2016 I: Q4 Exp

$$P_\zeta = m R v_\zeta - \frac{e}{c}\psi(r)$$

$v_\zeta \sim v_{th}\,\epsilon^{1/2}$

At mirror: $P_\zeta = -\frac{e}{c}\psi(r)$

At mid: $P_\zeta = m(r+R+\Delta)v_\zeta - \frac{e}{c}\psi(r+\Delta)$

$$\psi(r+\Delta) \approx \psi(r) + \Delta\frac{\partial\psi}{\partial r} = \Delta\,(R_0+r)B_p$$

$$\Rightarrow (r+R+\Delta)\epsilon^{1/2}v_{th} - \frac{e}{c}\Delta\,(R_0+r)B_p$$

$q = \frac{r}{R}\frac{B_T}{B_p} = \epsilon\frac{B_T}{B_p}$

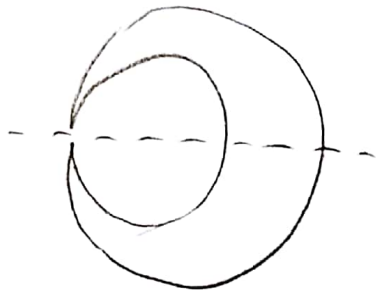
$$\Delta = \frac{mc}{e}\frac{r+R+\Delta}{r+R}v_{th}\epsilon^{1/2}\frac{1}{B_p}$$

$$= \frac{mc}{eB_T}v_{th}\,q\,\frac{\epsilon^{1/2}}{\epsilon}$$

$\frac{v_T}{\Omega} \sim \sqrt{\frac{kT}{m}}\frac{mc}{eB}$

$\Delta \sim \rho q \epsilon^{-1/2}$ $\quad \rho \sim \frac{v_T}{\Omega} \sim \frac{v_\perp}{\Omega} \Rightarrow \Delta \sim \frac{v_\perp}{\Omega}\frac{q}{\epsilon}v_{\parallel}$

Fatest banana:



$B_T \sim \frac{B_0}{R}$

$$\Delta \sim \underbrace{q\left(\frac{R}{r}\right)^{1/2}}_{4}\sqrt{kT}\sqrt{m}\,\frac{c}{e}\,\frac{1}{B_T}$$

(c only in cgs)

$\sqrt{kT}$: $\sim 2\times10^{3}$; $\sqrt{m}$: $2\sqrt{m_p} \sim 2\times4\times10^{-14}$; $\frac{c}{e}$: 2×10^{19} ; $\frac{1}{B_T} \rightarrow \frac{1}{5T}$

$m_p = 16\times10^{-28}$ kg

$16\times$

$\sqrt{eV}\sqrt{kg}$ / $\epsilon\cdot T$ → $\frac{s\sqrt{J}}{kg}$

$\sqrt{eV}\cdot(16\times10^{-20}\,\frac{J}{eV})^{1/2} = 4\times10^{-10}\sqrt{J}$

$= 4\times10^{-10}\frac{\sqrt{kg}\,m}{s}$

$$\Delta \sim 16\times3/5 \times10^{3}\times10^{19}\times10^{-14}\times4\times10^{-10}\ m$$

$16\times\frac{32}{5}$ $\qquad 10^{22}\times10^{-24} = 10^{-2}$

16×32 / 512

$512/5 \sim 100$

$$\Rightarrow \boxed{\Delta \sim 1\,m}$$

↳ expected 10's of centimeters