

# Vertical Beam Size Study during CHESS Operation

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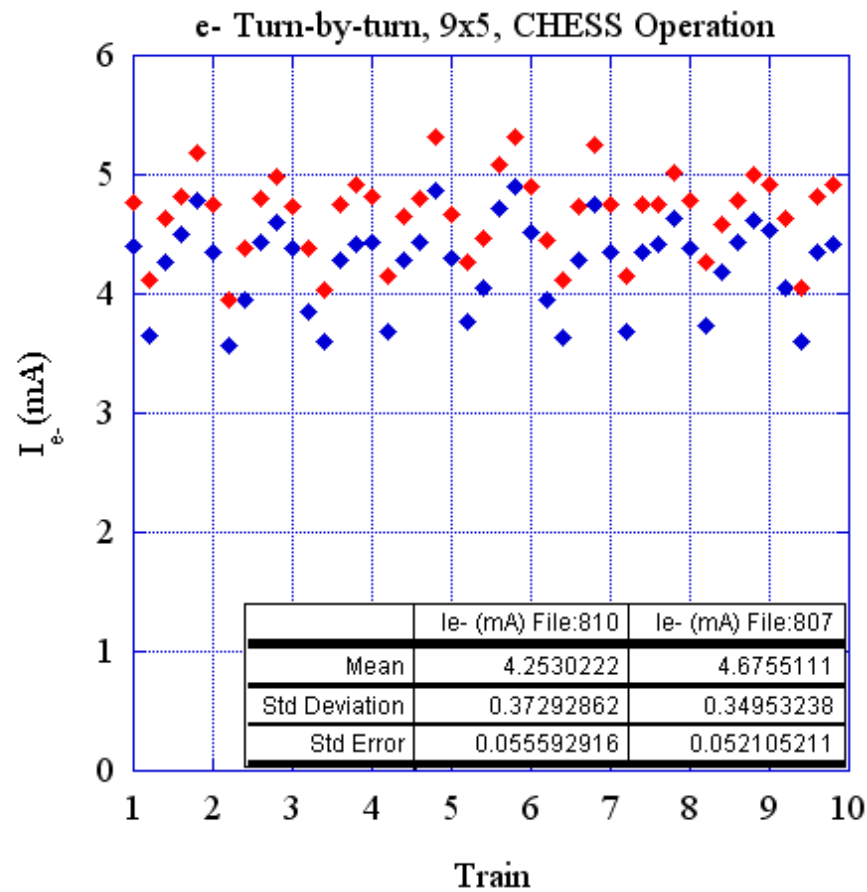
October 12, 2006

◆ File:810  $I_{e^-}=191.4\text{mA}$  (4.25mA/bunch),  $I_{e^+}=192.6\text{mA}$  (4.28mA/bunch)

◆ File:807  $I_{e^-}=210.4\text{mA}$  (4.68mA/bunch),  $I_{e^+}=206.3\text{mA}$  (4.58mA/bunch)

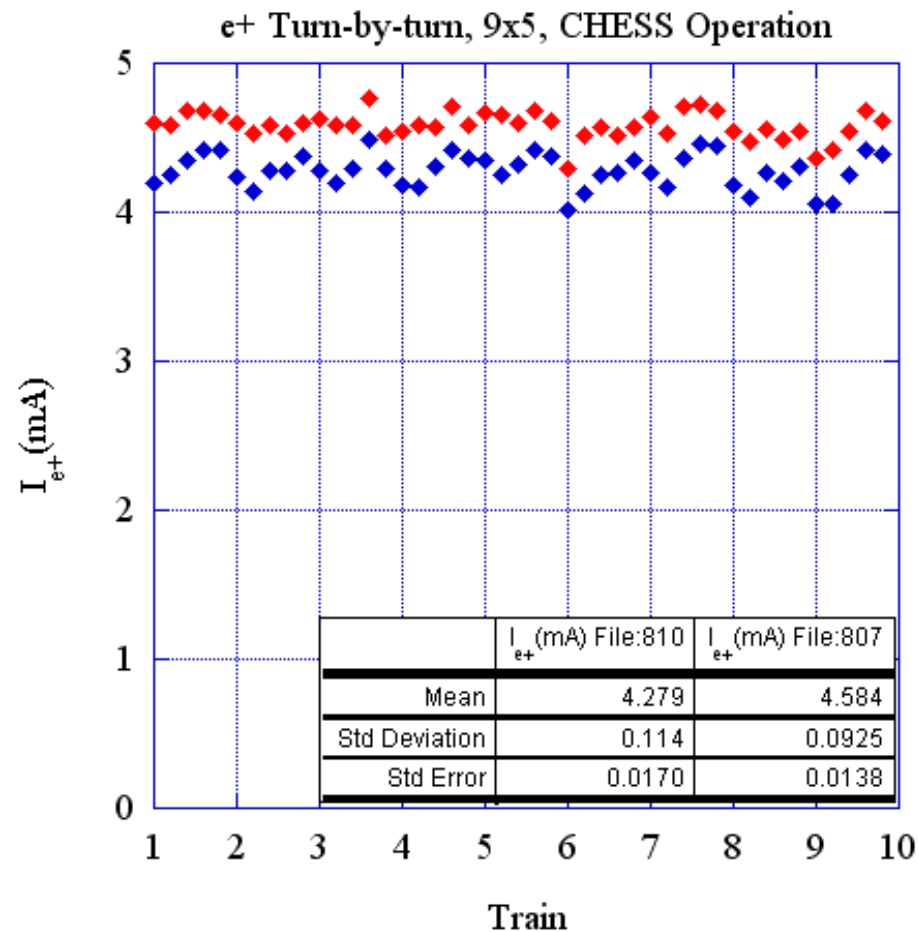
## 9x5 Pattern

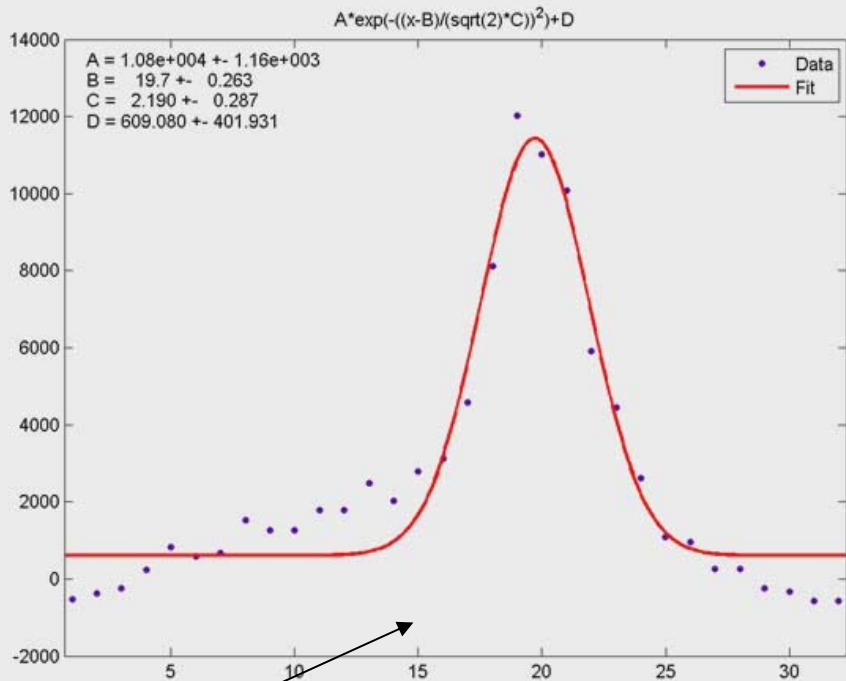
## Single bunch current for e+ study



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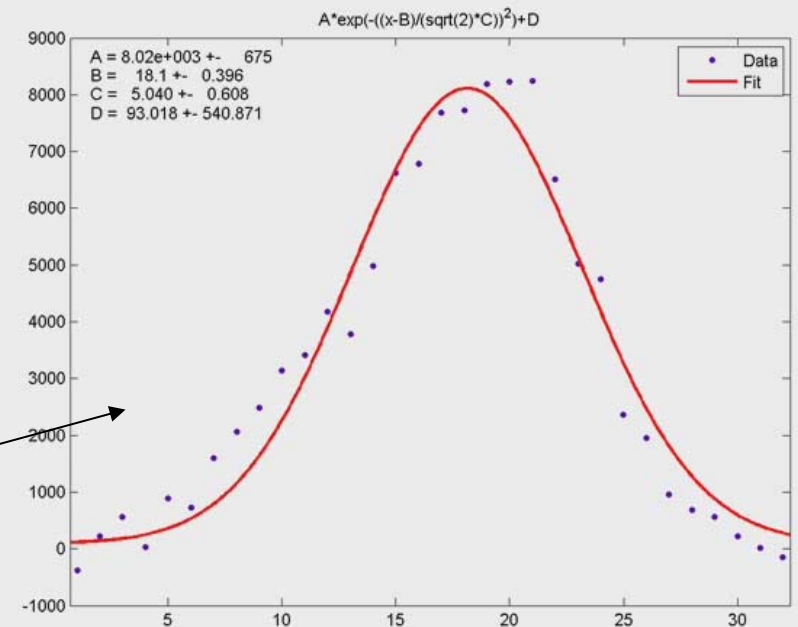


