

RHIC MPS Upgrades

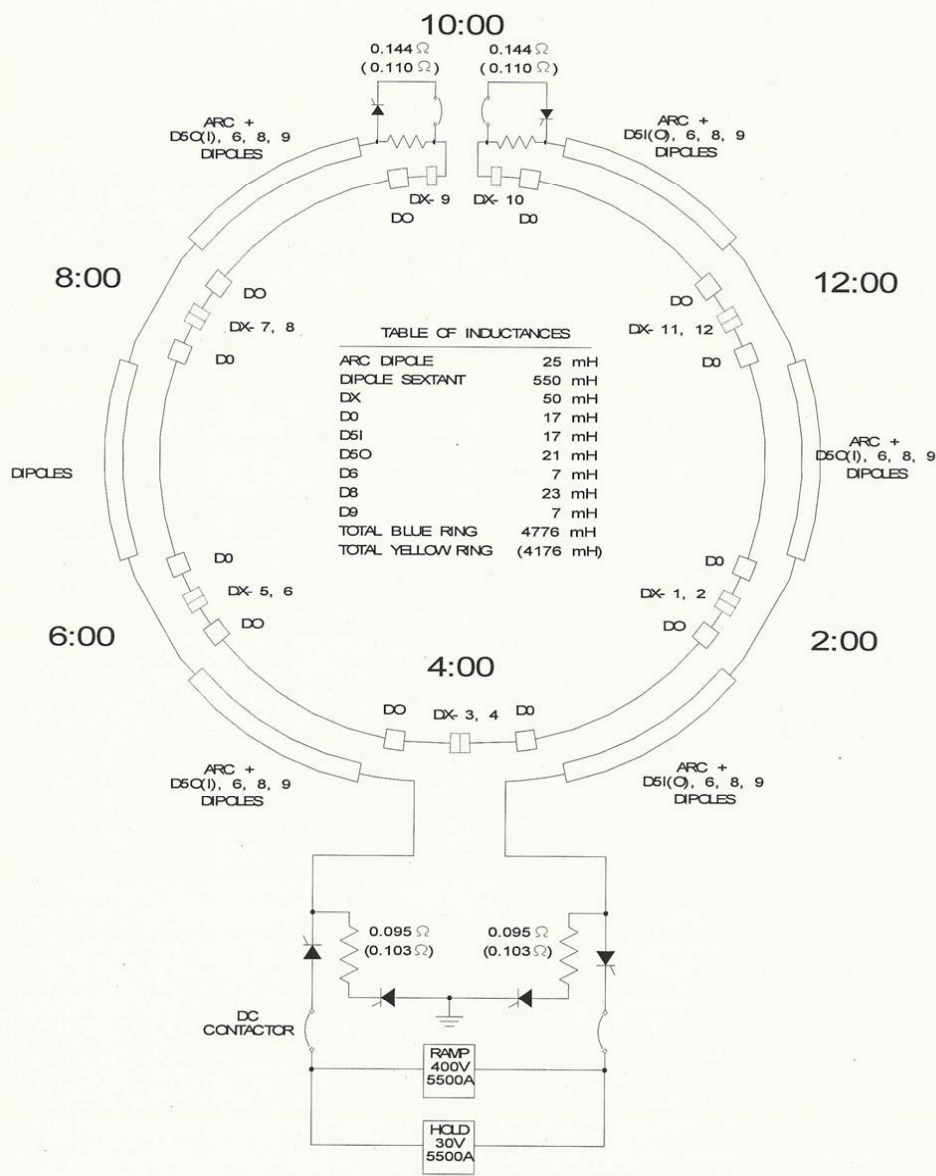
New (or modified) permit inputs based on:

- ✓ BLMs (tightened, needed some adjustments for special modes)
- ✓ Slow corrector power supply system (no changes)
- ➔ Fast corrector power supply system (CPS BPS)
- ✓ RF permit inputs (upgraded, no changes to 2017)
- ✓ Fast BPMs (from 10 Hz feedback system – was not enabled in run 18)
 - ADO modification to allow individual BPM limits in progress
- ✓ Positive experience with all systems (so far, provided they were used)

