WW/WZ SEMILEPTONIC UPDATE

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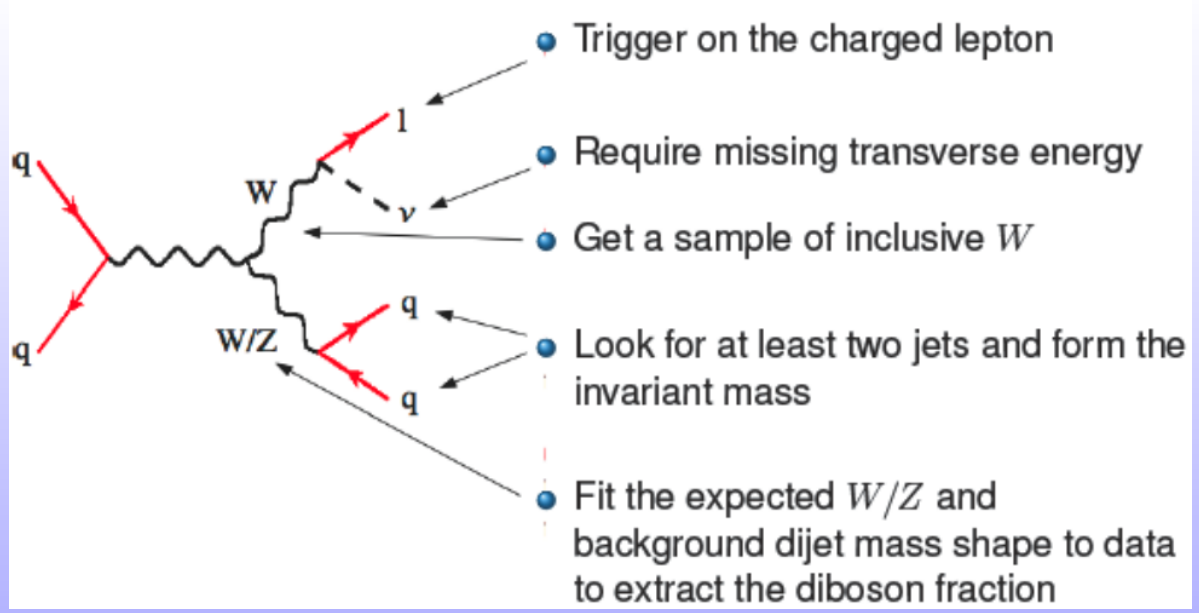
Overview

- process signature
- improvements:
  - QCD systematics
  - systematics studies
  - fitting procedure
- conclusions
  - fit results
  - Editorial Board meeting

jargon used:

- there are two important *fits* in the analysis:
  - the fit to the $\not\!\!E_T$: a min-χ^2 optimization
  - the fit to extract the signal: a real logLikelihood fit
- *template*:
  - once a cutflow is defined, the analysis is done up to that level
  - systematics, when possible, redo the complete analysis steps
  - we call templates the histograms of M_{jj} at the end of the selection, nominal and systematics
  - templates are organized by categories: top, boson+jets...

Process signature



Background processes:

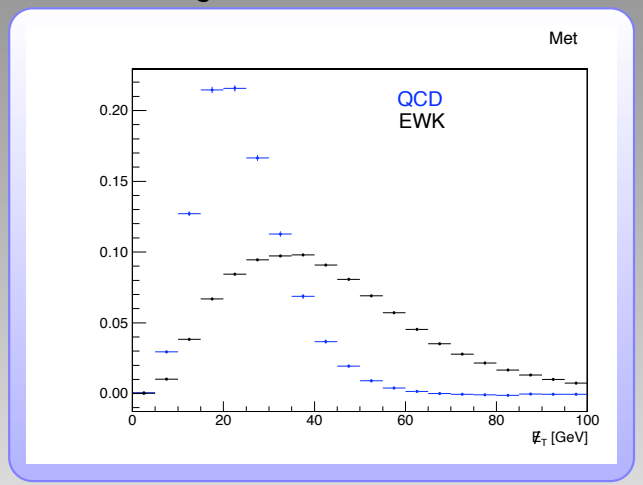
- W+jets – largest contribution
- Z+jets
- ttbar → WbWbbar → lv jj bbar
- QCD
- single top

