

# Hybrid Fast Ramping Synchrotron Lattice Design

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# Don Summer's Basic Concept

- Need a high average bending field
- But want to ramp like a synchrotron
  - Requires warm magnets with low field
- Solution: interleave fixed superconducting magnets and ramped warm magnets
  - More interleaved magnets gives:
    - Less excursion (like single magnet with average field)
    - More space wasted in drifts

# Don's Basic Cell Design

- FODO cells with 5 dipoles in each drift



- In addition to this, we need sections for
  - Injection and extraction
  - RF
- Will need to match into these
- Need to keep time of flight constant

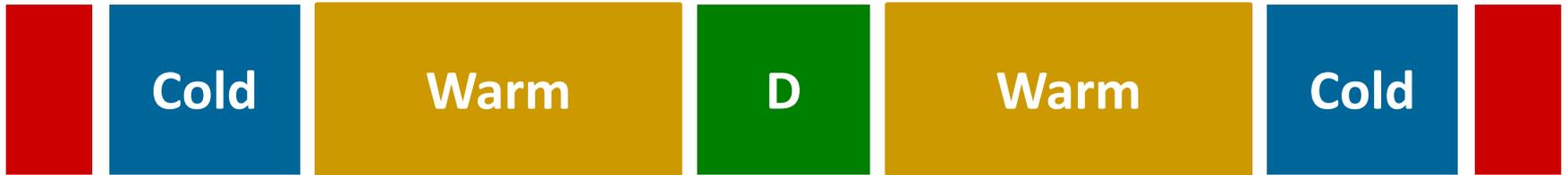
# Decisions on Structure

- 8 RF sections
  - Get sufficient synchrotron phase advance
  - More sections increases circumference
  - Three cells, two with RF
  - Third (center) cell for injection/extraction
- Arc-to-straight matching sections: 2 cells
  - Eliminate closed orbit variation with energy
  - Zero dispersion

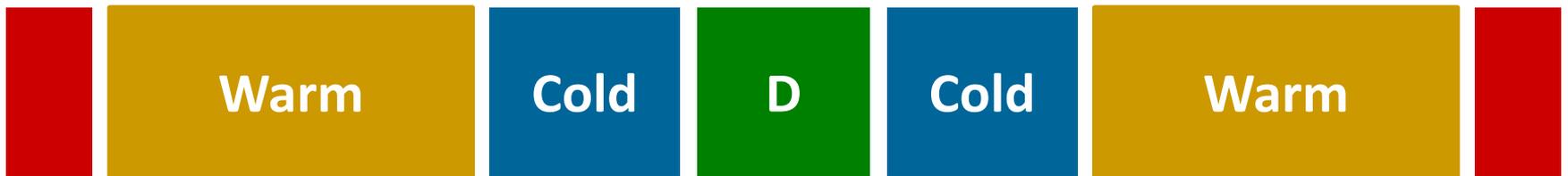
# My current studies

- Arc cell has constant tunes and time of flight
- Look at optimum structure for arc cell
  - Number and arrangement of dipoles in cell
  - Number of cells per arc
  - Increasing either count at first reduces excursions
  - With large counts, improvement stops
    - Inter-magnet drifts dominate length
    - Increased quadrupole strengths for short cells

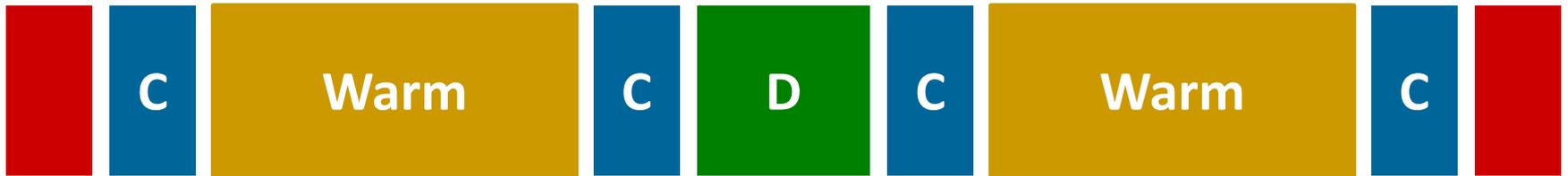
# Arrangement of Dipoles



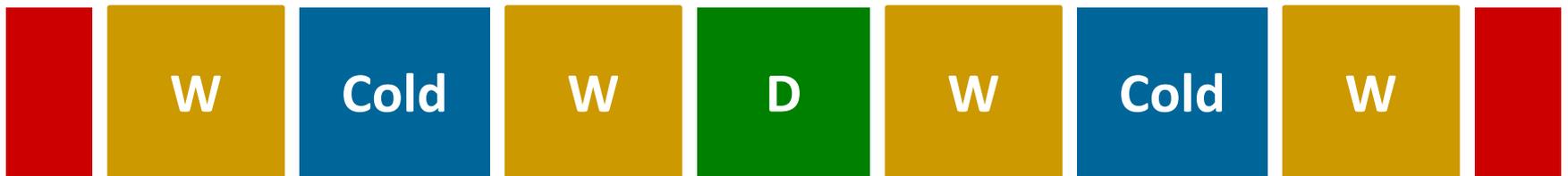
VS.



# Arrangement of Dipoles



VS.



# My Current Status

- Optimizing design of my first cell
  - 4 cells per arc (32 cells for full ring!)
  - 1 warm and 1 cold dipole per half cell
  - Starting with cold near F
- Not completed, but
  - Excursions are huge (expected)
  - Excursions severely imbalanced in F and D: warm near F likely better