Status of CPSBPS

- All 198 of the necessary cables are in-house
 - They are currently being tested.
 - Two alcoves have the cables installed.
 - Installation in the remaining alcoves will start soon.
- The Master Board schematic is about 95% complete.
 - will be sent to the design room for PCB design soon
 - All long lead ICs purchased and in-house
- Master Board software completion about 20%
- Control System Software: still needs to be written

Quench Switch layout



Once Quench switch has fired

Bd: 4776 mH $R=0.478$

Yd: 4176 mH $R=0.426$

$t_b = 9.99$

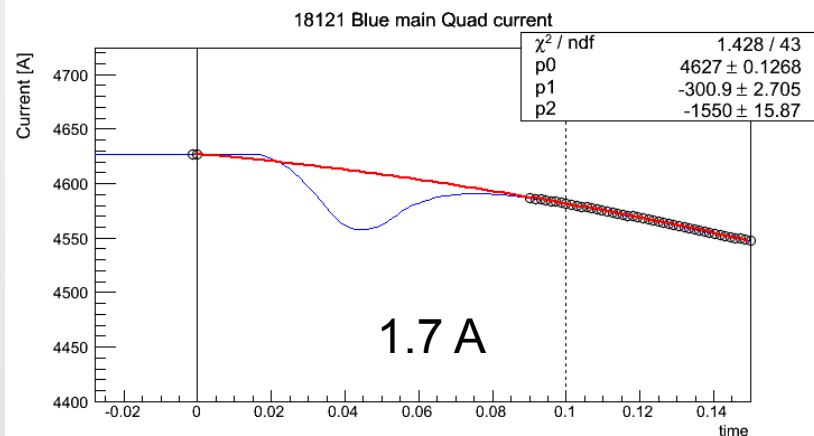
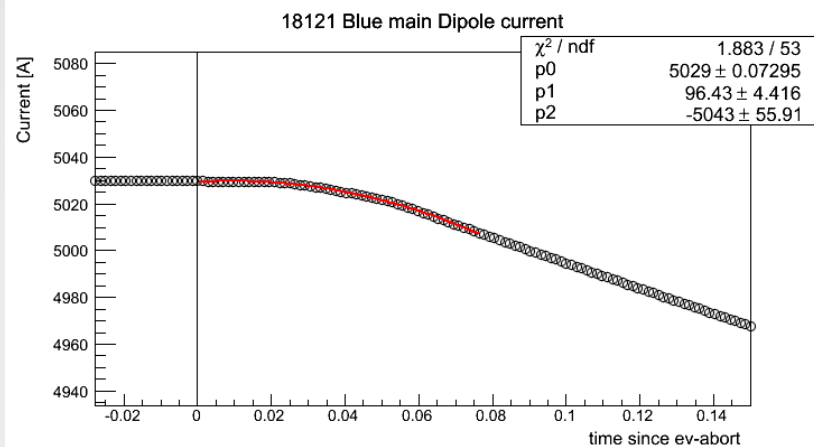
$t_y = 9.8$

Current will drop 0.1% in 10msec

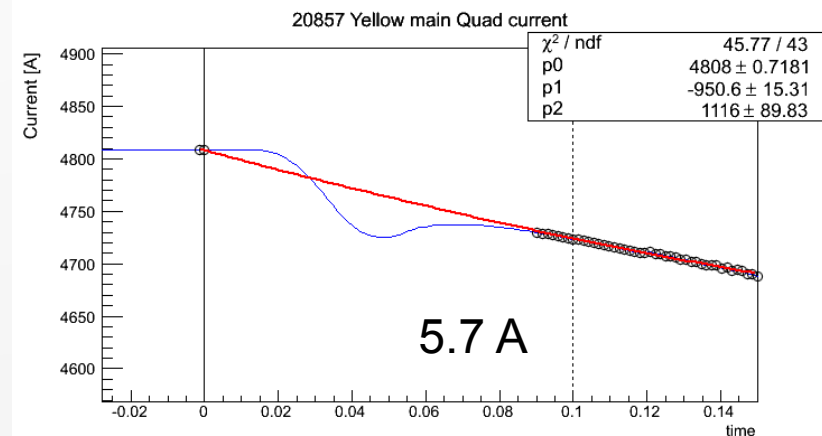
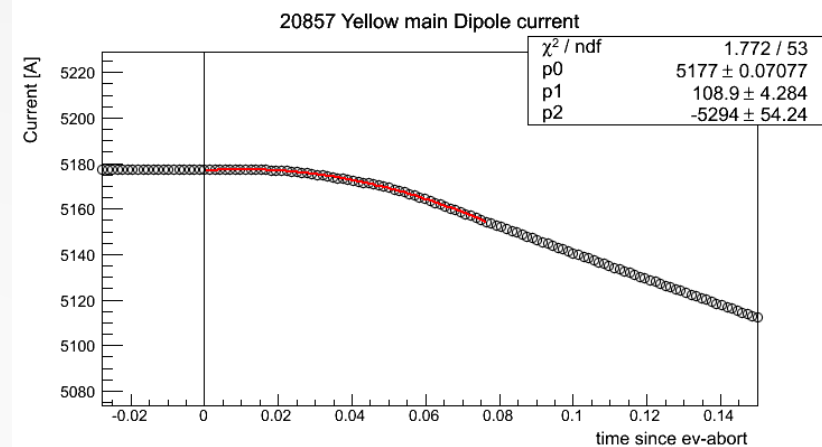
If we start at 5100 amps
That is 5.1 amps

