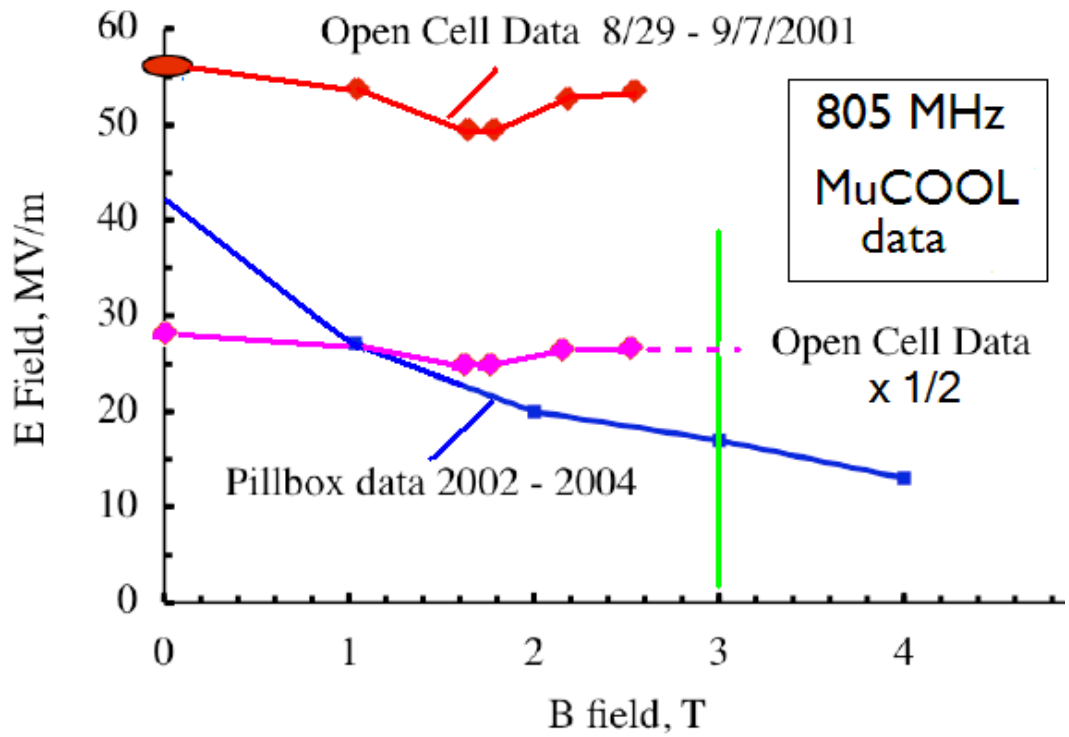
Open cell lattices

R. B. Palmer, J. S. Berg, R. Fernow, (BNL)

Friday April 27

- Introduction
- Open Cell RFOFO
- Simulation
- Conclusion

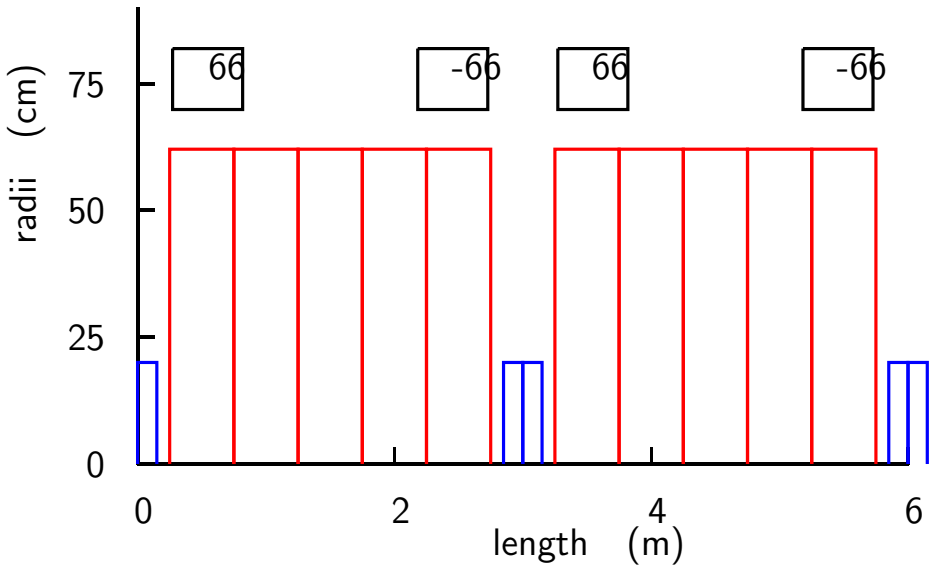