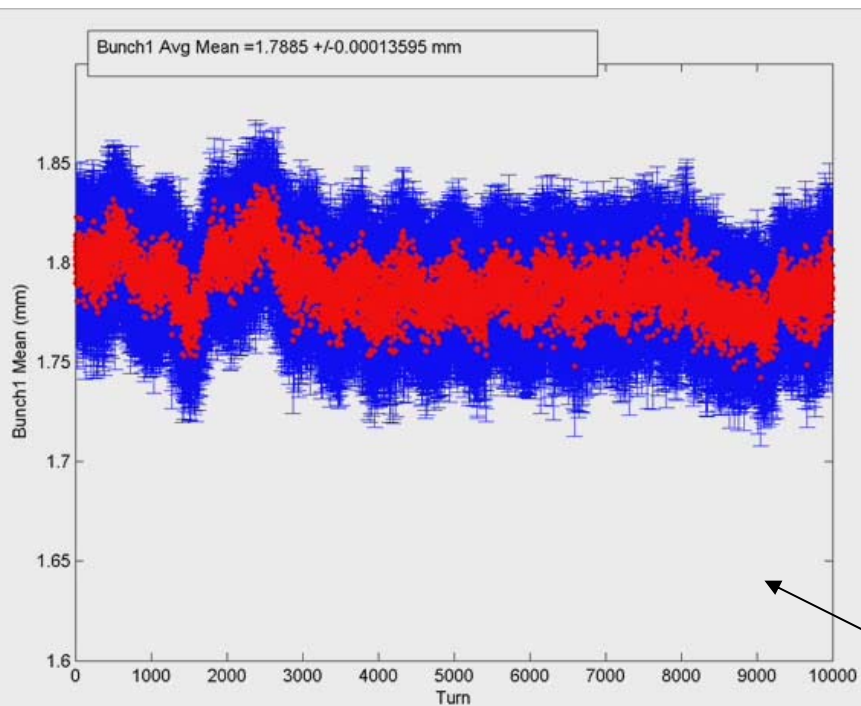
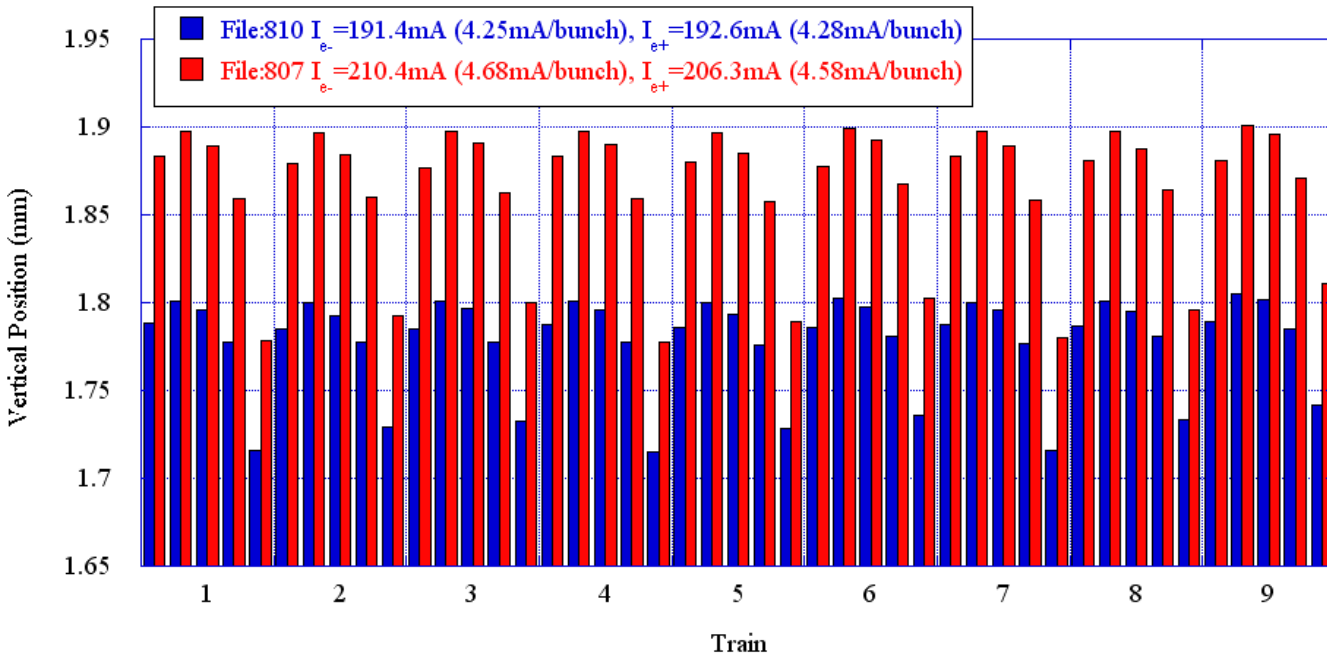
e+ single bunch vertical bunch distributions from the PMT array.

- 10,000 turns of all 45 e+/e- bunches.

Bunch 1 Train 1  
1<sup>st</sup> ten turns (movie)

Bunch 1 Train 5  
1<sup>st</sup> ten turns (movie)

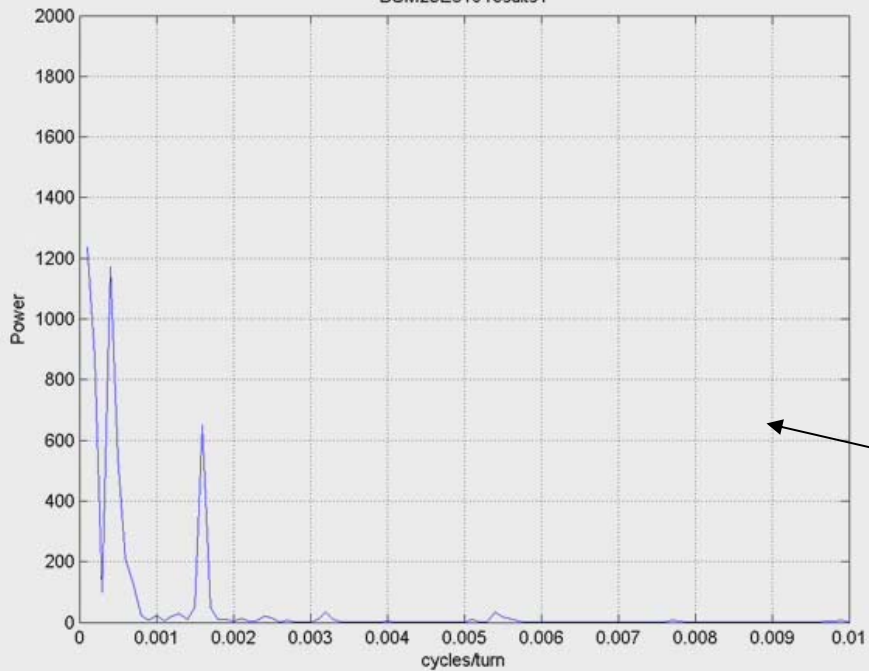




e+ mean vertical position along the train

- Last bunch in the train is vertically offset from other bunches.
- Low frequency vertical oscillation is denoted for all 45 bunches.

Mean vertical position for 10,000 turns for 45 bunches (File:810 movie)

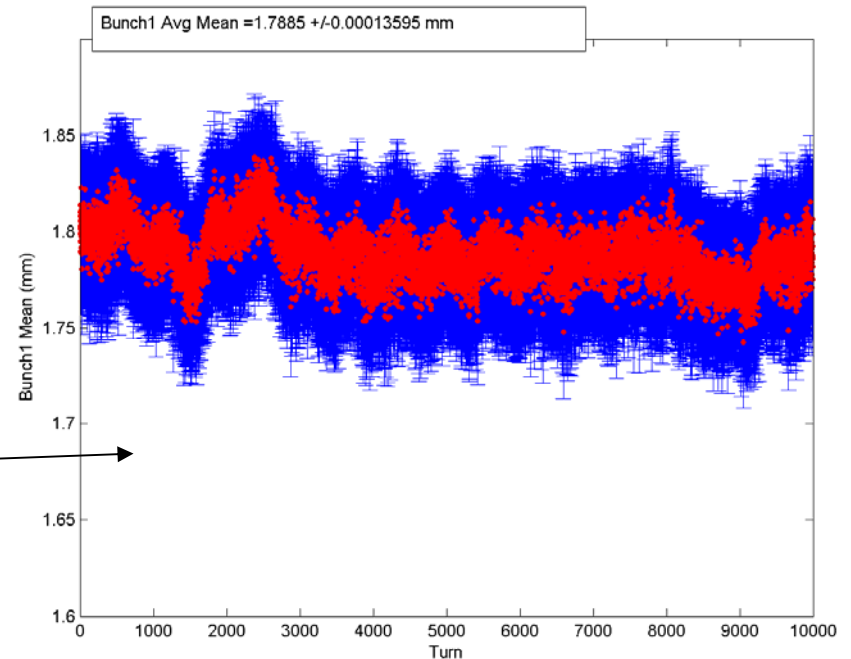


e+ low frequency vertical motion

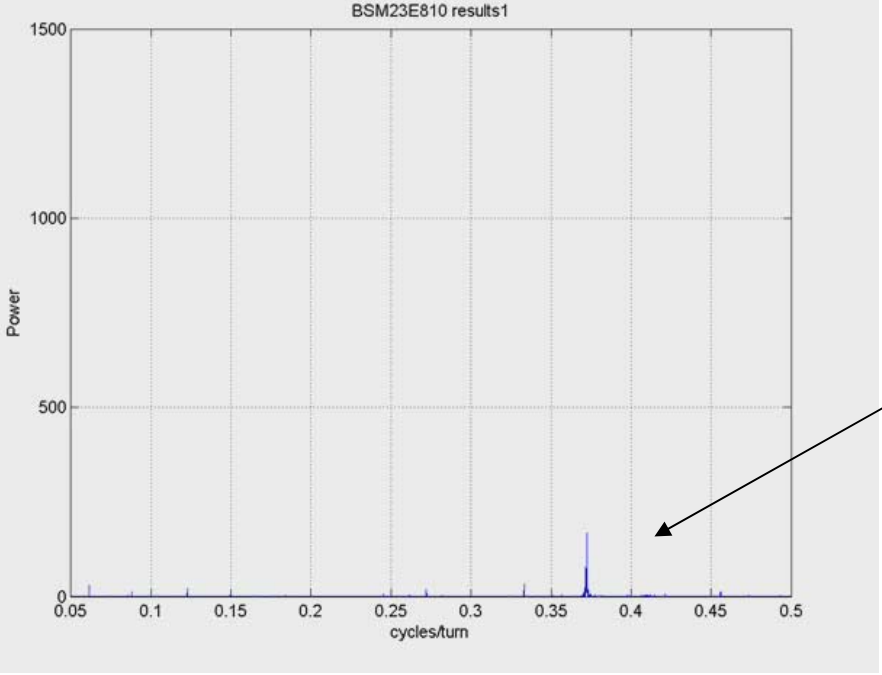
FFT of mean vertical position for 10,000 turns (movie)

