

W charge asymmetry studies:

xsection calculation,
asymmetry calculation,
results analysis

26.04.2018

General information

- Data 2015
- Luminosity = 2.157 fb^{-1} (2.3 in the paper)
- Object selected : muons
- Object definition: 
- $p_T > 25 \text{ GeV}$, $|\eta| < 2.4$
- MET to extract the $W^\pm$ signal.

Region	η_{min}	η_{max}
1	0.0	0.2
2	0.2	0.4
3	0.4	0.6
4	0.6	0.8
5	0.8	1.0
6	1.0	1.2
7	1.2	1.4
8	1.4	1.6
9	1.6	1.85
10	1.85	2.1
11	2.1	2.4

Table 3: Muon selection requirements	
Observable	Value or Range
p_T	$> 25 \text{ GeV}$
$ \eta $	< 2.4
Id	GlobalMuon
Id	PFMuon
χ^2/ndof	< 10
# Valid Mu Hits	> 0
# Matched Stations	> 1
# Tracker Layers	> 5
# Valid pixel Hits	> 0
$ d_{0,pv} $	< 0.2
$ d_{z,pv} $	< 0.5
PFIso/ p_T	< 0.12

Rochester corrected results

W->mu minus	Data	Signal	QCD	Other	Signal+QCD+Other	Data / Signal+QCD+Other	Acceptance*efficiency	Data	Signal %	QCD %	Other %	CROSS SECTION
0 Total:	8835493	7043894	1179216	612398	8835508	0.999983023	0.375	100%	79.7	13.3	6.9	8.71E-09
1 0.0 - 0.2	785783	660247	77535	47998	785780	1.000003818	0.034	9%	84	9.9	6.1	9.00E-09
2 0.2 - 0.4	730670	608042	70866	51752	730660	1.000013686	0.033	8%	83.2	9.7	7.1	8.54E-09
3 0.4 - 0.6	813480	675480	110665	27344	813489	0.9999889365	0.034	9%	83	13.6	3.4	9.21E-09
4 0.6 - 0.8	801520	628857	119615	53046	801518	1.000002495	0.035	9%	78.5	14.9	6.6	8.33E-09
5 0.8 - 1.0	736393	592387	98559	45451	736397	0.9999945681	0.031	8%	80.4	13.4	6.2	8.86E-09
6 1.0 - 1.2	740903	579079	105192	56630	740901	1.000002699	0.032	8%	78.2	14.2	7.6	8.39E-09
7 1.2 - 1.4	806372	620992	128592	56798	806382	0.9999875989	0.035	9%	77	15.9	7.0	8.22E-09
8 1.4 - 1.6	804511	599060	142138	63316	804514	0.999996271	0.032	9%	74.5	17.7	7.9	8.68E-09
9 1.6 - 1.85	882305	677705	137015	67592	882312	0.9999920663	0.035	10%	76.8	15.5	7.7	8.97E-09
10 1.85 - 2.1	863917	618814	143667	101435	863916	1.000001158	0.035	10%	71.6	16.6	11.7	8.19E-09
11 2.1 - 2.4	869639	663307	117433	88908	869648	0.999989651	0.034	10%	76.3	13.5	10.2	9.04E-09
Sum over bins	8835493	6923970	1251277	660270	8835517	0.9999972837						
Total/Sum over bins	1	1.017320121	0.9424100339	0.9274963273	0.9999989814							

•Cross section measurement:

$$\sigma = \frac{N}{A \cdot \epsilon \cdot \int L dt}$$

•Signal extraction

•Lepton selection

•Lepton efficiencies

•Acceptance

•Theory uncertainties

•Experimental setup = 2.157 fb⁻¹

Rochester corrected results

W->mu plus	Data	Signal	QCD	Other	Signal+QCD+Other	Data / Signal+QCD+Other	Acceptance*efficiency						CROSS SECTION
0 Total:	11007396	9179612	944324	883456	11007392	1.000000363	0.36	100%	83.4	8.6	8.0		1.18E-08
1 0.0 - 0.2	908163	771102	83254	53805	908161	1.000002202	0.03	8%	84.9	9.2	5.9		1.19E-08
2 0.2 - 0.4	848544	725252	96943	26366	848561	0.999979966	0.028	8%	85.5	11.4	3.1		1.20E-08
3 0.4 - 0.6	951901	797953	86488	67451	951892	1.000009455	0.031	9%	83.8	9.1	7.1		1.19E-08
4 0.6 - 0.8	950977	777333	105404	68231	950968	1.000009464	0.03	9%	81.7	11.1	7.2		1.20E-08
5 0.8 - 1.0	877905	734555	89082	54270	877907	0.9999977219	0.029	8%	83.7	10.1	6.2		1.17E-08
6 1.0 - 1.2	910356	739799	95639	74909	910347	1.000009886	0.029	8%	81.3	10.5	8.2		1.18E-08
7 1.2 - 1.4	1004326	803787	88346	112161	1004294	1.000031863	0.031	9%	80	8.8	11.2		1.20E-08
8 1.4 - 1.6	1023373	809093	107275	107001	1023369	1.000003909	0.033	9%	79.1	10.5	10.5		1.14E-08
9 1.6 - 1.85	1153777	894033	124942	134778	1153753	1.000020802	0.038	11%	77.5	10.8	11.7		1.09E-08
10 1.85 - 2.1	1170676	986704	139616	44364	1170684	0.9999931664	0.038	11%	84.3	11.9	3.8		1.20E-08
11 2.1 - 2.4	1207398	1054142	120965	32299	1207406	0.9999933742	0.038	11%	87.3	10	2.7		1.29E-08
Sum over bins	11007396	9093753	1137954	775635	11007342	1.000004906							
Total/Sum over bins	1	1.009441536	0.8298437371	1.139009972	1.000004542								

•Cross section measurement:

$$\sigma = \frac{N}{A \cdot \epsilon \cdot \int L dt}$$

•Signal extraction

•Lepton selection
•Lepton efficiencies

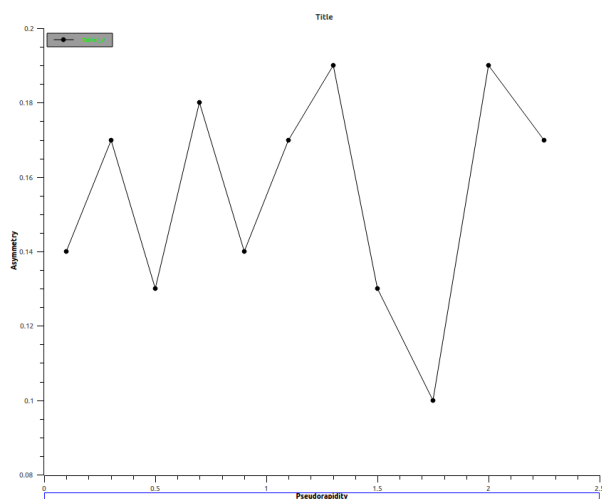
•Acceptance
•Theory uncertainties

•Experimental setup = 2.157 fb⁻¹

Asymmetries

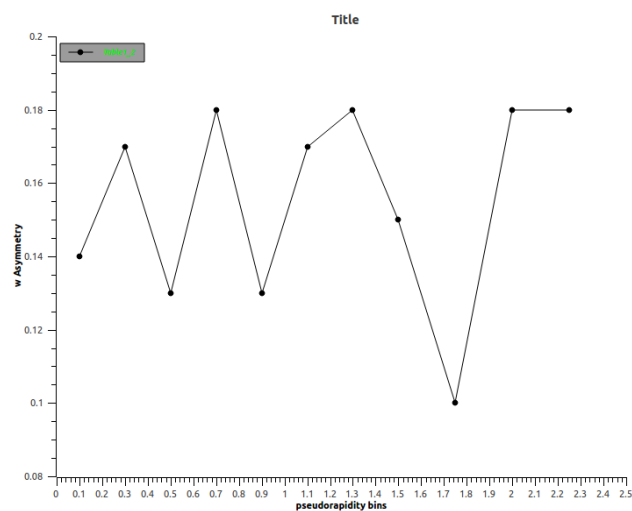
Rochester

	Asymmetry	Asymmetry(raw)
0 Total:	0.15	1.32E-01
1 0.0 - 0.2	0.14	7.74E-02
2 0.2 - 0.4	0.17	8.79E-02
3 0.4 - 0.6	0.13	8.31E-02
4 0.6 - 0.8	0.18	1.06E-01
5 0.8 - 1.0	0.14	1.07E-01
6 1.0 - 1.2	0.17	1.22E-01
7 1.2 - 1.4	0.19	1.28E-01
8 1.4 - 1.6	0.13	1.49E-01
9 1.6 - 1.85	0.10	1.38E-01
10 1.85 - 2.1	0.19	2.29E-01
11 2.1 - 2.4	0.17	2.28E-01

