
# Comparison of Jet Response & Validation of Pre-production Z($\rightarrow e^+e^-$)+jet Sample

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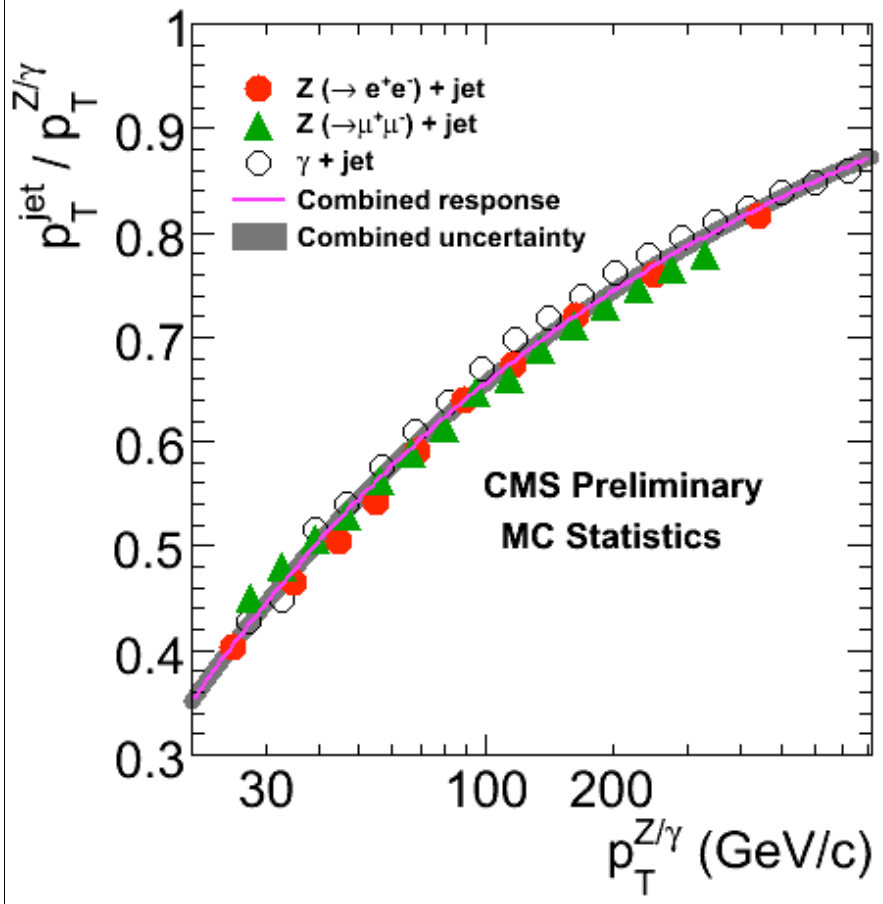
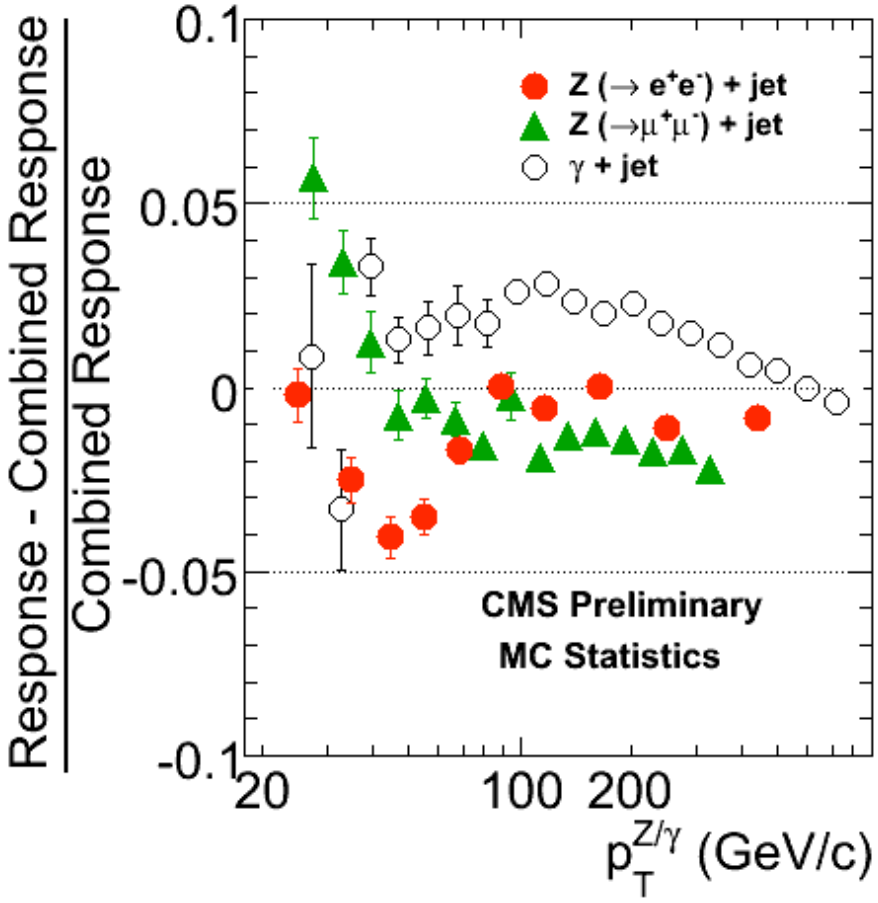
*Fermilab*

