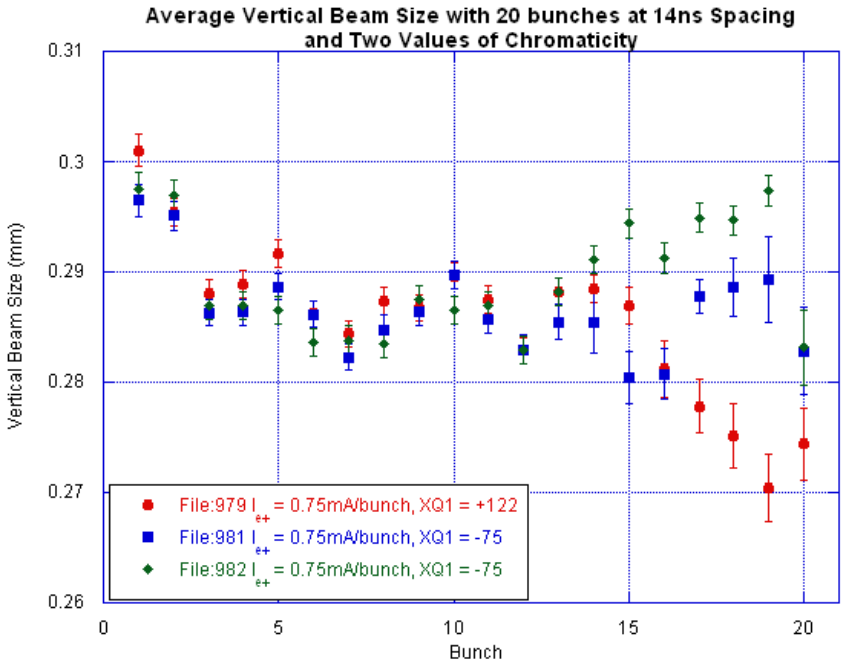
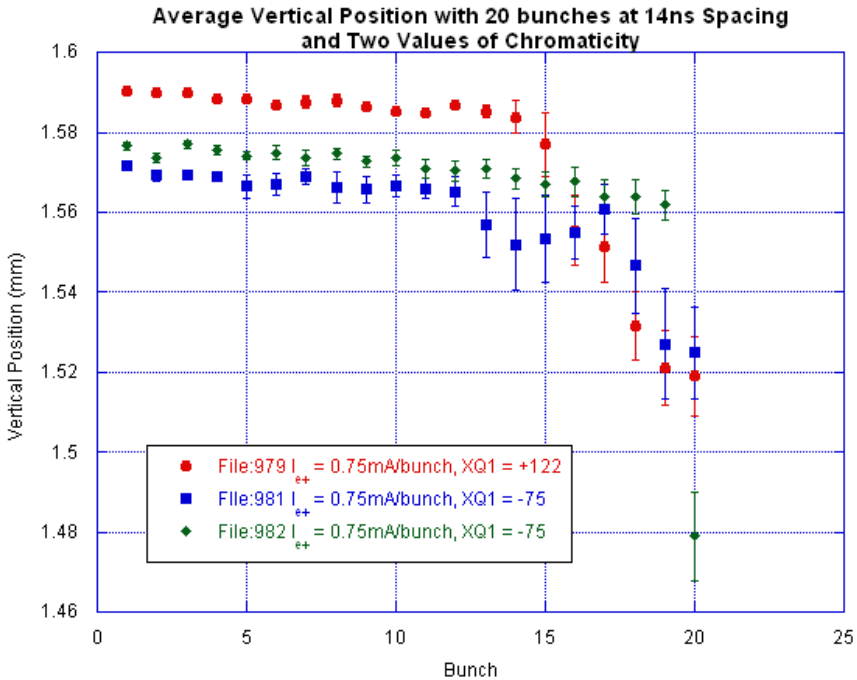
e+/e- Single Beam Vertical Beam Dynamics 1/30/07

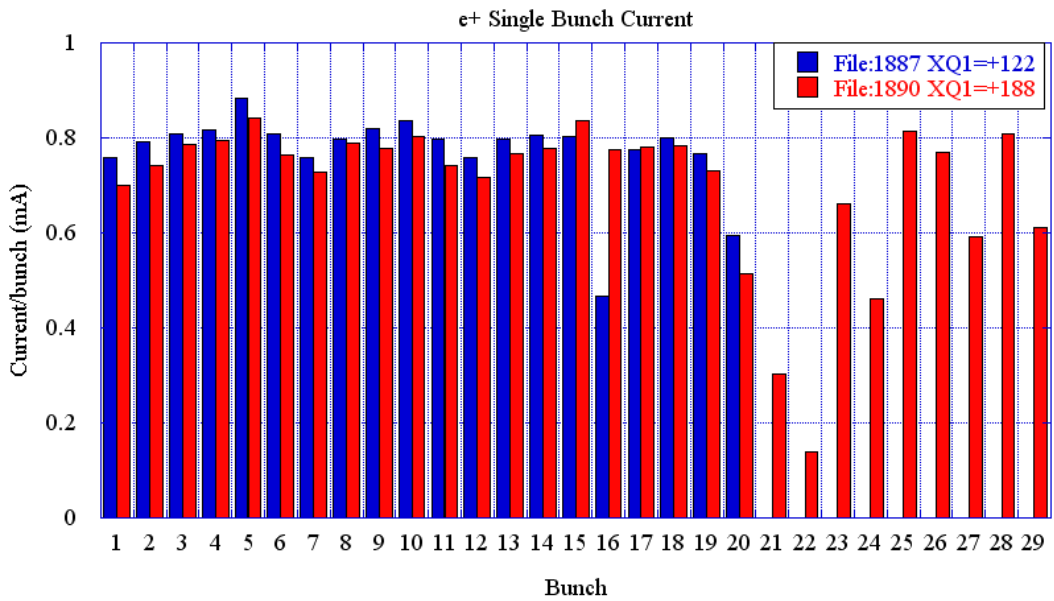
G. Codner, R. Holtzapple, J. Kern, M. Palmer, E. Tanke

20 Bunches at 14ns Spacing

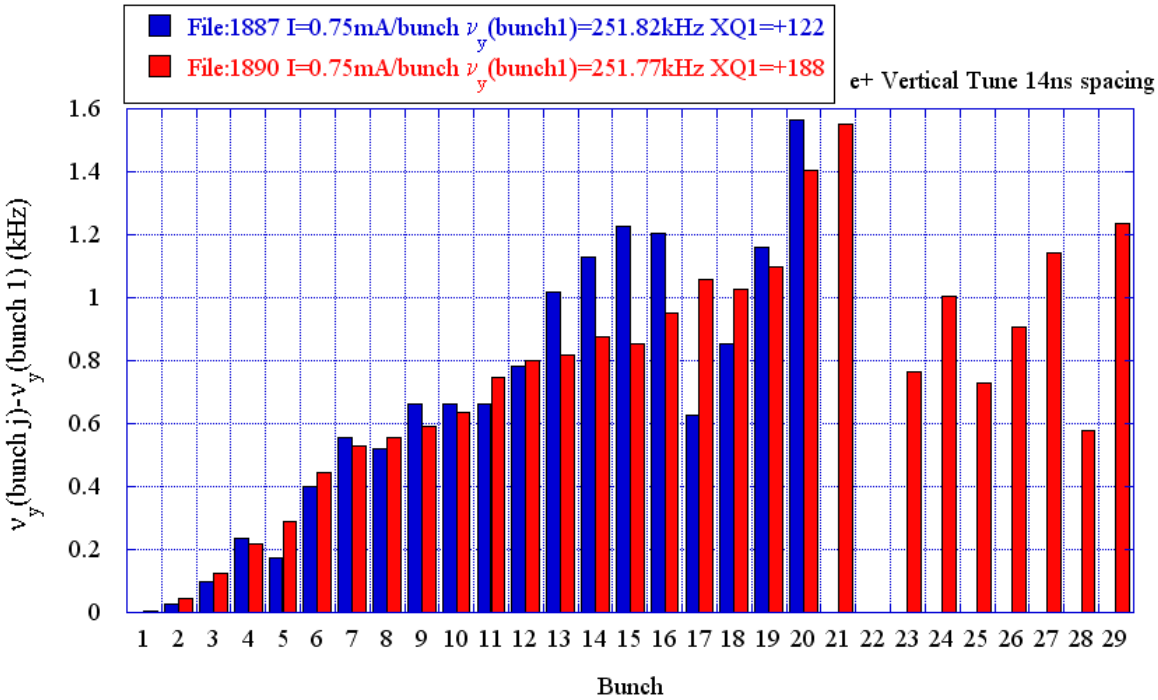


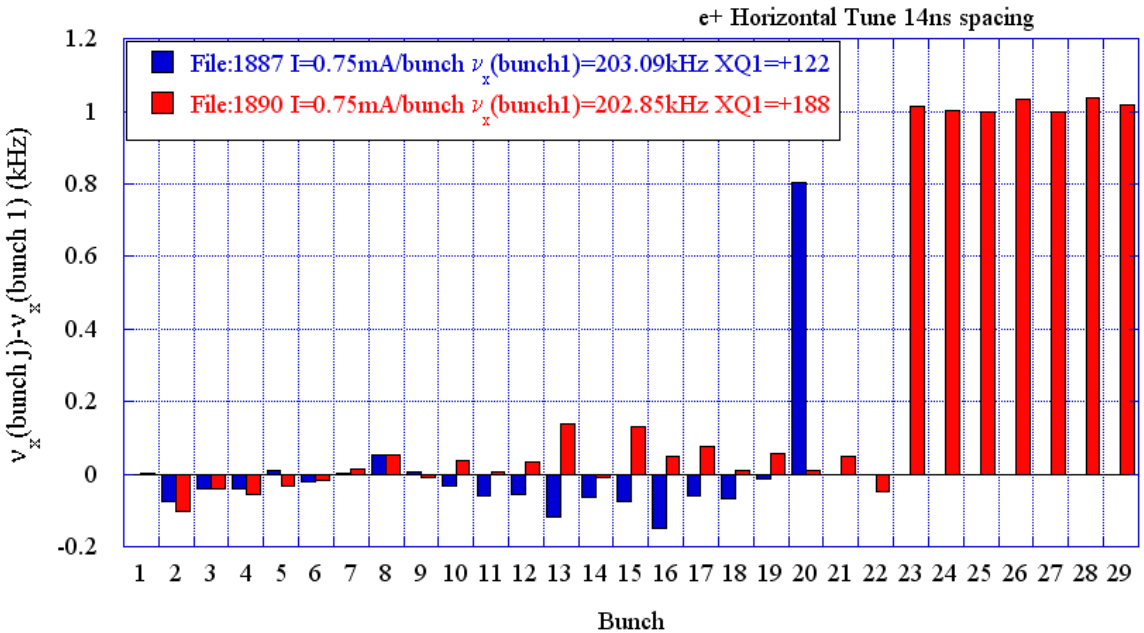
- All measurements taken at I_{e+} = 0.75mA/bunch.
- Beam size falls off after bunch 14 for the higher chromaticity measurement (979).
- Vertical position tends to decrease after bunch 14 for each measurement.
- Tune/current file 1887 corresponds to these measurements. The current/bunch does not exhibit an overall trend. Bunches 16 and 20 have considerably less current than the other bunches.





20 Bunches at 14ns Spacing – File 1887

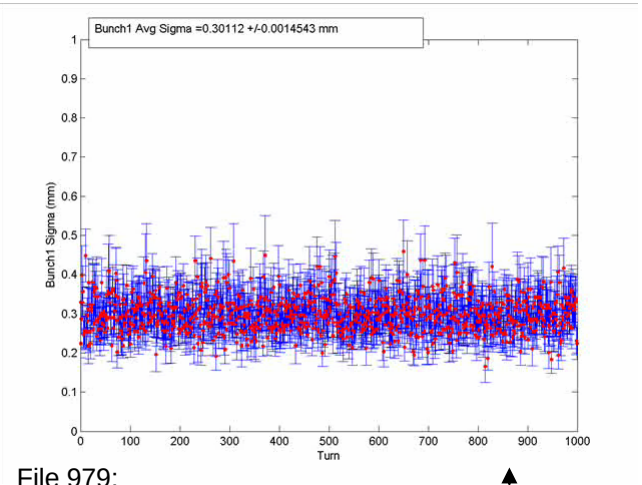




- Both the vertical and horizontal tunes to the left have been normalized to the tune for bunch 1 to show growth along the train.
- The vertical tune frequency increases along the train, though it takes a dive at bunch 17.
- The horizontal tune appears to be oscillating along the train until bunch 20, when it increases suddenly.

20 Bunches at 14ns Spacing – Vertical Beam Size

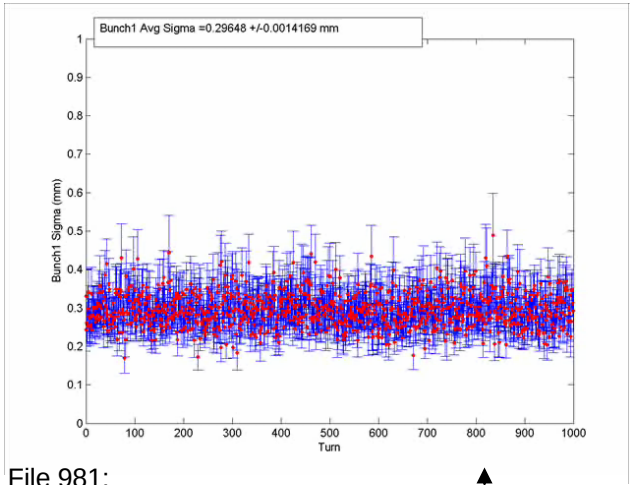
Movies



File 979:

I_{e+} = 0.75mA/bunch, XQ1 = +122

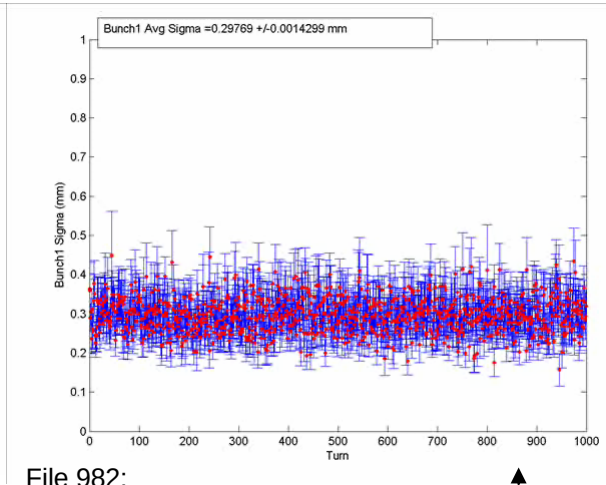
Fit uncertainties increase greatly after bunch 14.



File 981:

Ie+ = 0.75mA/bunch, XQ1 = -75

Fit uncertainties increase greatly after bunch 14.



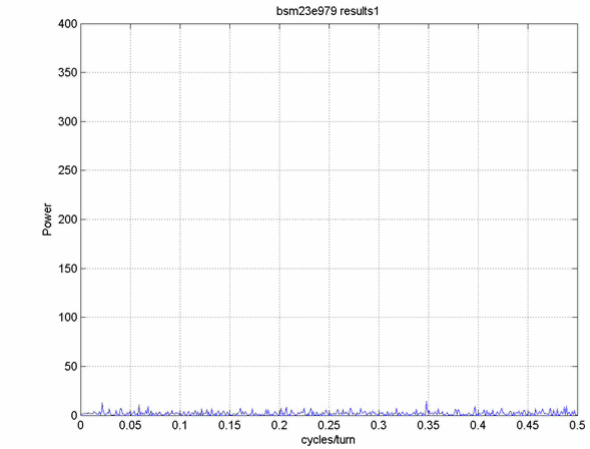
File 982:

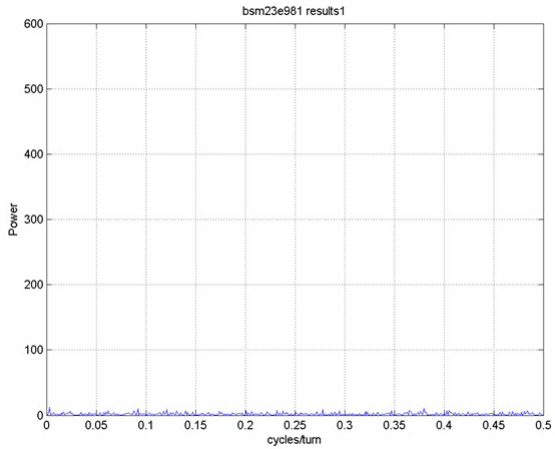
Ie+ = 0.75mA/bunch, XQ1 = -75

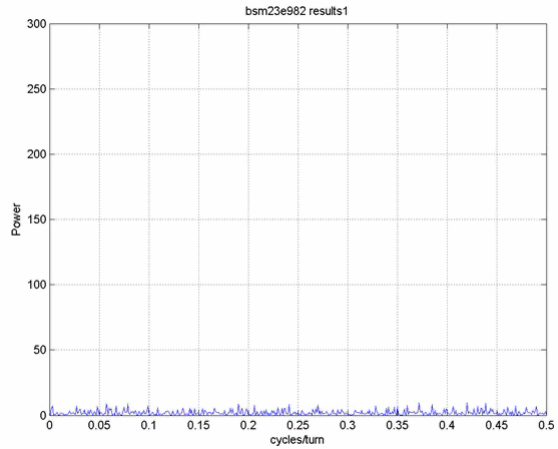
Fit uncertainties greatly increase for bunch 20.

20 Bunches at 14ns Spacing – Vertical Beam Size FFT

File 979 (movies) File 981 File 982







Ie+ = 0.75mA/bunch, XQ1 = +122

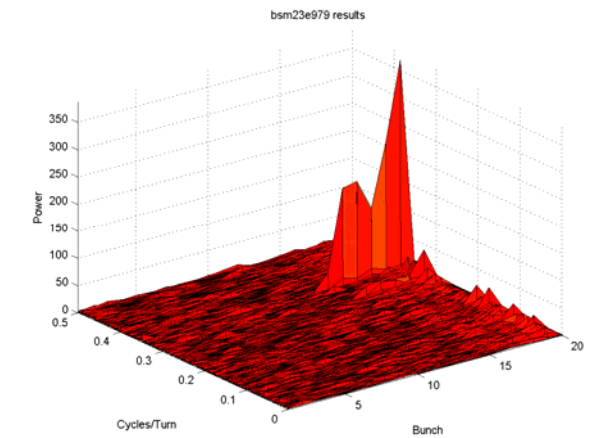
At bunch 14, a clear signal is detected at 0.352 cyc/turn (252.9kHz – very close to the vertical tune measurement for bunch 14). This signal generally increases in strength through bunch 19.

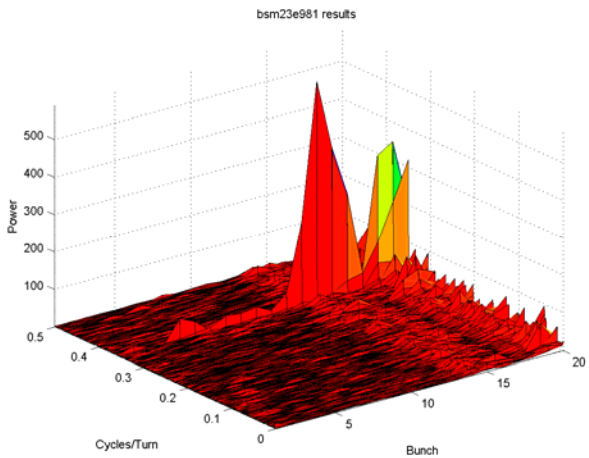
Ie+ = 0.75mA/bunch, XQ1 = -75

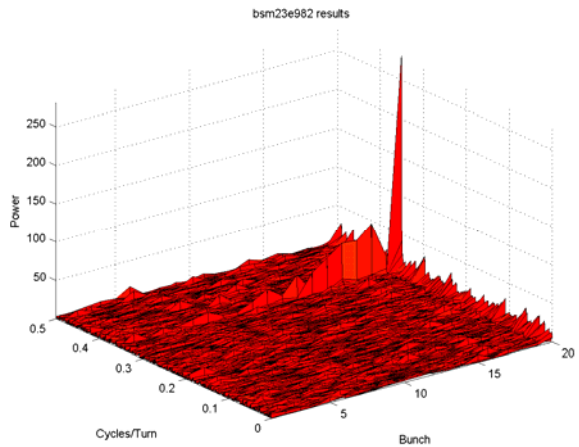
With the exception of bunches 1, 3 and 4, signals emerge for each bunch very near to the 252.9kHz signal detected in measurement 979. They range from 0.352 cyc/turn (252.6kHz) to 0.355 cyc/turn (251.8kHz).

Ie+ = 0.75mA/bunch, XQ1 = -75

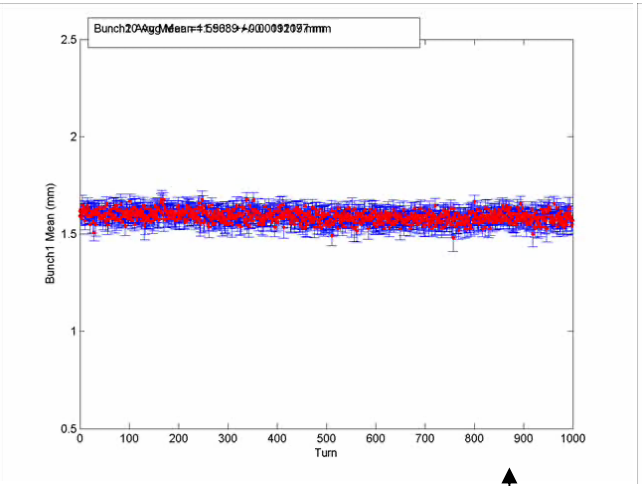
Most bunches again display a signal near the vertical tune, ranging from 252.2kHz to 253.4kHz.