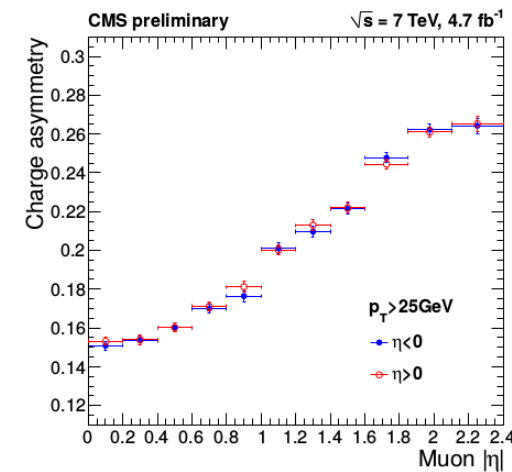
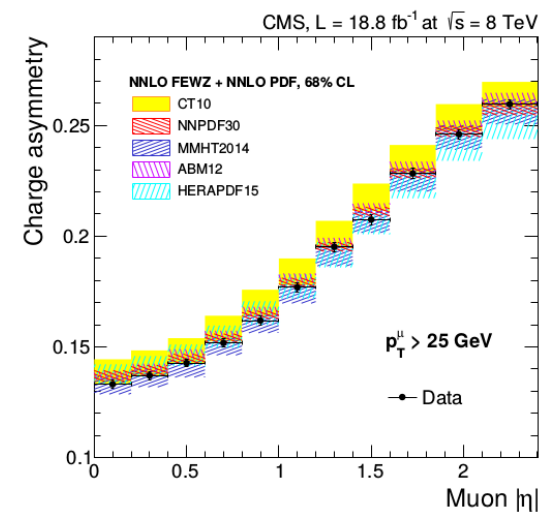


Non Rochester

	Asymmetry	Asymmetry(raw)
0 Total:	0.15	1.30E-01
1 0.0 - 0.2	0.14	7.98E-02
2 0.2 - 0.4	0.17	8.72E-02
3 0.4 - 0.6	0.13	8.10E-02
4 0.6 - 0.8	0.18	1.05E-01
5 0.8 - 1.0	0.13	9.38E-02
6 1.0 - 1.2	0.17	1.21E-01
7 1.2 - 1.4	0.18	1.19E-01
8 1.4 - 1.6	0.15	1.65E-01
9 1.6 - 1.85	0.10	1.39E-01
10 1.85 - 2.1	0.18	2.24E-01
11 2.1 - 2.4	0.18	2.31E-01



8 & 7 TeV



Back up

No Rochester correction

Region	W->mu minus	Data	Signal	QCD	Other	Signal+QCD+Other	Data / Signal+QCD+Other	Acceptance*efficiency					CROSS SECTION
0	Total:	8804750	7062229	1164884	577643	8804756	0.9999993186	0.375	80%	80.2	13.2	6.6	8.73E-09
1	0.0 - 0.2	784423	661001	76577	46842	784420	1.000003824	0.034	7%	84.3	9.8	6.0	9.01E-09
2	0.2 - 0.4	729416	608882	69492	51033	729407	1.000012339	0.033	7%	83.5	9.5	7.0	8.55E-09
3	0.4 - 0.6	811985	677854	116130	18008	811992	0.9999913792	0.034	7%	83.5	14.3	2.2	9.24E-09
4	0.6 - 0.8	800215	629351	118605	52259	800215	1	0.035	7%	78.6	14.8	6.5	8.33E-09
5	0.8 - 1.0	734645	595672	96762	42218	734652	0.9999904717	0.031	7%	81.1	13.2	5.7	8.91E-09
6	1.0 - 1.2	738902	581154	104213	53537	738904	0.9999972933	0.032	7%	78.7	14.1	7.2	8.42E-09
7	1.2 - 1.4	803617	625294	127040	51322	803656	0.9999514718	0.035	7%	77.8	15.8	6.4	8.28E-09
8	1.4 - 1.6	801109	601551	139607	59955	801113	0.9999950069	0.032	7%	75.1	17.4	7.5	8.71E-09
9	1.6 - 1.85	878560	678451	134289	65829	878569	0.9999897561	0.035	8%	77.2	15.3	7.5	8.98E-09
10	1.85 - 2.1	859033	631872	142820	84344	859036	0.9999965077	0.035	8%	73.6	16.6	9.8	8.37E-09
11	2.1 - 2.4	862845	664123	112239	86487	862849	0.9999953642	0.034	8%	77	13	10.0	9.05E-09
	Sum over bins	8804750	6955205	1237774	611834	8804813	0.9999928448						
	Total / Sum over bin	1	1.015387613	0.9411120285	0.9441171952	0.9999935263							

	W->mu plus	Data	Signal	QCD	Other	Signal+QCD+Other	Data / Signal+QCD+Other	Acceptance*efficiency					CROSS SECTION
0	Total:	10972017	9178469	921710	871833	10972012	1.000000456	0.36	100%	83.7	8.4	7.9	1.18E-08
1	0.0 - 0.2	907149	775653	97307	34204	907164	0.999983465	0.03	8%	85.5	10.7	3.8	1.20E-08
2	0.2 - 0.4	847318	725248	100287	21793	847328	0.9999881982	0.028	8%	85.6	11.8	2.6	1.20E-08
3	0.4 - 0.6	950538	797337	85747	67442	950526	1.000012625	0.031	9%	83.9	9	7.1	1.19E-08
4	0.6 - 0.8	949452	777774	104670	67001	949445	1.000007373	0.03	9%	81.9	11	7.1	1.20E-08
5	0.8 - 1.0	876317	718987	78149	79163	876299	1.000020541	0.029	8%	82	8.9	9.0	1.15E-08
6	1.0 - 1.2	908727	741708	95500	71512	908720	1.000007703	0.029	8%	81.6	10.5	7.9	1.19E-08
7	1.2 - 1.4	1001498	794559	94256	112662	1001477	1.000020969	0.031	9%	79.3	9.4	11.2	1.19E-08
8	1.4 - 1.6	1018756	839372	118046	61305	1018723	1.000032393	0.033	9%	82.4	11.6	6.0	1.18E-08
9	1.6 - 1.85	1148684	897827	120158	130677	1148662	1.000019153	0.038	10%	78.2	10.5	11.4	1.09E-08
10	1.85 - 2.1	1164150	995916	139458	28783	1164157	0.9999939871	0.038	11%	85.5	12	2.5	1.21E-08
11	2.1 - 2.4	1199428	1063586	116532	19317	1199435	0.9999941639	0.038	11%	88.7	9.7	1.6	1.30E-08
	Sum over bins	10972017	9127967	1150110	693859	10971936	1.000007382						
	Total / Sum over bin	1	1.005532667	0.8014102999	1.256498799	1.000006927							

Acceptance

The acceptance A of the W bosons defines as a fraction of simulated events with decay products passing kinematic requirements in the fiducial phase-space.

- $p_T > 25$ GeV;
- $|\eta| < 2.4$;

Calculated* Acceptance for W^+ & W^- in muon channel:

- $A(W^+) = 0.45$
- $A(W^-) = 0.46$

* - acceptance when only p_T & $|\eta|$ cuts are used.

Calculated* Acceptance for W^+ & W^- in muon channel:

- $A(W^+) = 0.381461$
- $A(W^-) = 0.394783$

* - acceptance when object selection is performed.

