CHESS 6x5 e+/e- Vertical Beam Size

At the CHESS energy and train pattern (6x5) the relative vertical beam size change as a function of current was measured with the PMT array on 4/24/2006.

Measurements

I. CHESS e+ 6x5 vertical beam size and tune

II. CHESS e- 6x5 vertical beam size and tune

III. Summary

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

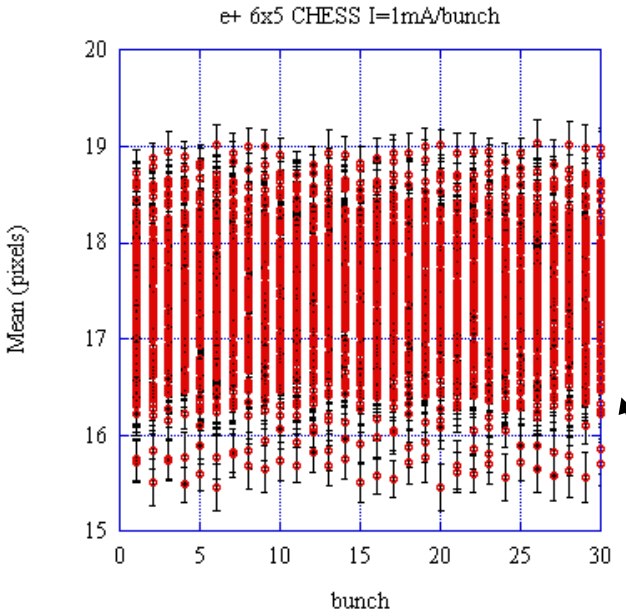
I. CHESS 6x5 e+ Vertical Beam Size and Tune

e+ 6x5 PMT set for 100 turn average/10K turns.

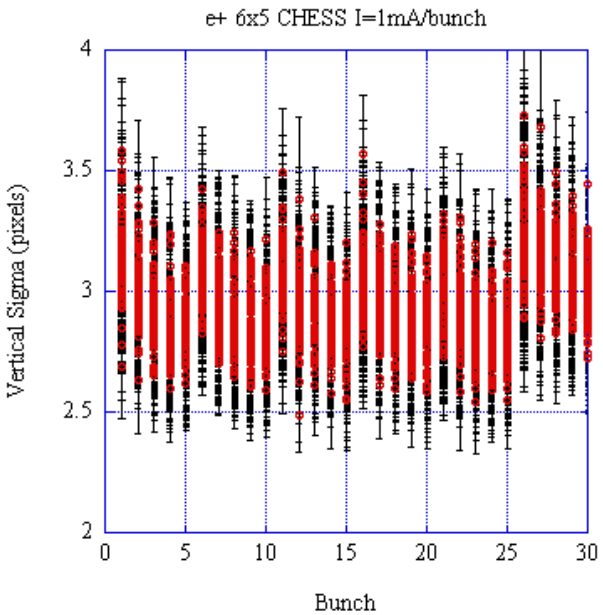
Vertical beam size and tune was measured at I=1, 2, 4, and 8mA/bunch.

I=1mA/bunch

Positive tune shift and σ_v reduction from front to back of each train.



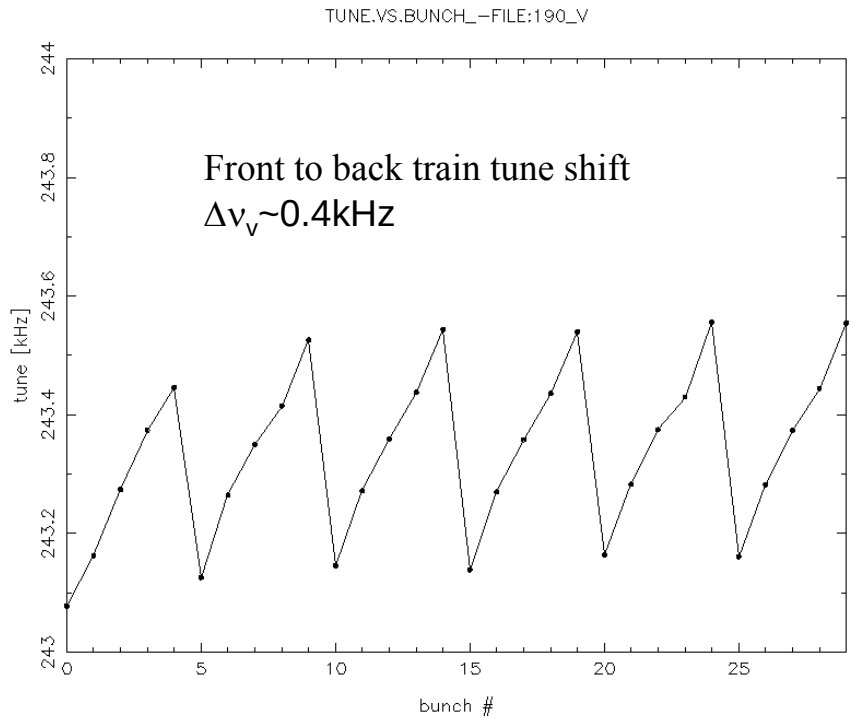
$\overline{y}$=17.4±0.6 pixels

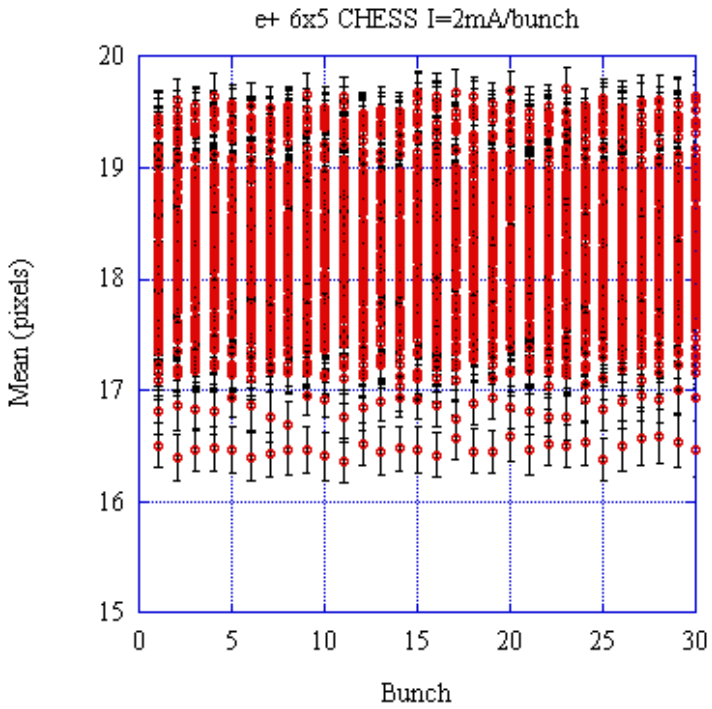


$\overline{\sigma}_v$=3.0±0.2 pixels

Centroid and σ_v for 6x5 pattern (100 measurements for each bunch)

