MUON TARGET STUDIES: TAPERED CAPTURE SOLENOID

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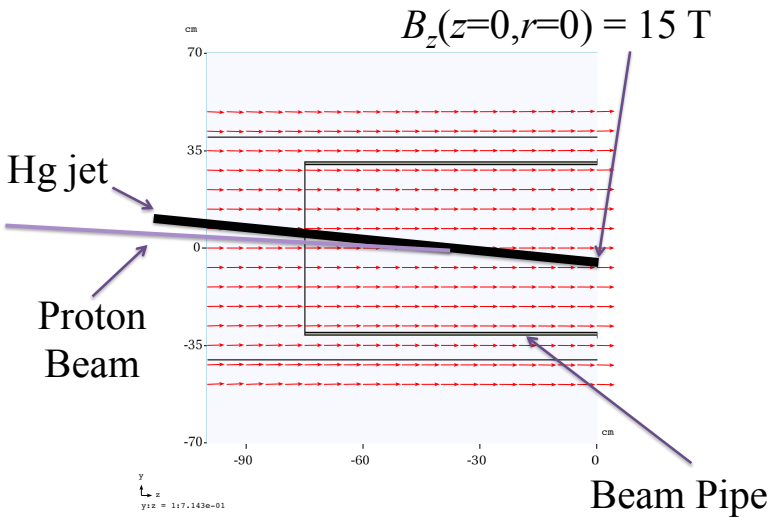
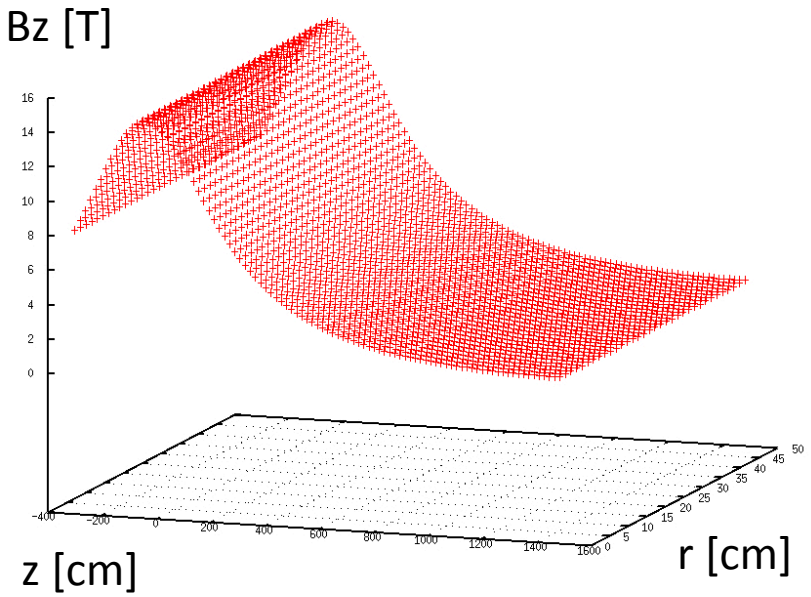
MARS Simulation Setup

- Beam Pipe with constant R=30 cm (eliminate particle loss due to scrapping)
- Beam Pipe material changed to balckhole to speed calculations
- Added subroutine to m1510.f (FIELD) to calculate the field using inverse cubic equations
- Store particles information at z=0
- Select (μ^+ & π^+)

