Tops as “Fat Jet”

WG6 meeting 1/04/2011

CERN

Outlook

- Preliminary remarks
- A look at $\gamma\gamma$ rejection
- Selection of fat top jet events (boosted tops)
- Discussion

Preliminary remarks

- ttbar events @CLIC 3TeV (all hadronic)
- $\gamma\gamma$ overlay w. M.Thomson's tight cut
- Kt algorithm, R=07
- Aim: reconstruct ttbar events and reject backgrounds
  - ttbar (180fb, 45.7% hadr. yield)
  - WW (4145fb, 45.7% hadr. yield)
  - ZZ (23fb, 48.9% hadr. yield)
  - WWZ (42fb, 31.9% hadr. yield)

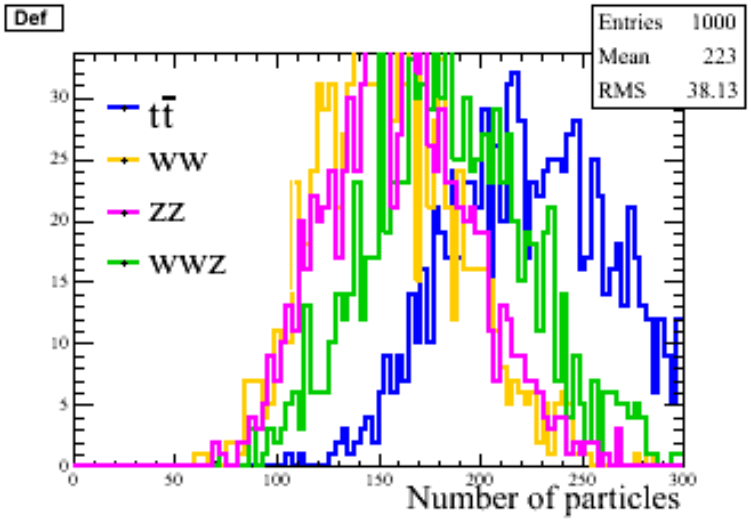
Preliminary remarks

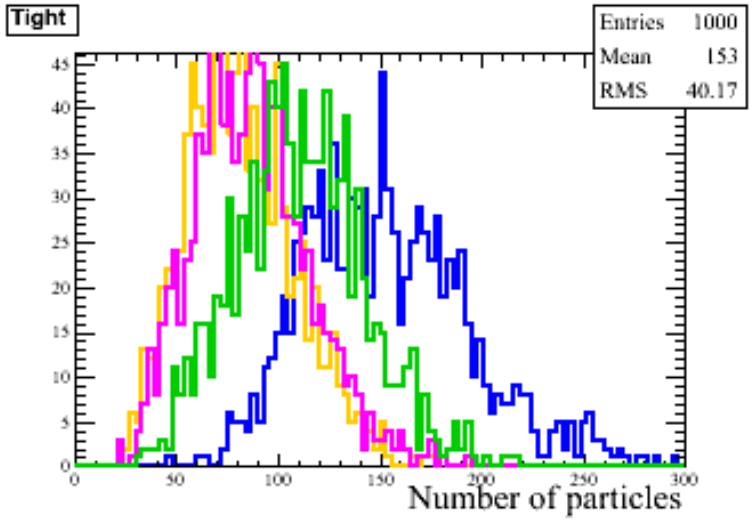
Boosted tops (γ=8,6 @1.5TeV)

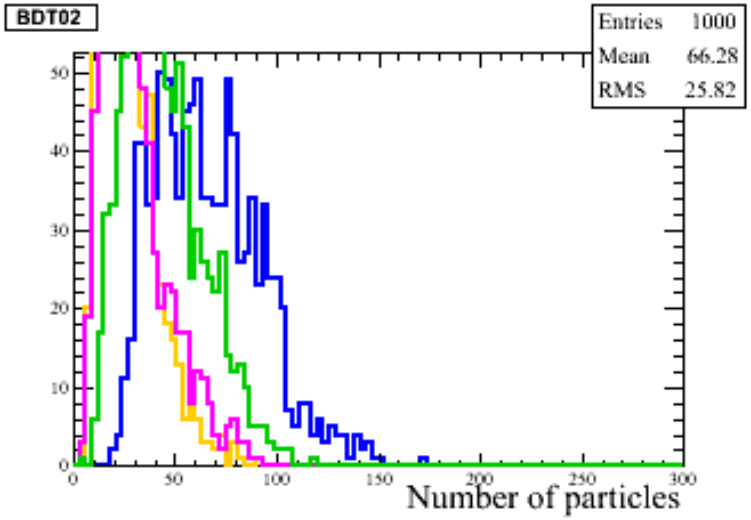
- > decay products tend to be very collimated
- > W in a 6° cone in the top axis
- > b more versatile but in the 6° cone w. ~45% chance

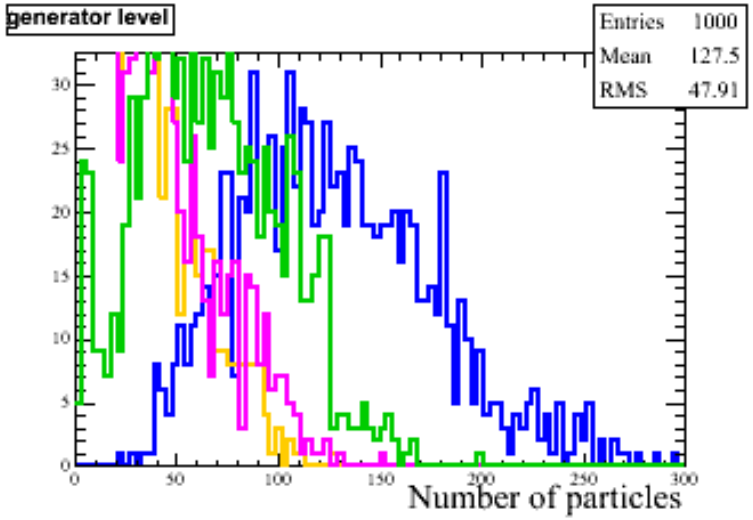
- > Top can often be clustered into a single “Fat Jet”