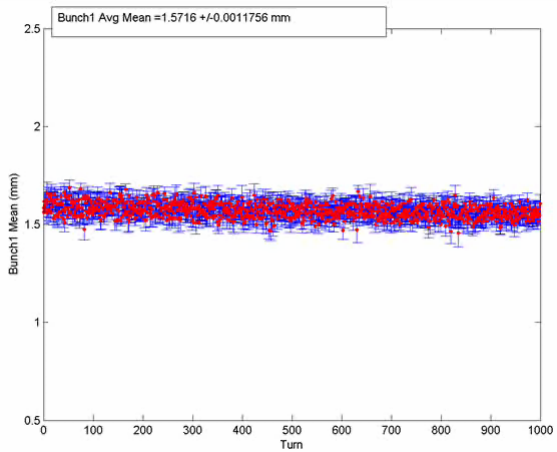
20 Bunches at 14ns Spacing – Vertical Position



File 979:

I_{e+} = 0.75mA/bunch, XQ1 = +122

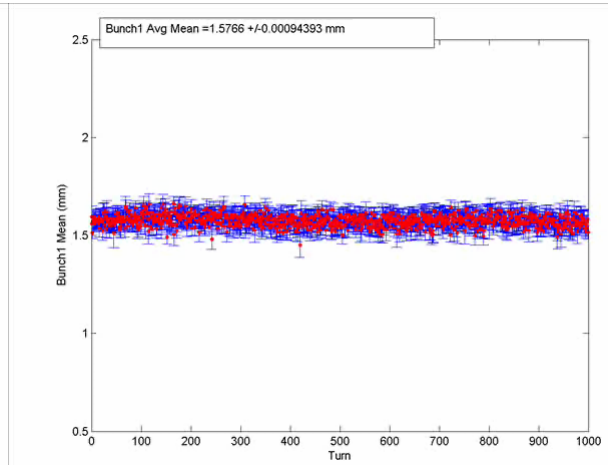
After bunch 12, the bunches are clearly oscillating along the vertical position axis.



File 981:

Ie+ = 0.75mA/bunch, XQ1 = -75

After bunch 4, the bunches show clear oscillation along the vertical position axis.



File 982:

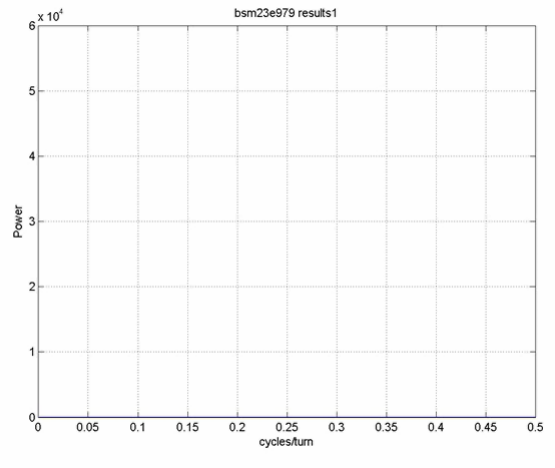
Ie+ = 0.75mA/bunch, XQ1 = -75

All bunches appear to show oscillation along the vertical position axis.

At first glance, there does not appear to be much difference between these three measurements.

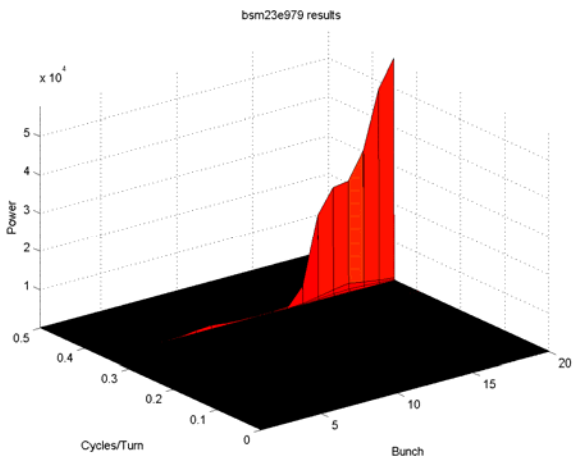
20 Bunches at 14ns Spacing – Vertical Position FFT

File 979

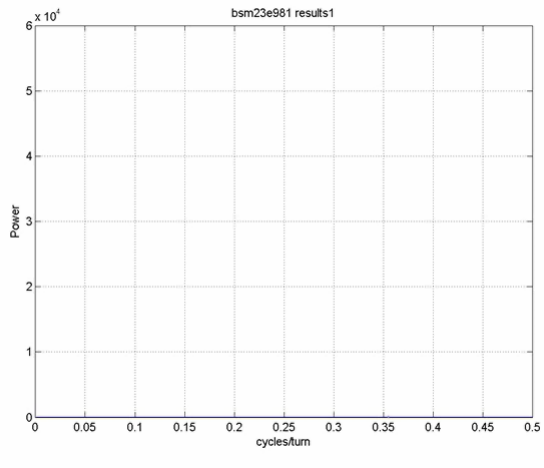


Ie+ = 0.75mA/bunch, XQ1 = +122

At bunch 1, a signal is detected at 0.354 cyc/turn (252.2kHz, very near the vertical tune). At bunch 4, a signal is detected at 0.353 cyc/turn (252.6kHz). This signal increases in strength through bunch 8 at which point other frequencies very close to it start gaining power. At bunch 14, the peak frequency shifts to 0.352 cyc/turn (252.9kHz). It is noted that this shift is in the same direction as the tune shift.

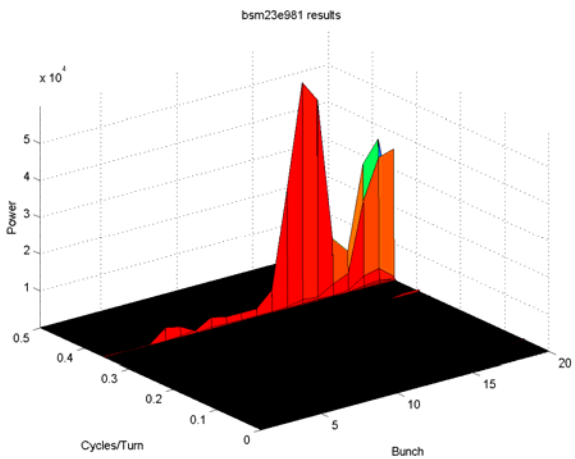


File 981

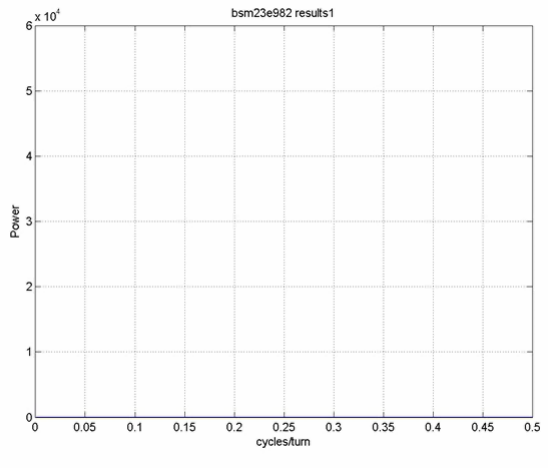


Ie+ = 0.75mA/bunch, XQ1 = -75

For all bunches, the peak signal ranges from 0.352 cyc/turn (252.6kHz) to 0.355 cyc/turn (251.8kHz). The peak frequency decreases along the train. Again, the shift is in the direction of the vertical tune shift measured.

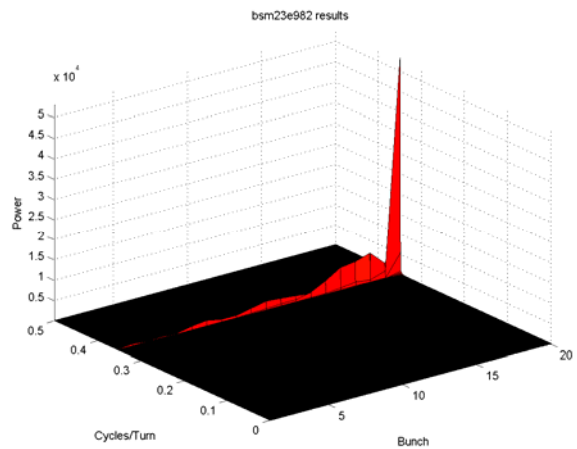


File 982

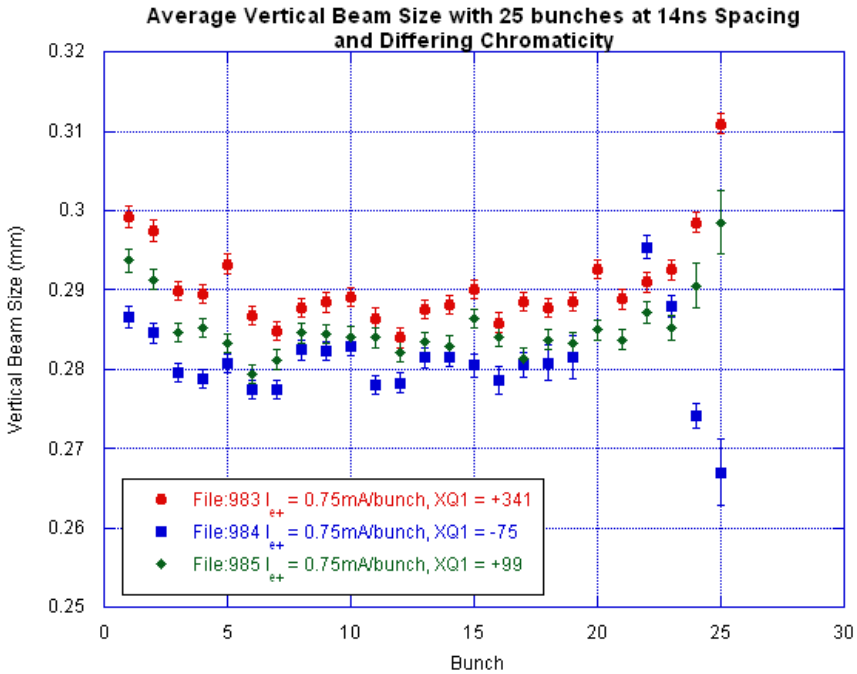


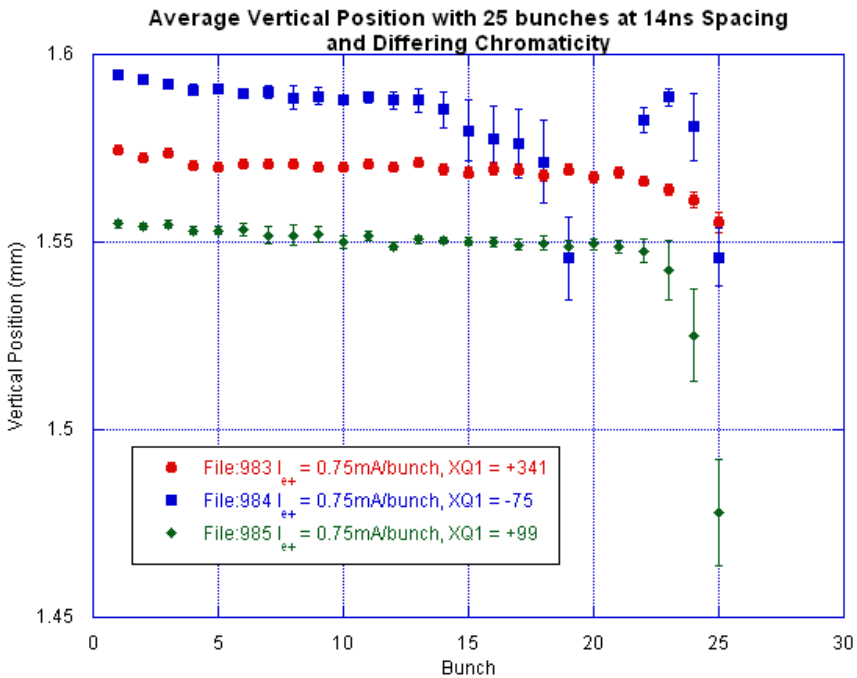
Ie+ = 0.75mA/bunch, XQ1 = -75

For all bunches, the peak signal ranges from 0.351 cyc/turn (253.4kHz) to 0.354 cyc/turn (252.2kHz). Again, the peak frequency increases along the train.



25 Bunches at 14ns Spacing

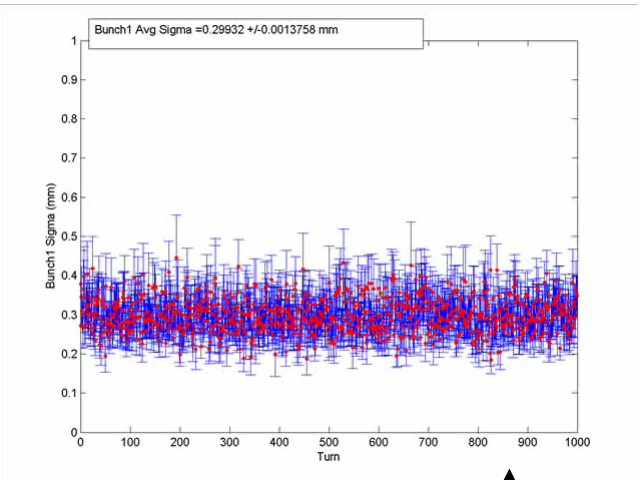




- All measurements taken at I_{e+} = 0.75mA/bunch (no electron current).
- Bunches 20 and 21 were lost during measurement for file 984.
- Vertical position tends to decrease with each bunch for each measurement.
- (current/tune data was poor for these measurements).

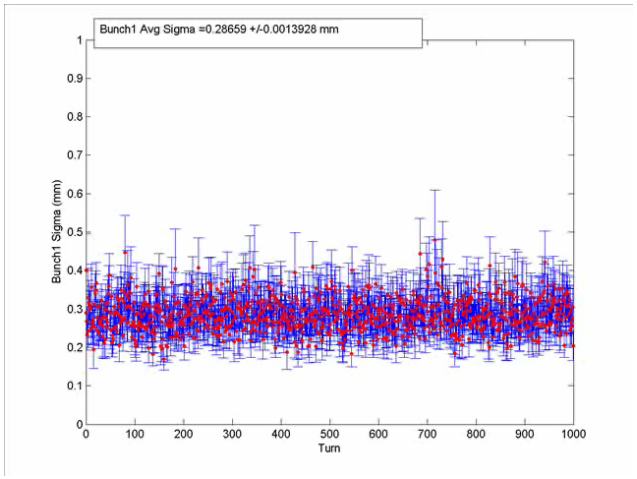
25 Bunches at 14ns Spacing – Vertical Beam Size

Movies: no cuts



File 983:

I_{e+} = 0.75mA/bunch, XQ1 = +341, vertical feedback at -1100

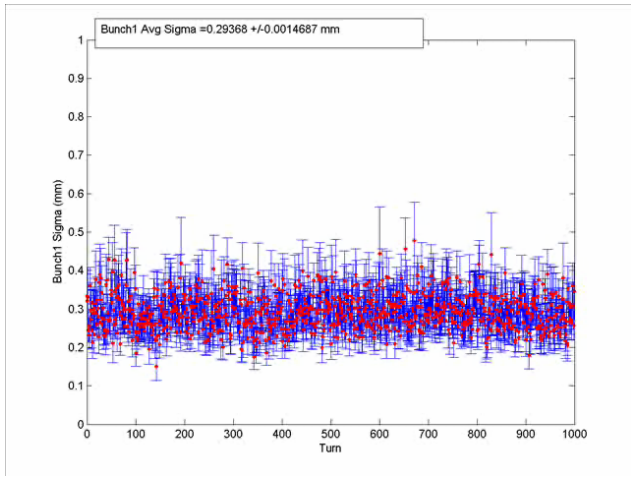


File 984:

Ie+ = 0.75mA/bunch, XQ1 = -75

After bunch 14, most of the bunches have very large errors in fit parameter sigma.

Bunches 20 and 21 appear to have been lost.



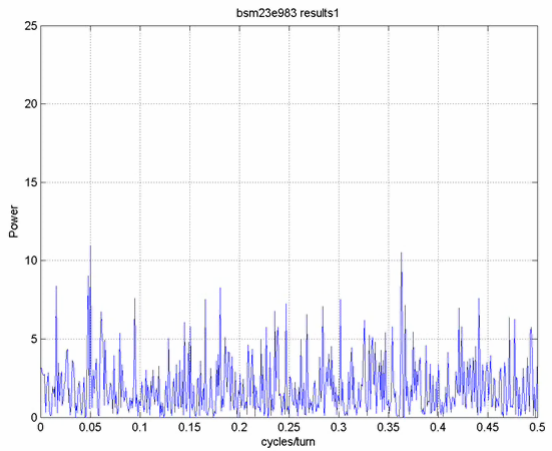
File 985:

Ie+ = 0.75mA/bunch, XQ1 = +99

After bunch 22, errors in fit parameter sigma increase greatly.

25 Bunches at 14ns Spacing – Vertical Beam Size FFT

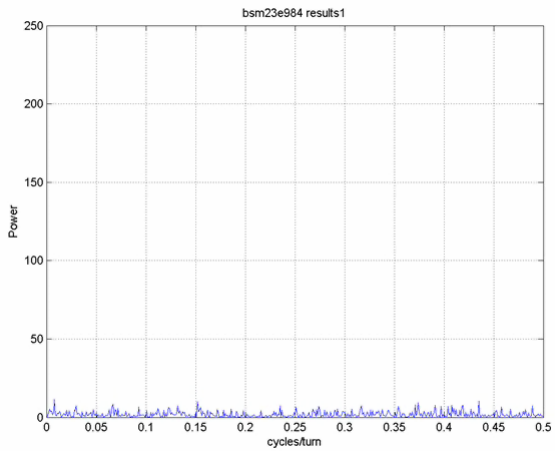
File 983



I_{e+} = 0.75mA/bunch, XQ1 = +341

No frequencies appear significantly above the noise level, although the ~252kHz group of signals do appear occasionally at very low power.

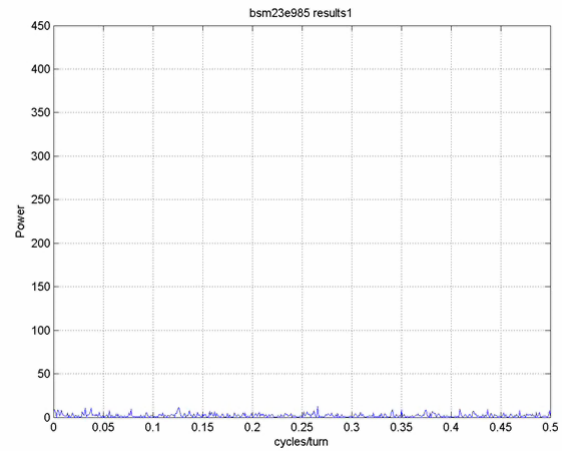
File 984



Ie+ = 0.75mA/bunch, XQ1 = -75

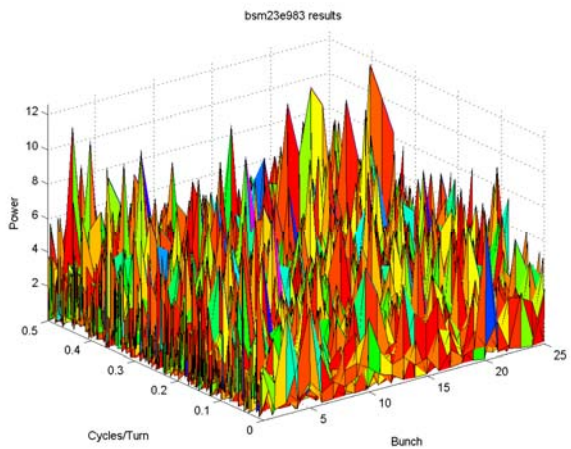
Bunches 20 and 21 appear to have been lost. (FFT could not run past that). Most bunches from bunch 8 on display a signal that increases from 252.2kHz to 252.6kHz along the train. The power also generally increases along the train. A secondary signal appears at bunch 14. It decreases in frequency from 275.6kHz to 274.8kHz and increases in power along the train.

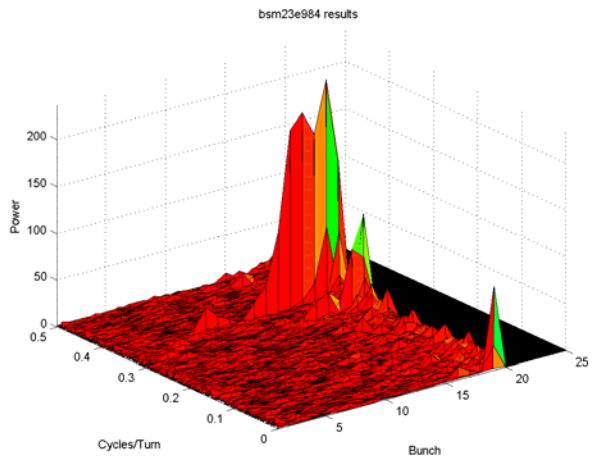
File 985

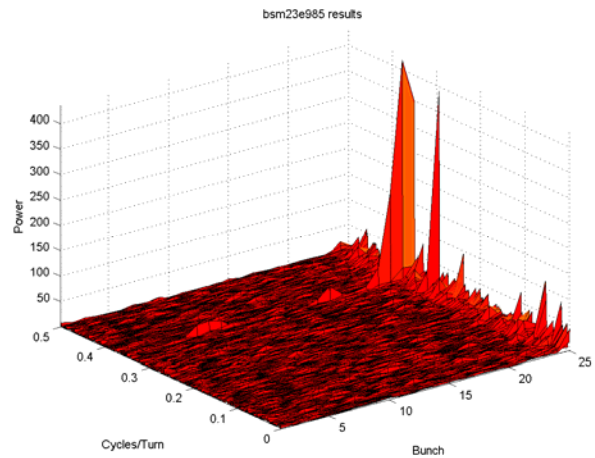


Ie+ = 0.75mA/bunch, XQ1 = +99

The ~252kHz signals pop up at low power occasionally before bunch 21. For bunches 21-24, the power of that signal increases, and is still present high above the noise in bunch 25. A second signal at 274.8kHz shows up at bunch 24, and becomes the primary signal for bunch 25.

