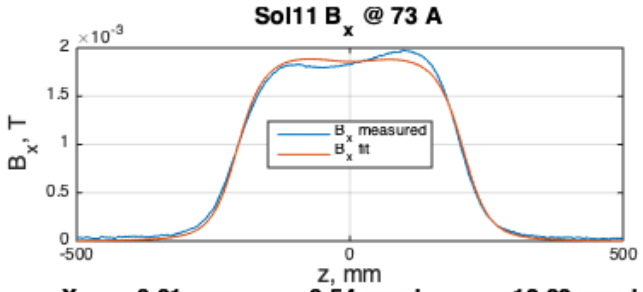
Analysis of Magnetic Measurements Data of PCA Solenoids

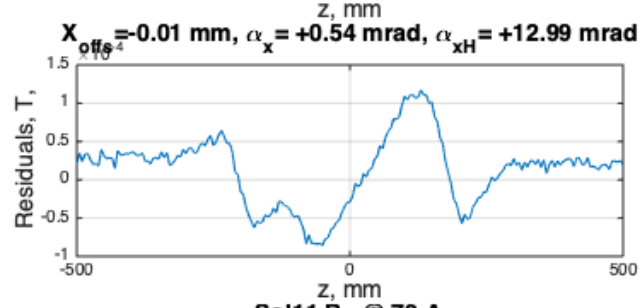
On axis

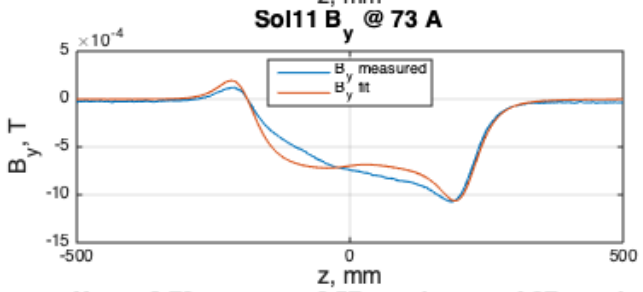
Processed Data

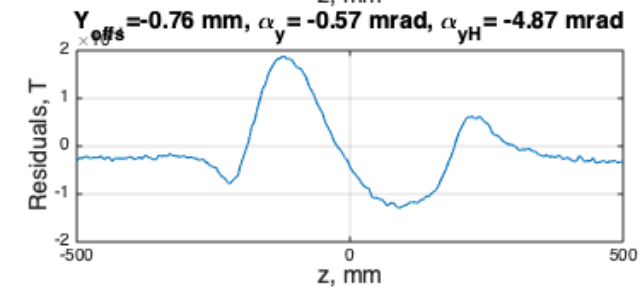
- Magnetic measurements data were collected and Superconducting Magnet Division
- Axial B_z, transverse B_x and B_y were measured on axis and with offset
- Only on axis data are presented here with fit of Hall probe tilt as well as scan line (offset and angle)
- Three current setpoints were analyzed 73, 122, and 145 A (36 A data are also available)

