# Bunch shortening along SPS bunch trains due to e-cloud (?)

G. Rumolo in RLC-LHC Meeting (10/03/2006)

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- Show preliminary results from the data analysis of 2 coasts during the August 2004 MD's, which clearly show bunch shortening and worse life time at the tail of a train of bunches in SPS

- In the MD's done in August 2004, a full train of 72 bunches was injected many times into the SPS and let it coast for several supercycles (up to 70 or more)

- BCT and bunch by bunch BCT were taken for each coast

- Emittance measurements gated at the head, middle and tail of the train were recorded

- Longitudinal bunch signal bunch by bunch was also acquired.
  - The analysis program (MATHEMATICA) was modified with 1) a peak finder to automatically find trace by trace the maxima around which the Gaussian interpolation should be done and 2) an integration routine bunch by bunch.

- Electron cloud monitored at each coast by using a strip monitor.

Some information on COAST6
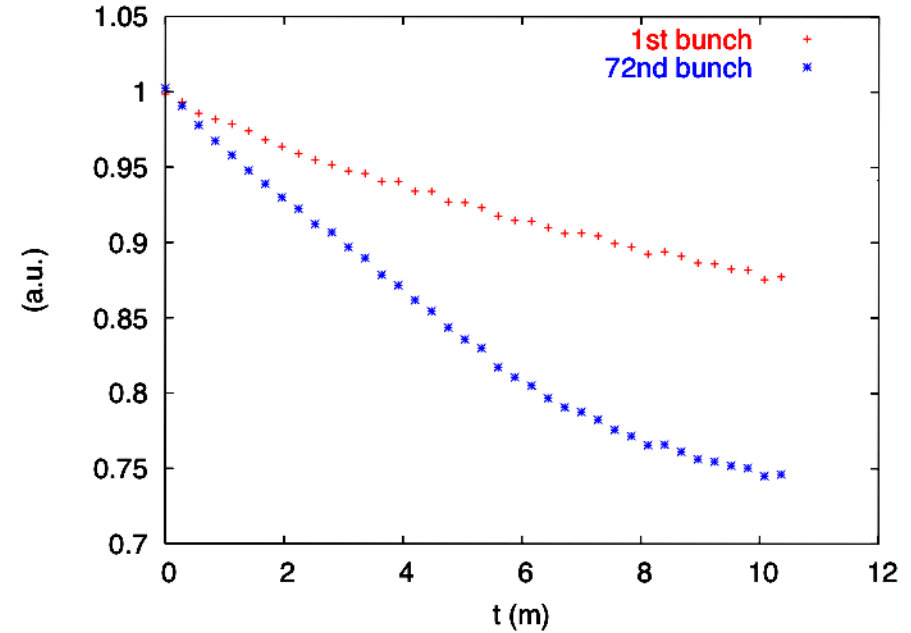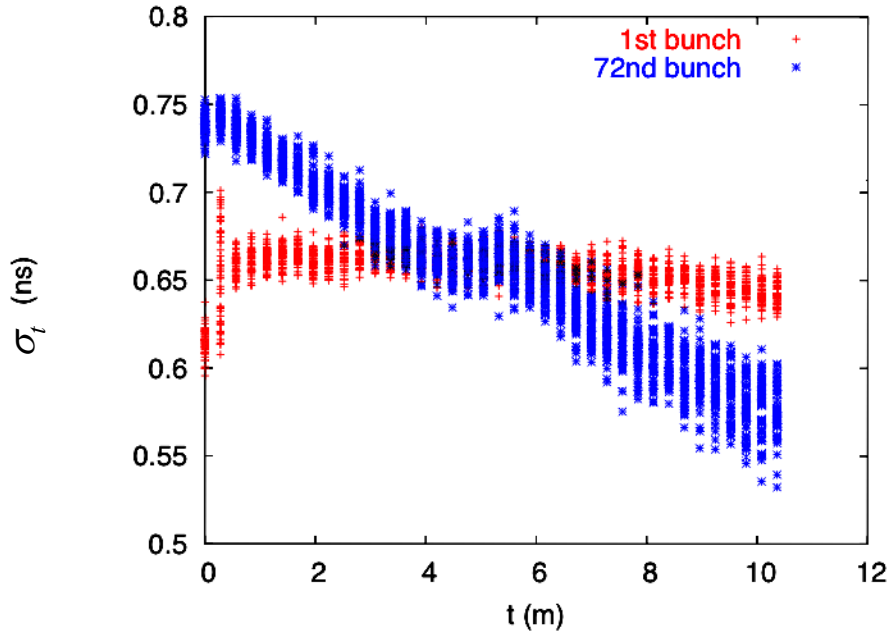
$Q_x$=0.135
$Q_y$=0.185
$\xi_x$=0.15
$\xi_y$=0.1
$\rightarrow$ Setting of the octupoles for detuning with amplitude
    reported in logbook

