Top Mass Measurement in the Lepton + Jets Channel using a Dynamical Likelihood Method(DLM)

Taichi Kubo
Junji Naganoma
Kuni Kondo

Mtop and JES measurement

Event Likelihood Definition

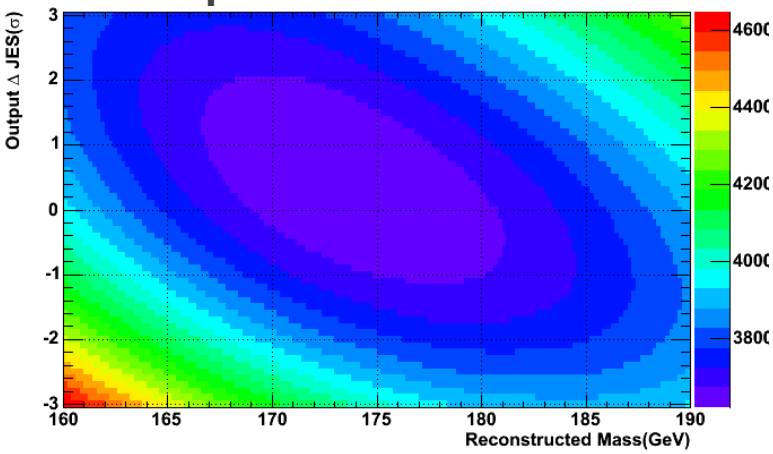
$$L_{ev}(M, \Delta JES; y_j) = N_j \int dx \frac{d\sigma}{d\Phi}(x; M) w(x, y_j; \Delta JES)$$

$$y_j' = (JES + (\Delta JES) * \sigma_{JES}) * E_j^{raw}; JES\ at\ L5$$

$$x: parton\ level\ quantity$$

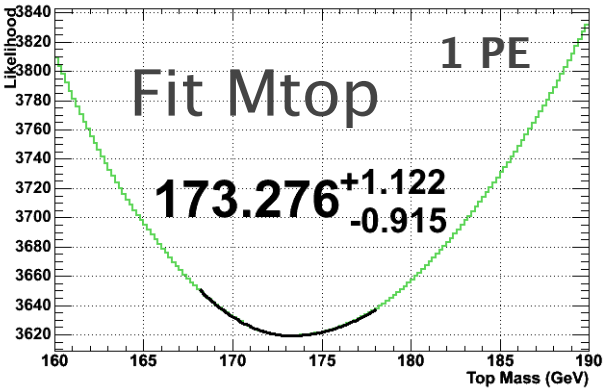
$$w: Transfer\ Function$$

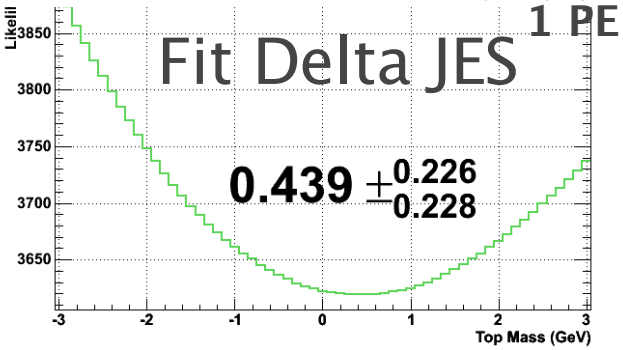
Example of Likelihood in a PE



Fitting Joint Likelihood Function

- Mtop
  - Search minimum likelihood in all JES range for each Mtop to fill 1D histogram
  - Fit it with asymmetric quadratic function
- JES
  - Search minimum value same as Mtop
  - Fit it with asymmetric quadratic function





