Backward Hadronic Calorimeter update

Diffractive dijet study

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THE OHIO STATE UNIVERSITY

Outline

Diffractive dijet - simulation setup

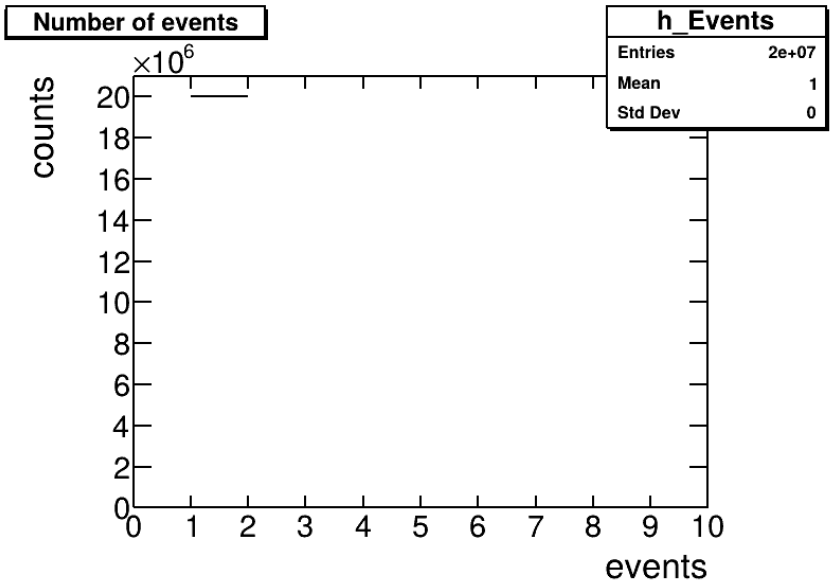
- Simulation setup for diffractive dijets
- PYTHIA version 8.311 simulation from EIC container:
  - $18 \times 275\ \mathrm{GeV}$ $e + p$ collisions, $0 < Q^2 < 1\ \mathrm{GeV}^2$
  - $20M$ events
- Run at Ohio Supercomputing Center (OSC) to use local computing resources

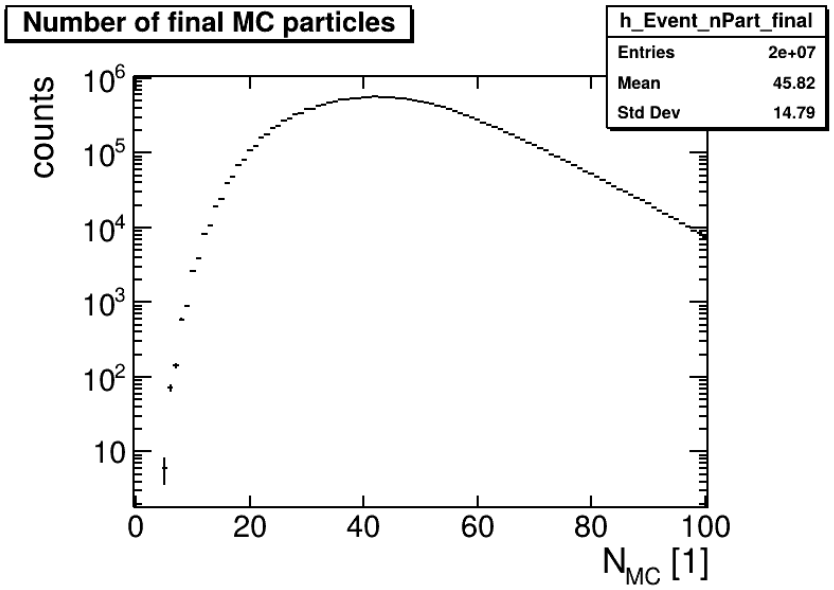
Listing: Simulation settings

```
pythia8->ReadString("Beams:frameType=2");
pythia8->ReadString("Beams:idA=2212");
pythia8->ReadString("Beams:idB=11");
pythia8->ReadString("275.");
pythia8->ReadString("18.");
  //according to main342 for H1 dijets
pythia8->ReadString("PDF:lepton2gamma = on"); // Allow for photon-from lepton
pythia8->ReadString("Photon:ProcessType = 0"); // Allow all photon processes
pythia8->ReadString("Photon:Q2max = 1."); // Maximal Q2
pythia8->ReadString("HardQCD:all = on"); // All dijet MEs
pythia8->ReadString("PhotonParton:all = on"); // All dijet MEs with photons
pythia8->ReadString("PhaseSpace:pThatMin = 4."); // Minimal pT cut
pythia8->ReadString("MultipartonInteractions:pT0Ref = 3."); // Tuned ep value

// Setup of diffractive framework.
pythia8->ReadString("Diffraction:doHard = on");
pythia8->ReadString("Diffraction:sampleType = 1"); // 'PDF' sample
pythia8->ReadString("Diffraction:hardDiffSide = 2"); // Diff. on photon side
pythia8->ReadString("SigmaDiffractive:PomFlux = 7"); // H1 Fit B LO
pythia8->ReadString("PDF:PomSet = 6"); // H1 Fit B LO
```

