

Preparation for RHIC PP Run in 2011

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RUN website: <http://www.cadops.bnl.gov/AP/Spin2010>

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RHIC Machine Planning Meeting

Projections for Run11 Polarized Protons

- For 100 GeV: **8.3 – 10 pb⁻¹/week, P = 55 – 65%**
- Beam $\beta^*=0.85\text{m}$. $1.35*10^{11}/\text{bunch}$
- For 250 GeV: **18 – 32 pb⁻¹/week, P = 35 – 50%**
- Beam $\beta^*=0.65\text{m}$. $1.4*10^{11}/\text{bunch}$

The possible gain of polarization is based on the new working point, new vertical survey and BPM offset sign reversal.

Run-11 main upgrades for p⁺-p⁺ performance

- AGS horizontal tune jump system
(up to 5% more polarization if successful)
- 9 MHz rf system (including 2 longitudinal dampers)
(preservation of both longitudinal and transverse emittance, ramp transmission)
- RHIC MMPS flattop-to-ramp and ramp-to-flattop switchover
(transients lead to beam loss and problems with 9 MHz system)
- Ramp feedbacks (orbit, tune, coupling, chromaticity)
- Global 1 Hz orbit feedback (tighter tolerances at IPs and collimators)
- 10 Hz orbit feedback at store (orbit stabilization in triplets, background reduction)
- CNI Polarimetry (new electronics, mitigates rate dependence)
- β^* reduction from 0.70 m to 0.65 m (perhaps lower)
- Blue spin flipper (re-commissioning after modifications)
- Beam dump modification (Q4 quenched with high intensity dumps, pipe inserts)
- New Be beam pipe in PHENIX (smaller ID – 40 mm vs. 74 mm previously)

Lattice Development Status

- The new lattices with working point near $2/3$ have been developed. In addition, the fractional part of the phase advance between IP6 and IP8 for blue ring has been adjusted near a quarter for nonlinear chromaticity compensation. This requires power supply upgrade.
 - Injection and store lattices are developed:
 - Injection: $\beta^* 7.5\text{m}$
 - Store: $\beta^* @\text{IP6\&8}: 0.65\text{m}$, others: 7.5m^1
 - Ramp lattice have been done for both blue and yellow. The blue lattice has been used for dynamic aperture simulation.
 - The injection energy remains the same. As the instability threshold could be lower with 9MHz cavity due to longer bunch, the γ_{tr} is lowered by $1/2$ unit using γ_{tr} quads.
1. It is possible to squeeze β^* at IP2 to 5m.

Schedule and Run Plan

- Dry run: mid of November
- 4 weeks of machine setup
 - Injection setup: 1.5 weeks
 - Trim quad P/S tuning after cool down 2-3 days.
 - Set up injection in each ring (beam + instrumentation)
 - Set up polarimeters
 - Commissioning the 9MHz cavity: 1 week
 - Ramp development: 2 weeks
 - 250 GeV ramp development
 - Store setup
 - Expect overnight stores after 3-3.5weeks

9MHz RF Cavity Commission Plan

(from M. Brennan)

9MHz requires upgrade to main PS + bouncer cavity for both rings + longitudinal damper or Landau cavity for each ring.

Establish ramps with 28 MHz

Set up injection and timing ($h=120$)

