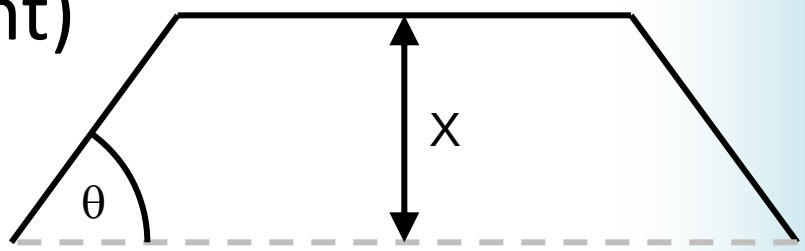
Splitter Magnet in Muon1

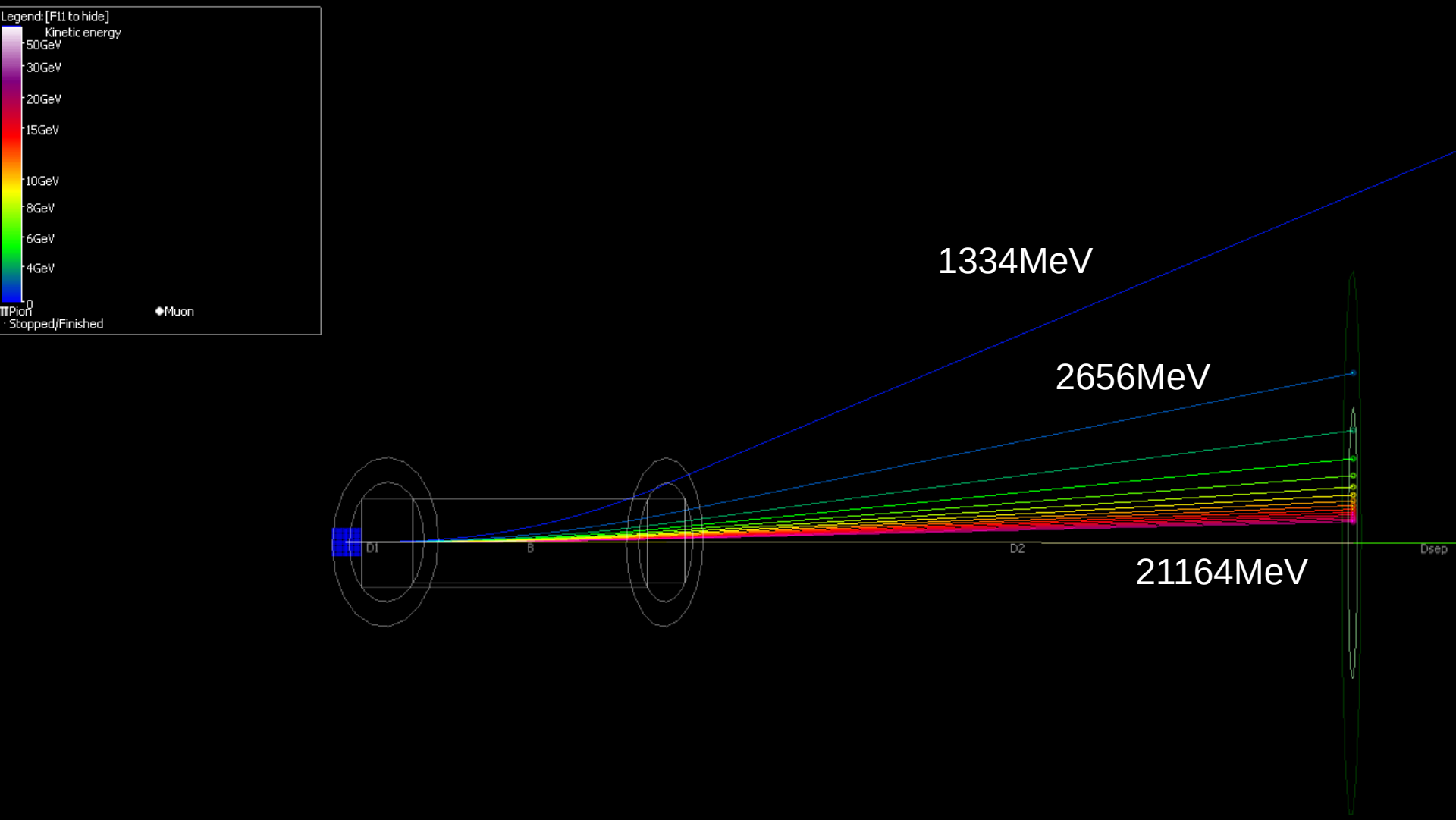
(Very slight update on Feb 3rd's slides)