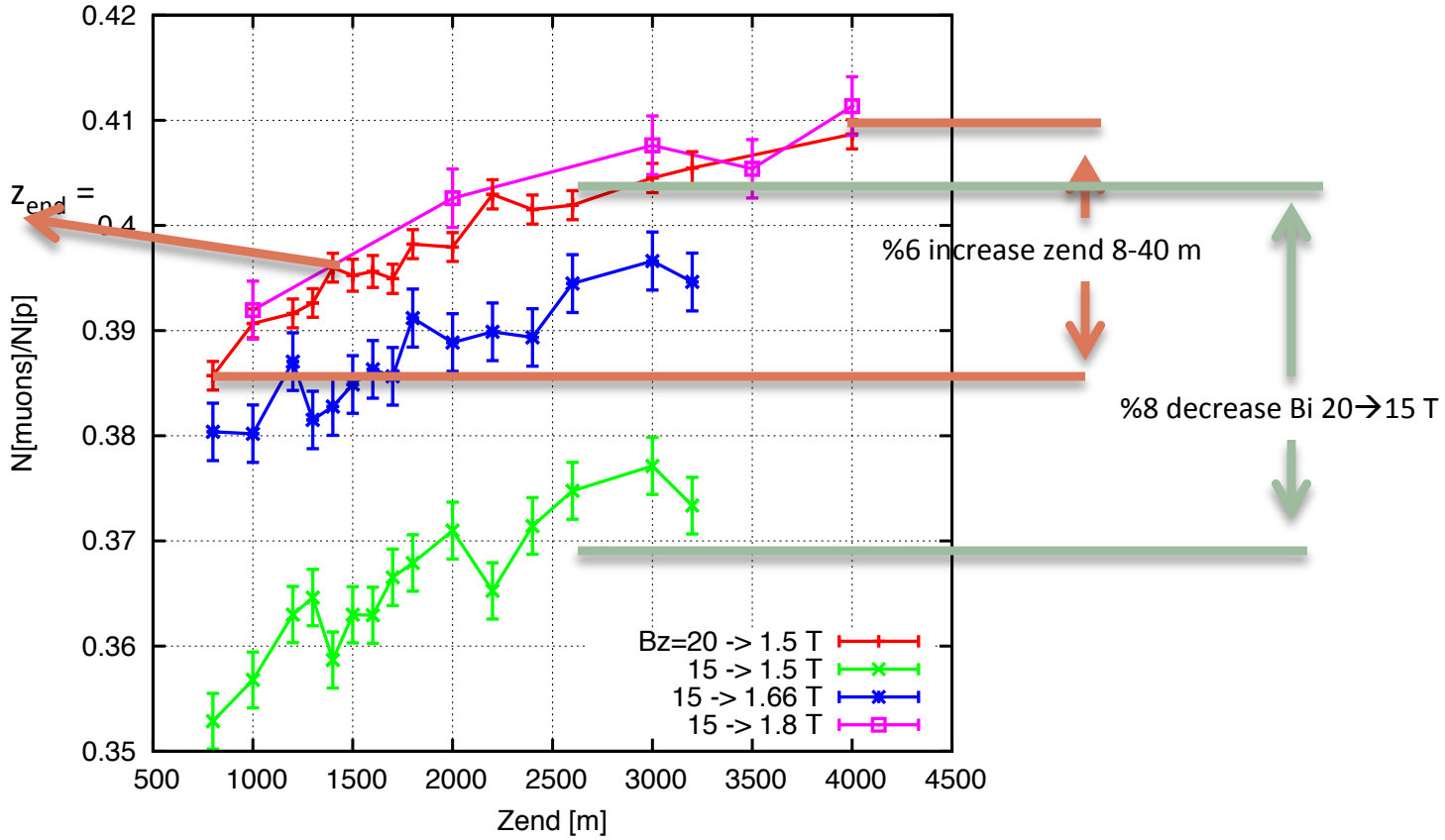




MARS Simulation Results

Muons+Pions count at z=50 m with K.E. 80-140 MeV

Present baseline:
B_i = 20 T, B_f = 1.5 T, z_{end} = 15 m.



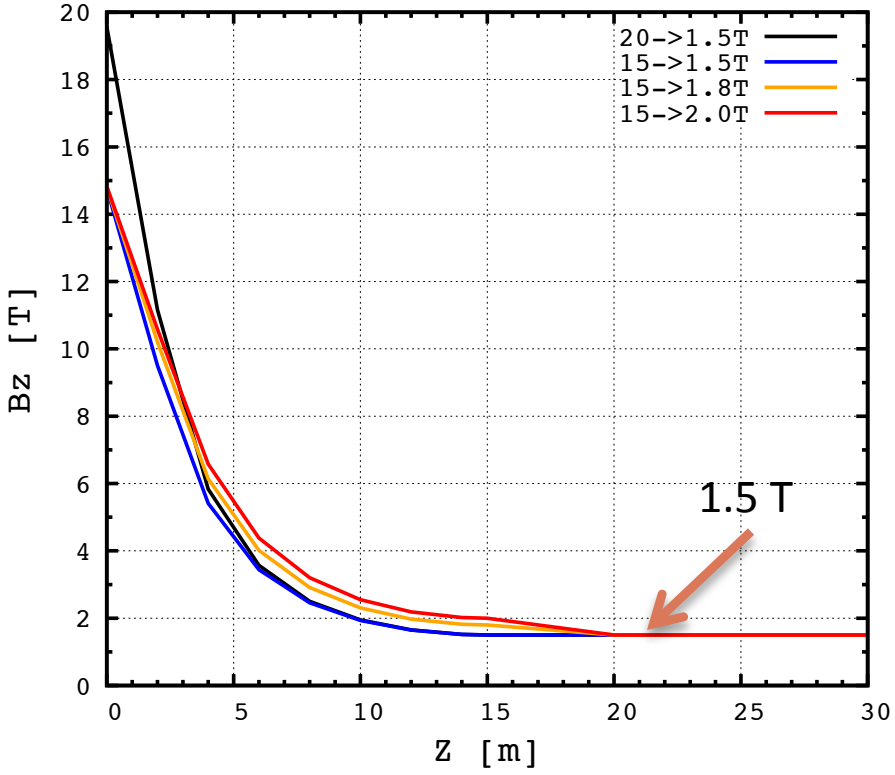
Tapered field using inverse-cubic field (P = 1)

