Observation of Scaling in the Ratio of Electroproduction Yields of Three Meson-Baryon Final States: $K^+\Lambda$, $n\pi^+$, $p\pi^0$

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Abstract

We measured the ratios of the electroproduction cross-sections for three exclusive meson-baryon final states: $K^+\Lambda$, $p\pi^0$, and $n\pi^+$ from 1.7 GeV up to 2.4 GeV in center-of-mass energy, W. We averaged the 4-fold differential cross-sections over $\phi*$, the angle between the leptonic and the hadronic production plane, and corrected for two-body phase-space to produce the ratios as a function of the three remaining independent kinematic variables: Q^2, W and $\cos\theta^*$. We observe only a moderate kinematic dependence ("scaling") of the ratios. Averaged over all bins, our result for the $K^+\Lambda\ /n\pi^+$ ratio is $0.278 \pm 0.013 \pm 0.042$. This is the first reported result for an exclusive channel in which only one $q\overline{q}$ pair is created. This is important because we know that only a single $q\overline{q}$ pair is produced, and also because we can do an explict two-body phase-space correction. Our result is consistent with the nominal value of the "strangeness suppression factor" of the Lund model of ≈ 0.3, measured in many semi-inclusive production reactions up to center-of-mass energies equal to the Z^0 mass. Likewise, our measurement of the $p\pi^0\ /n\pi^+$ ratio of $0.467 \pm 0.008 \pm 0.086$ is consistent with equality of the $u\overline{u}$ and $d\overline{d}$ pair creation probabilities in exclusive production.