

# Rhic Beam Experiments Workshop 2003

## Overview of the 2004 Beam Experiments Program

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BNL, October 15-16, 2003

# Overview

- Brief recall of Beam Ex 2003 program
- Run 2003 scheduling statistics
- Summary activities during the shutdown (Offline Model)
- Beam Experiments organization and plans for Run 2004

# Beam Ex: motivation, goals

## GOALS

- Improve machine **performance** (longer time scale than 'now' machine performance)
- **Luminosity, upgrade** (RHIC-II)
- Development of **beam diagnostics techniques**
- Inter-lab **collaborations** (common goals, exploit synergies, exchange personnel, remote operations etc.)

## Beam experiments → operations

Examples runs 2001, 2003:

- **IR correction**: skew quadrupole, sextupole
- **Chromaticity** measurements via radial wobble
- **Octupoles** around transition
- **PLL** high resolution tuning
- **Tune scans** in collision → working points

# Beam Ex Organization Run 2003

AC dipole (twiss, coupling)

Beam-beam

Chromaticity

Collimation, diffusion

Nonlinear studies

Instabilities

Pressure rise, e-cloud

Stochastic cooling

Transition

M. Bai

W. Fischer

S. Tepikian

A. Drees, R. Fliller

V. Ptitsyn

M. Blaskiewicz

S.Y.Zhang

M. Blaskiewicz

C. Montag

[www.rhichome.bnl.gov/AP/RHIC2003/BeamEx2003](http://www.rhichome.bnl.gov/AP/RHIC2003/BeamEx2003)

# Beam Ex Organization

- Proposals - WEB based form
- Prioritization (**Accelerator Experiments Approval Committee**)  
(met 2 times, prior to d-Au and to pp run)
- Up to **12 h of beam time/week** during physics running (not during set-up and ramp-up)
- WEB tools: Beam Experiments web-page, Beam Experiments **electronic logbook**

for Run 2004 **BeamEx logbook** integrated with operation logbook - but with advanced indexing capability for easy search into beam ex sessions (entry tags) - tested during dry-run

# Beam Experiments time 2003

period	Planned (h)	Scheduled (h)	Beam available (h)
first 5 weeks	60	36	24
d-Au run (10 weeks)	120	100	65
pp run	36	26	20
total 2003	156	126	85

Scheduled/planned

~80 %

Beam/planned

~55 %

Beam/scheduled

~66%

Useful figures  
for 2004 planning

Regular scheduling meeting on Monday very good

Time meeting, Mach-Ex meeting, Beam Ex meeting integration also worked (spin-off from Retreat 2002)

# Summer shutdown activities

## Analysis of 2003 data

- ✓ Use the AEAC worksheet on the WEB to collect **results from studies** - link to written documents or published papers mostly PAC2003 papers, write CAD notes for missing!

Existence of **written analysis** will be a factor in experiment evaluation and scheduling next run

## RHIC Model (Offline)

AC dipole, IR correction, physical apertures, dynamic aperture, diagnostics, beam-beam etc. etc.

SXF, SXF Filters, interface to MADX, interface to RE/online

Use **Beam Ex Meeting (Fri 11am)** as a working group on **Data Analysis and Modeling**

mid June → end August: Nikolay Malitsky organized the modeling meeting, effort now continuing as a by-weekly "Modeling Meeting"

