2005 RHIC Accelerator Physics

IBS Lattice Development

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IBS Lattice Development

- Theory
- RHIC optics design
- Measured optics
- Ramping
- Experimental results
- Summary

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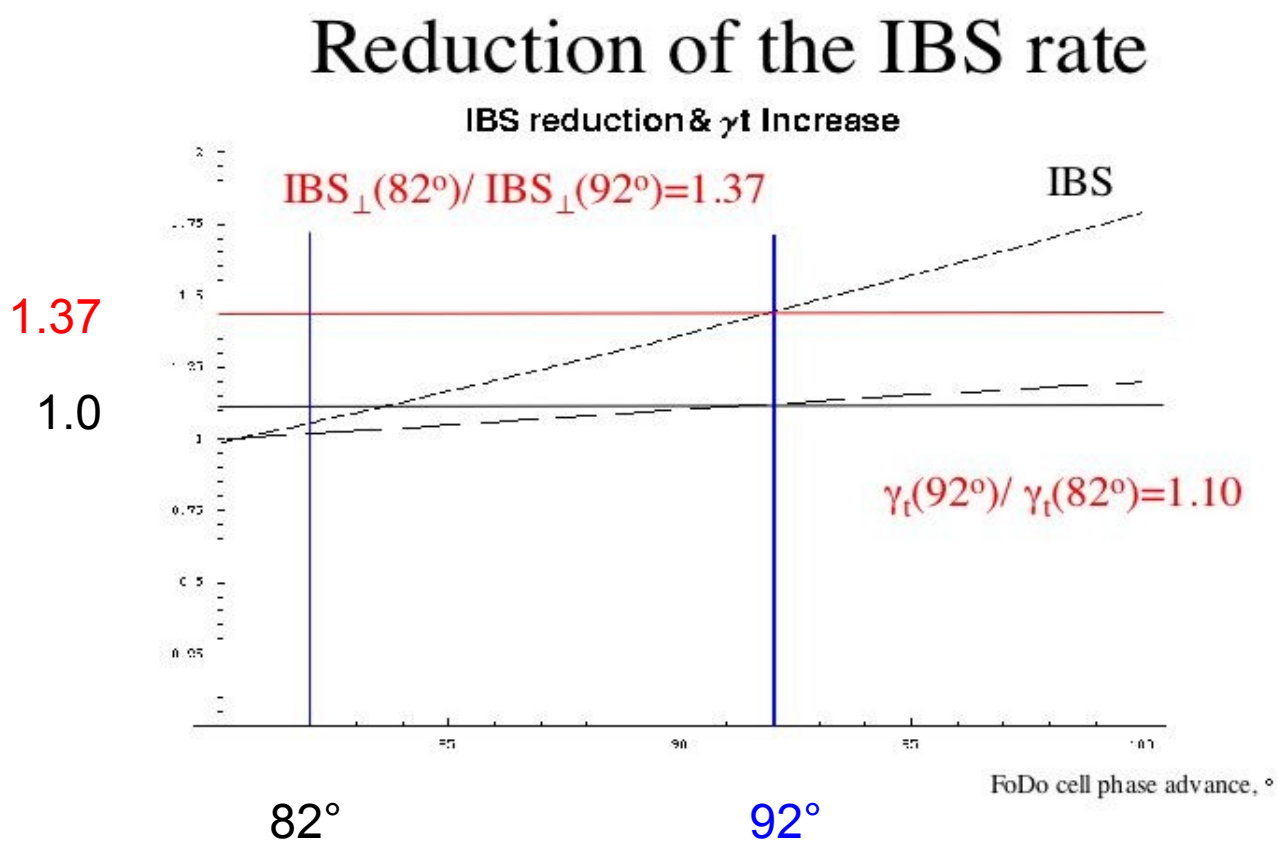

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- Raise the tune
  - Increases the cell phase advance
- Optics must work within existing power supplies
- Selected $\beta^* = 3m$
  - Enough aperture for beam at injection
  - Goal: $\alpha_1 = -1.5$ implying: γ_T transparent
    - Didn't turn out this way
- Ramp to different energies
  - Cu101: 100GeV; Cu102: 85GeV and Cu103: 33GeV