- ATR synchro

- Phase detector data for INJECTION_TUNING application

- Beam Sync clock and WCM application

Six-bunch ramps

- Low level for Bouncers and feedback

- Check glitch and its ramp-to-ramp variations

- 28 MHz offset and phasing

- Develop rebucketing

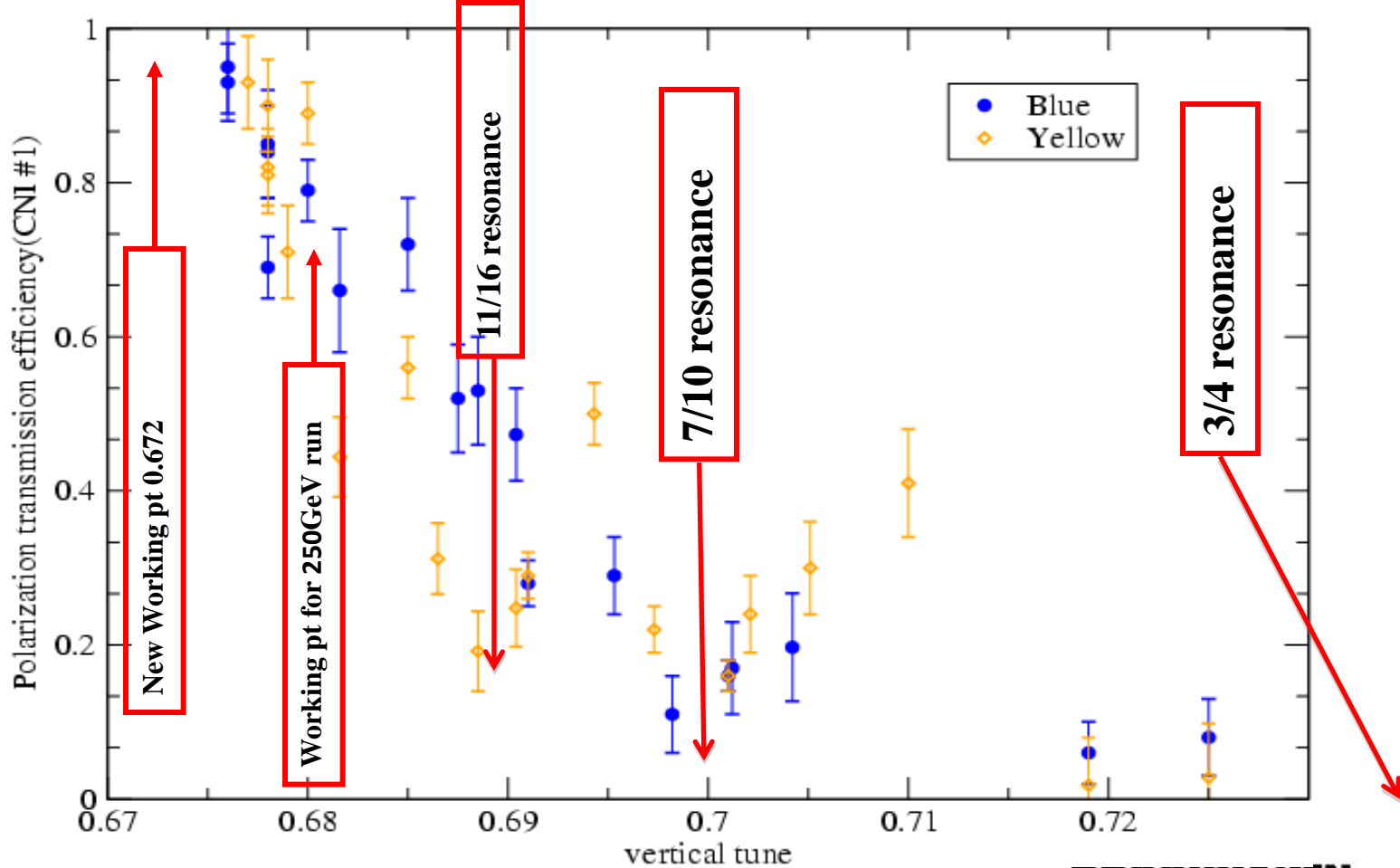
- Step up bunch intensity (feedback at injection)

Step up number of bunches

RHIC Polarization Transmission to 250GeV

These tune scan data have not been simulated yet. Various people are assigned to the job. Mei speculated that D' difference caused spin tune spread as large as 0.01 which in turn caused the wide width. So far no D' knob has been found yet.

