

More Stability Checks and Degaussing Order Tests

Alina Moore 4/4/2025

ORNL-UTK-UKY n-n' Monday meeting

Items

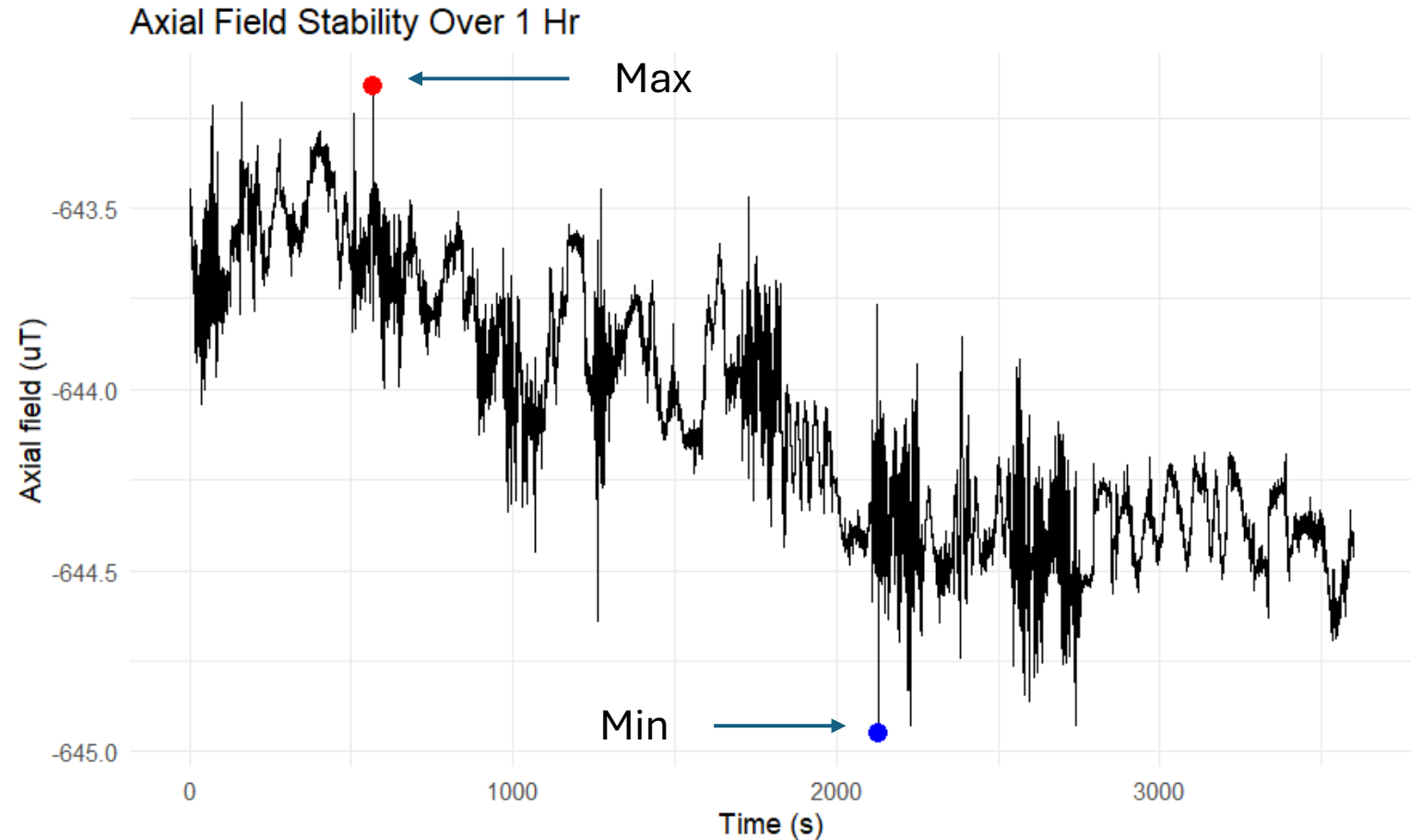
- 1-hour stability test with magnet off (10hz) to compare with magnet on
- 2 hour stability check (10hz)
 - Powered magnet, power supply, magnetometer on for 2 hours 15mins for warming up (0.35A)
 - Run for two 2 continuous hrs (72,000 datapoints). After the first hour, switch current from 0.35A to 0.32A.
- Studied different degaussing modes
 - All DG pulses are 16hz and last 62.5 sec
 - Tried different orders/combinations of using the main coil (MDG, max=0.5A, volts used: 100) and “normal degaussing coil” (NDG, max=2A, volts used: 2)
 - 3x: N in series
 - 3x: M in series (two trials)
 - 4x: N, M, N, M (four trials of this)