Main Source of Δ(Path Length)

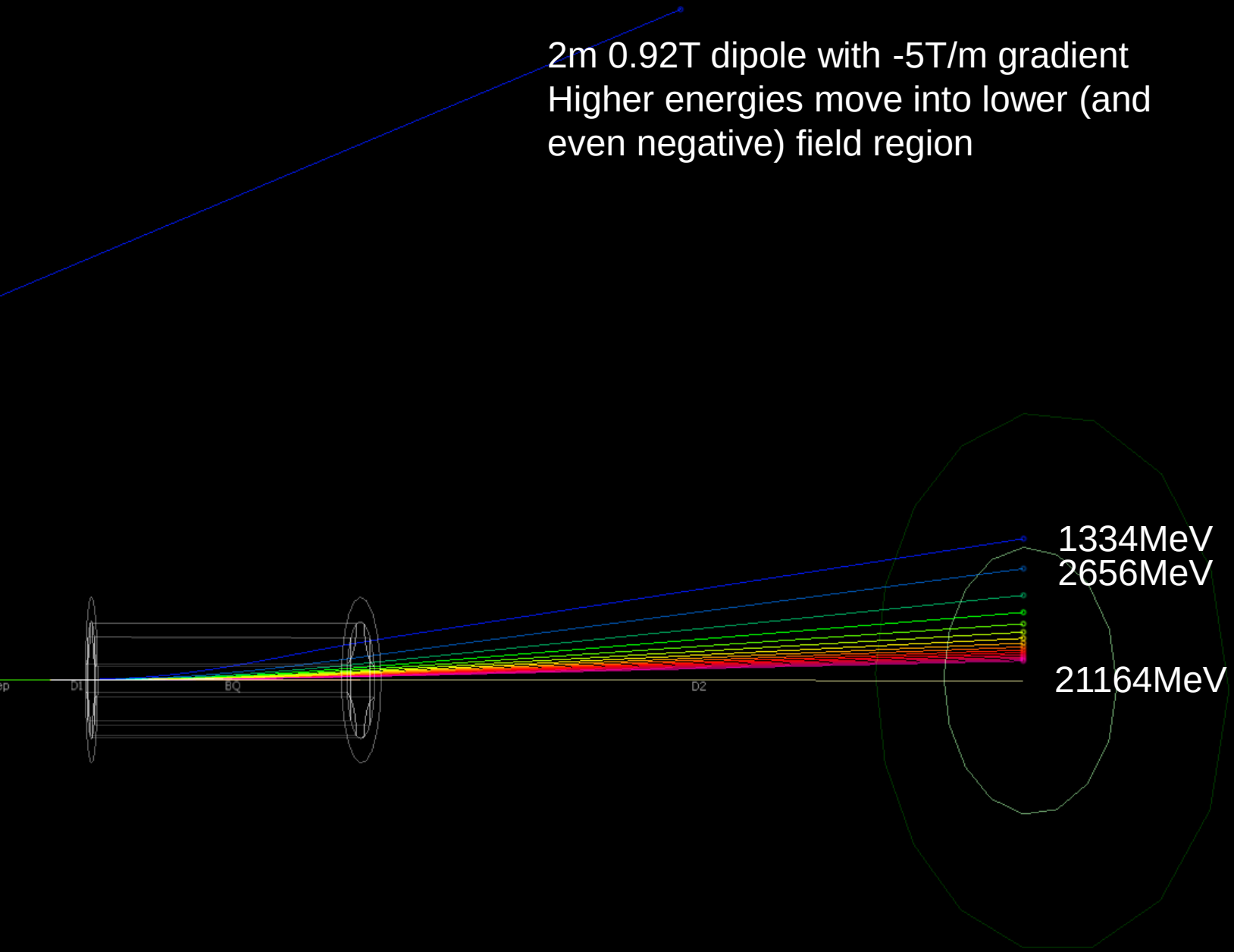
- $\Delta L = 2(\text{hypot.} - \text{adjacent})$
- $\text{Hypot.} = X/\sin\theta$
- $\text{Adjacent} = X/\tan\theta$
  - $= X\cos\theta/\sin\theta$
- So $\Delta L = 2X(1 - \cos\theta)/\sin\theta$
  - $= 2X(\theta/2 + \theta^3/24 + \theta^5/240 + \ldots)$ [Wolfram Alpha]
- Thus $\Delta L = X\theta + X\theta^3/12 + X\theta^5/120 + \ldots$
  - I focus on reducing θ, Nick reduced X