Introduction



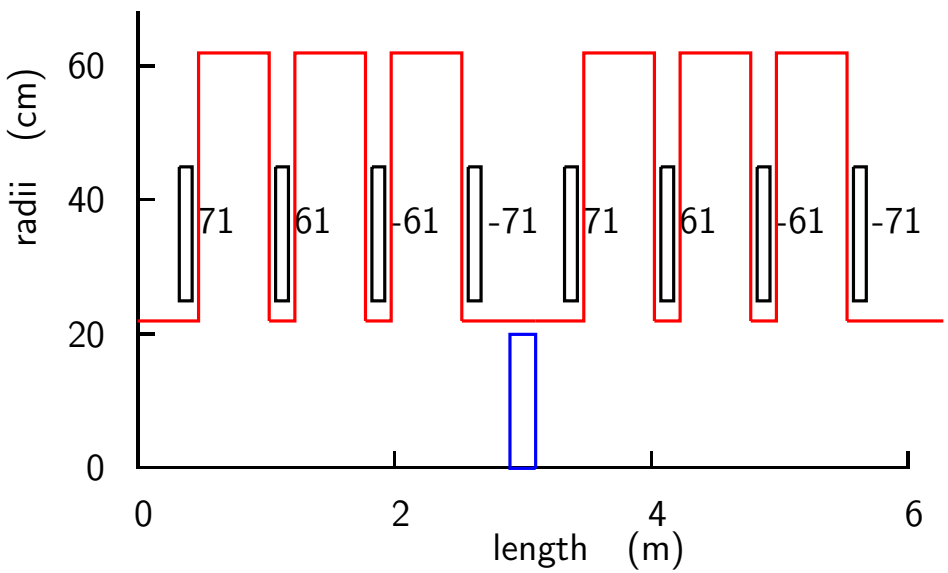
- B field effect on open cavity much less
  average field/surface fields $\approx 1/2$
  but open cavity still better at 3 T
- Should be even better if coils in irises

