

# STAR

## FY05 Beam Use Request and beyond

Bernd Surrow  
MIT

# Guidelines on machine performance

## Machine performance overview (FY02-FY05)

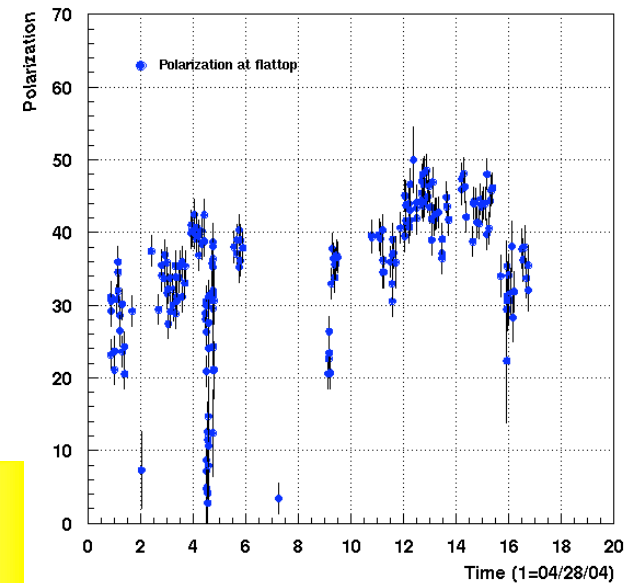
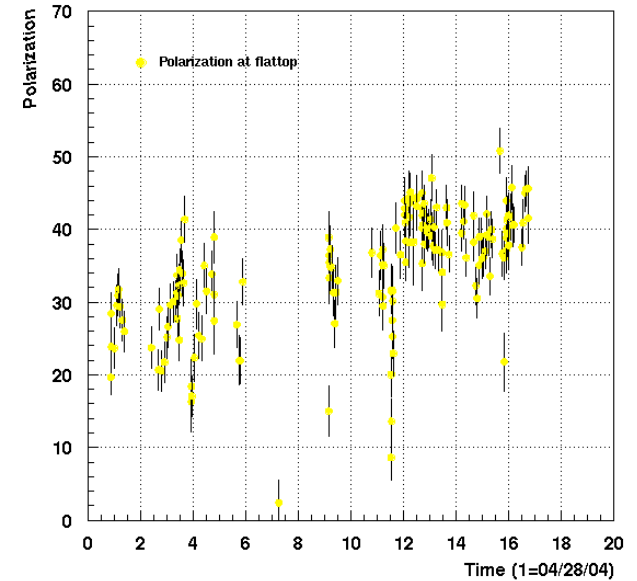
### Overview of performance parameter

	Bunch intensity [10 <sup>11</sup> ]	# of bunches	L <sub>peak</sub> [10 <sup>30</sup> cm <sup>-2</sup> s <sup>-1</sup> ]	L <sub>avg</sub> [10 <sup>33</sup> cm <sup>-2</sup> s <sup>-1</sup> ]	L <sub>week</sub> [pb <sup>-1</sup> ]	Polarization [%]
FY02	0.7	56	2	1.5	0.2	15
FY03	0.7	56	6	3	0.6	30
FY04	0.7	56	6	4	0.9	40
FY05	1.0	79	16	9	2.8	45

### Status

- ☑ Siberian snake and spin rotator magnets successfully commissioned
- ☑ Fast polarimeters in AGS/RHIC demonstrated to work
- ☑ Spin transfer AGS to RHIC demonstrated to work
- ☑ Successful commissioning of polarized gas-jet target (Absolute beam polarization measurement!)
- ☑ Successful installation and commissioning of warm AGS Siberian snake
- ☐ Installation and commissioning of cold AGS Siberian snake magnet
- ☐ Commissioning of 250GeV ramp

Adequate time for commissioning and luminosity development is absolutely essential!

