CONF-960812--41

Fermi National Accelerator Laboratory

FNAL/C--96/304-E(1)

September 1996

Presented at *1996 Annual Divisional Meeting (DPF 96) of the Division of Particles and Fields of the American Physical Society*, Minneapolis, Minnesota, August 10-15, 1996.

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Operated by Universities Research Association Inc. under Contract No. DE-AC02-76CHO3000 with the United States Department of Energy

FNAL/C--96/304-E(1)

THE INCLUSIVE JET CROSS SECTION AT $\sqrt{s} = 630$ GeV AT DØ

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We present a preliminary measurement of the cross section for central ($|\eta| \leq 0.5$) inclusive jet production at $\sqrt{s} = 630$ GeV using $\sim 400nb^{-1}$ of data collected during the December 1995 Fermilab collider run at DØ. These results are compared to NLO QCD predictions.

1 Introduction

The inclusive jet cross section $\sigma(\bar{p}p) -> Jet + x$ as a function of jet transverse energy has been measured at $\sqrt{s} = 630$ GeV [1] and comparisons were made to leading order QCD predictions. Next–to–leading order (NLO) predictions which are available now reduce the theoretical uncertainties to less than 20% over the available transverse energy range and have been found to be in good agreement with the inclusive jet cross section measured by DØ at $\sqrt{s} = 1800$ GeV [2,3]. Comparison of NLO QCD predictions with jet production at a lower center–of–mass energy can lead to a better understanding of QCD.

2 Jet Detection and Reconstruction

Data were recorded with the DØ detector [4], using triggers requiring localized energy depositions in the calorimeter. Several triggers were used to select jets in various transverse energy ranges.

Jets were reconstructed using a cone algorithm with a cone radius of 0.7 in $\eta - \phi$ space [5]. To remove contamination from electromagnetic objects, cosmic rays, and detector effects, a series of quality cuts were imposed. These included shower shape cuts and a cut on the ratio of the missing transverse energy to the E_T of the leading jet in each event. These cuts were found to be more than 92% efficient in the central region and rejected 95% of all backgrounds.

The transverse energy of each jet was corrected for effects due to the underlying event, detector noise, hadronic energy response, and out-of-cone showering. The corrections applied were typically 20% in the region of interest. The jet transverse energy spectrum obtained after the energy scale correction was then corrected for the distortion due to the finite jet energy resolution ("unsmearing"). The method is described in ref. 5.

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3 Results

The $\sqrt{s}$ = 630 GeV inclusive jet cross section was compared to several NLO predictions. The theoretical predictions were generated with JETRAD [3]. The predictions were compared with each other to determine the variation due to different choices of renormalization scales and parton distribution functions. These variations were found to be less than 20% in general.

In Figure 1 we present the resolution–corrected data, the ansatz ("physics curve" used in unsmearing the data), and the CTEQ2ML parton distribution function and renormalization $\mu = E_T/2$ of the leading jet. Also shown is the fractional difference between data and the NLO QCD prediction. There is an additional 13% normalization uncertainty due to luminosity that is not included in the error band. The primary sources of uncertainty in the band are due to the energy scale correction and the unsmearing procedure. The unsmearing correction contribution becomes significant below 55 GeV. The nominal points of the preliminary inclusive jet cross section vs. E_t show shape agreement at a 10% level with NLO QCD predictions for $\sqrt{s}$=630 GeV. The points fell between 20 to 40% lower than the prediction.

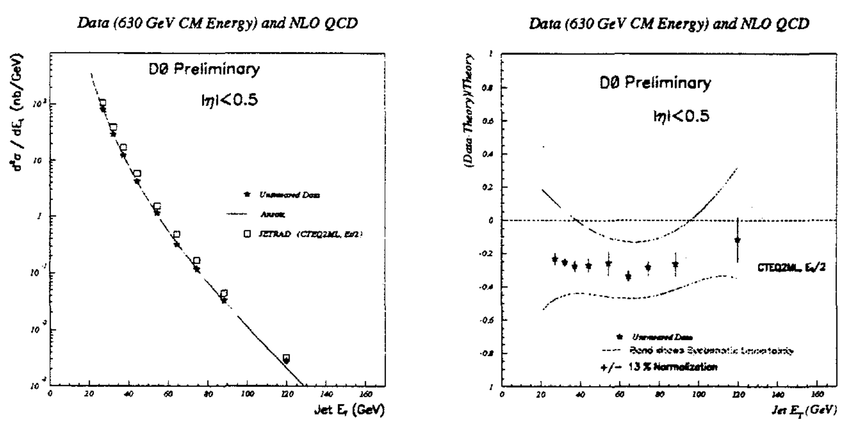

Figure 1: (Left) Inclusive jet cross section shown with JETRAD prediction using CTEQ2ML parton distribution function and renormalization scale of one-half the Et of the leading jet. (Right) Fractional difference of data and the NLO QCD prediction. Most systematic uncertainties are shown in the band, but an additional 13% normalization uncertainty due to luminosity is not shown.

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4 Conclusion

We have presented a preliminary inclusive jet cross section at $\sqrt{s} = 630$ GeV and made a comparison to NLO QCD predictions. Once systematic studies have been completed for the $\sqrt{s} = 630$ GeV analysis, the data set will be compared to that collected at $\sqrt{s} = 1800$ GeV. In the ratio we expect a significant reduction in systematic errors and a precise measurement of jet X_t scaling.

Acknowledgments

We thank the staffs at Fermilab and the collaborating institutions for their contributions to the success of this work, and acknowledge support from the Department of Energy and National Science Foundation (U.S.A.), Commissariat à L'Energie Atomique (France), Ministries for Atomic Energy and Science and Technology Policy (Russia), CNPq (Brazil), Departments of Atomic Energy and Science and Education (India), Colciencias (Colombia), CONACyT (Mexico), Ministry of Education and KOSEF (Korea), CONICET and UBACyT (Argentina), and the A.P. Sloan Foundation.

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