MUON COUNT AT END OF "FRONTEND"

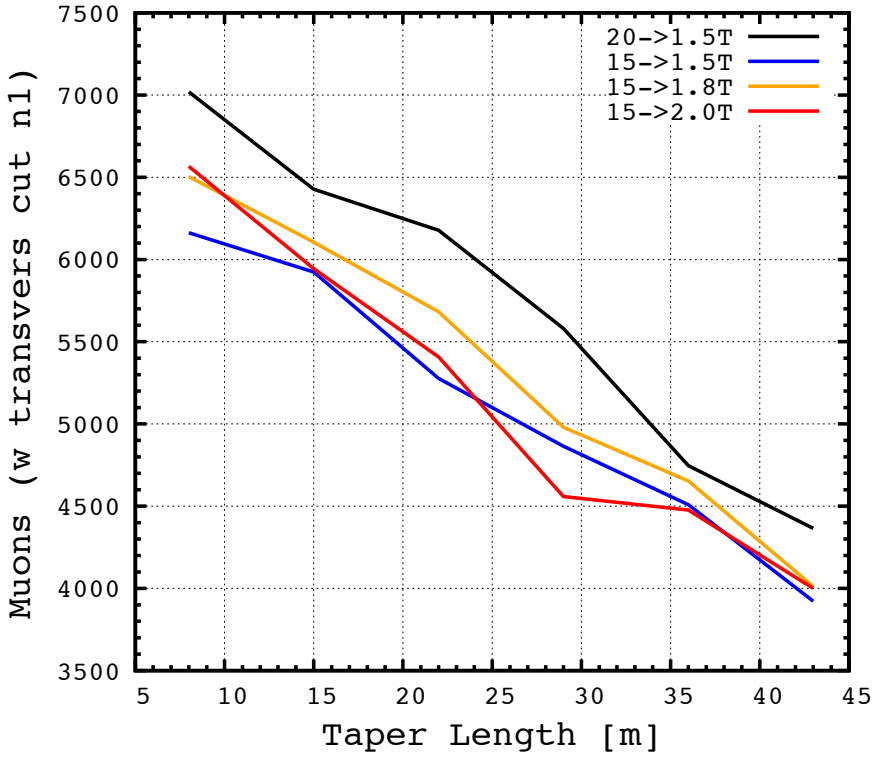
Muons within required acceleration acceptance cuts

