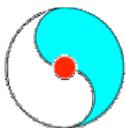




PHENIX Status & Plans for Run-6

Abhay Deshpande
Stony Brook & RBRC

Time & Planning Meetings
January 17th, 2006



PHENIX Status

- Last week in PHENIX
 - Installed the seismic restraints
 - Prepared EC to roll in
 - Start installation of Muon Piston Calorimeter (MPC) south
 - Cable trays in
 - 6 out of 8 modules laid out in the piston hole
- This week in PHENIX (1/17/2006)
 - Complete MPC installation (today) continue with cables etc.
 - HBD plumbing is being installed
 - **Plan to EC to roll in**
 - Area to be cleared for magnet tests
- Next week (1/23/2006)
 - Magnet tests, pink/blue sheets/connecting EC services....



- We know
 - Who the **Santa Claus** is? Thanks very much **Prof. James H. Simons**
 - That he has realized for us a **20**, not an 18, week Cryo run!
- Physics plan based on $20 - 5.5 = 14.5$ **weeks of physics** operation is now prepared
 - Includes spin physics as well as heavy ion physics components to it
- The core physics plans of PHENIX have not changed
 - Prepared with the motive **to maximize the PHENIX physics output** including HI and Spin physics programs
 - The **triggers for transitions** within the pp run have been clarified

We understand from CAD

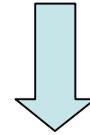
- That the preferred sequence of CM energies would be from **200 GeV to lower CM** with the exception that 500 GeV would be in the last week
 - Since this morning we have seen another proposal from Kevin Brown that reduces the cost of running in June'06. --Comment later
- A **maximum of 1 week of 500 GeV CM** studies would be essential from the accelerator point of view for future physics
- That it would take about **2 days for each transition**, i.e. to make the transition and go to maximum luminosity and polarization in the new mode

PHENIX BUP-->Yesterday

- 200 GeV CM transverse radial collisions at PHENIX to explore the Sivers effect (non-zero k_T) in protons
 - 5-7 pb⁻¹, at least 50% polarization, 3-4 weeks [**4 wks max**], **FOM=Sqrt{P²L}**
- 62.4 GeV CM transverse (radial?) collisions at PHENIX to gain the normalization data set for Au-Au, Cu-Cu data collected so far
 - 0.6 pb⁻¹, any polarization, 2 weeks [**2 wks max**], **FOM= Sqrt{L}**
- 22 GeV CM (polarized?) pp data for comparison with Cu-Cu data and a closes data point to SpS data at CERN
 - 4 nb⁻¹, 1-3 days [3 days max, **conditional on the ease to get there**], **FOM=Sqrt{L}**
- 500 GeV CM machine development dictated by CAD
 - **No luminosity expectations.** If collisions, will study trigger & local polarimetry
- **Remaining time allocated to 200 GeV CM longitudinal collisions**
 - 14.5 - 7.5 = 7 wks, we believe we *can make a significant improvement* in our measurement of pol. Gluon **if polarization is high, FOM=Sqrt{P⁴L}**

Physics Advisory Committee

PHENIX



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.

