Agenda of January 5, 2026, zoom meeting at 1:30 PM EST

1. Progress with 2021/2024 paper (Cary, Yuri)
2. ESS NNBAR/HIBEAM meeting January 20-21 (Leah, Andy, John) ?
3. UT Mu-metal prototype testing status (Yuri)
4. Magnetic field map (not yet quite ready – Yuri/Evan)
5. What will we do with nTMM 2025 data? plan
6. Two magnets back at UT in February (Lisa)
7. Do we need pool on the new nn' ORNL zoom meeting time for Spring 2026?
8. In the Spring'26 we'll have UT group meetings on Fridays at 4:00 pm
9. Expected visit of Linus Persson to UT/ORNL in ~ October 2026
10. AOB

1. Progress with 2021/2024 paper

- Chris made some editing
- I assume that Leah is working on editing (?)
- Fig 8 and Fig 9 are final (add more in captions)
- Problem in Cary's simulations for $|\Delta m|$ range 0.06 – 10 neV
- Nathan is calculating butterfly map in this $|\Delta m|$ region by different way using S.E. solution for non-Hermitian Hamiltonian: https://www.mdpi.com/2073-8994/14/2/230
  He will present his calculation at the next meeting January 12
- Data 2021 practically are not contributing. How should we justify the discussion of these in the paper?
- Suggestion to replace in Fig 11 coordinates from $(\tau, \Delta m)$ to $(\epsilon, \Delta m)$

2024 results

B-Field (T)	Counts, h^{-1}	Signal ($\times 10^{-12}$)	95% CL
2.40	-9 ± 21	-6.34 ± 14.7	2.28×10^{-11}
3.60	13 ± 20	9.1 ± 14.0	3.65×10^{-11}
4.80	-3 ± 20	-2.1 ± 14.0	2.55×10^{-11}
All fields	0.63 ± 12	0.42 ± 8.4	1.69×10^{-11}

TABLE I. Limits on the $n \to n' \to n$ regeneration probability per neutron at 95% CL [23] with Cd absorber for different values of magnetic field settings. Data of 2024 run.

2021 results

B-Field (T)	Counts, h^{-1}	Signal ($\times 10^{-12}$)	95% CL
2.50	-10.6 ± 35.0	-4.90 ± 16.1	2.67×10^{-11}
5.00	52.2 ± 38.8	23.9 ± 17.9	5.88×10^{-11}
All fields	17.5 ± 26.0	8.0 ± 12.0	3.13×10^{-11}

TABLE II. Limit on the $n \to n' \to n$ regeneration probability per neutron at 95% CL with Cd absorber for different values of magnetic field settings. Data of the 2021 run.

