

Studies of W +jets and Prompt Diphoton Production with the CDF Detector

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Introduction

We are succeed taking the data in CDF Run II experiment at Tevatron, Fermilab. U.S..

Used data is the integrated luminosity of $\sim 72 \text{ pb}^{-1}$ taken during the period of Mar.2002 and Jan.2003 with good data quality.

W+jets events --- Really QCD physics, which contains the multi-jets final state.

Also, lots of interests of many other analysis.

This is the first results for the W+jets studies of Run II.

Event Selection ($W \rightarrow e\nu$)

Luminosity : 72 pb^{-1} (Mar.2002 ~ Jan.2003)

Trigger Path : High Et Electron Trigger 18 GeV

Kinematical Cut : $E_t > 20 \text{ GeV}$, $P_t > 10 \text{ GeV}$

Geometric Cuts : $|\eta| < 1.1$ with good instrumented region

Identification Cuts : Had/EM etc.

W Selection Cuts : Missing $E_t > 30 \text{ GeV}$

W candidates : 31,726 events

Jet Selection : Cone jet algorithm (JETCLU),

$E_t > 15 \text{ GeV}$, $|\eta| < 2.4$, $R_c = 0.4$

MC Generator

Alpgen and GR@PPA (+ HERWIG) event generator was used to make the multi-jet final state.

no cut for lepton,

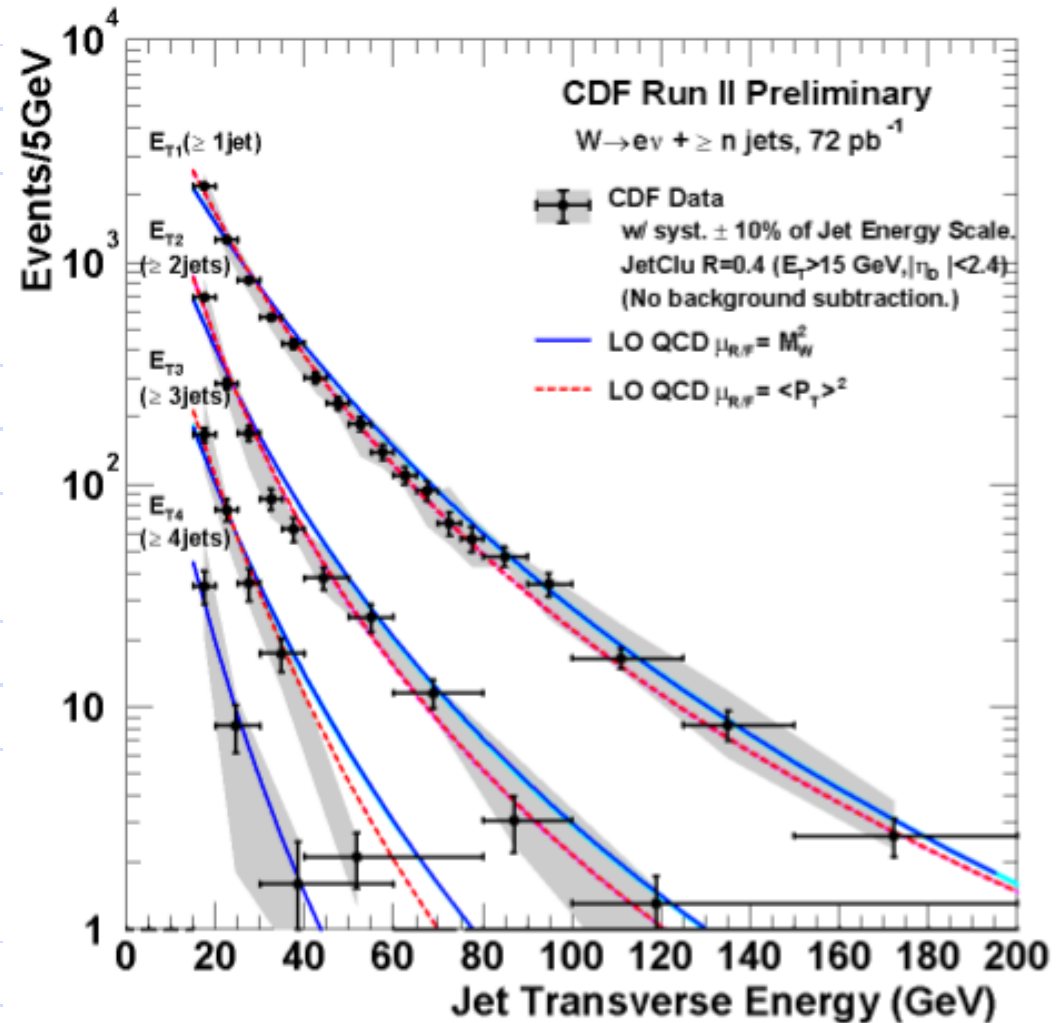
$P_t > 8 \text{ GeV}$, $|\eta| < 3.0$, $\Delta R > 0.4 \sim 0.8$ for parton

