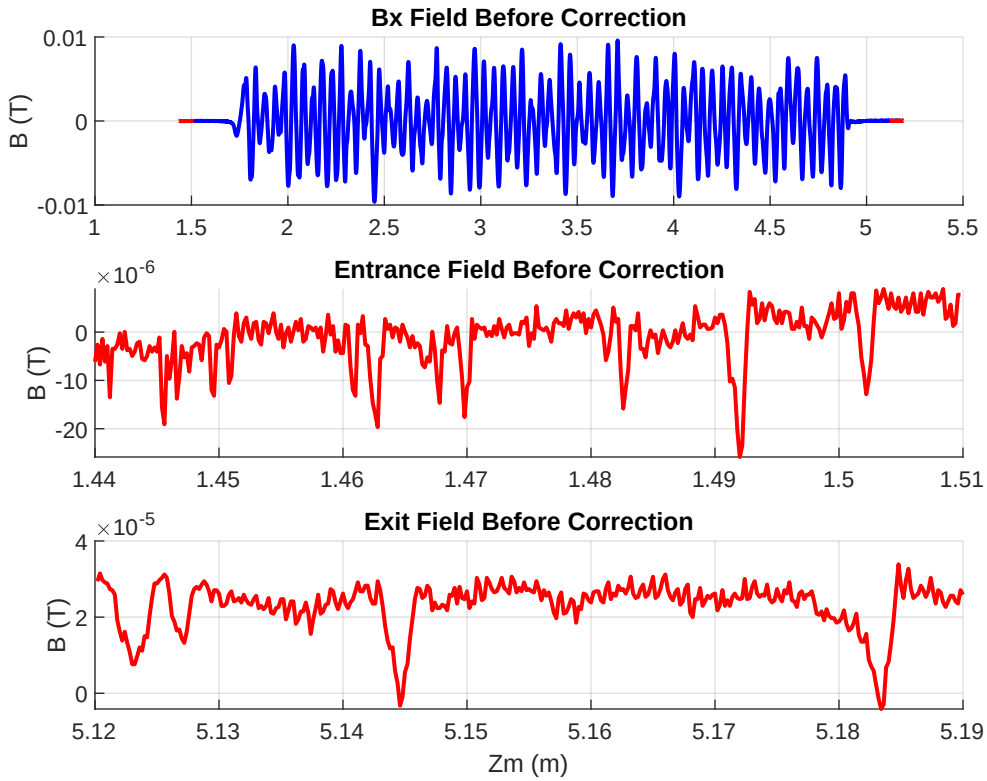
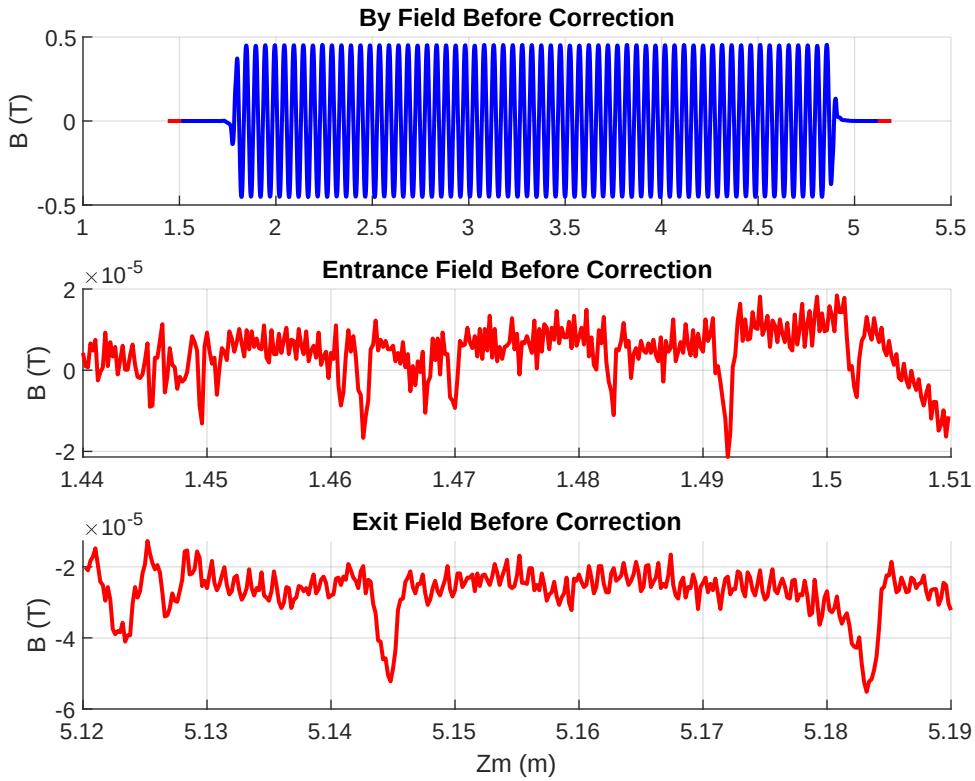
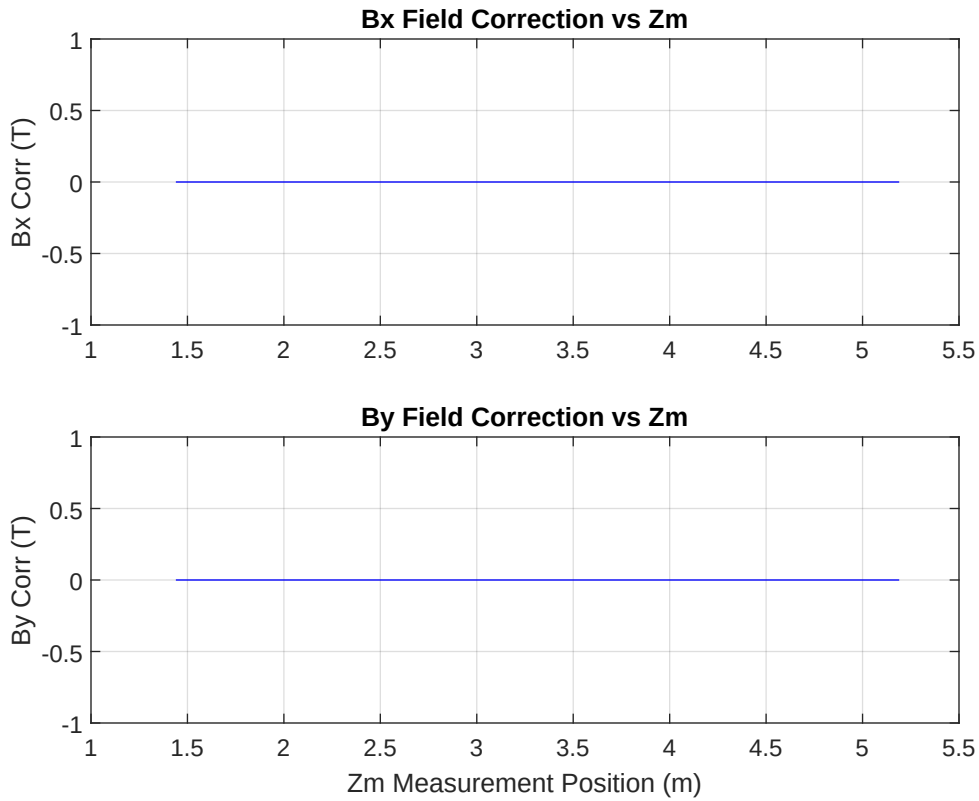
SLAC Magnetic Measurements