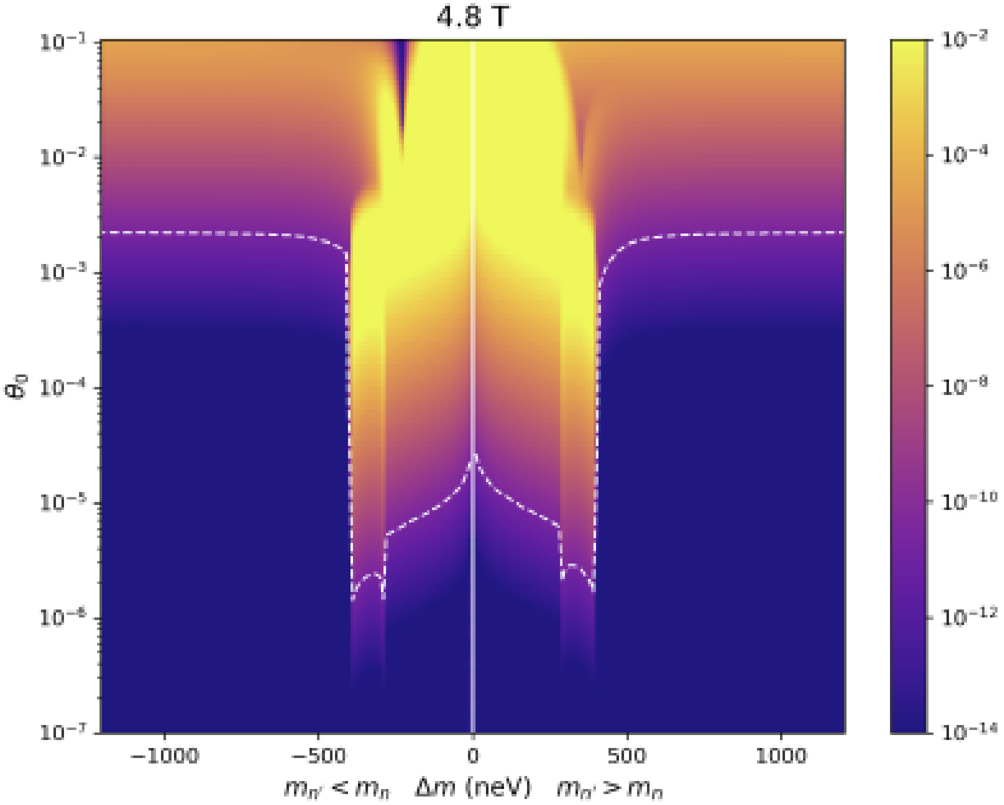


FIG. 8. Butterfly plot for 4.8 T field in 2024 (color online).

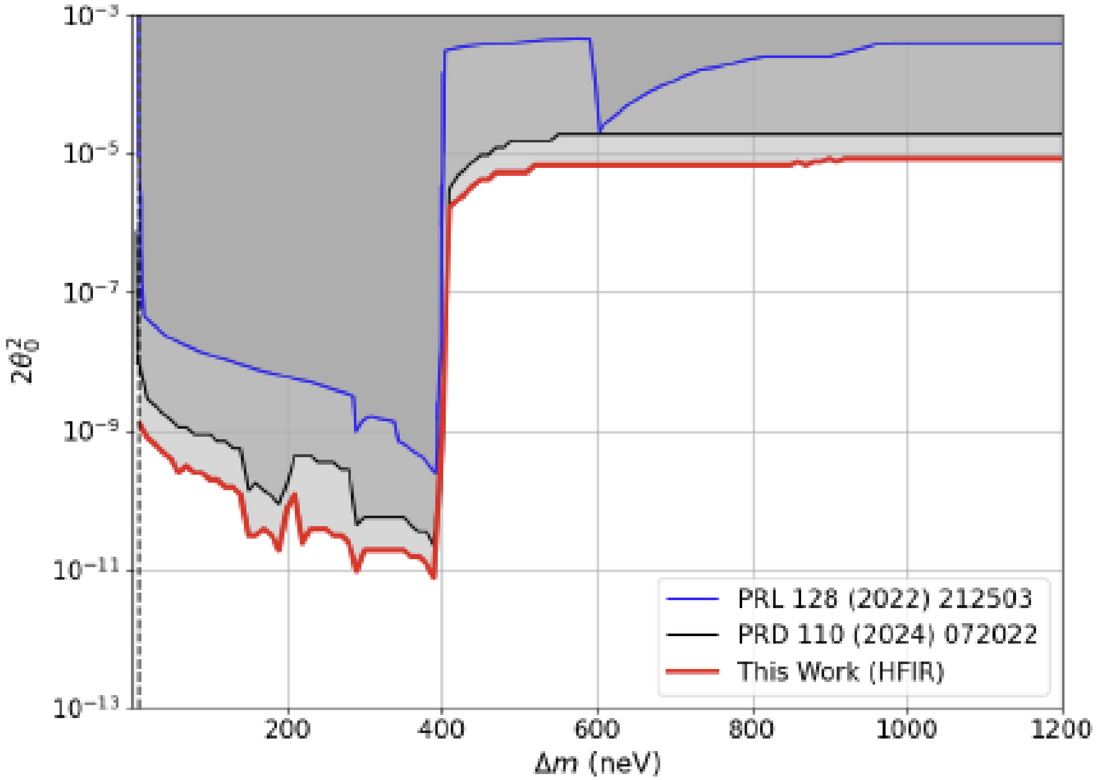


FIG. 9. Comparison of sensitivity of 2 SNS and current HFIR experiments (color online).

