MC@NLO In Top Events

I will address two questions:

- How to handle negative weights

  In a likelihood you just add or subtract the contribution of an event depending on the sign

  Mean and RMS in The Stat Box are a big problem

- Comparison of MC@NLO and PYTHIA V6.2 MC

  Top and W mass distributions

MC@NLO Statistics Box

MC@NLO has 12% of events with negative weights

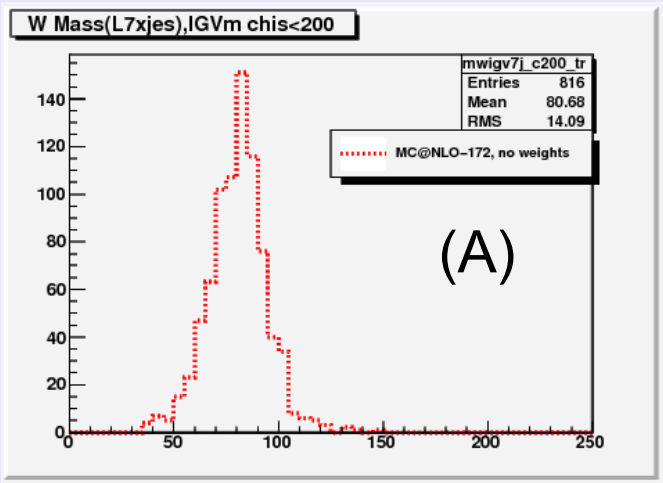
Presently negative weights are not properly handled by root

- **To get proper uncertainties on the bin content** you can do the following:
  - Plot the events with the proper weight for each event
  - Put h->Sumw2 after booking the histogram
    The plots will have correct bin uncertainties
- **To get proper values of Mean and RMS in the stat box** you have two choices:
  - Write a new version of TH1F to handle the weights correctly
    (Paul Lujan wrote a TH1FFix that works)
  - Plot the events with the negative and positive weights separately and do the calculations yourself

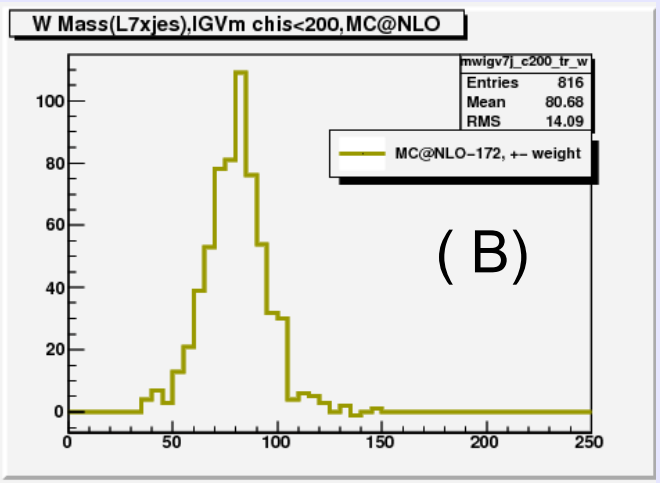
Bin uncertainty, Stat Box results

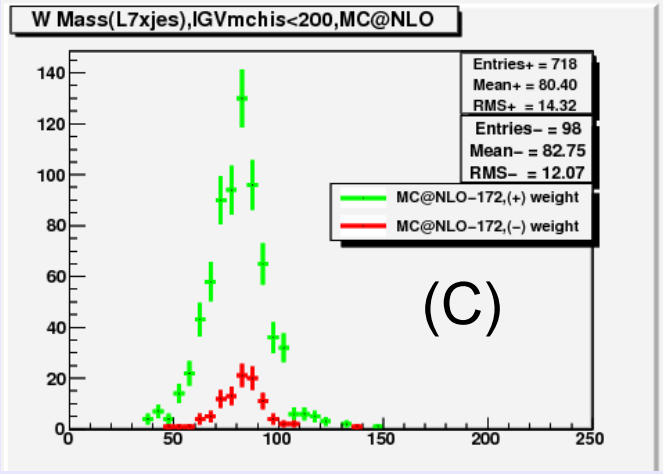
The use of Sumw2 gives correct bin errors.
Mean and RMS are wrong in all cases.

