Preliminary Results on Strange Baryon Production in Pb-Pb Interactions at 160 GeV/c per nucleon.

Presented by R. Lietava, Košice, Slovakia*.

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1 Introduction

The ultimate goal of heavy ion collisions is the formation of a new state of matter - the Quark Gluon Plasma (QGP). Strange particle and specially strange antibaryon production is considered to be a useful probe for the dynamics of hadron matter in heavy ion collisions [1,2,3]. QGP formation is expected to give rise to an enhanced strange particle production relative to that observed in normal hadronic collisions [2]. However, it has also been claimed [4,] that the enhancement of strange particle production could occur in a dense hadronic gas. Strange particle production data, and in particular strange (anti)baryon production data give us a set of important constraints which are needed to choose the true model for heavy ion collision dynamics.

An enhancement of the particle production with increasing strangeness has been observed already in sulphur-nucleus reactions [5,8]. The advent of lead beam at the CERN SPS gave the opportunity to explore interactions of really heavy nuclei , although posed a series of new experimental problems due to the extremely high secondary multiplicity. This is particularly the case when one wants to recognize strange particles in the central region, i.e. the region of very high track density.

2 Apparatus and Data Selection

The goal of WA97 experiment is high statistics study of strange and multistrange baryon and antibaryon production in central Pb-Pb collisions at 160 GeV/c pre nucleon. In particular, the experiment aims to measure the production of Λ, Ξ^- and Ω^- and their antiparticles. These particles are reconstructed from the measurement of their decay tracks in the channels: $\Lambda(uds) \rightarrow p\pi^-$, $\Xi^-(dss) \rightarrow \Lambda\pi^-$, $\Omega^-(sss) \rightarrow \Lambda K^-$.

The layout of the experiment has been described elsewhere [6,7], here we recall only its main components. The target is followed by three stations of multiplicity detectors, the first of them is used at trigger level in order to select central Pb - Pb collisions (typically about 30 % of the inelastic cross section). The WA97 silicon telescope , which has a length of 90 cm and 25 cm^2 cross section, is composed of 9 microstrips(50 μm pitch), 4 pixel planes and 1 silicon pad plane. The pixel cells are horizontal rectangles of 75 x 500 μm^2, i.e. giving better resolution in the non-bending plane. The telescope is placed inside a magnetic field of 1.7 T above the beam line, inclined at 50 mrad and pointing to the target 90 cm upstream from the telescope. In this configuration the telescope has good acceptance for the decays of hyperons produced at central rapidity and $p_T >$ 0.5 GeV/c while keeping the occupancy of the detectors at an acceptable level (20 - 30 hits per plane). Additional lever-arm tracking is provided by three planes of multiwire proportional chambers with pad cathode read-out placed at about 4m from the target. Finally, a very forward rapidity hadron calorimeter, placed at 26 m, completes the experimental setup.

3 Analysis

During the 1994 run we recorded about 60M central (about 30% of inelastic cross section) Pb-Pb collisions. Data were taken with both polarities of the magnetic field. The analysis starts with alignment and clean-up cuts, after which a track reconstruction was performed. The number of fully reconstructed tracks in telescope is on average 6 per event, but reaches about 20 in very central events. Secondary vertices are then looked for and events with V0 and Cascade topologies are selected. Here we present preliminary analysis of about 10M events.

Events with V0's in the decay region, starting at 50 cm from target and pointing back to primary vertex are retained for further analysis as $\Lambda(\bar{\Lambda})$ candidates. Of the two possible V0 topologies, only the so called cowboys were considered, as they do not require a large background correction.

All accepted V0 are shown in the Armenteros-Podolanski plot on fig.3a. A clear accumulation of Λ's, $\bar{\Lambda}$'s and K^0's can be seen. In order to isolate the Λ and $\bar{\Lambda}$ signals we selected events with a $\pi^+\pi^-$ mass outside the band $m_K \pm 25MeV/c$. The rapidity and transverse momentum window used is $2.5 < y < 3.4$ and $0.5 < p_T < 2.0Gev/c$. The resulting invariant mass distributions for Λ and $\bar{\Lambda}$, obtained applying cuts $|\alpha| > 0.45$ and $q_T > 0.02$ are shown in figures 1c and 1d. From the invariant mass distribution we estimate after background subtraction the number of Λ to be 8667 and of $\bar{\Lambda}$ to be 1335. This gives the preliminary ratio

$$\frac{\bar{\Lambda}}{\Lambda} = 0.154 \pm 0.005$$

where the quoted error is purely statistical. The evaluation of systematic error is in progress.

The Ξ, $\bar{\Xi}$, Ω and $\bar{\Omega}$ candidates were selected from cascade candidates releasing the cut that V0 should point back to primary vertex. Preliminary invariant mass distribution for $\Xi + \bar{\Xi}$ and $\Omega + \bar{\Omega}$ candidates is on fig.2.

4 Summary and Conclusions

Preliminary results are presented for Λ and $\bar{\Lambda}$ production in Pb-Pb interactions at 160GeV/c per nucleon. The data are not corrected for acceptance and reconstruction efficiency. The evaluation of these systematic errors is in progress.

In table 1 you can find the comparison of $\bar{\Lambda}/\Lambda$ ratios in five different collisions - p-S, p-W, S-S, S-W and Pb-Pb - all measured in Omega spectrometer.

