Update on Studies of Ionization Cooling Lattices

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Layout

- 3 versions of Bucked Coils, BC
- FSIIA vs BC:
  - Magnetic Field Comparison
  - Cooling Dynamics & Transmission
  - Summary & Future Plans

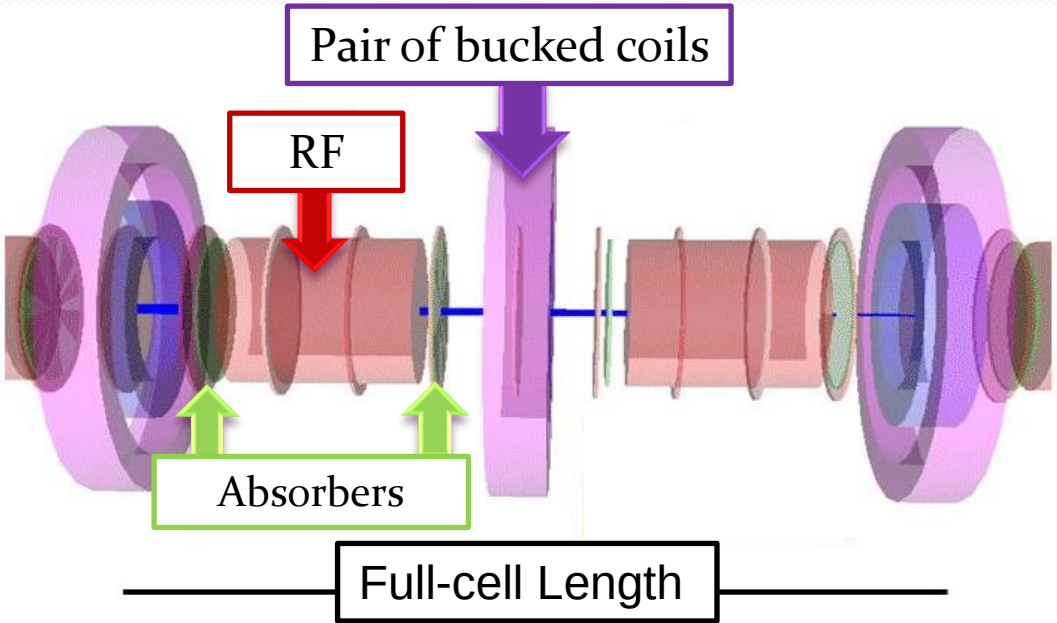
Bucked Coils, BC

Three different versions of BC were studied, BC-I, BC-II, BC-III. They **all have the SAME configuration except for**:

- the cell's length and
- the current densities of their coils

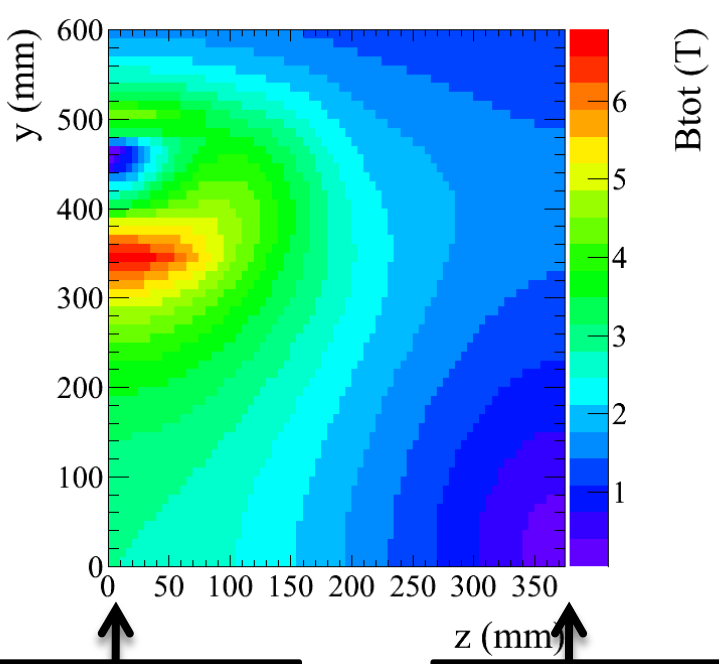
Differences of the BC versions

Lattice	BC-I	BC-II	BC-III
Full-cell Length (m)	2.10	1.80	1.80
Inner Coil Current Density (A/mm²)	90.24	128.10	99.26
Outer Coil Current Density (A/mm²)	120.00	112.80	132.00