- 0.1 <Pz< 0.3 GeV
- Transverse cut R < 0.3 m
- Longitudinal cut 0.15 m

Solenoid Field along z-axis



Shorter taper better survive the phase rotator & cooling



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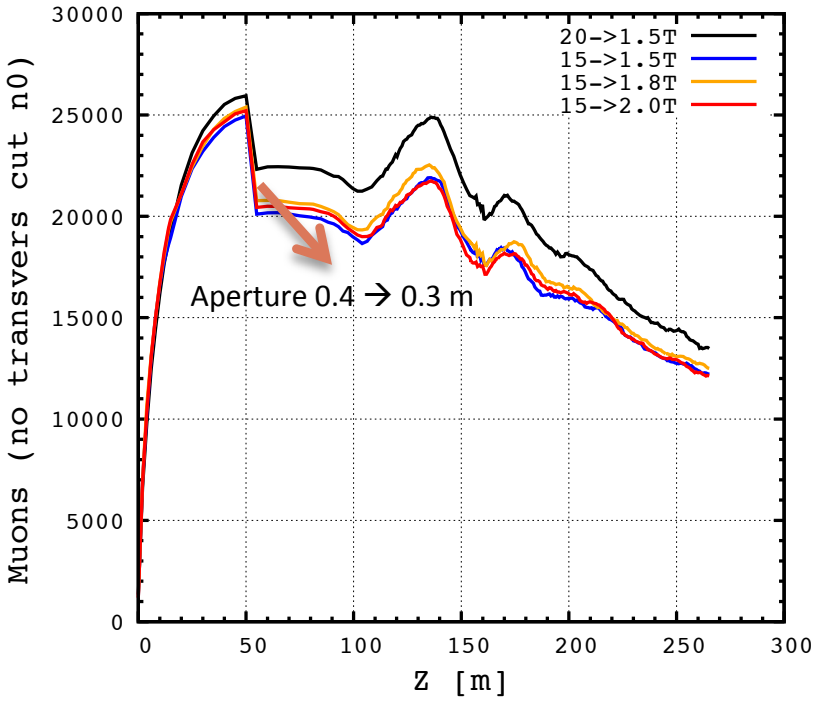
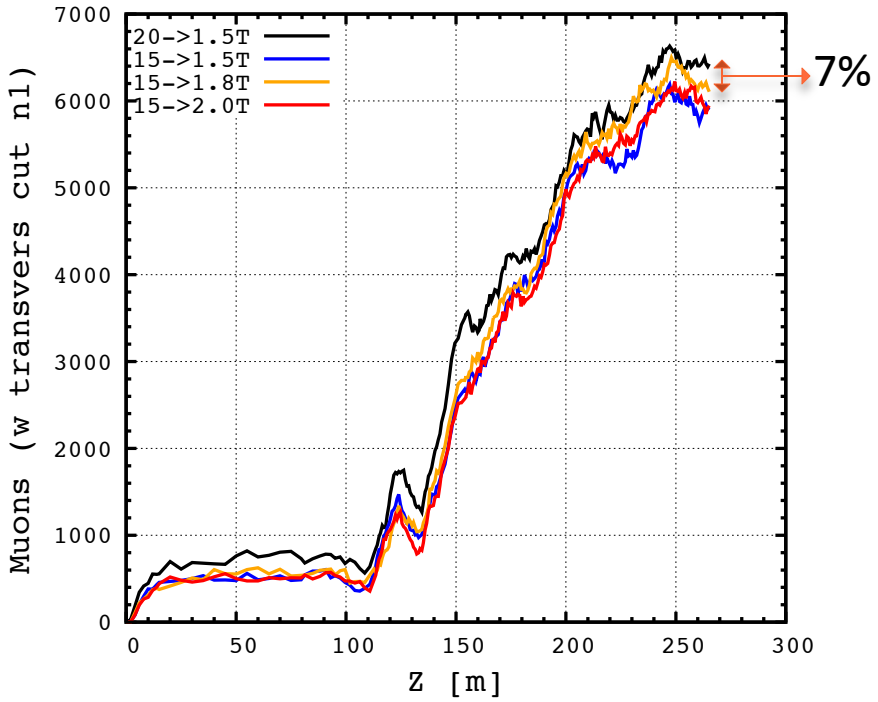
TRANSMISSION THROUGH FRONT END