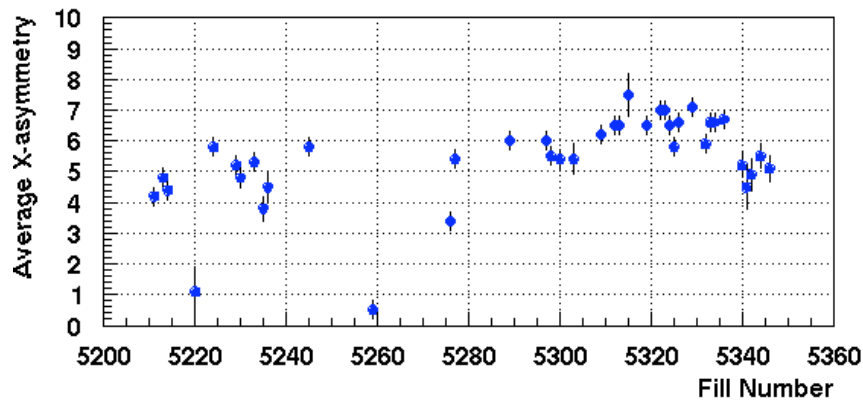


Blue and Yellow Beam polarization

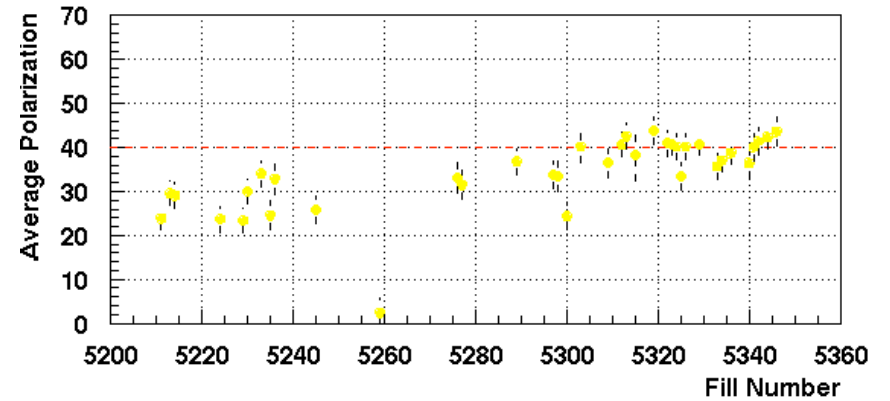
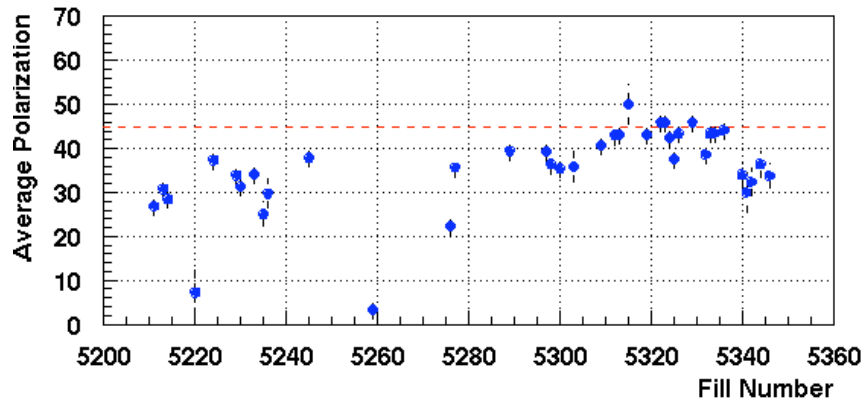
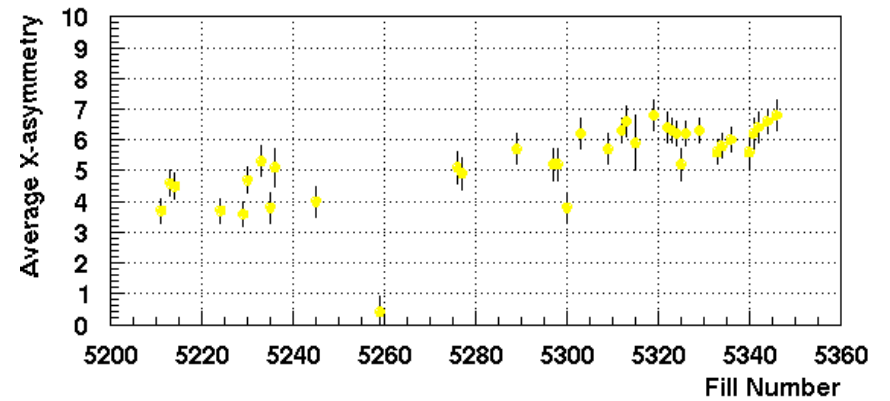
# Guidelines on machine performance

