Update on degaussing work with Magnet 1 at UT

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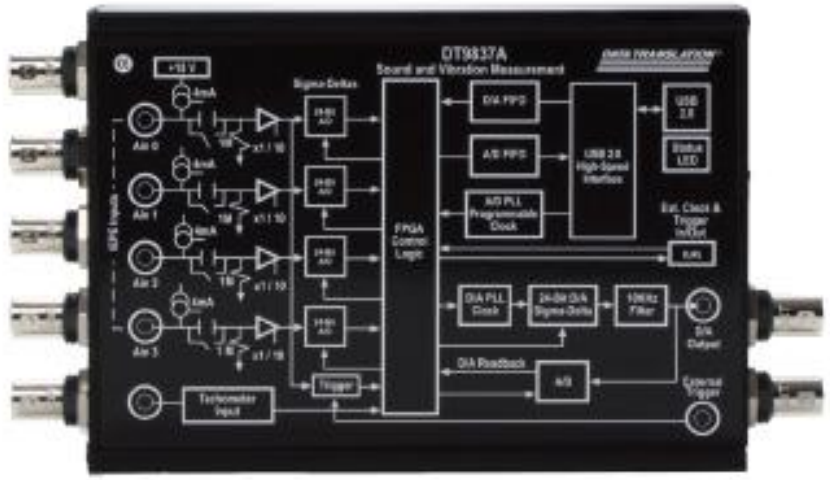
We re-modernized UT degaussing equipment:

Programmable function generator (same as UKY)



The DT9837A has 4 simultaneous IEPE sensor inputs plus a synchronous tachometer input and is ideal for portable noise and vibration measurement applications.

Provides required voltage shape of low power
with vertical 24 bit resolution

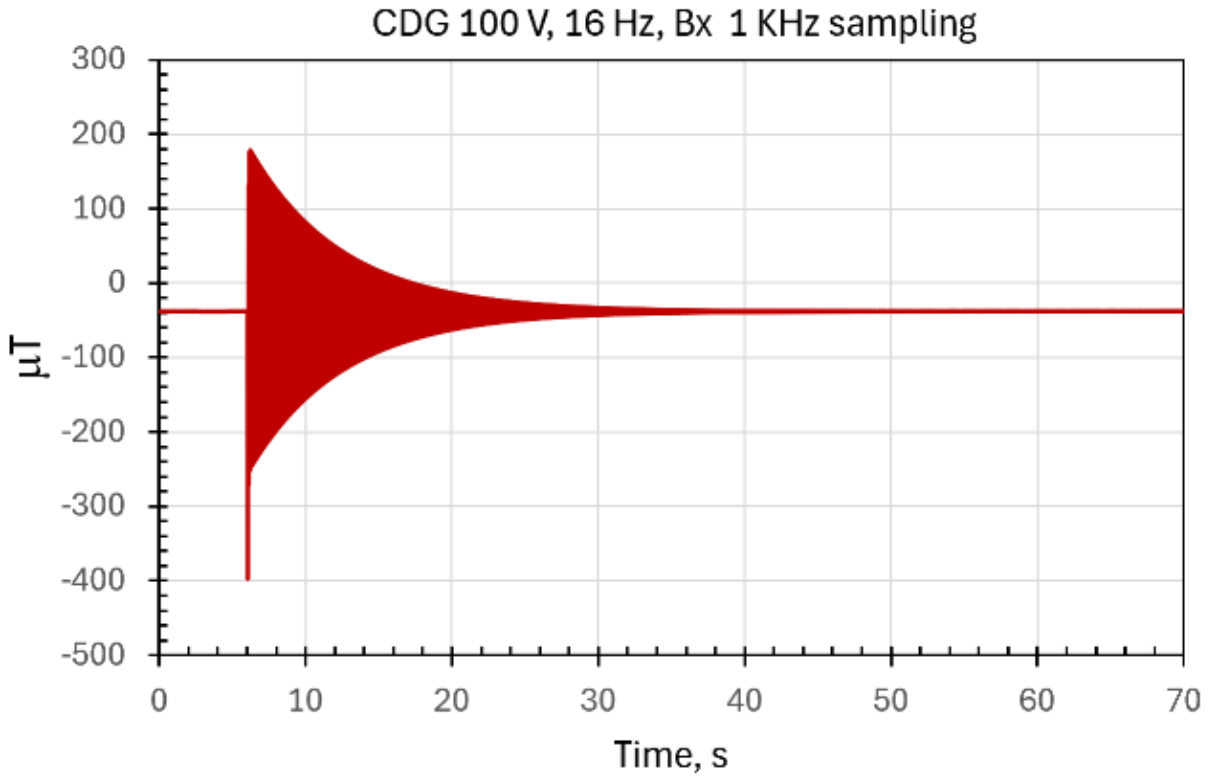
KEPCO BOP 100-2M GPIB
Bipolar Amplifier ± 100 V, 2A, 200 W

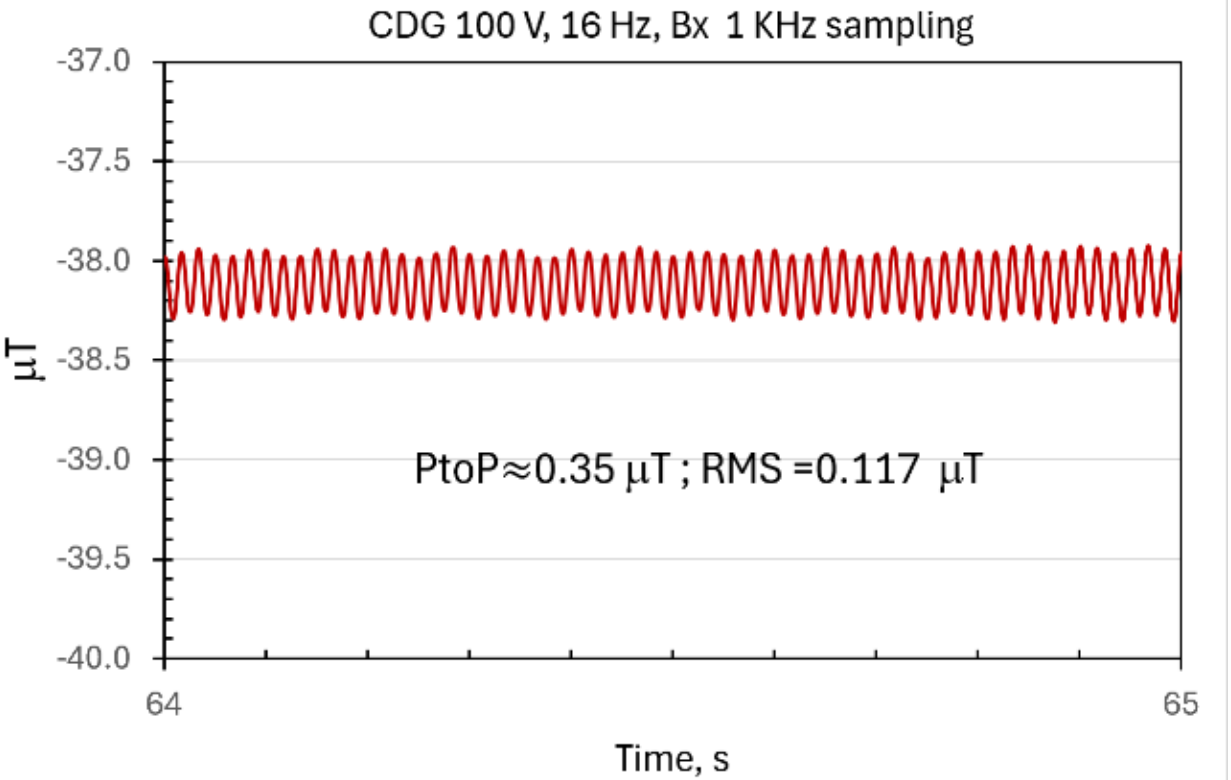
For main coil with 180 Ohms provides current 0.5 A
For degaussing coil 0.9 Ohma provides current 2-20 A

