

Meeting Minutes of the 34th FCC-ee MDI meeting and 5th FCCIS WP2.3 meeting

Indico: <https://indico.cern.ch/event/1071912/>
When: 11.10.2021 16:00-18:00 CET

Agenda

Presenter	Title
F. Franesini	Mechanical model of the IR beam pipe
A. Ciarma	Impact of smaller beam pipe on VXD geometry
R. Kersevan	Synchrotron radiation simulations in the IR
M. Hofer	Collimation update

1. General Information

M. Boscolo opens the meeting and introduces **M. Sullivan** as the new co-convener of the FCC-ee MDI group.

2. Mechanical model of the IR beam pipe

F. Franesini opens the presentation by giving a definition of the new beam pipe parameters in the MDI area, which has a smaller central part with radius 10mm and length 90mm made of AlBeMet (62%Be 38%Al) and space for cooling. Following the work presented by **F. Franesini** at the FCC Week 2021, a parametric study on the thickness of the beam pipe is currently being performed with a more detailed description including heat load, cooling and gravity. The heat load in the central part of the beam pipe is 150W/m in the first 90mm from the IP and 97W/m from 90mm to 5560mm (calculations by **A. Novokhatski**). A parametric study on the mechanical constraints for the pipe is presented, studying the supports thickness for several configurations.

M. Koratzinos comments on the range of the support thickness, 5mm supports are too large considering the aperture of the first quadrupole being 40mm.

A. Novokhatski notes that the gold coating is not present in the given description of the pipe. **F. Franesini** comments that the 5 μ m gold coating in the central beam pipe is negligible for the mechanical stability studies performed. **M. Boscolo** and **M. Dam** confirm that the 5 μ m gold coating is present.

A. Novokhatski asks if vacuum calculations have been performed for the smaller beam pipe and if it will be necessary to apply NEG coating. **R. Kersevan** comments that if the local pressure bump does not cause issues in the detector the coating might not be necessary; also the possibility to use a compact titanium-zirconium pump is being considered but the space constraints are very demanding. **N. Bacchetta** asks if the NEG and gold coatings can coexist and **R. Kersevan** says that it should not be a problem.

A. Novokhatski comments that with the new linear bunch density beam parameters recently presented by **K. Oide** at the FCC-ee optics meeting on September 30

(<https://indico.cern.ch/event/1077162/>) the heat load might grow of about 15%-20% due to an increase of the linear bunch density of about 30% at the Z pole. This might be a problem at the Z pole, where the beam current is high. **M. Koratzinos** and **D. Shatilov** comment that as the bunches are longer and the total beam current is the same this growth might be much less. **M. Boscolo** suggests that this discussion should be reprised in the next MDI meeting, and that a design considering safety margins of this order of magnitude should be studied in any case.

R. Kersevan adds that the cooling is needed all over the pipe, in order to prevent pressure bumps from thermal desorption and mechanical stress on the pipe. Cooling tubes could be placed around the copper chamber as an alternative to the double layer with water inside.

A. Novokhatski asks what the vacuum will be in the small chamber. **R. Kersevan** answers that it can be any value from $10E-6$ to $10E-11$ depending on desorption and beam gas.

3. Impact of smaller beam pipe on VXD geometry

A. Ciarma shows in his presentation that the change in the central beam pipe length will require some modifications on the design of the Vertex Detector. Several options are presented and should be studied in order to assess which one allows better performances in the event resolution.

N. Bacchetta comments that as a rule of thumb the distance between the barrel and the endcap of the detector should be minimized.

E. Perez suggests that the length of the barrel might go a bit beyond the length of the central beam pipe, even entering the 150mrad cone of the lumical, as the sensitive part of this detector does not go past ~ 120 mrad. **M. Dam** agrees on this.

4. Synchrotron Radiation simulations in the IR

R. Kersevan opens the presentation with a summary of the studies shown at the 8th FCC-ee MDI meeting (12.12.2016). He then shows the studies with the new lattice and smaller beam pipe design, using the CAD model provided by LNF with no ferrite HOM absorbers and “half-moon” SR masks just after the first quadrupole (as suggested by **M. Sullivan** in previous meetings). The power deposited on the central beam pipe is 0.31W at the Z pole and ~ 1 mW at the tbar, and at both energies the average photon energy is of about 90eV, therefore they will not penetrate the beam pipe. One of the half-moon SR masks has been moved away from the IP of 135cm: no relevant reduction of the SR flux in the chamber was observed, but it may reduce the Compton scattered photons produced from the tip of the mask (dedicated simulations are required).

K. Oide observes that during commissioning and operation the vertical emittance can be 10 times the nominal value and suggests to perform simulations with such emittance. **R. Kersevan** replies that simulations of this scenario can be performed and that a bigger beam will imply that more photons will hit the beam pipe.

R. Kersevan adds that the half-moon absorbers should be cooled separately.

5. Collimation update

M. Hofer exposes the need for the establishment of an aperture model for the whole ring and presented the workplan on this topic and also the status of the collimation study.

B. Roderik comments that one important point is to understand how much losses the several elements can take. **F. Zimmerman** notes that the reports from the LEP experience might be useful to get an idea on this.

Follow-up items

- New heat load evaluation from the latest beam parameters
- Study the Compton scattered photons from the tip of the SR masks

Participants

A. Abramov, A. Blondel, M. Boscolo, L. Brunetti, H. Burkhardt, P. Burrows, A. Ciarma, M. Dam, F. Franesini, G. Ganis, M. Hofer, B. Humann, R. Kersevan, M. Koratzinos, E. Montbarbon, A. Novokhatski, K. Oide, E. Perez, F. Poirier, B. Roderic, D. Shatilov, M. Sullivan, L. Watrelot, F. Zimmerman

Next meeting will be 08/11/2021

Minutes reported by A. Ciarma