Half Flip 6D Lattice

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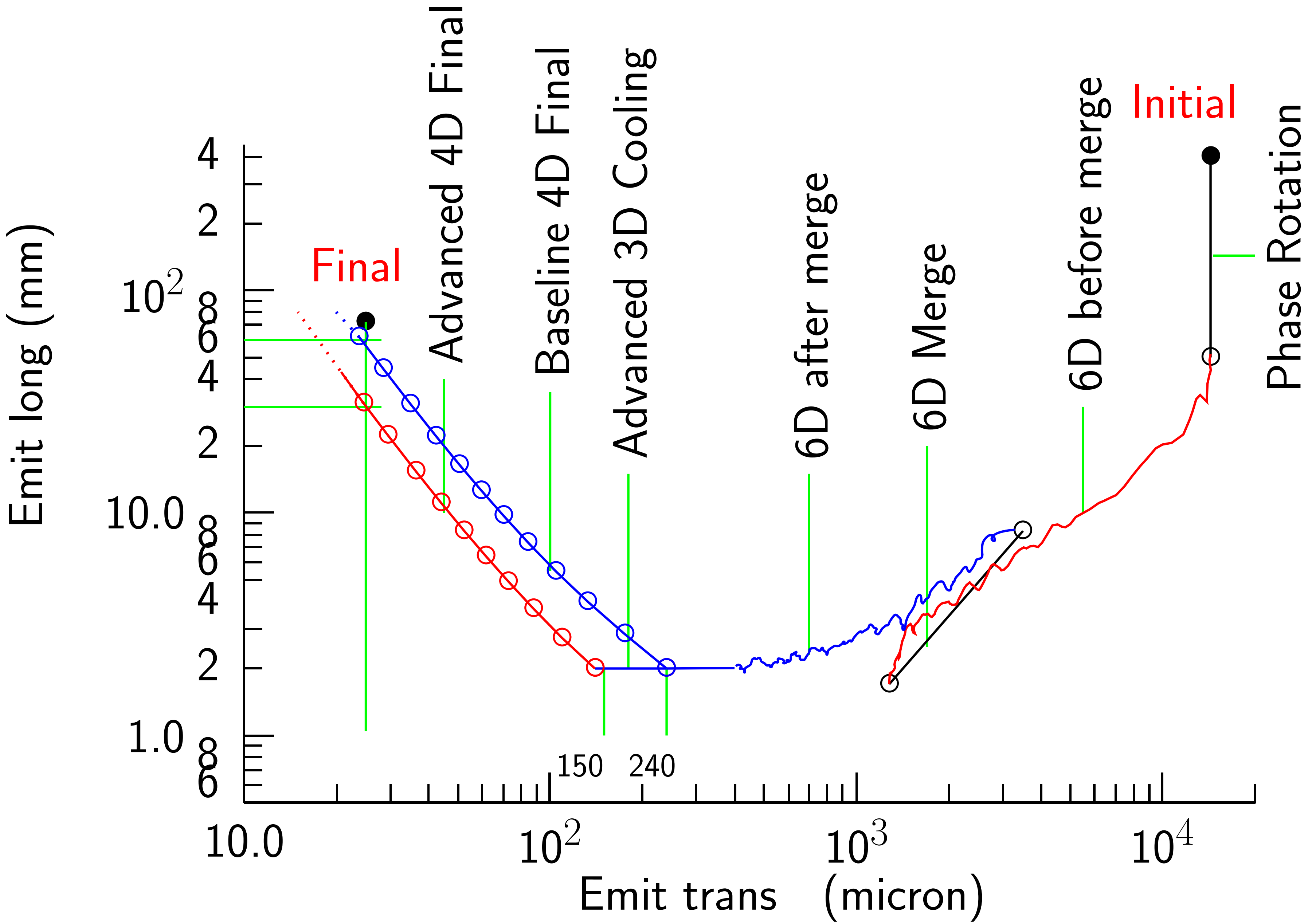
Thursday

