Front-end channel for a Neutrino Factory

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Front-End Phone Meeting

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Outline

- Define "front-end" baseline parameters

- Simulate & benchmark the concept:

  - G4Beamline and ICOOL

  - Sensitivity to different cooling models

- Discuss modifications needed for a realistic "front-end"

  - Engineering constrains

  - Effects on performance

- Conclusion

Note: This work is not complete. More details at the IDS-NF

Baseline Parameters
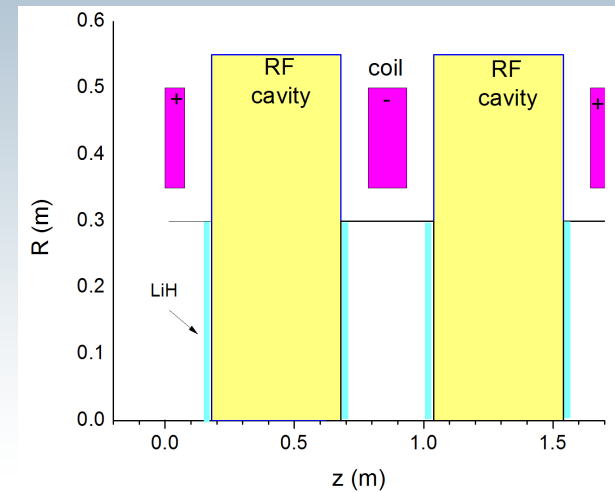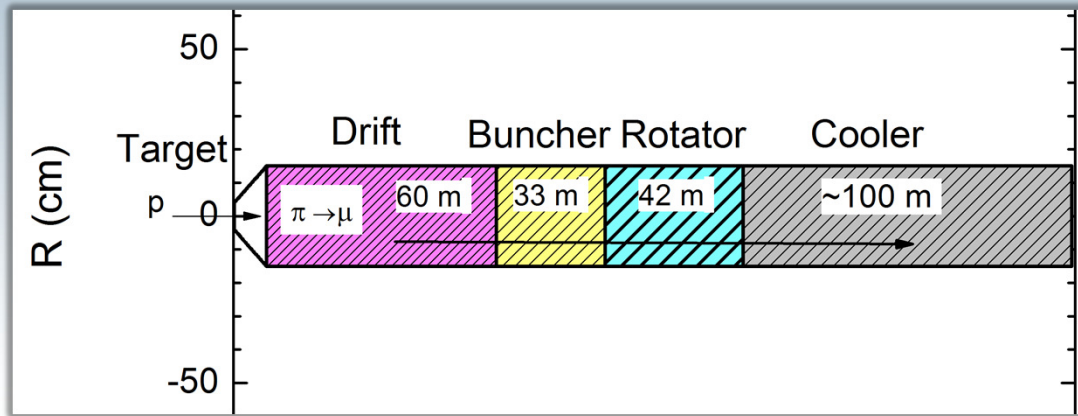
|	Length [m]	Number of cavities	Frequencies [MHz]	Number of frequencies	Peak gradient [MV/m]
Capture	18.9				
Drift	60.7				
Buncher	33.0	33	319.6 to 233.6	13	3.4 to 9.7
Rotator	42.0	56	230.2 to 202.3	15	13
Cooler	>97.5	130	201.25	1	16
TOTAL	>252	219	319.6 to 201.25	29	

Simulation Issues (from Chris's page)

- Our simulation files consider two cavities (per cooler cell) which is contrary to our engineering studies

  - I created new input files that now have only one cavity

- No windows included in the cooler section

  - Now 100 micron windows were added in the cooler

  - Windows are added in both G4BL and ICOOL

- Other minor issues on G4BL/ICOOL decks are fixed:

  - Different thicknesses on Be windows on rotator

  - Incorrect densities for windows in G4BL

  - All those items are fixed now.

