A bucked-coil cooling lattice for a Neutrino Factory front-end

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Front-End Phone Meeting

Outline

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- G4BL simulations
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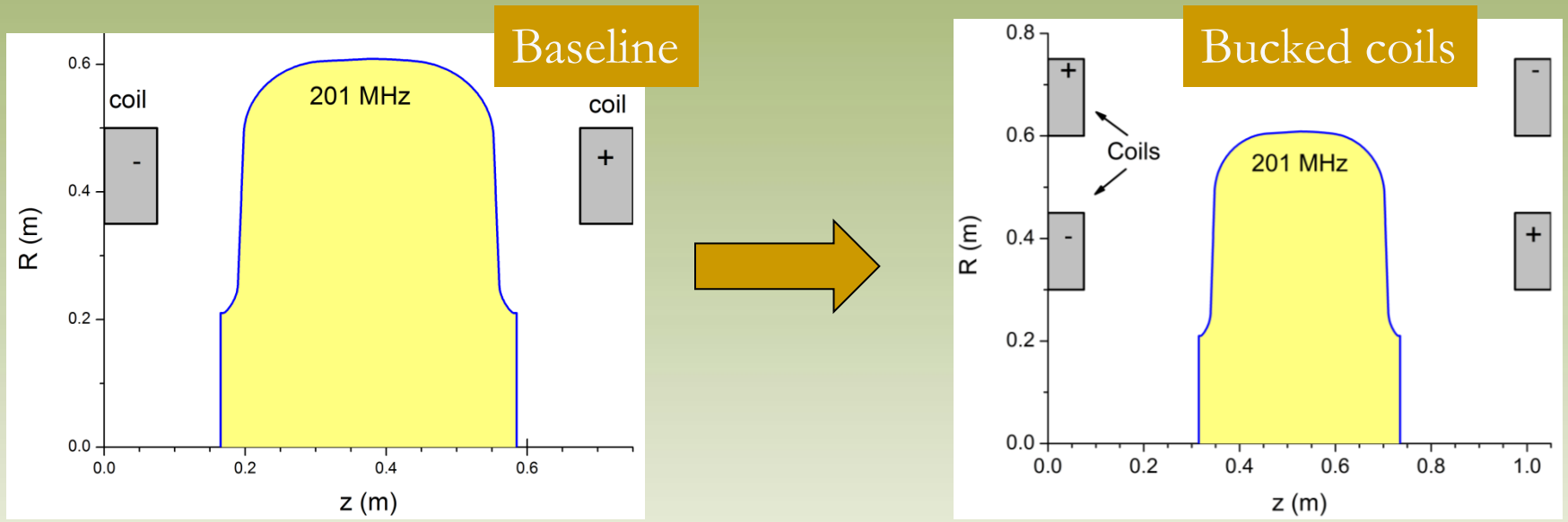
Motivation

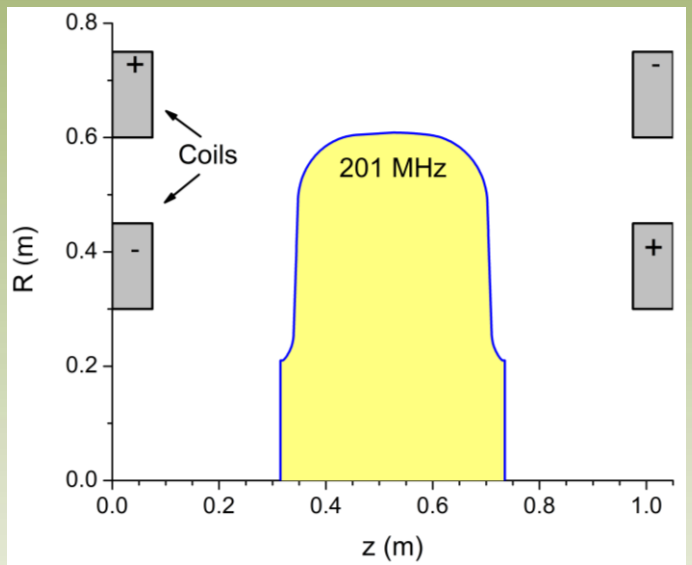
- The existing cooling scheme for the Neutrino Factory (NF) front-end (FE) requires rf cavities to operate within 2-3 T magnetic fields.
- Experiments suggest that rf cavities may experience problems when they operate in such high fields.
- This study examines a cooling channel based on bucked coils that reduces substantially the B-field inside the cavity

