W charge asymmetry studies

14.06.2018

Acceptance

For inclusive measurements of W xsection acceptance defined as:
“The acceptance ***A*** for W boson events is defined as the fraction of simulated events that have decay products within the fiducial volume satisfying the kinematic and geometrical selection.”

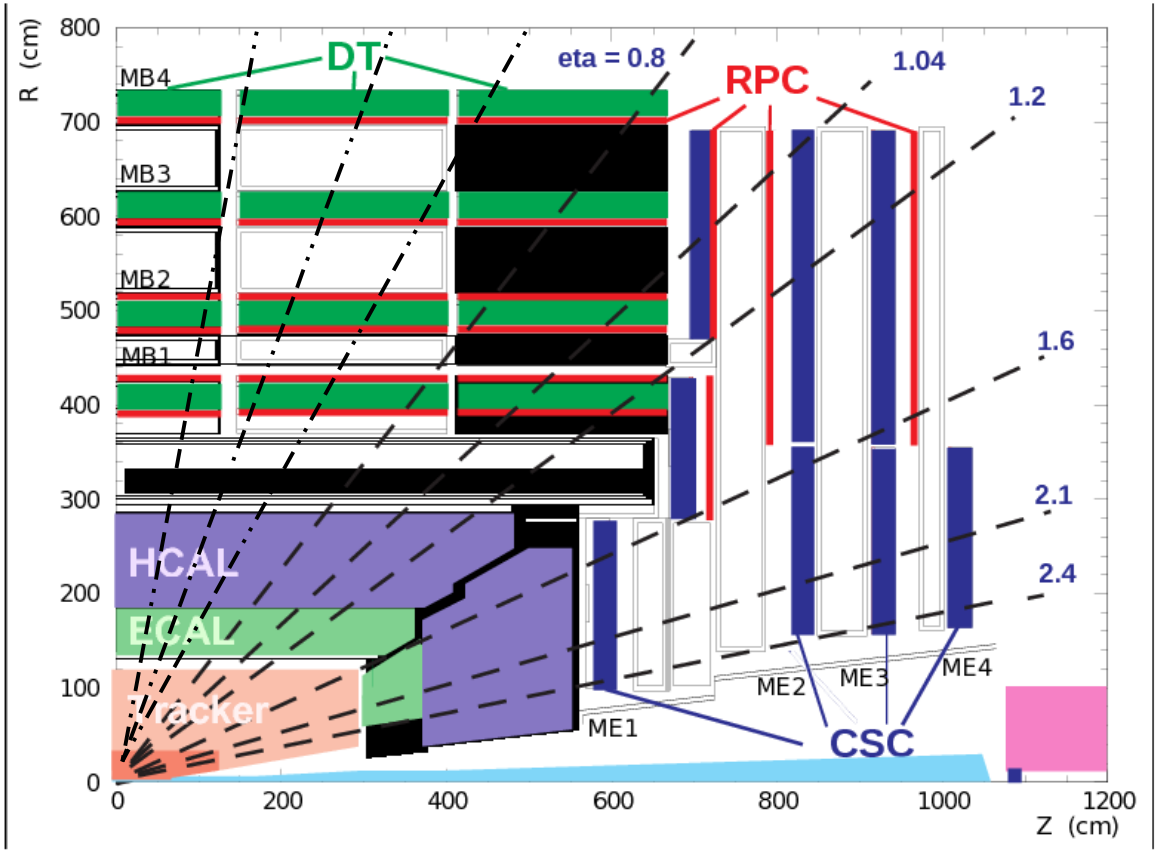
But for W asymmetry studies we have to redefine the acceptance due to a nature of the process.

Re-definition

Constraints on u/d ratio can be provided only in terms of pseudorapidity..

