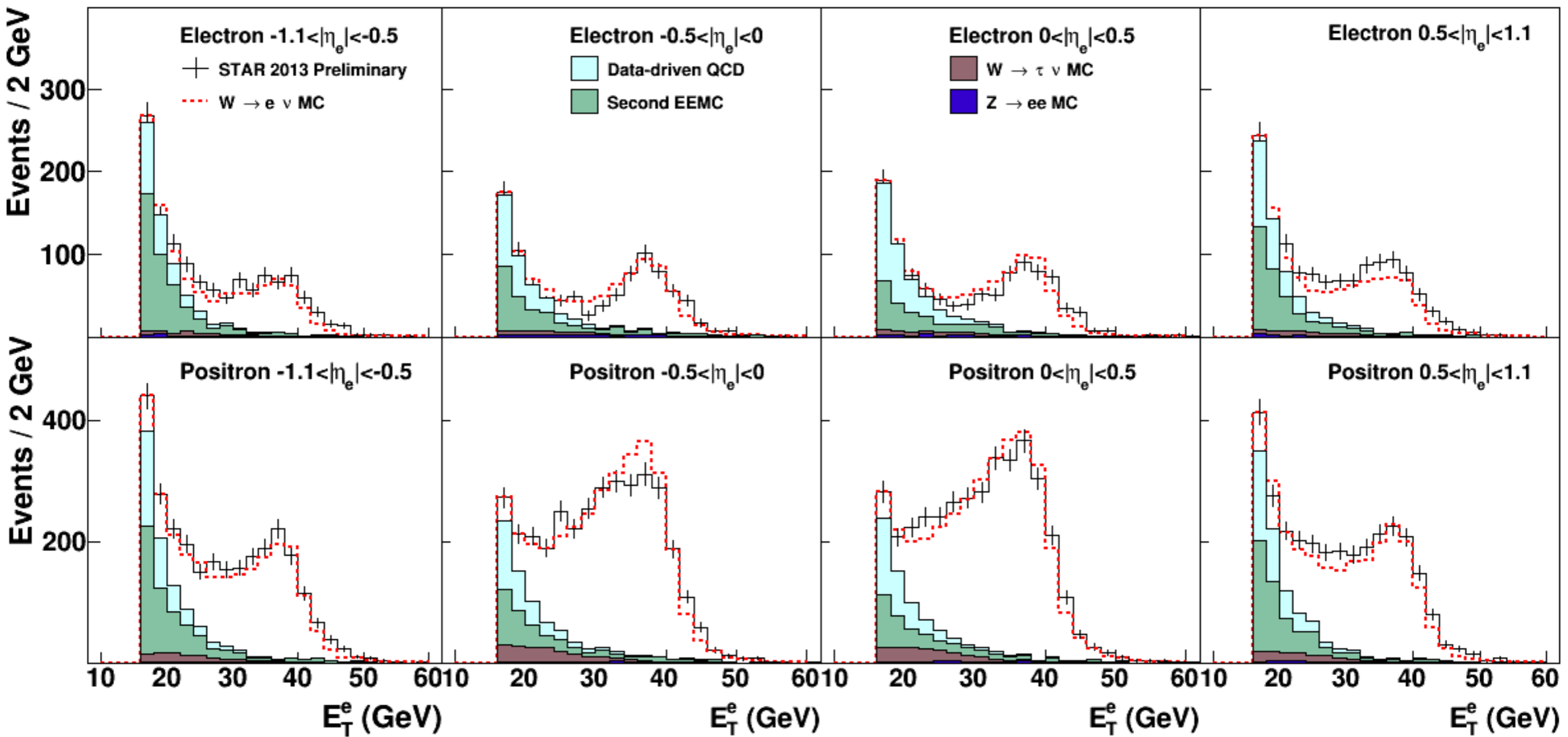
- New Cuts provide 10% better precision for $W A_L$ than preliminary cuts.
- The level of agreement between data and MC with new cuts is consistent with that of with preliminary cuts.
- The results with new cuts (central values of A_L for both W_+ and W_-) are consistent and within the statistical uncertainty of that of with preliminary cuts.
- Systematics are calculated. [EMC systematic with data are consistent with that of preliminary]. For mid-rapidity analysis, EMC systematics using theory are bigger (for W_+) than that of using data, therefore mid-rapidity A_L systematic in the final results will be bigger than that of in the preliminary results if the suggested theory method to be used to calculate EMC systematics.

New Cuts vs Preliminary Cuts

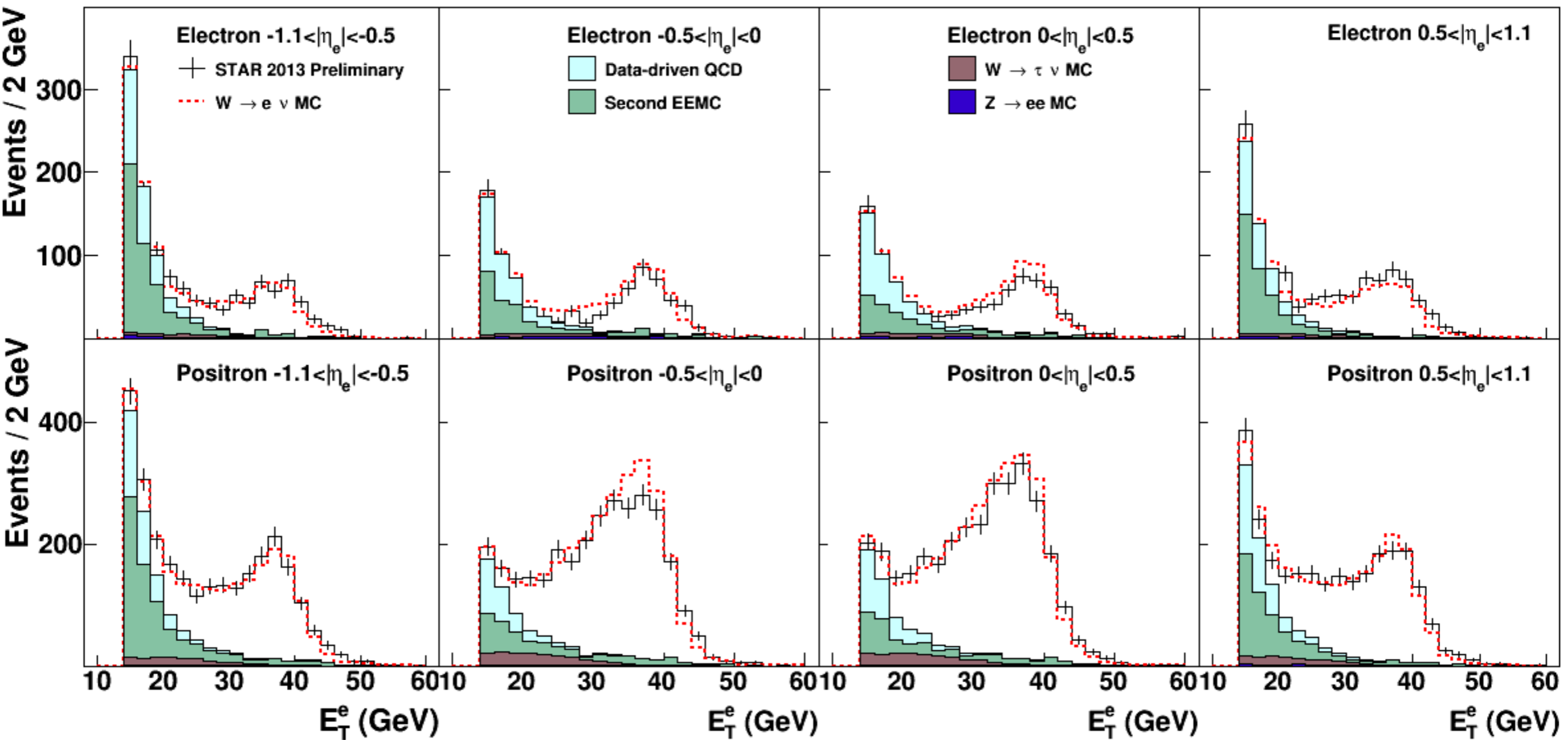
Cut	Preliminary	New cut Period 1	New cut Period 2
2x2 ET	14	16	16
2x2 ET / 4x4 ET	0.95	0.96	0.96
2x2 / near Cone	0.88	0.82	0.82
signPT	14	16	16
away ET	11	11	100

Cut Study : <https://drupal.star.bnl.gov/STAR/system/files/userfiles/3475/wMeeting09-20.pdf>

