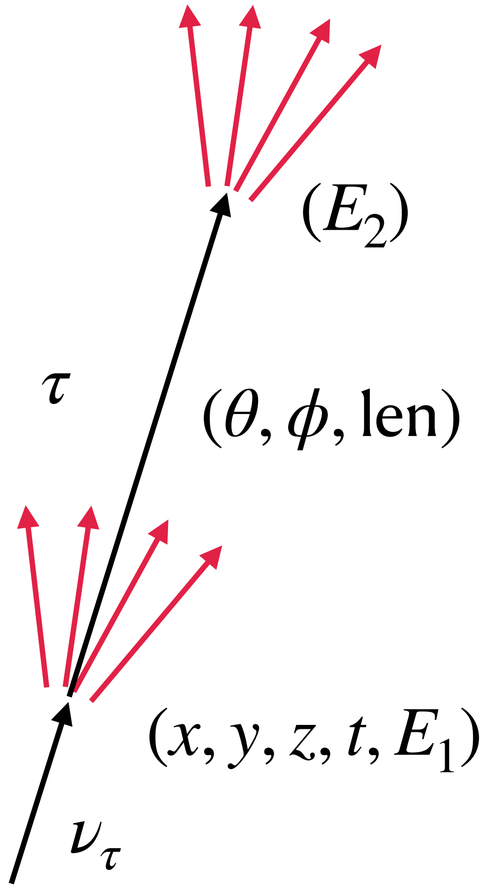
Reconstruction update

Thijs van Eeden - 03-12-2020

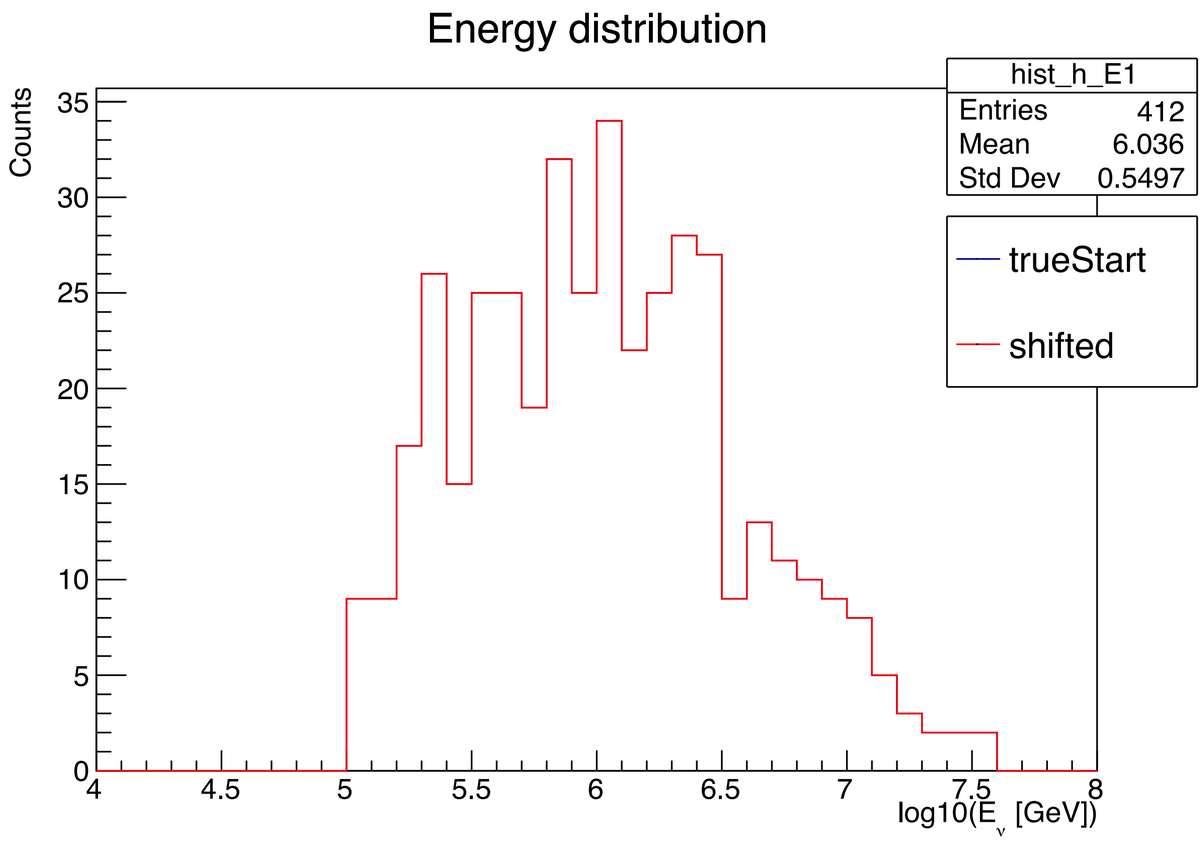
Double bang fit

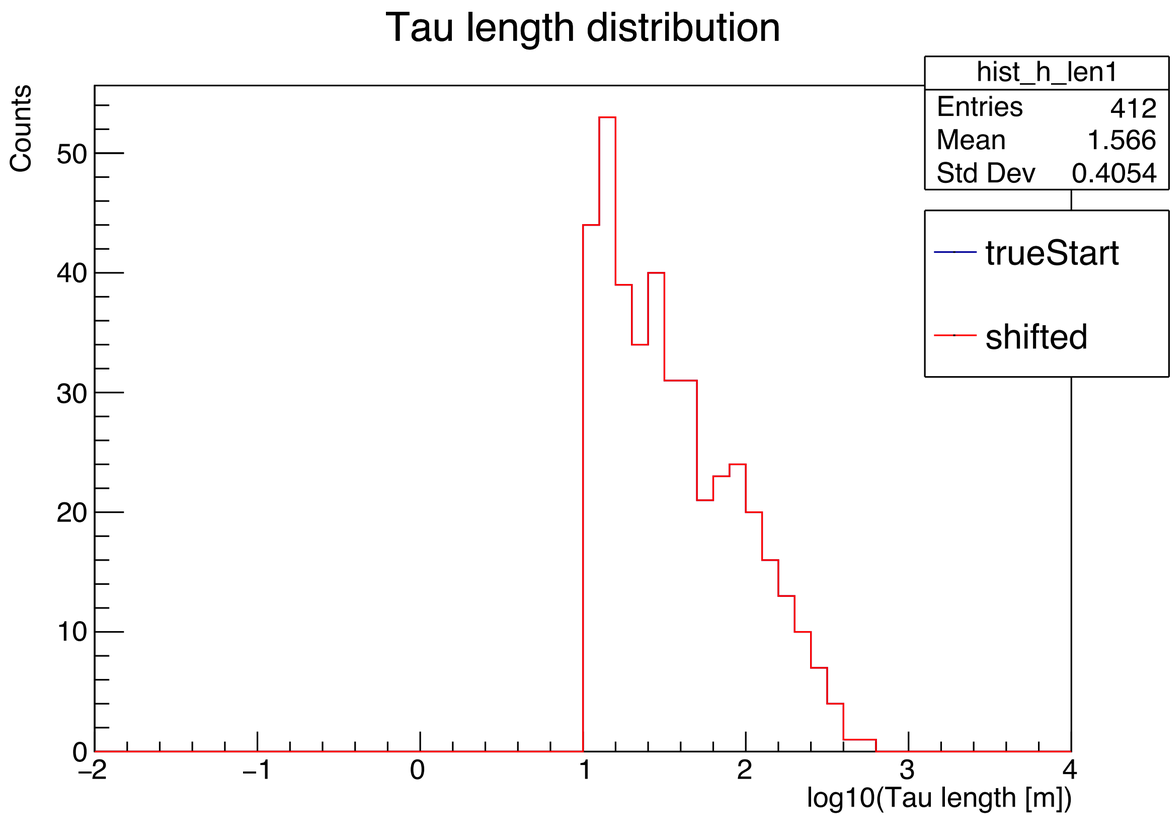
Fit starts at:

- True $(x, y, z, t, \theta, \phi, \text{len}, E_1, E_2)$
- Shifted starting position:
  $(x + 1, y + 1, z + 1, t + 1)$
  $(\theta + 3 * \pi/180, \phi + 3 * \pi/180)$
  $(1.3 * \text{len})$
  $(0.7 * E_1, 1.3 * E_2)$



