OPTIMIZING THE MUON COLLIDER/NEUTRINO FACTORY CAPTURE SECTION/TRANSPORT OF THE FRONTEND

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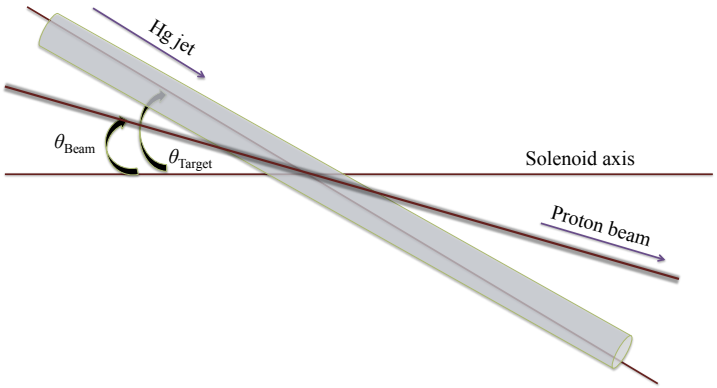
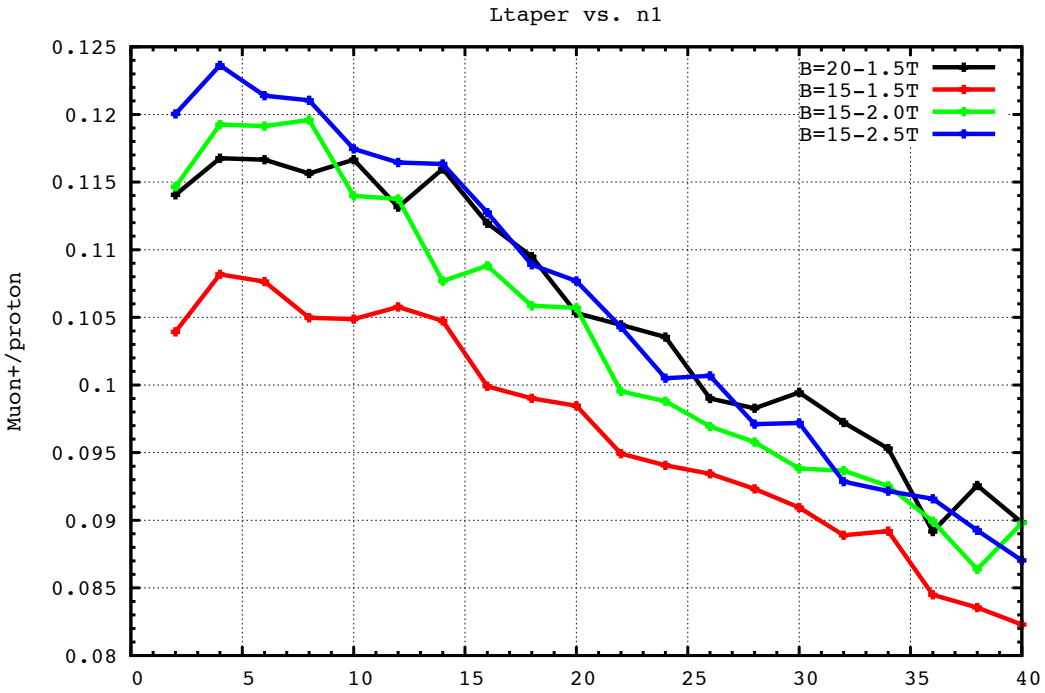
TARGET OPTIMIZED PARAMETERS

- Hg Target
  - θ_{Target}=0.137 rad
  - R_{Target}=0.404 cm
- Proton Beam
  - E=8 GeV
  - θ_{Beam}=0.117 rad
  - $\sigma_x=\sigma_y$=0.1212 cm (Gaussian Distribution)
  - $\sigma_t=\sigma_z$=0-1-2-3 nsec (Gaussian Distribution)
- Solenoid Field
  - 20-15 T peak field at target position (Z=-37.5)
  - End Field Z = 20-15 m → Bz=1.5-2.0-2.5-3.5 T
  - Aperture at Target R=10 cm - End aperture R = 30 cm