Magnetic Field Comparison

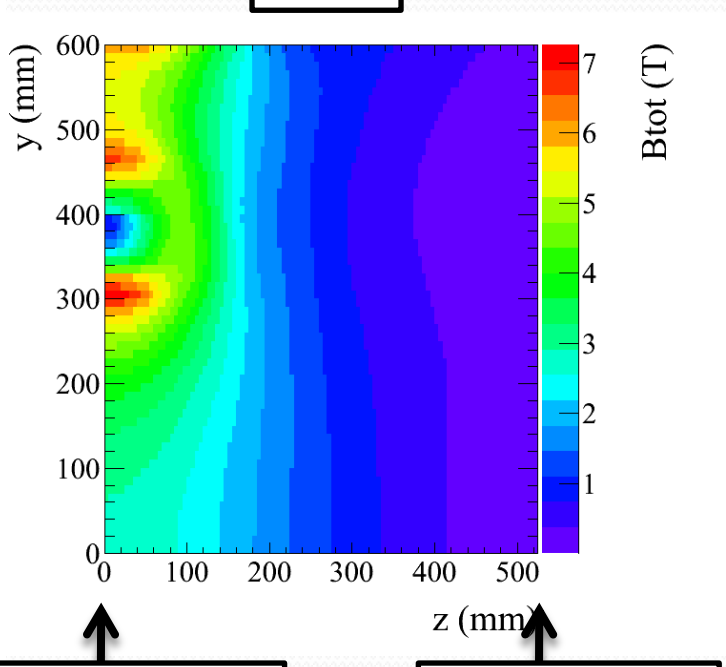
FSIIA



Centre of Coil

Centre of RF

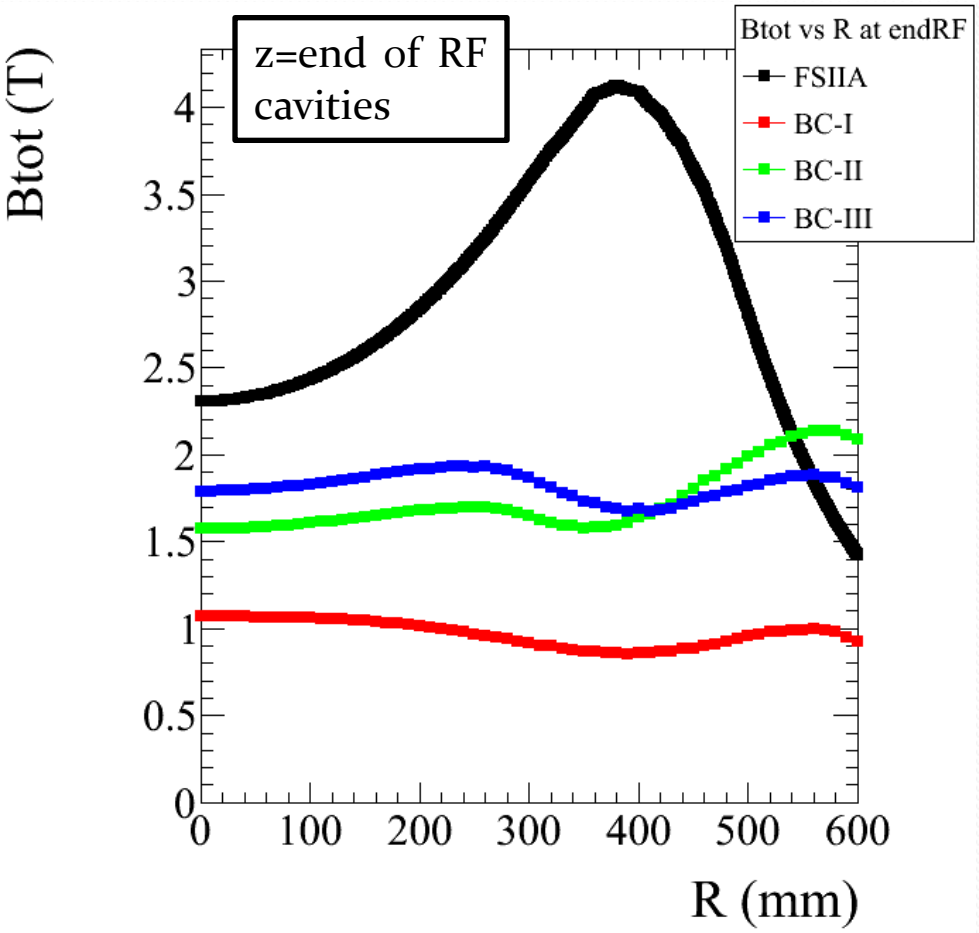
BC-I



Centre of Coil

Centre of RF

Magnetic Field Comparison



Black: FSIIA
Red: BC-I
Green: BC-II
Blue: BC-III

- **FSIIA: >4 T**
- **BC-I: 4 times lower than FSIIA**
- BC-II and BC-III: 2 times lower than FSIIA

