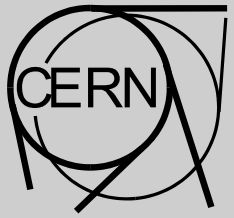


Cluster Corrections and Calibration Weights

S.Snyder (BNL)
S.Paganis (Wisconsin)

egamma Combined, Atlas Week
15-Feb-05

Outline

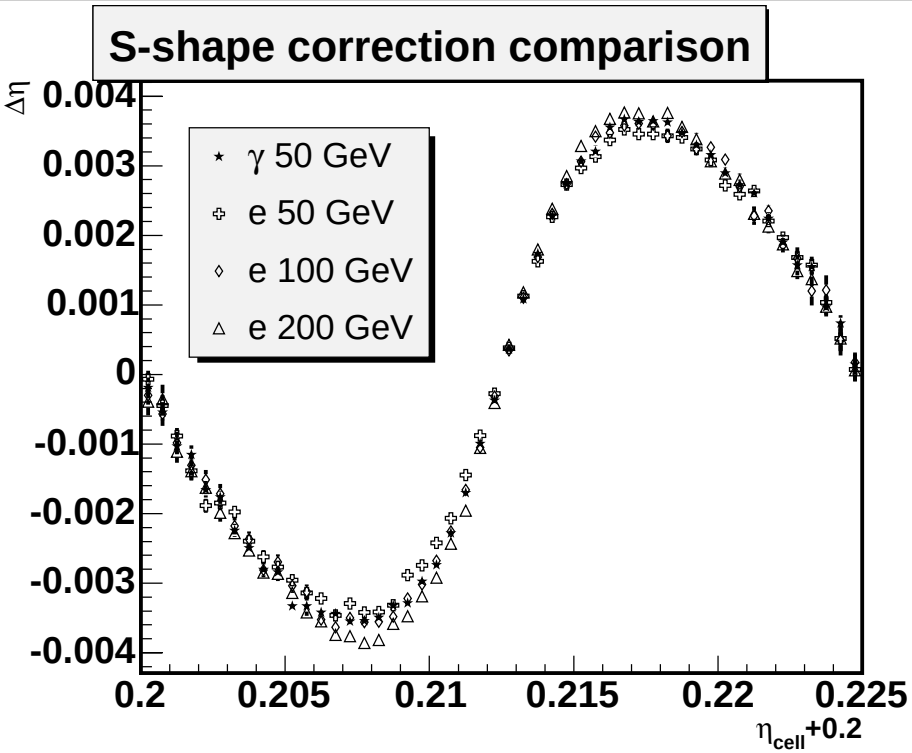
- Highlights of performance of new corrections
- Status of new weights
- Discussion on additional corrections
  - These are mainly due to energy losses due longitudinal, lateral leakage and losses between the PS and Strips.
- Intercalibration with Z->ee
  - This must come AFTER long. weights have been extracted.

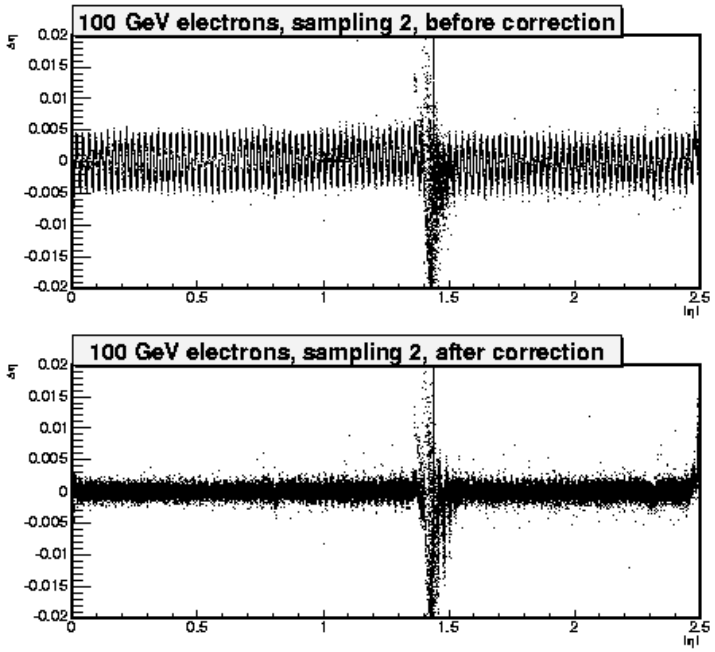
Cluster Level egamma Corrections

- Corrections (now)
  - η position, ϕ position
  - ϕ energy, η energy modulation
  - Intercryostat gap correction
  - Cluster containment (becoming an overall scale?)
  - Longitudinal Weights
- New (improved) electron corrections at the cluster level: will go in 10.0.0
- New set of weights for all cluster sizes is in production/validation phase

