Tracking for PCA Solenoids

Notes

- The length of scan is 1 m and integral of the earth field is 5×10^{-5} T m

- Data for 36 and 145 A on axis measurements were used (difference between two measurements was processed to remove offsets)

- The fit for tilt of the Hall probe and scan track was performed

- The residual transverse fields were used for tracking with beam rigidities of 0.05 and 35 T m. The beam was launched on the solenoid axes.

Solenoid 1 (s/n 9, file 19)

	0.05 T m	35 T m
X, mm	0.031	0.100×10^{-3}
X', mrad	-0.004	0.063×10^{-3}
Y, mm	0.050	0.041×10^{-3}
Y', mrad	0.023	0.005×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
13.7	-5.0	-0.07	-1.1	0.10	-0.74
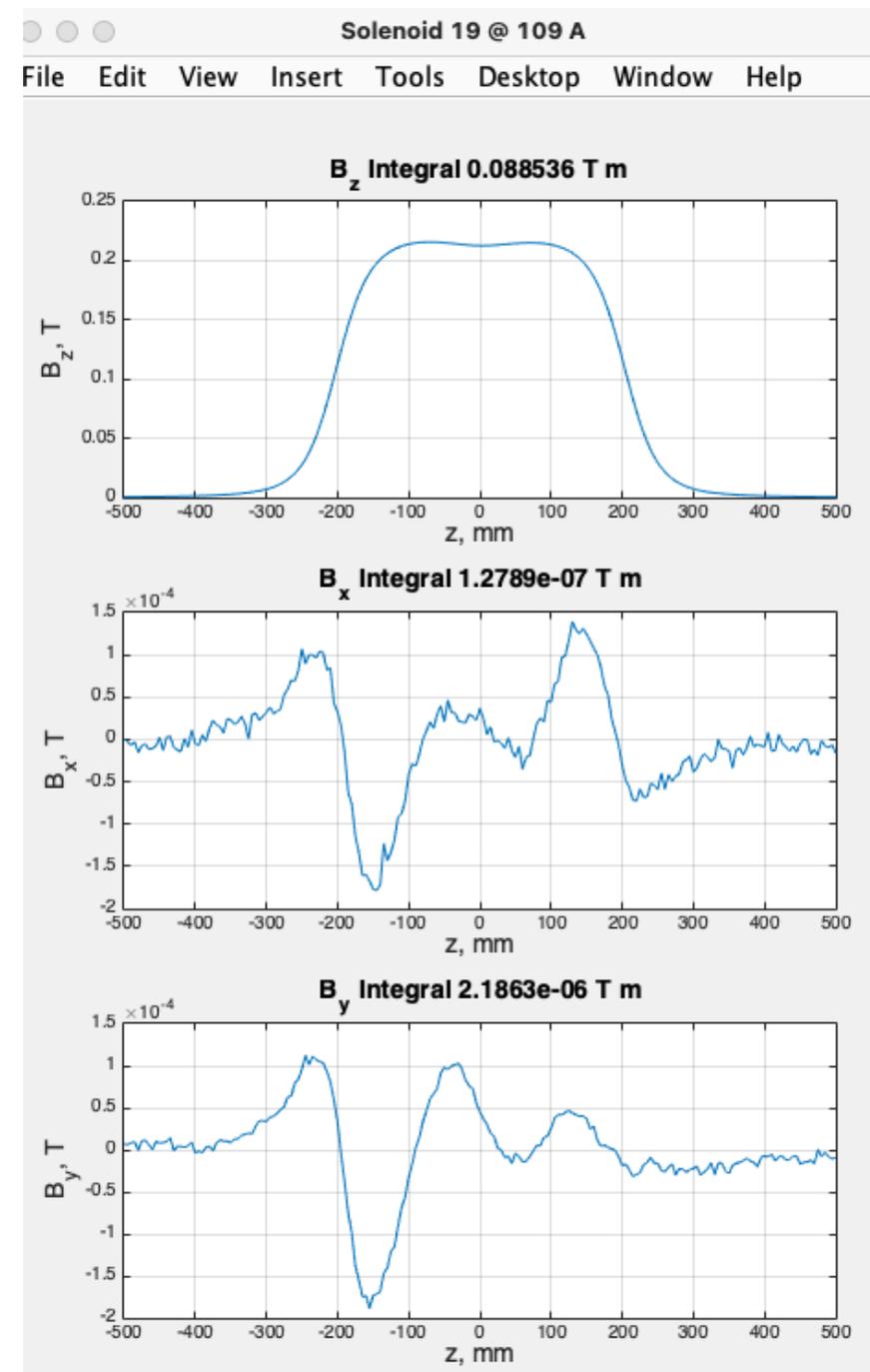
Solenoid 2 (s/n 5, file 15)