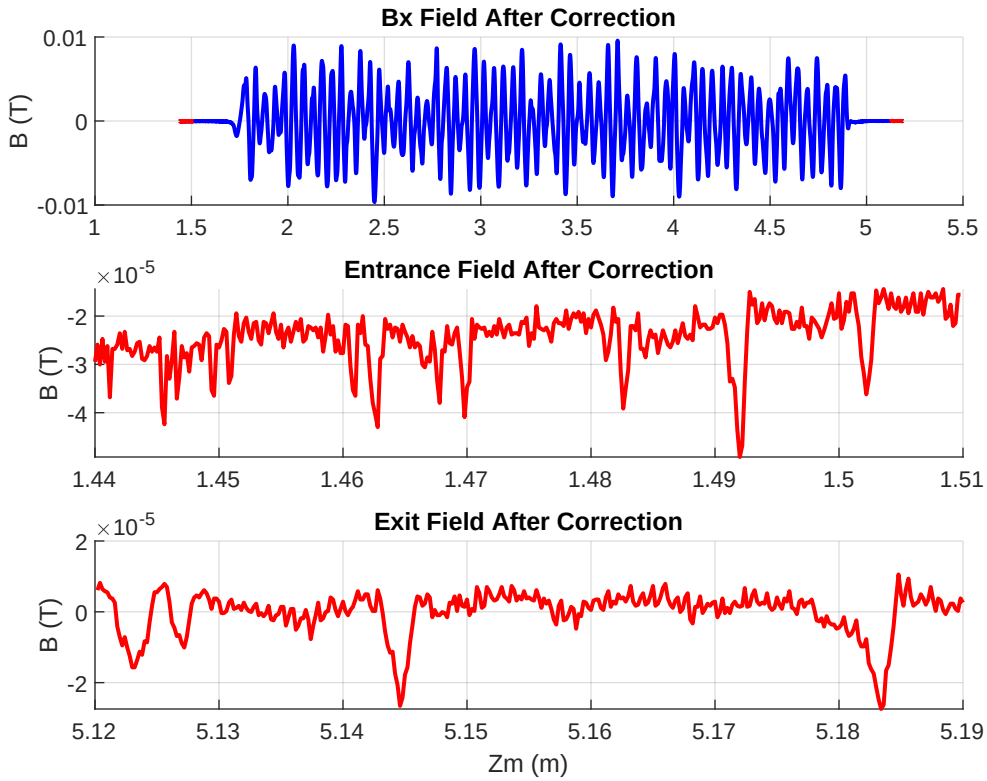
Planar Insertion Device Analysis

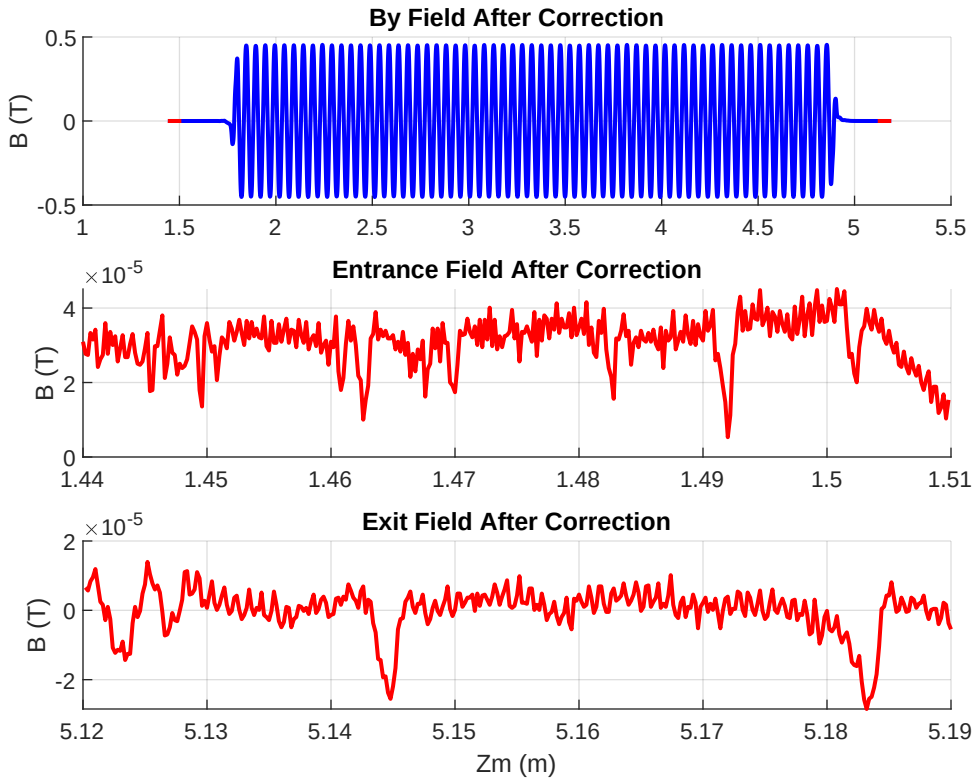
Parameters:
INPUT-FILE-DIR =c:\magdata\LCLS-II-HE\Undulator\DELTA-II\DATASET0001\Tuning\Z Scans\Run 135\0
INPUT-FILE-NAME =zscan.dat
INPUT-FILE-TYPE =ZVXYBXYH
CORR-REQUIRED =0
GAMMA =7827.79
NOM-LAMBDA-U =0.026
NOM-K-VALUE =3.5
NOM-LAMBDA-R =1.5116e-09
NUM-POLES =128
NUM-END-POLES =4
CELL-LENGTH =4

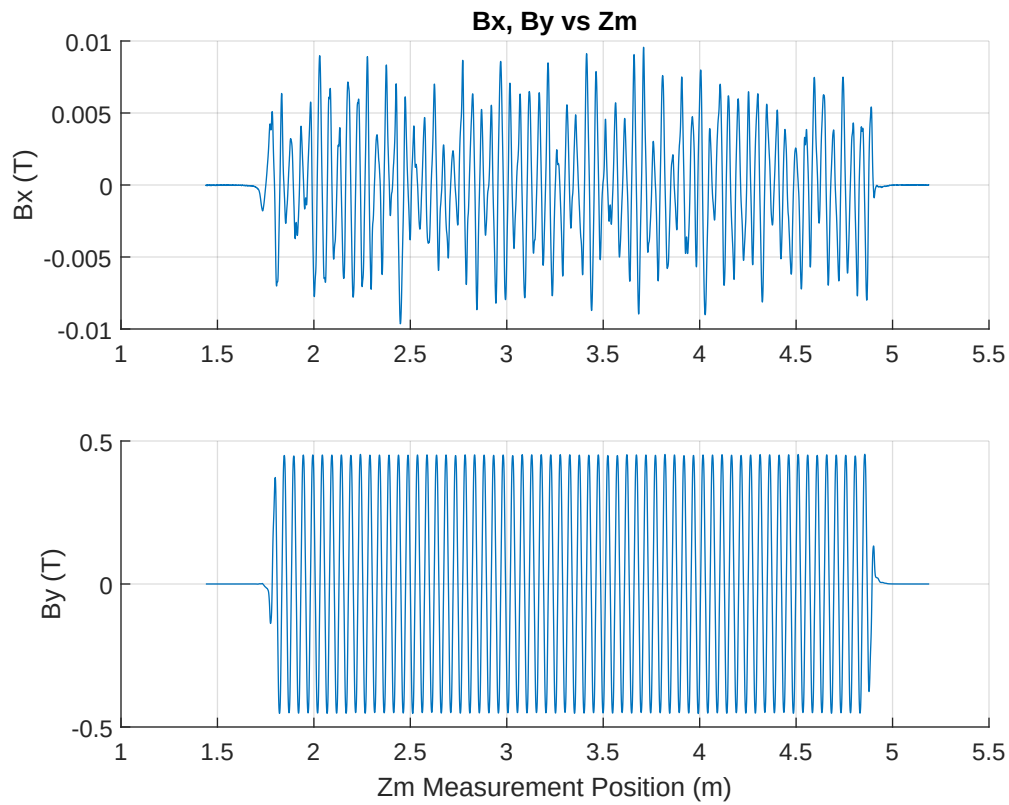

Bx Field Before Correction
B (T)
0.01
0
-0.01
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
Entrance Field Before Correction
×10^-6
B (T)
0
-10
-20
1.44
1.45
1.46
1.47
1.48
1.49
1.5
1.51
Exit Field Before Correction
×10^-5
B (T)
4
2
0
5.12
5.13
5.14
5.15
5.16
5.17
5.18
5.19
Zm (m)

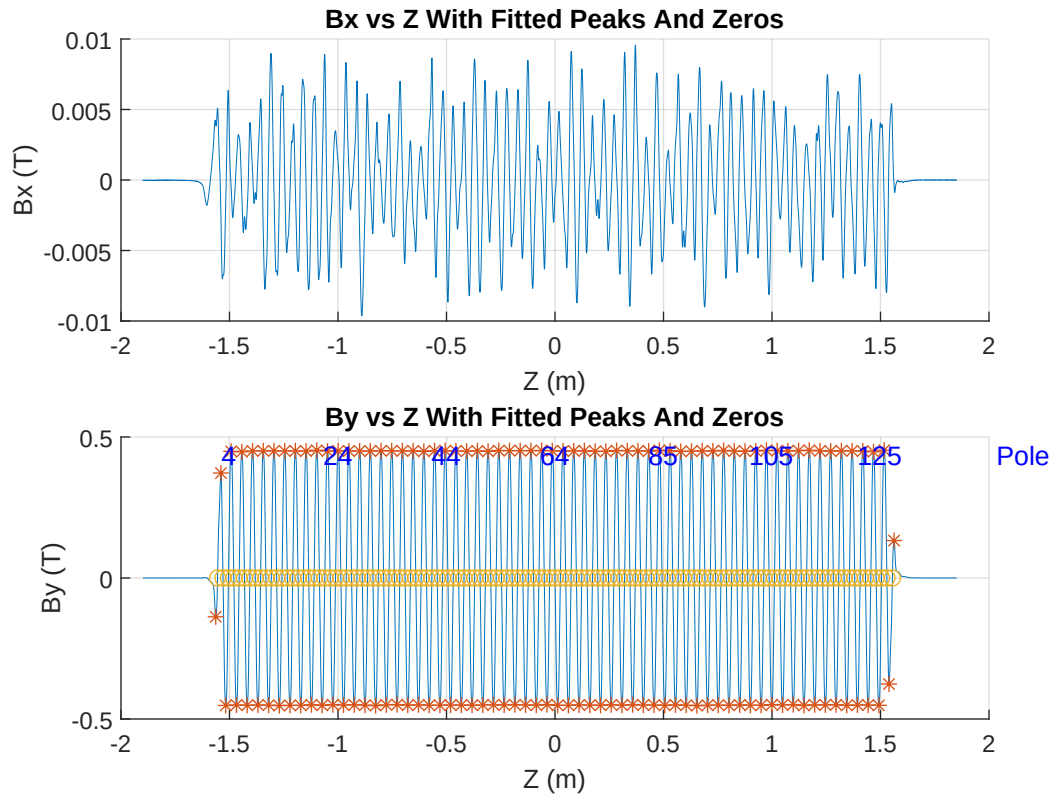

By Field Before Correction
B (T)
0.5
0
-0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
Entrance Field Before Correction
×10^-5
2
0
-2
1.44
1.45
1.46
1.47
1.48
1.49
1.5
1.51
Exit Field Before Correction
×10^-5
-2
-4
-6
5.12
5.13
5.14
5.15
5.16
5.17
5.18
5.19
Zm (m)

