Top Mass Measurement with DLM in lepton + 4 jets channel

Taichi Kubo
J. Naganoma
S. Kim
K. Kondo

Introduction and Contents

➔Top mass measurement in l+jets channel by DLM has been already done with Gen 5 at 318pb-1(K. Yorita)

➔We already confirmed that we could reproduce performance of the previous analysis in my previous talk

➔This talk is on Measurement of Mtop and JES in Gen6 analysis

- ✓ DLM (remainder)
- ✓ Transfer Function(TF)
- ✓ Checking 1D likelihood(Mass)
- ✓ Checking 2D likelihood(Mass and JES)

Dynamical Likelihood Method

Per Path Likelihood: **Single reconstruction x from y(Bayes' formula)**

$$L_{path}(x_i, M, JES; y_j) = N_j \frac{d\sigma}{d\Phi}(x_i; M)\, w(x_i; y_j, JES)$$

$$N_j^{-1} = \int dx \frac{d\sigma}{d\Phi}(x; M)\, w(x; y, JES)$$

i: path number
j: event number

Per Event Likelihood

$$L_{ev}(M, JES) = \sum_i L_{path}(x_i, M; y_j, JES)$$

Note: TF depends on JES

Joint Likelihood

$$L(M, JES) = \prod^{ev} L_{ev}(M, JES)$$

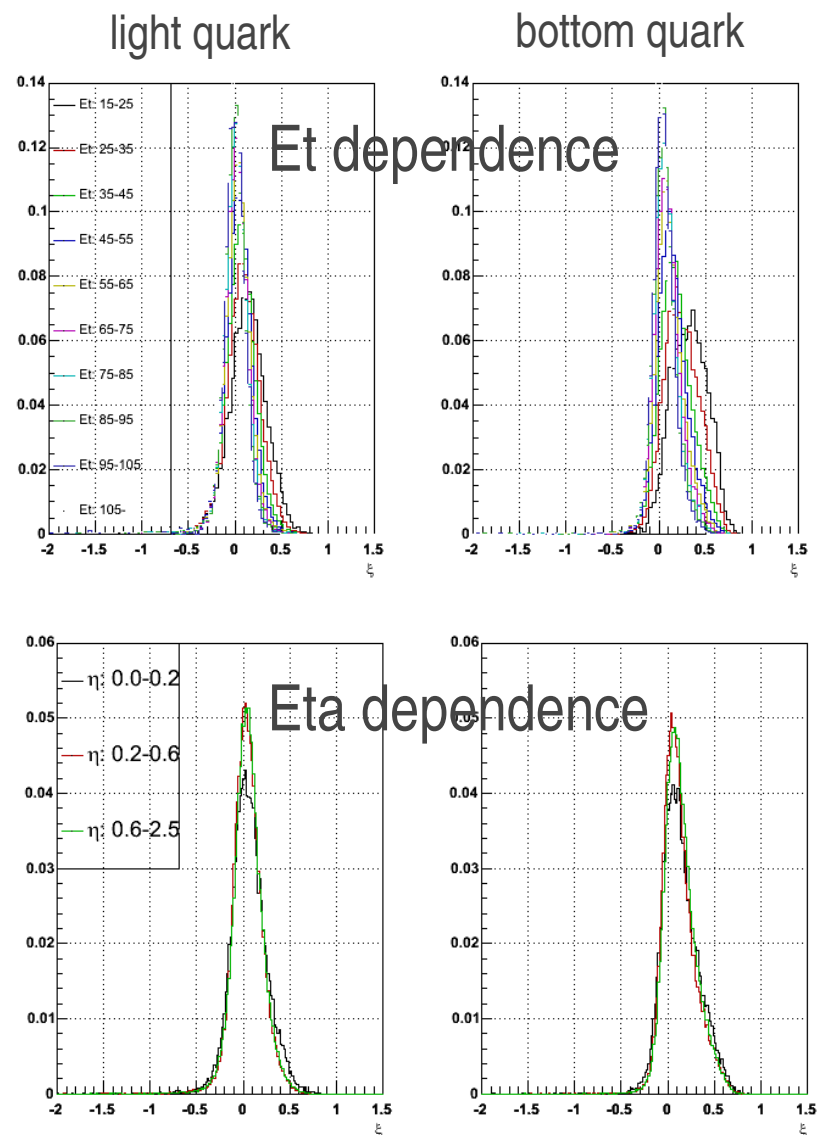
Mtop and JES are measured simultaneously in 2D likelihood