# Results 2003 - table

???  
→AP Note

Exp. No.	Key words	Spokesperson	Class	Priority	Rec.time [hour]	Requested time [hour]	Status	Record
03-1	Optics test with $b^*=0.5$ m (pp at 100 GeV)	Pilat		1 A	8	8 (p)	not done	
03-2	Diffusion measurements at injection	Fliller		1 B	2	1-2	done	PAC 2003 RPAG004
03-3	Crystal Channeling at Injection	Fliller		1 B	2x2	1.5-2	done	PAC 2003 TPPB034
03-4	Intrabeam scattering	Fischer		1 B	3x2	3x2	done	???
03-5	Transverse echos	Fischer		1 B	1+2	4 (p)	not done	
03-6	Q' measurement via RF phase modulation and PLL	Bruning, Tepikian		1 B		(2-8 static) + (4-8	not done	
03-7	Electron cloud and pressure rise	Fischer				3+		
03-8	Electron cloud vs. injection pattern	Fischer		1 A	3	3	done	???
03-9	Pressure rise in Atr	Fischer		1 C	0	0 (parasitic to RHI	not done	
03-10	Beam-beam	Fischer						
03-11	Tomographic measurement of alpha_1	Montag		1 A	3x1	3 ramps + (?)	done	PAC2003 RPAG006
03-12	Suppression of synchrotron radiation	Burkhardt, Pilat		2 C	3x2	3x(2-3)	not done	
03-13	RHIC electron cloud and vacuum pressure rise	He		0 A	3x2	3x2	part done	PAC 2003 MOPAD10 (SY)
03-14	Beam Scrubbing	Huang		0 A	8	during commissioning	not done	
03-15	Triplet roll and gradient from Action- Phase	Cardona		1 A/B	1+2	1 per triplet	part done	PAC 2003 RPAG003
03-16	Beam polarization profile measurement	Huang		1 A	2	2	part done	???
03-17	Sextupole calibration with Action-Phase	Cardona		1 B	1	1	done	PAC 2003 MOPAD10 (SY)
03-18	Nonlinear Chromaticity	Tepikian, Ptitsyn		1 A	2	2	done	???
03-19	Tune and coupling drift at injection	Fischer					done	
03-20	AC dipole - coupling	Bai		1 A	3+2	32	part done	PAC 2003 WPAB073
03-21	AC dipole - optics	Bai		1 A	3+2	12-16	done	PAC 2003 WPAB072
03-22	Incoherent tune spread of EC	Zhang		1		5	not done	
03-23	Nonlinear resonances	Ptitsyn		1 B	3x3	2x(3 inj. + 3 top)	part done	???
03-24	Beam halo scraping and beam loss	Ptitsyn		1 A	3	3	part done	
03-25	Stochastic cooling feasibility study	Blaskiewicz, Brennan		1 A	2x4	2x(4) + 2x(8) +	done	PAC 2003 WOAB005
03-26	Instabilities in RHIC	Blaskiewicz		1 A	0	0 (parasitic)	done	PAC 2003 RPPB007
03-27	Dynamic aperture at flattop	Pilat		1 B	4	4 for every optics	done	???
03-28	Solenoid effect on electron cloud	Zhang		0 A	1+2+2	5	done	???
03-29	Head-tail Q' measurement	Cameron, Jones		1 A	2+2	2-6	part done	
03-30	Beam-beam emittance growth vs. transverse offset	Fischer		1 A	2x1	2x1 + 1	not done	
03-31	Beam-beam, long bunches & large X-ing angle	Fischer		1 A	2x1	2x1 + 1	part done	???
03-32	Beam-beam: coherent modes	Fischer		1 B	4+2	6 (p)	done	PAC 2003 TOAA011
03-33	Beam-beam resonance driving terms	Fischer		1 B	3	3	not done	
03-34	Lifetime and background vs. working point	Fischer		1 A	3	3	done	???
03-35	Crystal channeling at flattop	Fliller		1 B	2	1	done	PAC 2003 TPPB034
03-36	Diffusion at flattop	Fliller		1 B	2	2	done	PAC 2003 RPAG004
03-37	Optics and transport for pp2pp	Satogata, Guryin		1 B	2	during commissioning	part done	
03-38	Optics test with $b^*=20$ m (pp at 100 GeV)	Tepikian, Guryin		N/A		8	not done	
03-39	Loss distribution from primary collimators	Drees		0 A	4	4	done	???
03-40	IR correction	Pilat		1 A	4	4	done	PAC 2003 TPPB041
03-41	Skew quadrupole modulation - coupling	Pilat		1 B	2	2	part done	???