Vertical tune for 6x5 bunch pattern



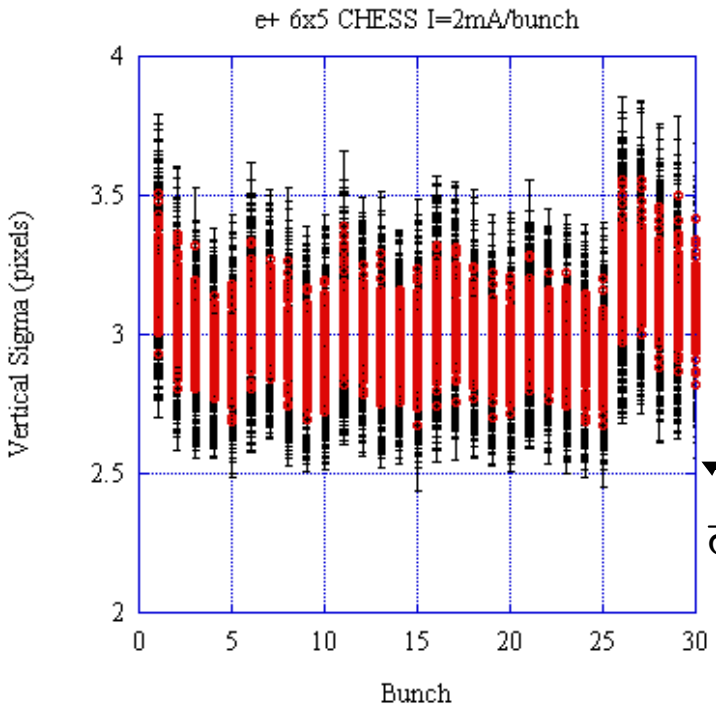


e+ I=2mA/bunch

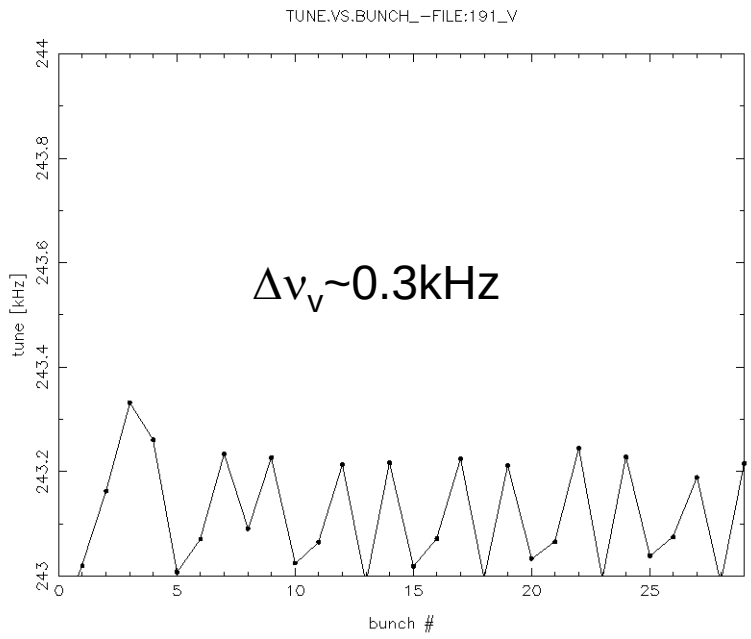
σ_v decreases from front to back of the train.

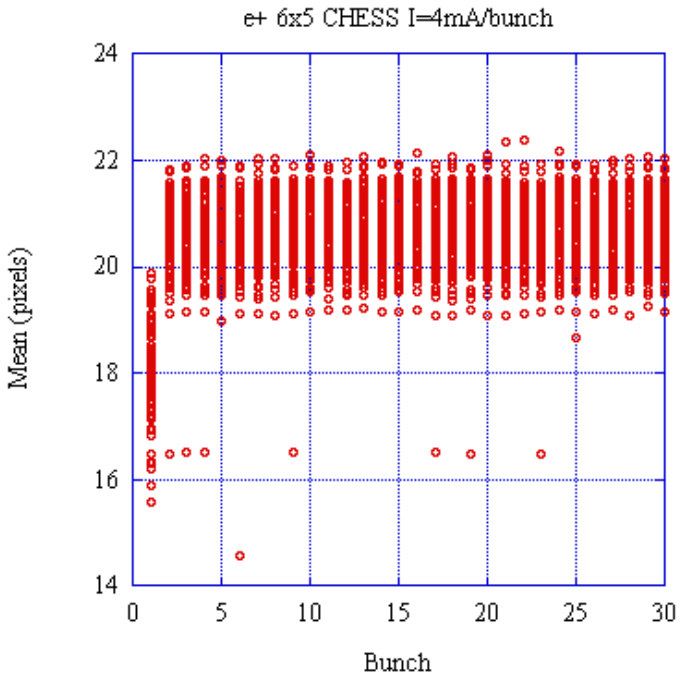
Tune shift along the train does not correlate with bunches in each train.

