Performance of the MPD-ECAL with emcKI clusterizer and new geometry (V3)

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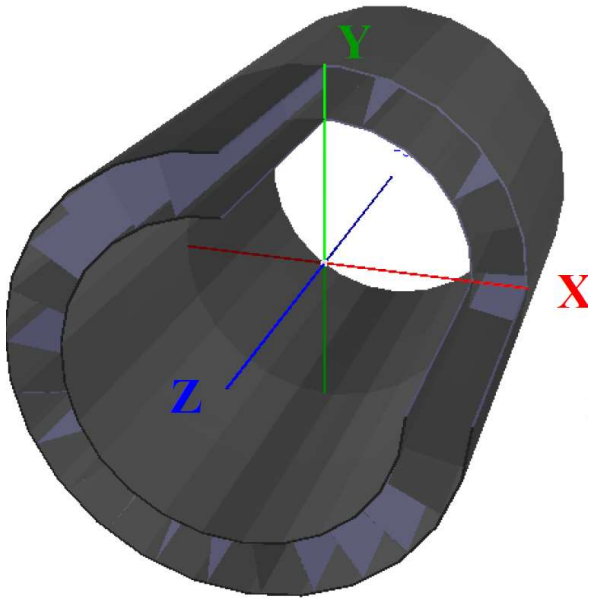
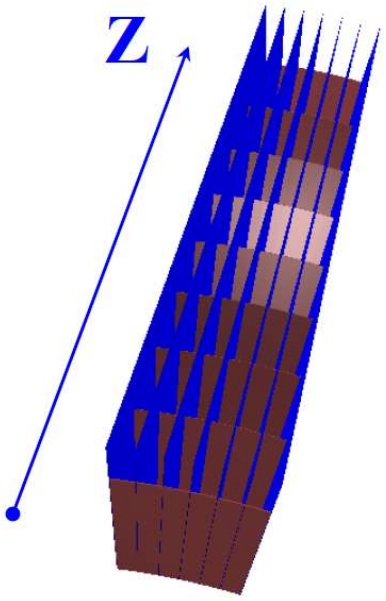
Outline

- Last time:
  - ✓ introduced new emcKI digitizer-clusterizer
  - ✓ compared MPD-ECAL performance with VR and emcKI → compatable
- Today:
  - ✓ updated emcKI digitizer-clusterizer to work with new geometry (V2 → V3)
- This presentation:
  - ✓ compare MPD-ECAL performance with emcKI: V2 geometry vs. V3 geometry

The main changes

- Nicely outlined in the number of presentations:
  - ✓ M. Martemyanov, V. Kulilov @ Nica week (Warsaw)
  - ✓ M. Martemyanov, last meeting
- Short summary:
  - ✓ non-homogeneous acceptance, towers are intervened with carbon fiber support structures of different width (up to a few centimeters) → irregular structure
  - ✓ 2.1 cm of paint in each tower, smaller number of tiles
  - ✓ support structure of 12.7% X_0 in front of the towers (carbon fiber cylinder)





