RHIC Status and Plans

Summary of RHIC commissioning and operation

Plans and goals for RUN2001

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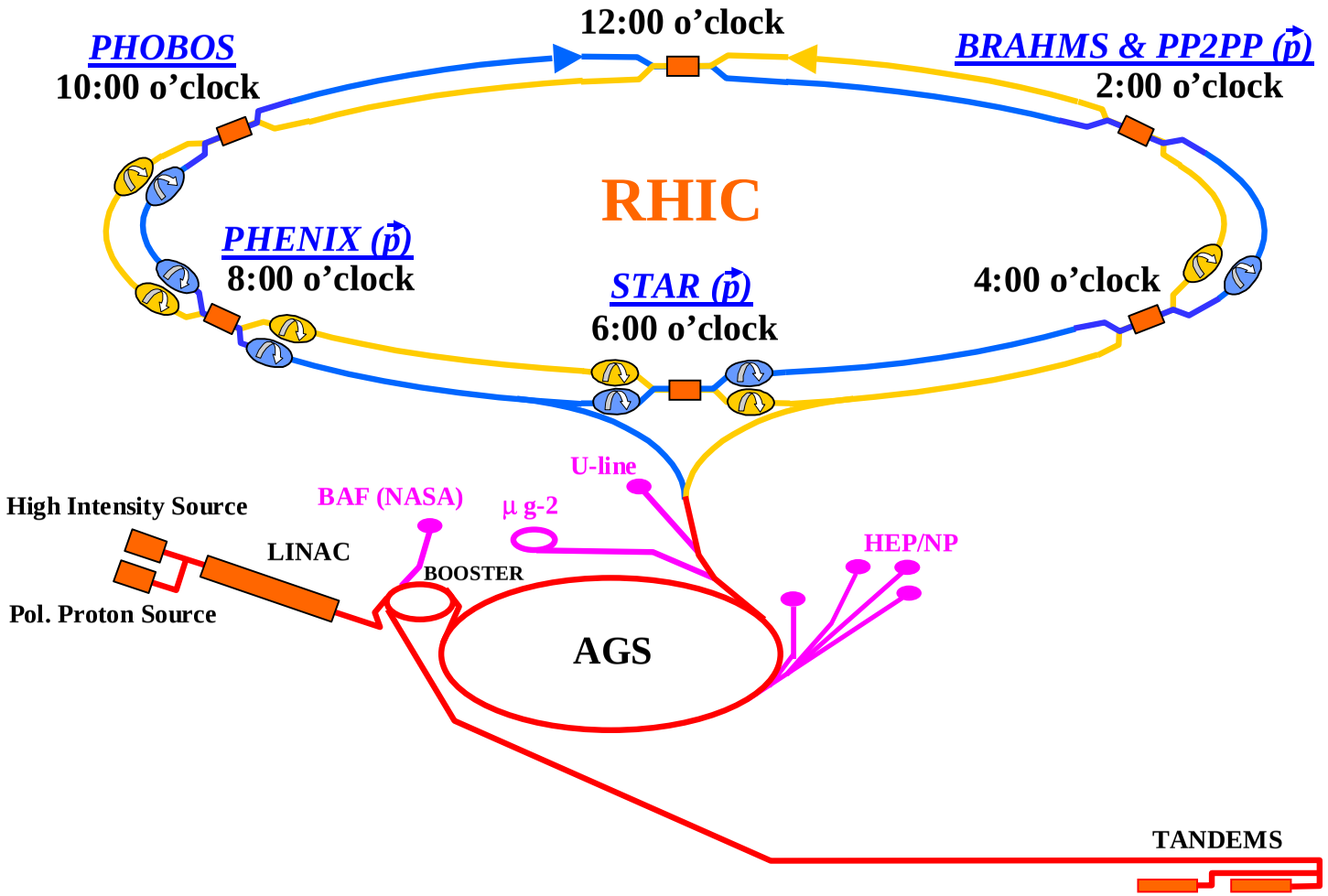
Thomas Roser
RHIC Retreat
November 16-17, 2000

C-AD Accelerator Complex



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Parameters and goals for RHIC RUN2000

- 60 bunches per ring ✓
- 5×10^{8} Au/bunch ✓
- Longitudinal emittance: 0.3 eVs/nucleon/bunch ✓
- Transverse emittance at storage: 15 π μm (norm, 95%) ✓
- Initial storage energy: $\gamma = 70$ [66 GeV/nucl.] ✓ (This energy is below the lowest quench of any DX magnet)
- Lattice at injection and acceleration: $\beta^{*}=$ 3 m @ 2, 4, 8, and 12 o'clock
  $\beta^{*}=$ 8 m @ 6 and 10 o'clock
- Lattice at storage and collision: $\beta^{*}=$ 3 m @ 2, 4, 8, and 12 o'clock
  $\beta^{*}=$2- 8 m @ 6 and 10 o'clock
- Luminosity: 2×10^{25} cm^{-2} s^{-1} ✓
- Integrated luminosity: a few (μb)$^{-1}$ ✓

