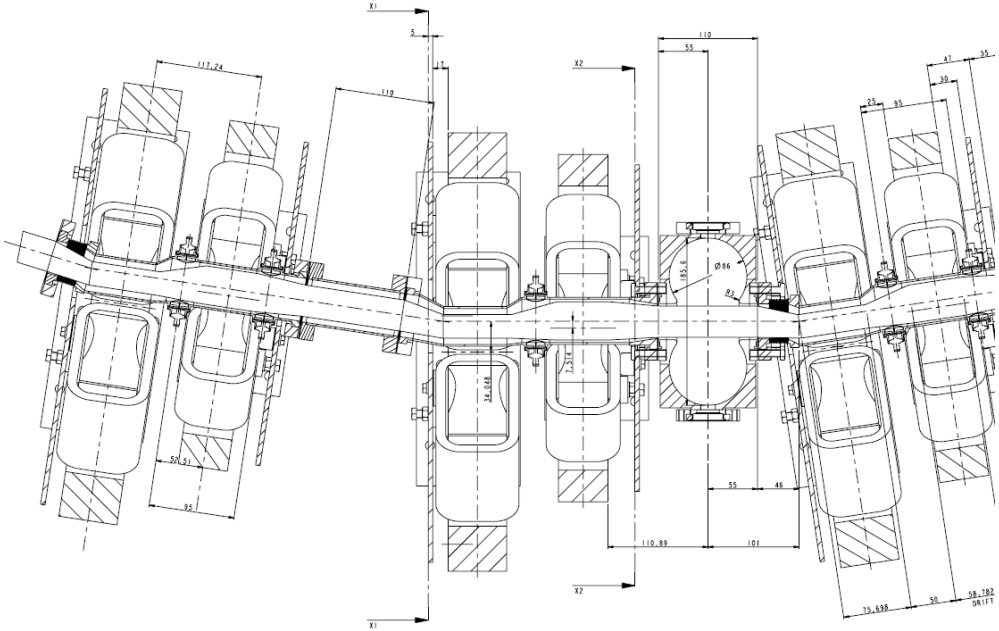
Cornell ERL-FFAG Lattice

Using Dejan's doublet arc cell

Reason for Using Doublets

- Shifting the F and D magnets together gives a larger drift (still only 10.1cm) without sacrificing much focussing strength
- This is the same tradeoff EMMA made