$\bar{y}$=18.3±0.6 pixels



$\bar{\sigma}_v$=3.0±0.1 pixels



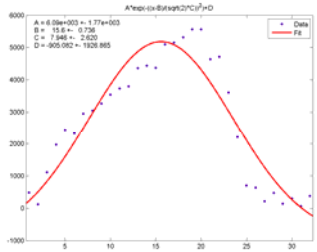


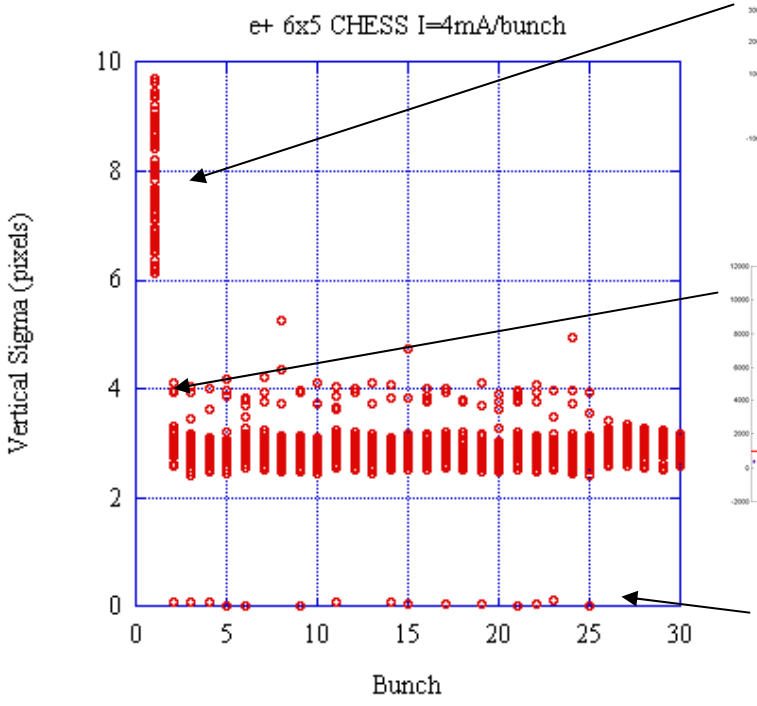
e+ I=4mA/bunch

Bunch 1 train 1 σ_v is 2-3 times larger than other bunches.

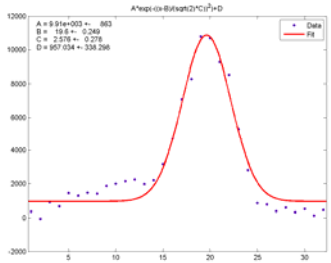
Front to back tune shift along each train (bunch 4 & 5 have the same tune)

Train 1 Bunch 1

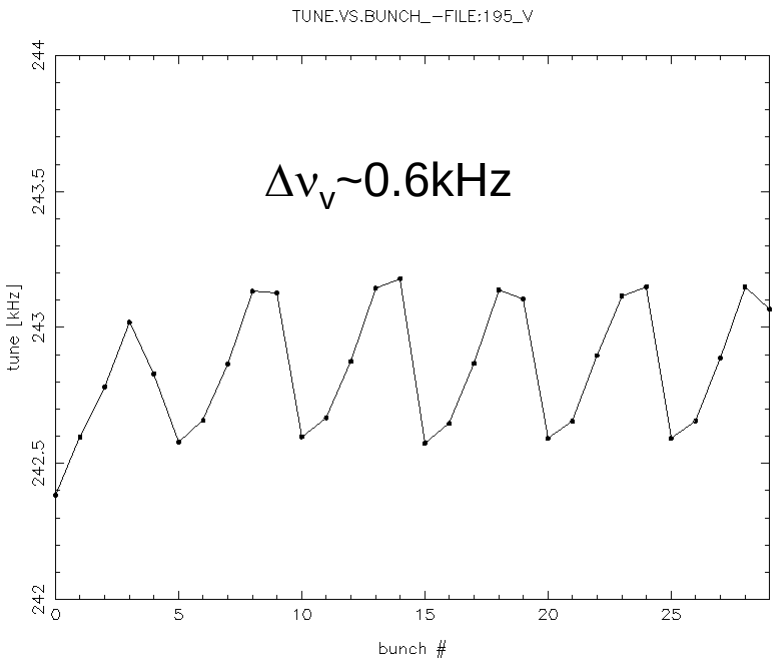


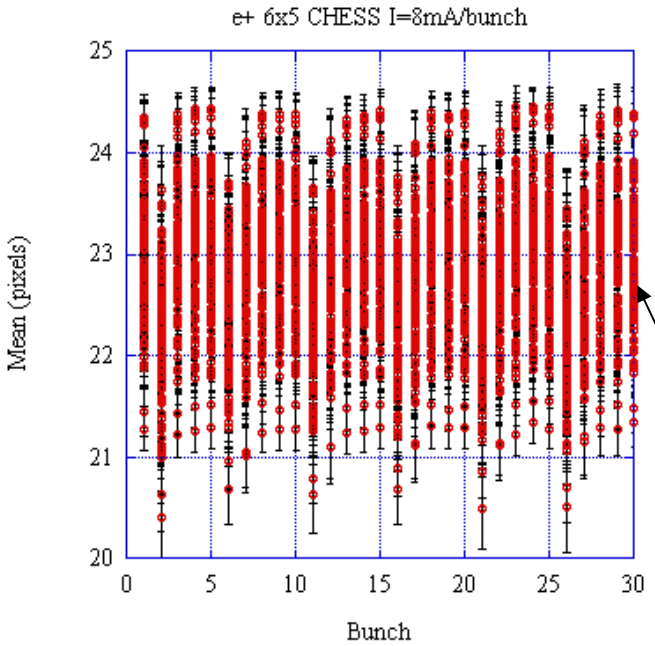


Train 1 Bunch 2



All zero's occurred on the same turn.





