v. e- 12 wigglers on

Slight positive shift in Q_y along the 45 bunch train.

e- 12 Wigglers On
Average Single Turn Beam Size

Vertical Beam Size (mm)

Legend:
- File:572 I=0.25mA/bunch Vert Fdbk@0
- File:574 I=0.25mA/bunch Vert Fdbk@400
- File:578 I=0.75mA/bunch Vert Fdbk@400
- File:555 I=1.25mA/bunch Vert Fdbk@400

0.7
0.6
0.5
0.4
0.3
0.2

0   10   20   30   40

Bunch

Legend:
- MeanAv file:572 I=0.25mA Vert Fdbk@0
- MeanAv file:574 I=0.25mA Vert Fdbk@400
- MeanAv file:578 I=0.75mA Vert Fdbk@400
- MeanAv file:555 I=1.25mA Vert Fdbk@400

e- 12 Wigglers On
Average Single Turn
Mean Vertical Position

Mean Vertical Position (mm)

1.95
1.9
1.85
1.8
1.75
1.7
1.65
1.6
1.55

0   10   20   30   40

Bunch

Summary of the vertical position and σ_v along the 45 bunch trains with 12 wiggler magnets on.

Legend:
- I=0.22mA/bunch File:434 Vert. Fdbk@400
- I=0.32mA/bunch File:433 Vert. Fdbk@0
- I=0.77mA/bunch File:437 Vert Fdbk@0
- I=0.71mA/bunch File:438 Vert Fdbk@400
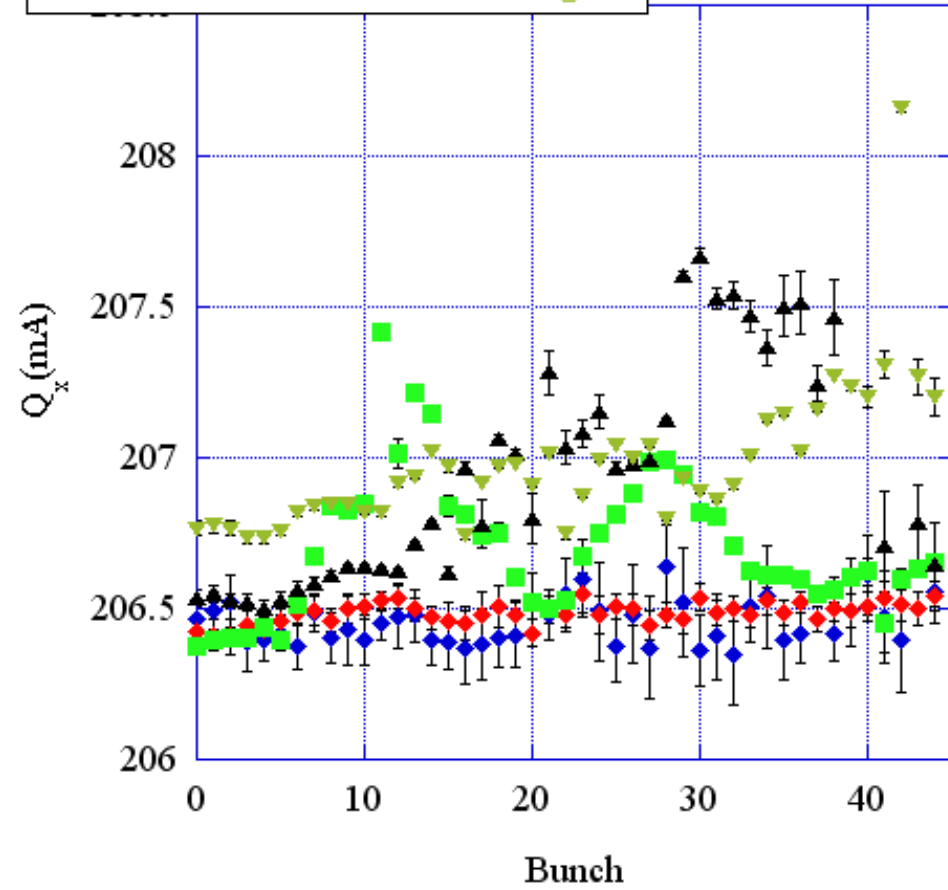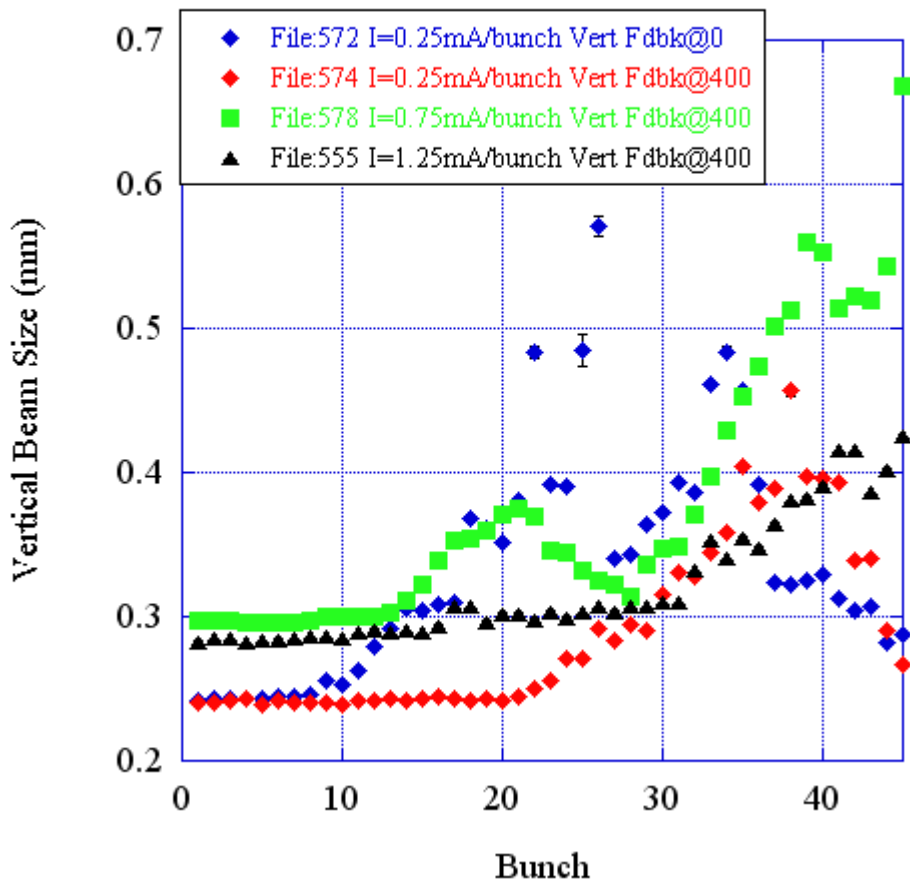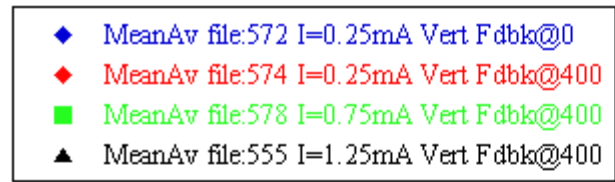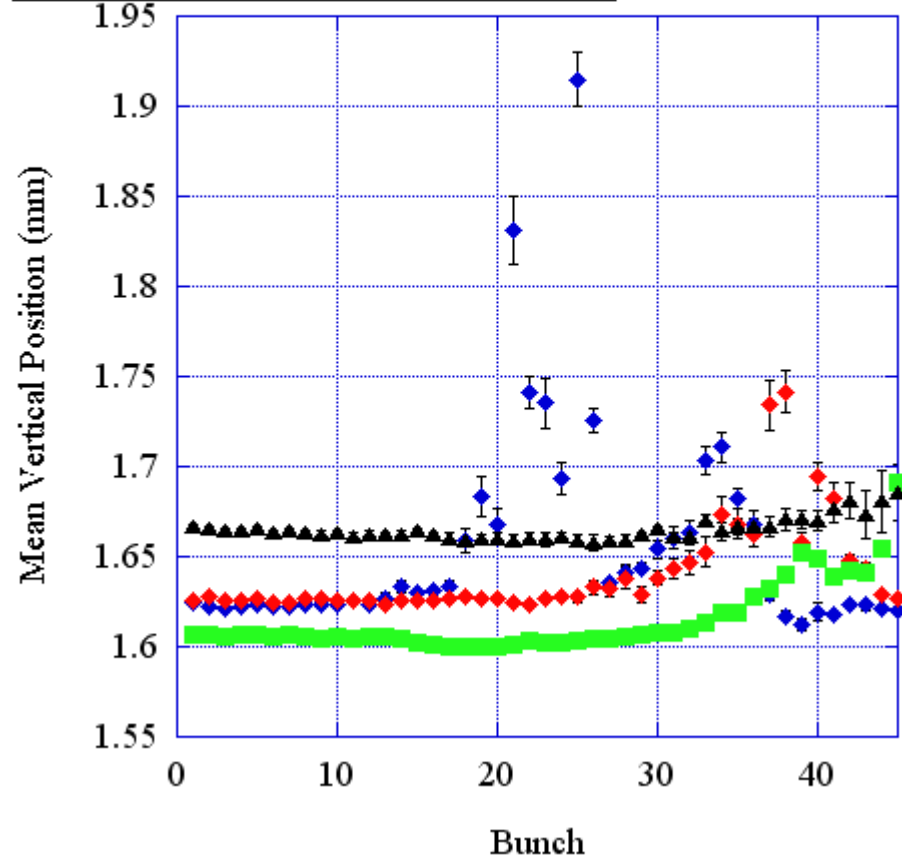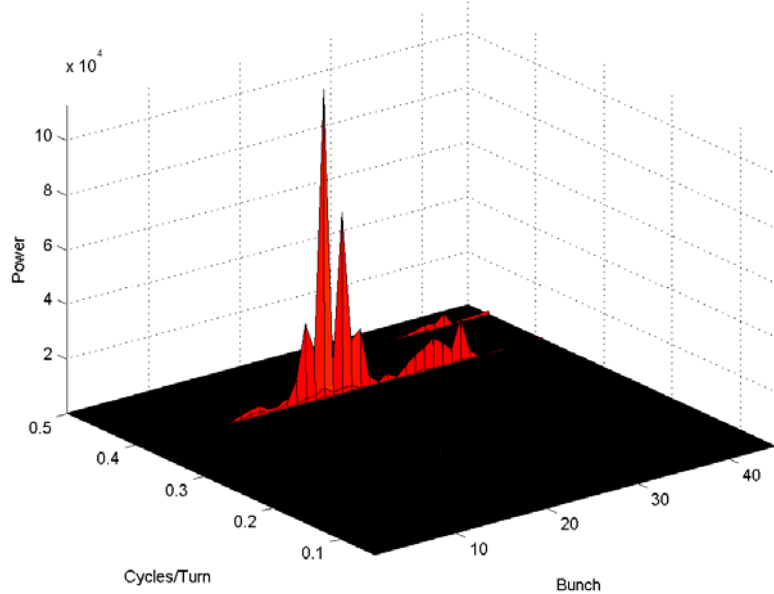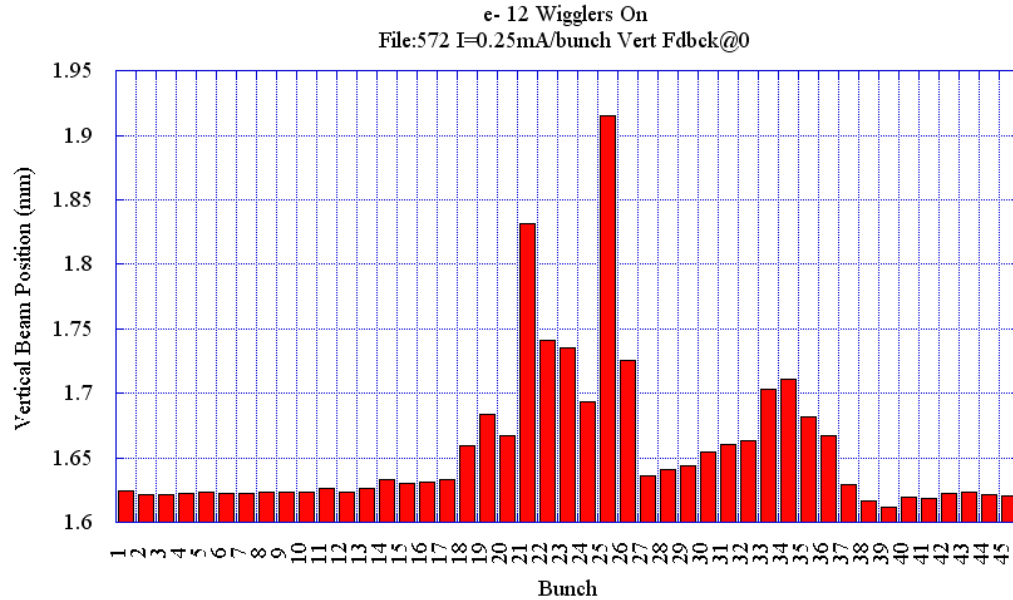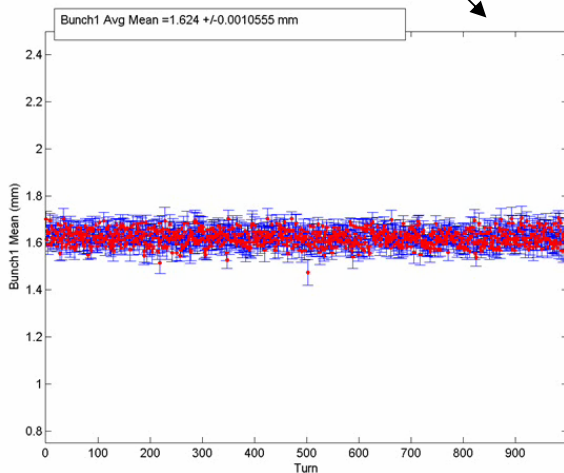- I=1.33mA/bunch File:439 Vert Fdbk@400

