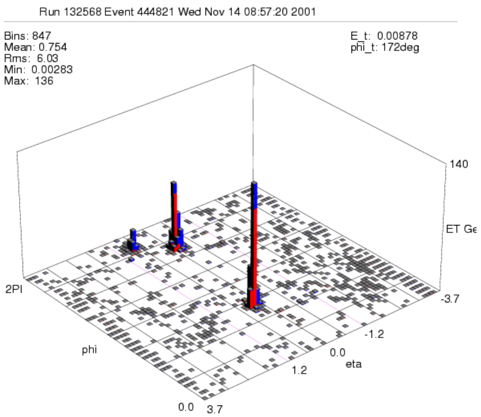
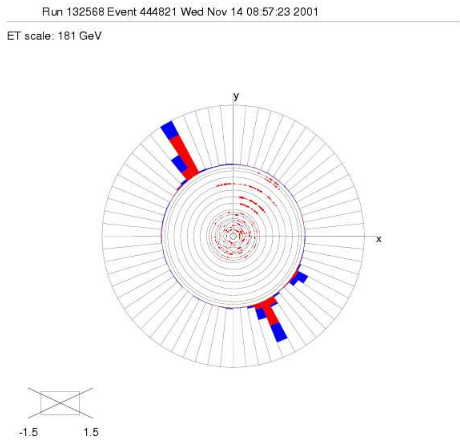
Jet/MEt ID

DØ Collaboration Meeting : February 15, 2002



Alexander Kupčo[1]

for Jet/MEt ID group



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Acknowledgement

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  - G. Bernardi F. Filthaut, S. Fu, S. Grinstein, J-F. Grivaz, I. Iashvili, R. Kehoe, M. Klute, J. Krane, A. Quadt, S. Trincaz-Duvoid, V. Zutshi
- Jet and MET certification notes
- http://www-d0.fnal.gov/~d0upgrad/d0_private/software/jetid/certification/certif.html

Jets and Missing ET

Certification Documentation

Jets and Trigger Efficiencies (ps)

Met and Hot Cells (ps)

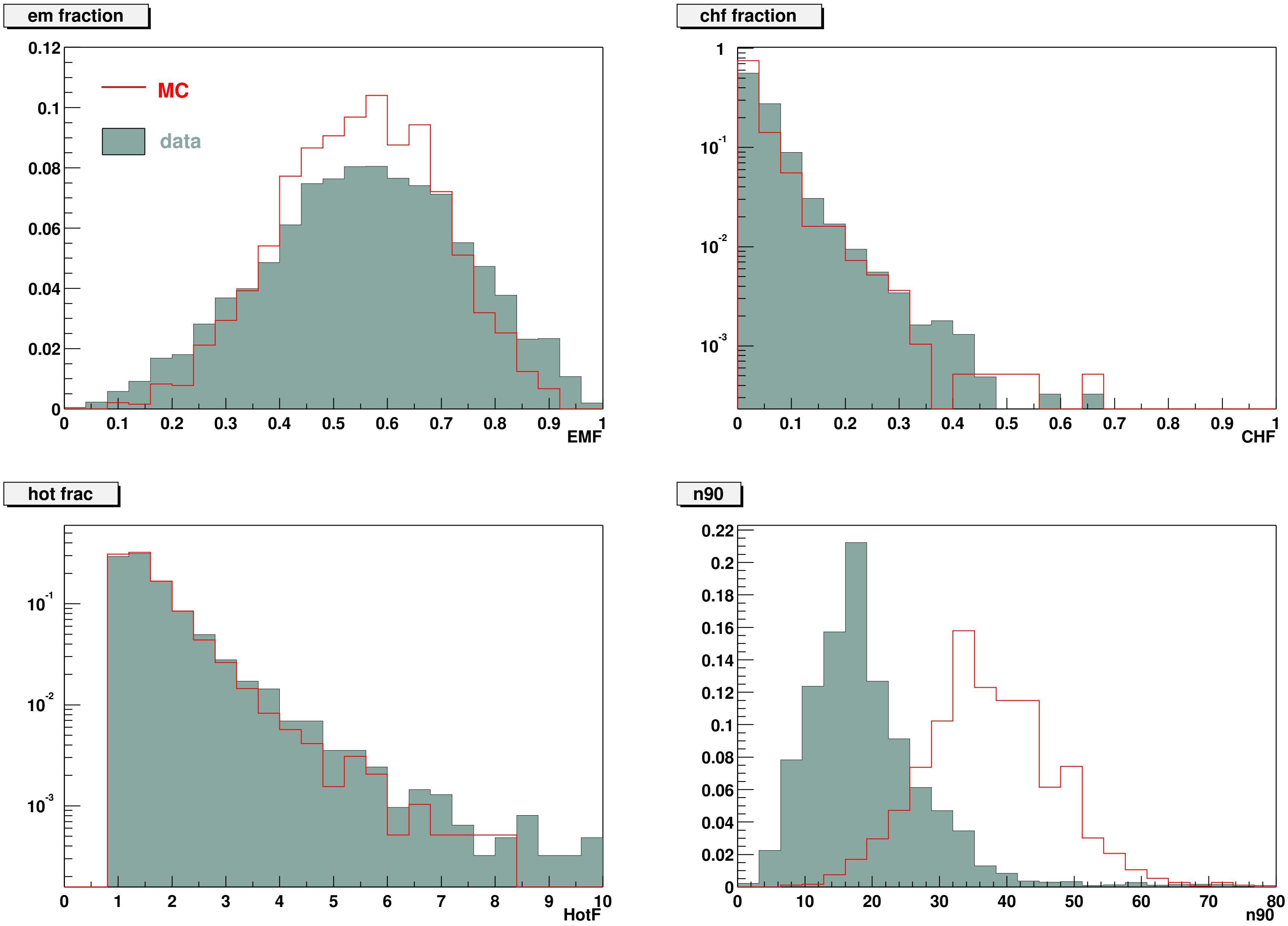
Macros

Hotcells_after_run_131087
Hotcells_before_run_130681
L1 trigger efficiencies for CJT (1,5) (1,10) and (1,40) (cpp) - (hpp)
sample code for using L1eff (cpp)
Bad_run list for post-shutdown data