The separation angle, ΔR , between two partons is adjusted based on the the jet separation criteria.

Then, to suppress the kinematical cut dependence, the parton-jet matching is required.

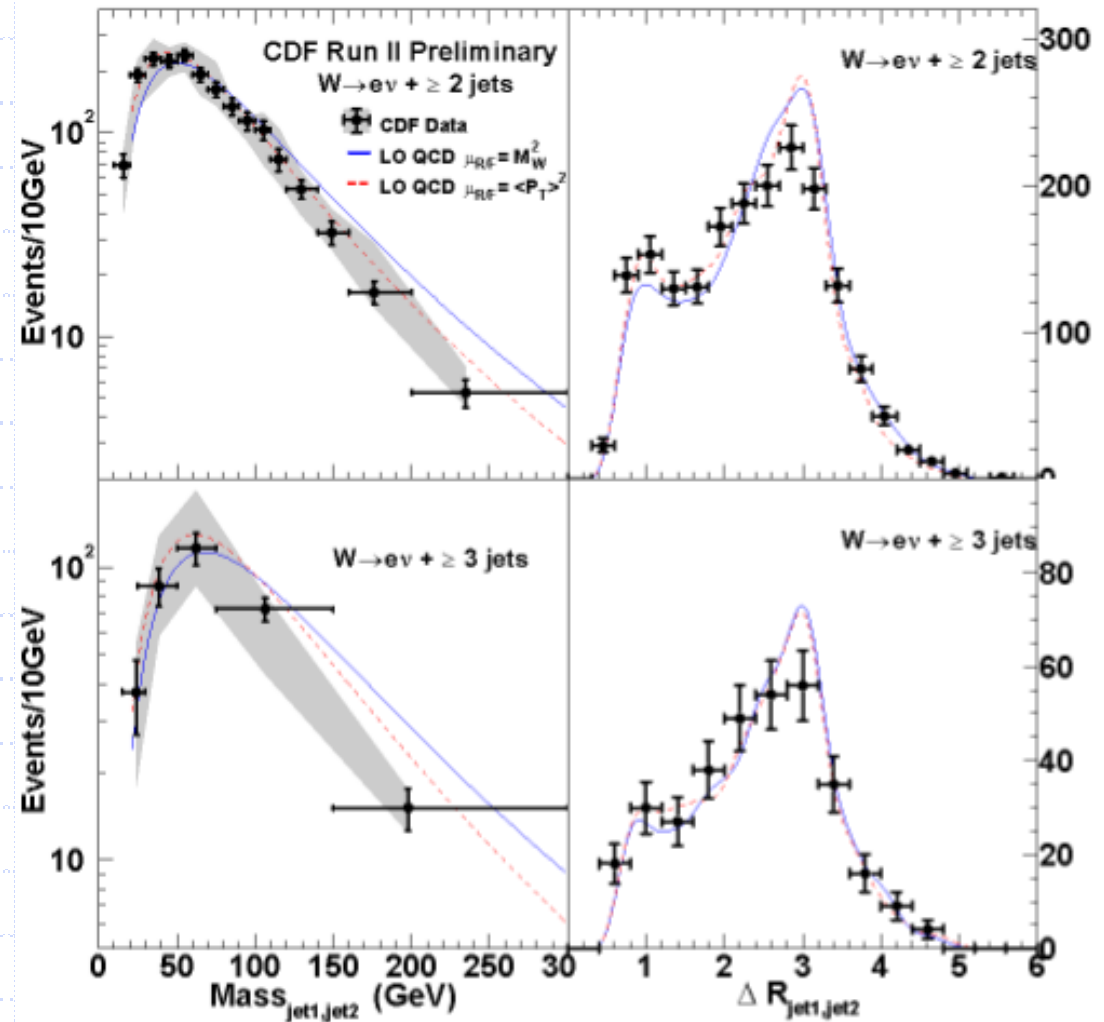
Jet Et Distribution

- JetClu, $R_c=0.4$
 $E_T > 15 \text{ GeV}, |\eta| < 2.4$
- Jet energy correction
 $\sim 10 \%$
- MC is normalized by Data.
- Two energy scales
 $\mu_{R/F} = M_W^2, \langle P_T \rangle^2$