4 wks

7 wks

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

2 wks

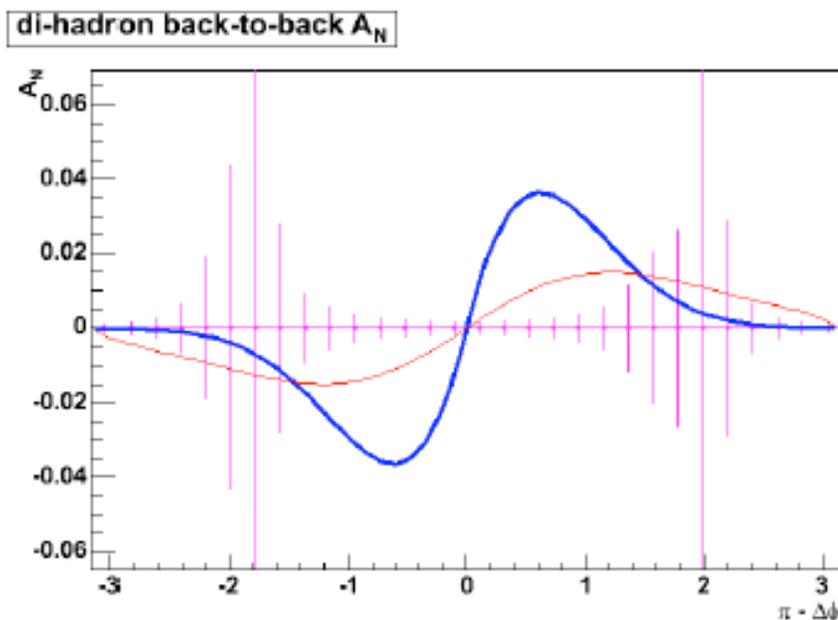
The PAC strongly recommends that at least one experiment focus on A_{LL} (longitudinal polarization studies), and is pleased that this is the stated preference for the STAR collaboration.

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.

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 is 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

The 62.4 CM pp Run

- 62.4 GeV is a **crucial set of data** for comparison with 62.4 Au-Au and Cu-Cu data
 - If realized: three data sets (including Run-6 pp) with *one detector*: significant advantage for systematic uncertainties
 - Comparisons (central vs. peripheral of Au-Au) can not substitute the **real thing (pp)** due to *problematic triggering efficiency on peripheral collisions*
 - **Peripheral** only ok for at best 25% accuracies or first look at results, **not for “precision measurements”**
 - Unreliability of pQCD calculations: as no definite data set exists for comparison with theory at this CM energy: All ISR experiments disagree with each other and R806 & R807 data disagree in spite of being same detector (neutral pion production)
 - **RHIC data will complete this physics, in a clean way, once and for all**
 - If polarized we will study single spin asymmetries at this CM Energy