Events

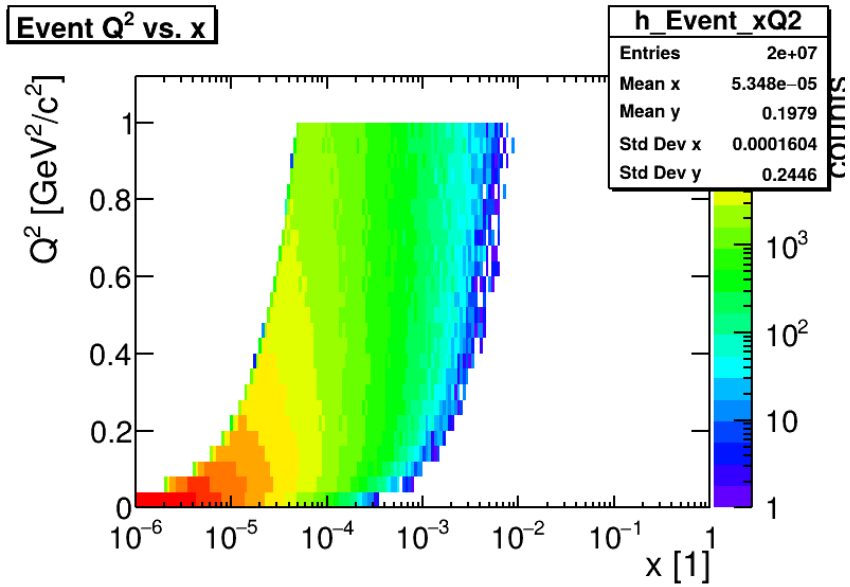


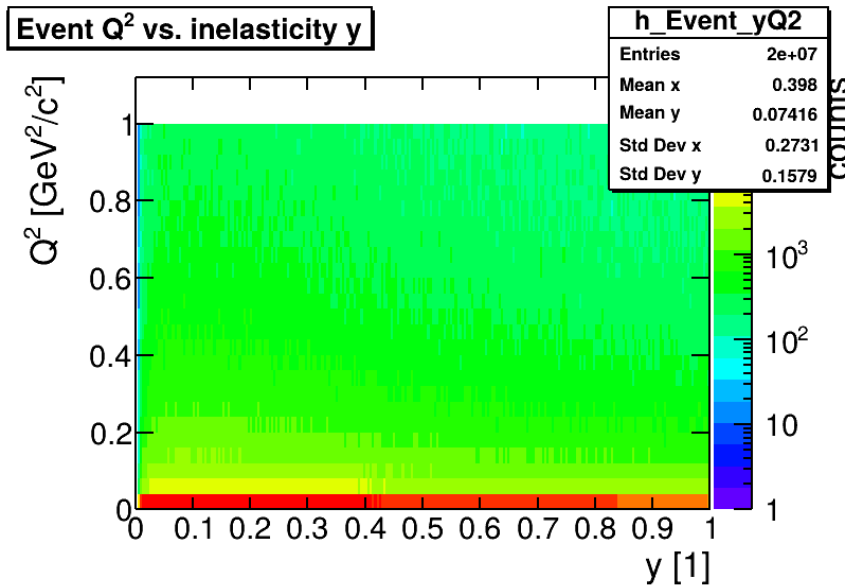


- First look at diffractive dijet events
- 46 final state particles on average
- Small amount of energy contained in diffractive dijets, rest mostly going forward

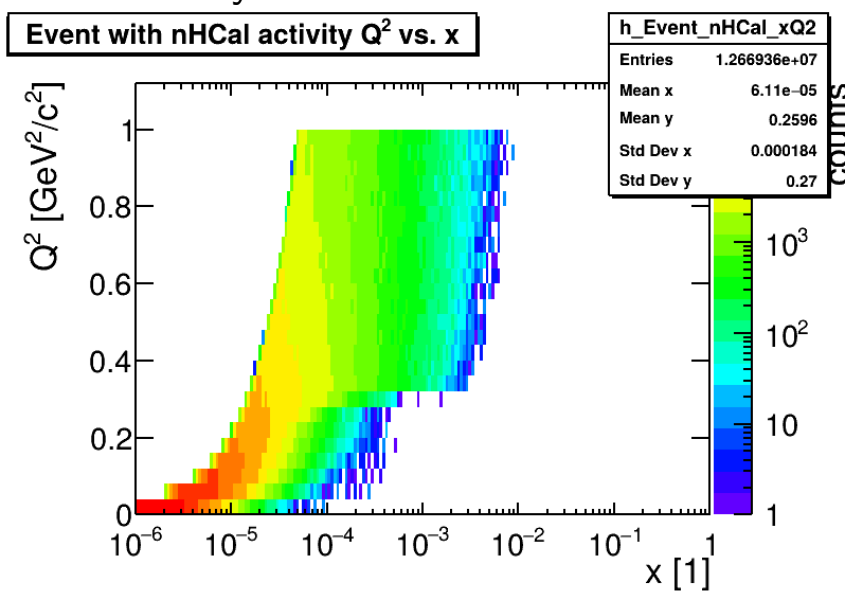
Event kinematics

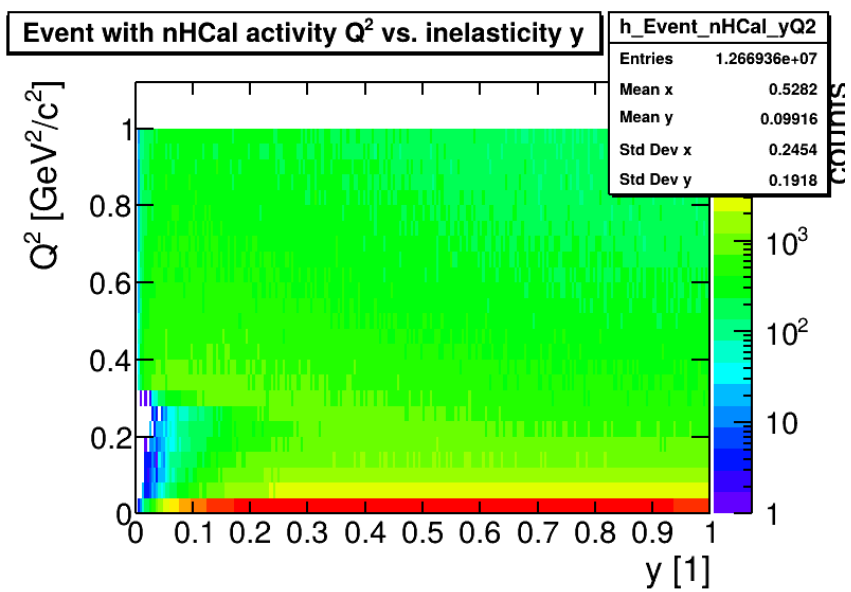
All events





With activity in nHCal

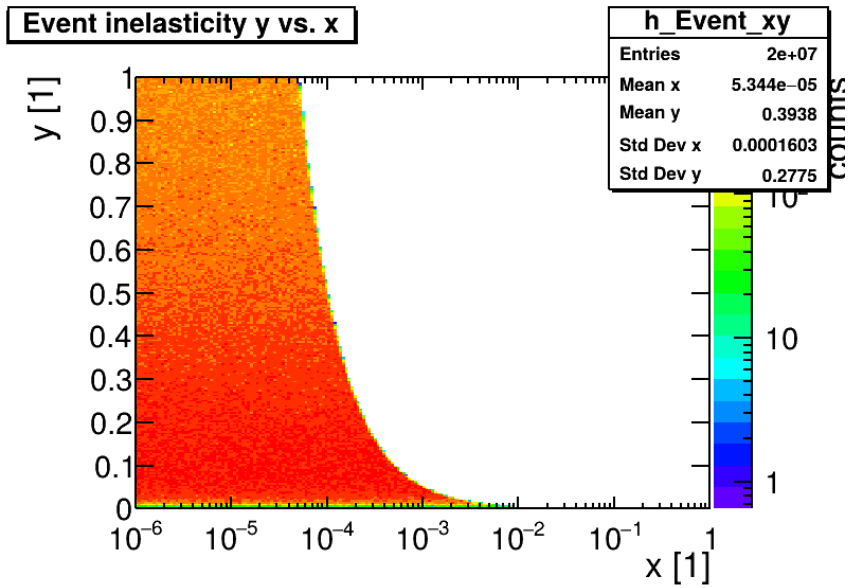




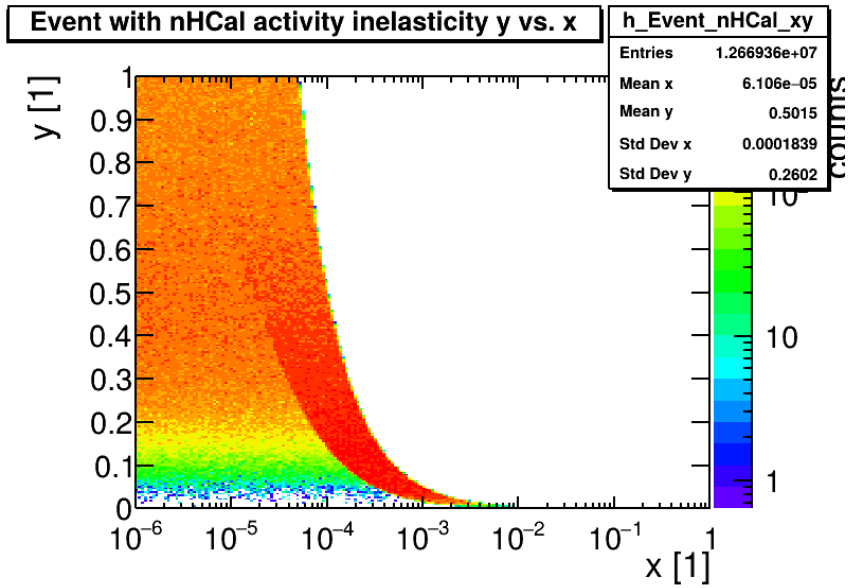
- $3.8M$ out of $6M$ (63%) events with activity in nHCal
- First look at diffractive dijet events
- nHCal crucial for low-x measurements coverage