Transfer Function

Transfer Function transforms observed variables into parton variables

How to make TF

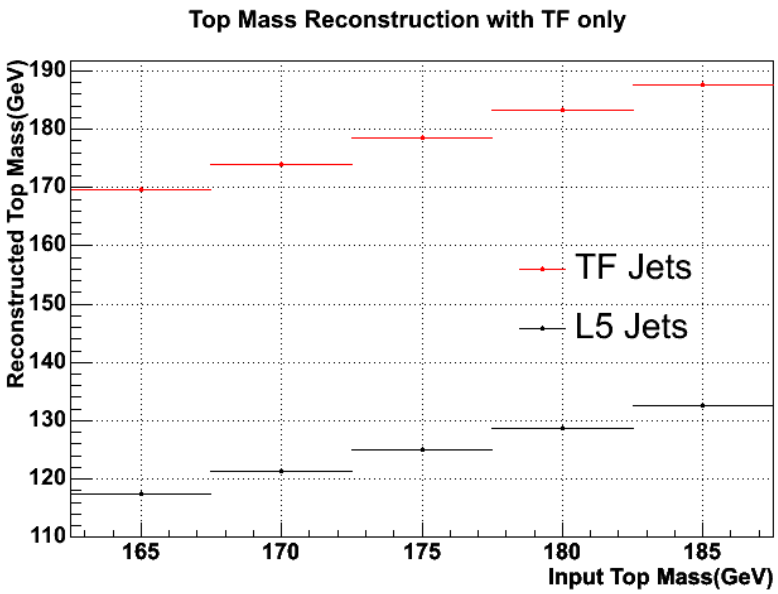
- ✓Exactly 4 jets events
- ✓Jet-parton matching(dR < 0.4)
- ✓From 175 GeV sample only
- ✓Fill $\xi = \frac{E_{parton} - E_{jet}}{E_{parton}}$
- ✓Use histograms as a Transfer Function
- ✓TF depends on JES



Performance of TF

Check how Transfer Function works without matrix elements

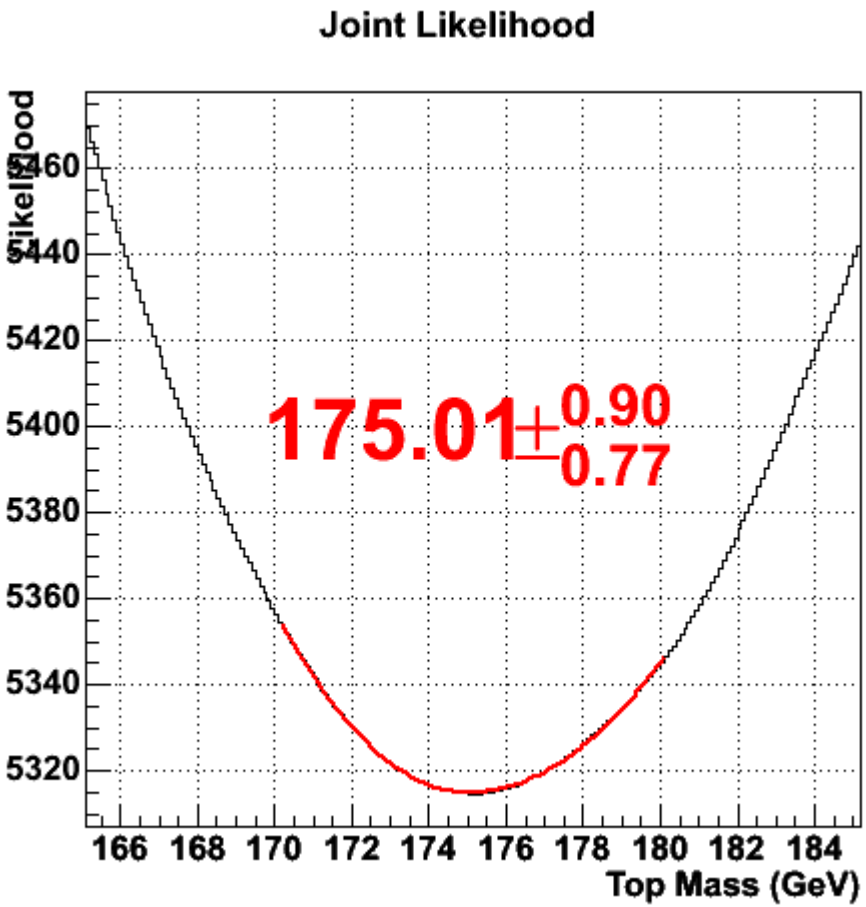
- Correct L5 jets with TF for each scan in an event and calculate Mtop
- Fill mean of Mtop for each event
- Pick up mean of Mtop for all events



