

Mori's Scaling FFAG Accelerator, with Berg's Thoughts

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Authorship

- Ideas by Yoshi Mori and Thomas Planche
- With my commentary thrown in!

Why Scaling FFAGs

- FFAGs allow many turns, increasing efficiency
- Non-scaling FFAGs have problems at low energy
 - Maybe even problems elsewhere...

Problems with Scaling FFAGs for Muon Acceleration



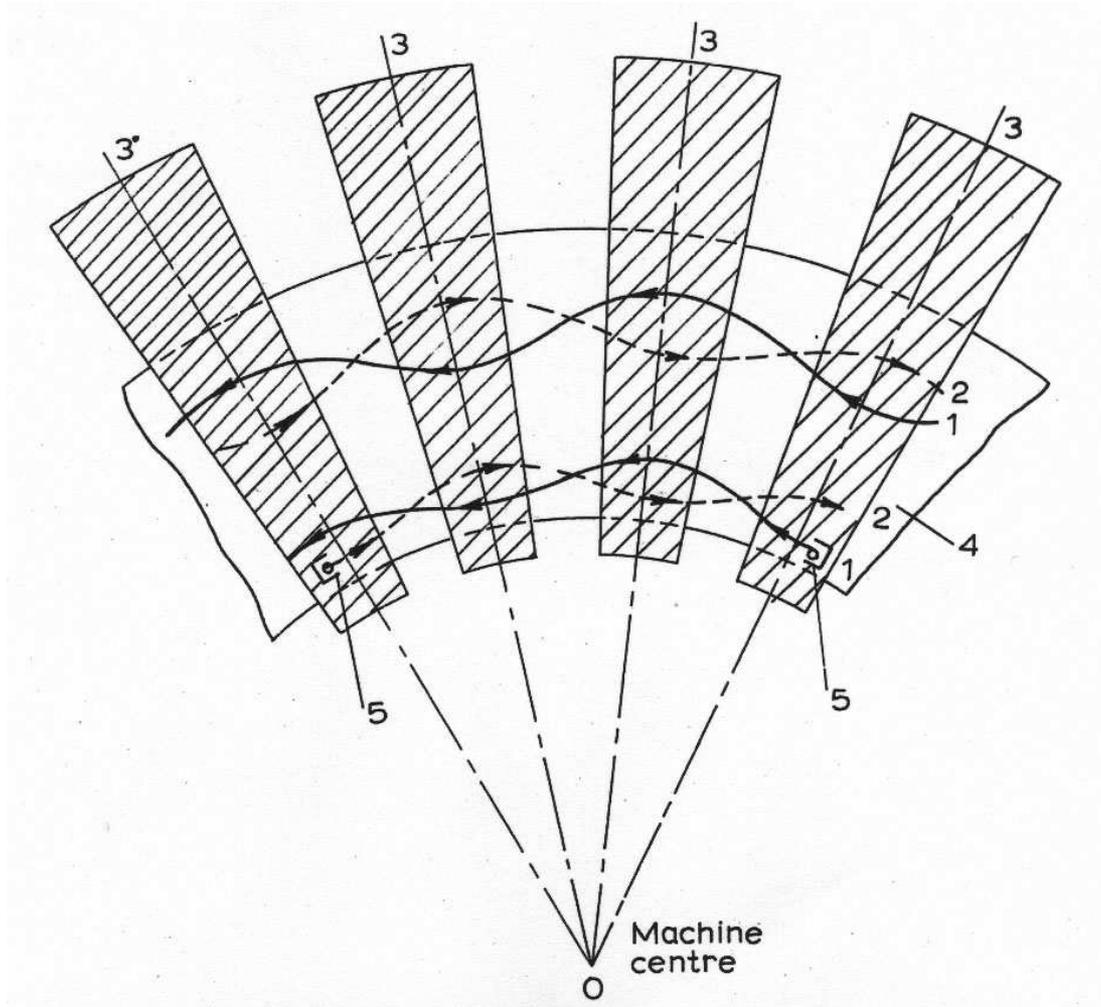
- Large apertures of scaling FFAG
- High field gradient magnets become unrealistic
- Solution: consider lower energies
 - Lower-field magnets
 - Use superferric magnets if high (but not too high) fields required

Problems with Scaling FFAGs for Muon Acceleration



- Large time of flight variation
- No time to vary RF frequency
- Solution: harmonic number jump (HNJ)
 - High frequency, different harmonic each turn
- Must fill ring with cavities
 - Can only synchronize HNJ in one direction
- Solution: FODO scaling FFAG

FODO FFAG



Preliminary Parameters

Injection Energy	3.2 GeV
Extraction Energy	10 GeV
Circumference	754 m
Cells	72
Maximum field	3.1 T
Orbit excursion	0.82 m

