

Accelerator Design meeting

Monday 18/09/2023, 16:00 – 17:30

(<https://indico.cern.ch/event/1323075/>)

Chair: Daniel Schulte

Speakers: Daniel Schulte, Natalia Milas, Chris Rogers, Alexej Grudiev and Donatella Lucchesi

Participants (zoom): 38
Akira Yamamoto, Alexej Grudiev, Andris Ratkus, Antoine Chancé, Anton Lechner, Avni Aksoy, Bernd Stechauner, Chris Rogers, Christian Carli, Claudia Ahdida, Daniel Schulte, Daniele Calzolari, Daniele Sertore, David Amorim, David Neuffer, Donatella Lucchesi, Erik Kvikne, Elias Métral, Fabian Batsch, Francisco Javier Saura Esteban, Fulvio Boattini, Ivan Karpov, Jerzy Manczak, Jose Antonio Ferreira Somoza, Jurj Paul Bogdan, Kyriacos Skoufaris, Leonard Thiele, Mark Palmer, Massimo Casarsa, Natalia Milas, Paula Desire Valdor, Roberto Losito, Roger Ruber, Rui Franqueira Ximenes, Ruihu Zhu, Scott Berg, Simone Gilardoni, Vitaliy Goryashko.

MEETING ACTIONS: NO PARTICULAR ACTION (TO BE CONTINUED)

1. NEWS (DANIEL SCHULTE)

- Back after some long vacation (last meeting was on 05/06/23). Priority is now on the parameters: today and next week.
- The 2nd MuCol Governing Board meeting took place last Friday, where in particular the rules for the PSC (Publication and Speakers Committee) were discussed and they will be sent around soon.

2. PARAMETERS: PROTONS (NATALIA MILAS)

- Natalia reminded the 2 WP3 tasks they are working on: 3.2 on high power linac and 3.3 on compressor ring design
- For the Linac, 2 scenarios envisaged
 - o What is possible now and identify R&D
 - o What is possible in 20 years
 - o Final energy is 5 GeV (SPL based)
 - o Emittance quoted on slide 4 is for the transverse plane (despite the L in index) and it is the geometrical one
- 2 rings needed: accumulator one and compressor one
- Natalia showed in particular the tables which she put in the Overleaf Document.
- ChristianC mentioned that it would be good to indicate the RF voltage needed to do the rotation in the compressor ring
- ScottB asked how we get to the 10 GeV. Natalia answered that someone is looking into it.
- ScottB added also that the transverse emittance value should be discussed also with the Target people.

3. PARAMETERS: MUON PRODUCTION AND COOLING (CHRIS ROGERS)

- Chris reminded that WP4 covers from target region till final cooling, including some elements of cooling Demonstrator, and that not all the aspects are discussed and that it is only a snapshot as the optimisation/lattice design is ongoing
- Chris showed the tables which he put in the Overleaf Document with some pictures as well
- Conclusions
 - o Current parameters documented
 - ⇒ Target geometry
 - ⇒ Rectilinear cooling
 - ⇒ Final cooling
 - ⇒ All a work in progress
 - Target/beam dump under investigation
 - Longitudinal/RF needs more development

- o Some work still needed
 - ⇒ More detail on magnet parameters in “updated” lattices
 - ⇒ This is a snapshot - optimisations are still ongoing
- o Seek to store lattices somewhere
 - ⇒ Prepared <https://github.com/orgs/MuonCollider-WG4>
 - Should be writeable by anyone, given suitable permissions
 - ⇒ Tag a release somewhere
 - ⇒ A lab-supported git repo would be better
- Daniel said that Natalia mentioned also 4 MW and therefore it would be good to specify other possibilities than graphite (which should not work) are studied. Rui mentioned that some simulations were indeed also performed with liquid targets.
- For the radial build, inner radius of 60 cm for the coil was assumed.
- Updated table is the one to be used for RF in the future, following the question from AlexejG.
- AlexejG asked some info about the Beryllium window and the length of the cavity but Chris said that they need to revisit this as there are issues with the length with the code.
- ChristianC asked about the pieces not included in this document: what are the plans for the parameters not included? For instance for longitudinal capture system. Chris said that David Neuffer worked on it and we could re-use this? However, for the charge separation, it is harder as nobody is working on this... For the moment, we could just add: from MAP studies as there were no studies yet within IMCC.
- DanielS said that we need to make some assumptions: which efficiency? How do the parameters change? Etc.
- ScottB mentioned that putting MAP and IMCC parameters into a document like this does not seem to be the best thing to do (AlexejG agreed) => ChrisR answered that they need to interact with RF, magnets, protons etc. so these low-level technical things are very important and we do need to list them. Furthermore, when new results have been obtained by IMCC it is fair to cite them but as it is not a complete list, for what was not simulated yet we still need to refer to the MAP parameters.

4. PARAMETERS: RF (ALEXEJ GRUDIEV)

- Slide 2 is a nice overview of what is used in the different stages
- Summary
 - o Although it is not a MUST, it makes sense to keep the close RF frequency in the proton driver, muon cooling and muon linacs the same

- o On a short timescale, availability of the RF power sources at 704 MHz drives the frequency choice for the RF test stand and possibly the first muon cooling cell cavity prototypes
- o Proton driver design is based on the SPL, ESS and used 352 and 704 MHz. No major redesign work seems to be necessary in the linac. It makes sense to keep these frequencies
- o On the other hand, muon cooling complex and muon linacs will be redesigned in any case, so it can be done at the different frequency compared to MAP design
- Alexej showed the table of parameters of the Overleaf Document in the last slide (#8)
- ScottB mentioned that it could be good to show the 2 frequencies which are used for RCS, where the frequency choice is driven by beam dynamics
- AntoineC mentioned that it would be good also to add in the table when the warm or SC technology is used

5. PARAMETERS: PHYSICS AND DETECTORS (DONATELLA LUCCHESI)

- Donatella showed what they wrote in the Overleaf Document, asking for comment about the level of details, etc.
- Reminder about the detector, from inside to the outside
 - o Tracking system
 - o Electromagnetic calorimeter (ECAL)
 - o Hadronic calorimeter (HCAL)
 - o A superconducting solenoid
 - o An iron joke instrumented with a resistive plate chamber for the muons detection
- She did not discuss the beam pipe and the nozzle.
- I made the comment that they need now to fill the summary tables, which will be used by the other chapters (if needed)
- DanielS asked about the performance, which is a needed ingredient. What about energy resolution? etc. Donatella said that for 3 TeV it is almost the same as CLIC => To be indicated. For the 10 TeV, they are preparing a presentation for October 5th.
- Donatella added that there is a point which is mentioned nowhere: how will we measure the luminosity? => Bhabha scattering at large angle could be a possibility but they would like also something at small angle.
- What about radiation? Would be good to mention also few numbers

6. AOB (EVERYBODY)

- Next meeting will take place next Monday 25/09/23 (see <https://indico.cern.ch/event/1323076/>)

Reported by E. Métral and D. Schulte