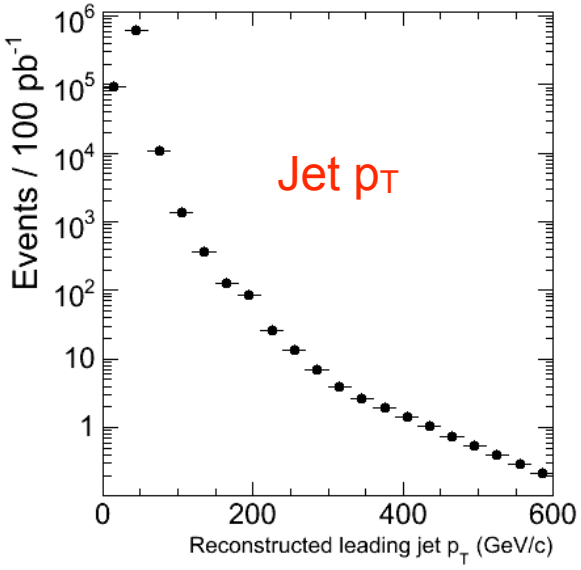
Z→ee + jet Analysis with Summer08 FullSim Sample

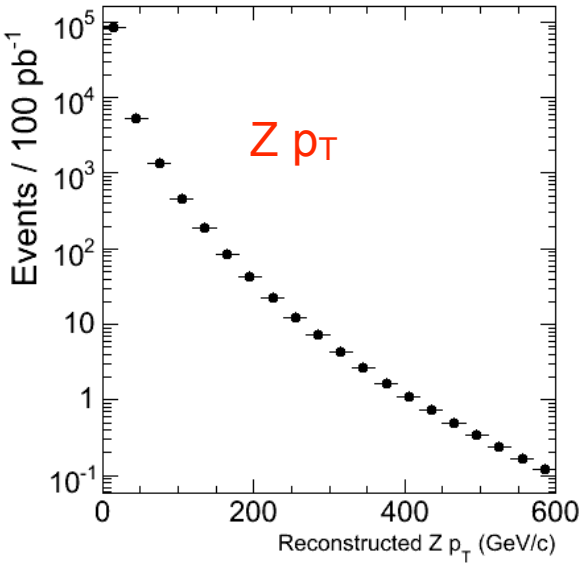
Robert Harris

Kalanand Mishra

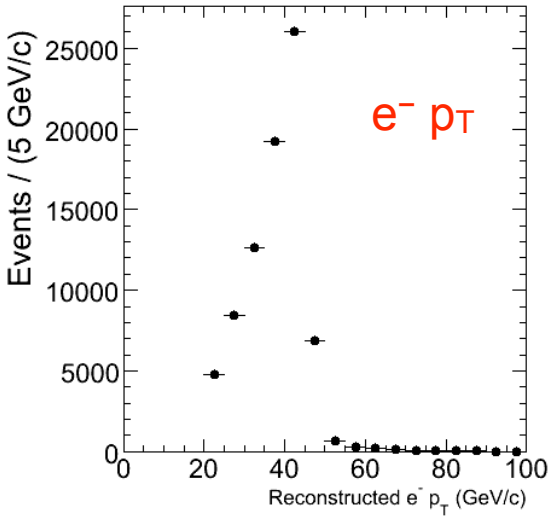
Fermilab

p_T spectra of Z, jet, and electron





Scaled to 100 pb^{-1} integrated luminosity

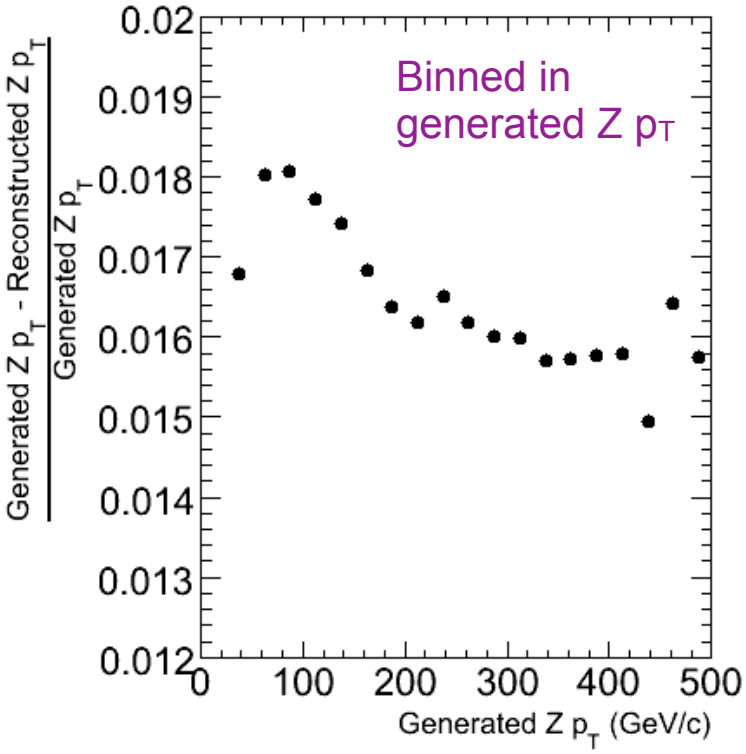


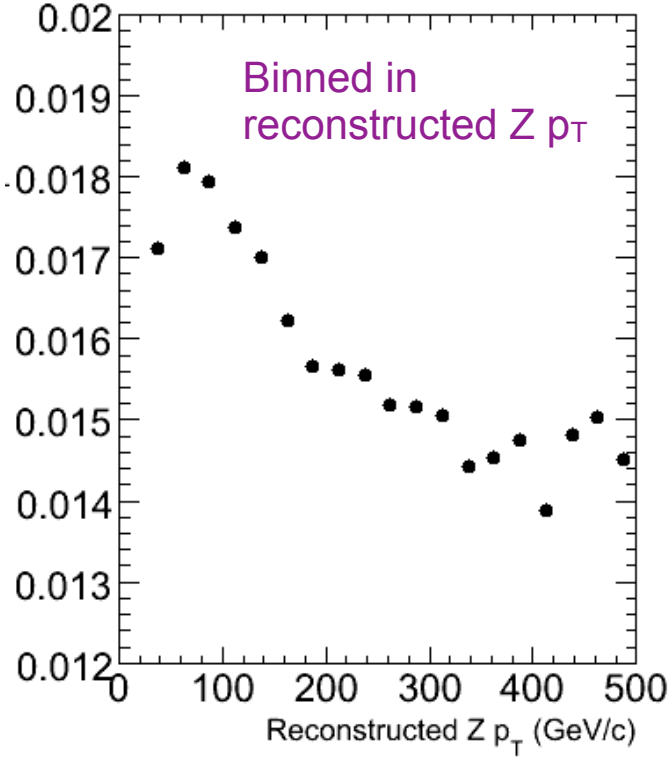
Event Selection Summary

- Lead-jet in the central region: $|\eta_{Jet}| < 1.3$
- Z & jet back-to-back: $|\phi_Z - \phi_{Jet} - \pi| < 0.2$
- $p_T^{SecondJet} / p_T^{Z} < 0.2$