Our region 0.06 – 10 neV is missing

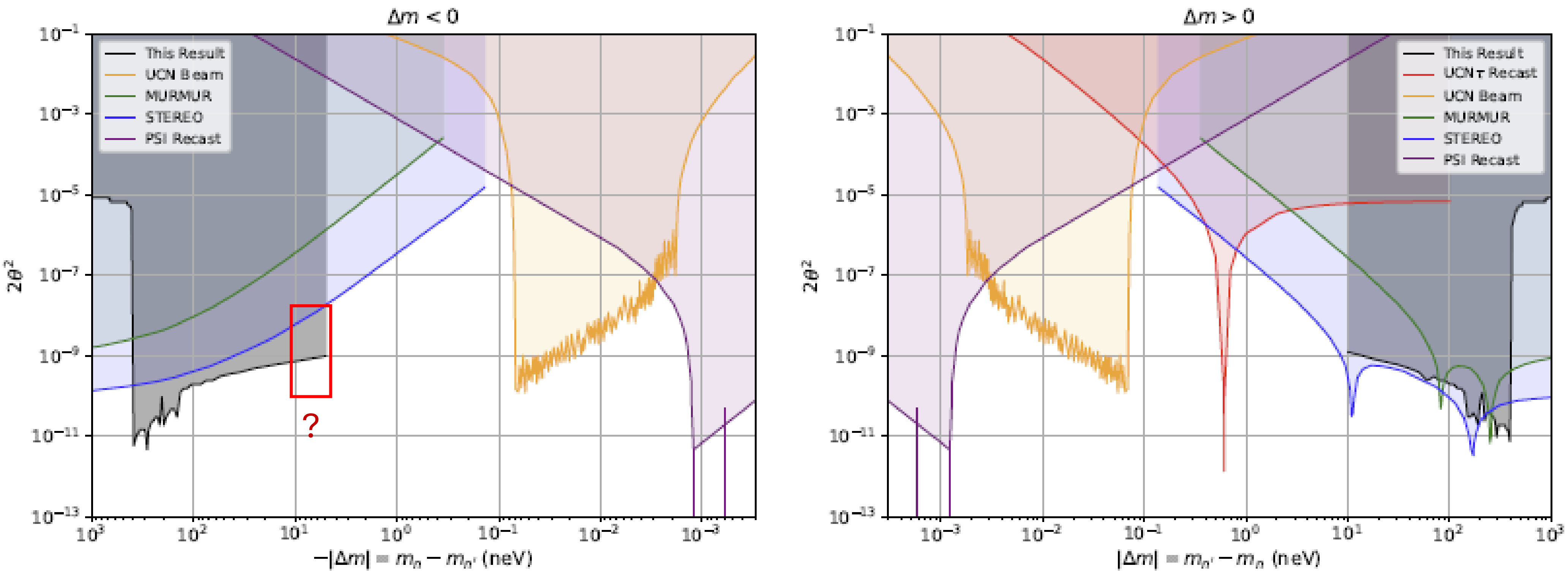


FIG. 10. Preliminary $2\theta^2$ comparison.

