RFOFO Update

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Outline

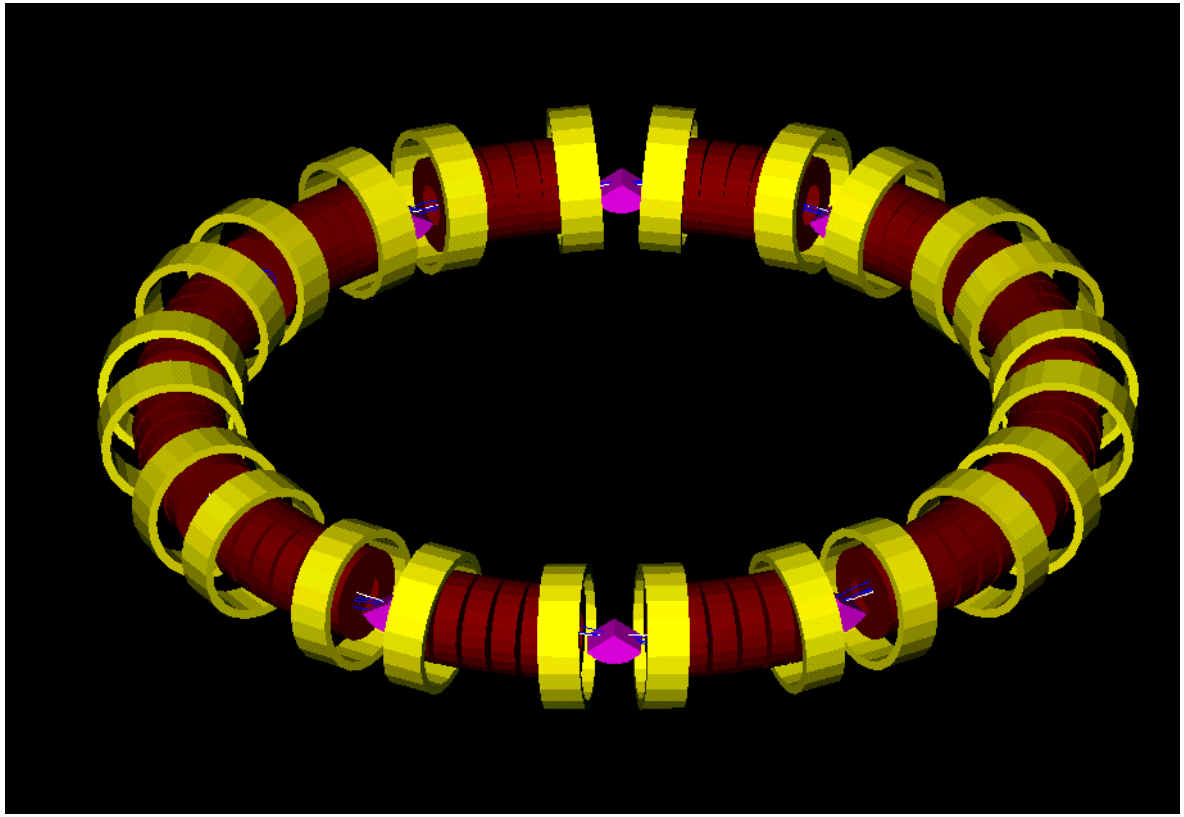
- G4Beamline simulation of the RFOFO ring
- RFOFO Helix (‘Guggenheim’) simulation
  - Magnetic field symmetry issues
  - The “twisted” RFOFO configuration

Why G4Beamline

- “GEANT4 is the future...”
  - Geant3 is not supported any more
- Unlike the old package (MUC_GEANT), G4Beamline allows changing coil and field configurations easily
  - CRUCIAL for realistic **RFOFO Helix** simulation
- Other features that weren’t yet introduced to “my” code are already built-in in G4BL

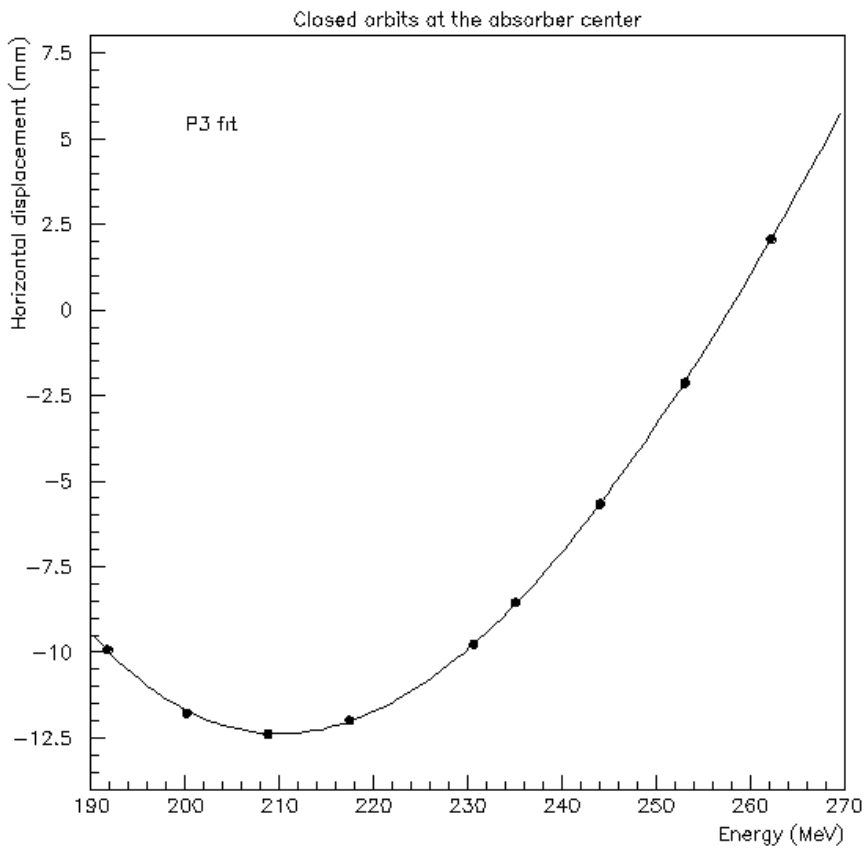
RFOFO@G4BL – Full View

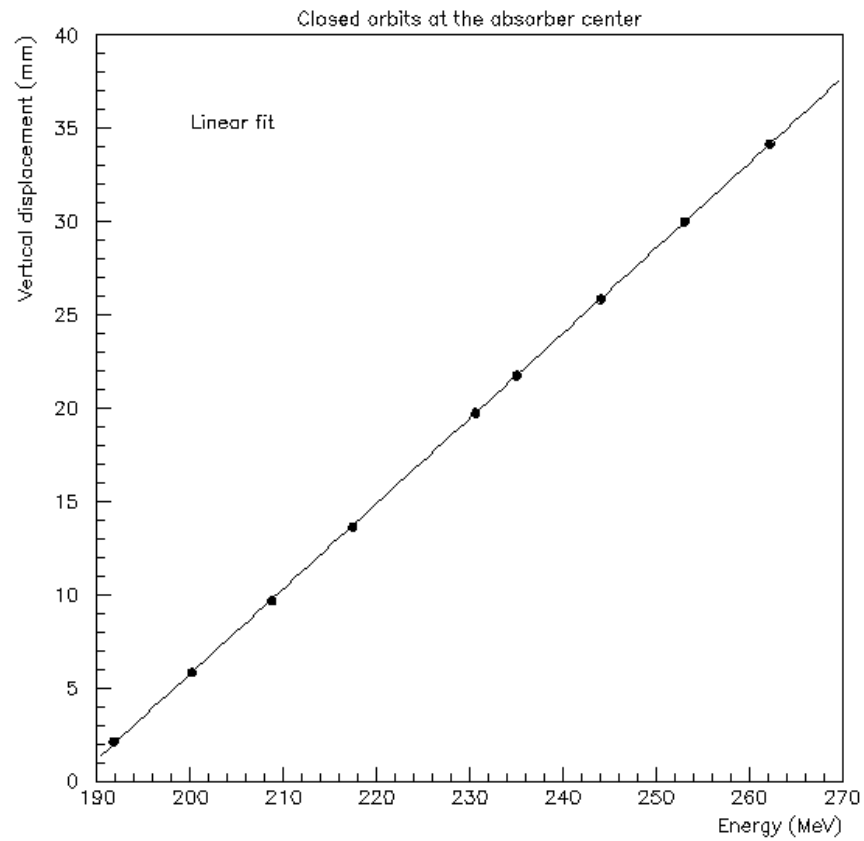
- Before going to the helix, start with something we know: the RFOFO Ring



