Hybrid Synchrotron Arc: 2 Dipoles per Half Cell

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Advanced Accelerator Group Meeting

28 July 2011

Basic Structure of Machine

- Hybrid synchrotron using fixed cold and warm ramped dipoles to get
  - High average bending field
  - Extremely fast ramping
- Accelerate 375 GeV to 750 GeV
- 8 straights for RF, injection, extraction, etc.

Basic Arc Cell Structure

- FODO cell, quads split in two
  - Eventually have sextupole in middle
  - Currently zero length nothing with drifts around it
- 75 cm drifts between magnets
- Cold 8 T dipole
- Warm ramped dipole, −1.8 to +1.8 T
- Quadrupoles ramped, maximum pole tip 1.3 T

Basic Arc Cell: Dipole Arrangement

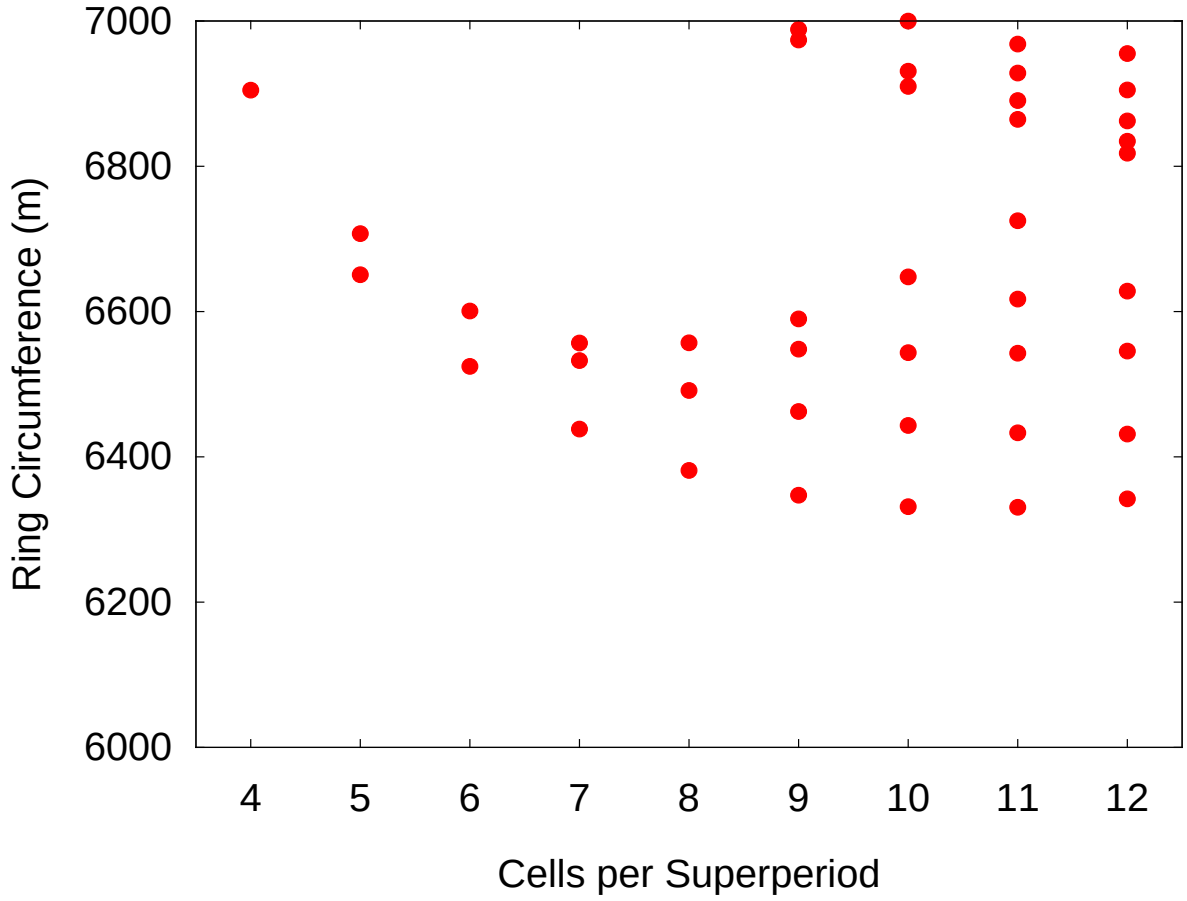
Optimization Process

- Find closed orbit at 375 GeV with warm dipoles at −1.8 T, 750 GeV with warm dioples at +1.8 T
- Set tunes to desired values, times of flight equal using quad fields and cold dipole length
- Minimize excursion with warm dipole length
- Adjust quadrupole lengths so pole tip fields low enough