For that case we have:
“The acceptance ***A*** for W boson events is defined as the fraction of simulated events that
have decay products within the fiducial volume satisfying the kinematic and certain geometrical requirements(eta range)”

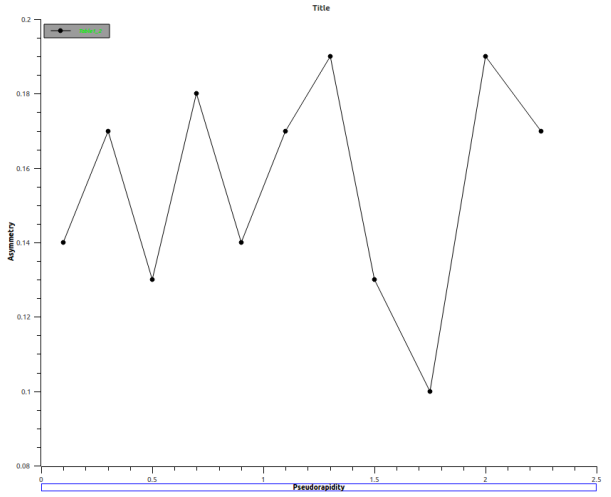
Pt < 25 GeV



Asymmetries

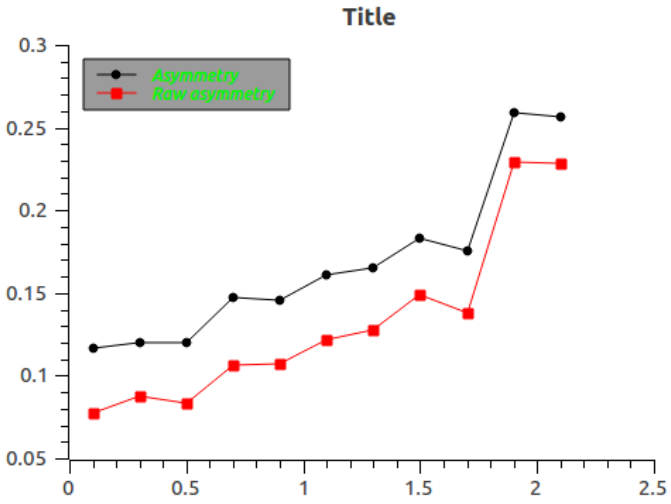
Old acceptance

		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

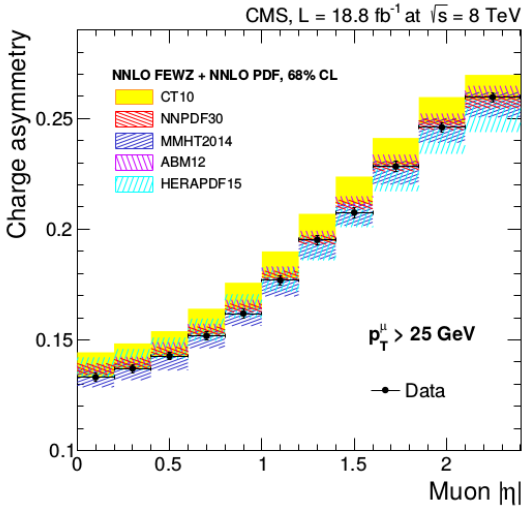


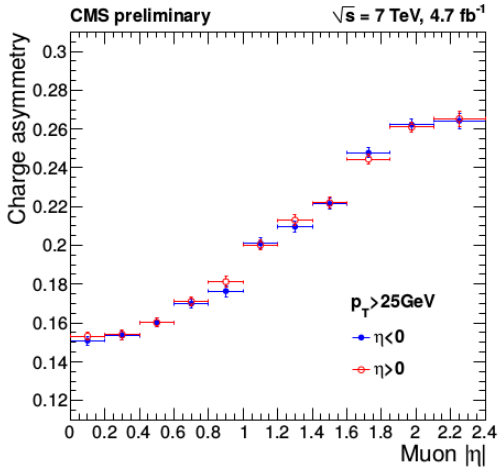
New acceptance

		Asymmetry	bin width	Asymmetry(raw)
0	Total:	0.15		1.32E-01
1	0.0 - 0.2	0.11636	0.2	7.74E-02
2	0.2 - 0.4	0.12020	0.2	8.79E-02
3	0.4 - 0.6	0.12037	0.2	8.31E-02
4	0.6 - 0.8	0.14693	0.2	1.06E-01
5	0.8 - 1.0	0.14579	0.2	1.07E-01
6	1.0 - 1.2	0.16098	0.2	1.22E-01
7	1.2 - 1.4	0.16547	0.2	1.28E-01
8	1.4 - 1.6	0.18292	0.2	1.49E-01
9	1.6 - 1.85	0.17554	0.25	1.38E-01
10	1.85 - 2.1	0.25883	0.25	2.29E-01
11	2.1 - 2.4	0.25686	0.3	2.28E-01



