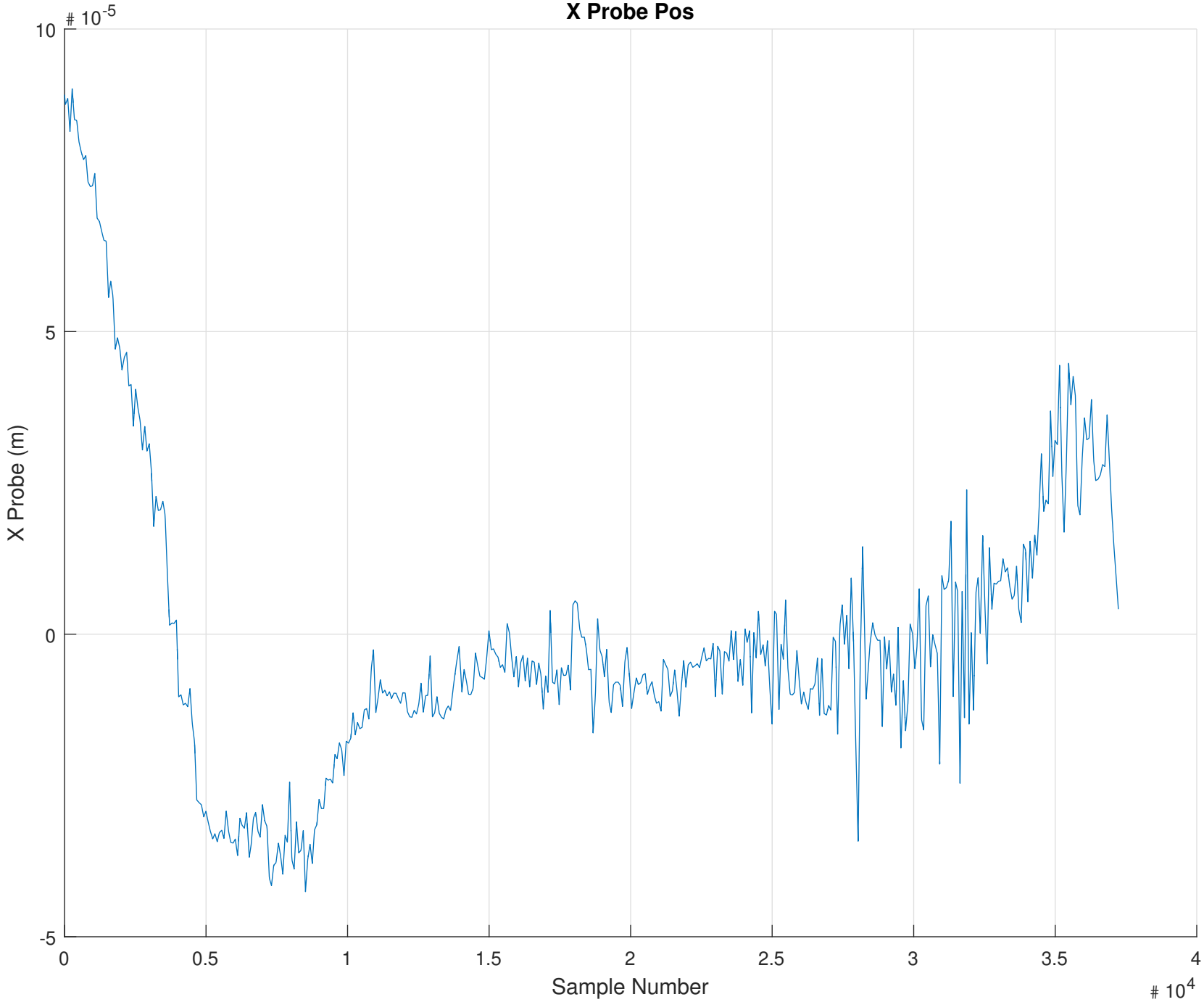
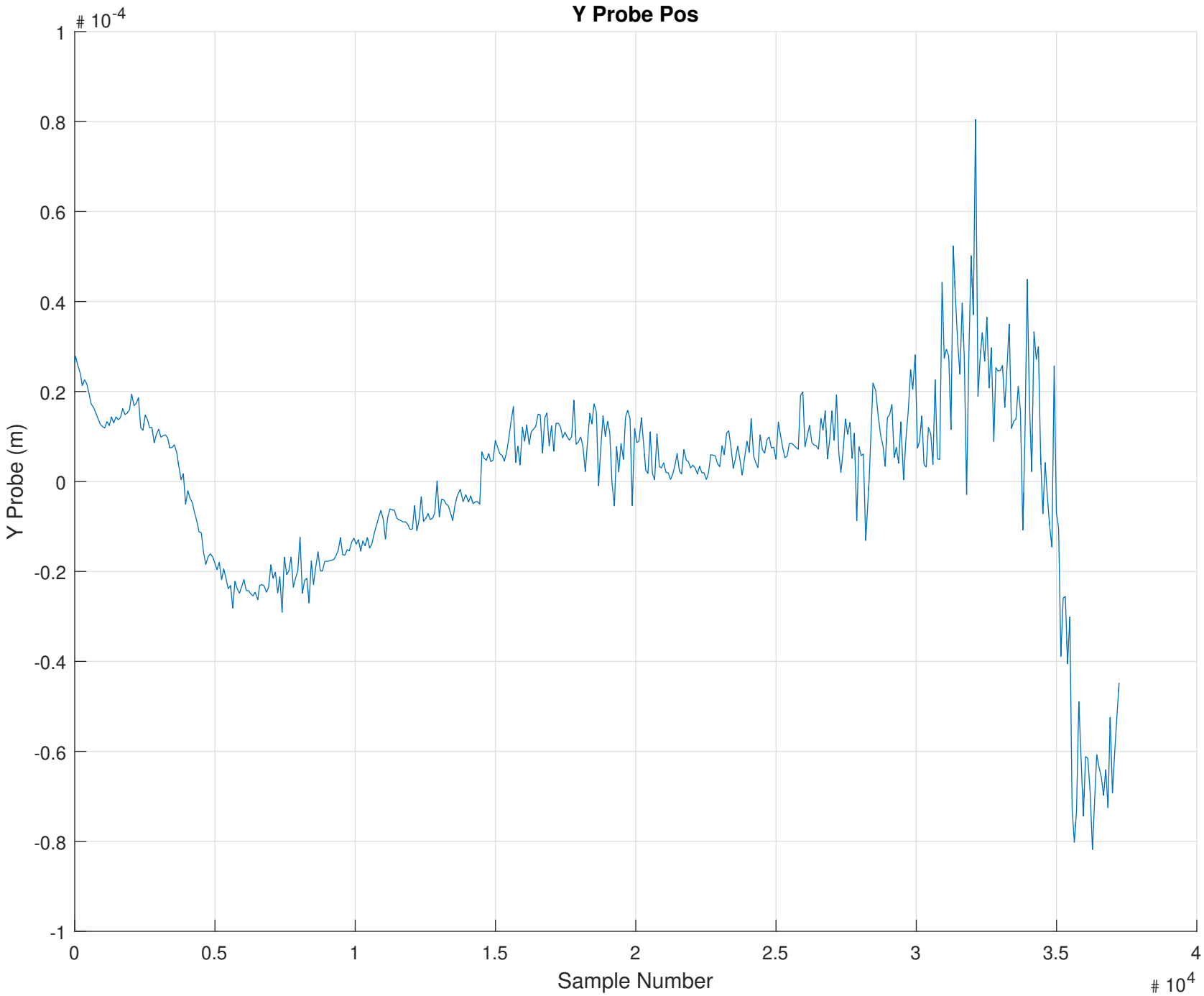
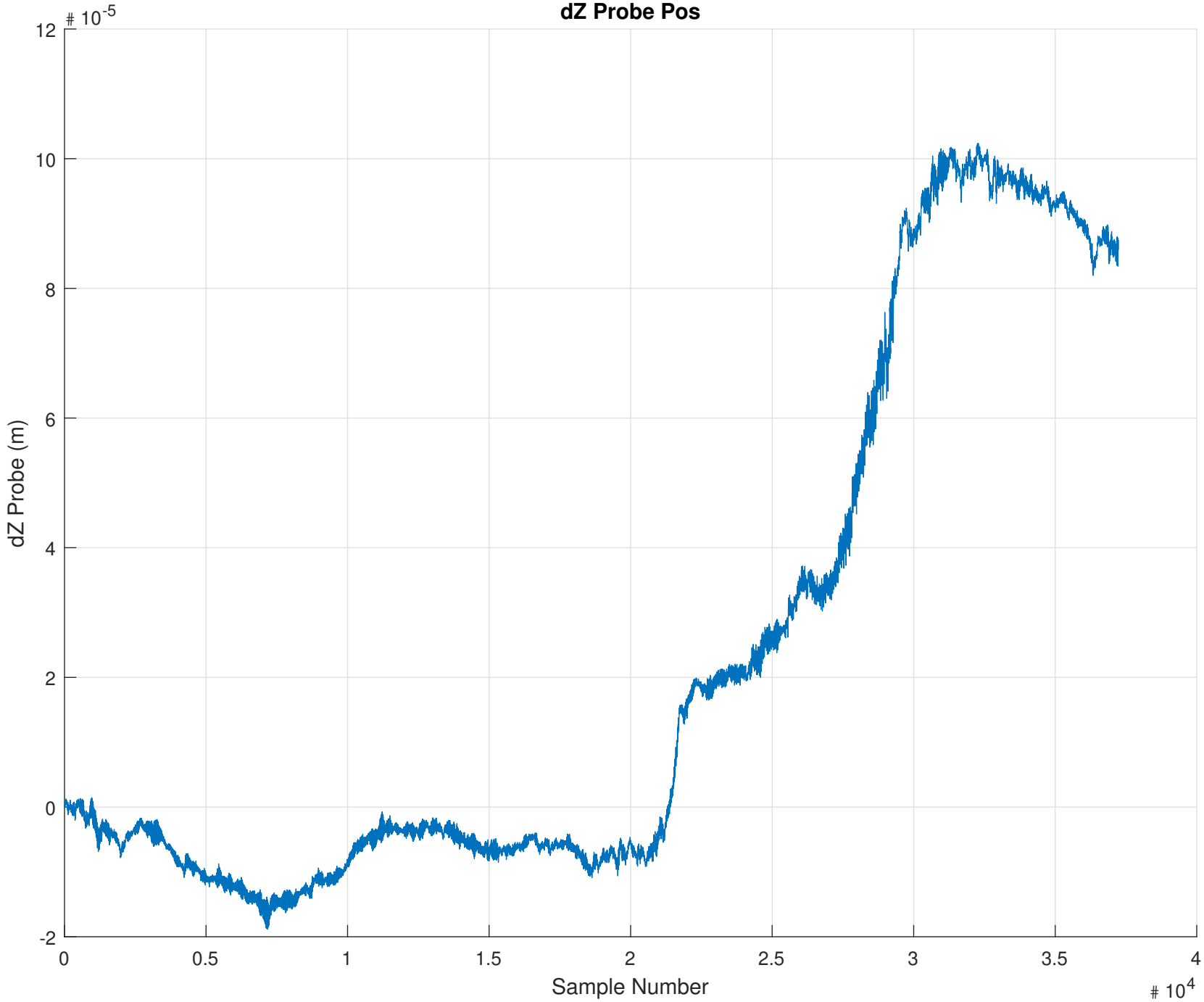
SLAC Magnetic Measurements

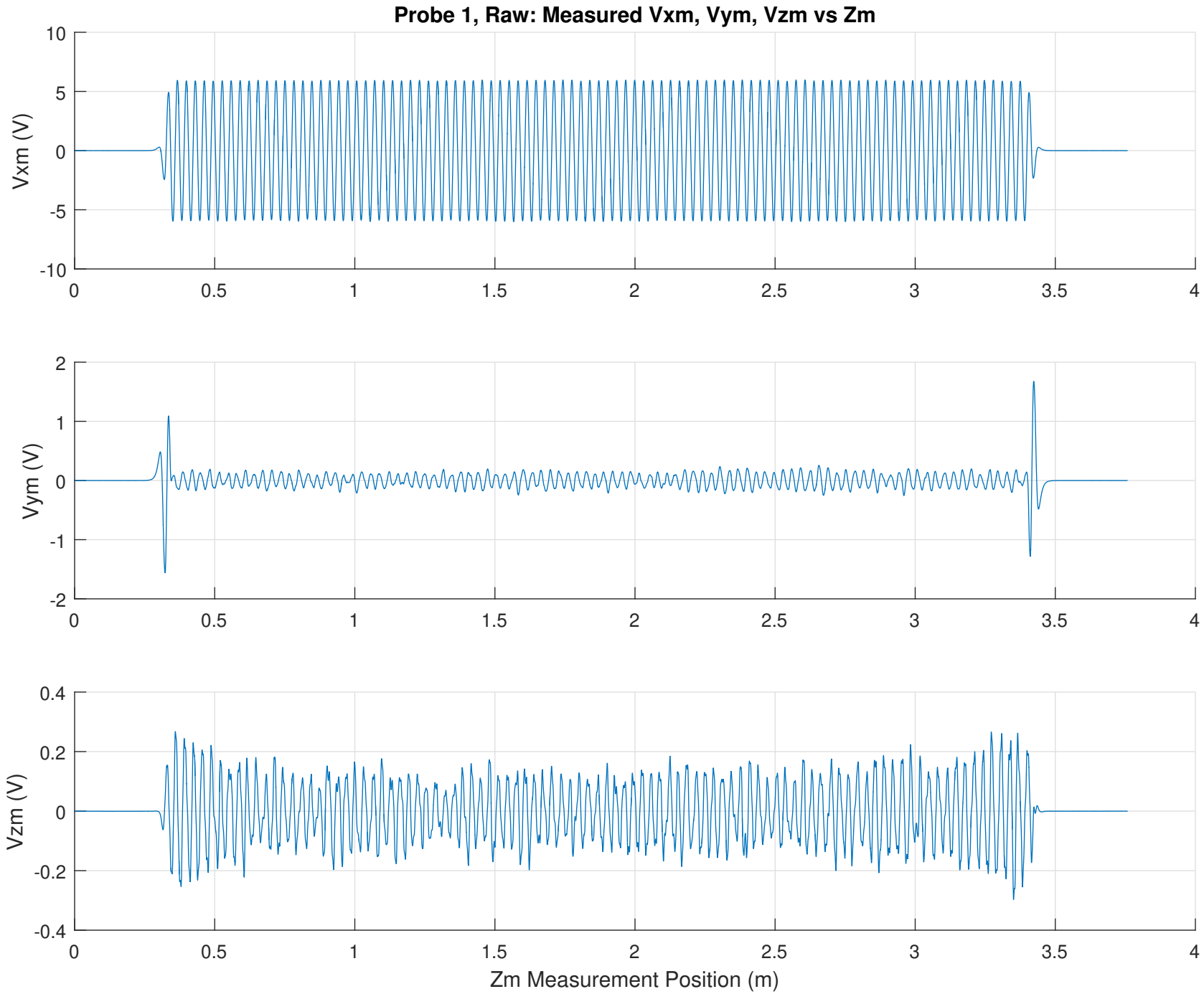
Hall Probe Array Analysis
****

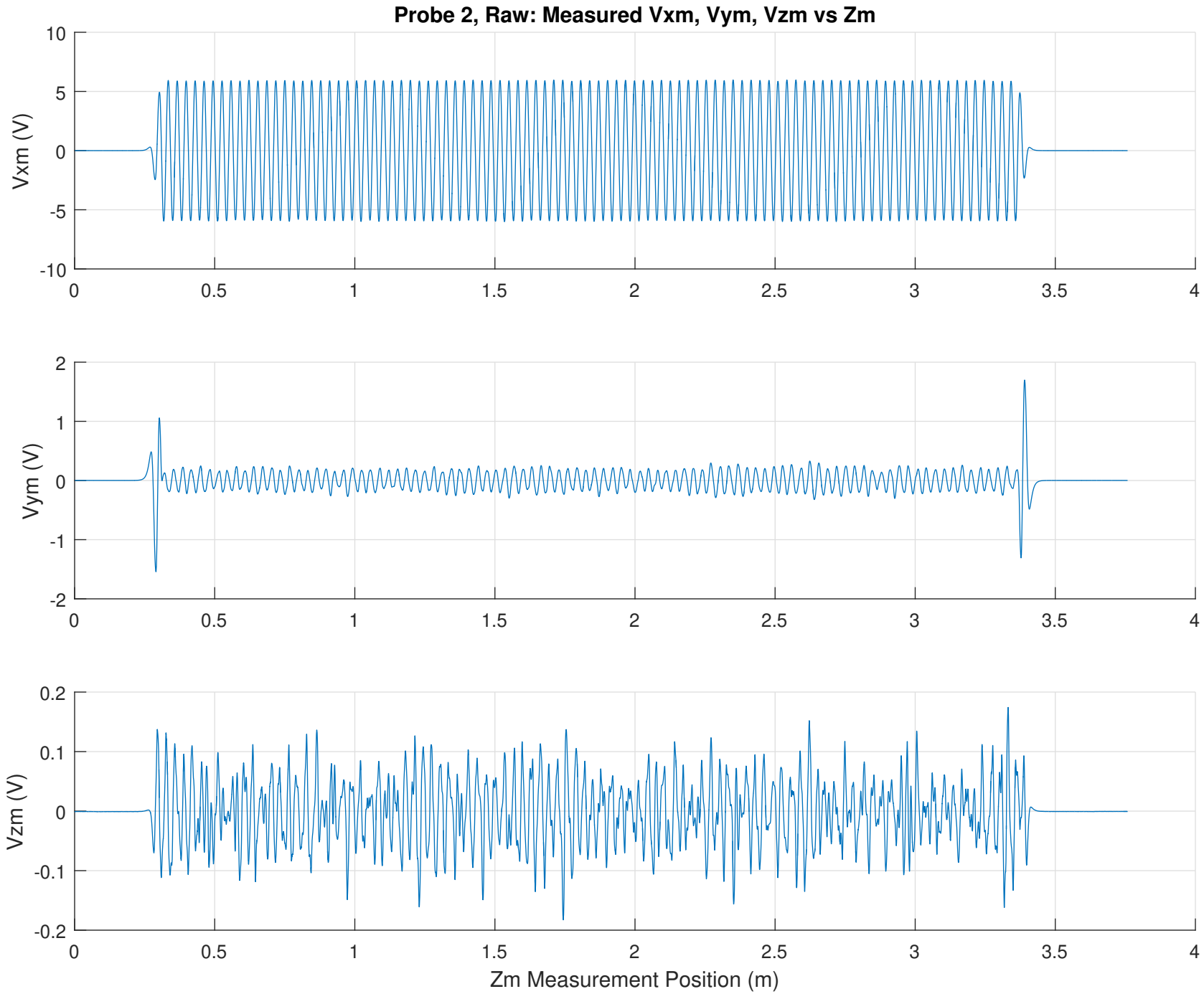
Parameters:
INPUT-FILE-DIR =V:\MET\MagServe\MagData\DELTA\Delta Data 2015\New Measurements\Run 142 Repeat 2014 Meas With New
INPUT-FILE-NAME =DUTestOutput.dat
INPUT-FILE-TYPE =ZVXYZVXYZH
UND-POL-MODE =LIN-POL-HORIZ-FIELD
PROBE1-BX-CALIB-FILE =V:\MET\MagServe\MagData\DELTA\Delta Data 2015\New Measurements\Yurii Hall Probe Calibrations\S
PROBE1-BY-CALIB-FILE =V:\MET\MagServe\MagData\DELTA\Delta Data 2015\New Measurements\Yurii Hall Probe Calibrations\S
PROBE2-BX-CALIB-FILE =V:\MET\MagServe\MagData\DELTA\Delta Data 2015\New Measurements\Yurii Hall Probe Calibrations\S
PROBE2-BY-CALIB-FILE =V:\MET\MagServe\MagData\DELTA\Delta Data 2015\New Measurements\Yurii Hall Probe Calibrations\S
NUM-ZERO-GAUSS-MEAS =200
PROBE2-OFFSET-DIR =Y

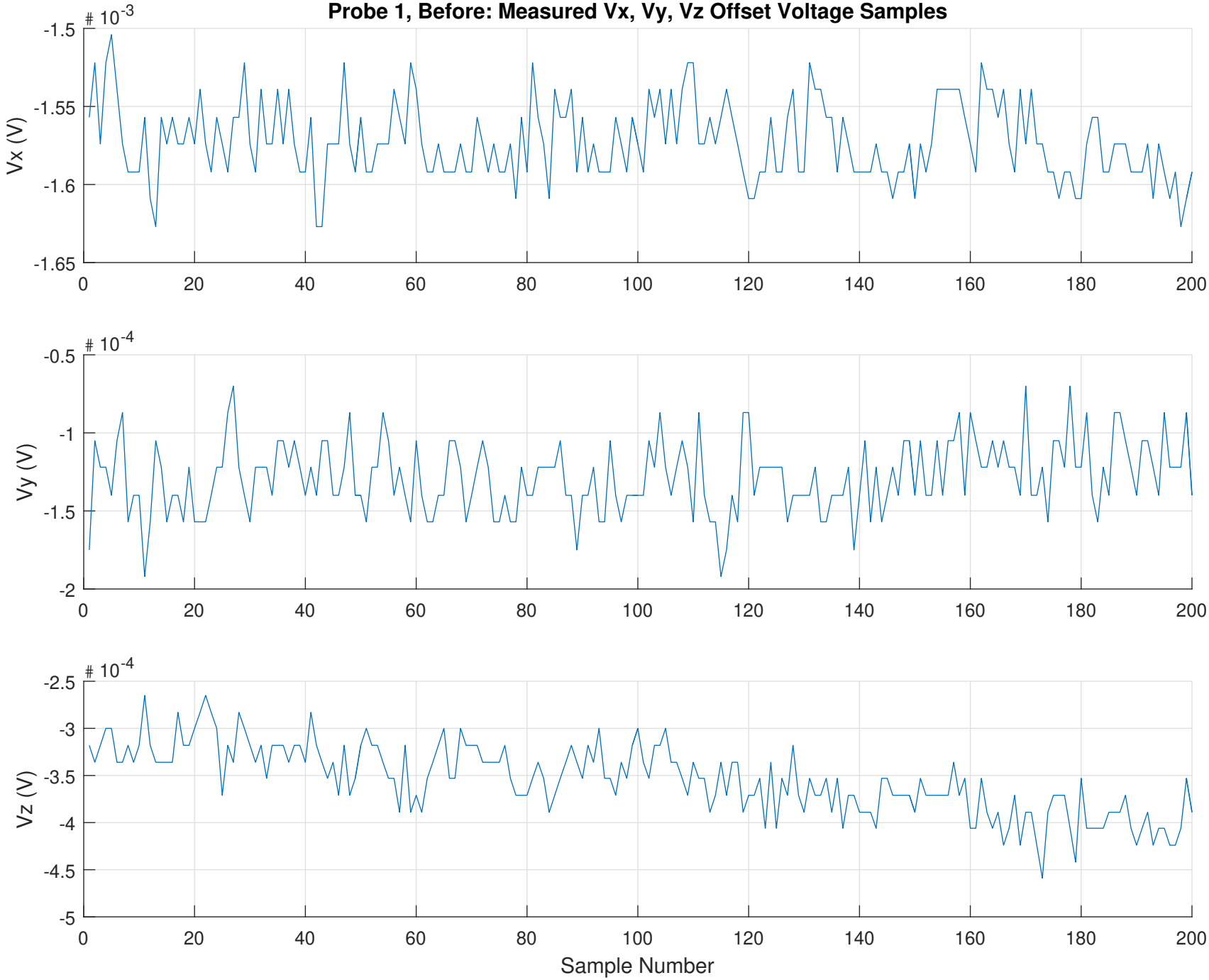

X Probe Pos
10-5
10
5
0
-5
X Probe (m)
0
0.5
1
1.5
2
2.5
3
3.5
4
Sample Number
10^4

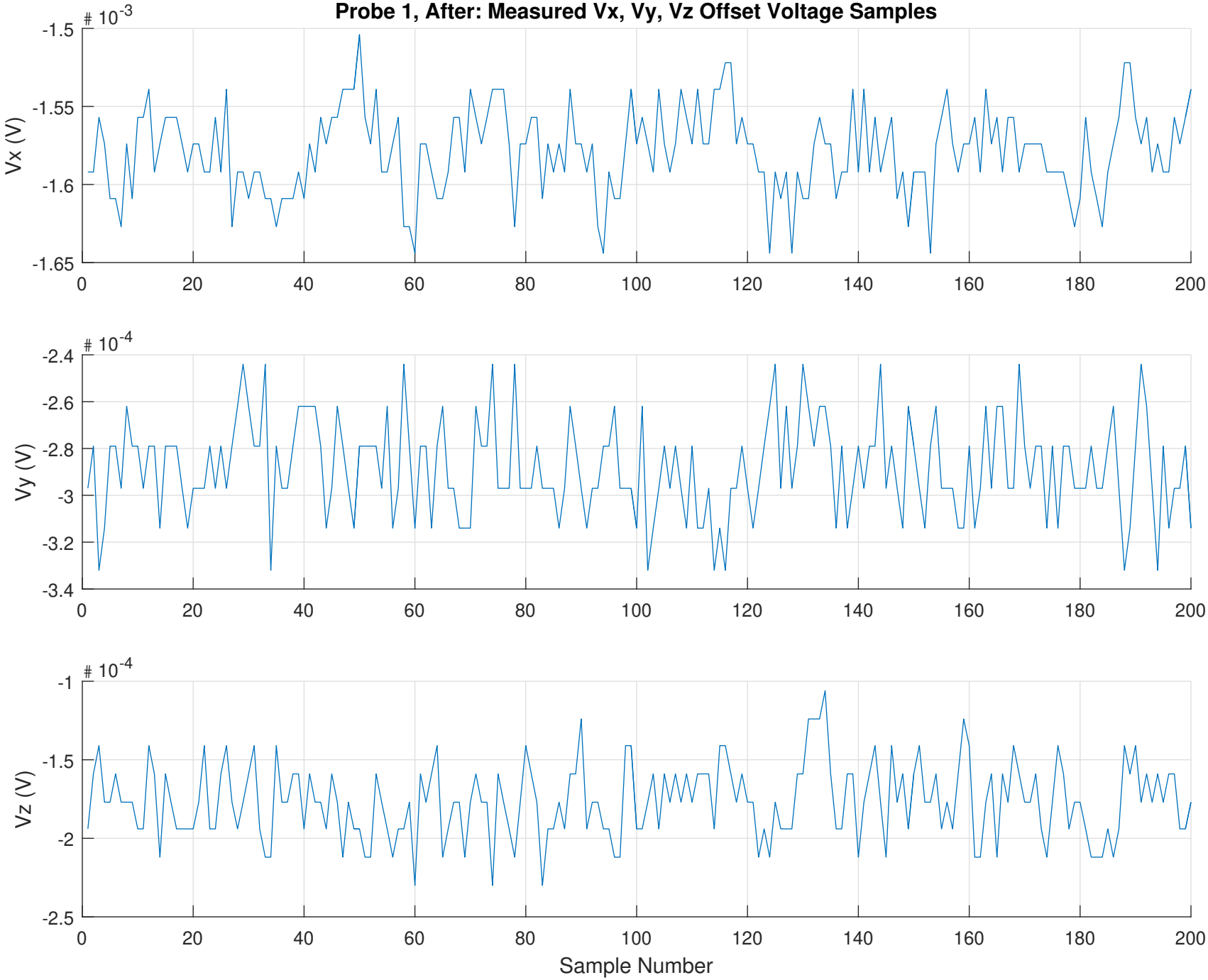

Y Probe Pos
10-4
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Y Probe (m)
0
0.5
1
1.5
2
2.5
3
3.5
4
Sample Number
10^4