# Old response comparison (full MC statistics)

**[ From our June 12 presentation: $p_T^{2nd\ jet} / p_T^{Z} < 0.2$ for Z+jet ]**

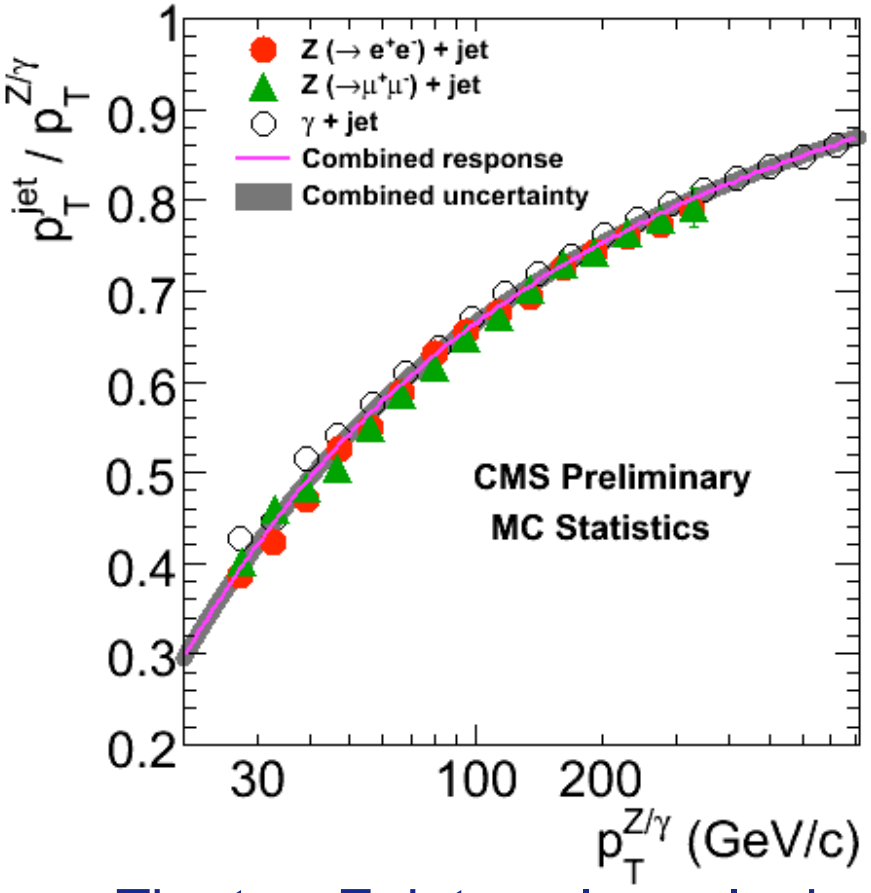


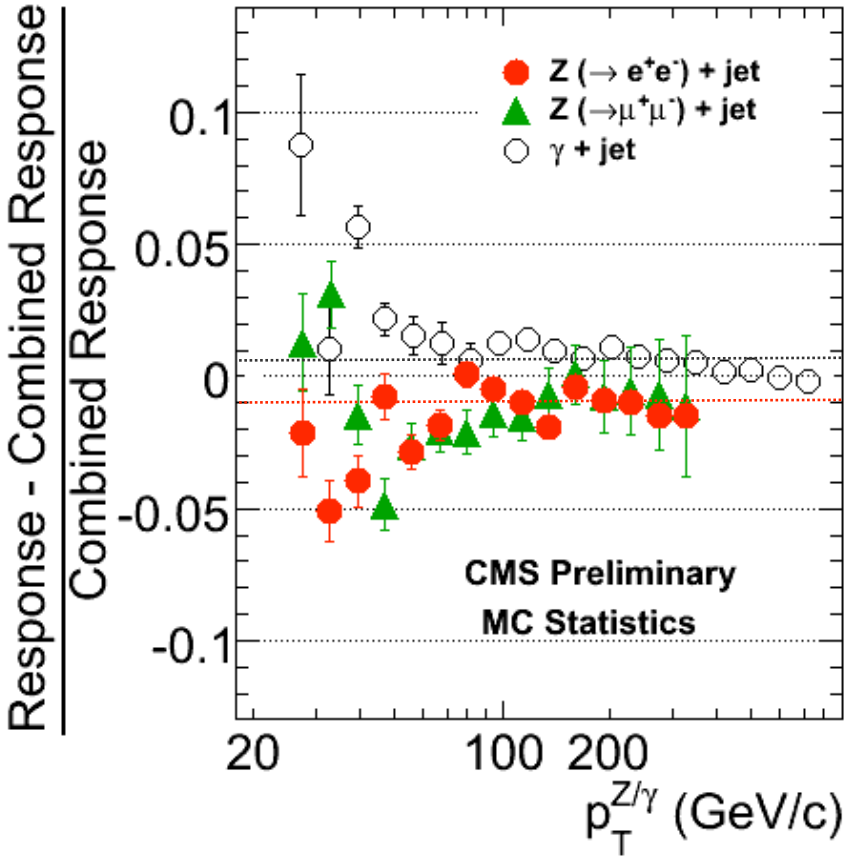




With tiny error-bars, now we can see the the systematic variation in response among the three analyses. The fractional difference between γ+jet and Z+jet is at the level of a few percent.