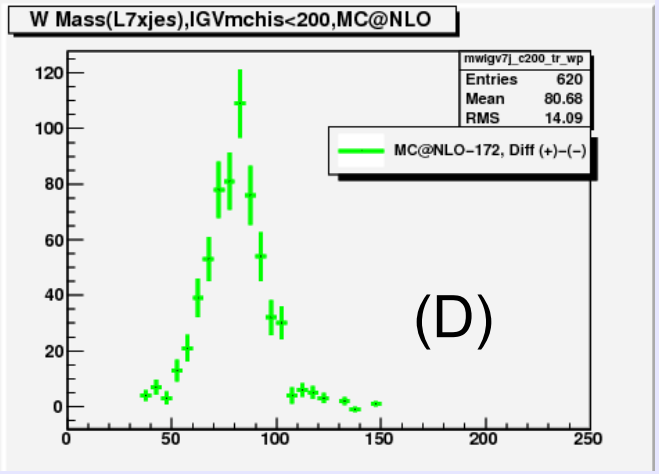
All events, no weights



All events, weighted







Plot separately + or - ev

Subtract + and - events

Weight	+1	-1
Events	718	98

Total = 816

	Mean	RMS
A =	80.68	14.09
B =	80.68	14.09

	Mean	RMS
D =	80.68	14.09

How to Get Correct Statistics

To get proper values of Mean and RMS in the Stat Box

You have two choices

- Write a new version of TH1F to handle the weights correctly

Or do the following:

- Write your own function: Myfix
  Plot the events with the negative weights adding
  hm->Sumw2 after booking the histogram
  Plot the events with positive weights in the same manner
  hp>Sumw2 after booking the histogram

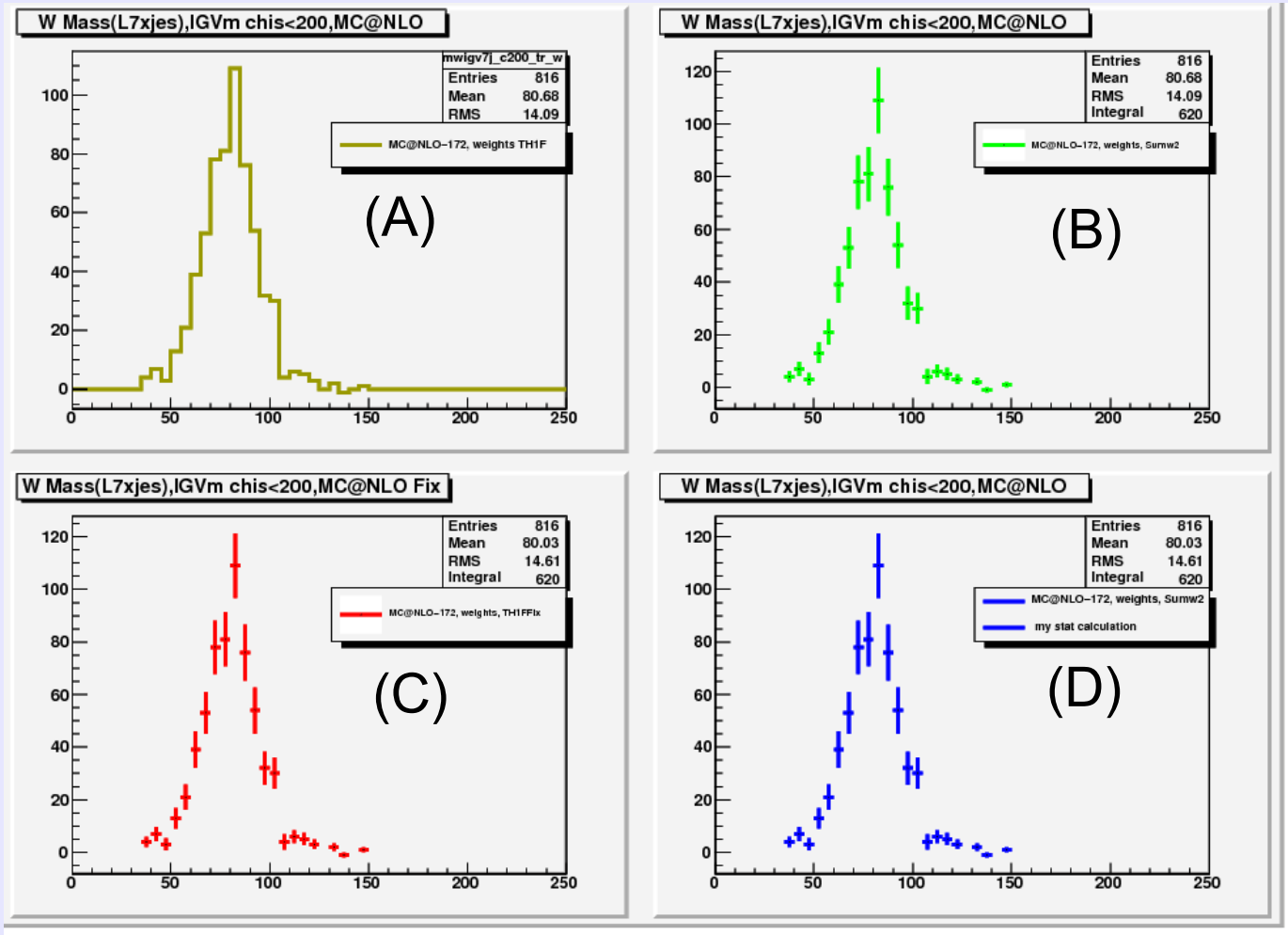
- Myfix: calculates the Mean and RMS for the final plot by using the values of Mean and RMS for the + and - hists