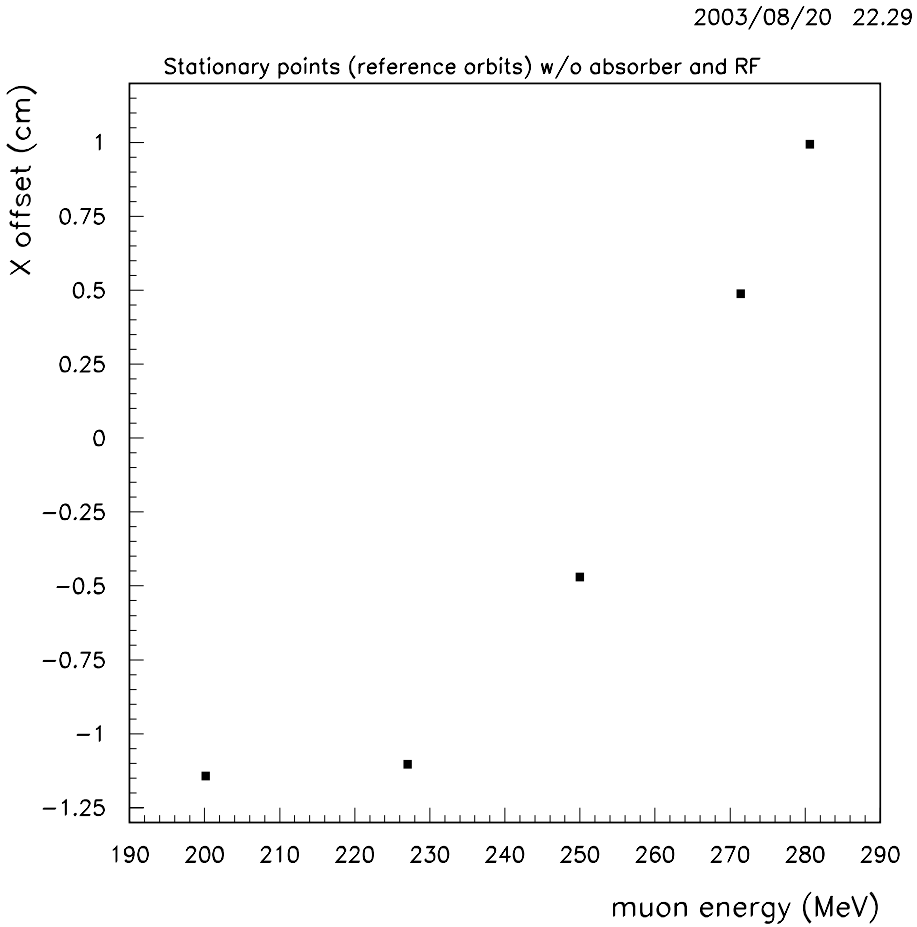
G4BL Simulation: Magnets Only

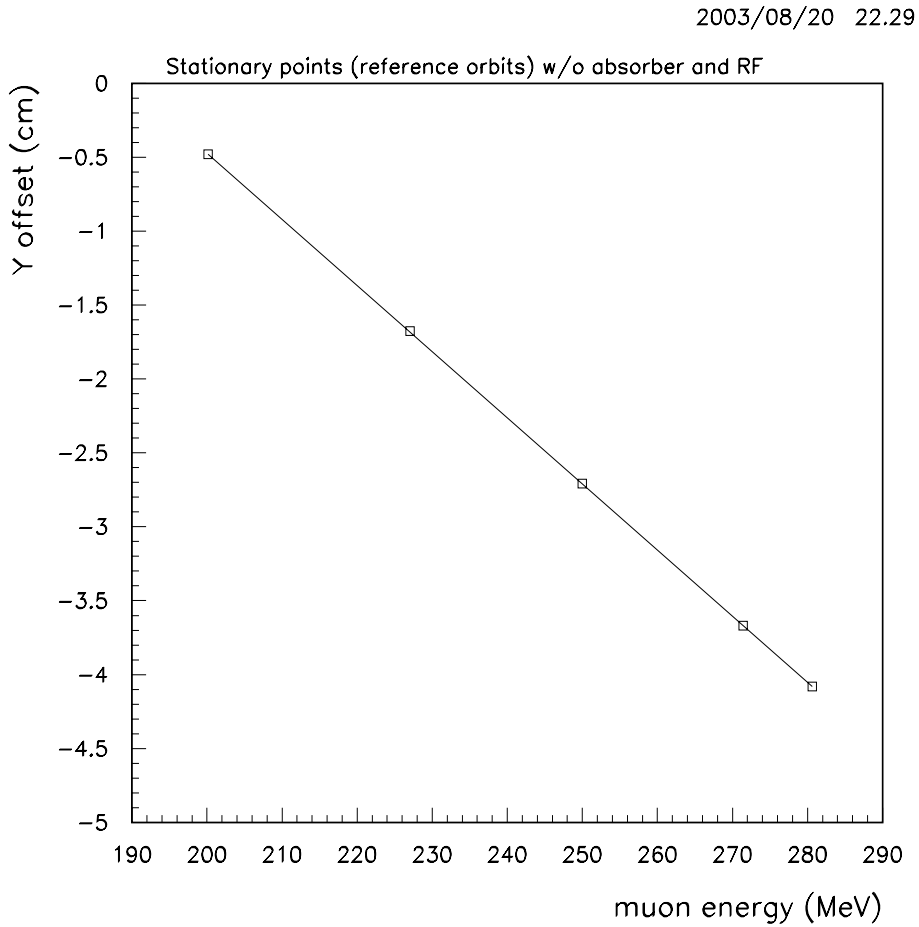
- Find closed orbits, dispersion functions