Transfer Function & JES

- TF corrects Ej's to parton level quantities
- TF depends on JES

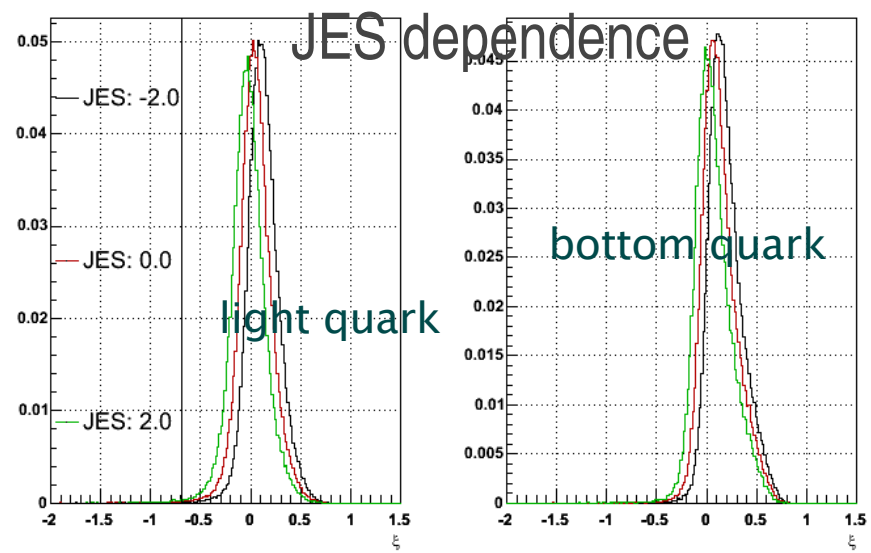
- JES can be measured by hadronic W mass
  - ➔ Reconstruct Sw (Invariant mass of W) with TF which depends on JES
  - ➔ Decay Matrix constrains Sw

