

# Backward Hadronic Calorimeter update

## Diffractive dijet study

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THE OHIO STATE UNIVERSITY

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- 1 Diffractive dijets with nHCal
  - Simulation setup
  - Events
  - Acceptance
  - Particle distributions in nHCal
  - Jets
  
- 2 Summary

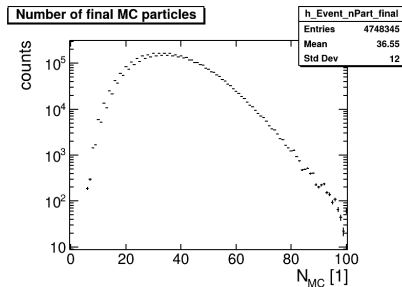
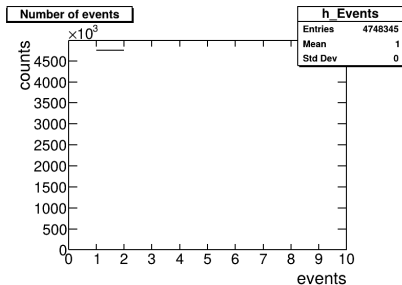
# Diffraction dijet - simulation setup

- Simulation setup for diffractive dijets
- PYTHIA version 8.311 simulation from EIC container:
  - $18 \times 275$  GeV  $e + p$  collisions,  $0 < Q^2 < 1$  GeV<sup>2</sup>
  - 4.7 events
- Run at Ohio Supercomputing Center (OSC) to use local computing resources
- Required Diffraction A or B or HardDiffraction A or B

## 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

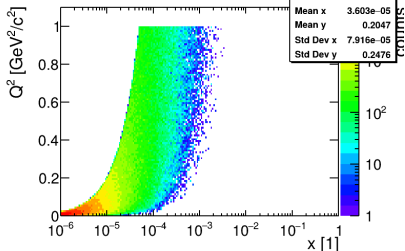
// Setup of diffractive framework.
pythia8->ReadString("Diffraction:doHard = on");
pythia8->ReadString("Diffraction:sampleType = 1"); // 'PDF' sample
pythia8->ReadString("Diffraction:hardDiffSide = 2"); // Diff. on photon side
pythia8->ReadString("SigmaDiffractive:PomFlux = 7"); // H1 Fit B LO
pythia8->ReadString("PDF:PomSet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



- First look at diffractive dijet events
- 36 final state particles on average

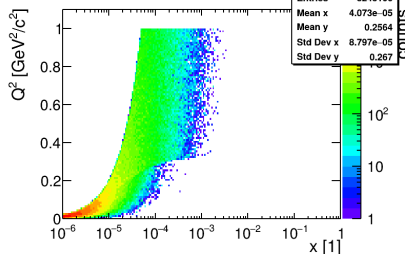
All events

Event  $Q^2$  vs.  $x$

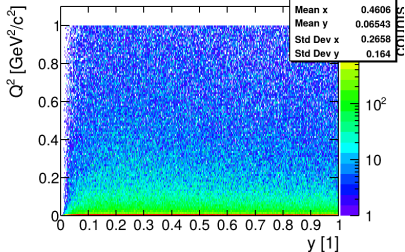


With activity in nHCal

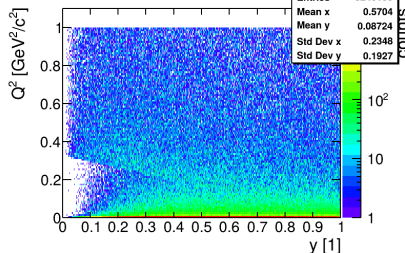
Event with nHCal activity  $Q^2$  vs.  $x$



Event  $Q^2$  vs. inelasticity  $y$



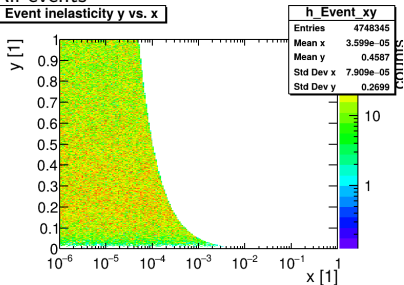
Event with nHCal activity  $Q^2$  vs. inelasticity  $y$