RFOFO lattices

Compare with RFOFO Guggenheim lattice

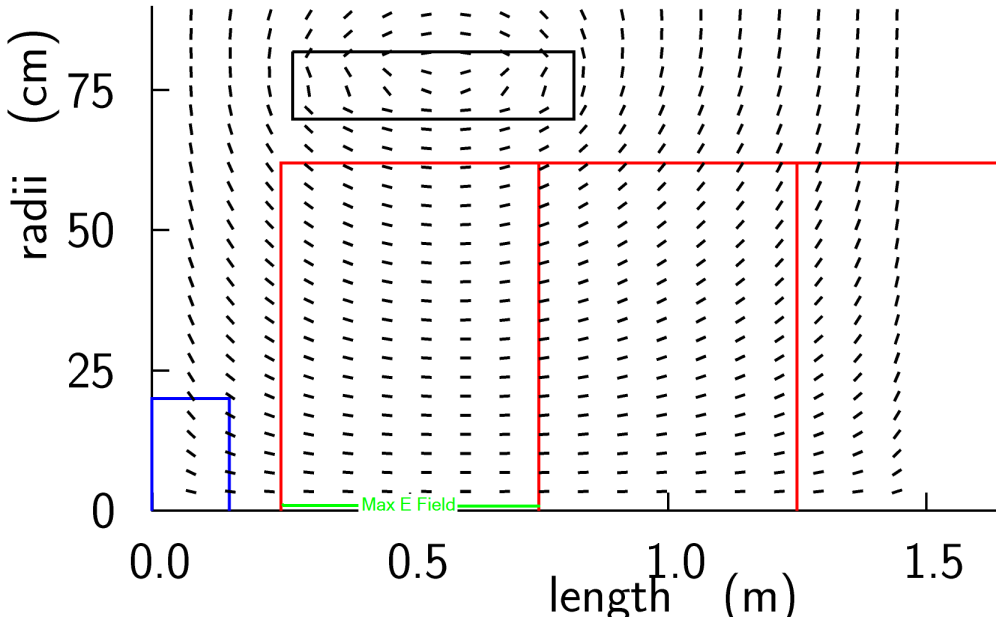


- Closed pill box $< + - | + - >$
- Coils outside rf
- Peak fields approx 5.5 T

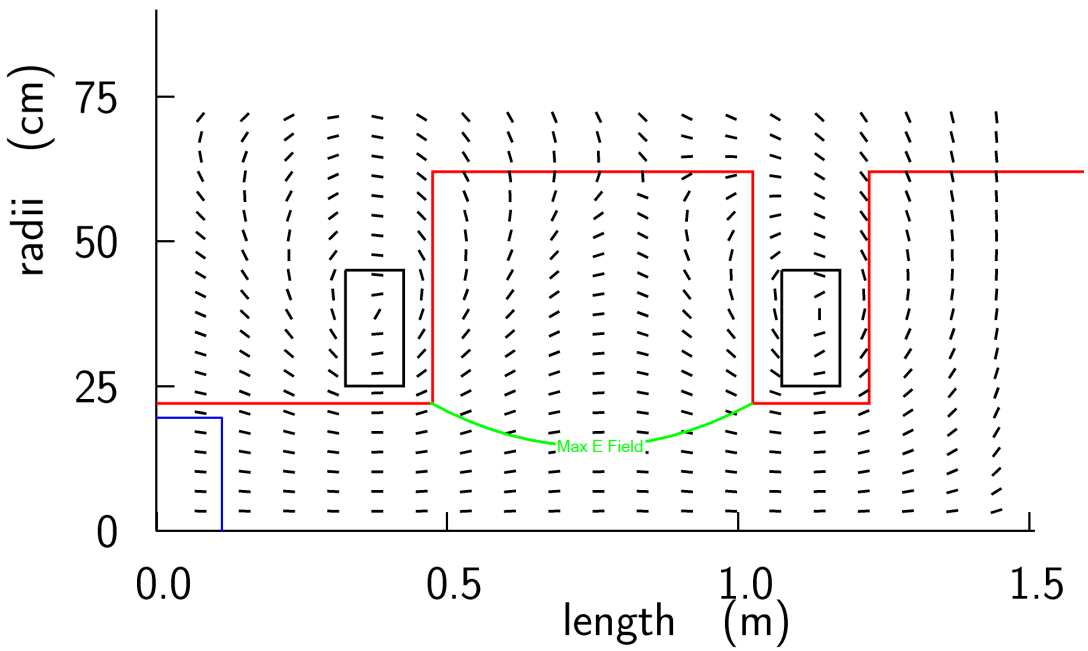


- Open cell proposal $< ++--|++-- >$
- Peak fields approx 4.9 T

Field directions



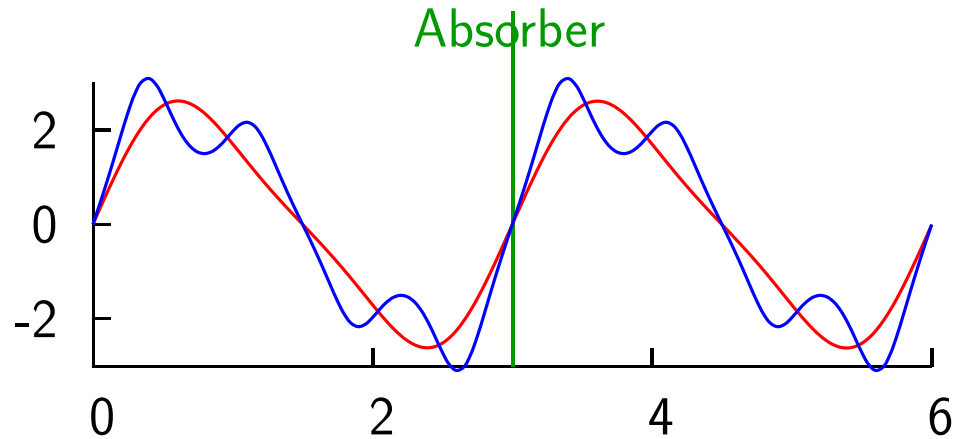
- Closed pill box as in Study 2
- B fields parallel to highest E fields