e-
12 Wigglers On

Y-axis: I(mA)
X-axis: Bunch
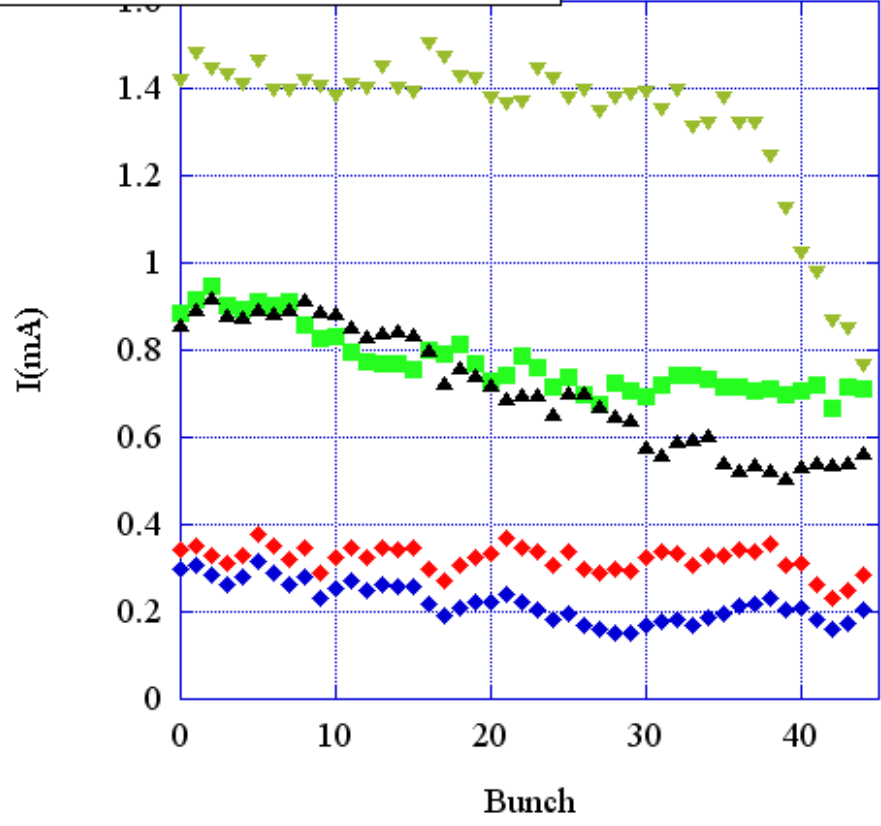
Non-uniform bunch current along the 45 bunch train at high current.

