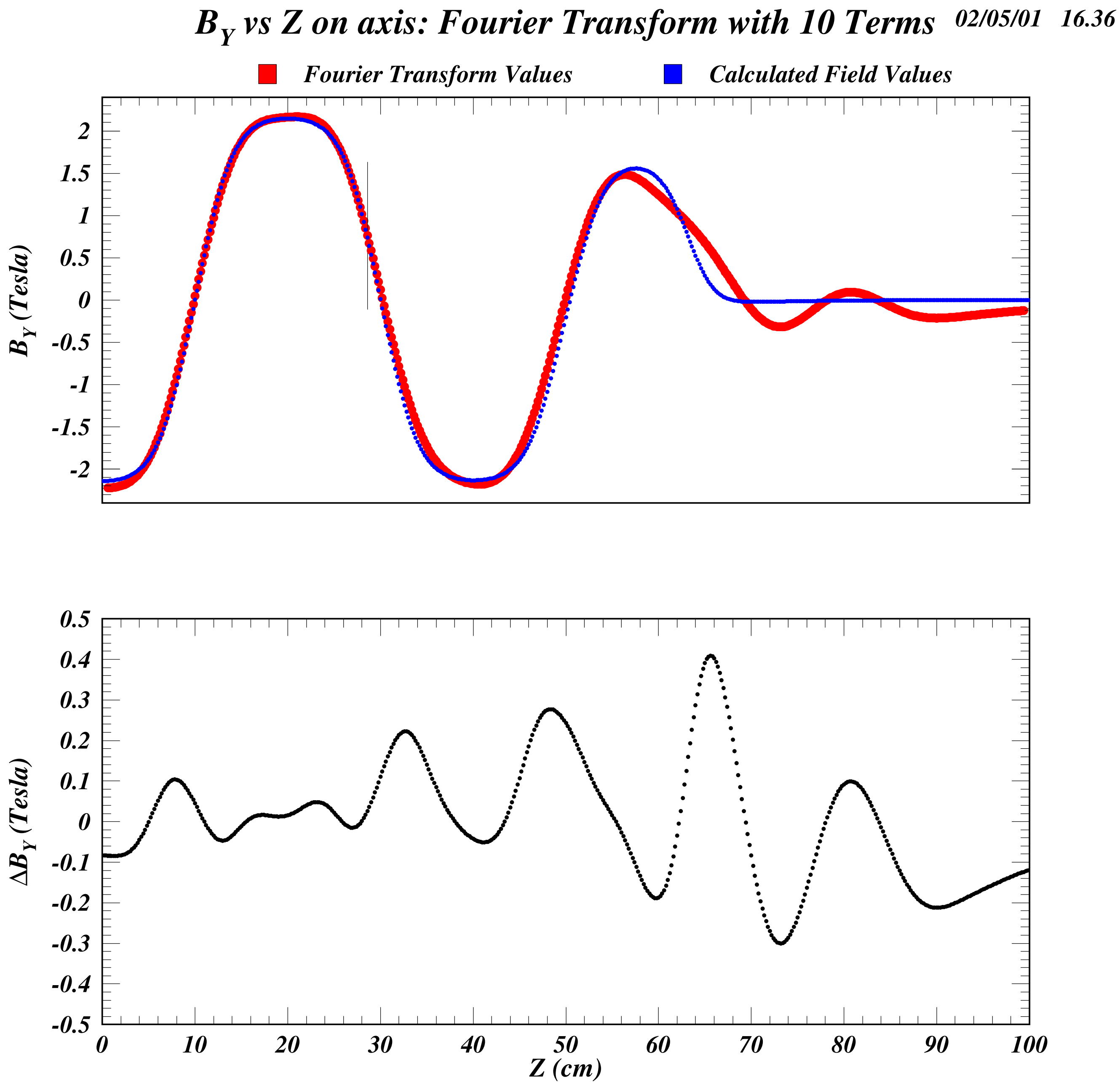
Fourier Transform of 7-Pole Wiggler Field and 8-Pole Wiggler Field Calculations

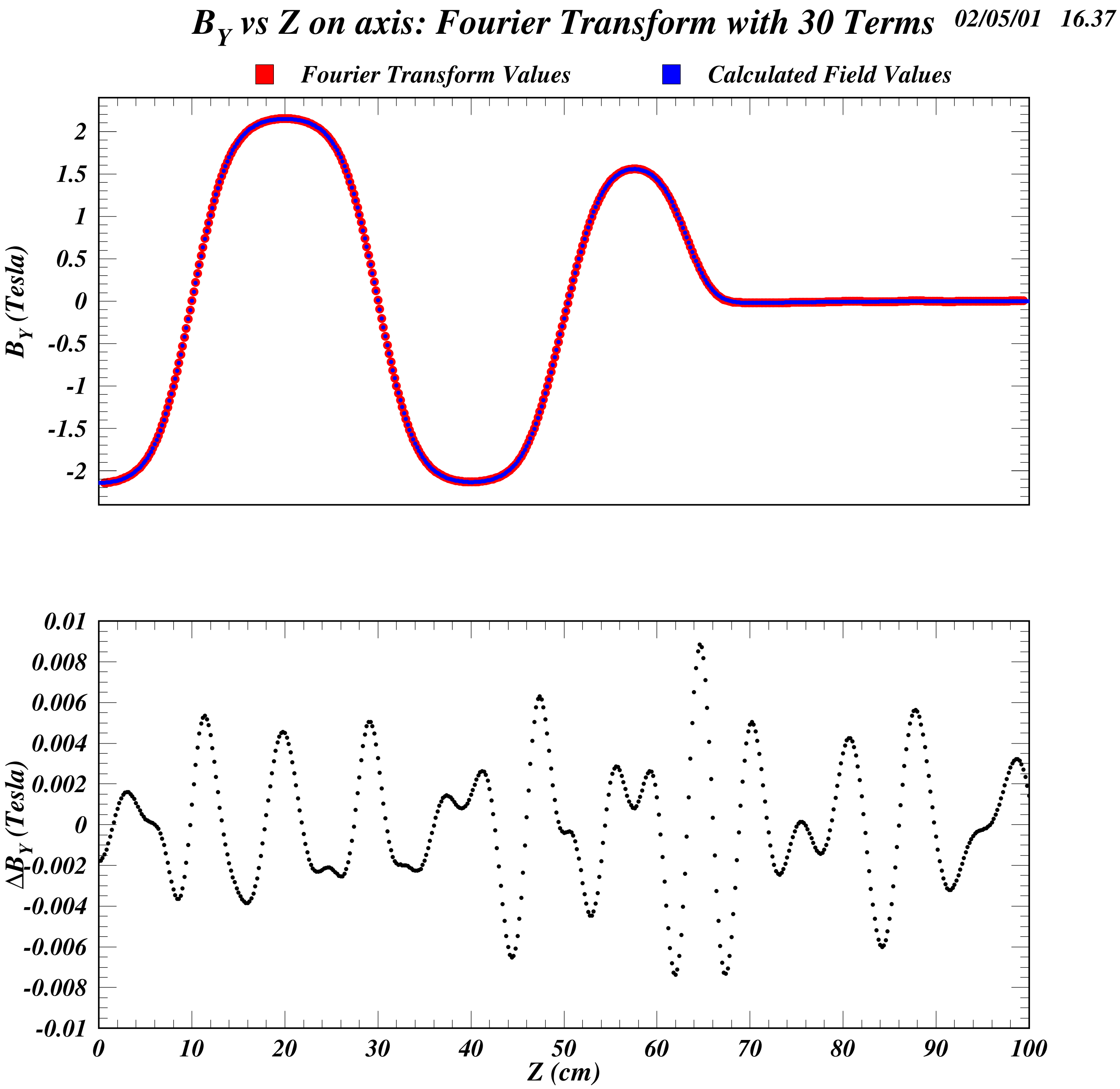
1. **Obtained Fourier transform of $B_Y(z)$ along axis of 7-pole wiggler**
   - Now know number of terms necessary for a given level of accuracy.
     40 terms suffice to reduce residuals below 20 G. Present numerical limit is $< 1\ G$.
   - Also know which terms they are
   - A fit to the field using these terms as input is now running.
   - Thinking about transform of x-dependence.
     Few terms but both real and imaginary.
     Desired result: Fit only coefficients of linearly-independent terms.