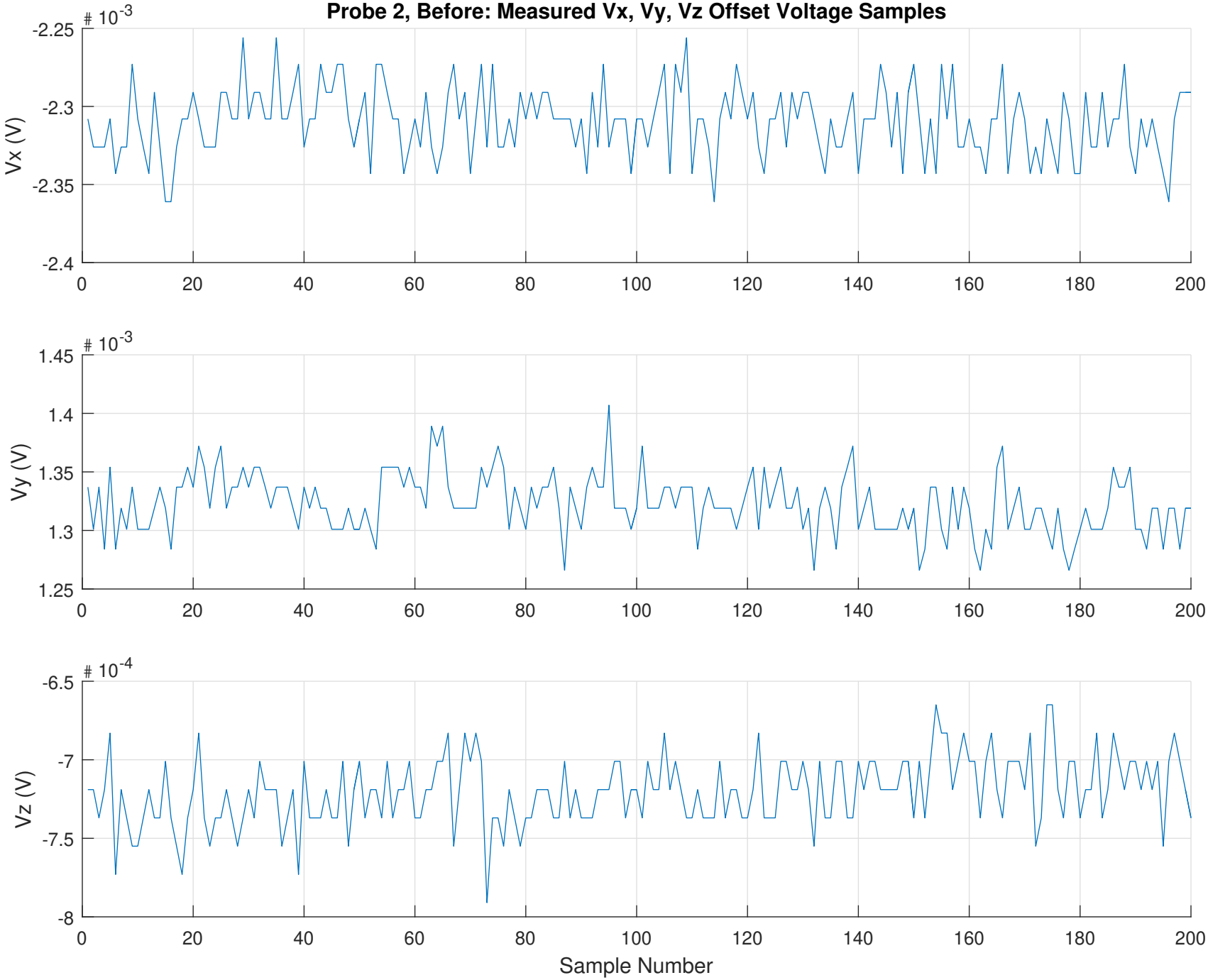

dZ Probe Pos
10-5
12
10
8
6
4
2
0
-2
dZ Probe (m)
0
0.5
1
1.5
2
2.5
3
3.5
4
Sample Number
10^4

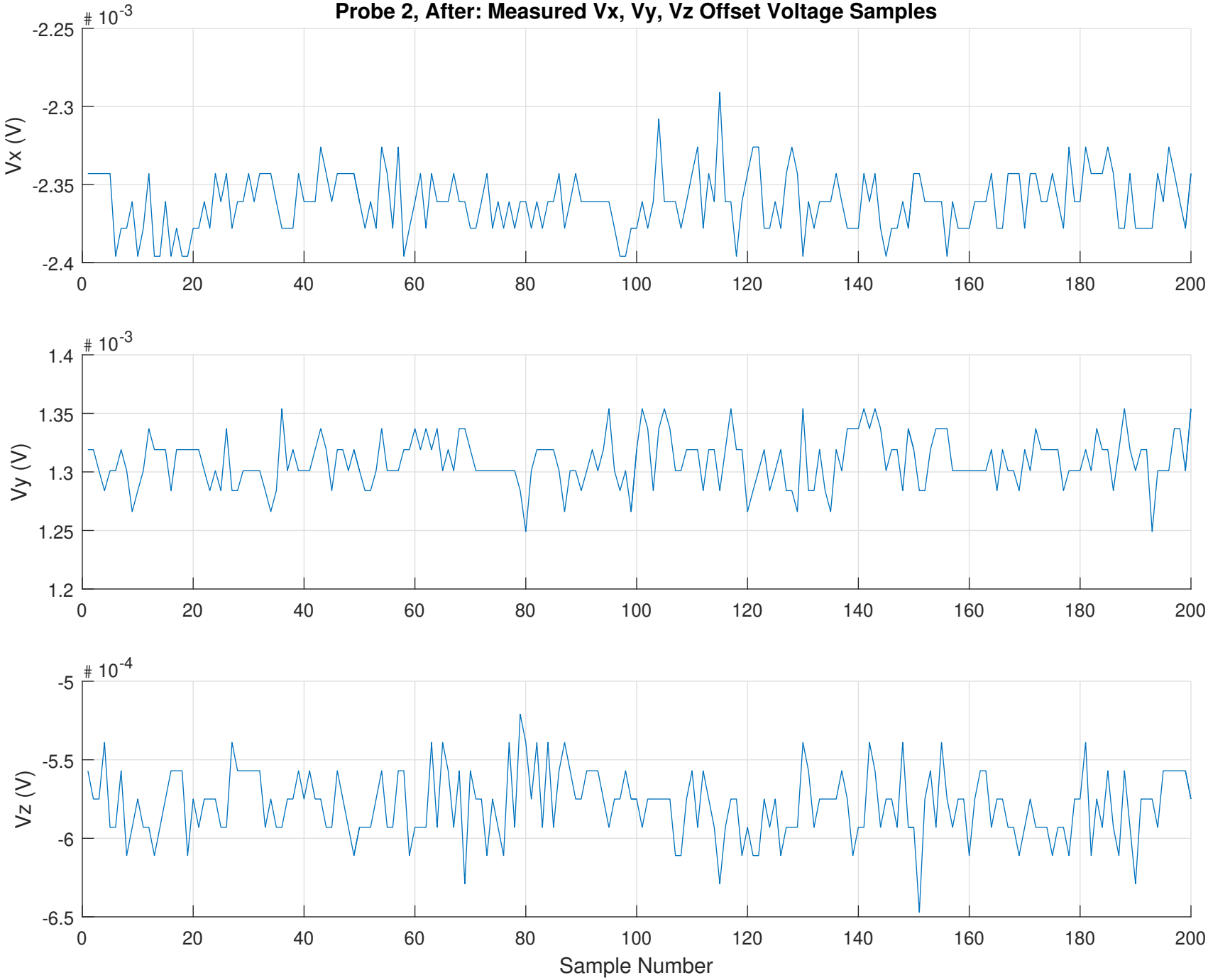

Probe 1, Raw: Measured Vxm, Vym, Vzm vs Zm
Vxm (V)
Vym (V)
Vzm (V)
Zm Measurement Position (m)

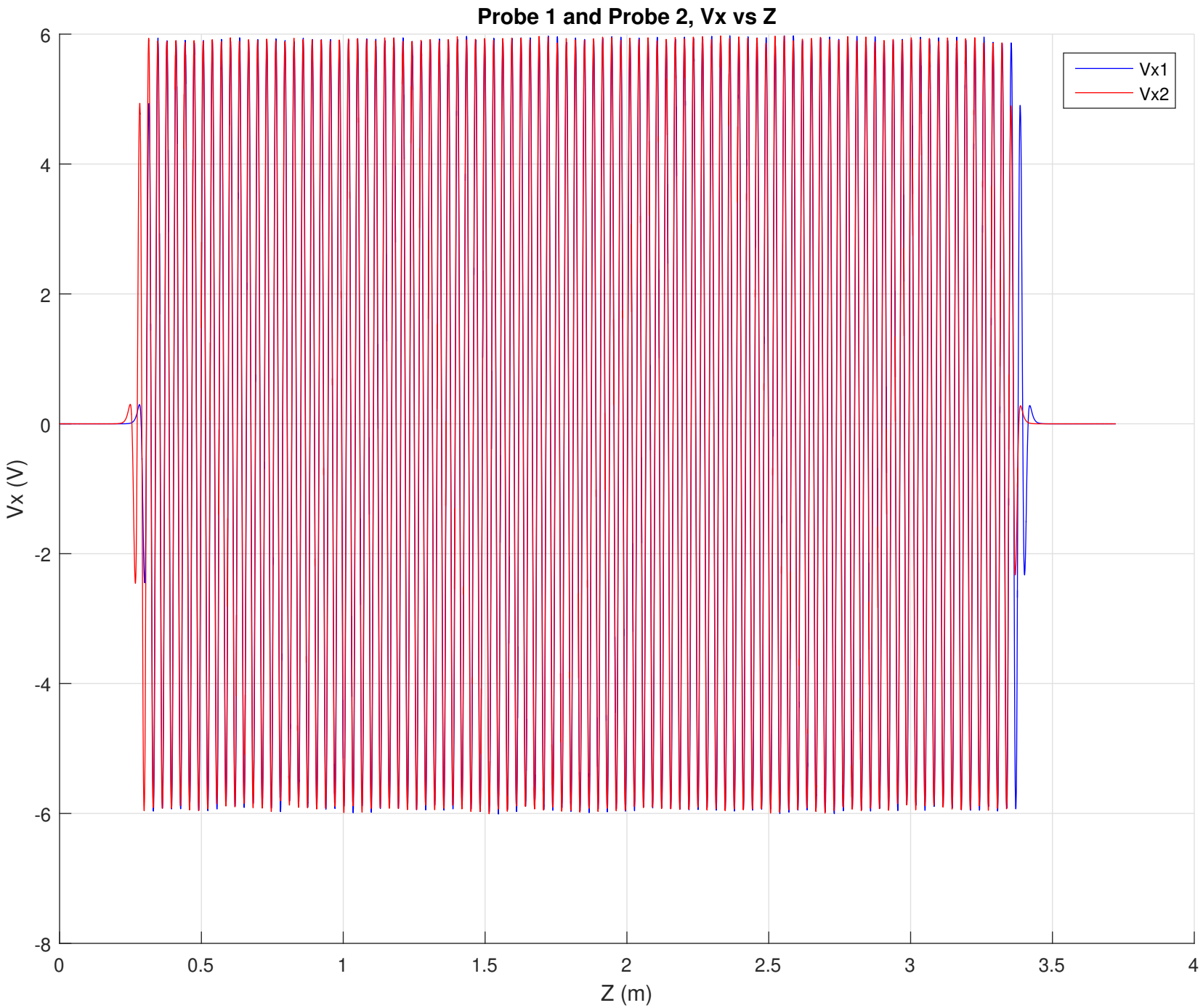

Probe 2, Raw: Measured Vxm, Vym, Vzm vs Zm
Vxm (V)
Vym (V)
Vzm (V)
Zm Measurement Position (m)

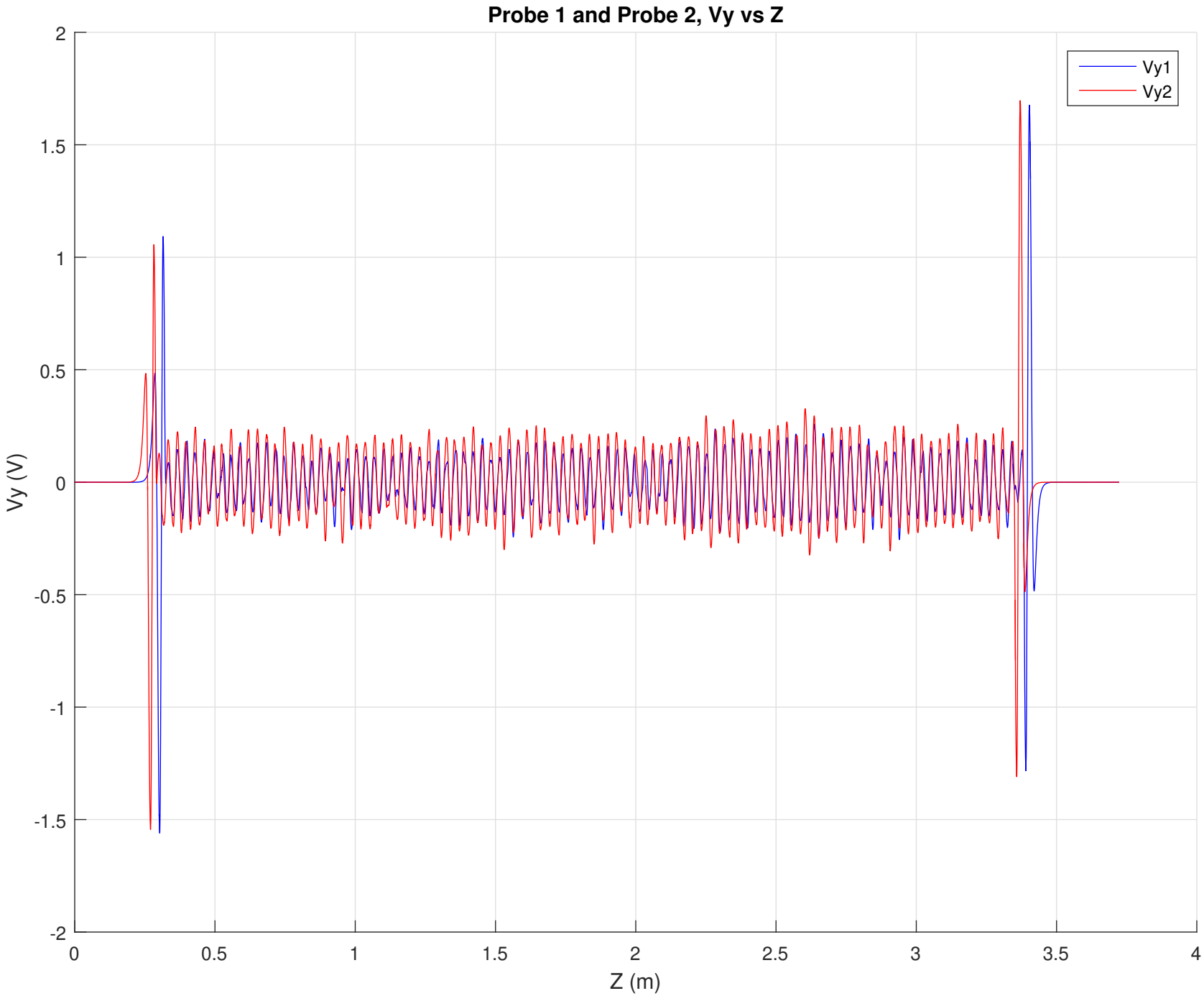

Probe 1, Before: Measured Vx, Vy, Vz Offset Voltage Samples
10^-3
Vx (V)
-1.5
-1.55
-1.6
-1.65
10^-4
Vy (V)
-0.5
-1
-1.5
-2
10^-4
Vz (V)
-2.5
-3
-3.5
-4
-4.5
-5
0
20
40
60
80
100
120
140
160
180
200
Sample Number

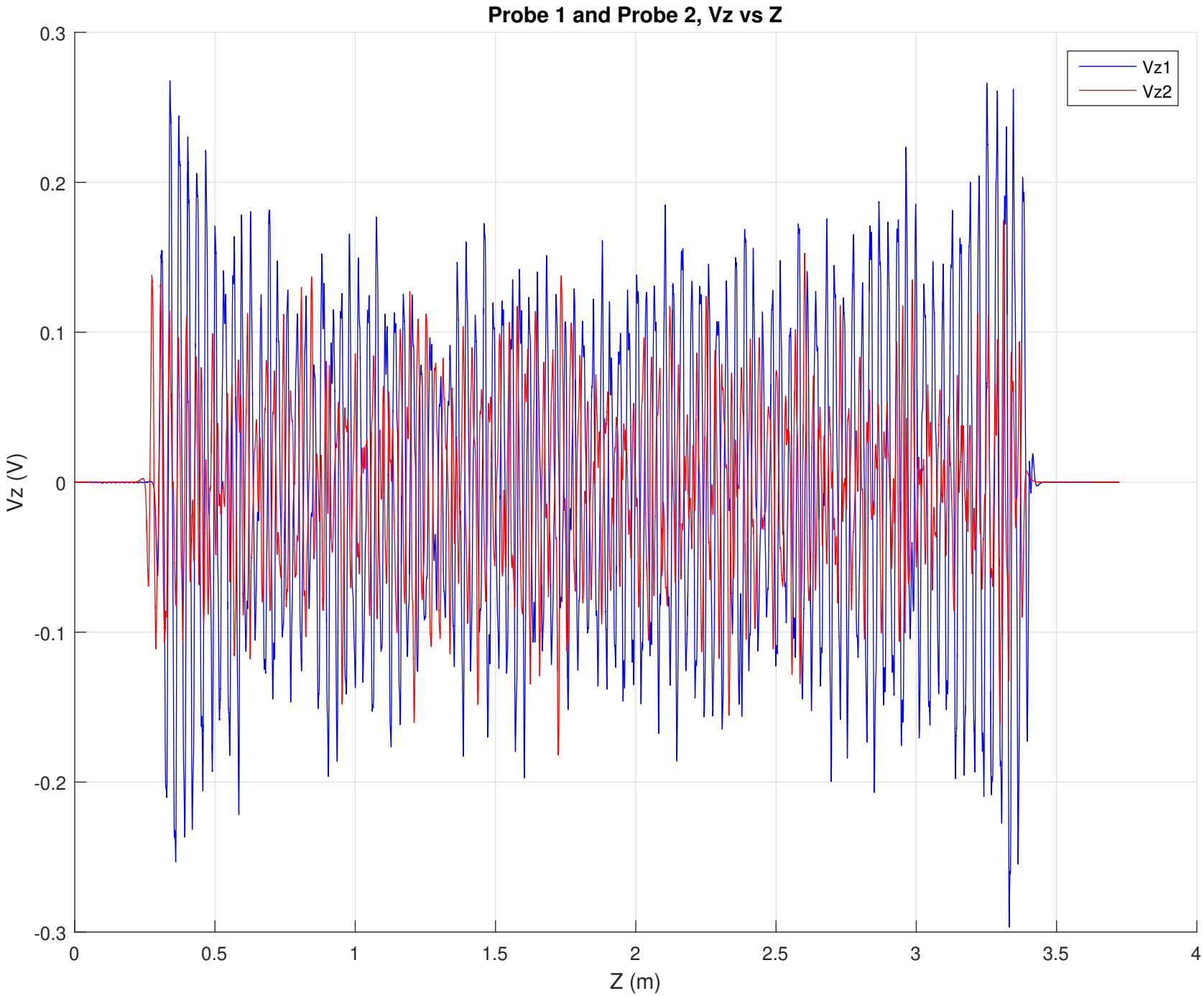

Probe 1, After: Measured Vx, Vy, Vz Offset Voltage Samples
10-3
-1.5
-1.55
-1.6
-1.65
Vx (V)
0
20
40
60
80
100
120
140
160
180
200
10-4
-2.4
-2.6
-2.8
-3
-3.2
-3.4
Vy (V)
0
20
40
60
80
100
120
140
160
180
200
10-4
-1
-1.5
-2
-2.5
Vz (V)
0
20
40
60
80
100
120
140
160
180
200
Sample Number

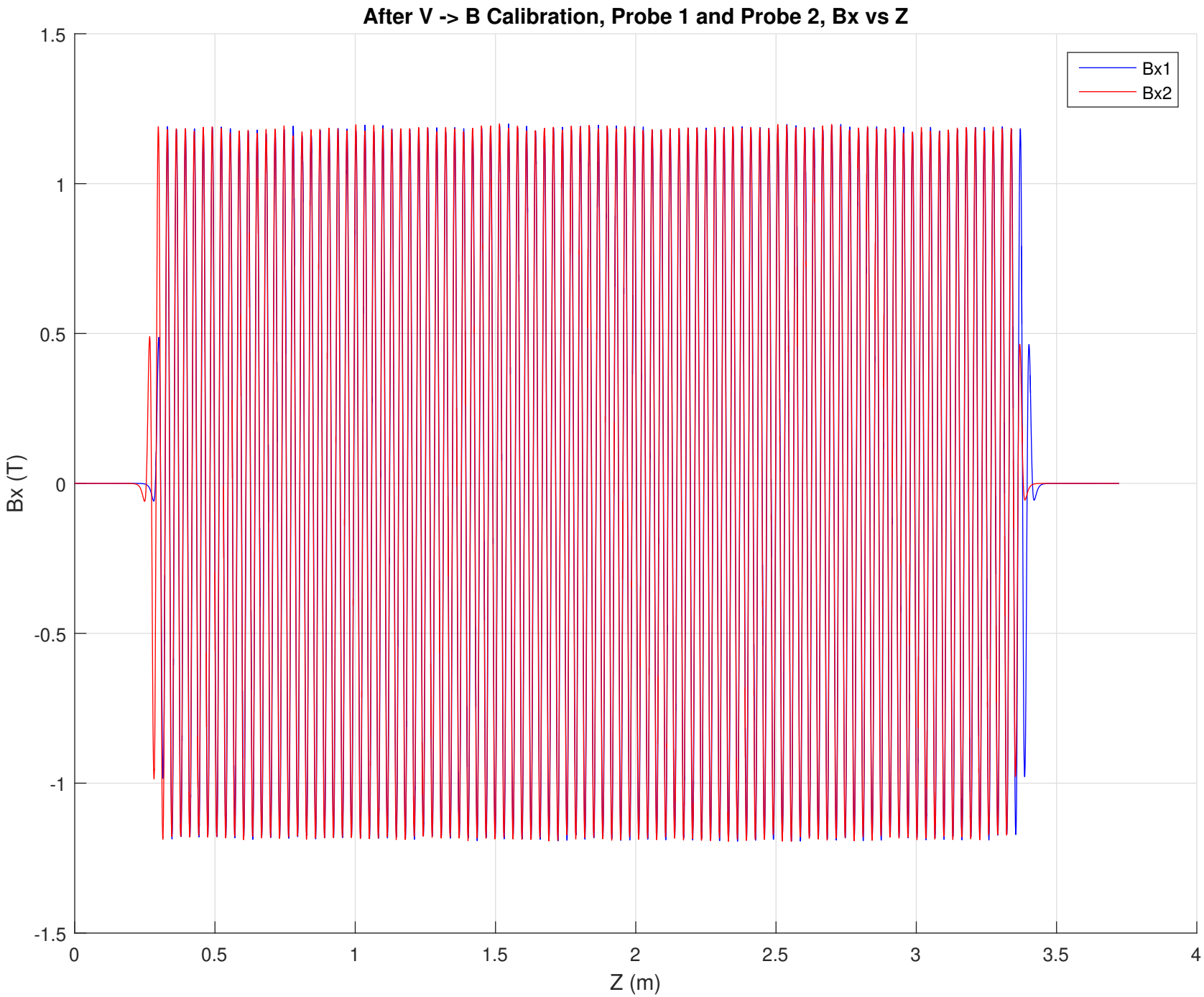

Probe 2, Before: Measured Vx, Vy, Vz Offset Voltage Samples
10^-3
Vx (V)
-2.25
-2.3
-2.35
-2.4
10^-3
Vy (V)
1.45
1.4
1.35
1.3
1.25
10^-4
Vz (V)
-6.5
-7
-7.5
-8
0
20
40
60
80
100
120
140
160
180
200
Sample Number

