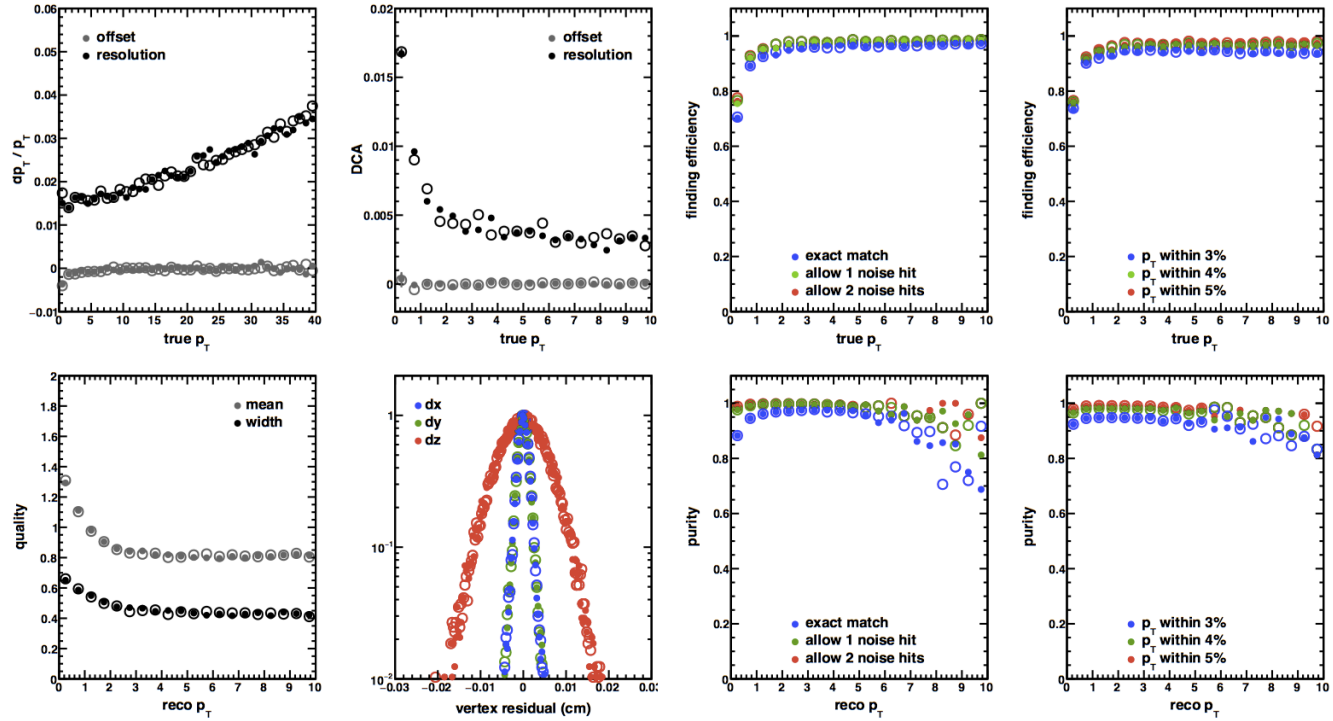
Standardized Calorimetry QA

Jin Huang (BNL)

Overview

- Today's discovery is tomorrow's calibration
- We need a standardized module to quickly check calorimetry performance, similar to that of tracking check from Mike
- Connected to plan on implementing QA history for ANA builds and new code submissions.
- Part I: First of the three stage merged via pull request https://github.com/sPHENIX-Collaboration/coresoftware/pull/104
- Part II: Updated QA module for jet: https://github.com/sPHENIX-Collaboration/coresoftware/pull/105
- Part III, to be pulled: QA modules for sum 3 calorimeter + tracking in development branch: https://github.com/blackcathj/coresoftware/tree/calo_qa3/

Standardized tracking check from Mike: https://github.com/sPHENIX-Collaboration/coresoftware/pull/89



QA Data flow

Current macros

- Actions from QA modules

Geant4 production

- Check G4 hit performance
- Propose to run with each production

Towering and clustering

- Check tower and clustering of each calorimeter layer
- Check sum of calorimeters

