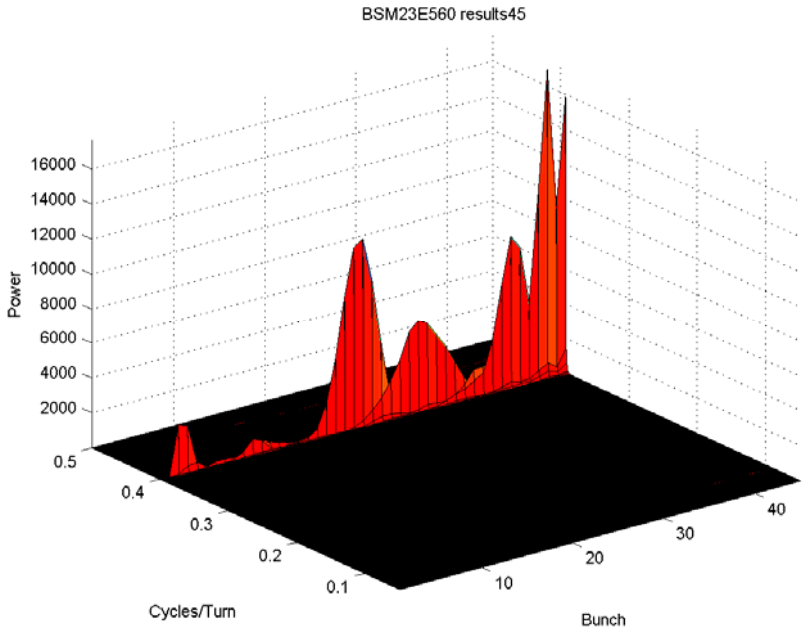
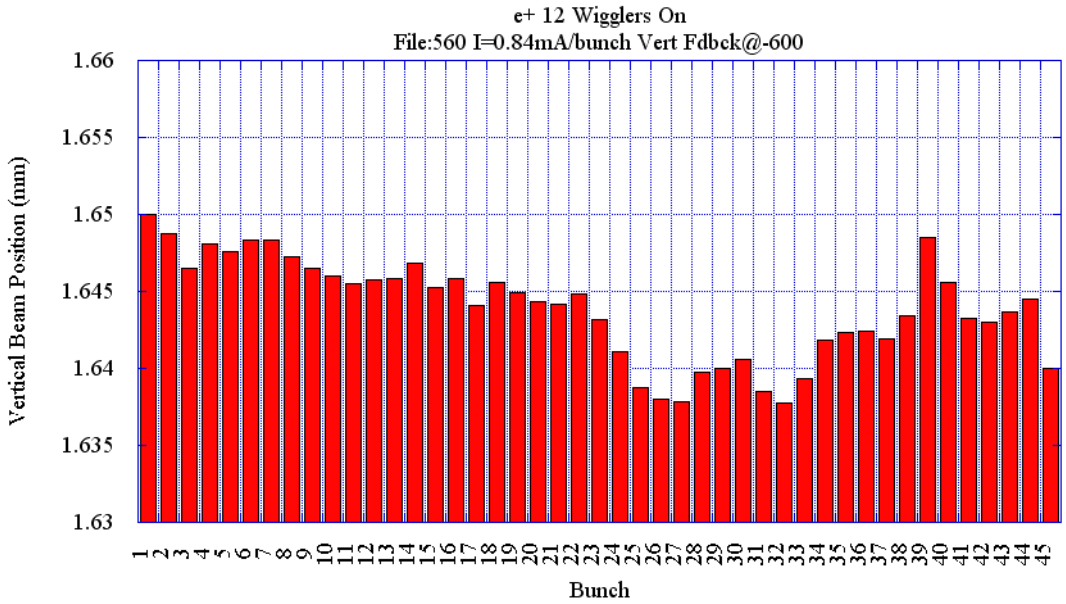
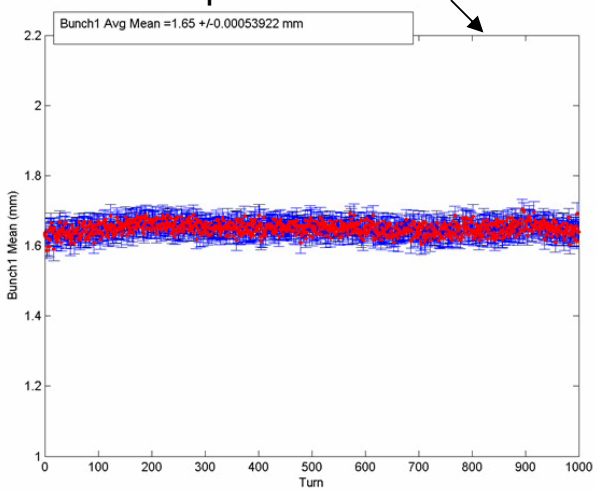


FFT Vertical position I_{e+}=0.84mA/bunch
File:560 e+ 12 wigglers on
Vert. Fdbck@-600

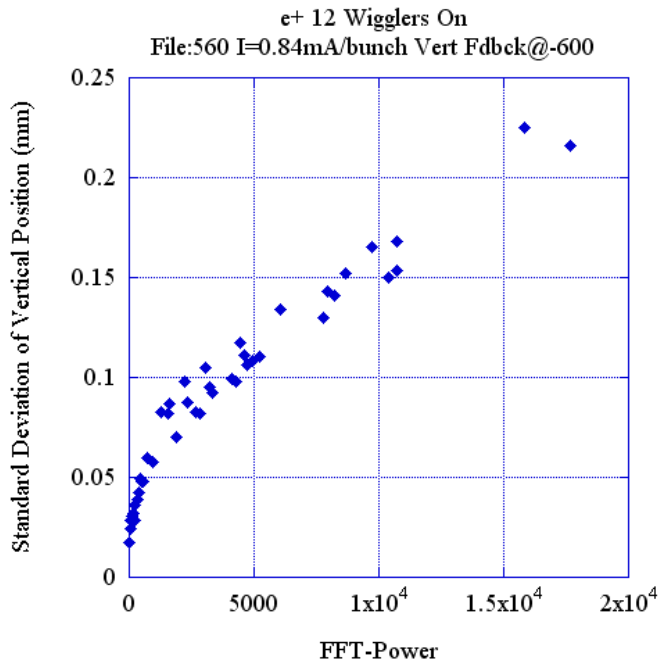


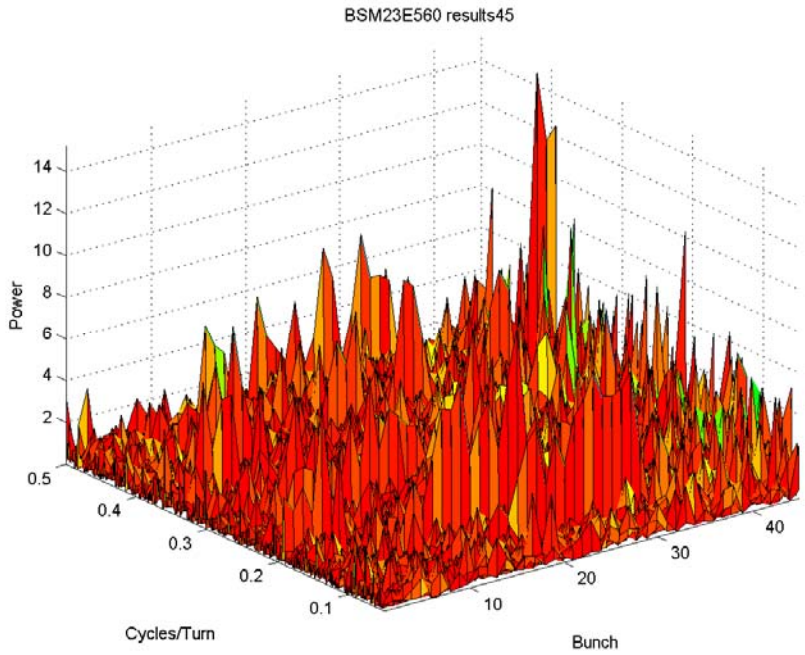
Vertical position movie



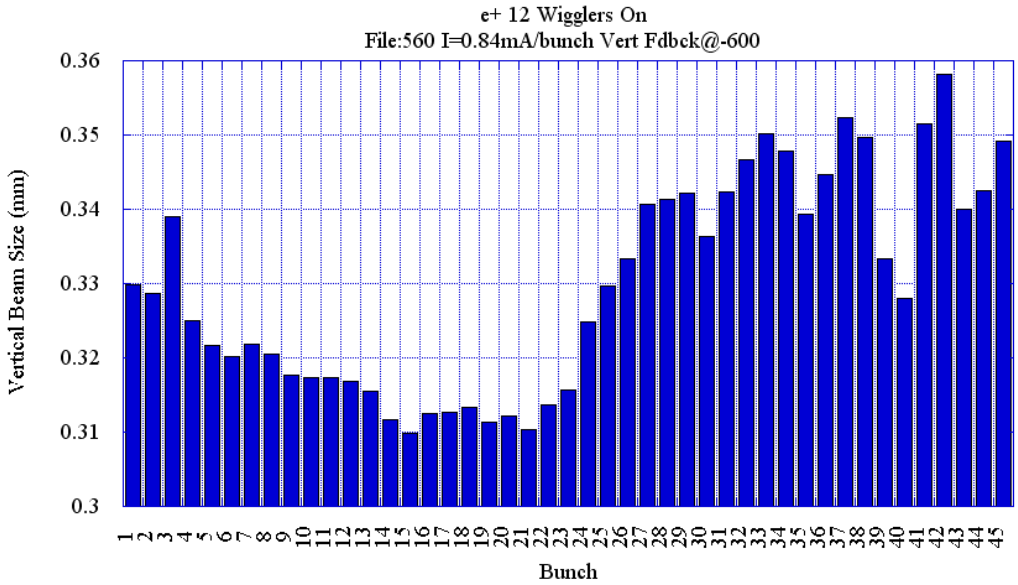
Turn on vertical feedback:

•Large reduction in vertical position oscillation amplitude (f_{osc}=234.6kHz). Oscillation amplitude correlates with FFT spectrum that grows along the train.



