Absolute Jet Energy Scale using MPF, Preparations for Data

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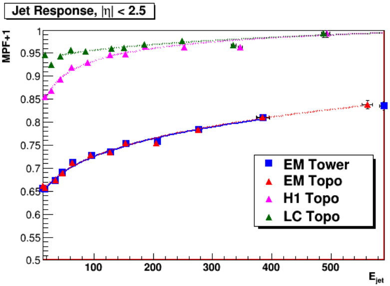
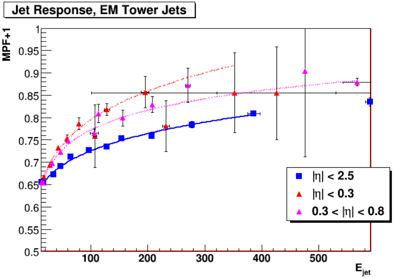
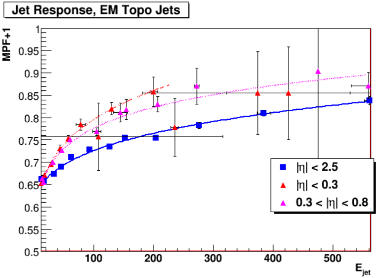
MPF Response measurements

Response measurement for the jet configurations for early data
Photon: $E_T > 10$ GeV, $|\eta| < 2.5$
Jet: $E_T > 7$ GeV, $|\eta| < 2.5$



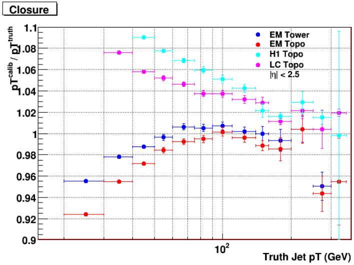
Compare the response in the eta bins. Conclusions limited by statistics.





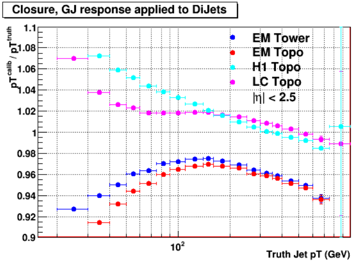
Performance - Closure Tests

Testing in Gamma-Jets



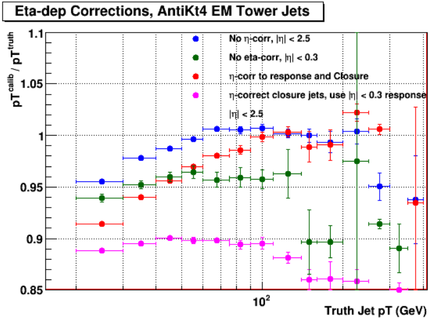
- EM scale jets do well, recall still need a showering correction
- H1 does not have consistent energy scale between jet and rest of calorimeter (E_T^{miss}), thus, not suitable for MPF
- LC does not seem to work

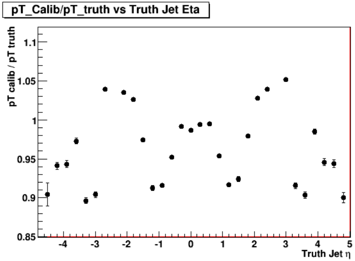
Testing in Di-Jets



- Up to 3.5% difference between γ-jet and di-jets
- Difference expected from theory

Eta-dependent corrections

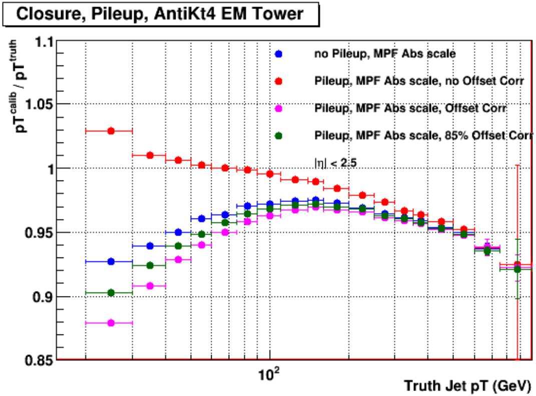




- No eta-corrections, $|\eta| < 2.5$
- No eta-corrections, $|\eta| < 0.3$
- Derive the response correction, and do the closure tests with eta-corrected jets.
- Apply the response correction derived in region $|\eta| < 0.3$, the reference region, to all eta-corrected jets

