Bucked Coils Lattice

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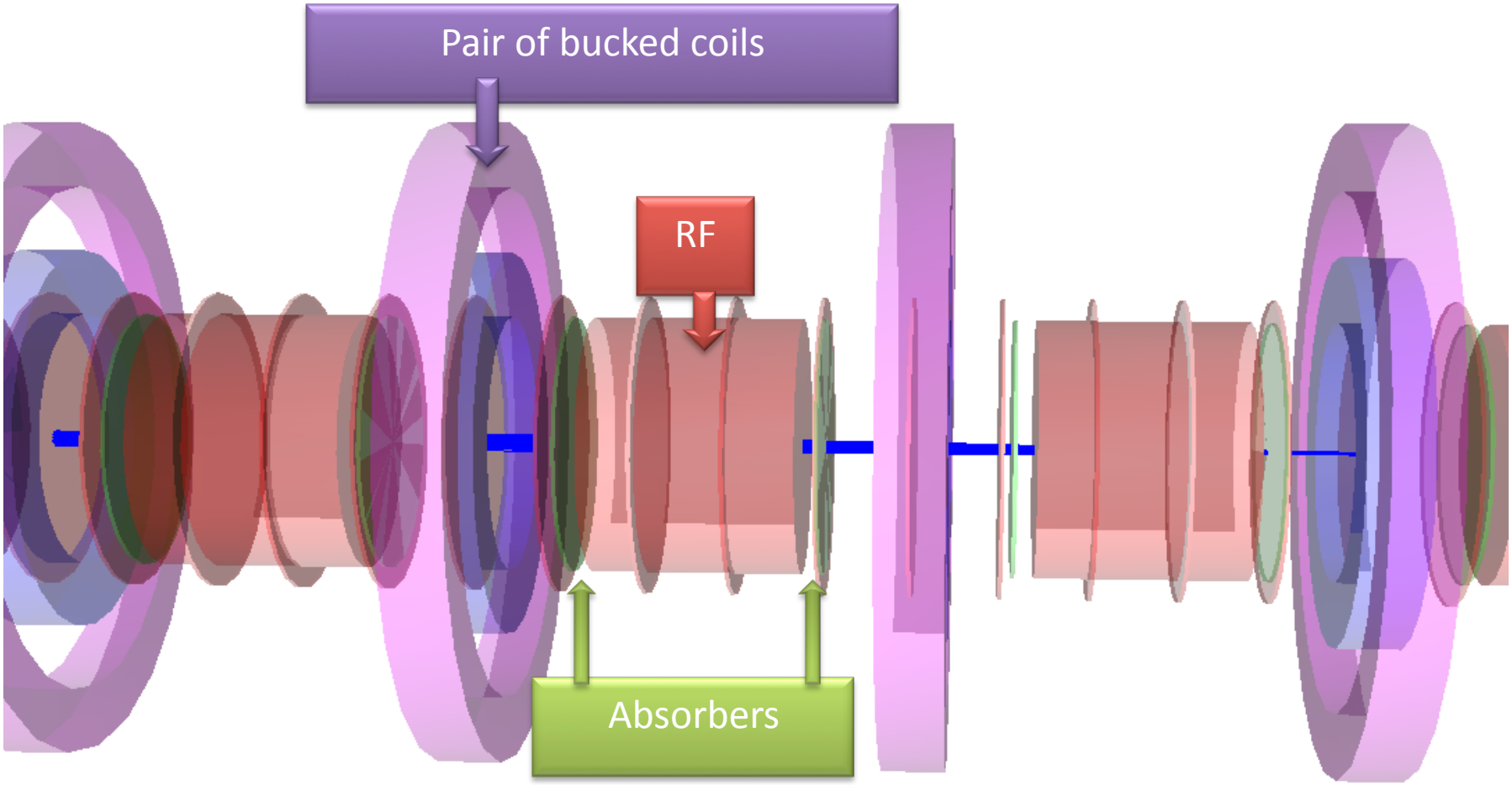
Outline