- 3.2M out of 4.7M (68%) events with activity in nHCal
- First look at diffractive dijet events

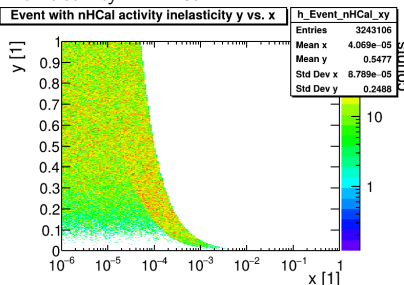
All events

Event inelasticity  $y$  vs.  $x$

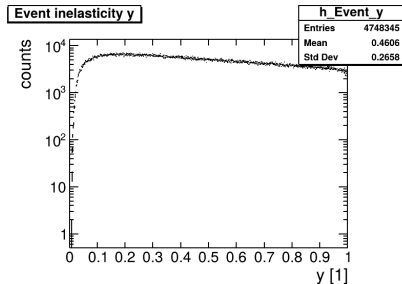
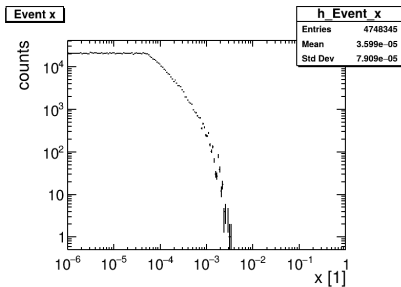
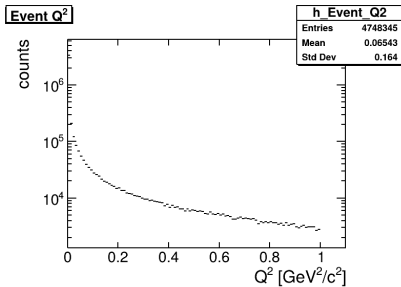


With activity in nHCal

Event with nHCal activity inelasticity  $y$  vs.  $x$



- 3.2M out of 4.7M (68%) events with activity in nHCal
- Includes scattered electron
- First look at diffractive dijet events

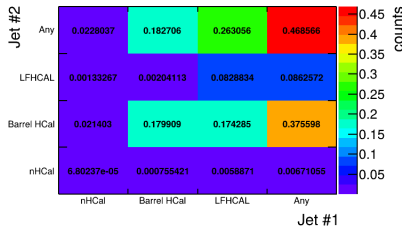


- All events

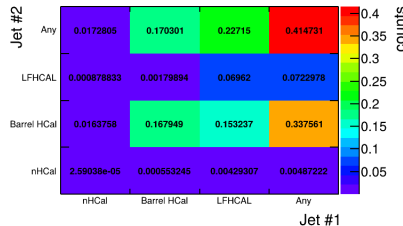
- Final state particles
- Beam particles not excluded
- $R = 1$
- Anti- $k_T$  algorithm (ee\_kT didn't work, found very few jets)
- Jet  $p_T > 4 \text{ GeV}/c$



Event with dijets in HCals

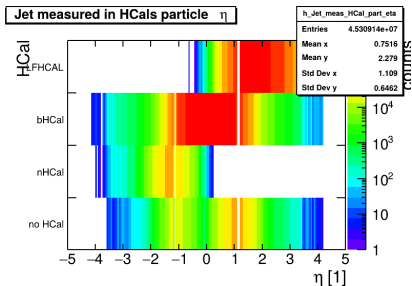
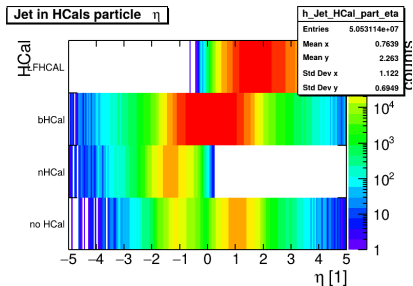
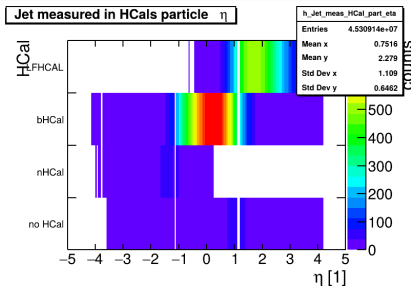
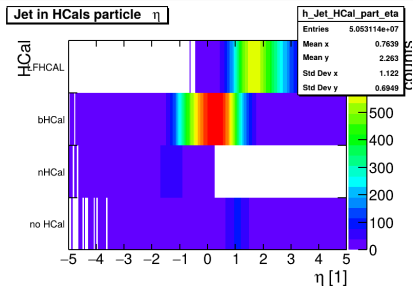