Vertical oscillation at ~625 and 2500 turns

625 turn oscillation is the dominant frequency and is clearly evident for all 45 bunches

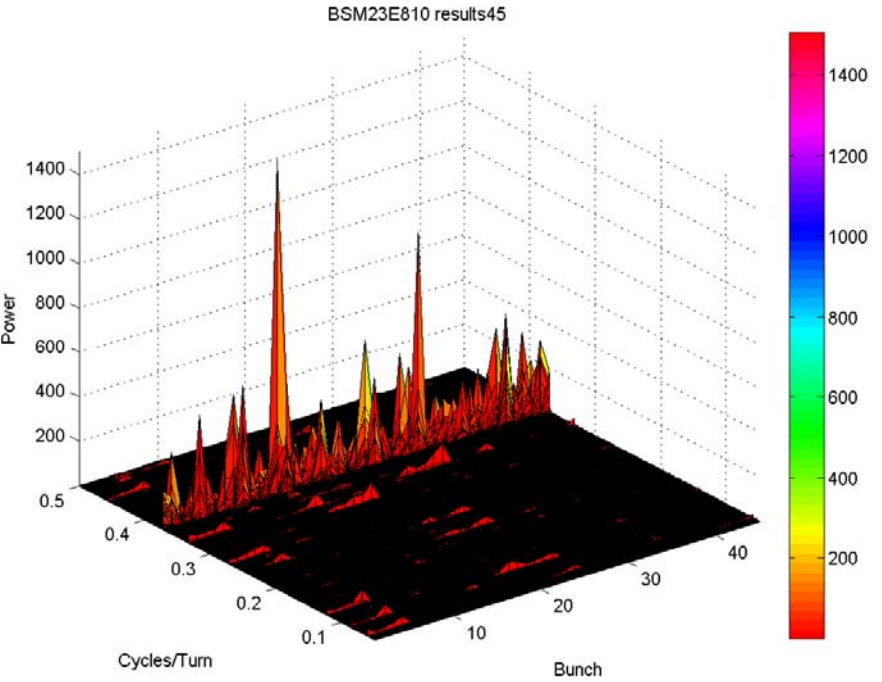
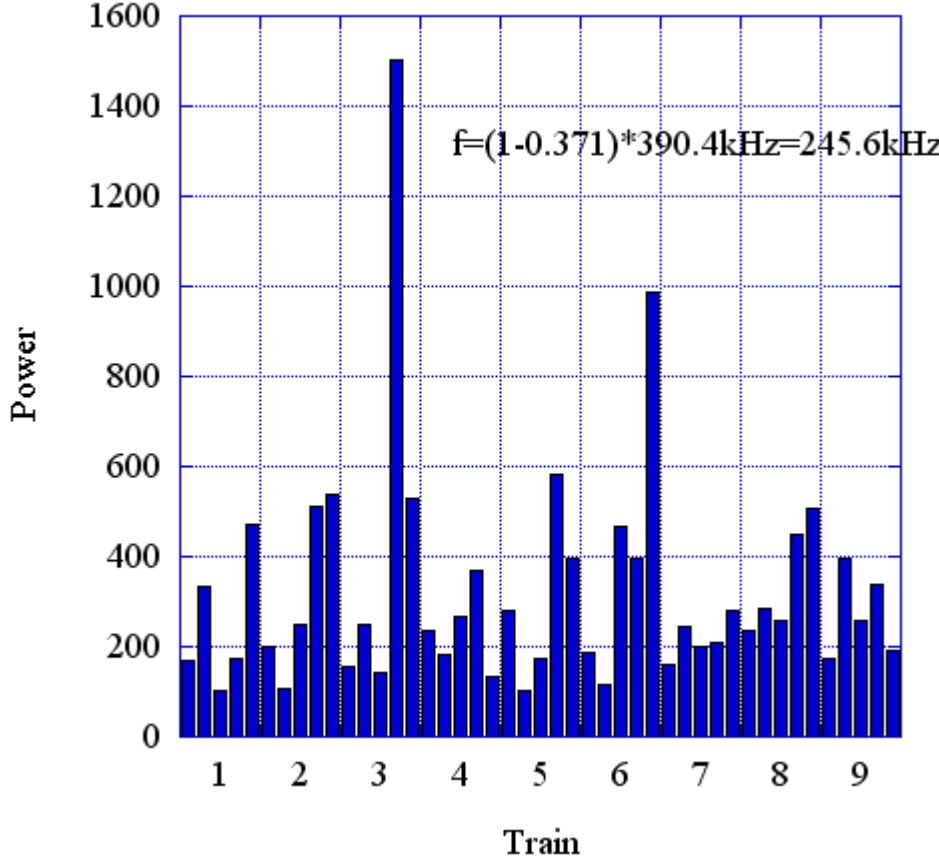


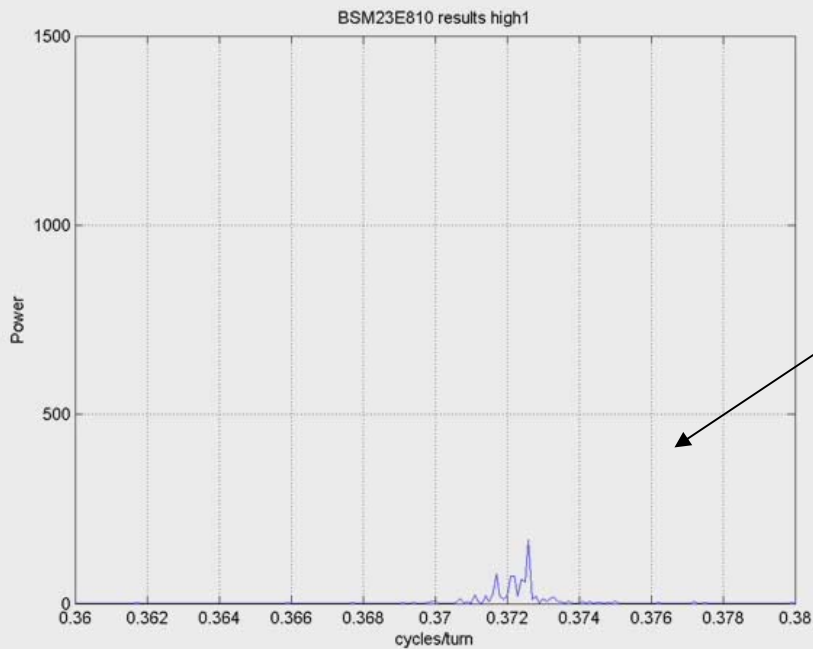
# e+ high frequency vertical motion



Vertical oscillation at the vertical tune is evident (movie)