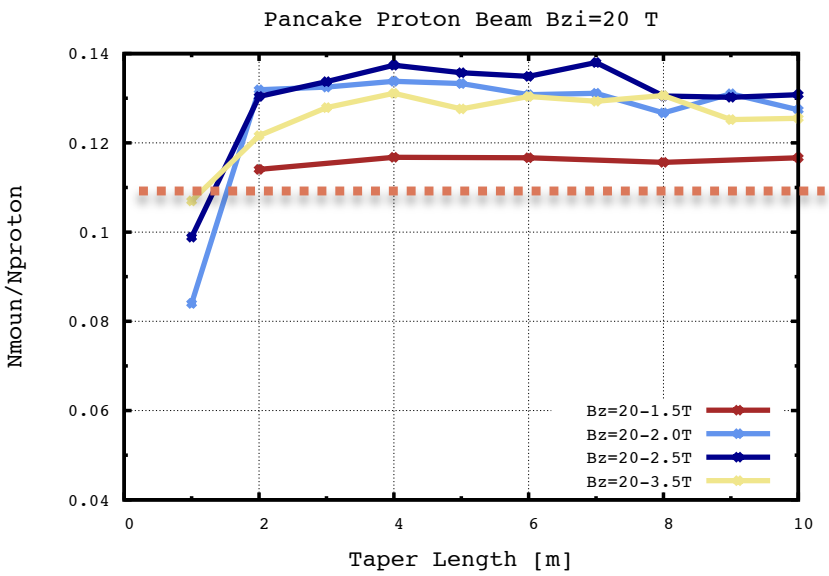


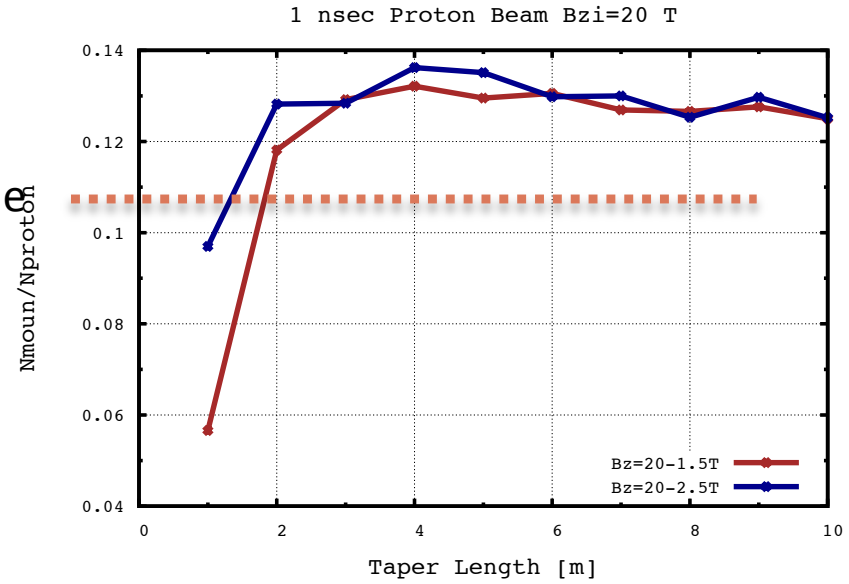
TIME & TAPER LENGTH SCAN

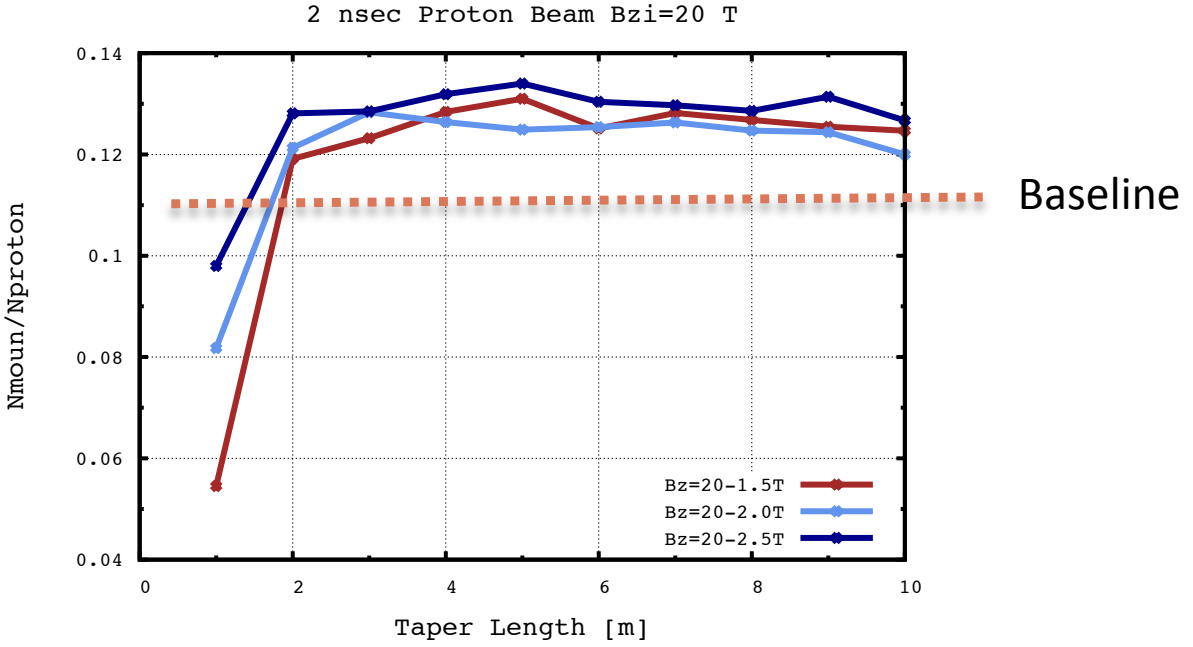