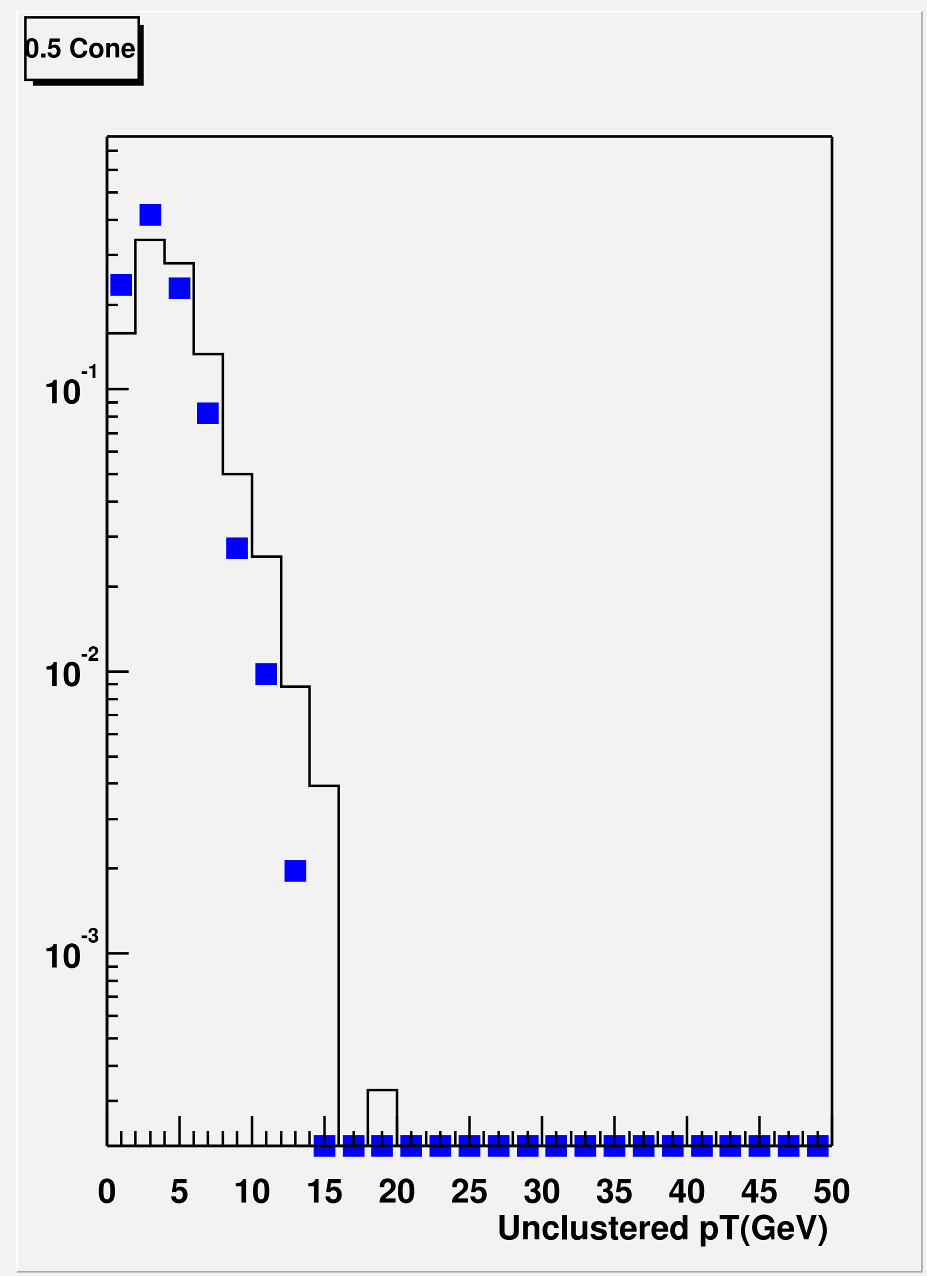
Jet ID

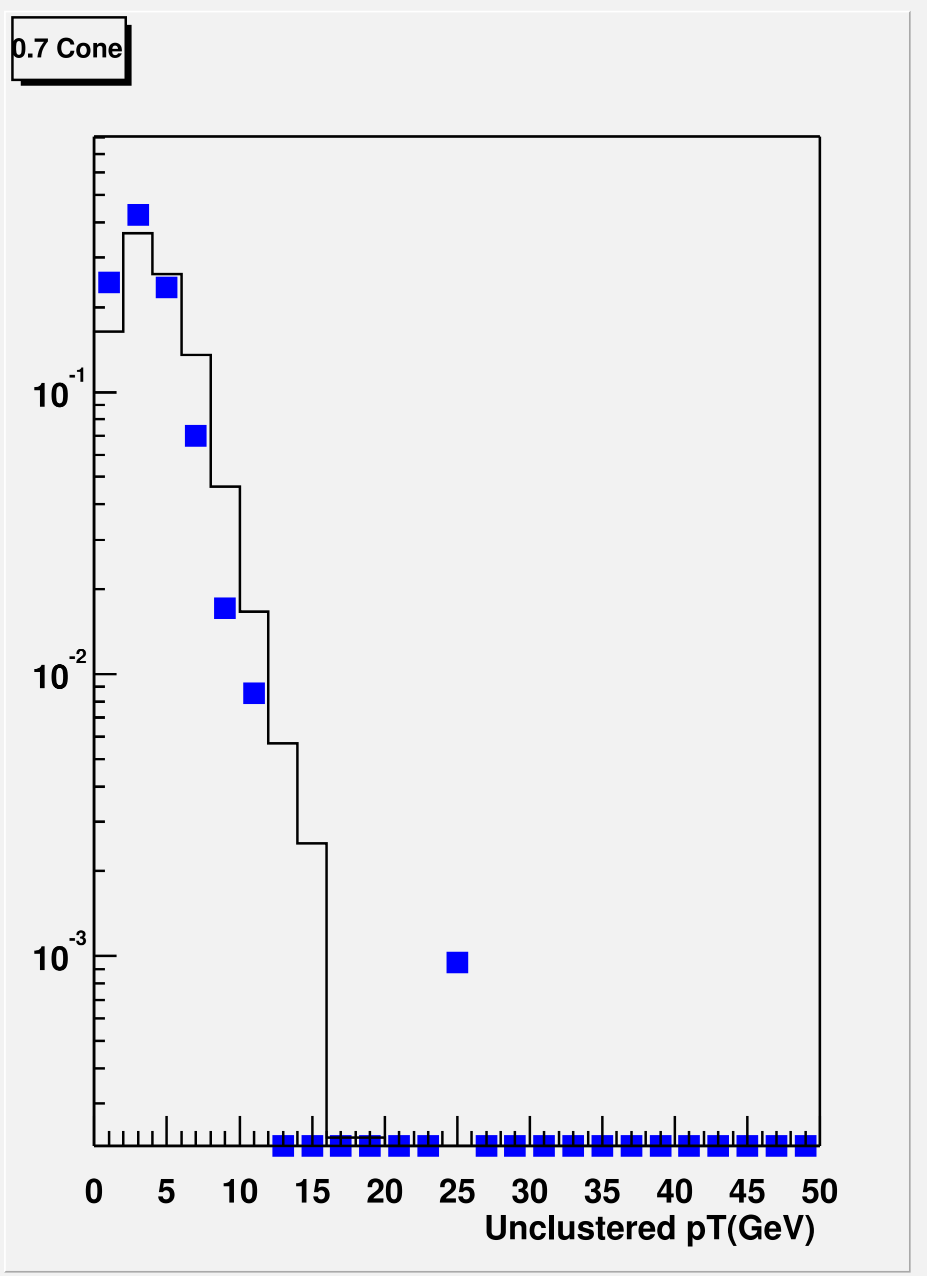
- jets in data and MC
- jet selection criteria (+ event selection criteria)
- L1 calibration
- L1 efficiencies
- reconstruction efficiencies

Data and MC comparisons



Data and MC, unclustered pT





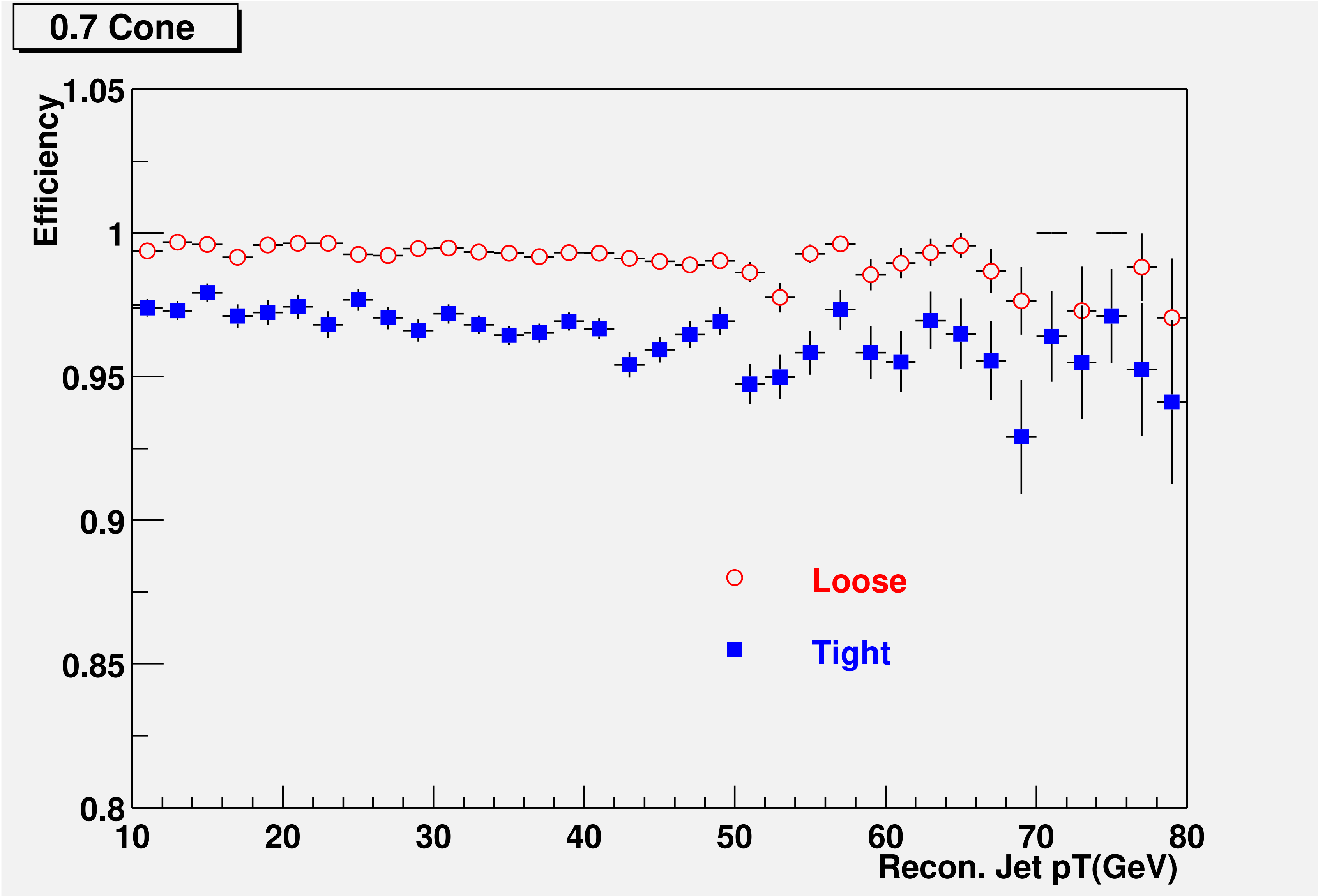
Jet Selection Criteria

- $0.05 < EMfraction < 0.95$
- $CHfraction < 0.4$ (0.25 for tighter definition)
- $Hotfraction < 10$ (5 for tighter definition)

$$HotF = \frac{E_T^{1st\ cell}}{E_T^{2nd\ cell}}$$

- $n90 > 1$
  - *number of towers (in descending order in E_T) that contains 90% E_T of the jet*