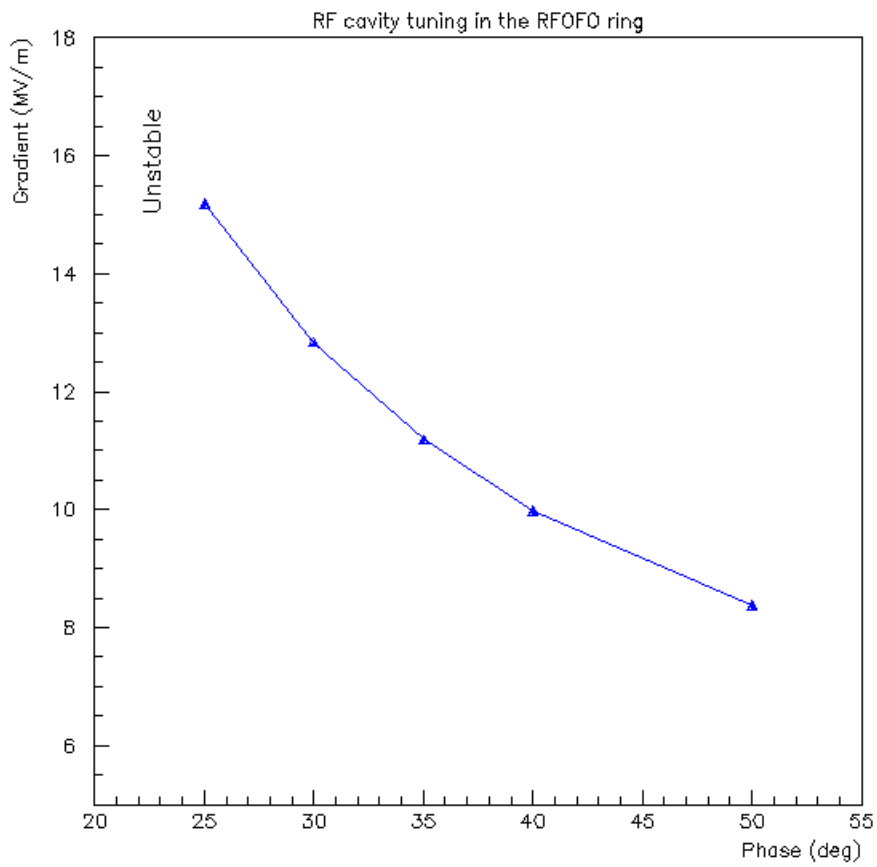
Old Stuff

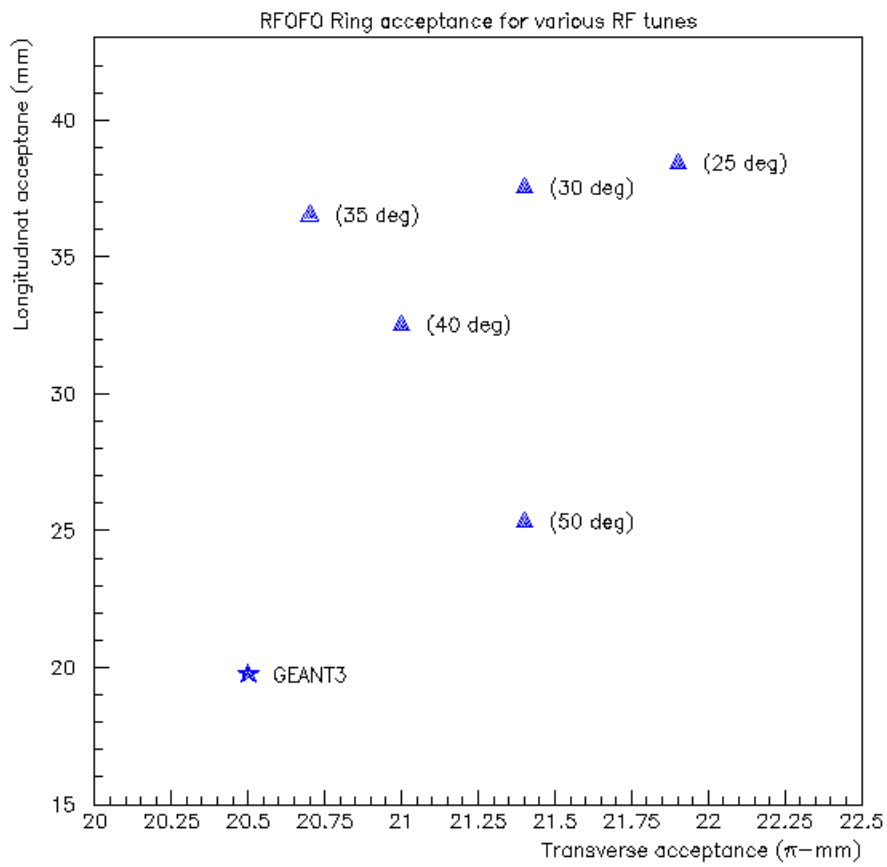

2003/08/20 22.29
Stationary points (reference orbits) w/o absorber and RF
X offset (cm)
1
0.75
0.5
0.25
0
−0.25
−0.5
−0.75
−1
−1.25
190 200 210 220 230 240 250 260 270 280 290
muon energy (MeV)


2003/08/20 22.29
Stationary points (reference orbits) w/o absorber and RF
Y offset (cm)
0
−0.5
−1
−1.5
−2
−2.5
−3
−3.5
−4
−4.5
−5
190 200 210 220 230 240 250 260 270 280 290
muon energy (MeV)

