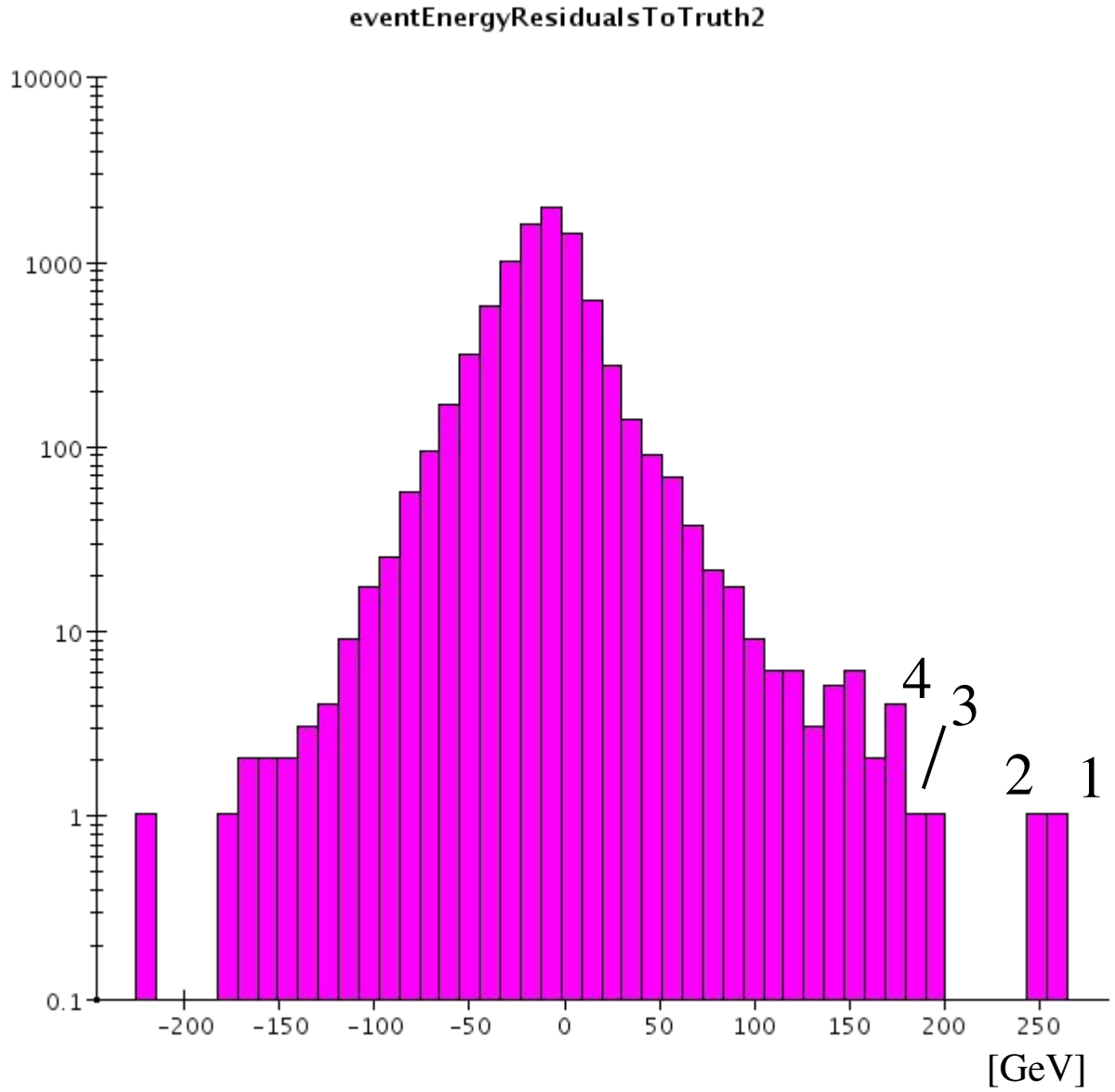
Improving the PFA

- Study of outliers:
  - Non-prompt muons
  - PFA-”jet” problems
- Determination of 500GeV qq resolution with rsp. fixes

