# Top events and Local Hadron Calibration

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# *Introduction*

► In this talk I will show preliminary results obtained by looking at some $t\bar{t}$ events

► These $t\bar{t}$ events are obtained from AODs and ntuples produced with release 12.0.6 and back-ported Local Hadron Calibration (and dead-material corrections) used in release 13.0.0

► The work here presented has been done together Nabil Ghodbane

# $t\bar{t} \to WWb\bar{b} \to (l\nu)(jj)b\bar{b}$ *events*

► The data analyzed here are $t\bar{t} \to WWb\bar{b}$:

► In these events one $W$ decays leptonically ($e, \mu$) and the other $W$ decays hadronically

► Special AODs with $t\bar{t} \to WWb\bar{b}$ events (about 500000 events) have been produced by our HEC group using data sample 5200 Task ID=7900 and Task ID= 8037 (30 micron cut)

► These AODs:

 ▷ have been produced using release 12.0.6 but they have the local hadron calibration and the dead-material correction used in release 13.0.0 (Sven and Gena)

 ▷ they include MC truth information (Emanuel)

# AODs and ntuples

► The new AODs include the extra jet containers:

 ▷ Kt with R=0.4:
   - KtTopoParticleJets (Kt with local hadron calibration applied)
   - KtTopoParticleJetsEM (Kt without local hadron calibration applied)

 ▷ Kt with R=0.6:
   - KtTopo06ParticleJets (Kt with local hadron calibration applied)
   - KtTopo06ParticleJetsEM (Kt without local hadron calibration applied)

 ▷ Cone 4:
   - Cone4TopoParticleJetsCAL (Cone4 with local hadron calibration applied)
   - Cone4TopoParticleJetsEM (Cone4 without local hadron calibration applied)

► One can find these AODs on the grid: "prod-lfc-atlas-central.cern.ch", "/grid/atlas/users/teresab/AODnew"

# $t\bar{t}$ *ntuples*

► Ntuples from these AODs have been produced by

  ▷ Nabil using his own code (also used by the SCT group at MPI)
  ▷ Emanuel and Andreas using EventView

► I have used here the ntuples produce by Nabil (they were available first)

► The idea is to check the results obtained with Nabil's ntuples with the ntuples produced by Emanuel and Andreas

# *Event pre-selection*

► Jets selection:

  ▷ 3 jets with $p_\perp > 40\,\text{GeV}$

  ▷ 1 jet with $p_\perp > 20\,\text{GeV}$

  ▷ $|\eta| < 2.5$

► Leptons selection:

  ▷ $p_\perp > 20\,\text{GeV}$ and $|\eta| < 2.5$

  ▷ Muons reconstructed with MUID isolation energy in a cone of $\triangle R = 0.2$, $< 2\,\text{GeV}$

  ▷ Electrons with EGAMMA, isEM==0 (tight identification)

  ▷ Isolation energy in a cone of $\triangle R = 0.2$, $< 6\,\text{GeV}$

► Overlap:

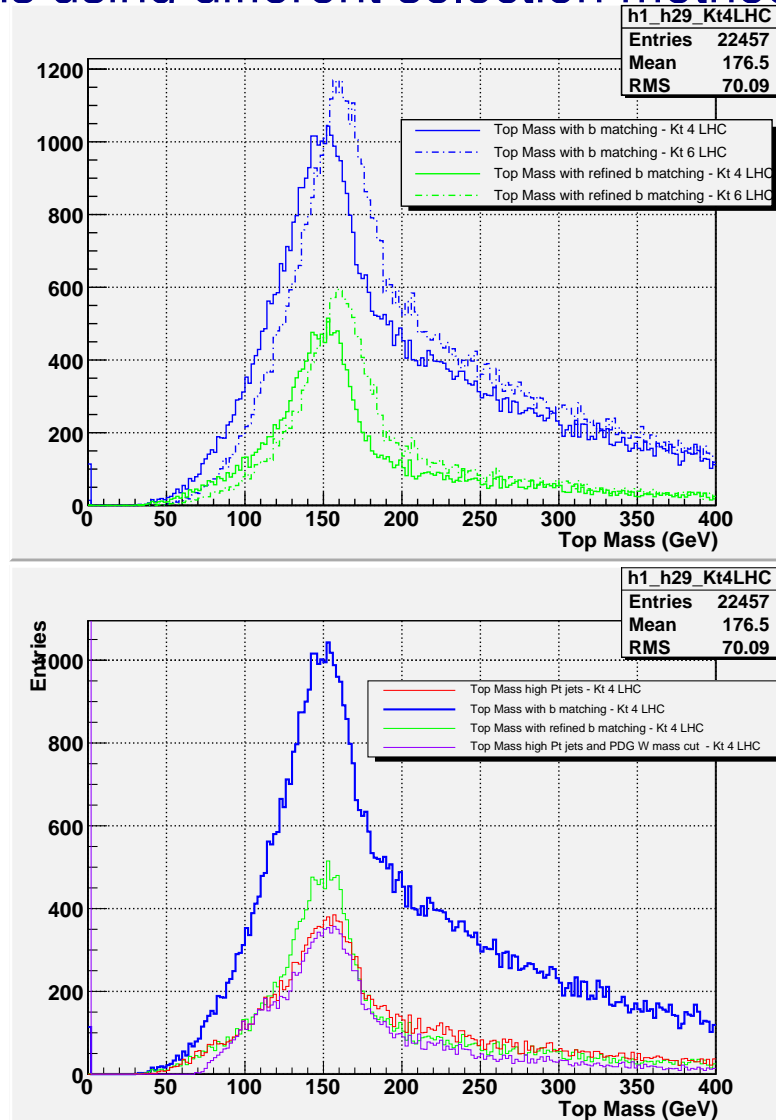  ▷ Jets were required not to overlap with the $e^\pm$ and the $\mu^\pm$ in a cone of $\triangle R = 0.4$

# *Different event selections*

► Meth.1: high $p_\perp$ schema:

  ▷ Consider only semi-leptonic events
  ▷ Loop over the jets and keep the 3 of them which give the maximal $p_\perp$ object. This object is the hadronic top

► Meth.2: basic b-matching schema:

  ▷ Consider only semi-leptonic events
  ▷ Find the two most energetic jets and match them with the b MC-truth
  ▷ Loop over the jets again and find the ones which combined with the hadronic b give the top

► Meth.3: refined b-matching schema:

  ▷ Consider only semi-leptonic events
  ▷ Find the two most energetic jets and match them with the b MC-truth
  ▷ Loop over the jets again, find the two ones close in DeltaR
  ▷ Combine the jets with the hadronic b to give the top

► Meth.4: high $p_\perp$ schema with *W* mass constrain:

  ▷ Consider only semi-leptonic events
  ▷ Loop over the jets and keep the 3 of them which give the maximal $p_\perp$ object. This is the hadronic top
  ▷ Mass of the top constrained by the PDG *W* mass applied