# RHIC Offline Model - then and now

RHIC design years: MAD8 + Fortran Teapot

Fortran Teapot → UAL      MAD8 → MADX

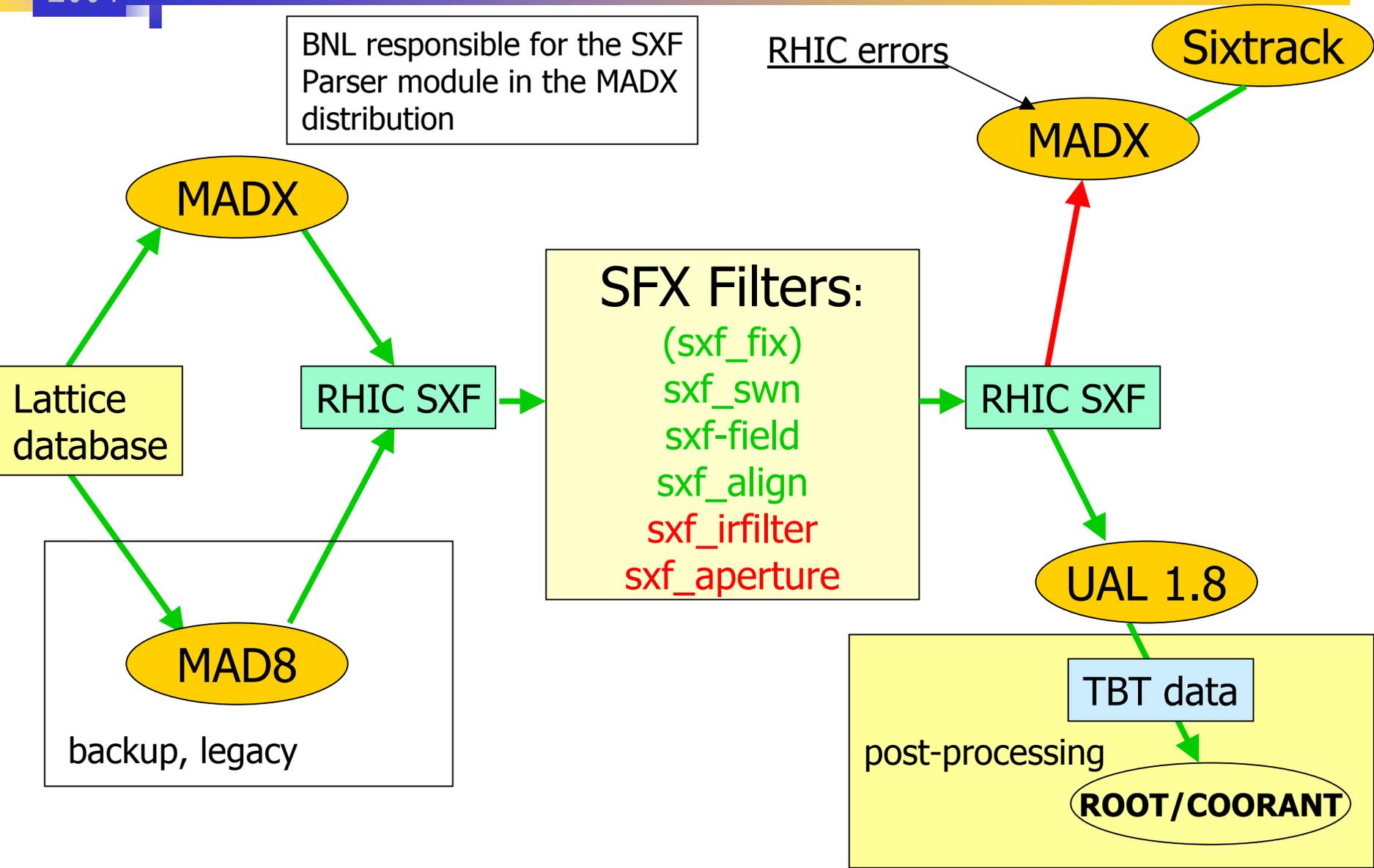
UAL much wider capability than Fortran Teapot but  
RHIC offline modeling software had to reconvert over  
the years (when focus was on operations)

- Emphasis on modeling now for operation analysis, beam experiments, etc.
- MAD8 → MADX, space charge, ... → integration of RHIC and AGS, Booster offline model
- Working group and regular meetings (Malitsky, Fliller, Ptitsyn, Luccio, Pilat, etc.)

