A CALIBRATION OF THE K600 FPP FROM 120 TO 200 MeV

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Experiment E367 measured $D_{NN'}$ for p+p elastic scattering at an incident beam energy of 200 MeV from 5°–38°.[1] Over this angular range, the energy of the protons incident on the carbon analyzer of the focal plane polarimeter, FPP, ranged from ~ 200 MeV down to 120 MeV. Hence, a calibration of the effective analyzing power of the FPP, A_{FPP}, extending down to about 120 MeV was needed.

The calibration methods employed for the K600 FPP have been described in a previous report.[2] In brief, by elastically scattering protons from a 0^+ target, and then choosing the scattering angle of the reaction such that the analyzing power, A_y, is either 0 or close to 1, the value of the polarization incident on the analyzer is determined. Doing calibration measurements at both A_y=0 and $A_y \approx 1$ results in information about possible systematic errors.

The thickness of the carbon analyzer used is a compromise between maximizing the efficiency of the reaction and minimizing the total energy lost within the analyzer. Thus, the optimal thickness is necessarily energy dependent, and in our calibration, thicknesses of 2″, 1″, and 1/2″ were used.

The calibration data were taken in two running periods, one in February, 1993 and the other in August, 1993. During each run, the incident beam energy (T_p) was varied and usually several scattering angles (θ_{lab}), or equivalently A_y values, were studied. In most cases, more than one thickness of carbon analyzer (t_C) was used. The values of these parameters for all of our runs are summarized in Table 1.

The calibration data were replayed with the intent of minimizing as many systematic errors as possible. The angle cuts on the FPP scattering angle are set from 6°–23°. The 6° lower limit is slightly larger than that used in previous calibrations in order to eliminate inclusion of the multiple scattering peak at all energies. Gates are consistently placed on the FPP ΔE and E spectra for the calibration by means of an algorithm that is also used to make these same cuts on the $D_{NN'}$ data. A 6-mm thick scintillator, S3, exists just upstream of the carbon analyzer block. To avoid including different contributions from S3 for different analyzer thicknesses, we decided to include all of S3 in our scattering vertex cuts. This results in an effective analyzer consisting of S3 plus the carbon block.

Results for the first part of our calibration are shown in Fig. 1. Energy values are assigned to each point as the average of the energy incident on the polarimeter and the energy remaining after passing through the carbon analyzer. This allows all points to be plotted on the same curve, regardless of the analyzer thicknesses used at the points. Hence, for protons of the same energy incident on the carbon analyzer, calibration points assigned to significantly different energies resulted by varying the analyzer thickness. The curve plotted against the data is a quadratic fit with a χ^2_ν= 0.68. Analysis of the second part of the calibration data is underway.

Running Period	T_p (MeV)	θ_{lab} (deg)	A_y	t_C (inches)
I	198	16.1	1	2
I&II	198	24.6	0	2
I	177	26.5	0	2
II	174	18.8	1	2
II	174	27.1	0	2
II	174	18.8	1	1
II	174	27.1	0	1
I	148	21.5	1	2
I	148	21.5	1	1
I	148	32.3	0	1
II	127	25.6	$\sim .7$	1
II	127	46.7	$\sim .9$	1
II	127	58.6	0	1
II	127	25.6	$\sim .7$	$\frac{1}{2}$
II	127	46.7	$\sim .9$	$\frac{1}{2}$
I	118	25.6	$\sim .7$	1
I	118	46.7	$\sim .9$	1
I	118	58.5	0	1
I	118	25.6	$\sim .7$	$\frac{1}{2}$

Table 1. Summary of FPP calibration running

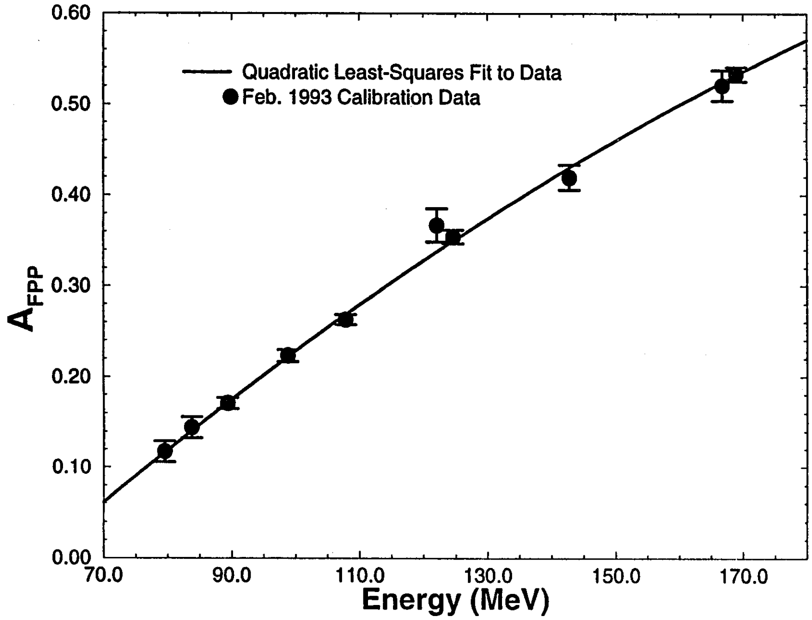

Figure 1. A_{FPP} versus energy for the first part of the E367 calibration data (see description in text).

1. S.M. Bowyer, *et al.*, this report.
2. E.J. Stephenson, *et al.*, IUCF Sci. and Tech. Rep., May 1988–April 1989.