Event with measured dijets in HCals

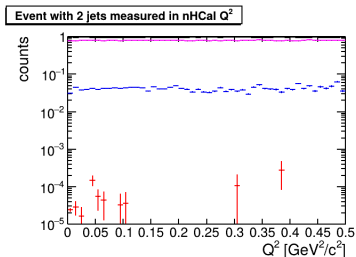
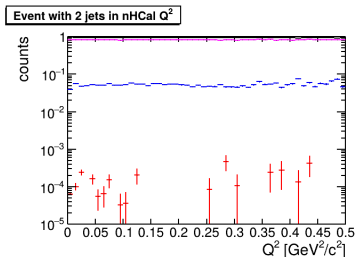
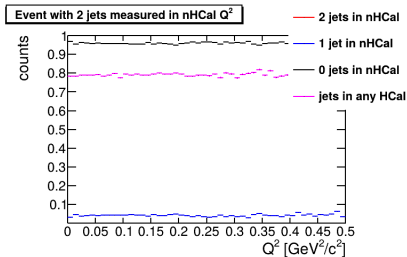
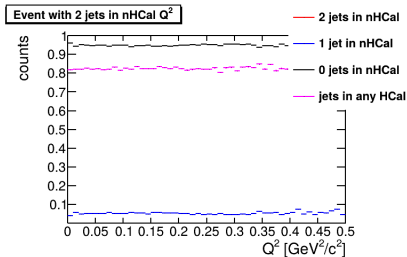


- Fractions of events with jets in HCals
- Fraction of all events, even those with 0 – 1 jets
- 47% of events with 2 or more jets
- Maybe it's better to scale by the events with 2 or more jets rather than all events

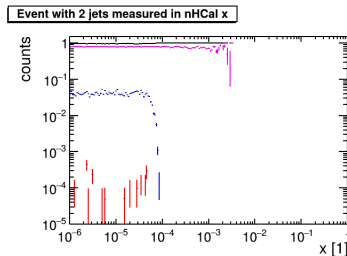
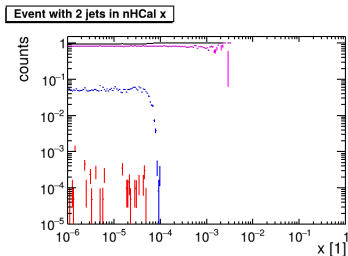
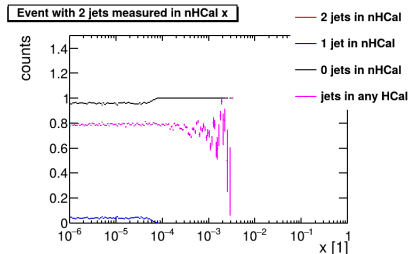
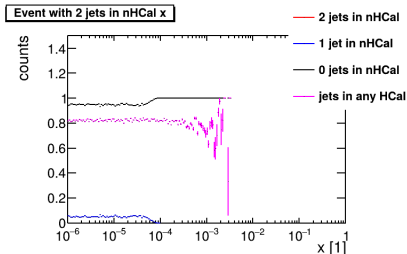
# Jets in HCals vs. constituent $\eta$



