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Λ Production in AuAu Collisions at 11.6 GeV/c

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ABSTRACT

I present the first measurement at AGS energies of the rapidity and transverse mass distributions for Λ production with Au beam on Au target. The measurements cover the rapidity region of 2.0 to 3.2 and transverse momenta of 0.0 to 1.4 GeV/c. The results are compared with the predictions of two models.

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1. Introduction

We have measured Λ production in Au Au collisions at 11.6 × A Gev/C the apparatus is shown in Fig. 1. The beam was incident on a Au target 80 cm from the active volume of a set of three Time Projection Chambers (TPC's) in the MPS magnet. The main trigger element is a scintillation counter downstream of the apparatus which was used to veto on ionisation in the beam region at a level of a Si nucleus or above. A counter just in front of the TPC's was used in coincidence in order to enhance the fraction of events from the target. The MPS magnet was run at 10KG.

2. Results

The apparatus has been described earlier [1], but basically the TPC's were designed for optimal two track separation using short anode wires parallel to the beam for the readout; up to 300 tracks were reconstructed in central collisions. No dE/dx information is obtained.

In order to select the more central events we cut on a total charges particle multiplicity of > 220, corresponding to a cross section of 270mb. Lambdas were selected by searching for pairs of positive and negative tracks that formed vertices more than 15cm downstream of the interaction point; the reconstructed momentum of the candidates were required to point back to the interaction point. Since there was no particle ID the positive track was assigned the proton mass, and the negatve track the pion mass. The resulting effective mass spectrum is shown in Fig. 2; a clear Λ signal is apparent; the solid curve is the result of a GEANT simulation of the apparatus.

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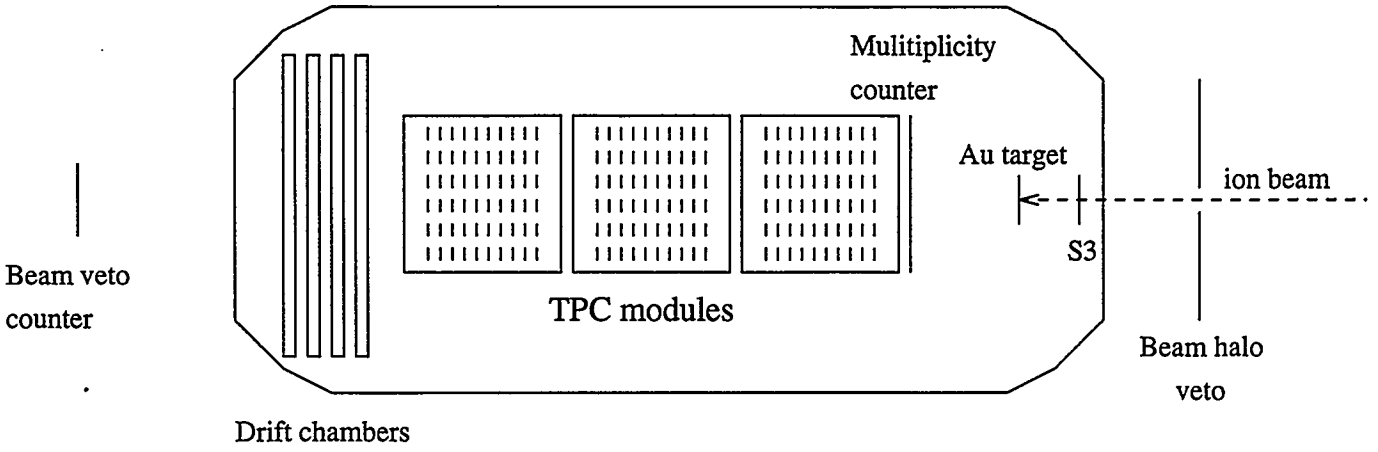

E-891 Plan View

Figure 1: A plan view of the apparatus.

The transverse mass distribution is shown in Fig. 3 for four rapidity bins. The solid lines are exponential fits to the data, except for the highest rapidity bin; for that bin the data were too sparse to allow a good determination of the slope, so the solid line is the result of the global fit discussed below. The ARC [2] and RQMDv.2.1 [3] predictions are shown as dashed and dotted lines respectively. Clearly neither model fits the data well over the whole rapidity range.

The inverse slopes are shown in Fig. 4(Left). The solid curve is the result of an earlier global fit to Si Si data [4]. The dashed curve is from RQMD (as is seen in Fig. 3 the ARC predictions are not purely exponential so they can't be shown on this figure). Clearly neither curve fits the trend of higher inverse slopes as one goes towards midrapidity. One should also note that the values are much higher than previously observed for light particles, a trend seen earlier for protons. This has led to suggestions of "flow".

In order to extrapolate to regions beyond our data points we have fitted all of the data ("global fit") to the function $A \cdot exp(-B \cdot m_t)$ where A is an arbitrary constant independent of rapidity, and $B = a + b \cdot cosh(y - y_0) + c \cdot (y - y_0)^2/m_t$, with a, b and c independent of rapidity and $y_0 = 1.6$. Integrating the function we obtain the points shown in Fig. 4(Right), along with the reflection around midrapidity. The solid curve is scaled from an earlier fit to the Si Si data [1], scaled up by the ratio of Kaon production in Au Au and Si Si interactions. The dashed line is the ARC prediction and the dotted line is from RQMD. Taking into account the sytematics in the data (10%) and in the models , the agreement is probably satisfactory, but, given the inability to fit the slopes this might be rather fortuitous!