Outliers in 500 GeV qq energy residual



1: muon problem

2: muon problem+"jet" problem

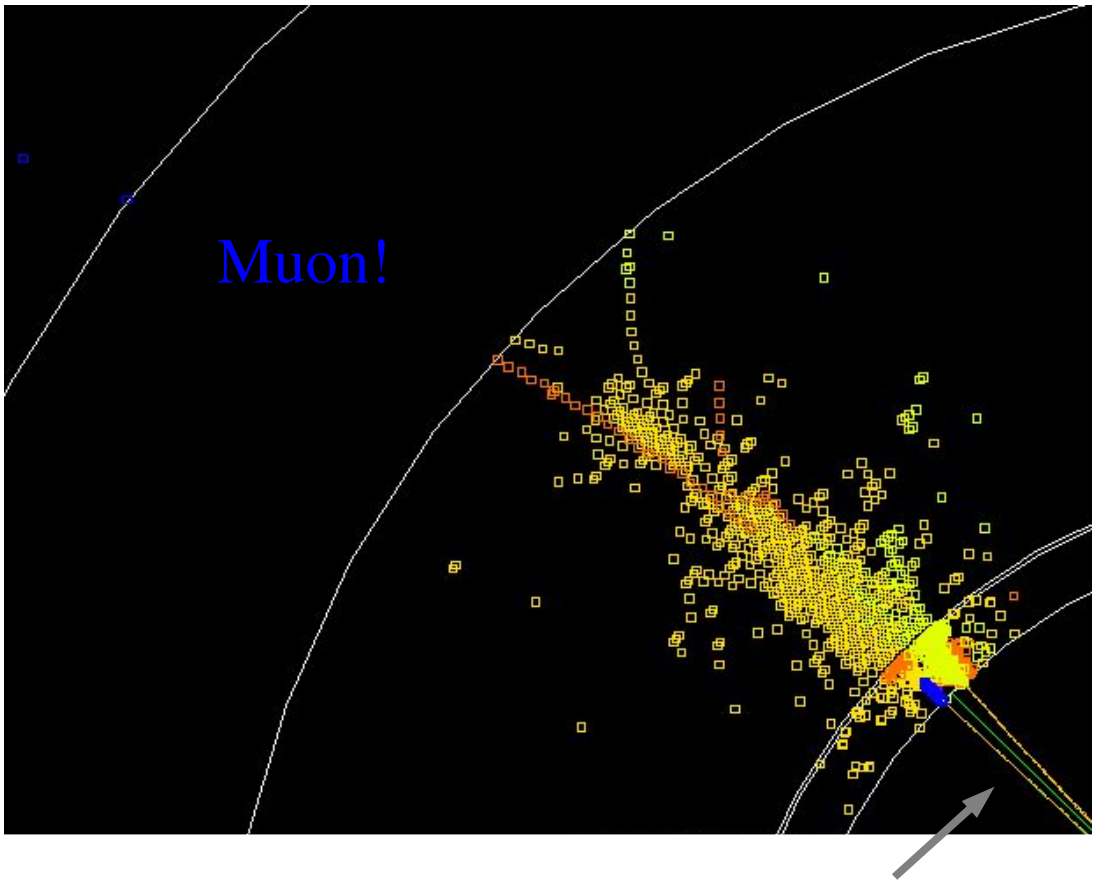
3: "jet" problem

4: 2 muon problems, 1 "jet" problem

Outliers: non-prompt muons (reminder)

