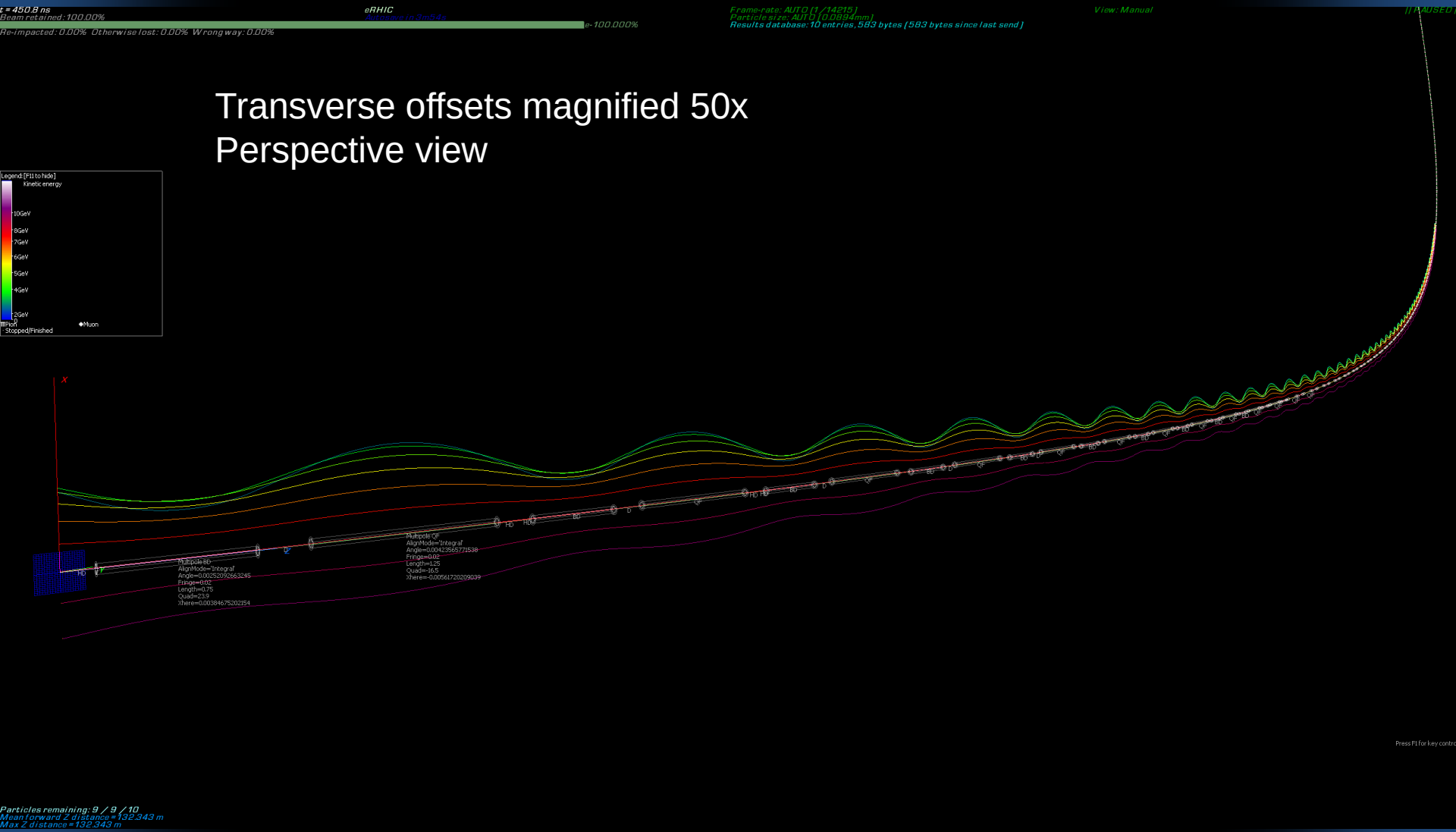
eRHIC FFAGs Rings Layout

Pictures obtained using Muon1 code

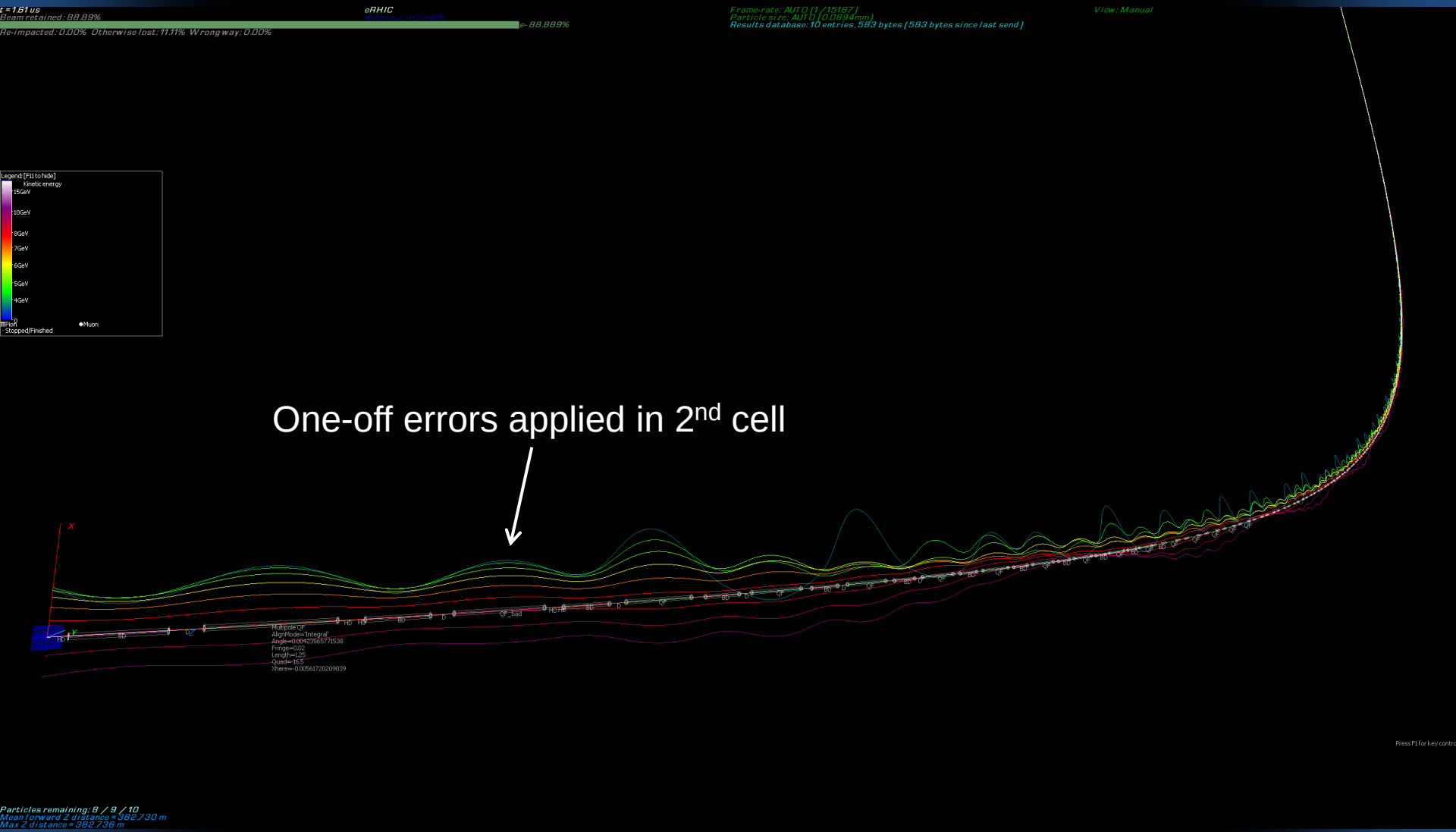
I. Errors in 2.7-10GeV Arcs

Lattice with No Errors

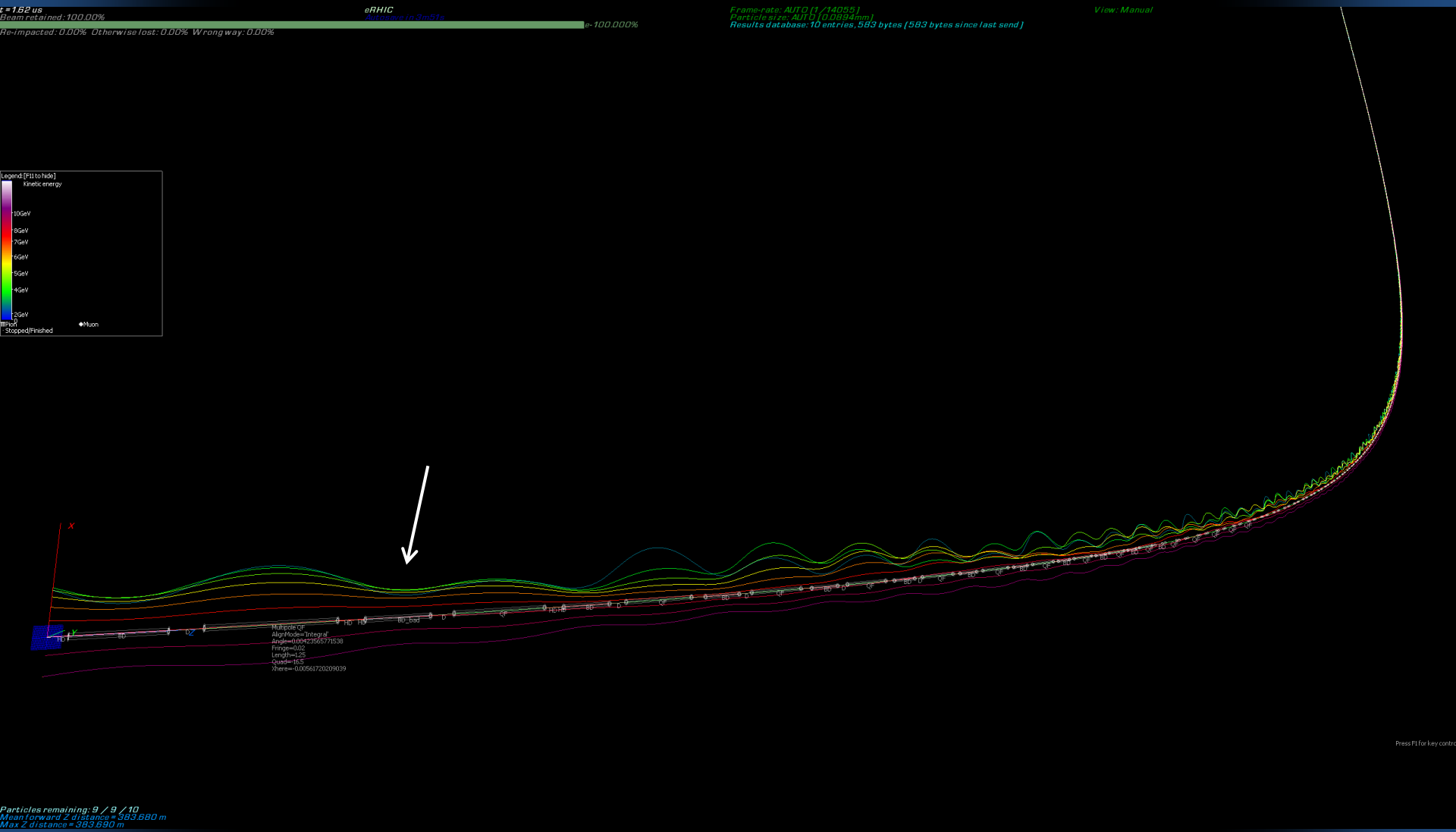
Transverse offsets magnified 50x
Perspective view



