ATLAS Calorimeter Compensation using the Numeric Method – a method description

Elin Bergeaas,
Sten Hellman, Kerstin Jon-And, David Milstead
Stockholm University

Cigdem Issever
University of Oxford

The numeric method

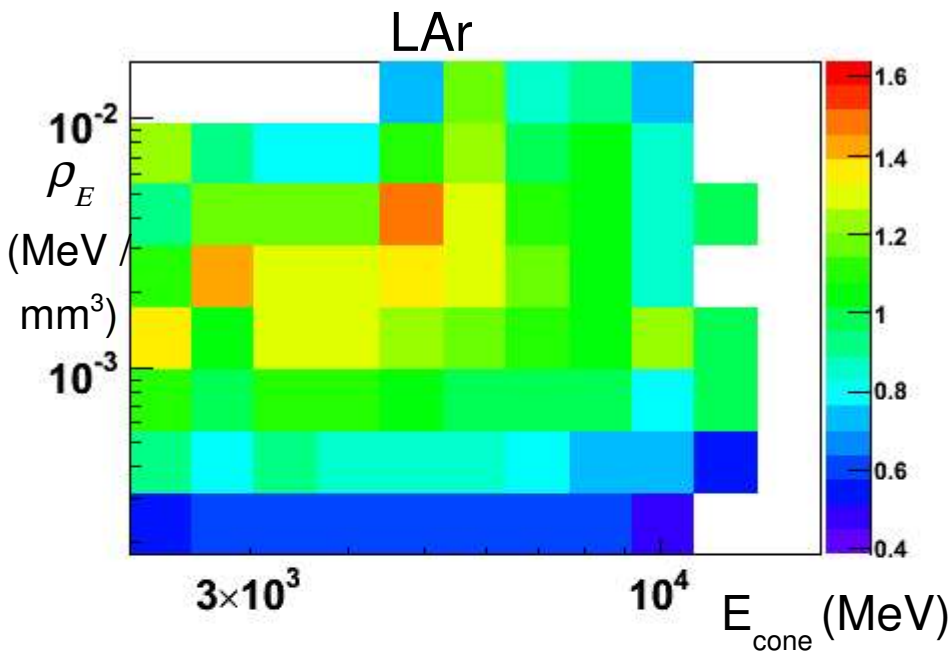
Non-iterative procedure using tabulated correction factors w on the cell level: $E^{\text{cell}}_{\text{corr}} = w(E^{\text{cell}}_{\text{rec}}/\text{Vol}^{\text{cell}},\ E_{\text{global}}) \cdot E^{\text{cell}}_{\text{rec}}$

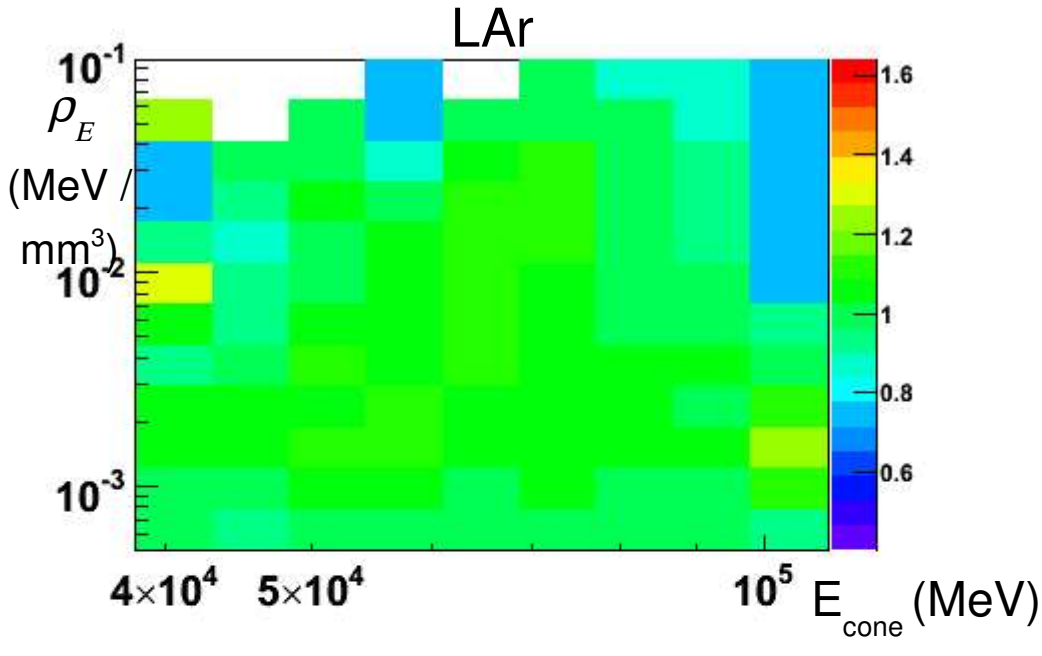
- Evaluate for each cell the **energy density** $E^{\text{cell}}_{\text{rec}}/\text{Vol}^{\text{cell}}$.
- Determine the **energy scale** E_{global} for the weighting procedure by searching for groups of neighbouring clusters within a cone.
  (E_{global} is the energy of the cone)
- Apply a correction factor w to each cell of the group E_{global} depending on the energy density of the cell.