Event kinematics

All events

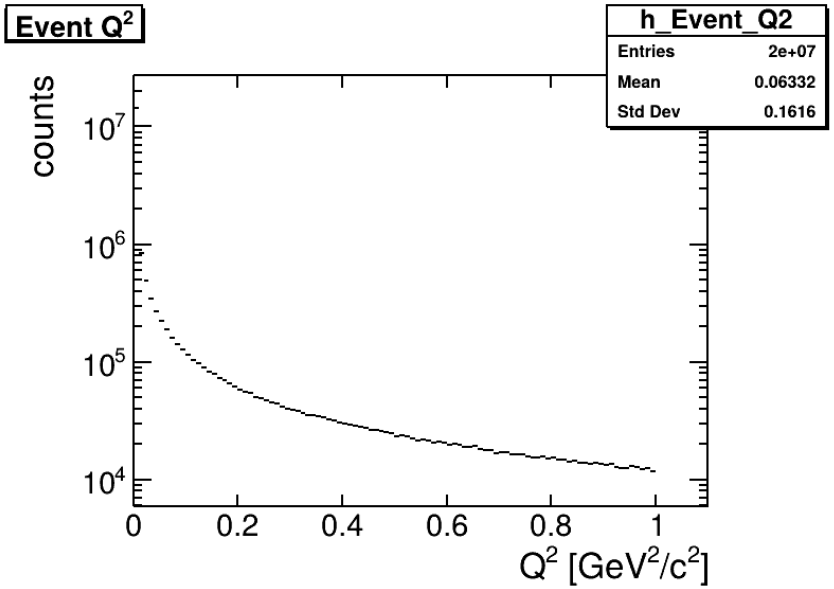


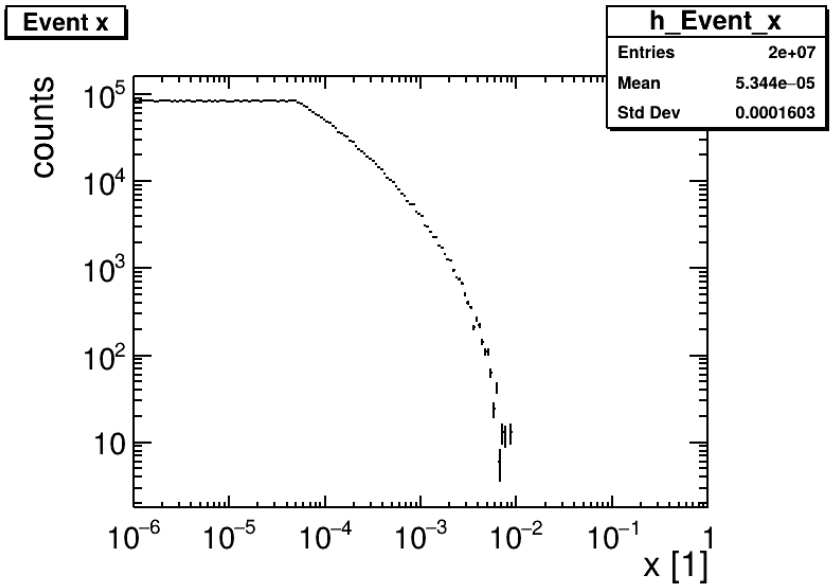
With activity in nHCal

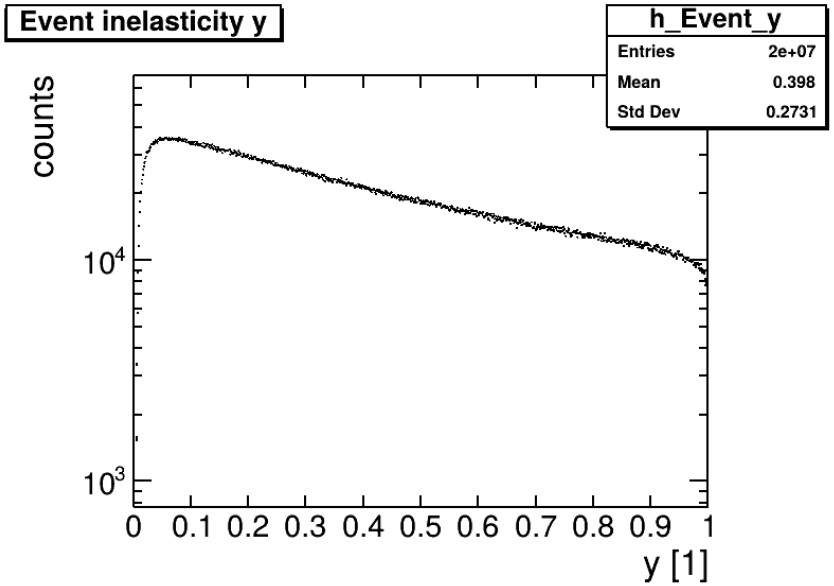


- $3.8M$ out of $6M$ (63%) events with activity in nHCal
- Includes scattered electron
- First look at diffractive dijet events
- nHCal crucial for low-x measurements coverage
- Looking for advice on the dijet clustering for next steps

