2nd[st] FCC-hh design meeting

Thursday 16th February 2023, 14:00 – 15:30

Chair:	Massimo Giovannozzi
Speakers:	Massimo Giovannozzi, Gustavo Pérez Segurana
Participants:	Andrey Abramov, Wolfgang Bartmann, Roderik Bruce, Sergio Calatroni, Massimo Giovannozzi, Patrick Krkotic, Gustavo Pérez Segurana, Thys Risselada

AGENDA

MEETING ACTIONS

OVERVIEW OF RECENT ACTIVITIES (MASSIMO GIOVANNOZZI)

The minutes of the previous meeting were approved without comments.

Massimo introduced the new ring layout with changes to the circumference length to match the harmonic number of FCC-hh and its injector and for improve the ring placement. This is done by shortening the length of the technical insertions to 2032 m. Together with the radial displacement of experimental IPs to match with the FCC-ee rings constitute V3.1.

The optics of V1.0 has new optics for collimation insertions and PB optics, which will be used to qualify the collimation system performance. A thin-lens lattice for collimation studies is being prepared.

For V3.0, a 16-dipole cell is being developed (see following presentation). Additionally, this will include replacing the normal conducting separation dipoles in experimental insertions with superconducting ones (design inspired by the HL-LHC separation dipoles in IR1 and 5).

Transfer lines will have the same regular cell as the FCC-hh with two solutions available: normal conducting, or permanent magnets.

Studies of coatings of the beam screen make possible raising the beam screen temperature to 70 K returning benefits with respect to the total electrical power to refrigerator.

Finally, **Massimo** mentioned progress in the collaboration of HTS coating of the beam screen and the possibility of collaboration with the Pakistan Atomic Energy Commission with details being worked out.

Discussion:

- **Wolfgang** asked if the updated beam energy value of 47 TeV could be used for computation of hardware parameters instead of 50TeV. Massimo responded that that would be ok if it is clearly stated where each value is used to keep in mind margins.
- **Thys** pointed out that the work of optimizing the layouts of FCC-hh and FCC-ee eventually must consider both FCC-ee rings.
- **Sergio** commented that no studies have been conducted relating the increase of the temperature of the beam screen and flux creep into the superconductor, yet, and that such studies are needed before taking any decision about the increased temperature. **Massimo** thanked him for mentioning this concern.

STUDIES OF AN FCC-HH LATTICE WITH 16-DIPOLE FODO CELLS (GUSTAVO PÉREZ SEGURANA)

The current baseline design of the arcs uses 12-dipole cell arcs, like the designed reported in the CDR. The possibility of using 16-dipole FODO cells instead has been studied. The main motivation is that by increasing the number of dipoles per cell, the number of quadrupoles in the arcs is reduced and therefore a higher filling factor is achieved. After generating this new 16-dipole cell, we reconstruct the dispersion suppressors, and compare the geometry of this new arcs with the 12-dipole baseline to ensure their compatibility.

With the longer arc cell, a modification to the geometry of the beam screen is necessary to avoid beam stay clear issues.

The resulting overall geometries differ less than 10 cm at the IPs with respect to the 12-dipole version of the ring.

A schematic of the new dispersion suppressors was shown. This includes space reserved for collimators around the first dispersion peaks. Overall, the change from the 12-dipole version results in a 4.1% increase in the filling factor.

Finally, matches of the arcs to the technical insertions were shown, with already satisfactory configurations for the collimation insertions PF and PH, and partial solutions for the injection insertions PB and PL.

These changes together with updates to the technical insertions with reduced lengths, displacement of the experimental IPs to match the FCC-ee layout and replacement of the normal conducting separation dipoles with superconducting ones in the experimental insertions are expected to conform the future baseline lattice.

Discussion:

- **Roderik** congratulated on the progress made on the new optics design and inquired about the choice of the placement of the reserved space for collimators in the dispersion suppressors and their lengths. **Gustavo** responded that they are currently at the first and second dispersion peaks, and about 6m long; but that the overall geometry can be shifted if collimation studies suggest they would be more effective elsewhere.
- **Massimo** asked **Thys** if he had any thoughts about how to shorten the collimation insertions. **Thys** responded that he had not worked on this yet.

Minutes reported by Gustavo Pérez Segurana