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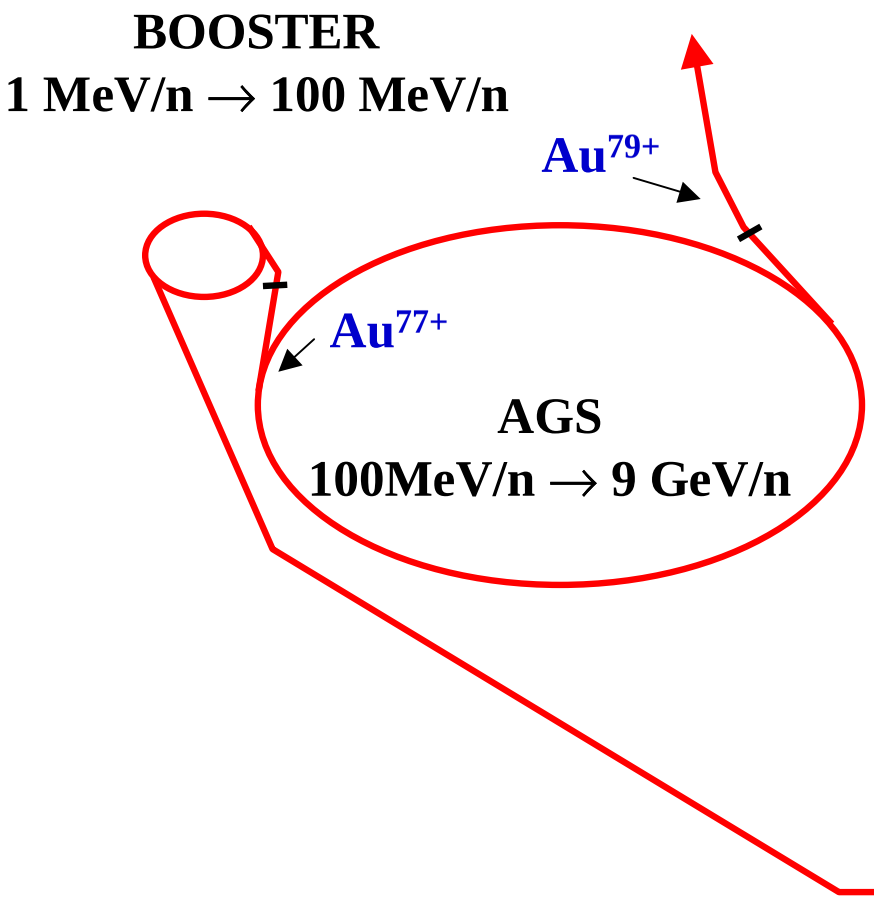
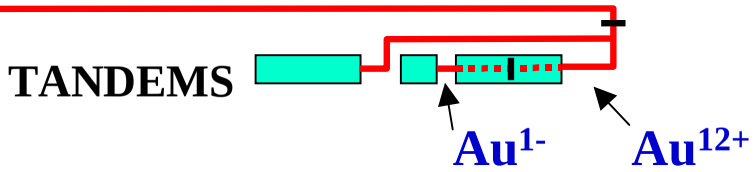
RHIC Injector Performance



	Intensity/RHIC bunch	Efficiency
Tandem	3.8×10^9	
Booster Inj.	2.2×10^9	58%
Booster Extr.	1.8×10^9	81%
AGS Inj.	0.9×10^9	50%
AGS Extr.	0.9×10^9	95%
Total		23%

Au^{32+} : 1.1 part. μA, 530 μs (40 Booster turns)



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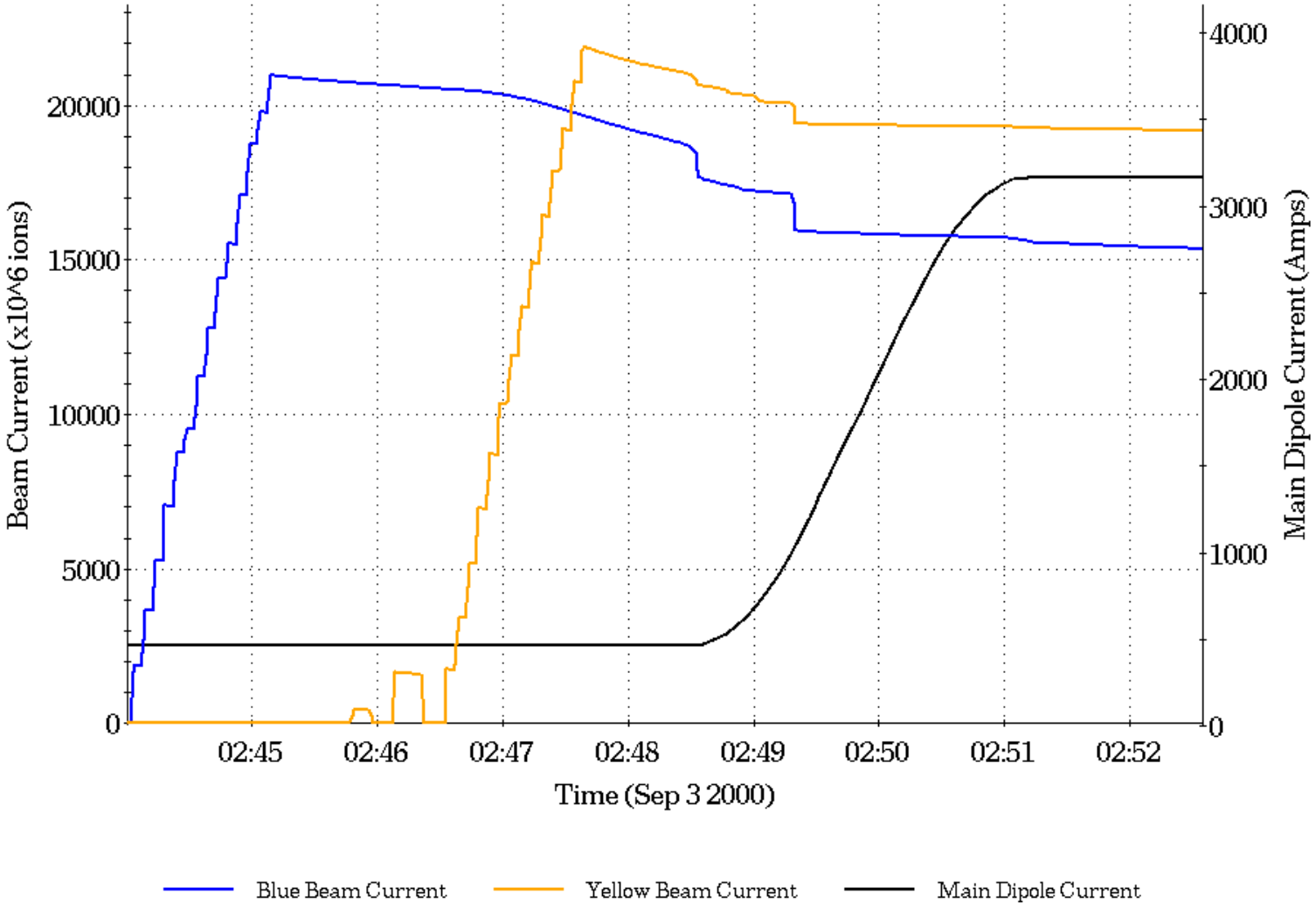
RHIC Injection and Acceleration

(3.6×10^8 Au/bunch)



