Luminosity from the Machine Perspective

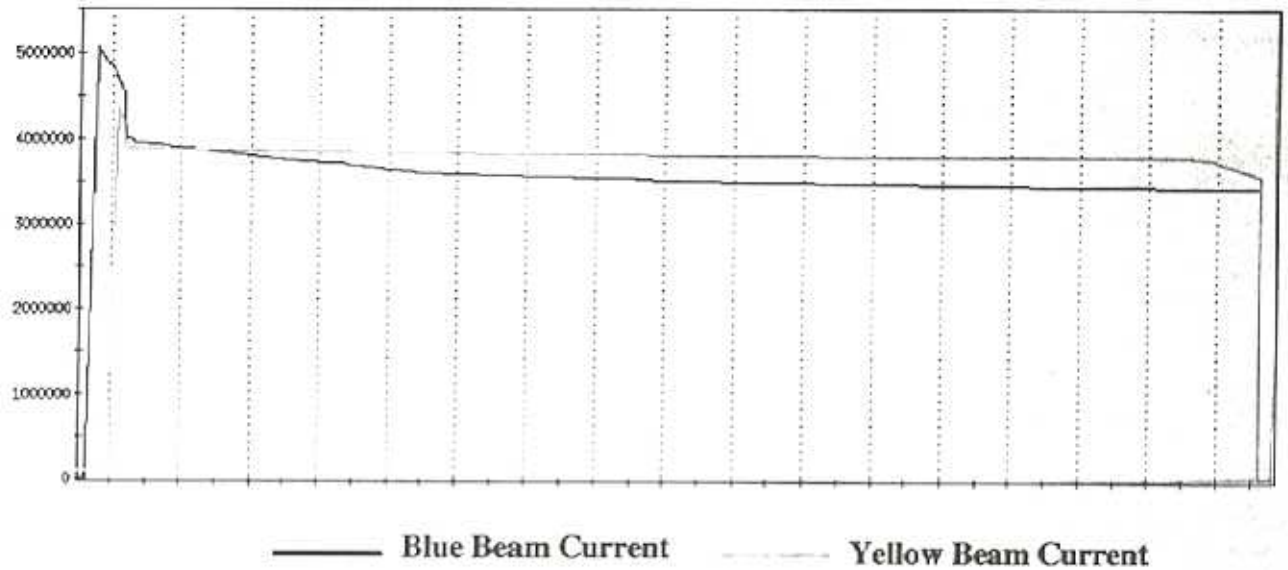
T. Roser

May 22, 2002

for
RHIC Spin Collaboration Meeting IX
RIKEN BNL Research Center

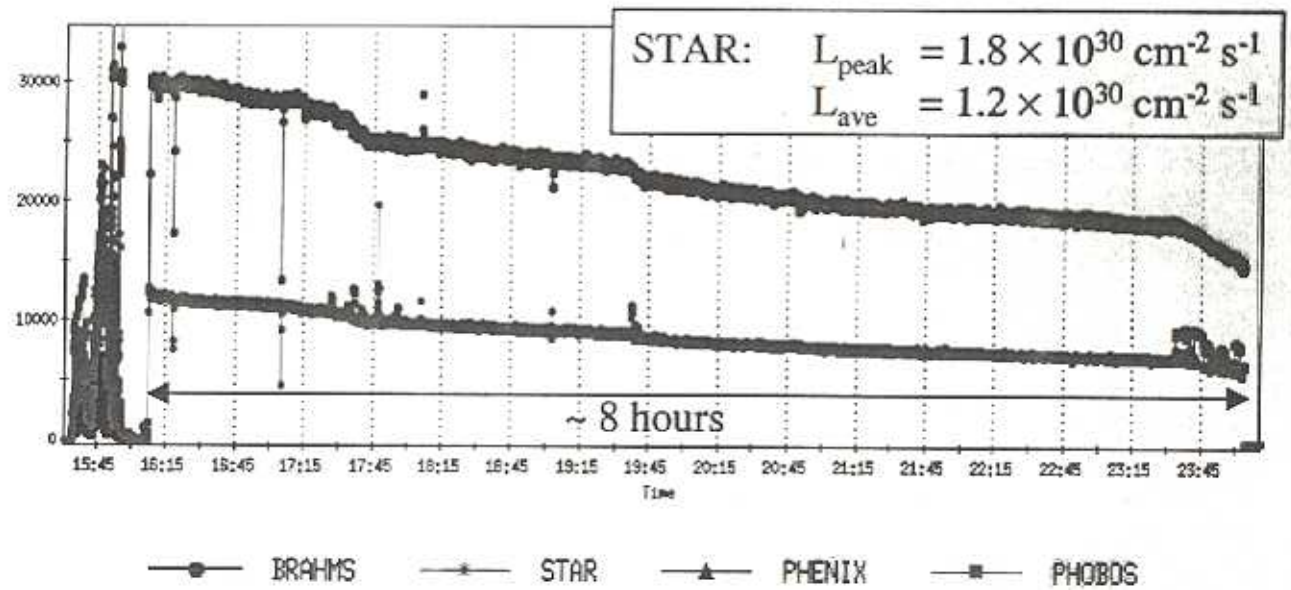
"Typical Store" # 2304