FIX in TWO WAYS

We correct the Mean and RMS with **TH1FFix** and **Myfix** function

All events, weighted

All events, w's, Sumw2



All events, w's, TH1FFix

All events, w's, Myfix

	Mean	RMS
A =	80.68	14.09
B =	80.68	14.09
C =	**80.03**	**14.61**
D =	**80.03**	**14.61**

Correct values

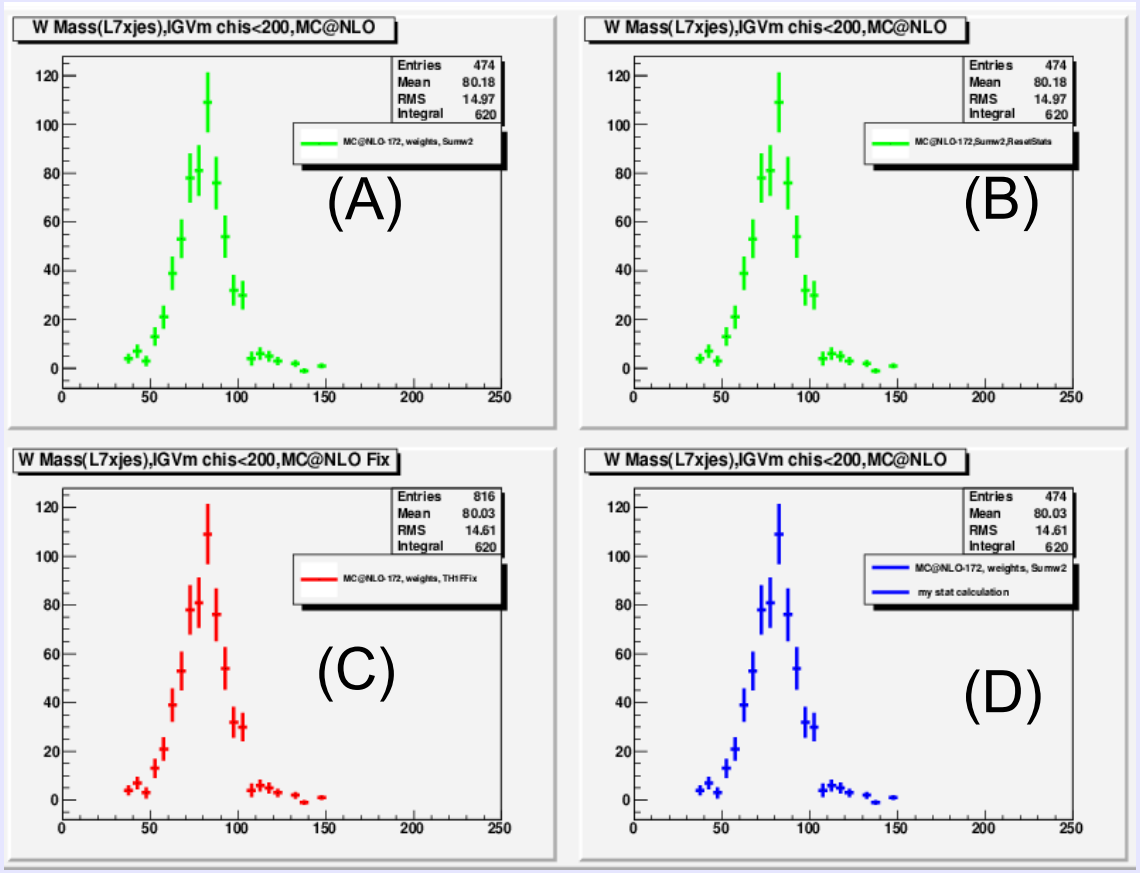
h->ResetStats

IT DOES NOT WORK!! (used root V5.26)

It gives wrong values for NeV, Mean, and RMS in the plots where it was used (B), also puts wrong NeV in A and D

All events, weighted

All events, w's, Sumw2



All events, w's, TH1FFix

All events, w's, Myfix

	Events
A =	474 wrong