# RHIC Offline Model - now

BNL responsible for the SXF Parser module in the MADX distribution

RHIC errors



# RHIC Offline Model - issues

## Short term (< Run 2004)

- MADX→SXF→UAL
- UAL→SXF→MADX
- SXF aperture filter
- SXF IR filter
- Post-processing
- SXF from online model

OK  
fixed Nov 14 (NM)  
finish development  
debugging now  
add some capabilities

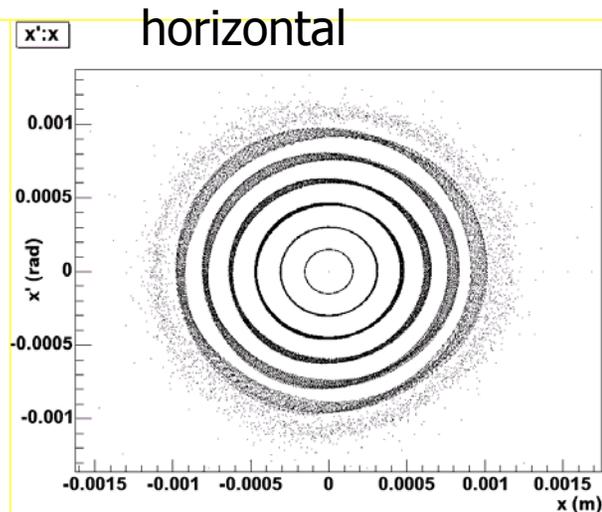
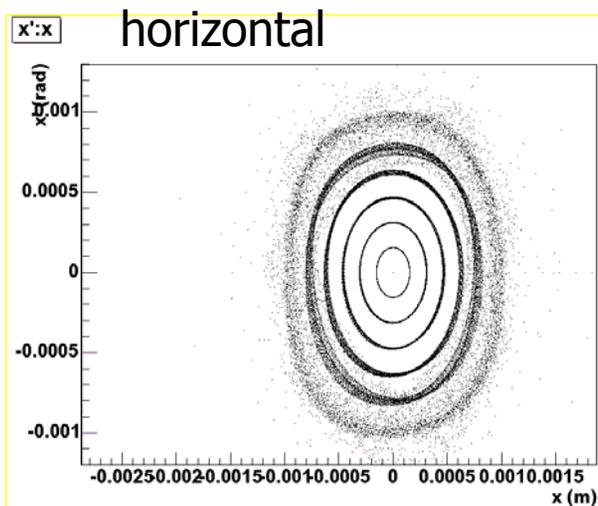
## Longer term (> Run 2004)

- SXF arc field error filter
- Beam-beam in UAL
- Spin tracking in UAL

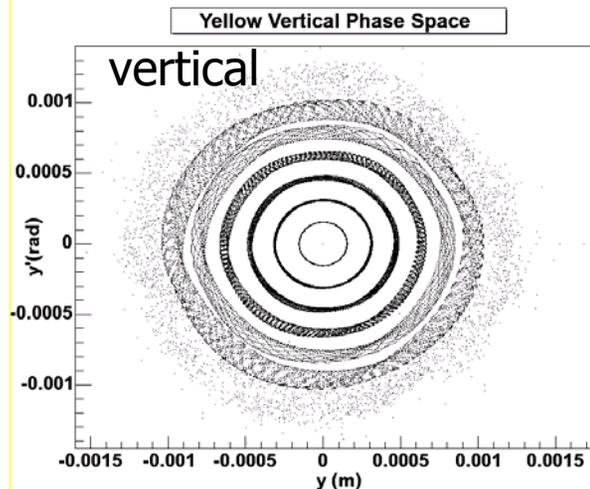
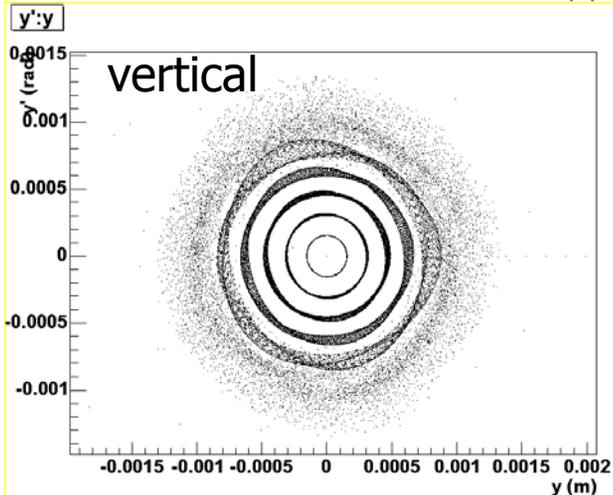
# Post-processing - phase space