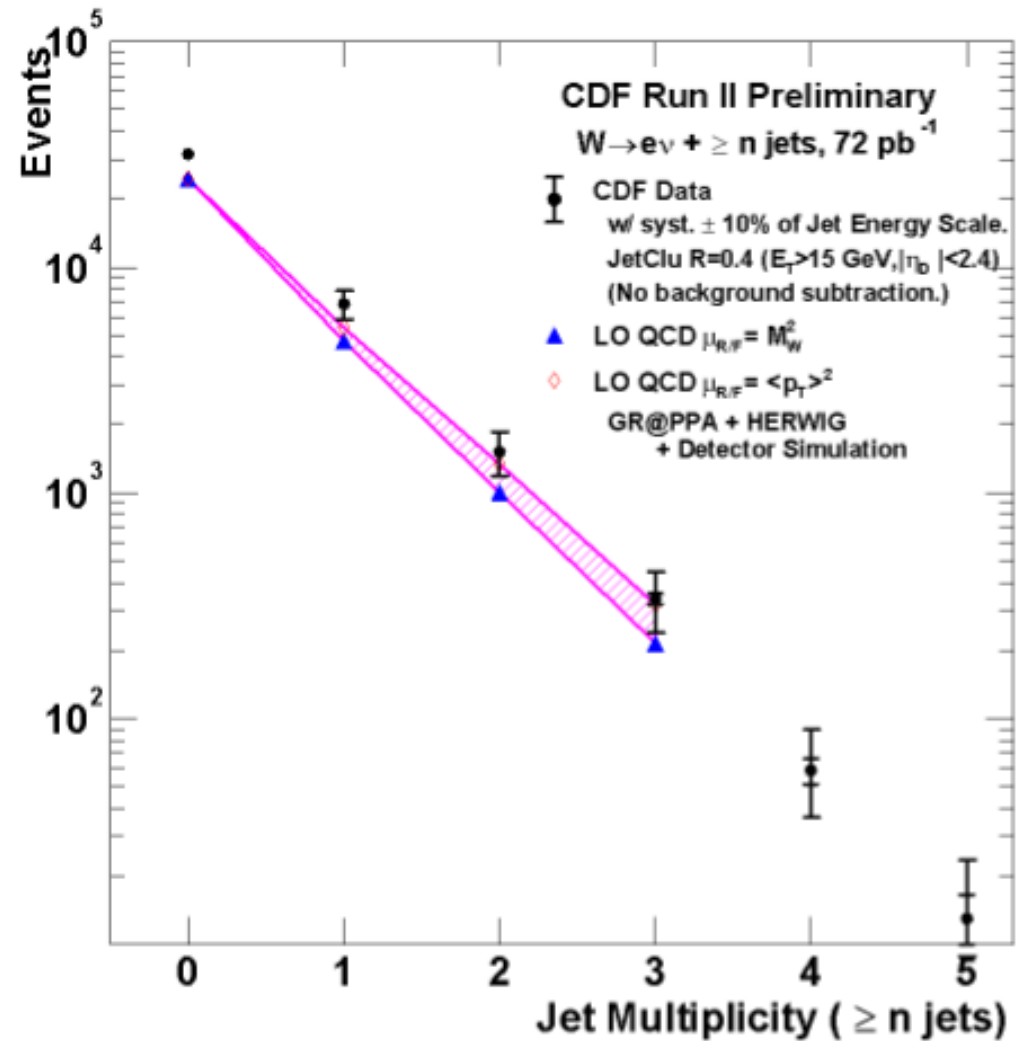
Invariant Mass and ΔR

- Leading and secondary jets mass and ΔR
- Sensitive variable to the higher order calc.
- $W + \geq 2$, and ≥ 3 jets