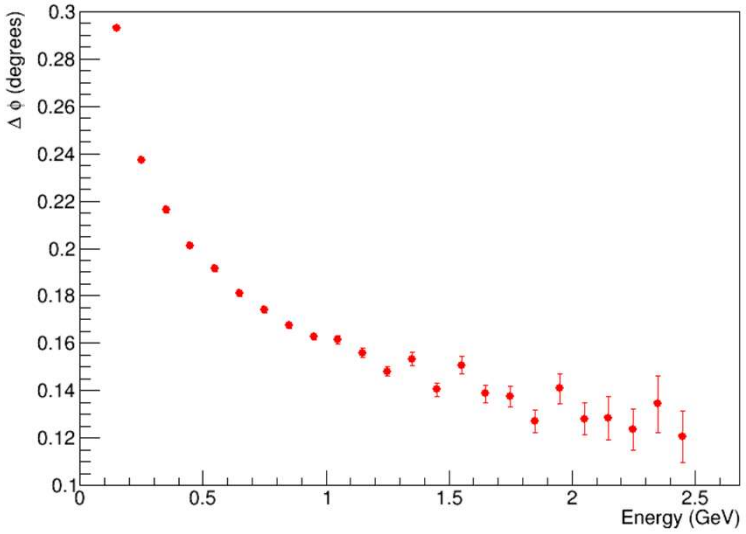
Expectations

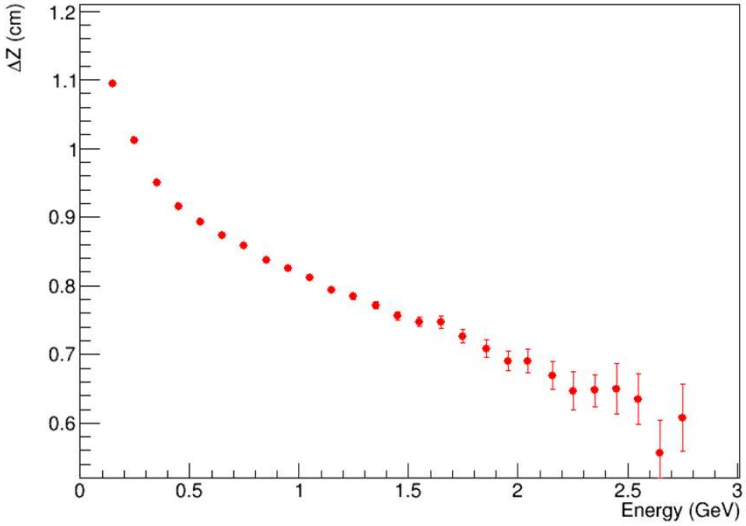
- Smaller efficiency due to higher photon conversion probability
- Worse energy resolution due to smaller light collection and dependence of the absolute energy scale on the photon position. The scale depends on how much of the carbon fiber is in the shower volume
- Worse spatial resolution due to dependence of the shower shape on the photon position
- Worse effectivity of signal unfolding in high multiplicity environment. Unfolding is based on the average shower shape, which can prefer biased signal splitting in some specific cases

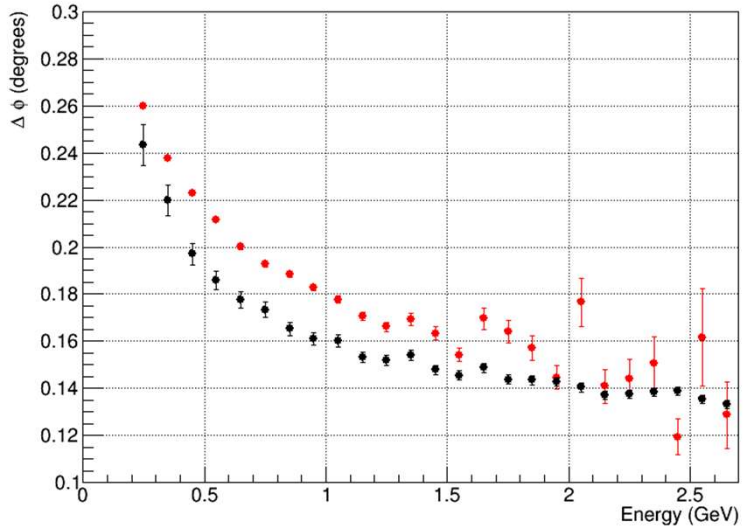
How much in grams?

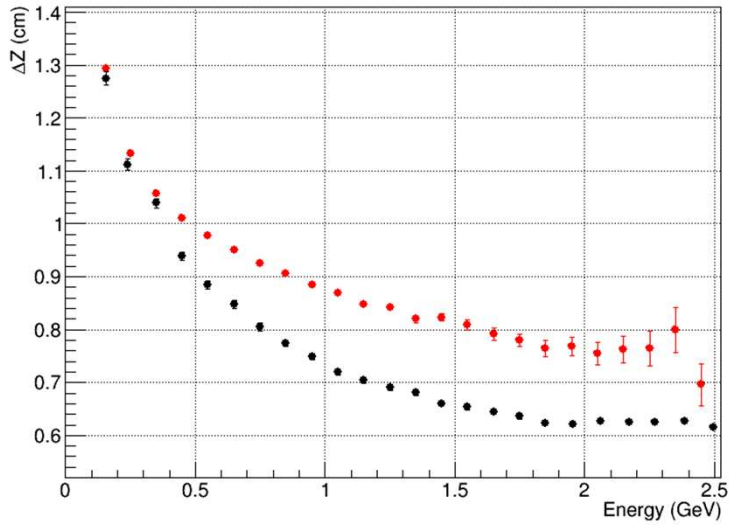
Photon spatial resolution

- Black markers – single photons; Red markers – UrQMD; realistic vertex distribution
- Spatial resolution worsens, but not dramatically



