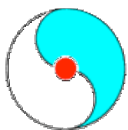




Plans for Run-6

Abhay Deshpande
Stony Brook & RBRC

RHIC Spin Meeting
Friday the 13th January, 2006



Overview

- Run-6 a reality
- RHIC Schedule according to CAD
- Run-6 plan:
 - What could it be? --> This talk. From “BUP to Today”
 - What should it be? --> PAC guidelines + **PHENIX EC 1/12**
 - What will it be? --> **ALD's decision** ~Tuesday 1/17 + ??

RHIC Schedule:

January 2006

- 03 Linac Setup
- 09 N₂ cool down begins
- 16 Cold snake commissioning
- 23 RHIC dry run

February 2006

- 01 He cool down begins
- 07 2-p watch shifts at PHENIX**
- 13 Both rings at 4K
- 22 5-p shifts at PHENIX**
- First Maintenance Day
- Earliest beam available for detector commissioning
- 2 shifts CAD + 1 shift Exp

March 2006

- 01 Latest beam available at night for detector commissioning
- 08 Physics begin**
- 1 shift CAD & 2 shifts Exp
- Maintenance day
- 15 Beam experiments & optional experimental maintenance day
- 29 CAD Maintenance (every 3 wks)

April 2006

May 2006

31 End of Run-6

June 2006

03 Warm up & end of Cryo

Run-6 Physics: What should we do?

- 18 wks of Cryo - 5.5 wks of startup & end = 12.5 wks of Physics
 - We now have 20 Cryo weeks! **[Add two weeks to Physics]**
- Beam Use Proposal was made for 29 or 20 wks of Cryo
- Fewer the weeks, we suggested running one species
- Now we have 18+2 weeks: **only pp**
- Physics: combination of spin and for heavy ion physics

Strategy for run planning decisions

- Maximize the physics out put of the run: Spin + HI
 - Significant impact measurements:
 - Transverse physics --> not done dedicated searches yet
 - Significant improvement in A_{LL} possible **if L and P are LARGE compared to Run-5**
 - HI Case is based on need for lower CM energy pp comparison data
- A firm plan, but have *reasonable* freedom to modify according to the situation
 - Whenever **during the run** questions will arise as to what to run, the decisions will be made based on what **we have** on tape up to that time, AND what the prospects look like for high **polarization and luminosity** at the time.

PHENIX BUP: What could we run?

- 200 GeV CM running with transverse (radial) spin orientation to explore the Siver's function, a most direct evidence for non-zero orbital angular momentum
 - 5-7 pb⁻¹, polarization better or equal to last year (> 0.5) $P^2L=2-2.5 \text{ pb}^{-1}$
 - Estimate ~4 weeks of running
- 62.4 GeV CM running (if possible) polarized transverse (radial?)
 - 0.6 pb⁻¹, polarization at least 0.5
 - Estimated 2 wks of running
- 22 GeV CM running (polarized?)
 - 4 nb⁻¹
 - Estimate 3 days
- 500 GeV CM CAD development week
 - 1 week, also PHENIX trigger and local polarimetry studies

4.5+2 weeks remaining from the 12.5+2 wks of physics: Longitudinal

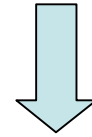
$P^4L=1.0 \text{ pb}^{-1}$ 6

My questions to CAD & Answers

- Is there a preferred sequence of operation from CAD's point of view?
 - **From 200 GeV CM to lower CM, Except the 500 GeV CM**
 - 200 GeV, then 62.4 GeV to 22 GeV followed by 500 GeV CM
 - 500 GeV is not really a Physics Run, it's a development run
- How long a minimum 500 GeV development CAD needs?
 - **1 week**
- How long a development time between any of these two scenarios?
 - **2 days to get to maximum luminosity and polarization**

Physics Advisory Committee

PHENIX



4 wks

6.5 wks

RHIC Run 6

Because the length of RHIC operations in Run 6 is expected to be **20 weeks**, the PAC reluctantly recommends that the run be limited to the study of a single species, in particular **polarized protons**. This should be run for a long enough time to provide a significant publishable result at 200 GeV. BRAHMS should take data during the run at 62 GeV.