FFT of e+ CHESS bunches @~245.6kHz

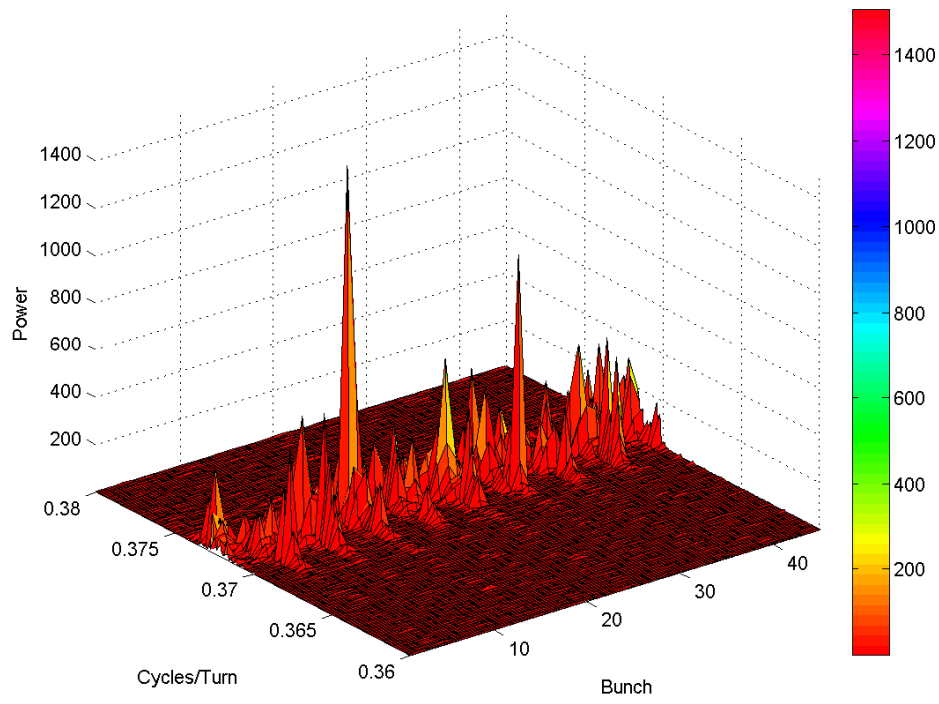




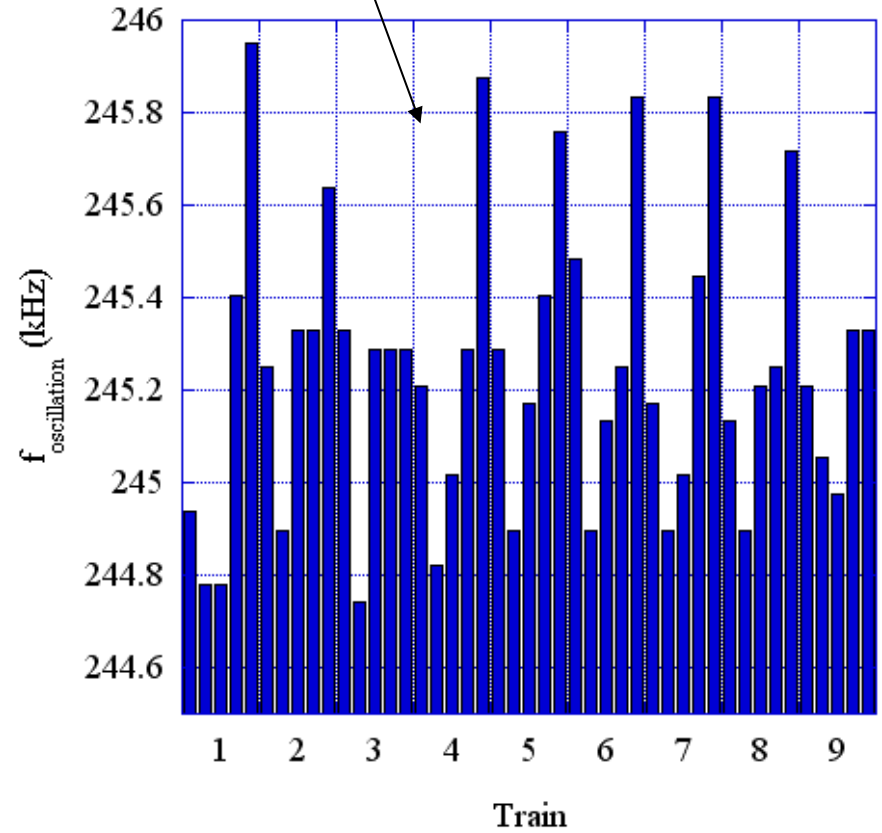
e+ high frequency vertical motion: Close-up

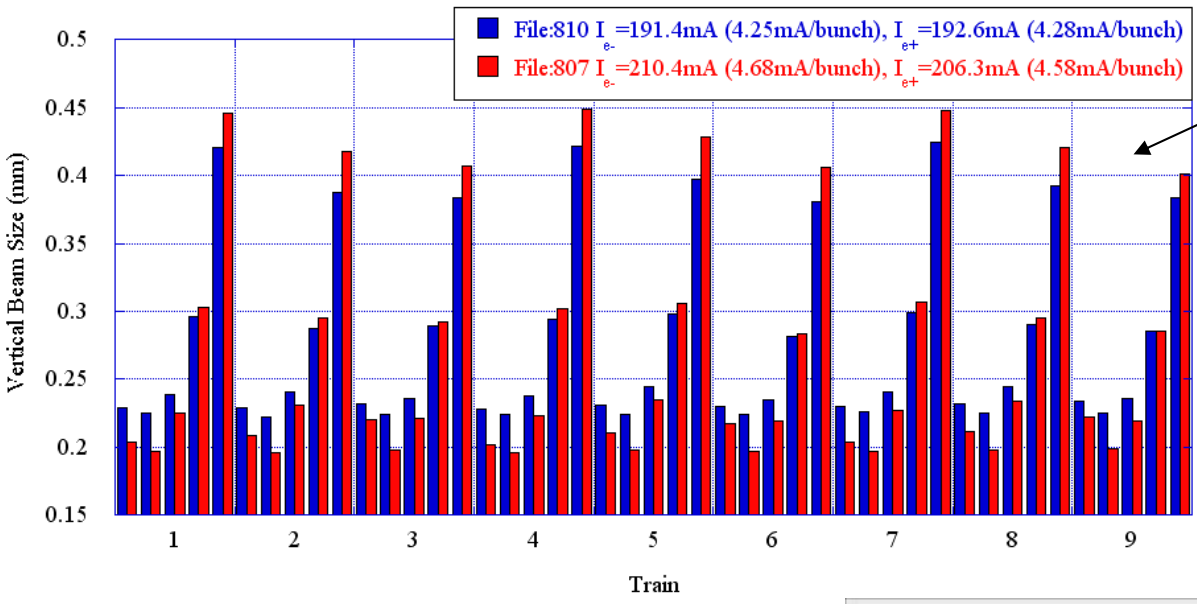
Close-up of FFT (movie)

Frequency of oscillation along the train



FFT of e+ mean vertical position for CHESS 9x5 pattern

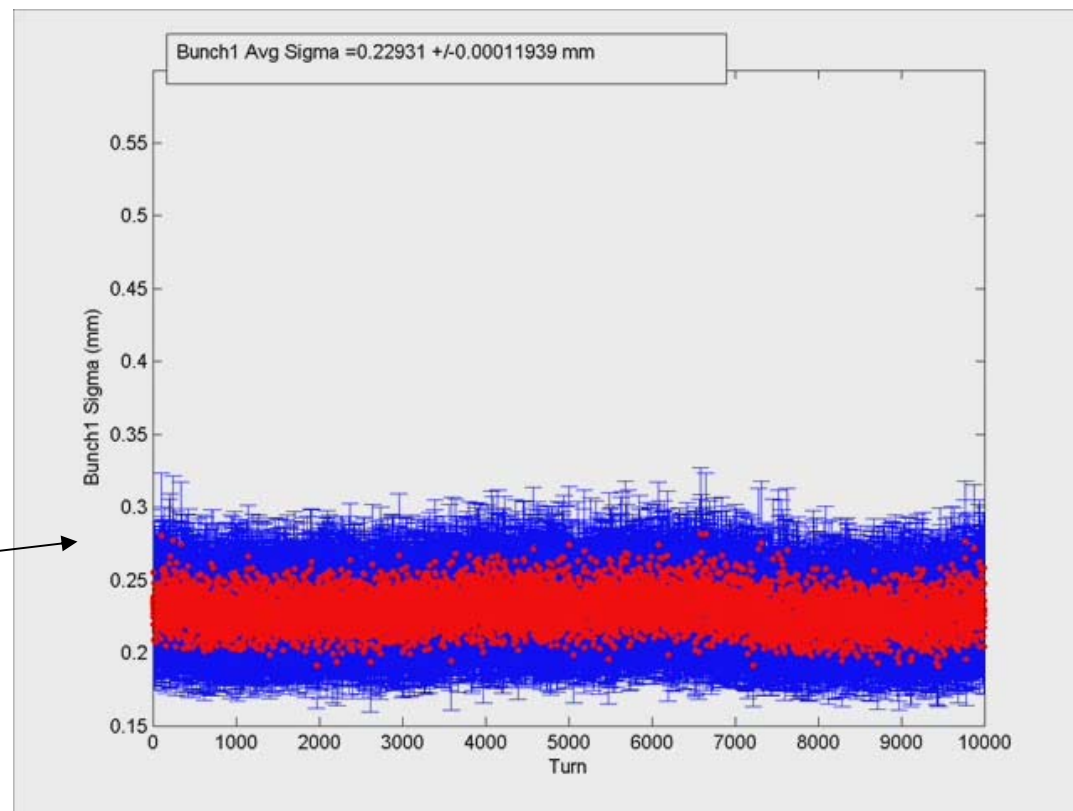




e+  $\sigma_v$  along the train

- Significant vertical beam size growth along each train.

$\sigma_v$  10,000 turns for 45 bunches (movie)