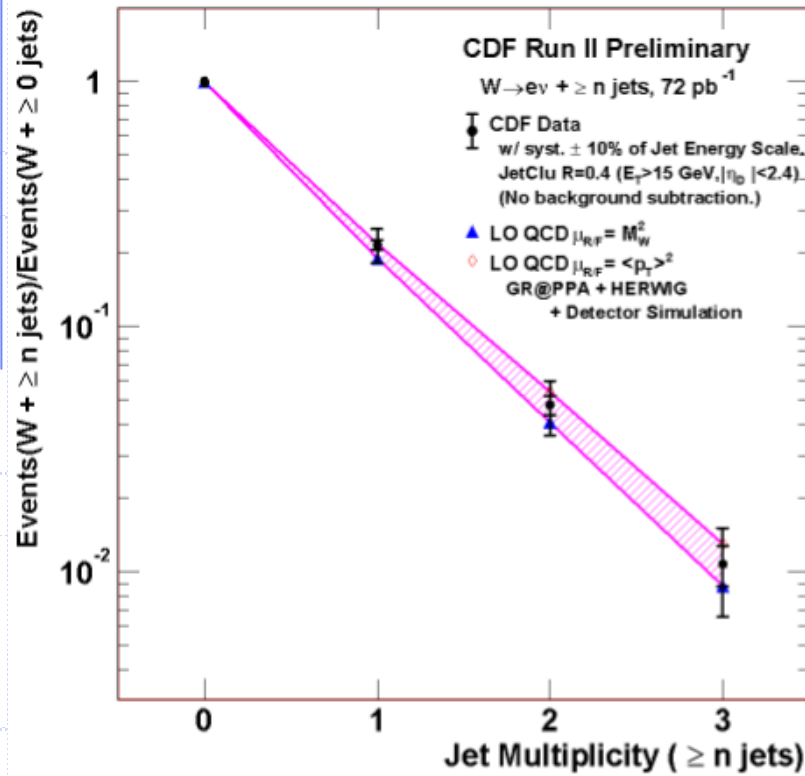


Jet Multiplicity

- ◆ Inclusive jet prod.
- ◆ Stat. + syst. on Data
- ◆ No bkg. subtraction, but negligible effect in ≤ 3 jets events.
- ◆ 1.3%, 4.4%, 4.7%, and 10.1% bkg. contribution in $W + 0,1,2,3$ jet bins.

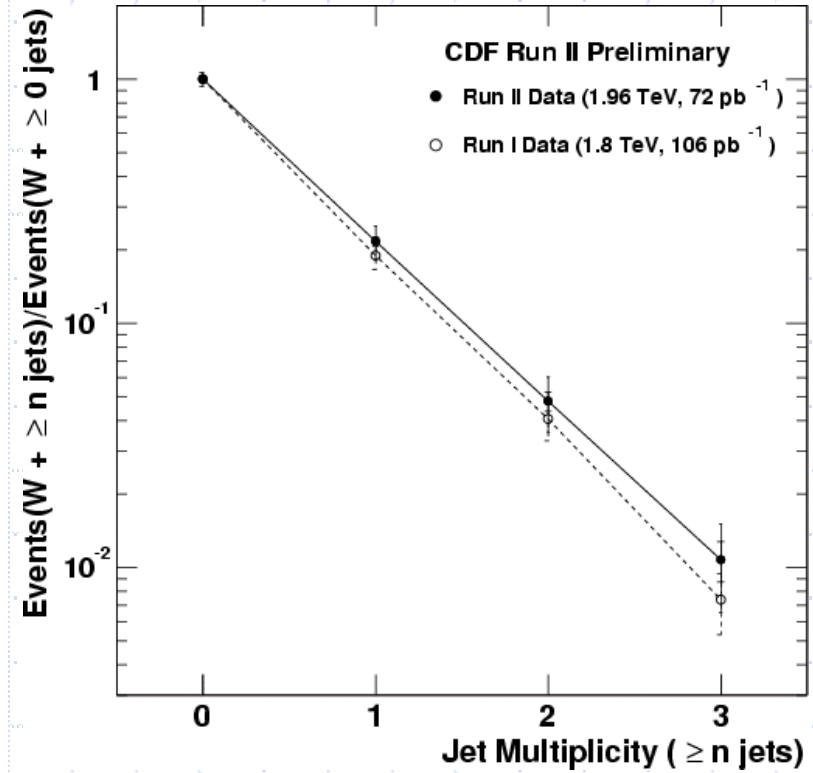


Fraction of jets



Very good agreement with data.