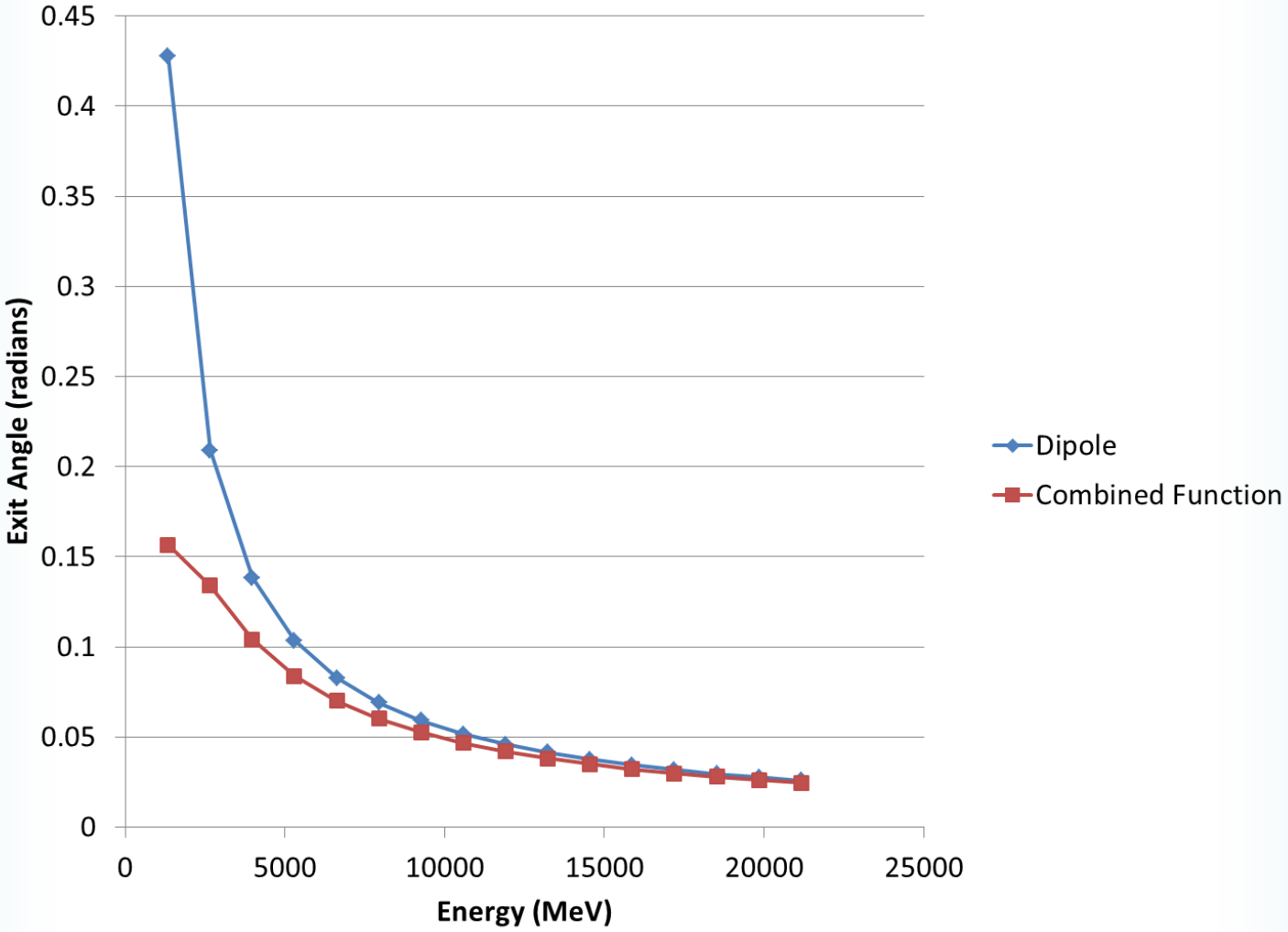
2m 0.92T dipole from Tsoupas design
Horizontal and vertical to scale