All events kinematics

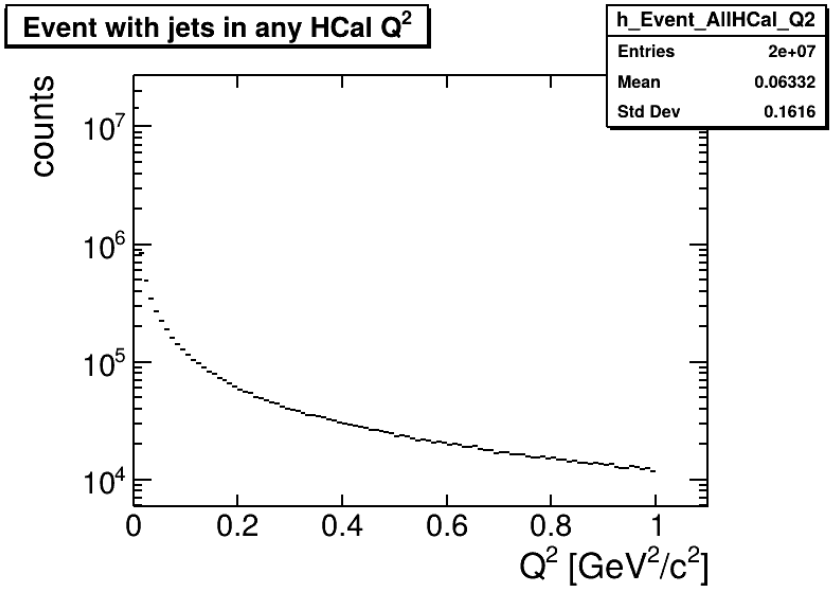


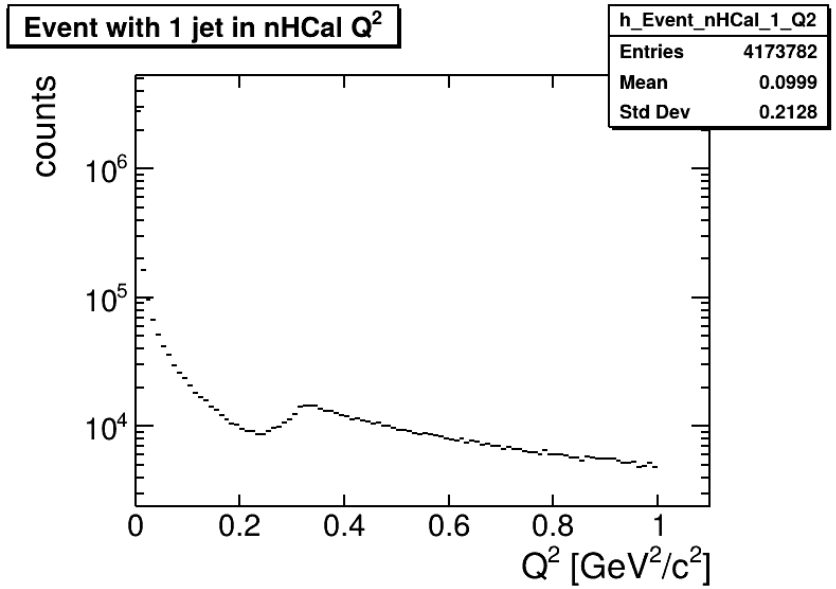


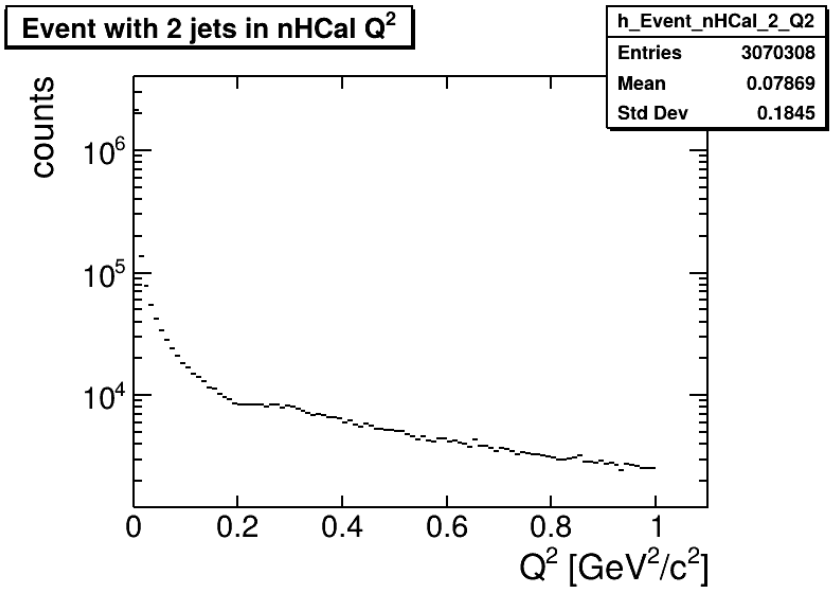


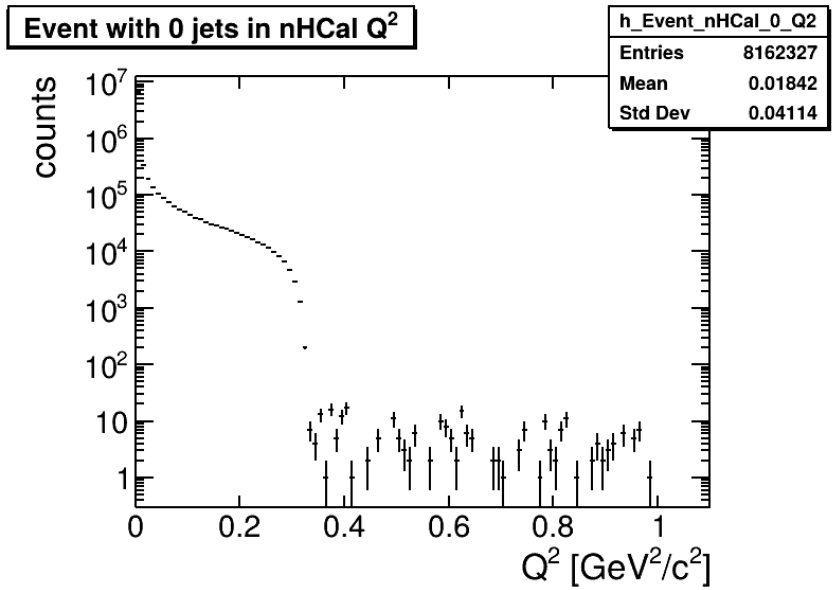
- All events

Event kinematics - Q^2



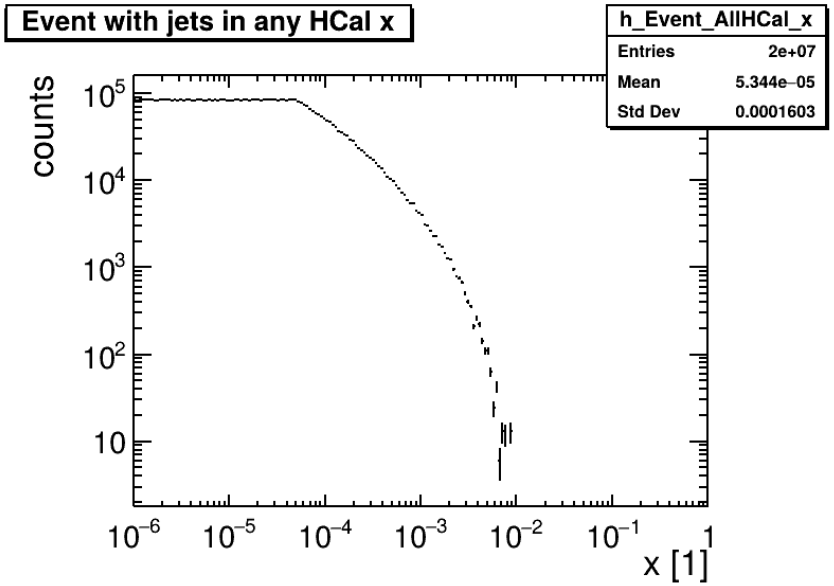


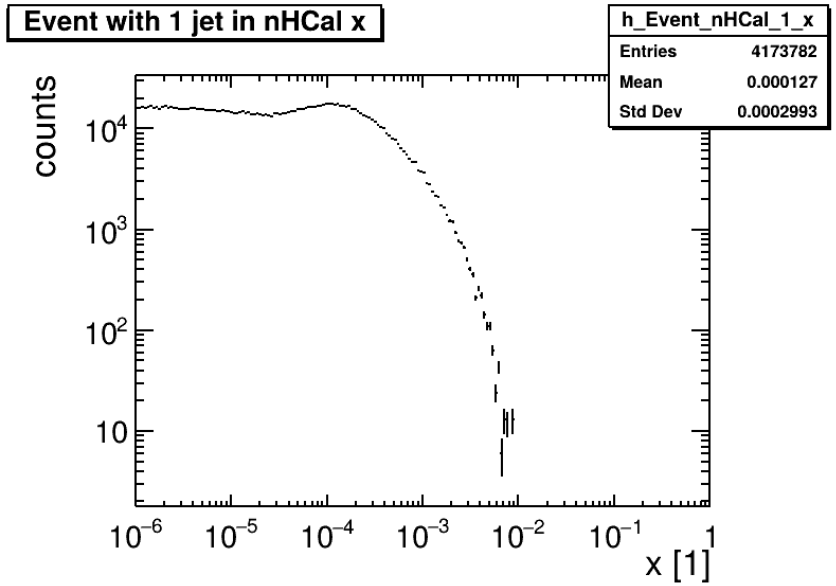