Harmonic Number Jump

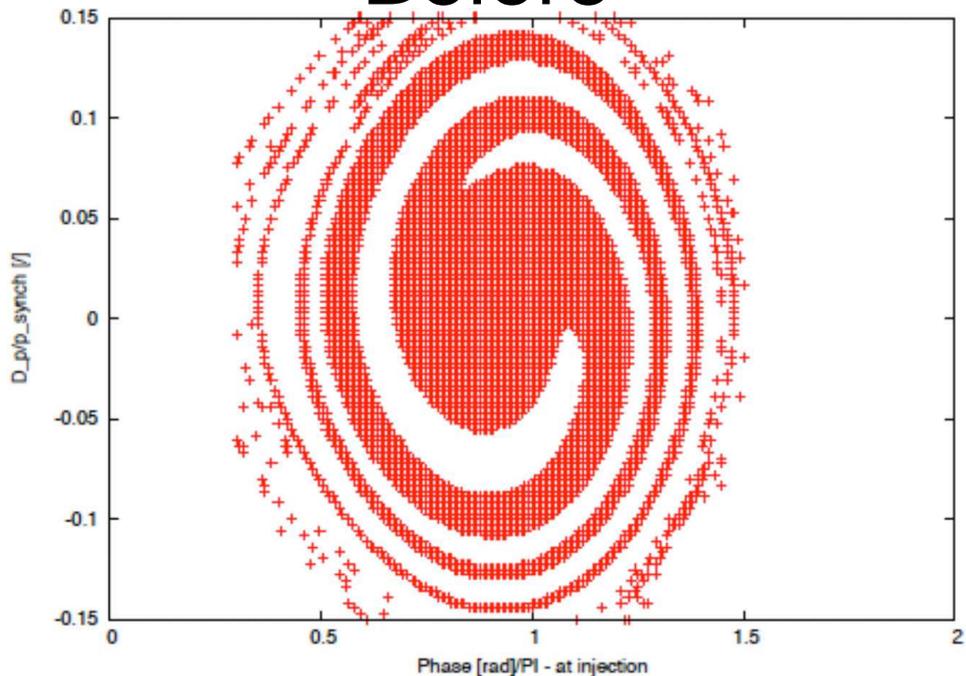
- Change harmonic number by 1 each turn
- Requires voltage gain varying with turn
 - Time of flight not linear with energy
- Solutions
 - Voltage varies with horizontal position
 - Coordinate phase with desired voltage variation
 - ✦ Seems more realistic

Longitudinal Tracking

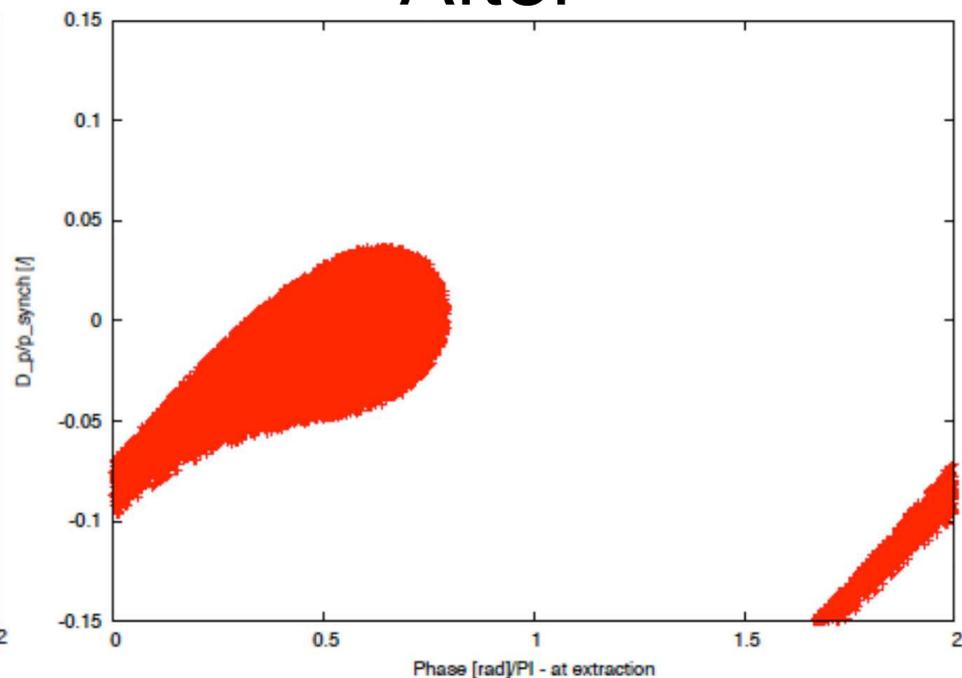
- Preliminary longitudinal tracking
- Get strong longitudinal focusing
 - Very good for bunch trains
- Energy acceptance a bit tight, but close
- Only 5 turns

Longitudinal Tracking

Before



After



My Personal Thoughts

- Good ideas here
 - Unidirectional FODO
 - HNJ correcting voltage gain with phase slip
 - Strong longitudinal focusing from HNJ
- Apertures pretty wide
 - Wide for 200 MHz cavity
 - High fields (likely beyond 3.1 T); maybe OK with superferric
- Only 5 turns so far

My Personal Thoughts

- May be able to improve all these parameters
- Interesting point of comparison to other designs
- My wife says I'm always too negative. . .