Minutes of 1st FCC Collimation Design Meeting

Participants: M.I. Besana (MiB), R. Bruce (RB), M. Fiascaris (MF) A. Lechner (AL), E. Metral (EM), D. Mirarchi (DM), S. Redaelli (SR) (chairman), D. Schulte (DSc),

Indico event here.

1 Introduction (S. Redaelli)

SR introduced this meeting by recalling that that the necessary tools are now well setup for initial studies of collimation systems for FCC-hh, thank to the work of MF. The outputs of the simulations are available to start an iterative process with the other teams. This motivates the start of this meeting series where we want to get together key competence from teams related to collimation activities.

In addition, a couple of meeting before the FCC workshop in Washington will also be organized to synchronize a few talks related to collimation topics, from the collimation team (MF), MME (A. Bertarelli) and STI (AL).

SR commented that details of participants to this meetings and reporting lines will be discussed in a later meeting when representative of more teams will be available.

2 FCC-hh: collimation system design (M. Fiascaris) [slides]

2.1 Summary of the presentation

MF presented the status of the first collimation system design for a betatron cleaning system for the FCC-hh. The initial approach adopted has been to scale up the present LHC collimation system design to the FCC energies, using a scaling that allows to maintain similar gaps and settings as in the LHC. The motivation for that is to profit from the LHC experience by starting with a validated design that worked well at the LHC. In addition, in this initial approach we avoid putting immediately challenges on very small collimation gaps.

MF presented the results from the first tracking simulations obtained using a toy-lattice where only betatron cleaning is implemented. Given that no aperture model is available yet, the performance of the collimation system is characterized by the cleaning inefficiency as function of the beam halo radial amplitude and off-momentum population. The cleaning inefficiency versus transverse aperture look consistent. The plot for the inefficiency versus off-momentum halo has been newly implemented by MF. These preliminary simulations assume CFC primary and secondary collimators. For the moment, only a three-stage betatron cleaning system is considered (with W shower absorbers, TCLAs).

MF also showed how the cleaning inefficiency is affected when changing the retraction of the secondary collimators with respect to the primaries. This is first step toward a detailed parameter study to optimized the system settings. Finally she discussed the next steps, which include the implementation of collimators in the DS after the betatron cleaning insertion and of tertiary collimators around the interaction regions. The FCC collimation settings equivalent to the HL-LHC baseline were also presented for discussion on the low-beta insertion design and $\beta^\star$ reach.

2.2 Discussion

EM asked if the goals of the collimation system are going to be be the same as for the LHC. The answer was positive and SR pointed out that as for the LHC the halo-cleaning role is going to be the driving constraint.

AL commented that for energy deposition studies on the collimators, the ionization contribution is expected to be important and should also be provided as input.

Following a question from DSc, it was agreed that a sensitivity study of the simulations on the impact parameter should be performed.

RB pointed out that the results on the TCP-TCSG retraction could be biased because the current collimation layout was optimized for a retraction of one sigma. It was agreed that it would be better to redo these studies reoptimizing the phase advance locations of secondary collimators. These studies would also be useful for the HL-LHC, for which the setting baseline is now foreseeing a 2 sigma retraction between TCP and TCS collimators.

RB asked if the dispersion function shown on slide 18 (regarding the DS collimators) is the periodic or single passed dispersion. MF answered that this is the periodic dispersion, but the plots can be remade with the single pass dispersion. The latter is more representative for this specific case where collimators should catch losses in the DS from particles from single diffractive events occuring in the betatron cleaning in the same turn.

DSc asked what is the off-momentum distribution ending up in the DS region and commented that for DS collimators we should iterate with the optics team. The dispersion functions in the arcs are not yet optimized. DSc asked if we can specify criteria to optimize the optics in order to maximize the collimation performance. SR and RB agreed that one should make sure that the single-pass dispersion is maximized immediately downstream of the collimation insertion, in a way that ensures that future DS collimators in this region shield all other momentum losses around the ring.