

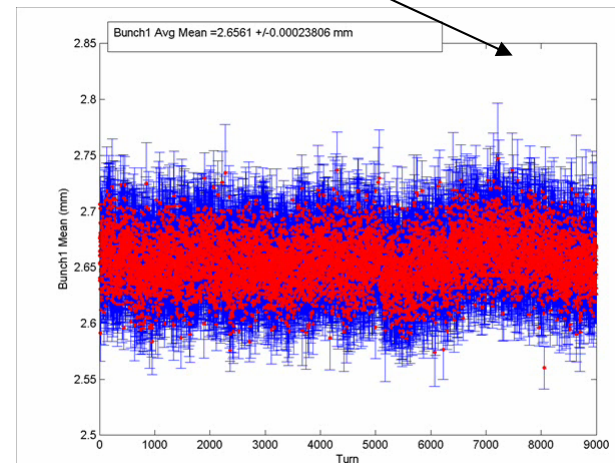
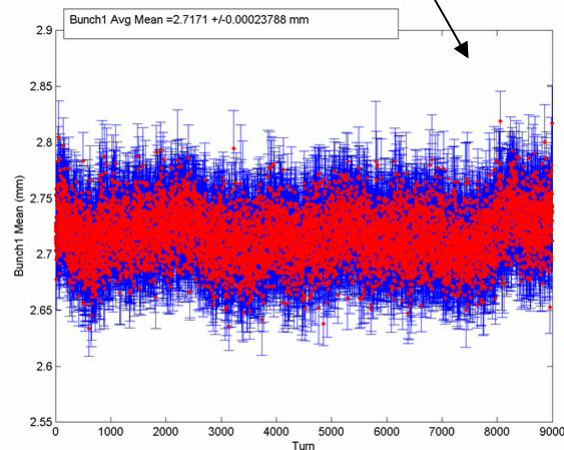
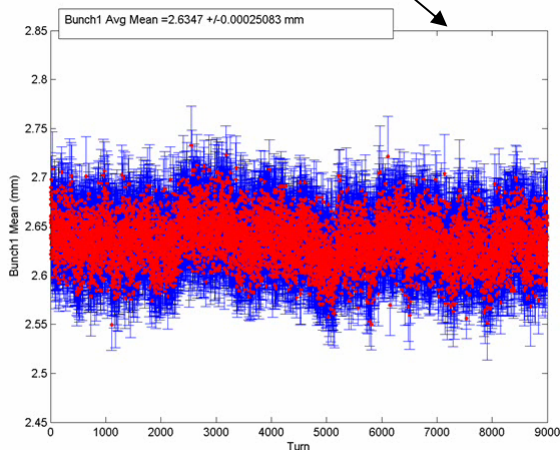
e- Vertical Position

- Mean vertical position for 9,000 turns for 54 bunches.

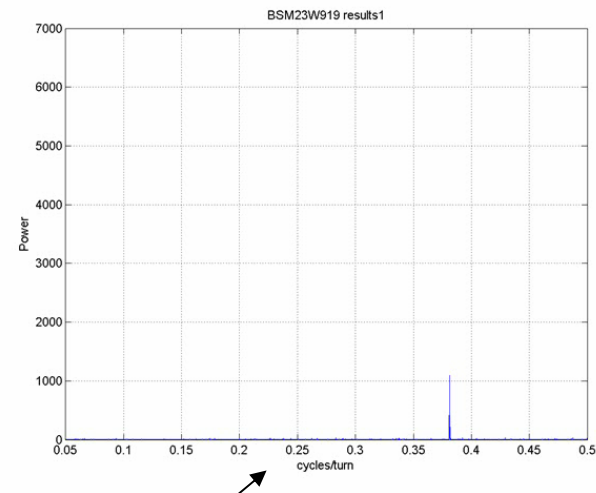
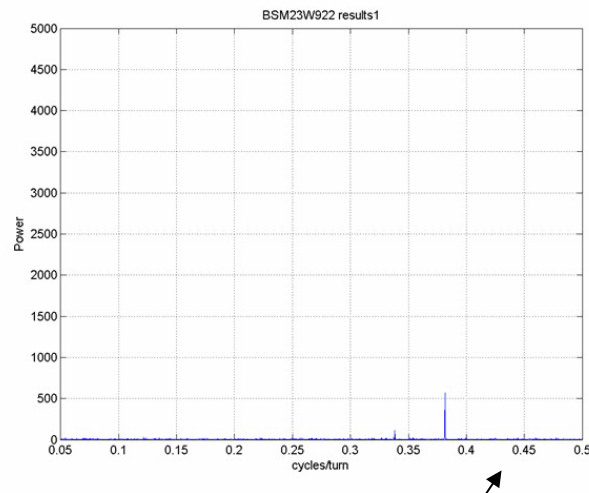
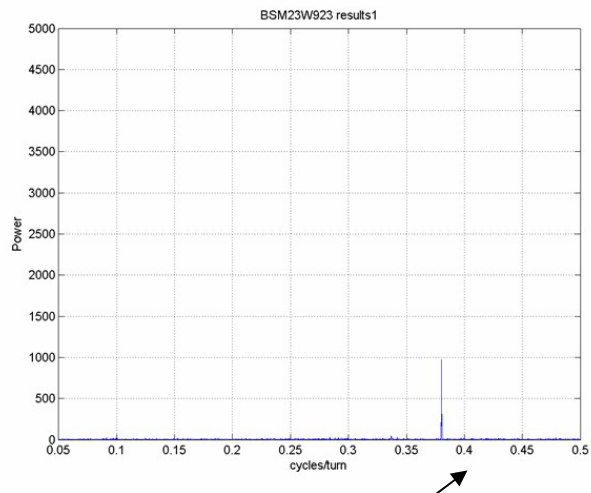
High I File:923
 $I_{e^-} = 4.3$ mA/bunch (movie)

Medium I File:922
 $I_{e^-} = 4.1$ mA/bunch (movie)

Low I File:919
 $I_{e^-} = 3.8$ mA/bunch (movie)



e- high frequency vertical position oscillation-FFT of vertical position for 9,000 turns