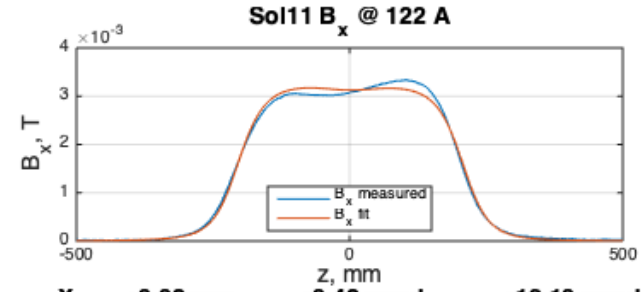
Solenoid 11

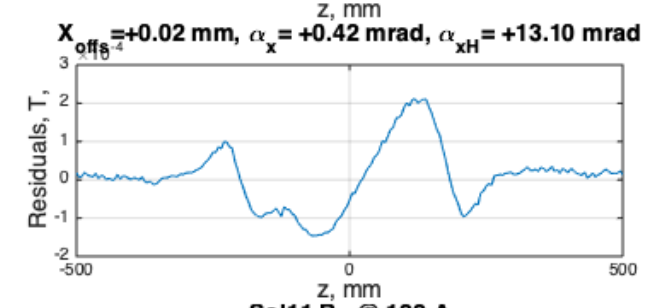

Sol11 B_x @ 73 A
B_x measured
B_x fit
B_x, T
z, mm

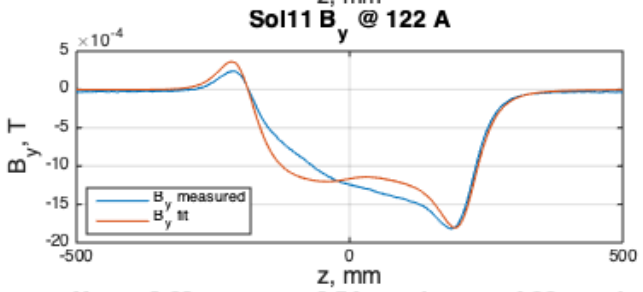

X_offs=-0.01 mm, α_x= +0.54 mrad, α_xH= +12.99 mrad
Residuals, T,
z, mm

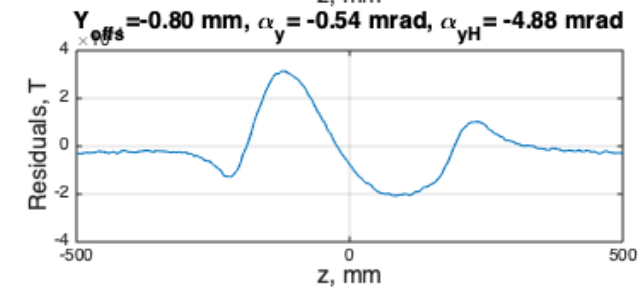

Sol11 B_y @ 73 A
B_y measured
B_y fit
B_y, T
z, mm

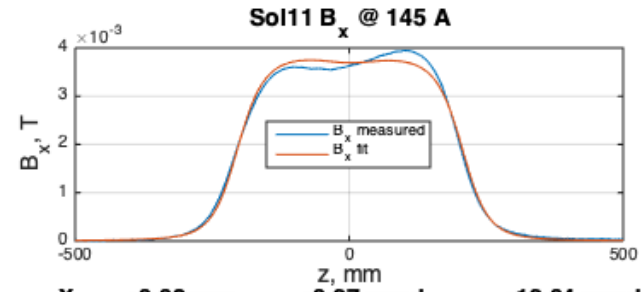

Y_offs=-0.76 mm, α_y= -0.57 mrad, α_yH= -4.87 mrad
Residuals, T
z, mm

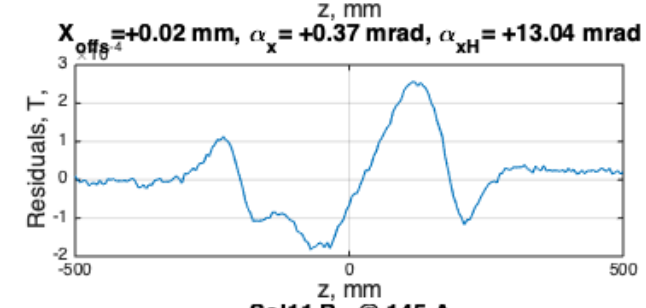

Sol11 B_x @ 122 A
B_x measured
B_x fit
B_x, T
z, mm

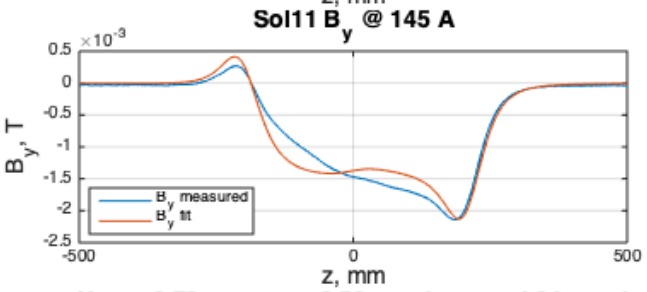

X_offs=+0.02 mm, α_x= +0.42 mrad, α_xH= +13.10 mrad
Residuals, T,
z, mm

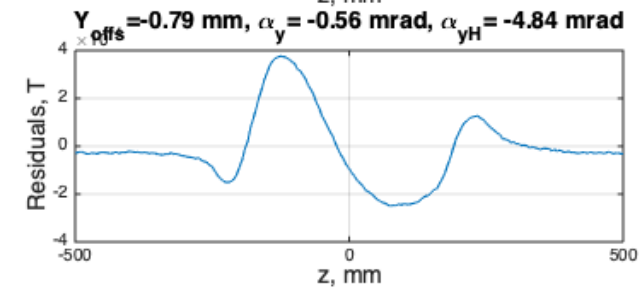

Sol11 B_y @ 122 A
B_y measured
B_y fit
B_y, T
z, mm


Y_offs=-0.80 mm, α_y= -0.54 mrad, α_yH= -4.88 mrad
Residuals, T
z, mm

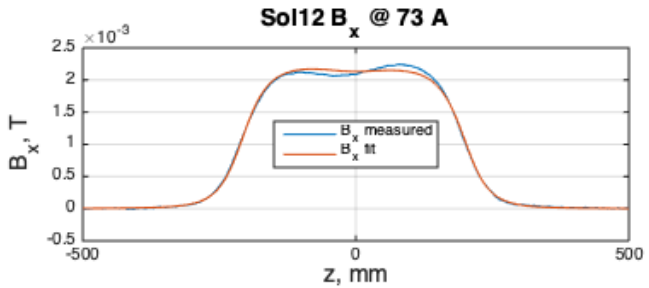

Sol11 B_x @ 145 A
B_x measured
B_x fit