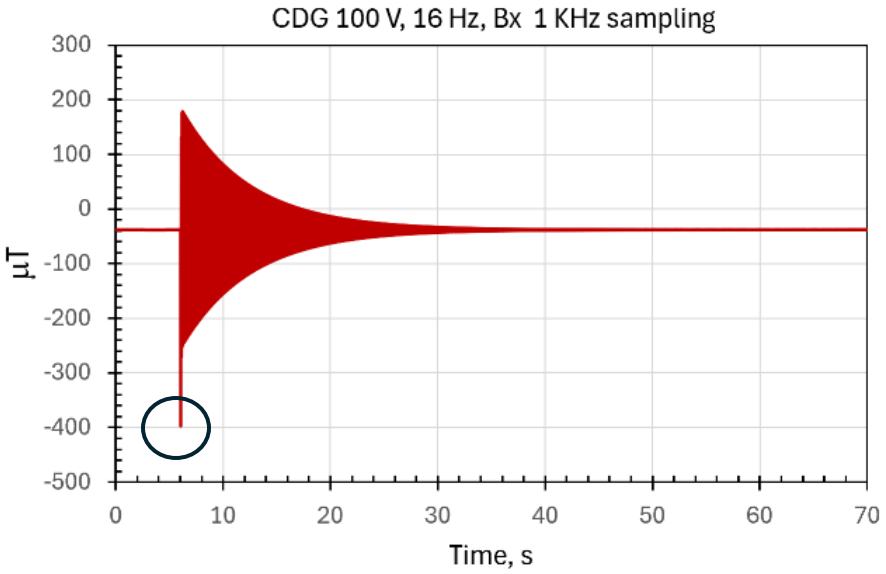
Study of Degaussing signal on **Main Coil** of Magnet 1
16 Hz, 100 V to 180 Ohm (+ 3.29 Henry)
Measured on Magnet 1 on DS side with Bartington magnetometer Bx - axial

[The low-pass filter should not be used for degaussing the main coil]

Axial component Bx during main coil degaussing







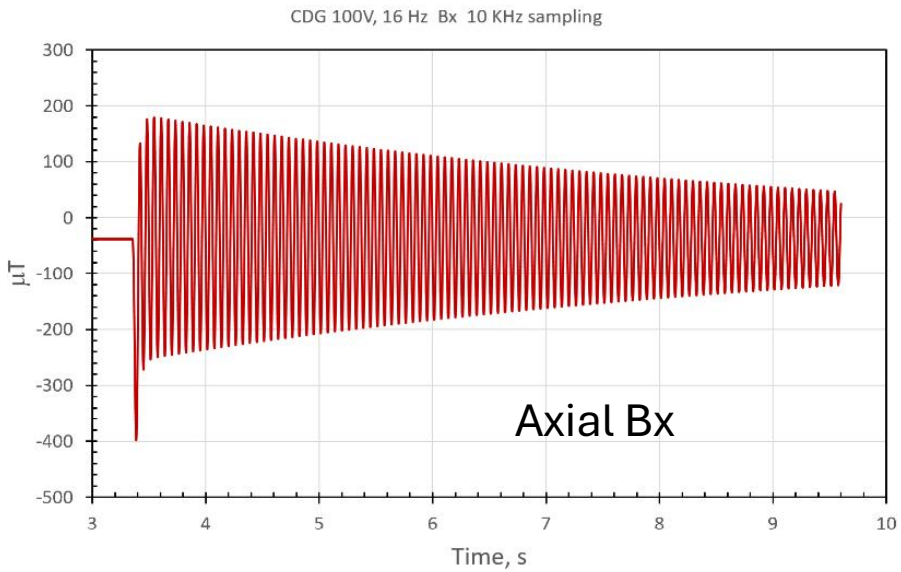
Measurement with magnetometer $-400\ \mu T$ DS on Mag 1 corresponds to Bx "central" field ~16.3 G
DC current 0.35 A in the main coil reads in magnetometer as - 660 μT and corresponds to the field inside the solenoid of 27.3 G

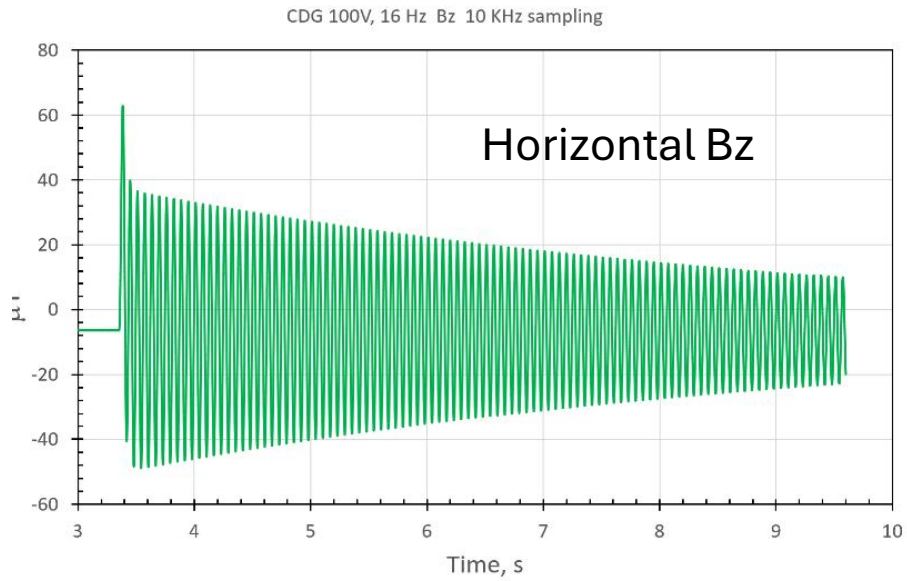
$$Z(coil) = \sqrt{R_{coil}^2 + (\omega L)^2} = \sqrt{180^2 + (2\pi \cdot 16 \cdot 3.29)^2} = 376\ \Omega$$