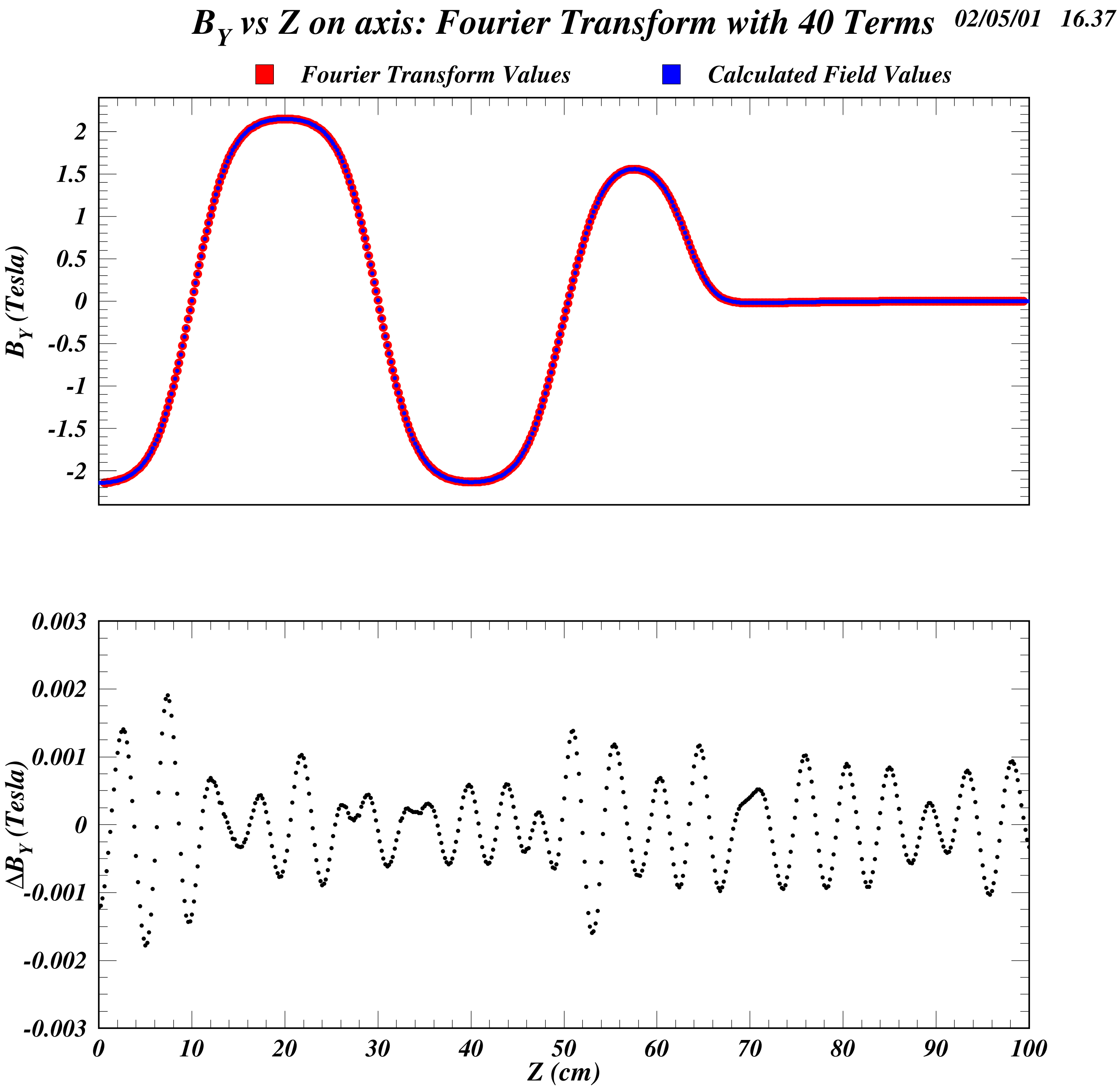
2. **8-Pole Wiggler Field Calculations**
   - Antisymmetric field. $B_Y = 0$ at center of magnet.
   - Currents in main and end poles independent.
     Will adjust end pole current to give desired tracking result.

3. **Fit Gymnastics for 7-Pole Field**
   - Minimize with respect to B_Y only.
     $\Rightarrow$ No change. Fit remained at minimum previously found.