A look at γγ rejection

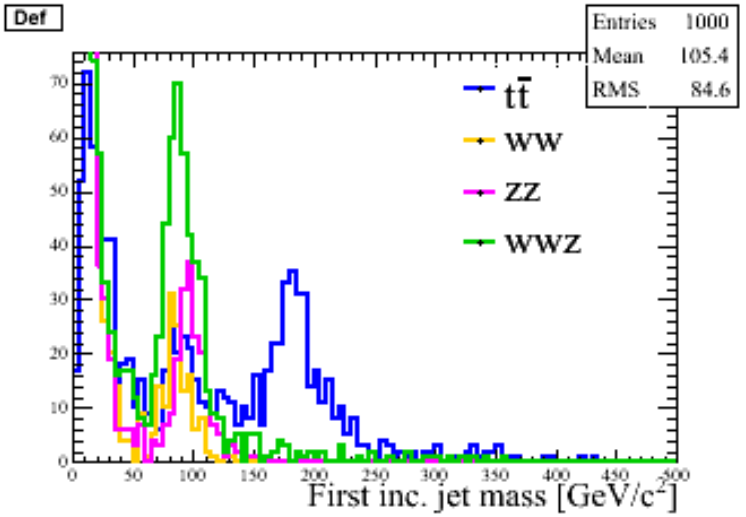


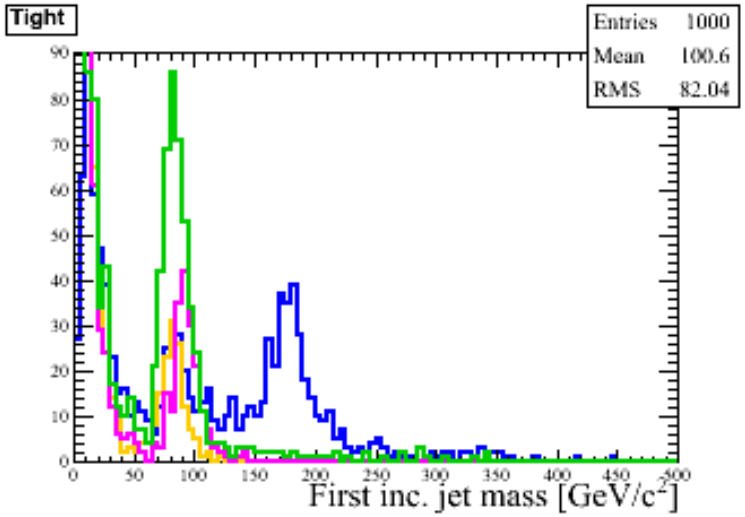


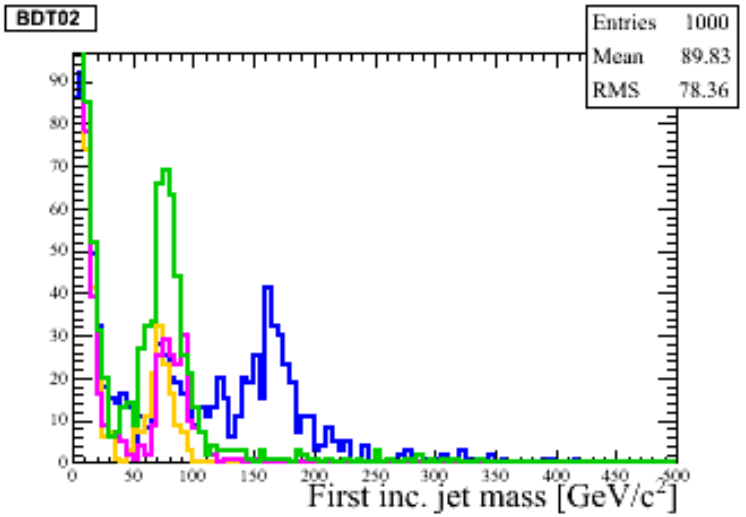


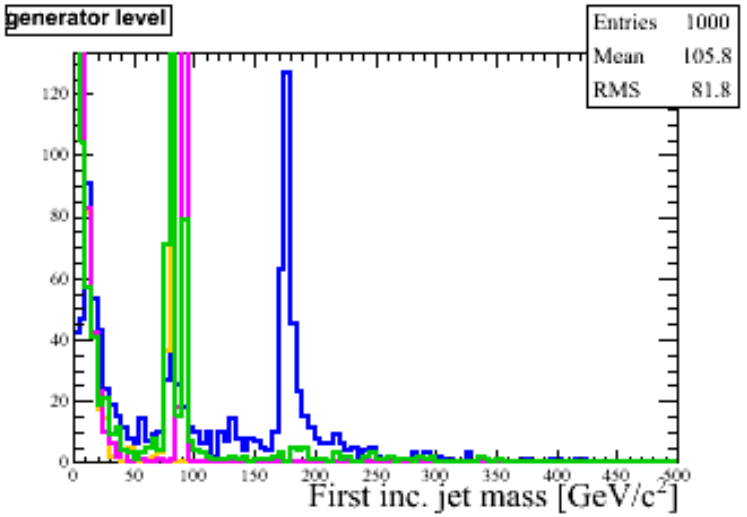