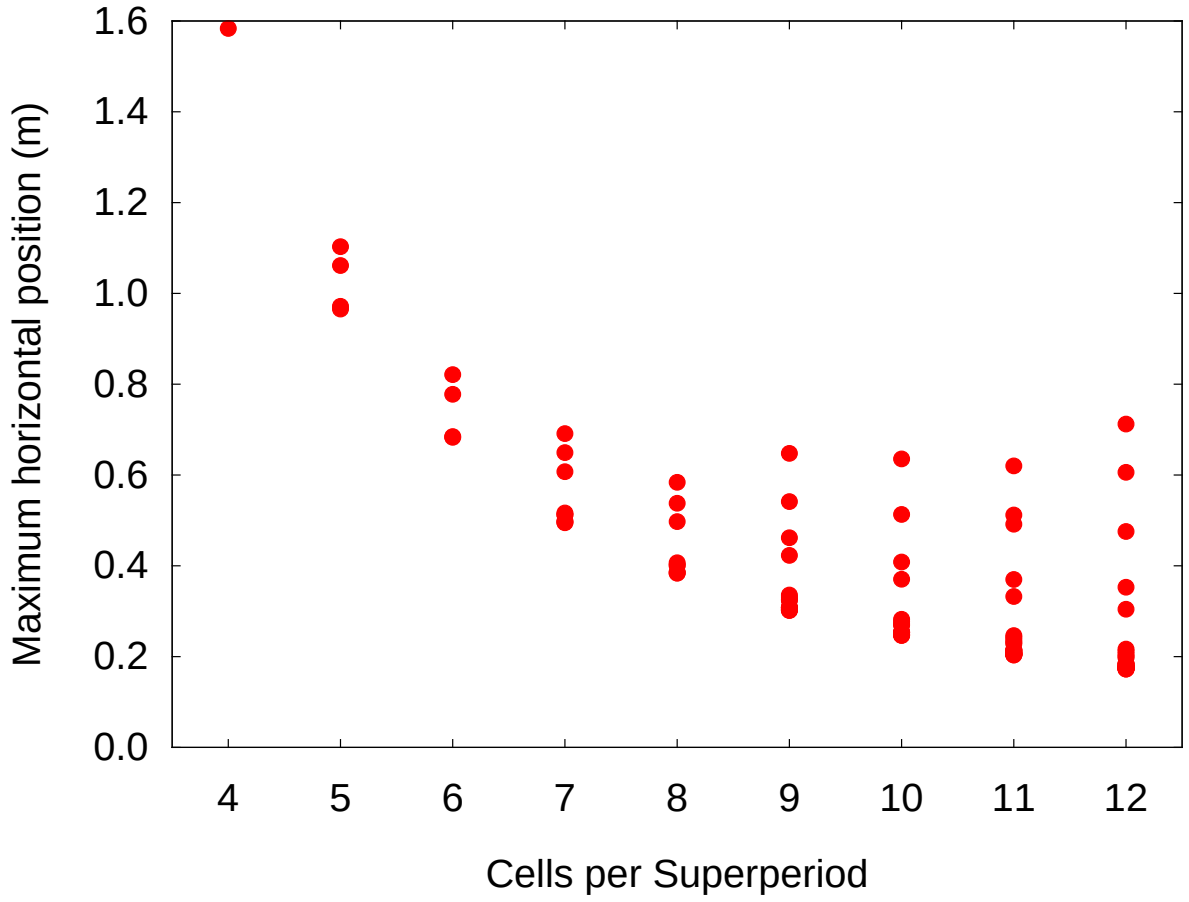
Results and Analysis

- Results look awful, but intentionally non-optimal lattice structure
  - Should have more dipoles per cell
  - Probably better with cold dipole near D
- Look at how excursions, circumference depend on number of arc cells