# *Results: top mass I*

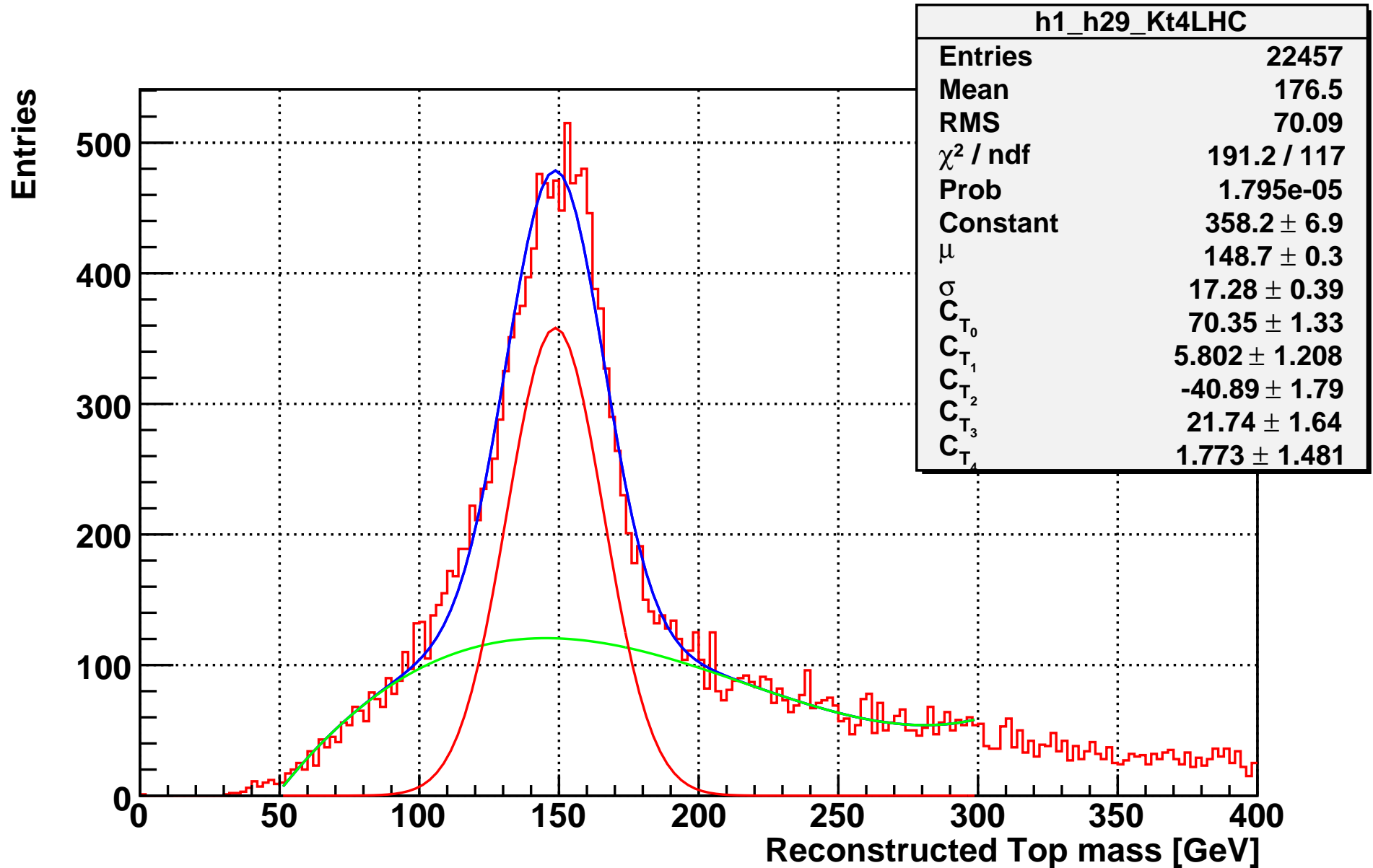Top mass distributions using different selection methods