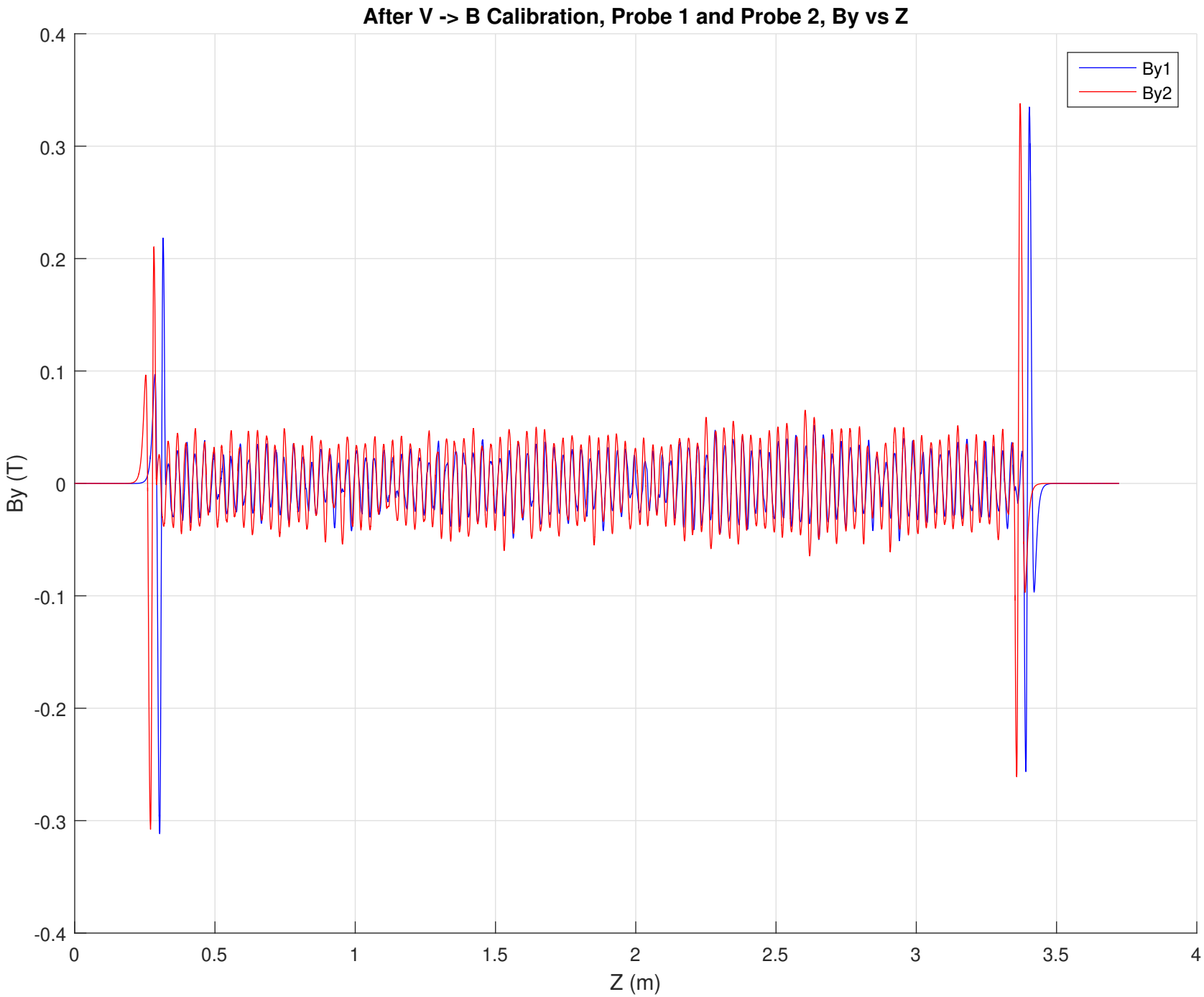

Probe 2, After: Measured Vx, Vy, Vz Offset Voltage Samples
10^-3
-2.25
-2.3
-2.35
-2.4
Vx (V)
0
20
40
60
80
100
120
140
160
180
200
10^-3
1.4
1.35
1.3
1.25
1.2
Vy (V)
0
20
40
60
80
100
120
140
160
180
200
10^-4
-5
-5.5
-6
-6.5
Vz (V)
0
20
40
60
80
100
120
140
160
180
200
Sample Number

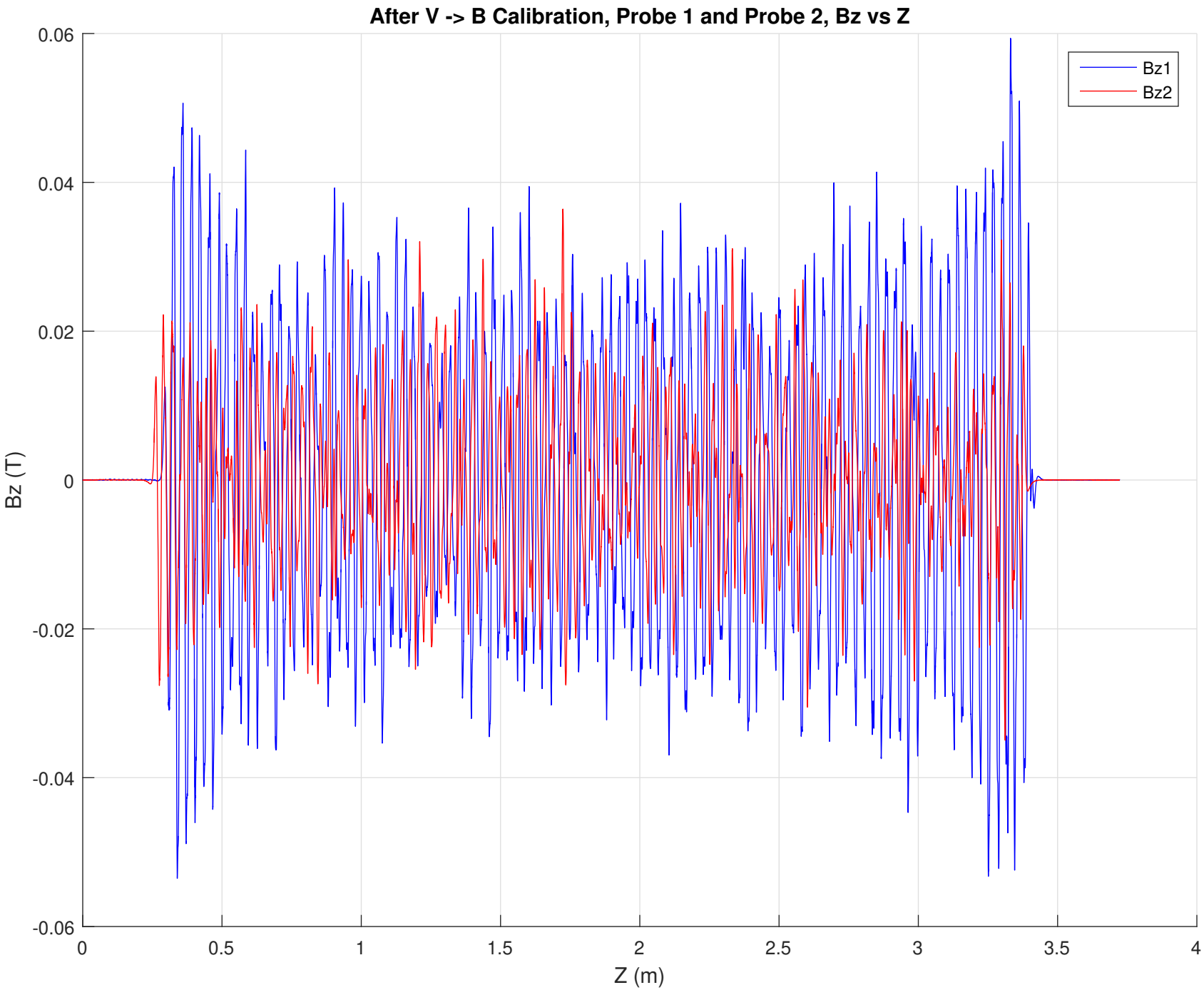

Probe 1 and Probe 2, Vx vs Z
Vx1
Vx2
Vx (V)
Z (m)
6
4
2
0
-2
-4
-6
-8
0
0.5
1
1.5
2
2.5
3
3.5
4

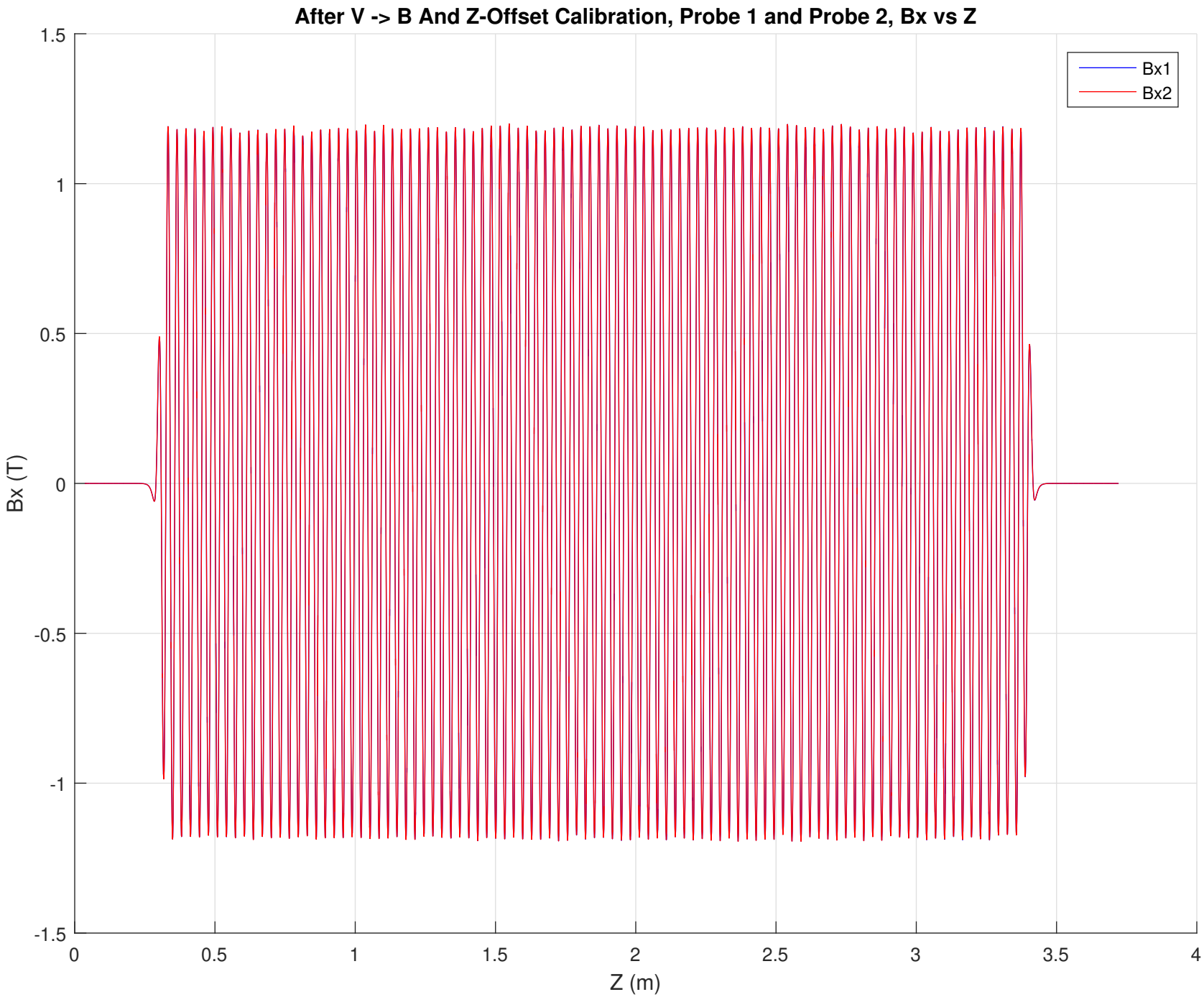

Probe 1 and Probe 2, Vy vs Z
Vy1
Vy2
Vy (V)
Z (m)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
0.5
1
1.5
2
2.5
3
3.5
4

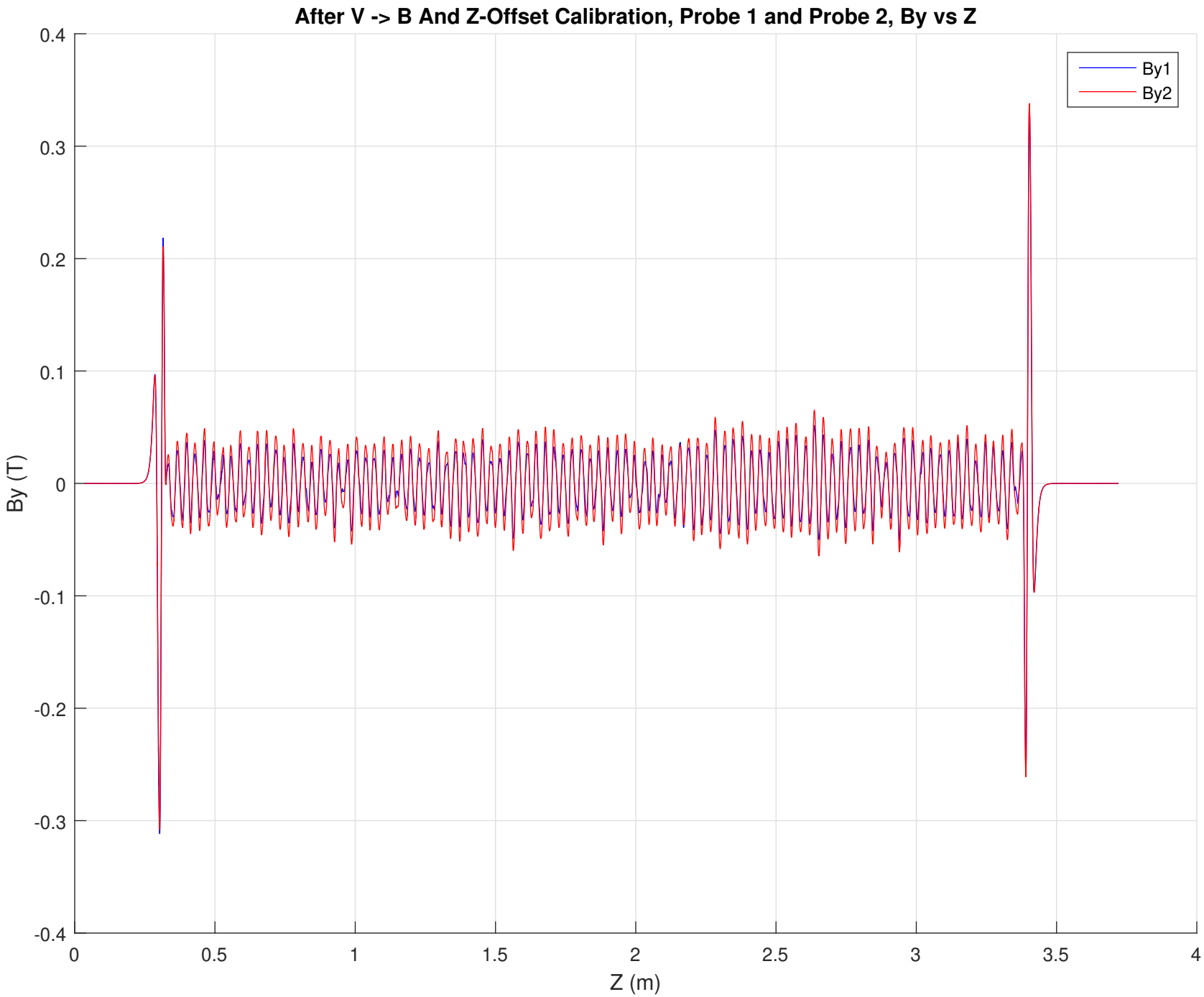

Probe 1 and Probe 2, Vz vs Z
Vz1
Vz2
Vz (V)
Z (m)
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
0
0.5
1
1.5
2
2.5
3
3.5
4

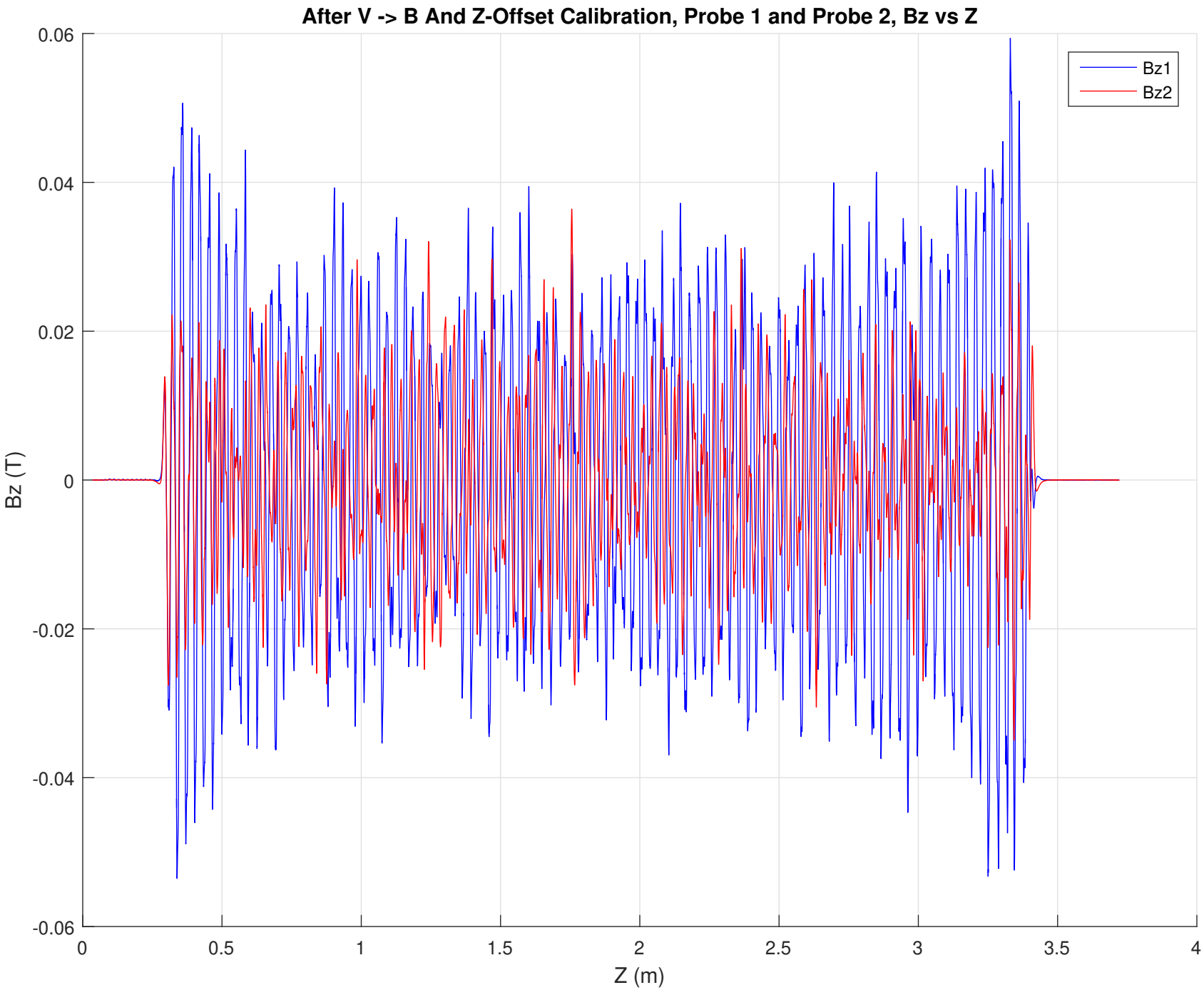

After V -> B Calibration, Probe 1 and Probe 2, Bx vs Z
Bx1
Bx2
Bx (T)
Z (m)
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.5
1
1.5
2
2.5
3
3.5
4

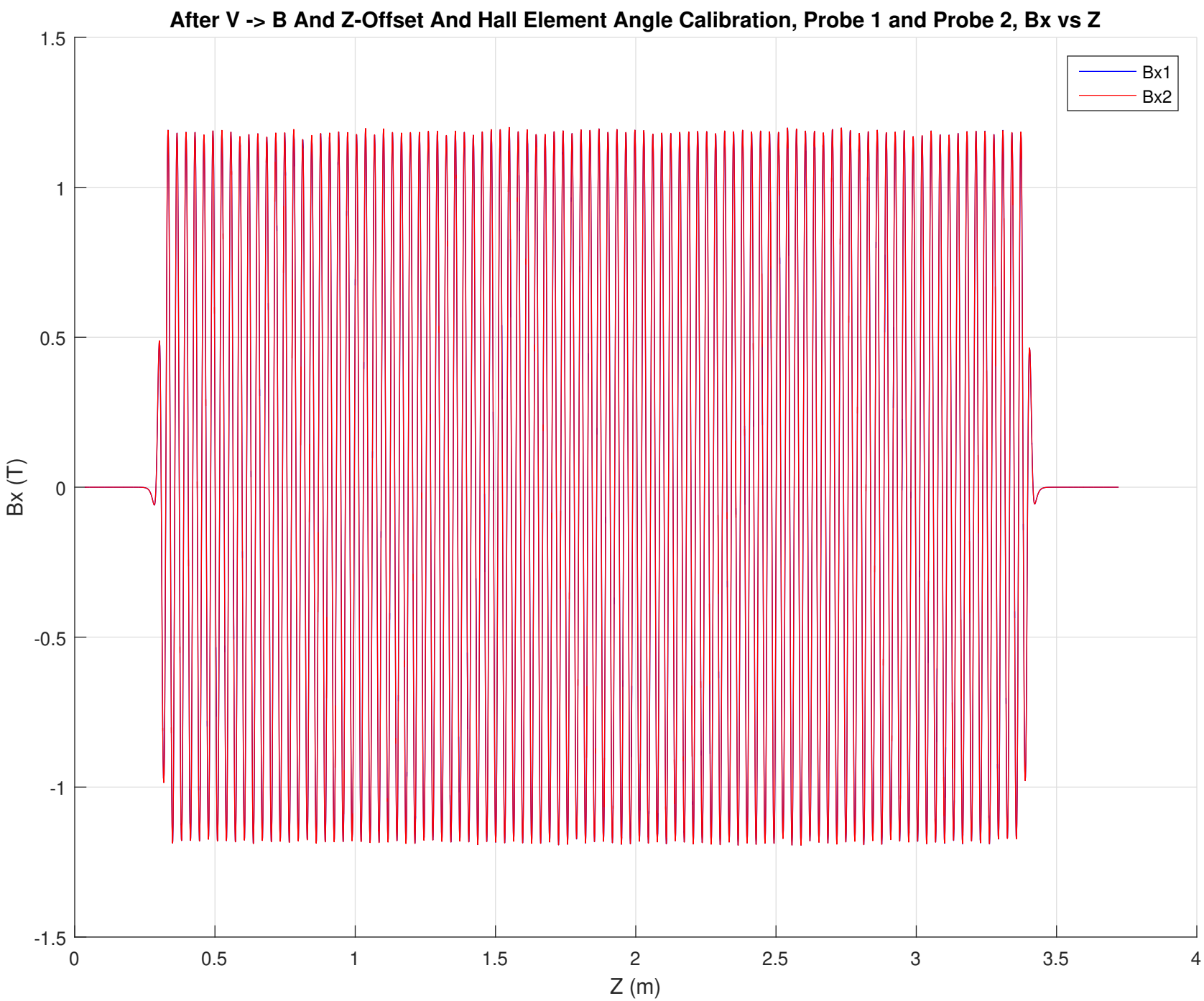

After V -> B Calibration, Probe 1 and Probe 2, By vs Z
By1
By2
By (T)
Z (m)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
0
0.5
1
1.5
2
2.5
3
3.5
4

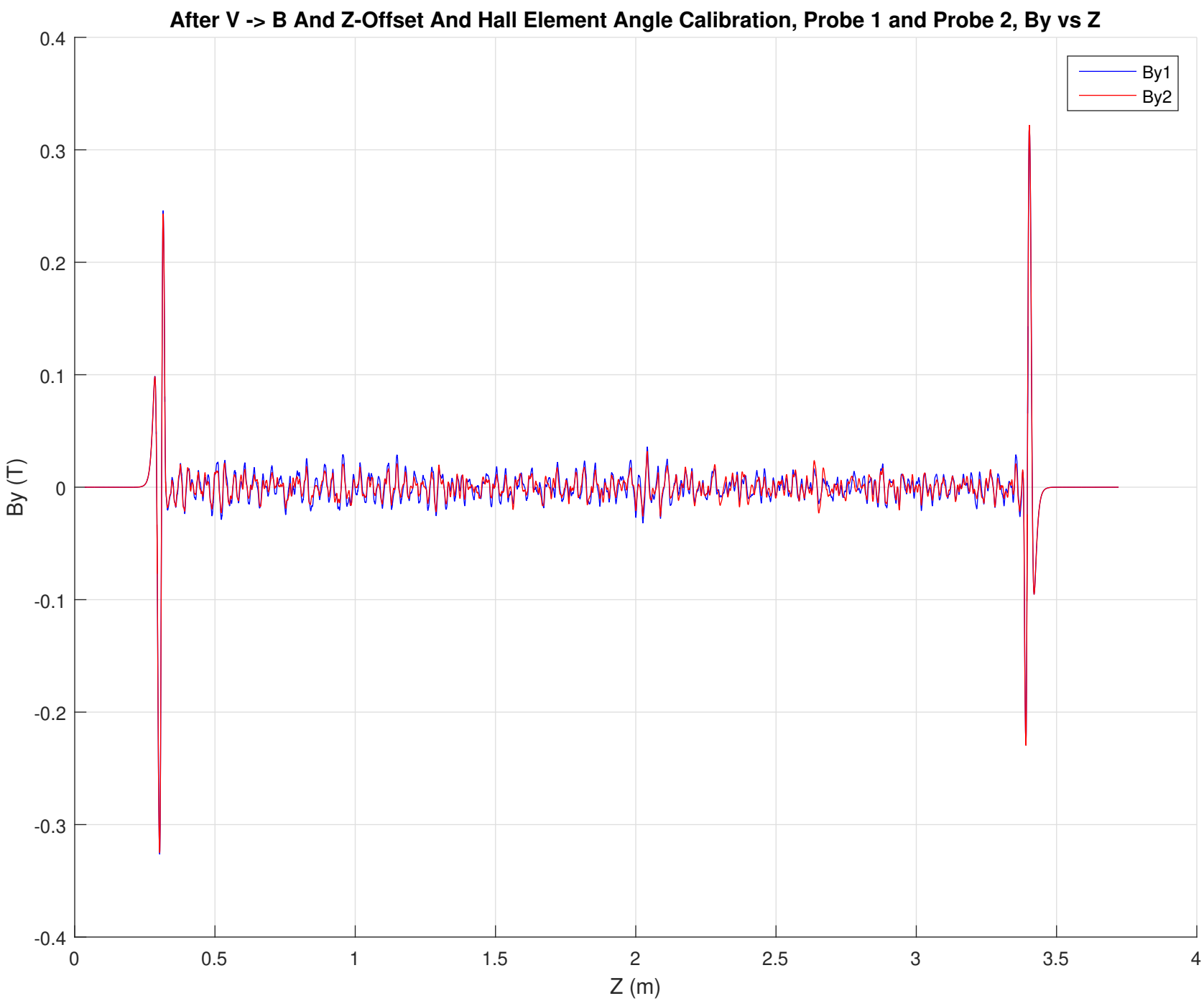

After V -> B Calibration, Probe 1 and Probe 2, Bz vs Z
Bz1
Bz2
Bz (T)
Z (m)
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
0
0.5
1
1.5
2
2.5
3
3.5
4

