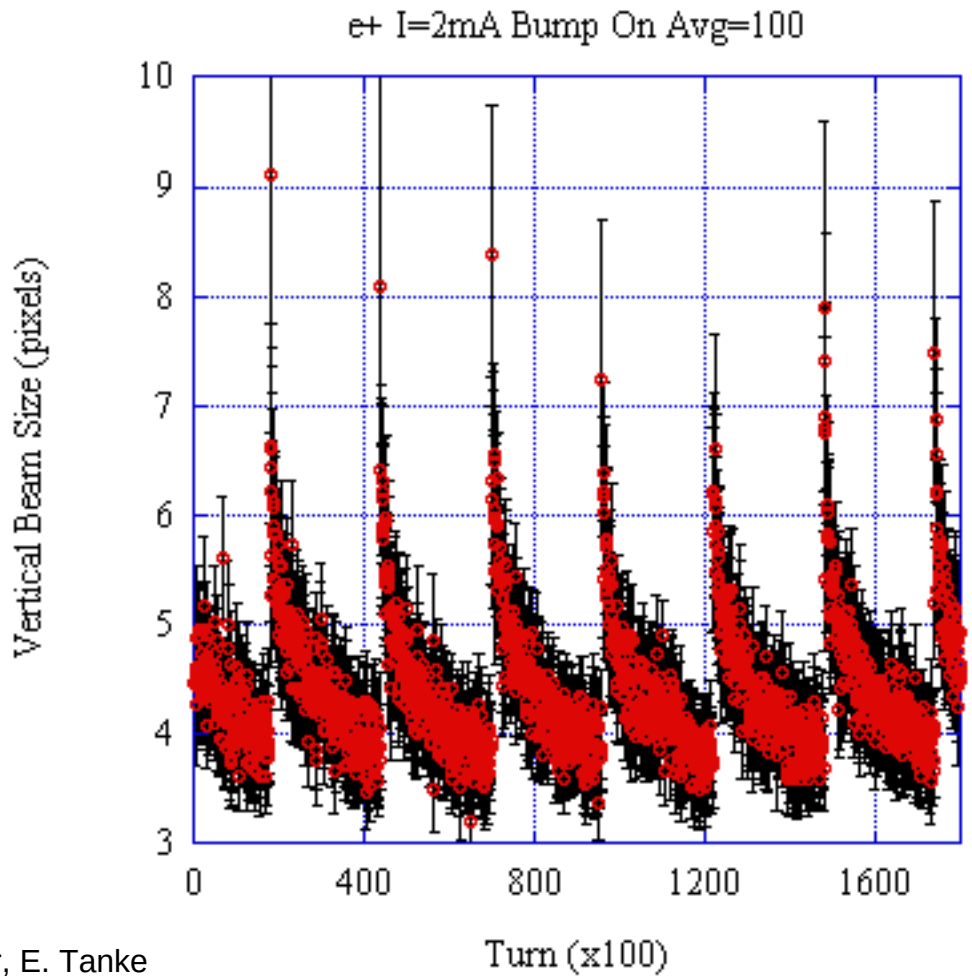
# e+ Vertical Damping Time

Used pulsed beam bumpers, operating at 15Hz, for beam excitation and damping time measurement.

PMT measured $\sigma_v$ for 180K turns with 100 turn average.

Beam excitation occurs every ~26K turns.

Data taken on 4/24/2006.