NF front-end Benchmarking (1)

- Simulation with ICOOL (3.28) and G4BL (2.12) [20K muons]

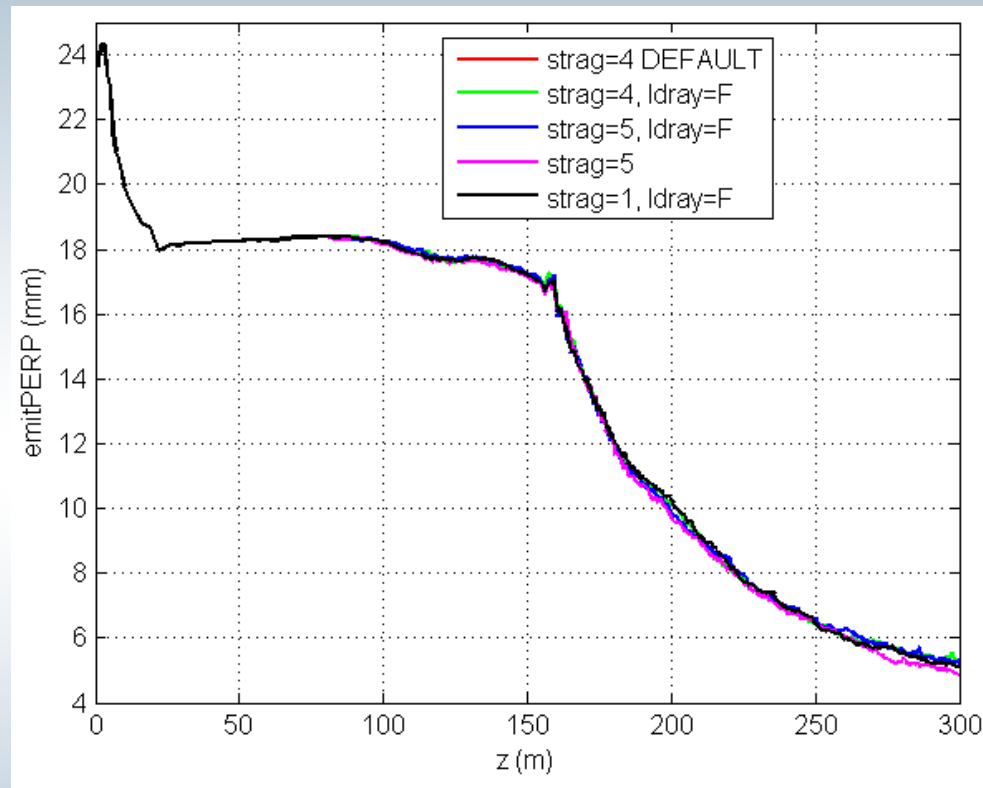- Be-windows