B_x, T
z, mm

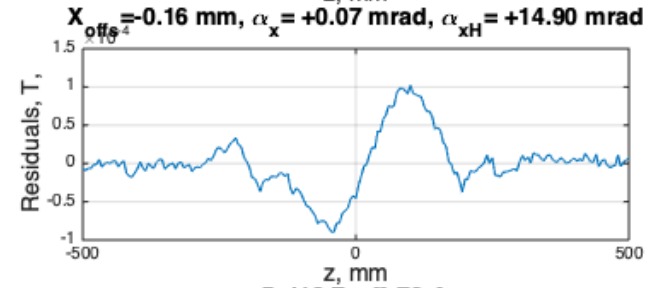

X_offs=+0.02 mm, α_x= +0.37 mrad, α_xH= +13.04 mrad
Residuals, T,
z, mm

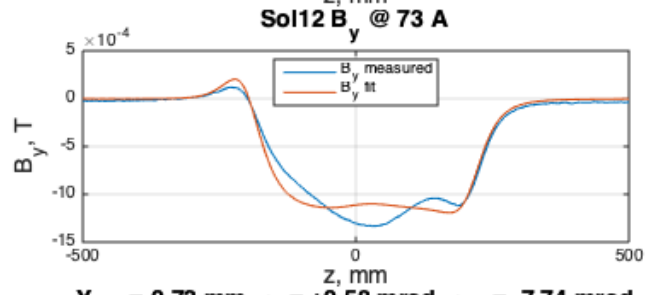

Sol11 B_y @ 145 A
B_y measured
B_y fit
B_y, T
z, mm

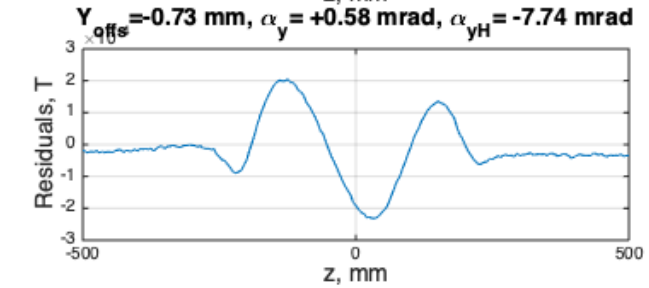

Y_offs=-0.79 mm, α_y= -0.56 mrad, α_yH= -4.84 mrad
Residuals, T
z, mm

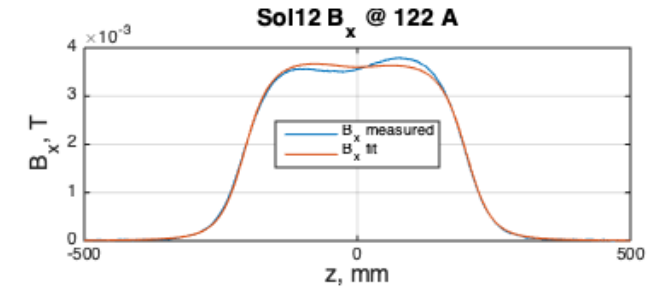
Solenoid 12 (6)

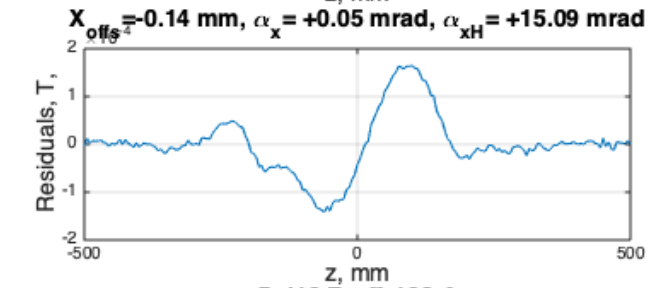


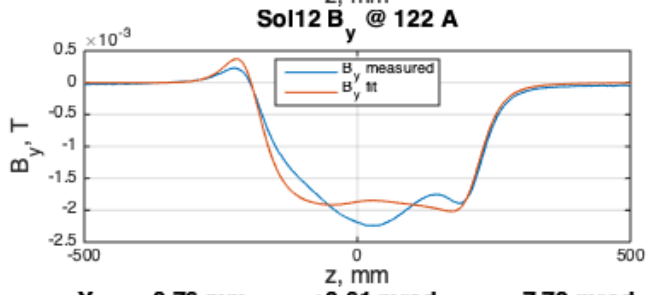


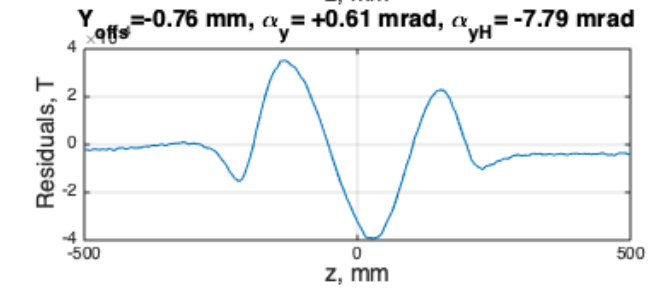


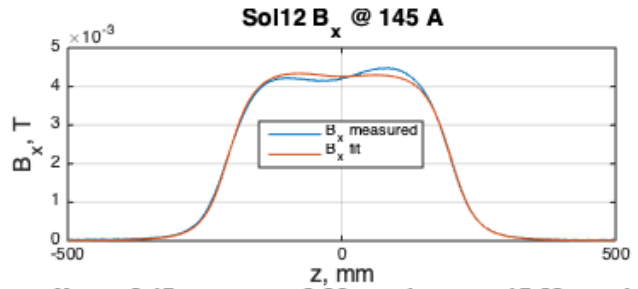


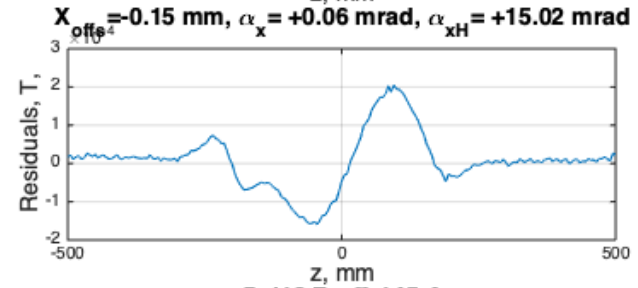


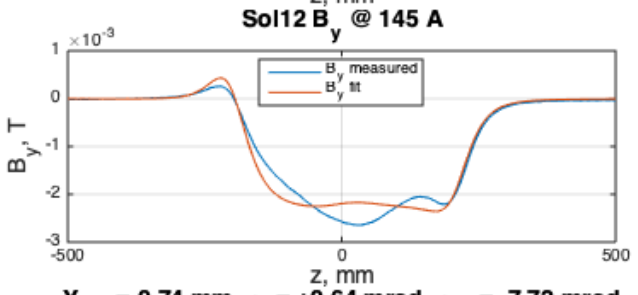


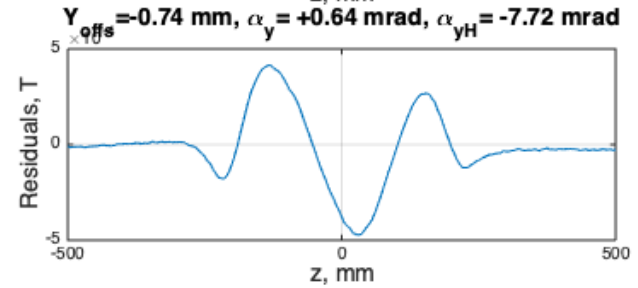




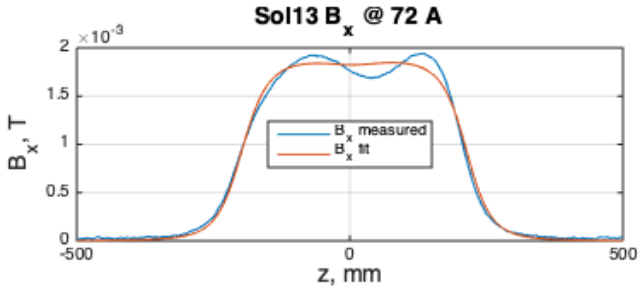


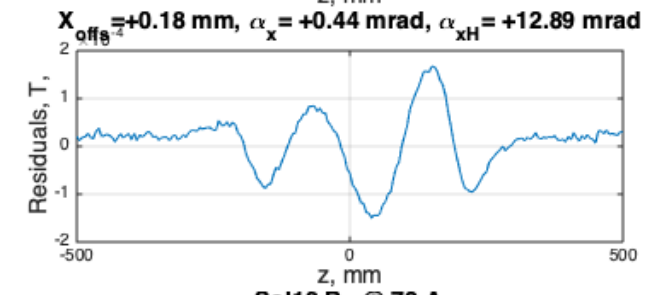


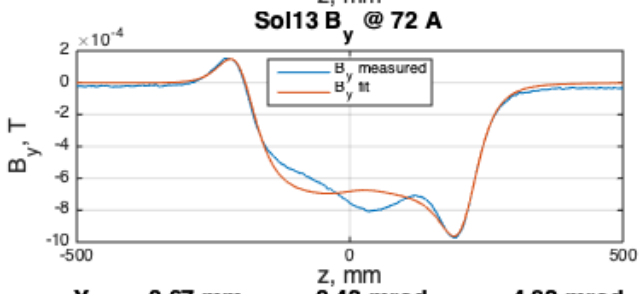


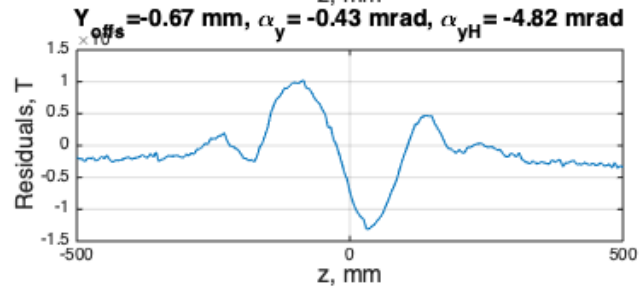


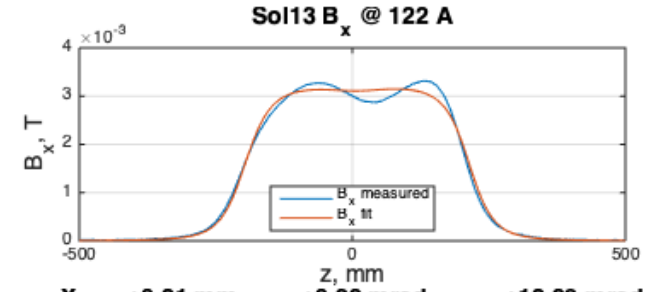
Solenoid 13 (5)

