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BACKWARD K^-p ELASTIC SCATTERING AND $0° \Sigma^-\pi^+$ PRODUCTION

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ABSTRACT

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ABSTRACT

A high precision measurement of the momentum dependence of backward K^-p elastic scattering from 476 to 1077 MeV/c incident momentum has been performed at the Brookhaven National Laboratory Alternating Gradient Synchrotron. With the same apparatus we have also measured the 0° production of pions in the reaction $K^-p \rightarrow \Sigma^-\pi^+$.

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INTRODUCTION

The forward and backward angular distributions decomposed into partial waves are particularly simple since the Legendre polynomials are either ±1, and the spin-flip amplitude is absent. The forward elastic cross section is well determined through the total cross section using the optical theorem and dispersion relations.(1) The backward elastic cross section has been found by bubble chamber experiments(2) to quite small, generally an order of magnitude smaller than the forward cross section. This is easily understood; the many absorption channels present make the amplitudes largely imaginary so that even and odd parity states cancel in their contributions to backward scattering. For this reason a small resonant amplitude will be expected to reveal itself most prominently in the backward direction. If a resonance has too small an elasticity to be seen in the elastic channel, but has a large branching fraction into $\Sigma\pi$ then it should be observed at 0° in this reaction.

METHOD

The apparatus to measure the momentum spectra of particles at 0° is shown in Fig. 1. The K^- beam is focused on an 8" liquid hydrogen target, with suitable counters in front of the target to define the beam and identify

METHOD (continued)

those particles which are K mesons. Immediately following the target is a bending magnet whose purpose is to sweep away the unscattered beam and most of the unwanted particles at 0°. This is immediately followed by a pair of quadrupoles capable of capturing approximately 10 msr. of solid angle in the forward direction and another bending magnet to yield a high dispersion at the image of the target 2 meters beyond the magnet. A thin counter (P) directly in front of the first quadrupole defines the solid angle acceptance and a counter hodoscope (H) at the focus counts the desired particles and measures the spectrum of particles of nearby momenta. Time-of-flight between the beam counter (M) and the timing counter (T) 8 meters from the target serve to further define the particles of interest.

Runs were made at all momenta with the target full and empty and a subtraction performed. A small background from other reactions was also subtracted.

RESULTS

Figures 2 and 3 show preliminary results for both reactions together with the predictions of two recent phase shift analyses.[3] In both reactions the results agree well with the predictions. We find no evidence for the narrow structures between 500 and 600 MeV/c reported by Carroll et al.[4]

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FIGURE CAPTIONS

1. Experimental Apparatus
2. Differential Cross-section for $K^-p \rightarrow K^-p$ at 180°
3. Differential Cross-section for $K^-p \rightarrow \Sigma^-\pi^+$ at 0°

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