Working Group 1 Summary

J. Scott Berg
Brookhaven National Laboratory
FFAG06 KEK
10 November 2006

Broad Themes

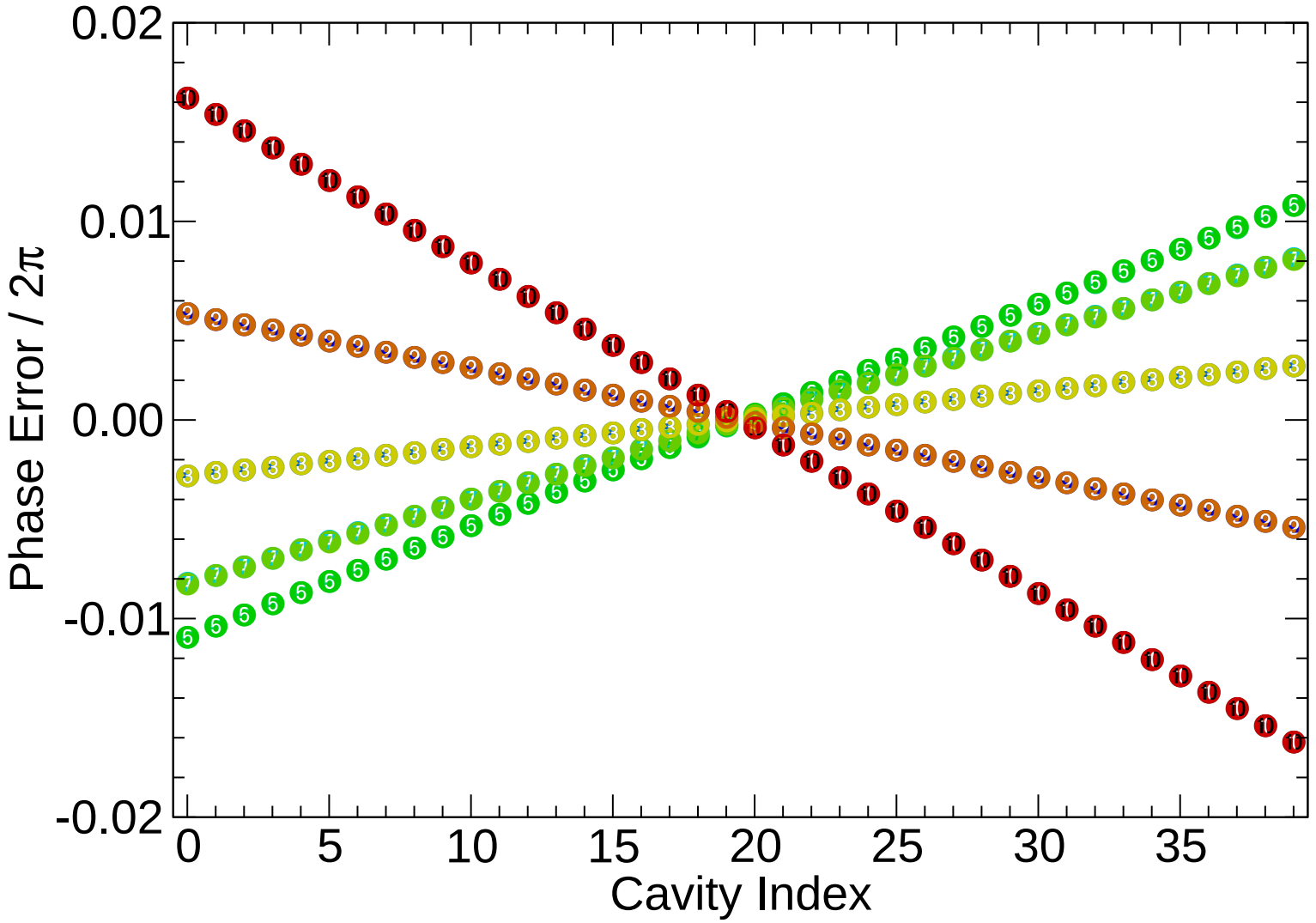
- Acceleration with harmonic number jump
- Ionization cooling
- PRISM and muon phase rotation
- Tracking and error analysis
- Understanding of scaling and non-scaling FFAGs

Harmonic Number Jump (HNJ)