- Electron: super cluster matched to a track, $p_T > 20$ GeV/c
- Electron: $|\eta| < 1.4442$ OR $1.56 < |\eta| < 2.5$

Changed from $p_T^{SecondJet}/p_T^{LeadJet}$. More on this in a later slide.

Bias in the Z p_T reconstruction

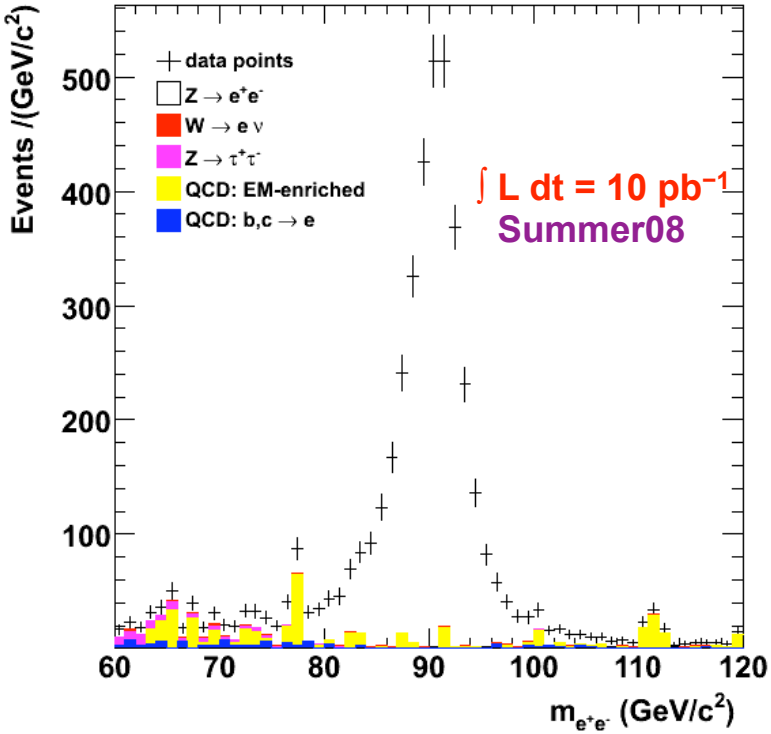




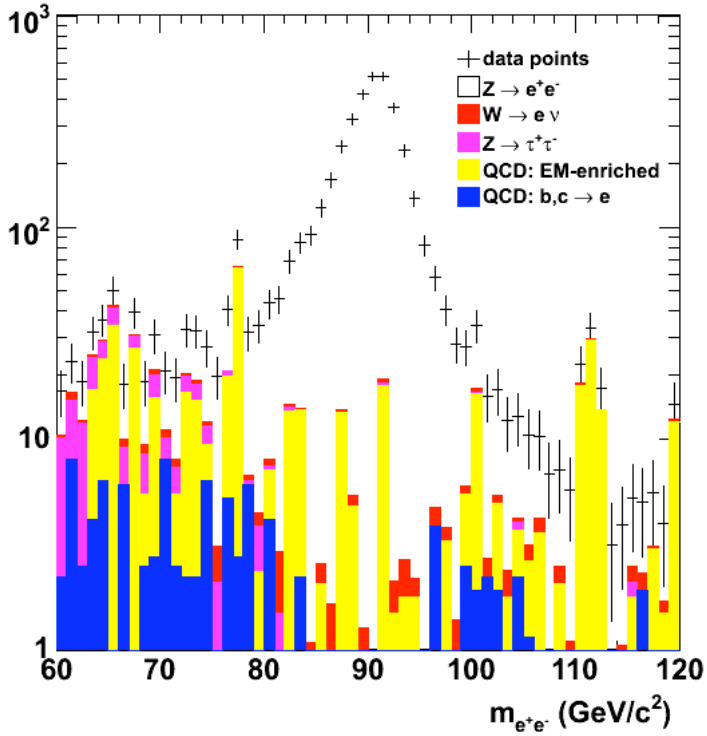
(Generated − Reconstructed)/Generated Z p_T distribution as a function of generated p_T and also as a function of reconstructed p_T.

The reconstructed p_T is underestimated by about 1.5 − 1.8 %. This is a slight improvement over the CSA07 sample.

