

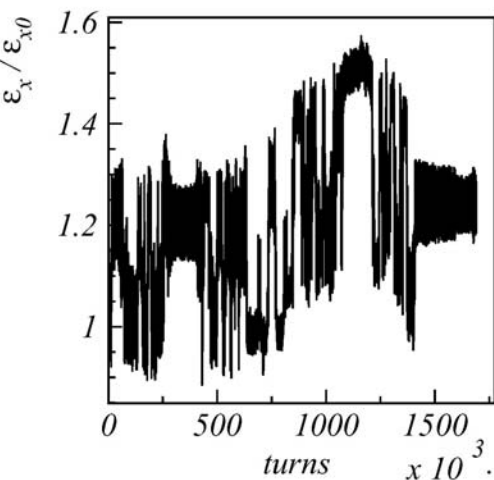
Electron cloud induced  
Emittance Growth below the  
threshold of the “TMCI”

E.Benedetto, F.Zimmermann,  
G.Franchetti (GSI)

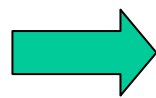
# Mechanism of resonance crossing and trapping-detrapping

- Similar to what happen in space charge dominated bunches
  - G.Franchetti's talk at CARE-HHH'04

<http://care-hhh.web.cern.ch/care-hhh/HHH-2004/Talks%20Session%202/Franchetti.pdf>



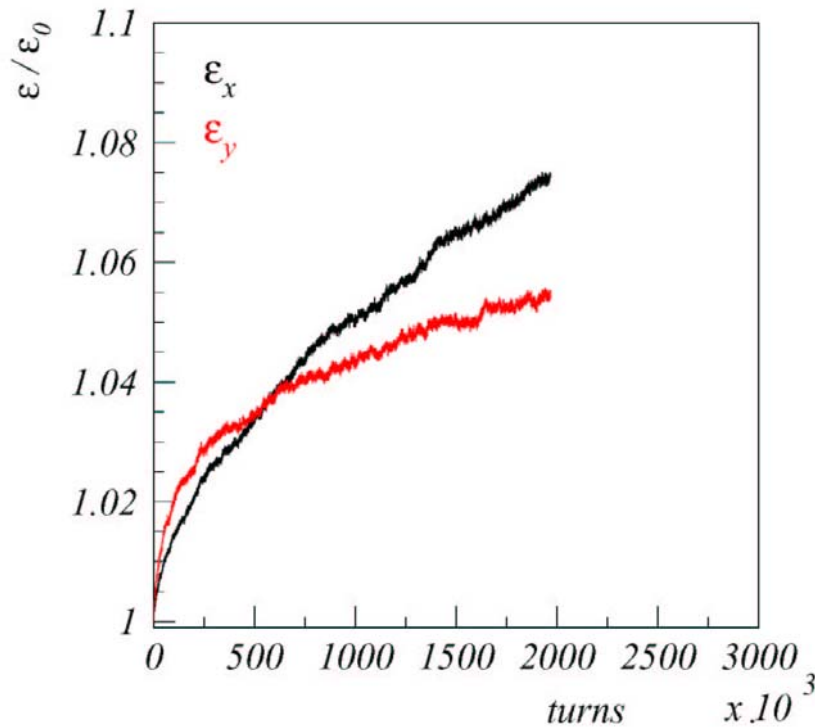
Single particle action vs. # turns  
(synchrotron motion is present)



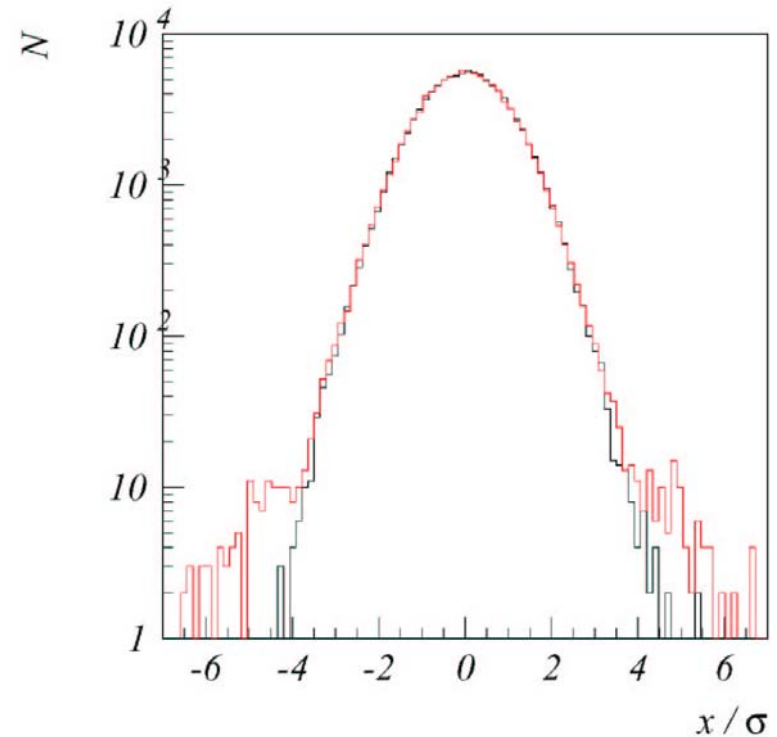
Found the same kind of  
behavior w. HEADTAIL

