



Max-Planck-Institut für Physik (Werner-Heisenberg-Institut)

The top quark mass has been measured with the template method in the dilepton  $t\bar{t}$  decay channel, based on  $\sqrt{s} = 7$  TeV collision data collected by ATLAS in 2011 and with an integrated luminosity of



The total uncertainty is dominated by systematic effects, with the largest contribution coming from jet and *b*-jet energy scale uncertainties. The top quark mass is measured to be

about 4.7 fb<sup>-1</sup>.

 $m_{top} = 173.09 \pm 0.64_{stat} \pm 1.54_{syst}$  GeV.

### Importance of the top quark mass

### Top quark decay channels

# Final states and the estimator





Constraint on the higgs boson mass by indirect measurements of the W boson and top quark mass.

The relative branching ratio of the top quark pair decay channels. The dileptonic channel yields low statistics but a very clean signal.  $t\overline{t} \rightarrow b\overline{b}l^{+}l^{-}v\overline{v}$  $m_{lb} = \frac{m(l^{+}b) + m(l^{-}\overline{b})}{2}$ 

The process involves two invisible neutrinos, leading to difficulties in reconstruction. The  $m_{lb}$  estimator is defined as the average invariant mass of the two lepton plus *b*-jet pairs in each event and does thus only rely on well defined final states. *b*-jets are matched to partons with a minimum  $m_{lb}$  criterion.

# Monte Carlo (MC) validation



The estimator distribution







m<sub>lb</sub> [GeV]

Comparison of MC distributions with the onesTheobserved in the 2913 data events. Thisdataexample shows the b-jet  $p_T$  distribution afterassuthe event selection.the

The  $m_{lb}$  estimator distribution observed in data and from MC for a top quark mass assumption. The shape difference is used for the measurement.

Dependence of the m<sub>lb</sub> distribution on m<sub>top</sub> for MC samples generated with different input top quark masses together with the signal Probability Density Functions (PDF).

# Fit to 2011 ATLAS data

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С)	I • √s=7 TeV data	ATLAS Preliminary
ю 10	400 3% background	<b>,</b>

### Systematic uncertainties

Description	Value [GeV]
Measured value	173.09

# Top quark mass measurements

ATLAS Preliminary		July 2013	
ATLAS 4.7 fb <sup>-1</sup> I+jets (3d)		172.31±0.75±1.35	



The fitted PDFs for signal and background. The inset shows the  $-2 \ln \mathcal{L}$  profile as a function of the fitted top quark mass.

Statistical uncertainty	0.64
Method calibration	0.07
Signal MC generator	0.20
Hadronisation	0.44
Underlying event	0.42
Colour reconnection	0.29
ISR/FSR	0.37
Proton PDF	0.12
Background	0.14
Jet energy scale	0.89
<i>b</i> -jet energy scale	0.71
<i>b</i> -tagging efficiency and mistag rate	0.46
Jet energy resolution	0.21
Missing transverse momentum	0.05
Pile-up	0.01
Electron uncertainties	0.11
Muon uncertainties	0.05
Total systematic uncertainty	1.50
Total uncertainty	1.63



The present result in comparison with other measurements, showing the statistical (red) and the total uncertainty (blue).

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