Z signal purity from Summer08 $Z \rightarrow e^+e^-$ sample



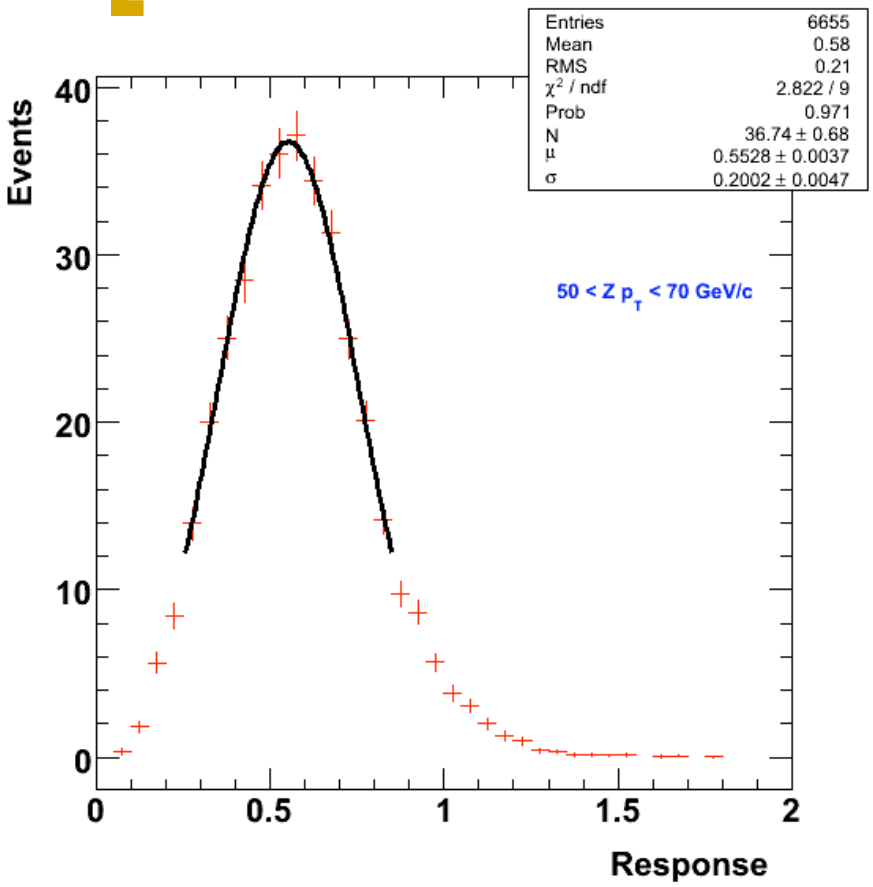
Linear scale

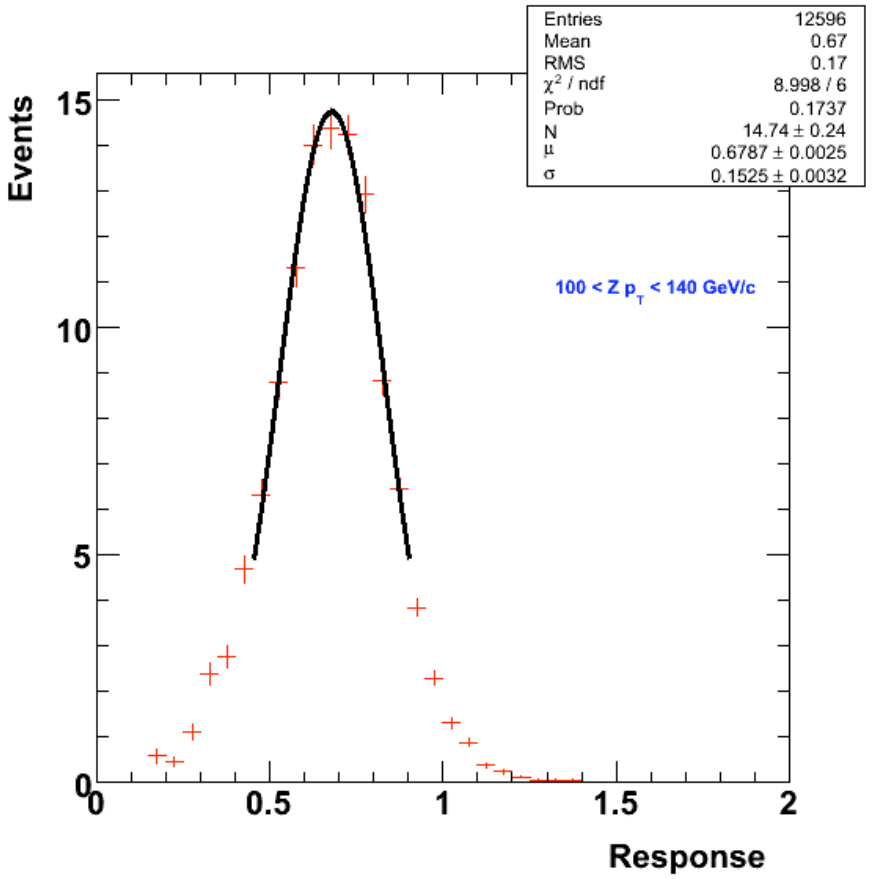


Logarithmic scale

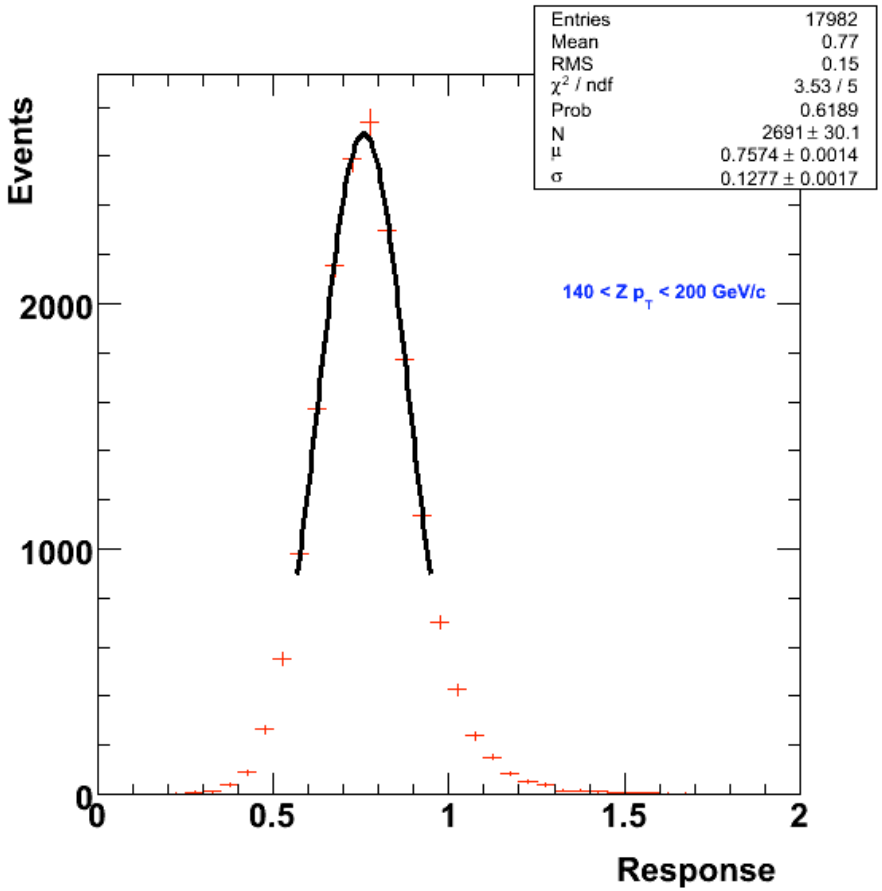
- Dielectron invariant mass for $e^{\pm}$ candidates passing our selection criteria.
- Signal purity within 3σ of the peak = 96.5 %.