- Open cell proposal
- B fields approximately perpendicular to highest E fields
  But not quite as good as in $< +|- >$

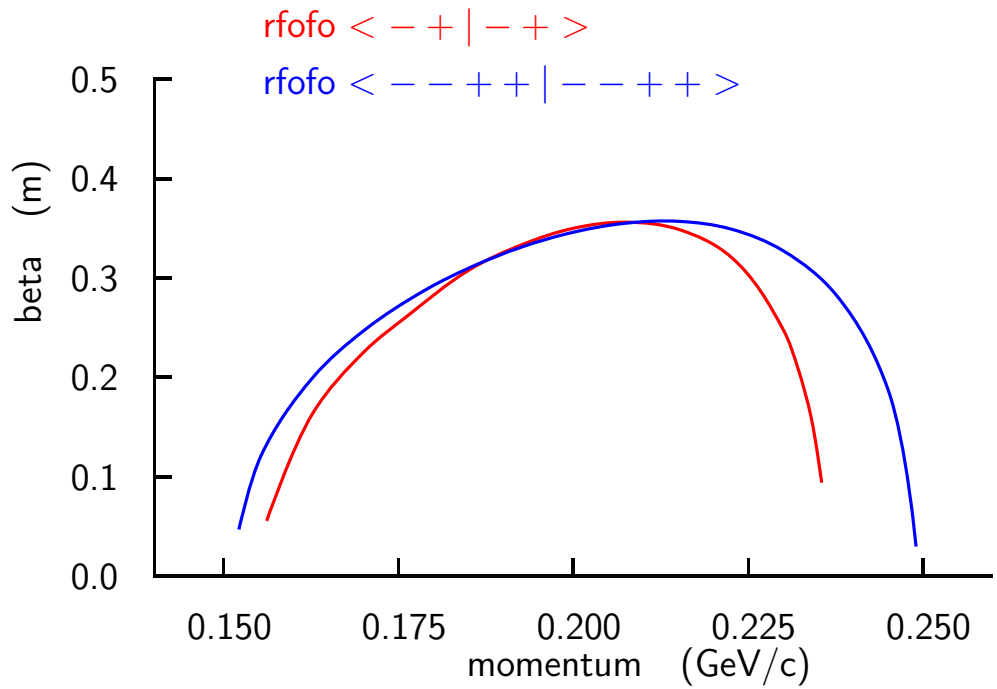
Fields vs. z

Red is for coils outside
Blue is for coils in irises