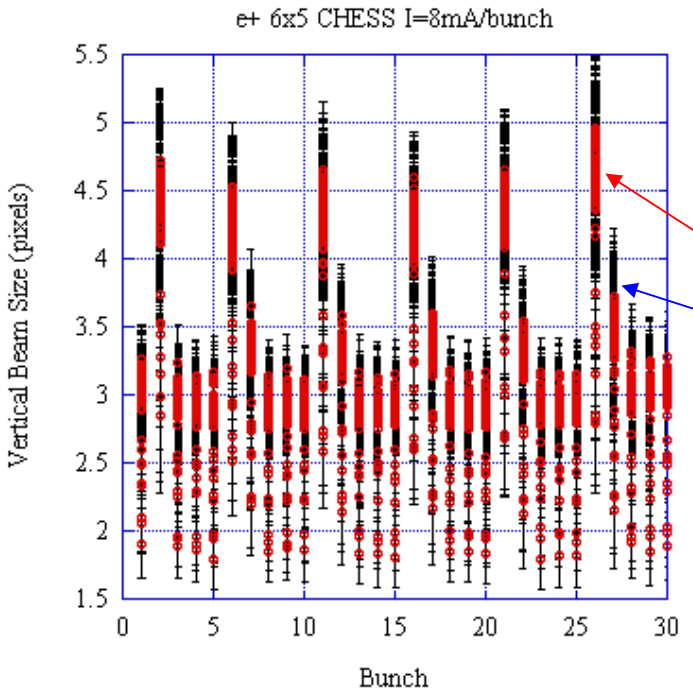
e+ I=8mA/bunch

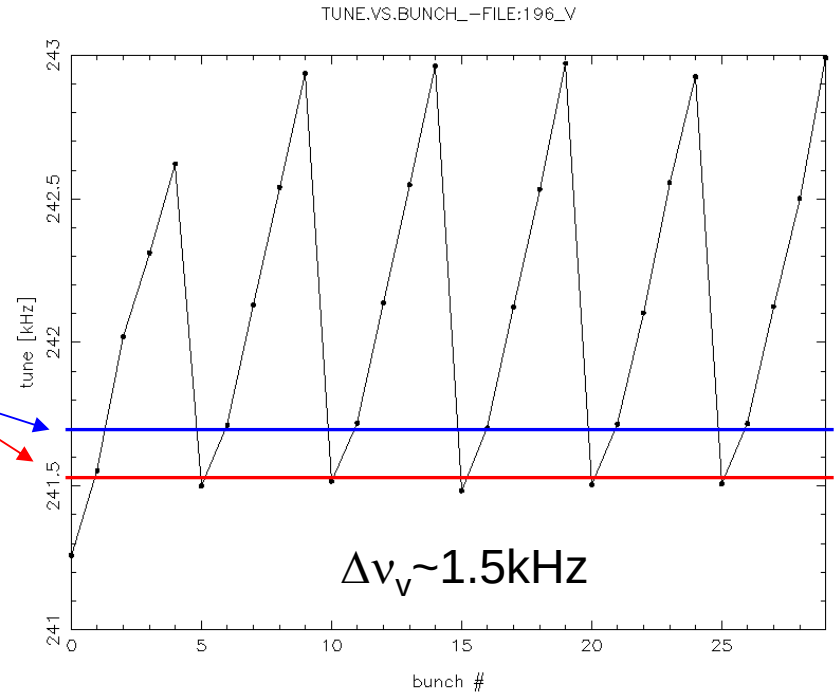
Bunches with ν_v~241.5kHz have 50% larger σ_v (resonance).

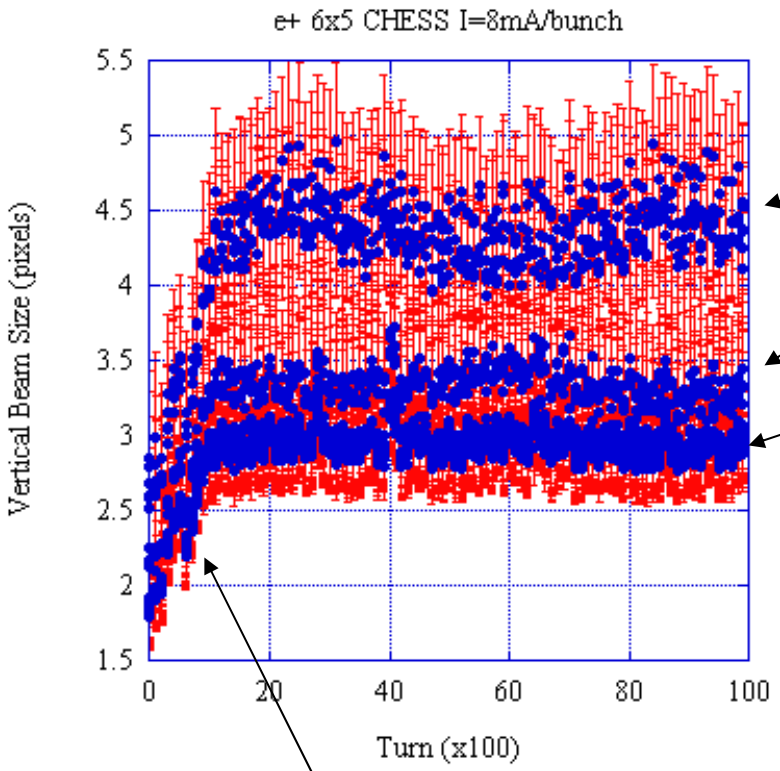
Bunches with ν_v~241.7kHz have slightly larger σ_v (close to resonance).

Strong vertical tune shift ~1.5kHz along each train.

$\bar{y}$=22.8±0.7 pixels







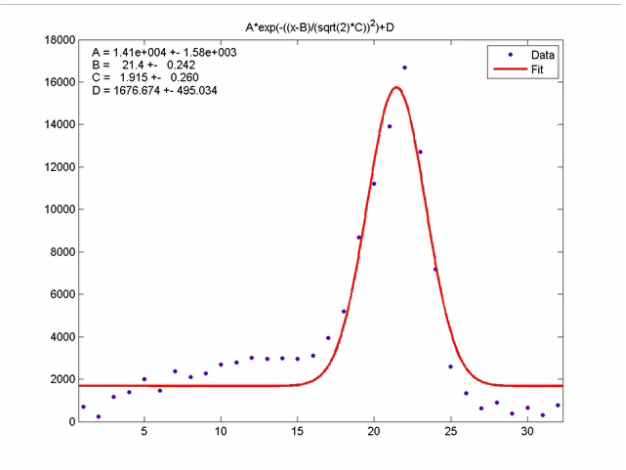
Bunch 2 train 1, bunch 1 train 2-6 with ν_v~241.5kHz