# New response comparison (full MC statistics)

**[ $p_T^{2nd\ jet} / p_T^{Z} < 0.1$ and use exact same binning for all three analyses. ]**

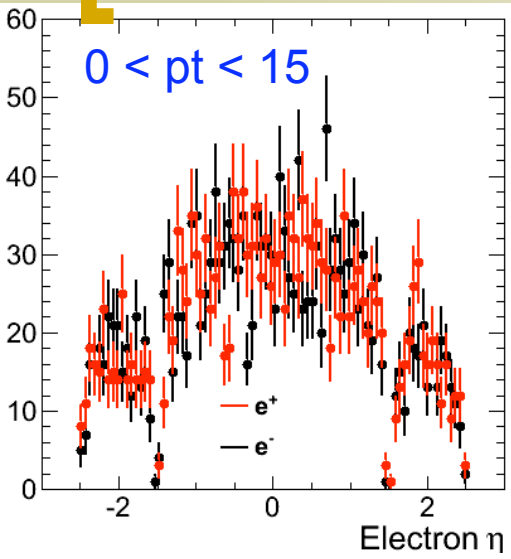


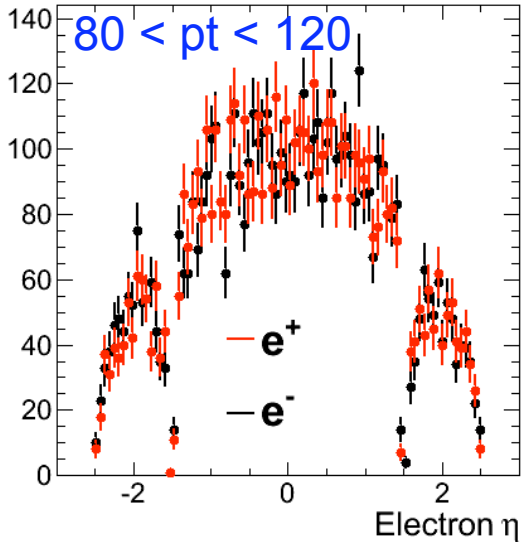



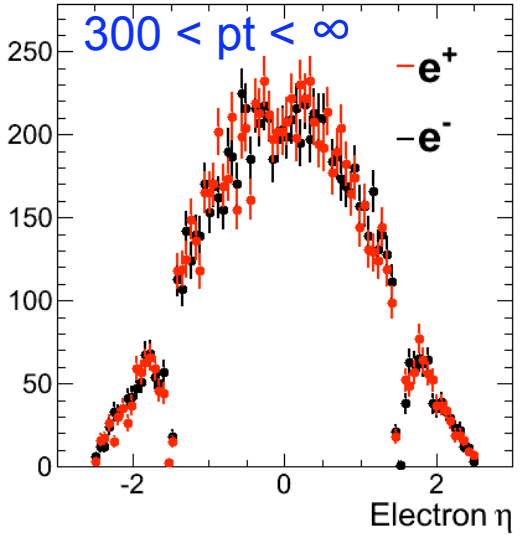

The two Z+jet analyses look close to each other now. The difference between γ+jet and Z+jet is still at 1−2% level. Keep in mind that γ+jet and Z+jet use different methods to derive response.

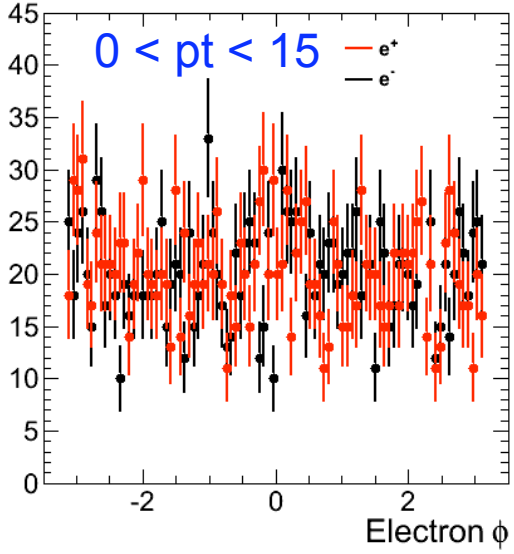
# Validation study of ZeeJet 3.1.1 pre-production samples