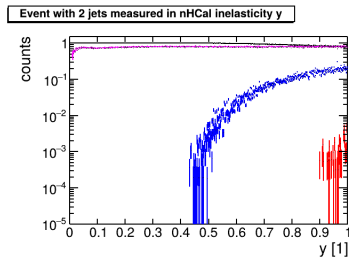
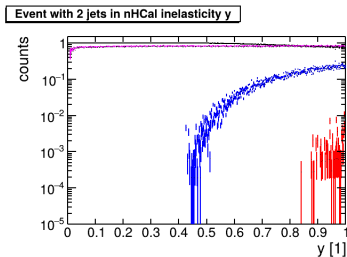
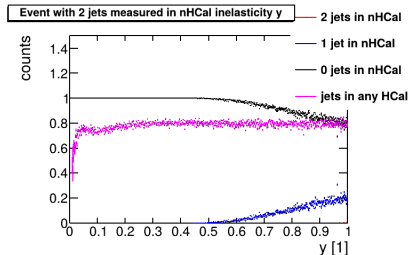
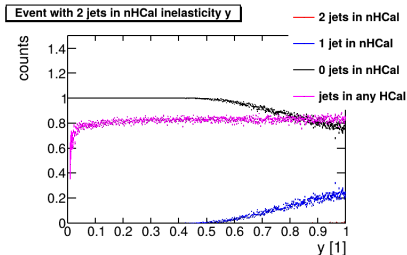
- $\eta$  distributions for constituents of jets in HCals



- Fractions of events with jets in HCal



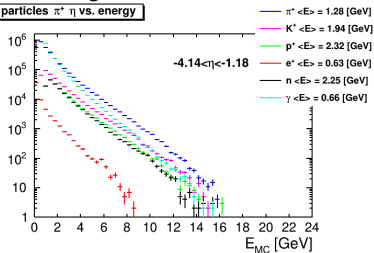
- Fractions of events with jets in HCals



- Fractions of events with jets in HCal

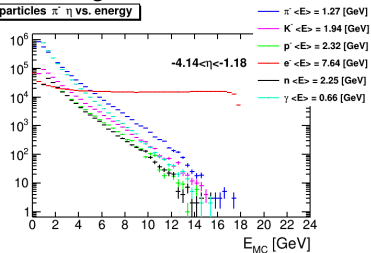
## positive charge

MC particles  $\pi^+$   $\eta$  vs. energy

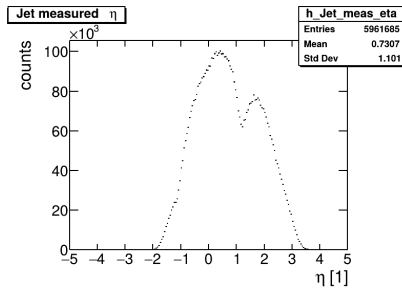
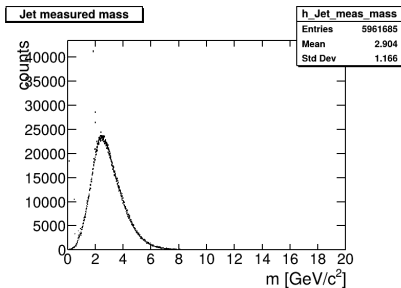
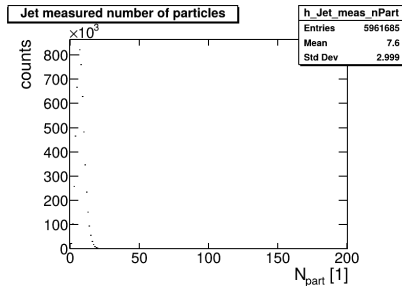
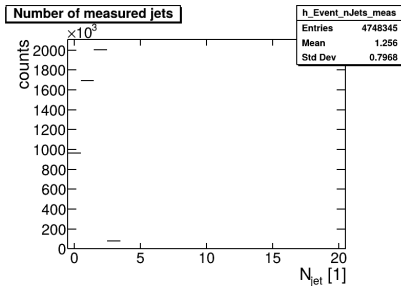


## negative charge

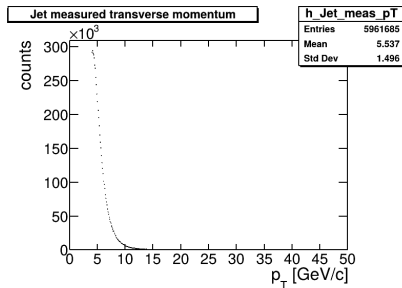
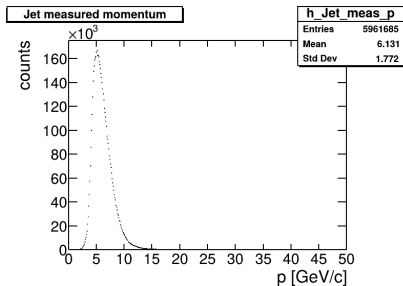
MC particles  $\pi^-$   $\eta$  vs. energy