Pz & Σ cut



Trans, Pz, & Σ cut



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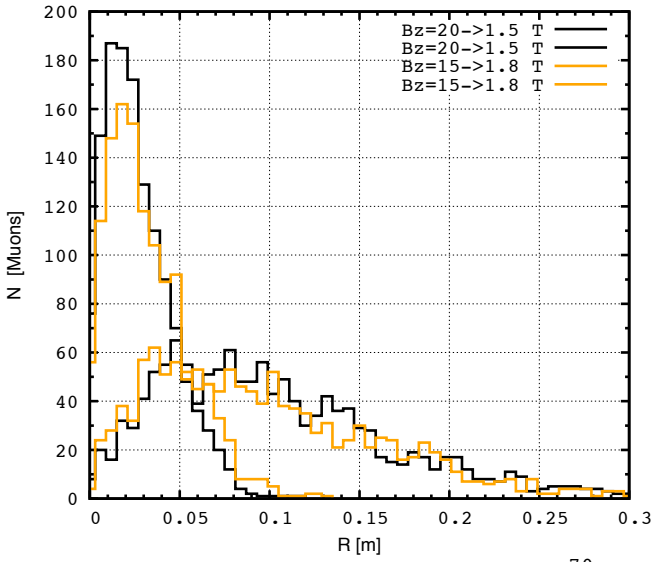
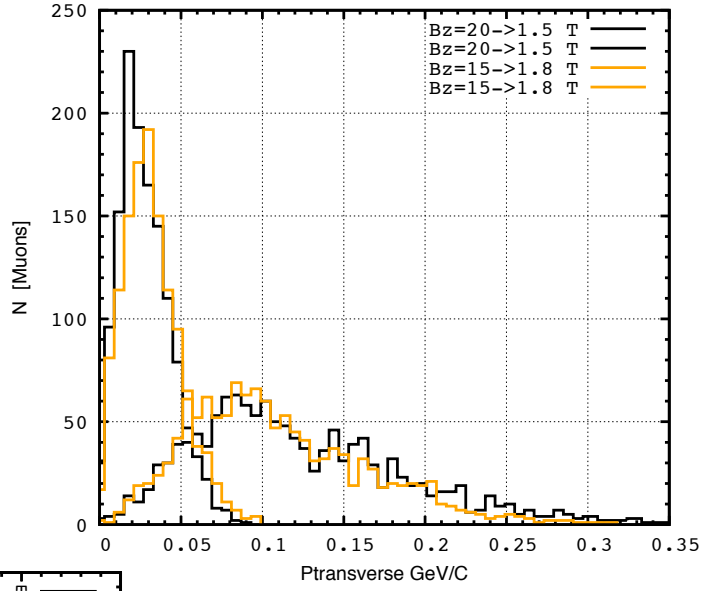
DISTRIBUTIONS OF PARTICLES SURVIVED THE FRONT END AND ACCELERATION CUTS

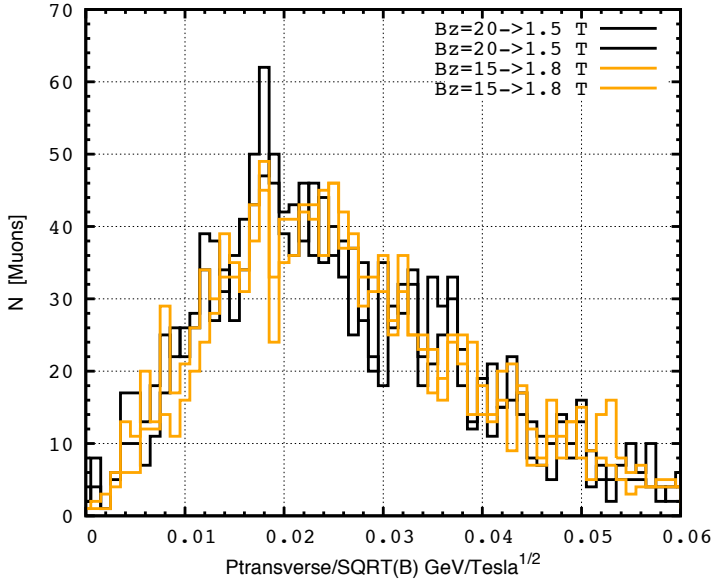
1- Taper solenoid field: 20 --> 1.5 T over 15 m
2- ICOOL applied aperture for decay region R_aperture= 0.4 m & 0.3 afterwords
3- Good particles are those who satisfy the following conditions/cuts
    1- Survived the phase rotator and cooling sections
    2- Fall within required acceleration acceptance cuts
        - 0.1 <Pz< 0.3 GeV
        - Transverse cut R < 0.3 m
        - Longitudinal cut 0.15 m

