$\bar{p}p \rightarrow \bar{p}p\pi^+\pi^-$ REACTIONS AT 7 GeV/c

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The topological cross-sections for $\bar{p}p$ reactions at 6.94 GeV/c are given in Table 1 together with other published results.

We have analysed a total of 1,294 events corresponding to $\bar{p}p \rightarrow \bar{p}p\pi^+\pi^-$ interactions at 7 GeV/c. Table 2 shows the cross-sections of isobar productions, which were obtained by applying the peripheral phase-space method on the $M(p\pi^+)-M(p\pi^-)$ plane.

Figure 1 is the four-body LPS plot. Figure 2a shows the $\bar{\Delta}^{--}\Delta^{++}$ production in the most favourable region 4. The smear out of $\bar{\Delta}^{--}\Delta^{++}$ events from region 4 is estimated to 5% at 7 GeV/c. Figure 2b shows the $\bar{\Delta}^0\Delta^0$ production in region 2.

Figure 3 is the mass plot of (N$\pi\pi$) in regions 1 and 3, where the diffractive dissociations are expected to be enriched. Figure 4b shows the $t[p \rightarrow N^*(1470)]$ distribution and Fig. 4c $t(p \rightarrow \Delta)$ in the above regions 1 and 3. The absence of steep drop in the distribution of $t(p \rightarrow \Delta)$ and the concentration of Δ events in the resonance region $1400 < M(p\pi\pi) < 1700$ strongly suggest that most single isobar final states come through the diffractive dissociation-like process.

Figure 5 is the decay angular distributions of Δ in the $\bar{\Delta}\Delta$ channel. The solid curves are drawn by the fitted density matrix elements of Table 3.

Table 1

Topological cross-section

No. of prongs	Millibarns
0	2.4 ± 0.21
2	31.2 ± 0.11 [a]
4	19.5 ± 0.61
6	7.7 ± 0.40
8	1.7 ± 0.08
10	0.24 ± 0.03
Total	62.7 ± 0.66

a) Loss of elastic events in the forward direction is corrected.

Table 2

Relative frequency for each channel (%)

Incident momentum (GeV/c) / Channels	6.94	3.6	5.7	12.0
$\bar{p}p \rightarrow \bar{\Delta}^{--}\Delta^{++}$	34.7 ± 1.6	63.8 ± 4.9	43.6 ± 6.8	27.1 ± 1.4
$\bar{\Delta}^{--}p\pi^{+}$	17.6 ± 1.8	8.0 ± 4.3	22.1 ± 4.8	18.3 ± 2.2
$\Delta^{++}\bar{p}\pi^{-}$	14.4 ± 1.7	5.4 ± 3.8	17.9 ± 4.3	18.5 ± 2.8
$\bar{p}p\pi^{+}\pi^{-}$	33.3 ± 4.0	22.8 ± 7.6	16.4 ± 8.8	25.7 ± 5.1
$\bar{\Delta}^{--}\Delta'^{++}$				5.1 ± 3.0
$\Delta^{++}\bar{\Delta}'^{--}$				5.3 ± 2.3
Total cross-section (mb)	3.05 ± 0.10	3.8 ± 0.2	3.31 ± 0.16	2.35 ± 0.25

Table 3

Spin density matrix elements

	Jackson frame		
	$-t \leq 0.12$ $(GeV/c)^2$	$0.12 < -t \leq 0.25$ $(GeV/c)^2$	$0.25 < -t \leq 0.6$ $(GeV/c)^2$
ρ_{11}	0.386 ± 0.030	0.310 ± 0.039	0.213 ± 0.035
Re ρ_{31}	-0.030 ± 0.031	0.015 ± 0.035	0.041 ± 0.037
Re ρ_{3-1}	0.011 ± 0.026	-0.026 ± 0.034	0.032 ± 0.038
	Helicity frame		
	$-t \leq 0.12$ $(GeV/c)^2$	$0.12 < -t \leq 0.25$ $(GeV/c)^2$	$0.25 < -t \leq 0.6$ $(GeV/c)^2$
ρ_{11}	0.342 ± 0.031	0.263 ± 0.036	0.234 ± 0.039
Re ρ_{31}	0.091 ± 0.028	0.044 ± 0.037	-0.049 ± 0.035
Re ρ_{3-1}	-0.014 ± 0.028	-0.053 ± 0.035	0.044 ± 0.037