	Process	A_{Gen} (Pre-FSR)	A_{Gen} (Post-FSR)
Results from the	$W^+ \rightarrow \mu^+ \nu$	0.45	0.44
	$W^- \rightarrow \mu^- \bar{\nu}$	0.47	0.46

Eta binned results($w_+ \rightarrow \mu \nu$)

Total: $4.71501\text{e}+09 / 1.24498\text{e}+10 = 0.37872 \pm 6.47613\text{e}-06 \Rightarrow \text{eff corr} \Rightarrow 0.360807 \pm 0.00310237$

barrel[1]: $3.99056\text{e}+08 / 1.24498\text{e}+10 = 0.0320531 \pm 1.63006\text{e}-06 \Rightarrow \text{eff corr}[1] \Rightarrow 0.0305616$

barrel[2]: $3.806\text{e}+08 / 1.24498\text{e}+10 = 0.0305707 \pm 1.59078\text{e}-06 \Rightarrow \text{eff corr}[2] \Rightarrow 0.0287337$

barrel[3]: $4.03371\text{e}+08 / 1.24498\text{e}+10 = 0.0323997 \pm 1.63913\text{e}-06 \Rightarrow \text{eff corr}[3] \Rightarrow 0.0312932$

barrel[4]: $3.96931\text{e}+08 / 1.24498\text{e}+10 = 0.0318824 \pm 1.62558\text{e}-06 \Rightarrow \text{eff corr}[4] \Rightarrow 0.0307903$

barrel[5]: $3.89954\text{e}+08 / 1.24498\text{e}+10 = 0.031322 \pm 1.61079\text{e}-06 \Rightarrow \text{eff corr}[5] \Rightarrow 0.0299129$

barrel[6]: $3.89283\text{e}+08 / 1.24498\text{e}+10 = 0.0312681 \pm 1.60937\text{e}-06 \Rightarrow \text{eff corr}[6] \Rightarrow 0.0294953$

endcap[7]: $4.06746\text{e}+08 / 1.24498\text{e}+10 = 0.0326708 \pm 1.64619\text{e}-06 \Rightarrow \text{eff corr}[7] \Rightarrow 0.0314942$

endcap[8]: $4.29147\text{e}+08 / 1.24498\text{e}+10 = 0.0344701 \pm 1.69238\text{e}-06 \Rightarrow \text{eff corr}[8] \Rightarrow 0.0332266$

endcap[9]: $4.9364\text{e}+08 / 1.24498\text{e}+10 = 0.0396503 \pm 1.81964\text{e}-06 \Rightarrow \text{eff corr}[9] \Rightarrow 0.0382124$

endcap[10]: $5.03098\text{e}+08 / 1.24498\text{e}+10 = 0.04041 \pm 1.83766\text{e}-06 \Rightarrow \text{eff corr}[10] \Rightarrow 0.0389353$

endcap[11]: $5.23182\text{e}+08 / 1.24498\text{e}+10 = 0.0420232 \pm 1.87543\text{e}-06 \Rightarrow \text{eff corr}[11] \Rightarrow 0.0381518$

Eta binned results($w_+ \rightarrow \mu \nu$)

Total: $4.65864\text{e}+09 / 1.1893\text{e}+10 = 0.391711 \pm 6.77035\text{e}-06 \Rightarrow 0.375226 \pm 0.00327445$

barrel[1]: $4.27792\text{e}+08 / 1.1893\text{e}+10 = 0.0359699 \pm 1.7701\text{e}-06 \Rightarrow 0.0345333 \pm 0.00098118$

barrel[2]: $4.2028\text{e}+08 / 1.1893\text{e}+10 = 0.0353383 \pm 1.75395\text{e}-06 \Rightarrow 0.0333996 \pm 0.000964363$

barrel[3]: $4.26984\text{e}+08 / 1.1893\text{e}+10 = 0.035902 \pm 1.76837\text{e}-06 \Rightarrow 0.0347743 \pm 0.00101263$

barrel[4]: $4.33239\text{e}+08 / 1.1893\text{e}+10 = 0.036428 \pm 1.78172\text{e}-06 \Rightarrow 0.0352837 \pm 0.00100308$

barrel[5]: $3.89079\text{e}+08 / 1.1893\text{e}+10 = 0.0327149 \pm 1.68545\text{e}-06 \Rightarrow 0.0312791 \pm 0.00094685$

barrel[6]: $4.03756\text{e}+08 / 1.1893\text{e}+10 = 0.033949 \pm 1.71797\text{e}-06 \Rightarrow 0.0320549 \pm 0.000946603$

endcap[7]: $4.36571\text{e}+08 / 1.1893\text{e}+10 = 0.0367081 \pm 1.7888\text{e}-06 \Rightarrow 0.0354939 \pm 0.000994308$

endcap[8]: $4.05794\text{e}+08 / 1.1893\text{e}+10 = 0.0341203 \pm 1.72245\text{e}-06 \Rightarrow 0.0329891 \pm 0.000971514$

endcap[9]: $4.35248\text{e}+08 / 1.1893\text{e}+10 = 0.0365968 \pm 1.786\text{e}-06 \Rightarrow 0.0353848 \pm 0.00102721$

endcap[10]: $4.34167\text{e}+08 / 1.1893\text{e}+10 = 0.036506 \pm 1.7837\text{e}-06 \Rightarrow 0.0353007 \pm 0.0010235$

endcap[11]: $4.45728\text{e}+08 / 1.1893\text{e}+10 = 0.037478 \pm 1.80814\text{e}-06 \Rightarrow 0.0347326 \pm 0.000984858$

Very raw cross section results

	Yields	Luminosity	Acceptance	Efficiency*	BR	xSection[pb]
• W+	9154760	2.3E+15	0.45	0.82	1	10740
• W-	7038593	2.3E+15	0.46	0.82	1	8078

Analysis note(SMP 16-013) results:

Source	$W \rightarrow \mu\nu$	$W^+ \rightarrow \mu^+\nu$	$W^- \rightarrow \mu^-\bar{\nu}$
Yields	17046299 ± 12022	9645191 ± 10066	7401108 ± 6573
Acceptance	0.45 ± 0.01	0.44 ± 0.01	0.46 ± 0.01
Efficiency	0.82 ± 0.01	0.82 ± 0.01	0.82 ± 0.01

Channel		$\sigma \times \mathcal{B}$ [pb] (total)	NNLO [pb]
W ⁺	$e^+\nu$	11052 ± 22 (stat) ± 241 (syst) ± 298 (lumi)	11329^{+324}_{-269}
	$\mu^+\nu$	11534 ± 12 (stat) ± 262 (syst) ± 311 (lumi)	
	$\ell^+\nu$	11274 ± 13 (stat) ± 177 (syst) ± 304 (lumi)	
W ⁻	$e^-\nu$	7937 ± 16 (stat) ± 183 (syst) ± 214 (lumi)	8369^{+244}_{-213}
	$\mu^-\nu$	8493 ± 8 (stat) ± 173 (syst) ± 229 (lumi)	
	$\ell^-\nu$	8231 ± 9 (stat) ± 126 (syst) ± 222 (lumi)	

Raw asymmetries

$$\mathcal{A}(\eta) = \frac{\sigma_{\eta}^{+} - \sigma_{\eta}^{-}}{\sigma_{\eta}^{+} + \sigma_{\eta}^{-}} = 14\%;$$

Results from SMP 014-022 (8 TeV)