BSM23W572 results45

FFT Vertical position I_{e-}=0.25mA/bunch
File:572 e- 12 wigglers on
Vert. Fdbck@0

e- 12 Wigglers On
File:572 I=0.25mA/bunch Vert Fdbck@0
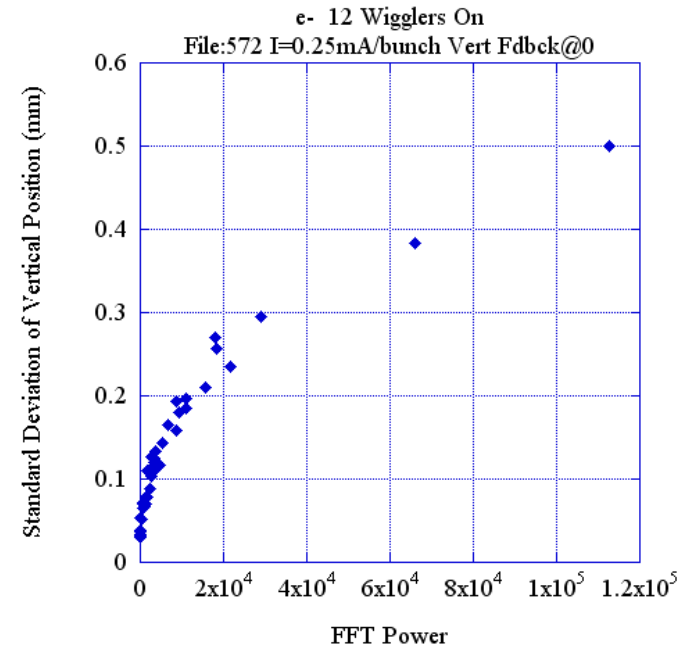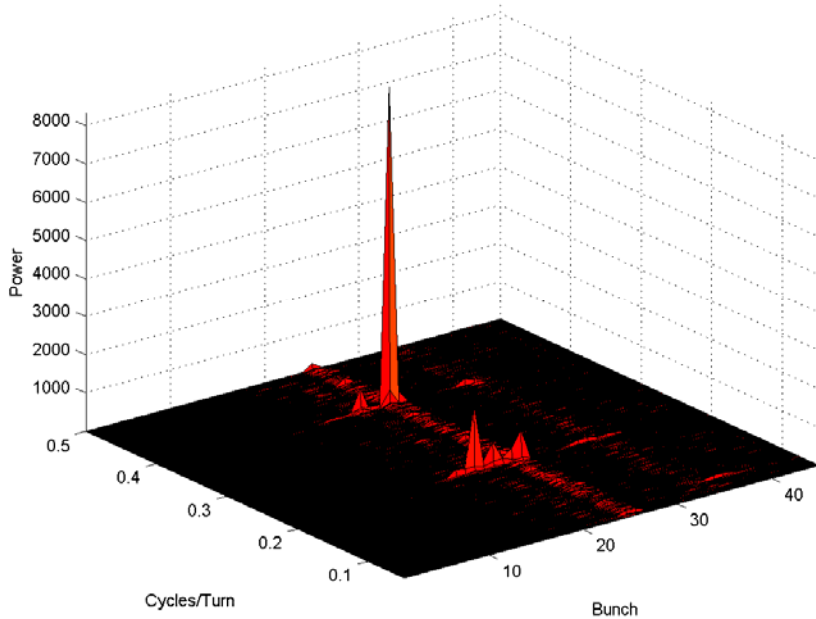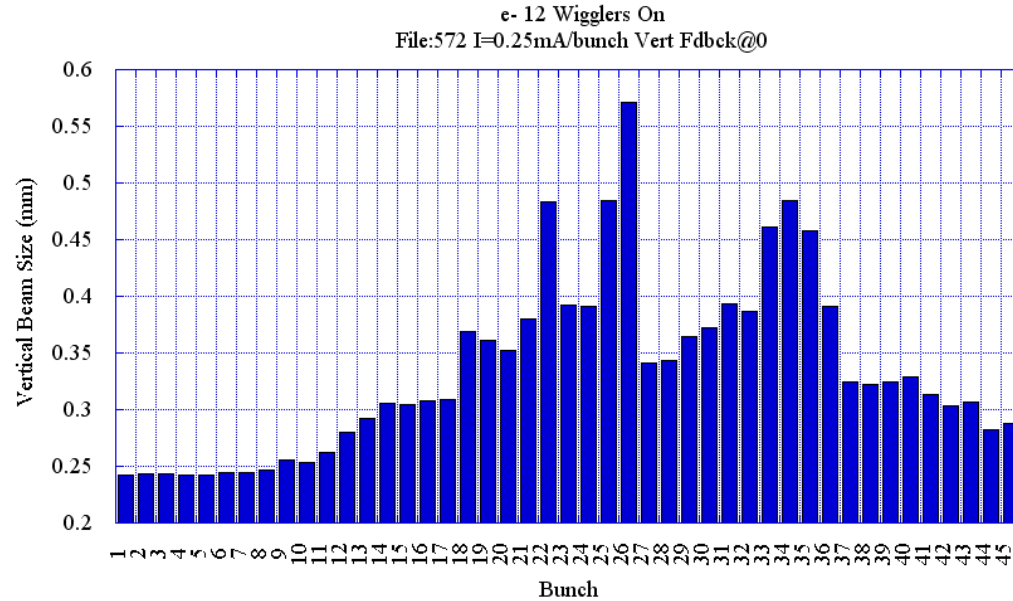
Vertical position movie

Low I with vertical feedback off:

• Vertical position oscillation occurs at bunch 12 (f_{osc}=237.8kHz) and the oscillation amplitude correlates with FFT power.

• The oscillation dies out near the end of the train (~bunch 40).

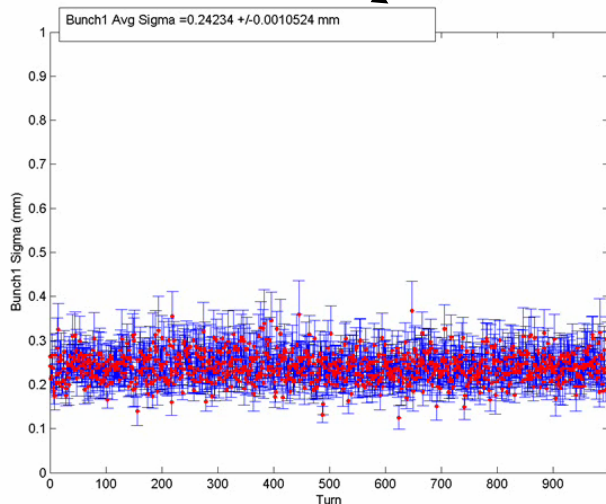e- 12 Wigglers On
File:572 I=0.25mA/bunch Vert Fdbck@0