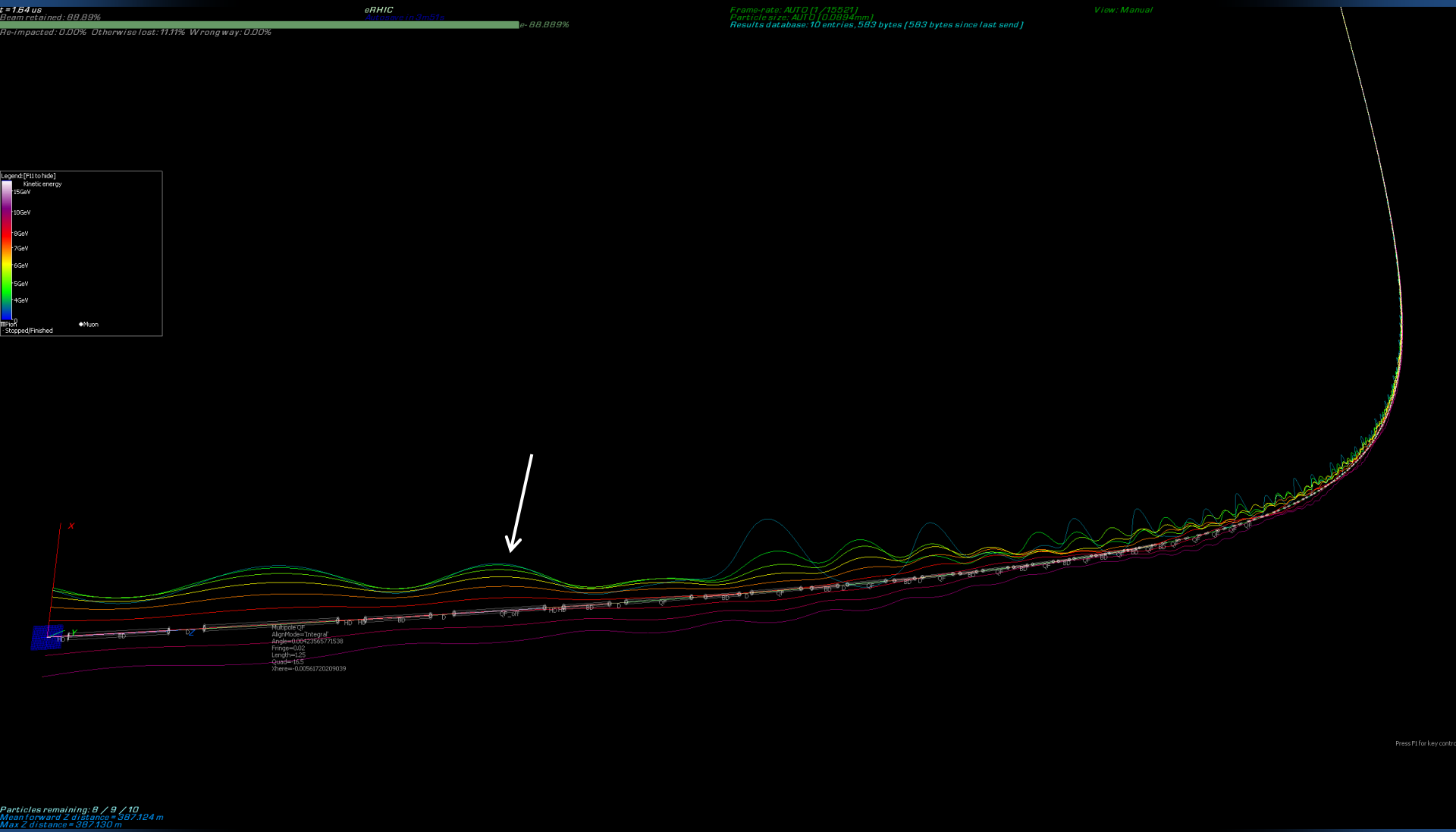
QF Gradient Decreased by 20%



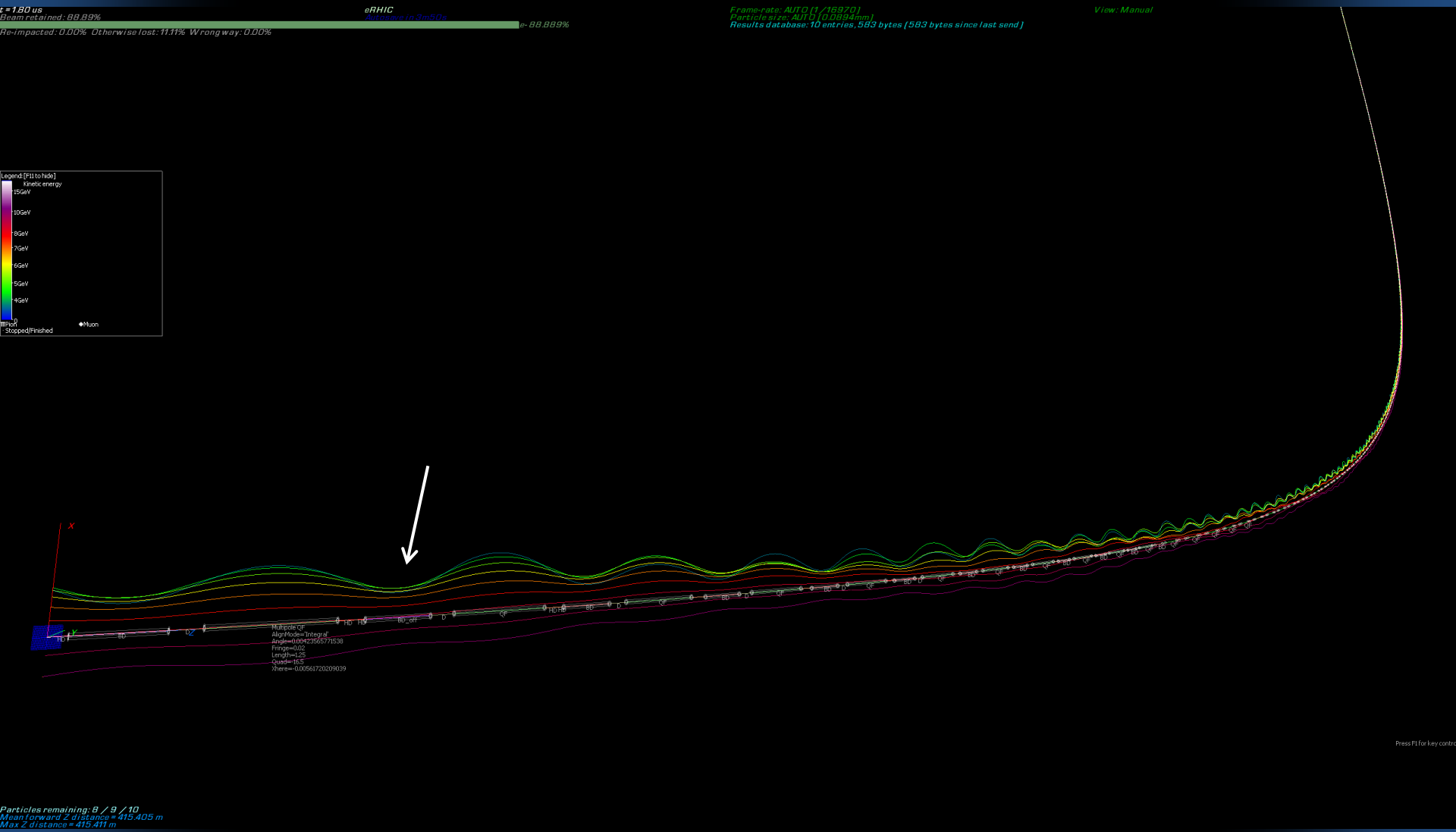
BD Gradient Decreased by 20%



QF Shifted by 1mm

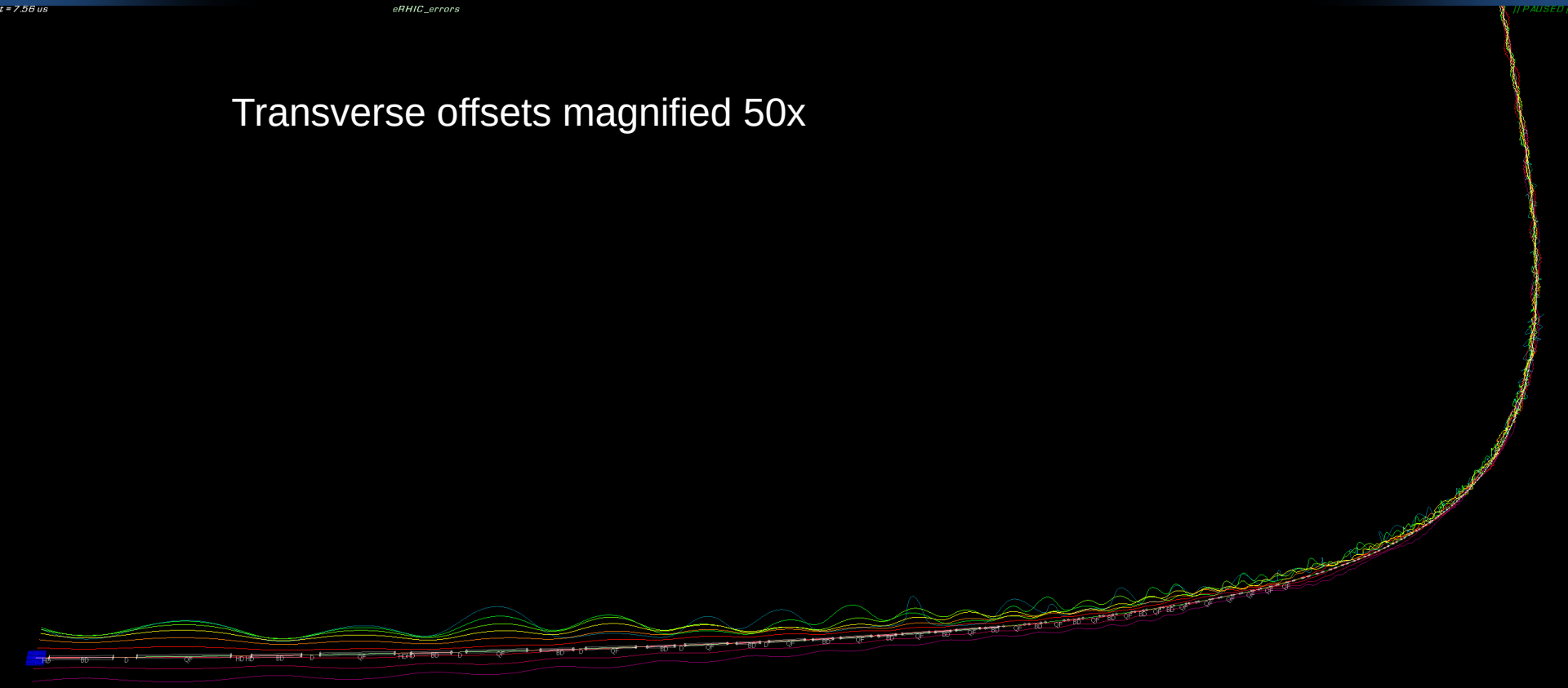


BD Shifted by 1mm

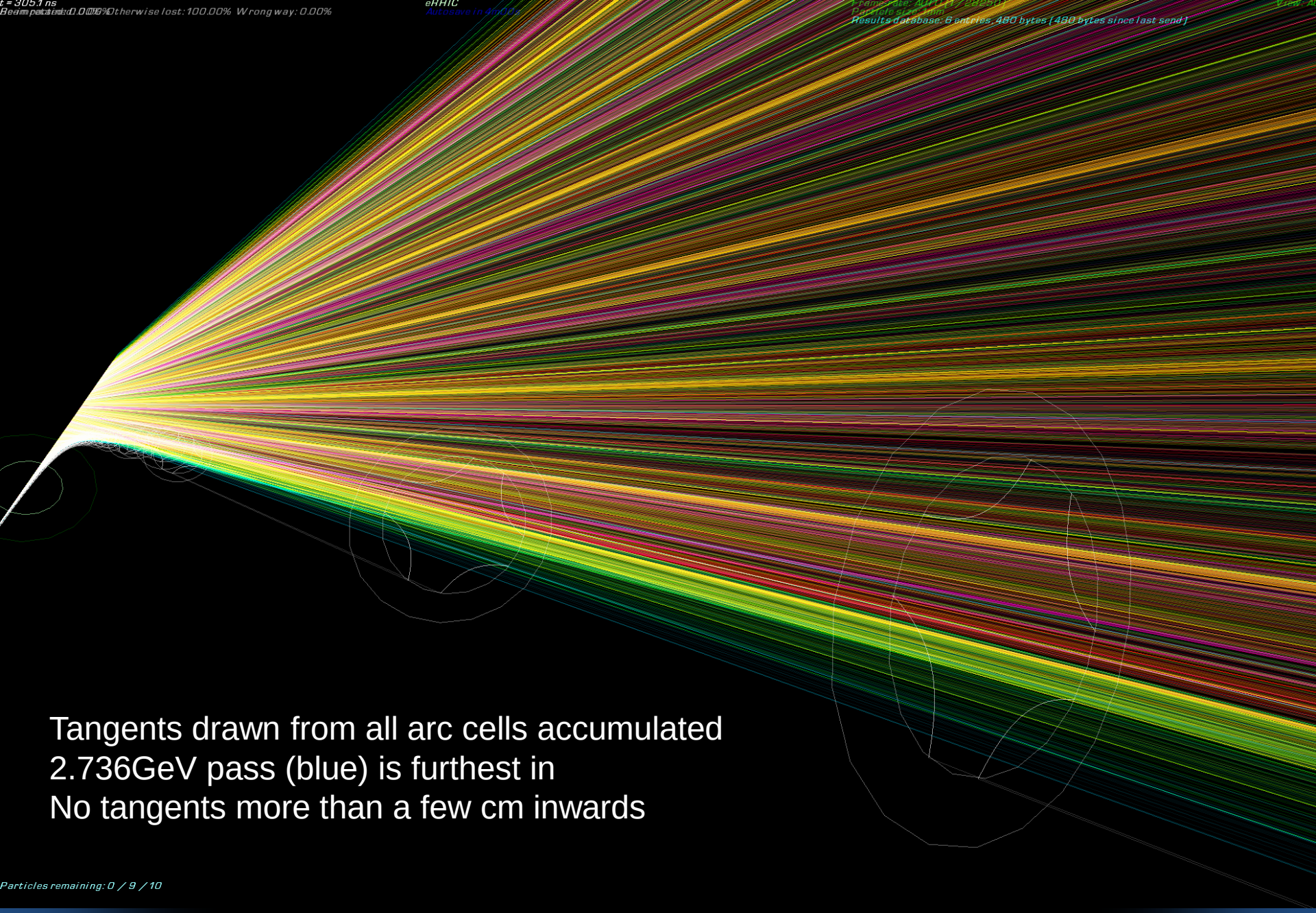


II. Gaussian X, Y Errors in Arcs

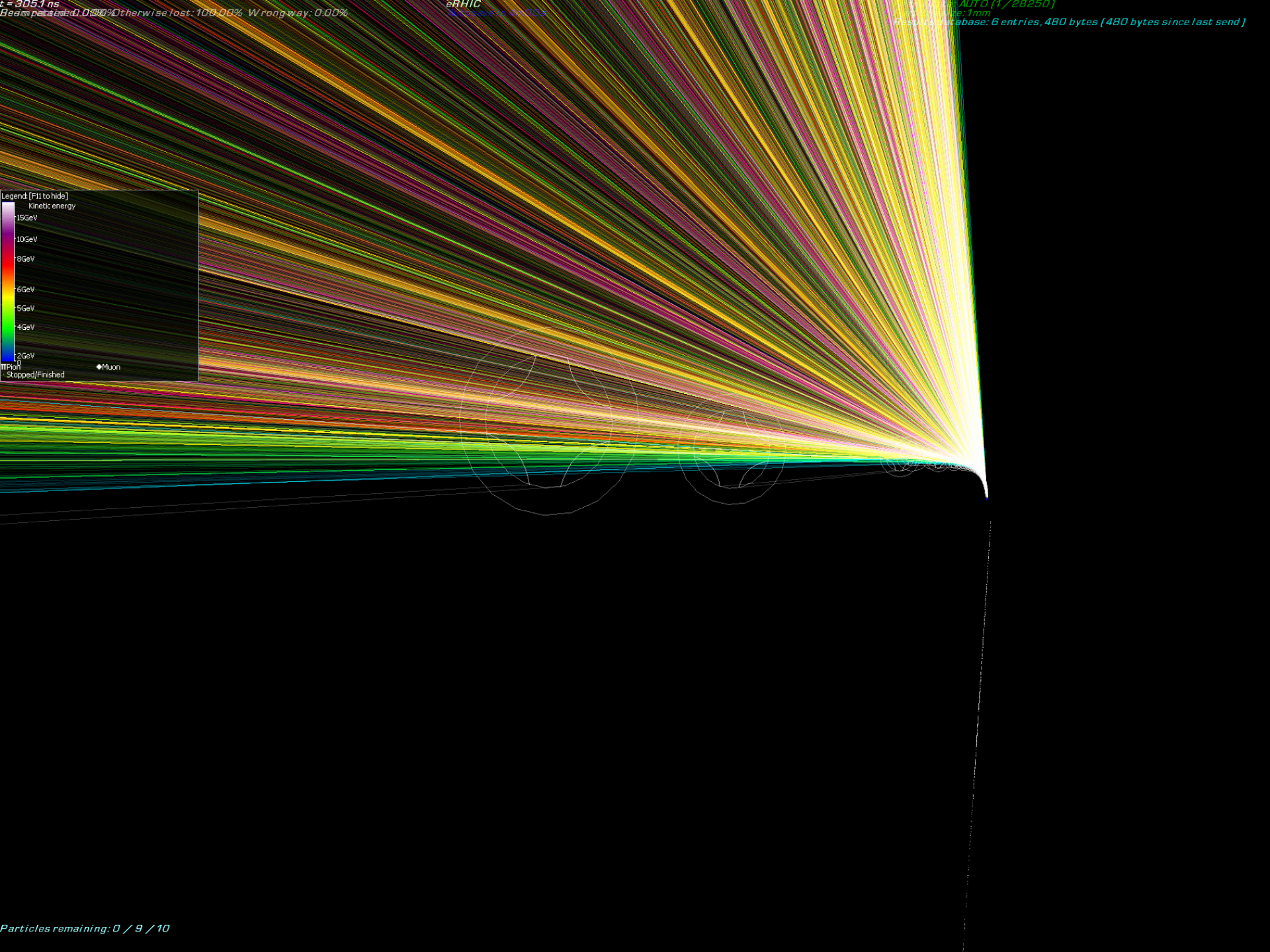
200um RMS Error in all Magnets



