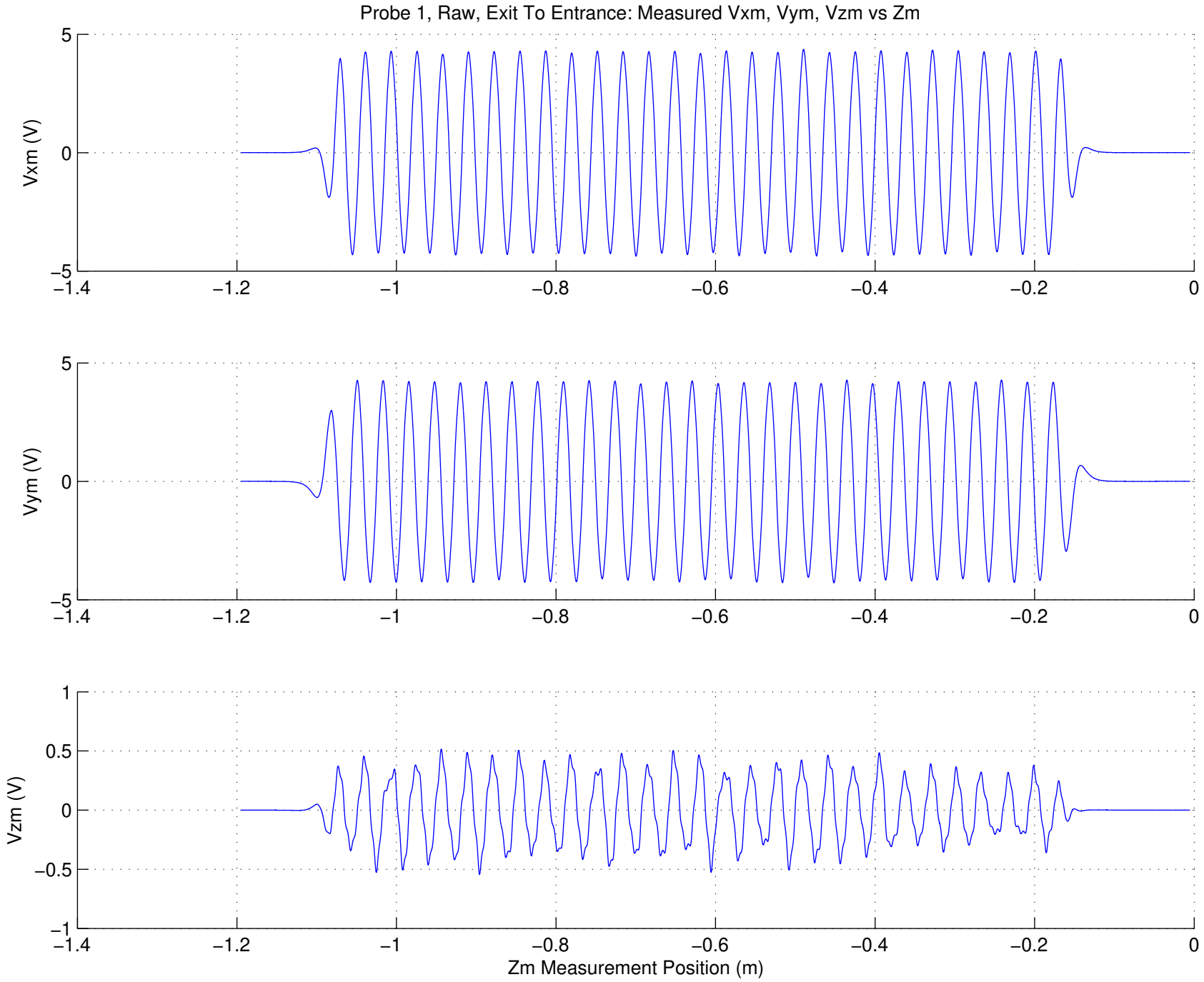
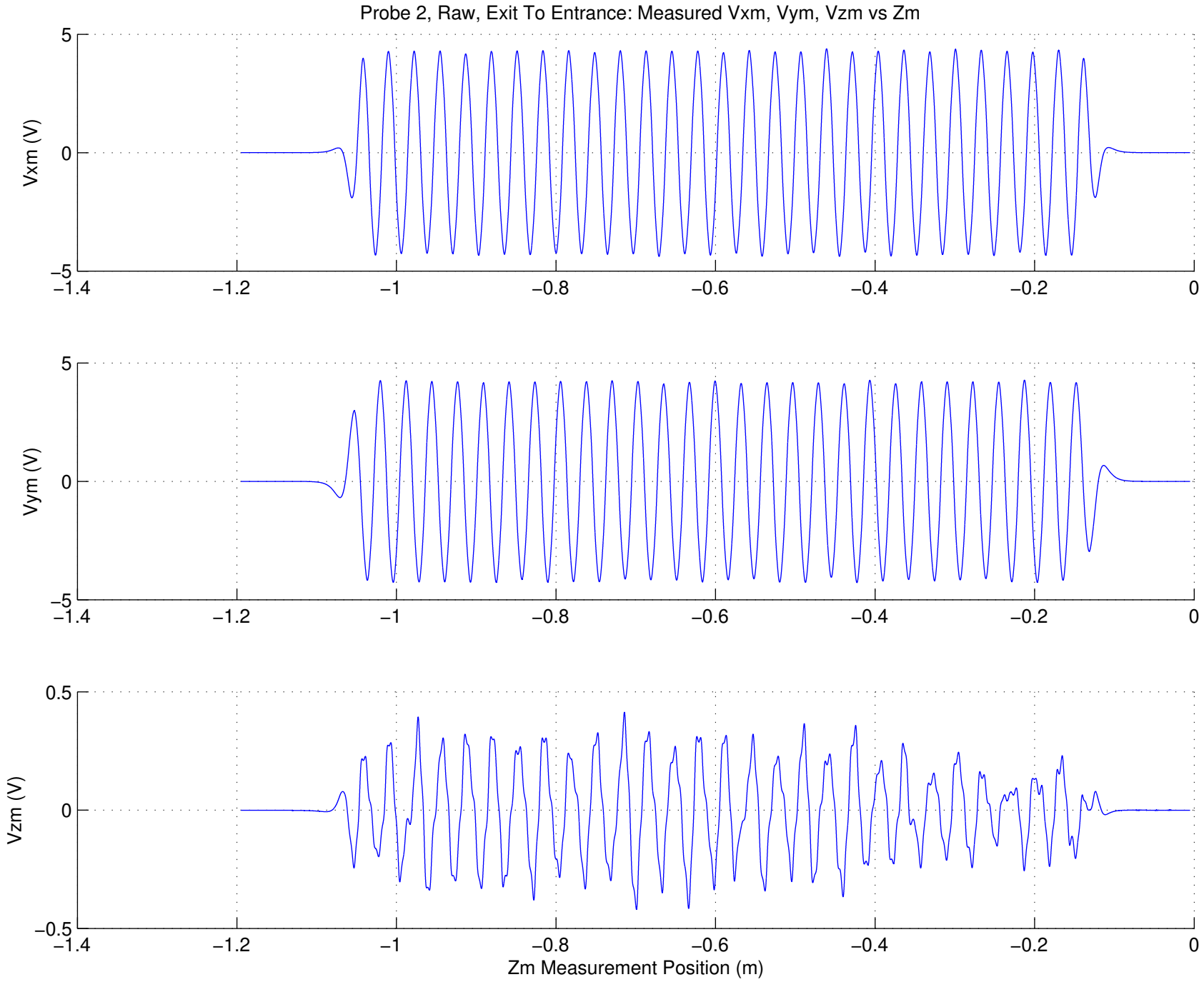
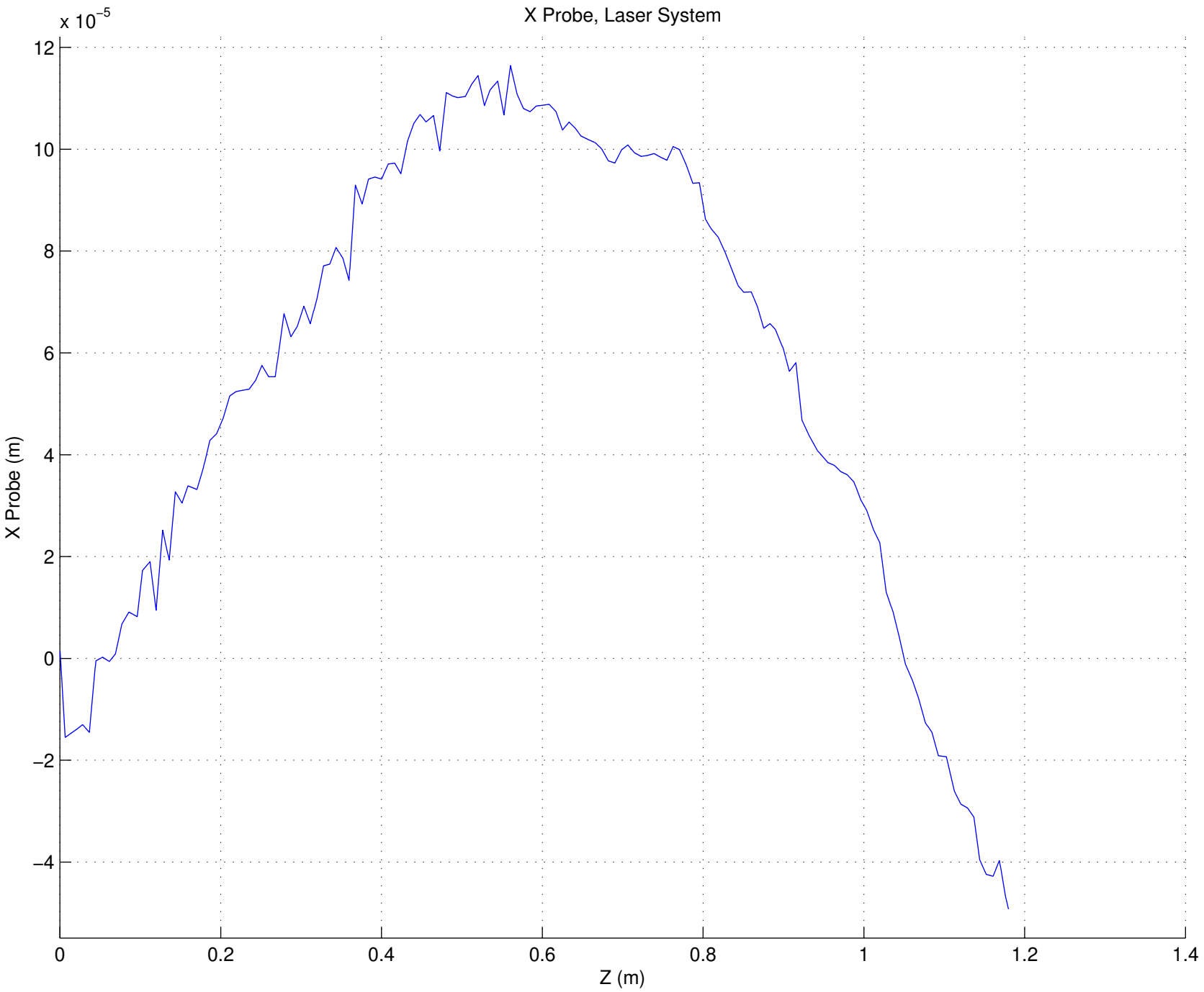
SLAC Magnetic Measurements

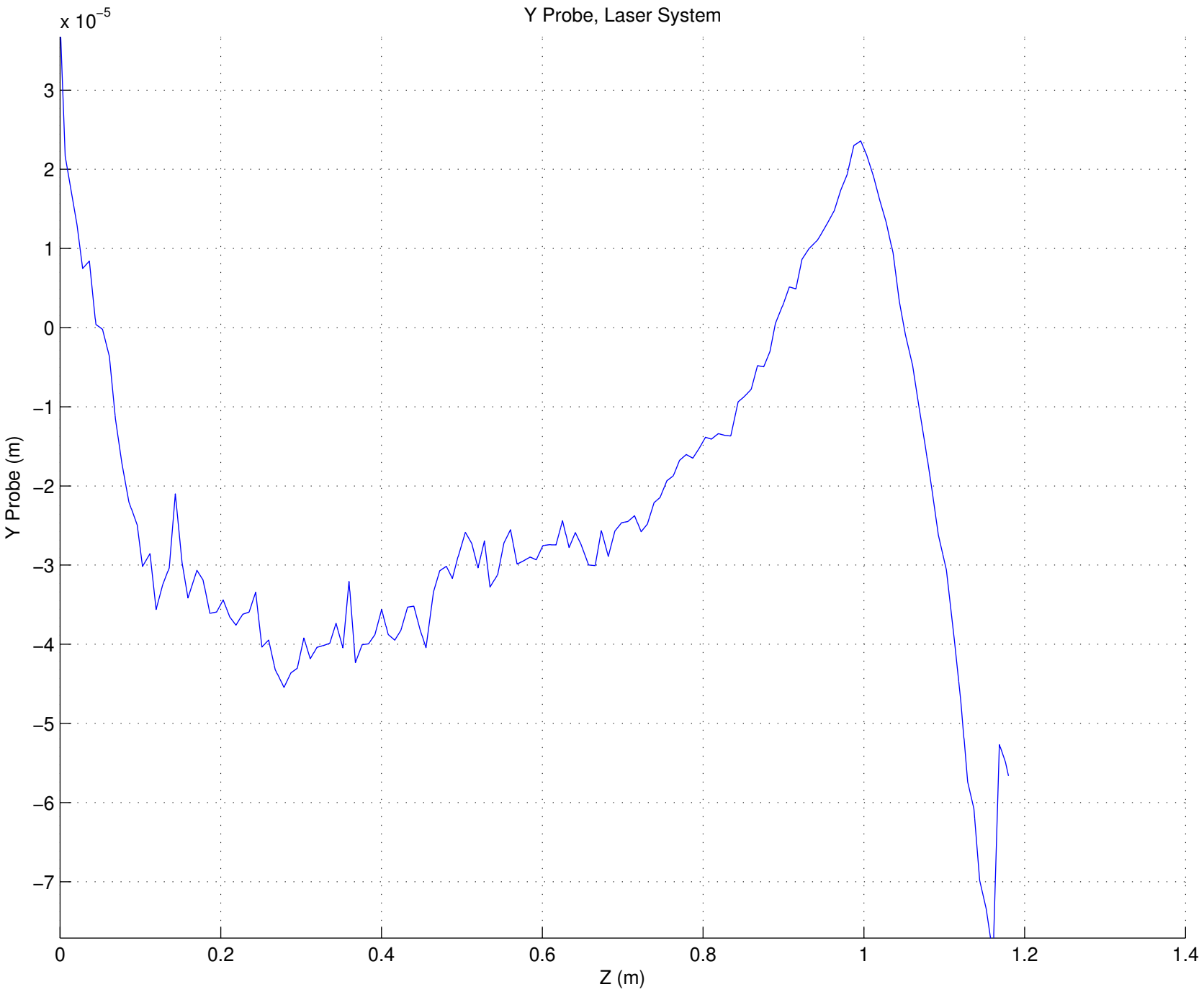
Hall Probe Array Analysis
****

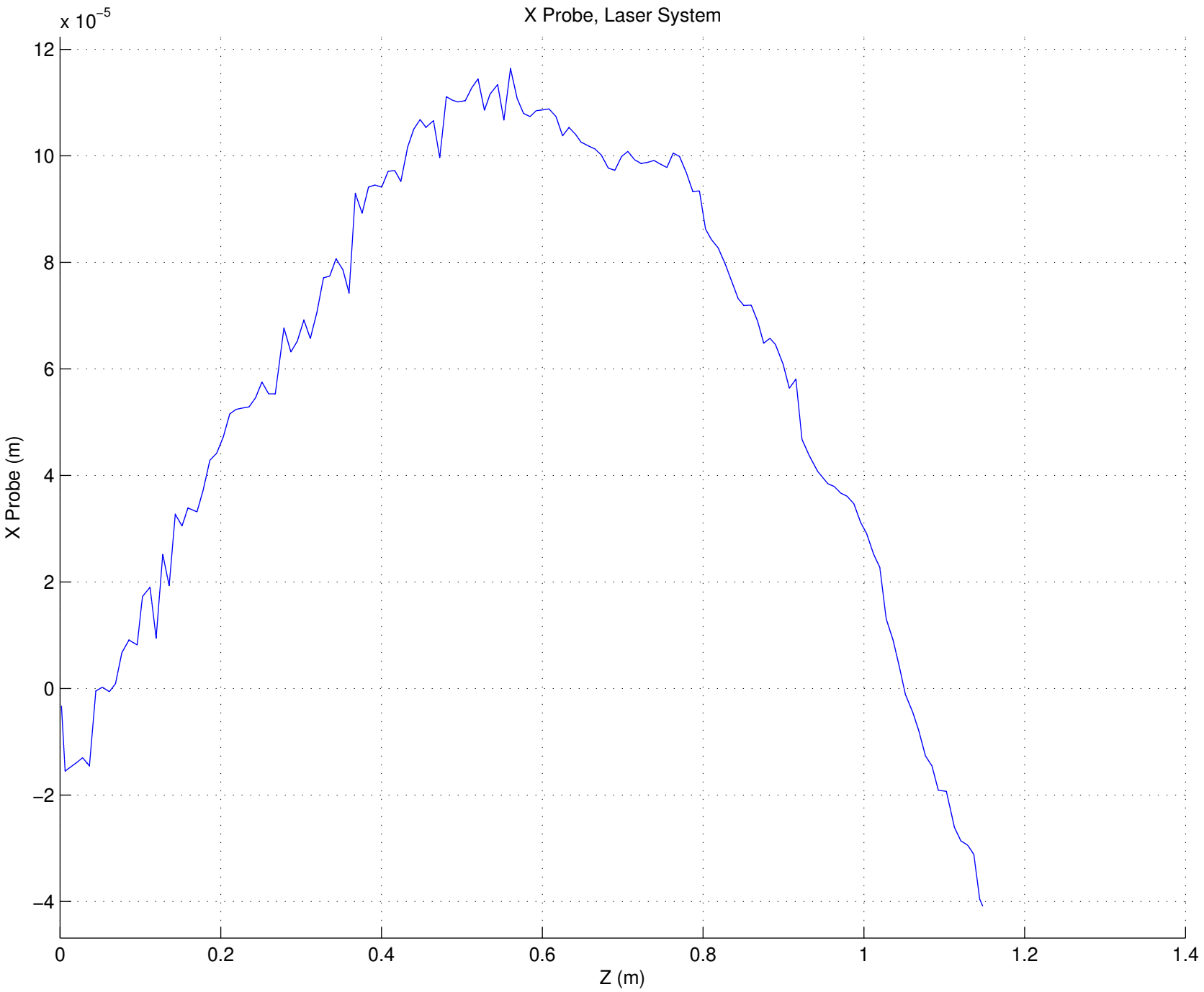
Parameters:
INPUT−FILE−DIR =s:\MagData\LCLS\Undulator\DELTA\Data\Run 430\
INPUT−FILE−NAME =DUTestStep+0.005
INPUT−FILE−TYPE =ZVXYZVXYZH
UND−POL−MODE =CIRC−POL−LEFT−HAND
PROBE1−BX−CALIB−FILE =v:\MET\MagServe\MagData\LCLS\Hall probe\SENIS−119−12\SENIS−119−12−X.ini
PROBE1−BY−CALIB−FILE =v:\MET\MagServe\MagData\LCLS\Hall probe\SENIS−119−12\SENIS−119−12−Y.ini
PROBE2−BX−CALIB−FILE =v:\MET\MagServe\MagData\LCLS\Hall probe\SENIS−120−12\SENIS−120−12−X.ini
PROBE2−BY−CALIB−FILE =v:\MET\MagServe\MagData\LCLS\Hall probe\SENIS−120−12\SENIS−120−12−Y.ini
NUM−ZERO−GAUSS−MEAS =200
PROBE2−OFFSET−DIR =Y