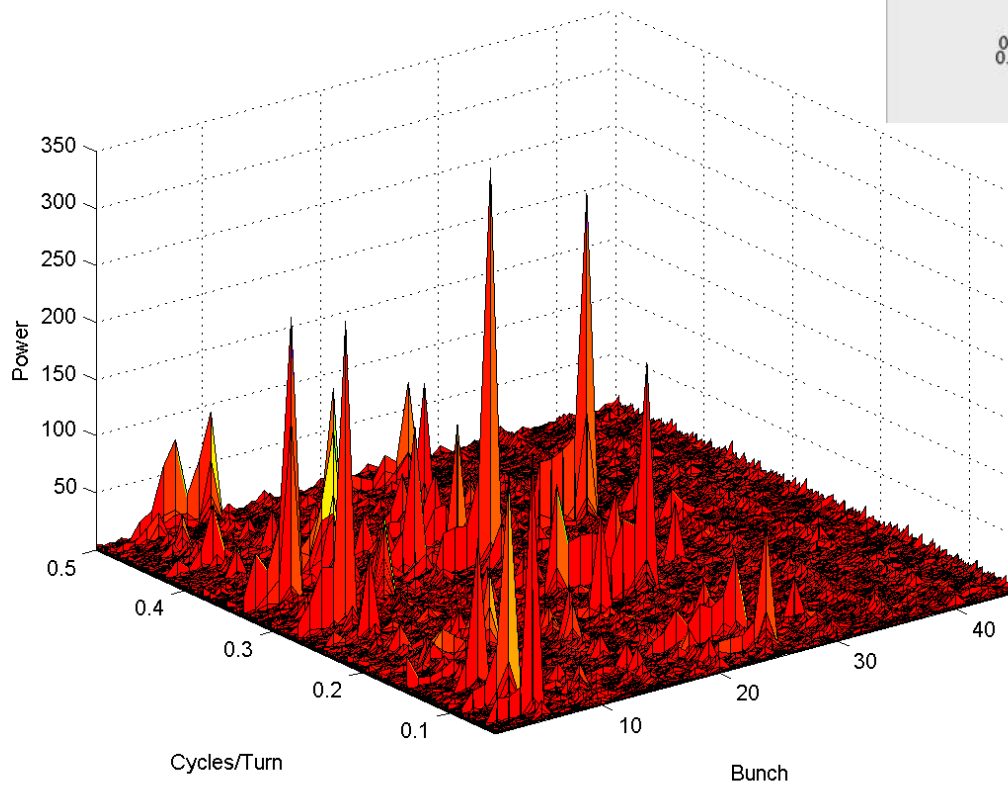


e+ high frequency motion of  $\sigma_v$

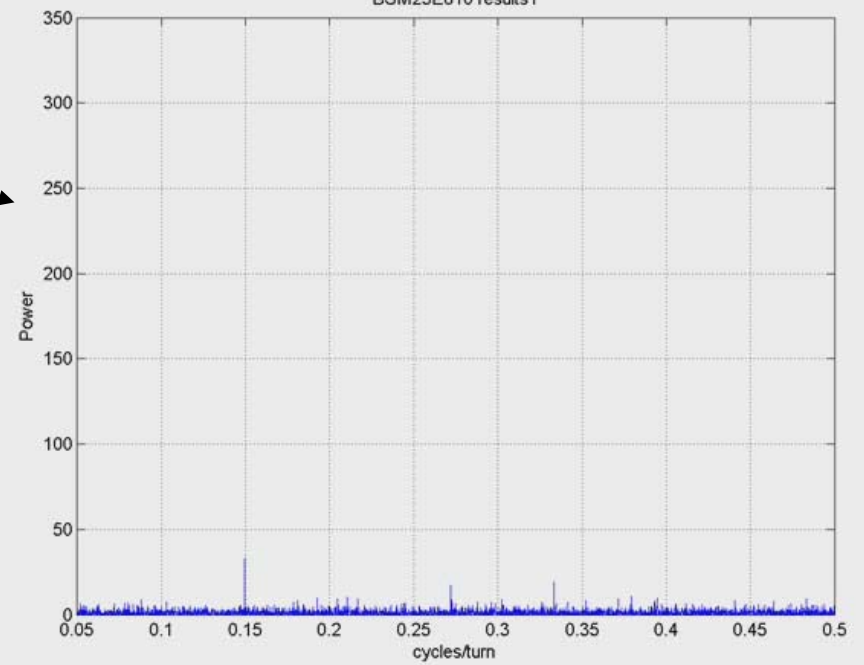
FFT of vertical beam size (movie)

No clear oscillation in the vertical beam size

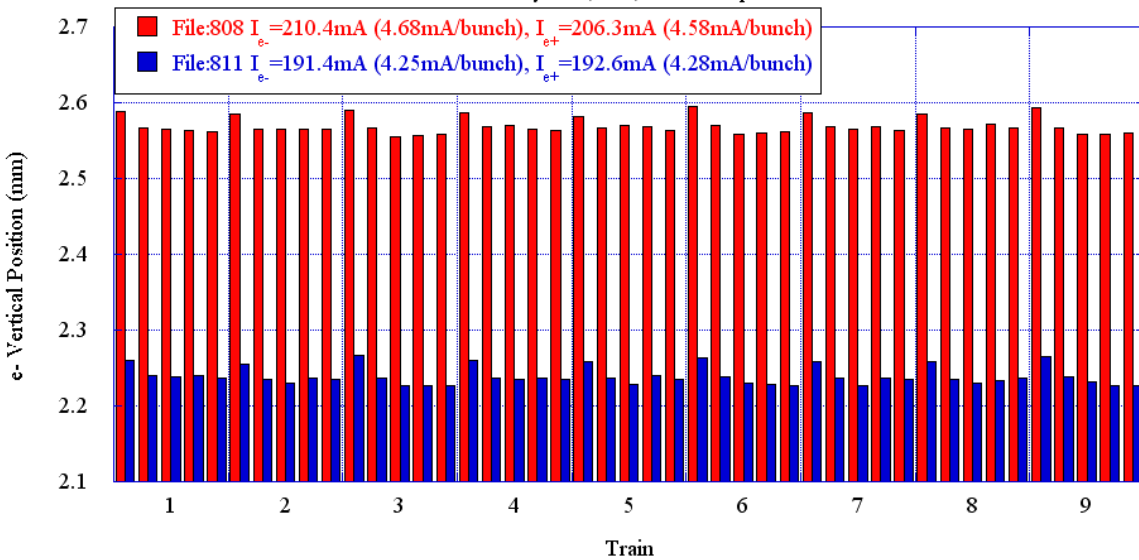
BSM23E810 results45



BSM23E810 results1



e- Turn-by-turn, 9x5, CHESS Operation

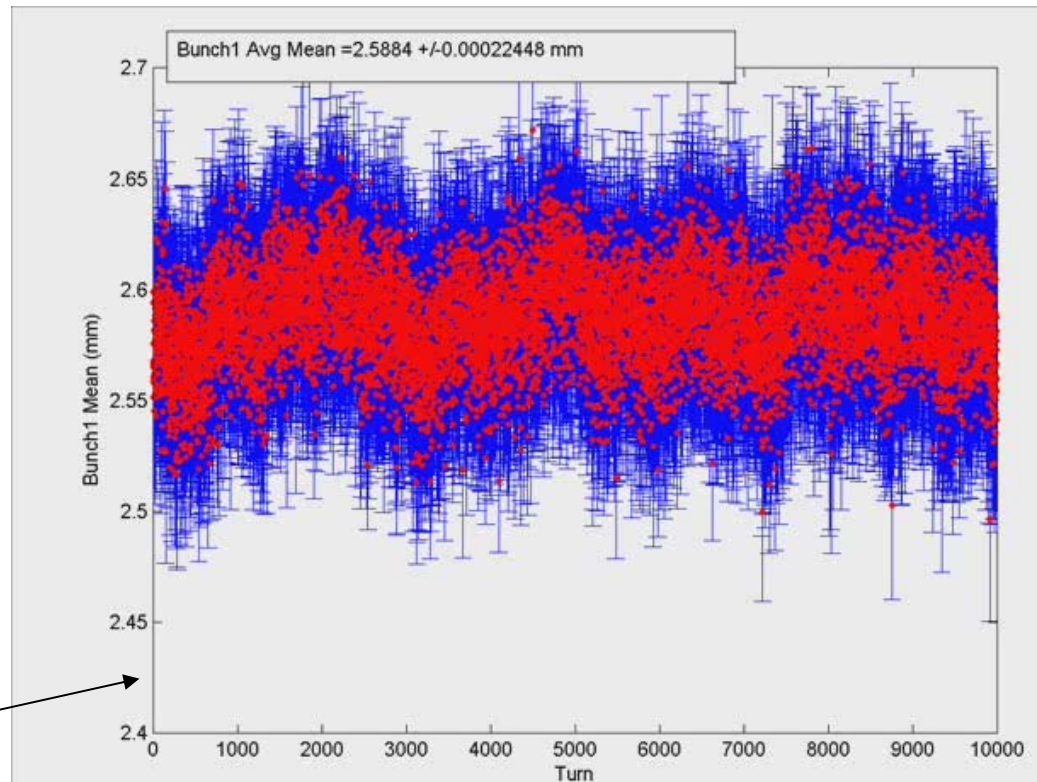


e- mean vertical position along the train

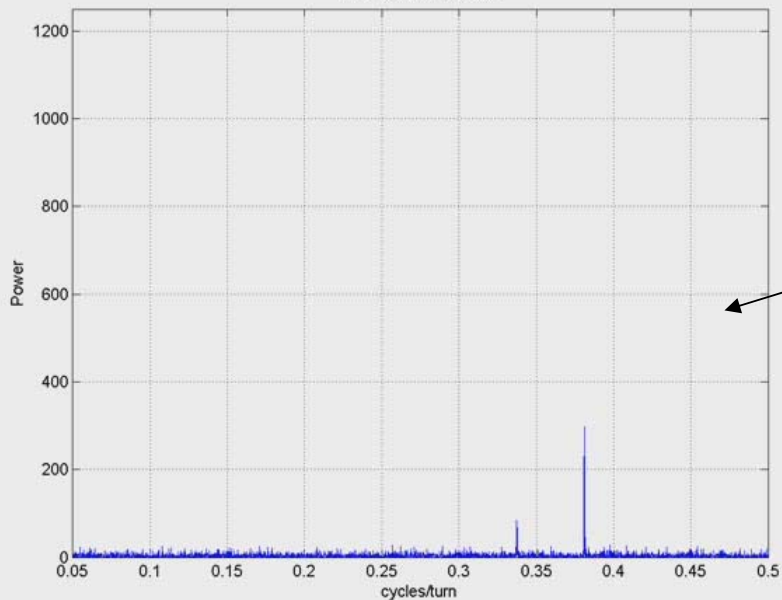
First bunch in the train is vertically offset from other bunches.

No clear low frequency vertical oscillation is denoted for all 45 bunches.