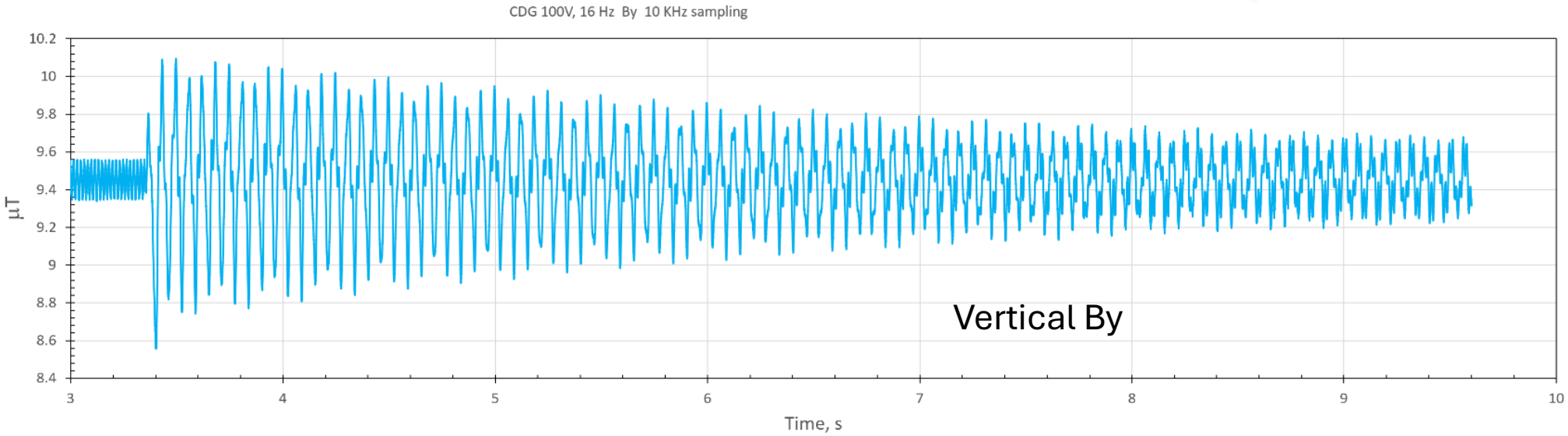
Max of degaussing current 100 V/376 Ω =0.265 A should correspond to the field 20.7 Gauss and to magnetometer reading of ~ 500 μT

Degaussing signal on Main Coil of Magnet 1, 16 Hz, 100 V to 180 Ohm
Measured on Magnet 1 on DS side with magnetometer Bx - axial

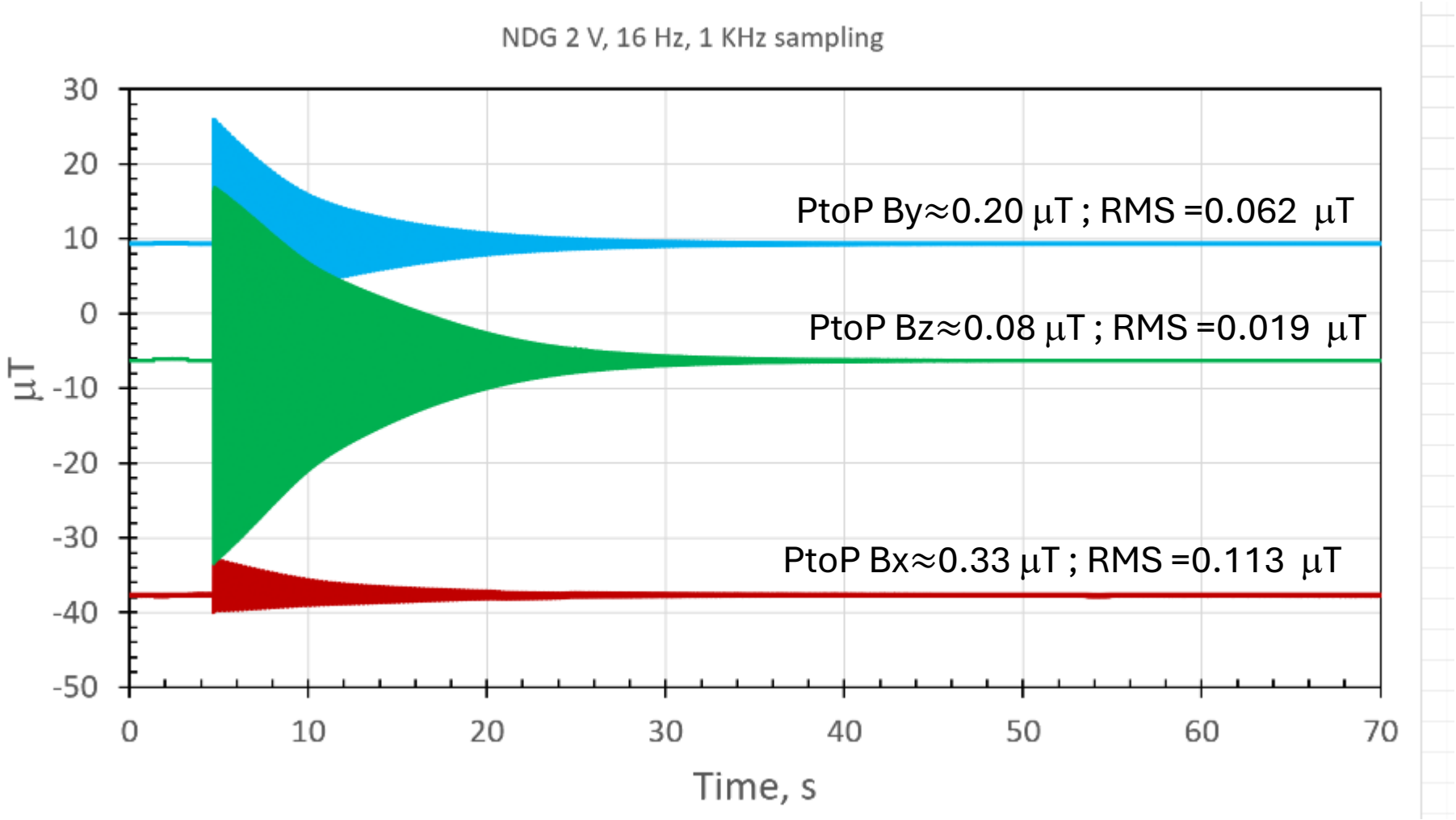
Detailed view of first several seconds in CDG at 10 KHz sampling







