Strange Particle and Antiparticle Production in Proton-Beryllium Interactions at 40 GeV/c at the CERN NA57 Experiment

Stephen Andrew Bull

Thesis submitted for the degree of
Doctor of Philosophy

Particle Physics Group,
School of Physics and Astronomy,
University of Birmingham.

May, 2005.

Abstract

Results are presented on the production of singly strange Λ and $\bar{\Lambda}$ hyperons and K^0_S mesons in p–Be collisions at 40 GeV/c beam momentum. The data were obtained by the NA57 experiment at the CERN SPS in the 1999 data taking period. A comprehensive study of yields and transverse mass spectra for each of the three particle species is given. The results are compared to Pb–Pb data at 40 *A* GeV/c. In particular, the yields per wounded nucleon are seen to increase for all three particle species when going from p–Be to Pb–Pb collisions. This is a proposed signature that marks the transition of hadronic matter into a new phase of matter known as a *Quark-Gluon Plasma* (QGP).

An overview of QGP physics, its signatures and experimental results together with its importance to the understanding of QCD is given. The NA57 experimental apparatus is described in detail and the analysis procedures and techniques along with the results detailed. A study of the systematics is made. The results are compared to WA97/NA57 results at the top SPS energy and to results from other SPS and RHIC experiments. A brief insight into future experiments that will study the QGP is given.