Jets in the first DØ Run II data

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Jets

Jet is collection of towers within a given cone $R$
- calorimeter jet

Particle jet
- after hadronization
  - a spread of particles running roughly in the same direction as the parton

Jet is collection of parton jets and parton showers due to hard scattering and parton showers de-scrambled by pQCD

Jet pseudorapidity $\eta$ is related to the polar angle $\theta$
- $\eta = \log \tan (\theta/2)$

Jet azimuthal angle $\phi$
- $\eta = \sqrt{\phi^2 + \phi^2}$

Particle jet
- calorimeter
- main tool for jet measurement

Jets
basic jet distributions (like inclusive jet $p_T$ cross section or dijet mass cross section) are well described by pQCD

- RunI jet inclusive spectrum
- RunI dijet mass spectrum

Phys. Rev. D 64, 032003 (2001)
Higher $p_T$ jets in Run II

- Slightly higher CMS energy
- Slightly higher luminosity
- Expect $2\mathcal{L}_p^{-1}$ in Run II
- $10^9 \mathcal{L}_p^{-1}$ in Run II
- More than 4 times larger cross section
- More than 2 times larger $p_T$ jets
- Positively excited quarks, $Z'$, $W'$, $W'$ ex-
- Searches for new physics (quark com-
- Improves knowledge of proton structure
- Leave dimensions, $\ldots$
RunII upgrade

- Faster trigger and readout electronics
- Shorter time between bunch crossings (396 ns)
- Commissioned 100% only
- 50 bad channels out of 55000
- Good energy resolution
- RunII -- excellent performance
- \( \mathcal{E} / \mathcal{E}_0 \approx 1 \times 0.1 \) 
- Good segmentation (e/\( \sigma \))
- \( |\mathcal{E}| > |\mu| \) up to 4.2
- Uniform and hermetic

Calorimeter
January 2002

Jet selection efficiencies, 

no other correction factors applied (unsmearing, trigger efficiencies,

jet energy scale correction

Jet corrections

Current corrections

Jet selection criteria - based on EME, CHF, HOT, n90

jet on total energy deposited in calorimeter,

- cut on primary vertex position,

- cut on missing $E_T$,

- cut on event selection

Selection criteria

Region

all results are for jets with cone size $R = 0.7$ in the central calorimeter

$\mu > 0.5$ (unsmearing, trigger efficiencies, jet selection efficiencies,

DØ RunII data taken during February and March 2002

Data sample

Datasample

V

W X

W collisions

TeV, integrated luminosity $\int = 1.96 \text{ TeV}$, integrated luminosity is $\int = 1.96 \text{ pb}^{-1}$. 

V

V

V

V
Jet energy scale

- systematic error about 1.0% on jet energy
- preliminary jet energy scale correction
- calorimeter out of the jet cone
- loss due to showering the energy in the calorimeter
- measured from $E_T$ balance in $\gamma+\text{jet}$ events
- EM part calibrated on $Z\rightarrow \mu\mu$ mass peak
- additional $p\bar{p}$ interaction
- energy not associated with the hard interaction

\[ \frac{S_{\text{Jet}}}{O_{\text{Jet}}} = \frac{E_{\text{Jet}}}{E_{\text{Jet}}^\text{det}} \]

Detector level to the jet energy on the particle level

Correlation of the jet energy measured on the

Jet energy scale
Jettriggers

Trigger system is essential for measurement of rare processes that are simple and fast.

PC Linux farm

Software triggers

Hardware triggers

- multi lower triggers
- current coverage up to $|u| > 0.8$
- fast trigger readout
- triggering on calorimeter towers

Multi with rate 50 Hz
- able to write events to tape
- bunch crossing rate (2.5 MHz)

High luminosity means high control of too frequent processes
- allows to select the desired measurement of rare processes

Jet triggers

Joint acceptance

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$|u| > 0.5$

JT_LO9, $L = 0.0045 \text{ pb}^{-1}$

JT_LO15, $L = 0.034 \text{ pb}^{-1}$

JT_LO30, $L = 0.5 \text{ pb}^{-1}$

JT_MD_3CJT5, $L = 1.9 \text{ pb}^{-1}$

JT_HI_4CJT5, $L = 1.9 \text{ pb}^{-1}$
Results

Inclusive jet $p_T$ spectrum

Dijet mass spectrum

- only statistical errors
- integrated luminosity $\mathcal{L} = 1.9 \text{ pb}^{-1}$ (uncertainty about 10%)
- preliminary jet energy scale correction
  - 30-50% systematic error in cross section
- not fully corrected (unsmearing, selection cuts efficiencies, trigger efficiencies, …)
Summary

Preliminary results on jet inclusive spectrum (60 GeV ± 360 GeV) measured in the first DØ Run II data were presented:
- dijet mass spectrum (150 GeV > Mjj > 650 GeV)
- jet inclusive spectrum (60 GeV > pTj > 360 GeV)

Looking forward to more data.

- Run II jet measurements are well underway.
- DØ detector operates properly after the upgrade.
- Although not fully corrected (and hence not comparable to theory), they show that jet measurements are well underway.
- New jet measurements are presented:
  - dijet mass spectrum (150 GeV > Mjj > 650 GeV)
  - jet inclusive spectrum (60 GeV > pTj > 360 GeV)

Running forward to more data.

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