Transfer Function works well to give jets back to parton

1 PE with 1D Likelihood

1 typical pseudo experiment with right combination

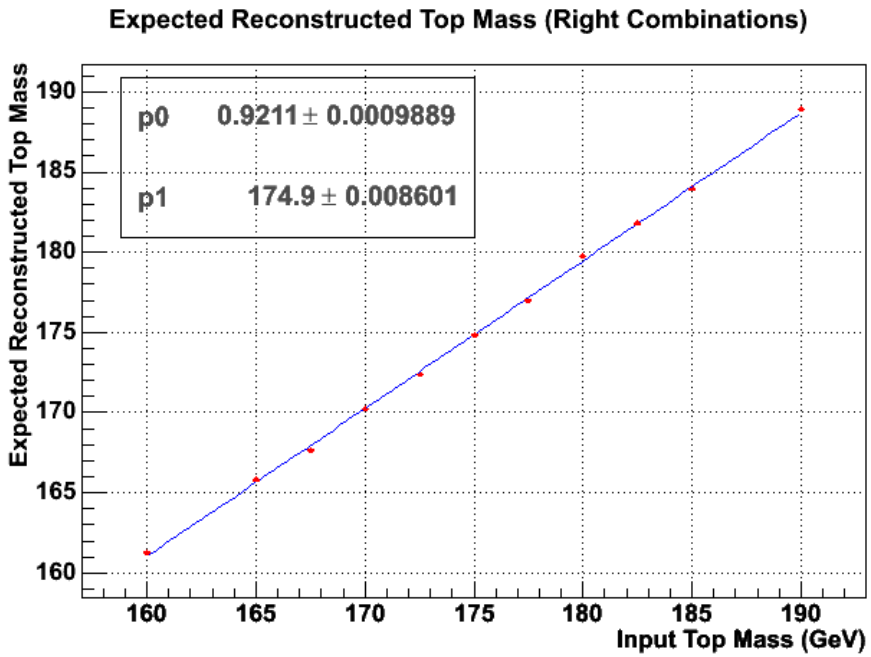


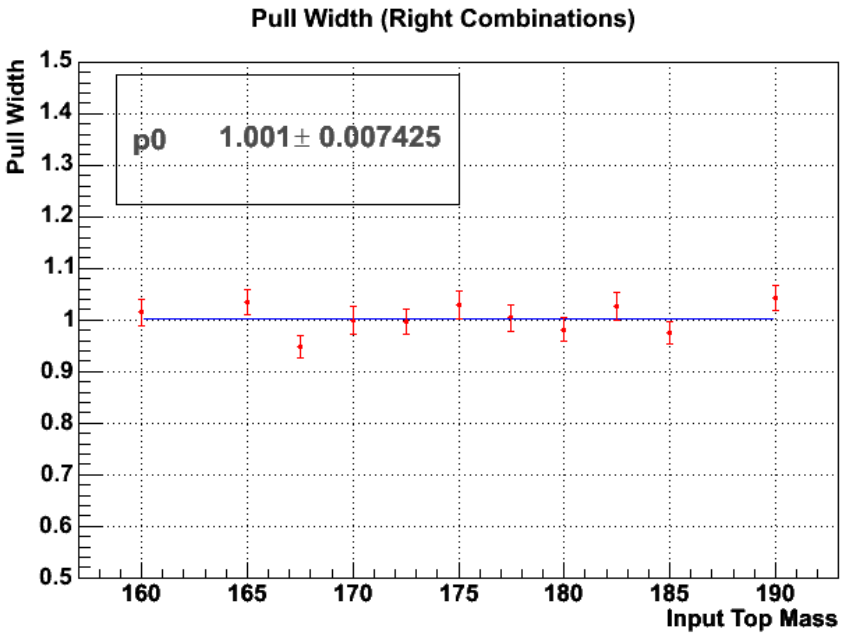
- input = 175GeV
- Nev = 200 (assuming 1.2fb-1)
- 50k scans