Next: RF with 'Ideal' Absorber

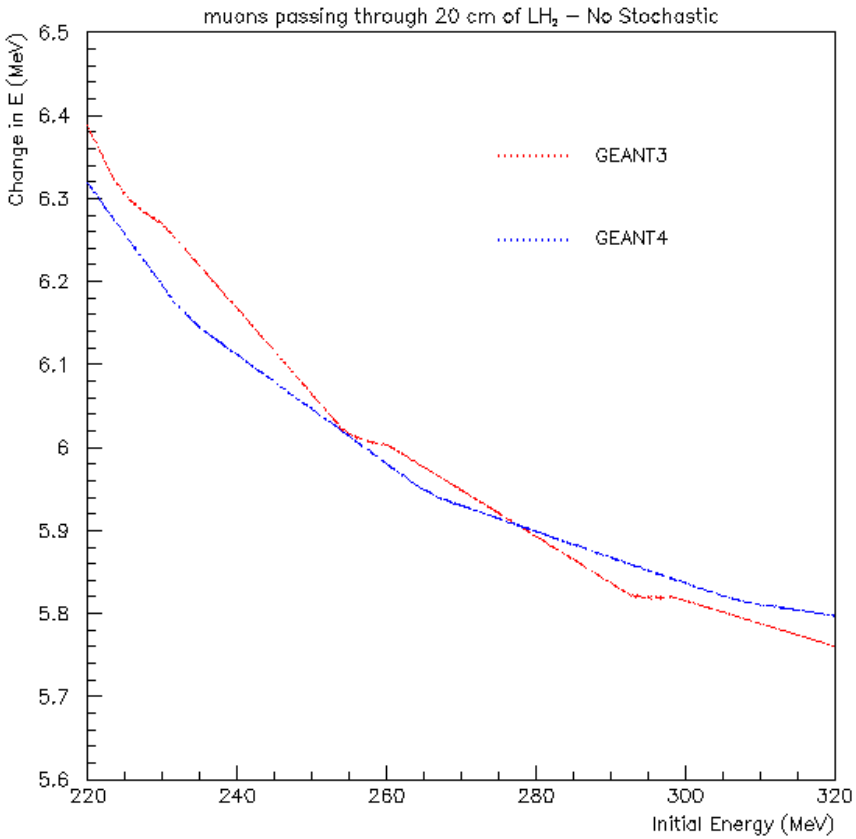
- Tuning is automatic in G4Beamline





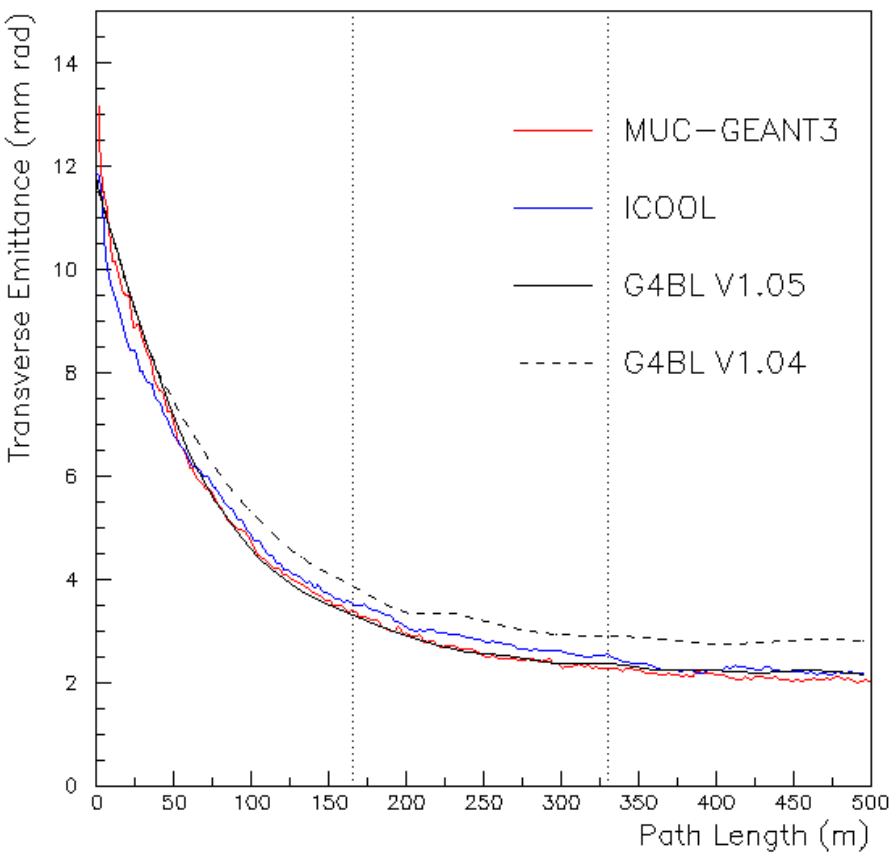
Difference in Acceptance

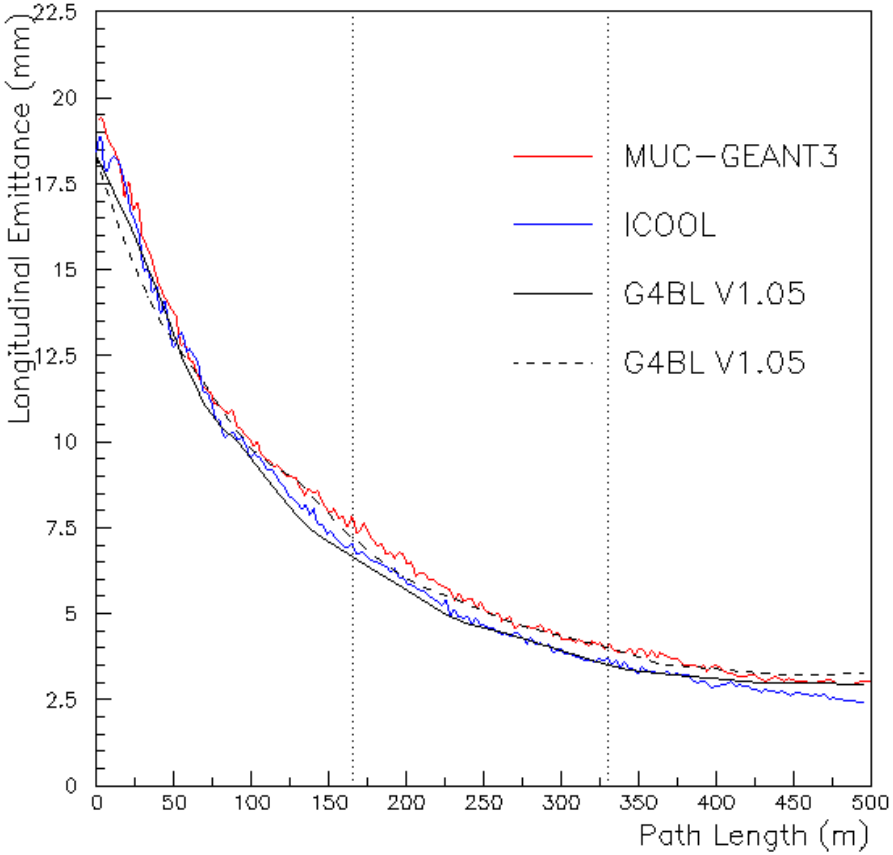
- Could it be due to different dE/dx?
- Could it be better tuning scheme?
  - in Geant3 ref. particle was not affected by momentum change



Turn On Stochastic Processes

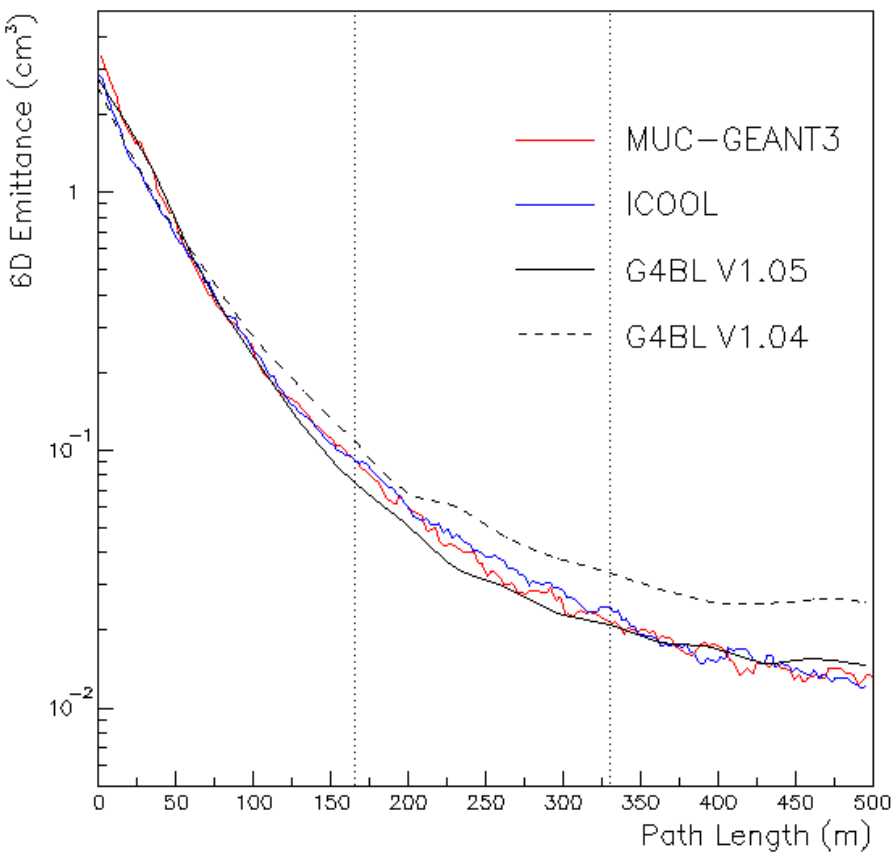
- Geant4 v8.1 finally got it right...