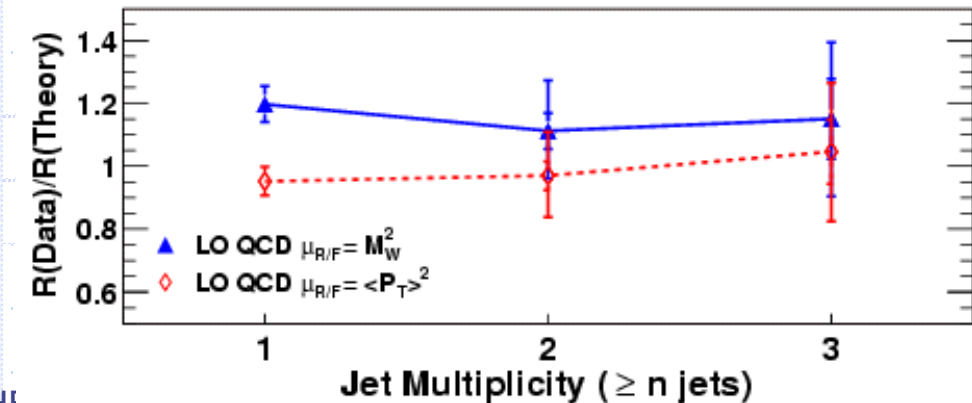
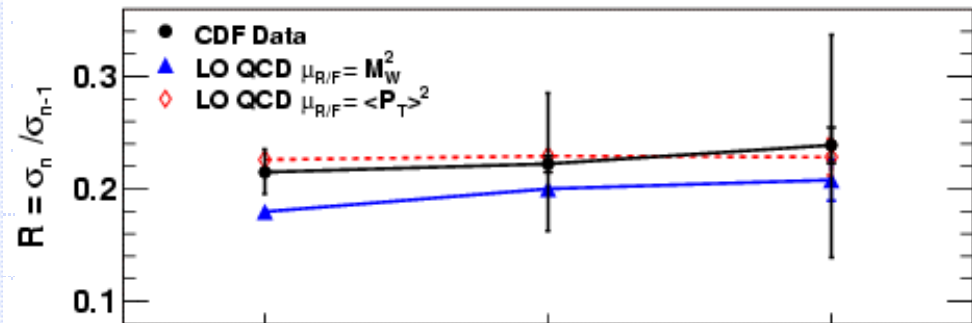
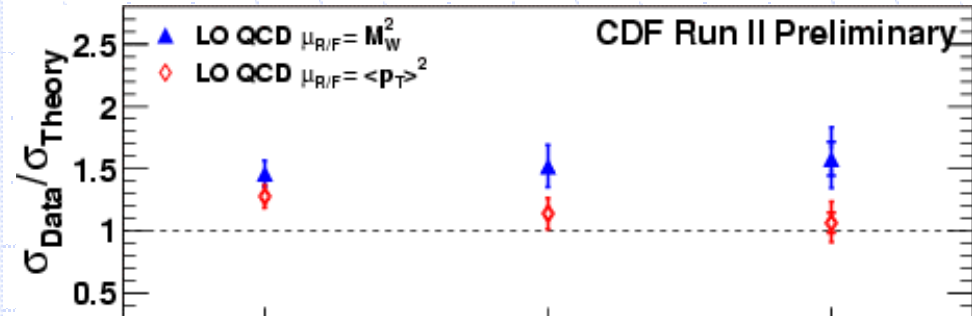
Run II v.s. Run I



Run II is larger fraction of jets.

Ratio of jet multiplicity

- ◆ Some of systematics are cancel out.
- ◆ Data/Theory \sim const.
 ~ 1.5 for $\mu_{R/F} = M_W^2$
 ~ 1.2 for $\mu_{R/F} = \langle P_T \rangle$
- ◆ $R_{n/(n-1)} = \sigma_n / \sigma_{n-1}$
- ◆ Important for α_s measurement.



Summary

The lowest order QCD prediction have been tested by a new data in Tevatron Run II experiment.

All the kinematical distributions are good agreement with data. Jet multiplicity is also compared with data. MC well describes the fraction of jets.

Prompt photon analysis is also important topics to understand the QCD phenomena, since that production mechanism is similar with the jet production mechanism.