

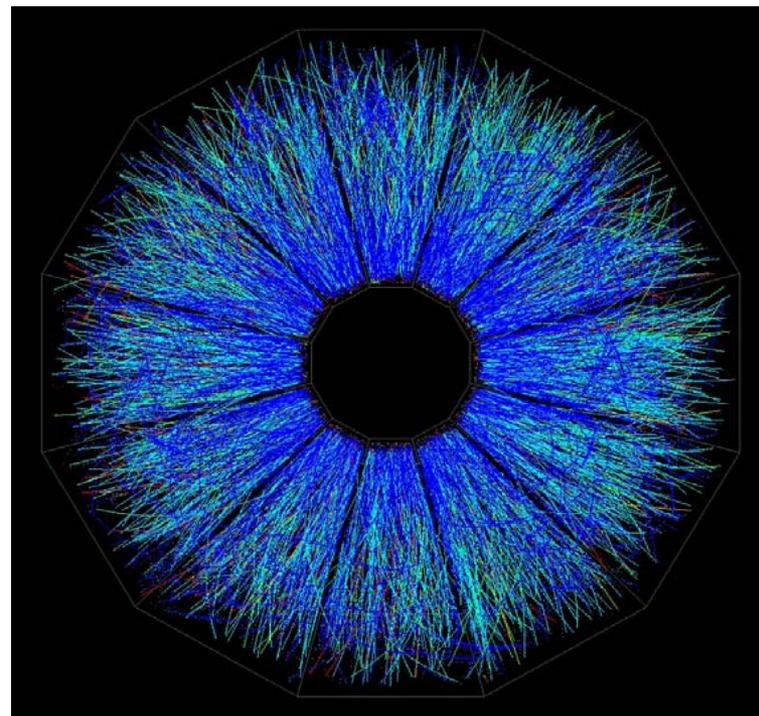
# Brief Overview of STAR Goals for FY05 RHIC Run



*Presented at the December 8, 2004 RHIC Coordination meeting*

## Outline:

- Executive Summary from FY05 STAR Beam Use Request
- Table of Requested beams & energies
- Time estimates & Luminosity requirements



# RHIC Run V Beam Use Request

## The STAR Collaboration



August 14, 2004

### Executive Summary

The first four RHIC runs have resulted in compelling evidence that a qualitatively new form of matter is produced in central AuAu collisions. To further probe the nature of this matter and understand its properties, STAR proposes to acquire > 50M minimum-bias events and to sample  $\sim 10 \text{ nb}^{-1}$  for rare triggers (1-2  $\text{nb}^{-1}$  recorded) at  $\sqrt{s_{\text{NN}}} = 200 \text{ GeV}$  with an A+A system in the mass range  $A \sim 60$ . These data will provide important additional experimental controls, illuminating the nature of high  $p_t$  particle suppression, elliptic flow, and heavy flavor production by testing the dependence of the gluon density and pressure in the early stage of the collision on system size. Combined with data acquired in Run IV, they will allow investigation of the centrality dependence of global observables and afford important tests key to our understanding of the dependence of observables such as jet quenching, resonance production, elliptic flow, radial flow and meson/baryon scaling on energy density and system size ( $N_{\text{part}}$ ).

The time requested for this measurement is 4+10 weeks. Depending on machine performance, if the  $\sqrt{s_{\text{NN}}} = 200 \text{ GeV}$  goals are substantially met before the end of the ten week period proposed for heavy ion data taking, a run of 1-2 weeks is proposed with the same species at reduced energy ( $\sqrt{s_{\text{NN}}} = 62.4 \text{ GeV}$ ). This will allow robust comparison with the Au+Au data acquired in Run IV with respect to both energy and system size.

During Run V STAR will continue measurements related to its ultra-peripheral collisions program.

At the end of the proposed heavy ion run STAR requests 3+11 weeks of polarized proton running. STAR's goal is to sample  $> 7 \text{ pb}^{-1}$  with beams of longitudinally polarized protons ( $P > 40\%$ ) to obtain a significant measurement of the gluon helicity preference in the proton through studies of  $A_{\text{LL}}(\pi^0)$  and  $A_{\text{LL}}(\text{jet})$  out to  $p_t > 8$  and  $20 \text{ GeV}/c$  respectively. These are beginning measurements which will be followed by a detailed mapping of  $\Delta G(x)$  as a function of Bjorken  $x_{\text{gluon}}$  using direct  $\gamma + \text{jet}$  coincidences once further improvements in luminosity and polarization have been achieved. Once the goal with longitudinal polarization is substantially met, STAR proposes to sample  $> 4 \text{ pb}^{-1}$  with beams of transversely polarized protons ( $P > 40\%$ ) to measure the transverse spin dependence of di-jet back-to-back correlations related to the Sivers function and to further study the transverse spin asymmetry observed earlier for forward  $\pi^0$  production. Concurrent with these measurements, most probably at the beginning of the polarized proton running period, STAR's goal is to acquire  $> 20\text{M}$  minimum bias pp events for comparison with Au+Au heavy ion data from Run IV.

