ELBT SN0002 Solenoid

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Contents

1 Summary

Nominal Current $\mathrm{I_n}$	5 A
R @ 22° C	1.5 Ω
Inductance	66.1 mH
$\int_{\mathbb{R}} B_s(s;\mathrm{I_n})\mathrm{d}s$	$4.41 \cdot 10^4$ Gmm
$\int_{\mathbb{R}} B_s^2(s;\mathrm{I_n})\mathrm{d}s$	$2.00 \cdot 10^7$ $\mathrm{G^2mm}$

Figure 1 shows ξ defined in equation 1:

$$\boxed{\int_{\mathbb{R}} B_s(s;\mathrm{I})\mathrm{d}s = m\mathrm{I} + \xi} \tag{1}$$

where m is

$$m = \frac{\text{B-I Linear Slope}}{B_{max} \text{ of B-I curve}} \int_{\mathbb{R}} B(s;\mathrm{I_n})\mathrm{d}s = 8.94 \cdot 10^3 \ \mathrm{G \cdot mm \cdot A^{-1}} \tag{2}$$

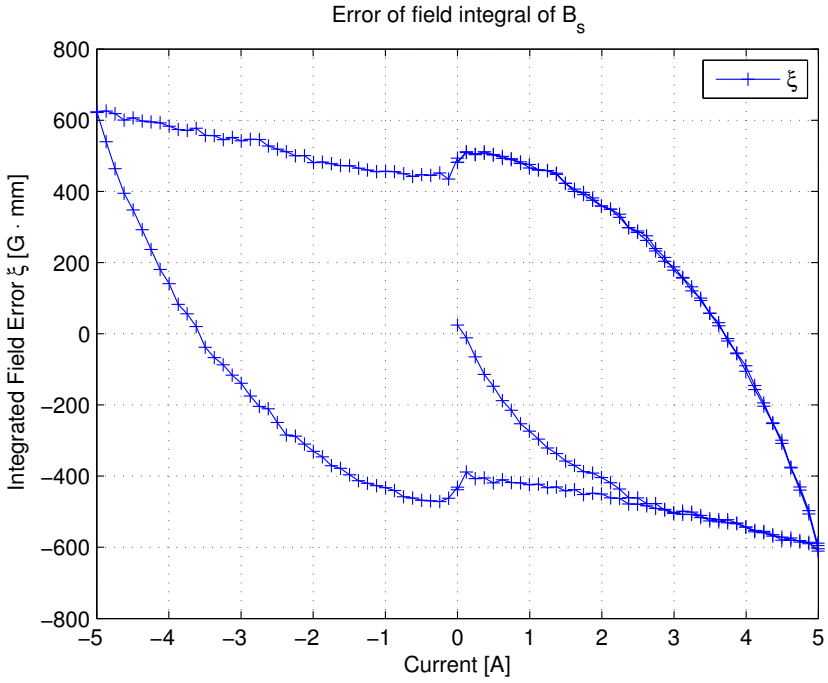

Figure 1: The raw data used in this plot can be found in LongEgun2_5A.csv and egunSol2_5A_14Mar17_1558.dat.

Figure 2 shows ξ^* defined in equation 3:

$$\boxed{\int_{\mathbb{R}} B_s^2(s;I)\mathrm{d}s = m^* I + \xi^*} \tag{3}$$

where m^* is

$$m^* = \frac{\text{B-I Linear Slope}}{B_{max} \text{ of B-I curve}} \int_{\mathbb{R}} B(s;\mathrm{I_n})^2 \mathrm{d}s = 4.06 \cdot 10^6 \ \mathrm{G^2 \cdot mm \cdot A^{-1}} \tag{4}$$

