In-situ MET performance from W→μν decay

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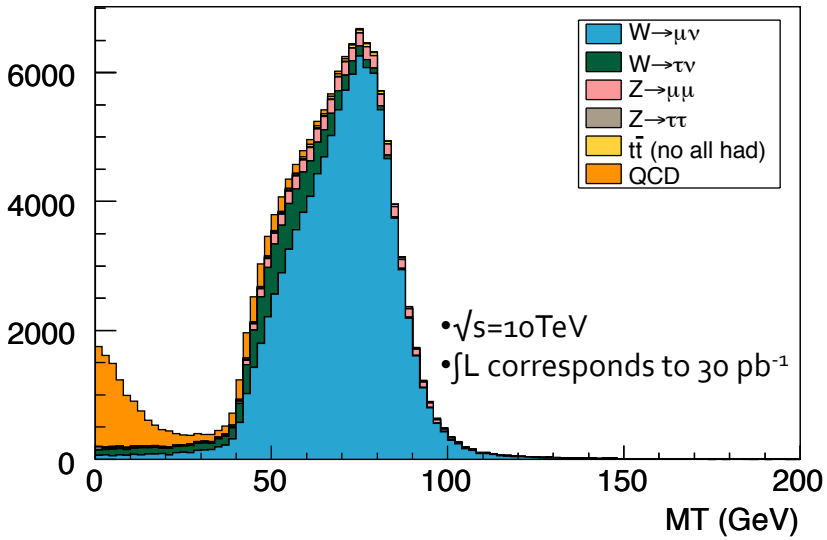
Further details in
http://indico.cern.ch/materialDisplay.py?contribId=6&materialId=slides&confId=52567

Motivation and Goal

Measure the MET scale(offset)/resolution and validate our MC descriptions by first data

Selection
1. EF_mu15i_loose
2. One isolated μ and no *e* with p_T > 20GeV/c
3. MET>20GeV, SumET>100GeV



- Use W's transverse mass
  - "Jacobian peak" is sensitive to MET scale.
  - "Spread distribution" indicates the size of MET resolution.
- Difficulties:
  - Backgrounds (W/Z, ttbar and heavy-favor QCD processes)
  - MET scale and resolution are correlated. Visible hadronic activities (SumET) are lower than truth (visible SumET scale), which results in Met offset.

Method

MET resolution is described as

$$\sigma(E_x^{miss}) = \alpha \cdot \Sigma E_T^{calo} \oplus \sigma(\mu \text{ inefficiency})$$

stochastic effect

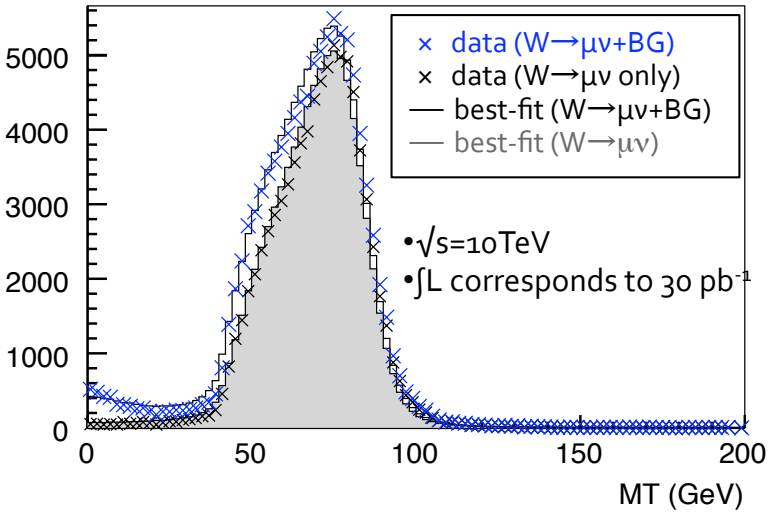
$\Sigma E_T^{calo} = \beta \Sigma E_t^{truth}$ (E-loss in ID material)