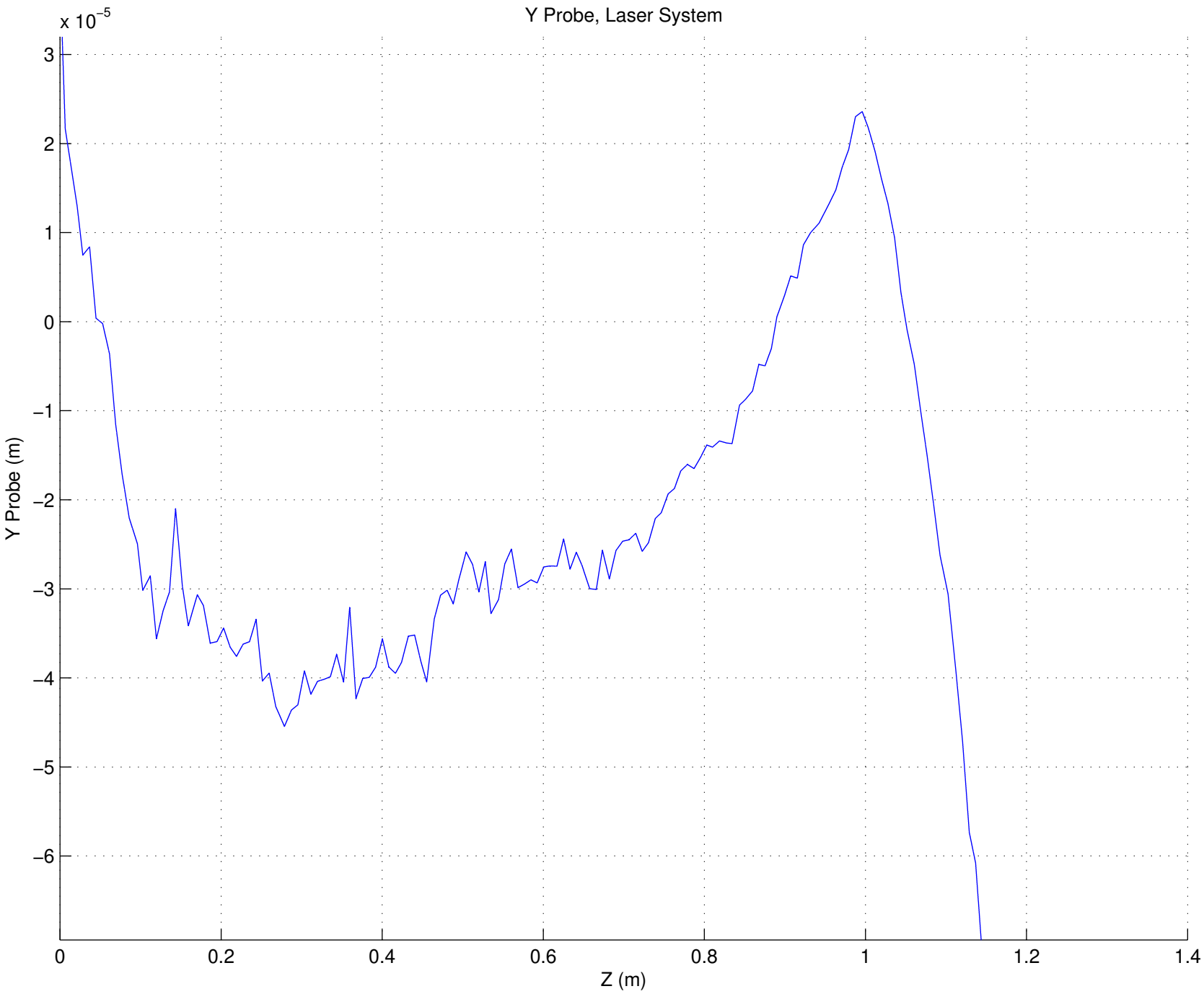

Probe 1, Raw, Exit To Entrance: Measured Vxm, Vym, Vzm vs Zm
Vxm (V)
Vym (V)
Vzm (V)
5
0
−5
1
0.5
−0.5
−1
−1.4
−1.2
−1
−0.8
−0.6
−0.4
−0.2
0
Zm Measurement Position (m)

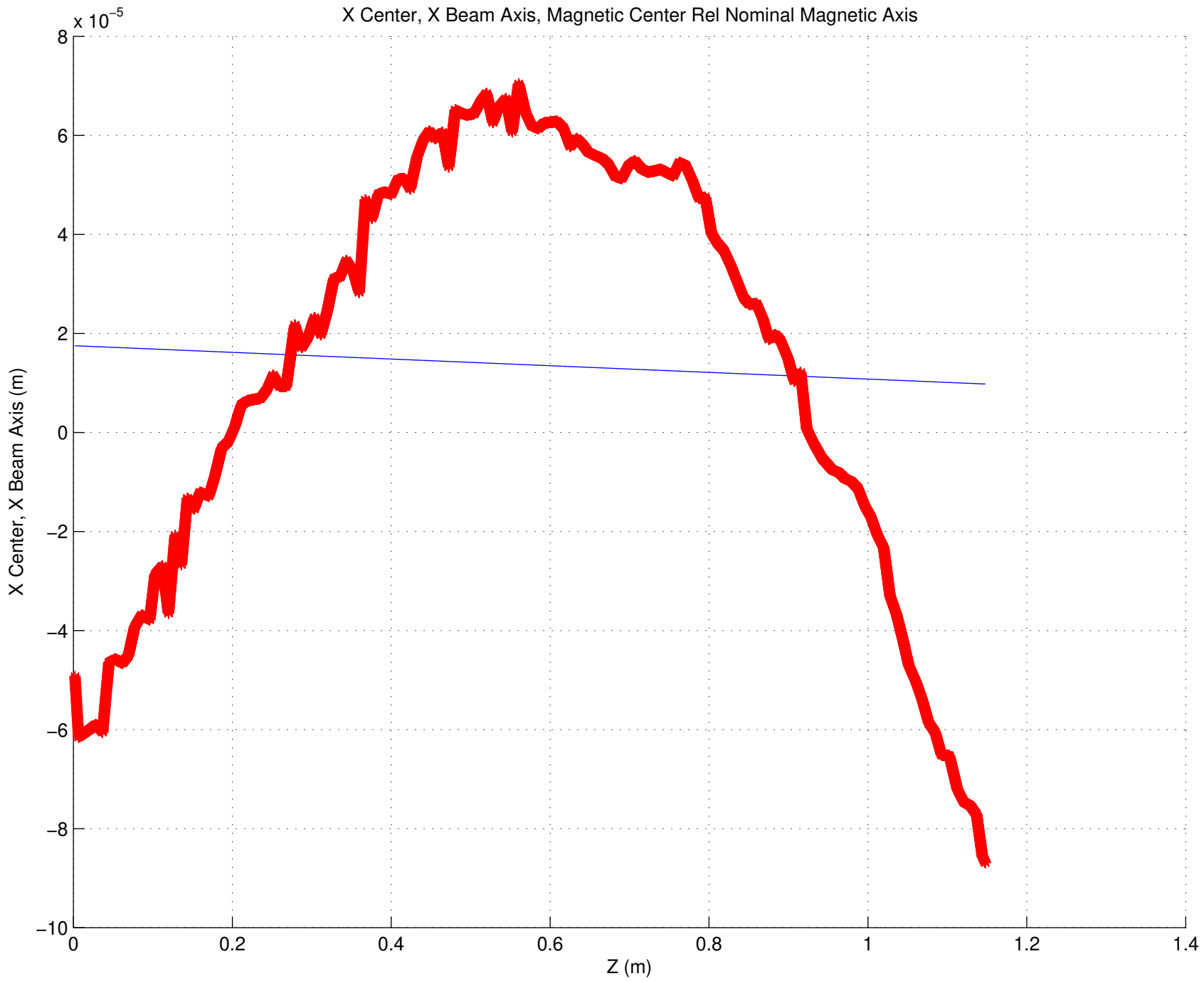

Probe 2, Raw, Exit To Entrance: Measured Vxm, Vym, Vzm vs Zm
Vxm (V)
Vym (V)
Vzm (V)
5
0
−5
0.5
−0.5
−1.4
−1.2
−1
−0.8
−0.6
−0.4
−0.2
0
Zm Measurement Position (m)

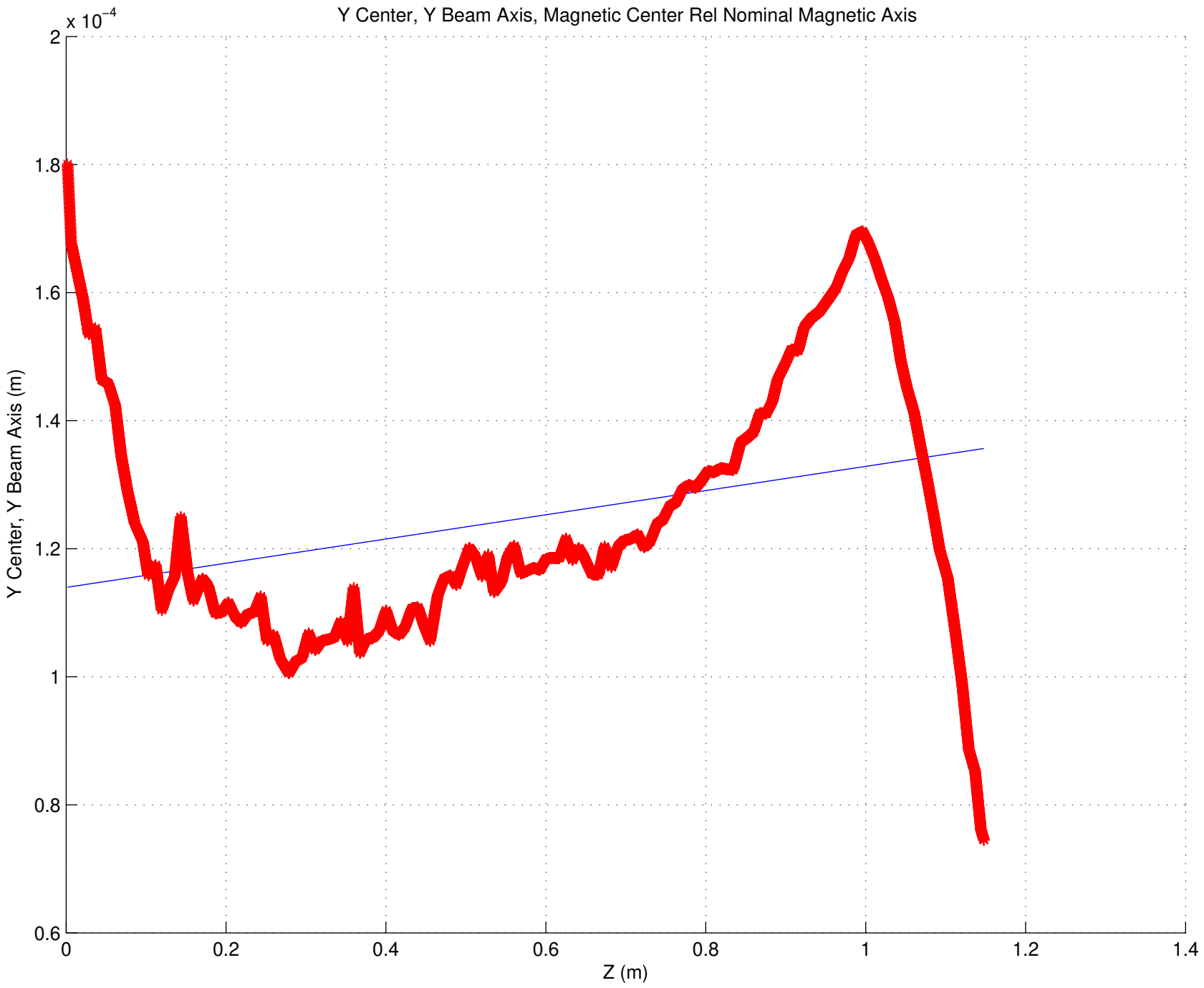

X Probe, Laser System
x 10^-5
12
10
8
6
4
2
0
−2
−4
X Probe (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

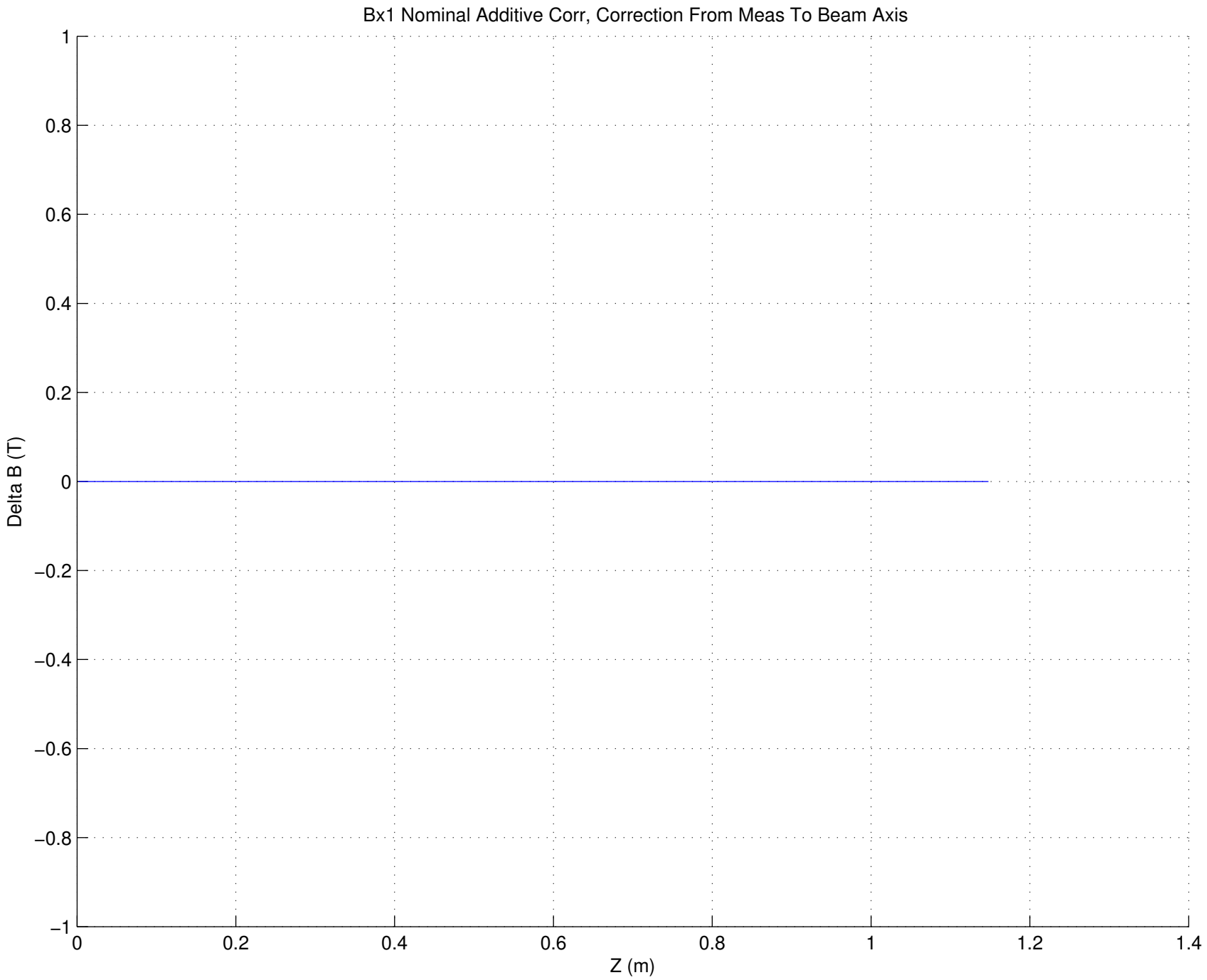

Y Probe, Laser System
x 10^-5
3
2
1
0
−1
−2
−3
−4
−5
−6
−7
Y Probe (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

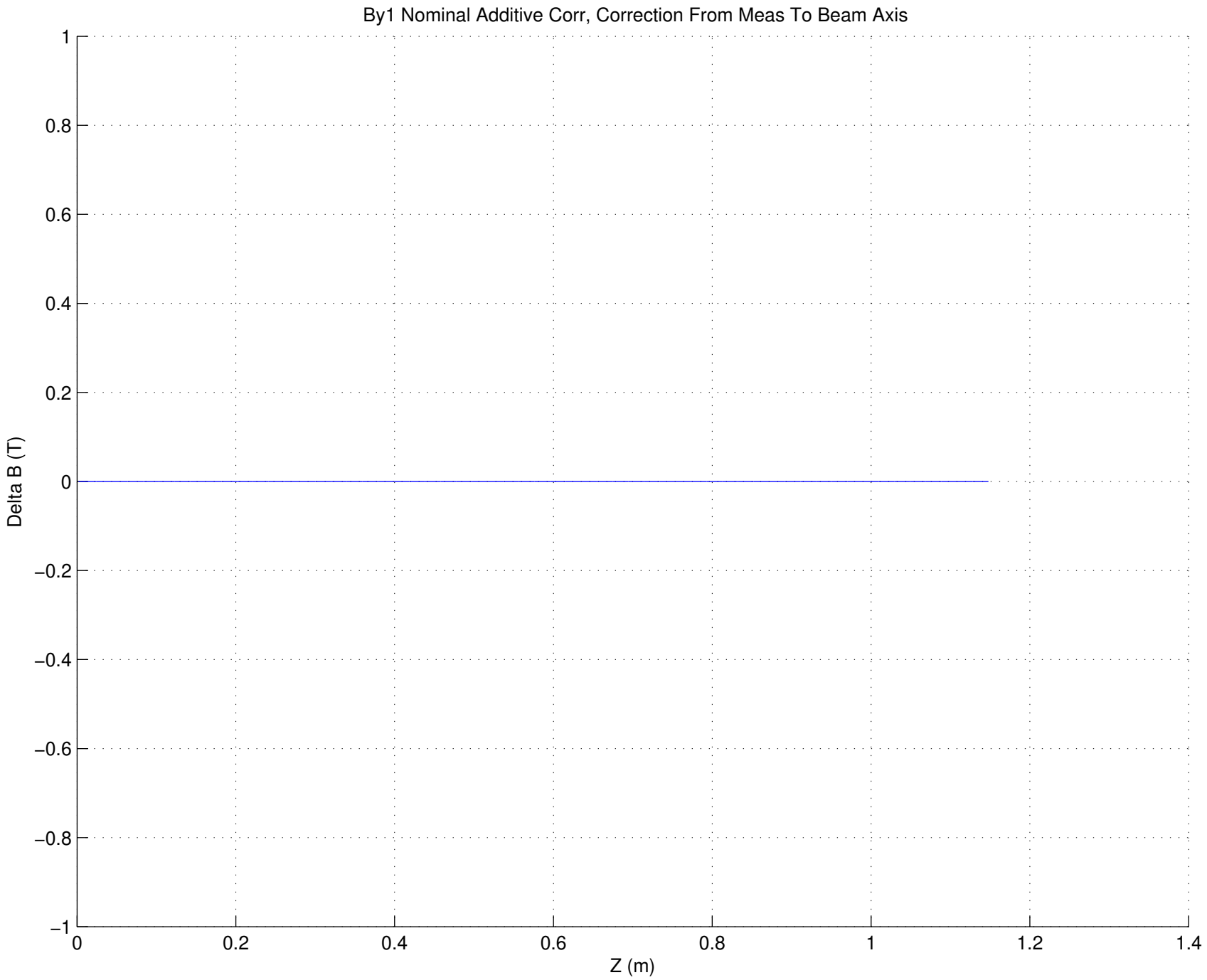

X Probe, Laser System
x 10^-5
12
10
8
6
4
2
0
−2
−4
X Probe (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

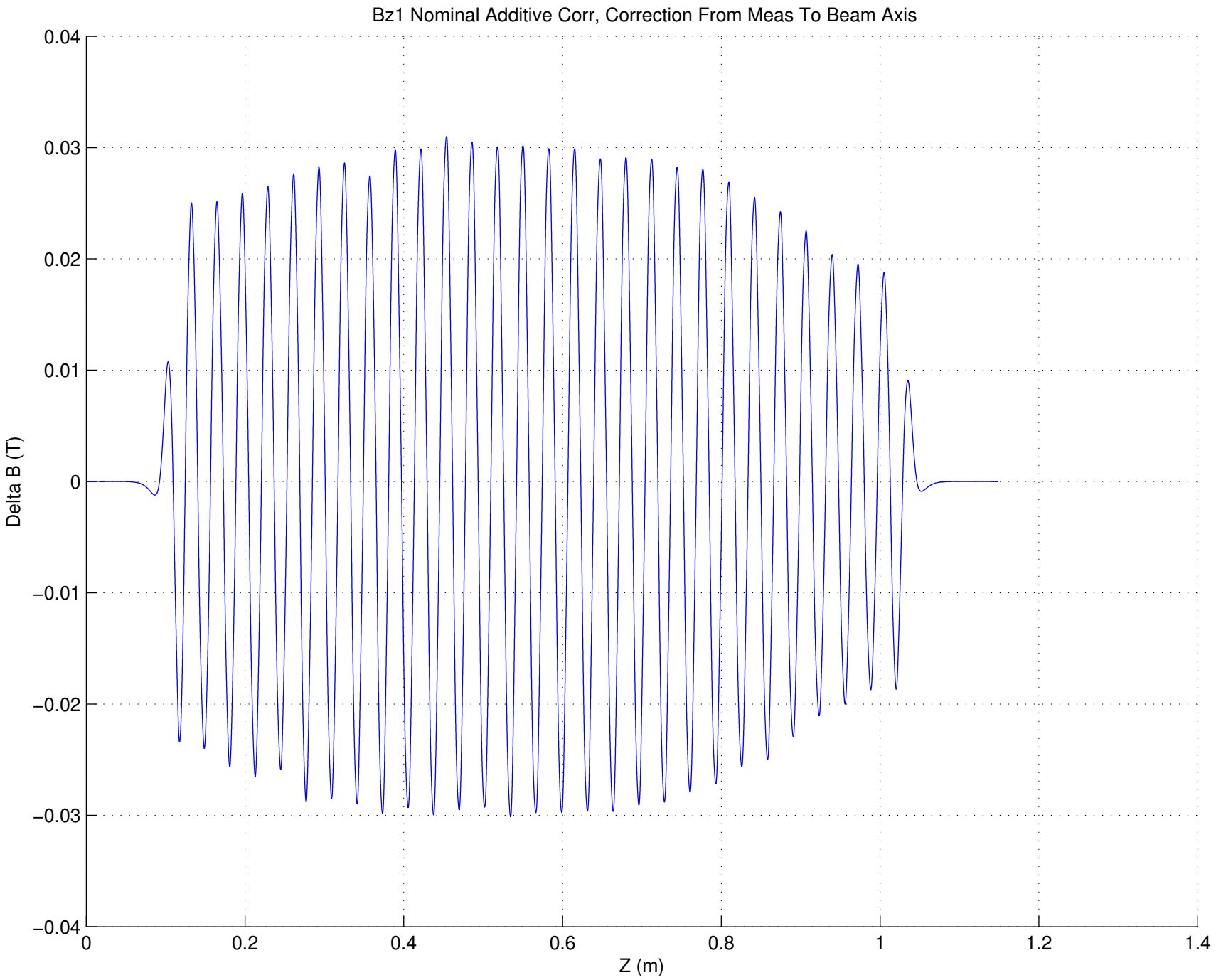

Y Probe, Laser System
x 10^-5
3
2
1
0
−1
−2
−3
−4
−5
−6
Y Probe (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