## Summary of achieved polarization performance in FY04

RHIC polarized pp performance (04/28/04 - 05/14/04): Blue Beam

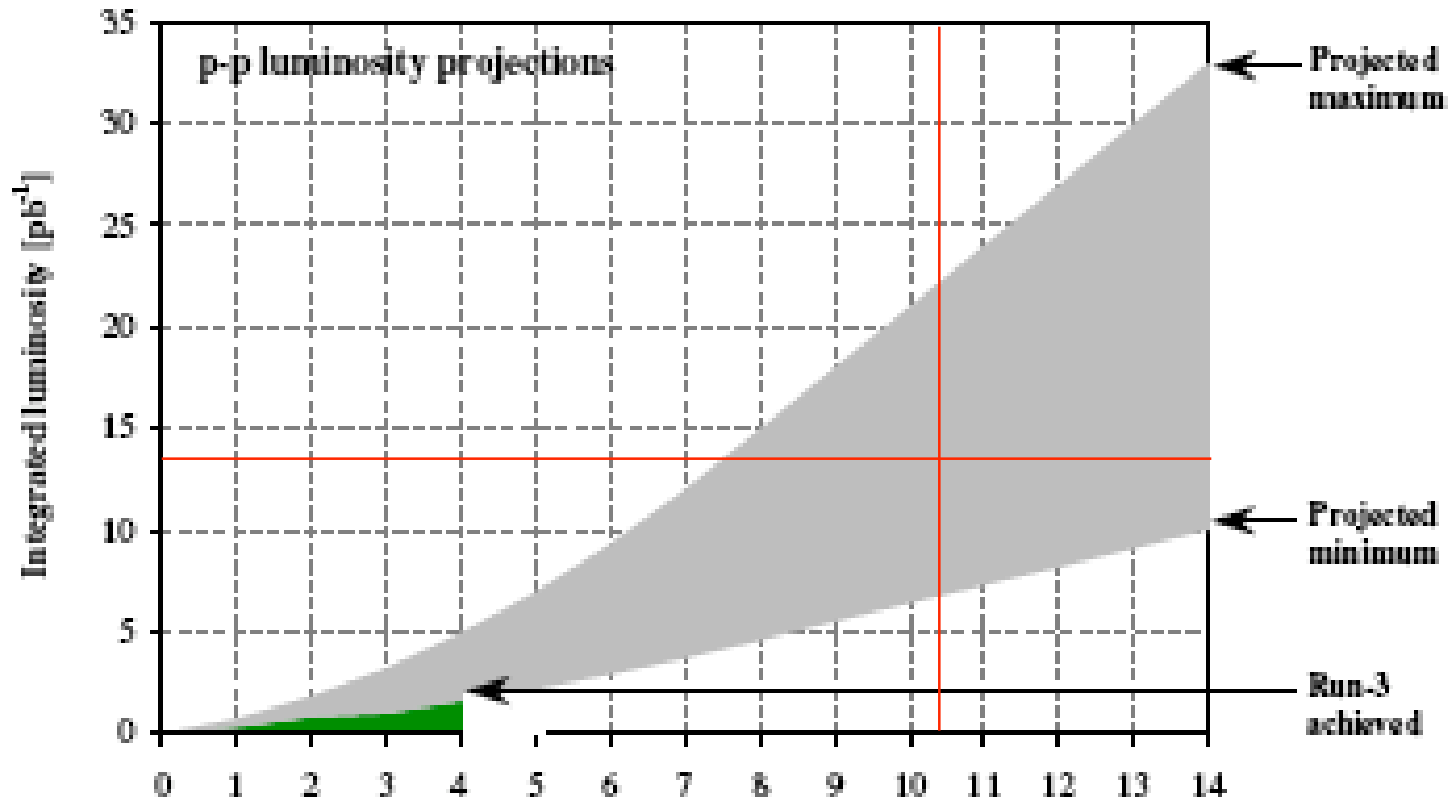


RHIC polarized pp performance (04/28/04 - 05/14/04): Yellow Beam



# Expectations on RHIC performance

- Expectations for FY05



# Overview of FY05 STAR SPIN BUR

## ■ Comments on FY05 polarized pp physics run request

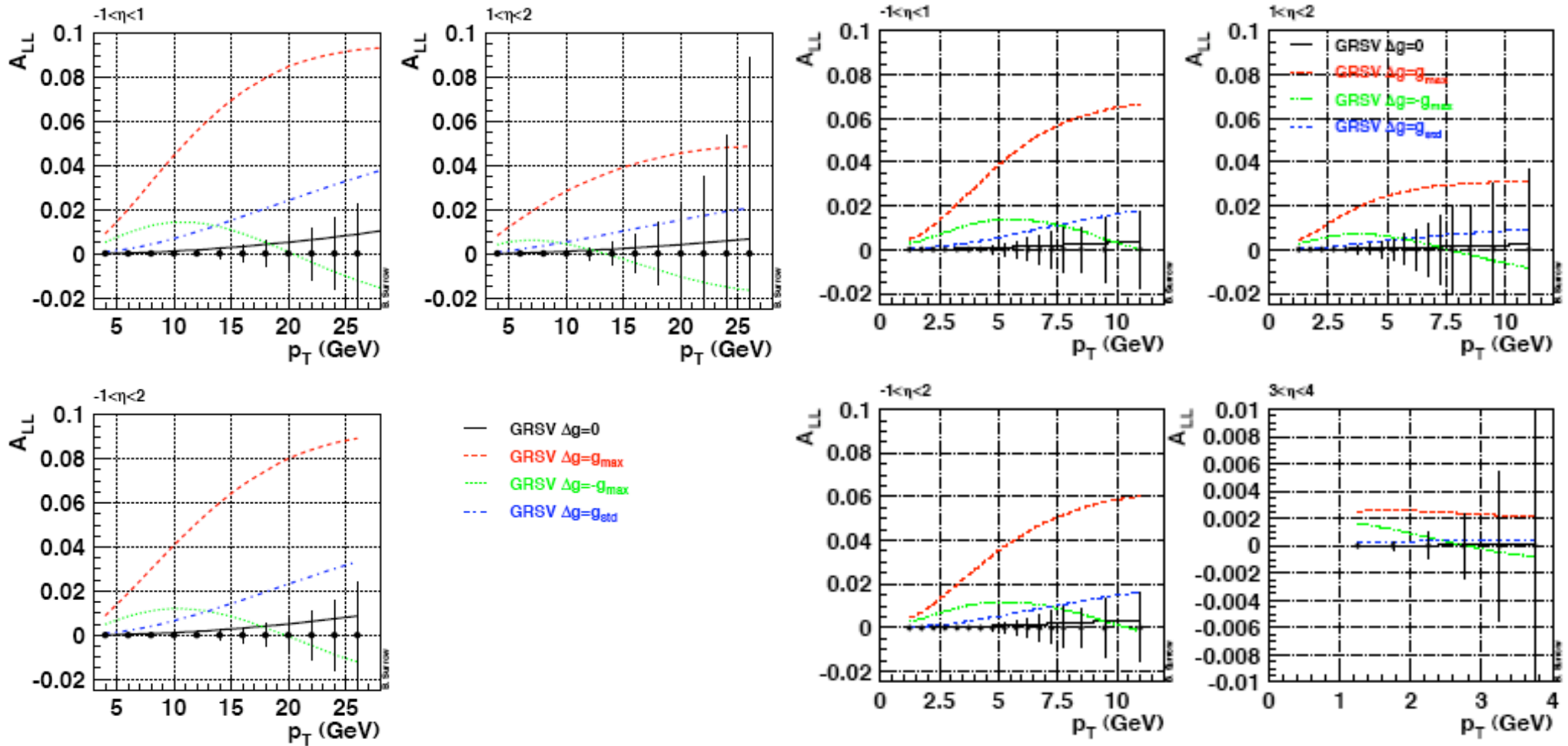
- 3+11 weeks (3 weeks setup and 11 weeks polarized pp collisions)
- Long polarized pp run is crucial to make significant progress on the RHIC performance
- Physics goals:
  - Primary goal: Gluon contribution to proton spin (7 pb<sup>-1</sup> at 40% beam polarization)
    - $A_{LL}$  of  $\pi^0$  production to  $p_T$  to  $\sim 8$  GeV/c
    - $A_{LL}$  of inclusive jet production to  $p_T$  to  $\sim 20$  GeV/c
  - Secondary goals: Transverse spin phenomena, provided that 7pb<sup>-1</sup> for the anticipated  $A_{LL}$  measurements can be achieved: Goal collect 4 pb<sup>-1</sup> of transverse pp data
    - Measurements of transverse spin dependence of di-jet back-to-back correlations to the gluon Sivers functions
    - Analyzing power of forward  $\pi^0$  production with the FPD besides BEMC/EEMC
- Strongly endorse recommendation by C-AD
  - Polarized pp run should follow measurements with another species: Commissioning work of cold snake (Success of commissioning is not considered critical for the FY05 run)
  - Other critical tasks: Spin flipper commissioning and 250GeV ramp (Important for long-term spin program)