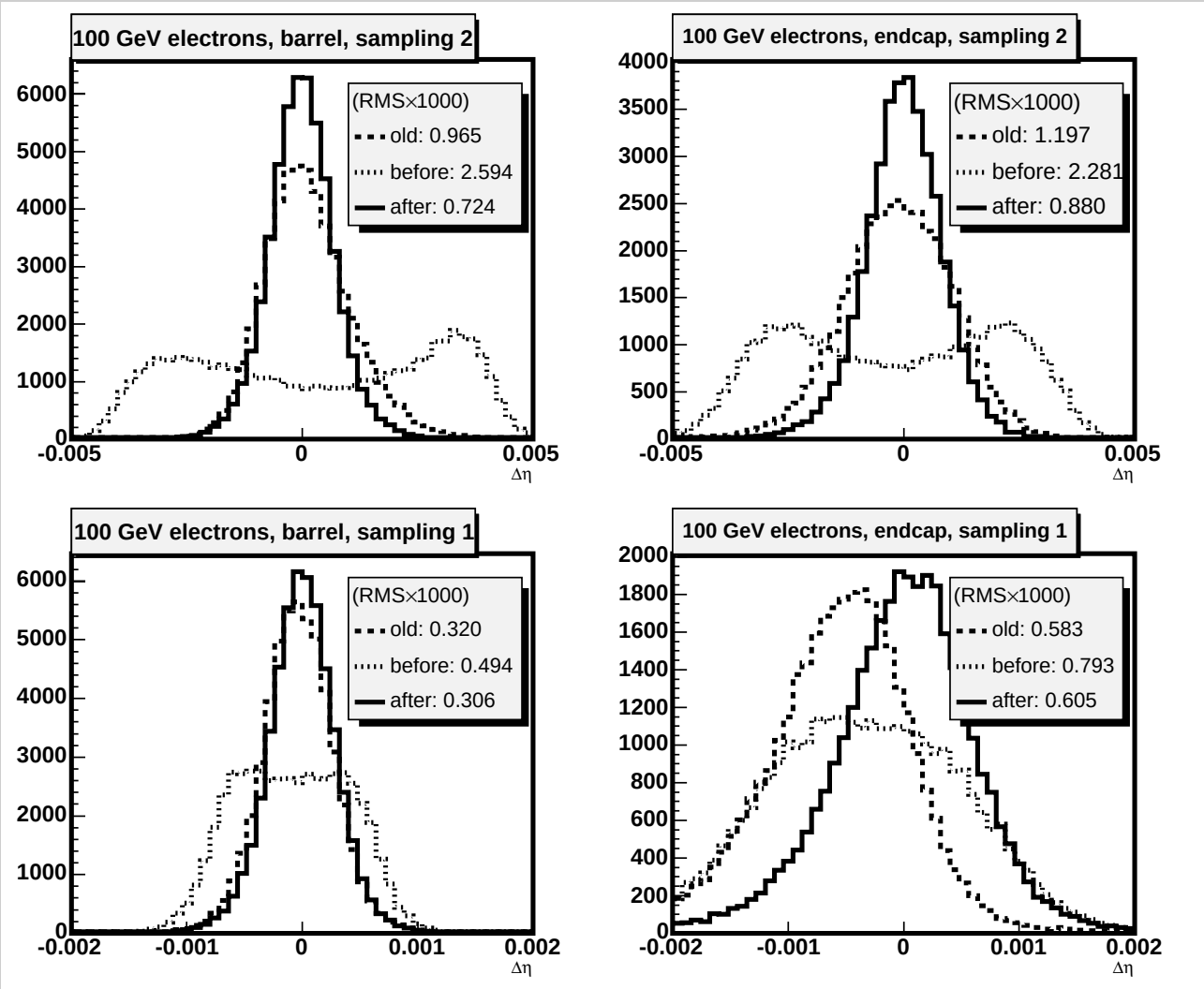
η position correction

$$\Delta\eta = \eta_{true} - \eta_{rec}$$

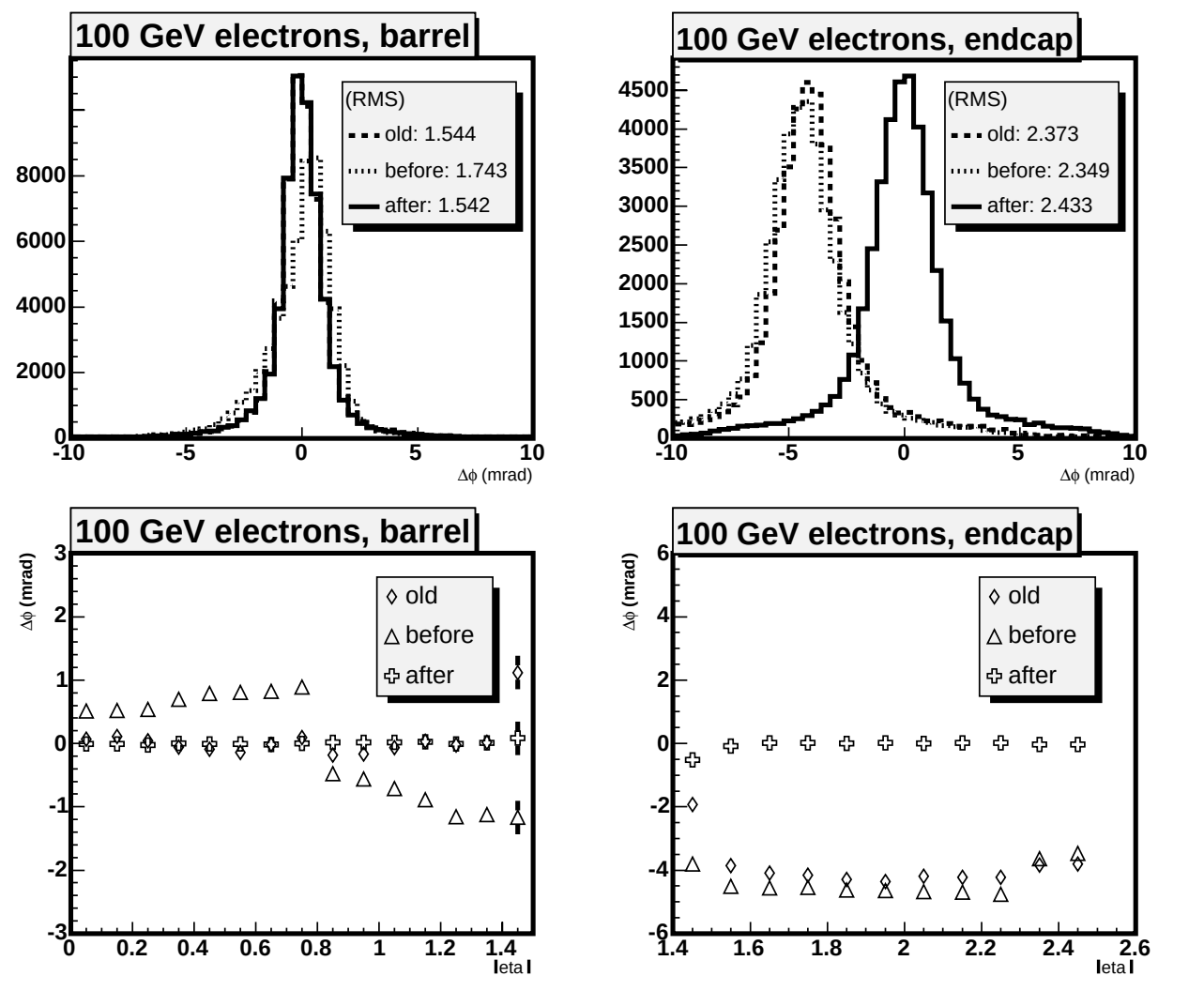




η position correction



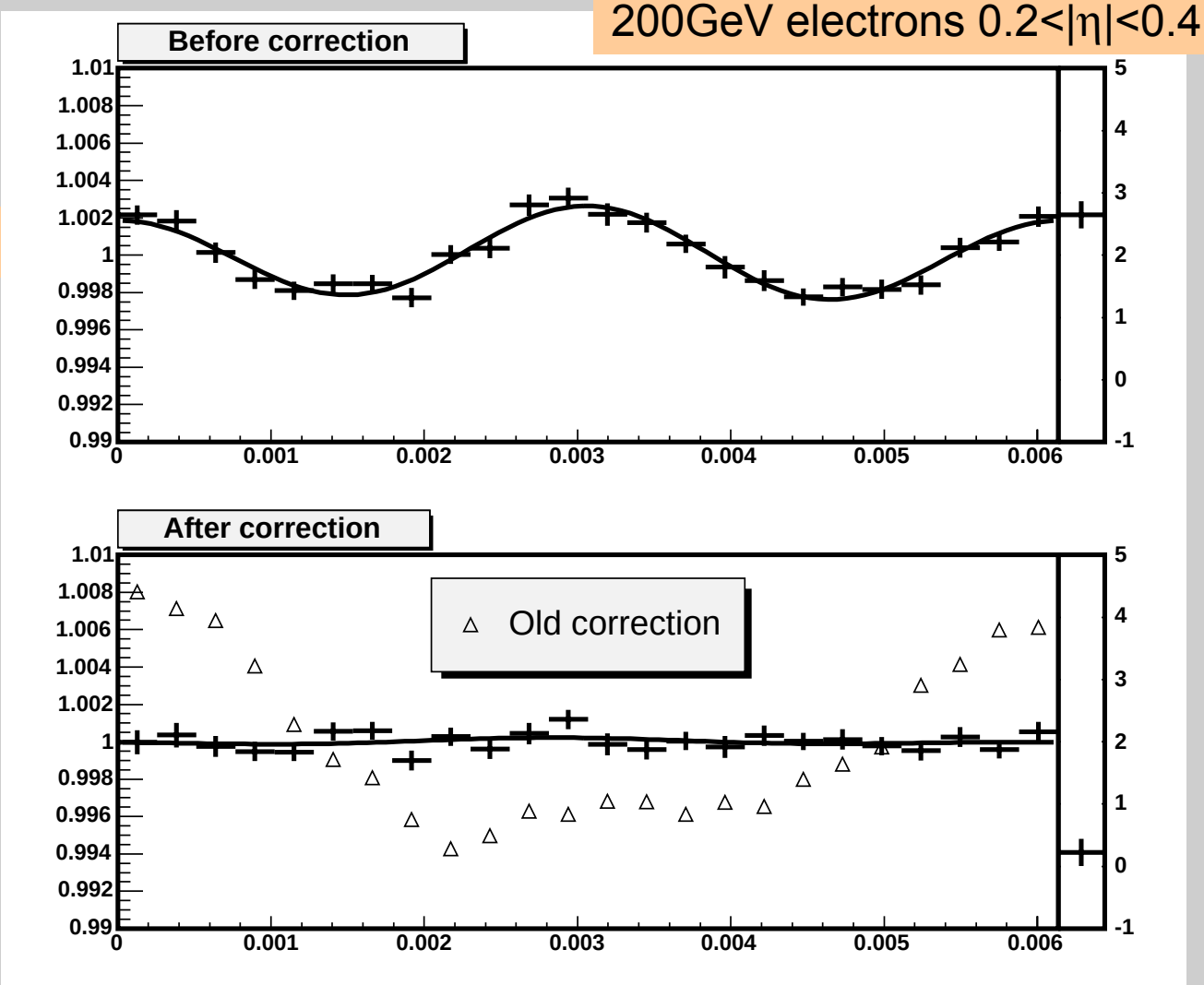
ϕ position correction