Used TDK-Lambda power supply with DC filter for all

3/9/2025: Previous 1 hr stability measurements

Magnetometer positioned on edge of Magnet 1 with 0.35A of current

- 36,000 points at 10Hz
- Mean: $-644.1 \mu T$
- $|\text{Max} - \text{Min}| = 1.79 \mu T$
 - max: $-643.16 \mu T$
 - min: $-644.95 \mu T$
 - % change from max to min:
 $2.8 * 10^{-3} (0.28\%)$

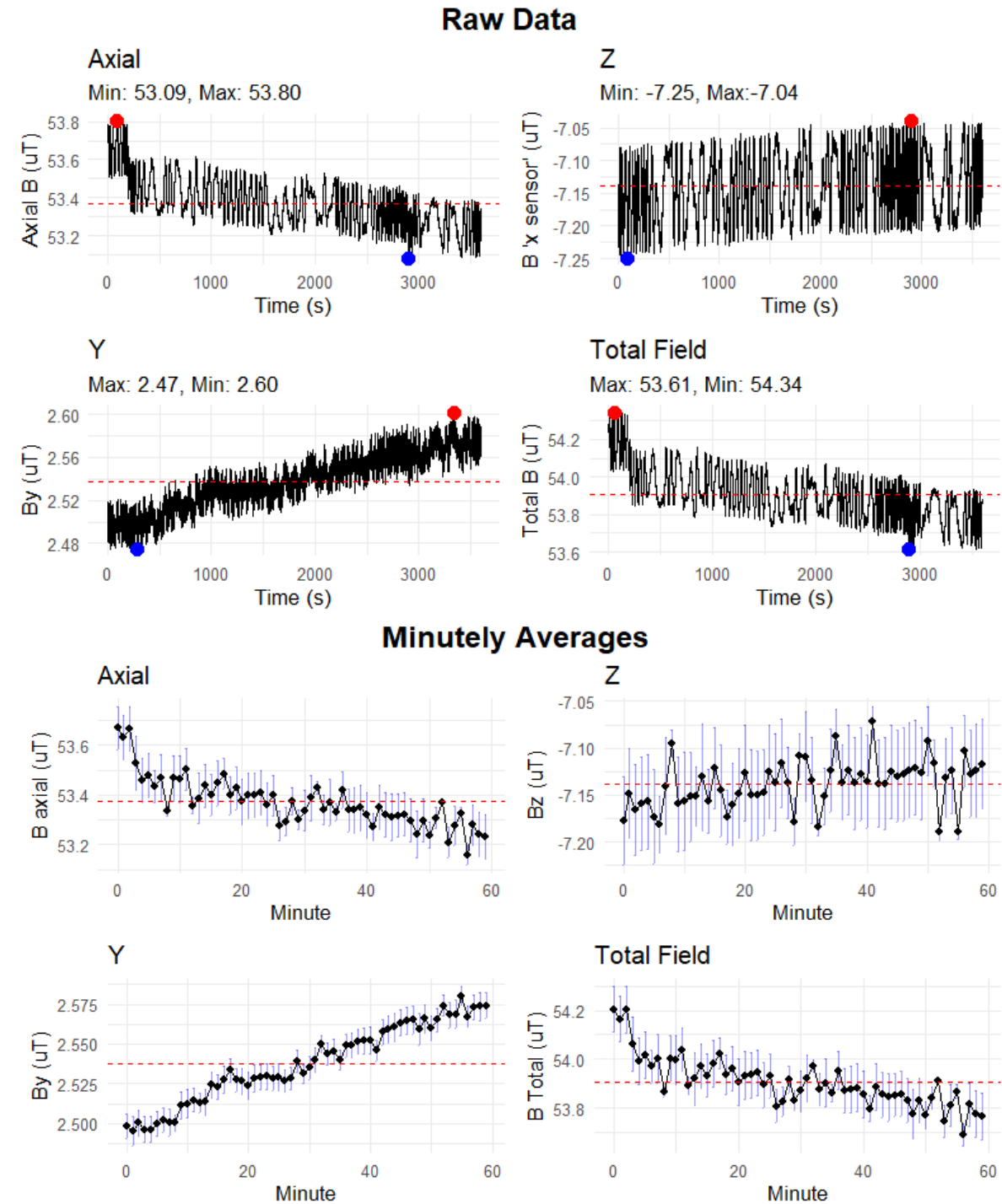


4/2/2025 magnetometer 1-hr stability measurement

- Magnet powered off, magnetometer positioned on edge of magnet 1
 - Performed with warmed up magnet and power supply (for ~3 hrs)
- Largest change on axial (X) component
- Similar behavior to with power ON
- May be good to try again further from the magnet and/or degauss before this measurement

