ilcsoft validation: single photon samples

ilcsoft v02-01 recently released
- preparing for large MC production @ 250 GeV for physics studies

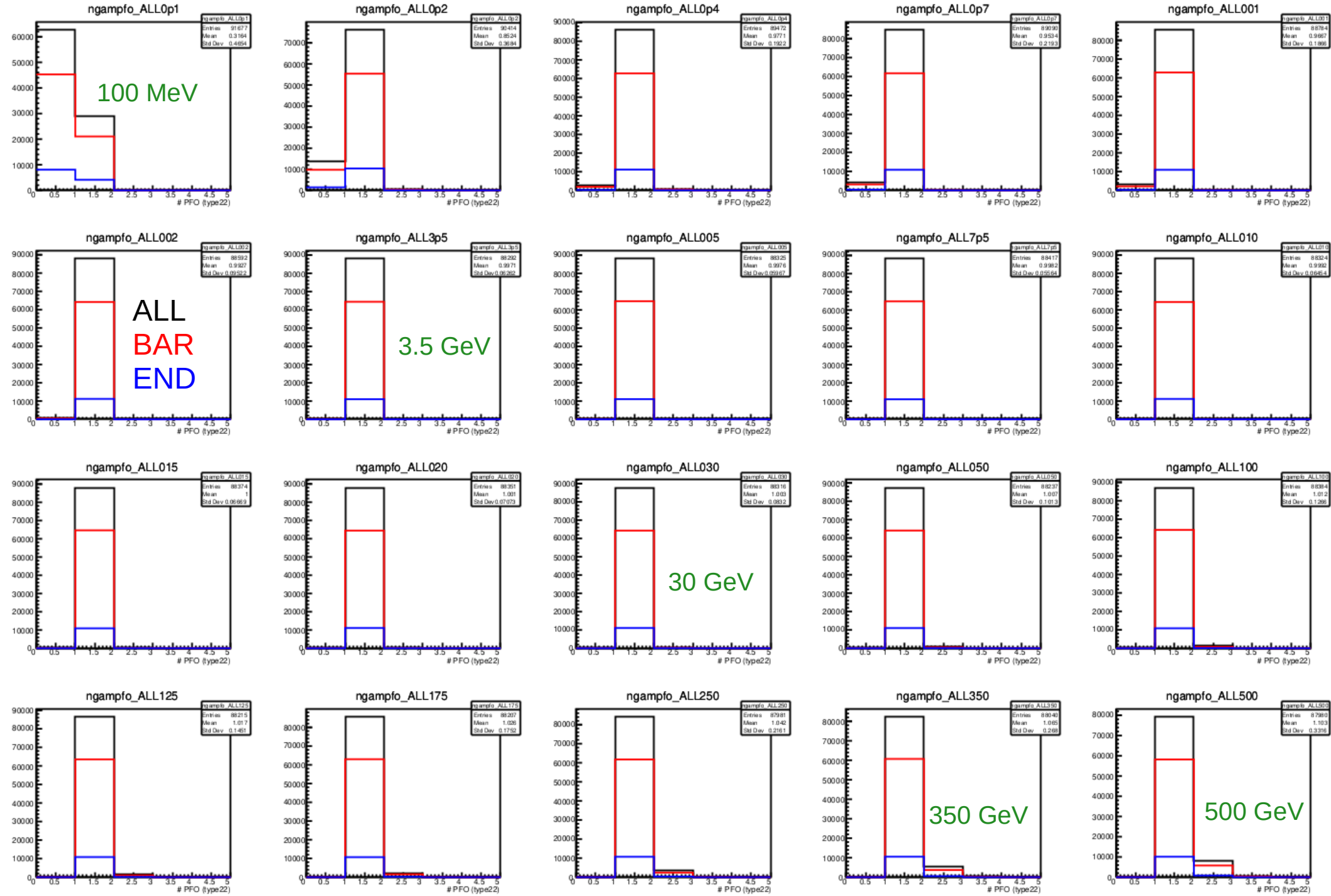
Miyamoto-san & Ono-san (ILD MCprod group) have produced test samples

I looked at single photon samples
- discrete energy points, 0.1 GeV → 500 GeV
- float in cos(theta), phi from 0→pi (not 2*pi as intended?)
- no crossing angle or beam backgrounds

- new photon PFO-level calibration corrections applied in central reconstruction
  - functions of cos(theta), phi, energy

reject events in which photon interacted in tracker region (mostly conversions)
- using MC information

number of photon-like PFOs per event



BAR : |cos(theta)|<0.7 END : 0.8<|cos(theta)|<0.95

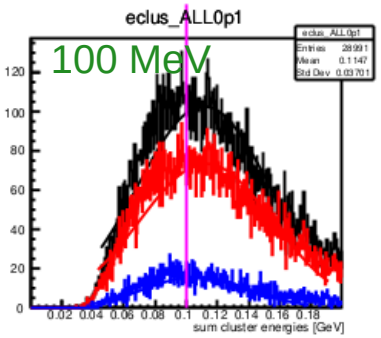
number of photon-like PFOs per event

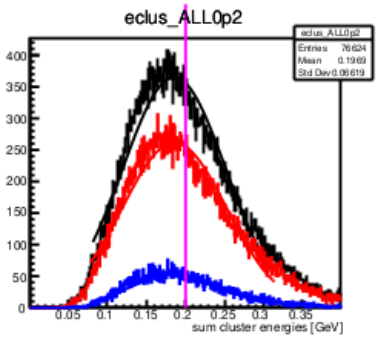
inefficiency at very low energies

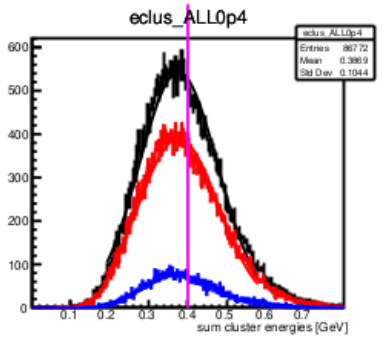
some cluster splitting at very high energies

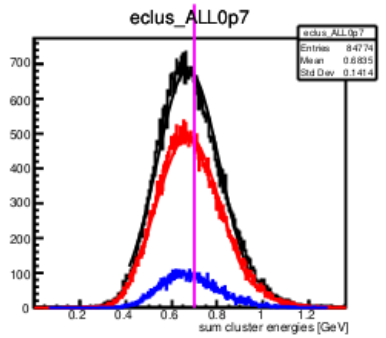
BAR : |cos(theta)|<0.7 END : 0.8<|cos(theta)|<0.95

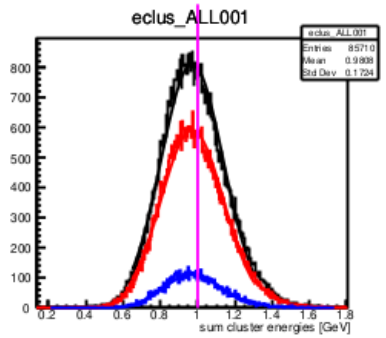
sum of cluster energies/event = sum of clustered hit energies