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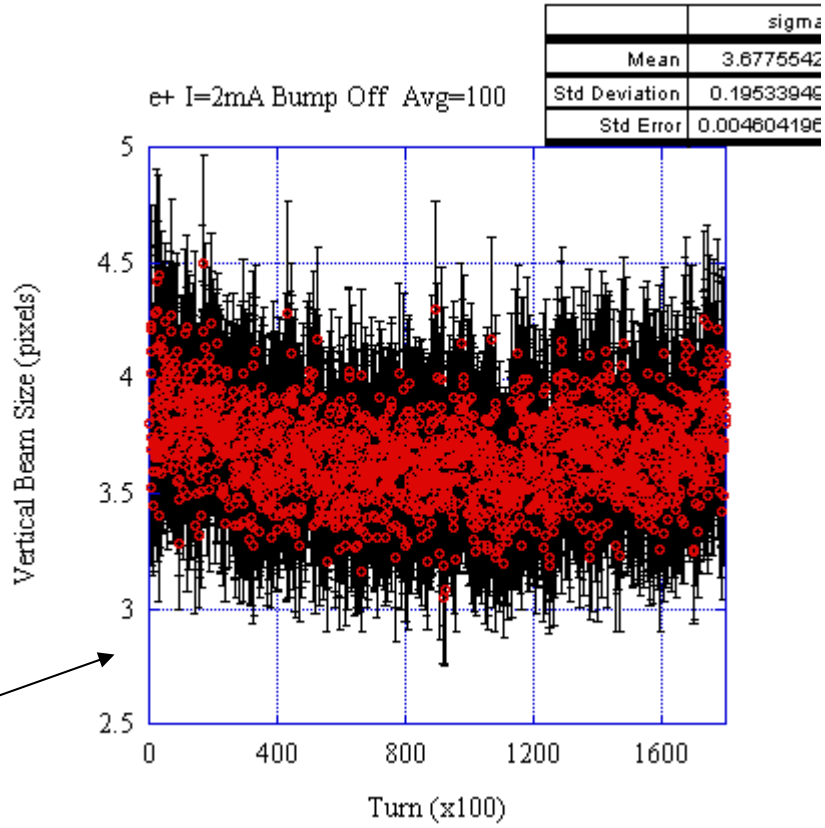
After each excitation σ was $\chi^2$ fit to the following curve

$$\sigma^2(t) = \left(\sigma_{exc}^2 - \sigma_{eq}^2\right) e^{-\frac{2t}{\tau}} + \sigma_{eq}^2$$

where $\sigma_{eq}$ and $\sigma_{exc}$ are the equilibrium and excited beam sizes respectively and τ is the damping time.

The damping time was determined two ways: 1) Using the measured equilibrium beam size as a constant. 2) Using equilibrium beam size as a fit parameter.

Measured vertical damping time at four currents: I=0.2, 0.5, 1, and 2mA.



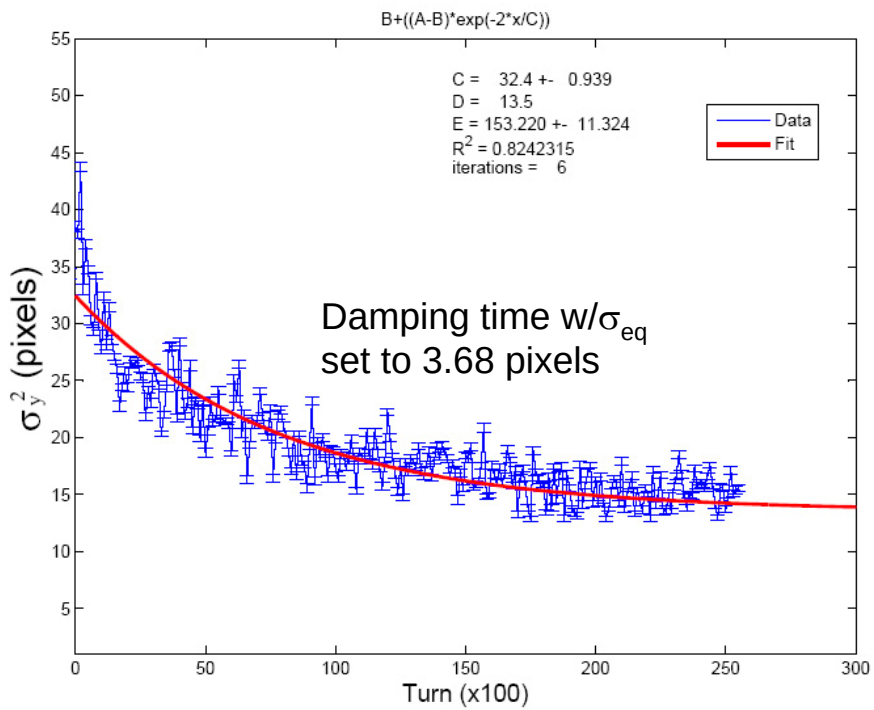

Equilibrium vertical beam size at I=2mA is $\sigma_{eq}$=3.678+/-0.005 pixels.