Main Current after ev-Quench

2014



2017



- No obvious signs of quench switch actions in the measured dipole/quad currents
- Does not reflect actual ring current during the first 80 ms?
- => need measurement with beam (1 bunch only)

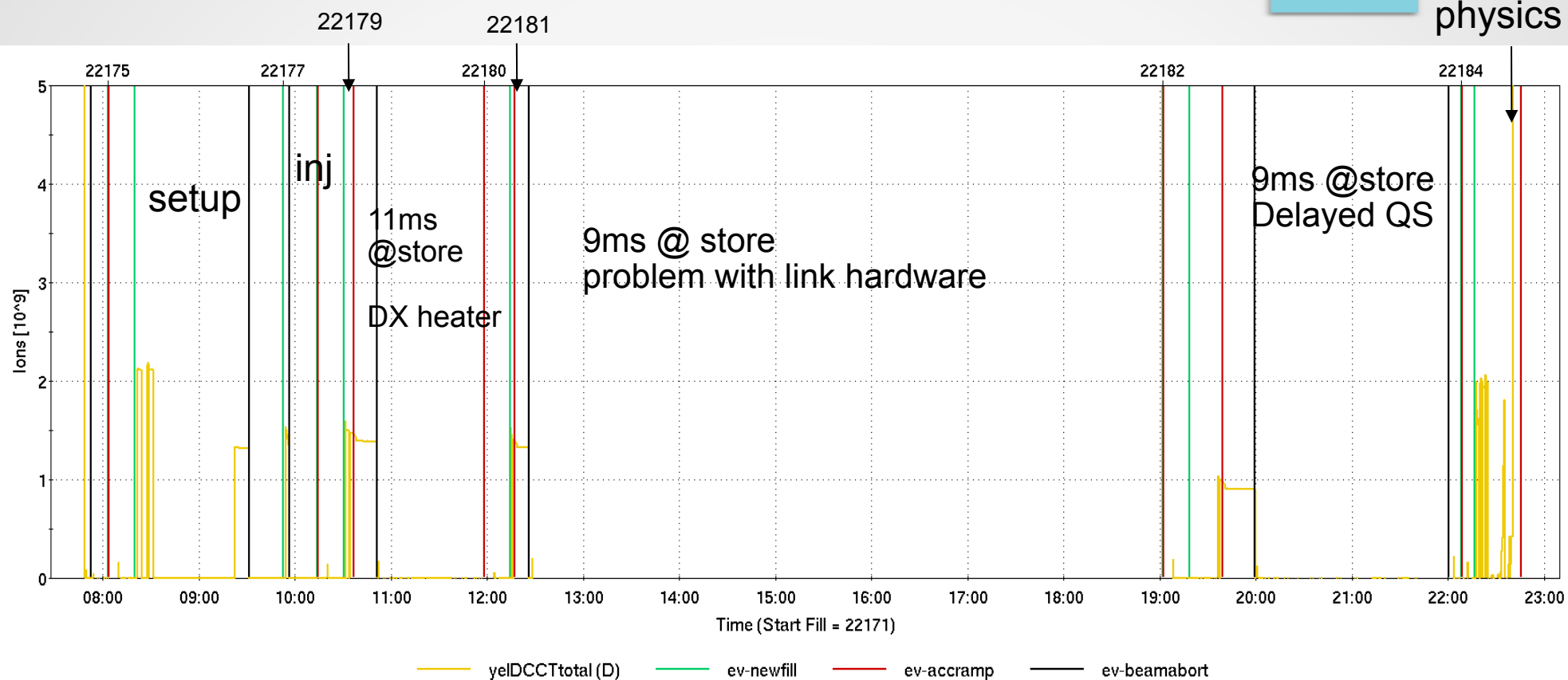
Delayed abort system testing with beam 06/14/2018