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

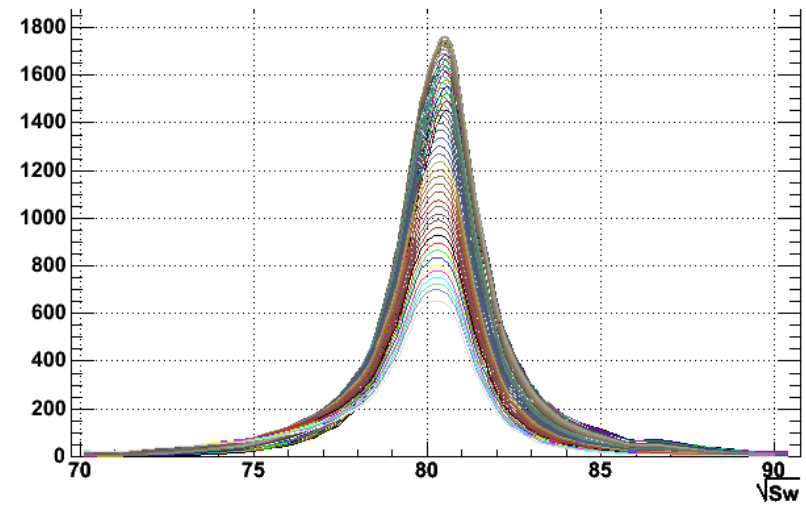
Reconstructed

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

$w(\xi, JES)$

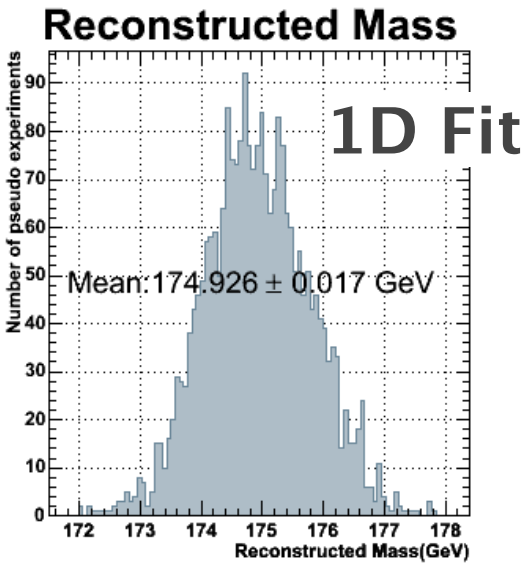


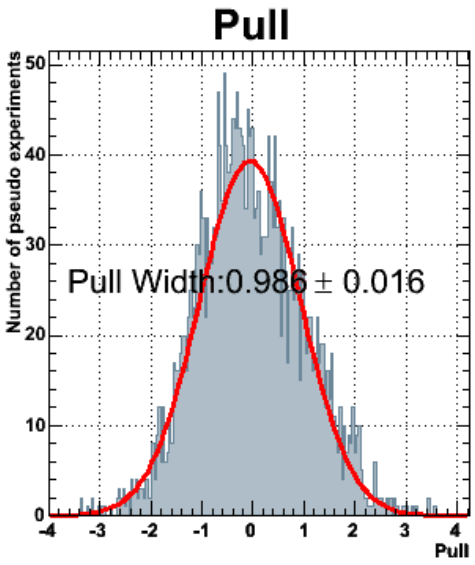
Reconstructed Sw with TF in one event



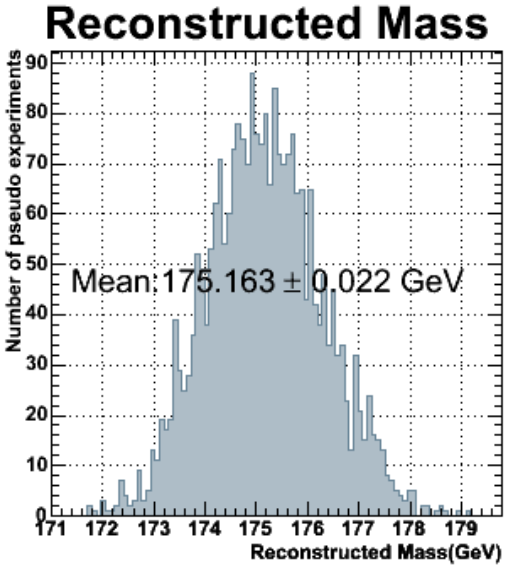
Reconstructed Top Mass

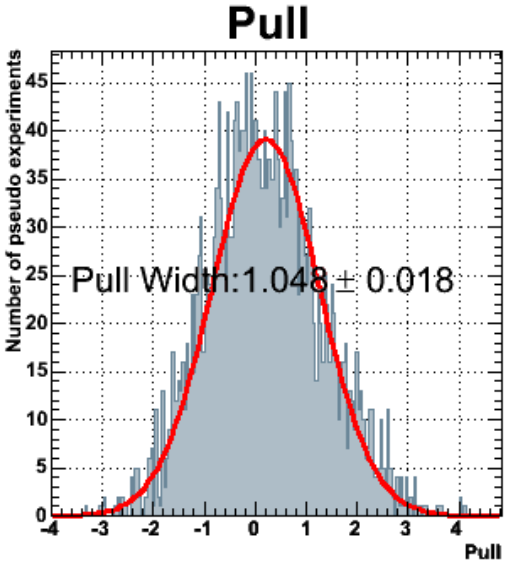
- Input Mtop = 175
- Input ΔJES = 0.0(L5 default)
- 2500 PEs
- 200 events/PE
  Correspond to 1.2fb-1
- Signal only
- Correct jets assignments