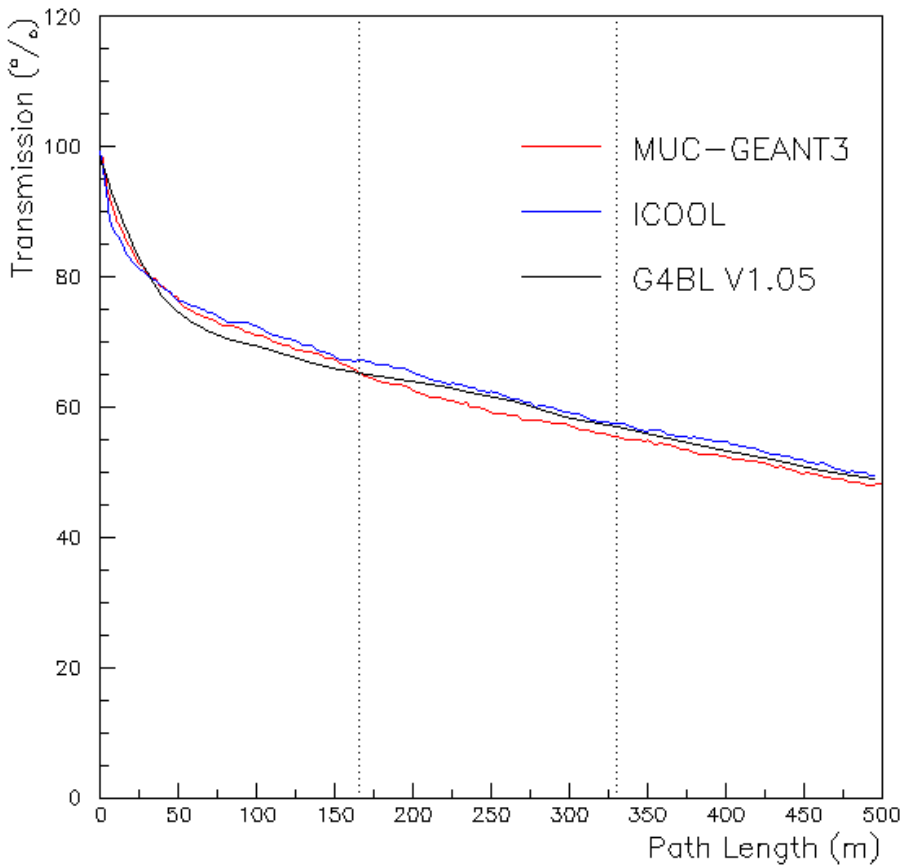




More Comparisons with Geant3

- Good agreement with the latest version

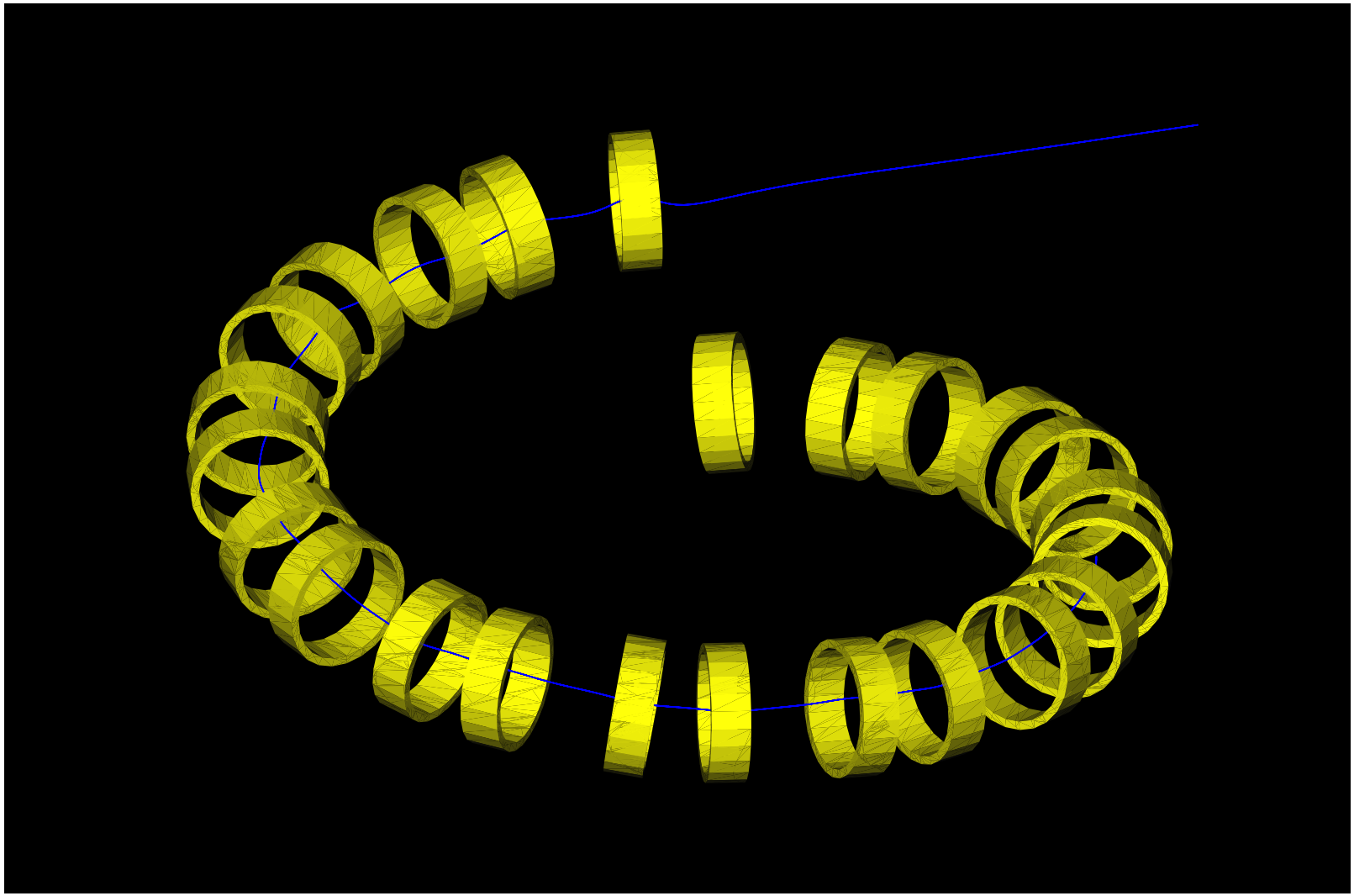




Next Step: Helix (‘Guggenheim’)

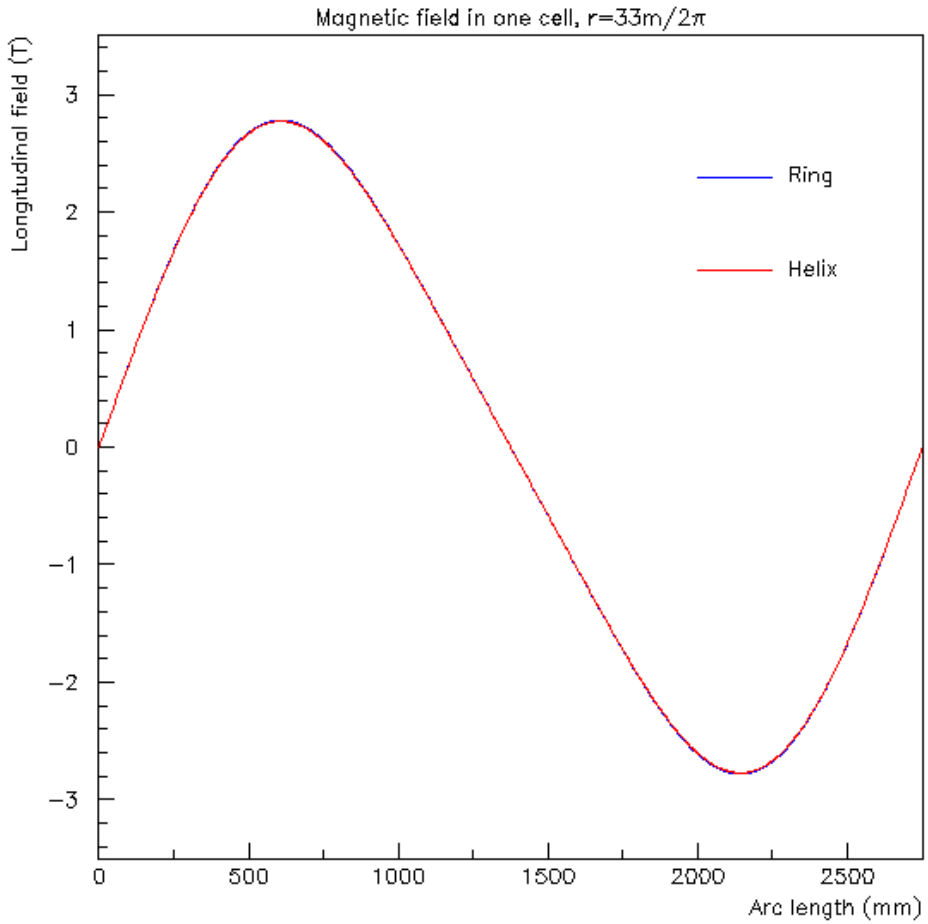
- Before cooling simulation, understand difference from RFOFO ring
  - Work in progress
- With G4Beamline, it is easy to generate and change realistic field maps
  - No geometrical manipulations! (that’s good)
  - make it as realistic as possible by placing around the ‘measured’ cell as many cells as possible, but not too many (coils above/below cell may distort field – no shielding in G4BL!)