Make jets

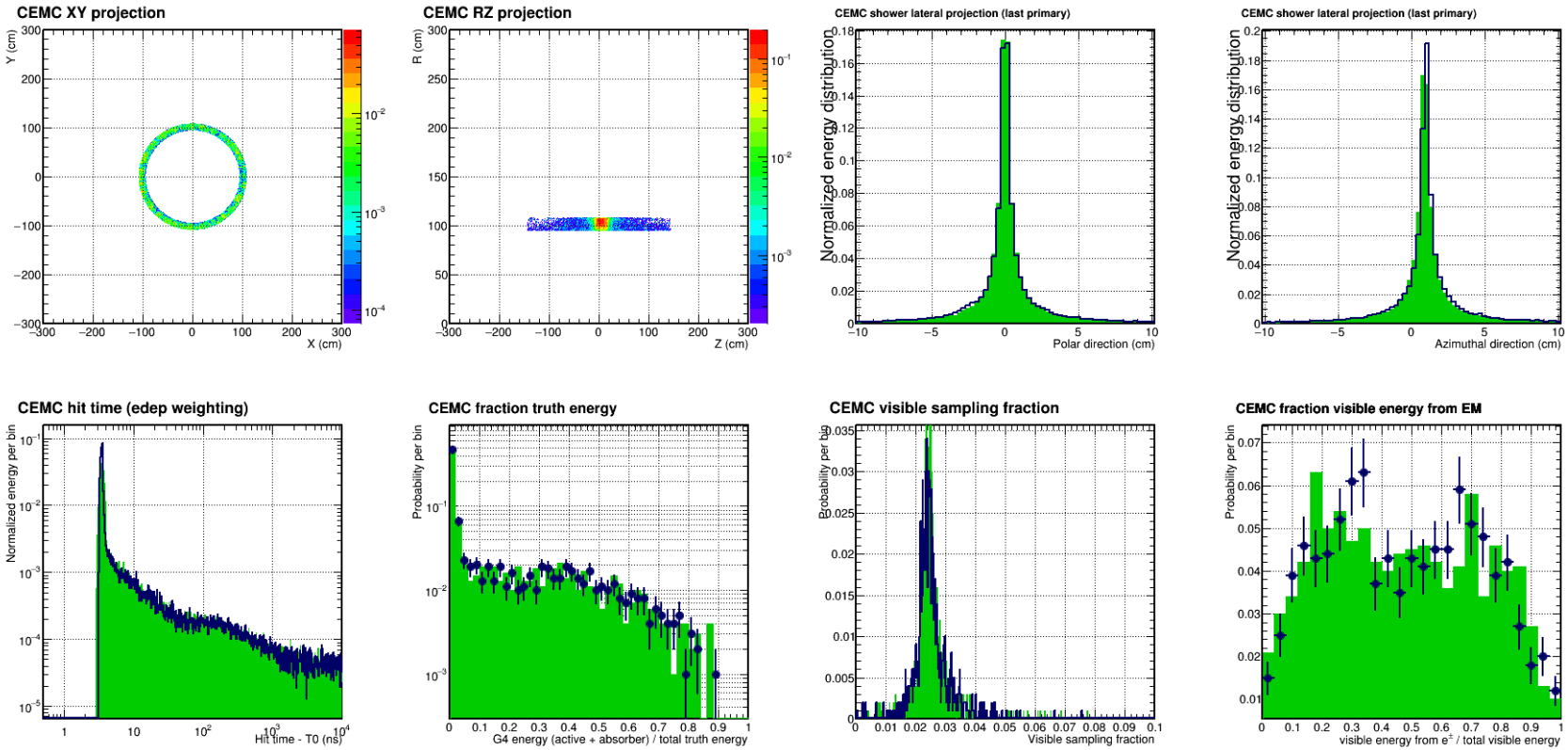
- Jet spectrum
- Jet matching with truth jet
- Summary plots

Part I
Checking recent production
»

CEMC hit checks

24 GeV negatively charged pions at eta ~ 0

- 1000 pion event latest production
- 1000 pion with QGSP_BERT list (my simulation)



