The “Guggenheim RFOFO Ring”

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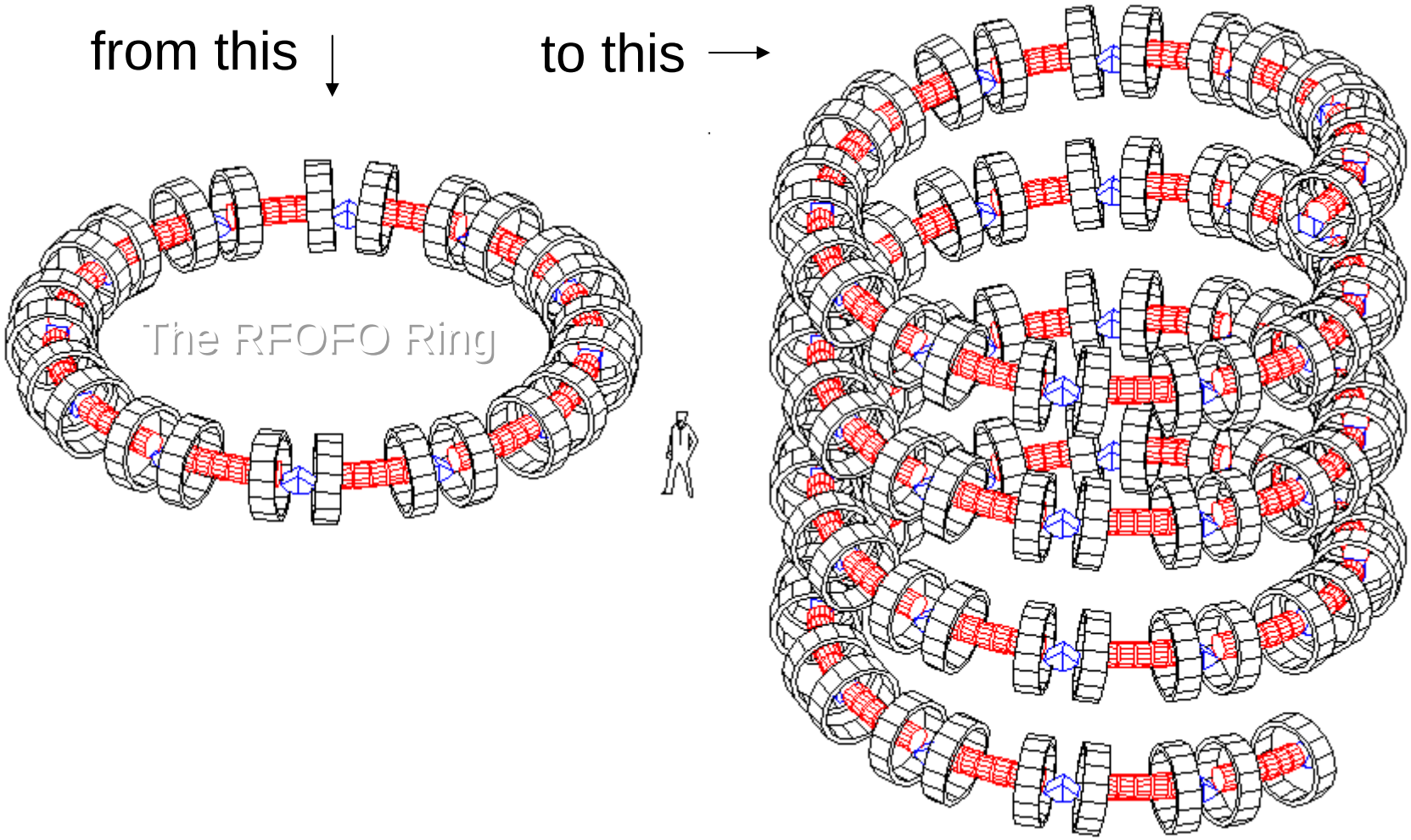
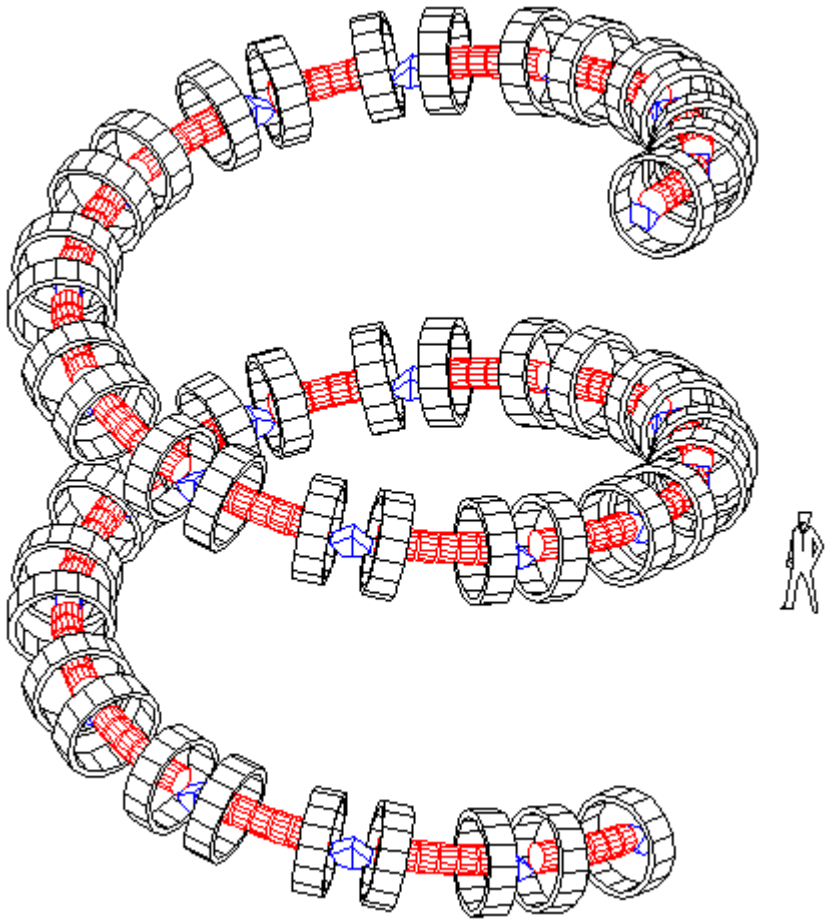
The idea: change the geometry

