

## MuCol WP 6.1 Meeting Notes (9th meeting) – 10/06/2024, <https://indico.cern.ch/event/1383957/>, via Zoom

### Participants:

CERN: Alexej Grudiev, Leonard Thiele, Fabian Batsch, David Amorin, Simon Albright, Erik Kvikne, Bernd Stechauner

University of Strathclyde: Liang Zhang, Robert Kyle

University of Rostock: Ursula van Rienen, Simon Adrian, Sosoho-Abasi Udongwo

STFC: Chris Rogers

### Presentation by Fabian Batsch

Title: Updates on counter-rotating muon beams in the high-energy acceleration chain

#### Outline:

- General aspects of counterrotating bunches
- Simulations with FM wakefields from counter-rotation
- Cavity voltage modulations (more in L. Thiele's presentation)
- Changes in momentum compaction factor

#### Summary:

- Induced voltage of the counter-rotating beams build-up due to their relative phase offset of  $0$  ( $2n\pi$ )
- Careful placement/alignment of cavities required, as done for LEP
- Providing larger RF voltages seems to allow for beam-loading compensation
- Modulation of the cavity voltage from the CR bunch under study
- Changes in the momentum compaction factor might have large consequences on the longitudinal and transverse design and will be the topic of a dedicated meeting at the end of June

#### Remarks:

- Ursula van Rienen: Why is there such a big difference in momentum compaction factor?
  - o Probably because the first value was estimated. Now, it is calculated, but the optimisation objectives are not known for sure. To be discussed with Antoine
- Alexej Grudiev: Question on counter-rotating bunches. You have 32 RF stations ring, with different distances between bunches. Was it taken into account?
  - o Yes, it was considered.
- Alexej Grudiev: Picture of alternating voltage intended to see how RF station is combined.
  - o In BlonD, bunches meet in the middle of the arc (assumption), which is calculated time before the other bunch passes. Induced voltage affects the beam implemented in BlonD.
- Simon Albright: Question on plot beam load comparison. Do the simulation results match that from Leonard when the set point voltage is taken to include beam loading?
  - o Not yet checked. The scenario might be different.

## Presentation by Leonard Thiele

Title: Transient beam loading in RCS chain

### *Outline:*

- Introduction to beam loading in RF cavities
- Transient beam loading in the muon collider
- Simulation of cavity voltage and phase during acceleration
- Changed RF power requirements

### *Summary:*

- Usage of non-optimal cavity detuning leads to higher power consumption.
- The phase at which the beam sees the correct voltage changes during the acceleration.
- The transient beam loading simulation shows that the cavity voltage reaches its equilibrium above the current baseline of 30 MV/m.
  - This indicates, that a higher surface field would be present during the acceleration.
  - Try to adjust RCS parameters in order to change the equilibrium voltage.

### *Remarks:*

- Ursula van Rienen: How is the phase calculated?
  - Formula from Ivan Karpov (page 7)
- Alexej Grudiev: It is not obvious what the nominal voltage is in Pg 7. Perhaps it is a question of definition. If the bunch is injected at nominal voltage and phase, there should be no transients.

### Round table discussions & AOB:

- Next meeting 29.07.2024