Dejan's 100 cells/turn, 11.5 m diameter Cornell Lattice

G_F = 52.973 T/m
B_{yF} = -0.170 T

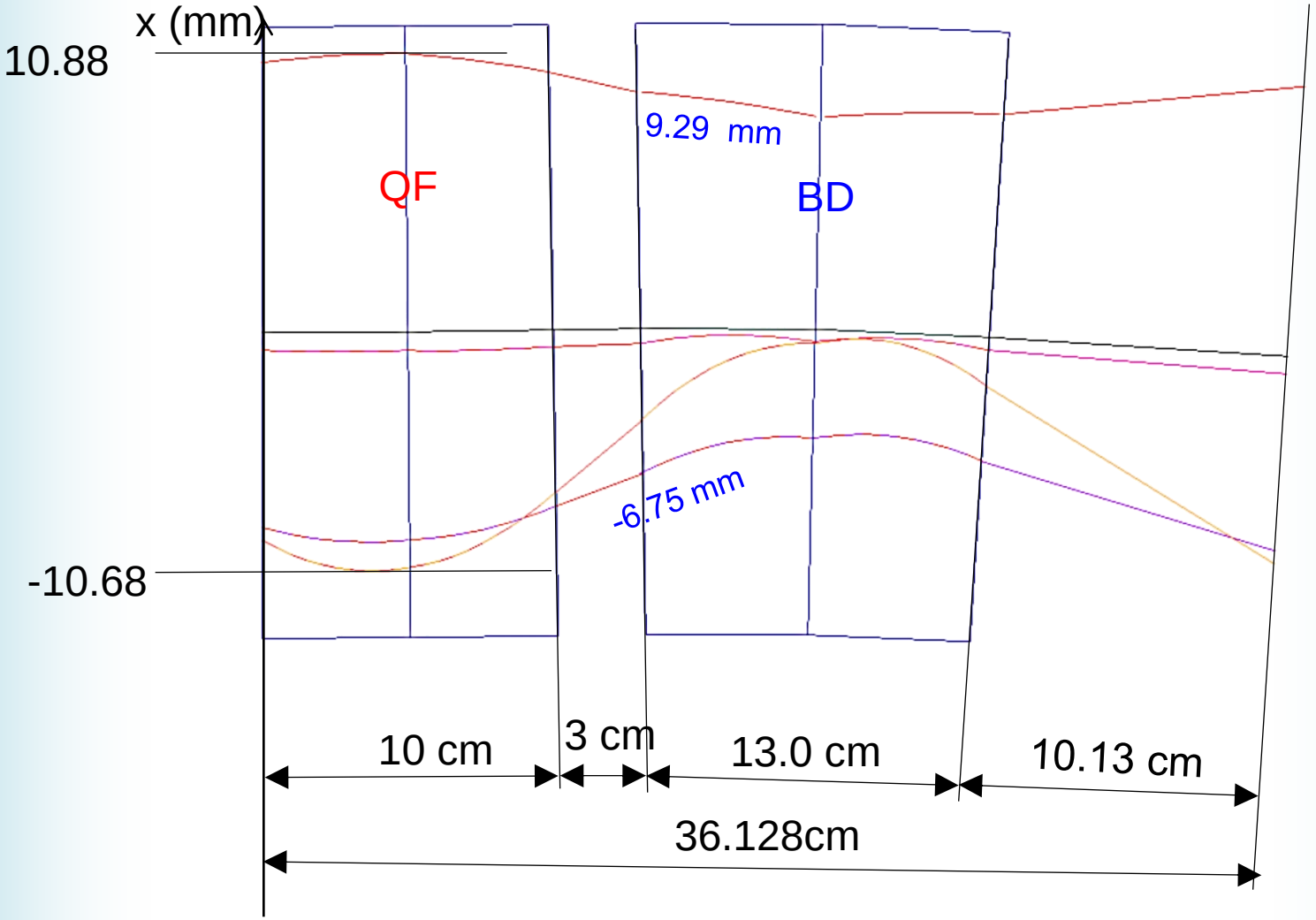
True quadrupole with offset

G_D = -35.33 T/m
B_{yD} = 0.655 T

Combined function B>0

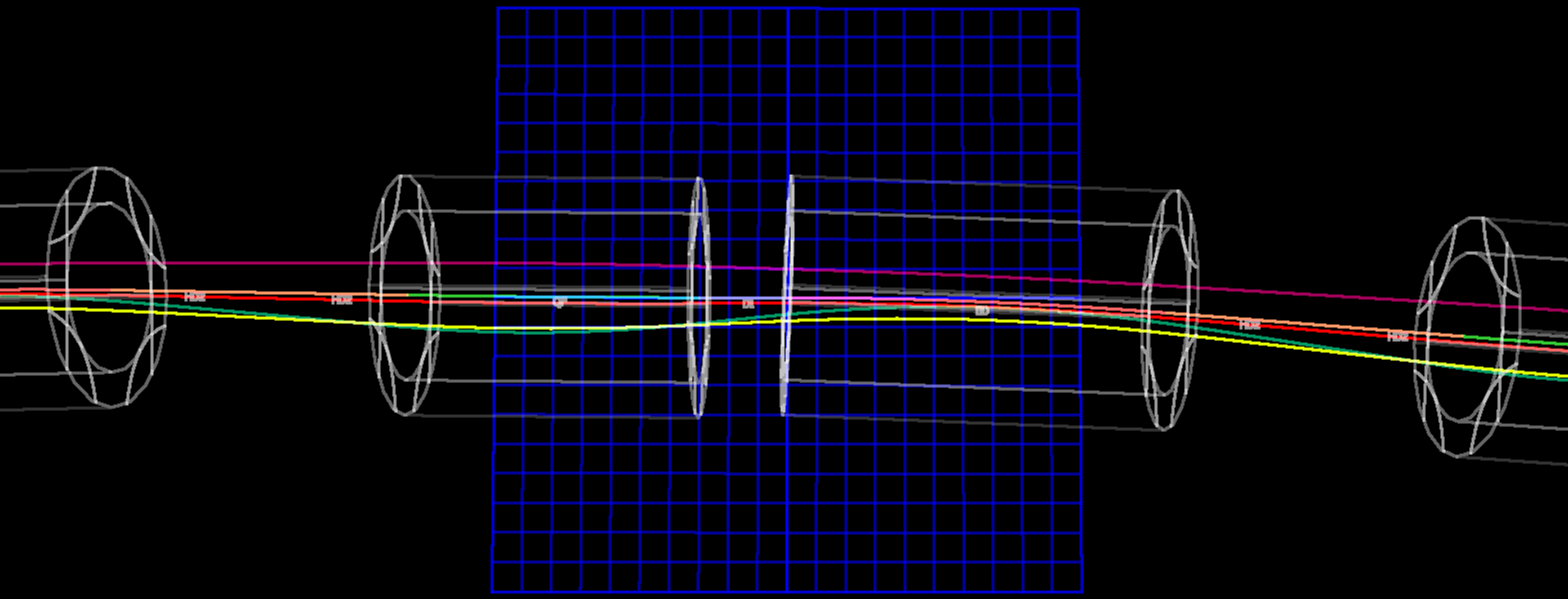
B_F= -0.170 + 52.973∗ x =0
x = 0.170/52.973 = 3.2 mm