# $A_{LL}$ for inclusive jet and $\pi^0$ production

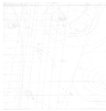


STAR  $A_{LL}$  projection ( $P=0.4$   $L=7\text{pb}^{-1}$ ): Inclusive jet production  
(Calculations provided by Jäeger, Stratmann and Vogelsang)

STAR  $A_{LL}$  projection ( $P=0.4$   $L=7\text{pb}^{-1}$ ): Inclusive  $\pi^0$  production  
(Calculations provided by Jäeger, Stratmann and Vogelsang)

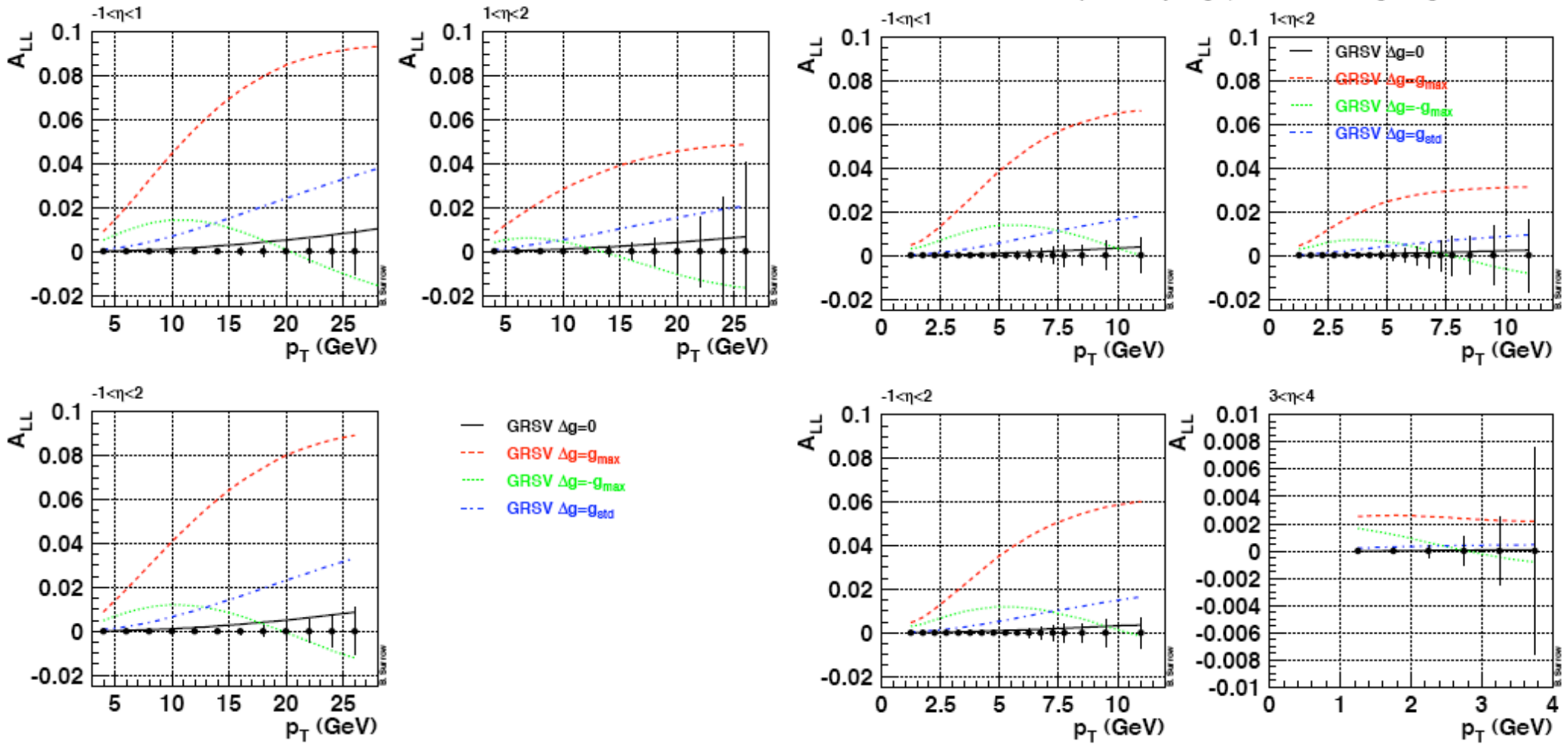


# $A_{LL}$ for inclusive jet and $\pi^0$ production

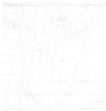


STAR  $A_{LL}$  projection ( $P=0.5$   $L=14\text{pb}^{-1}$ ): Inclusive jet production  
(Calculations provided by Jaeger, Stratmann and Vogelsang)