The Team

Don Bruno, Angelika Drees, Ken Hartmann, Greg Heppner, Rob Michnoff, Kevin Mernick, Chaofeng Mi, Jian-Lin Mi, John Morris, Fred Orsatti, Eric Rydout, Theo Samms, Jon Sandberg, Vincent Schoefer, Carl Schultheiss, **Travis Shrey**, Charlie Theissen, **Matthieu Valette**

Thanks to Al Marusic for setting up the ramp!

Experiment 06/15/2018: overview



22175: hysteresis
22176: setup
22177: test at injection
22178: hysteresis
22179: 11ms @ store, DX heaters fired

22180: hysteresis
22181: 9ms @ store, problems with link & ATR
22182: hysteresis
22183: 9ms @store & delayed QS
22184: hysteresis

Details of events

Setup:

- abort kickers in delayed mode
- setup for 100 GeV ramp with one bunch Au, no feedback

22177 at injection:

- pulling the quench link by sending OFF signal to bi1-qd2, yellow abort event not generated (off since Jan 3 2006)
- setup of Artus to measure tune at injection
- yellow abort event turned back on
- successful test at injection, 6 tune measurement per plane, orbit shifts by 0.5 mm

22179, 11ms at store:

- kicker delay set to 11 ms (from 9 ms) to compensate for 2ms extra delay
- setup of Artus to measure tune at store (same settings for all the other experiments)
- successful test at store, orbit swing of +/- 10 mm
- DX heaters firing, could be induced by the one bunch being lost (high losses >600rad/h observed) or crosstalk

22181, 9ms at store:

- reproducibility experiment
- link drop triggered by physical button in 1004B
- successful test at store, orbit data is identical to previous test
- problem with link recovery

Details of events (contd.)

Downtime:

- quench recovery failed
- error on the modbus for quench protection switches, node card 11 needed repair
- various trips of AtR transfer line power supplies requiring repair (3-4 hours)
- hysteresis ramp, QS delayed

22183, 9ms at store & delayed QS:

- successful test at store, no measurable effect on the tune and orbit until 9 ms
- alarm on the abort kicker voltage ignored (beam didn't go to the dump but to the collimators instead, it is identified that the abort kickers were in local mode and not tracking the ramp)

Recovery:

- abort kickers reset to normal mode
- turning yellow beam abort event back off
- Artus back to normal mode
- Access from ~21 to ~22
- hysteresis ramp, the abort kickers behave normally