Post-processing package ROOT/CORAANT Ray Filler

Blue  
2004  
lattice

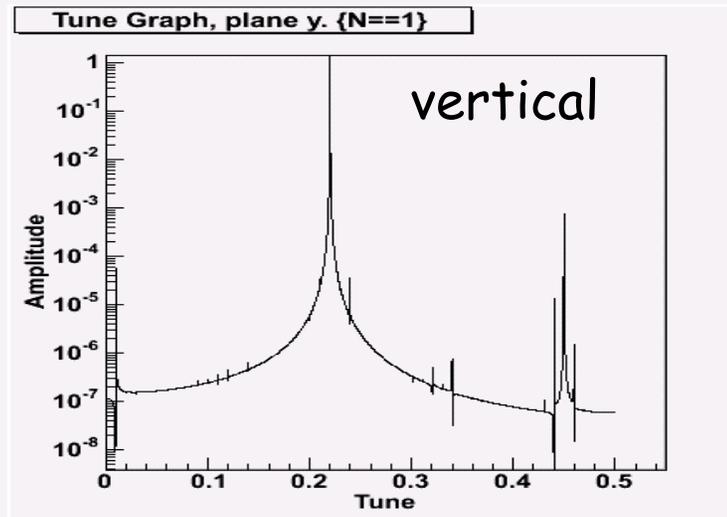
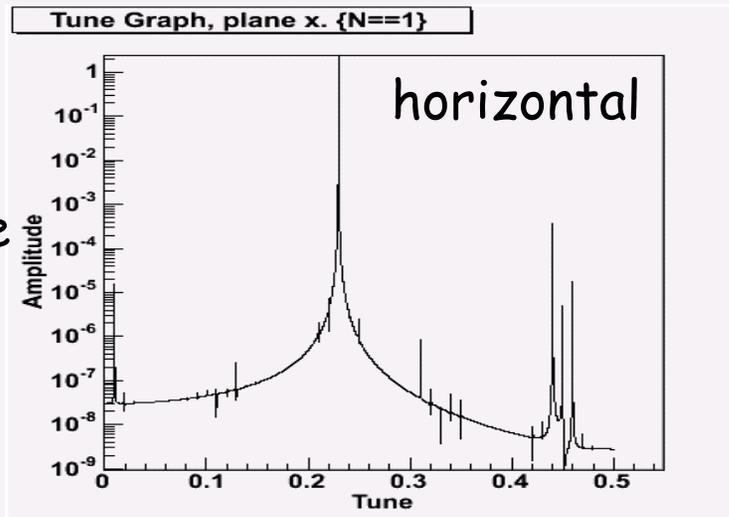


Yellow  
2004  
lattice

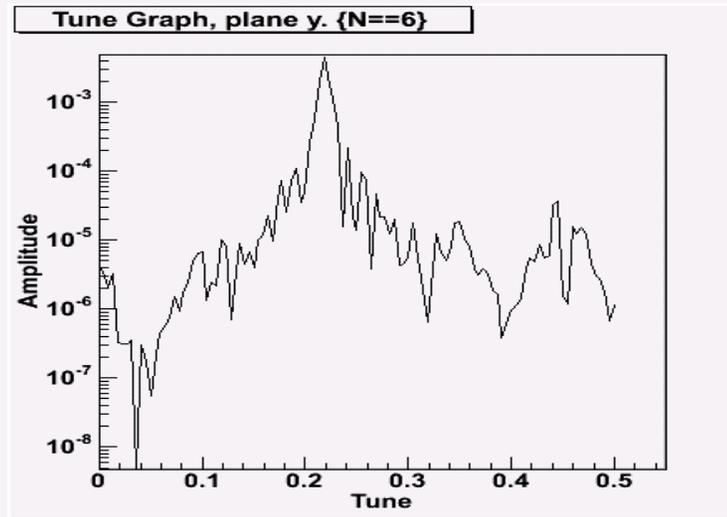
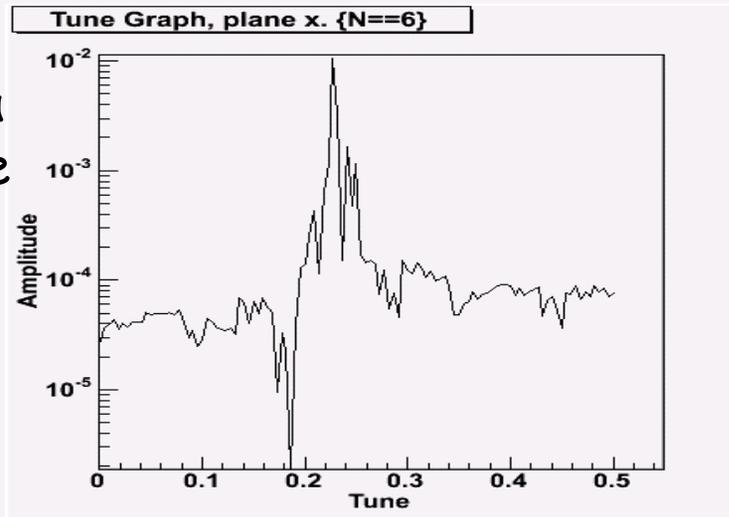