500 GeV qq event 456, in

pythia_uds_nobeam_nobrem-1-500_SLIC-v2r5p2_geant4-v9r1p2_LCPhys_sid02.slcio



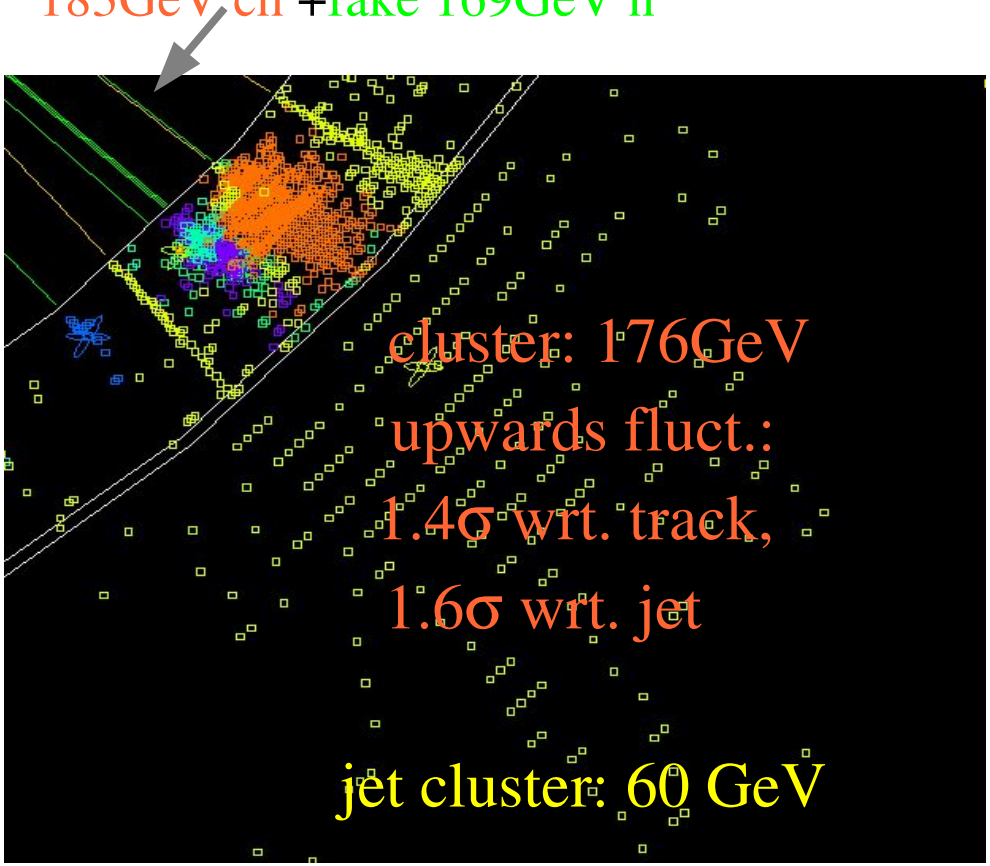
191 GeV track + 164, 2 GeV fake neutrals

- studied isolation criterion: At least 7 isolated or semi-isolated hits in HCAL
- 5 of the top 10 outliers are of this kind and cured