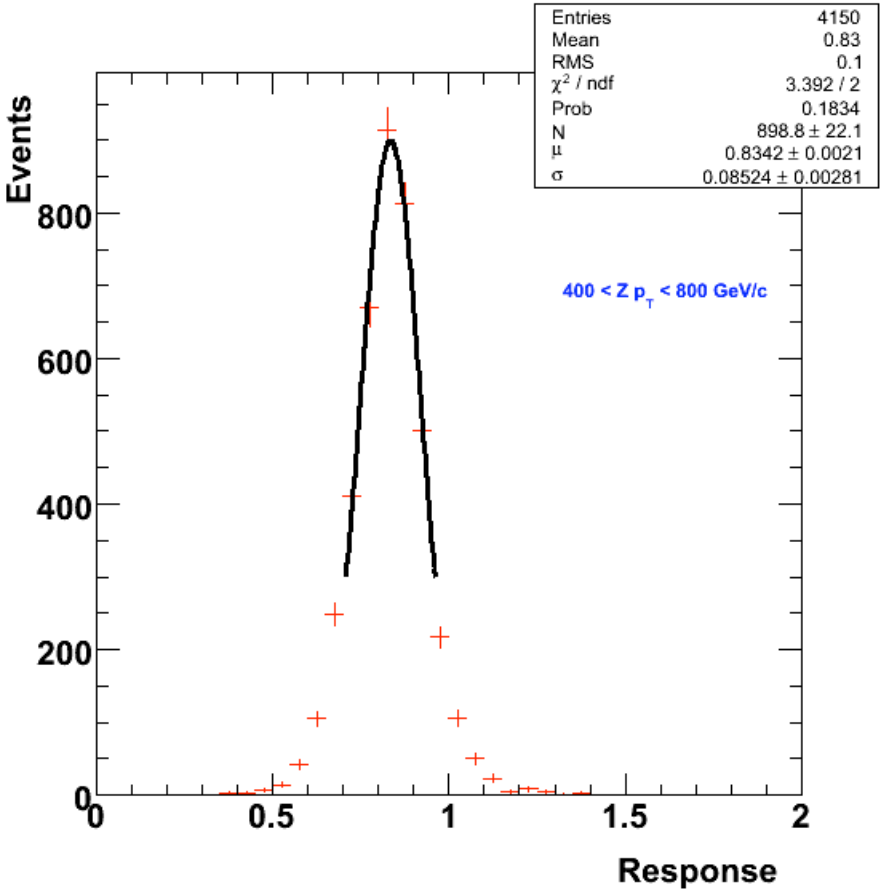
Jet response in specific reference p_T bins – I