$\rightarrow$ RF voltage is ramped at 201ms from 1.85MV to 3MV,
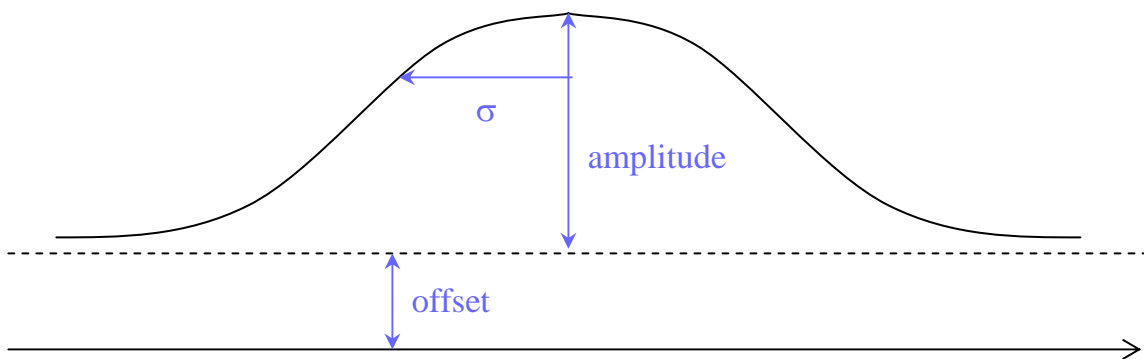    then at 604 to 3.07MV
$\rightarrow$ Dampers were on
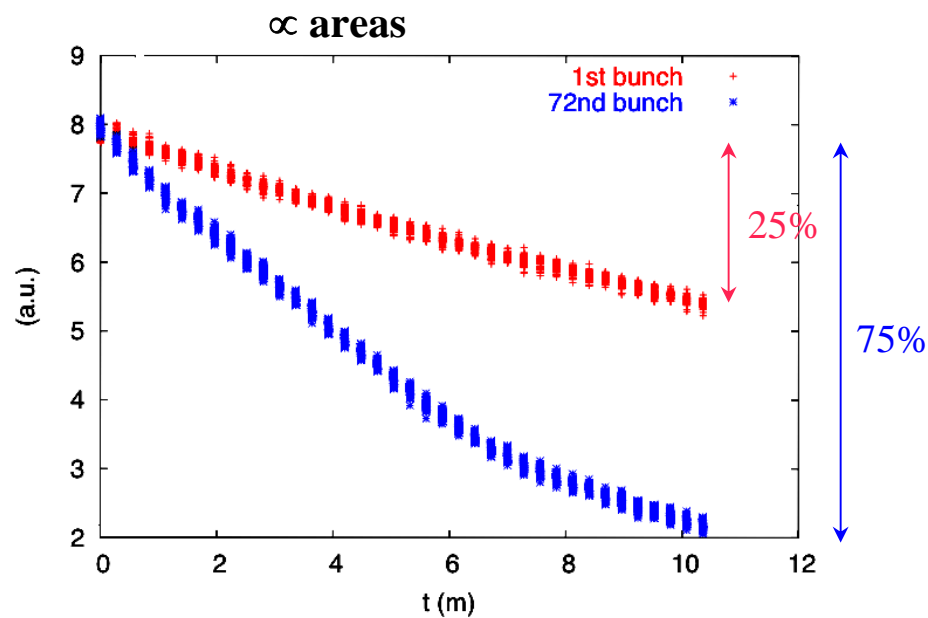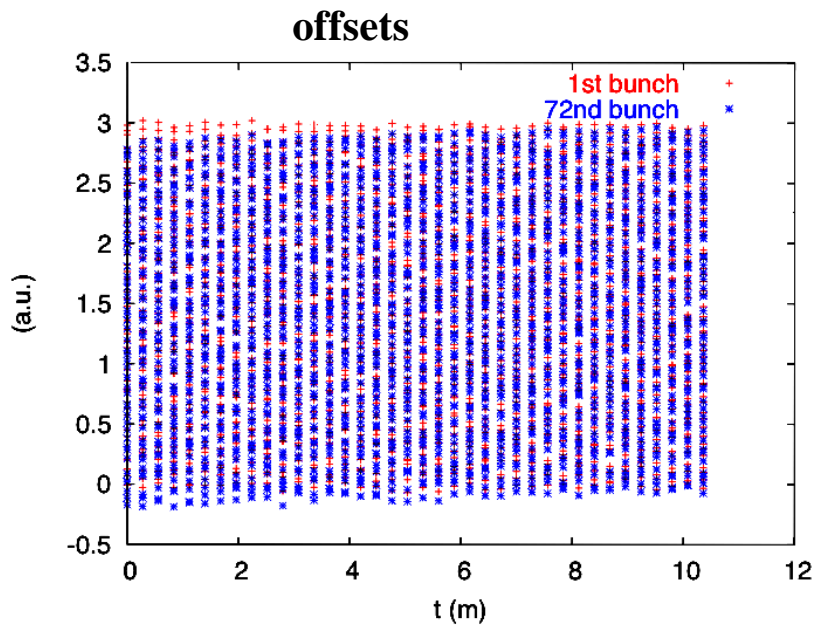$\rightarrow$ Machine coupling = 0.008