	0.05 T m	35 T m
X, mm	-0.017	0.052×10^{-3}
X', mrad	-0.164	-0.148×10^{-3}
Y, mm	0.106	0.091×10^{-3}
Y', mrad	0.125	0.128×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
11.8	-6.7	0.91	0.13	0.02	-0.73
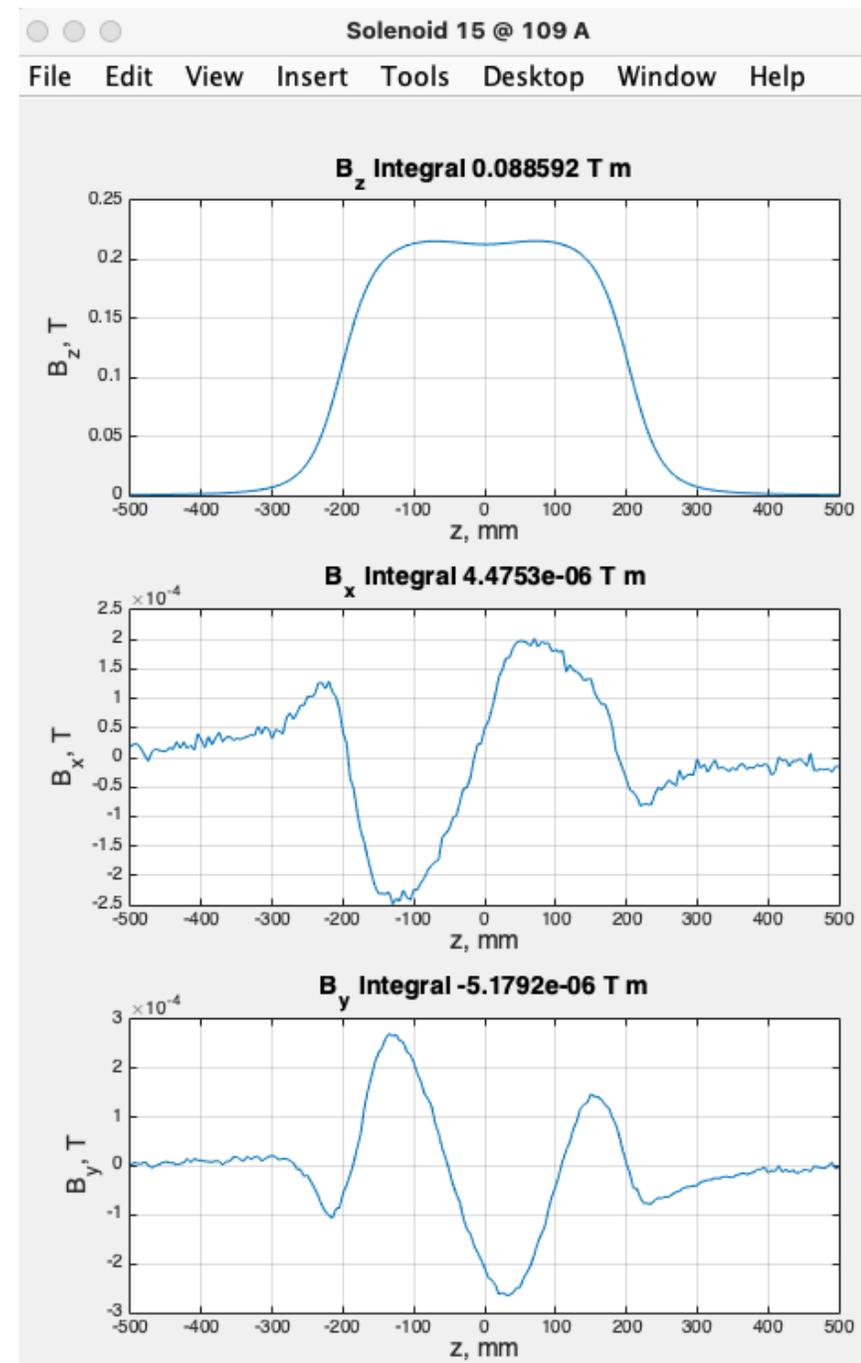
Solenoid 3 (s/n 6, file 16)

	0.05 T m	35 T m
X, mm	0.081	-0.006×10^{-3}
X', mrad	0.062	-0.081×10^{-3}
Y, mm	0.008	-0.074×10^{-3}
Y', mrad	0.143	0.052×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
12.5	-3.4	0.59	-0.96	0.18	-0.67

