CURRENT PROGRESS IN THE MUON COLLIDER/NEUTRINO FACTORY FRONTEND

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A new tool was implemented at NERSC ICOOL-MPI by R. Ryne.

Two test runs.

Neutrino Factory Front End Bench Mark

Nmu=45000

Icool330 runtime~ 30 mins  -  MPI-ICOOL330~ 2 mins with 480 cores
◆ A new tool was implemented at NERSC ICOOL-MPI by R. Ryne.
◆ Two test runs

Post Merge 6D G cooling Channel (R. Fernow - Diktys version)
Nmu=225000
MPI-ICOOL330~ 2 mins with 480 cores
D. Neuffer Scheme

Convert a muon bunch with large energy spread into a long string of bunches matched into 200 MHz rf cooling section

**MOTIVATION:** optimizing upstream capture-decay sections changes phase space distribution getting to buncher-rotator sections.

**Ultimately:** Global optimization of the Front-End utilizing NERSC & Genetic optimization algorithms (LBL R. Ryne & J. Qiang)

Target – Decay – Buncher – Rotator - Cooling

1. **The Drift section:** length of the section
2. **The Buncher section:**
   - length of the section
   - Bunching voltage
   - Voltage increase (parabolic increase in voltage \( V_{rf} = V_{rf_{inal}} (z/L_{buncher})^2 \))
   - Distance between the reference energy particles.
3. **The \( \phi-\delta E \) rotation:**
   - The length (optimum rf rotation section length should be adjusted)
   - rf voltage
   - The rf frequency is constant and set to the matched value at the end of the buncher
   - The rf wavelength and phase could be perturbed to optimize performance
   - Central reference energy could be perturbed for optimization.
4. **The cooling system:**
   - The rf wavelength readjusted to match the spacing between the reference particles
Tweaking Neuffer’s High Frequency Buncher & Phase Rotator

RF fixed from FE standard Lattice

Drift  Buncher  Rotator  Cooling

13/12/12
TWEAKING NEUFFER’S HIGH FREQUENCY BUNCHER & PHASE ROTATOR

RF fixed from FE standard Lattice

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<th>Drift</th>
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<th>Rotator</th>
<th>Cooling</th>
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RF Varied by ICOOL from FE standard Lattice

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RF fixed

Cooling

RF Varied

n1

P_avg+0.2

Eps_L

Eps_T*10

13/12/12
RF Frequency

FE Section | Region # | Z [m]
---|---|---
End of decay channel | 34 | 79.6
End of Buncher | 210 | 112.6
End of Phase Rotator | 308 | 130.6
End of Cooling | 2117 | 323.726
FOURIER ANALYSIS OF BUNCH STRUCTURE AT END OF PHASE ROTATOR

Time structure of Bunches at end of phase rotator

Frequency Spectrum of Bunches at end of phase rotator

~ 202 MHz