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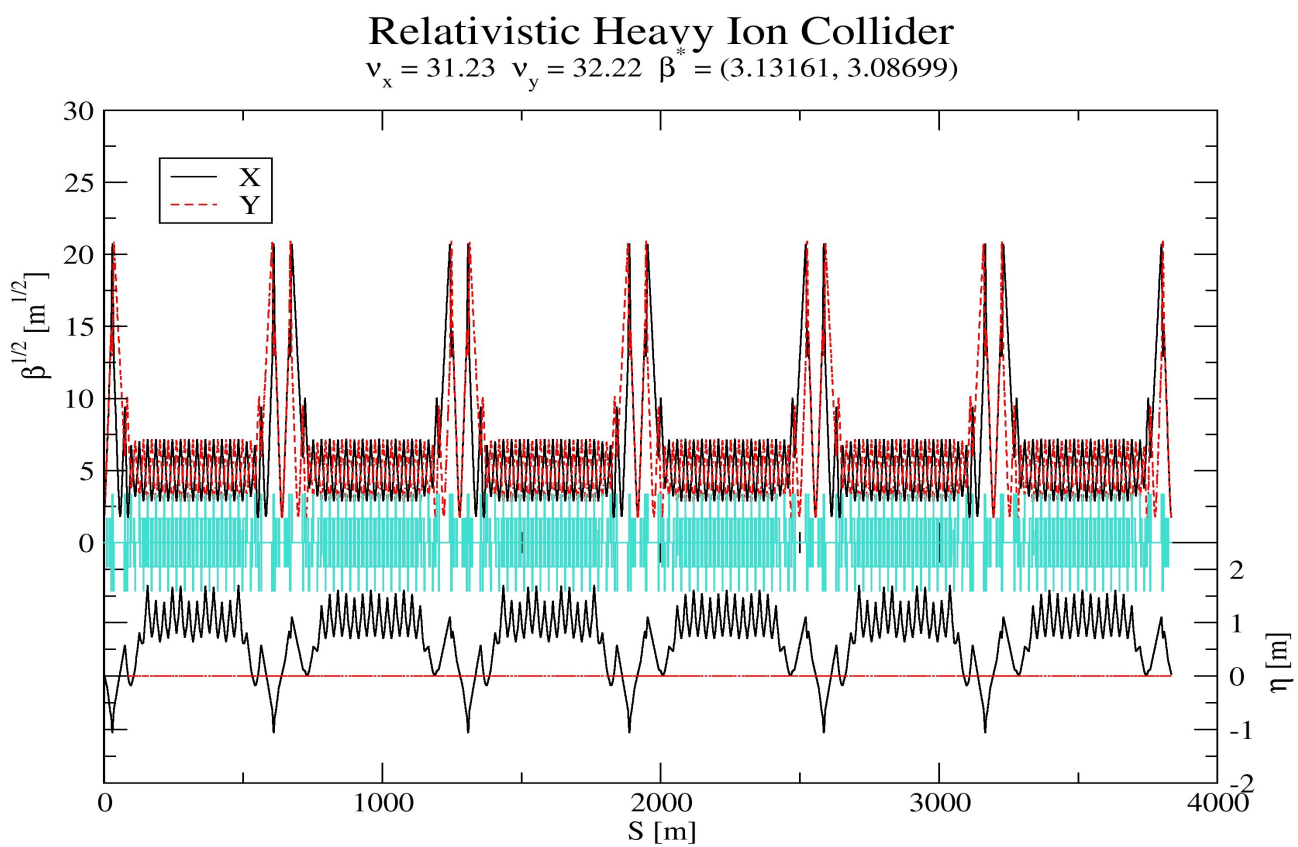
Cell phase advance

$\Phi_x = 91.64°$

$\Phi_y = 96.25°$



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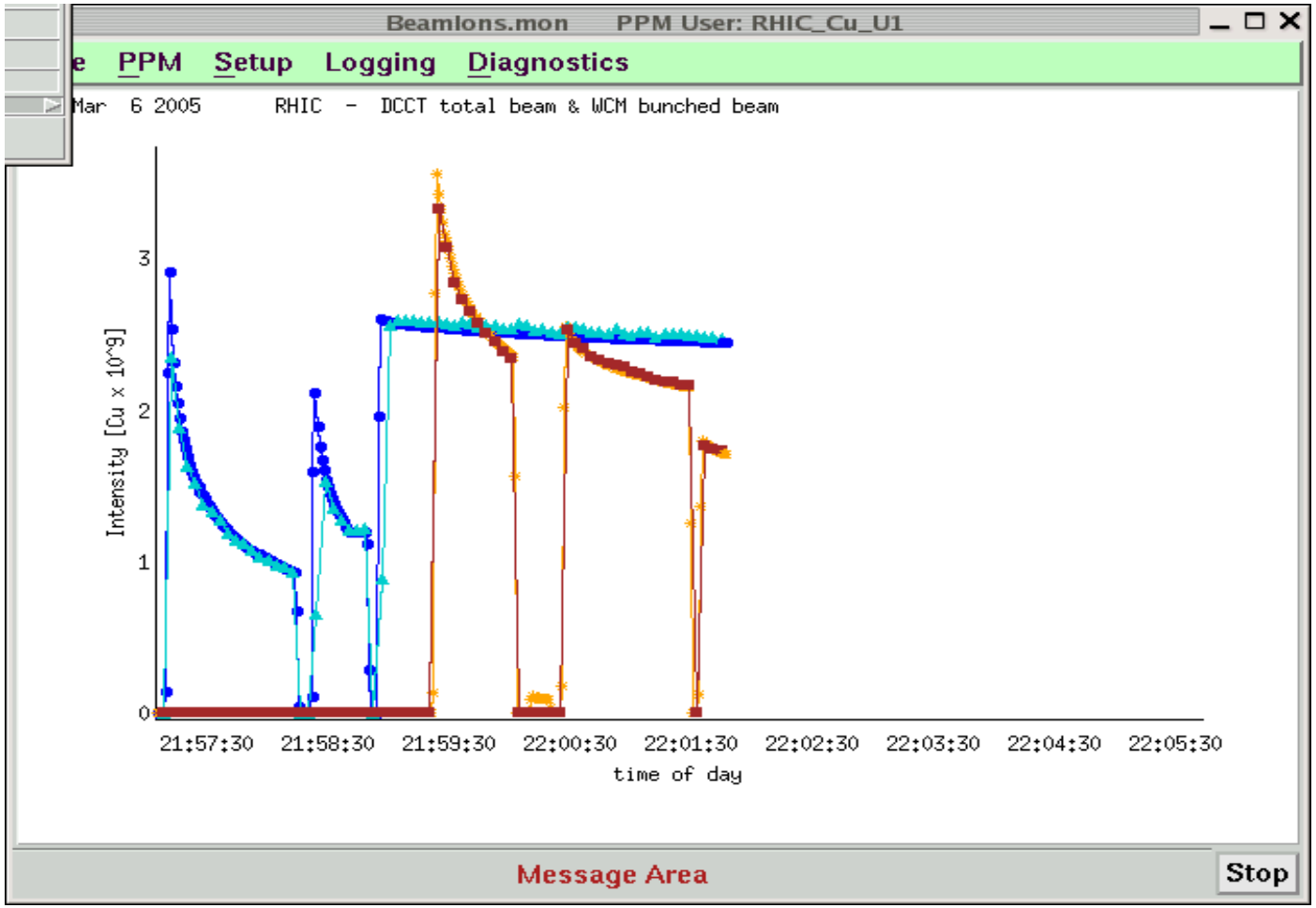