BD=0.655 + (-35.33) x = 0
x = + 18.53mm

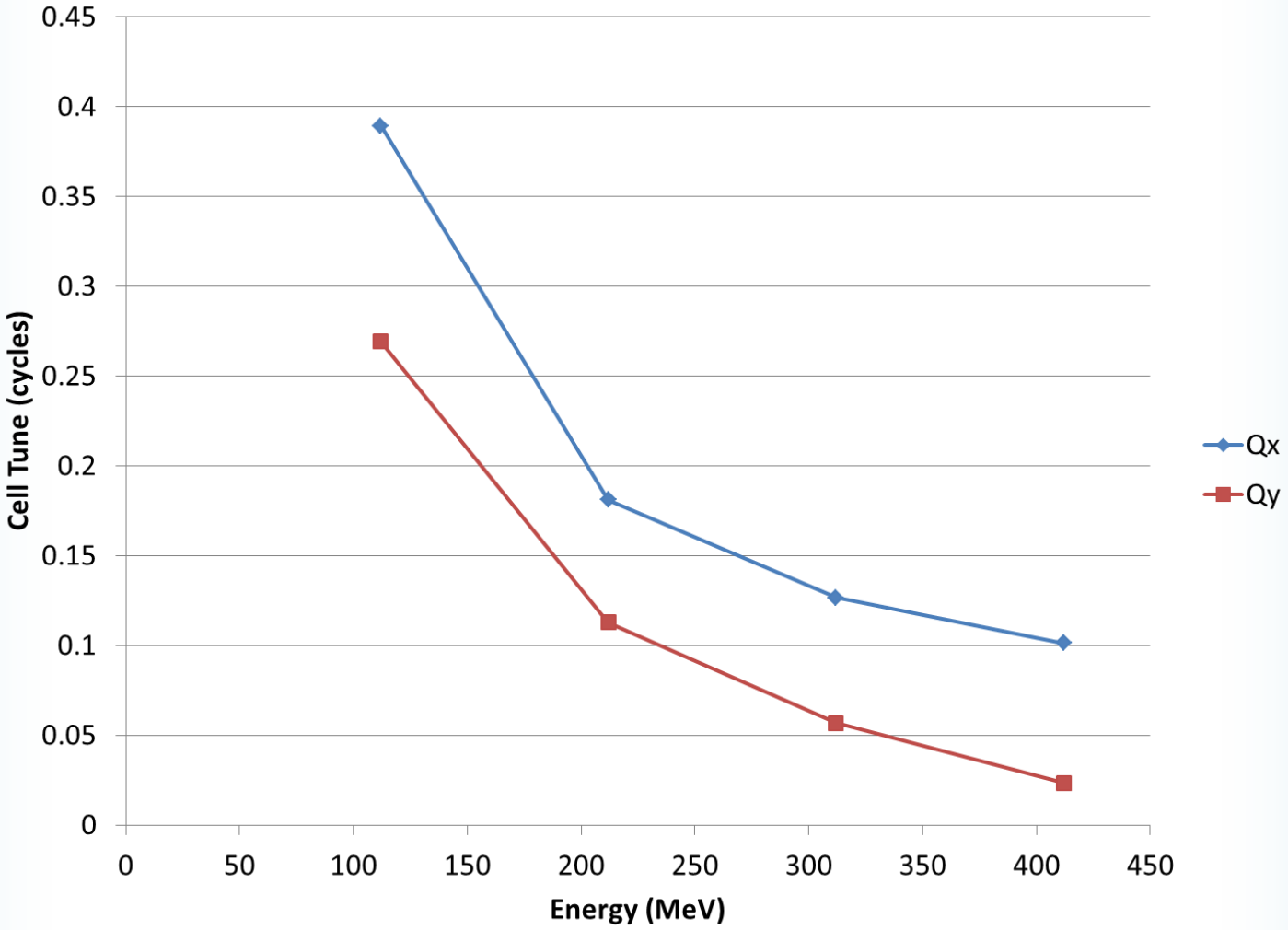


Orbits in Real Space in Muon1

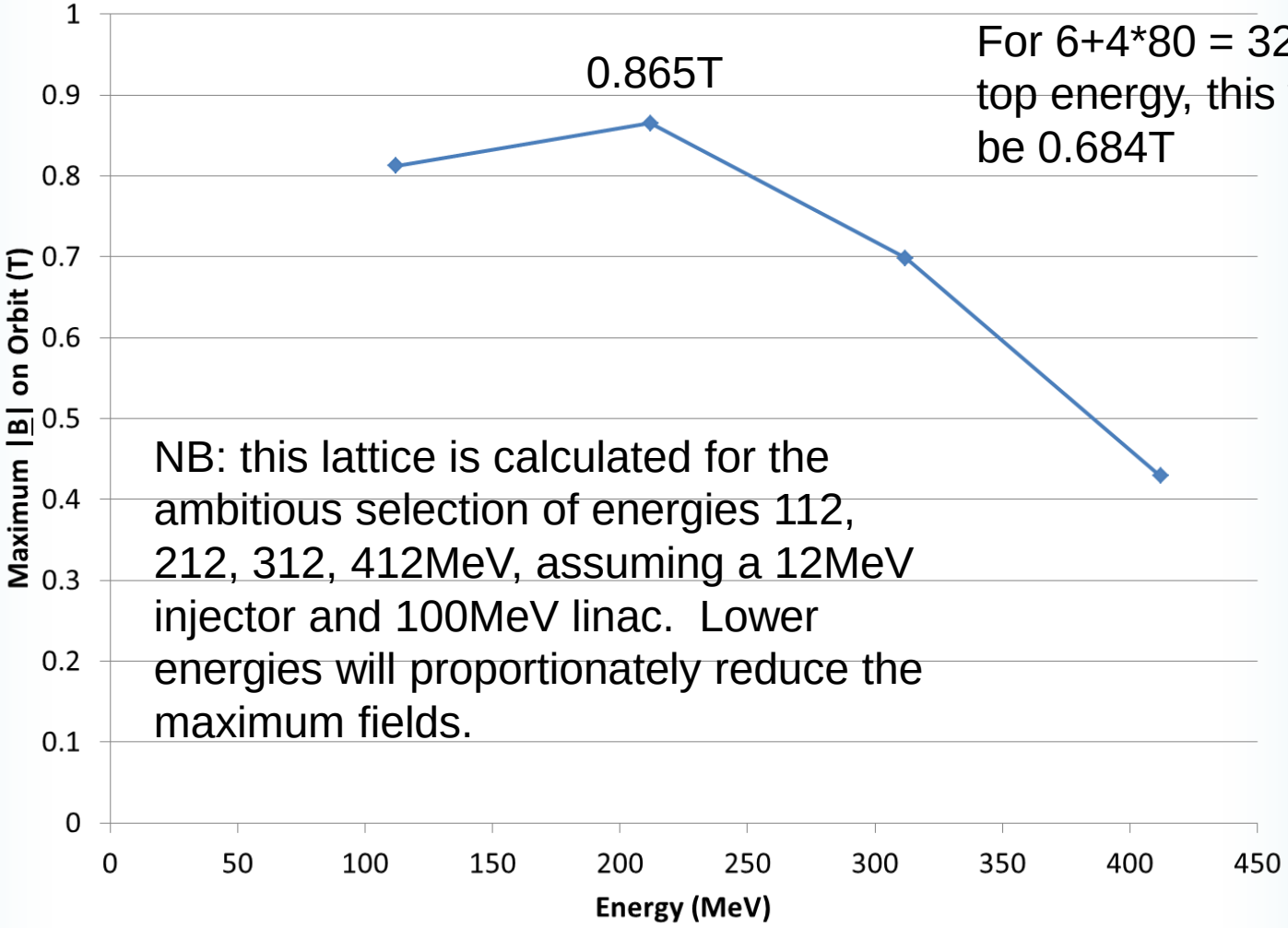
Orbits not exaggerated, cm grid shown
Central multicoloured line is “reference curve”



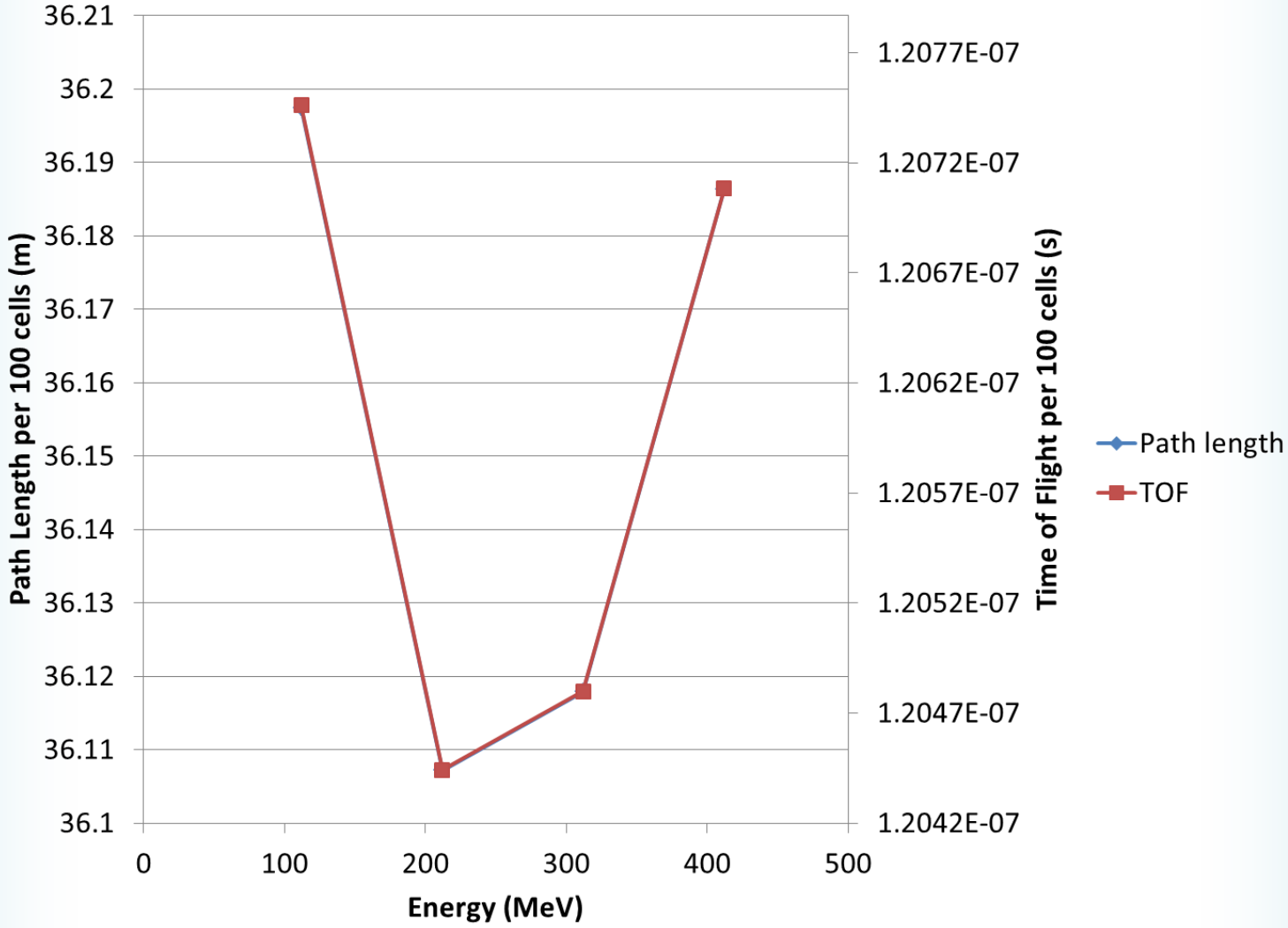
Cell Tunes


0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Cell Tune (cycles)
0
50
100
150
200
250
300
350
400
450
Energy (MeV)
Qx
Qy

