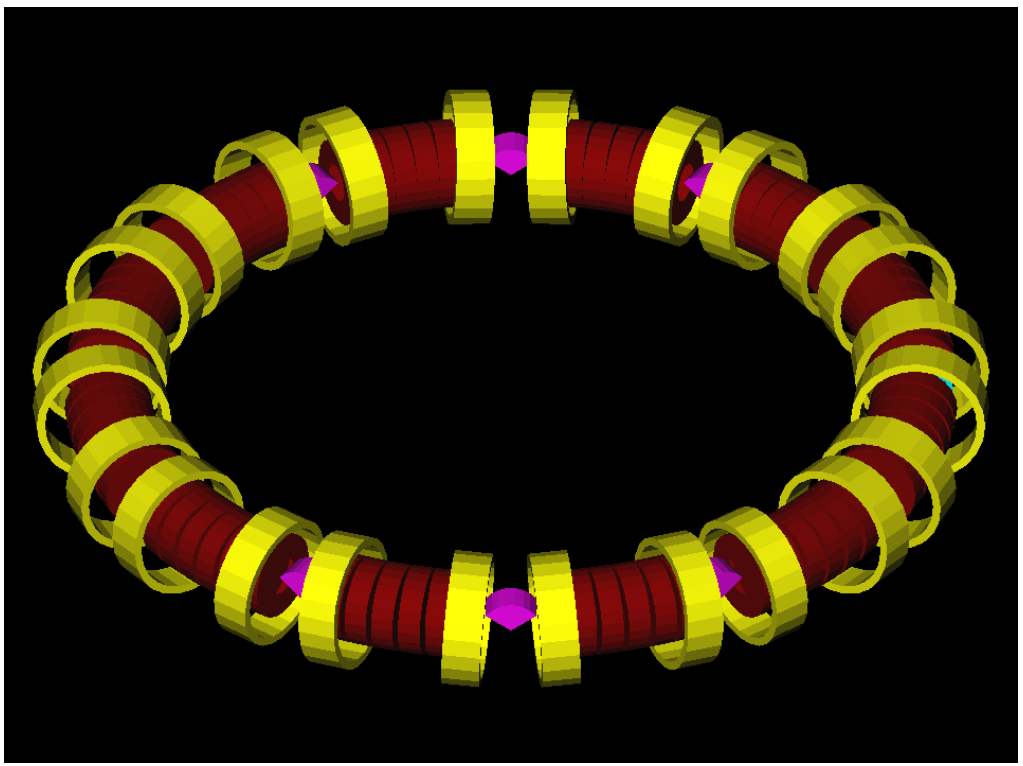
Guggenheim Update

Pavel Snopok

March 19, 2008

Outline

Good old RFOFO ring

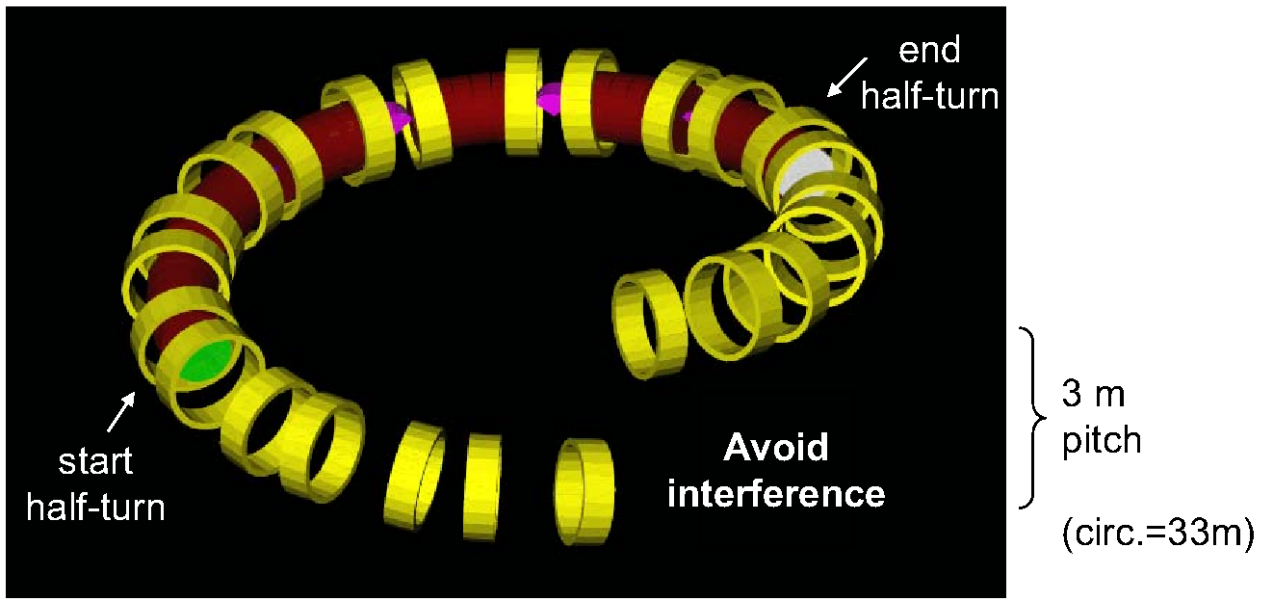


$P_{ref} = 201 - 204$ MeV
(25th harmonic)
RF grad=11.451 – 12.835 MV/m
RF freq=201.25 MHz
Cells=12
Circumference=33 m
Coil Tilt=3 deg

1/2 turn at a time

Introduce RF to Guggenheim

- Simulate a single layer (12 cells), but fill only 6 of them with cavities & absorbers

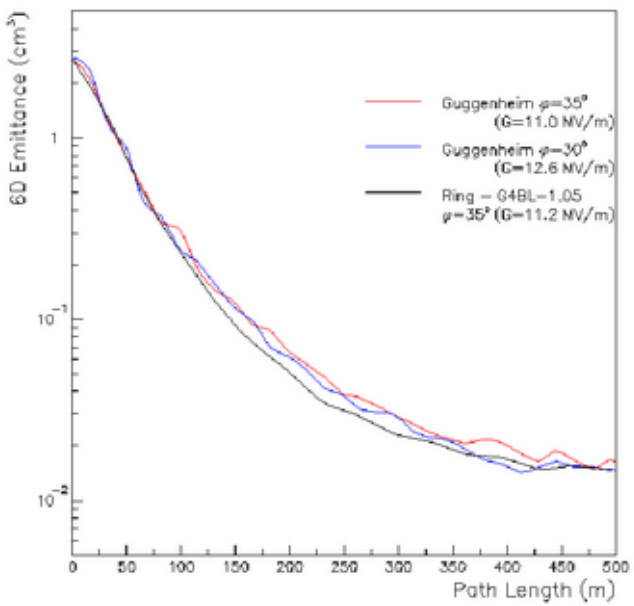


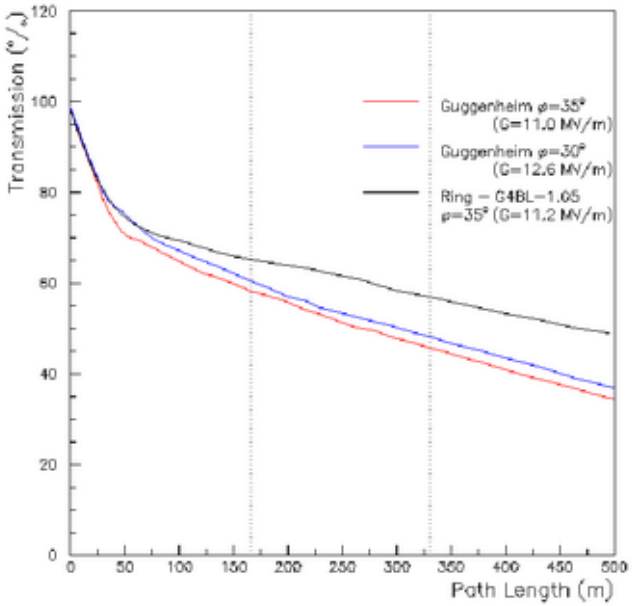
Transmission issue

Performance (II)

transmission falls!