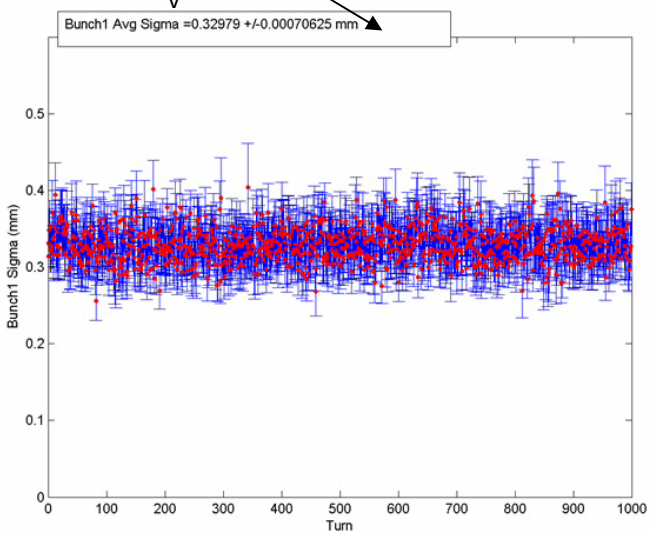


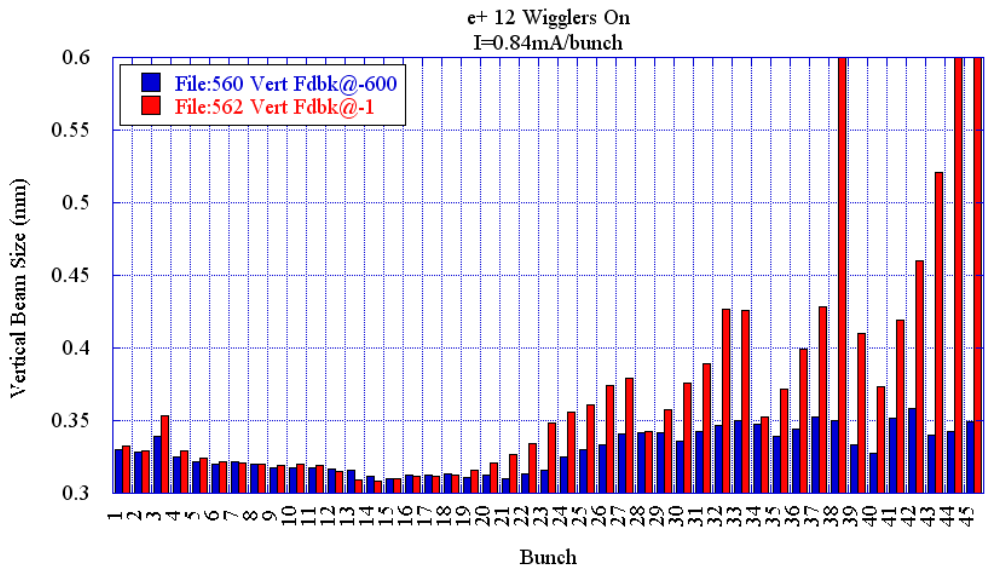
FFT σ_v I_{e+}=0.84mA/bunch
File:560 e+ 12 wigglers on
Vert. Fdbck@-600

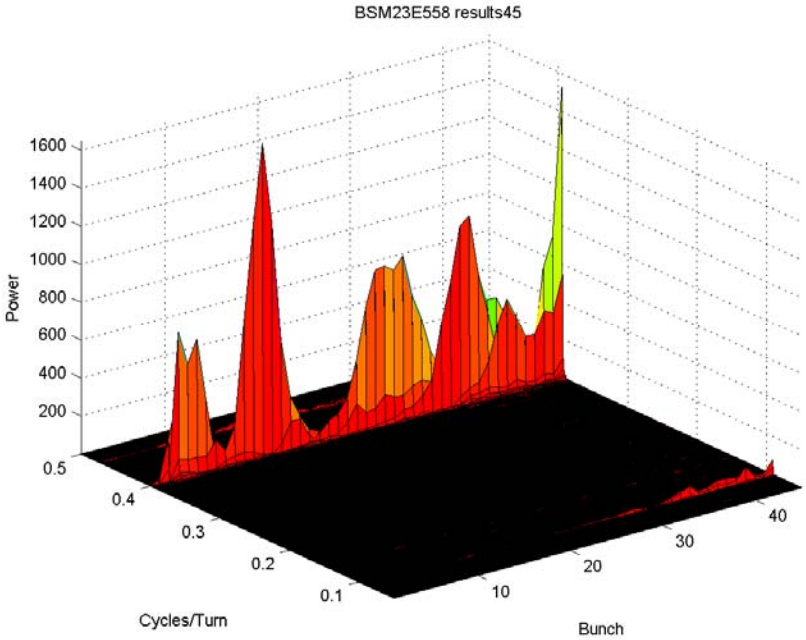


- σ_v growth occurs at bunch 25 (@bunch 20 w/o feedback).
- No clear σ_v oscillation frequency is denoted in the FFT spectrum.

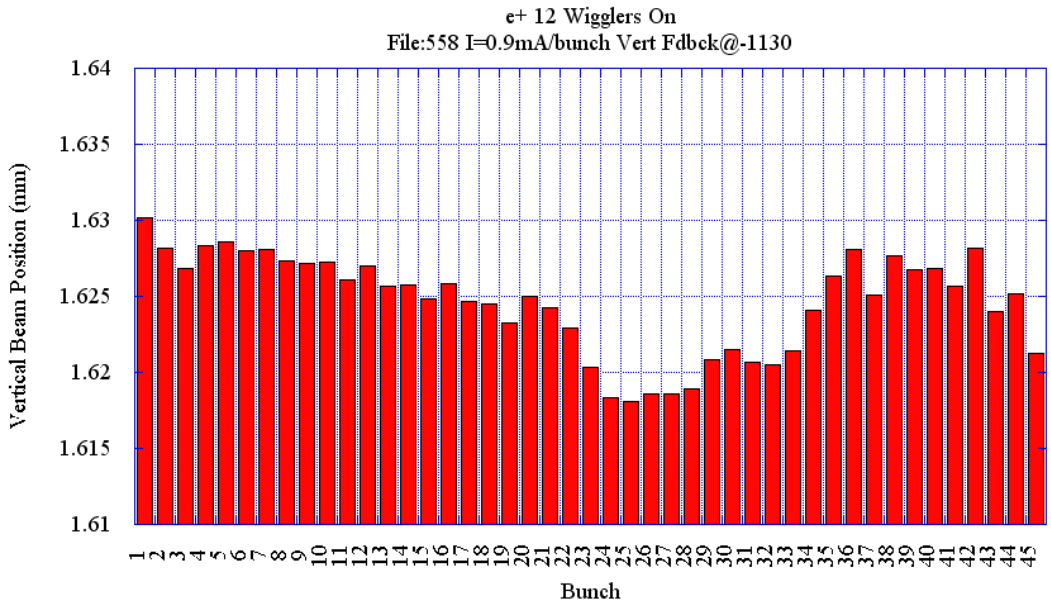
σ_v movie



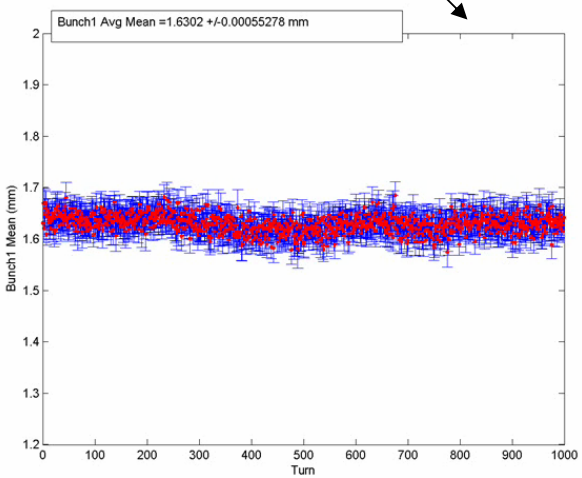




FFT Vertical position I_{e+}=0.90mA/bunch
File:558 e+ 12 wigglers on
Vert. Fdbck@-1130

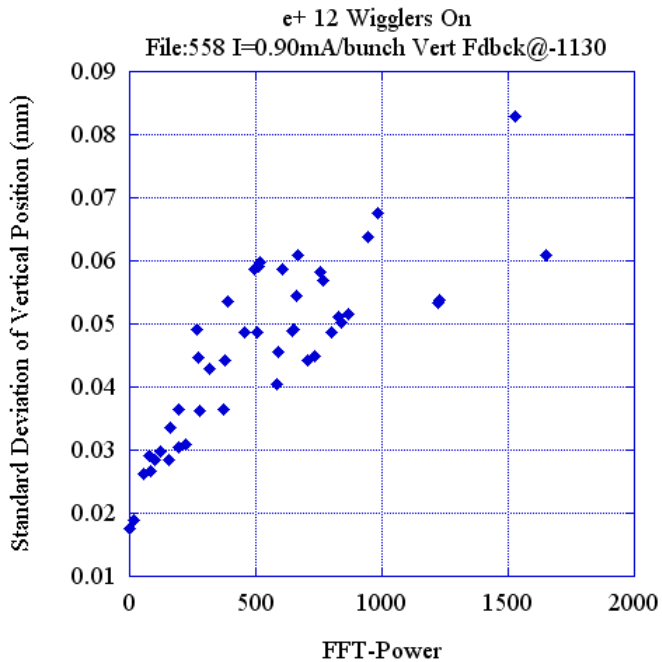


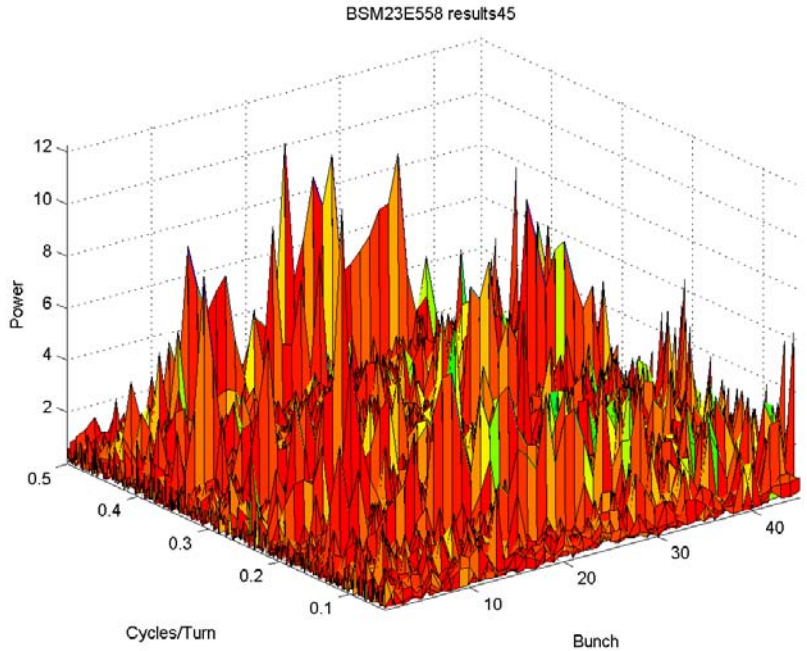
Vertical position movie



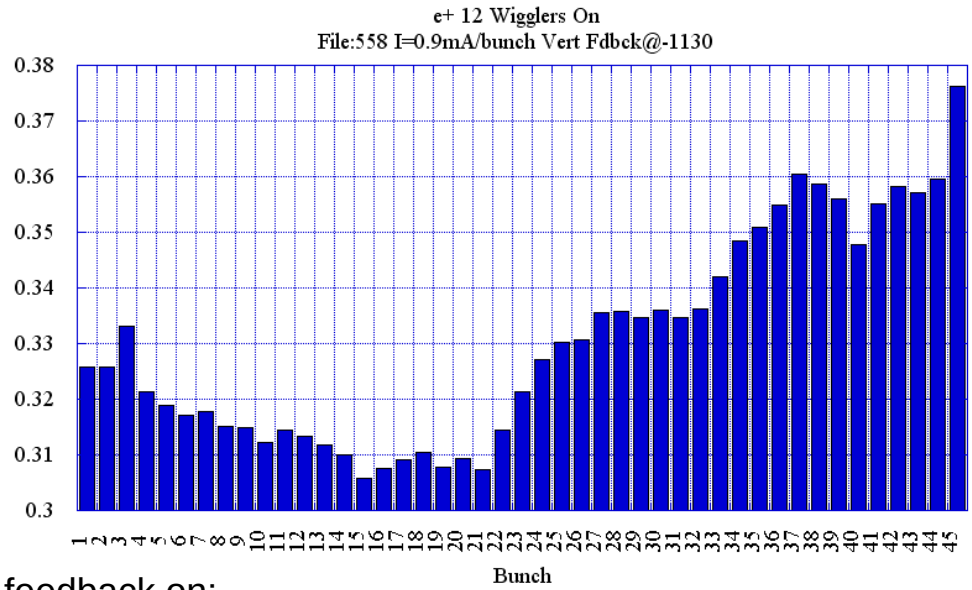
Increase current and feedback:

•Vertical position oscillation amplitude is reduced (f_{osc}=234.2kHz). Amplitude correlates with FFT power.