2D Fit

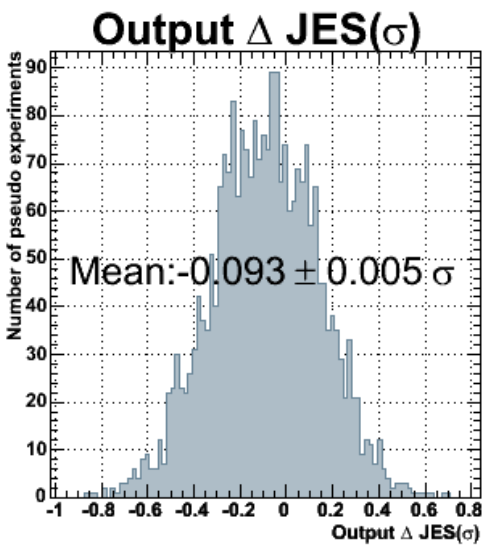


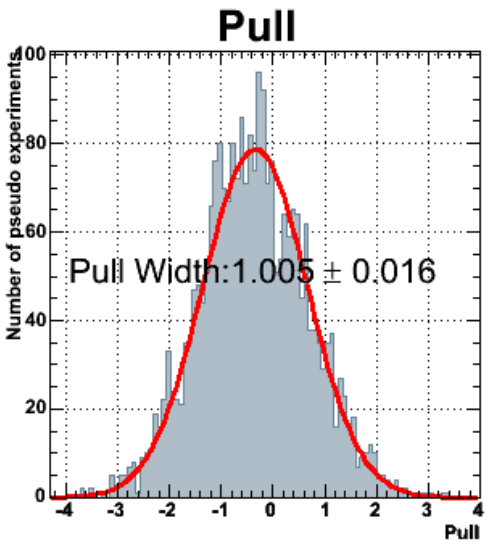


- Good Mtop reconstruction
- Good pull width

Output JES

- Input Mtop = 175
- Input ΔJES = 0.0
- 2500 PEs
- 200 events/PE
- Signal only
- Correct jets assignments

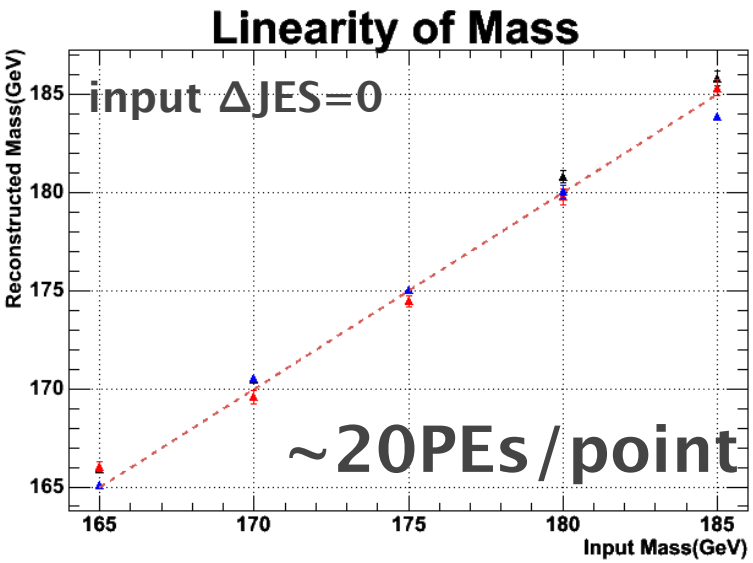


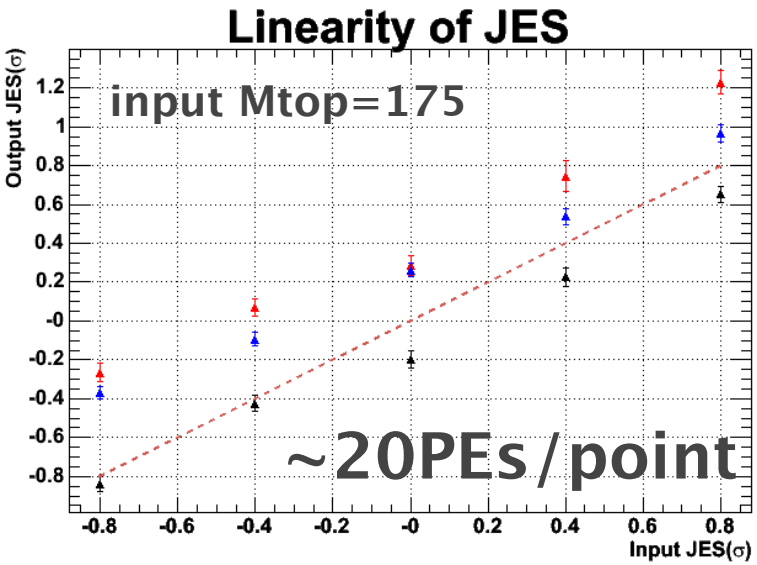


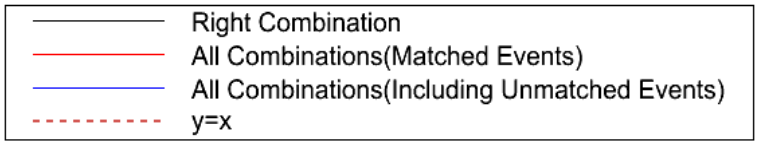
- Lower output JES
  - → TF should be corrected.
- Good pull width