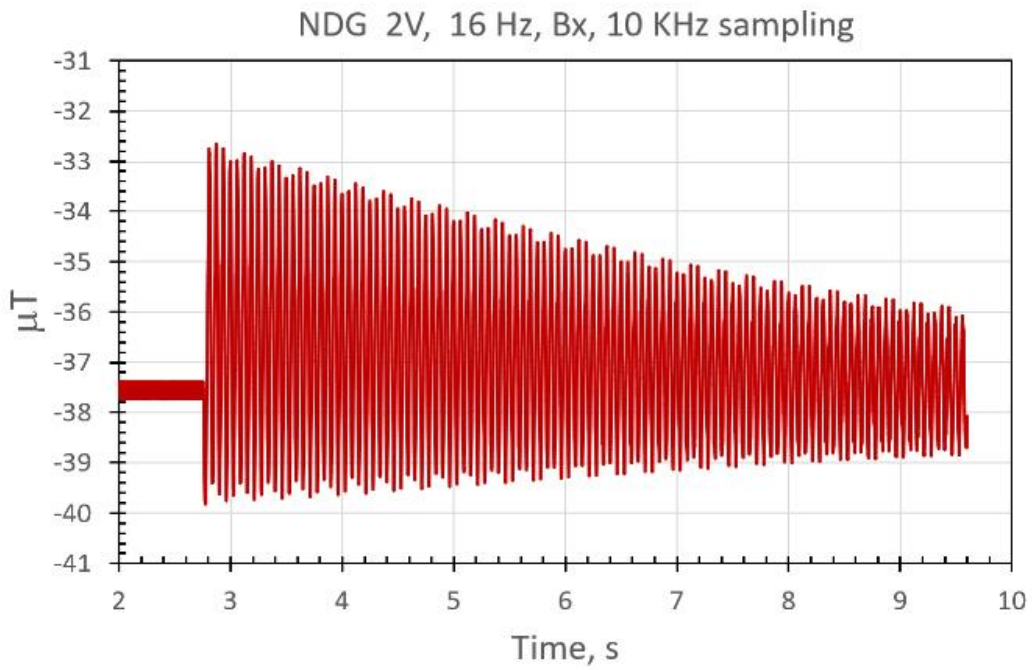
Normal (Standard) **Degaussing Coil** signal of Magnet 1, 16 Hz, 2 V to 0.9 Ohm
Measured on Magnet 1 on DS side with magnetometer Bx - axial

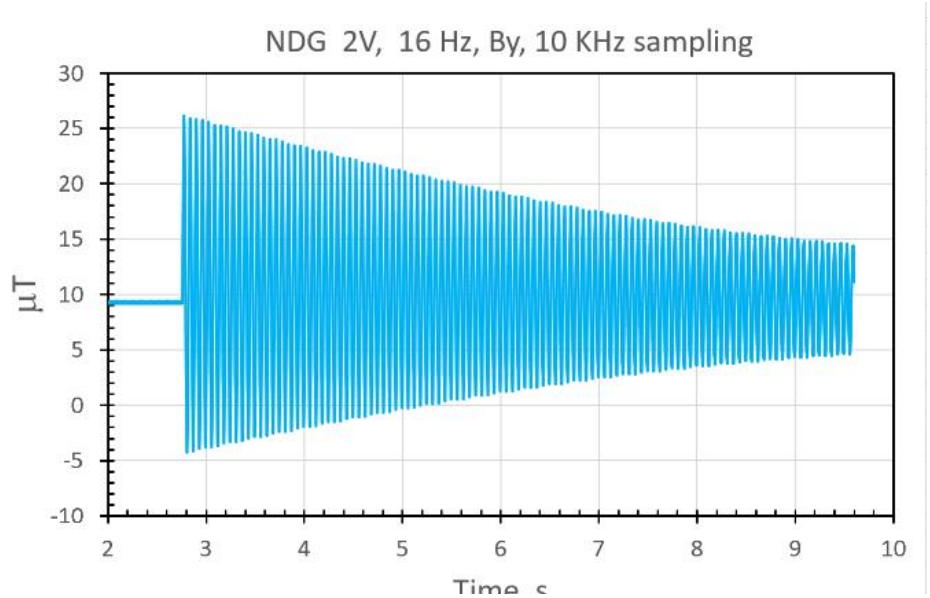


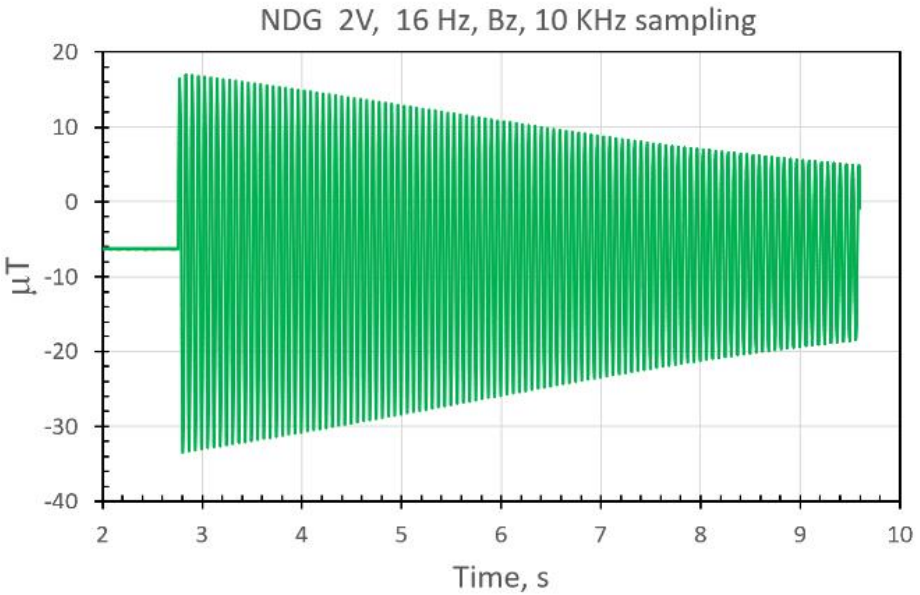
Degaussing max current in NDG coil is ~ 2.2 A

Normal (Standard) Degaussing Coil signal of Magnet 1, 16 Hz, 2 V to 0.9 Ohm Measured on Magnet 1 on DS side with magnetometer Bx - axial

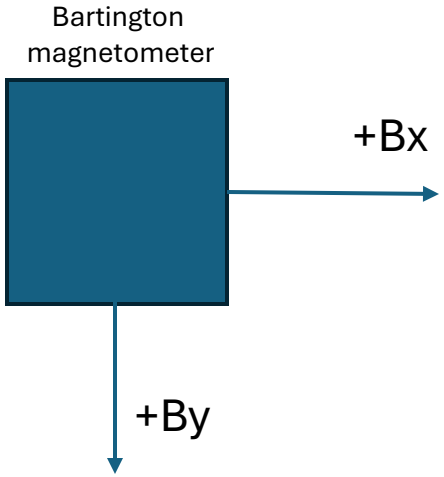
Detailed view of first several seconds in NDG at 10 KHz sampling