from this ↓ to this →



A simpler view of the Guggenheim



Why “Guggenheim”

- Injection/extraction – not a problem!
- Less heating of the absorbers
- Tapering possible – more efficient cooling

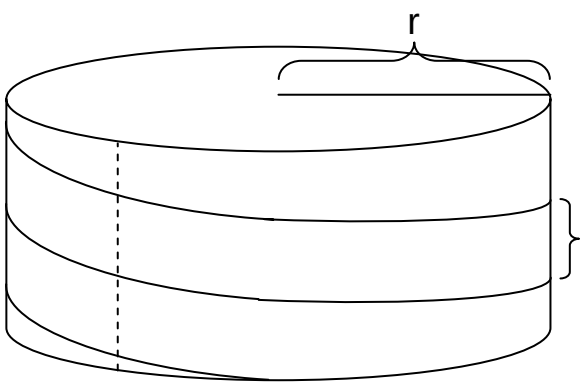
- BUT –
- massive, expensive (more RF cavities)
- Magnetic shielding of some sort is needed

Simulating the Guggenheim ring

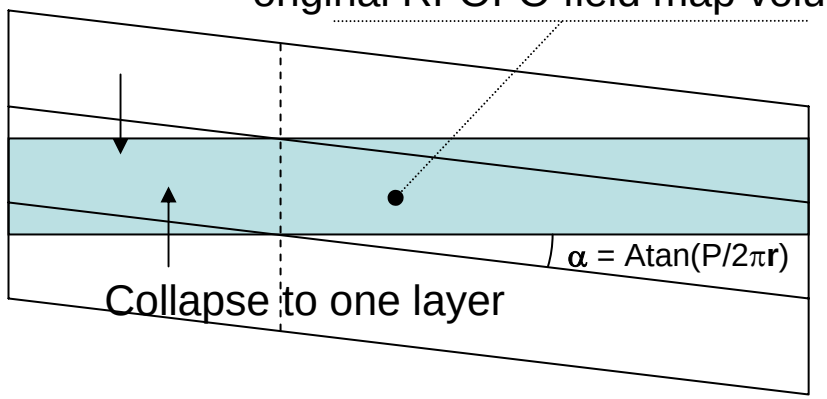
- Starting with:
  - a working GEANT3 simulation of the RFOFO
  - magnetic field map for the RFOFO ring
- Software modification:
  - a simple way of turning the existing field map into a “Guggenheim” using only 2 parameters: P (pitch) and ϕ_0 (azimuthal angle offset)
  - This modification does not take into account the effects of “ring stacking”

Turning a ring into a helix

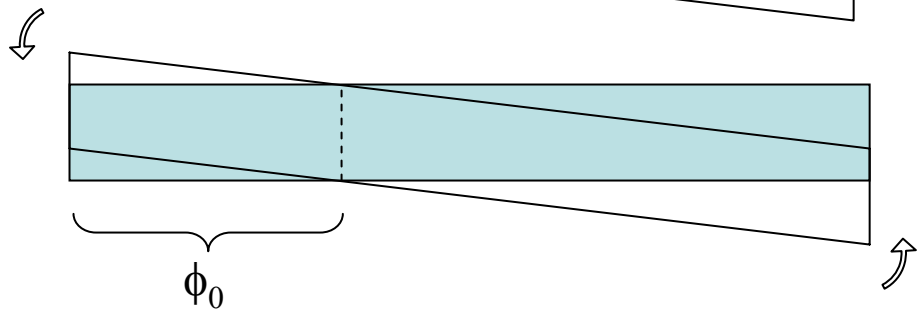
For each point x,y,z ➔ r,ϕ,y



"peel off"