## Blue 2004 lattice

1 sigma  
particle



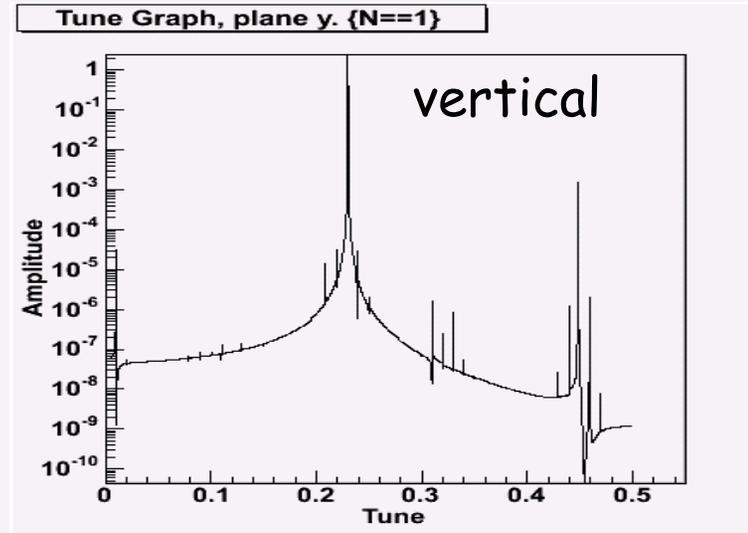
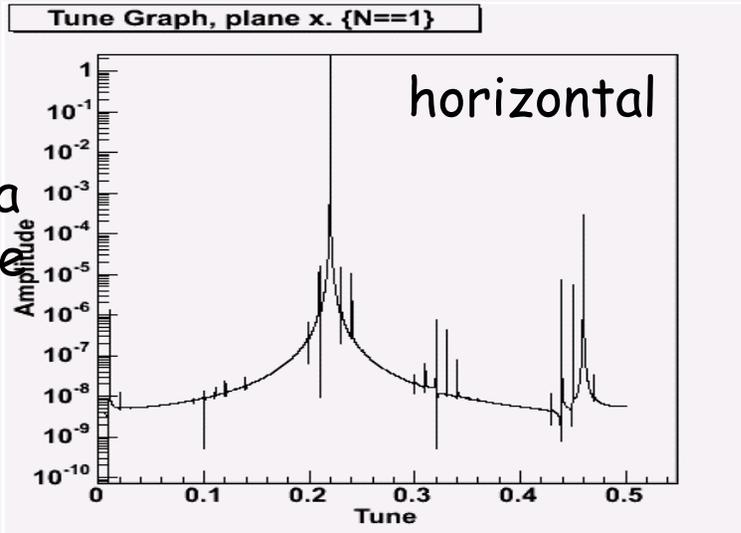
6 sigma  
particle