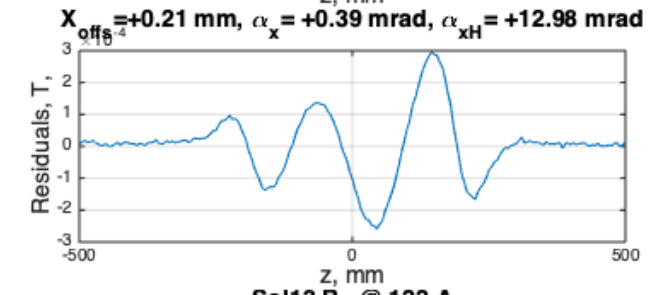


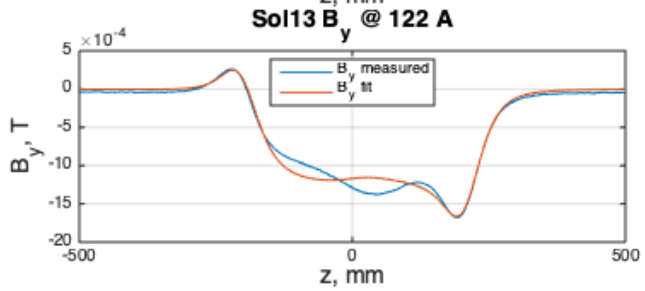


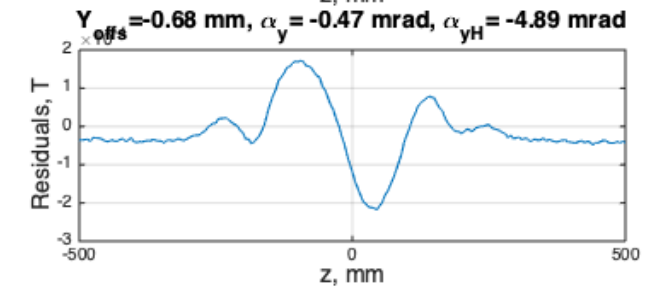


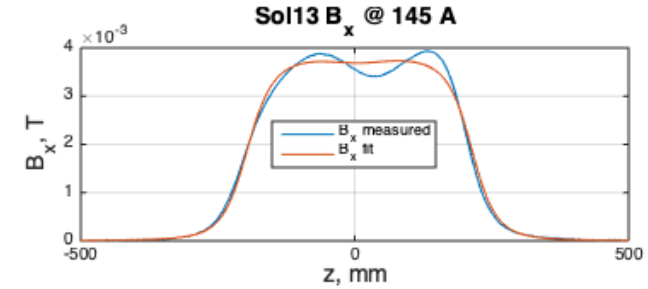


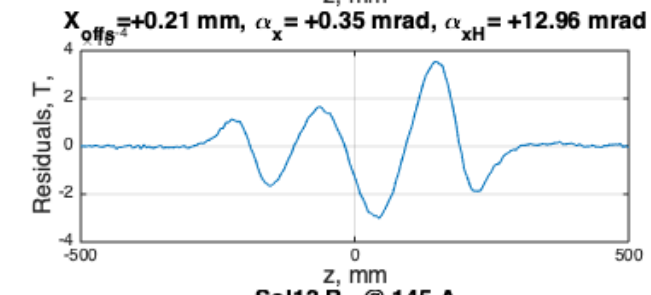


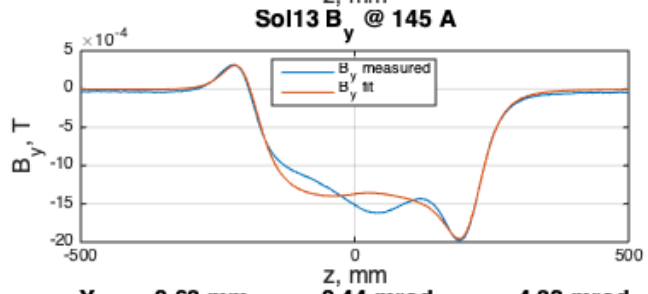


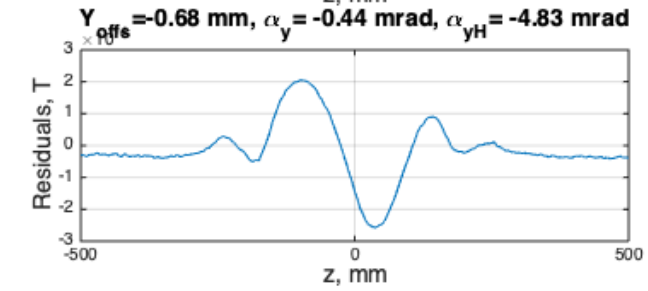




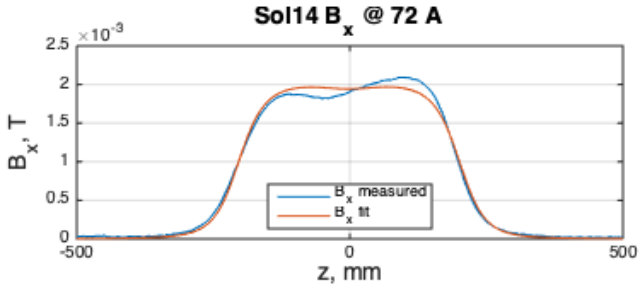


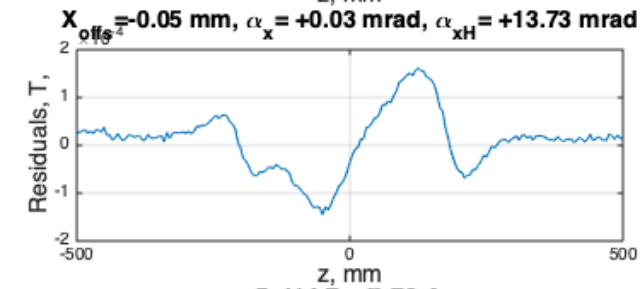


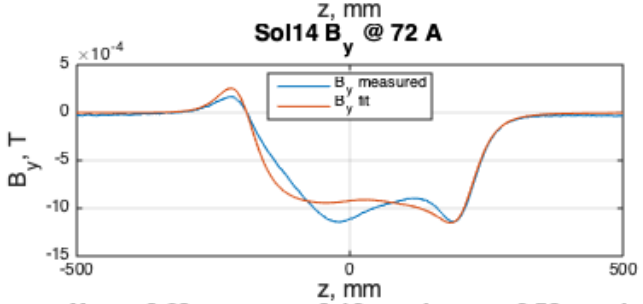


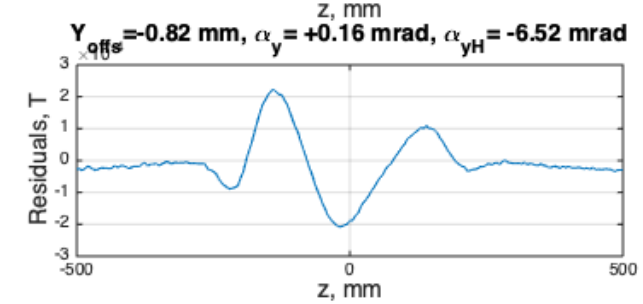


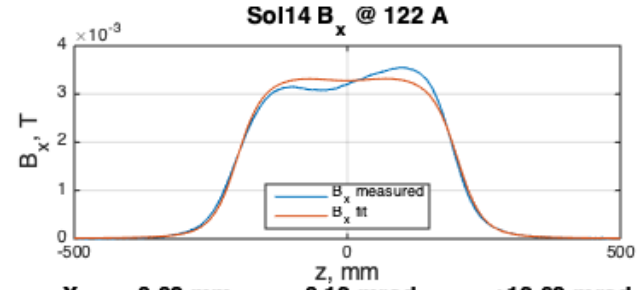
Solenoid 14 (4)