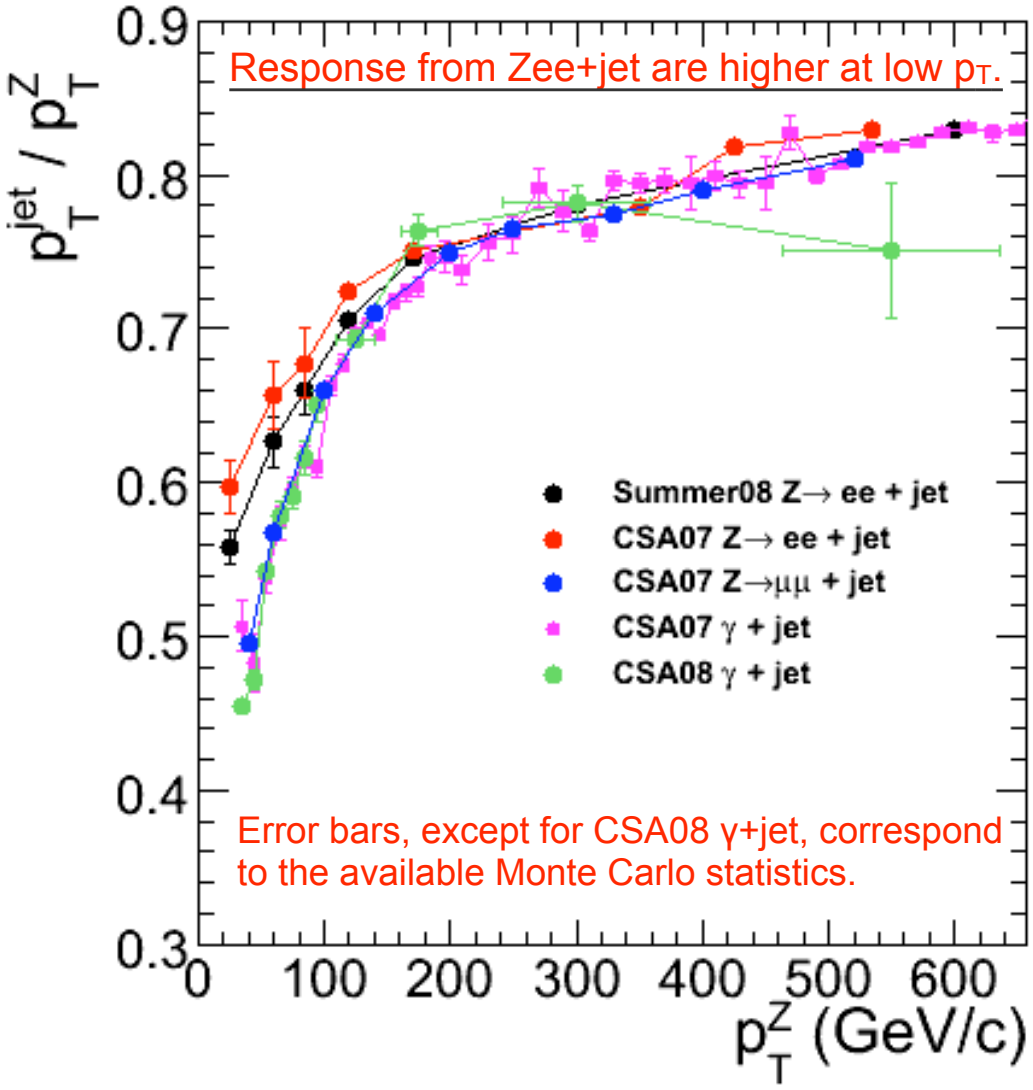


Jet response in specific reference p_T bins – II





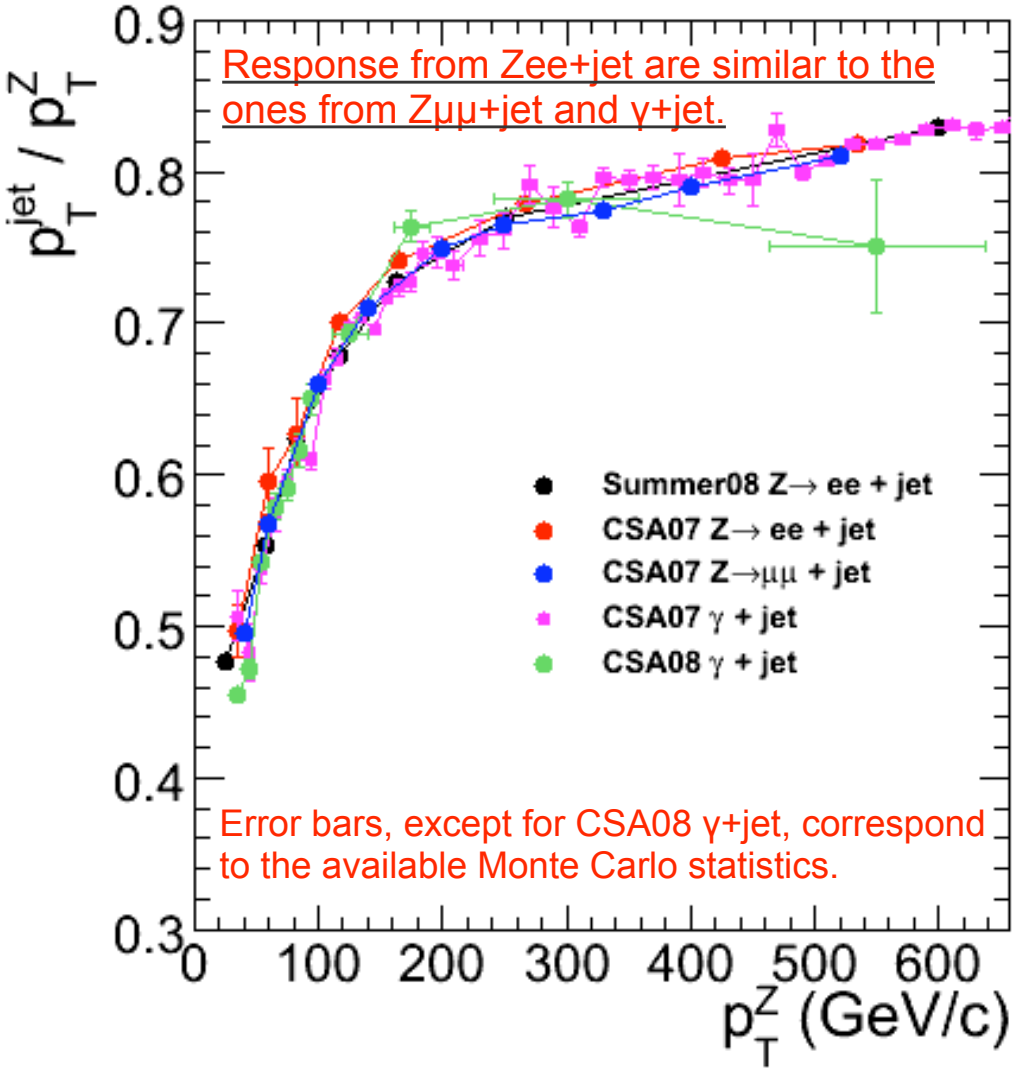
Jet response Comparison (when using p_T^{jet2}/p_T^{jet1} <0.2 cut)



Problem with p_T^{jet2}/p_T^{jet1} cut

- In Zee+jet analysis, we have been using cut on p_T^{jet2}/p_T^{jet1} (due to my oversight).
- The problem with cutting on p_T^{jet2}/p_T^{jet1} is that it can bias the p_T of jet1 to fluctuate high, and artificially bias the Z+jet balance to give higher response − especially at lower values of p_T.
- It seems we are seeing the effect of the bias in this plot.
- Both Zμμ+jet and γ+jet analyses used p_T^{2nd}/p_T^Z cut.

Jet response Comparison (when using p_T^{jet2}/p_T^Z <0.2 cut)



Good agreement among the Zee+jet, Zμμ+jet, and γ+jet response values, when using p_T^{jet2}/p_T^Z <0.2 cut in the Zee +jet analysis as well.