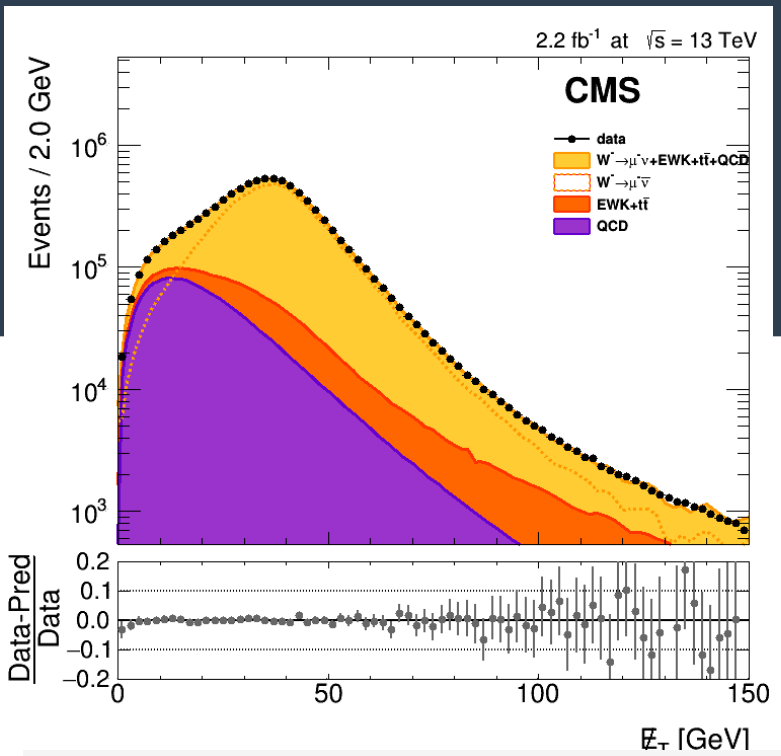
8 & 7 TeV

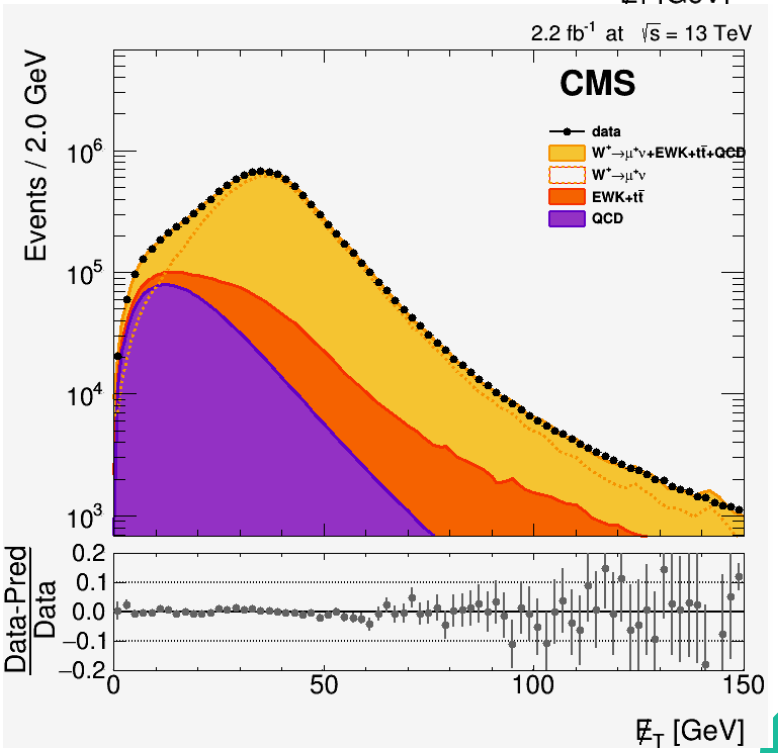




QCD background

- **QCD background should be the same for W+ and W-(we assume that possible QCD bkg from asymmetry effect is negligible or we can astimate it's contribution from the asymmetry values).**
- **In the analysis code simultaneous fit performed for the Signal and Control regions.**
- **Due to invariance to W+/- processes the simultaneous fit should be applied to W+ and W-.**