III. Synchrotron Radiation Lines

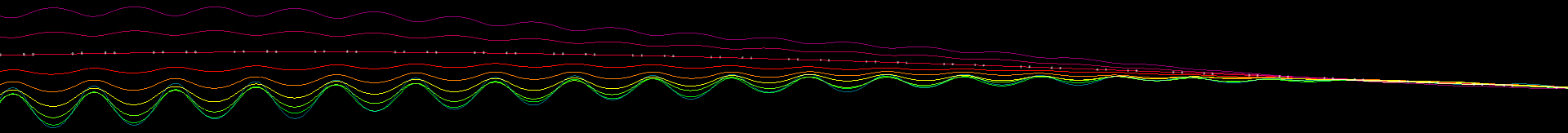


Tangents drawn from all arc cells accumulated
2.736GeV pass (blue) is furthest in
No tangents more than a few cm inwards

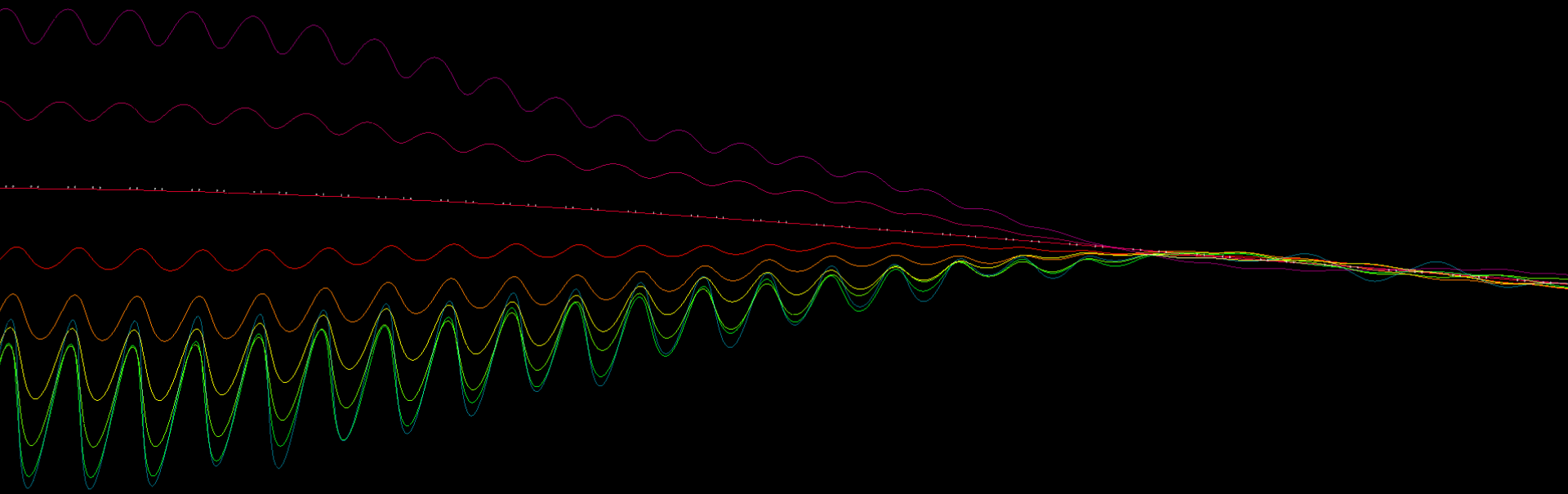

t = 305.1 ns
Beam parameters: 0.0 GeV
Otherwise lost: 100.00% Wrongway: 0.00%
eRHIC
AUTO (1/28250)
Persistent database: 6 entries, 480 bytes (480 bytes since last send)