STAR  $A_{LL}$  projection ( $P=0.5$   $L=14\text{pb}^{-1}$ ): Inclusive  $\pi^0$  production  
(Calculations provided by Jaeger, Stratmann and Vogelsang)

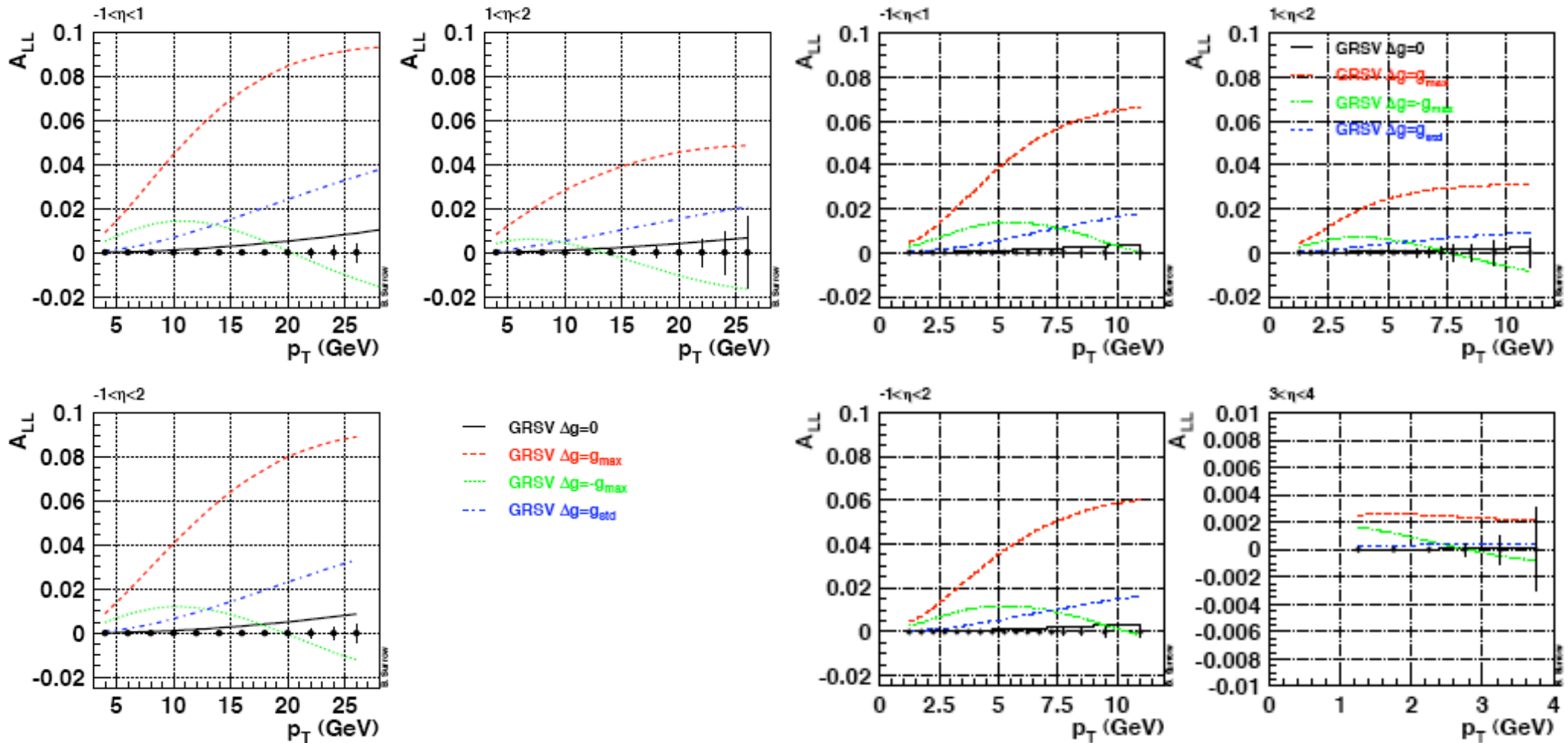


# $A_{LL}$ for inclusive jet and $\pi^0$ production



STAR  $A_{LL}$  projection ( $P=0.6$   $L=42\text{pb}^{-1}$ ): Inclusive jet production  
(Calculations provided by Jaeger, Stratmann and Vogelsang)