Solenoid 16 @ 109 A

B_z Integral 0.08854 T m

B_x Integral 1.8185e-06 T m

B_y Integral -2.8292e-06 T m
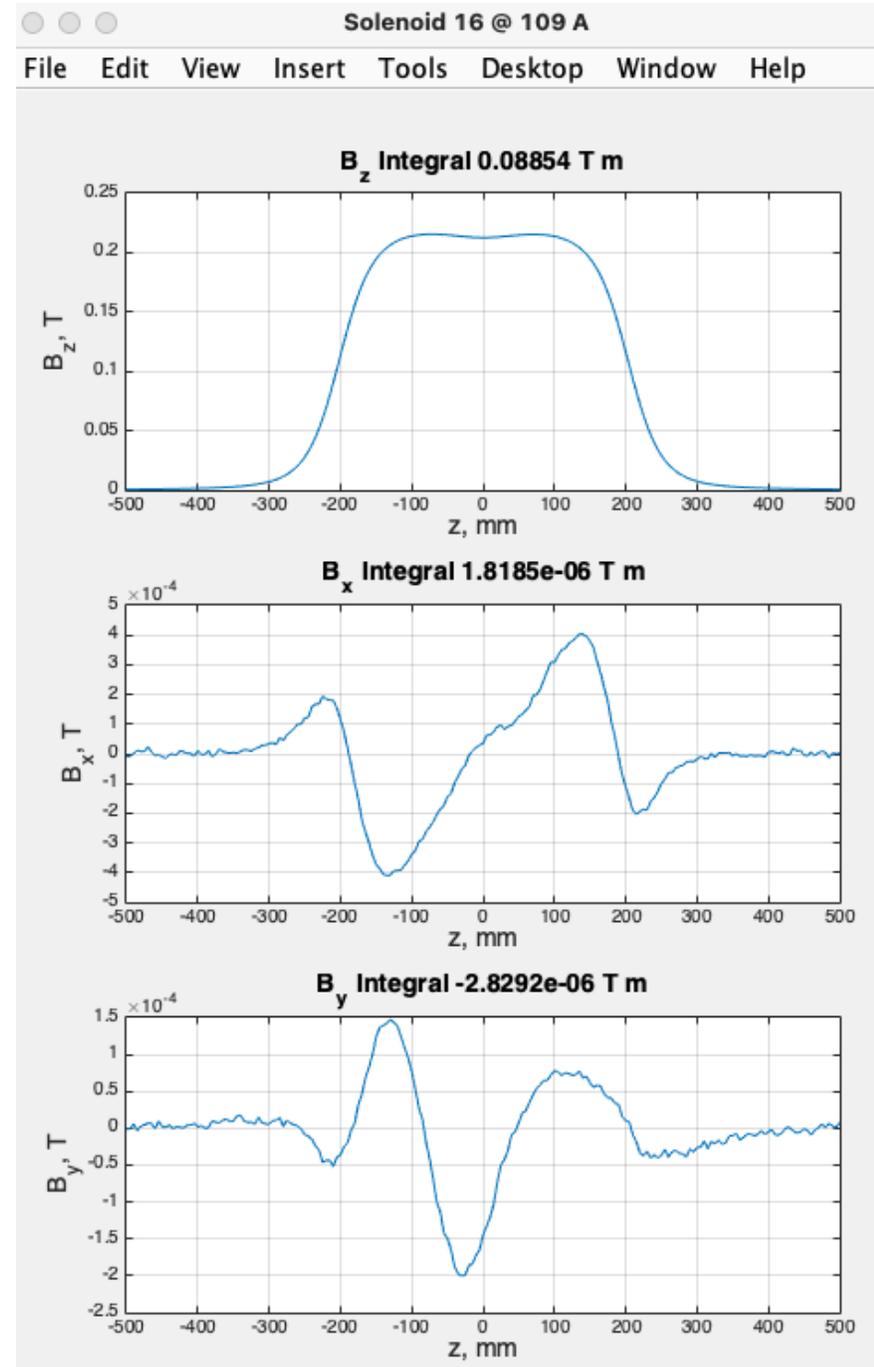
Solenoid 4 (s/n 4, file 14)

	0.05 T m	35 T m
X, mm	0.011	0.001×10^{-3}
X', mrad	-0.013	-0.057×10^{-3}
Y, mm	0.028	0.001×10^{-3}
Y', mrad	0.066	0.059×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
13.8	-6.5	-0.20	0.16	-0.04	-0.86
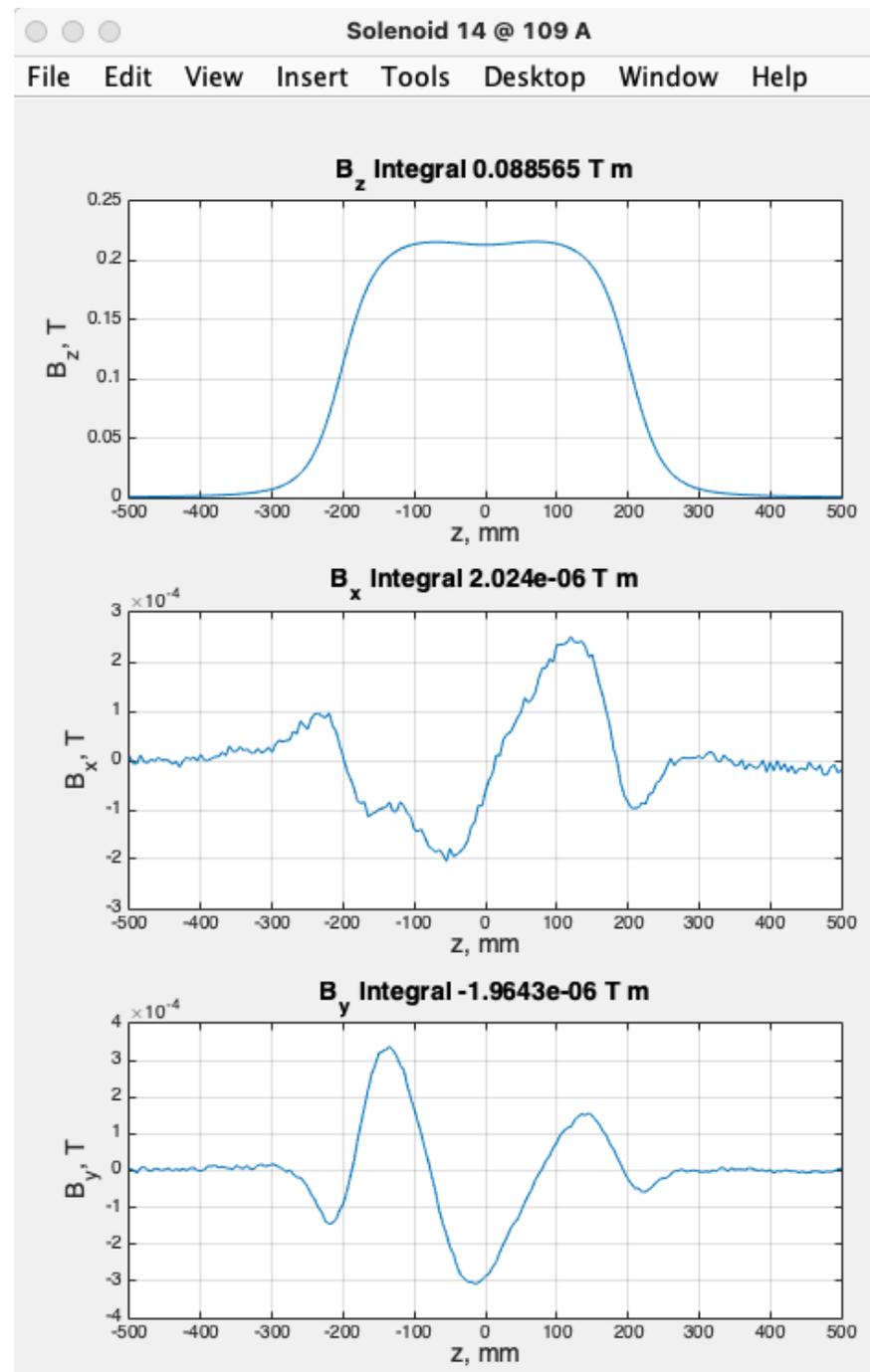
Solenoid 5 (s/n 3, file 11)

