Defining a new baseline for beam cooling for a muon accelerator front-end

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Outline

- Review existing baseline with:
  - Engineer requirements for buncher & rotator
  - Engineer requirements for cooler

- Compare this baseline with a bucked coiled front-end with:
  - Bucked coils on rotator
  - Bucked coils on cooler (schemes with longitudinal bucked coils and radial bucked coils)

- New: After optimizations the bucked coil scheme underperform only 13% instead of 20% (reported 15 days ago).
Simulations suggest that it is safe to increase the gap up to g=0.50 m without loss of performance or presence of stop bands.

**Conclusion**: Keep g=0.431 m (see engineers report)
New cooler for Baseline (empty cell)

- There is a loss of ~5% if empty cell is after 5 cavities
- **Conclusion**: Keep a group of five cavities
There is a loss of ~3-5% when adding bucked coils on phase rotator. Not a big problem!
Bucked Coils for cooler: Two schemes

Baseline

Radial BC (RBC)

Longitudinal BC (LBC)
• RBC performs better than LBC
• After optimization RBC gives 13% less muon per protons than baseline
• Cooling performance of BC schemes is comparable to baseline
Summary

For the baseline:

- It is safe to increase the gap between the coils in the buncher & rotator as desired by the engineering studies. ‘Safe’ means same good cooling and a high muon/p rate.
- 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 or 7 cavities instead of 3.
- Performance goes down by 5-7%.

Bucked Coils (BC) were applied in both rotator and cooler.
- Two schemes tested on cooler, but RBC looks better so far.
- With bucked coils and after optimization the losses are ~13% which looks more promising.