ϕ modulation

200GeV electrons 0.2<|η|<0.4

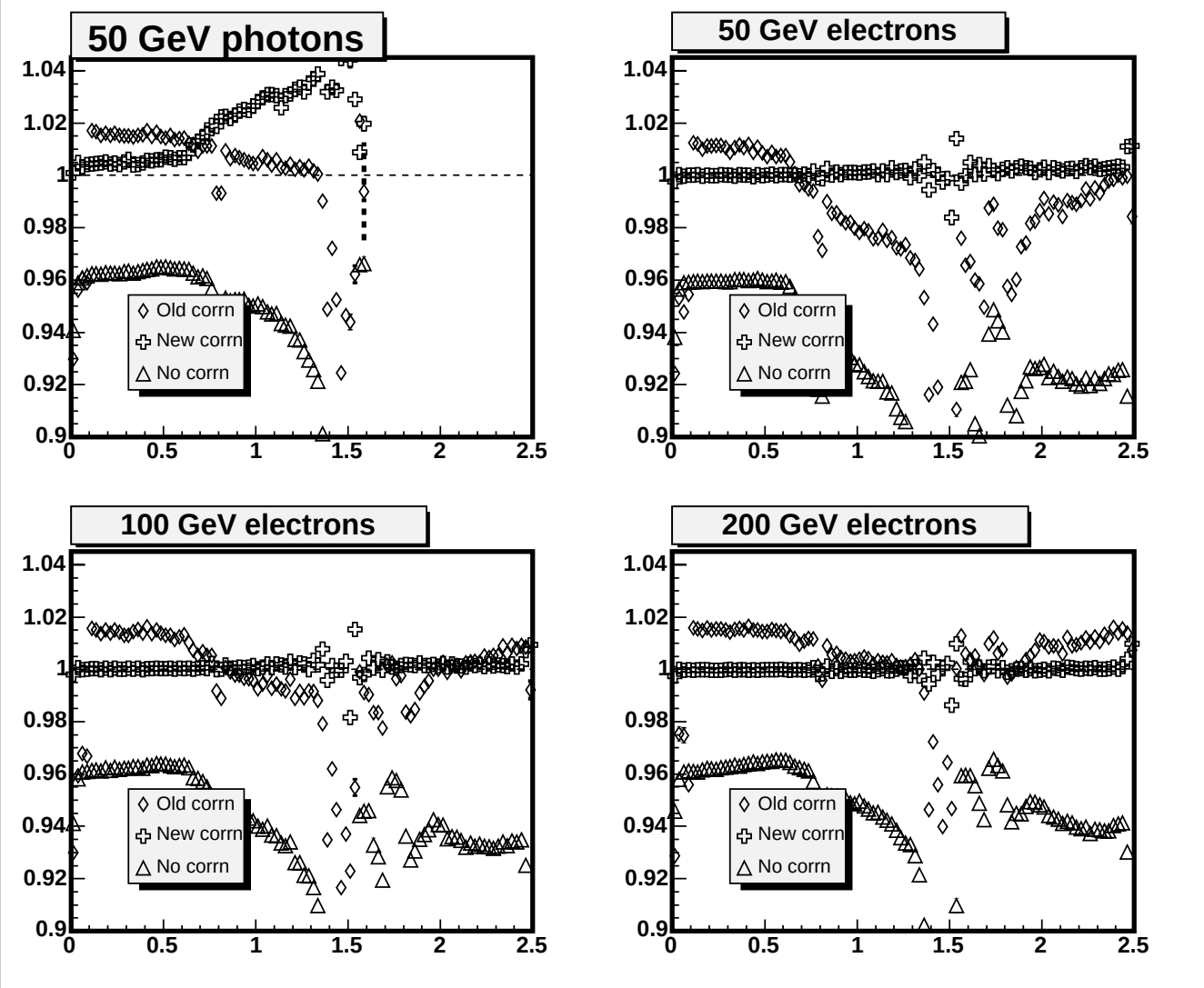
Erec/Etrue



Uniformity/Linearity

Linearity looks fine but we may have problems at lower Energy electrons

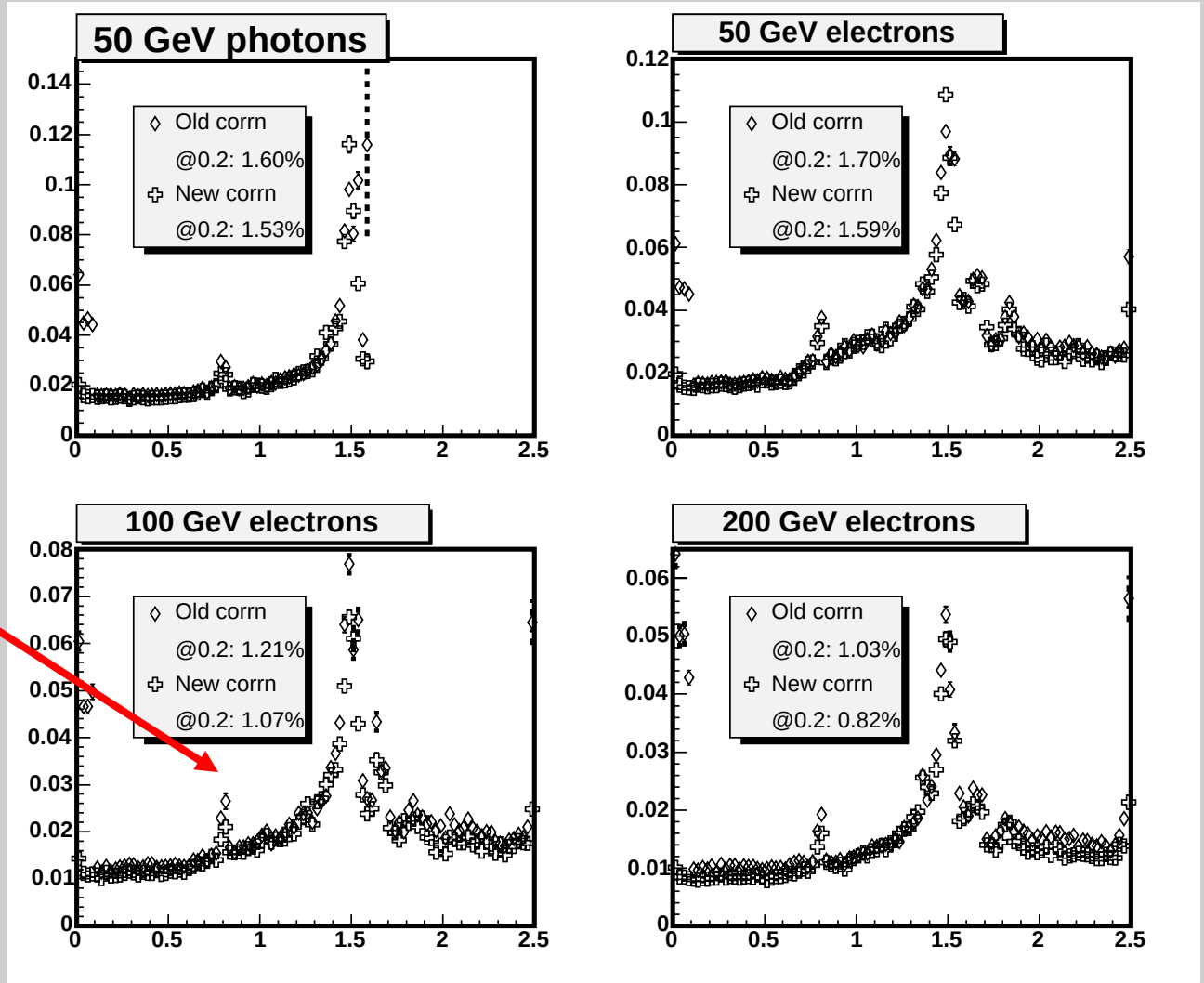