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



- All jets



- All jets

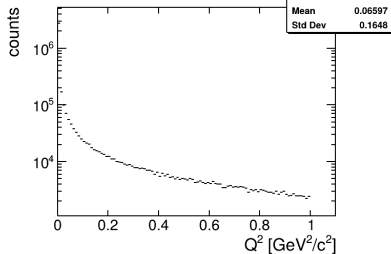


## Conclusions

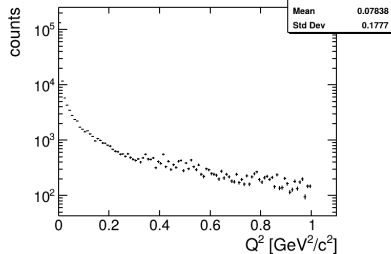
- Implemented FastJet
- First look at jets

**BACKUP**

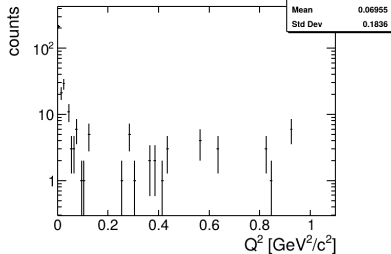
Event with jets in any HCal  $Q^2$



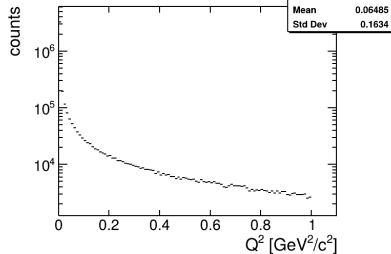
Event with 1 jet in nHCal  $Q^2$



Event with 2 jets in nHCal  $Q^2$

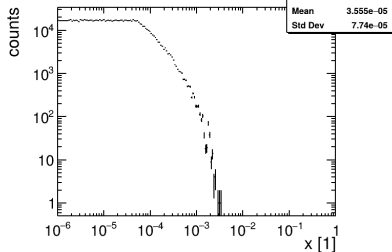


Event with 0 jets in nHCal  $Q^2$

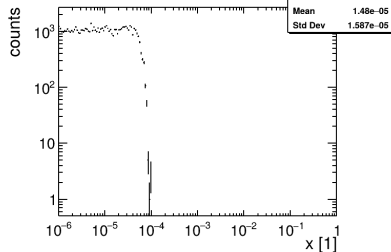


- All events

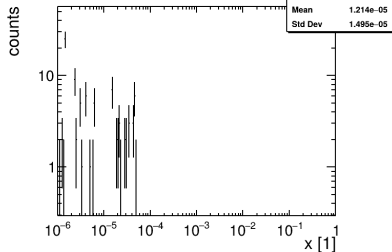
Event with jets in any HCal x



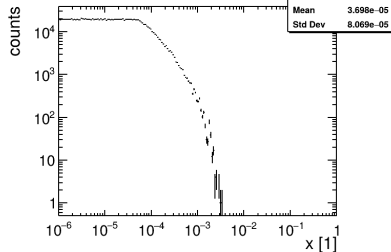
Event with 1 jet in nHCal x



Event with 2 jets in nHCal x

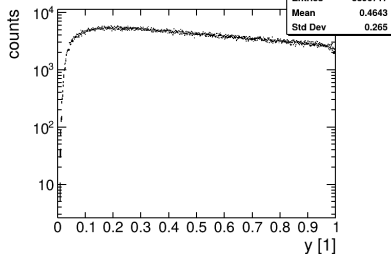


Event with 0 jets in nHCal x

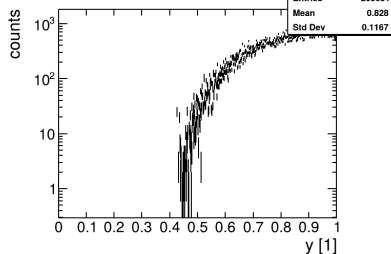


- All events

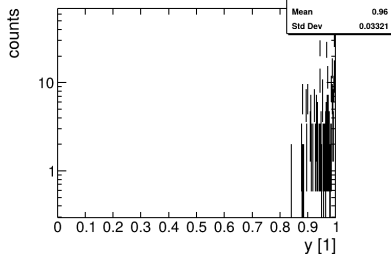
Event with jets in any HCal inelasticity  $y$



