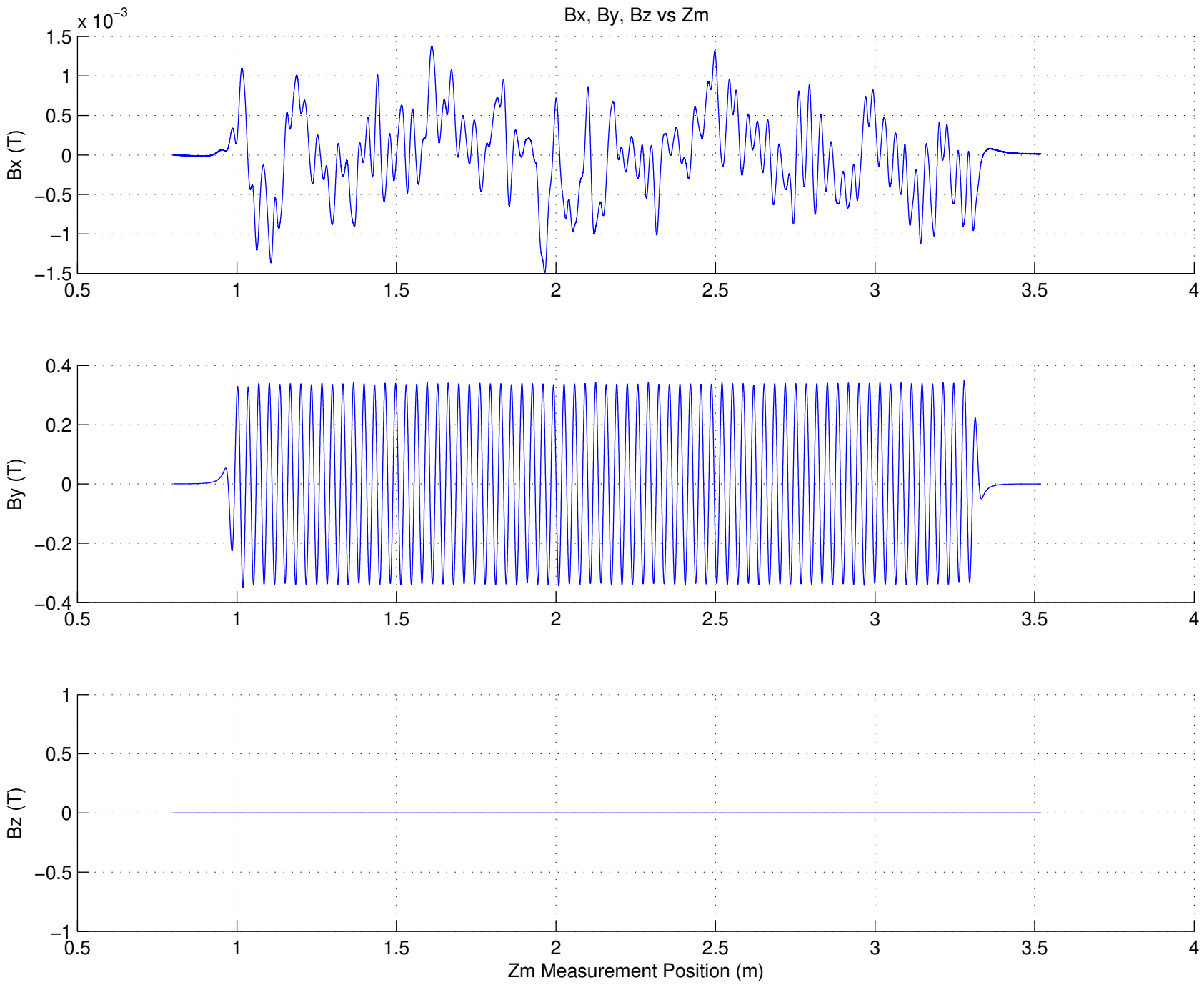
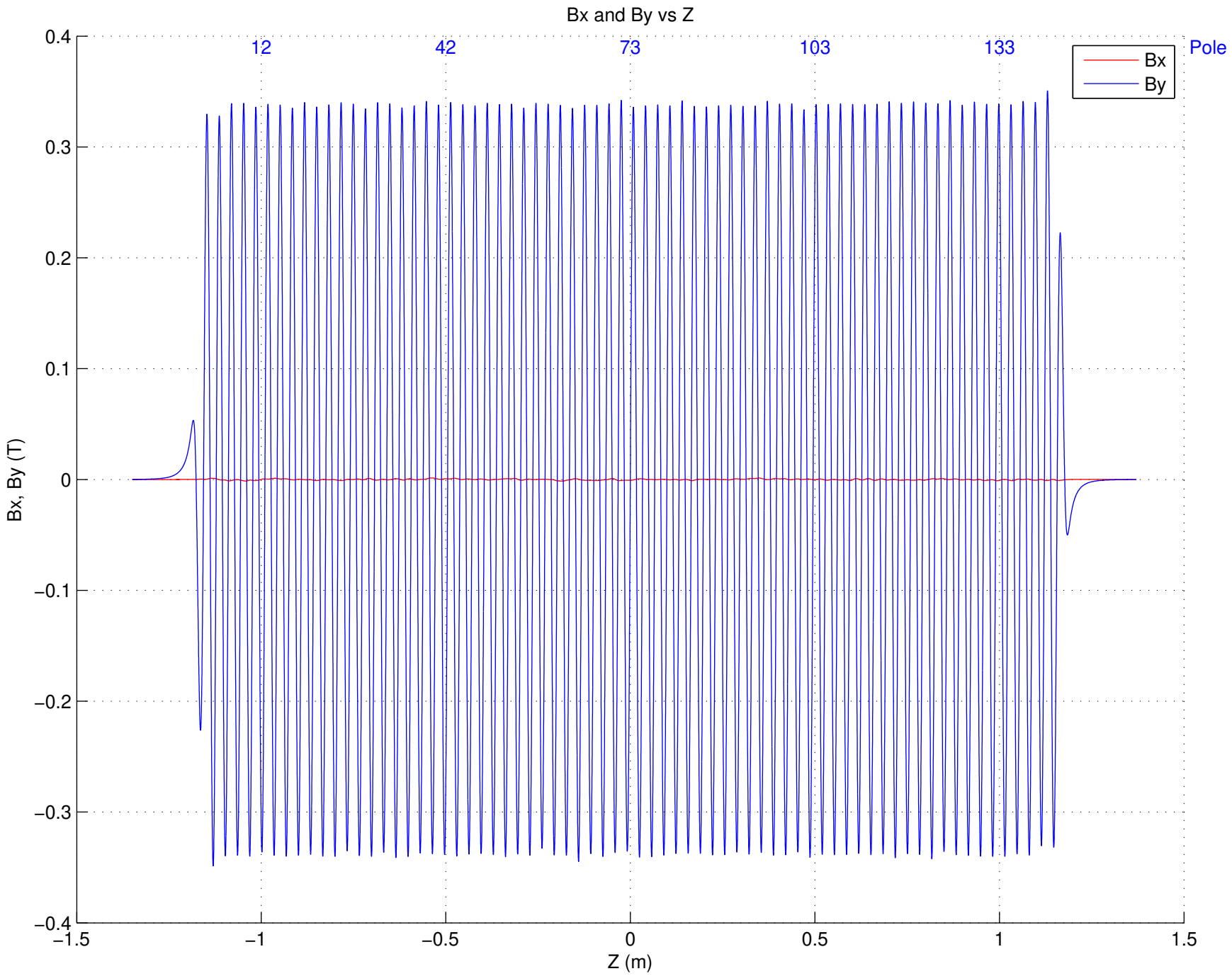
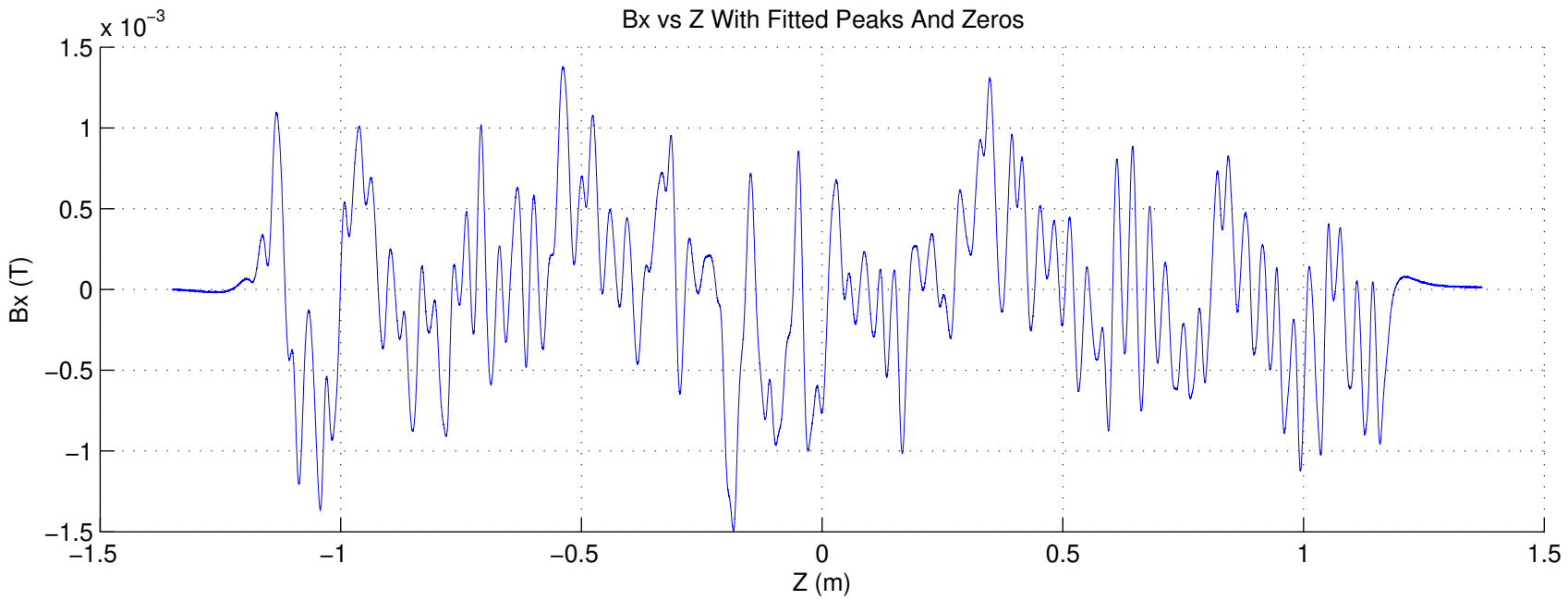
SLAC Magnetic Measurements