Our HFIR data
of 2024
in the new paper

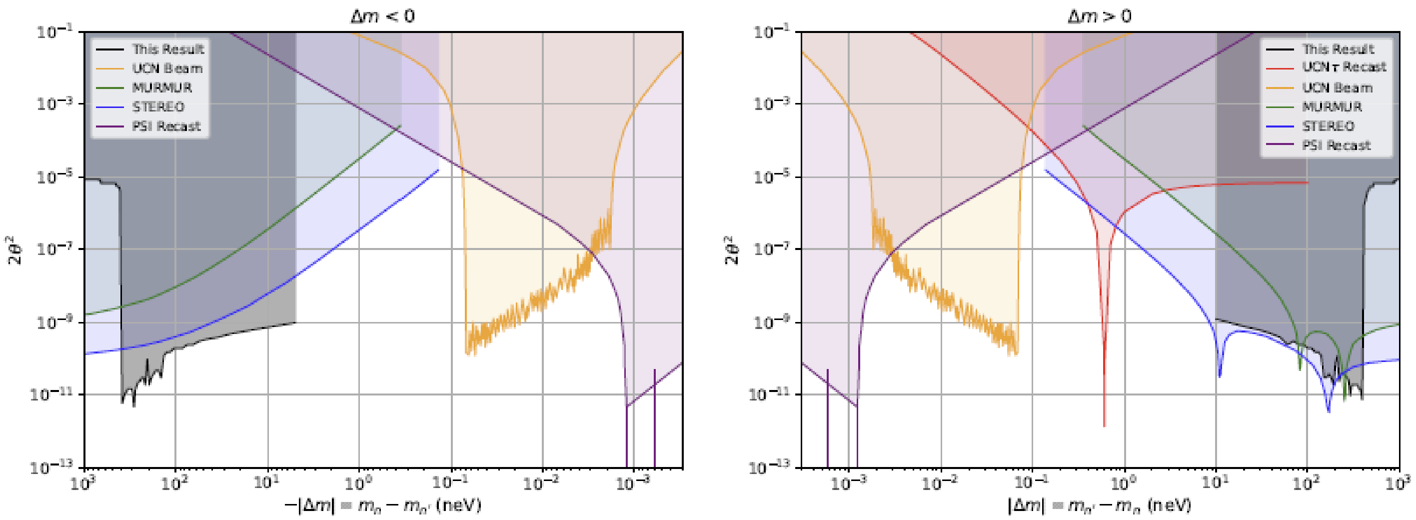
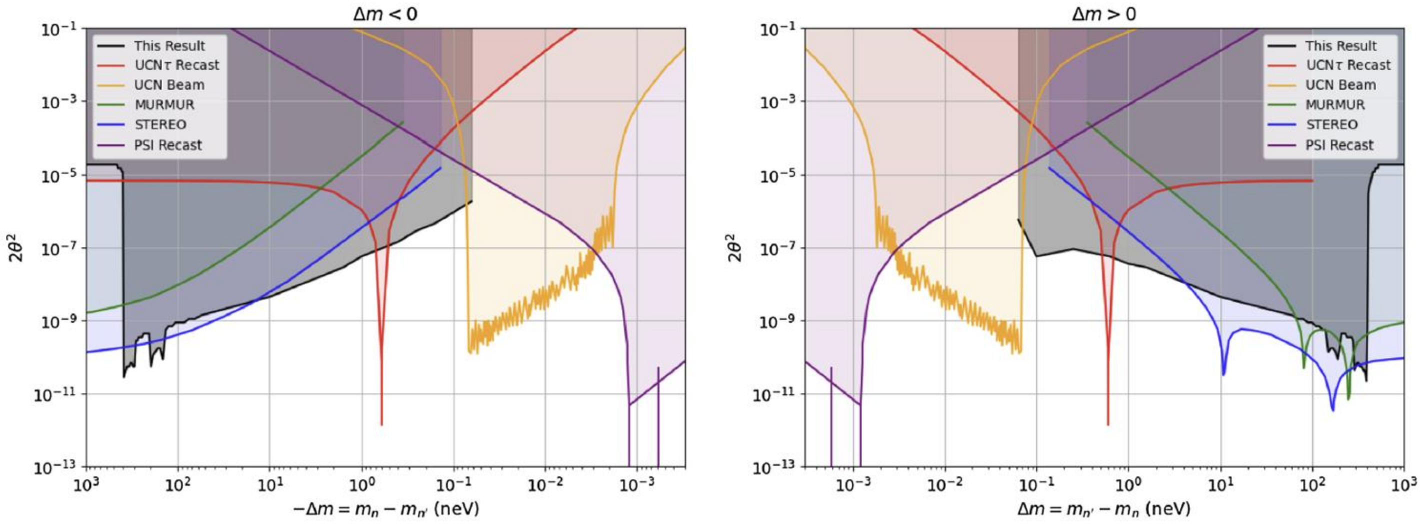


