

Combined template-based top quark mass measurements in the Lepton+Jets and Dilepton Channels using 2.7 fb^{-1} of data

The Top Mass Template Group¹

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Abstract

We report on a simultaneous measurement of the mass of the top quark (M_{top}) using the template method in both the Lepton+Jets and Dilepton channels. Two-dimensional probability density functions in each channel are derived using kernel density estimation. In the Lepton+Jets channel, the reconstructed top quark mass and the dijet mass from the hadronically decaying W are used to measure M_{top} and to constrain *in situ* the uncertain jet energy scale. In the dilepton channel, the mass from the neutrino weighting algorithm and the H_T in each event are used.

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1 Introduction

This note is just simple update of top mass measurement simulataneously using L + J
<http://www-cdf.fnal.gov/htbin/twiki/bin/view/TopMassTemplate/AnalysisFall08>

2 Cross checks

We run a widths. As in our previous LJ measurement, removing the JES prior does not significantly affect our results (the prior does not play a role in the DIL-only measurement). Removing the background constraint also does not change the central value significantly, though as in the previous analysis, the 1-tag LJ measurement prefers more background than expected and the 2-tag LJ measurement prefers no background. The DIL measurements prefers slightly less background than expected from the prior. Note that the 0.0 error indicates that data shape does not have enough power to constrain the background component within the physical region, and no background constraints for all of seperated samples.

Table 1: Cross-checks on the data

Fit type	Comb	$M_{\text{top}}(\text{GeV}/c^2)$		$\Delta_{\text{JES}}(\sigma_c)$	
		LJ 1tag n_s	LJ 2tag n_s	LJ 1tag n_b	LJ 2tag n_b
		DIL 0tag n_s	DIL tagged n_s	DIL 0tag n_b	DIL tagged n_b
Fit type	LJ-only	$M_{\text{top}}(\text{GeV}/c^2)$		$\Delta_{\text{JES}}(\sigma_c)$	
		1tag n_s	2tag n_s	1tag n_b	2tag n_b
		Fit type	DIL-only	$M_{\text{top}}(\text{GeV}/c^2)$	
0tag n_s	tagged n_s			0tag n_b	tagged n_b
Nominal	Combo			171.2 ^{+1.4} _{-1.5}	
		309.7 ^{+23.7} _{-23.0}	155.3 ^{+13.2} _{-12.5}	76.1 ^{+15.3} _{-15.1}	7.1 ± 2.8
		127.6 ^{+15.9} _{-15.3}	111.3 ^{+11.1} _{-10.4}	56.5 ± 9.6	4.7 ± 1.4
Nominal	LJ	172.0 ^{+1.5} _{-1.6}		0.16 ^{+0.34} _{-0.32}	
		308.6 ^{+23.7} _{-23.0}	155.2 ^{+13.2} _{-12.5}	77.0 ^{+15.3} _{-15.1}	7.1 ± 2.8
		Nominal	DIL	169.9 ^{+2.1} _{-2.2}	
128.1 ^{+15.9} _{-15.3}	111.3 ^{+11.1} _{-10.4}			56.1 ^{+9.6} _{-9.5}	4.7 ± 1.4
No JES prior	Combo			171.1 ^{+1.4} _{-1.5}	
		309.6 ^{+23.7} _{-23.0}	155.3 ^{+13.2} _{-12.5}	76.2 ^{+15.3} _{-15.1}	7.1 ± 2.8
		127.6 ^{+15.9} _{-15.3}	111.3 ^{+11.1} _{-10.4}	56.5 ± 9.6	4.7 ± 1.4
No JES prior	LJ	171.9 ± 1.6		0.18 ^{+0.37} _{-0.34}	
		308.5 ^{+23.7} _{-23.0}	155.2 ^{+13.2} _{-12.5}	77.1 ^{+15.3} _{-15.1}	7.1 ± 2.8
		No JES prior	DIL	169.9 ^{+2.1} _{-2.2}	
128.1 ^{+15.9} _{-15.3}	111.3 ^{+11.1} _{-10.4}			56.1 ^{+9.6} _{-9.5}	4.7 ± 1.4
No bkgd prior	Combo			171.1 ^{+1.3} _{-1.4}	
		303.3 ^{+27.5} _{-26.8}	161.0 ^{+13.0} _{-12.3}	83.7 ^{+23.3} _{-22.2}	0.0 ^{+3.0} _{-0.0}
		153.1 ^{+23.0} _{-23.6}	115.0 ^{+11.1} _{-10.4}	27.9 ^{+21.9} _{-18.8}	0.0 ^{+2.4} _{-0.0}
No bkgd prior	LJ	171.9 ^{+1.5} _{-1.6}		0.19 ^{+0.34} _{-0.32}	
		301.2 ^{+27.5} _{-26.7}	161.0 ^{+13.0} _{-12.4}	85.8 ^{+23.3} _{-22.2}	0.0 ^{+3.1} _{-0.0}
		No bkgd prior	DIL	169.9 ^{+1.9} _{-2.0}	
154.6 ^{+22.6} _{-23.3}	115.0 ^{+11.1} _{-10.4}			26.4 ^{+21.5} _{-18.2}	0.0 ^{+2.3} _{-0.0}
1-tag LJ	LJ			170.3 ^{+2.8} _{-3.3}	
		311.5 ^{+24.0} _{-23.2}	-	74.5 ^{+15.5} _{-15.3}	-
2-tag LJ	LJ	172.9 ^{+2.0} _{-1.8}		0.25 ^{+0.40} _{-0.43}	
		-	155.1 ^{+13.2} _{-12.6}	-	7.2 ± 2.8
0-tag DIL	DIL	162.5 ^{+6.0} _{-5.2}		-	
		126.4 ^{+15.8} _{-15.2}	-	57.2 ± 9.5	-
Tagged DIL	DIL	171.4 ^{+2.7} _{-2.6}		-	
		-	111.3 ^{+11.1} _{-10.4}	-	4.7 ± 1.4