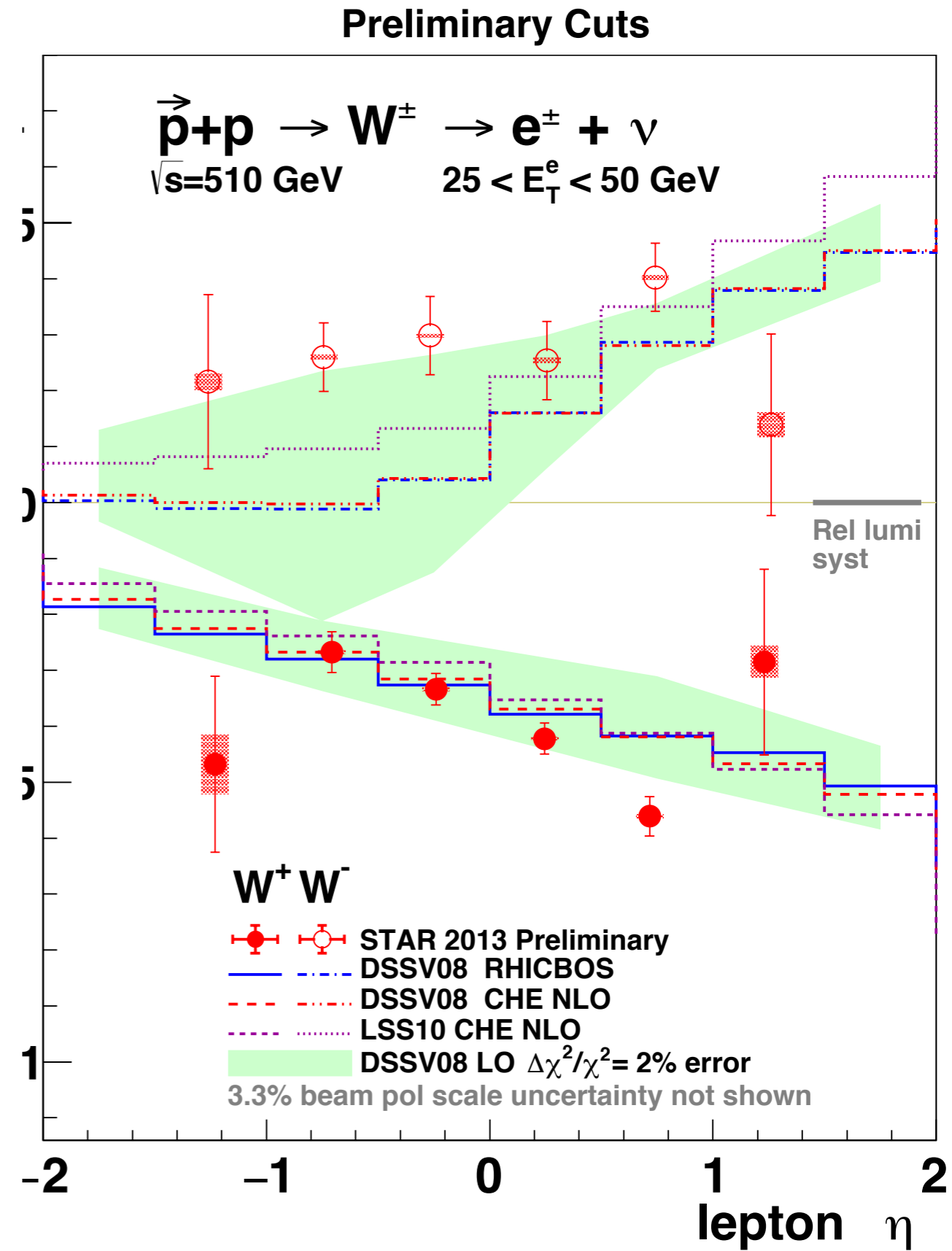
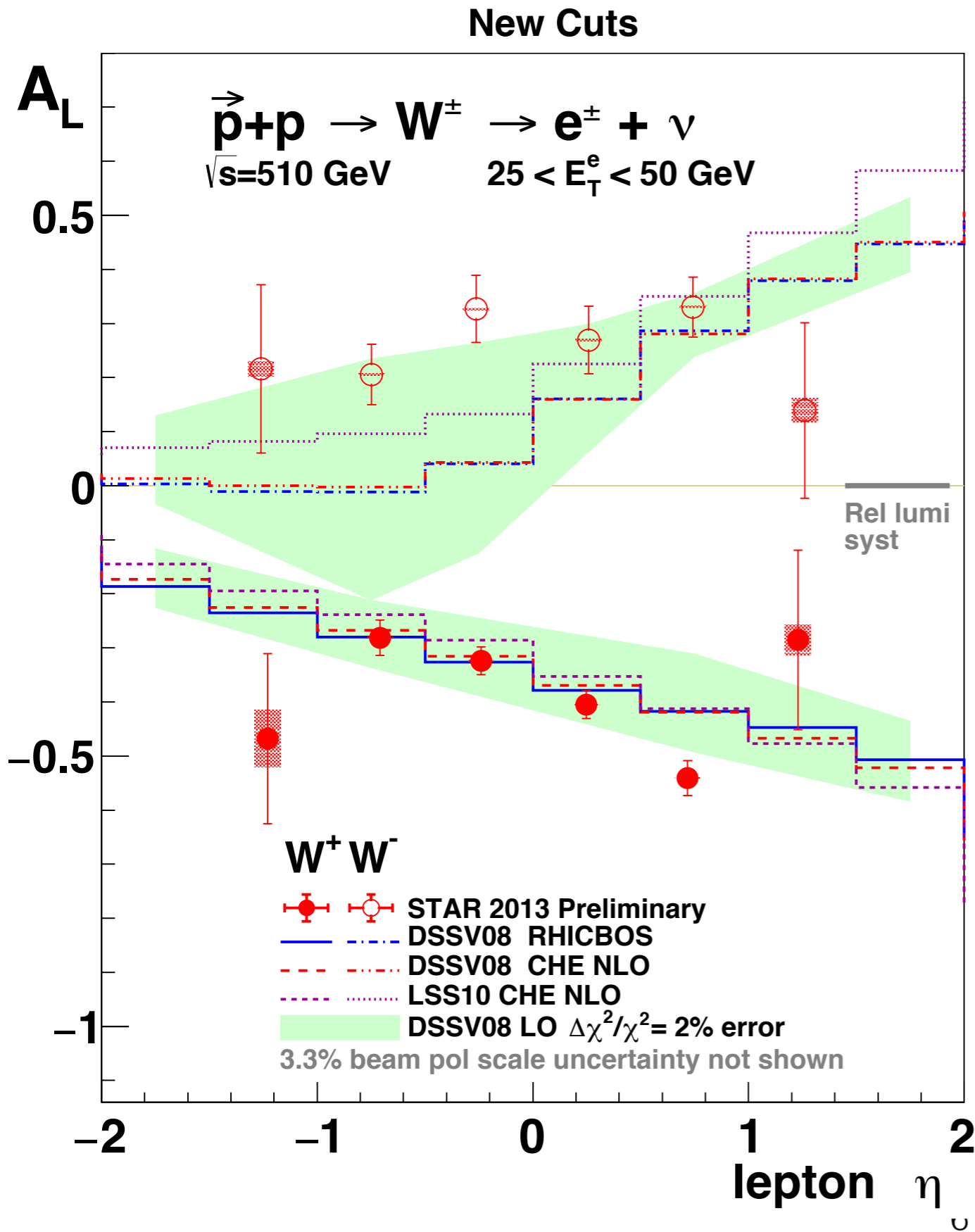
Update Figure 1 - New Cuts



Update Figure 1 - Preliminary Cuts



New cuts - preliminary cuts (not a proposed figure)



Systematics

- **EMC calibration**

Eta	EMCsys- DSSV14	EMCsys- BS15	EMCsys- NNPDF	EMCsys- Final (devika-for now)	EMCsys- Data New Cuts	EMCsys- Data / Preliminary cuts
	W+	W+	W+	W+	W+	W+
-1.25	0.014	0.009		0.014		0.014
-0.75	0.013	0.008		0.013	0.001	0.003
-0.25	0.006	0.005		0.006	0.001	0.003
0.25	0.002	0.002		0.002	0.001	0.003
0.75	0.014	0.011		0.014	0.001	0.003
1.25	0.020	0.013		0.020		0.022
	W-	W-	W-	W-	W-	W-
-1.25	0.004	0.001		0.004		0.053
-0.75	0.004	0.000		0.004	0.002	0.004
-0.25	0.001	0.001		0.001	0.002	0.004
0.25	0.001	0.001		0.001	0.002	0.004
0.75	0.001	0.001		0.001	0.002	0.004
1.25	0.001	0.005		0.005		0.028