|Max-Min| power ON $1.79 \mu T$
|Max-Min| power OFF $0.71 \mu T$

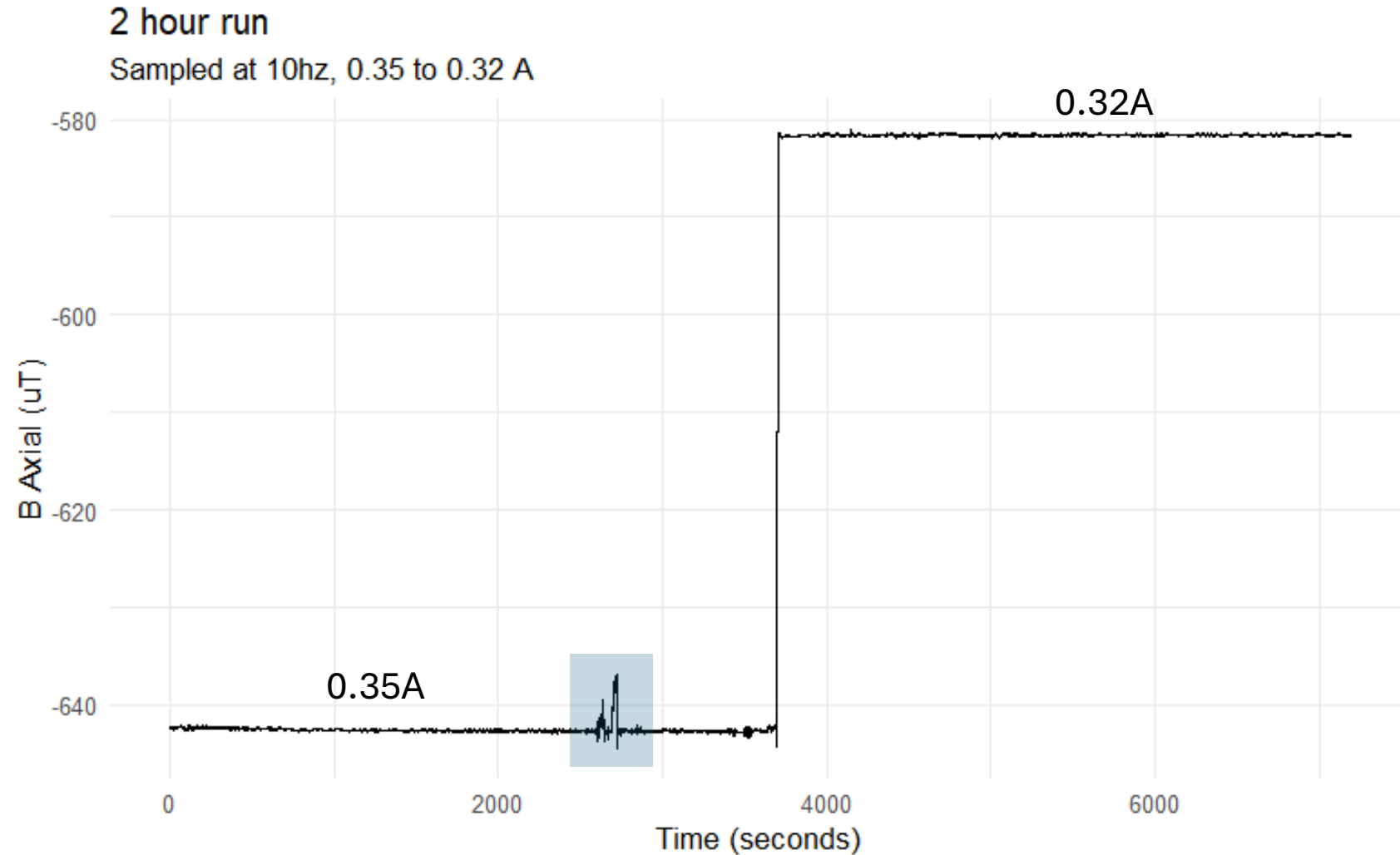
2.52x larger effect when power is on



2-hour run

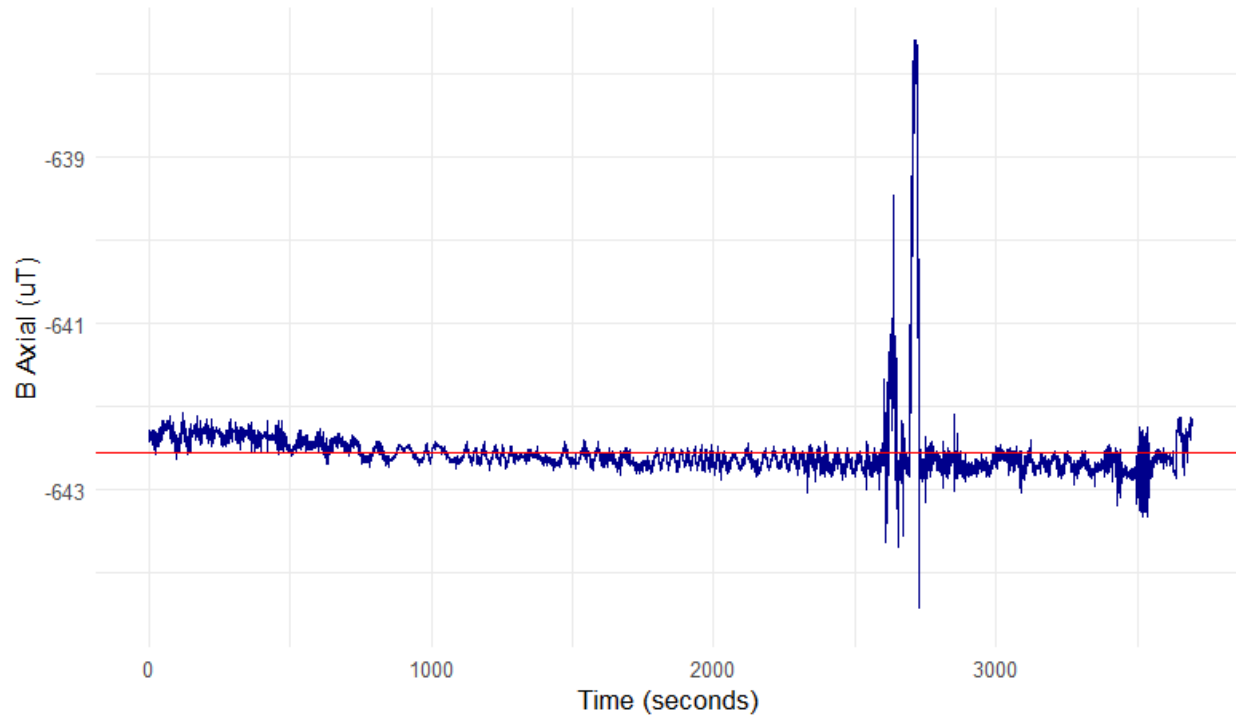
- Disturbance seen
- 0.32A seems more stable
- This data available as a CSV

To do: examine behavior during current change. How many seconds does it take to settle?