Table 2: More cross-checks on the data

Fit type	Comb	$M_{\text{top}}(\text{GeV}/c^2)$		$\Delta_{\text{JES}}(\sigma_c)$	
		LJ 1tag n_s	LJ 2tag n_s	LJ 1tag n_b	LJ 2tag n_b
	DIL- only	DIL 0tag n_s	DIL tagged n_s	DIL 0tag n_b	DIL tagged n_b
LJ- only	$M_{\text{top}}(\text{GeV}/c^2)$		$\Delta_{\text{JES}}(\sigma_c)$		
	1tag n_s	2tag n_s	1tag n_b	2tag n_b	
DIL- only	$M_{\text{top}}(\text{GeV}/c^2)$		$\Delta_{\text{JES}}(\sigma_c)$		
	0tag n_s	tagged n_s	0tag n_b	tagged n_b	
p0-p17 data	Combo	172.3 ± 1.5		0.07 ± 0.33	
		$240.6^{+21.3}_{-20.5}$	$122.5^{+11.8}_{-11.1}$	$70.9^{+13.9}_{-13.7}$	6.7 ± 2.4
		$65.0^{+12.8}_{-12.1}$	$71.8^{+9.2}_{-8.5}$	$54.8^{+8.8}_{-8.7}$	5.4 ± 1.4
LJ	172.7 ± 1.6		$0.13^{+0.35}_{-0.33}$		
	$239.4^{+21.3}_{-20.5}$	$122.5^{+11.8}_{-11.1}$	$71.9^{+13.9}_{-13.7}$	6.7 ± 2.4	
DIL	$169.6^{+2.9}_{-3.0}$	-	-	-	
p0-p18 data	Combo	$171.2^{+1.4}_{-1.5}$		$0.21^{+0.35}_{-0.30}$	
		$309.7^{+23.7}_{-23.0}$	$155.3^{+13.2}_{-12.5}$	$76.1^{+15.3}_{-15.1}$	7.1 ± 2.8
		$127.6^{+15.9}_{-15.3}$	$111.3^{+11.1}_{-10.4}$	56.5 ± 9.6	4.7 ± 1.4
LJ	$172.0^{+1.5}_{-1.6}$		$0.16^{+0.34}_{-0.32}$		
	$308.6^{+23.7}_{-23.0}$	$155.2^{+13.2}_{-12.5}$	$77.0^{+15.3}_{-15.1}$	7.1 ± 2.8	
DIL	$169.9^{+2.1}_{-2.2}$	-	-	-	
p18 data	Combo	$169.3^{+5.9}_{-5.4}$		$0.33^{+0.98}_{-1.05}$	
		$31.0^{+8.1}_{-7.7}$	$15.1^{+4.8}_{-4.1}$	$3.6^{+7.6}_{-0.0}$	5.1 ± 2.7
		$0.0^{+4.5}_{-0.0}$	$5.0^{+2.9}_{-2.3}$	$33.0^{+5.9}_{-6.3}$	$4.2^{+1.4}_{-1.3}$
LJ	$171.7^{+4.5}_{-7.0}$		$-0.01^{+1.10}_{-0.79}$		
	$30.7^{+8.1}_{-7.7}$	$15.1^{+4.7}_{-4.1}$	$3.9^{+7.6}_{-0.0}$	5.1 ± 2.7	
DIL	$167.4^{+11.5}_{-9.1}$	-	-	-	
		$0.0^{+4.5}_{-0.0}$	$5.0^{+3.0}_{-2.3}$	$33.0^{+5.9}_{-6.3}$	$4.2^{+1.4}_{-1.3}$