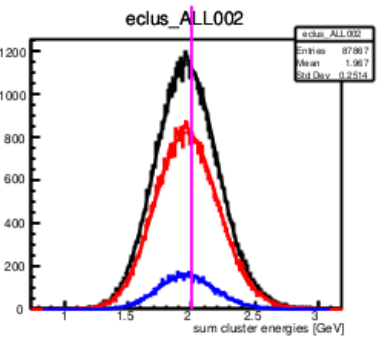


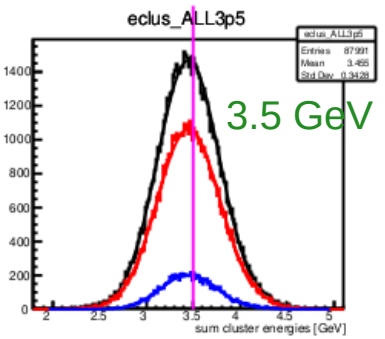


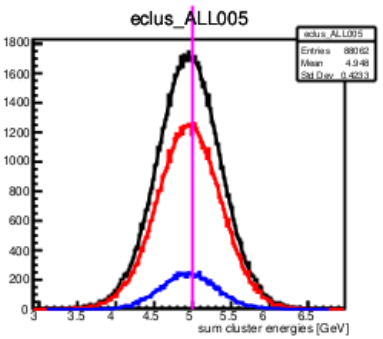


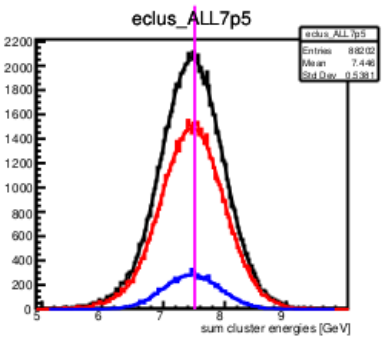


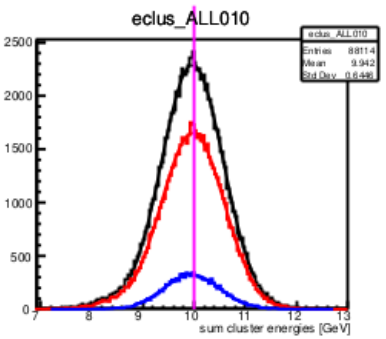


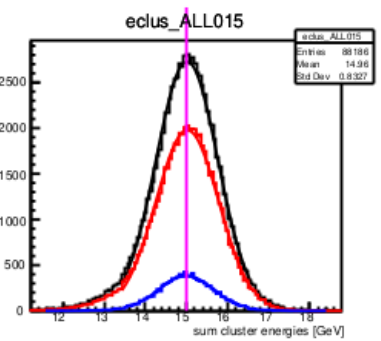


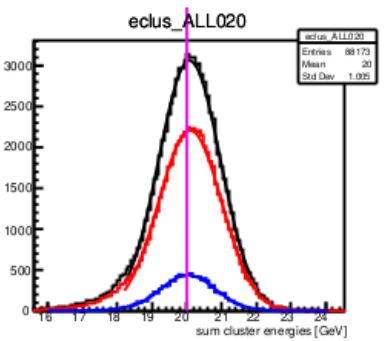


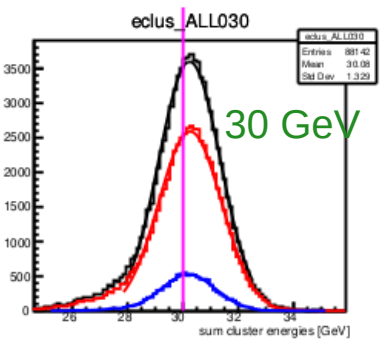


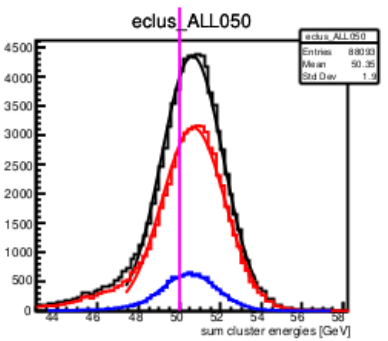


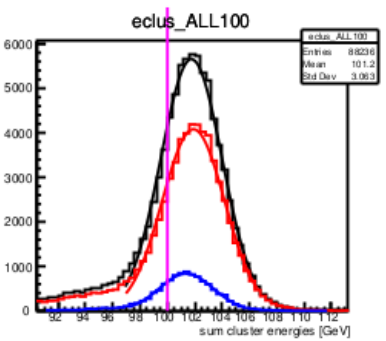


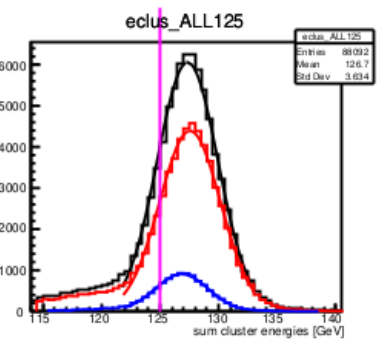


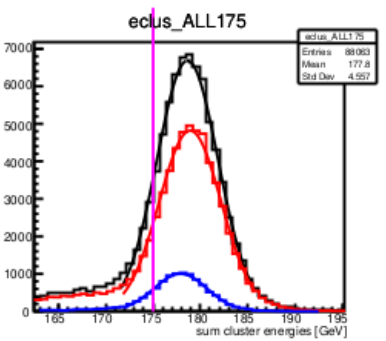


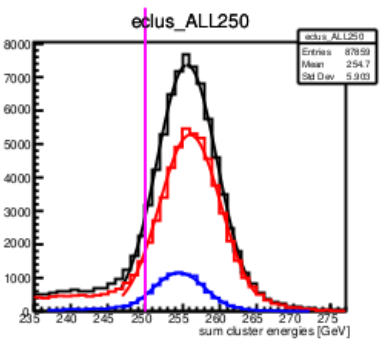


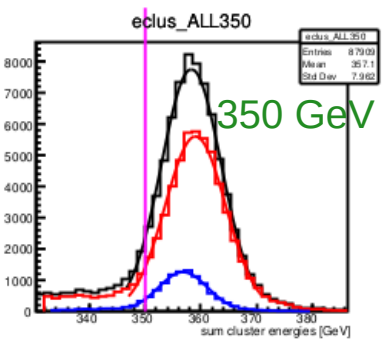


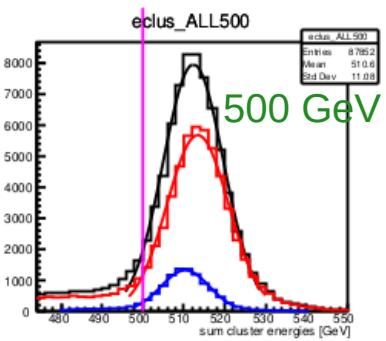












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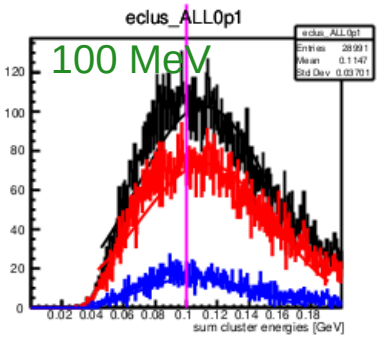
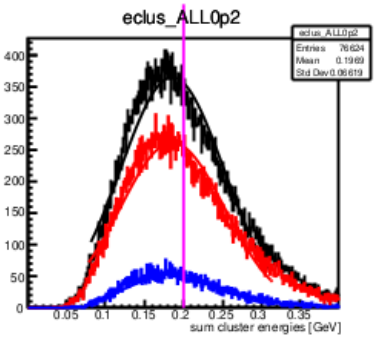
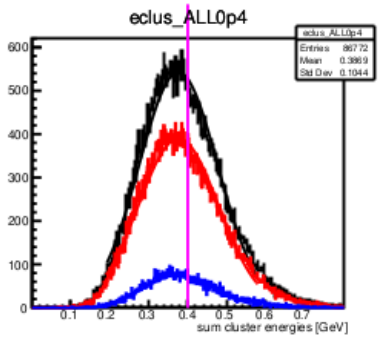
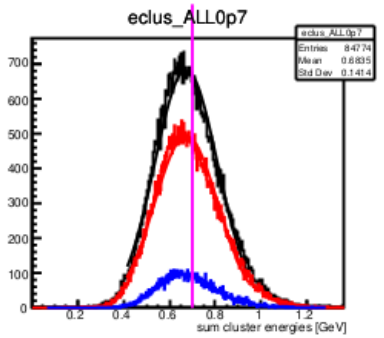
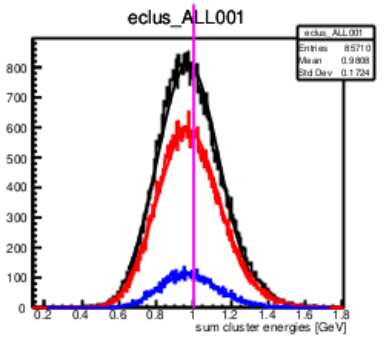
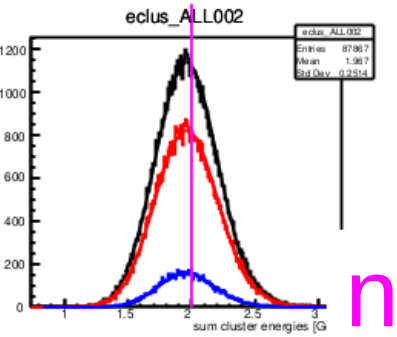