- **Relative Luminosity**

	W+	W-
New Cuts	0.004	0.004
Preliminary cuts	0.004	0.004

Systematics EMC (using theory) -Devika vs Jinlong

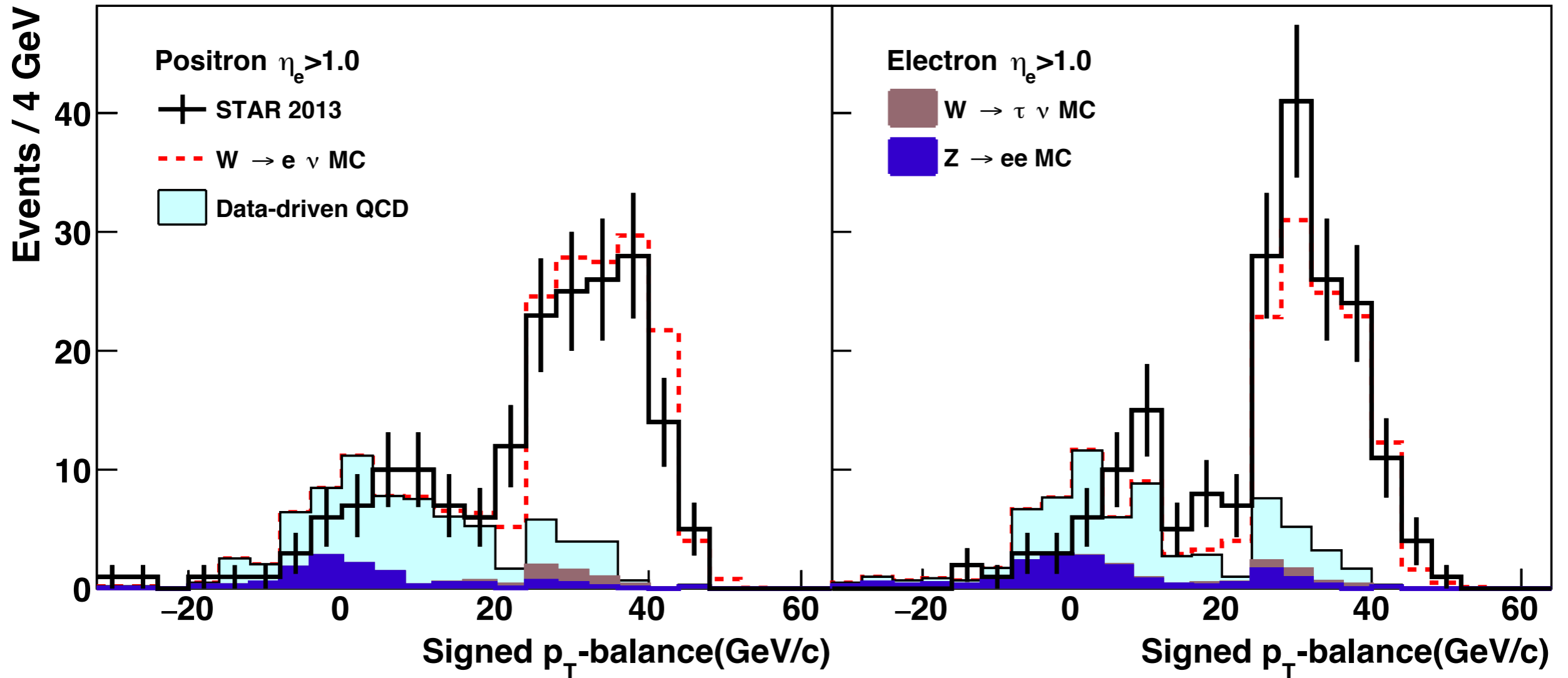
- EMC calibration**

Eta	EMCsys- DSSV14	EMCsys- DSSV14- Jinlong	EMCsys- BS15	EMCsys- BS15-Jinlong	EMCsys- Final (devika-for now)	EMCsys- Final - Jinlong
	W+	W+	W+		W+	W+
-1.25	0.014	0.008	0.009	0.010	0.014	0.015
-0.75	0.013	0.012	0.008	0.009	0.013	0.012
-0.25	0.006	0.003	0.005	0.006	0.006	0.006
0.25	0.002	0.002	0.002	0.004	0.002	0.004
0.75	0.014	0.014	0.011	0.013	0.014	0.014
1.25	0.020	0.007	0.013	0.019	0.020	0.019
	W-	W-	W-	W-	W-	W-
-1.25	0.004	0.003	0.001	0.001	0.004	0.003
-0.75	0.004	0.004	0.000	0	0.004	0.004
-0.25	0.001	0.001	0.001	0	0.001	0.001
0.25	0.001	0	0.001	0.001	0.001	0.002
0.75	0.001	0.001	0.001	0.001	0.001	0.004
1.25	0.001	0	0.005	0.003	0.005	0.003

- Relative Luminosity**

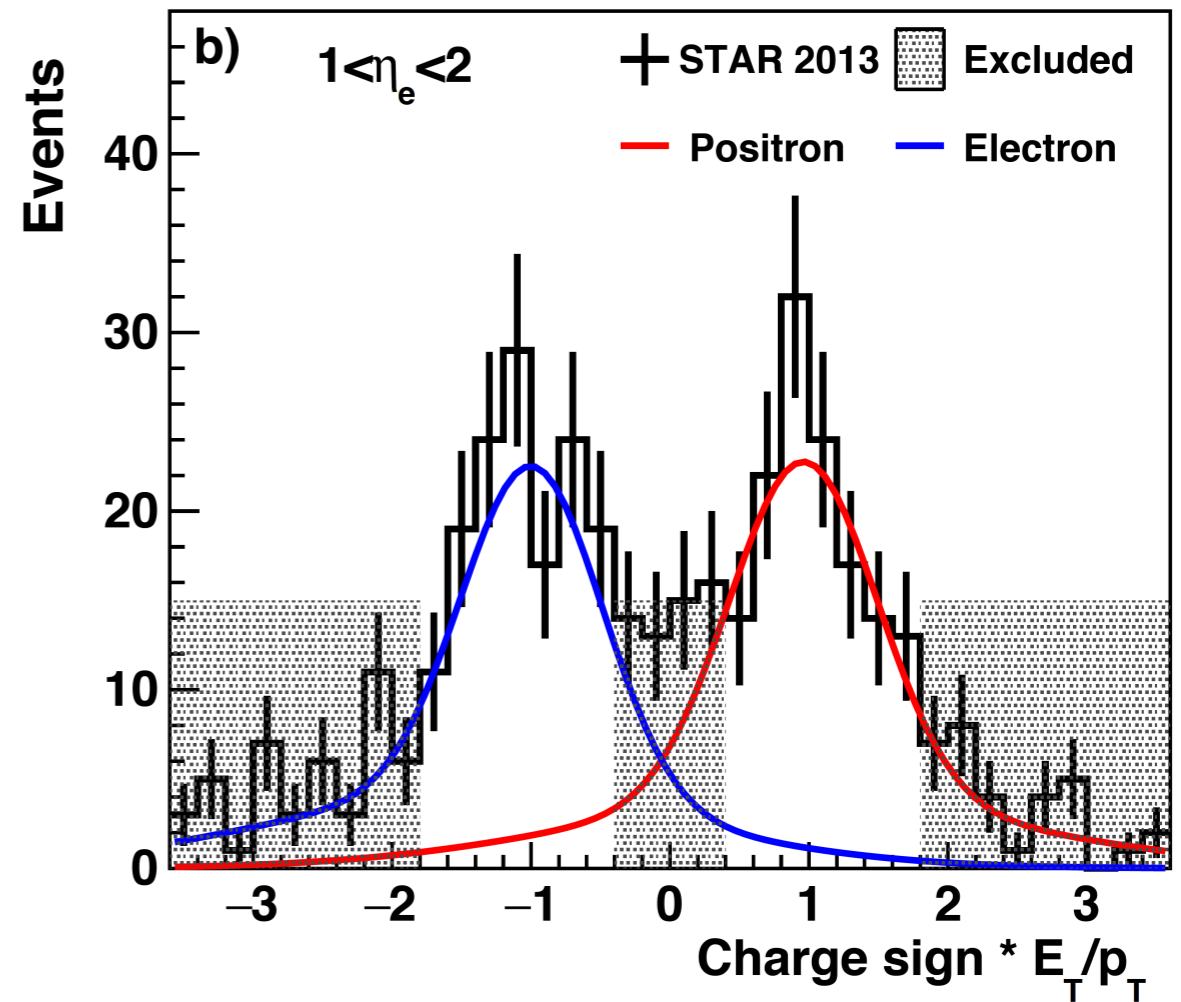
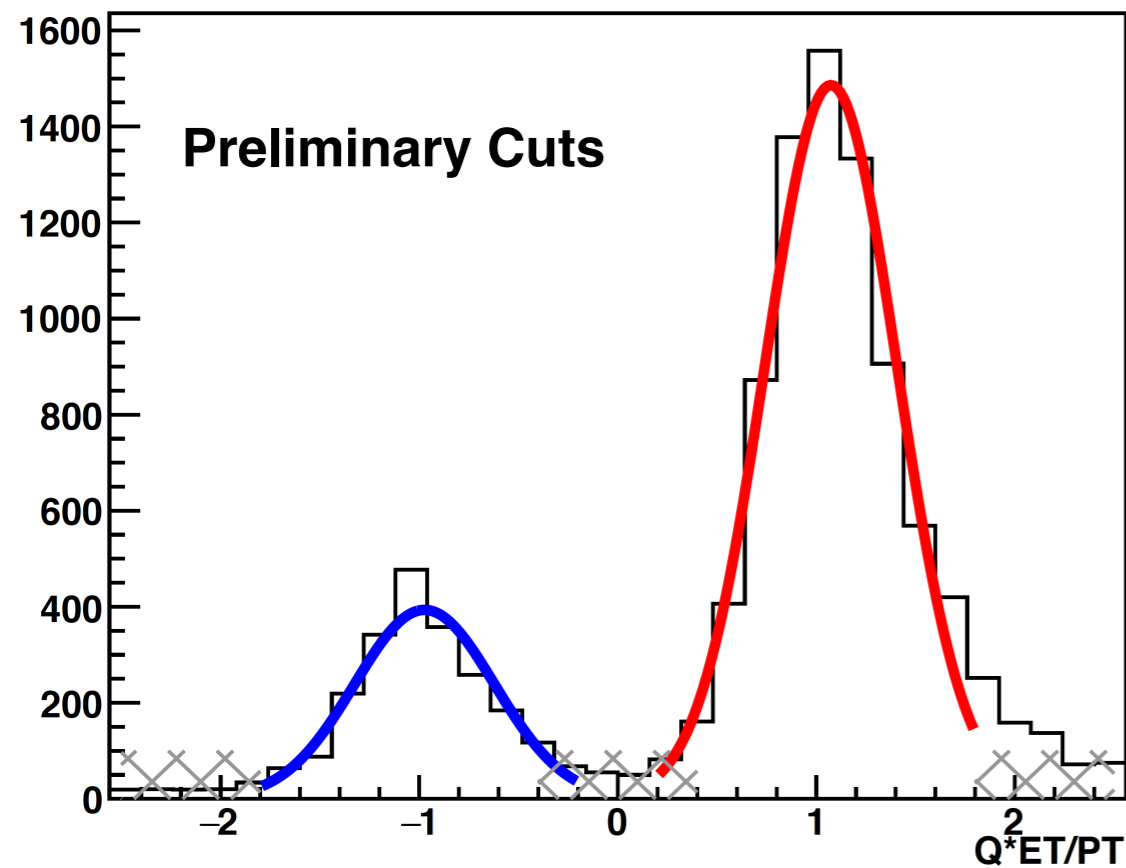
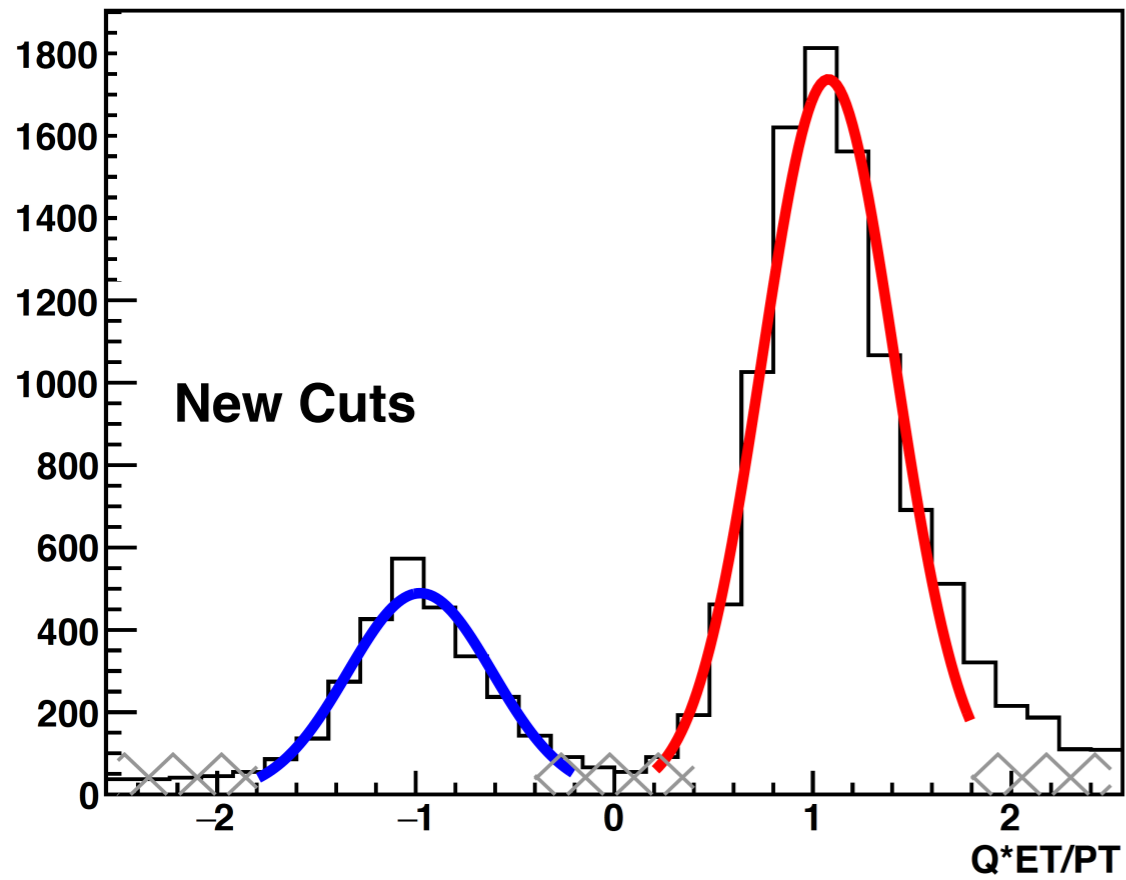
	W+	W-
New Cuts	0.004	0.004
Preliminary cuts	0.004	0.004

