Underlying Event Generator Study
(based on Niladri's analysis)

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SMIX meeting
14. March 2008

- Particle Multiplicities and Particle energy flow study

- Jet area issues

Generated Samples

- Niladri's analysis ported from pythia 6.4.08 to pythia 6.4.14 (bug fixes in MI sector made)

- Minimum Bias Study: MI switched off
                                            MI tune A

- Top production Study: MI switched off
                                            MI tune A

Questions, Questions, Questions

this analysis:

- trigger in Castor region required

  $0 < \sum E_{PART} < 100$ GeV

  $100 < \sum E_{PART} < 300$ GeV

  $300 < \sum E_{PART} < 1000$ GeV

  $\sum E_{PART} < 1000$ GeV

- particle multiplicities and energy flow studied as function of η

Niladri's analysis:

- trigger in Castor region required

  $0 < \sum E_{PART} < 100$ GeV

  $100 < \sum E_{PART} < 300$ GeV

  $300 < \sum E_{PART} < 1000$ GeV

  (sum over charged particles only)

- **charged** particle multiplicities and energy flow studied as function of η

- qualitatively similar results obtained in as in older pythia version

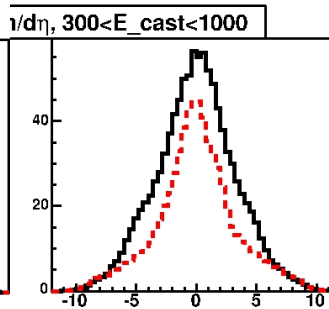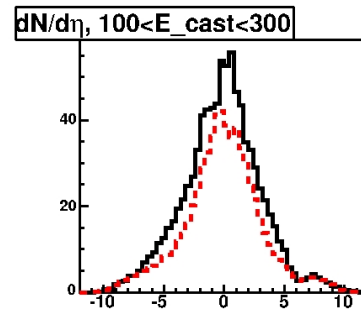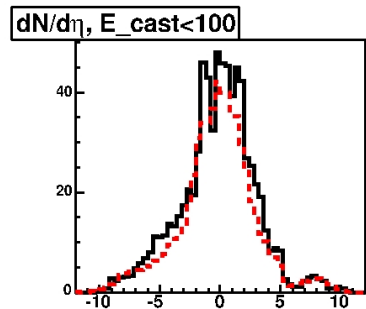# Multiplicities (no E_part cuts)

Min Bias:

— Tune A
--- no MI

top:
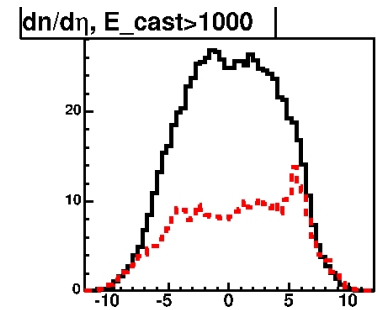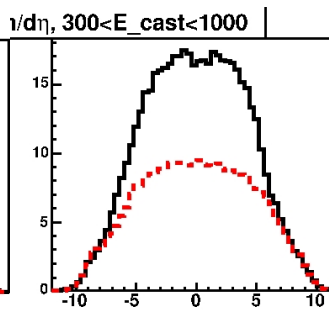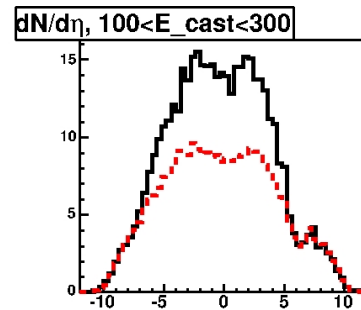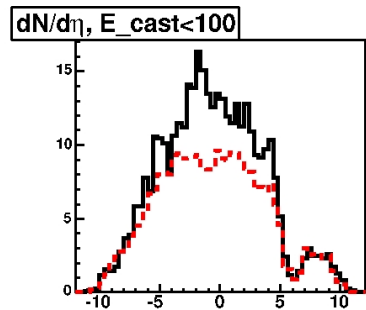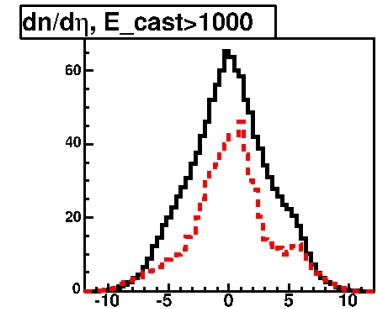
— Tune A
--- no MI