Possible minor difference on vertex and angle ranges

CEMC tower/cluster checks

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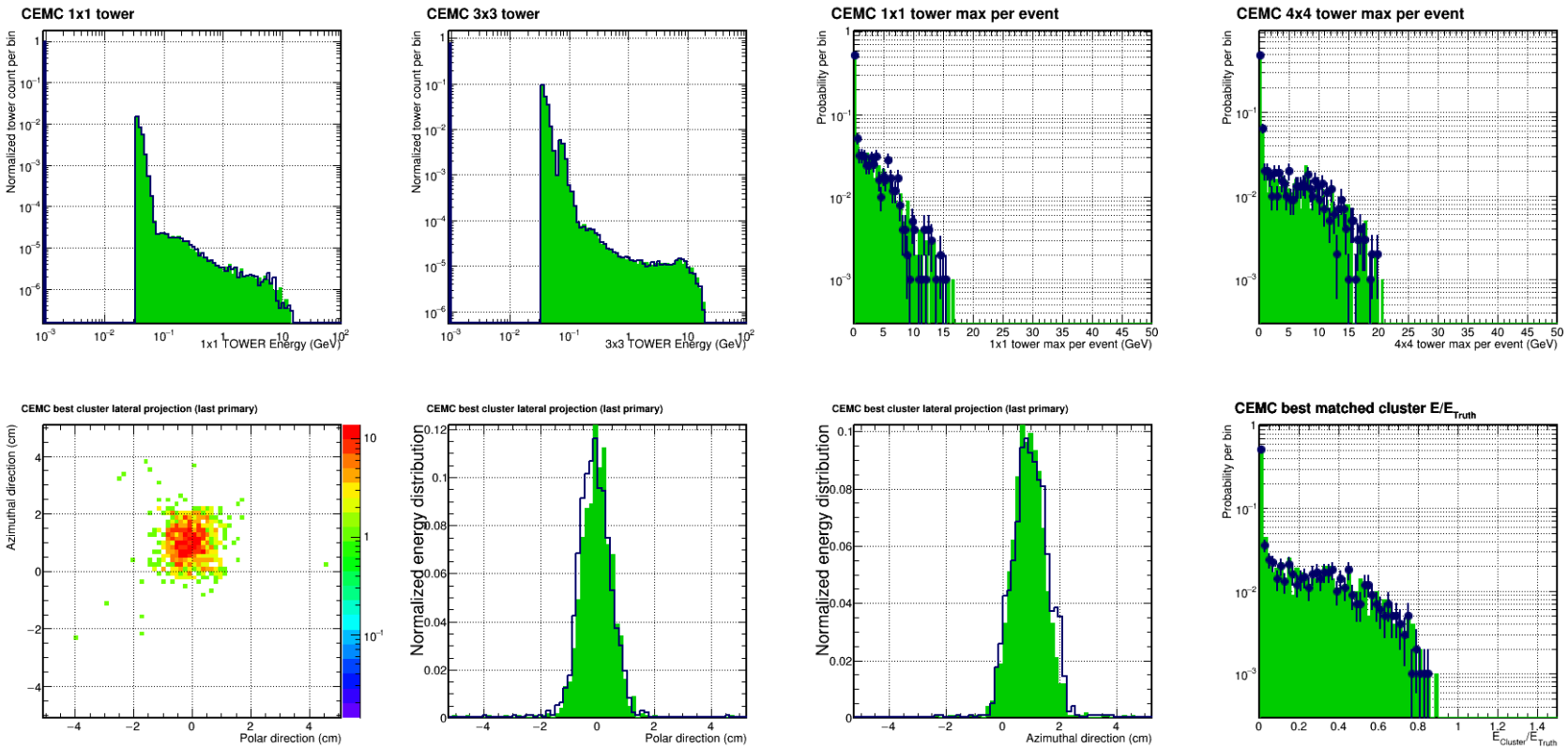
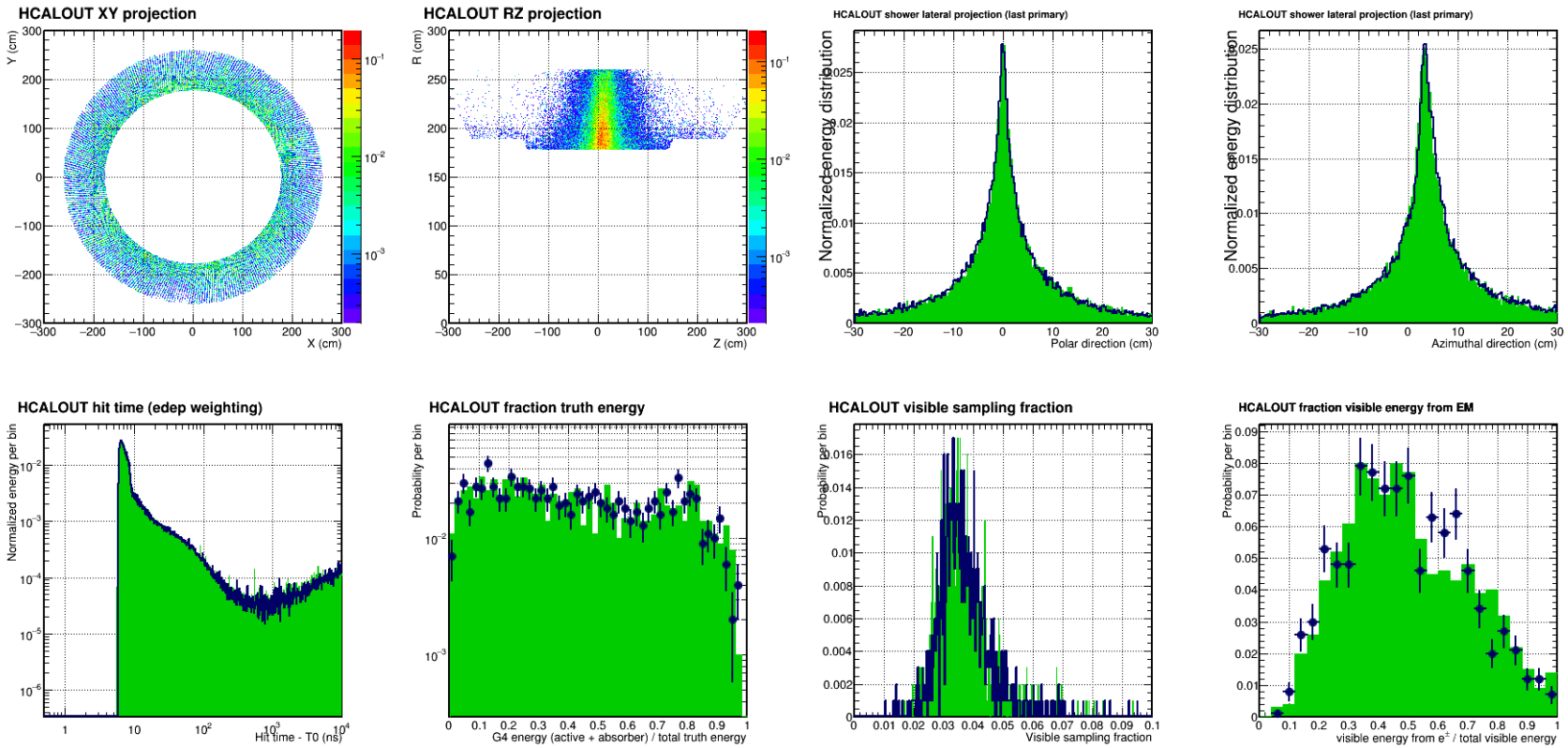


Possible minor difference on vertex and angle ranges

Outer HCal hit checks

24 GeV negatively charged pions at eta ~ 0

- 1000 pion event latest production
- 1000 pion with QGSP_BERT list (my simulation)



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Outer HCal tower/cluster checks