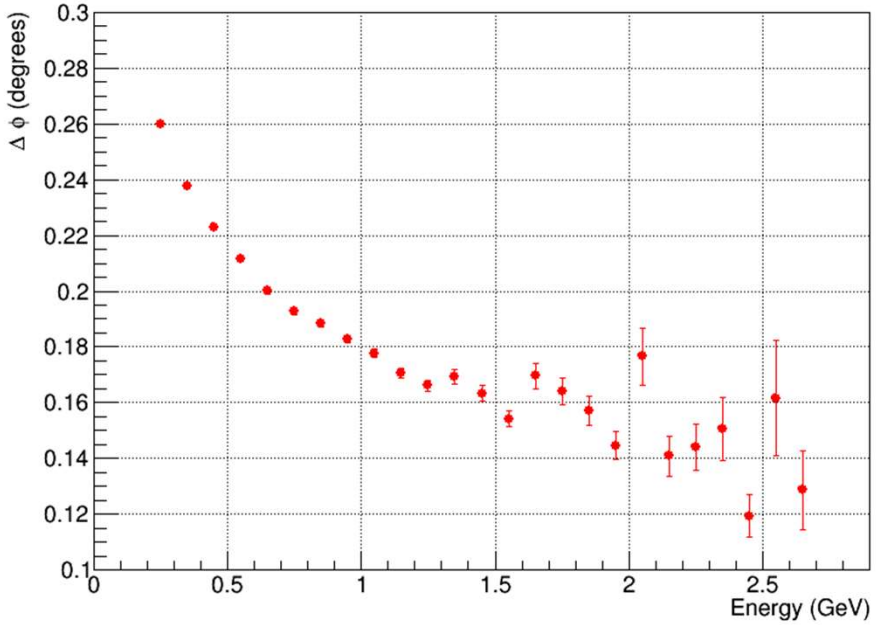


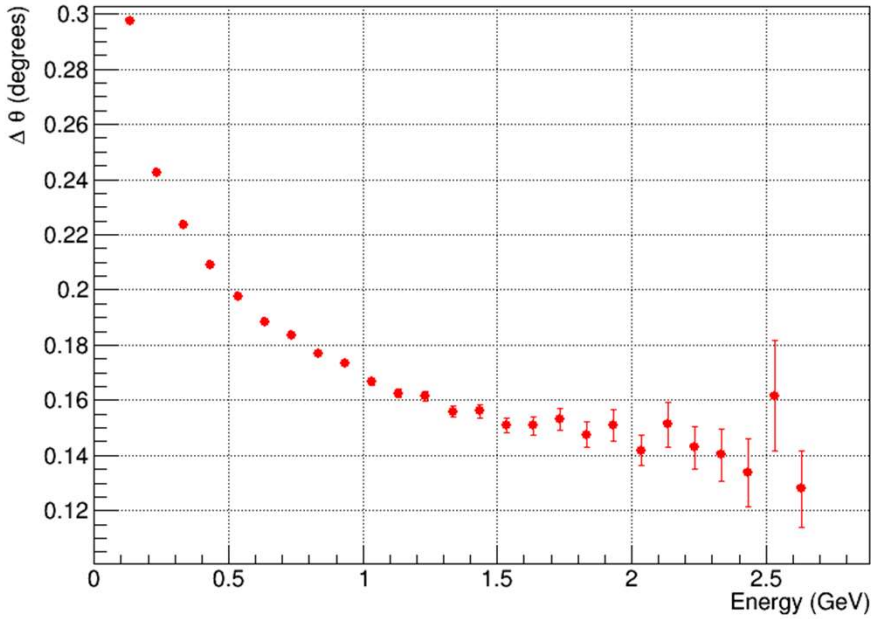




dPhi vs. dTheta (UrQMD)