included & single cavities in cooler
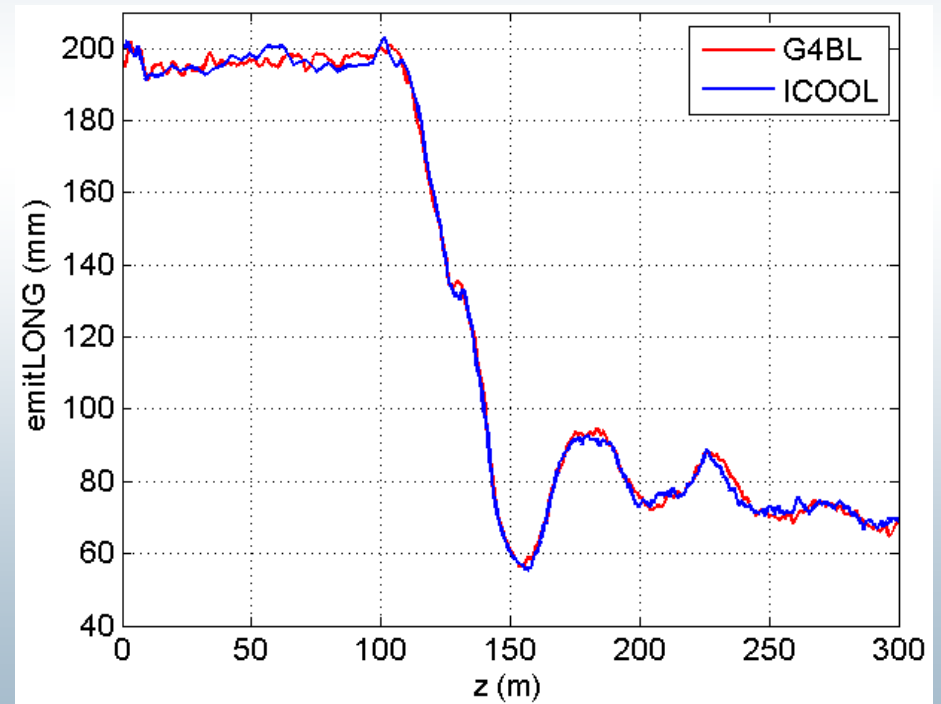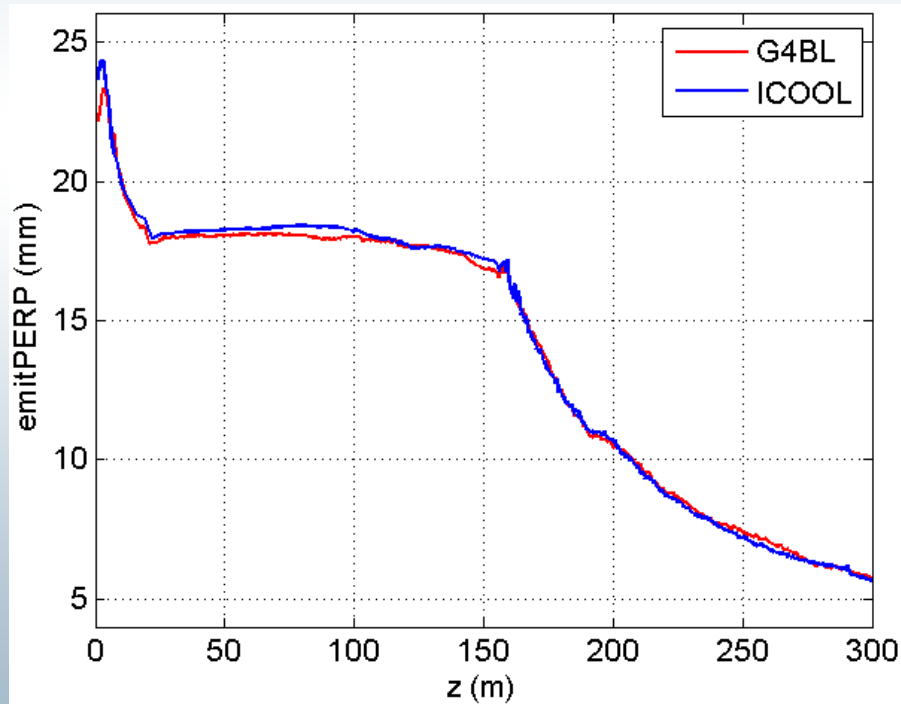