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RHIC LinearOptics

File Lattice SetUp Help

Hori Betatron function and phase advance | Hori Beta Beat

sqrt(beta function [m]) — phase [degree] — # of turns

hori beta func (Y1) — model beta (Y1)
hori phase (Y2) — model phase (Y2)

Beam ==> Lattice: Blue

magnets hsteer vsteer hbpms vbpms

Vert Betatron function and phase advance | Vert Beta Beat

sqrt(beta function [m]) — phase [degree] — # of turns

Optics/Coupling: Optics, Coupling, other

Fit Method: Amp Fit, PhaseSpaceFit

Designed Optics: plotModel, NoModel

which model: LiveMachine, injection, flattop

ac dipole setup

	Q_d	Amp	Up	Flat	down
H:	0.2990	0.1000	15.000	30.000	15.000
V:	0.2590	0.1500	15.000	30.000	15.000

H On/Off

V On/Off

BPM Injection Acquisition

Trigger AC dipole

Beta* at IPs

	IP2	IP4	IP6	IP8	I
H:	1.64390	8.23710	8.44839	4.17288	8.
V:	-0.0179	0.00000	-0.0002	0.00011	-0

The orbit saved into /operations/app_store/RunData/run_fy05/06252/RHIC/RhicOrbitDisplay/Blue/orbit_data/acd04.sdds
Stop Acquisition

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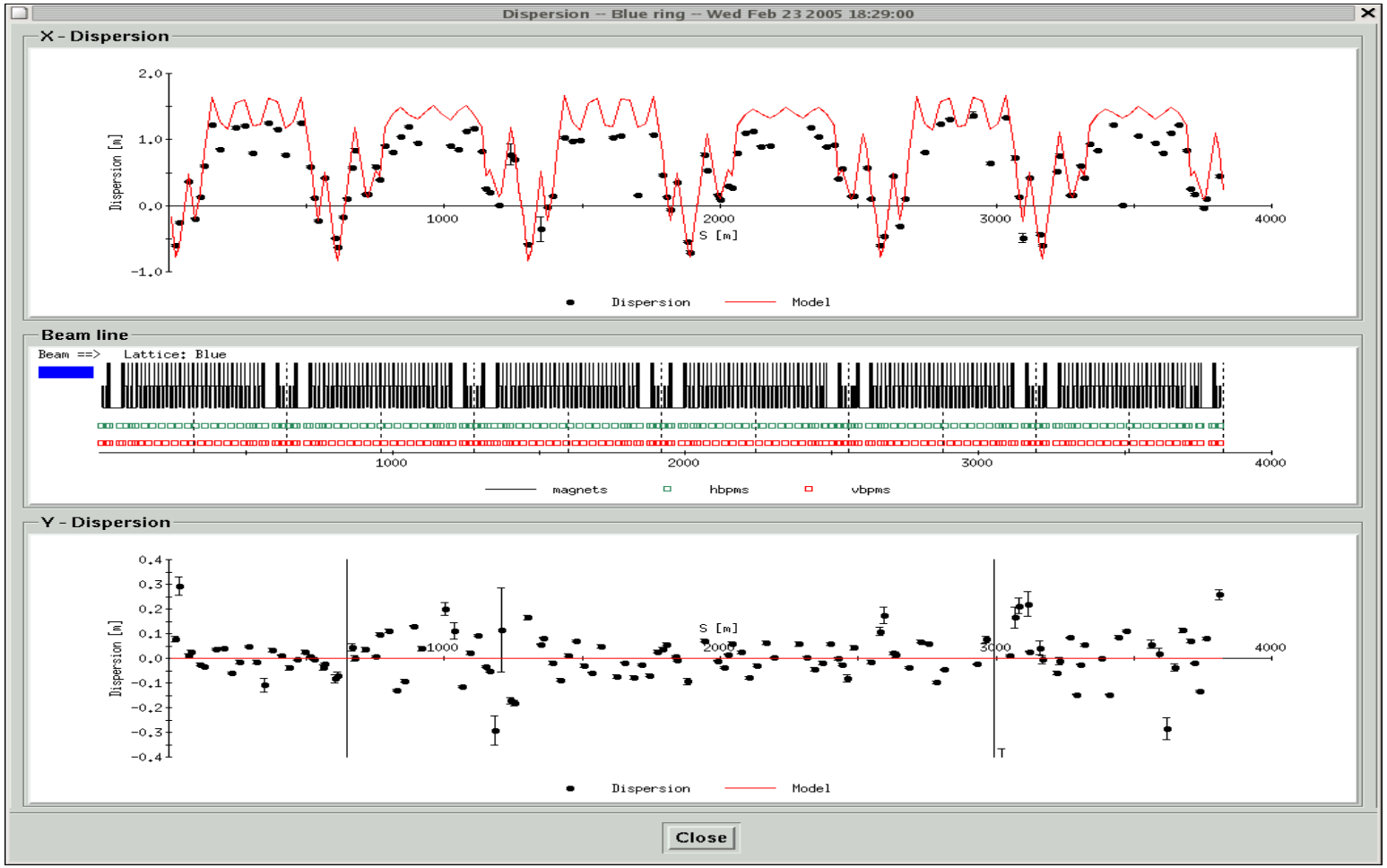