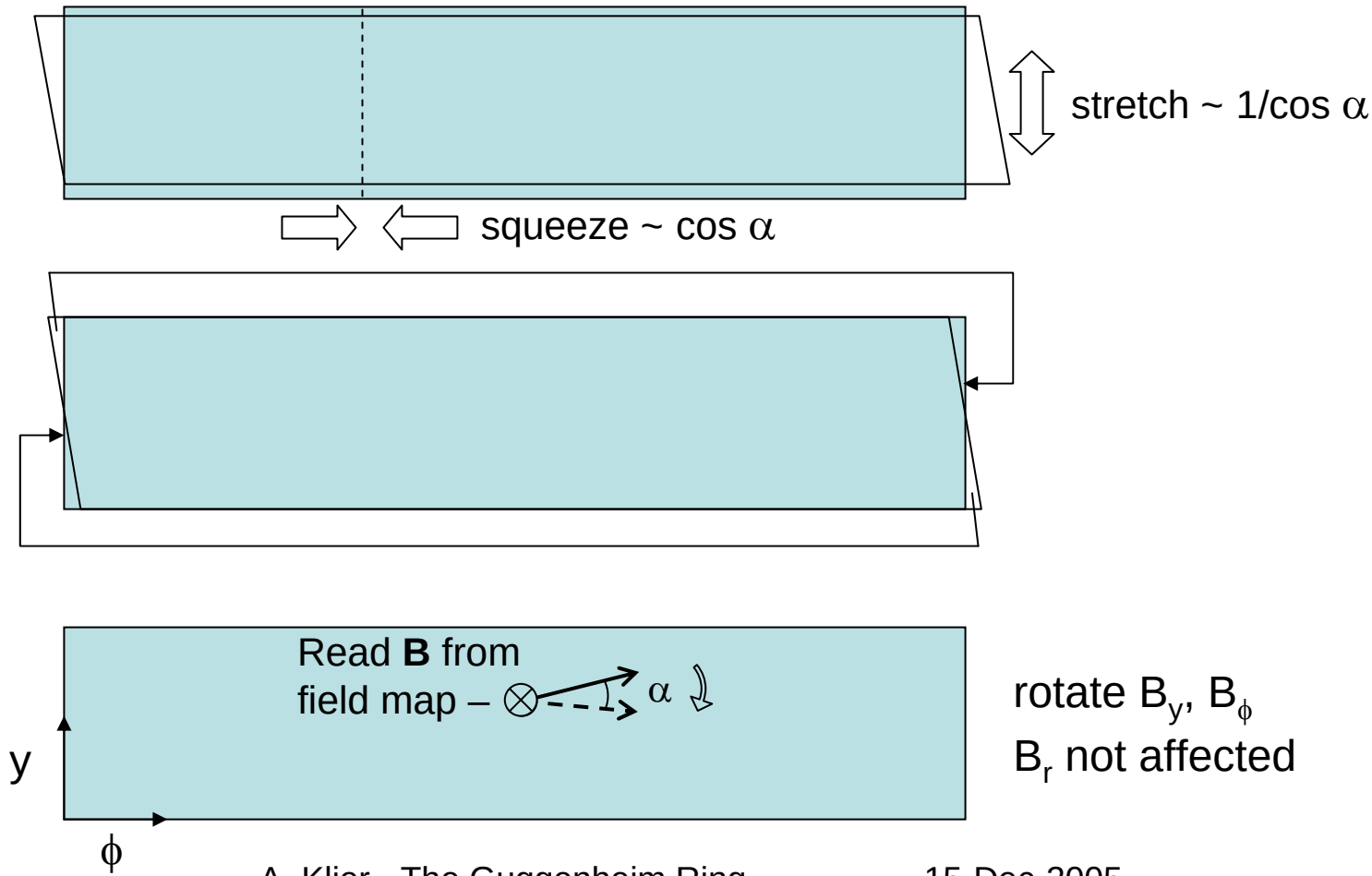
Rotate by angle α



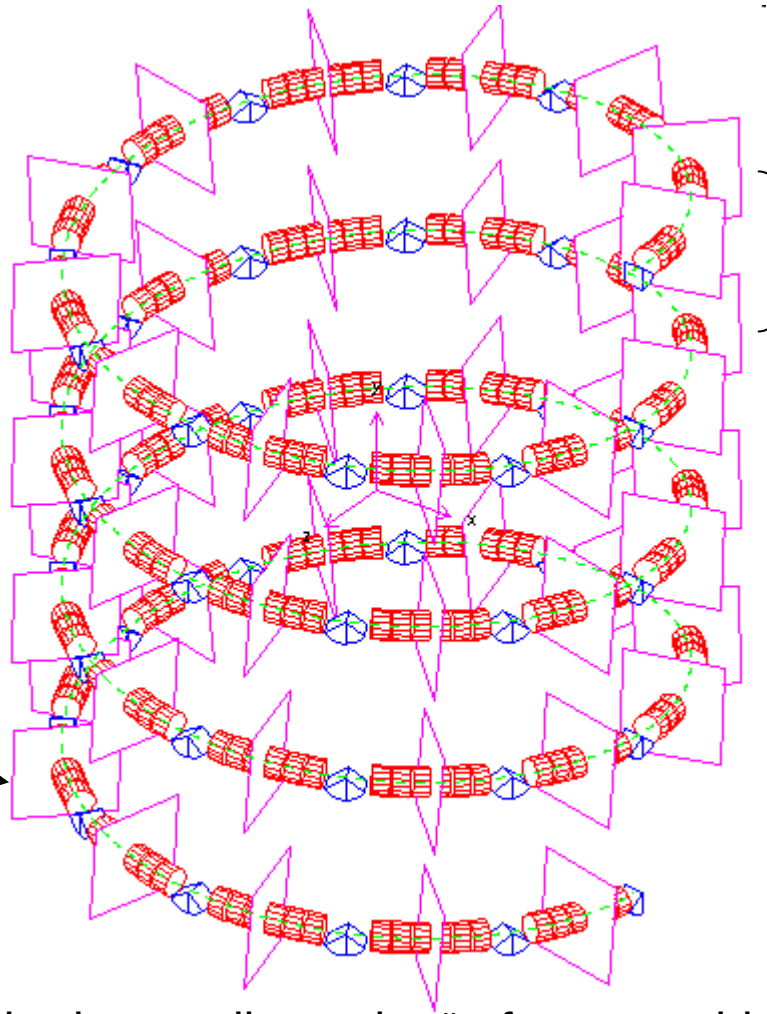
More adjustments needed

Turning a ring into a helix

Exaggerated view of a single “slice”:



It works!



dashed green line – the “reference orbit”

