Noise Test of the CAENels Current Transducer BOX

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This note describes the performance test of the CT-BOX to determine if the CT-BOX is the source of the 2 G noise. Results show that the CT-BOX is not the source.

The CAENels Current Transducer BOX (CT-BOX) was chosen to provide current readings for the HDice NMR program, due to its accuracy of 0.005%. The CT-BOX reads the magnetic field produced by the current generated by the power supply and calculates the corresponding current value.

During the NMR program run, the CT-BOX signal showed noise of about 1–2 G (Fig. 1). To investigate the source and severity of the noise, a test was performed in the control room with the CT-BOX detached from other equipment used for the NMR run.

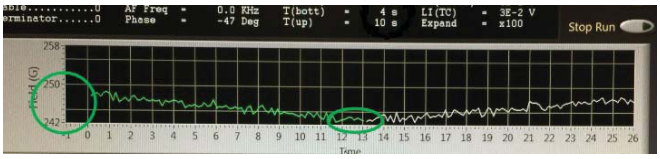

FIG. 1. The display in the NMR program showing the CT-BOX signal noise of 1–2 G.

Reading the noise from the CT-BOX required the development of a LabVIEW-based data acquisition program that reads current values with varying frequency. The user sets the acquisition rate and graph length (both circled in red, in Fig. 2). The signal is displayed in the graph on the right of the screen. The lock-in amplifier, which will be triggered to read at the same time as the CT-BOX, has a buffer depth of 16,000 points. Figure 2 shows the signal displayed by the data acquisition program for a frequency of 500 Hz and a buffer depth of 16,000 points.

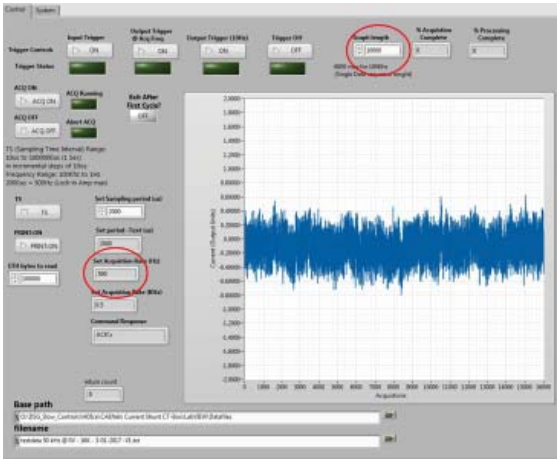

FIG. 2. The data acquisition program created in LabVIEW to read current at rates set by the user.

The test was run for 27, 53, and 500 Hz. It was found that the noise level increases slightly as the frequency increases; however, the noise level was found to be insignificant. The signal for 500 Hz (the maximum frequency for the lock-in amplifier) is graphed and shown in Fig.3. The power supply used in the NMR program was programed for ~516 G/A, which is ~2 mA/G. The noise for a 500 Hz signal is ~1 mA, which is ~0.5 G.

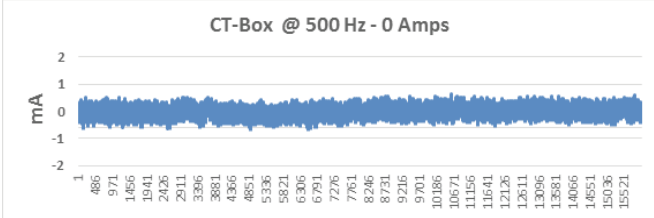

FIG. 3. The signal of the CT-BOX at 500 Hz for 0 A. Noise is shown to be ~1 mA, or ~0.5 G.

The CT-BOX was also tested for varying current values. Figure 4 shows the noise test at 500 Hz for 10 A and 20 A, with offsets to center signal at 0 A. The signals at 10 A and 20 A show the same noise as that of 0 A and 500 Hz (~1 mA).

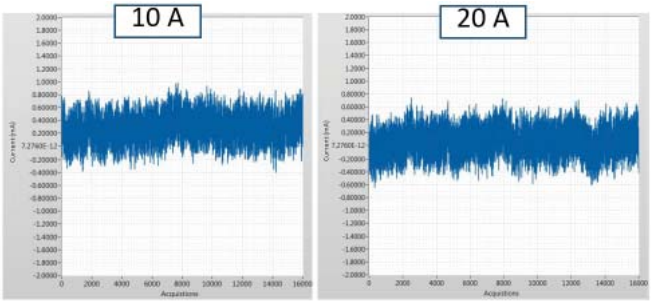

FIG. 4. The signal of the CT-BOX at 500 Hz for 10 A and 20 A. Noise is still shown to be ~1 mA, or ~0.5 G.

The noise test showed that the CT-BOX did not have a noise of 1–2 G. The CT-BOX had noise of ~1 mA (~0.5 G) at 500 Hz, the maximum frequency to be run with the lock-in amplifier. The source of the 1–2 G noise observed during the NMR run is unclear.