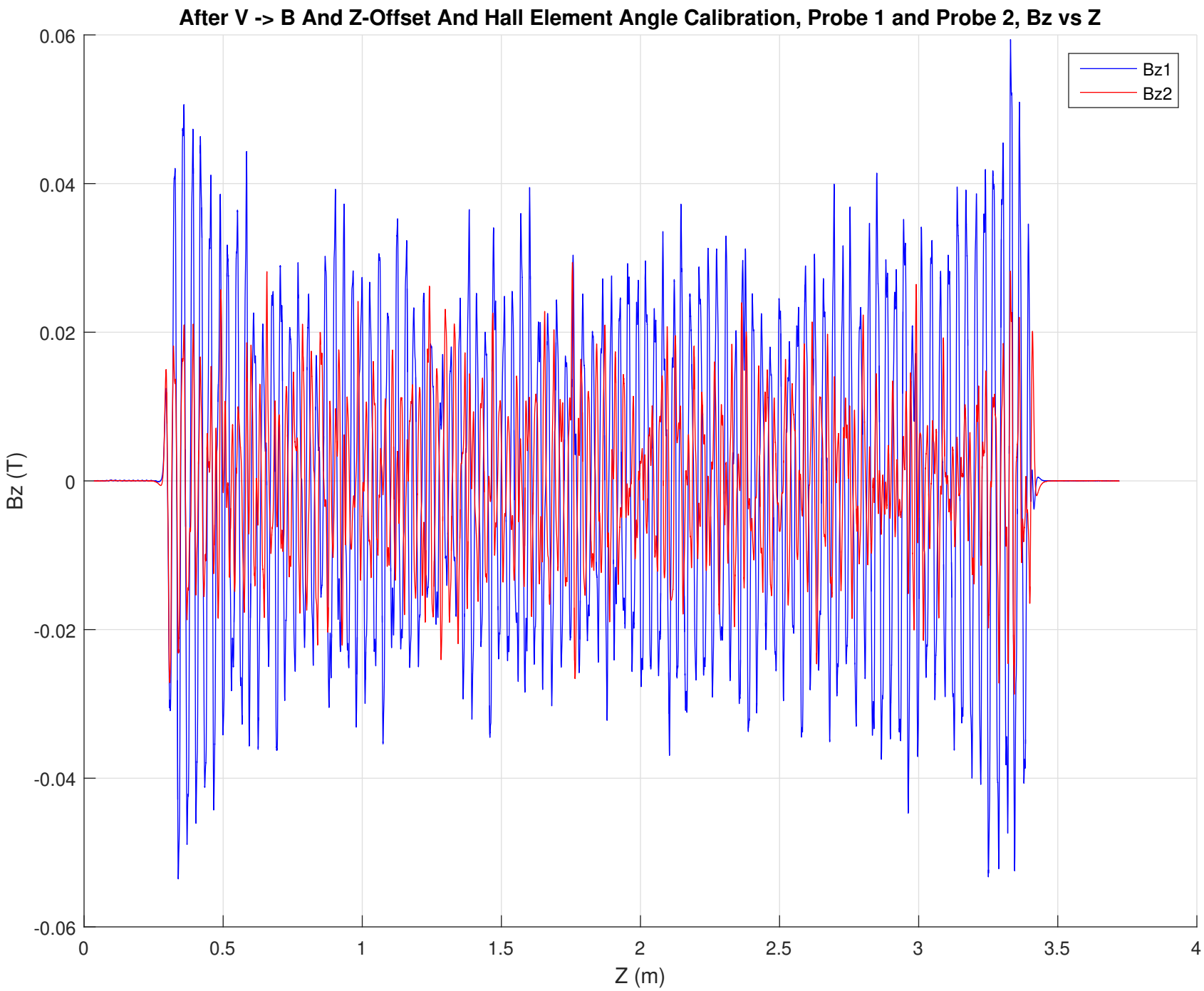

After V -> B And Z-Offset Calibration, Probe 1 and Probe 2, Bx vs Z
Bx1
Bx2
Bx (T)
Z (m)
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.5
1
1.5
2
2.5
3
3.5
4

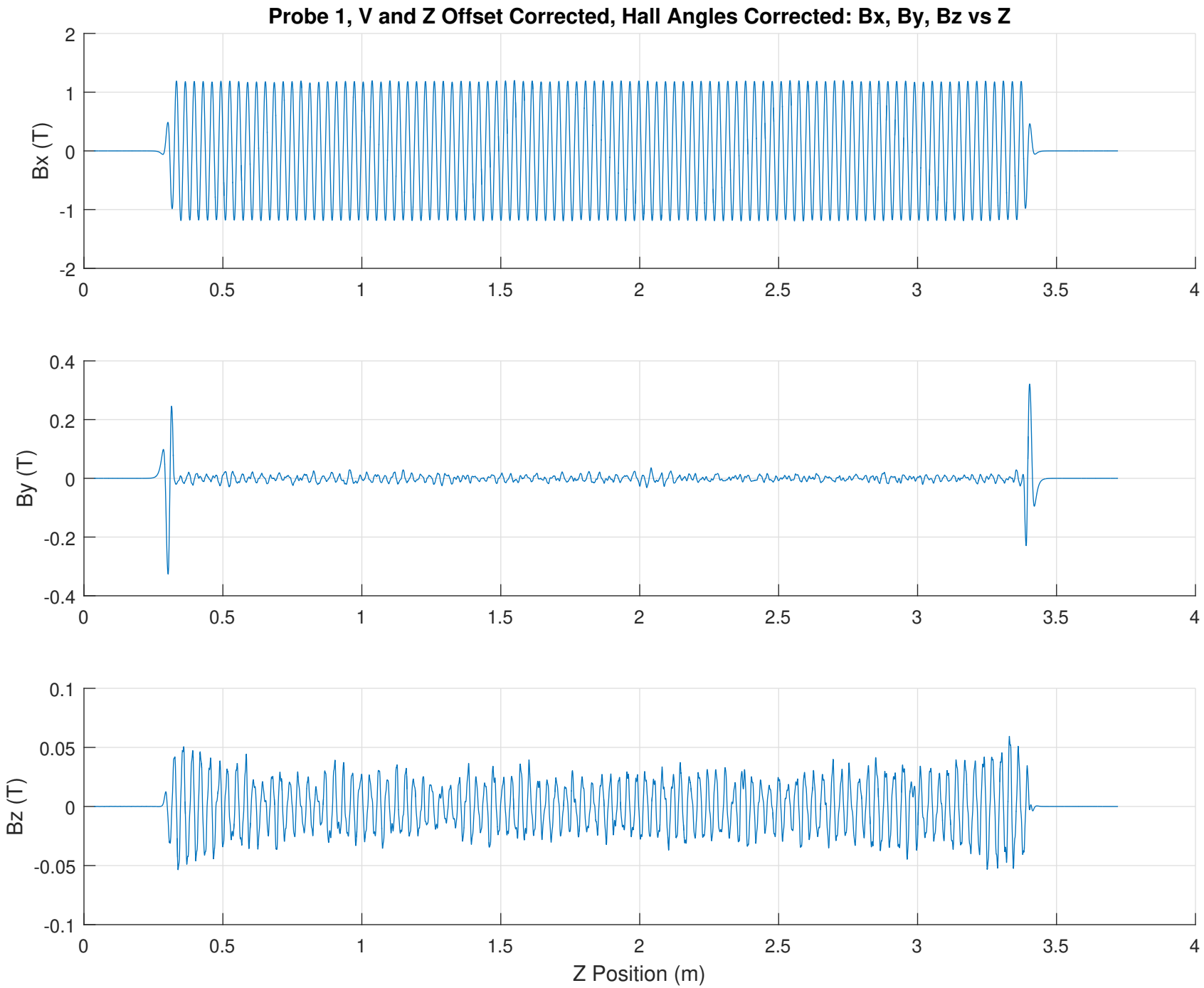

After V -> B And Z-Offset Calibration, Probe 1 and Probe 2, By vs Z
By1
By2
By (T)
Z (m)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
0
0.5
1
1.5
2
2.5
3
3.5
4

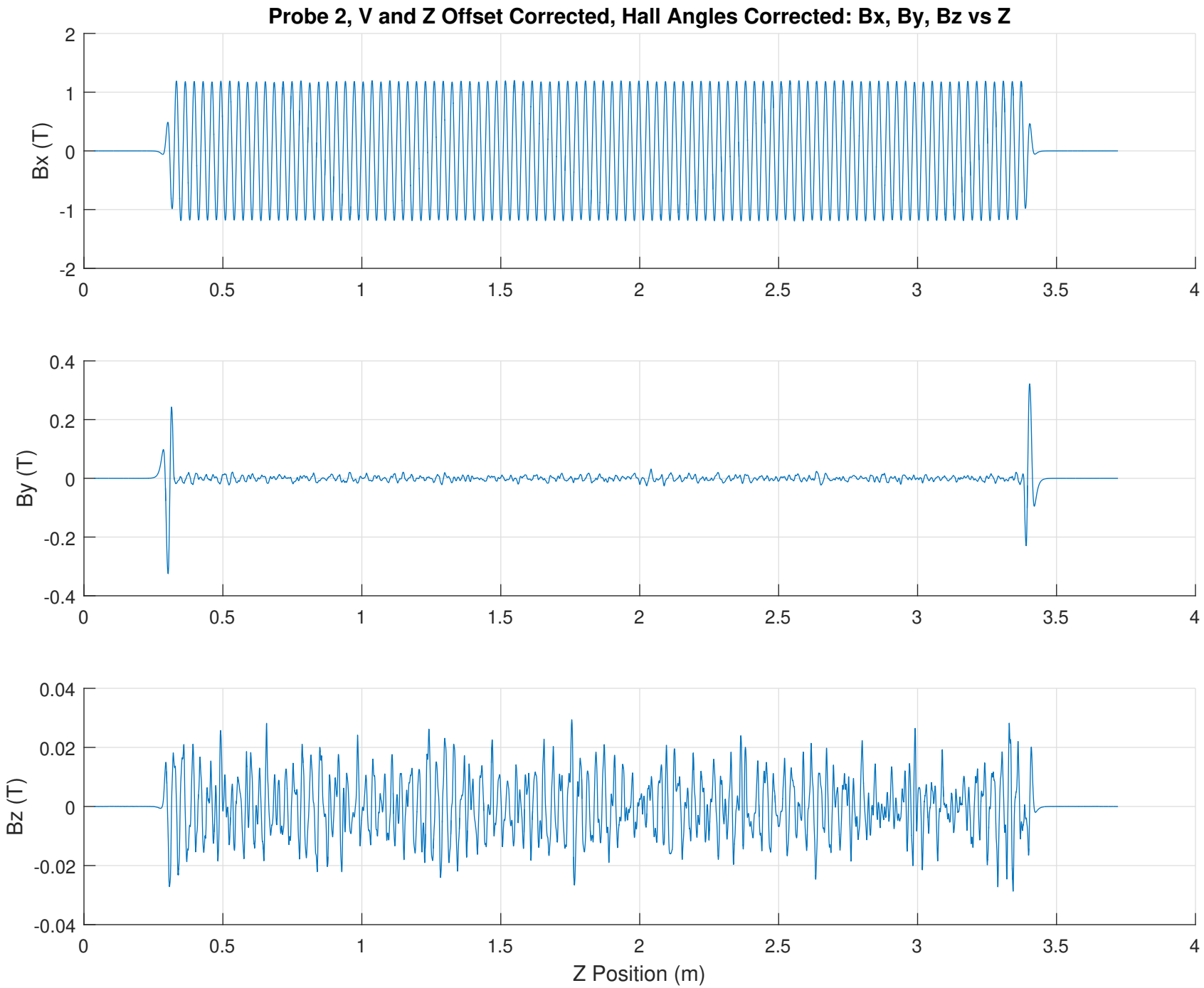

After V -> B And Z-Offset Calibration, Probe 1 and Probe 2, Bz vs Z
Bz1
Bz2
Bz (T)
Z (m)
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
0
0.5
1
1.5
2
2.5
3
3.5
4

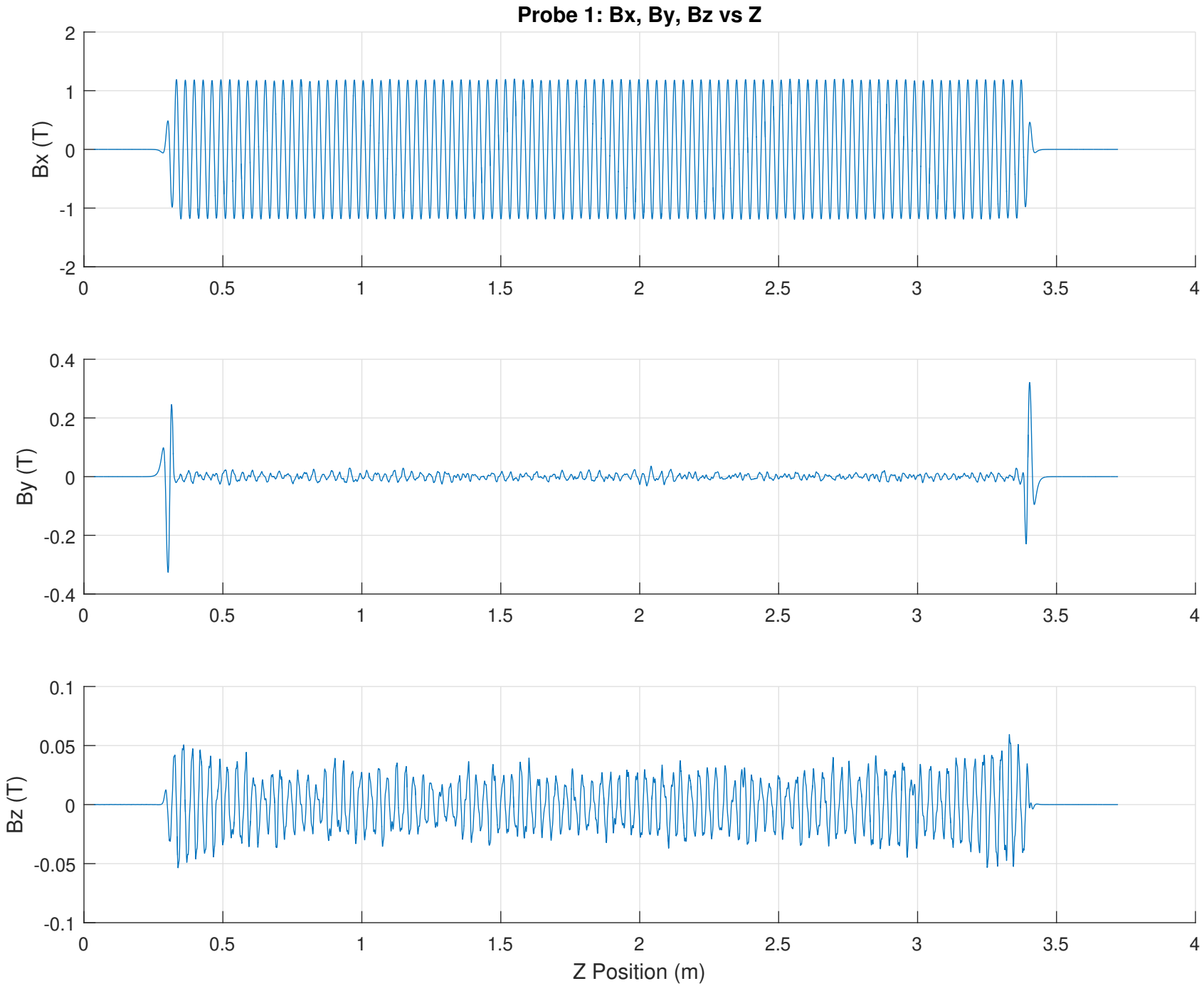

After V -> B And Z-Offset And Hall Element Angle Calibration, Probe 1 and Probe 2, Bx vs Z
Bx1
Bx2
Bx (T)
Z (m)
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.5
1
1.5
2
2.5
3
3.5
4

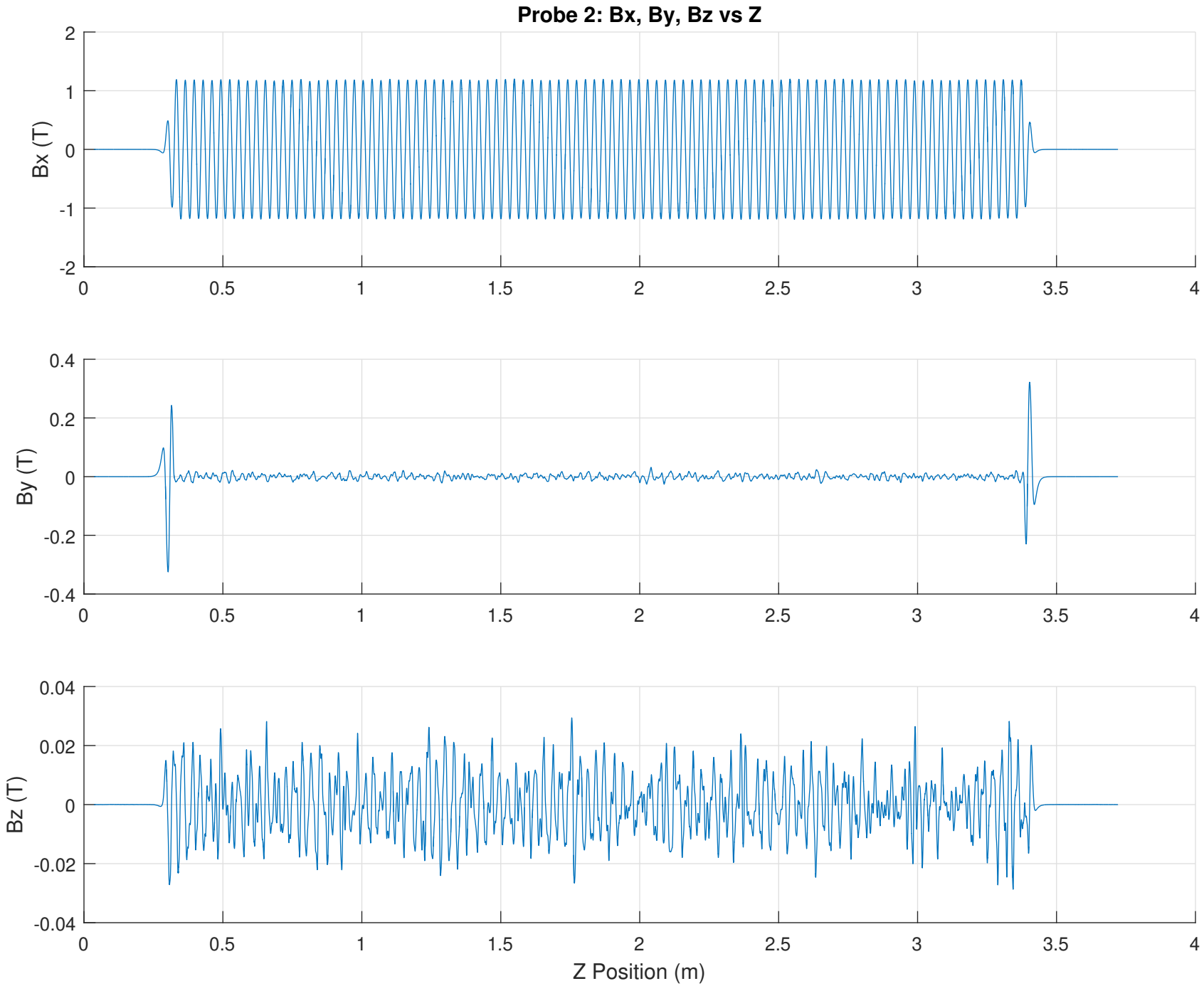

After V -> B And Z-Offset And Hall Element Angle Calibration, Probe 1 and Probe 2, By vs Z
By1
By2
By (T)
Z (m)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
0
0.5
1
1.5
2
2.5
3
3.5
4

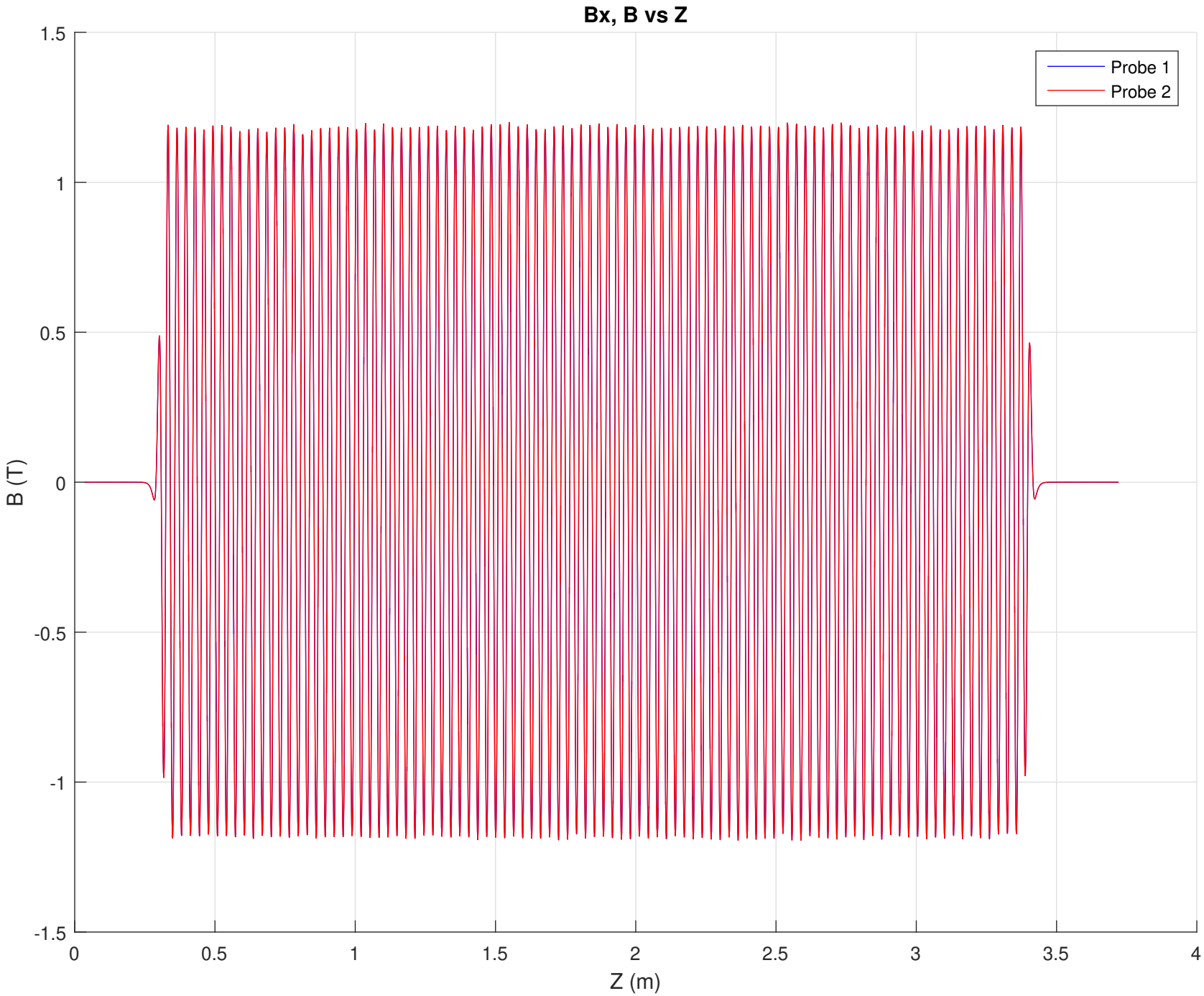

After V -> B And Z-Offset And Hall Element Angle Calibration, Probe 1 and Probe 2, Bz vs Z
Bz1
Bz2
Bz (T)
Z (m)
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
0
0.5
1
1.5
2
2.5
3
3.5
4

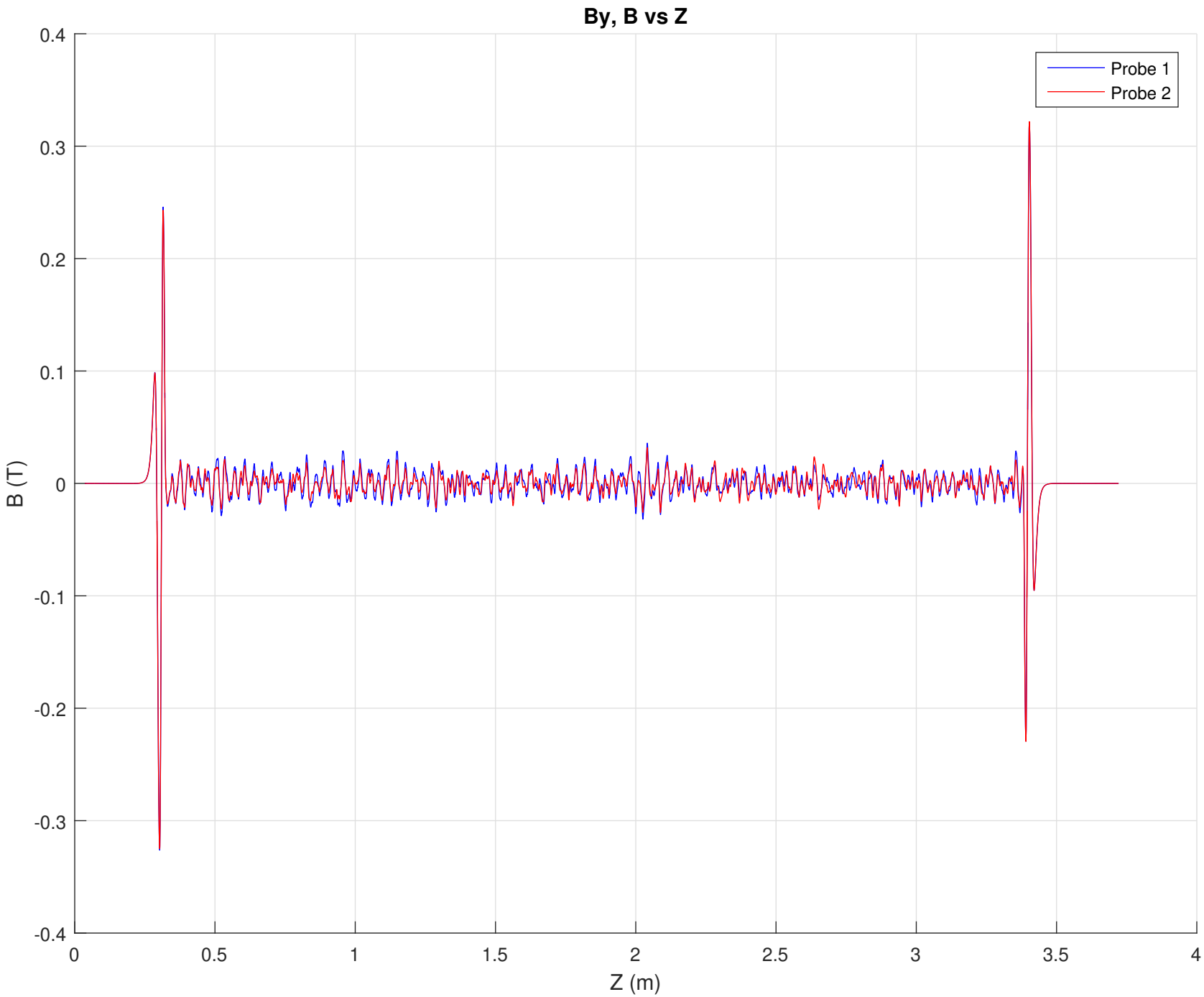

Probe 1, V and Z Offset Corrected, Hall Angles Corrected: Bx, By, Bz vs Z
Bx (T)
By (T)
Bz (T)
Z Position (m)
2
1
0
-1
-2
0.4
0.2
0
-0.2
-0.4
0.1
0.05
0
-0.05
-0.1
0
0.5
1
1.5
2
2.5
3
3.5
4

