PROTON-BERYLLIUM INTERACTIONS AT 40 GeV/c

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Synopsis

The theory of strong interactions, Quantum Chromodynamics, predicts that the vacuum is not empty, but consists of a strongly interacting and complex structure of virtual quarks and gluons. Ordinary matter in the world around us is mainly made from hadrons, which themselves are made from quarks. It is thought that it is the vacuum that confines the quarks inside the hadron, and their interactions with the vacuum that gives the hadron 98% of its mass. It is predicted that at extreme pressures and temperatures there will be a phase change, where the vacuum 'melts' and the quarks are effectively free. This new state of matter is called the Quark Gluon Plasma (QGP). At the Super Proton Synchrotron at CERN, lead ions accelerated to relativistic energies, were collided with lead targets. During a collision of two lead ions it is possible that the QGP can be created under laboratory conditions here on earth. To detect the signals of plasma formation through the background of normal hadronic interactions is a challenging task experimentally.

This thesis is based on data taken in 1999 at the NA57 experiment. NA57 uses an enhancement of strange particles to detect plasma formation. A large enhancement in strange particle production in lead-lead interactions, with respect to proton-nucleon interactions, is considered a good probe of plasma formation. NA57 took data at two beam momenta, 40 GeV/c per nucleon and 160 GeV/c per nucleon. This thesis is concerned with the work done on the 1999 proton-Beryllium 40 GeV/c data which is used to normalise data from the NA57 40 GeV/c per nucleon lead-lead runs and calculate the strangeness enhancements at this energy. This thesis details the methods used to calculate corrected inverse slopes, see table 4.5, and final yields, see table 4.6 for the proton-Beryllium data for the Λ, $\overline{\Lambda}$ and K^0 signals. Enhancements in the NA57 lead-lead data have been seen when compared to the proton-Beryllium data and are shown in figure 5.1.