γ/Z + jet $\not{E}_T$-Projection

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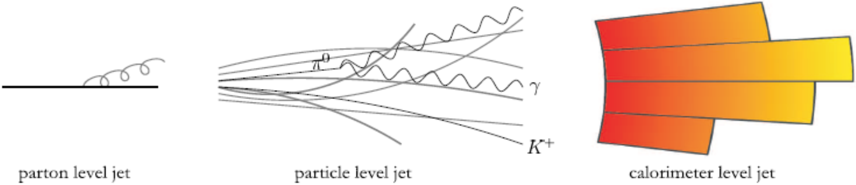
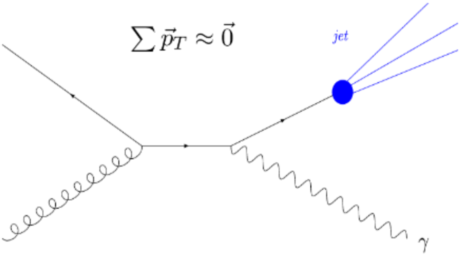
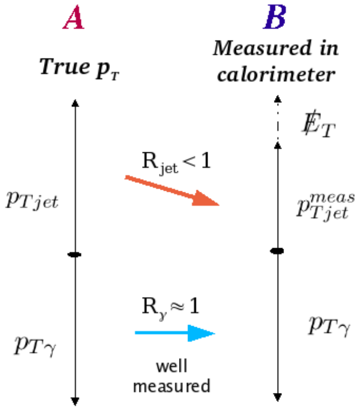
Reminder: motivation



- the jet response calibration takes a calorimeter-level jet back to a particle-level jet
  - given some calorimeter signal, what was the energy of the incident particle jet?
- other effects also contribute to the overall energy scale: out of cone corrections, showering correction, noise offset

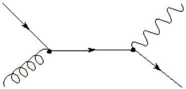




(1) $\vec{p}_{Tjet}^{\,meas} = R_{jet}\vec{p}_{Tjet} \approx -R_{jet}\vec{p_T}_{\gamma}$

(2) $\vec{p}_{Tjet}^{\,meas} + \vec{p_T}_{\gamma} + \vec{\not{E}}_T = \vec{0}$

Missing E_T Projection Fraction



In an ideal calorimeter, the γ and jet from prompt-γ production processes satisfy the equation

$$\overrightarrow{E}_T^{\gamma} + \overrightarrow{E}_T^{jet} = 0. \tag{1}$$

In a real (Atlas) calorimeter, the hadronic energy is not measured as well as the electromagnetic energy, and so the modified equation is

$$R_{em}\overrightarrow{E}_T^{\gamma} + R_{jet}\overrightarrow{E}_T^{jet} = -\not{E}_T \tag{2}$$

Anticipating that the EM scale can be measured well enough with Z, J/Ψ, and π^0 samples that $R_{em} \approx 1$, this reduces to

$$E_T^{\gamma} + R_{jet}\overrightarrow{E}_T^{jet} \cdot \hat{n}_{\gamma} = -\hat{n}_{\gamma} \cdot \not{E}_T$$

MPF

$$R_{jet} = 1 + MPF = 1 + \frac{\hat{n}_\gamma \cdot \overrightarrow{\not{E}}_T}{E_T^\gamma} \quad (3)$$

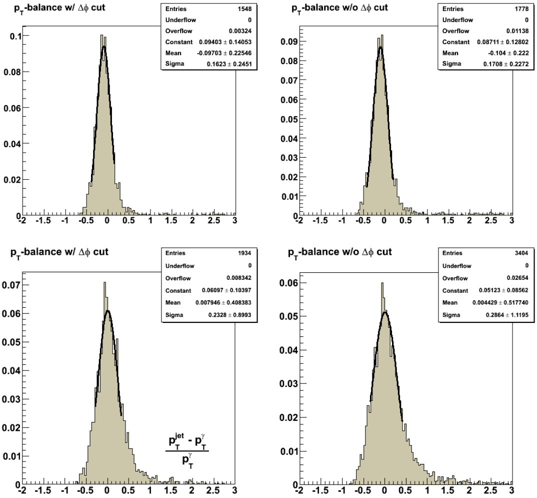
Some things to note:

- $\overrightarrow{\not{E}}_T$ independant of jet algorithm, underlying event, and (somewhat) FSR
- method is sensitive to falling γ cross-section in E_T/jet resolution (low energy bias)
  - use $E^{'} = cosh(\eta_{jet})E_T^\gamma$ instead of E_T^{jet}
- cut on $\Delta\phi$ lessens effects of ISR/FSR

