

# Transverse Spin effects in the Drell-Yan Process from Pions on a Transversely Polarized Proton Target

## 1 Introduction and Theory

### 1.1 Transverse Momentum Dependent Parton Distribution Functions

TMDs take into account the transverse momentum of partons to describe how constituent quark and gluon momentum makes up the proton's momentum. At leading twist there are eight TMDs needed to describe the proton. One specific TMD is called the Sivers function. The Sivers function gives a correlation between the parton's transverse momentum and the transverse spin of the hadron it makes up. It is believed that this function can be used to determine the angular momentum of a constituent parton.

### 1.2 Drell-Yan

The amplitudes of the spin dependent Drell-Yan cross section give convolutions of TMDs of the scattering hadrons. With a transversely polarized target the amplitude related to the Sivers function can be measured.

## 2 COMPASS Experiment

COMPASS took nine two week periods of Drell-Yan data in the summer of 2015. Specifically COMPASS took Drell-Yan data from a 190 GeV pion beam on a transversely polarized Ammonia target. The COMPASS data can be used to determine the amplitude of the Drell-Yan cross-section related to the proton Sivers function.

### 2.1 Drift Chamber 5

Simulations showed that 95% of Drell-Yan data will include a track in the large angle spectrometer. With two aging detectors in this section of the spectrometer, it was shown that the reconstruction efficiency for Drell-Yan events could reduce to less than 30%.

Drift chamber 5 was build at UIUC, Old Dominion University, and assembled at CERN.

## **2.2 Alignment**

The alignment of the spectrometer is an important aspect for reconstruction. There are over 200 detector planes which need to be aligned in order to have track resolutions approximately 100  $\mu\text{m}$ . This is accomplished by minimizing the  $\chi^2$  function of all the track positions minus hit positions in each detector.

# **3 Data Analysis**

## **3.1 Physics cuts**

A clean DY sample is ensured through various cuts.

## **3.2 Amplitude Extraction**

Through comparing the number of hits from the two oppositely polarized targets, all the amplitudes of the polarized Drell-Yan cross section can be determined.