Linearities of Reconstruction

- Signal only
- ~20 PEs
  We are processing more now
- 200 events/PE





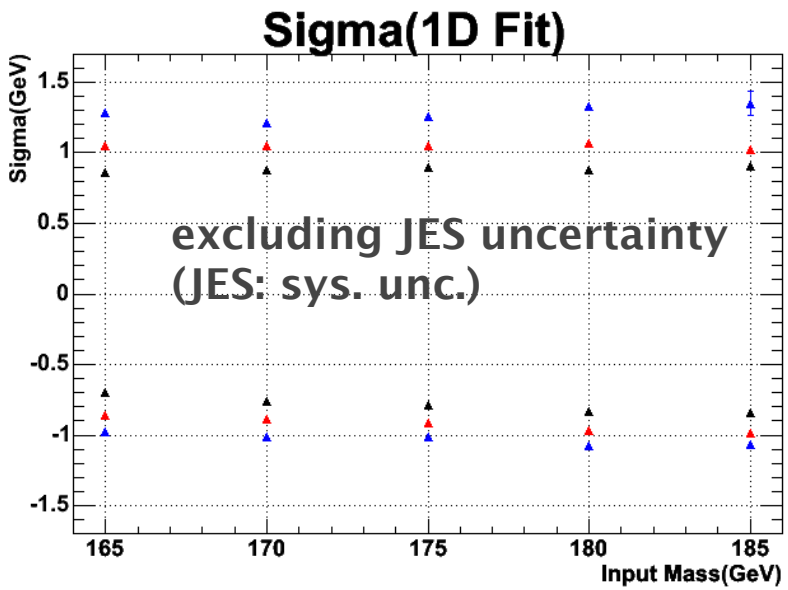


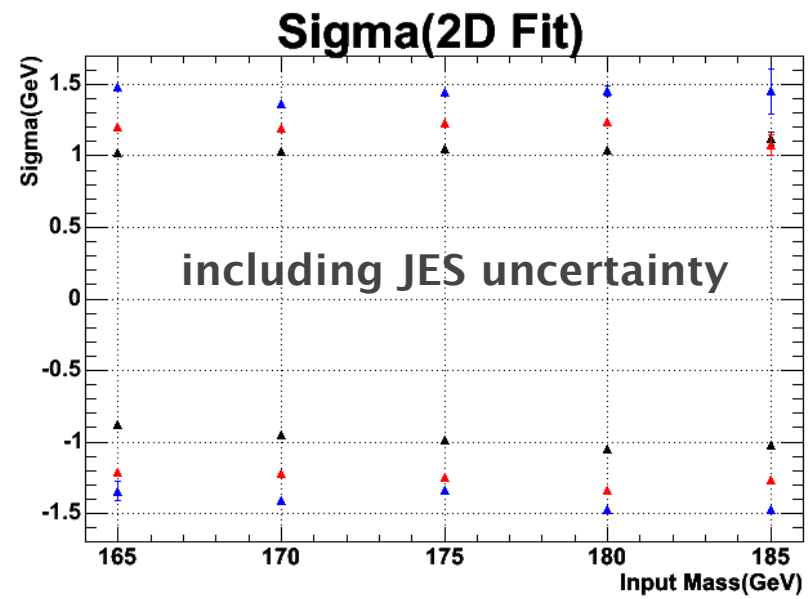
Discrepancy will be fixed by turning TF

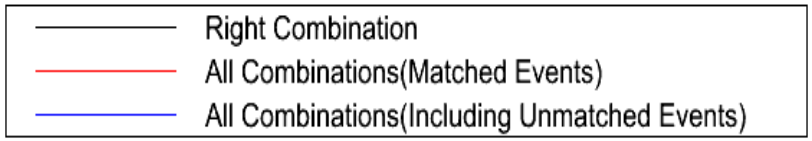
- Background effect will be added.
- Measured Mtop and JES are corrected by slopes.

