Measurement of the Top Quark Mass in the $t\bar{t} \rightarrow$ lepton+jets channel form $\sqrt{s} = 13$TeV ATLAS data

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ATLAS EXPERIMENT

Why Measuring the Top-Quark mass?

How the Data is taken?

How is the Top-Qark mass measured?

Measurement is based on a 3D-Template method:

- Variable 1: m_{top}^{reco} from reconstructed Events
- Variable 2: m_{W}^{reco} from chosen jet permutation, sensitive to JSF
- Variable 2: R_{bq}^{reco} from chosen jet permutation, sensitive to bJSF

$$R_{bq}^{reco,1b} = \frac{p_T^{b_{tag}}}{(p_T^{W_{jet1}} + p_T^{W_{jet2}})/2} \qquad R_{bq}^{reco,2b} = \frac{p_T^{b_{had}} + p_T^{b_{lep}}}{p_T^{W_{jet1}} + p_T^{W_{jet2}}}$$

Determination of m_{top} :

- Need fully reconstruction of $t\bar{t}$-finale state
- Template parametrisation of the 3 variables
- Unbinned likelihood fit is performed

Object definition for 2016 data

Electrons

- E_T >28 GeV, $|\eta|$<2.47
- Gradient isolation, TightLH
- HLT_e26_lhtight_nod0_ivarloos, HLT_e60_lhmedium_nod0, HLT_e140_lhloose_nod0

Muons

- E_T >28 GeV, η <2.47
- Medium, Gradient isolation
- HLT_mu26_ivarmedium, HLT_mu50

Small-R jets

- antiKt R = 0.4, EM-Jets
- JVT >0.59 for $p_T < 60$GeV and $|\eta|$<2.4
- b-tagging: MV2_c10, 77% WP

MET/MTW

- $E_T^{miss} > 20$GeV
- $E_T^{miss} + m_T^W > 60$GeV

AnalysisTop-02-04-27, with 25 fb-1 for 2016 data Top Mass Ntuple production

Pre-selection

- At least one good primary vertex with five associated tracks
- Exactly one isolated high p_T lepton
- At least 4 central jets with highp_T
- 1 or 2 b-tagged jets
- Cuts on E_T^{miss} , m_T^W or $E_T^{miss} + m_T^W$
- W+jets normalization and HF fraction estimated from data
- Multijet background obtained from data in control region

Event yields after preselection

- Background contamination dominated by W + Jets
- Mass dependence of single-top $\Rightarrow$ include in signal
- Reduction of background via cuts on 2 b-tagged jets
- **Good data/MC agreement**

Data/MC agreement

- good Data/MC agreement for jet multiplicities and Missing E_T
- see larger discrepancies for higher b-tag multiplicities
- when we cut on at least two b-tagged jets, the Data/MC agreement gets worse

Data/MC agreement

- Multijet estimate: preliminary estimate from 2015 data from Nedaa scaled to 20
luminosity
- Therefore see discrepancy at low electron p_T

Data/MC agreement

- Used four jets for KLFitter: priority for b-tagged jets
- Do not use b-tag veto mode, but working point

Data/MC agreement

- Variables used for likelihood fit
- Did not store information to calculate MW_reco, will be shown in the next prese

$t\bar{t}$-final state

- 4 jet event $\Rightarrow$ 24 possible jet-parton assignments
- 12 permutations left since light jets from W are indistinguishable
- Kinematic liklihood fit with KLFitter

$\Rightarrow$ Chose best permutations for calculation

Reconstruction with KLFitter

- KLFitter input: charged lepton, missing E_T and at least four jets

  $\Rightarrow$ one or two b-tagged jets + untagged jets with highest p_T

- Definition of kinematic Likelihood:
  - Transfer functions (W) for Detector response
  - Breit-Wigner distributions (BW)
  - different options to use b-tagging information

Template parametrisation

- Schau in die Int note!!!!

Workflow for Optimization studies

In the following

Previous results

Summery Conclusion