B =	474 wrong
C =	**816 TH1Fix**
D * =	474 wrong

	Mean	RMS
A =	80.68	14.09
B =	80.68	14.09
C =	**80.03**	**14.61**
D =	**80.03**	**14.61**

correct

* I can fix this by entering correct Nev in Myfix

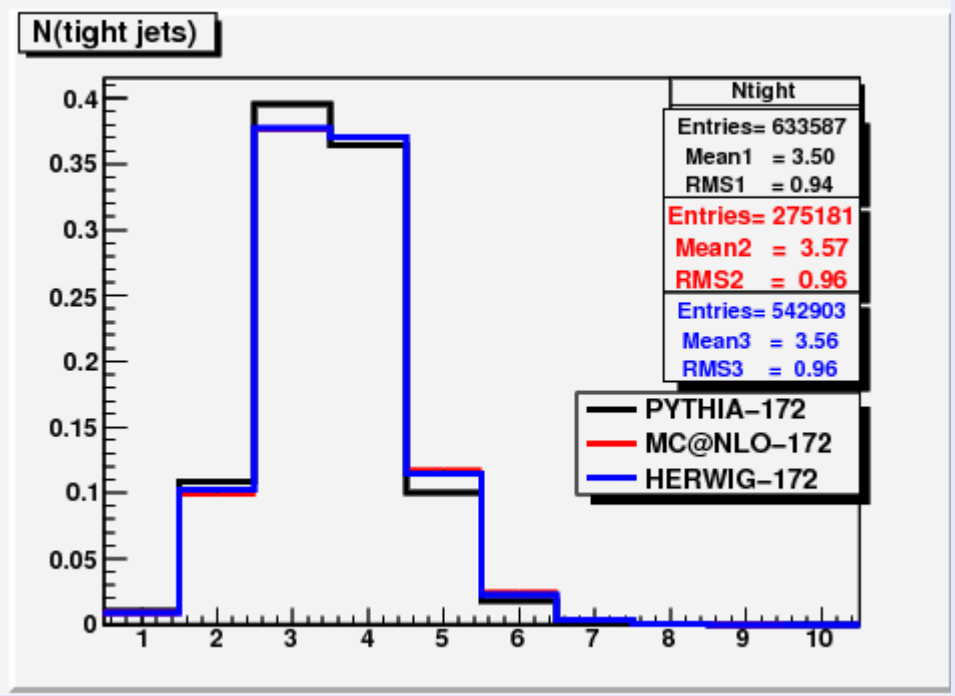
SUMMARY (Stat Box)

To get correct values of Events, Mean and RMS

Do the calculations yourself:

- Write a new Class (like TH1FFix)
- Write your own function: use the values from the negative and positive weights events plotted separately to get the Mean and RMS for the whole sample

PYTHIAV6.2 -MC@NLO Comparison



Fist we compare the distribution of the number of tight jets.