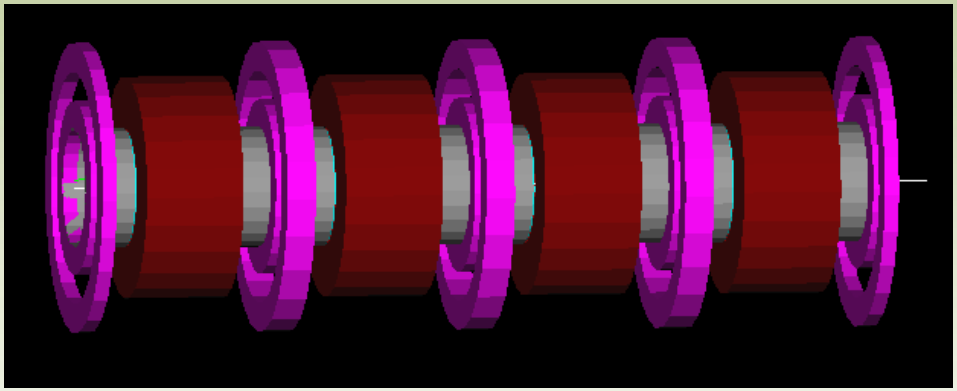
Bucked Coils Cooling Scheme (1)

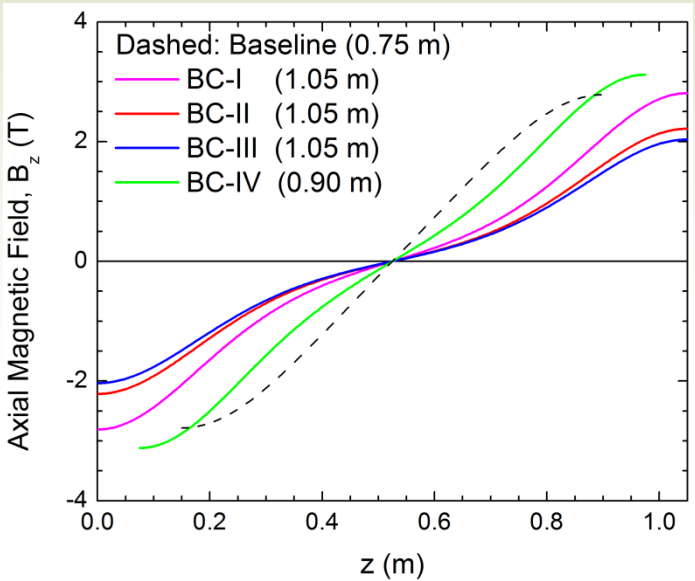


Lattice ID	Inner Coil (A/mm^2)	Outer Coil (A/mm^2)	Period (m)
Baseline	105.65		0.75
BC-I	120.0	90.24	1.05
BC-II	97.20	77.14	1.05
BC-III	87.48	66.72	1.05
BC-IV	132.0	99.26	0.9

Bucked Coils Cooling Scheme (2)