Photons need at least an overall scale correction



Energy Resolution after corrections

Resolution is improved and follows the material X0 maps.

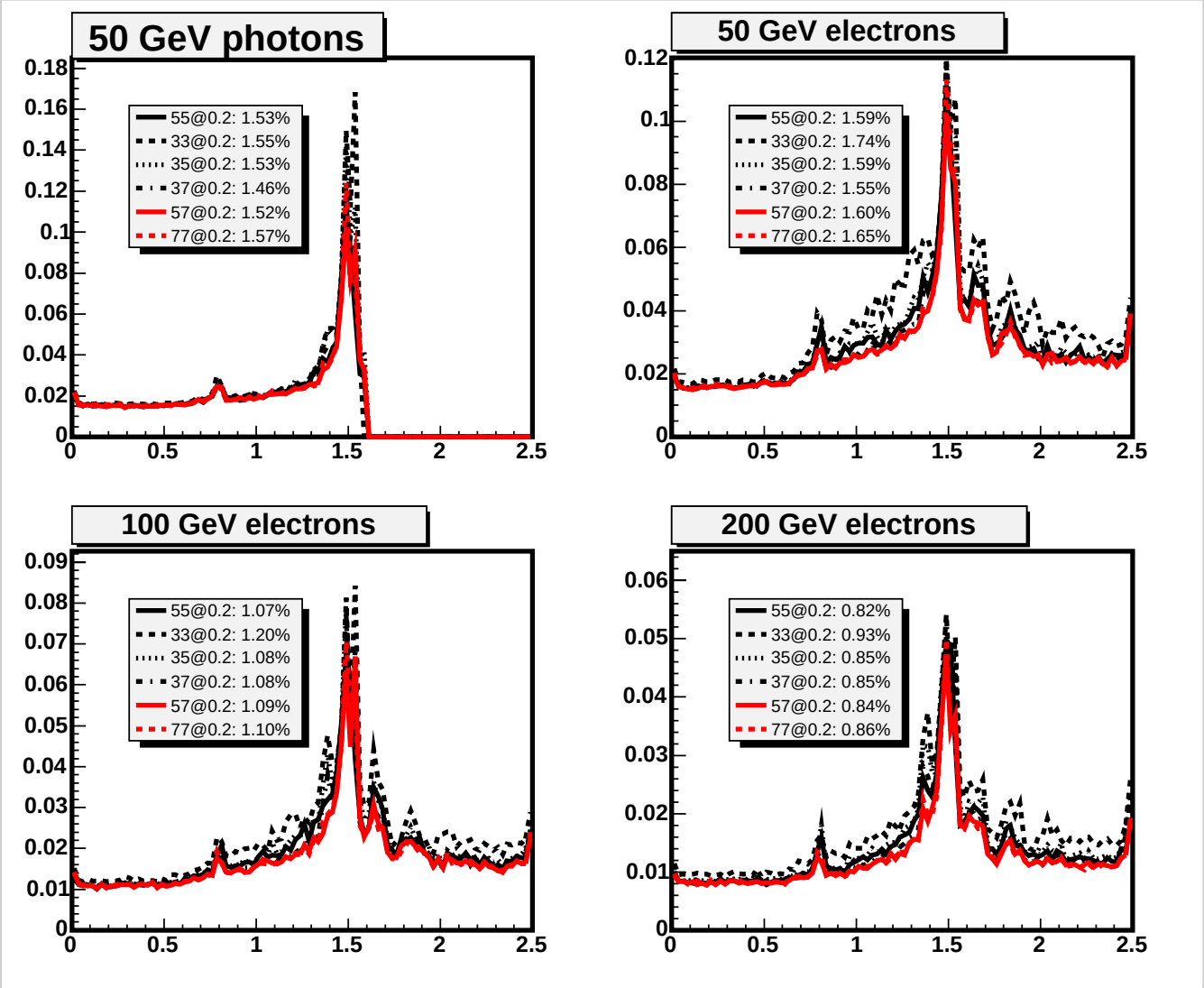
If we understand how resolution is lost we may be able to improve it.