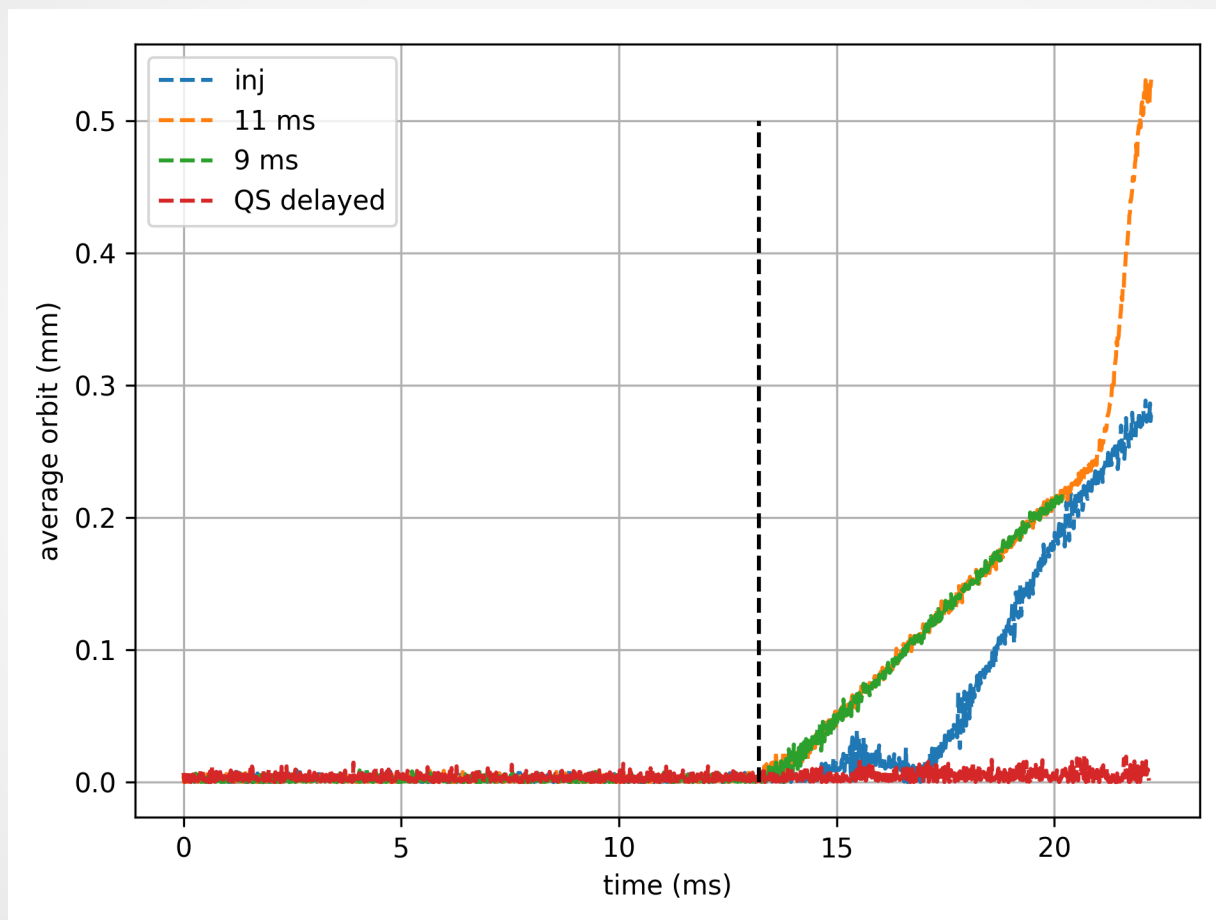
Node card test:

Monday 07:55, setting up bumps

Monday 07:57, successful node card test with recorded data, again no abort triggered