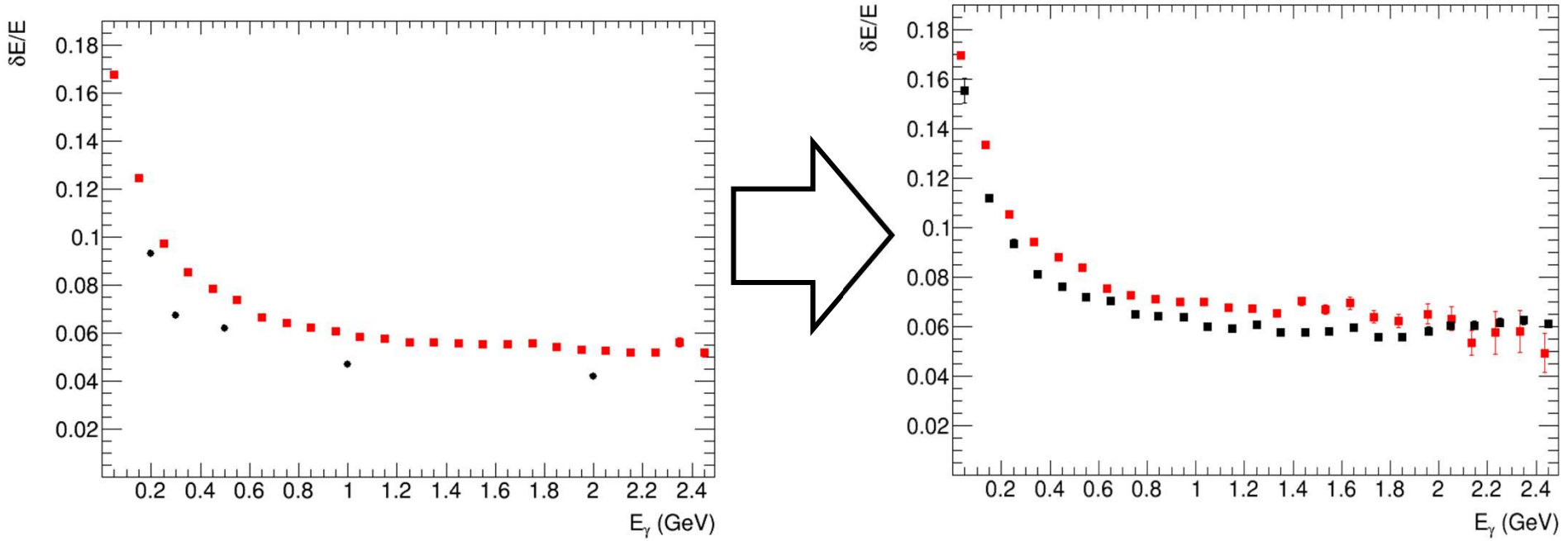
- Red markers – UrQMD; realistic vertex distribution
- Resolution in dTheta is comparable (or even better) to dPhi
  → little reserve for better dZed





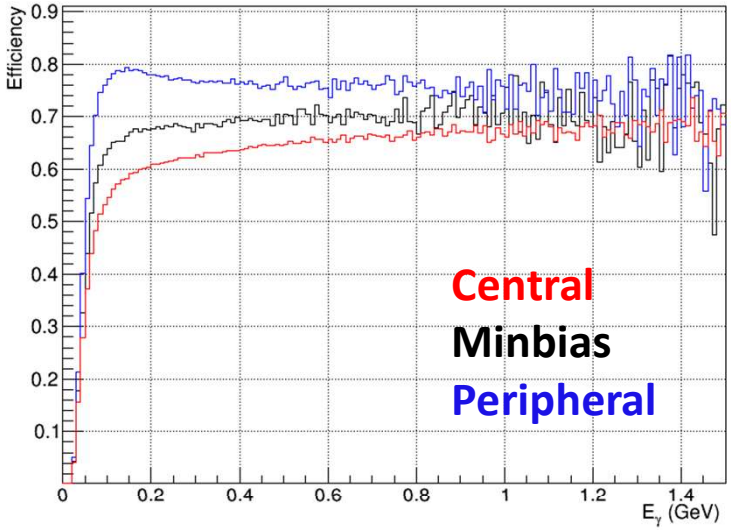
Photon energy resolution

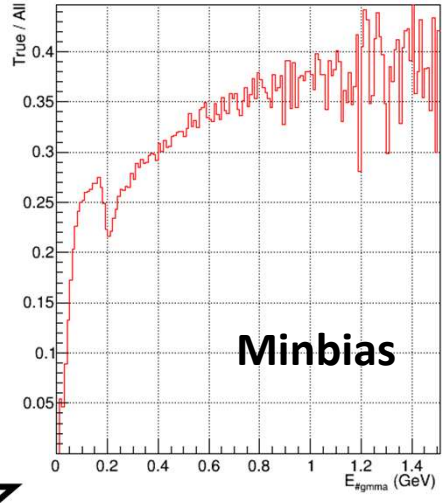
- Black markers – single photons; Red markers – UrQMD; realistic vertex distribution
- Energy resolution is worse by ~ 1%: 5(6)% → 6(7)% at 1 GeV