Bunch 2 train 2-5 with ν_v~241.7kHz

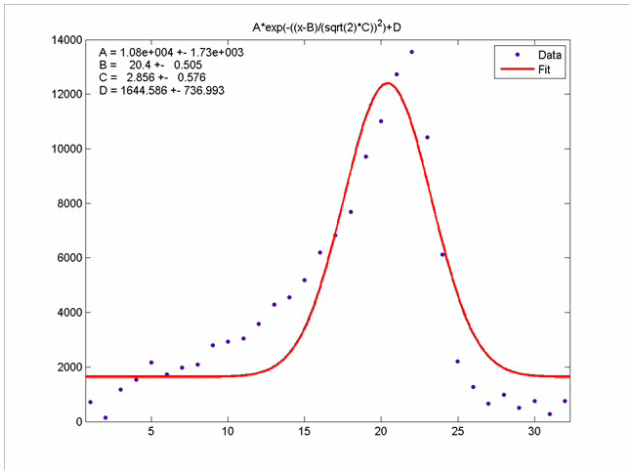
All other bunches

σ_v changed during the measurement

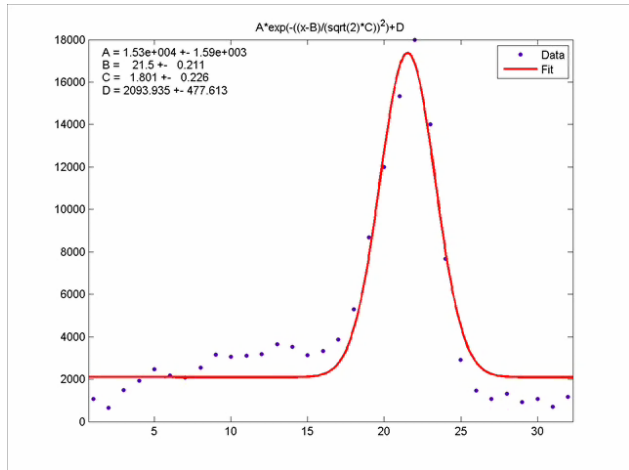
Bunch 1 train 1 movie

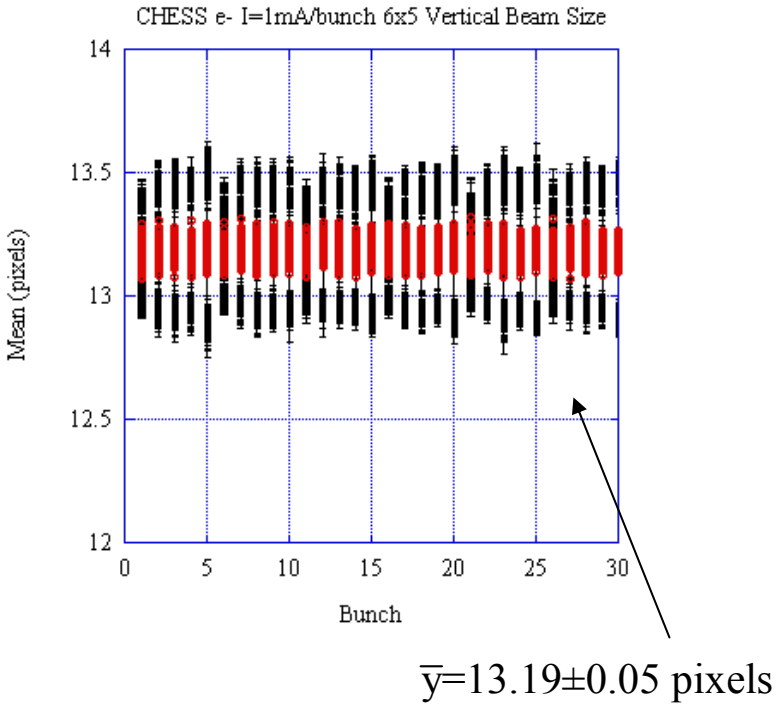


Bunch 2 train 1 movie



Bunch 1 train 5 movie





$\bar{y}$=13.19±0.05 pixels

II CHESS e- Vertical Beam Size

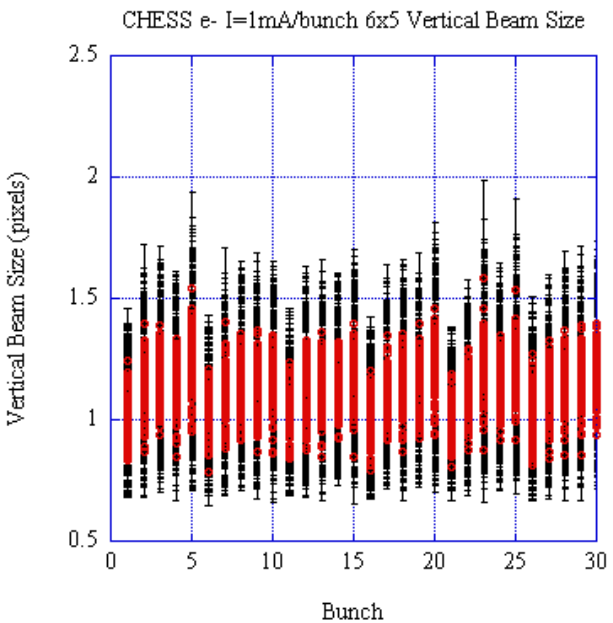
e- 6x5 100 turn average/10K turns.

Vertical beam size measured at I=1, 2, 4, and 7.5 mA/bunch.

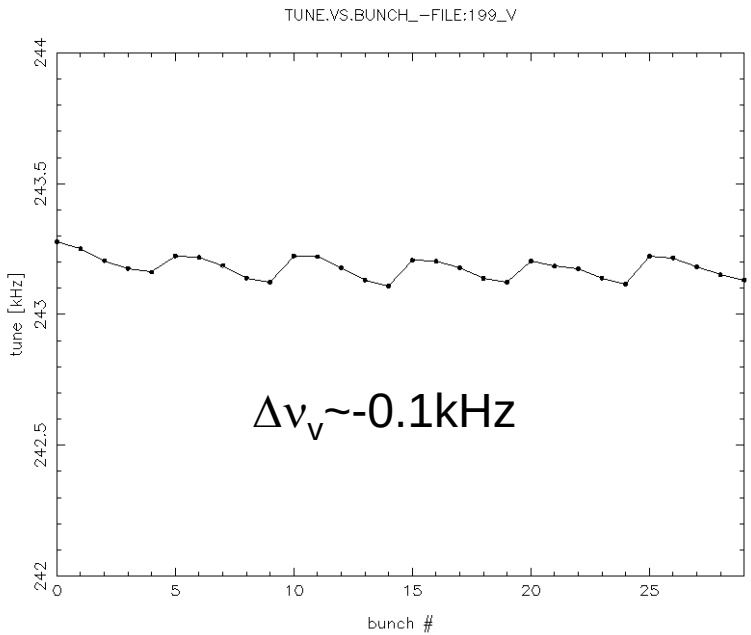
e- I=1mA/bunch

Slight σ_v growth along each train

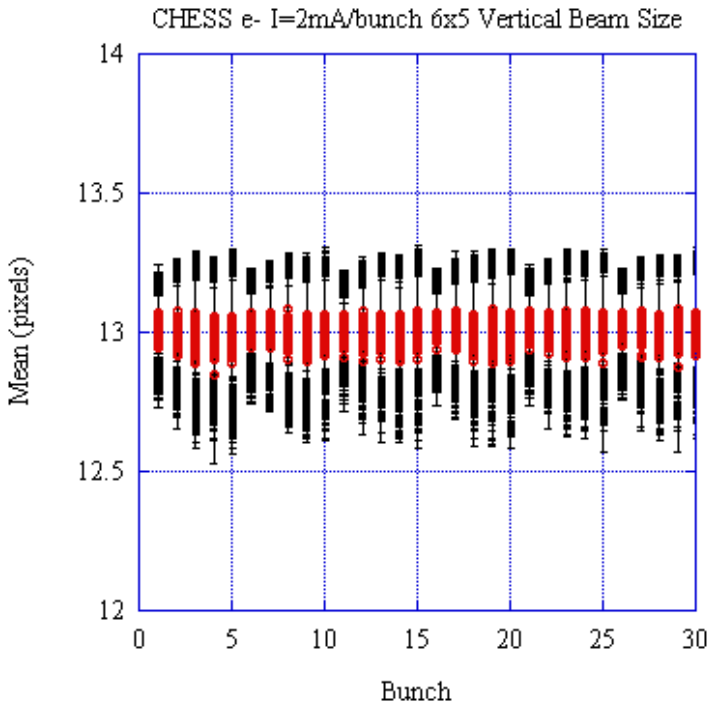
Vertical tune reduction along each train.