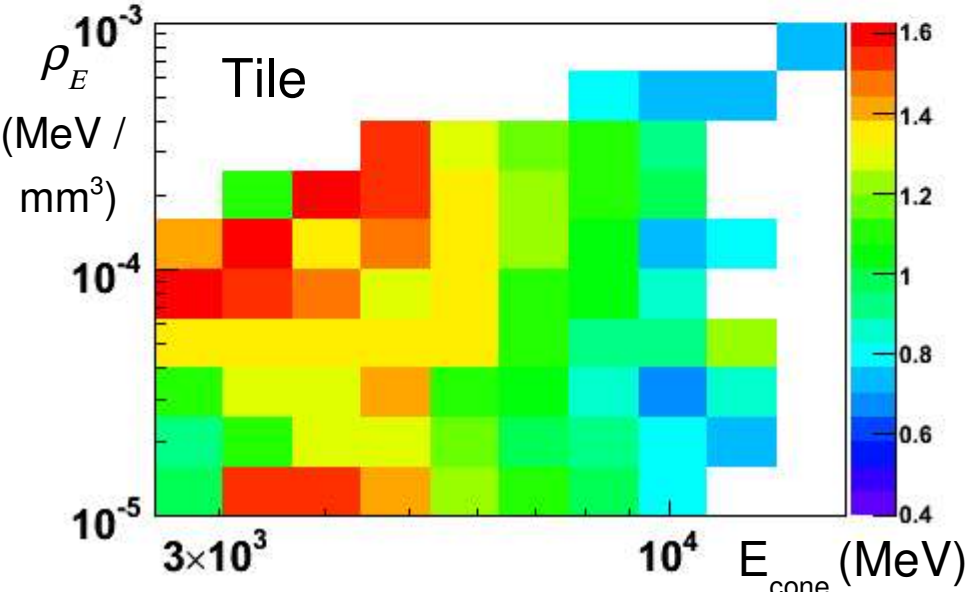
Determination of the weighting factor tables

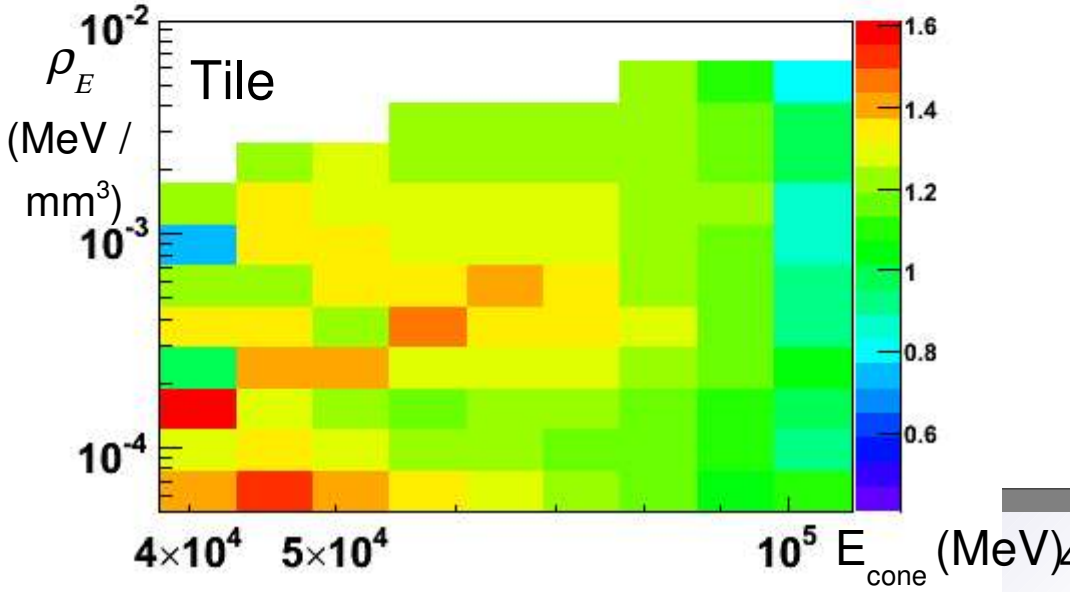
- Use fully simulated pion events for each calorimeter module.
  Intended energy range [0.5, 300] GeV.
- Determine the **most energetic topo cluster** in a pion event.
- Set the energy scale $E_{\text{global}} = E_{\text{cone}}$ by drawing a cone axis through the hottest cluster, and compute $E_{\text{cone}} = \Sigma_{\text{cluster} \in \text{ cone}} E_{\text{cluster}}$
- Determine for the cells of the **most energetic cone**
  - $E^{\text{cell}}_{\text{dep}}$ (energy truly deposited in the cell)
  - the reconstructed $E^{\text{cell}}_{\text{rec}}$ (energy on EM scale in the cell)
- Enter the weights, $w = E^{\text{cell}}_{\text{dep}} / E^{\text{cell}}_{\text{rec}}$ into 3D histograms as a function of $E^{\text{cell}}_{\text{rec}}/\text{Vol}^{\text{cell}}$ and E_{cone}.