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

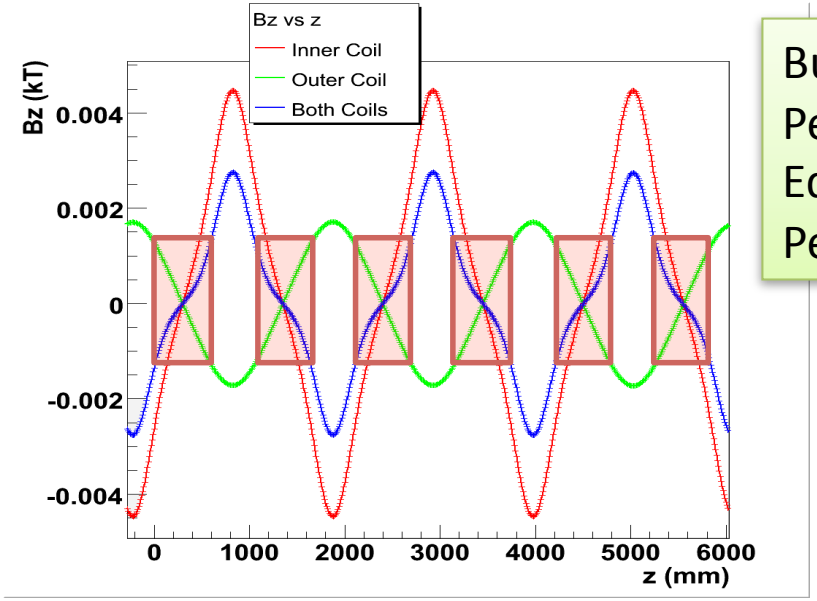
Aim

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

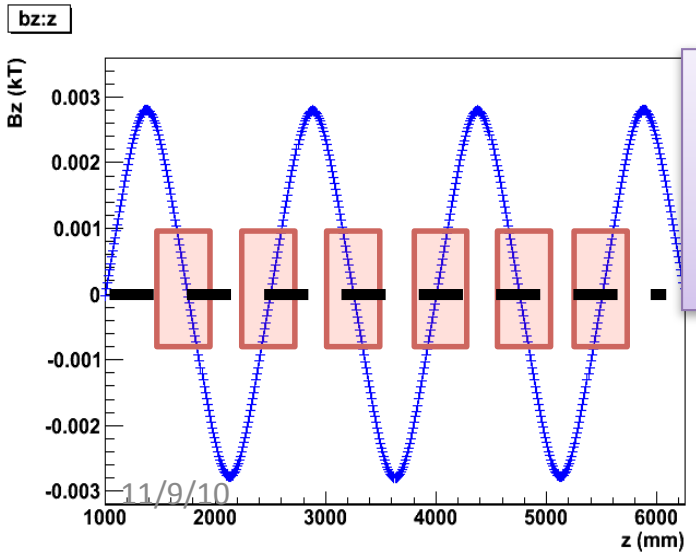
Configuration



Bz comparison to FS2A

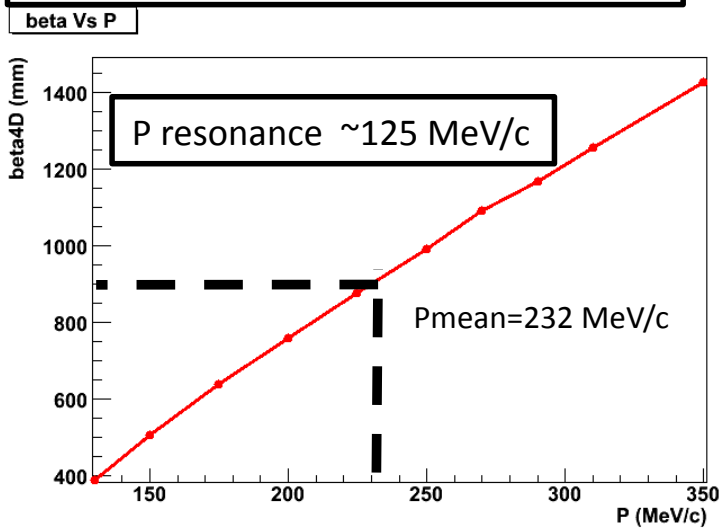


Bucked Coils:
Peak: 2.7 T
Edge of RF: 1 T
Peak/Edge =2.7



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

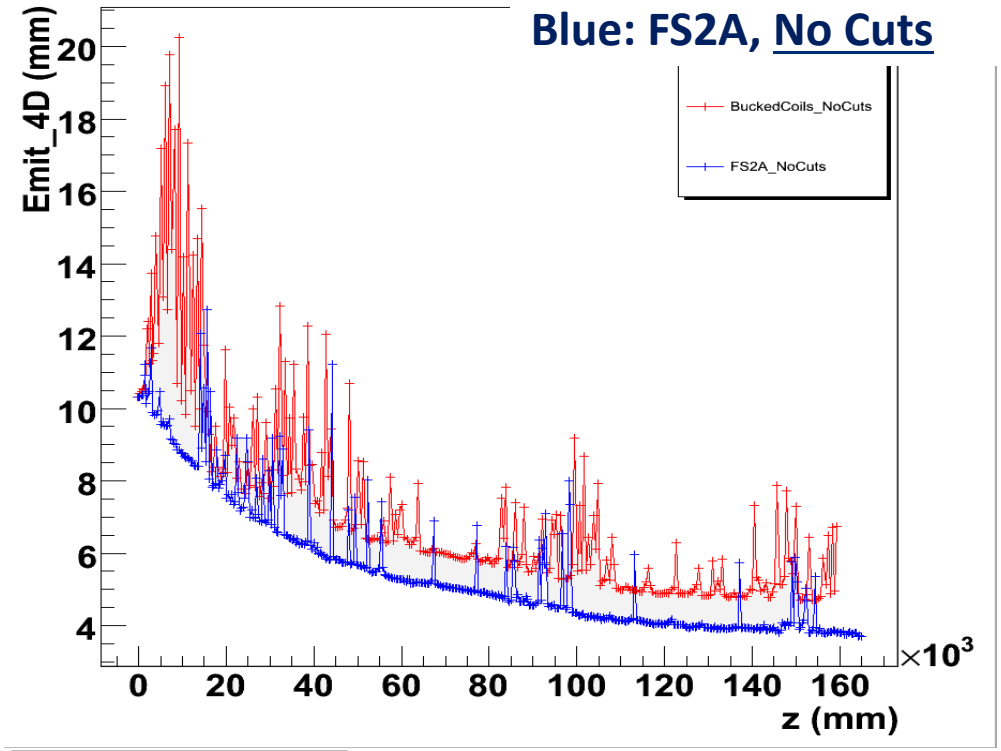


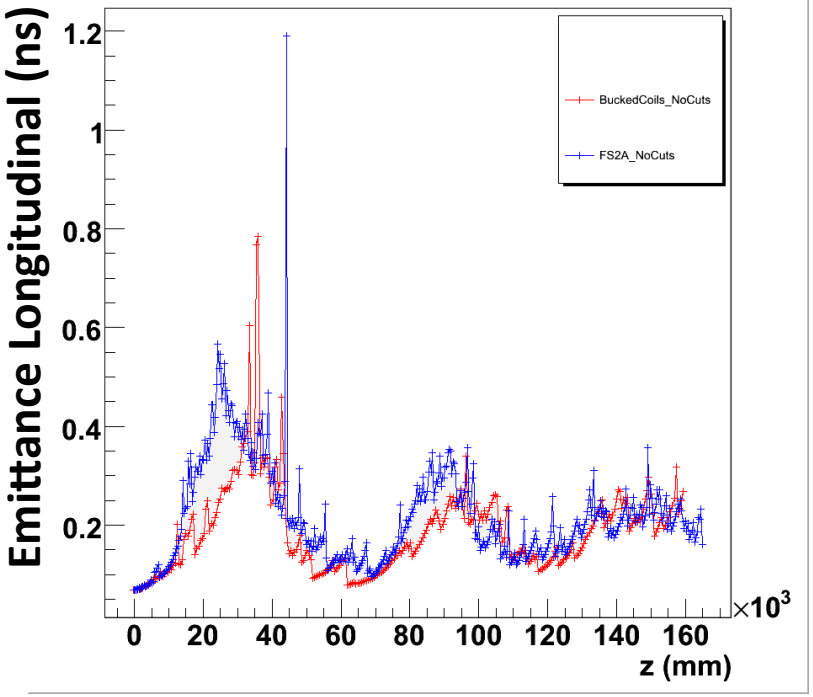
Input beam specifications (same for FS2A and Bucked Coils):

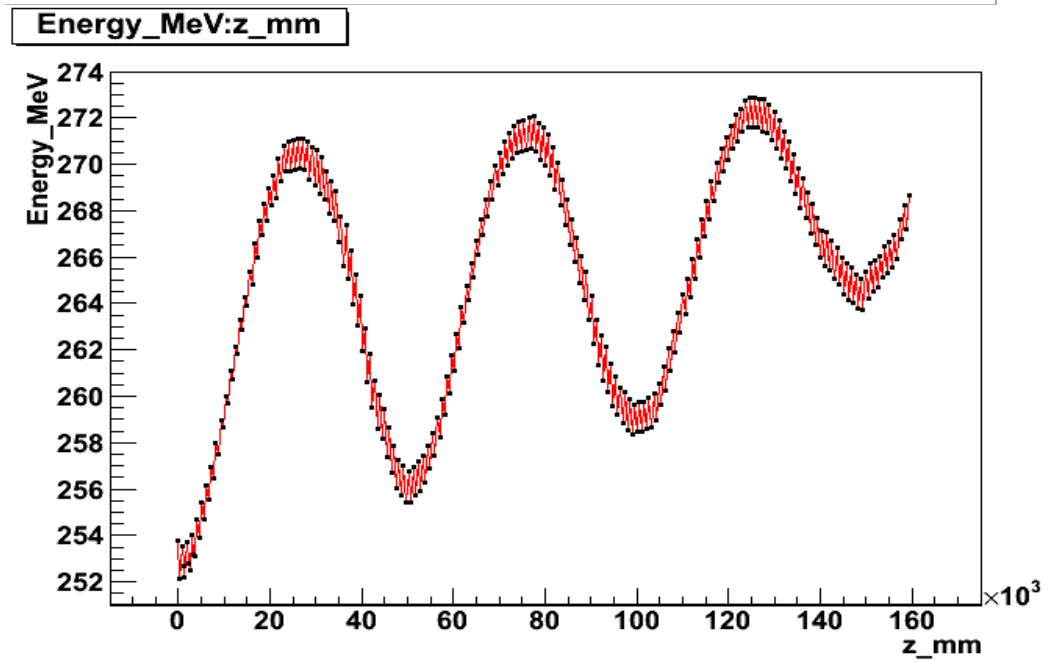
- 1000 particles
- <P> 232 MeV/c
- 10 mm Transverse Emittance
- 0.07 ns Longitudinal Emittance

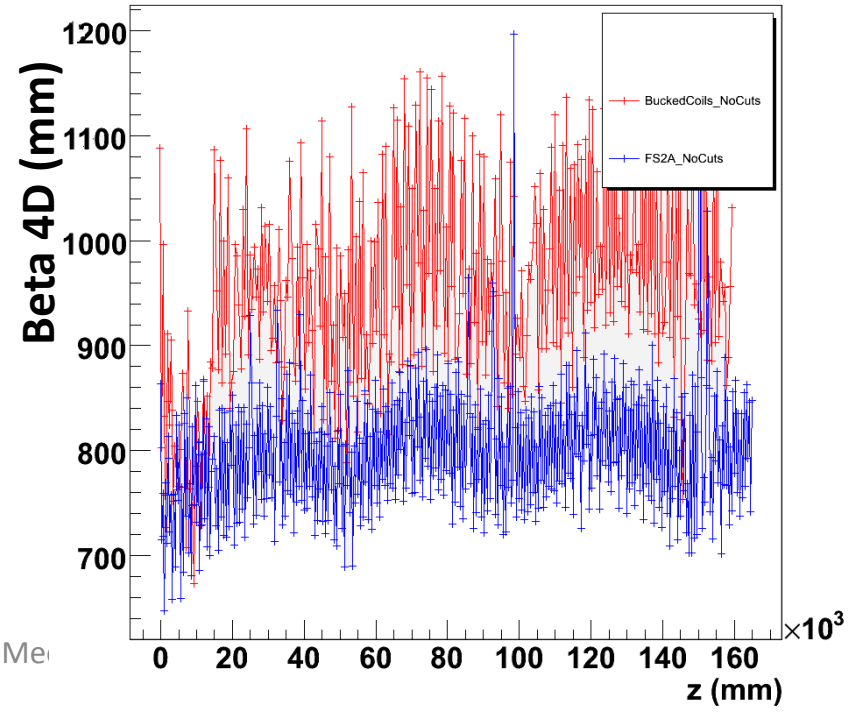
Red: Bucked Coils, No Cuts

Blue: FS2A, No Cuts









Cuts

Applying P and R cuts <u>on every plane</u>:

•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

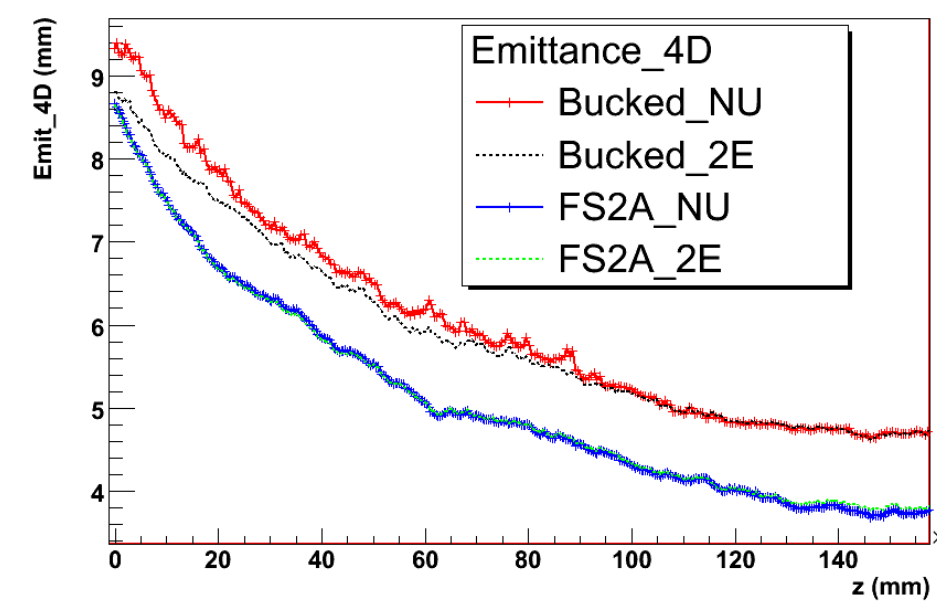
•Any particles that don't make the R cuts will not be taken into account on the specific plane or further downstream.