Efficienies of jet selection cuts



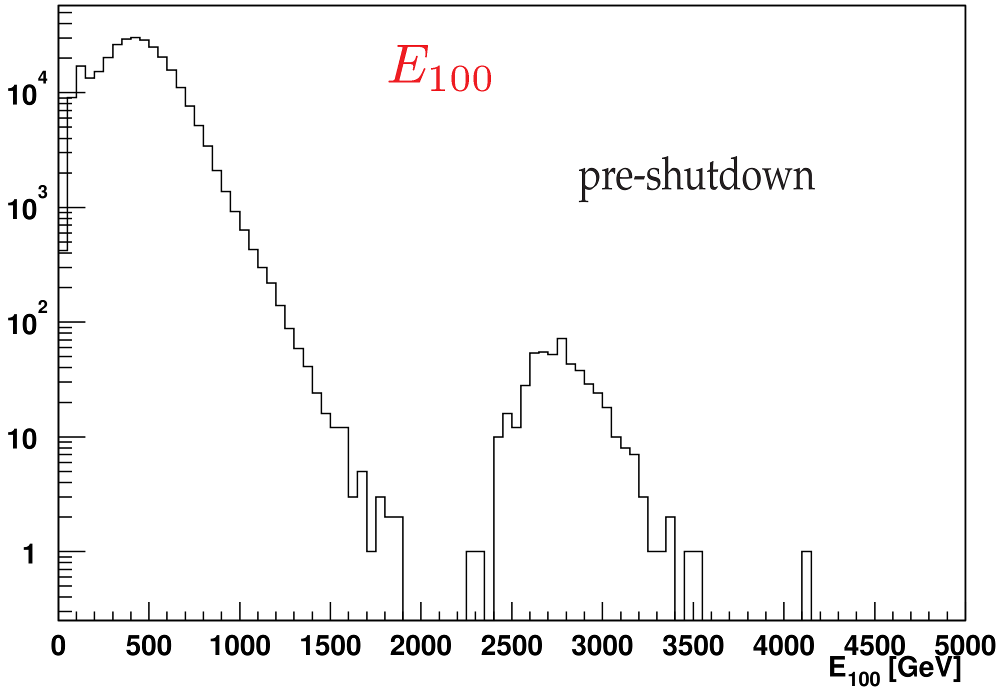
Event Selection Cuts

- E_{sum} of cells above 100 MeV

  $$E_{100} < 2TeV$$

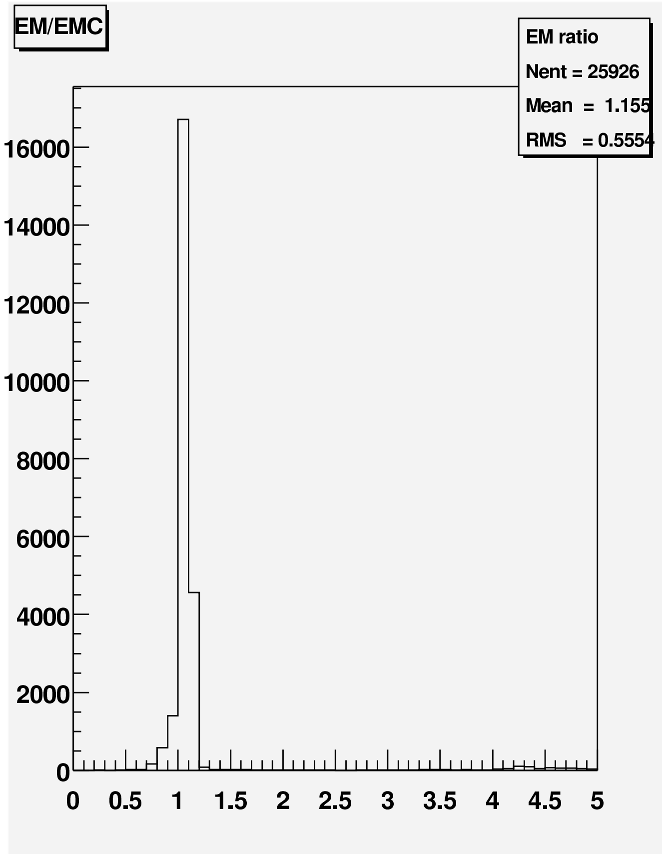
  - remove events when the whole calorimeter fired
- remove runs with hot regions
  - list of bad runs in the note
  - based on monitoring

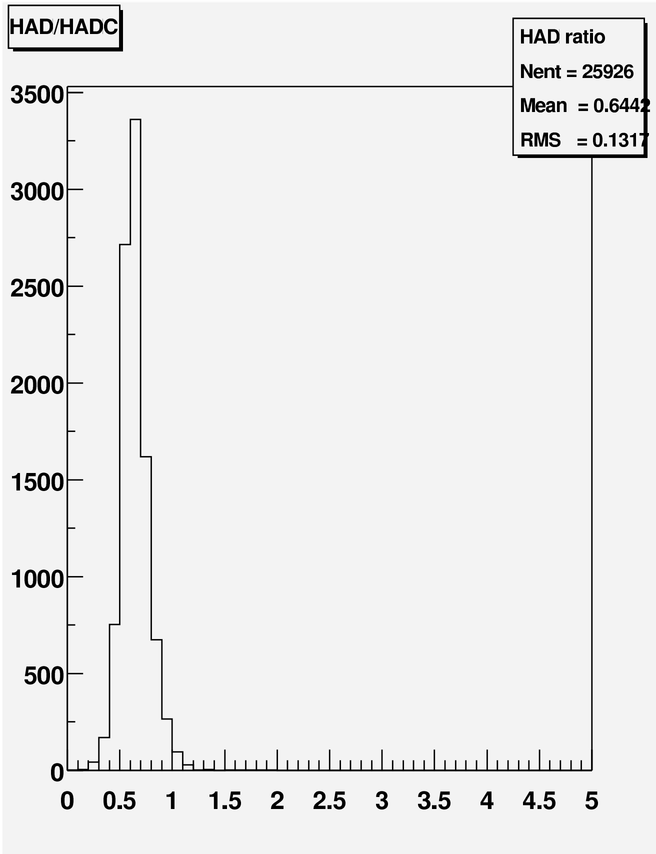
    MEx and MEy



L1 calibration

- comparison with precision readout
- EM responce is about OK
- hadronic response is about 0.6
  - not optimal values of summing resistors
  - hardware fix soon (CTFE boards that allow to change the gain)





L1 efficiencies, trigger v2

- three jet triggers (single tower)
  - `JT_LO` (5 GeV on L1, 10 GeV on L3)
  - `JT_HI` (10 GeV on L1, 15 GeV on L3)
  - `CJT40` (40 GeV on L1)
- L1 efficiencies - *function of uncorrected* p_T of the leading jet
  - *available in the note*

- `JT_LO` and `JT_HI`

  events from minium bias trigger

  $+$

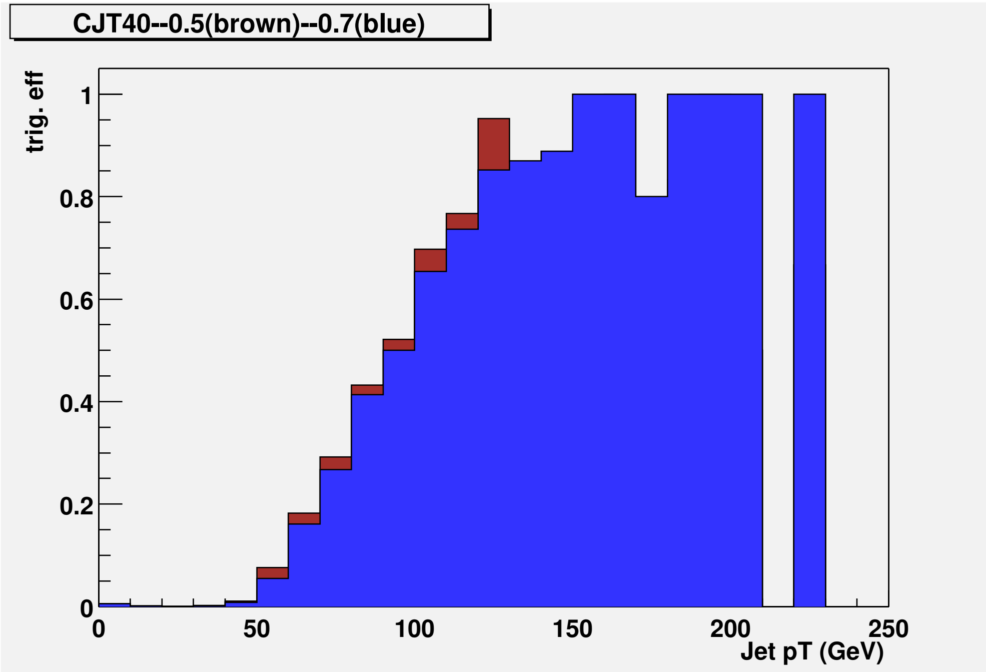
  appropriate L1AndOrTerm

- `CJT40`

  events from trigger `JT_HI`

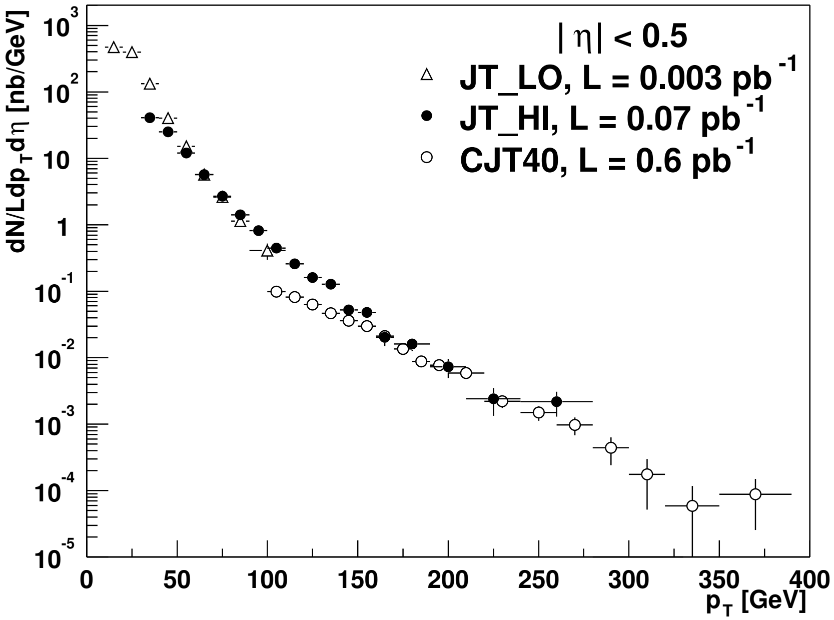
  $+$

  appropriate L1AndOrTerm

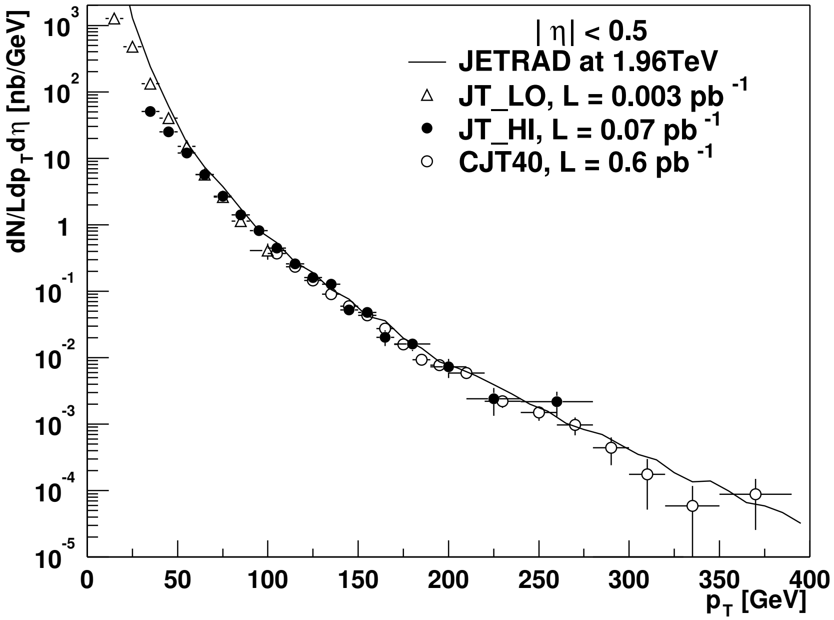


L1 eff. and jet inclusive spectrum

- pre-shutdown data
  - luminosity at L1



p_T spectrum for cone R=0.7 (JES correction)

