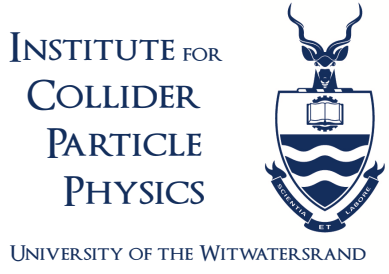
Weekly meeting

Abdualazem Fado

May 11, 2020



4ℓ+MET

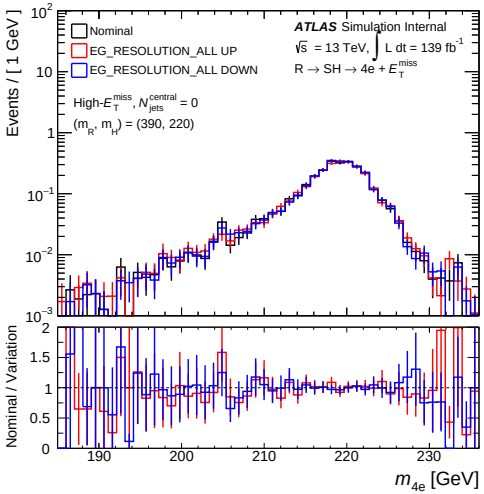
Systematic uncertainties on signal shape

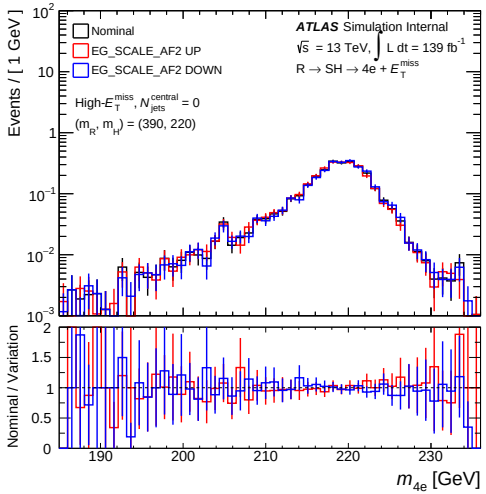
- Looking at the shape systematic uncertainty
- And their impact on the 4-lepton invariant mass system.
- $(m_R, m_H) = 390, 220$ GeV
- Electrons variables:
  - EG_RESOLUTION_ALL
  - EG_SCALE_ALL
  - EG_SCALE_AF2
- Muons variables:
  - MUON_ID
  - MUON_MS
  - MUON_SAGITTA_RHO
  - MUON_SAGITTA_RESBIAS
  - MUON_SCALE

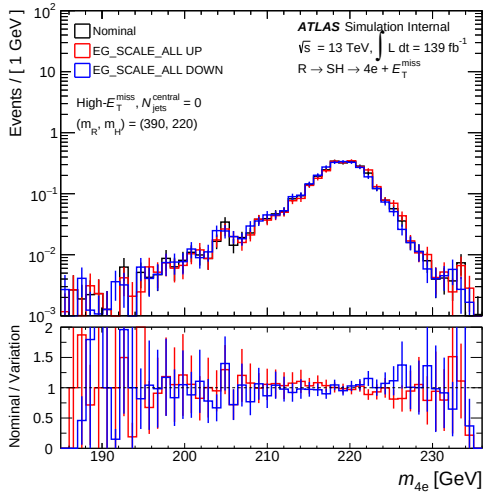
Normalisation	Shape
Electrons	
EL_EFF_ID_CorrUncertaintyNP[0-15] EL_EFF_ID_SIMPLIFIED_UncorrUncertaintyNP[0-17] EL_EFF_Iso_TOTAL_1NPCOR_PLUS_UNCOR EL_EFF_Reco_TOTAL_1NPCOR_PLUS_UNCOR	EG_RESOLUTION_ALL EG_SCALE_ALLCORR EG_SCALE_E4SCINTILLATOR EG_SCALE_LARCALIB_EXTRA2015PRE EG_SCALE_LARTEMPERATURE_EXTRA2015PRE EG_SCALE_LARTEMPERATURE_EXTRA2016PRE
Muons	
MUON_EFF_ISO_STAT MUON_EFF_ISO_SYS MUON_EFF_RECO_STAT MUON_EFF_RECO_STAT_LOWPT MUON_EFF_RECO_SYS MUON_EFF_RECO_SYS_LOWPT MUON_EFF_TTVA_STAT MUON_EFF_TTVA_SYS	MUON_ID MUON_MS MUON_SAGITTA_RESBIAS MUON_SAGITTA_RHO MUON_SCALE
Jets	
	JET_BJES_Response JET_EffectiveNP_[1-7] JET_EffectiveNP_8restTerm JET_EtaIntercalibration_Modelling JET_EtaIntercalibration_NonClosure_highE JET_EtaIntercalibration_NonClosure_negEta JET_EtaIntercalibration_NonClosure_posEta JET_EtaIntercalibration_TotalStat JET_Flavor_Composition JET_Flavor_Response JET_JER_DataVsMC JET_JER_EffectiveNP_[1-6] JET_JER_EffectiveNP_7restTerm JET_Pileup_OffsetMu JET_Pileup_OffsetNPV JET_Pileup_PtTerm JET_Pileup_RhoTopology JET_PunchThrough_MC16 JET_SingleParticle_HighPt
Missing transverse energy	
	MET_SoftTrk_Reso MET_SoftTrk_Scale
Other	
HOEW_QCD_syst HOEW_syst HOQCD_scale_syst PRW_DATASF	

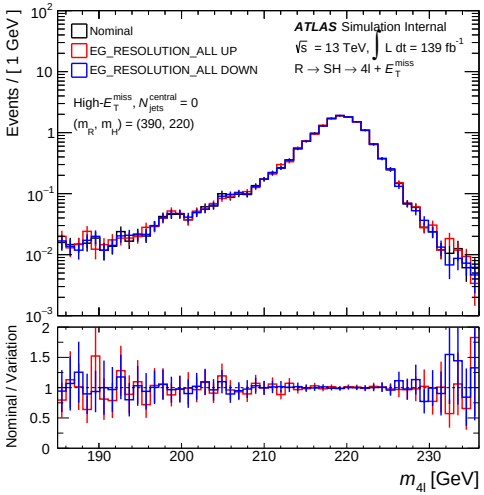
4ℓ+MET

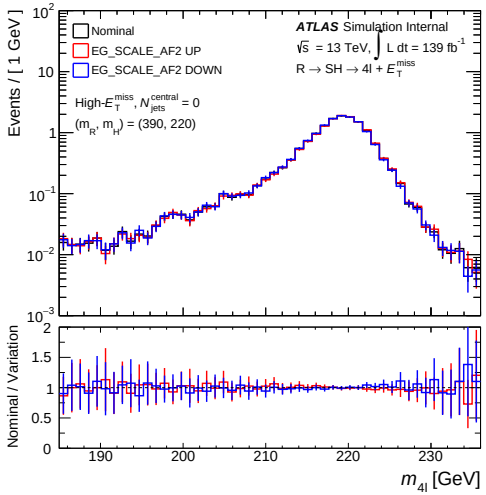
4e-channel for High-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} = 0$

