Impedance meeting
11 August 2017

Presents: D.Amorim (DA), S.Antipov (SAnt), S.Arsenyev (SArs), N.Biancacci (NB), F.Caspers (FC), E.Métral (EM), A.Pessah (AP), J.Pfingstner (JP).

The slides can be found at https://indico.cern.ch/event/659278/.

HL-LHC WP meeting

LHC TDIS: the baseline has been updated. For mechanical reasons, the longitudinal RF fingers have been removed. This creates multiple HOMs that could be detrimental for impedance and beam stability. G.Mazzacano is currently simulating this new baseline with CST.

The related presentations can be found at: https://indico.cern.ch/event/657954/.

ColUSM meeting

The results of the impedance measurements of LHC collimators (TCP, TCSG and three stripes collimator TCSPM) were reported during the 91th ColUSM meeting.

The presentations can be found at: https://indico.cern.ch/event/657903/.

Wakefield issues dues to a slotted foil for a THz source (JP)

Juergen Pfingstner presented the work done to estimate the wakefields created by a beam passing through a slotted foil. This slotted foil will be used to pre-bunch a beam for a THz source at SwissFEL.

The wakefields created by this foil could be a problem for beam transport. A first estimation was made using Bane/Stupakov theory, in the tilted beam case (slide 9). But this formula assumes a Gaussian beam distribution and doesn’t include slits in the foil.

EM and NB noted that simulations with field matching technique are not suited here as they require a steady state regime. Also CST doesn’t take into account the transverse beam size.

SArs suggested to try CST periodic boundary: it would assume that the beam is infinitely long and the slots repeat infinitely. The solving would allow to know the wakefield for one slot. JP pointed that the beam is tilted before entering the foil: the field phase has to be taken into account.

FC remarked that this problem could be solved with a time domain code. NB added that the dimensions used in the simulation could be reworked to launch simulations with a reasonable computation time. Then the results could be scaled.

FC also suggested to investigate the use of a Fabry-Perot resonator for the bunching. According to its radiation frequency, it will deflect some parts of the beam and create the bunching.
Impedance calculations for a beam pipe of elliptical cross-section (AP)

Arthur Pesah presented a new analytical model for elliptical chambers impedance. Currently two methods are used to compute these impedances: CST or ImpedanceWake2D (assuming either a round or flat chamber). These methods are time consuming (CST) or approximate (IW2D).

The solving of Maxwell equations in an ellipse was done assuming $\beta_{rel} < 1$. It was done (1) for a PEC pipe and (2) for a resistive pipe.

(1) For the PEC case:

- the longitudinal impedance is between the flat and circular pipe equivalent from IW2D (slide 9)
- for the quadrupolar impedance there are three orders of magnitude difference between the circular and the flat case. The analytical formula gives a much better estimate of the impedance (slide 11)
- for the dipolar impedance, there is a disagreement at high frequencies between the analytical formula and IW2D simulation for the limit cases (flat and round chamber)

(2) For the case with resistivity, AP pointed that the solutions (expressed in terms of Mathieu functions) contain nested loops. This can cause a propagation of numerical errors. Also in the case of high $q_r$ (i.e. approaching a flat chamber geometry), the form factor does not match Yokoya factors (slides 15-16)

EM suggested to use $q_r = 1$ or approach it to check if the form factor converges to Yokoya factors. AP and NB noted that there could be convergence problems.

EM suggested to test the case $\beta_{rel} = 1$: it could simplify the computations for the benchmarking.

EM asked if the space-charge and the resistive wall impedance are separated: yes, only the resistive wall part is showed.

AP, NB and EM added that CST simulations could be performed to investigate the discrepancies found in some cases.

Minutes written by: D. Amorim