Updated Figure 2



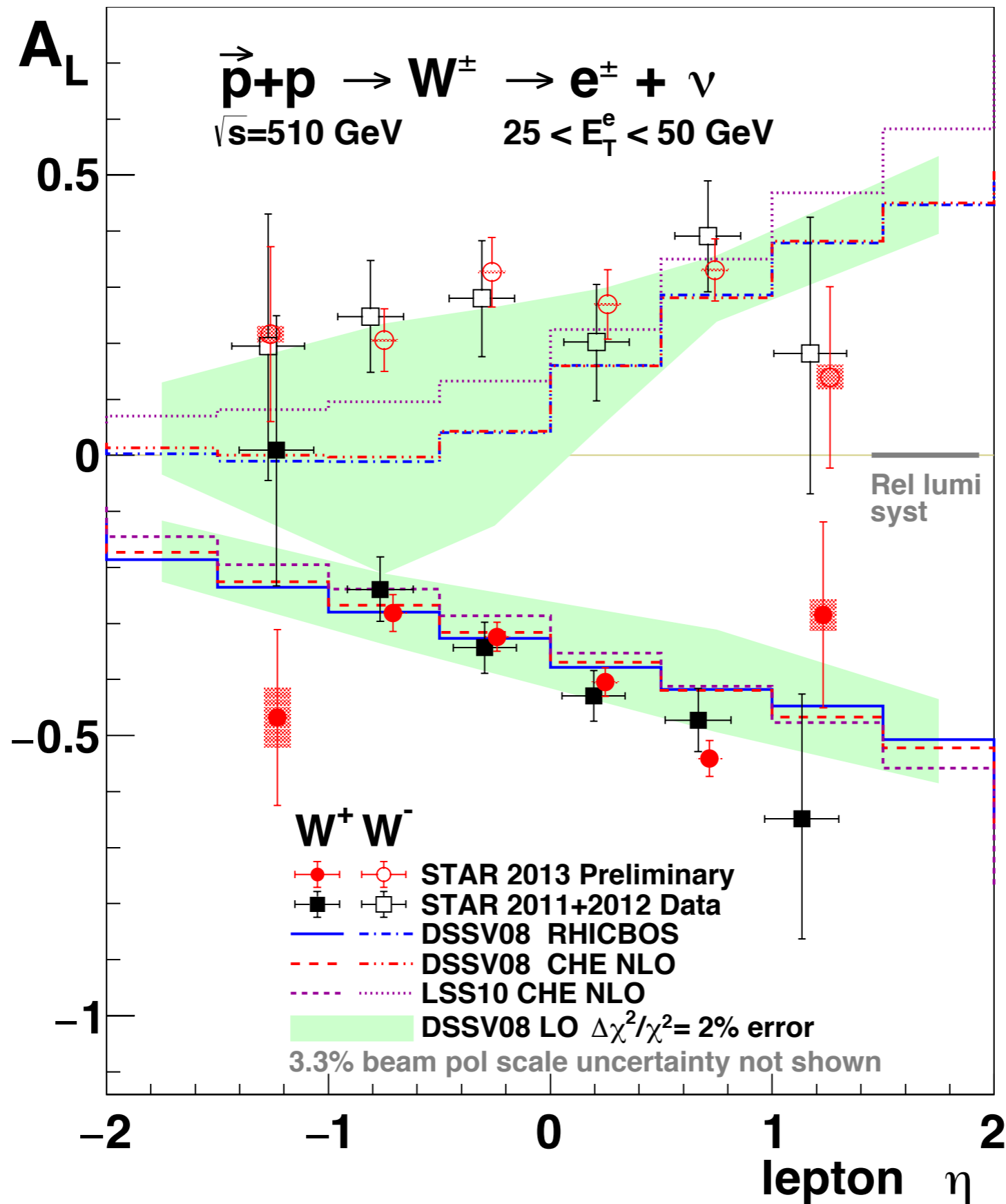
	F_Z	F_QCD	B	χ^2/ndf
W^+	0.0116 +/- 0.001	0.049 +/-	0.938 +/-	16.789/19
W^-	0.041 +/- 0.002	0.039 +/-	0.936 +/-	26.652/19