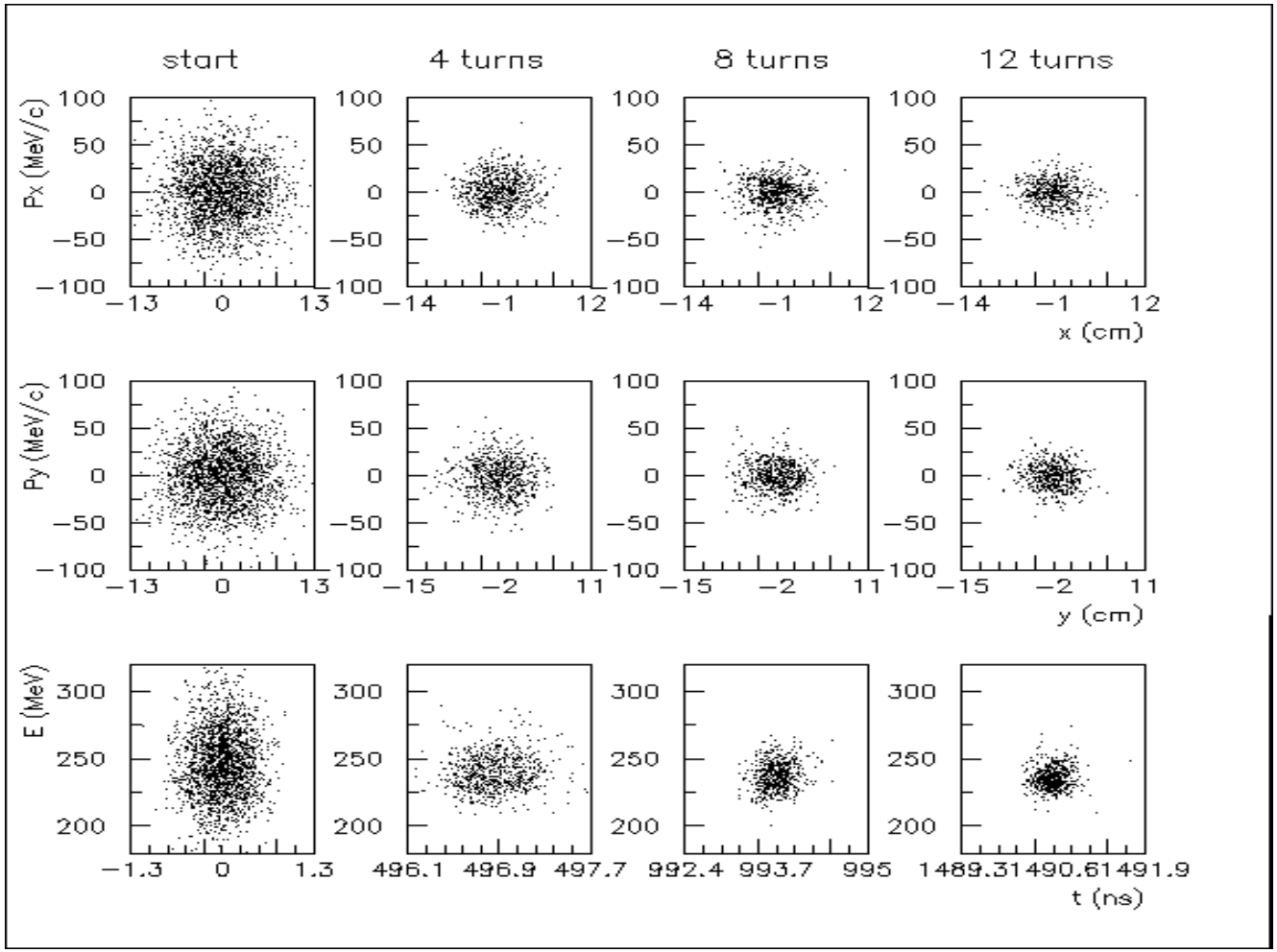
Cooling simulation

- No windows, but otherwise realistic...
- The “reference orbit” – 25th harmonic of the 201.25 MHz (but that’s not necessary!)
  - Longitudinal momentum = 205 MeV/c, compared to 201 MeV/c for RFOFO

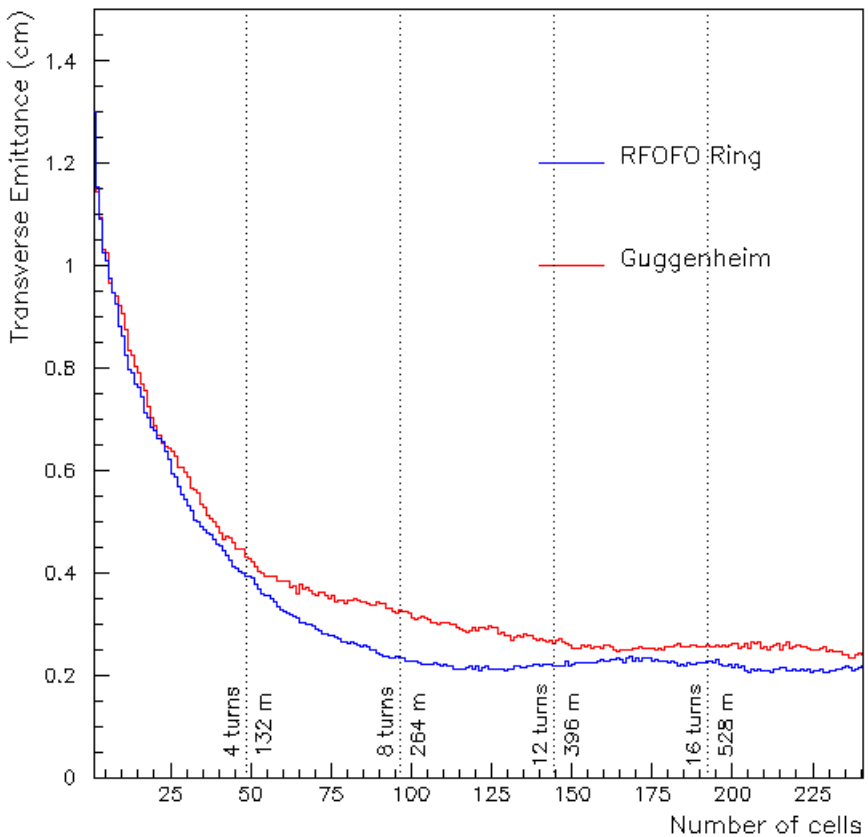
    (longer path requires β ratio = $1/\cos \alpha(r)$)
- Use the same 1000-muon beam as the RFOFO
  - rotate by α about the x/r axis at entry