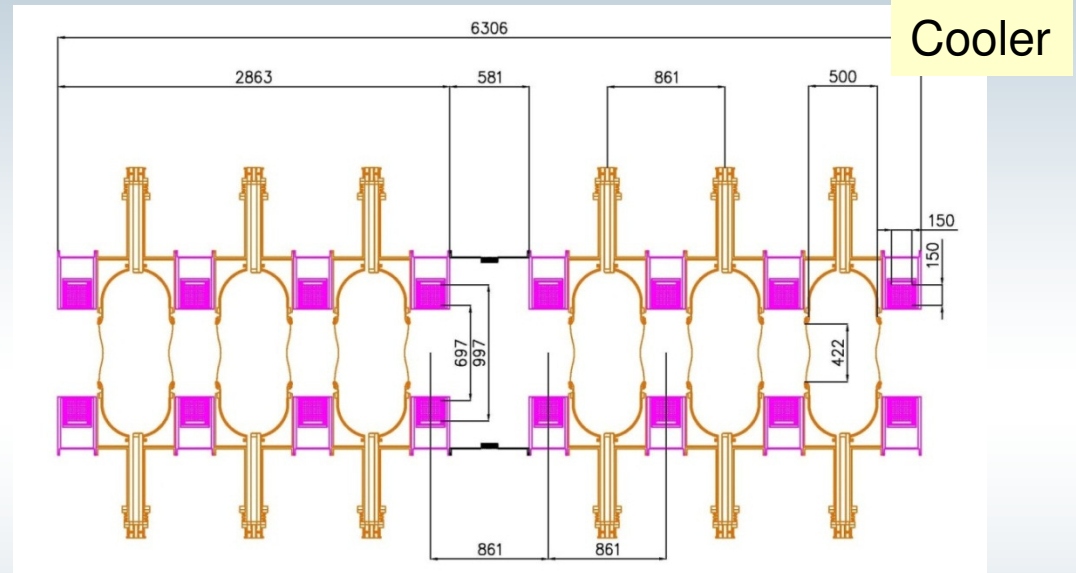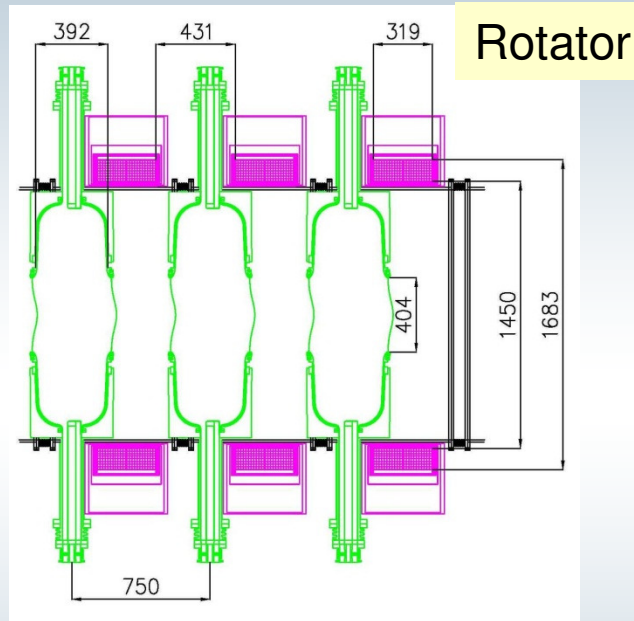
NF front-end Benchmarking (2)