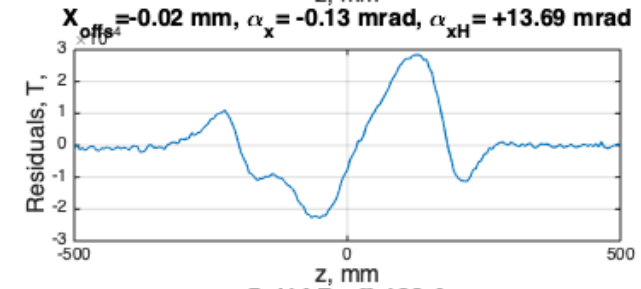


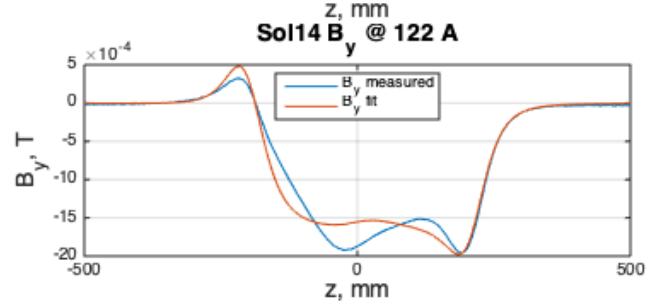


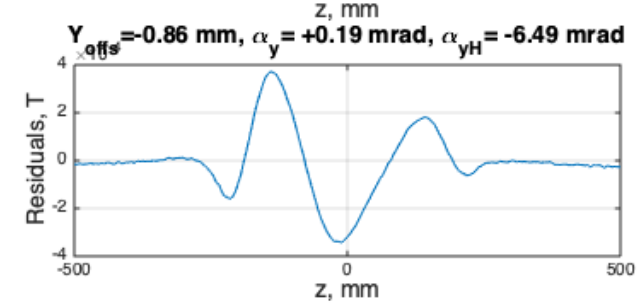


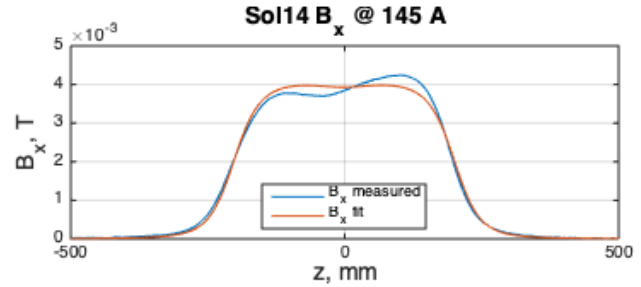


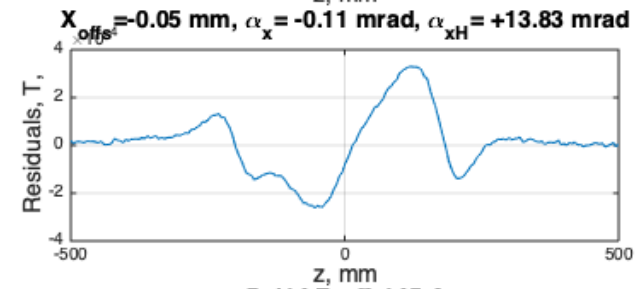


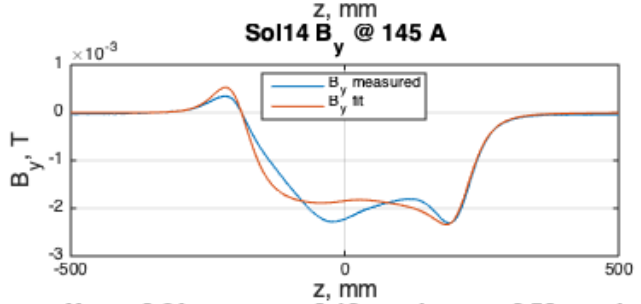


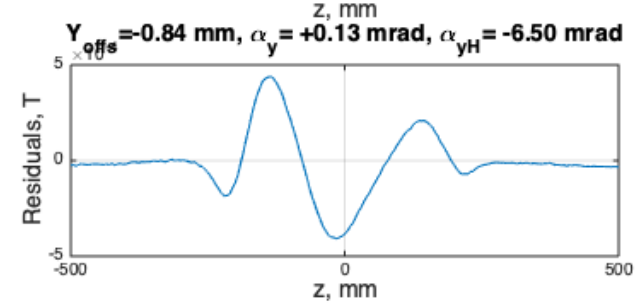




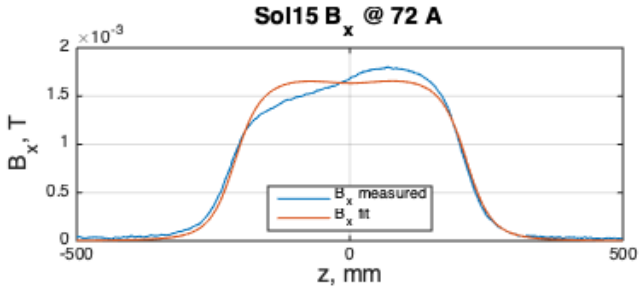


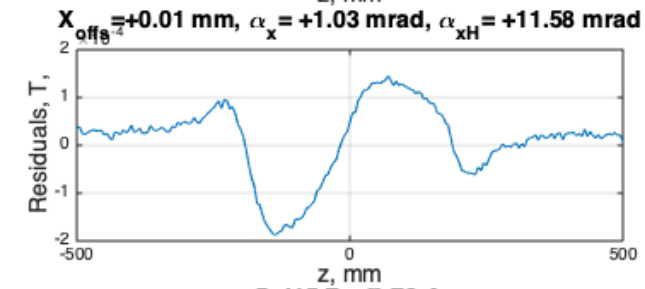


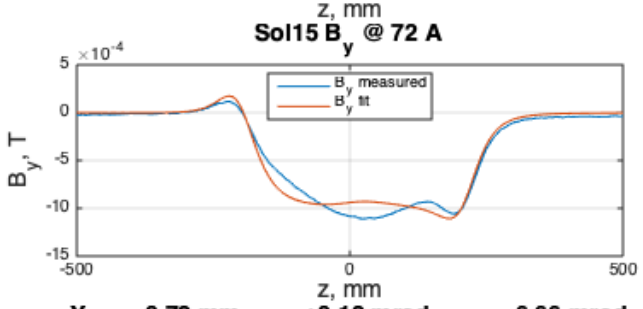


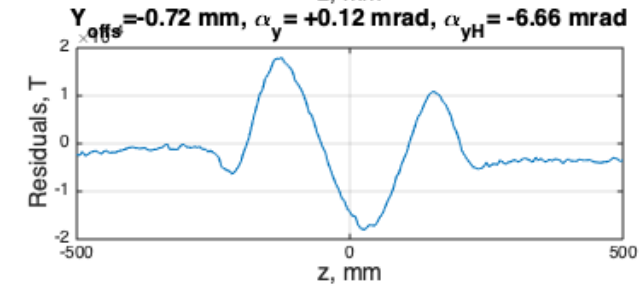


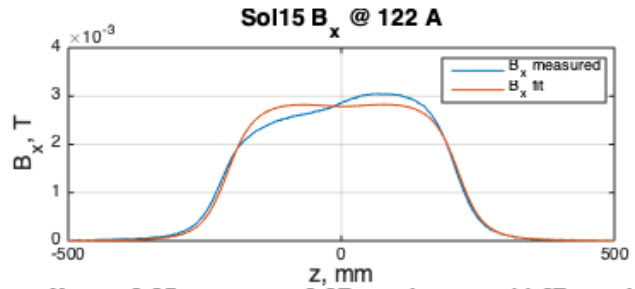
Solenoid 15 (2)