The individual experiments, using their spin rotators, can determine whether they study transversely or longitudinally polarized protons. The PAC believes that the PHENIX and STAR collaborations are best able to decide on the optimal mix of transverse and longitudinal polarizations. It is important to complete the 2-3 week 62 GeV p-p running, both for heavy ion comparison and equally important the single spin asymmetries A_N at lower energy. BRAHMS should definitely run during this time

The PAC strongly recommends that at least one experiment focus on A_{LL} (longitudinal polarization studies), and is pleased that this is the stated preference for the STAR collaboration.

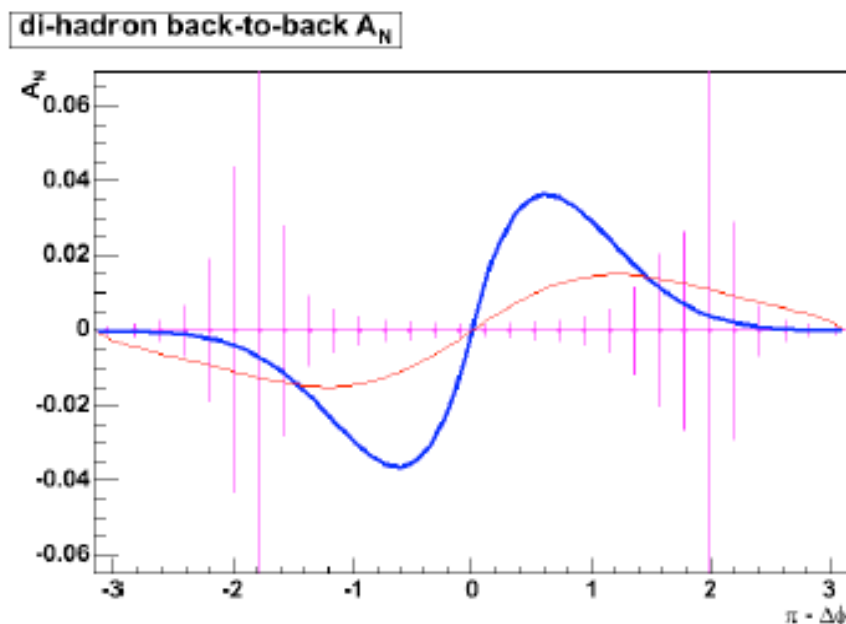
The PAC also notes that the short runs of different proton energies are most efficiently done at the time when that species is already established in RHIC. As a result, we urge that, even in the 20 week run, a short 500 GeV run for accelerator development be incorporated and, if possible, a short run at 22 GeV.

2 wks

1 wk

3 days

Run-6: Possible Siver's effect



Boer and Vogelsang, *Phys. Rev. D* 69, 094025, 2004

$$\hat{f}(x, k_T, S_T) = f(x, k_T) + \frac{1}{2} \Delta^N f(x, k_T) \frac{S_T \cdot (P \times k_T)}{|S_T| |P| |k_T|}$$

Results in an asymmetry in $\delta\phi$ distribution of back to back jets
Should also be able to see this with fragments of jets (hadrons)

Assume 5-7 pb^{-1} luminosity at 60% polarization (radial)
About 4 weeks of run time according to CAD projections

Plot by Mickey Chiu

What should our run plan be?