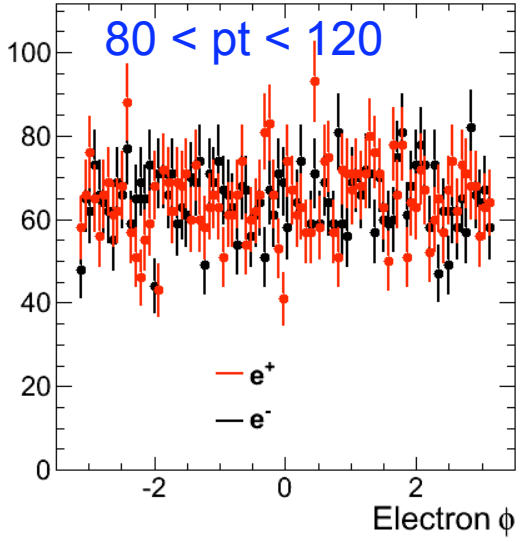
# Electron eta, phi

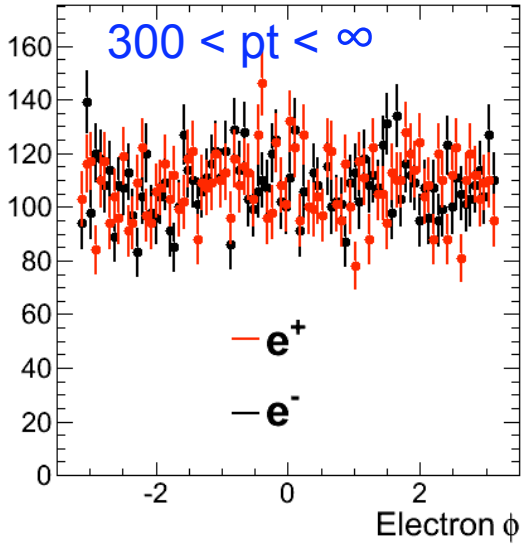


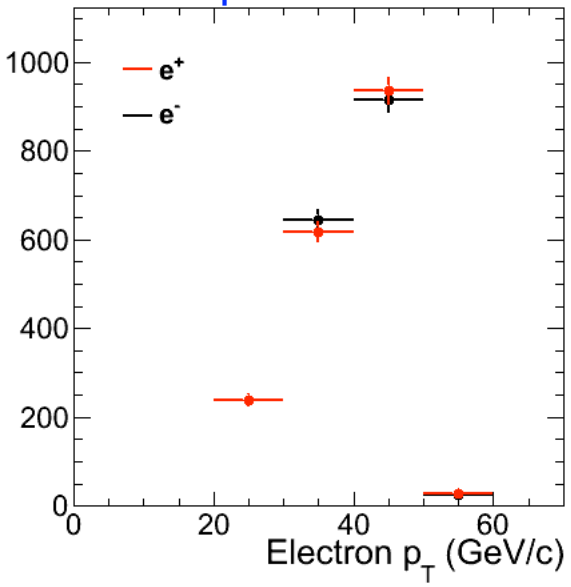



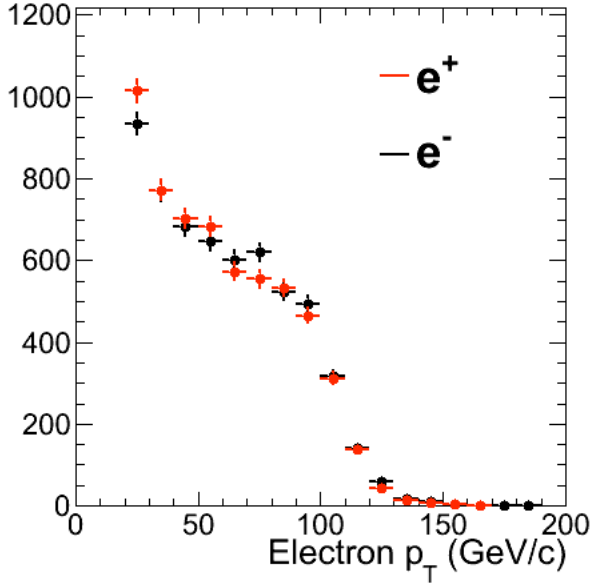



# Electron et

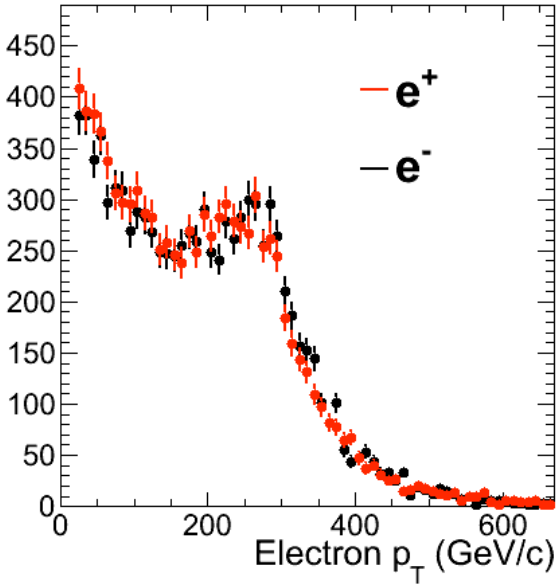
0 < pt < 15




80 < pt < 120




300 < pt < ∞

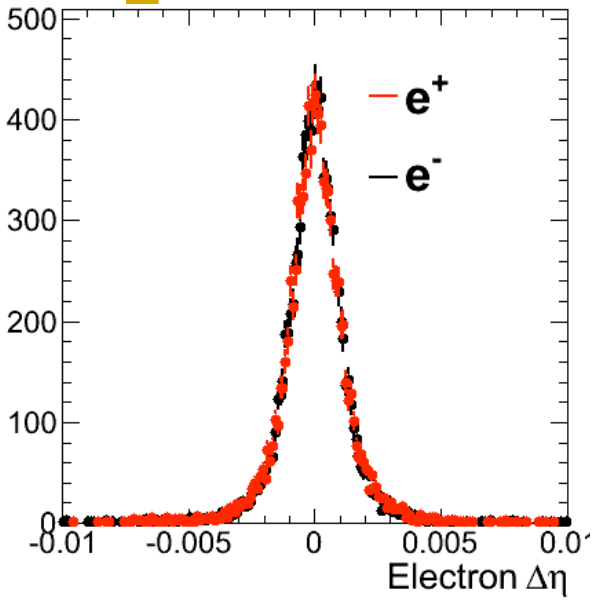


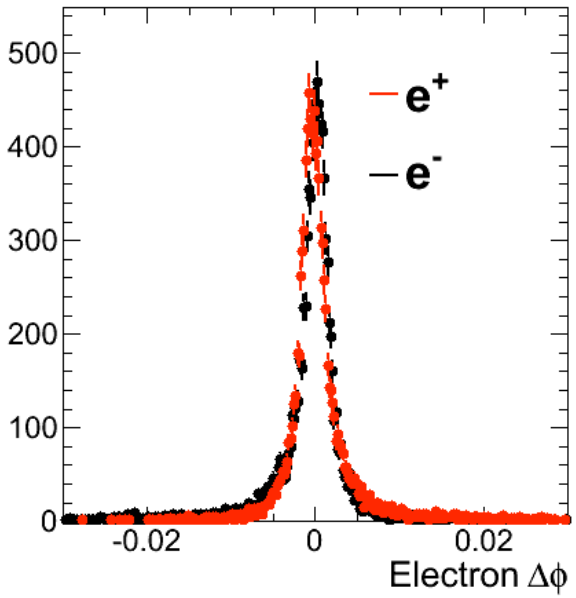

Electrons selection:

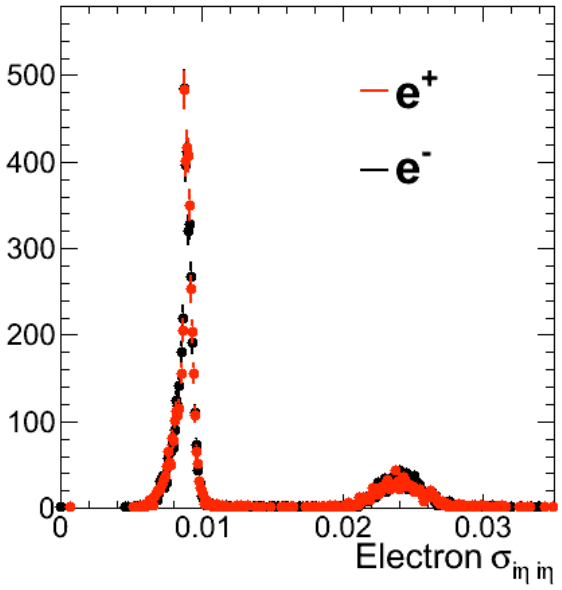
- super cluster matched to track (*gsfElectrons*)
- $p_T$ > 20 GeV/c
- within ECAL and tracker acceptance:
  |η| < 1.4442 (barrel) OR 1.56 < |η| < 2.5 (endcaps)

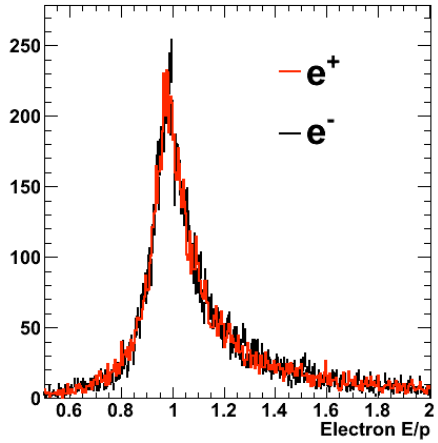
# Electron id variables

all plots: 300 < pt < ∞




Definition

Electron identification variables:

Δη : difference between η of electron supercluster and electron track

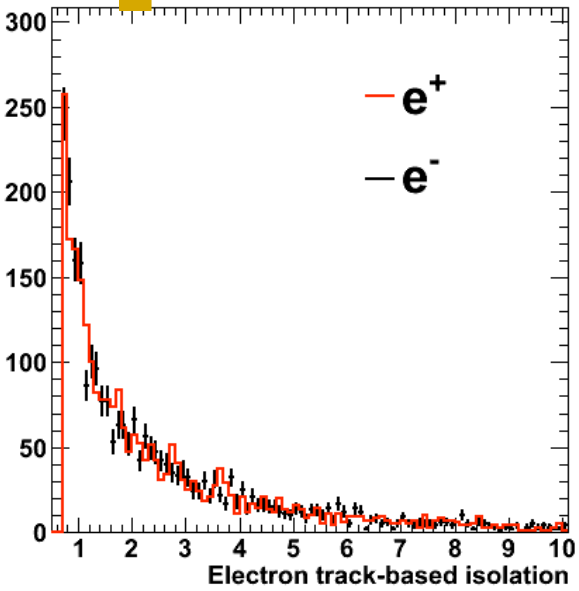
$\sigma_{i\eta i\eta}$ : electron super cluster resolution

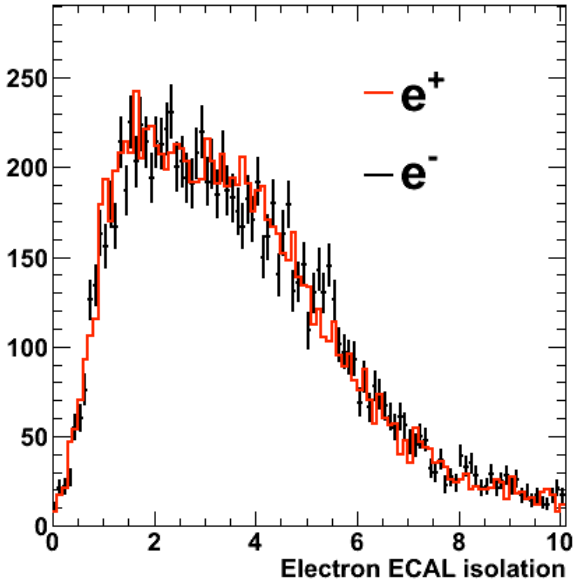
ΔΦ : difference between Φ of electron supercluster and electron track

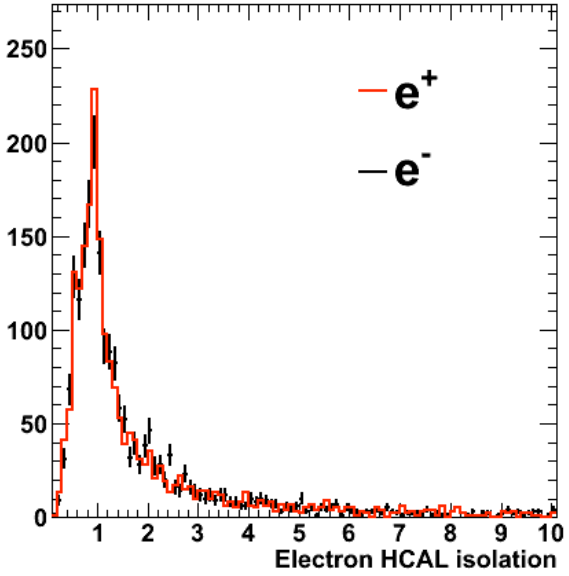
E/p : ratio of electron supercluster energy to track momentum

# Electron isolation variables

all plots: 300 < pt < ∞




## Definition

Track isolation: $\sum_{0.015<\Delta R<0.3,\ p_T^{Track}>1.0} \left(p_T^{\text{track}}\right)$