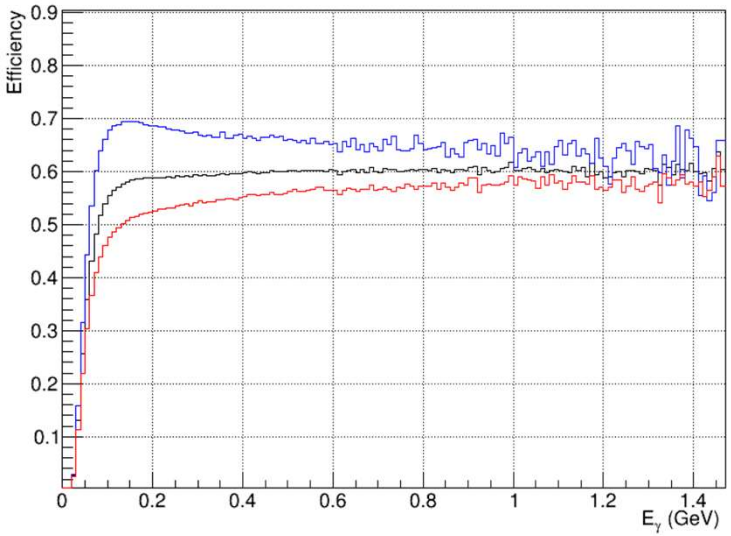


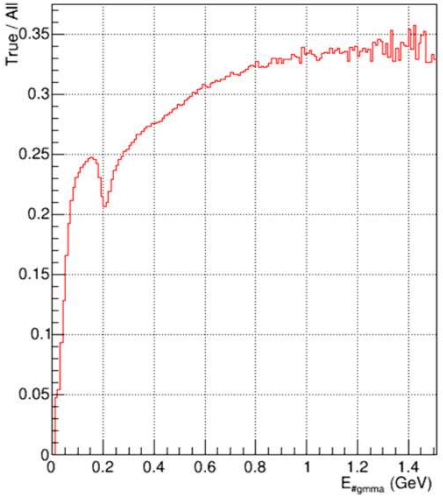
Photon efficiency & purity

- UrQMD; realistic vertex distribution
- Photon efficiency and purity are lower by ~ 10%; consistent with exp(-7/9*12.7%X_0)