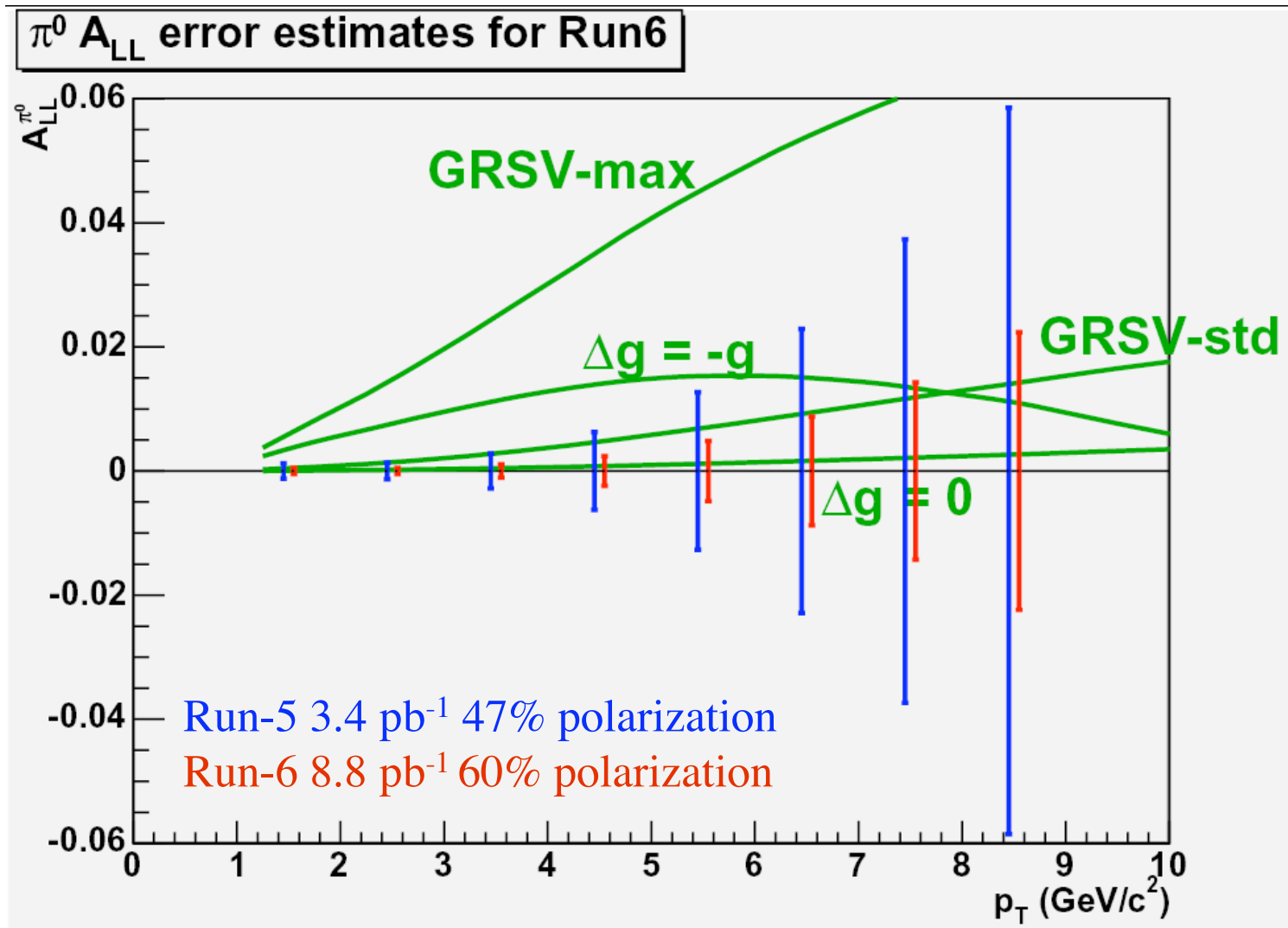
- 4 wks of 200 GeV CM transverse radial [Sivers function]
- 4.5+2 wks of 200 GeV CM longitudinal [pol. Gluon]
- 2 wks of 62.4 GeV CM transverse (radial?) comparison and single transverse spin measurement (luminosity?)

- If only 1 wk or part of it left
 - 500 GeV CM development so that CAD gets what they want & we get some exploratory trigger data/local polarimetry data
- If more than 1 wk of run left
 - Run 22 GeV CM and then go to 500 GeV CM operation

- Led by PHENIX determination **to maximize the Physics Output from this run** & considering what it takes to go to different setting as spelled out in the CAD guidelines

