Lab Experiment #10:

Measurement of Earth's Magnetic Field

David McNeary
Partner: Glendy Lara
PHYS 220BL
11/15/2021

Data

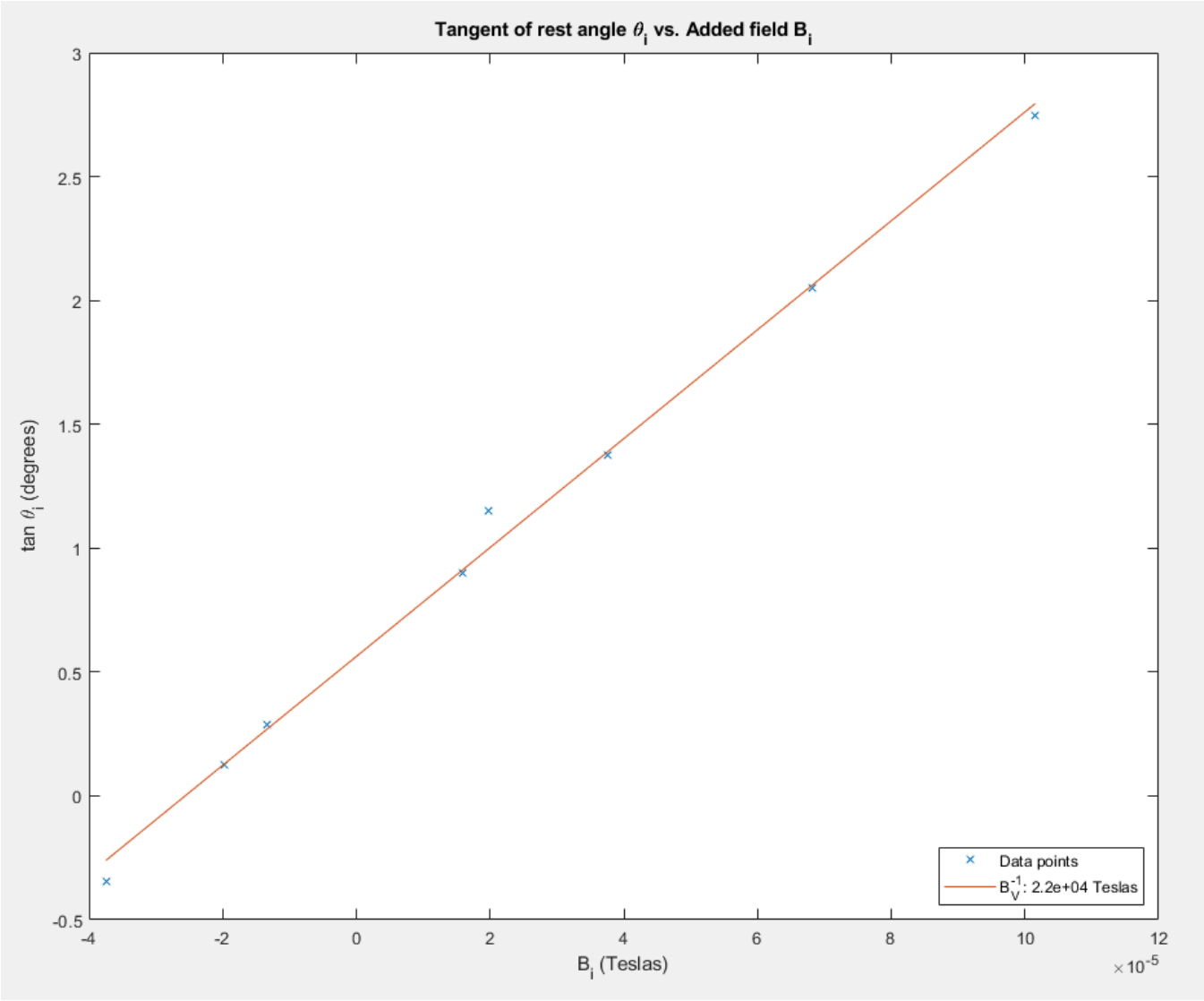
Initial dip angle: $\theta_0 = 31^\circ$
Helmholtz coil radius: $R = 11\ \mathrm{cm}$
Helmholtz coil wrap quantity: $N = 124\ \mathrm{turns}$

Dip angle vs current

Iteration	1	2	3	4	5	6
Resistance	100Ω	50Ω	30Ω	250Ω	300Ω	100Ω
Current i	$37\mathrm{mA}$	$67.2\mathrm{mA}$	$100.2\mathrm{mA}$	$15.66\mathrm{mA}$	$-13.14\mathrm{mA}$	$-36.97\mathrm{mA}$
Dip angle θ_i	54°	64°	70°	42°	16°	-19°
Calculated B_i	$37.5\mu T$	$68.1\mu T$	$101.6\mu T$	$15.9\mu T$	$-13.3\mu T$	$-37.5\mu T$

7	8
200Ω	200Ω
$-19.4\mathrm{mA}$	$19.4\mathrm{mA}$
7°	49°
$-19.7\mu T$	$19.7\mu T$

Calculations and plots



Calculated values

$B_V = 4.55 \times 10^{-5}\ \mathrm{T}$
$B_H = 2.56 \times 10^{-5}\ \mathrm{T}$
$B_E = \sqrt{B_V^2 + B_H^2} = 5.22 \times 10^{-5}\ \mathrm{T}$

Reference value

$B_E = 4.65 \times 10^{-5}\ \mathrm{T}$
Measured at: CSUN Library
Latitude: 34° 14' 21" N
Longitude: 118° 31' 40" W
Model used: WMM-2020
Referenced from: https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml

Percent difference: 11.6%

Data sheet + Quiz

(Quiz was a physical exercise)

10.6 Data sheet

Name: David McNeely	Date: 11/9/21	Instructor's initials:
Partner: Glendy Lara	Group No:	

Data

1. Record the initial dip angle θ_0 = 37°. Note that 0° is straight down, so adjust your readings accordingly.

2. Set the source to 4 V. Vary the resistance and record six values of the dip angle θ vs. current. Pay attention to the sign of the current as described in section 10.4. Only record resistance R if you are using method 1 to control the current.

20-100mA

	1	2	3	4	5	6	7	8
(Resistance R)	100Ω	50Ω	30Ω	250Ω	300Ω	100Ω	200Ω	200Ω
Current i	37mA	67.2mA	100.2mA	15.66mA	-13.14mA	-36.97mA	-19.4	19.4
Dip angle θ_i	54°	64°	70°	42°	16°	-19°	7°	49°
Calculated B_i	37.5μT	68.1μT	101.6μT	15.9μT	-13.3μT	-37.5μT	-19.7μT	19.7μT

3. Record the Helmholtz coil radius : R = 11 cm

4. Record the Helmholtz coil number of turns: N = 124

Calculations

Plot $\tan\theta_i$ vs. B_i and fit it with a straight line (see Fig. 10.2).
Deduce the values of B_V and B_H from the graph.
B_V = 4.55×10^{-5}T
B_H = 2.56×10^{-5}T
Calculate B_E = 5.22×10^{-5}T
Lookup value of B_E = 4.65×10^{-5}T