DISTRIBUTIONS OF PARTICLES SURVIVED THE FRONT END AND ACCELERATION CUTS

Particle radii distribution Ltaper=15







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Conclusion

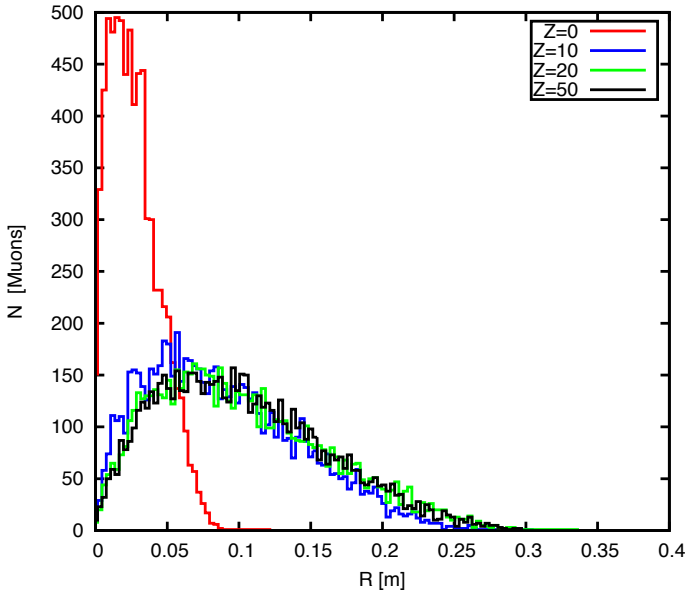
Peak Field of Target Capture Solenoid

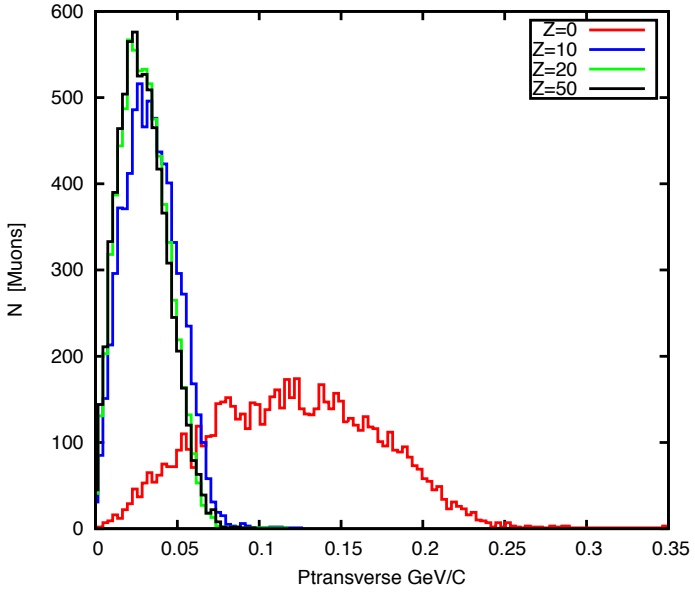
- 15 T peak field case has ~ 7% less yield at end of cooling though it produces about the same number of muons at the target.
- No clear mismatch in the lattice that shows huge particle loss

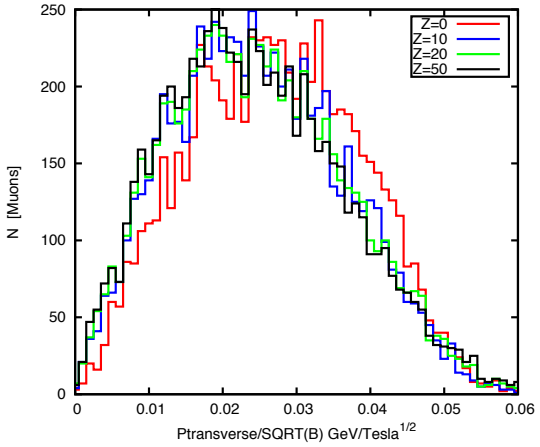
Taper Length	End of Decay Channel z=50 m No cuts	End of FE z=265 m Eclac acceleration acceptance cuts
Short		Better
Long	Better	