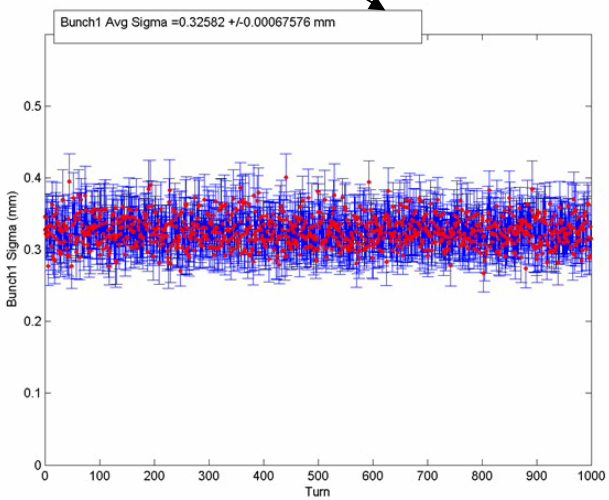
FFT σ_v I_{e+}=0.90mA/bunch
File:558 e+ 12 wigglers on
Vert. Fdbck@-1130

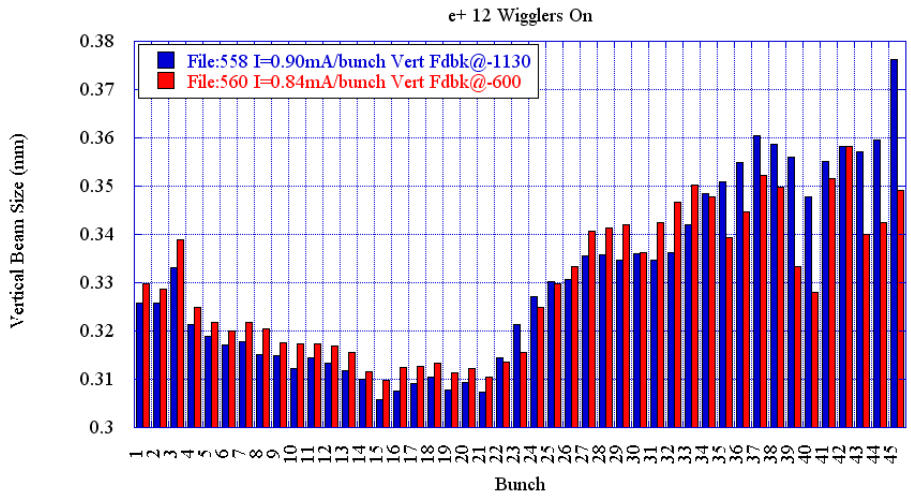


At high I with feedback on:

- σ_v growth starts at bunch 22. No distinct σ_v oscillation frequency is apparent in the beam spectrum.
- No significant change in σ_v along the 45 bunch train due to the increase vertical feedback.

σ_v movie





Summary e+ vertical dynamics with 12 wigglers on

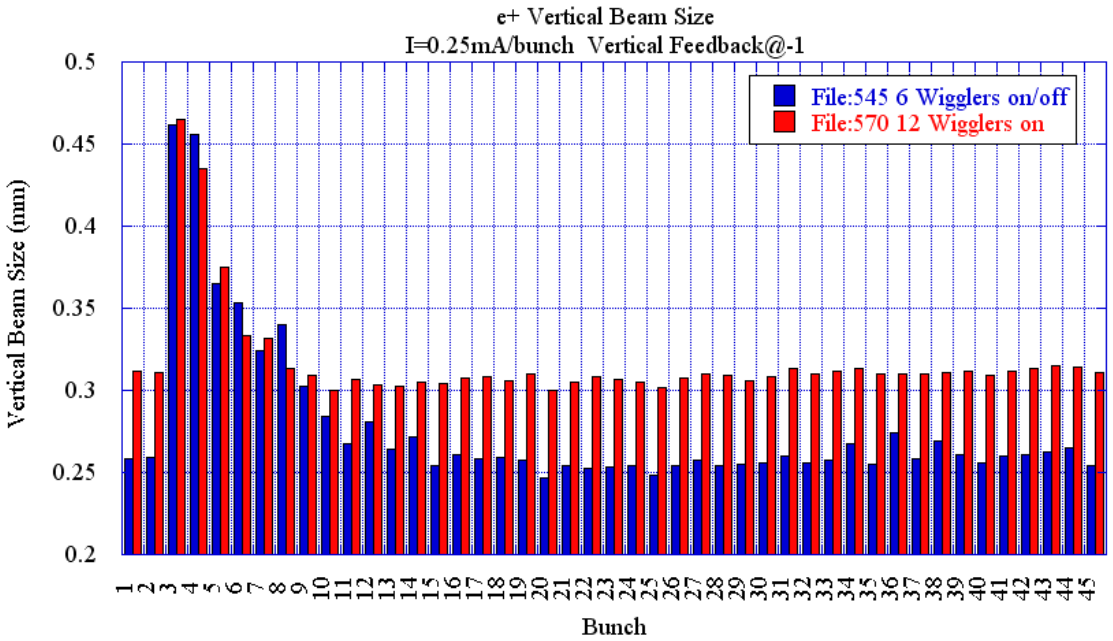
• The vertical tune shift along the 45 bunch train increases with current.
□ΔQ_y(12 wigglers) > ΔQ_y(6 wigglers on/off).

•At low current, the σ_v blows-up for bunches 3-7. As the bunch current is increased, σ_v for bunches 3-7 decreases.

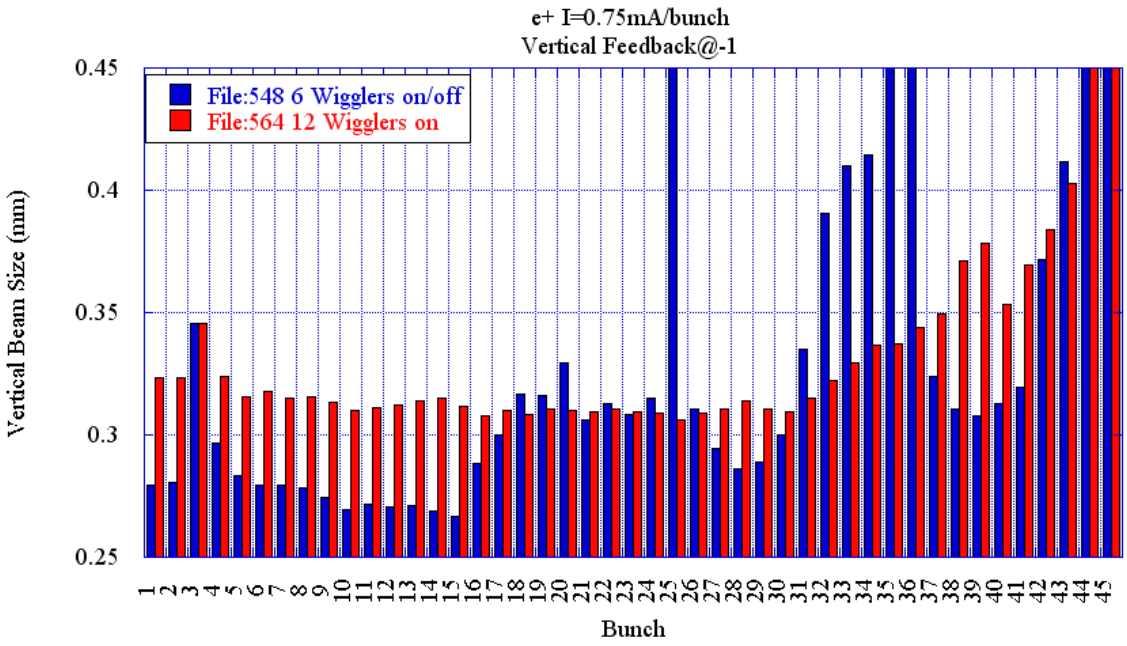
•A coherent vertical position oscillation along the 45 bunch train is always present (at all currents measured). The position oscillation amplitude increases with current and decreases with vertical feedback. The FFT power from the vertical position correlates with the vertical oscillation amplitude.

• As the bunch current is increased, σ_v growth along the 45 bunch train occurs. If vertical feedback is turned off, the vertical position oscillation amplitude increases and results in a significant increase in the σ_v. This σ_v blow-up appears to be incoherent due to the lack of structure in the FFT spectrum.