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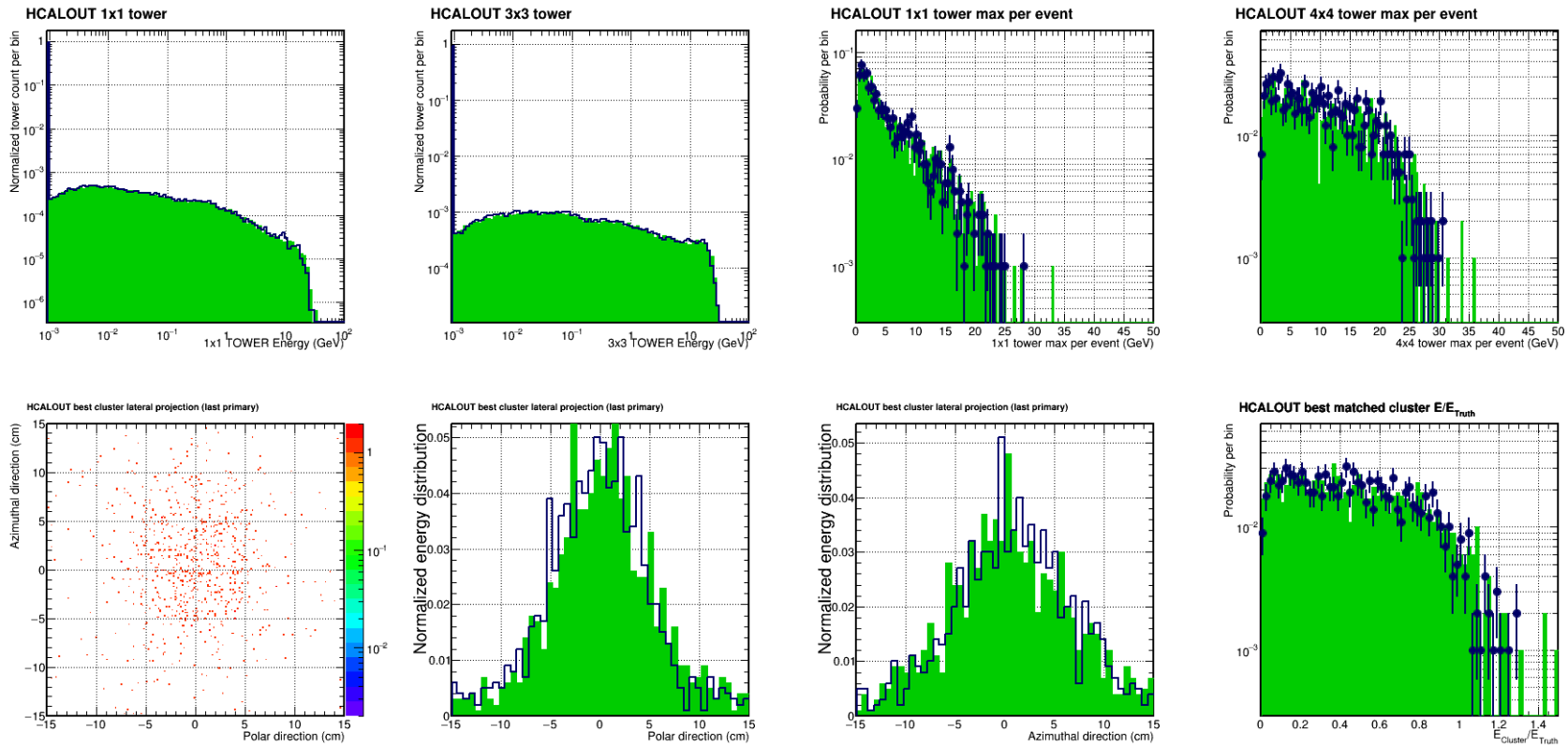
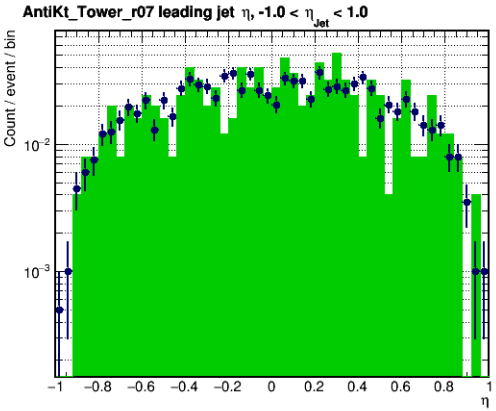


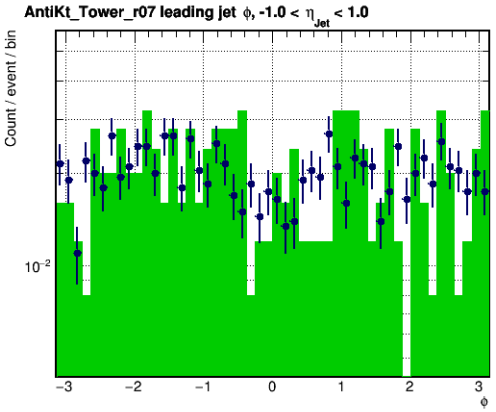
Possible minor difference on vertex and angle ranges

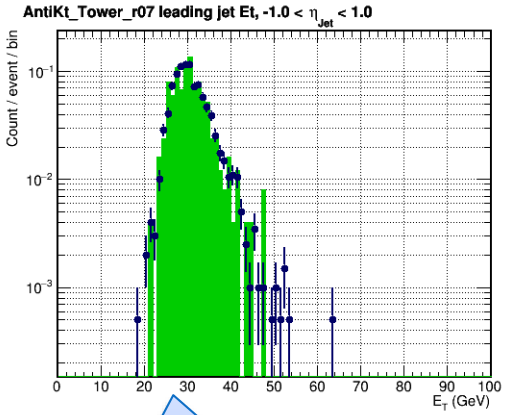
Part II
Update to jet plots

Reconstructed tower jet spectrum

- Pythia8 200pp, s>25GeV, truth jet trigger E>30GeV, 2000 event
- 250 events of the same setting as reference for now....