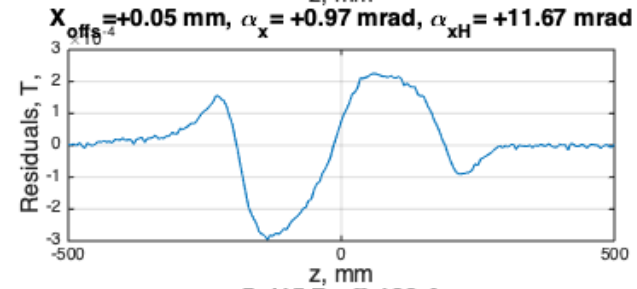


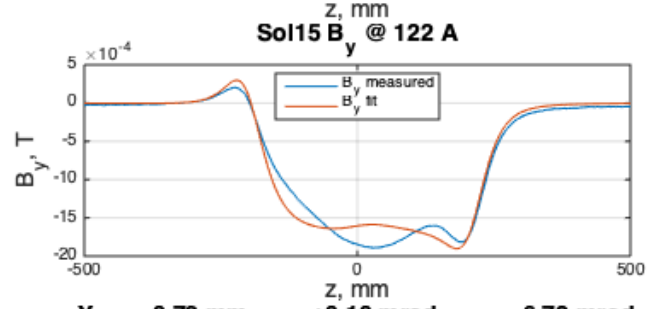


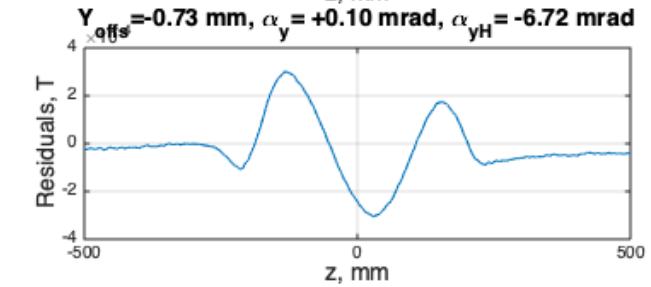


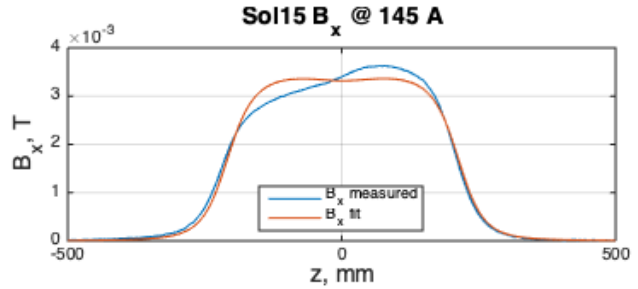


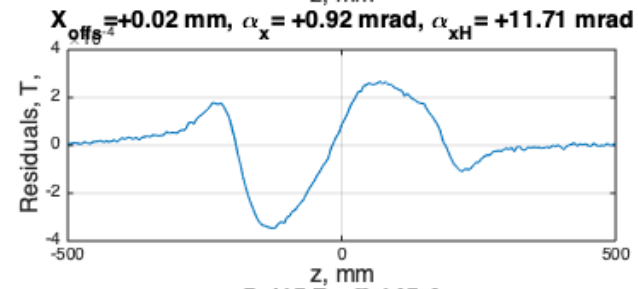


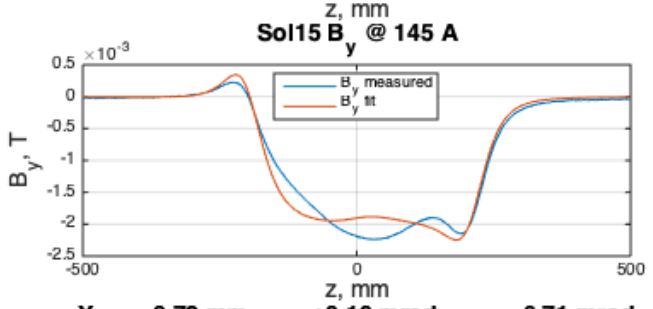


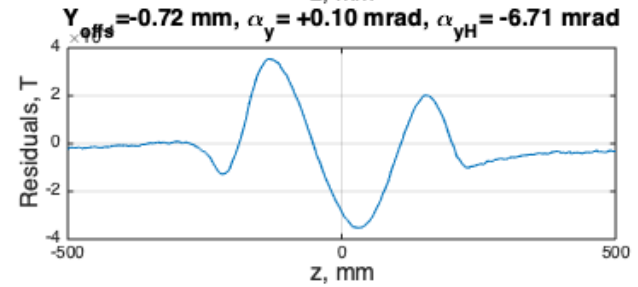




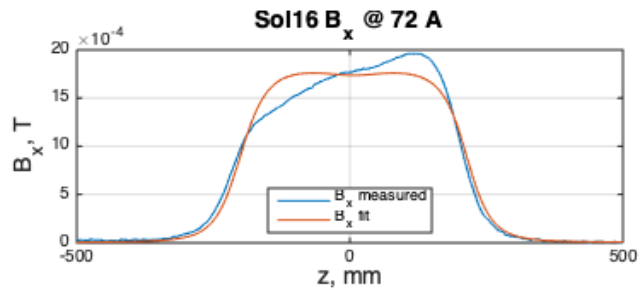


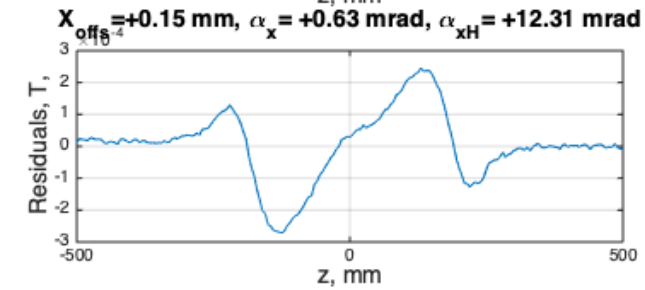


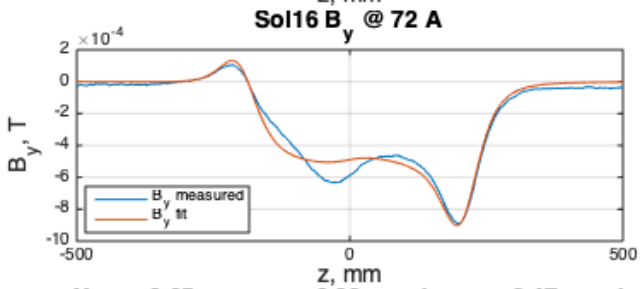


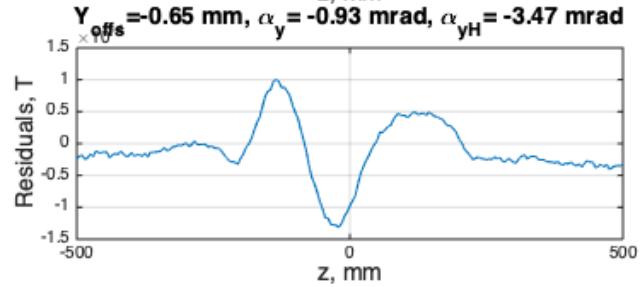


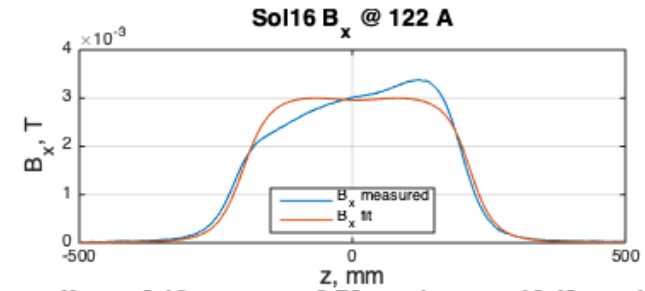
Solenoid 16 (3)

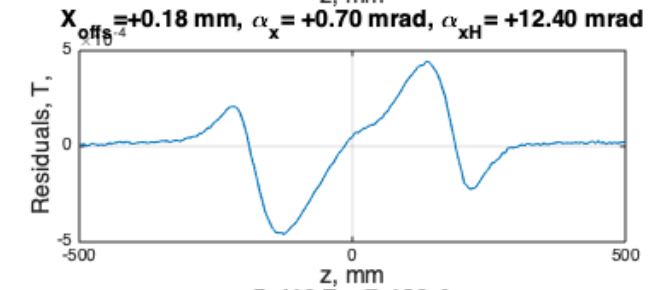


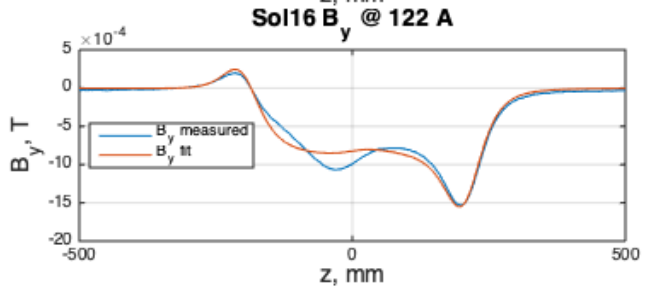


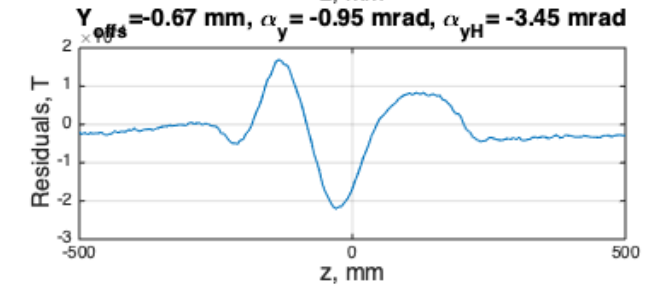


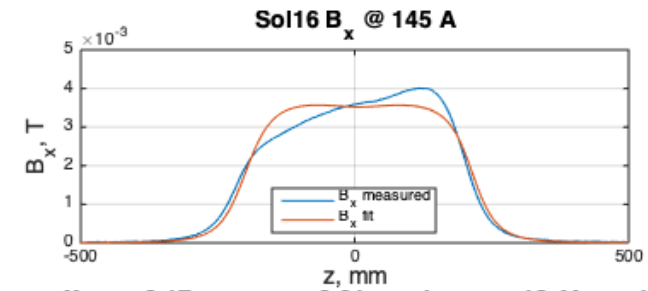


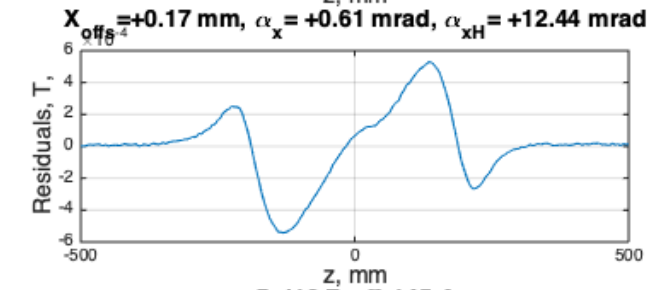


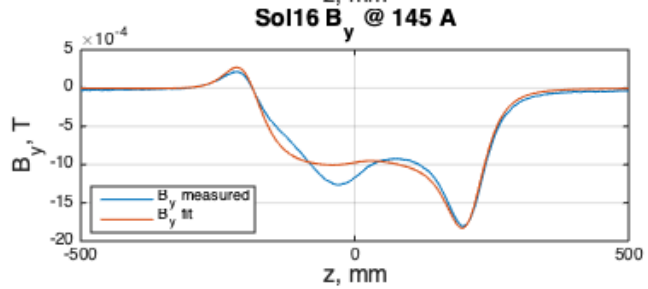


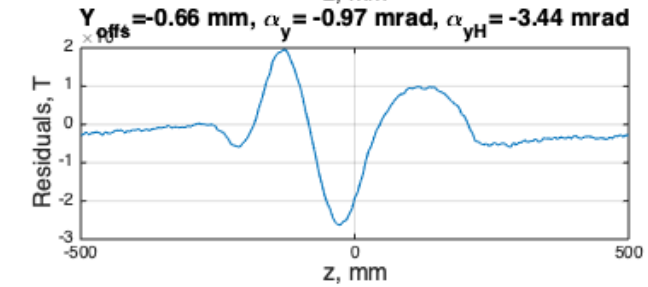




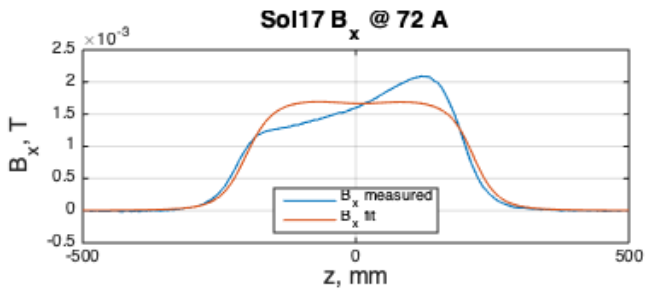


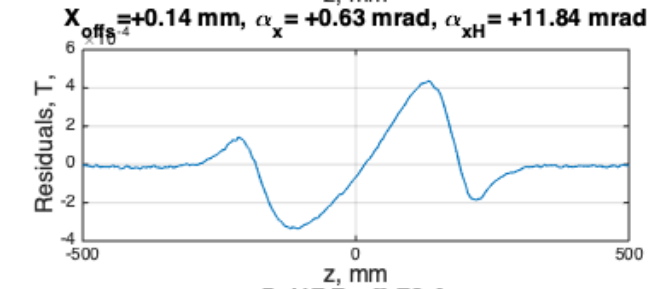


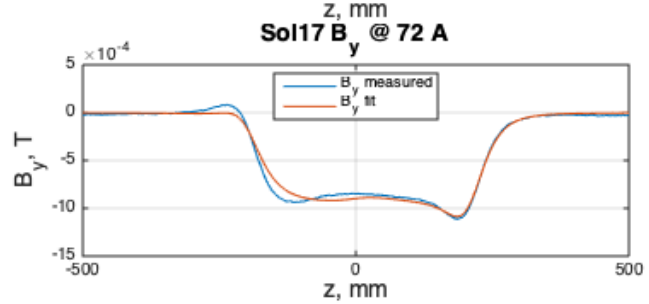


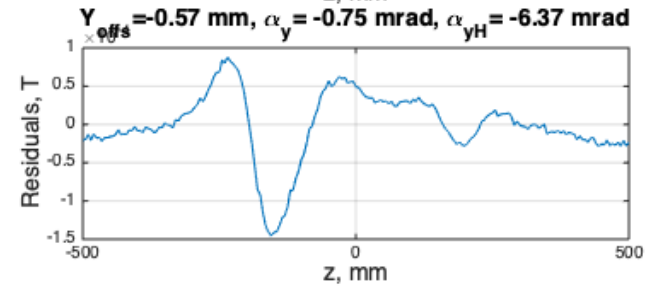


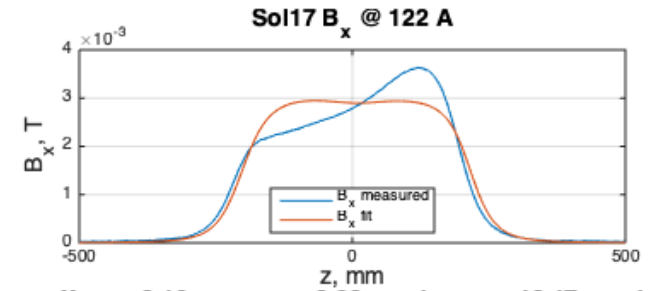
Solenoid 17 (7)