- High frequency RF (200–400 MHz) good for accelerating muons
- Would like to use NC scaling FFAG at lower energies, due to time-of-flight vs. transverse amplitude issue
- HNJ lets you do scaling FFAG with high frequency RF (Mori)
- Issue: how to have cavity every cell with HNJ (Berg)
  - Looks like it can be done for muon acceleration parameters
  - Needs more work on the details

Type	Spiral	Triplet	Spiral
Radius (m)	25	200	40
k	20	150	38
h	200	1200	320

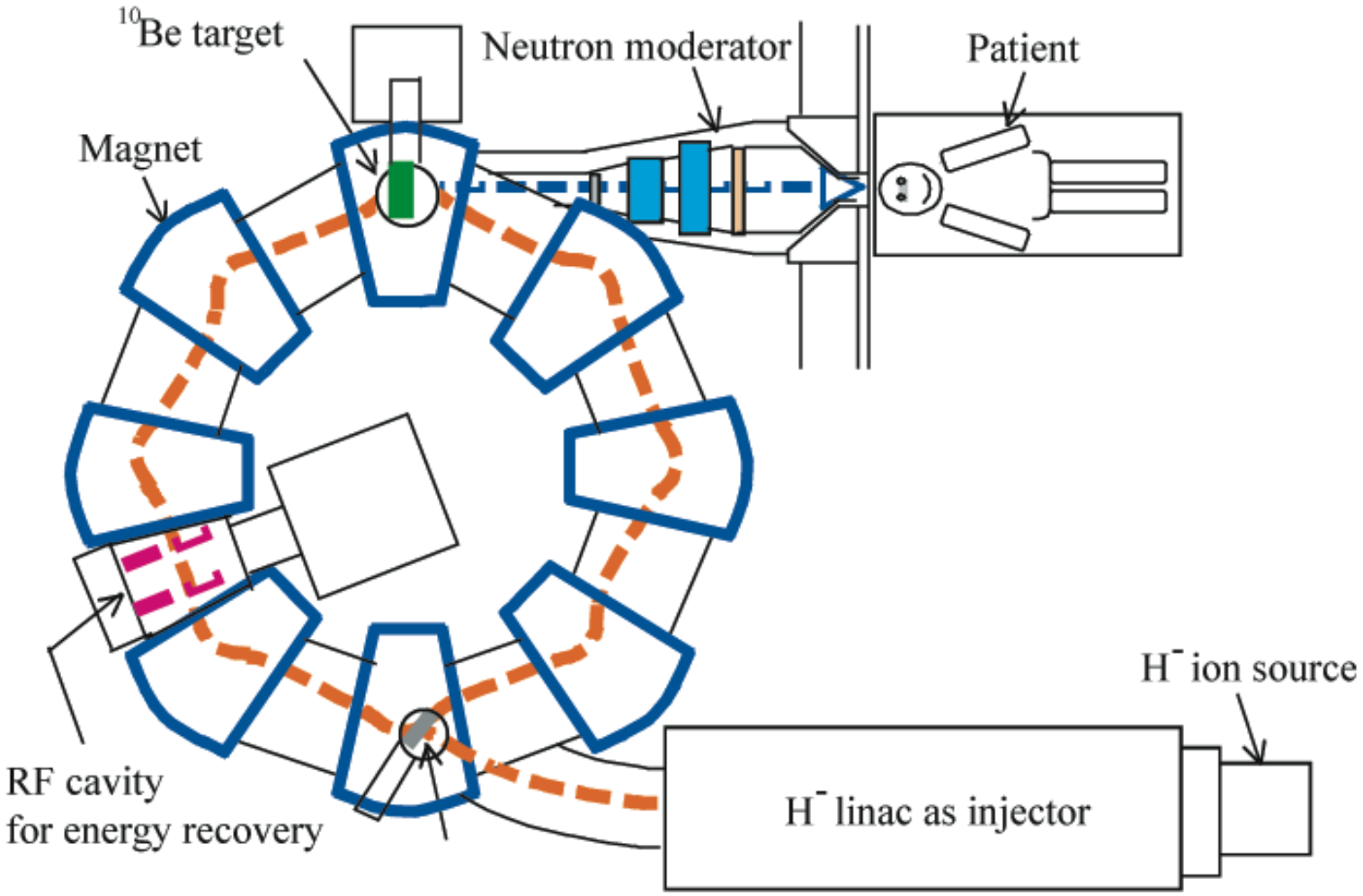
Bunch Phases in HNJ



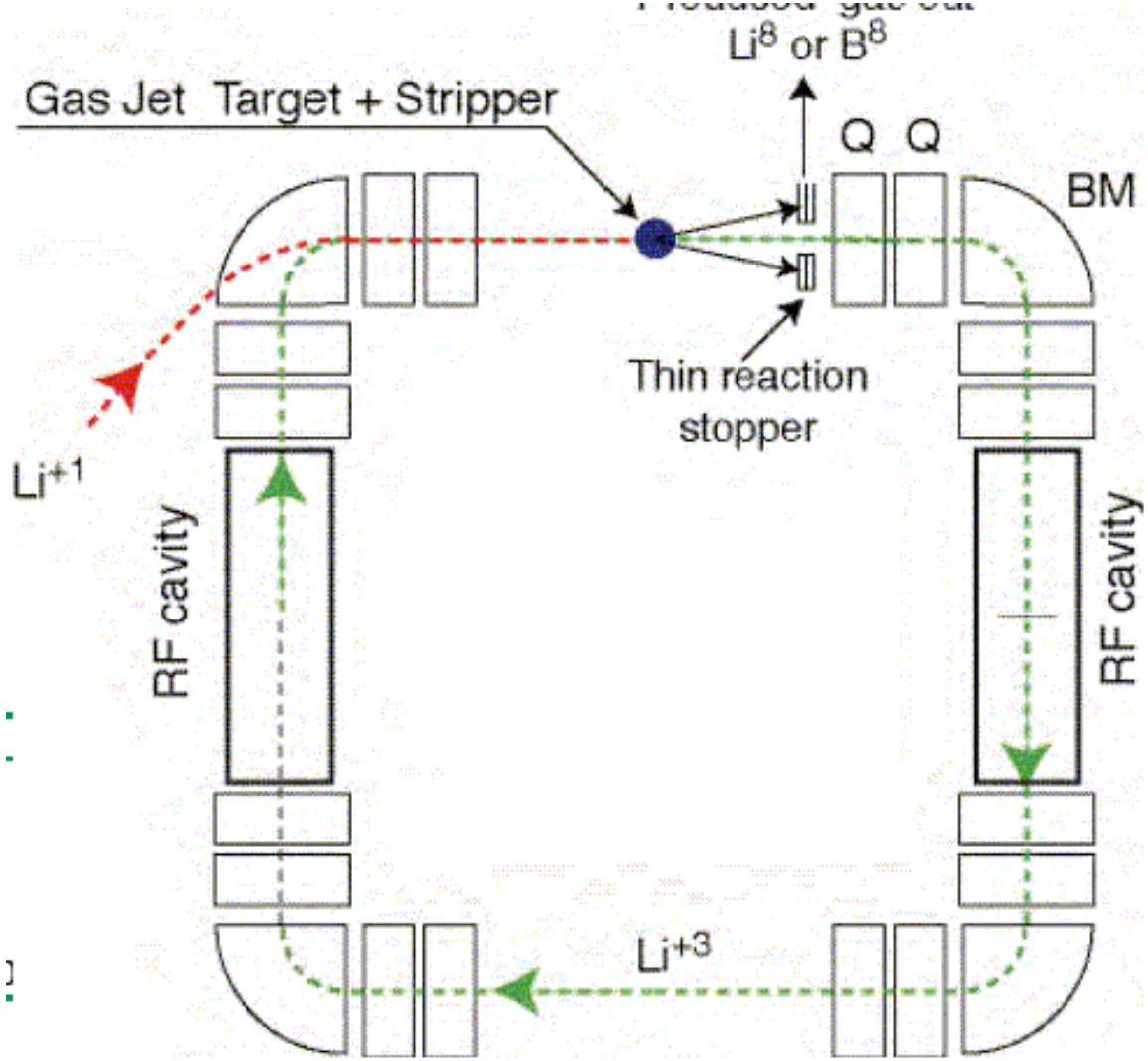
Ionization “Cooling” in FFAGs

- Lots of applications of ionization cooling in FFAGs
  - ERIT: slowing beam growth rate (Okabe)
    - ⋆ Proposed, designed, funded
  - Beta beam ion production (Neuffer, regarding work by Rubbia *et al.*)
  - Ionization cooling of muons (Sato)
- Large energy acceptance of FFAGs

