# Overview of Phase Rotation Simulations

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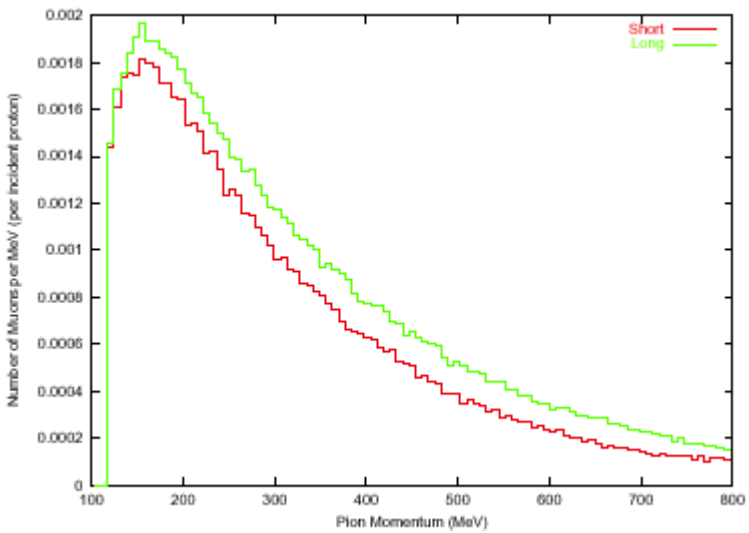
# Overview

- "phase rotation" = beam manipulations
  exit of target to start of cooling
- almost all work in this area was centered at Fermilab
  1. reoptimization of pion collection system
  2. adiabatic buncher and phase rotation
  3. muon collider front end design

# Study of solenoid taper and π decay channel

- K. Paul, C. Johnstone, N. Mokhov
- MARS beam for FS1 target: 80 cm long, 1.5 cm diameter graphite at 50 mrad
- optimized π collection as a function of solenoid taper function

  $R(z) = \{ P(z) \}^{1/k}$
- better π collection with longer taper
- optimize decay channel with B=5 T, R=15 cm
- even better with second solenoid taper down to 1.25 T



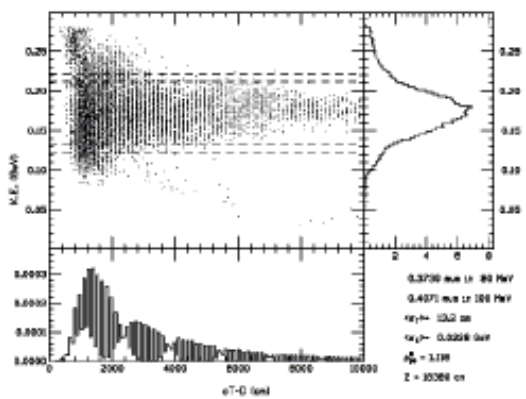

π momentum distribution for short and long solenoid tapers

π collection summary

| short (2.4 m) | | long (7.2 m) | |
|---|---|---|---|
| $\pi^+/p$ | $\pi^-/p$ | $\pi^+/p$ | $\pi^-/p$ |
| 0.163 | 0.154 | 0.181 | 0.170 |

# Adiabatic buncher and phase rotation

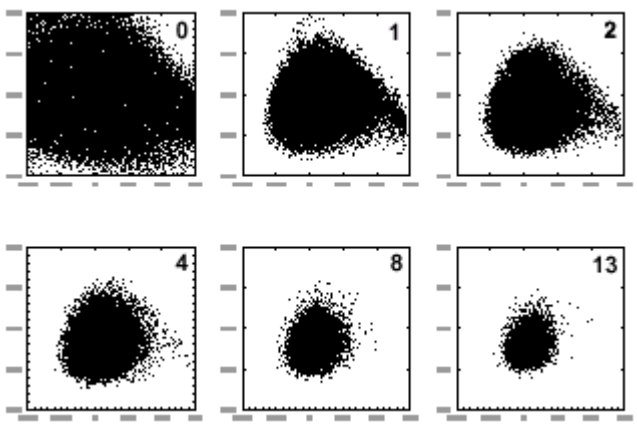
- D. Neuffer, A. Van Ginneken, D. Elvira, N. Keuss
- current status summarized by D. Neuffer [MC269]
- extensive studies using Simucool, Geant4, and Icool
  - adiabatic bunching with finite set of rf frequancies
  - improved phase rotation with vernier tuning
  - significant transmission into mismatched cooling cell
- present simulations with FS2 cooling channel give 0.22 μ/p ~ FS2 yield
- needs to be incorporated into self-consistent, integrated front end design



Longitudinal phase space after phase rotation

# Bunch compressor for a muon collider

- V. Balbekov, N. Mokhov [MC272]
- FS2 target configuration
- 4 m taper + 30 m PR-decay-drift + 72 m bunch compression ring
- hard-edge model of ring
- uses only 36 MHz, 6.4 MV/m rf
- should repeat exercise to prepare beam for NF cooling rings




Longitudinal phase space versus turn number

After BCR
0.11 μ/p
$\varepsilon_{TN}$ = 63 mm
$\varepsilon_{LN}$ = 25 mm