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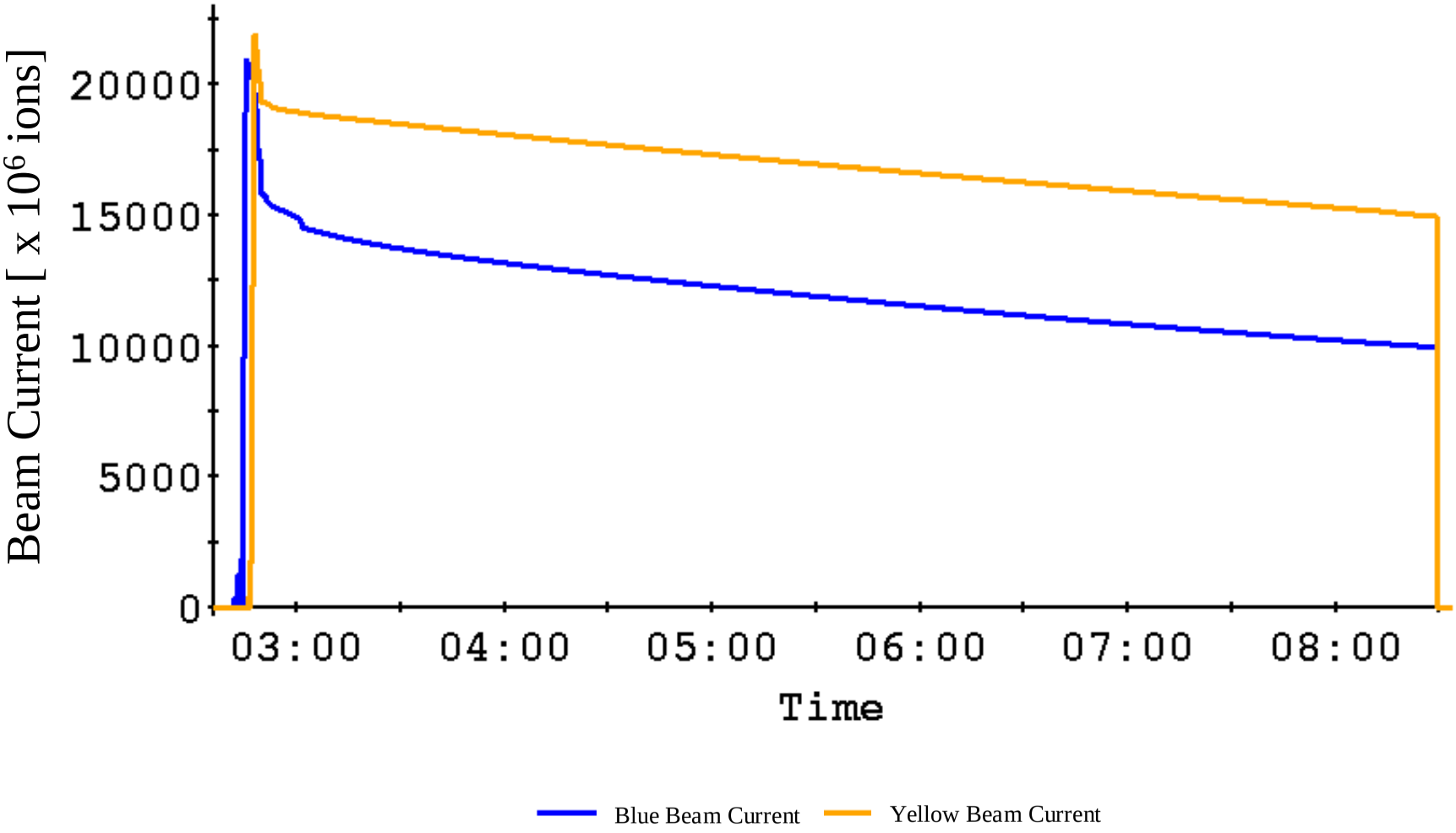
Typical Store



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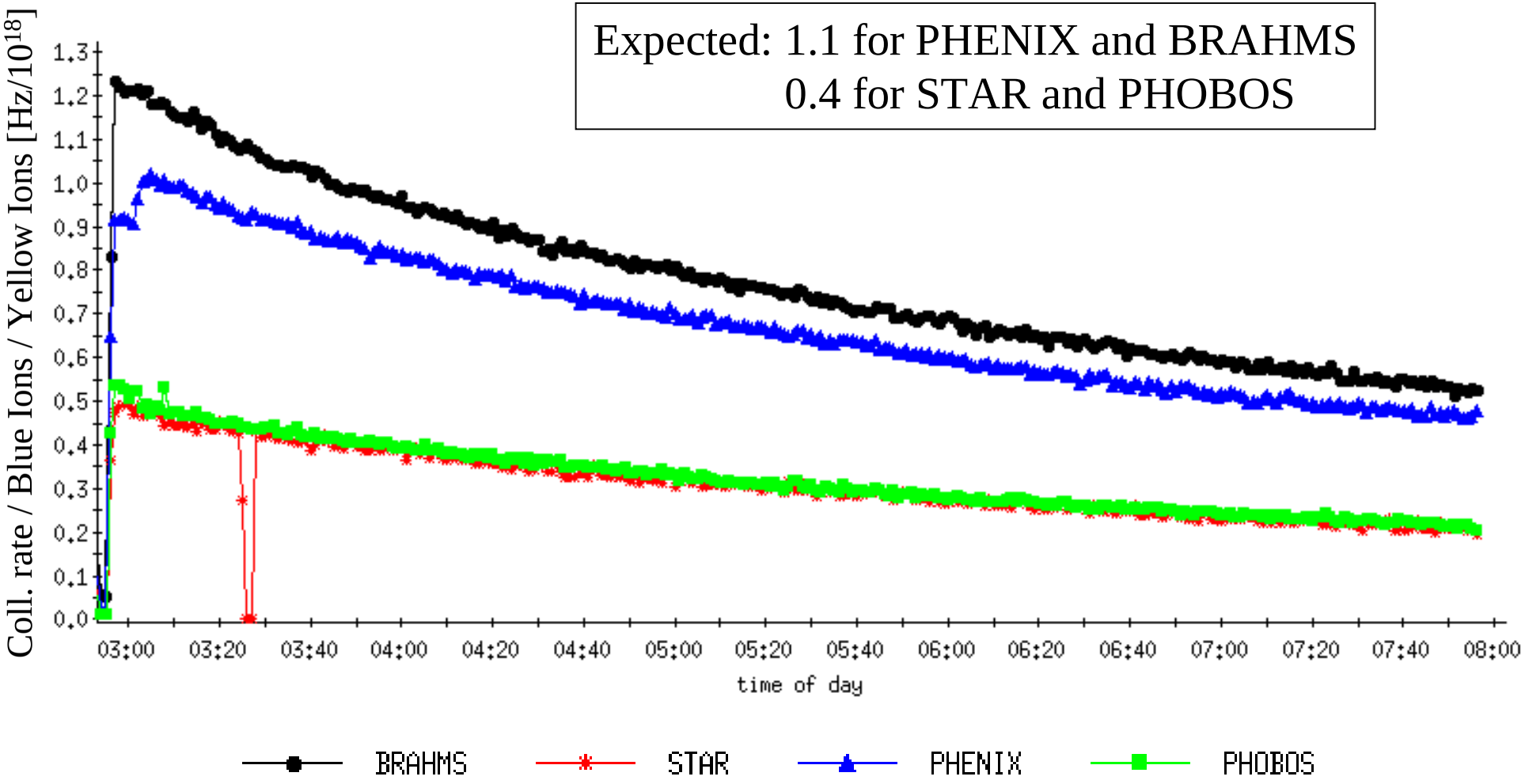
Specific luminosity