this is a cut-based analysis

QCD systematics

QCD evaluation reminder

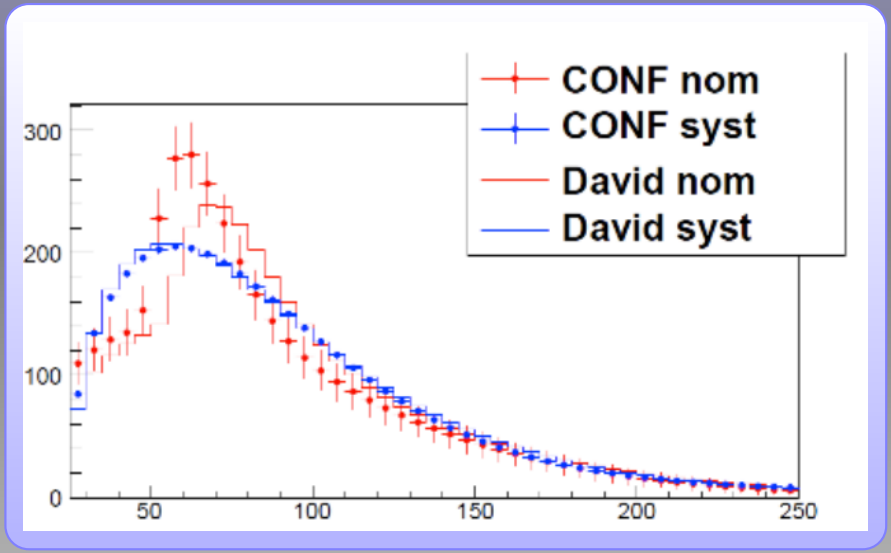
- use a data-driven method, since no good MC description exists
- control sample dominated by QCD multijet background
- but kinematics as close as possible to those of the signal selection
- shape is extracted from a QCD-enriched sample
  - invert quality requirements for electrons
  - invert pointing request for muons
  - orthogonal selection wrt the signal selection
- normalization is extracted fitting the $\not\!\!E_T$ for MC and data
  - technique used also in CDF
  - $\not\!\!E_T$ is the best variable which separate the W+jets contribution from the multijet



- boson + jet is left floating
- QCD and V+jets normalization are used for the fit
- tipical V+jets correction: less than 10 %

Problem found in QCD

- the QCD shape is smoothed after the fit
- comparing current results with CONF-note results, an error was found in the smoothing

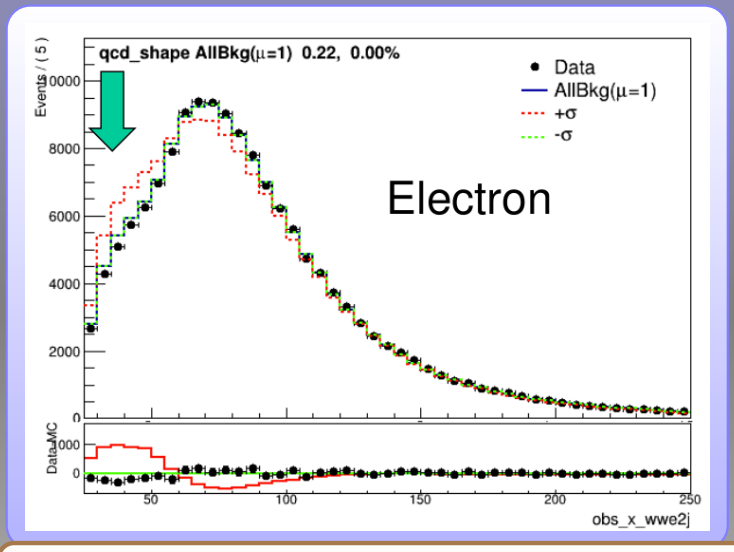


- new templates shifted to the right
- systematics and nominal templates for QCD are more different