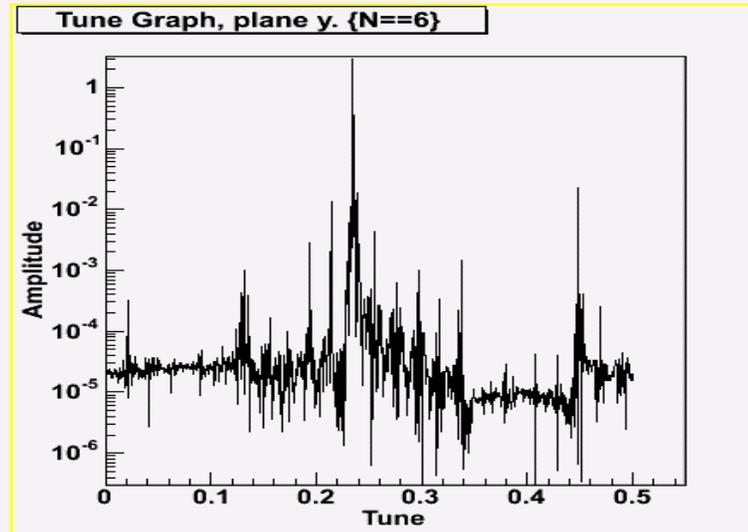
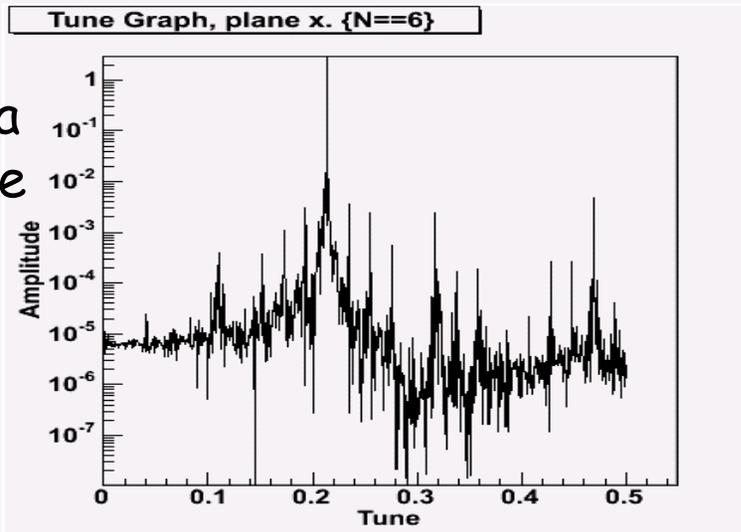
# Post-processing tune FFT's