From online polarization measurements

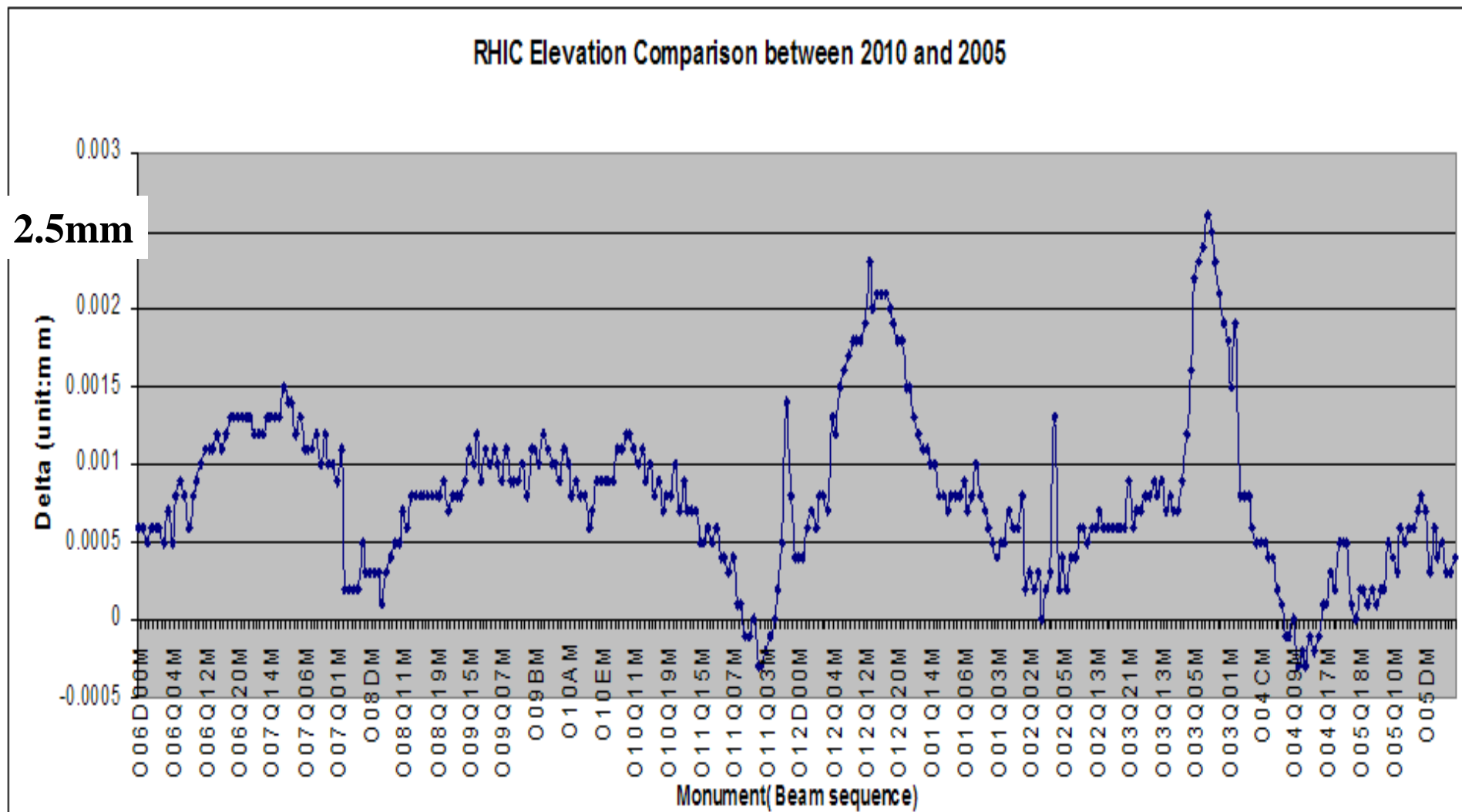


Modelling Efforts

- V. Ranjabar has joined us to carry the simulation going. The goal is to understand the polarization vs. vertical tune (on the ramp) data.
- F. Meot is working on another spin tracking code called ZGOUBI. The code is slow and will be mostly for AGS simulation and RHIC spin flipper.
- C. Montag is searching for D' knob to maintain them the same value at both snakes. But so far no solution yet.
- X. Gu and Y. Luo are working on dynamic aperture simulation. First pass with blue lattice showed no problem for $\beta^*=0.65\text{m}$.