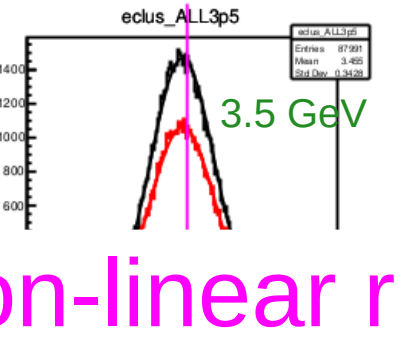


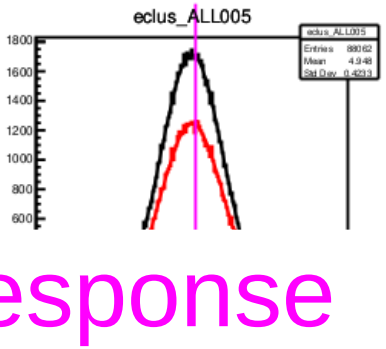


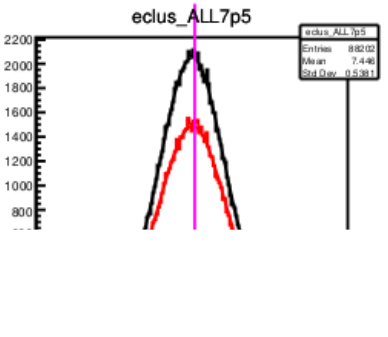


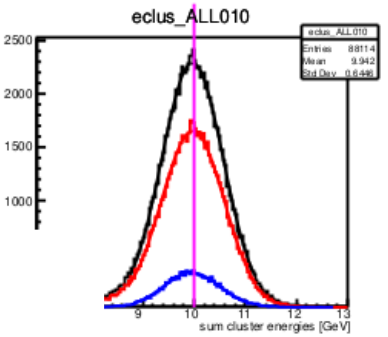








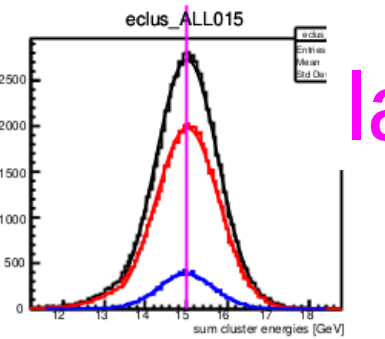


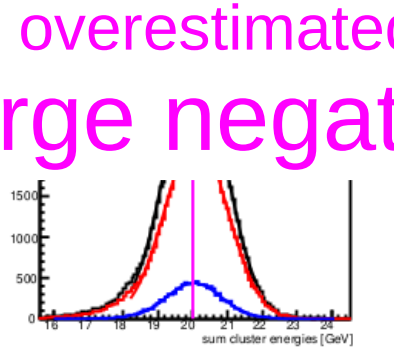


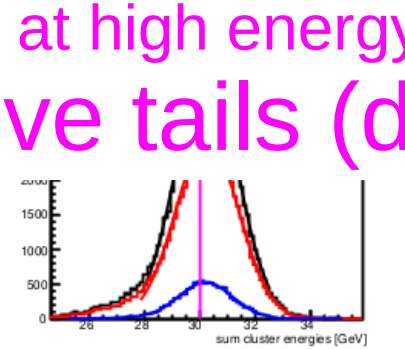
non-linear response

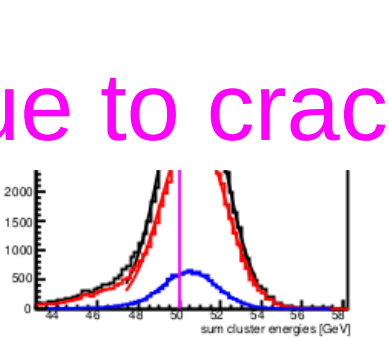
overestimated at high energy

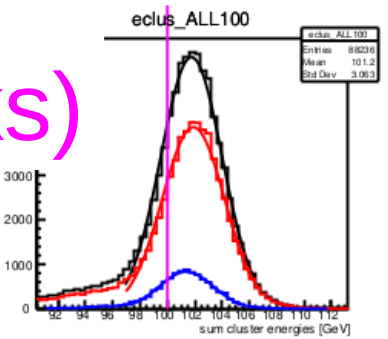
large negative tails (due to cracks)