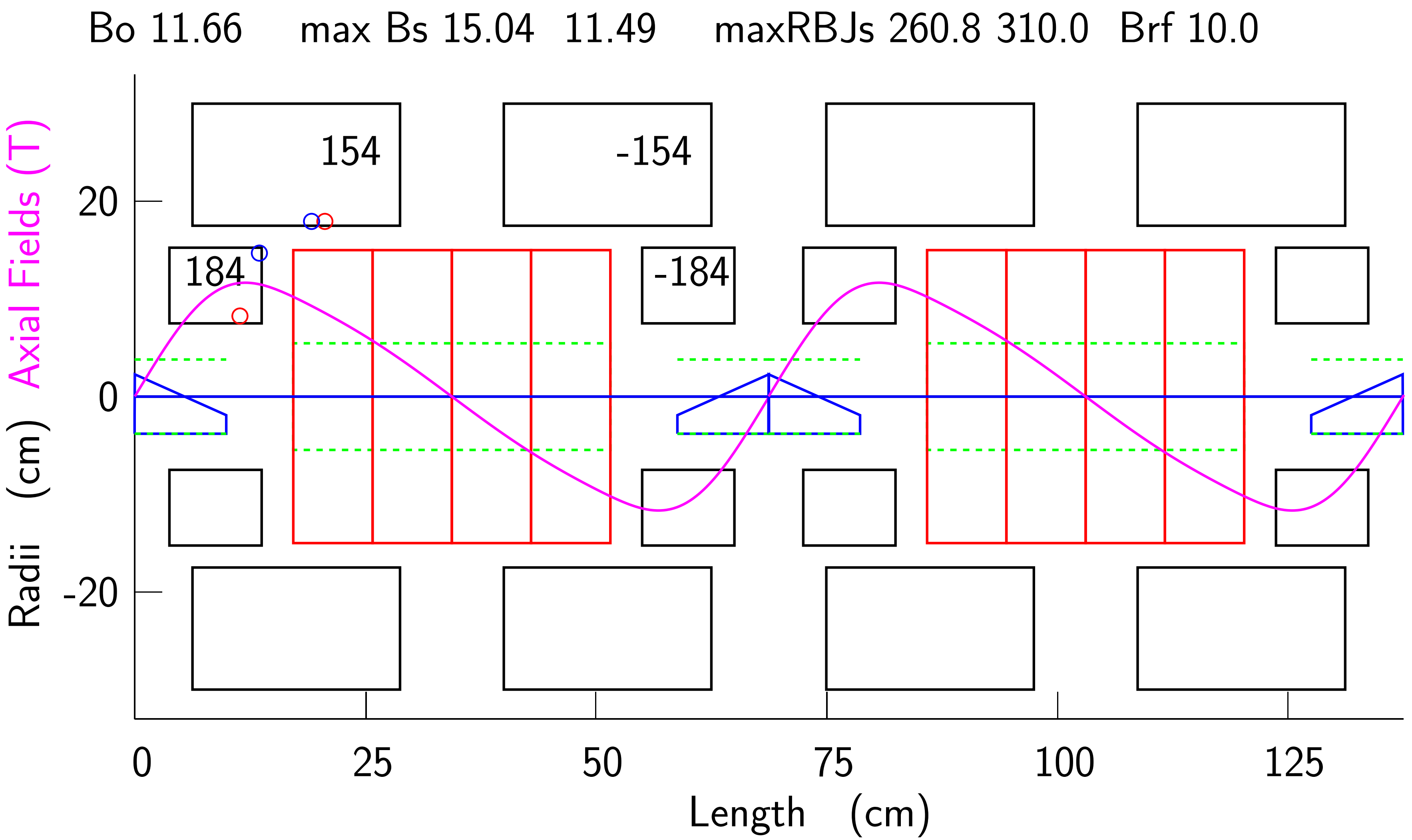
2/14/13

- Introduction
- lattice types
- Parameters of Half-Flip lattices
- ICOOL simulation using matrices
- Conclusion