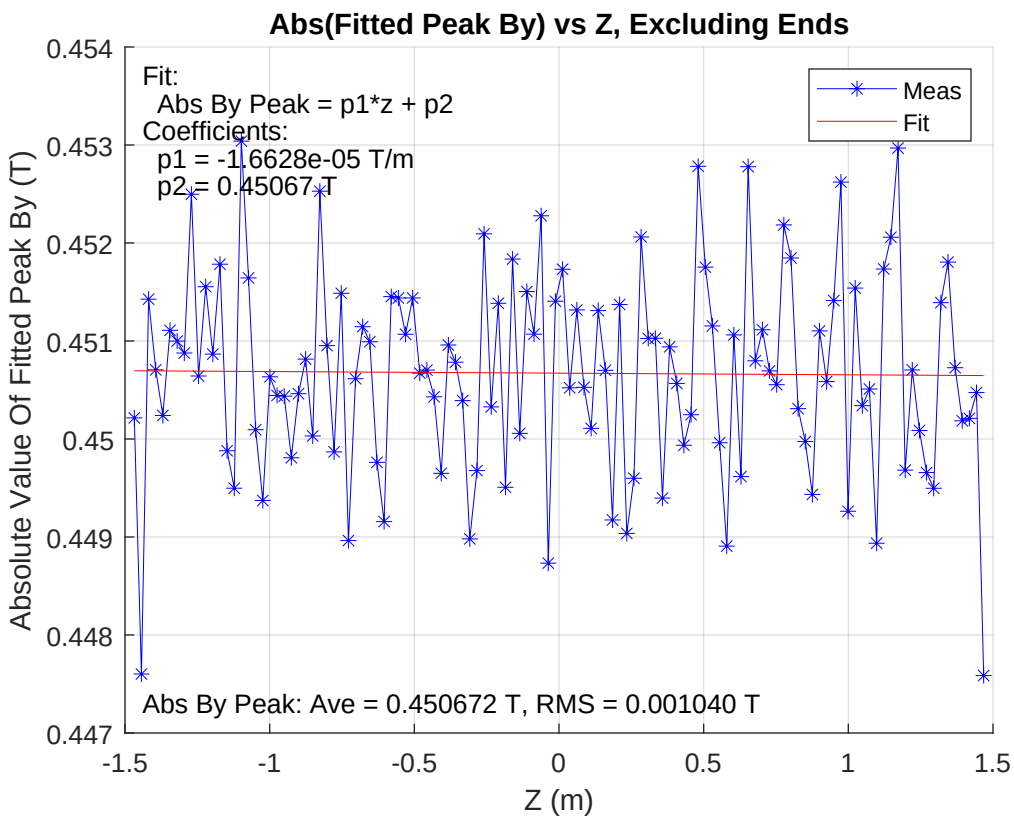

Bx Field Correction vs Zm
Bx Corr (T)
1
0.5
0
-0.5
-1
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
By Field Correction vs Zm
By Corr (T)
1
0.5
0
-0.5
-1
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
Zm Measurement Position (m)

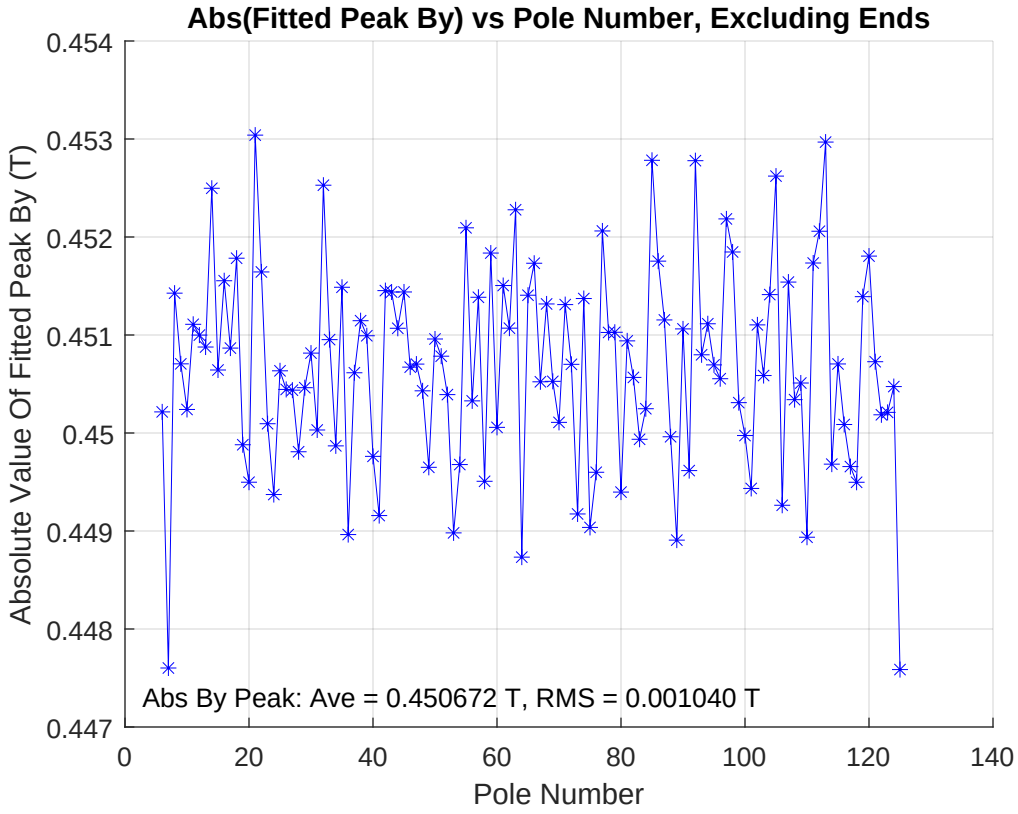

Bx Field After Correction
B (T)
0.01
0
-0.01
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
Entrance Field After Correction
×10^-5
B (T)
-2
-3
-4
1.44
1.45
1.46
1.47
1.48
1.49
1.5
1.51
Exit Field After Correction
×10^-5
B (T)
2
0
-2
5.12
5.13
5.14
5.15
5.16
5.17
5.18
5.19
Zm (m)

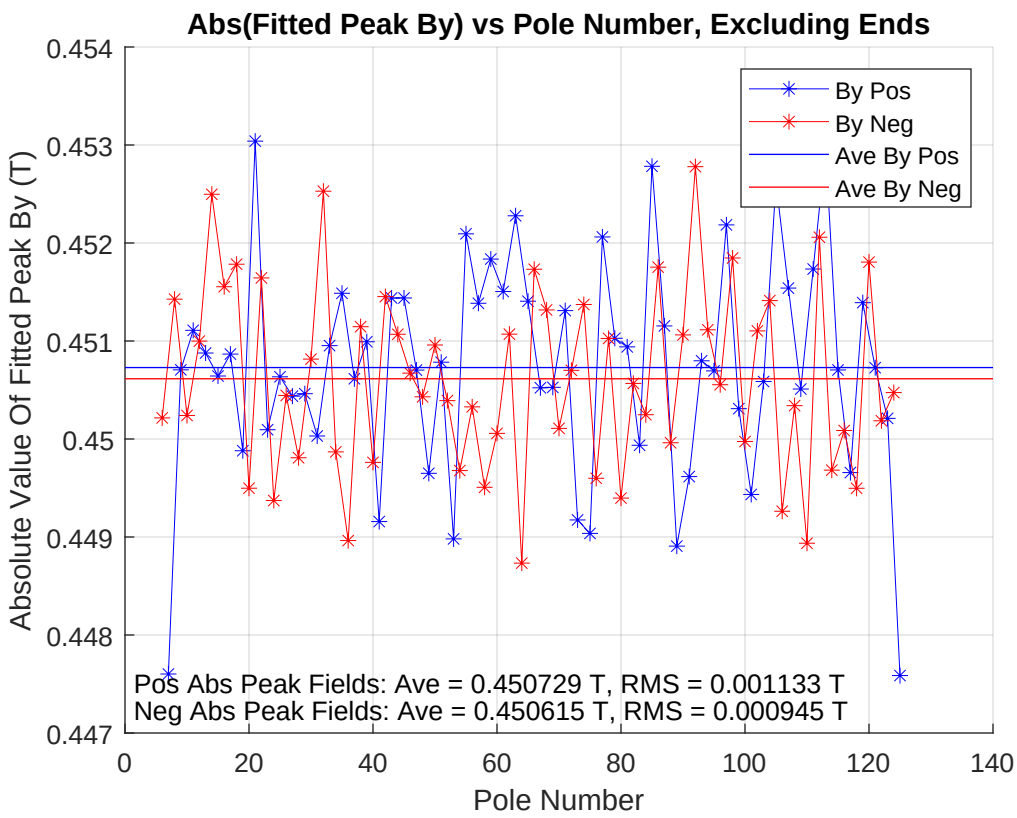

By Field After Correction
B (T)
0.5
0
-0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
Entrance Field After Correction
×10^-5
B (T)
4
2
0
1.44
1.45
1.46
1.47
1.48
1.49
1.5
1.51
Exit Field After Correction
×10^-5
B (T)
2
0
-2
5.12
5.13
5.14
5.15
5.16
5.17
5.18
5.19
Zm (m)