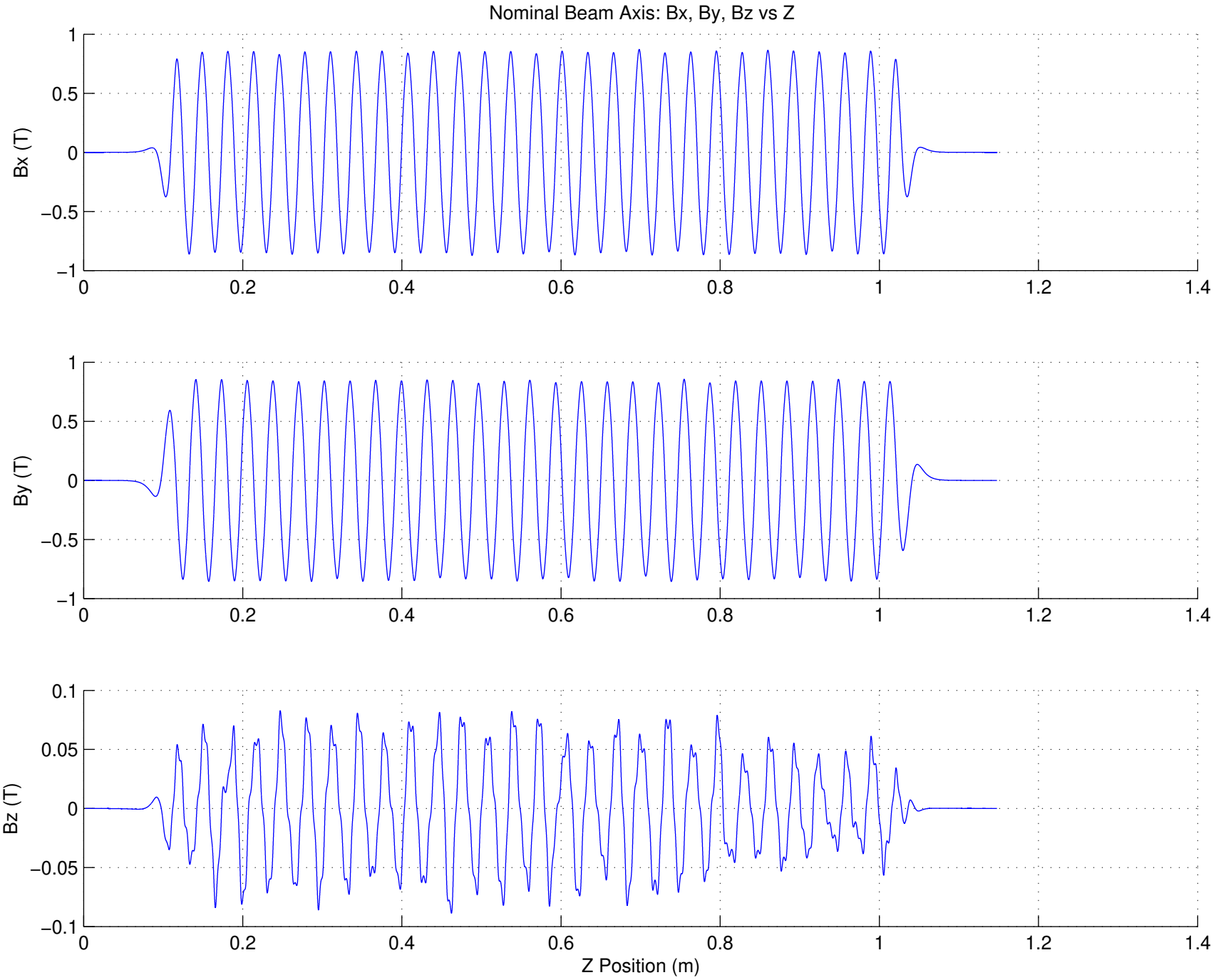

X Center, X Beam Axis, Magnetic Center Rel Nominal Magnetic Axis
x 10^-5
8
6
4
2
0
−2
−4
−6
−8
−10
X Center, X Beam Axis (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

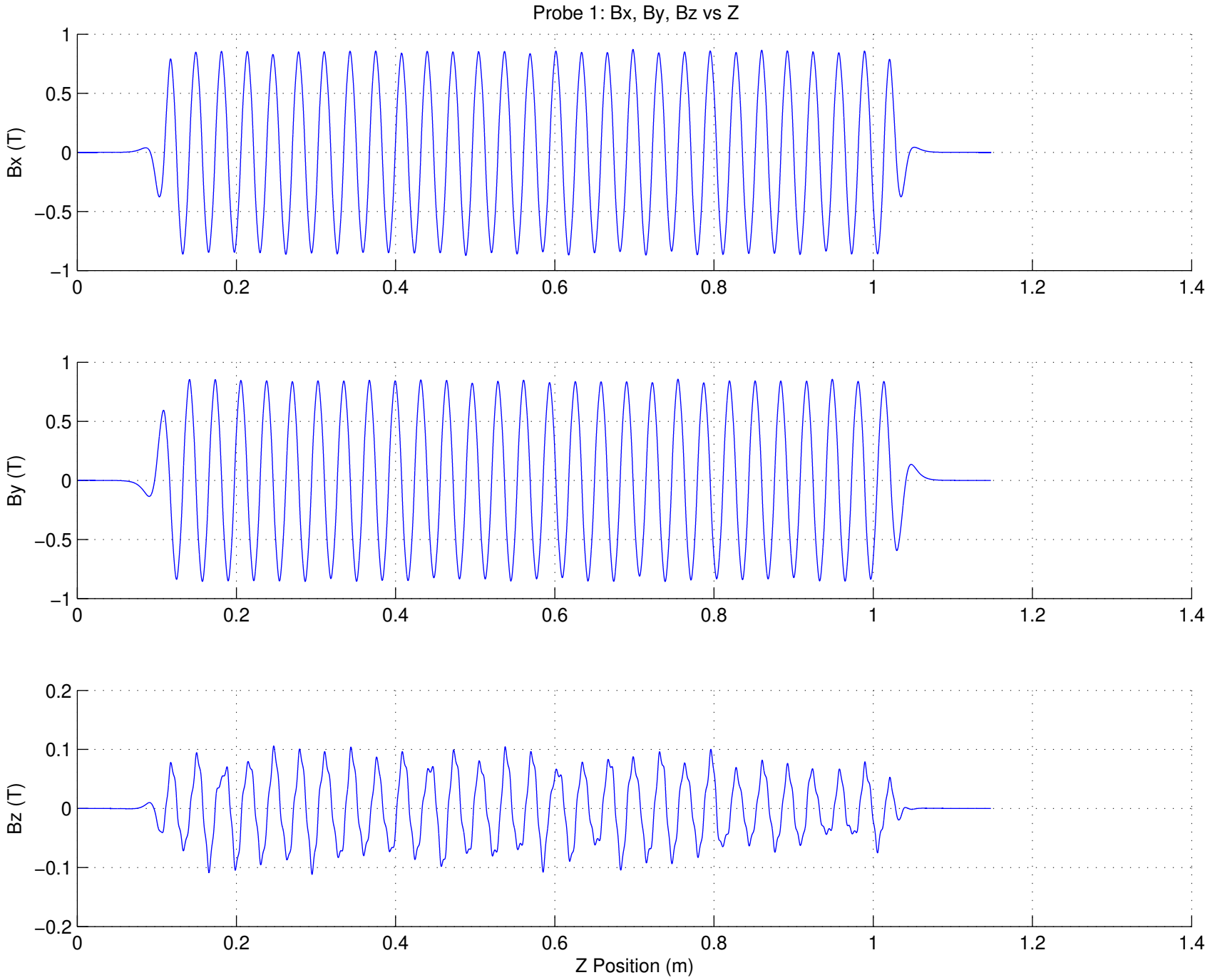

Y Center, Y Beam Axis, Magnetic Center Rel Nominal Magnetic Axis
x 10^-4
2
1.8
1.6
1.4
1.2
1
0.8
0.6
Y Center, Y Beam Axis (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

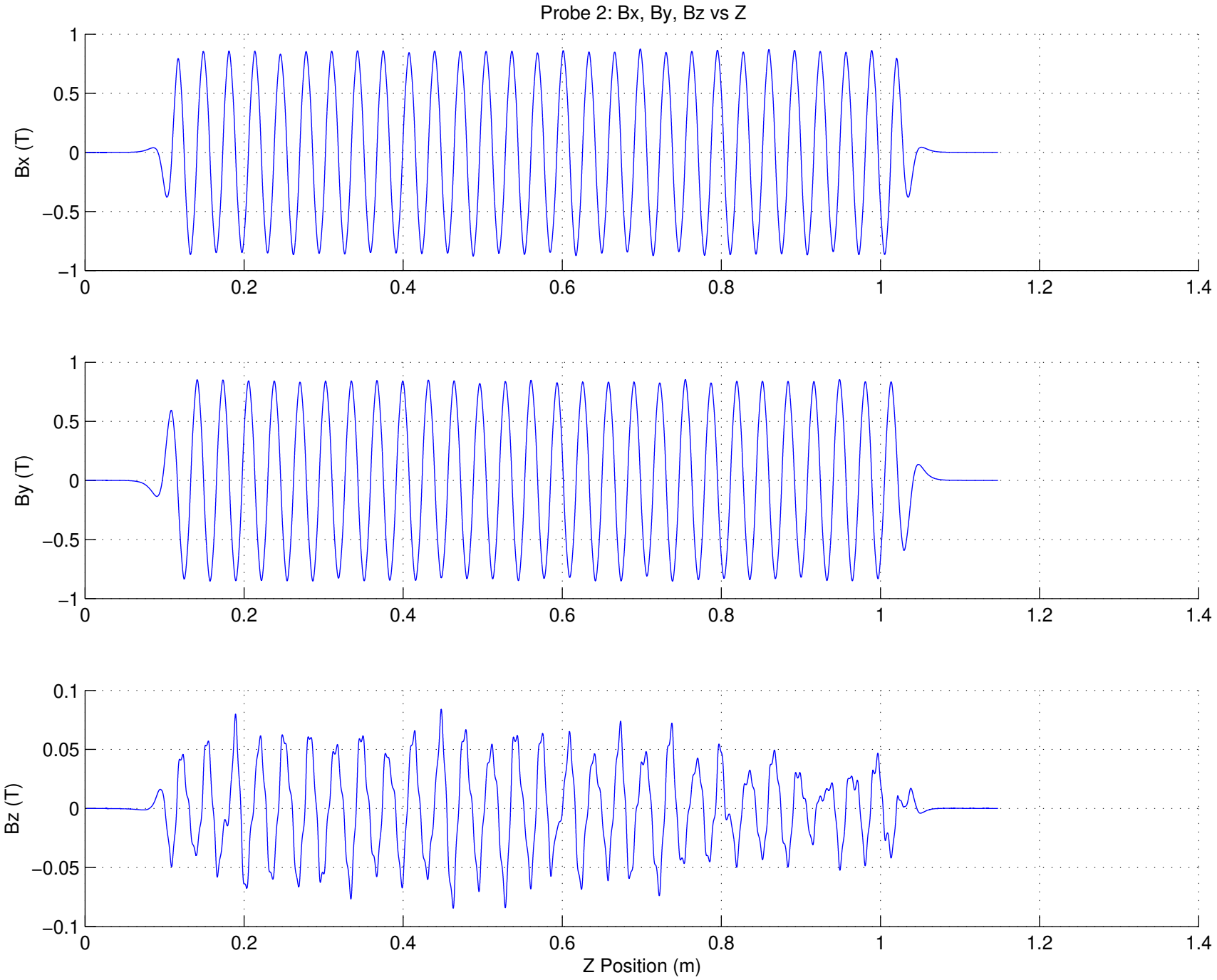

Bx1 Nominal Additive Corr, Correction From Meas To Beam Axis
Delta B (T)
Z (m)
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
0
0.2
0.4
0.6
0.8
1
1.2
1.4

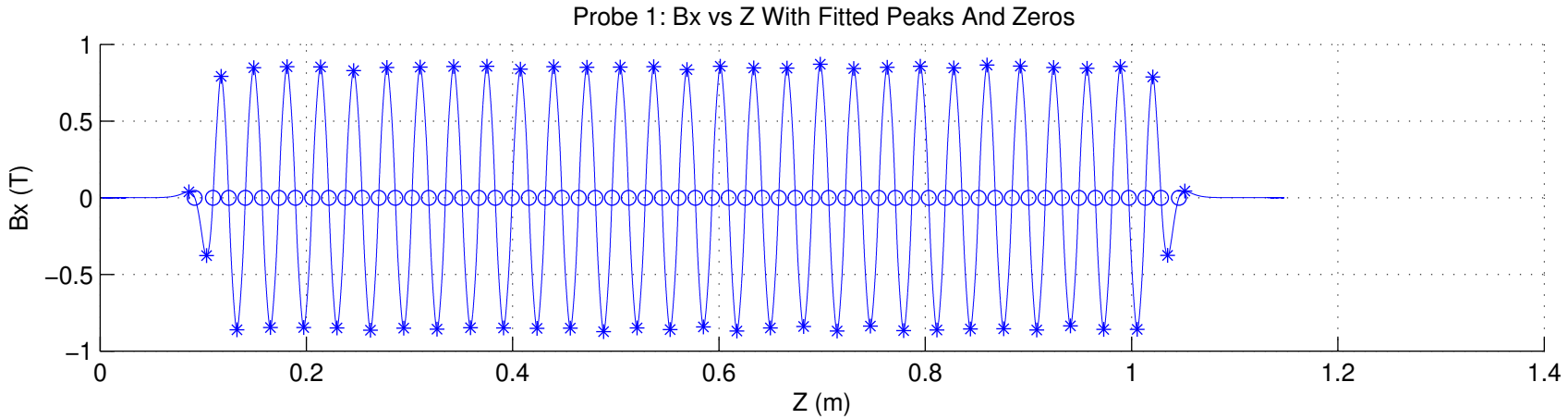

By1 Nominal Additive Corr, Correction From Meas To Beam Axis
Delta B (T)
Z (m)
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
0
0.2
0.4
0.6
0.8
1
1.2
1.4

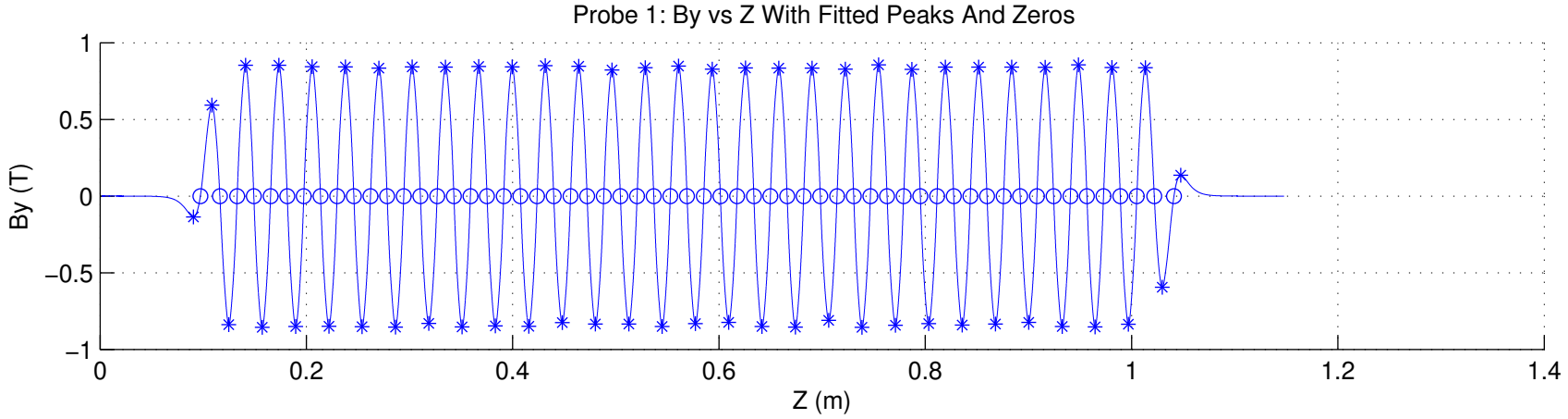

Bz1 Nominal Additive Corr, Correction From Meas To Beam Axis
0.04
0.03
0.02
0.01
0
−0.01
−0.02
−0.03
−0.04
Delta B (T)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

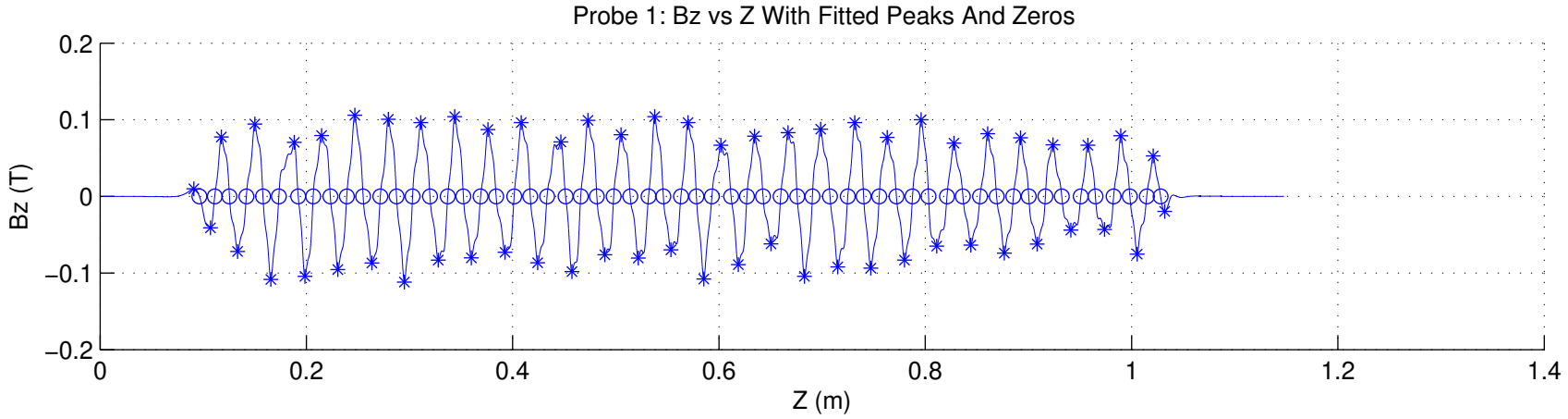

Nominal Beam Axis: Bx, By, Bz vs Z
Bx (T)
By (T)
Bz (T)
Z Position (m)
1
0.5
0
−0.5
−1
0.1
0.05
−0.05
−0.1
0
0.2
0.4
0.6
0.8
1
1.2
1.4

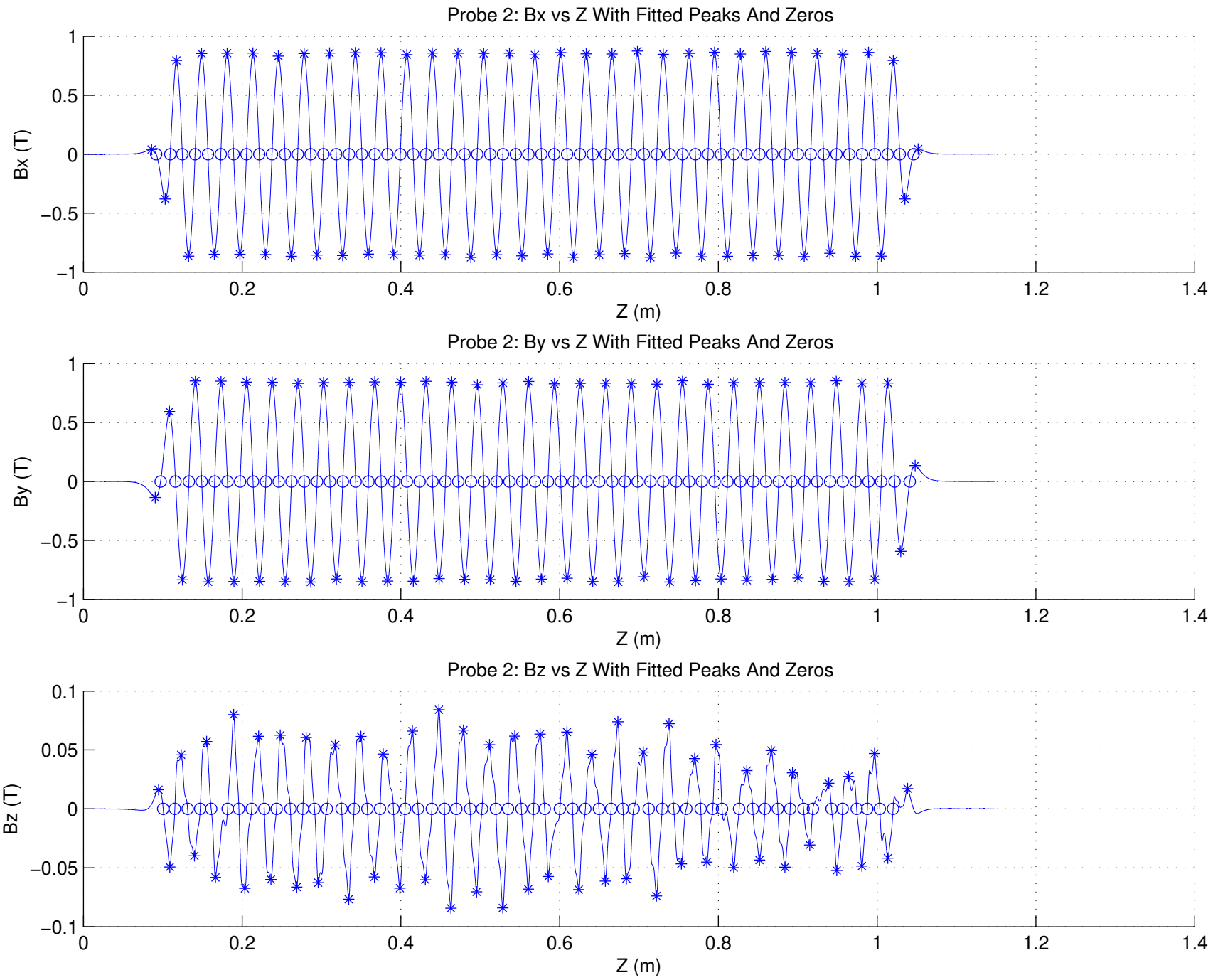

Probe 1: Bx, By, Bz vs Z
Bx (T)
By (T)
Bz (T)
Z Position (m)
1
0.5
0
−0.5
−1
0.2
0.1
−0.1
−0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4