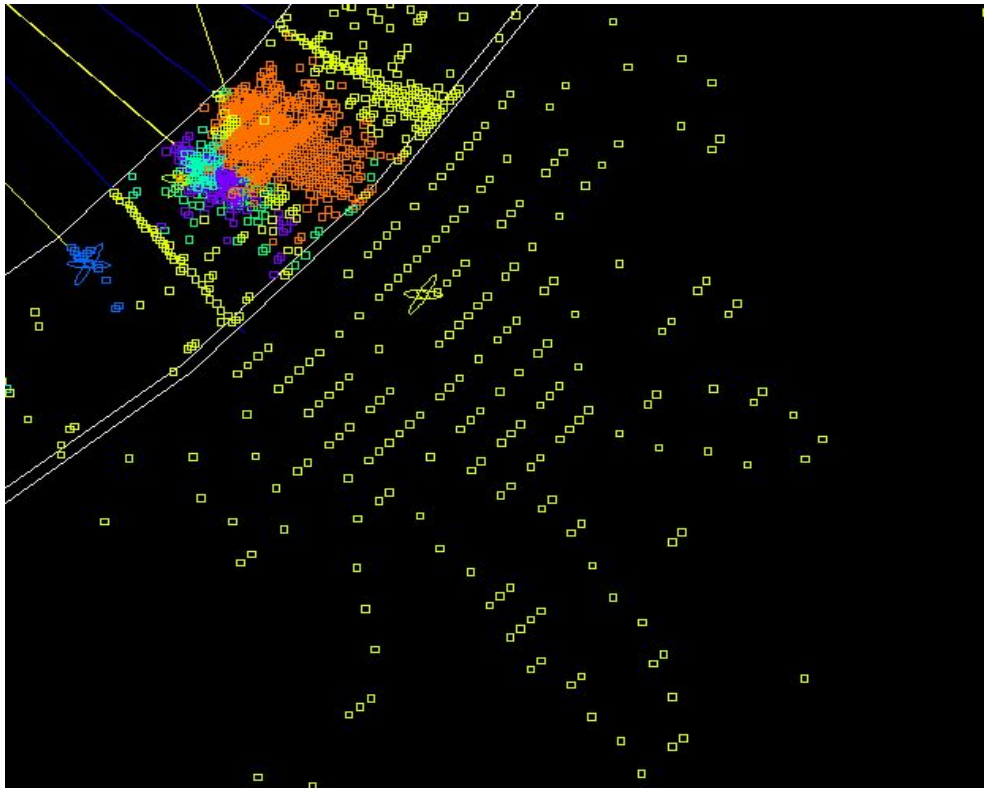
Outliers: PFA-"jet" problems

500 GeV qq event 37, in

pythia_uds_nobeam_nobrem-12-500_SLIC-v2r5p2_geant4-v9r1p2_LCPhys_sid02.slcio



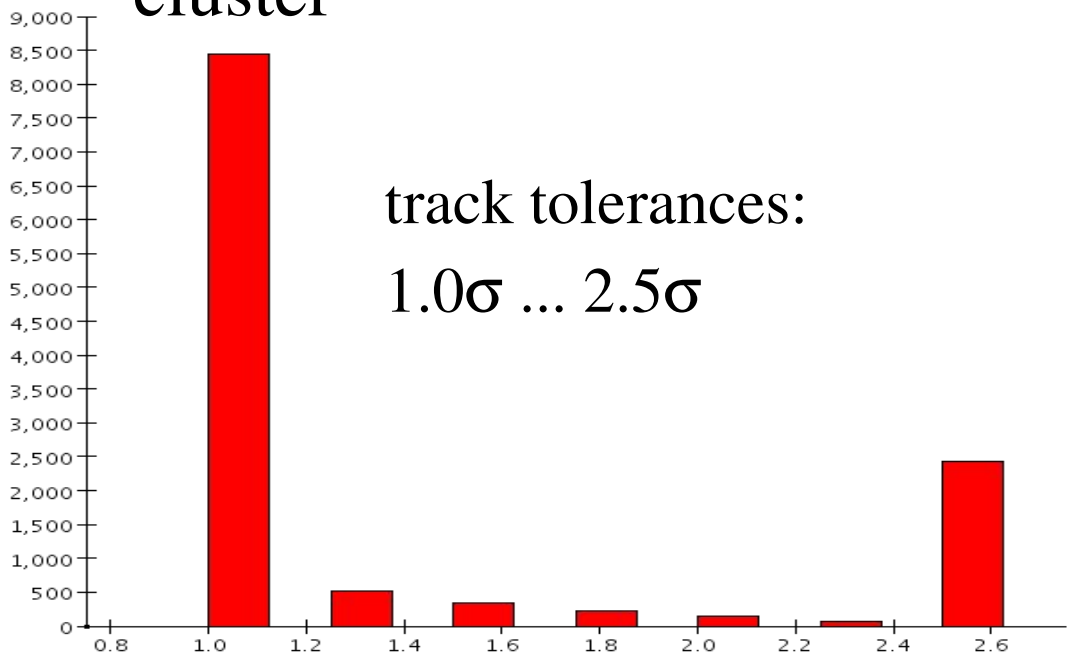
Reconstructed clusters
and reconstructed particles