Pseudo Experiments with 1D Likelihood

Right Combination with signal samples

- 200 events/PE
- ~900 PEs



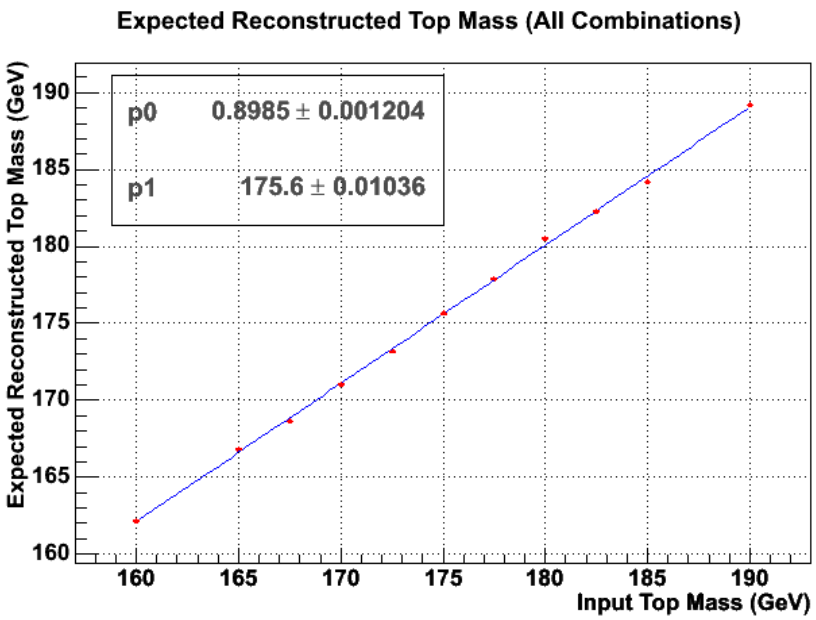


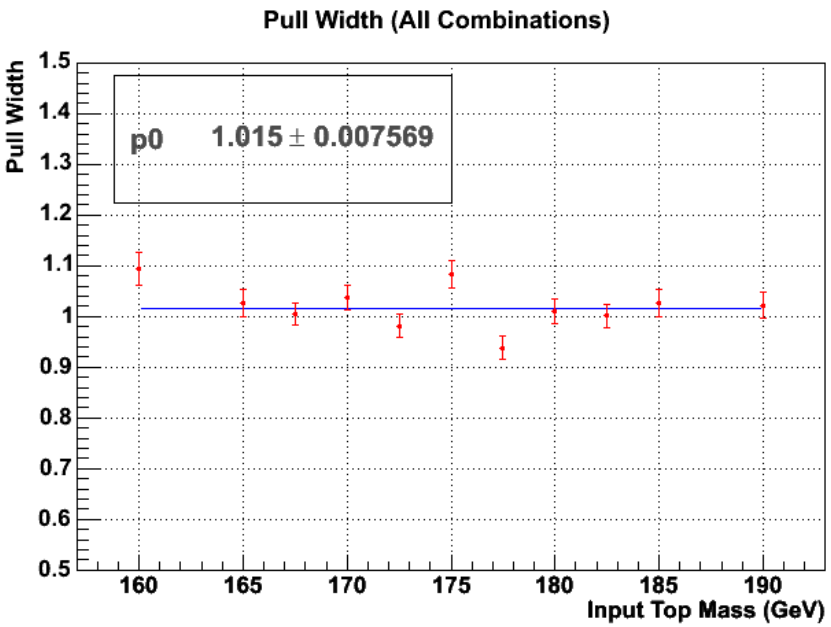
Pull Width is almost 1

Pseudo Experiments with 1D Likelihood

All Combinations with signal samples

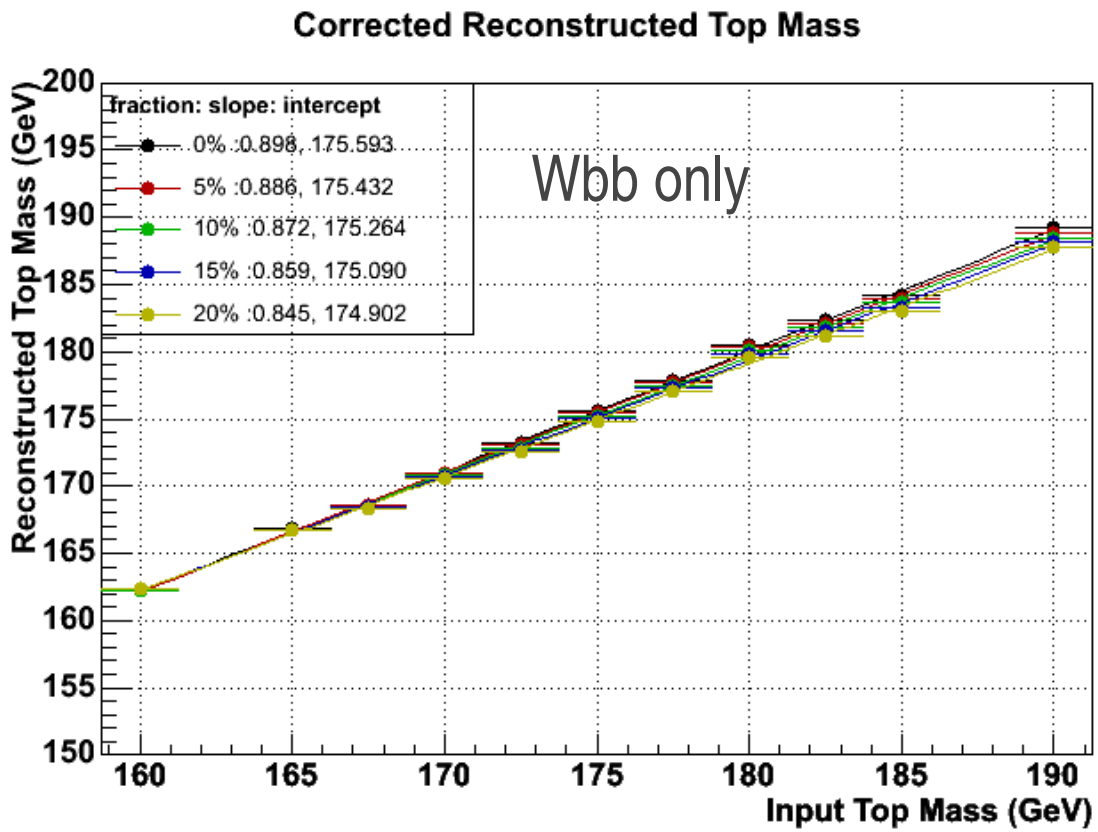
- 200 events/PE
- ~900 PEs





Background Effects

Preliminary check on background effects



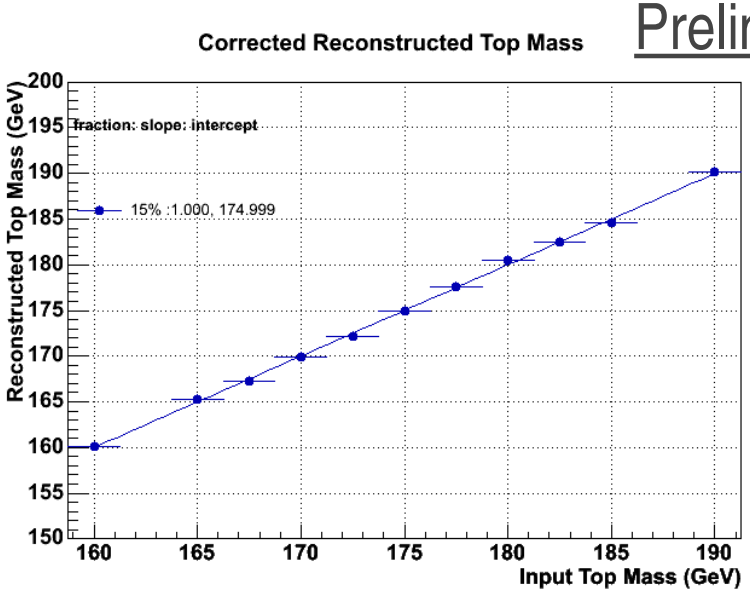