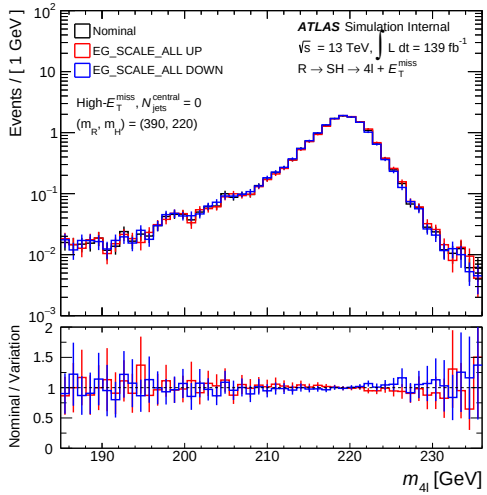






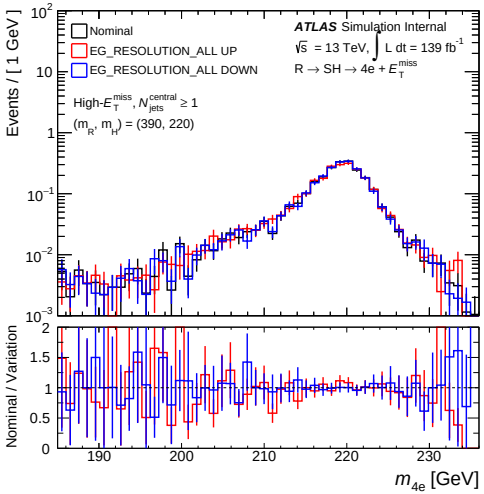


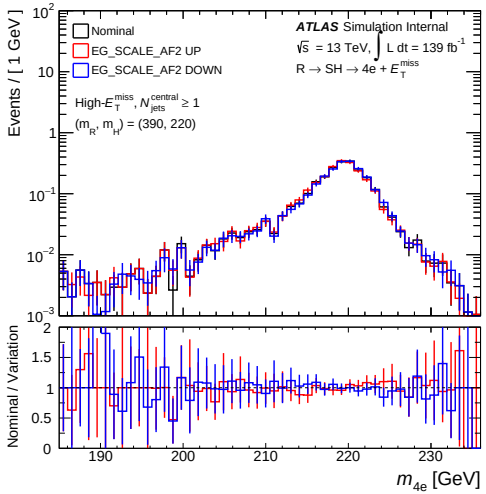


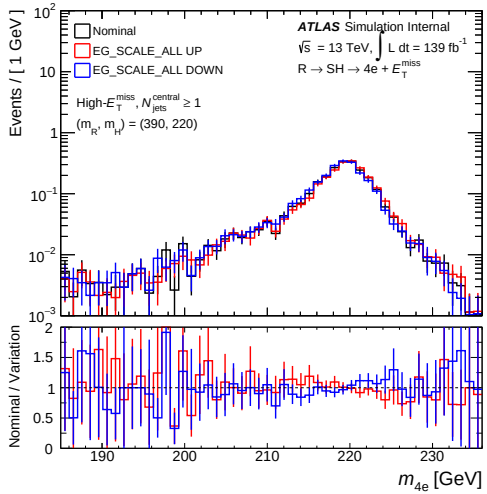


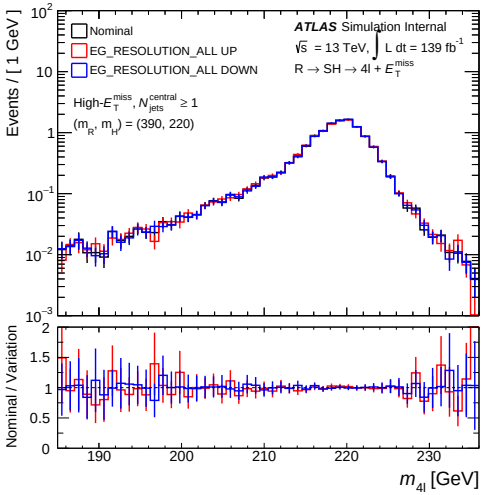
4ℓ+MET

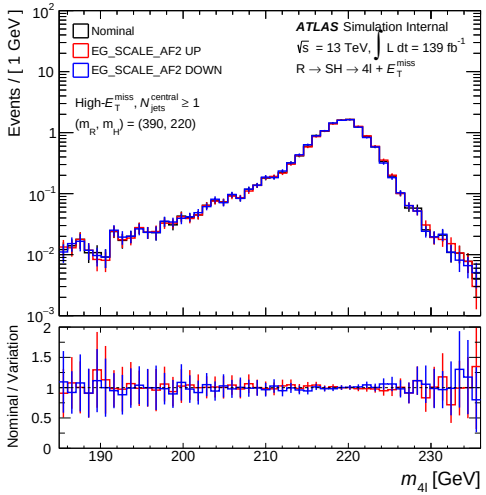
4e-channel for High-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} \geq 1$

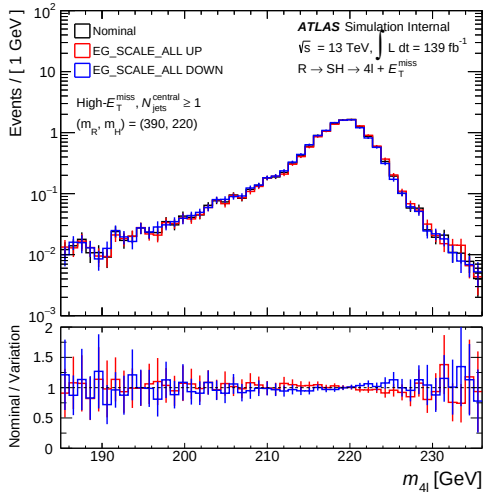






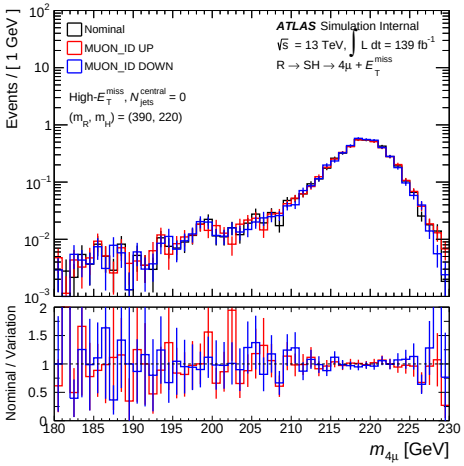


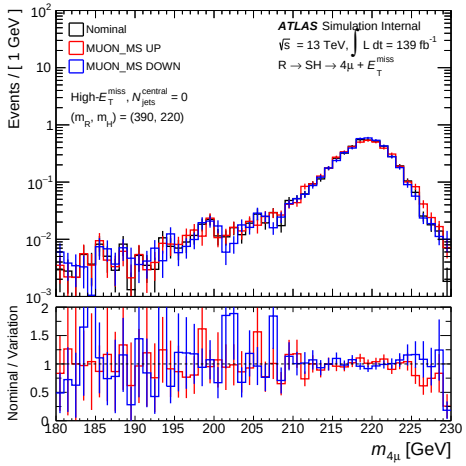


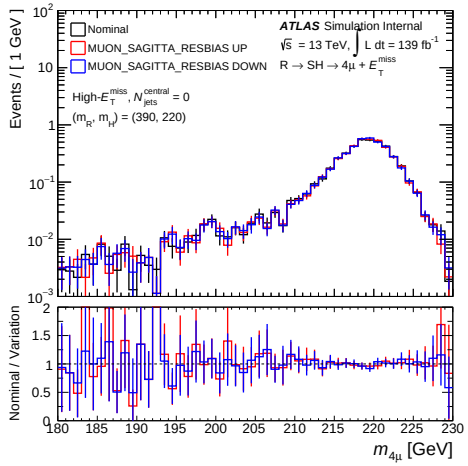


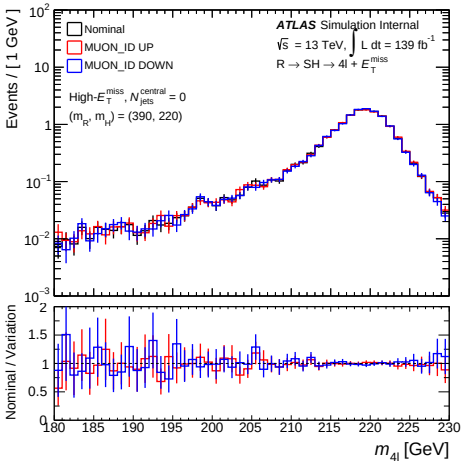
4ℓ+MET

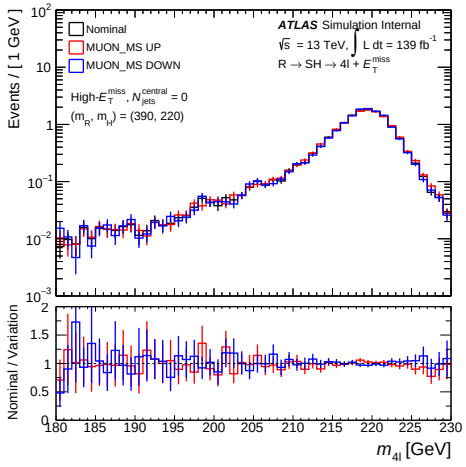
4μ-channel for High-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} = 0$