Geometry (Solenoids Only)



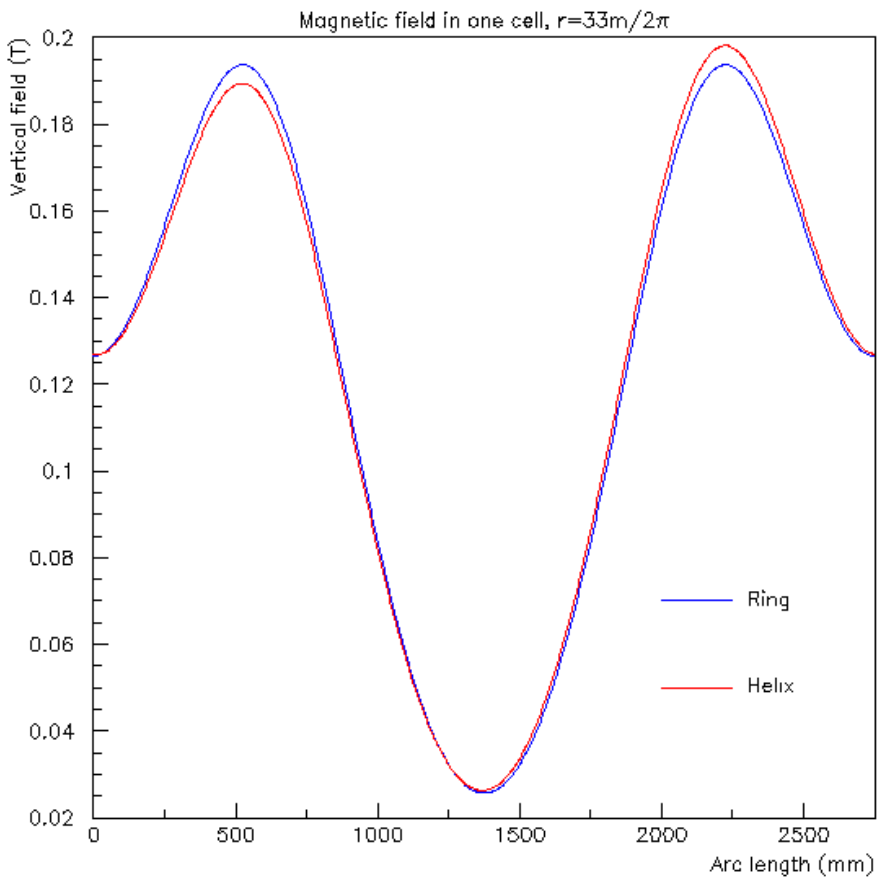
Compare Helix Field to Ring

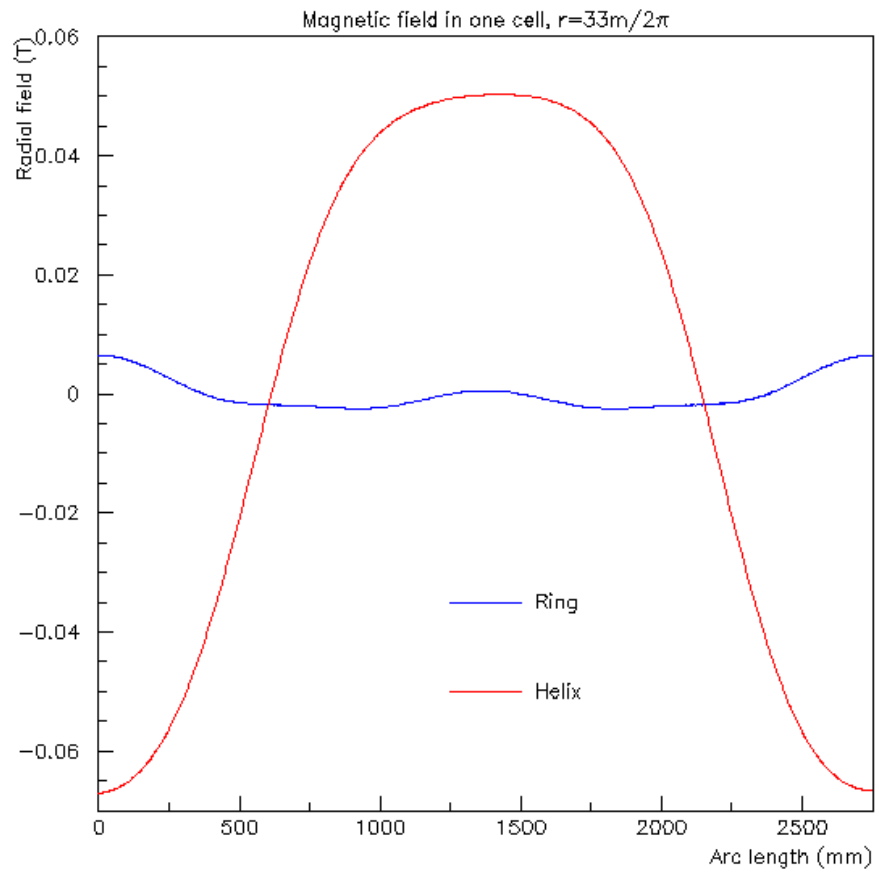
- ‘Longitudinal’ (ascending) field seems OK



But...

- Vertical asymmetry
- Radial component





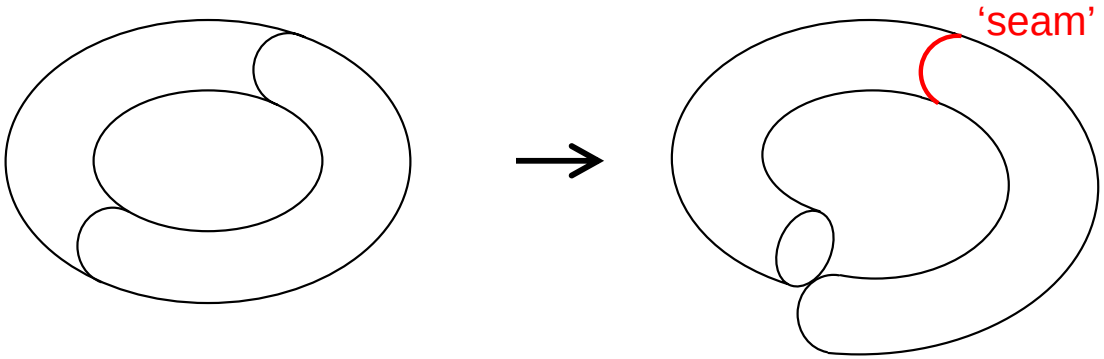
The Problem

- The asymmetry in B_y is due to the up-down asymmetry of the tilted solenoids
  - Can’t be fixed (at least I don’t know of a way)