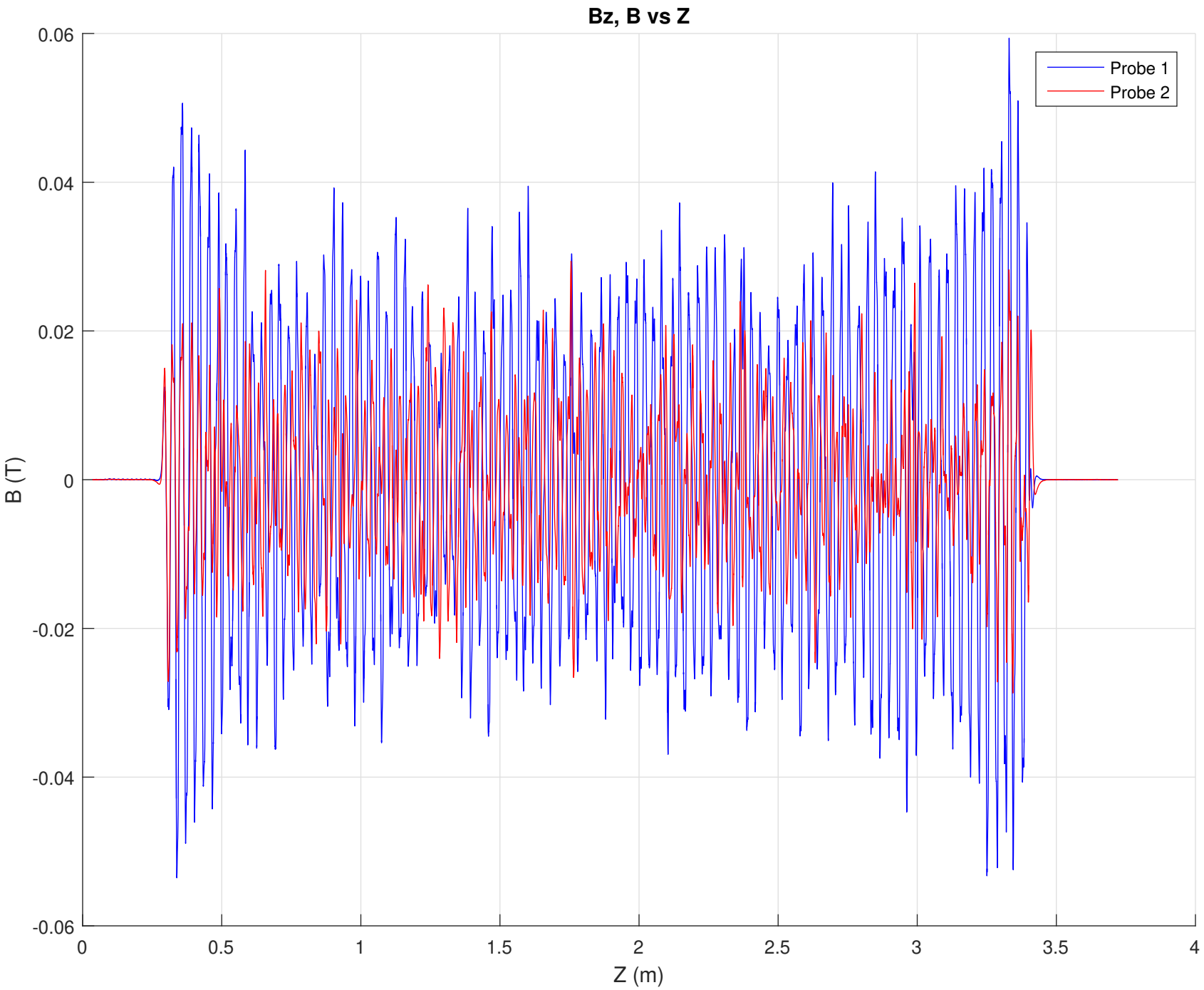

Probe 2, V and Z Offset Corrected, Hall Angles Corrected: Bx, By, Bz vs Z
Bx (T)
By (T)
Bz (T)
Z Position (m)
2
1
0
-1
-2
0.4
0.2
0
-0.2
-0.4
0.04
0.02
0
-0.02
-0.04
0
0.5
1
1.5
2
2.5
3
3.5
4

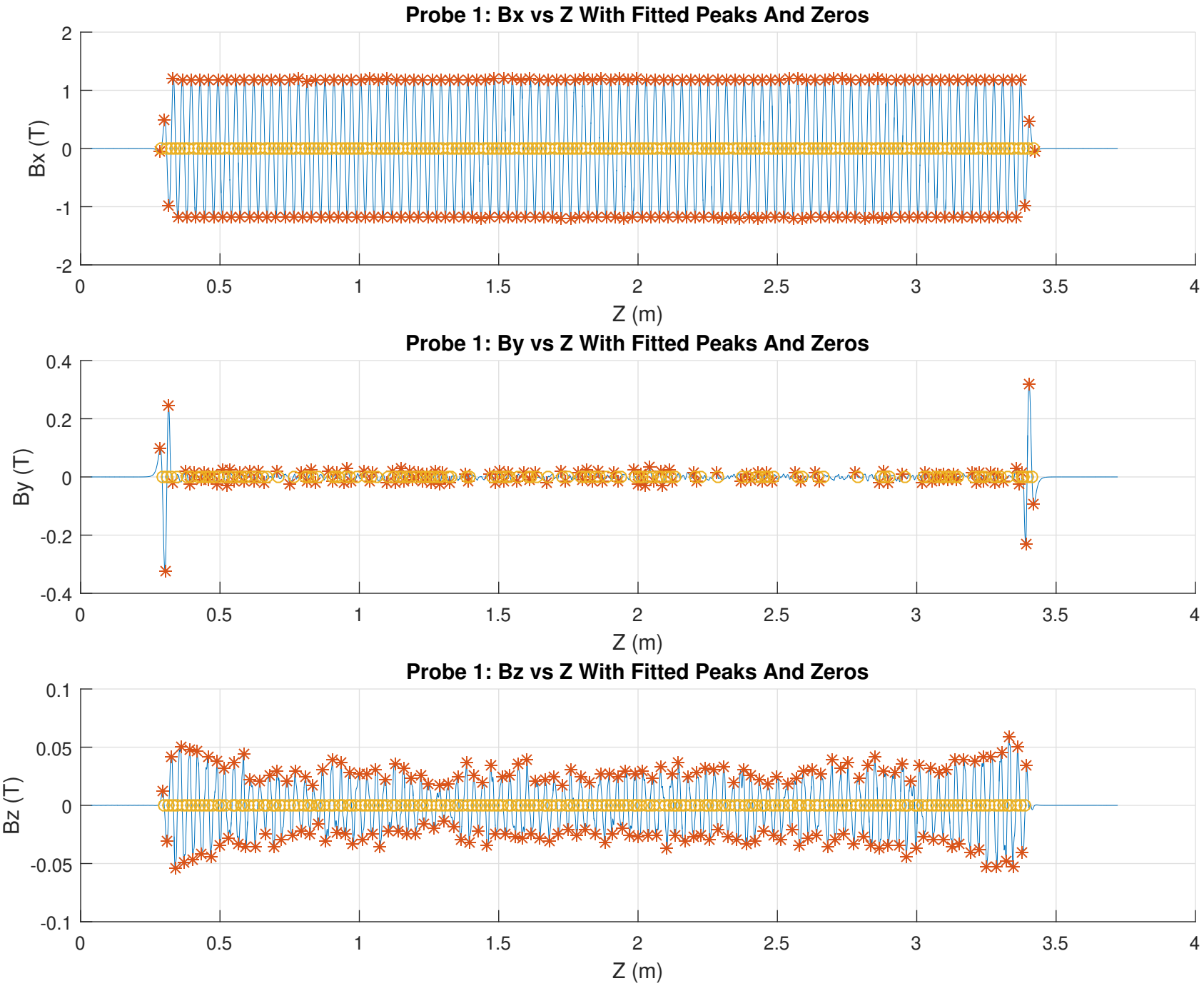

Probe 1: Bx, By, Bz vs Z
Bx (T)
By (T)
Bz (T)
Z Position (m)
2
1
0
-1
-2
0.4
0.2
0
-0.2
-0.4
0.1
0.05
0
-0.05
-0.1
0
0.5
1
1.5
2
2.5
3
3.5
4

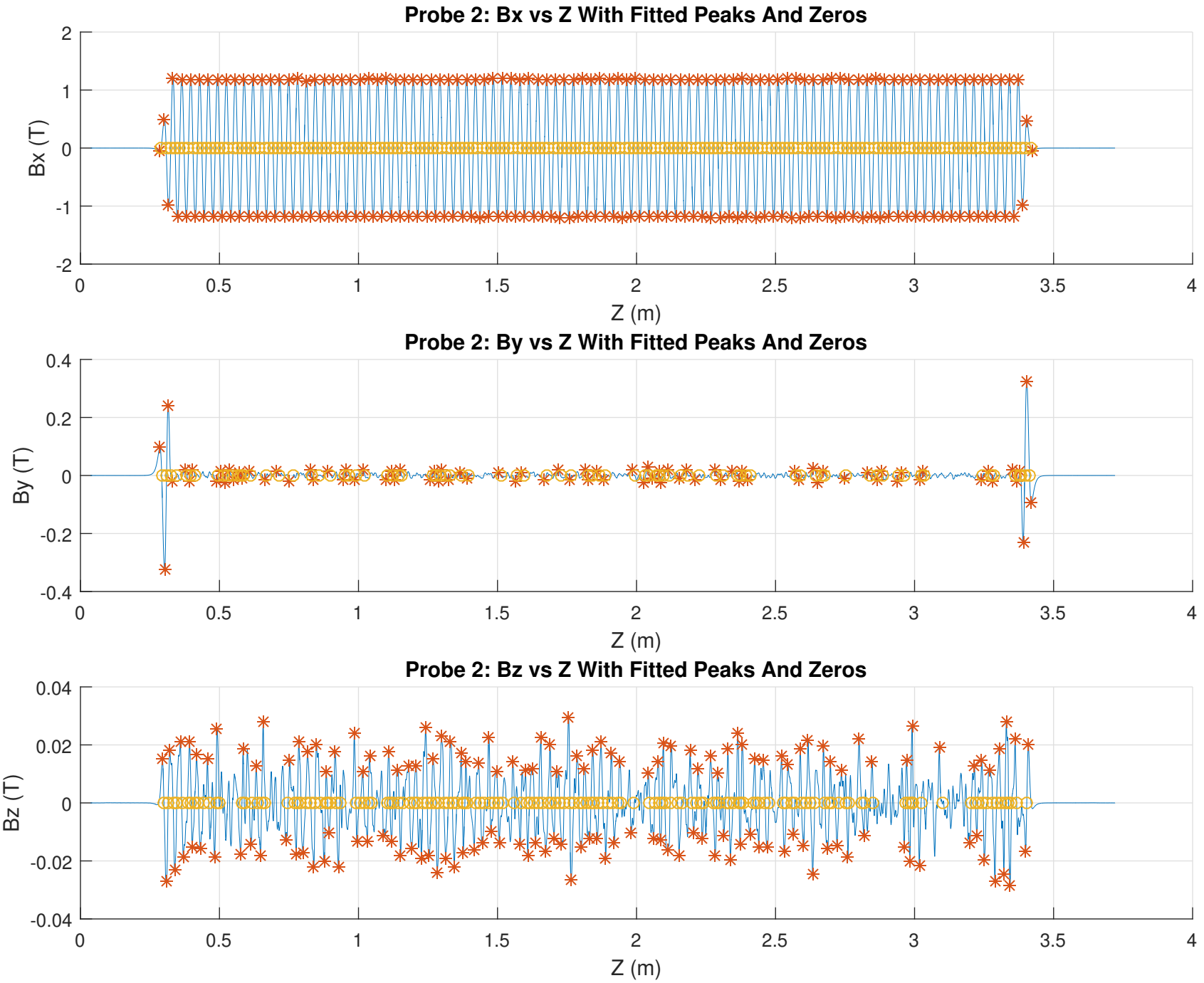

Probe 2: Bx, By, Bz vs Z
Bx (T)
By (T)
Bz (T)
Z Position (m)
2
1
0
-1
-2
0.4
0.2
0
-0.2
-0.4
0.04
0.02
0
-0.02
-0.04
0
0.5
1
1.5
2
2.5
3
3.5
4

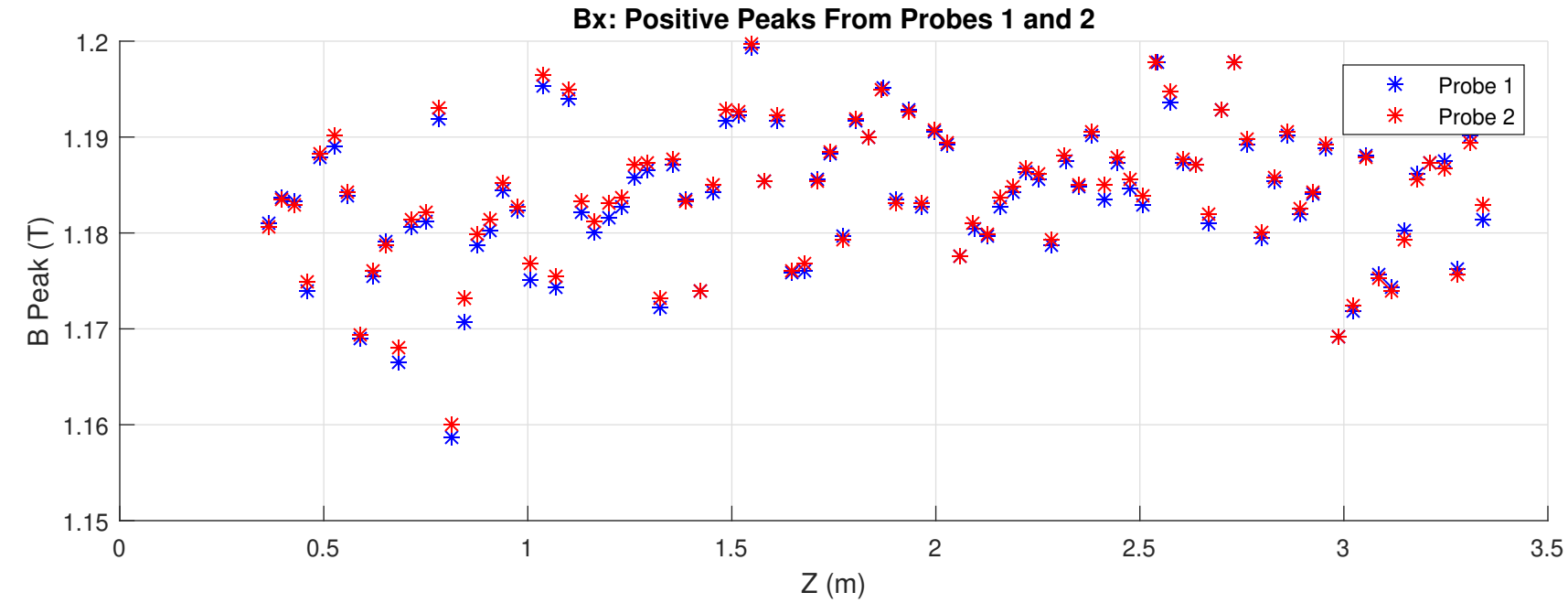

Bx, B vs Z
Probe 1
Probe 2
B (T)
Z (m)
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.5
1
1.5
2
2.5
3
3.5
4

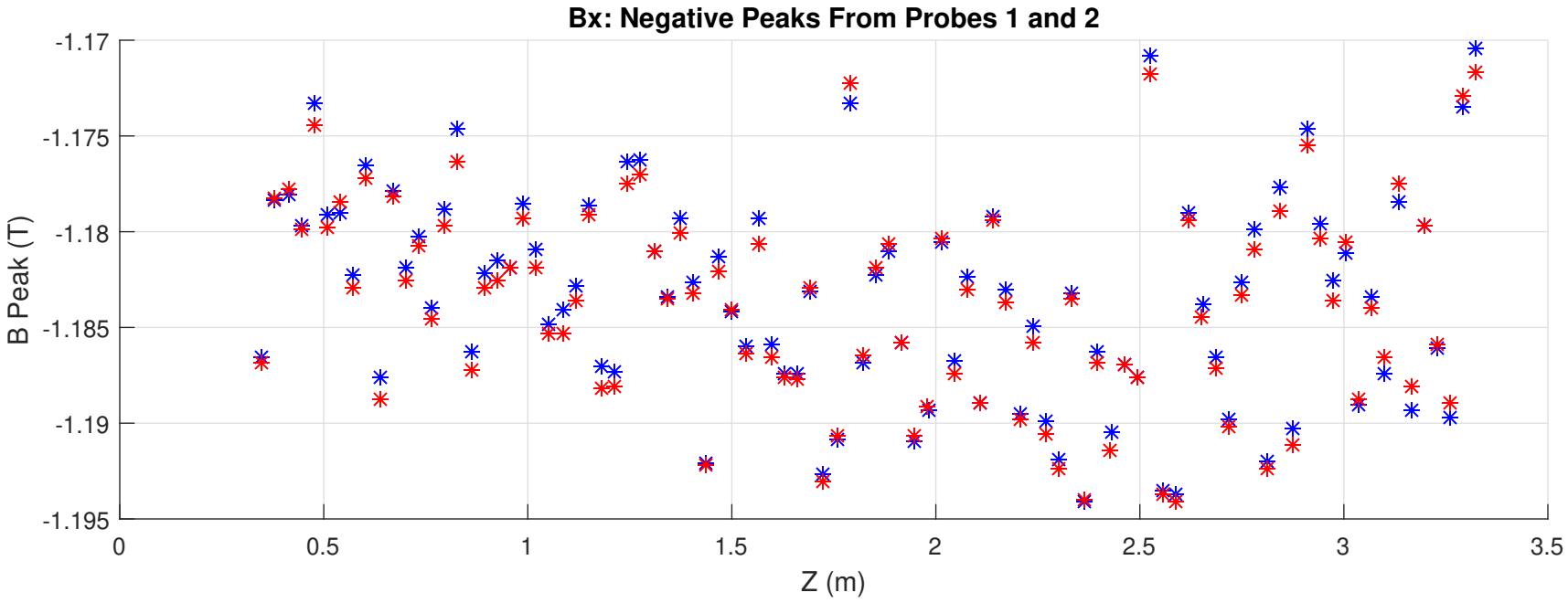

By, B vs Z
Probe 1
Probe 2
B (T)
Z (m)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
0
0.5
1
1.5
2
2.5
3
3.5
4

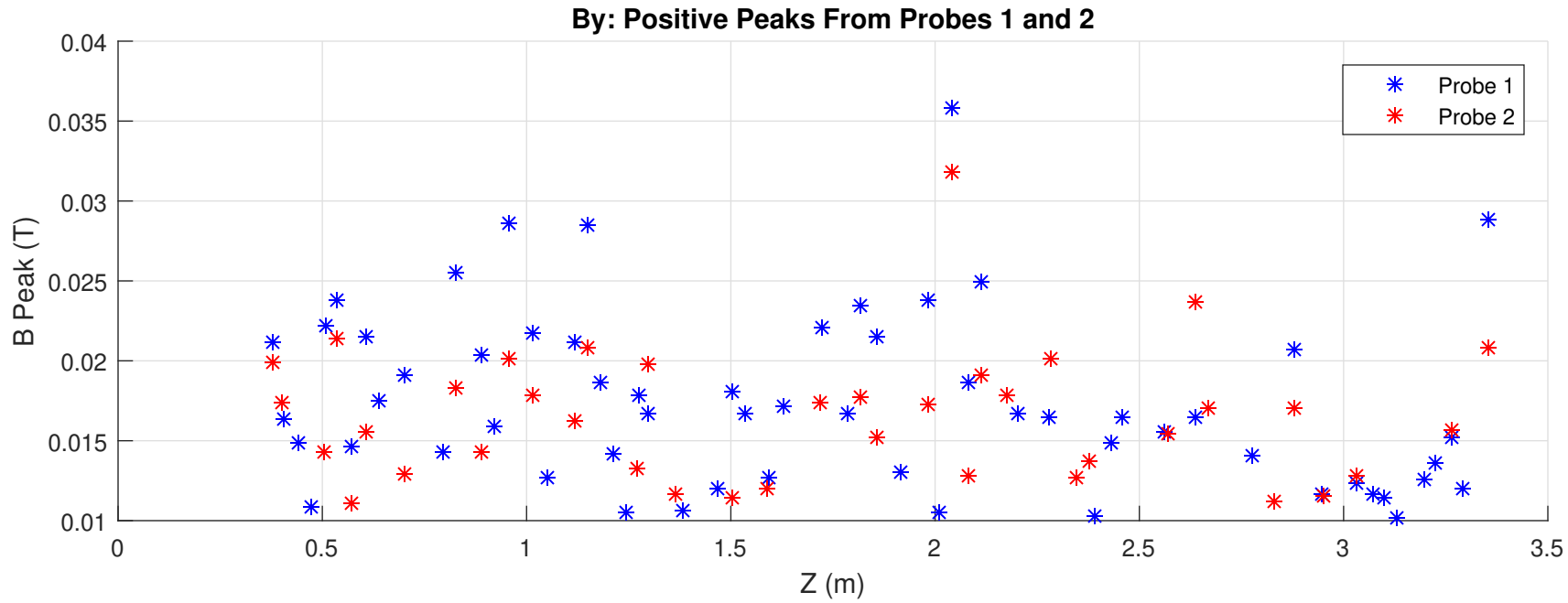

Bz, B vs Z
Probe 1
Probe 2
B (T)
Z (m)
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
0
0.5
1
1.5
2
2.5
3
3.5
4

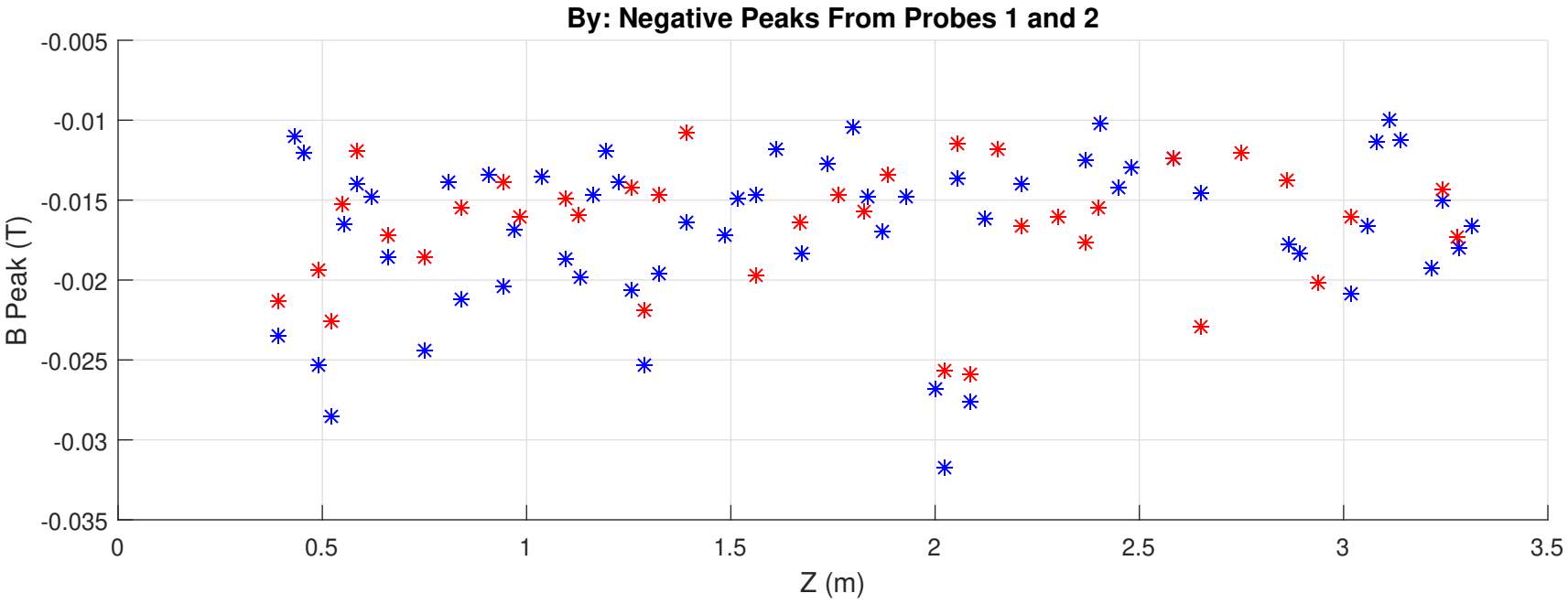

Probe 1: Bx vs Z With Fitted Peaks And Zeros
Bx (T)
Z (m)
Probe 1: By vs Z With Fitted Peaks And Zeros
By (T)
Z (m)
Probe 1: Bz vs Z With Fitted Peaks And Zeros
Bz (T)
Z (m)