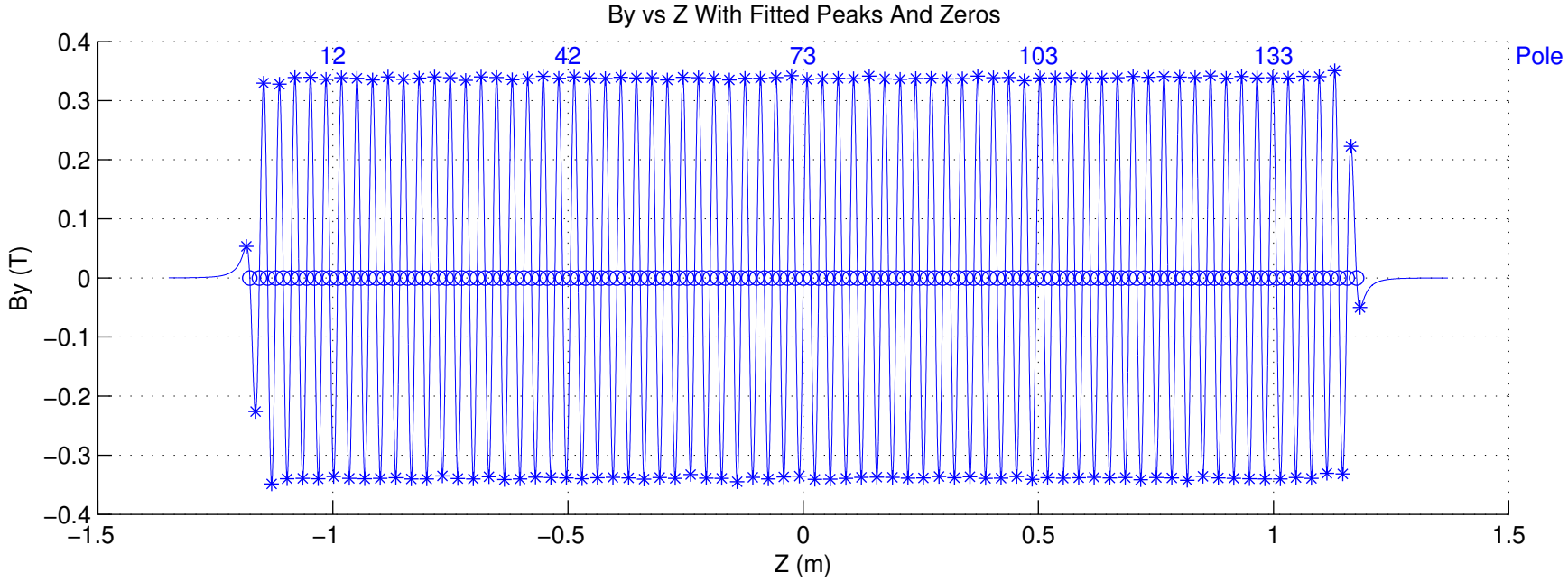
EPU Analysis
−−−−−−−−−−−

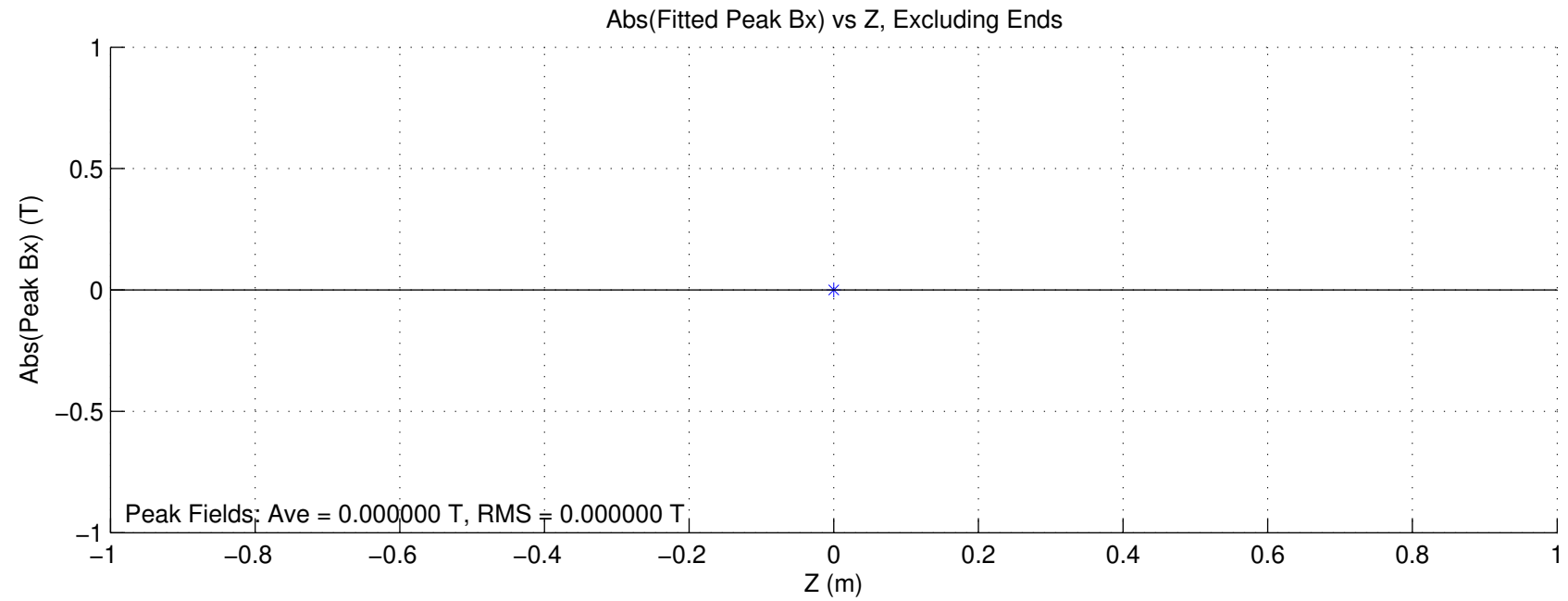
Parameters:
INPUT−FILE−DIR =S:\MagData\LCLS\Undulator\A1−ANL\DATASET0001\Rough Tuning\Z Scans\Run 001\
INPUT−FILE−NAME =x+00000−y+000−bscanz.dat
INPUT−FILE−TYPE =ZVXYBXYH
CORR−REQUIRED =0
GAMMA =26627.1
NOM−LAMBDA−U =0.033
NOM−K−VALUE =1.047
NOM−LAMBDA−R =3.6028e−011
NUM−POLES =144
NUM−END−POLES =4
CELL−LENGTH =4

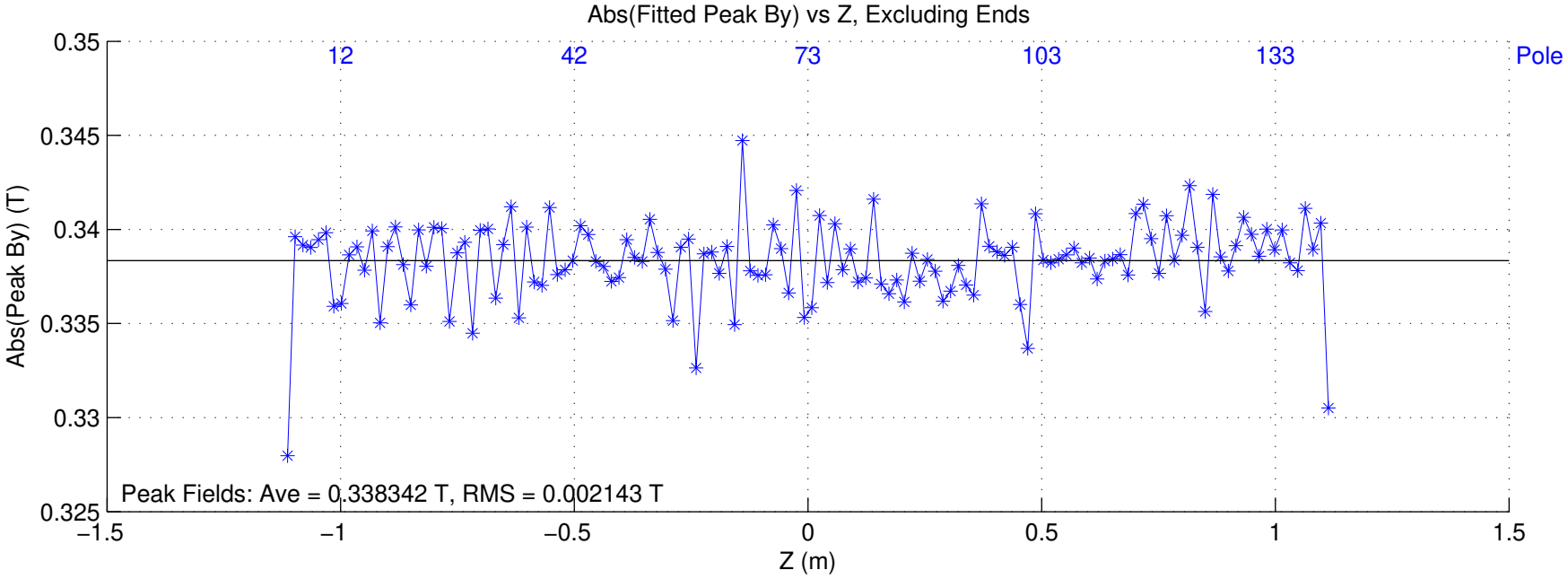

Bx, By, Bz vs Zm
x 10^-3
Bx (T)
By (T)
Bz (T)
Zm Measurement Position (m)

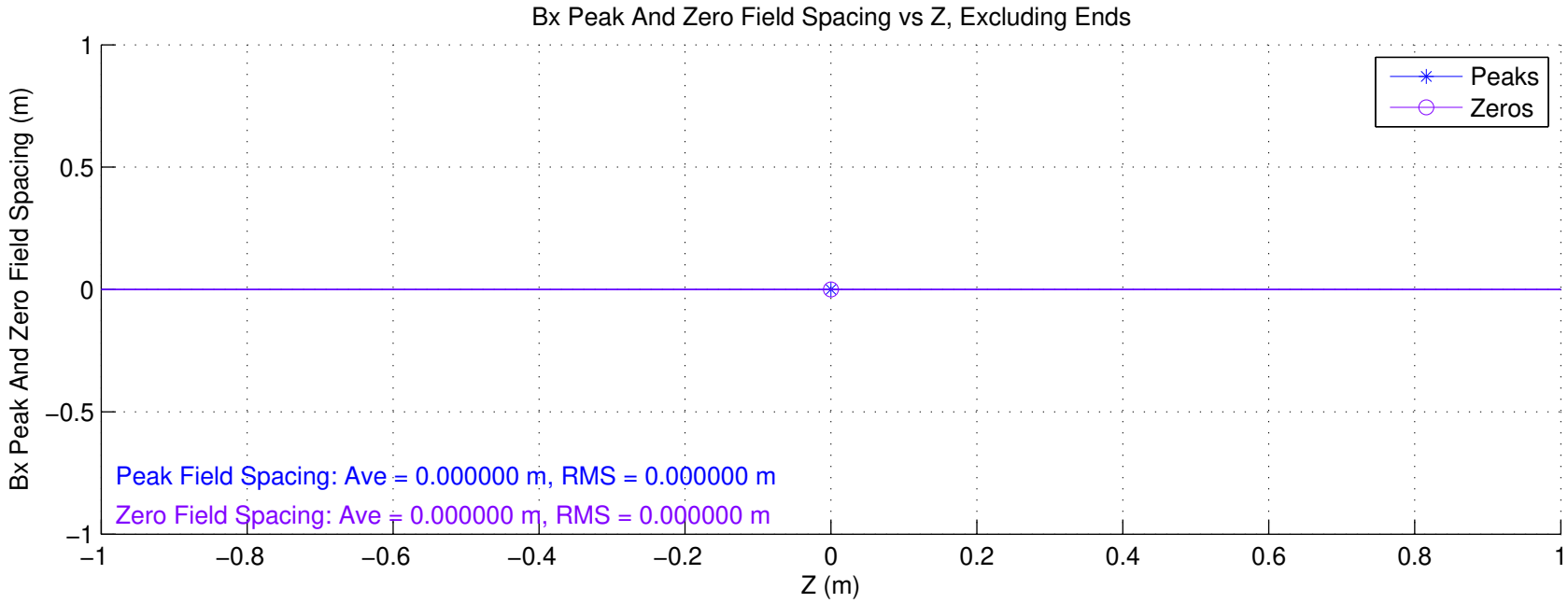

Bx and By vs Z
12
42
73
103
133
Pole
Bx
By
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
Bx, By (T)
−1.5
−1
−0.5
0
0.5
1
1.5
Z (m)