BSM23W572 results45

FFT σ_v I$_{e-}$=0.25mA/bunch
File:572 e- 12 wigglers on
Vert. Fdbck@0

e- 12 Wigglers On
File:572 I=0.25mA/bunch Vert Fdbck@0

σ_v movie

Bunch1 Avg Sigma =0.24234 +/-0.0010524 mm

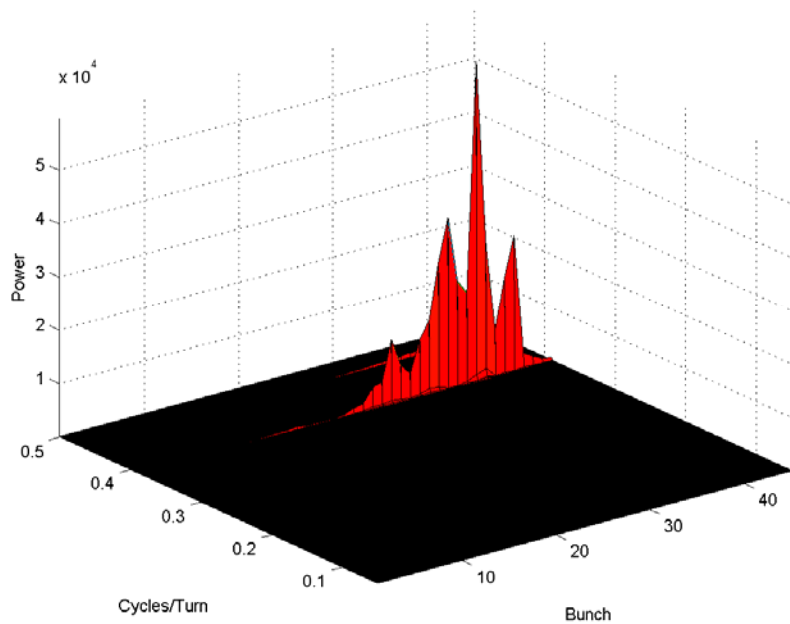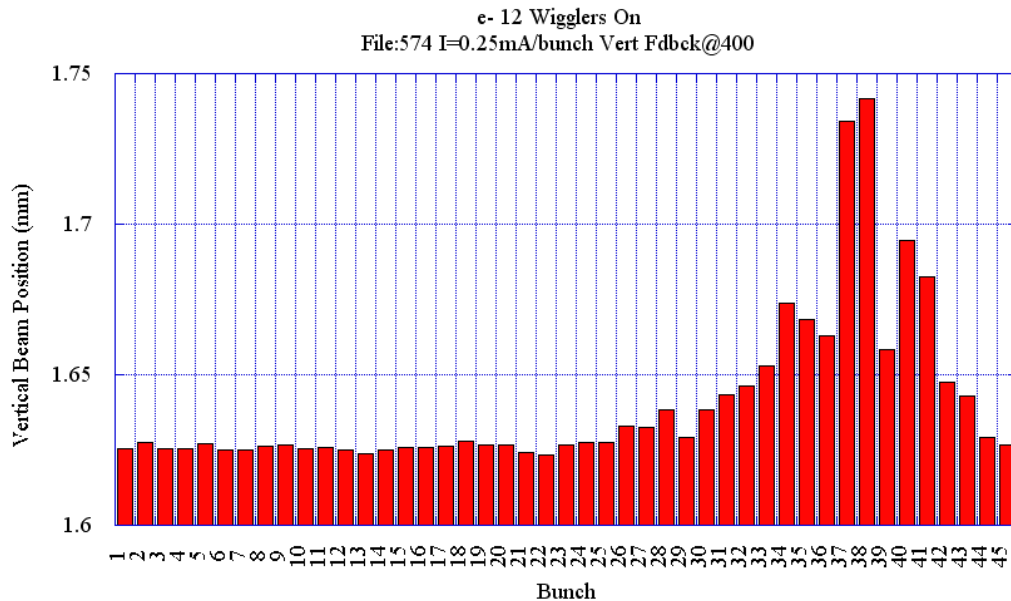• σ_v growth along the train starts at ~bunch 10. Two oscillation frequencies are presents in the beam spectrum at f_{osc}=237.8kHz (0.391 cycles/turn) and 305.3kHz (0.218 cycles/turn).
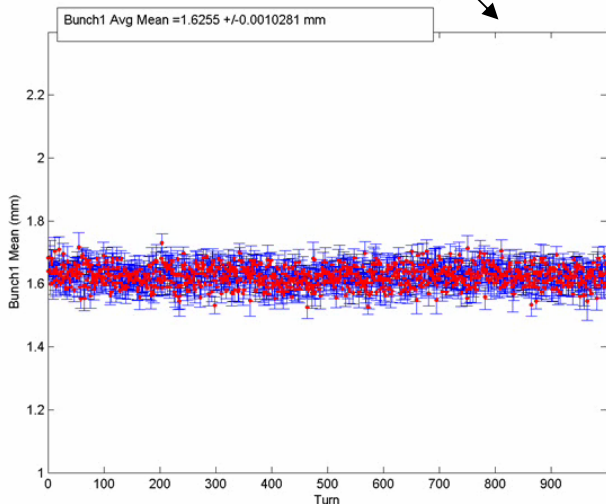
•A broad beam spectrum is observed for bunches 25 and 34 which correlates with the peak in σ_v.

BSM23W574 results45

FFT Vertical position I_{e-}=0.25mA/bunch
File:574 e- 12 wigglers on
Vert. Fdbck@400

e- 12 Wigglers On
File:574 I=0.25mA/bunch Vert Fdbck@400

Vertical position movie

Bunch1 Avg Mean =1.6255 +/-0.0010281 mm
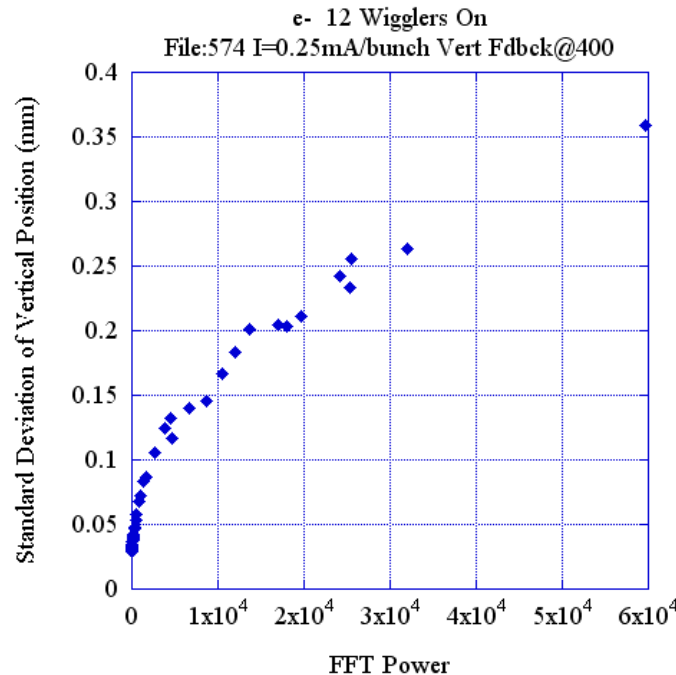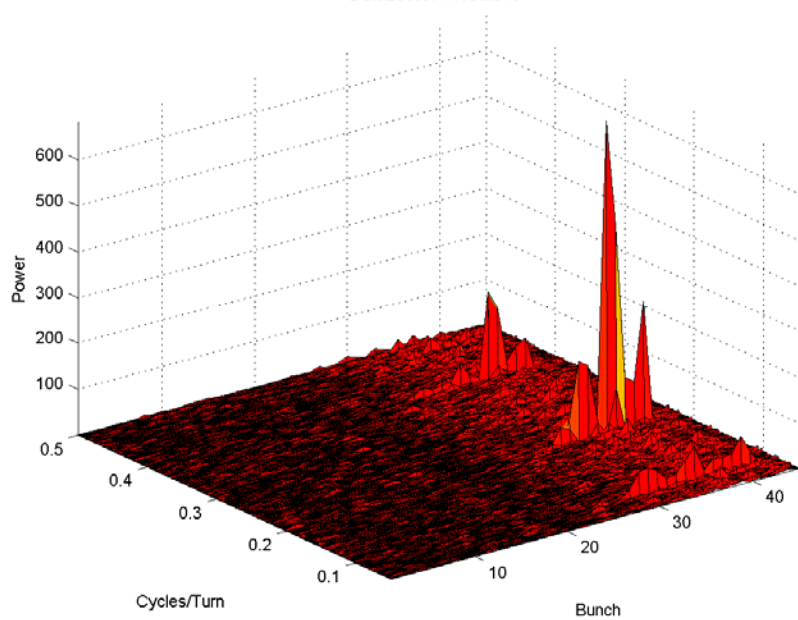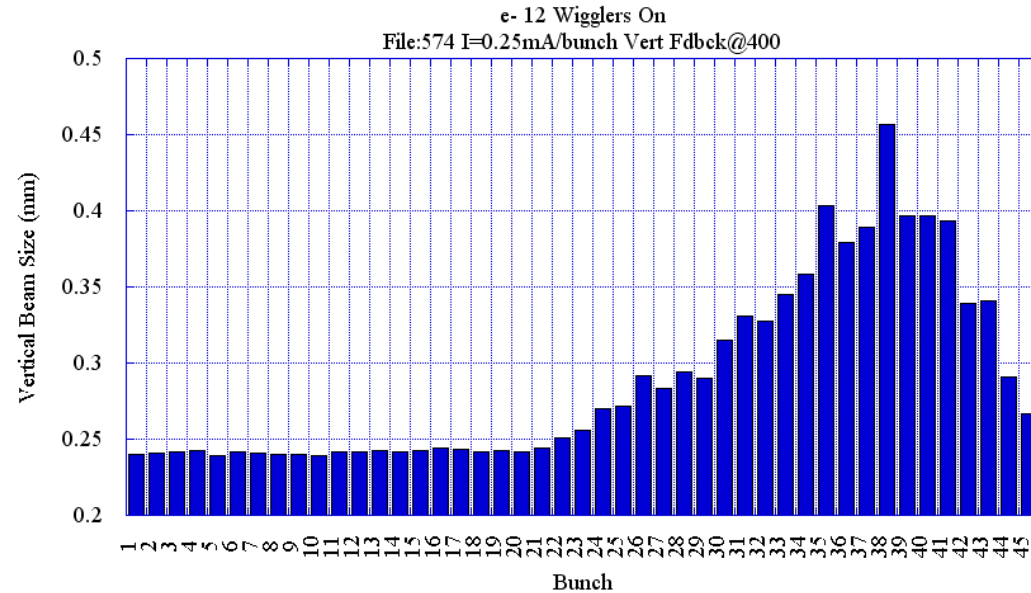
At low I with vertical feedback on:

• Vertical position oscillation occurs later in the train (~bunch 26) and the oscillation amplitude correlates with FFT power (fosc=238.1kHz) but with a reduced amplitude.