- Will try to define an eta-dependent correction, based on relative response
- Expect to be be applied after absolute scale

Pile-up



- Pile up samples with no correction gives response > 1, adding in extra energy to jet which is not balanced by photon
- We see that the offset correction approaches the response we see without pile-up

Systematics

- Largest systematic is deriving energy scale in γ+jet events, and applying to Di-Jets. Up to 3.5%
- Looked at loosening the photon isolation cuts, no significant effect
- Varied the response correction by the errors on the Wigmans fit parameterization, closure plots changed by 1% in samples with adequate statisitcs
- Inserted an additional 5 GeV of E_T^{miss} in constant direction, not correlated with jet or photon direction. Try to mimic extraeous E_T^{miss} from detector effects. Changes to response correction function $< 0.2\%$. More study planned.

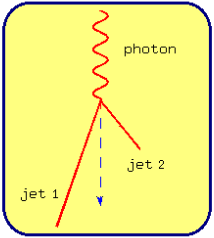
Backup

Introduction - $\not{E}_T$ Projection

- developed first for DØ experiment
- in words: sum up all $\overrightarrow{E}_T$ outside of γ and balance against γ

definition: $\not{E}_T$ projection

$$R_j(E) = 1 + \frac{\not{E}_T \cdot \hat{n}_\gamma}{p_T^\gamma} = \frac{\sum' \overrightarrow{E}_T \cdot \hat{n}_\gamma}{p_T^\gamma}$$



$\sum' \rightarrow$ sum over $\overrightarrow{E}_T$ outside of p_T^γ system.

Pros and Cons

- sensitive to ISR/FSR (more to ISR) - reduce with a $\Delta\phi(\text{jet}, \gamma)$ cut
- not sensitive to UE (to 1^{st} order) since UE is ϕ-symmetric and terms cancel in the sum
- (almost) independent of jet algorithm (therefore of cone correction, seed thresholds, etc.)

Thoughts on p_T balanced η-intercalibration

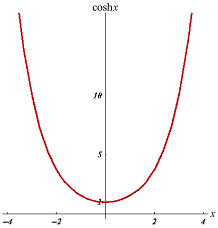
At particle level the balance equation is

$$E_T^j = E_T^r$$

The condition for η correction is to set

$$E_T^j \cdot R(E_T^j \cosh\eta_j; \eta_j) = E_T^r \cdot R(E_T^r \cosh\eta_r; \eta_r)$$

$$\frac{R(E_T^j \cosh\eta_j; \eta_j)}{R(E_T^r \cosh\eta_r; \eta_r)} = 1$$

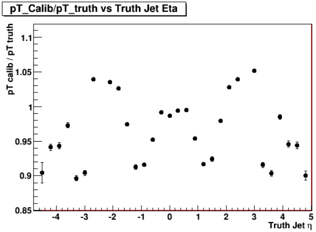


- In the reference region $\cosh\eta \sim 1$, $R(E^r) = R(E_T^r)$
- For forward jets, neglecting differences in dead material across η, the η-correction demands that

$$\frac{R(\cosh\eta_j E_T^j)}{R(E_T^j)} \neq 1$$

- For $\eta = 3$, $\cosh\eta \sim 10$!
- Recall $R\alpha \log(E)$

Next Steps



- The structure of the calorimeters is clearly seen
- The η-dependence is mostly due to different response in different sub-detectors
- Better to apply an η-correction after absolute corrections