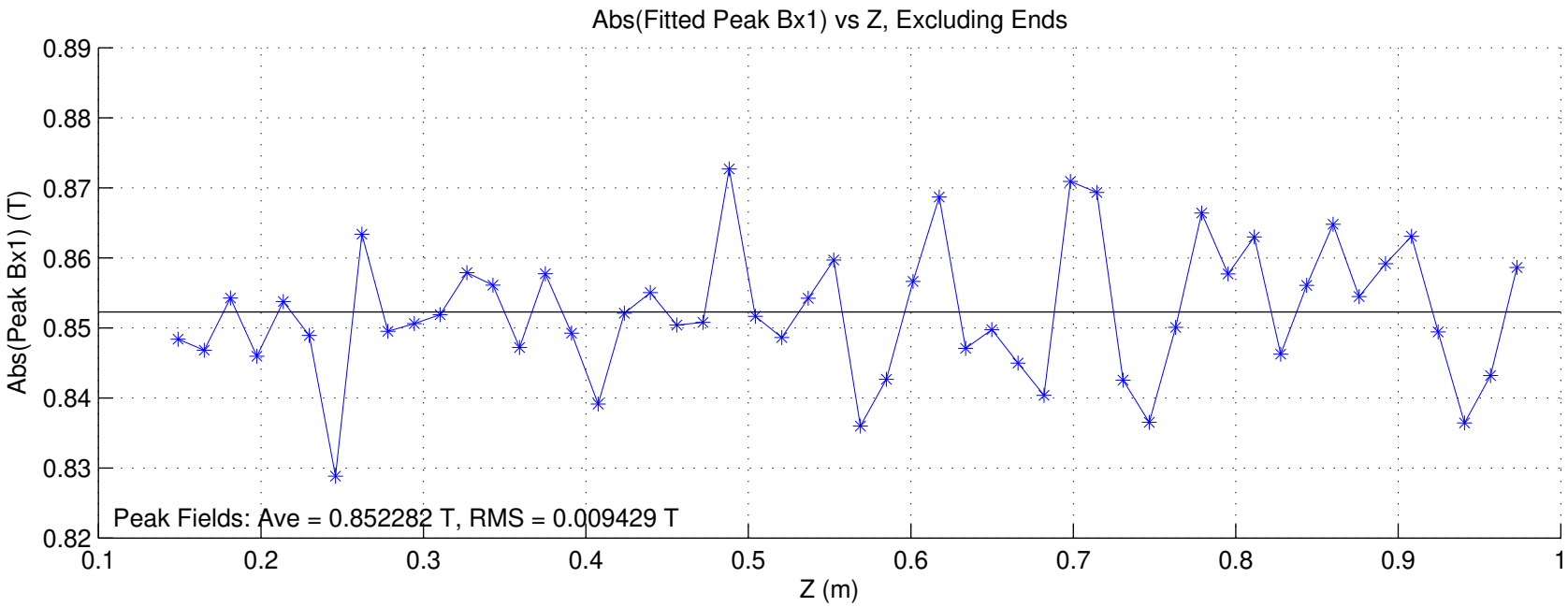

Probe 2: Bx, By, Bz vs Z
Bx (T)
By (T)
Bz (T)
Z Position (m)
1
0.5
0
−0.5
−1
0.1
0.05
−0.05
−0.1
0
0.2
0.4
0.6
0.8
1
1.2
1.4

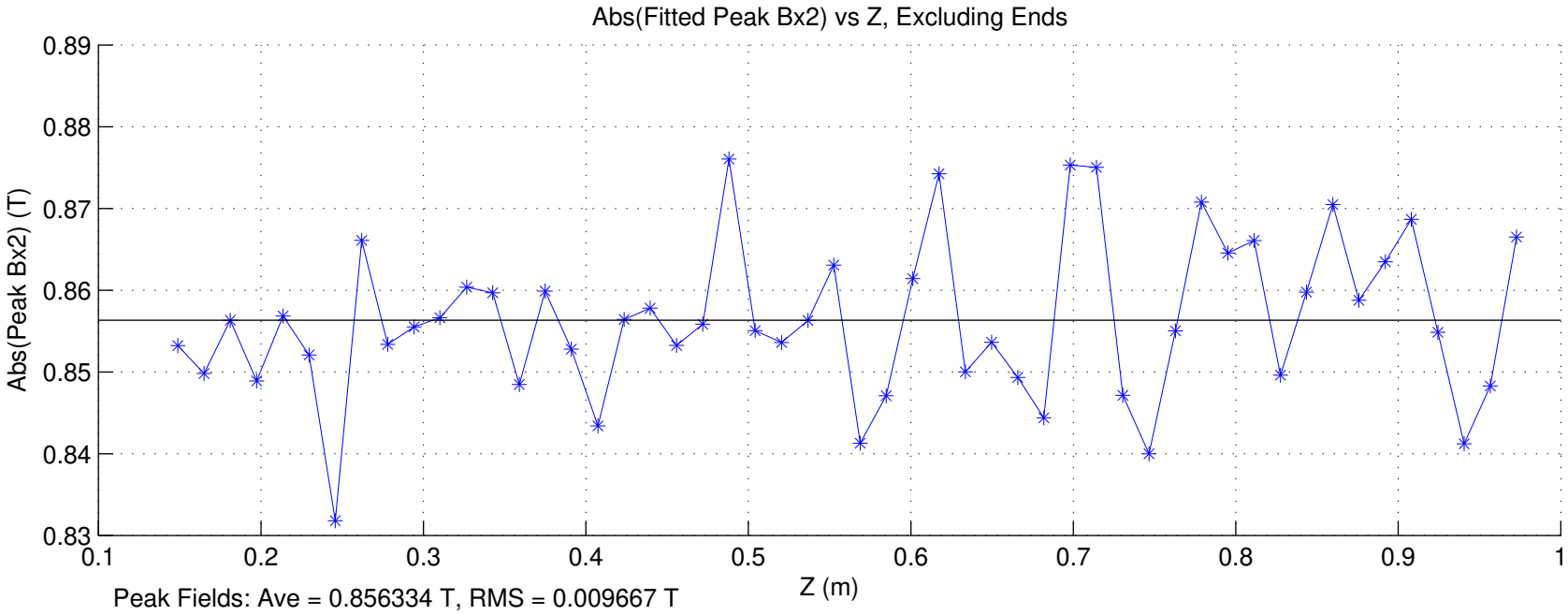

Probe 1: Bx vs Z With Fitted Peaks And Zeros
Bx (T)
Z (m)
1
0.5
0
−0.5
−1
0
0.2
0.4
0.6
0.8
1
1.2
1.4

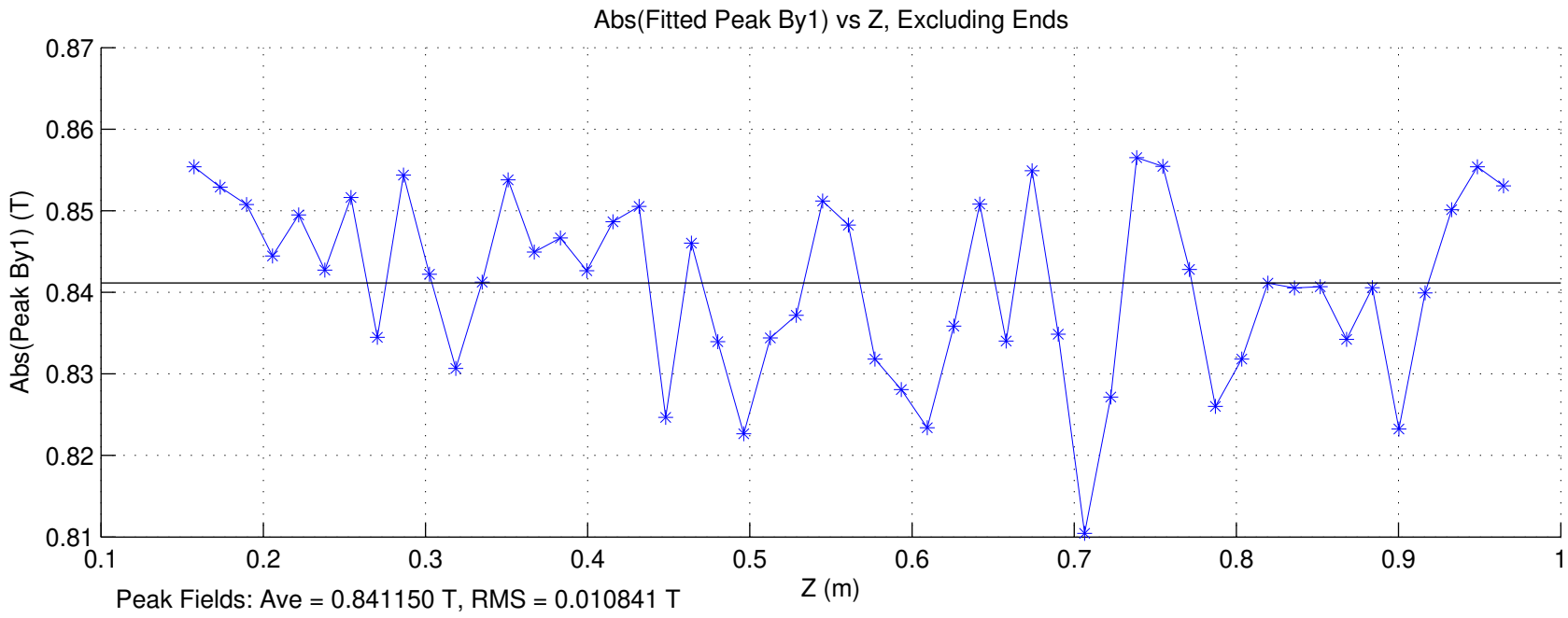

Probe 1: By vs Z With Fitted Peaks And Zeros
By (T)
Z (m)
1
0.5
0
−0.5
−1
0
0.2
0.4
0.6
0.8
1
1.2
1.4

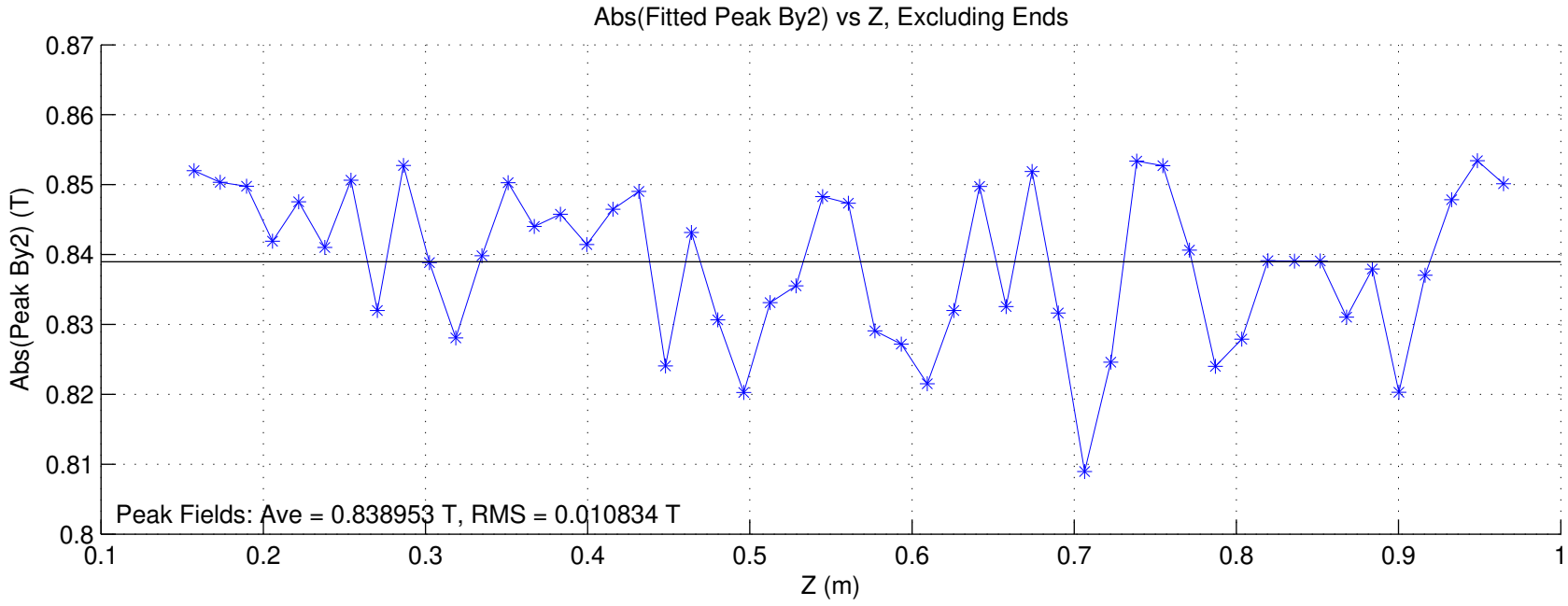

Probe 1: Bz vs Z With Fitted Peaks And Zeros
Bz (T)
Z (m)
0.2
0.1
0
−0.1
−0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4

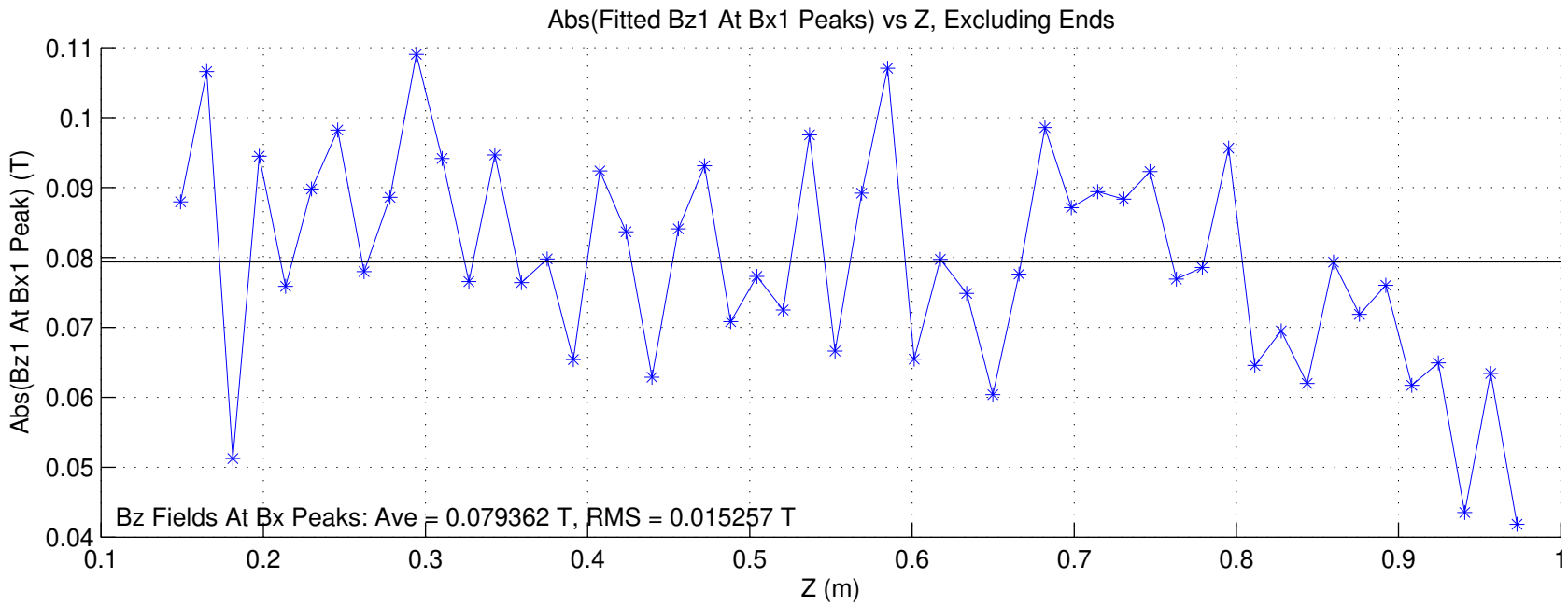

Probe 2: Bx vs Z With Fitted Peaks And Zeros
Bx (T)
Z (m)
Probe 2: By vs Z With Fitted Peaks And Zeros
By (T)
Z (m)
Probe 2: Bz vs Z With Fitted Peaks And Zeros
Bz (T)
Z (m)

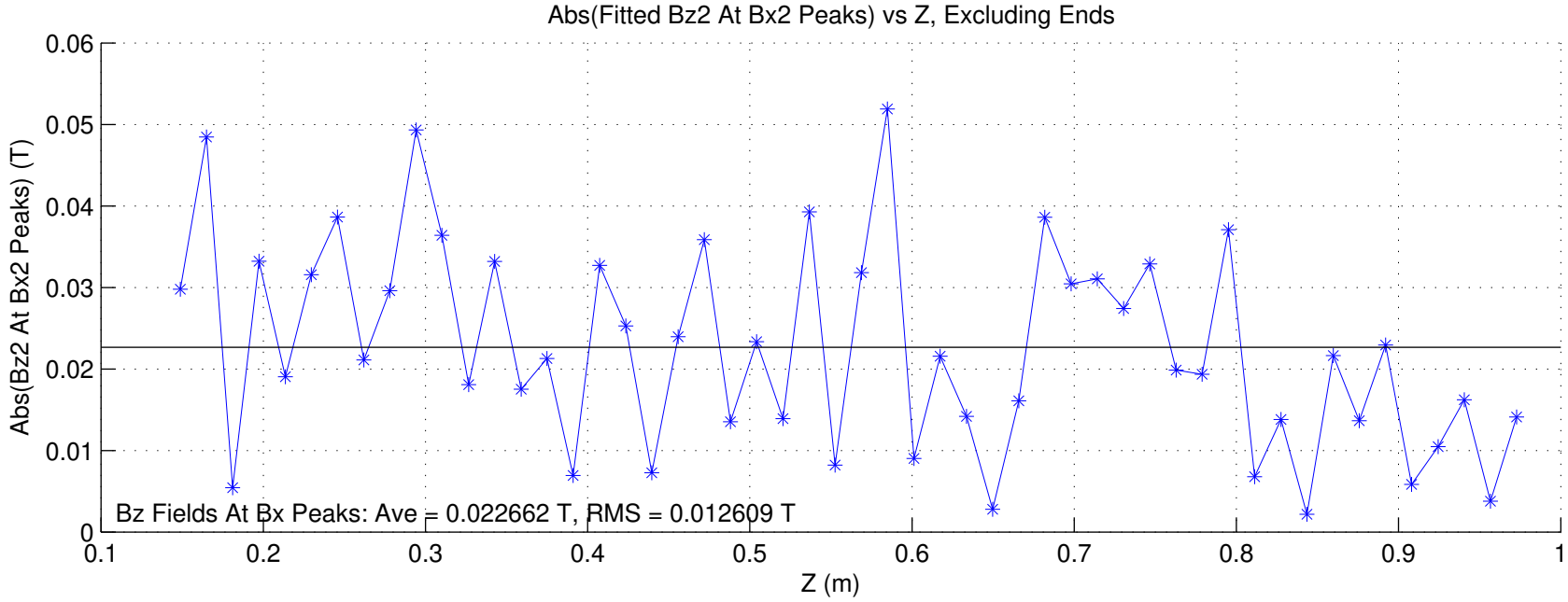

Abs(Fitted Peak Bx1) vs Z, Excluding Ends
Abs(Peak Bx1) (T)
Z (m)
Peak Fields: Ave = 0.852282 T, RMS = 0.009429 T
0.89
0.88
0.87
0.86
0.85
0.84
0.83
0.82
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