The slope is going down by increasing background fraction.
We are now processing other backgrounds

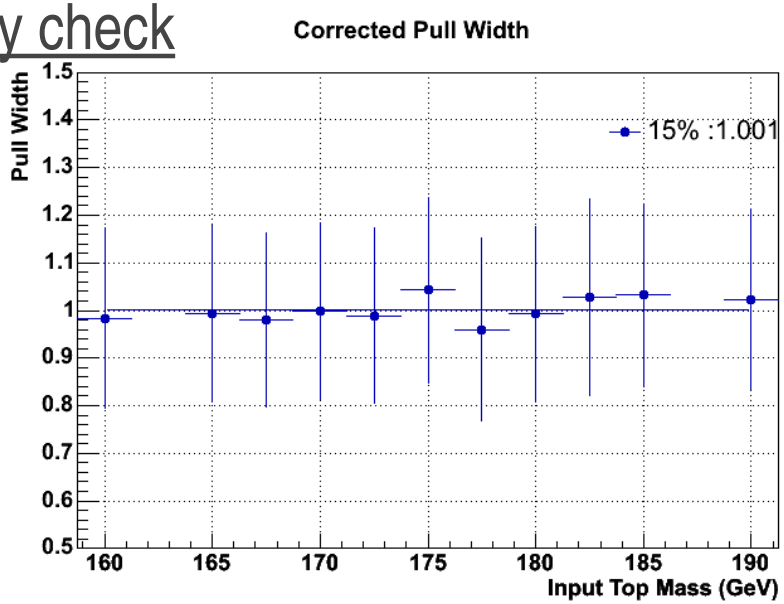
Sanity check with 1D Likelihood

Measured top mass and errors were corrected with slope and constant

- assume 15% background(Wbb only)
- Take slope 0.859 and constant 175.09
- Correct measured mass for each PE
- Correct bias of measured uncertainty with pull width including 15% background