Legend: [F11 to hide]
Kinetic energy
15GeV
10GeV
8GeV
6GeV
5GeV
4GeV
2GeV
Pion
Muon
Stopped/Finished
Particles remaining: 0 / 9 / 10

IV. 2.7-10GeV Straight Matching

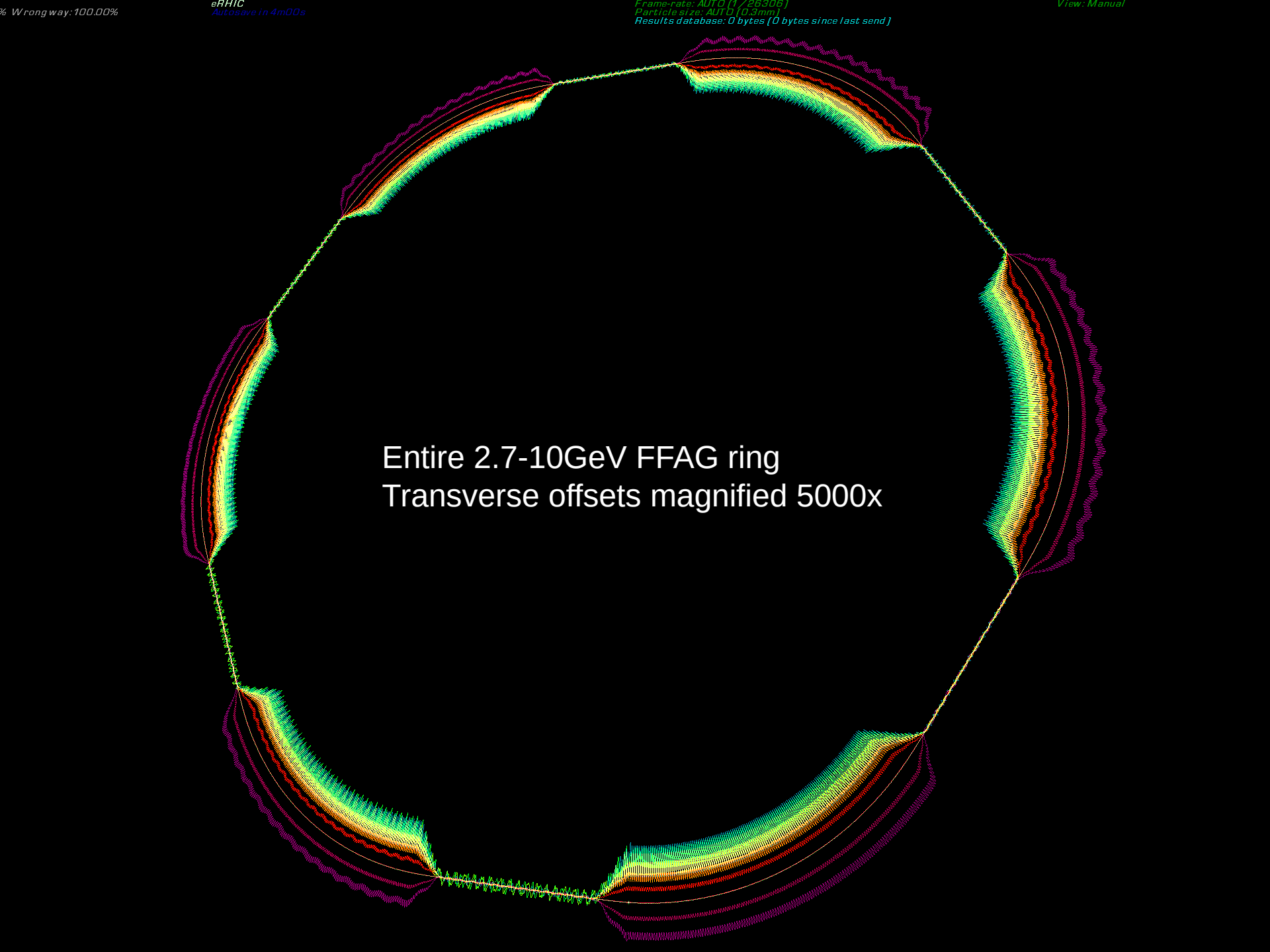
Transverse offsets magnified 200x
17 cells used in adiabatic matching of FFAG to straight quad channel
|x|<0.375mm in straight, can probably be improved

