Production of Strange Particles in Ultra-Relativistic Proton-Tungsten Collisions at 200 GeV/c

J. Paul Davies

Thesis submitted for the degree of
Doctor of Philosophy

School of Physics and Space Research,
Faculty of Science,
University of Birmingham.

November 1995.

Synopsis

The production of strangeness is a vital tool in the study of hot, dense hadronic matter. Indeed, the primary aim of the WA85 experiment is the study of strange and multistrange baryon and anti-baryon production, which are expected to be enhanced if an exotic state known as the Quark Gluon Plasma is formed in heavy ion collisions.

The WA85 experiment collided sulphur ions and protons on a tungsten target at 200 GeV/c per nucleon. Particles were detected in the kinematic window of central rapidity and $p_T \geq 0.6$ GeV/c. The results in this thesis are based on the data recorded during the 1990 proton-tungsten run. This run was used as a control in the sense that the conditions formed will not provide a suitable environment for the formation of the plasma phase of matter.

The relative production yields and transverse mass spectra for Λ, $\overline{\Lambda}$, $\Xi^-$and $\overline{\Xi^-}$ decays are presented and compared with the results obtained from the 1990 sulphur-tungsten run. The particle to anti-particle ratios are compatible when comparing the proton-tungsten to the sulphur-tungsten data. However, there is an increase in the ratio of multi(anti)strange to (anti)strange baryons of about 30% when going from proton-tungsten to sulphur-tungsten interactions. The difference in these ratios corresponds to about a two standard deviation effect. The inverse slopes obtained from the transverse mass distributions from the proton-tungsten data lie in the range of 200 MeV to 210 MeV, lower than those found in the sulphur-tungsten data which are compatible with 230 MeV.

The production of negative particles has also been studied, and if interpreted as π^-s, yield an inverse slope of 196 MeV $\pm$ 2 MeV, when plotted over the entire range of transverse mass. The results show that there is an increase in the inverse slope above an m_T of about 1.5 GeV/c.