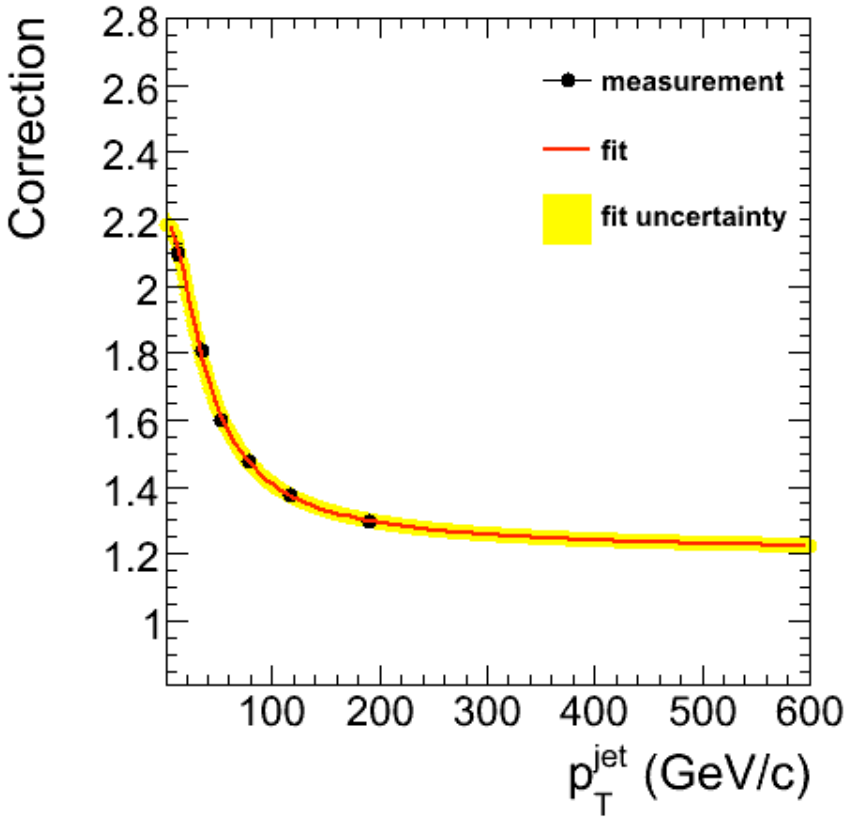
Recap of p_T balance method for abs correction

- Step 1: Bin in p_T^Z . In each bin record
  - Response = p_T^{Jet} (uncor.) / p_T^Z
  - p_T^{Jet} (uncorrected)
- Step 2: Fit the p_T^{Jet} vs. (1/Response) distribution with the functional form:

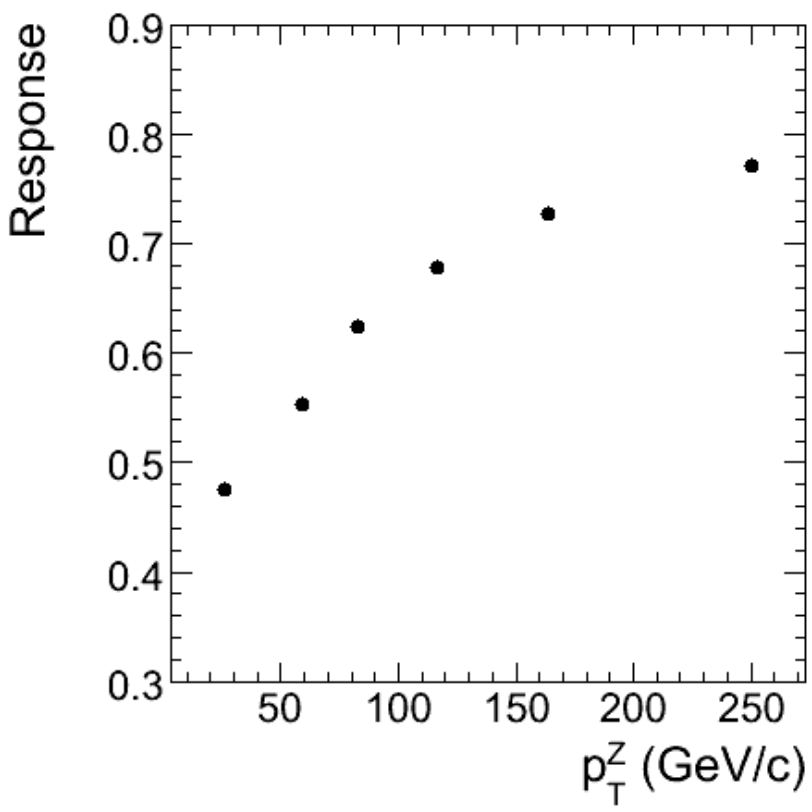
$$C(p_T) = a_0 + \frac{a_1}{[log(p_T)]^{a_2} + a_3}$$

$C(p_T)$ is the required absolute correction.