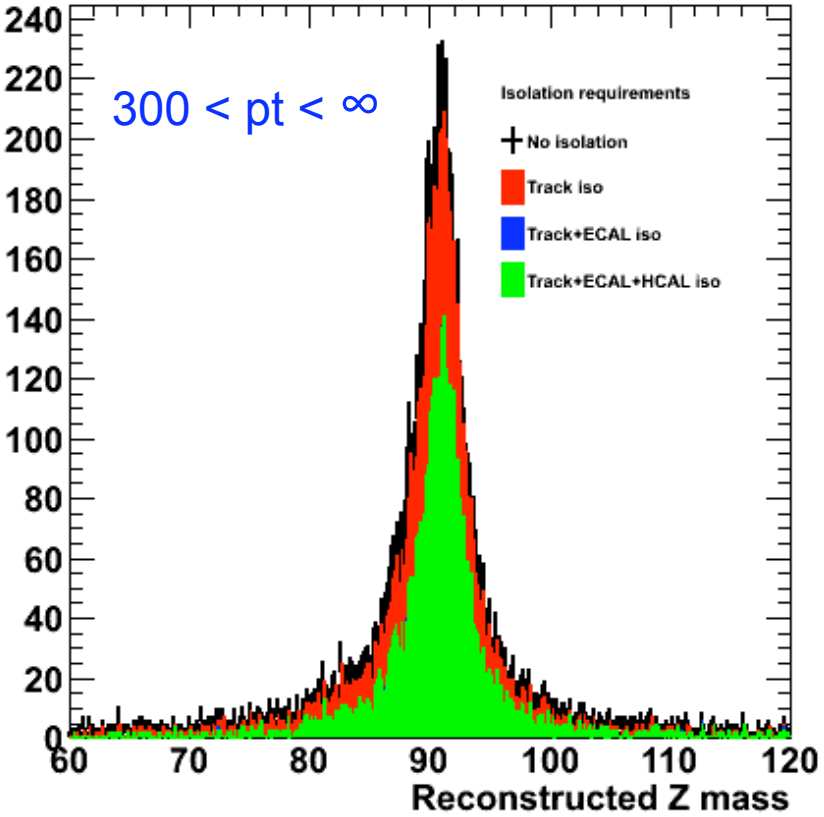
ECAL & HCAL isolation: $\sum_{\Delta R<0.4} \left(E_T^{\text{RecHits}}\right)$

## Veto for ECAL isolation

- Inner cone radius
  barrel: $\Delta R > 0.045$, endcaps: $\Delta R > 0.070$
- $E_T$ threshold
  barrel: $E_T > 0.08$, endcaps: $E_T > 0.3$
- "Jurassic footprint removal"
  $0.02 < |\Delta\eta| < 0.5$ (both barrel and endcaps).

**These are default *Egamma* definitions**

# Reconstructed Z mass



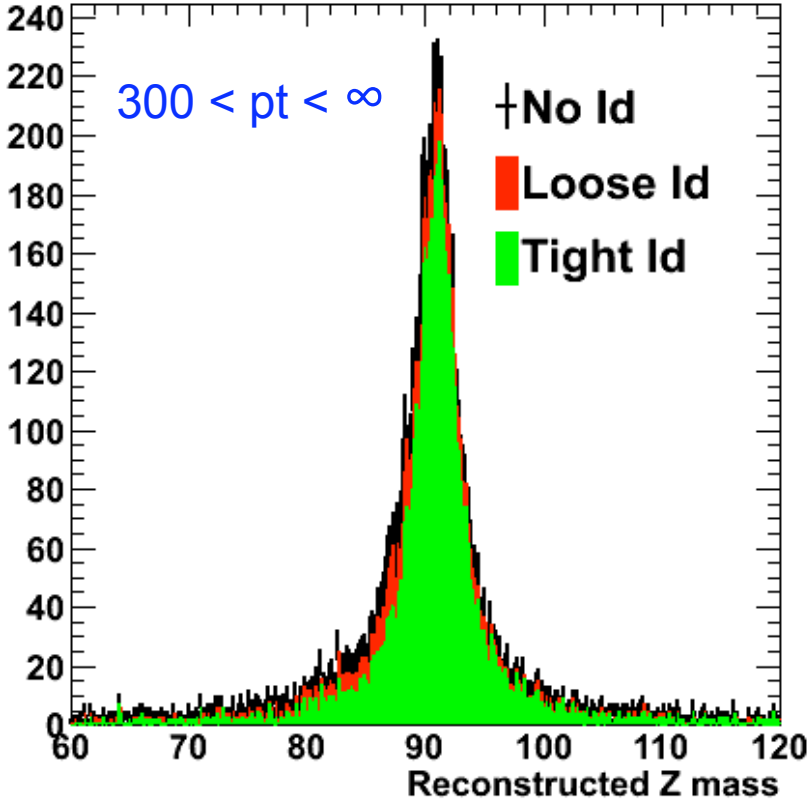



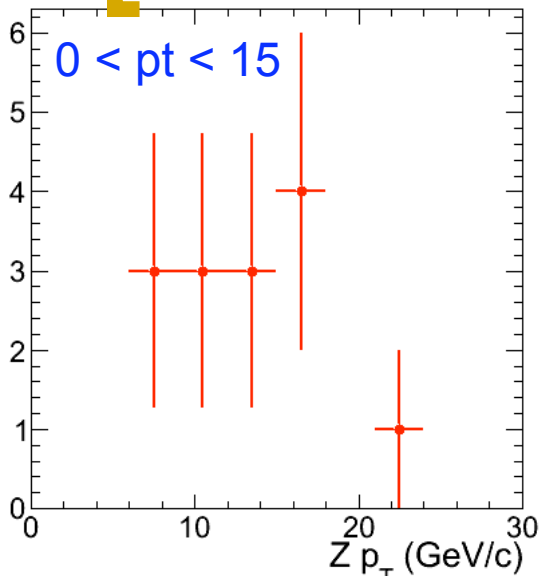

Table 1: Isolation criteria for $\gamma^*/Z \rightarrow e^+e^-$ candidates.