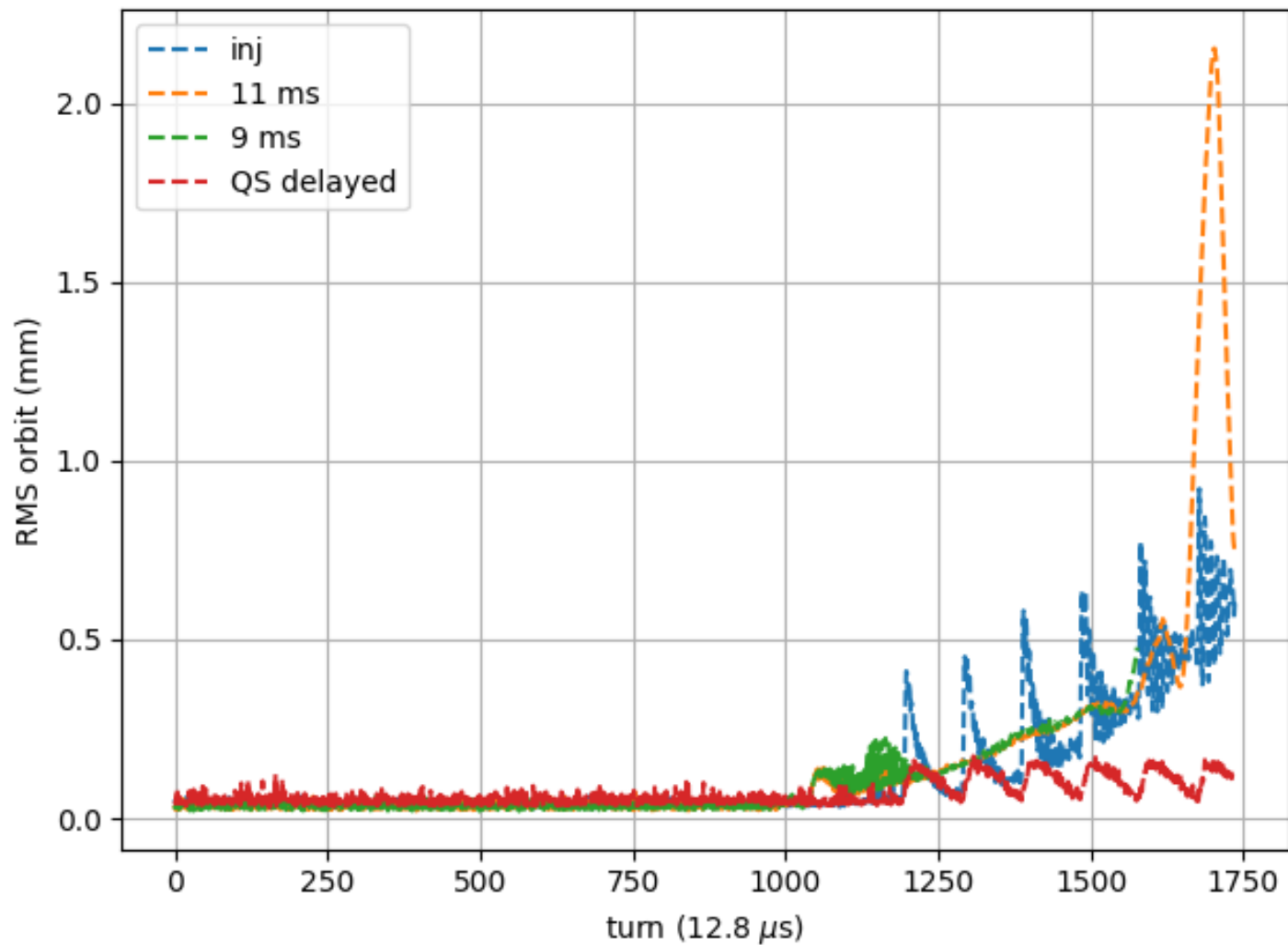
Monday 08:00 shutdown of RHIC

Preliminary results: orbits



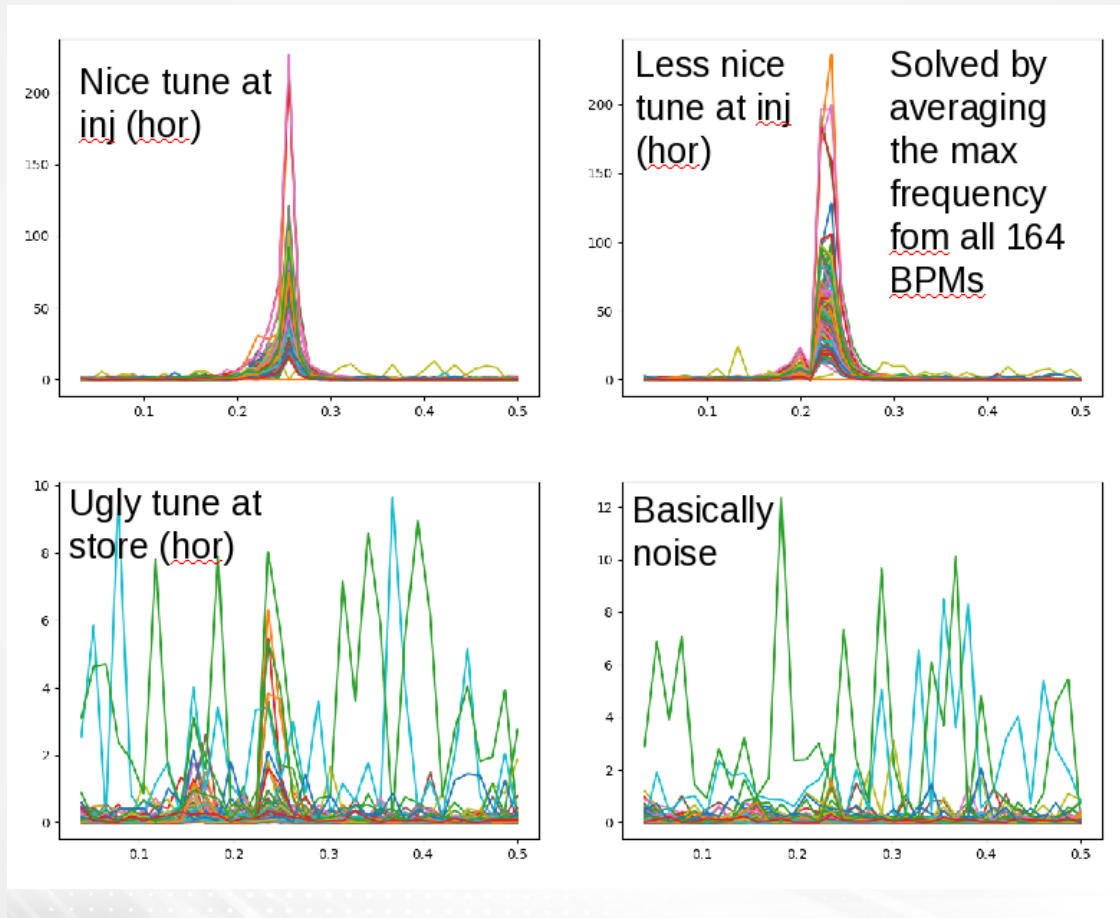
No avg orbit changes with QS delayed

RMS orbit (prelim.)