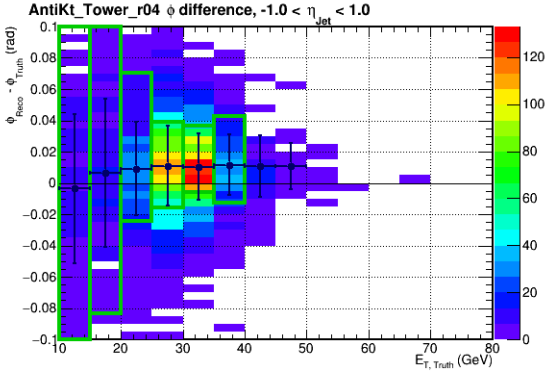


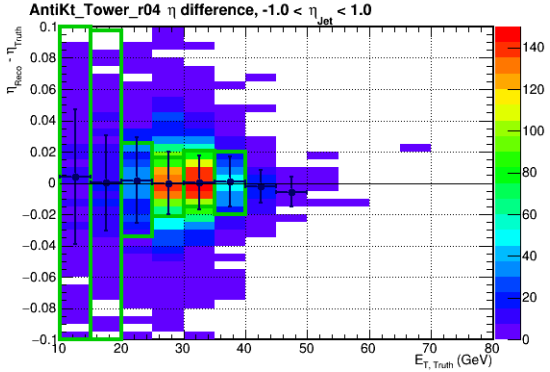
Pythia trigger threshold, 30GeV

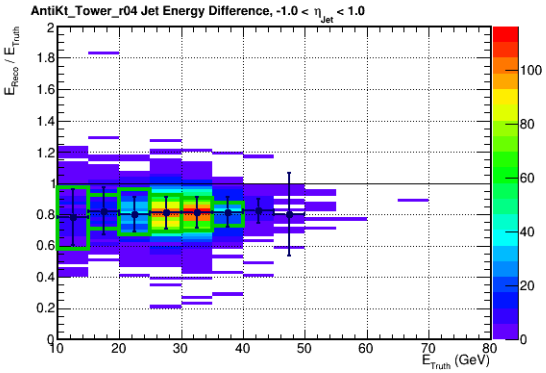
(removed inclusive jet plots)

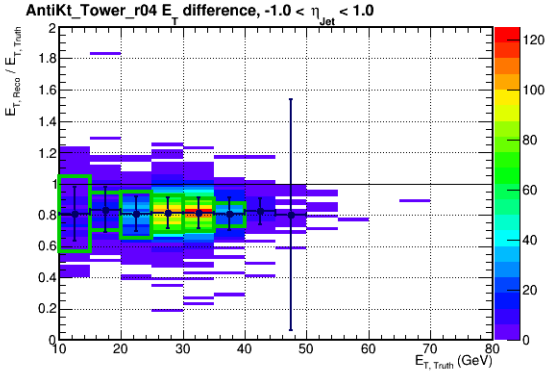
Truth Matching

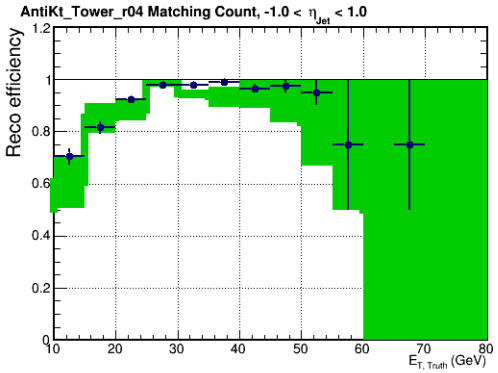
- Pythia8 200pp, s>25GeV, truth jet trigger E>30GeV, 2000 event
- 250 events of the same setting as reference for now....