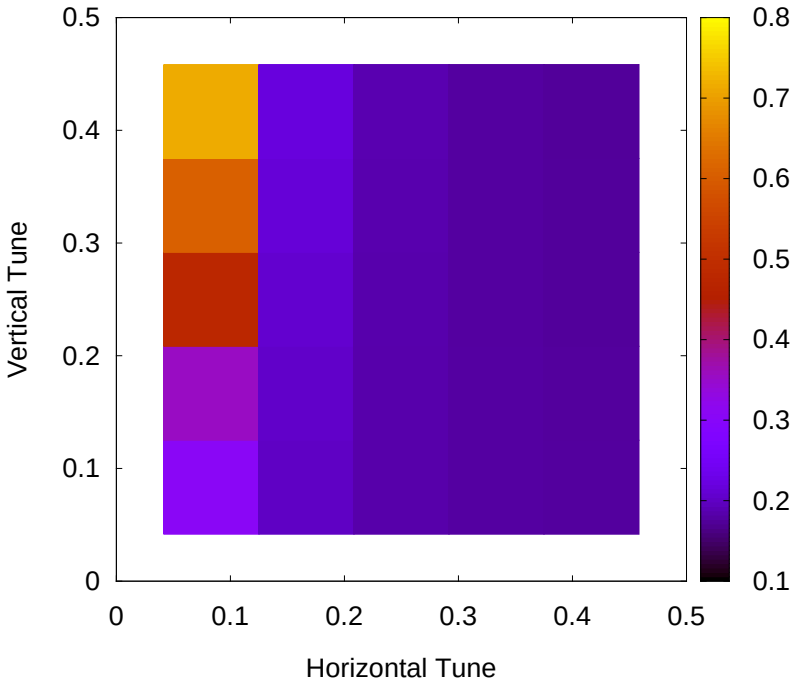
Ring Circumference (Arcs Only)