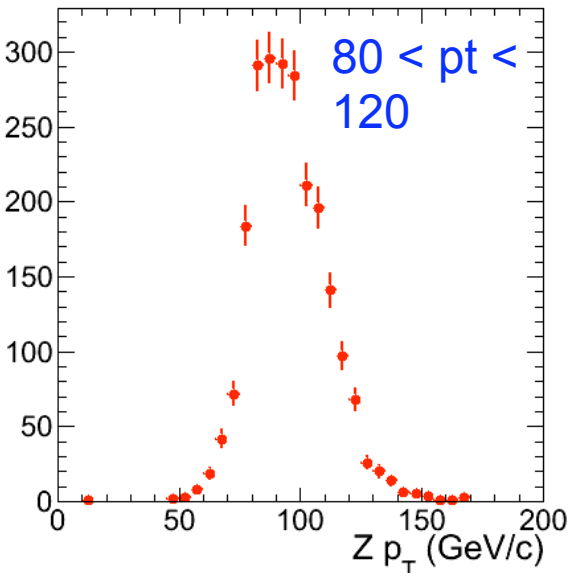
| | Track | Ecal | Hcal |
|---|---|---|---|
| Barrel | 7.2 | 5.7 | 8.1 |
| Endcap | 5.1 | 5.0 | 3.4 |

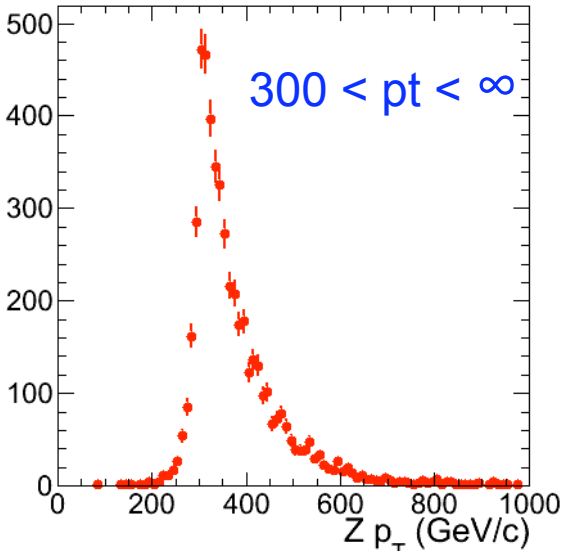
**Standard *Egamma* electron ID:**

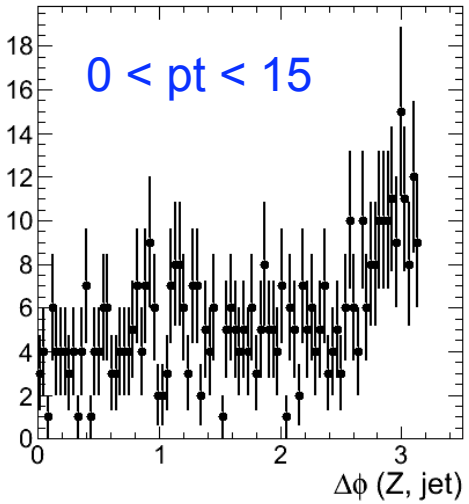
https://twiki.cern.ch/twiki/bin/view/CMS/SWGuideCutBasedElectronID