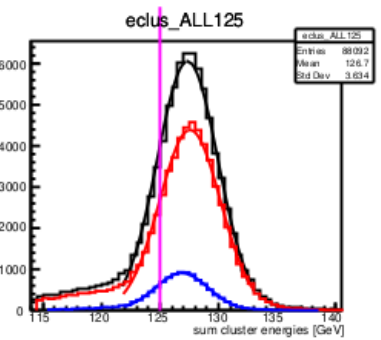


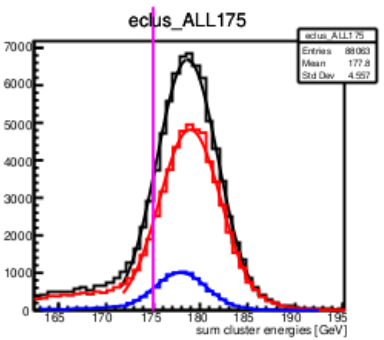


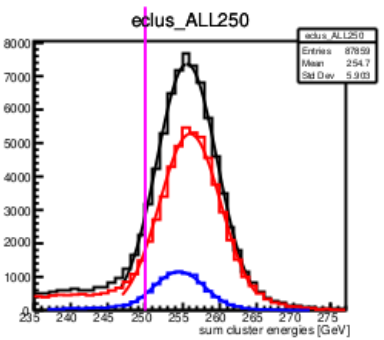


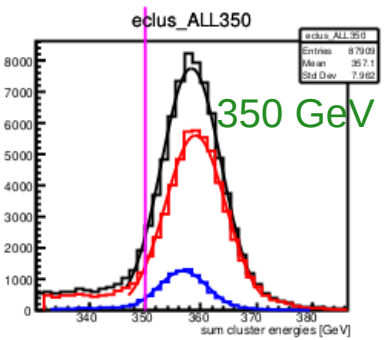


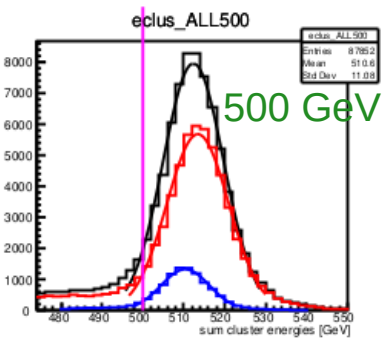












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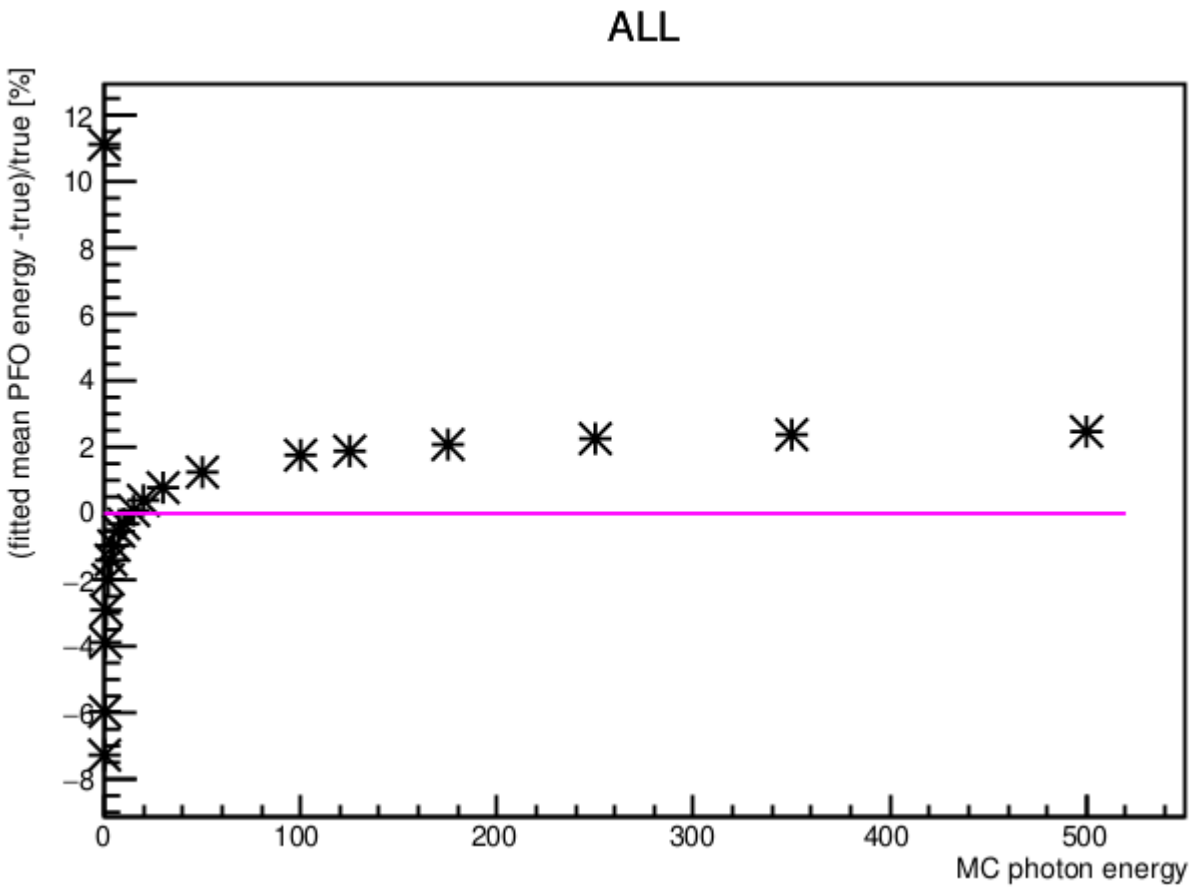
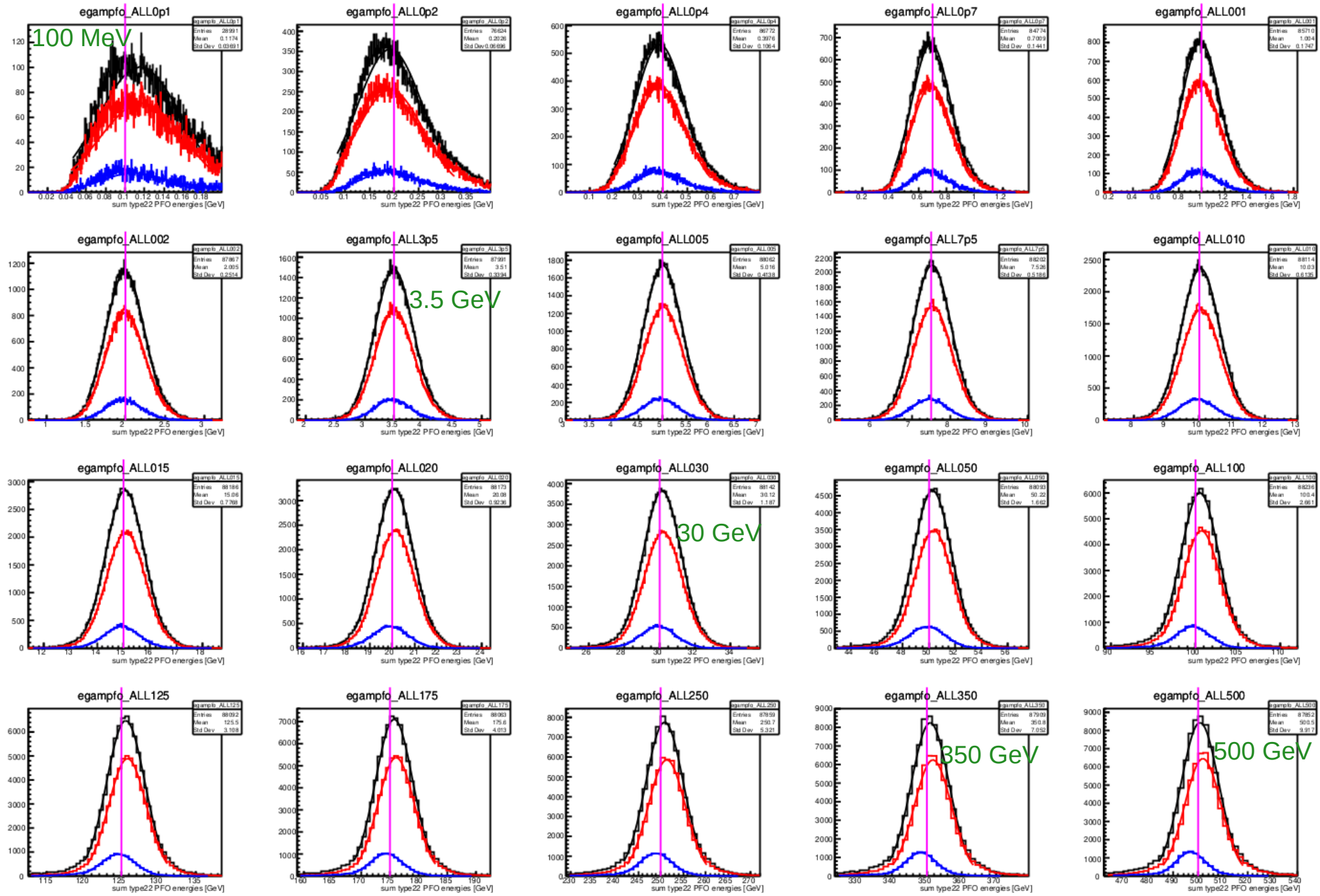

ALL
(fitted mean PFO energy -true)/true [%]
12
10
8
6
4
2
0
−2
−4
−6
−8
0
100
200
300
400
500
MC photon energy

PFO-level corrections are now applied to photon-like PFOs

sum of corrected photon-like PFO energies / event



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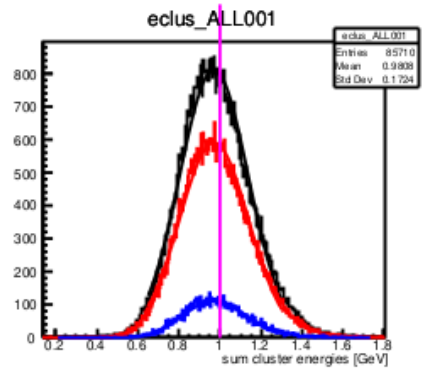
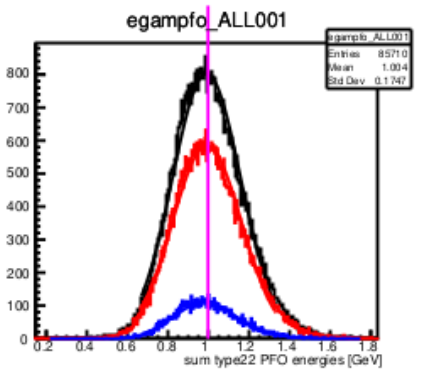
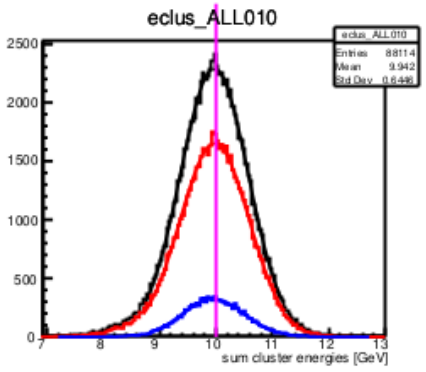
cluster energy