CSV link: https://drive.google.com/file/d/1eEtEjdyJGB98HJ7352ZPTwKZUB9X2Omo/view?usp=drive_link

0.35A



0.35A

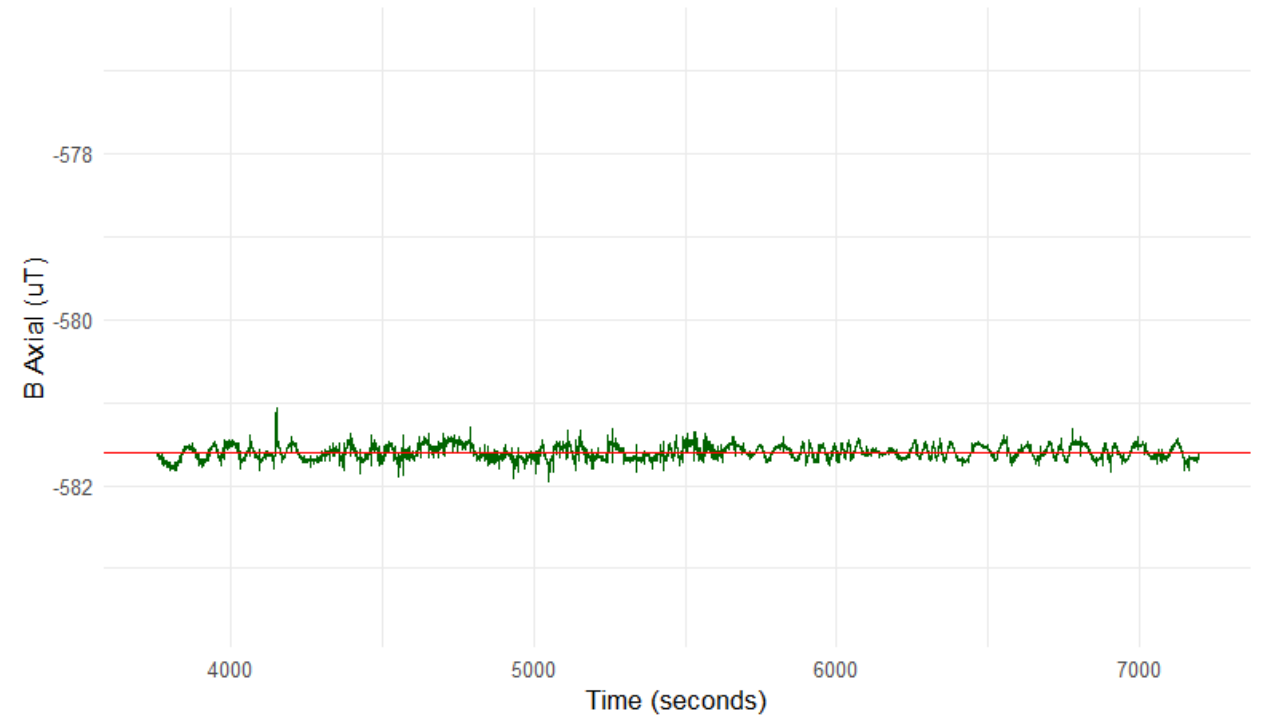
Mean: -642.55

Std deviation 0.41

Min: -644.416

Max: -636.929

0.32A



0.32A

Mean: -581.6

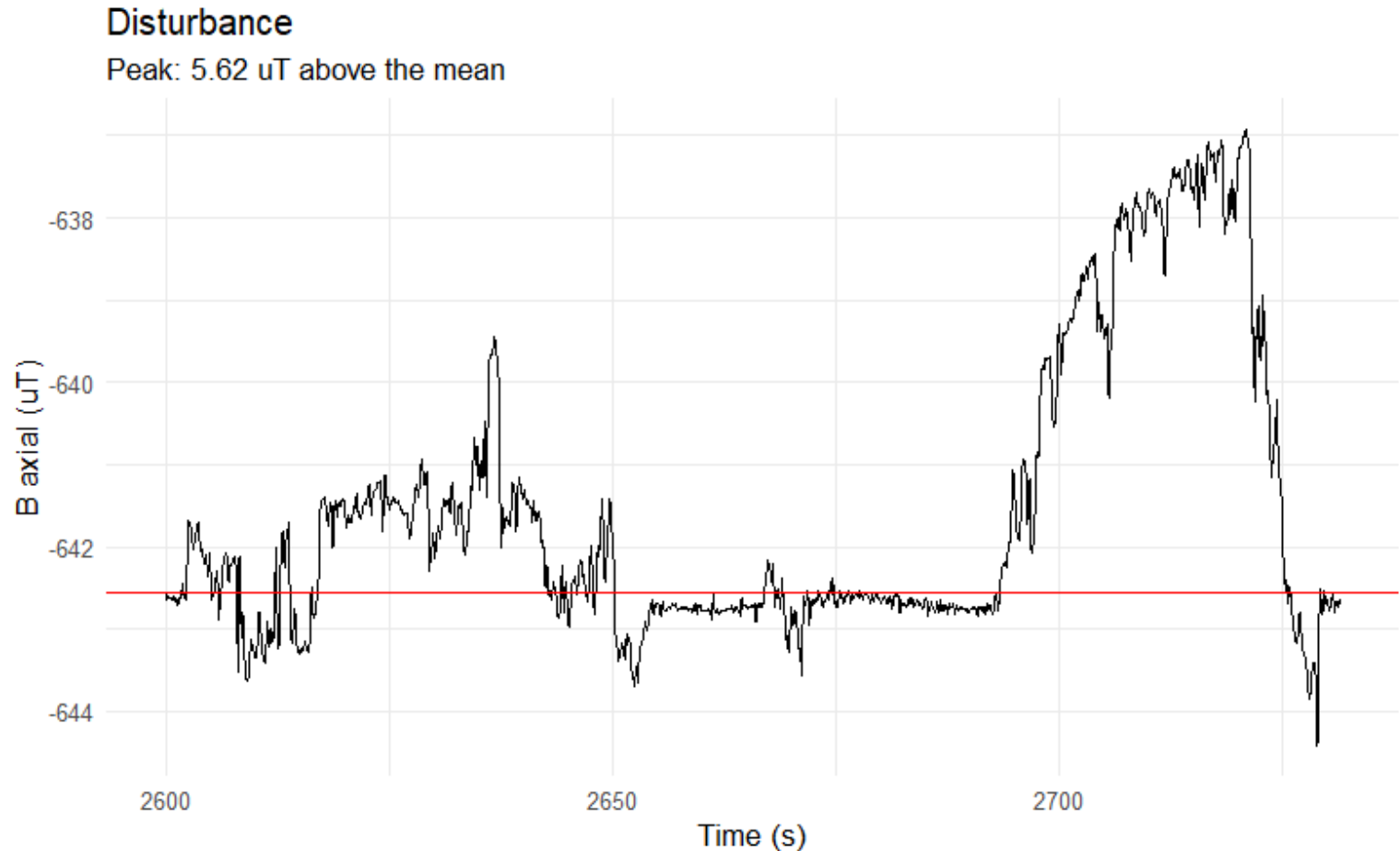
Std deviation: 0.076

Min: -581.959

Max: -581.06

Disturbance in 2-hr run

- Lasted about a minute
- Nothing unusual happened in the room during this time
 - Did not turn on any new devices, etc. Power supply stayed stable
- Something like this could happen the experiment
- Need a way to control it
 - Installing two more magnetometers?