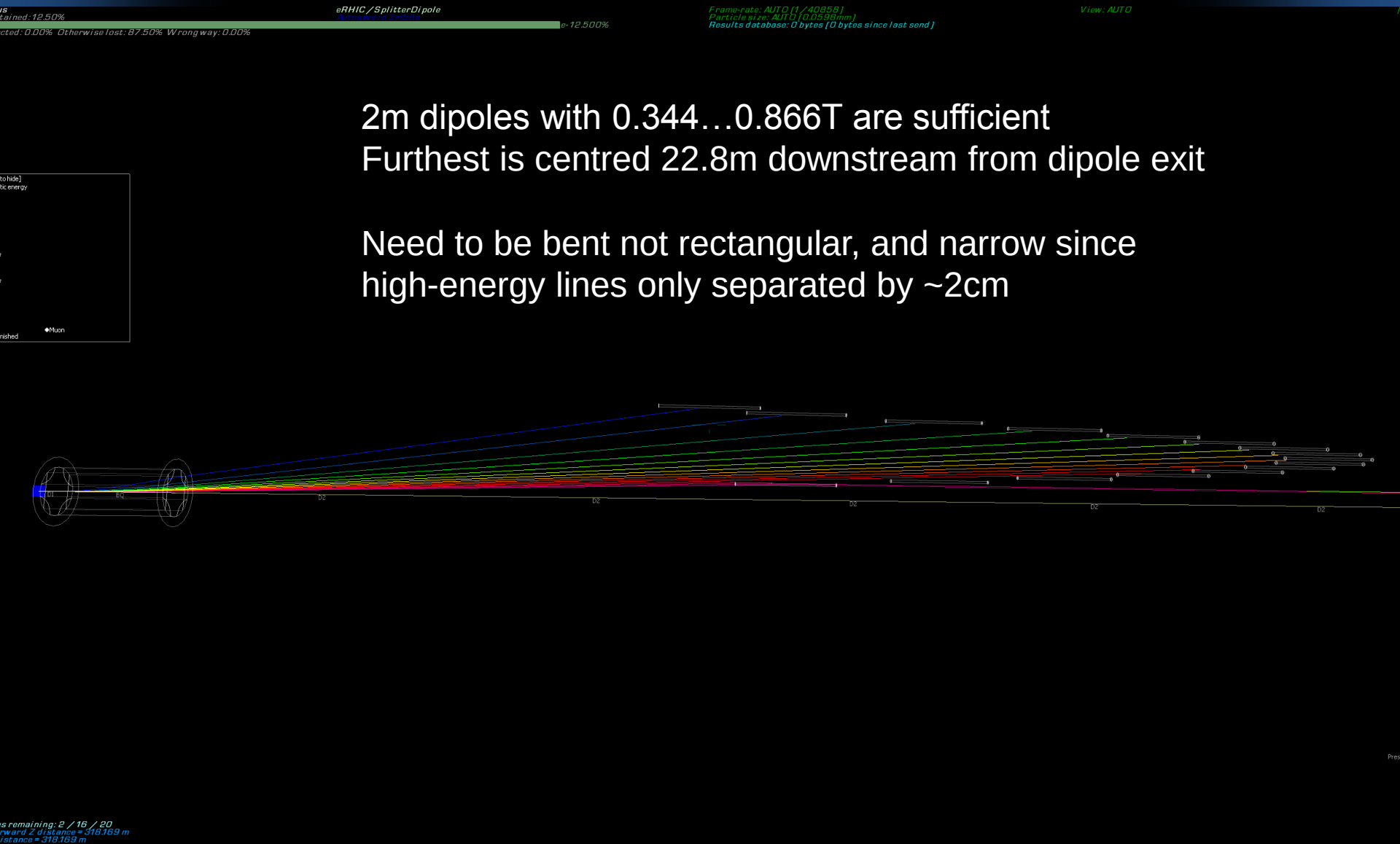
2m 0.92T dipole with -5T/m gradient
Higher energies move into lower (and even negative) field region



