Meeting Minutes of the
151st FCC-ee optics design meeting and 22nd FCCIS WP2.2 meeting

Indico: https://indico.cern.ch/event/1118299/
When: 17.03.2022 14:30-16:30 CET

Agenda

Presenter	Title
K. Oide	**Optics for Z with $\beta_x^* = 10cm$**
F. Peauger	**FCC-ee RF system update**
M. Hofer	**FCC-ee optics repository**

1 General information

F. Zimmermann opens the meeting by reviewing the minutes. The sole action item from the last meeting will be followed up in the first presentation.

The FCC-Week 2022 preparation is ongoing, and more information as well as the program will be communicated in due time.

Two white papers, one on FCC-hh and one on -ee, have been submitted for consideration in the Snowmass process.

There will be a midterm review in the summer of 2023, and the scope and goals are being reviewed by the CERN council.

2 Optics for Z with $\beta_x^* = 10cm$

K. Oide presents on an optics with a lower β_x^* for the Z operation mode. As discussed in the previous FCC-ee optics meeting, no tune area could be identified where coherent beam-beam instabilities are suppressed for an optics with β_x^* of 15 cm, whereas this is the case for β_x^* of 10 cm. New parameters for the optics with lower β^*, but also for the $t\bar{t}$ operation mode are presented, both taking as constraint the vertical beam-beam parameter $\xi_y \leq 0.14$. The dynamic aperture for the new optics is found to be slightly worse, but is deemed acceptable. Touschek lifetime is reduced by 12 %.

A brief update on the studies on polarization, first presented in the 149th FCC-ee optics design meeting, is given. After a bug in the code was fixed, the spread and rise time of the polarization when including the solenoid behave similar to the case without. The question is raised how the spread of polarization will affect the polarization measurements.

A. Blondel asks if the presented parameters are for a 4-IP design. **K. Oide** confirms. On the spread of polarization over all particles, **A. Blondel** notes that this feature has not been studied in the past, however, he believes that it will not affect the measurements.

D. Shatilov comments the vertical beam-beam parameter is not the driving constraint. In his opinion, the momentum acceptance is more critical, as it limits the bunch population, which then factors into the beam-beam parameter. He asks how to the Touschek lifetime is calculated in the code. **K. Oide** replies that an ellipse is fitted inside the dynamic aperture, and the probability for the loss is then calculated for a number of points around the ring. He agrees that this underestimates the real Touschek lifetime.

3 FCC-ee RF system update

F. Peauger present an update on the RF strategy for the FCC-ee and the Booster. RF parameters have been updated to follow the beam parameters in the new layout. Cavities for the FCC-ee will be installed in PH in all operation modes, with additional cavities in PL for the $t\bar{t}$ mode. For the booster, cavities will be installed in PL. The different options are presented, with the baseline option using 400/800 MHz elliptical cavities. The second option uses slotted waveguide elliptical cavities with 600 MHz, but more studies will be necessary before a conclusion can be made. The old baseline RF parameters are presented for all operation modes, and it is noted that using 400 MHz, 4 cell cavities poses some challenges. Instead, it is proposed to use 400 MHz 2 cell cavities for the collider. For the booster, 800 MHz 5 cell cavities are proposed for all operation modes except the Z mode, where 400 MHz 2 cell cavities shall be used. The RF parameters and the staging strategy for the proposed changes are presented. The number of cryomodules increases by 18 units compared to the CDR strategy. The challenges from the RF point of view and their priority, together with the program timeline is presented.

B. Holzer asks why 1.3 GHz is studied. **F. Peauger** replies that these cavities are simpler to manufacture and test, allowing to refine procedures.

M. Koratzinos asks how the strategy will change if the project switches to the SWELL option. **F. Peauger** answers that detailed strategy has not been studied, but will certainly affect cryomodule design and power distribution amongst others. The promise of this cavities is the damping of higher order modes together with ease in processing to create seamless structures to allow for high gradient, high current cavities.

A. Blondel asks if the new strategy is compatible with a run at a center of mass energy of 125 GeV after the ZH operation, where a center of mass energy of 240 GeV is targeted. In particular, it also requires that all cavities will be located in one straight section. **F. Peauger** comments that this should be possible.

K. Oide points out that with a common RF at ZH, the total RF voltage is 2.5 GV for the 400 MHz cavities. The same will be also required at $t\bar{t}$, together with more than 9 GV for the 800 MHz cavities. **O. Brunner** points to the integration strategy, where all 400 MHz cavities will be located in one point, and the 800 MHz in the other. The only concern is the overall length of the 800 MHz system, which should be below 2 km and is being looked into at the moment.

For impedance studies, **M. Migliorati** asks how the geometry of the cavities will be affected. **O. Brunner** comments that the parameters at Z should remain the same as there still single cell cavities will be used. However, the option to use 2 cell cavities at this operation mode should be studied in the future.

4 FCC-ee optics repository

M. Hofer presents an update on the FCC-ee optics repository. Following the announcement in the Work package 2 workshop in December 2021, the FCC-ee repository was moved to the acc-models group, where models of many of the accelerators at CERN can be found. The repository was restructured, and a website

is now in place to provide easy access to key parameters, examples scripts, and more. Following major changes, a snapshot of the repository will be published on zenodo.org, together with a DOI for easier citation.

Follow-up items

TASK
Add new optics for Z with lower β_x^* to optics repository

52 Participants:
A. Abramov, I. Agapov, K. André, J. Bauche, M. Behtouei, A. Blondel, M. Boscolo, O. Brunner, X. Buffat, H. Burkhardt, P. Burrows, K. Cantun, E. Carideo, F. Carlier, T. Charles, A. Ciarma, B. Dalena, L. Deniau, F. Francesini, C. Garcia, M. Hofer, B. Holzer, B. Humann, P. Hunchak, P. Janot, H. Jiang, J. Keintzel, P. Kicsiny, M. Koratzinos, A. Krainer, R. Losito, M. Migliorati, N. Mirian, E. Montbarbon, N. Nikolopoulos, K. Oide, C. Ormond, F. Peauger, T. Pieloni, F. Poirier, R. Ramjiawan, T. Raubenheimer, M. Reissig, L. van Riesen-Haupt, L. Sabato, D. Shatilov, G. Simon, R. Wanzenberg, F. Yaman, L. Zhang, F. Zimmermann, and M. Zobov