The data presented here has now been published [4].

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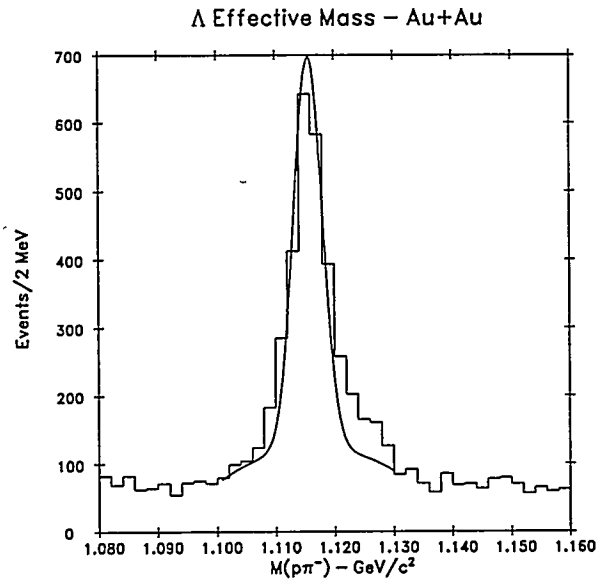

Figure 2: Effective mass plot of the proton π^- hypothesis for $2.0 < y(\Lambda) < 3.2$ and $p_t < 1.4$ GeV/c. The solid curve is not a fit, but represents the Λ effective mass reconstruction from the Monte Carlo simulation of the experiment.

3. Acknowledgements

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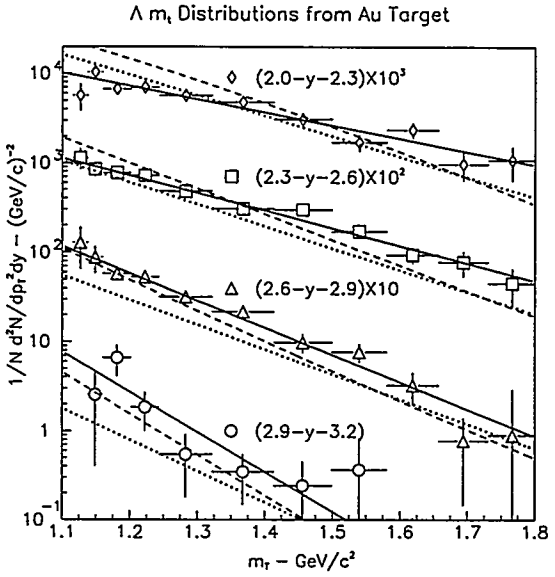

Figure 3: Transverse mass (m_t) distributions for Λ's. Each rapidity range has been scaled up by a factor of 10 as shown in the legend on the plot. The solid lines for $2.0 < y(\Lambda) < 2.9$ are fits to the points and for $2.9 < y(\Lambda) < 3.2$ the solid line is the result of the global fit described in the text. Errors shown are statistical only. The dashed lines are the ARC predictions and the dotted lines are the RQMD predictions (scaled the same way as the data).

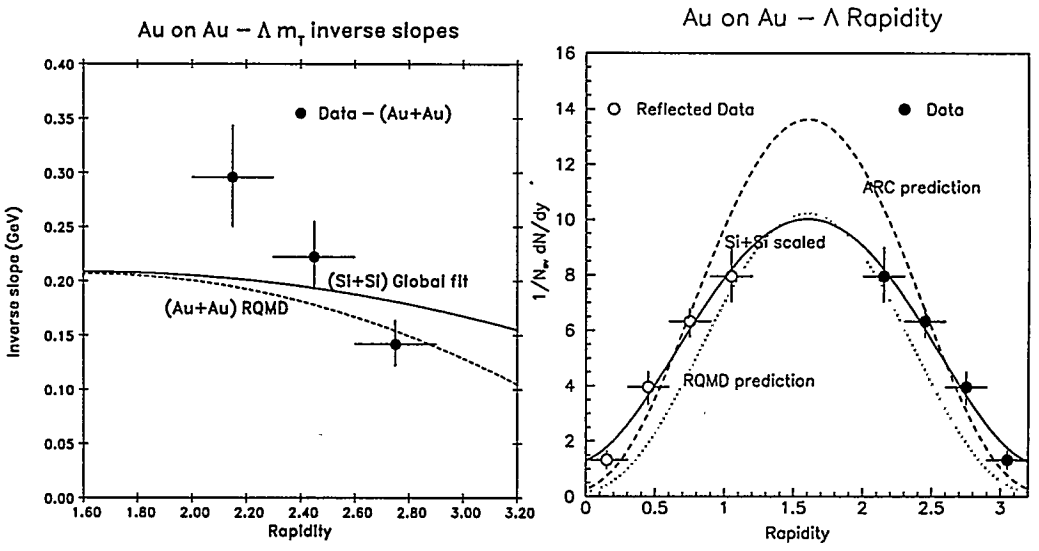

Figure 4: Left:Inverse slopes from exponential fits to m_t dependence of the differential cross sections as a function of rapidity. The solid curve is the result of the global fit explained in the text. The dashed curve is the prediction of RQMD. Right:Rapidity distribution for Λ's. The solid curve is the result of scaling $Si+Si$ data as explained in the text. The dashed curve is the ARC prediction. The dotted curve is the RQMD prediction. Errors shown are explained in the text.