► Distributions in red are Meth.1, in blue are Meth.2, in green are Meth.3, violet Meth.4
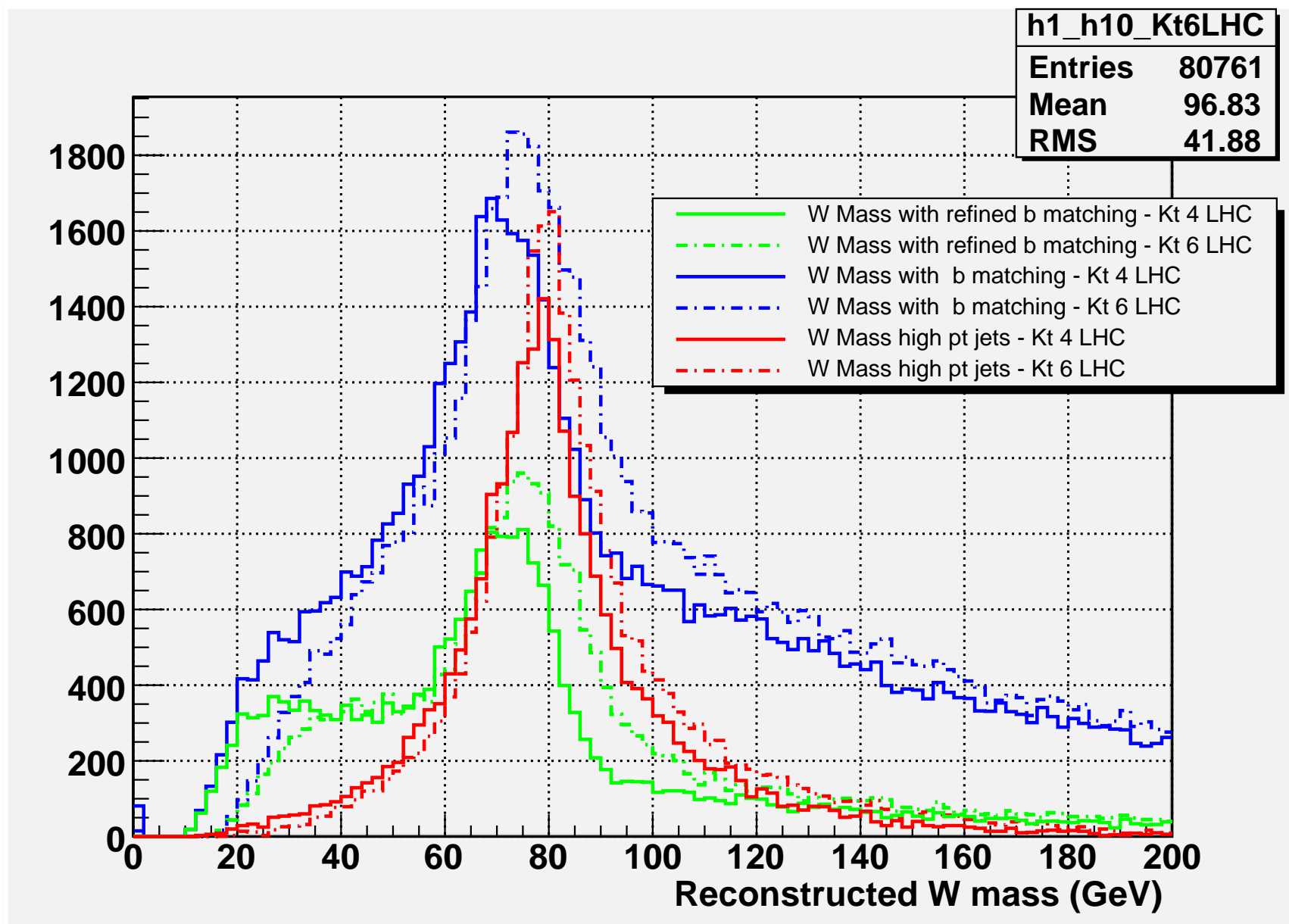
# *Top mass*