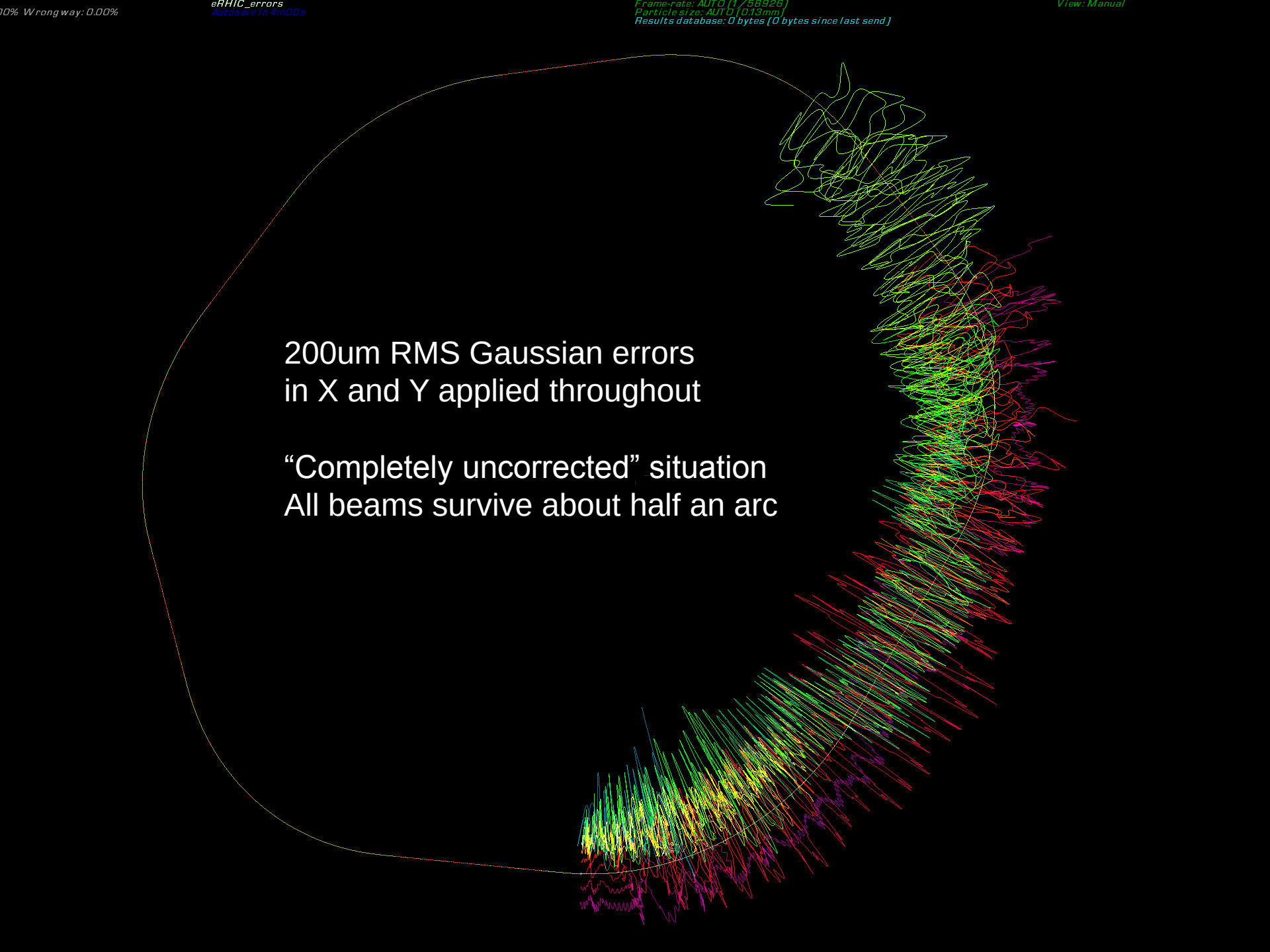


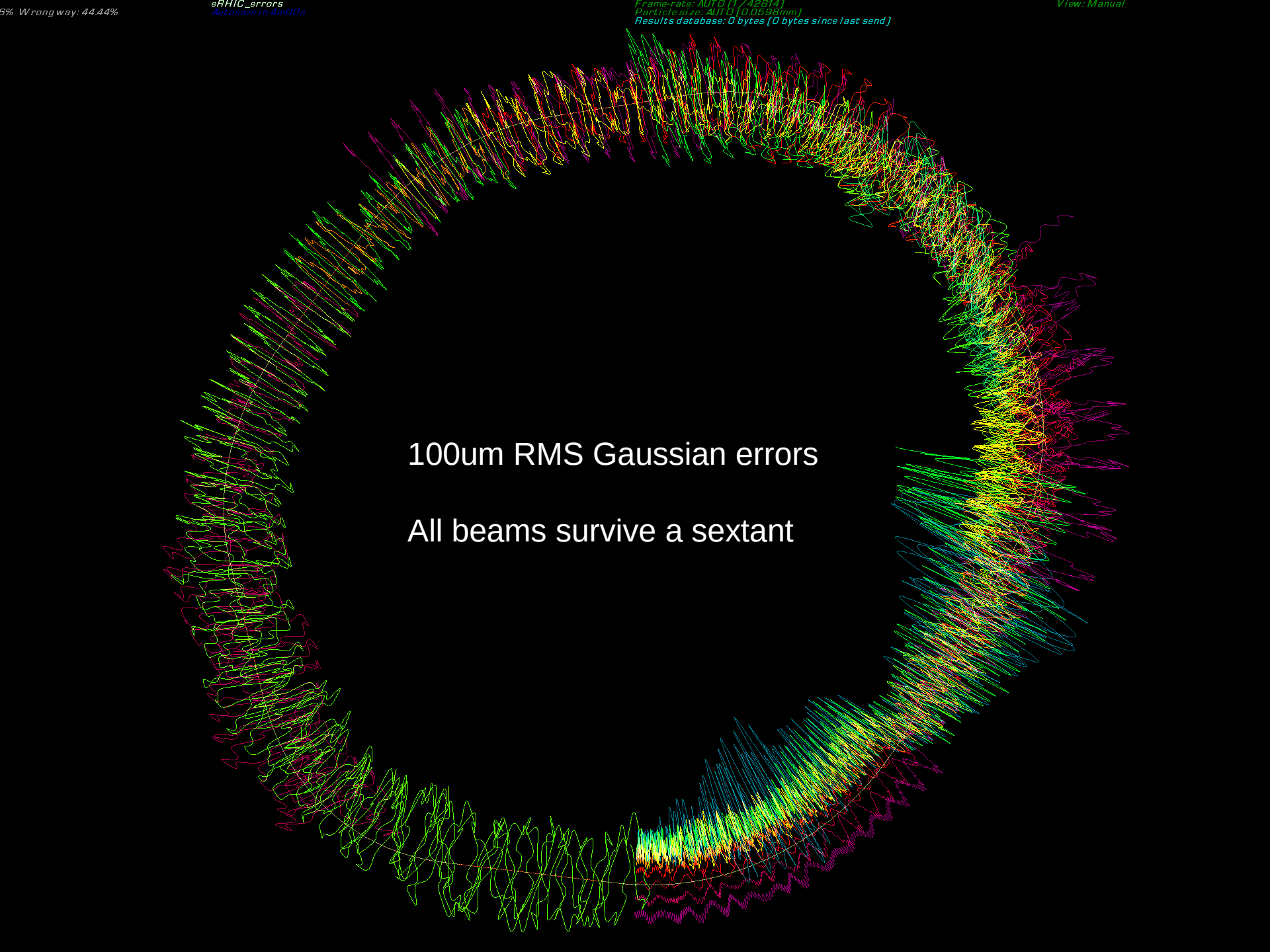
Transverse offsets magnified 1000x
Residual oscillations in straight visible