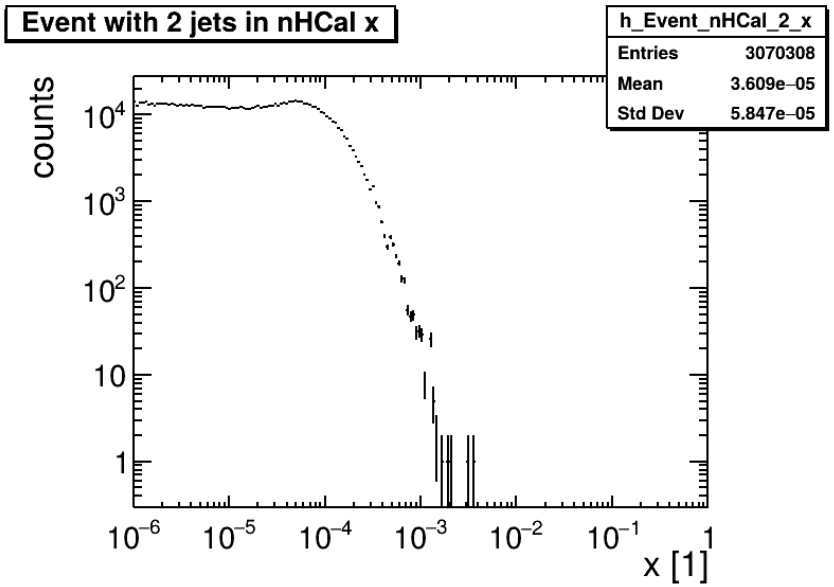


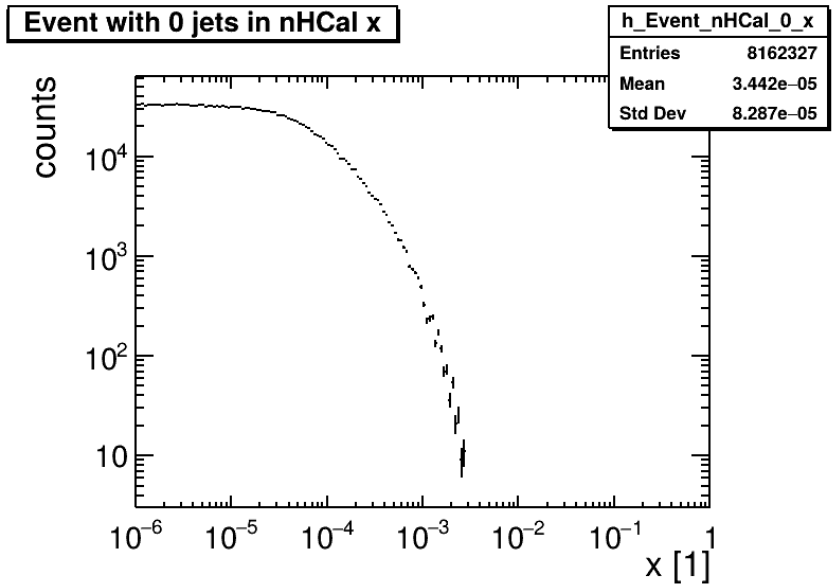
- All events

Event kinematics - Q^2



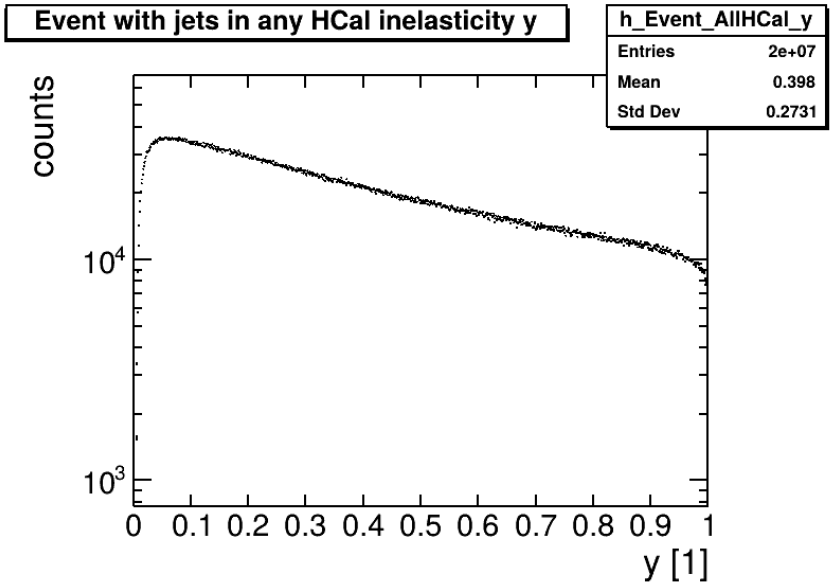


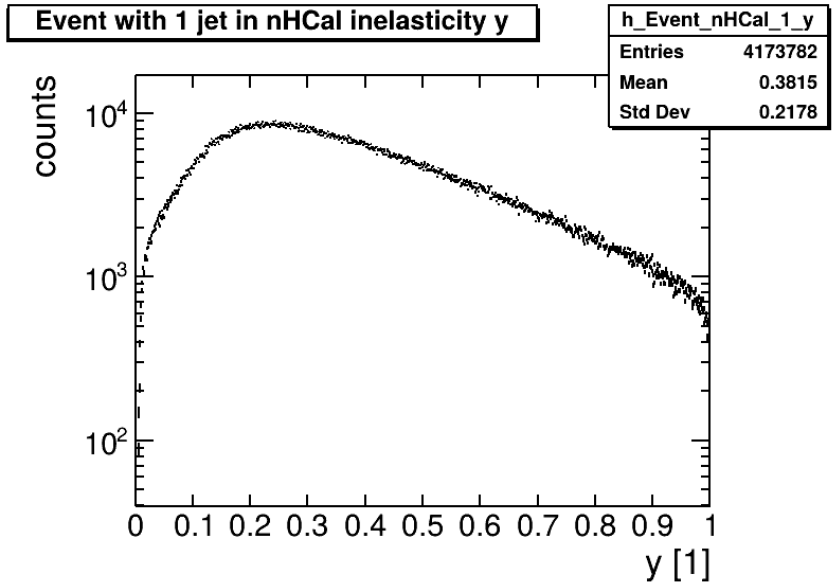


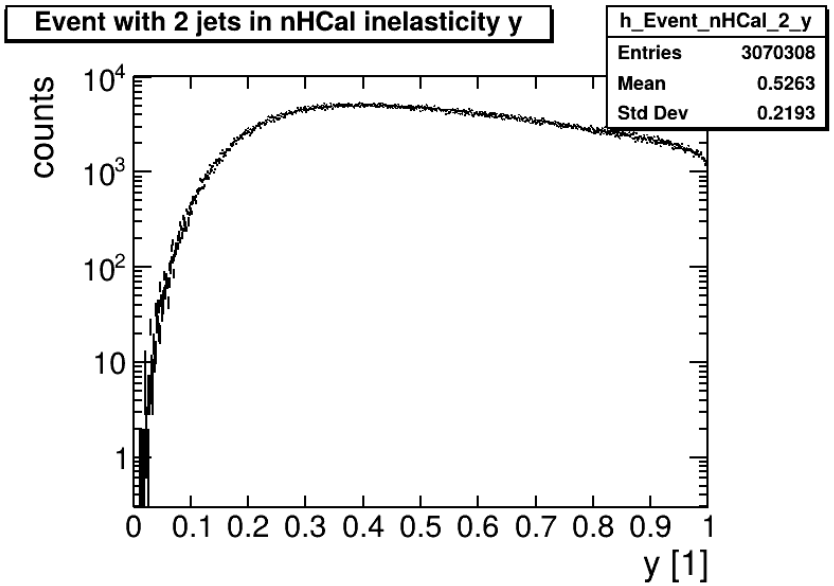


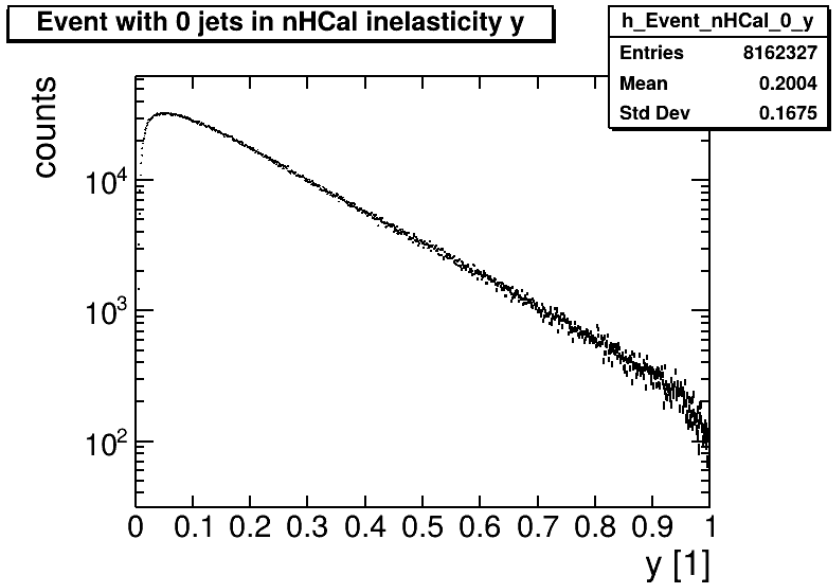
- All events