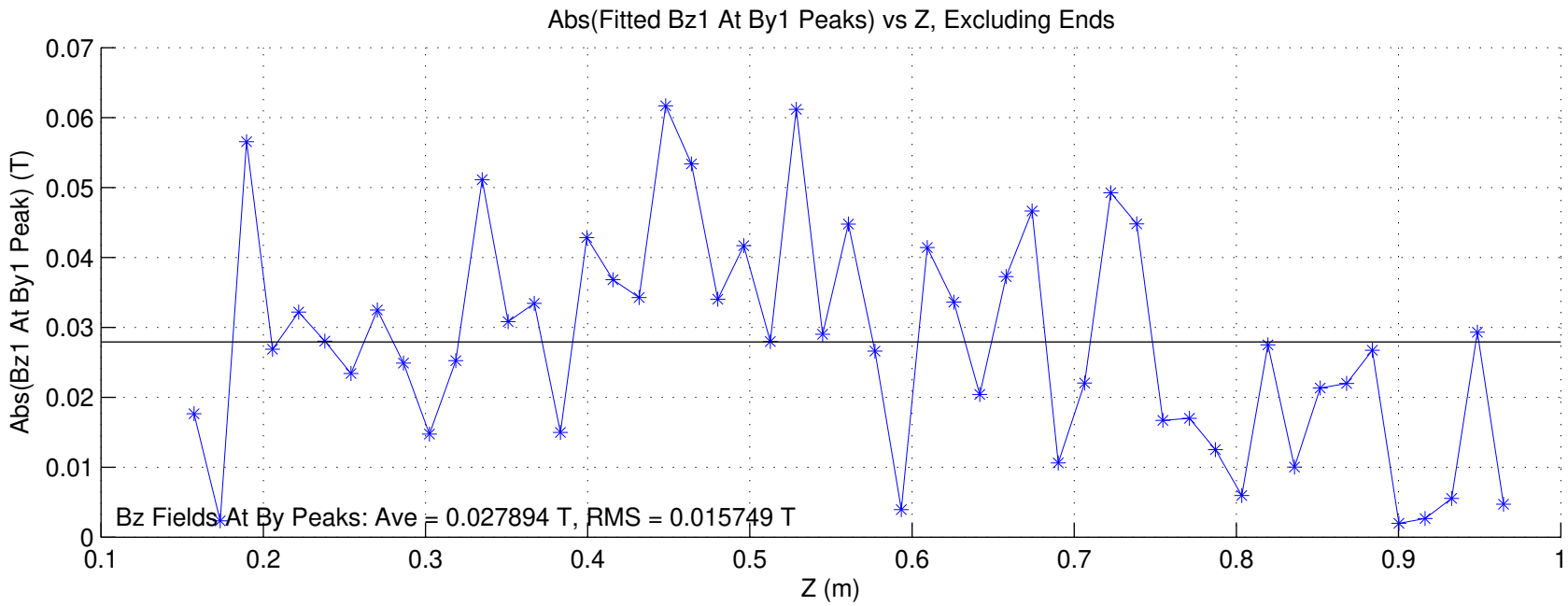

Abs(Fitted Peak Bx2) vs Z, Excluding Ends
Abs(Peak Bx2) (T)
Z (m)
Peak Fields: Ave = 0.856334 T, RMS = 0.009667 T
0.89
0.88
0.87
0.86
0.85
0.84
0.83
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

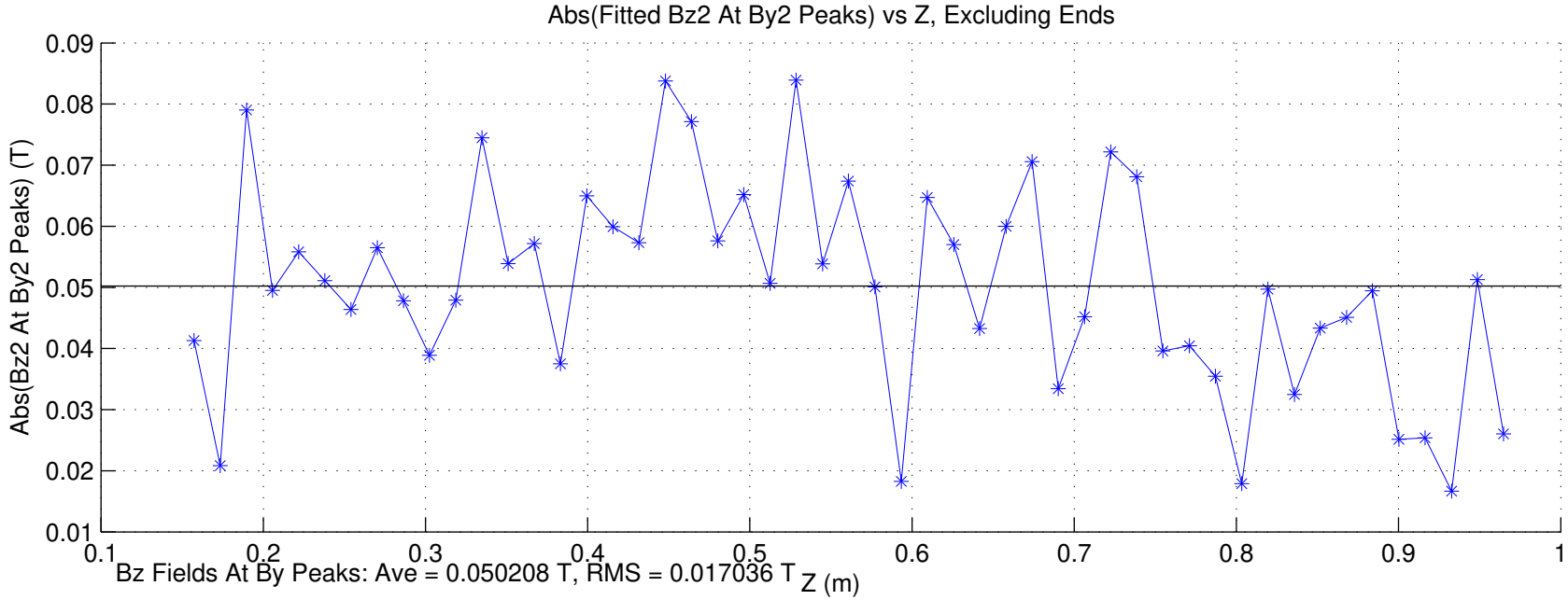

Abs(Fitted Peak By1) vs Z, Excluding Ends
Abs(Peak By1) (T)
0.87
0.86
0.85
0.84
0.83
0.82
0.81
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Z (m)
Peak Fields: Ave = 0.841150 T, RMS = 0.010841 T

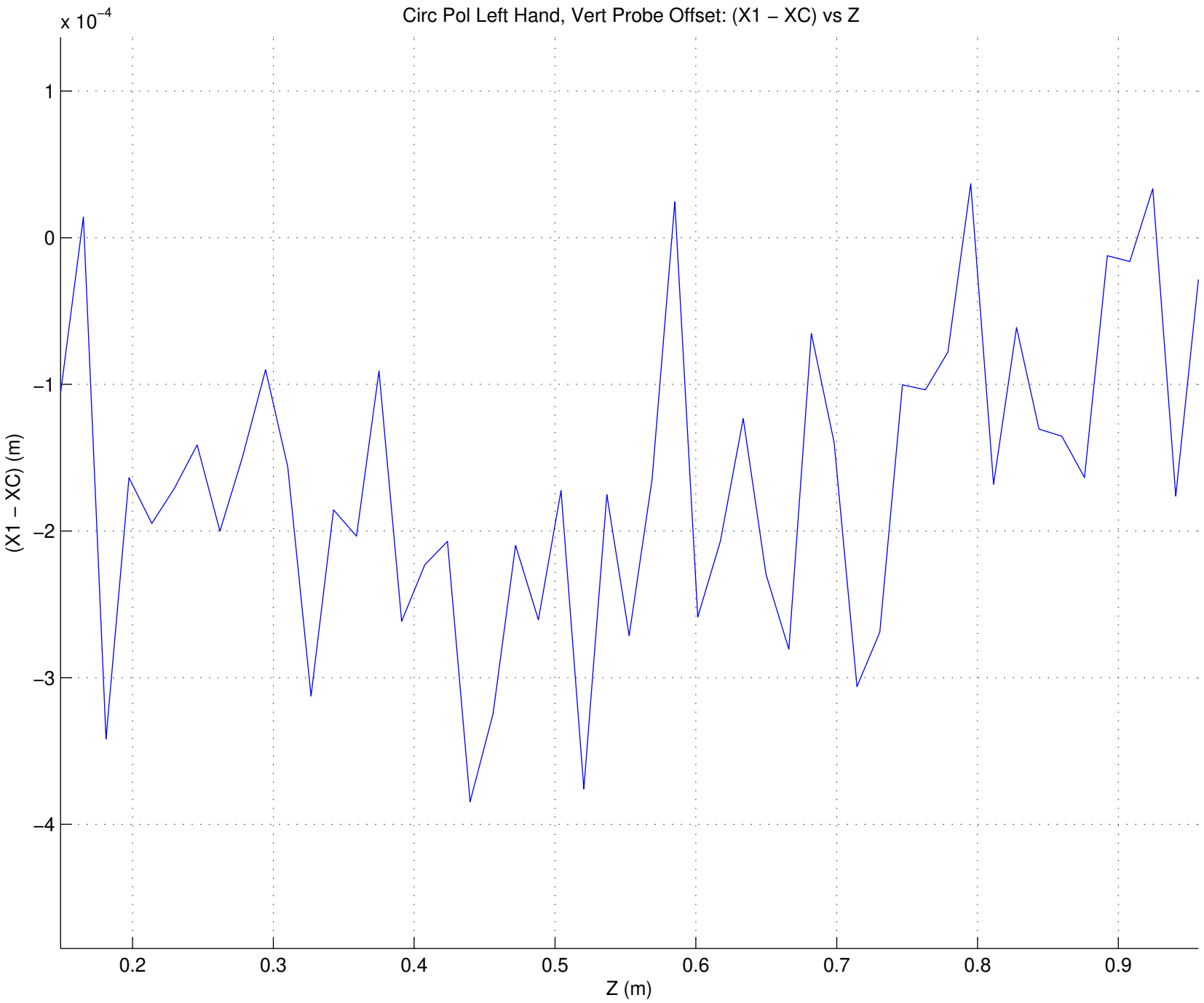

Abs(Fitted Peak By2) vs Z, Excluding Ends
Abs(Peak By2) (T)
0.87
0.86
0.85
0.84
0.83
0.82
0.81
0.8
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Z (m)
Peak Fields: Ave = 0.838953 T, RMS = 0.010834 T

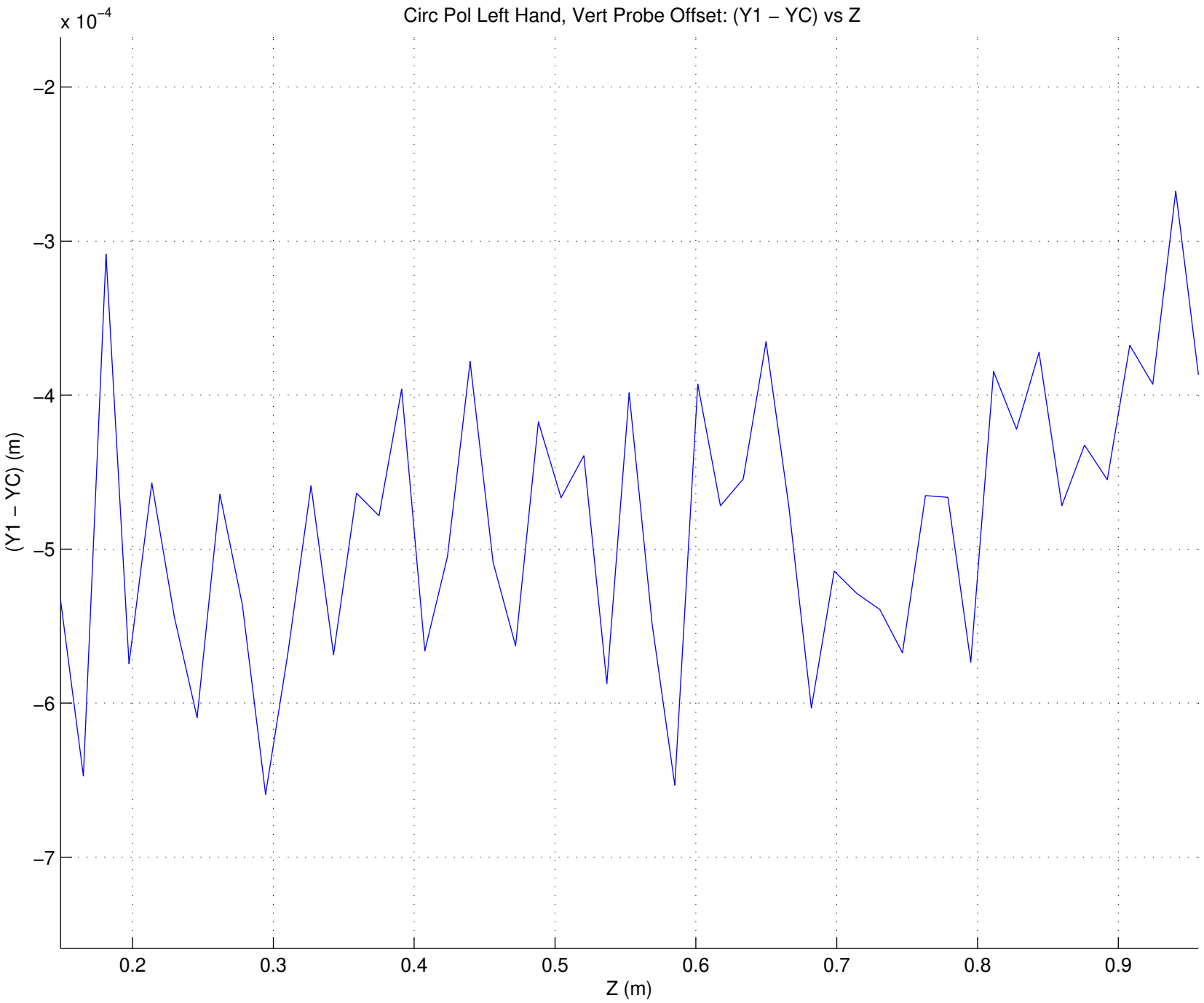

Abs(Fitted Bz1 At Bx1 Peaks) vs Z, Excluding Ends
Abs(Bz1 At Bx1 Peak) (T)
Z (m)
Bz Fields At Bx Peaks: Ave = 0.079362 T, RMS = 0.015257 T
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

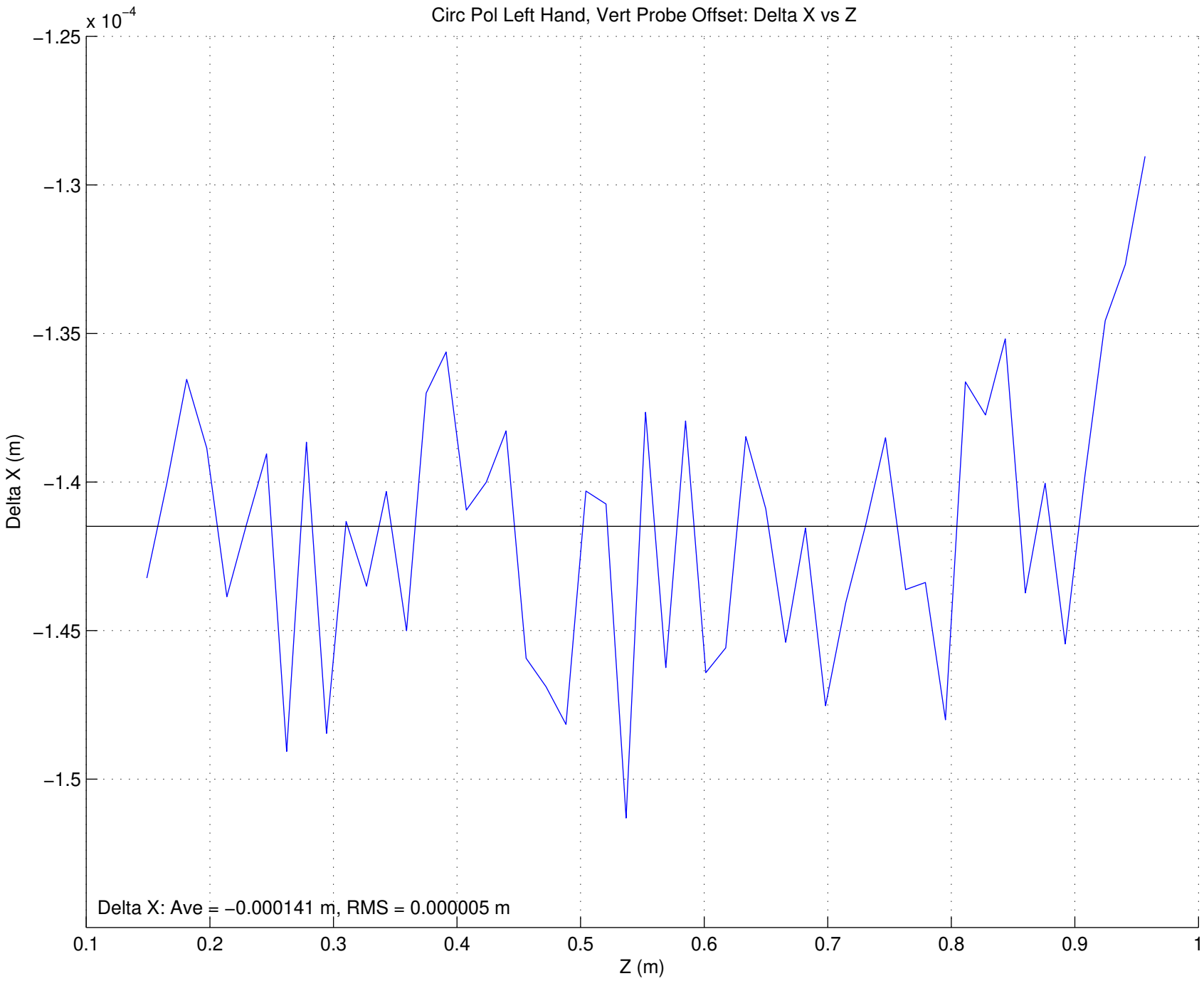

Abs(Fitted Bz2 At Bx2 Peaks) vs Z, Excluding Ends
Abs(Bz2 At Bx2 Peaks) (T)
Z (m)
Bz Fields At Bx Peaks: Ave = 0.022662 T, RMS = 0.012609 T
0.06
0.05
0.04
0.03
0.02
0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

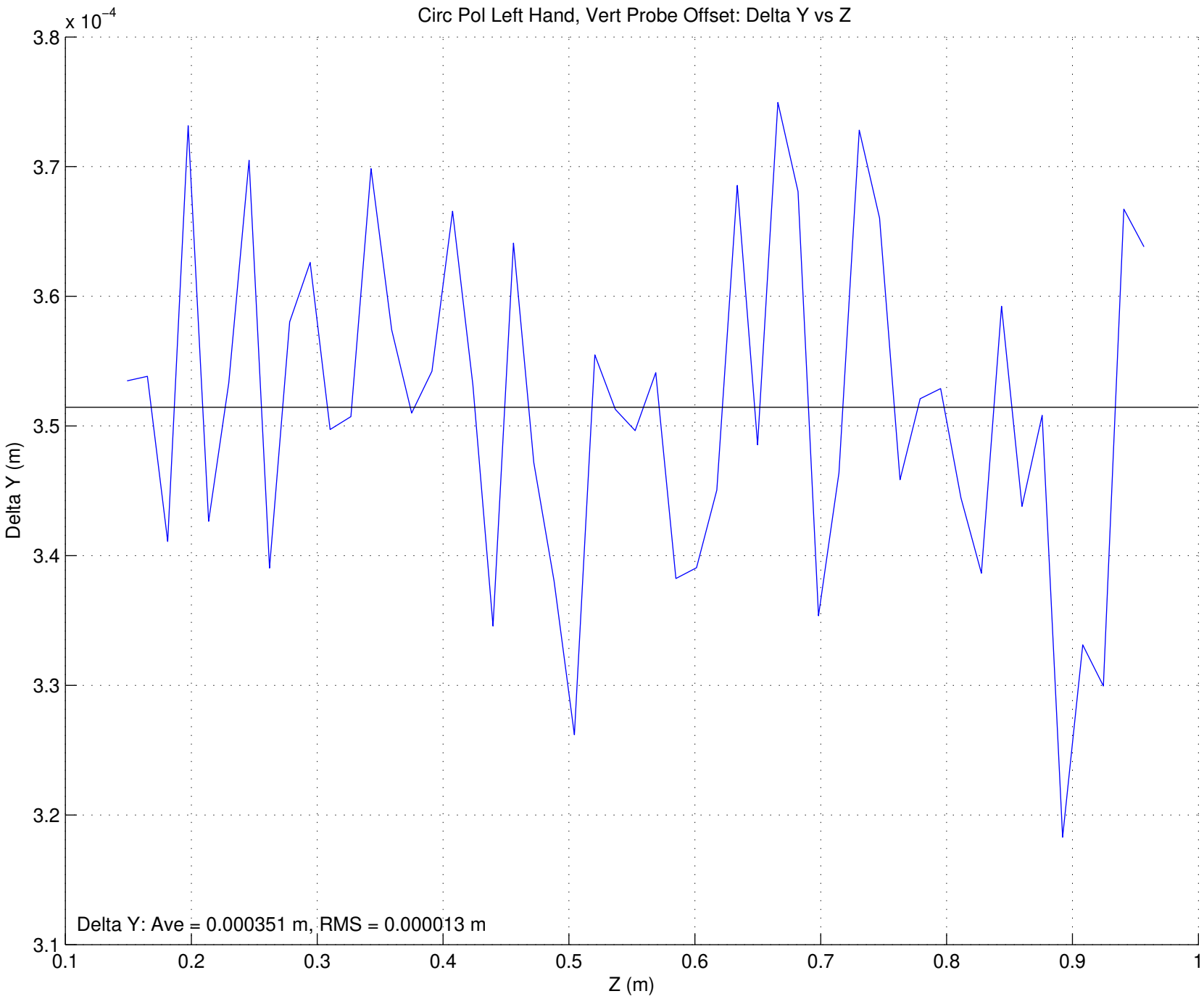

Abs(Fitted Bz1 At By1 Peaks) vs Z, Excluding Ends
Abs(Bz1 At By1 Peak) (T)
Z (m)
Bz Fields At By Peaks: Ave = 0.027894 T, RMS = 0.015749 T
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

