INVESTIGATION OF POSSIBLE A_2 STRUCTURE*C. M. Ankenbrandt, B. B. Brabson, R. R. Crittenden[†],R. M. Heinz, J. E. Mott, H. A. Neal[‡], and A. J. Pawlicki[§]

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This report presents the results of an investigation of the significance of structure in the charged A_2 mass spectra measured by the Indiana group¹. The A_2 's were produced in the reaction $\pi^\pm p \rightarrow A_2^\pm p$ at 4 BeV/c. The A_2 mass spectra were measured using a missing-mass technique. The momentum transfer region of concern in this report is $-.45 \leq t \leq -.25$ (BeV/c)². (The experiment covered $-.72 \leq t' \leq -.12$ (BeV/c)². At the A_2 mass, $t = t' - .06$ (BeV/c)².) It is this t region which yielded A_2^- data that were most suggestive of the existence of A_2 structure.

The A_2^- data are shown in Figure 1(a); the experimental mass resolution for these data has a standard deviation of 3.5 MeV. Figure 1(b) contains the A_2^- data with a vertex cut which reduces the mass resolution from 3.5 MeV to 3.4 MeV.² Figure 1(c) displays data with the above vertex cut plotted in bins shifted by 2.5 MeV relative to Figure 1(b). (All data have a standard vertex cut to eliminate events that do not occur in the liquid hydrogen.) The data in Figure 1(a)

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which are not contained in Figure 1(b) and 1(c) have a mass resolution of 3.8 MeV; the final-state protons for these data travel through approximately .5" more liquid hydrogen, on the average, than the Figure 1(b) and 1(c) data. Figure 2 displays the A_2^+ data with the same cuts.

The smooth and dashed curves in Figure 1 and 2 are fits to the data using the dipole and Breit-Wigner hypotheses respectively.³ The χ^2 values for these fits, with 43 degrees of freedom, are given in Table I. The Breit-Wigner fit having the highest χ^2 , 59.2, is for the Figure 1(b) data; the corresponding confidence level is .05. However, when the same data are plotted in bins shifted by 2.5 MeV, the χ^2 drops to 41.8 and the confidence level is .53. The dipole fits to these data have confidence levels of approximately 10^{-4} .

We conclude that the A_2^- data are statistically compatible with the Breit-Wigner hypothesis. The dipole fits are not consistent with the data - especially if the few bins around 1.310 BeV/c are considered, in which case the confidence levels are $\leq 10^{-5}$. The A_2^+ data, similarly, agree with the Breit-Wigner hypothesis and reject the dipole hypothesis.

TABLE I

χ^2 values for fits to the data in Figures 1 and 2. The first three columns correspond to the A_2^- data from Figure 1; the last three columns are for the A_2^+ data from Figure 2.

	A_2^-			A_2^+		
	a)	b) Vertex Cut	c) Vertex Cut Bin Shift	a)	b) Vertex Cut	c) Vertex Cut Bin Shift
Breit-Wigner	55.7	59.2	41.8	27.5	27.0	34.8
Dipole	128.5	90.9	85.4	128.3	112.0	116.8

REFERENCES

1. C. M. Ankenbrandt, B. B. Brabson, R. R. Crittenden, R. M. Heinz, J. C. Krider, J. E. Mott, H. A. Neal, and A. J. Pawlicki, "Production of Charged A_2 Mesons at 4 BeV/c," submitted for publication in Phys. Rev. Letters.
2. These are the data referred to in Reference 1, footnote 15.
3. See Reference 1 for the details of these fits.

FIGURE CAPTIONS

1. a) The missing-mass spectra for $\pi^- p \rightarrow pX^-$ at 4 BeV/c and $-.45 \leq t \leq -.25 \text{ (BeV/c)}^2$. See the text for a discussion of the smooth curves.
b) Data from a) with a vertex cut. See the text for details.
c) Data from b) plotted in bins which are shifted by 2.5 MeV relative to b).
2. a) The missing-mass spectra for $\pi^+ p \rightarrow pX^+$ at 4 BeV/c and $-.45 \leq t \leq -.25 \text{ (BeV/c)}^2$. See the text for a discussion of the smooth curves.
b) Data from a) with a vertex cut. See the text for details.
c) Data from b) plotted in bins which are shifted by 2.5 MeV relative to b).

FIGURE 1

FIGURE 2