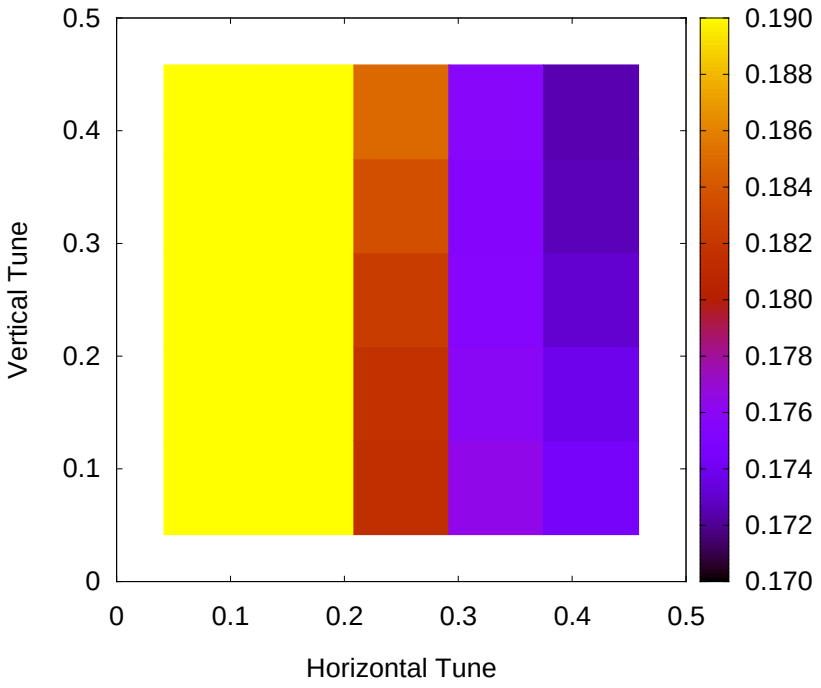


Maximum Orbit Excursion

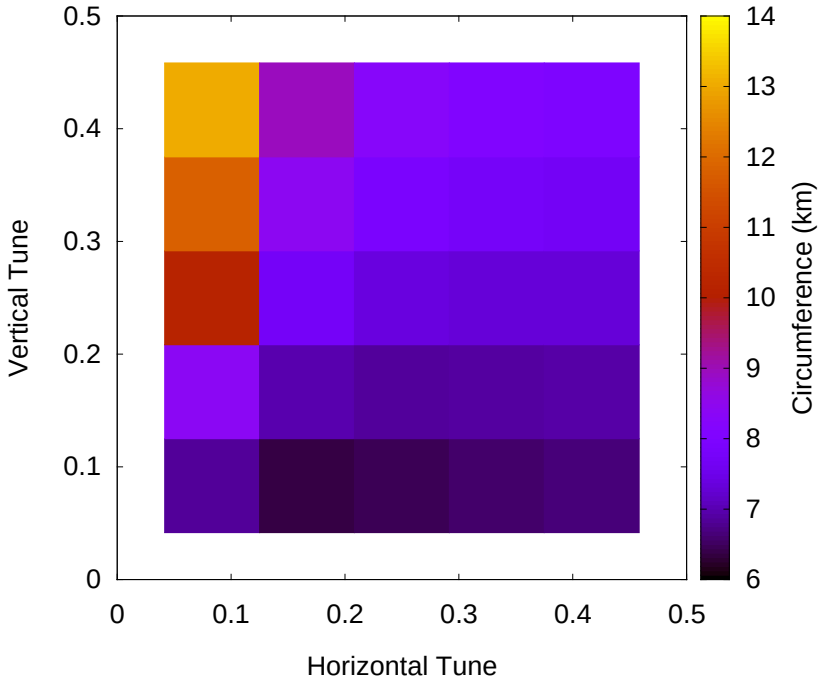


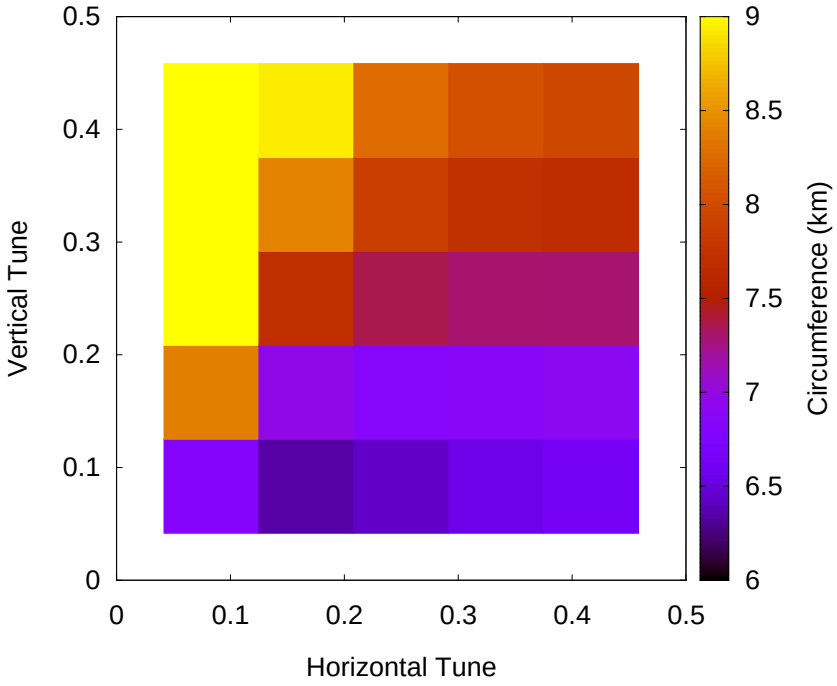
Displacement vs. Tune





Circumference vs. Tune





Results and Analysis: Cold near F

- Circumference min at 11 cells/superperiod
- Aperture reduced for more cells
- Lower aperture for higher horizontal tune
  - Dependence on vertical tune weaker
- Shortest circumference for low vertical tune, moderate horizontal tune, vertical most important

Results and Analysis
Dipole Arrangement

- Only first couple results for cold near D
- Apertures comparable: largest near warm dipole
- Circumference much shorter when warm near F
  - Greater excursion in F
  - F acts as combined-function magnet