$\rightarrow$ Duration of the coast: 10.65 min

Comparison between the bunch rms-length (inferred by Gaussian interpolation of the shape signal) and population (inferred by summing up the channels of the shape signal) evolution along the coast of a bunch at the head of the train and at its tail.

σ

amplitude

offset

There is a systematic growing offset over the traces in each acquisition at the beginning of the supercycle, therefore a better estimation of the area is given by multiplying the fit coefficients $\sigma$ and *amplitude* for each trace.



**offsets**

1st bunch  +
72nd bunch  *

**∝ areas**

1st bunch  +
72nd bunch  *

25%

75%

Some information on COAST12

$Q_x$=0.135
$Q_y$=0.185
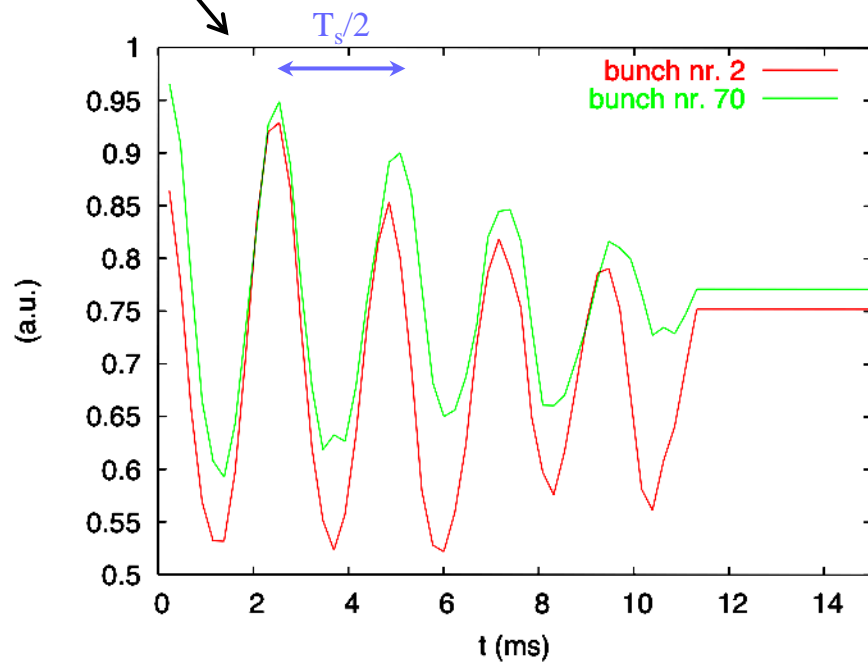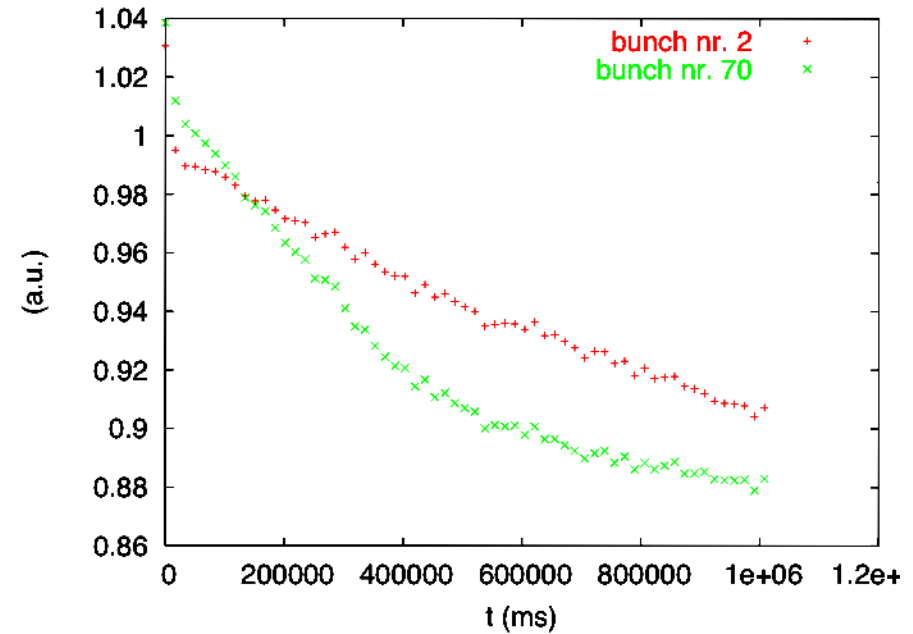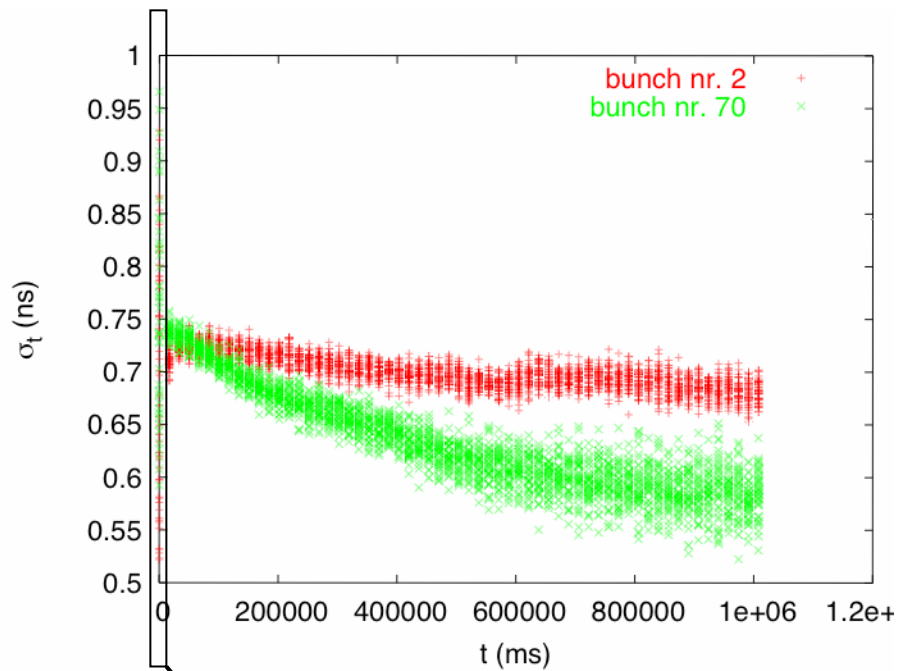$\xi_x$=0.15
$\xi_y$=0.4
$\rightarrow$ Setting of the octupoles for detuning with amplitude
 reported in logbook

$\rightarrow$ RF voltage is ramped at 201 ms from 1.85MV to 3MV, then at
 604 to 3.07MV
$\rightarrow$ Dampers on
$\rightarrow$ Machine coupling = 0.008

$\rightarrow$ Full duration of the coast: 16.6167 min

In the first supercycle the bunches were strongly mismatched in their buckets and performed damped quadrupole oscillations

Do bunch shortening and worse life time at the train tail **necessarily** mean that we are losing protons at the large synchrotron amplitudes because of an incoherent electron cloud effect??