	0.05 T m	35 T m
X, mm	0.057	0.039×10^{-3}
X', mrad	-0.028	-0.039×10^{-3}
Y, mm	0.053	-0.079×10^{-3}
Y', mrad	0.234	0.096×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
13.1	-4.8	0.36	-0.55	0.03	-0.79
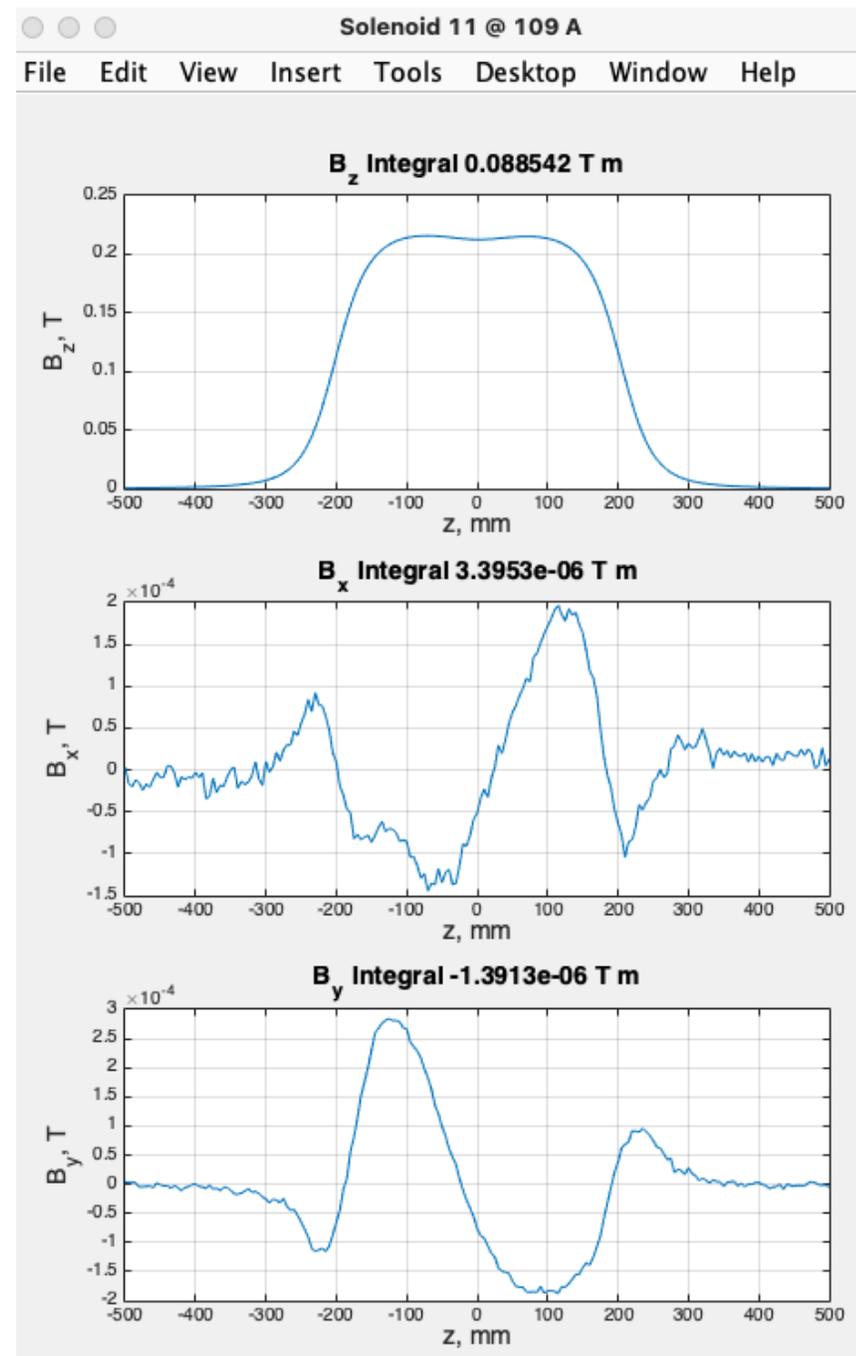
Solenoid 6 (s/n 2, file 13)