Abs correction for Summer08 MC statistics

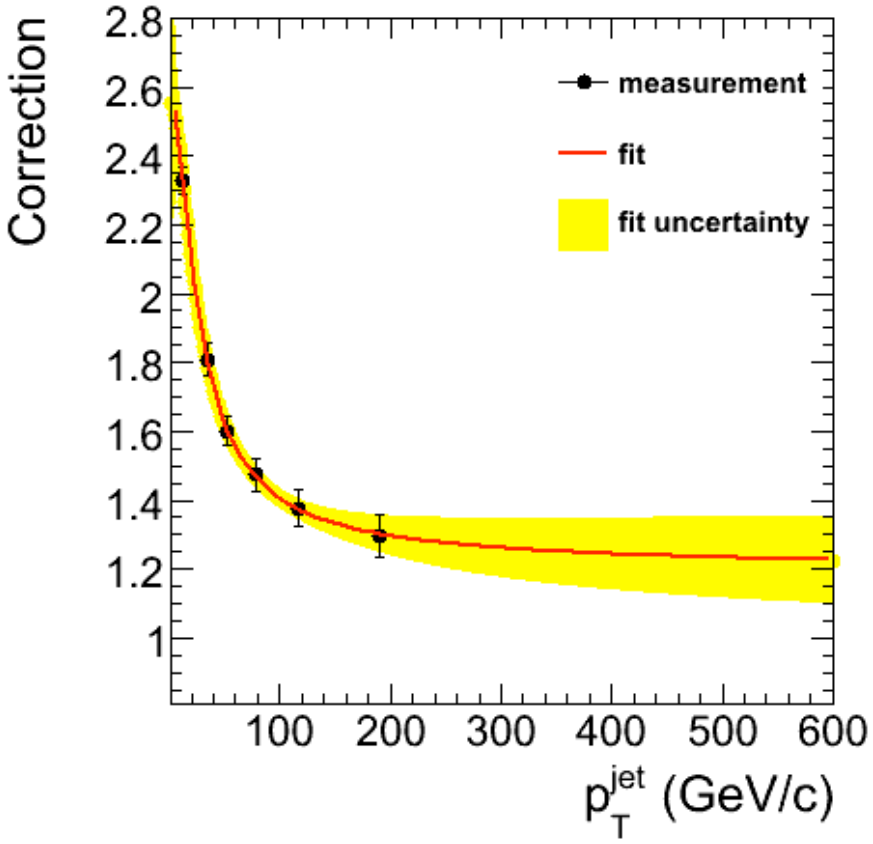


Correction

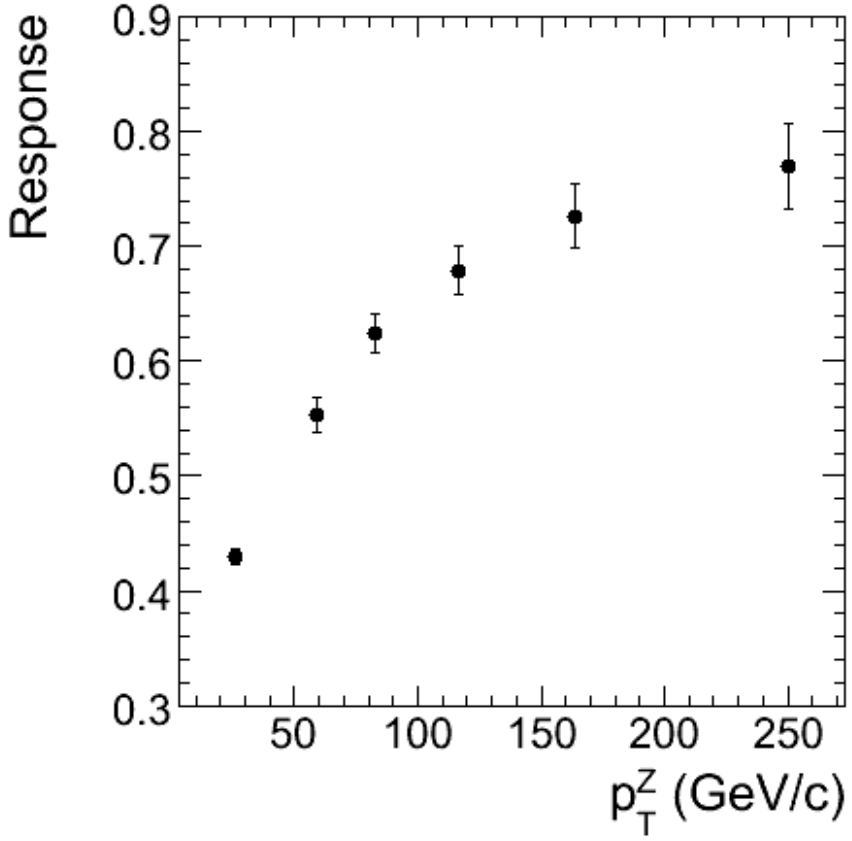


Response

Absolute correction & response for 100 pb^{-1}

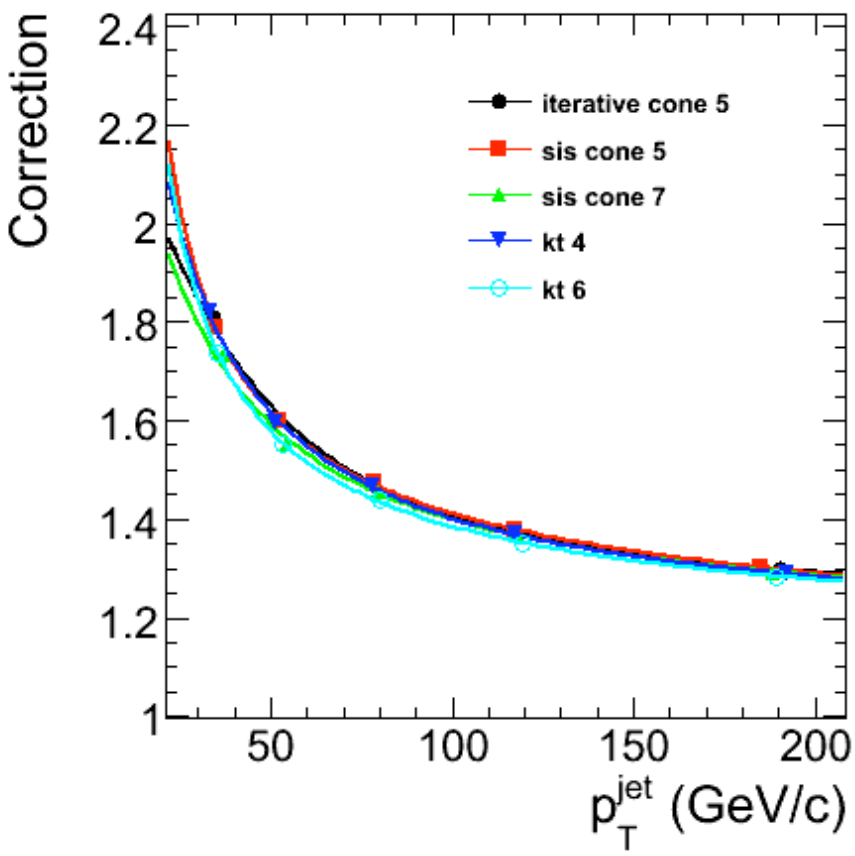


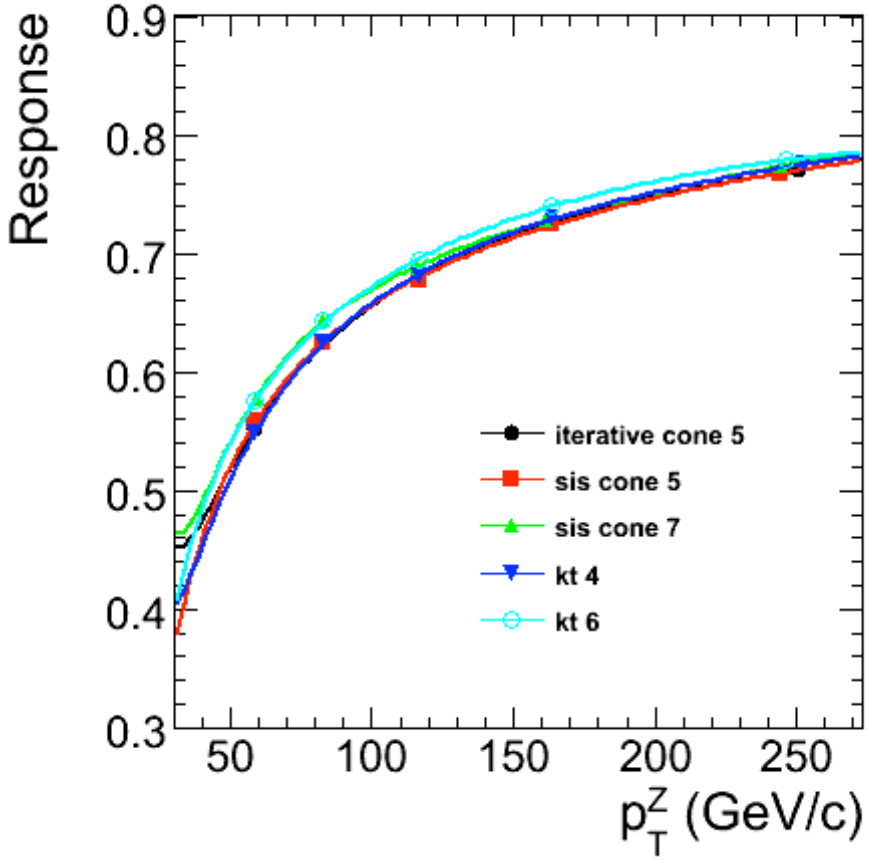
Correction



Response

Comparison of Corr. for different jet algorithms





Correction **Response**

Error bars correspond to the MC statistics.

Status & summary

✓ First draft of the $Z \rightarrow e^+e^-$ + jet analysis note (with CSA07 data) uploaded. (CMS AN−2009/004)

✓ Update to Summer08 sample ongoing :

✓Absolute correction from Summer08 $Z \rightarrow e^+e^-$ + jet sample obtained.

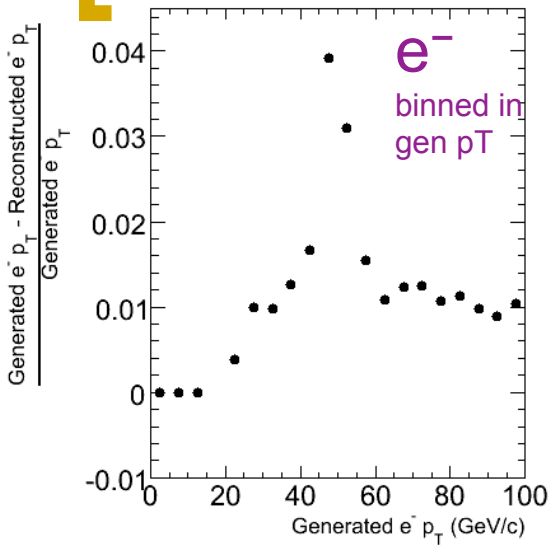