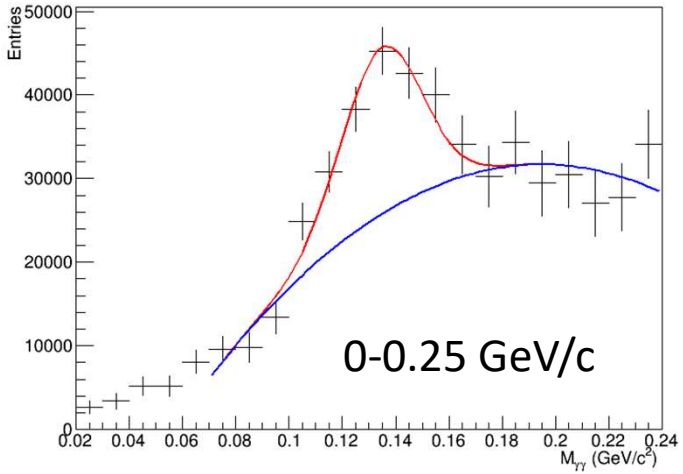


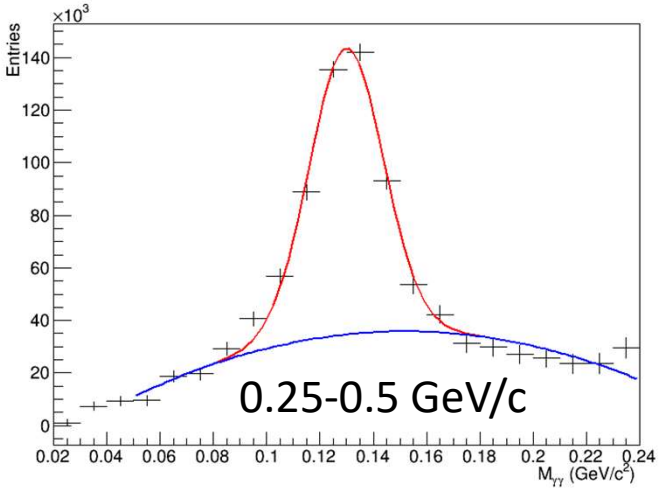


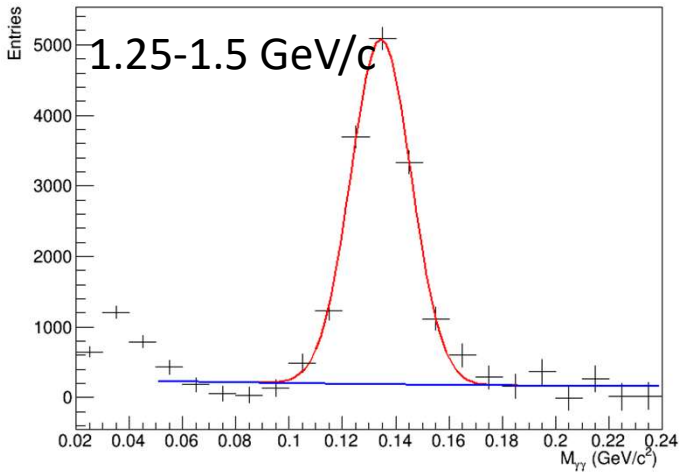


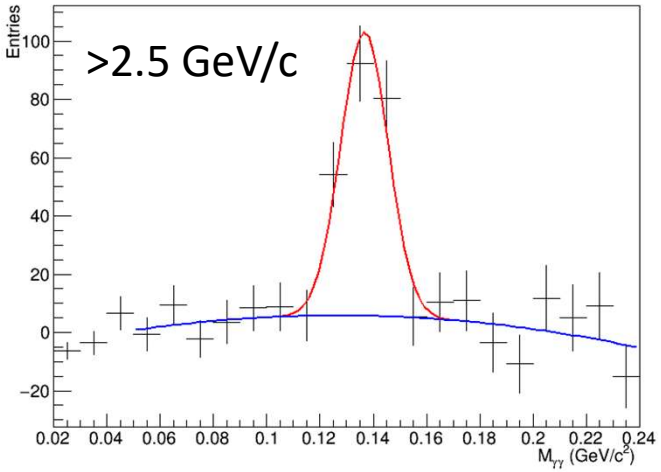
π^0 mass and width

- UrQMD; realistic vertex distribution
- Examples of the reconstructed M_{inv} distributions