Spikes are tune measurements

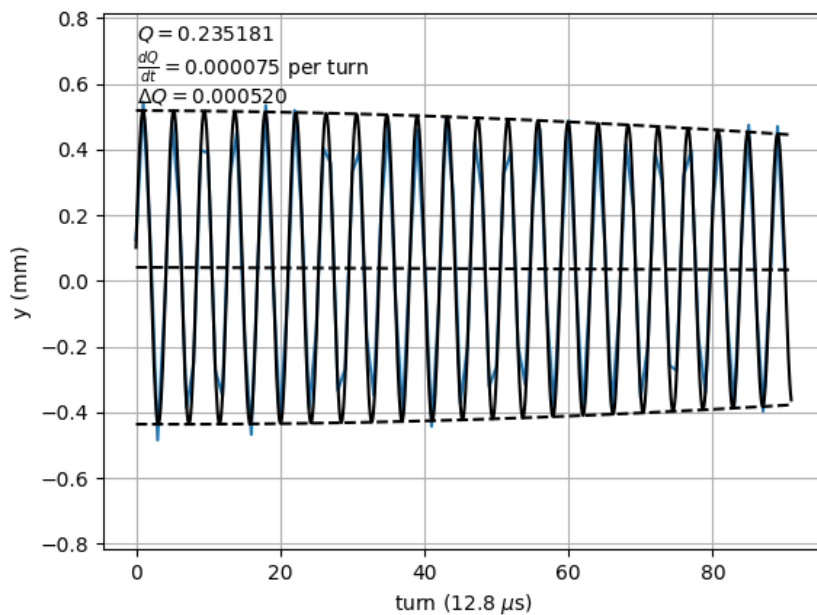
Tune measurements (FFT)



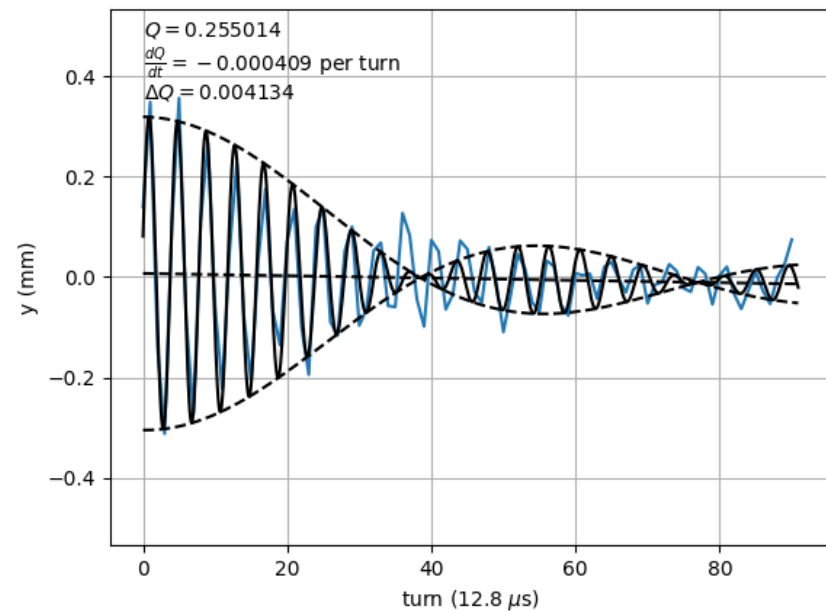
Spectra at store very noisy (to say the least)