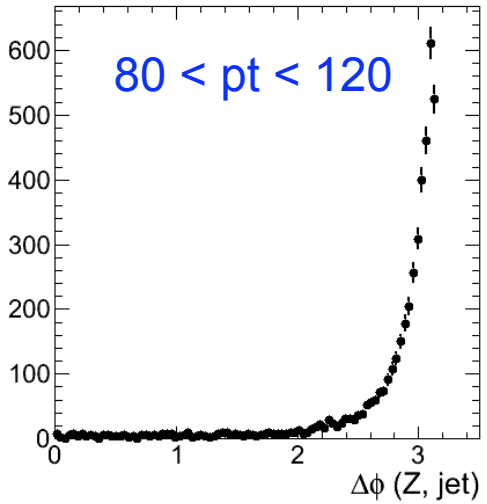
# Z $p_T$ and Δϕ(Z, jet) distributions

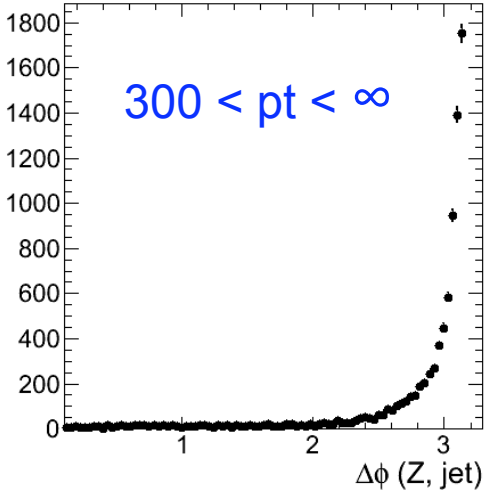


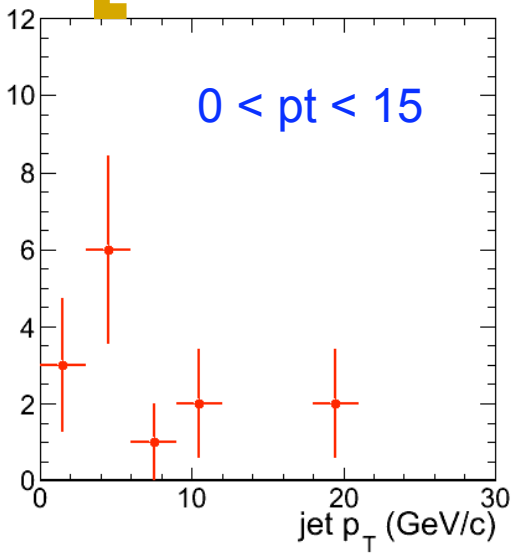



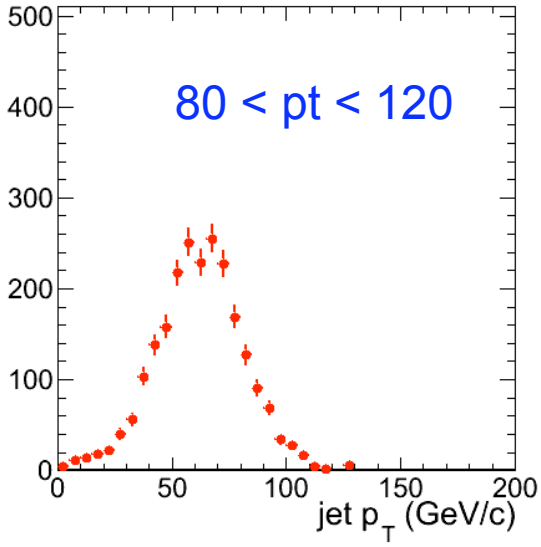



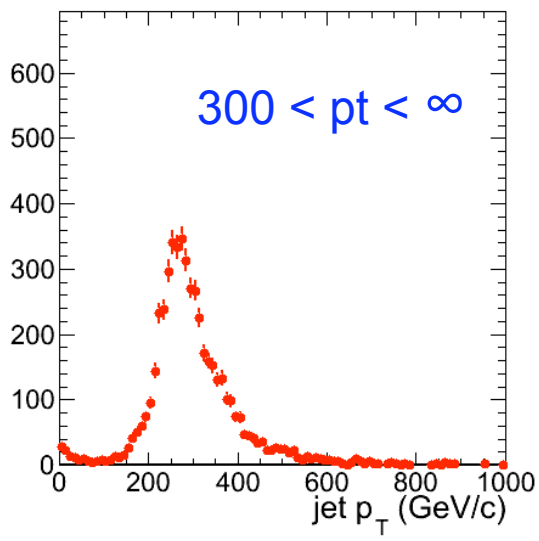



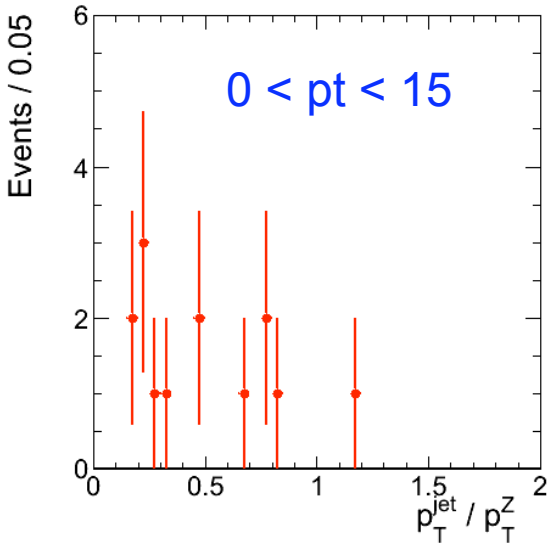



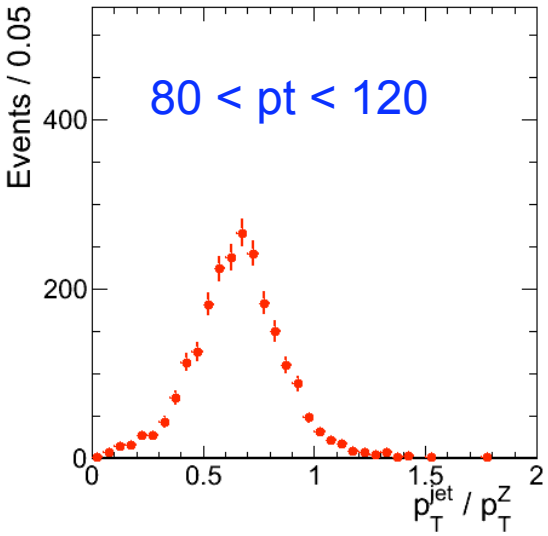
# CaloJet $p_T$ and response distributions

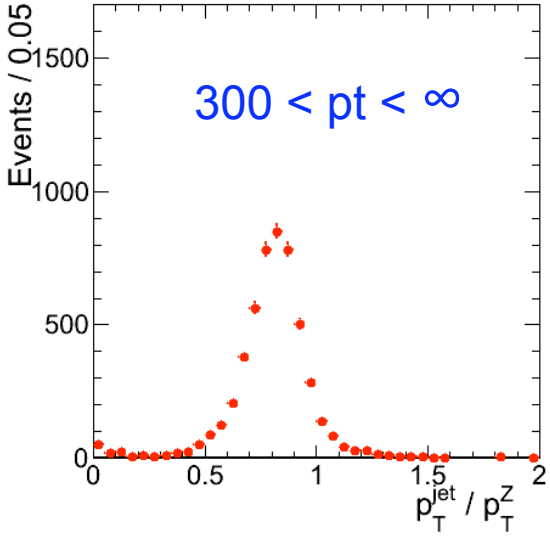


# Summary


✦Implemented the same binning and same second jet $p_T$ cut in Z/γ $p_T$ for deriving response for all three analysis.

- This makes a bin-by-bin comparison easier.
- The two Z+jet samples have essentially identical response now.
- Residual difference (apart from flavor) w.r.t. photon+jet response is due to due to systematic difference in how one obtains the response.

✦Physics validation of pre-production ZeeJet sample looks good.

✦Many thanks to Volker Büge for providing the Zμμ+jet response plot with second jet $p_T$ cut of 0.1.

**End of Talk ! Thank You !**