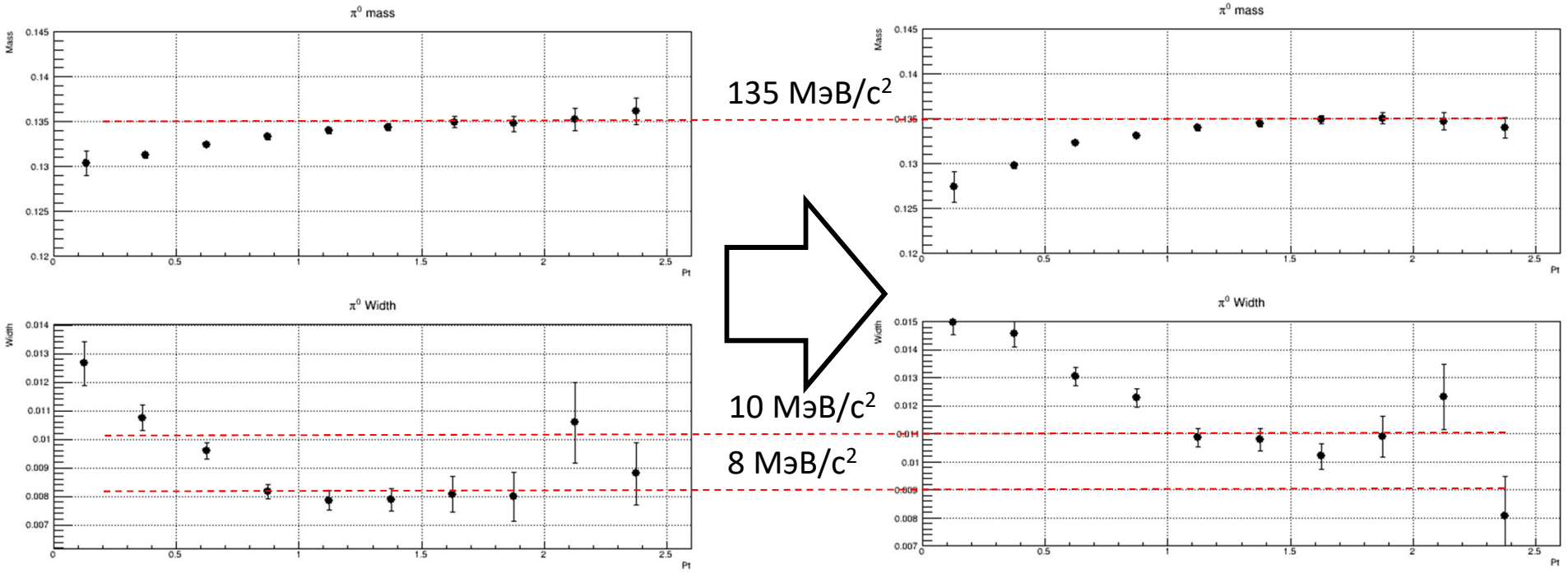






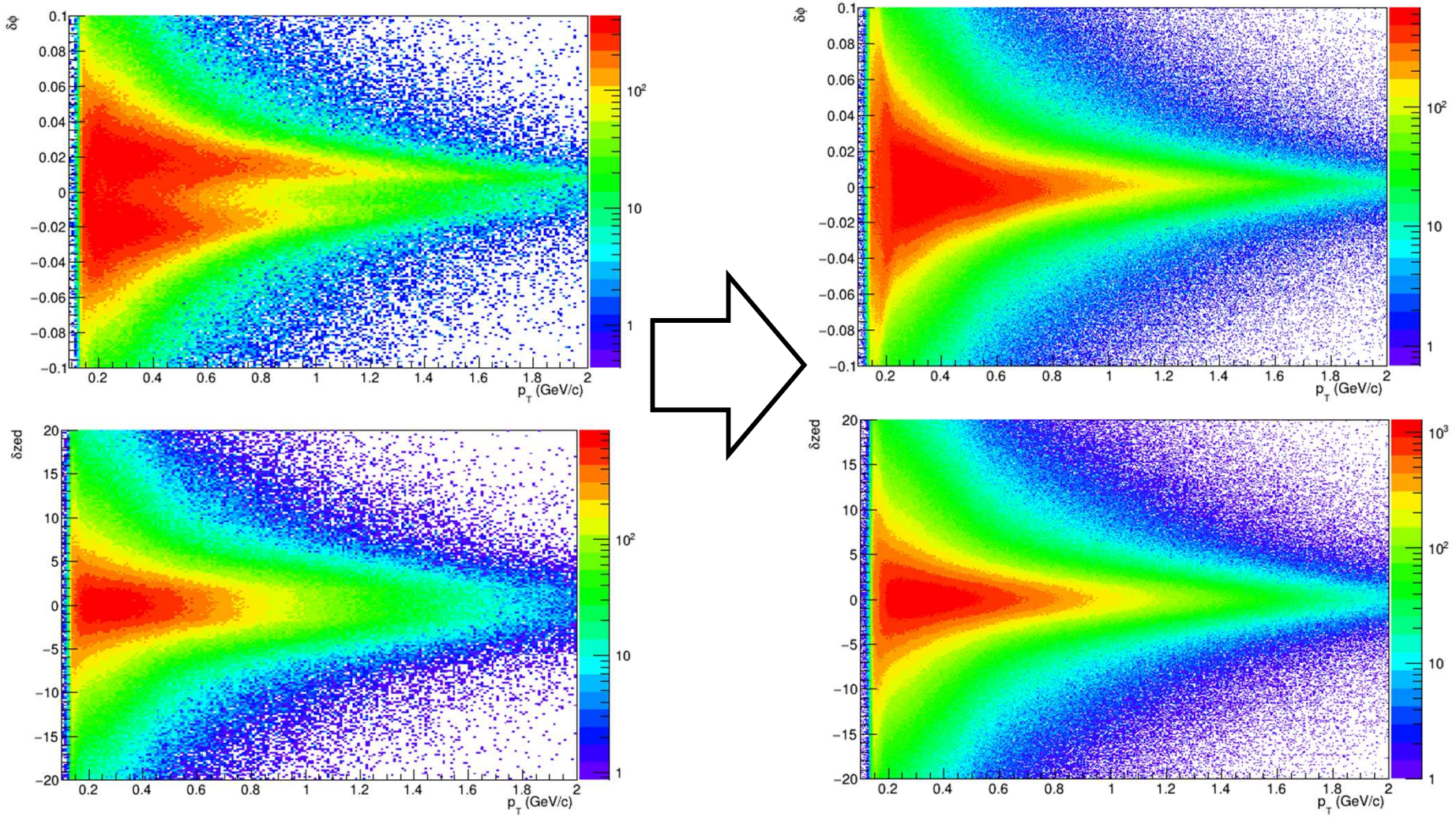
π^0 mass and width

- UrQMD; realistic vertex distribution
- Reconstructed widths are larger by ~1% → consistent with δE/E