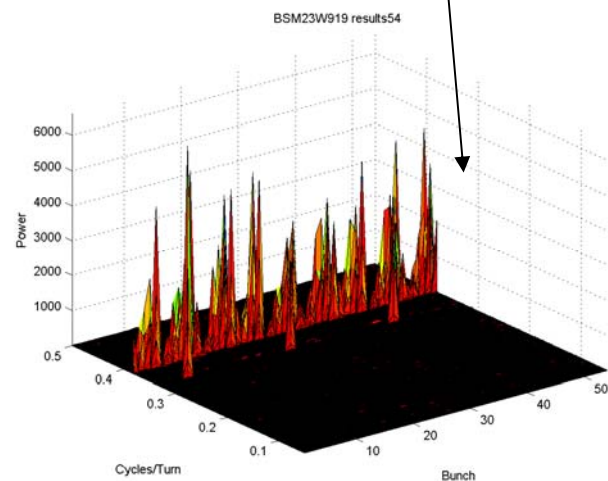
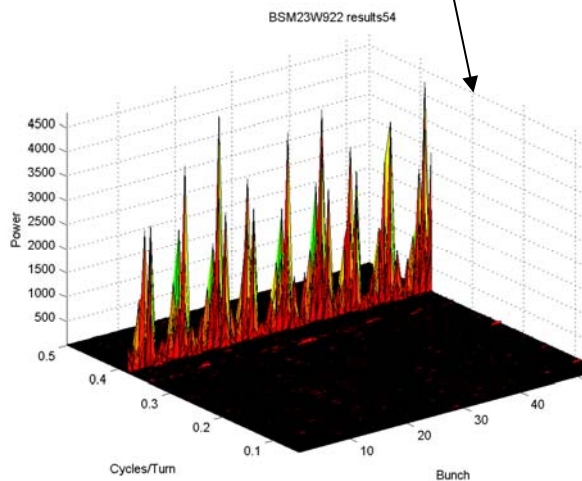
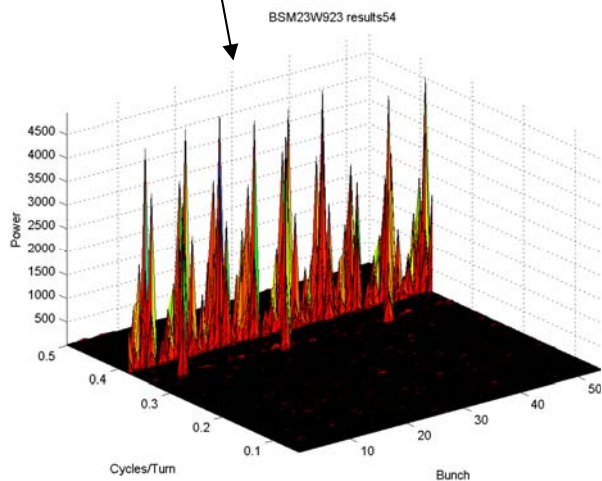


High I File:923
 $I_{e^-}=4.3\text{mA/bunch}$ (movie)

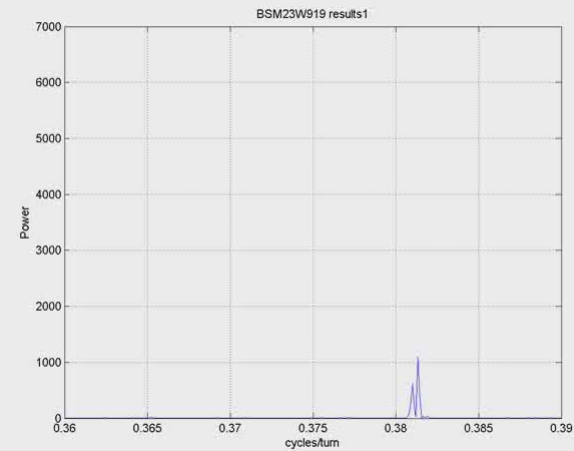
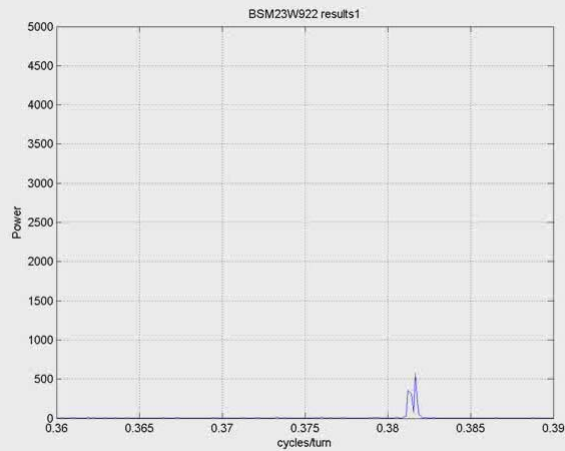
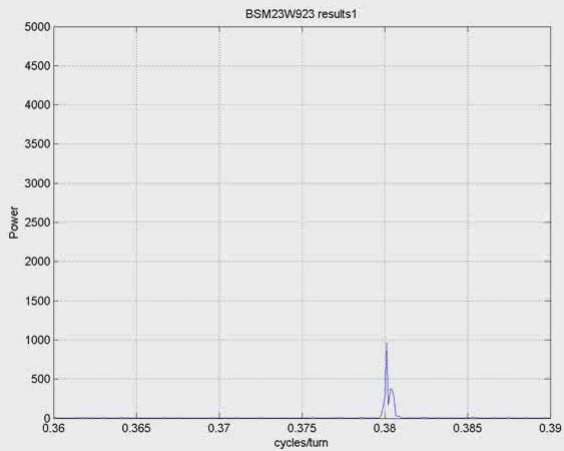
Medium I File:922
 $I_{e^-}=4.1\text{mA/bunch}$ (movie)

Low I File:919
 $I_{e^-}=3.8\text{mA/bunch}$ (movie)

- FFT of the vertical position.
- Vertical position oscillation signal is prominent in the FFT spectrum.



e- high frequency vertical position oscillation-close up of the oscillation frequency $f_{\text{oscillation}}$