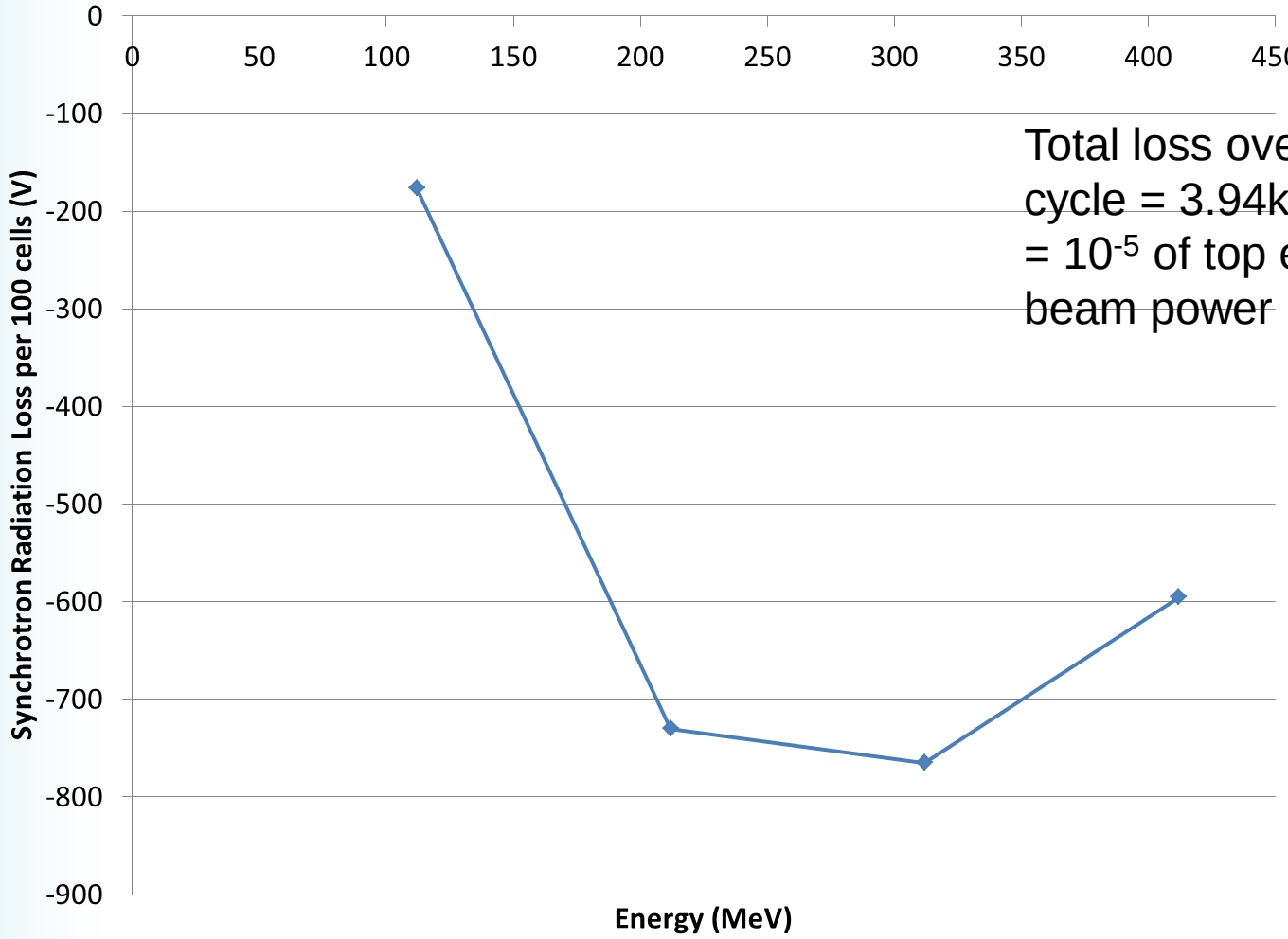
Maximum Field on Closed Orbits



TOF and Path Length per "Turn"

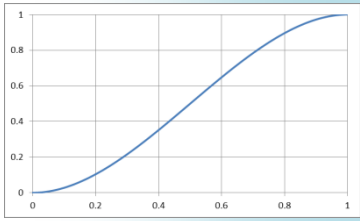


Synchrotron Radiation per "Turn"