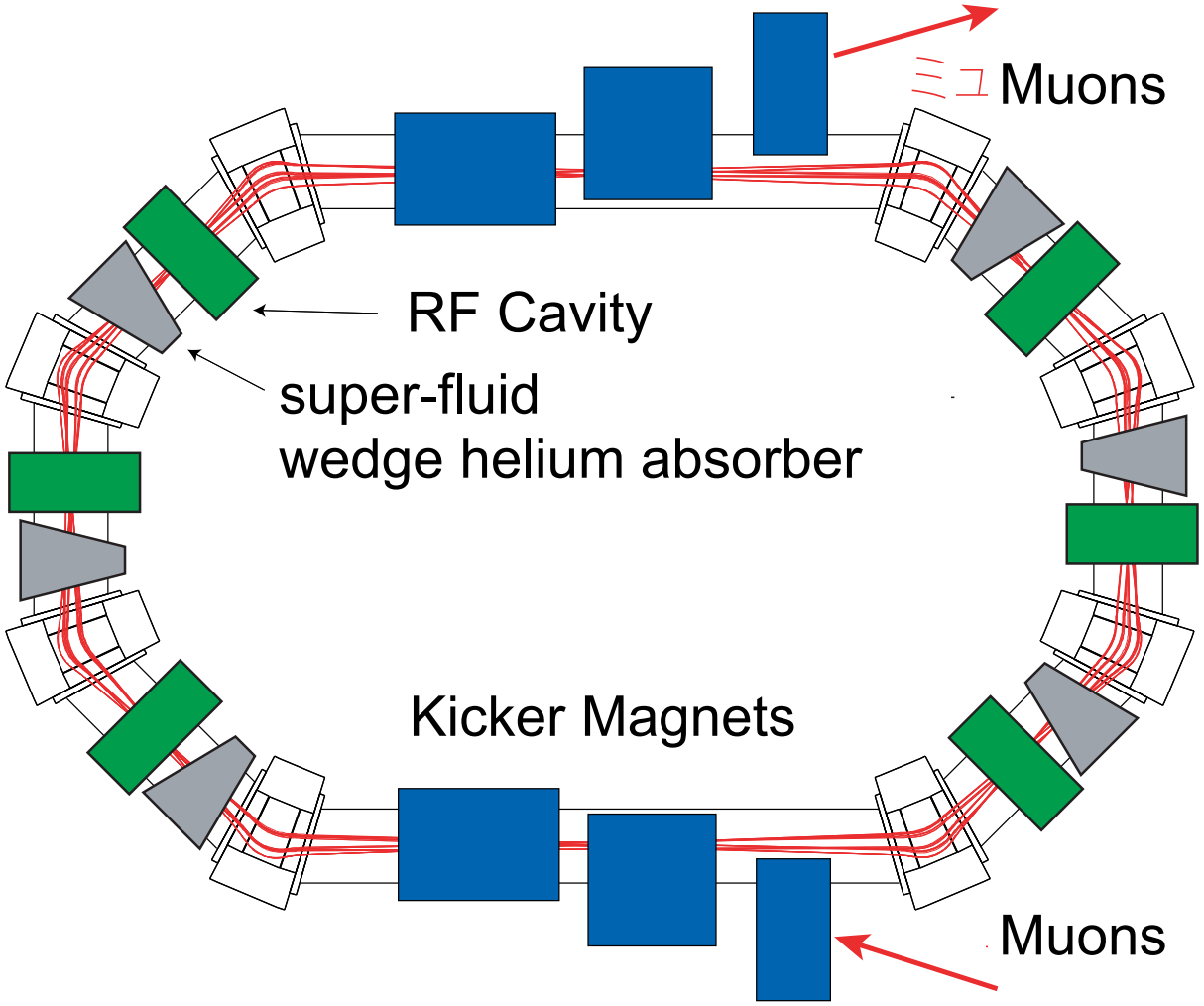
ERIT


^{10}Be target
Neutron moderator
Patient
Magnet
RF cavity
for energy recovery
H$^-$ ion source
H$^-$ linac as injector