Study of zero of Magnetometer by flipping sensors



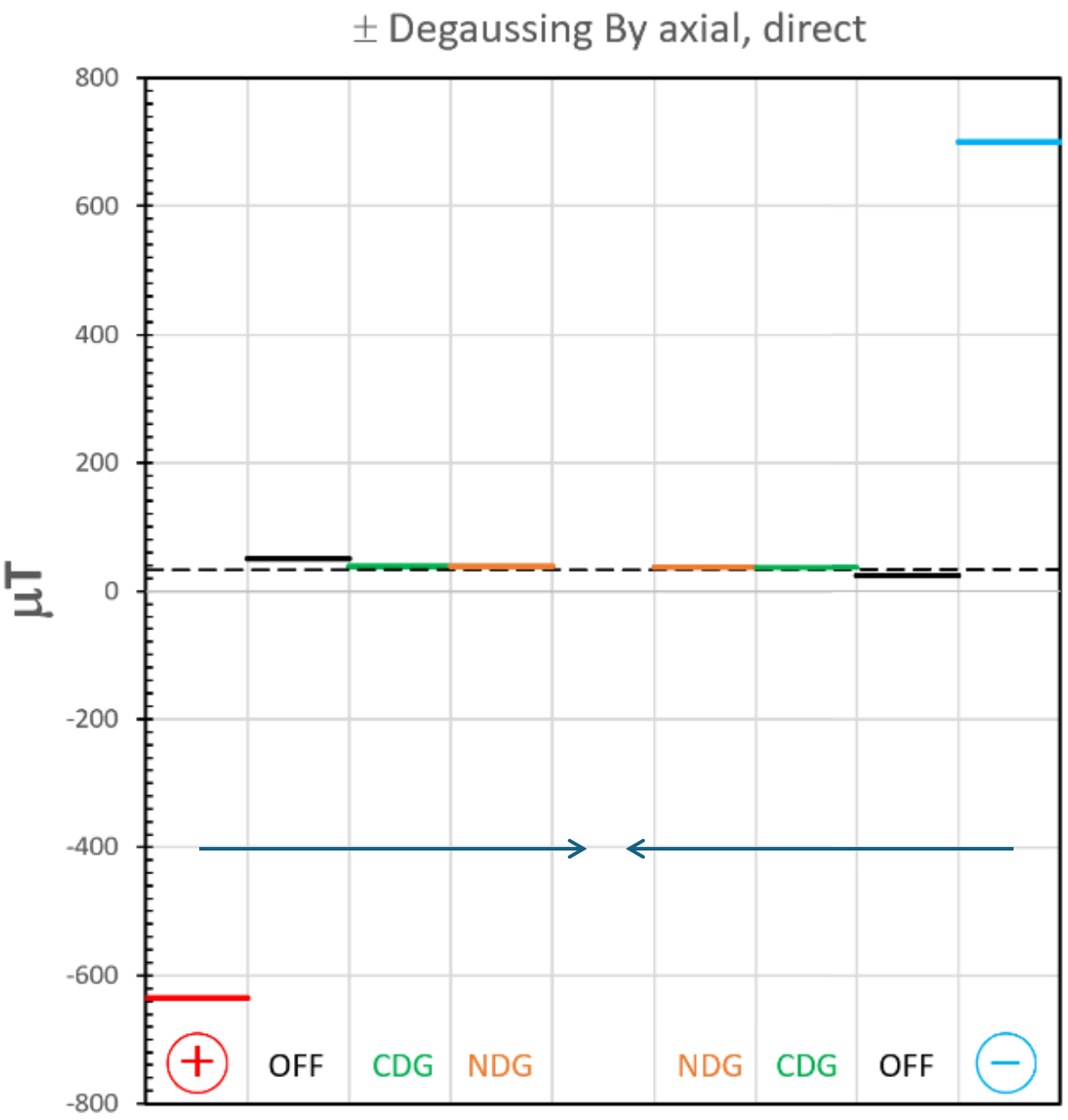
Magnet current +0.35 A,	Bx aligned with field	Bx=+627.175 μT	Diff 5.89 %
	Bx is flipped	Bx=-665.212 μT	
Magnet OFF + 0 A	Bx aligned with field	Bx=+36.44 μT	Diff 0.14 %
	Bx is flipped	Bx=-36.49 μT	
Vertical B_E on floor	Bx aligned with field	Bx=+27.993 μT	Diff 0.08 %
	Bx is flipped	Bx=-28.016 μT	
Magnet current +0.35 A,	By aligned with field	By=+649.513 μT	Diff 1.86%
	By is flipped	By=-661.705 μT	

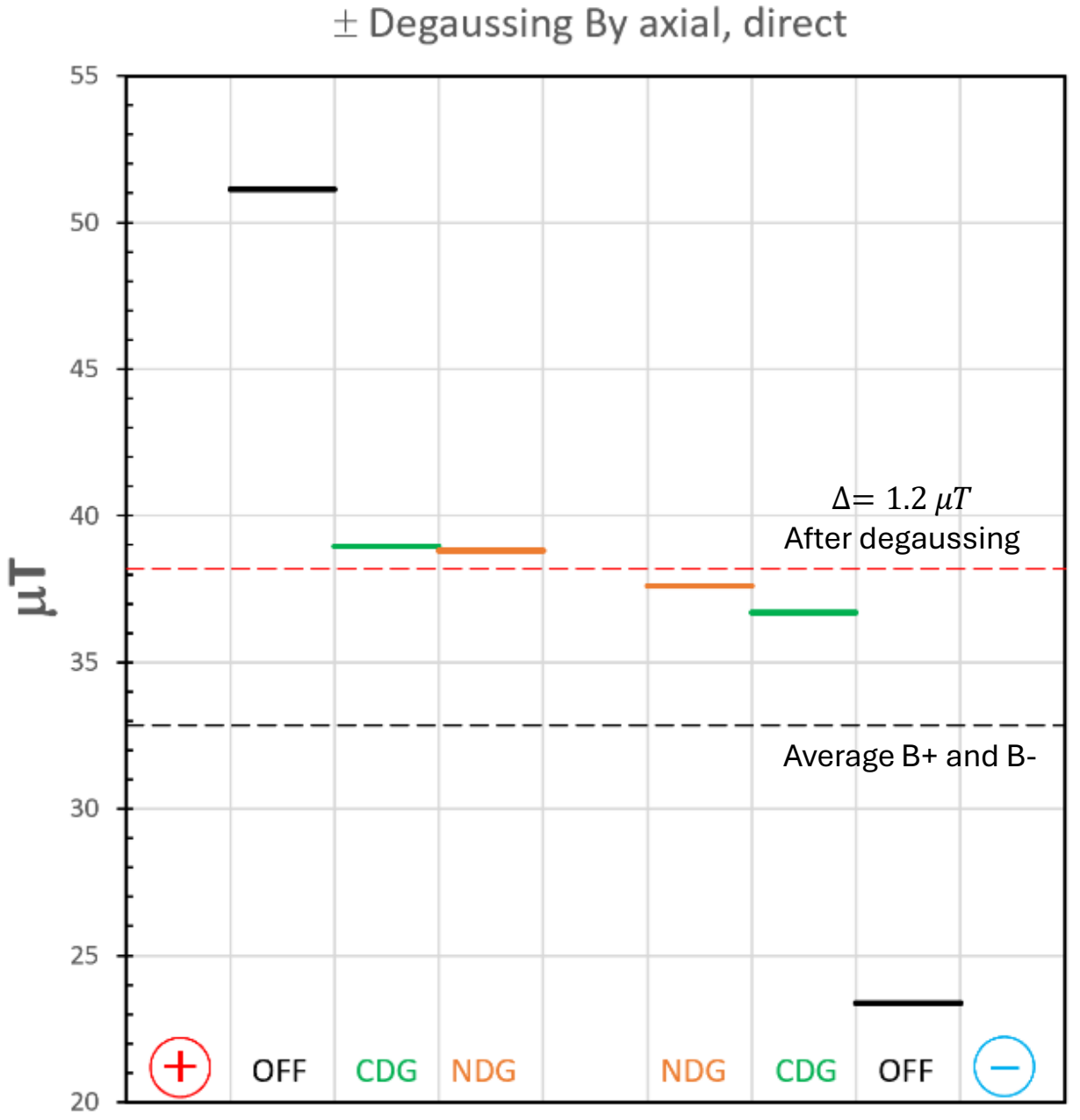
Difference between Bx and By sensors of magnetometer