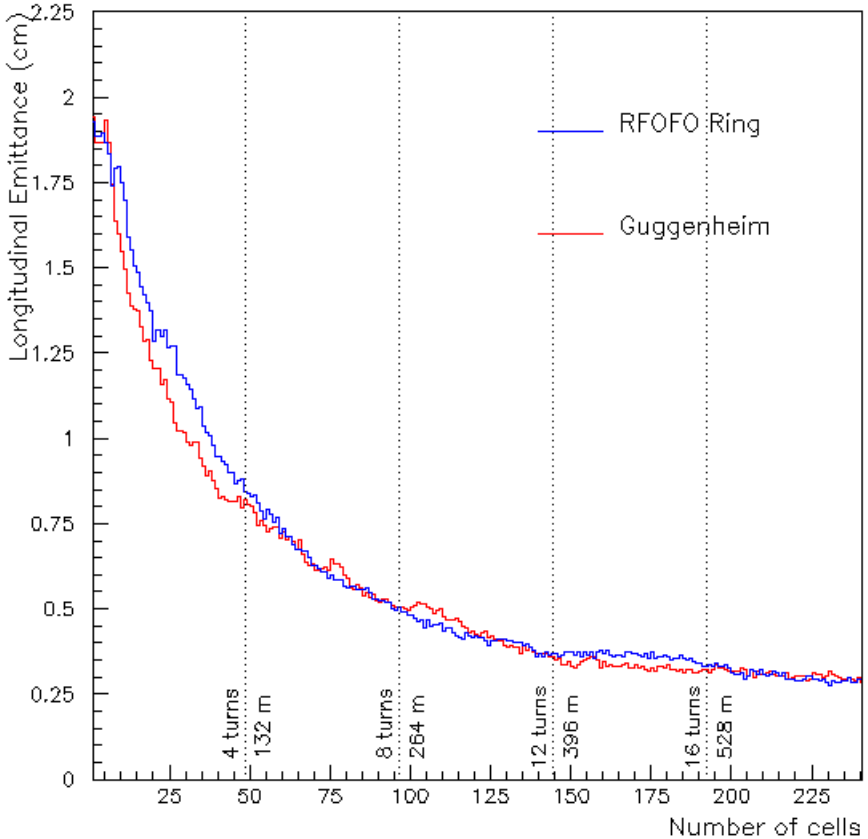
    (another new feature – 3-D rotation of the beam)