Beta Beam Ion Production



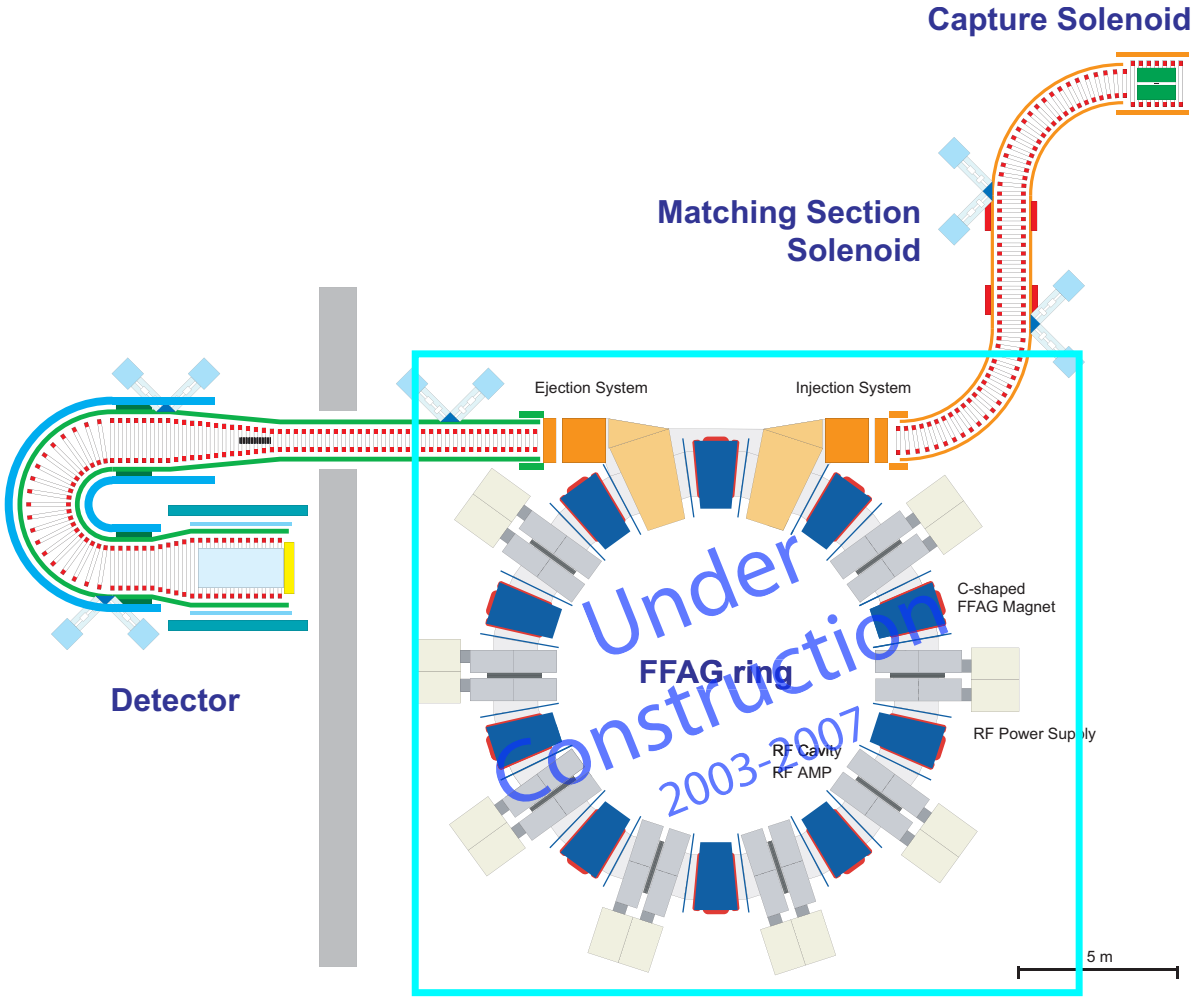
Ionization Cooling for Muons



PRISM and Phase Rotation (Sato)

- PRISM is under construction
- Don’t have enough money for all cavities
- Ideas for improving cavity perfomance (Ohmori)
  - Improving MA core impedance
  - Ceramic cavities
- Use of PRISM-like lattice to do neutrino factory/muon collider phase rotation (Kurup)