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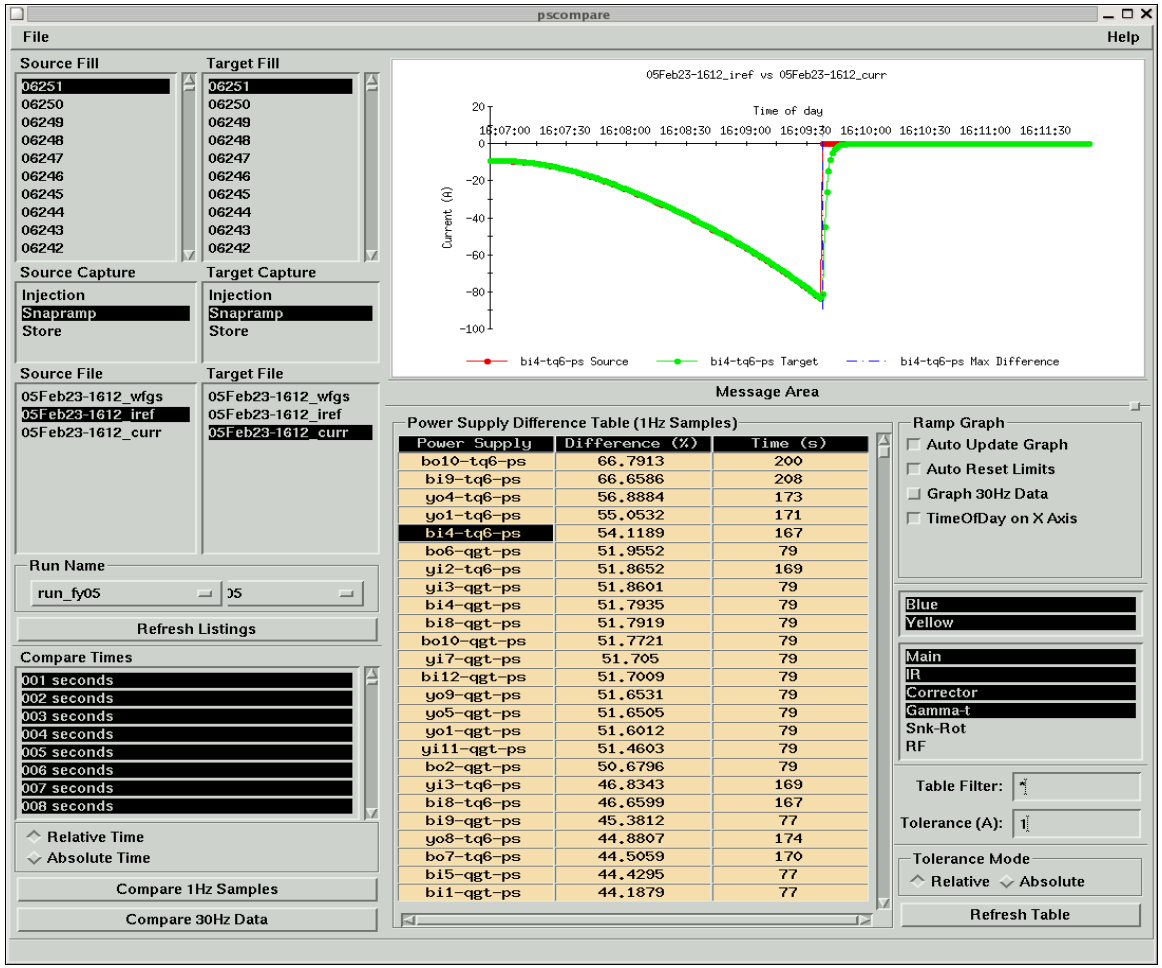
Using Cu101, the trim quads QLI'd at about 80 *Amps*. This was repeatable.

