SUMMARY

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for
RHIC Spin Collaboration Meeting IX
RIKEN BNL Research Center

Since its inception, the RHIC Spin Collaboration (RSC) has held semi-regular meetings each year to discuss the physics possibilities and the operational details of the program. Having collected our first data sample of polarized proton-proton collisions in Run02 of RHIC, we are now in the process of examining the performance of both the accelerator and the experiments. From this evaluation, we not only aim to formulate a consensus plan for polarized proton-proton during Run03 of RHIC but also to look more forward into the future to ensure the success of the spin program.

In the third meeting of this series (which took place at BNL on May 22, 2002), we focused on three, more immediate topics:

- luminosity performance at the experiments,
- the status of the local polarimetry test efforts from PHENIX and STAR, and
- a discussion of the proposals for Run-03 from the three spin experiments.[1]

In addition, there was an update presentation on the analysis of the RHIC CNI polarimeter data from Run-02.

To start the luminosity discussion, Gerry Bunce summarized his comments at previous RSC meetings on the importance of the relative luminosity measurement for spin measurements. Since the bunches are prepared and accelerated separately, they will inherently have different characteristics. If the polarization state remains fixed, these differences could result in a false asymmetry if, for example, the luminosity of the parallel and anti-parallel bunches are different. This difference – called the relative luminosity – thus needs to be measured and then used when computing the spin asymmetry. In order to keep the systematic error in the asymmetry on the order of 10^{-3}, the relative luminosity should be measured to a precision of 10^{-4}. This level of precision requires a detector which monitors a high-rate process in order to collect the statistics needed for this precision. Effects such as saturation, accidentals, beam gas/scraping, and sensitivity to the vertex distribution could result in a mis-measurement of the relative luminosity. Corrections of the relative luminosity for these effects are likely not possible because of the required precision. And, finally, the monitored process ideally should not have any polarization dependence.

Following Gerry's talk, Joanna Kiryluk presented the status of the luminosity analysis underway at STAR using the data from the beam-beam counters (BBCs) which had been installed for the Run-02 proton-proton run. In this presentation, she presented preliminary results from the van der Meer scan that indicated that the peak luminosity at STAR was on the order of $10^{30}/\mathrm{cm}^2 \cdot \mathrm{s}$ with an error bar which was estimated to be in the range of 15 to 25%. For spin measurements, she showed that the STAR luminosity data corroborated the observation from the RHIC CNI polarimeter that bunch 11 in each beam is anomolous.[2] She then showed that, after removing this bunch, the relative luminosity was measured with

[1] Subsequent to this meeting, it was realized that, with the addition of bunch-sorted luminosity scalers (such as the scalers which were developed by STAR for spin), the BRAHMS experiment would be able to measure $A_N(\pi)$ at forward rapidity over a large p_t range. Such a measurement will be performed by BRAHMS in Run-03.

[2] It has been since been learned that bunch 11 in each beam is used by the tune-measurement system, so the machine group is not surprised that it is an anomoly.

a precision of up to 10^{-3} by the BBCs by comparing the transverse asymmetry computed by the square-root formula with that computed with the luminosity normalized formula. In addition, she notes that, from the data collected with the BBC counters, there is a slight (10^{-3}) transverse asymmetry – an observation which, if confirmed by further analysis, would provide STAR with an already operational local polarimeter.

On the same topic, Yuji Goto presented the plan for evaluating the relative luminosity error at PHENIX.[3] Unlike at STAR, PHENIX has several luminosity detectors in the experiment and thus can compare the response of one against the other to evaluate their performance as relative luminosity monitors. In this talk, Yuji showed some initial results from this work – notably, confirming the "Bunch-11" problem seen by STAR and the CNI polarimeter – and outlined the analysis plan for the data.

And, finally, to close out this portion of the program, Thomas Roser presented the luminosity goals in Run-03. In this presentation, he recounted the performance of the machine for Au-Au and p-p running in Run-02 and, based upon this performance, estimated that the luminosity expectations for Run-03. Specifically, he expects something in the neighborhood of $\sim$2.8 pb^{-1}/week for proton-proton running. Folding in an efficiency of 50% for the experiments, we decided that we should use $\sim$1.0 pb^{-1}/week as a reference luminosity when estimating the physics output from a spin run as part of Run-03.