Current Status

- New corrections are calculated using 5x5 clusters and are applied to all cluster sizes (3x5, 3x7 etc)
- Containment corrections have been calculated for all cluster sizes
- A single (non-optimized) set of weights is applied to all clusters. Linearity is fine but we will get a hit in resolution
- **New cluster-size dependent, optimized weights are being evaluated**

Energy Resolution vs cluster size



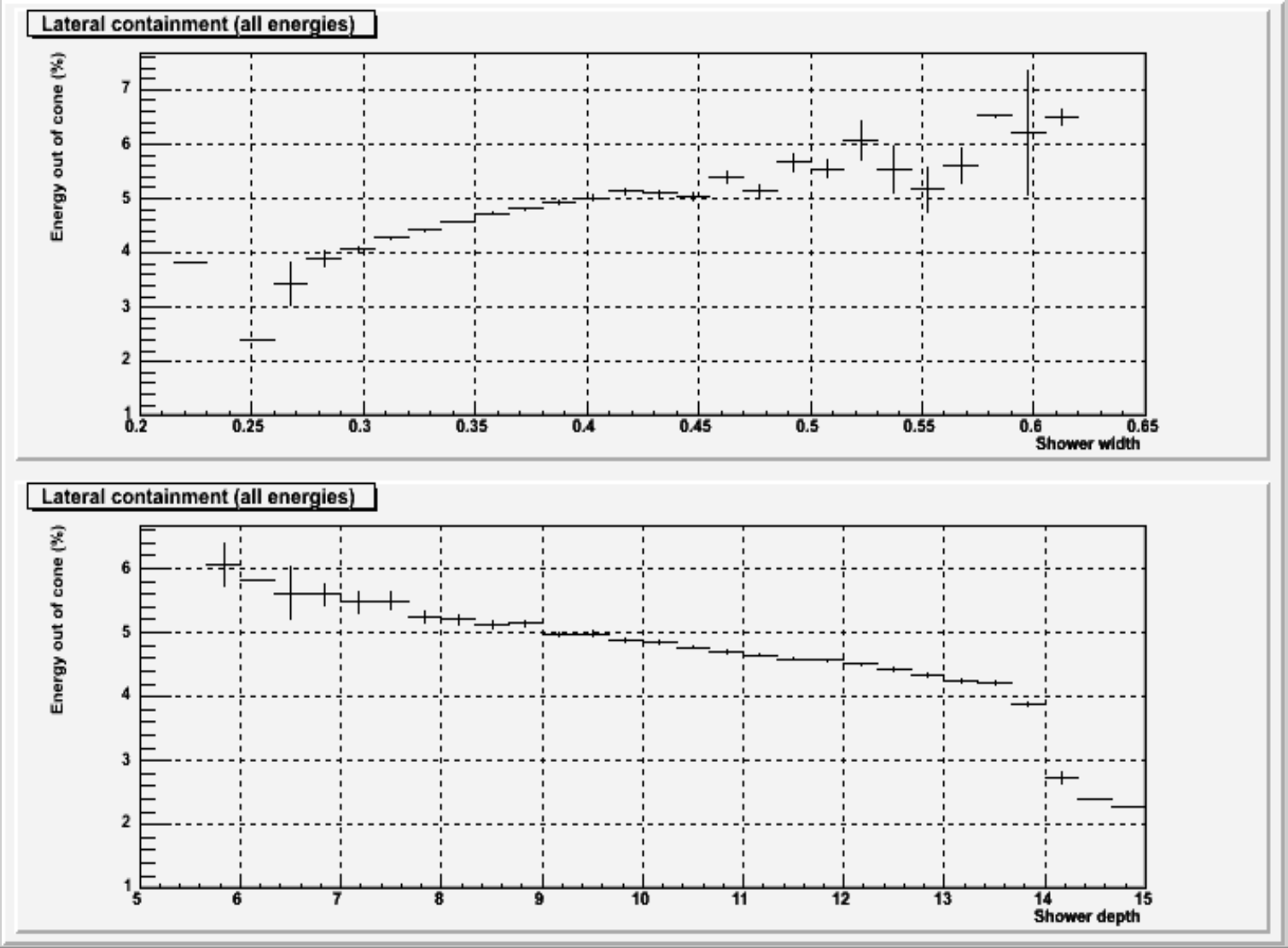
Additional corrections needed...

New Corrections

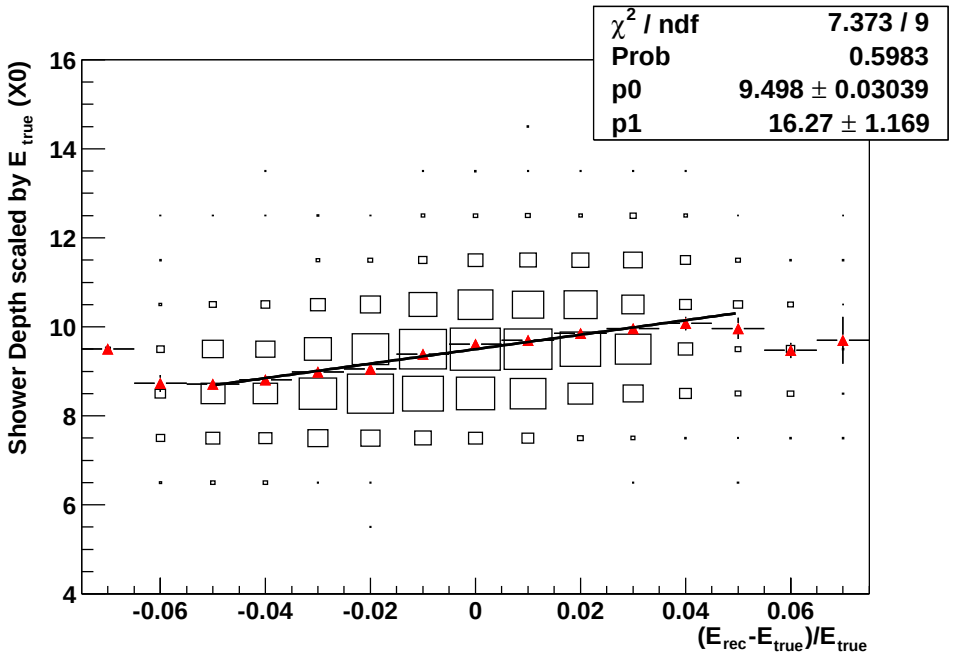
- Longitudinal Leakage (Orsay)
- Energy Loss between PS and Strips (Carli)
  - Cannot be applied for $|\eta|>1.8$
- Shower profile dependent lateral and upstream losses (Carminati, Paganis, Carli)
- Sampling Fraction Correction (all)

But, all of the above correlate. We must find what the more sensitive variables are. An example is the Paris groups study on a universal shower depth correction for longitudinal leakage.
Studies by LC and SP with “calibration hits” already started.