Updated Figure 3 - NewCuts

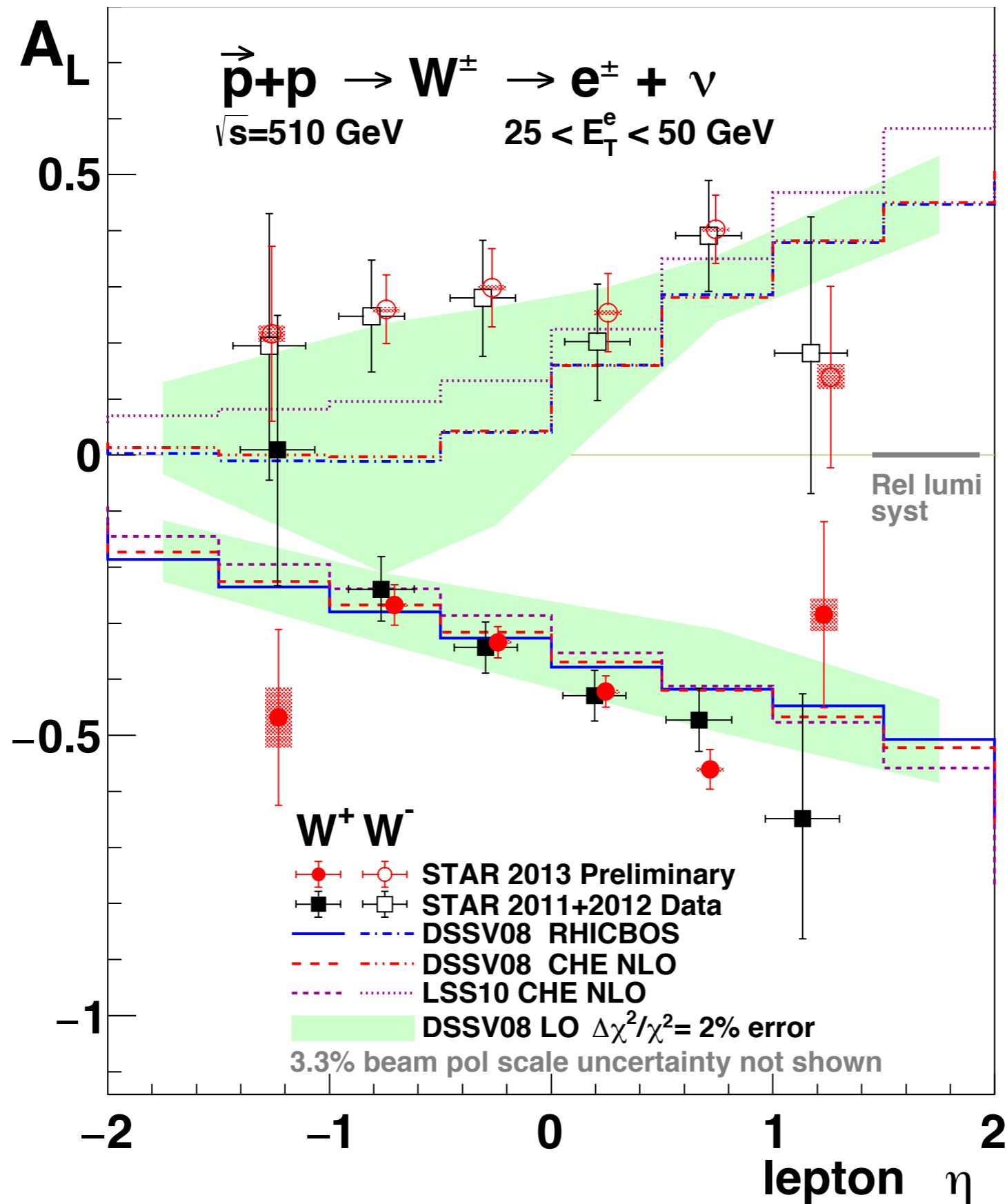


	W ⁺	W ⁻
Sum_Fit	136	143
Mis_ID	0.058	0.092

Updated Figure 4 - New Cuts



Updated Figure 4 - Preliminary Cuts



Jinlong Plot

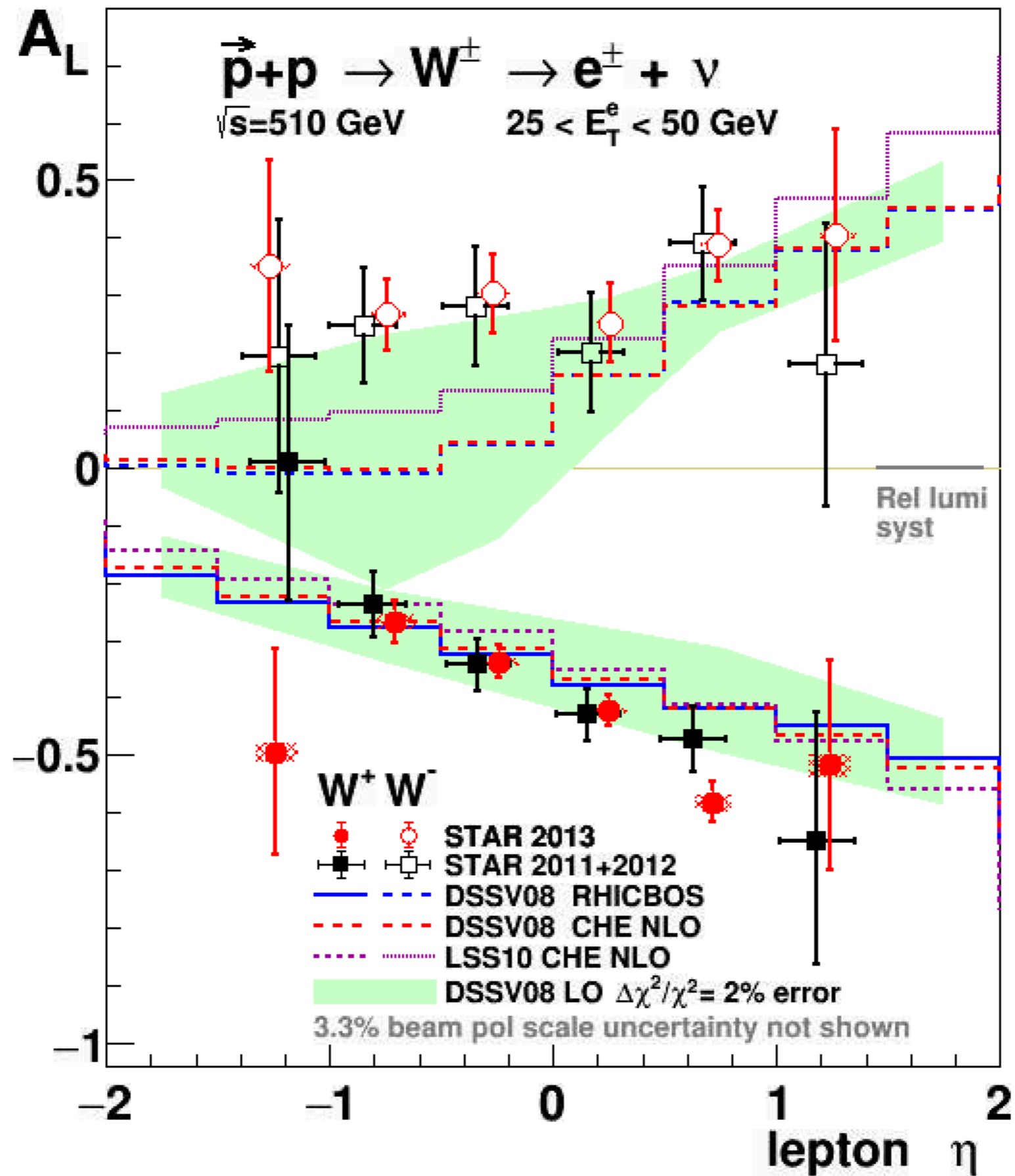


Table - AL Values - Run 13 (Not the proposed table)

W_P	New cuts	Preliminary cuts	uncertainty reduction	Ch2 test (new-prel)
Etabin1	-0.281+/-0.033	-0.267+/-0.036	8%	
Etabin2	-0.324+/-0.026	-0.334+/-0.028	7%	
Etabin3	-0.405+/-0.026	-0.422+/-0.028	7%	
Etabin4	-0.541+/-0.032	-0.561+/-0.035	9%	0.131618869
Eta 7 min		-0.468 +/- 0.157		
Etabin7 plus		-0.285 +/- 0.166		
W_N				
Etabin1	0.205+/-0.056	0.260+/-0.061	8%	
Etabin2	0.327+/-0.062	0.298+/-0.070	11%	
Etabin3	0.269+/-0.062	0.254+/-0.070	11%	0.327581207
Etabin4	0.331+/-0.055	0.402+/-0.061	10%	
Eta 7 min		0.216 +/- 0.156		
Etabin7 plus		0.139 +/- 0.162		

Proposed Table - (Run 11+12+ Run 13 New cuts)

$\langle \eta_e \rangle$	$A_L (\pm \text{stat} \pm \text{sys})$	$A_{LL} (\pm \text{stat} \pm \text{sys})$ [only run 13]
	W_+	W_+
-1.25	$-0.483 \pm 0.141 \pm 0.014$	
-0.75	$-0.280 \pm 0.033 \pm 0.013$	
-0.25	$-0.324 \pm 0.026 \pm 0.006$	
0.25	$-0.405 \pm 0.026 \pm 0.002$	0.020 ± 0.047
0.75	$-0.541 \pm 0.032 \pm 0.014$	0.091 ± 0.059
1.25	$-0.307 \pm 0.142 \pm 0.020$	
	W_-	W_-
-1.25	$0.209 \pm 0.150 \pm 0.004$	
-0.75	$0.205 \pm 0.055 \pm 0.004$	
-0.25	$0.325 \pm 0.061 \pm 0.001$	
0.25	$0.269 \pm 0.061 \pm 0.001$	0.183 ± 0.112
0.75	$0.332 \pm 0.055 \pm 0.001$	-0.076 ± 0.100
1.25	$0.24 \pm 0.144 \pm 0.005$	

Proposed Table - (Run 11+12+ Run 13 Preliminary cuts)

Cross check between devika and jinlong is not consistent!