The final presentation of the morning session was an update on the CNI polarimeter by Osamu Jinnouchi. With the data collected on January 23rd during the dedicated polarimeter fill, the polarization of the individual bunches was computed with the square root asymmetry formula using the unpolarized bunches as the reference. After observing markedly different polarizations for the up and down bunches based on this analysis, Osamu realized that the first bunch, which was one of the three unpolarized bunches, exhibited non-zero and wildly fluctuating asymmetries when matched with either of the other two unpolarized bunches. Further investigation showed that this behavior occurred in all fills. Omitting this anomolous bunch from his analysis, he found that the polarizations for the up and the down bunches were much more consistent, but still these studies need to be pursued a bit further before it is reasonable to draw any definite conclusions from these data.

In the afternoon session, Les Bland presented a first look at the analysis of the data from the forward pion detector (FPD) installed for the Run-02 proton-proton run at STAR. The aim of this effort was to measure the cross section and the transverse asymmetry for π° production at forward rapidity (x_f between 0.3 and 0.6) with a p_t of $\sim$1.5 GeV/c. This detector setup consisted of the prototype for the STAR end-cap calorimeter for the left-arm and arrays of lead-glass detectors (obtained from E704) for the top, bottom, and right arms. At this point, the analysis has verified that the detectors worked as expected and they are now working on extracting both the cross section and the transverse asymmetry. It is hoped that this analysis will be finalized by September for the Spin 2002 conference.

And, finally, there was a discussion of the Run-03 plans from the three main spin experiments. Matthias Grosse-Perdekamp presented a summary of the detector performance at PHENIX in Run-02, including a first look at the absolute π° cross section result from an online analysis by Sasha Bazilevsky and an estimate for the precision of the A_N measurement from

[3]The results of this analysis were presented by Takehiro Kawabata during the September meeting and the transperencies from his talk have been included in a later section of these proceedings.

these data. He then showed that we could make a significant measurement of ΔG in Run-03 in the π° channel if the polarization was $\geq 40\%$ and the recorded, integrated luminosity was ≥ 3 pb $^{-1}$. With this result as our main goal, PHENIX will likely ask for a proton-proton run as part of Run-03.

Geary Eppley then presented the thoughts on Run-03 for the STAR spin group. He informed us that STAR also was leaning towards requesting a proton-proton run as part of their beam proposal because the spin group feels that it can improve the $A_N(\pi^\circ)$ from the FPD (discussed early by Les) by increasing both the statistics and the kinematic coverage and also start a ΔG measurement using the jet+X channel. In addition, he emphasized the need for continuity in the spin program. So, as with PHENIX, STAR will likely ask for a spin run.

To close this discussion, Stephen Buehtmann presented the Run-03 plans for the pp2pp experiment. To open, he summarized the performance of pp2pp in Run-02. In this run, they had 4 Roman pots (2 on each side of the IP) instrumented with silicon microstrip detectors and trigger scintillators to cover a range in momentum transfer from 4×10^{-3} to 0.03 $(\mathrm{GeV/c})^2$. With this setup, they were able to collect $\sim$400k elastic events during the dedicated running at $\beta^* = 10$ m. He showed a first (x,y) distribution for hits in one of these detectors. The analysis of these data is still under way.[4] For Run-03, they plan to adjust the detectors to extend their momentum transfer acceptance down to $\sim 2\times10^{-3}$ and, with a 2-3 day run at $\sim$10 times the Run-02 luminosity, collect 2 to 3 million elastic triggers. With these data, they would be able to measure the cross section to $\sim$3% and A_N with a statistic precision of 0.002; however, it should be noted that, within the collaboration, discussions of the conditions and the duration of a run during Run-03 are still ongoing.

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[4] In the June meeting, Stephen Buehtmann made a presentation on the analysis of these data.