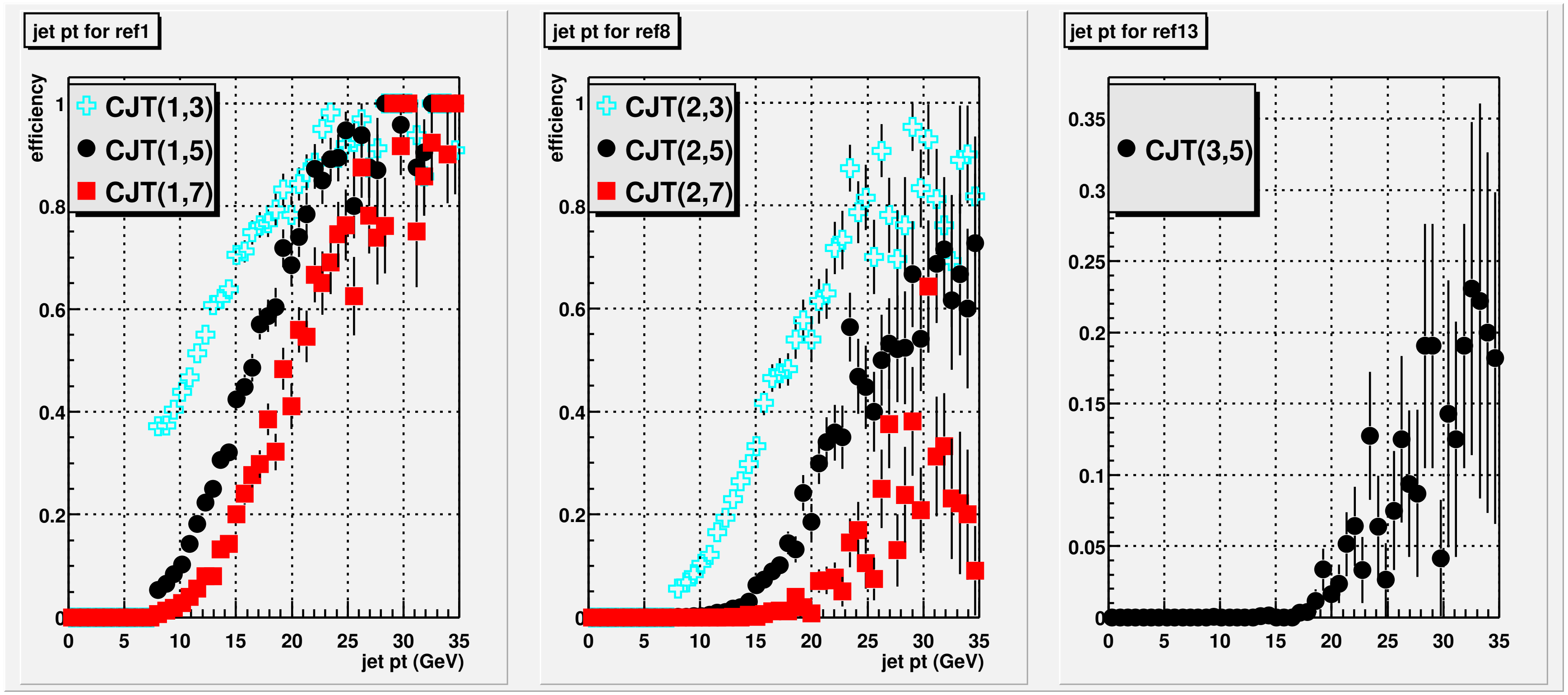


p_T spectrum for cone R=0.7 (JES + L1 eff.)

L1 efficiencies, trigger v3

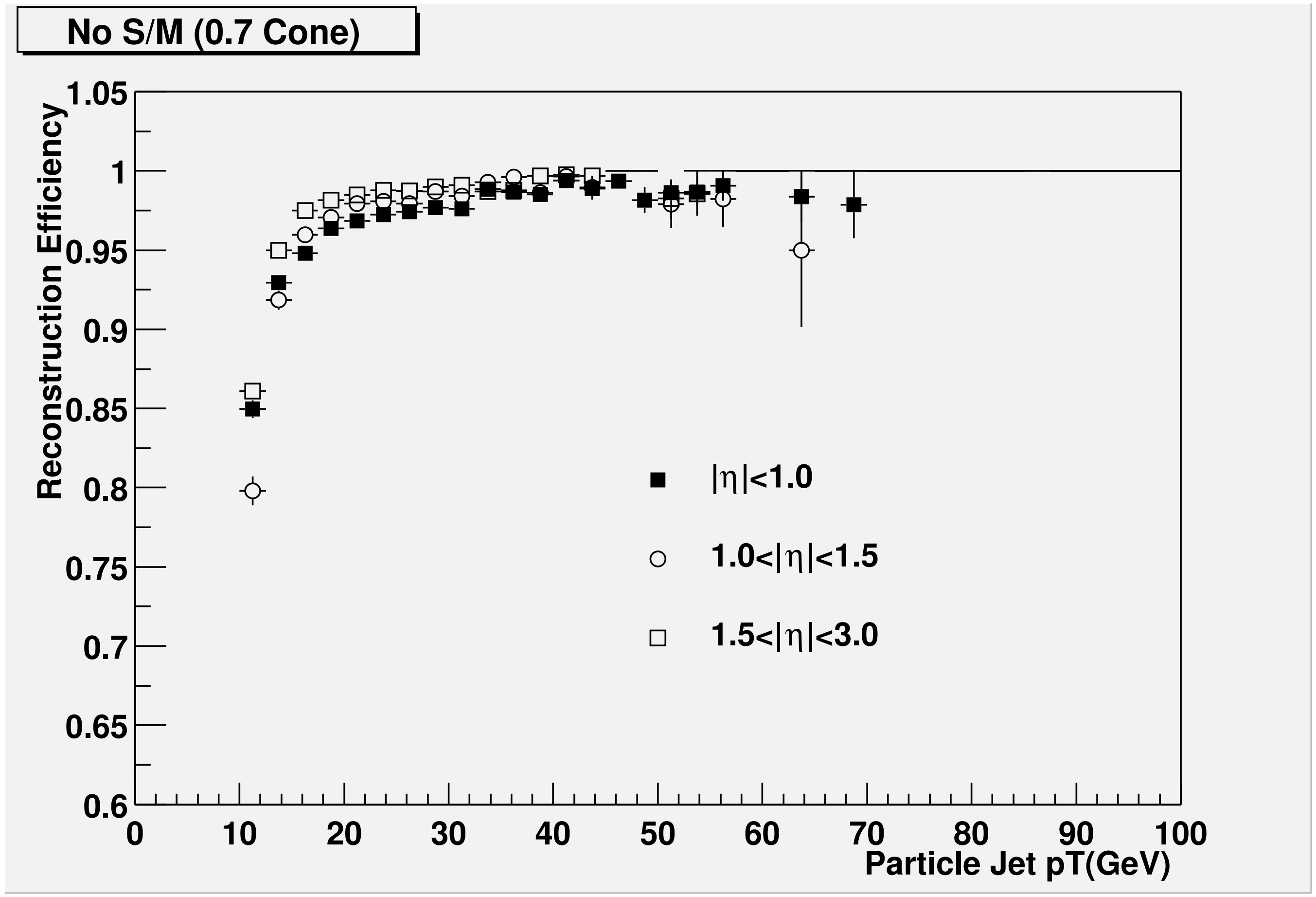
- multi-tower triggers
  - efficiency could be different when there is one jet in the triggered region or when there are two (or more) jets

L1 efficiency for cone 0.5 when there was one jet in the trigger region



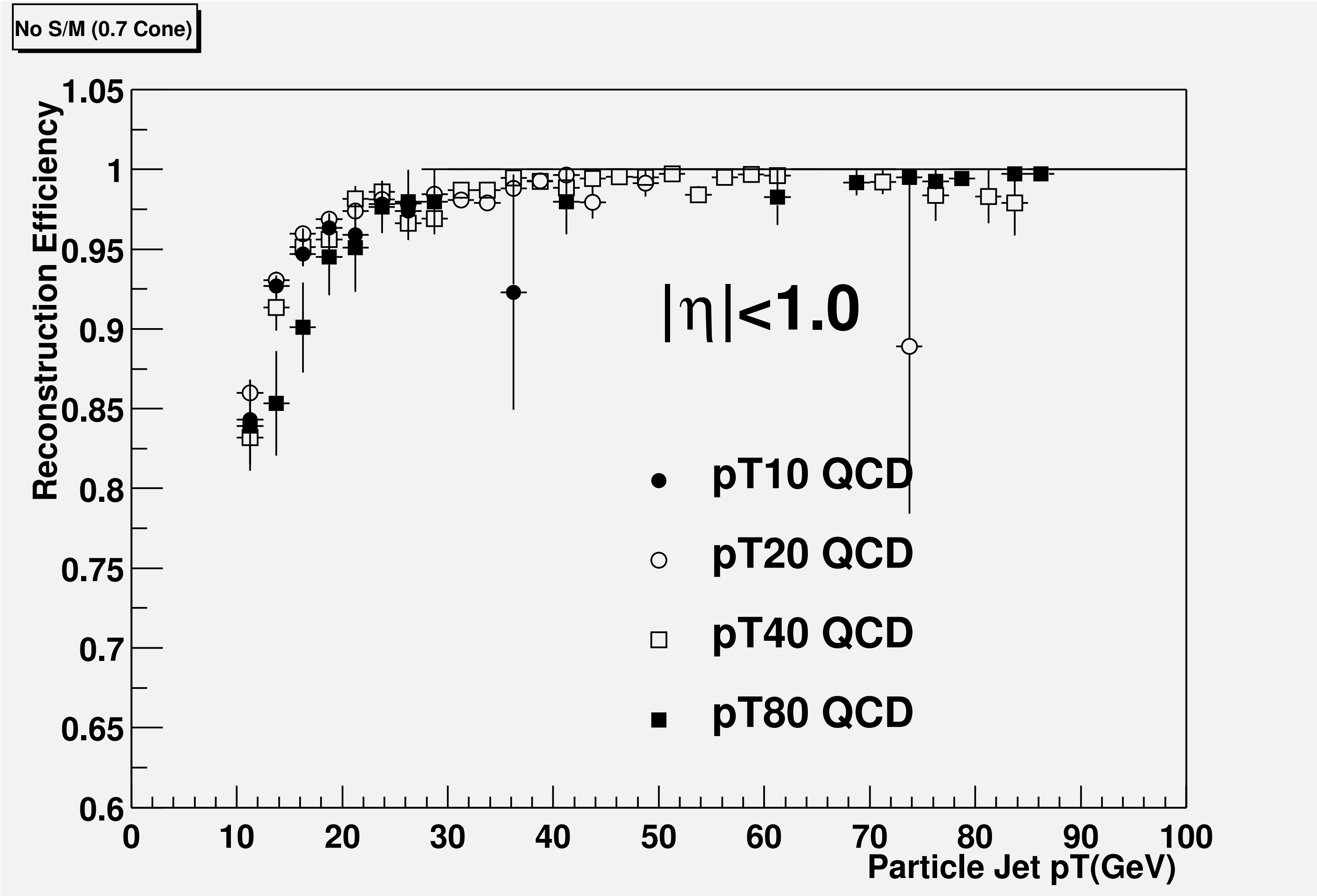
Reconstruction efficiencies

- calculated from MC (mixture, QCD sample with $p_T > 20\,\mathrm{GeV}$)
- ratio of matched calorimeter jets to particle jets
- spatial matching within $\Delta R < 0.3$
- different for splitted or merged jets