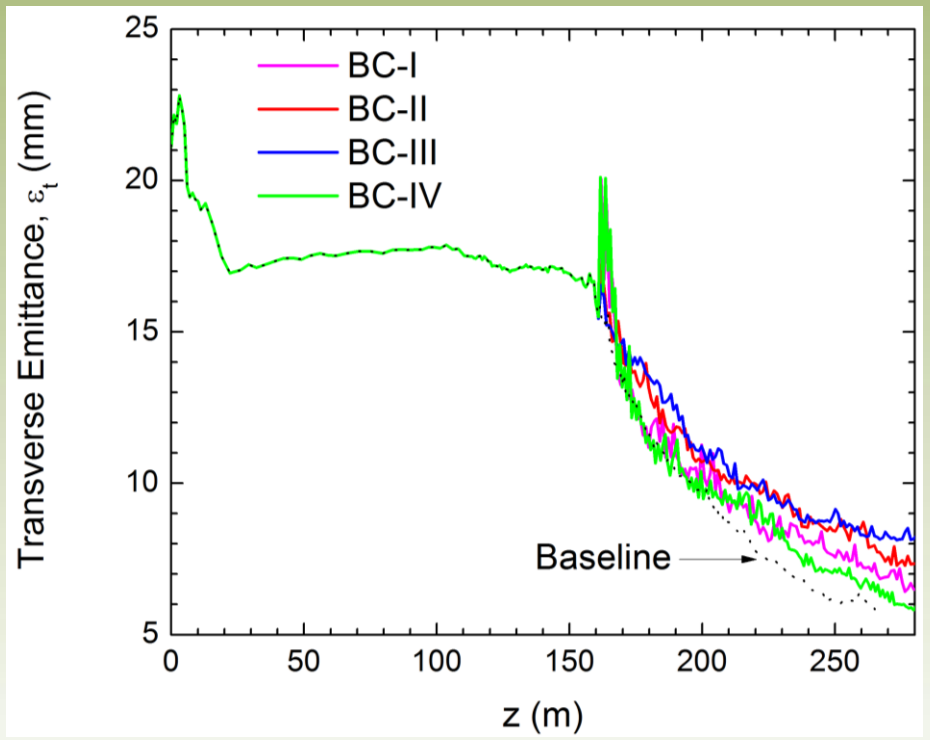


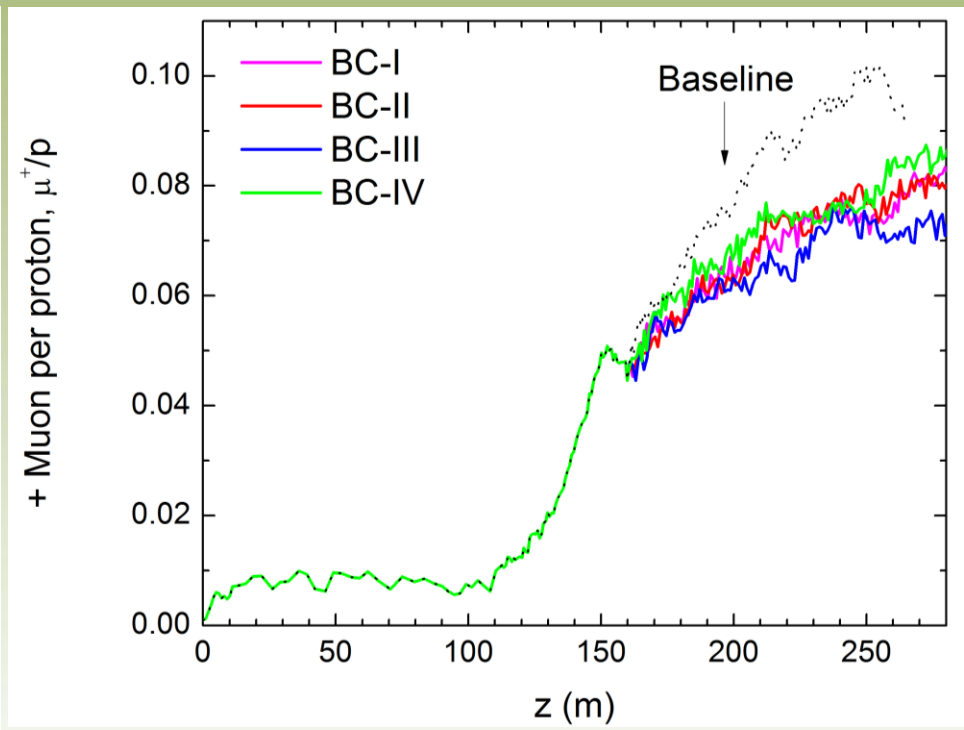


Simulation Details

- The capture, buncher and rotator sections are left as the baseline.
- Bucked coils are only implemented in the cooler
- I used ICOOL v. 3.28 and G4BL v. 2.10
- 5000 particles
- I run simulations once. Work is preliminary!