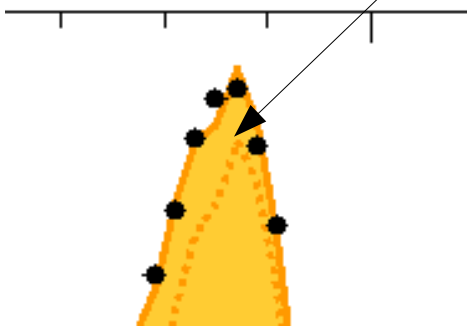
Main questions

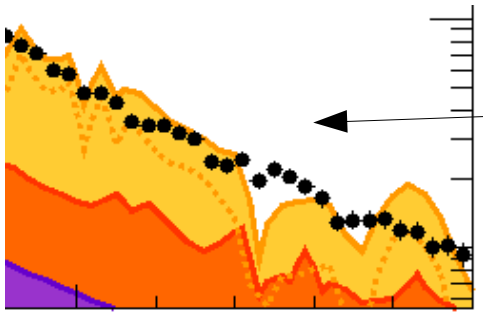
1) “Spikes” in MET distributions for different eta regions:
- Probably MET binning, for the whole eta region all is ok.

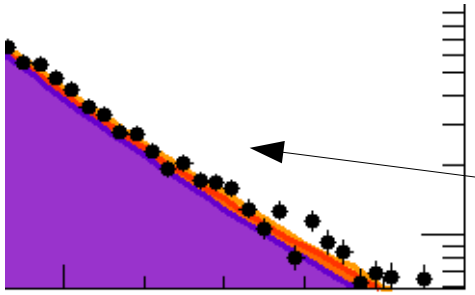
2) QCD MC has not enough of statistics.

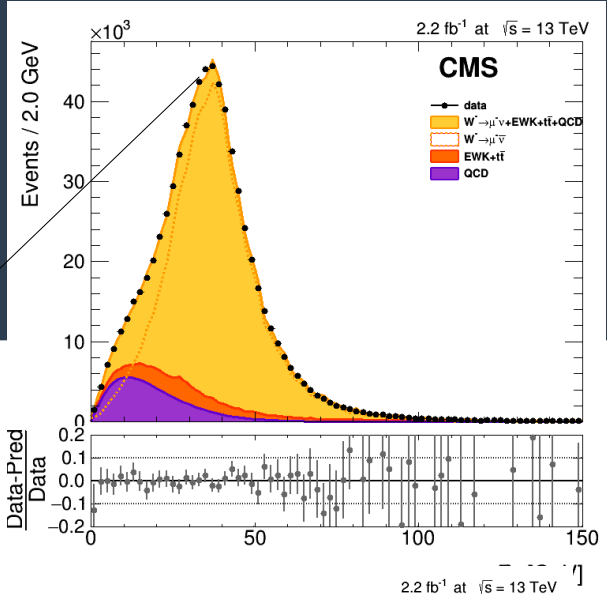
3) For signal and control region σ1 is fixed because it corresponds to a tail and that part is difficult to fit.

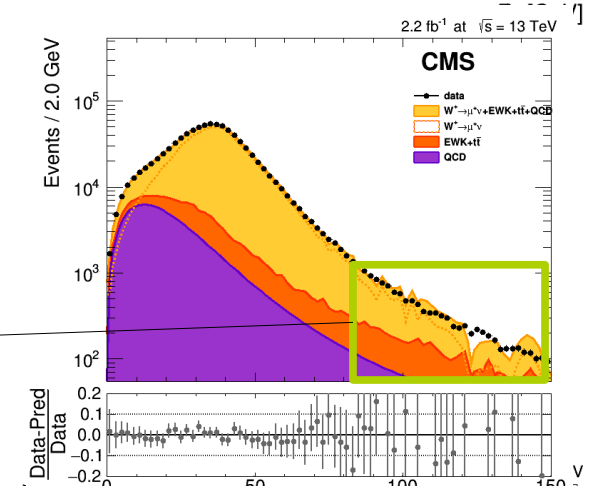
4) dewk in a control region is setted as a constant because they had some problems converging the fit.