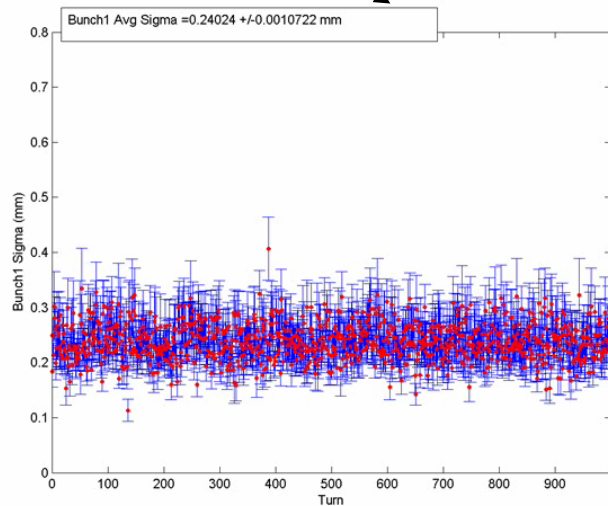• Again, the oscillation dies out near the end of the train (~bunch 44).

e- 12 Wigglers On
File:574 I=0.25mA/bunch Vert Fdbck@400

FFT σ_v I_{e-}=0.25mA/bunch
File:574 e- 12 wigglers on
Vert. Fdbck@400

σ_v movie

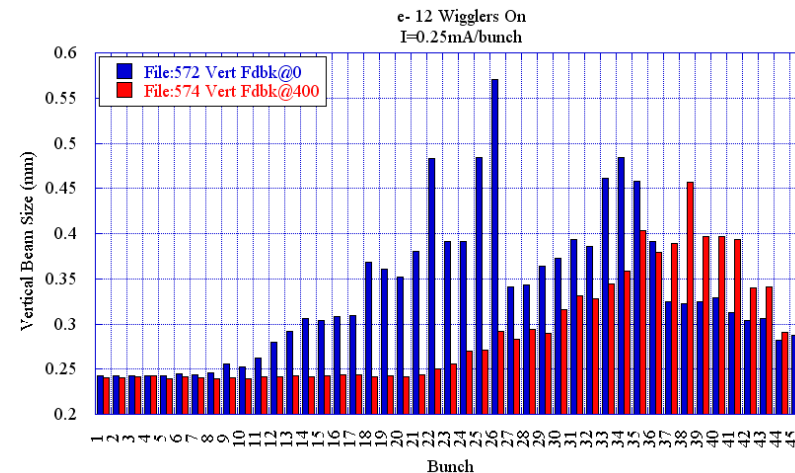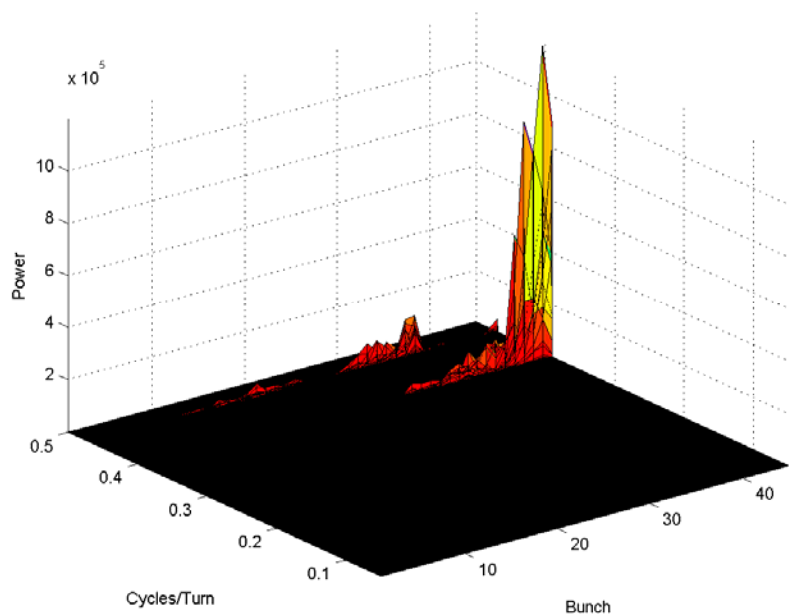- σ_v growth along the train starts at ~bunch 22. Three oscillation frequencies are presents in the beam spectrum at f_{osc}=238.1kHz (0.390 cycles/turn), 304.5kHz (0.22 cycles/turn), and 359.2kHz (0.08cycles/turn). Maximum σ_v correlates with maximum vertical oscillation amplitude.
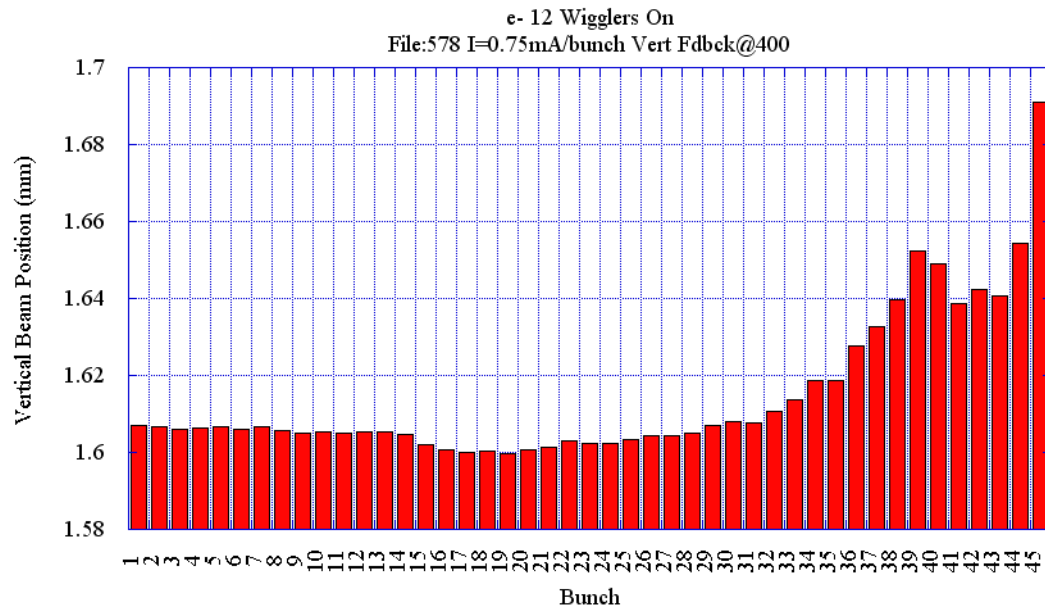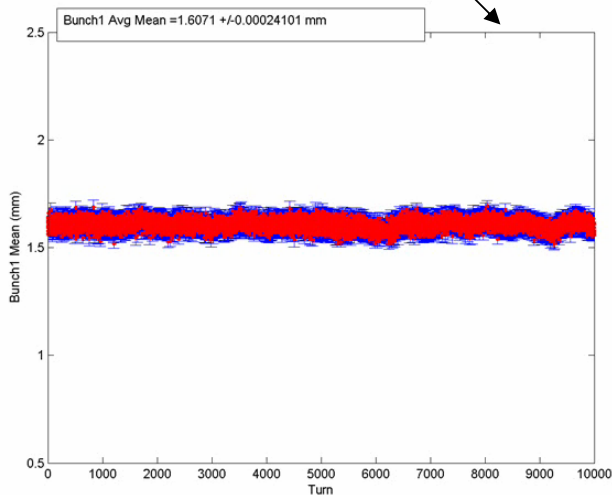- Wide frequency spectrum is not as evident with feedback on.