(higher gradient seems a little better)



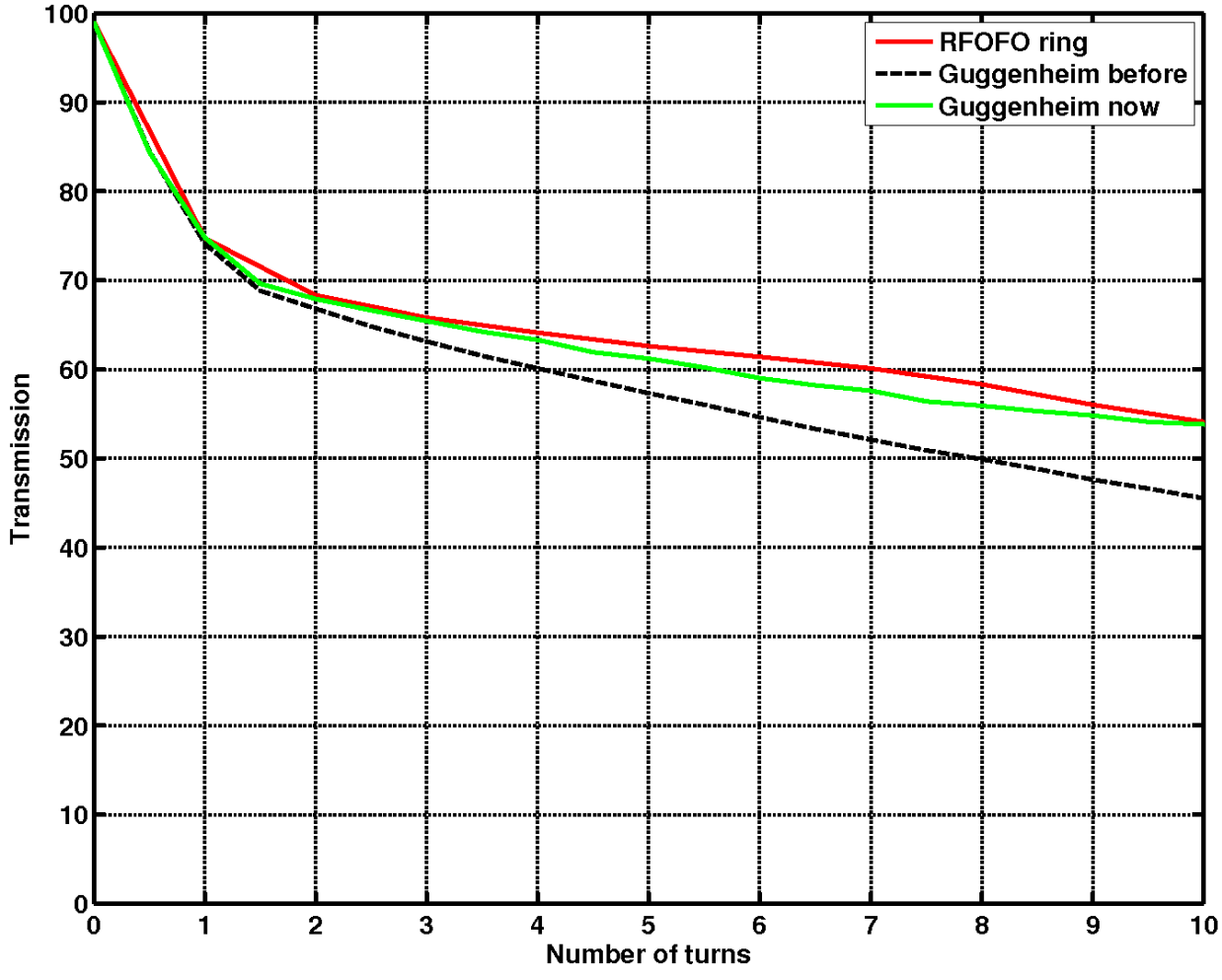


Before Amit left

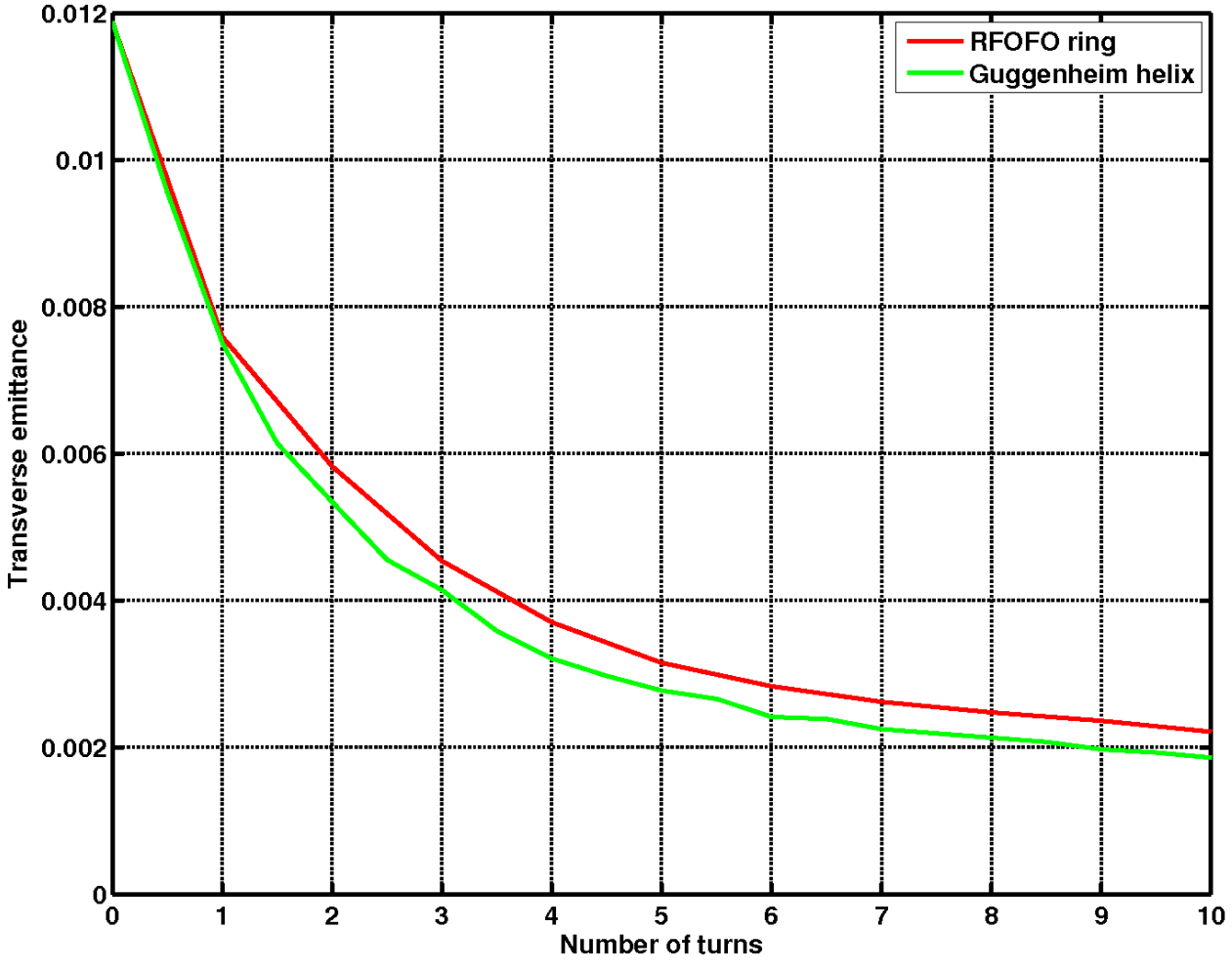
The future

- Understand (solve!) transmission/matching problem
- Use G4BL simulation to design a complete cooling channel
  - More realistic: include RF & absorber windows
  - Simulate smaller helixes (402, 805 MHz) and match between stages (incl. bunch merging)
  - Design a realistic 805-MHz helix (R.Palmer?)