Event kinematics - Q^2





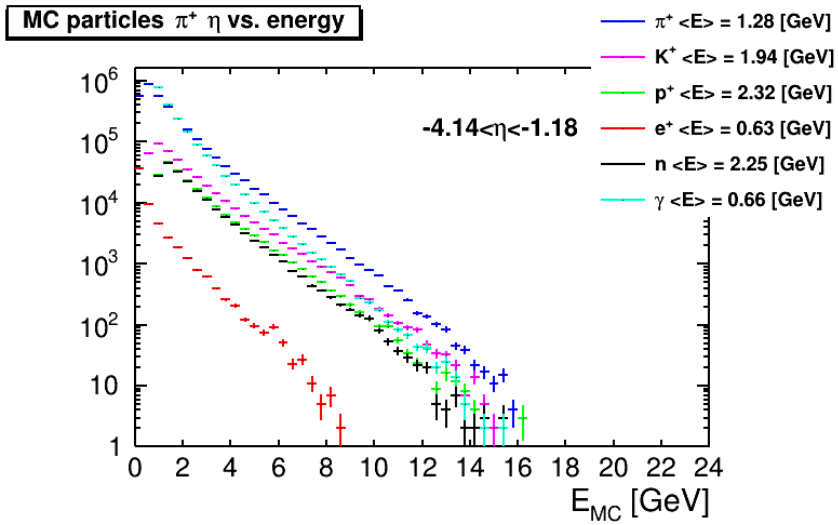




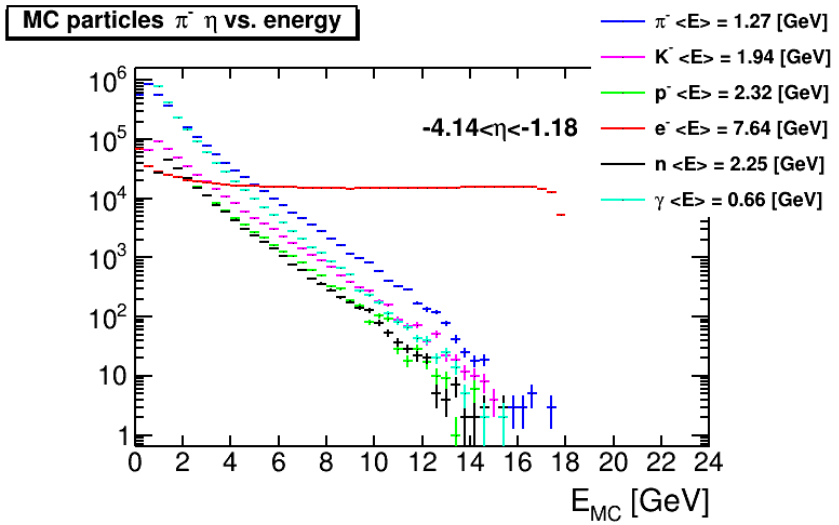
- All events

Particle distributions in nHCal

positive charge



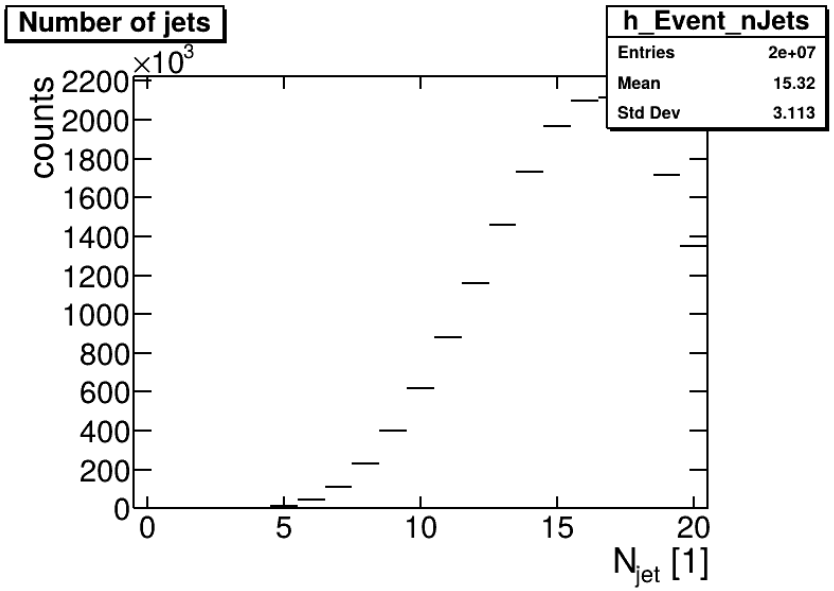
negative charge

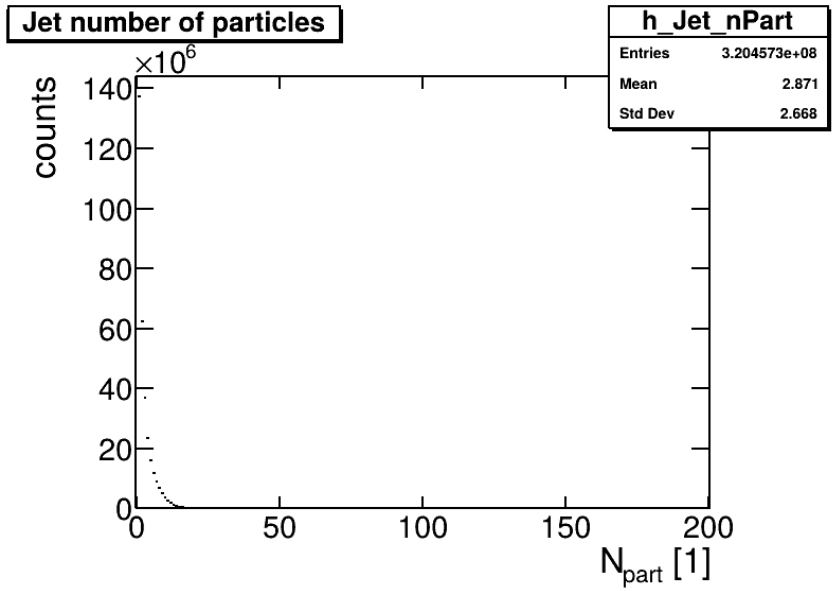


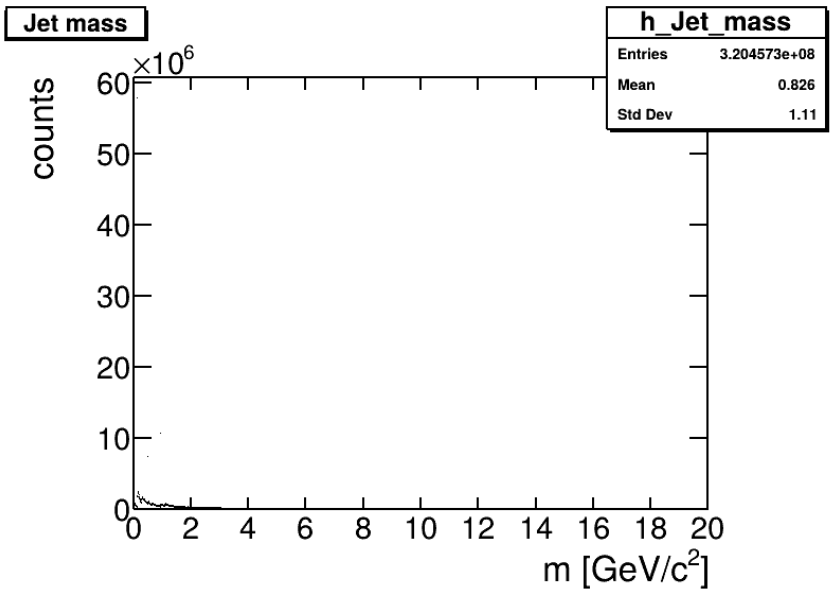