Error of Reconstruction

- Signal only
- ~20 PEs
  We are processing more now
- 200 events/PE







~20PEs/point

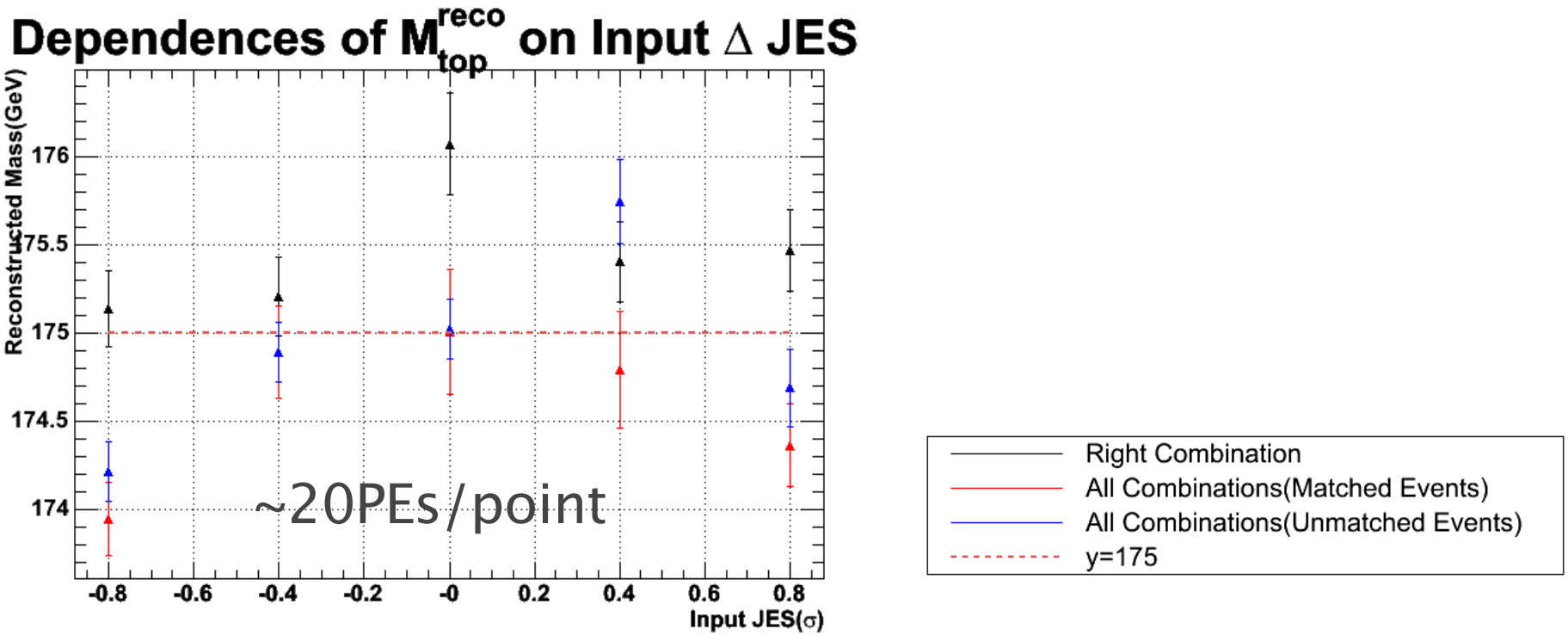
Expected Error is ~1.5 GeV without correction and background effect

Summary and Plan

- Pull widths in Mtop and JES are almost 1.
- More events(~10k) should be analyzed to check linearities of Mass and JES. (We need one hour*CPU to process one event.)

- PE will be done with background estimation for 2.0fb-1 .
- Blind samples will be processed.
- We wish to do Full Status Report as soon as processing ~10k events which include background is done.

Backup

Dependences of Mtop on JES

It is assumed that reconstructed Mtop doesn't depend on Input JES when Mtop is corrected by mapping.
Deferences of reconstructed Mtop on input JES will be taken into systematic uncertainty.