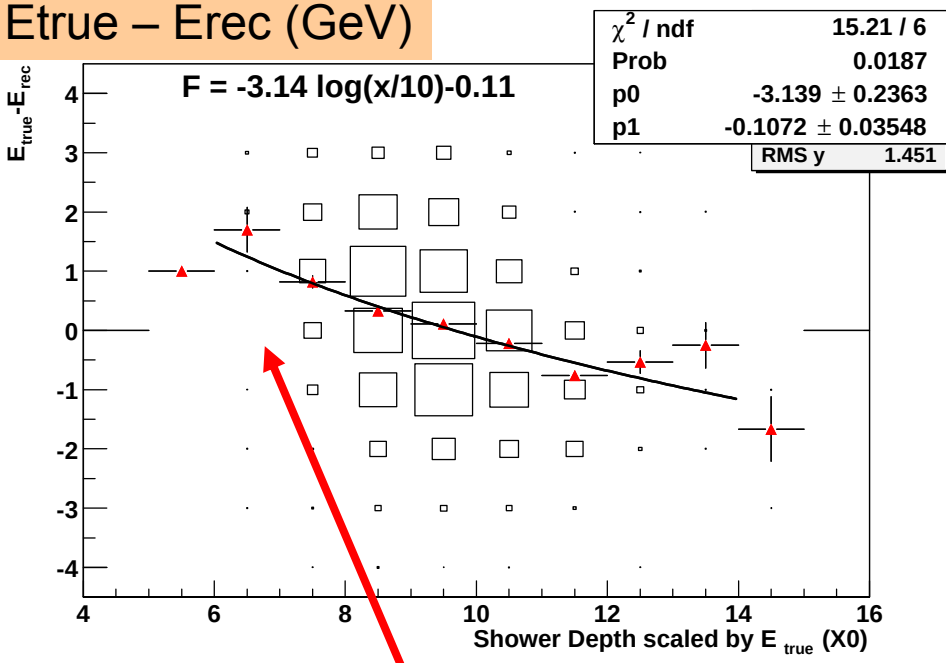
Lateral containment vs shower width/depth (L.Carminati)



The Problem: Resolution depends on the shower depth (3x7 50GeV e^- η=1.3125)



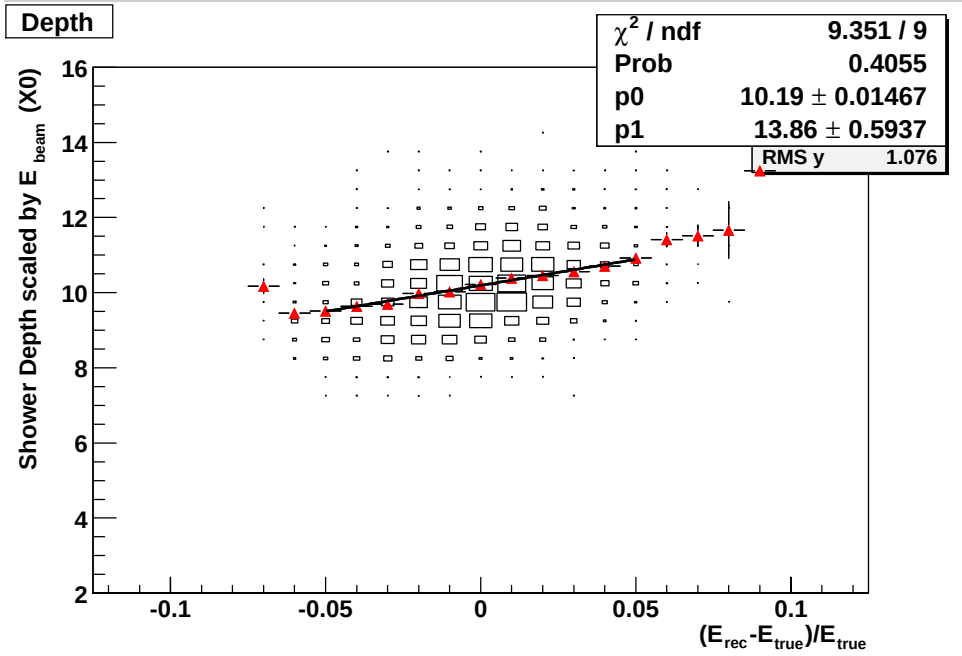
Etrue – Erec (GeV)