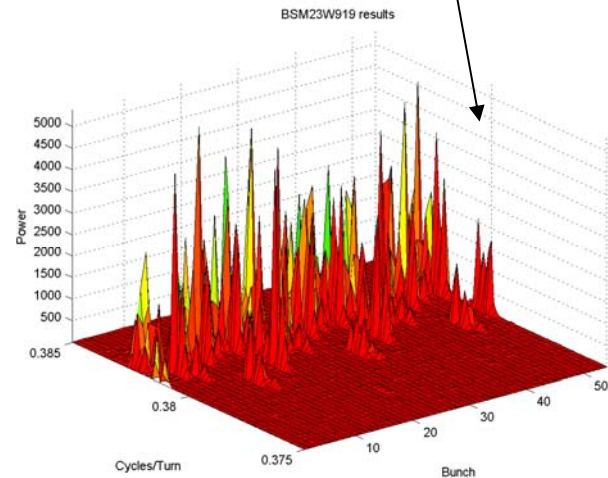
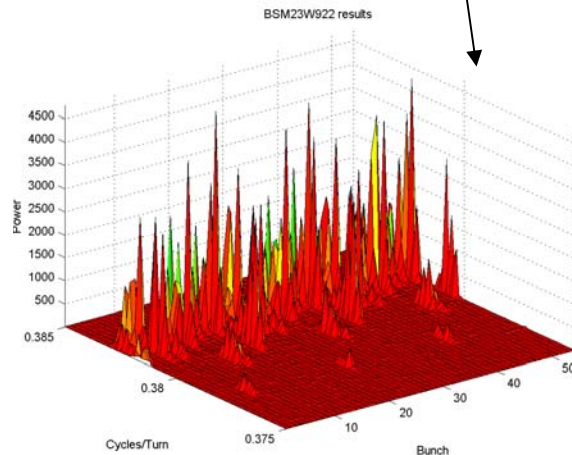
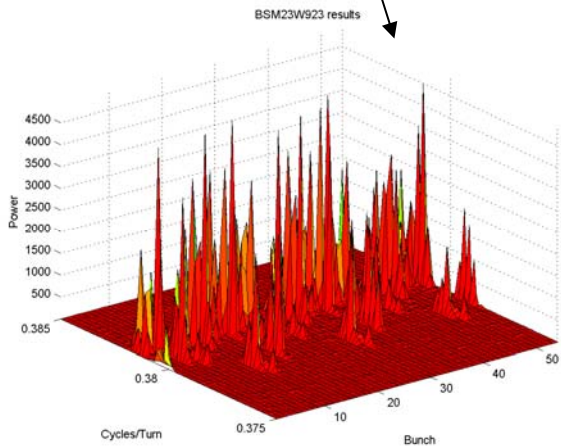


High I File:923
 $I_{e^-}=4.3\text{mA/bunch}$ (movie)

Medium I File:922
 $I_{e^-}=4.1\text{mA/bunch}$ (movie)

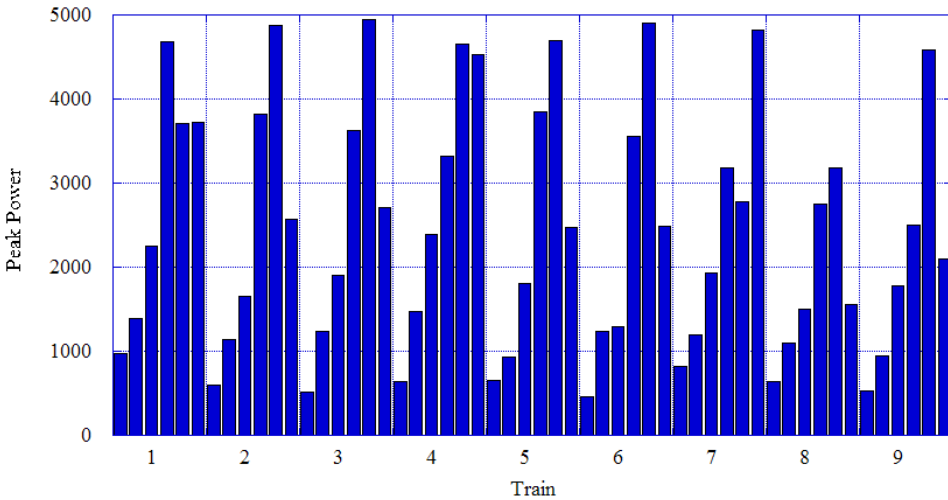
Low I File:919
 $I_{e^-}=3.8\text{mA/bunch}$ (movie)

•Vertical position oscillation frequency shifts along the train.



