MEASUREMENT OF PRODUCTION POLARIZATION AND MAGNETIC MOMENT OF Ξ^- HYPERON

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The production polarization and magnetic moment of Ξ^- hyperons produced in the inclusive reaction p(400 GeV/c) + Cu→Ξ^- + X have been determined from data collected in experiment E715 at Fermilab. The main goal of the E715 experiment was to study the beta decay of polarized hyperons.

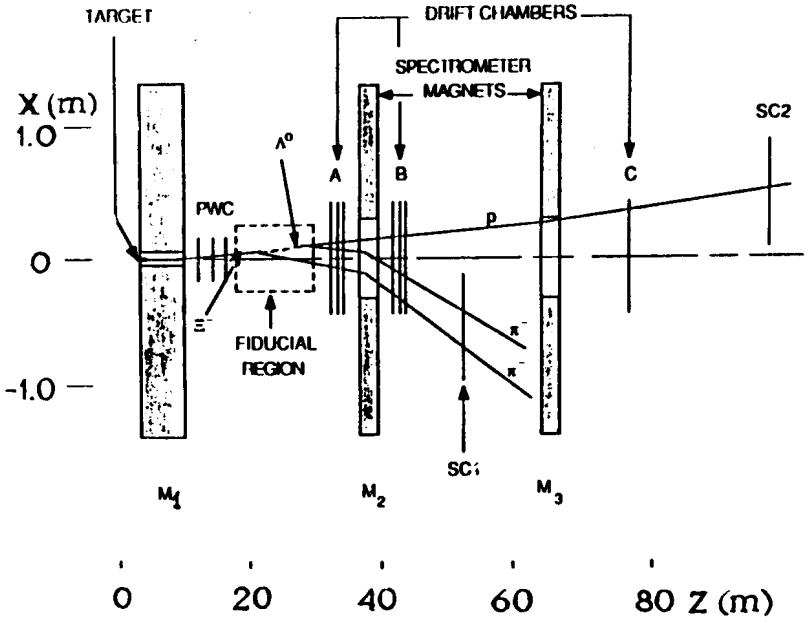

Fig. 1. Experimental apparatus

The E715 apparatus is described in detail in ref. [1] together with the Σ^- beta decay results. In addition, the hyperon beam contained a 0.5% admixture of Ξ^-, so it was possible to collect (parallel with the main experiment) 89 K of Ξ^- events containing the decay chain $\Xi^-\to\Lambda^0+\pi^-$ followed by $\Lambda^0\to p+\pi^-$ within the fiducial region (fig. 1). The average momentum of the Ξ^- beam was 250 GeV/c, and the targeting angle could be fixed at ± 3 mrad in the vertical or in the horizontal planes. Magnet M_1 had a length of 7.3 m and it provided a vertical magnetic field with a field integral of 17.6 T · m. The Ξ^- events were selected by reconstructing Λ^0 and Ξ^- masses (fig. 2). The Ξ^- polarization was determined from the horizontal targeting data by measuring the vertical direction asymmetry in the Ξ^- and Λ^0 decays:

$$P_{\Xi^-} = -0.070 \pm 0.008 \pm 0.010 \text{ at } p_t = 0.63 \text{ GeV/c}.$$

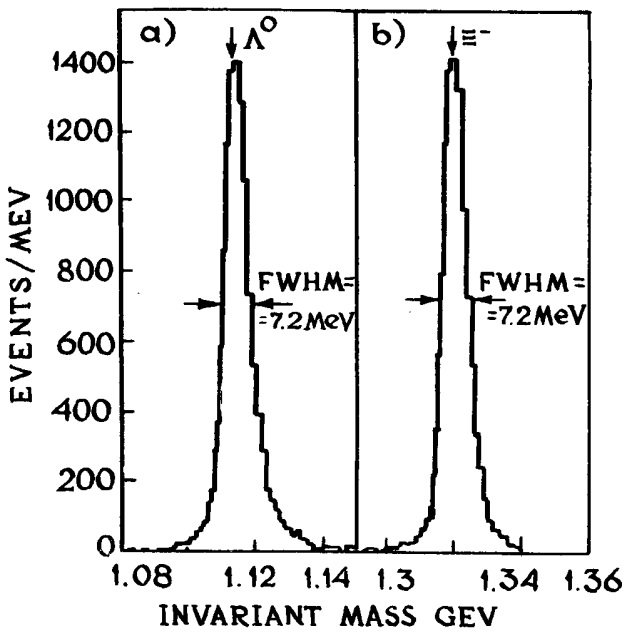

Fig. 2. Invariant mass spectra: a) Based on the hypothesis that positive and negative downstream tracks are proton and π^-, respectivelly. Peak is centered on Λ^0 mass indicated by vertical arrow. b) Based on the hypothesis that decay products of beam particles are Λ^0 and π^-. Peak is centered on Ξ^- mass

The Ξ^- magnetic moment was determined from the precession of polarization using the vertical targeting data:

$$\mu_{\Xi^-} = (-0.661 \pm 0.036 \pm 0.036)\ \mu_N .$$

The results are published [2].

REFERENCES

1. E715 collaboration. Phys. Rev. D. 1988. 38. 2056.
2. E715 collaboration. Fermilab-Pub-89/145-E; Phys. Rev. D. to be published.