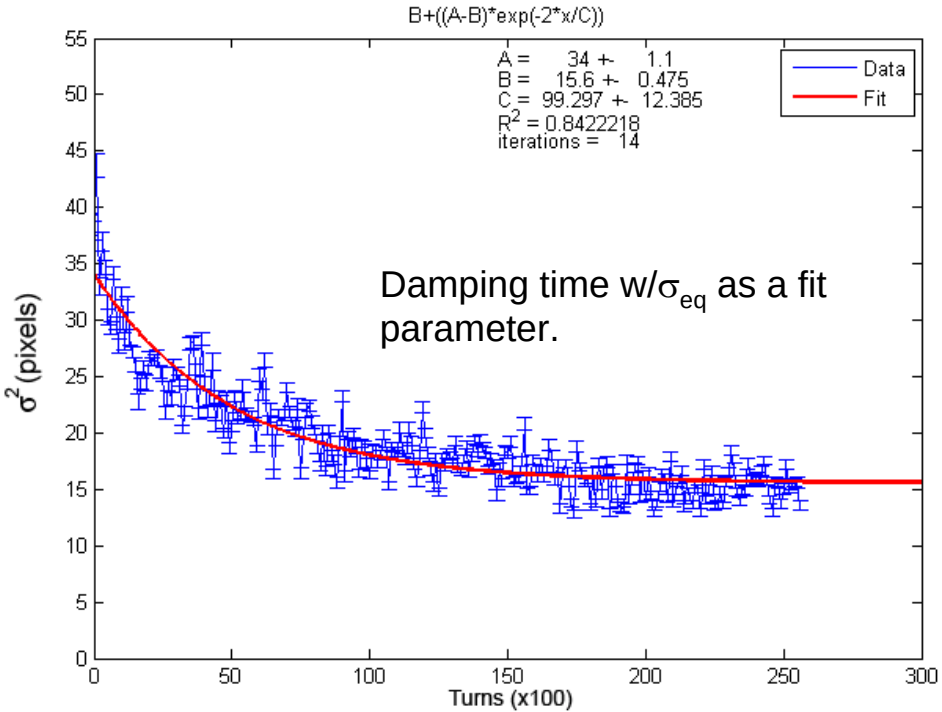
The damping time is highly dependent on the equilibrium beam size!

# Results

| I (mA) | Method 1: $\tau_y$ (ms)/measured $\sigma_{eq}$(pixels) | Method 2: $\tau_y$ (ms)/ fit $\sigma_{eq}$(pixels) |
|---|---|---|
| 2 | 36.8 ± 2.3 / 3.68 | 21.4 ± 4.1 / 4.01 |
| 1 | 47.8 ± 9.0 / 3.57 | 31.5 ± 15.5 / 3.91 |
| 0.5 | 32.6 ± 4.2 / 3.72 | 39.1 ± 20.6 / 3.62 |
| 0.2 | 54.4 ± 11.1 / 3.6 | 67.1 ± 34.1 / 3.53 |
| 0.2 | 39.0 ± 9.8 / 4.1 | -- |

Equilibrium beam size was measured twice at I=0.2mA.



# Summary

- Using the PMT to measure the pulsed bump excitation is a viable method to measure the vertical damping time.
- From this data set there is no apparent current dependence on damping time.
- The equilibrium beam size is crucial for the measurement. It would be beneficial to reduce the excitation period to achieve the equilibrium beam size.
- Fitting the damping time with the equilibrium beam size included as a fit parameter increased error and caused a large spread in measured damping times. This may be a result of short time intervals between beam excitations.