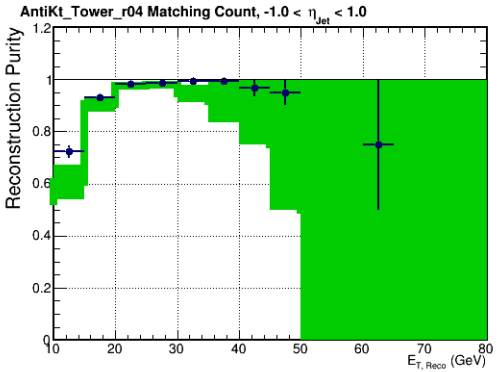






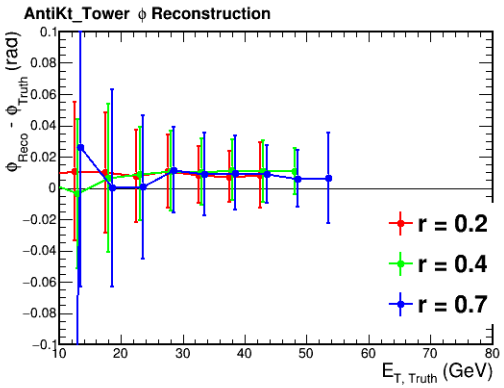


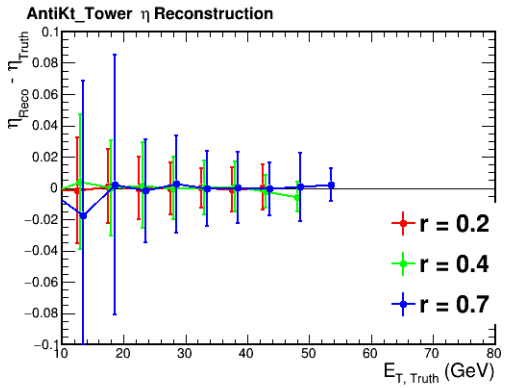


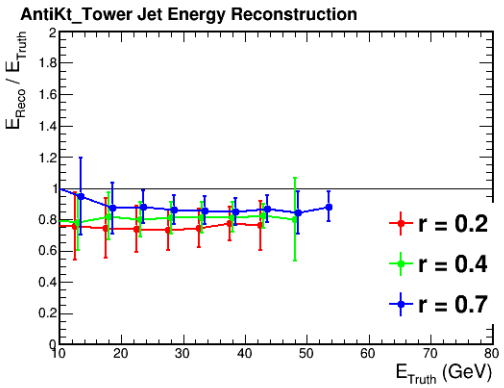


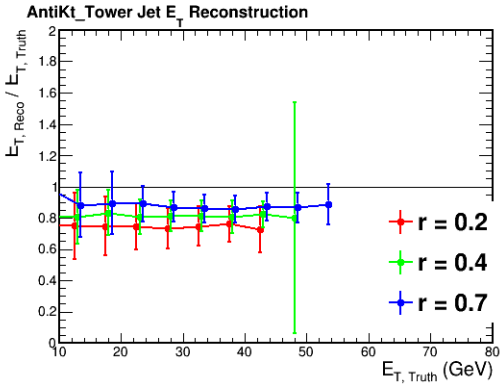
Reconstruction quality summary

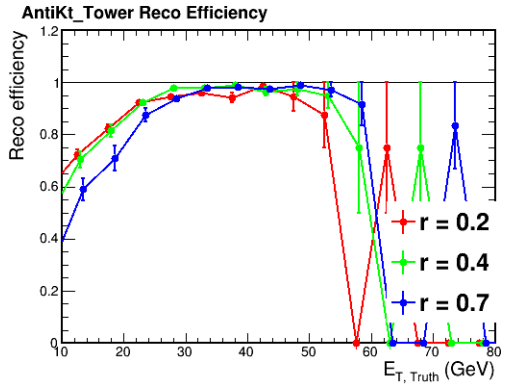
- Pythia8 200pp, s>25GeV, truth jet trigger E>30GeV, 2000 event