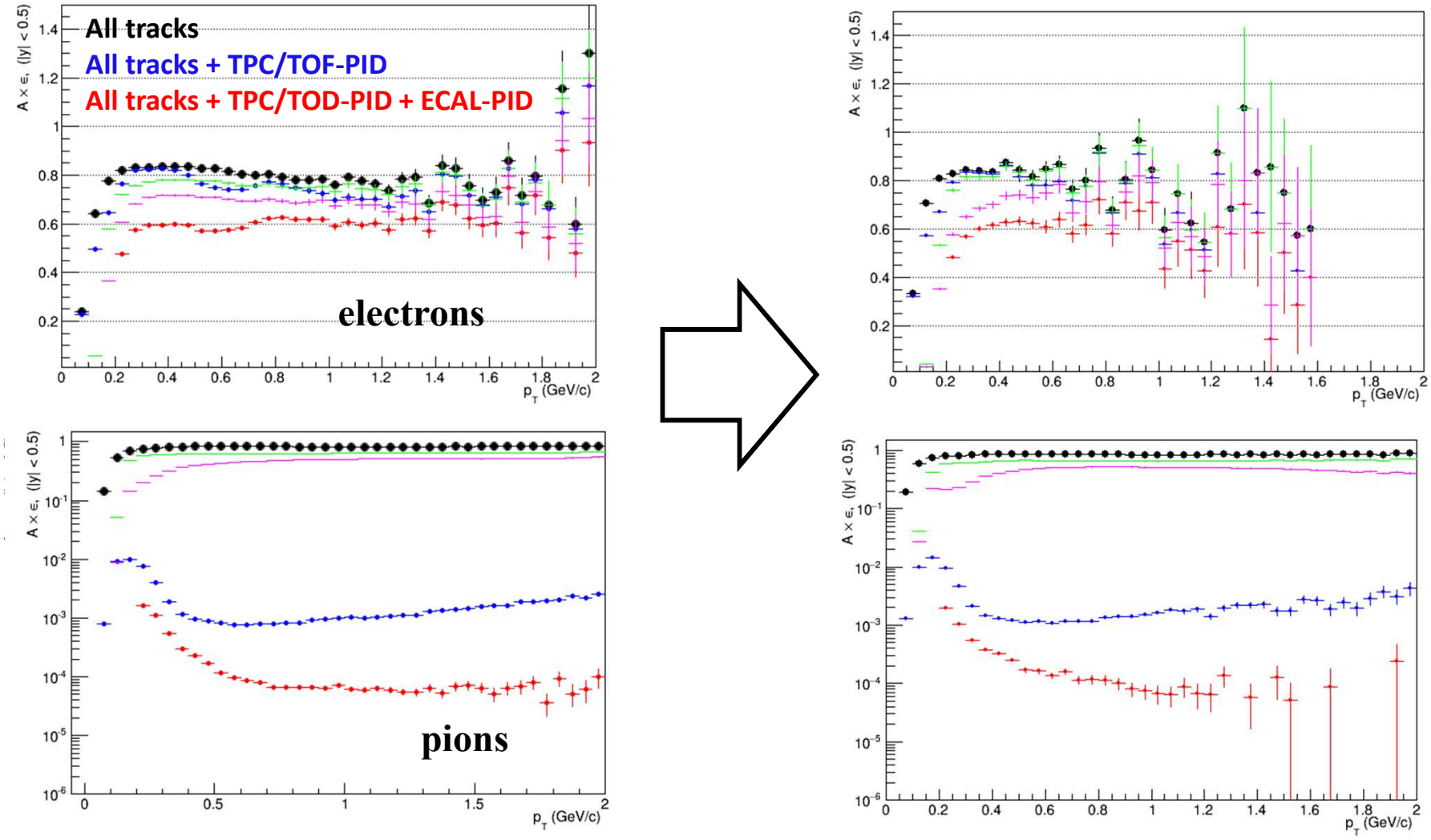
Track to cluster matching

- UrQMD; realistic vertex distribution
- Track matching is better due to optimized cluster depth (minimal charge splitting)



eID efficiency and hadron rejection

- UrQMD; realistic vertex distribution
- eID efficiency and hadron rejection are comparable



Tutorial and examples

- Everything is pretty much the same as for V2 geometry
- The tutorial and the output files will be updated soon

Conclusions

- New (V3) geometry provides worse detector performance → expected
- The most noticeable change is for the energy resolution due to smaller light collection and irregular detector geometry (dependence of the absolute scale on position)
- At the first glance, the physics performance of the MPD-ECAL for neutral mesons and electrons does not change dramatically with V3 geometry
- Further fine tuning of the clusterizer requires cross checks with the prototype tests

Please report any problems ……..

BACKUP