   - Weight field values with 1-G errors rather than with VF error bars.
     $\Rightarrow$ Weird result. Y-dependence wrong. Peak field poorly constrained.

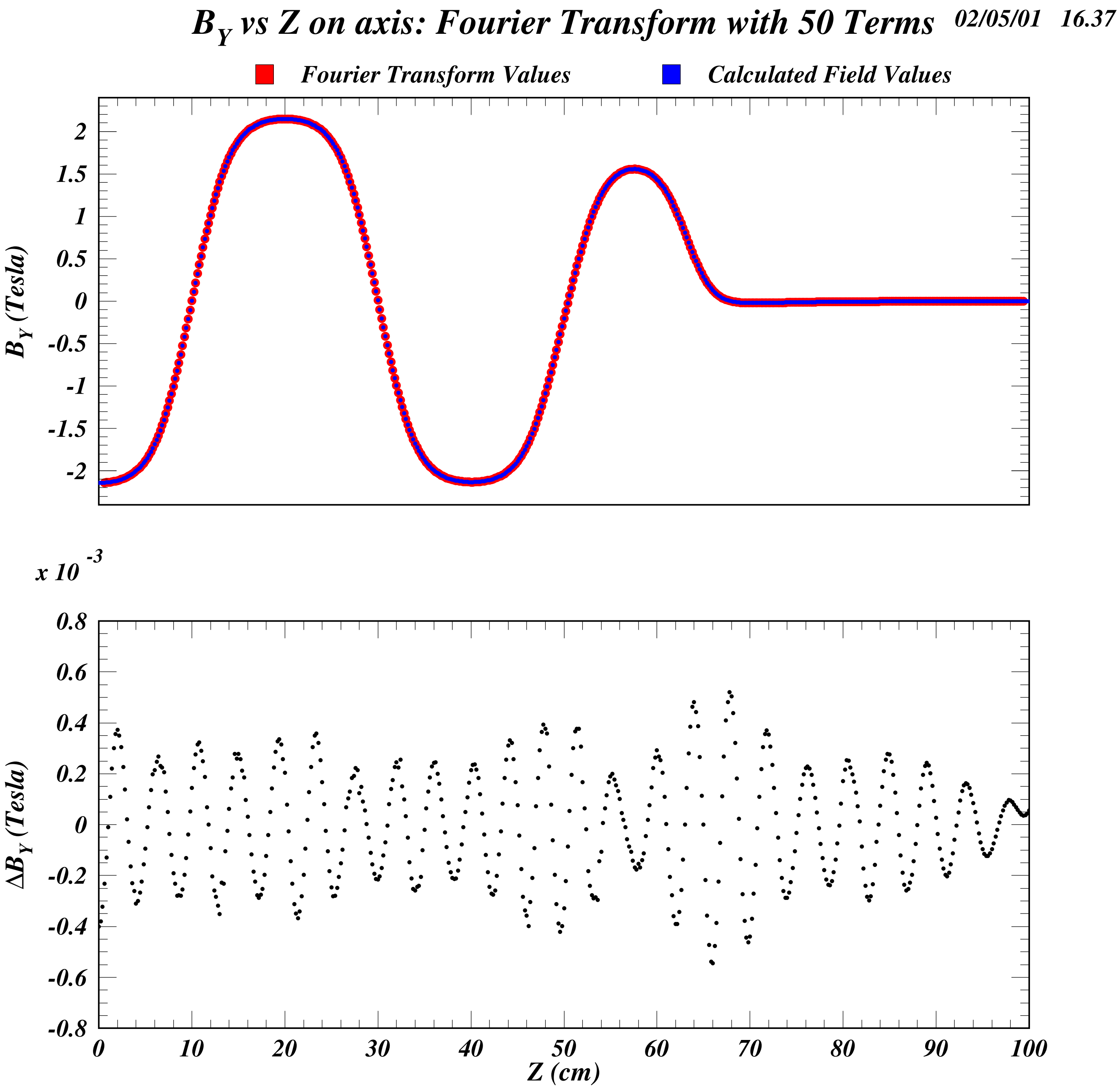


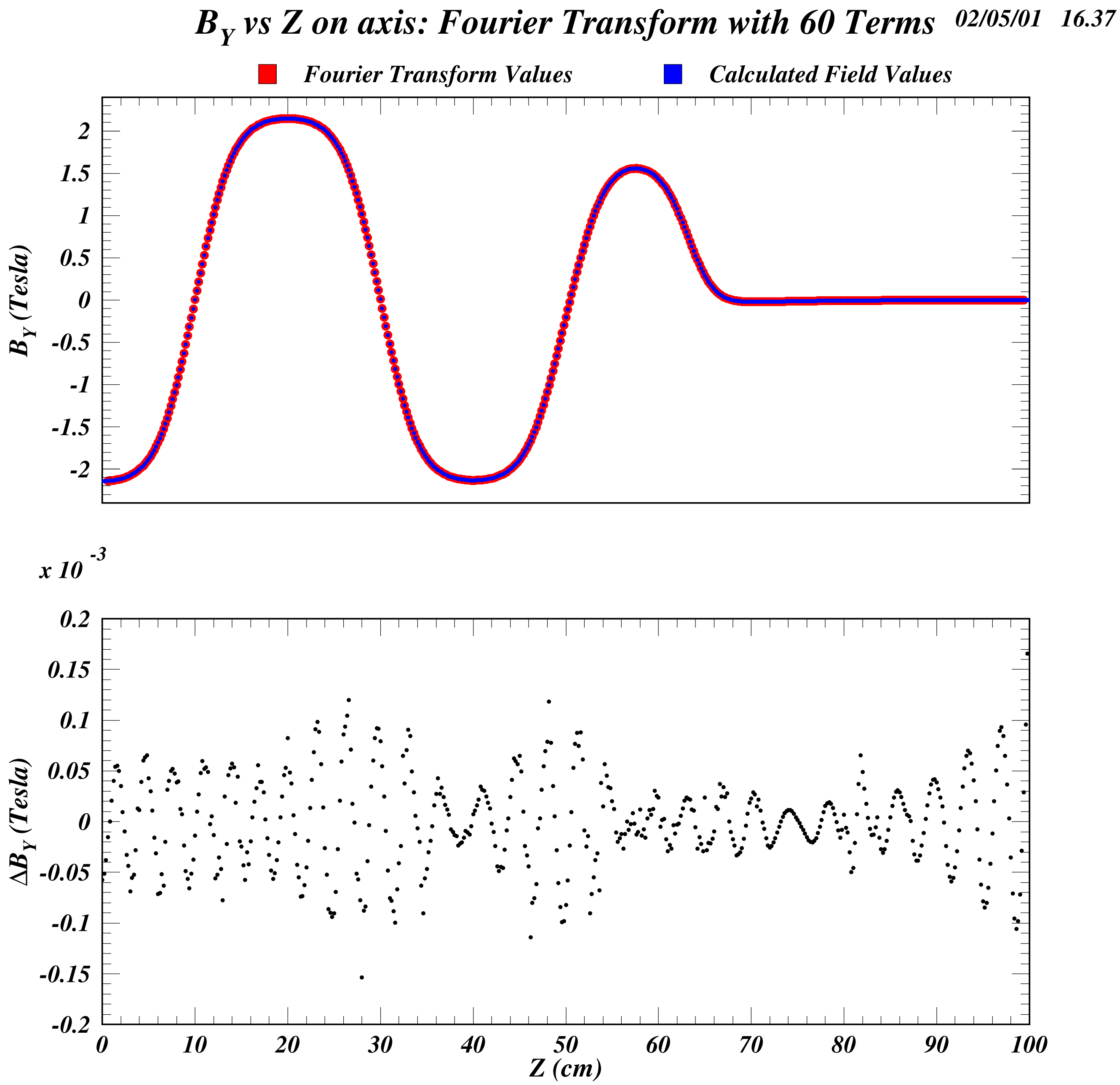
B_Y vs Z on axis: Fourier Transform with 10 Terms
02/05/01 16.36
Fourier Transform Values
Calculated Field Values
B_Y (Tesla)
ΔB_Y (Tesla)
Z (cm)


B_Y vs Z on axis: Fourier Transform with 30 Terms
02/05/01 16.37
Fourier Transform Values
Calculated Field Values
B_Y (Tesla)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
ΔB_Y (Tesla)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
10
20
30
40
50
60
70
80
90
100
Z (cm)



B_Y vs Z on axis: Fourier Transform with 40 Terms
02/05/01 16.37
Fourier Transform Values
Calculated Field Values
B_Y (Tesla)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
ΔB_Y (Tesla)
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
0
10
20
30
40
50
60
70
80
90
100
Z (cm)


B_Y vs Z on axis: Fourier Transform with 50 Terms
02/05/01 16.37
Fourier Transform Values
Calculated Field Values