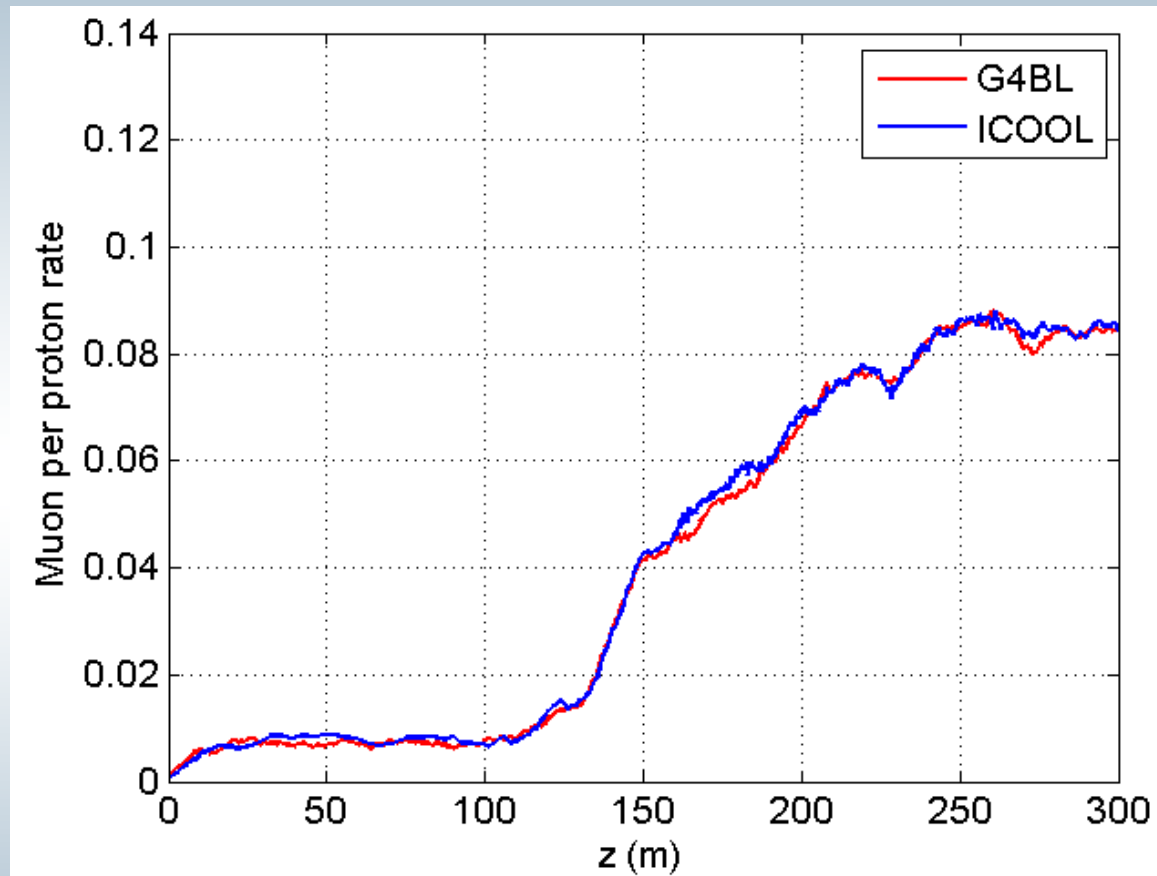
- The μ/p rate is within A_T < 30 mm, A_L < 150 mm and cut in momentum 100<Pz<300 MeV/c

