

Meeting Minutes of the 42th FCC-ee MDI meeting joint with Detector Concepts

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When: 05.09.2022 16:00-18:00 CET

Agenda

Presenter	Title
M. Boscolo	Minutes, general information
F. Franesini, S. Lauciani	Mechanical model of IR and of IR vacuum chamber
F. Palla	Vertex Detector study for its integration in the IR
L. Watrelot	Considerations about the IR supporting tube structure for the alignment system needs
A. Ciarma	Detector Beam Background studies & material budget for the beam pipe
M. Koratzinos	Proposal for fully cooled trapezoidal beam pipe

1. Minutes, general information – M. Boscolo

Minutes from last meeting are discussed and approved.

The proposal dates for the 4th MDI working meeting 17-28 October. Dedicated sessions on critical topics we've been discussing will be organized as well as time for discussion.

2. Mechanical model of IR and of IR vacuum chamber – F. Franesini, S. Lauciani

A summary on the new model of the trapezoidal beam pipe chamber is presented, together with the study of the influence of the VTX weight on the pipe itself. Preliminary simulations on the carbon fiber cylindrical structure for the assembly/support of the beam pipe and vertex detectors show sustainable mechanical stress on the structure.

M. Koratzinos asks about how the deformation of the cylindrical structure will affect the alignment of the LumiCal. **S. Lauciani** comments that the already foreseen alignment active system for the LumiCal will be used to compensate also these deformations $O(10-100\mu\text{m})$.

M. Koratzinos suggests that to attach the LumiCal to the support structure by its top-bottom sides. **S. Lauciani** and **M. Dam** (which also comments that this will avoid moving further the LumiCal toward the IP) agree that in principle it could be done, but detailed description of the LumiCal support itself is necessary.

S. Lauciani suggests that LumiCal should be made in two halves to be assembled around the beam pipe. **F. Palla** comments that figuring out how to assemble the various elements in the structure will be challenging.

M. Dam asks who supports the support. **S. Lauciani** answers that it is supported by the main detector. **M. Dam** comments that he is not sure if the beam pipe can be fixed to the detector or should be left floating, which could allow reducing the thickness of the central pipe. **M. Koratzinos** suggests that the pipe should be more loosely coupled to the detector. **F. Palla** comments that the LumiCal is the heaviest element inside the structure.

M. Dam asks if the IDEA Drift Chamber could be used to support the structure. **L. Pellegrino** answers that this is currently under study, and feedback from the detector will be useful. **M. Dam** and **P. Janot** propose to extend the pipe until reaching something to attach it to. **S. Lauciani** comments that as this depends on the detector(s) design, it will be necessary to have constraints from the two current concepts in order to progress on the design of the support structure.

3. Vertex Detector study for its integration in the IR – F. Palla

The technical drawings for the integration of the IDEA Vertex Detector Barrel, together with the chip ladder layout is presented.

M. Dam comments that 150mrad is as far as the LumiCal extends, but the active area is considerably small and there is no problem outshadowing down to ~110mrad or something. **F. Palla** comments that like this another chip could be added.

P. Janot asks how it compares in terms of radiation length w.r.t. ALICE. **F. Palla** answers that this will be addressed in the next meeting.

4. Considerations about the IR supporting tube structure for the alignment system needs – L. Watrelot

The support structure could be useful to provide stability and support for the alignment system, and also pre-alignment for the LumiCal. But it will be important not to increase the shadowing.

M. Dam comments on the importance of having the LumiCal mounted perpendicular to the outgoing beam and knowing the distance between them.

S. Lauciani comments that between the two LumiCals there could be material to prevent optical alignment. **F. Palla** adds that already endcaps can prevent this optical connection, and suggests to study a setup using the displacement of the outer cylinder.

F. Palla asks how the temperature modification of the air refraction index can affect this measurement in terms of precision, and if it could be possible to use some wavelengths which are transparent to Si but still detectable.

L. Pellegrino comments that it is important to add all the needed elements in the IR in order to have a more realistic description in terms of temperature, weights, supports, optical paths, etc.

5. Detector Beam Background studies & material budget for the beam pipe – A. Ciarma

First results for the tracking of the beam losses particles in the MDI area and of the SR photons in the CLD detector with VXD modified for the 10mm radius beam pipe have been presented. From the comparison in terms of material budget only, the baseline design for the trapezoidal section of the beam pipe and the design proposed by M. Koratzinos are comparable.

A. Lechner comments that the power deposition density on the FFQs would be a more relevant information than the total power deposition.

6. Proposal of fully cooled trapezoidal beam pipe – M. Koratzinos

M. Dam asks how the water flows in and out this system. **M. Koratzinos** answers that it uses two intertwined spirals to have the inlet and outlet on the same side.

M. Dam comments that while copper is outside the LumiCal acceptance, it could give rise to secondaries scattering inside. The effect of such particles should be checked by dedicated studies on the event reconstruction on the LumiCal.

F. Franesini and **S. Lauciani** ask the manufacturing process which is planned to be used (e.g. deformation due to welding the spiral), vacuum resistance and maintenance. **M. Koratzinos** suggest to spot-weld the spiral on the inner sleeve and then apply the outer sleeve. **S. Lauciani** comments that spot-welding can induce deformations, and also having the weldings hidden does not allow inspection/maintenance (which is an important request). **M. Koratzinos** also adds that this design has been already proposed for the beam pipe section 2~6m from the IP (below the FFQs), so if it does not work here, it does not work anywhere. **M. Koratzinos** proposes to realize a prototype and do some tests, also because a prototype for the 2-6m beam pipe is also necessary. **L. Pellegrino** comments that this

(in principle simple) design looks difficult in terms of feasibility. Comparison with the central pipe design is not easy due to the great difference in length, which brings several technical difficulties.

Action items:

- Get constraints from the two detector concepts on where the support structure could be attached to
- Study the entity of the secondaries produced on the copper cooling and their effect on the LumiCal efficiency

Participants

M. Boscolo, A. Ciarma, A. Ilg, F. Palla, A. Blondel, A. Novokhatski, Z. El Bitar, M. Dam, L. Watrelot, B. Humman, E. Montbarbon, K. Oide, F. Franesini, F. Grancagnolo, G. Wilkinson, L. Pellegrino, S. Grabon, E. Perez, D. Contardo, G. Bernardi, B. Francois, L. Brunetti, P. Janot, S. Lauciani, F. Sefkow, F. Bosi, F. Zimmerman, I. Dawson, P. Raimondi, P. Azzi, M. Koratzinos, A. Lechner, F. Poirier, D. Bortoletto

Minutes prepared by A. Ciarma
Next meeting will be replaced by the MDI Working Meeting on 17-28/10/2022