Measurement of the Absolute Drell-Yan Dimuon Cross Sections in 800 GeV/c pp and pd Collisions

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The Fermilab E866/NuSea Collaboration has measured the cross sections for Drell-Yan dimuon production in 800 GeV/c pp and pd collisions. Doubly-differential cross sections, $M^3\, d^2\sigma/dM\,dx_F$, and triply-differential cross sections, $E\, d^3\sigma/dp^3$, have been determined over broad ranges of dimuon effective mass and Feynman-x. The results are sensitive to the magnitude of the antiquark sea in the nucleon, and they also have some sensitivity to the gluon composition of the nucleon at large Bjorken-x [1]. These data represent the first extensive measurements of doubly-differential Drell-Yan cross sections in pp collisions, and the most precise Drell-Yan cross section measurements to date in pd collisions.

E866 measured Drell-Yan muon pair production in proton-induced collisions on liquid hydrogen and liquid deuterium targets using the Meson East spectrometer at Fermilab. Data were taken with three different spectrometer settings to enhance the acceptance for low, intermediate and high mass muon pairs. Experimental details can be found in Ref. [2], which describes an analysis of the cross section ratios $\sigma^{pd}/2\sigma^{pp}$ to determine the $\bar{d}/\bar{u}$ ratio in the proton as a function of Bjorken-x.

The event selection is different in this analysis from that in [2] in order to retain only those events for which the *absolute* acceptance of the spectrometer can be determined reliably. Also, several improvements have been made to the event reconstruction and Monte Carlo, resulting in a better match between the real and simulated events, and a detailed study has been performed of the overall and point-to-point systematic uncertainties in the extracted cross sections. Approximately 61K pp and 149K pd Drell-Yan events over the longitudinal momentum range $-0.05 < x_F < 0.8$ and the mass ranges $4.2 < M_{\mu^+\mu^-} < 8.7$ GeV/c^2 and $10.85 < M_{\mu^+\mu^-} < 16.85$ GeV/c^2 are included. The data analysis will be described, and the results will be compared to previous measurements by E605 [3] and E772 [4] and to predictions based upon next-to-leading-order calculations utilizing the MRST2001 [1] and CTEQ6 [5] global parton distribution function fits.

References

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