

POLARIZATION AND CORRELATION COEFFICIENTS OF Λ 's AND $\bar{\Lambda}$'s
IN THE REACTION $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$ BETWEEN 1.50-2.04 GeV/c

V. Vuillemin

Glasgow-Liverpool-Lausanne/Neuchâtel-Paris (IPN)
Collaboration

Introduction

The events come from a 2 m-HBC experiment at CERN undertaken by the Glasgow-Liverpool-Lausanne/Neuchâtel-Paris (IPN) collaboration. The data used for these results are only those from the part of film allocated to Glasgow, Lausanne and Neuchâtel Laboratories.

After scanning and rescanning, we obtain an over-all scanning efficiency of 92 % for the one- V^0 events and of 97 % for the two- V^0 events (ref. 4). The kinematic reconstruction was made by the THRESH-GRIND programs. The number of events for the different topologies is the following :

(a) $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$	4c fit	211 events
(b) $\bar{p}p \rightarrow \bar{\Lambda}(\Lambda_F)^+$	1c fit	149 events
(c) $pp \rightarrow (\bar{\Lambda}_F)^+ \Lambda$	1c fit	168 events

Polarization and spin correlation

Figure 1 illustrates the coordinate system in which the axes in the Λ 's frame are specified. Under CP conservation, the following quantities vanish (6) :

$$P_x(\Lambda) = P_z(\Lambda) = P_x(\bar{\Lambda}) = P_z(\bar{\Lambda}) = 0$$

$$C_{xy} = C_{yx} = C_{yz} = C_{zy} = 0$$

Otherwise :

$$P(\Lambda) = P(\bar{\Lambda})$$

$$C_{xz} = C_{zx}$$

⁺ (Λ_F) , $(\bar{\Lambda}_F)$ means a Λ or $\bar{\Lambda}$ fitted, but not observed.

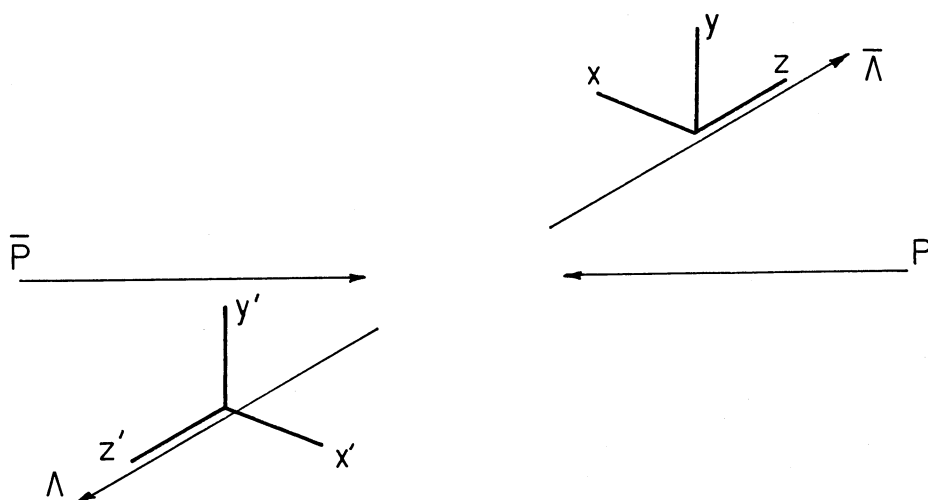


Figure 1 : Coordinate system in the c.m. frame

The asymmetry parameters have the following values :

$$\alpha_{\Lambda} = -\alpha_{\bar{\Lambda}} = 0.647 \pm 0.013$$

The polarization P as a function of E_{CM} for the Λ 's and $\bar{\Lambda}$'s of reactions (a), (b) and (c) is shown in figure 2 a, and as a function of t' in figure 2 b.

The averages of the polarizations are :

$$\begin{aligned} P_{\Lambda} &= -0.30 \pm 0.11 & P &= -0.25 \pm 0.08 \\ P_{\bar{\Lambda}} &= -0.19 \pm 0.11 & & \text{(CP assumed)} \end{aligned}$$

For the reaction (a), the correlation parameters are found to be :

$$\begin{aligned} C_{xx} &= -1.13 \pm 0.46 \\ C_{yy} &= 1.04 \pm 0.46 \\ C_{zz} &= -0.95 \pm 0.46 \\ C_{xz} &= 0.27 \pm 0.33 \end{aligned}$$

Table I presents our results in the 1.5 - 2.04 GeV/c momentum region - near the threshold of Λ production - and the results obtained in other experiments.