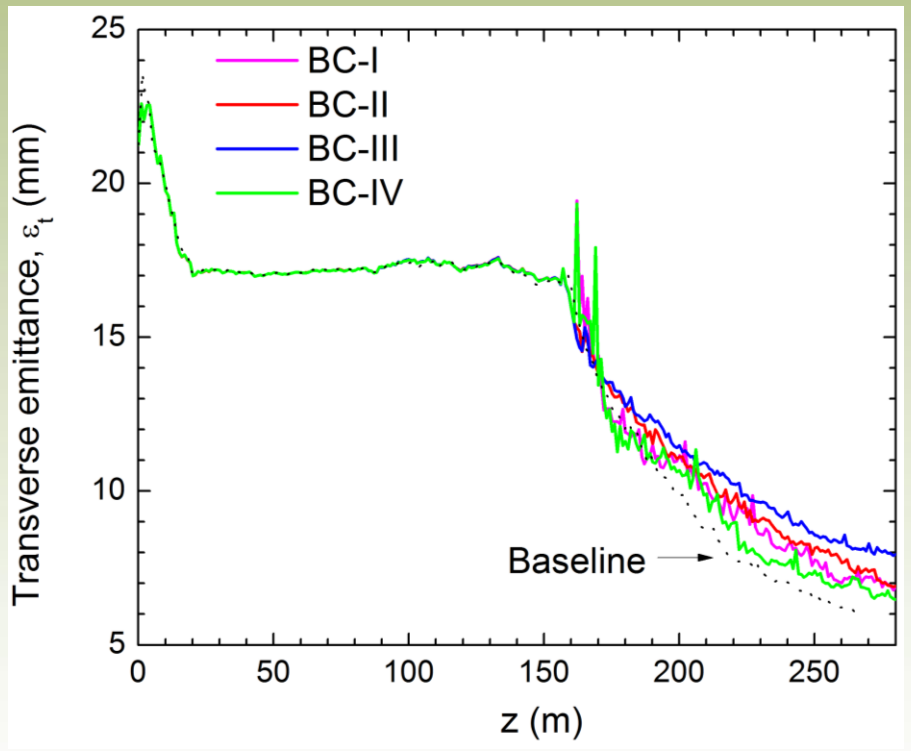
Simulation Results (ICOOL)

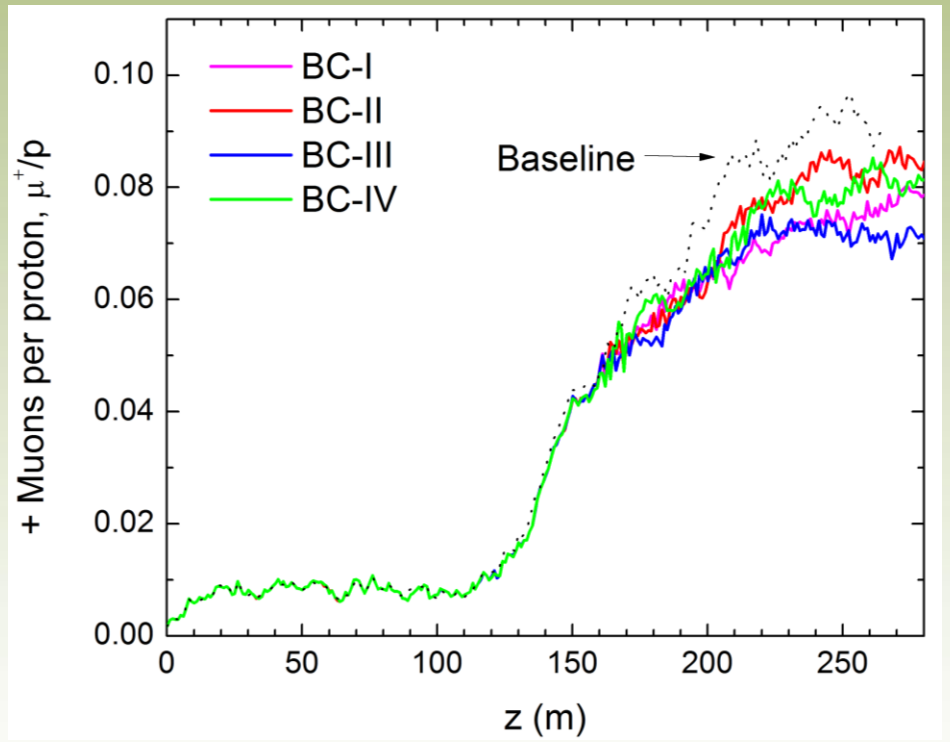




- The μ/p rate within acceptance A_T < 30 mm, A_L< 150 mm and cut in momentum 100<Pz<300 MeV

Simulation Results (G4BL)





Next Steps/ Summary

- Preliminary ICOOL and G4BL results suggest that the scheme with bucked coils does not achieve the same performance as the existing baseline
- BC-IV has the best performance but it is also the one with the strongest field inside the rf
- There is room for optimizations:
  - Better matching between rotator and cooler
  - Optimize width of the absorber
  - Vary lattice period and magnet settings
- Once again this work is preliminary. More results will be presented at the IDS Workshop in Glasgow.