	$\mathcal{A}(\%)$					
0.00–0.20	$13.31 \pm 0.06 \pm 0.17$	$13.89^{+0.55}_{-0.57}$	13.68 ± 0.25	$13.16^{+0.48}_{-0.30}$	13.69 ± 0.20	$13.71^{+0.50}_{-0.43}$
0.20–0.40	$13.70 \pm 0.06 \pm 0.18$	$14.28^{+0.56}_{-0.59}$	13.94 ± 0.23	$13.48^{+0.49}_{-0.30}$	14.04 ± 0.20	$14.07^{+0.51}_{-0.44}$
0.40–0.60	$14.27 \pm 0.06 \pm 0.18$	$14.83^{+0.56}_{-0.60}$	14.47 ± 0.21	$13.92^{+0.48}_{-0.30}$	14.66 ± 0.23	$14.58^{+0.53}_{-0.45}$
0.60–0.80	$15.18 \pm 0.06 \pm 0.18$	$15.85^{+0.55}_{-0.61}$	15.40 ± 0.19	$14.93^{+0.49}_{-0.30}$	15.52 ± 0.21	$15.42^{+0.54}_{-0.47}$
0.80–1.00	$16.19 \pm 0.06 \pm 0.19$	$17.01^{+0.57}_{-0.64}$	16.44 ± 0.19	$15.95^{+0.50}_{-0.31}$	16.59 ± 0.22	$16.49^{+0.58}_{-0.50}$
1.00–1.20	$17.69 \pm 0.07 \pm 0.20$	$18.44^{+0.55}_{-0.65}$	17.92 ± 0.19	$17.31^{+0.51}_{-0.34}$	18.11 ± 0.21	$17.69^{+0.58}_{-0.51}$
1.20–1.40	$19.52 \pm 0.07 \pm 0.22$	$20.14^{+0.56}_{-0.67}$	19.52 ± 0.20	$19.03^{+0.53}_{-0.38}$	19.70 ± 0.23	$19.13^{+0.62}_{-0.54}$
1.40–1.60	$20.75 \pm 0.07 \pm 0.23$	$21.82^{+0.56}_{-0.68}$	21.10 ± 0.21	$20.59^{+0.55}_{-0.42}$	21.26 ± 0.23	$20.63^{+0.60}_{-0.54}$
1.60–1.85	$22.83 \pm 0.06 \pm 0.23$	$23.57^{+0.55}_{-0.68}$	22.84 ± 0.23	$22.50^{+0.57}_{-0.48}$	23.14 ± 0.23	$22.26^{+0.63}_{-0.55}$
1.85–2.10	$24.61 \pm 0.06 \pm 0.22$	$25.43^{+0.54}_{-0.67}$	24.74 ± 0.25	$24.44^{+0.57}_{-0.52}$	24.99 ± 0.24	$24.01^{+0.69}_{-0.60}$
2.10–2.40	$25.96 \pm 0.07 \pm 0.21$	$26.47^{+0.50}_{-0.62}$	25.75 ± 0.28	$25.61^{+0.57}_{-0.55}$	26.19 ± 0.29	$25.05^{+0.78}_{-0.67}$

Back up

Object and event selection

For this analysis, the events are collected when triggered by the presence of at least one electron(or muon) with large transverse energy and η cut:

- $P_T > 25 \text{ GeV}$
- $|\eta| < 2.5$

Several Monte Carlo event generators are used to simulate the signal and background processes:

- MadGraph5 aMC@NLO - event samples for the W and Z boson signal and top background.
- PYTHIA 8 with NNPDF3.0 - parton shower.
- PYTHIA 8 and POWHEG - diboson backgrounds.
- GEANT4 - detector response.

Probability Density Function fits*

QCD background modeled by analytical function:

$$f(x) = x \cdot \exp(\{-x^2\} / \{ax^2+bx+c\}) *$$

$$a = 4.0 \in [-10.0, 10.0]$$

$$b = 6.0 \in [0.0, 20.0]$$

$$c = 2.9 \in [0.3, 6.0]$$

$$X \in [0.0, 2.0, 150.0]$$

Signal and EWK backgrounds are modeled with simulation based fitting functions.

As a minimum finder used Minos

*both codes uses the same function

*new function to come

smth like that $f(x) = (x \cdot \exp(\{-x^2\} / \{ax^2+bx+c\})) * (\{ax^2+bx+c\})$

NEW improvements!

Lepton efficiencies are measured in different eta bins:

- New electron eta binning:

-2.5, -2.0, -1.566, -1.4442, -1.0, -0.5,
0.0,
0.5, 1.0, 1.4442, 1.566, 2.0, 2.5

- New muon eta binning:

-2.4 -2.1, -1.2, -0.9, -0.3, -0.2,
0.0,
0.2, 0.3, 0.9, 1.2, 2.1, 2.4

Old binning:

0.0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.85, 2.1, 2.5
(for muons: up to 2.4)

Efficiency

- The total efficiency of the electrons can be factorized as follows for the electrons with the total efficiency defined with respect to a reconstructed supercluster passing the kinematic cuts

$$\epsilon_{total} = \epsilon_{GSF+ID+ISO} \times \epsilon_{trigger} ?$$

- For the muons, a similar factorization can be done

$$\epsilon_{total} = \epsilon_{tracking+ID+ISO} \times \epsilon_{STA} \times \epsilon_{trigger} ?$$

Included in the muon selection efficiency

- All efficiencies implemented as a weights to events in a form:

$$\text{weight} = \text{scale1fb} * \text{lumi} * \prod_i \text{eff_data}_i(\text{eta}, \text{Pt}) / \text{eff_MC}_i(\text{eta}, \text{Pt})$$

- Acceptance code exists but it crashes, I need to discuss it with Maria

Summary table on event numbers for eta binned E_T distributions of $W \rightarrow \mu^+$

	W-> mu plus	Selected	Signal	QCD	Other		Signal+QCD+Other	Selected / Signal+QCD+Other
0	Total:	10972017	9154760	1005162	812093		10972015	1.000000182
1	-2.4 - -2.0	597843	506271	54482	37099		597852	0.9999849461
2	-2.0 - -1.566	2162007	1765001	252645	144368		2162014	0.9999967623
3	-1.566 - -1.442	683300	562309	74244	46747		683300	1
4	-1.442 - -1.0	1397945	1170317	125906	101707		1397930	1.00001073
5	-1.0 - -0.5	193760	161895	31196	670		193761	0.999994839
6	-0.5 - 0.0	452744	381590	51068	20090		452748	0.9999911651
7	0.0 - 0.5	454405	381027	44802	28565		454394	1.000024208
8	0.5 - 1.0	192171	156236	31358	4586		192180	0.9999531689
9	1.0 - 1.442	1394476	1186889	119002	88581		1394472	1.000002868
10	1.442 - 1.566	670700	557706	76749	36251		670706	0.9999910542
11	1.566 - 2.0	2171081	1739613	200562	230890		2171065	1.00000737
12	2.0 - 2.4	601585	504372	64709	32513		601594	0.9999850397
	Sum over bins	10972017	9073226	1126723	772067		10972016	1.000000091
	Total / Sum over bins	1	1.008986219	0.8921110158	1.051842651		0.9999999089	

The table represents yields on signal, QCD, other(background) and total(selected) distribution for the whole region of eta and per bin.

The last row and column represents ratios to estimate possible correlation of number of events in the whole eta region and eta binned distributions.

Summary table on event numbers for eta binned E_T distributions of $W \rightarrow \mu^-$

	W->mu minus	Selected	Signal	QCD	Other		Signal+QCD+Other	Selected / Signal+QCD+Other
0	Total:	8804750	7038593	1138882	626977		8804452	1.000033847
1	-2.4 - -2.0	430063	332454	63676	33942		430072	0.9999790733
2	-2.0 - -1.566	1671140	1277199	263588	130358		1671145	0.999997008
3	-1.566 - -1.442	557101	440939	82959	33210		557108	0.9999874351
4	-1.442 - -1.0	1185837	969787	155547	60508		1185842	0.9999957836
5	-1.0 - -0.5	166746	139222	24165	3367		166754	0.9999520251
6	-0.5 - 0.0	390755	321187	58570	11007		390764	0.9999769682
7	0.0 - 0.5	393668	328566	45544	19562		393672	0.9999898393
8	0.5 - 1.0	167513	136985	23947	6590		167522	0.9999462757
9	1.0 - 1.442	1186698	984177	143105	59419		1186701	0.999997472
10	1.442 - 1.566	551268	433588	84103	33582		551273	0.9999909301
11	1.566 - 2.0	1671179	1302068	275760	93367		1671195	0.999990426
12	2.0 - 2.4	432782	334737	61081	36970		432788	0.9999861364
	Sum over bins	8804750	7000909	1282045	521882		8804836	0.9999902326
	Total / Sum over bins	1	1.00538273	0.8883323128	1.20137694		0.9999563876	

The table represents yields on signal, QCD, other(background) and total(selected) distribution for the whole region of eta and per bin.