Using longer cooling section
(200 Cooling cell)



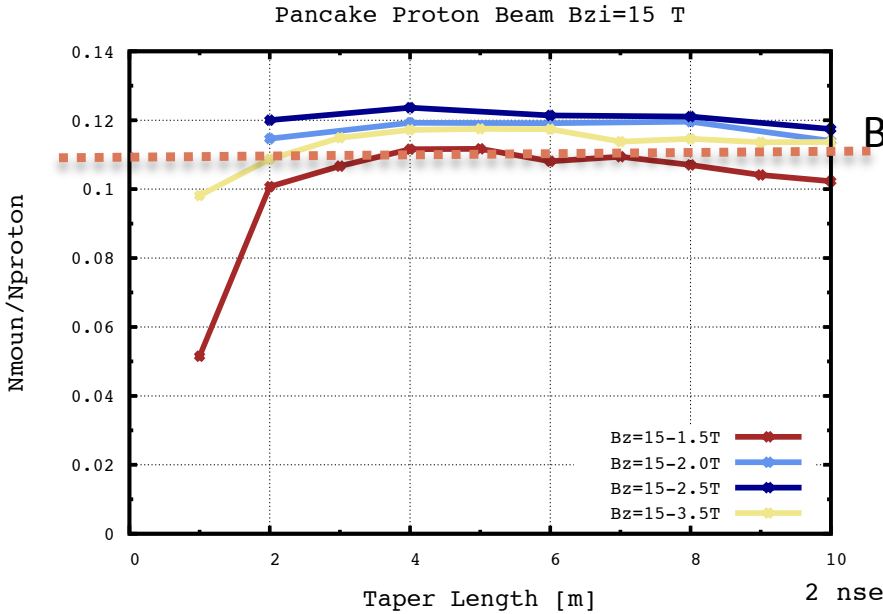
OPTIMIZED MUON PRODUCTION AT END OF FRONTEND (B_{PEAK}=20 T)