bsm23w578 results45

FFT Vertical position I_{e-}=0.75mA/bunch
File:578 e- 12 wigglers on
Vert. Fdbck@400

e- 12 Wigglers On
File:578 I=0.75mA/bunch Vert Fdbck@400
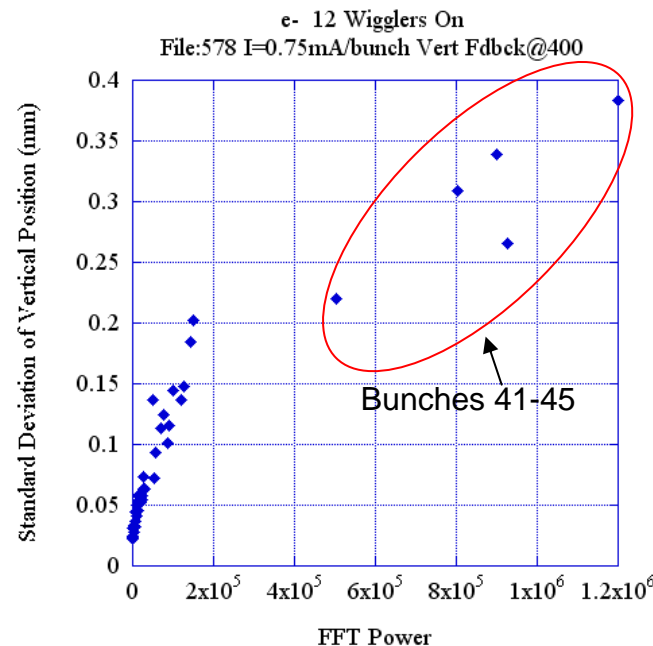
Vertical position movie
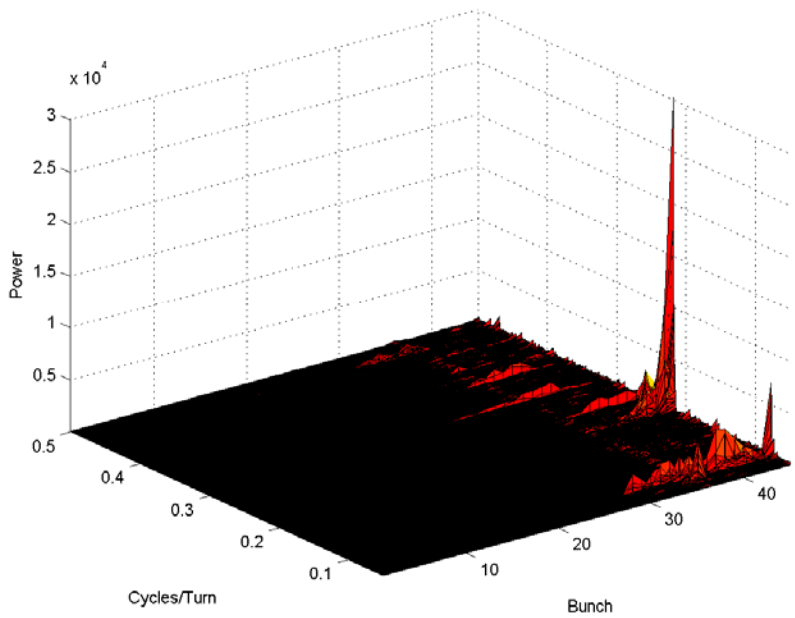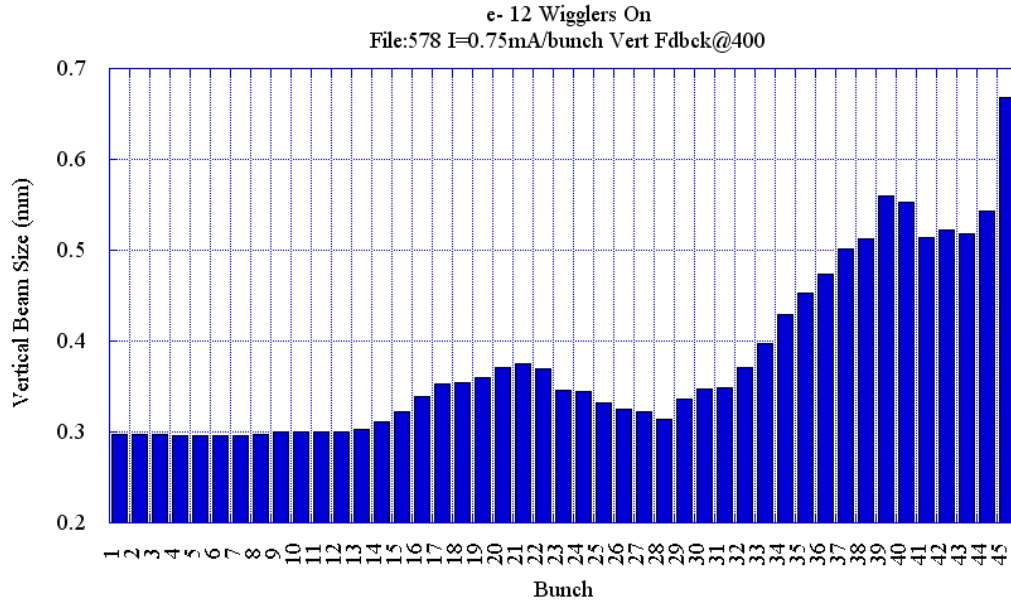

At I=0.75mA/bunch with vertical feedback on:

• Vertical position oscillation occurs at ~bunch 26 in the FFT. The oscillation amplitude increases with FFT power

•Two oscillation frequencies are present, f_{osc}=237.8kHz (0.391cycles/turn) and 207.7kHz (0.468cycles/turn).

e- 12 Wigglers On
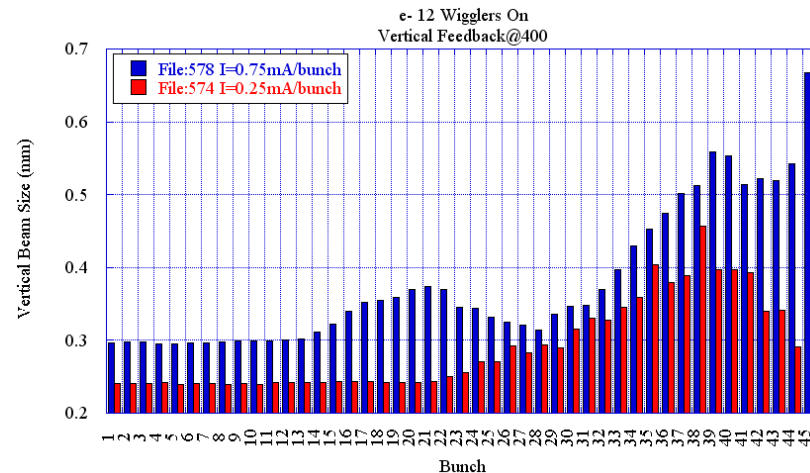File:578 I=0.75mA/bunch Vert Fdbck@400

Bunches 41-45

bsm23w578 results45

FFT σ_v I_{e-}=0.75mA/bunch
File:578 e- 12 wigglers on
Vert. Fdbck@400

e- 12 Wigglers On
File:578 I=0.75mA/bunch Vert Fdbck@400

• σ_v growth along the train starts at two locations, at bunch 15, and bunch 30. Many oscillation frequencies are presents in the beam spectrum.
• At higher current, σ_v growth along the train starts earlier and has a steeper slope. σ_v(I=0.75mA/bunch) > σ_v(I=0.25mA/bunch)

σ_v movie

e- 12 Wigglers On
Vertical Feedback@400
File:578 I=0.75mA/bunch
File:574 I=0.25mA/bunch