# G.Franchetti: Emittance growth is due to the population of the halo?

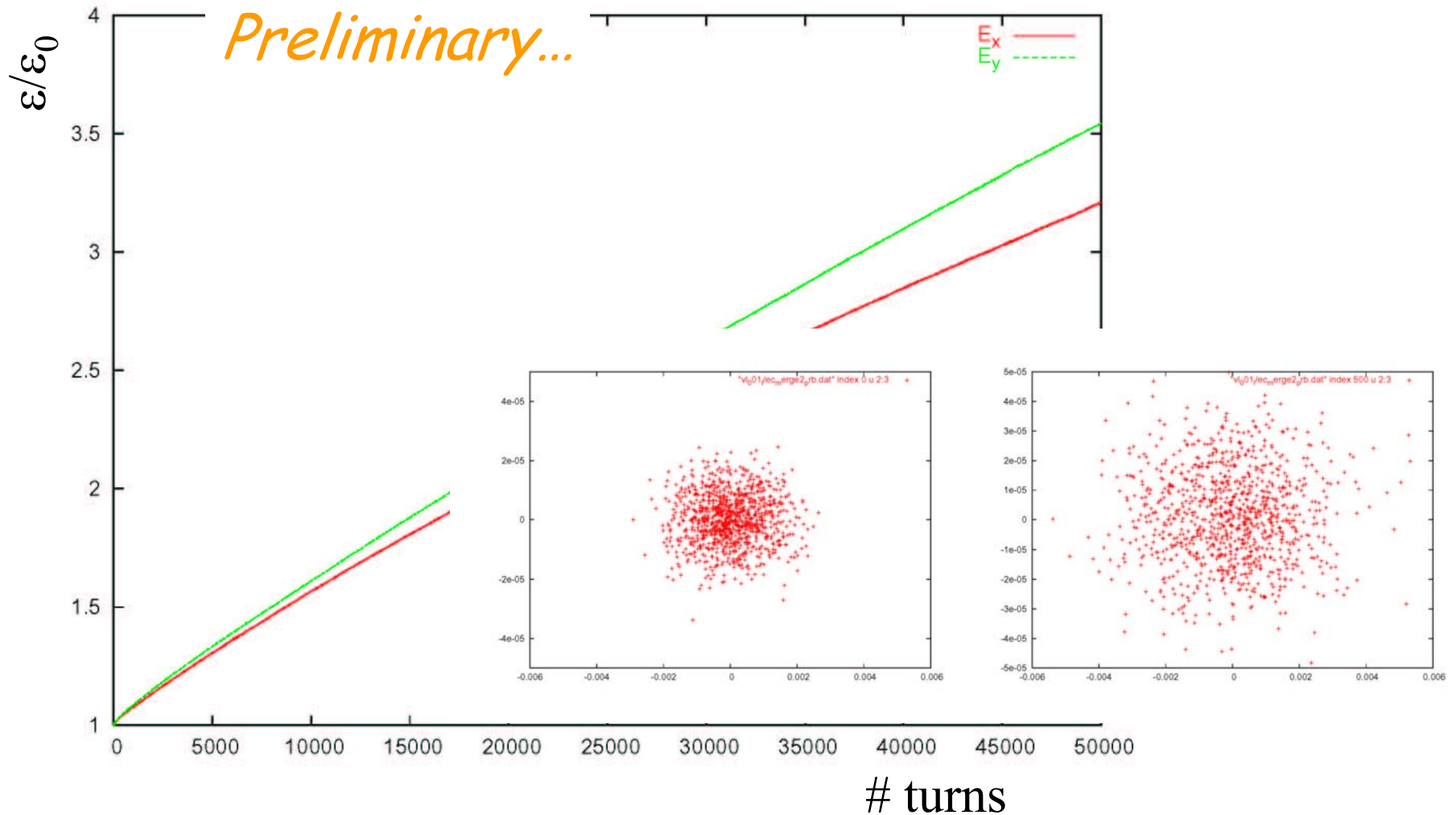
$N. \text{ kicks} = 1$



$N. \text{ kicks} = 1, \text{ dist at } 19 \times 10^5 \text{ turns}$



# HEADTAIL+Frozen Potential: Doesn't seem so... and the growth is larger



# Differences in the 2 models

## GIULIANO's model

- Analytical expression
- Gaussian cloud:  
$$\text{rms} = \sigma_b / \sqrt{2}$$
- The electron distrib is linearly increasing longitudinally

## HEADTAIL

- PIC module
- The distribution is very peaked toward the axis
- The dependence in z is more complicated
- See the .avi files:
  - EB-anello.avi
  - EB-rhodierre.avi

# K. Ohmi's approach

- The emittance growth is due to Arnold diffusion since the system has more than 2 degrees of freedom
- K. Ohmi, *Incoherent Beam Size Blow Up ...*, *Chaos and Emittance Growth*, KEK Acc-Physics Seminar 25 March 2005
  - <http://wwwslap.cern.ch/collective/electron-cloud/ohmi/IncoBBUEC.pdf>