e- high frequency vertical position oscillation-FFT Power

FFT of e- Vertical Position CHESS bunches @~243kHz

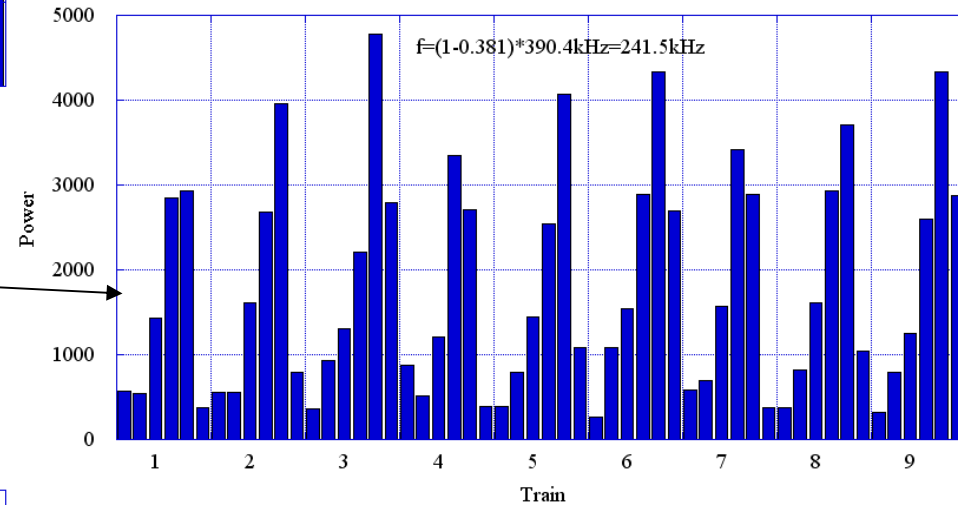


High I File:923

$I_{e^-}=4.3\text{mA/bunch}$

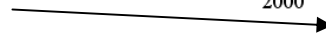


FFT of e- Vertical Position CHESS bunches @~241.5kHz

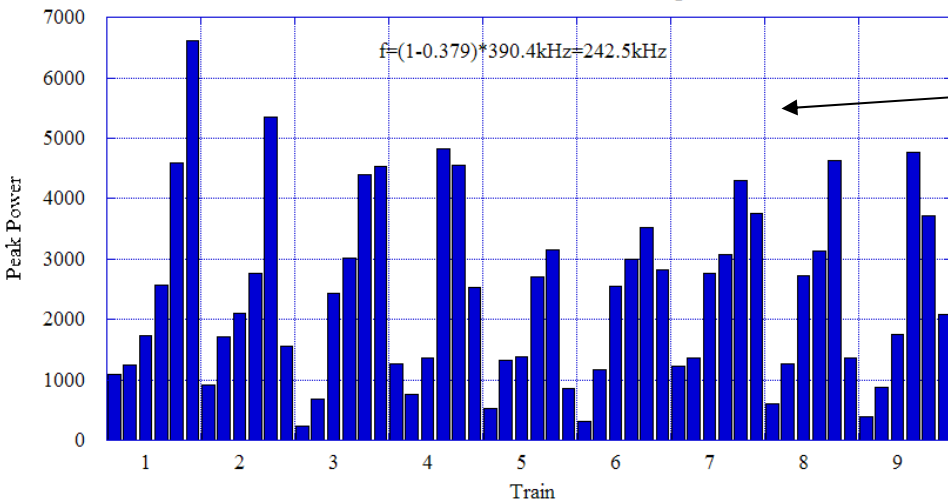


Medium I File:922

$I_{e^-}=4.1\text{mA/bunch}$



FFT of e- Vertical Position CHESS bunches @242.5kHz



Low I File:919

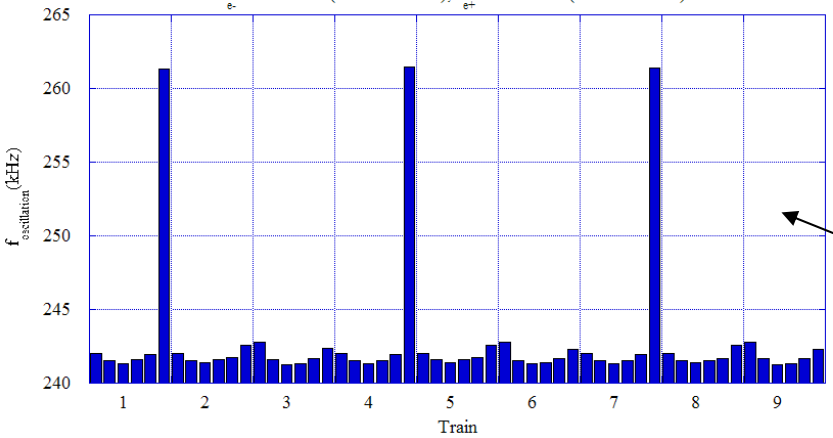
$I_{e^-}=3.8\text{mA/bunch}$



FFT power increases along the train

e- high frequency vertical position oscillation-Frequency of Oscillation

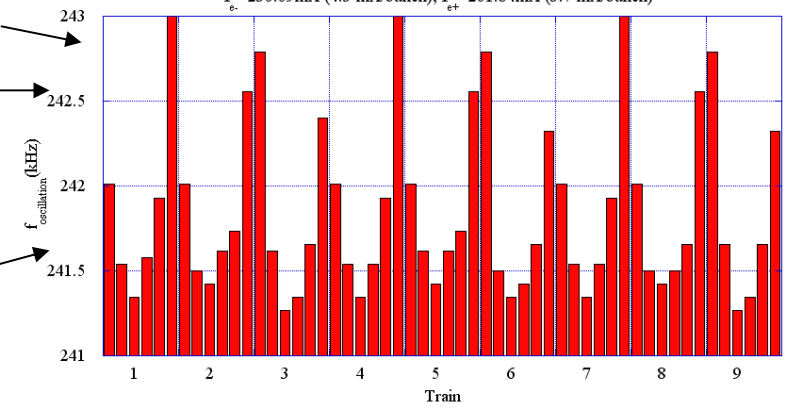
e- Vertical Position Oscillation Frequency at Peak Power
 $I_{e^-} = 230.09\text{mA}$ (4.3 mA/bunch), $I_{e^{++}} = 201.84\text{mA}$ (3.7 mA/bunch)



Detailed View

$\Delta f_{\text{osc}} = 1.5\text{kHz}$

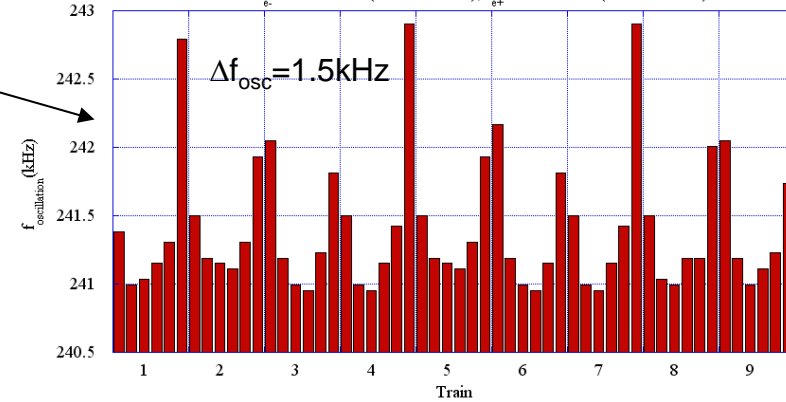
High I File:923
 $I_{e^-} = 4.3\text{mA/bunch}$



- Oscillation frequency shift, Δf_{osc} , along the trains is current dependent.
- Large frequency jump is occasionally noted

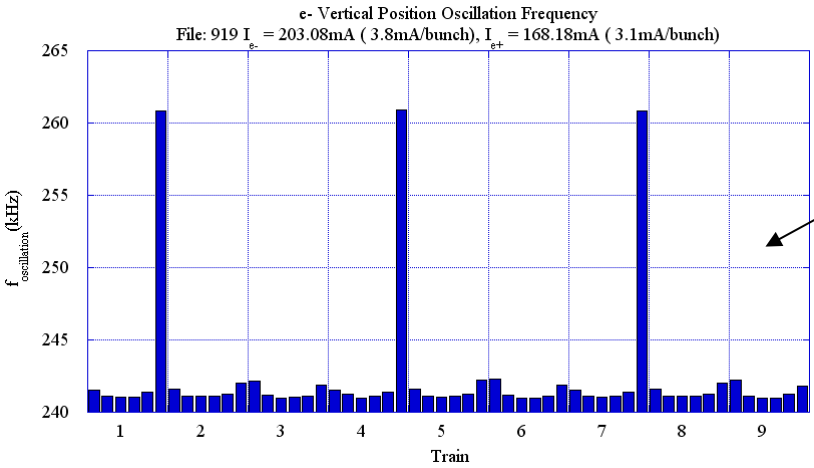
Medium I File:922
 $I_{e^-} = 4.1\text{mA/bunch}$

e- Vertical Position Oscillation Frequency
 File:922 $I_{e^-} = 203.08\text{mA}$ (3.8mA/bunch), $I_{e^{++}} = 168.18\text{mA}$ (3.1mA/bunch)