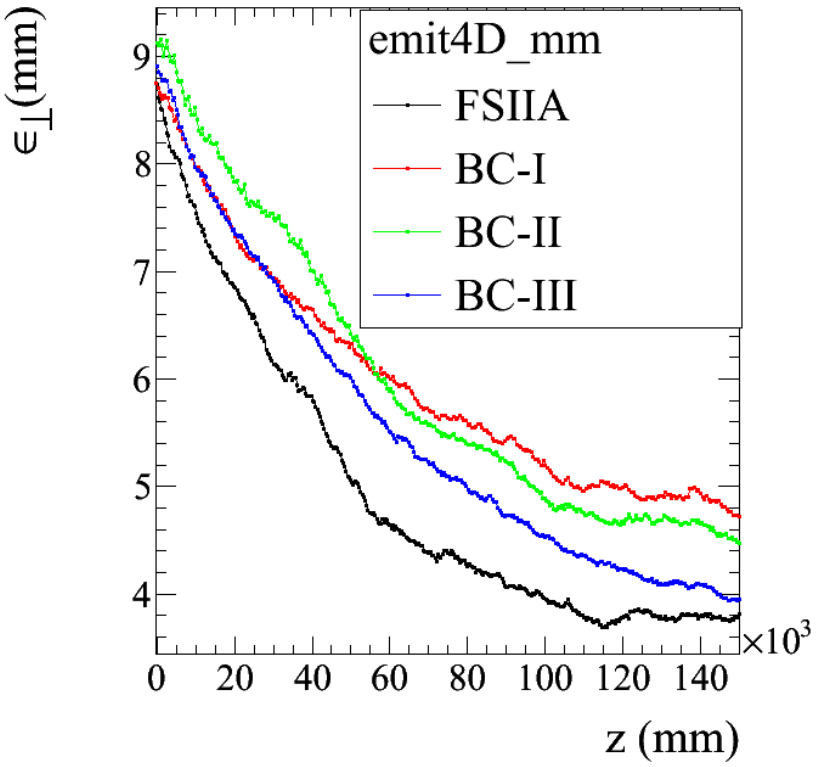
Beam initial characteristics

Lattices were compared using the same initial beam:

- 1,000 muons
- 10 mm Transverse Emittance
- 0.07 ns Longitudinal Emittance
- P: Gaussian distribution centred at 232 MeV/c

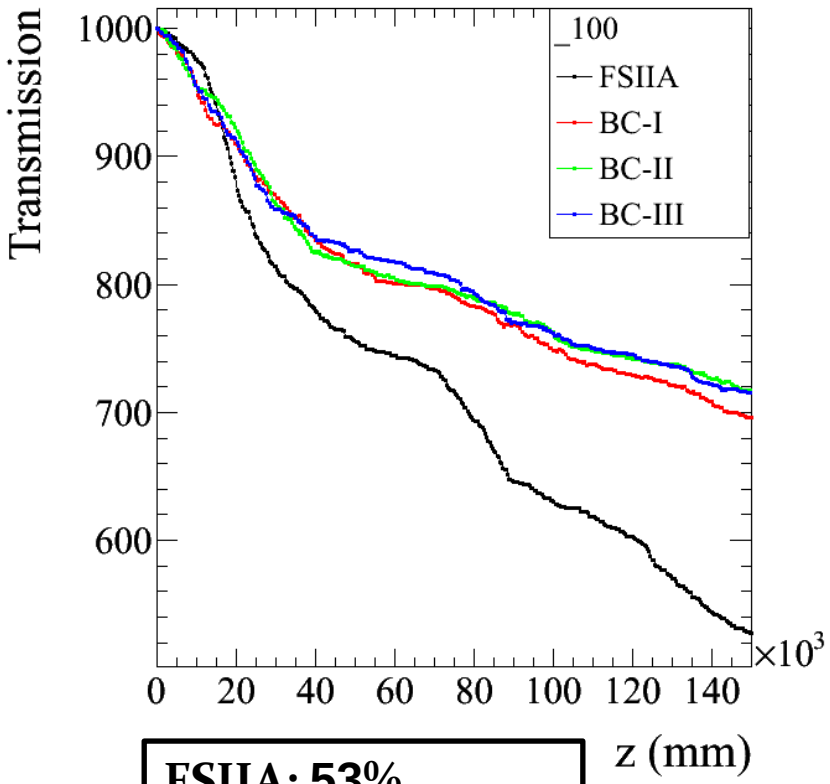
Cooling Dynamics & Transmission

Transverse Emittance (4D)