Sensitivity to Straggling Models

- Results do not appear sensitive to different straggling models
- Bob Palmer has derived a similar conclusion for a "Guggenheim" lattice
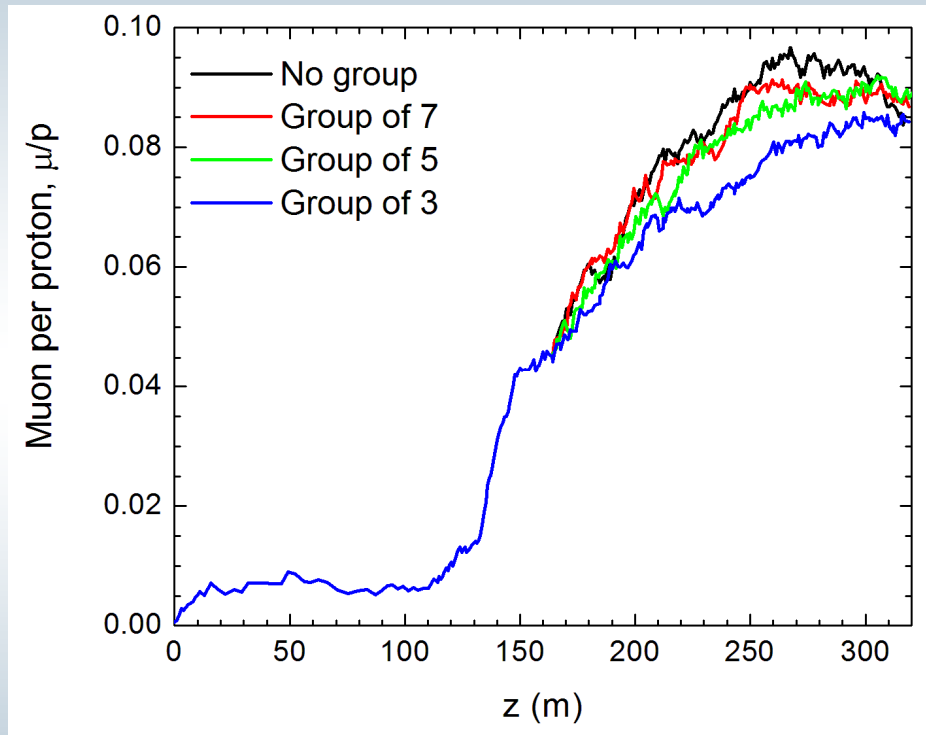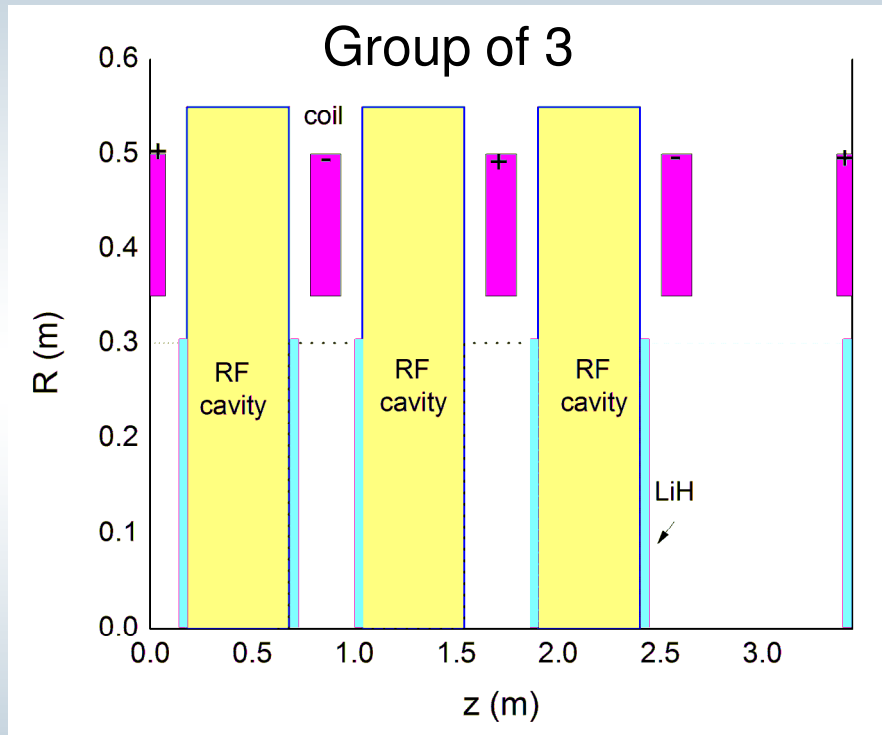
Engineering challenges

Rotator

Cooler

N. Bliss, IDS-NF Meeting (April, 2012)

- Recent engineering studies suggest to:

  - Increase the gap between coils in buncher & rotator

  - Increase cooler cell length from 0.75 m to 0.86 m

  - Have one "empty" cell after a series of cavities
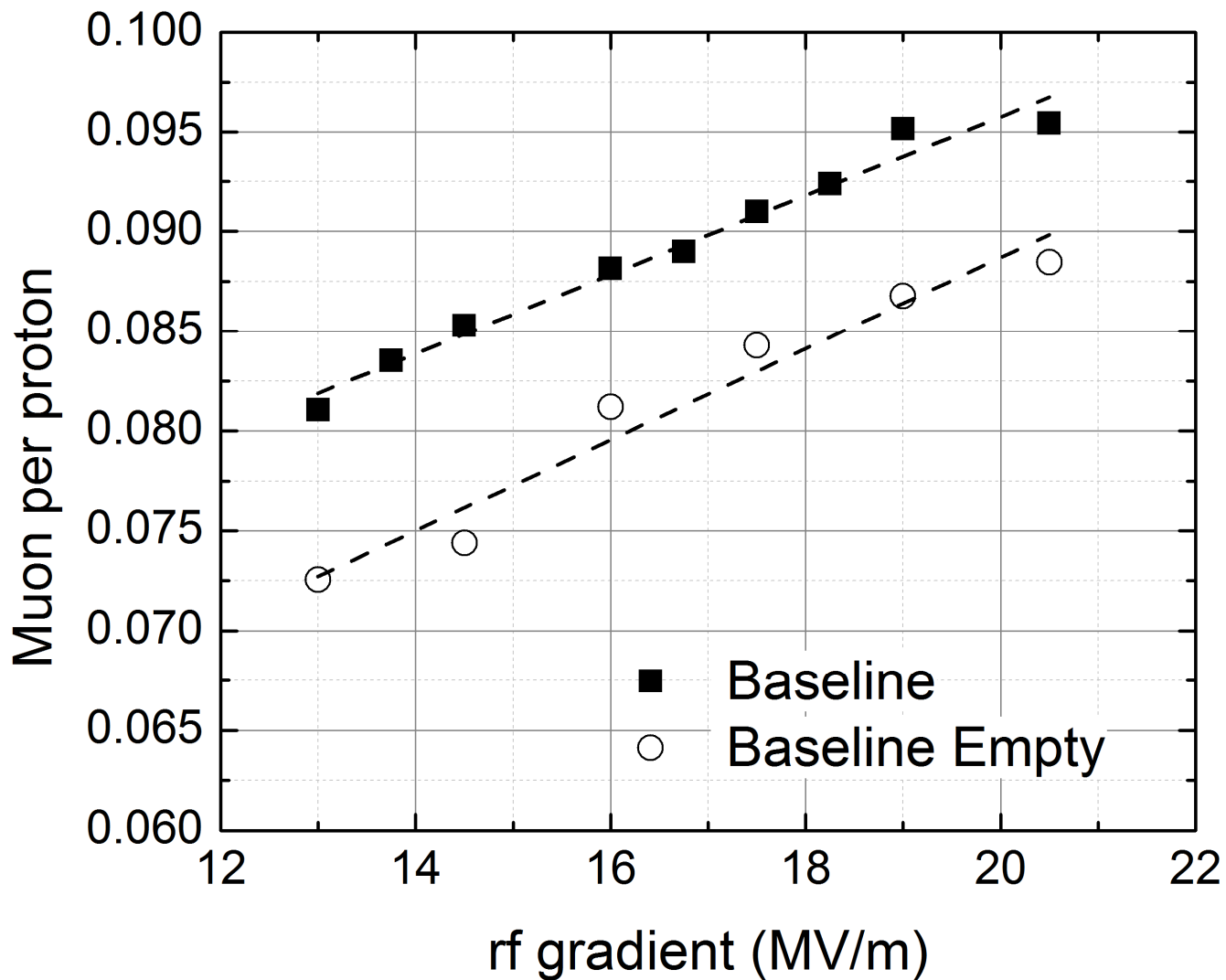
New cooler for Baseline (empty cell)