Table 3: More cross-checks on the data

Fit type	Comb	$M_{\text{top}}(\text{GeV}/c^2)$		$\Delta_{\text{JES}}(\sigma_c)$	
		LJ 1tag n_s	LJ 2tag n_s	LJ 1tag n_b	LJ 2tag n_b
	DIL 0tag n_s	DIL tagged n_s	DIL 0tag n_b	DIL tagged n_b	
LJ-only	DIL-only	$M_{\text{top}}(\text{GeV}/c^2)$		$\Delta_{\text{JES}}(\sigma_c)$	
		1tag n_s	2tag n_s	1tag n_b	2tag n_b
		0tag n_s	tagged n_s	0tag n_b	tagged n_b
Electron-only LJ	LJ	172.1 ± 2.1		$0.04^{+0.40}_{-0.44}$	
		$161.7^{+20.2}_{-19.5}$	$78.0^{+9.2}_{-8.5}$	$48.3^{+17.3}_{-16.2}$	$0.0^{+4.0}_{--0.0}$
Muon-only LJ	LJ	$171.5^{+2.2}_{-2.4}$		$0.39^{+0.50}_{-0.49}$	
		$138.9^{+18.8}_{-18.1}$	$83.0^{+9.4}_{-8.8}$	$38.1^{+16.0}_{-15.0}$	$0.0^{+2.3}_{--0.0}$
ee DIL	DIL	$162.6^{+6.3}_{-5.4}$		-	
		27.0 ± 10.9	$14.0^{+4.1}_{-3.4}$	$8.0^{+10.9}_{-0.0}$	$0.0^{+1.0}_{--0.0}$
mumu DIL	DIL	$171.3^{+4.5}_{-4.8}$		-	
		$35.0^{+6.3}_{-6.9}$	$28.0^{+5.6}_{-6.7}$	$0.0^{+5.6}_{--0.0}$	$0.0^{+5.5}_{--0.0}$
emu DIL	DIL	$170.3^{+2.6}_{-2.5}$		-	
		$89.3^{+17.6}_{-18.2}$	$73.0^{+8.9}_{-8.2}$	$21.7^{+17.2}_{-14.3}$	$0.0^{+2.2}_{--0.0}$