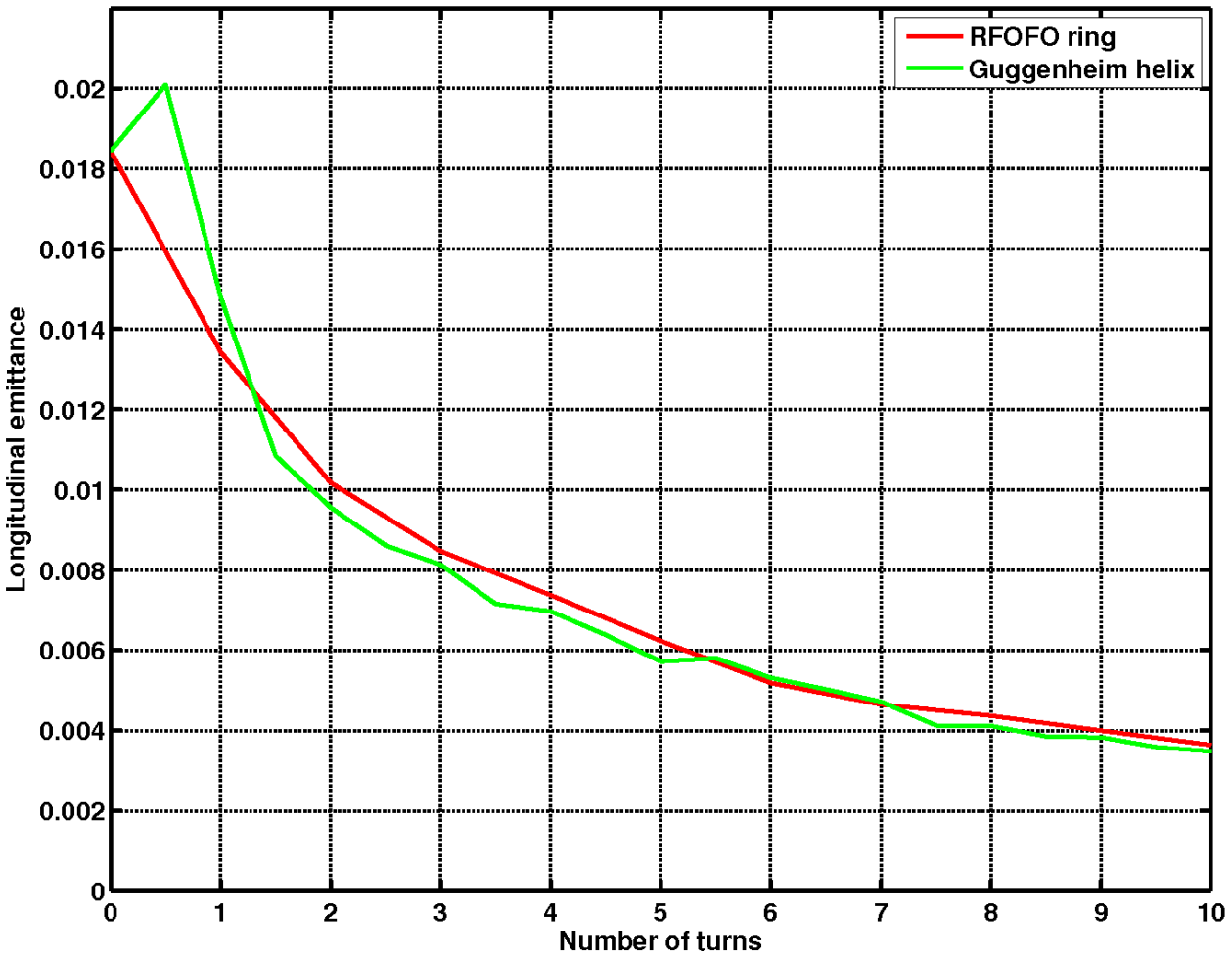
Randomseed time = Problem solved



Transverse emittance



Longitudinal emittance

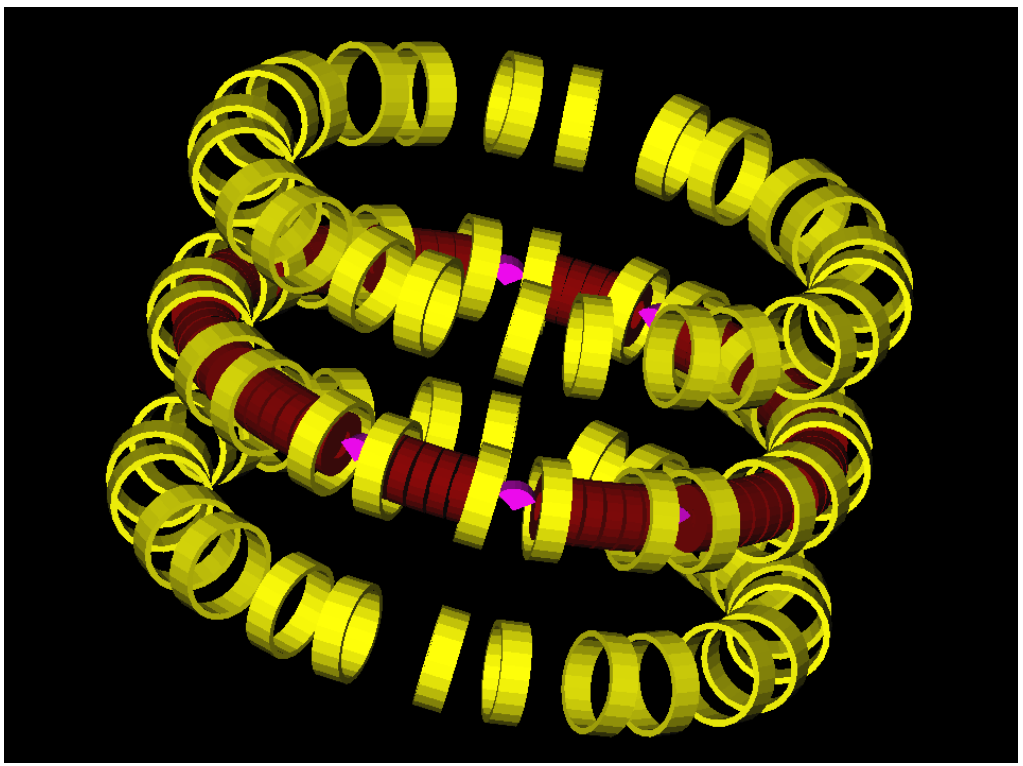


RFOFO Helix cooling

"6D cooling seems to work" $\Rightarrow$
"6D cooling works"???