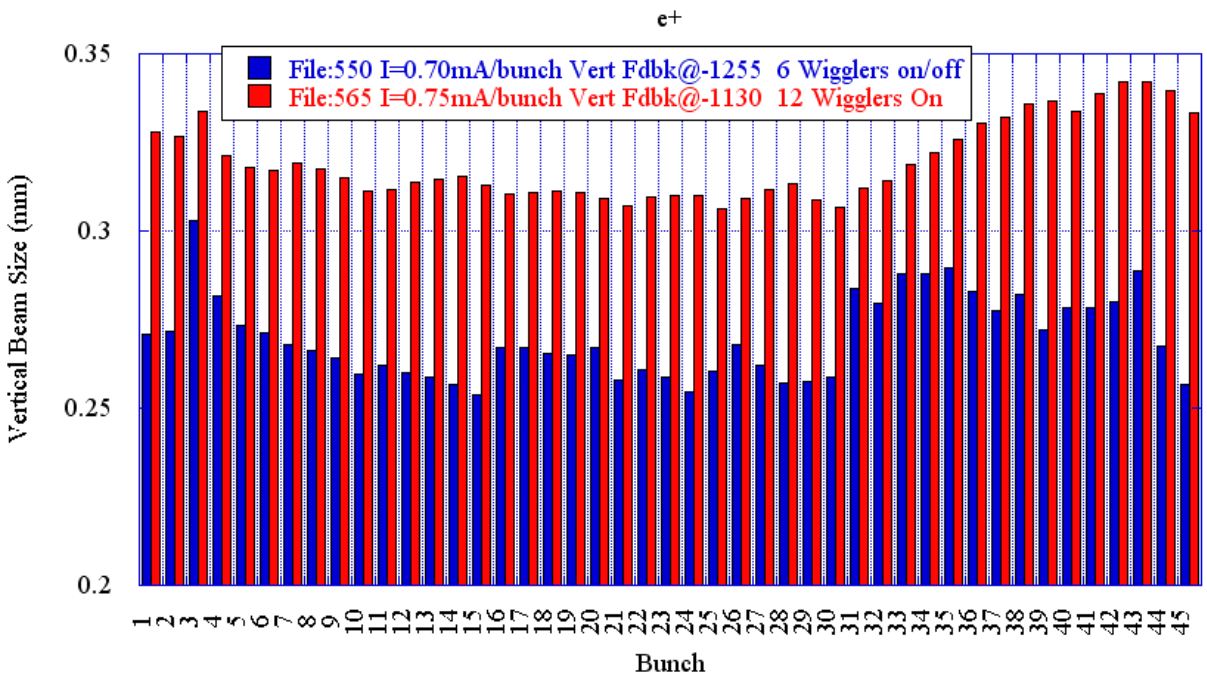
e+ comparison of σ_v with wigglers on/off



- σ_v blow-up occurs at bunch 3 with wigglers on/off.
- The equilibrium σ_v is larger with 12 wigglers on.
- σ_v(12 wigglers) > σ_v(6 wigglers on/off)



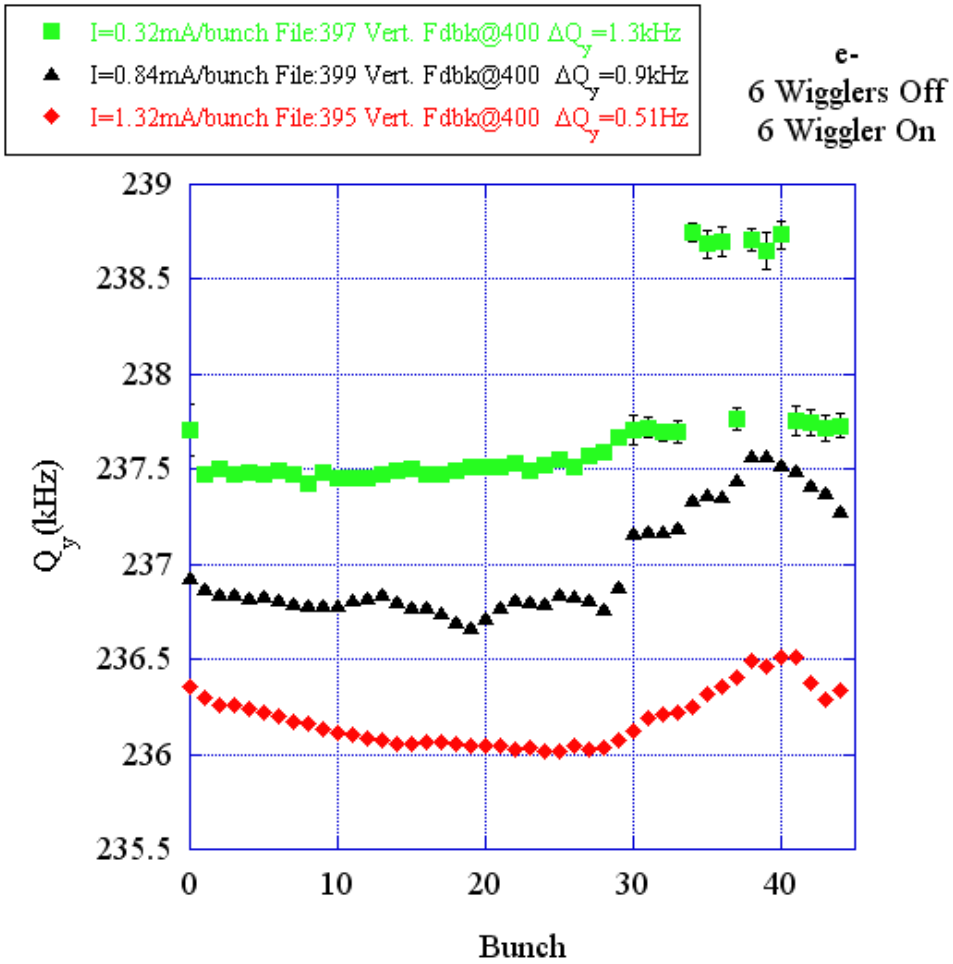
- σ_v reduction for bunch 3 with current.
- σ_v growth occurs at bunch 16 with 6 wigglers on/off and at bunch 31 with 12 wigglers on. Significant incoherent contribution with 6 wigglers on/off.

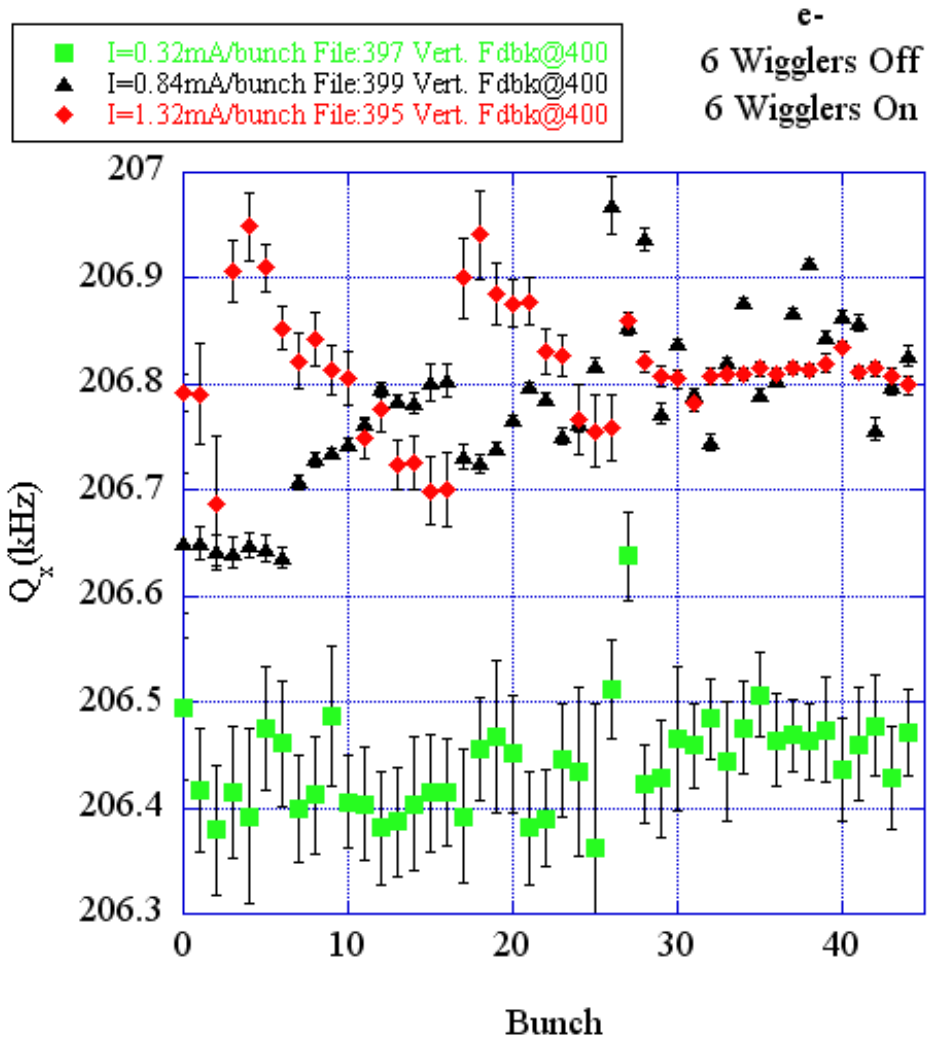


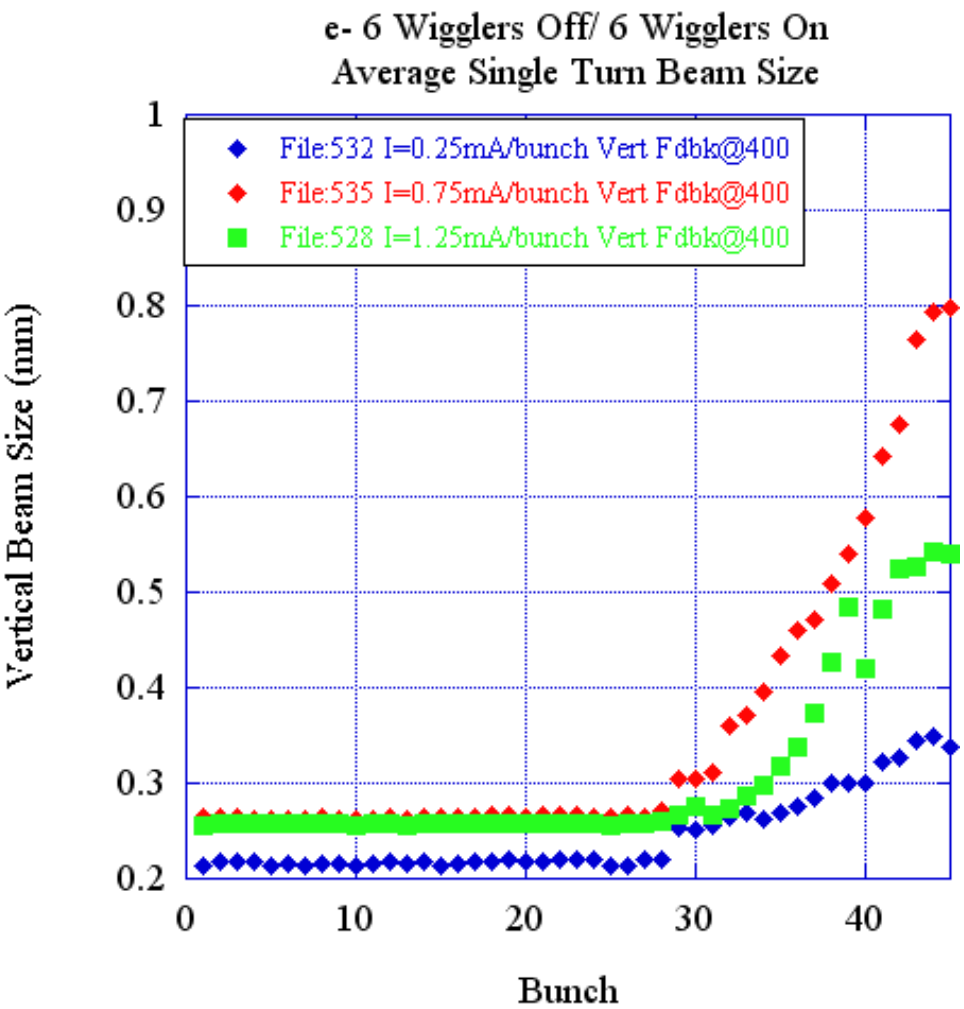
- σ_v (12 wigglers on) > σ_v (6 wigglers on/off).