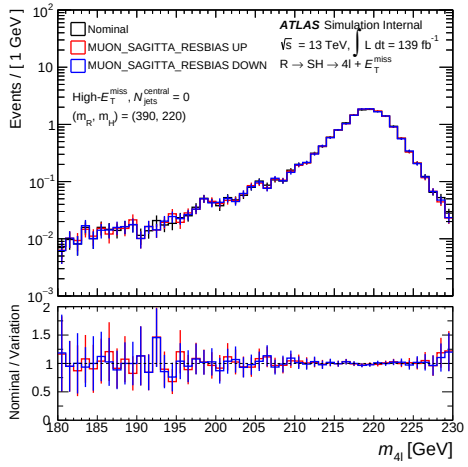






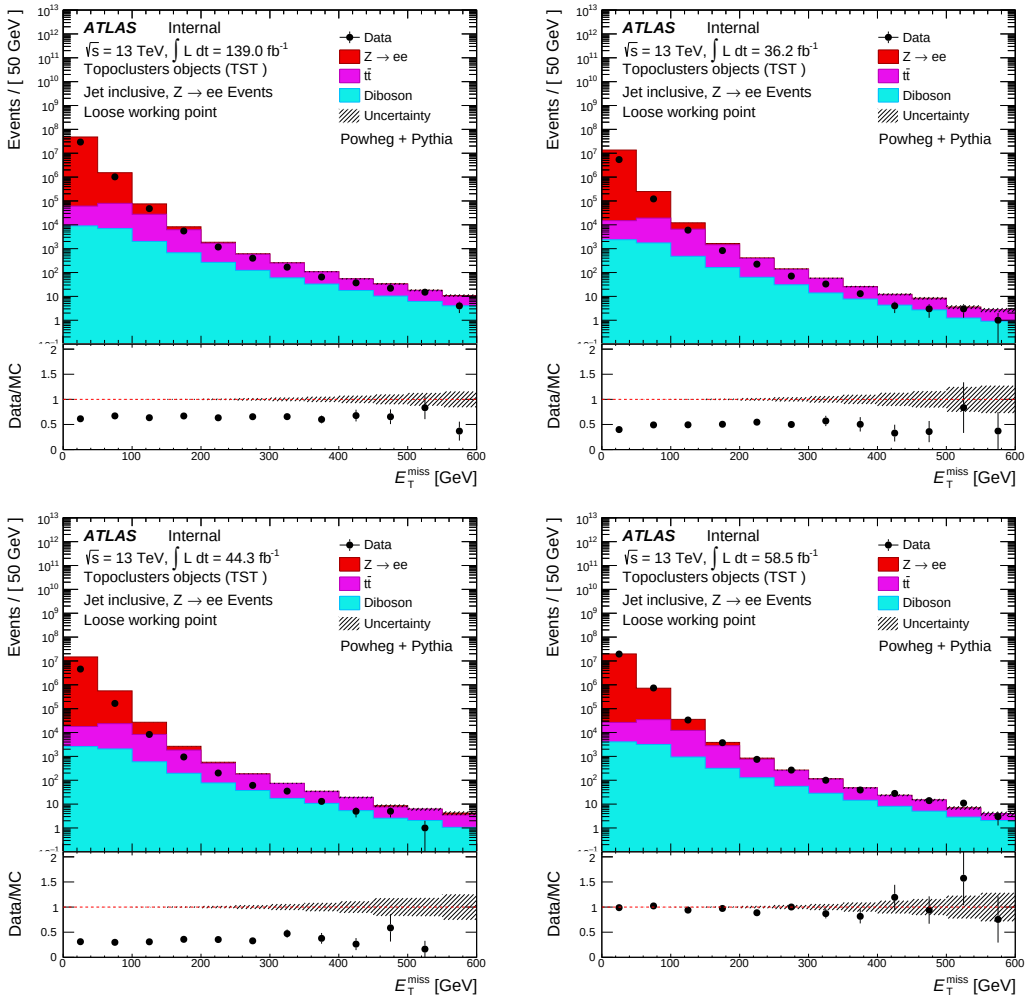






data/MC comparison

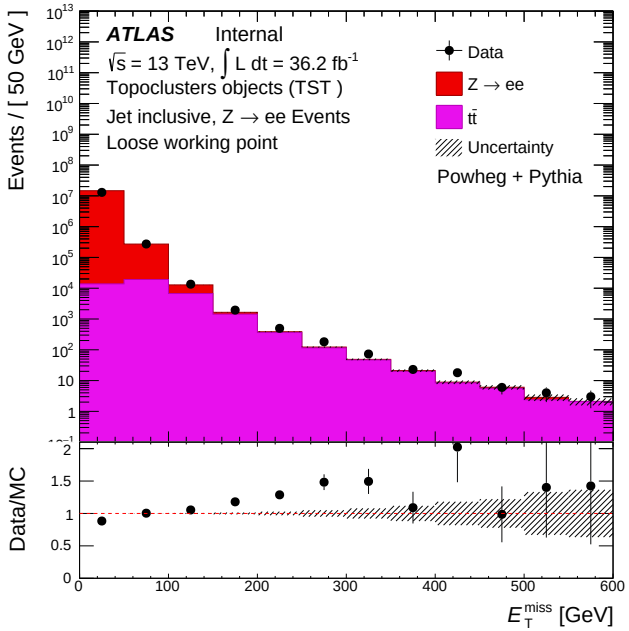
$Z \rightarrow ee$ (Topoclusters, Loose): the problem

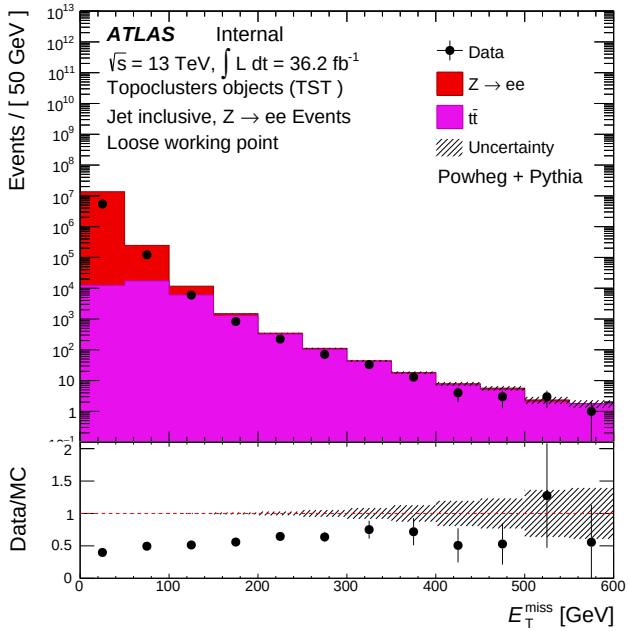


- Normalisation problem? Or a problem with missing data?

data/MC comparison

$Z \rightarrow ee$ (Topoclusters, Loose)