This was a puzzle, since, the trim quads quench about 190 *Amps* and have 150 *Amp* power supplies.

Since, the trim quads were only measured to 100 *Amps*, there was a hard 100 *Amp* limit in the Ramp system.

The 85GeV ramp, Cu102, had a similar problem.



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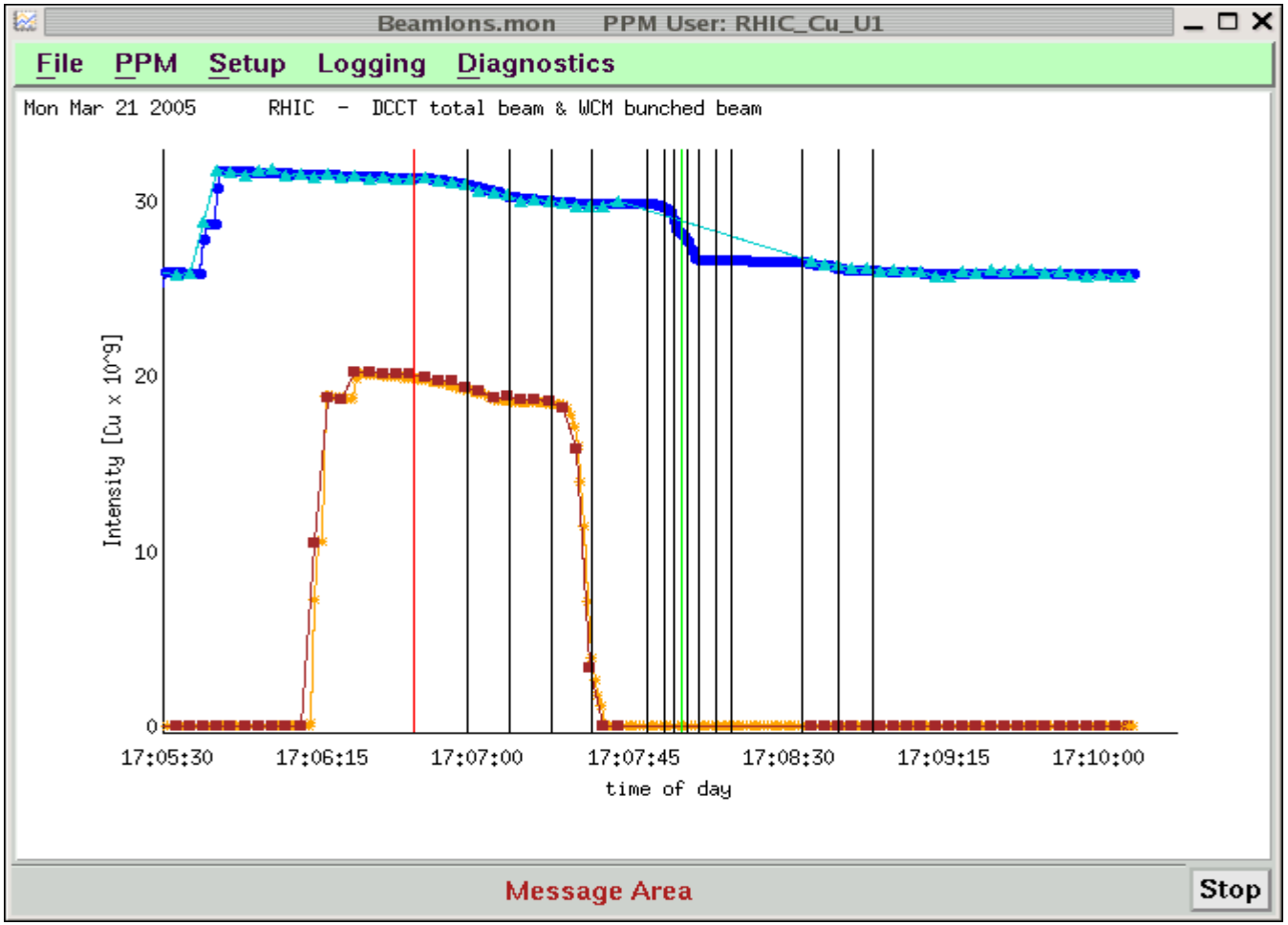
Cu103: 33GeV
Blue beam
83% Transmission



