Electron cloud meeting #76, 09/10/2020 (indico)

Participants: M. Himmerlich, G. Iadarola, L. Mether, N. Mounet, E. Metral, K. Parachou,. V. Petit, G. Rumolo, B. Salvant

Coherent tune shifts from coupled-bunch simulations for SPS and LHC (L. Mether)

Lotta presented a simulation study using the PyECLOUD-PyHEADTAIL suite in coupled-bunch mode to investigate the behavior of coherent tune shifts:

- For the SPS at injection, when kicking all bunches, the horizontal tune shift is of the order of 1e-4, oscillating between positive and negative. The vertical tune shift is larger and positive, with a magnitude around 6e-3 (similar tune shift was estimated from single-bunch instability studies). Only the effect of the e-cloud in the MBB dipoles is considered in the study.
- The observed behavior is not consistent with tune shift measurements, suggesting that the experimentally observed tune shifts could be due to a different mechanism (e.g. impedances).
- For the LHC, the coherent tune shifts at 450 GeV have been determined. Only e-cloud in the dipole magnets is included in the simulations.
    - With 1.1e11 p/b the horizontal tune shift is of the order of 2e-4. The vertical tune shift is around 3e-3.
    - With 2.3e11 p/b The horizontal tune shift reaches up to 2e-3, the vertical tune shift is around 2e-3.
- The horizontal tune shift is very different when kicking the entire train or individual bunches.
    - If all bunches are kicked equally, the horizontal tune shift is small.
    - Individual bunches that are kicked acquire a negative tune shift that can be at least an order of magnitude larger.
- This effect is not observed in the vertical plane. The vertical tune shift observed when kicking all bunches is positive and corresponds to the single-bunch tune shift.
- As a next step, the effect of the e-cloud in quadrupole magnets should be included in the simulations.

Application of Vlasov method to instabilities driven by e-cloud in the LHC dipoles (G. Iadarola)

Gianni showed a study on the beam stability for the LHC using the recently-developed Vlasov method:

- The method had been mostly tested for the case of instabilities driven by e-cloud in the LHC quadrupoles at injection energy. It is now applied to the case of transverse instabilities driven by e-cloud in the LHC dipoles.
- As for the case of the quadrupoles, instabilities are found to be triggered by transverse mode coupling.

- The main features of the instabilities (tune of the unstable line, threshold, risetime) are found to be consistent with the results of PIC simulations
- A slow instability found in the PIC simulations for low e-cloud strength is also identified by the linearized method.
- The coherent tune shift below the (fast-)instability threshold is predicted very well by the linearized method.