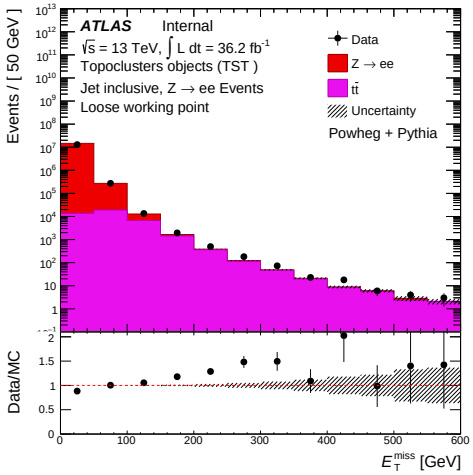


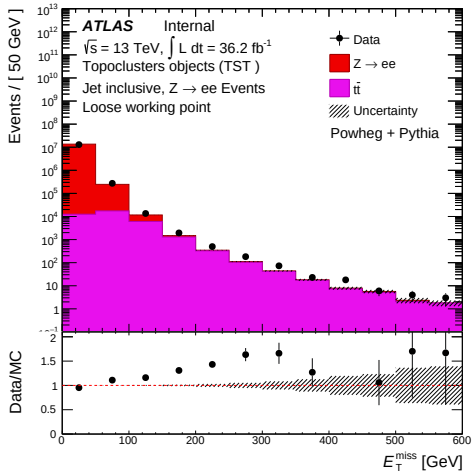


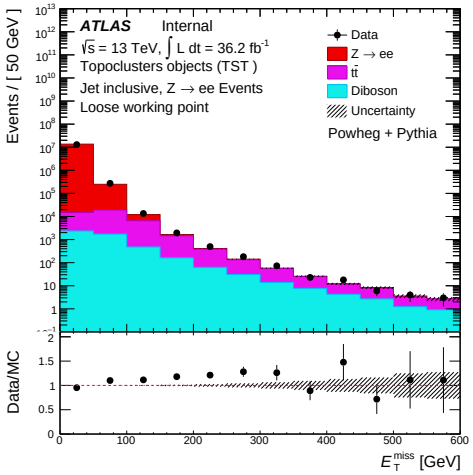
- New p-tag (left) with 21.2.106, old p-tag (right) with 21.2.78

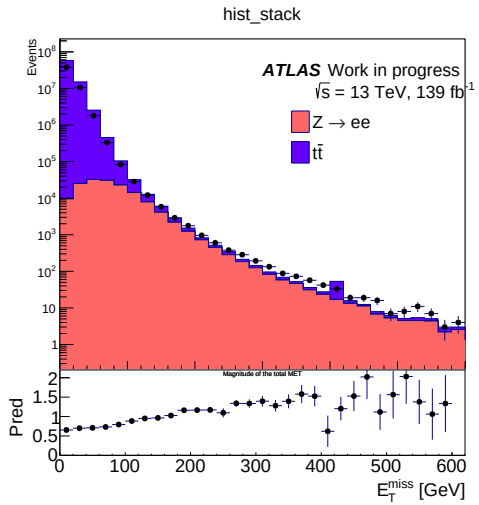
data/MC comparison

$Z \rightarrow ee$ (Topoclusters, Loose)









- New p-tag (left) with 21.2.106, old p-tag (right) with 21.2.78

Summary

- Still missing Diboson samples, and we submitted a new p-tagg request.
- Experimental uncertainties on signal shape is presented.
- Plots showed for one mass point, gonna have to add the rest soon.
- How do we want to put these uncertainties into the fit?
- What do we do with the JET_* variables?
- I'm going to work of the statistics in parallel to this.
- I'll try to use HistFitter to do that.
- https://twiki.cern.ch/twiki/bin/view/AtlasProtected/H4LMET
- https://indico.cern.ch/event/916442/

Coming up soon . . .

- Experiment on background yields
- Experiment on background shape: It depends on the function, no?

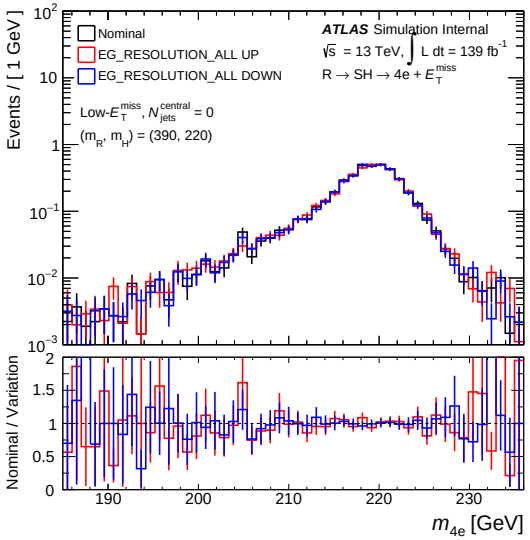
Thank you!

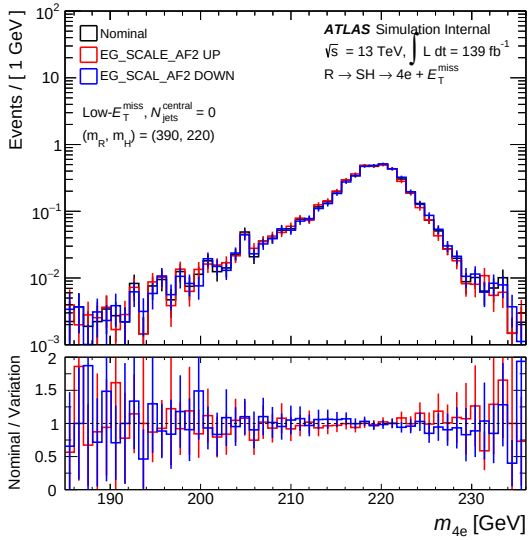
Additional slides

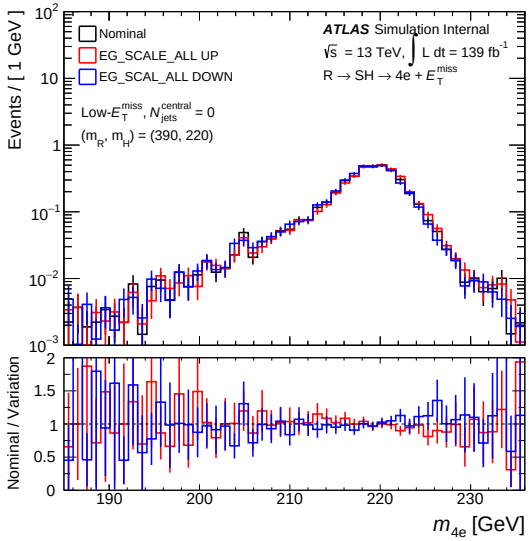
Event Selection	
Quadruplet Selection	- Require at least one quadruplet of leptons consisting of two pairs of same-flavour opposite-charge leptons fulfilling the following requirements: - p_T thresholds for three leading leptons in the quadruplet: 20, 15 and 10 GeV - At most 1 calo-tagged, stand-alone or silicon-associated muon per quadruplet - Leading di-lepton mass requirement: $50 < m_{12} < 106$ GeV - Sub-leading di-lepton mass requirement: $m_{\text{threshold}} < m_{34} < 115$ GeV - $\Delta R(\ell, \ell') > 0.10$ for all lepton pairs in the quadruplet - Remove quadruplet if alternative same-flavour opposite-charge di-lepton gives $m_{\ell\ell} < 5$ GeV - Keep all quadruplets passing the above selection
Isolation Needs updating	- Contribution from the other leptons of the quadruplet is subtracted - Muon track isolation ($\Delta R = 0.30$): $\Sigma p_T / p_T < 0.15$ - Muon calorimeter isolation ($\Delta R = 0.20$): $\Sigma E_T / p_T < 0.30$ - Electron track isolation ($\Delta R = 0.20$) : $\Sigma E_T / E_T < 0.15$ - Electron calorimeter isolation ($\Delta R = 0.20$) : $\Sigma E_T / E_T < 0.20$
Impact Parameter Significance	- Apply impact parameter significance cut to all leptons of the quadruplet - For electrons: $d_0/\sigma_{d_0} < 5$ - For muons: $d_0/\sigma_{d_0} < 3$
Best Quadruplet	- If more than one quadruplet has been selected, choose the quadruplet with highest Higgs decay ME according to channel: 4μ, $2e2\mu$, $2\mu2e$ and $4e$
Vertex Selection	- Require a common vertex for the leptons: - $\chi^2/\text{ndof} < 5$ for 4μ and < 9 for others decay channels

Additional slides

Electron systematic effects: 4*e*-channel for Low-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} = 0$