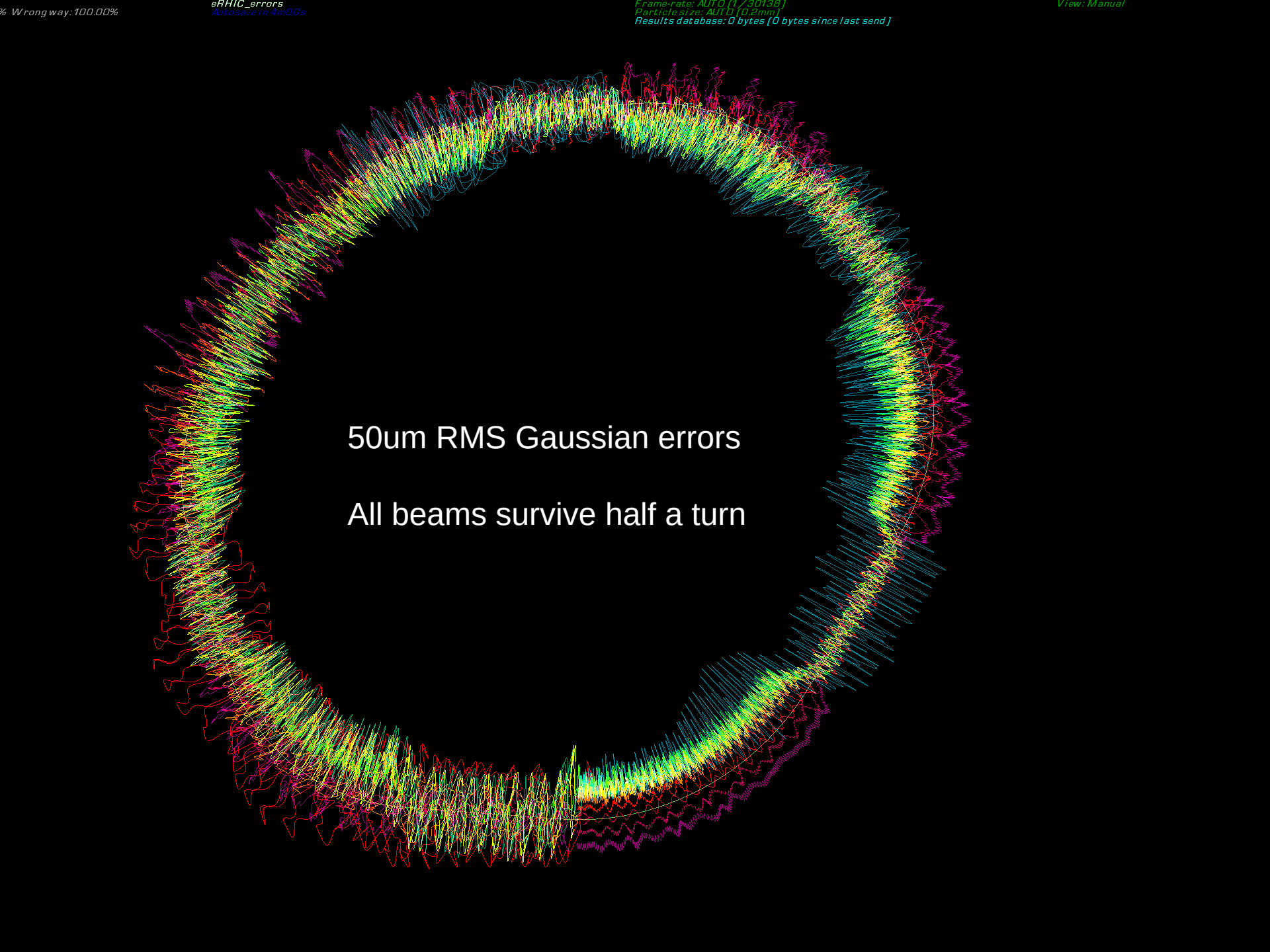


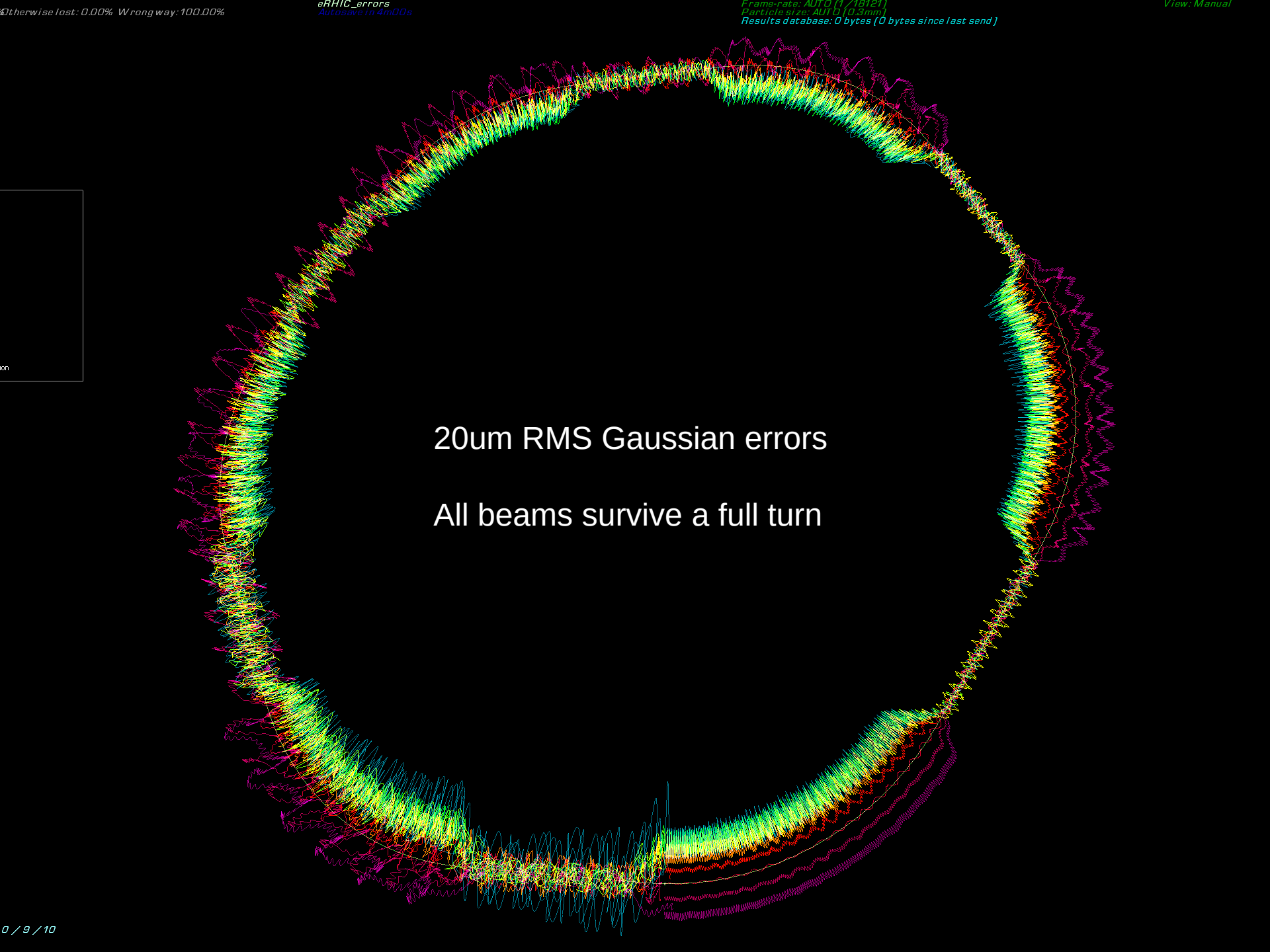
V. 2.7-10GeV Ring and Errors


% Wrong way: 100.00%
eRHIC
Autosave in 4m00s
Frame-rate: AUTO (1 / 26306)
Particle size: AUTO (0.3mm)
Results database: 0 bytes (0 bytes since last send)
View: Manual
Entire 2.7-10GeV FFAG ring
Transverse offsets magnified 5000x


00% Wrongway: 0.00%
eRHIC_errors
Autosave in 4m00s
Frame-rate: AUTO (1.58926)
Particle size: AUTO (0.13mm)
Results database: 0 bytes (0 bytes since last send)
View: Manual
200um RMS Gaussian errors
in X and Y applied throughout
“Completely uncorrected” situation
All beams survive about half an arc

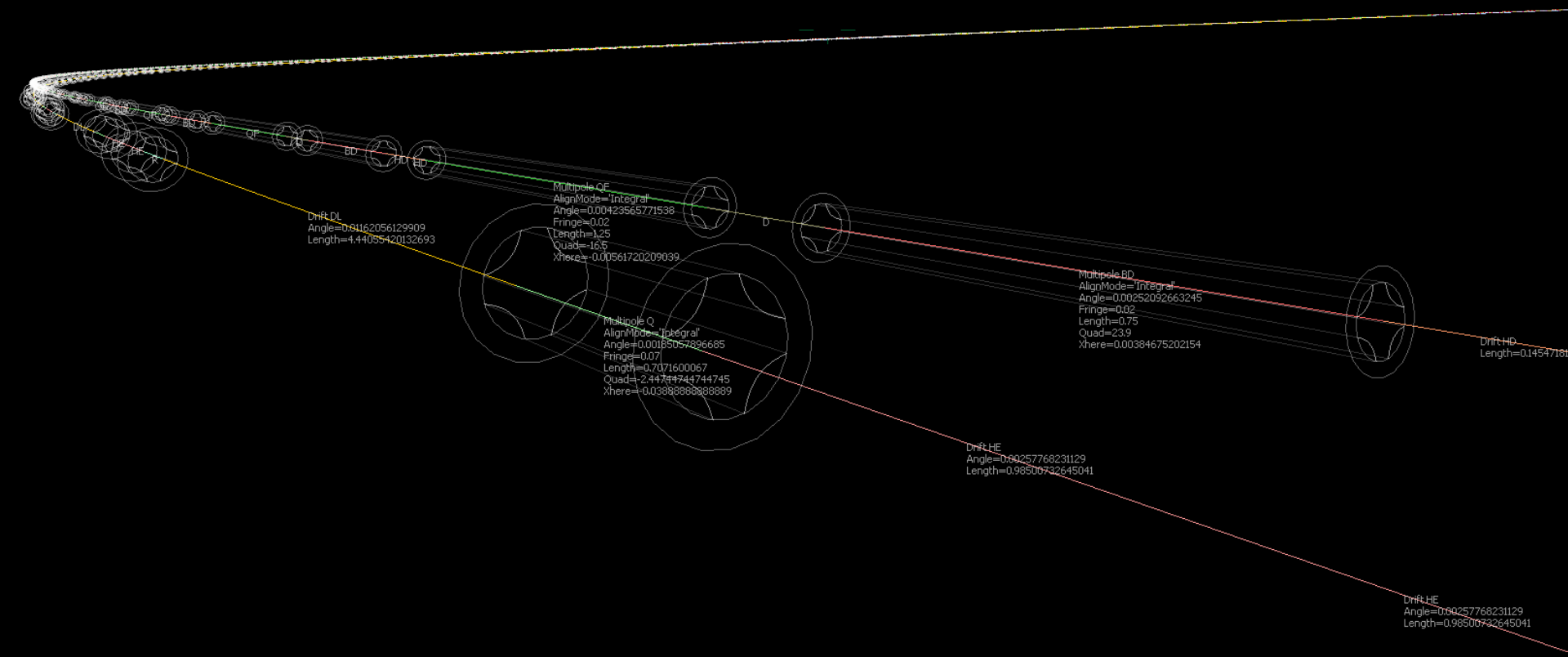

5% Wrongway: 44.44%
eRHIC_errors
Autosave in 4m00s
Frame-rate: AUTO (1742814)
Particle size: AUTO (0.0598mm)
Results database: 0 bytes (0 bytes since last send)
View: Manual
100um RMS Gaussian errors
All beams survive a sextant


% Wrong way: 100.00%
eRHIC_errors
Autosave in 4m00s
Frame-rate: AUTO (1 / 30138)
Particle size: AUTO (0.2mm)
Results database: 0 bytes (0 bytes since last send)
View: Manual
50um RMS Gaussian errors
All beams survive half a turn

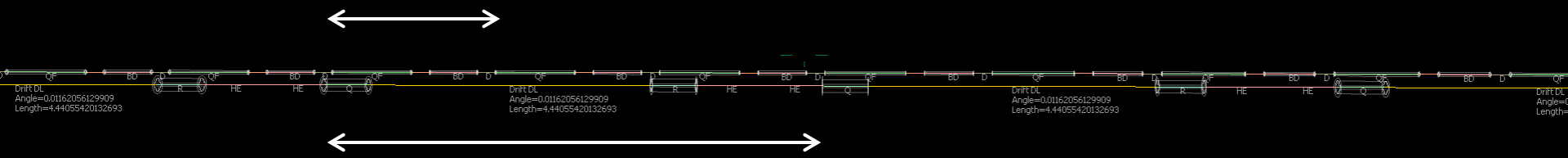

Otherwise lost: 0.00% Wrong way: 100.00%
eRHIC_errors
Autosave in 4m00s
Frame-rate: AUTO (1/18121)
Particle size: AUTO (0.3mm)
Results database: 0 bytes (0 bytes since last send)
View: Manual
20um RMS Gaussian errors
All beams survive a full turn
0 / 9 / 10