Exit Angle as Function of Energy



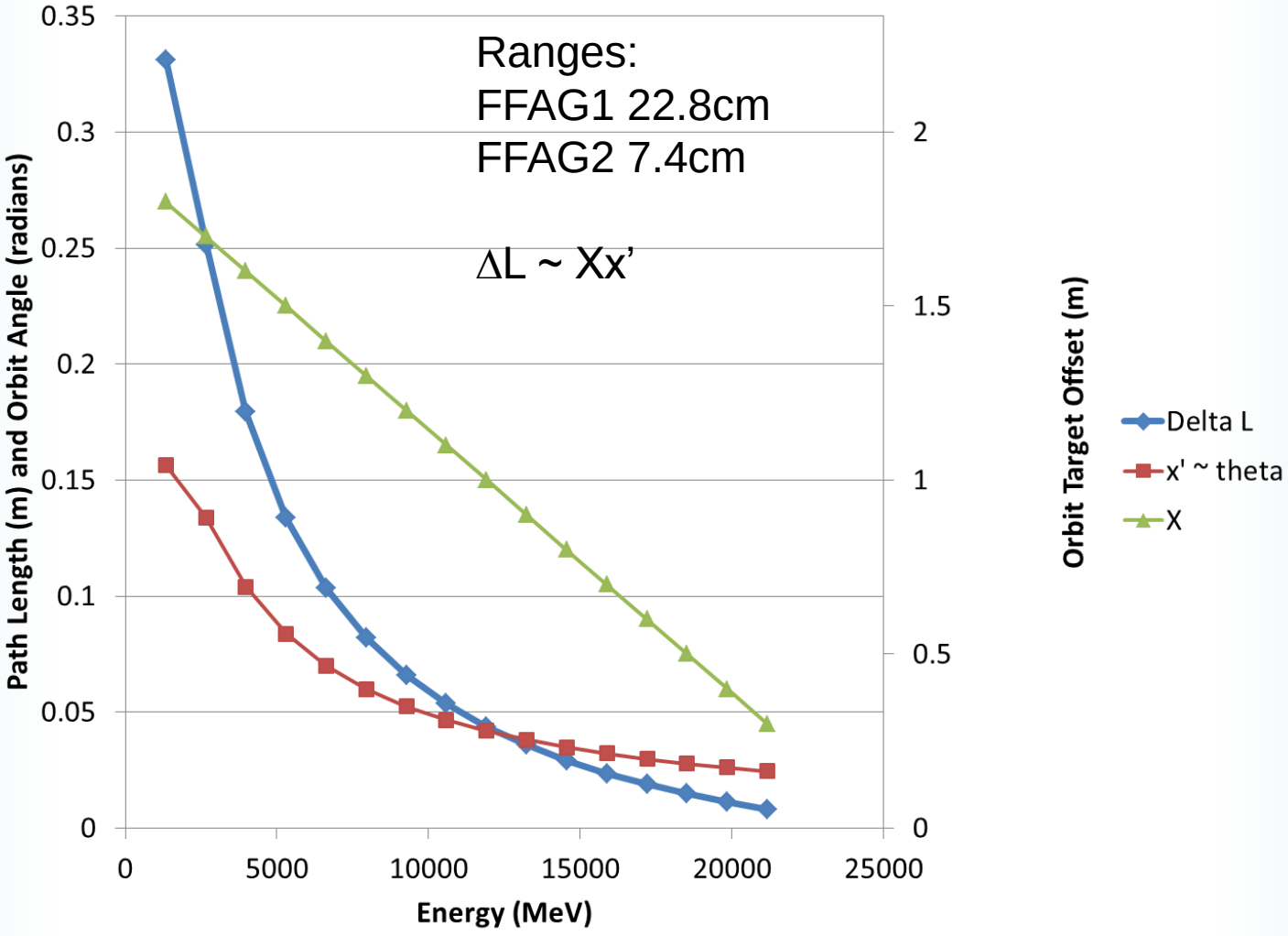
Dipoles Placed for X=0.3,0.4…1.8m



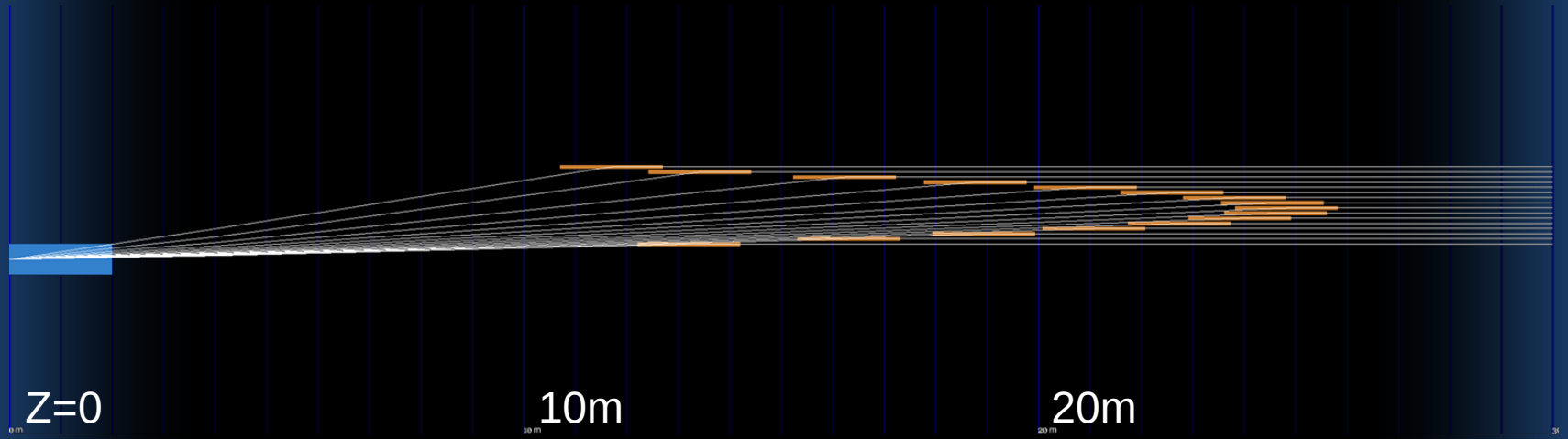
2m dipoles with 0.344…0.866T are sufficient
Furthest is centred 22.8m downstream from dipole exit

Need to be bent not rectangular, and narrow since high-energy lines only separated by ~2cm

