

# *Issues on MC@NLO*

- Overview
- Usage in B/top/QCD physics
- Implementation in CDF

Un-ki Yang

University of Chicago

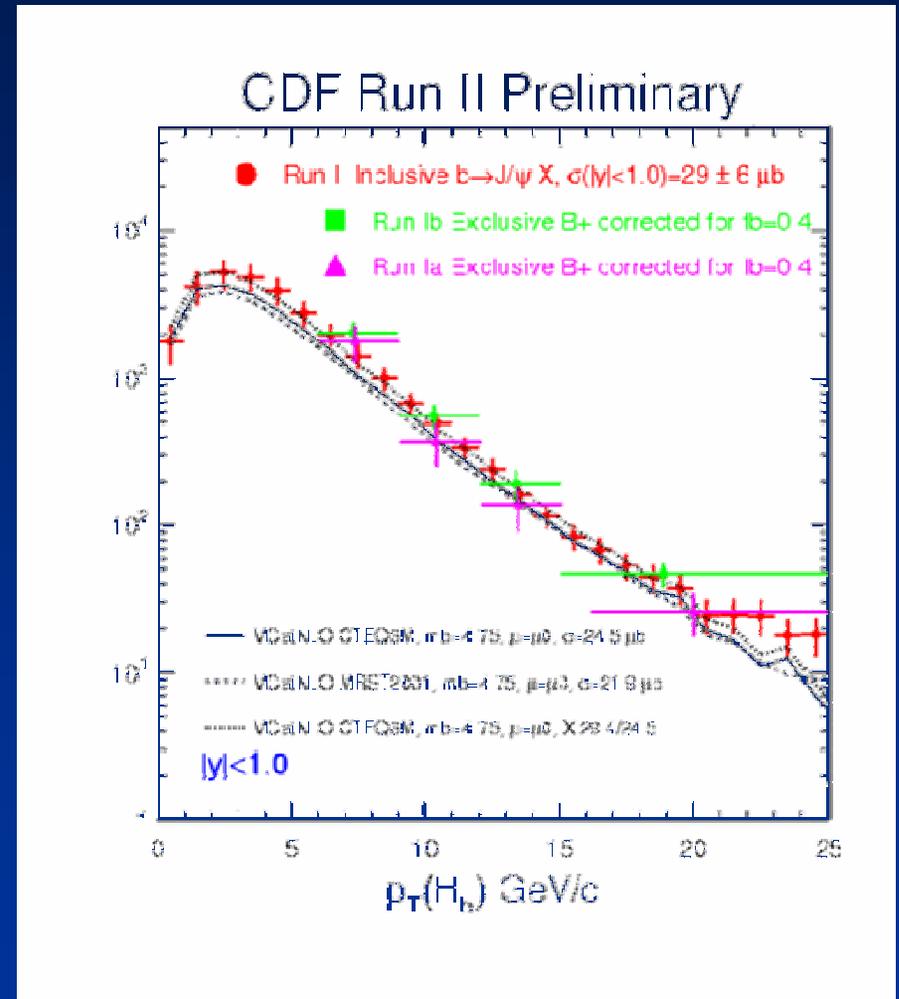
Simulation Meeting, Nov. 18, 2004

# Overview

- MC@NLO is a Parton shower MC (like Pythia, Herwig), but the partonic hard processes are calculated by including the full NLO QCD correction.
  - Only sensible way to compute K factor event by event.
  - Pythia and Herwig LO MC are poor for multi-jets, multi-scale events
  - ME (ALPGEN, MadGraph) are fine for multi-jets, after double counting problem is removed using CKKW or MLM, but still LO accuracy.
  - MC@NLO:
    - Soft, collinear region: by Herwig
    - Hard region by NLO
    - Involve with negative weight.
    - But not all processes are available
    - (W/Z+jet, bbar, ttbar, and diboson )
    - Spin-correlation is not included.
  