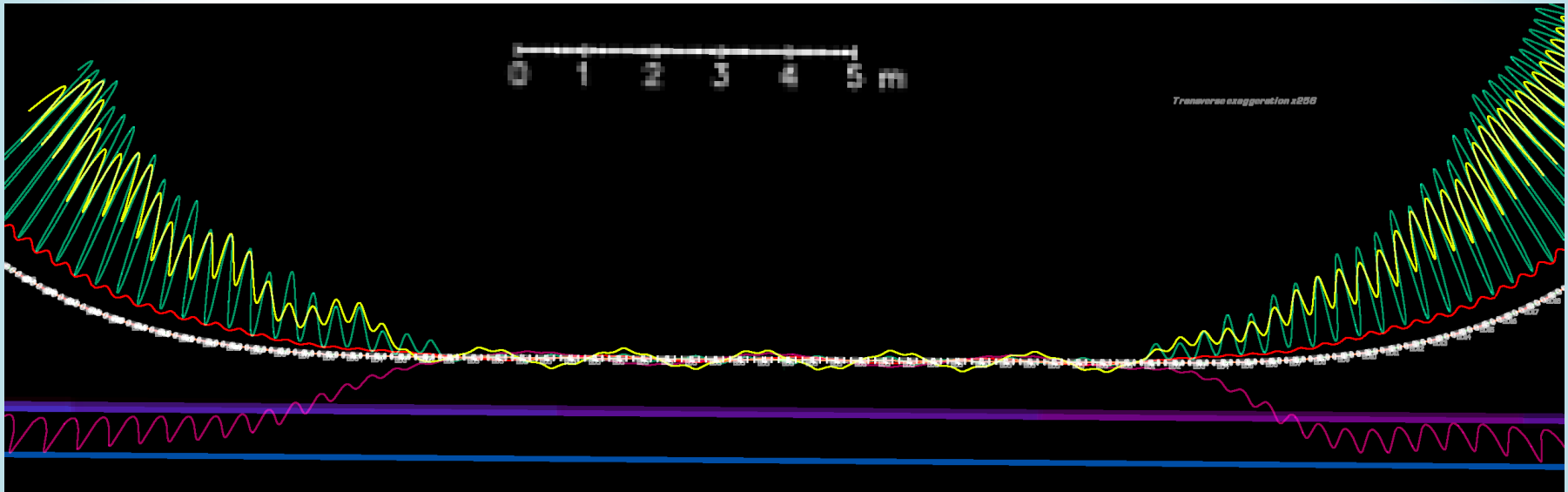


Total loss over full cycle = 3.94keV = 10^{-5} of top energy beam power

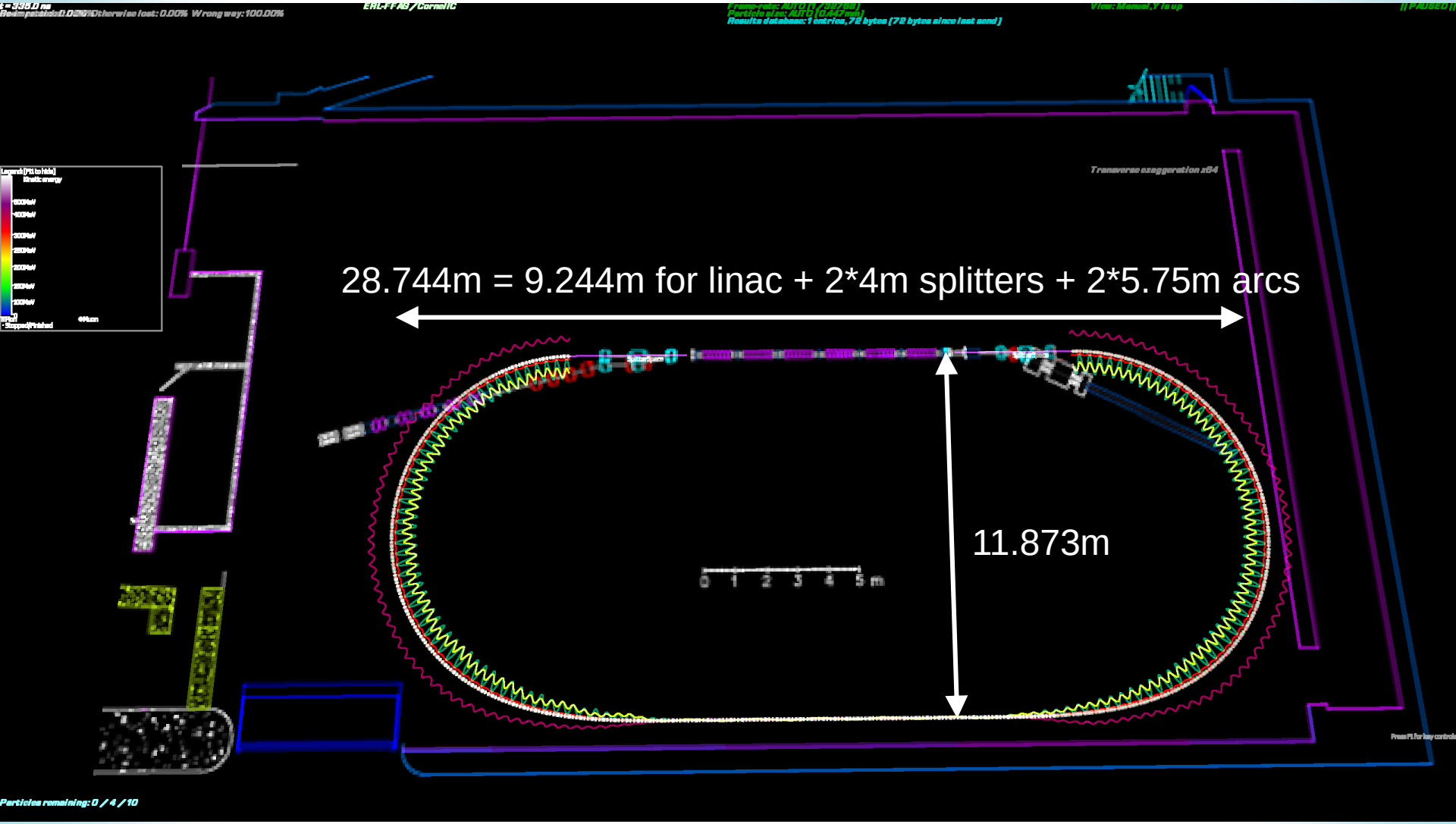
Adiabatic Matching to Straight



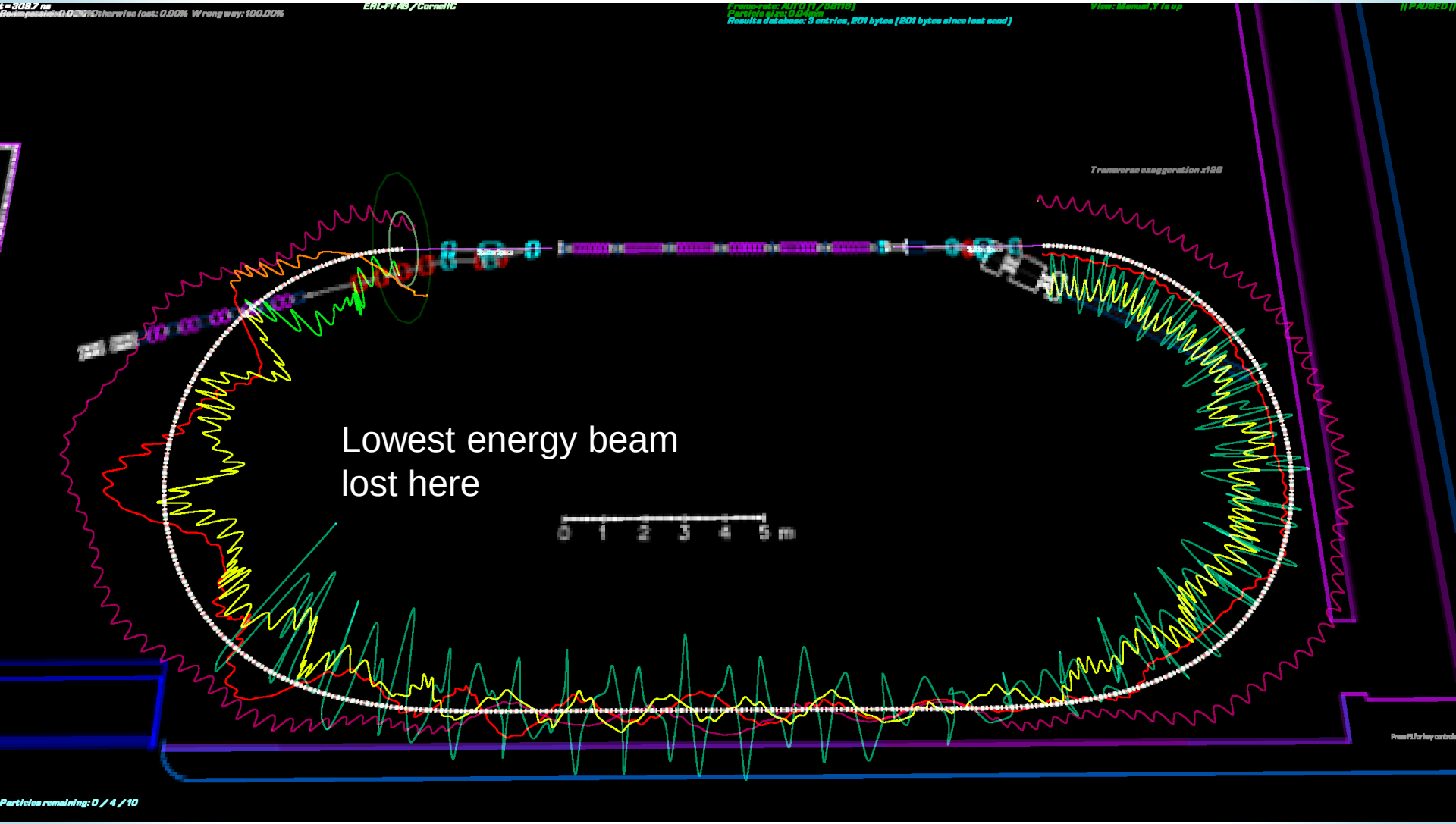
- Over 20 cells, reduces dipole and angle according to $3x^2-2x^3$ where x=(cell #)/21
  - 50-cell 180° arc becomes 40 cells plus 20 half-curvature matching cells
- Corrects orbits to ±0.7mm from centre line



