D0 note 5498-CONF

Combination of top quark mass measurements by the D0 experiment

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Introduction

D0 has carried out measurements of the top quark mass in three channels, the dilepton channel[1], the lepton+jets channel[2,3], and the all-jets channel[4]. All these results (except the measurement in the all-jets channel) have been included in the world average top quark mass determined by combining the best measurements in each channel from the D0 and CDF collaborations[5]. Here we document the combination of the measurements by the D0 experiment only. Since this world average was determined D0 has released two new results in the dilepton channel[6,7] and their combined result[8] which we include in this combination.

Combination procedure

We use the BLUE method[9] to carry out the combination. This is the same procedure as was used for the world average combination. In Table 1, we reproduce the table from Ref. 5, listing the D0 results only. Since this is simply the D0 part of the world average computation, we do not include the Run I all-jets result. The column for the result in the dilepton channel from the Run II data was updated to reflect the latest result. In Table 2, we give a representation of the correlations that were assumed between the uncertainties and Table 3 gives the pulls and weights for the four individual measurements.

Combined result

The combined result is

$$m_{top} = 172.1 \pm 1.5 \text{ (stat)} \pm 1.9 \text{ (syst) GeV}$$

or

$$m_{top} = 172.1 \pm 2.4 \text{ GeV}$$

The χ^2 for this combination is 3.14 for 3 degrees of freedom. The probability to get this or a larger value for χ^2 is 37.1%. Figure 1 shows a plot of the individual measurements from Run II and the combined result.

Table 1: Input values for the combination. For a definition of the uncertainty components, see Ref. 5.

	Run I		Run II	
	lepton+jets	dilepton	lepton+jets	dilepton
$\int Ldt$	130 pb^{-1}	130 pb^{-1}	0.9 fb^{-1}	1.0 fb^{-1}
top quark mass	180.1 GeV	168.4 GeV	170.5 GeV	173.7 GeV
aJES	0.0 GeV	0.0 GeV	0.6 GeV	1.9 GeV
bJES	0.7 GeV	0.7 GeV	0.5 GeV	0.9 GeV
cJES	2.0 GeV	2.0 GeV	0.0 GeV	2.1 GeV
dJES	0.0 GeV	0.0 GeV	1.6 GeV	0.9 GeV
rJES	2.5 GeV	1.1 GeV	0.0 GeV	0.0 GeV
signal	1.1 GeV	1.8 GeV	0.6 GeV	0.8 GeV
background	1.0 GeV	1.1 GeV	0.3 GeV	0.6 GeV
fit	0.6 GeV	1.1 GeV	0.4 GeV	0.9 GeV
MC	0.0 GeV	0.0 GeV	0.0 GeV	0.2 GeV
UE/MI	1.3 GeV	1.3 GeV	0.0 GeV	0.0 GeV
systematic	3.9 GeV	3.6 GeV	2.0 GeV	3.4 GeV
statistical	3.6 GeV	12.3 GeV	1.8 GeV	5.4 GeV
total	5.3 GeV	12.8 GeV	2.7 GeV	6.4 GeV

Table 2: Correlation between categories of uncertainties. Within each category uncertainties with the same symbol are taken to be 100% correlated.

	Run I		Run II	
	lepton+jets	dilepton	lepton+jets	dilepton
aJES			•	•
bJES	•	•	•	•
cJES	•	•	•	•
dJES	•	•	o	o
rJES	•	•	•	•
signal	•	•	•	•
background	•	o	•	o
fit				
MC	•	•	•	•
UE/MI	•	•		
statistical				

Table 3: Summary of pulls and weights of the individual measurements in the combination.

	Run I		Run II	
	lepton+jets	dilepton	lepton+jets	dilepton
pull	1.7	-0.3	-1.5	0.3
weight	15.5%	1.6%	77.6%	5.3%

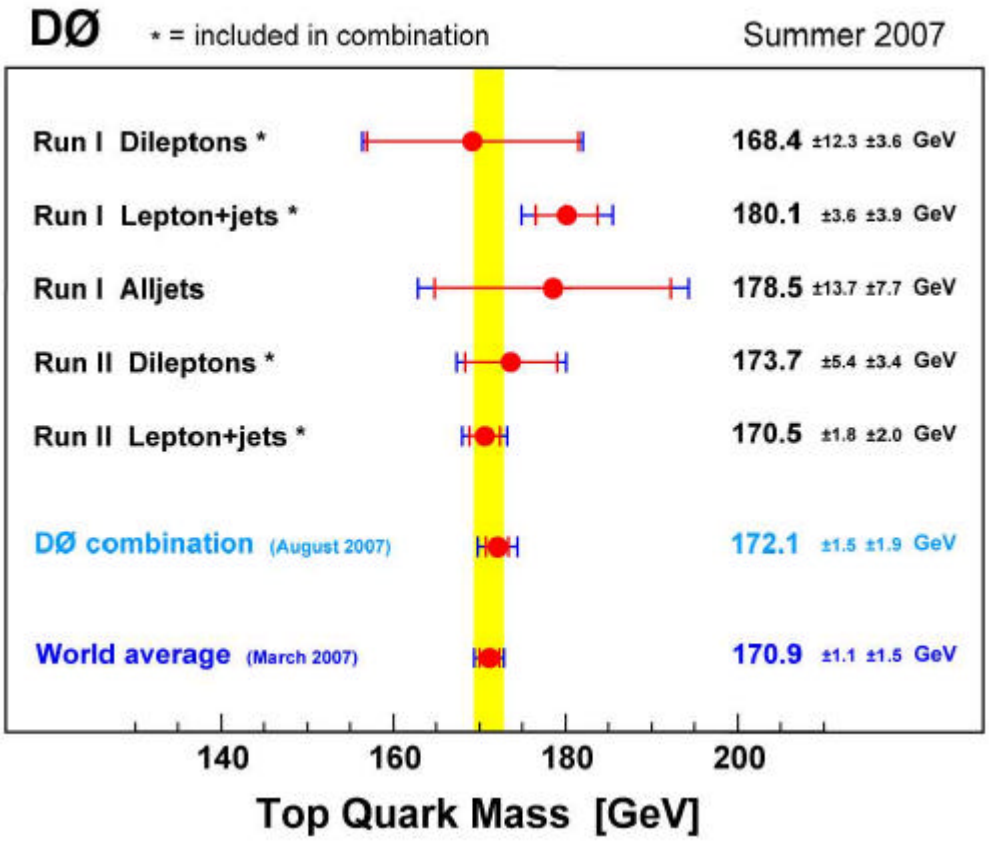

Figure 1: Summary of measurements of the top quark mass by D0. The red error bars indicate the statistical uncertainties. The blue error bars indicate the total (statisticalÅsystematic) uncertainties.

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[8] D0 Collaboration, "Combination of preliminary dilepton mass measurements by the D0 experiment", D0 note 5460-CONF.
[9] L. Lyons, D. Gibaut, and P. Clifford, Nucl. Instrum. Meth. **A270**, 110 (1988) and A. Valassi, Nucl. Instrum. Meth. **A500**, 391 (2003).