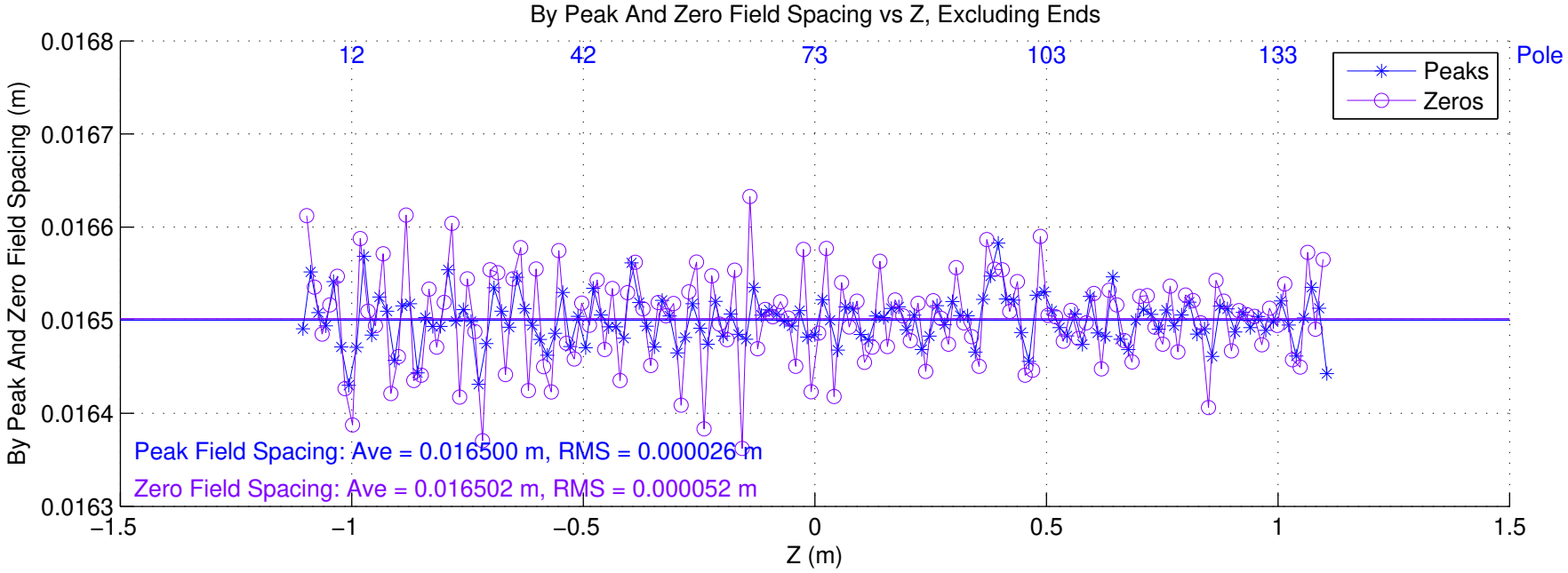

Bx vs Z With Fitted Peaks And Zeros
x 10^-3
Bx (T)
Z (m)
1.5
1
0.5
0
−0.5
−1
−1.5

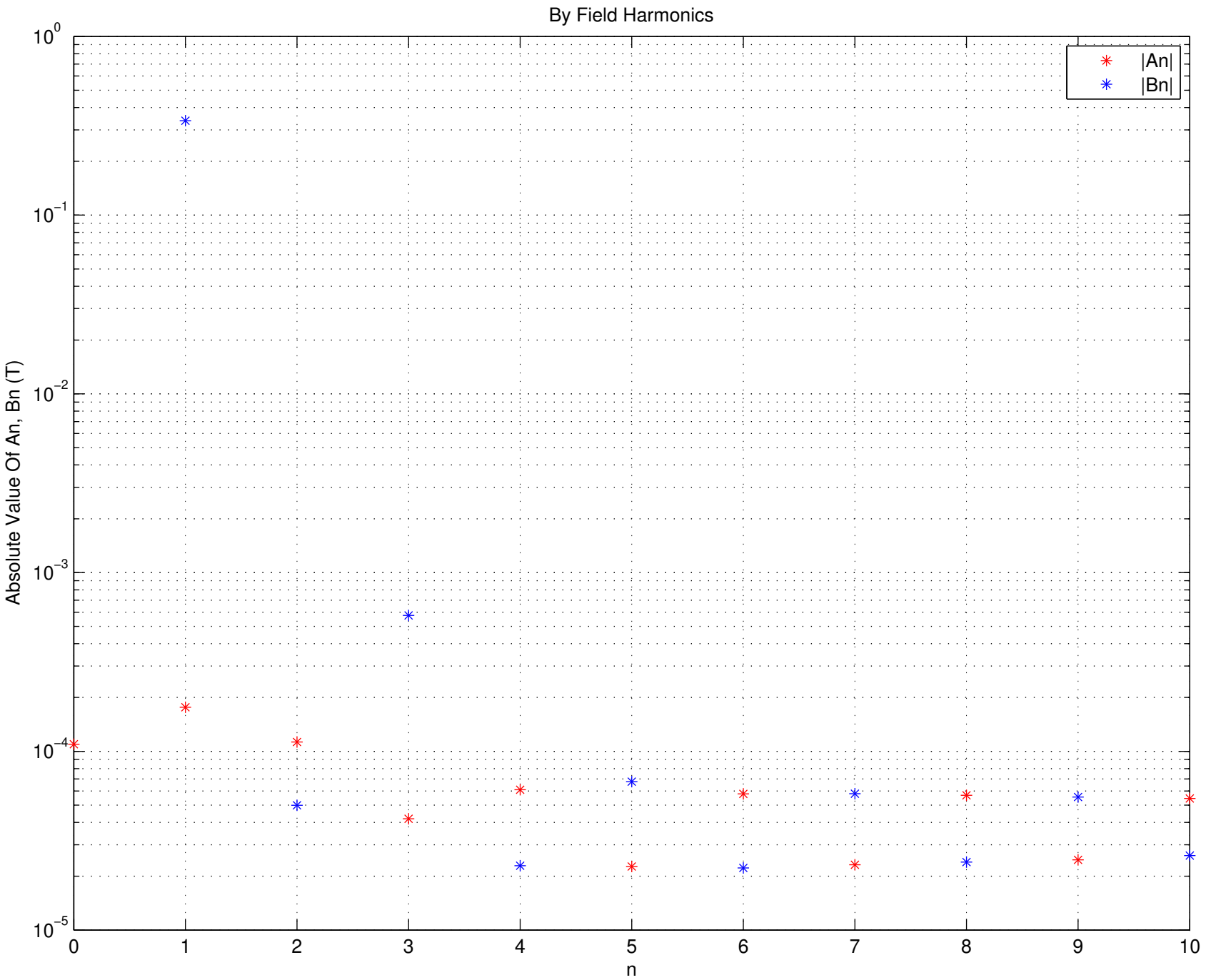

By vs Z With Fitted Peaks And Zeros
12
42
73
103
133
Pole
By (T)
Z (m)
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4

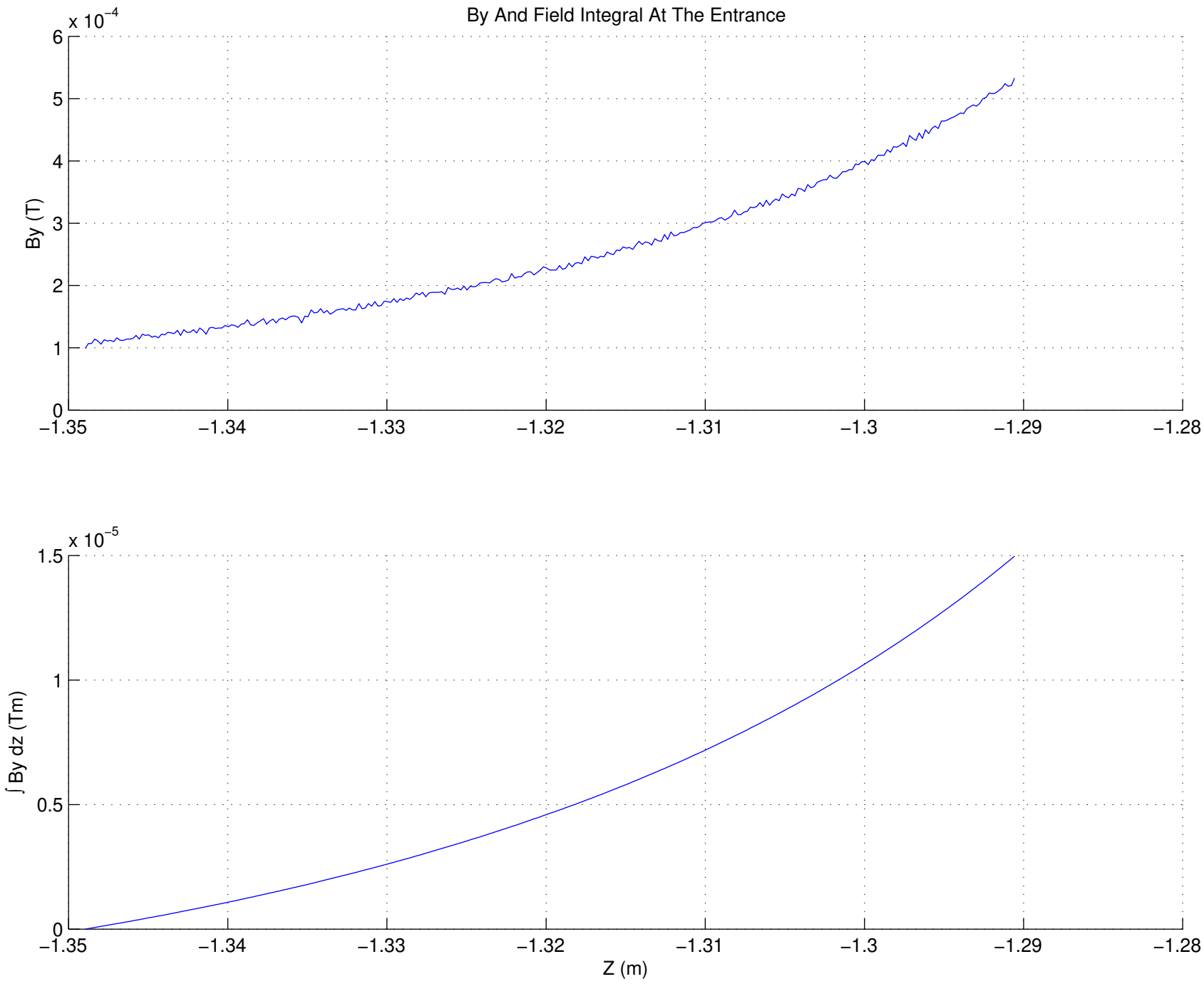

Abs(Fitted Peak Bx) vs Z, Excluding Ends
Abs(Peak Bx) (T)
Z (m)
Peak Fields: Ave = 0.000000 T, RMS = 0.000000 T
1
0.5
0
−0.5
−1
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1