- Total energy distributions vs. η
  - Average neutron energy similar to inclusive events
- Kinetic energy is measured in nHCal

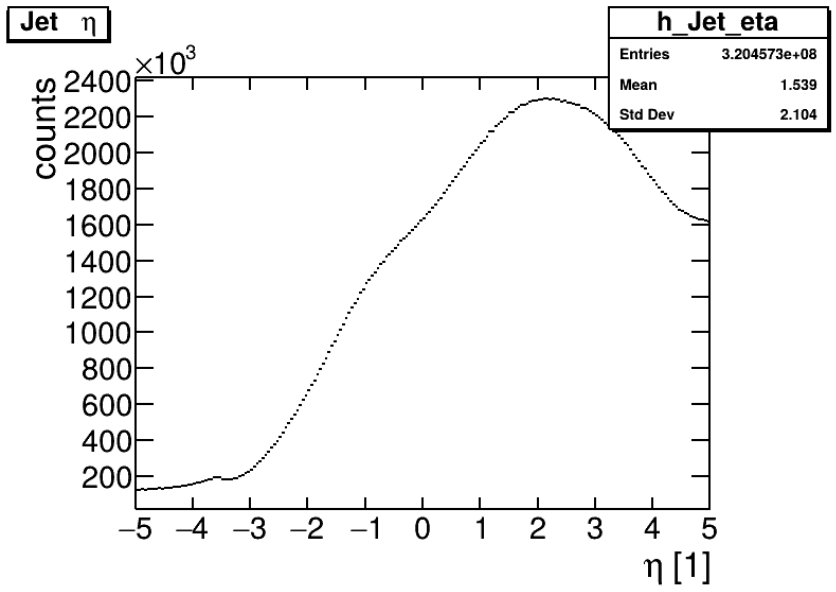
Jet clustering

- Final state particles
- Beam particles not excluded
- Anti-k_T algorithm
- Jet $p_T > 0\,\mathrm{GeV/c}$