	0.05 T m	35 T m
X, mm	-0.016	-0.028×10^{-3}
X', mrad	-0.077	-0.122×10^{-3}
Y, mm	0.001	-0.010×10^{-3}
Y', mrad	0.009	-0.012×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
13.0	-4.8	0.37	-0.46	0.22	-0.69
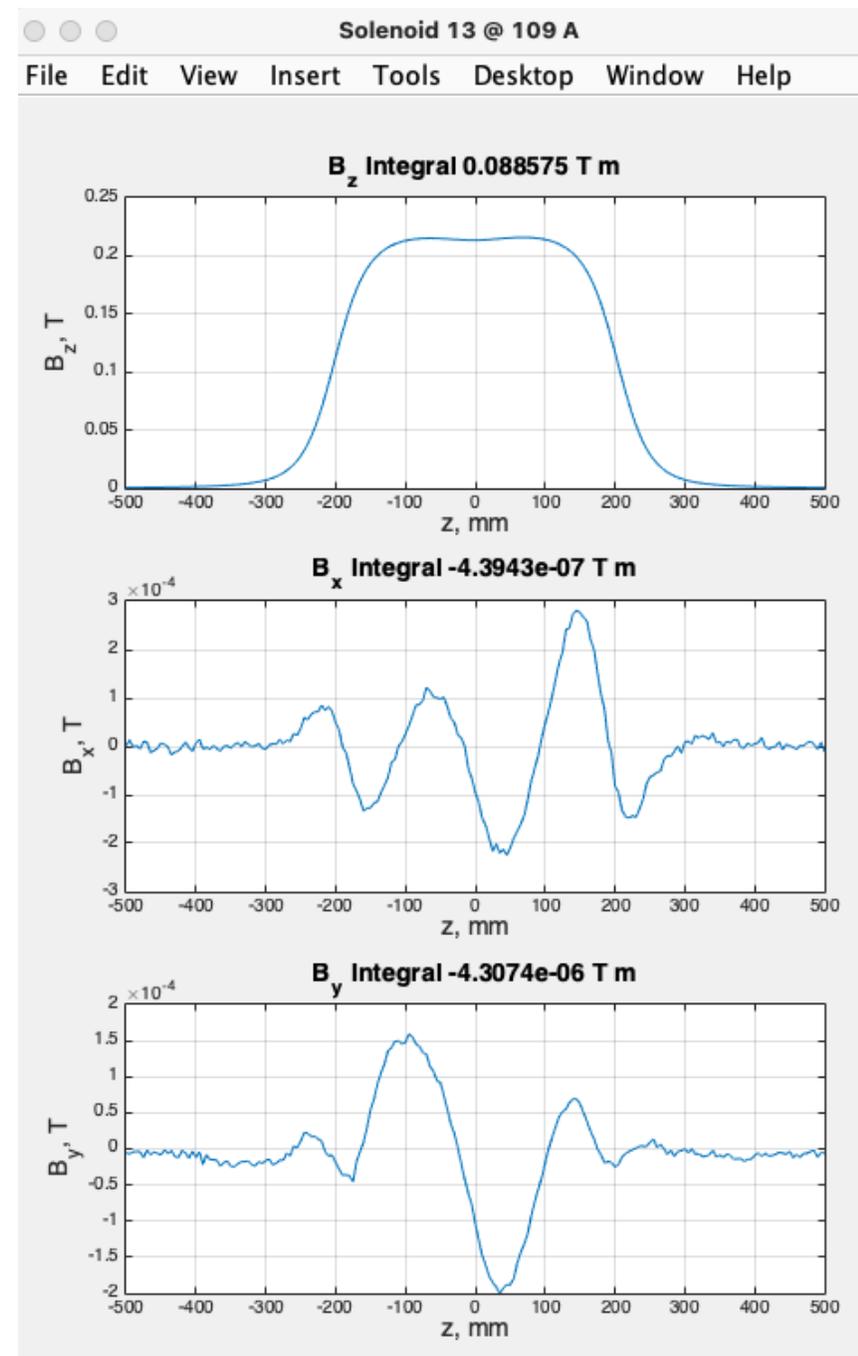
Solenoid 7 (s/n 7, file 17)

	0.05 T m	35 T m
X, mm	0.237	0.174×10^{-3}
X', mrad	0.415	0.350×10^{-3}
Y, mm	-0.122	-0.122×10^{-3}
Y', mrad	0.094	0.094×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
12.1	-6.4	0.72	-0.77	0.14	-0.59