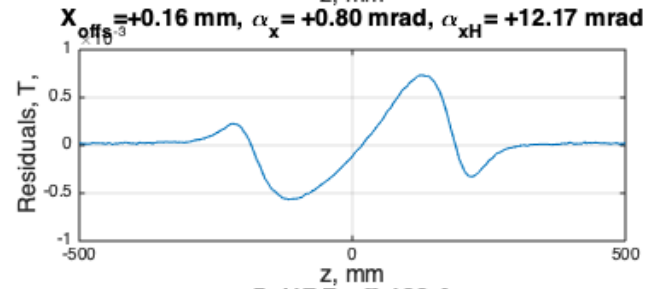


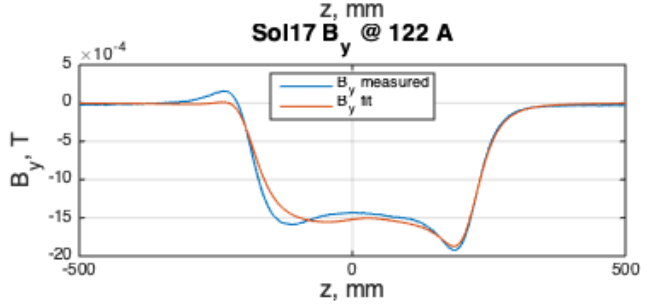


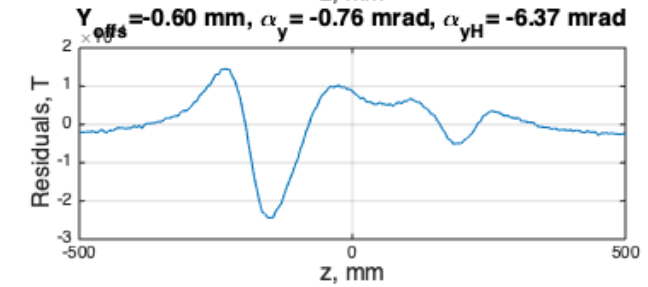


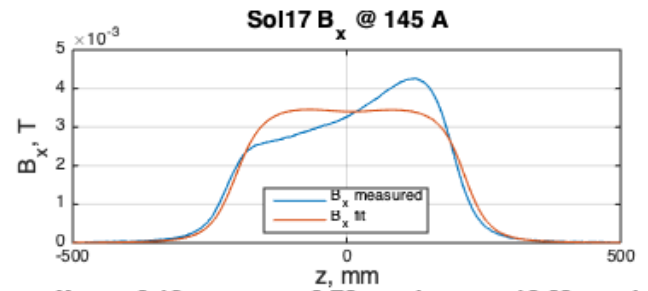


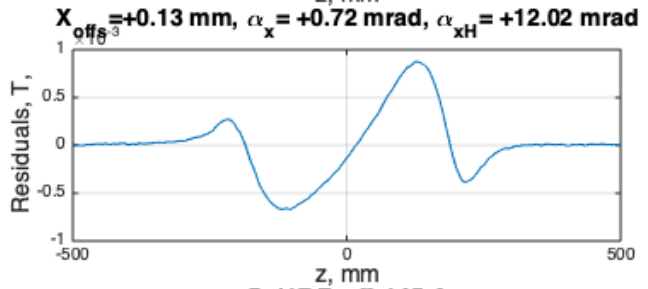


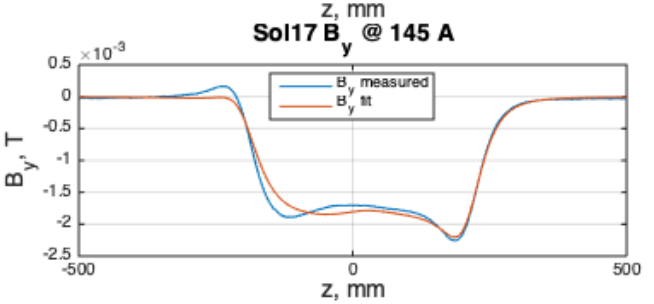


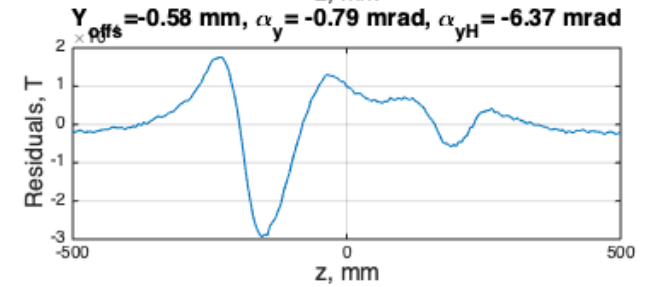




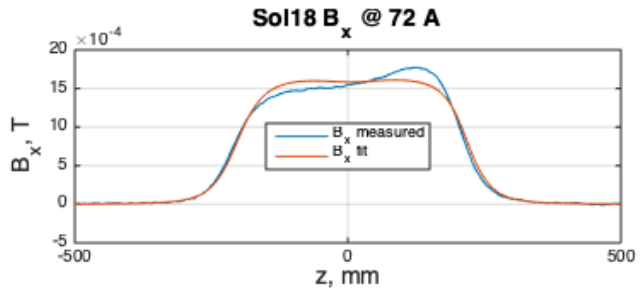


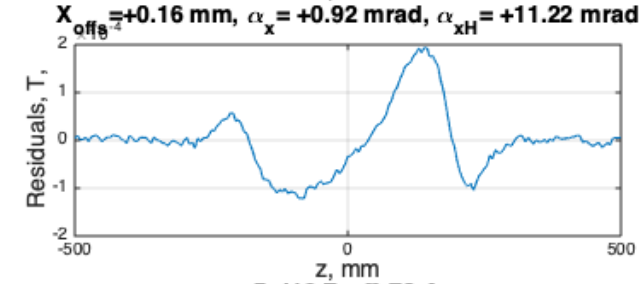


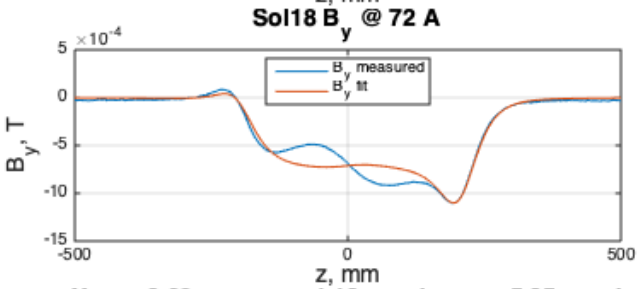


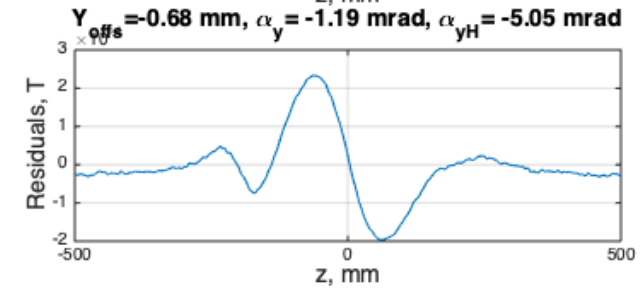


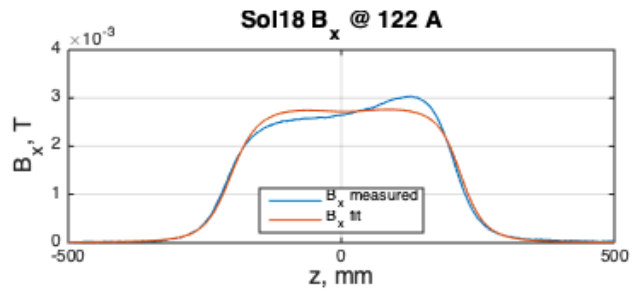
Solenoid 18

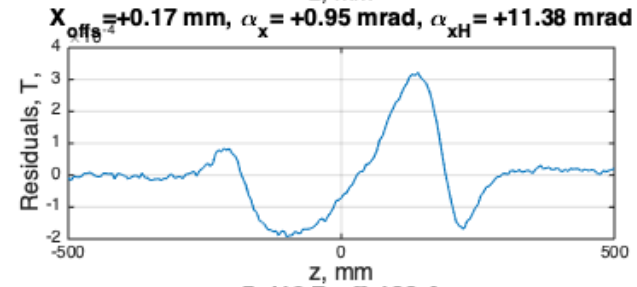

Sol18 B_x @ 72 A
B_x, T
z, mm
B_x measured
B_x fit

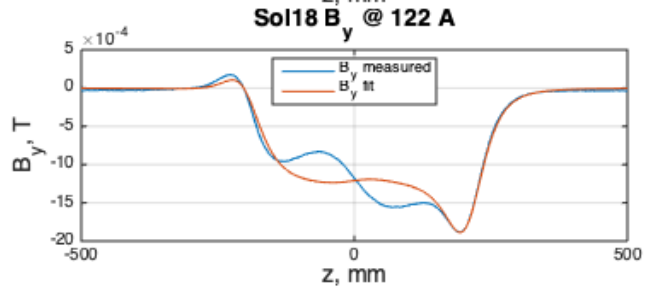

X_offs=+0.16 mm, α_x= +0.92 mrad, α_xH= +11.22 mrad
Residuals, T,
z, mm

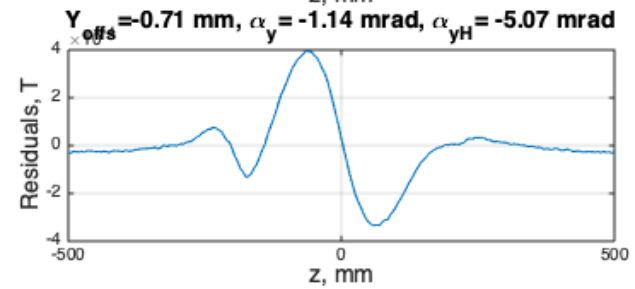

Sol18 B_y @ 72 A
B_y, T
z, mm
B_y measured
B_y fit

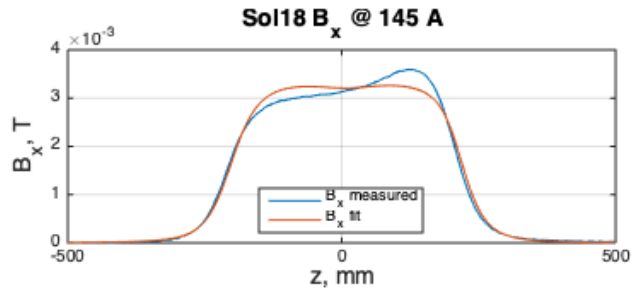

Y_offs=-0.68 mm, α_y= -1.19 mrad, α_yH= -5.05 mrad
Residuals, T
z, mm

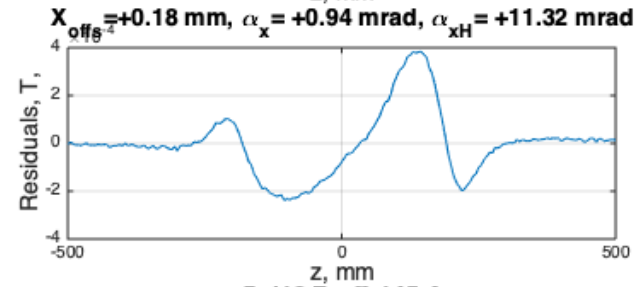

Sol18 B_x @ 122 A
B_x, T
z, mm
B_x measured
B_x fit

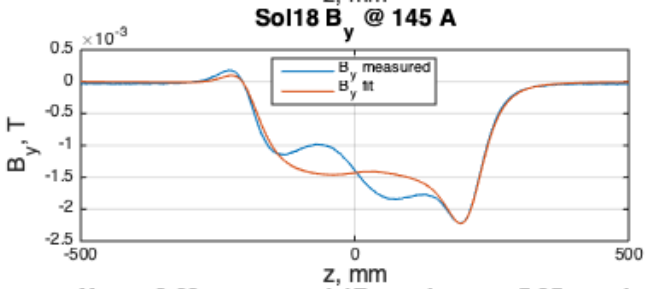

X_offs=+0.17 mm, α_x= +0.95 mrad, α_xH= +11.38 mrad
Residuals, T,
z, mm

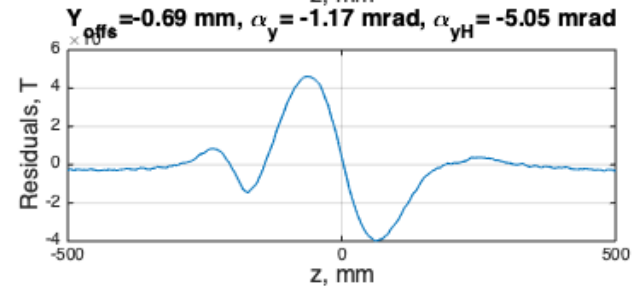

Sol18 B_y @ 122 A
B_y, T
z, mm
B_y measured
B_y fit


Y_offs=-0.71 mm, α_y= -1.14 mrad, α_yH= -5.07 mrad
Residuals, T
z, mm

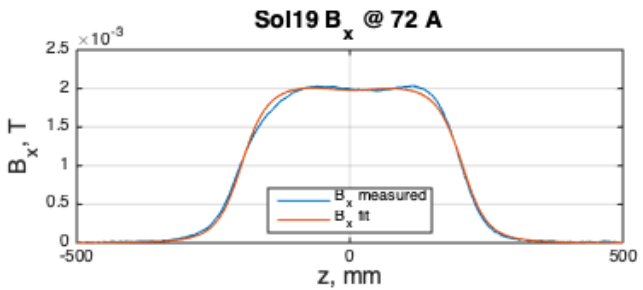

Sol18 B_x @ 145 A
B_x, T
z, mm
B_x measured
B_x fit

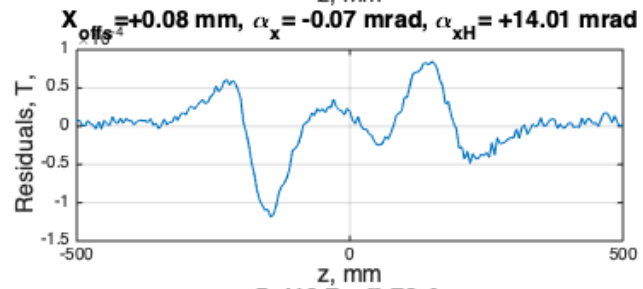

X_offs=+0.18 mm, α_x= +0.94 mrad, α_xH= +11.32 mrad
Residuals, T,
z, mm

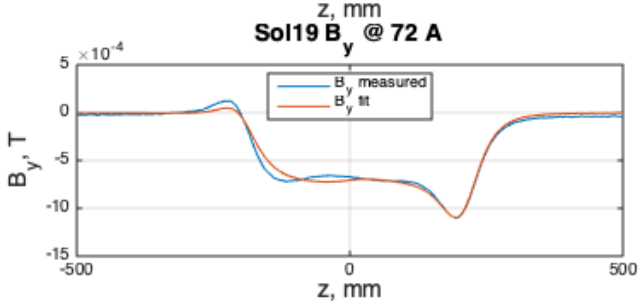

Sol18 B_y @ 145 A
B_y, T
z, mm
B_y measured
B_y fit

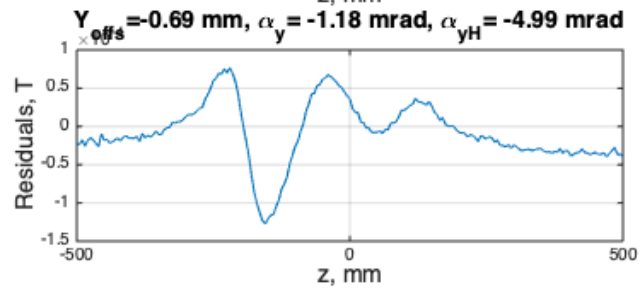

Y_offs=-0.69 mm, α_y= -1.17 mrad, α_yH= -5.05 mrad
Residuals, T
z, mm

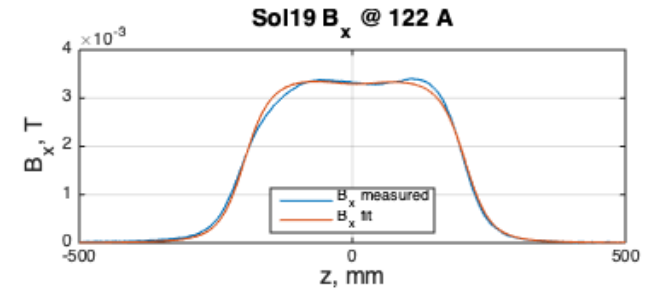
Solenoid 19 (1)