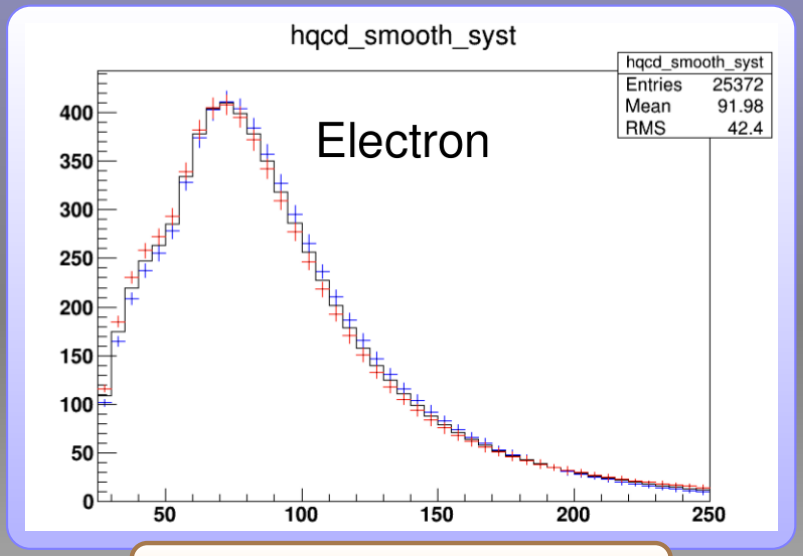
- QCD systematics and nominal are more different than in the CONF
- the new QCD systematics is larger

New QCD systematics from QCD CR

- find the qcd systematics looking at the disagreement between data and MC in the QCD CR



old QCD systematics in QCD CR



new QCD systematics

- it is a sort of weighting technique (one weight per bin)
- it is directly extracted from and applied on the dijet mass variable
- the systematic is then symmetrized with respect to the nominal template

Systematics improvements with respect to the CONF

- MC statistics
- JES treatment per component

Differences wrt the CONF

- enlarged MC statistics
- different JES treatment
- jet veto: no other jets in the event (apart the 2 W candidates) with $p_T > 25$ GeV within $|\eta| < 2.8$
- MC@NLO WW signal sample
- modified $\Delta R(j, j)$ cut

Systematics in the conf note

The main contributions to the systematics in the CONF came from MC statistics and Jet Energy Scale:

Source	$\Delta\sigma/\sigma$[%]
Data Statistics	±12
MC Statistics	±18
W/Z+jets normalization	±11
W/Z jets shape variation	±5
Multijet shape and normalization	±5
Top normalization	±6
Top ISR/FSR	±1
Jet energy scale (all samples)	±12
Jet energy resolution (all samples)	±6
Lepton reconstruction (all samples)	±1
WW/WZ ISR/FSR	±2
JES uncertainty on WW/WZ normalization	±6
PDF (all samples)	±2
Luminosity	±3.9
Total systematics	±28

More MC stat

- the most important contribution to the MC stat comes from W+jets
- requested more W+jets samples in order to reduce the MC syst contribution to the level of the JES

Sample	Requested New Stat
W0p	30M
W1p	4M
W2p	20M
W3p	4M
Wbb1p	0.8M
Wcc1p	1.5M
Wc1p	2M

- old value: 18 %
- new MC systematics: 12 %

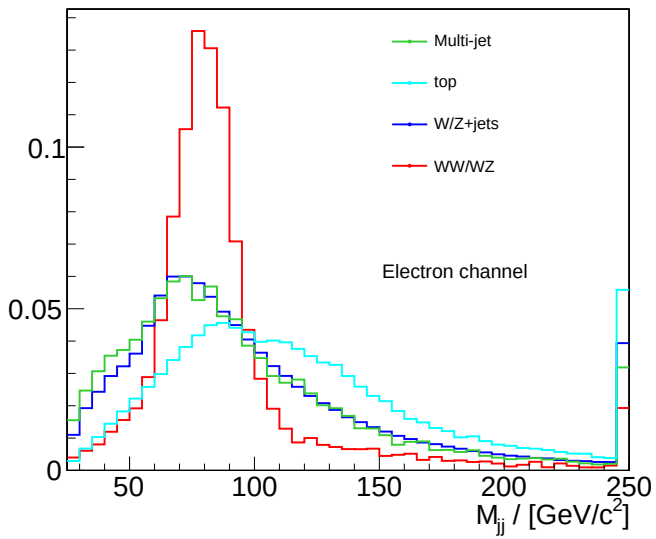
JES improved treatment

- in the CONF we treated the JES as a single contribution
- now we splitted it into various contributions
- the components are varied separately
- the templates are used in the fit and scaled by nuisance parameters
- some of the components do have direct physical meaning
- some of them are a combination of contributions built to minimize correlations