	WA97	WA94	WA94	WA85	WA85
Rapidity	$2.5 < y < 3.4$	$2.5 < y < 3.0$	$2.5 < y < 3.0$	$2.3 < y < 2.8$	$2.3 < y < 2.8$
P_T	$0.5 < p_T < 2.0$	$1.2 < p_T < 3.0$	$1.4 < p_T < 3.0$	$1.2 < p_T < 3.0$	$1.2 < p_T < 3.0$
Collision	Pb-Pb	S-S	p-S	S-W	p-W
$\bar{\Lambda}/\Lambda$	0.154 ± 0.005	0.23 ± 0.01	0.22 ± 0.01	0.19 ± 0.01	0.19 ± 0.01
Reference	[7]	[8]	[9]	[5]	[10]

Table 1. Ratio $\bar{\Lambda}/\Lambda$ for different collisions

measured in Omega spectrometer

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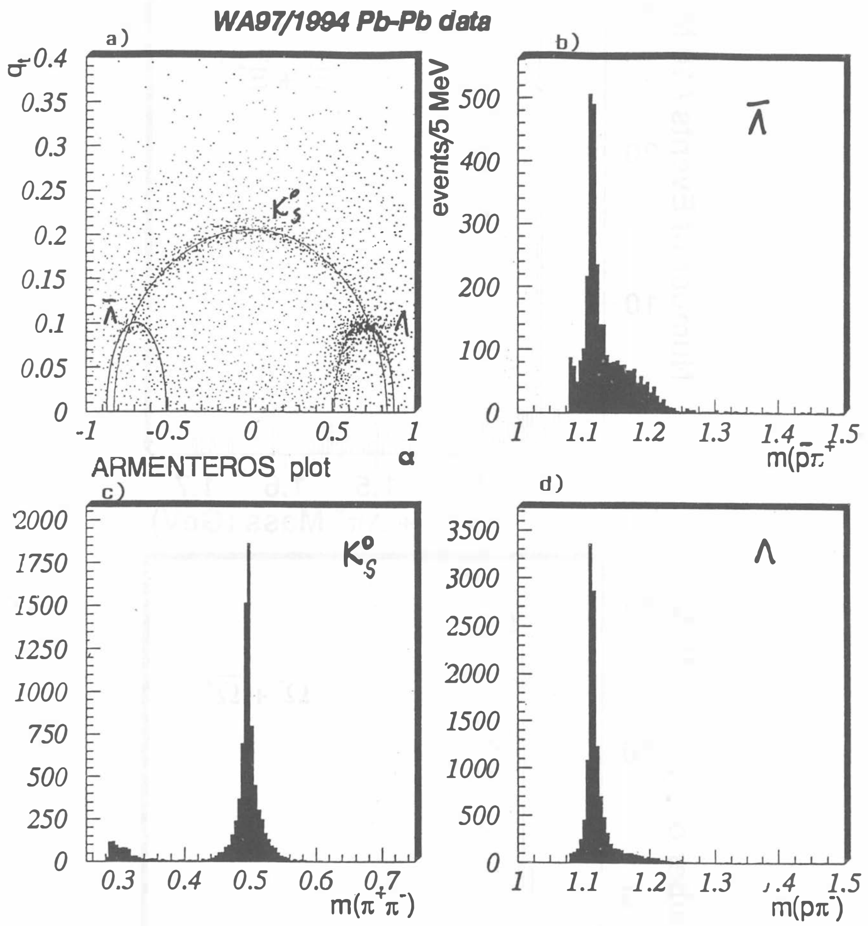

WA97/1994 Pb-Pb data
a)
b)
c)
d)
ARMENTEROS plot
q_t
α
K^0_S
$\bar{\Lambda}$
Λ
events/5 MeV
$m(\bar{p}\pi^+)$
$m(\pi^+\pi^-)$
$m(p\pi^-)$

Figure 1.

WA97 Ξ^- and Ω^- signals in Pb–Pb

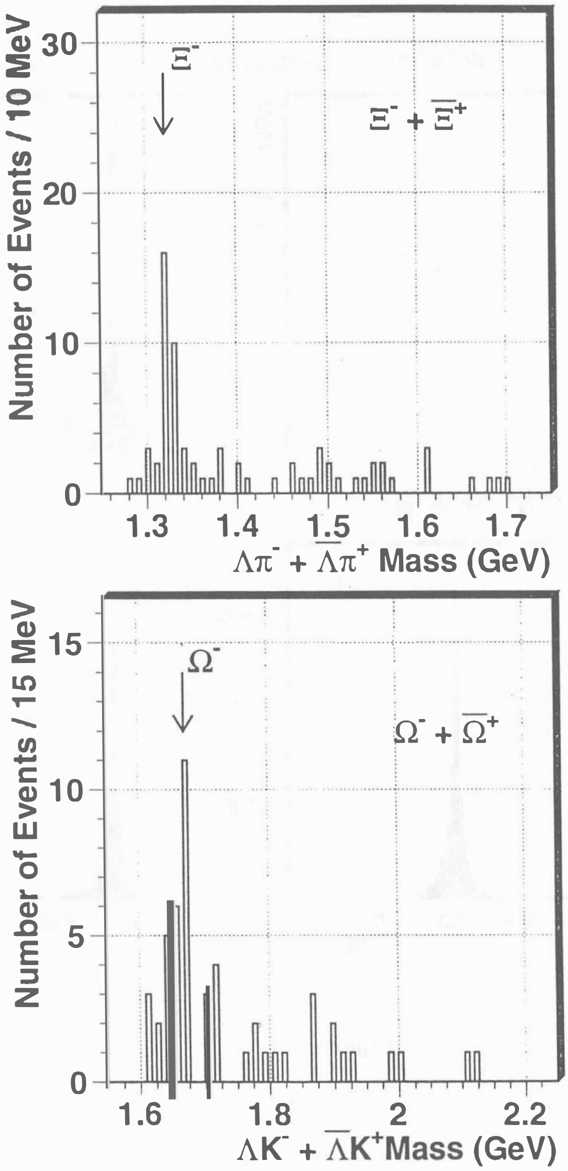

Figure 2.