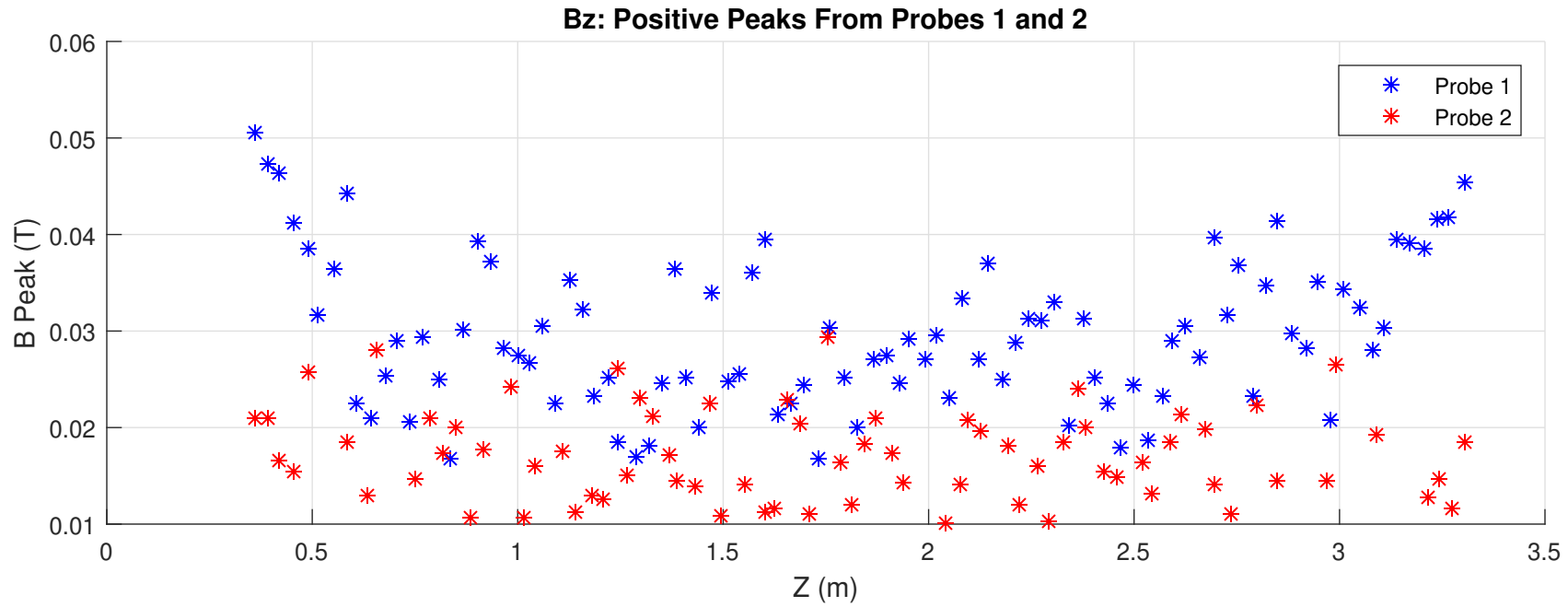

Probe 2: Bx vs Z With Fitted Peaks And Zeros
Bx (T)
Z (m)
Probe 2: By vs Z With Fitted Peaks And Zeros
By (T)
Z (m)
Probe 2: Bz vs Z With Fitted Peaks And Zeros
Bz (T)
Z (m)

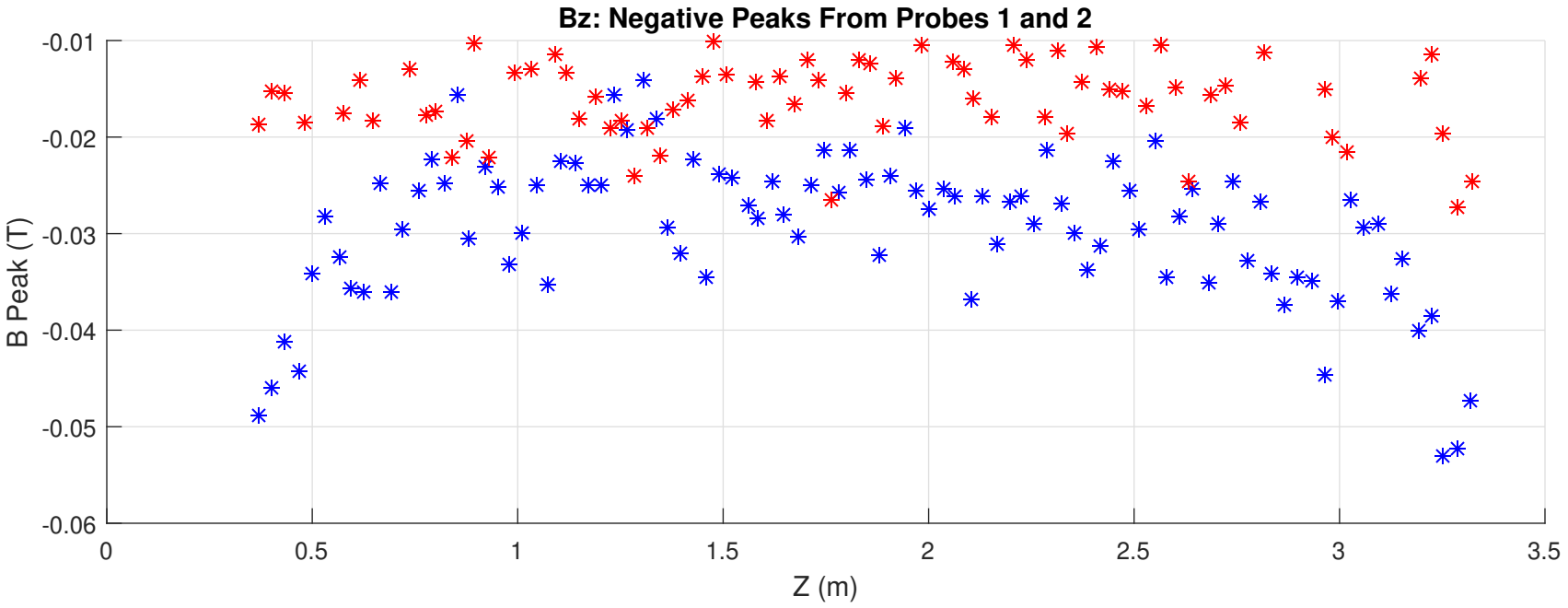

Bx: Positive Peaks From Probes 1 and 2
B Peak (T)
Z (m)
Probe 1
Probe 2
1.2
1.19
1.18
1.17
1.16
1.15
0
0.5
1
1.5
2
2.5
3
3.5

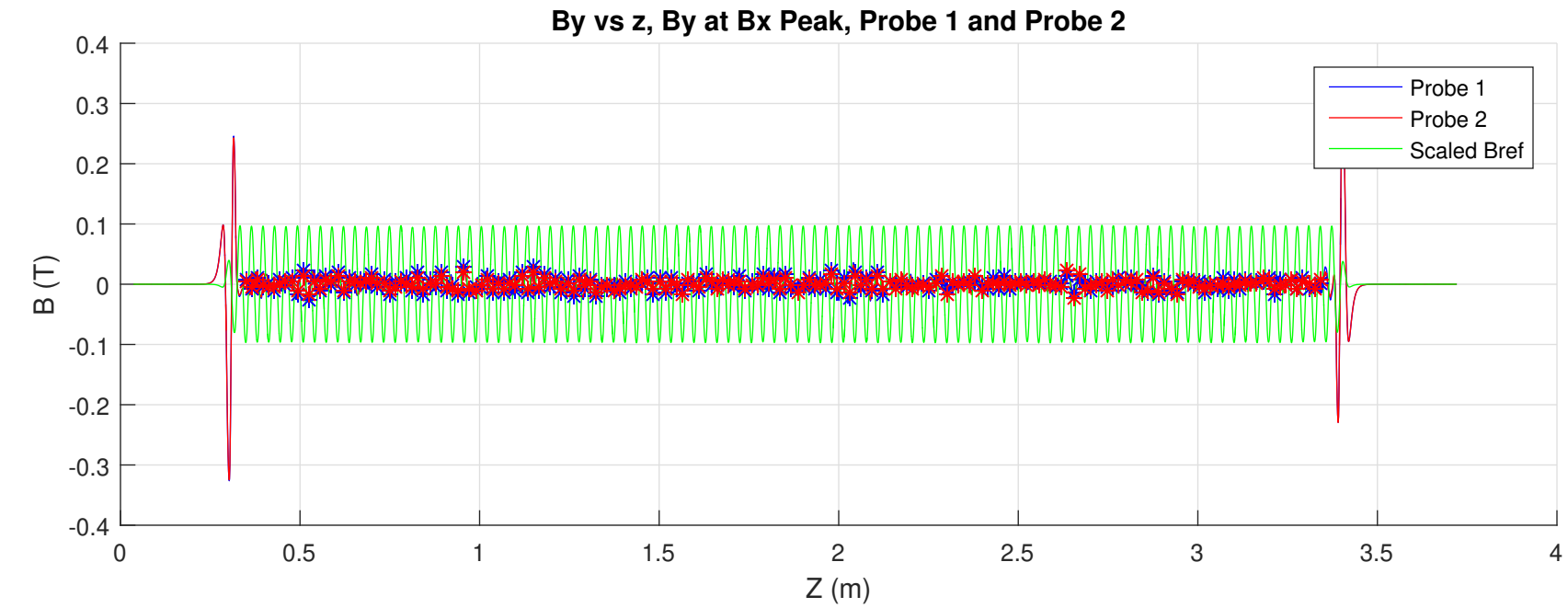

Bx: Negative Peaks From Probes 1 and 2
B Peak (T)
Z (m)
-1.17
-1.175
-1.18
-1.185
-1.19
-1.195
0
0.5
1
1.5
2
2.5
3
3.5

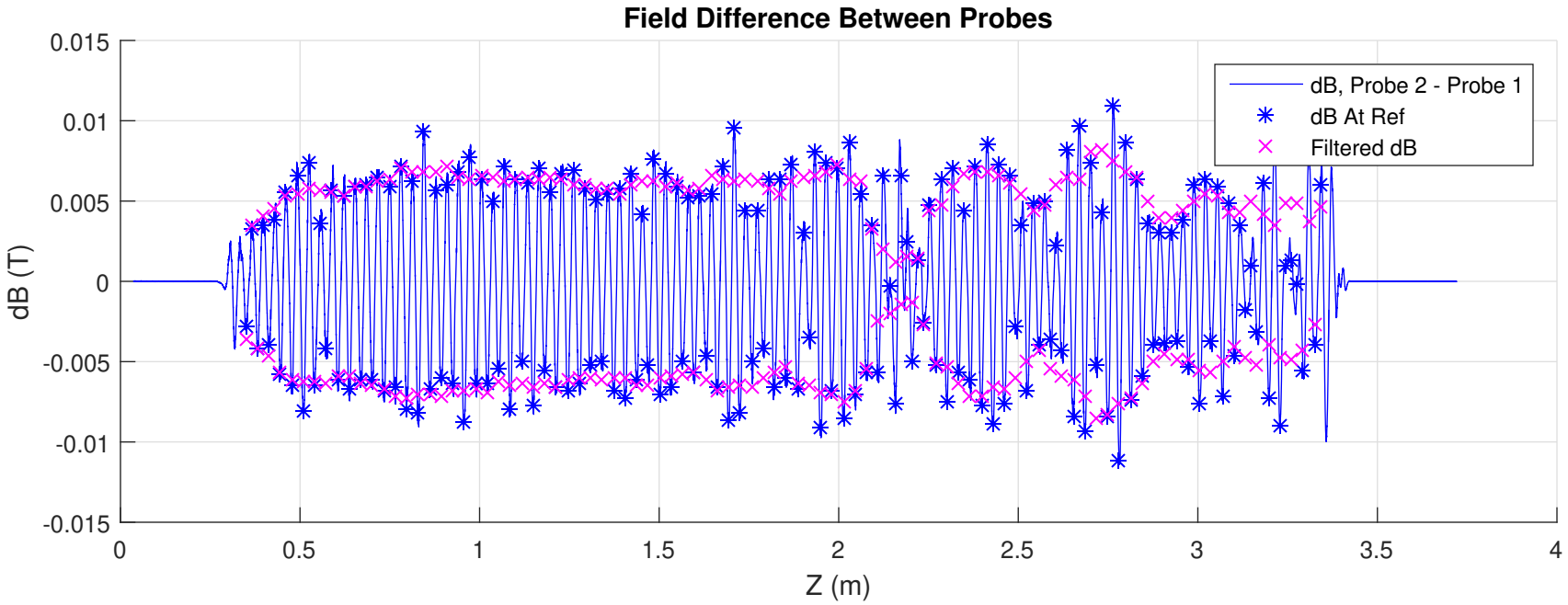

By: Positive Peaks From Probes 1 and 2
B Peak (T)
Z (m)
Probe 1
Probe 2
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0
0.5
1
1.5
2
2.5
3
3.5

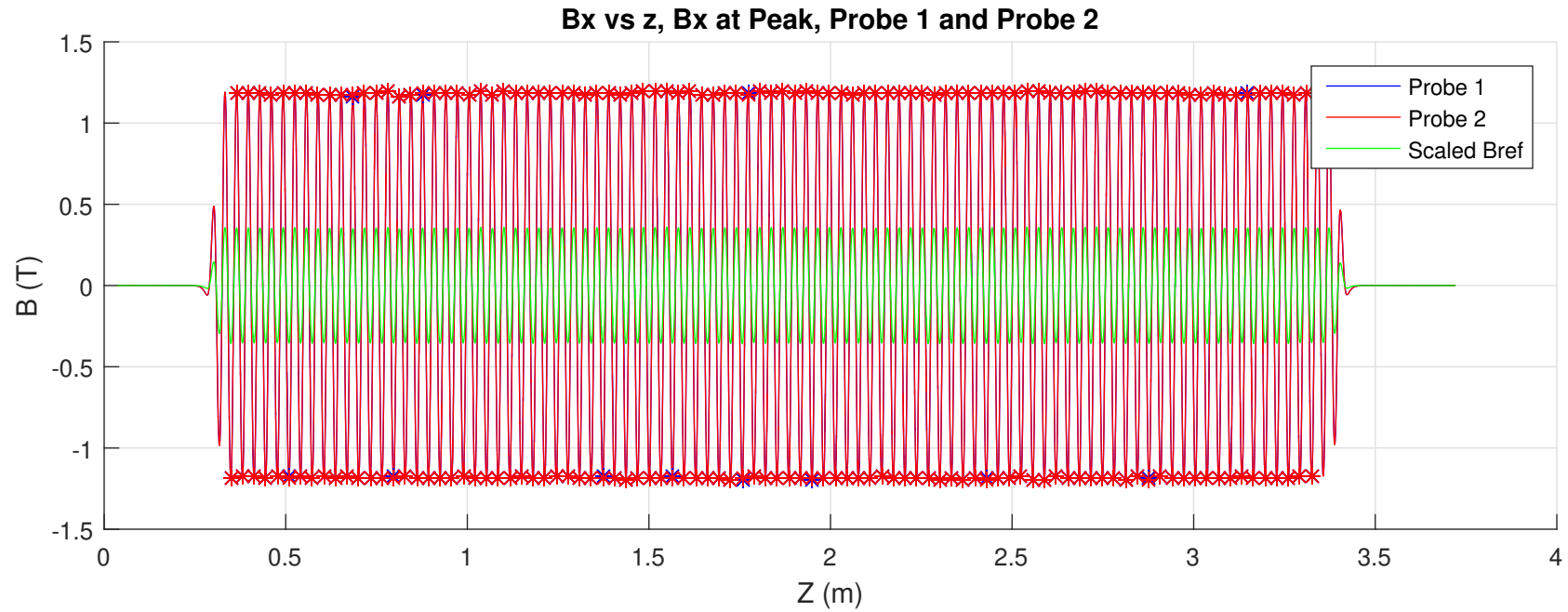

By: Negative Peaks From Probes 1 and 2
B Peak (T)
Z (m)
-0.005
-0.01
-0.015
-0.02
-0.025
-0.03
-0.035
0
0.5
1
1.5
2
2.5
3
3.5

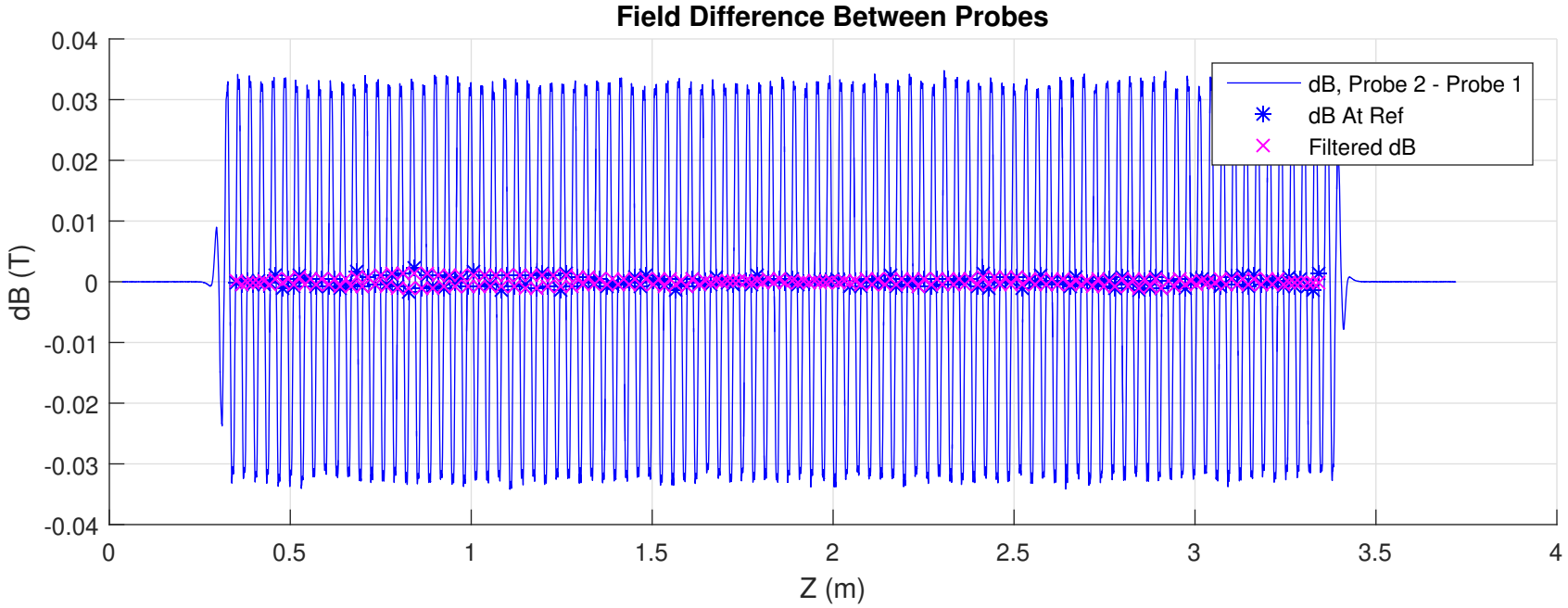

Bz: Positive Peaks From Probes 1 and 2
Probe 1
Probe 2
B Peak (T)
Z (m)
0.06
0.05
0.04
0.03
0.02
0.01
0
0.5
1
1.5
2
2.5
3
3.5

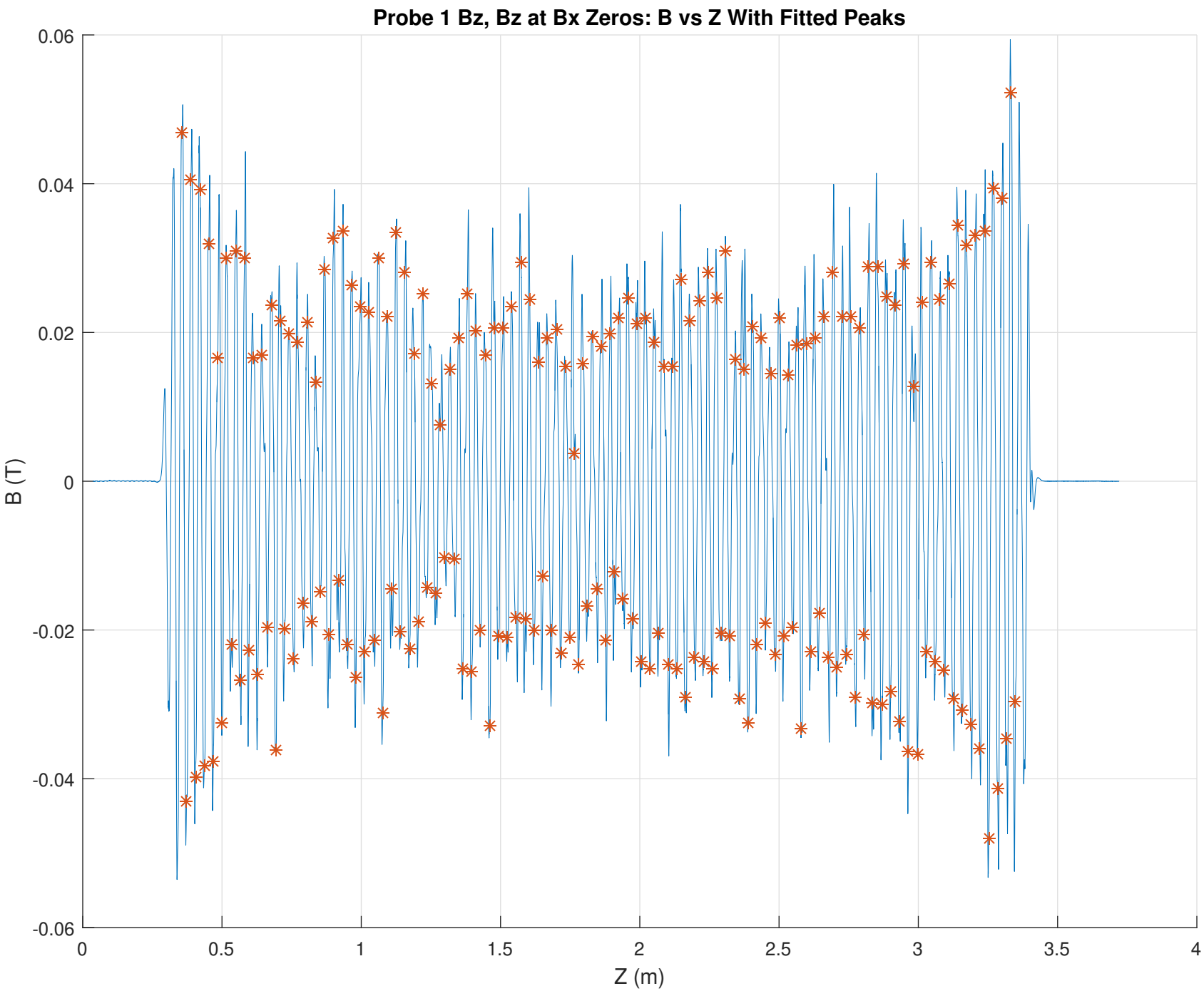

Bz: Negative Peaks From Probes 1 and 2
B Peak (T)
Z (m)
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
0
0.5
1
1.5
2
2.5
3
3.5

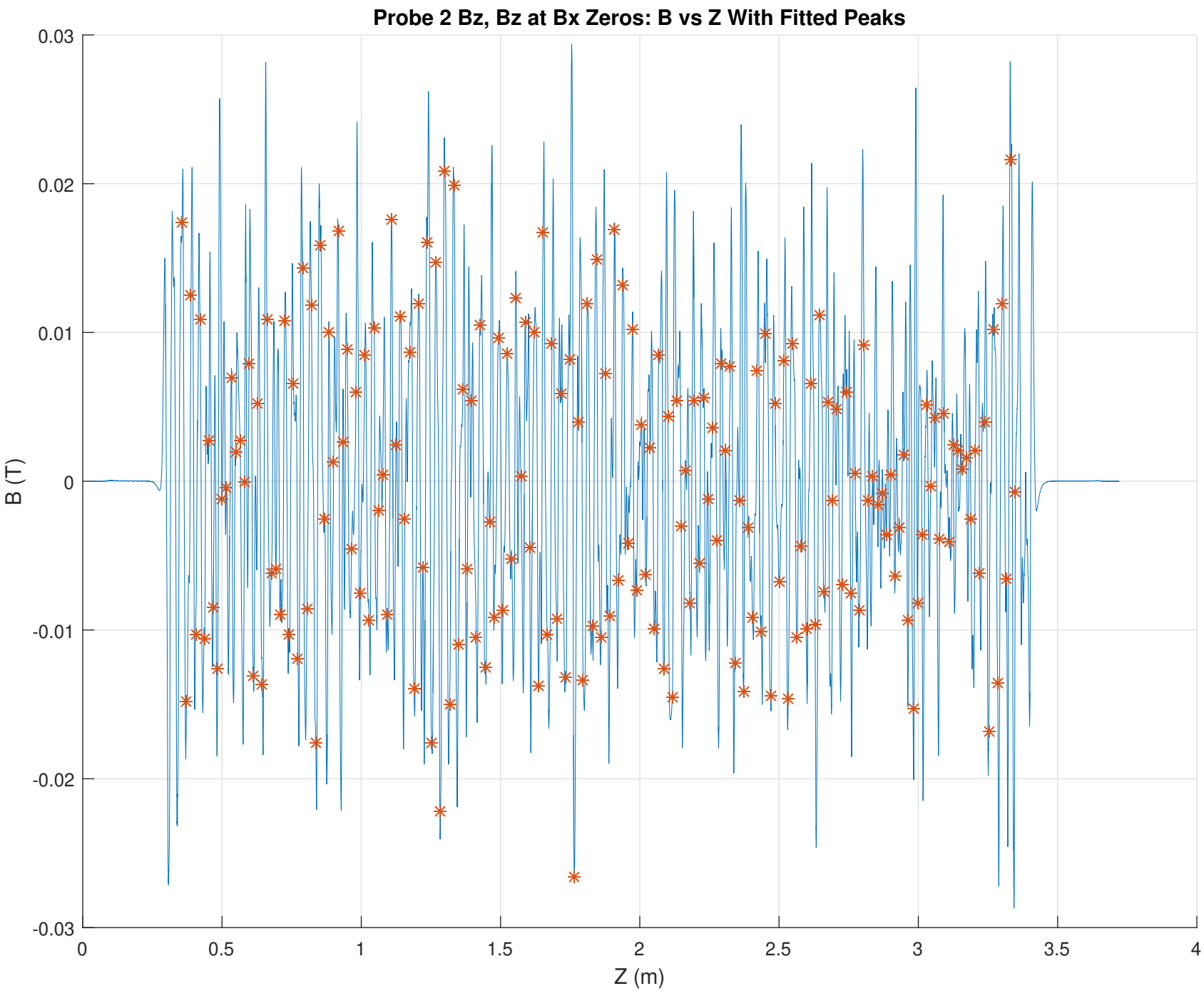

By vs z, By at Bx Peak, Probe 1 and Probe 2
Probe 1
Probe 2
Scaled Bref
B (T)
Z (m)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
0
0.5
1
1.5
2
2.5
3
3.5
4