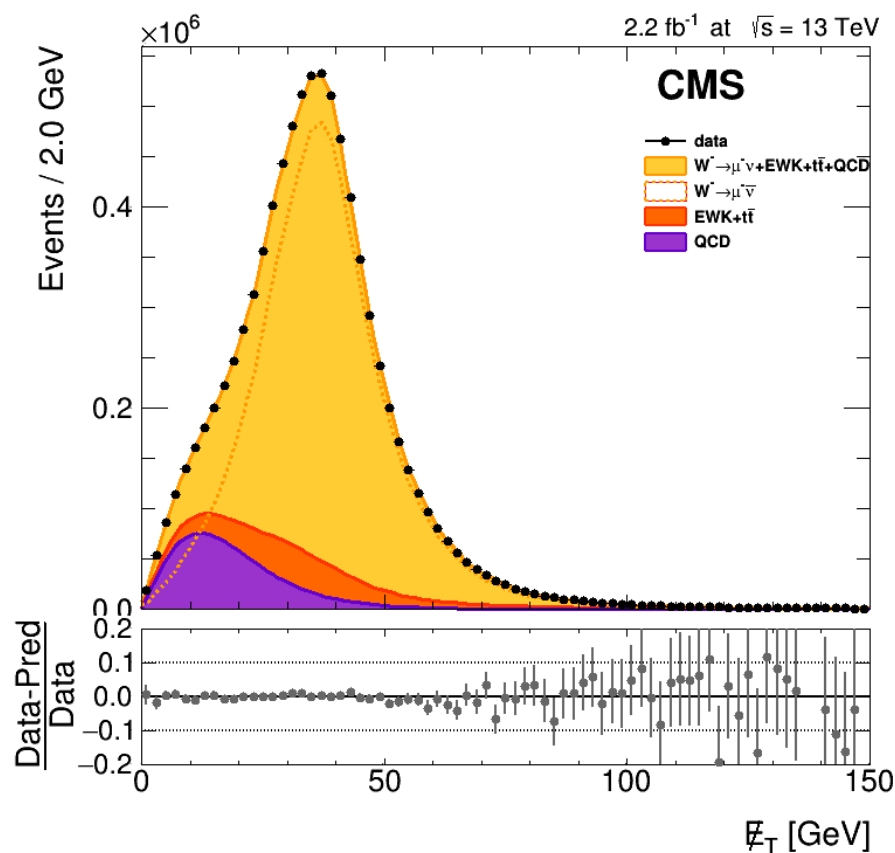
The last row and column represents ratios to estimate possible correlation of number of events in the whole eta region and eta binned distributions.

Number of events and chi2/ndf in different eta bins

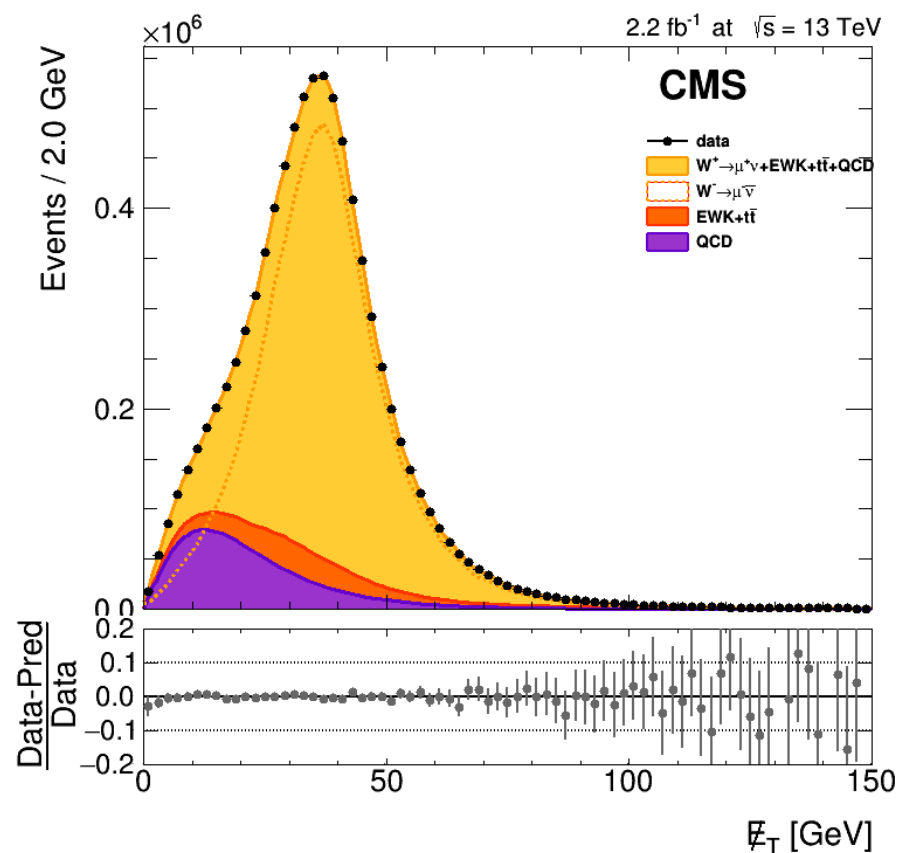
eta bins	N + (Signal)	N - (Signal)	chi2/ndf (N +)	chi2/ndf (N -)
-2.4 - 2.4	9154760	7038593	0.6562	0.408
-2.4 - -2.0	506271	332454	0.704	0.2375
-2.0 - -1.566	1765001	1277199	0.3233	0.3122
-1.566 - -1.442	562309	440939	0.4019	0.314
-1.442 - -1.0	1170317	969787	0.361	0.3224
-1.0 - -0.5	161895	139222	0.3447	0.2717
-0.5 - 0.0	381590	321187	0.3362	0.3216
0.0 - 0.5	381027	328566	0.3365	0.5061
0.5 - 1.0	156236	136985	0.3469	0.3878
1.0 - 1.442	118689	984177	0.3165	0.3373
1.442 - 1.566	557706	433588	0.4605	0.3457
1.566 - 2.0	1739613	1302068	0.9921	0.2603
2.0 - 2.4	504372	334737	0.3259	0.3012

From the table we may conclude that we overestimate uncertainties

Comparing missing E_T for the whole eta region (W^- to muon ch.)