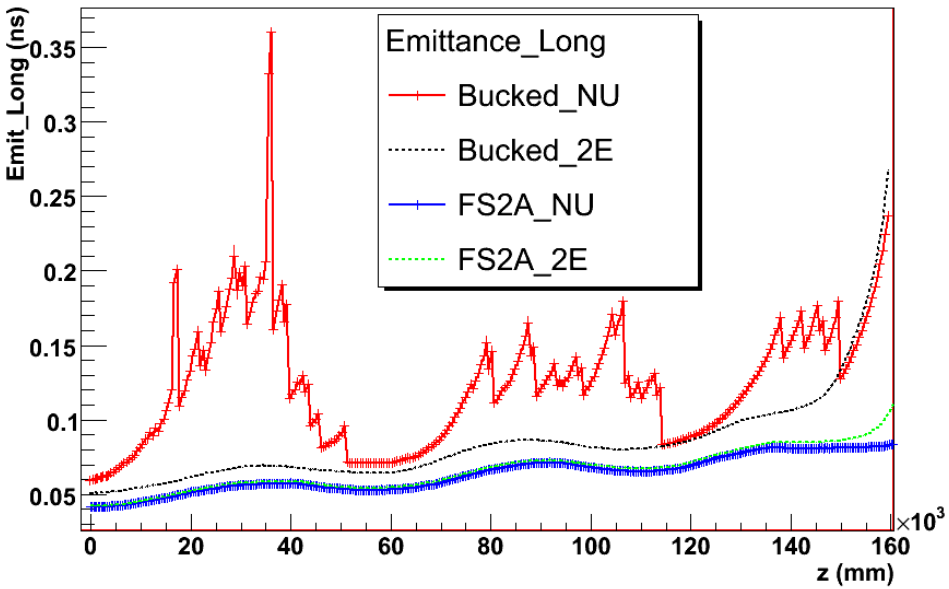
- •R<30 cm

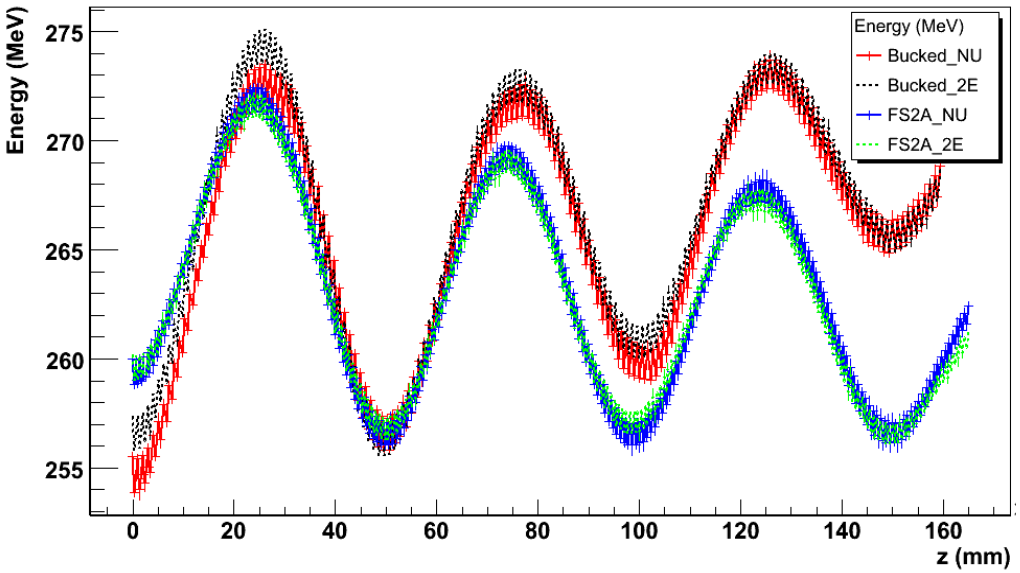
Symbol in following plots: NU (Non Uniform cuts)

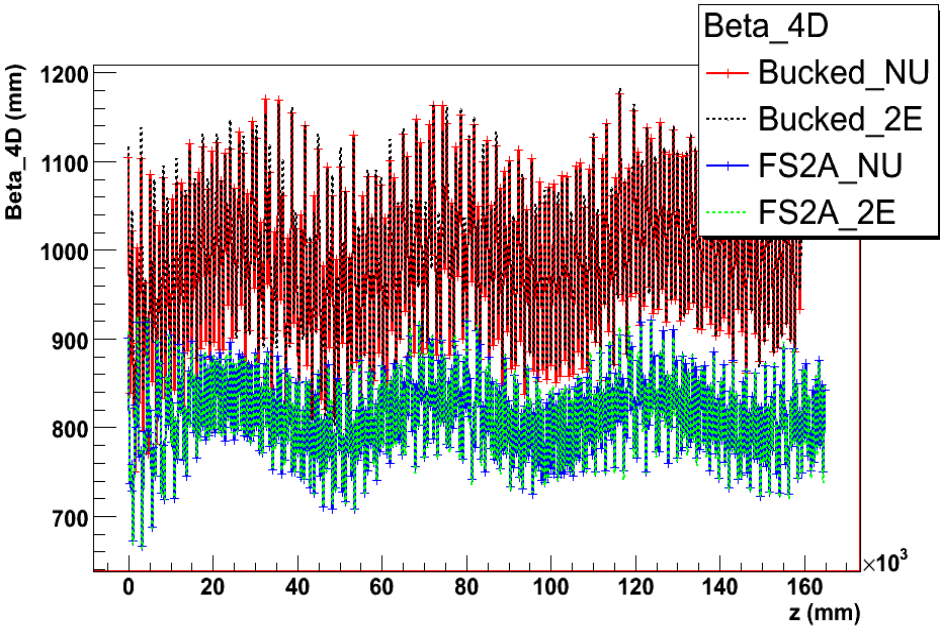
No cuts of R or P, but only track particles that made it to the end.

Symbol in following plots: 2E (To the End)