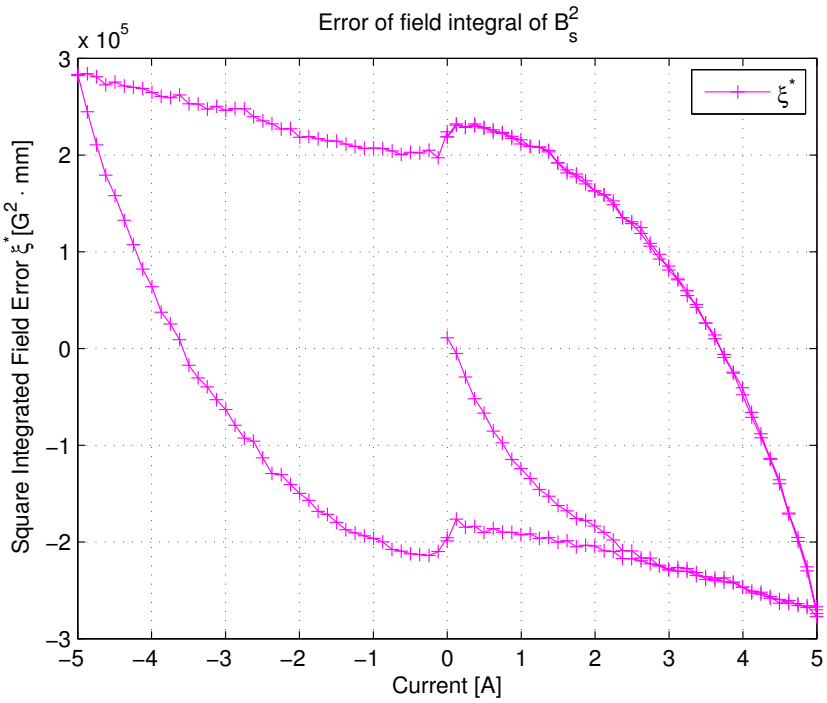

Figure 2: The raw data used in this plot can be found in LongEgun2_5A.csv and egunSol2_5A_14Mar17_1558.dat.

2 Measurements Details

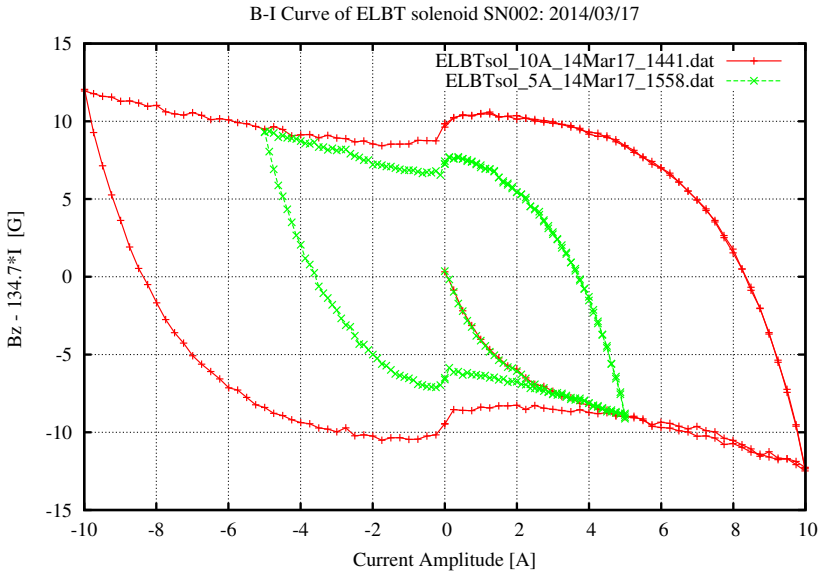

Figure 3: This is the BI curve with maximum current amplitude of I_n beginning from a demagnetized state.

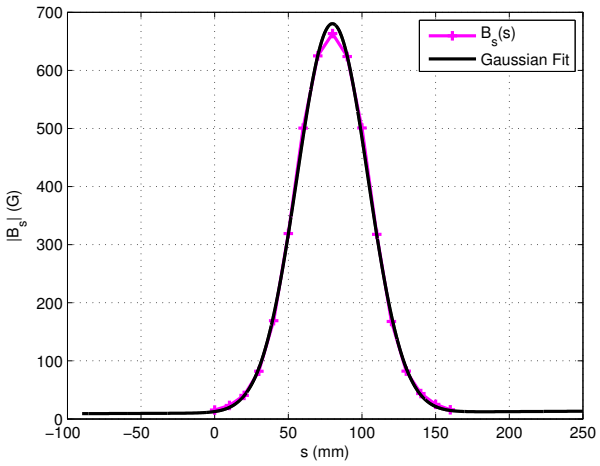

Figure 4: The raw data used in this plot can be found in LongEgun2_5A.csv. This plot is a longitudinal field profile measured at I_n with a Gaussian fitted to the data. The fit was used to calculate the field integrals.

An asymmetry is present in the longitudinal field profiles. The cause of this asymmetry is the unequal sizes of the flanges in the section of the pipe that the measurement occured in. To determine the how large the effect of the flanges is the magnetic field inside and outside of the pipes were measured by leaving the probe in place and sliding the beam pipe. The difference between inside and outside is larger on one side than the other, which is the cause of the asymmetry. The longitudinal asymmetry can be seen in figures 4, 5.