Tune measurements by fitting turn-by-turn data

injection

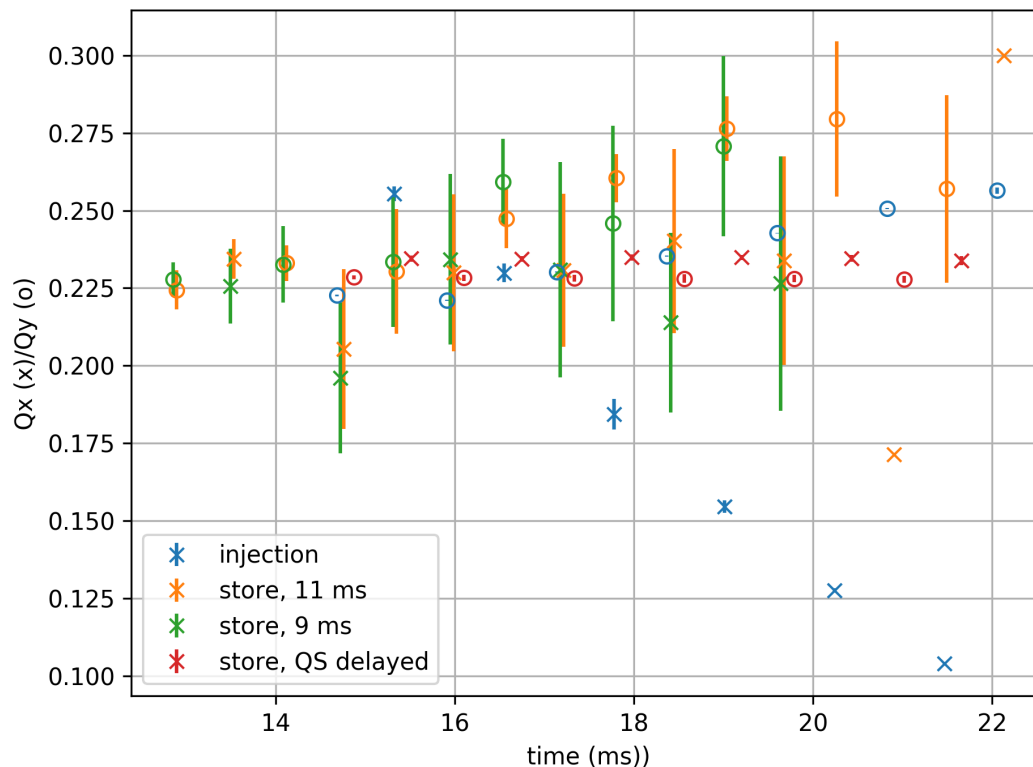


store



Fit function: $C + Bt + A\cos(2\pi t(Q + \frac{dQ}{dt} t/2) + \Phi) \text{sinc}(2\pi t\Delta Q)$

Tunes (prelim.)



Tune measurements
based on FFT too noisy
-> use fitted results

Still large error bars

QS delayed data set is
'clean' and accurate,
results reliable, small
errors

No significant drifts
observed if QS is
delayed

What's next?

- ◆ permit inputs (run 19)
 - ◆ As in run-17 (with or without standard abort triggering)
 - add CPS BPS
- ◆ Keep working on action items:
 - ◆ Quench database (P.Ingrassia, M. Valette, A. Drees)
 - ◆ Cold diode measurements (J. Escallier, T. DiLieto, O.Biletskyi, D. Bruno, A.Drees)
 - ◆ Finish data analysis and report(s)
- ◆ Abort relays:
 - ◆ Both rings are fully equipped (with redundant systems, down to 7 ms)
 - ◆ Delayed aborts with quenching machine look fully acceptable with QS delay
 - ◆ use during physics operations for some time (last 3 weeks?)
 - ◆ More tests?