Yellow 2004 lattice

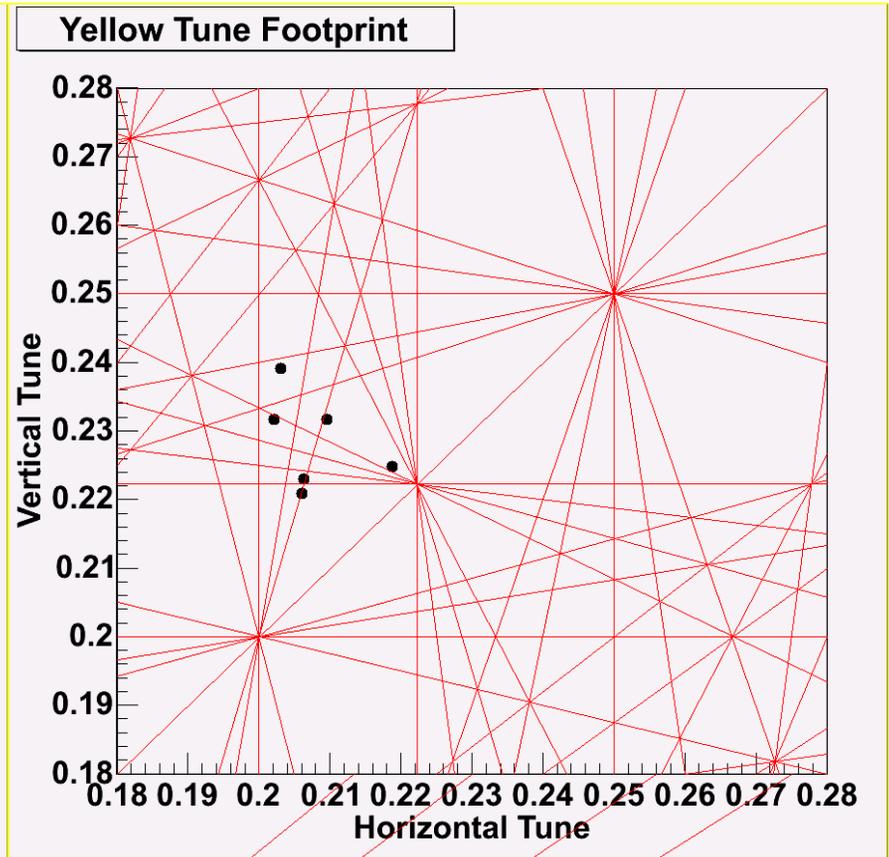
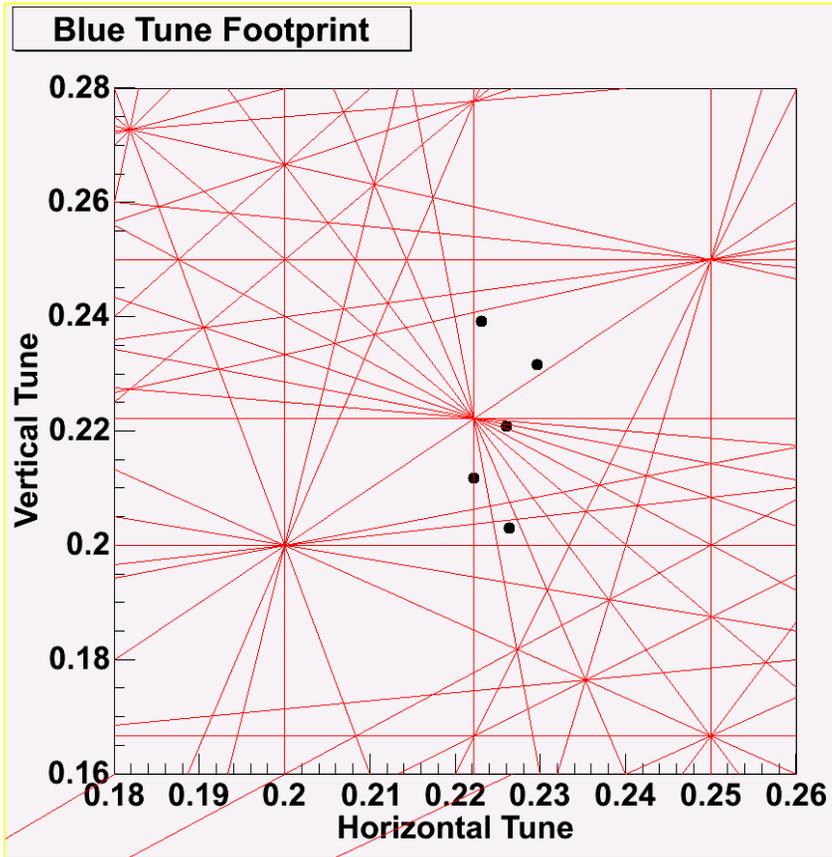
6 sigma  
particle



6 sigma  
particle



# Post-processing - tune footprints



# Beam Ex 2004: Organization

AC dipole studies

Beam-beam

Chromaticity

Collimation, backgrounds

Nonlinear studies

Instabilities

Pressure rise, e-cloud

Remote Operations

Stochastic cooling

Transition

M. Bai

R. Tomas

S. Tepikian

A. Drees

V. Ptitsyn

M. Blaskiewicz

S.Y.Zhang

F.Pilat/T.Satogata

M. Blaskiewicz

C. Montag

# Beam Ex 2004 - cont'

- **AEAC** meeting in ~mid december (+ possibly follow-up in ~march). **Missing written results to be submitted prior to that.**
- **Program** & coordinators similar to last year (with appropriate additions and inclusion of new arrivals)
- **More discussion/integration** with RHIC physics experiments
- **Continuation external collaborations**
- **Limited start of Remote Operation Experiments**  
parasitic" to experiments already in the program  
identify collaborating institutions/individuals  
FNAL, CERN, existing collaborators a good start

# Beam Ex 2004 - Scheduling

Assume here that the weekly scheduling process from Run 2003 is retained:

Scheduling Meeting	Monday
Experiments Meeting (beam experiment time)	Wednesday
Beam Ex Meeting	Friday

Propose to identify a “**leading beam experiment**” in each beam-ex session, that is given more time (~1/2 of the shift) and priority.

- Better **preparation** for the experiment
- **Focusing** of the beam experiment session goals