Solenoid 17 @ 109 A
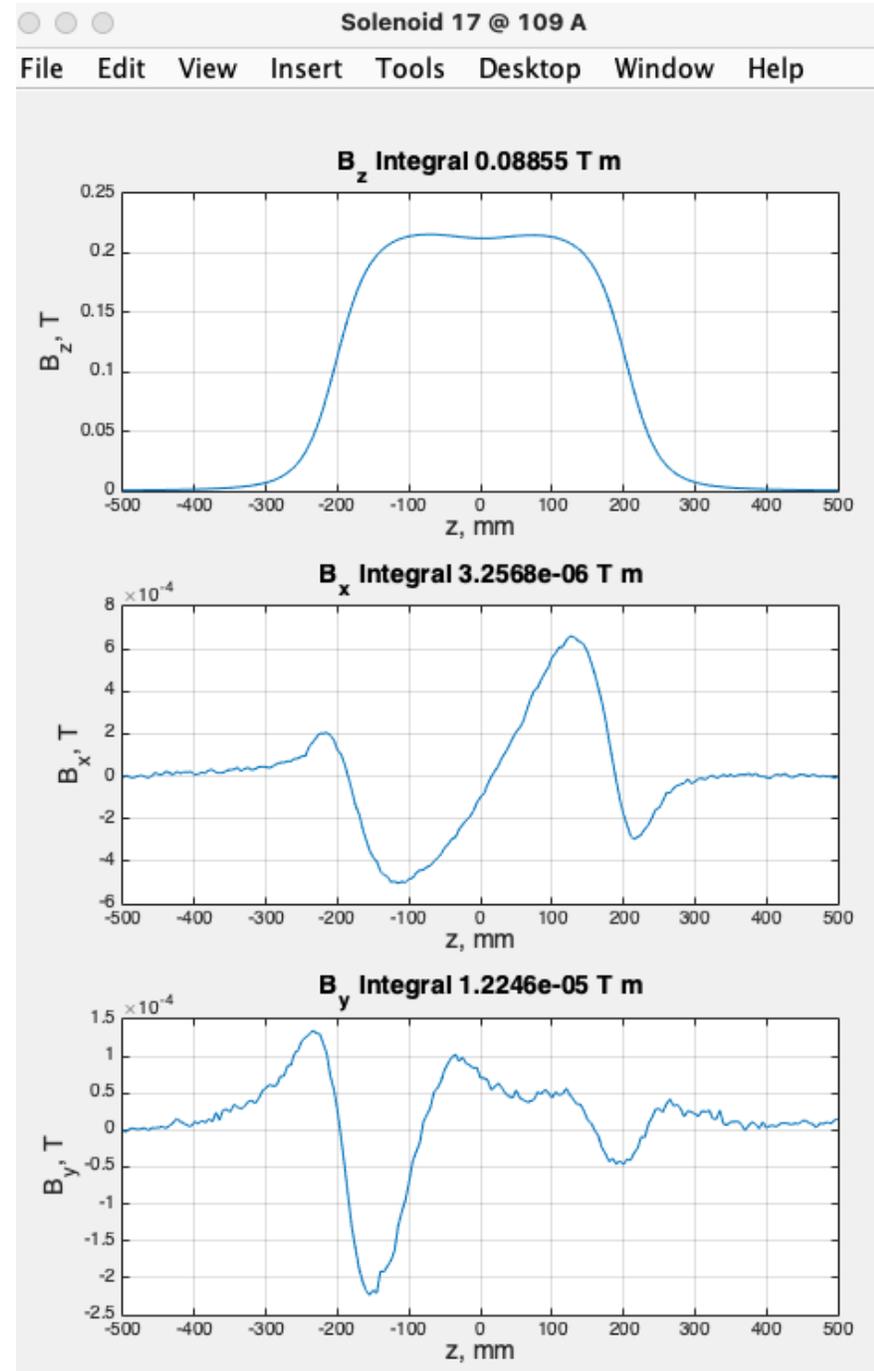
Solenoid s/n 1, file 12

	0.05 T m	35 T m
X, mm	-0.013	0.080×10^{-3}
X', mrad	-0.133	-0.062×10^{-3}
Y, mm	0.091	0.048×10^{-3}
Y', mrad	0.119	0.124×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
15.1	-7.7	0.04	0.67	-0.15	-0.74

Solenoid 12 @ 109 A

File   Edit   View   Insert   Tools   Desktop   Window   Help

B_z Integral 0.088545 T m

B_x Integral 4.3795e-06 T m

B_y Integral -2.1385e-06 T m
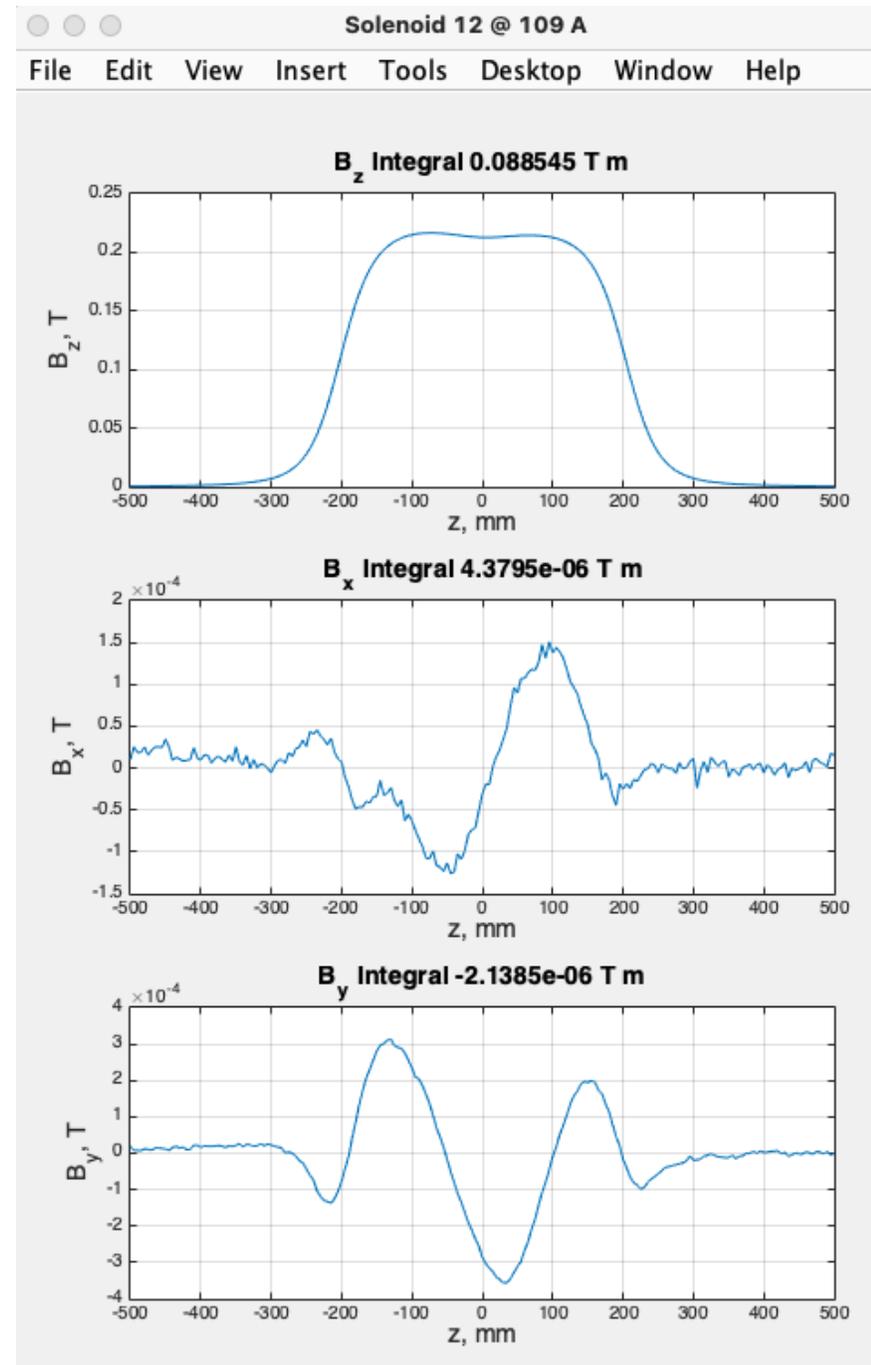
Solenoid s/n 8, file 18