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

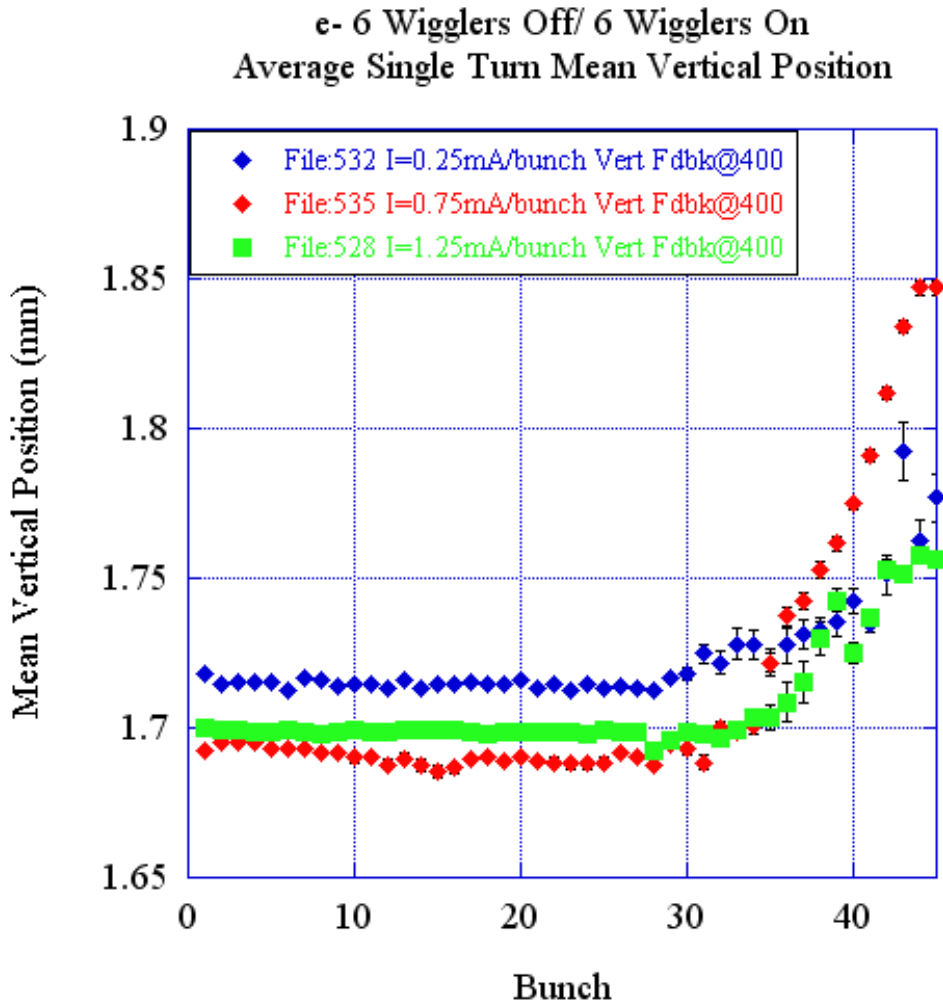
IV. e- 6 wigglers on/6 wigglers off



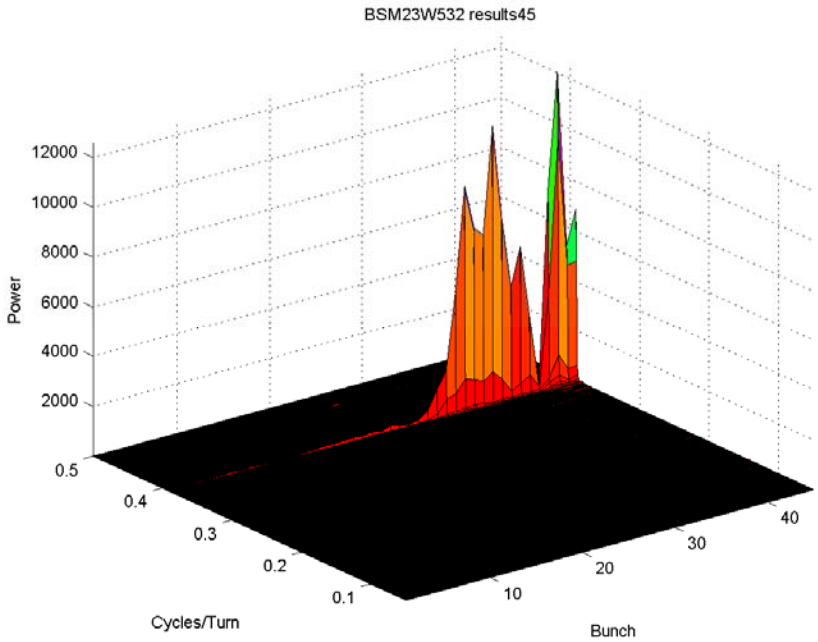




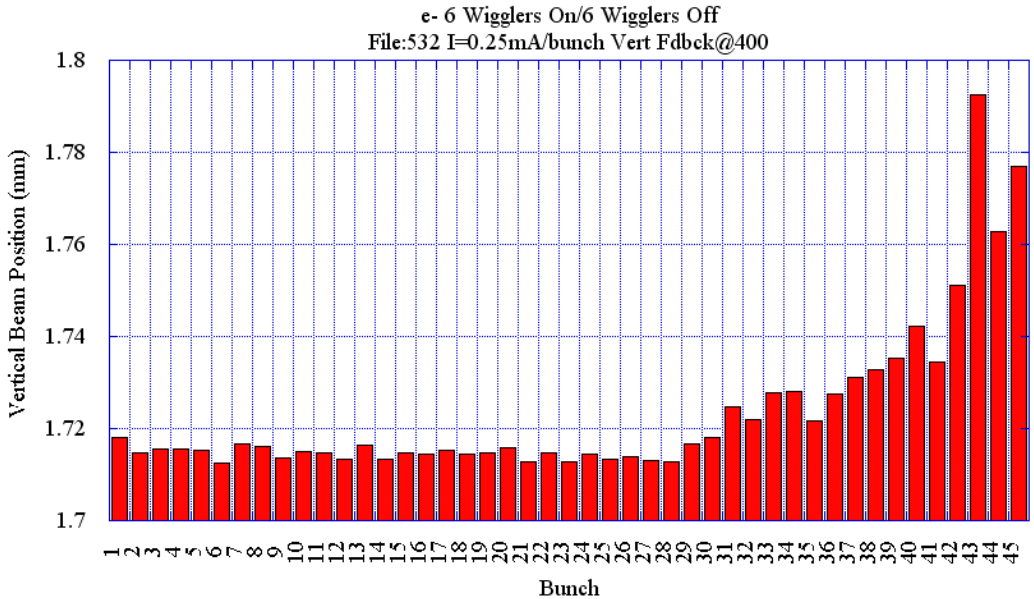
Summary of the vertical position and σ_v along the 45 bunch trains with 6 wiggler magnets on/off.



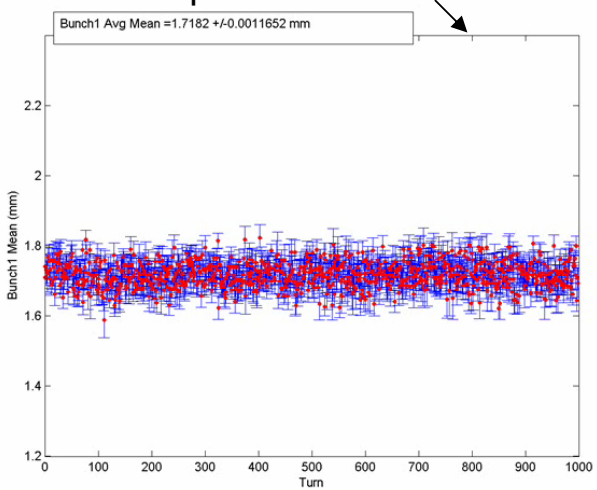
Vertical position change and σ_v growth occur at the same location along the 45 bunch train.



FFT Vertical position I_{e-}=0.25mA/bunch
File:532 e- 6 wigglers on, 6 wigglers off
Vert. Fdbck@400