- Ref:hep-ph/0204244, hep-ph/0305252

# MC@NLO in B/QCD group

- Inclusive b-hadron cross section is correctly described (only generator)
- Important for  $\bar{b}$ , b cross section in QCD group

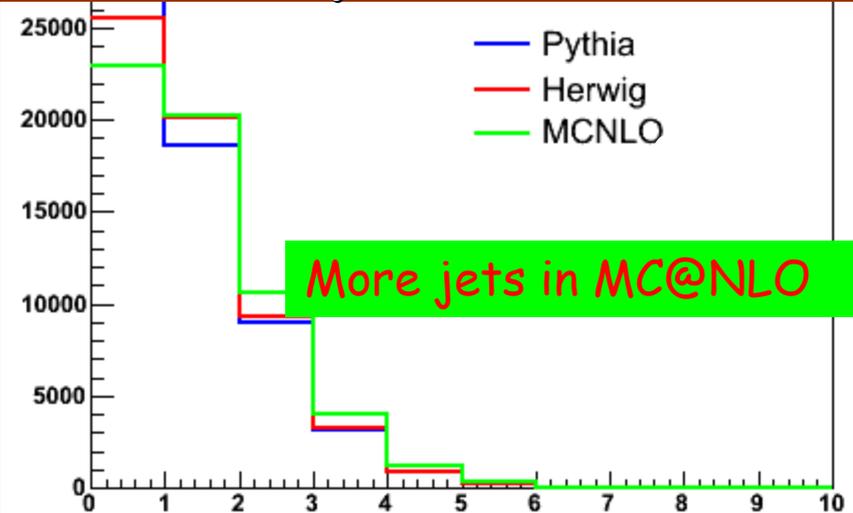


# MC@NLO in top/EWK

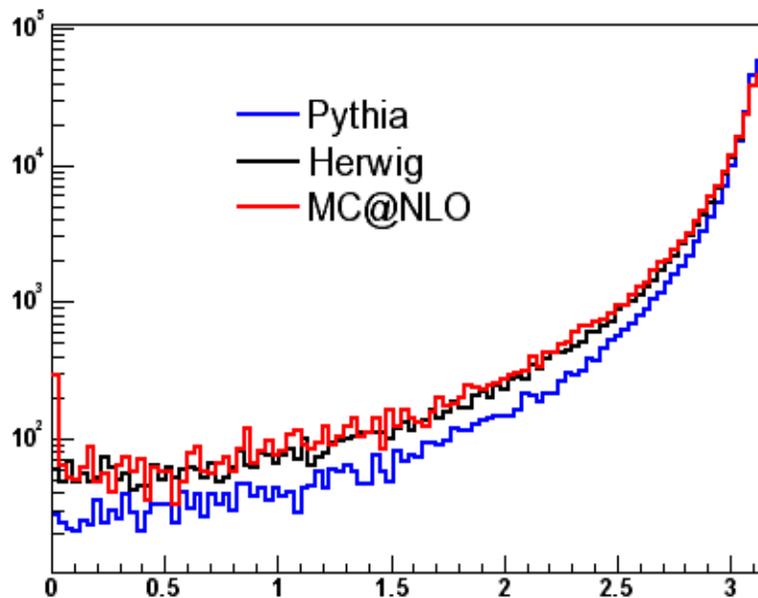
- ttbar as a systematic sample, but will be default MC soon.
- WW group: to study size of  $\geq 1$  jet contribution.