Expected: 1.1 for PHENIX and BRAHMS
0.4 for STAR and PHOBOS



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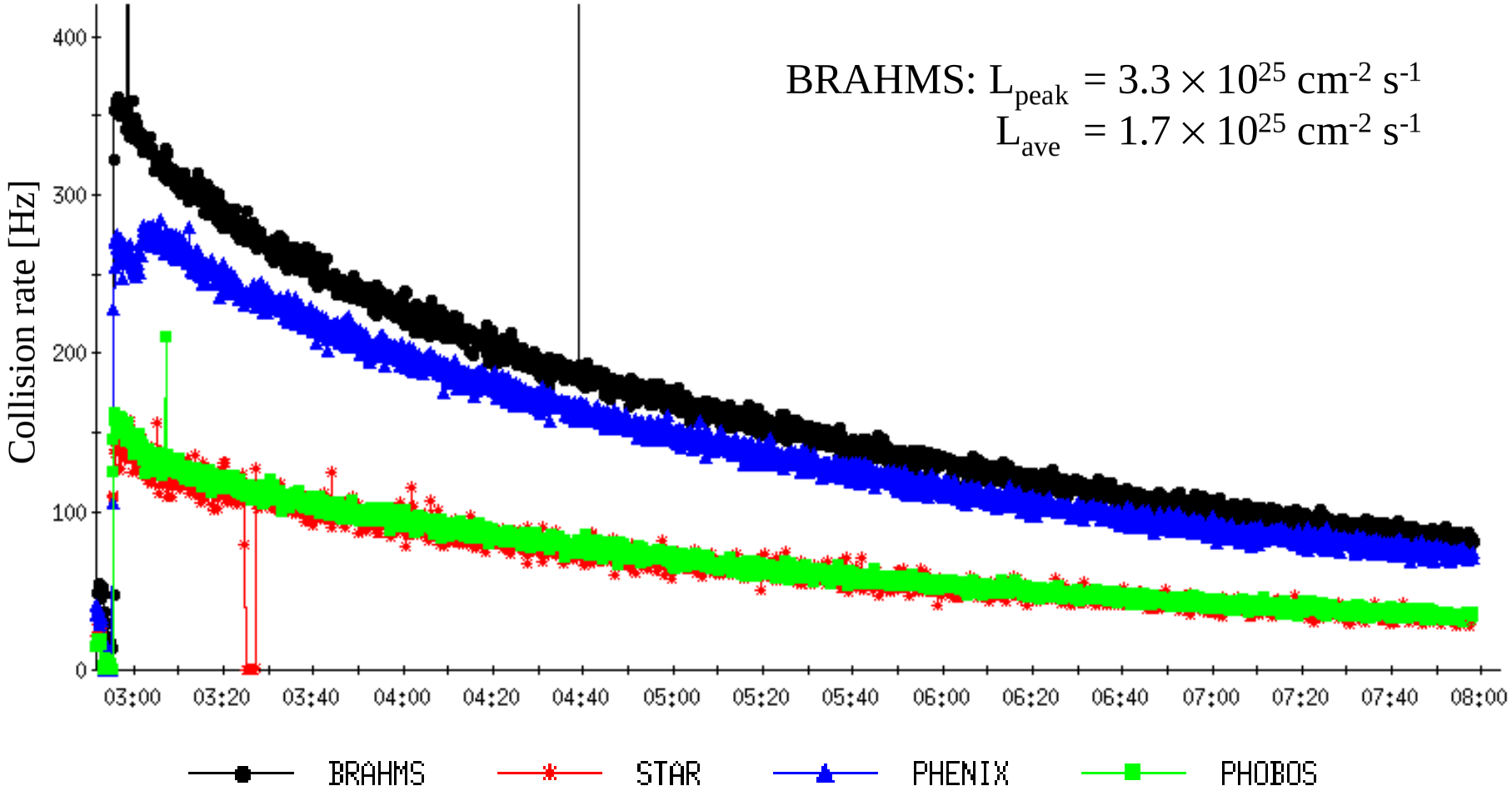
Collision rate at detectors