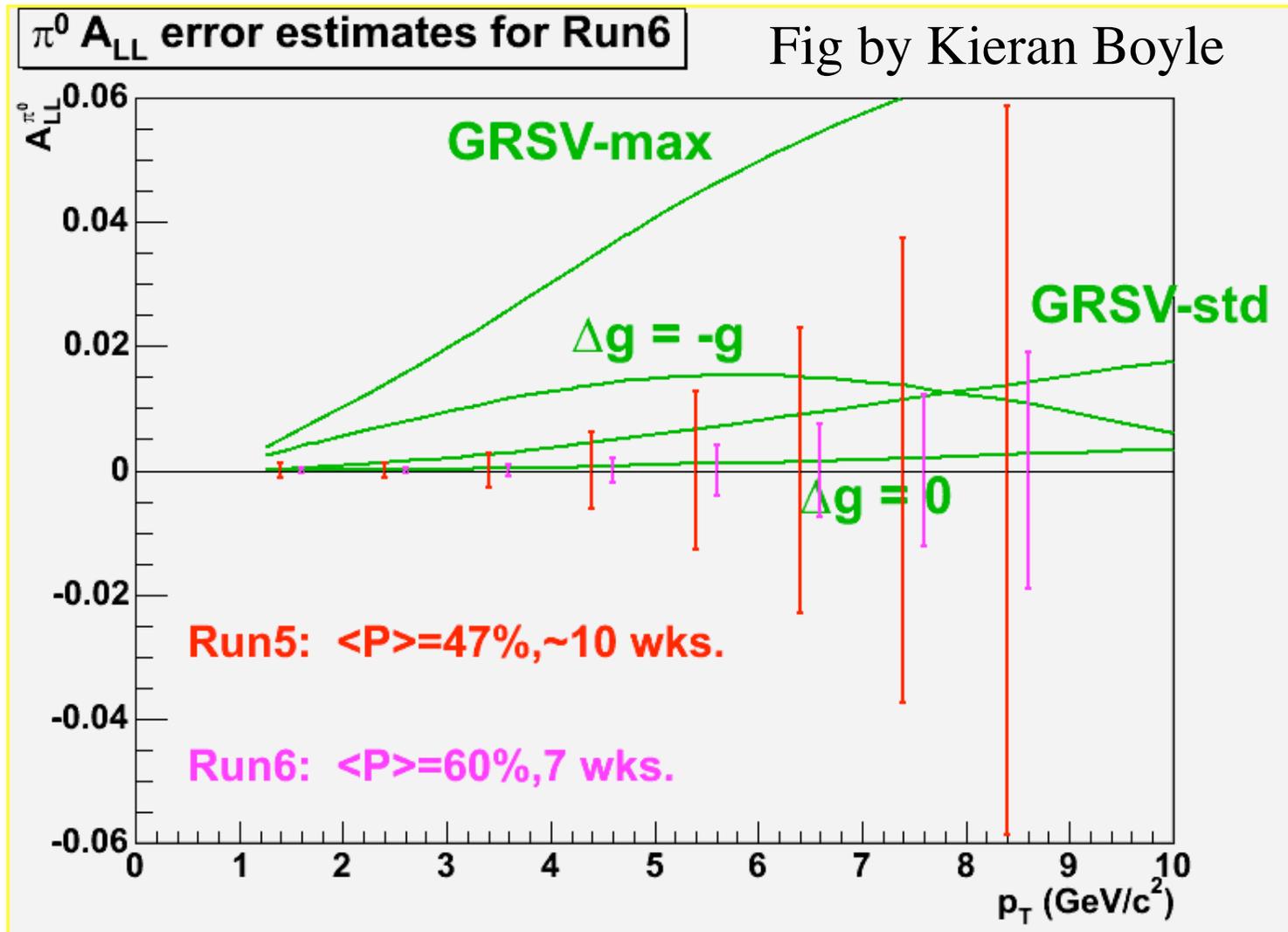
22 GeV Run

- 22 GeV is highly desirable data set in a short run
 - If realized we would have Cu-Cu vs. p-p data at 22, 62.4 and 200 GeV CM --> **A real complete set of comparison with single detector(s)**
 - Peripheral to central collisions comparison problematic for precision studies as definition of centrality has large uncertainties due to trigger inefficiencies & similar unreliability issues with pQCD comparisons.
 - **PHENIX would want it to be realized**
 - Proposes trying it at the end of 62.4 GeV running