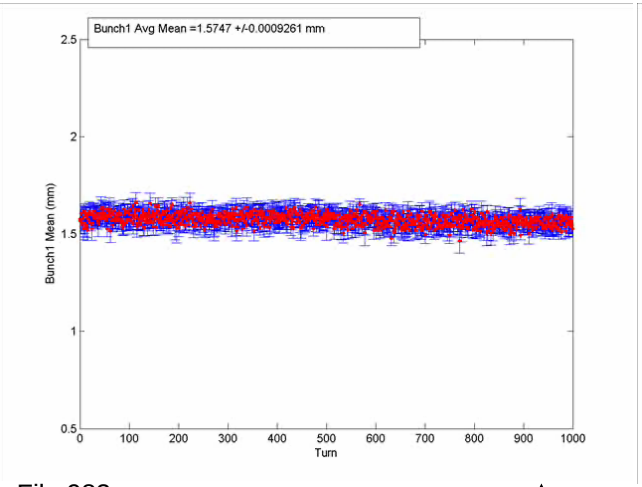






25 Bunches at 14ns Spacing – Vertical Position

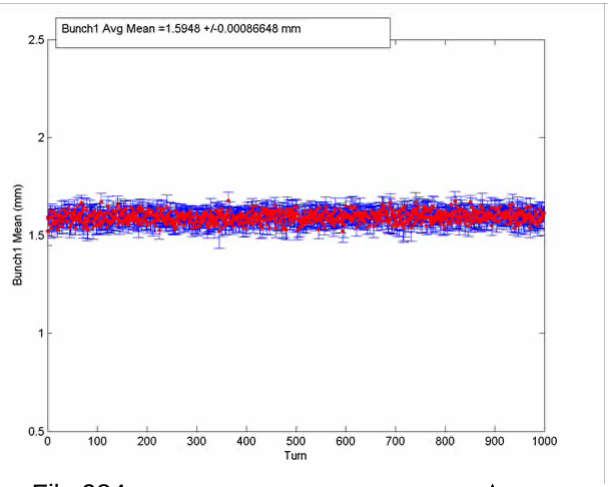
Movies: no cuts



File 983:

I_{e+} = 0.75mA/bunch, XQ1 = +341

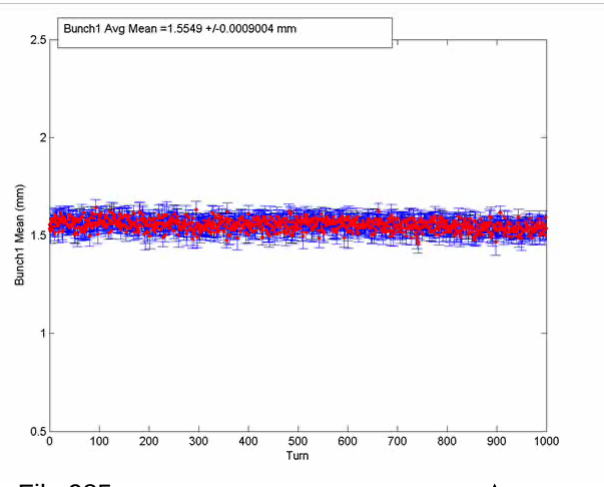
After bunch 7, an oscillation in vertical position is clearly visible.



File 984:

Ie+ = 0.75mA/bunch, XQ1 = -75

After bunch 3, oscillations in vertical position are clearly visible. Bunches 20 and 21 were lost.



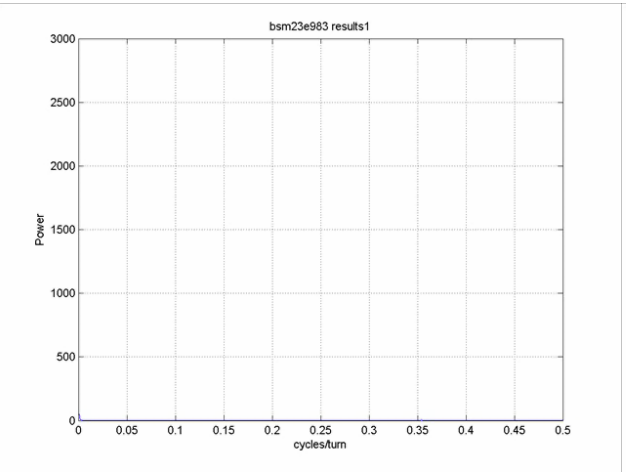
File 985:

Ie+ = 0.75mA/bunch, XQ1 = +99

After bunch 4, oscillations in vertical position are clearly visible.

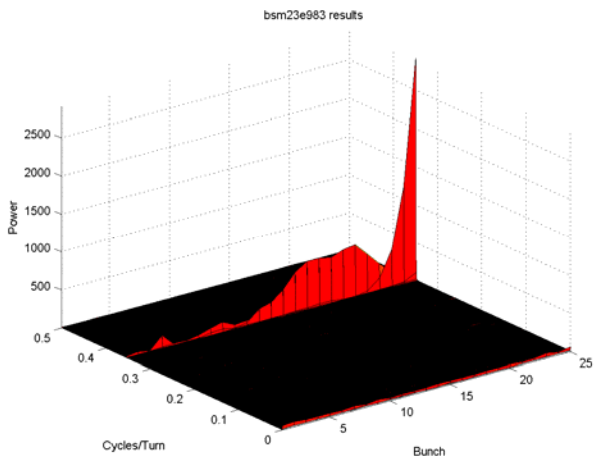
25 Bunches at 14ns Spacing – Vertical Position FFT

File 983

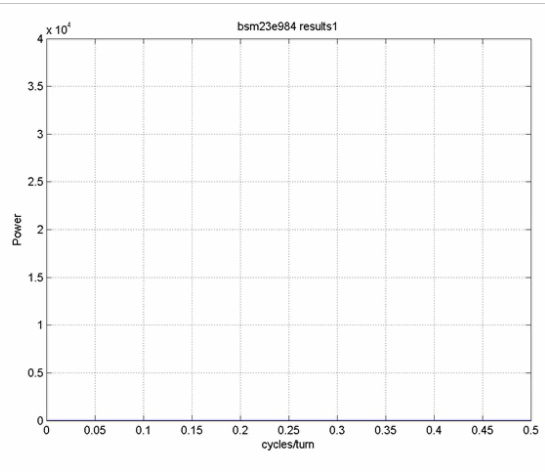


I_{e+} = 0.75mA/bunch, XQ1 = +341

Only the ~252kHz group of signals appear significantly above the noise. The peak frequency increases along the train from 252.6kHz to 253.4kHz, and the power of the signal generally increases, also.

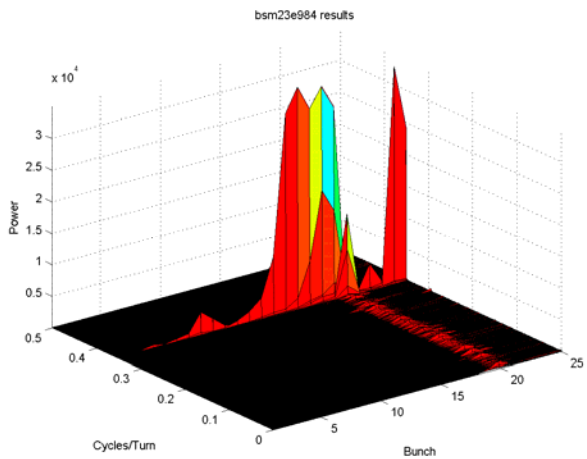


File 984

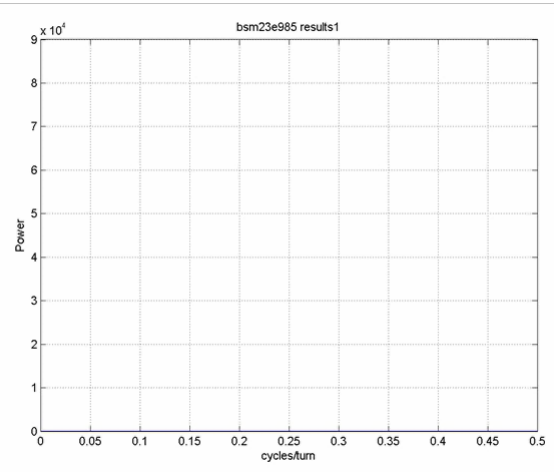


Ie+ = 0.75mA/bunch, XQ1 = -75

For all bunches, the main oscillation frequency is in the ~252kHz group of signals, increasing from 251.8kHz to 252.9kHz along the train. The power of the signal is generally higher for the later bunches, but with a significant dip at bunches 21, 22 and 23.

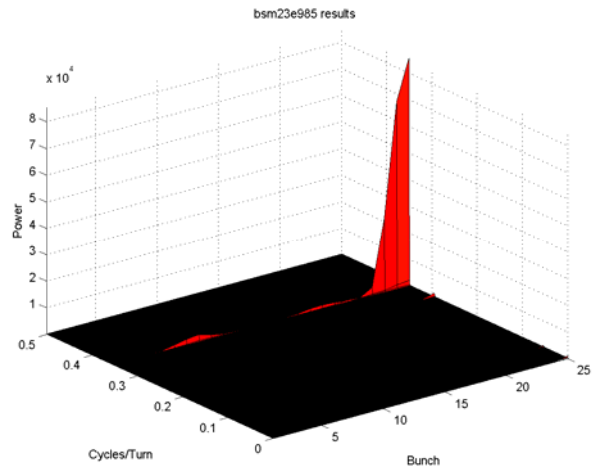


File 985

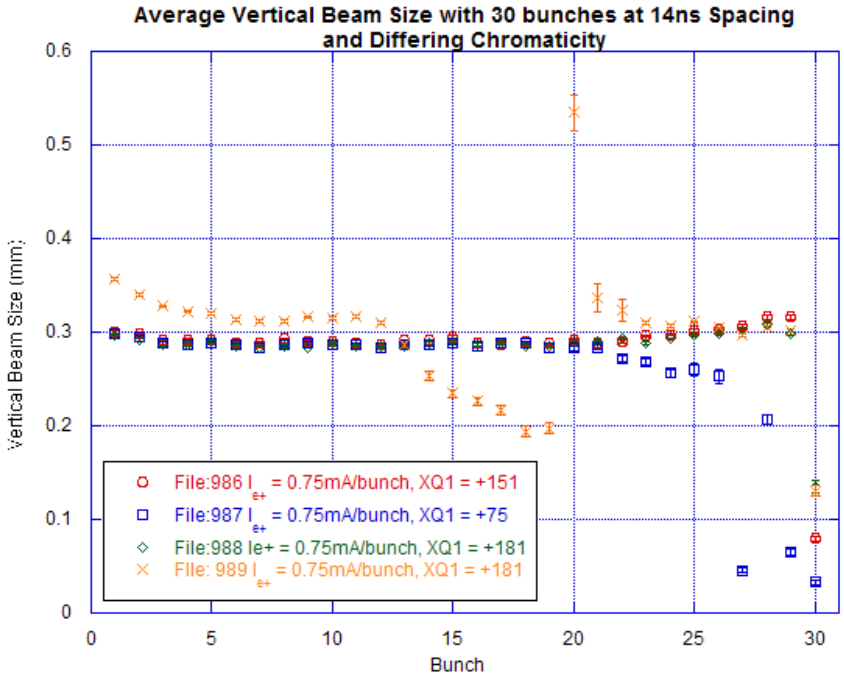


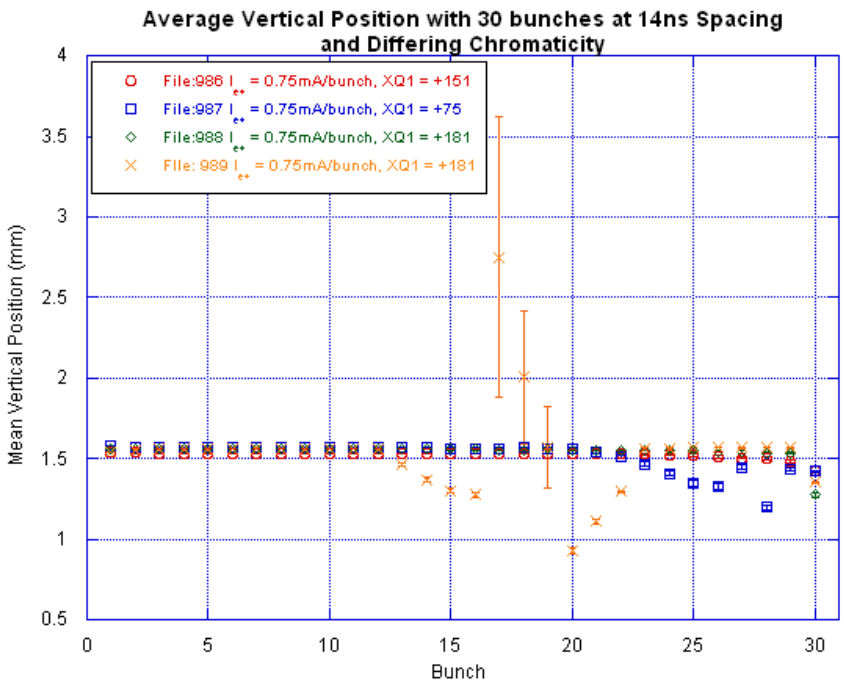
Ie+ = 0.75mA/bunch, XQ1 = +99

The peak oscillation frequency is in the ~252kHz group for all bunches except 1, 2 and 3, which appear to be stable. The peak frequency increases along the train from 252.2kHz to 252.9kHz, and the last 3 bunches' signals are at a power more than an order of magnitude higher than the other bunches.

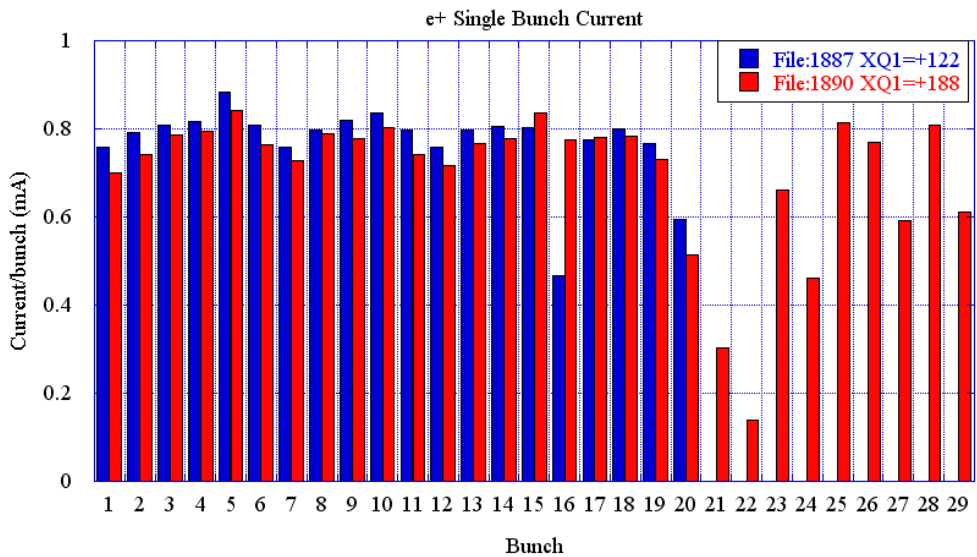


30 Bunches at 14ns Spacing

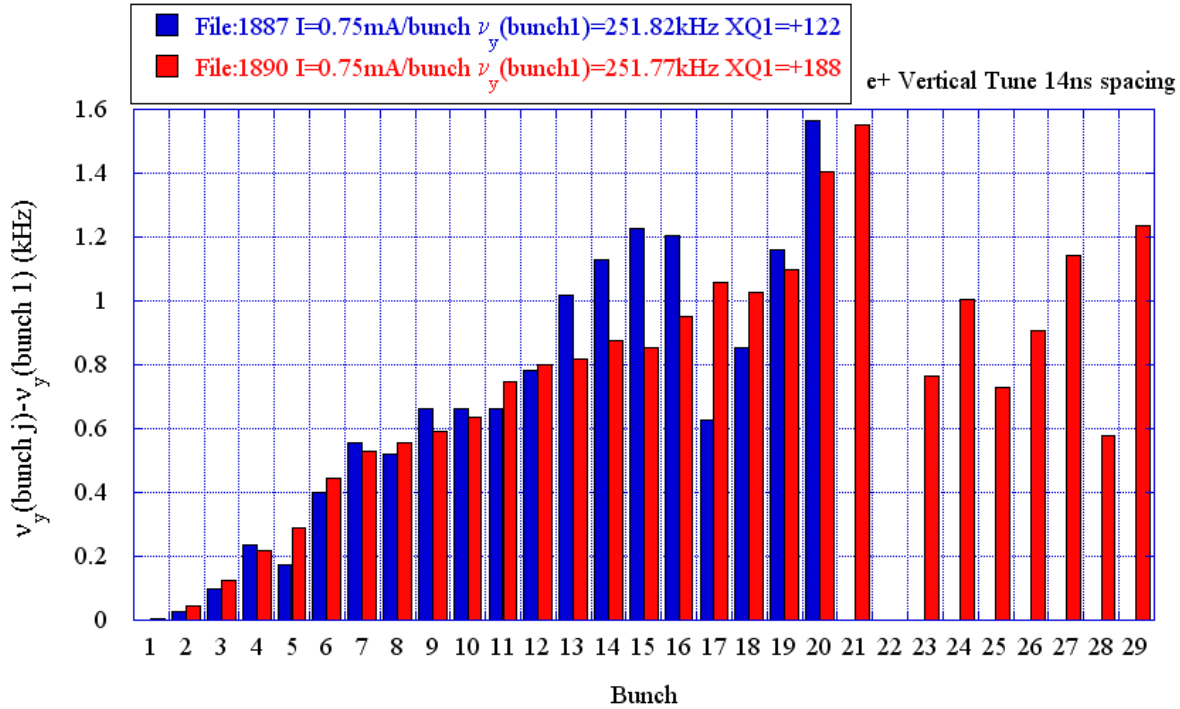


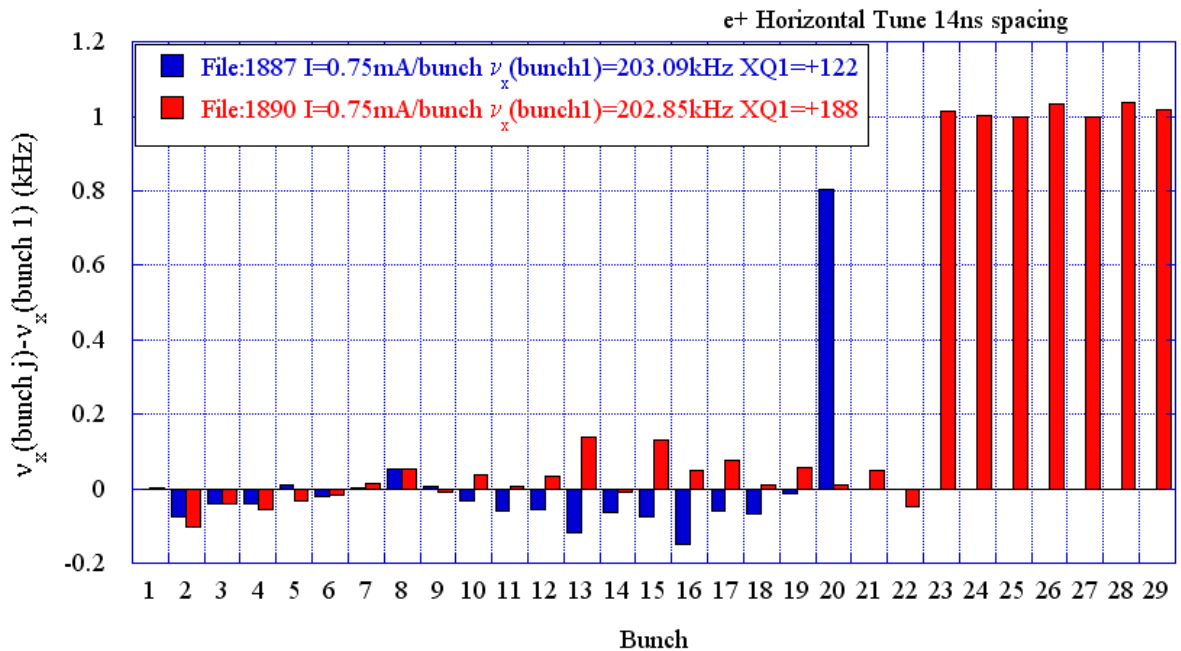


- All measurements taken at I_{e+} = 0.75mA/bunch (no electron current).
- Bunches 26 – 30 partially lost during measurement for file 987.
- For file 988, the vertical feedback was turned on at -2000.
- Tune/current file 1890 corresponds to this data. There is a considerable drop in current for bunches 20, 21, 22 and 24.



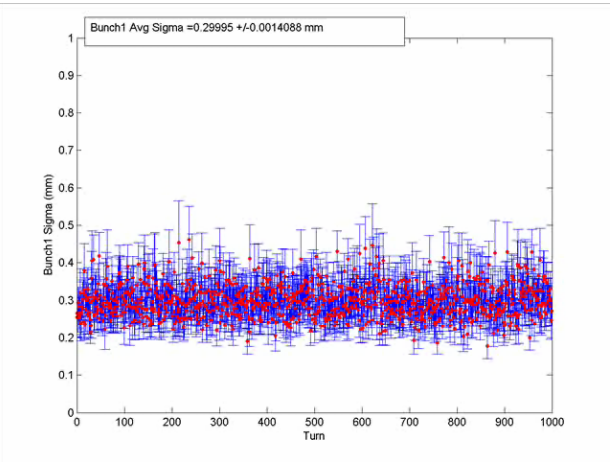
30 Bunches at 14ns Spacing





- The vertical and horizontal tunes have been normalized to bunch 1.
- The vertical tune increases along the train until bunch 22, where the current was very low. After bunch 22, the tune variably increases and decreases between bunches.
- The horizontal tune seems to be oscillating until bunch 23, at which point it suddenly increases by about 1kHz and nearly flattens out.