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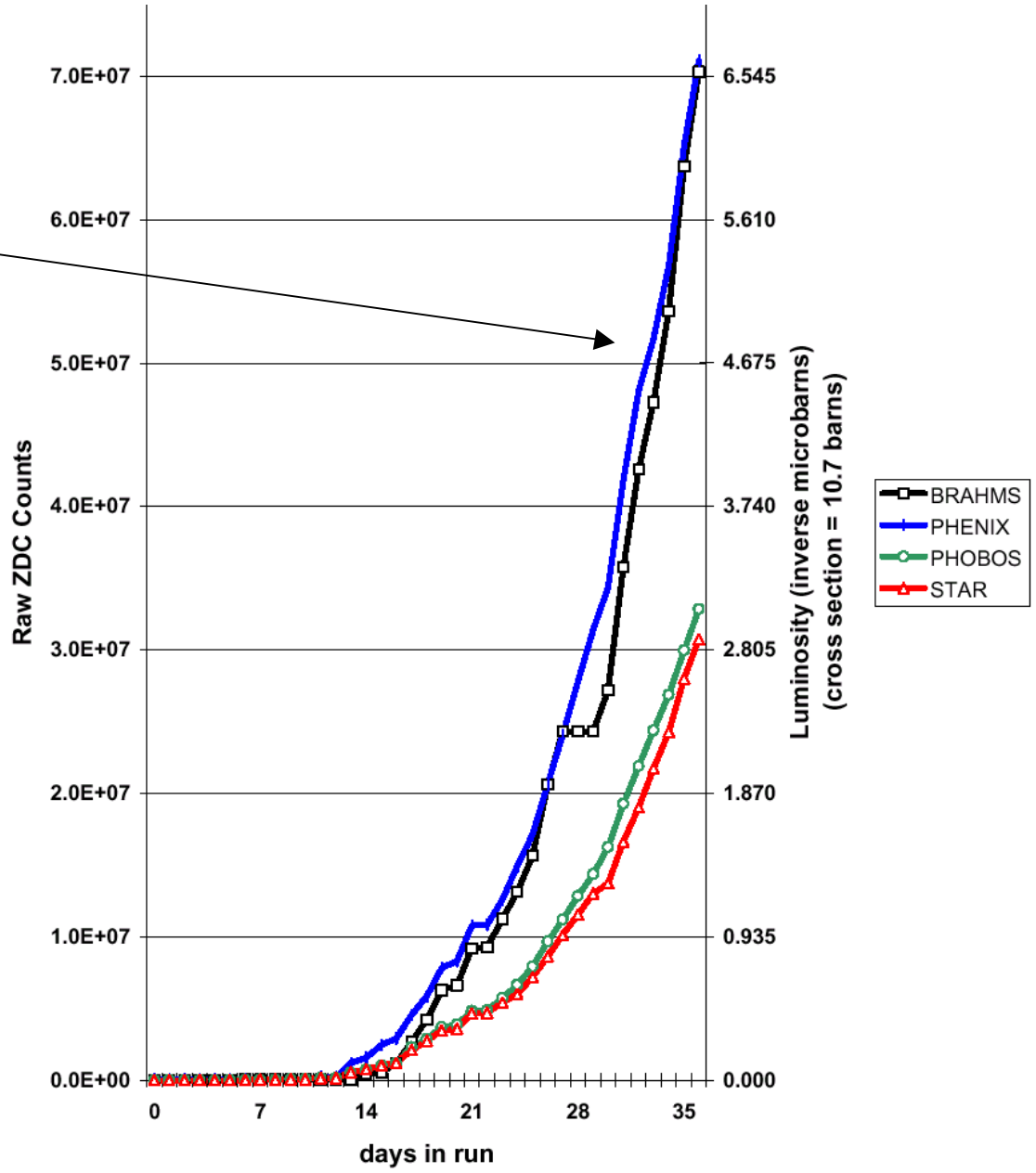
RUN2000 integrated Au-Au luminosity

BRAHMS during last 6 days:
$L_{ave} = 0.8 \times 10^{25}$ cm^{-2} s^{-1}
Availability: 47 %



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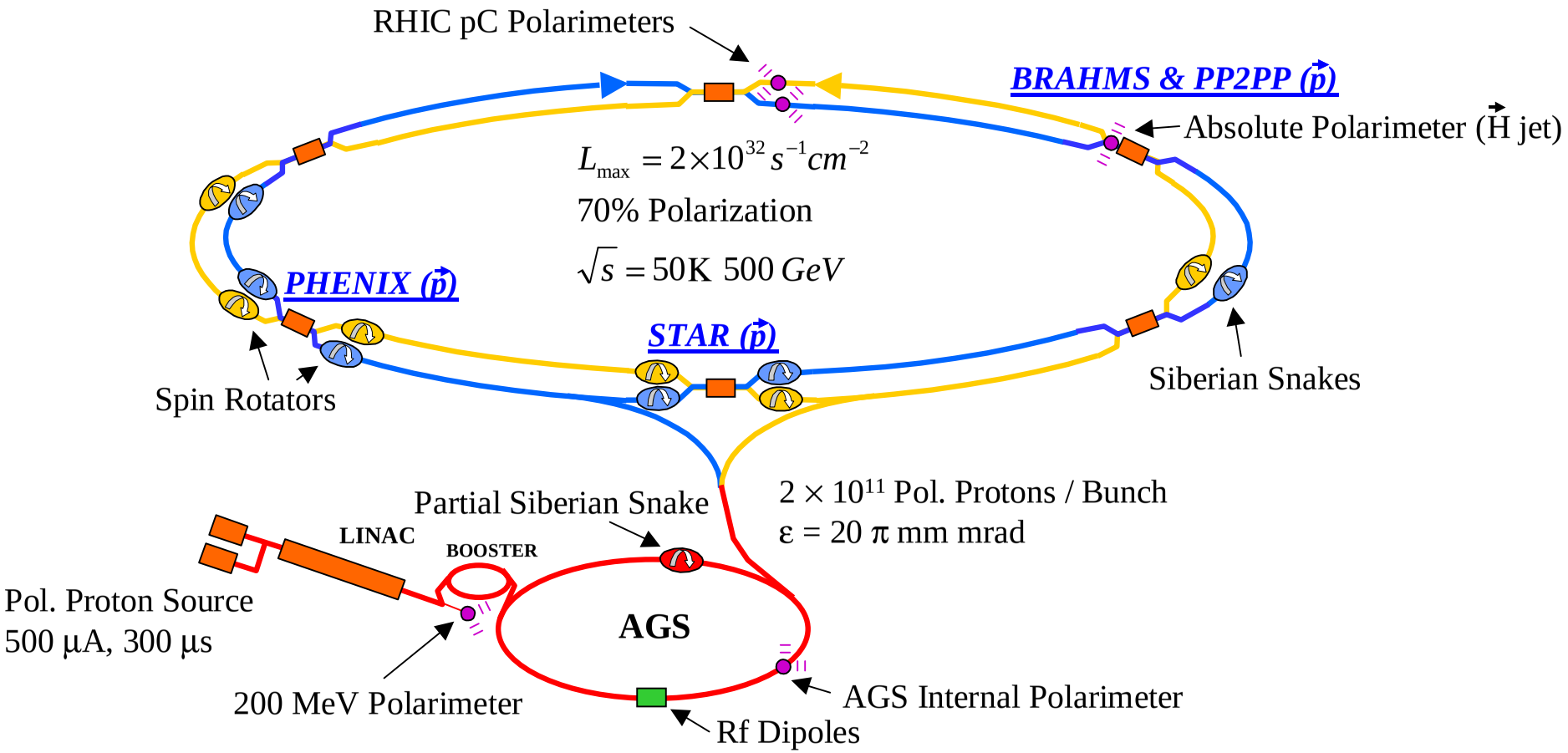
Polarized proton collisions in RHIC