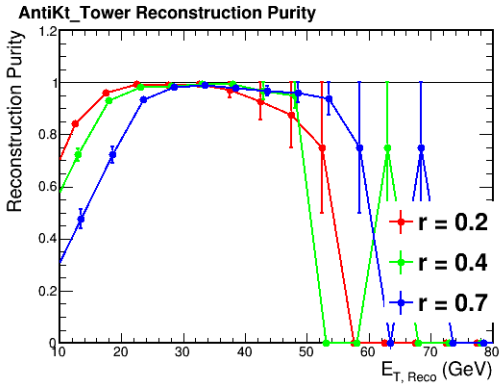










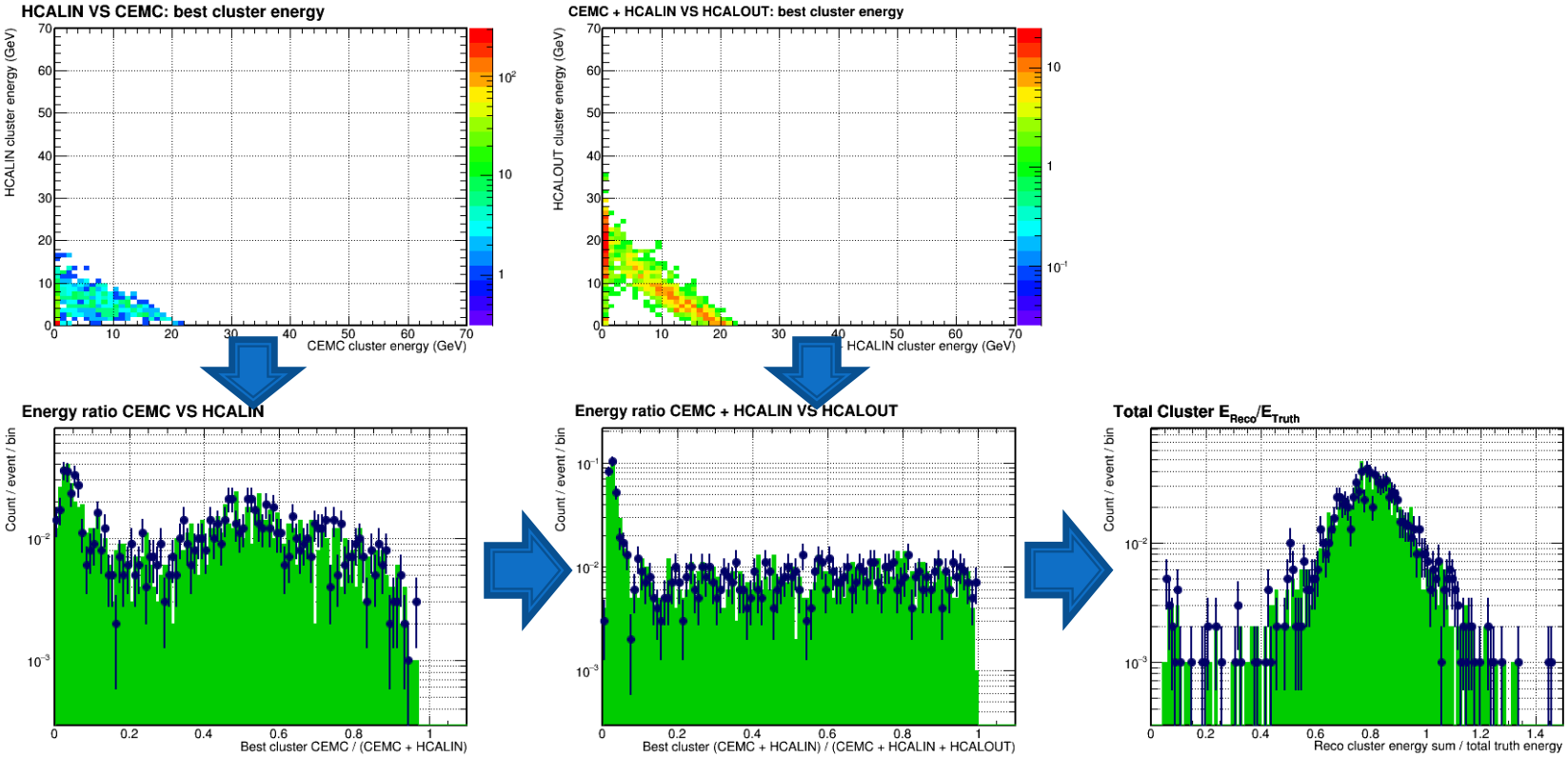


Part III

New calorimeter summary

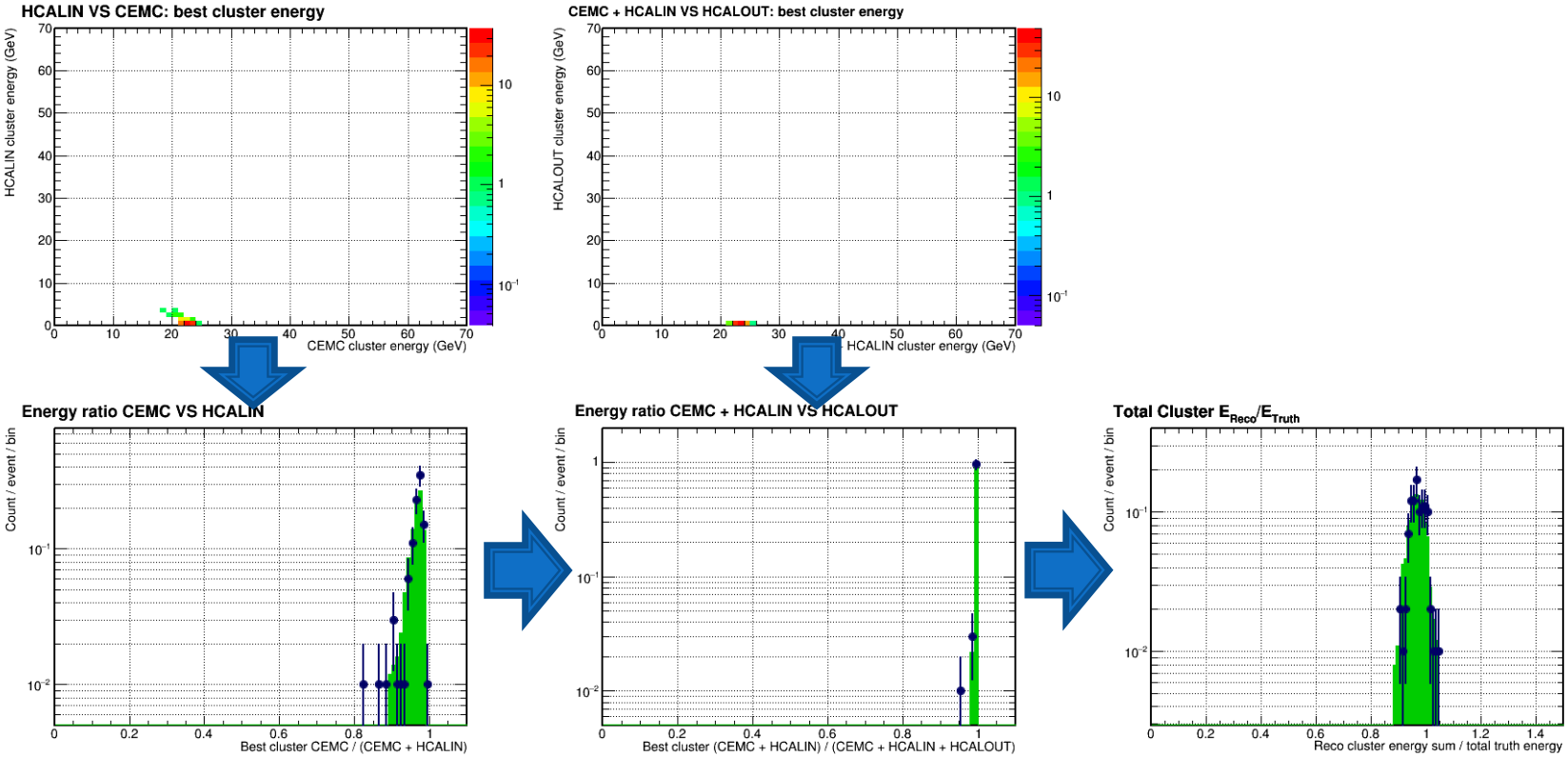
24 GeV negatively charged pions at eta ~ 0

