Impedance meeting  
14 July 2017

Presenters: S. Arsenyev (SArs), M. Beck (MB), E. Belli (ElB), O. Berrig (OB), N. Biancacci (NB), P. Collins (PC), I.L.Garcia (ILG), J.Gardner (JG), A. Gilardi (AGil), F. Giordano (FG), I. Karpov (IK), G. Mazzacano (GM), M. Migliorati (MM), C. Parkes (CP), M. Pasquali (MP), A. Passarelli (AP), L. Teofili (LT), M. Williams (MW), V. Vlachodimitropoulos (VV).

The slides can be found at https://indico.cern.ch/event/653098/.

Follow up of LHCb RF box studies (NB)

NicoloB presents an overview of the possible impedance-related studies concerning the phase-II LHCb Velo. In order to improve the detector resolution different scenarios are envisaged for the RF box design, which is the main limitation in terms of particle track loss.

1. Al RF foil polishing: A test bench could be provided to test the thinning achievable with mechanical etching. Uniformity and vacuum tightness should be checked.

2. Metal coating on polymers: A PEEK block could be produced and coated with Cu. RF impedance and resistivity measurements should be done, as well as shielding and vacuum tightness and outgassing rate before/after backout.

3. RF foil absence: The CAD model is needed for the simulation of the impact on impedance when the RF box is completely removed. The STP file will be provided.

4. Wire mesh: A Be wire mesh can be produced which is effective on shielding and impedance. It would not be compatible with the two vacuums presently in the design.

5. Two semi-cylinders: PaulaC reminded that there is also another option on the table where the flat RF boxes are replaced with half-cylinder. Detailed introduction in https://indico.cern.ch/event/481359/contributions/1157546/attachments/1254457/1851411/paula_collins_supervelo_theatre_of_dreams.pdf

Despite the timeline looks favourable, a lot of work is foreseen and resources should be allocated.

Damping a resonances with the help of a loop connected to an external resistor (JG)

JackG presents an overview of empirical tentatives done for damping the two main resonance modes in the BBS-Quattro tank. Resonances are at 1.01 and 1.3 GHz.

He compares damping obtained with a ferrite tile and with loops with different damping resistor termination. A damping resistor of 100Ω would damp effectively the first resonance, while 1kΩ the second one.
The theory behind should be further developed and compared with past results obtained, for example, for the SPS flanges by J.Varela. OlavB informs that the same method will be tried on the LHC BGI.

**Deposited power map in CST (LT)**

LorenzoT presents a new method to study local power deposition with CST and ANSYS.

The field induced by a beam is computed in a cylinder of poorly conducting material. A reflection effect is found at the boundary, which is un-physical. NicoloB comments that the effect at the boundaries comes from the not perfect modelling of an open boundary: we could clean it enlonging the vacuum pipe and setting PEC background boundaries.

In CST, two solvers are available for thermal simulations. Nevertheless the thermal simulations were done in ANSYS as it is already a well tested solver for time varying heating sources.

Two benchmark were performed: on a resistive pipe (broadband losses) and on a cavity (narrow band losses).

In the first case, the longitudinal impedance is computed both with CST and analytical formulas. The agreement is acceptable within 10%. A disagreement of 20% is found between “lossy” and “normal” models for conductive material which may be due to mesh limitations. Once the power deposited in the volume in time is calculated, this is set as input in ANSYS. The agreement in total power loss is of a few percents which is excellent.

In the second case, a resonance in a cavity is characterized in terms of frequency, shunt impedance and Q factor. NB comments that the Q factor should only be calculated in Eigenmode simulations as in Wakefield we would have the load of the beam pipe impedance on it. The agreement between the single reonator model and CST simulation is acceptable.

Some work is still needed to ease the input/output of the CST simulated power loss maps which are quite redundant. NB suggests to write a VBA script.

The application of the method for losses due to resonances needs further development as the full beam cannot be simulated in CST and therefore the powerloss map in time would be convoluted by a train of Dirac functions leading to a quadratic dependence on current (linear in case of broadband impedance).