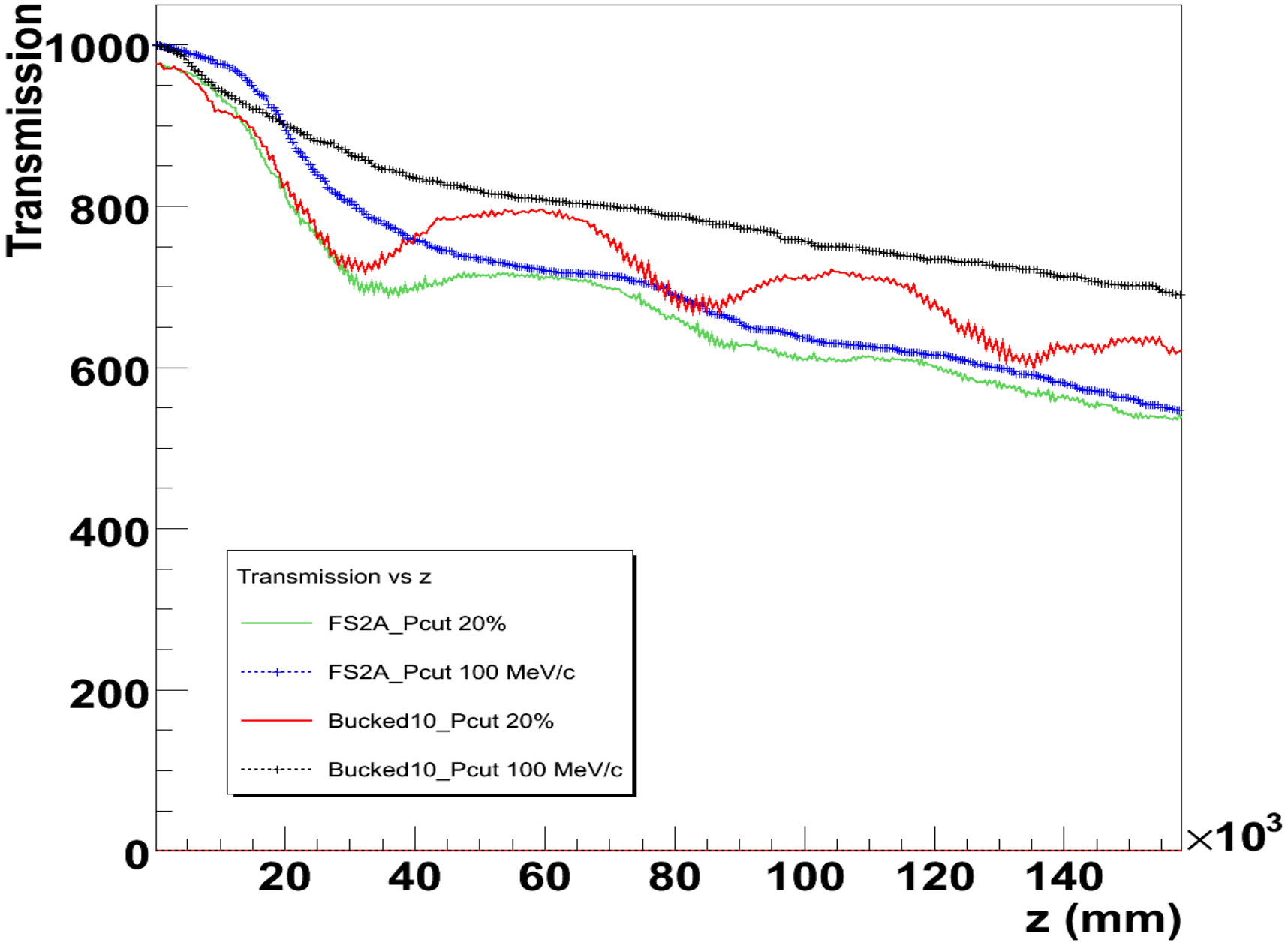






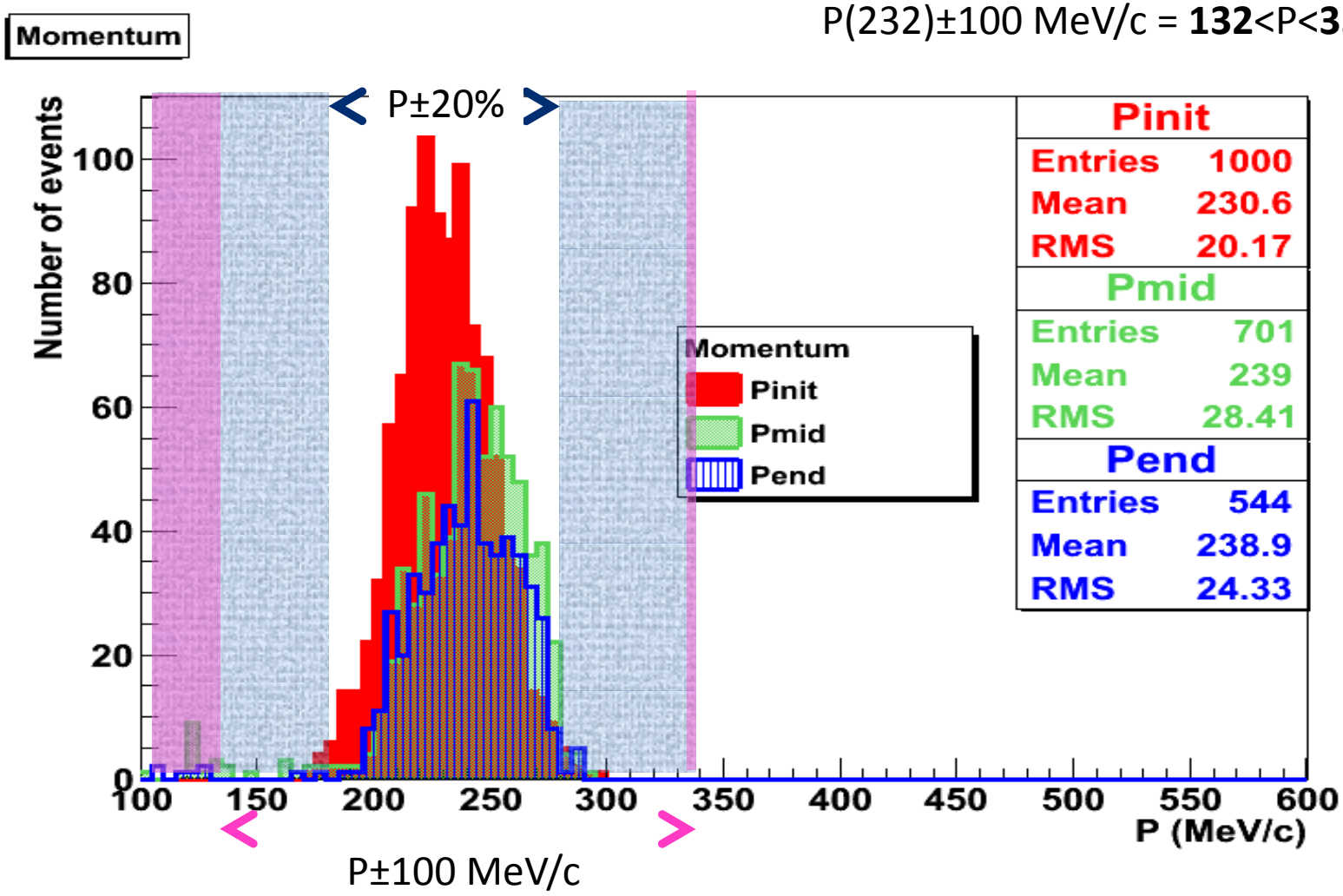


Note that although both beams should start with same <E>=254.65 (i.e. 232 MeV/c), there is a small difference at the energy start point between FS2A and Bucked. Also different start point at Emit4D and EmitLong. This is due to the Beta4D difference.


Transmission
1000
800
600
400
200
0
20
40
60
80
100
120
140
×10³
z (mm)
Transmission vs z
FS2A_Pcut 20%
FS2A_Pcut 100 MeV/c
Bucked10_Pcut 20%
Bucked10_Pcut 100 MeV/c

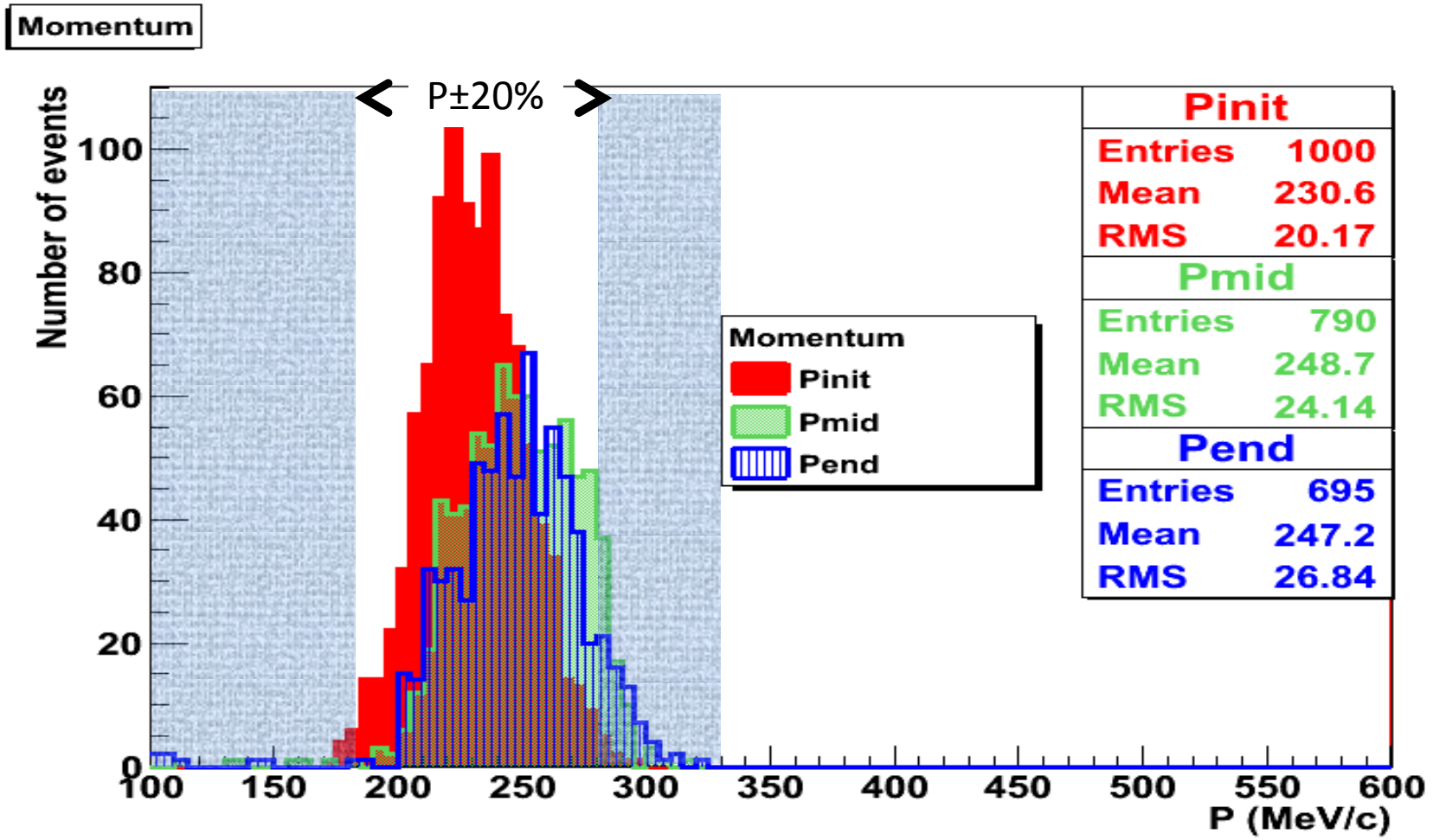
FS2A P distribution **(No Cuts Applied)**