- 1000 pion event with QGSP_BERT list
- 1000 pion from latest production



24 GeV electrons at eta ~ 0

- 1000 e- event with QGSP_BERT list
- 1000 e- from latest production



Extra information

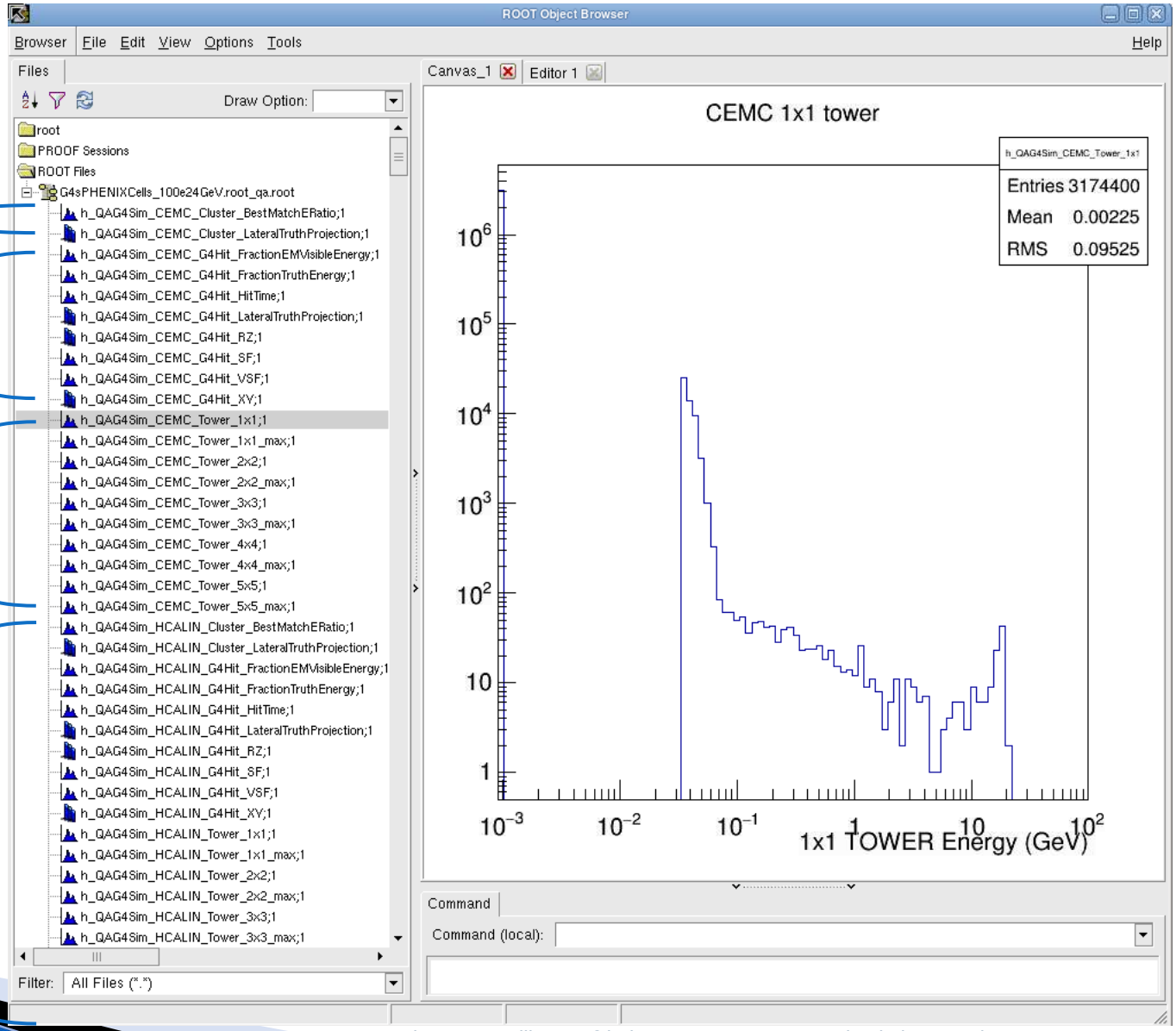
Macros to run the QA module

```
gSystem->Load("libqa_modules");

se->registerSubsystem( new QAG4SimulationCalorimeter("CEMC") );
se->registerSubsystem( new QAG4SimulationCalorimeter("HCALIN") );
se->registerSubsystem( new QAG4SimulationCalorimeter("HCALOUT") );

QAG4SimulationCalorimeterSum * calo_qa = new QAG4SimulationCalorimeterSum();
  calo_qa->Verbosity(10);
se->registerSubsystem(calo_qa );

  if (do_jet_reco)
    {
      QAG4SimulationJet * calo_jet7 = new QAG4SimulationJet(
          "AntiKt_Truth_r07");
      calo_jet7->add_reco_jet("AntiKt_Tower_r07");
      calo_jet7->add_reco_jet("AntiKt_Cluster_r07");
      calo_jet7->add_reco_jet("AntiKt_Track_r07");
  calo_jet7->Verbosity(2);
      se->registerSubsystem(calo_jet7);

      QAG4SimulationJet * calo_jet7 = new QAG4SimulationJet(
          "AntiKt_Truth_r04");
      calo_jet7->add_reco_jet("AntiKt_Tower_r04");
      calo_jet7->add_reco_jet("AntiKt_Cluster_r04");
      calo_jet7->add_reco_jet("AntiKt_Track_r04");
      se->registerSubsystem(calo_jet7);

      QAG4SimulationJet * calo_jet7 = new QAG4SimulationJet(
          "AntiKt_Truth_r02");
      calo_jet7->add_reco_jet("AntiKt_Tower_r02");
      calo_jet7->add_reco_jet("AntiKt_Cluster_r02");
      calo_jet7->add_reco_jet("AntiKt_Track_r02");
      se->registerSubsystem(calo_jet7);
    }
```

QA histogram root file

CEMC/Clusters

CEMC/Geant4 checks

CEMC/Towers

HCALIN/HCALOUT/...