Cooling Scheme

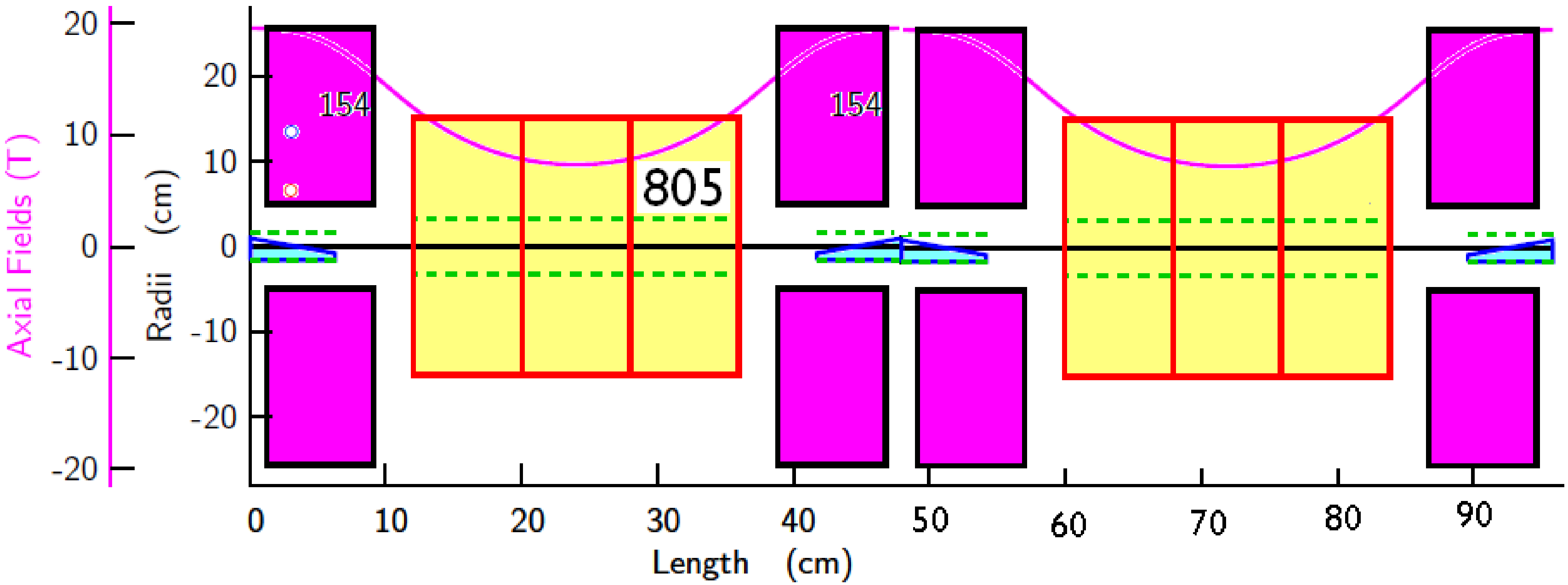


RFOFO Flip



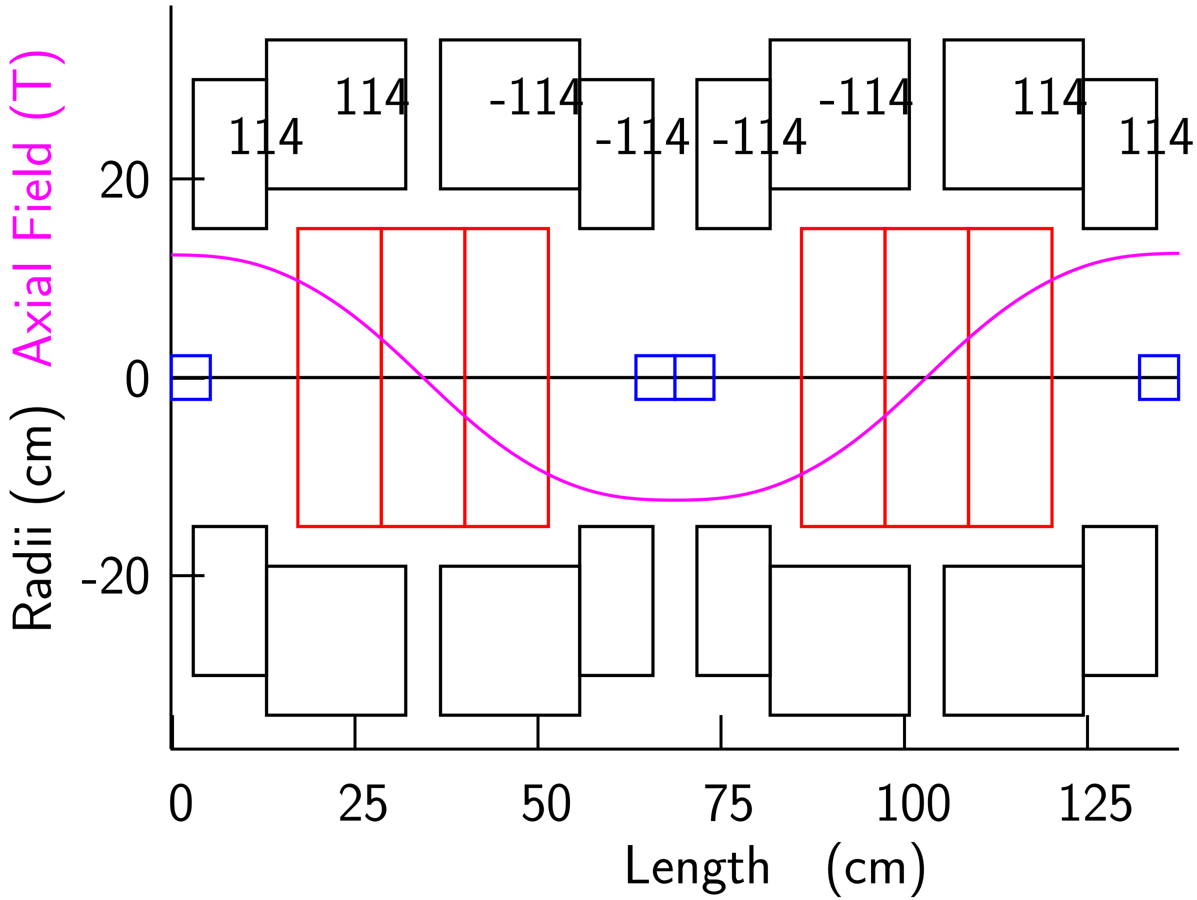
Bo 11.66 max Bs 15.04 11.49 maxRBJs 260.8 310.0 Brf 10.0
154
-154
184
-184
20
0
-20
Radii (cm) Axial Fields (T)
0
25
50
75
100
125
Length (cm)