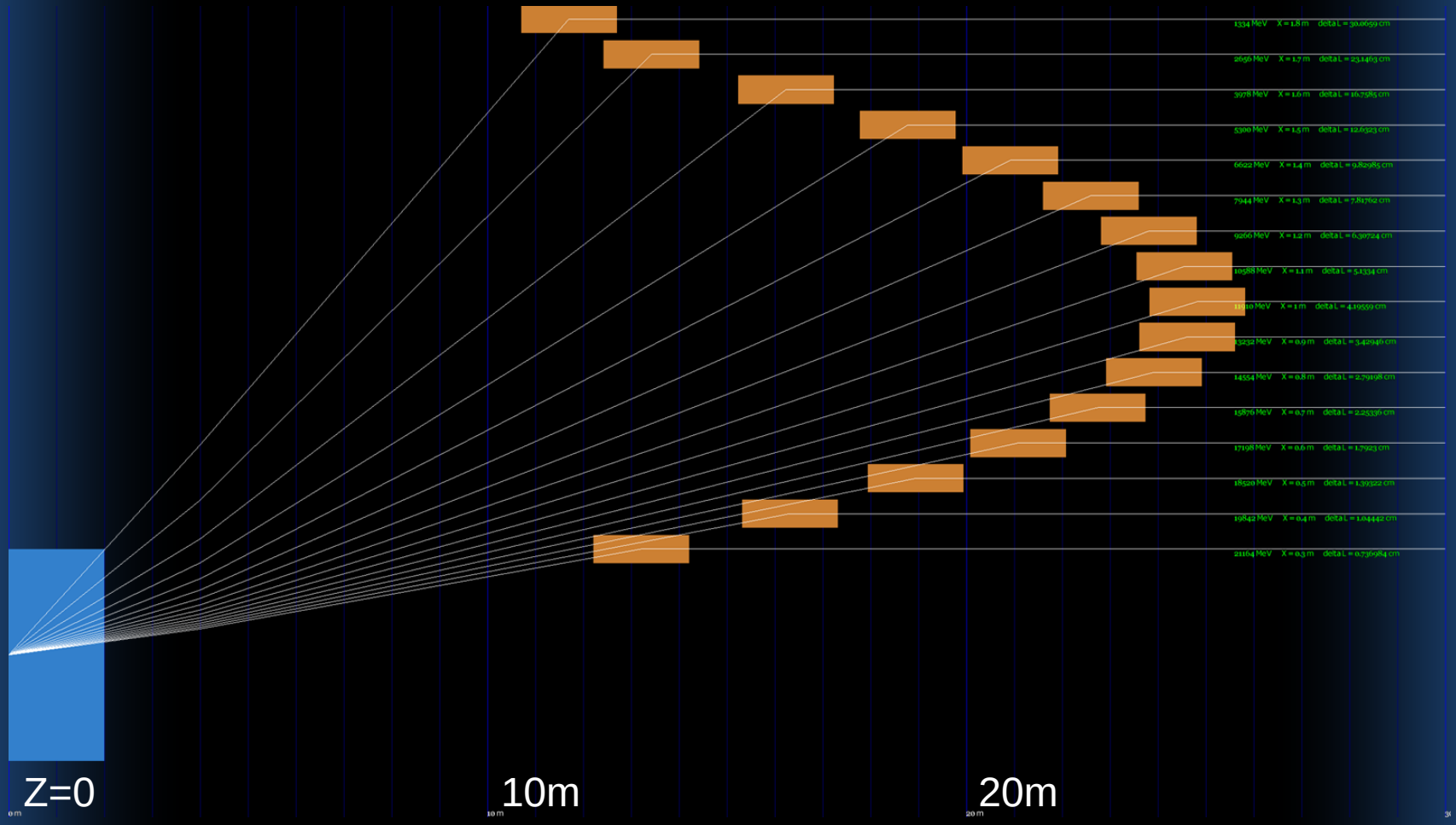
Δ(Path Length) vs. Energy (C.Fn.)