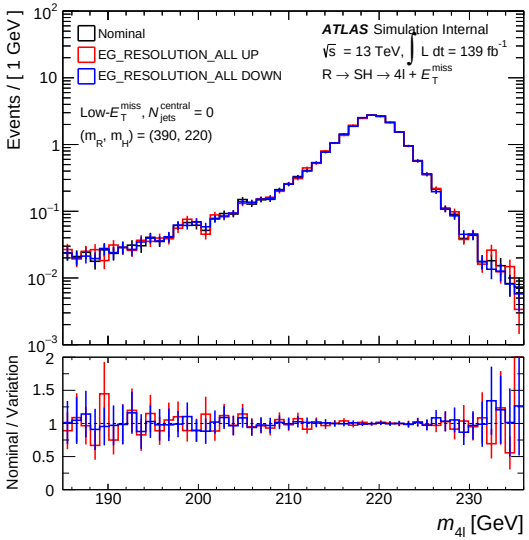


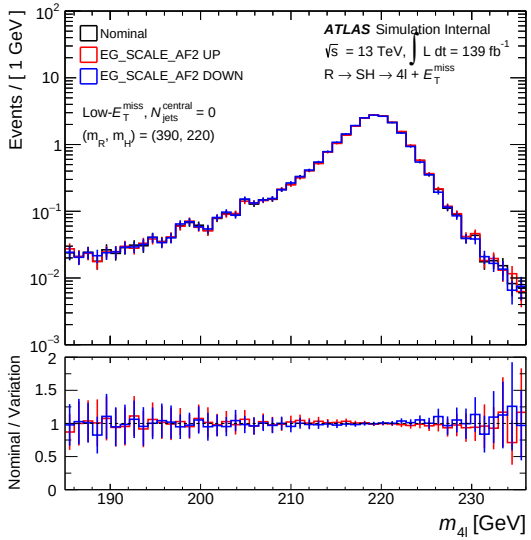


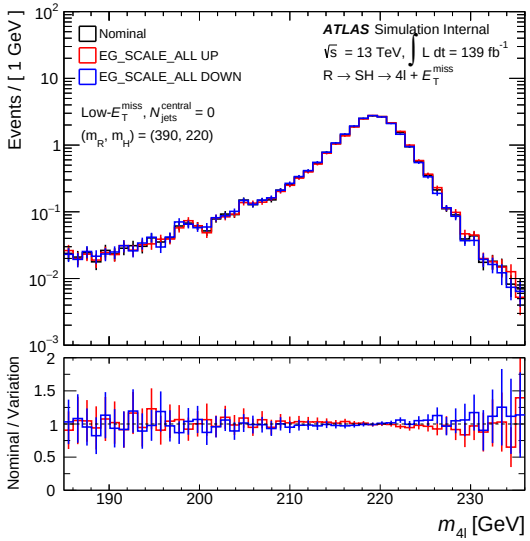


Additional slides

Electron systematic effects: 4*l*-channel for Low-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} = 0$

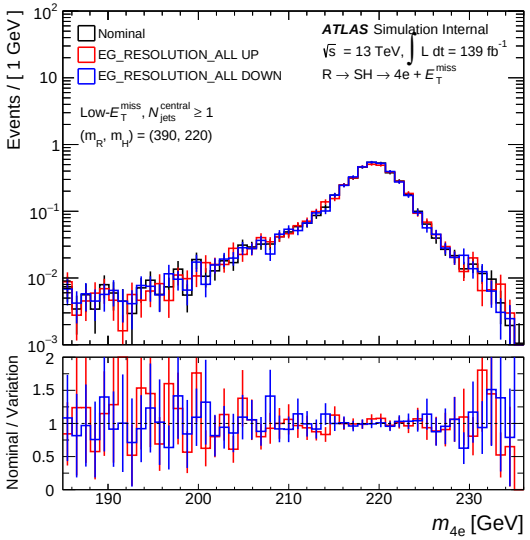


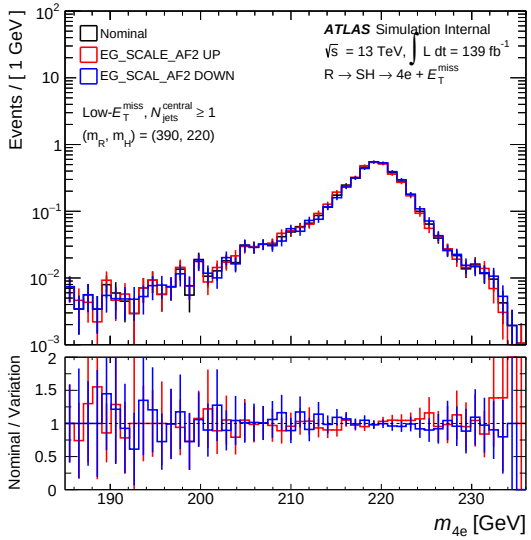


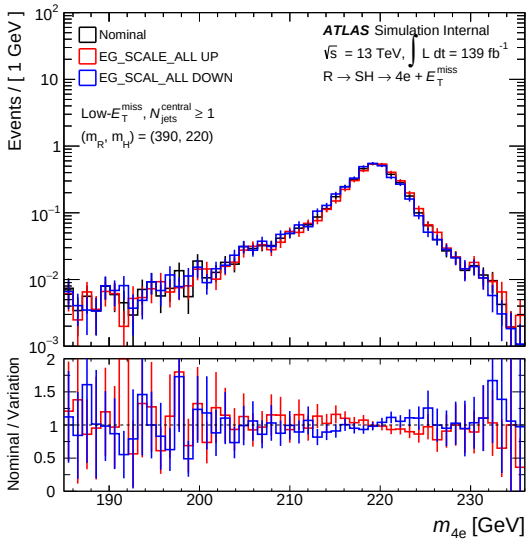


Additional slides

Electron systematic effects: 4*e*-channel for Low-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} \geq 1$







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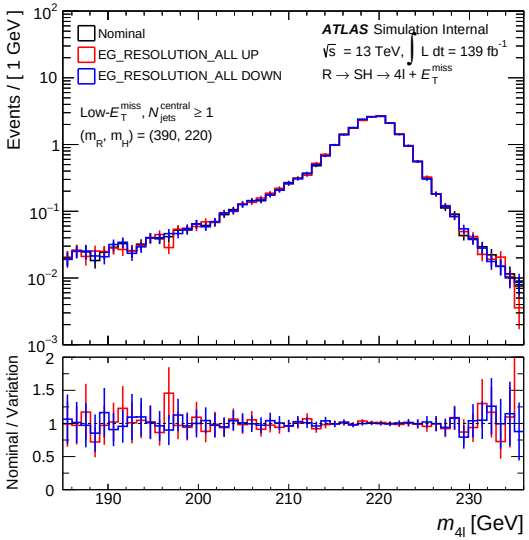
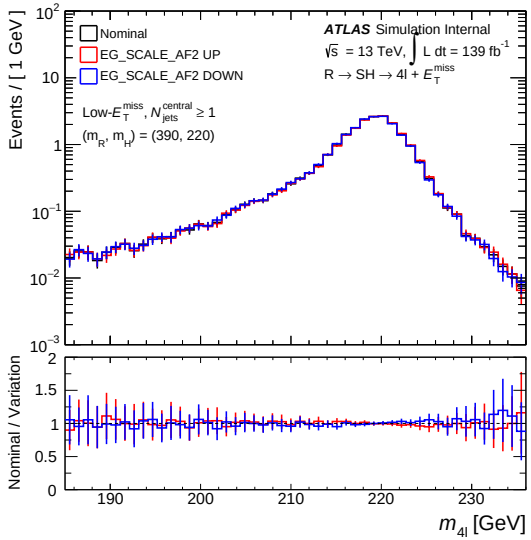
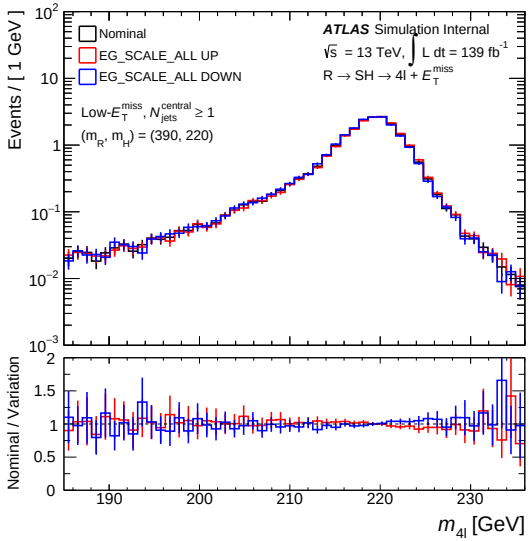
Electron systematic effects: 4*l*-channel for Low-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} \geq 1$