**Run V:** Soft physics and High  $p_T$  comparison spectra; Charm and –Onium Yields;  
*Goal is  $> 50 M$  min-bias,  $\sim 10 \text{ nb}^{-1}$  sampled by HT trigger,  $\sim 10\%$  at half field*  
 Significant measurement of  $\Delta G$  at  $\sqrt{s} = 200 \text{ GeV}$ ; Transverse spin studies  
 related to the Sivers Function

**Table II: Run V Scenario**

|                 |                  |  |
|-----------------|------------------|--|
| <b>Beams</b>    | <b>AA, A~ 60</b> | <b><math>p \rightarrow p \rightarrow, p^\uparrow p^\uparrow</math></b> |
| Weeks           | <b>4 + 10</b>    | <b>3+11</b>  |
| $\sqrt{s_{NN}}$ | <b>200*</b>      | <b>200**</b>   |

(\* Depending on performance, 1-2 weeks at  $\sqrt{s_{NN}} = 62.4 \text{ GeV}$  may be requested)

(\*\* Goal is to sample  $> 7 \text{ pb}^{-1}$  with longitudinal polarization ( $P > 40\%$ ); depending on performance, goal will then be to sample  $> 4 \text{ pb}^{-1}$  ( $P > 40\%$ ); a second goal is to acquire  $> 20M$  min bias pp events for comparison with  $\sqrt{s_{NN}} = 200 \text{ GeV}$  AuAu dataset.)

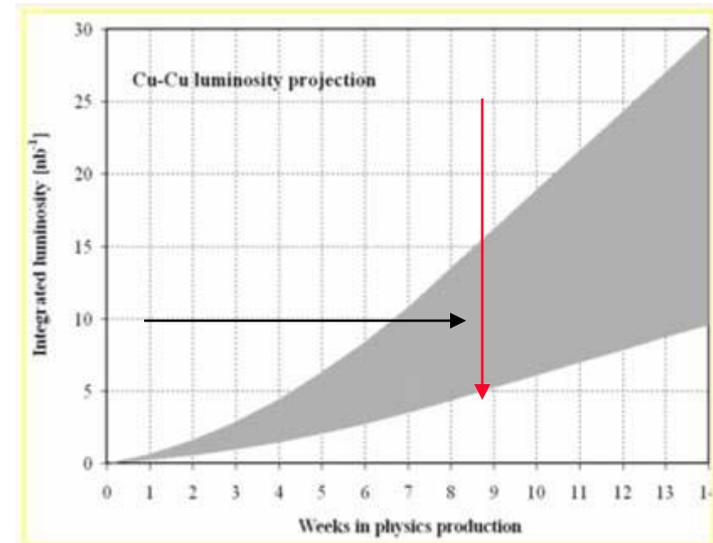
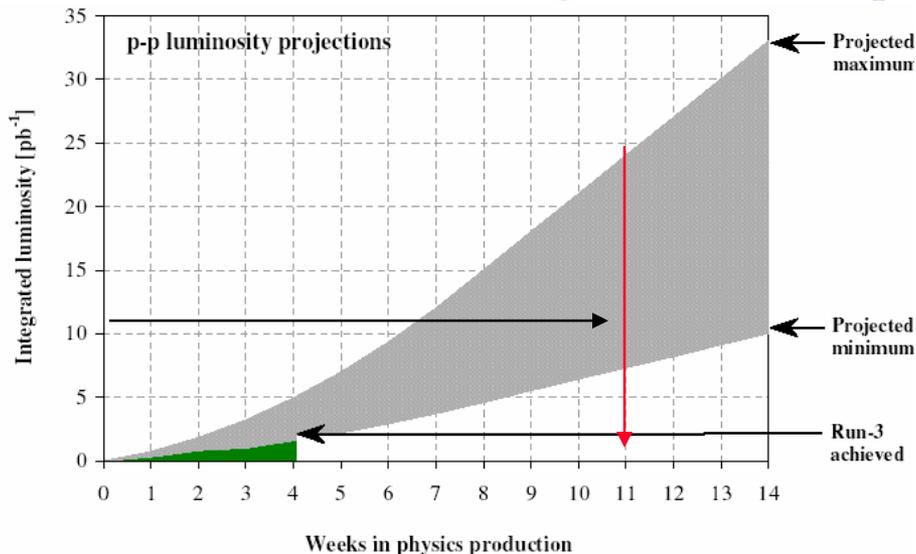
# Rough Time/luminosity Estimates

## Cu-Cu Run:

Running with 50% live time for Rare Triggers, we estimated that, with smooth Collider operations, we will accumulate  $\sim 10$  M evts of min-bias/week.

- This goal only requires L of  $\sim 4 \times 10^{26} \text{ cm}^{-2} \text{ s}^{-1}$  (i.e. minimal requirement)

To integrate the integrated luminosity goal for the rare triggers ( $\sim 10 \text{ nb}^{-1}$ ) looks reasonable in about 9 weeks, given the C-AD projections



## Polarized pp Run:

To achieve the entire request, 7  $\text{pb}^{-1}$  of longitudinal polarization and 4  $\text{pb}^{-1}$  of transverse polarization, in an 11 week period, requires an average of 1  $\text{pb}^{-1}$ /week, in line with C-AD proj.