Mean vertical position for 10,000 turns for 45 bunches (movie)  
File:808



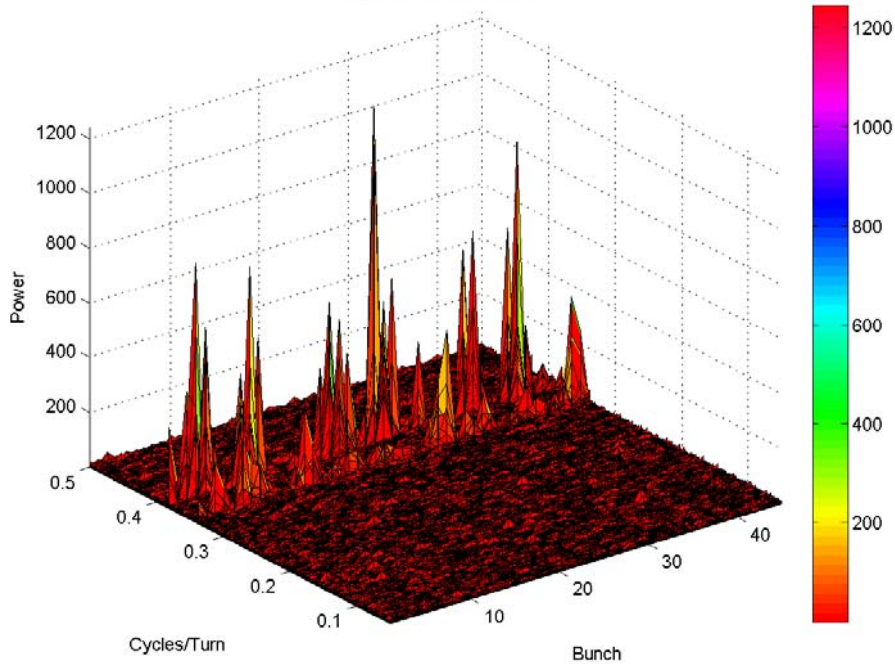
BSM23W811 results1



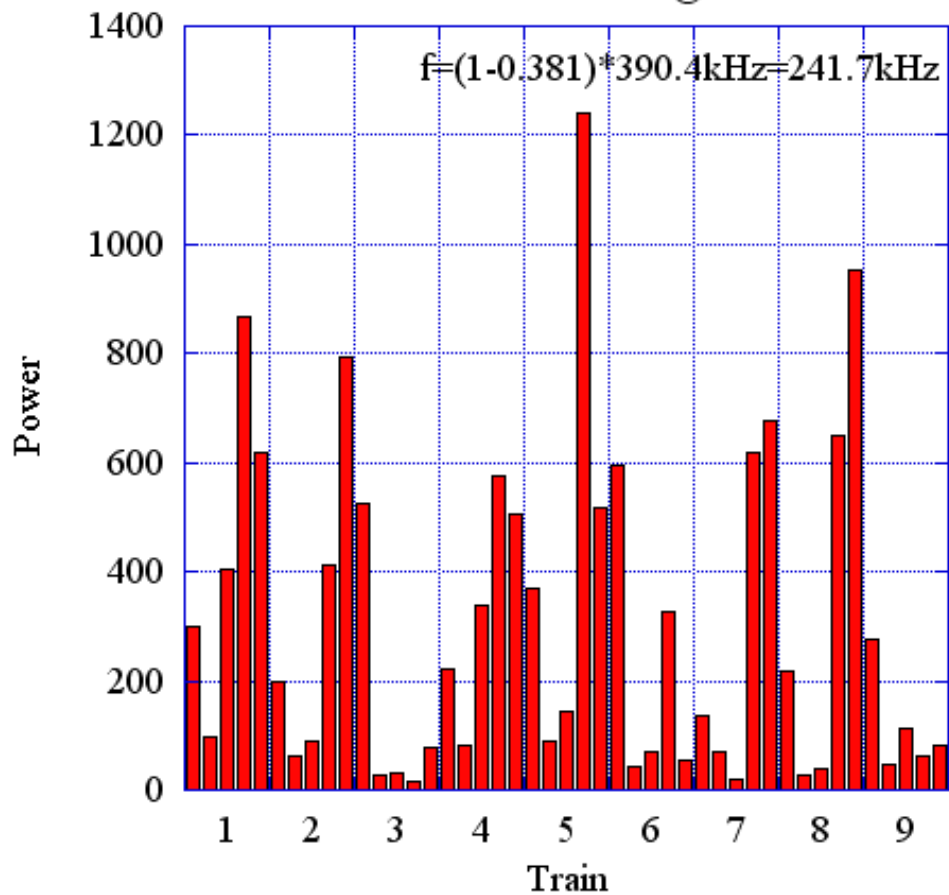
e- high frequency vertical motion

Vertical oscillation at the vertical tune is evident (movie) File:811

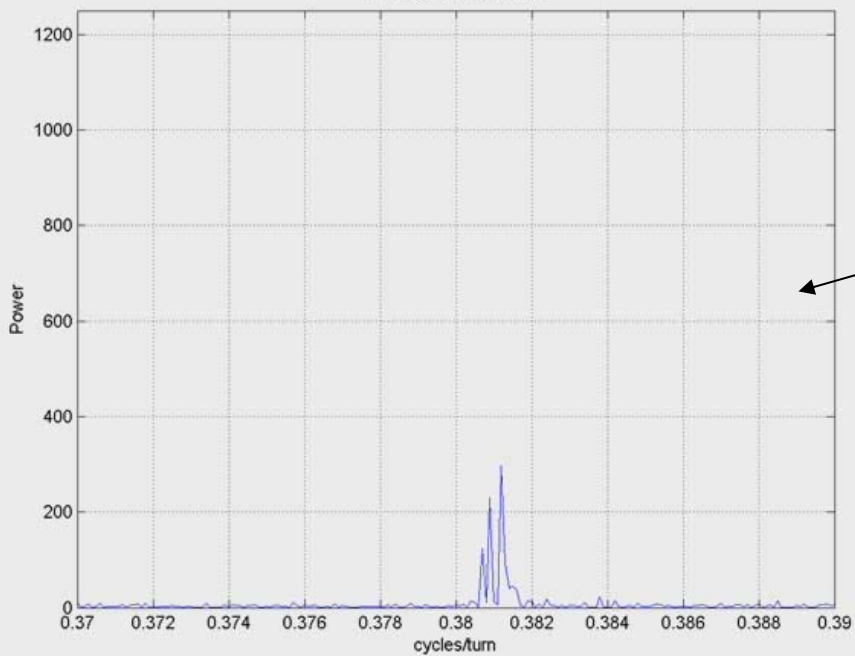
BSM23W811 results45



FFT of e- CHESS bunches @~241.7kHz



BSM23W811 results1

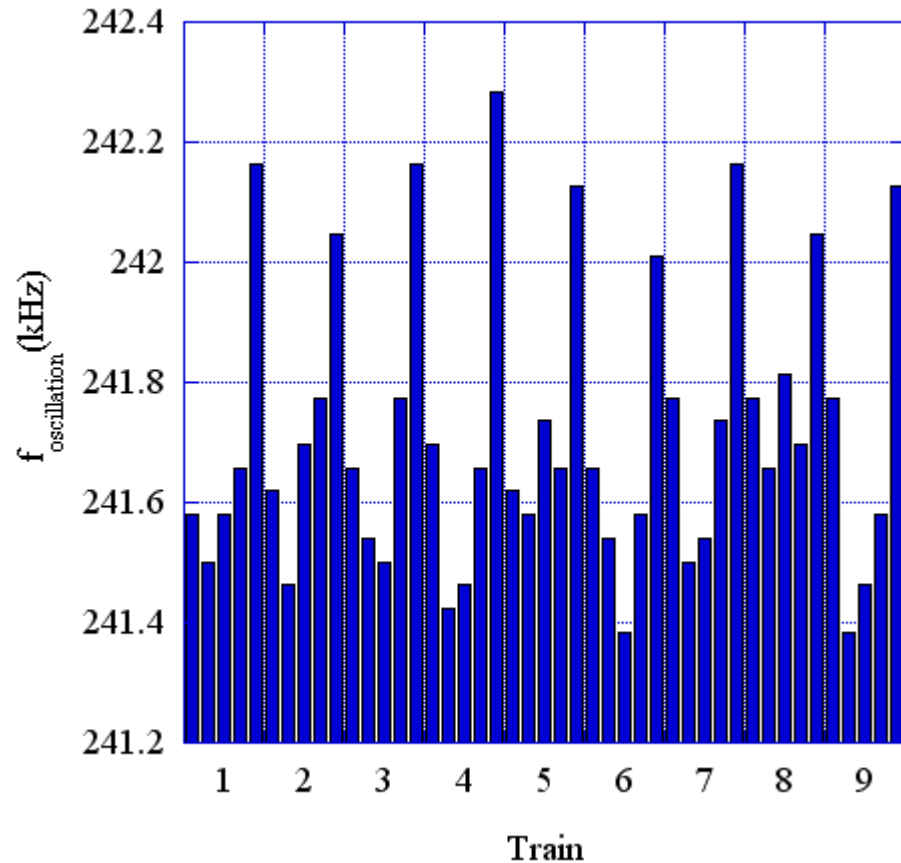


e- high frequency vertical motion: Close-up

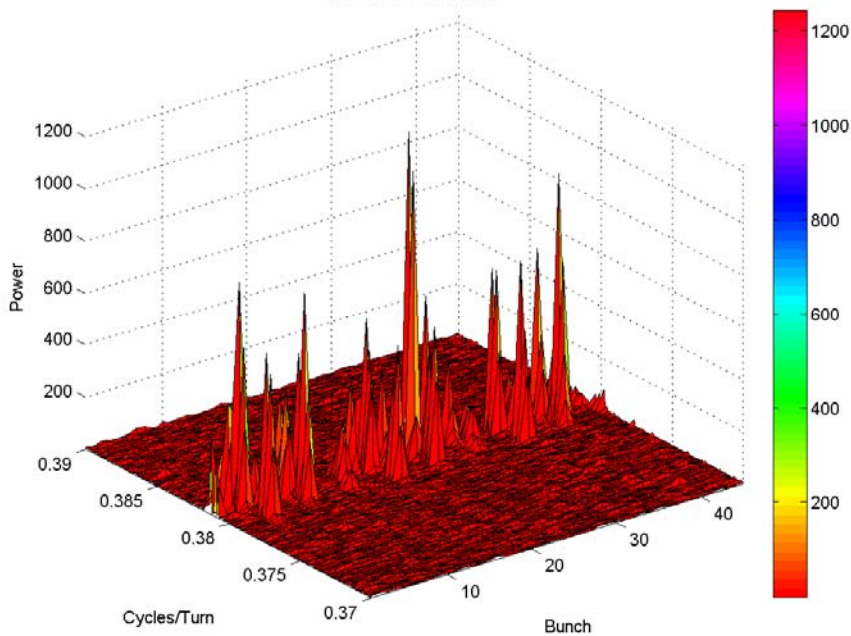