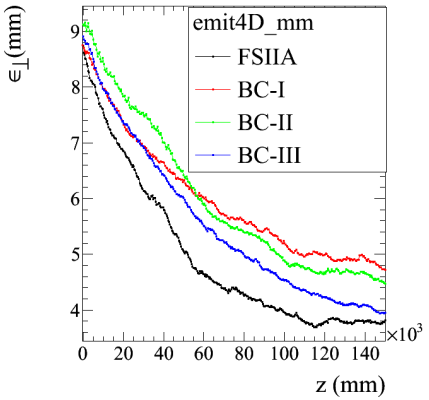
Better cooling for FSIIA and BC-III

Transmission



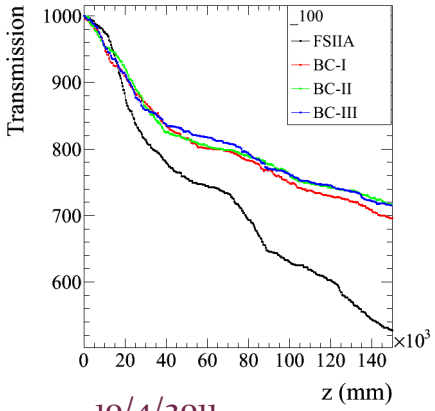
FSIIA: 53%
BC-I: 70%
BC-II, BC-III: 72%

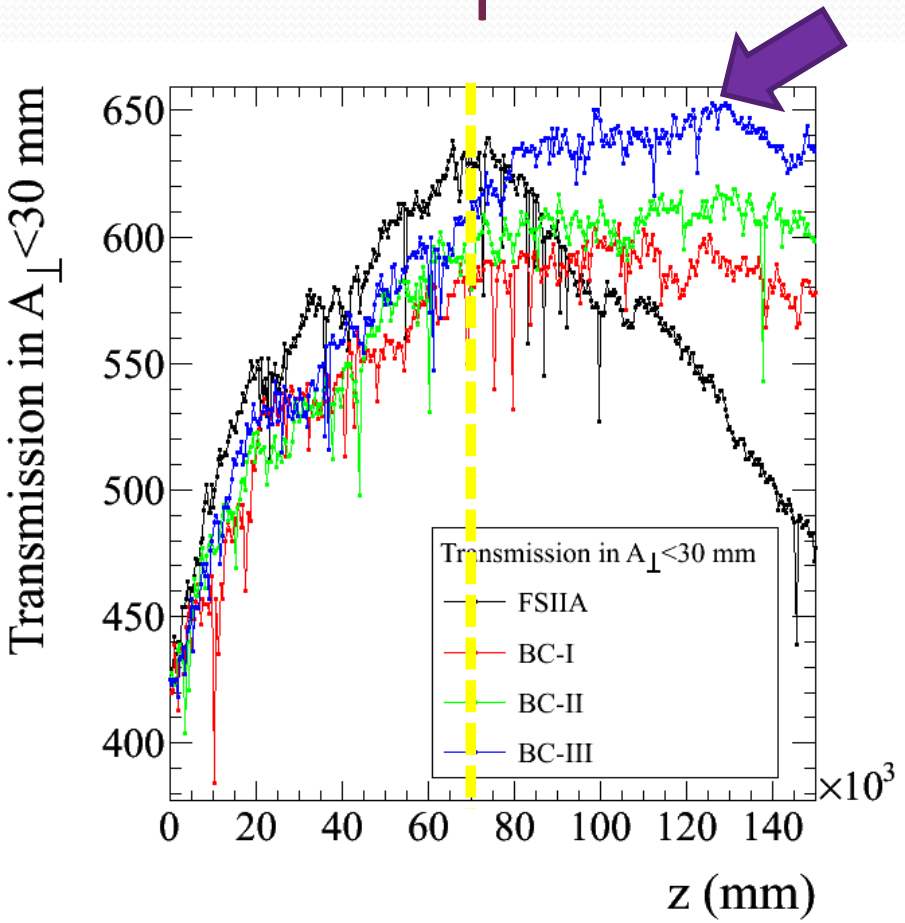
Transmission in A_T<30 mm



Emittance 4D

Transmission





- **BC-III**: **best transmission** at 120 m
- FSIIA maximum at 70 m
- **BC-I: less than 4% lower transmission than FSIIA at 70 m (BC-II and BC-III less than 3%)**

Summary

- **New lattices based on Bucked Coils** (BC-I, BC-II, BC-III) were designed to lower the magnetic field in the RF cavities
- **BC-I, has ~4 times less magnetic field than FSIIA at the position of the RF cavities and transmission within 30 mm A_T only ~4% lower than FSIIA**

Future Plans

- BC optimisation: find an improved lattice with a lower B at the position of the RF cavities **while** *also* providing much better transmission than FSIIA

Note: Update on 6D cooling will be given when I have better results...