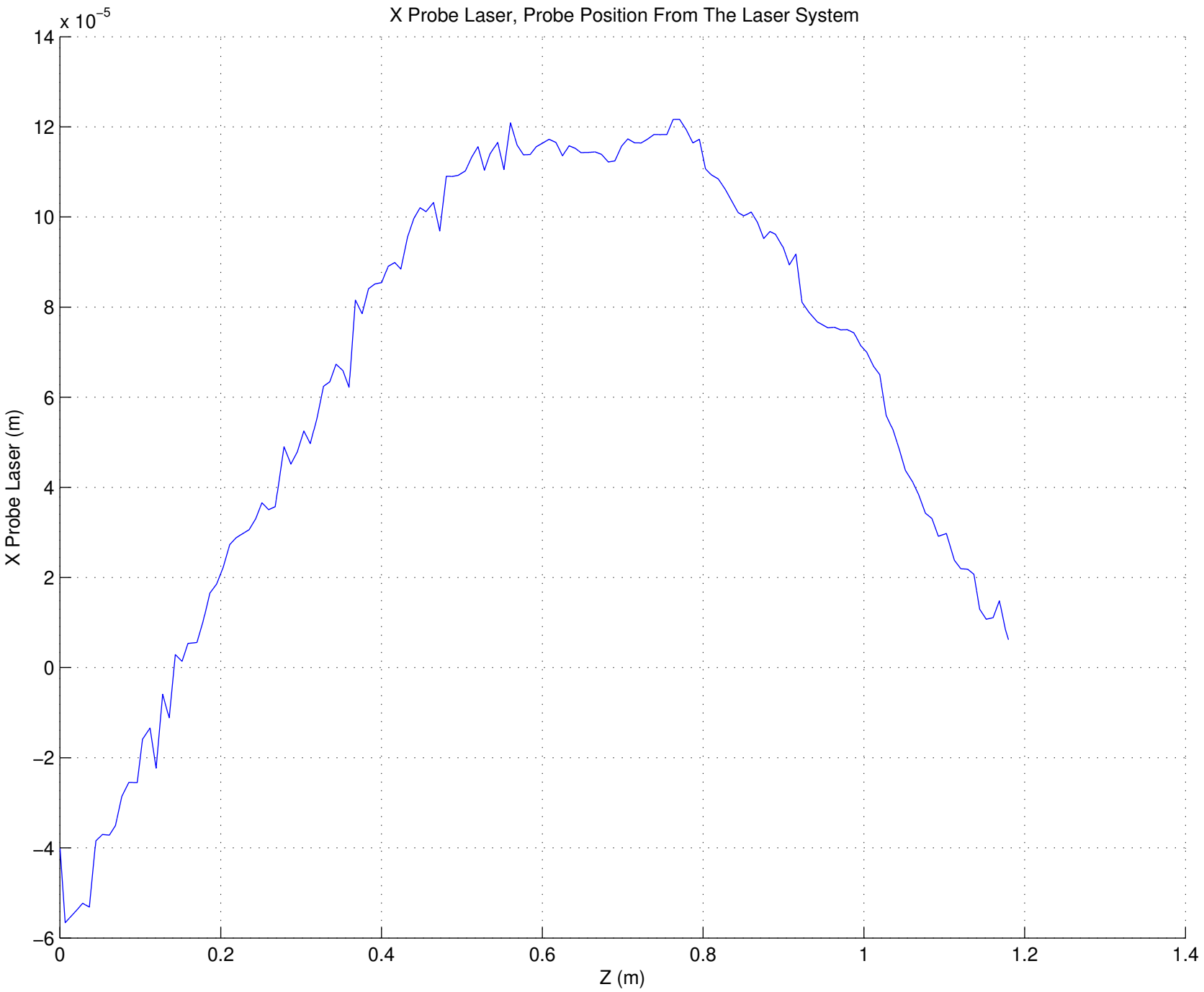

Abs(Fitted Bz2 At By2 Peaks) vs Z, Excluding Ends
Abs(Bz2 At By2 Peaks) (T)
Z (m)
Bz Fields At By Peaks: Ave = 0.050208 T, RMS = 0.017036 T
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

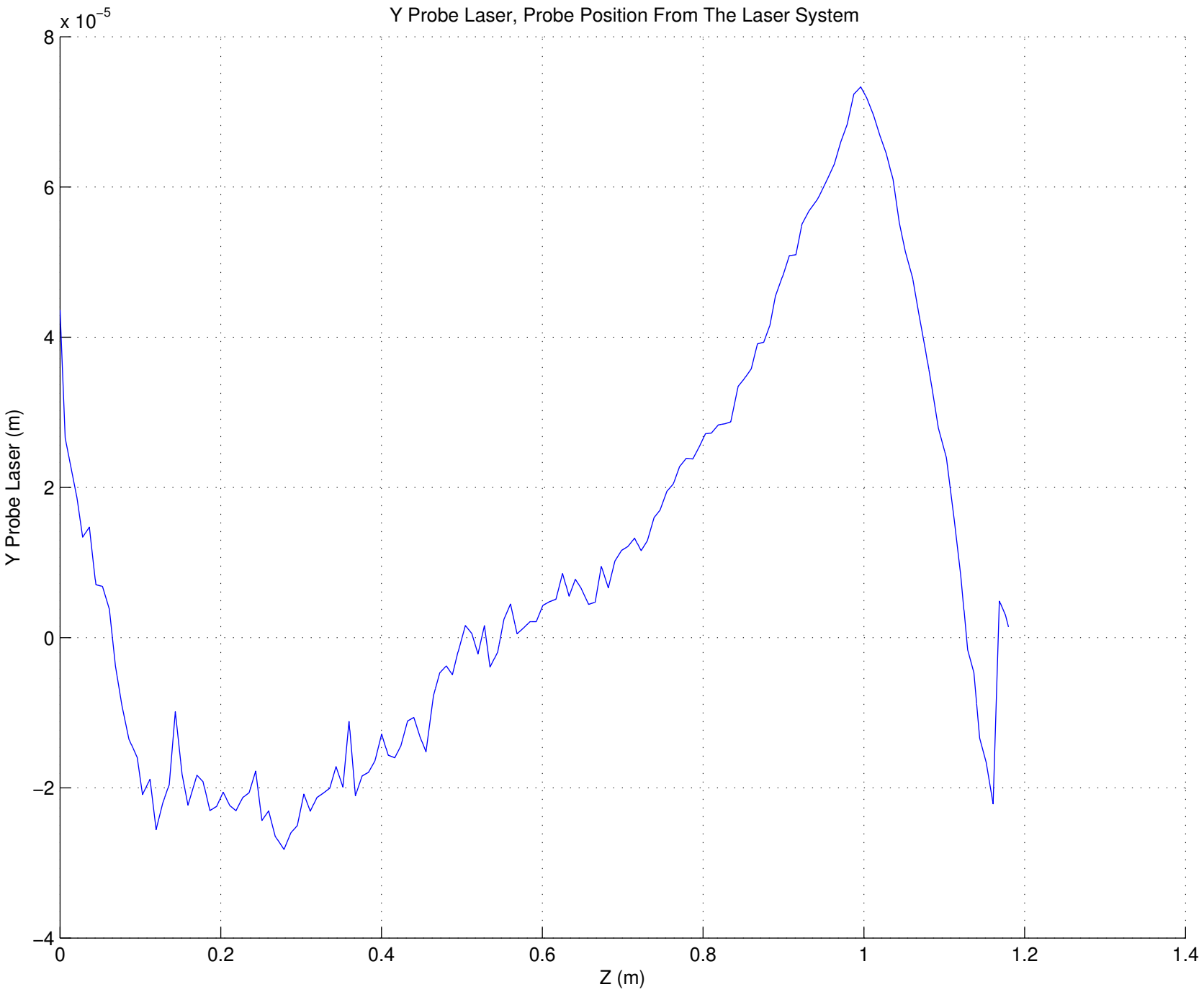

Circ Pol Left Hand, Vert Probe Offset: (X1 – XC) vs Z
x 10^-4
1
0
–1
–2
–3
–4
(X1 – XC) (m)
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Z (m)

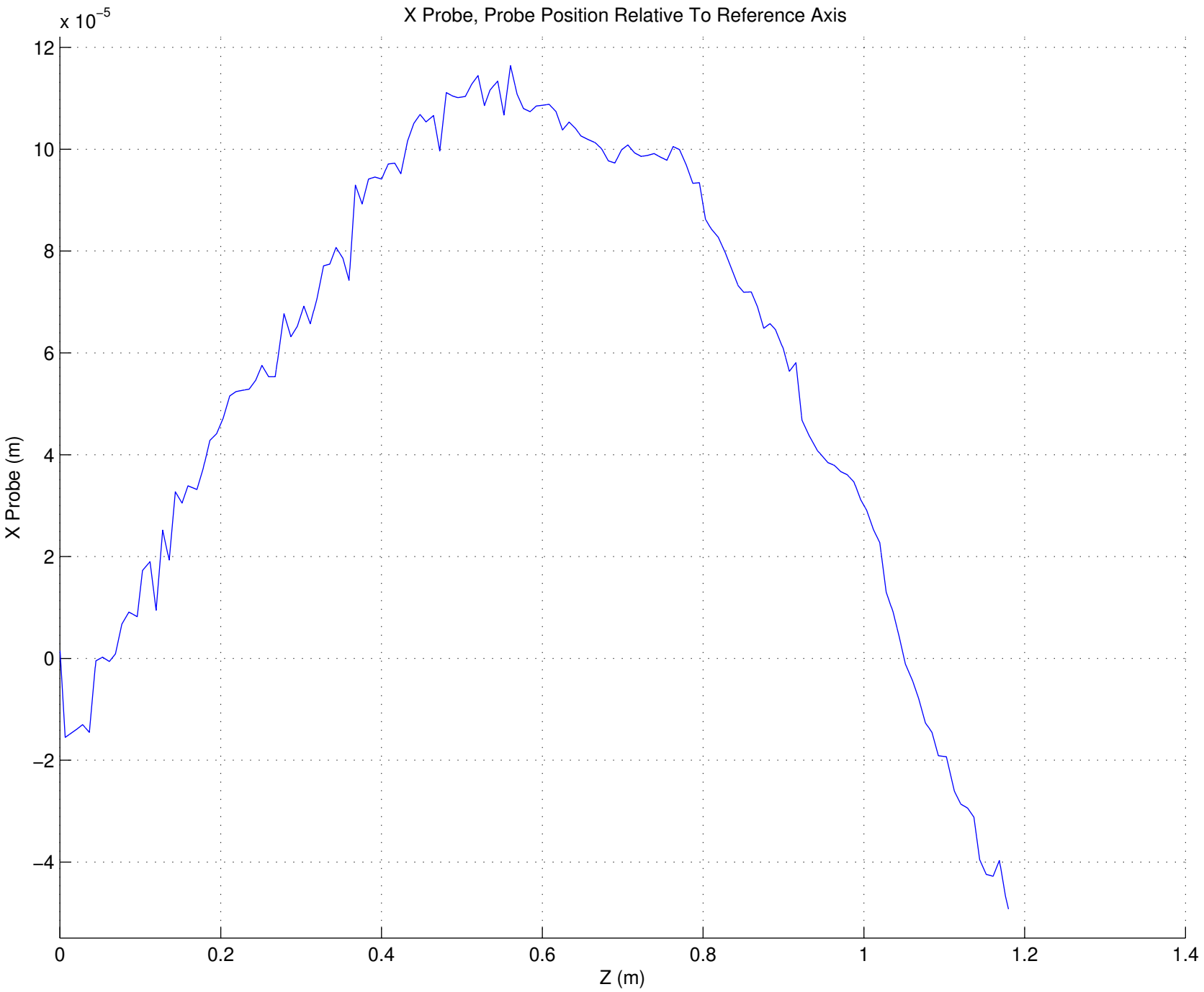

Circ Pol Left Hand, Vert Probe Offset: (Y1 – YC) vs Z
x 10^-4
−2
−3
−4
−5
−6
−7
(Y1 – YC) (m)
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Z (m)

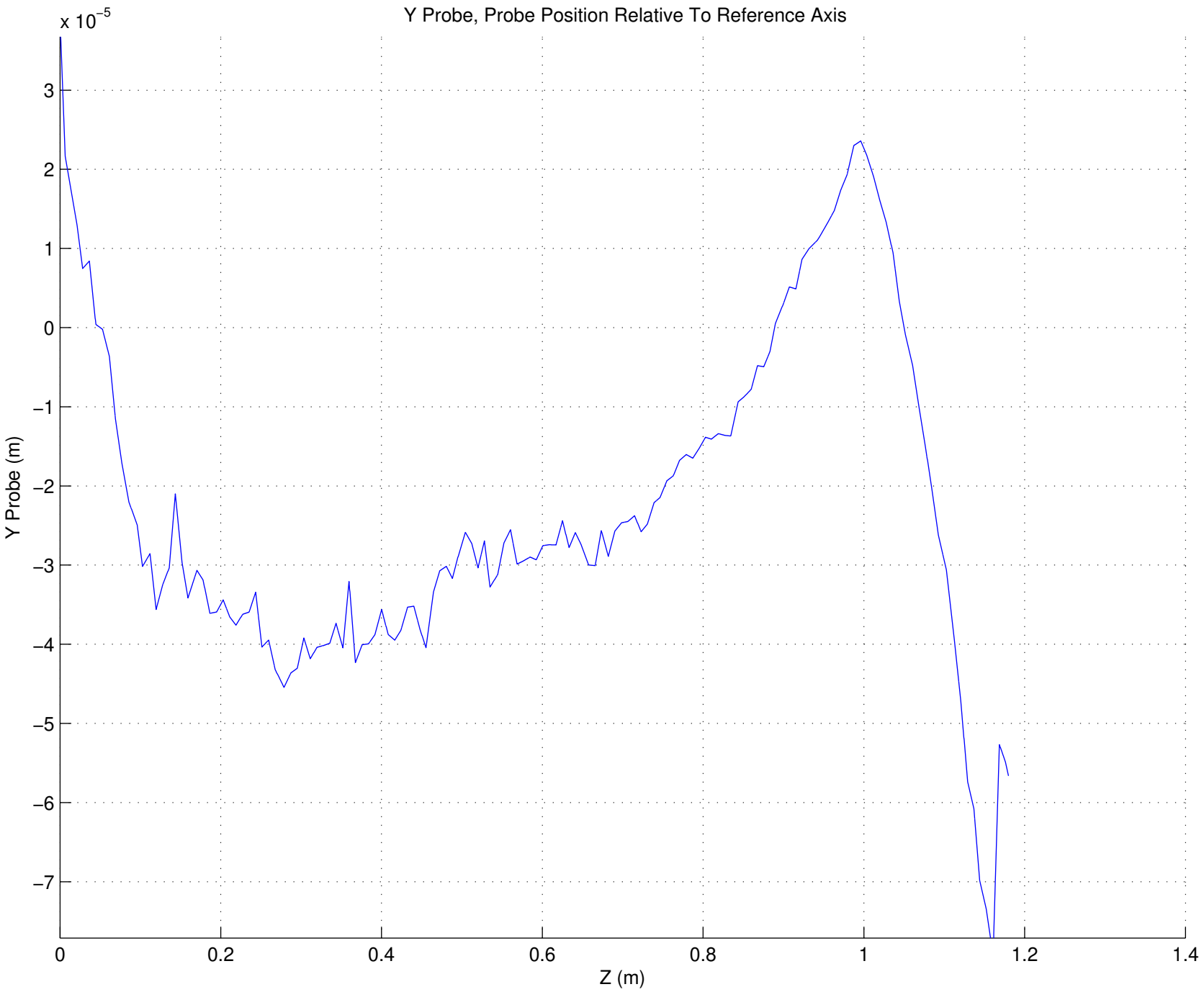

Circ Pol Left Hand, Vert Probe Offset: Delta X vs Z
x 10^-4
−1.25
−1.3
−1.35
−1.4
−1.45
−1.5
Delta X (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Z (m)
Delta X: Ave = −0.000141 m, RMS = 0.000005 m

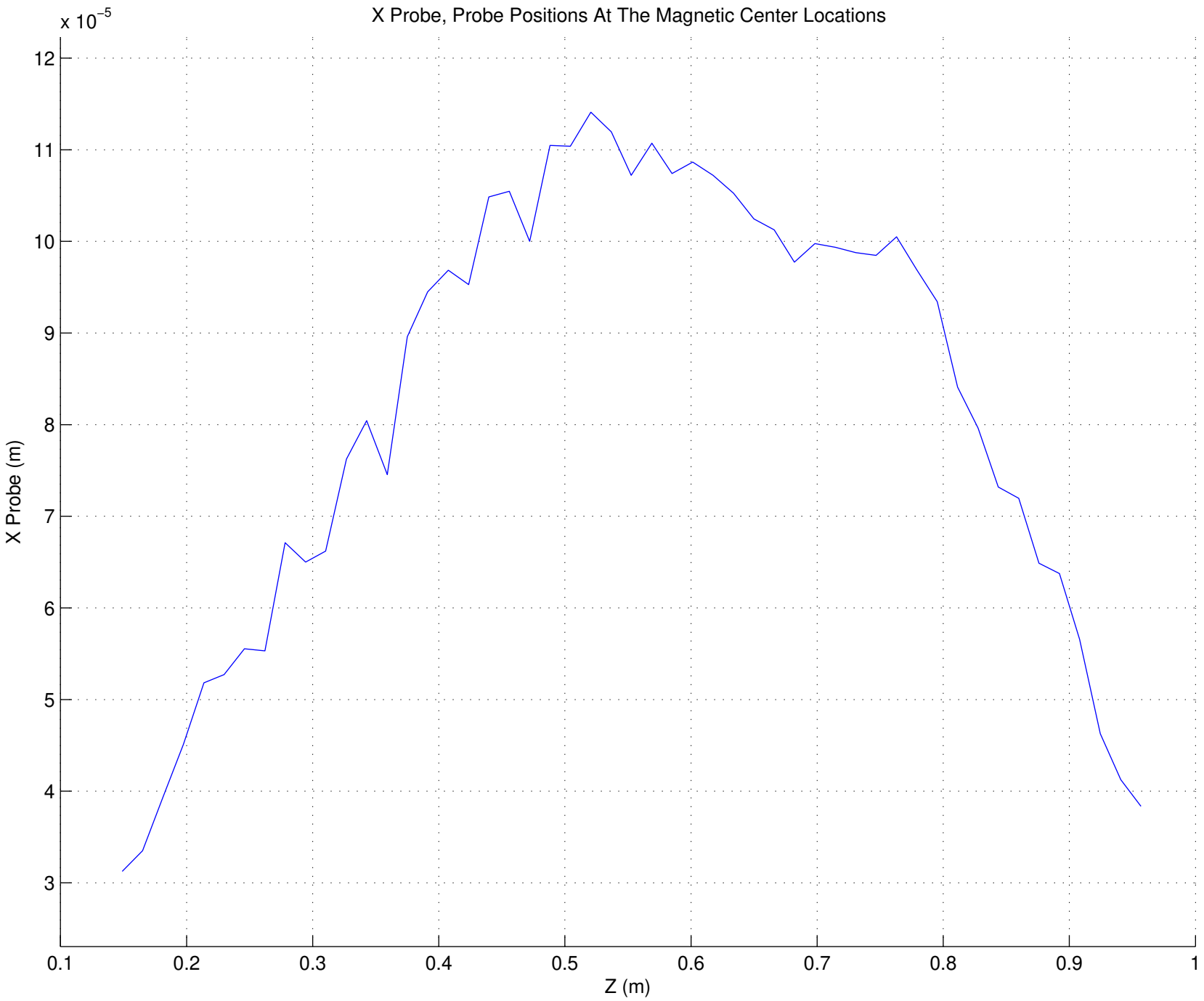

Circ Pol Left Hand, Vert Probe Offset: Delta Y vs Z
x 10^-4
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
Delta Y (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Z (m)
Delta Y: Ave = 0.000351 m, RMS = 0.000013 m

