





RCS chain parameters discussion

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Inputs for transverse impedance/stability simulation in RCS and Collider

- Impedance/Wake simulations
 - Vacuum chamber geometry, material and length? (See slide on current assumptions)
 - Average beta function (and/or transverse tune)?
 - First RF cavities number and properties (Shunt impedance, quality factor, frequency)?
 - Effect of eddy currents in the beam pipe?
- Stability simulations
 - Transverse and longitudinal beam emittances in RCS chain : ~25 um rad (transverse) / 7 mm rad (longitudinal)? (from https://muoncollider.web.cern.ch/design/general-parameters)
 - Number and position of RF stations, energy gain per RF station?
 - Collider: RF and beam parameters (RF voltage, harmonic, tune...)?
 - Longitudinal/transverse stability cross-effects?



Investigations for next meeting

- PyHEADTAIL/Xsuite/BLOND longitudinal and transverse tracking with multiple RF stations
- Parameters for the Collider ring





Additional content

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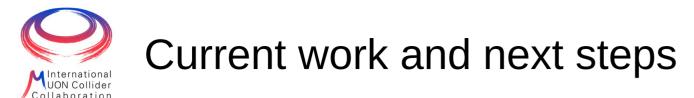
Key inputs for RCS chain transverse impedance/stability

- Beam chamber geometry, size, and materials
- RF cavities properties (shunt impedance, quality factor, main frequency), number of cavities
 - Not yet included in impedance model
- Twiss beta values
 - Can use average beta function approximation for now
- Beam parameters (number of bunches, intensity, emittances...)



Current assumptions for impedance/stability

- Vacuum chamber
 - circular 30mm radius, copper at room temperature (300K, RRR=70, B=7T \rightarrow rho=18 n Ω m)
 - infinite thickness
 - 5990m (complete ring length)
- Average beta = 50m in x and y
- Beam parameters (transverse and longitudinal) \rightarrow from Fabian's parameters table
 - Single bunch, intensity 2.0e12 p.p.b
 - Momentum compaction factor : 2.4e-3
 - Synchrotron tune Qs=1.5/0.5/0.5 (at injection in RCS-LE/ME/HE)



- Transverse (and longitudinal) resistive wall impedance and wakefield with PyWIT and ImpedanceWake2D
 - PyWIT: toolbox to easily construct impedance and wake models
 - ImpedanceWake2D : for circular or flat axisymetric structures, uses field matching technique
- Transverse stability simulations with PyHEADTAIL
 - In RCS: Large energy change per turn → longitudinal stability issue if the RF cavities are lumped in one element (see IK and HD presentations at https://indico.cern.ch/event/1049297/)
 - Should be possible in PyHEADTAIL to split the RF systems in several substations (join separate Drift and Kick elements to form the longitudinal map)