A CNI Polarimeter for the AGS

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1) Need for fast, high statistics measurements of the AGS beam polarization
a) at RHIC injection energy
b) while ramping

2) Luminosity & Rate Estimate

3) Some Questions about the CNI Detector Characteristics

4) Objective: CNI polarimeter for the AGS for next year's run

Meeting: CNI Polarimetry for the AGS – 28 June 2001

Attendees: Les Bland, Gerry Bunce, George Igo, Kazu Kurita, Yousef Makdisi, Tom Roser, Naohito Saito, Dave Underwood

Count rate estimate:

$I = 10^{11}(protons\,in\,bunch)\ x\ 1/2.6\mu s(AGS\ frequency)$

$= 4\ x\ 10^{16}\ p/s$

$T = (w\ x\ 2\sigma_x)/(\pi\sigma_x^{\ 2})\ x\ \rho l\ x\ N_A/12$

where w is the width of the carbon foil, σ_x is the half-width of the beam, ρl, the areal density of the carbon foil.

For a 0.02 micrometer thick target,

$T = (5x\ 10^{-2} cm\ x\ 2x\ .08\ cm)/(\pi\ x\ (.08cm)^2)\ x\ \ 4x\ 10^{-6} g/cm^2\ x\ \ (6x10^{23})/12$

$T = 8x\ 10^{16} carbon\ atoms/cm^2$

$L = I \times T = 3.2 \times 10^{33}\ cm^{-2}\ s^{-1}$

Rate =

$$L \int d\sigma/dt\ \Delta t\ \Delta\varphi/2\pi$$

Where $d\sigma/dt = 0.7 barns/GeV^2$, $t = 4.5x10^{-3} GeV^2$

$\Delta t = 3x\ 10^{-3}\ GeV^2$, $\Delta\varphi/2\pi = 10cm/2\pi\ x\ 10cm = 0.14$

Rate = $3.2 \times 10^{33}\ cm^{-2}\ s^{-1} \times 0.7 \times 10^{-24}\ cm^2/GeV^2 \times 3 \times 10^{-3}\ GeV^2 \times 0.14$
$= 0.9 \times 10^6$ events/s

On the basis of a 10^6 events/s count rate, Tom Roser thought it possible to use the CNI to accumulate polarization data during ramping dividing the count rate into order of tens of milliseconds bins.

Accumulating 10^6 events in 1 second would give $\Delta asym = 10^{-3}$. The asymmetry is $PA_N = 0.5 \times 0.02 = 0.01$, and $\Delta P/P = 10^{-1}$.

Because of the length of the AGS bunch, it may be necessary to move the detectors further away, possibly to 15 cm, thus reducing the rate or alternately to increase the sizes of the silicon arrays to keep the event rate high.

The magnitude of the proton-carbon elastic cross section at the t-value where the measurements are made needs to be researched.
Another meeting will be scheduled shortly.

3. CNI Detector Characteristics

TOF start from beam bunch arrival time.
Si recoil detectors only in left-right orientation for transverse polarization measurements. Do we want to measure radial polarization component?
0.5 mm wide, 500 μg carbon target- Bill Lozowski

4) Summary and Objective
Come to an agreement about CNI detector design features
Left-right detectors only?
TOF start?
0.5 mm wide C target
Objective: CNI detector for AGS for next year's run.