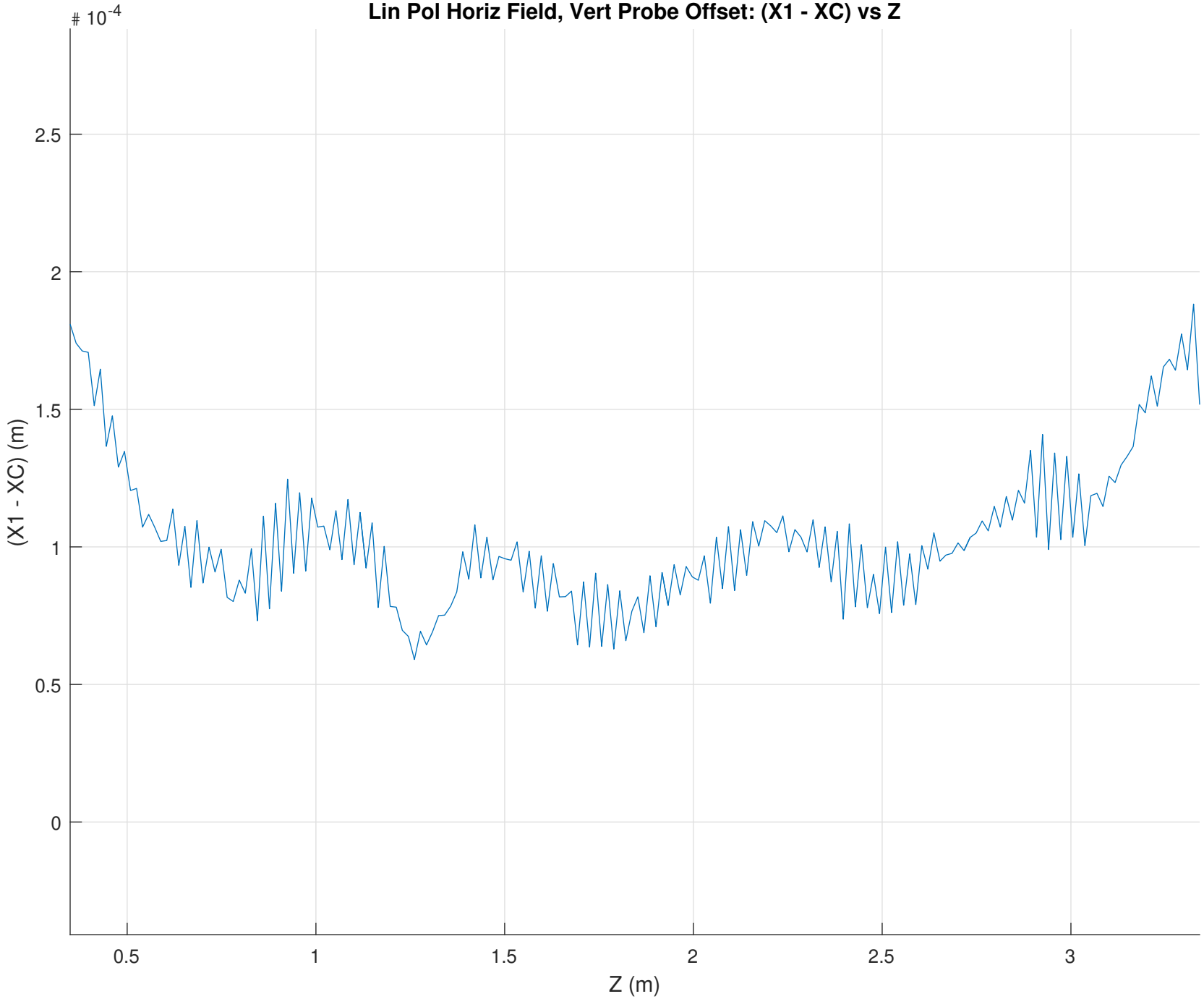

Field Difference Between Probes
dB, Probe 2 - Probe 1
dB At Ref
Filtered dB
dB (T)
Z (m)
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
0
0.5
1
1.5
2
2.5
3
3.5
4

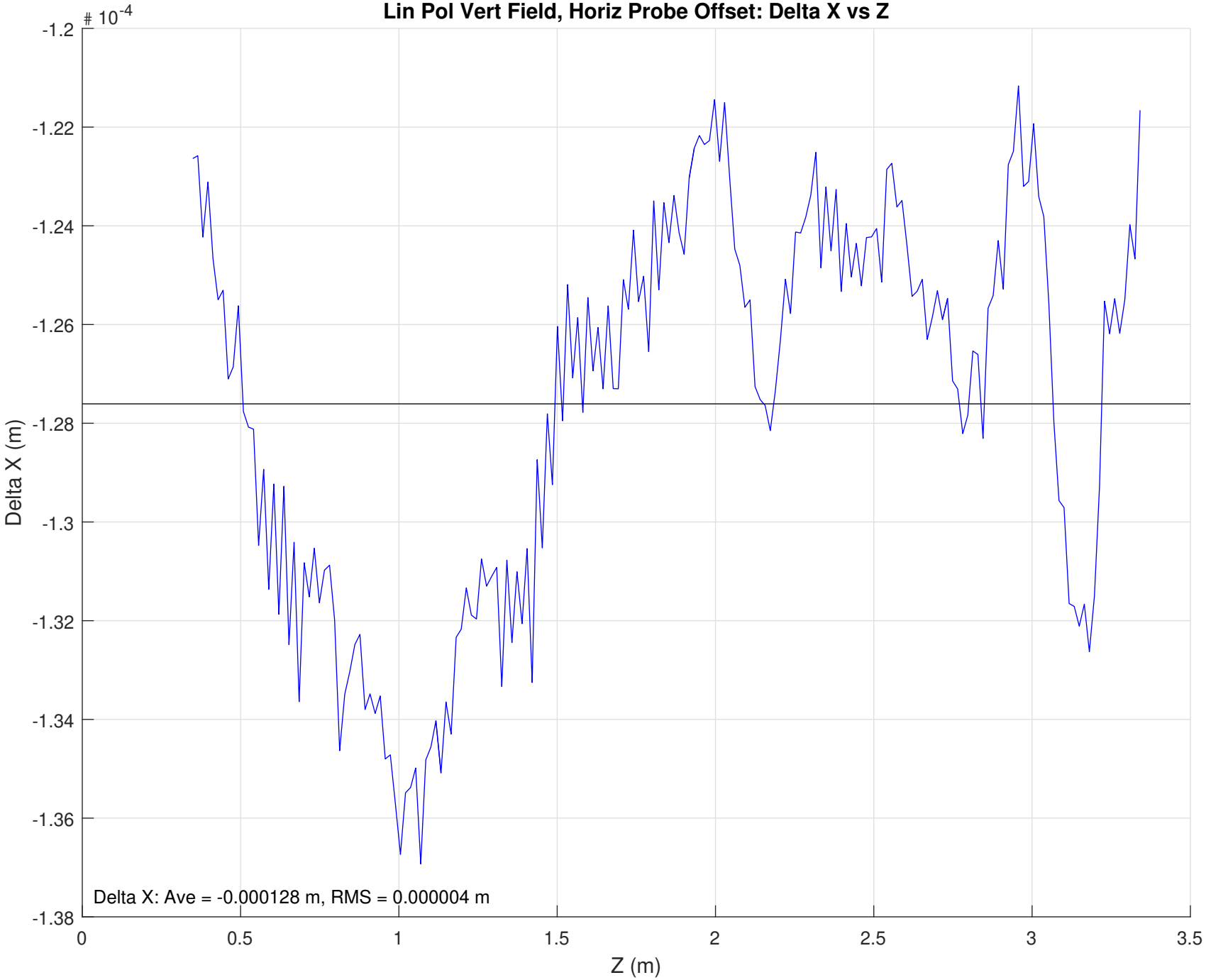

Bx vs z, Bx at Peak, Probe 1 and Probe 2
Probe 1
Probe 2
Scaled Bref
B (T)
Z (m)
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.5
1
1.5
2
2.5
3
3.5
4

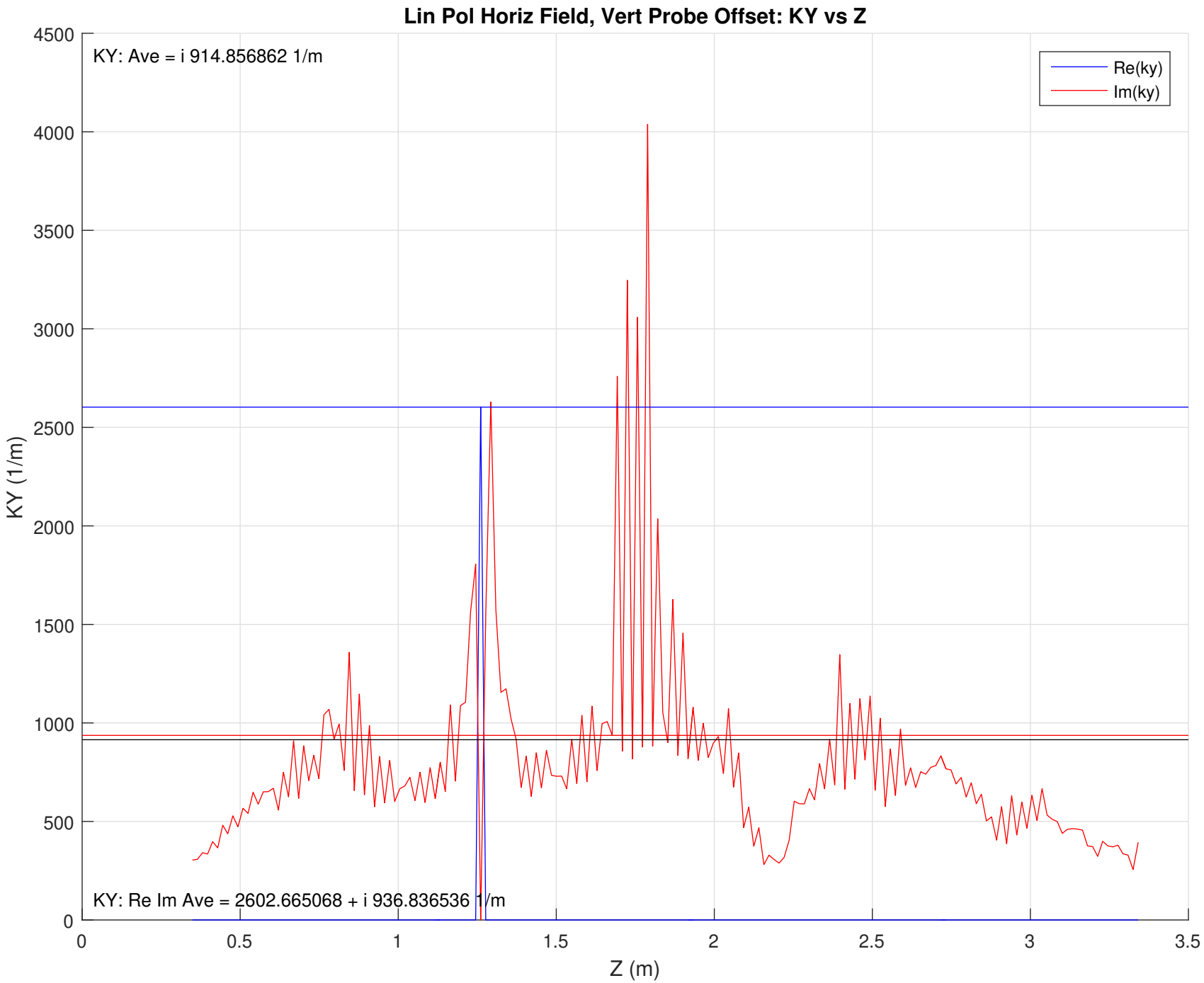

Field Difference Between Probes
dB, Probe 2 - Probe 1
dB At Ref
Filtered dB
dB (T)
Z (m)
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
0
0.5
1
1.5
2
2.5
3
3.5
4

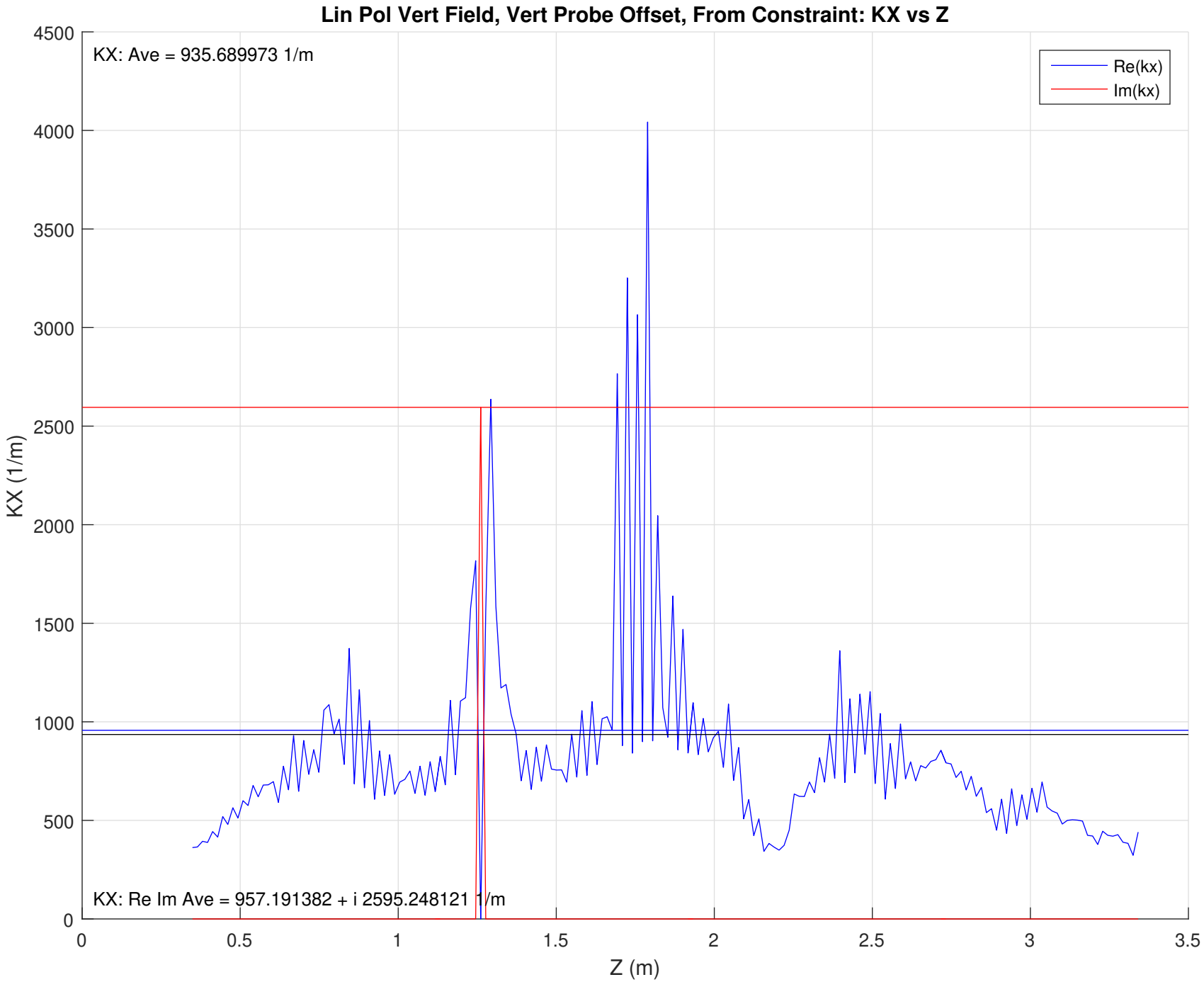

Probe 1 Bz, Bz at Bx Zeros: B vs Z With Fitted Peaks
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
B (T)
0
0.5
1
1.5
2
2.5
3
3.5
4
Z (m)

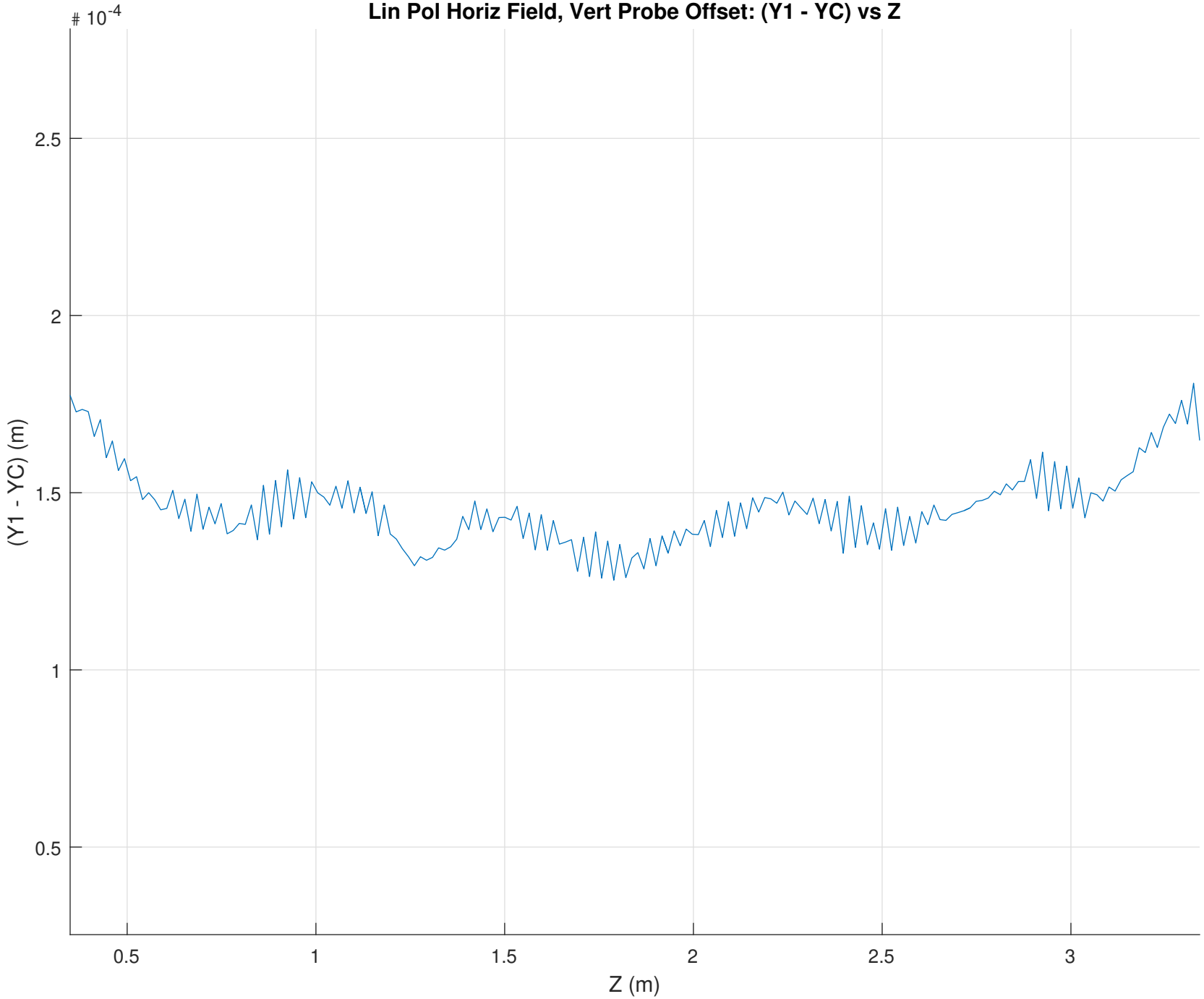

Probe 2 Bz, Bz at Bx Zeros: B vs Z With Fitted Peaks
B (T)
Z (m)
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
0
0.5
1
1.5
2
2.5
3
3.5
4

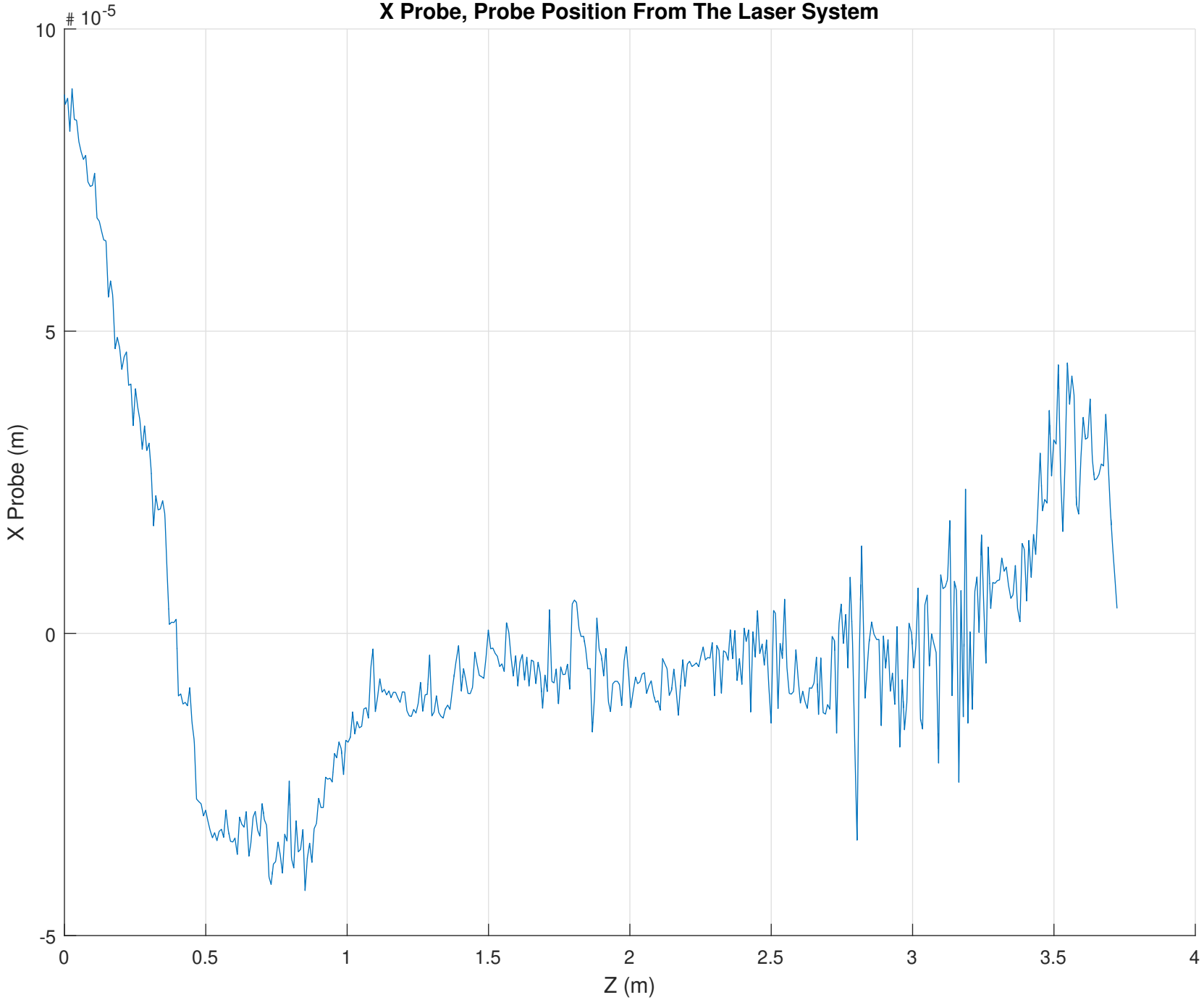

Lin Pol Horiz Field, Vert Probe Offset: (X1 - XC) vs Z
10^-4
2.5
2
1.5
1
0.5
0
(X1 - XC) (m)
0.5
1
1.5
2
2.5
3
Z (m)

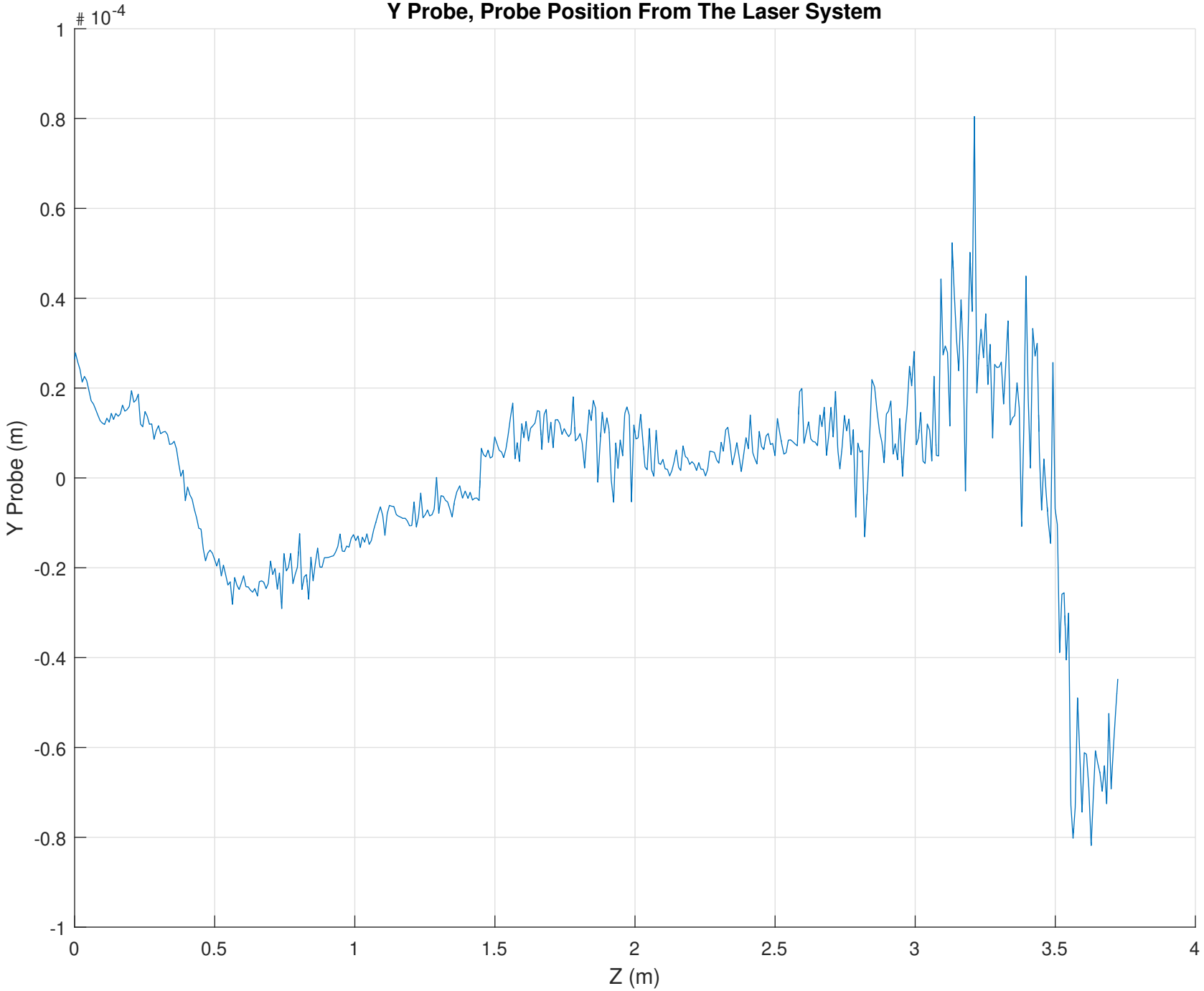

Lin Pol Vert Field, Horiz Probe Offset: Delta X vs Z
10^-4
-1.2
-1.22
-1.24
-1.26
-1.28
-1.3
-1.32
-1.34
-1.36
-1.38
Delta X (m)
0
0.5
1
1.5
2
2.5
3
3.5
Z (m)
Delta X: Ave = -0.000128 m, RMS = 0.000004 m

