Research Plan for Spin Physics at RHIC

Abstract

1 Spin plan schedule (Gerry)

In the charge, we were requested to consider two running schedules: 10 and 5 physics weeks on spin per year. These follow, showing *example* plans. We emphasize that we expect that the actual run plan will be developed from the experiment beam use proposals. Our consideration of these scenarios should not suggest that we advocate a change to this successful approach.

A key issue is the completion of experiment hardware to run the W physics program. The required hardware are the muon trigger improvements for PHENIX, and a forward tracker for STAR. The PHENIX improvements are being proposed to NSF ($1.8M for resistive plate chambers) and to the Japan Society for Physical Sciences ($1.0M for muon tracking readout electronics), with a planned completion for the 2008 RHIC run. The STAR tracker is planned to be proposed to DOE (estimated $5M) in 2006, and to be complete for the 2010 run.

The example plan below for the 10 physics week/year case is ”technically driven”. The plan assumes that the funding is received, and the work is completed as planned. For the 5 week plan, the delay in reaching luminosity goals for $\sqrt{s}$=200 GeV delays the start of the W running considerably, by greater than three years. An early completion of the W hardware is less of an issue for this case.

A second key issue is machine performance. We assume that we reach the polarization goal of 70% in 2006. For luminosity, we assume in the example plan that we reach two thirds of the ”maximum” luminosity (see section 3). This assumption is discussed there.

A third key issue is experiment availability, in which we include up time, live time, and the fraction of the collision vertex accepted by the experiment. This results in ”recorded luminosity” for each experiment. We have taken the up time to be 70% for each experiment, as has been achieved. The live time for PHENIX is 90%, due to multi-event buffering; the live time for STAR is 50%. The online data selection adjusts thresholds, for example the lower p_T requirement, to reach these live time levels. The PHENIX vertex acceptance for the 200 GeV running is 60%, requiring the vertex to be within 20 cm of the IP. We have used this acceptance also for 500 GeV. The STAR vertex acceptance contains all collisions. The overall factor for recorded/delivered luminosity for both experiments is 35%. The physics sensitivities shown in section 2 also include apparatus acceptance and event selection acceptance.

1.1 10 physics weeks

Table 2 shows the example spin plan for 10 physics weeks per year, with a *technically driven* schedule. The 200 GeV running continues through 2008, with a total of 300 pb^{-1} delivered, and 100 pb^{-1} recorded luminosity by both PHENIX and STAR. By the year 2009, the PHENIX muon triggering improvements are complete, and the STAR forward tracking is partially in place, and complete for the 2010 run. The year 2009 is considered an engineering run, for both the accelerator and the experiments. By the completion of the year 2012, for 500 GeV, 800 pb^{-1} luminosity is delivered, and 300 pb^{-1} recorded by each experiment. These luminosities and polarizations provide the physics sensitivities presented in section 2.

Table 1: RHIC spin example schedule, 10 physics weeks per year, technically driven.

Fiscal year	Spin Weeks	CME(GeV)	P	L(pb^{-1}	Remarks
2002	8	200	0.15		First pol. pp collisions! Transverse spin
2003	10	200	0.27		Spin rotators commissioned, first helicity measurements
2004	1	200	0.4		New betatron tune developed, first jet absolute meas. P
2005	9	200	0.5	10-20	$A_{LL}(\pi^0, jet)$, also 500 GeV studies
2006	10	200	0.7		AGS Cold Snake commissioned, NEG vacuum coating complete
2007	0				
2008	20	200	0.7		Direct γ, completes goal for 200 GeV running
2009	10	500	0.7		PHENIX muon arm trigger installed, eng. run
2010	10	500	0.7		STAR forward tracker installed, W physics
2011	10	500	0.7		
2012	10	500	0.7		Completes 500 GeV goal

1.2 5 physics weeks

Table **??** gives the example spin plan for 5 physics weeks per year, which we have interpreted to mean 10 physics weeks each two years to reduce the end effects. As has been presented in section 3, the delay in the RHIC spin physics results is actually greater than a factor of two, compared to 10 physics weeks each year. This is due to an assumed ”turn-on” period of reaching the instantaneous luminosity maximum that is based on our experience, from the heavy ion program. In any case, the programs are stretched out to over 6 years for the gluon polarization measurements at 200 GeV, and an additional 6 years or more for the W physics program. The proposed measurements would be completed in 2018 or later.

Table 5.2 RHIC spin example schedule, 5 physics weeks per year.

Table 2: RHIC spin example schedule, 10 physics weeks per year.

Fiscal year	Spin Weeks	CME(GeV)	P	L(pb^{-1}	Remarks
2005	9	200	0.5	10-20	$A_{LL}(\pi^0, jet)$, also 500 GeV studies
2006-2007	10	200	0.7		AGS Cold Snake commissioned, NEG vacuum coating complete
2008-2009	10	200	0.7		Direct γ
2010-11	10	200	0.7		completes goal for 200 GeV running
20012-13	10	500	0.7		PHENIX muon arm trigger installed, eng. run
2014-2015	10	500	0.7		STAR forward tracker installed, W physics
2016-2017	10	500	0.7		
2018-2019	10	500	0.7		Completes 500 GeV goal