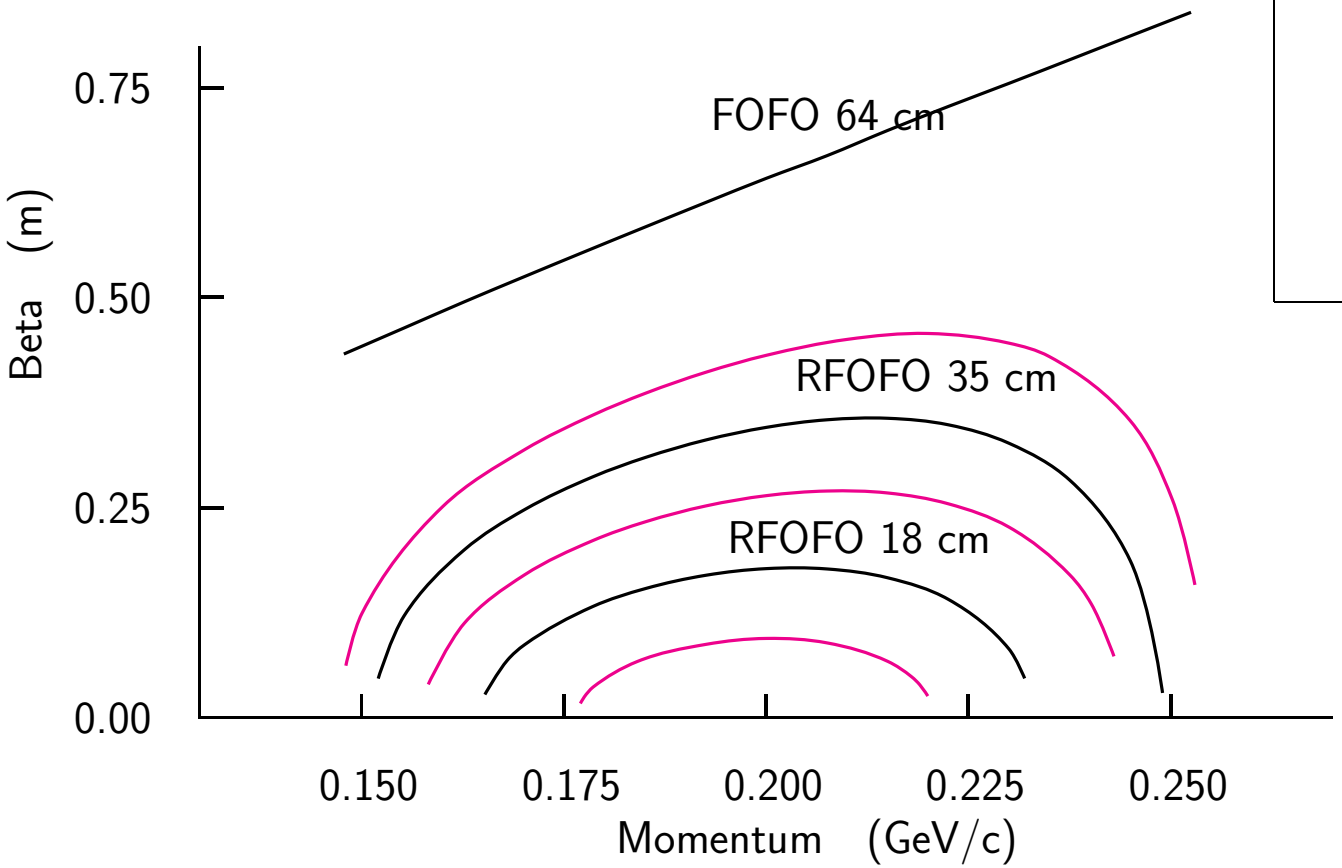
Betas vs. Momentum

Red is for coils outside
Blue is for coils in irises



- Open cell RFOFO has significantly more momentum acceptance than old version
- But poorer transmission, presumably nfrom richer harmonic content