$$\hat{p}=(1,0,0)$$

$$\hat{\pi}=(-1/3,2\sqrt{2}/3,0)$$

$$\hat{\bar{p}}=(-1/3,-\sqrt{2}/3,\sqrt{2/3})$$

$$\hat{\pi}=(-1/3,-\sqrt{2}/3,-\sqrt{2/3})$$

$$r=\frac{\sqrt{3}}{2}(q_p^2+q_\pi^2+q_{\bar{p}}^2+q_\pi^2)^{1/2}$$

$$\theta=\cos^{-1}(q_p/r)$$

$$\phi=\tan^{-1}\left[\frac{\sqrt{3}(q_{\bar{p}}-q_\pi)}{3q_\pi+q_p}\right]$$

$$q_p=\hat{p}\cdot\vec{r}$$

$$q_\pi=\hat{\pi}\cdot\vec{r}$$

$$q_{\bar{p}}=\hat{\bar{p}}\cdot\vec{r}$$

$$q_\pi=\hat{\pi}\cdot\vec{r}$$

Fig. 1

a)

b)

Fig. 2

M($\bar{p}\pi^{+}\pi^{-}$) in Region 1 , M($p\pi^{+}\pi^{-}$) in Region 3   (GeV)
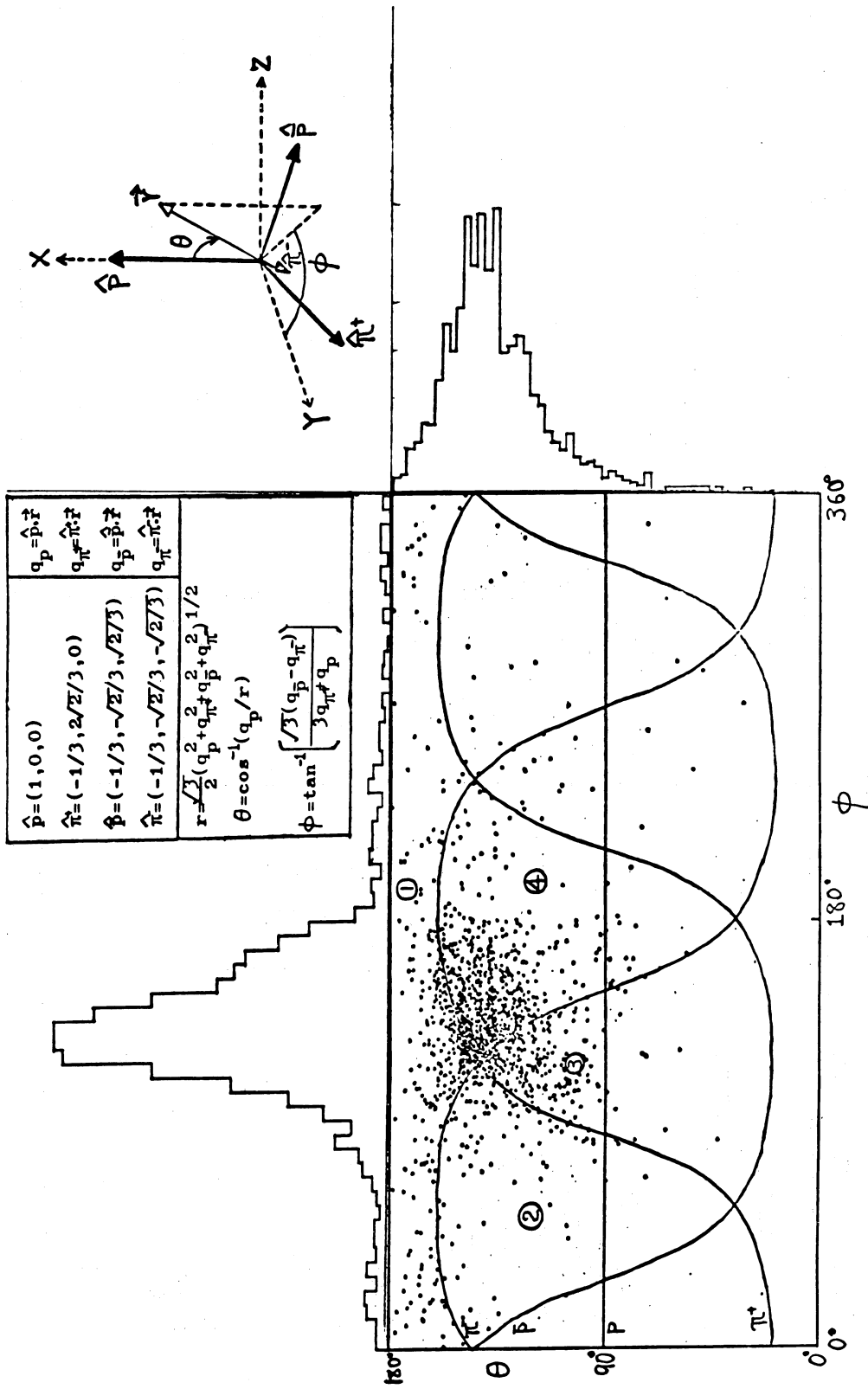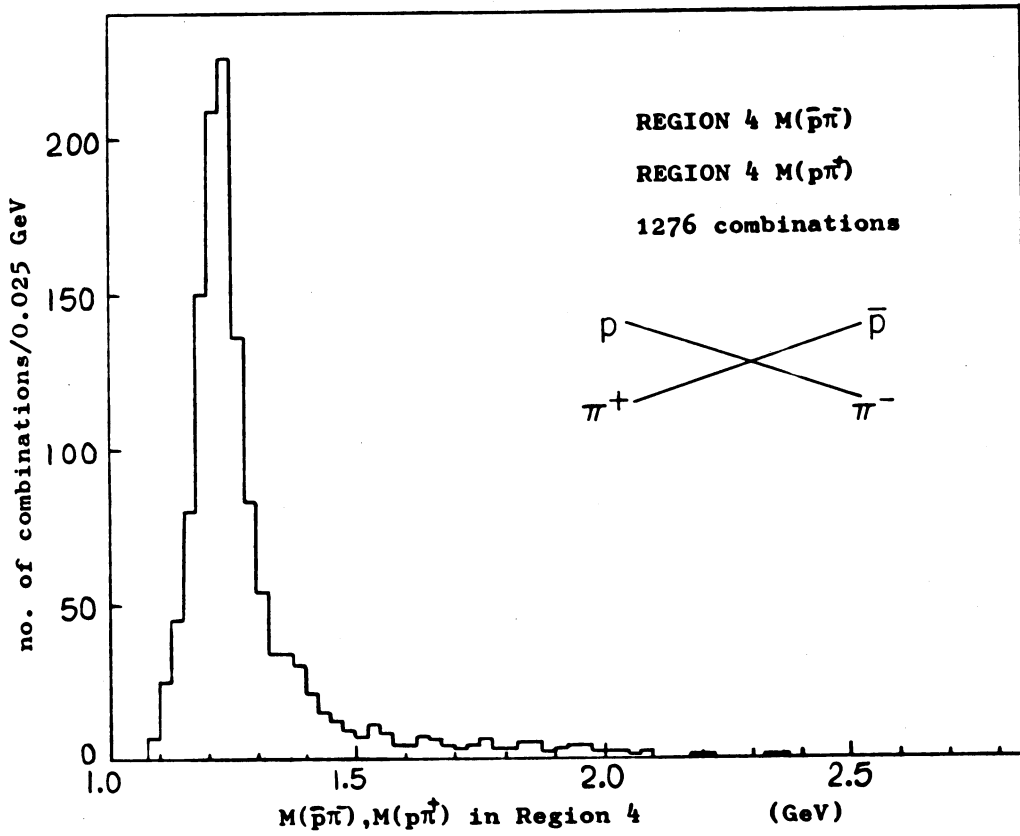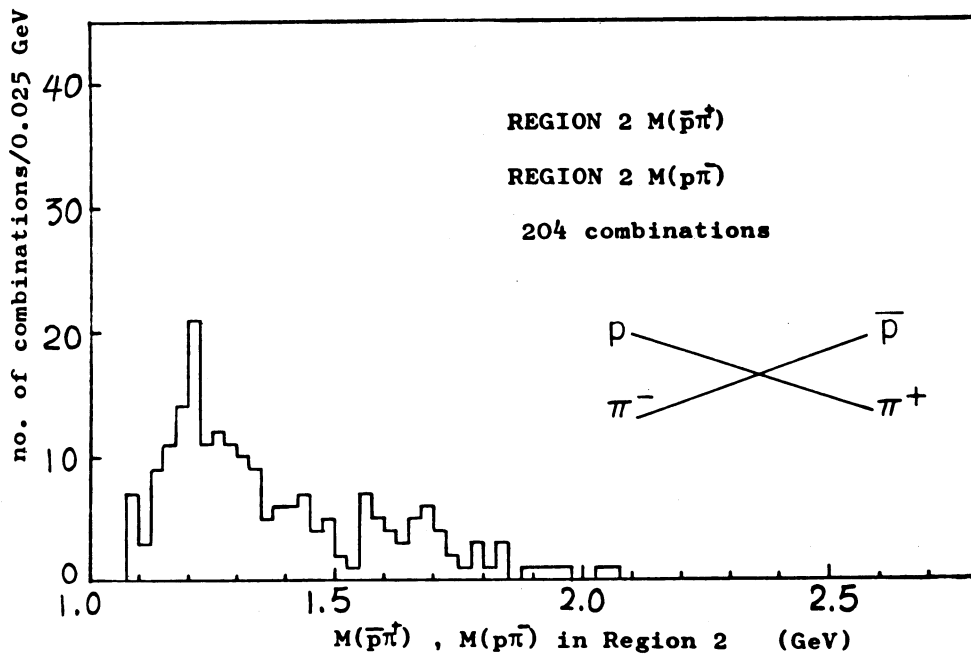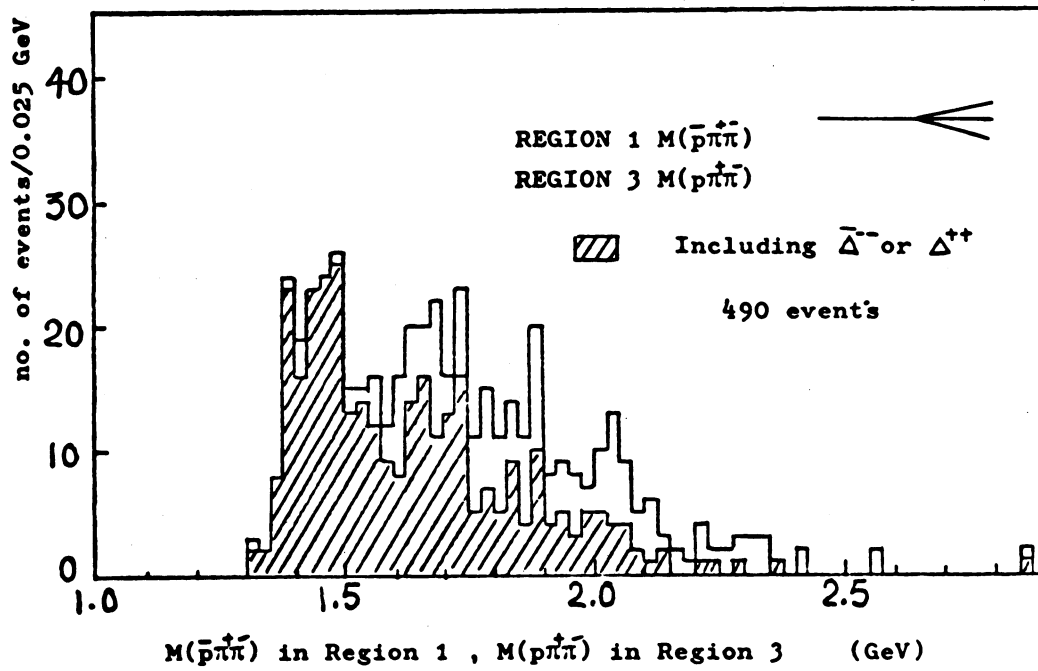
Fig. 3
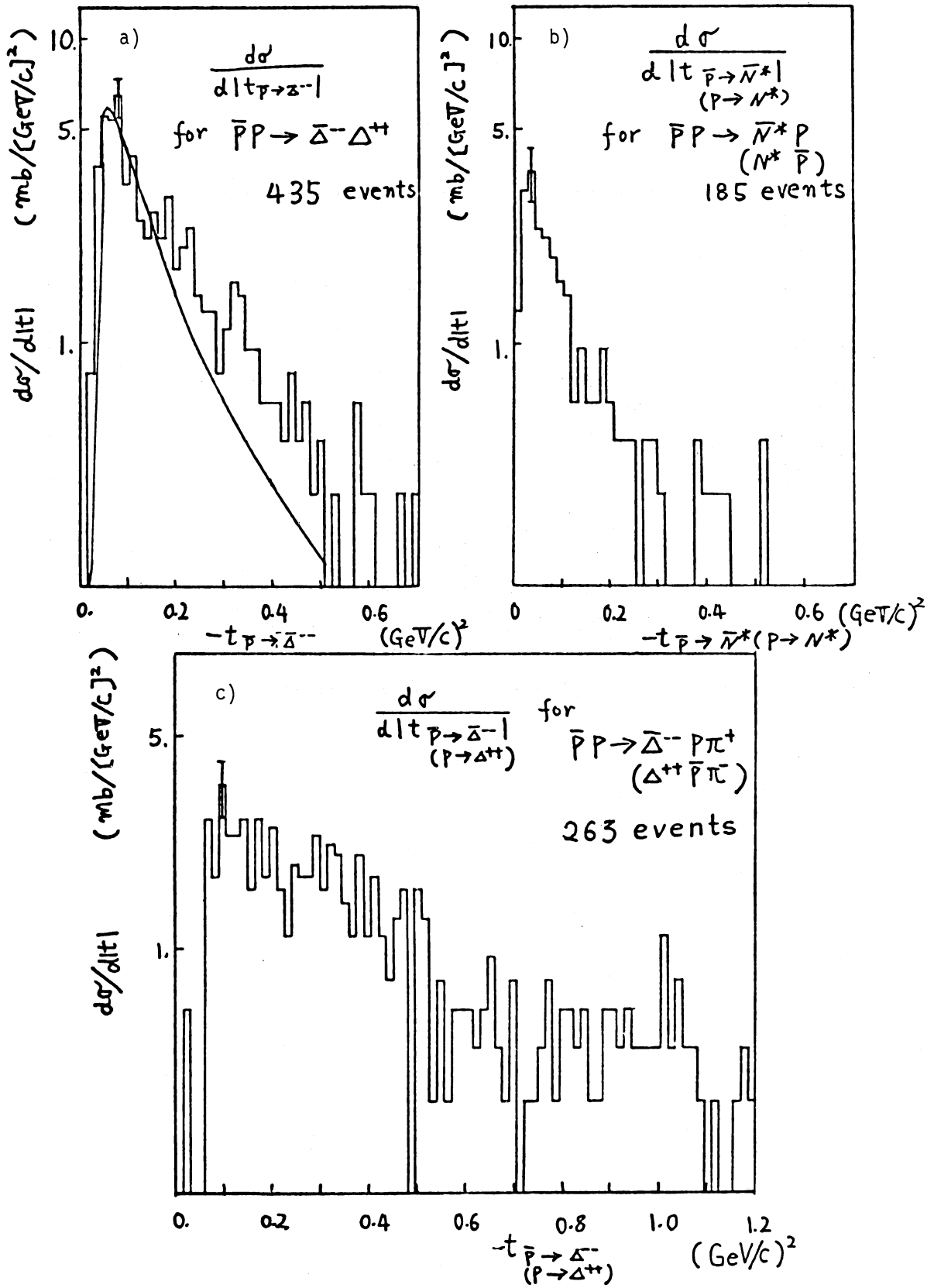
Fig. 4