P(232)±20% = **185.6**<P<**278.4** MeV/c
P(232)±100 MeV/c = **132**<P<**332** MeV/c



Bucked P distribution **(No Cuts Applied)**

P(232)±20% = 185.6<P<278.4 MeV/c
P(232)±100 MeV/c = 132<P<332 MeV/c

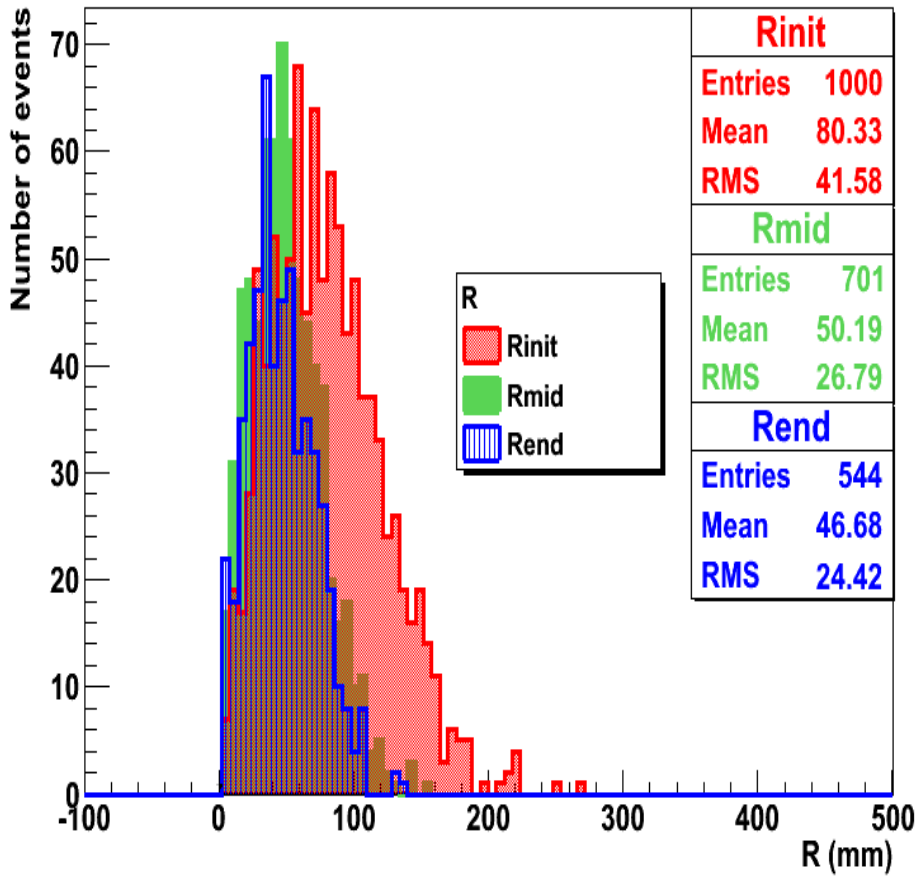


R distribution for FS2A and Bucked **(No Cuts Applied)**

R<30 cm

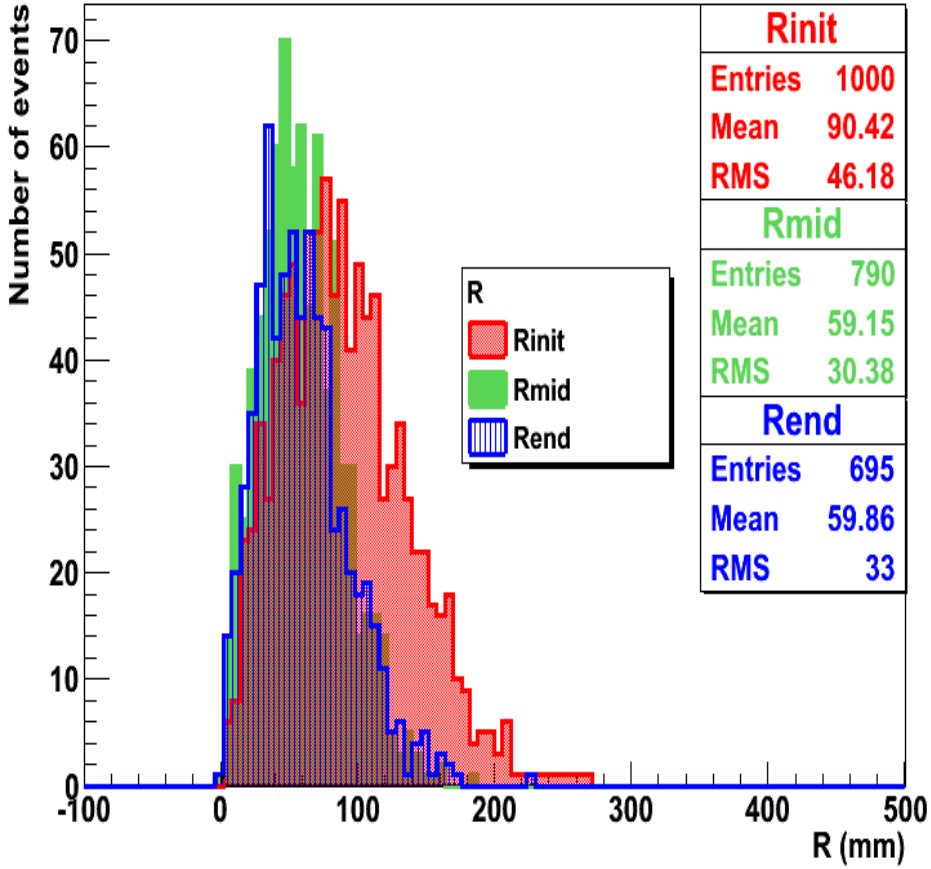
Rmid