MI - noMI:

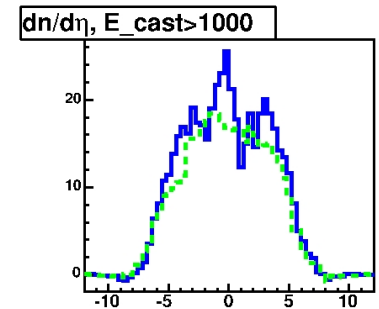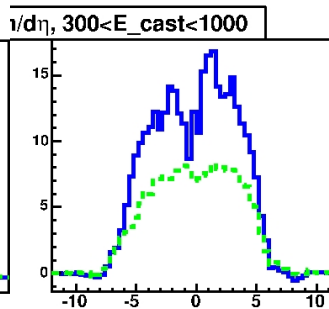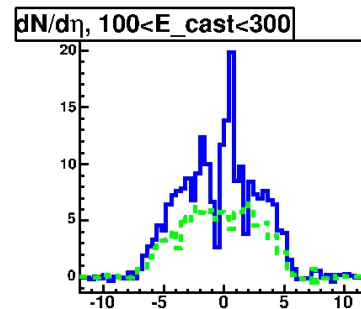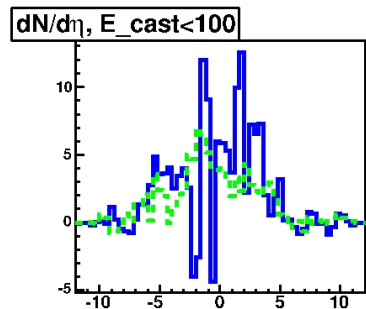| --- min bias MI-noMI |
| --- |
| — top MI-noMI |

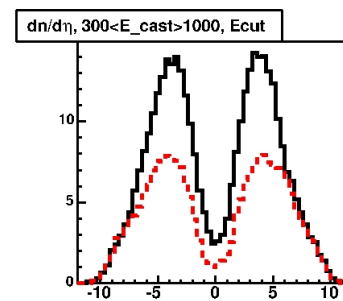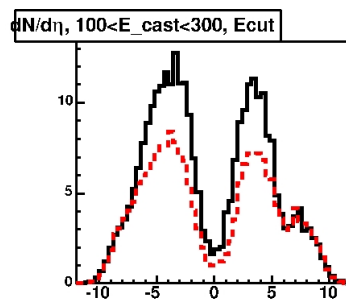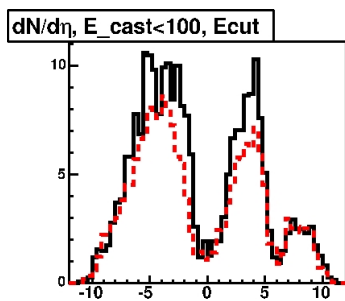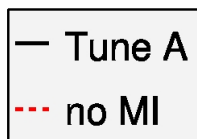# Multiplicities (E_part> 1 GeV)

Min Bias:

— Tune A
--- no MI

top:

— Tune A
--- no MI

MI - noMI:
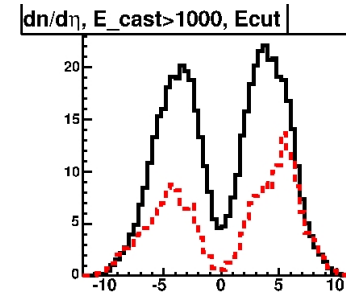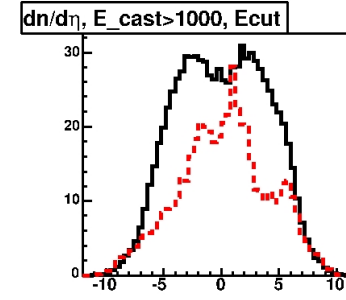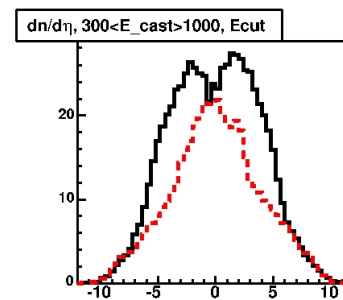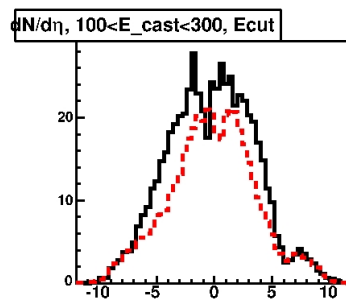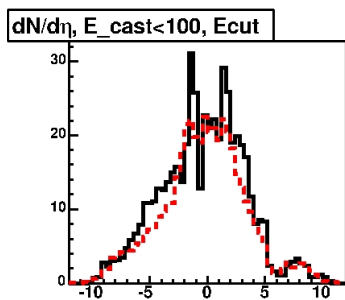
--- min bias MI-noMI
— top MI-noMI
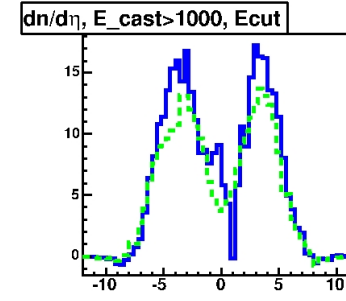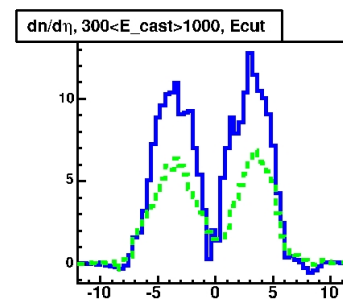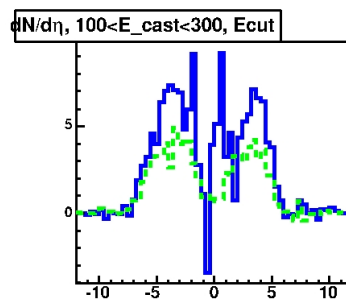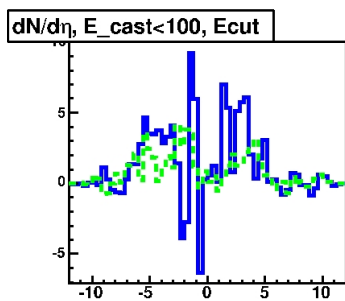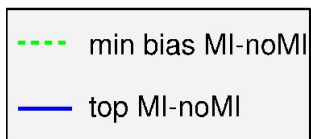
Energy Flow (no E_part cut)

Min Bias:

— Tune A
-- no MI

top:

— Tune A
-- no MI

MI - noMI:
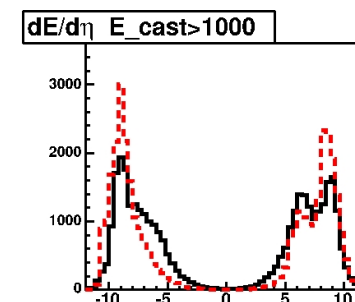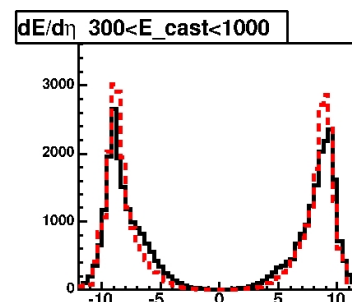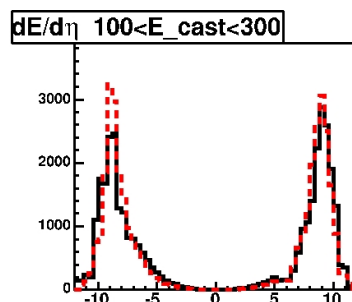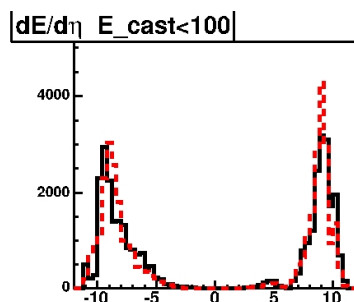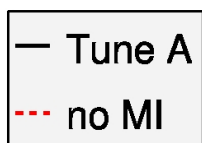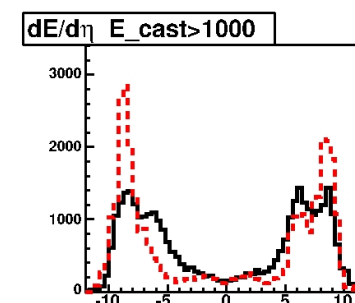
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—— top MI-noMI
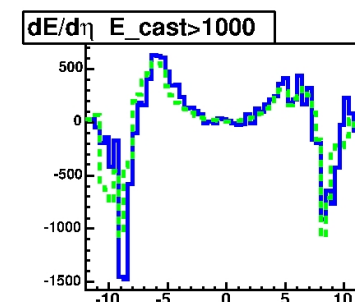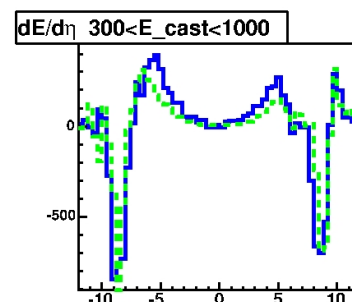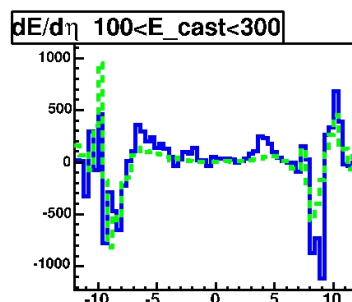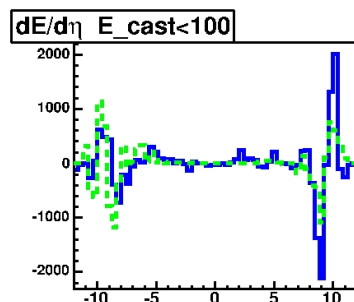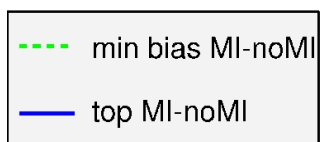
Energy Flow (E_part > 1 GeV)

Min Bias:

| — Tune A |
| ---- no MI |

top:

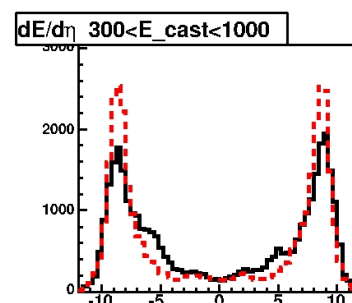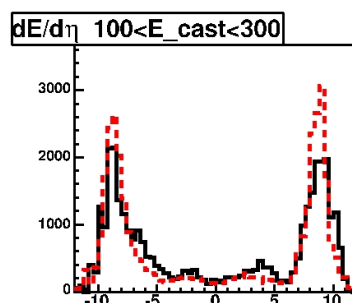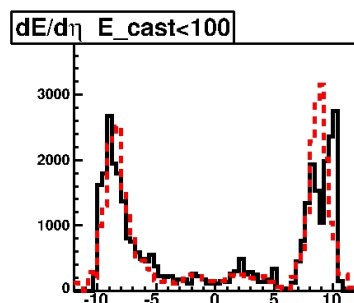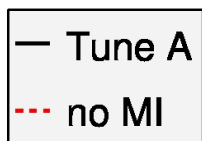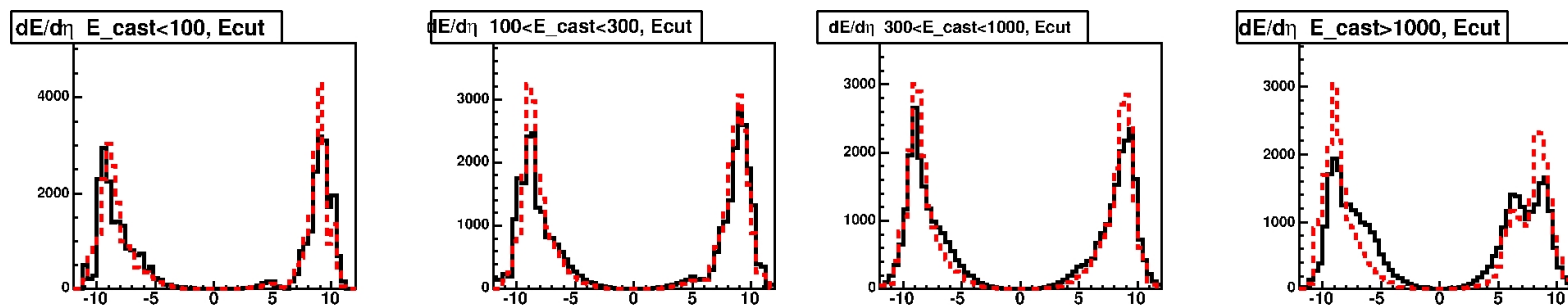| — Tune A |
| ---- no MI |
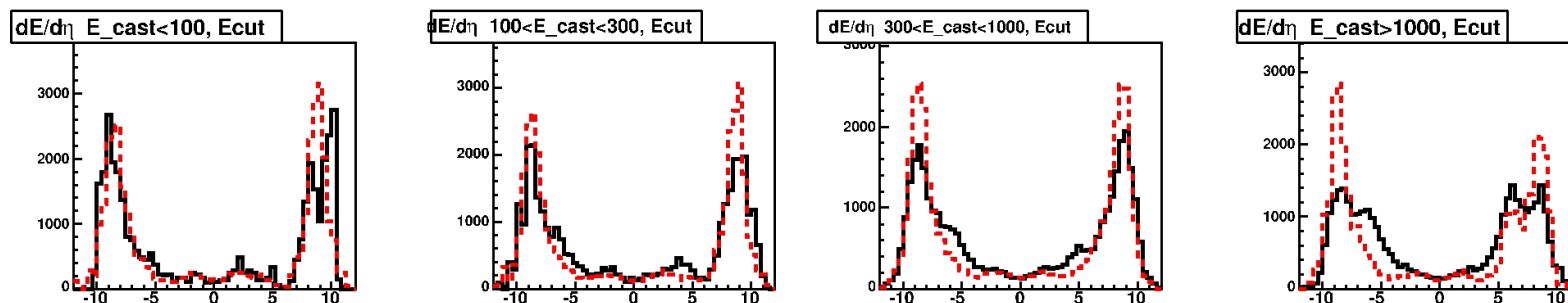
MI - noMI:

| ---- min bias MI-noMI |
| — top MI-noMI |
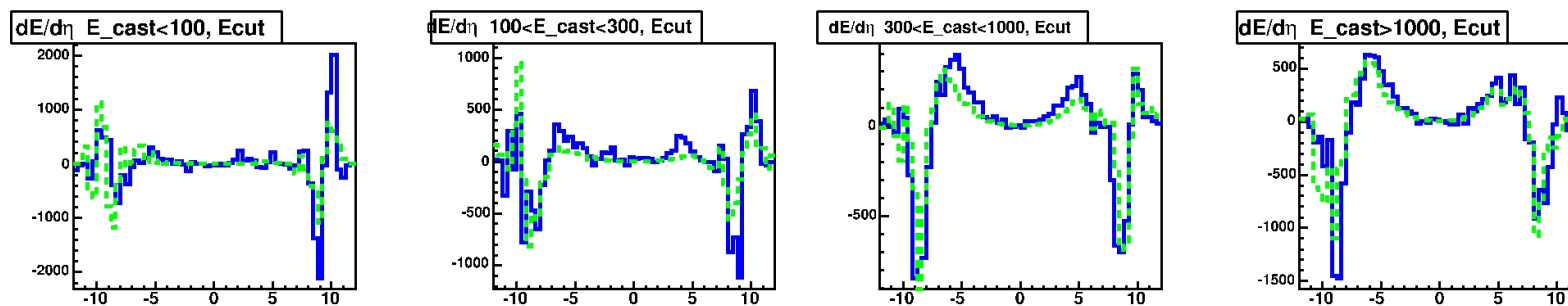
Active Jet Area Issues