Tunability

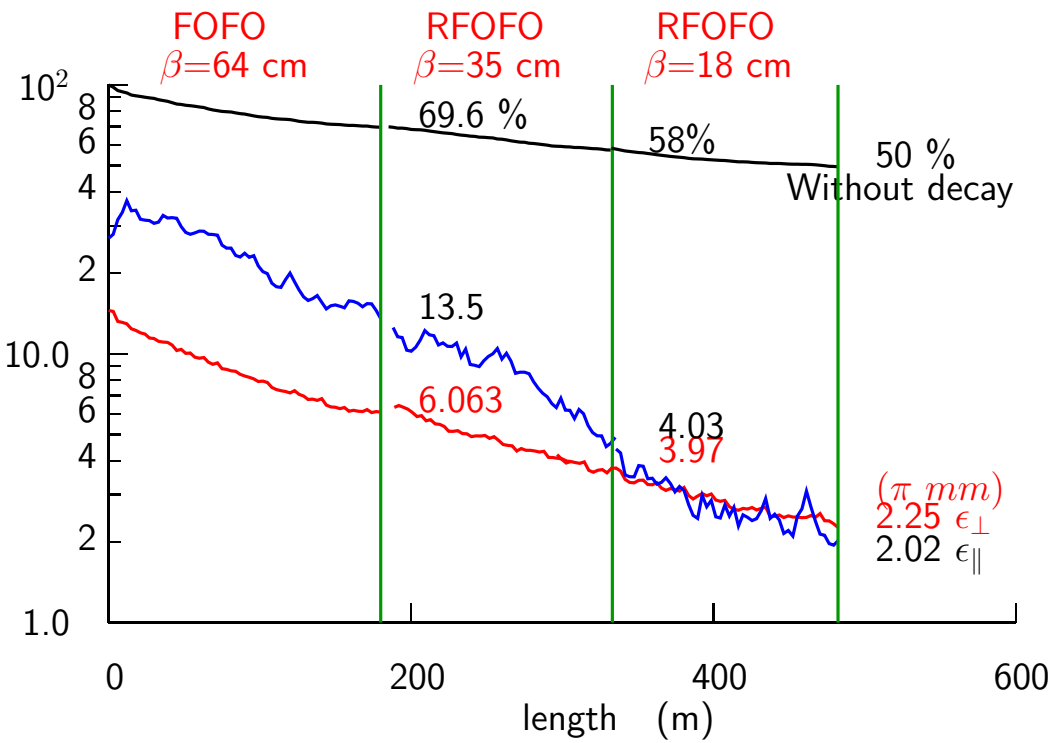


Beta Max cm	j1 A/mm^2	j2 a/mm^2
45.7	54	42
35.7	59	39
27.0	64	34
12.3	78	24
9.5	83	0

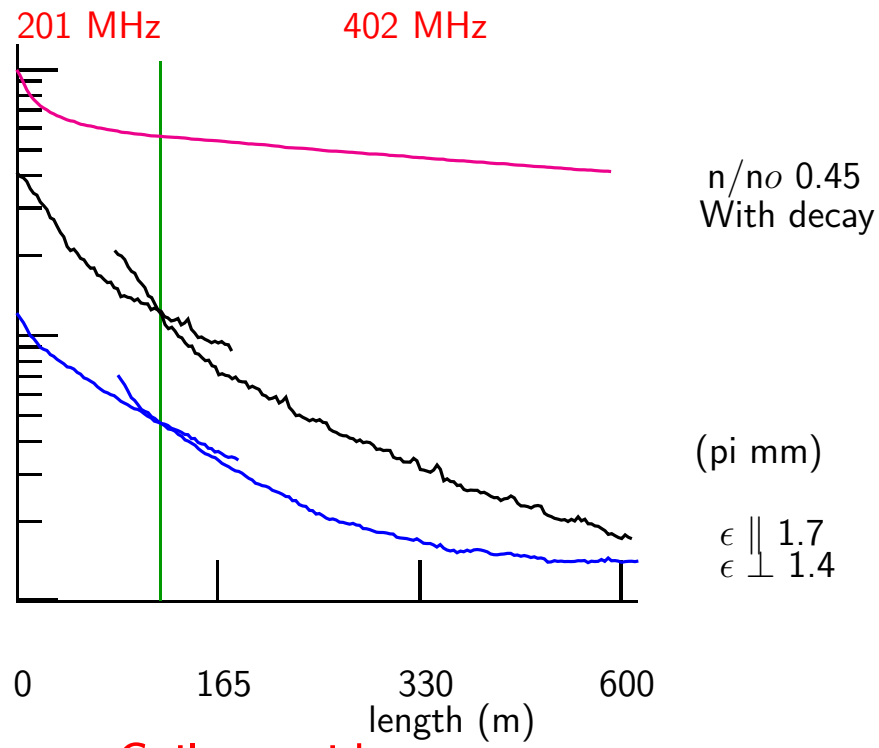
- Beta adjustable from 10 to 42 cm with RFOFO
- And to 64 cm or more with FOFO
- all by adjusting currents alone
- Black examples used in 3 step tapered lattice

Start of simulations of open cavity lattice cooling

Both cases with 0.125 T bending (circ=22 m)