$\bar{\sigma}_v$ =1.1±0.1 pixels



$\Delta\nu_v$~-0.1kHz



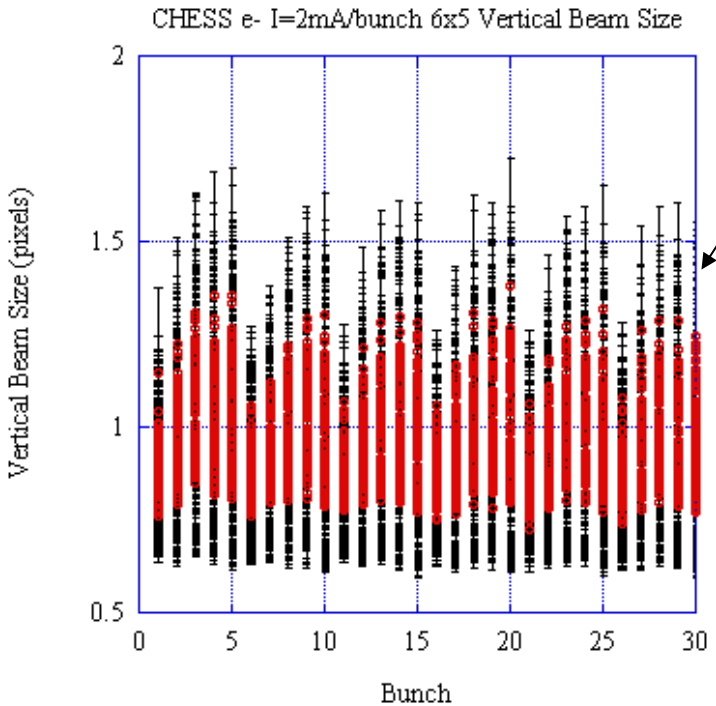
e- I=2mA/bunch

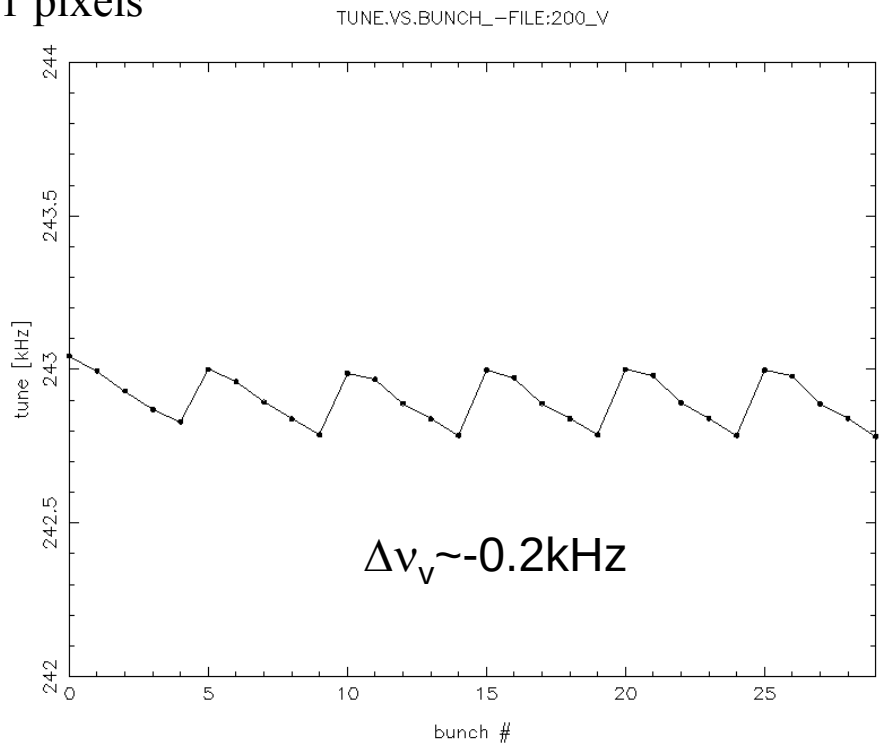
σ_v growth along each train

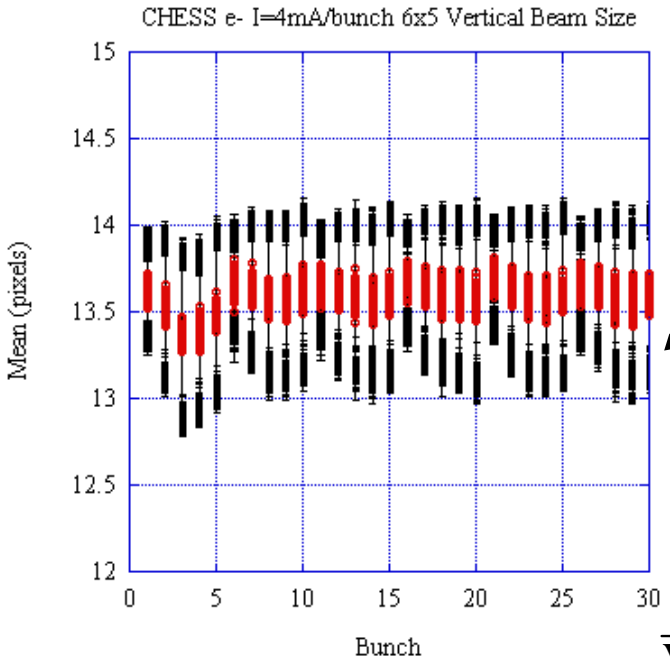
$\Delta\nu_v$~-0.2kHz shift along each trains.