$\langle \eta_e \rangle$	$A_L (\pm \text{stat} \pm \text{sys})$	$A_{LL} (\pm \text{stat} \pm \text{sys}) - \text{Jinlong}$	$A_{LL} (\pm \text{stat} \pm \text{sys})$
	W+	W+	W+
-1.25	-0.483 ± 0.141 ± 0.014	-0.494 ± 0.180 ± 0.015	
-0.75	-0.267 ± 0.036 ± 0.013	-0.267 ± 0.036 ± 0.012	
-0.25	-0.334 ± 0.028 ± 0.006	-0.337 ± 0.028 ± 0.006	
0.25	-0.422 ± 0.028 ± 0.002	-0.422 ± 0.027 ± 0.004	0.035 ± 0.051
0.75	-0.561 ± 0.035 ± 0.014	-0.582 ± 0.035 ± 0.014	0.052 ± 0.065
1.25	-0.307 ± 0.142 ± 0.020	-0.517 ± 0.181 ± 0.019	
	W-	W-	W-
-1.25	0.209 ± 0.150 ± 0.004	0.350 ± 0.184 ± 0.003	
-0.75	0.258 ± 0.060 ± 0.004	0.267 ± 0.062 ± 0.004	
-0.25	0.296 ± 0.069 ± 0.001	0.304 ± 0.069 ± 0.001	
0.25	0.255 ± 0.068 ± 0.001	0.251 ± 0.069 ± 0.002	0.097 ± 0.126
0.75	0.402 ± 0.061 ± 0.001	0.387 ± 0.061 ± 0.004	-0.048 ± 0.110
1.25	0.24 ± 0.144 ± 0.005	0.403 ± 0.184 ± 0.003	

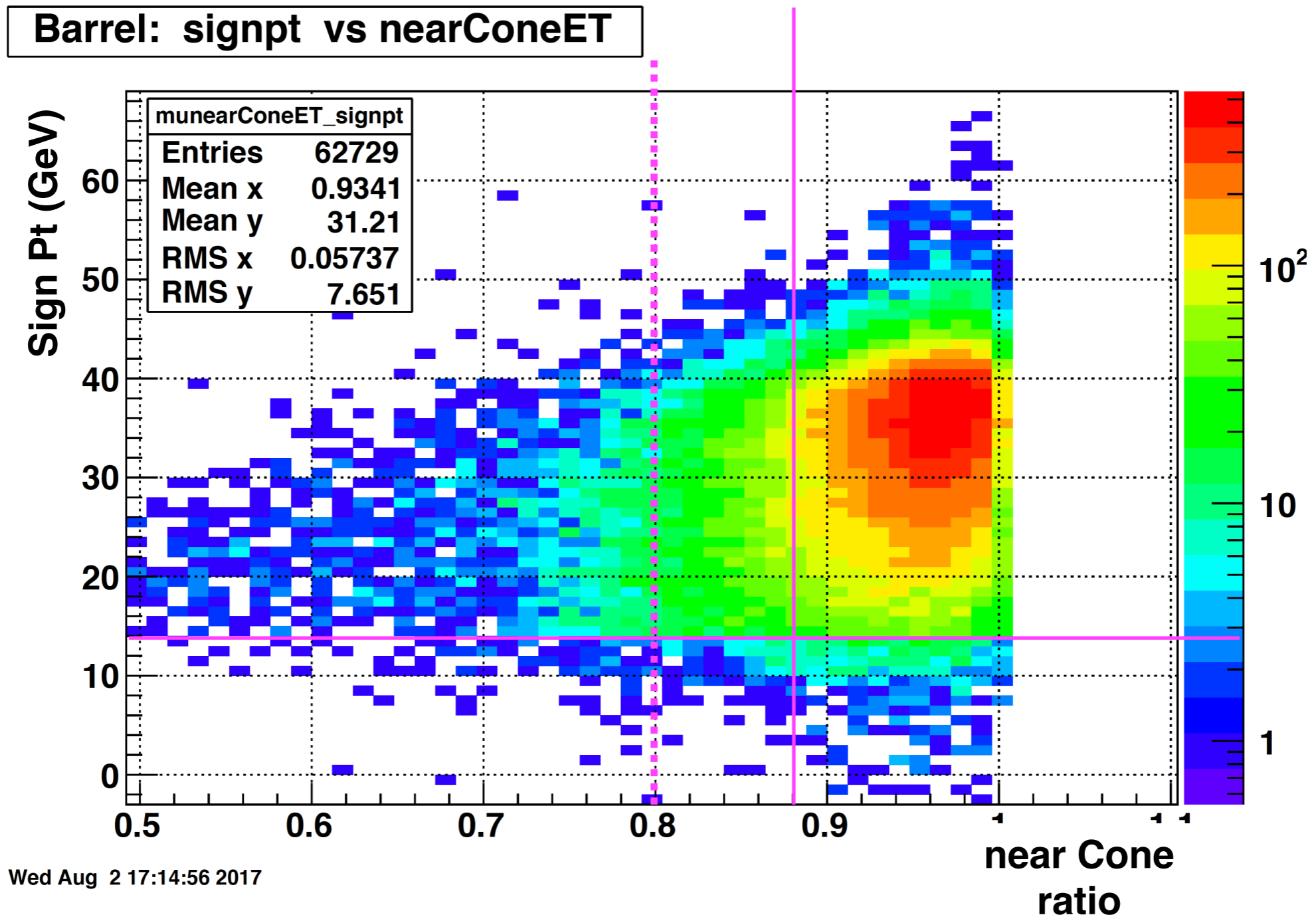
Questions / comments

- Why the central values of forward and backward endcap bins in Jinlong's results change more than 1 sigma than Amani's results or preliminary results ?
- Is the calculating EMC systematics using W AL theory for mid-rapidity bins (which increased the systematics than preliminary results for W+) the most effective way?
- The cross check between devika's and Jinlong's mid-rapidity results tells that they are not consistent with each other. We use same data and embedding. So this need an investigation. Final results that agrees between independent analysis should obtain.