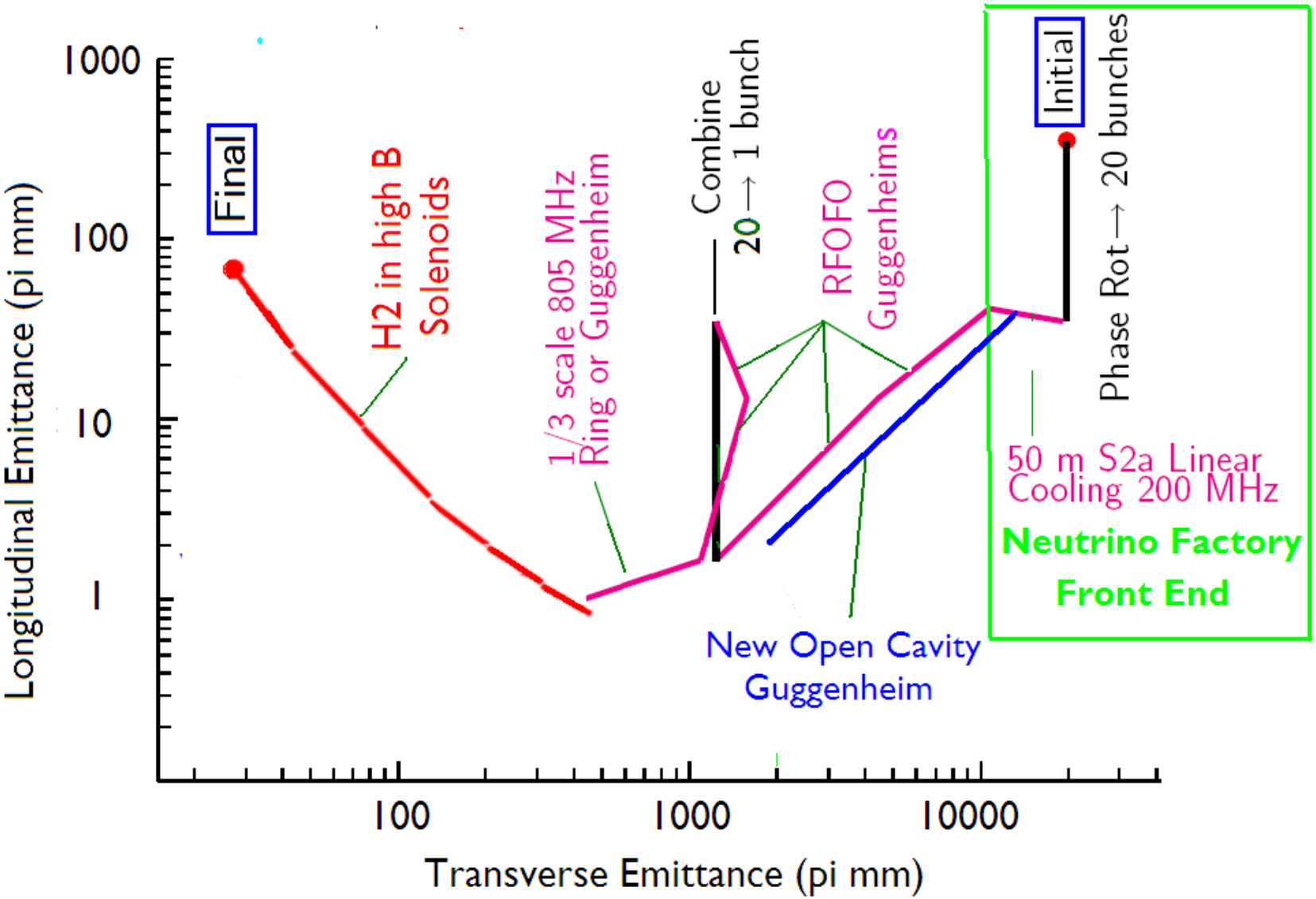
Open Cell
All 201 MHz



Coils outside
201/402 MHz

- Simulations used ideal matching from section to section
- This simulation at 201 MHz gives lower emittances than previous all 201 MHz simulations (2.25 & 2.07 vs. 3.4 & 2.4)
- Losses are a somewhat worse (35% vs. 45% including decays)
- May be improved when also switching to higher gradient 402 MHz

Cooling Schemes Work in progress in blue



Conclusions

- Open Cell lattices have small magnetic field dependence on breakdown
  But reduced accelerating/maximum gradient
  Accelerating gradient still better for open cavities at $B \geq 1$ T
- If coils placed inside irises
  - Open cells have magnetic and electric fields approximately perpendicular
  - Expected to further suppress breakdown
- For FOFO
  - Absorbers can be placed at beta minima, in occasional missing cavities
- For RFOFO
  - Coils in irises have lower peak fields and much less stored energy
  - Momentum acceptance for the same betas are greater
  - Betas (and momentum acceptances) can be tuned by currents alone
- Simulations with three stage taper
  - Cooling somewhat better than old RFOFO with coils outside
  - But transmission appears somewhat worse
- More study needed