Reconstruction eff., sample dependence

- jet reconstruction efficiencies are sensitive to the trigger that was used to select the data sample
- MC studies for different p_T^{cut} (10, 20, 40, and 80 GeV)



MET ID

- ▷ hot cell removal
  - online
  - during the reconstruction (NADA)
- ▷ threshold settings for MET and SET measurements
- ▷ MET resolution
- ▷ MET in MC and data
- ▷ MET behaviour in post-shutdown data

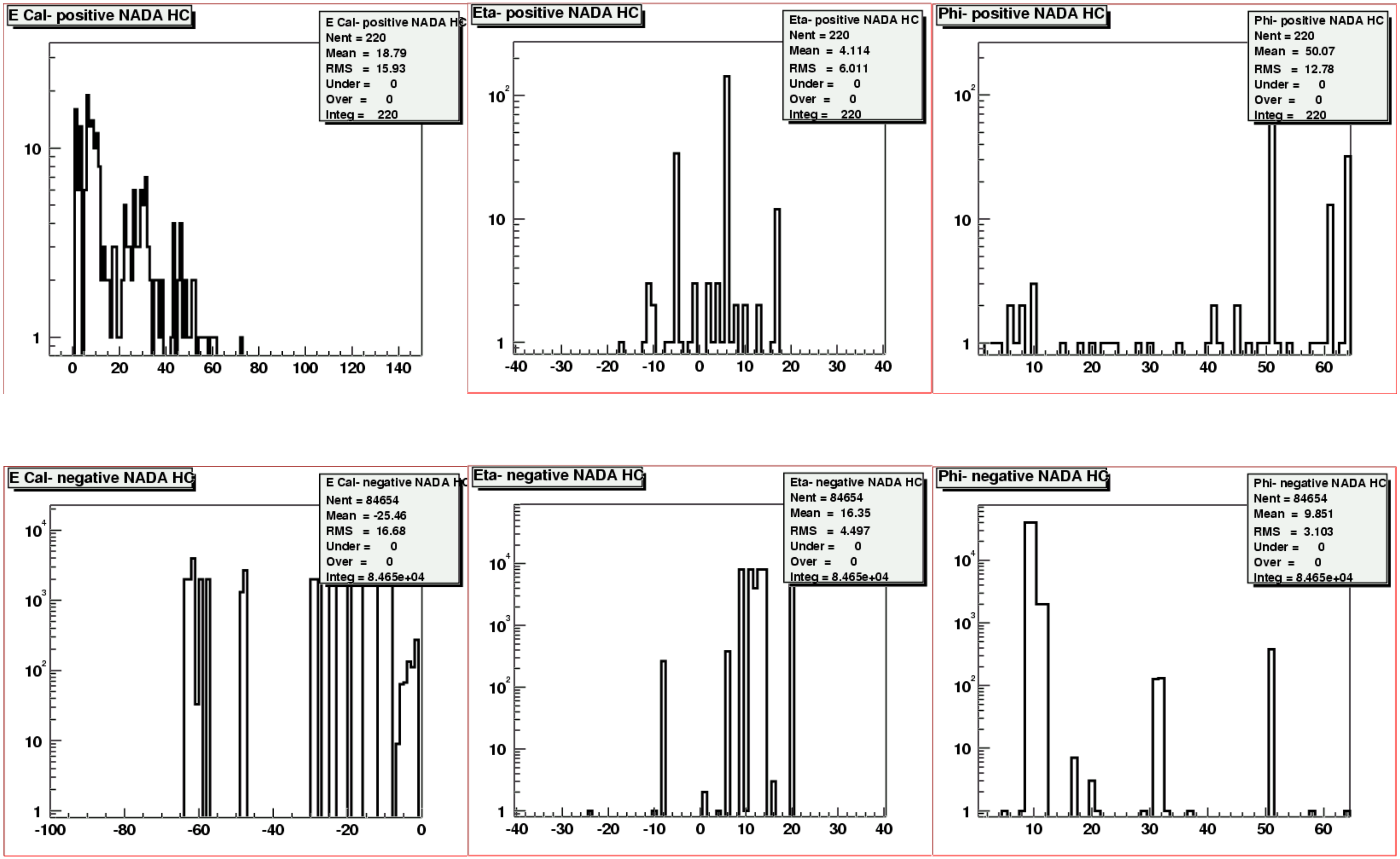
Hot cells and NADA

- online removal
  - between stores: pedestal calibration + special zero-bias run
  - list of found hot cells is removed from the calorimeter readout
- reconstruction level - NADA
  - `p10.11.00` - NADA running with static cut in killing mode (step 2)
  - starting from `p10.14.00` - new dynamic NADA in killing mode

Dynamic NADA

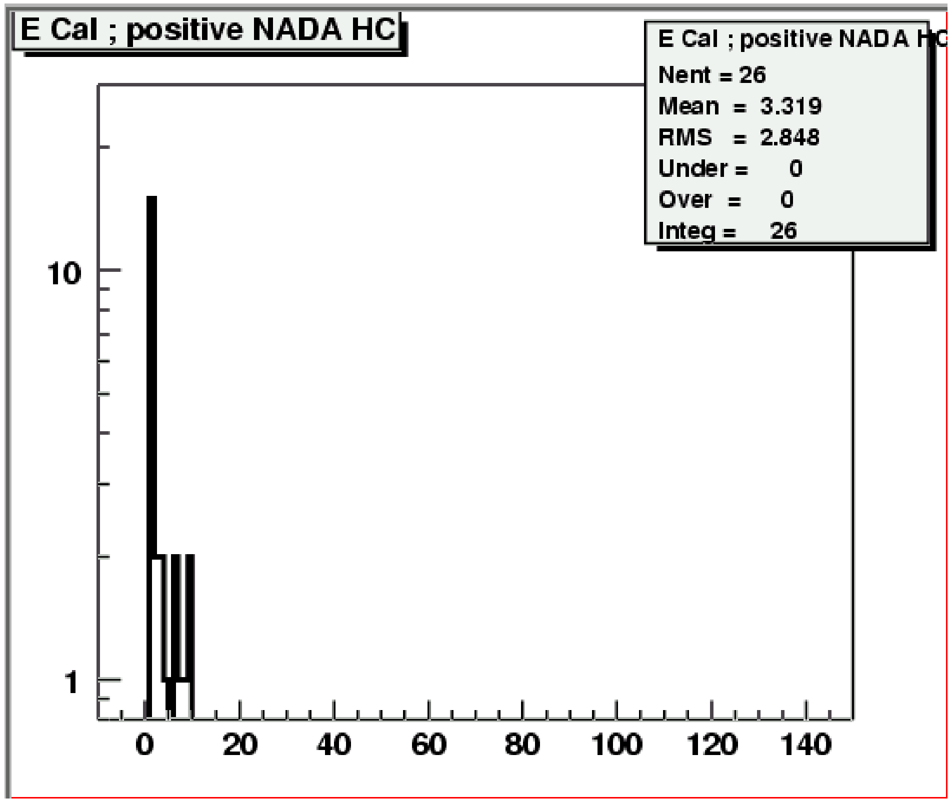
1) negative cell with $E_T < -1\,\mathrm{GeV}$ is always removed
2) positive cell with $1\,\mathrm{GeV} < E_T < 5\,\mathrm{GeV}$ is removed when
   - no 3D neighbour with $E_{cell} > 100\,\mathrm{MeV}$ (static cut)
   - not for cells in the edge layers of $\mathrm{EM}(1,7)$, $\mathrm{HAD}(11,15)$, or $\mathrm{ICD}(8,9,10)$
3) positive cell with $5\,\mathrm{GeV} < E_T < 500\,\mathrm{GeV}$ is removed when
   - no 3D neighbour with $E_{cell} > 0.02 E_T^{cand}$
4) positive cell with $E_T > 500\,\mathrm{GeV}$ is always removed

