

CEI section meeting 22-08-2024

Present: Bernardo Abreu, Xavier Buffat, Lorenzo Giacometti, Dora Gibellieri, Miguel Gonzalez Torre, Christophe Lannoy, Szymon Łopaciuk, Lotta Mether, Elias Métral, Nicolas Mounet, Konstantinos Paraschou, Giovanni Rumolo, Leonardo Sito, Carlo Zannini

Online: Gianni Iadarola, Elena Macchia, Mauro Migliorati, Roxana Soos

Excused: David Amorim, Chiara Antuono, Elena de la Fuente Garcia, Fredrik Grønvold, Luca Sabato

Scientific secretary: Xavier Buffat

General information (G. Rumolo)

Communications and Arising matters

- Section meetings will start at 13h40 as of the next one.
- The JAP workshop follows a new structure based on joint sessions combining operation, equipment, beam dynamics and controls.
- A complete and self consistent study of the SPS 'stuck' wire was presented by Elena at the IPP.
- The ongoing LHC MD block is strongly limited by issue with RF preventing injection of high intensity beams. Gianni said that the RF is now ready to take high intensity beams for the tails study by S. Kostoglou which required heavy preparation in the injectors. However at the time of the meeting the LINAC4 is down.
- Gianni mentioned that intensity limit from the BCCM will be sorted out by BI by the next MD block.
- The range of chromaticity featuring lower octupole current in the LHC at flat top was confirmed in MDs. Thanks to the fixing of the issue with the delay in the publishing of the ObsBox data, allowing for a fast reaction to an instability, several instability threshold could be performed with three cycles. Lower bunch length compatible with HL-LHC design parameters were also investigated.

- Schottky spectrum were measured with different bunch lengths (longitudinal emittances) and intensities, as well as with different coupling settings.

Impedance / wake model for the FCC-ee (Dora)

- The existing impedance model features the impedance of the beam pipe based on IW2D neglecting the impact of the wigglets, as well as the resistive wall contribution of the collimators. Recently the geometric part of the collimator was integrated based on CST computation with a simplified model featuring a linear taper. Low taper angles are favoured since their geometric contribution dominates their resistive wall contribution. The current collimation system features 11 collimators with MoGr-based primaries, Mo-based secondaries and W-based absorbers.
- As an initial guess, the taper angle is set to 15 degree. Maybe a better trade-off between geometrical contribution and resistive wall of the taper could be found. It is assumed that the taper is made out of the same material as the bulk.
- Resonances were observed in the collimators, they are affected by the cut-off frequency of the jaw and the resistivity of the collimator material. A more realistic taper model, featuring wigglets, will be studied in the future.
- The total impedance is obtained by combining all contributions weighted by the beta function at their locations using PyWIT. Overall the collimator impedance dominates the full model. Their geometric impedance is also significant.
- There are 6000 photon stoppers yielding about 3% of the total impedance.
- The polarimeter impedance was also included in the model. This is only one element and its contribution weighs less on the global impedance.
- Kostas asked whether the trapped mode in the collimator may be numerical. Dora answered that they are real and caused by the cut-off of the jaws. The behaviour is very similar to a step-in step-out.
- **Giovanni suggested improving the workflow for impedance by compiling a clear list of operational scenarios that need to be included in terms of beam stability (e.g., only transverse impedance, only longitudinal impedance, both combined, one beam, two beams, with and without beamstrahlung, intensities to be covered, with and without feedback, e-cloud) and the related work in terms of modelling to ensure that the work on impedance, beam-beam and e-cloud are covered in a consistent manner.** Carlo added that the machine protection aspect linked to fast

instabilities that came up recently should be integrated as well.

- Carlo mentioned that at the FCC-ee, unlike in existing machines at CERN, the beam spectrum extends beyond the pipe cut-off such that propagating waves could be relevant for the beam dynamics. Mitigation such as mode traps could be necessary. Xavier suggested to survey existing machines to find out whether some accelerators already operate in such a regime.
- Mauro mentioned that strong instabilities may occur during the ramping of the intensity (bootstrap injection), the highest intensity is not necessarily the most critical. Xavier added that the change of stable working point with the bunch intensity is not compatible with the bootstrap scheme recently proposed to mitigate electron cloud instabilities, as it features bunches with very different intensities circulating simultaneously and thus have the same working point.

AOB and end of the meeting

The next meeting will take place on the 12th of September. Miguel Gonzalez Torre will present a summary of his trainee project on the SPS 'dark impedance', as it will also be close to the end of the traineeship (13 September).