OPTIMIZATION OF THE CAPTURE SECTION OF A STAGED NEUTRINO FACTORY

H.K. Sayed,*[1] H.G. Kirk,[1] K.T. McDonald[2]

[1] *Brookhaven National Laboratory, Upton, NY 11973, USA*

[2] *Princeton University, Princeton, NJ* 08544, USA

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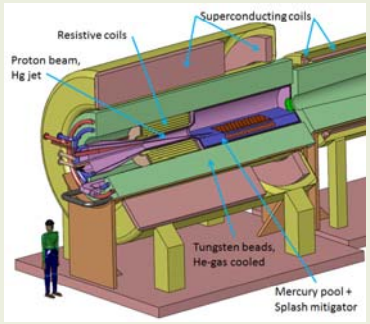
CONCEPT

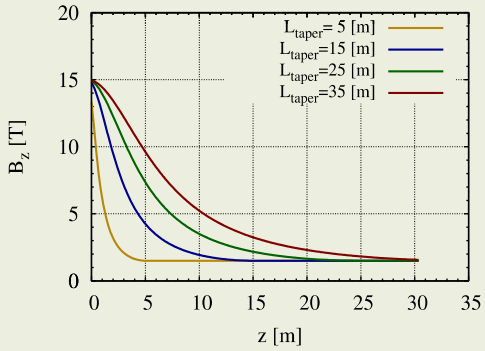
A proposed staged Neutrino Factory producing lower muon intensity of 10^{20} muons per year and 10-14 GeV muon beam energy initially requires target station for 1 MW proton beam power with a proton beam energy of 3 GeV, which could be upgraded to the full power of 4 MW at 8-GeV beam energy. The optimization of the initial Target Station and the following Decay Channel and Buncher/Phase Rotator Channels are discussed.

PION PRODUCTION & CAPTURE

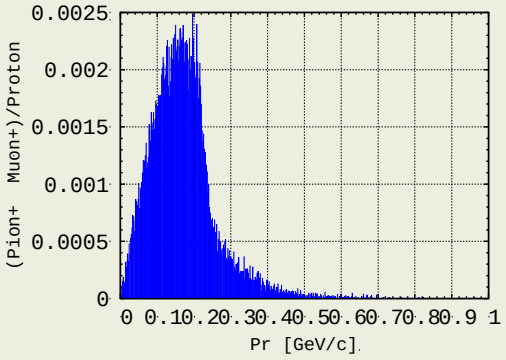
PION-PRODUCTION TARGET SYSTEM



SOLENOID CAPTURE FIELD

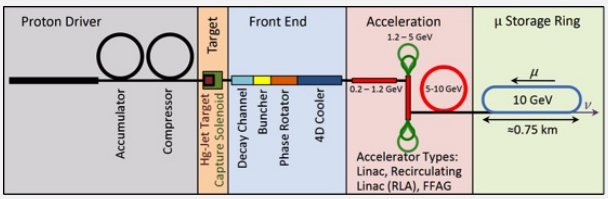


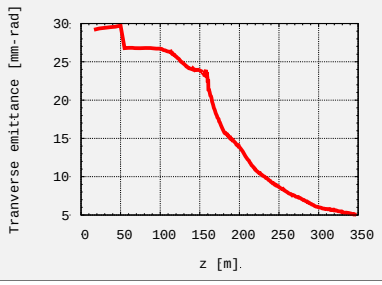
TRANSVERSE MOMENTUM SPECTRUM

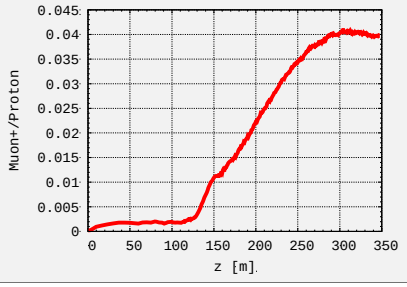


Carbon rod target	Proton beam
Length 0.72 [m]	σ_t = 2 [nsec]
Diameter 0.692 [cm]	$\sigma_{x,y}$ = 0.0865 [cm]
Angle to solenoid axis 42 mrad	42 mrad

MUON FRONT END







OPTIMIZING THE CAPTURE SOLENOID & BUNCHER/PHASE ROTATOR RF PHASE

The figure of merit for the optimization: The number of positive muons per incident proton within the subsequent muon-accelerator

Momentum acceptance $100 < p_z < 300$ MeV/c

Longitudinal phase space $A_z < 150$ mm

Transverse phase space $A_r < 30$ mm

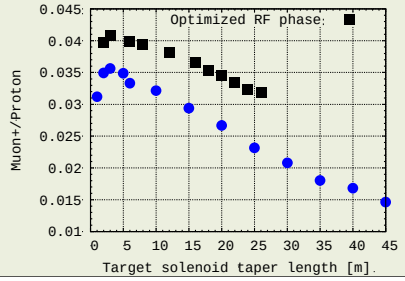
The solenoid-taper length has a distinct influence on the number of the transported muons to the end of cooling channel.

Optimum muons yields for L_{taper} = 3-4 m

RF-phase optimization

The taper length affects the longitudinal phase space ⇒ RF-phase optimization

Muon yield increased by ~ 16-40 %



*Email: hsayed@bnl.gov

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