▶ **article from Cacciari** arXiv:0706.2728:v1 [phep-ph] 19 Jun 2007

▶ hard jet: hard jet energy + background from UE which is proportional to the jet area (A)
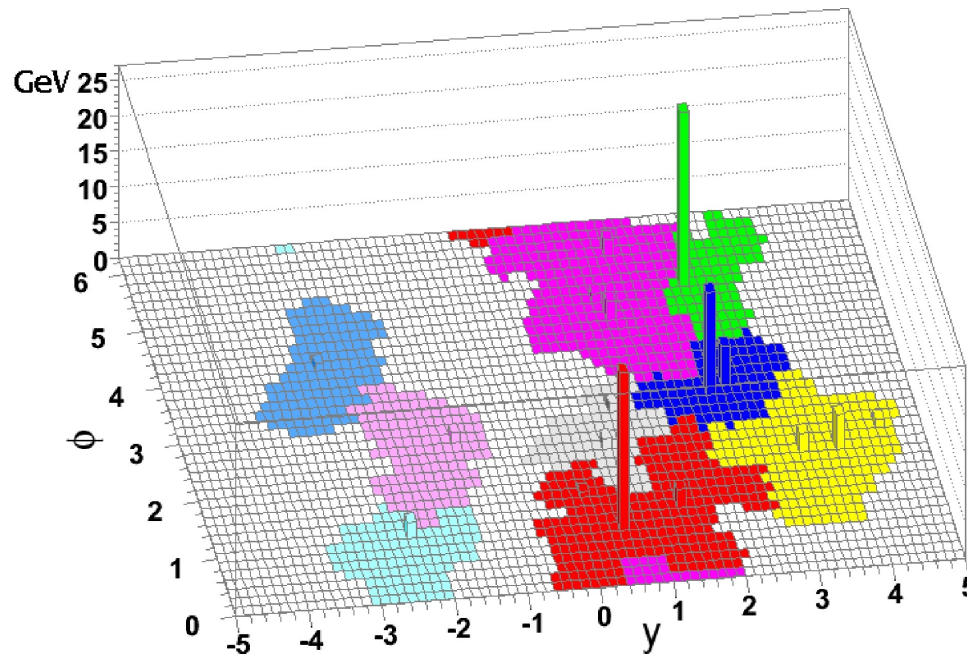
hard Jets <--> UE jets

Figure 1: a) Active area distributions for the k_t algorithm[3]. Cambridge/Aachen[4] has a very similar behaviour. b) Average area of jet containing a hard particle as a function of the ratio of its momentum to that of the soft background jets.