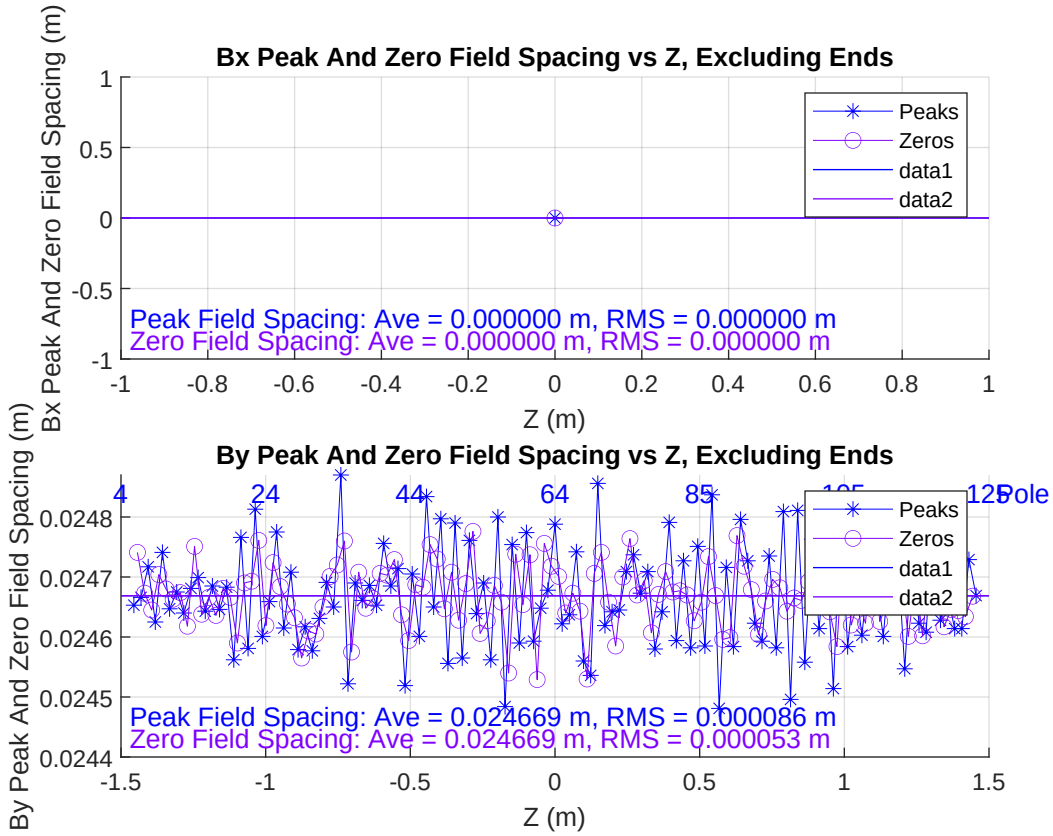

Bx, By vs Zm
0.01
0.005
0
-0.005
-0.01
Bx (T)
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
0.5
0
-0.5
By (T)
Zm Measurement Position (m)

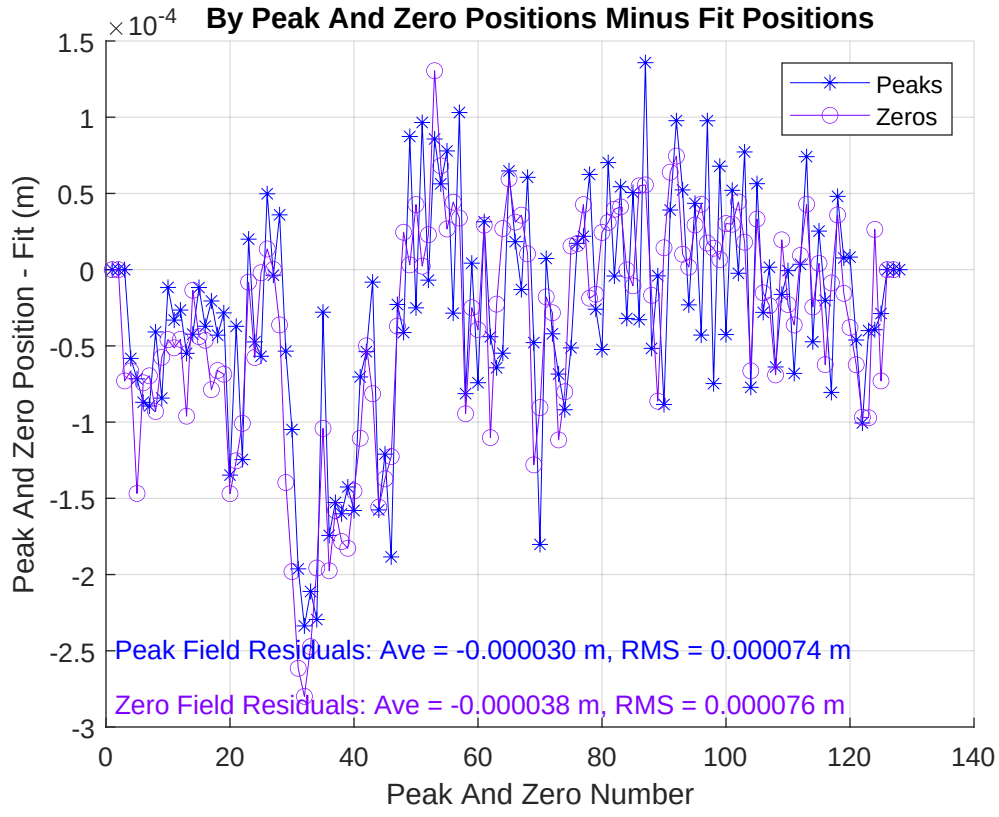

Bx vs Z With Fitted Peaks And Zeros
Bx (T)
0.01
0.005
0
-0.005
-0.01
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z (m)
By vs Z With Fitted Peaks And Zeros
By (T)
0.5
0
-0.5
4
24
44
64
85
105
125
Pole
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z (m)

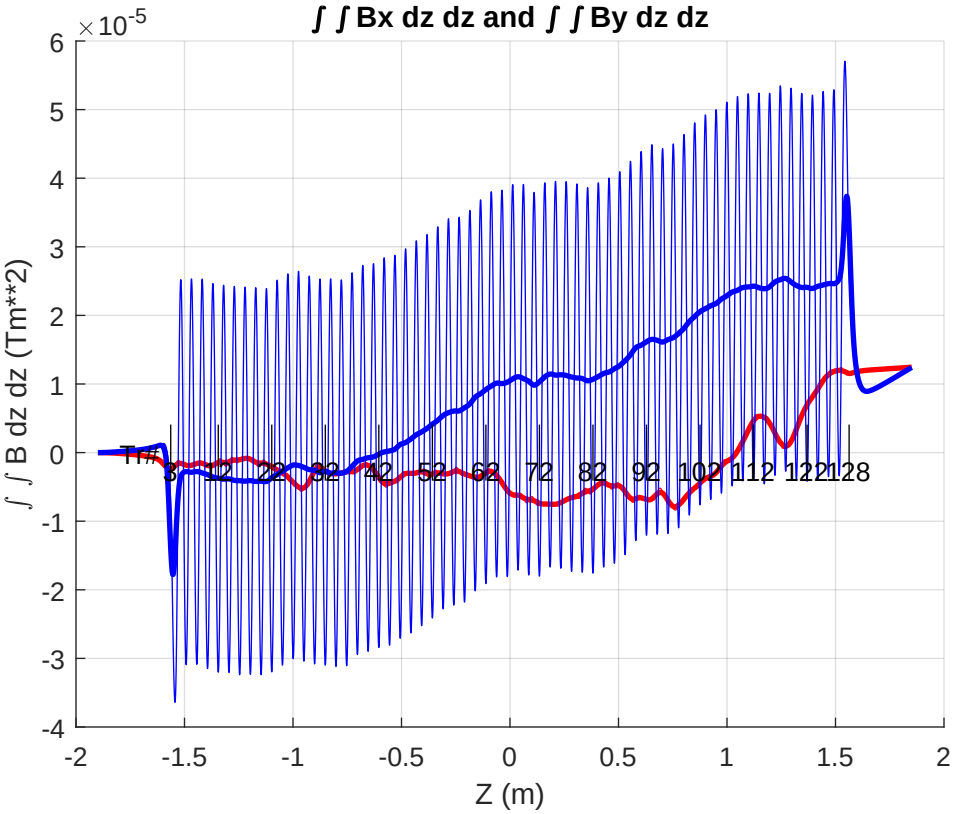

Abs(Fitted Peak By) vs Z, Excluding Ends
Fit:
Abs By Peak = p1*z + p2
Coefficients:
p1 = -1.6628e-05 T/m
p2 = 0.45067 T
Meas
Fit
Abs By Peak: Ave = 0.450672 T, RMS = 0.001040 T
Absolute Value Of Fitted Peak By (T)
Z (m)
0.454
0.453
0.452
0.451
0.45
0.449
0.448
0.447
-1.5
-1
-0.5
0
0.5
1
1.5