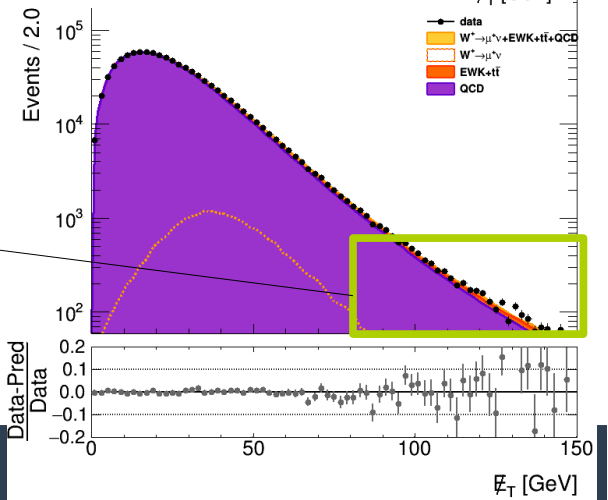






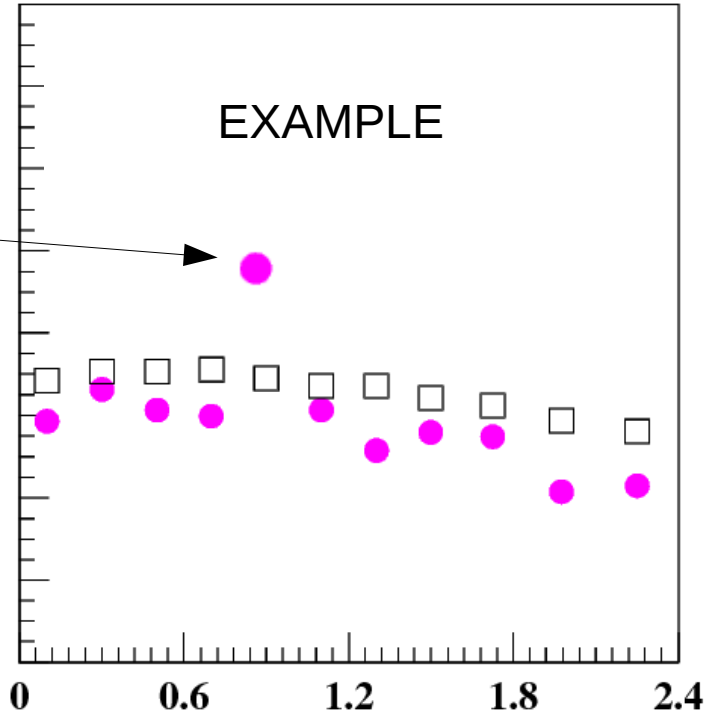






Next step - QCD

1) Perform a usual fit and plot the *sigma* parameters as a function of eta, that would help us to spot a problematic region in a QCD fit.



2) To improve the quality of a fit two ways were proposed:

a) Simultaneous QCD fit between W+ and W-, exactly what we discussed.

b) Fit with different isolation cut (0.4-0.5, 0.5-0.6, etc). The QCD shape should be the same, having certain number of fits we may extrapolate parameters to our phase-space.

Next step - EWK

Split EWK bkg on ttbar+WW+Z→mu & W→tau:
1) ttbar+WW+Z→mu – these values can be taken from MC and should be fixed in the fit
2) W→ tau – cannot be fixed, should stay float.
Instead of fitting Nsignal and Newk → Nsignal*α,