RHIC Vertical Survey Results

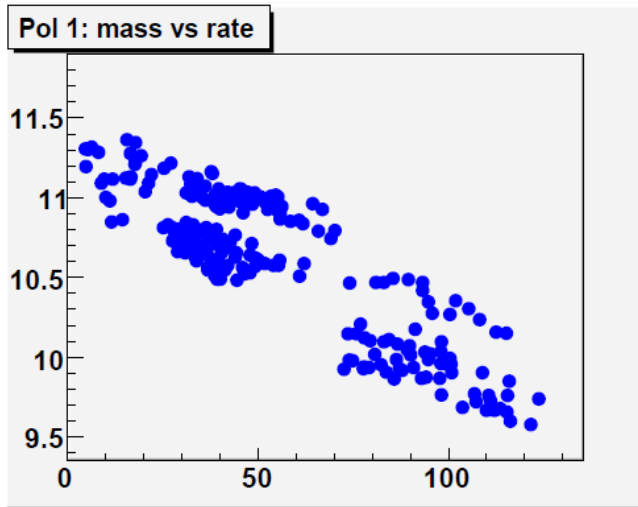
(from Frank Karl)



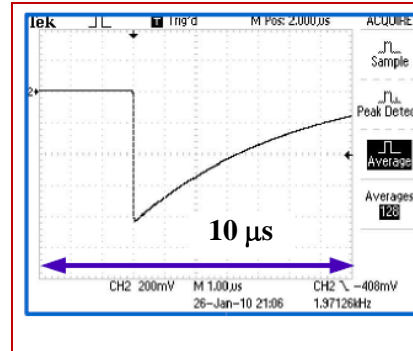
Realignment is going on. The effects on spin dynamics have not been estimated yet.

Rate Problem in Run9 and Solution

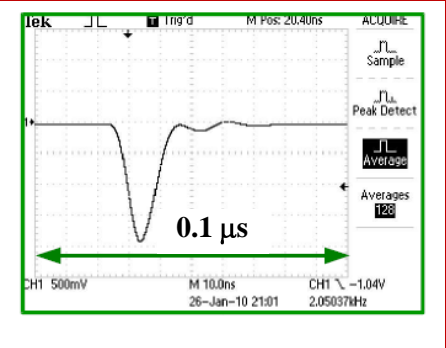
Run9, $\sqrt{s}=500$ GeV:
 $M \propto E \cdot \text{ToF}^2$ vs Rate (kHz/strip)



Old amplifier

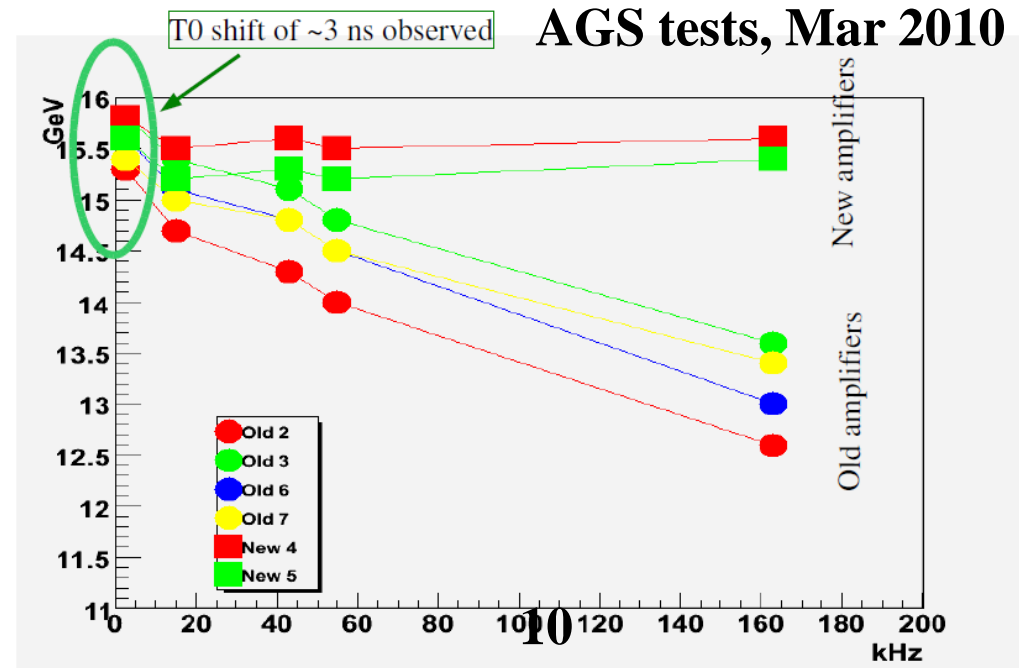


New amplifier



Problems reproduced at
 AGS in Run 2010

No problems with new FEE
 (faster amplifiers)