Close-up of FFT (movie) File:811

Frequency of oscillation along the train

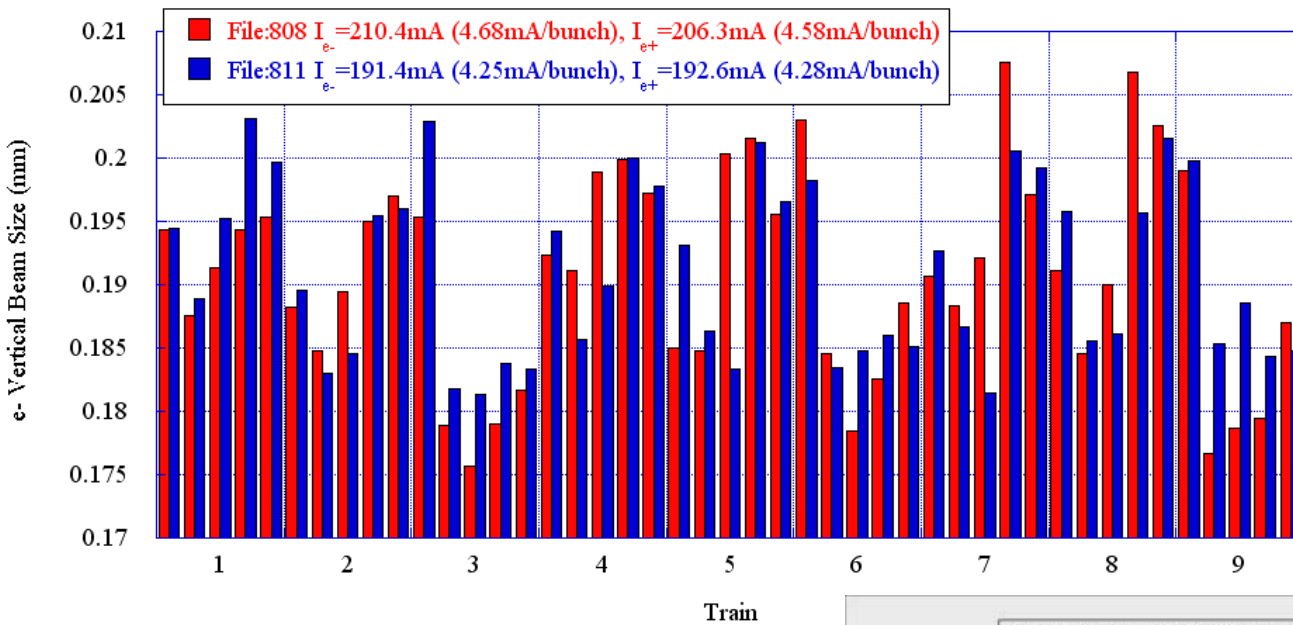
FFT of e- CHESS bunches



BSM23W811 results45

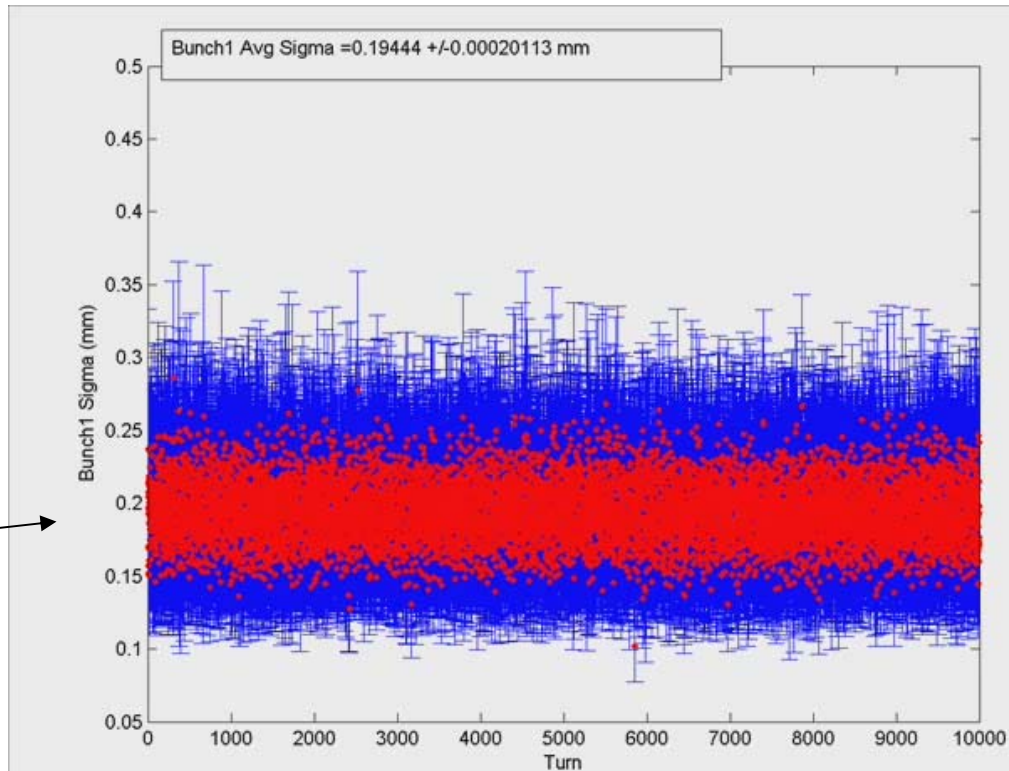


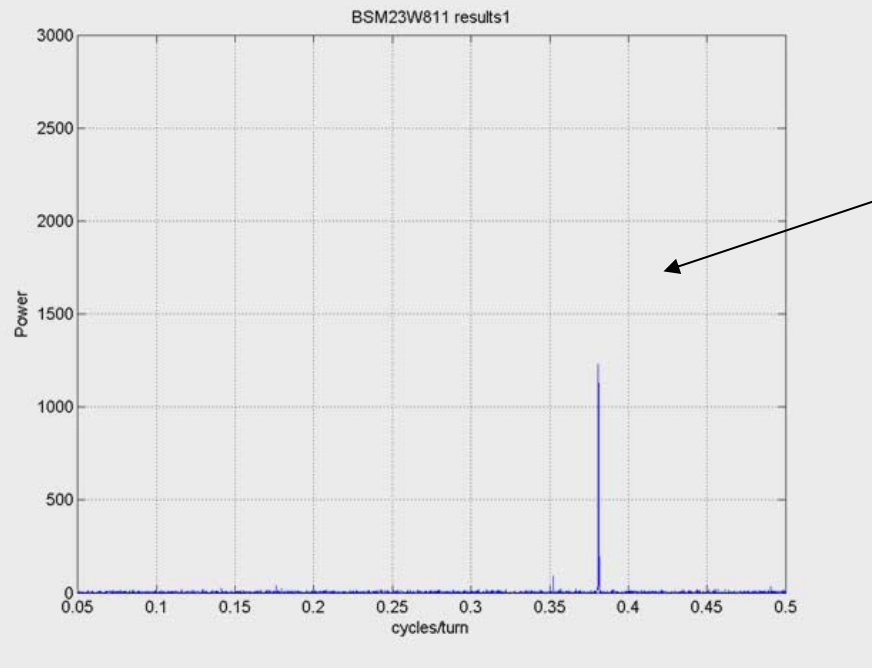
e- Turn-by-turn, 9x5, CHESS Operation



e-  $\sigma_v$  along the train

$\sigma_v$  10,000 turns for 45 bunches (movie) File:811





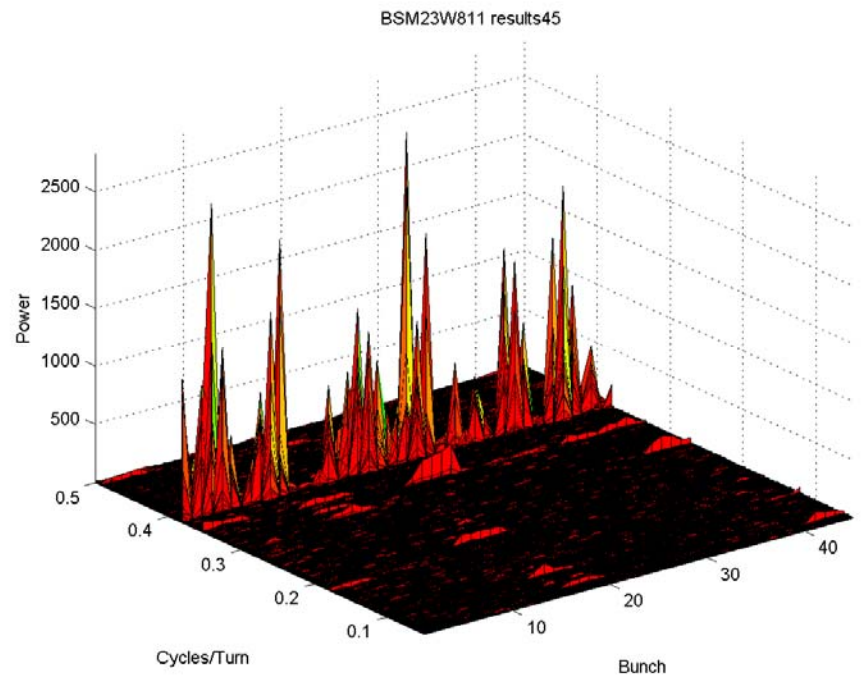
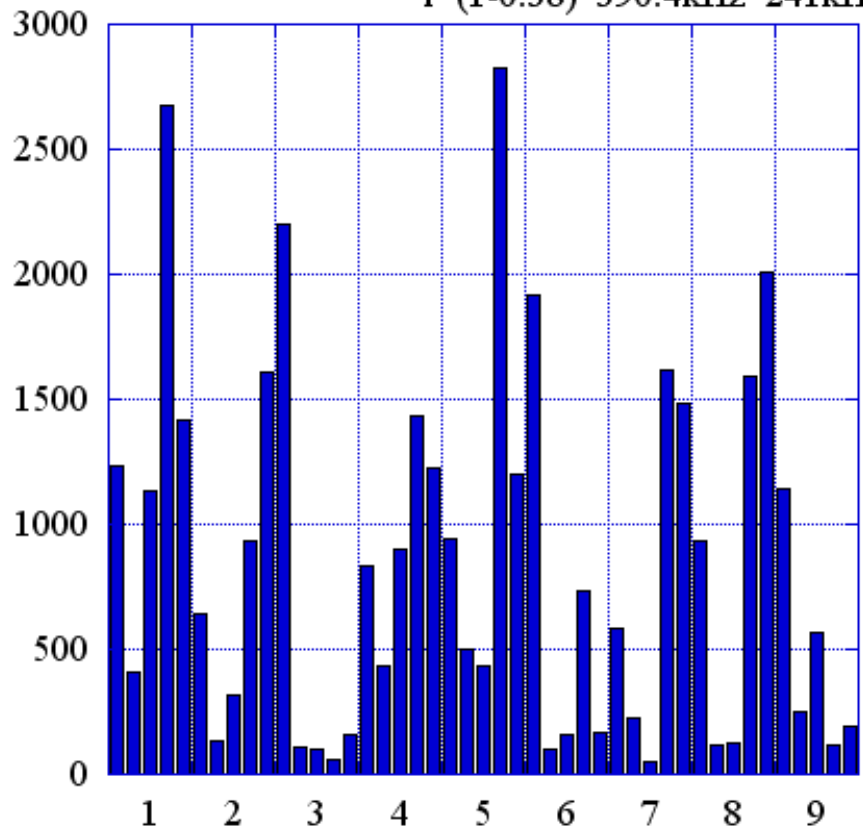
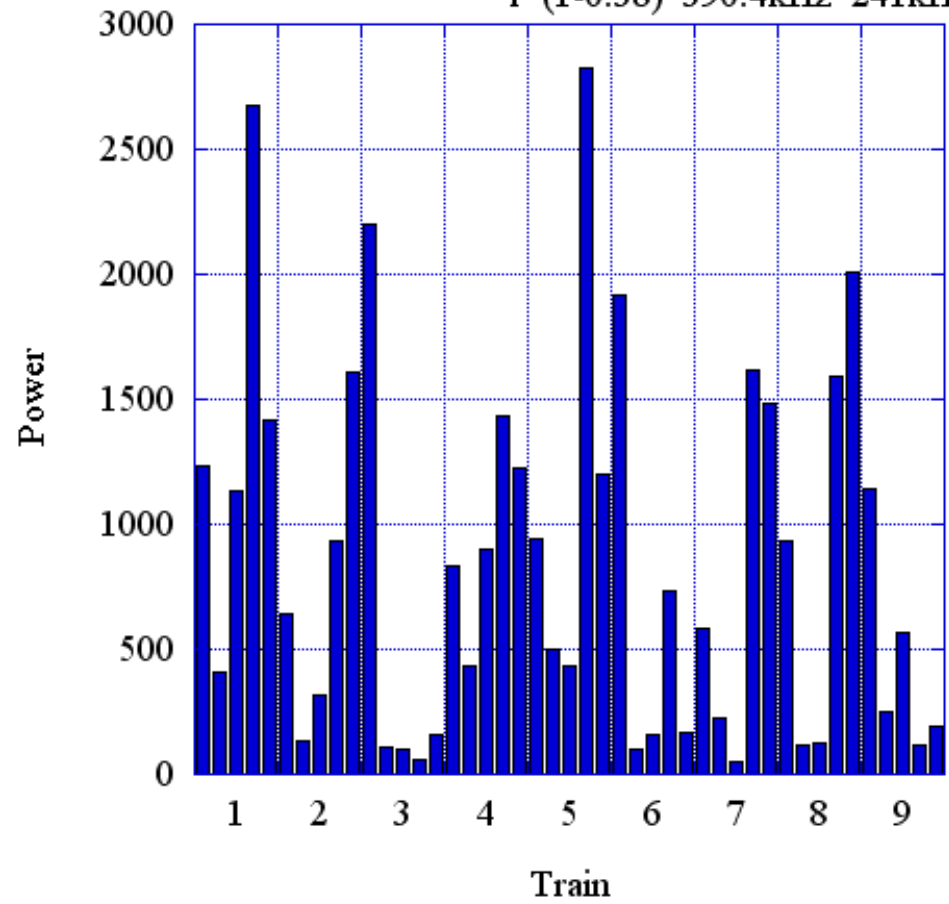