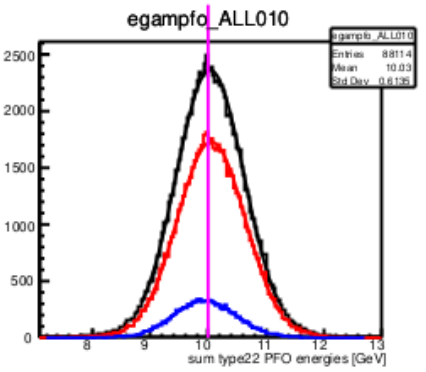


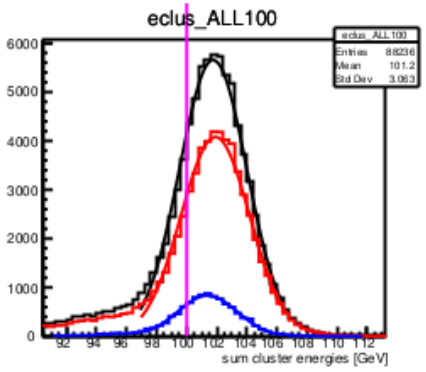
1 GeV



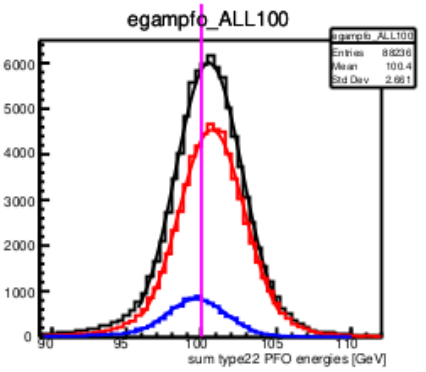


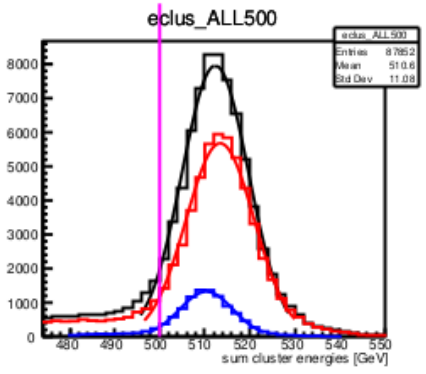
10 GeV



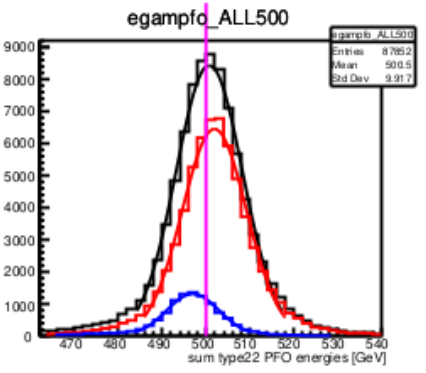


100 GeV





500 GeV



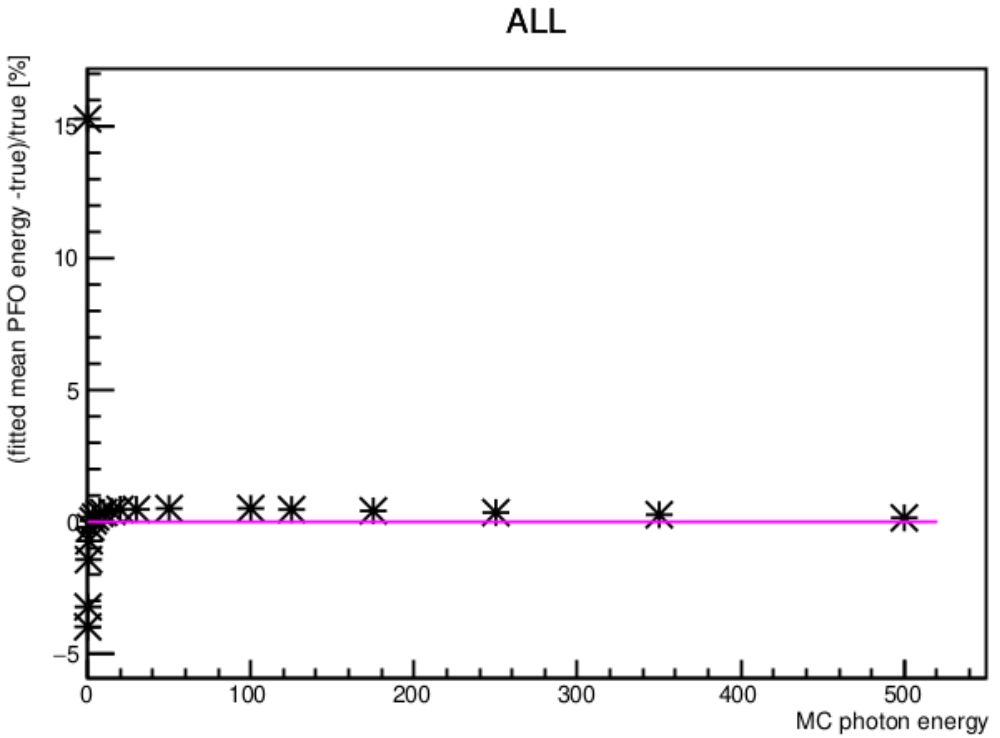
PFO energy

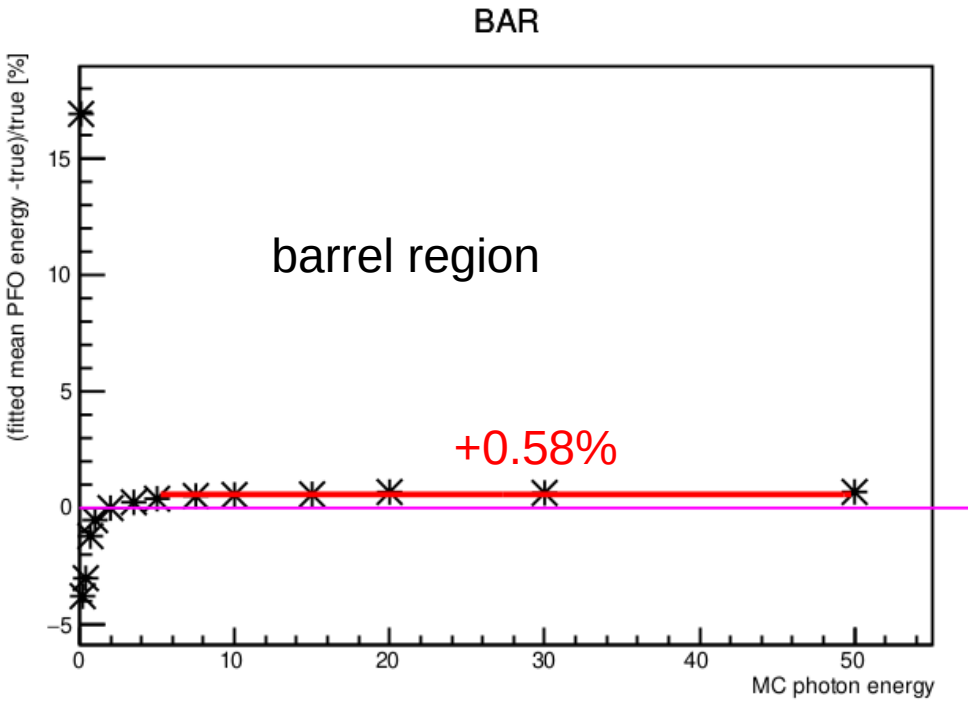
PFO-level energy distributions much better than cluster level:

