Lab 10: Earth's Magnetic Field

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1. Record the initial dip angle $\theta_0 = 36°$
2. Set source to 4V.

Table 1: Earth's Measurement of Magnetic Field						
Resistance	20Ω	40Ω	75Ω	150Ω	180Ω	200Ω
Current i	0.122A	0.0733A	0.0442A	0.0256A	0.0212A	0.0182A
Dip Angle Θ_i	-71°	-49°	-14°	6°	12°	15°
Calculated B_i	1.44e-4	8.65e-5	5.22e-5	3.02e-5	2.50e-5	2.15e-5
$tan(\theta_i)$	-2.90	-1.15	-2.49	1.05	2.13	2.68

3. Record the Helmholtz coil radius: R = 9.75cm → $\boxed{0.0975m}$
4. Record the Helmholtz coil number of turns: N = $\boxed{128}$
5. Calculations: ($B_i = \frac{8N_{\mu_0}I_i}{R\sqrt{125}}$, $where\ \mu_0 = 4\pi \times 10^{-7}Tm/A$, $\tan(36°) = \frac{B_H}{B_V} = 0.727$)
   - Plot $tan\theta_i$ vs B_i with straight line. Deduce the values of B_V and B_H from the graph.
   - $B_V = B_E \cdot cos(\theta_0) \rightarrow\ B_E \cdot cos(36°) = \boxed{0.809T}$
   - $B_H = B_E \cdot sin(\theta_0) \rightarrow\ B_E \cdot sin(36°) = \boxed{0.588T}$
   - Calculate $B_E = \frac{B_H}{sin(36°)} \rightarrow\ \frac{0.588}{sin(36°)} = \boxed{1.0004T}$
   - Lookup value of $B_E = \frac{3.02e{-}5}{1.05 - 0.727} = \boxed{9.34 \times 10^{-5}T}$
   - $Slope = \frac{1}{9.34\times10^{-5}T} \rightarrow\ \boxed{1.07 \times 10^{4}T}$

Graph

$tan(\theta_i)$ vs B_i