$\bar{y}$=13.01±0.03 pixels

$\bar{\sigma}_v$=1.0±0.1 pixels





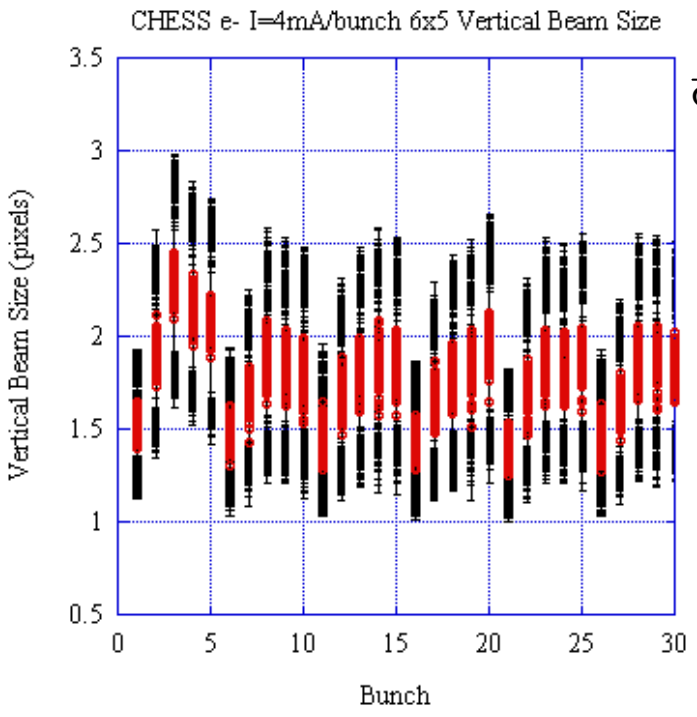


e- I=4mA/bunch

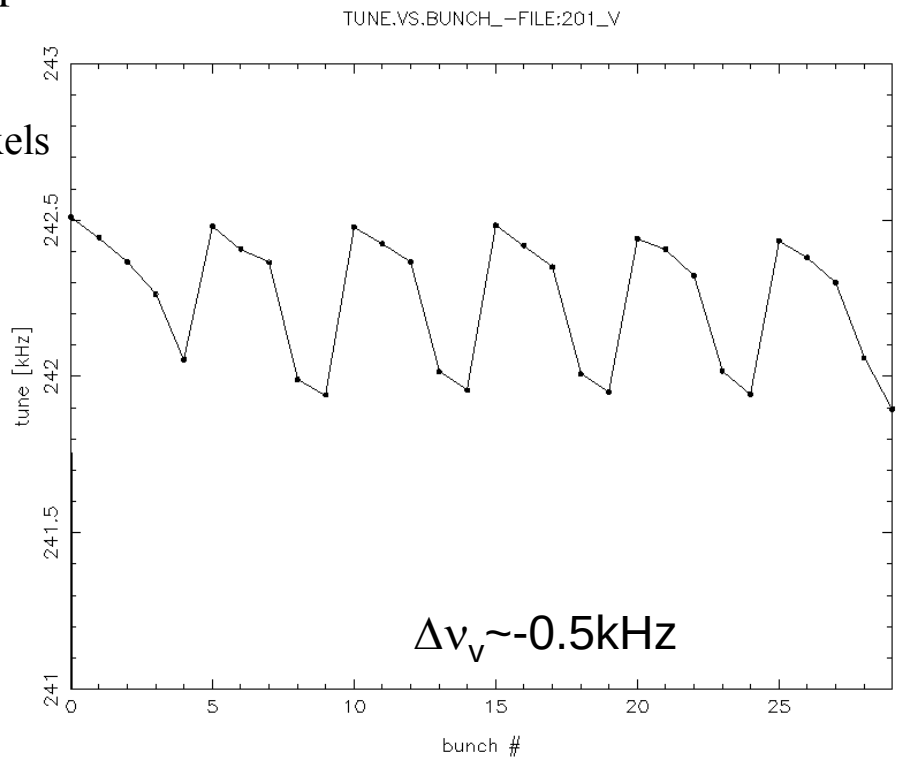
Significant σ_v growth along each train. σ_v increased by ~80% from the I=2mA/bunch measurement.

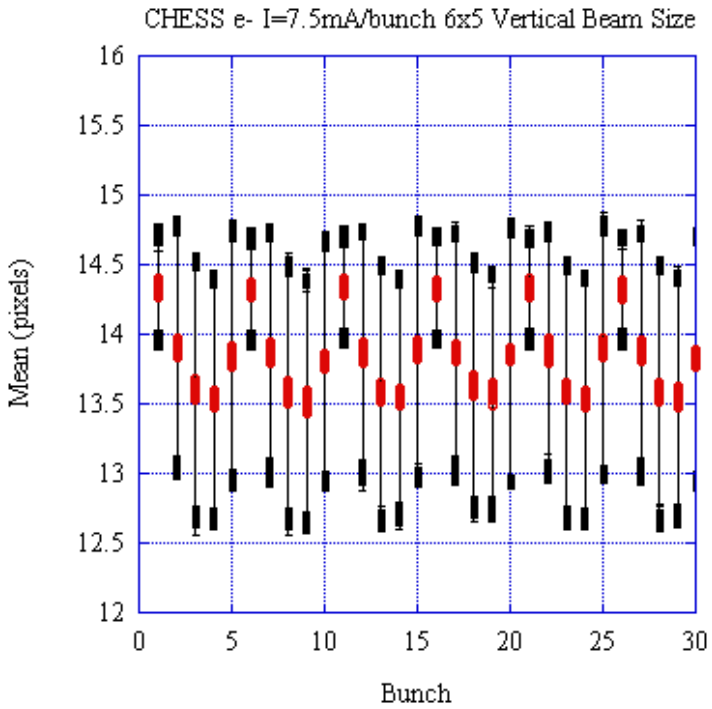
Negative tune shift along each train. Large tune shift between bunch 3 and 4.