Cooling... seems to work

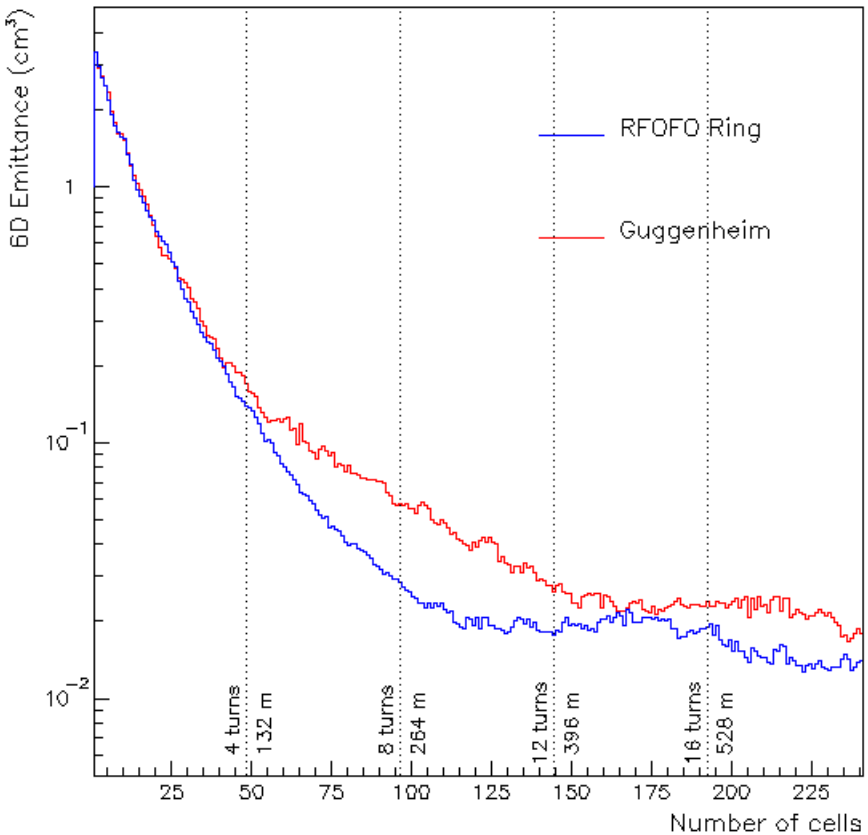


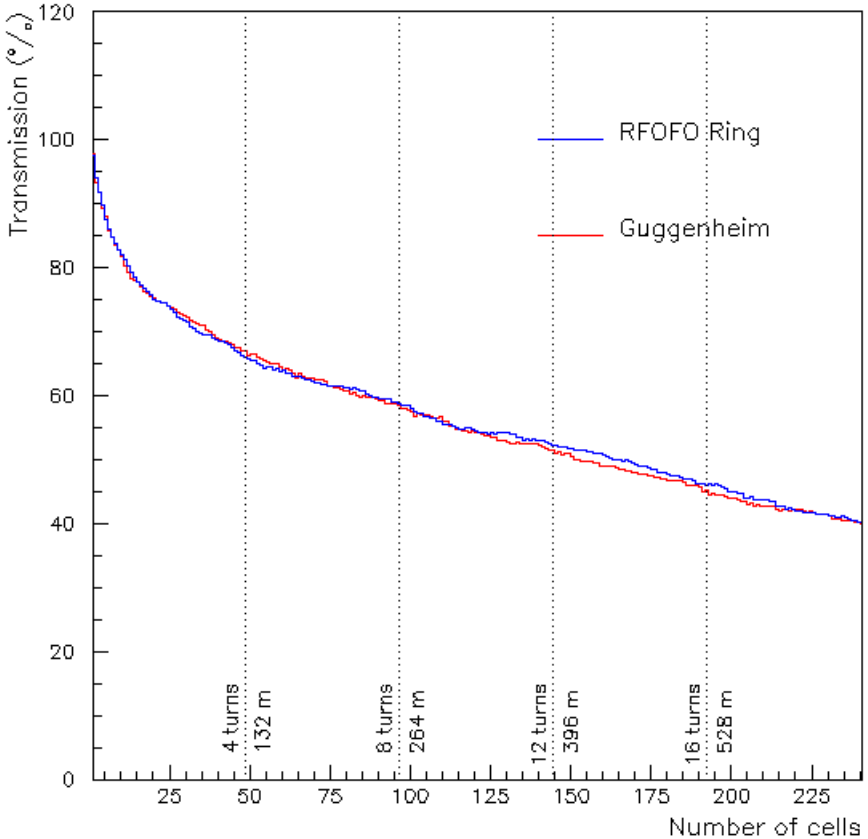
Comparing results



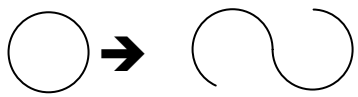


Comparing results





To Do

- More realistic magnetic field simulations
  - Examine how “ring stacking” influences magnetic field
  - Find the best shielding scheme:
    - with/without iron, additional solenoids, etc.
- Tapering – higher RF frequencies at later stages
  - lower cost, possibly better cooling
- Consider the “snake” option 
    - has the advantages of the Guggenheim, without the stacking
    - however, less dispersion – possibly less 6-D cooling