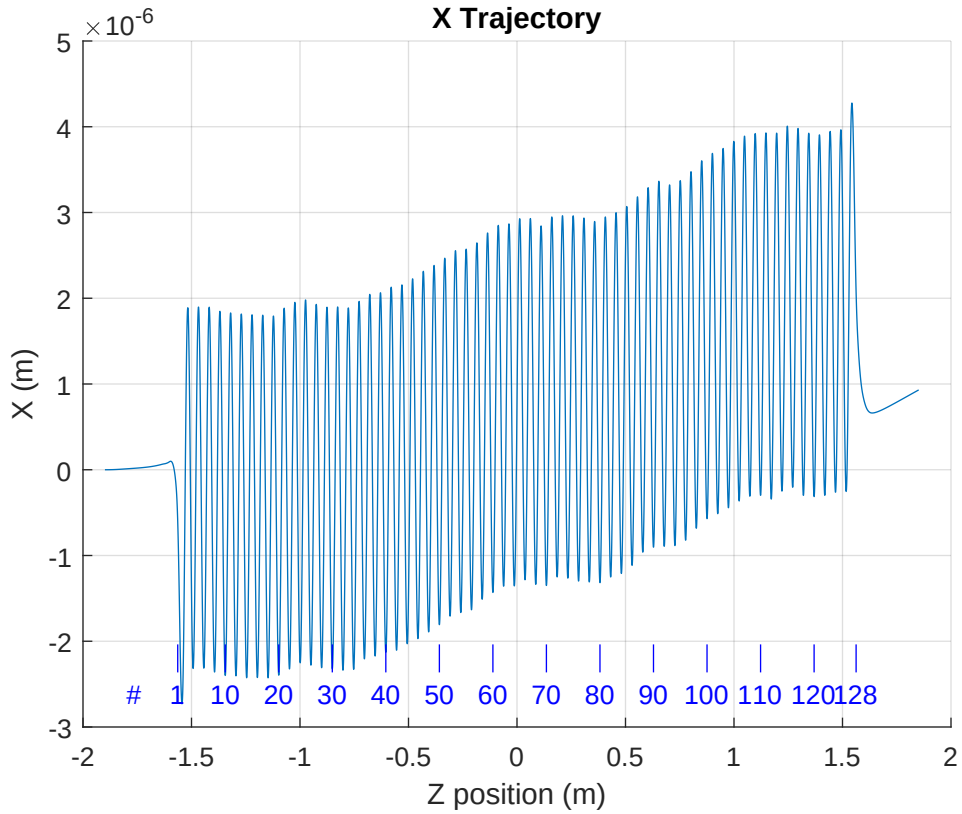

Abs(Fitted Peak By) vs Pole Number, Excluding Ends
Absolute Value Of Fitted Peak By (T)
Pole Number
Abs By Peak: Ave = 0.450672 T, RMS = 0.001040 T
0.454
0.453
0.452
0.451
0.45
0.449
0.448
0.447
0
20
40
60
80
100
120
140

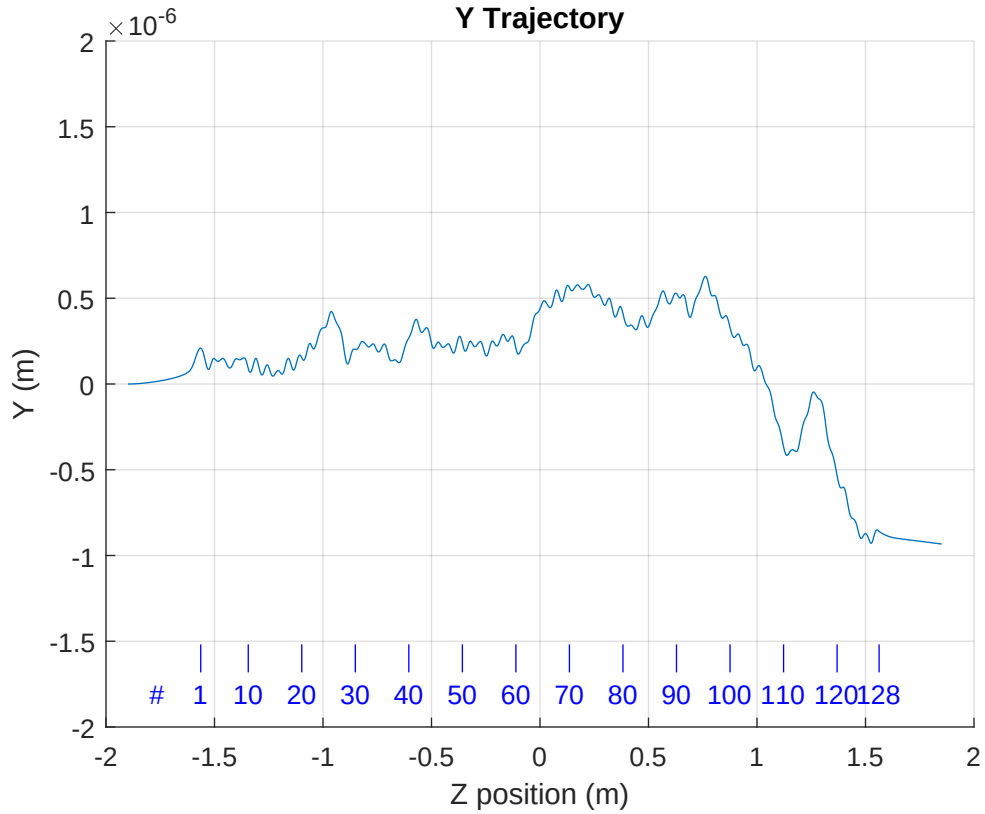

Abs(Fitted Peak By) vs Pole Number, Excluding Ends
Absolute Value Of Fitted Peak By (T)
Pole Number
By Pos
By Neg
Ave By Pos
Ave By Neg
Pos Abs Peak Fields: Ave = 0.450729 T, RMS = 0.001133 T
Neg Abs Peak Fields: Ave = 0.450615 T, RMS = 0.000945 T
0.454
0.453
0.452
0.451
0.45
0.449
0.448
0.447
0
20
40
60
80
100
120
140

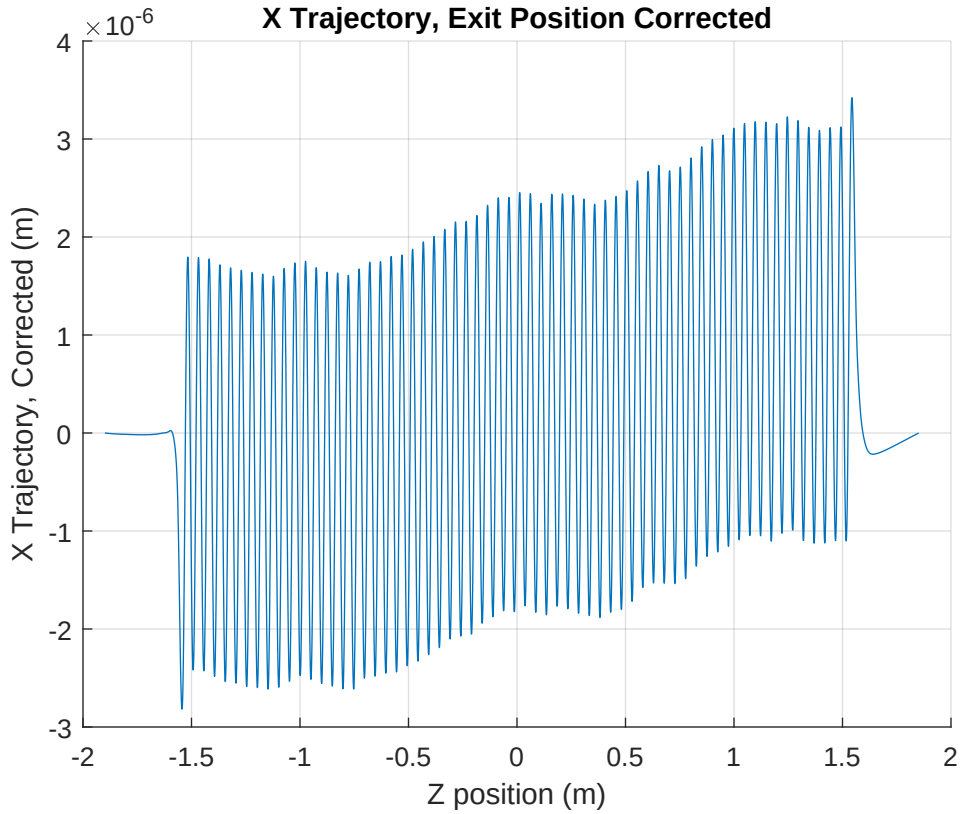

Bx Peak And Zero Field Spacing vs Z, Excluding Ends
Bx Peak And Zero Field Spacing (m)
Z (m)
Peaks
Zeros
data1
data2
Peak Field Spacing: Ave = 0.000000 m, RMS = 0.000000 m
Zero Field Spacing: Ave = 0.000000 m, RMS = 0.000000 m
By Peak And Zero Field Spacing vs Z, Excluding Ends
By Peak And Zero Field Spacing (m)
Z (m)
4
24
44
64
85
125
Pole
Peak Field Spacing: Ave = 0.024669 m, RMS = 0.000086 m
Zero Field Spacing: Ave = 0.024669 m, RMS = 0.000053 m

