ANALYZING POWER MEASUREMENTS IN HIGH-$P_\perp^2$ p-p ELASTIC SCATTERING*

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ABSTRACT

The analyzing power in 28 GeV/c proton-proton elastic scattering was measured at $P_\perp^2 = 5.95$ and 6.56 $(GeV/c)^2$ using a polarized proton target and an unpolarized proton beam at the Brookhaven National Laboratory AGS. Results indicate that the analyzing power, A, is rising sharply with $P_\perp^2$.

Previous measurements[1] of the analyzing power, A, in p + p → p + p suggested a rise in A at large-$P_\perp^2$, but the statistical uncertainty in the highest point at $P_\perp^2 = 5.95$ $(GeV/c)^2$ made it impossible to determine the magnitude of the increase. In an effort to clarify this situation, we made new measurements of A at $P_\perp^2 =$ 5.95 and 6.56 $(GeV/c)^2$.

An unpolarized beam of typically 5×10^{10} 28 GeV/c protons from the AGS at Brookhaven National Laboratory was incident upon the University of Michigan polarized proton target. This target contains irradiated ammonia beads cooled to 0.5° K by a ^3He-^4He evaporation refrigerator, in a 2.5 T magnetic field. The polarizing transitions are driven by a 70 GHz microwave system. The polarization of the hydrogen protons is measured with a 107 MHz NMR system, and is typically P_T = 45% with beam and 60% without beam.

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Elastic proton events were detected in the double-arm forward-backward spectrometer shown in Fig. 1 consisting of six magnets and six scintillation counter hodoscopes with a $P_{\perp}^2$ acceptance of about 1 $(GeV/c)^2$.

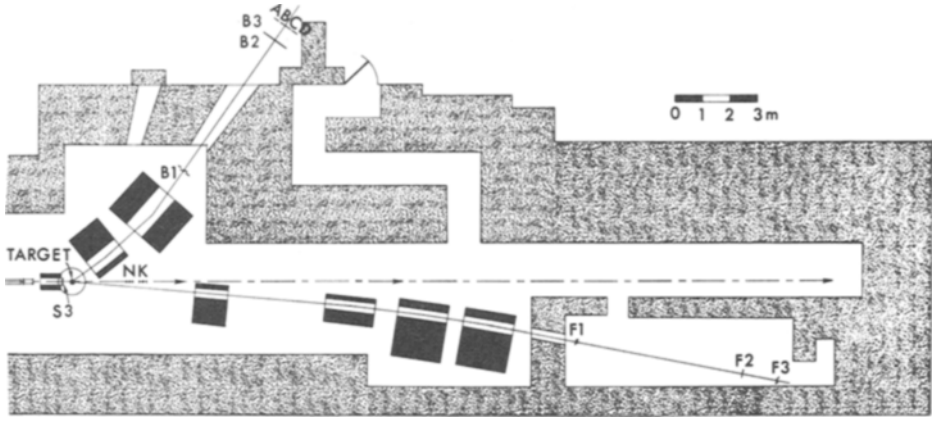

Fig. 1. Double-arm forward-backward spectrometer.

The analyzing power for these measurements is obtained, following the Basel convention, from

$$A = -\frac{1}{P_T}\frac{N(\uparrow) - N(\downarrow)}{N(\uparrow) + N(\downarrow)}$$

where $N(\uparrow)$ and $N(\downarrow)$ are the numbers of events with the target polarization up and down, respectively. The new values for A are:

$P_{\perp}^2$ $[(GeV/c)^2]$	A [%]
5.95	16 ± 5.7
6.56	51 ± 17

The point at $P_{\perp}^2 = 5.95$ $(GeV/c)^2$ includes our earlier data.[2] These points are plotted in Fig. 2 along with earlier data from the AGS[1,2] and CERN.[3] Notice the sharp increase in A near $P_{\perp}^2 = 6$ $(GeV/c)^2$, which was totally unexpected.

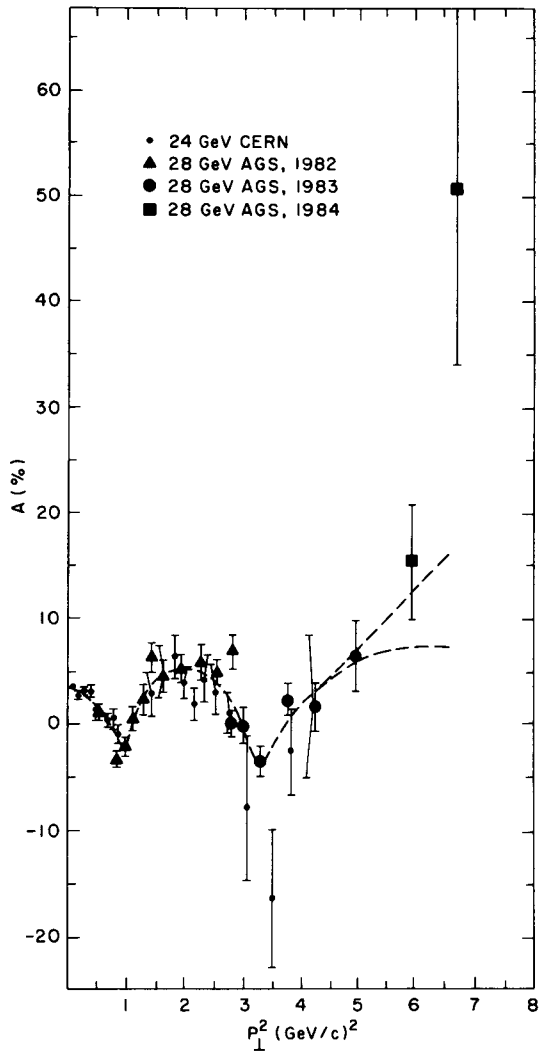

Fig. 2. Analyzing power for proton-proton elastic scattering as a function of $P_{\perp}^{2}$.

REFERENCES

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