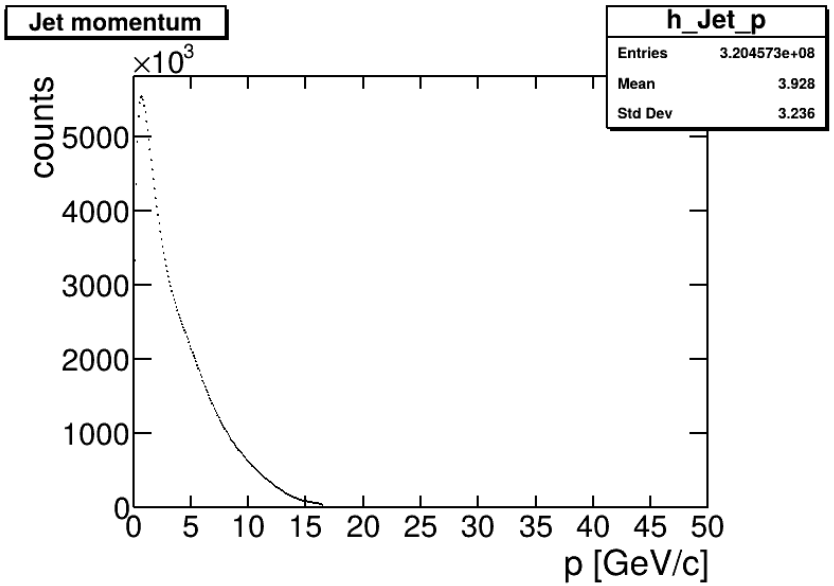

Number of jets
h_Event_nJets
Entries 2e+07
Mean 15.32
Std Dev 3.113
counts
×10^3
N_jet [1]

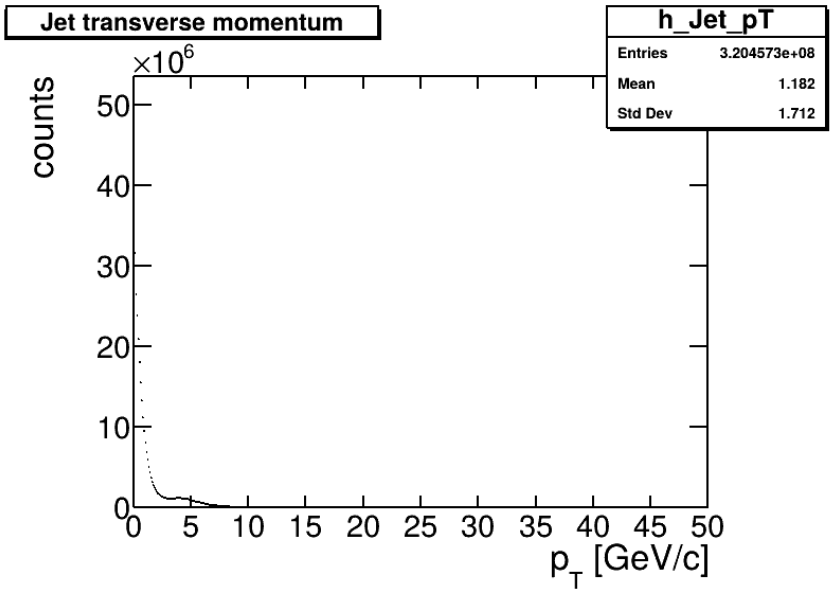

Jet number of particles
h_Jet_nPart
Entries 3.204573e+08
Mean 2.871
Std Dev 2.668
counts
×10^6
N_part [1]


Jet mass
h_Jet_mass
Entries 3.204573e+08
Mean 0.826
Std Dev 1.11
counts
×10^6
m [GeV/c^2]


Jet η
h_Jet_eta
Entries 3.204573e+08
Mean 1.539
Std Dev 2.104
counts
×10^3
η [1]

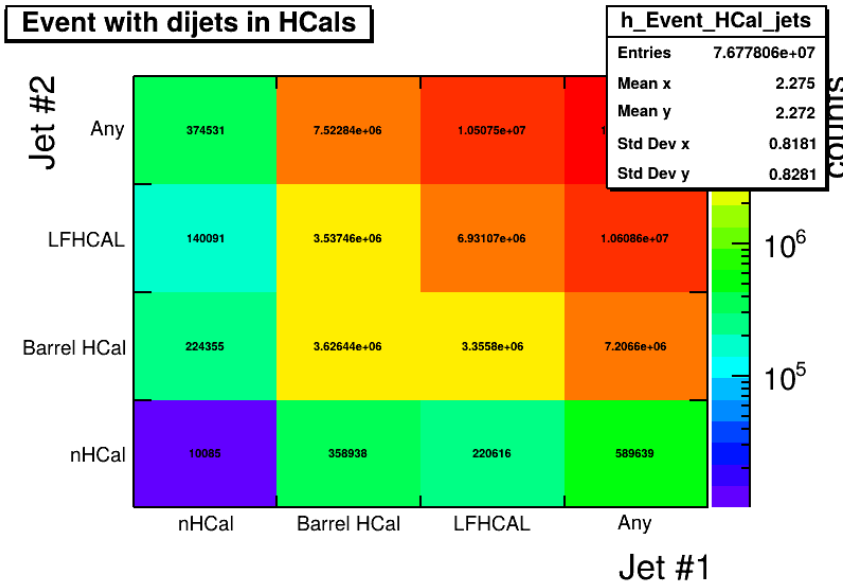
- All jets

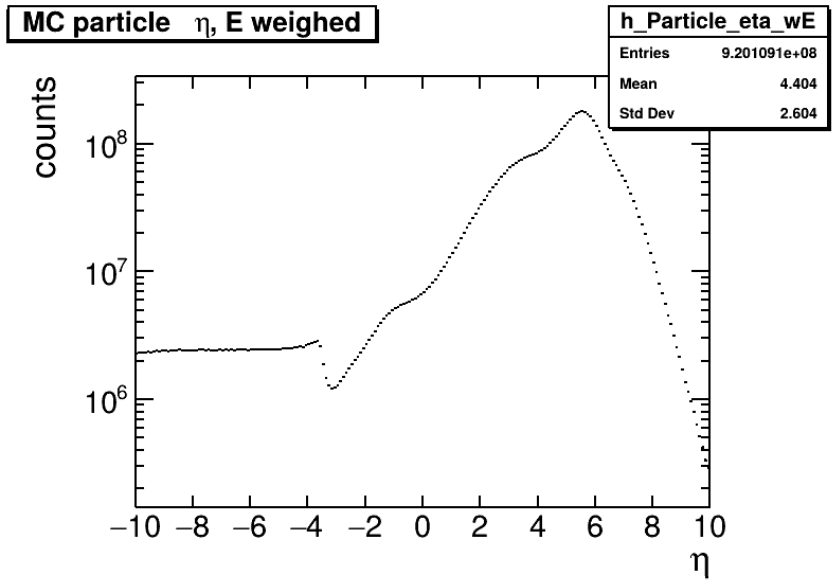

Jet momentum
h_Jet_p
Entries 3.204573e+08
Mean 3.928
Std Dev 3.236
×10^3
counts
5000
4000
3000
2000
1000
0
0 5 10 15 20 25 30 35 40 45 50
p [GeV/c]


Jet transverse momentum
h_Jet_pT
Entries 3.204573e+08
Mean 1.182
Std Dev 1.712
×10^6
counts
50
40
30
20
10
0
0 5 10 15 20 25 30 35 40 45 50
p_T [GeV/c]

- All jets

Events with jets in HCals





- Calculated average energy in acceptance of HCals

Summary

Conclusions

- Implemented FastJet
- First look at jets

BACKUP