Reconstructed clusters
and truth particles

Outliers: PFA-"jet" problems

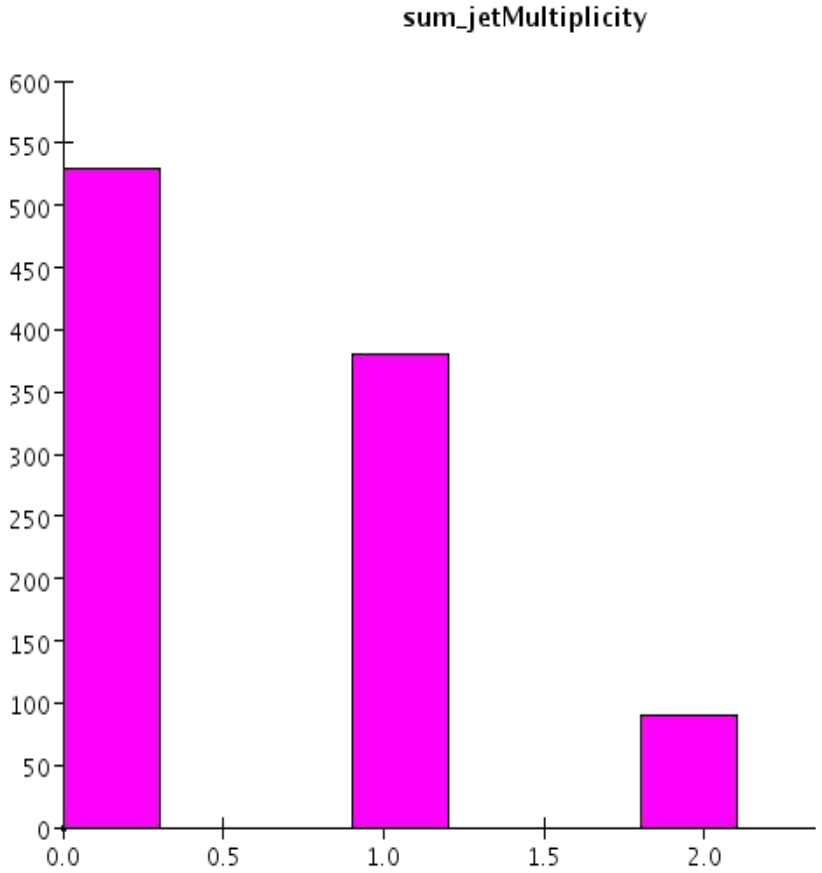
- 170GeV cluster not attached to 183GeV track
- "jet" is formed, eats seed
- "jet" cannot eat the 170GeV cluster

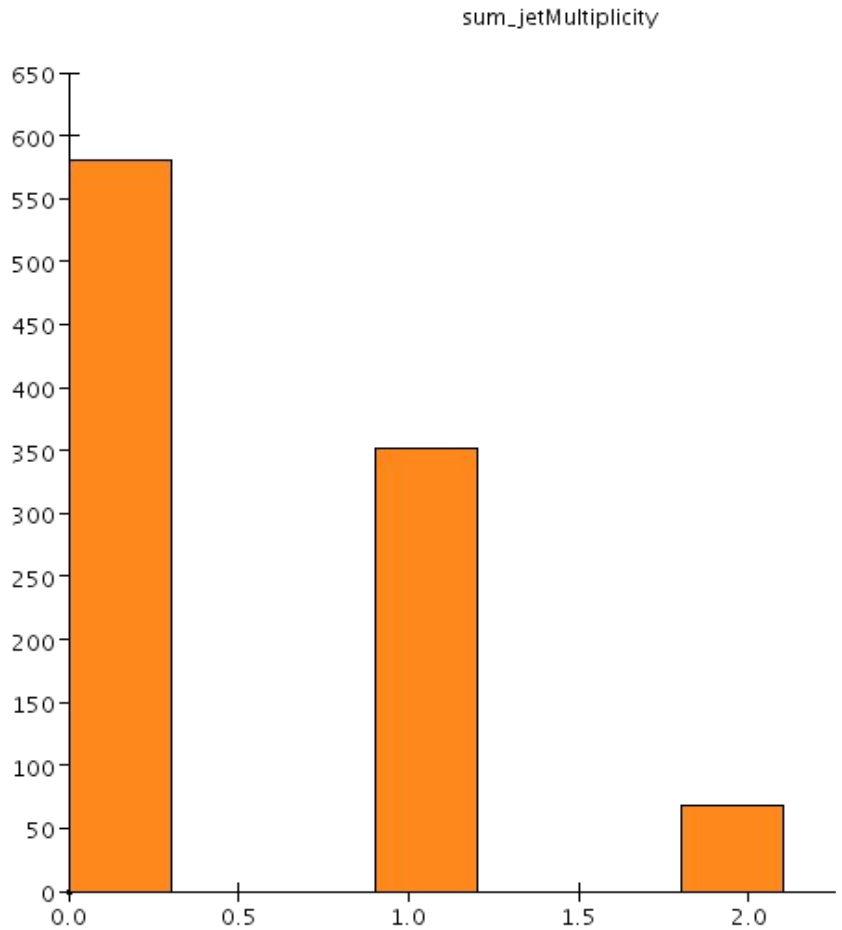


track tolerances:
1.0σ ... 2.5σ

- switching off "jets" deteriorates the resolution esp. in endcaps
- track tolerance loops up to 2.5σ; allow "jets" only when some included track reaches this limit
- cures all scanned "jet" problems

