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DIJET PRODUCTION IN HADRON COLLISIONS AT FERMILAB†

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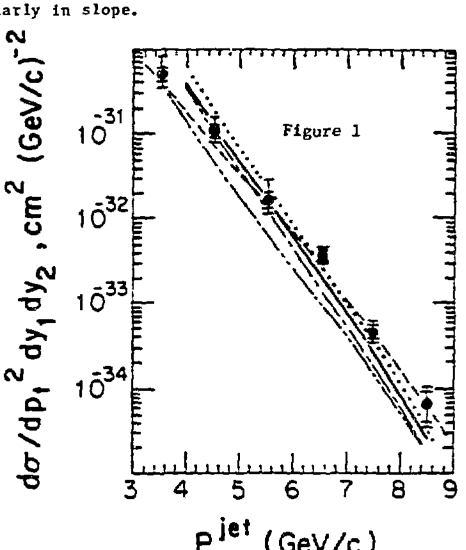
Introduction - We have studied dijet final states produced in hard hadron collisions at Fermilab using the E-609 calorimetric detector. This calorimeter has 132 towers of four layers each, in a projective geometry. In order to measure dijet cross sections at Fermilab energies, it is necessary to accurately evaluate backgrounds from non-jet particles. For this purpose, we have used a model-independent background analysis method as well as comparisons with 4-jet Monte Carlo models.

The results given here used a trigger we called the two-high, requiring that any two calorimeter towers each collect more than 1.3 GeV of transverse energy. In the offline analysis, a jet-finding algorithm with a cone half-angle of 55° was used. The value of p_T was taken as the average of the two highest p_T jets found in each event. Extensive Monte Carlo studies were made of backgrounds, trigger efficiency, and resolution effects.

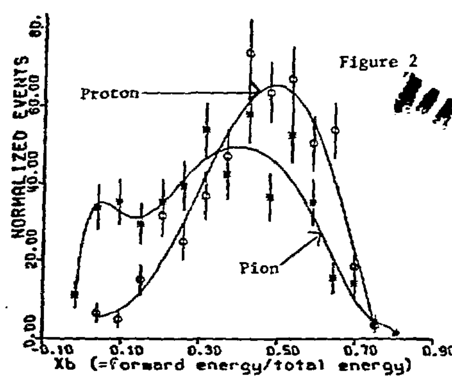
$pp \to$ Dijets at 400 GeV - The measured invariant cross section as a function of p_T is shown in Fig. 1. The mean c.m. angle is 80°, and there is a ± 7% systematic uncertainty in the p_T scale. Background is small above 6 GeV/c. The curves show QCD model predictions using various structure function assumptions. Agreement with the QCD model curves is good, particularly in slope.



Search for Higher-Twist Process - Using dijet events produced in $\pi^- p$, $\pi^+ p$ and pp collisions at 200 GeV, we have made a detailed search for the higher-twist process proposed by Berger and Brodsky[1]. In this process, the entire energy at the incident pion goes into dijet production, leaving an event with no forward beam jet and satisfying two-body kinematics.

Two initial requirements were imposed: that the c.m. angle of both jets be greater than 40°, and that the average jet p_T be greater than 3 GeV/c. An examination of the forward energy flow was then made. Higher-twist events should have little or no forward energy and are expected mainly in the pion induced events, allowing the proton induced dijets to be used as a background sample. A variable X_B was defined as the ratio of the forward energy flow ($\theta_{c.m.} < 30°$) to the total energy. The distribution of this variable was studied as a function of the planarity. For non-jetty events (with planarity < 0.5), there was little difference in the πp and pp X_B distributions.

For larger planarity, the X_B distributions were found to differ. Figure 2 shows the X_B distribution for events with planarity > 0.95. The curves are only to guide the eye. There are 75 events at low X_B for pions compared to 3 events for the proton sample. When these events are examined it is found that they balance transverse momentum momentum well and do have most of the beam energy in the dijets. Further analysis is being carried out to investigate whether such events might also arise from triggering on fluctuations in beam jets or from differences in the structure functions of pions and protons.



1) E. L. Berger and S. J. Brodsky, Phys. Rev. D24, 2428 (1981).

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