BSM23W555 results45
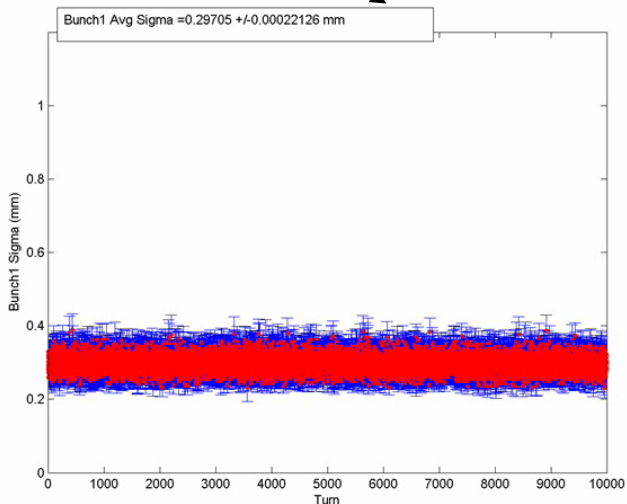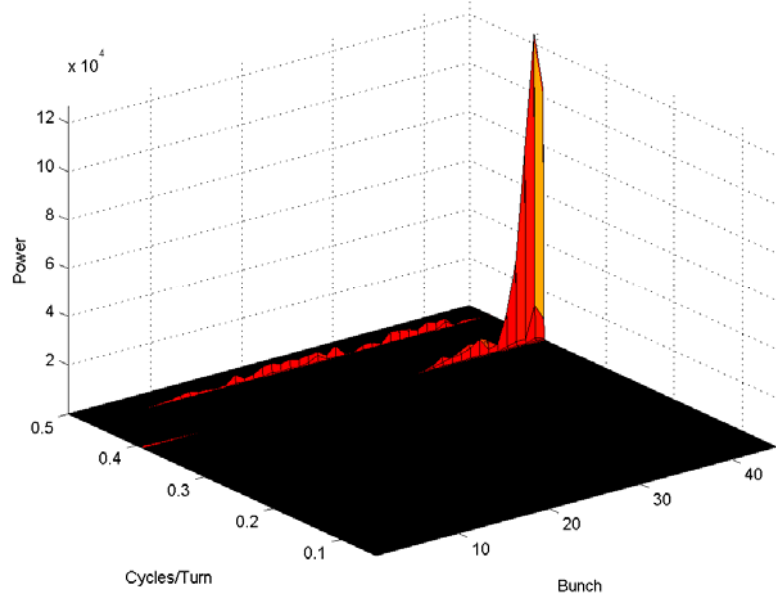
FFT Vertical position I_{e^-}=1.25mA/bunch
File:555 e- 12 wigglers on
Vert. Fdbck@400

e- 12 Wigglers On
File:555 I=1.25mA/bunch Vert Fdbck@400
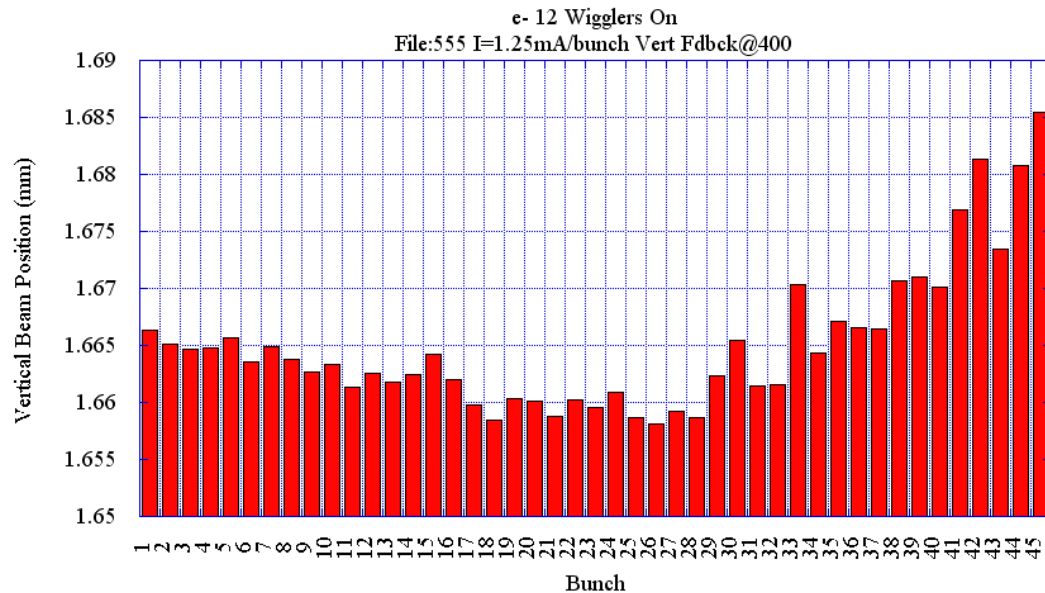
Increased current with vertical feedback on:

• The vertical position oscillation amplitude increased. The oscillation amplitude correlates with FFT power.

• The vertical position initially decreases. At ~bunch 26 the vertical position increases.

• Two oscillation frequencies are present, f_{osc}=237.4kHz (0.392 cycles/turn) and 207.3kHz (0.469 cycles/turn).
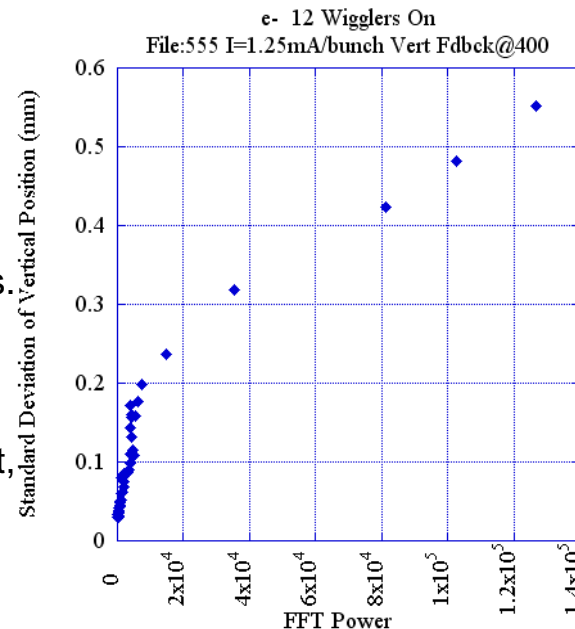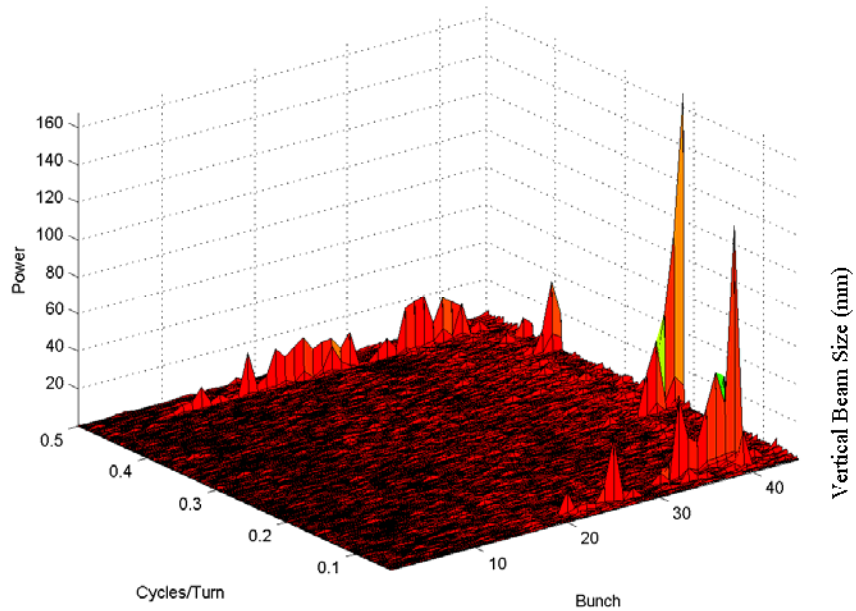
Vertical position movie