for same field:	Bx=+627.175 μT	By=+649.513 μT	Diff 3.5 %
if flipped	Bx=-665.212 μT	By=-661.705 μT	Diff 0.53 %

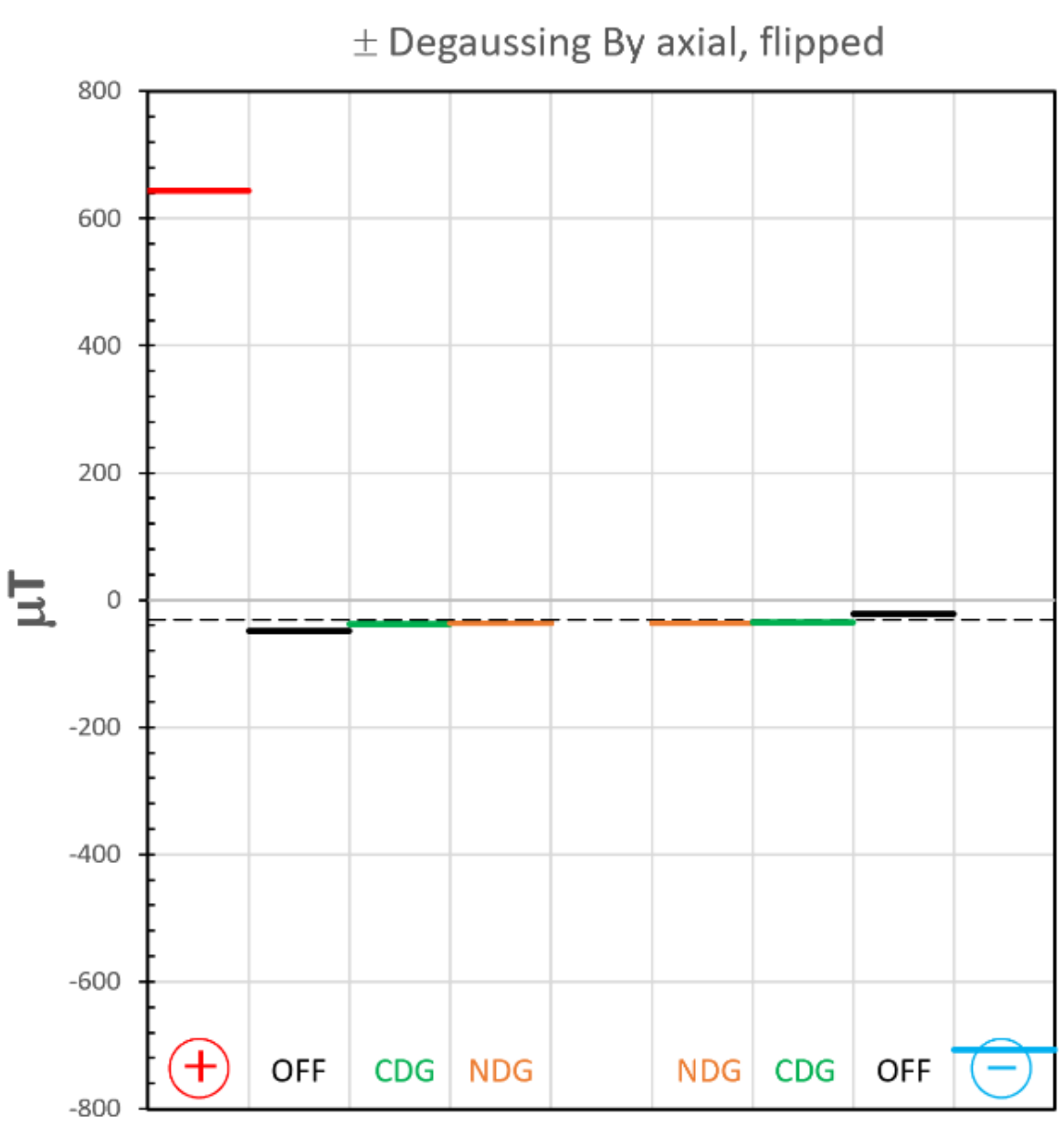
Ergo, magnetometers are linear around zero for small fields but become not linear for the large fields (several G).
Non-linearity is different for positive and negative fields along the positive sensor axis.
At least, for large fields sensitivity of Bx and By sensors is different by several %