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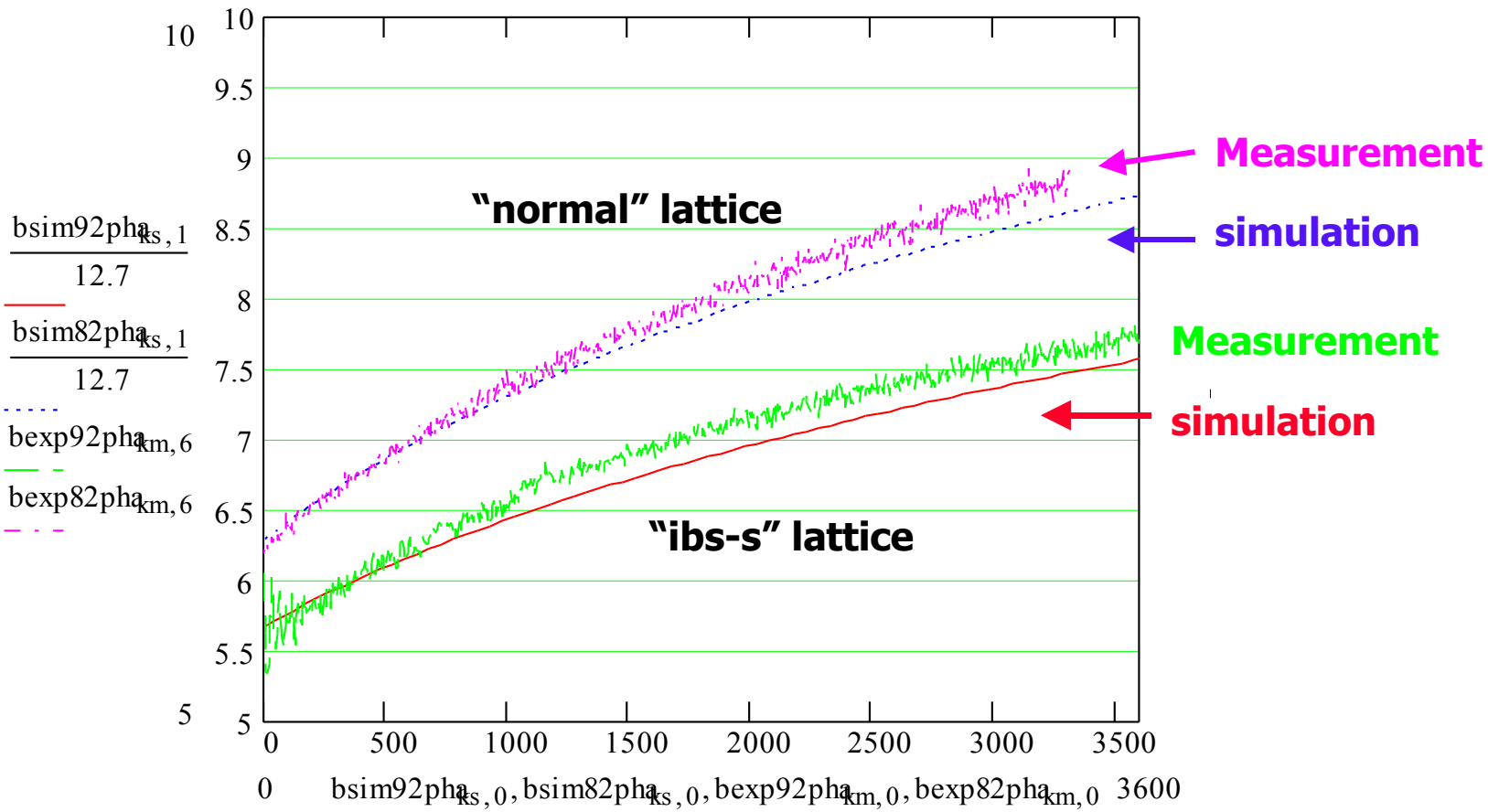
A. Fedetov