Weight tables

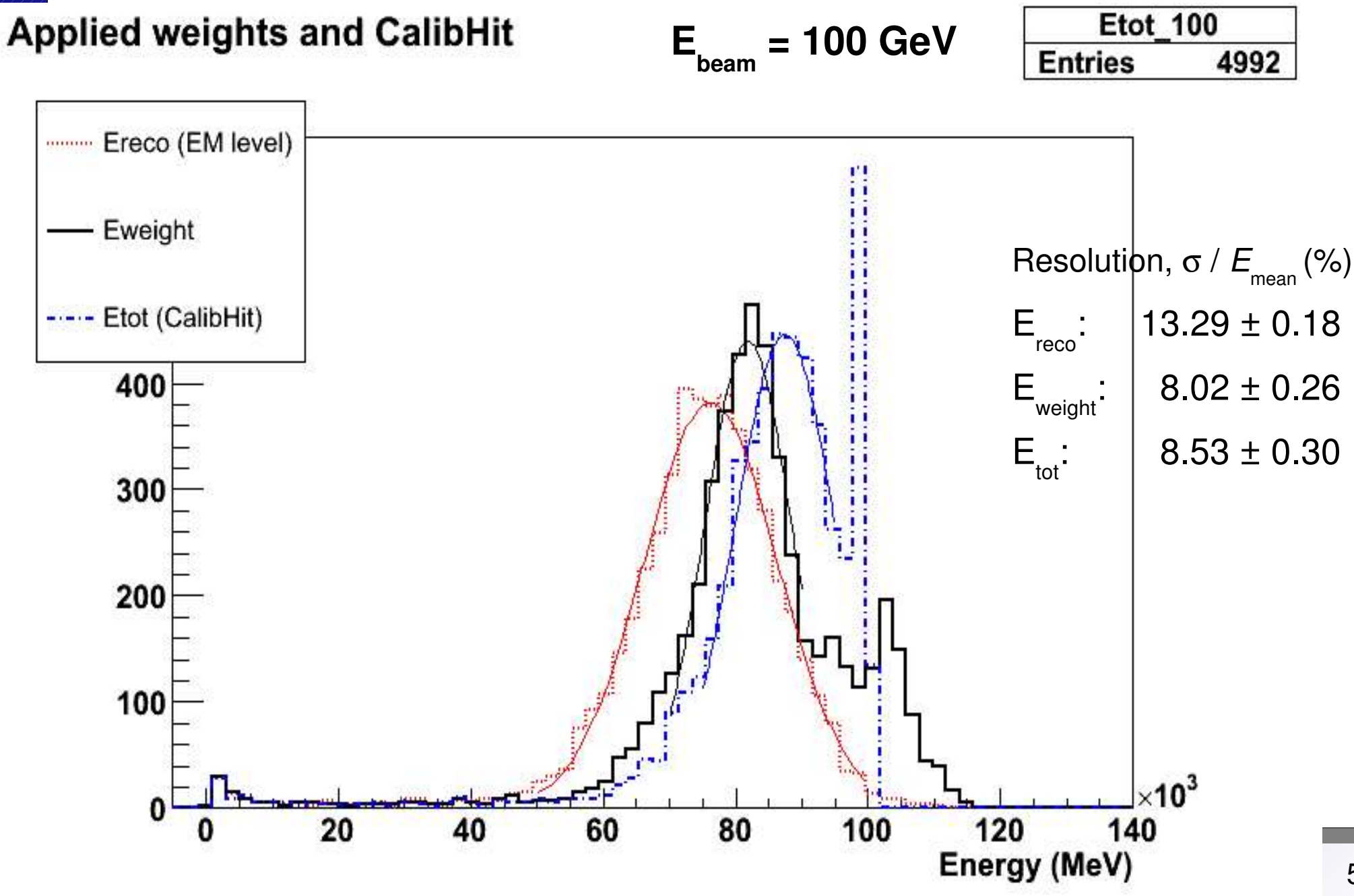




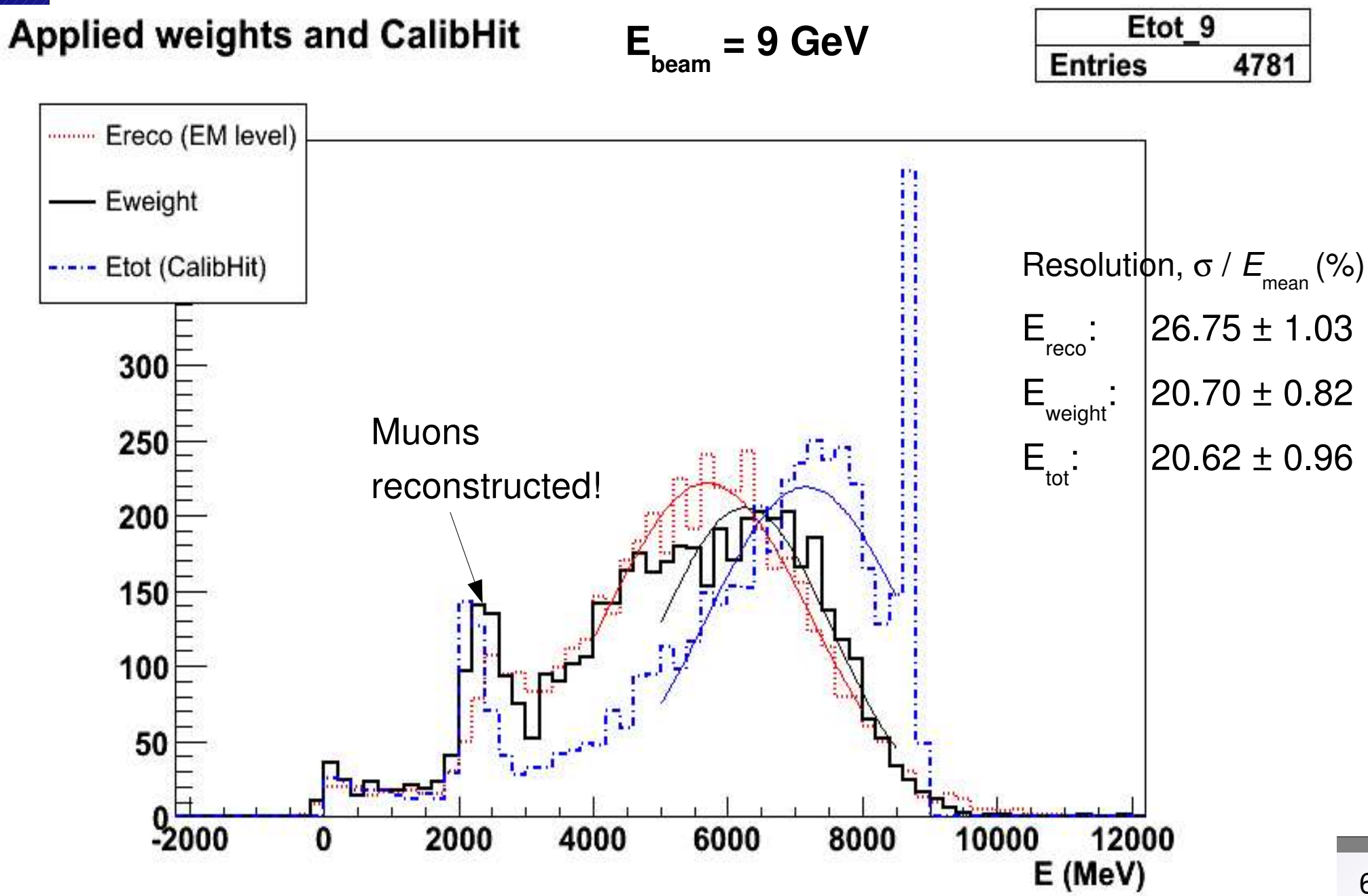




Weights applied on independent MC sample



Weights applied on independent MC sample



Outlook

- Our current aim: test beam
- Long-term aim: ATLAS

  - Implement the algorithm on reconstruction level

The numeric method has been successfully used on the calorimeters of H1 at HERA:

- C. Issever et.al., NIM A 545 (2005) 803-812
- C. Schwanenberger, Calorimetry in Particle Physics, Pasadena, 2002, pp. 761-766 (application on jets)