
Meeting Minutes of the 191st FCC-ee Accelerator Design Meeting and 62nd FCCIS WP2.2 Meeting

Indico: <https://indico.cern.ch/event/1447284/>

When: 21.08.2024 14:30-16:00 GVA time

Agenda

Presenter	Title
F. Zimmermann	Plan for the Feasibility Study Report
G. Roy	Update on the RF geometry

1 General information

F. Zimmermann opens the meeting. The minutes of the previous meeting are approved with minor corrections.

- **Beam lifetime discrepancy:** **L. van Riesen-Haupt** explains that a rounding error has been identified in Xsuite as the likely cause. After correction, the results seem to better agree between Xsuite and SAD. The results will be reported at the next accelerator design meeting.
- **2-cell 400 MHz RF cavities at Z and W modes:**
 - **F. Zimmermann** raises concern about whether collective effects will be manageable. He suggests that **M. Migliorati** or **C. Zannini** might examine this issue. Additionally, he proposes that **K. Oide** could perform tracking simulations including beam-beam to spot potential instabilities.
 - **I. Karpov** Adds that the transit beam loading should be investigated causing, within a train, different bunch length and synchrotron tune and it needs to be carefully studied.
- **Optics study topics:**
 - **F. Zimmermann** proposes several optics topics, namely to study the option of having the same optics between Z, W and Zh operation modes, which **K. Oide** estimates to reduce the luminosity at Zh mode by 50%. **G. Roy** argues that the integrated luminosity should be considered as there is less commissioning needed, he adds that the reconfiguration of the arcs from Z, W to Zh is a lengthy process. Besides, there is the flexibility to have one year at Z to understand potential issues *e.g.* detector-wise, move for some time to W or Zh and return to Z operation. **F. Zimmermann** adds that having the LCC arcs matched to the GHC lattice could be a solution.
 - **C. Carli** comments that matching and optimizing the collimation, injection/extraction and RF insertions to the collider design is an important optics topic to address.

2 Plan for the Feasibility Study Report

F. Zimmermann presents the structure for the Feasibility Study Report, proposing two main chapters/volumes: "FCC-ee Design and Performance" and "FCC-ee Technical Systems". He emphasizes the importance of highlighting the synergies between the electron-positron and hadron-hadron colliders, such as shared infrastructures like cryolines, transfer lines, power systems. Furthermore, the decommissioning of FCC-ee is very well documented thanks to the experience of past colliders.

G. Roy suggests that each section should include a subsection dedicated to specifications to ensure clarity.

J. Wenninger recommends adding a specific section on survey and alignment under the "FCC-ee Technical Systems" chapter.

A. Lechner raises a concern about where the beam dump design should be included, noting that in the LHC CDR and/or TDR, design and systems were not separated. This topic requires further discussion to decide the best approach.

S. Redaelli questions the placement of the injection design within the report and argues that specifications should belong to the design chapter rather than the technical systems.

F. Zimmermann acknowledges the feedback, indicating that the current separation Design and Technical Systems might not be optimal and will be revised.

J. Keintzel asks about the writing process for the report. Reflecting on the Mid-term Report process, where each contributor worked on independent documents. **A. Lechner** comments that it should be an Overleaf document for each chapter/volume, although this still needs to be confirmed.

3 Update on the RF geometry

G. Roy presents an update on the RF geometry to implement seamless transitions between Z to Zh operation modes within the RF section. The proposed RF insertion must accommodate the following requirements:

- **Crossing design for Z and W modes:** The beam should cross in the center of the RF section, passing through the RF cavities once and crossing from inside to outside and vice versa with about 10% stronger dipoles than in the arcs, depending on the available space.
- **Crossing design for Zh mode:** Both beams should pass through all RF cavities to compensate for synchrotron radiation energy loss, and electromagnetic separators placed on either extremity of the straight section (one active for each beam) enables the beams the inside/outside permutations for (anti-)clockwise beams.

K. Oide suggests using a vertical chicane to mitigate long-range beam-beam interactions, referencing the approach used by SKEKB with separated beam pipes. He adds that it should not affect polarization. **J. Wenninger** comments that horizontal and vertical steering should be done separately.

G. Roy raises concern on a potential impedance impact due to the increased number of RF cavities needed for the Z mode operation. He notes that it is crucial to evaluate performance based on integrated luminosity rather than only peak luminosity.

P. Janot wonders whether the booster could go above or below the detector to avoid obstructing the opening of the detectors in the smaller cavern. **J. Wenninger** comments that while it would not pose an issue for energy calibration, a vertical separation in the booster might complicate the conservation of polarization.

F. Zimmermann adds that avoiding vertical emittance blow-up in the booster is important. **G. Roy**

suggests to design a long drift section in the booster that would allow the detector to be opened without interference.

48 Participants:

M. Ady, K. André, H. Bartosik, M. Benedikt, M. Boscolo, G. Broggi, Q. Bruant, X. Buffat, H. Burkhardt, D. Butti, F. Carra, A. Ciarma, H. Damerau, L. Deniau, A. Frasca, C. Garcia, V. Gawas, A. Ghribi, C. Goffing, E. Howling, B. Humann, P. Hunchak, A. Inanc, S. Jagathuni, P. Janot, I. Karpov, J. Keintzel, R. Kieffer, C. Kiel, M. Koratzinos, T. Lefevre, A. Lechner, K. Oide, A. Piccini, S. Redaelli, G. Roy, B. Salvachua Ferrando, J. Salvesen, R. Soos, A. Vanel, U. van Rienen, L. van Riesen-Haupt, R. Wanzenberg, J. Wenninger, S. Yue, C. Zannini, F. Zimmermann, and M. Zobov