A look at γγ rejection

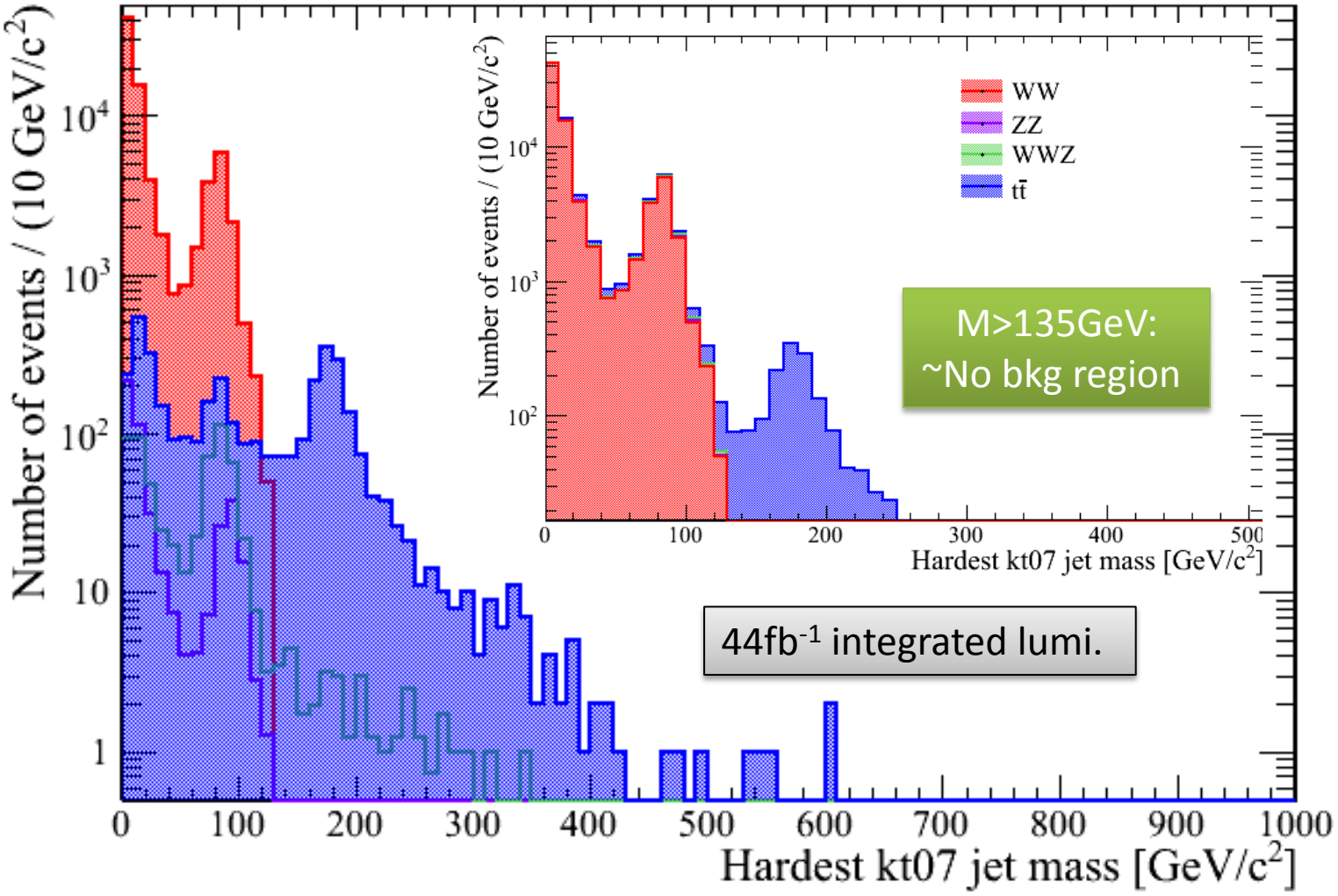




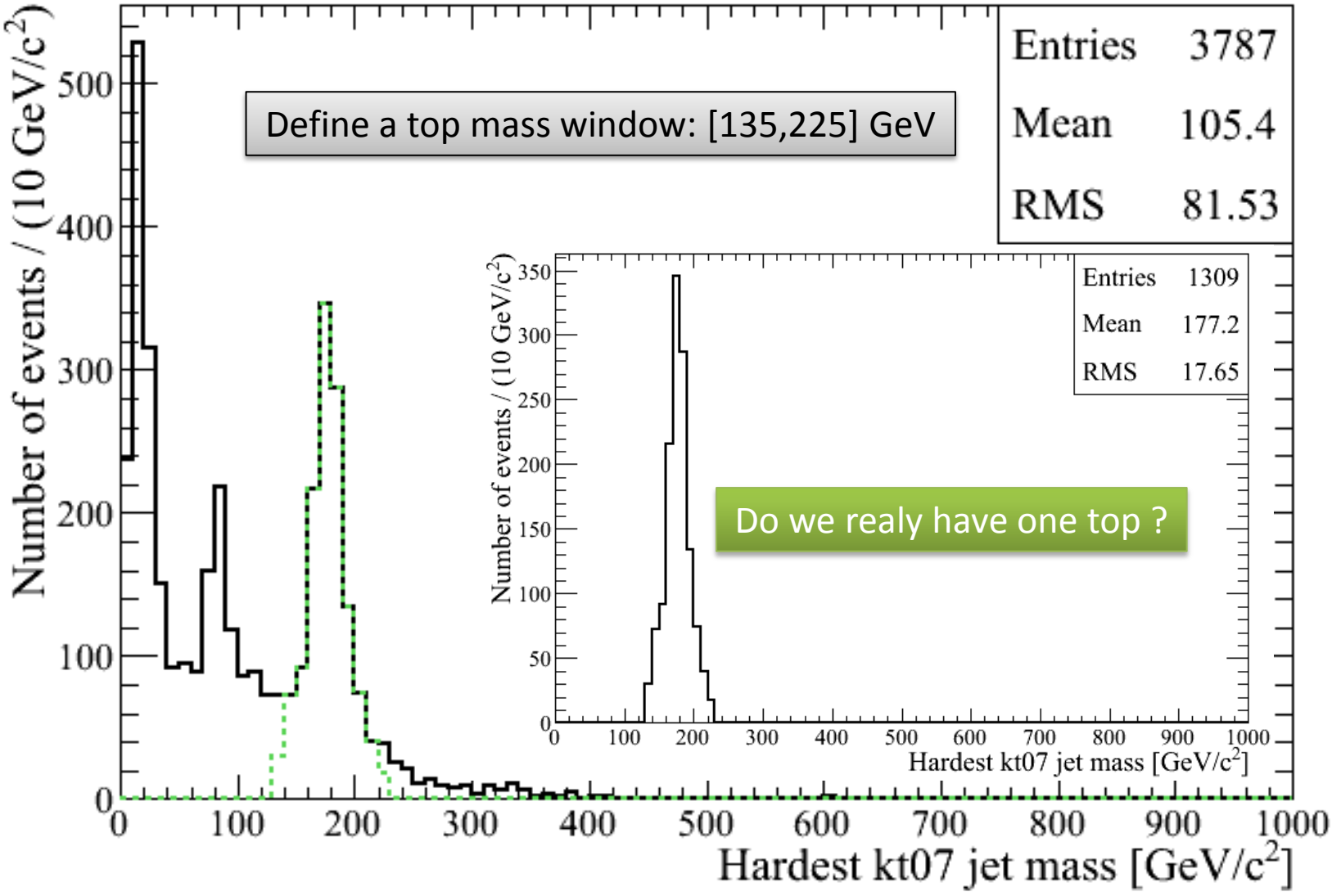




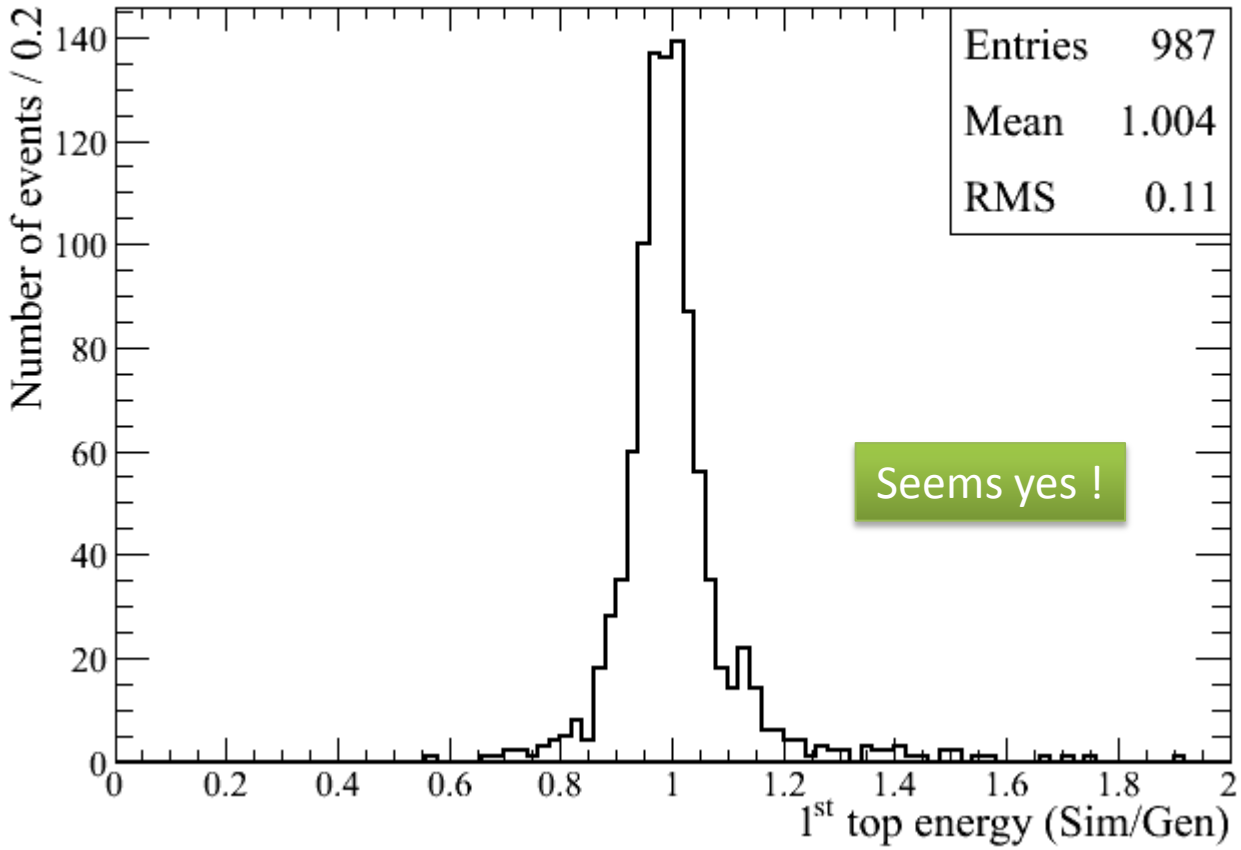
Mass spectrum



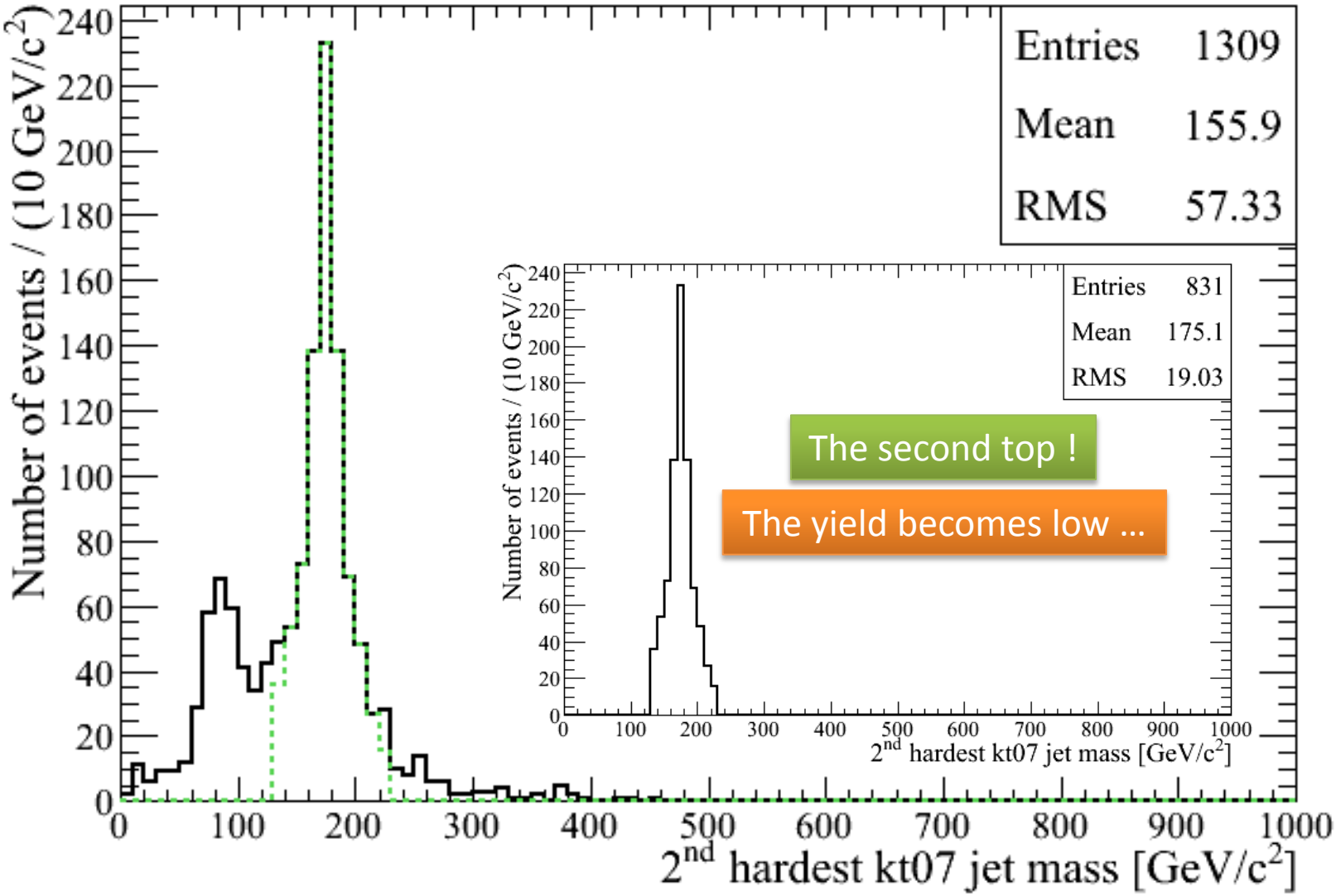
“Fat Jet” peak


Define a top mass window: [135,225] GeV
Entries 3787
Mean 105.4
RMS 81.53
Number of events / (10 GeV/c²)
Hardest kt07 jet mass [GeV/c²]
Entries 1309
Mean 177.2
RMS 17.65
Do we realy have one top ?