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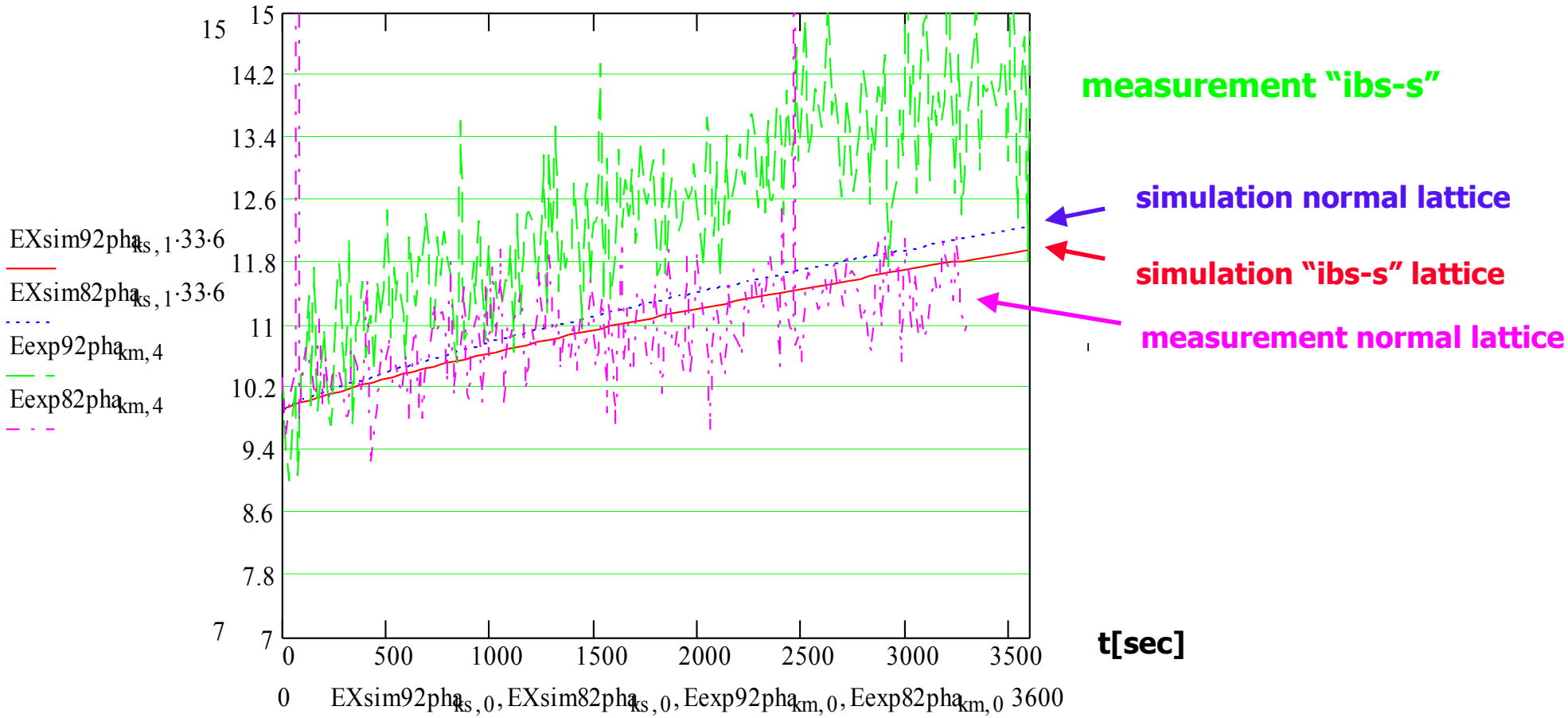
A. Fedetov



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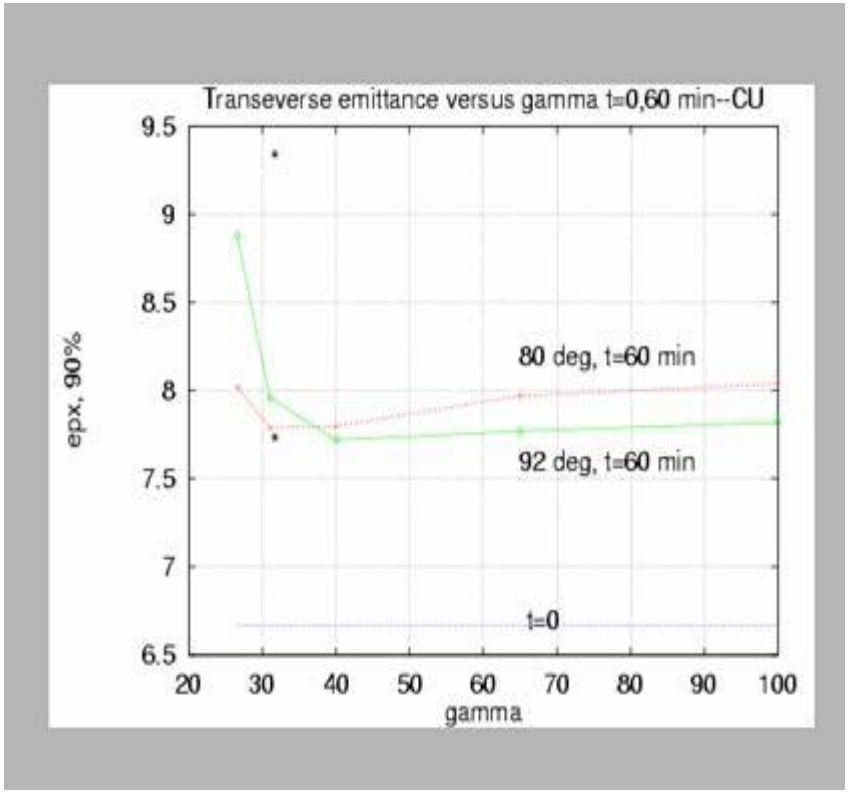
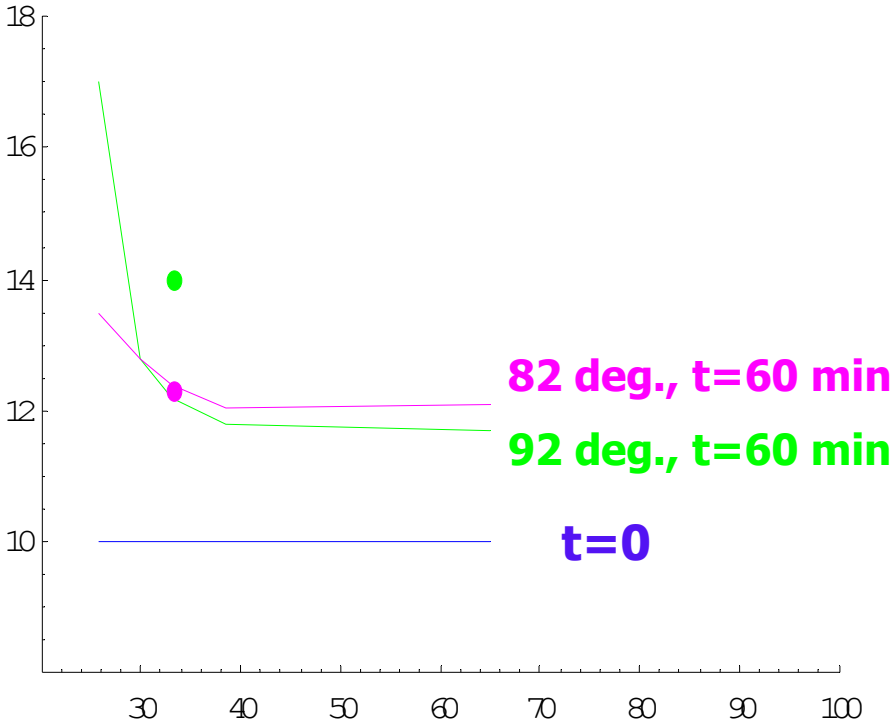
G. Parzen