	0.05 T m	35 T m
X, mm	0.145	0.146×10^{-3}
X', mrad	0.090	0.119×10^{-3}
Y, mm	0.050	-0.180×10^{-3}
Y', mrad	0.194	-0.105×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
11.3	-5.1	0.92	-1.2	0.18	-0.69

Solenoid 18 @ 109 A

B_z Integral 0.088538 T m

B_x Integral -3.6551e-06 T m

B_y Integral 4.1262e-06 T m
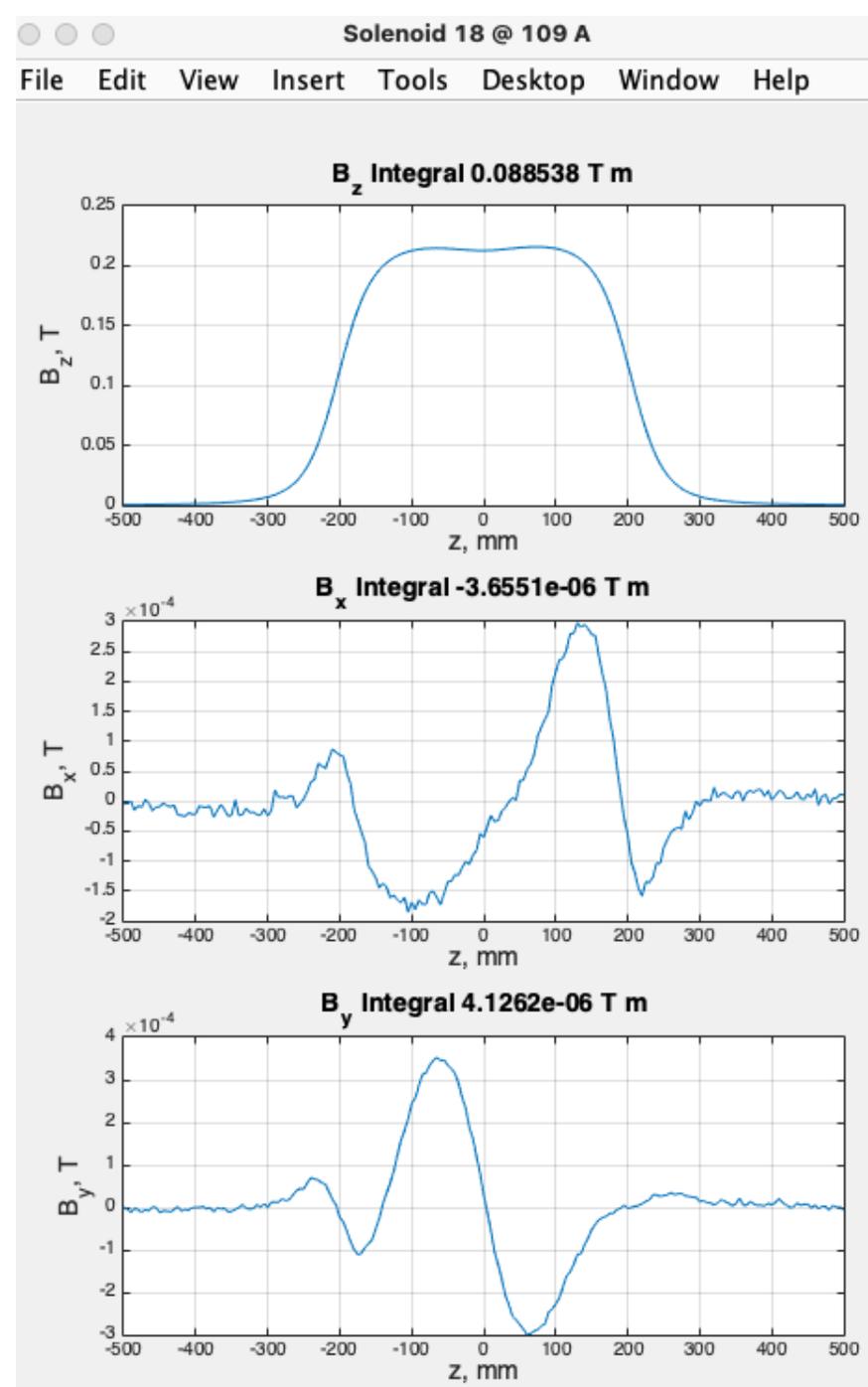
Solenoid s/n 10, file 20