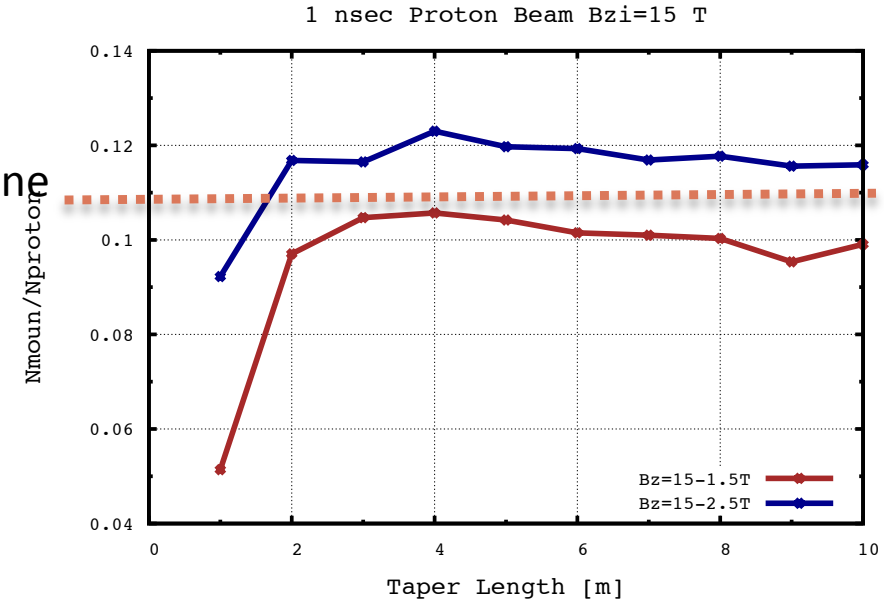


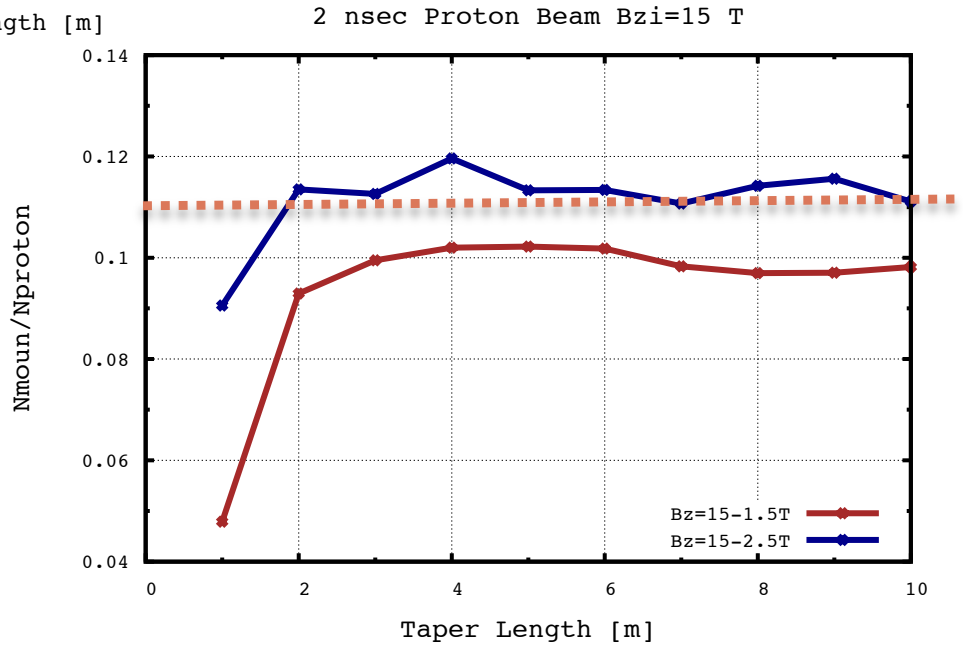


OPTIMIZED MUON PRODUCTION AT END OF FRONTEND (B_{PEAK}=15 T)