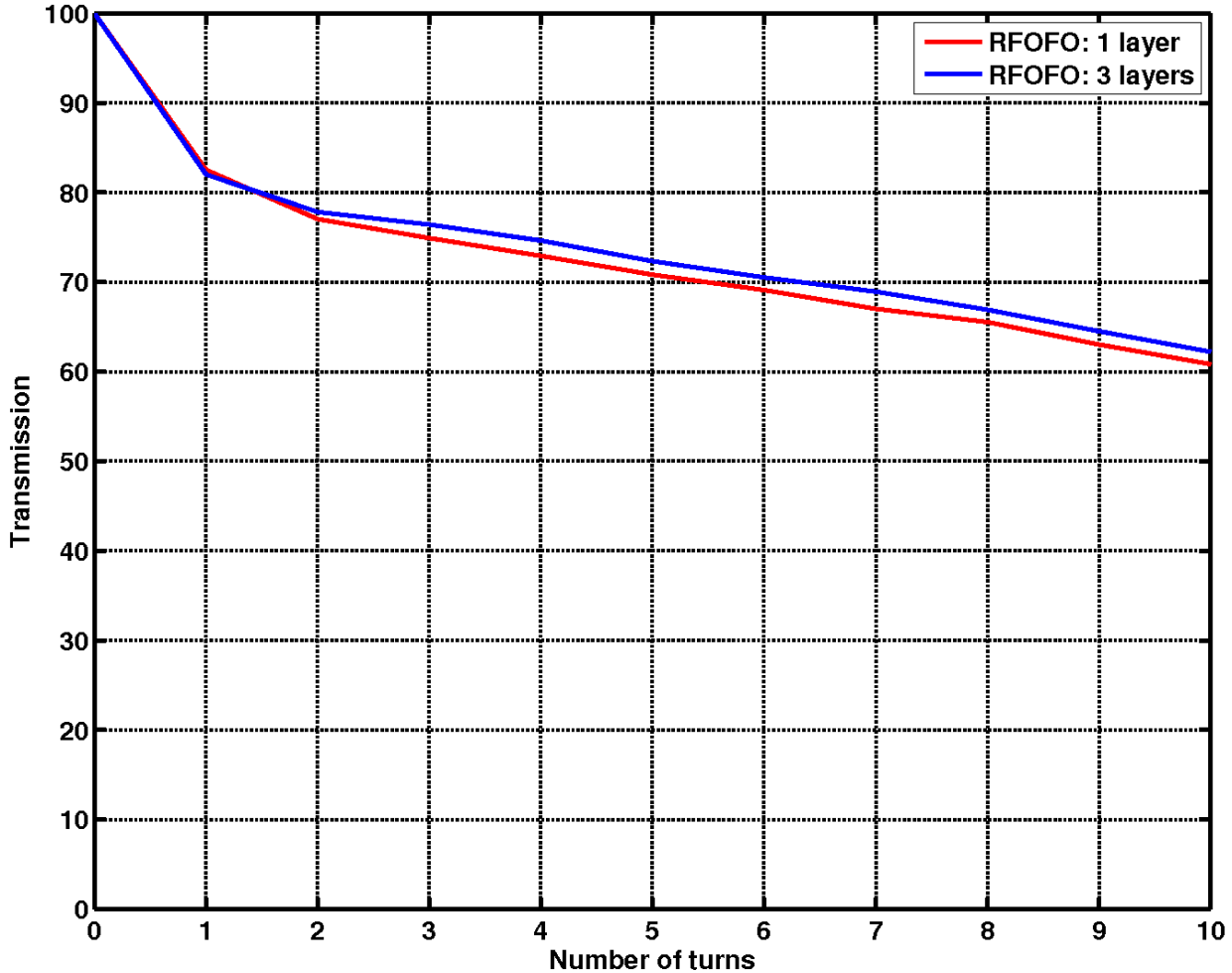
3 layers

3-layer RFOFO

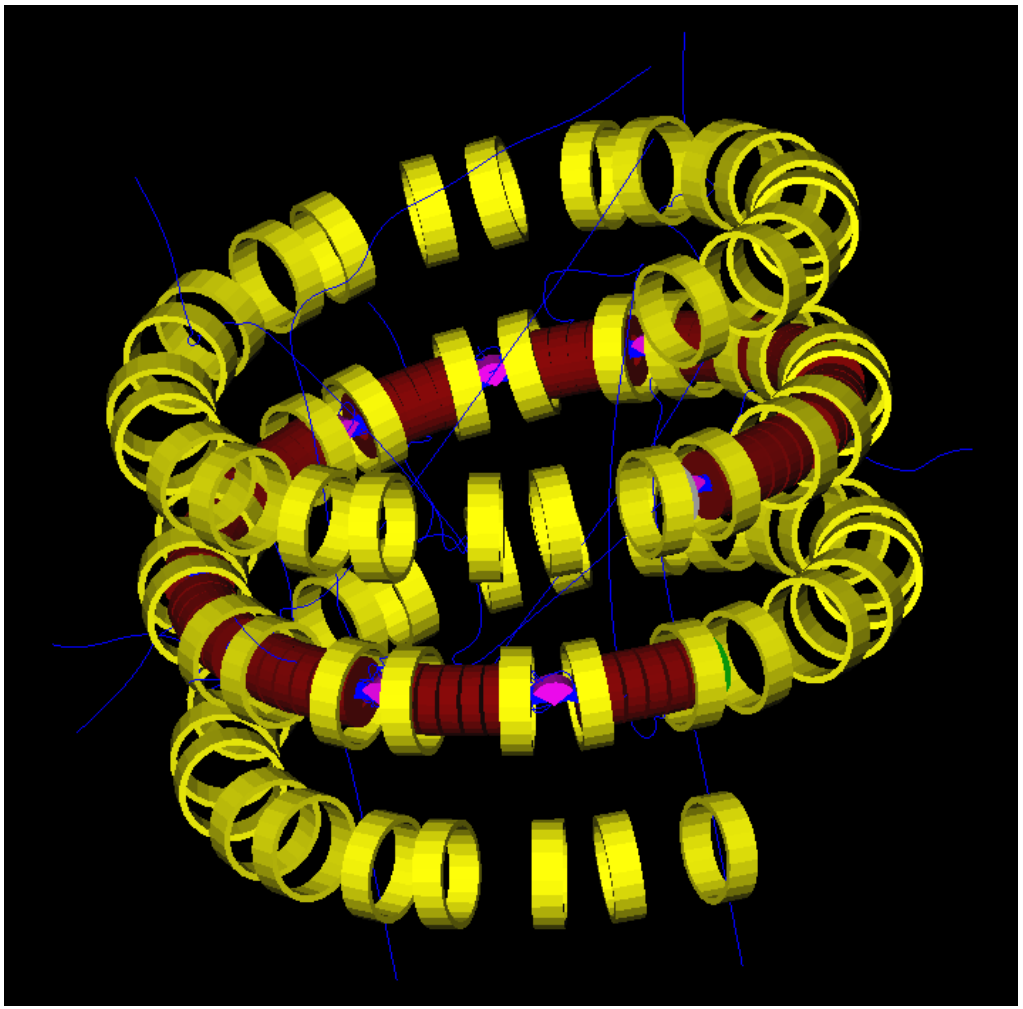


RF grad=11.607 MV/m

Transmission: 1 vs 3 layers