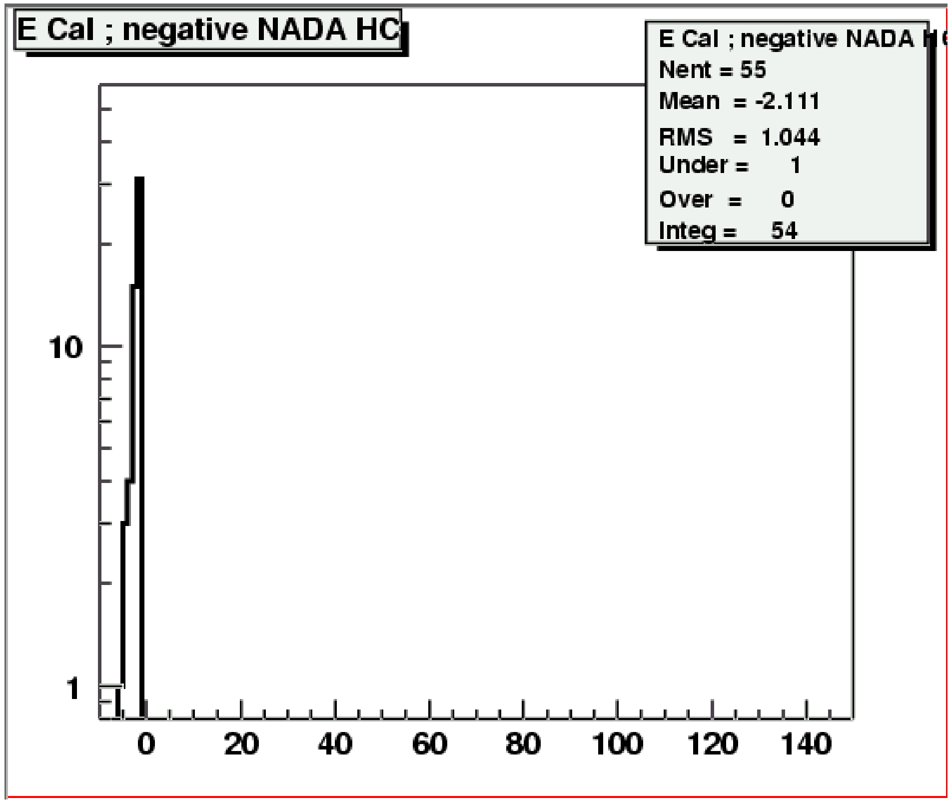
NADA hot cells in Run 142844



NADA misidentification

- determined from MC sample (PtGt 10 GeV) + minimum bias (0.5 per event)
- rate about 0.5% of the cells with $E_T > 1\,\mathrm{GeV}$
- total rate about 0.8 cell per event
- in agreement with the value observed in clean runs (about 1 cell per event)





MET and SET

- *computed as a vector (for MET) or scalar (for SET)* E_T *of cells or towers*
- *energy threshold dependence is different between towers and cells*

Presently

- *towers are used*
- MET, SET *- no threshold applied on towers*
- METNE, SETNE *- calculated only from towers above* 200 MeV *(recommended)*

Future

- *both, cell and tower definitions will be available in root-tuples*
- *threshold at* 100 MeV *(tunable)*
- *information available for sub-detectors*
  - EM, *hadronic*, ICD, *and muon*

threshold and NADA effect on MET

MET

$$mean = 484\,\mathrm{GeV}$$
$$RMS = 31\,\mathrm{GeV}$$

METNE

$$mean = 7.8\,\mathrm{GeV}$$
$$RMS = 8.1\,\mathrm{GeV}$$

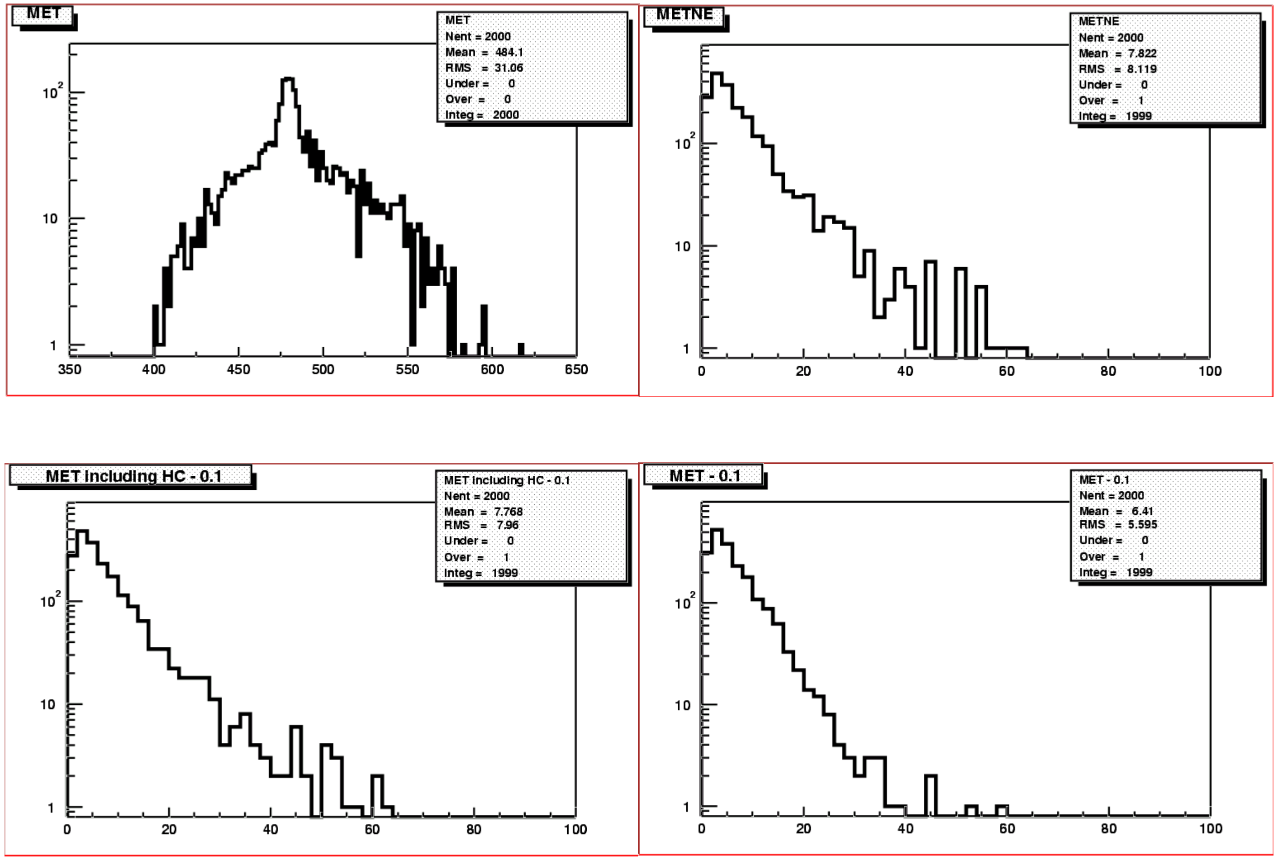
Cells above 100 MeV

$$mean = 7.8\,\mathrm{GeV}$$
$$RMS = 8.0\,\mathrm{GeV}$$

$E > 100$ MeV + NADA

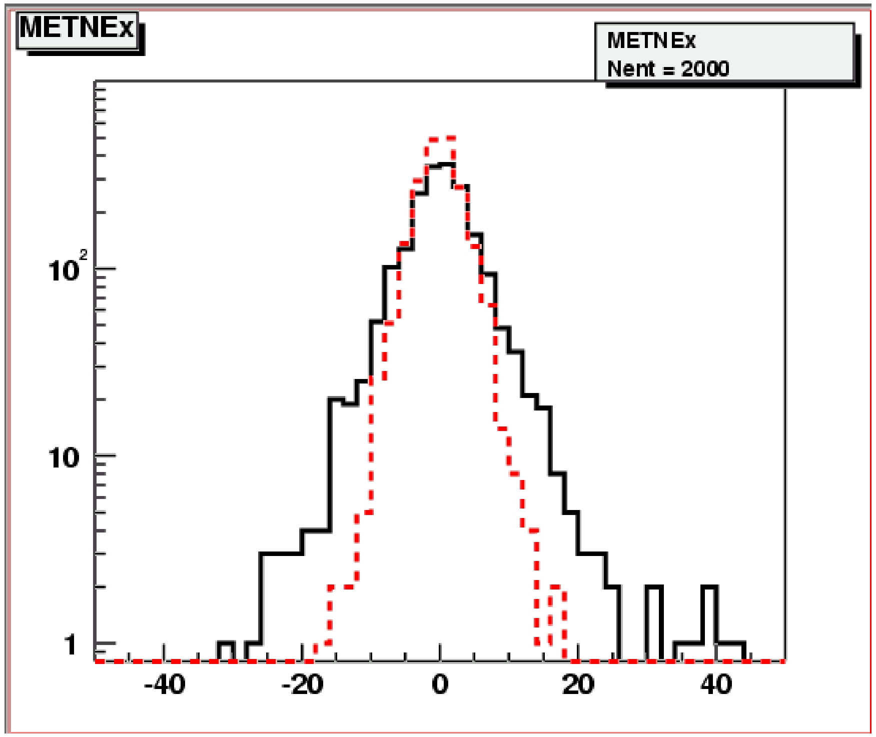
$$mean = 6.4\,\mathrm{GeV}$$
$$RMS = 5.6\,\mathrm{GeV}$$