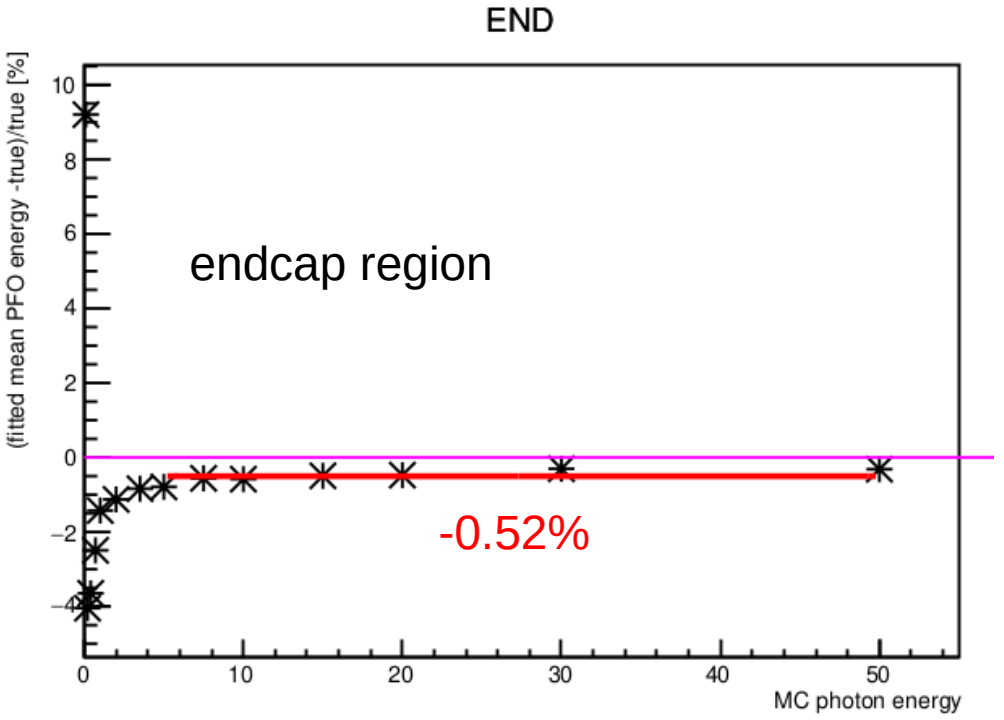
more linear
more Gaussian

some barrel – endcap difference

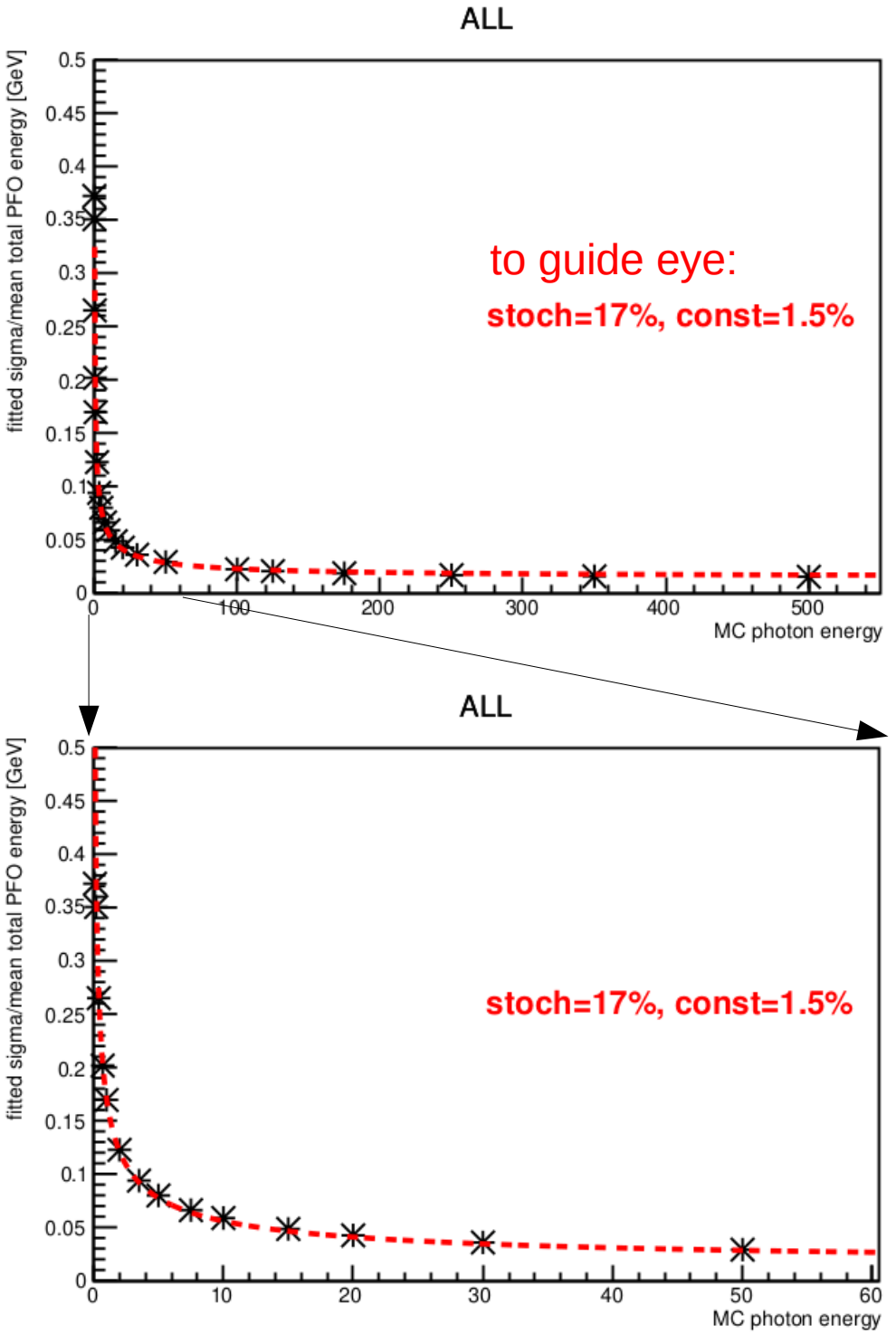
PFO energy deviation from MC truth







PFO-level energy resolution

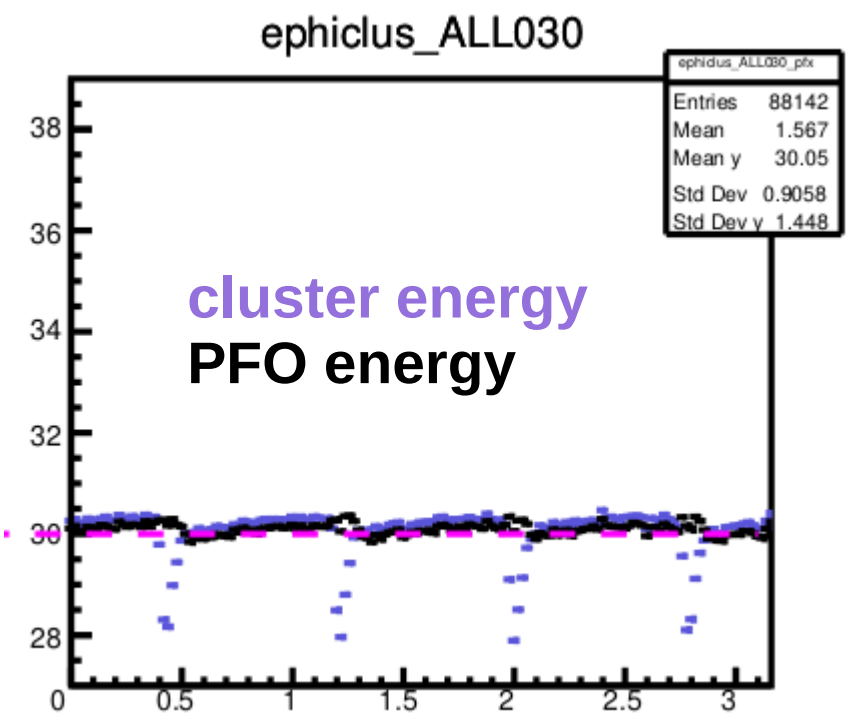