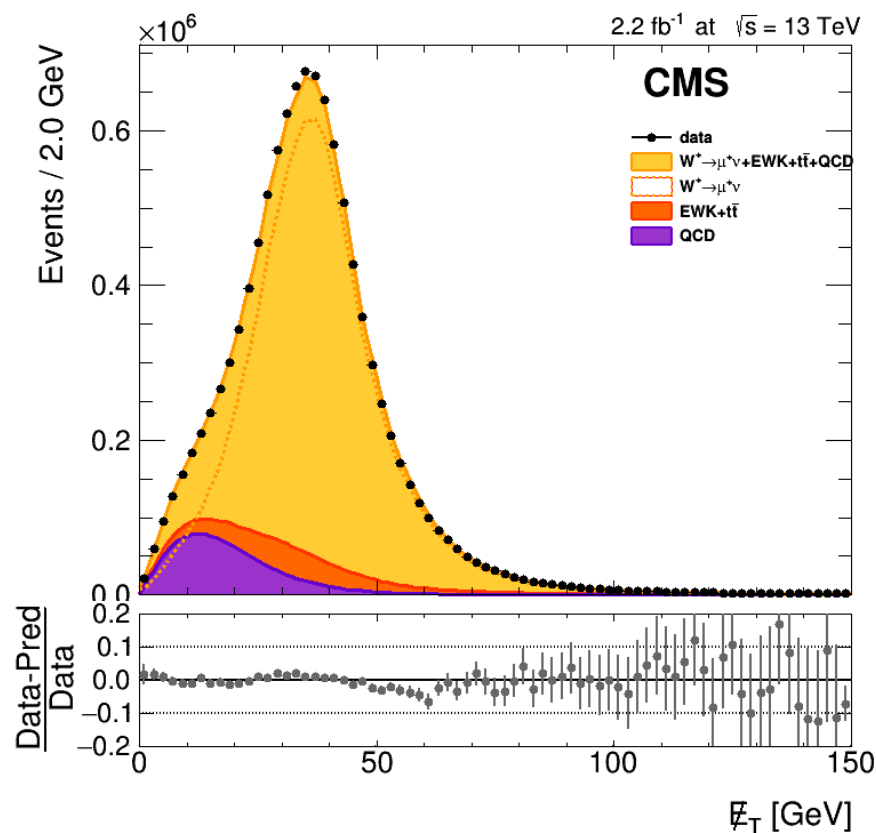


Old binning

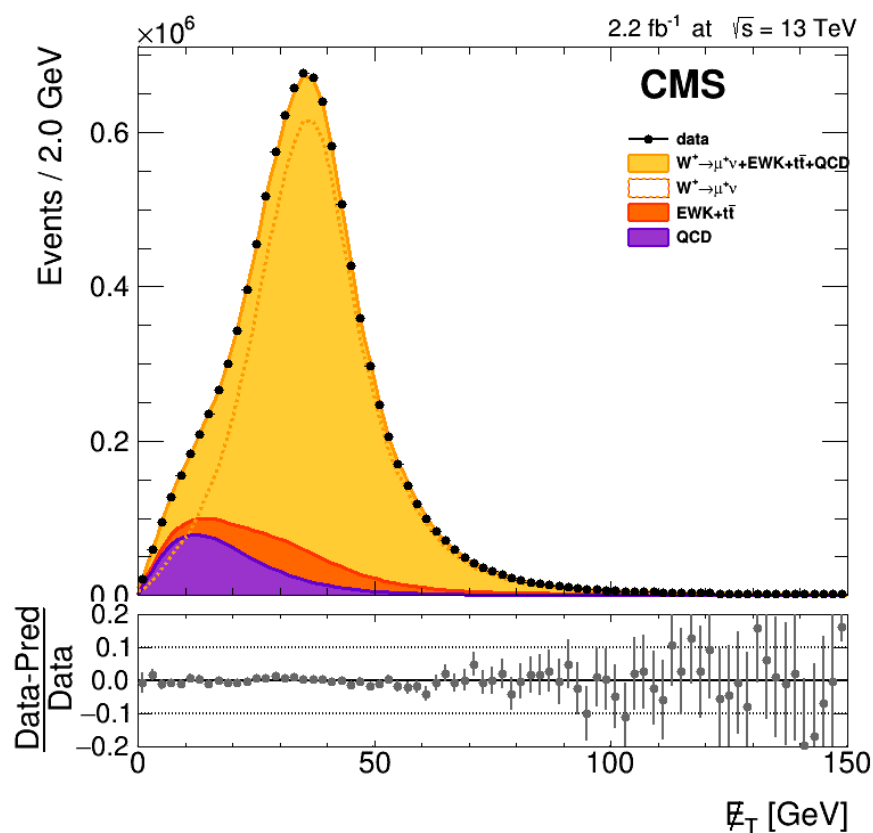


New binning

Comparing missing E_T for the whole eta region (W^+ to muon ch.)

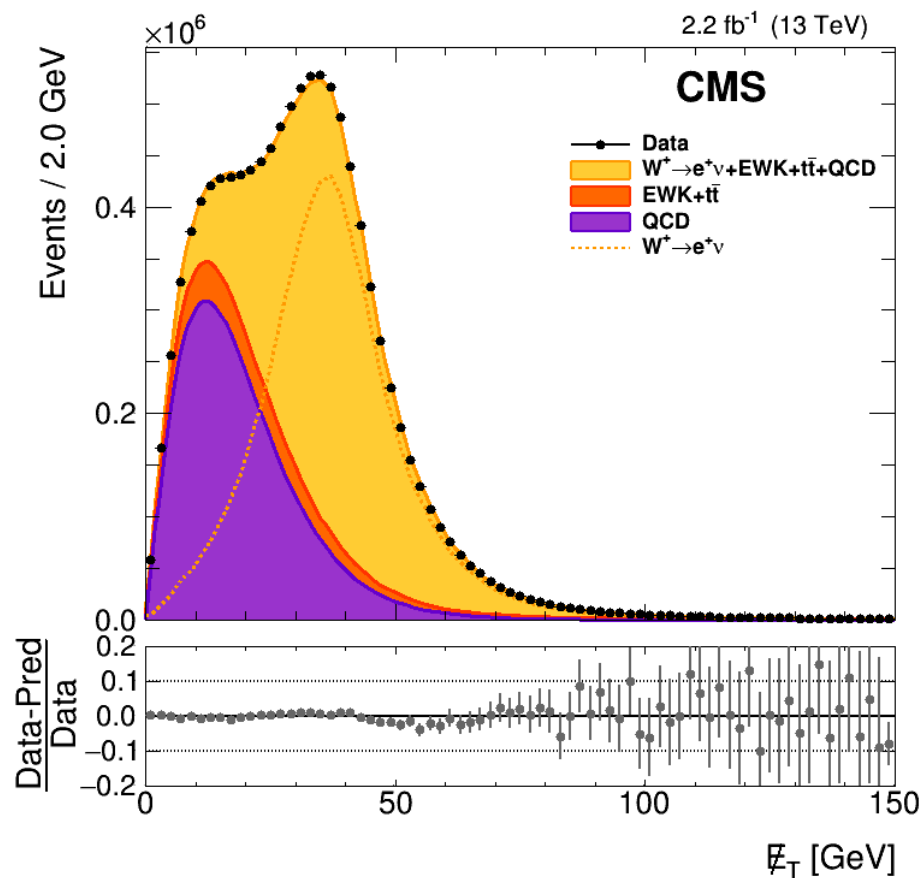


Old binning

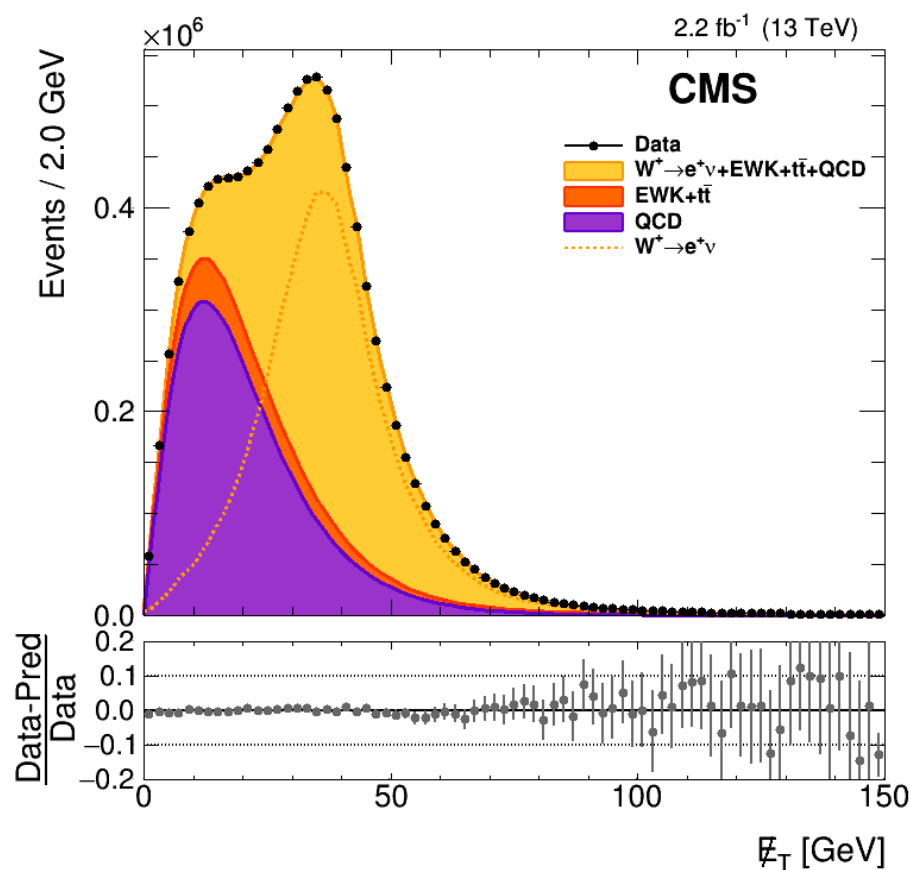


New binning

Comparing missing E_T for the whole eta region (W^+ to electron ch.)