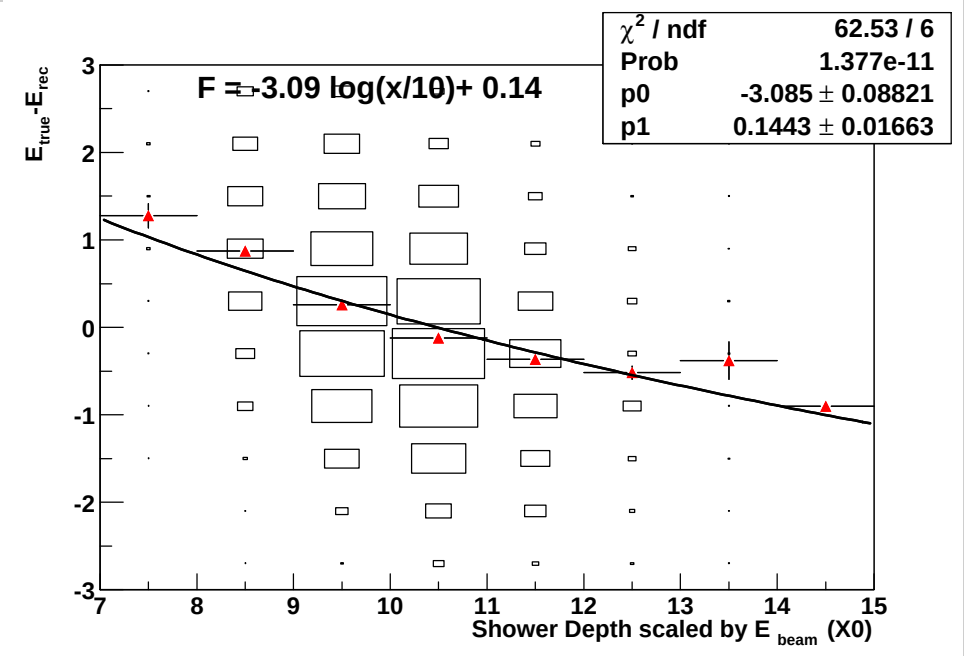


$$d_{true} = \frac{E_{PS}X_0^{PS} + E_1X_0^1 + E_2X_0^2}{E_{true}}$$

less energy is reconstructed for early showers

CTB04: Same behaviour as in ATLAS sim





50GeV electron data with ~2X0 upstream the CALO

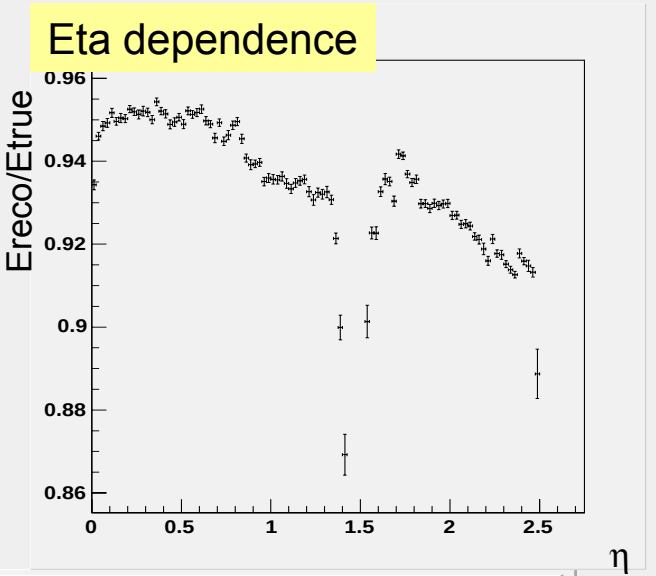
$$d_{true} = \frac{E_{PS}X_0^{PS} + E_1X_0^1 + E_2X_0^2}{E_{beam}}$$