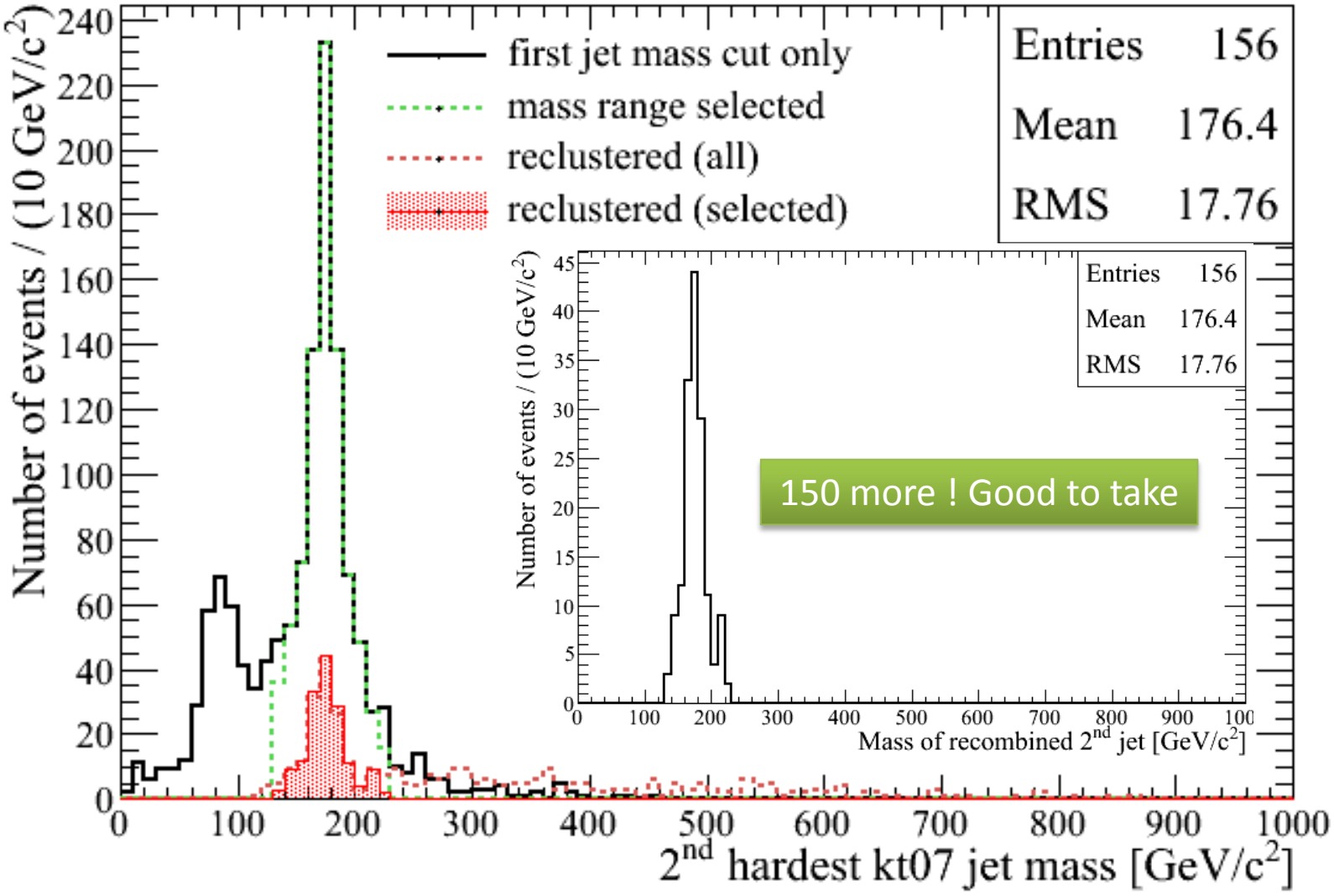
First top reconstructed



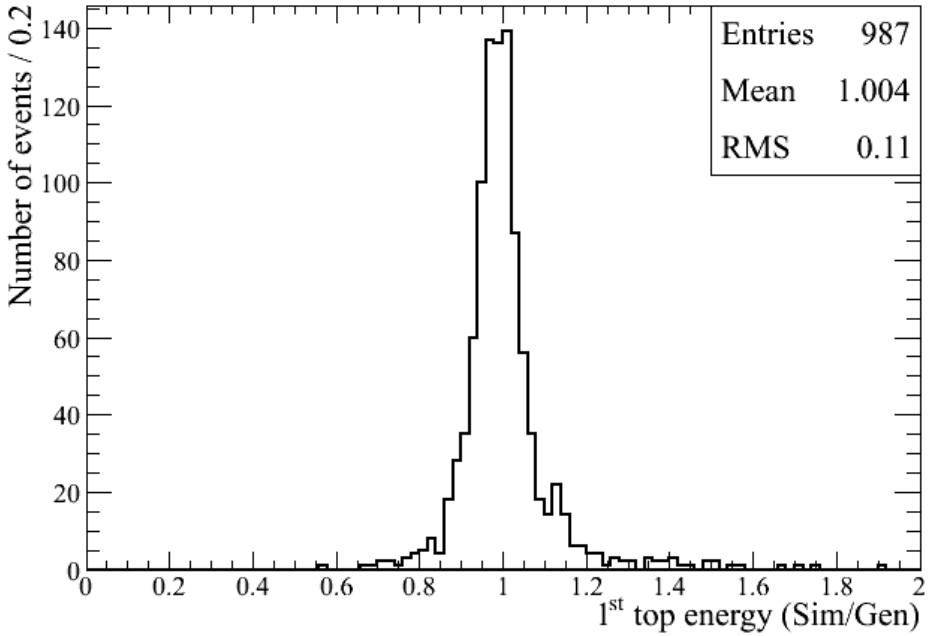
Look at the second hardest jet

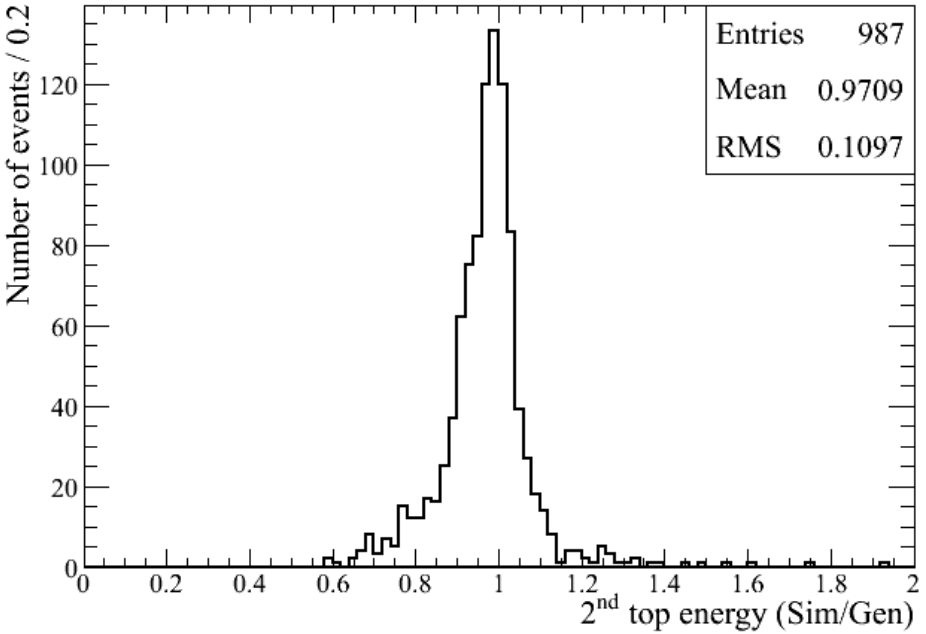


Merge second jet with third



Two tops reconstructed





~10% precision on both top energies
987/3787 = 26% efficiency

~1/4 of the ttbar events are reconstructed “for free”

Possible refinements

- Adding b-tagging information for the 2nd top reconstruction (may not gain so much)

- Cleaning fat jets (reclusterisation w. smaller R to remove soft radiations and identify individual decay products)

- Other ideas ?