Distribution of $\cos\theta_J$ and ϕ_J in the Jackson frame

$$\bar{p}p \rightarrow \bar{\Delta}^{--}\Delta^{++}$$
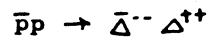
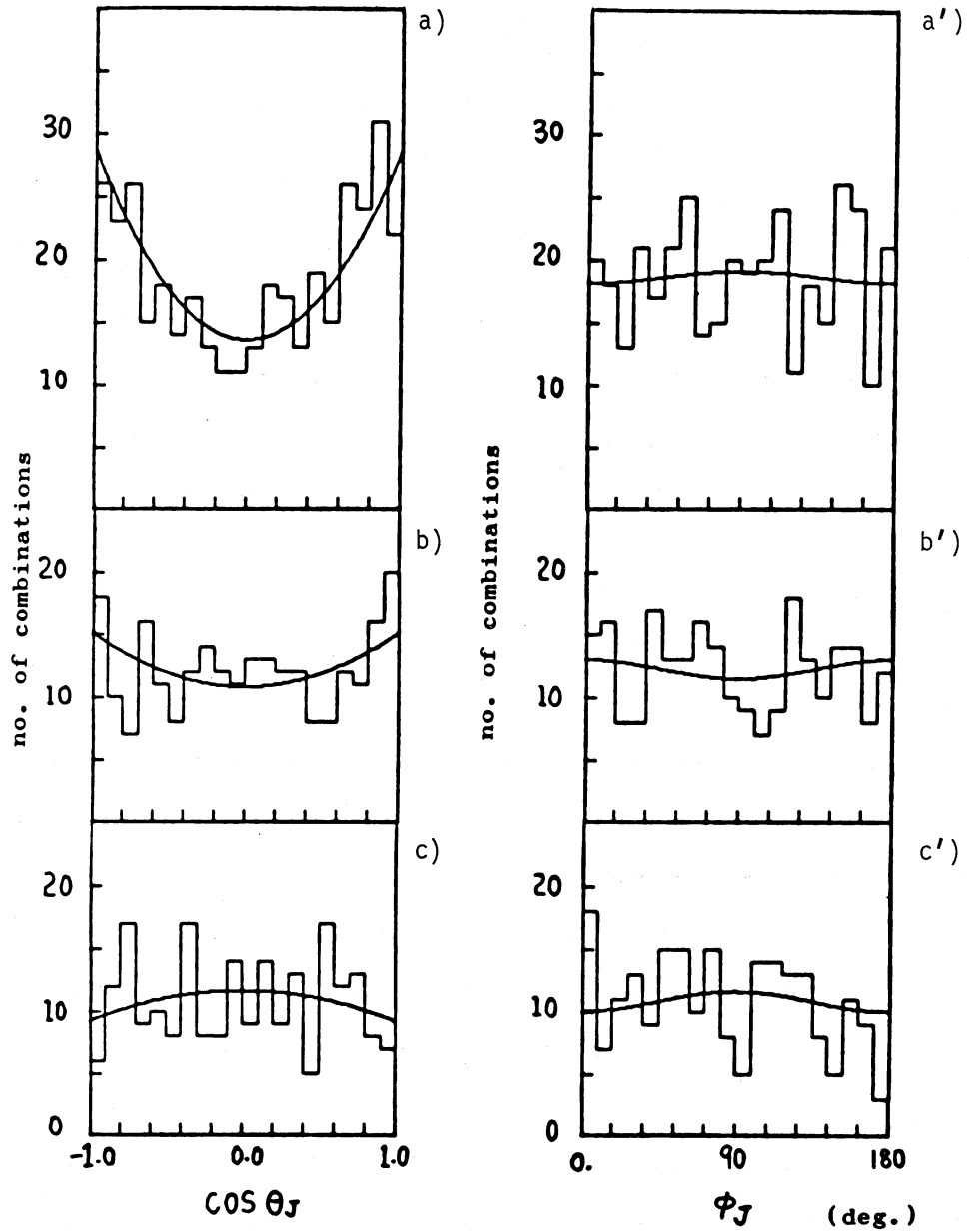| a) and a') | | $-t \leqq 0.12$ | $(\text{GeV}/c)^2$ |
| b) and b') | $0.12 < -t \leqq 0.25$ | | $(\text{GeV}/c)^2$ |
| c) and c') | $0.25 < -t \leqq 0.60$ | | $(\text{GeV}/c)^2$ |

Fig. 5