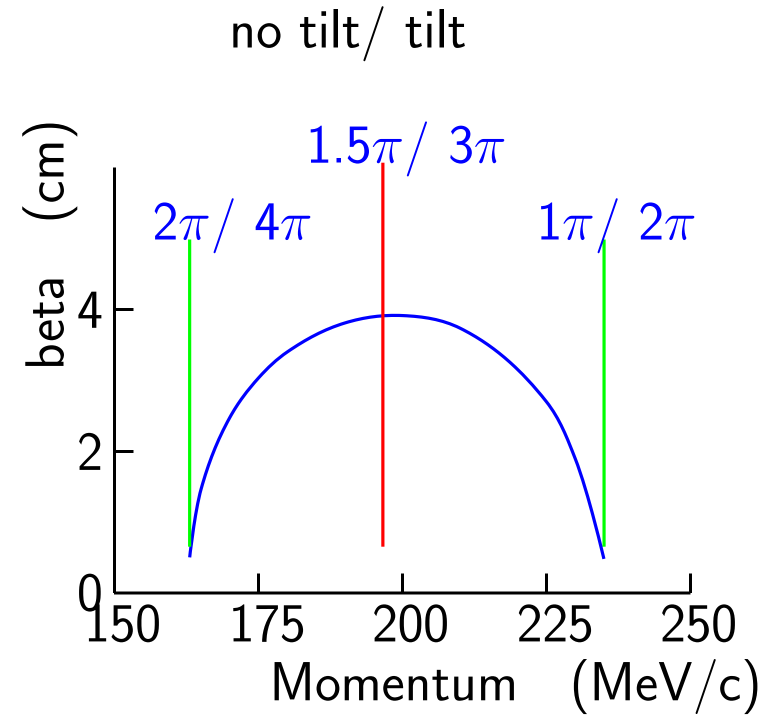
Non-Flip



Rick: this has no stable orbits, unless very little bending

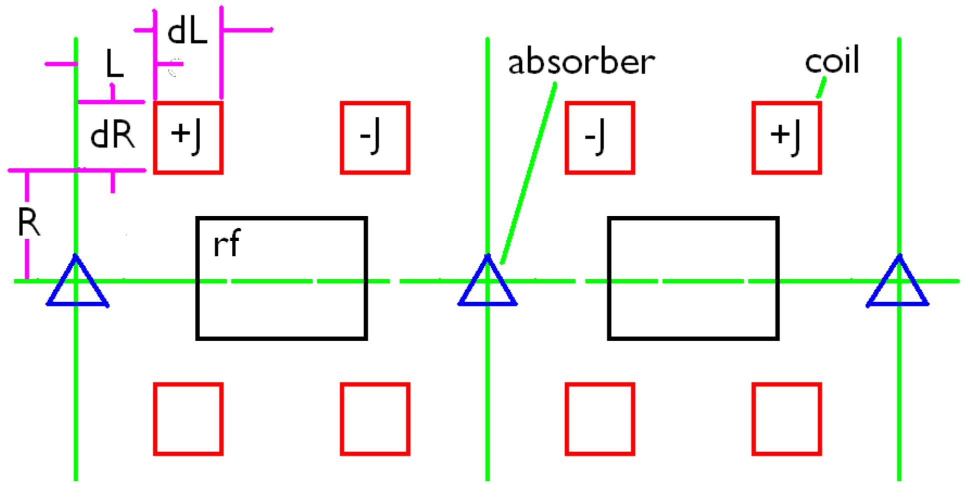
Half Flip





- Without bending all cells have identical focusing ($\propto\ B^2$)
- With bending (Guggenheim), or coil tilting (Balbakov) the symmetry is broken and a resonance exists in the center of the pass band
- But the coil tilts are very small and this resonance may not be too bad