BetaCool, A. Fedetov



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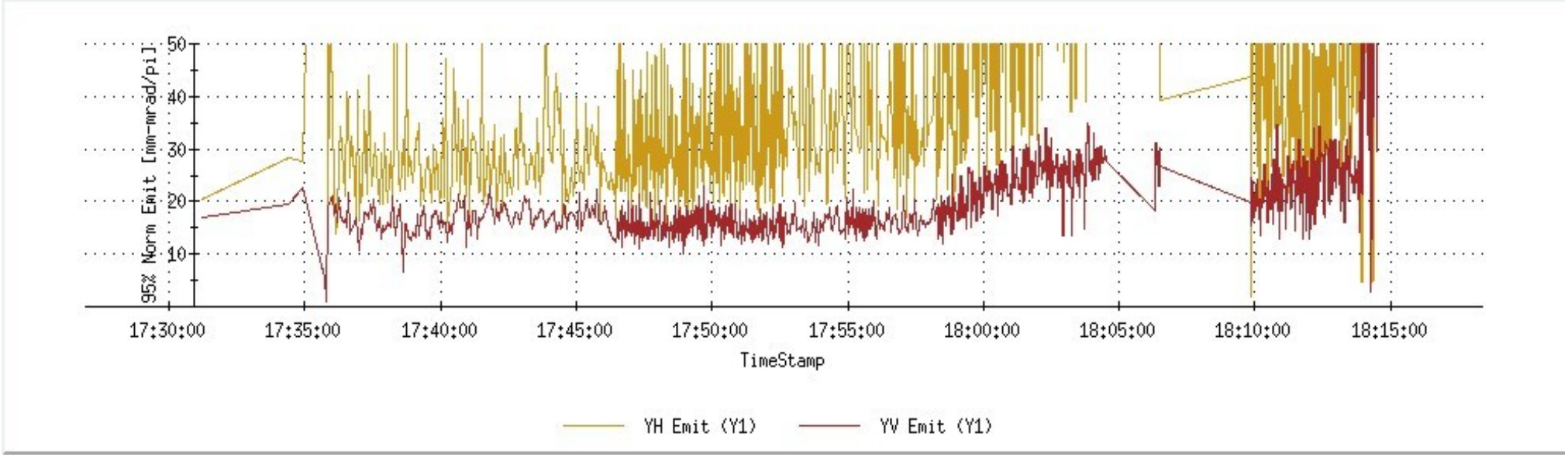

IBS Measured every 15 secs at 33GeV Cu

Two possible sources of growth:
(1) From residual gas ions
(2) Electromagnetic field kicks

Testing the IPM for growth with pp at injection:

0.25 Hz 17:37-17:46

1 Hz 17:47 ... 17:58 (few back and forth)

17:78 - 10 Hz

18:12 - 60 Hz for a short period

Summary

- Test the feasibility of reducing IBS growth by using large ARC phase advance
- Use current RHIC hardware
- Measure: at 33GeV Cu and 92° phase advance
  - Agrees with theory longitudinally
  - Larger growth transversely than theory
    - *Tracking by Parzen and BetaCool show energy dependance*
    - *Possible beam growth by IPM's, or other sources*
- Goal: Attempt to create a 120° RHIC lattice at 100GeV Cu or Au