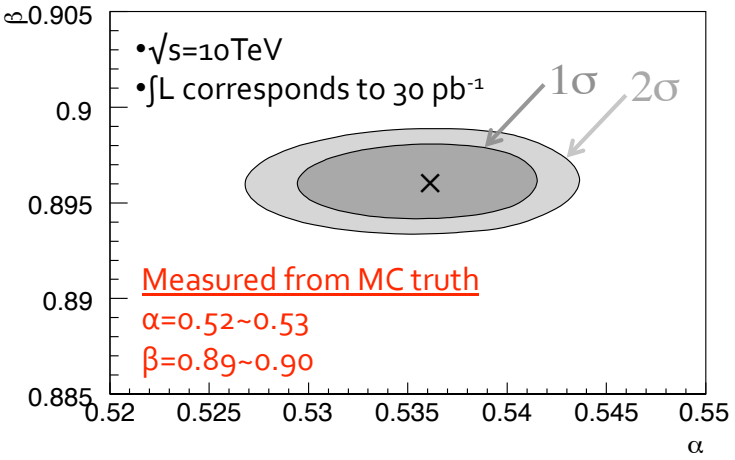
Perform Maximum likelihood fit with "MT-SumET" distribution

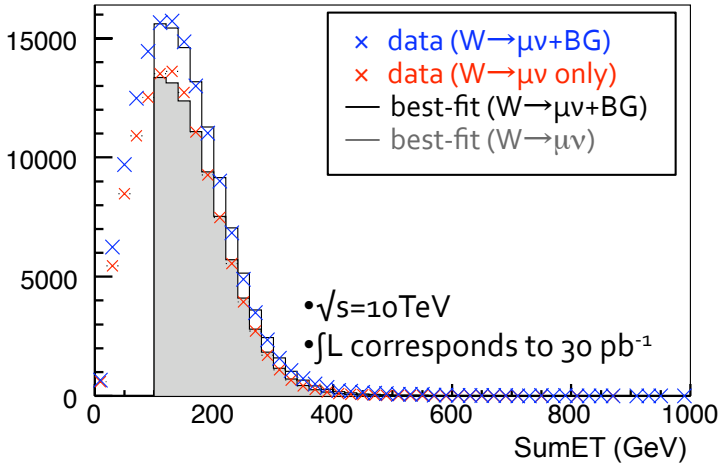
- MC templates of signal/BG are fitted to data
  - Templates with various sets of stochastic term coefficient (α) and visible SumET scale (β), incorporating muon rec. efficiencies.
- Use shape information only
  - 5 fitting parameters: α, β and W/Z, ttbar and QCD fractions (sum of fractions is set to be 1, DoF=4)
    - "W/Z BG"/"W signal" ratio is predictable.
    - Distinction in "MET-SumET" between W/Z and ttbar/QCD.
- Advantages:
  - Can unfold the correlation between MET scale and resolution by fitting α and β simultaneously.
  - Can obtain a general description of MET performance
    → predictions of MET performances for various event topologies.

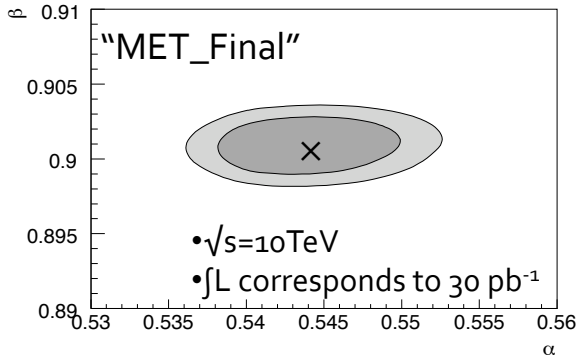
Benchmark analysis

Result with "RefFinal": Works fine!!









Also works well to evaluate scale/resolution of "MET_Final" and more primitive algorithms.

Discussion

- What' the systematic uncertainties in MC templates?
  - Primary source could be boson pT.
    - One idea is to tune/reweight MC templates from Z(→μμ) pT measurement.
  - UE model in generators
- Extrapolate the measured result to higher (lower) SumET region.
  - Cross check with measurements of minbias and W's in ttbar (Manouk's slide) will help for our correct understanding.
- This works properly under pileup situation?
  - This is just a future plan. (modify fitting templates with additional smearing effect?)