Coil dimensions

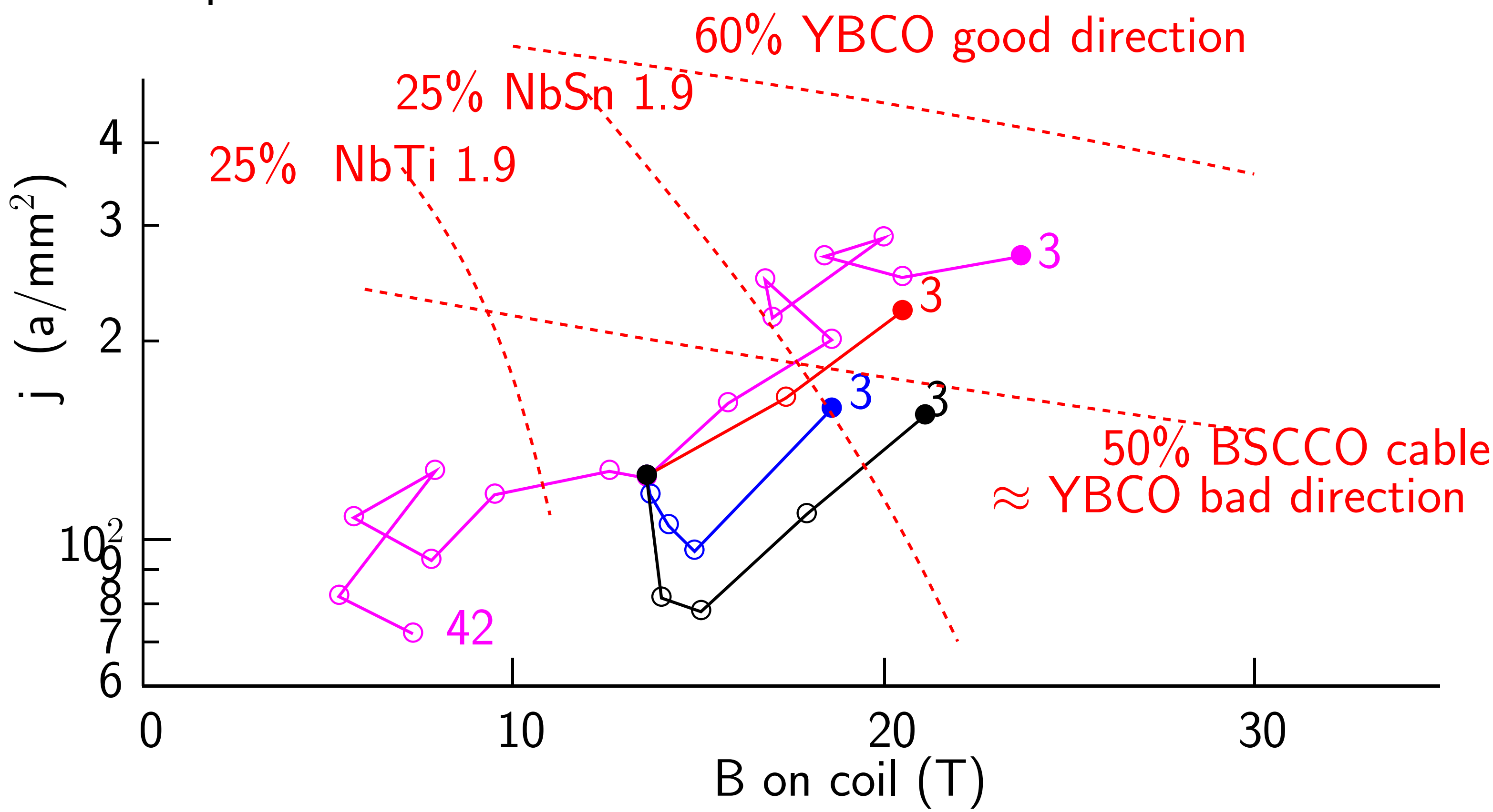


file	β	cell	L	dL	R	dR	j
	cm	cm	cm	cm	cm	cm	A/mm^2
70	5.2	68.75	3.000	28.000	18.000	15.000	117.26
71	4.6	68.75	0.000	29.000	18.000	15.000	105.77
72	3.9	68.75	0.000	13.000	12.000	15.000	96.80
			13.000	16.000	18.000	15.000	96.85
74	2.9	58	4.218	8.436	5.905	21.091	158.14
			12.655	6.327	19.404	7.593	134.22
76	2.1	58	1.687	10.967	4.218	16.873	153.79
77	1.6	58	0.000	10.967	4.218	16.873	158.75

- locations and dimensions are symmetric left-right in each cell
- currents are reversed left-right in each cell
- when there are two lines for one file, there are two coils per half cell