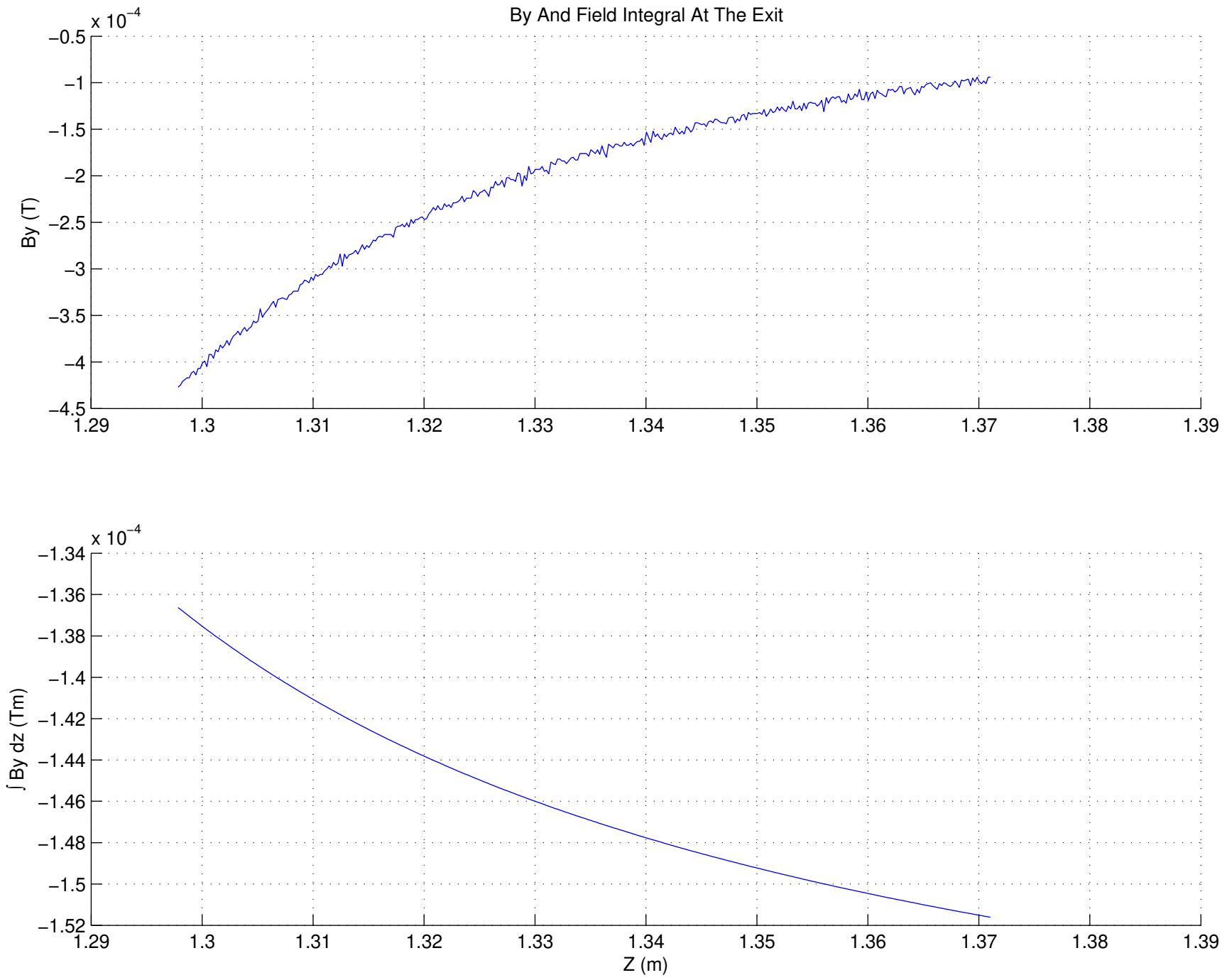

Abs(Fitted Peak By) vs Z, Excluding Ends
Abs(Peak By) (T)
Z (m)
Peak Fields: Ave = 0.338342 T, RMS = 0.002143 T
12
42
73
103
133
Pole
0.35
0.345
0.34
0.335
0.33
0.325
−1.5
−1
−0.5
0
0.5
1
1.5

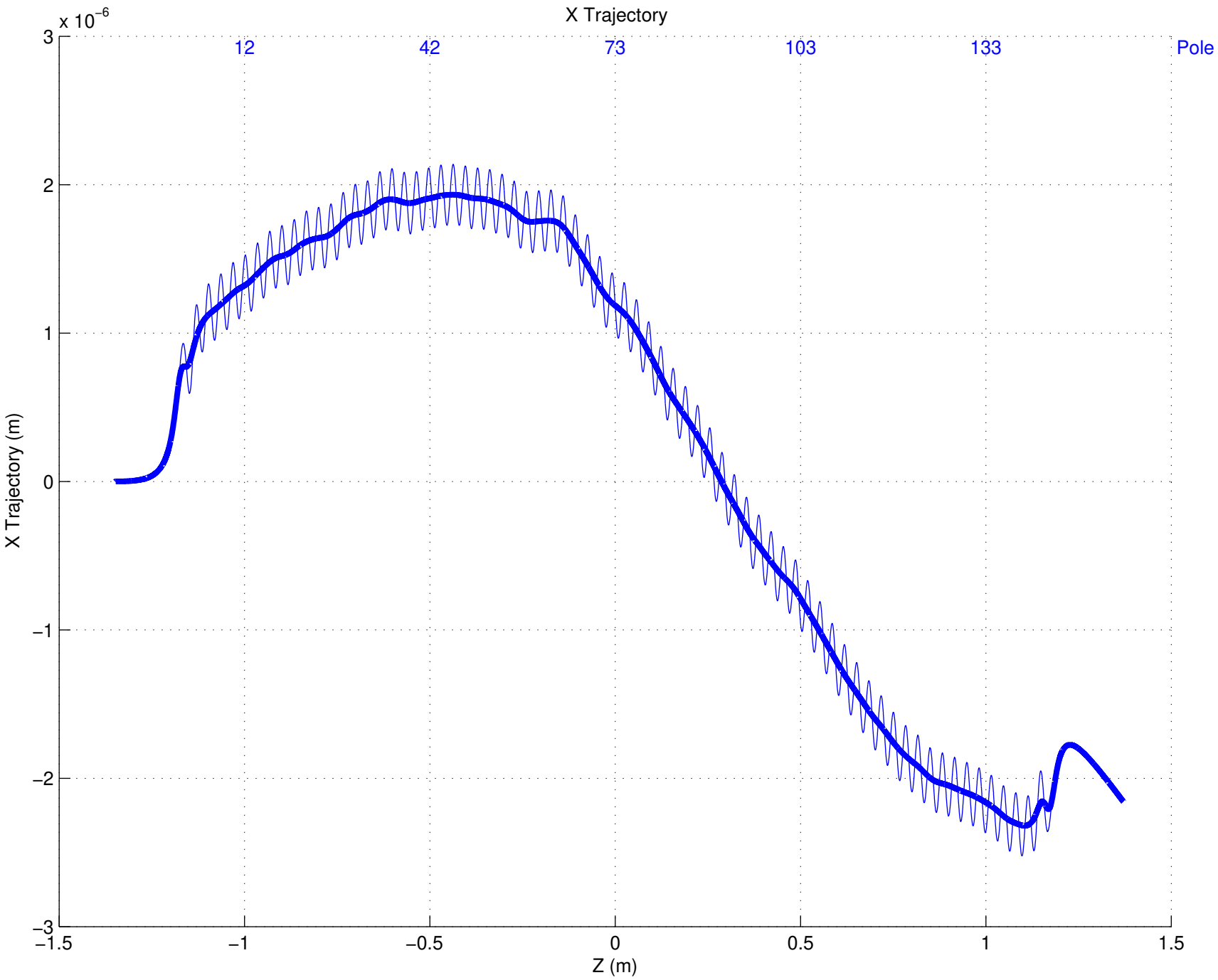

Bx Peak And Zero Field Spacing vs Z, Excluding Ends
Bx Peak And Zero Field Spacing (m)
Z (m)
Peaks
Zeros
Peak Field Spacing: Ave = 0.000000 m, RMS = 0.000000 m
Zero Field Spacing: Ave = 0.000000 m, RMS = 0.000000 m