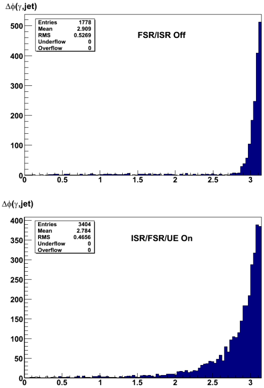
see note by B. Kehoe ATL-COM-PHYS-2005-050

ISR/FSR

- final state radiation may add jets to the event topology
  - problem: assume that $\vec{\not{E}}_T$ only from imbalance of γ and jet
  - if 2nd jet $<(>)90^\circ$ from 1st jet, response is under(over)-estimated
- initial state radiation skews p_T balance



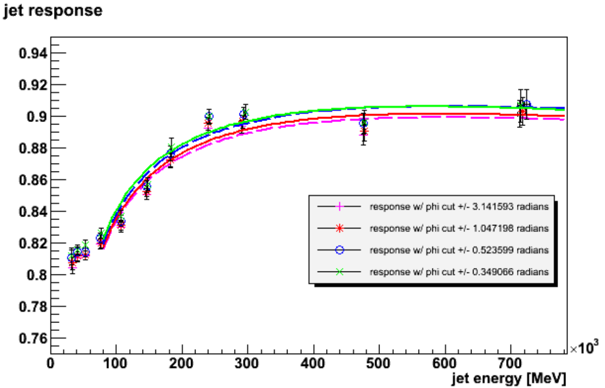
ISR/FSR turned off (top row), Rome data (bottom row)



ISR/FSR II: $\Delta\phi(\text{jet},\gamma)$ Cuts

try to negate effects of ISR/FSR by imposing strict $\Delta\phi$ cuts

- guarantees that γ and jet are back-to-back, so p_T balance $\simeq$ holds



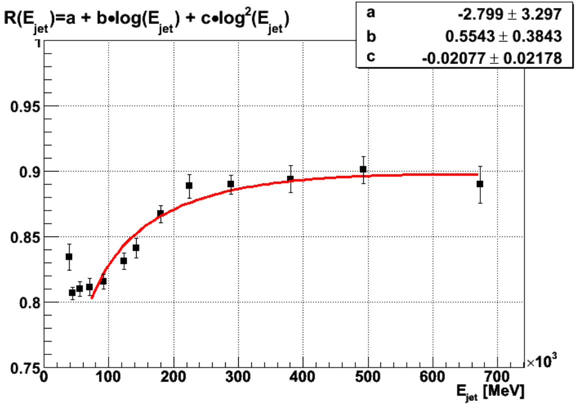
ISR/FSR effects

- about a 2% shift in response between no $\Delta\phi$ cut, $\Delta\phi > 2.7$
- low-E_T bias due to convolution of jet reconstruction threshold/resolution

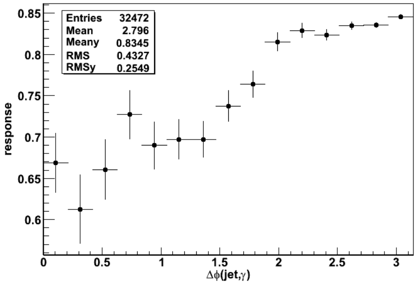
MPF

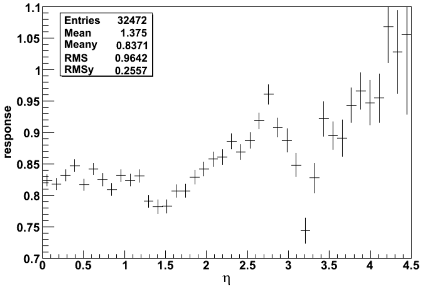
algorithm

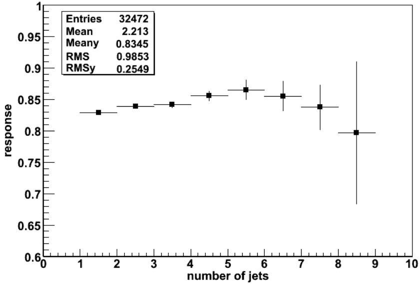
- identify leading γ w/ isolation $E_T < 0.15$, isEM % 0x7ff $= 0$
- match leading jet in $\Delta\phi > 2.7$ window
- bin R_{jet}, E_{jet} in E'



MPF







notice

- weak dependance on number of jets
- η dips same as reported by Kehoe, Paige
- relatively constant for $\Delta\phi \gtrsim 2.2$

Status/Future Plans

Conclusions:

- verified qualitatively the results presented by Kehoe et al, at Rome workshop
- jury still out on quantitative differences: H1-calibration?
- $\not{E}_T$ projection seems to be a good method of in-situ calibration, with ample experience at $D\emptyset$

Future Work:

- currently concentrating on later running conditions (high luminosity): how does pileup affect the jet energy scale?
- redo analysis @ EM scale to settle differences noted above