Hyperon Production in Lead-Lead and Proton-Beryllium Interactions at 158 GeV/c per Nucleon

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Synopsis

One of the key probes of the behaviour of hot, dense hadronic matter is strangeness production. Such matter is produced in ultra-relativistic heavy ion collisions and may undergo a phase transition into a state called the *Quark Gluon Plasma* (QGP). The formation of the QGP would lead to an enhancement in the production of strange particles; the measurement of this enhancement being the aim of the WA97 experiment, following on from experiments WA85 and WA94.

In both 1995 and 1996 the WA97 experiment studied lead ion collisions on a lead target at 158 GeV/c per nucleon while control data using a proton beam was also taken in the same years. In 1995 a lead target was used for the proton data while in 1996 the target was changed to beryllium. The proton beam data acted as a control since the conditions found in such collisions are not sufficient to create the QGP. Charged particles were detected in a kinematic acceptance region around central rapidity and at medium p_T. The production of strangeness in all runs was measured by reconstructing the weak decays of strange hadrons, primarily the Λ, Ξ and Ω hyperons.

The geometry of the WA97 apparatus results in the acceptance region having curved limits in rapidity and p_T. Various methods of compensating for the shape of the acceptance region when extracting transverse mass distributions will be described in this thesis, with these methods tested and compared using the 1995 Pb-Pb hyperon data samples. These comparisons confirmed that the log likelihood method already in use was the best method.

Analysis has also been performed on the 1996 p-Be data, with transverse mass distributions and normalised yields per event for Λ and $\overline{\Lambda}$ hyperons being presented. These results are compared with the p-Be results for Ξ^-, $\overline{\Xi}^+$ and Ω^-+$\overline{\Omega}^+$ hyperons as well as similar results from the p-Pb and 1995 Pb-Pb data. The inverse slopes obtained from the transverse mass distributions, for Λs and Ξs, increase from p-Be through p-Pb to Pb-Pb. A similar increase with the collision system is observed with the yields per event for all studied particle species. The yields per event per participant are consistent between the p-Be and p-Pb data and, for the centrality range studied in the Pb-Pb data, show no increase with centrality. These yields are, however, significantly greater in Pb-Pb than in the proton beam data, with this enhancement increasing with the strangeness content of the particle.