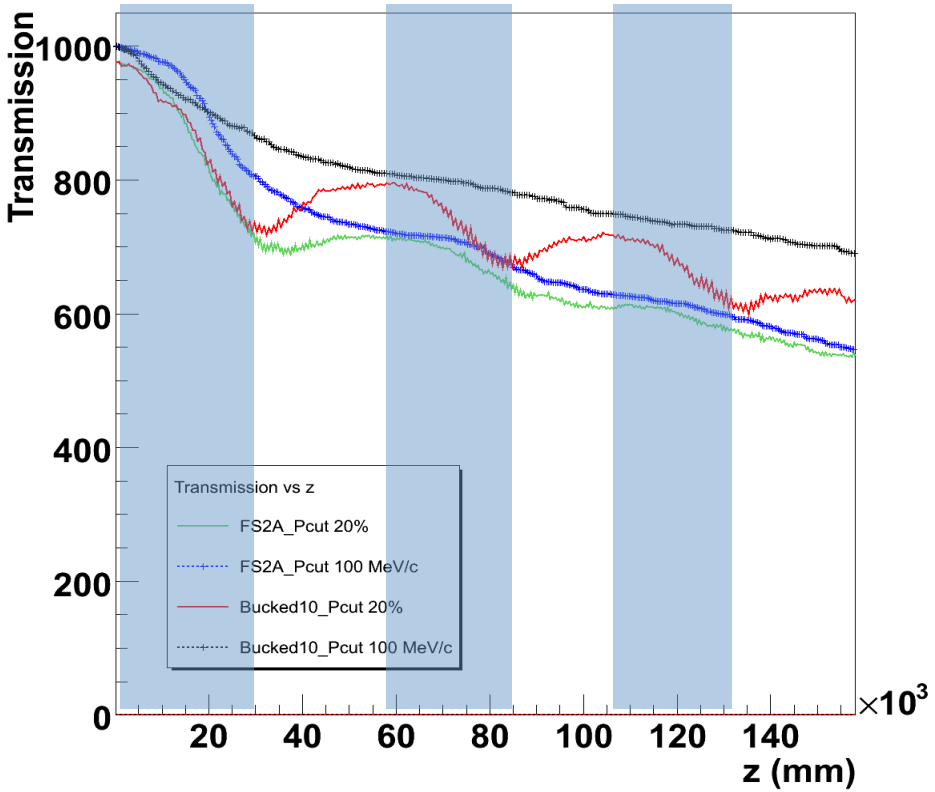
FSA2 R distribution

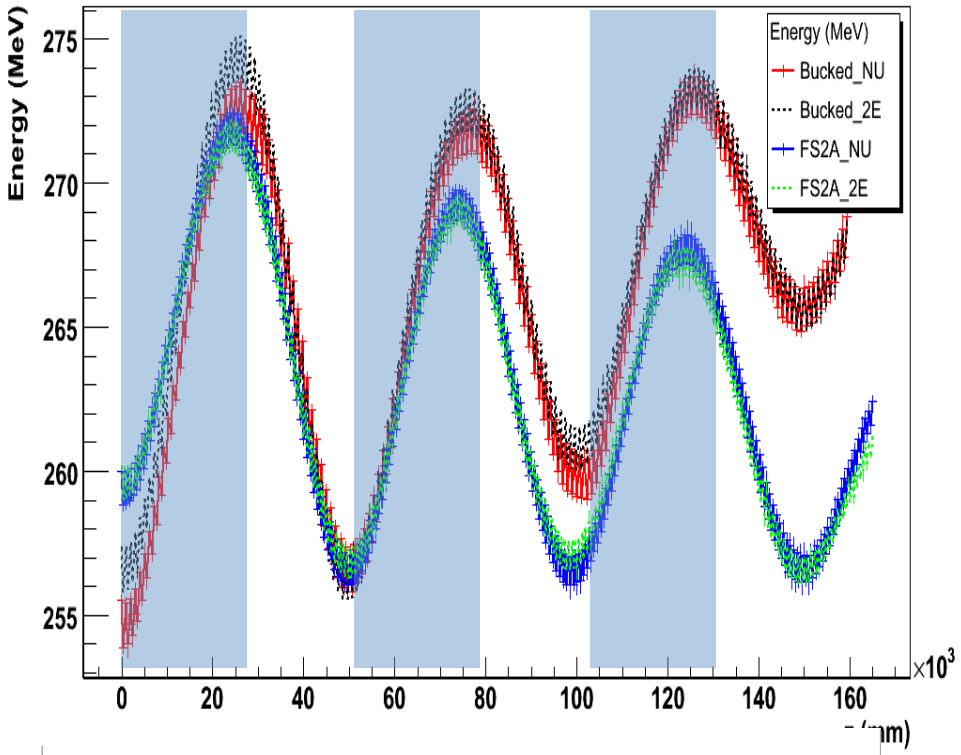


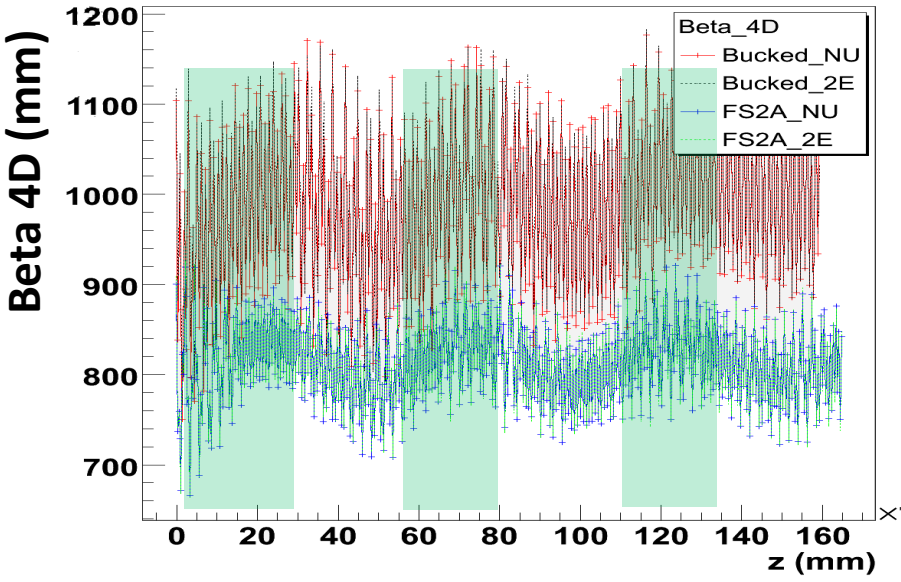
Rmid

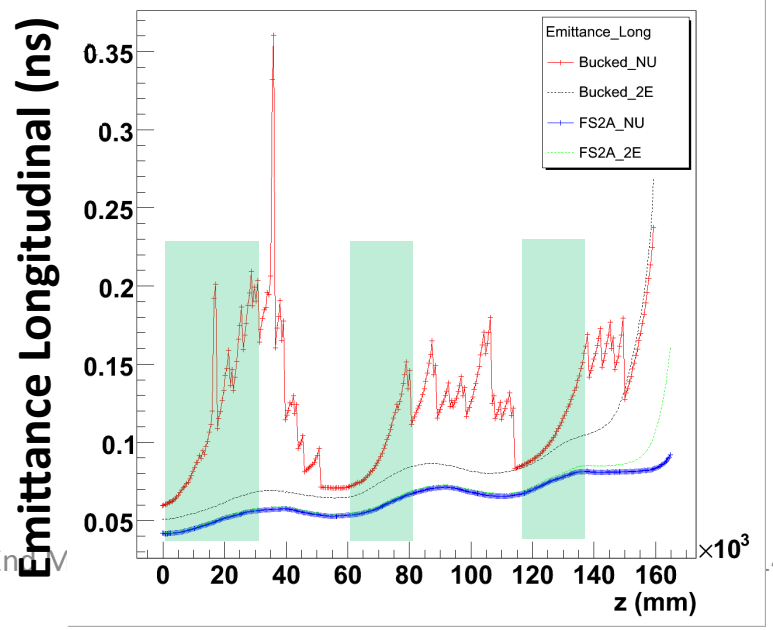
Bucked R distribution



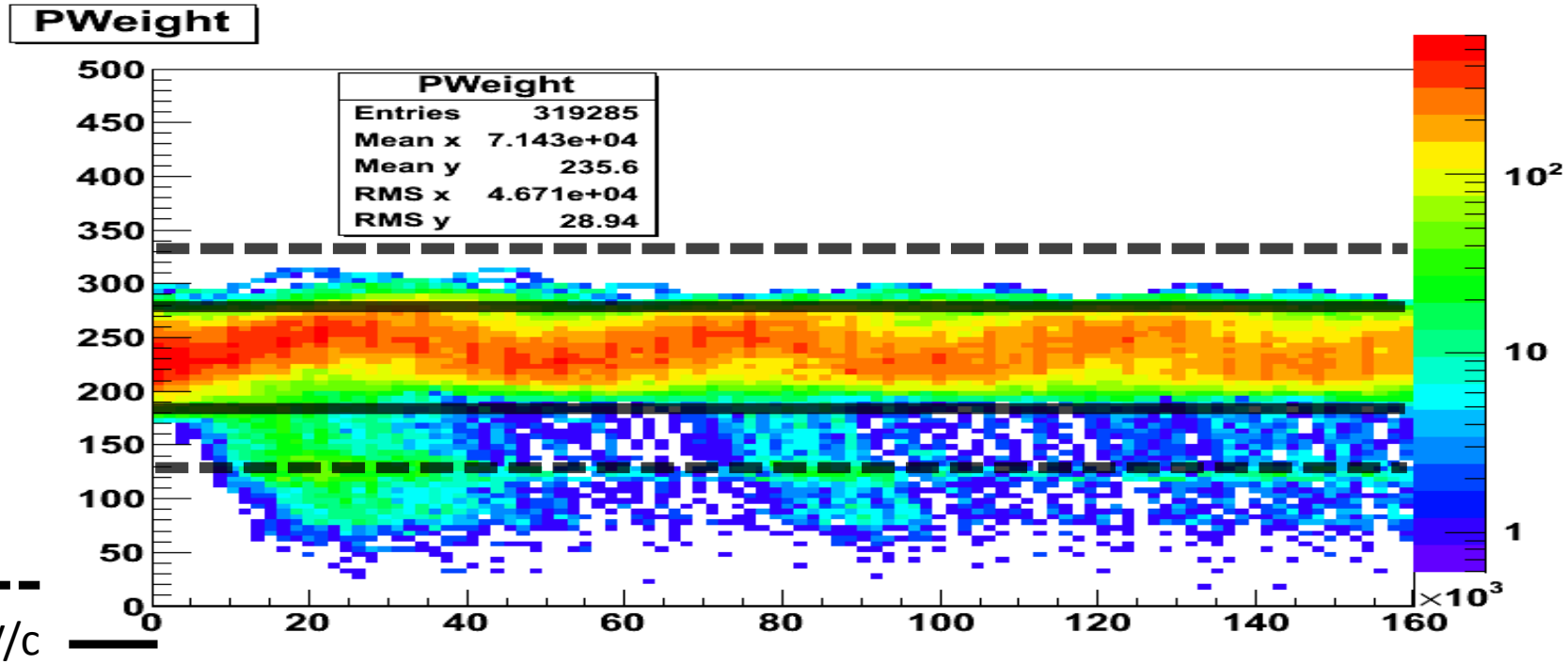

Transmission
Transmission vs z
FS2A_Pcut 20%
FS2A_Pcut 100 MeV/c
Bucked10_Pcut 20%
Bucked10_Pcut 100 MeV/c
z (mm)
×10³