$\overline{y}$=13.60±0.09 pixels



$\overline{\sigma}_v$=1.8±0.2 pixels

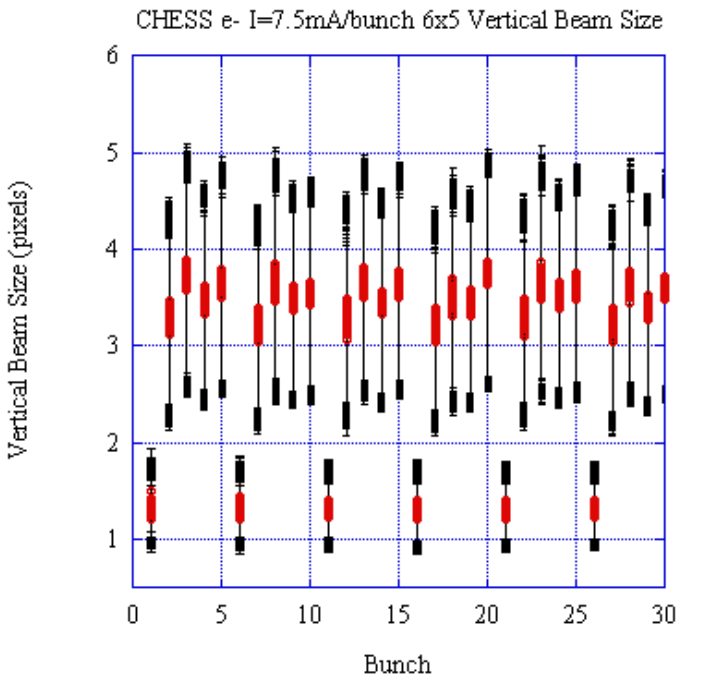


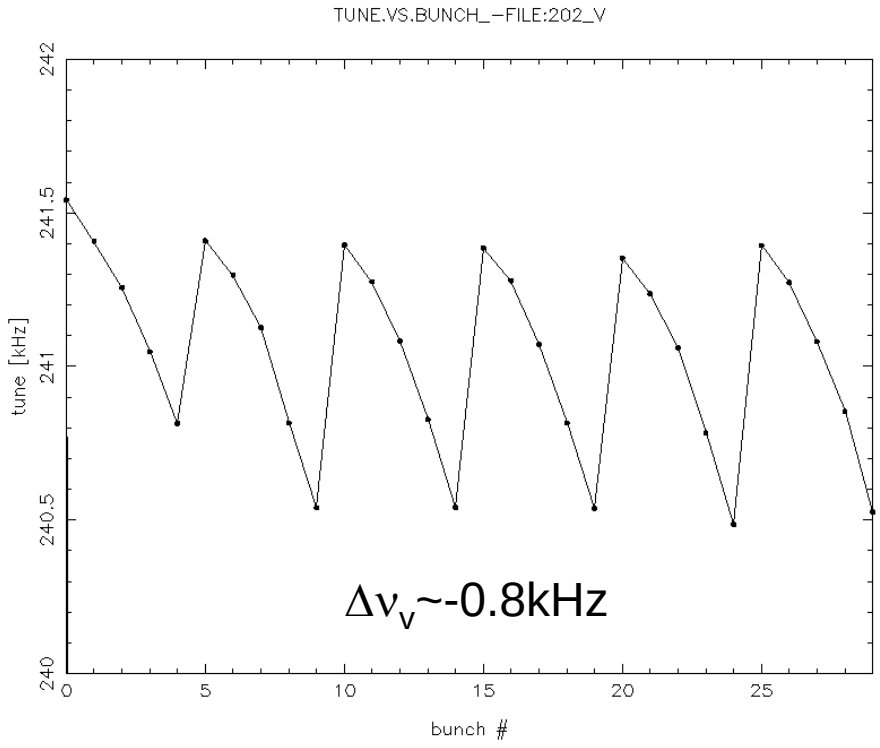


e- I=7.5mA/bunch

Factor of 2.5 σ_v increase between bunch 1 and bunches 2-5.

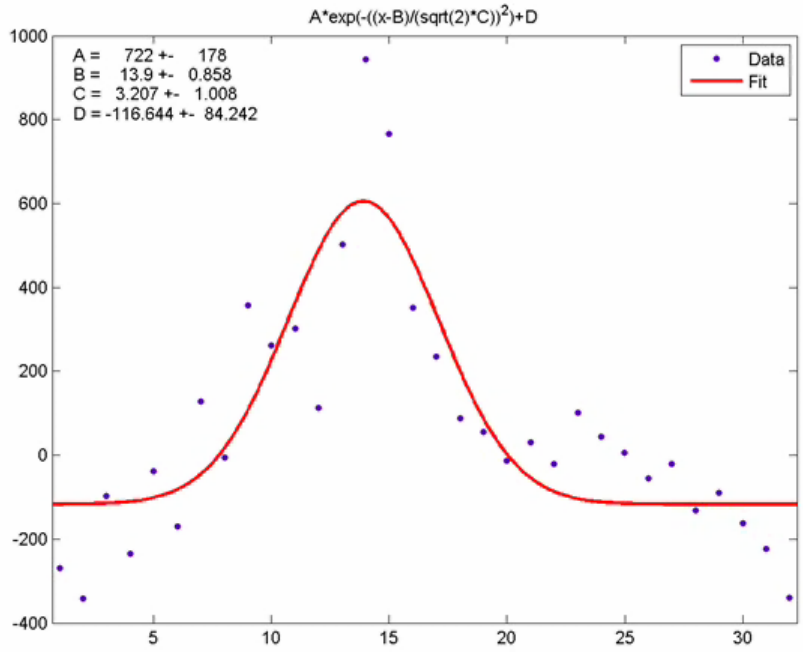
Strong negative tune shift along each train.





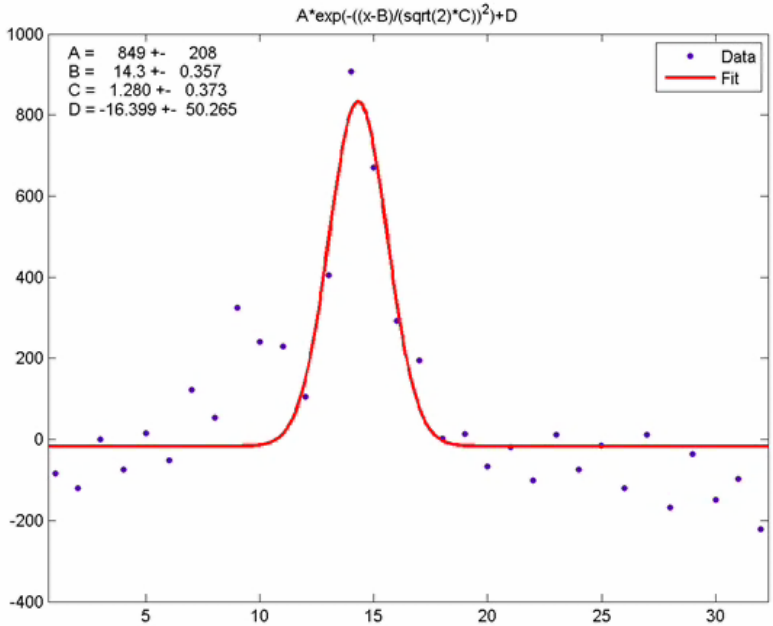
$\overline{\sigma}_v$ =3.3±0.1 pixels, $\overline{y}$=13.91±0.03 pixels

Bunch 2 train 1 movie I=7.5mA/bunch



$\overline{\sigma}_v$ =1.3±0.1 pixels, $\overline{y}$=14.33±0.03 pixels

Bunch 1 train 1 movie I=7.5mA/bunch



Summary

CHESS 6x5 e+ trains:

• The vertical tune shift along each train increased with bunch current. With I=8mA/bunch, the vertical tune shift is ~1.5 kHz which can be large enough to cross a tune resonance.

• The vertical beam size decreases along each train.

CHESS 6x5 e- trains:

• A negative vertical tune shift along each train was measured that increases with current.

• As the bunch current is increased the vertical beam size along the train increases.