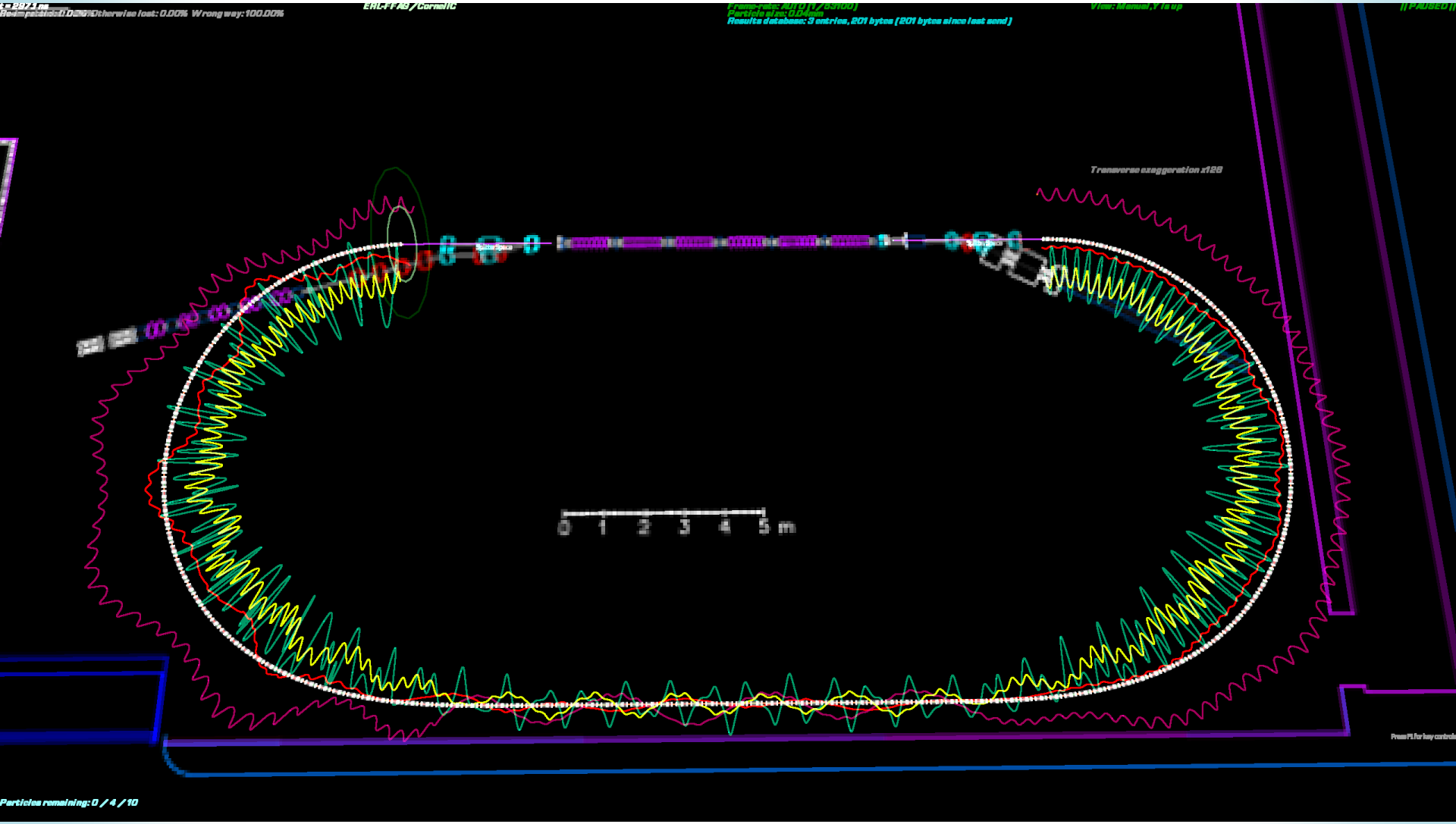
Oval Layout in Cornell L0E Hall



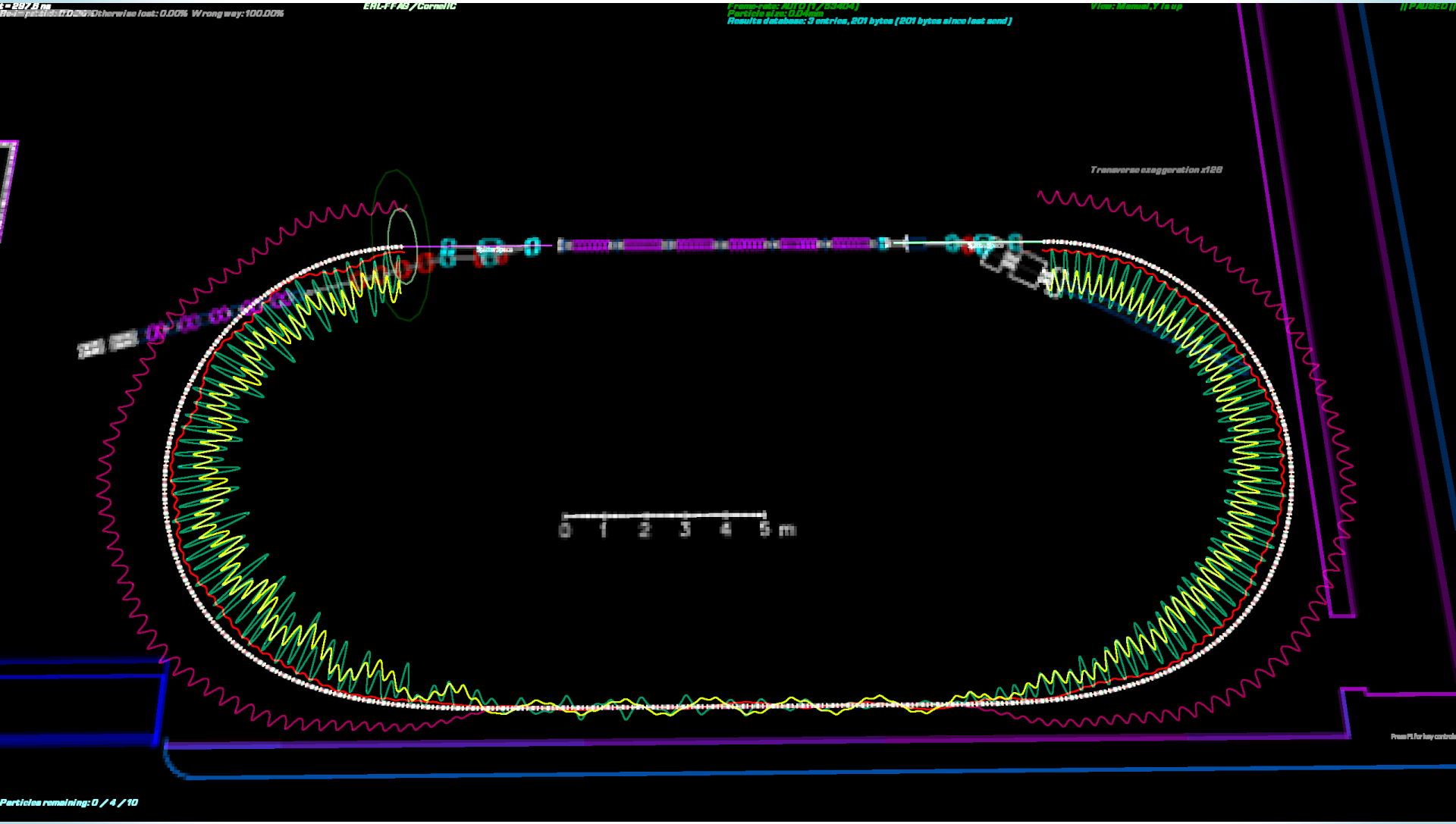
Errors 100um RMS in XYZ Positions



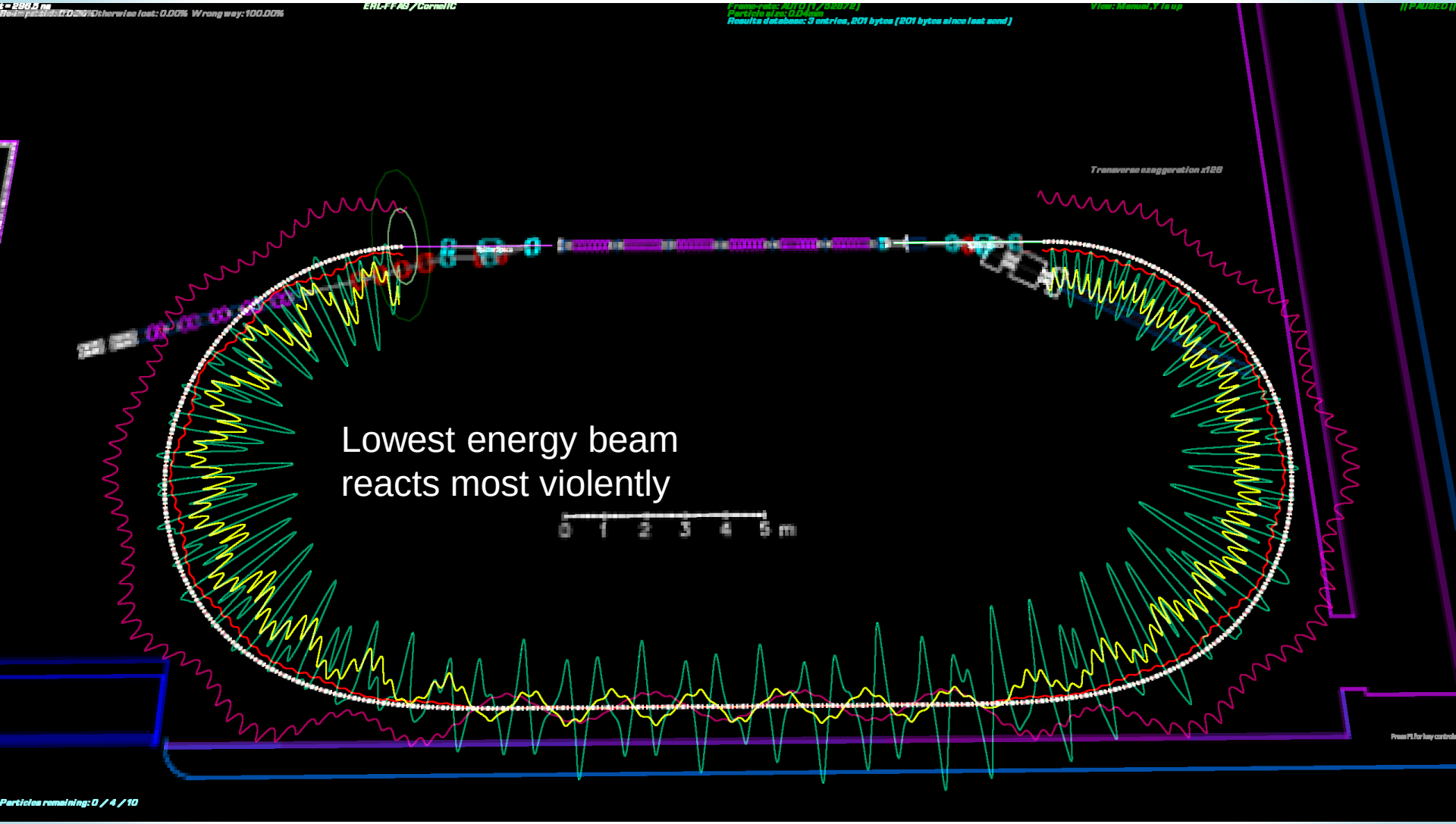
