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HARD QUARK-QUARK SCATTERING WITH EXCLUSIVE REACTIONS*

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We have begun a program designed to study hard quark-quark scattering with exclusive reactions, focusing on quasi-elastic two-body reactions with all possible quark flavor exchanges. Examples are $\pi^+p \to \pi^-\pi$, p^-p, $\pi^+\Lambda$, $K^+\Sigma^-$, or $K\Lambda$. Of the two body exclusives, only elastic scattering had been measured at such large t previous to our experiment. By comparing the relative importance of different final states, the energy dependence of the production ratios of these states, the prominence of resonances such as ρ^- over background in this region, and measuring polarizations where accessible, we have collected a large body of data on hard scattering in a completely new domain. Previously, essentially all short distance QCD tests have been for inclusive processes.

We have taken data with both negative and positive incident beam at 10 GeV/c on a hydrogen target and will present the first results, for $\pi^-p \to \pi^-p$ and p^-p at $\theta_{cm} = 90°$, $-t = 9$ GeV^2/c^2. The apparatus consists of a magnetic spectrometer, with Cerenkov particle identification, which selects stable charged particles (protons in this case) at high momentum near 90° in the center-of-mass. A large aperture array of PWCs observes the recoil particle or charged decay products. Cross sections are extremely low, approximately 2 nb/(GeV/c)^2 for elastic scattering. We will report on a sample of more than 1000 π^-p elastic events, and on p^-p, where the p^- decay distribution was observed.

We find a surprisingly large p^-p cross section in this large momentum transfer region, with p^-p about half the elastic cross section, and a striking spin alignment.

Further details may be found in the Proceedings of the 6th International Symposium on High Energy Spin Physics held at Marseille, France, September 12-19, 1984, presented by G. Bunce.

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