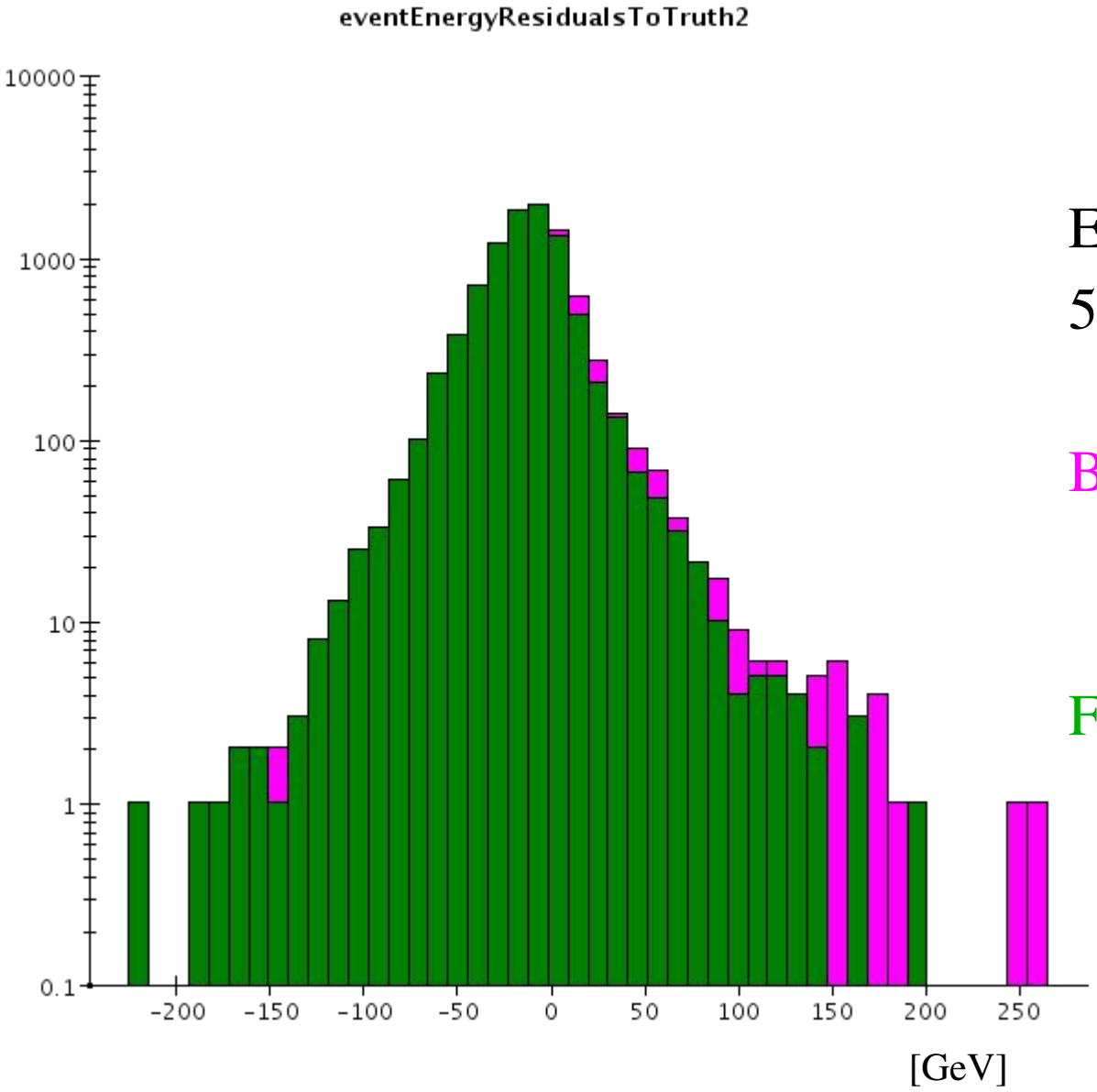
Outliers: PFA-"jet" problems





Jet multiplicity: "jets" unfixed "jets" fixed

Outliers: muons and ”jets” fixed



Energy resolution RMS90
500 GeV qq (cheat tracking):

Baseline:
3.4%(barrel), 3.3%(endcaps)

Fixes:
3.3%(barrel), 3.2%(endcaps)

Conclusion and outlook

- Problem of too aggressive PFA “jets” fixed
- Fixes of the two most common outlier types are visible in the resolution
- Other processes should be studied, using full tracking
- Also studying cluster/track matching