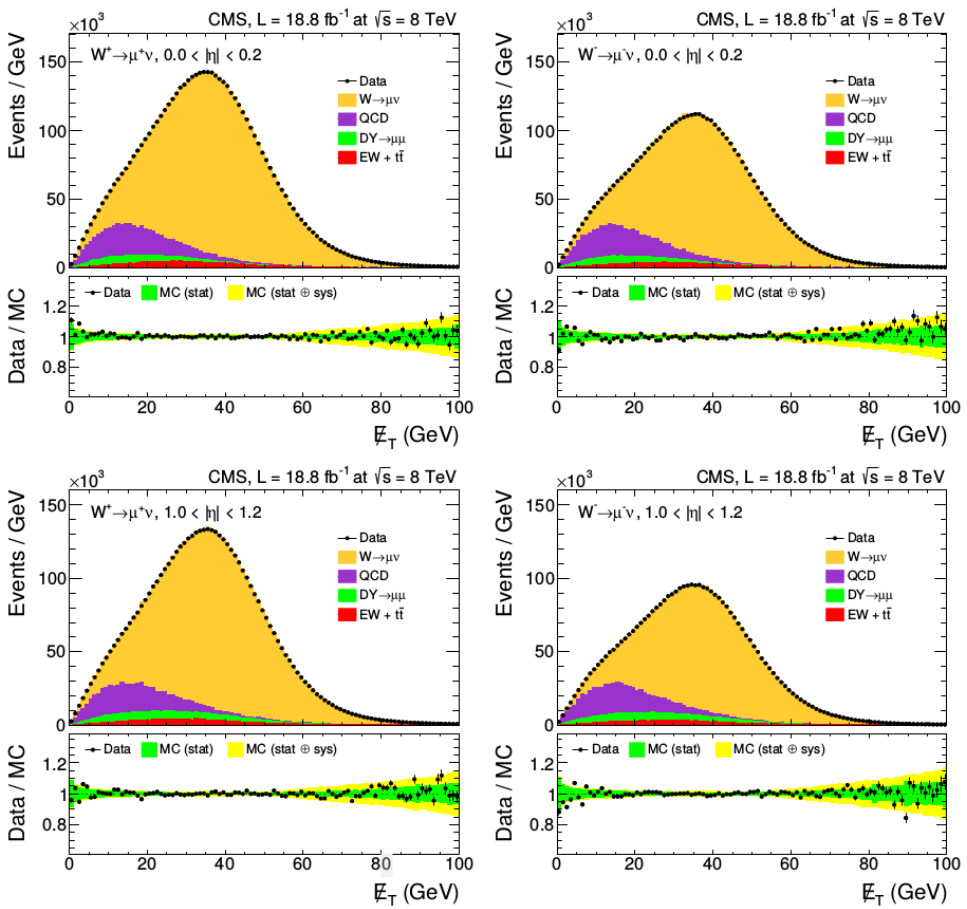
$$\alpha = \text{Newk(W→ tau)} / \text{Nsignal(MC)}$$

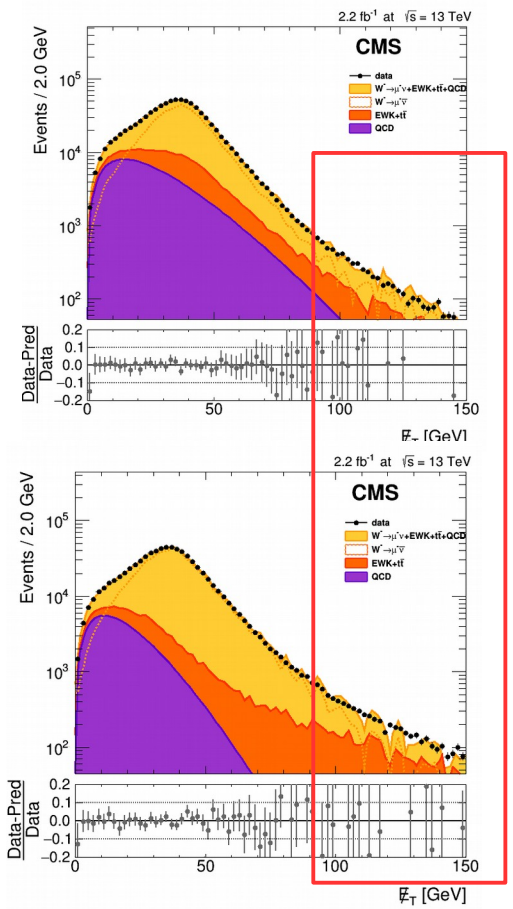
All the components of α comes from MC while the Nsignal is a fitted parameter.

Since BR of W→ l is the same up to few percent of systematics, it's important to have fitted yields with this principle, for that reason ratio of α is applied.