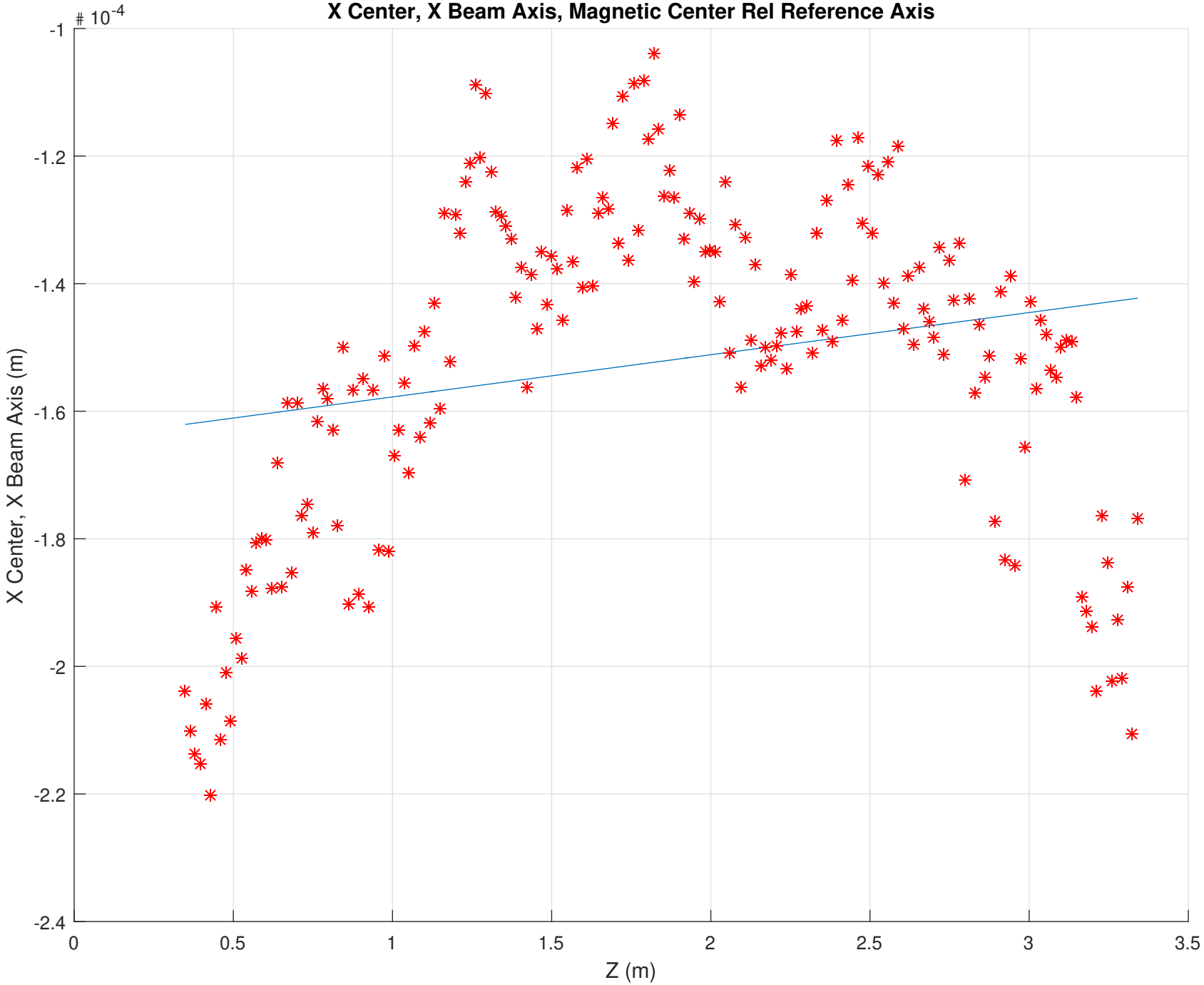

Lin Pol Horiz Field, Vert Probe Offset: KY vs Z
KY: Ave = i 914.856862 1/m
KY: Re Im Ave = 2602.665068 + i 936.836536 1/m
Re(ky)
Im(ky)
KY (1/m)
Z (m)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.5
1
1.5
2
2.5
3
3.5

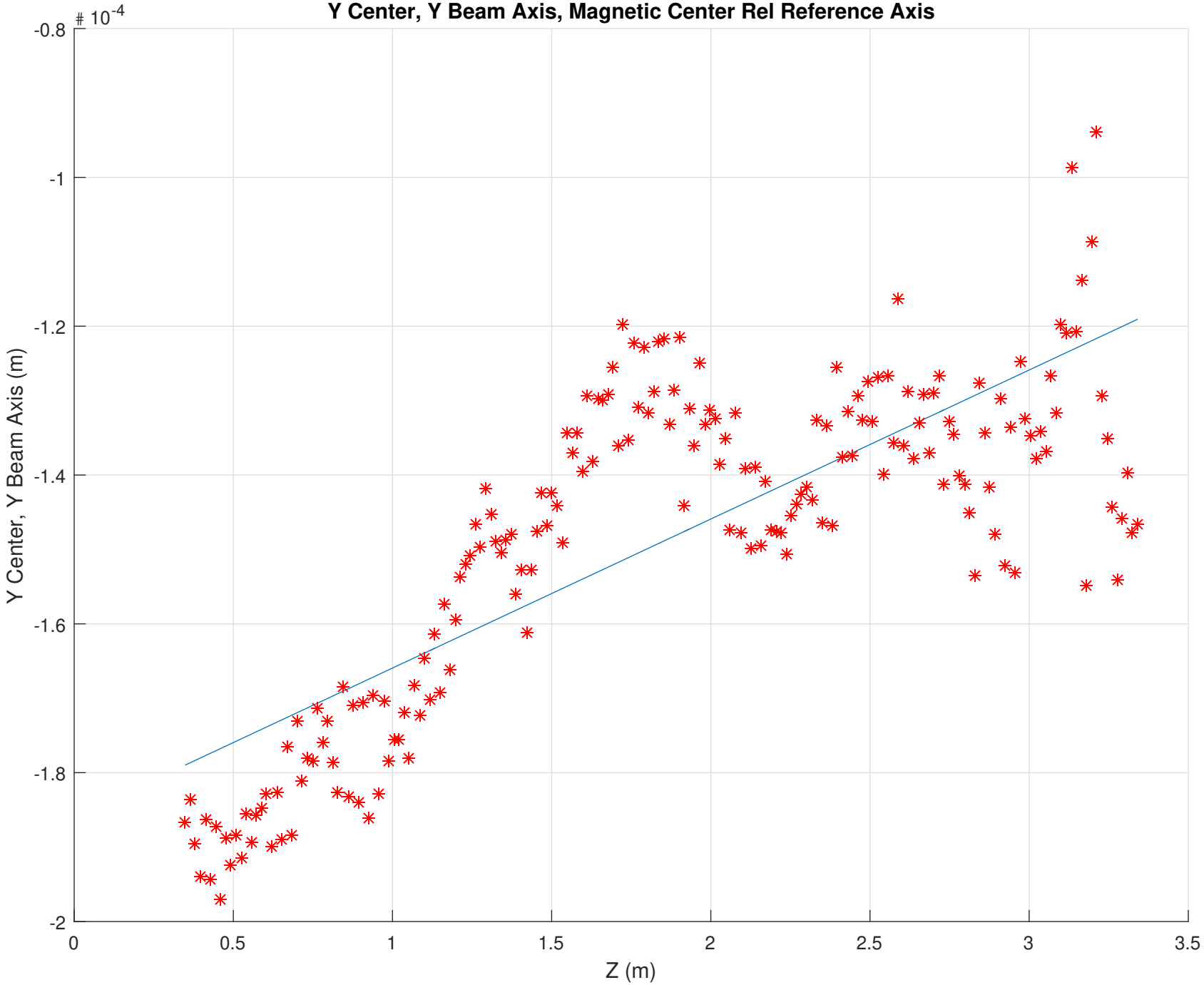

Lin Pol Vert Field, Vert Probe Offset, From Constraint: KX vs Z
KX: Ave = 935.689973 1/m
KX: Re Im Ave = 957.191382 + i 2595.248121 1/m
Re(kx)
Im(kx)
KX (1/m)
Z (m)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0
0.5
1
1.5
2
2.5
3
3.5

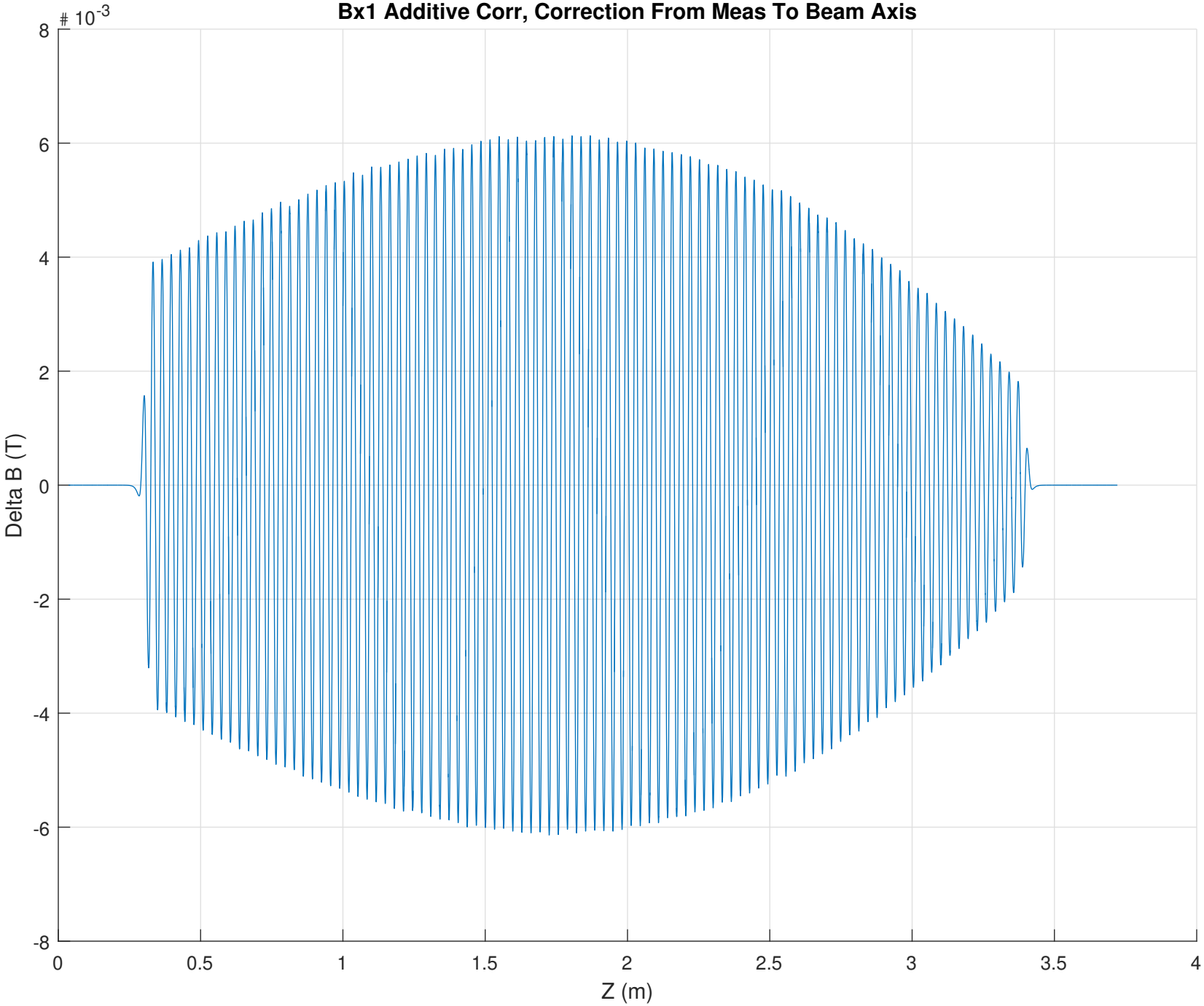

Lin Pol Horiz Field, Vert Probe Offset: (Y1 - YC) vs Z
10^-4
2.5
2
1.5
1
0.5
(Y1 - YC) (m)
0.5
1
1.5
2
2.5
3
Z (m)

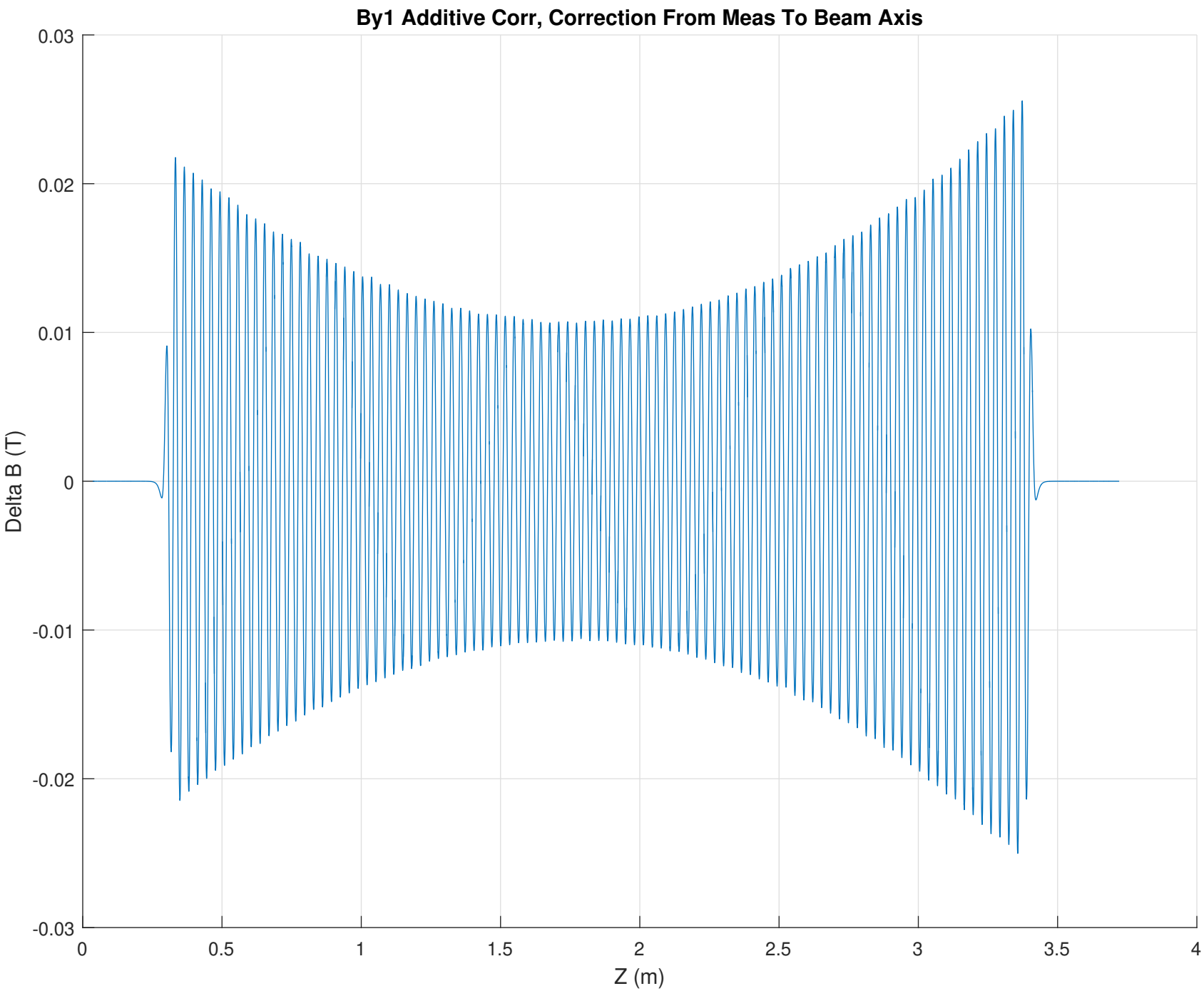

X Probe, Probe Position From The Laser System
10-5
10
5
0
-5
X Probe (m)
0
0.5
1
1.5
2
2.5
3
3.5
4
Z (m)

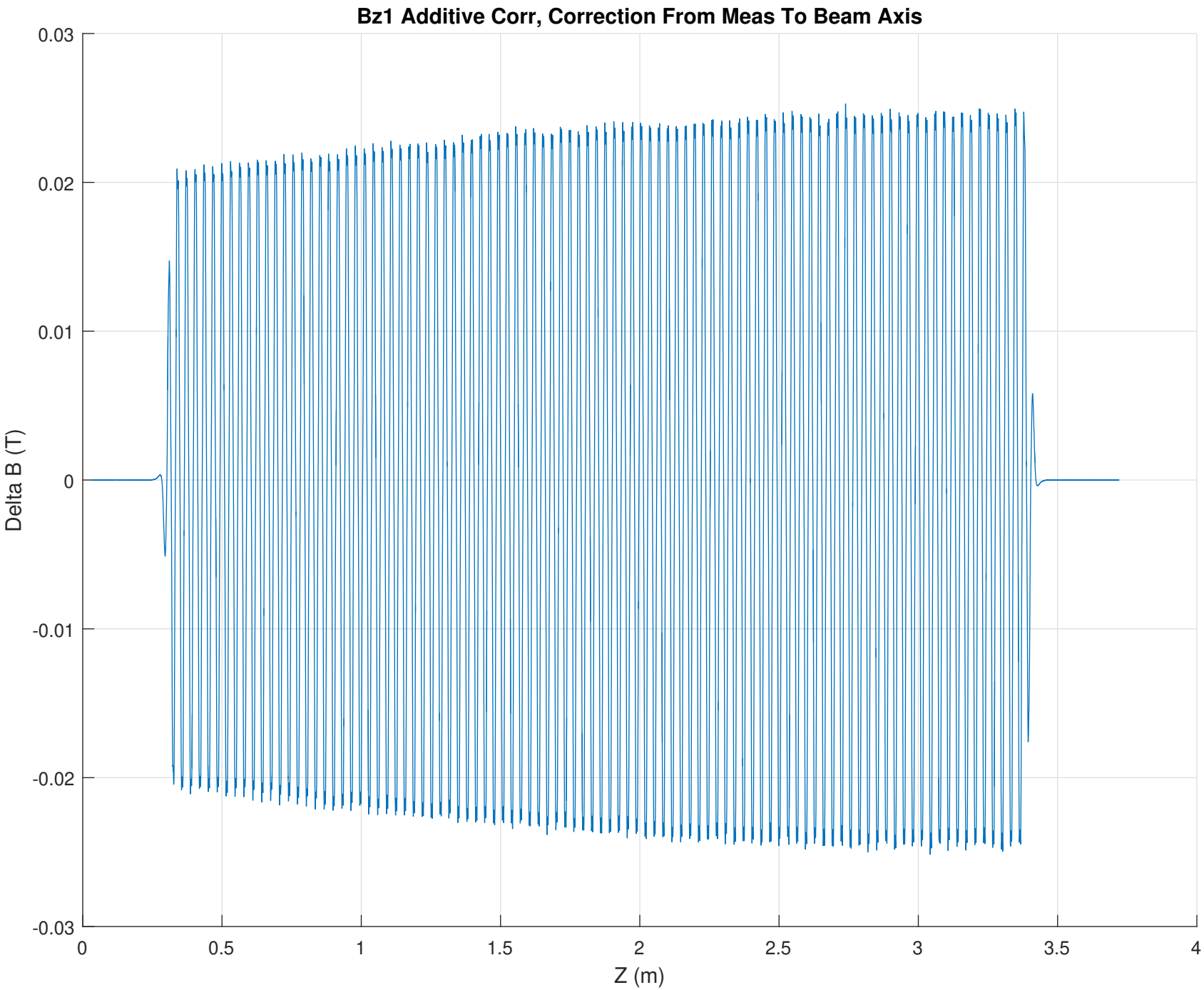

Y Probe, Probe Position From The Laser System
10^-4
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Y Probe (m)
0
0.5
1
1.5
2
2.5
3
3.5
4
Z (m)

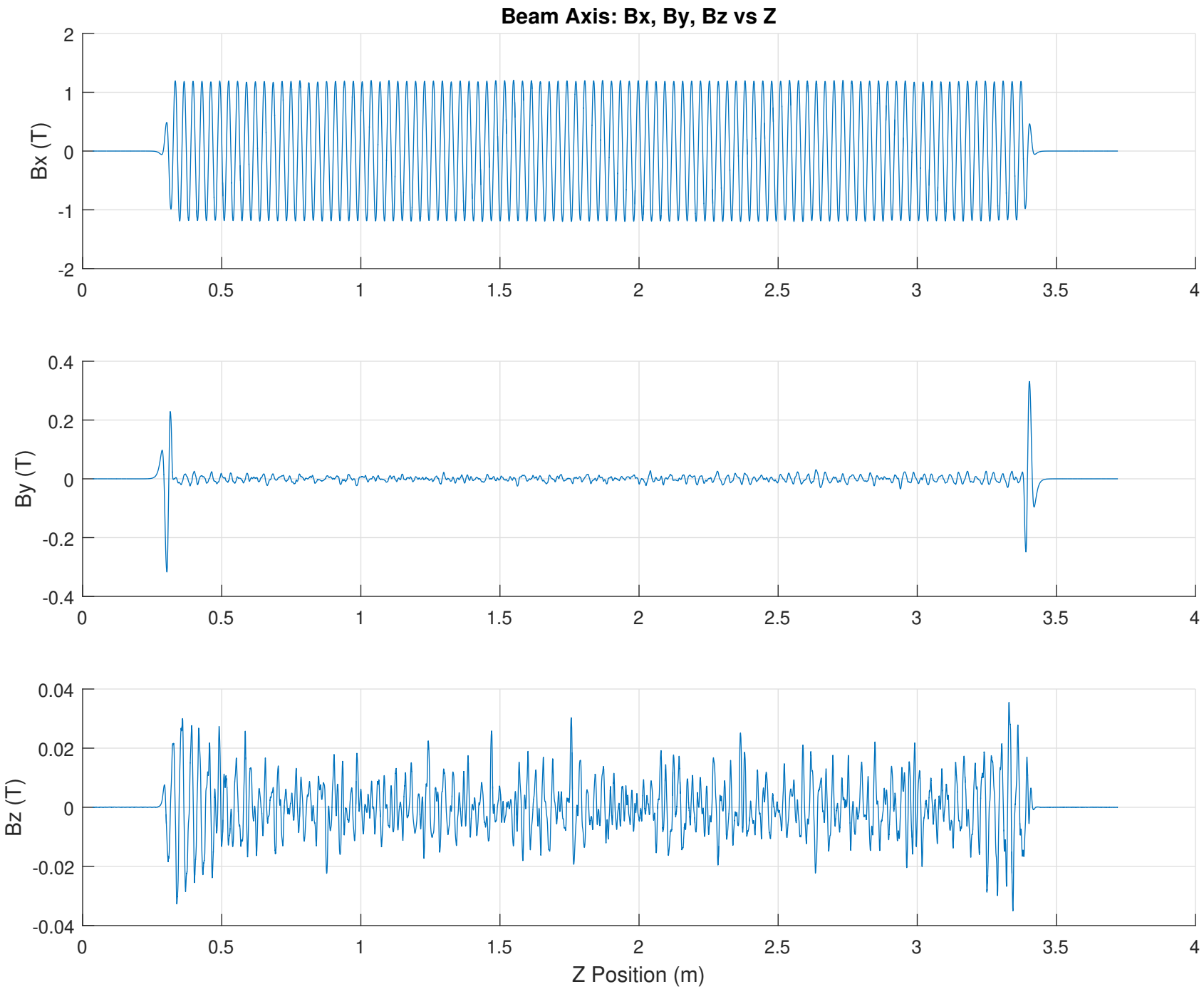

X Center, X Beam Axis, Magnetic Center Rel Reference Axis
10-4
-1
-1.2
-1.4
-1.6
-1.8
-2
-2.2
-2.4
X Center, X Beam Axis (m)
0
0.5
1
1.5
2
2.5
3
3.5
Z (m)


Y Center, Y Beam Axis, Magnetic Center Rel Reference Axis
10-4
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
Y Center, Y Beam Axis (m)
0
0.5
1
1.5
2
2.5
3
3.5
Z (m)


Bx1 Additive Corr, Correction From Meas To Beam Axis
10^-3
8
6
4
2
0
-2
-4
-6
-8
Delta B (T)
0
0.5
1
1.5
2
2.5
3
3.5
4
Z (m)


By1 Additive Corr, Correction From Meas To Beam Axis
Delta B (T)
Z (m)
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
0
0.5
1
1.5
2
2.5
3
3.5
4


Bz1 Additive Corr, Correction From Meas To Beam Axis
Delta B (T)
Z (m)
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
0
0.5
1
1.5
2
2.5
3
3.5
4


Beam Axis: Bx, By, Bz vs Z
Bx (T)
By (T)
Bz (T)
Z Position (m)
2
1
0
-1
-2
0.4
0.2
-0.2
-0.4
0.04
0.02
-0.02
-0.04
0
0.5
1
1.5
2
2.5
3
3.5
4