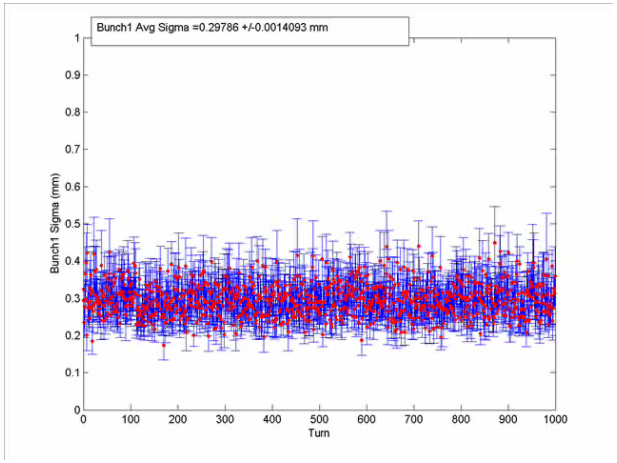
30 Bunches at 14ns Spacing – Vertical Beam Size



File 986:

I_{e+} = 0.75mA/bunch, XQ1 = +151

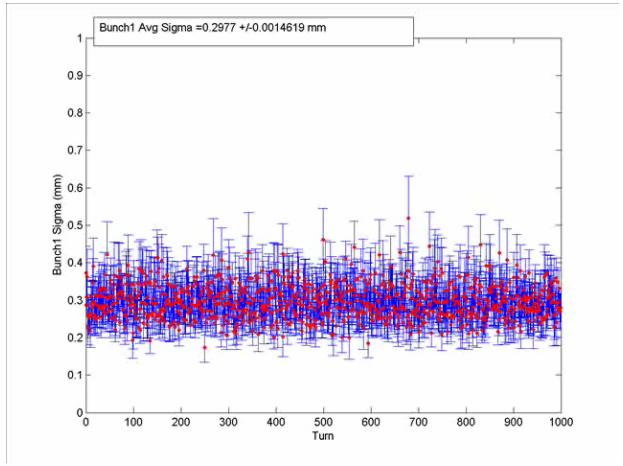
It looks as if bunch 30 may have been lost.



File 987:

Ie+ = 0.75mA/bunch, XQ1 = +75

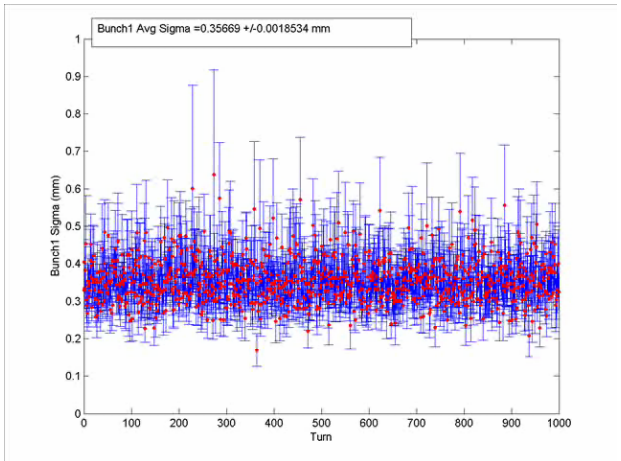
Starting with ~bunch 20, it looks like vertical position oscillation caused the loss of beam size data.



File 988:

Ie+ = 0.75mA/bunch, XQ1 = +99

It looks as if bunch 30 may have been lost.



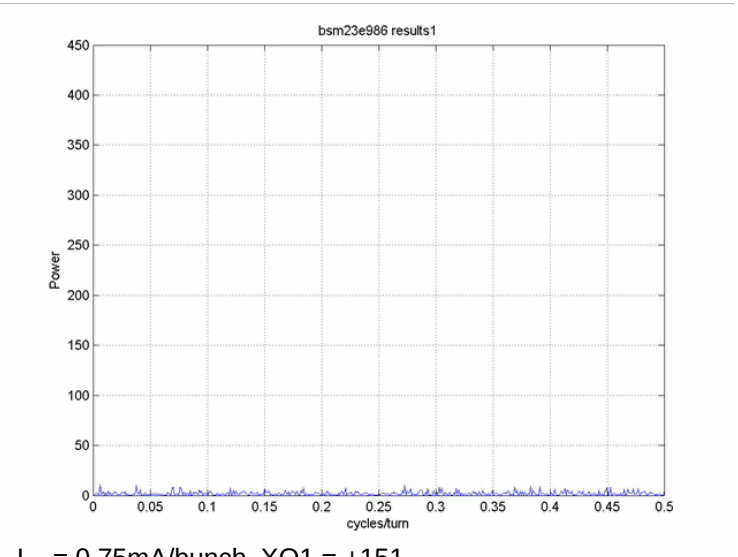
File 989:

Ie+ = 0.75mA/bunch, XQ1 = +99

Starting with bunch 13, it looks like a lot of beam size data was lost due to vertical position oscillation.

30 Bunches at 14ns Spacing – Vertical Beam Size FFT

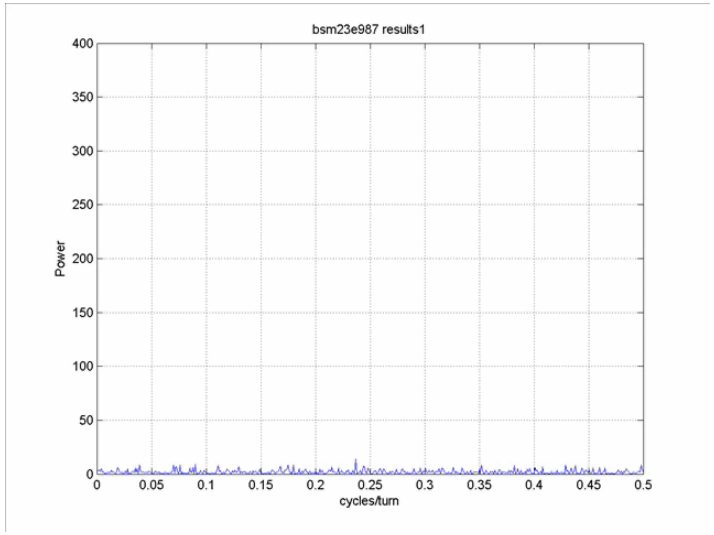
File 986



I_{e+} = 0.75mA/bunch, XQ1 = +151

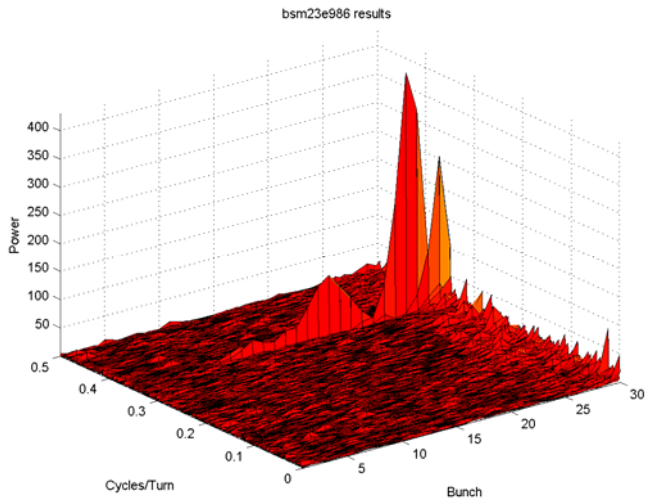
At bunch 10, a low-power signal emerges at 252.6kHz. The signal increases in frequency to 253.8kHz along the train. The highest power oscillation detected is in bunch 26, at 253.4kHz.

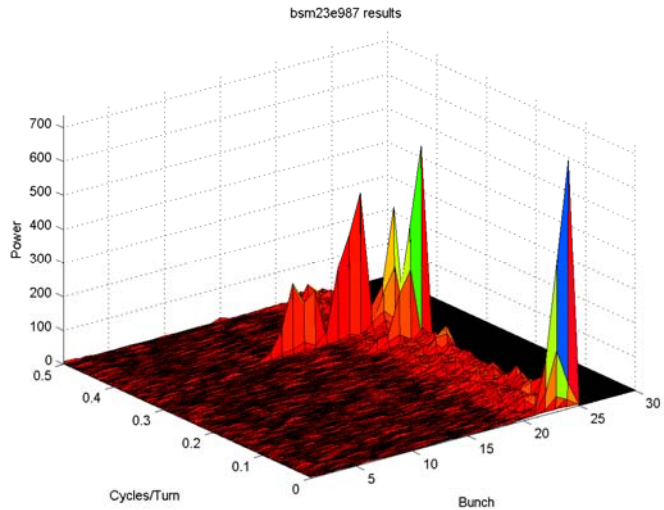
File 987



I_{e+} = 0.75mA/bunch, XQ1 = +75

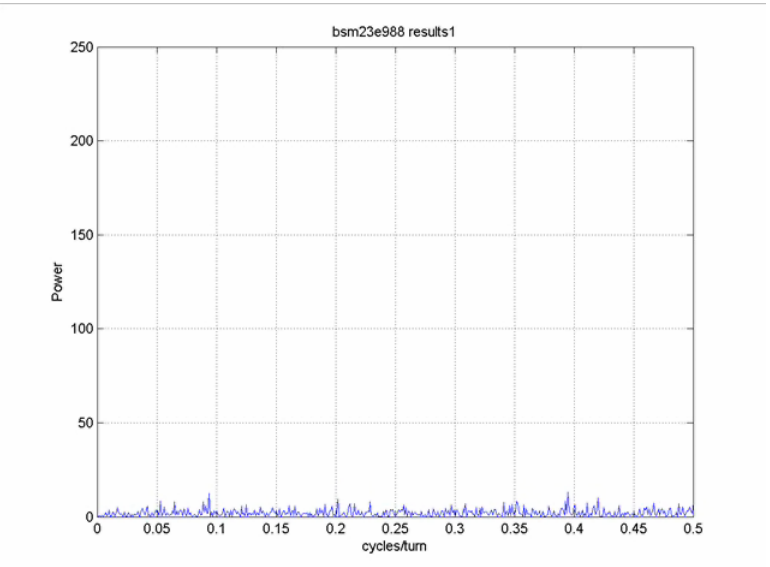
Bunch 26 was lost (FFT unable to run on bunches after that). (Is incoherent oscillation going on for bunch 20 and after?) At bunch 13, a signal emerges at 252.6kHz and increases to 252.9kHz through bunch 21. A secondary signal appears at bunch 20 and increases in strength until bunch 24, starting at 274.8kHz and decreasing to 274.5kHz. For bunches 22 – 24, another signal at ~390kHz appears at higher power than the other two.





30 Bunches at 14ns Spacing – Vertical Beam Size FFT

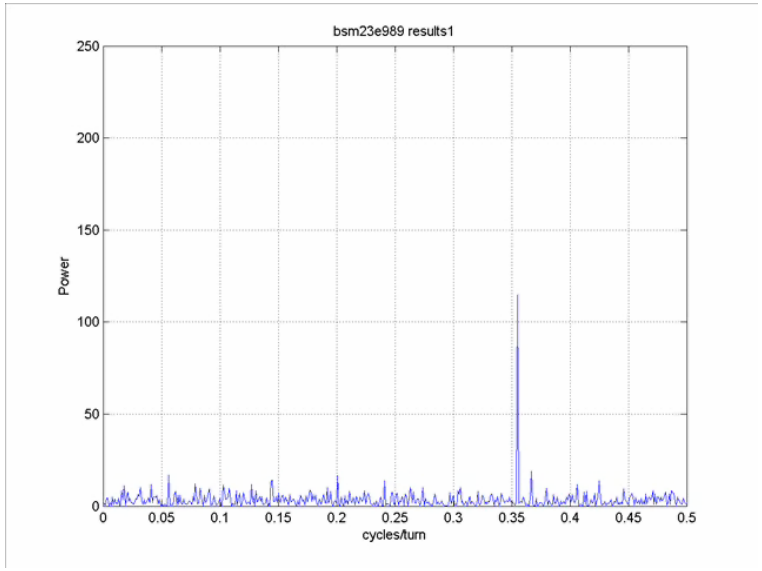
File 988



I_{e+} = 0.75mA/bunch, XQ1 = +99

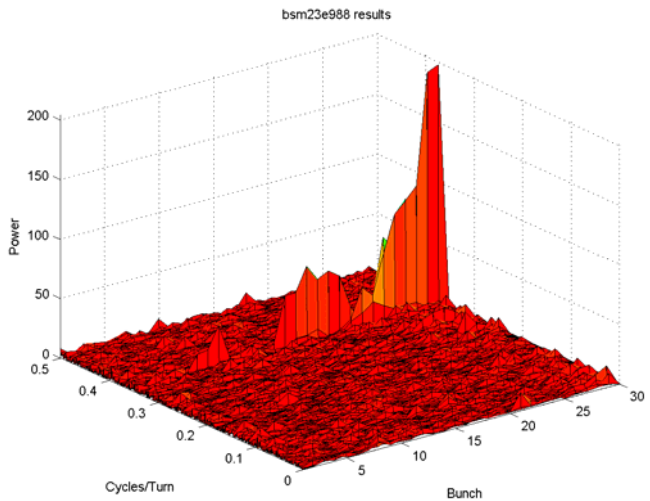
There is very little above the noise level until the signal at bunch 15 at 252.6kHz, which generally increases in power along the train (although for some bunches, the peak frequency is at 252.9kHz).

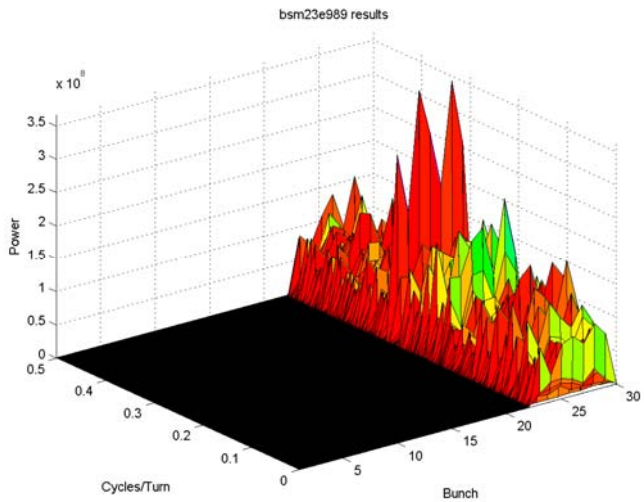
File 989



Ie+ = 0.75mA/bunch, XQ1 = +99

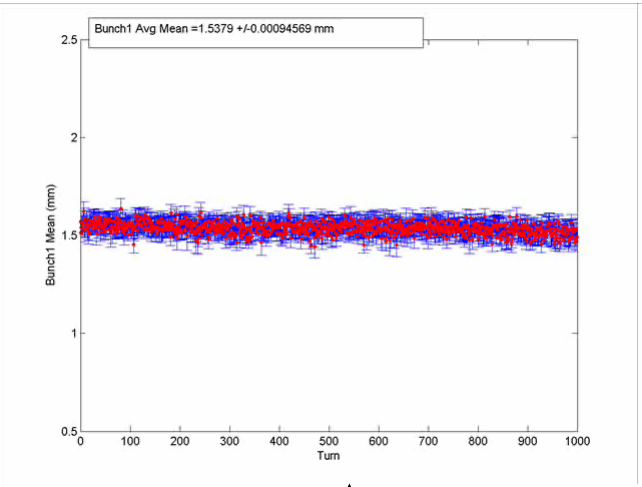
While frequencies near 252kHz do show up as the peak frequencies for most bunches through bunch 13, the signal power is low. No oscillations are detected between bunches 14 and 22. Bunches 23 – 29 all appear to be oscillating strongly at 275.6kHz.





30 Bunches at 14ns Spacing – Vertical Position

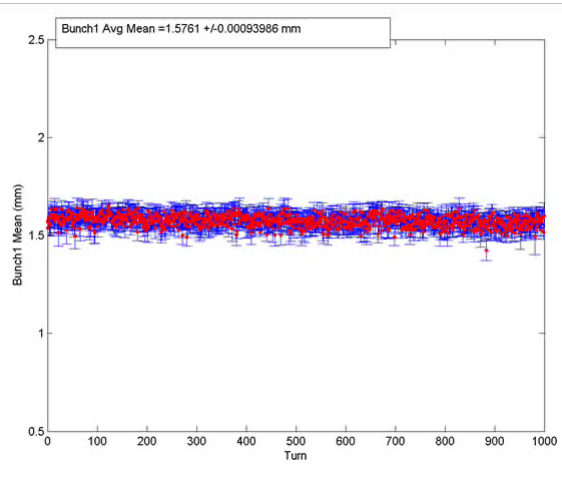
Movies: no cuts



File 986:

I_{e+} = 0.75mA/bunch, XQ1 = +151

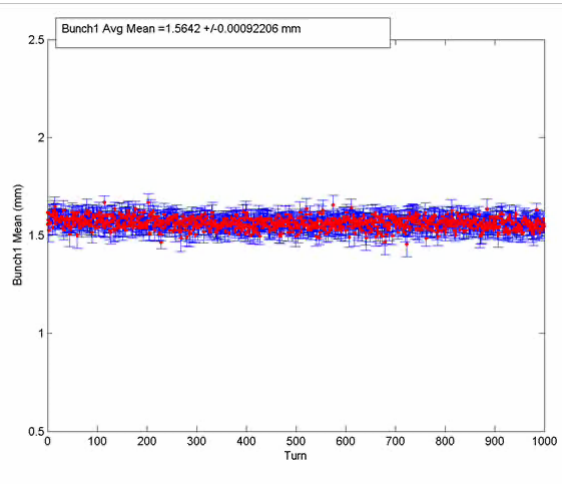
Beam instability can clearly be seen after bunch 1.



File 987:

I_{e+} = 0.75mA/bunch, XQ1 = +75

Beam instability clearly visible after bunch 1. The instability appears to have a slightly larger magnitude here than in measurement 986.

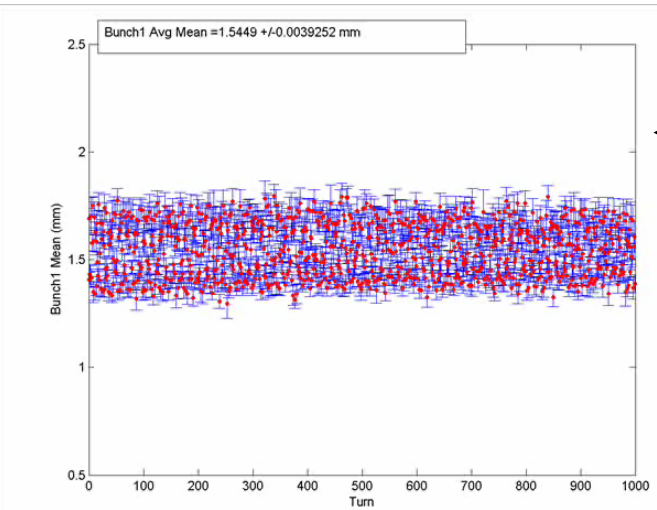


File 988:

I_{e+} = 0.75mA/bunch, XQ1 = +181, vertical feedback at -2000.

Beam instability clearly visible after bunch 1. The instability has a smaller magnitude here than in the previous two measurements.

Vertical Feedback ON



File 989:

I_{e+} = 0.75mA/bunch, XQ1 = +181

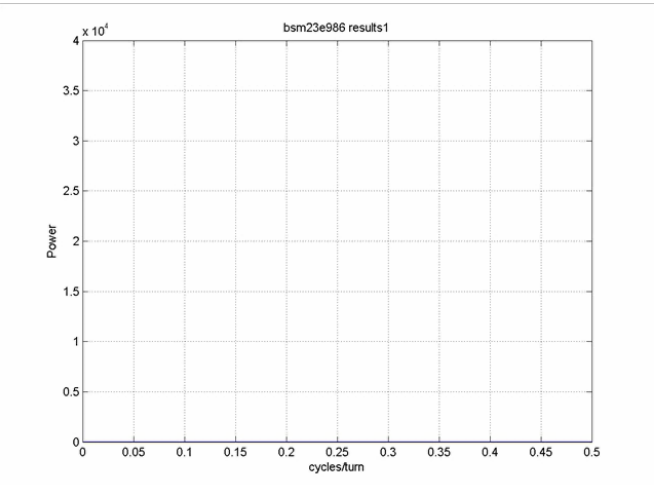
Beam instability immediately visible. The instability has a larger magnitude than the previous three.

Vertical Feedback OFF

It appears as if a higher chromaticity causes a larger amplitude of oscillation when the beam is unstable. In measurement 988, the vertical feedback was turned on – this seems to have reduced the effect.

30 Bunches at 14ns Spacing – Vertical Position FFT

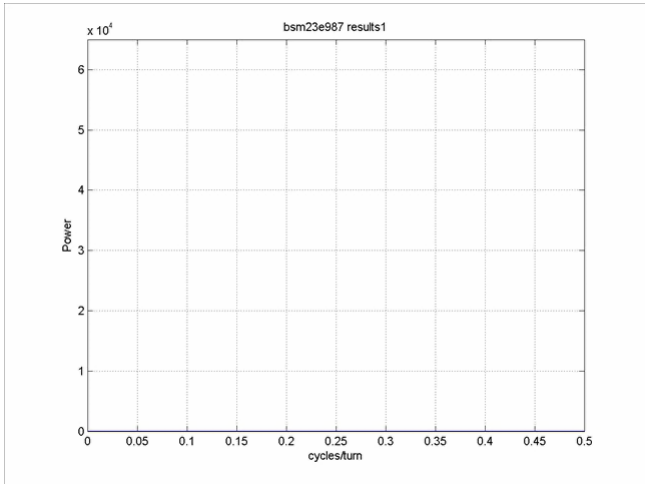
File 986



I_{e+} = 0.75mA/bunch, XQ1 = +151

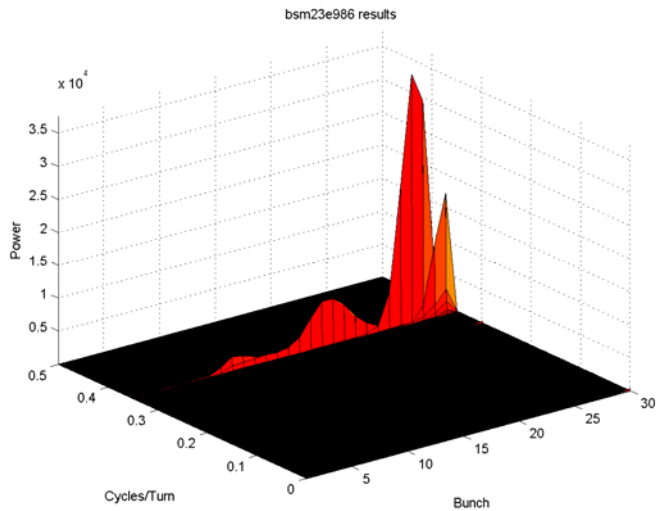
All bunches except bunch 1 display a peak oscillation frequency near 252kHz. The frequency generally increases from 252.2kHz to 253.8kHz along the train, although the last bunch's decreases slightly. The power of the oscillation also generally increases along the train, with occasional dips.