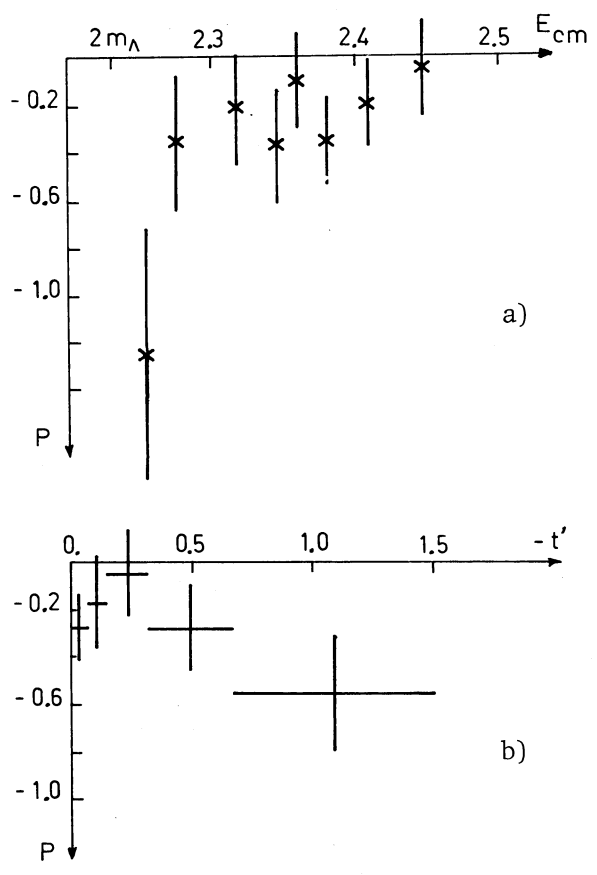


Fig. 2

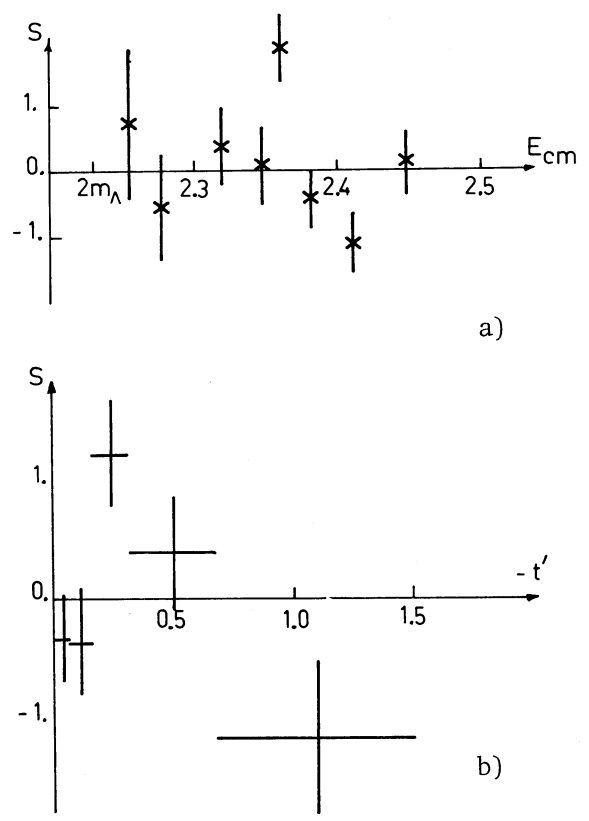


Fig. 3

Table I : Polarization and correlation coefficients

P_{lab} (GeV/c)	P	C_{zz}	S	Ref.
1.5 - 2.04	-0.25 ± 0.08	-0.95 ± 0.46	0.035 ± 0.2	This exp.
2.19	-0.46 ± 0.18	-0.96 ± 0.44	0.025 ± 0.19	(1)
2.5	-0.11 ± 0.11	-0.66 ± 0.45	-0.21 ± 0.19	(2)
3.6	-0.17 ± 0.17	-0.78 ± 0.27	-0.03 ± 0.11	(5)
5.7	0.14 ± 0.15	-1.6 ± 0.6	-0.6 ± 0.25	(3)

It is to be remarked that the quantity :

$$\begin{aligned}
 S &= \frac{1}{4} (1 - \langle \vec{\sigma}_{\Lambda} \cdot \vec{\sigma}_{\bar{\Lambda}} \rangle) = \\
 &= \frac{1}{4} (-C_{xx} - C_{yy} + C_{zz})
 \end{aligned}$$

represents the fraction of the $\bar{\Lambda}\Lambda$ state which is in the singlet state, namely :

S = 0 : all events are triplet

S = 1 : all events are singlet

The figures 3a and 3b present the S value for the reaction (a) as a function of E_{CM} and t' .

REFERENCES

- (1) N. Kwak et al., Phys. Rev. 186 (1969) 1392
- (2) J. Badier et al., Phys. Letters 25B (1967) 152
- (3) H.W. Atherton et al., Phys. Letters 30B (1969) 494
- (4) S. Vallet, Ph. D. Thesis, Univ. of Neuchâtel (1972)
- (5) H.W. Atherton et al., Nucl. Phys. 69B (1974) 1
- (6) A. Pais, Phys. Rev. Letters 3 (1959) 242