Beam currents [$\times 10^6$ ions]



Collision rate [Hz]

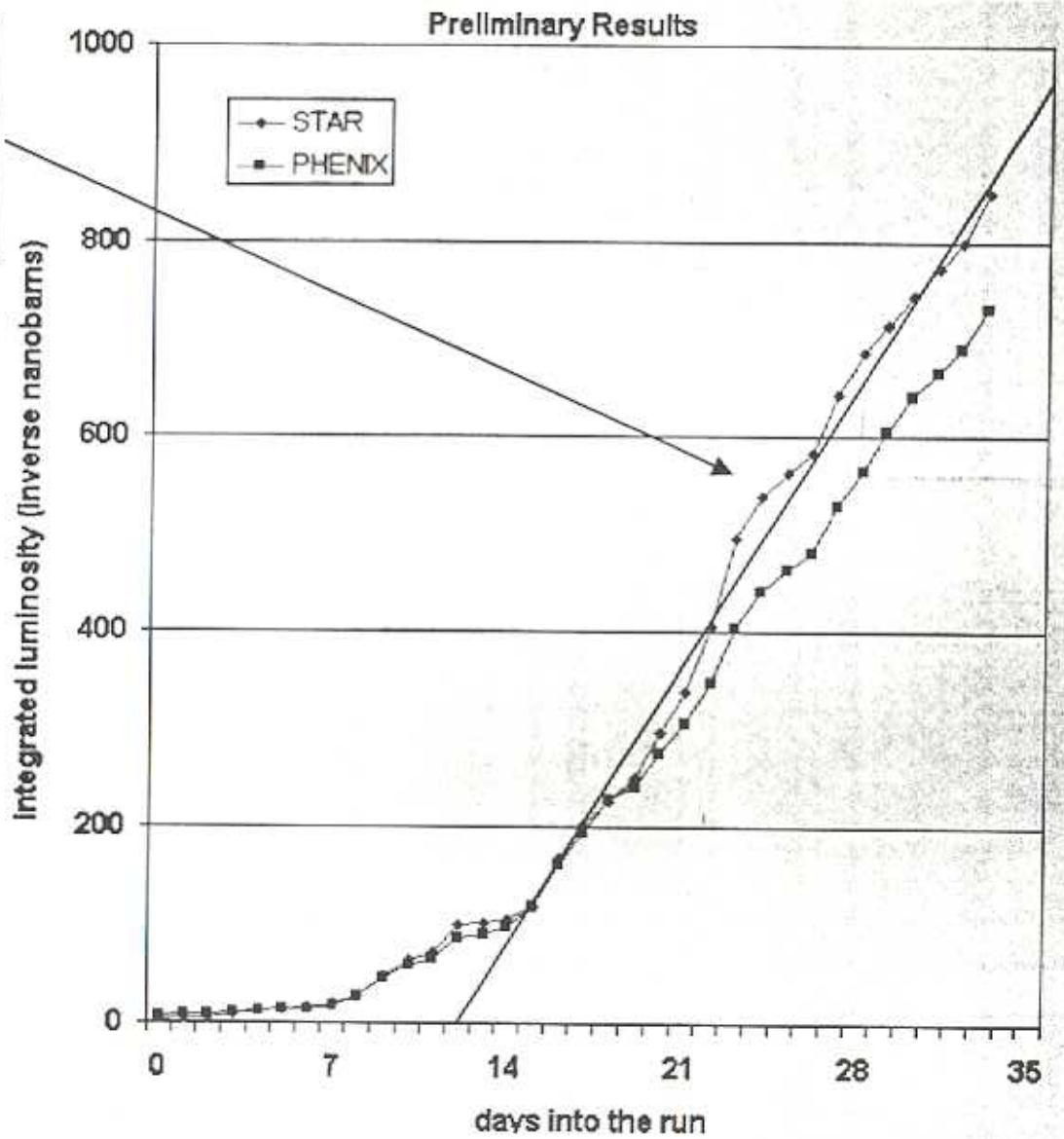
Vernier scans:
STAR: $10^4 \rightarrow 0.6 \times 10^{30}$ cm^{-2} s^{-1}
PHENIX: $10^4 \rightarrow 1.6 \times 10^{30}$ cm^{-2} s^{-1}