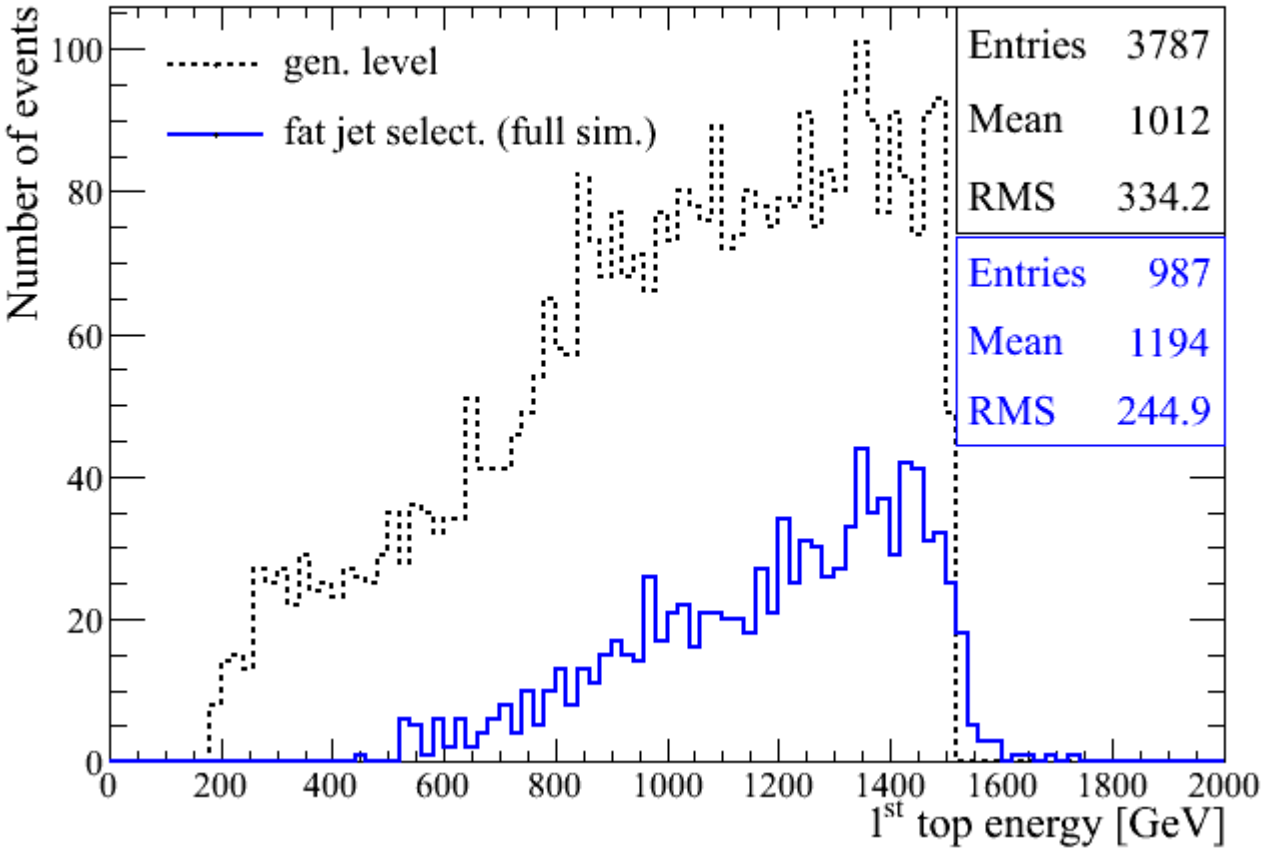
Discussion

- MVA don't take easily this advantage into account.
  - > complementary to a full top tagging study
  - > better remove them before going to MVA

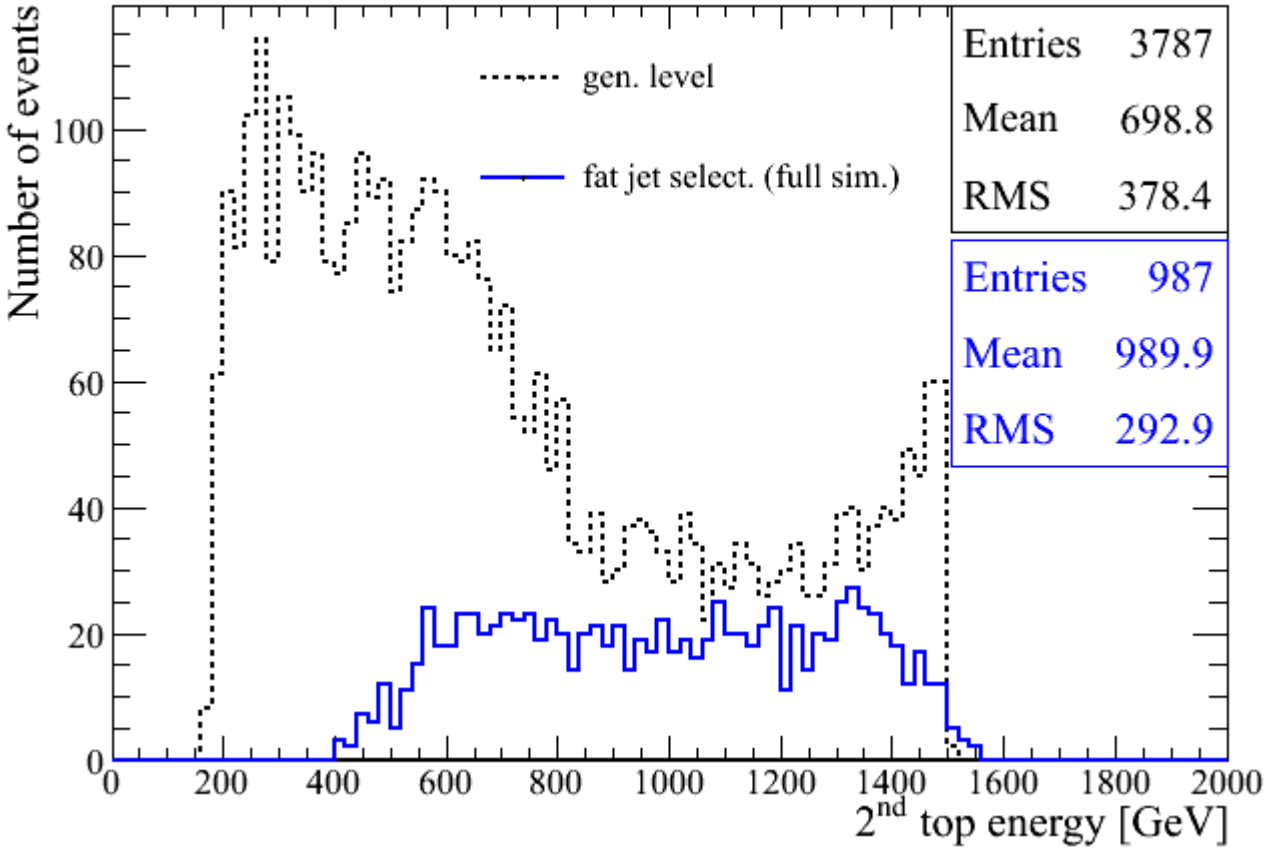
- Boosted tops have their own potential
  - > Boosted object worksop review: **arXiv:1012.5412** (thx Frank Simon)
  - > Top polarisation measurement (eg: JHEP 07(2010) 041)
  - > no significant background in the top mass window ?
  - > Precision top physics @ 3TeV ?