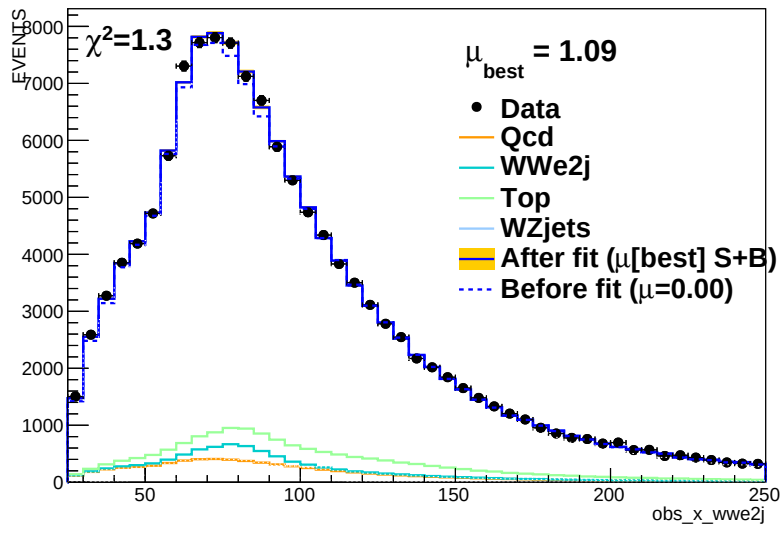
Uncertainity 1 , Effective JES Uncertainty Component 1
Uncertainity 2 , Effective JES Uncertainty Component 2
Uncertainity 3 , Effective JES Uncertainty Component 3
Uncertainity 4 , Effective JES Uncertainty Component 4
Uncertainity 5 , Effective JES Uncertainty Component 5
Uncertainity 6 , Effective JES Uncertainty Component 6
Uncertainity 7 , Eta intercalibration: stat uncertainties
Uncertainity 8 , Eta intercalibration: MC generator modelling uncertainty
Uncertainity 9 , High Pt term (temporary, 2010 uncertainty)
Uncertainity 10 , Closure of the calibration, relative to MC11b
Uncertainity 11 ,NPV pile-up Unc
Uncertainity 12 ,Mu pile-up Unc
Uncertainity 13 ,Close-by jet Unc
Uncertainity 14 ,Flavor Comp jet Unc
Uncertainity 15 ,Flavor Response jet Unc
Uncertainity 16 ,b-jet Unc