RHIC Polarimetries

- ✓ **New FEE (current sensitive preamplifiers): to be replaced before Run 11**
- ✓ **Same Si detector except two trip sizes: 2mm and 1mm(test first)**
- ✓ **Half (blue1 and yellow1) inside, half (blue2 and yellow2) outside**
- ✓ **Tools for accelerator physicists: ramp measurement**
- ✓ **New targets (better quality, narrower overall)**

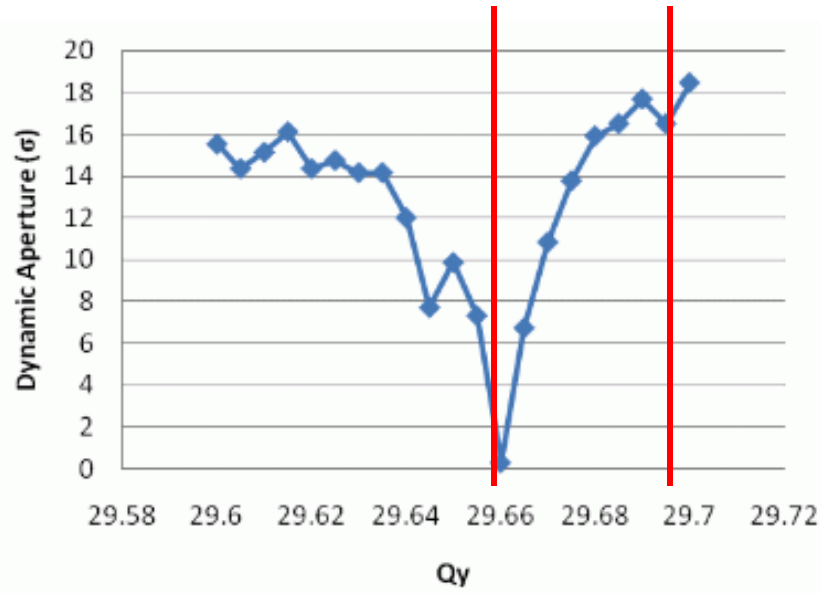
- New targets and new Si detectors installation tentatively slated for early – mid November.
- DAQ upgrade progressing well, minor work left. New cables have been installed already.
- Two experts (Igor and Dima) will arrive in the mid-November and working on the software (including the ramp measurement capability). Two postdocs are added to work on offline analysis. One physicist is onboard to work on the online software.
- A new Si detector will be installed for H jet to replace the damaged one before run9 (increase events by 50%).

RHIC Spin Flipper Status and Plan (From Mei)

- Installed in the tunnel: all 4 DC dipoles, all 5 ceramic pipe as well as ac dipole stands
- working progress:
 1. Re-terminate all 5 ac dipoles' litz wire with chemical stripping. All 5 ac dipoles expect to be ready for installation in 3 weeks
 2. 2 additional cap-banks and two tuning boxes
 3. Boards of ac dipole controllers are about ready to be ordered, waiting for quotes
 4. Ac dipole control software development
 5. Pulling 2 additional DC cables for DC dipoles as soon as the ceramic pipes are protected
- commissioning plan:
 1. Demonstrate single resonance at injection
 2. Demonstrate spin flipping at injection and measure spin flipping efficiency at injection
 3. Repeat step 2 at store.