Errors 50um RMS in XYZ Positions



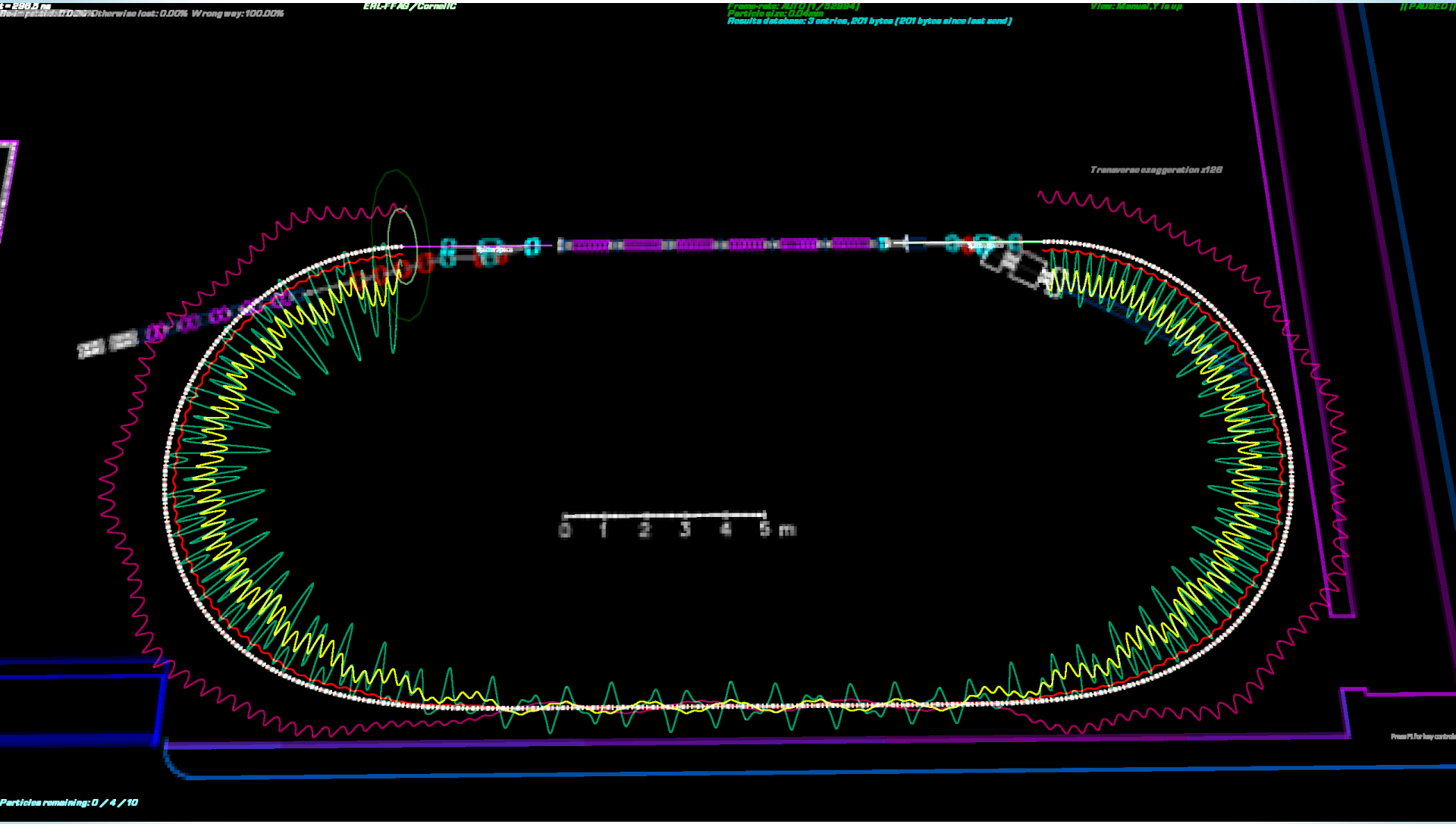
Errors 20um RMS in XYZ Positions



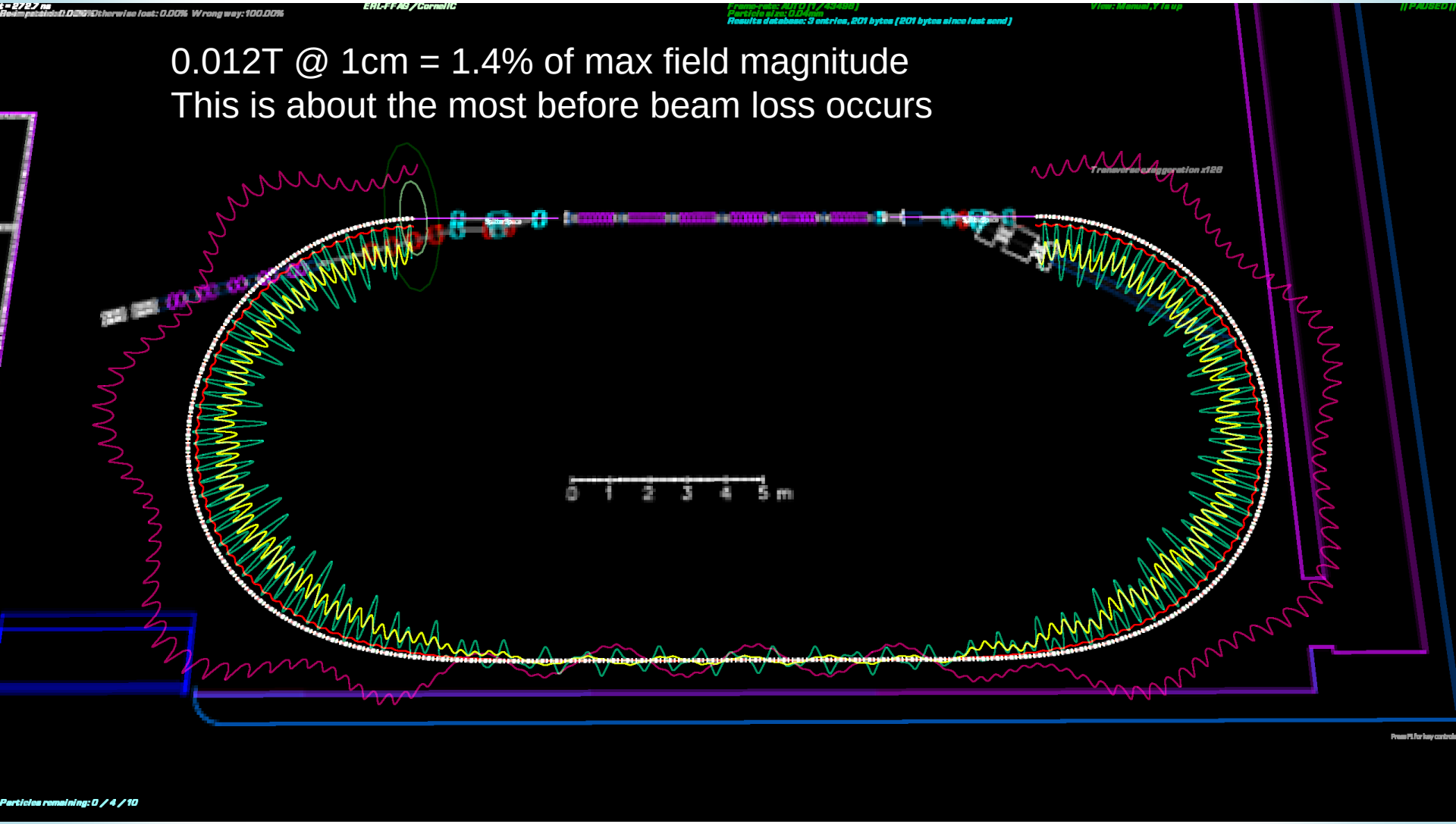
1% RMS Quad Strength Errors