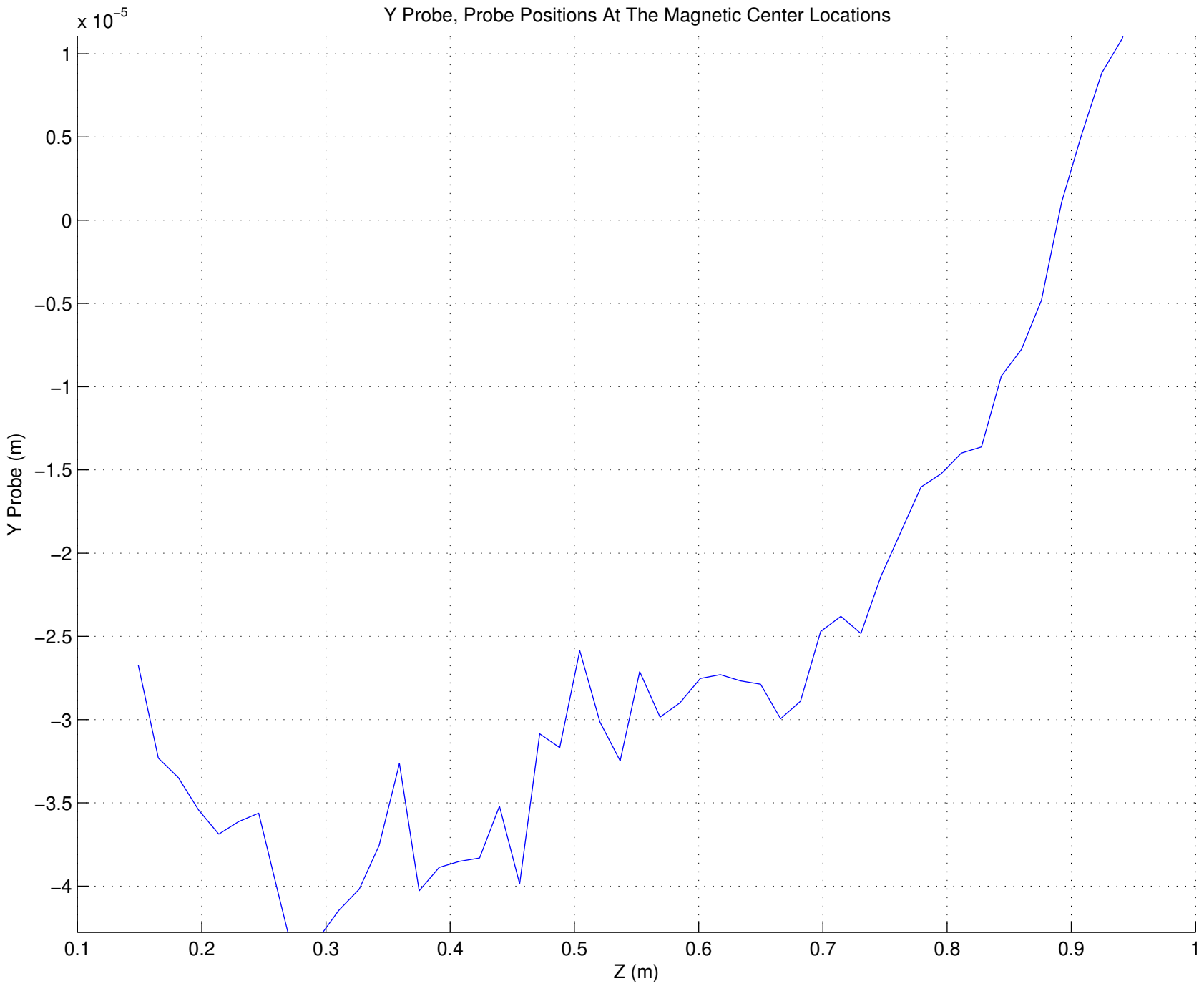

X Probe Laser, Probe Position From The Laser System
x 10^-5
14
12
10
8
6
4
2
0
−2
−4
−6
X Probe Laser (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

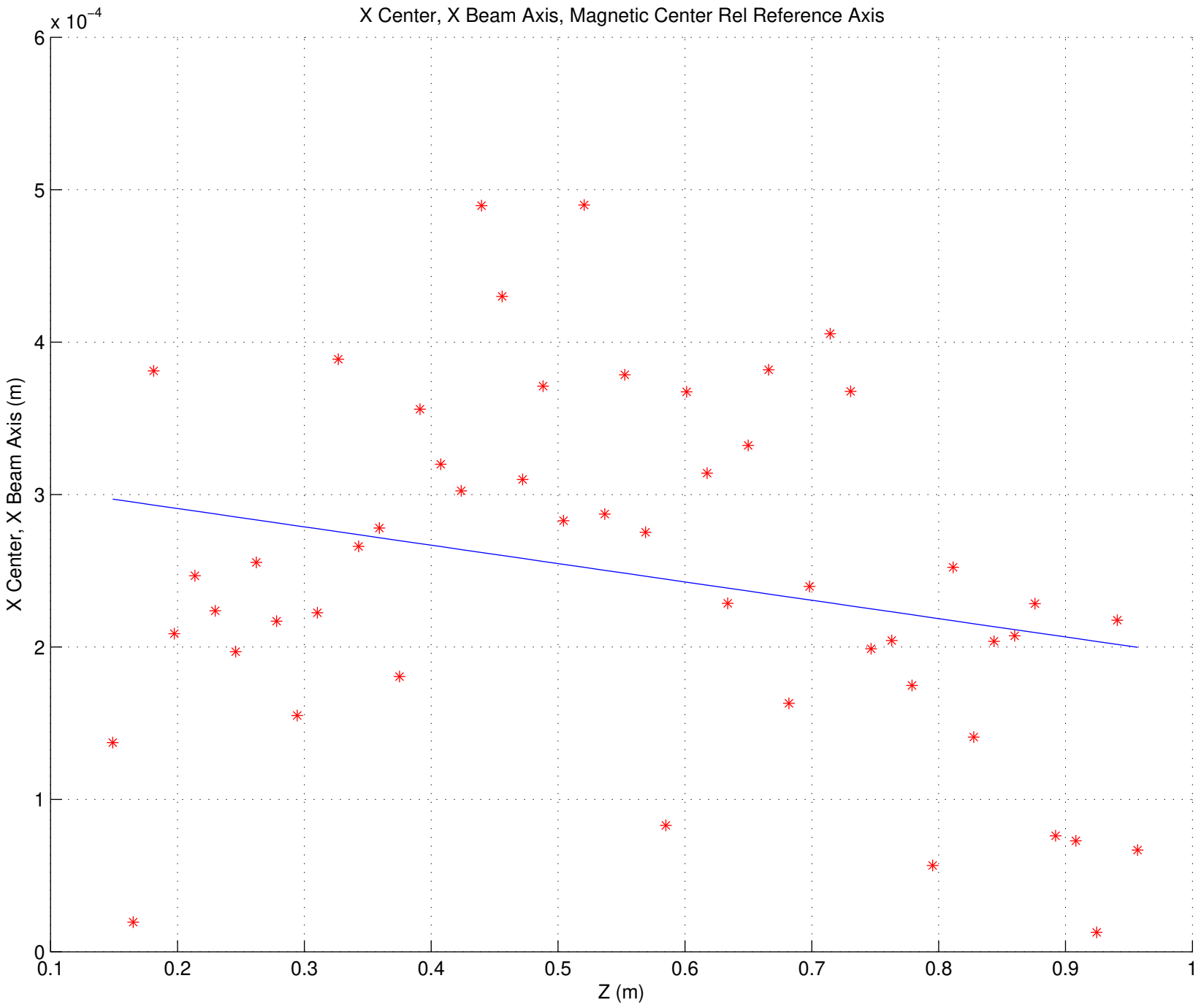

Y Probe Laser, Probe Position From The Laser System
x 10^-5
8
6
4
2
0
−2
−4
Y Probe Laser (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

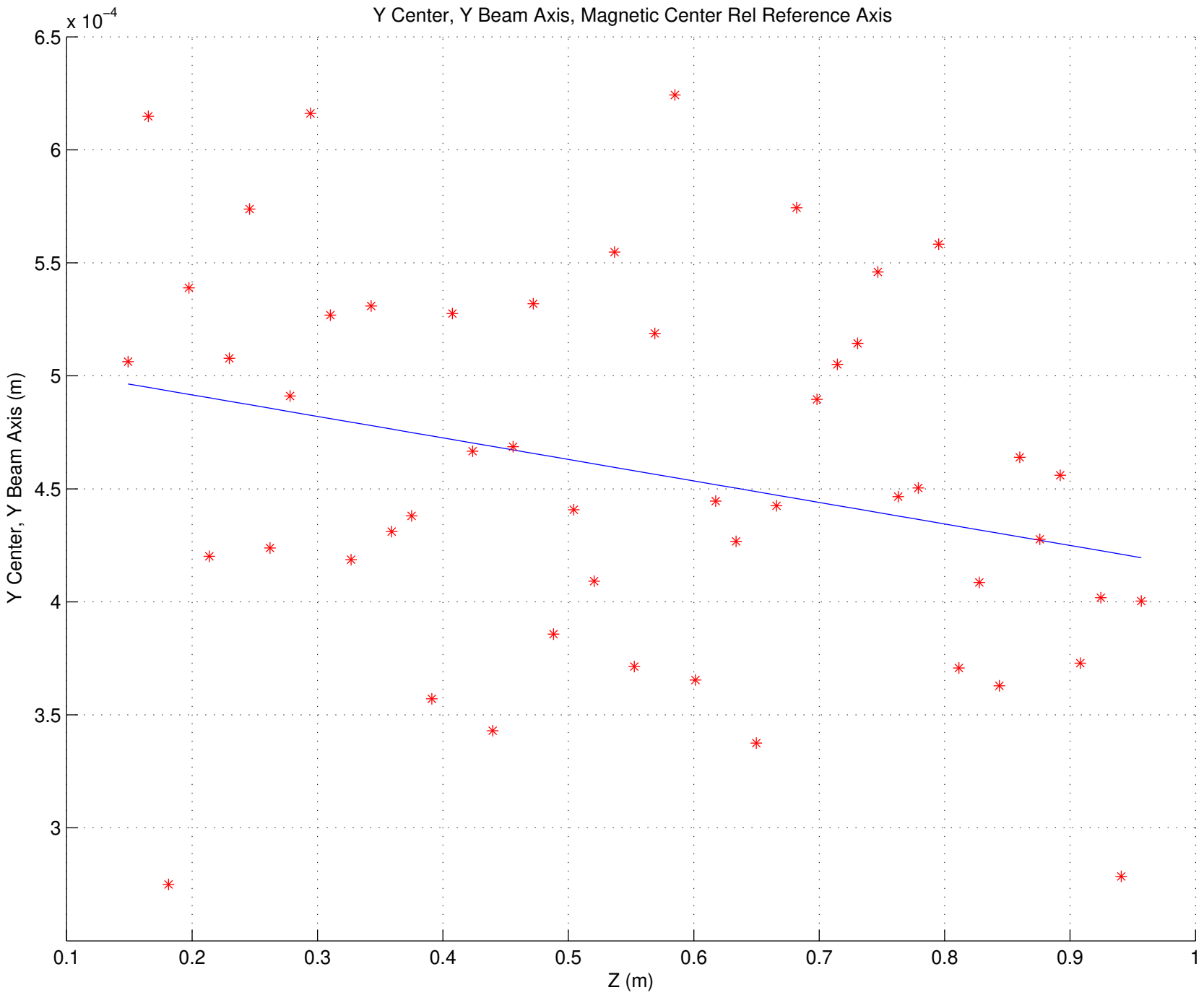

X Probe, Probe Position Relative To Reference Axis
x 10^-5
12
10
8
6
4
2
0
−2
−4
X Probe (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Z (m)

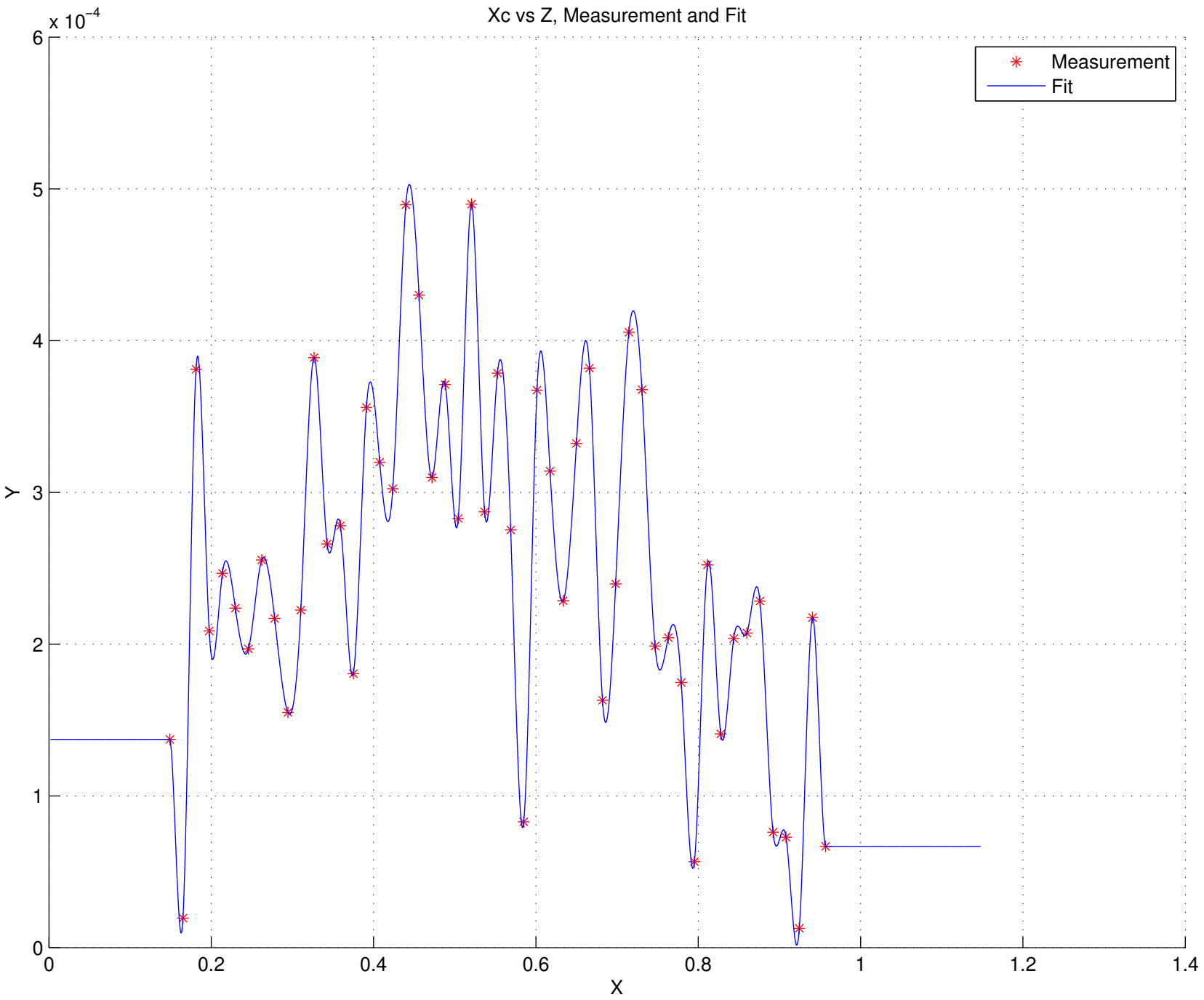

Y Probe, Probe Position Relative To Reference Axis
x 10^-5
Y Probe (m)
Z (m)
3
2
1
0
−1
−2
−3
−4
−5
−6
−7
0
0.2
0.4
0.6
0.8
1
1.2
1.4

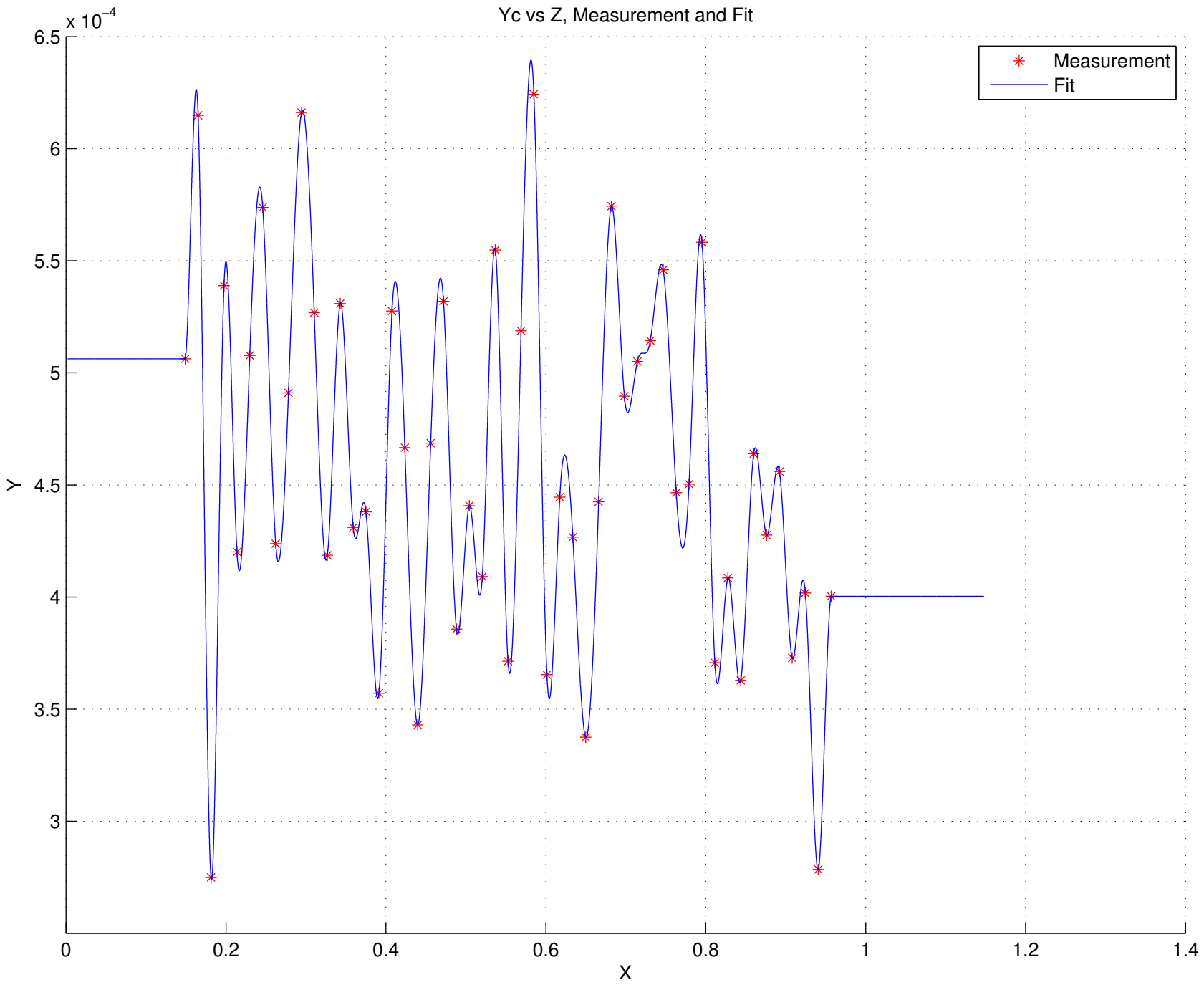

X Probe, Probe Positions At The Magnetic Center Locations
x 10^-5
12
11
10
9
8
7
6
5
4
3
X Probe (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Z (m)

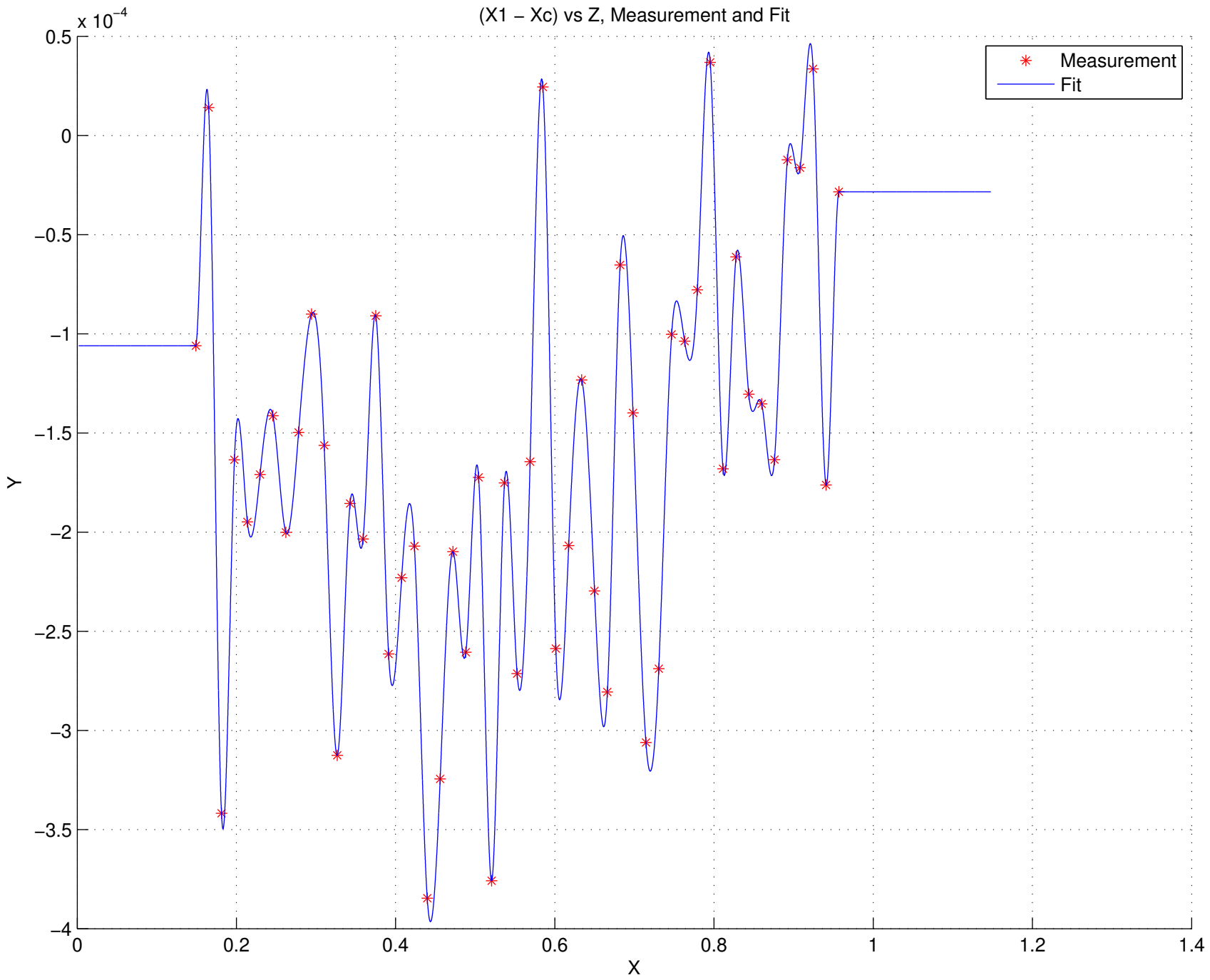

Y Probe, Probe Positions At The Magnetic Center Locations
x 10^-5
Y Probe (m)
Z (m)
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
−3
−3.5
−4
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