Additional Njet ( $E_t > 12 \text{ GeV}$ ,  $|\eta| < 3$ )

Gen: extra n jets ( $E_t > 12 \text{ GeV}$ ,  $|\eta| < 3$ )

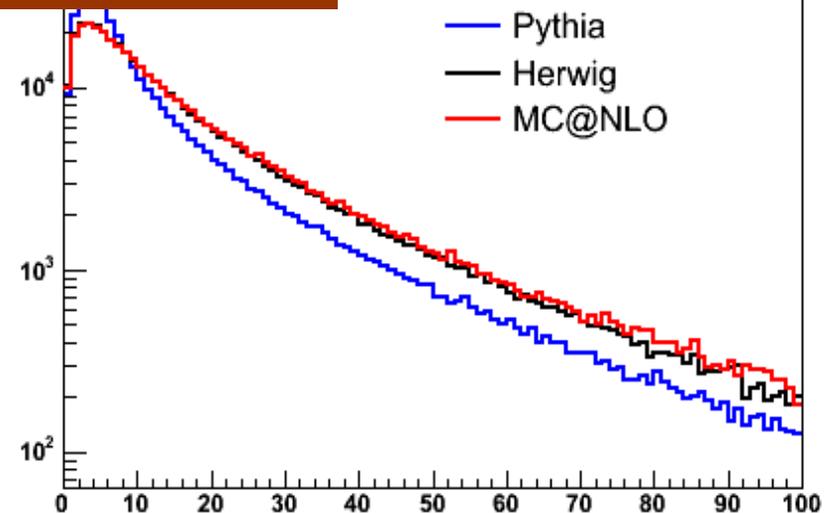


del(phi) between top and atop



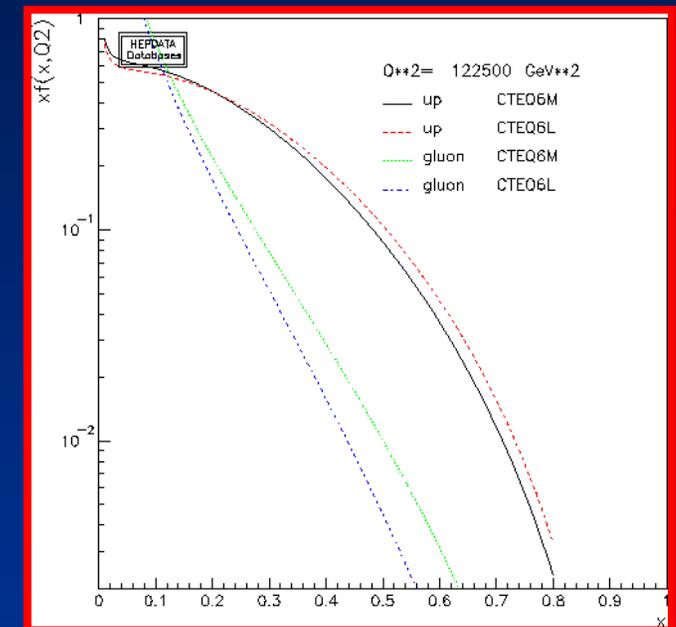
Pt (tt)

Gen: Pt(tt)



# Comparison of acceptance MC@NLO vs HERWIG?

Acceptance(%)	HERWIG (gg: 5.5%)	MC@NLO gg: 14.3%
Lepton(muon)	7.46	7.33
Lep-jet ( $\geq 3$ jet) (relative gg frac)	61.0 (5.7)	60.6 (14.5)
Lep-jet(3jet)	26.2 (4.6)	25.2 (11.4)
Lep-jet(4jet)	34.9 (6.5)	35.3 (16.7)



- gg channel has a higher acceptance in lepton+4jets.
- gg diagram produce more jets (larger acceptance)
- MC@NLO (no spin correlation)

# Current implementation and discussions

- MC@NLO: standalone package  
(works with Herwig 6.5)
  - B group: Take spectrum from MC@NLO, feed it to single particle MC (Bgenerator) to study acceptance, efficiency, any other usage?  
May want this for b-tagging too with full Herwig showering?
  - Top/EWK group: MC@NLO + Herwig shower  
(stdhep output -> HEPG file)
  - Negative weight: -1 is if  $E(p)-E(pbar)=0.01$  (ad hoc solution)
- It would be good to implement in standard ac++ framework (then straight forward to use CDF default setting, like underlying event etc)