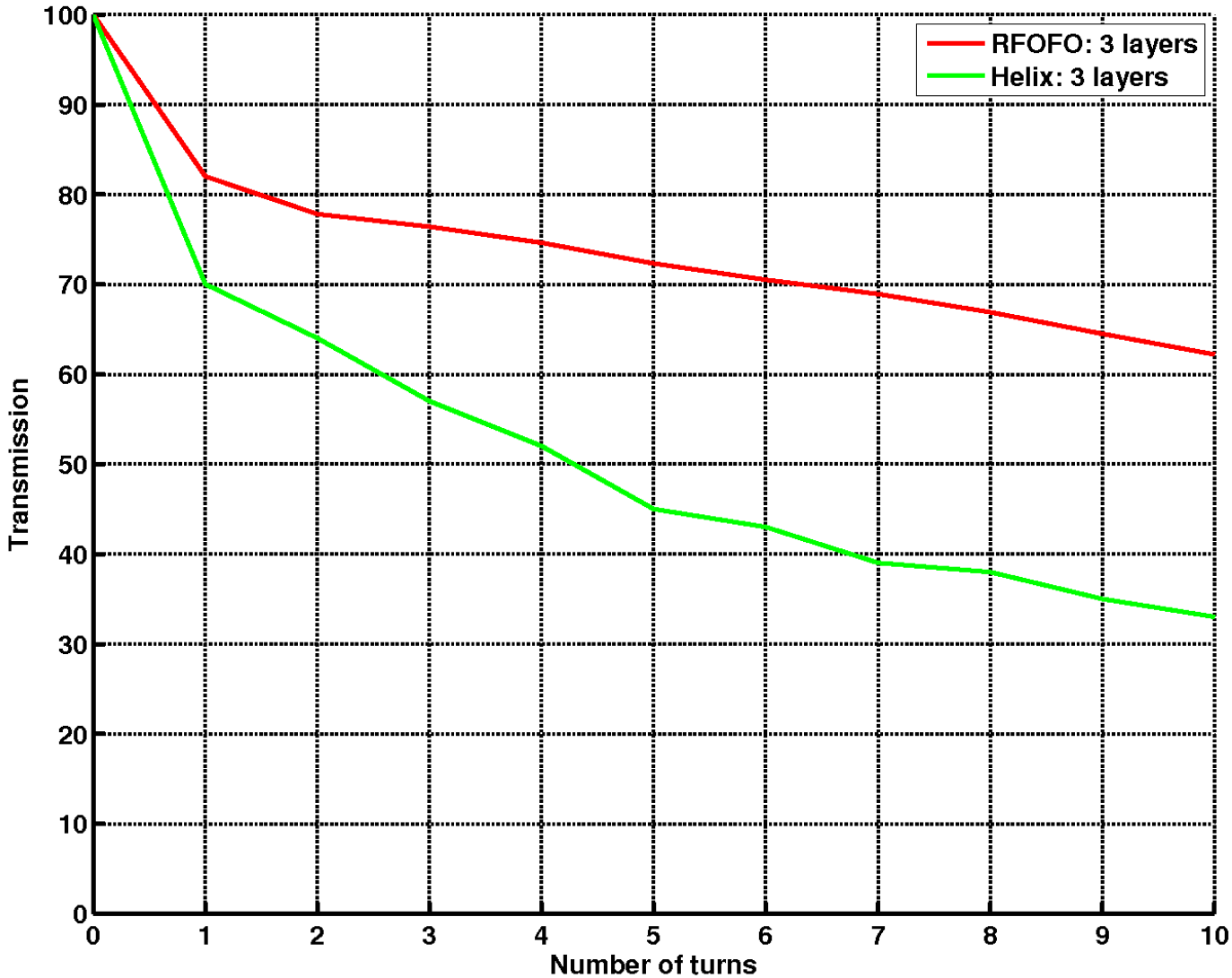


From RFOFO to Guggenheim, full turn: not so promising



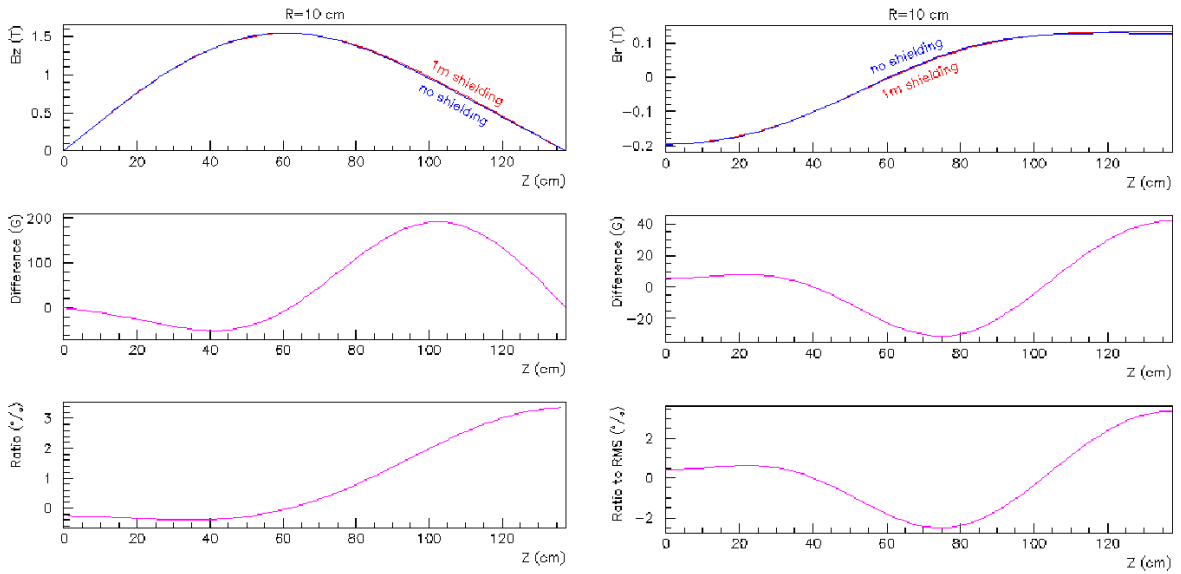
As reported at the NFMCC Friday meeting on March 8

