22 February 2002
G. Bunce

AGS CNI Polarimeter

Goal: use proton-carbon CNI elastic scattering, as for the RHIC polarimeters, measure asymmetry from AGS injection energy to RHIC injection energy. If possible, measure on AGS ramp.

---CNI polarimetry, when the recoil carbon is measured using time of flight and energy, clearly identifies the elastic reaction

---the microribbon target survives the high beam intensity we use

---with a wide target width, the measurement can be made in a short time (seconds to minutes)

---it might be possible to measure the asymmetry on the ramp, so that it won't be necessary to set up a flattop at the desired energy

The present polarimeter: uses proton-proton elastic scattering at medium t ($t=0.15\ GeV^2/c^2$)

---with the high polarized source intensity, a hydrocarbon target cannot survive. Therefore a carbon target is used, and quasi-elastic scattering is measured instead of pp elastic. The analyzing power is about half, and the recoil proton is not clearly identified.

---at 24 GeV, the measurement takes about 20 minutes, with a flattop and debunching required

The idea is to provide a better tool to investigate depolarization and corrections in the AGS.

Experience: E950, where we first tested and calibrated the RHIC CNI polarimetry.

Issues:

1. **beam size at injection into AGS ==> longer target than RHIC (Bill Lozowski of Indiana is working on this, along with a wider target.)**

2. **long bunches in AGS, time of flight resolution ==> place detectors at 25 cm radius vs. 15 cm for RHIC (time is then roughly 120 ns for 200 keV carbon)**

3. **noise environment in AGS ==> E950 worked, but this is a major issue requiring work**

4. **analyzing power vs. energy ==> cross calibrate with AGS pp polarimeter, can also consider calibrating at injection energy at COSY. Calibrated at 22 GeV by E950. Absolute calibration not as important—issue is to spot depolarizing resonances in ramp**

5. **sufficient rate ==> factor 100 wider target than for RHIC, use 6 bunches with 2 x 10^{11}/bunch, 2 RHIC type silicon detectors, get 1M events in 300 ms at injection energy****

6. **ramp measurement requires 50 measurements over 600 ms ramp ==> 10 ms time window, or 30 ramps to collect 1M events at lowest energy**

7. **coding wave form digitizer for 50 measurements ==> new WFD has capability (decision to use new version WFDs, which were used for half the channels for the RHIC polarimeter this year, for AGS. RHIC will also use all new version WFDs next year)**

8. **too much rate ==> present calculation gives about 20% double hits in strip. We need to decide what is acceptable, and select the target width**

Plans and schedule: we are designing the chamber, ordering valves and parts for the target mechanism, etc. Plan is to have the AGS CNI polarimeter in place for the 2003 run.

Do we need help? You bet. We have a small group from CAD, UCLA and RBRC working on this now, and certainly can use help!

20 February 2002
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Accelerator Spin Issues and Questions

The RHIC spin run this year was extremely successful, with the new high intensity polarized source, new RHIC polarimetry and readout, new Siberian Snakes (first use at high energy), tune lock on ramp, maintaining polarization at injection, ramp to 100 GeV, storage for up to 14 hours without apparent polarization loss, studies showing the new spin flipper works, and reaching luminosity goals. The AGS polarization was low, and the accelerator and experiments required most of the alloted time for commissioning, but physics data was taken for the first time ever for a polarized proton collider at root(s)=200 GeV. Experiments saw some striking online physics asymmetries.

In preparation for the March RHIC retreat, and also to prepare a spin plan for the future, this list is intended to collect questions which should be addressed on the acceleration and storage of polarized protons.

Source

Is there an understanding of the source polarization being about 70%, and is there a plan or studies planned to improve to over 80%? What is the time scale for this?

Do we understand the absolute polarization of the source (or at the end of the linac)?

What intensity did we reach, what is available, and what maintenance schedule should be used during a run? Polarization vs. intensity for source?

Booster

A significant intensity loss seemed to occur in transfers to and from the Booster. What is the expectation for transfer efficiency, what did we have, do we understand the differences, and what improvement is expected? When?

AGS

Can (and will) we understand the polarization losses in the AGS

with the 2001/2 run? How quantitative is this understanding--
can we use spin tracking confidently to predict AGS polarization?

What polarization should be achieved in the AGS using present techniques, and the Siemens ramp rate?

Issues of polarization vs. luminosity tradeoffs (intensity and emittance)?

What are the systematic errors for the AGS polarimeter? What is the absolute calibration that we should use? Is there any intensity dependence?

Will a new AGS CNI polarimeter be ready for the next run? What are the issues to do this? Team? Schedule? What are its goals?

Will the strong AGS partial snake overcome all polarization issues? What are the predictions of spin tracking? What should we expect for final AGS polarization?

What are the issues with designing and building the strong AGS partial snake? What is a reasonable
(if aggressive) time scale for building it? How long to install?
What would be the commissioning sequence with it,
and rough commissioning time scale? (Without polarized beam as much as possible.)

What is our experience in repeatability of extraction from the AGS? Are there plans to improve reliability? When?

RHIC

Issues of RHIC polarimetry: systematic errors from identified or unidentified sources? Estimates of false asymmetries? Intensity dependence? Other dependence (bunch length, poor transfer from AGS)? Schedule for completing studies on data? Radiation damage--what needs to be replaced, funds required, schedule. Changes for next run in FPGA code, etc.

What do we know about polarization loss in transfer from the AGS to RHIC? Did we see any variation? If so, do we understand why?

What quantitatative information and understanding do we have of polarization loss on the ramp from the 2001/2 run? When will this evaluation be complete?

What are the issues with having reliable tune locking on the ramp?

What work is needed, schedule, plan?

Is the present machine flat enough? What was achieved vs. what is required for polarization?

Quantitative information and understanding of polarization loss at flattop? Plan for using tune lock on flattop?

Intensity vs. lifetime? What are limits? Luminosity vs. lifetime? What should we expect for lifetime with beta*=1m?

Downramp--understanding of difficulties and plan.

Spin flipper--plan to have it operational for next run.

Spin studies in RHIC--what is essential to study, what was missed in this run? Realistic estimate of study time required.

Local polarimeter plan for PHENIX and STAR to calibrate spin rotators--results of tests, plan?

Spin rotators--installation plan, commissioning plan, time estimate for commissioning (separate estimates for using gold, polarized beam).

Evaluation of 2001/2 run in terms of commissioning efforts, time required for steps. What should we expect for next spin run? Issue of time required to reach luminosity goal and polarization studies.

250 GeV/c issues? Additional requirements on flatness, tune control, snake alignment?

For the Executive summary

What should be expected for a 2003 spin run at root(s)=200 GeV? Luminosity, lifetime, integrated luminosity, polarization, commissioning time, studies time? (Without/with AGS strong partial snake.)

What length AGS study should be expected to achieve and demonstrate polarization goal for a 2003 run?

RHIC commissioning time to have physics at root(s)=500 GeV in 2003? Luminosity?

Is the RHIC spin goal of reaching luminosity 2 x 10^32 at root(s)=500 GeV (and 8 x 10^31 at 200 GeV) and 70% polarization achievable in 2004,

or what should be assumed based on present understanding?

What issues/studies are seen as crucial/important to know in 2003, to achieve full luminosity and polarization in 2004? Pros and cons from the accelerator perspective of a short run in 2003, longer run in 2004, vs. long run in 2004.