Double bang events

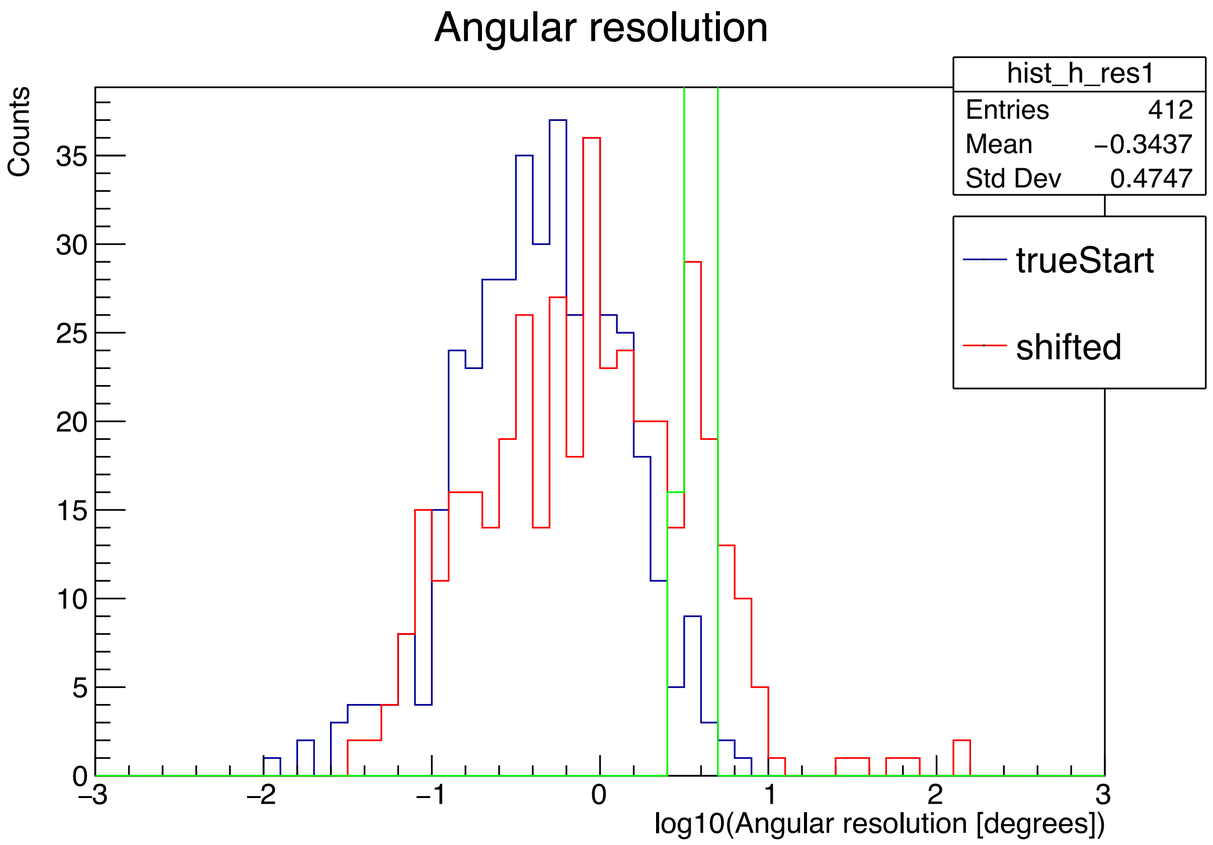




- Tau length cut: Len > 10 m

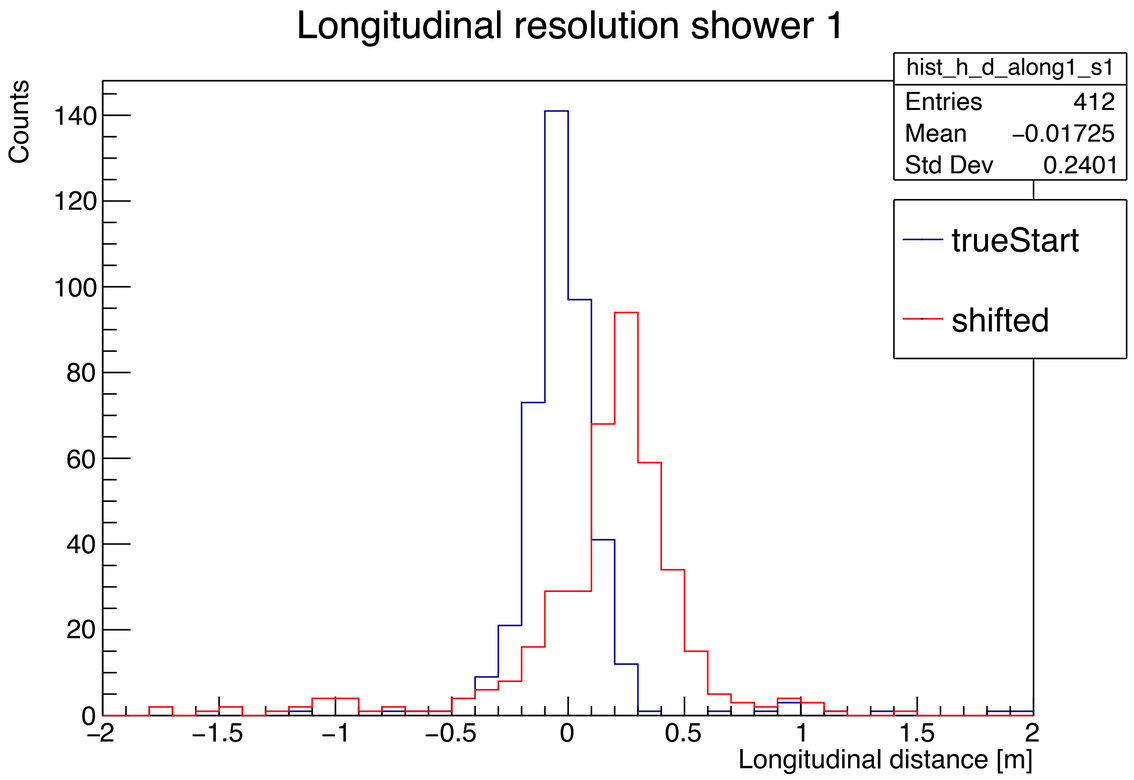
Angular resolution

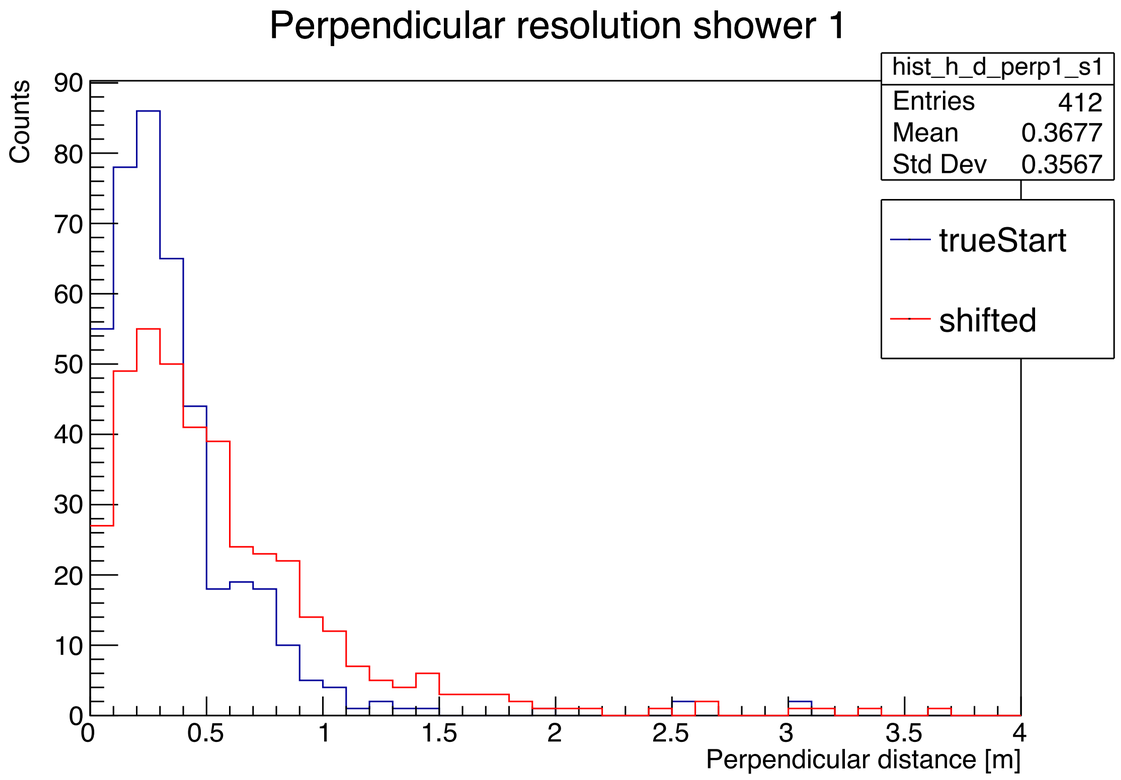
- **Fit start at true:** mean at 0.45°
- **Fit start at shifted:** mean at 0.83°
- **Some events stay in the green bins: starting direction of the shifted fit**