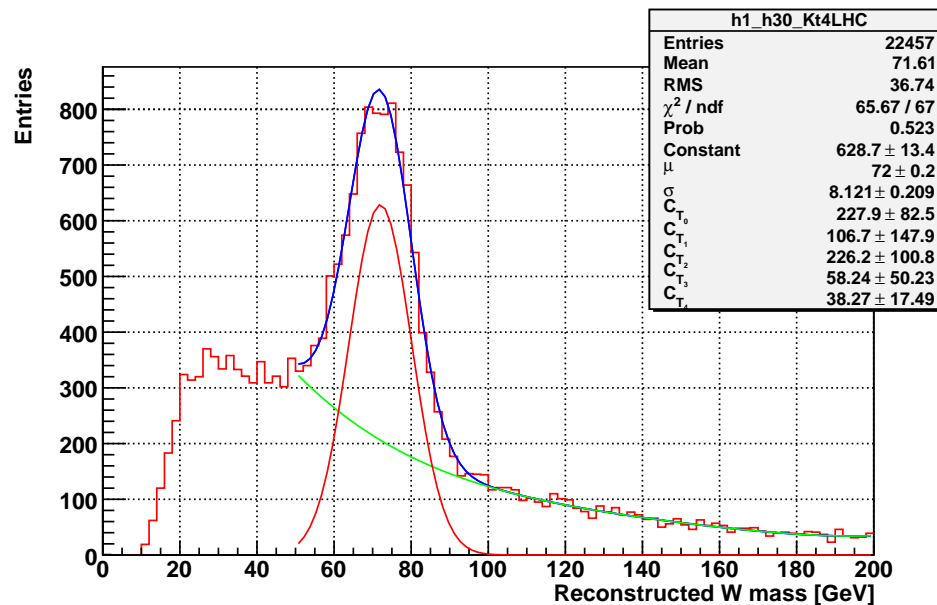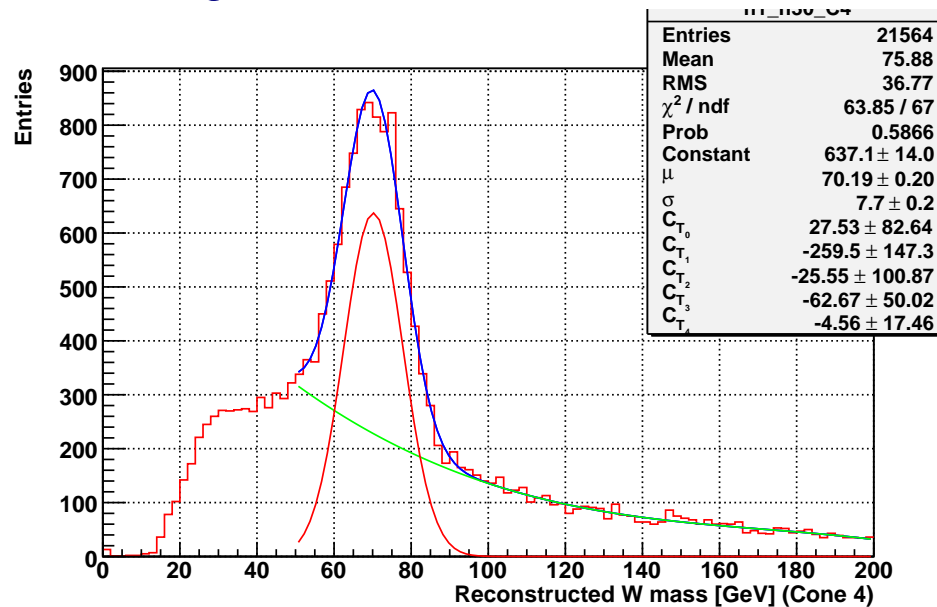► Top mass distribution using Kt 4 with the refined b-matching selection method



| h1_h29_Kt4LHC | |
|---|---|
| Entries | 22457 |
| Mean | 176.5 |
| RMS | 70.09 |
| $\chi^2$ / ndf | 191.2 / 117 |
| Prob | 1.795e-05 |
| Constant | $358.2 \pm 6.9$ |
| $\mu$ | $148.7 \pm 0.3$ |
| $\sigma$ | $17.28 \pm 0.39$ |
| $C_{T_0}$ | $70.35 \pm 1.33$ |
| $C_{T_1}$ | $5.802 \pm 1.208$ |
| $C_{T_2}$ | $-40.89 \pm 1.79$ |
| $C_{T_3}$ | $21.74 \pm 1.64$ |
| $C_{T_4}$ | $1.773 \pm 1.481$ |

# *Results: W mass I*

► W mass distributions using different selection methods and different jet algos

# *W mass*

► W mass distributions using Kt4 and Cone4

# *Methods comparison*

► Comparing the "High $p_\perp$ selection method" with the PDG *W* mass cut, and the "refined b-matching selection method"