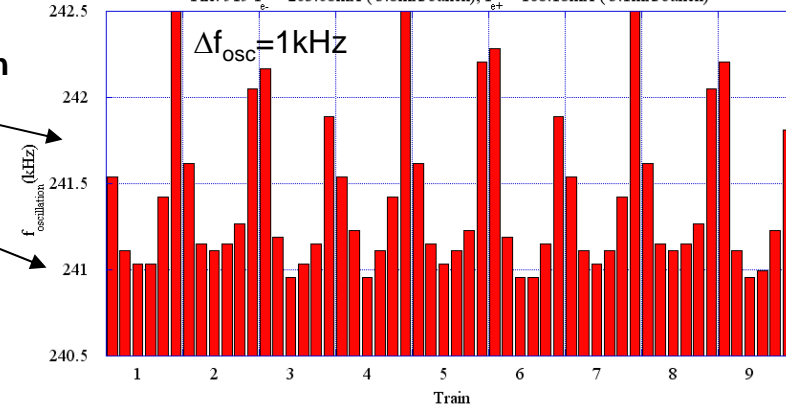


Low I File:919
 $I_{e^-} = 3.8\text{mA/bunch}$

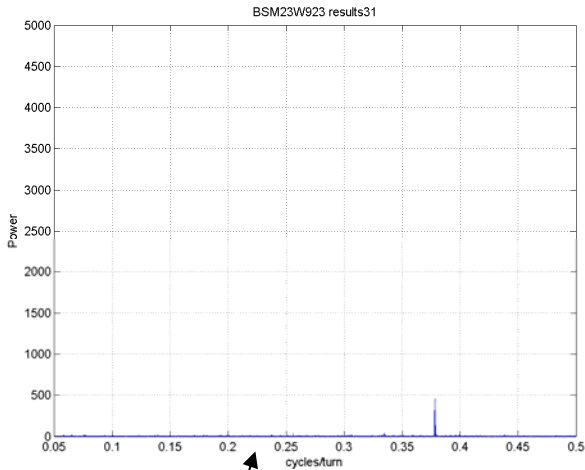
e- Vertical Position Oscillation Frequency
 File: 919 $I_{e^-} = 203.08\text{mA}$ (3.8mA/bunch), $I_{e^{++}} = 168.18\text{mA}$ (3.1mA/bunch)



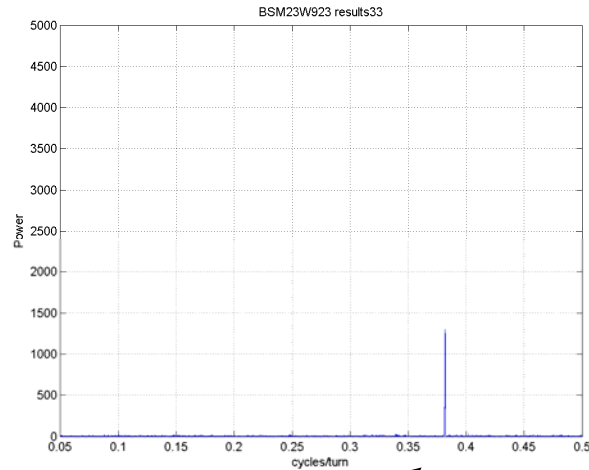
Detailed View



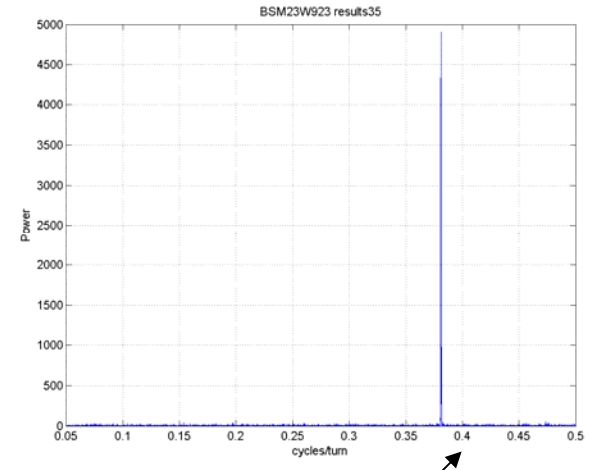
e- high frequency vertical position oscillation - FFT of vertical position – High I