e- high frequency motion of  $\sigma_v$

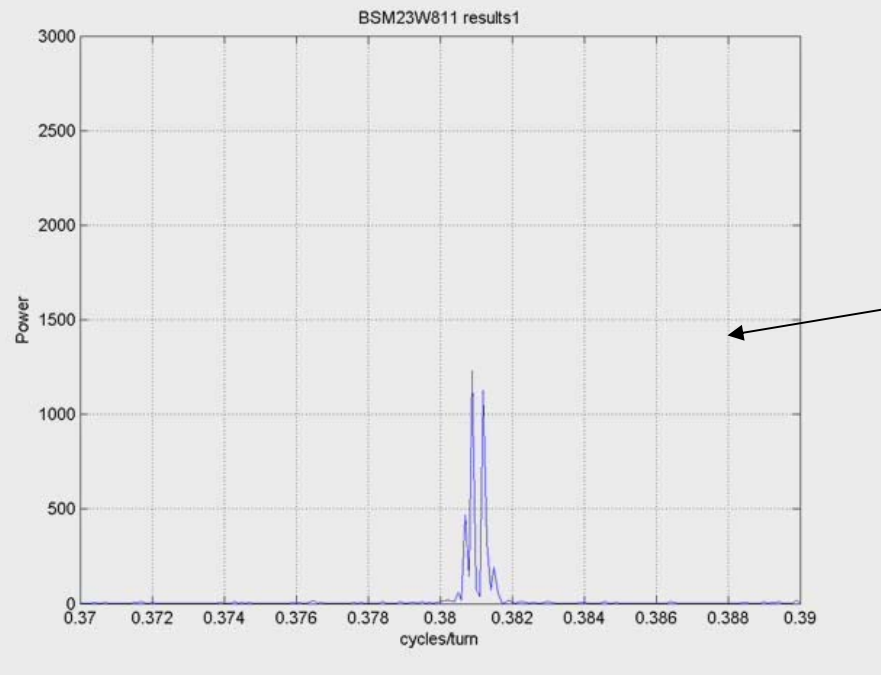
FFT of vertical beam size (movie) File:811

Strong oscillation in the vertical beam size at vertical tune.

FFT of e-  $\sigma_v$  CHESS bunches @~241kHz

$$f=(1-0.38)*390.4\text{kHz}=241\text{kHz}$$

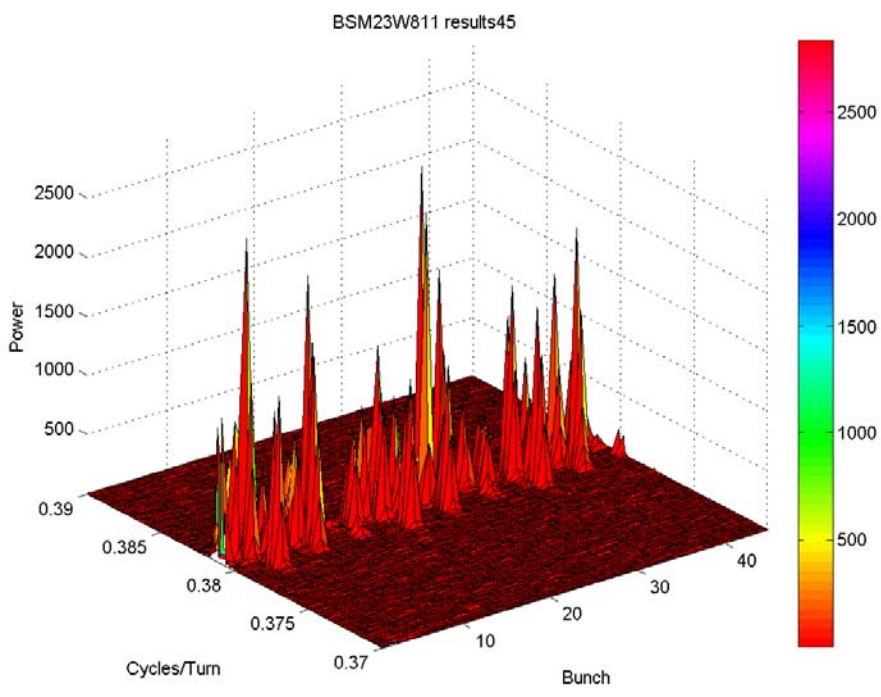




e- high frequency motion of  $\sigma_v$ : Close-up

Close-up of FFT (movie) File:811

Frequency of oscillation along the train



FFT of e-  $\sigma_v$  CHESS bunches @~241.7kHz