Thank you

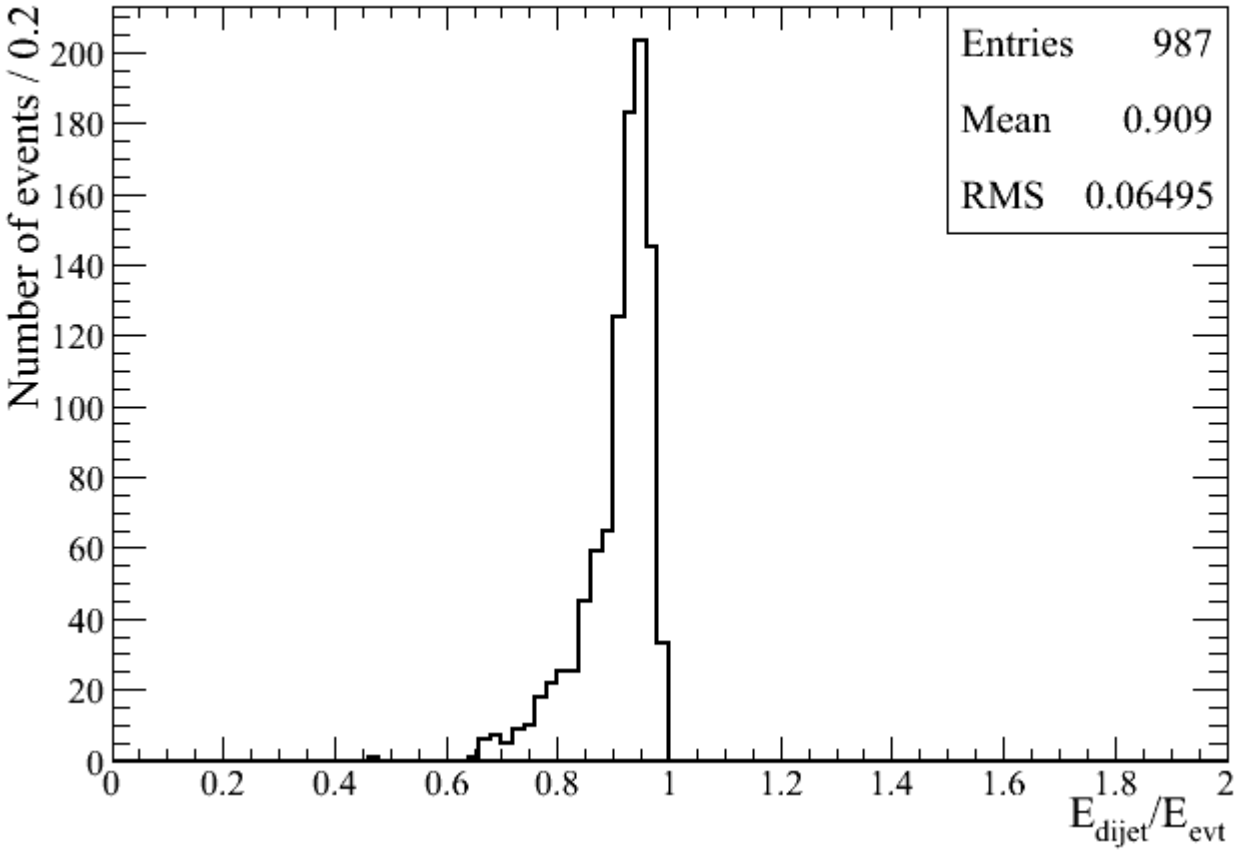
backup


Number of events
gen. level
fat jet select. (full sim.)
Entries 3787
Mean 1012
RMS 334.2
Entries 987
Mean 1194
RMS 244.9
1st top energy [GeV]

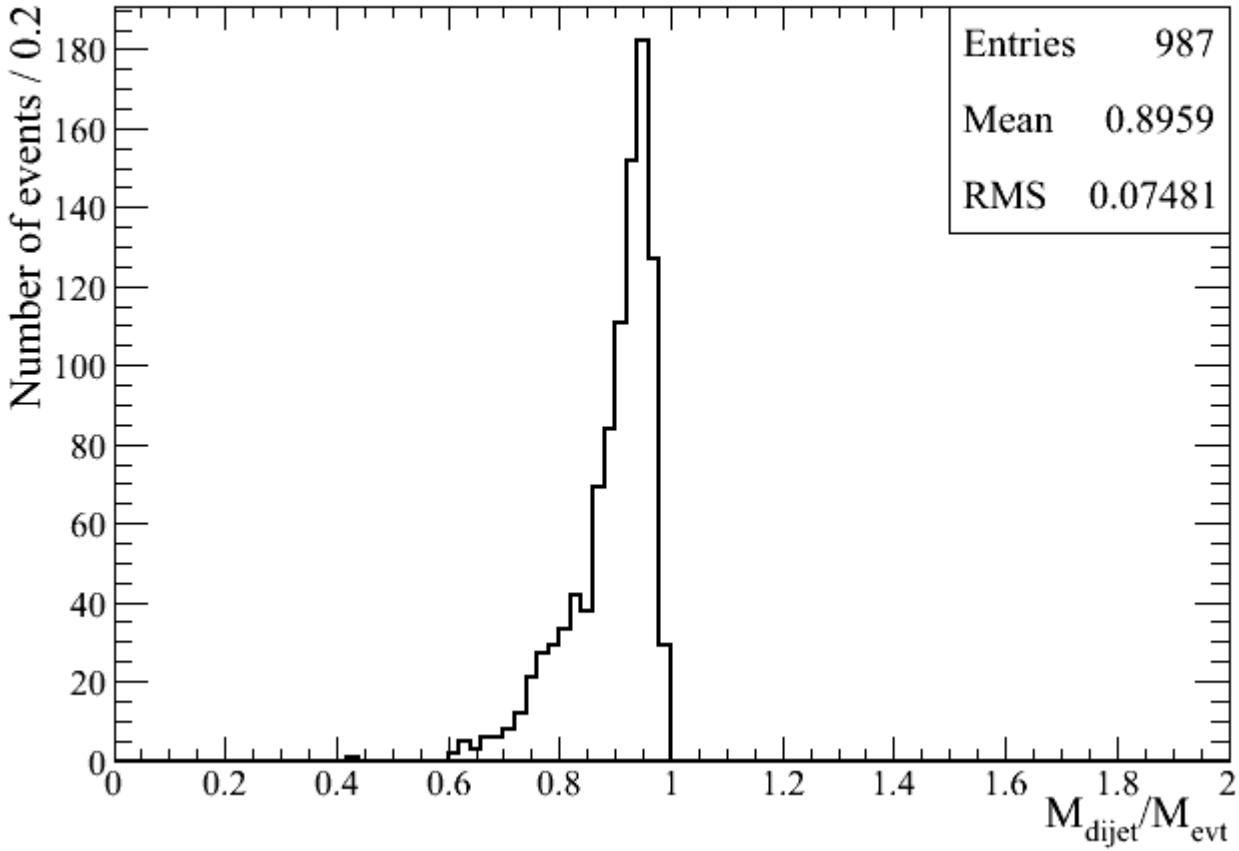
backup


Number of events
gen. level
fat jet select. (full sim.)
Entries 3787
Mean 698.8
RMS 378.4
Entries 987
Mean 989.9
RMS 292.9
0
20
40
60
80
100
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2nd top energy [GeV]

backup


Entries 987
Mean 0.909
RMS 0.06495
Number of events / 0.2
E_{dijet}/E_{evt}

backup


Entries 987
Mean 0.8959
RMS 0.07481
Number of events / 0.2
M_{dijet}/M_{evt}