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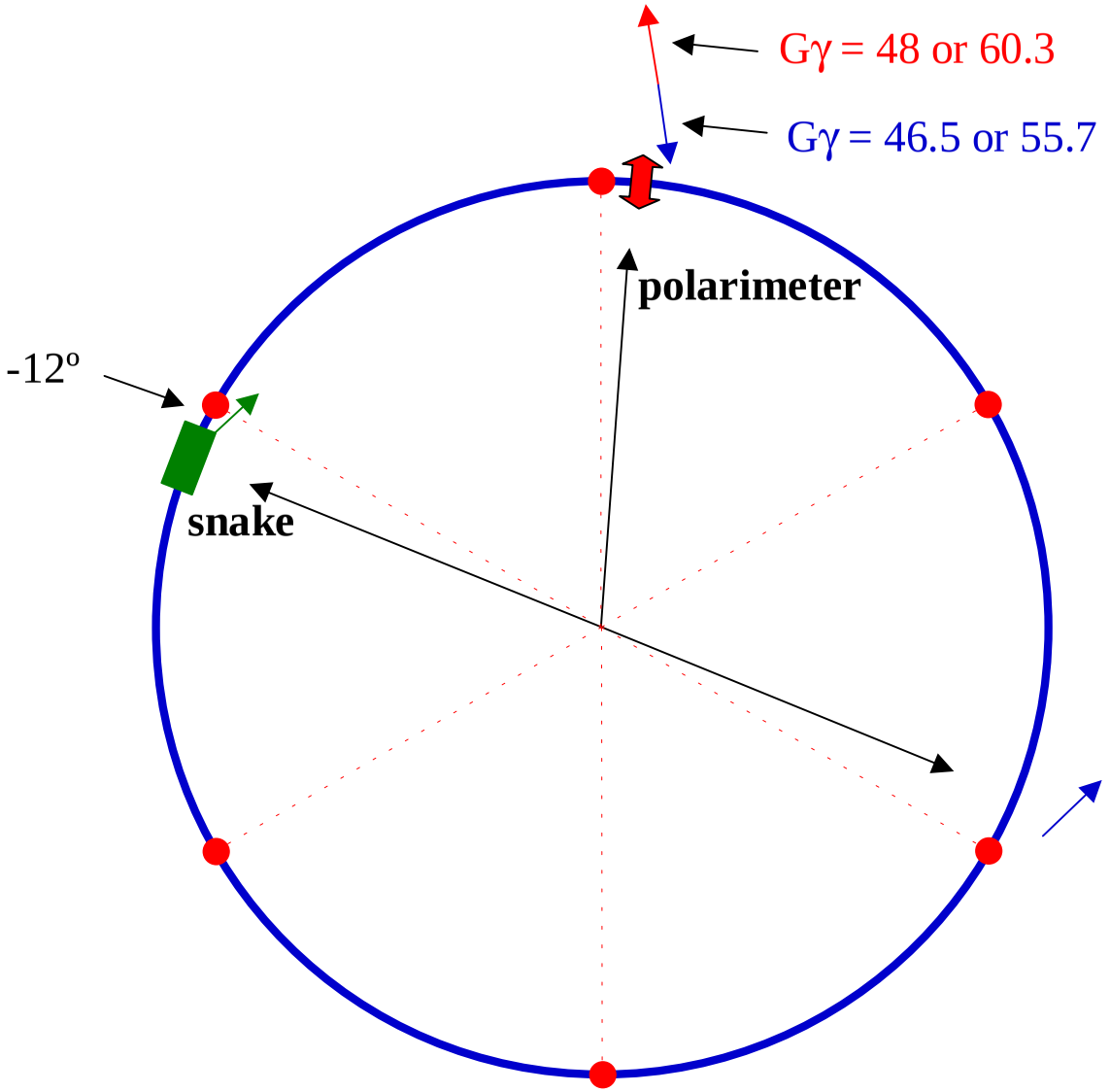
Spin commissioning with a single Snake