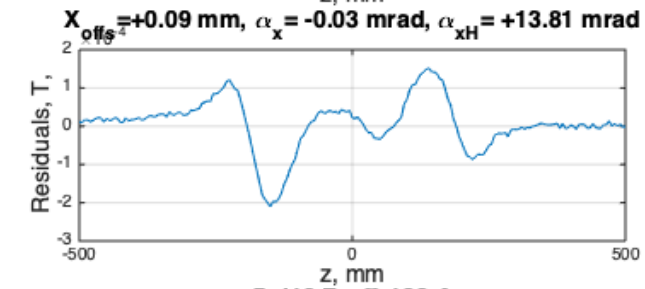


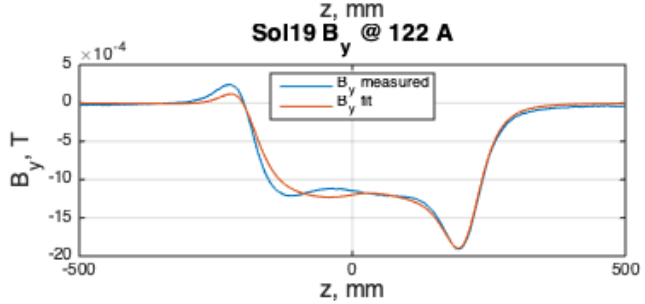


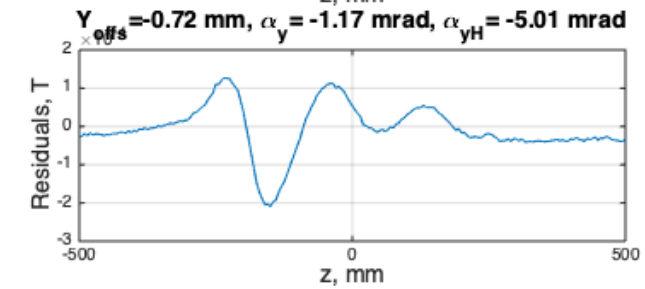


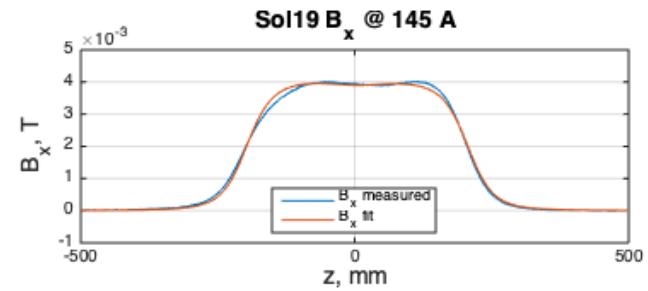


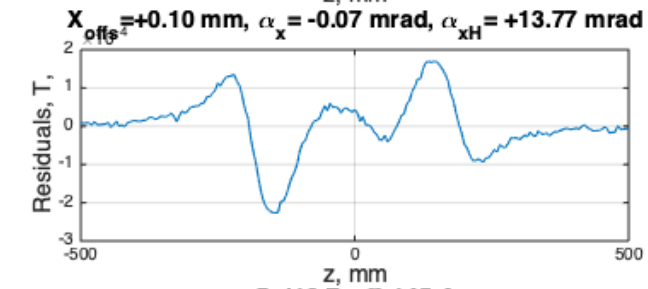


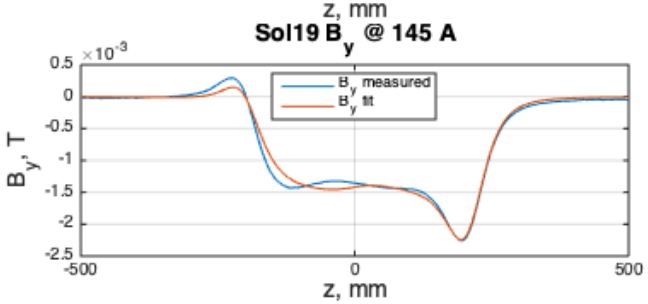


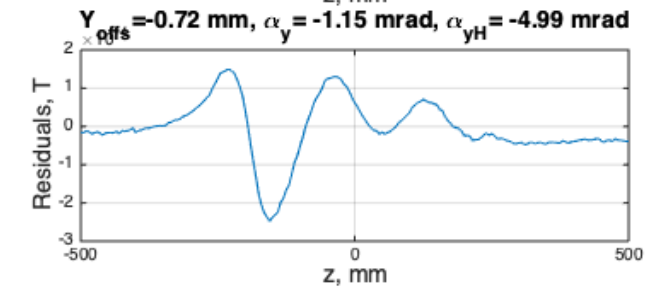




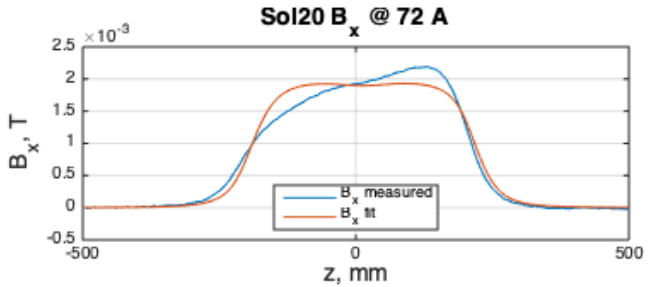


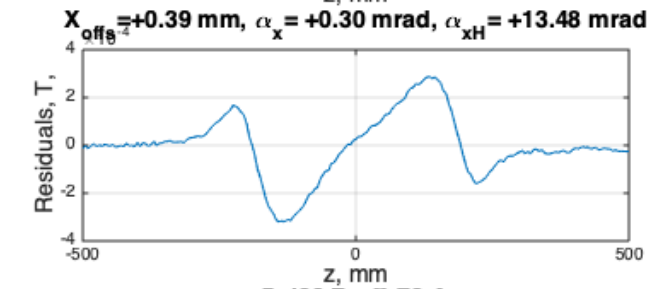


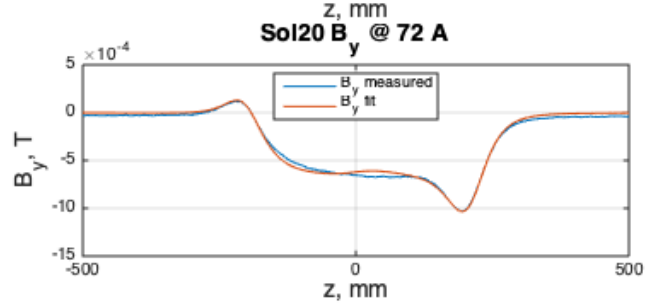


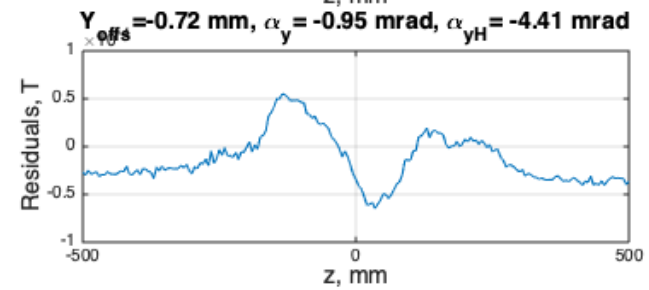


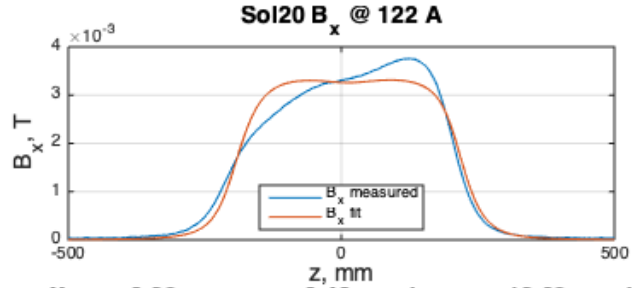
Solenoid 20

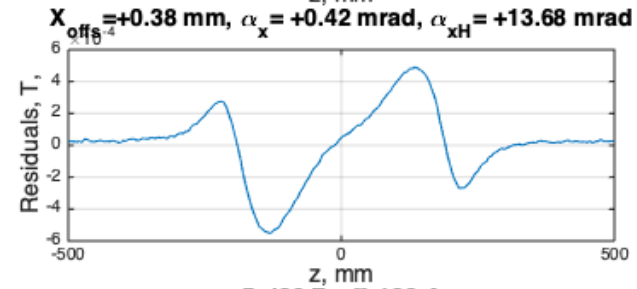

Sol20 B_x @ 72 A
B_x, T
z, mm
B_x measured
B_x fit

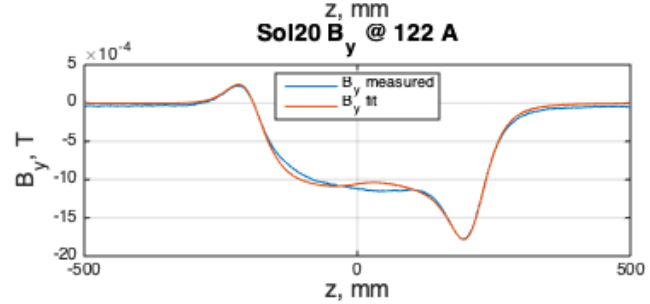

X_offs=+0.39 mm, α_x= +0.30 mrad, α_xH= +13.48 mrad
Residuals, T,
z, mm

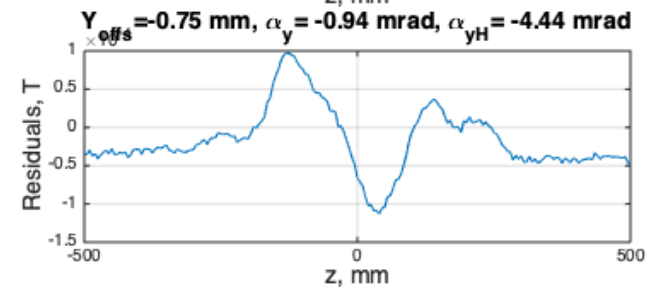

Sol20 B_y @ 72 A
B_y, T
z, mm
B_y measured
B_y fit

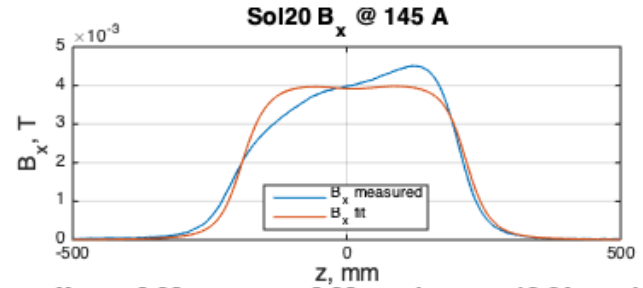

Y_offs=-0.72 mm, α_y= -0.95 mrad, α_yH= -4.41 mrad
Residuals, T
z, mm

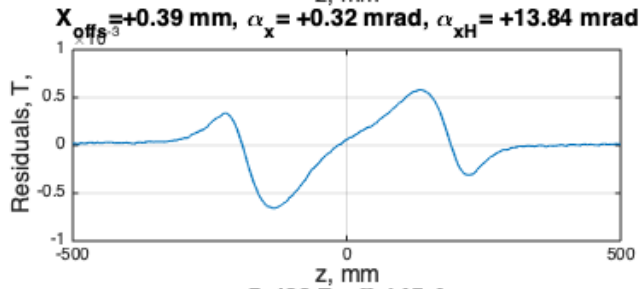

Sol20 B_x @ 122 A
B_x, T
z, mm
B_x measured
B_x fit

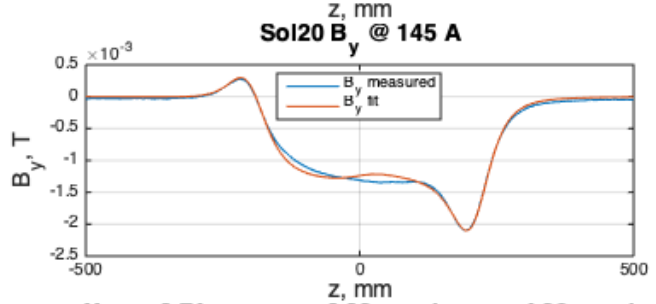

X_offs=+0.38 mm, α_x= +0.42 mrad, α_xH= +13.68 mrad
Residuals, T,
z, mm

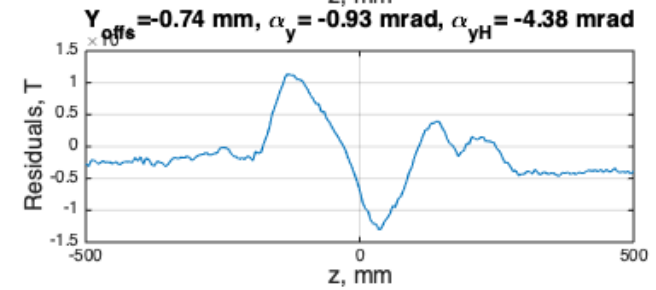

Sol20 B_y @ 122 A
B_y, T
z, mm
B_y measured
B_y fit


Y_offs=-0.75 mm, α_y= -0.94 mrad, α_yH= -4.44 mrad
Residuals, T
z, mm


Sol20 B_x @ 145 A
B_x, T
z, mm
B_x measured
B_x fit


X_offs=+0.39 mm, α_x= +0.32 mrad, α_xH= +13.84 mrad
Residuals, T,
z, mm


Sol20 B_y @ 145 A
B_y, T
z, mm
B_y measured
B_y fit


Y_offs=-0.74 mm, α_y= -0.93 mrad, α_yH= -4.38 mrad
Residuals, T
z, mm

Conclusion

- Most of the observed transverse field is caused by tilt of the Hall probe
- The tilt angles are reproducible for different current setting but vary slightly from solenoid to solenoid
- The residuals are scaled with excitation current – no effect of the yoke saturation