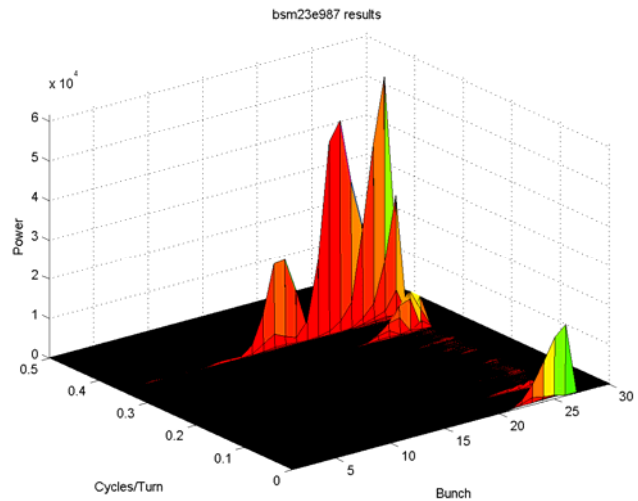
File 987



I_{e+} = 0.75mA/bunch, XQ1 = +75

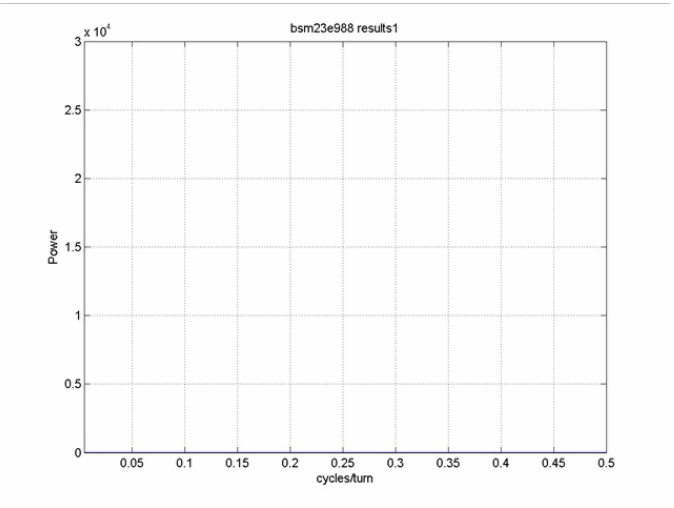
All bunches but bunch 1 have a signal (usually the peak signal) near 252kHz. The frequency increases from 252.2kHz to 253.8kHz along the train, until bunch 27 which appears to have been lost.





30 Bunches at 14ns Spacing – Vertical Position FFT

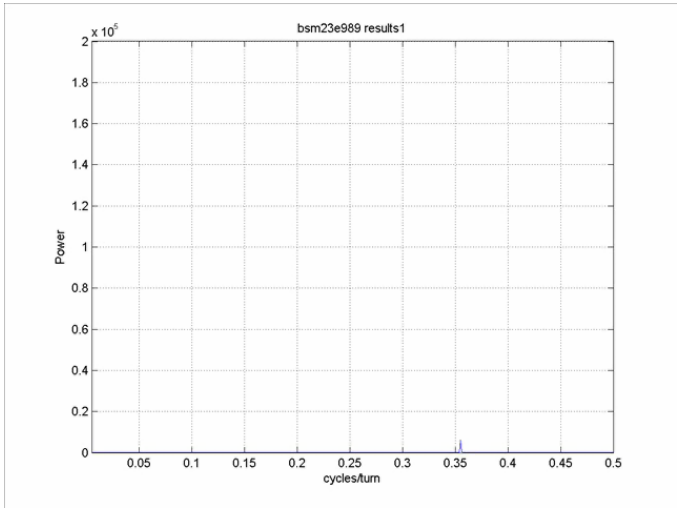
File 988



I_{e+} = 0.75mA/bunch, XQ1 = +151

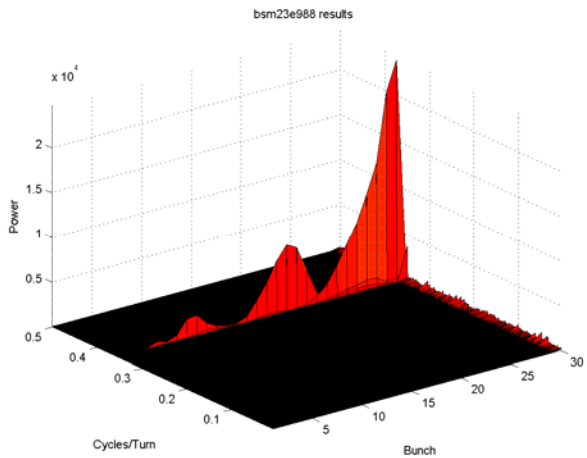
All bunches except bunch 1 have a peak oscillation frequency near 252kHz, generally increasing in power along the train with some dips. The frequency itself increases from 251.8kHz to 253.8kHz along the train.

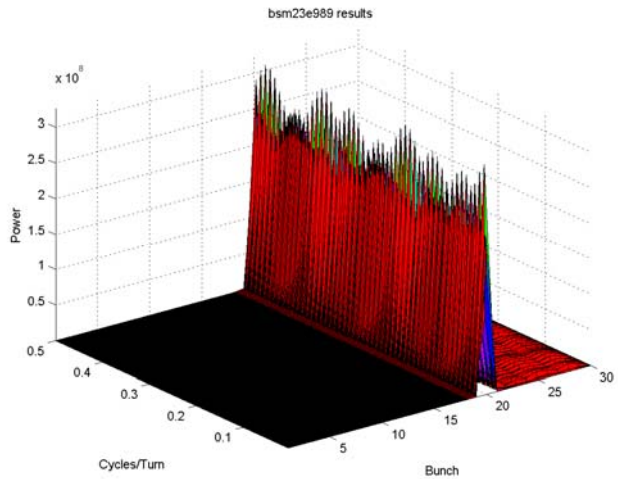
File 989



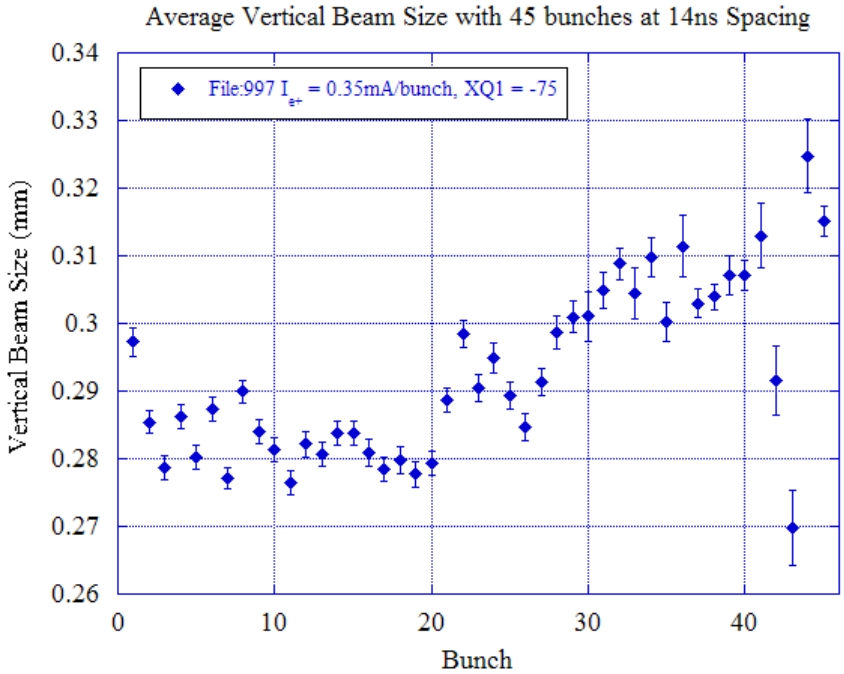
I_{e+} = 0.75mA/bunch, XQ1 = +75

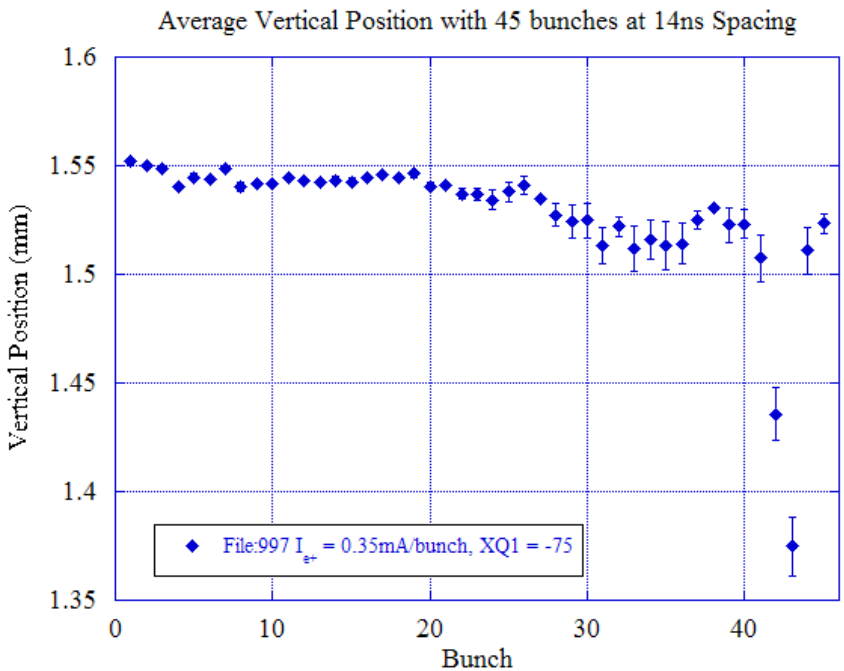
Current loss occurred starting with bunch 20, and through bunch 22. As seen in the vertical beam size measurements for these bunches, this resulted in poor fits that produced both extremely large and small vertical beam sizes, and the apparent (but non-existent) incoherent oscillation in the figure below.





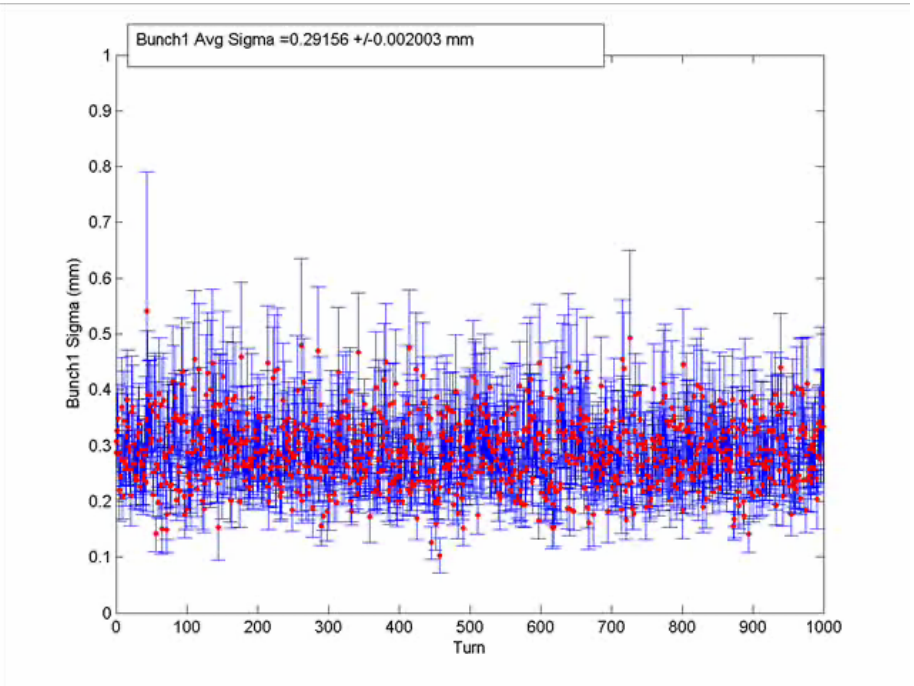
45 Bunches at 14ns Spacing



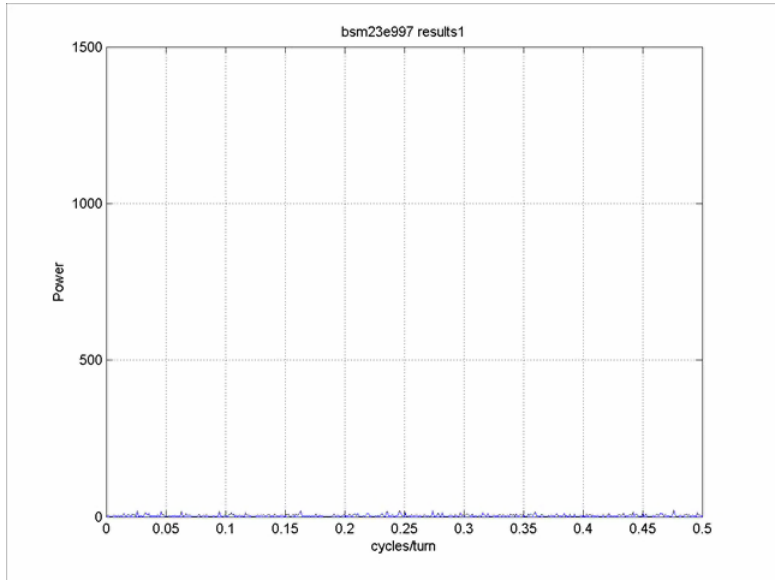


- All measurements taken at I_{e+} = 0.75mA/bunch (no electron current).
- Vertical feedback at -2000.
- The beam size tends to increase with bunch while the position tends to decrease with bunch.

45 Bunches at 14ns Spacing – Vertical Beam Size



FFT

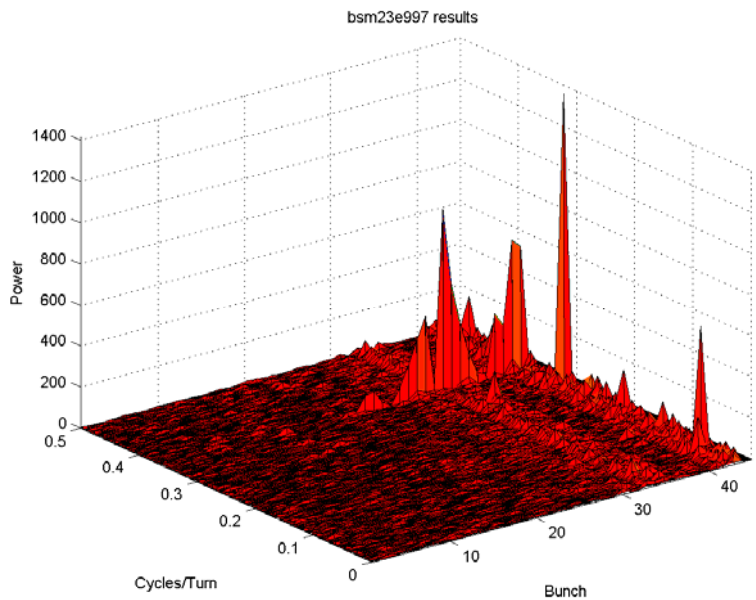


File 997:

I_{e+} = 0.35mA/bunch, XQ1 = -75

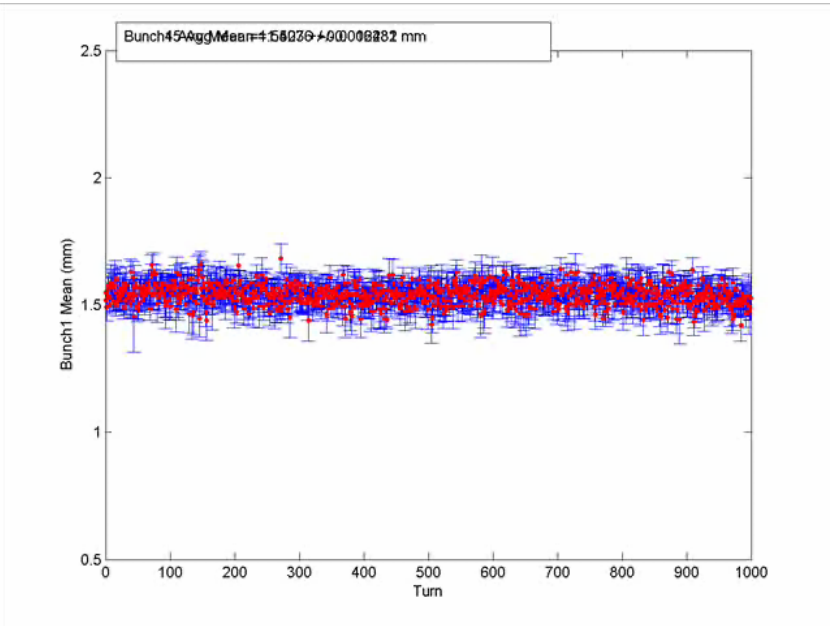
For some of the later bunches, it looks like many of the signals were off the PMT.

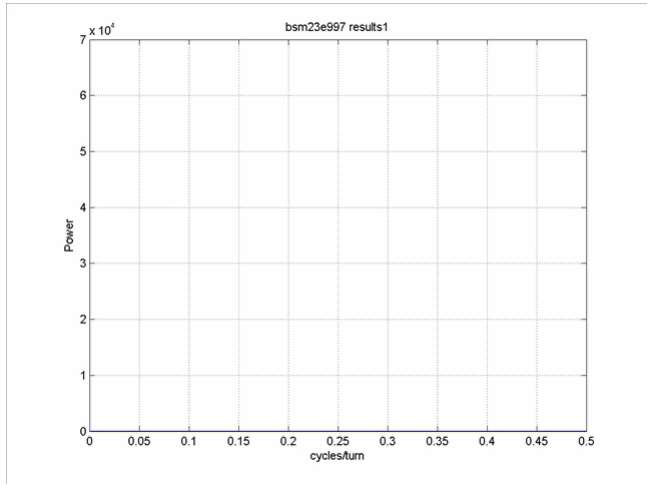
At bunch 23, a frequency near 252kHz pops up as the peak oscillation frequency. It decreases suddenly at bunch 27 to 247.9kHz, but returns to about 292kHz at bunch 28. 252.6kHz is the peak oscillation frequency for all bunches afterward until bunch 43, when the 275.6kHz frequency shoots up.



45 Bunches at 14ns Spacing – Vertical Position

Movie: no cuts



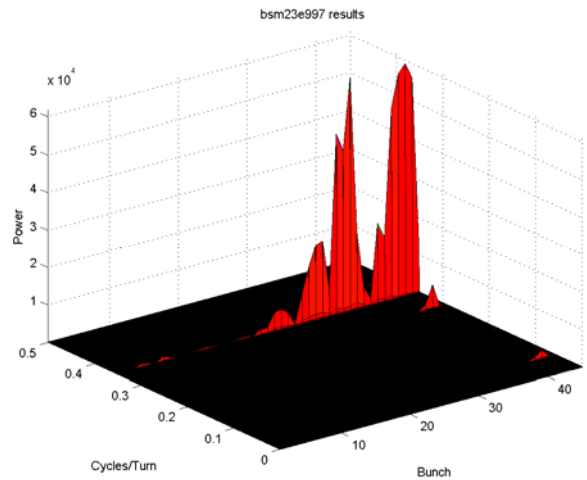


File 997:

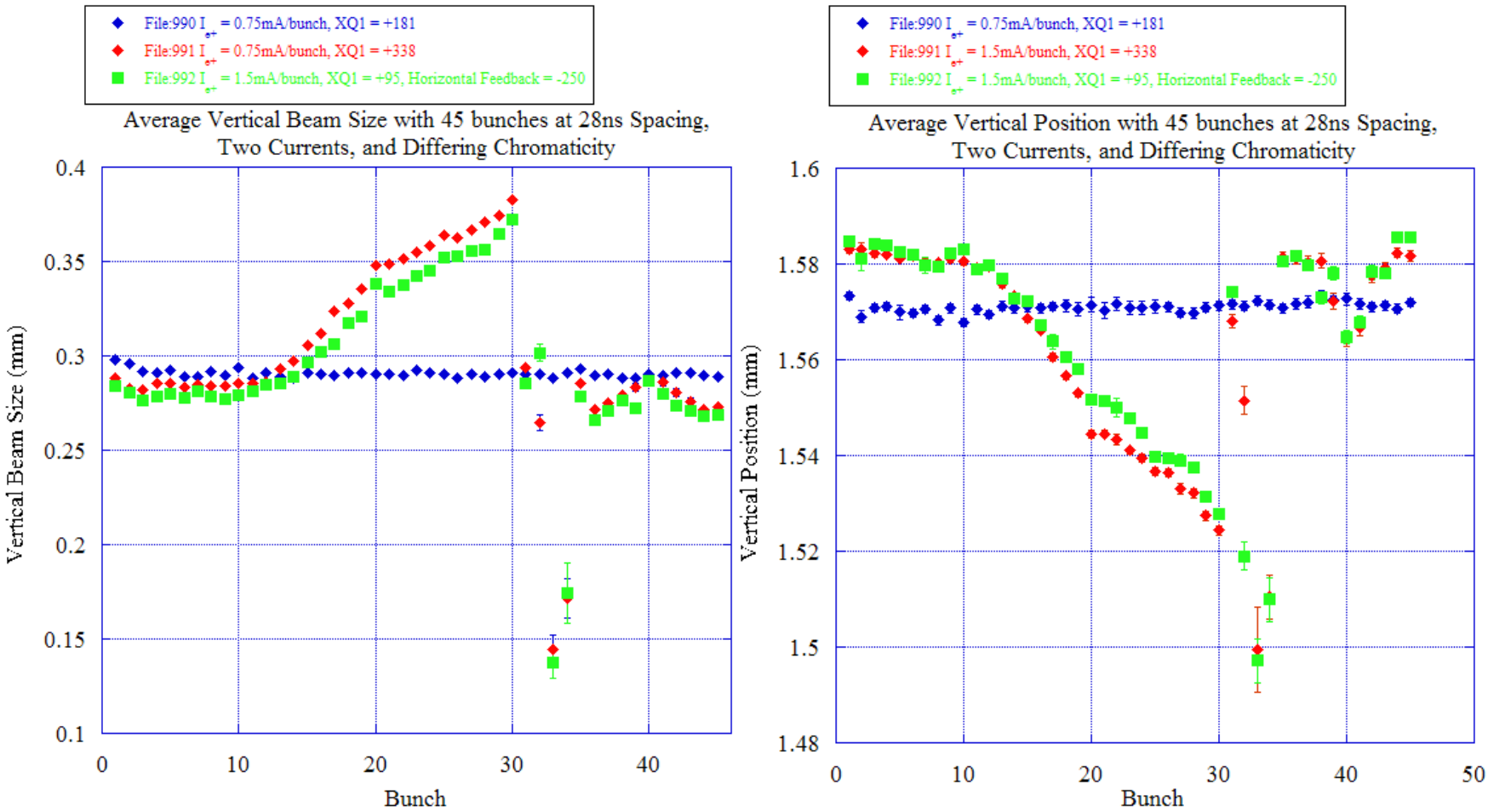
I_{e+} = 0.35mA/bunch, XQ1 = -75

Vertical position oscillation clearly present, especially from bunch 22 on.