	Large Flange Side	**Small Flange Side**
Inside Pipe	52.45 G	55.42 G
Outside Pipe	49.43 G	55.16 G

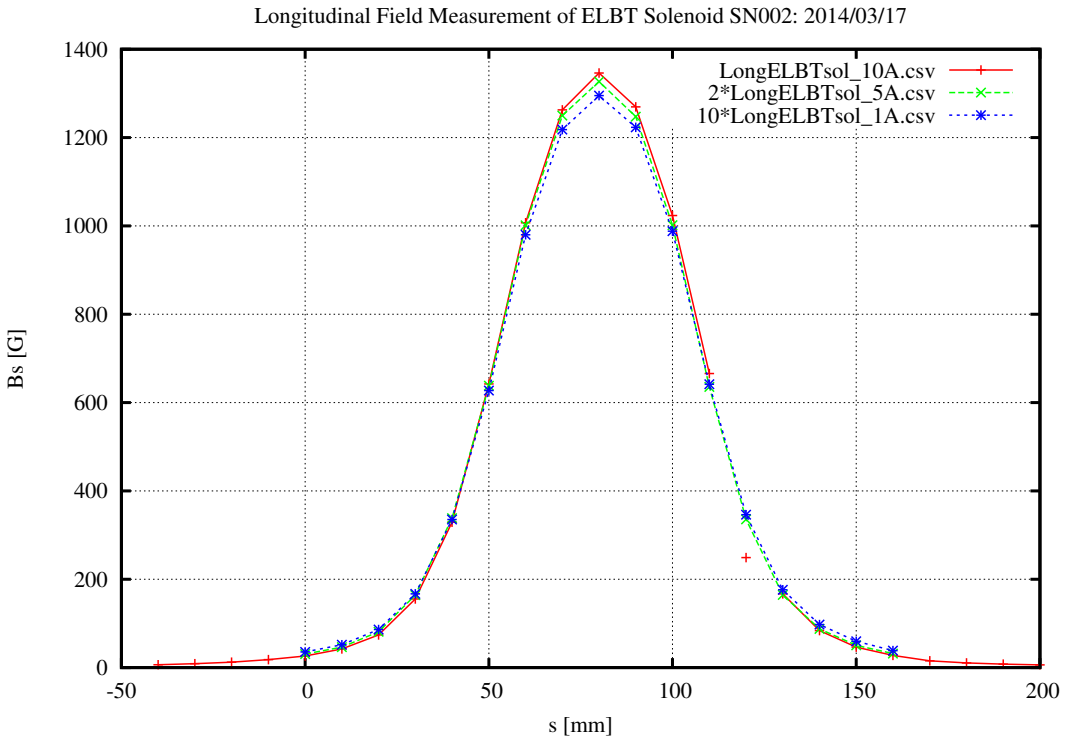

Figure 5: Longitudinal field profile measurements with driving currents.

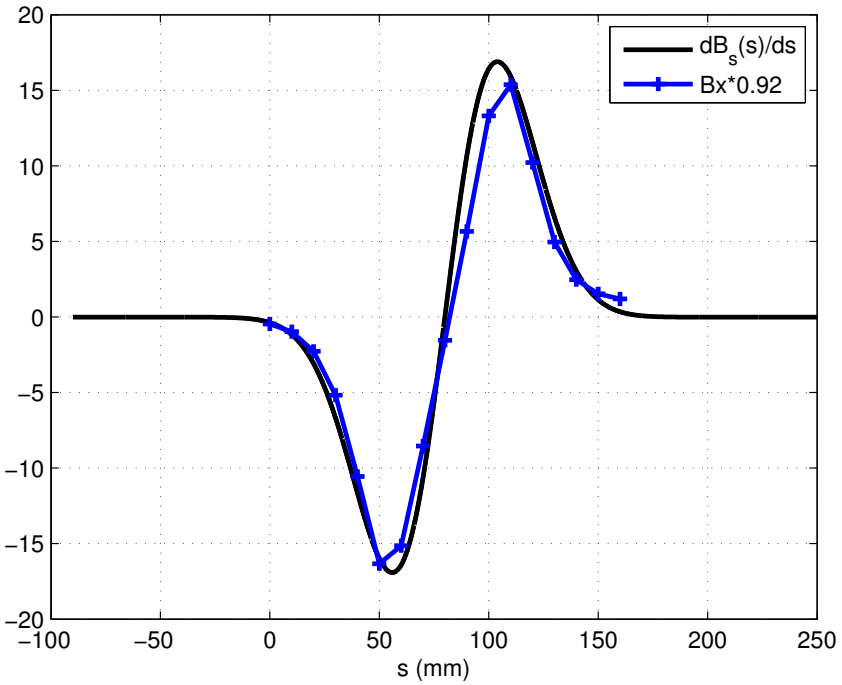

Figure 6: This is the derivative of the fit versus B_x – it serves as an aid in determining if the fit is sound.