Backup

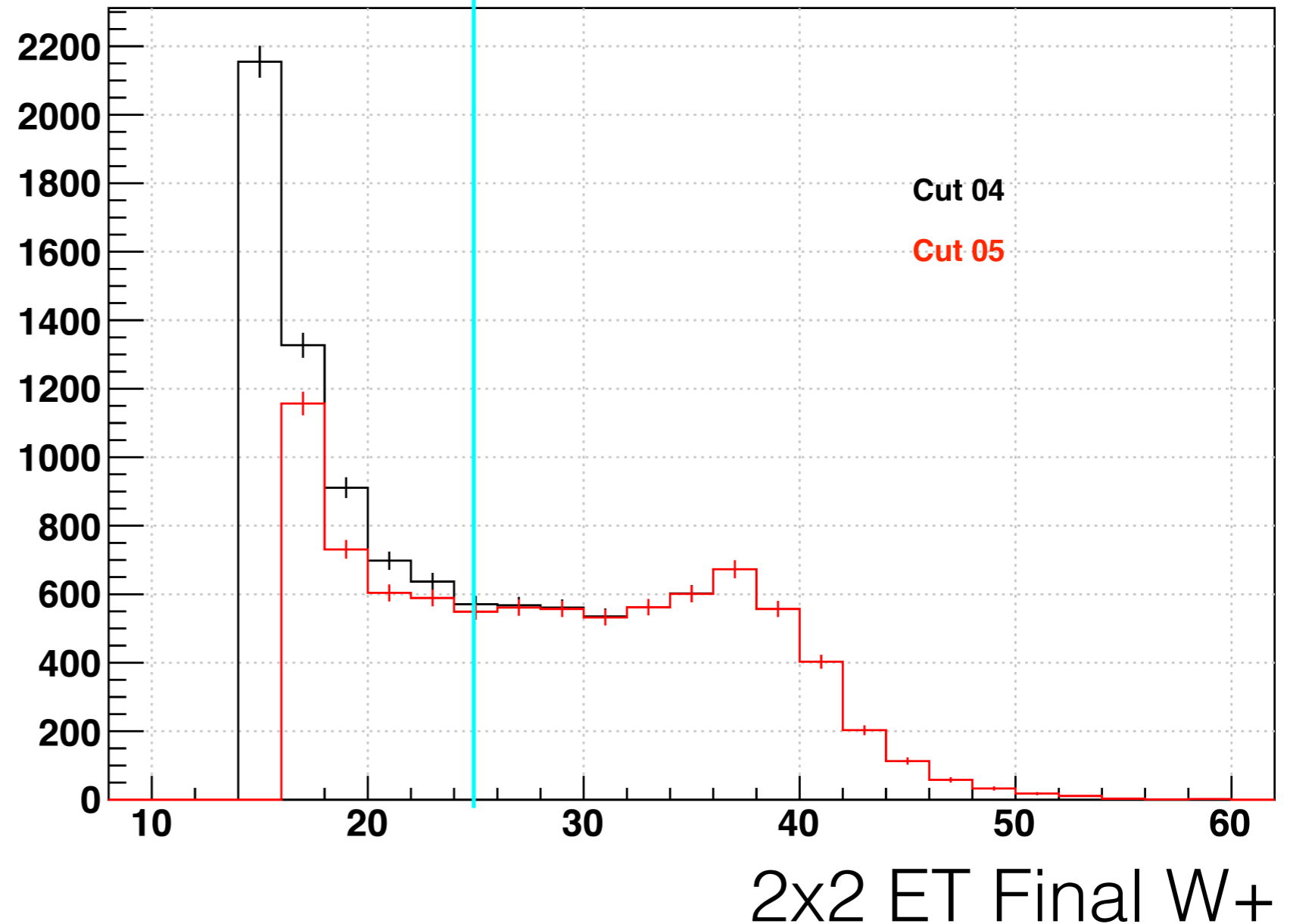
Impact of 2x2 / Near Cone cut

- Sign Pt Cut Vs 2x2 / nearCone cut - MC



Cuts-Optimization - Impact of signPt cut

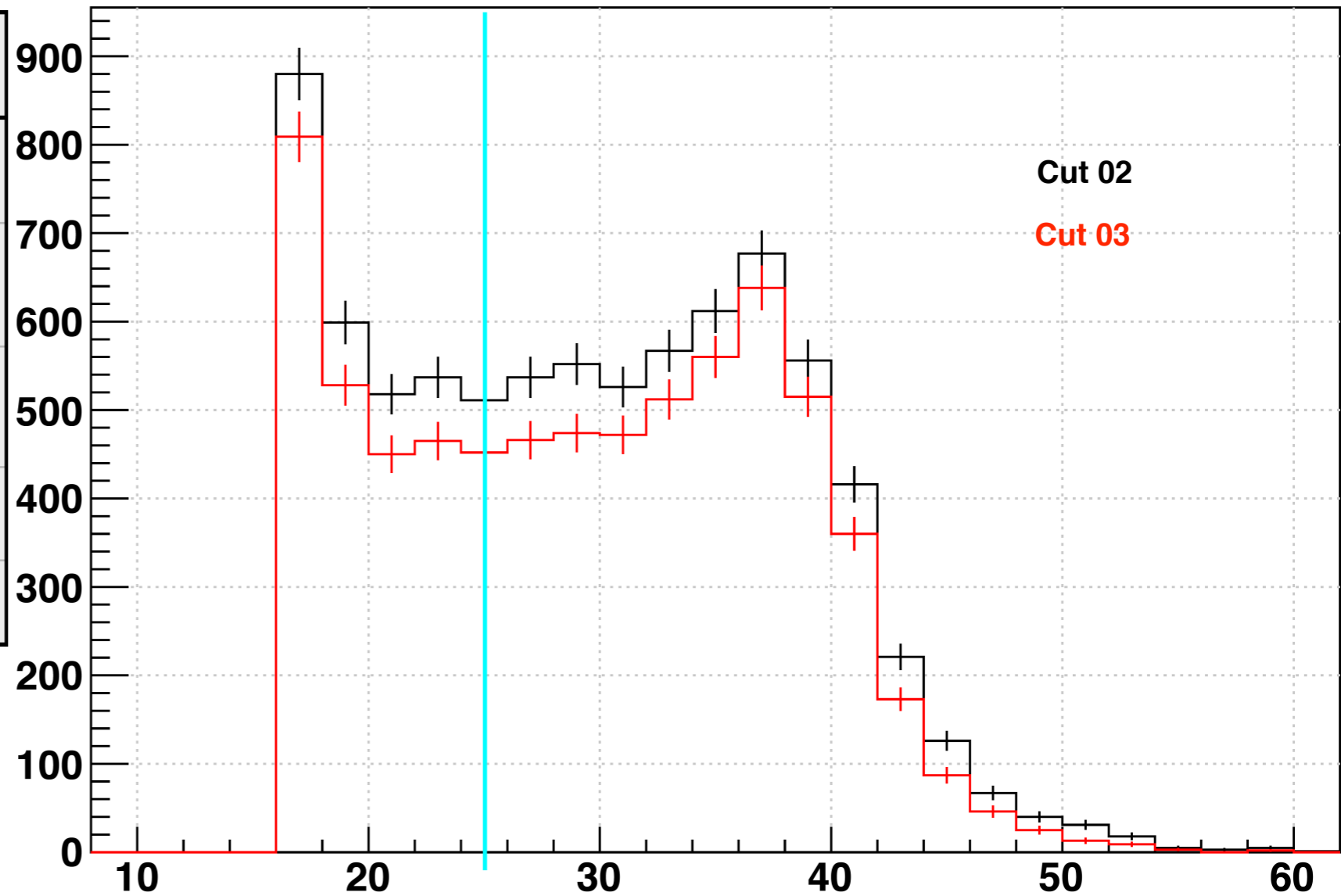
Cut	Cut 04	Cut 05
2x2 ET	14 GeV	16 GeV
2x2 ET / 4x4 ET	0.95	0.95
2x2 / near Cone	0.75	0.75
signPT	14 GeV	16 GeV
away ET	20 GeV	20 GeV



- Remove large QCD BG at low ET. Does not impact the signal region.

Cuts-Optimization - Impact of change in away ET cut

Cut	Cut 02	Cut 03
2x2 ET	16 GeV	16 GeV
2x2 ET / 4x4 ET	0.95	0.95
2x2 / near Cone	0.80	0.80
signPT	16 GeV	16 GeV
away ET	100 GeV	11 GeV



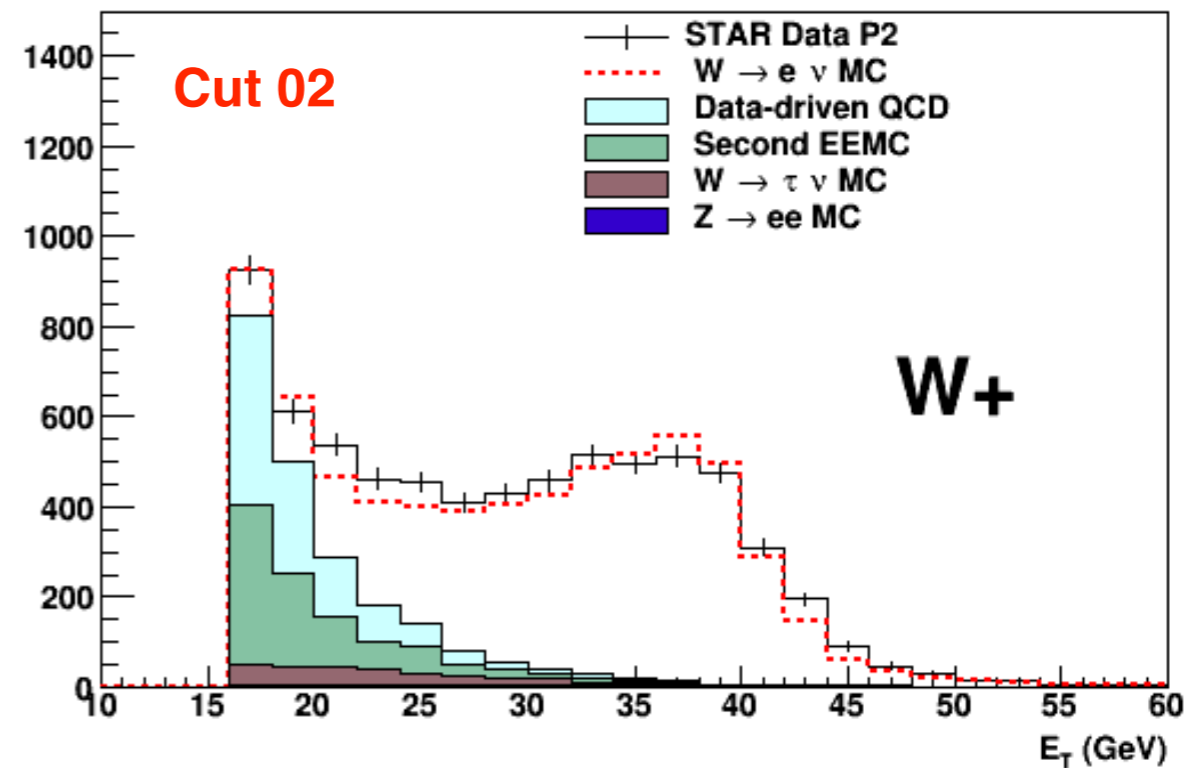
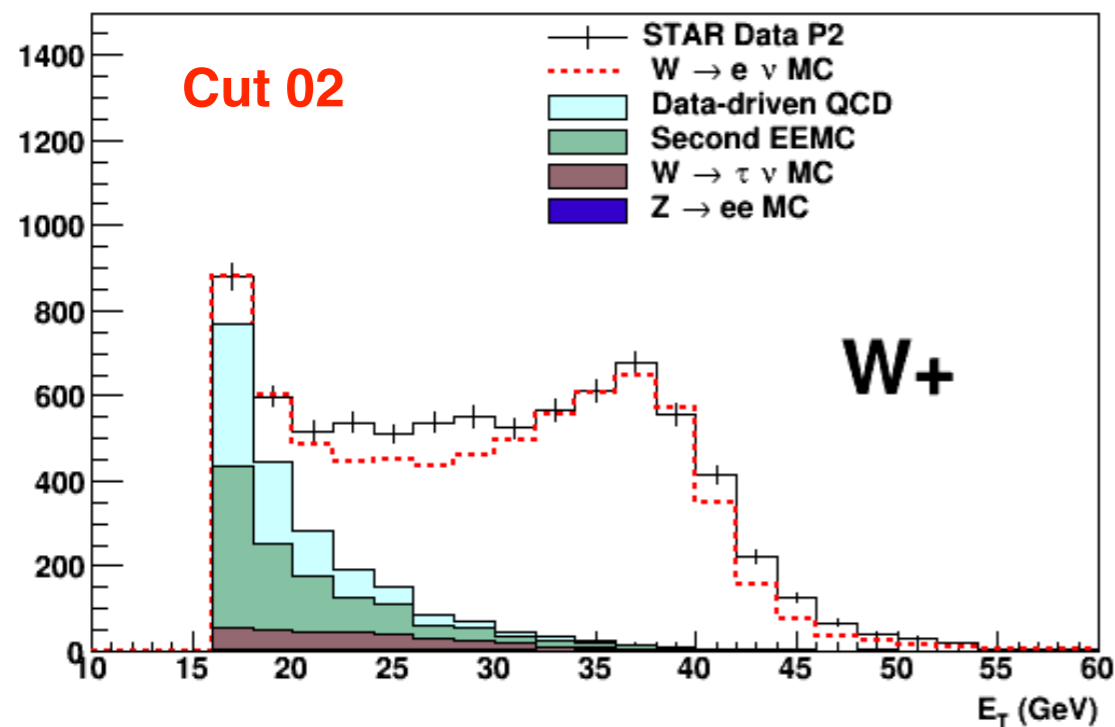
2x2 ET Final W+