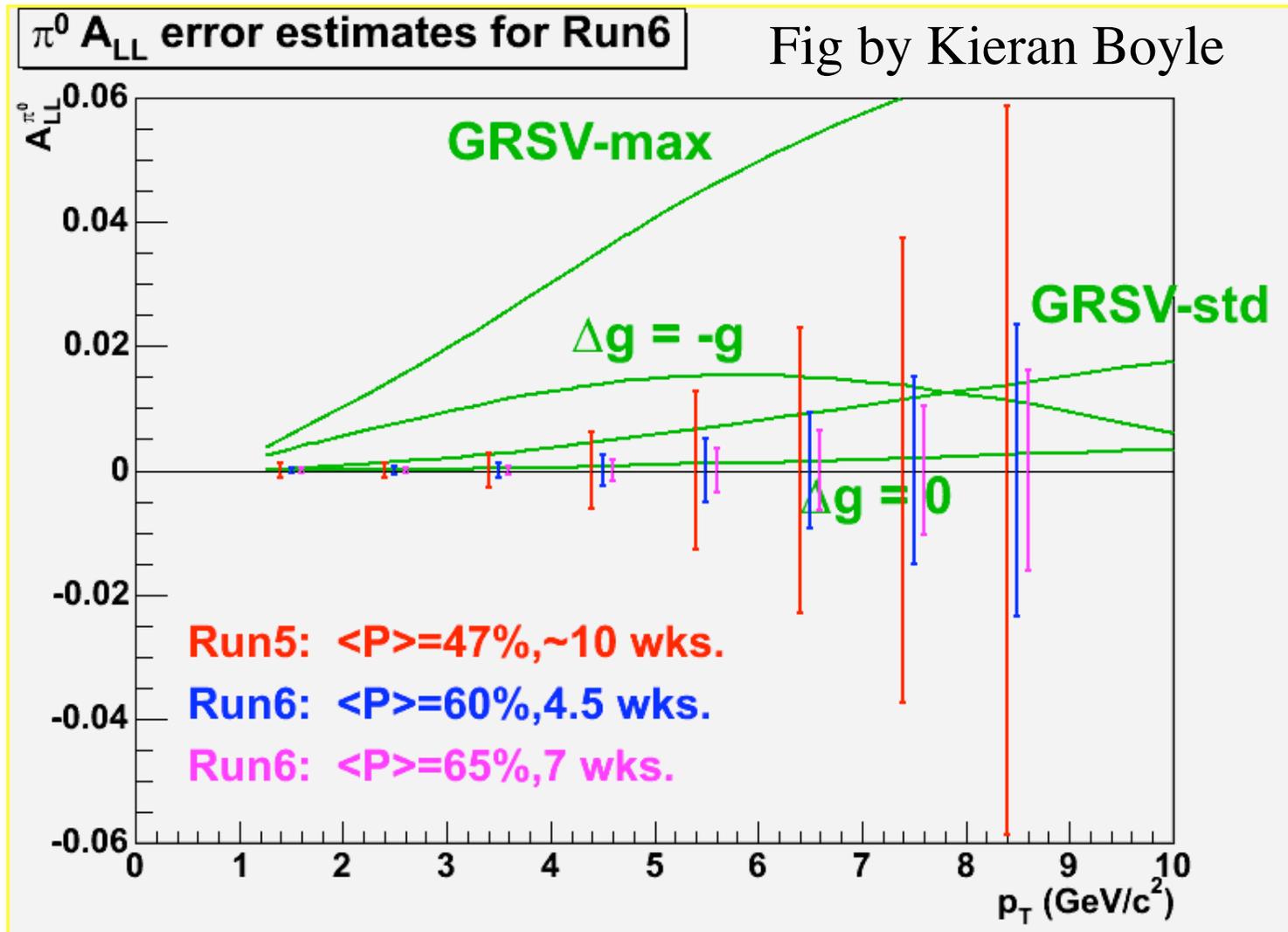
**What can we achieve for 6.5-7 weeks
remaining?**

**A lot if the polarization and luminosity
are high!**

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



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



PHENIX Run-6 Plan pre-KB's email

- 200 GeV CM radial $\text{Sqrt}\{P^2L\} \sim 1.25 \text{ pb}^{-1}$ or **4 wks max**
 - 200 GeV CM longitudinal $\text{Sqrt}\{P^4L\}$, **whatever we get**, ~ 7 wks max (*sequence based on our interpretation of CA guidance*)
 - **Argument for this run is stronger if polarization is higher**
 - **May be willing to shorten this run** in favor of achieving lower CM physics goals if the beam L & P have **not improved significantly**
 - 62 GeV CM (transverse) $\text{Sqrt}\{L\}$, 0.6 pb^{-1} minimum, 2 wks max, **whichever comes first**
-
- At this time depending on how much time is left in the run decide:
 - On a 1-week 500 GeV CM for CAD studies or
 - Attempt the 22 GeV CM physics run [1-3 days] & 1-week 500 GeV

In sync with the PAC recommendations

Kevin Brown's proposal based on cost savings.....

PHENIX BUP-->This Morning!!

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- 500 GeV CM machine development dictated by CAD
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PHENIX will go with this.

Concluding thoughts

- Run-6 is truly a Santa's gift to the RHIC community. PHENIX plans to maximize its physics output.
- Our plan has been developed based on our main goals and CAD input; & it matches well with the PAC recommendations
- While we seek multiple transitions in run plan, each has a **well defined trigger** based on
 - the achieved figure of merit and
 - experimental conditions & potential for improvement in terms of polarization and luminosity
- Kevin Brown's suggestions from this morning **based on cost savings are consistent with PHENIX's original BUP in the first place**. The only question is **“when to run the 500 GeV CM test?”**