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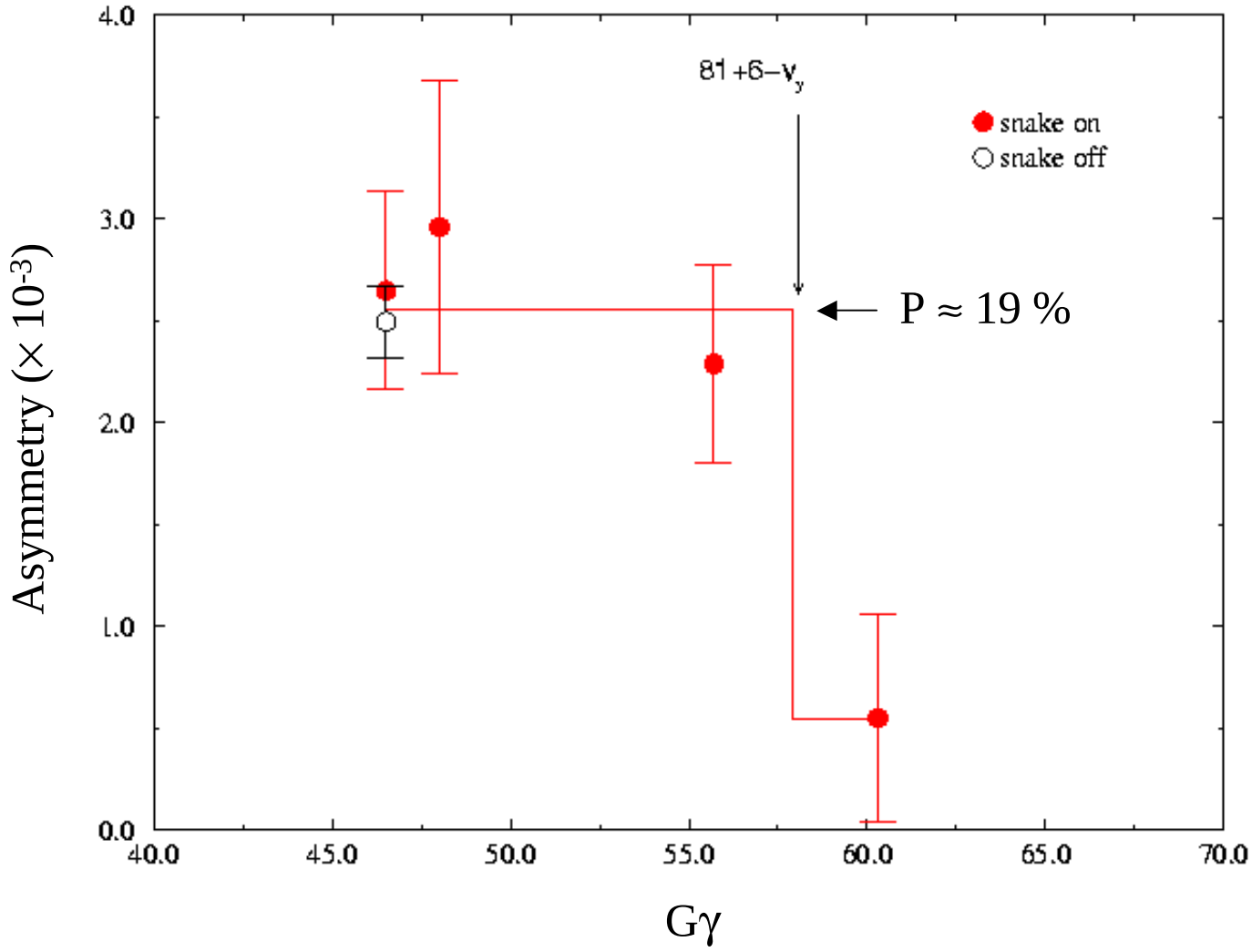
Measured RHIC asymmetries



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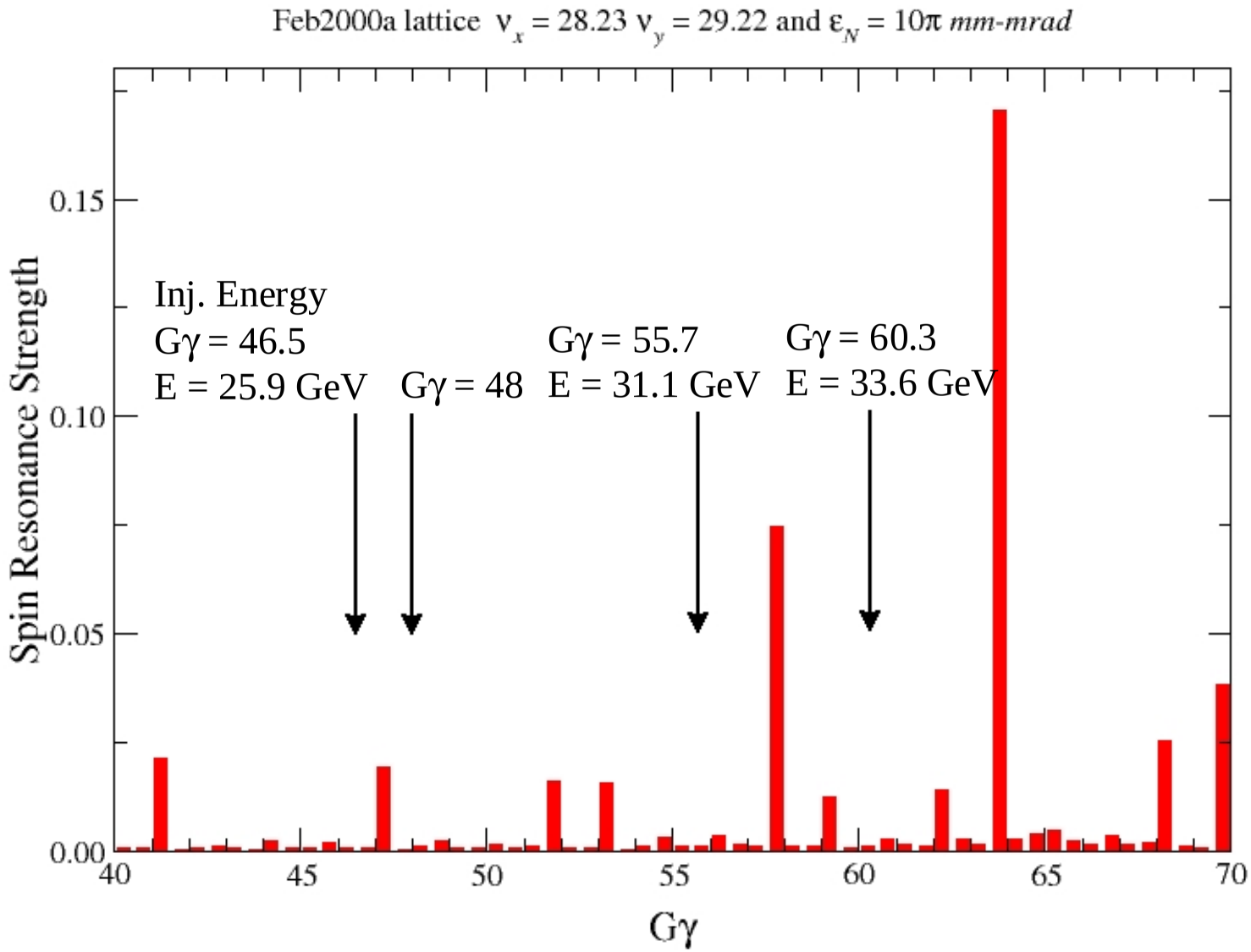
Spin resonances in RHIC (w/o Snakes)