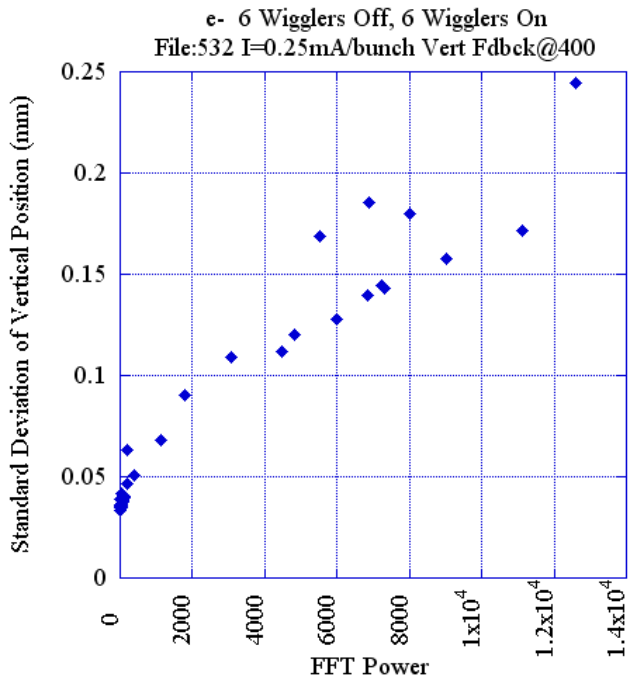


Vertical position movie

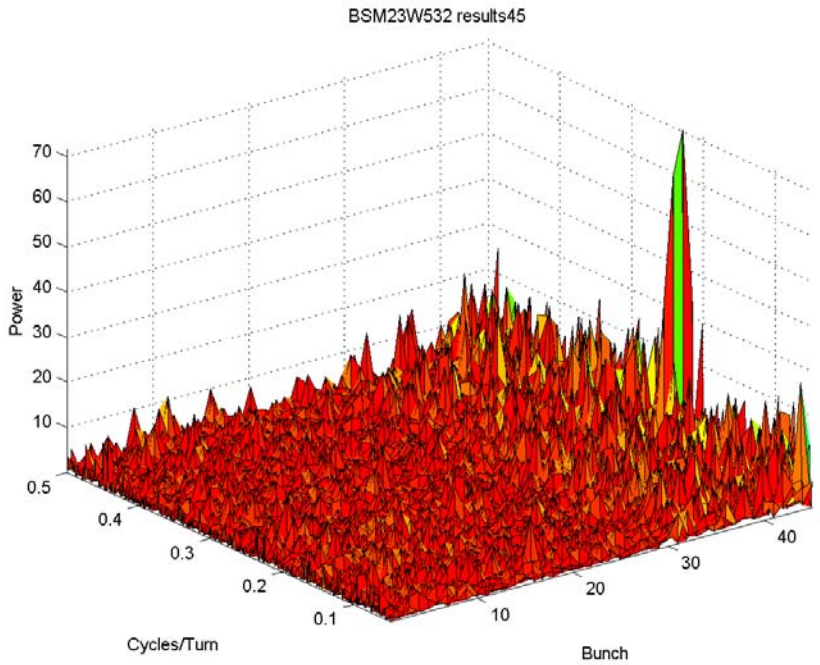


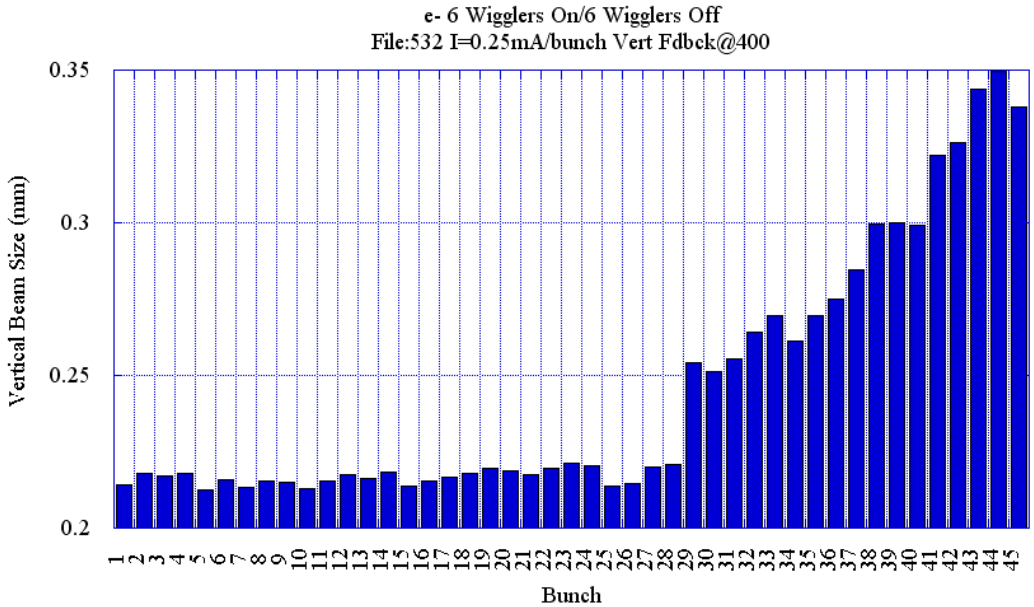
- No large vertical position oscillation for bunch 3.

- Vertical position oscillation amplitude increases along the train at ~bunch 29. The amplitude correlates well with FFT power (f_{osc}=237.4kHz)

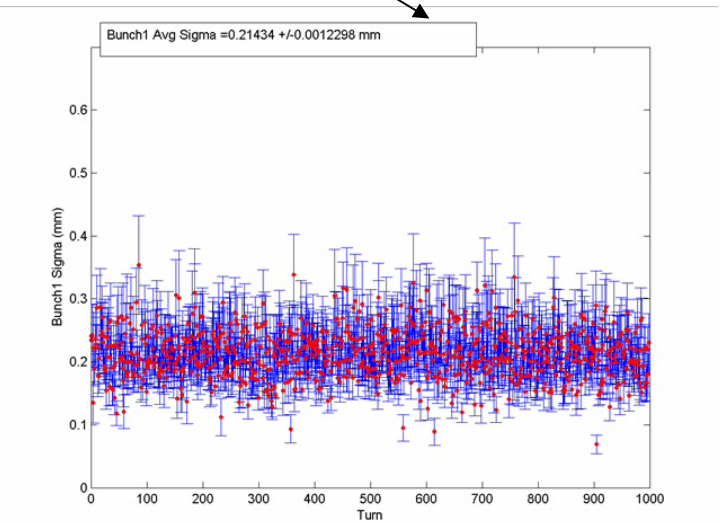


FFT σ_v I_{e-}=0.25mA/bunch
File:532 e- 6 wigglers on, 6 wigglers off
Vert. Fdbck@400



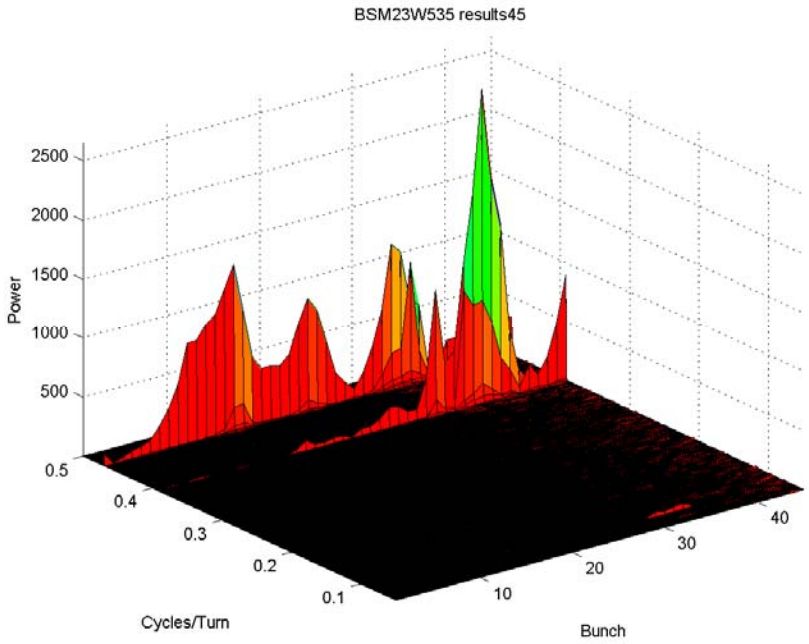


σ_v movie

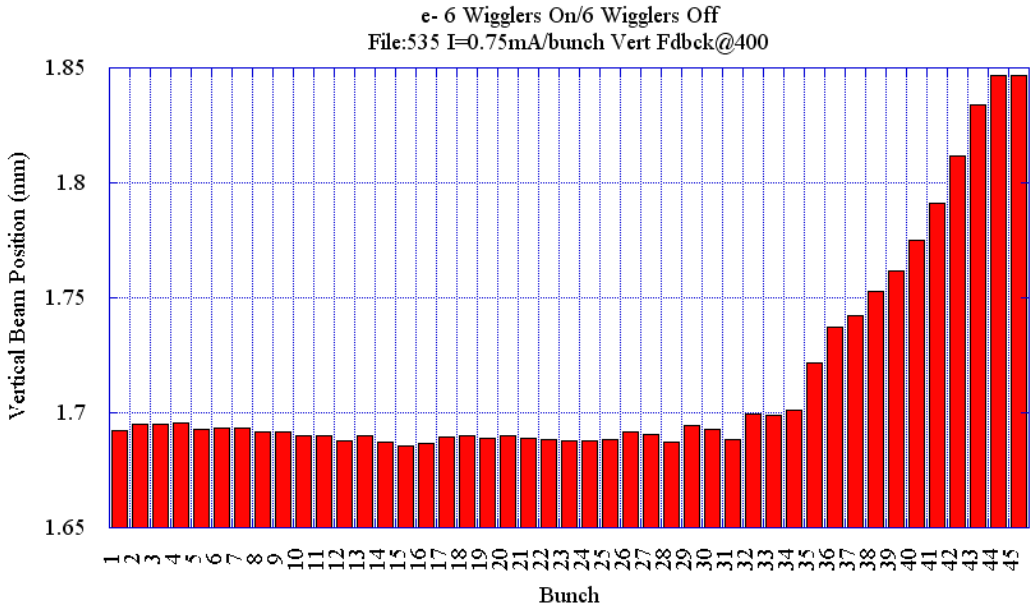


• σ_v growth occurs at ~bunch 29 with no clear oscillation frequency in the vertical beam size except for the last few bunches.

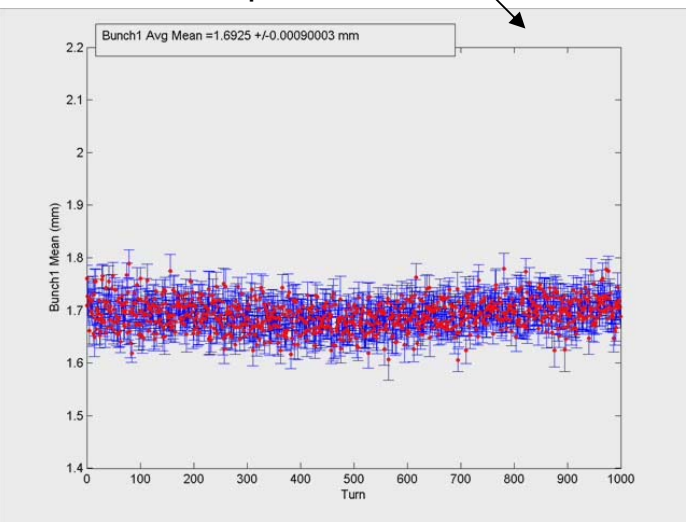
•No distinct σ_v oscillation frequency is apparent (incoherent instability).



FFT Vertical position I_{e-}=0.75mA/bunch
File:535 e- 6 wigglers on, 6 wigglers off
Vert. Fdbck@400