VI. Dual FFAG Common Girders

The 920-1828MeV FFAG and the 2.736-10GeV FFAG will be stacked in the same tunnel

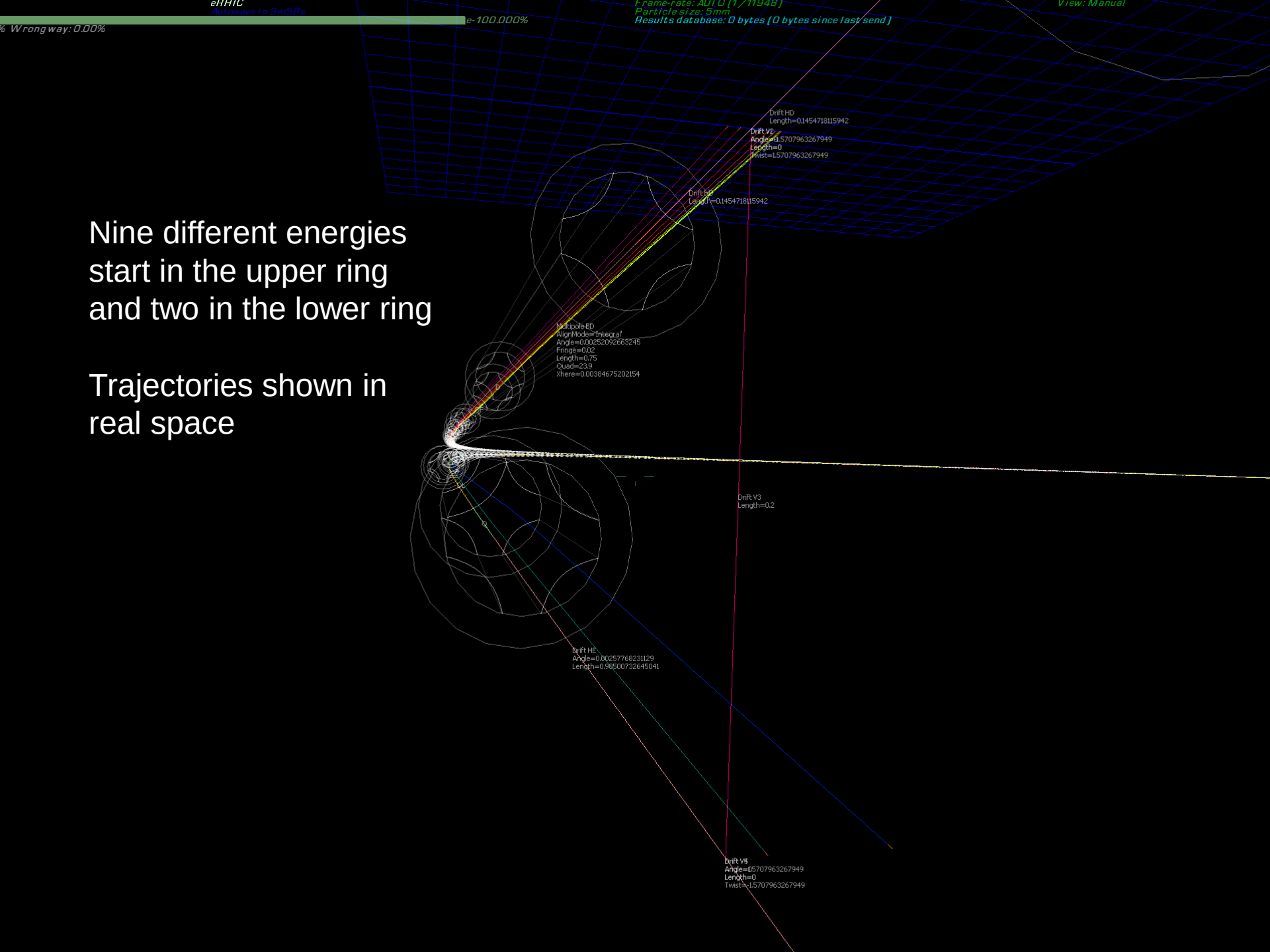


The low-energy FFAG cell is 3x the length of the main FFAG cell to allow a common girder and also economise on magnets



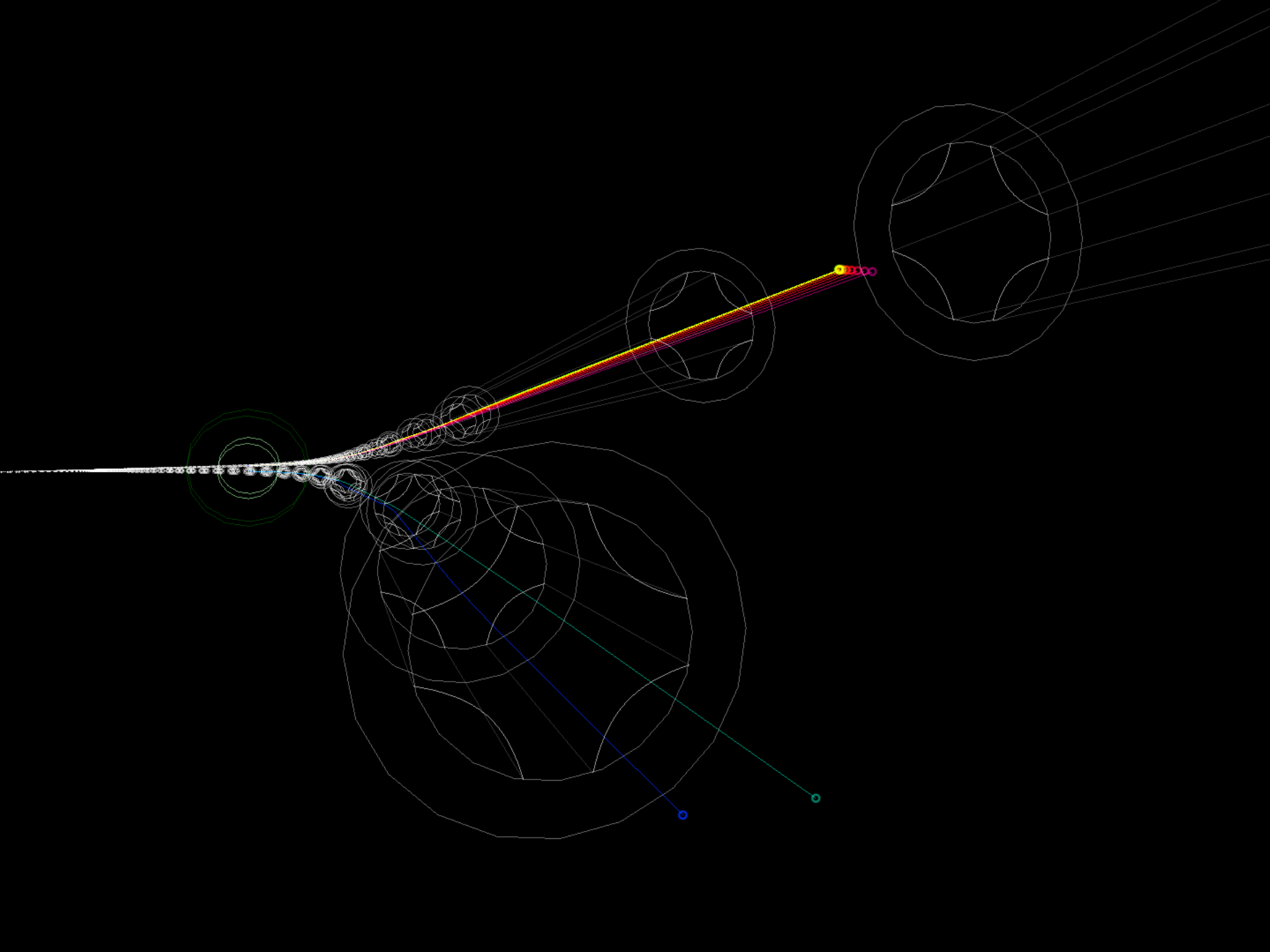
In total 8 magnets will be installed
on each 7.746m girder