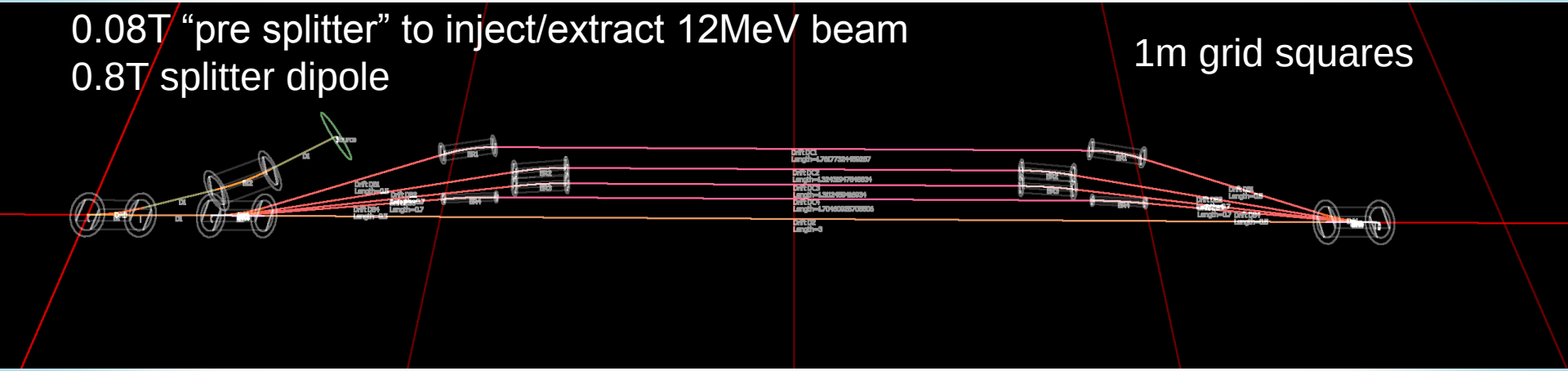
0.5% RMS Quad Strength Errors

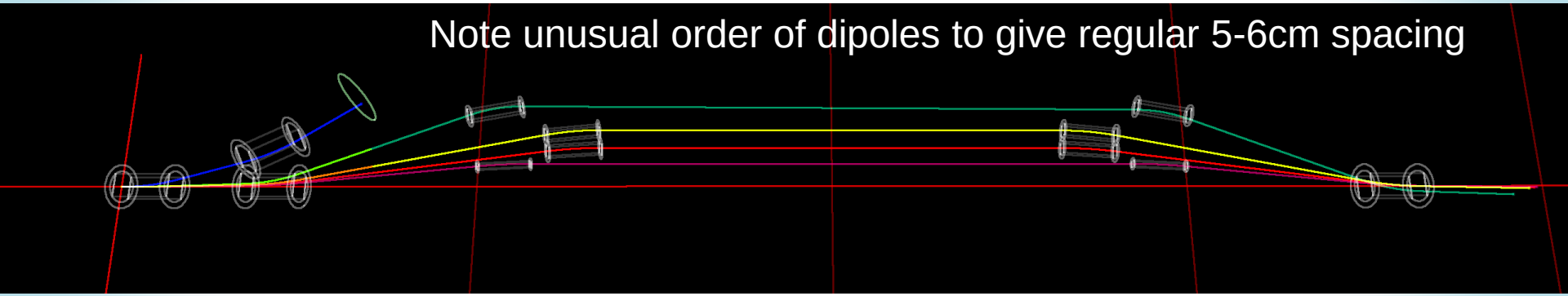


Systematic Sextupole 120T/m^2



4m Splitter Attempt (just dipoles)





4m Splitter Attempt (zoom)