A Study of $\Lambda\bar{\Lambda}$ Correlations

Cheryl Theroux

Dr. Homer Neal

Daniel Scheirich

Analysis Overview

- We are studying correlations between hyperons produced in high energy collisions
  - Specifically, we are looking at $\Lambda\ \bar{\Lambda}$ pairs where

$$p + p \rightarrow \Lambda + \bar{\Lambda} + X$$

$$\Lambda \rightarrow p\,\pi^- \text{ and } \bar{\Lambda} \rightarrow \bar{p}\,\pi^+$$

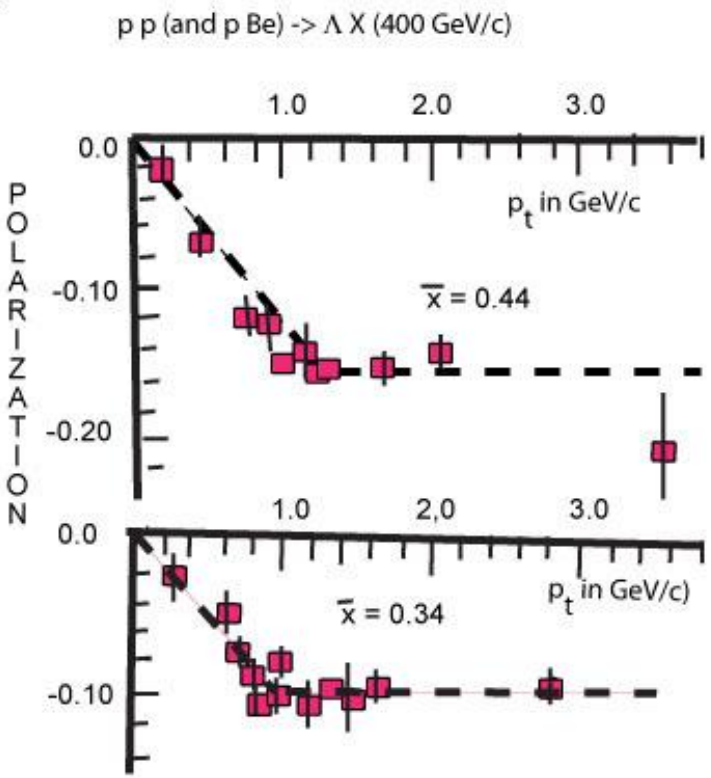
  - Incident proton energies = 3.5 TeV/c each (highest energy at which these reactions have been studied)
- Hyperon production is not well understood
  - In this study, we want to know if $\Lambda\ \bar{\Lambda}$ pairs come from an $s\bar{s}$ pair produced in the vacuum
  - We will look at **spin correlations** to do this
  - A correlation between the spins would be evidence that the Λ and $\bar{\Lambda}$ come from the same $s\bar{s}$ pair

Analysis Overview

- Previous studies have found that for

  $$p + p \rightarrow \Lambda + X$$

  the Λs have a large polarization, which has never been satisfactorily explained
  - We hope to achieve a better understanding of this effect in our analysis



Analysis Method

- Using data from the ATLAS experiment
- We cannot directly measure the spin of the Λ or $\bar{\Lambda}$
  - The angular distribution of the protons/antiprotons depends on the spin of the Λ / $\bar{\Lambda}$ and is given by

$$\frac{1}{2}(1 \pm \alpha_\Lambda P \cos\gamma) \text{ where } P = \frac{N^\uparrow - N^\downarrow}{N_{total}}$$

  - We will study these angular distributions in our analysis to extract the relevant spin information
- We also plan to develop a toy Monte Carlo to simulate/validate our analysis

Current Data