Bunch 31
 Peak Power=459@242.8kHz
 $y_{avg}=2.631\text{mm}$
 Std=0.022mm

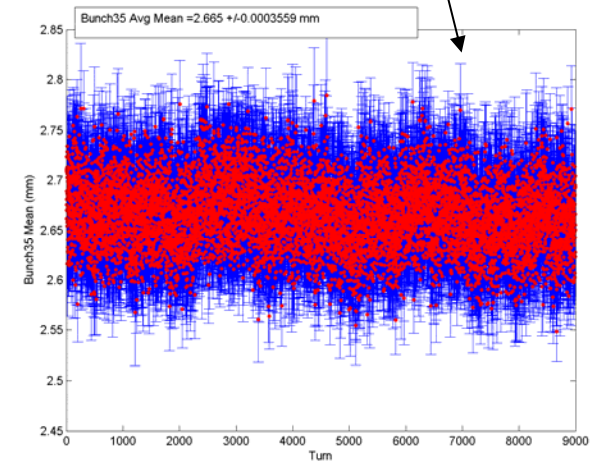
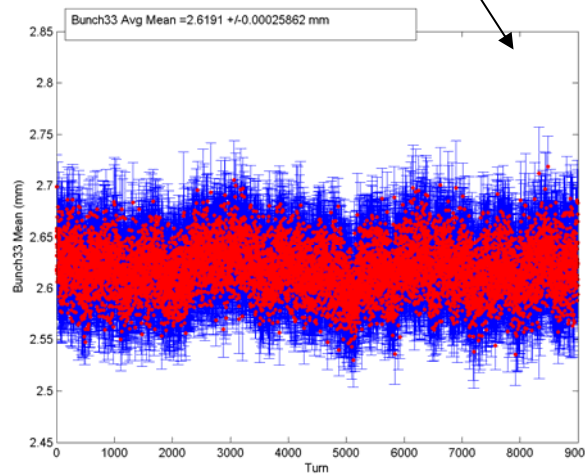
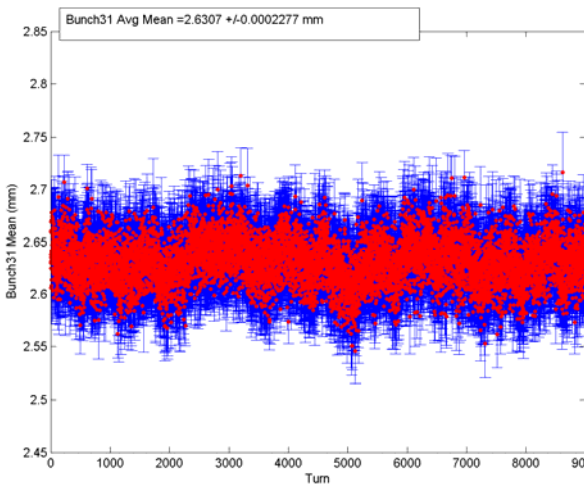


Bunch 33
 Peak Power=1300@241.3kHz
 $y_{avg}=2.619\text{mm}$
 Std=0.024mm

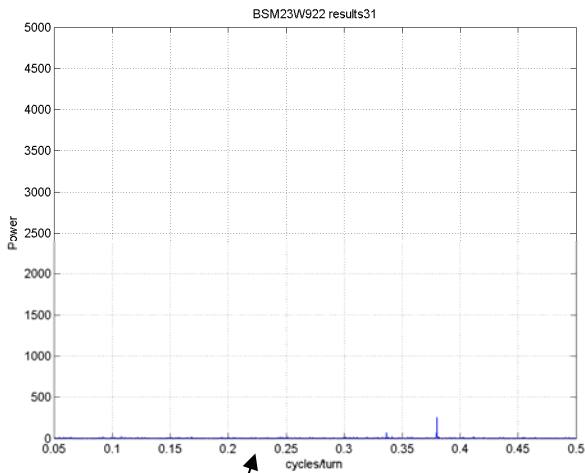


Bunch 35
 Peak Power=4905@241.7kHz
 $y_{avg}=2.665\text{mm}$
 Std=0.034mm

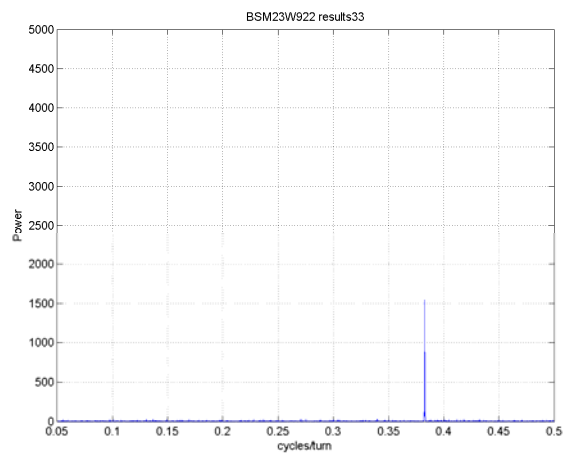
File:923 $I_{e-}=4.3\text{mA/bunch}$
 •Vertical position oscillation amplitude correlates with FFT power.



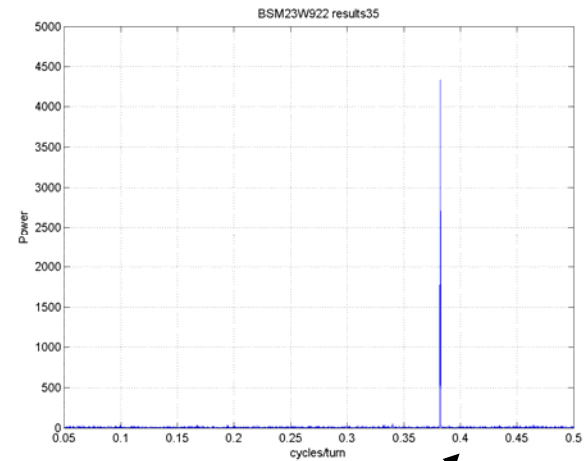
e- high frequency vertical position oscillation - FFT of vertical position – Medium I



Bunch 31
Peak Power=261 @242.2kHz
 $y_{avg}=2.715\text{mm}$
Std=0.021mm

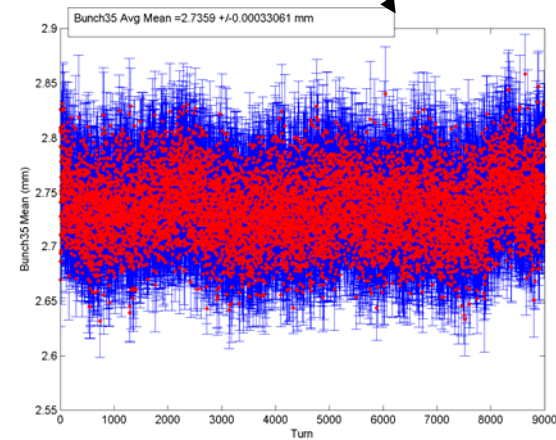
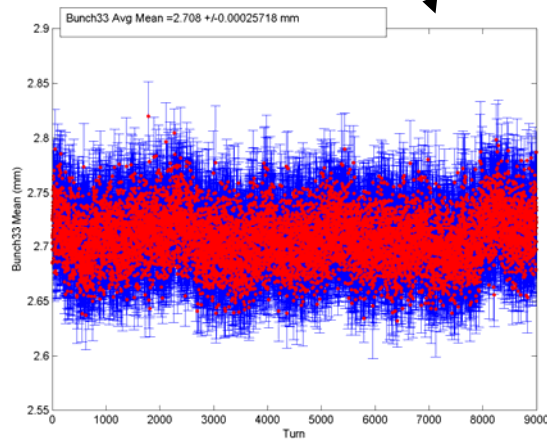
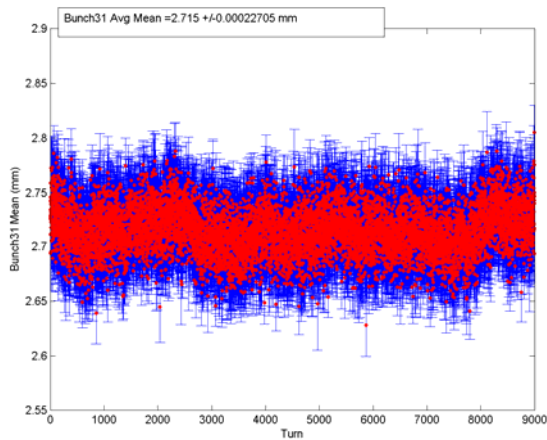