For every bunch except bunch 1, a position oscillation near 252kHz is present (although at very low power for bunches 2 and 3) as the primary oscillation frequency. The peak frequency generally shifts along the train from 252.2kHz to 252.6kHz. A secondary frequency shows up again toward the end of the train, centered at 275.6kHz.

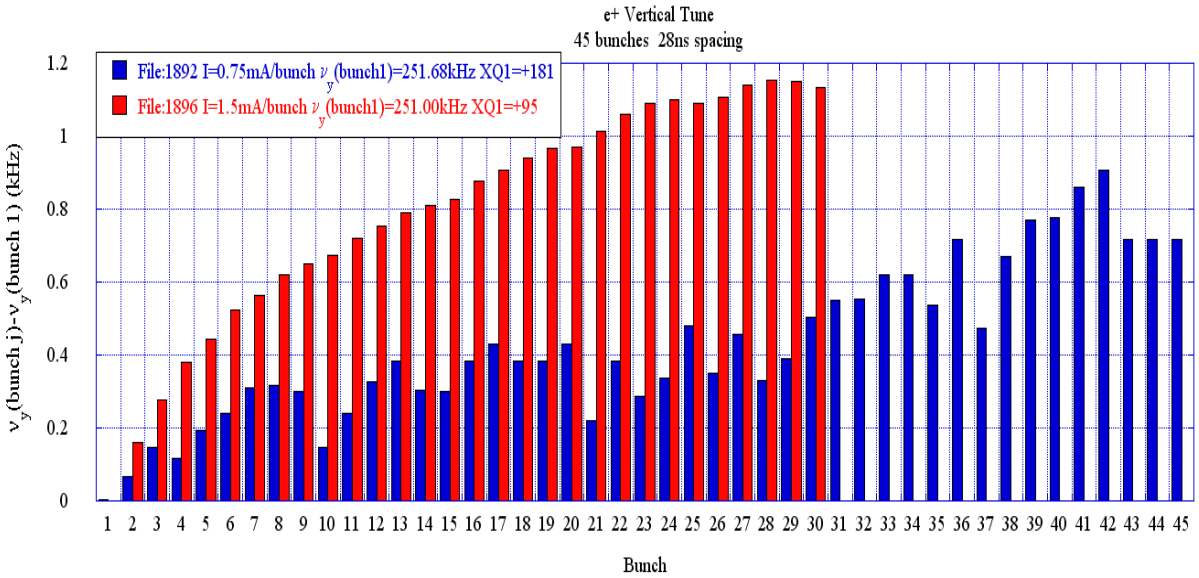


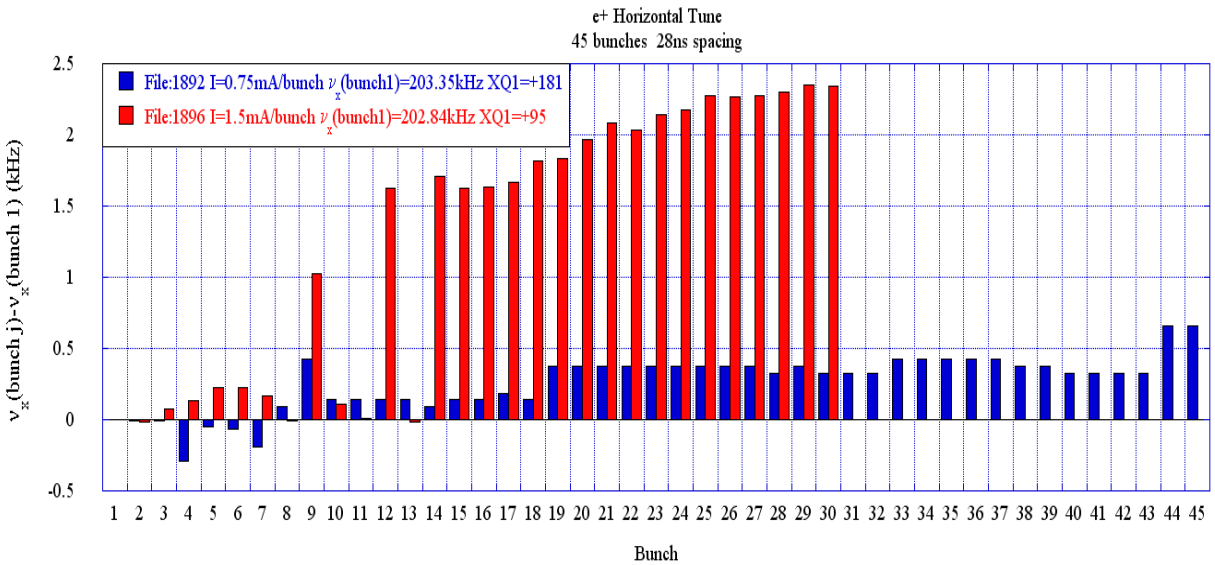
45 Bunches at 28ns Spacing



- All measurements taken at I_{e+} = 0.75mA/bunch (no electron current).
- Vertical feedback set to -2000 for file 990.
- The trends in files 991 (XQ1 = +338) and 992 (XQ1 = +95) are interrupted at bunch 30 for both vertical beam size and position. File 990 (for which vertical feedback was turned on at -2000) does not display this behavior.

45 Bunches at 28ns Spacing

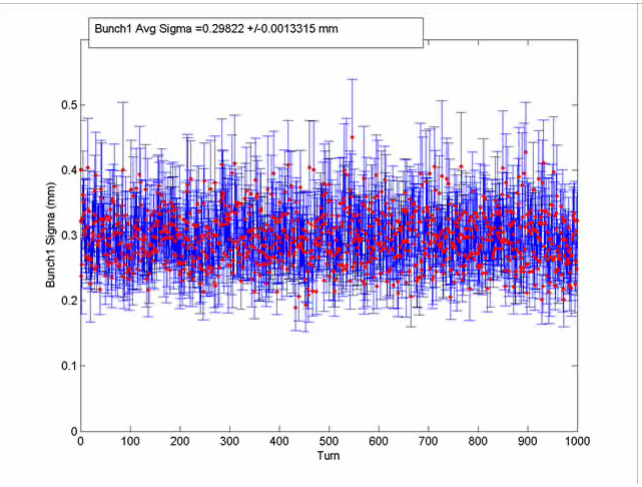




- These tune measurements were taken near the beginning (1892) and at the end (1896) of data collection for 28ns spacing.
- Both measurements were taken with pinger.
- Measurement 1892 was taken with vertical feedback on (at -2000), and horizontal feedback off. Measurement 1896 was taken with vertical feedback off and horizontal feedback on (at -520).
- The vertical tune increases along the train in both cases, but more so for measurement 1896 (which was taken in conditions similar to measurement 992). 1892 was taken in conditions similar to measurement 990.
- The horizontal tune for 1892 is mostly flat, especially after bunch 18. For 1886, the tune seems to start off with the oscillating behavior seen in the 14ns spacing conditions, then rapidly increases and decreases from bunch 9 through 14, then increases overall until bunch 30.

45 Bunches at 28ns Spacing – Vertical Beam Size

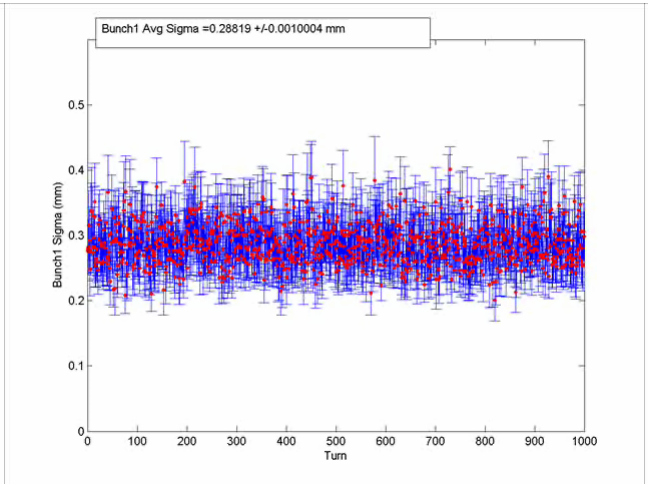
Movies: no cuts



File 990:

I_{e+} = 0.75mA/bunch, XQ1 = +181, vertical feedback at -2000

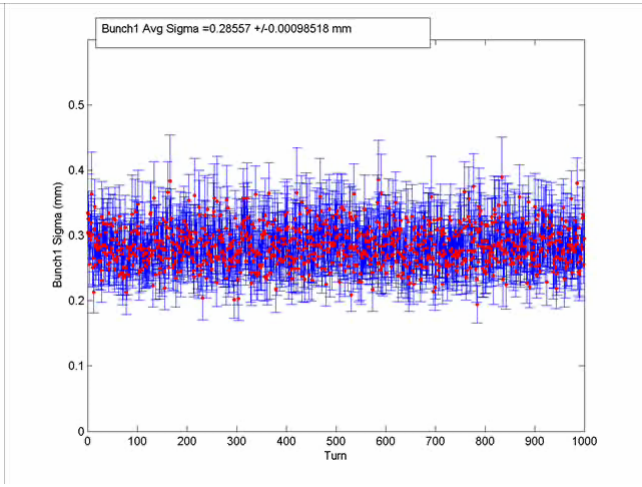
The beam size does not appear to change much along the train.



File 991:

I_{e+} = 0.5mA/bunch, XQ1 = +338

The beam size tends to increase along the train, as seen on the previous slide, until bunch 30. (Too many losses afterward).



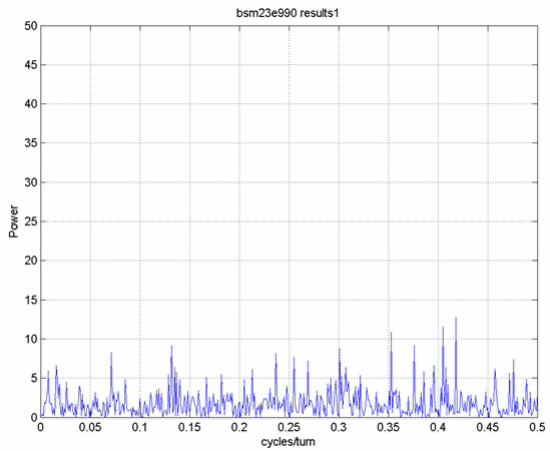
File 992:

I_{e+} = 0.35mA/bunch, XQ1 = +95, horizontal feedback at -250

The beam size tends to increase along the train, as seen on the previous slide, until bunch 30. (Too many losses afterward).

45 Bunches at 28ns Spacing – Vertical Beam Size FFT

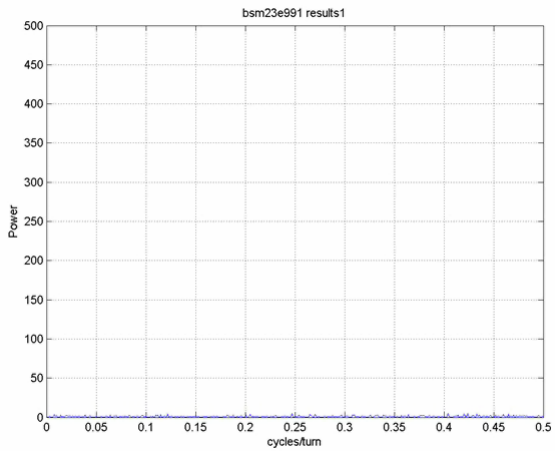
File 990



I_{e+} = 0.75mA/bunch, XQ1 = +181, vertical feedback at -2000

There is only one detection significantly above the noise level. Bunch 34 has a low-power oscillation in vertical beam size at 195.2kHz.

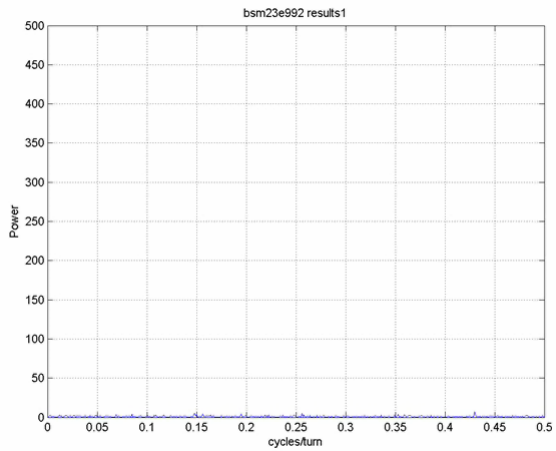
File 991



I_{e+} = 0.5mA/bunch, XQ1 = +338

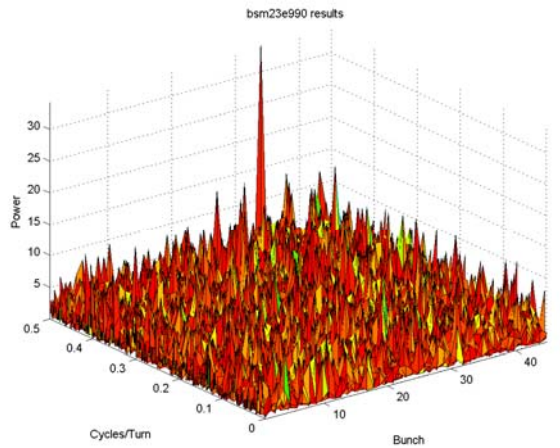
Bunches 32 and 33 appear to be oscillating at many frequencies. (The FFT was unable to pass bunch 34 – re-do?)

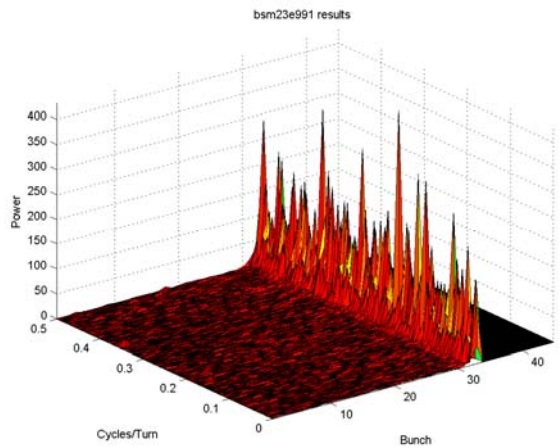
File 992

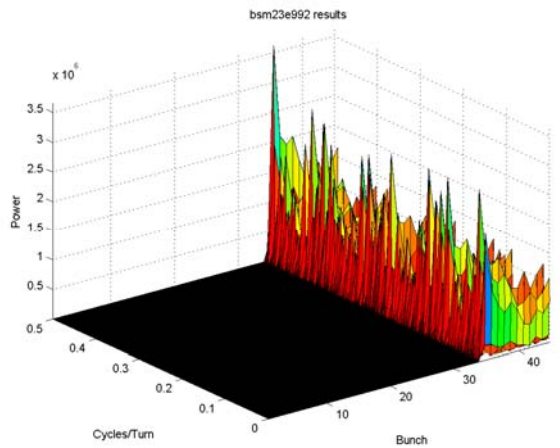


I_{e+} = 0.35mA/bunch, XQ1 = +95, horizontal feedback at -250

From bunch 32 to bunch 45, there are oscillations detected at many frequencies at high power. After bunch 34, the peak oscillation frequency is always 198.3kHz.

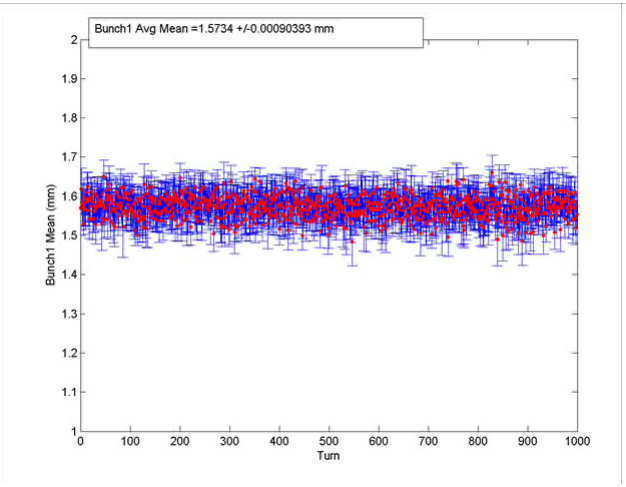


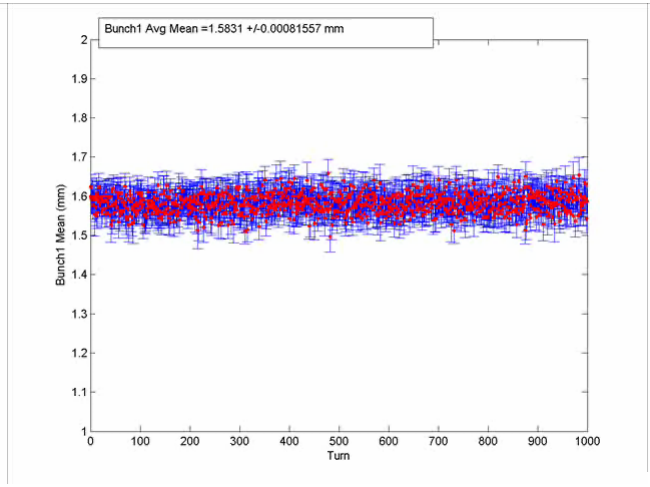


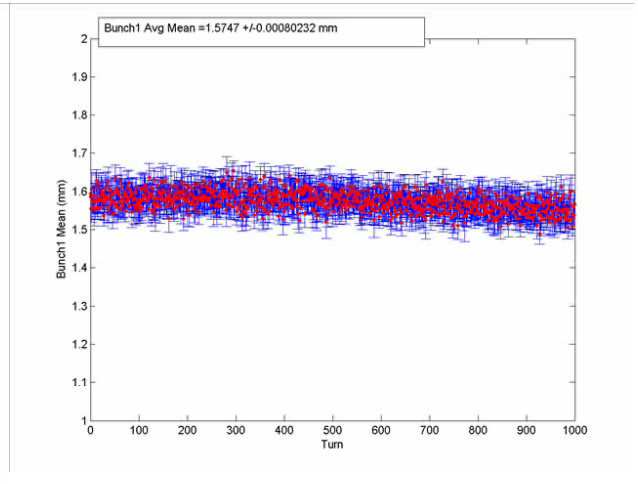


45 Bunches at 28ns Spacing – Vertical Position

Movies: no cuts







File 990:

I_{e+} = 0.75mA/bunch, XQ1 = +181, vertical feedback at -2000

Bunches toward the middle of the train are oscillating with greater amplitude than bunches toward the front and back.

File 991:

I_{e+} = 0.5mA/bunch, XQ1 = +338

The amplitude of the position oscillation seems to vary periodically until bunch 31.

File 992:

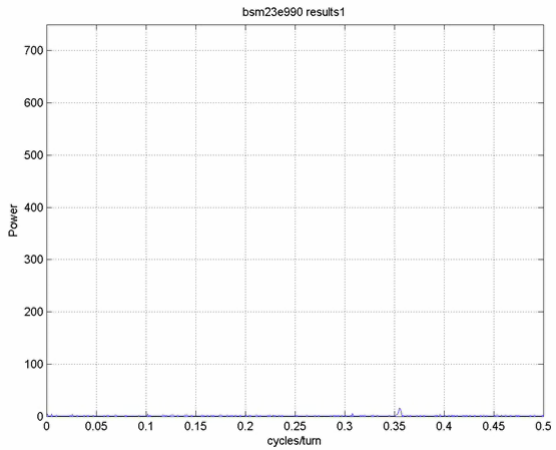
I_{e+} = 0.35mA/bunch, XQ1 = +95, horizontal feedback at -250

The amplitude of the position oscillation seems to vary periodically until bunch 31.

There may be a very slow oscillation in the beam position – note how the position shifts from high to low throughout the measurement of bunch 1 and most of the other bunches.

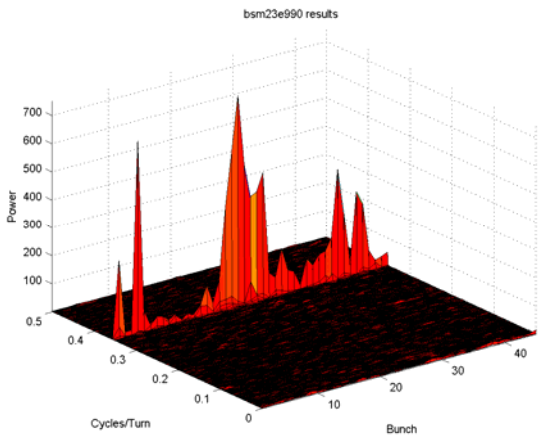
45 Bunches at 28ns Spacing – Vertical Position FFT

File 990

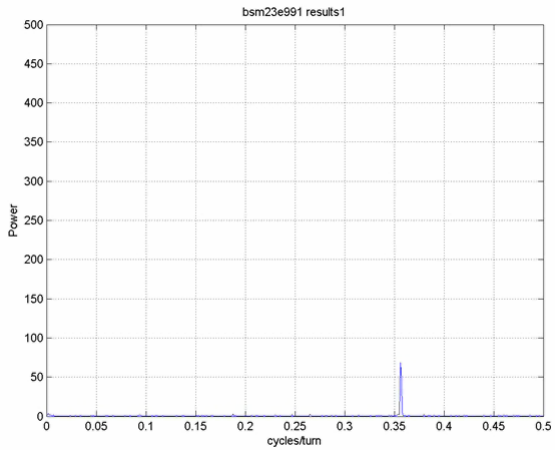


I_{e+} = 0.75mA/bunch, XQ1 = +181, vertical feedback at -2000

For all bunches, the peak oscillation frequency is near 252kHz. It generally increases from 251.8kHz to 252.2kHz along the train.