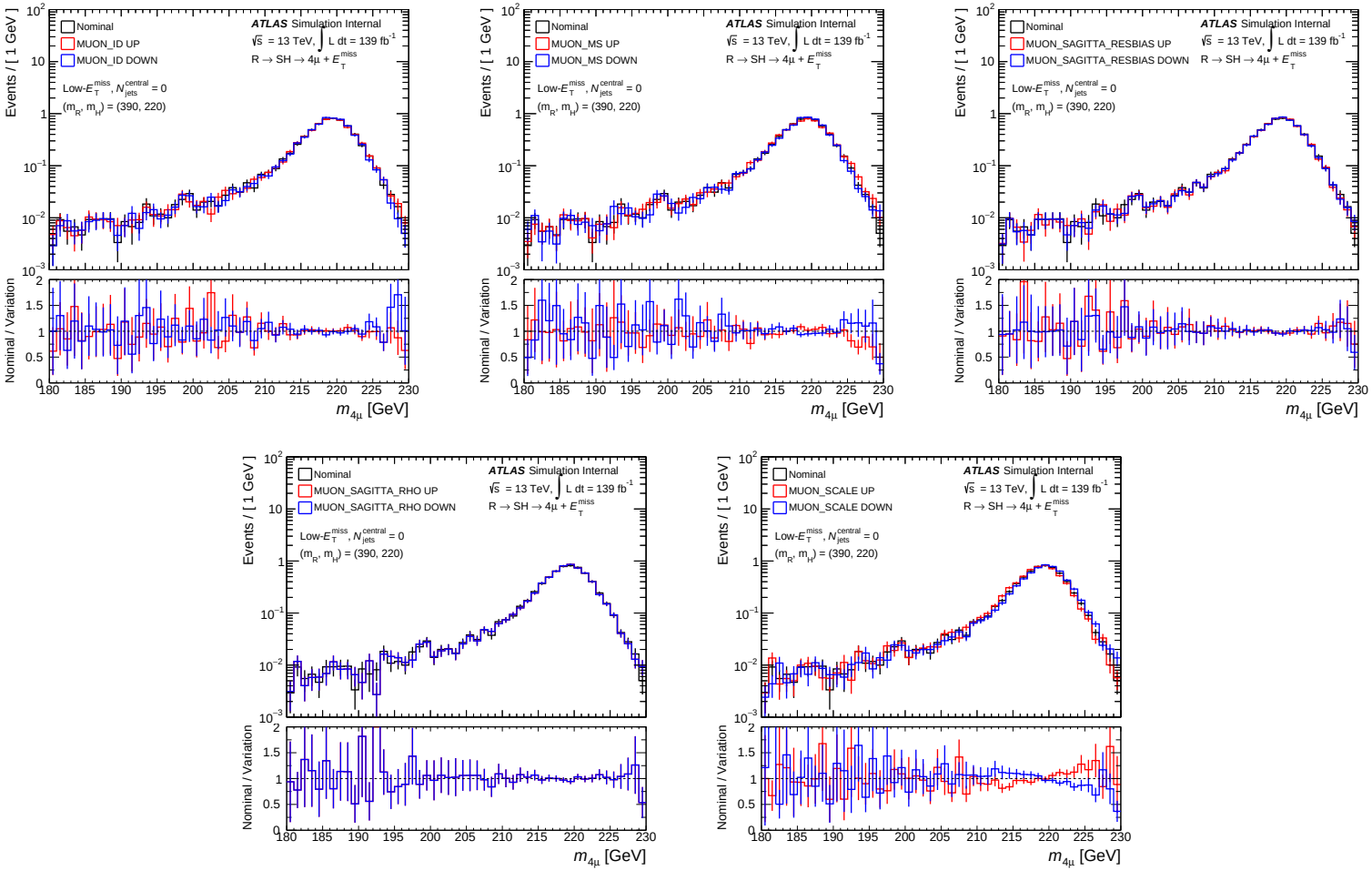




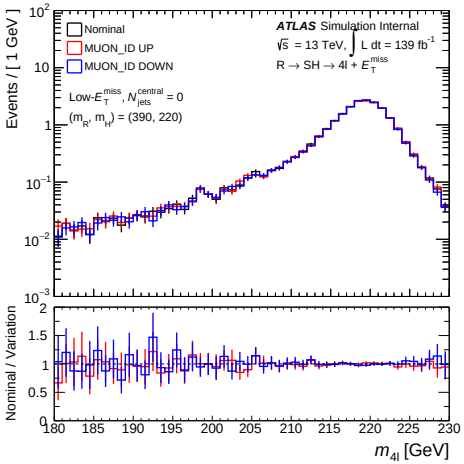


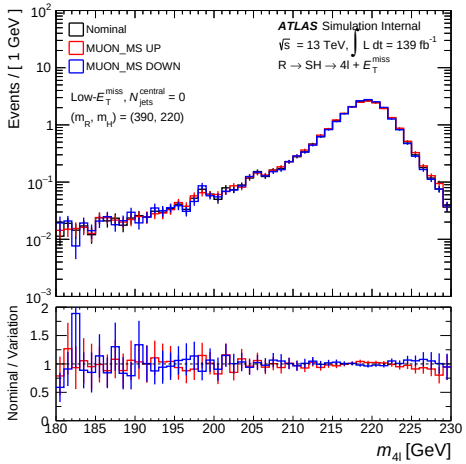
Additional slides

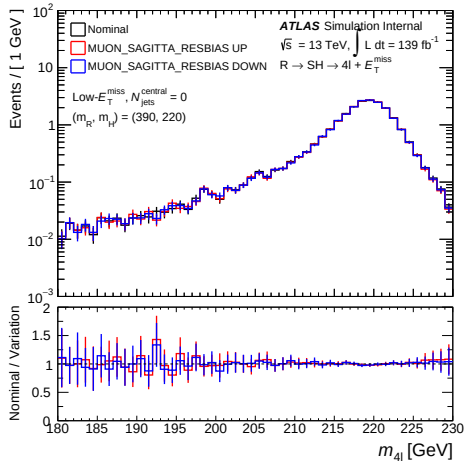
Muon systematic effects: 4μ-channel for Low-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} = 0$

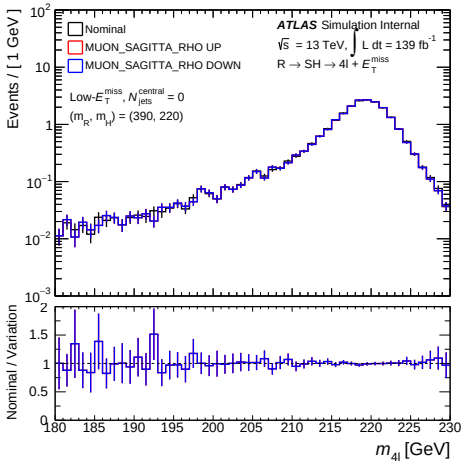


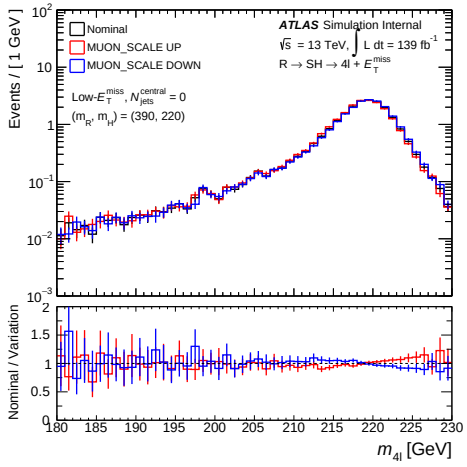
Muon systematic effects: 4/-channel for Low-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} = 0$