Bunch 33
Peak Power=1543 @241kHz
 $y_{avg}=2.708\text{mm}$
Std=0.024mm

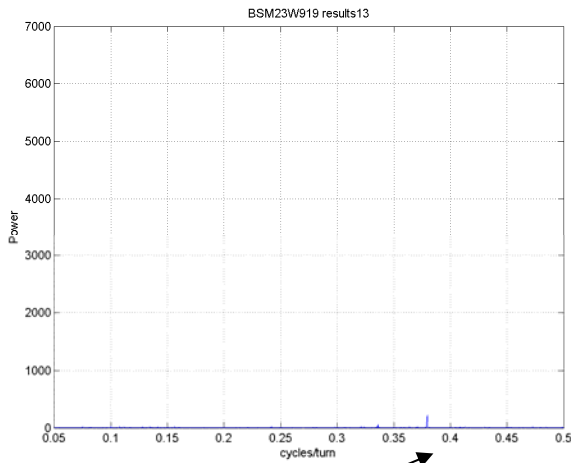


Bunch 35
Peak Power=4335 @241.1kHz
 $y_{avg}=2.736\text{mm}$
Std=0.031mm

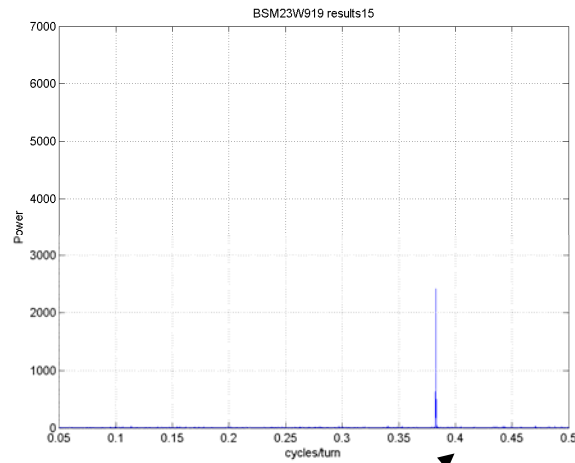
File:922 $I_{e-}=4.1\text{mA/bunch}$
•Vertical position oscillation amplitude correlates with FFT power.



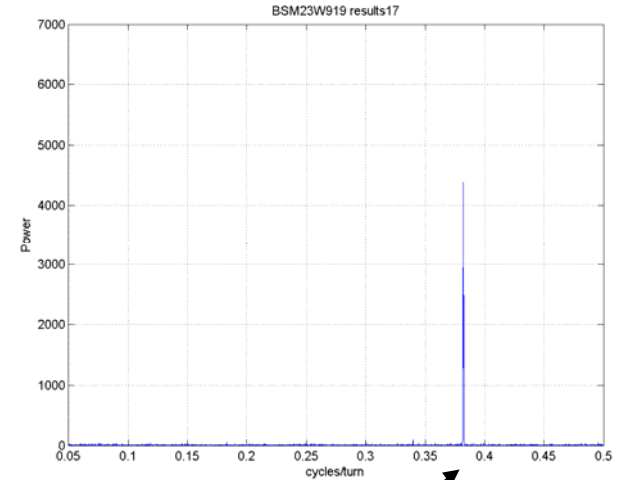
e- high frequency vertical position oscillation - FFT of vertical position – Low I



Bunch 13
Peak Power=228@242.2kHz
 $y_{avg}=2.651\text{mm}$
Std=0.021mm

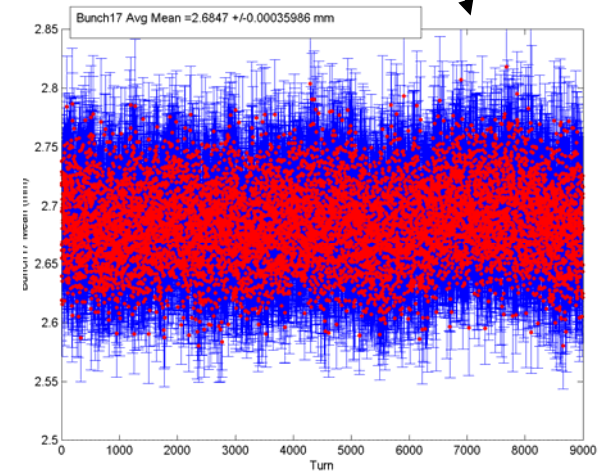
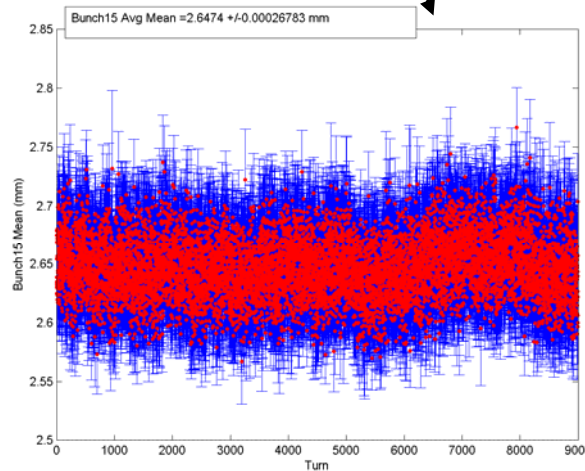
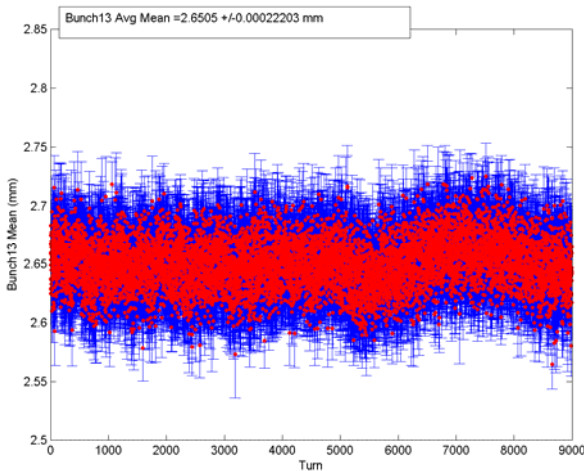