	<Njet>
PYTHIA	3.50
MC@NLO	3.57
HERWIG	3.56

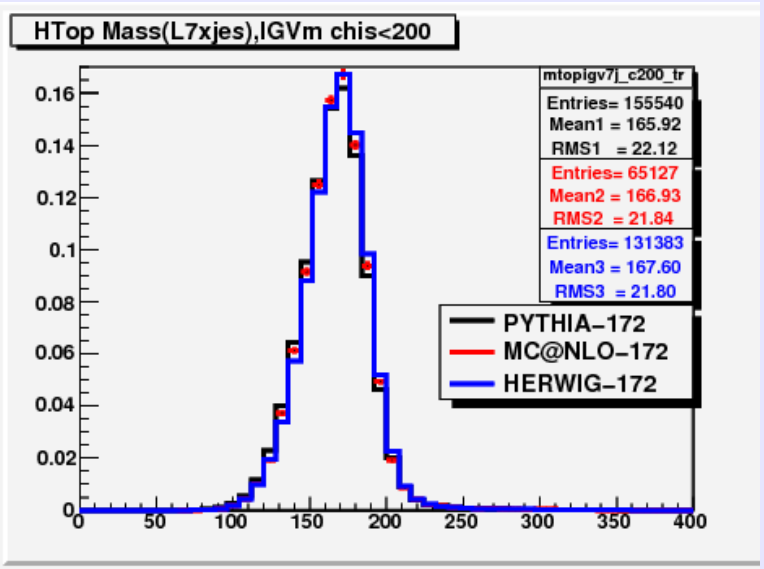
Not very different

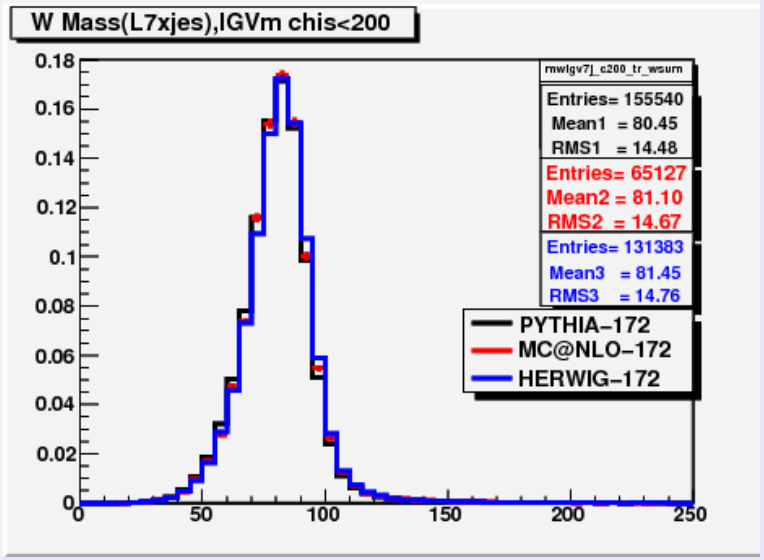
To compare the three Monte Carlo, we use the same procedure used for the Color Reconnection studies.