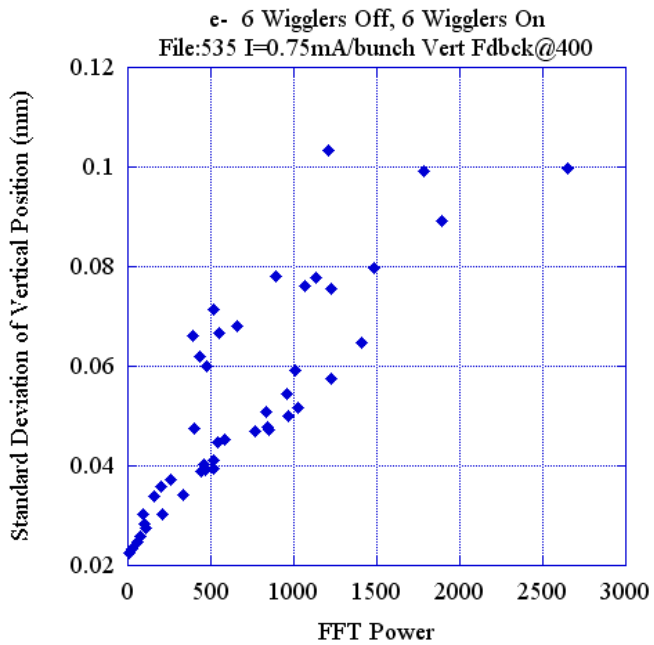


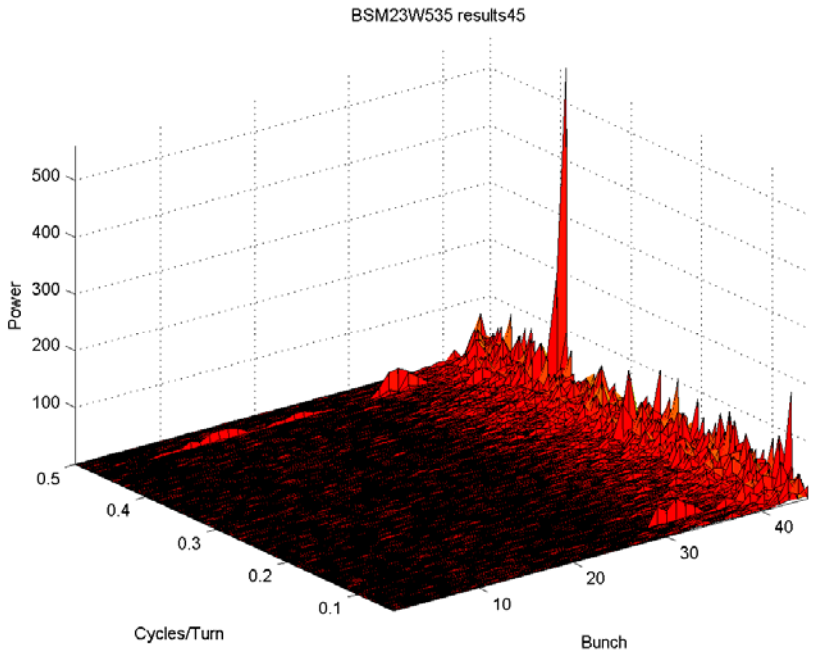
Vertical position movie



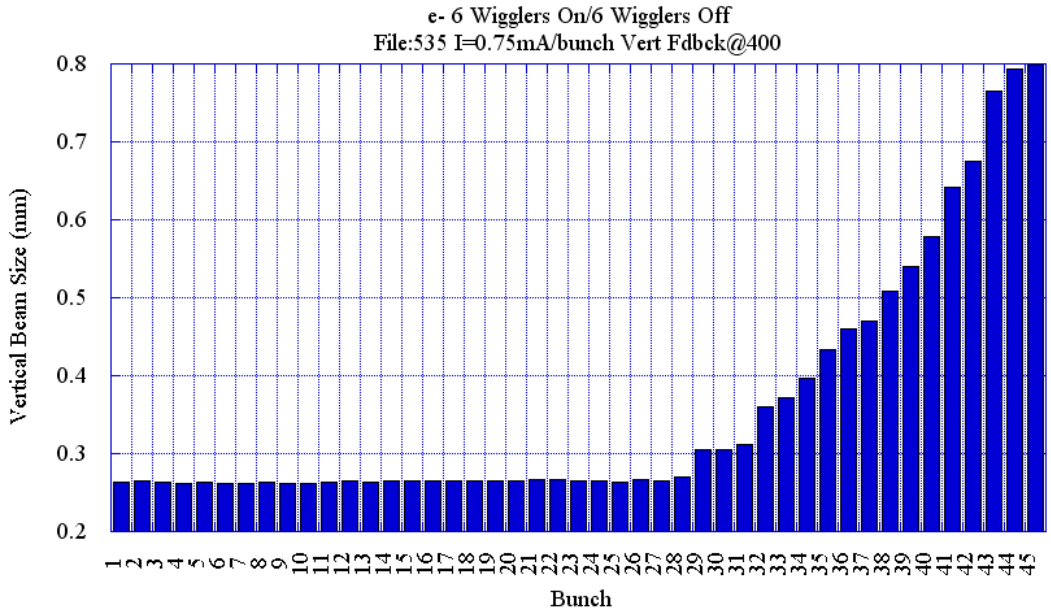
Increase the current per bunch with feedback constant:

•Now two vertical position oscillation frequencies are present, f_{osc}=237kHz(0.393 cycles/turn) and f_{osc}=206.9kHz (0.47 cycles/turn). The oscillation amplitude increase with FFT power.



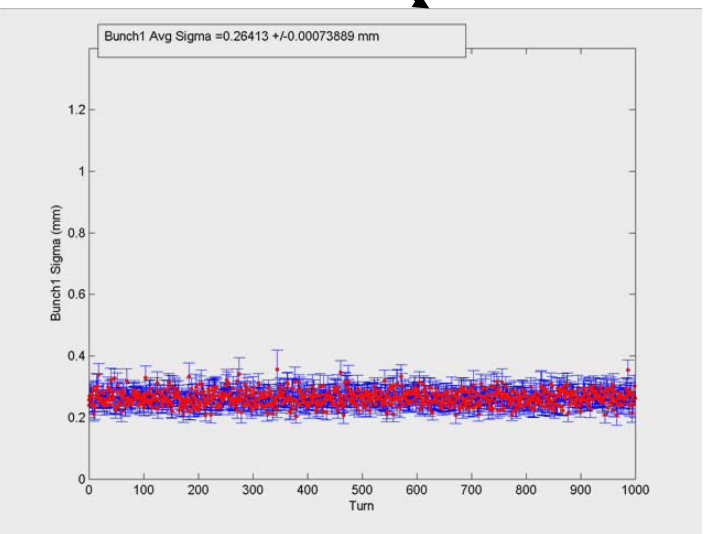


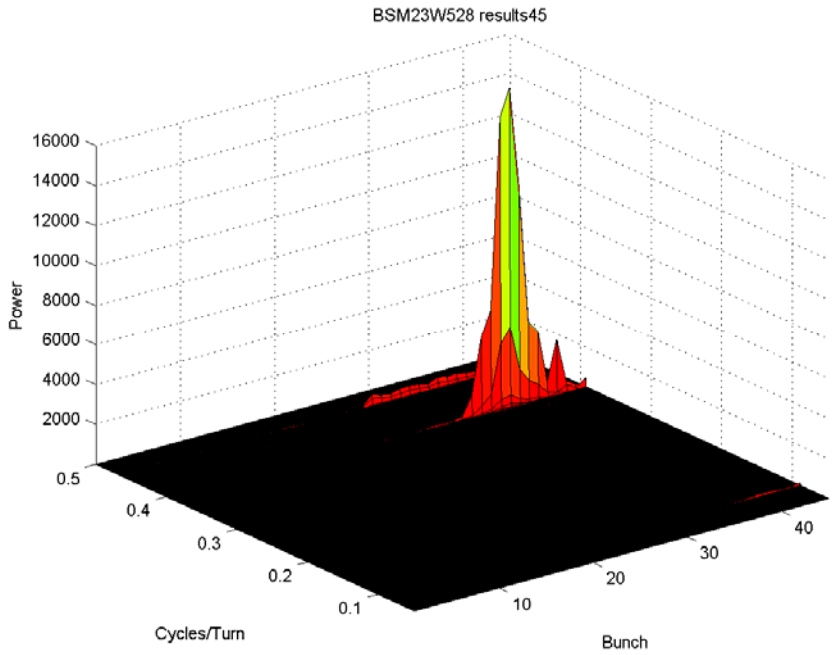
FFT σ_v I_{e-}=0.75mA/bunch
File:535 e- 6 wigglers on, 6 wigglers off
Vert. Fdbck@400



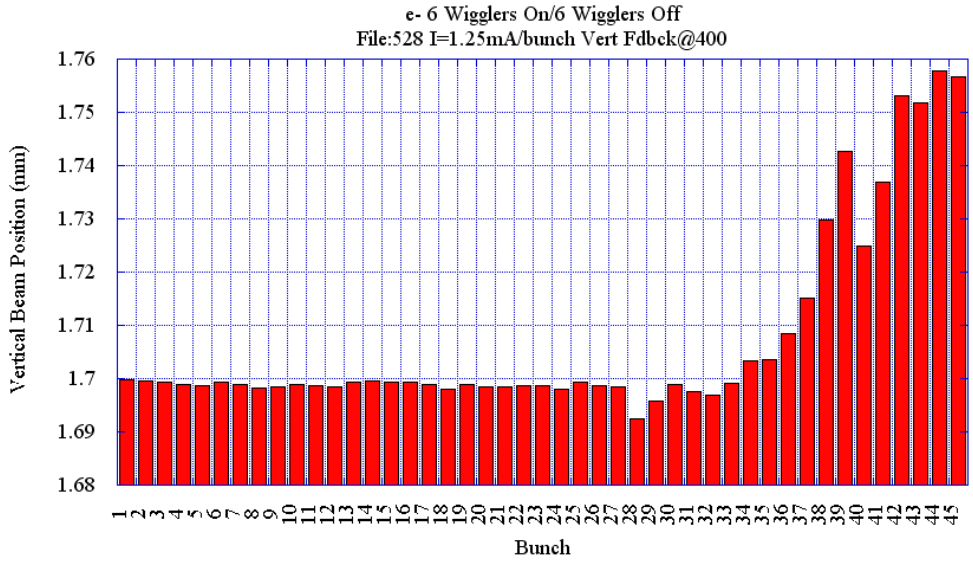
• Significant σ_v growth along the train starting at bunch 30 with no σ_v oscillation frequency in the FFT spectrum until the last 3 bunches.

σ_v movie

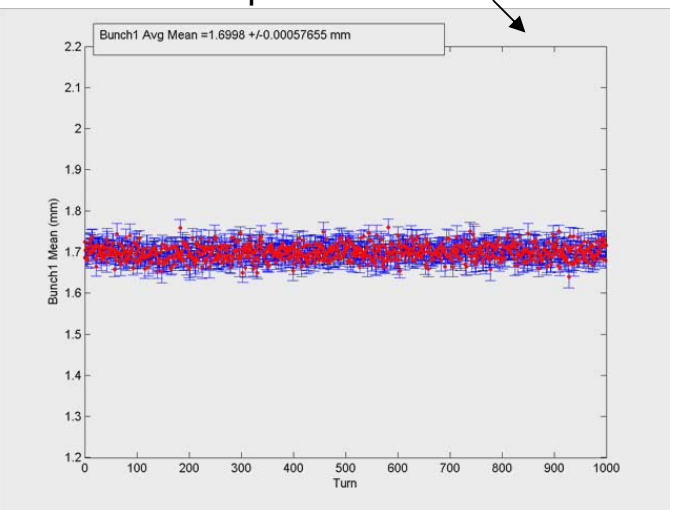




FFT Vertical position I_{e-}=1.25mA/bunch
File:528 e- 6 wigglers on, 6 wigglers off
Vert. Fdbck@400