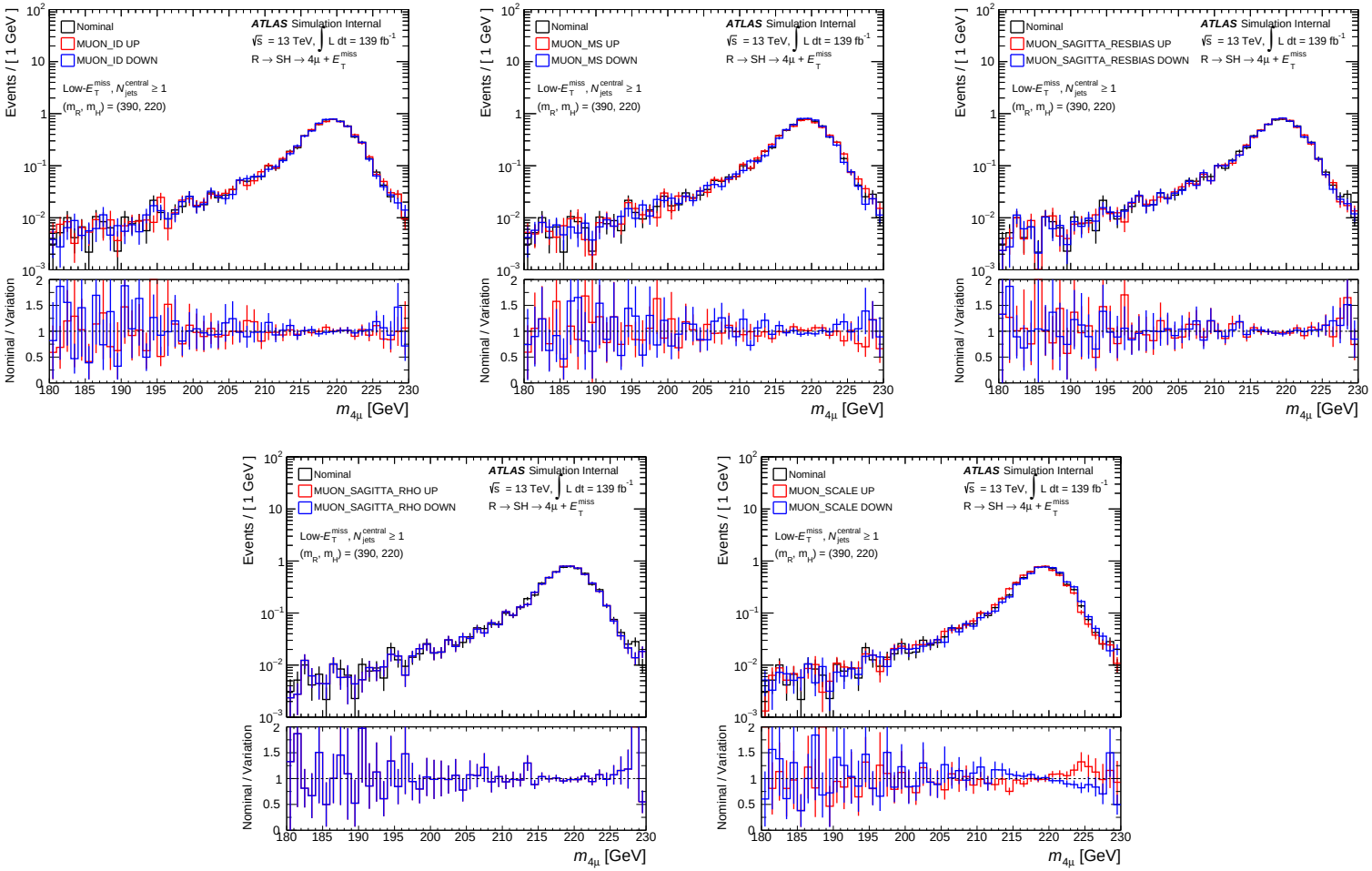






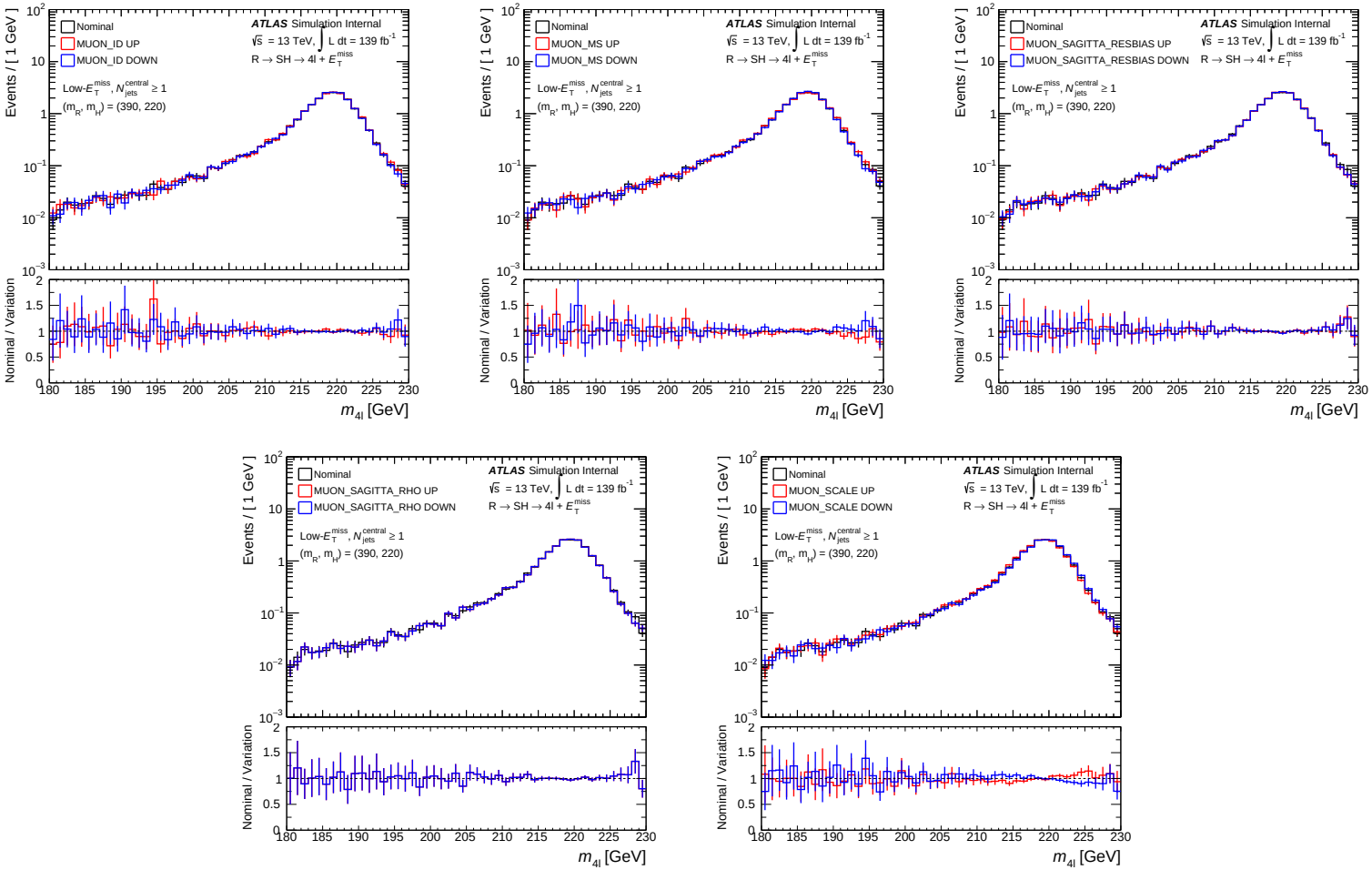
Additional slides

Muon systematic effects: 4μ-channel for Low-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} \geq 1$