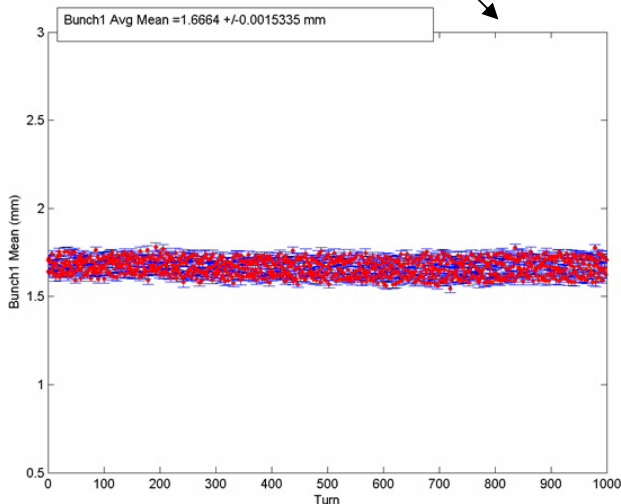Bunch1 Avg Mean =1.6664 +/-0.0015335 mm

e- 12 Wigglers On
File:555 I=1.25mA/bunch Vert Fdbck@400

BSM23W555 results45

FFT σ_v I_{e-}=1.25mA/bunch
File:555 e- 12 wigglers on
Vert. Fdbck@400

e- 12 Wigglers On
File:555 I=1.25mA/bunch Vert Fdbck@400
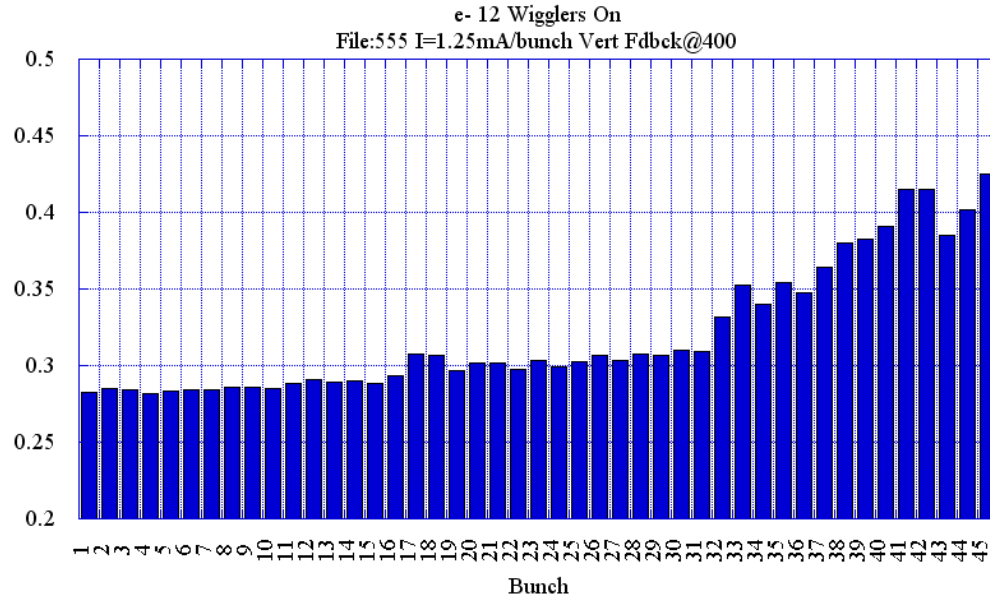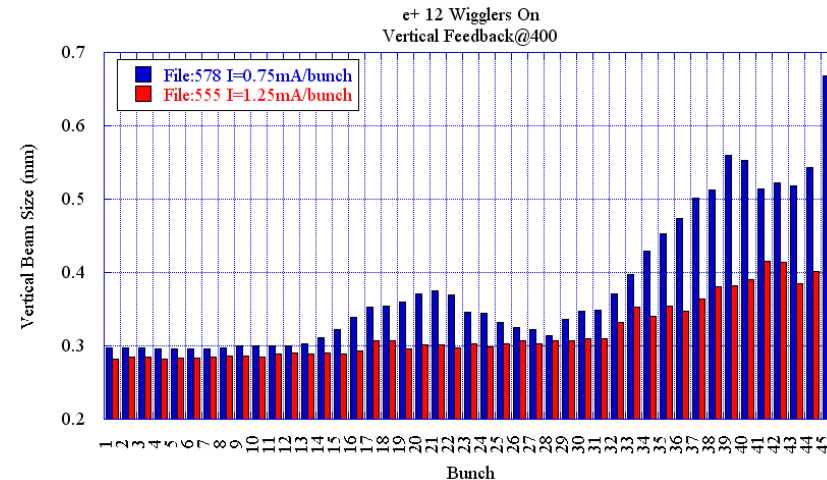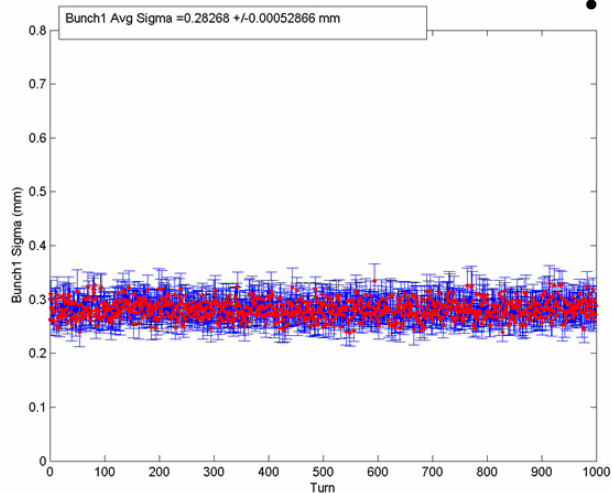
• σ_v growth along the train has two slopes: 1) gradual increase-bunches 1-29 (coincides with vertical position decrease). 2) steeper slope-bunches 30-45 (coincides with vertical position increase).
• Several oscillation frequencies are presents in the beam spectrum.
• σ_v is larger at low current (I=0.75mA/bunch) than at high current (I=1.25mA/bunch).

σ_v movie

Bunch1 Avg Sigma =0.28268 +/-0.00052866 mm

e+ 12 Wigglers On
Vertical Feedback@400

File:578 I=0.75mA/bunch
File:555 I=1.25mA/bunch

Summary e- vertical dynamics with 12 wigglers on

• The vertical tune shift along the 45 bunch train is positive.

• The vertical position oscillation is always present (even with vertical feedback on). The oscillation amplitude correlates with FFT power.

• σ_v growth along the 45 bunch train is observed at all bunch currents with feedback on and off. Vertical feedback reduces the σ_v growth along the train and shifts the growth to a later point in the train. The vertical position oscillation correlates with σ_v growth.
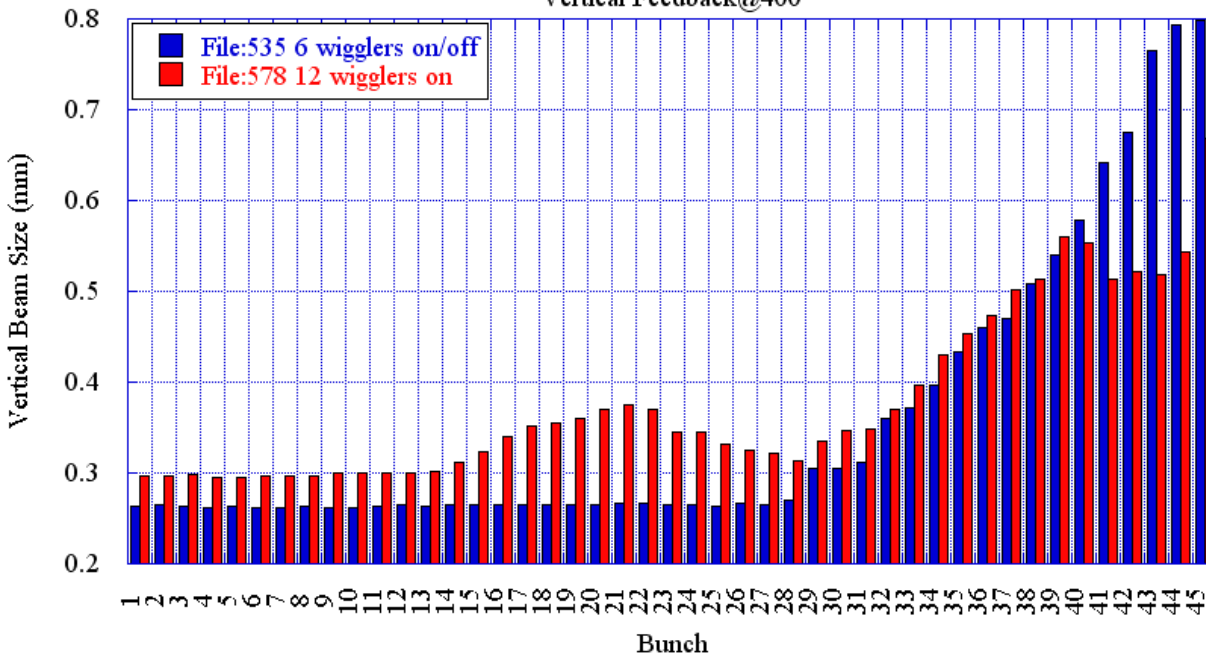
e- comparison of σ_v with wigglers on/off

• σ_v blow-up occurs earlier with 12 at wigglers on.

• The equilibrium σ_v is larger with 12 wigglers on.

• σ_v(12 wigglers) > σ_v(6 wigglers on/off).

• σ_v growth occurs earlier with 12 wigglers on.

• σ_v(12 wigglers) > σ_v(6 wigglers on/off).

- Initially,
σ_v(12 wigglers on) > σ_v(6 wigglers on/off).

- σ_v growth along the train occurs roughly at the same location (~bunch 31).

- σ_v growth rate with 6 wigglers on/off is greater than with 12 wigglers on.

e- I=1.25mA/bunch
Vertical Feedback@400