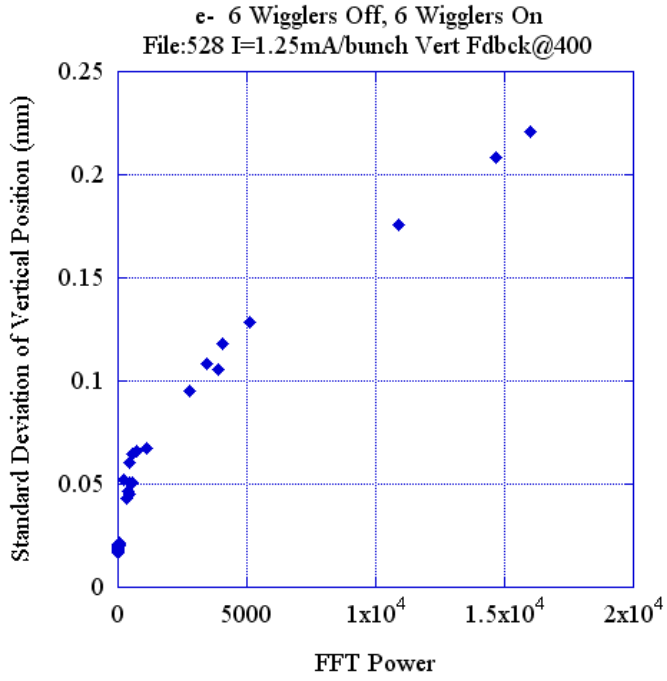
Vertical position movie

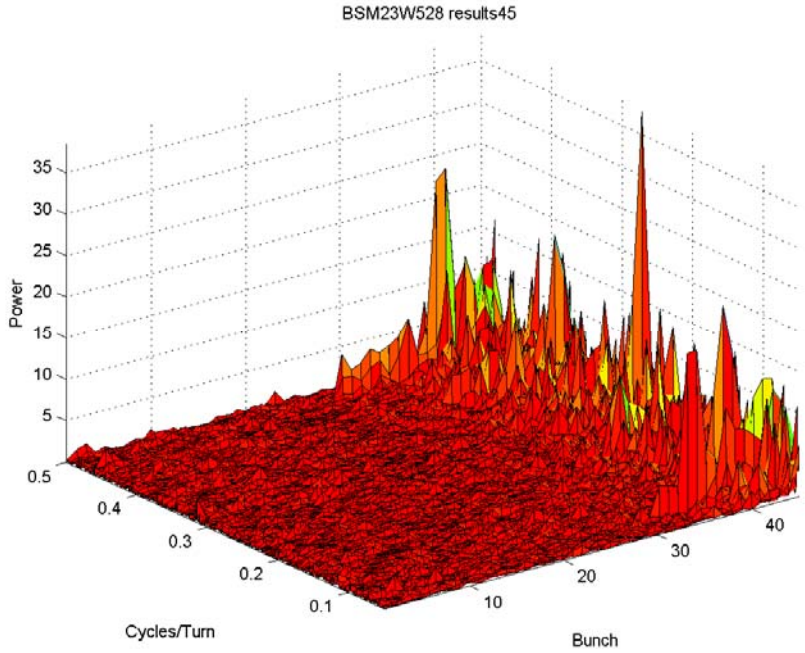


Increasing the current results in:

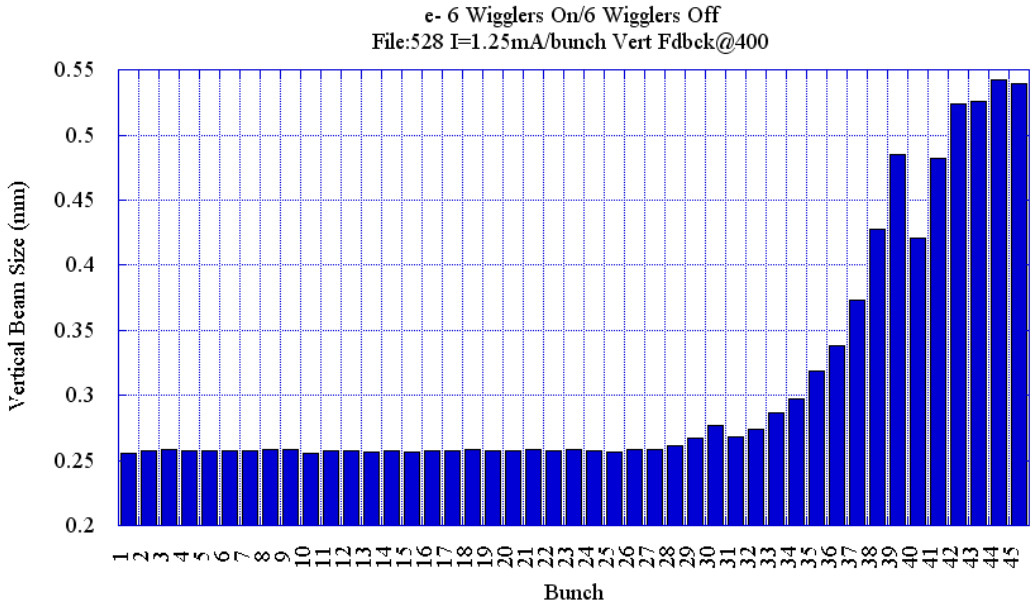
• A vertical position oscillation amplitude increase at f_{osc}=236.2kHz (0.395 cycles/turn) and 202.7kHz (0.47 cycles/turn).

•Vertical position changes at bunch 34. The oscillation amplitude correlates with FFT power.

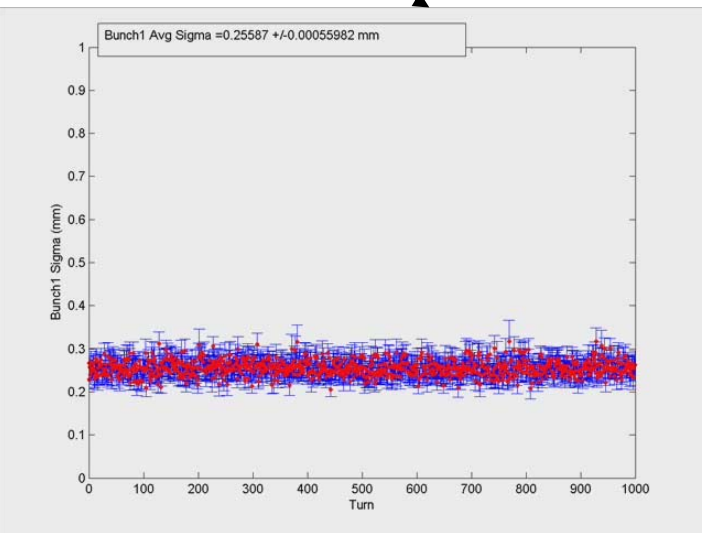




FFT σ_v I_{e-}=1.25mA/bunch
File:528 e- 6 wigglers on, 6 wigglers off
Vert. Fdbck@400



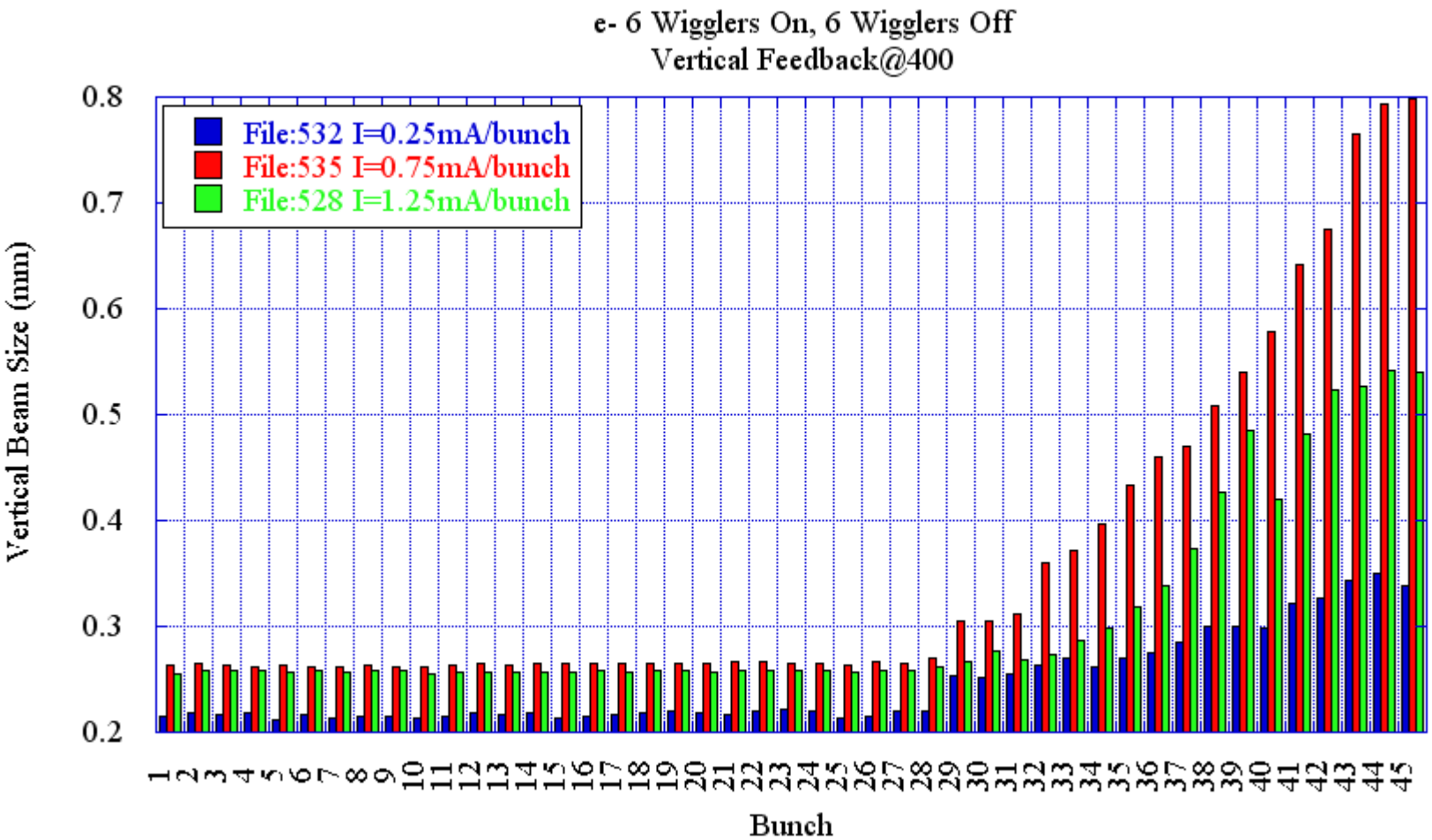
σ_v movie



• σ_v growth along the train starts at bunch 30 with no clear frequency of oscillation for the vertical beam size-Incoherent oscillation.

σ_v growth (@I=0.75mA/bunch) > σ_v growth (@I=1.25mA/bunch).

Comparison of σ_v with 6 wigglers on/off



- For all bunch currents, σ_v growth starts at ~bunch 30.
- σ_v(I=0.75mA/bunch)>σ_v(I=1.25mA/bunch)>σ_v(I=0.25mA/bunch)

Summary e- vertical dynamics with 6 wigglers on/off

• The vertical tune shift along the 45 bunch train initially is negative and then turns positive. The positive tune shift correlates with the vertical beam size growth along the train (~bunch 30).

•The vertical position oscillation is a coherent oscillation that is present at all currents measured. The FFT vertical position power correlates with the vertical oscillation amplitude.

• σ_v growth occurs along the train, which starts at bunch 30, is due to a incoherent oscillation and is present at all currents measured. σ_v growth coincides with a shift in the vertical position in the bunches.