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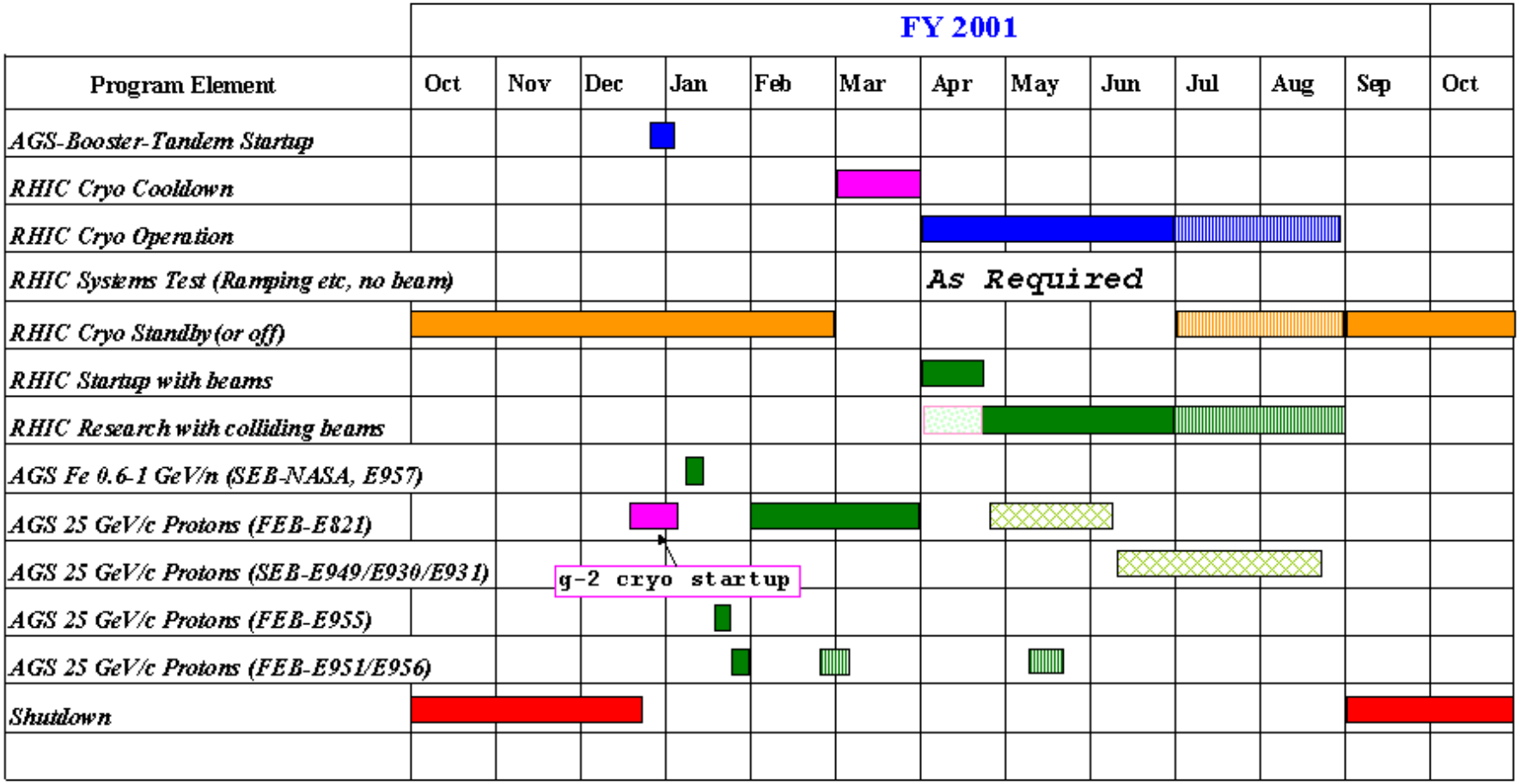
C-A Operation FY2001

Preliminary schedule, subject to funding and other issues

to be determined

concurrent with RHIC operations



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RUN2001 Goals

- Au - Au: 56 bunches per ring with 1×10^9 Au/bunch
  Design average luminosity: 2×10^{26} cm^{-2} s^{-1} [60 (μb)$^{-1}$/week]
  Design energy/beam: 100 GeV/nucl.
  Design diamond length: σ = 20 cm
- p↑ - p↑: 56 bunches per ring with 1×10^{11} p↑/bunch
  Average luminosity: 5×10^{30} cm^{-2} s^{-1} [1.5 (pb)$^{-1}$/week]
  Energy/beam: 100 GeV (Acceleration to 250 GeV)
  Beam polarization ≥ 50 %
- To reach these goals the following new hardware is being installed:
  - All remaining IR power supplies
  - Transition energy pulsed power supplies
  - 200 MHz storage rf system
  - All four Siberian snakes
  - Both RHIC polarimeters

Thoughts for RUN2001 (1)

- To make Au operation reproducible and polarized proton operation possible tunes and closed orbit will have to be controlled much better:
  - Tune feed-back system with reliable tune measurement and software feedback using knobs: $Q_{meas} - Q_{desired} \leq 0.005$
  - Closed orbit corrected to ≤ 0.5 mm rms at all stones during acc. ramp. Automatic feed forward from one acc. ramp to next.
  - Closed orbit correction should NOT change average radius.
- Use symmetric lattice during injection and acceleration.
  - $\beta^* = 3$ m at all IR's: About 150 fewer p.s. that need to track.
    No bipolar supplies at 4:00 and 12:00.
    $\alpha_1 \approx -1.5$ which is ideal for γ_T jump.
  - $\beta^* = 10$ m at all IR's: Smaller β at IR's.

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Thoughts for RUN2001 (2)

- Collision steering worked well using ramps. But we need direct ramp execution from orbit control application and maybe other applications.
  - Proposal: Knobs only for feedback use, not available for direct use by operators
- Need longitudinal and transverse injection damping.
- Commission bunch transfer to storage rf system
  - Yellow bunch length was bigger than blue bunch length. Why?
- Commission squeeze from β^* = 3 m (10 m) to 2 m.

Summary

- RUN2000 RHIC commissioning and first operation was very successful

- Full design Au luminosity and collisions of polarized protons are planned for RUN2001

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