

# **Non-Scaling FFAG Arcs for Muon RLAs**

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Conferences/08FFAG/arcRLA.pdf](http://keil.home.cern.ch/keil/Conferences/08FFAG/arcRLA.pdf)

## Motivation and History

- Motivation
  - 2 RLAs in IDS design of neutrino factory have 2 drop-shaped arcs at either end
  - Ratio of beam momenta  $\leq 2$  within range of typical non-scaling FFAG rings
  - Replace the 2 arcs in IDS design each by one non-scaling FFAG arc?
- History
  - Sessler and Keil had racetrack RLA at FFAG workshop in 2002 with compact arcs, expanded straight sections for RF cavities with  $D_x = 0$  at reference momentum, and adiabatic transitions between them
  - We considered  $\delta p/p$  a continuous variable, saw spikes of  $D_x$  when  $Q_x$  had certain values at certain values of  $\delta p/p$ , and got discouraged
  - There were much less spikes in  $\beta_x$  and  $\beta_y$
  - It should be possible to avoid spikes at just two values of  $\delta p/p$  by choice of appropriate values of the cell tunes  $q_x$  and  $q_y$  at these values of  $\delta p/p$
  - Sessler, Trbojevic and Keil have compact gantries with change of sign of curvature, and know how to match at reference momentum

## Implementation

- Typical FFAG rings designed such that difference  $\Delta t$  in times of flight ToF vanishes between two extreme values of  $\delta p/p$
- $\Delta t$  could take any small value, and compensate differences in ToF in other parts of RLA
- Chicanes are not needed
- No restriction of difference between largest and smallest ToF as in FFAG for muons
- Gantries use triplet lattices with reflection symmetry and  $D_x = D'_x = 0$  once in cell
- Change curvature to achieve drop shape where  $D_x = D'_x = 0$ , which only works at reference momentum
- Could use Meads's insertions
- Fun part is switching magnet and surrounding elements, which must match orbits and orbit functions at 2 values of  $\delta p/p$  simultaneously
- No resonances are crossed
- Since acceleration is in buckets, dependence of ToF on transverse amplitude does not smear out the bunches longitudinally, but rather excites synchrotron oscillations