Conclusions

M_{jj} distribution before fit



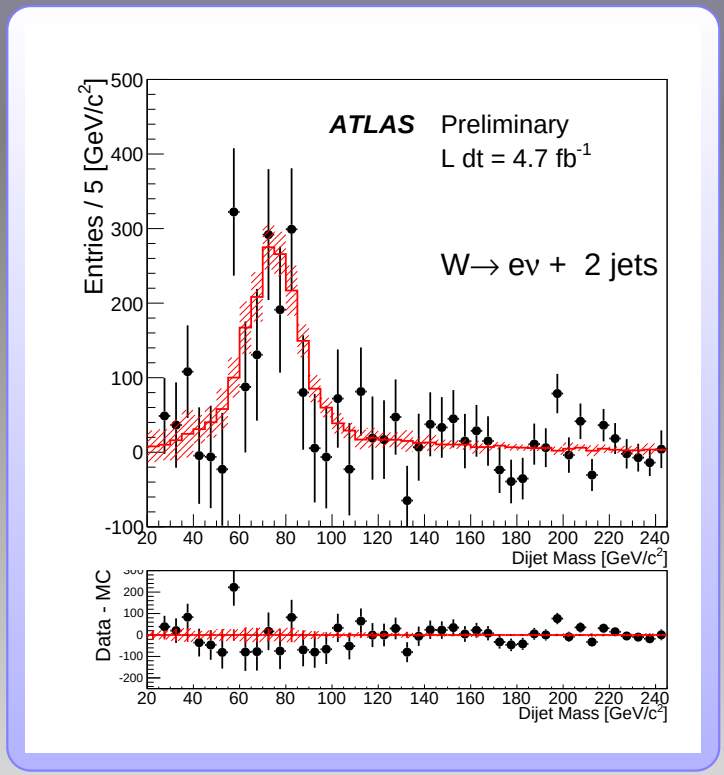
templates

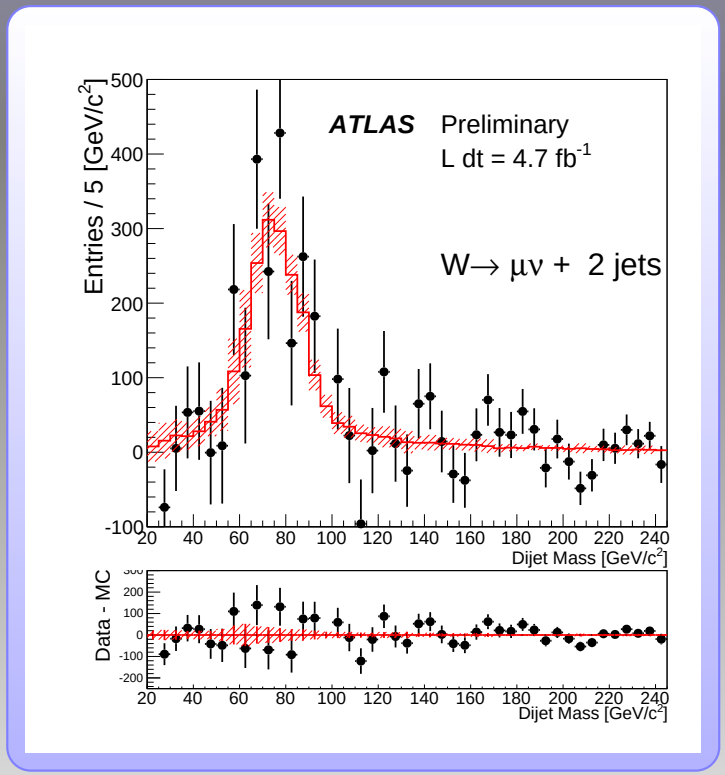


pre-fit results

Last fit results (I)

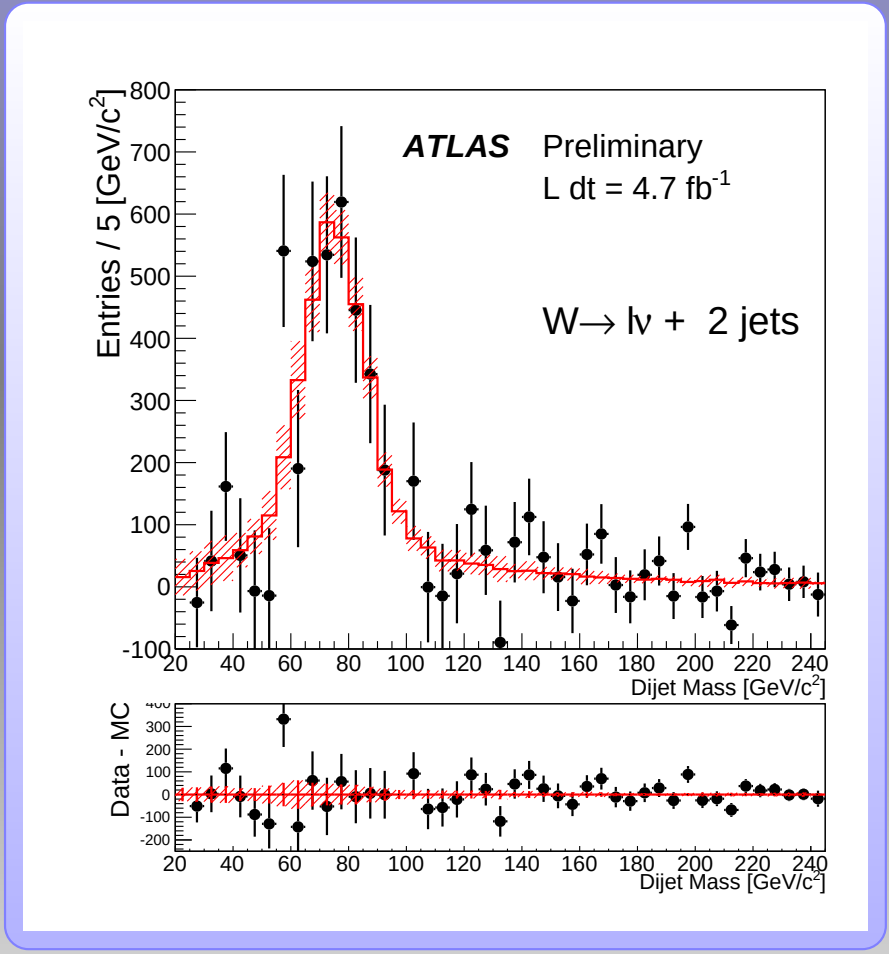
- we think that our understanding of the fit sensitivity to the various systematics is greatly improved
- fit configuration seems near to a freeze
- last results (splited channels):