Position resolution

Shower 1

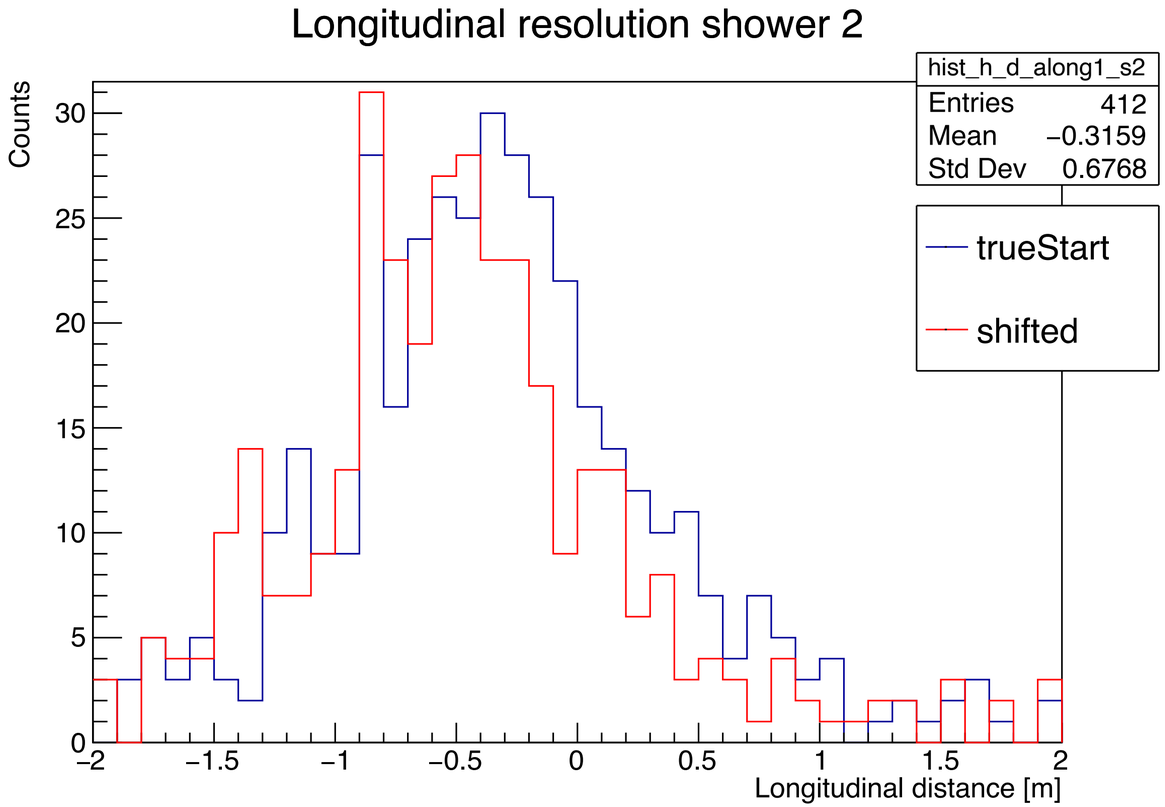


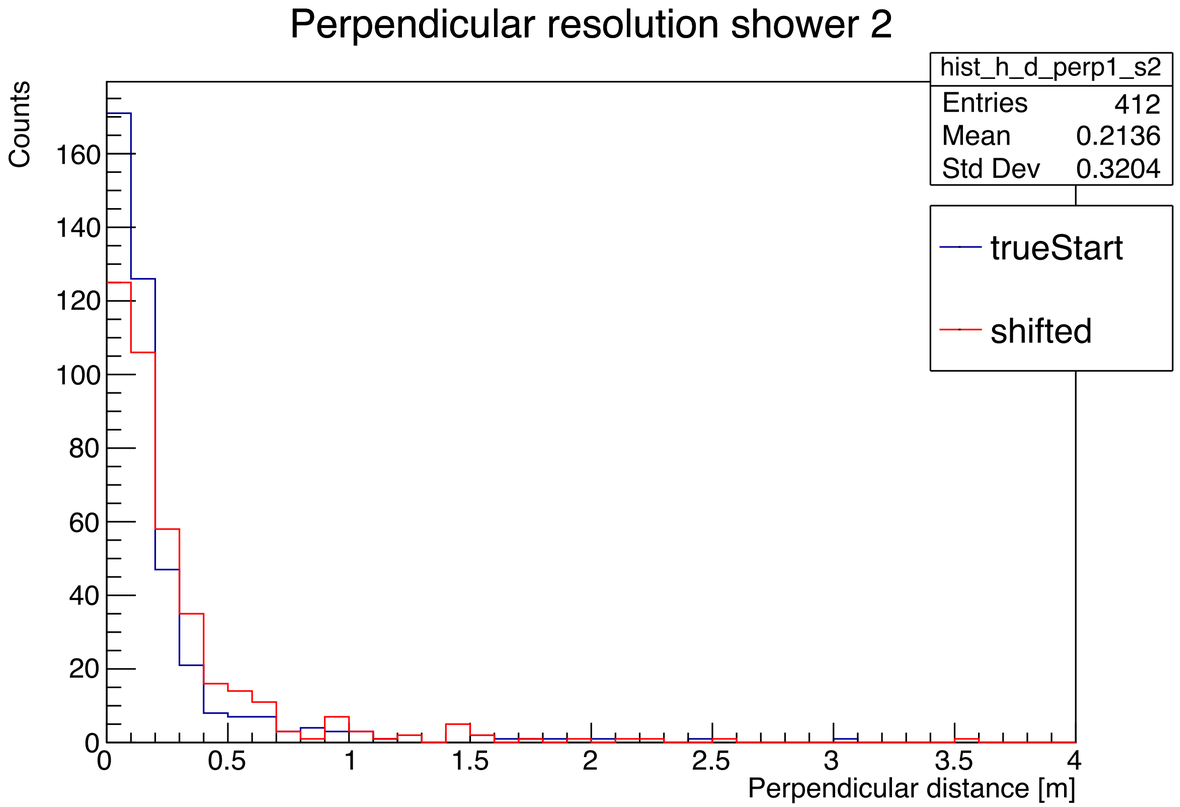


- Longitudinal bias moves towards second shower for shifted starting points
- Perpendicular resolution: 36-57 cm