B_Y (Tesla)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
x 10^{-3}
ΔB_Y (Tesla)
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
10
20
30
40
50
60
70
80
90
100
Z (cm)



B_Y vs Z on axis: Fourier Transform with 60 Terms
02/05/01 16.37
Fourier Transform Values
Calculated Field Values
B_Y (Tesla)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
x 10^-3
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
ΔB_Y (Tesla)
0
10
20
30
40
50
60
70
80
90
100
Z (cm)

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term(02) =	-1.421923	0.000000	15.339808	0.000000
term(03) =	-0.844177	0.000000	18.407768	0.000000
term(04) =	-0.582427	0.000000	12.271846	0.000000
term(05) =	0.222278	0.000000	9.203884	0.000000
term(06) =	0.159008	0.000000	24.543692	0.000000
term(07) =	0.157127	0.000000	21.475731	0.000000
term(08) =	-0.151745	0.000000	27.611652	0.000000
term(09) =	0.136467	0.000000	46.019421	0.000000
term(10) =	0.100196	0.000000	49.087383	0.000000
term(11) =	0.099185	0.000000	42.951462	0.000000
term(12) =	0.098541	0.000000	33.747578	0.000000
term(13) =	0.088205	0.000000	6.135923	0.000000
term(14) =	-0.071344	0.000000	3.067961	0.000000