looks OK

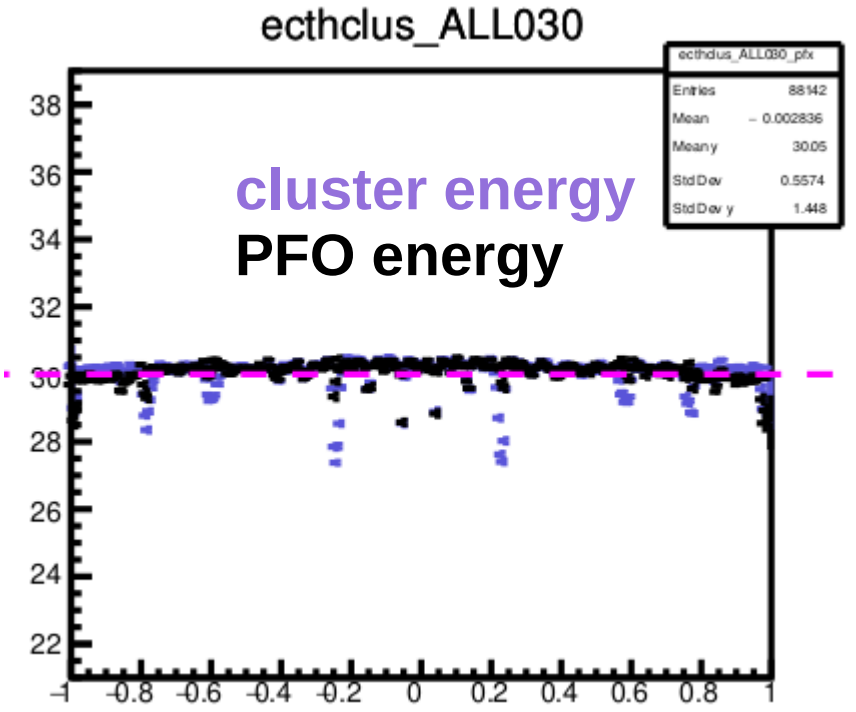
energy vs. phi

energy vs. cos(theta)

e.g. for 30 GeV photons



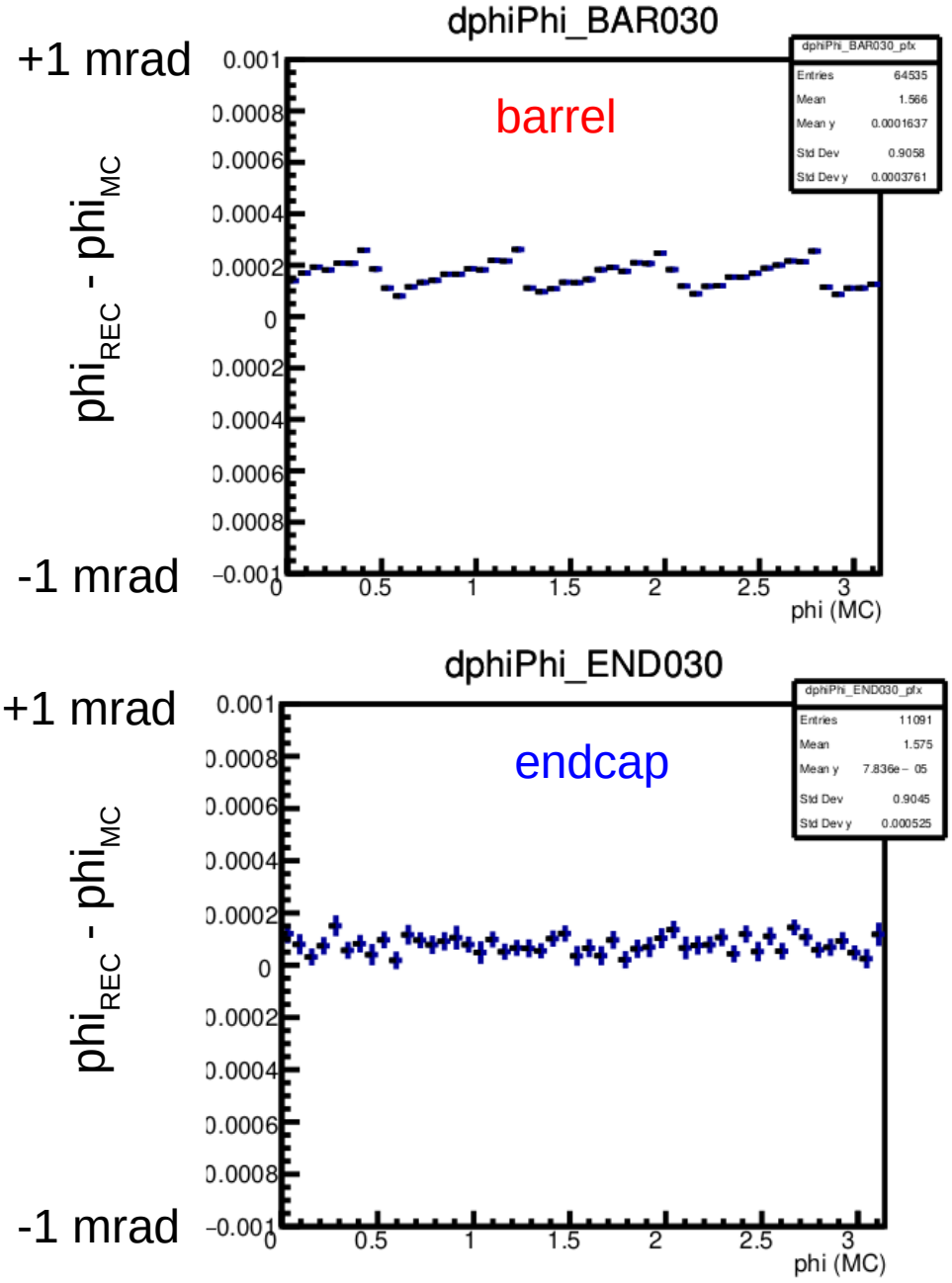
MC photon azimuthal angle



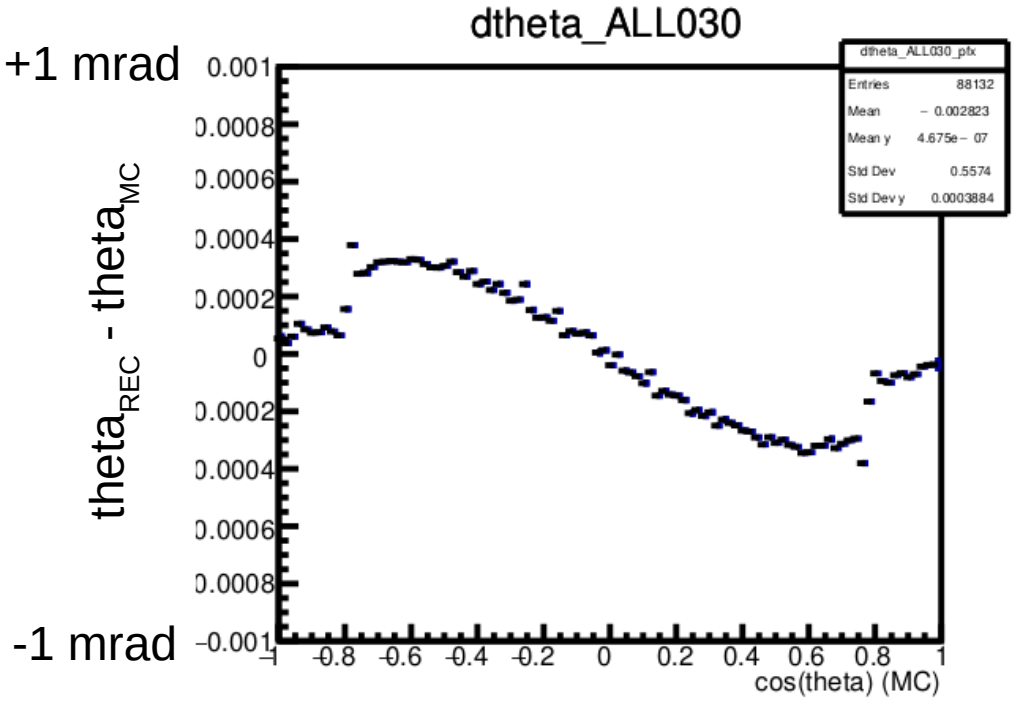
cos(MC photon polar angle)