j vs B for required 3 cm betas

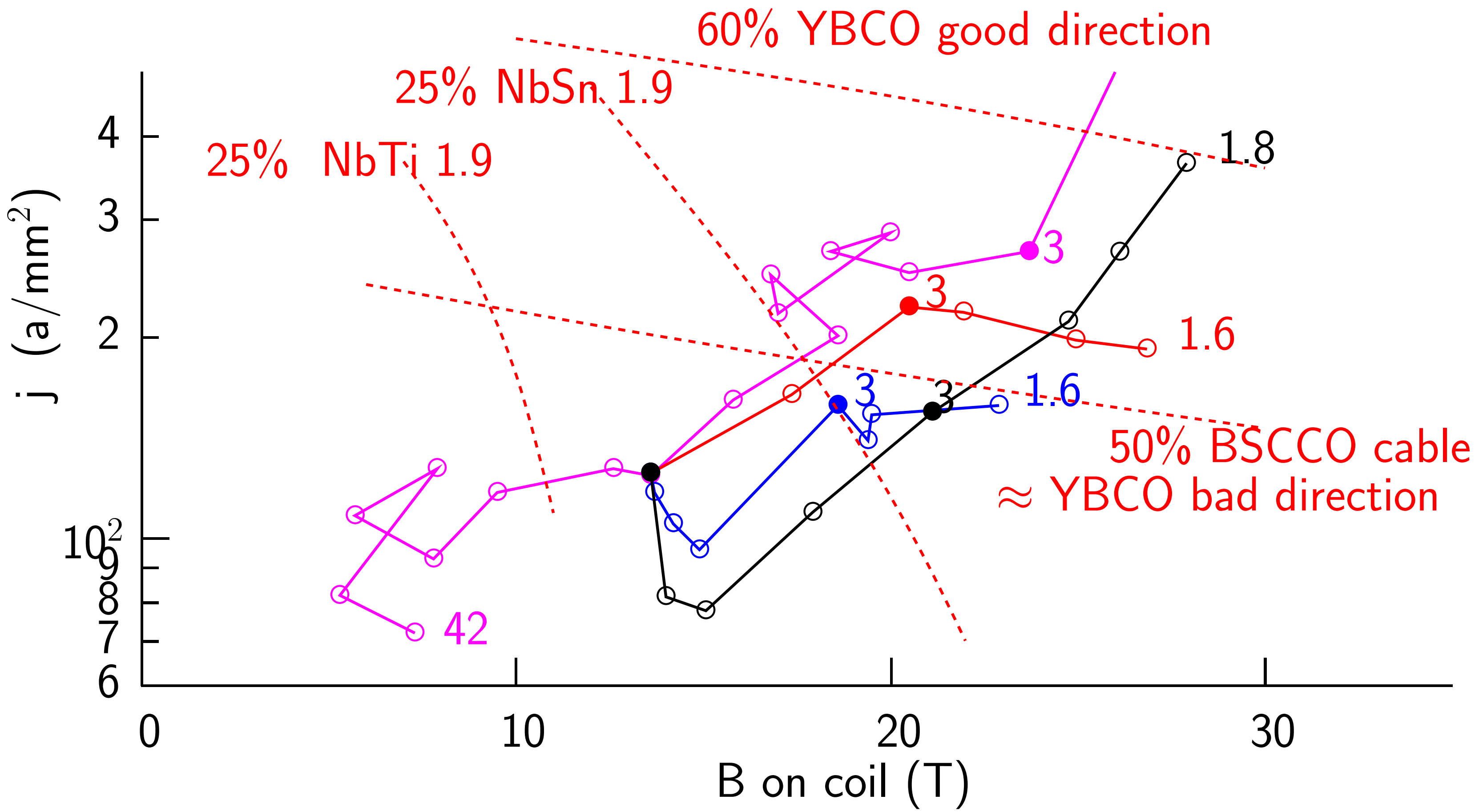
RFOFO flip — magenta
Half flip lattices — red shorter — blue longer
Non-flip — black



- Half flip design uses less fields on coils than Non-flip but its cells are longer
- They are now ok for both Nb_3Sn and YBCO in the bas direction
- In addition, the field lines are more axial than in the flip lattice