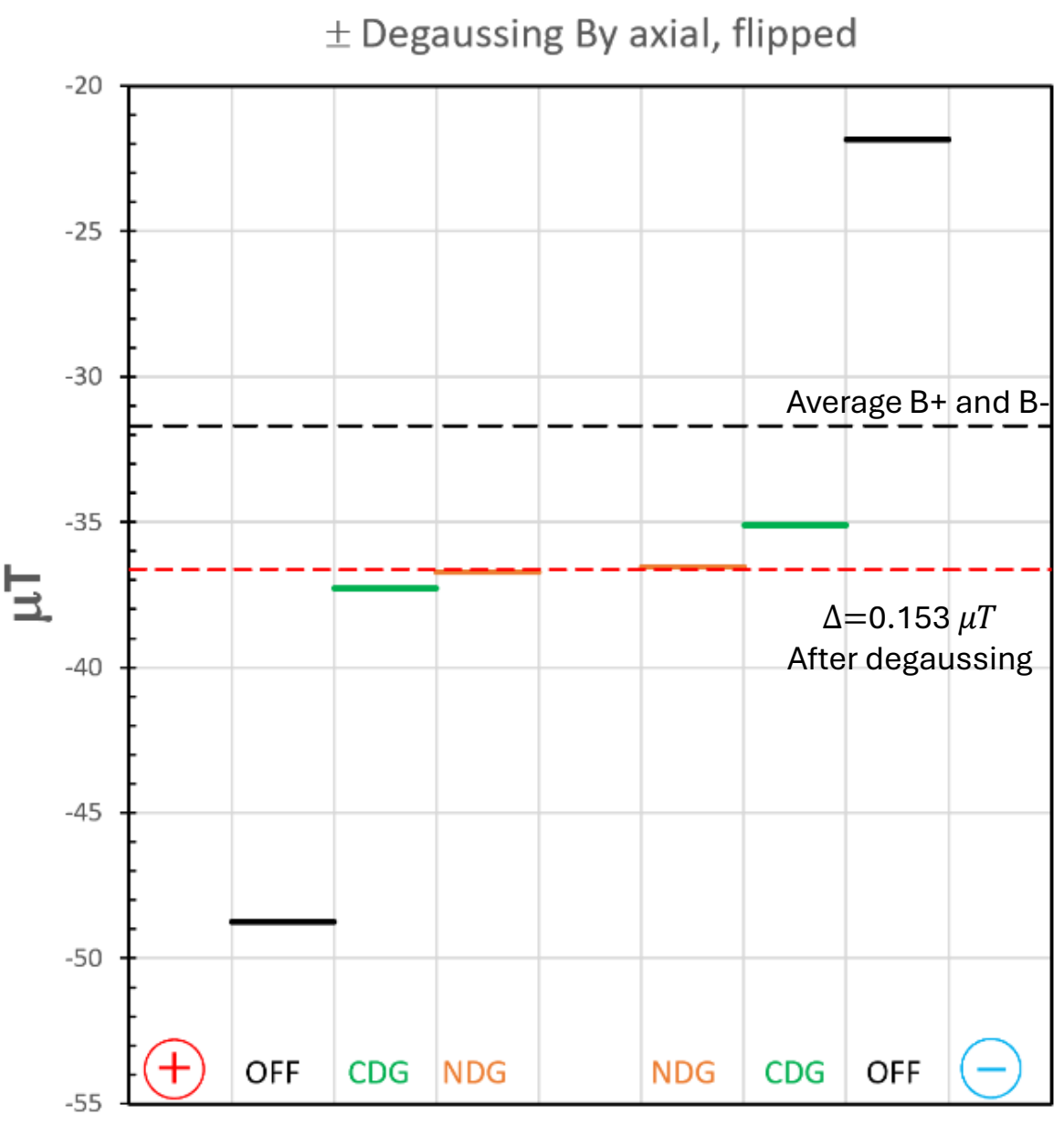
Degaussing study with By axial sensor (DIRECT)



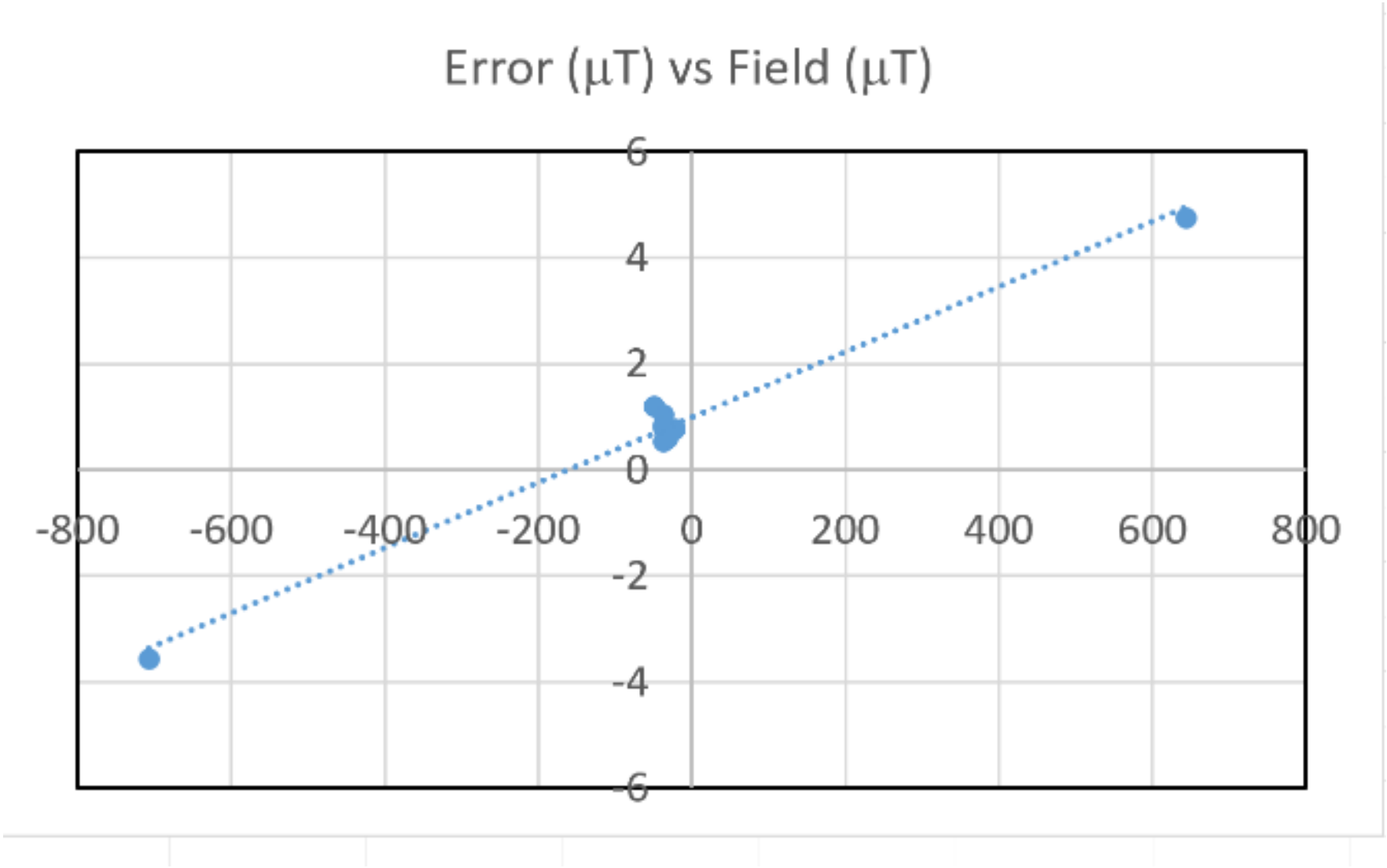


Degaussing study with By axial sensor (FLIPPED)





Error is a sum of (Direct and Flipped readings)/2
Measurements with By axial.