✓ Study of systematic uncertainties underway.

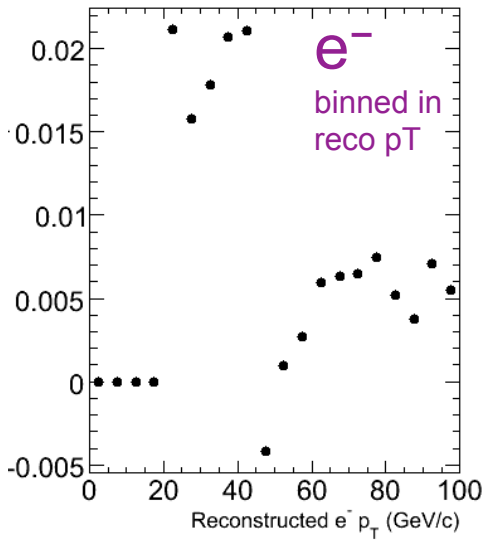
- In the process of repeating all the studies done with CSA07 data.
- Work underway to combine corrections from Zee+jet, Zμμ+jet, and γ+jet.

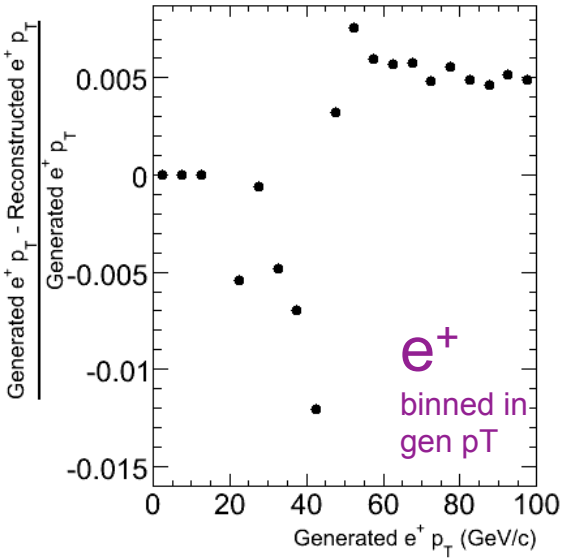
✓ Plan to update the analysis note with the new Summer08 plots and results by the end of this month.

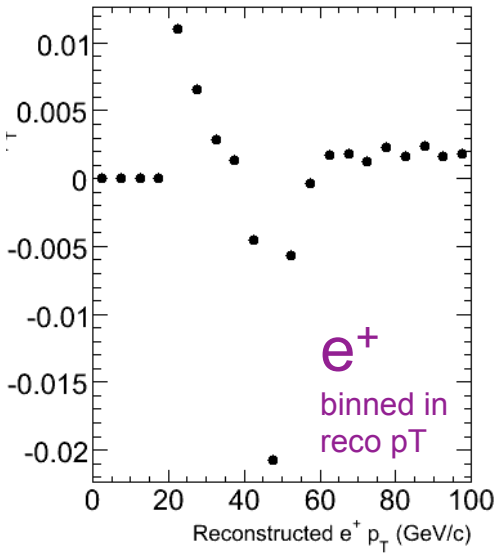
Backup slides

Bias in the electron p_T reconstruction









Plot (Generated − Reconstructed)/Generated p_T distribution for the electron.

Notice that a cut of p_T > 20 GeV/c is applied to the reconstructed electron p_T.

The reconstructed p_T is biased differently in e^- and e^+.

Uncertainty in abs correction for 100 pb^{-1}