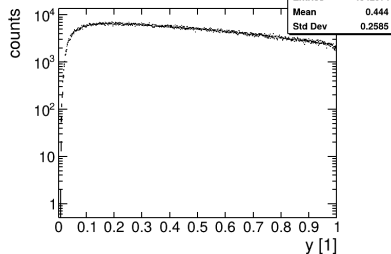
Event with 1 jet in nHCal inelasticity  $y$



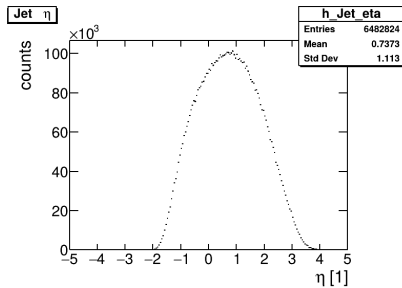
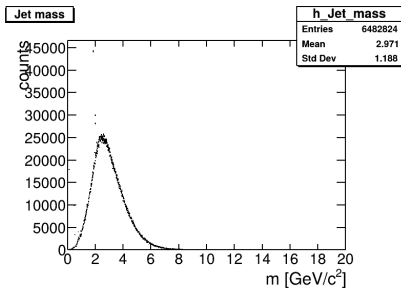
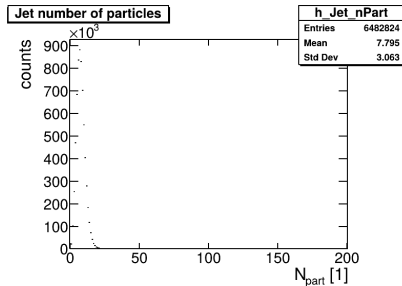
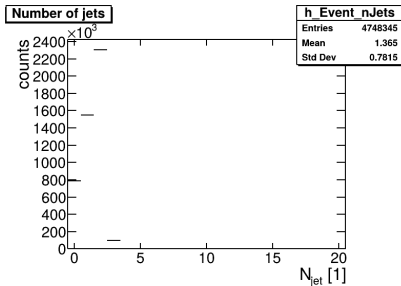
Event with 2 jets in nHCal inelasticity  $y$



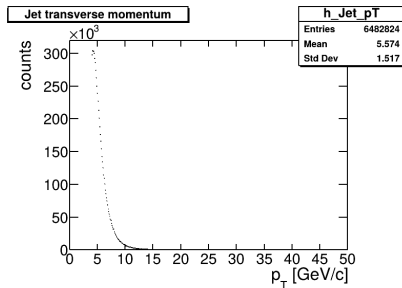
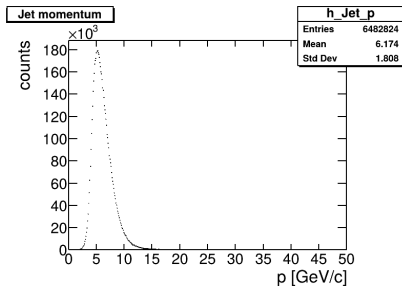
Event with 0 jets in nHCal inelasticity  $y$



- All events

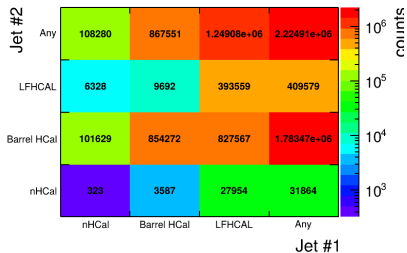


- All jets

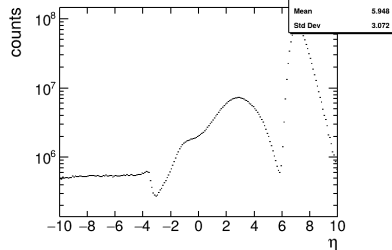


- All jets

Event with dijets in HCals



MC particle  $\eta$ , E weighed



- Calculated average energy in acceptance of HCals