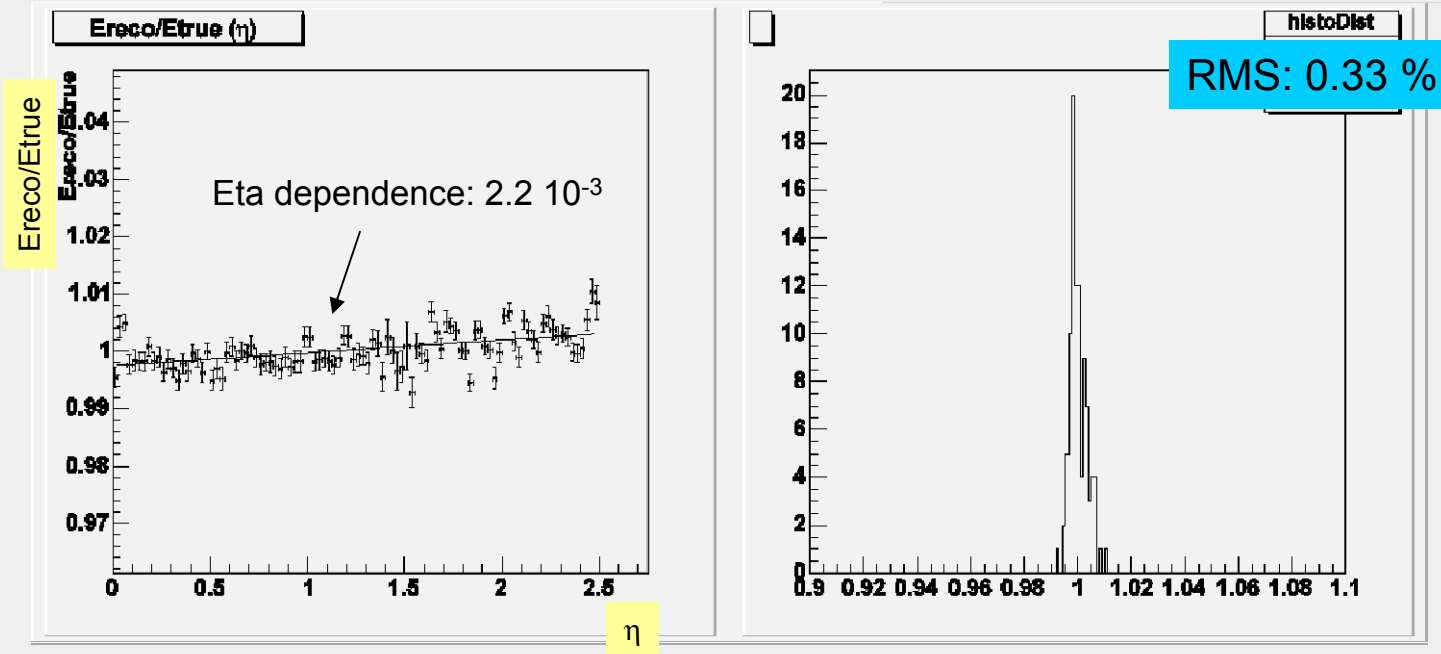
Intercalibration

M. Boonekamp, N. Kerschen

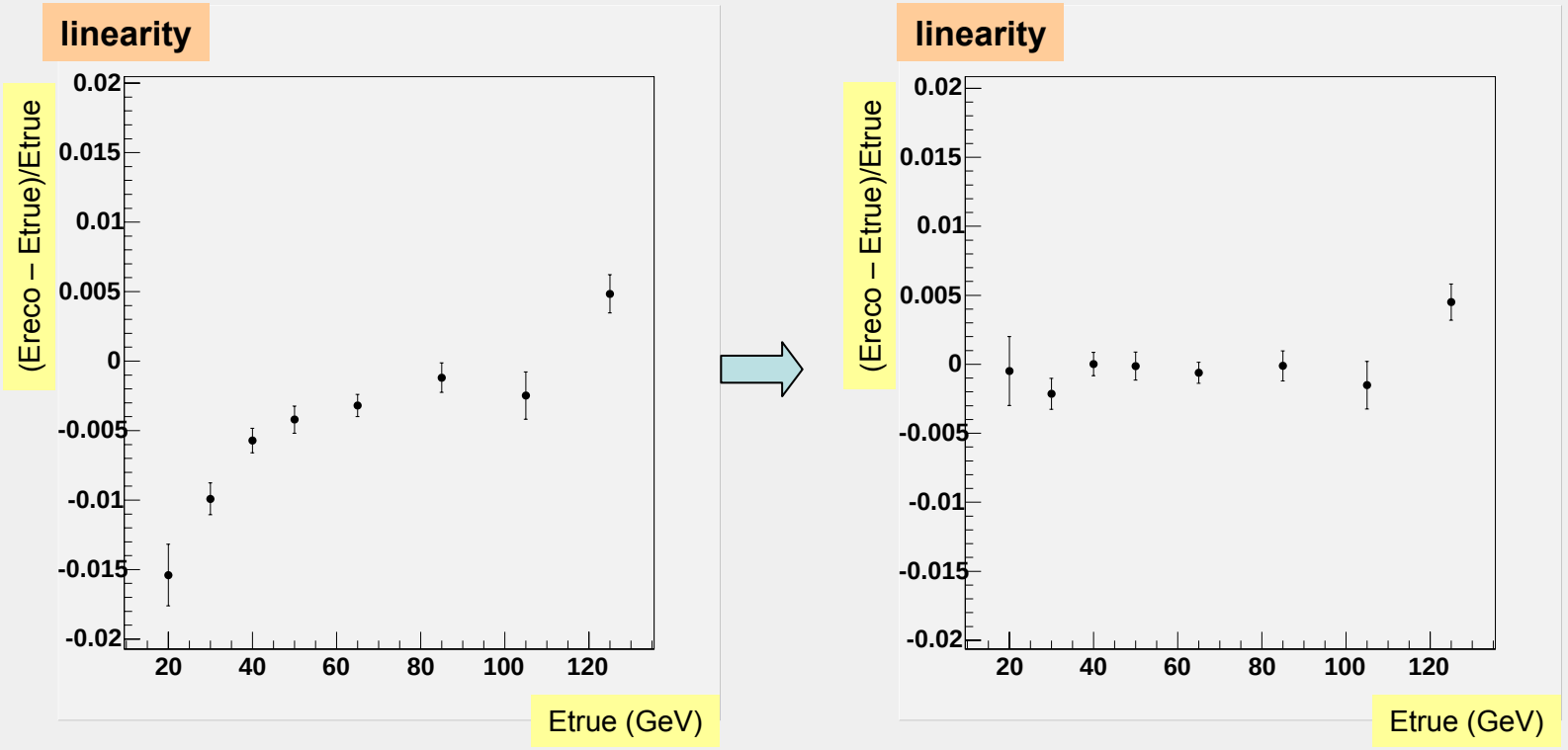
(Must happen after LW extraction so that material effects decouple)

- **Uniformization of calorimeter response (cluster 3x7, athena release 7.7.0)**
  - using athena release 7.7.0 and a 3x7 cluster. Matching the true electron to the cluster
    (45000 Z→ee events)
  - Uniformisation in η
    - Reference smeared with observed resolution on reconstruction

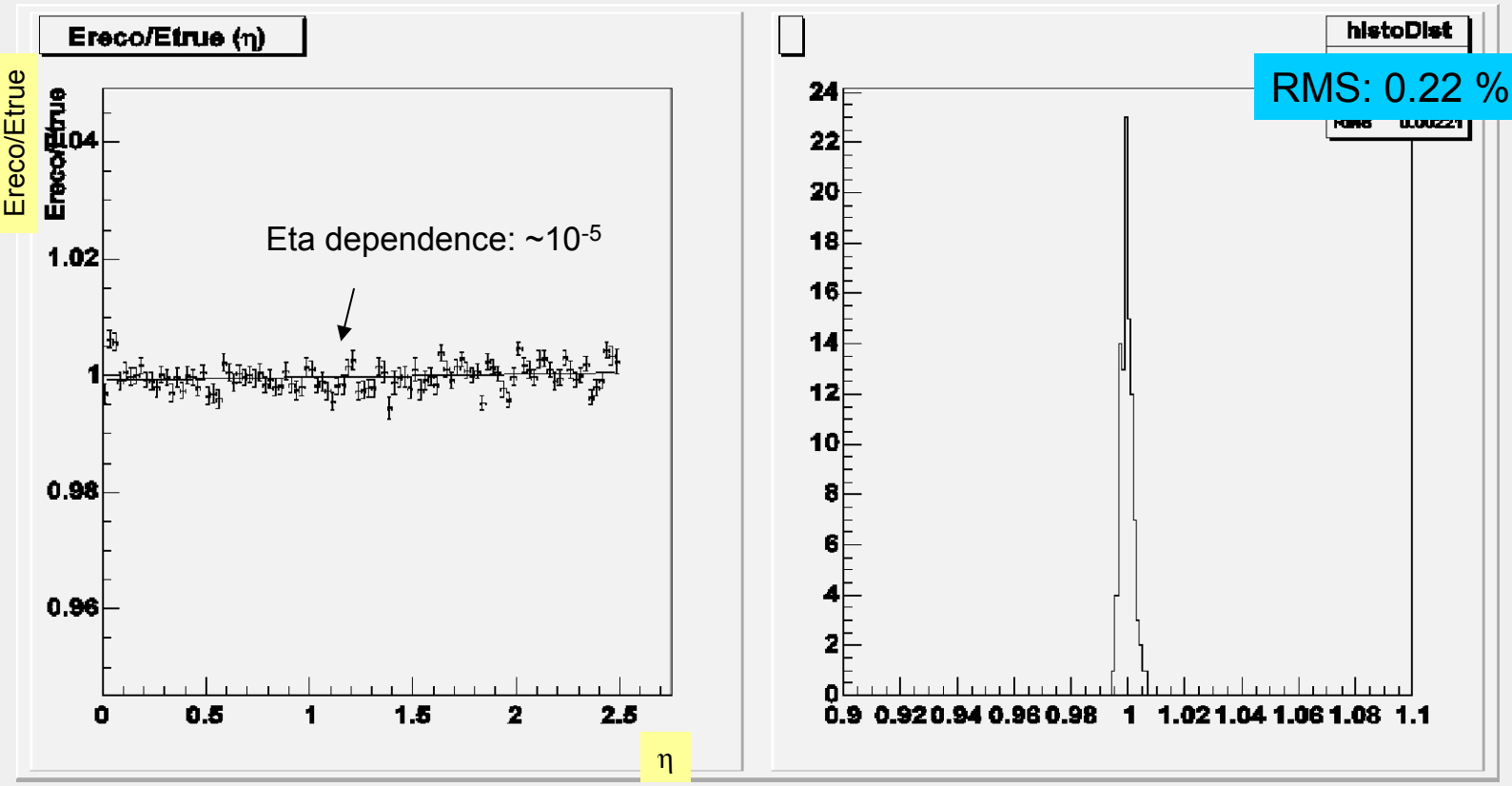




– Non-linearity remaining after uniformization
– Can be corrected by fitting a global offset and a scale factor on the reference distribution $E_{rec} = \lambda(b + E_{corr})$ where E_{corr} is the energy after uniformization



- After linearity correction, η dependence vanishes and uniformity improves



Summary

- We now have new improved cluster corrections which provide good linearity and resolution for all cluster sizes.
- New cluster dependent weights are under evaluation (maybe in 10.0.0).
- Additional corrections mainly due to energy losses are necessary, but must be studied.
  - CTB04 crucial for testing such corrections
- After material correction extraction we can determine Intercalibration factors with Z->ee
  - A new method was presented with DC1 Z->ee events can obtain IC weights per middle cell, and Uniformity at the 0.2% level
  - These weights must be fed back in the cluster energy.

Supporting ViewGraphs