BROOKHAVEN
NATIONAL LABORATORY

Integrated p - p luminosity

STAR during last 20 days:
290 $(nb)^{-1}$/week
$L_{ave}(week) = 0.5 \times 10^{30}\ cm^{-2}\ s^{-1}$
$L_{ave}(week)/L_{ave}(store) = 42\ \%$



BROOKHAVEN
NATIONAL LABORATORY

RUN2003 Goals (~ 3-4 weeks into run)

- Prepare for four modes; all with:
  Energy/beam: 100 GeV/nucl., diamond length: $\sigma = 20$ cm, $L_{ave}(\text{week})/L_{ave}(\text{store}) = 40$ %

Mode	# bunches	Ions/bunch [$\times 10^9$]	β^* [m]	Emittance [$\pi\mu$m]	L_{peak} [$cm^{-2}s^{-1}$]	L_{ave}(store) [$cm^{-2}s^{-1}$]	L_{ave}(week) [$week^{-1}$]
Au-Au	56	1	1	15-40	14×10^{26}	3×10^{26}	70 $(\mu b)^{-1}$
$(p\uparrow\text{-}p\uparrow)^*$	112	100	1	25	16×10^{30}	10×10^{30}	2.8$(pb)^{-1}$
d-Au	56	100(d), 1(Au)	2	20	5×10^{28}	2×10^{28}	5 $(nb)^{-1}$
Si-Si	56	7	1	20	5×10^{28}	2×10^{28}	5 $(nb)^{-1}$

* Beam polarization ≥ 50 %; Acceleration test to 250 GeV

- New hardware installed and to be commissioned:
  - All eight spin rotators for PHENIX and STAR

BROOKHAVEN NATIONAL LABORATORY

RUN2003 Integrated Luminosity Estimate

Estimate for integrated luminosity for 29 week FY2003 run (starting October 1, 2002):

- 4 weeks cool down, 1 week warm-up, 2 weeks setup (for each mode), 3 weeks ramp up (for each mode): →

  29 weeks of cryo ops.: 2 modes: 7 weeks at "final" luminosity / mode
  3 modes: 3 weeks at "final" luminosity / mode
  4 modes: 1 week at "final" luminosity / mode
- Minimum: performance at end of FY2001/02 run
- Maximum: luminosities from previous slide

Mode	L_{ave} (week) [week^{-1}]	Int. Lumi. 2 modes	Int. Lumi. 3 modes	L_{ave} (week) [week^{-1}]	Int. Lumi. 2 modes	Int. Lumi. 3 modes
Au-Au	24(μb)$^{-1}$	168(μb)$^{-1}$	72(μb)$^{-1}$	70 (μb)$^{-1}$	490(μb)$^{-1}$	210(μb)$^{-1}$
(p↑-p↑)*	0.3(pb)$^{-1}$	2.1(pb)$^{-1}$	0.9(pb)$^{-1}$	2.8(pb)$^{-1}$	19.6(pb)$^{-1}$	8.4(pb)$^{-1}$
d-Au	?	?	?	5 (nb)$^{-1}$	35 (nb)$^{-1}$	15 (nb)$^{-1}$
Si-Si	?	?	?	5 (nb)$^{-1}$	35 (nb)$^{-1}$	15 (nb)$^{-1}$

BROOKHAVEN NATIONAL LABORATORY