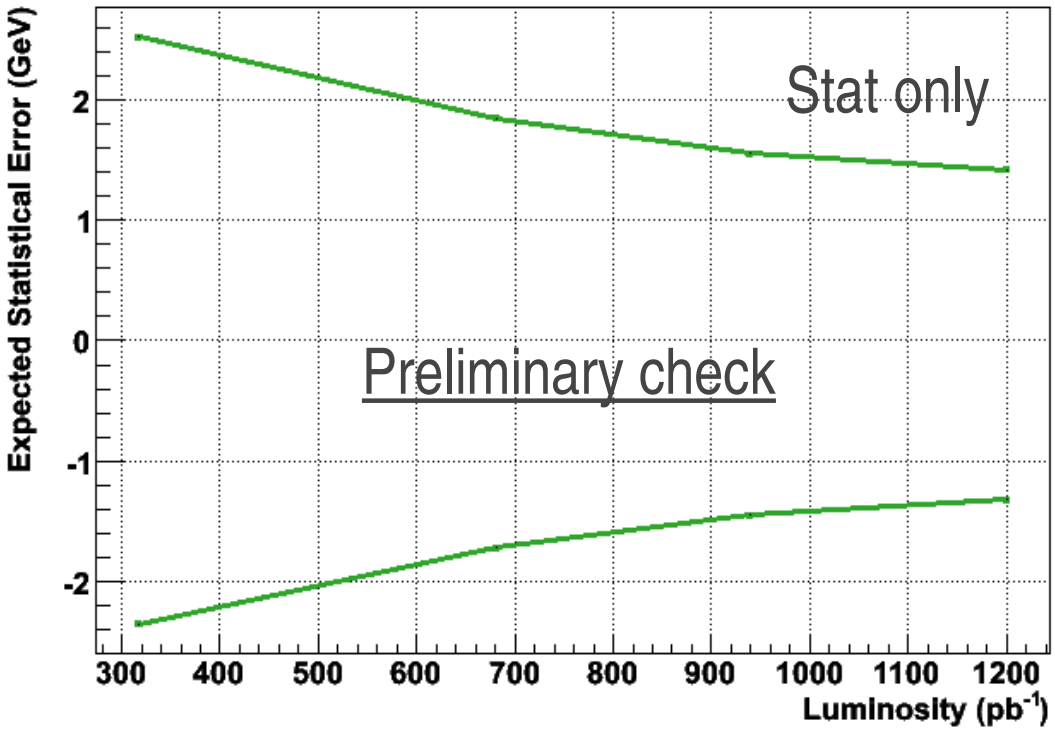
Preliminary check





Sensitivity Check

Rough estimation of sensitivity for 1.2 fb-1
(15% wbb background only)