Position resolution

Shower 2



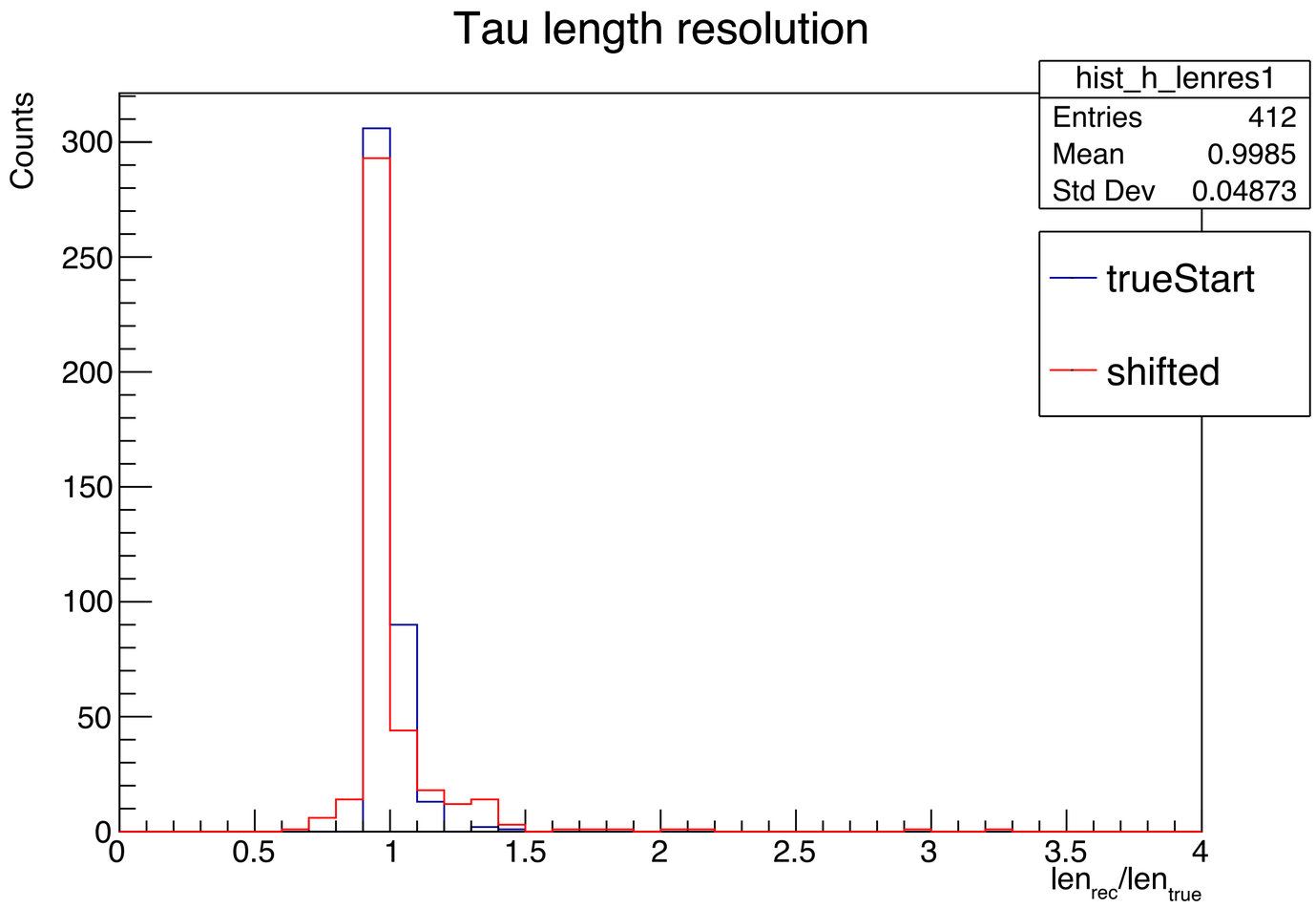


- Longitudinal bias moves towards 1st shower for shifted starting points
- Perpendicular resolution: 20-28 cm