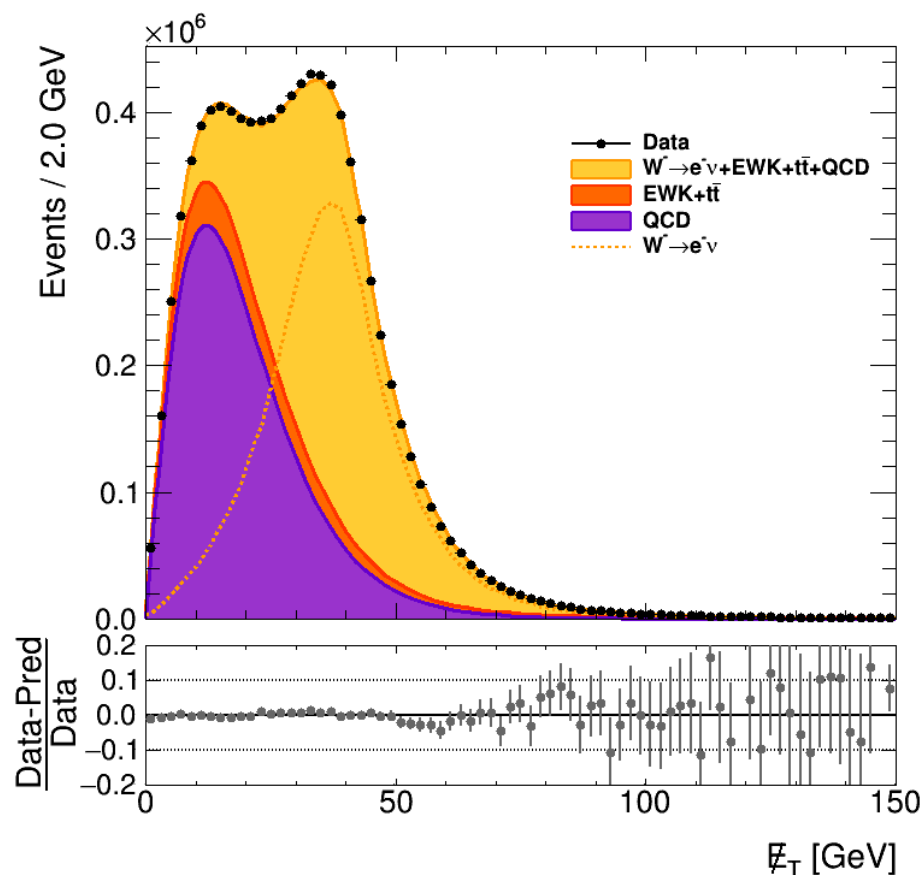


Old binning

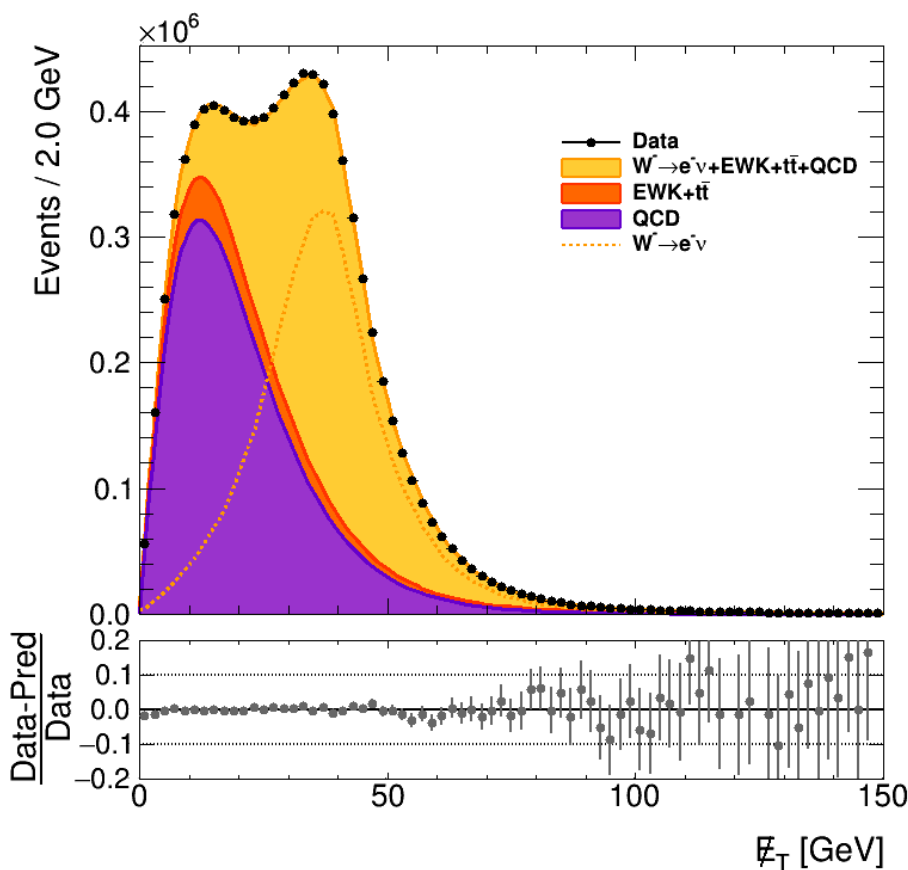


New binning

Comparing missing E_T for the whole eta region (W^- to electron ch.)