DISTRIBUTIONS OF PARTICLES SURVIVED THE FRONT END AND ACCELERATION CUTS

Particle radii distribution Ltaper=15







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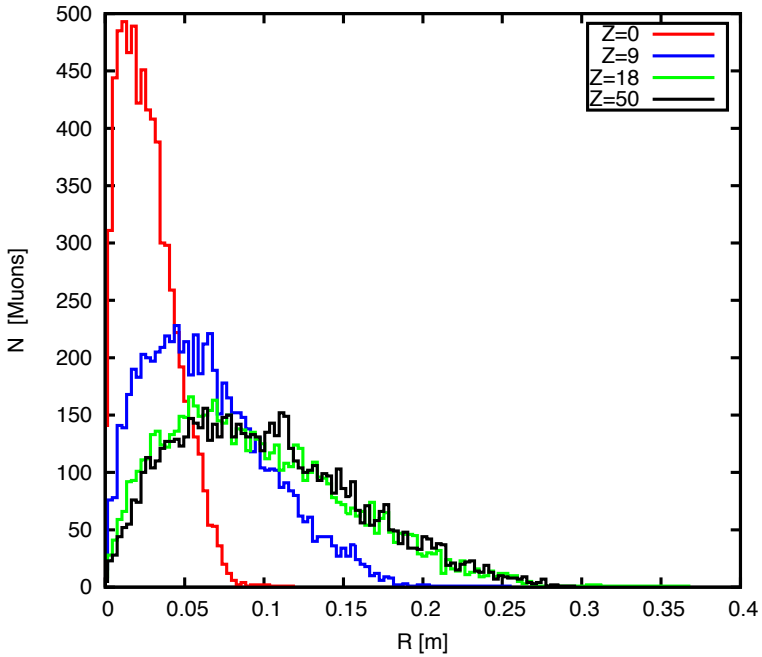
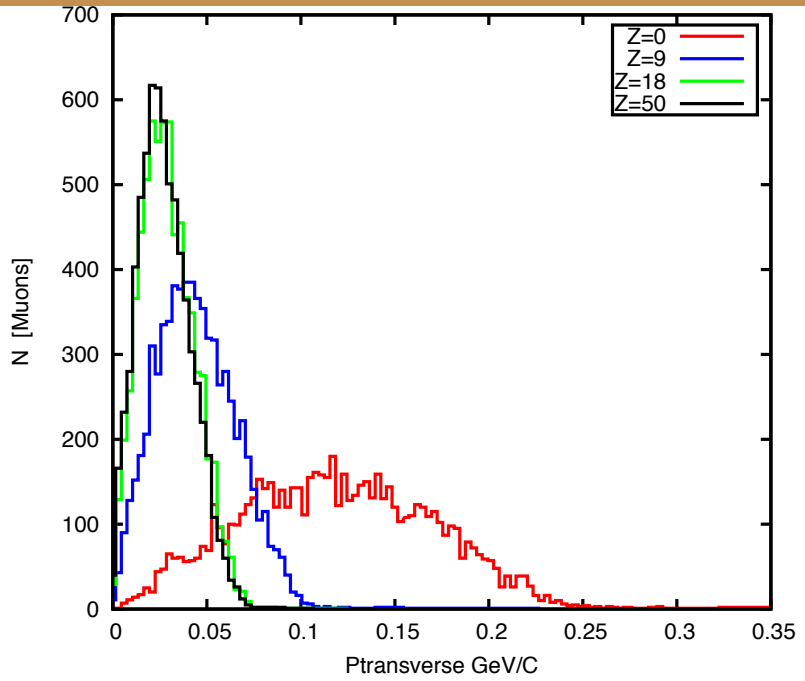
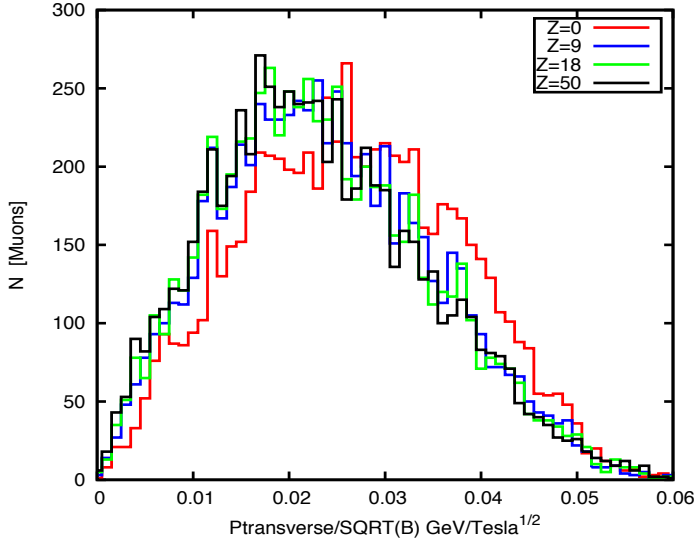
DISTRIBUTIONS OF PARTICLES SURVIVED THE FRONT END AND ACCELERATION CUTS