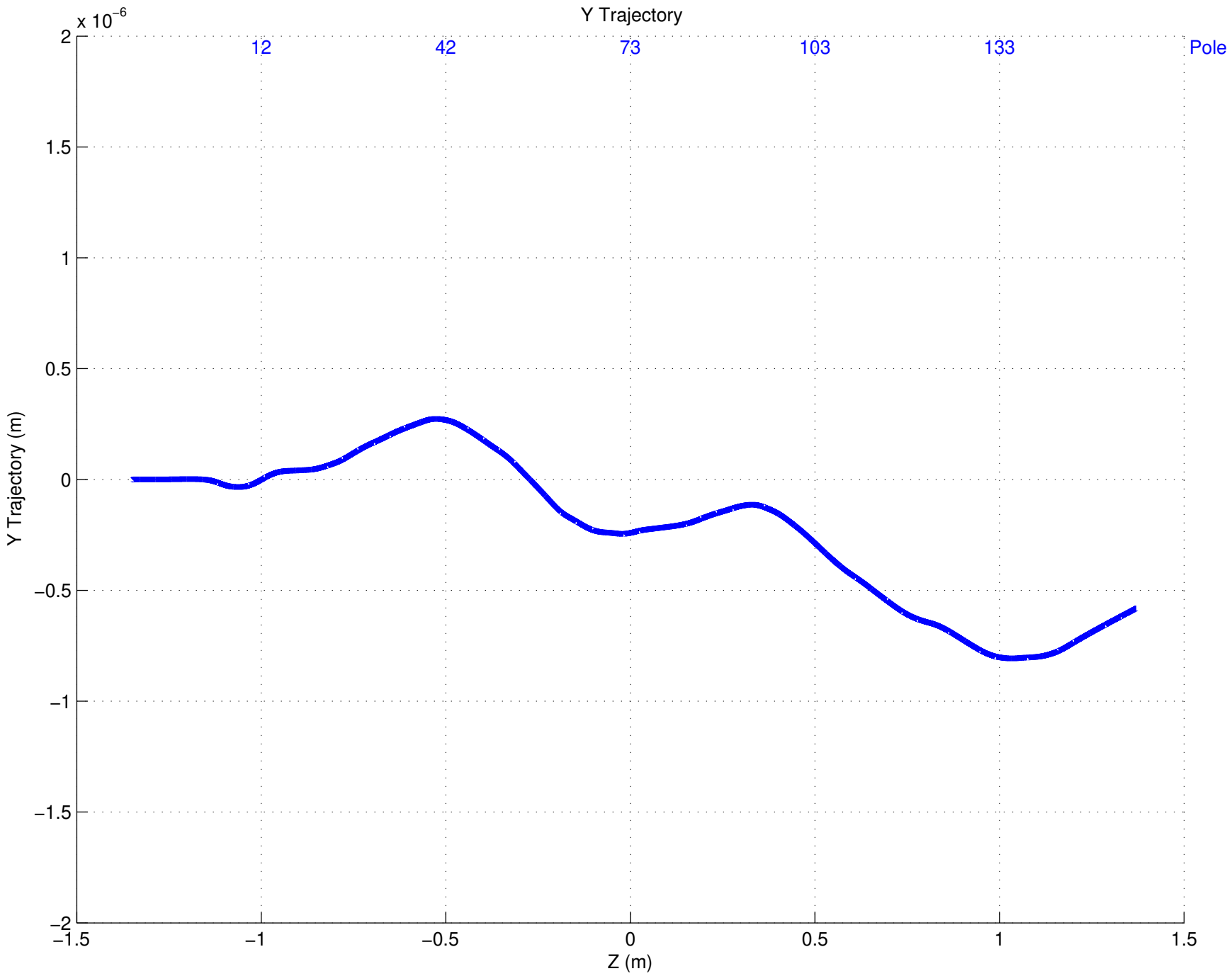

By Peak And Zero Field Spacing vs Z, Excluding Ends
By Peak And Zero Field Spacing (m)
Z (m)
12
42
73
103
133
Pole
Peaks
Zeros
Peak Field Spacing: Ave = 0.016500 m, RMS = 0.000026 m
Zero Field Spacing: Ave = 0.016502 m, RMS = 0.000052 m

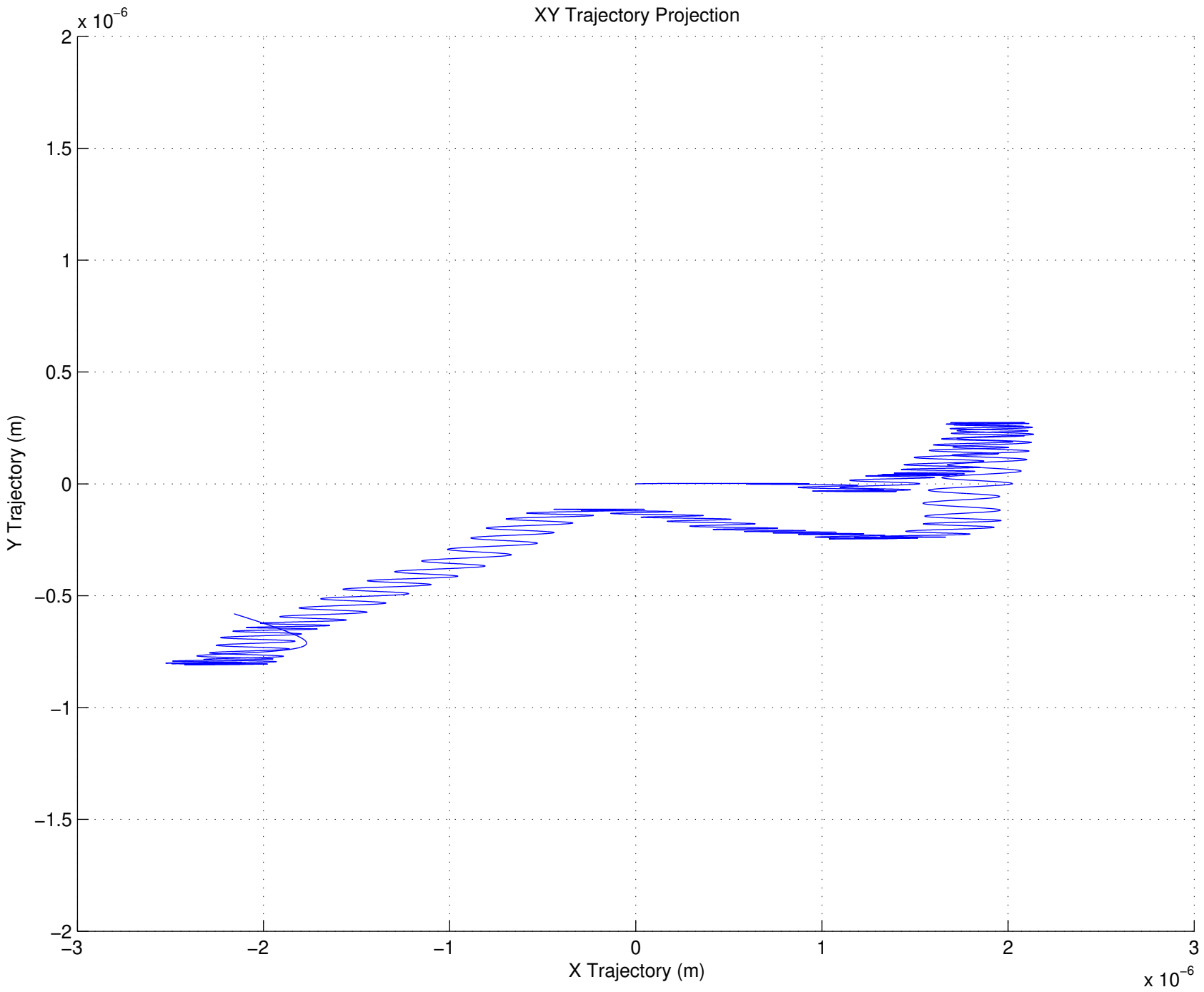

By Field Harmonics
|An|
|Bn|
Absolute Value Of An, Bn (T)
n
$10^{0}$
$10^{-1}$
$10^{-2}$
$10^{-3}$
$10^{-4}$
$10^{-5}$
0
1
2
3
4
5
6
7
8
9
10

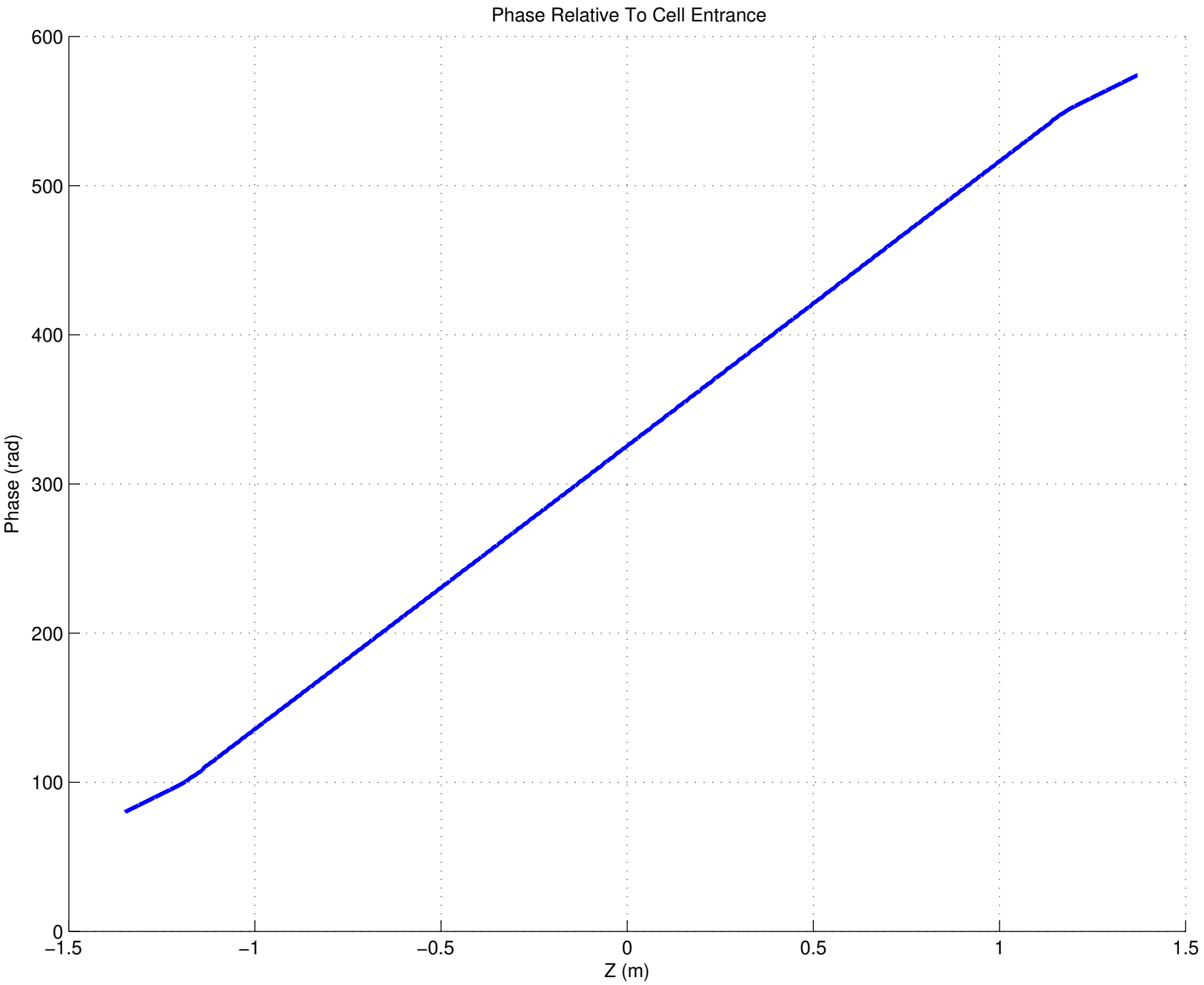

By And Field Integral At The Entrance
x 10^-4
By (T)
6
5
4
3
2
1
0
−1.35
−1.34
−1.33
−1.32
−1.31
−1.3
−1.29
−1.28
x 10^-5
∫ By dz (Tm)
1.5
1
0.5
0
Z (m)