Noise Level Determination

$$Et_{REAL} = Et_{MEASURED} - \rho.A$$

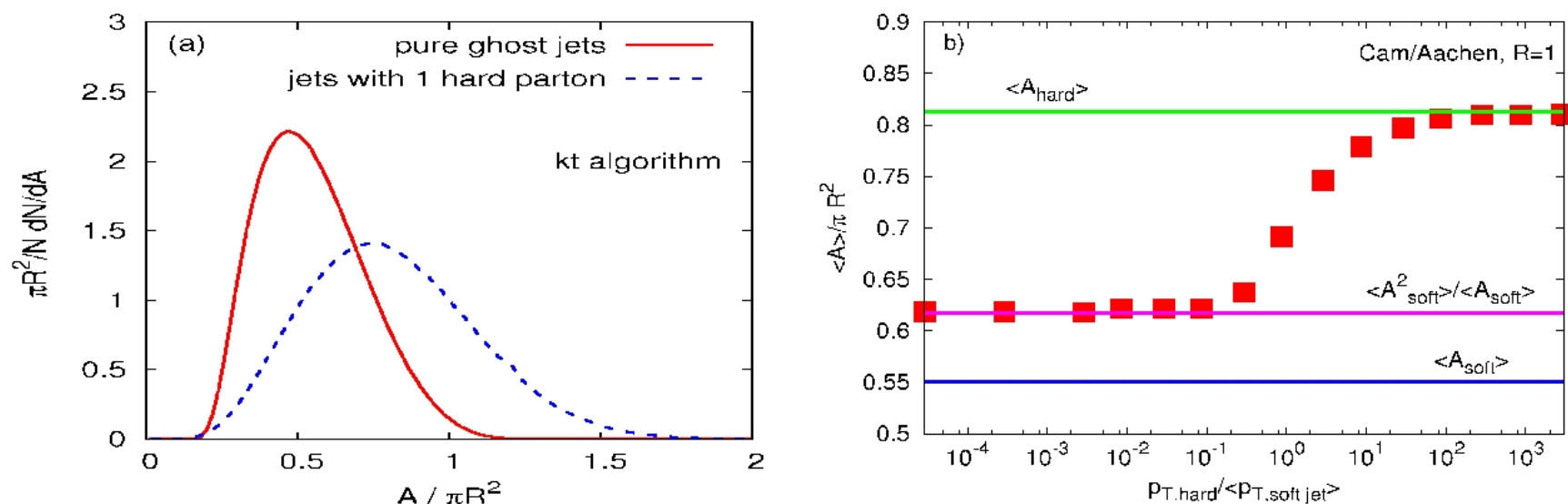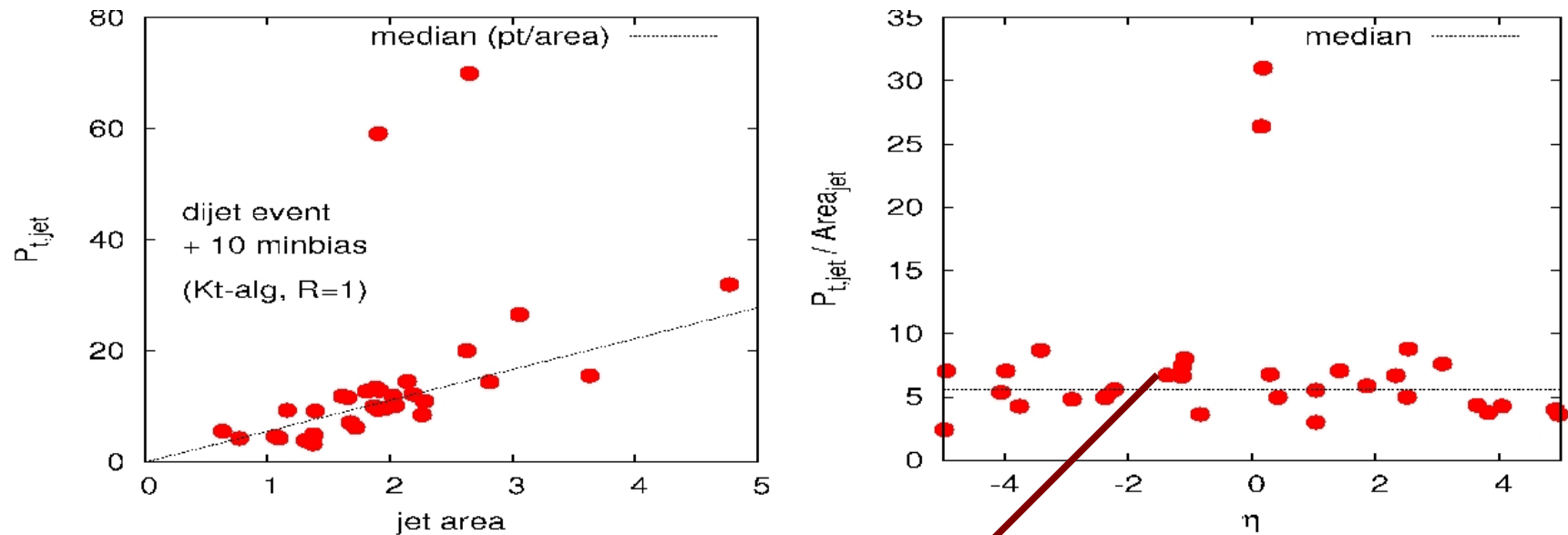Figure 2: A dijet event superimposed to 10 minimum bias events originated by moderate-luminosity pileup in *pp* collisions at the LHC, as simulated by PYTHIA.

noise level ρ

Study of UE with Jet Areas?

- maybe jet areas can differentiate better between various MI tunes

- if yes Fast Kt jet algorithm needed

    - more than 100 faster than usual Kt jet algorithm

    - packages available in C++ framework