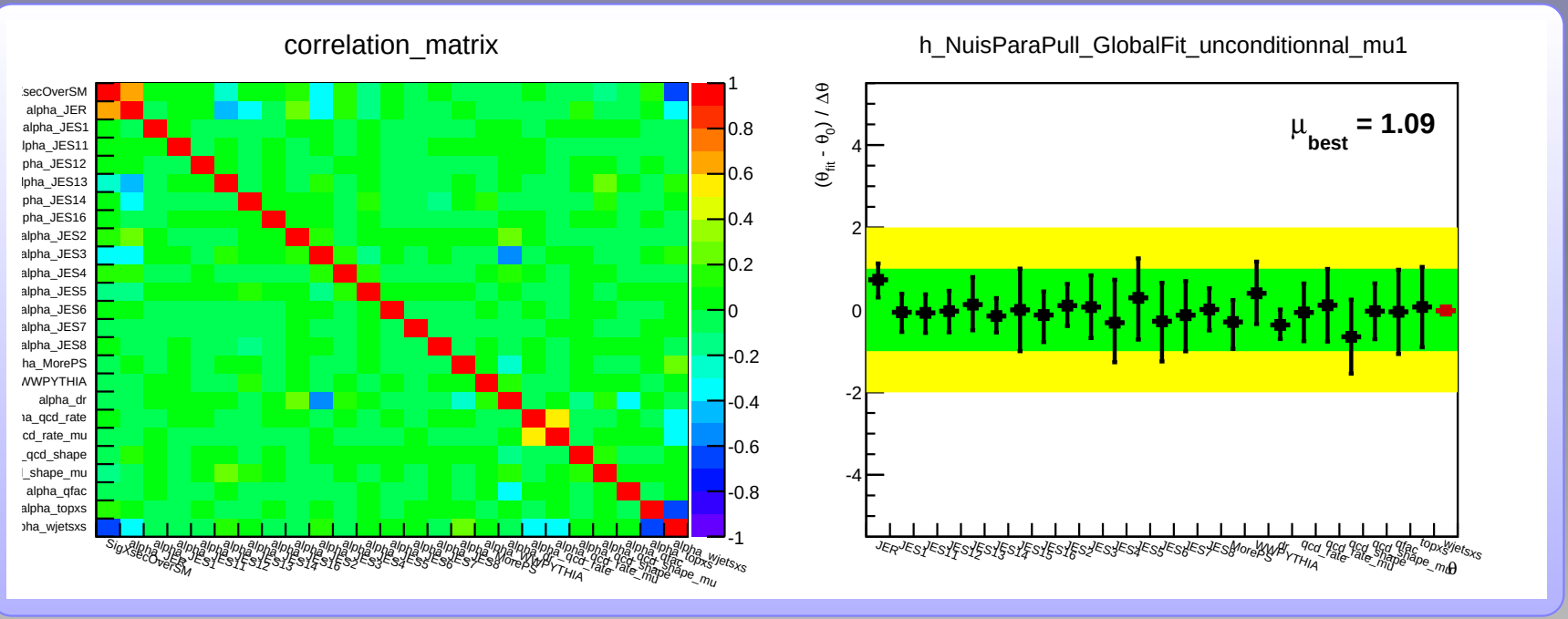
Last fit results (II)

- combined e- and μ-channels



Nuisance parameters after fit

Shift of the nuisance parameters with respect to the nominal value.
The high constraint on the W+jets cross section is understood.



We verified that the constraints of the nuisance parameters are not due to the presence of signal in the fit.

Editorial Board report

- the Editorial Board is responsible for checking an analysis before it is exposed to the ATLAS community
- Chiara and Brian gave a first update on the Analysis status and on the aTGC studies of Sept.16$^{\mathrm{th}}$
- impressive amount of material
- updates are also given periodically to the SM group
- the fitting procedure is much more under control and understood
- a few items are still being discussed

Summary

- not talked about other studies we have done (aTGC, signal stability...)
- really hard to set the systematics to a level comparable to that of the error on data
- still discussing a few points
- first iteration with the Editorial Board