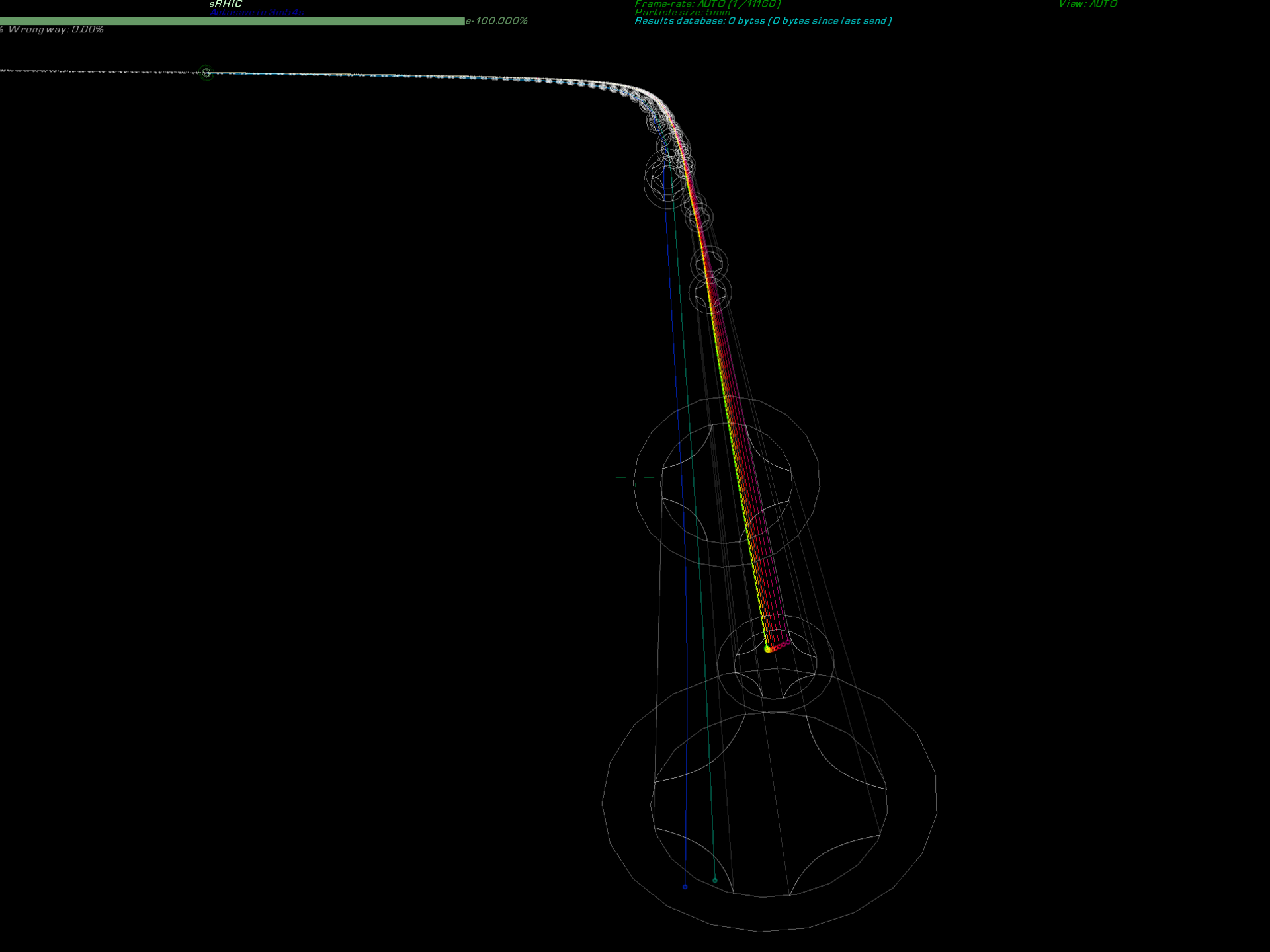
VII. Particle Tracking in Both FFAGs

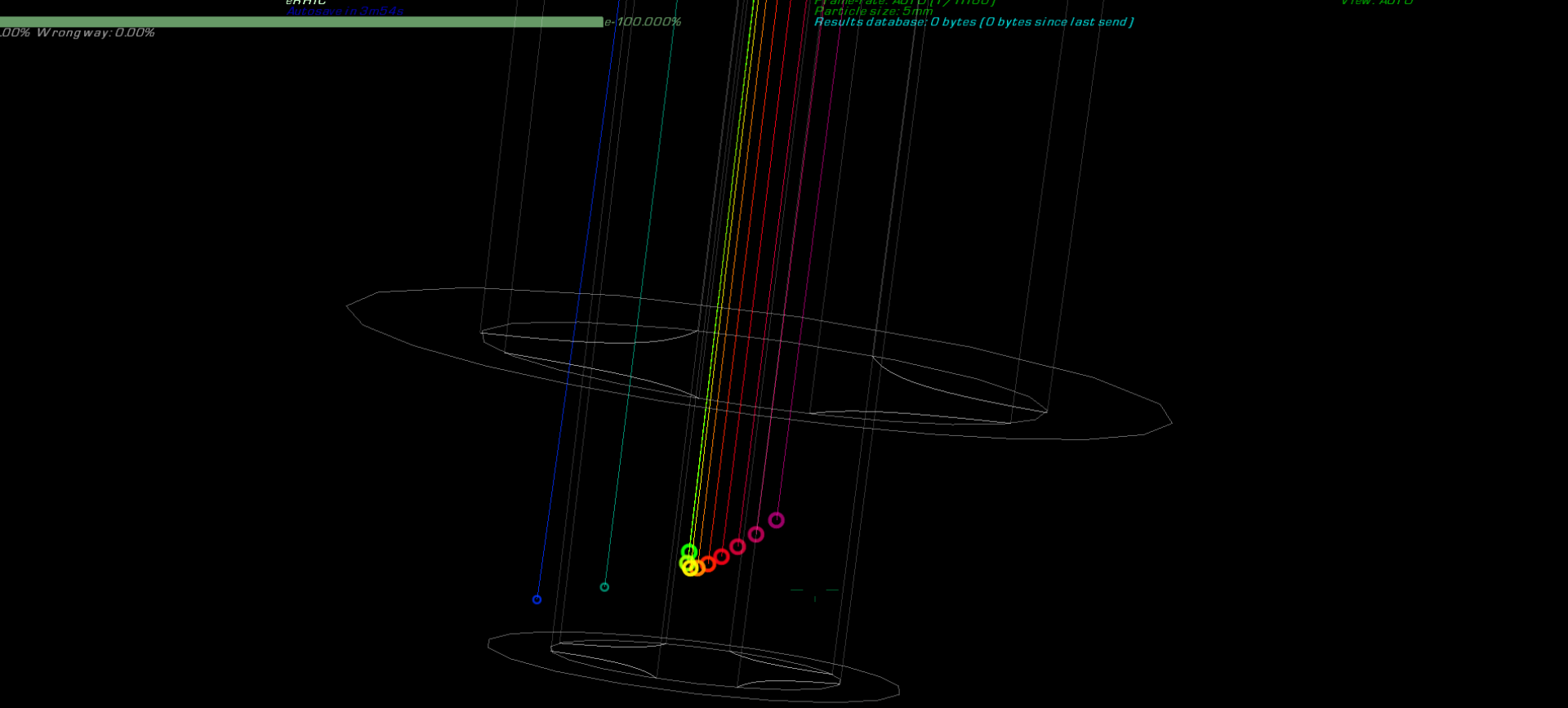


Nine different energies start in the upper ring and two in the lower ring

Trajectories shown in real space

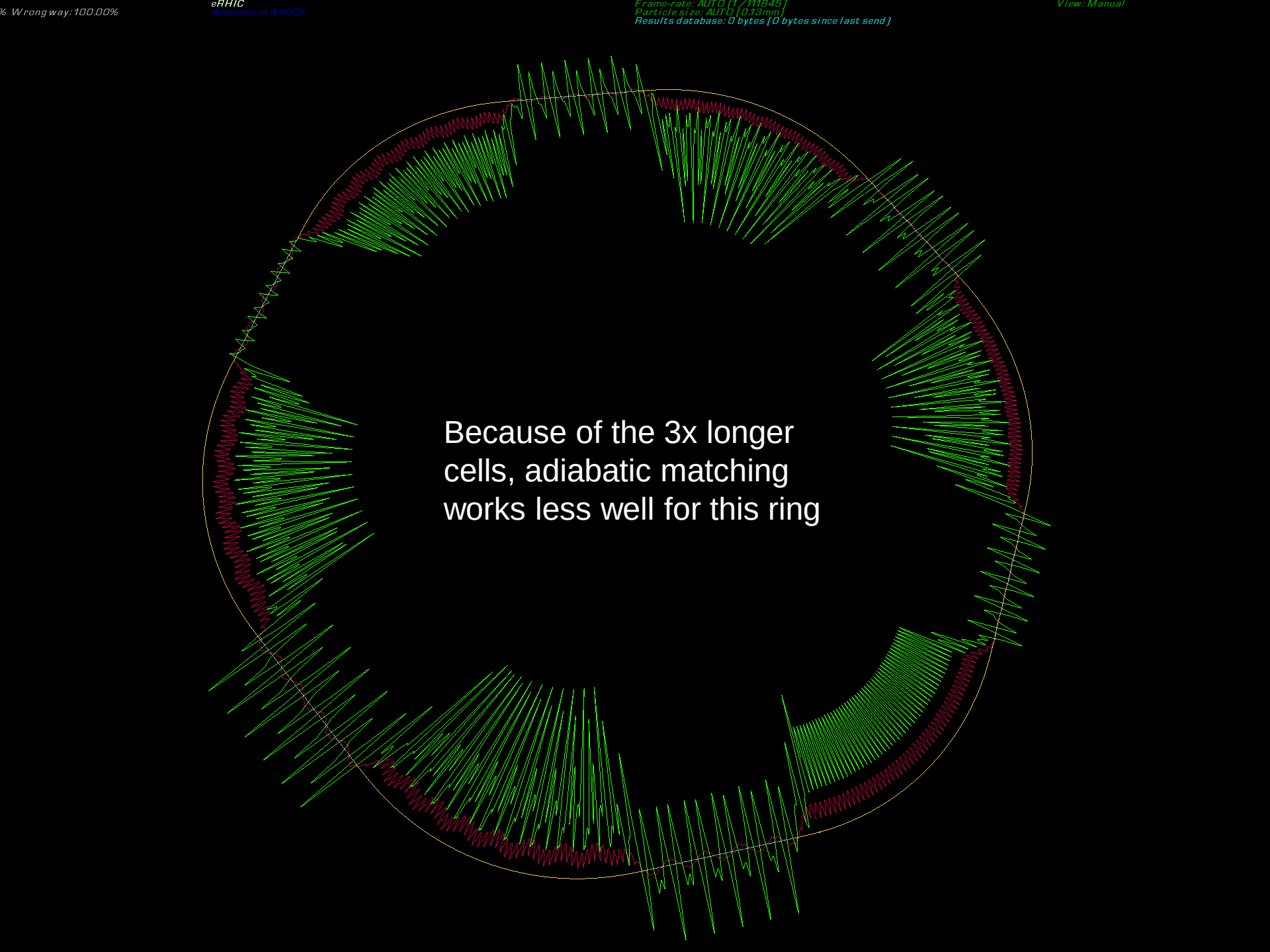



eRHIC
Autosave in 3m54s
e-100.000%
% Wrong way: 0.00%
Frame-rate: AUTO (1/11160)
Particle size: 5mm
Results database: 0 bytes (0 bytes since last send)
View: AUTO



After some distance in the arcs, the parabolic time-of-flight variation with energy becomes evident in the high-energy FFAG

VIII. Low-Energy Ring


% Wrong way: 100.00%
eRHIC
Autosave in 4m00s
Frame-rate: AUTO [1 / 111845]
Particle size: AUTO [0.13mm]
Results database: 0 bytes [0 bytes since last send]
View: Manual
Because of the 3x longer
cells, adiabatic matching
works less well for this ring

Only having two energies may mean a non-adiabatic match is possible: work in progress. Below: orbits in both rings, 2000x magnification.