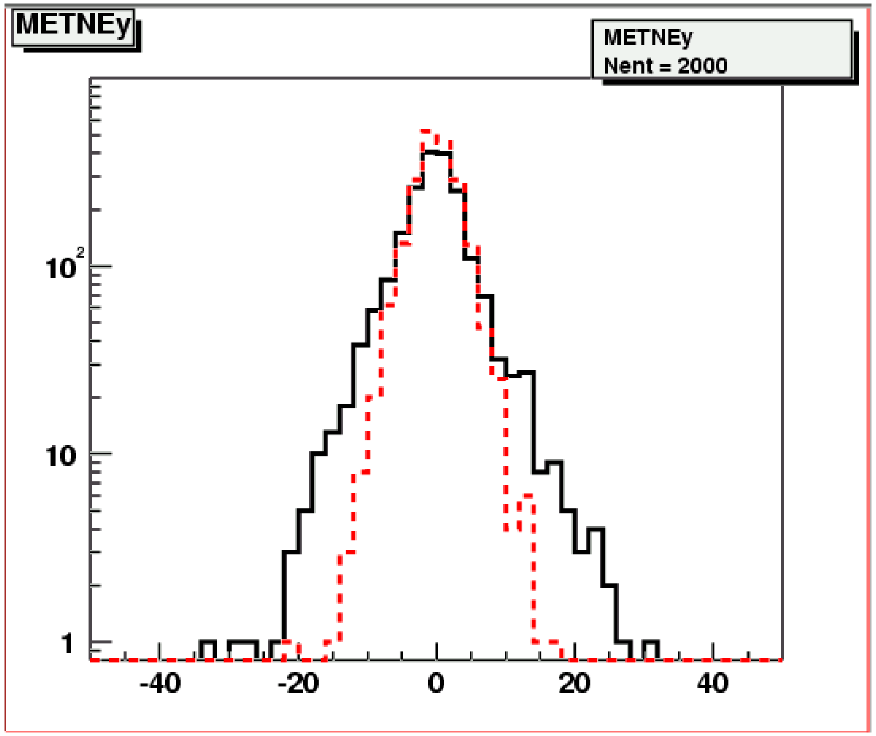
Run 142844



MET in MC and data

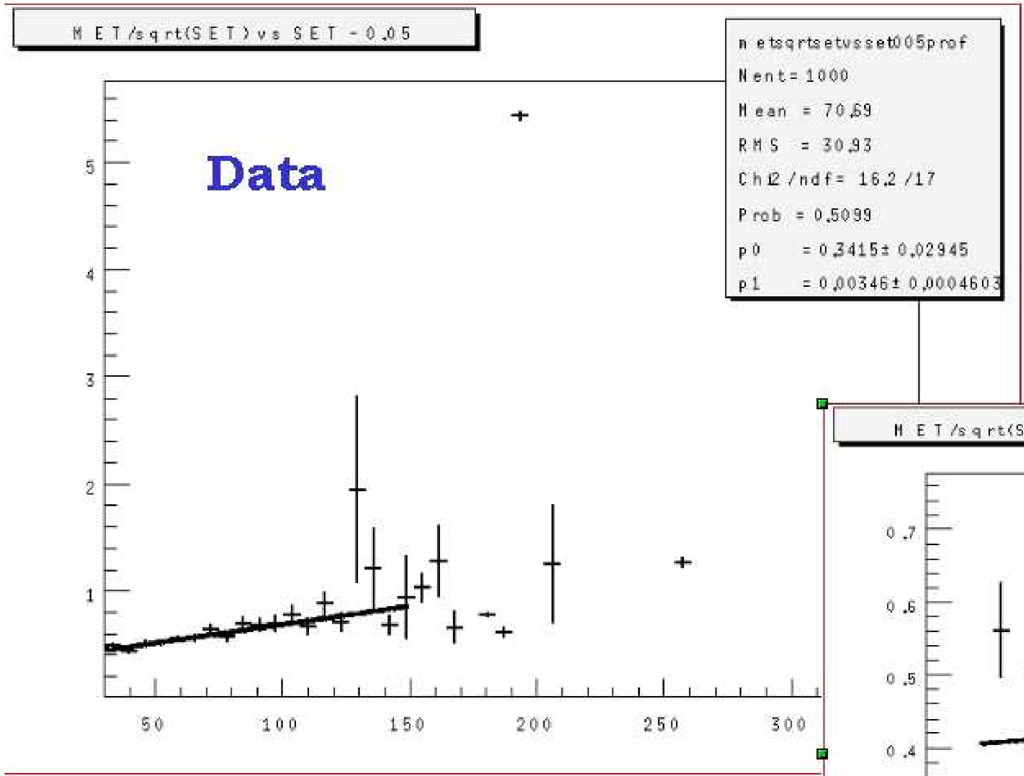
- plate MC (mcp10) - QCD sample ($p_T > 10\,\mathrm{GeV}$) + 0.5 minimum bias
- data -quiet run 142815

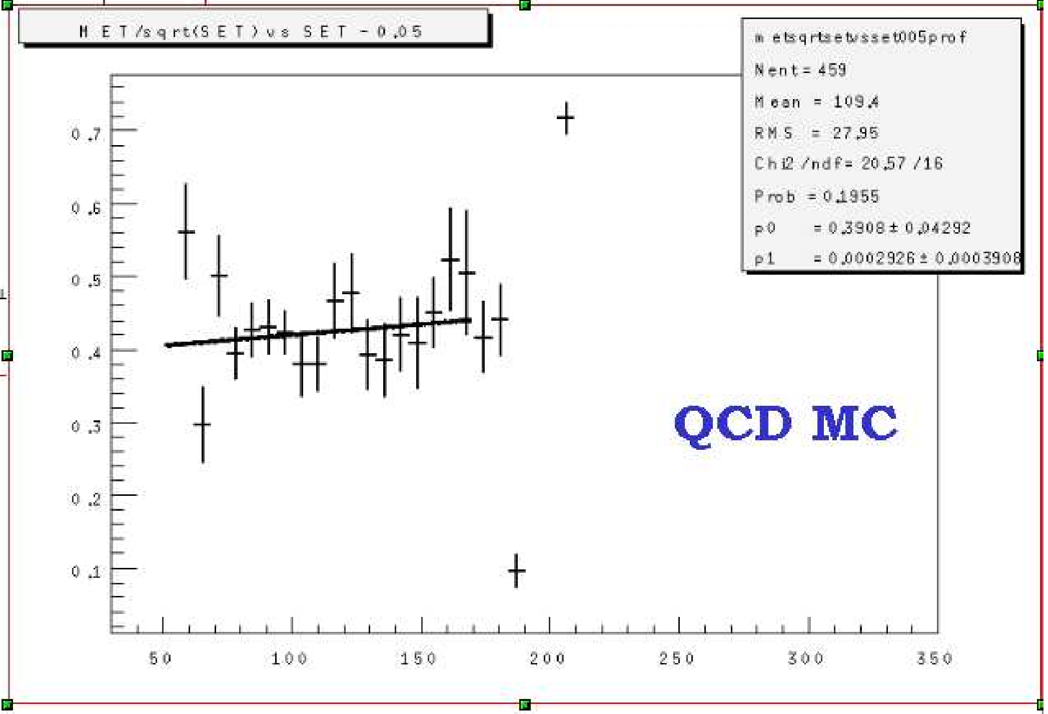




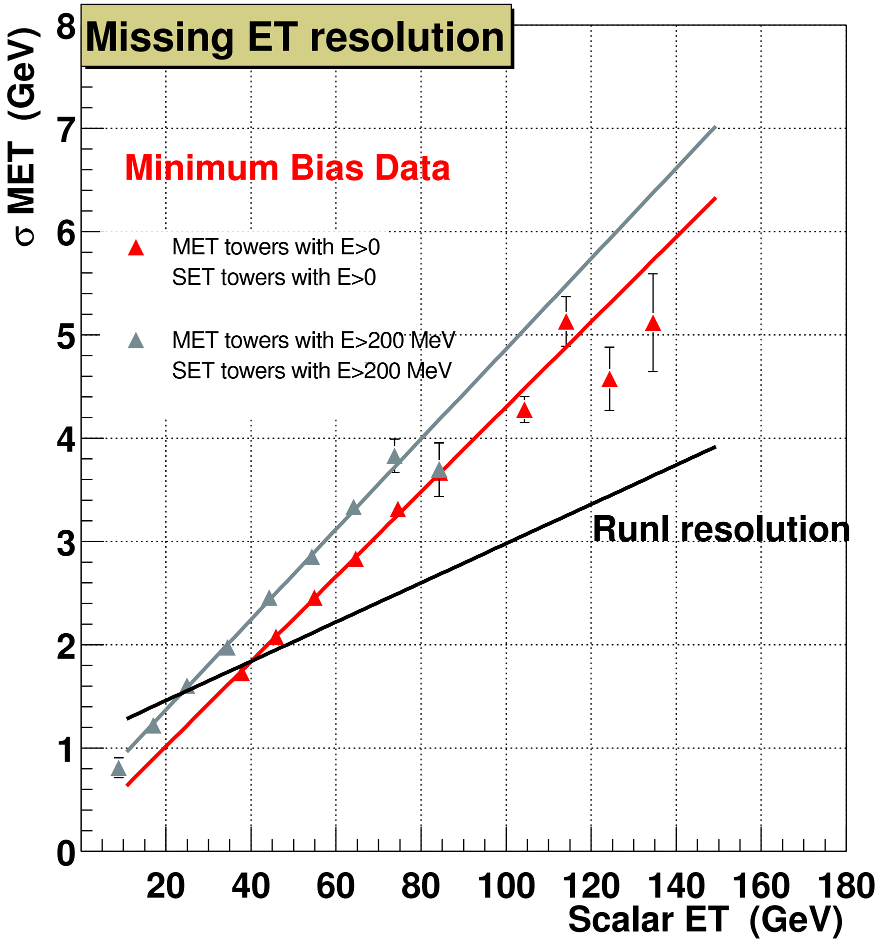
- different width for METNEx (and METNEy)