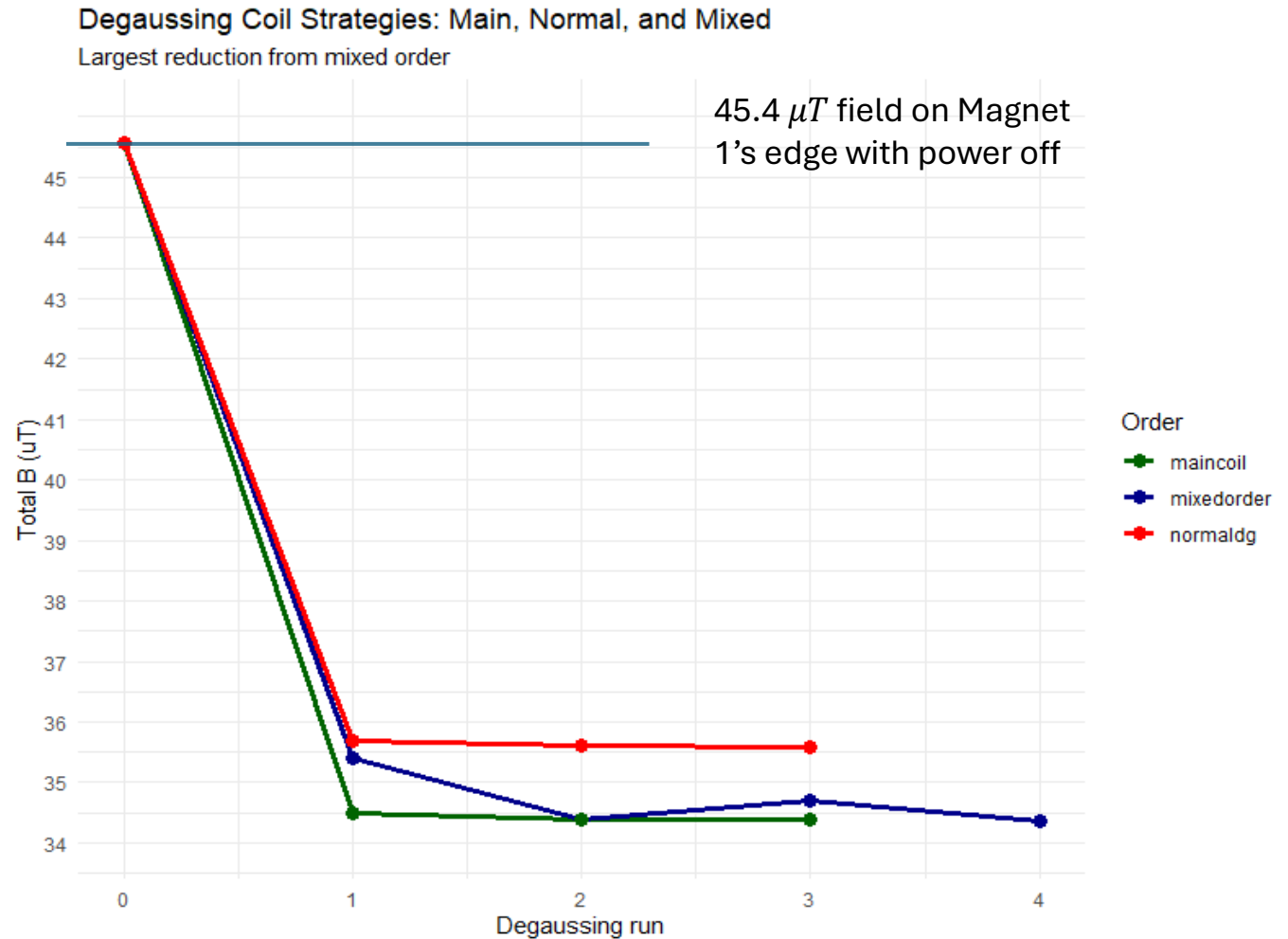
Degaussing

- Sampled at 1Khz for 1 minute
 - Alternating from normal (N) degaussing to main (M) may be best.
 - Highest reduction from using both (Mixed), specifically on it's second run
 - After pulses sent through Normal, Main)
- N, which degausses endcaps alone not sufficient

How effect is measured:

Start: avg of first 500, before pulse

Final: avg of last 500, after pulse



Mixed order vs main coil DG

- Comparable results to 3x with main only, but covers endcaps and takes one less run
 - More efficient