term(15) =	-0.064426	0.000000	36.815536	0.000000
term(16) =	-0.052643	0.000000	39.883499	0.000000
term(17) =	0.039124	0.000000	52.155346	0.000000
term(18) =	-0.026820	0.000000	55.223305	0.000000
term(19) =	-0.023990	0.000000	76.699036	0.000000
term(20) =	0.022041	0.000000	61.359230	0.000000
term(21) =	-0.014792	0.000000	58.291267	0.000000
term(22) =	-0.014109	0.000000	67.495155	0.000000
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term(29) =	-0.002254	0.000000	98.174767	0.000000
term(30) =	-0.002205	0.000000	95.106804	0.000000
term(31) =	0.002151	0.000000	73.631073	0.000000
term(32) =	-0.001884	0.000000	64.427193	0.000000
term(33) =	-0.001812	0.000000	107.378654	0.000000
term(34) =	0.001701	0.000000	82.834961	0.000000
term(35) =	0.001062	0.000000	141.126221	0.000000
term(36) =	0.000867	0.000000	110.446609	0.000000
term(37) =	-0.000780	0.000000	116.582535	0.000000
term(38) =	-0.000651	0.000000	134.990311	0.000000
term(39) =	-0.000592	0.000000	125.786415	0.000000
term(40) =	0.000516	0.000000	113.514572	0.000000
term(41) =	0.000400	0.000000	128.854385	0.000000