Cuts-Optimization - away ET cut - period 2 ?

Preliminary	Cut 02
14	16 GeV
0.95	0.95
0.88	0.80
14	16 GeV
11	100 GeV

Period 1

Period 2



- There is no a significant “bump” pronounced in Period 2 similar to Period 1
- We do not need to use away ET cut for period 2.

New cuts - Yields / BG Statistics- Period 1

WN background summary: yields 25<ET<50

starPhysEt aBin	rawYield	qcdBkgd	secondEE MC	zeeBkgd	wTauYield	totalBkgd	wYield	beta +/- err	+/- cvst
1	274	4.05	24	3.58	5.41	32.47	241.53	0.883 +/- 0.019	0.001
2	305	10.03	37	8.29	6.67	55.37	249.63	0.823 +/- 0.022	0.003
3	294	12.2	32	4.49	7.3	49.24	244.76	0.830 +/- 0.021	0.003
4	345	14.65	33	3.62	6.49	52.06	292.94	0.860 +/- 0.018	0.002
8	1230	35.33	126	19.57	25.88	180.91	1049.09	0.856 +/- 0.010	0.002

WP background summary: yields 25<ET<50

starPhysEt aBin	rawYield	qcdBkgd	secondEE MC	zeeBkgd	wTauYield	totalBkgd	wYield	beta +/- err	+/- cvst
1	811	7.6	60	4.19	15.3	72.51	738.49	0.911 +/- 0.010	0.001
2	1375	12.69	60	7.85	26.68	81.34	1293.66	0.941 +/- 0.006	0.001
3	1420	19.2	62	8.32	26.59	90.52	1329.48	0.937 +/- 0.006	0.001
4	862	17.8	41	3.64	16.85	62.86	799.14	0.933 +/- 0.008	0.002
8	4478	52.07	226	24.88	85.42	302.95	4175.05	0.933 +/- 0.003	0.001

Preliminary cuts - Yields / BG Statistics- Period 1

WN background summary: yields 25<ET<50 GeV

starPhysEt aBin	rawYield	qcdBkgd	secondEE MC	zeeBkgd	wTauYield	totalBkgd	wYield	beta +/- err	+/- syst
1	258	6.94	24	3.68	5.23	34.81	223.19	0.866 +/- 0.020	0.002
2	270	11.21	29	8.46	6.31	49.13	220.87	0.822 +/- 0.022	0.005
3	259	13.15	22	4.13	6.58	39.33	219.67	0.851 +/- 0.020	0.005
4	315	8.93	18	3.2	5.59	30.49	284.51	0.904 +/- 0.014	0.002
8	1113	34.75	92	18.28	23.72	145.03	967.97	0.871 +/- 0.009	0.003

WP background summary: yields 25<ET<50 GeV

starPhysEt aBin	rawYield	qcdBkgd	secondEE MC	zeeBkgd	wTauYield	totalBkgd	wYield	beta +/- err	+/- syst
1	781	8.12	61	4.33	14.5	73.83	707.17	0.905 +/- 0.010	0.001
2	1246	8.69	53	7.39	24.35	69.28	1176.72	0.945 +/- 0.006	0.001
3	1282	12.73	52	7.87	23.25	73.1	1208.9	0.943 +/- 0.006	0.001
4	775	17.09	30	3.87	15.41	51.2	723.8	0.934 +/- 0.007	0.003
8	4094	41.55	197	24.35	77.51	262.9	3831.1	0.936 +/- 0.004	0.001

New cuts - Yields / BG Statistics- Period 2

WN background summary: yields

25<ET<50

starPh ysEtaB	rawYield	qcdBkgd	secondEE MC	zeeBkgd	wTauYiel d	totalBkgd	wYield	beta +/- err	+/- syst
1	322	14.26	23	6.69	4.84	44.19	277.81	0.868 +/- 0.016	0.003
2	276	16.82	17	10.72	6.98	44.64	231.36	0.840 +/- 0.017	0.004
3	309	22.44	24	11.06	8.41	57.92	251.08	0.819 +/- 0.018	0.007
4	361	10.03	16	6.93	5.4	33.76	327.24	0.909 +/- 0.012	0.004
8	1280	57.68	81	36.56	25.63	175.24	1104.76	0.867 +/- 0.008	0.002

WP background summary: yields 25<ET<50

starPh ysEtaB	rawYield	qcdBkgd	secondEE MC	zeeBkgd	wTauYiel d	totalBkgd	wYield	beta +/- err	+/- syst
1	763	25.22	21	8.02	14.2	54.82	708.18	0.931 +/- 0.007	0.003
2	1102	22.38	18	9.09	25.03	50.37	1051.63	0.955 +/- 0.004	0.001
3	1276	18.92	18	9.7	27.43	47.49	1228.51	0.962 +/- 0.004	0.001
4	904	16.76	32	6.68	17.17	55.83	848.17	0.937 +/- 0.007	0.001
8	4052	81.27	87	34.72	83.98	202.99	3849.01	0.950 +/- 0.002	0.001

Preliminary cuts - Yields / BG Statistics- Period 2

WN background summary: yields 25<ET<50 GeV

starPhysEta Bin	rawYield	qcdBkgd	secondEEM C	zeeBkgd	wTauYield	totalBkgd	wYield	beta +/- err	+/-syst
1	228	7.63	21	4.32	3.88	32.95	195.05	0.856 +/- 0.021	0.003
2	190	5.85	20	6.94	5.63	33.5	156.5	0.823 +/- 0.026	0.004
3	211	6.75	24	6.83	6.89	37.99	173.01	0.819 +/- 0.025	0.005
4	257	4.8	11	5.17	4.36	21.96	235.04	0.915 +/- 0.014	0.005
8	891	22.67	82	22.98	20.76	127.64	763.36	0.857 +/- 0.011	0.003

WP background summary: yields 25<ET<50 GeV

starPhysEta Bin	rawYield	qcdBkgd	secondEEM C	zeeBkgd	wTauYield	totalBkgd	wYield	beta +/- err	+/-syst
1	604	10.39	49	5.69	10.99	65.64	538.36	0.893 +/- 0.012	0.002
2	883	8.24	47	5.36	18.93	61.3	821.7	0.930 +/- 0.008	0.001
3	1031	7.63	39	5.45	23.34	53.03	977.97	0.948 +/- 0.006	0.001
4	686	6.4	44	5.07	14.84	55.86	630.14	0.919 +/- 0.010	0.001
8	3207	29.77	181	21.22	68.26	231.99	2975.01	0.928 +/- 0.004	0.001

Systematics - Each bin value separately in mid-rapidity

- EMC calibration**

Eta	EMCsys- DSSV14	EMCsys- BS15	EMCsys- NNPDF	EMCsys- Final (devika- for now)	EMCsys- Final -Jinlong	EMCsys- Data New Cuts	EMCsys- Data /Preliminary
	W+	W+	W+	W+	W+	W+	W+
-1.25	0.014	0.009		0.014	0.015		0.014
-0.75	0.013	0.008		0.013	0.012	0.013	0.010
-0.25	0.006	0.005		0.006	0.006	0.008	0.005
0.25	0.002	0.002		0.002	0.004	0.016	0.007
0.75	0.014	0.011		0.014	0.014	0.006	0.013
1.25	0.020	0.013		0.020	0.019		0.022
	W-	W-	W-	W-	W-	W-	W-
-1.25	0.004	0.001		0.004	0.003		0.053
-0.75	0.004	0.000		0.004	0.004	0.000	0.030
-0.25	0.001	0.001		0.001	0.001	0.001	0.006
0.25	0.001	0.001		0.001	0.002	0.012	0.019
0.75	0.001	0.001		0.001	0.004	0.008	0.001
1.25	0.001	0.005		0.005	0.003		0.028

- Relative Luminosity**

	W+	W-
New Cuts	0.004	0.004
Preliminary cuts	0.004	0.004