Lowest value observed: $34.0 \mu T$

- $45.4 - 34.0 = 11.4 \mu T$ reduction
- $11.4/45.4 = 25.1\%$

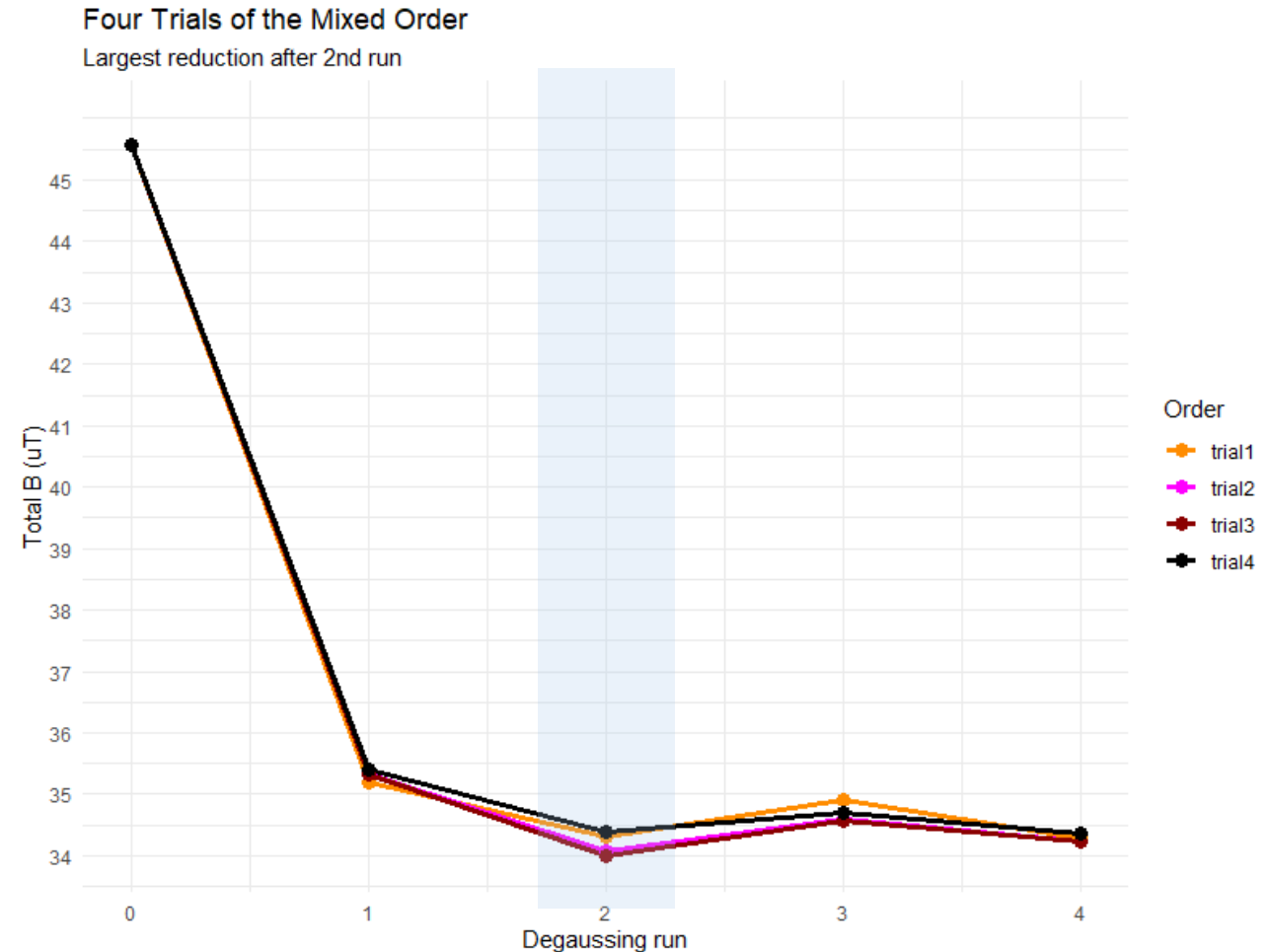
Average value at this point (from 4 trials):

$34.3 \mu T$

- $45.4 - 34.3 = 11.1 \mu T$ reduction
- $11.1/45.4 = 24.2\%$

3XMDG average final value (from 2 trials): $34.32 \mu T$

- Serial NM has the potential for a higher reduction, but on average they give almost identical results
 - More trials of 3XMDG and 2XNM needed to make decision?



Effect from Amplifier

- Amplifier is connected to NDG leads
- Amplifier just switched ON with no function generator output
- $\sim 7 \mu T$ drop in axial field. (Y)
- Repeat with amplifier not connected to degaussing leads