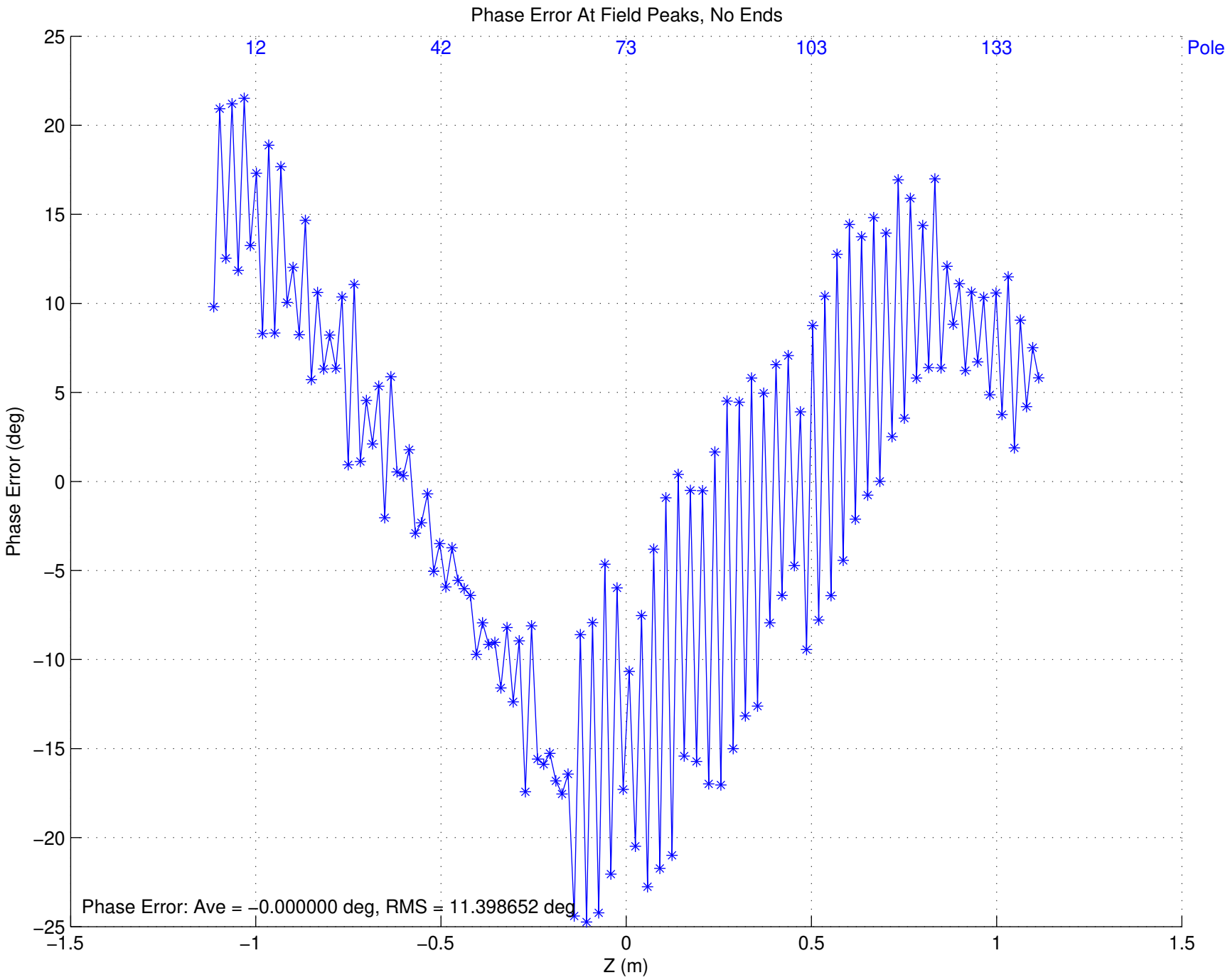

By And Field Integral At The Exit
x 10^-4
−0.5
−1
−1.5
−2
−2.5
−3
−3.5
−4
−4.5
By (T)
1.29
1.3
1.31
1.32
1.33
1.34
1.35
1.36
1.37
1.38
1.39
x 10^-4
−1.34
−1.36
−1.38
−1.4
−1.42
−1.44
−1.46
−1.48
−1.5
−1.52
∫ By dz (Tm)
Z (m)

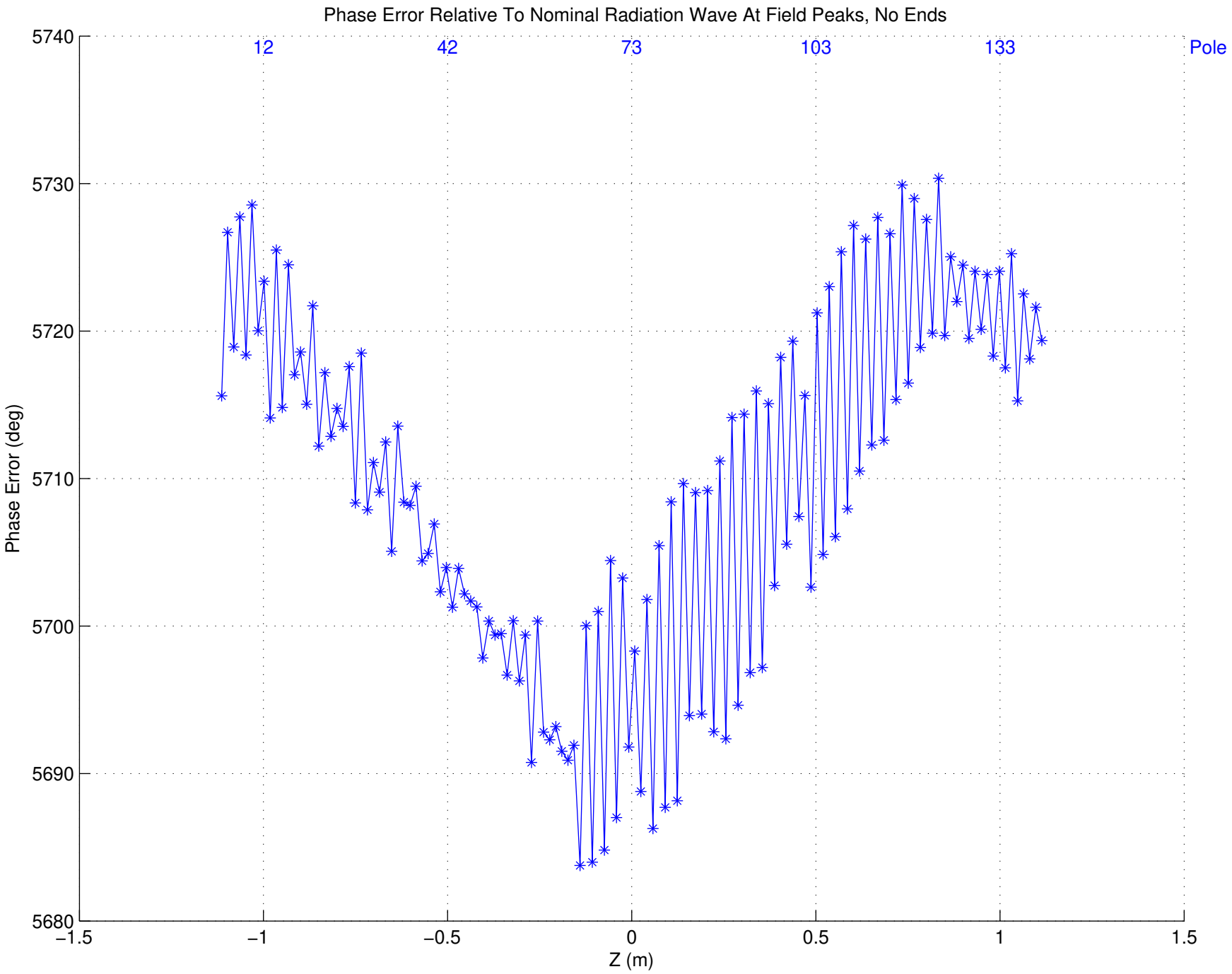

X Trajectory
x 10^-6
3
2
1
0
−1
−2
−3
12
42
73
103
133
Pole
X Trajectory (m)
−1.5
−1
−0.5
0
0.5
1
1.5
Z (m)

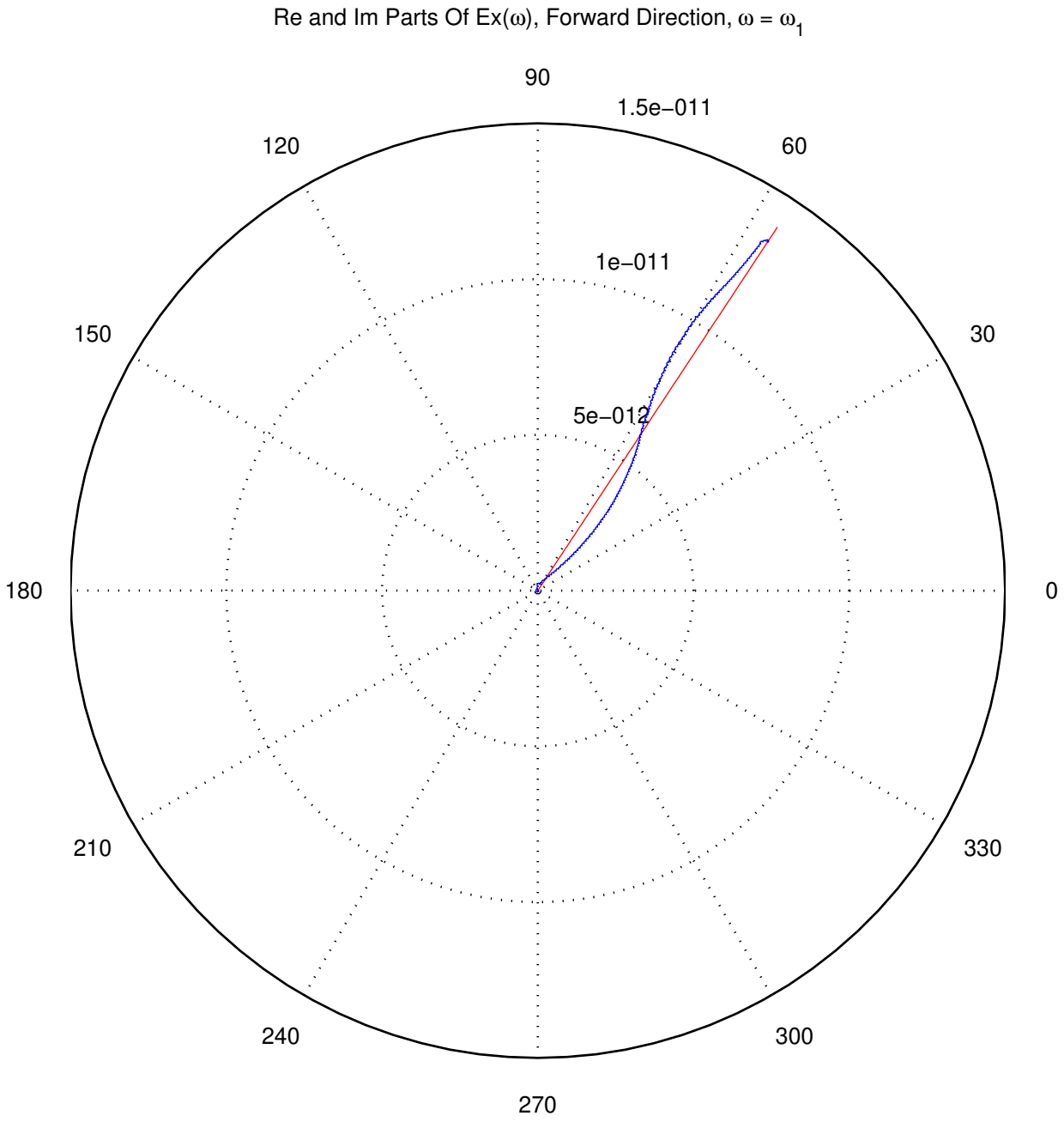

Y Trajectory
x 10^-6
12
42
73
103
133
Pole
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
Y Trajectory (m)
−1.5
−1
−0.5
0
0.5
1
1.5
Z (m)