	0.05 T m	35 T m
X, mm	0.061	-0.002×10^{-3}
X', mrad	0.022	-0.115×10^{-3}
Y, mm	0.055	0.021×10^{-3}
Y', mrad	0.214	0.171×10^{-3}

AhallX, mrad	AhallY, mrad	AprobeX, mrad	AprobeY, mrad	Xprobe, mm	Yprobe, mm
14.0	-4.4	0.33	-0.93	0.40	-0.75
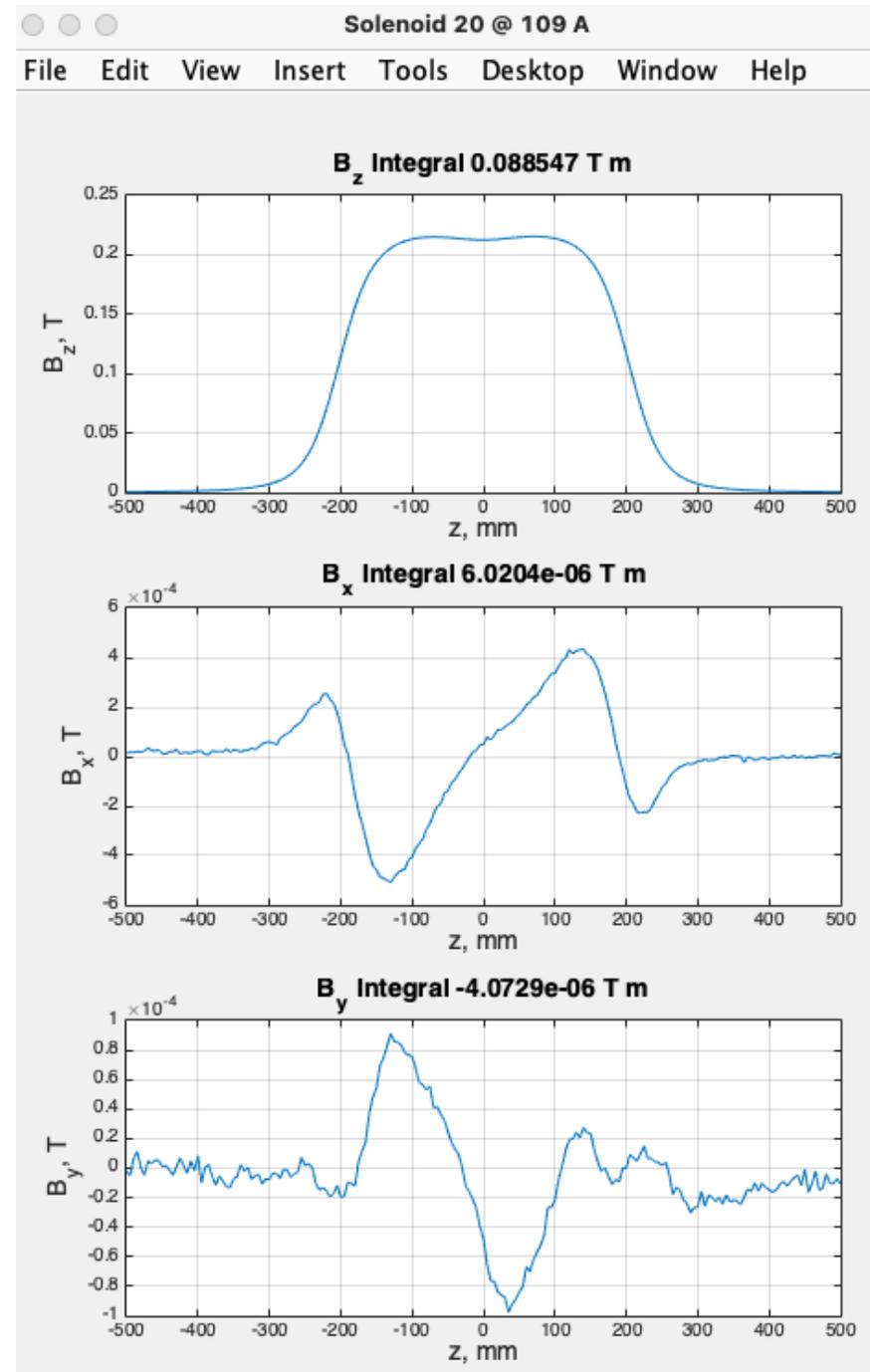
Effect on the solenoid alignment with hadrons

For measurements with high rigidity beam when only rotation term is taken into the account and residual field proportional to solenoid current the systematic error in the solenoid axis tilt is introduced

$$\text{Rotation angle } \theta = \frac{\int B_z dz}{2B\rho}$$

$$\text{Kick angle } \alpha_{x,y} = \pm \frac{\int B_{y,x} dz}{B\rho} \approx \theta \alpha_{y,x0}, \qquad \text{where } \alpha_{y,x0} = \pm 2 \frac{\int B_{y,x} dz}{\int B_z dz}$$

Similar to the kick the displacement is defined by the second integrals