- With broken ring symmetry, it’s hard (if possible at all) to find symmetry planes for closed orbits

A Possible Solution

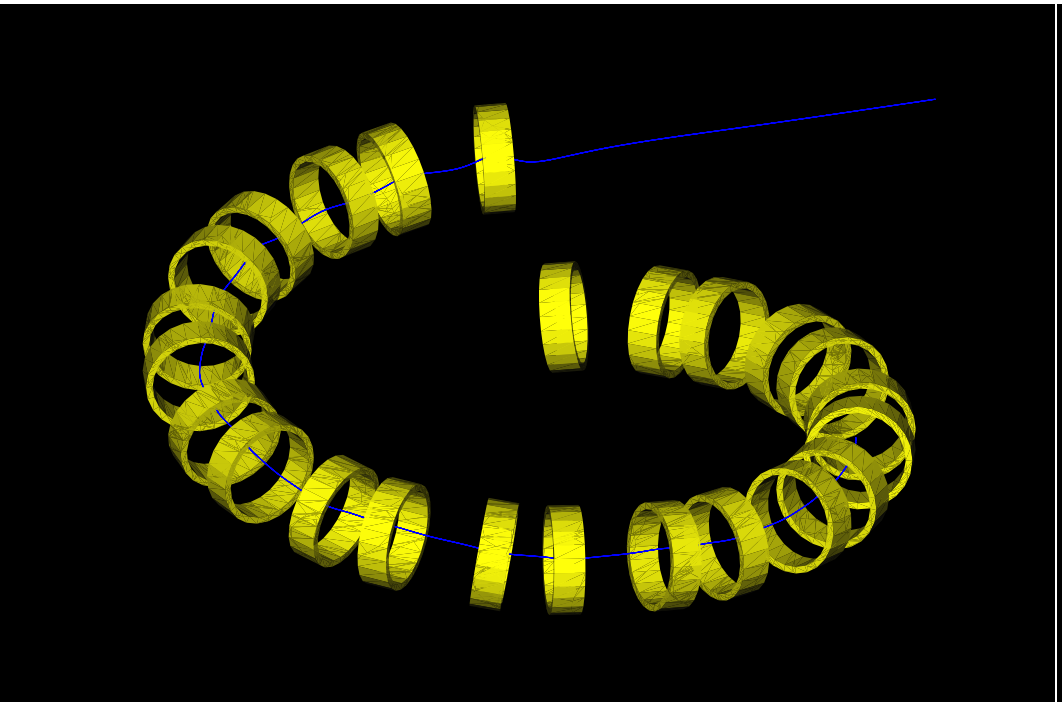
- The ‘Twisted RFOFO’ is made of half-rings



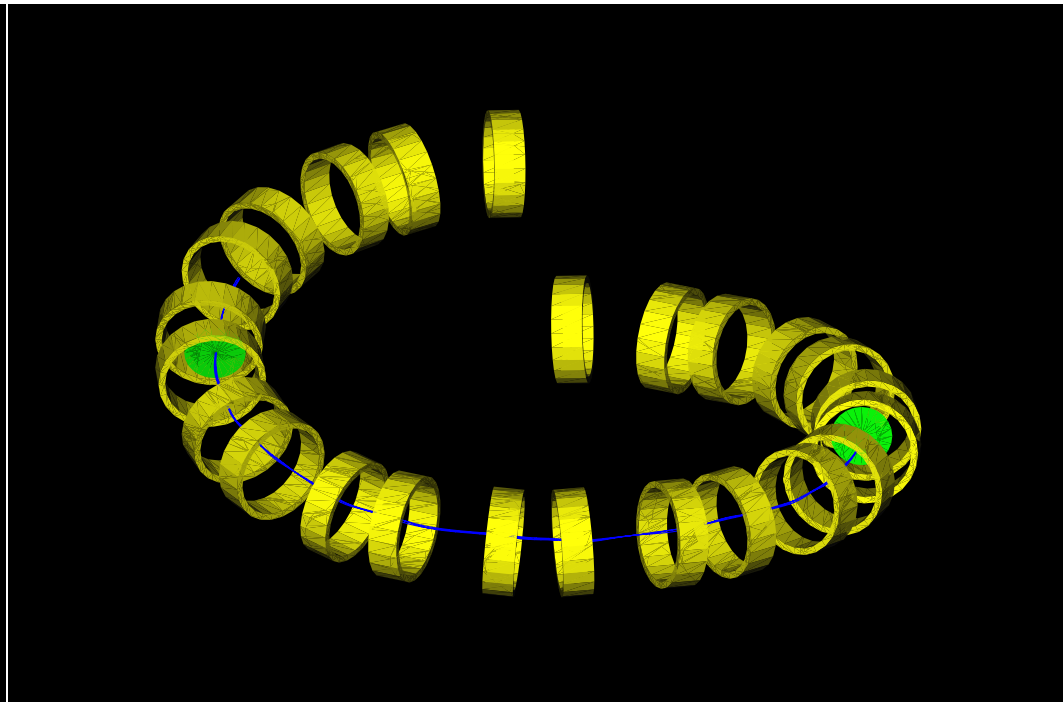
- The middle of each half-ring can be considered a symmetry plane

Can you yell the difference?

Helix RFOFO:

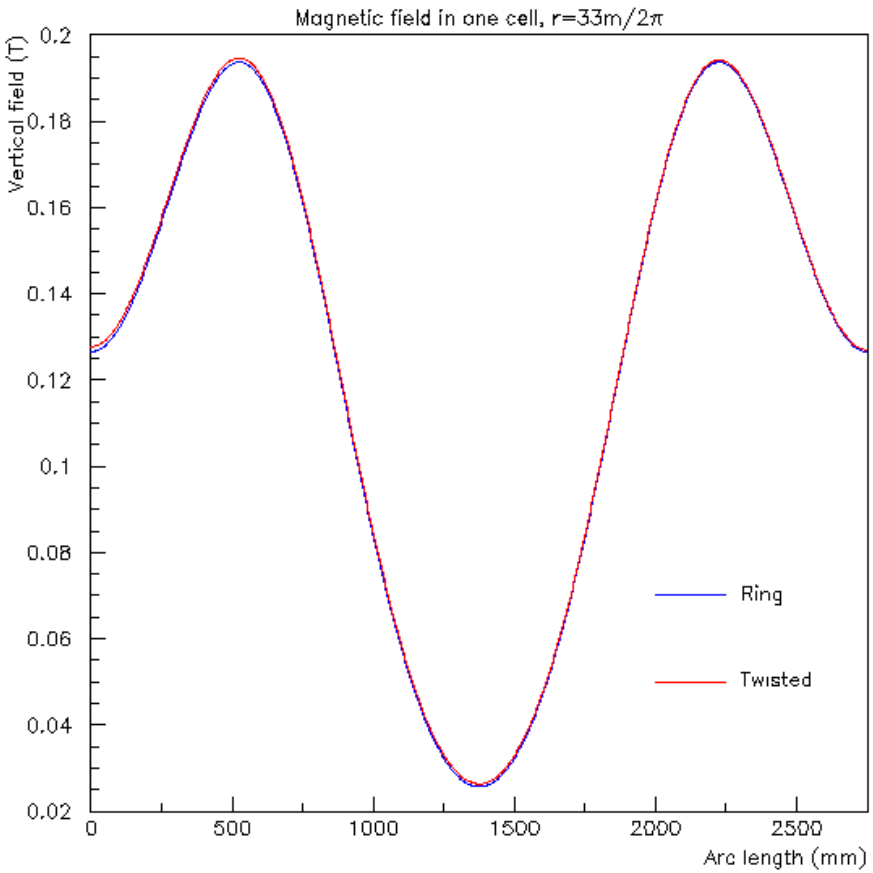


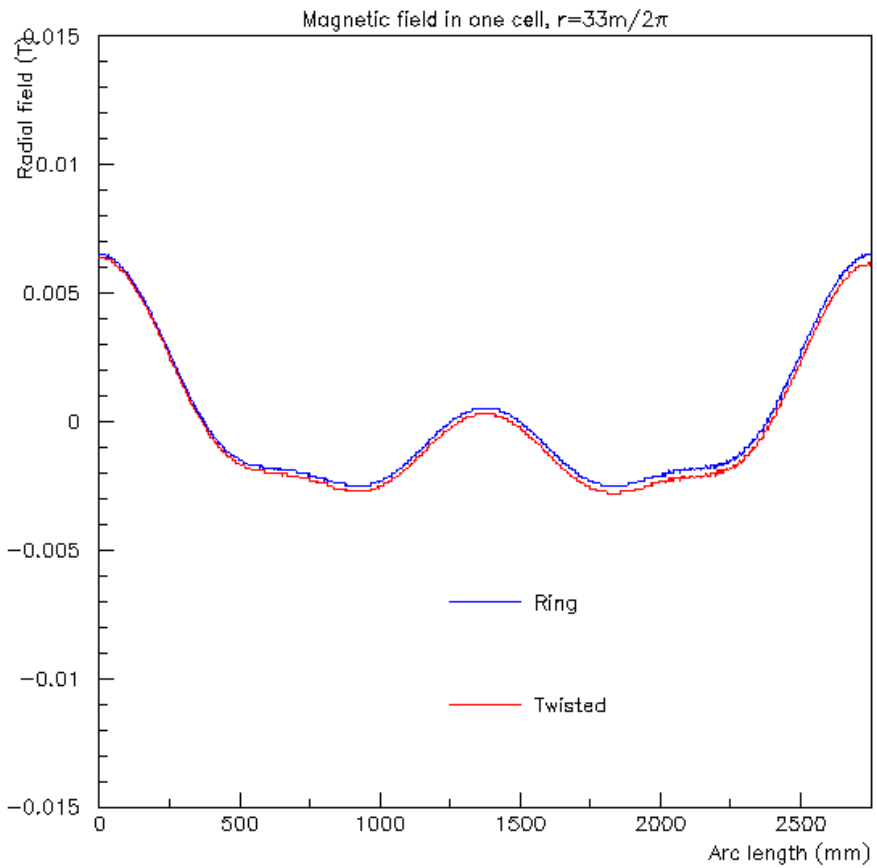
Twisted RFOFO:



Compare Twisted RFOFO to Ring

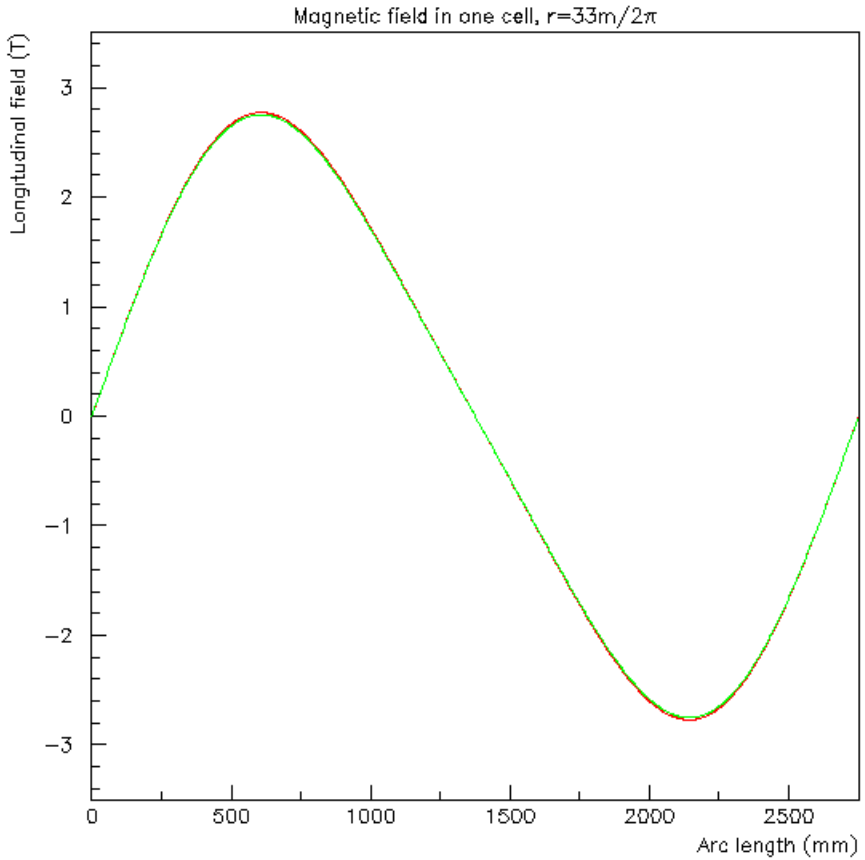
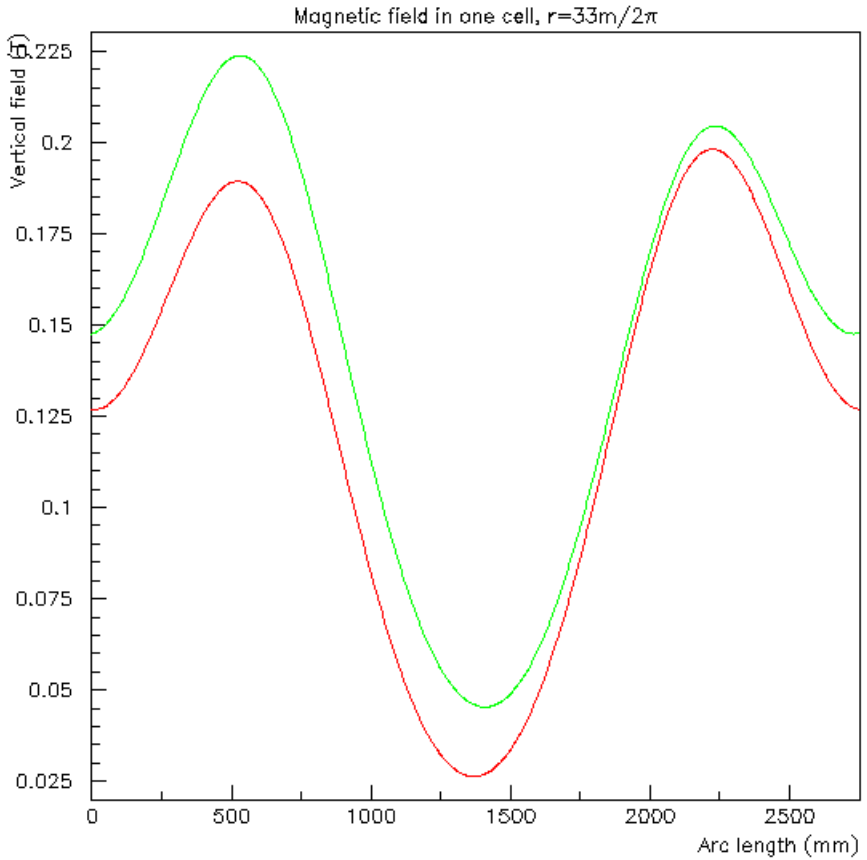
- Good agreement. Is it good enough?





To Do

- That's where I got so far
- Find closed orbits
  - The seam area may be a delicate issue
    - The 'pivot' location seems important
    - How important?
- Next on the list:
  - Cooling simulations
  - Other issues, such as tapering, etc.

The Effect of 'Ring Stacking'

- 'No shielding' significantly affects B_y.