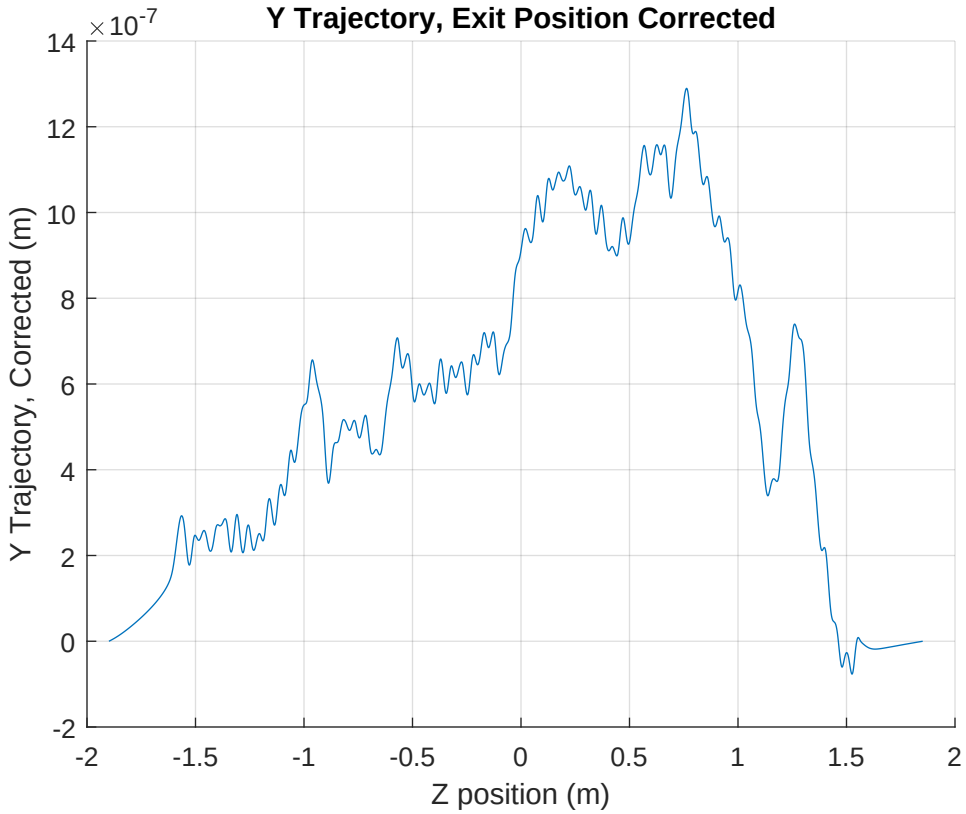

By Peak And Zero Positions Minus Fit Positions
×10^-4
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
Peak And Zero Position - Fit (m)
0
20
40
60
80
100
120
140
Peak And Zero Number
Peaks
Zeros
Peak Field Residuals: Ave = -0.000030 m, RMS = 0.000074 m
Zero Field Residuals: Ave = -0.000038 m, RMS = 0.000076 m

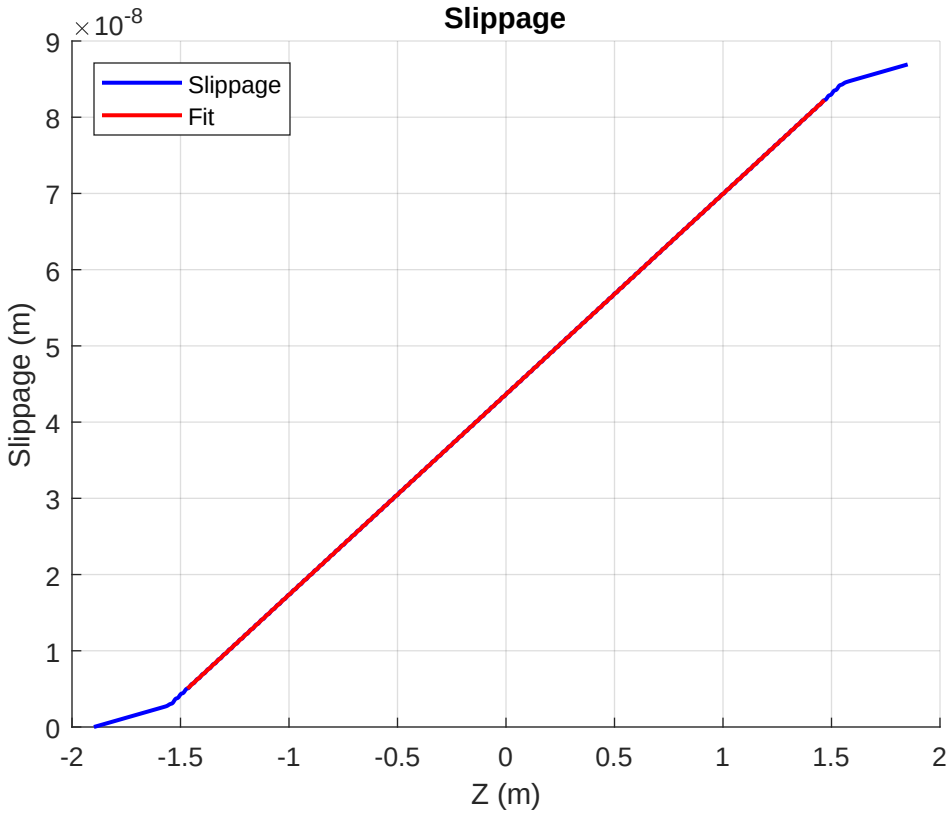

∫ ∫ Bx dz dz and ∫ ∫ By dz dz
×10^-5
6
5
4
3
2
1
0
-1
-2
-3
-4
∫ ∫ B dz dz (Tm**2)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z (m)
Tiff
3
12
22
32
42
52
62
72
82
92
102
112
122
128

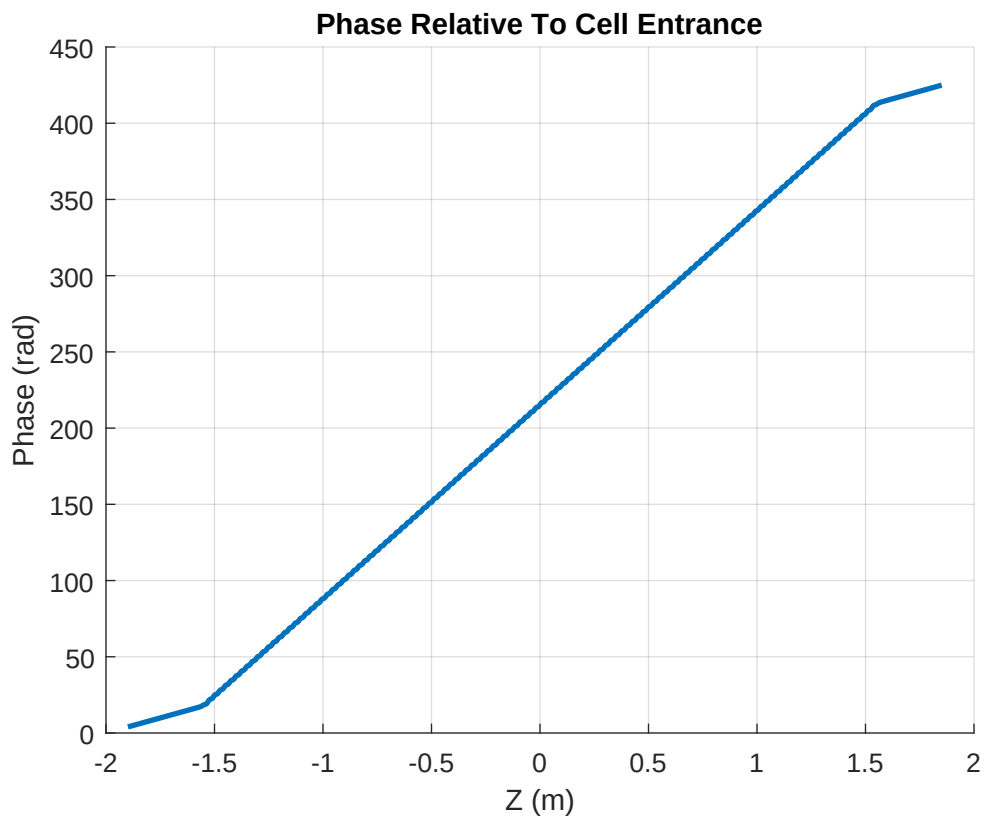

X Trajectory
×10^-6
5
4
3
2
1
0
-1
-2
-3
X (m)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z position (m)
1 10 20 30 40 50 60 70 80 90 100 110 120 128