~1.4 GeV@1.2fb-1

2D Likelihood

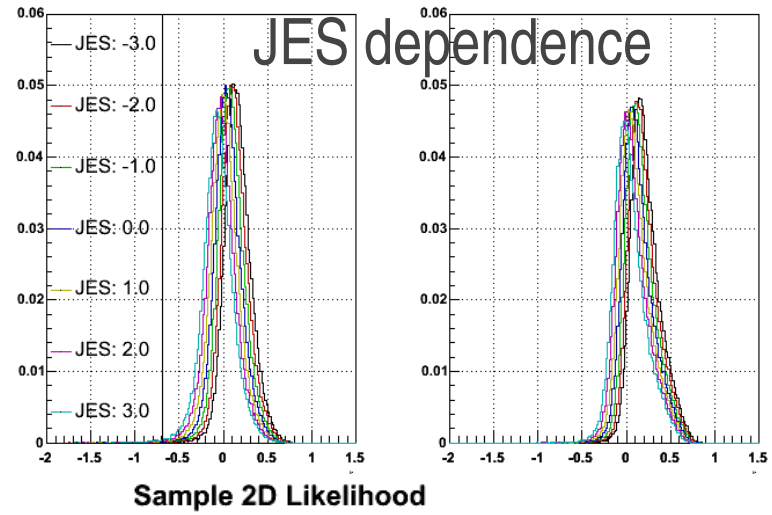
JES can be measured by hadronic W mass

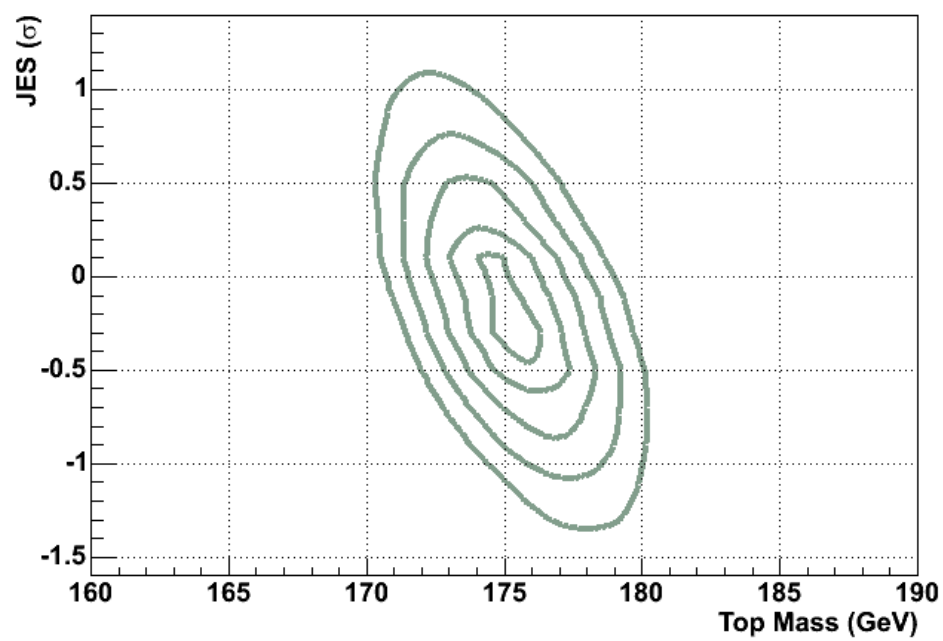
- Reconstruct Sw with TF depending on JES
- Decay Matrix constrains Sw

$$|D_{th}|^2 = \frac{g_w^4}{4}\frac{1}{2}\sum \frac{(t\cdot l)(b\cdot \nu)}{(\boxed{S_w} - M_W^2)^2 + M_W^2 \Gamma_W^2}$$

input

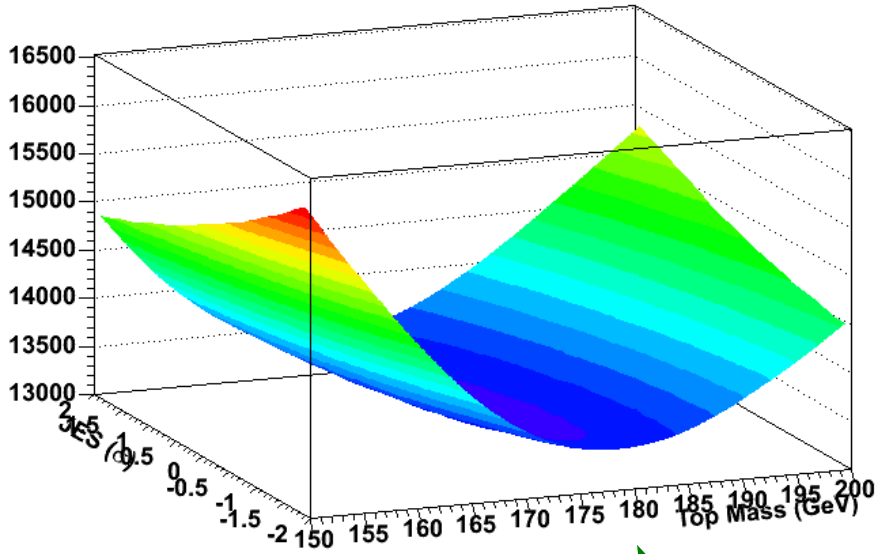
- Mtop and JES can be measured simultaneously by 2D Likelihood





Fitting 2D Likelihood

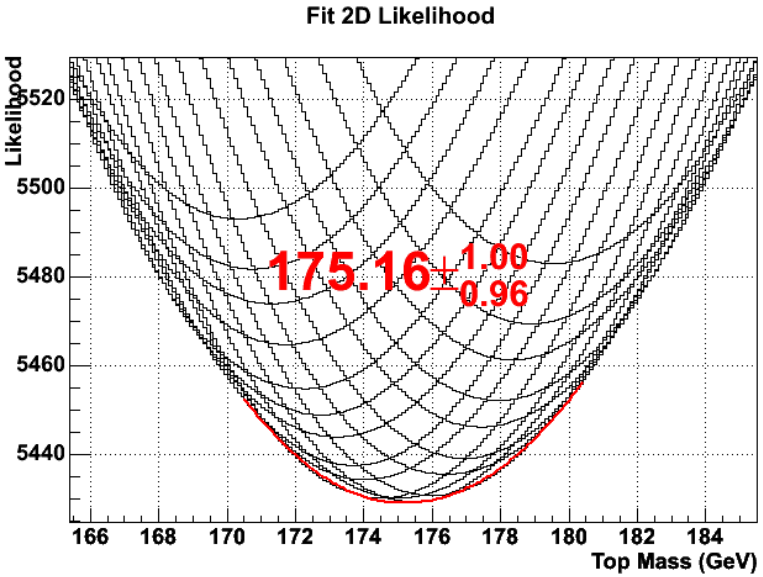
Typical 2D likelihood with right conbination in 1 PE