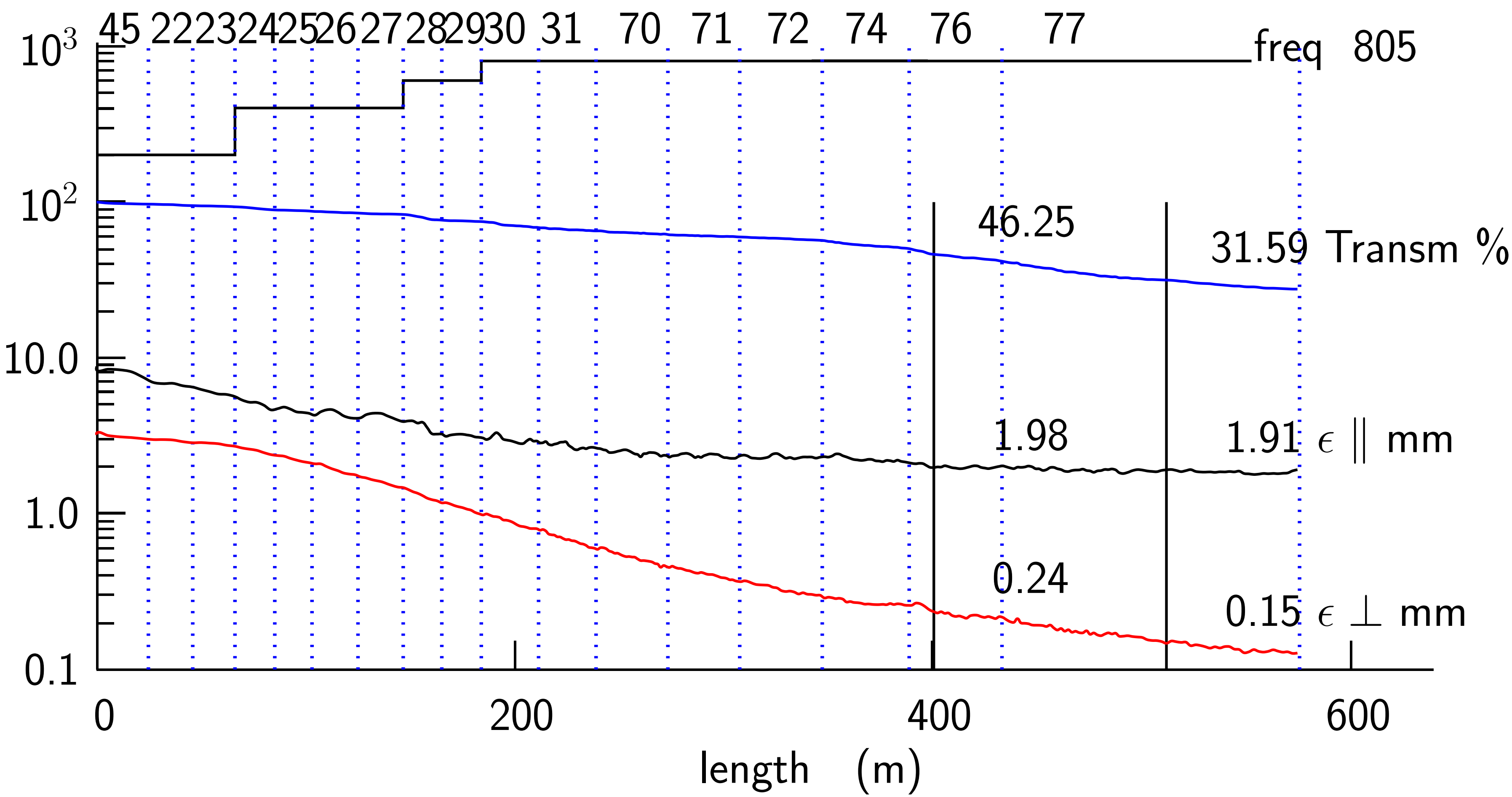
j vs B extended to lower betas

RFOFO flip	magenta	
Half flip lattices	red shorter	blue longer
Non-flip	black	



- Half flip solution probably ok to 1.6 cm with longer cells
- This should cool to 150 μm for the enhanced performance goal

ICOOL using matrices for half-flip with longer cells



- Performance should be a little better with shorter cells
- And this has not been optimized yet

Conclusion

case	files		$\epsilon_\perp$=240 μm Len	$\epsilon_\parallel$	Trnsm. %	$\epsilon_\perp$=150 μm Len	$\epsilon_\parallel$	Trnsm. %
1	tap16a0	RFOFO	470	2.1	47.3			
3	tap16a5v	Non-flips	375	2.1	53.7	471	2.15	46.2
3	tap16a5x	Half flips	410	1.98	46.2	510	1.91	31.6

- Half-Flip lattice meets current density requirements
- And meets minimum cooling requirements (240 μm)
  - More losses than Non-Flip
  - But about the same as original RFOFO Flip lattices
- Even meets extended cooling requirement (150 μm)
  - But with more losses than Non-Flip
- But may have additional losses from resonance in center of acceptance if bending one way
- Rick: Simple coil tilts did not give enough dispersion
  - Perhaps the Valeri Balbakov version would allow more flexibility in the generation of dispersion
- Needs real simulation with/without Balbakov modification