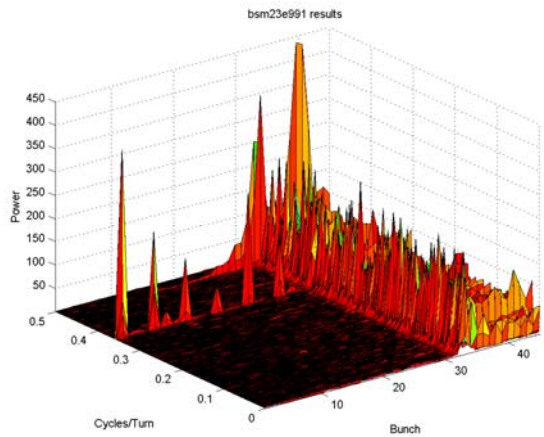


File 991

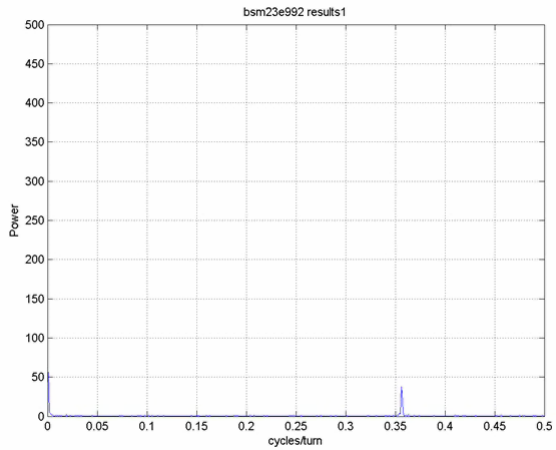


I_{e+} = 0.5mA/bunch, XQ1 = +338

Many of the bunches before bunch 28 are oscillating near 252kHz, although there appear to be periodic decreases in the strength of that signal. Another signal ranging from 205.7kHz to 204.6kHz is prominent from bunch 21 through bunch 40. After bunch 30, each bunch has oscillation signals at many frequencies.

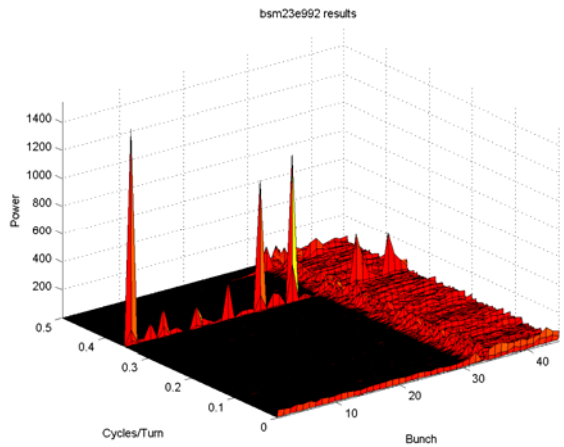


File 992

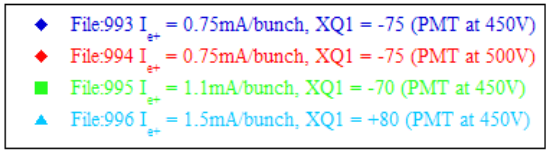


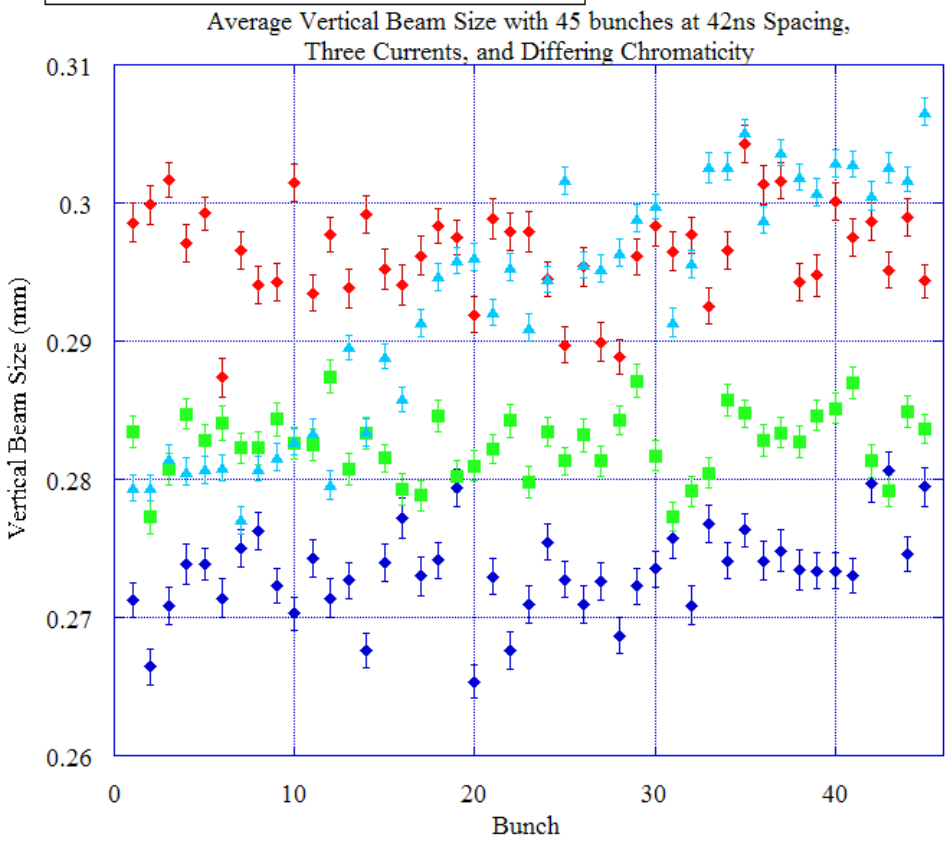
I_{e+} = 0.35mA/bunch, XQ1 = +95, horizontal feedback at -250

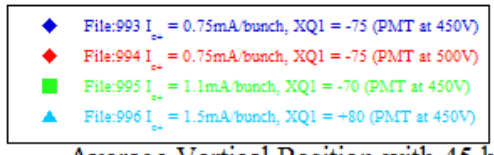
Nearly all of the bunches have a peak oscillation frequency near 252kHz. There is a second signal present after bunch 25, ranging from 206.1kHz to 204.6kHz, which sometimes is detected at a higher power than the near 292kHz signal.

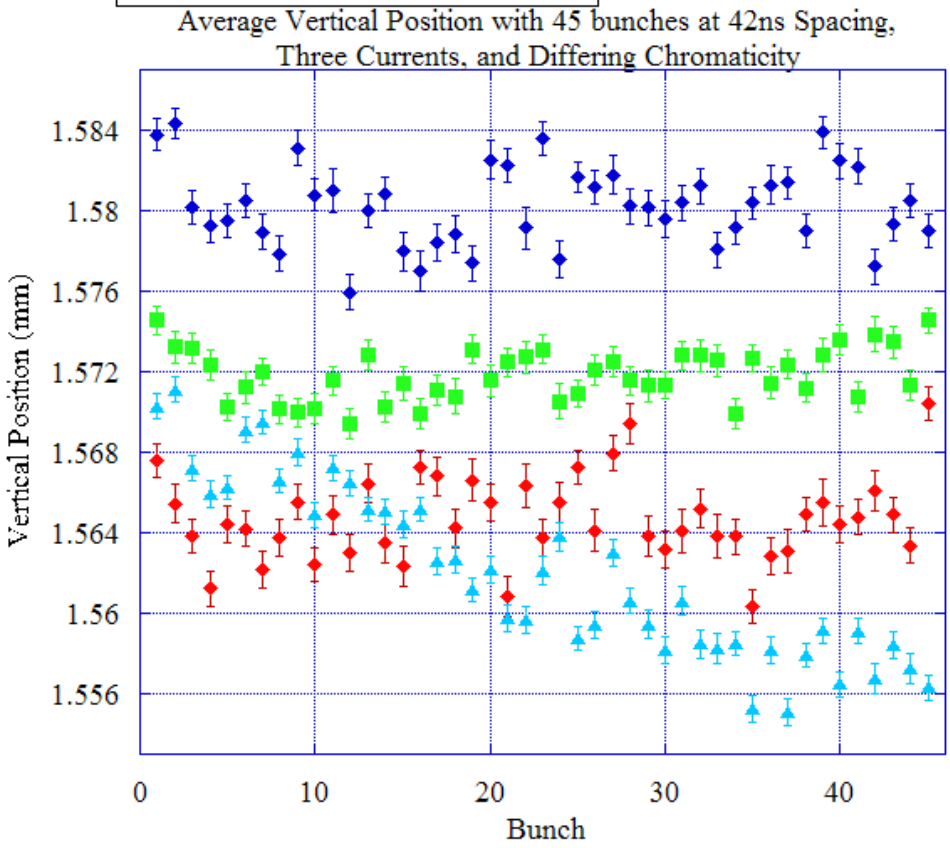


45 Bunches at 42ns Spacing



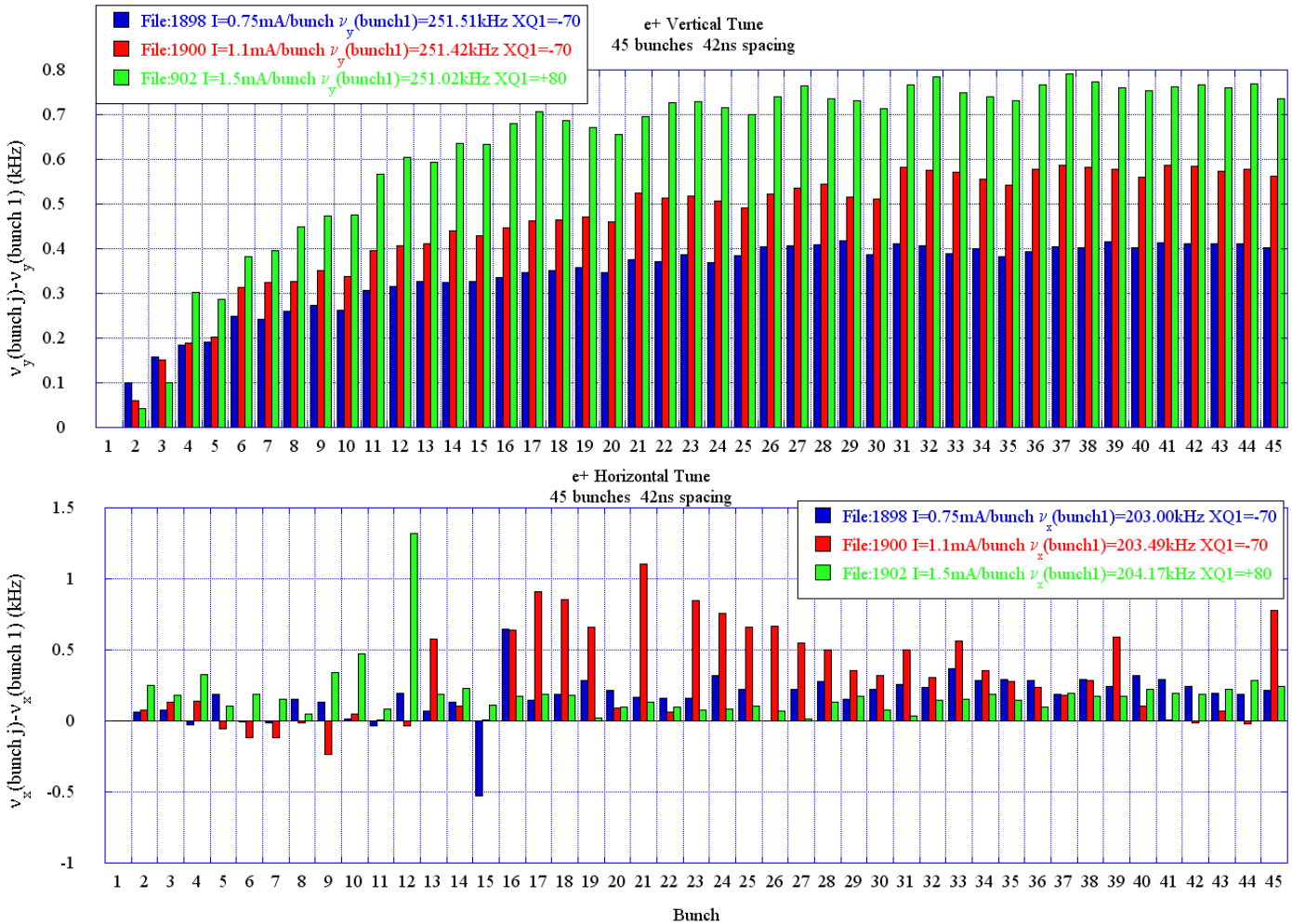






- Data taken at 0.75, 1.1 and 1.5 mA/bunch.
- File 996 (high I) displays a beam size trend to increase with bunch, and a position trend decreasing with bunch. The chromaticity for this measurement was also set to +80, higher than the other measurements taken with 42ns spacing.

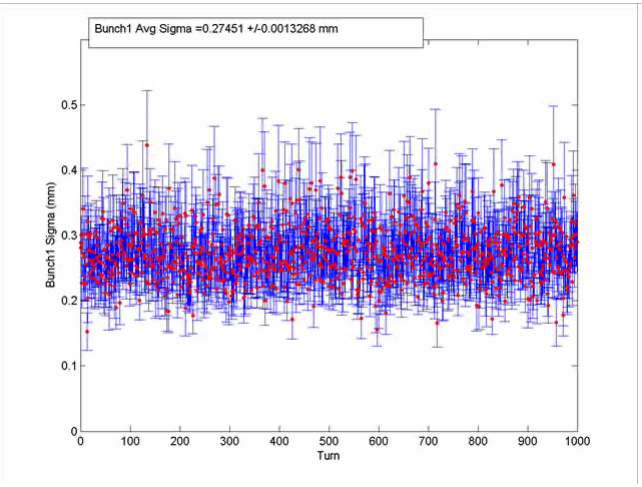
45 Bunches at 42ns Spacing



- Vertical and horizontal tunes for 42ns spacing. File 1898 was taken in conditions similar to measurements 993 and 994, 1900 in conditions similar to measurement 995, and 1902 in conditions similar to 996.
- In all cases, the vertical tune increases along the train until flattens out (with small, periodic variations) near bunch 31. High current produces a larger increase in the vertical tune along the train.
- The horizontal tunes in the high and low I files seem to show some periodic variation, though there are occasional bunches that stray from it. File 1900 also appears to display this until bunch 13, at which point it increases then decreases suddenly, though it generally has higher values throughout the middle of the train than the other two files.

45 Bunches at 42ns Spacing – Vertical Beam Size

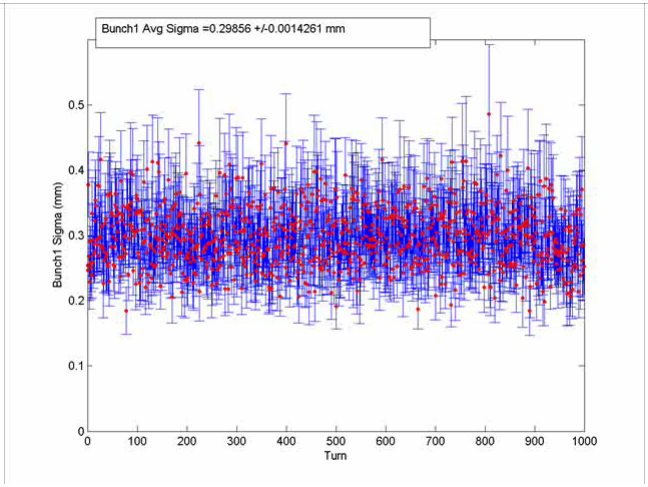
Movies: no cuts



File 993:

I_{e+} = 0.75mA/bunch, XQ1 = -75 (PMT at 450V)

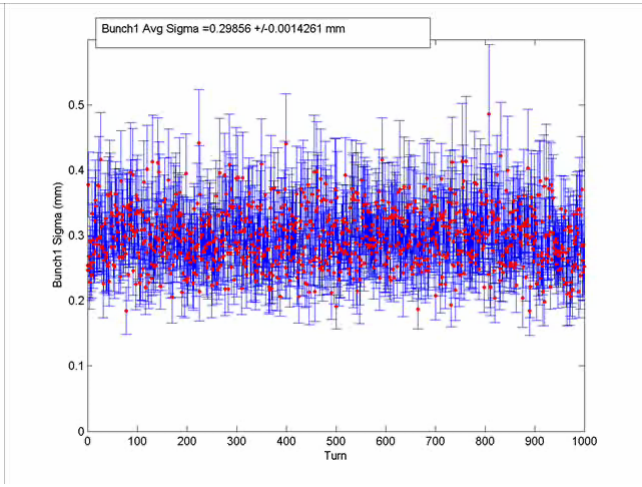
Beam size does not appear to change much between bunches.



File 994:

I_{e+} = 0.75mA/bunch, XQ1 = -75 (PMT at 500V)

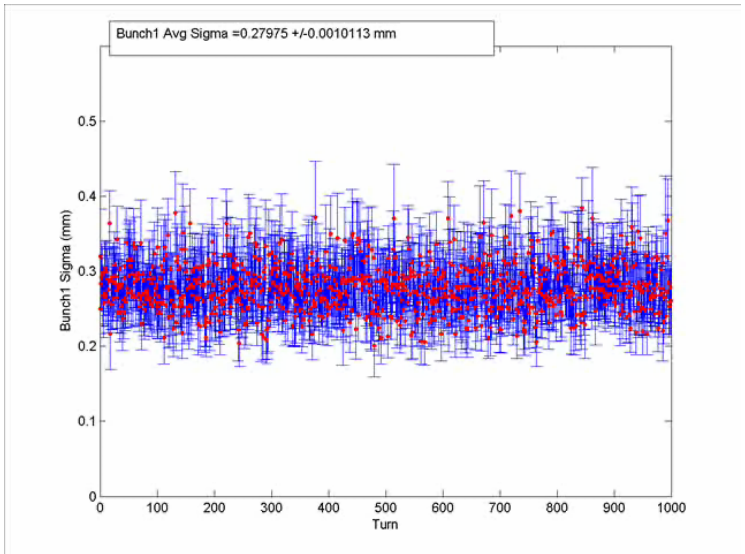
Beam size does not appear to change significantly between bunches.



File 995:

I_{e+} = 1.1mA/bunch, XQ1 = -70 (PMT at 450V)

Beam size does not appear to change significantly between bunches.



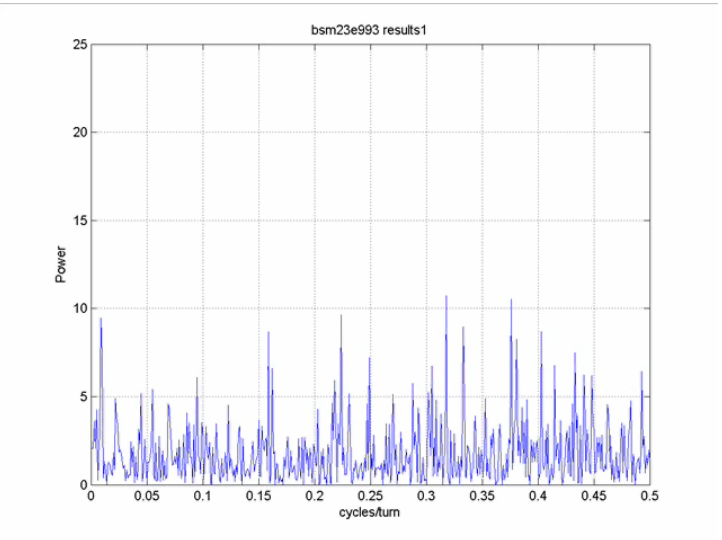
File 996:

I_{e+} = 1.5mA/bunch, XQ1 = +80 (PMT at 450V)

Beam size appears to increase slightly along the train.

45 Bunches at 42ns Spacing – Vertical Beam Size FFT

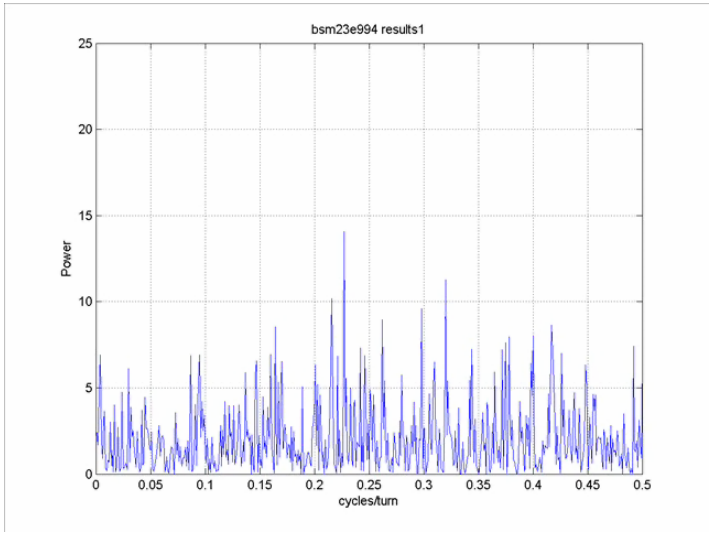
File 993



I_{e+} = 0.75mA/bunch, XQ1 = -75 (PMT at 450V)

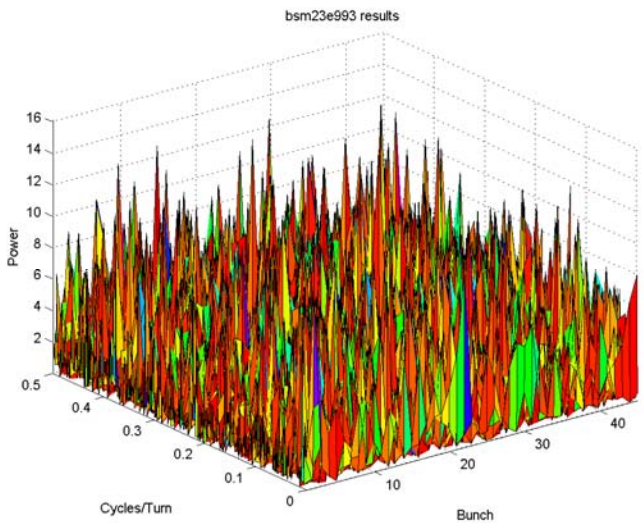
There are no detections of vertical beam size oscillation significantly above the noise level.

