Bucked Coils Lattice

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Outline

• Aim
• Bucked Coils Configuration
• Bz
• Tracking results analysis: Bucked Coils vs FS2A
• Summary and Future Plans
Aim

Find a cooling lattice with lower Bz at position of RF’s and higher transmission than FS2A
Bz comparison to FS2A

**Bucked Coils:**
- Peak: 2.7 T
- Edge of RF: 1 T
- Peak/Edge = 2.7

**FS2A:**
- Peak: 2.8 T
- Edge of RF: 2.3 T
- Peak/Edge = 1.2

**Beta4D (mm) vs P (MeV/c):**
- Linear relation between Beta and P

**P resonance ~125 MeV/c**

**Pmean = 232 MeV/c**
Input beam specifications (same for FS2A and Bucked Coils):
• 1000 particles
• \( \langle P \rangle \) 232 MeV/c
• 10 mm Transverse Emittance
• 0.07 ns Longitudinal Emittance
Red: Bucked Coils, No Cuts
Blue: FS2A, No Cuts
Cuts

Applying P and R cuts on every plane:

• Any particles that don’t make the P cuts will not be taken into account on that specific plane but will still be taken into account further downstream.
  • P±20% or
  • P±100 MeV/c

• Any particles that don’t make the R cuts will not be taken into account on the specific plane or further downstream.
  • R<30 cm

Symbol in following plots: NU (Non Uniform cuts)

No cuts of R or P, but only track particles that made it to the end.
Symbol in following plots: 2E (To the End)

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Note that although both beams should start with same $<E> = 254.65$ (i.e. 232 MeV/c), there is a small difference at the energy start point between FS2A and Bucked. Also different start point at Emit4D and EmitLong. This is due to the Beta4D difference.
FS2A P distribution (No Cuts Applied)

\[ P(232) \pm 20\% = 185.6 < P < 278.4 \text{ MeV/c} \]
\[ P(232) \pm 100 \text{ MeV/c} = 132 < P < 332 \text{ MeV/c} \]
Bucked P distribution (No Cuts Applied)

\[ P(232) \pm 20\% = 185.6 < P < 278.4 \text{ MeV/c} \]
\[ P(232) \pm 100 \text{ MeV/c} = 132 < P < 332 \text{ MeV/c} \]

**Pinit**
- Entries: 1000
- Mean: 230.6
- RMS: 20.17

**Pmid**
- Entries: 790
- Mean: 248.7
- RMS: 24.14

**Pend**
- Entries: 695
- Mean: 247.2
- RMS: 26.84
R distribution for FS2A and Bucked (No Cuts Applied)

R<30 cm

FSA2 R distribution

Bucked R distribution

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P distribution Bucked/FS2A
Radius Distribution
4D Amplitude

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Conclusions

- Bucked Coils have lower Bz than FS2A at the position of RF’s
- Transmission is better
- Emittance 4D reduction:
  - 1.79 (or 1.93 depending on cut) for Bucked Coils, 2.32 for FS2A
- Unless only particles that made it to the end are taken into account for the tracking results, longitudinal emittance of Bucked Coils has peaks (they disappear when changing cuts): Peaks are due to particles that go to infinity increasing in this way the average emittance.
Future Plans

• Further work on Bucked Coils
• Currently running Simulation of a realistic Neutrino Factory beam. Compare results of Bucked Coils to FS2A
• Try to find a lattice with lower Bz at RF’s than Bucked Coils that gives good transmission
• Work on different lattice: Insert wedge absorbers and dipoles in FS2A or Bucked Coils configuration → Study 6D cooling

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