We select events with four tight jets (PT>20 GeV)
We find the best match for the four partons (2 light quarks, 2 b quarks) with the final 4 jets.
We take the combination with the best chisq (<200)

MC @NLO-PYTHIA 6.2 Comparison

Compare values of M(top) and M(W)





	PYT-V6.2	MC@NLO	HERWIG
M(top)	165.9	166.9	167.6
M(W)	80.45	81.10	81.45

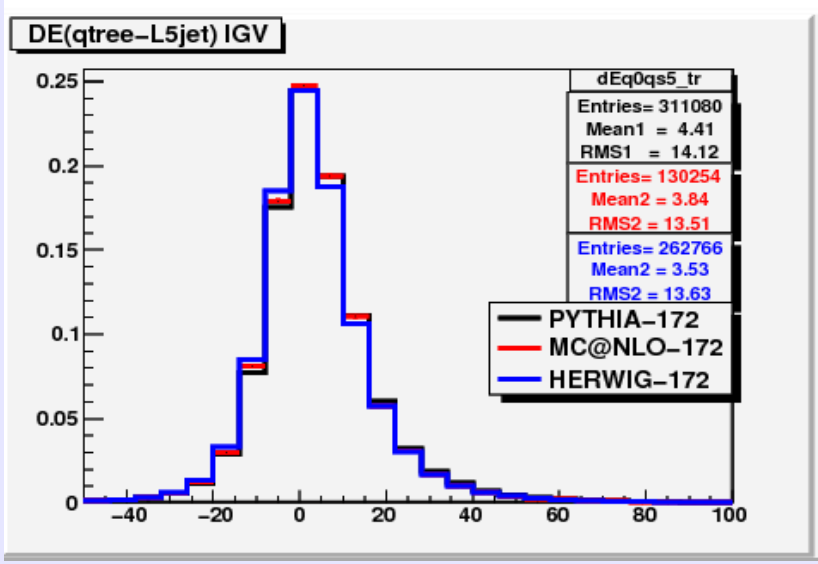
	ΔM(top)	ΔM(W)
MC@NLO-PYT	+1.0	+0.65
MC@NLO-HER	-0.87	-0.35

W and Top Mass in MC@NLO are larger then in PYTHIA and smaller than in HERWIG

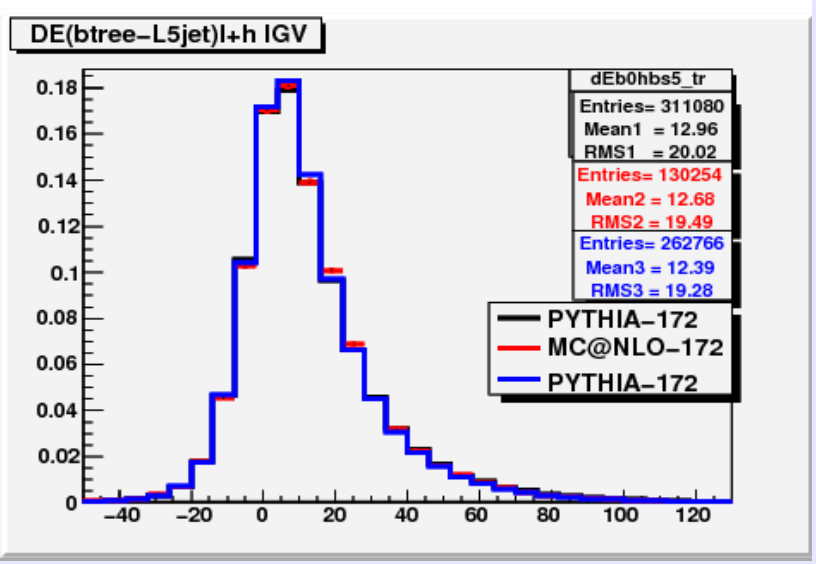
PYTHIAV6.2-MC@NLO Comparison

This is due to more energy in the cone = 0.4 of jets

Light quark jets



b quark jets



	PYTHIAV6.2	MC@NLO	HERWIG
ΔE(parton-q jet)	4.41	3.84	3.53
ΔE(parton-b jet)	13.0	12.7	12.4
E (cone-qjet)	-0.57	-----	+0.31
E (cone-bjet)	-0.28	-----	+0.29

Summary

The jets in MC@NLO have
more energy in the cone of $\Delta R = 0.4$ than PYTHIA V6.2
Less energy in the cone of $\Delta R = 0.4$ than HERWIG

Since we are using the Out of Cone correction derived from PYTHIA jets, we get a larger Energy for the MC@NLO jets

The differences of Energy in the cone are consistent with the observed differences in top and W mass