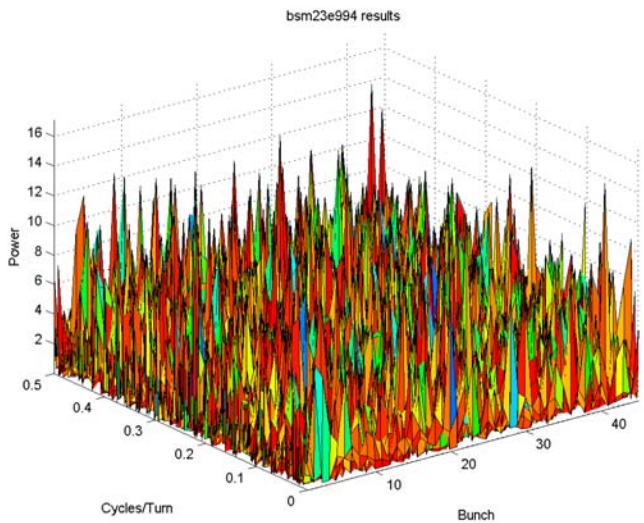
File 994



I_{e+} = 0.75mA/bunch, XQ1 = -75 (PMT at 500V)

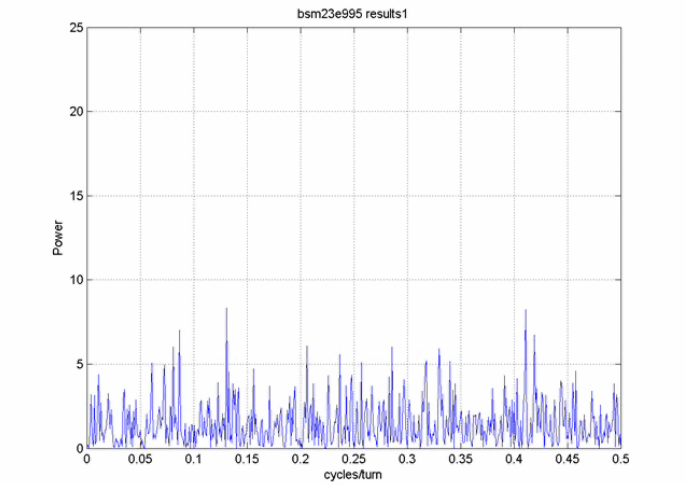
There are no detections of vertical beam size oscillation significantly above the noise level.





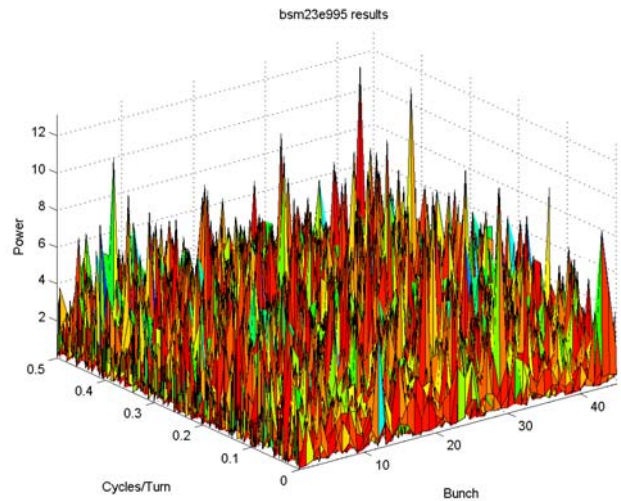
45 Bunches at 42ns Spacing – Vertical Beam Size FFT

File 995

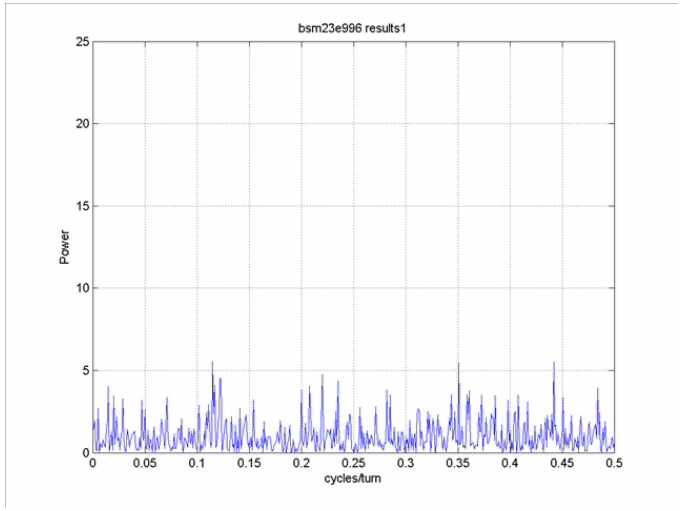


I_{e+} = 1.1mA/bunch, XQ1 = -70 (PMT at 450V)

There are no detections significantly above the noise level.

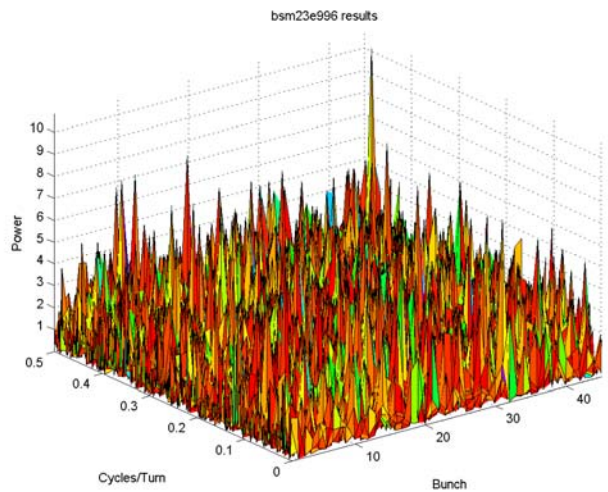


File 996



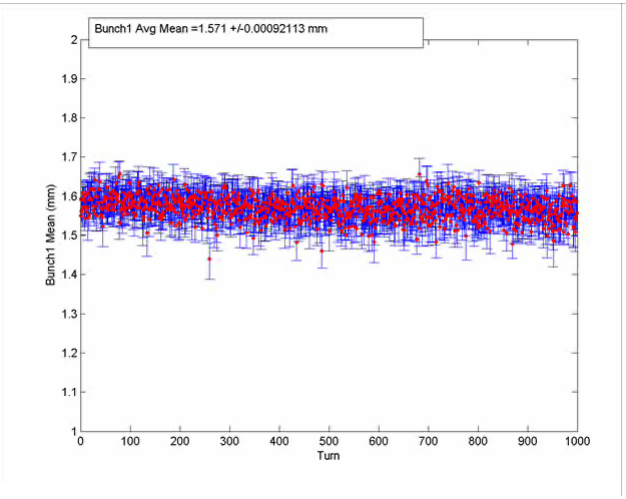
I_{e+} = 1.5mA/bunch, XQ1 = +80 (PMT at 450V)

There are no detections significantly above the noise level.



45 Bunches at 42ns Spacing – Vertical Position

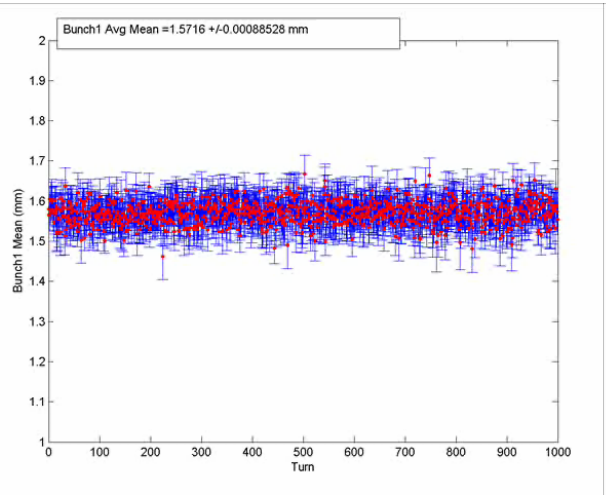
Movies



File 993:

I_{e+} = 0.75mA/bunch, XQ1 = -75 (PMT at 450V)

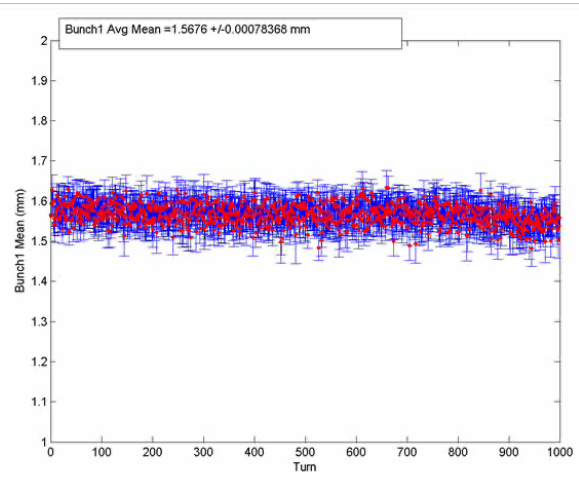
No obvious large-amplitude oscillations or changes in position along the train. There may be a very slow oscillation in position.



File 994:

I_{e+} = 0.75mA/bunch, XQ1 = -75 (PMT at 500V)

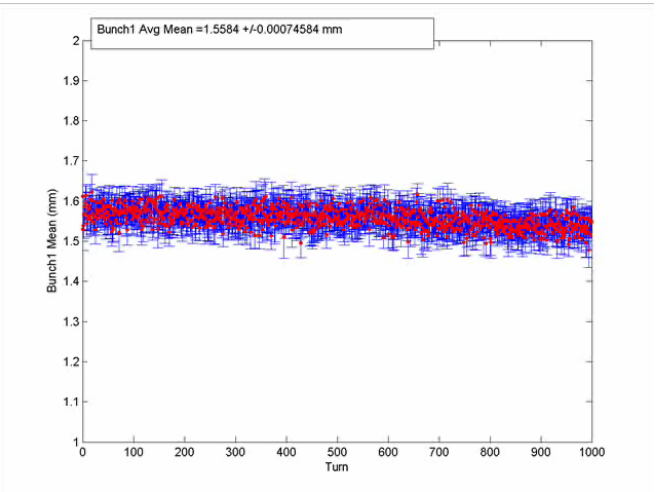
There appear to be some oscillations with amplitudes large enough to see clearly.



File 995:

I_{e+} = 1.1mA/bunch, XQ1 = -70 (PMT at 450V)

No obvious large-amplitude oscillations or changes in position along the train.



File 996:

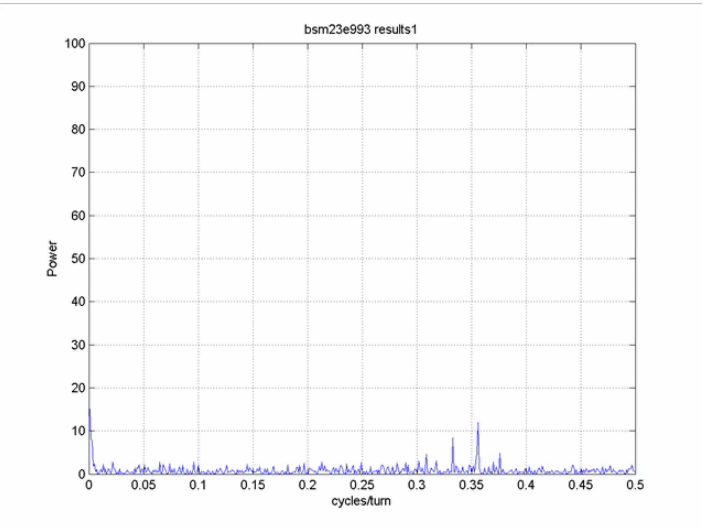
I_{e+} = 1.5mA/bunch, XQ1 = +80 (PMT at 450V)

No obvious large-amplitude oscillations.

The bunches in these measurements are much more stable than in the others from 1/30/07.

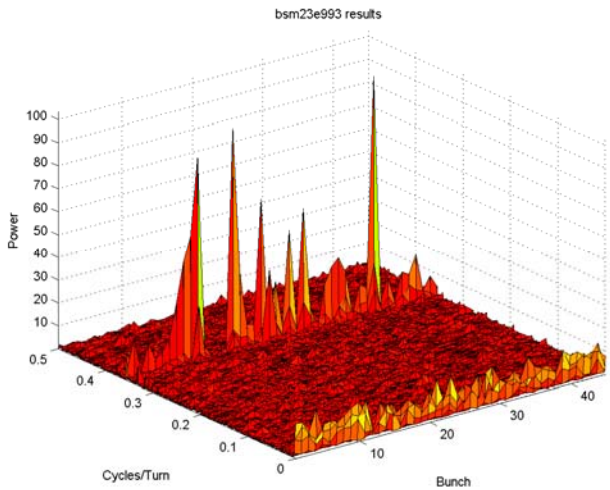
45 Bunches at 42ns Spacing – Vertical Position FFT

File 993

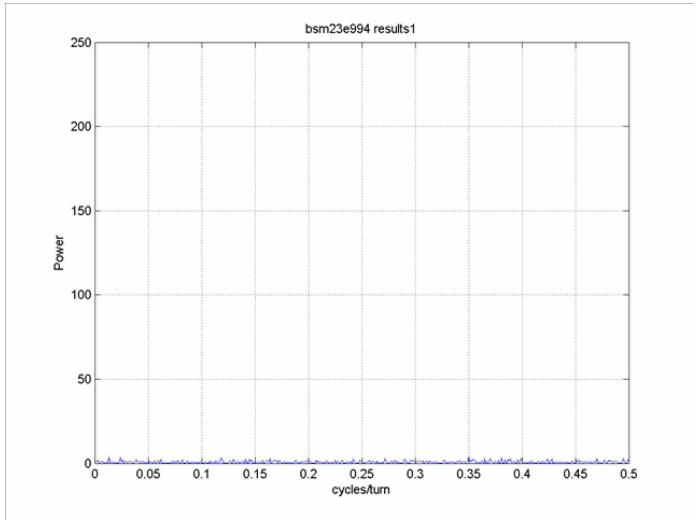


I_{e+} = 0.75mA/bunch, XQ1 = -75 (PMT at 450V)

Most bunches have peak oscillation frequencies near 252kHz. It looks like bunches 12, 13, 14 and 15 are not oscillating at that frequency, or at any other. (The small peaks toward very low frequency approach the length of the sample, and mean little).

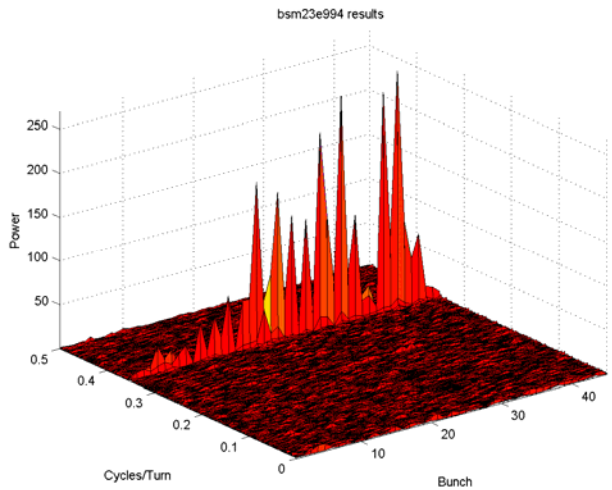


File 994



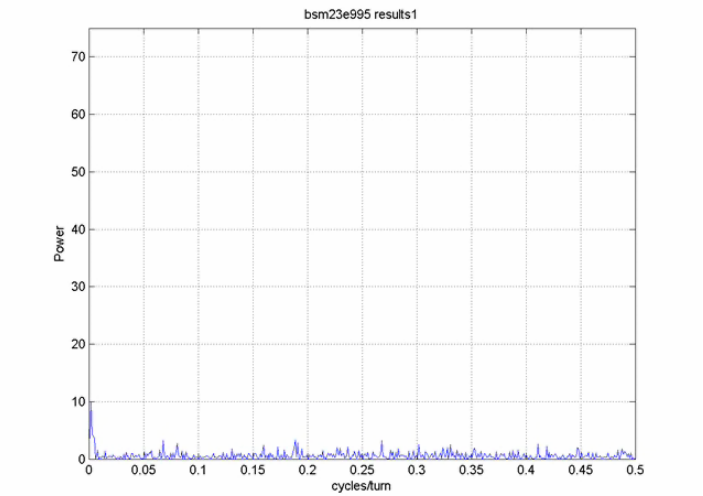
Ie+ = 0.75mA/bunch, XQ1 = -75 (PMT at 500V)

All bunches except bunch 10 have peak oscillation frequencies near 252kHz, although many of them are at low power. The frequency range is from 252.2kHz to 253.8kHz, with the beginning of the train generally at lower frequency than the end.



45 Bunches at 42ns Spacing – Vertical Position FFT

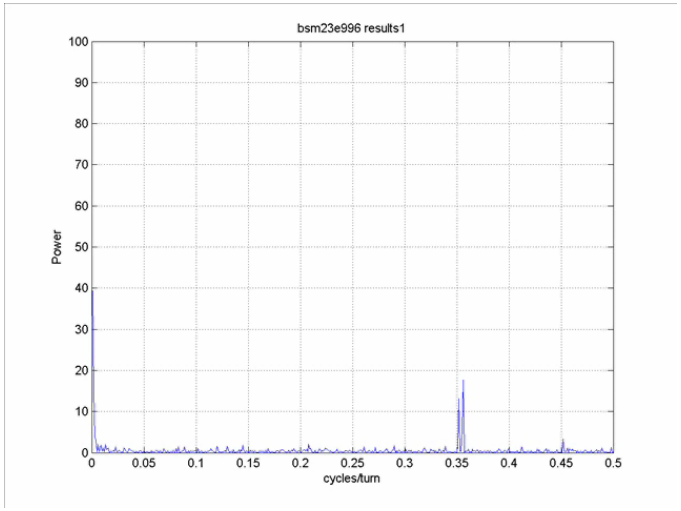
File 995



Ie+ = 1.1mA/bunch, XQ1 = -70 (PMT at 450V)

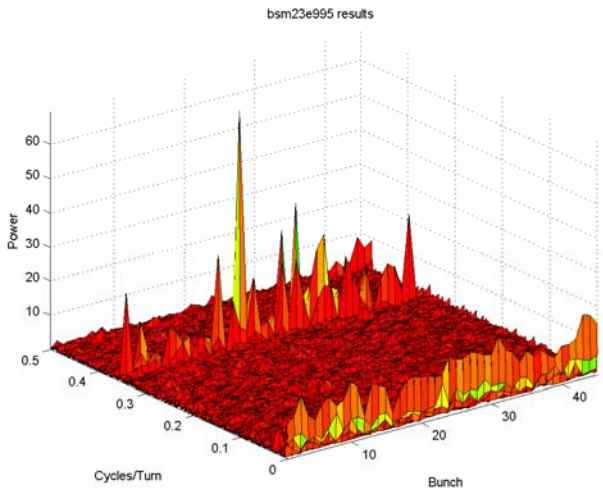
Nearly every bunch has a peak oscillation frequency near 292kHz, but at low amplitude.

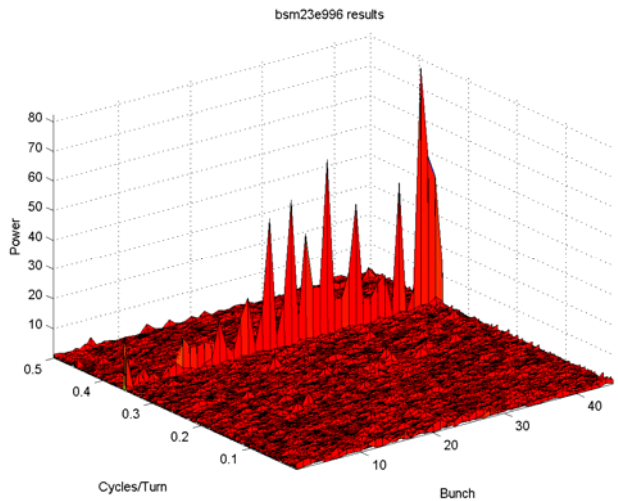
File 996



Ie+ = 1.5mA/bunch, XQ1 = +80 (PMT at 450V)

There are no detections significantly above the noise level. Nearly every bunch has a peak oscillation frequency near 292kHz, increasing along the train.





Summary

- The ~252kHz oscillations that appear in both beam size and mean correspond to the vertical tune. The frequency shift from low to high in each measurement corresponds approximately to the tune shift along the train - it is always in the same direction as that shift.
- Another oscillation frequency near 275kHz shows up in measurements 985, 987, 997, and possibly in 981 (a blip is visible on the 3D plot, but the power was much lower than the tune oscillation). This may be a signature of beam instability.
- Higher values of chromaticity may increase the amplitude of instability that already exists in vertical position.
- Vertical feedback reduces vertical beam instability significantly.
- Higher current produces larger changes in vertical tune along a train.
- Measurements 993 – 996 are much more stable than the other measurements. For the most part, their chromaticities are lower than in other measurements, but file 997, for example, also has low chromaticity but displays high instability. Measurements 995 and 996 were taken at increased current, but 993 and 994 were taken at the same current as most of the other measurements.