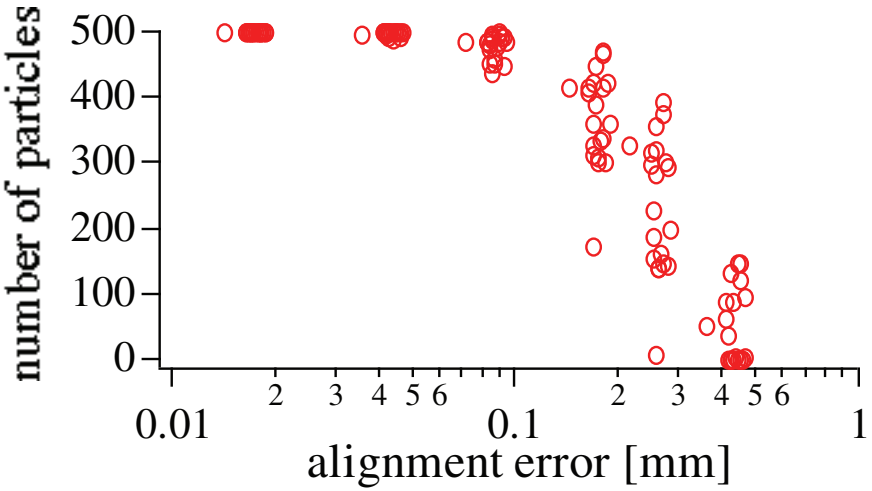
PRISM

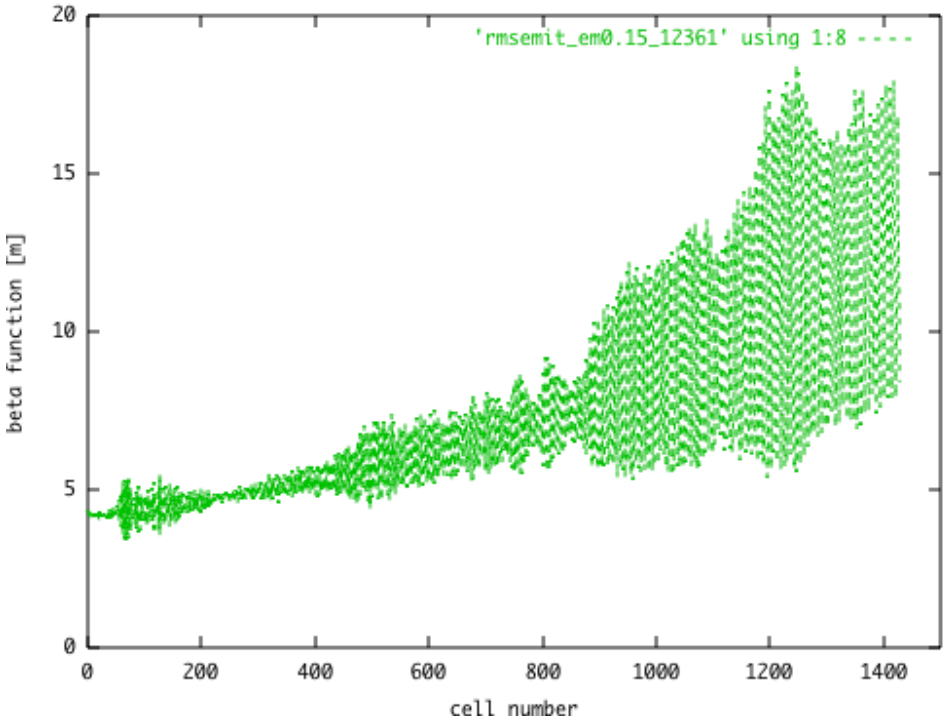

Capture Solenoid
Matching Section
Solenoid
Ejection System
Injection System
Detector
FFAG ring
C-shaped
FFAG Magnet
RF Power Supply
RF Cavity
RF AMP
Under
Construction
2003-2007
5 m

Tracking and Error Analysis

- Work being done on error analysis for muon machines and EMMA (Machida, Méot)
- Understanding of source of growth, sort of (Machida)
  - Envelope mismatch leading to large amplitudes and then distorted by nonlinearities
  - $\nu_x - 2\nu_y$ resonance

Error Analysis





Understanding Non-Scaling and Scaling FFAGs

- Can construct FFAG with very small chromaticity (Machida)
- Machine looks comparable to scaling FFAG

Conclusion

- FFAGs are finding more expanded uses
  - Ionization cooling
  - Phase rotation
- We are increasing our understanding of FFAGs and coming up with more ideas
  - Low-chromaticity non-scaling FFAGs
  - Error analysis of FFAGs
  - Harmonic number jump with many cavities
- PRISM is proceeding with construction
  - Cavity R&D is continuing