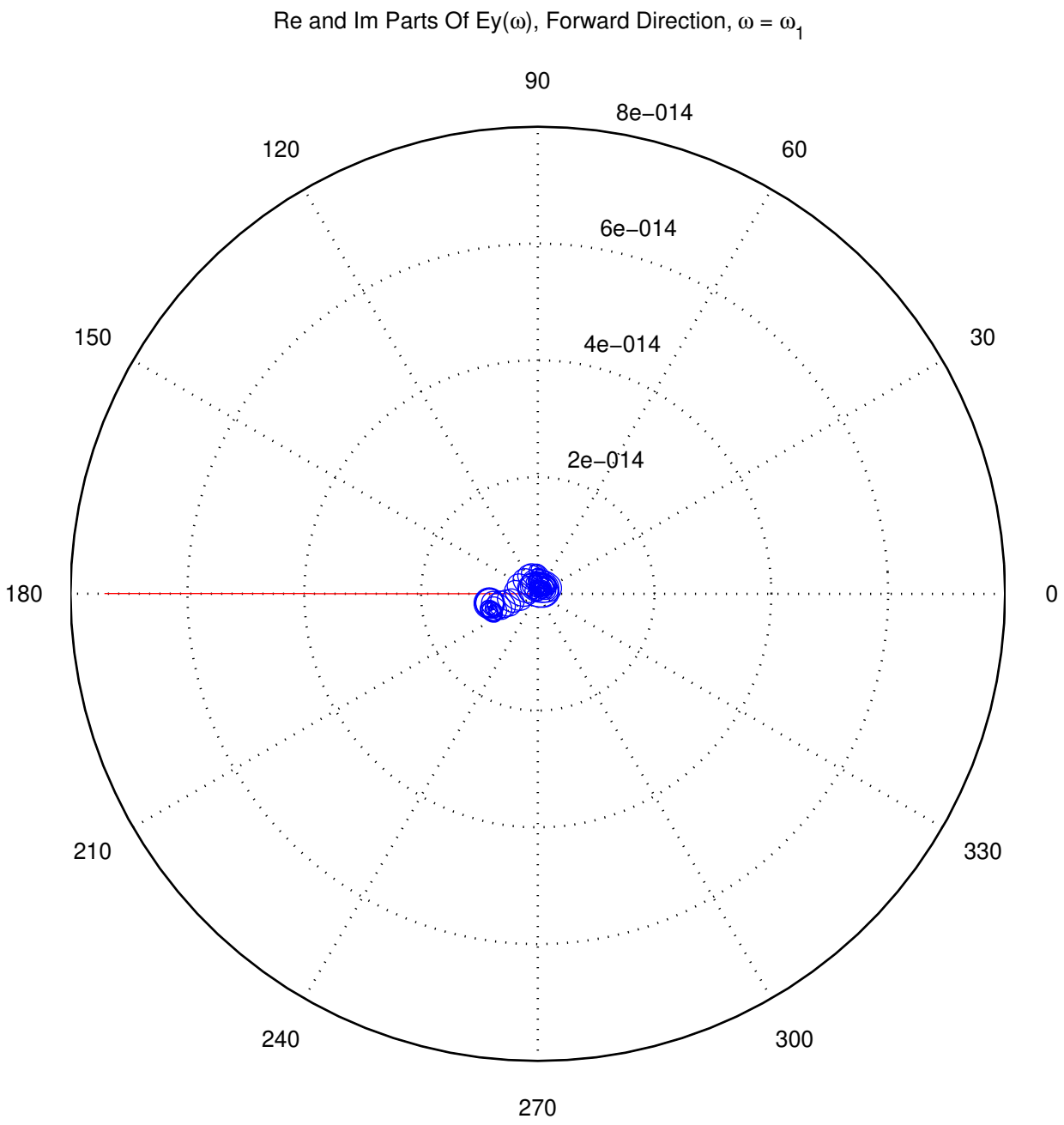

XY Trajectory Projection
x 10^-6
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
Y Trajectory (m)
−3
−2
−1
0
1
2
3
X Trajectory (m)
x 10^-6

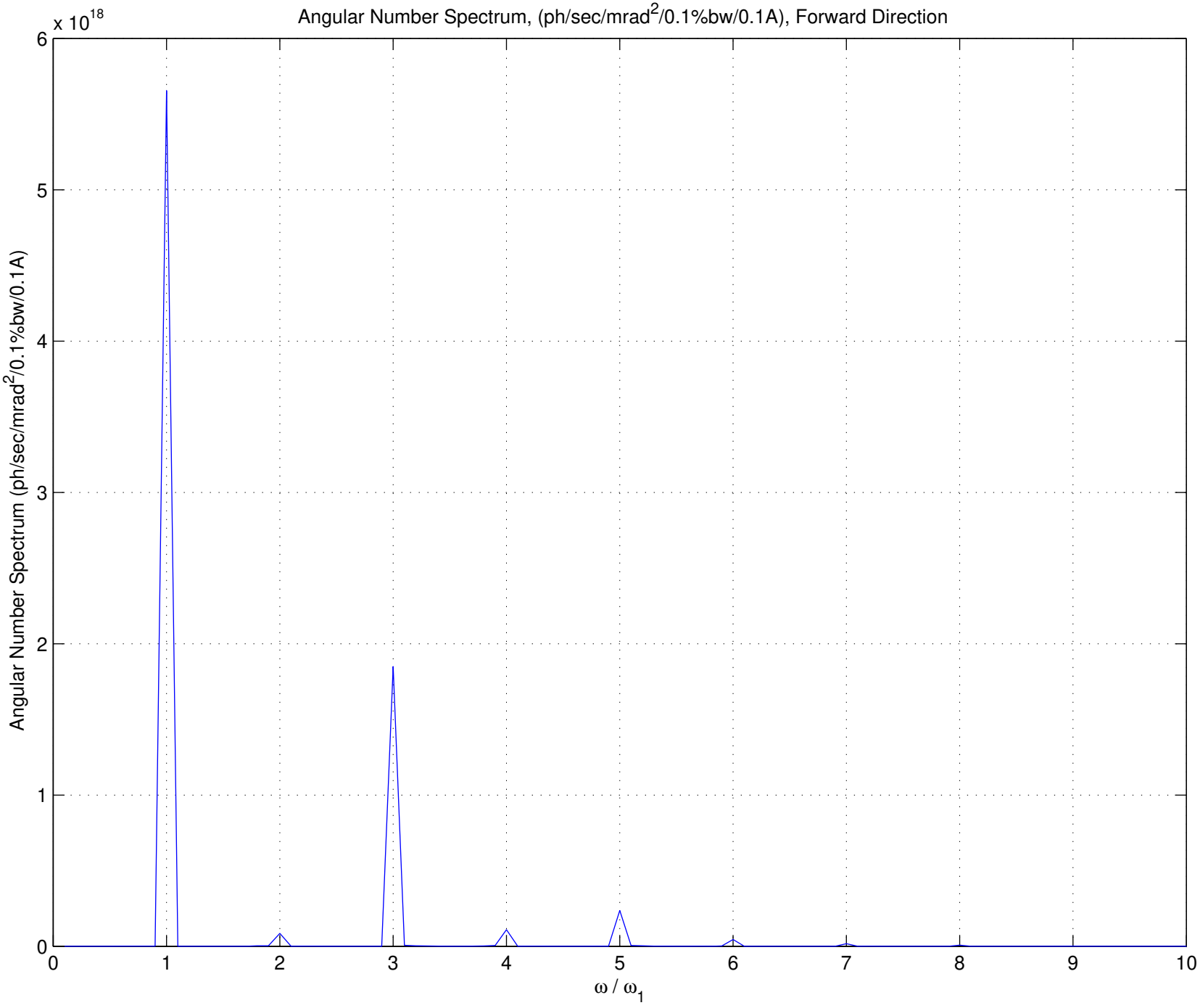

Phase Relative To Cell Entrance
600
500
400
300
200
100
0
Phase (rad)
−1.5
−1
−0.5
0
0.5
1
1.5
Z (m)

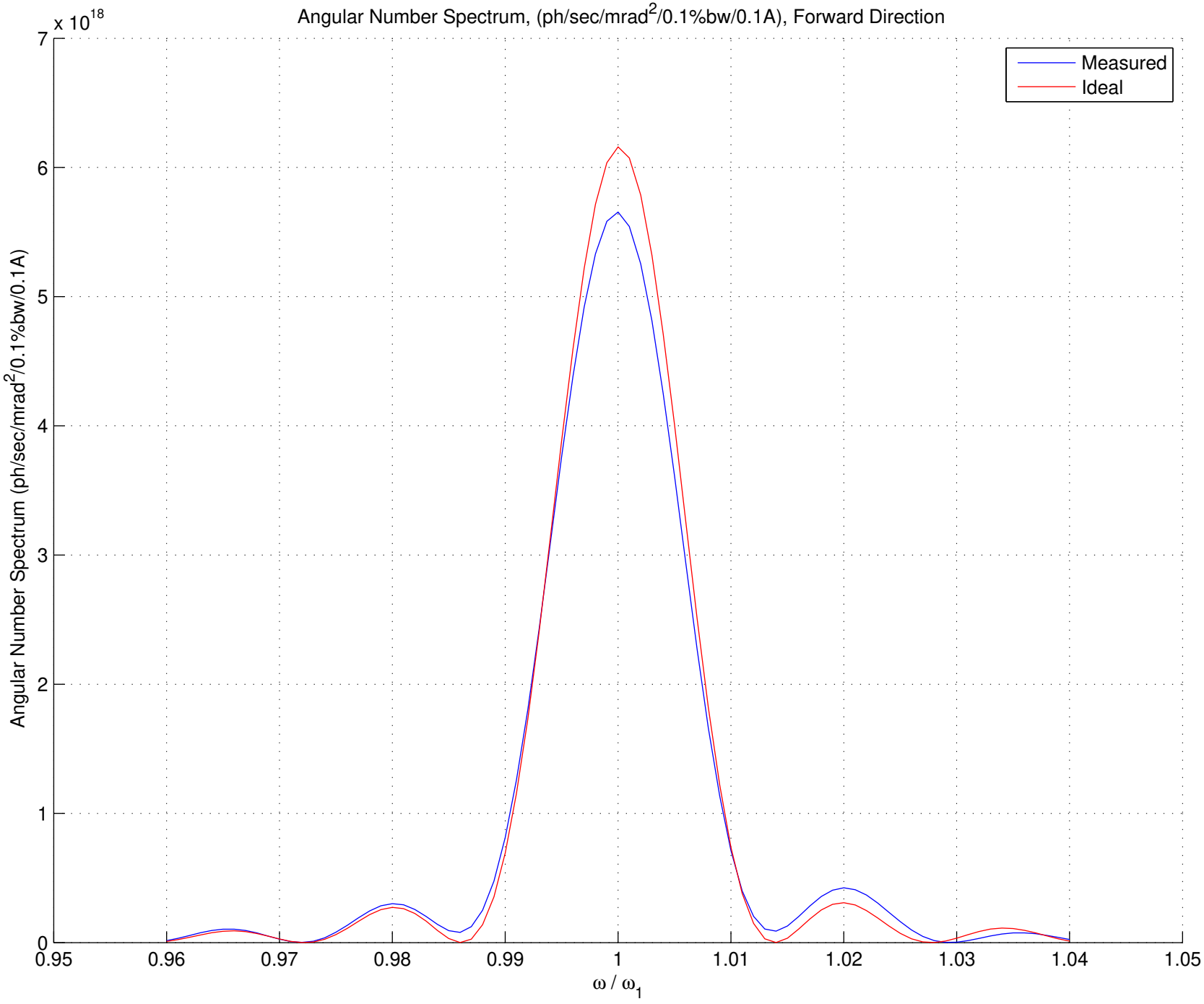

Phase Error At Field Peaks, No Ends
12
42
73
103
133
Pole
25
20
15
10
5
0
−5
−10
−15
−20
−25
Phase Error (deg)
−1.5
−1
−0.5
0
0.5
1
1.5
Z (m)
Phase Error: Ave = −0.000000 deg, RMS = 11.398652 deg