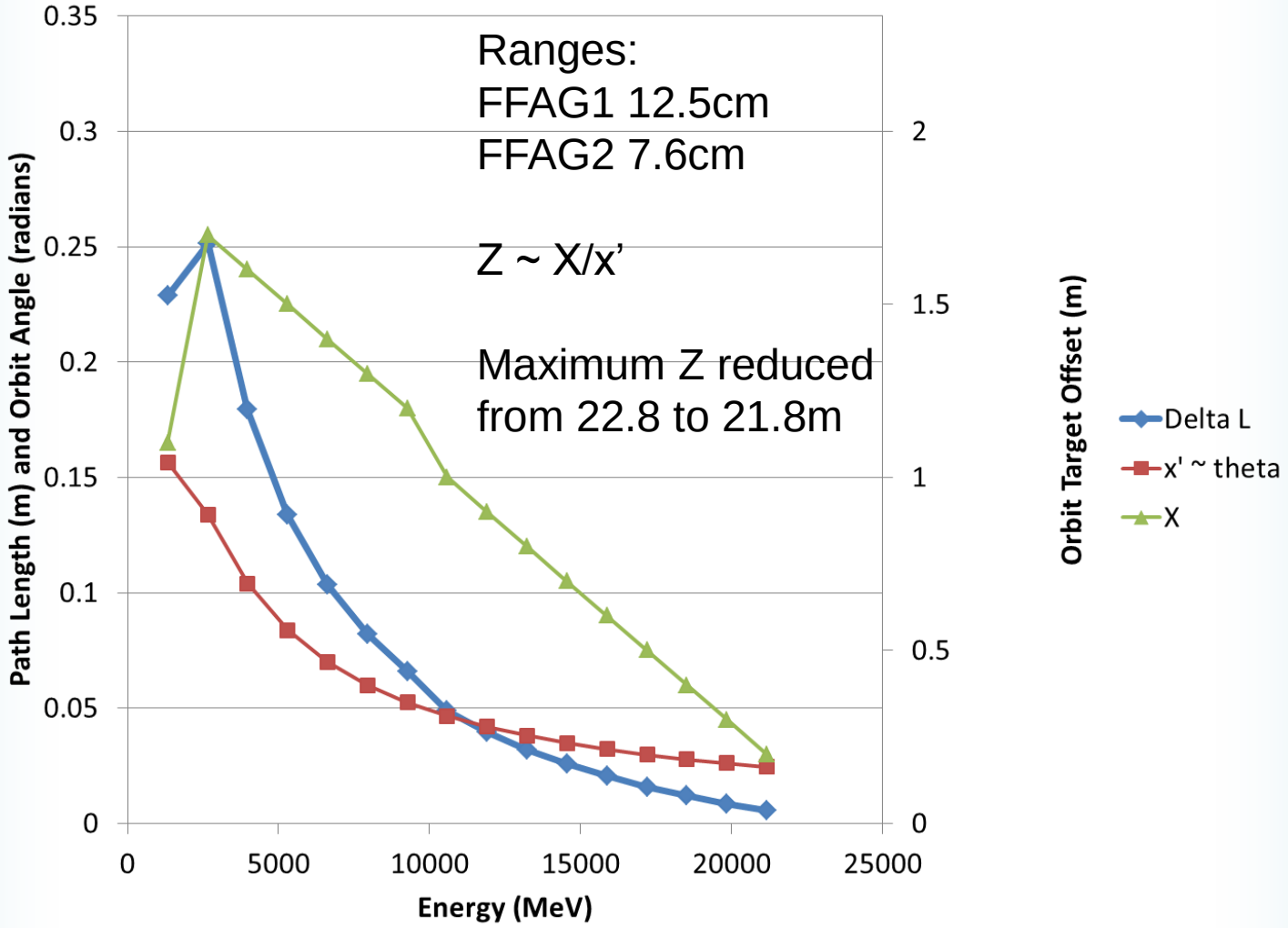
Regular Design (1:1 scale)