Bunch 15
Peak Power=2424@241kHz
 $y_{avg}=2.647\text{mm}$
Std=0.025mm



Bunch 17
Peak Power=4387@241.1kHz
 $y_{avg}=2.685\text{mm}$
Std=0.035mm

File:919 $I_{e-}=3.8\text{mA/bunch}$
•Vertical position oscillation amplitude correlates with FFT power.

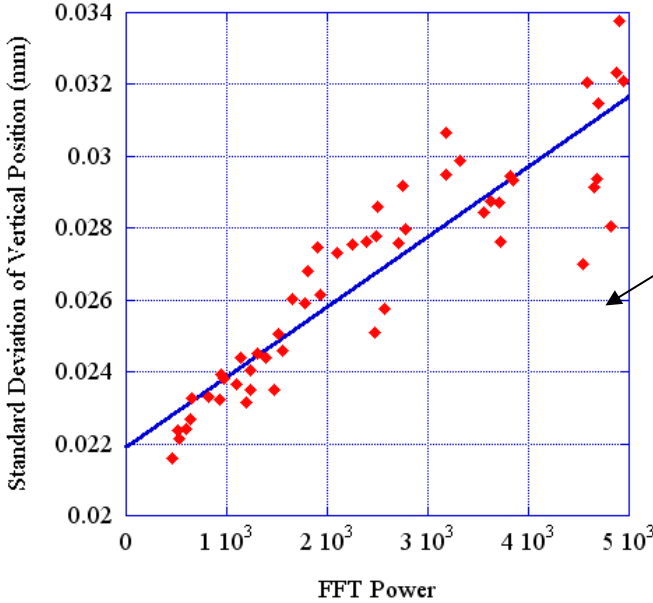


e- vertical position oscillations amplitude correlation FFT Power

— STD (vertical position) = $0.021919 + 1.9534e-6 * (\text{FFT Power})$ R = 0.91235

e- 9x6 CHESS Operation File:923 $I_{e^-} = 4.3\text{mA/bunch}$

Correlation of STD Vertical Position vs. FFT Power



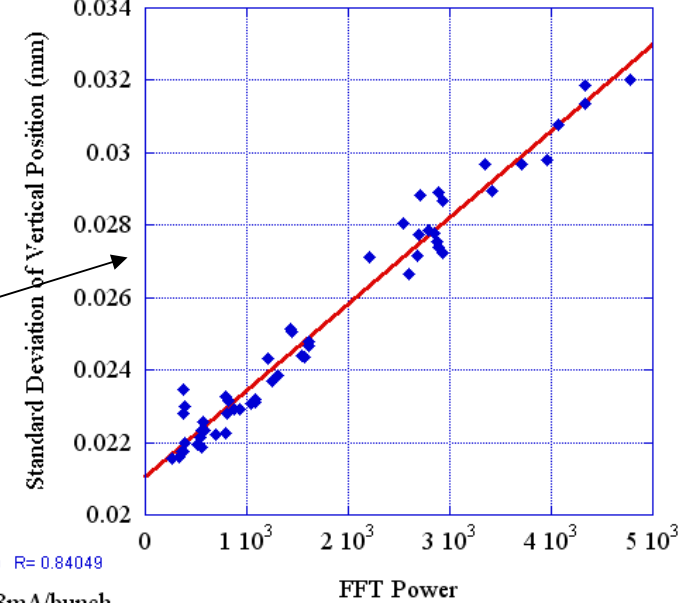
High I File:923
 $I_{e^-} = 4.3\text{mA/bunch}$

Medium I File:922
 $I_{e^-} = 4.1\text{mA/bunch}$

— STD (vertical position) = $0.021058 + 2.3875e-6 * (\text{FFT power})$ R = 0.985

e- 9x6 CHESS Operation File:922 $I_{e^-} = 4.1\text{mA/bunch}$

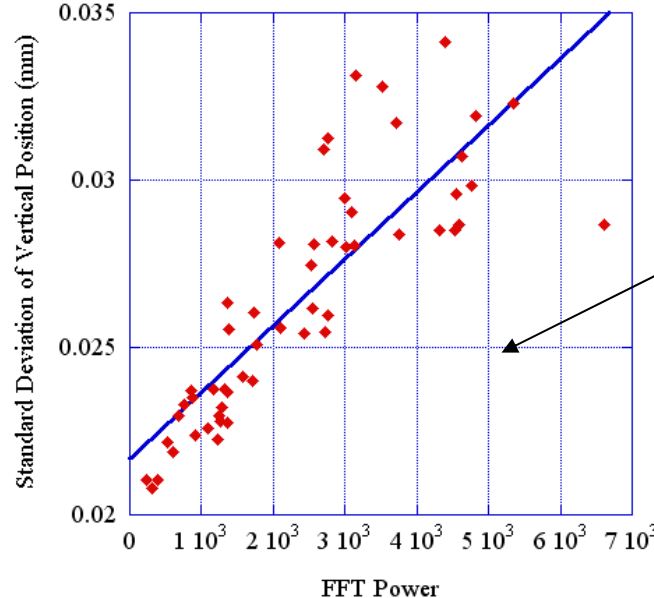
Correlation of STD Vertical Position vs. FFT Power



— STD (vertical position) = $0.021649 + 1.9887e-6 * (\text{FFT Power})$ R = 0.84049

e- 9x6 CHESS Operation File:919 $I_{e^-} = 3.8\text{mA/bunch}$

Correlation of STD Vertical Position vs. FFT Power



Low I File:919
 $I_{e^-} = 3.8\text{mA/bunch}$

•Correlation between e- vertical position oscillation amplitude and FFT power. Signature of coherent oscillation.