Baseline



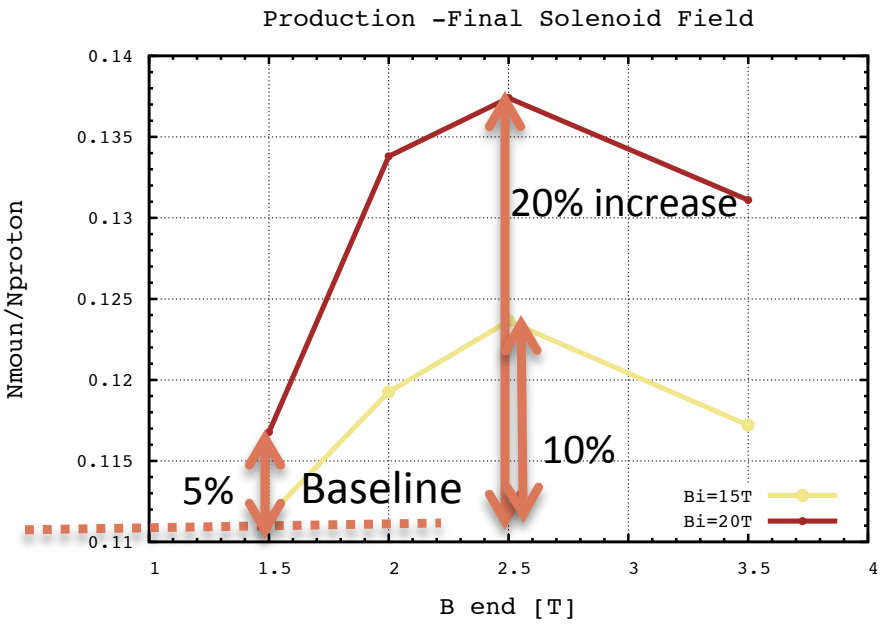


Baseline

Muon yield versus end field & Bunch Length

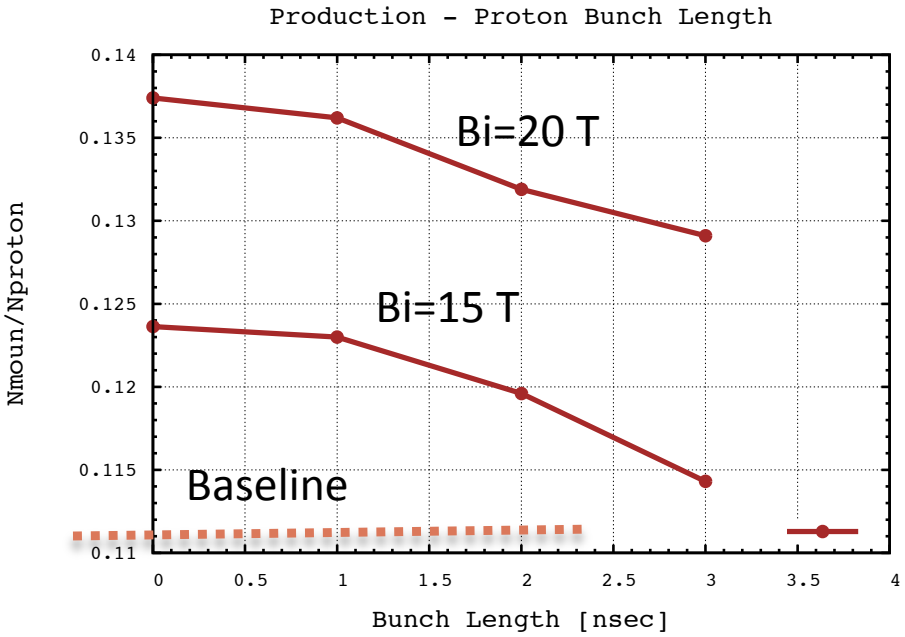
Muon yield versus end field

Bunch length=0 nsec



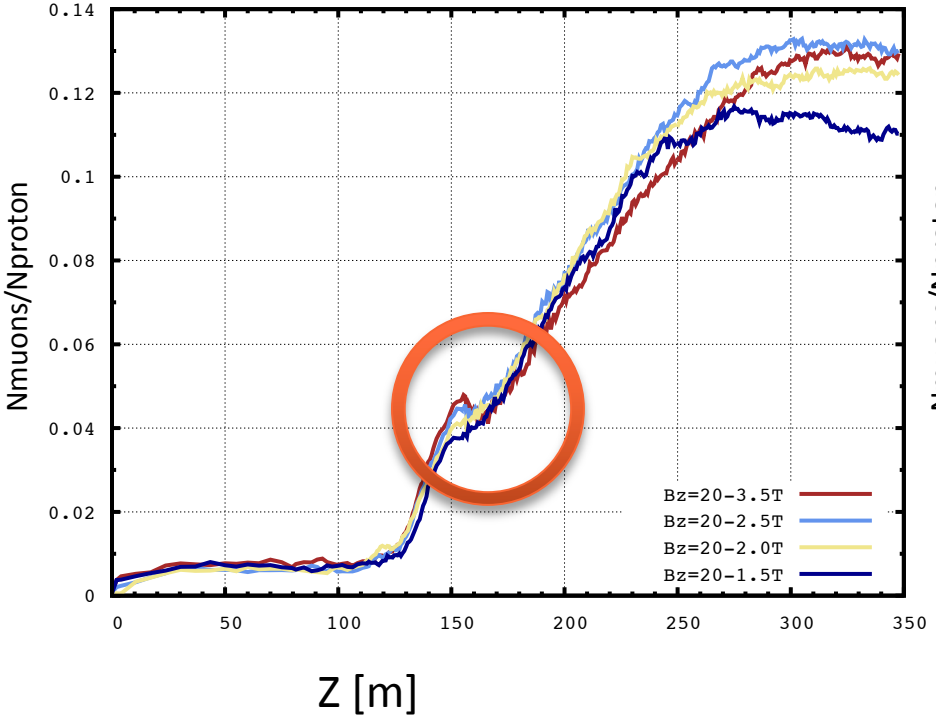
Losses at B=3.5T might be due to match to the cooling section

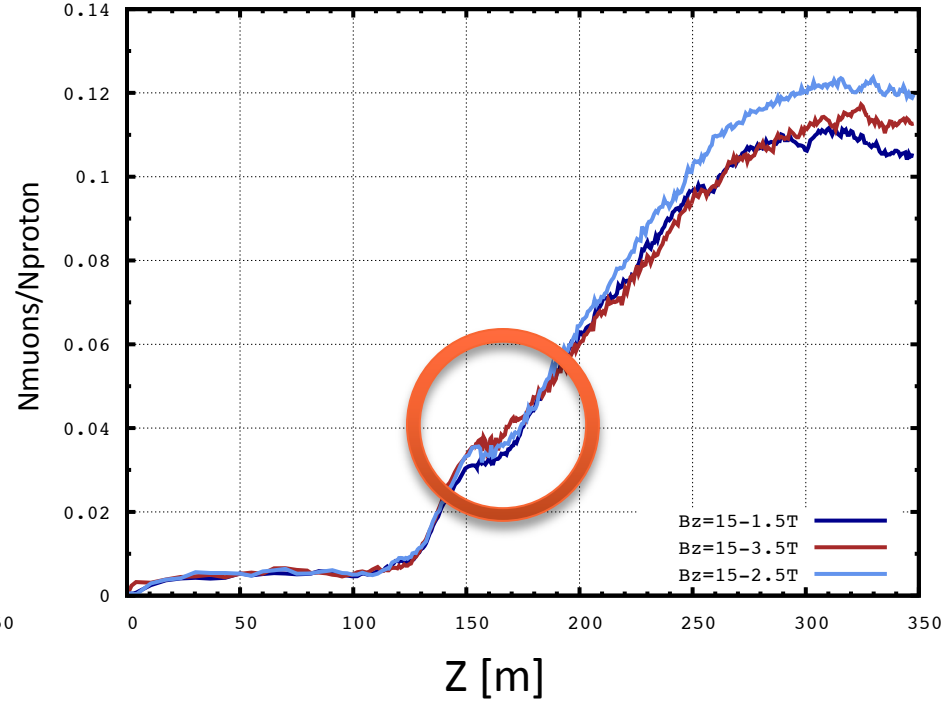
Muon yield versus Bunch Length



~2.5% loss per 1 nsec increase in bunch length

WHY WE LOSE MORE PARTICLES FOR END FIELD OF 3.5 T





Matching section before the cooling channel needs retuning for fields higher than 2.5 T (Possible increaser in yield)

CONCLUSION & SUMMARY

- Shorter tapers produce "more good" muons which could be bunched & cooled.
- The maximum yield requires taper length of 4-5 m for all cases (20-15T)

  (1.5-3.5T) any bunch length.
- Longer cooling channel is required to reach maximum cooling.
- Higher end field → more muon yield

  → Matching section before the cooling channel needs retuning

  for fields higher than 3.0 T (Possible increaser in yield)
- Longer bunch → Less yield; we lose about 2.5% per 1 nsec increase in bunch length.