Energy (MeV)
Bucked_NU
Bucked_2E
FS2A_NU
FS2A_2E
×10³


Beta 4D (mm)
Beta_4D
Bucked_NU
Bucked_2E
FS2A_NU
FS2A_2E
z (mm)
×10³


Emittance Longitudinal (ns)
Emittance_Long
Bucked_NU
Bucked_2E
FS2A_NU
FS2A_2E
z (mm)
×10³

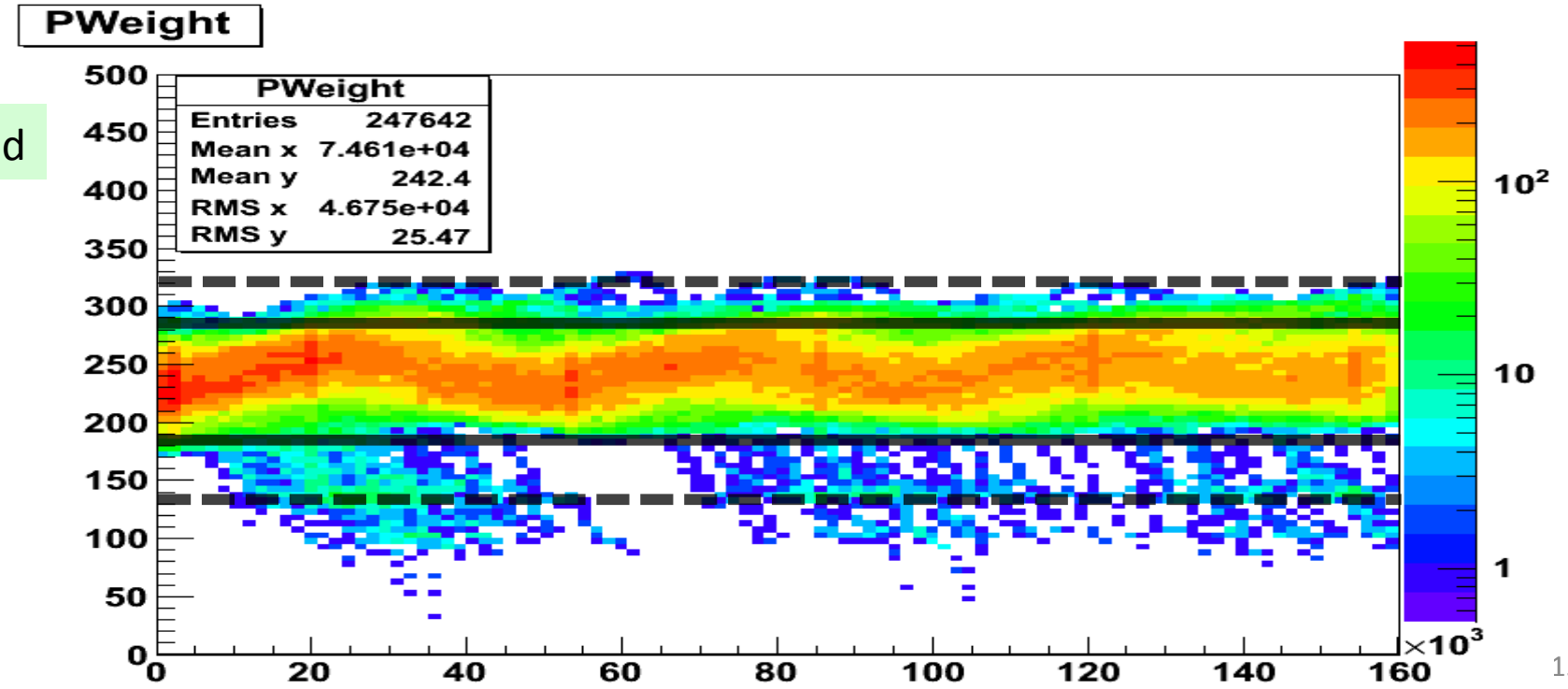
FS2A



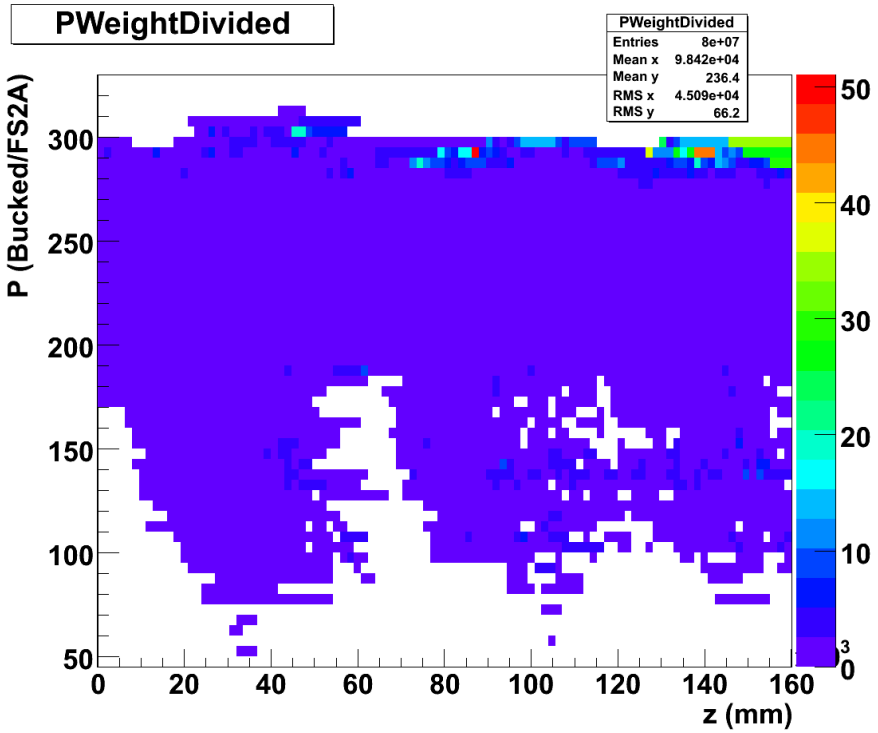
20% ---