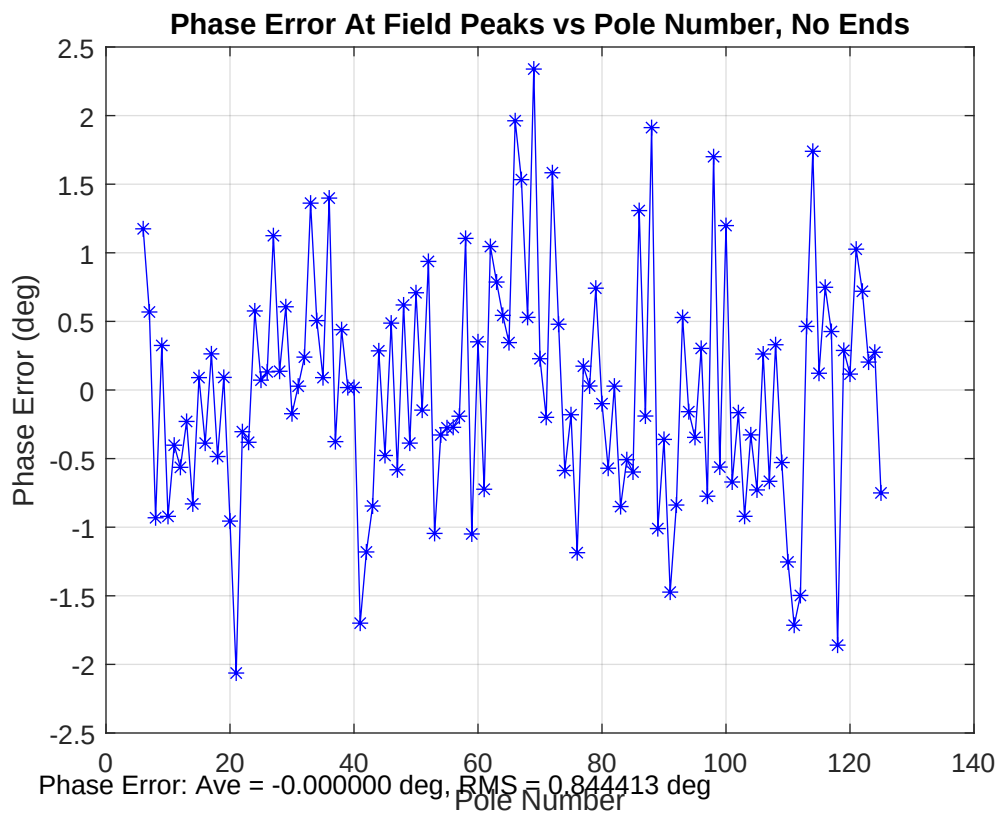

Y Trajectory
×10^-6
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
Y (m)
1 10 20 30 40 50 60 70 80 90 100 110 120 128
-2 -1.5 -1 -0.5 0 0.5 1 1.5 2
Z position (m)

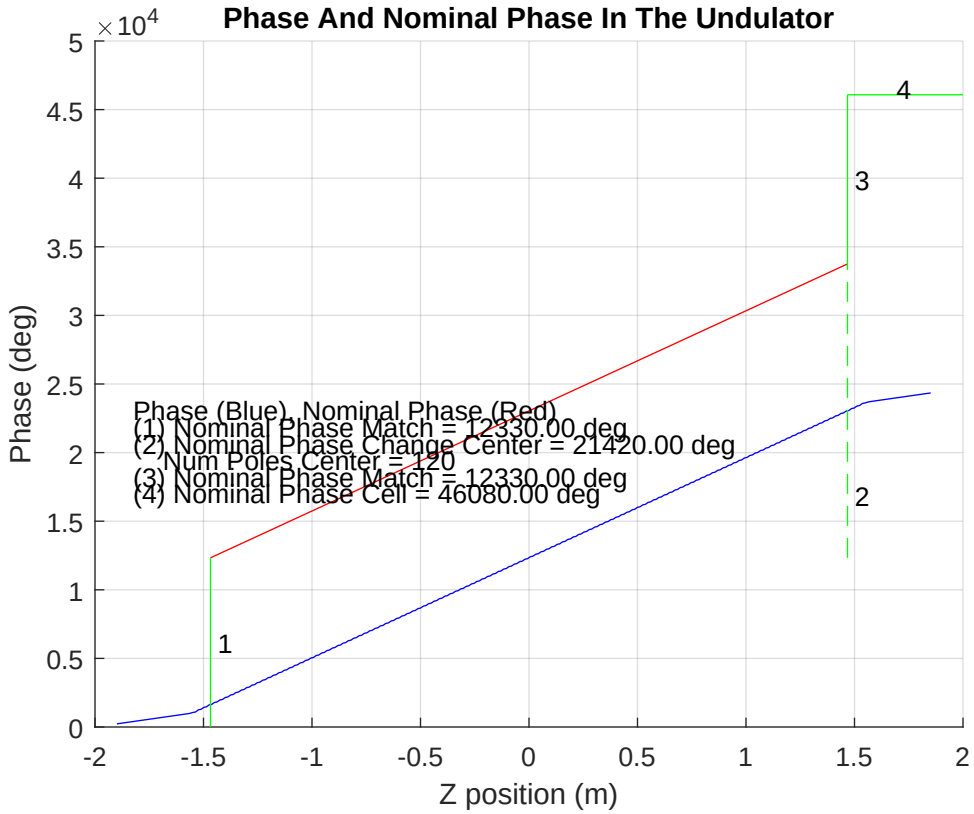

X Trajectory, Exit Position Corrected
×10^-6
4
3
2
1
0
-1
-2
-3
X Trajectory, Corrected (m)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z position (m)

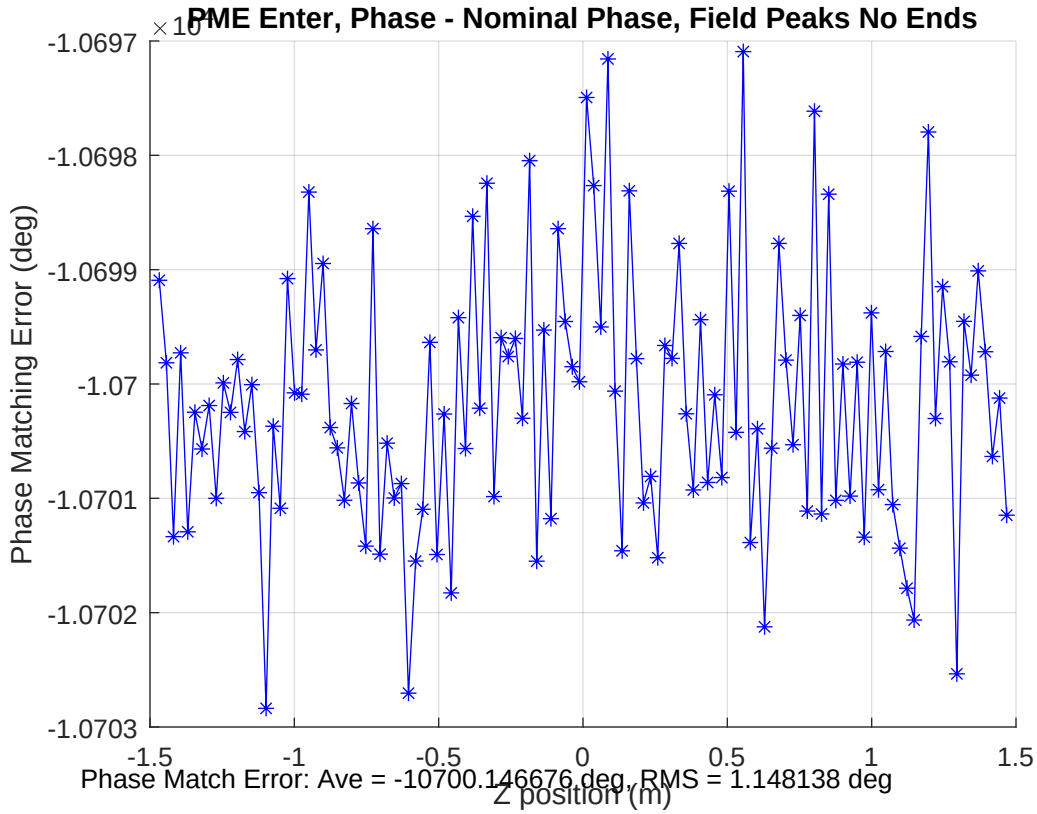

Y Trajectory, Exit Position Corrected
×10^-7
14
12
10
8
6
4
2
0
-2
Y Trajectory, Corrected (m)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z position (m)