Transmission: 3 layers

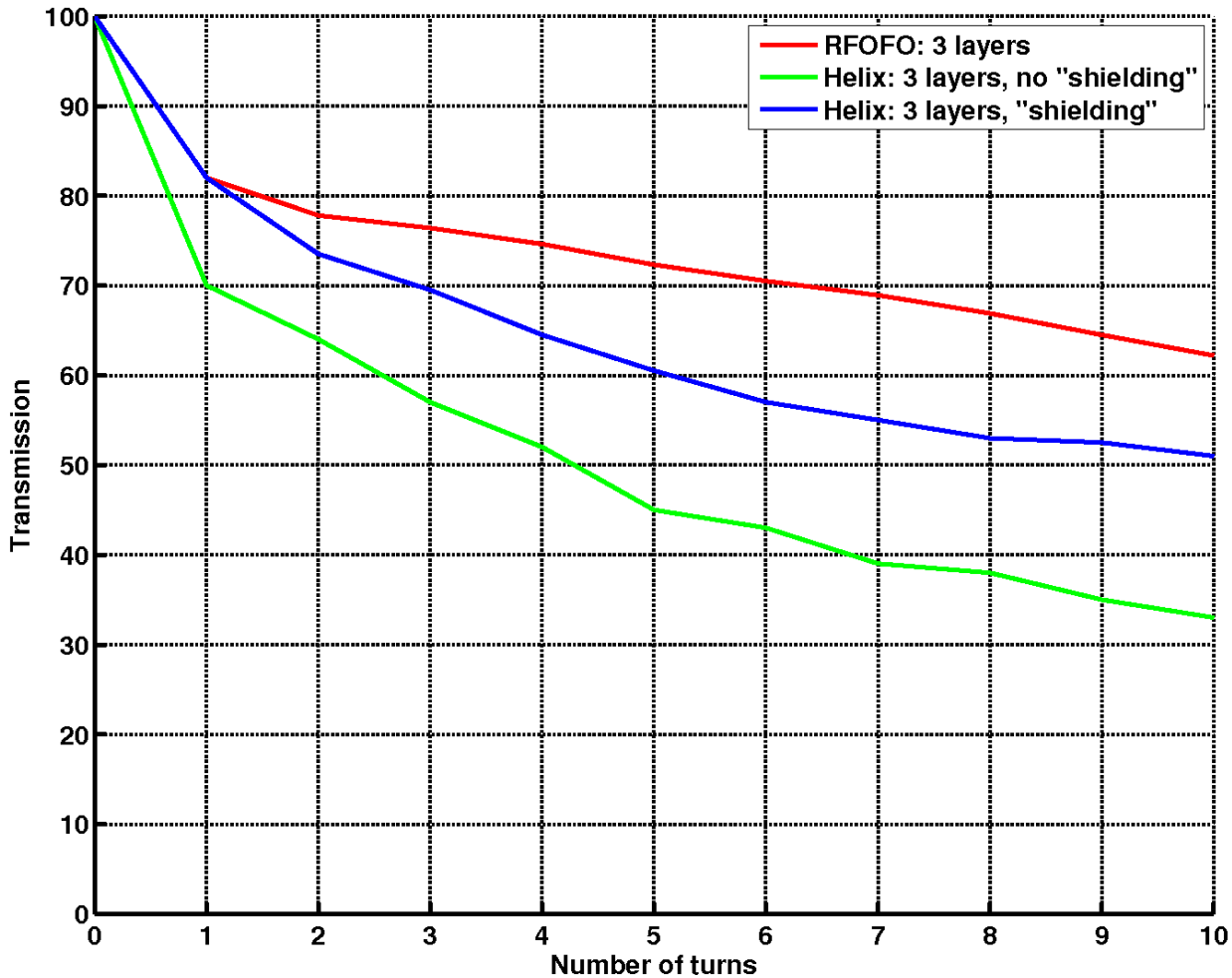


Amit Klier on shielding

Comparing no shielding and "worst case" (norm.) at r = 10 cm



Limit the field in the coils: "fake shielding"

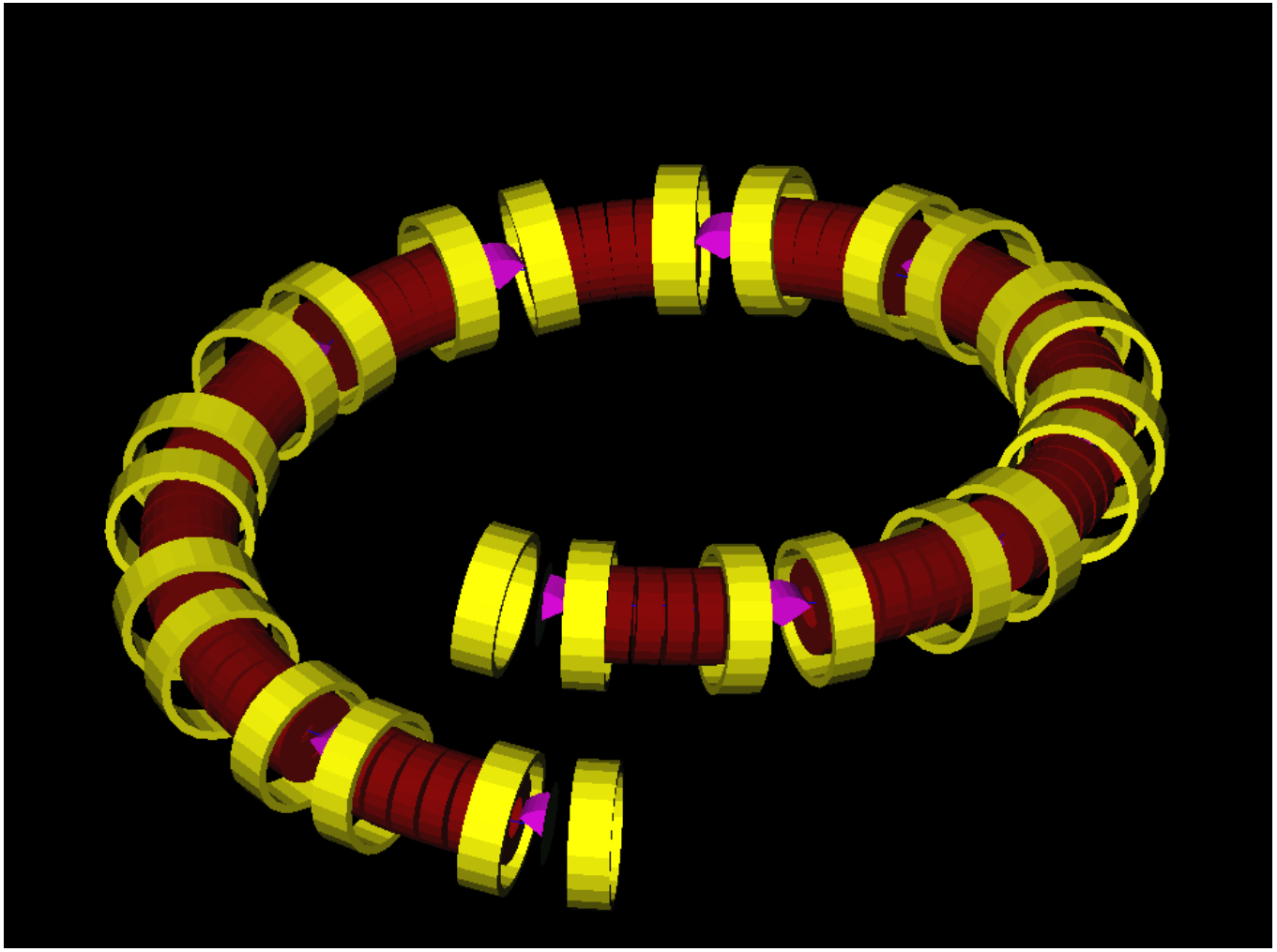


3 layers to 1 layer

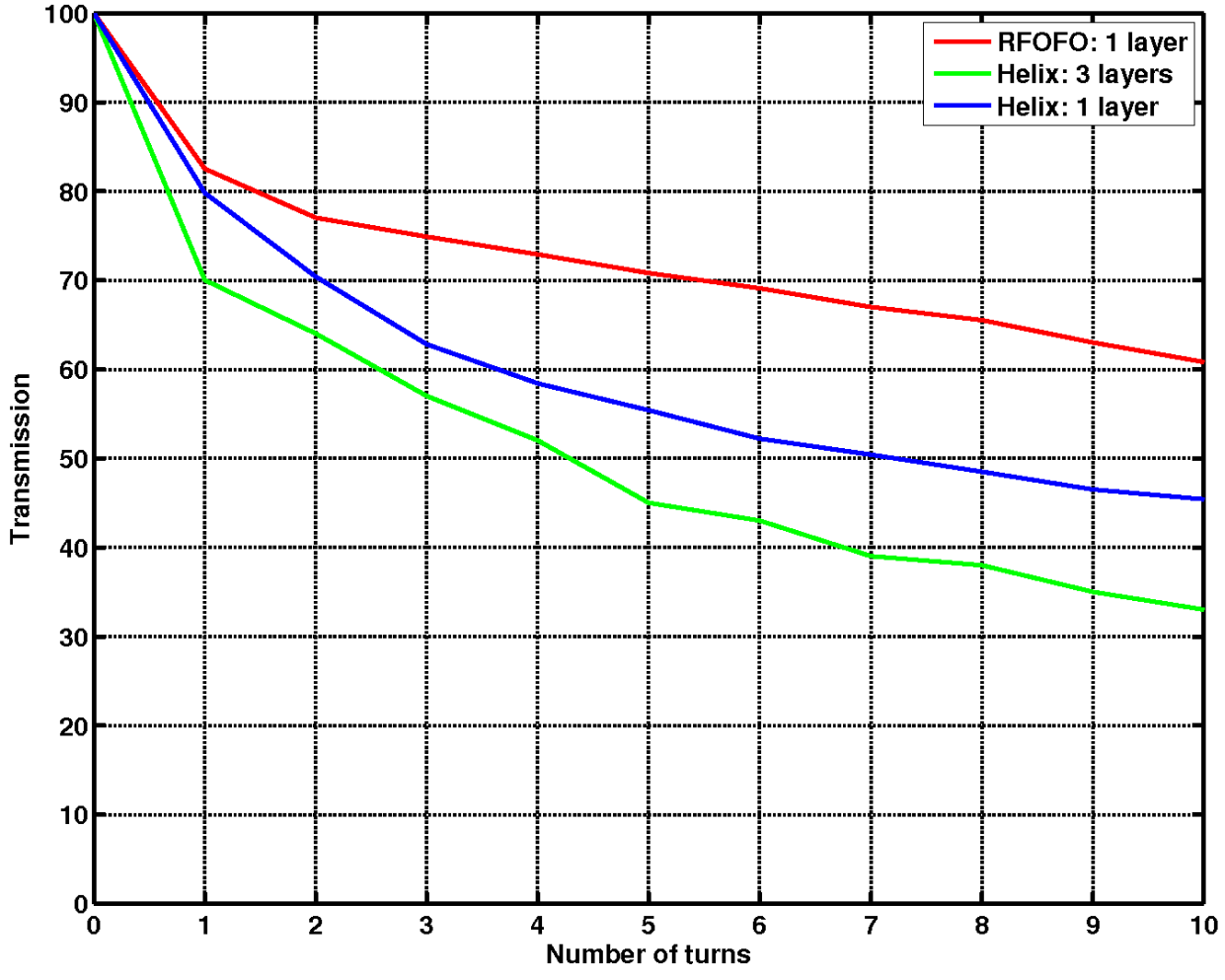
3-layer layout performs o.k. Let's try removing extra layers:

- Simple removal of the two extra layers with the corresponding tuning of parameters, such as the reference momentum and the RF gradient does not help much;
- Solution: keep an extra pair or two of the coils at the edges;
- Method works with both "shielding" and no "shielding".

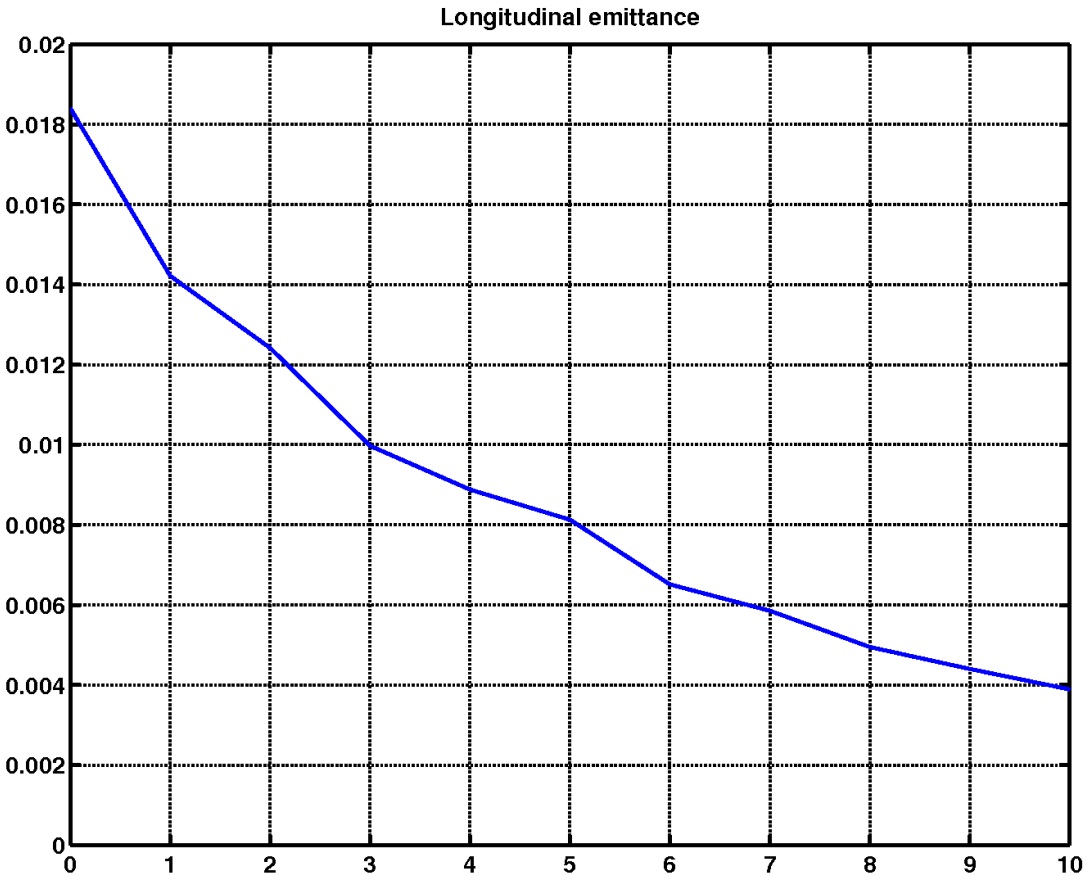
1 layer, one extra coil on each side



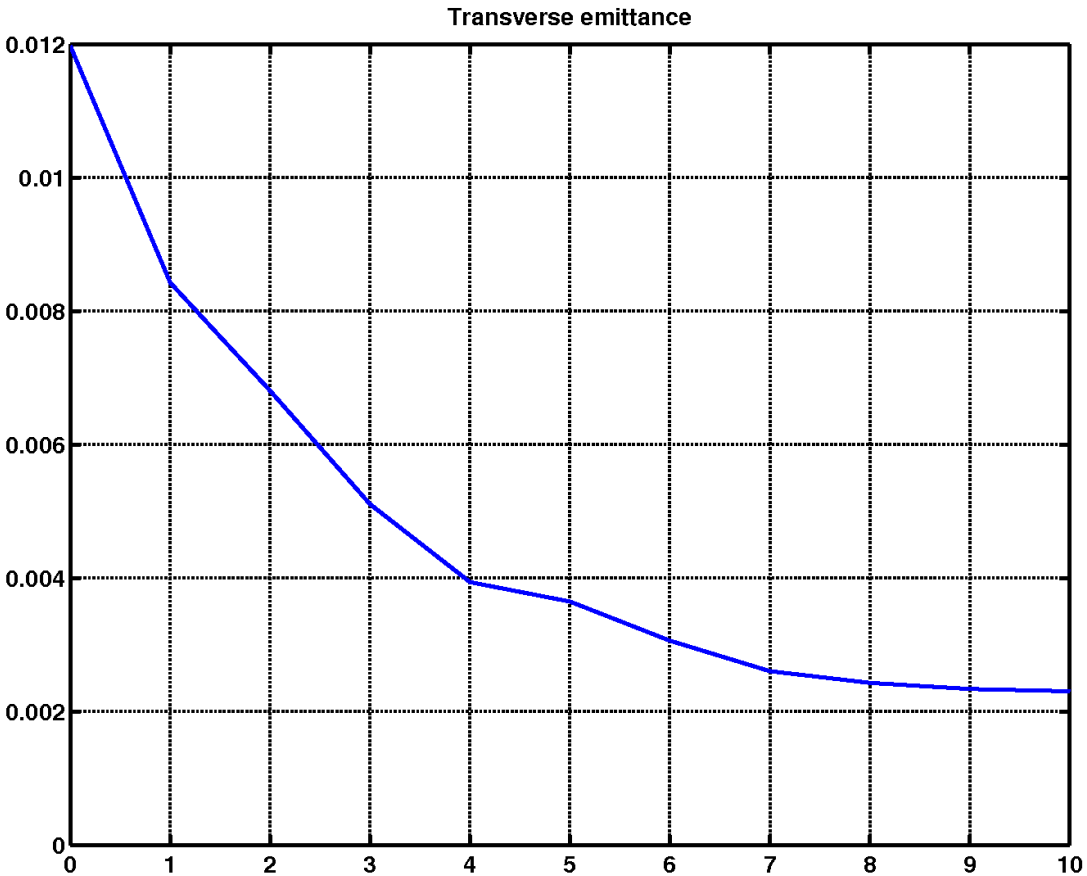
Transmission



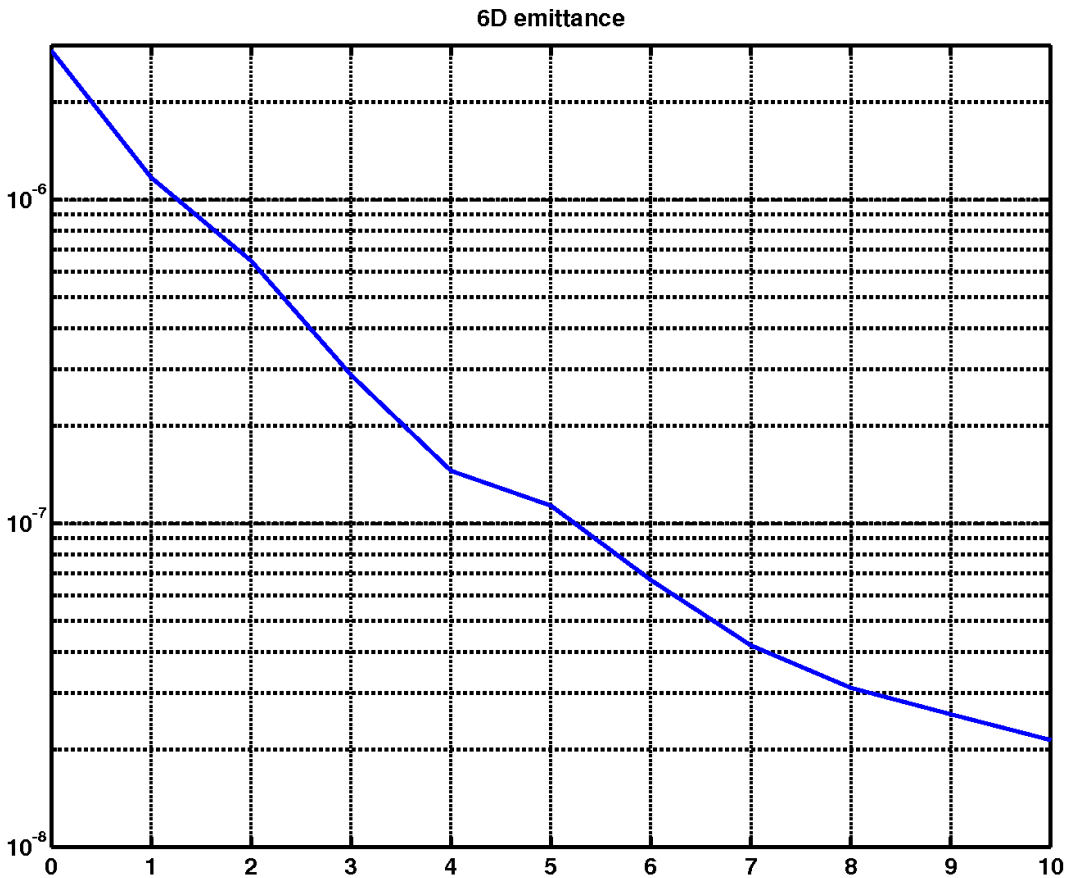
Longitudinal emittance



Transverse emittance



6D emittance

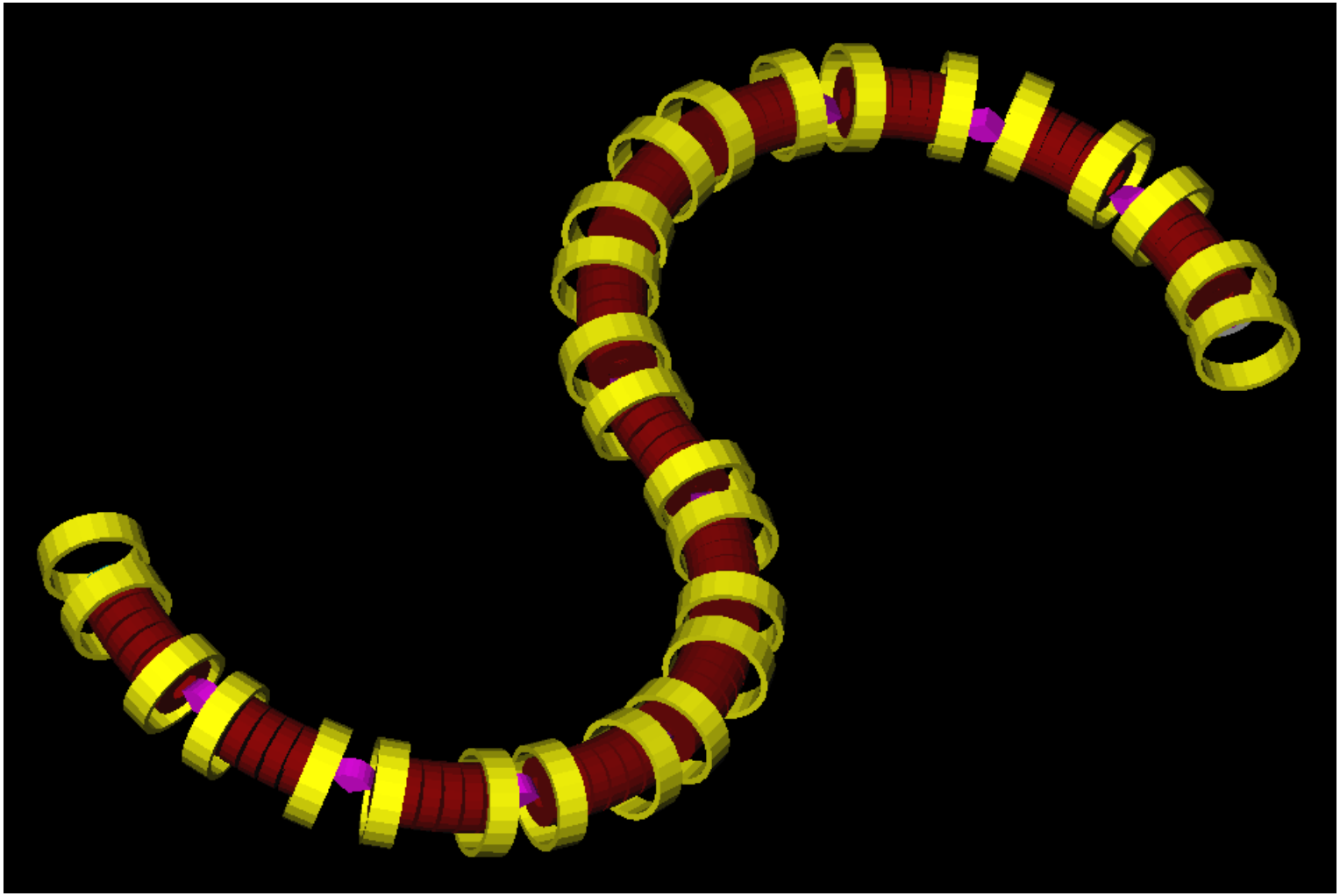


ε_{6D} goes from $3 \cdot 10^{-6}$ to $2 \cdot 10^{-8}$

Next steps:

- implement more realistic elements (absorbers, RF cavities);
- consider alternative geometries (some words below);
- consider alternative lattices.

RFOFO snake



Summary

- Transmission problem is solved;
- Various parameters are tuned in such a way that the 3-layer "shielded" model transmission is 51%, and the 1-layer "non-shielded" model transmission is 45% versus the RFOFO 60%;
- 6D emittance after 10 turns (330 m) reduces 150 times;
- Overall I'd say "6D cooling in the Guggenheim seems to work" should be replaced by "6D cooling in the Guggenheim works!"