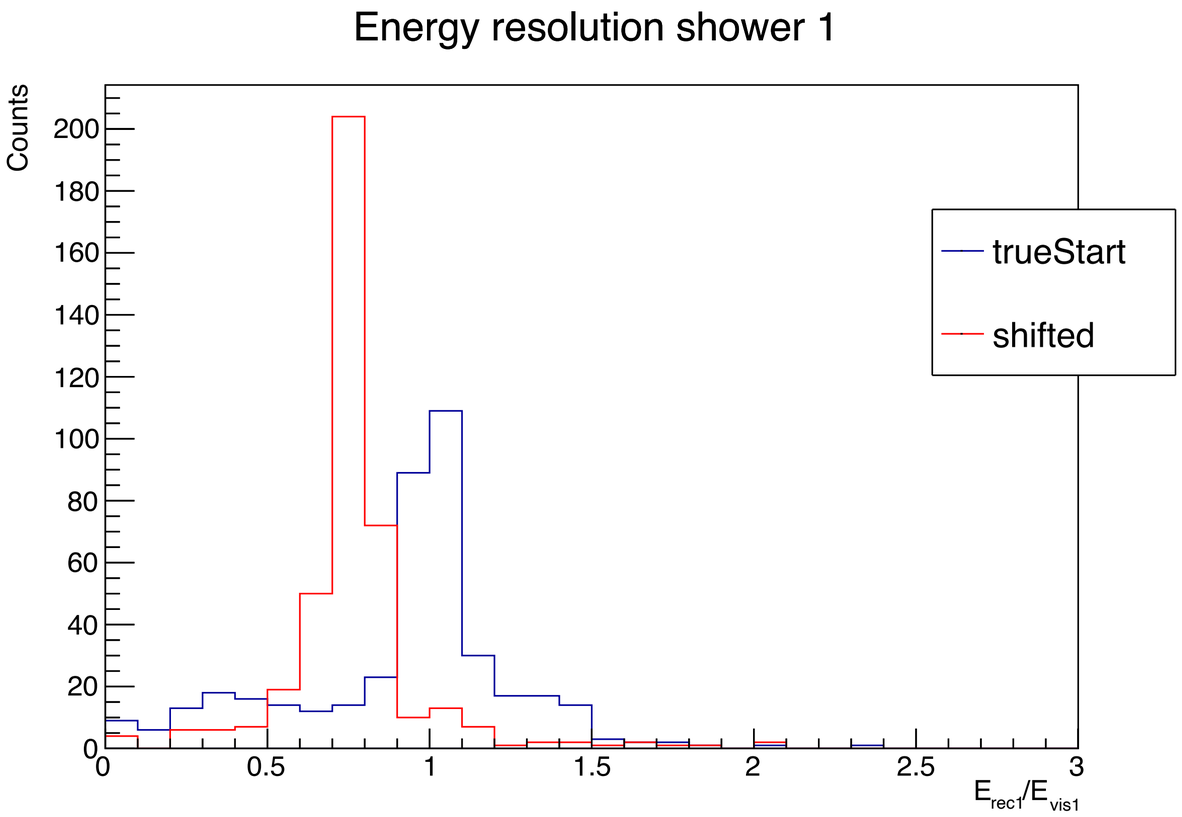
Tau length resolution

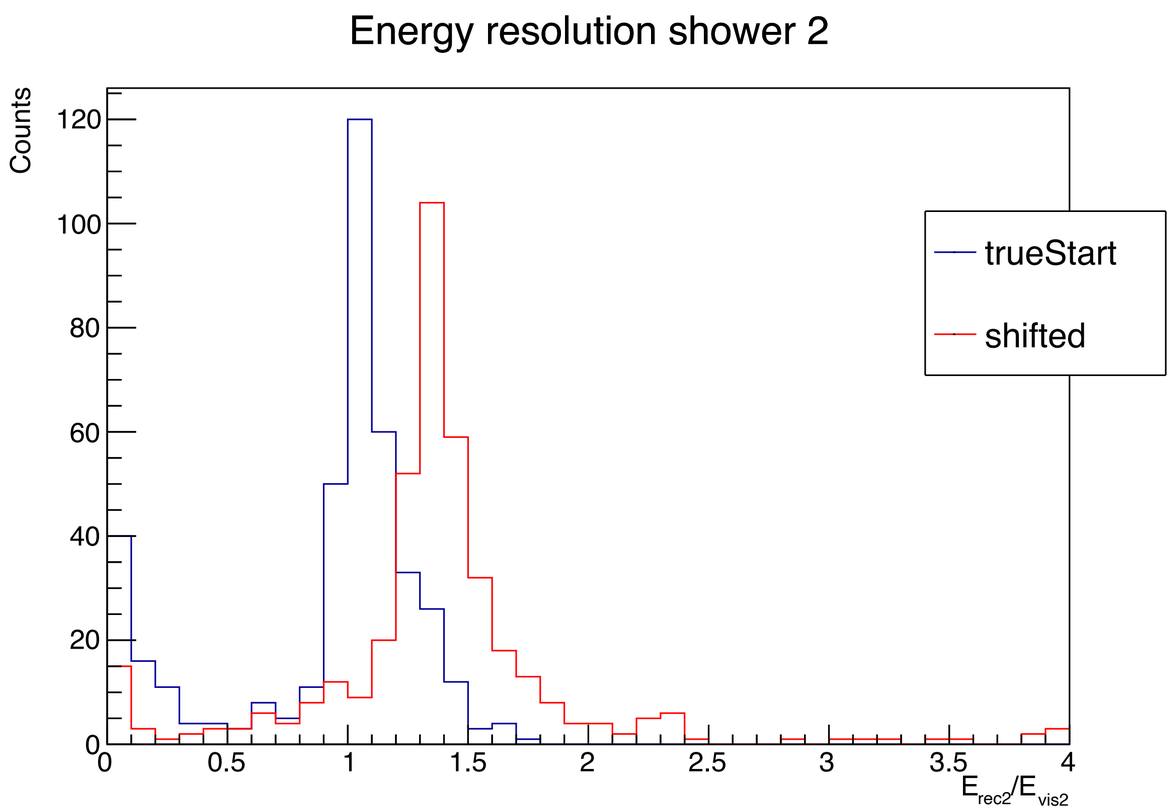
- Tau length is reconstructed well
- Same as the position of the vertices

How about the energy resolution?