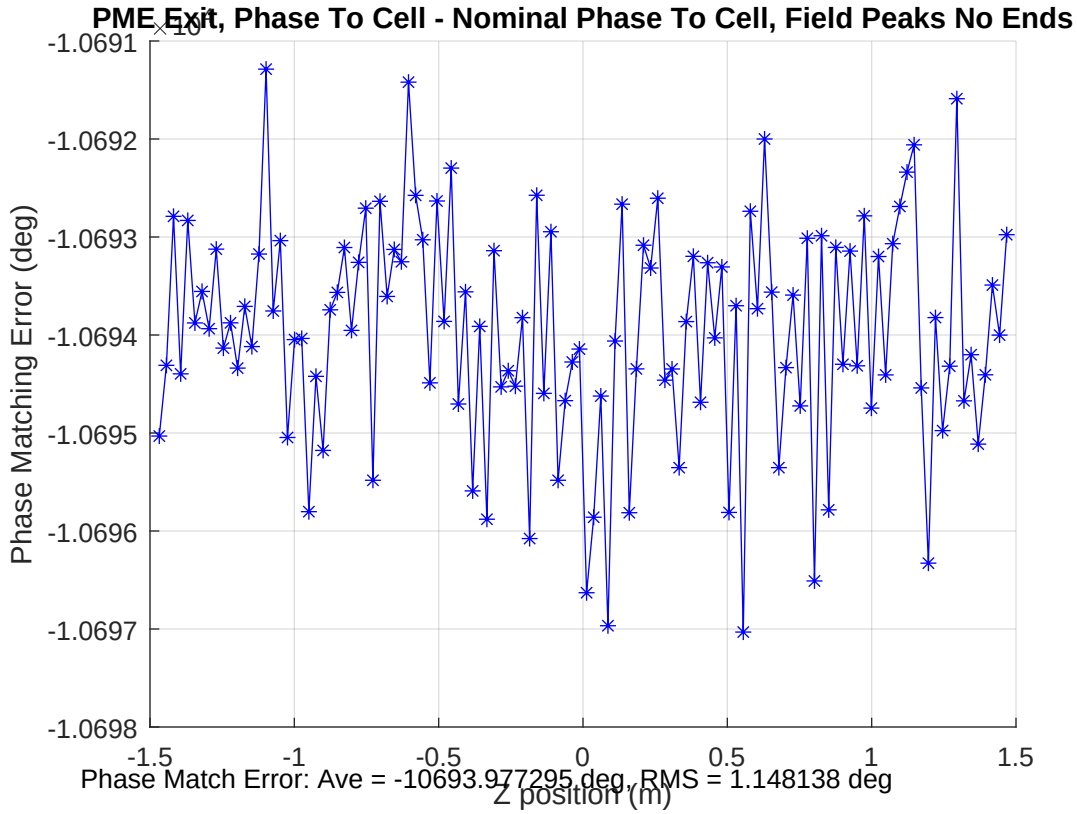

Slippage
×10^-8
9
8
7
6
5
4
3
2
1
0
Slippage (m)
Slippage
Fit
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z (m)

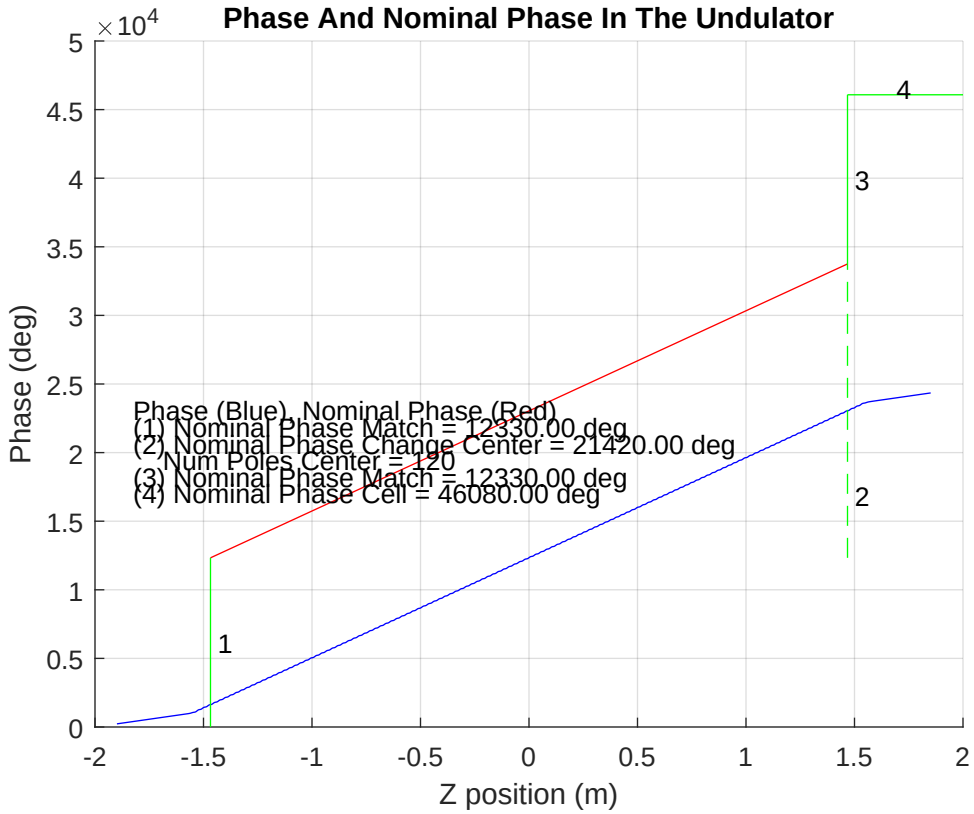

Phase Relative To Cell Entrance
Phase (rad)
450
400
350
300
250
200
150
100
50
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z (m)

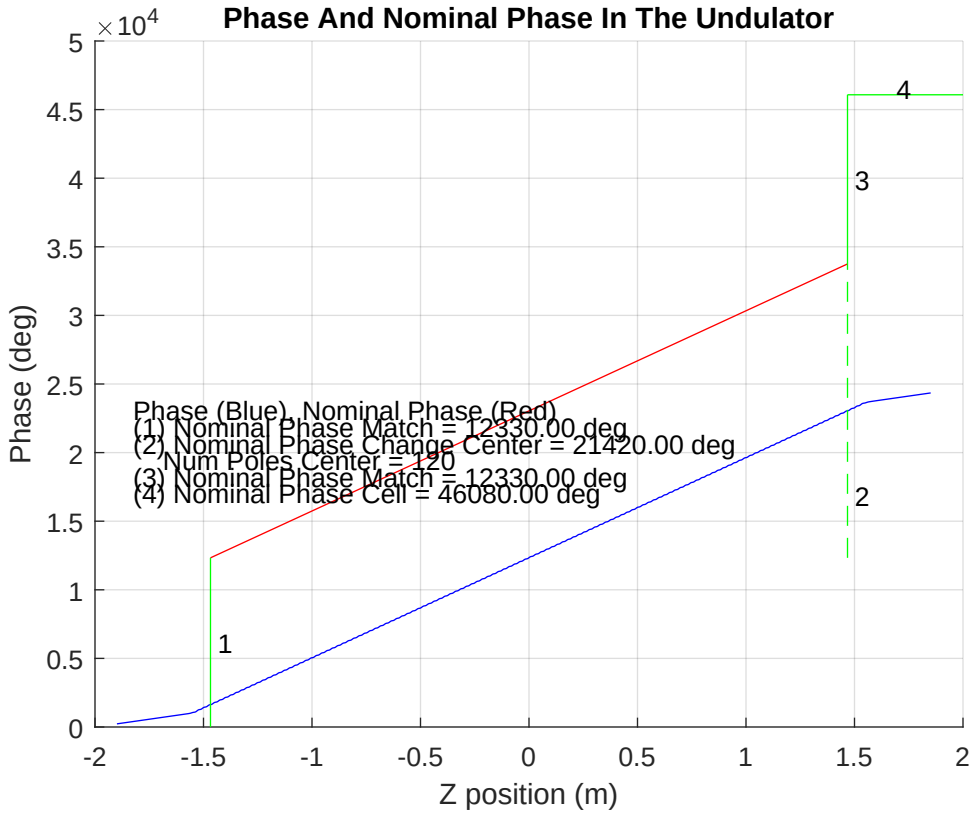

Phase Error At Field Peaks vs Pole Number, No Ends
Phase Error (deg)
Pole Number
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
0
20
40
60
80
100
120
140
Phase Error: Ave = -0.000000 deg, RMS = 0.844413 deg


Phase And Nominal Phase In The Undulator
×10^4
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Phase (deg)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z position (m)
Phase (Blue), Nominal Phase (Red)
(1) Nominal Phase Match = 12330.00 deg
(2) Nominal Phase Change Center = 21420.00 deg
Num Poles Center = 120
(3) Nominal Phase Match = 12330.00 deg
(4) Nominal Phase Cell = 46080.00 deg
1
2
3
4


PME Enter, Phase - Nominal Phase, Field Peaks No Ends
×10
-1.0697
-1.0698
-1.0699
-1.07
-1.0701
-1.0702
-1.0703
Phase Matching Error (deg)
-1.5
-1
-0.5
0
0.5
1
1.5
Z position (m)
Phase Match Error: Ave = -10700.146676 deg, RMS = 1.148138 deg


PME Exit, Phase To Cell - Nominal Phase To Cell, Field Peaks No Ends
×10
-1.0691
-1.0692
-1.0693
-1.0694
-1.0695
-1.0696
-1.0697
-1.0698
Phase Matching Error (deg)
-1.5
-1
-0.5
0
0.5
1
1.5
Z position (m)
Phase Match Error: Ave = -10693.977295 deg, RMS = 1.148138 deg


Phase And Nominal Phase In The Undulator
×10^4
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Phase (deg)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z position (m)
Phase (Blue), Nominal Phase (Red)
(1) Nominal Phase Match = 12330.00 deg
(2) Nominal Phase Change Center = 21420.00 deg
Num Poles Center = 120
(3) Nominal Phase Match = 12330.00 deg
(4) Nominal Phase Cell = 46080.00 deg
1
2
3
4


Phase And Nominal Phase In The Undulator
×10^4
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Phase (deg)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Z position (m)
Phase (Blue), Nominal Phase (Red)
(1) Nominal Phase Match = 12330.00 deg
(2) Nominal Phase Change Center = 21420.00 deg
Num Poles Center = 120
(3) Nominal Phase Match = 12330.00 deg
(4) Nominal Phase Cell = 46080.00 deg
1
2
3
4