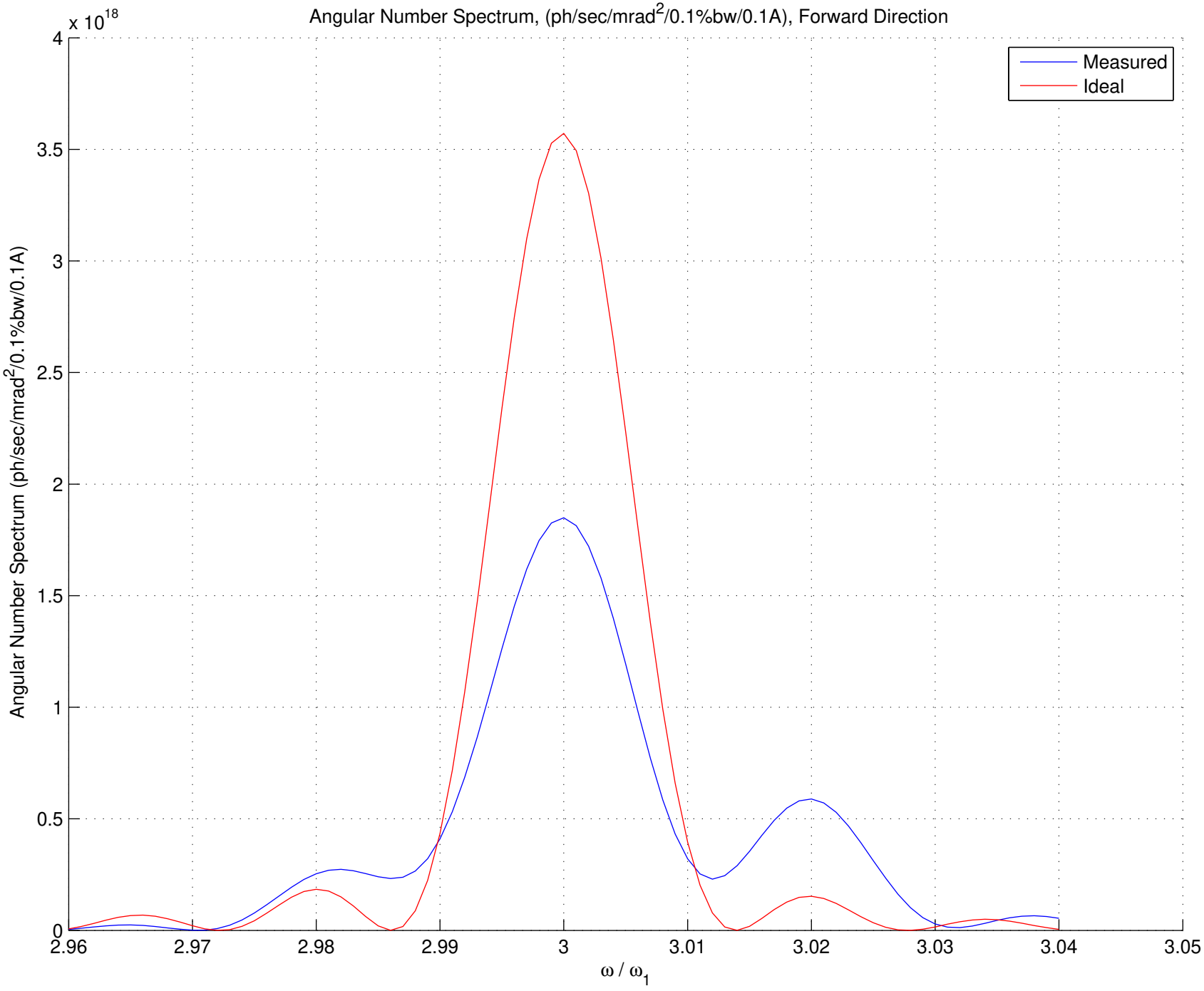

Phase Error Relative To Nominal Radiation Wave At Field Peaks, No Ends
12
42
73
103
133
Pole
5740
5730
5720
5710
5700
5690
5680
Phase Error (deg)
−1.5
−1
−0.5
0
0.5
1
1.5
Z (m)

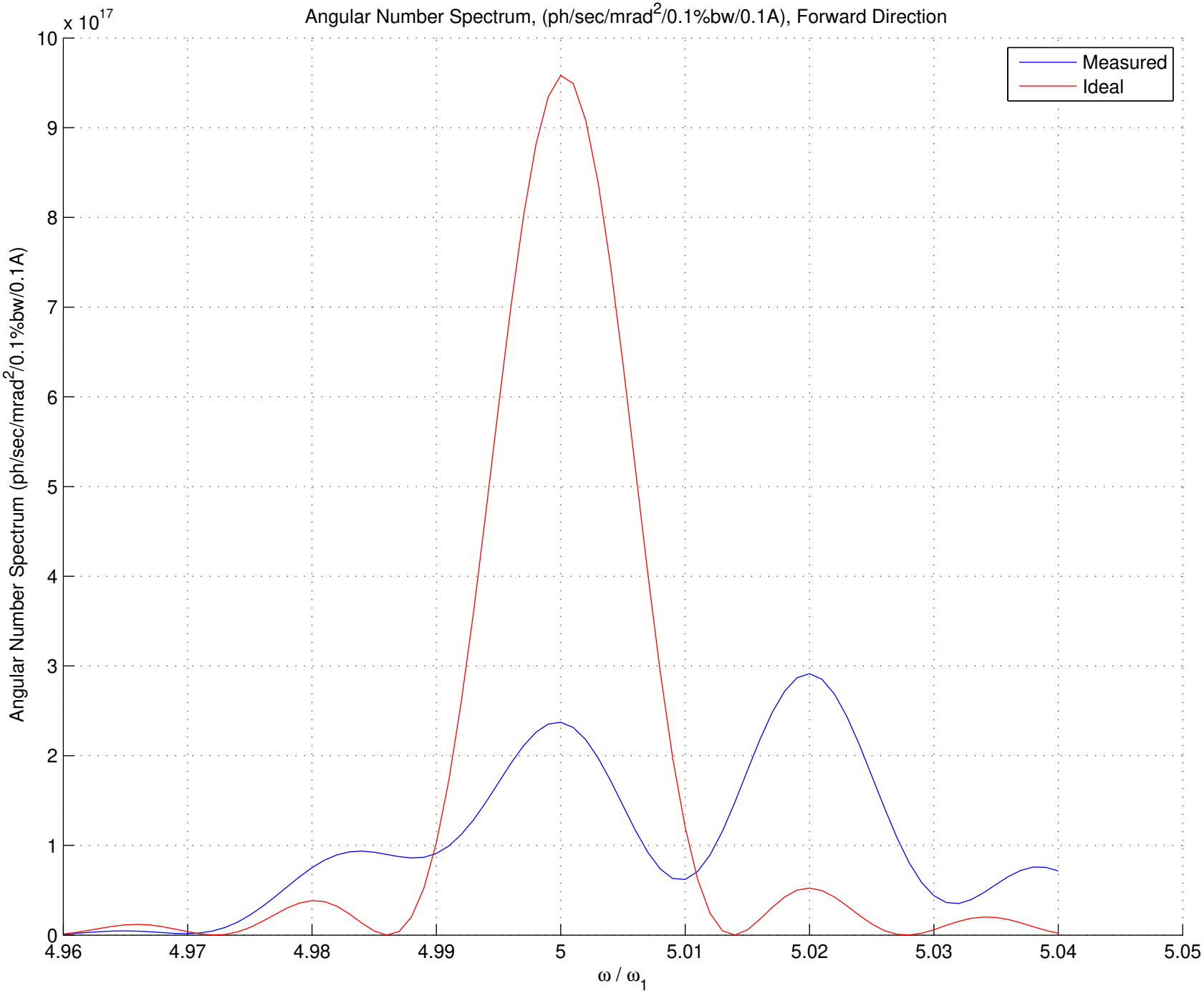

Re and Im Parts Of Ex(ω), Forward Direction, ω = ω1
90
1.5e−011
120
60
1e−011
150
30
5e−012
180
0
210
330
240
300
270


Re and Im Parts Of Ey(ω), Forward Direction, ω = ω1
90
8e−014
120
60
6e−014
150
30
4e−014
2e−014
180
0
210
330
240
300
270


Angular Number Spectrum, (ph/sec/mrad2/0.1%bw/0.1A), Forward Direction
x 10^18
Angular Number Spectrum (ph/sec/mrad2/0.1%bw/0.1A)
ω / ω1
0
1
2
3
4
5
6
7
8
9
10


Angular Number Spectrum, (ph/sec/mrad2/0.1%bw/0.1A), Forward Direction
x 10^18
Measured
Ideal
Angular Number Spectrum (ph/sec/mrad2/0.1%bw/0.1A)
ω / ω1
0
1
2
3
4
5
6
7
0.95
0.96
0.97
0.98
0.99
1
1.01
1.02
1.03
1.04
1.05


Angular Number Spectrum, (ph/sec/mrad$^2$/0.1%bw/0.1A), Forward Direction
x $10^{18}$
Measured
Ideal
Angular Number Spectrum (ph/sec/mrad$^2$/0.1%bw/0.1A)
$\omega$ / $\omega_1$
0
0.5
1
1.5
2
2.5
3
3.5
4
2.96
2.97
2.98
2.99
3
3.01
3.02
3.03
3.04
3.05


Angular Number Spectrum, (ph/sec/mrad2/0.1%bw/0.1A), Forward Direction
x 10^17
Measured
Ideal
Angular Number Spectrum (ph/sec/mrad2/0.1%bw/0.1A)
ω / ω1
10
9
8
7
6
5
4
3
2
1
0
4.96
4.97
4.98
4.99
5
5.01
5.02
5.03
5.04
5.05