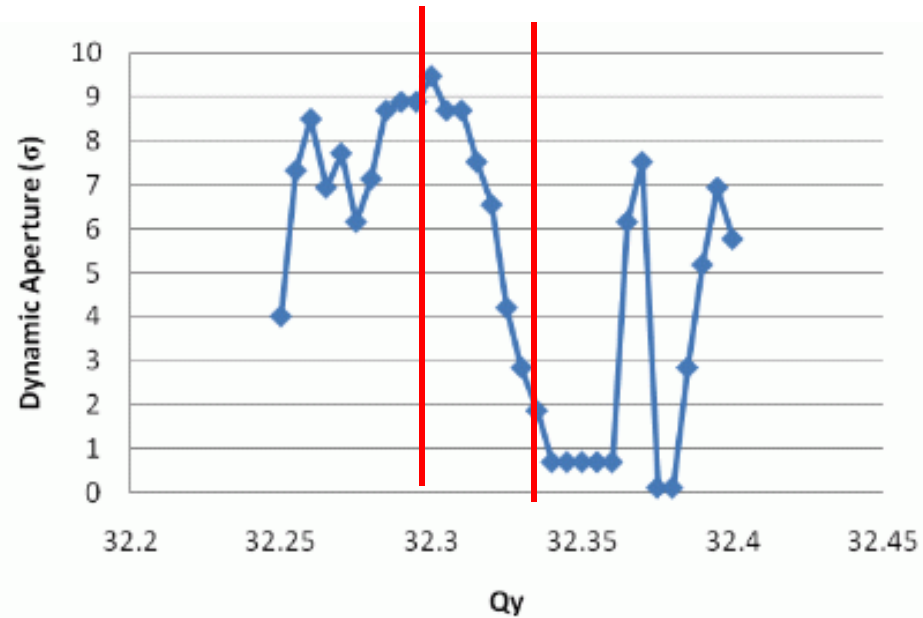
Backup Slides

Dynamic Aperture Simulation on the Ramp



(Courtesy of X. Gu & Y. Luo)

← Proton 250GeV Ramp

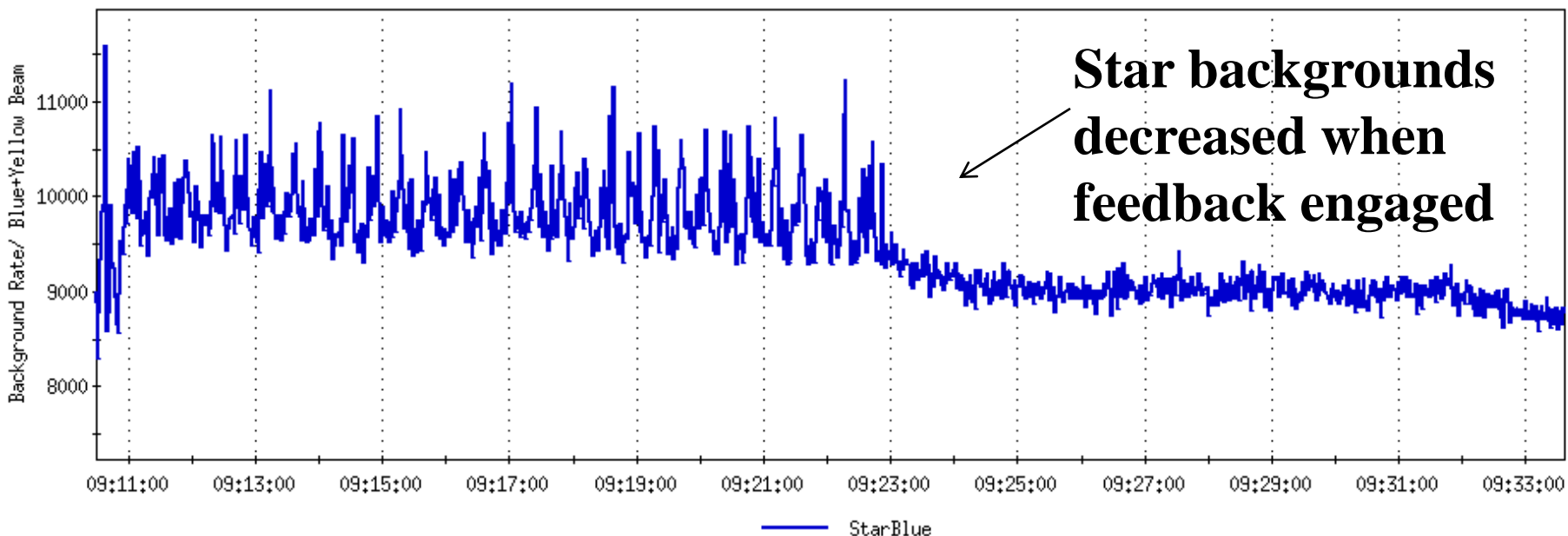


Au 100GeV Ramp →

The situation of pp at 250GeV seems better.

10Hz Orbit Feedback Reduced STAR background

All Experiments Background Monitor



BPM position : bi8-bh1

Microns