More to add

8 TeV results were done with with
1 GeV MET binning up to 100 GeV





Results

	W->mu minus	Data	Signal	Signal norm	QCD	Other	Signal+QCD+C	Data / Signal+QCD+Other	Acceptance*efficiency	Acceptance*efficiency NEW(per eta bin)	Data	Signal %	QCD %	Other %	CROSS SECTION
0	Total:	8835493	7043894		1179216	612398	8835508	0.9999983023	0.375	0.466	100%	79.7	13.3	6.9	7.01E-09
1	0.0 - 0.2	785783	660247	3301235	77535	47998	4087015	0.1922633022	0.034	0.45	9%	84	9.9	6.1	3.40E-09
2	0.2 - 0.4	730670	608042	3040210	70866	51752	3770870	0.1937669556	0.033	0.443	8%	83.2	9.7	7.1	3.18E-09
3	0.4 - 0.6	813480	675480	3377400	110665	27344	4190889	0.1941067874	0.034	0.455	9%	83	13.6	3.4	3.44E-09
4	0.6 - 0.8	801520	628857	3144285	119615	53046	3945803	0.2031322902	0.035	0.459	9%	78.	14.9	6.6	3.17E-09
5	0.8 - 1.0	736393	592387	2961935	98559	45451	3698332	0.1991148983	0.031	0.45	8%	80.	13.4	6.2	3.05E-09
6	1.0 - 1.2	740903	579079	2895395	105192	56630	3636296	0.2037521148	0.032	0.443	8%	78.	14.2	7.6	3.03E-09
7	1.2 - 1.4	806372	620992	3104960	128592	56798	3911342	0.2061624885	0.035	0.451	9%	77.	15.9	7.0	3.19E-09
8	1.4 - 1.6	804511	599060	2995300	142138	63316	3799814	0.2117237844	0.032	0.462	9%	74.	17.7	7.9	3.00E-09
9	1.6 - 1.85	882305	677705	2710820	137015	67592	3593132	0.2455531831	0.035	0.468	10%	76.8	15.5	7.7	2.68E-09
10	1.85 - 2.1	863917	618814	2475256	143667	101435	3339172	0.2587219227	0.035	0.474	10%	77.6	16.6	11.7	2.42E-09
11	2.1 - 2.4	869639	663307	2211023.333	117433	88908	3080671.333	0.2822887955	0.034	0.464	10%	76.3	13.5	10.2	2.21E-09
	Sum over bins	8835493	6923970		1251277	660270	41053336.33	0.2152198527							
	Total/Sum over	1	1.017320121		0.942410(	0.9274963	0.2152202181								

	W->mu plus	Data	Signal		QCD	Other	Signal+QCD+C	Data / Signal+QCD+Other	Acceptance*efficiency	Acceptance*efficiency NEW(per eta bin)	Data	Signal %	QCD %	Other %	CROSS SECTION
0	Total:	11007396	9179612		944324	883456	11007392	1.000000363	0.36	0.45	100%	83.4	8.6	8.0	9.45E-09
1	0.0 - 0.2	908163	771102	3855510	83254	53805	4763671	0.1906435184	0.03	0.416	8%	84.9	9.2	5.9	4.30E-09
2	0.2 - 0.4	848544	725252	3626260	96943	26366	4474821	0.189626356	0.028	0.415	8%	85.5	11.4	3.1	4.05E-09
3	0.4 - 0.6	951901	797953	3989765	86488	67451	4941657	0.1926278979	0.031	0.422	9%	83.	9.1	7.1	4.38E-09
4	0.6 - 0.8	950977	777333	3886665	105404	68231	4837633	0.1965789831	0.03	0.422	9%	81.	11.1	7.2	4.27E-09
5	0.8 - 1.0	877905	734555	3672775	89082	54270	4550682	0.1929172375	0.029	0.416	8%	83.	10.1	6.2	4.09E-09
6	1.0 - 1.2	910356	739799	3698995	95639	74909	4609342	0.1975023767	0.029	0.409	8%	81.	10.5	8.2	4.19E-09
7	1.2 - 1.4	1004326	803787	4018935	88346	112161	5023229	0.1999363358	0.031	0.418	9%	80.	8.8	11.2	4.46E-09
8	1.4 - 1.6	1023373	809093	4045465	107275	107001	5068834	0.2018951499	0.033	0.431	9%	79.	10.5	10.5	4.35E-09
9	1.6 - 1.85	1153777	894033	3576132	124942	134778	4729885	0.2439334149	0.038	0.433	10%	77.5	10.8	11.7	3.83E-09
10	1.85 - 2.1	1170676	986704	3946816	139616	44364	5117500	0.2287593552	0.038	0.445	11%	84.3	11.9	3.8	4.11E-09
11	2.1 - 2.4	1207398	1054142	3513806.667	120965	32299	4721212.667	0.2557389563	0.038	0.436	11%	87.3	10	2.7	3.73E-09

Acceptance

The acceptance $\mathcal{A}$ 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:

- $\mathcal{A}(W^+) = 0.45$
- $\mathcal{A}(W^-) = 0.46$

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

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

- $\mathcal{A}(W^+) = 0.381461$
- $\mathcal{A}(W^-) = 0.394783$

* - acceptance when object selection is performed.

Results from the

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