**Abstract**

Experimental data on the J/ψ cross section in p+p collisions can be described relatively well by many models that are currently available on the market. These models have different predictions regarding the J/ψ polarization. Therefore measurements of the J/ψ polarization may allow discriminating among the models and provide new insight into the J/ψ production mechanism.

The previous STAR J/ψ polarization analysis [1] was performed only for the polarization parameter λ, and in one reference frame due to limited statistics. Proton-proton data taken in year 2011 at RHIC at $\sqrt{s} = 500$ GeV with integrated luminosity of 22 $fb^{-1}$ will allow us to extract the full information about the dielectron decay angular distribution of the J/ψ in different reference frames. In this presentation, the status of the J/ψ polarization measurement at mid-rapidity at $\sqrt{s} = 500$ GeV in p+p collisions in the STAR experiment is shown.

**Method - decay angular distribution**

J/ψ polarization is analyzed via the angular distribution of a lepton pair from the J/ψ decay:

$$d^2N/d(\cos\theta)d\phi \propto 1 + \lambda_\psi \cos^2 \theta + \lambda_\phi \sin^2 \theta \cos 2 \phi + \lambda_{00} \sin 2 \theta \cos \phi$$

Polar angle $\theta$ – angle between momentum of a positive lepton in the J/ψ rest frame and the polarization axis $z$.

$\phi$ angle is a corresponding azimuthal angle.

$z$ is the polarization axis and depends on the choice of the reference frame.

In the helicity frame $z$ is defined along the J/ψ momentum in the center of mass frame.

Frame-invariant approach [2]:

$$\lambda = \frac{\lambda_\psi + 3 \lambda_\phi}{1 - \lambda_\phi}$$

**Dataset, cuts and electron identification**

- p+p collisions at $\sqrt{s} = 500$ GeV from the year of 2011.
- High Tower Trigger – trigger is fired when transverse energy in BEMC tower $E_T > 4.3$ GeV.
- Integrated luminosity ~ 22 $fb^{-1}$.

J/ψ is reconstructed through its dielectron decay channel: $J/\psi \rightarrow e^+e^-$ (BR 5.9%).

**Electrons identification**:

- TPC – $dE/dx$ information
- BEMC – $E/p > 0.5$ (E - single BEMC tower energy)
- TOF – $|1/\beta - 1| < 0.03$ ($\beta$ = pathLength/TimeOfFlight/c)

Kinematic cuts:

- $p_T > 0.3$ GeV/c
- $|\eta| < 1$
- $p_T > 3.5$ GeV/c - for electron from J/ψ decay that fired the trigger

**Corrections**

J/ψ corrections obtained using MC simulations.

**Example of Corrected cosθ and φ distributions, Helicity frame**

Statistical uncertainties only

**Summary**

- First J/ψ polarization measurement at $\sqrt{s} = 500$ GeV from STAR in progress.
- J/ψ signal up to $p_T \sim 15$ GeV/c, can be divided into several $p_T$ bins.
- Reconstruction of both $\theta$ and $\phi$ angles.

**Outlook**

- Polarization of the correlated background needs to be subtracted.
- Full decay angular distribution analysis of $\lambda_\phi$ and $\lambda_\psi$ parameters as a function of $J/\psi$ $p_T$.

**References**


The STAR Collaboration: http://drupal.star.bnl.gov/STAR/presentations