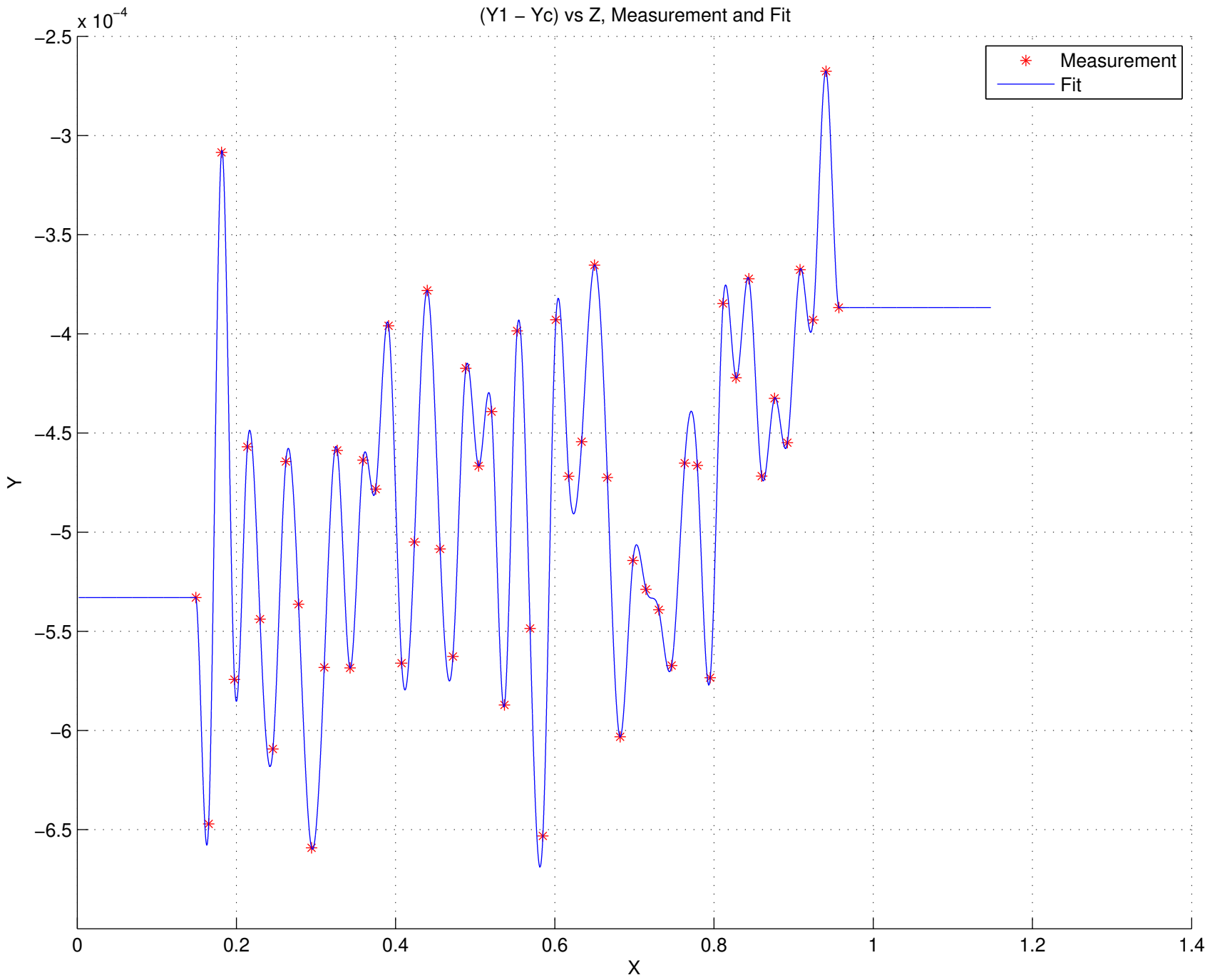

X Center, X Beam Axis, Magnetic Center Rel Reference Axis
x 10^-4
X Center, X Beam Axis (m)
Z (m)
0
1
2
3
4
5
6
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

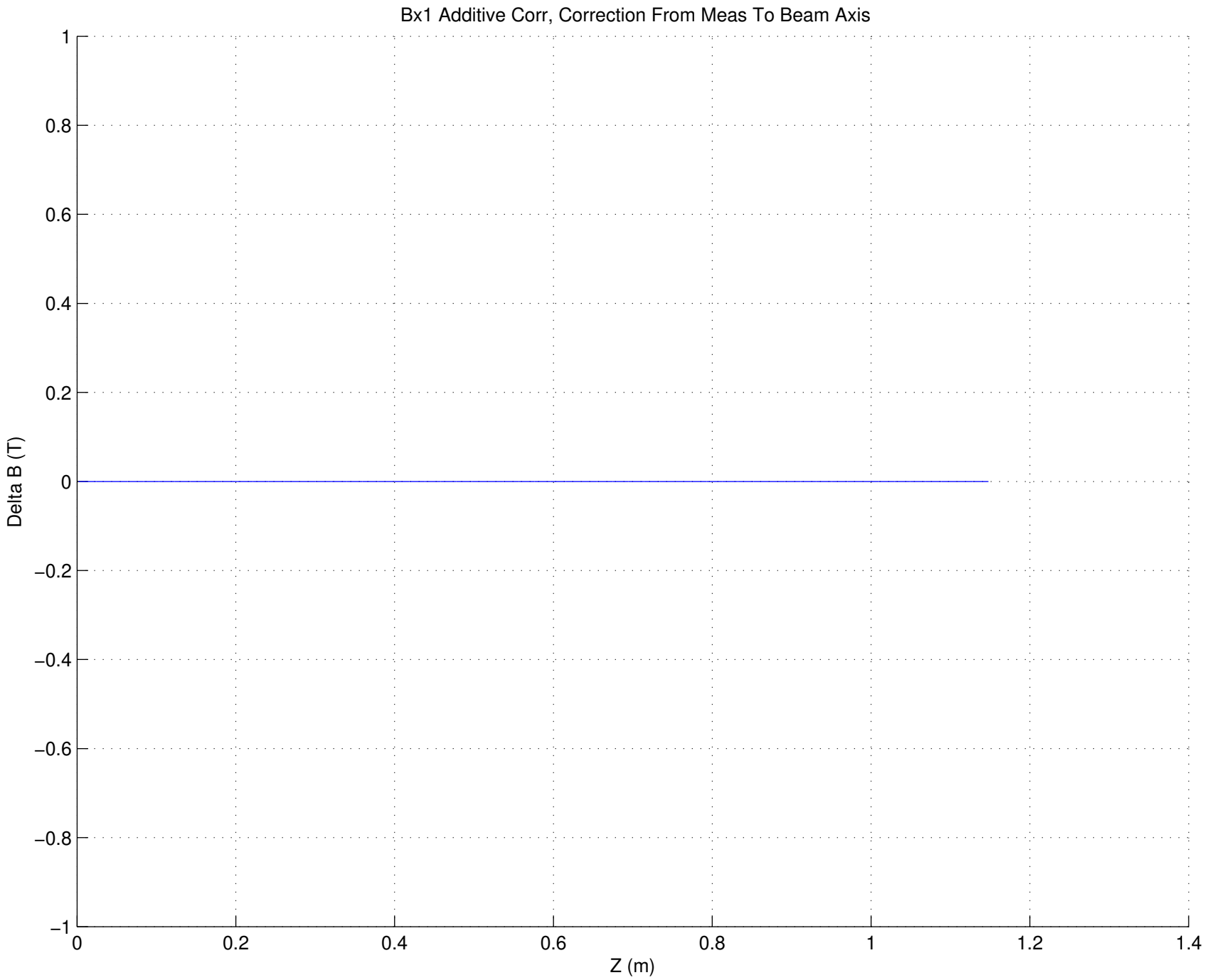

Y Center, Y Beam Axis, Magnetic Center Rel Reference Axis
x 10^-4
6.5
6
5.5
5
4.5
4
3.5
3
Y Center, Y Beam Axis (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Z (m)

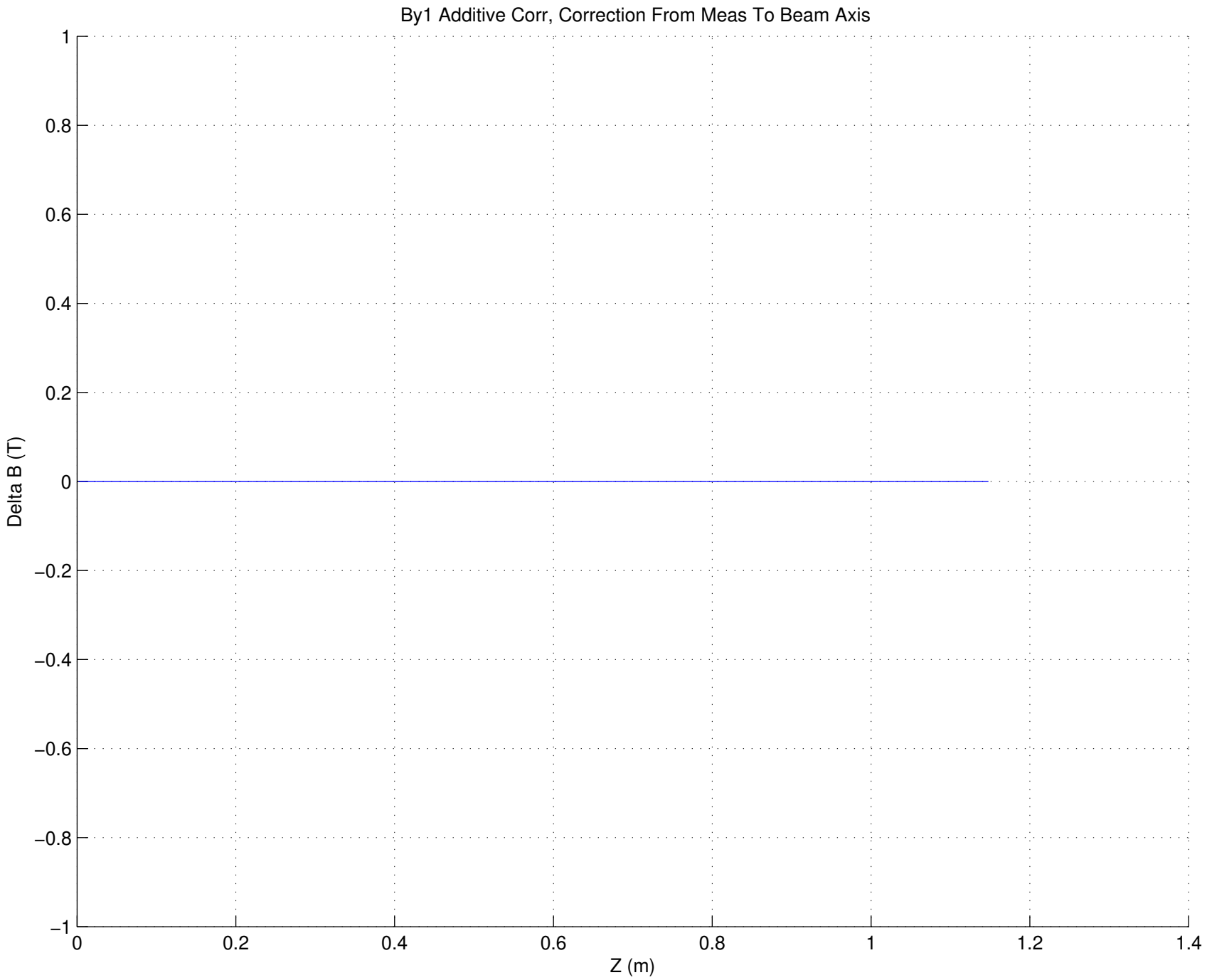

Xc vs Z, Measurement and Fit
x 10^-4
Measurement
Fit
Y
X
0
1
2
3
4
5
6
0
0.2
0.4
0.6
0.8
1
1.2
1.4

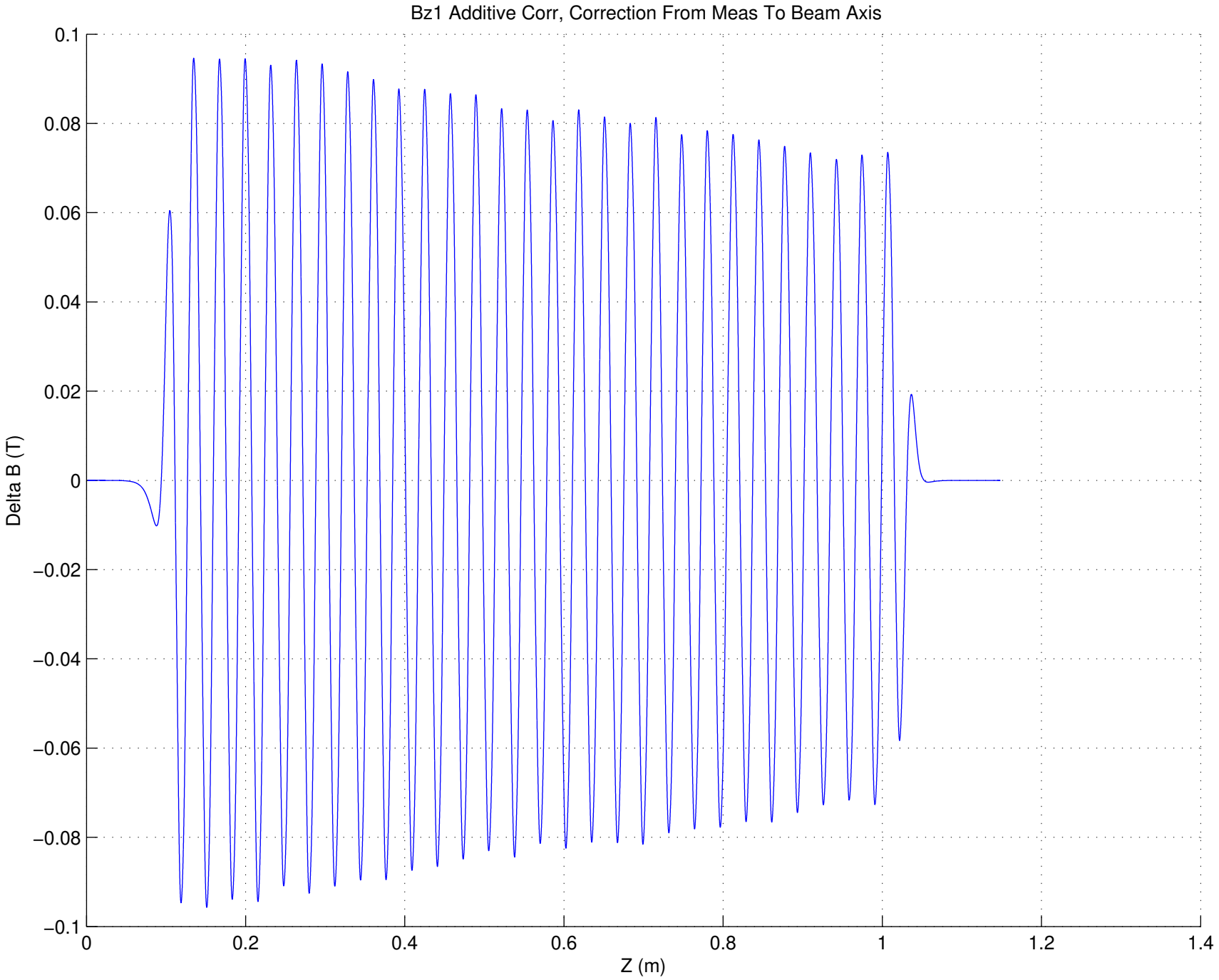

Yc vs Z, Measurement and Fit
x 10^-4
6.5
6
5.5
5
4.5
4
3.5
3
Y
0
0.2
0.4
0.6
0.8
1
1.2
1.4
X
Measurement
Fit

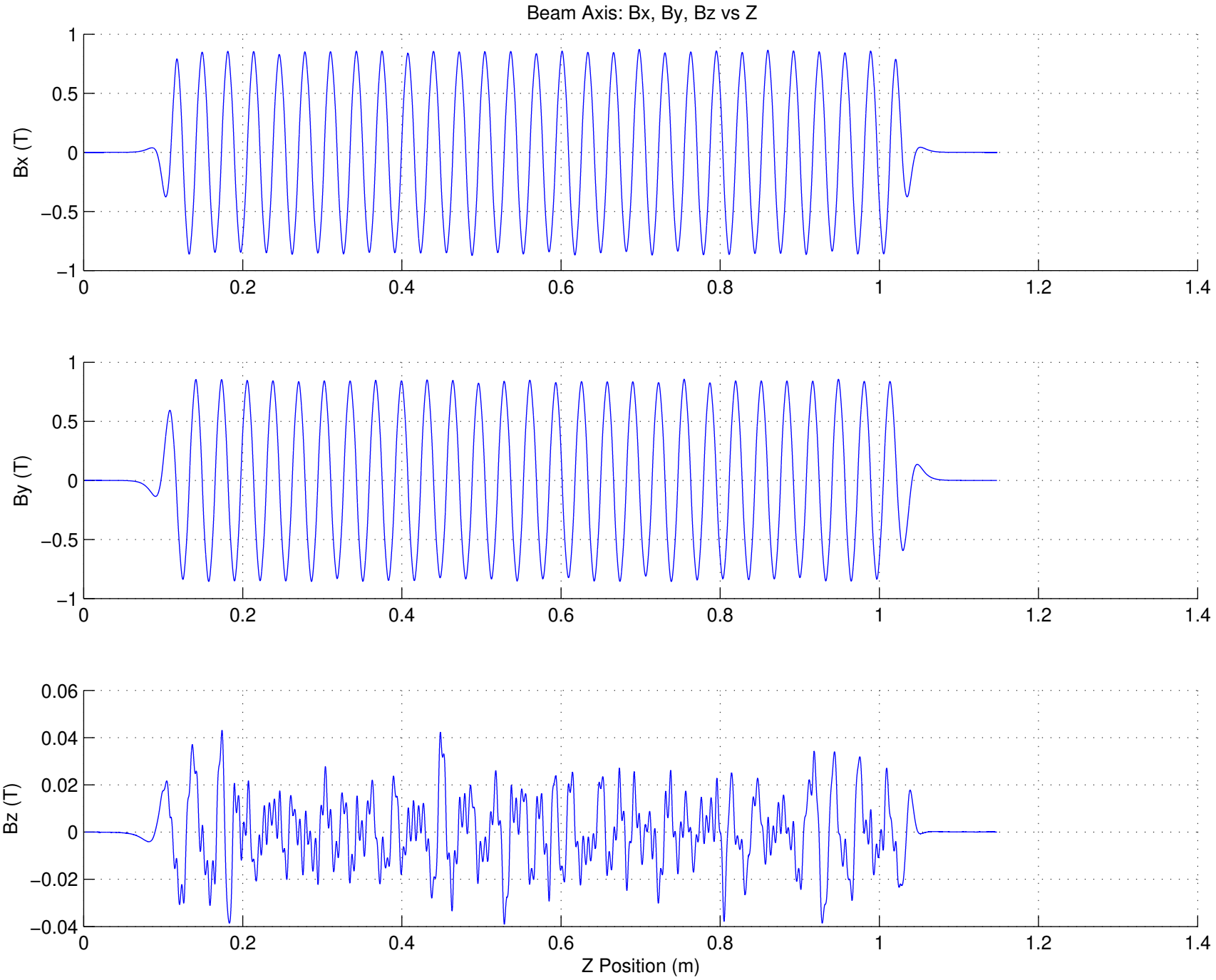

(X1 – Xc) vs Z, Measurement and Fit
x 10^-4
0.5
0
−0.5
−1
−1.5
−2
−2.5
−3
−3.5
−4
Y
0
0.2
0.4
0.6
0.8
1
1.2
1.4
X
Measurement
Fit


(Y1 – Yc) vs Z, Measurement and Fit
x 10^-4
−2.5
−3
−3.5
−4
−4.5
−5
−5.5
−6
−6.5
Y
0
0.2
0.4
0.6
0.8
1
1.2
1.4
X
Measurement
Fit


Bx1 Additive Corr, Correction From Meas To Beam Axis
Delta B (T)
Z (m)
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
0
0.2
0.4
0.6
0.8
1
1.2
1.4


By1 Additive Corr, Correction From Meas To Beam Axis
Delta B (T)
Z (m)
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
0
0.2
0.4
0.6
0.8
1
1.2
1.4


Bz1 Additive Corr, Correction From Meas To Beam Axis
Delta B (T)
Z (m)
0.1
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
−0.1
0
0.2
0.4
0.6
0.8
1
1.2
1.4


Beam Axis: Bx, By, Bz vs Z
Bx (T)
By (T)
Bz (T)
Z Position (m)
1
0.5
0
−0.5
−1
0.06
0.04
0.02
−0.02
−0.04
0
0.2
0.4
0.6
0.8
1
1.2
1.4