Particle radii distribution Ltaper=22 m







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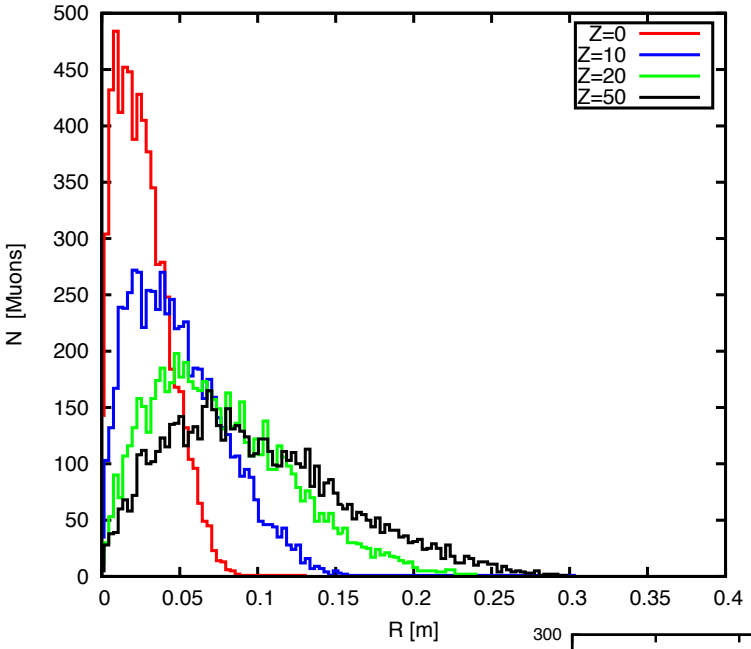
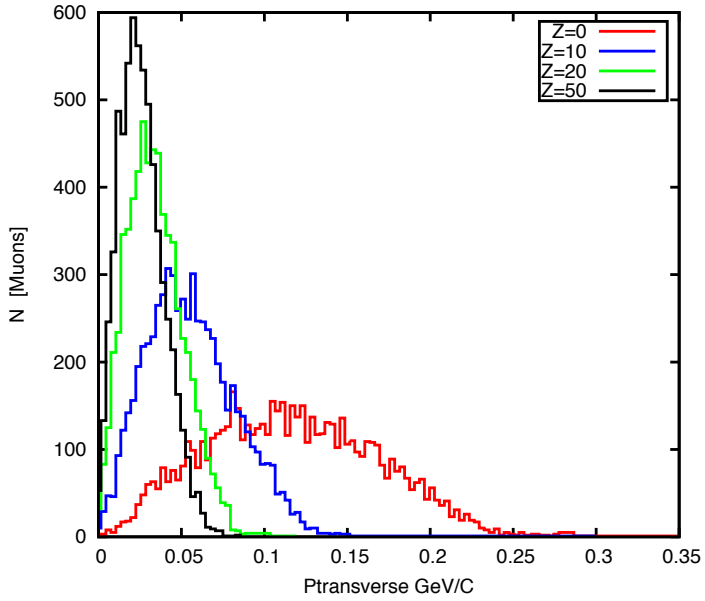
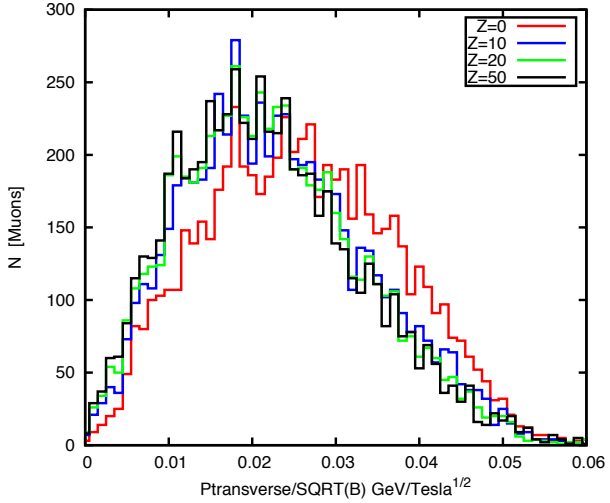
DISTRIBUTIONS OF PARTICLES SURVIVED THE FRONT END AND ACCELERATION CUTS

Particle radii distribution Ltaper=36







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