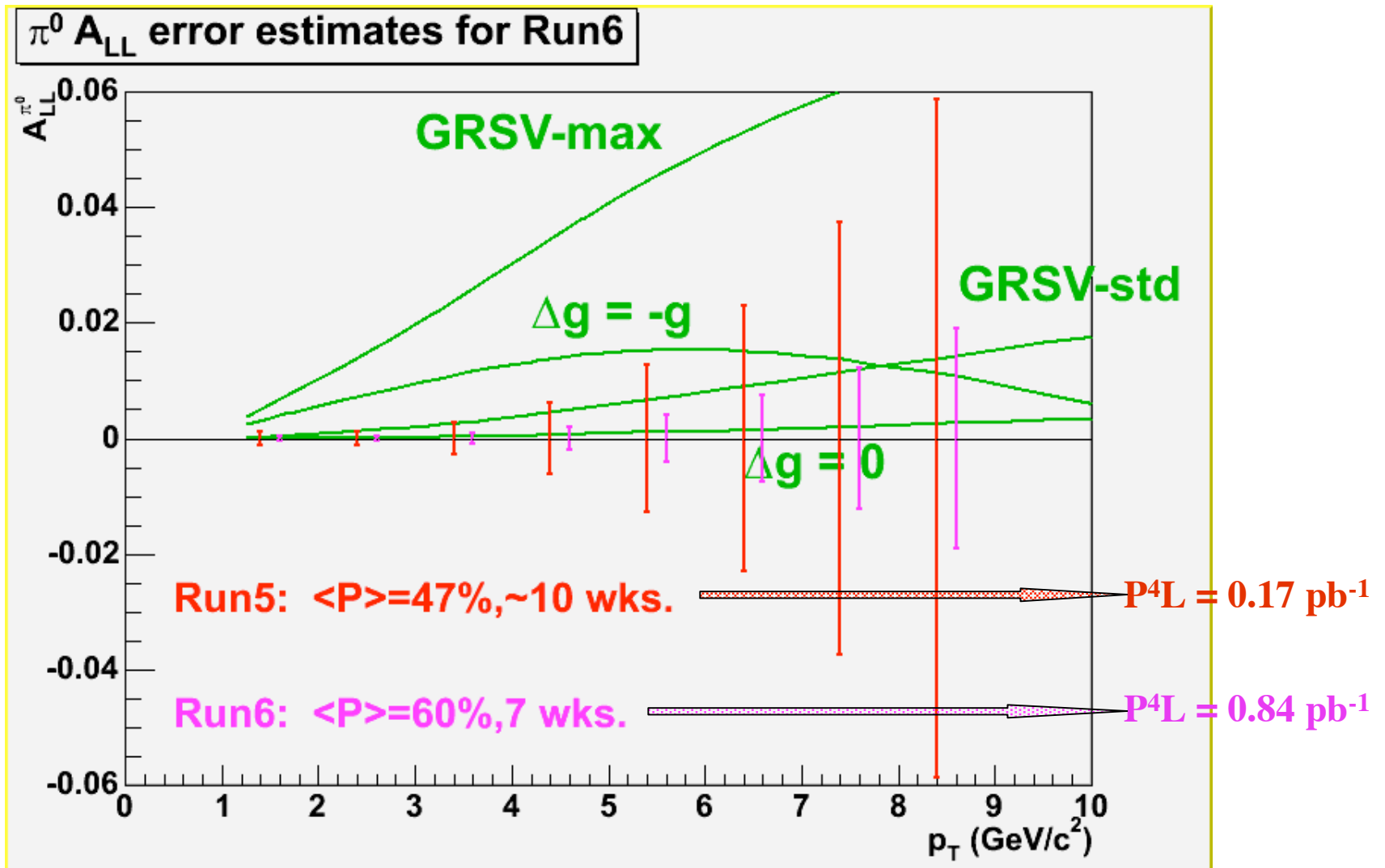
Very consistent with the PAC recommendations

$A_{LL}(\pi^0)$ Run 5 vs. Run 6 (18 wks)



Plots by Kieran Boyle

$A_{LL}(\pi^0)$ Run 5 vs. Run 6 (18+2 wks)



Concluding thoughts

- PHENIX is getting ready
- Schedule is tight but every one is trying his/her level best
- Run-planning: with 20 wks of cryo now available, our proposal will essentially what we had at PAC.
 - Core program of transverse and comparison runs at lower CM
 - Whatever extra we get we will use for longitudinal double spin asymmetries
 - During the runs decisions to switch from transverse to longitudinal and others will be driven by the our accomplishments of core goals and the polarization/luminosity in the collider