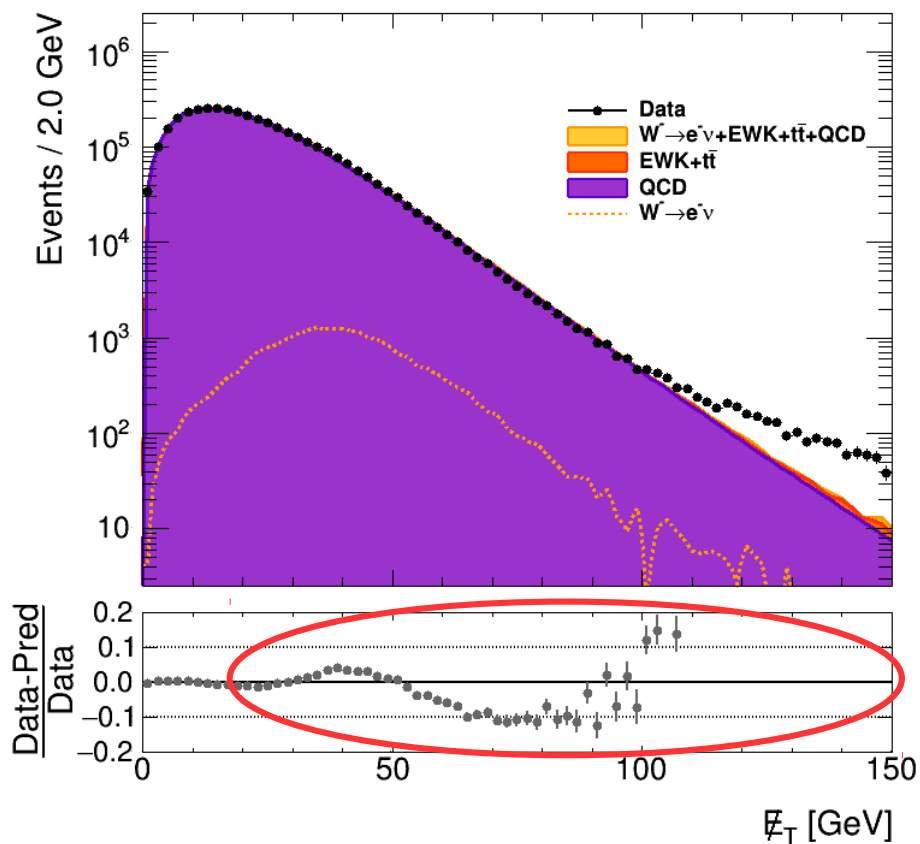


Old binning

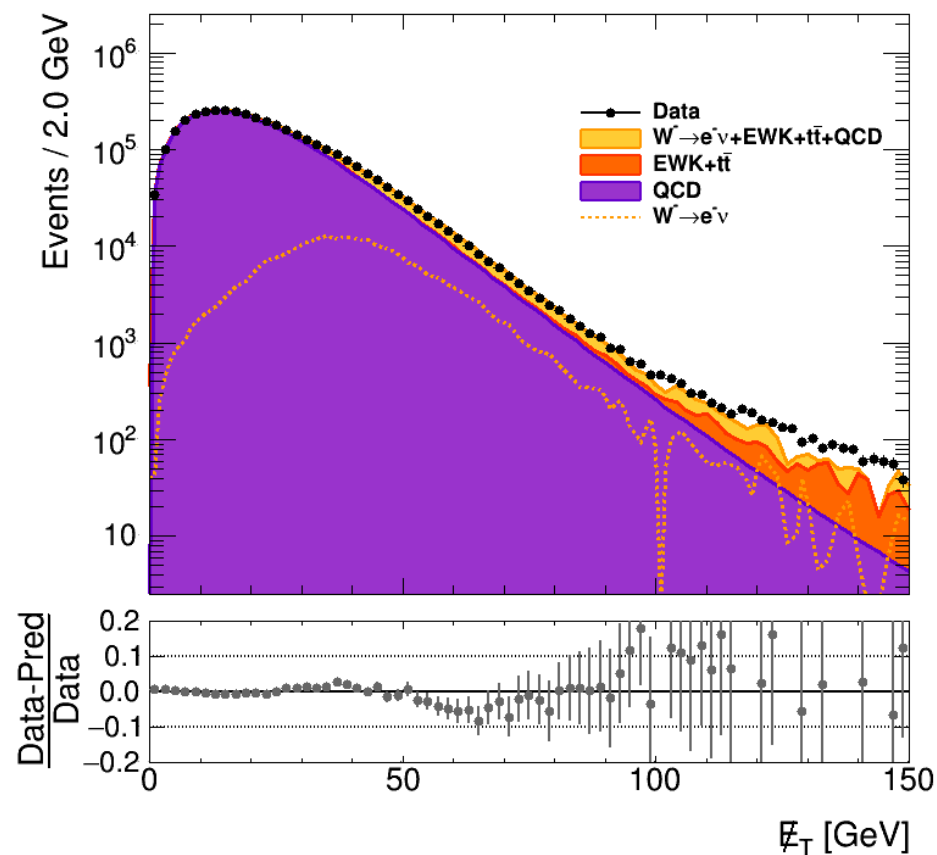


New binning

Control region

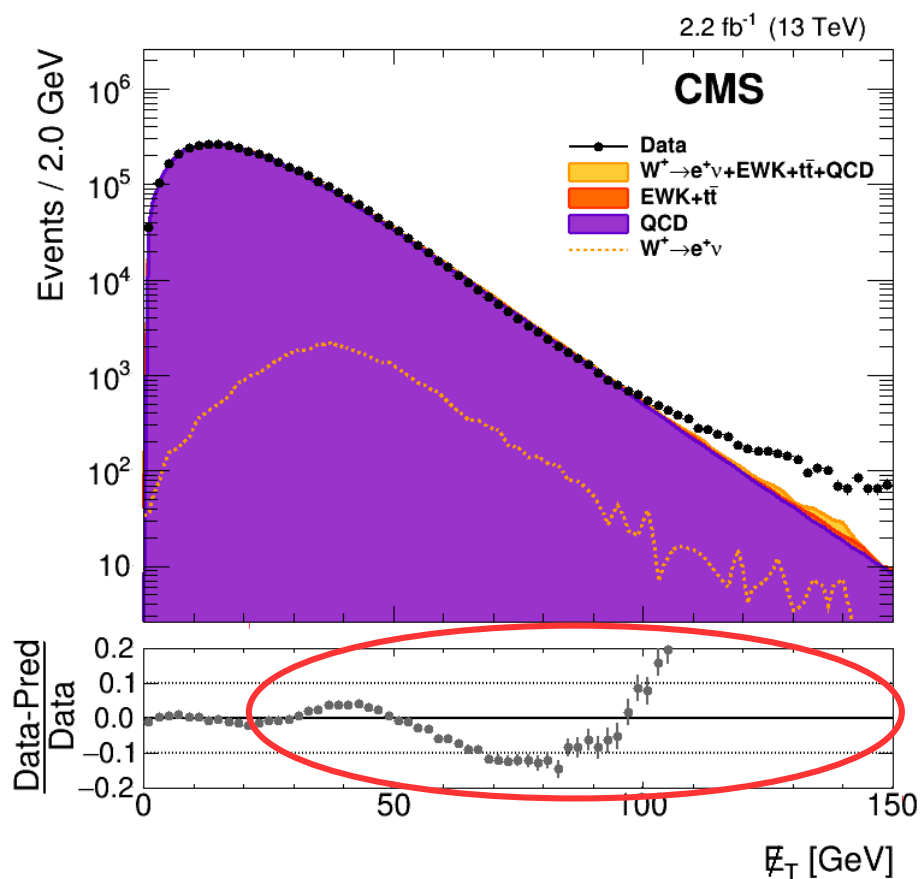


Old binning

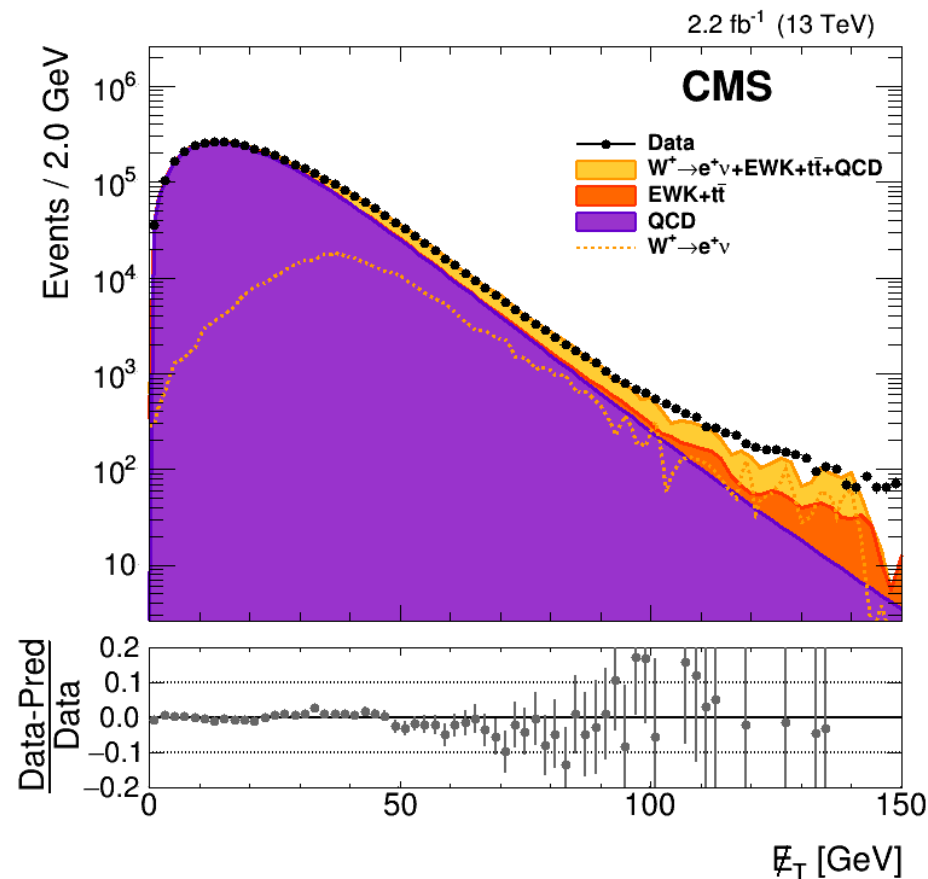


New binning

Control region



Old binning



New binning