Energy resolution





- Resolution bias at the true energies
- Resolution bias at the shifted energies ($0.7 * E_1, 1.3 * E_2$), fit not working?

Outlook

- Direction, vertex and length fit seems to work
- Energy fit does not seems to work

Likelihood that is minimised: $-\text{Log Likelihood} = -\sum_{\text{hits}} \text{Log } P_{1st}$

Uses only time information: no sensitivity for energy?

Include hit/nohit information!

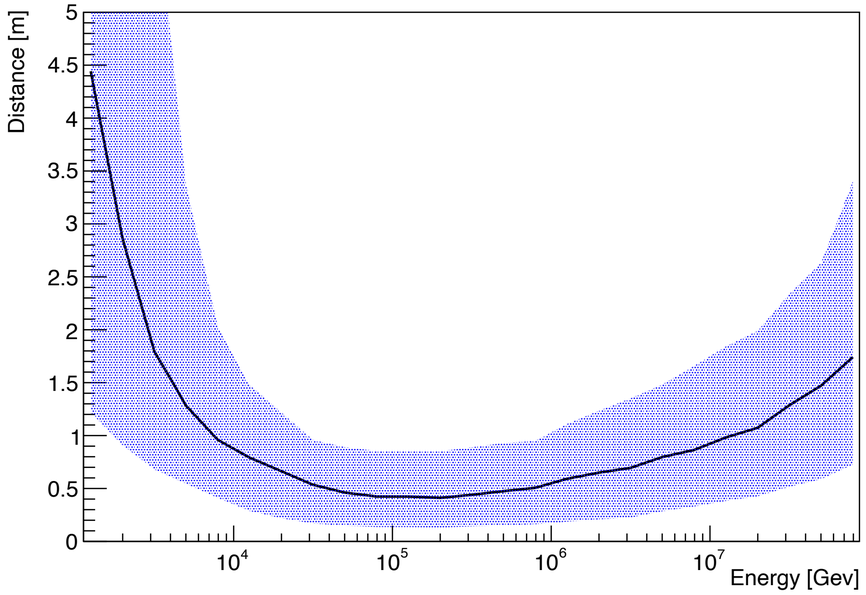
Vertex reco in Aashowerfit

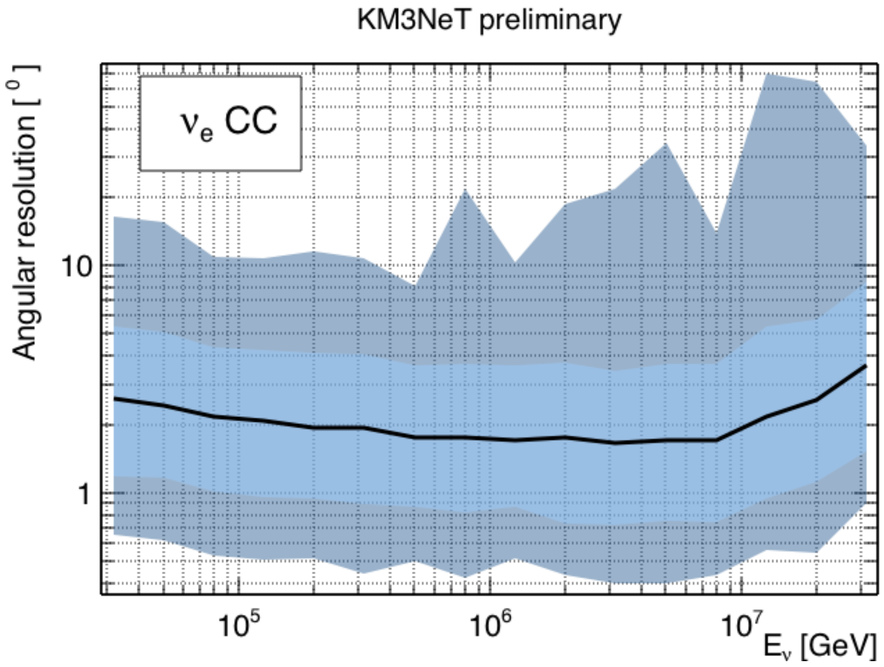
Last week in the reco meeting

- Performance M-estimator not optimal for lower energies (100 GeV - 10 TeV)
- How can aashowerfit improve if the vertex fit is better (or perfect?)

Rerun aashowerfit with

- M-estimator vertex fit
- True vertex





Vertex reco in Aashowerfit

- Resolution improvement for E < 10 TeV
- Resolution improves slightly or is comparable for E > 10 TeV, depending on the cuts

Suggestion: try Lorentzian estimator