Fitting 2D Likelihood

- Project to x axis in 1D
- Fit contour of the projections with a quadratic function

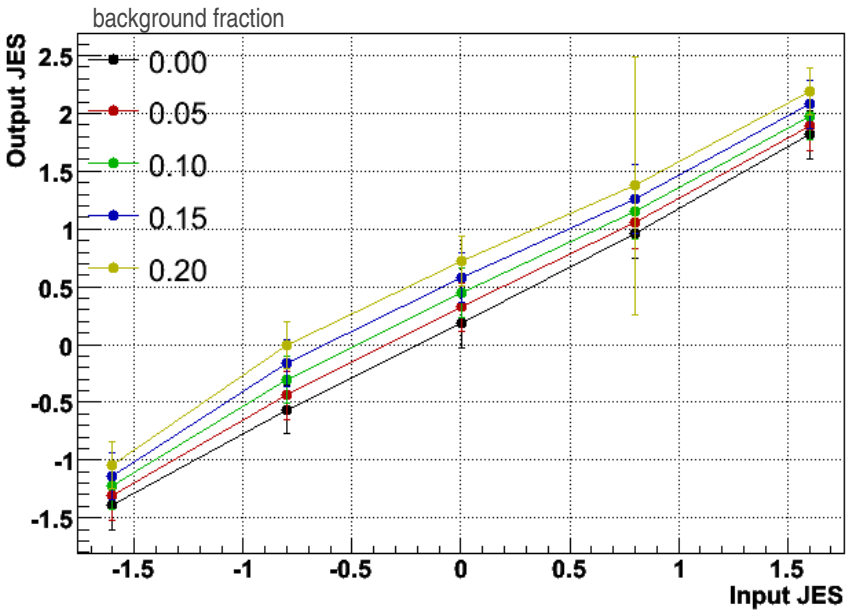
look from x axis side

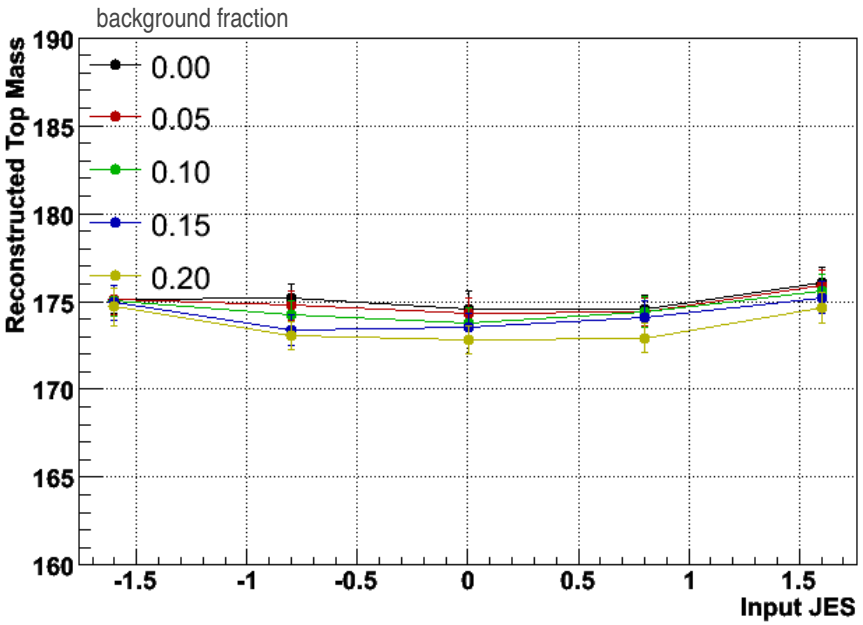


Input JES Dependences

Preliminary check of dependence on Input JES

- Input mass: 175 GeV
- Wbb background only
- Just one pseudo experiment with ~600 events





With 15% of Wbb background, a bias of delta JES measurement is approximately 0.5sigma

We are now processing more events and other background

Summary and Plan

- ✓Methodology check has been done with 1D likelihood.
  - ✓ Sensitivity is almost same as in the previous analysis from Gen5

- ✓2D Likelihood is ready to use
  - ✓ We need much more events to check in detail
  - ✓ More work will be done on signal samples:
    - ✗ ttop65, ttop70, ttop75, ttop80 and ttop85
  - ✓ Background samples to be examined:
    - ✗ Mistag
    - ✗ Wbb
    - ✗ Wcc
    - ✗ Wc
    - ✗ Single top
    - ✗ Non-W
    - ✗ Diboson