- There is a loss of <10 % if empty cell is after 5 cavities

- <u>Conclusion</u>: Keep a group of five cavities

Simulation Results (1)
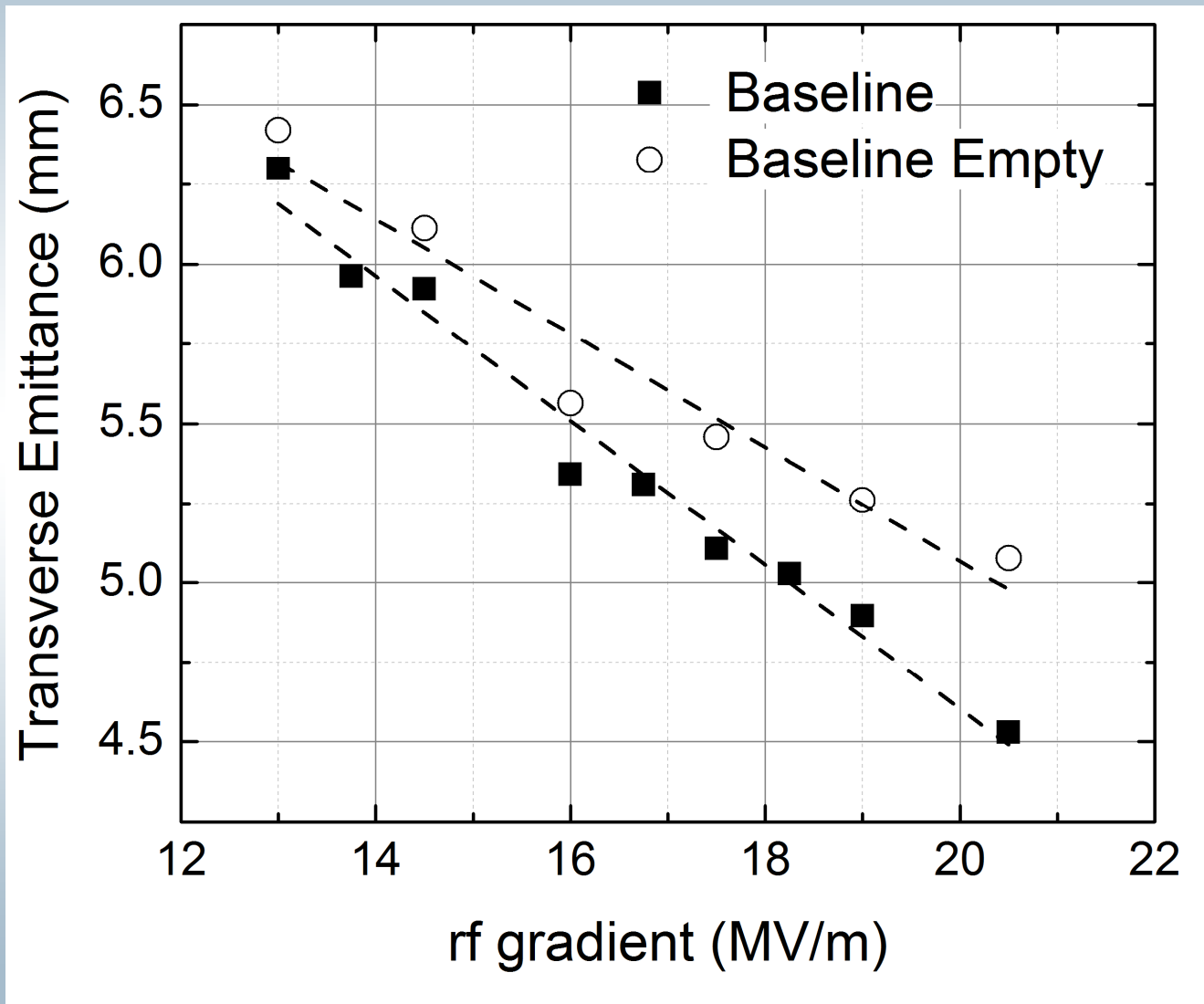
Simulation Results (2)

Summary & Outlook

- Defined parameters for the baseline

- Benchmarked the concept with G4BL & ICOOL

- Results appear not sensitive to different straggling models

- For the baseline:

  - It is also safe to increase the cooler cell length up to 0.86 m

  - It is better if the gap is placed every 5 instead of 3

  - Performance goes down by 7-10%

- Next, I like to determine # of cavities and lattice length required with empty cell configuration

- Compare performance with Bucked Coils schemes