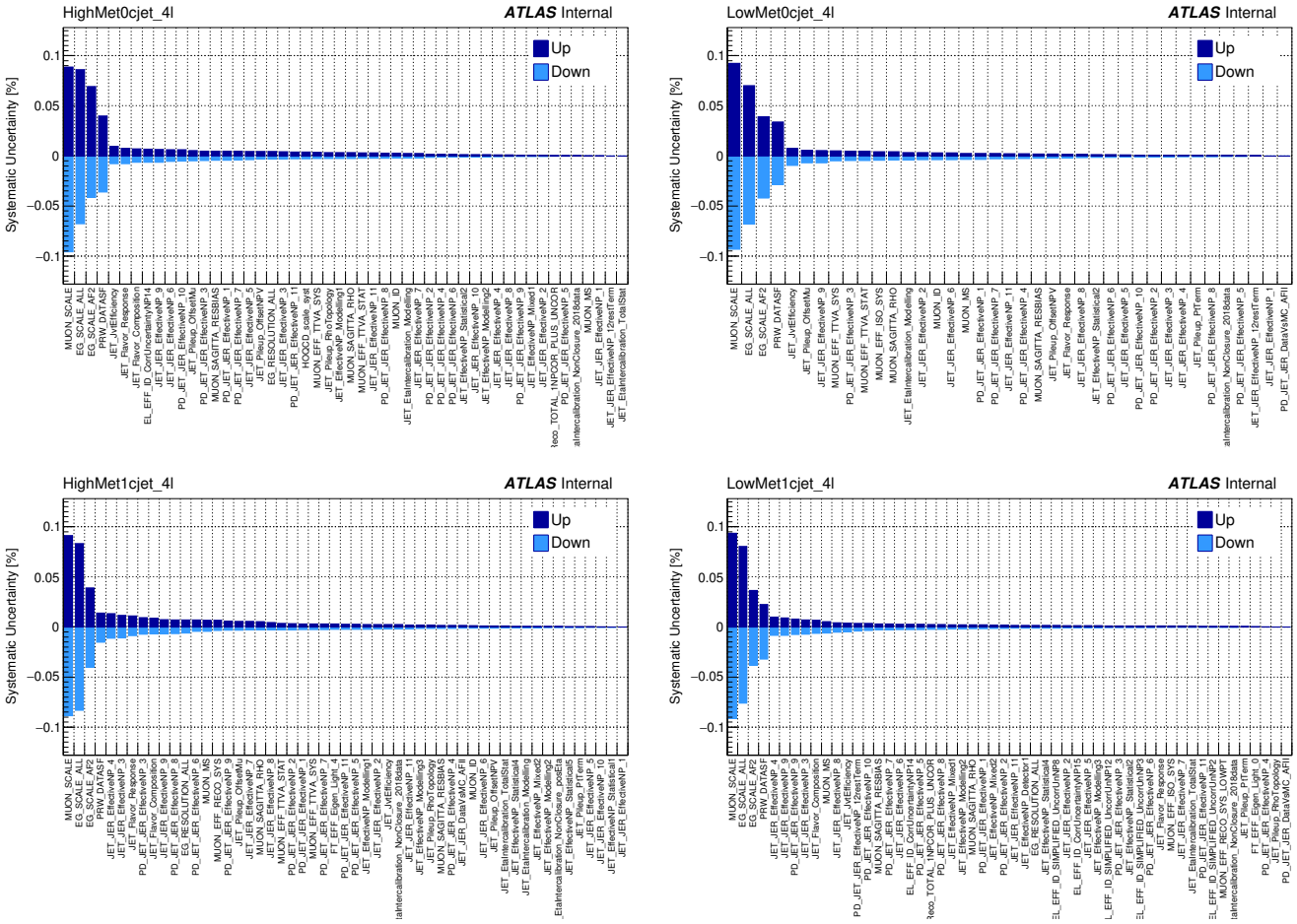
Additional slides

Muon systematic effects: 4*l*-channel for Low-$E_{\mathrm{T}}^{\mathrm{miss}}$ of $N_{\mathrm{jets}}^{\mathrm{central}} \geq 1$



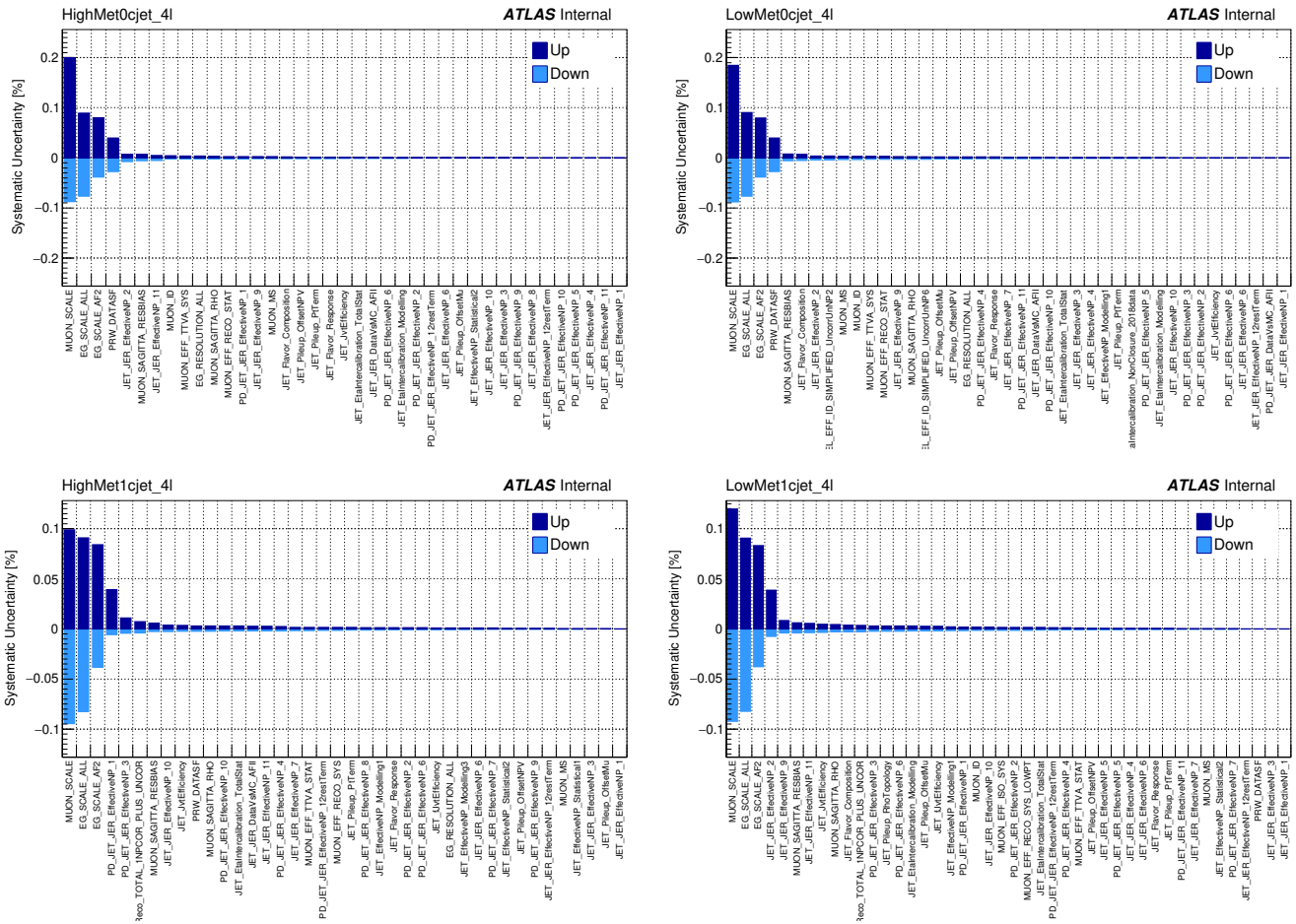
Additional slides

Experimental systematic uncertainties



- Uncertainties in the normalisation of the $m_{4\ell}$ for R390H220.
- Removing nuisance parameter below 0.00001.

Additional slides
Experimental systematic uncertainties



- Uncertainties in the normalisation of the $m_{4\ell}$ for R450H220.
- Removing nuisance parameter below 0.00001.