- Changing current direction in the magnet produces at the edge of the magnet fields with opposite polarity but not equal by magnitude.

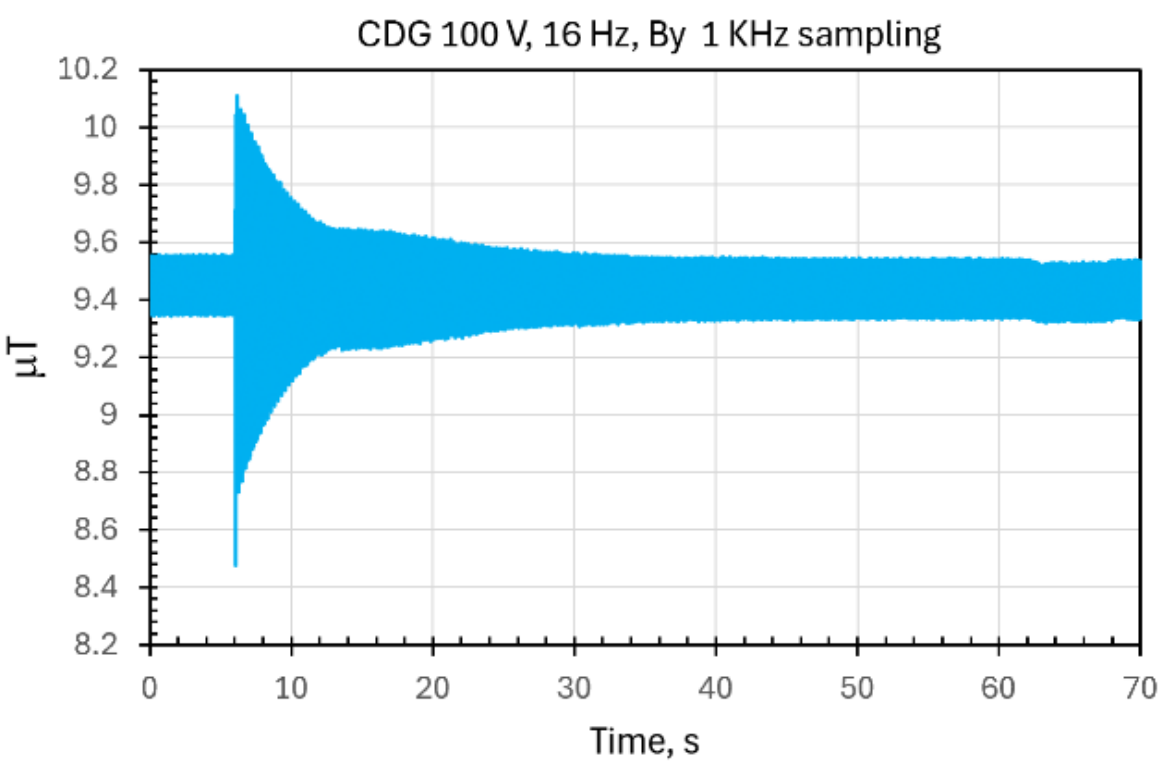
- The difference seems determined by the presence of Earth magnetic field and mu-metal

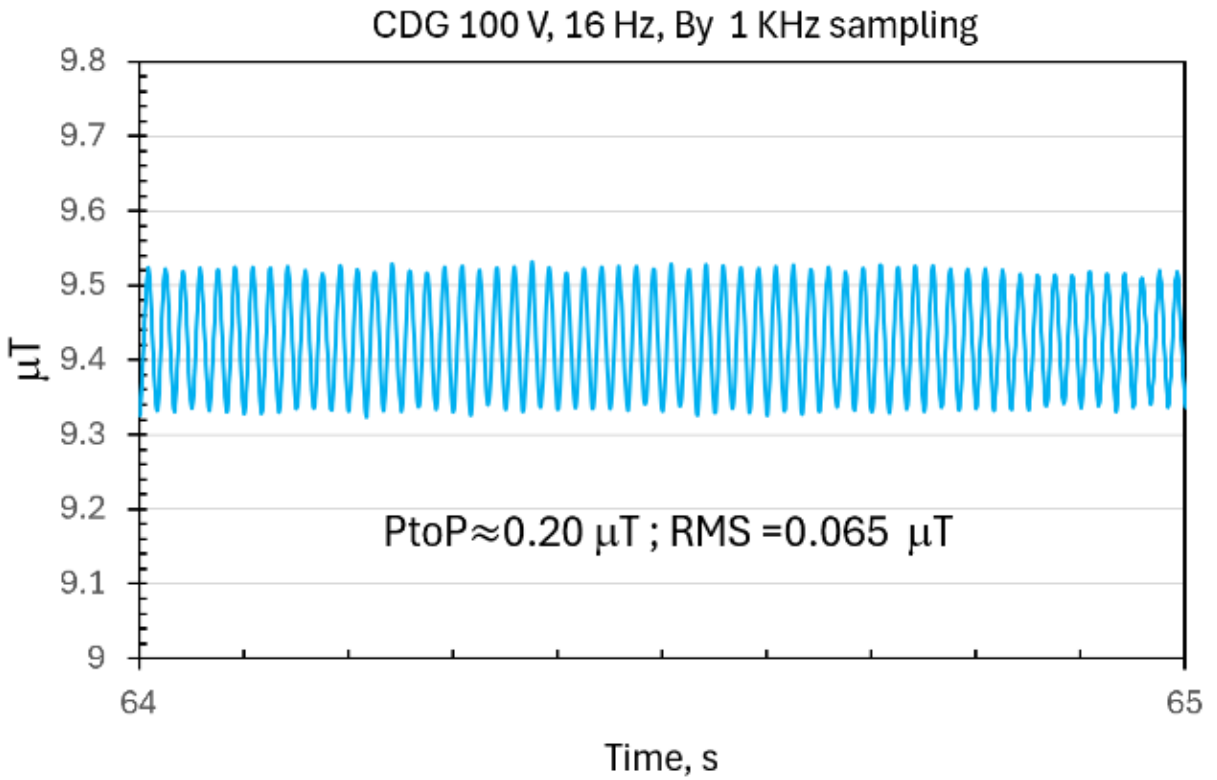
- Field measurements are affected by observed non-linearity of magnetometers.

- It seems possible to degauss the magnet system such that after operation at $\pm 27\ Gauss$ it can be degaussed to the common value (due to B_{Earth} and mu-metal) with difference ~ 1.5 mG

Degaussing signal on Main Coil of Magnet 1, 16 Hz, 100 V to 180 Ohm
Measured on Magnet 1 on DS side with magnetometer Bx - axial

Vertical component By during main coil degaussing





Degaussing signal on Main Coil of Magnet 1, 16 Hz, 100 V to 180 Ohm
Measured on Magnet 1 on DS side with magnetometer Bx - axial

Horizontal component Bz during main coil degaussing