term(42) =	0.000382	0.000000	119.650497	0.000000
term(43) =	0.000323	0.000000	131.922348	0.000000
term(44) =	-0.000313	0.000000	147.262146	0.000000
term(45) =	0.000246	0.000000	138.058273	0.000000
term(46) =	-0.000243	0.000000	88.970879	0.000000
term(47) =	0.000195	0.000000	104.310692	0.000000
term(48) =	-0.000176	0.000000	171.805847	0.000000
term(49) =	0.000172	0.000000	122.718460	0.000000
term(50) =	-0.000158	0.000000	174.873810	0.000000
term(51) =	0.000156	0.000000	144.194199	0.000000
term(52) =	0.000150	0.000000	150.330124	0.000000
term(53) =	-0.000123	0.000000	156.466049	0.000000
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term(55) =	0.000061	0.000000	162.601959	0.000000
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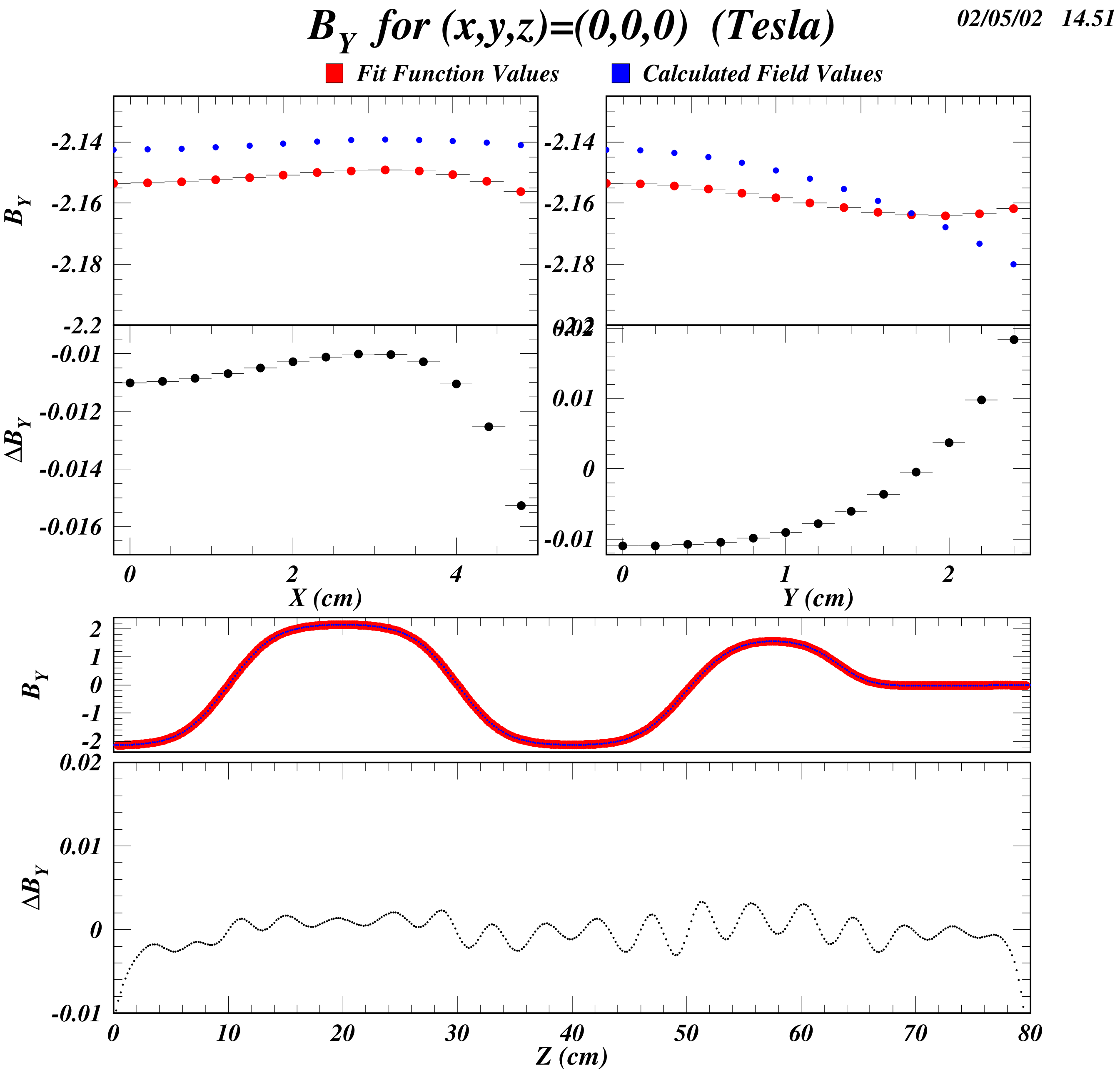
term(57) =	-0.000050	0.000000	184.077682	0.000000
term(58) =	0.000043	0.000000	190.213608	0.000000
term(59) =	-0.000035	0.000000	196.349533	0.000000
term(60) =	-0.000032	0.000000	159.533997	0.000000



B_Y for (x,y,z)=(0,0,0) (Tesla)
02/05/02 14.51
Fit Function Values
Calculated Field Values
B_Y
ΔB_Y
X (cm)
Y (cm)
Z (cm)