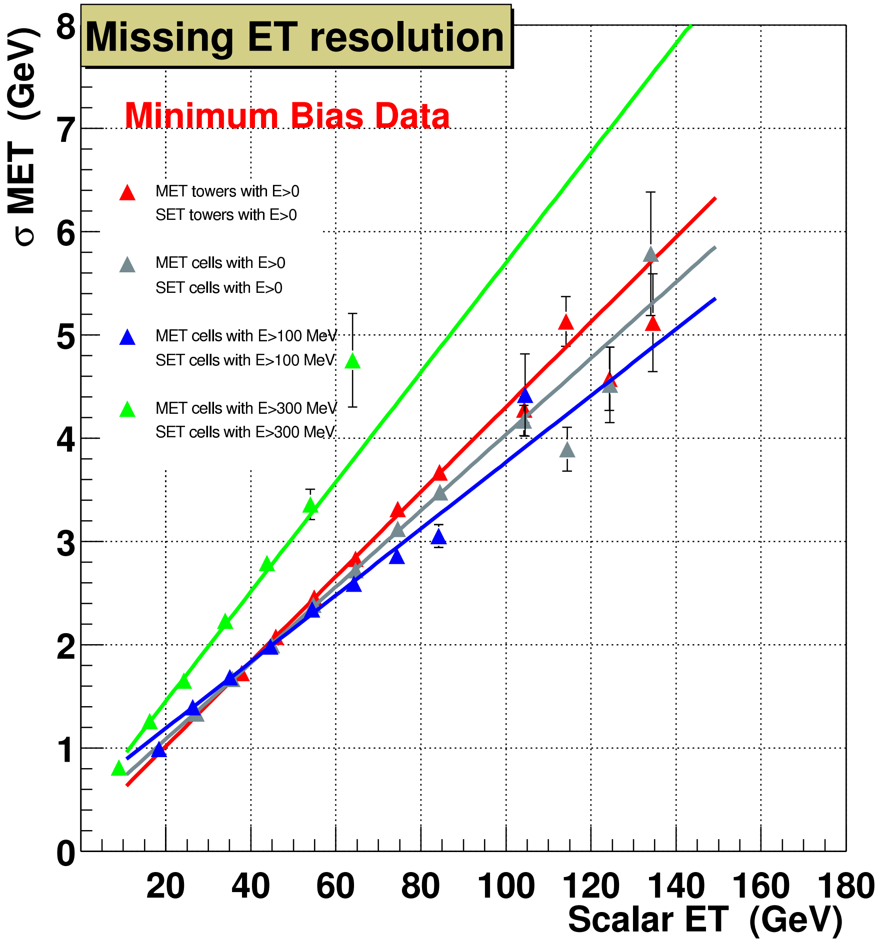
MET / $\sqrt{\text{SET}}$ vs SET





MET resolutions

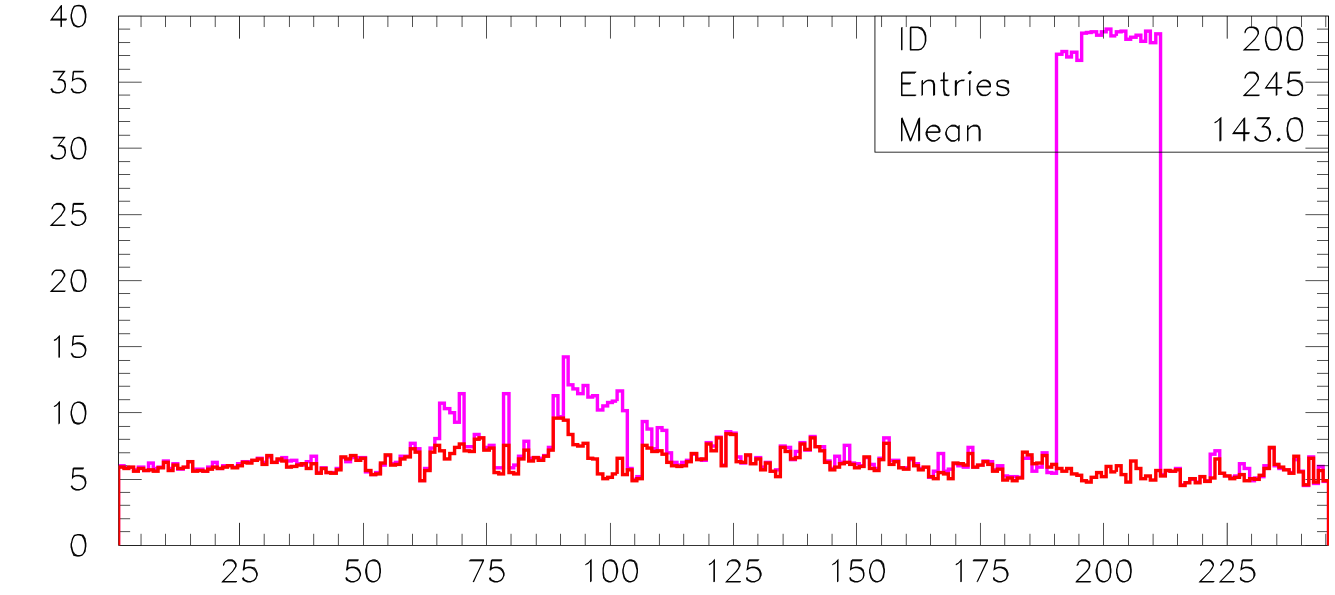




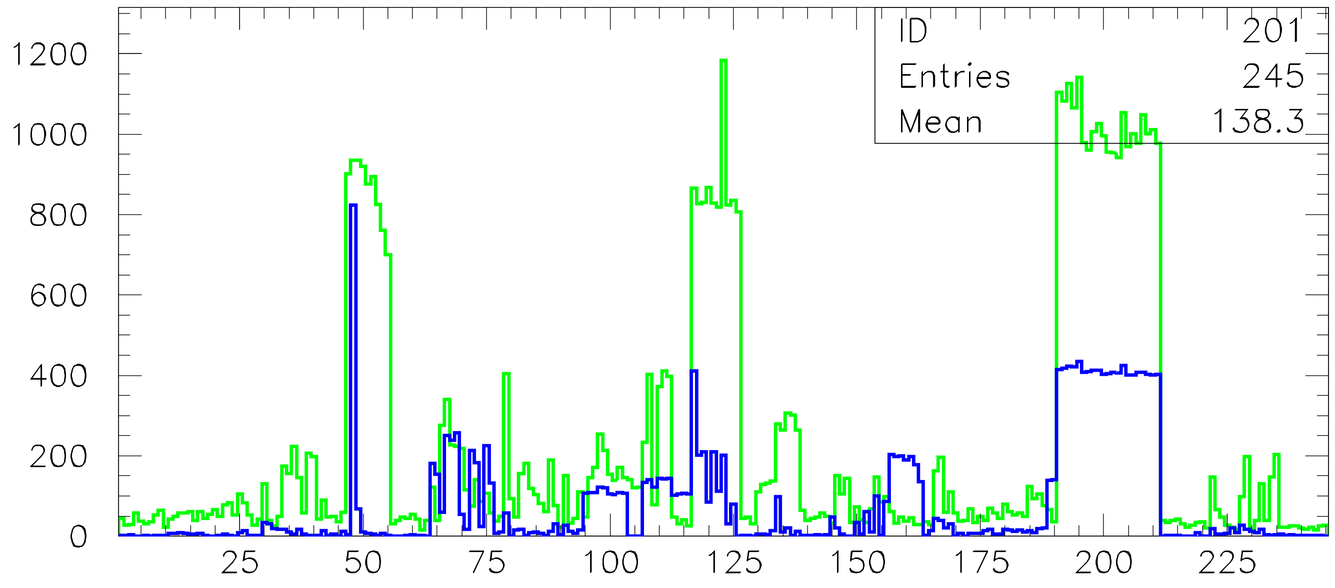
- ▷ threshold on cells
  - provides better control on MET (different parts of the detector could be studied)

MET behaviour

in post-shutdown data

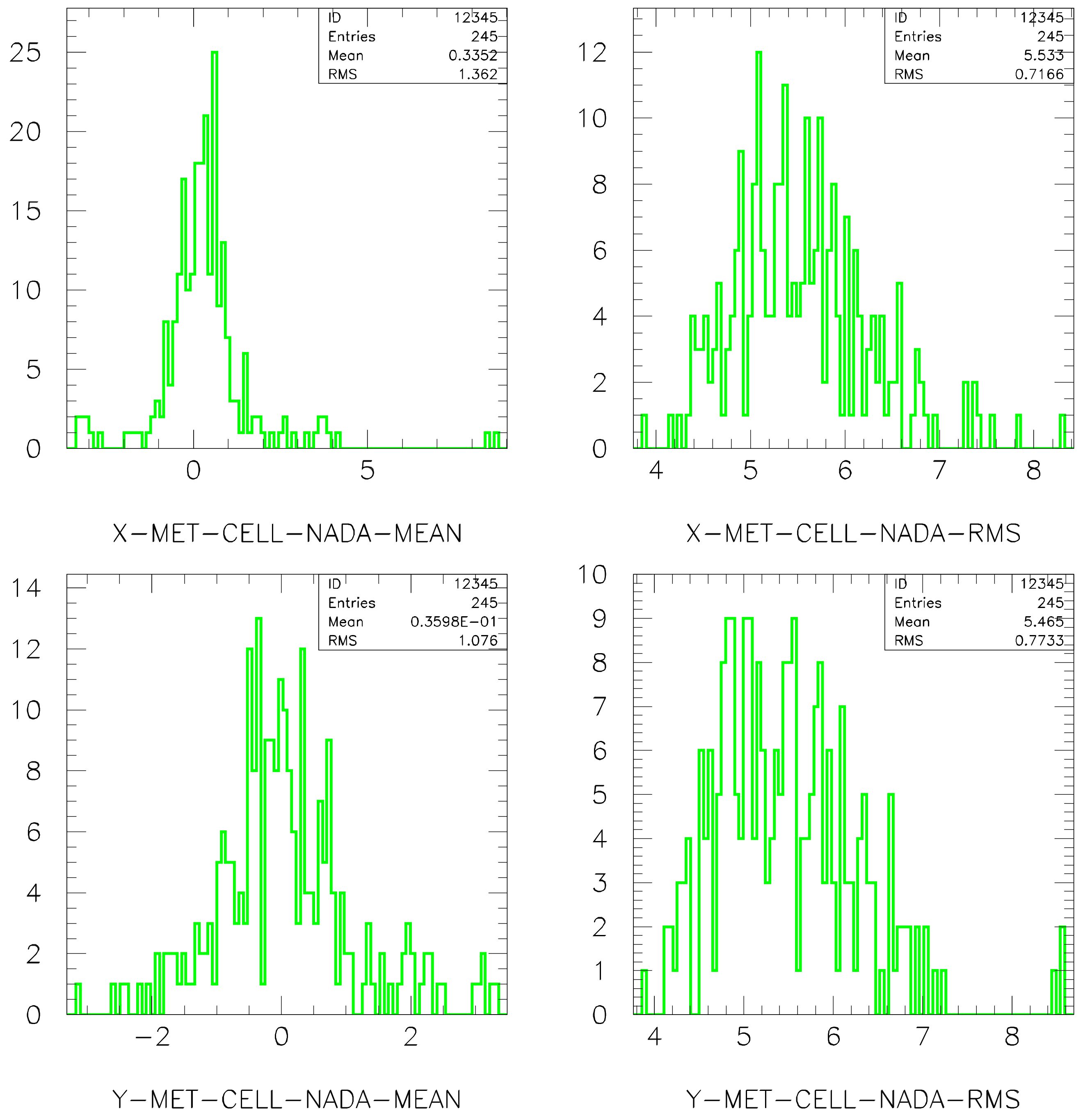


METNE−p10.11 (purple) vs METNE−p10.14 + hot spot correction (red)



Positive (green) and Negative (blue) NADA Hot Cells (1000 events per Run)

MET behaviour II



MET summary

- ▷ MET and SET shows correct behaviour in the most of the post-shutdown data after
  - hot cell removal
  - application of 100 MeV or 200 MeV threshold on towers
- ▷ some very noisy runs still remains (due to large hot zone)
  - must be treated separately (macro that removes the hot zones and recalculate MET) or removed from analysis

Moriond recommendation

- use variables calculated with 200 MeV threshold on towers (SETNE, METNE, METNEx, METNEy)
- use the data reprocessed with `p10.14.00` d0reco
- remove bad runs listed on Jet/MET ID page

JET summary

- certification v1.0 was done
  - jet selection criteria
  - L1 trigger efficiencies
  - jet reconstruction efficiencies

Jet/MEt ID