Experiment 4

Damping rate

We can measure the rate at which the centroid motion of the beam is damped, by pinging it with a pulsed kicker (pinger), and then tracking position turn by turn. We can then reconstruct decay time. The program PLOTIR when given the appropriate instruction will collect position data at 12 detectors for 1024 turns. The data taking is initiated by the transfer trigger, as are the pulsed elements used for injection, including the pinger. We can vary the delay between ping and the start of data taking by adjusting (CESR TIMING $\rightarrow$ CESR FTIM $\rightarrow$ 9) where one computer unit is one turn.

1. With 2mA of positrons in bunch 1, turn on the pinger triggers, (push button on injection panel labelled east pinger). Then increase pinger amplitude as far as it will go before degrading lifetime, (or tripping off). (E- TRANSFER $\rightarrow$ EXF PING HV)

2. Collect turn by turn data vs horizontal feedback gain. (E- TRANSFER $\rightarrow$ CSR FEED CON $\rightarrow$ 5) Take data at full gain, half gain and at zero.

3. With horizontal feedback off measure damping rate vs horizontal chromaticity. (GROUP TUNING $\rightarrow$ CSR XQUENING $\rightarrow$ 2). Take data with chromaticity at its maximum setting, at zero and the minimum value of XQUNEING 2 consistent with good lifetime. With feedback off, damping time is much longer than 1024 turns. The radiation damping time is about 20,000 turns. In order to see what is happening on this longer time scale, we delay the turn by turn trigger. For each setting of chromaticity:

   (a) type PLOTIR to get 1024 turns

   (b) Delay trigger with CESR FTIM 9 by 3000 turns (3000 units)

   (c) type PLOTIR again and get turns 3000 - 4024

   (d) Delay trigger another 3000 turns

   (e) repeat 5 or 6 times, so that you data delayed by 20,000 turns.

4. Off line you will extract dependence of damping time on feedback and chromaticity from the turn by turn data

5. We can also use an FFT to compute the frequency of the horizontal motion. Since the amplitude of the oscillations decays with time, an fft of early turns will yield tune at big amplitudes and an fft of later turns, of smaller amplitudes. If there are guide field nonlinearities, the tune will depend on amplitude. Try to find this amplitude dependence.