STAR  $A_{LL}$  projection ( $P=0.6$   $L=42\text{pb}^{-1}$ ): Inclusive  $\pi^0$  production  
(Calculations provided by Jaeger, Stratmann and Vogelsang)





# RHIC collider projections

## Expected RHIC pp performance FY05-FY08

	Bunch intensity [ $10^{11}$ ]	# of bunches	Lpeak [ $10^{30}$ ] $\text{cm}^{-2} \text{s}^{-1}$	Lavg [ $10^{33}$ ] $\text{cm}^{-2} \text{s}^{-1}$	Lweek [ $\text{pb}^{-1}$ ]	Polarization [%]
FY05	1.0	79	16	9	2.8	45
FY06	1.4	79	31	22	7.1	65
FY07	2.0	112	80	64	21.6	70
FY08	2.0	112	89	72	26	70

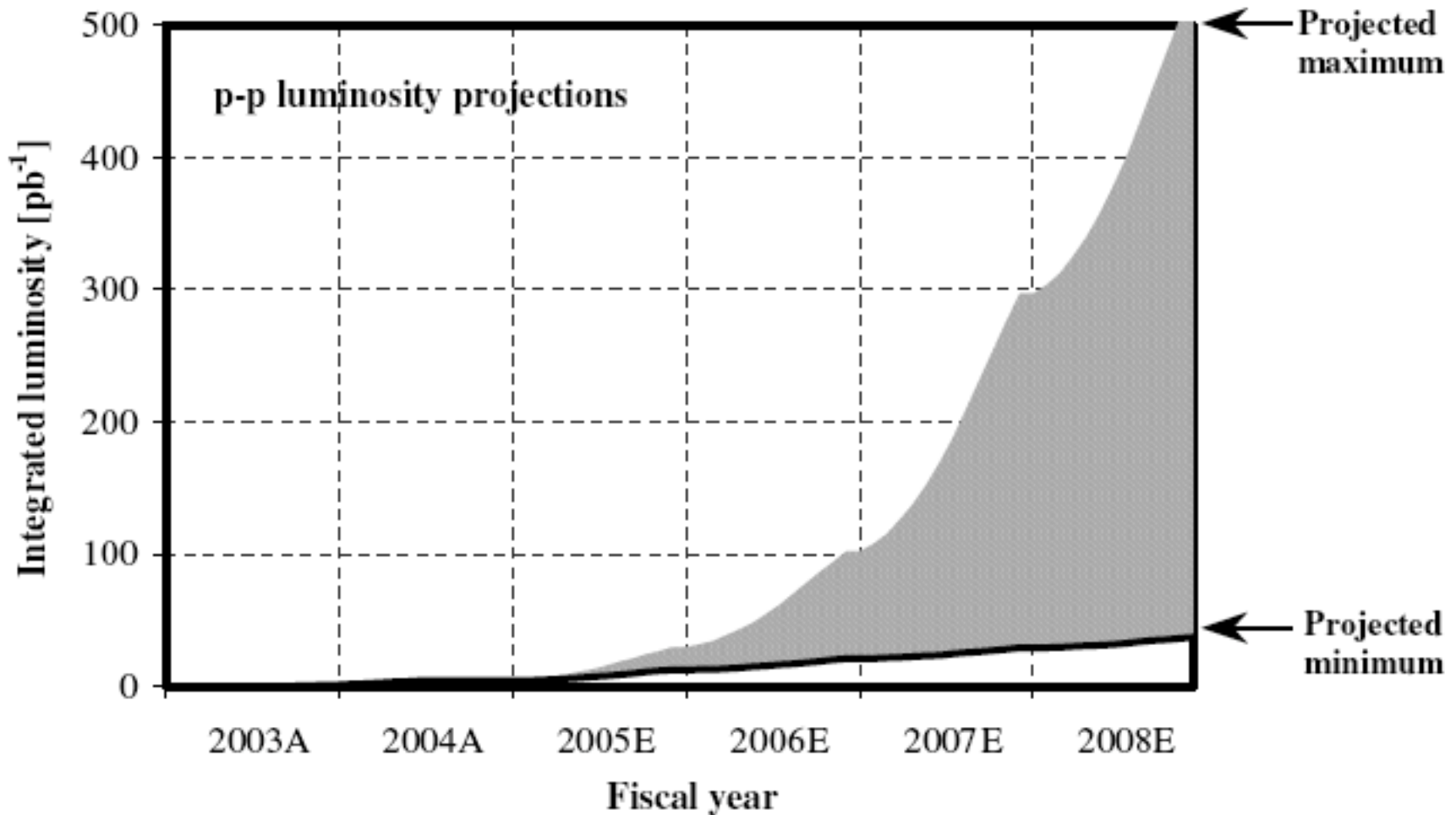
## Essential upgrades and improvements of the RHIC polarized pp collider complex:

- FY05
  - Survey and realignment
  - AGS cold snake commissioning
  - NEG coating 100m warm beam pipe sections
  - 250GeV ramp studies
- FY06
  - AGS cold snake operational
  - More NEG coating
- FY07
  - New solenoid for the polarized proton source OPPIS
- FY08
  - First 250GeV polarized pp run (STAR 5-year BUR)
- FY09
  - Potential first long 250GeV production run ? (Beyond STAR 5-year BUR)

Adequate time for commissioning and luminosity development is absolutely essential!

# Expectations on RHIC performance

- Expectations for FY06 and beyond



# STAR 5-year BUR

- STAR 5-year BUR (FY05-FY08): Twenty-Year Planning Study for RHIC at BNL

Fiscal Year	27 weeks/year BUP (submitted 8/03)		"Optimized Constant Effort" Scenario		32 weeks each year run scenario	
2004	5+14 Au+ Au 200	5+0 pp 200	5+14 Au+ Au 200	5+0 pp 200	5+14 Au+ Au 200	5+0 pp 200
2005	5+9 Au+ Au Escan	5+5 pp 200	6+11 Au+ Au Escan	5+12 pp 200	6+8 Au+ Au Escan	5+10 pp 200
2006	5+9 d+Au 200	5+5 pp 200			5+8 d+Au 200	5+11 pp 200
2007	5+5 Au+ Au 200	5+9 pp 200	5+9 d+Au 200	5+13 pp 200	5+10 Au+ Au 200	5+9 Cu+ Cu 200
2008	5+10 Au+ Au 200	5+5 pp 500	5+15 Au+ Au 200	5+8 Cu+ Cu 200	5+10 Au+ Au 200	5+9 pp 200
$\int L_{\max} dt$ pp 200	76 pb <sup>-1</sup>		88 pb <sup>-1</sup>		156 pb <sup>-1</sup>	
$\int L_{\max} dt$ post-TOF Au+Au	1.4 nb <sup>-1</sup>		1.6 nb <sup>-1</sup>		2.1 nb <sup>-1</sup>	
What's missing?	Any Cu+Cu 200; 2 <sup>nd</sup> +3 <sup>rd</sup> long pp		3 <sup>rd</sup> long pp; 2 pp devel. chances		1 pp devel. chance	

BNL-71881-2003

Long-term physics goals such as: Prompt photon production and W production (500GeV running critical!)

# Overview and timeline - STAR tracking upgrade

## ■ Integrated Tracking upgrade

- The study of heavy flavors and W production will require an **upgrade of the STAR inner/forward tracking system**
  - **Integrated tracking design** of a new inner and forward STAR tracking system is mandatory
  - **Staging of tracking upgrade** in accordance with readiness of detector technology and beam development
- STAR tracking upgrade program actively pursued by several STAR institutions
- STAR tracking upgrade working group
  - W physics case (Flavor structure of quark helicities)
  - Heavy flavor spin case under investigation (Strong dependence of partonic asymmetry on heavy quark mass- study of heavy flavor tagged jets): STAR Heavy flavor program driven by STAR's relativistic heavy-ion program
  - Simulation work and integrated design of detector layout based on **pixel, silicon and triple-GEM technology** (R&D work has been started) has been started
- Possible scenario:
  - Stage 1: Installation of pixel detector together with a minimal new barrel tracking detector based on silicon technology ( $-1 < \eta < 1$ ) (Heavy Flavor Physics)
    - Goal: Proposal by summer 2005
    - Installation of new inner tracking system in time for next long Au-Au run
  - Stage 2: Upgrade of the forward (inner silicon and outer GEM) tracking system ( $1 < \eta < 2$ ) (W physics)
    - Goal: Proposal by summer 2006
    - Installation of forward system in time for 500GeV production run
- **Dedicated time for machine development** with polarized protons to achieve **high luminosity** and **high polarization** is vital for the success of this novel program!

Documented  
in STAR  
decadal plan  
and  
AGS/RHIC  
PAC