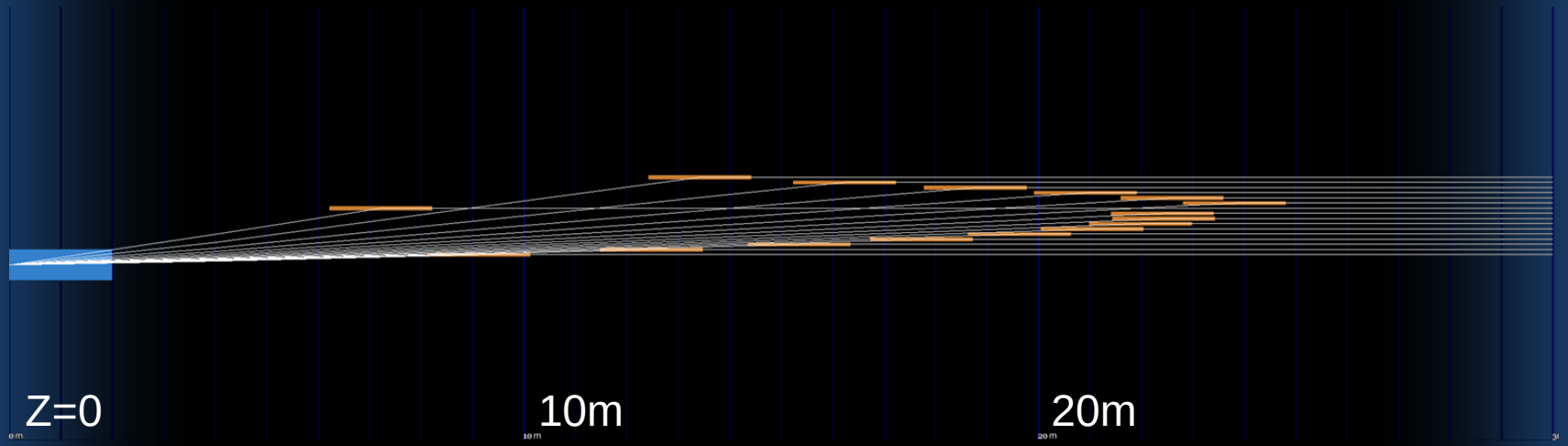
Regular Design (X exaggerated)



Reducing X for Lowest Energy



Reordered Design (1:1 scale)



Reordered Design (X exaggerated)