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CENTRALITY DEPENDENCE OF K^+ PRODUCED IN PB+PB COLLISIONS AT 158 GEV PER NUCLEON

SONJA KABANA FOR THE NA52 COLLABORATION:

R ARSENECU, H P BECK, K BORER, S KABANA, R KLINGENBERG, G LEHMANN,
R MOMMSEN, U MOSER, K PRETZL, J SCHACHER, R SPIWOKS, M WEBER*Laboratory for High Energy Physics, University of Bern, Sidlerstrasse 5, CH-3012 Bern,
Switzerland (E-mail: sonja.kabana@cern.ch)*

K ELSENER, K D LOHMANN

CERN, CH-1211 Geneva 23, Switzerland

C BAGLIN, A BUSSIÈRE, J P GUILLAUD

CNRS-IN2P3, LAPP Annecy, F-74941 Annecy-le-Vieux, France

T LINDÉN, J TUOMINIEMI

*Dept. of Physics and Helsinki Institute of Physics, University of Helsinki, PO Box 9,
FIN-00014 Helsinki, Finland*

PH GORODETZKY

PCC-College de France, 11 place Marcelin Berthelot, 75005 Paris, France

The NA52 collaboration searches for a discontinuous behaviour of charged kaons produced in Pb+Pb collisions at 158 A GeV as a function of the impact parameter, which could reveal a hadron to quark-gluon plasma (QGP) phase transition. The K^+ yield is found to grow proportional to the number of participating ('wounded') nucleons N , above $N=100$. Previous NA52 data agree with the above finding and show a discontinuous behaviour in the kaon centrality dependence near $N=100$, marking the onset of strangeness enhancement -over e.g. p+A data at the same \sqrt{s} - in a chemically equilibrated phase.

1 Introduction

The hadron to quark-gluon plasma phase transition predicted by QCD ² may occur and manifest itself in ultrarelativistic heavy ion collisions through discontinuities in the energy density dependence of relevant observables. A major example of such a discontinuity is seen in the $J/\Psi/DY$ ratio ³. The NA52 collaboration searches for discontinuities in strangeness production measuring charged kaons as a function of the impact parameter. Results from the 1995 NA52 run are published in ⁴. We report here on new preliminary results from the 1998 run of the NA52 experiment, on K^+ at rapidity 4.1 and trans-

verse momentum near 0 produced in Pb+Pb collisions at 158 A GeV ⁵. In this run a new electromagnetic lead/quartz fiber calorimeter (QFC) with improved acceptance and resolution ⁶ was used.

2 Results and discussion

For the kaon measurement we modified the 1998 set up of NA52 ⁷ by placing the target 0.6 m upstream of the calorimeter. The results have been corrected for empty target contributions. The number of participant nucleons N has been estimated from the energy measured with the calorimeter (figure 1) in the way described in ⁴. Particle identifica-

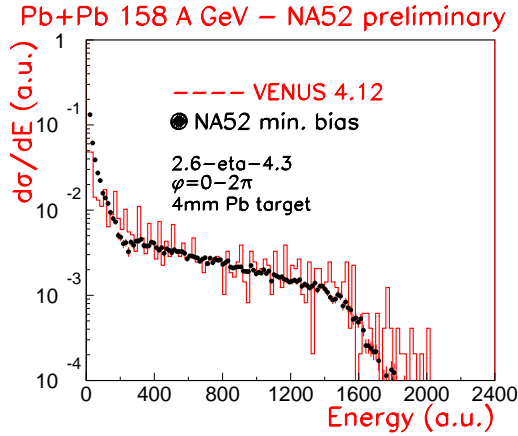


Figure 1. Preliminary energy distribution in arbitrary units in minimum bias Pb+Pb collisions at 158 A GeV, from the 1998 NA52 run.

tion is described in ⁴ and references there. The positive kaon yield divided by N is independent of N , for $N > 100$ (figure 2) in agreement with previous NA52 results ⁴. Assuming that N is proportional to the volume of the particle source, figure 2 shows that the kaon number density exhibit a discontinuity, saturating above $N=100$.

This indicates a transition to a phase characterized by a high degree of chemical equilibrium and enhancement ⁴ of kaons from the point $N=100$ on, corresponding to energy density $\epsilon \sim 1.3 \text{ GeV}/\text{fm}^3$ ^{8,9,1}, near the critical energy density $\epsilon_c \sim 1-2 \text{ GeV}/\text{fm}^3$ ^{2,10}. This change marks the onset of strangeness enhancement seen in kaons in an equilibrated phase, which may be suggestive for a QCD phase transition, depending on the simultaneous appearance of thresholds in other signatures like e.g. the J/Ψ suppression at the relevant ϵ values and their theoretical understanding ^{10,3,8,11}.

Acknowledgments

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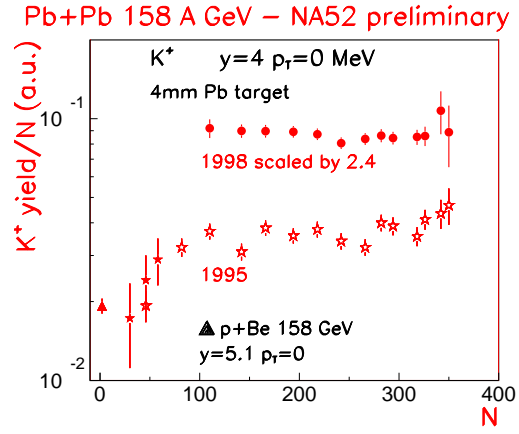


Figure 2. Preliminary K^+ yield in arbitrary units per participant nucleon N , as a function of N from Pb+Pb collisions at 158 A GeV, measured in the 1998 NA52 run. For comparison the 1995 NA52 data ⁴ are also shown. The 1998 data are scaled by 2.4 with respect to the 1995 data.

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