PFO energy corrections work pretty well (but not perfect)

biases in PFO directions

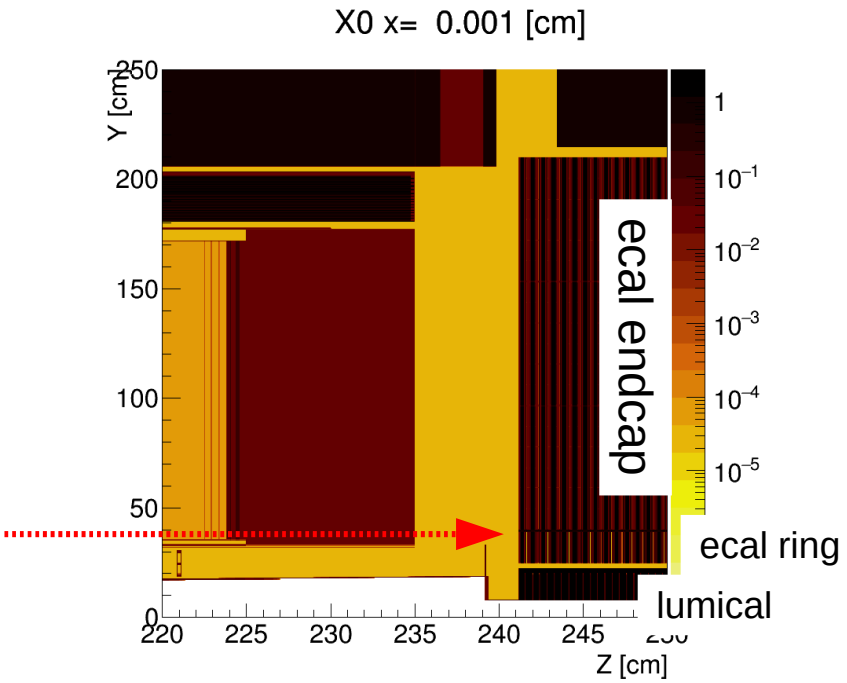


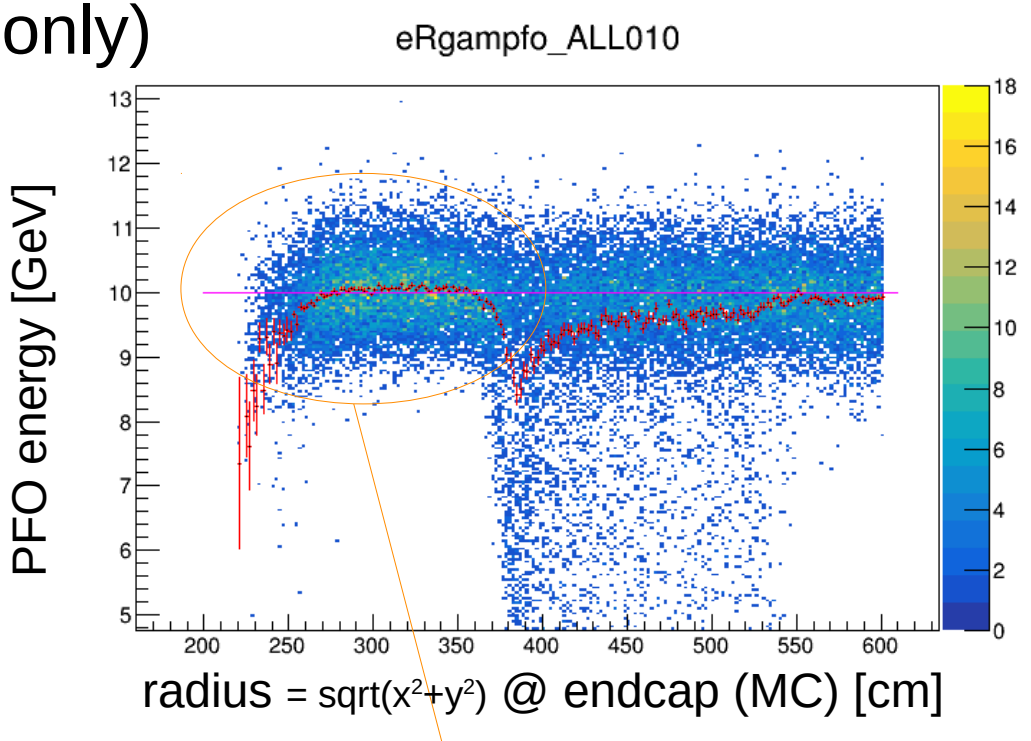
e.g. @ 30 GeV

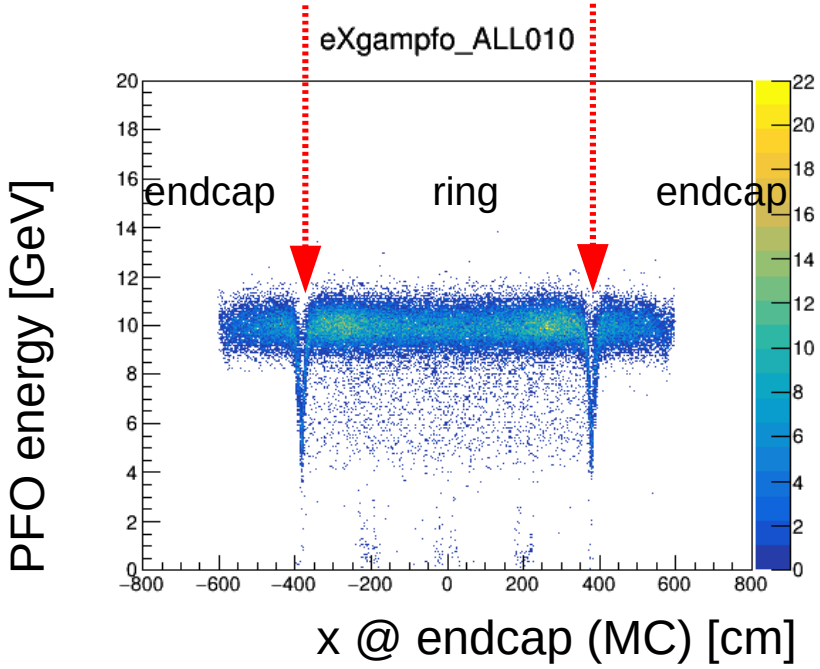


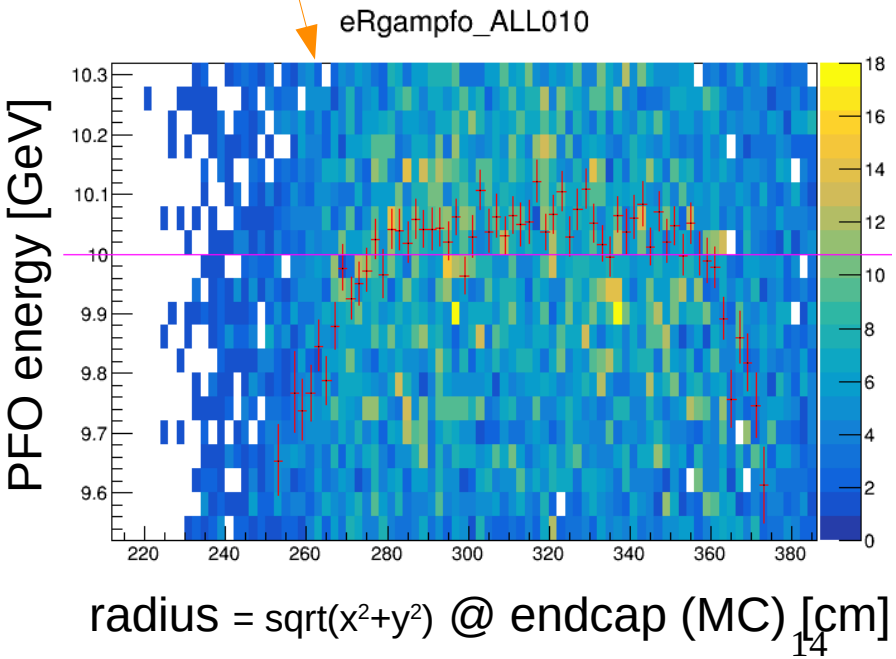
some biases in PFO direction, at level ~0.2 mrad ~ 0.5 mm @ ECAL

rather forward photons (10 GeV only)









probably the deepest ECAL “crack”

~0.5% overestimation in the ECAL ring

summary

looked at single photons in new ILD software release

generally looks pretty reasonable

potential for 0.5%-level tuning of calibration,
separately in barrel, endcap, endcap ring

“overlap regions” between modules quite well corrected for
barrel-endcap and endcap-ring transitions could do with extra study

small angular biases remain to be fully understood & corrected