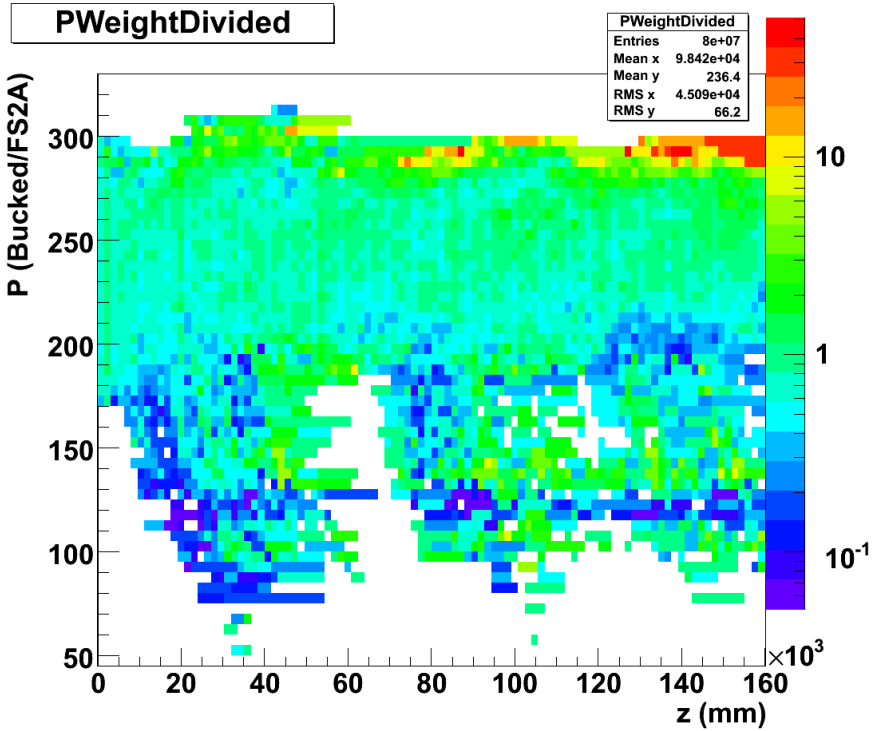
100MeV/c ——

Bucked

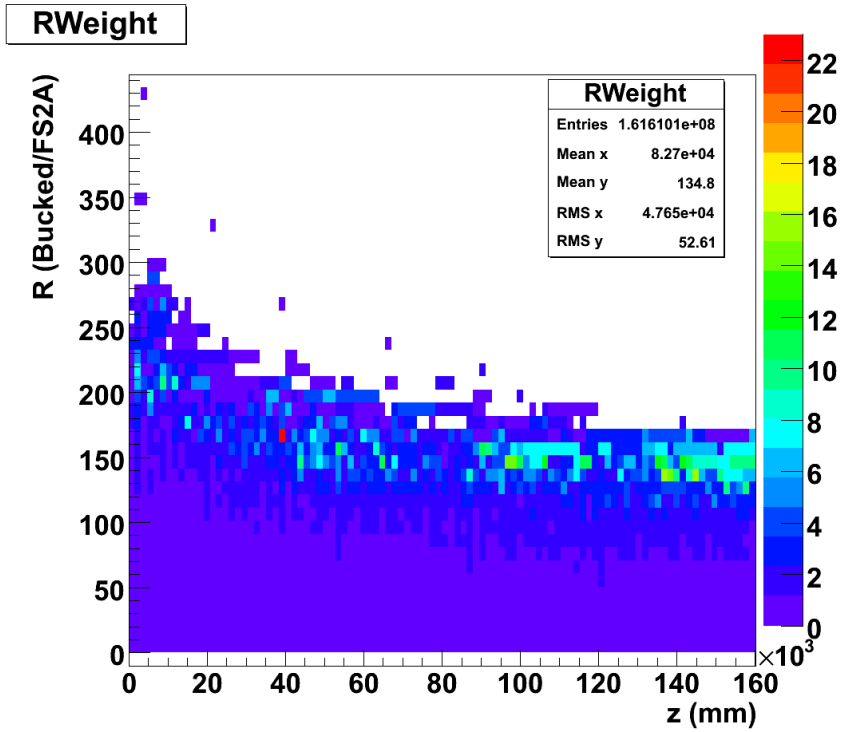


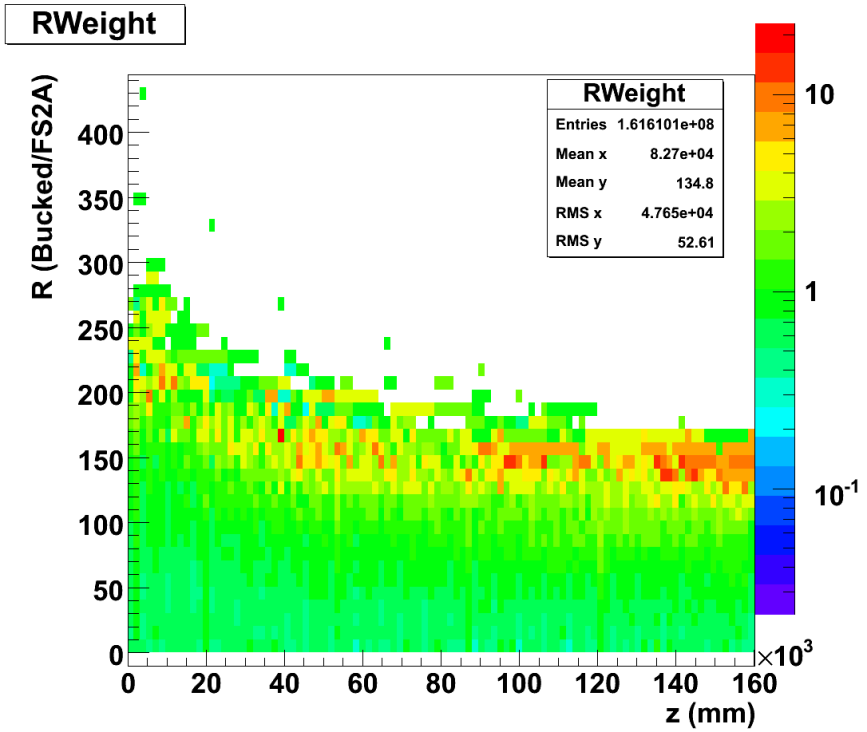
P distribution Bucked/FS2A



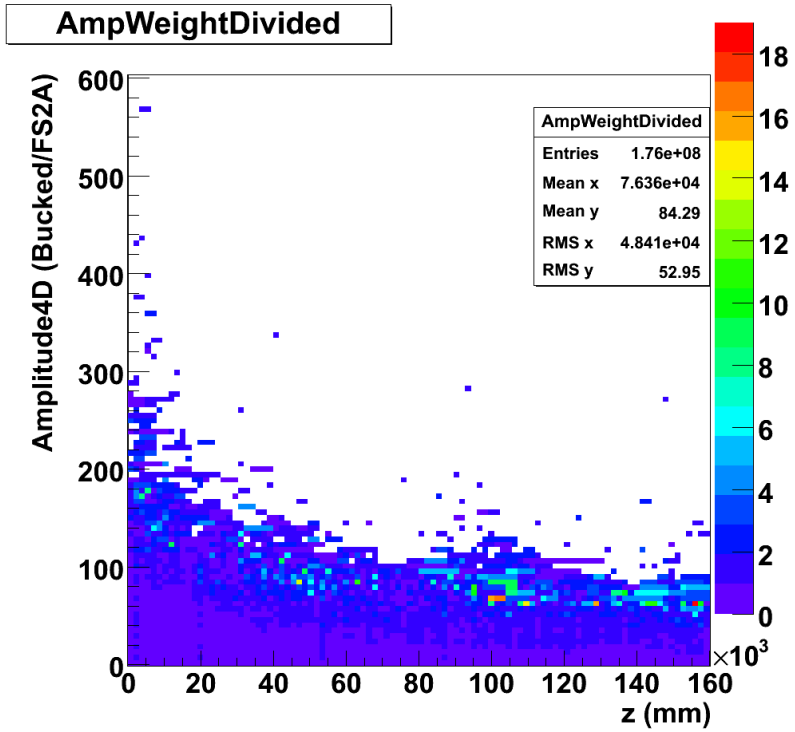


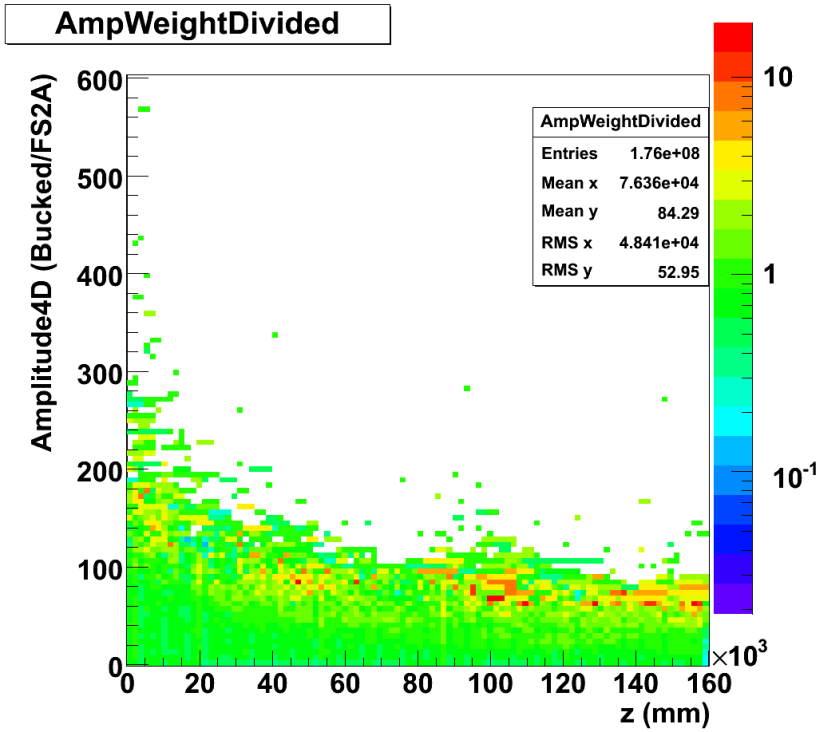
Radius Distribution





4D Amplitude





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