FIG. 10. Preliminary $2\theta^2$ comparison.

Our SNS data
in PRD 2024



Our region 0.06 – 10 neV is missing

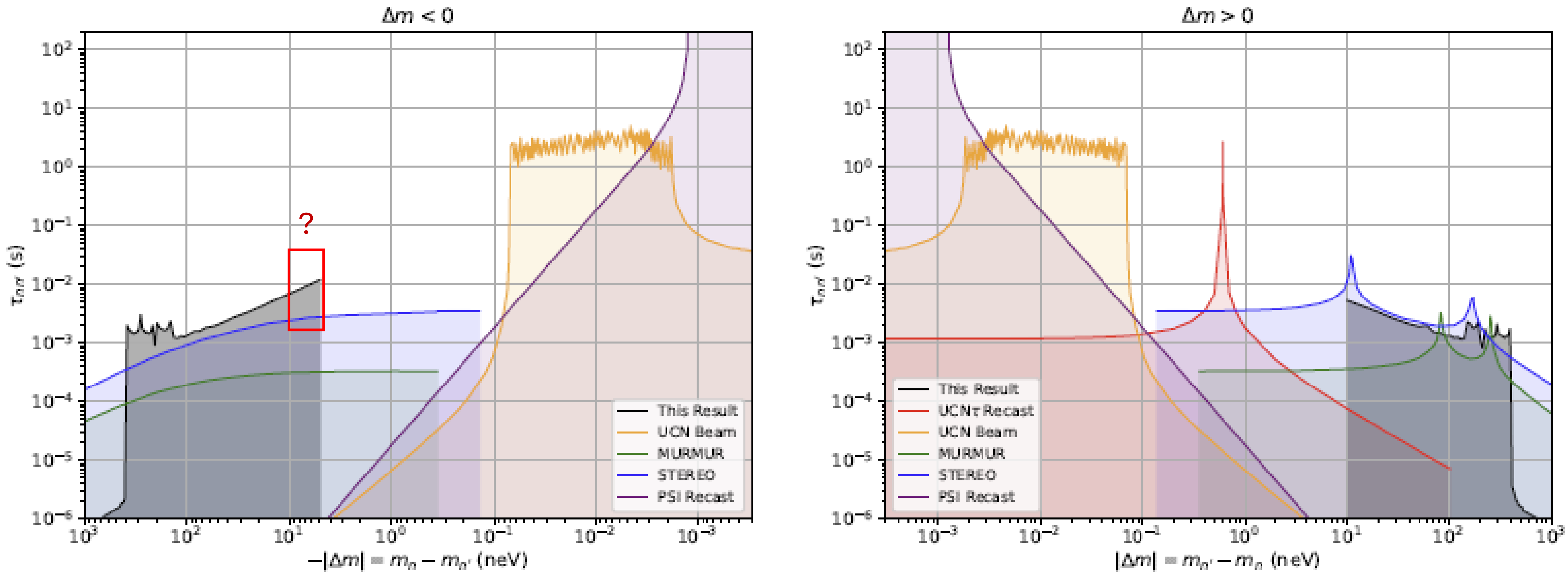


FIG. 11. Preliminary τ comparison.

3. UT Mu-metal prototype testing status (Yuri)

Short repeat of UT group zoom meeting • December 15-2025 • YK & SV

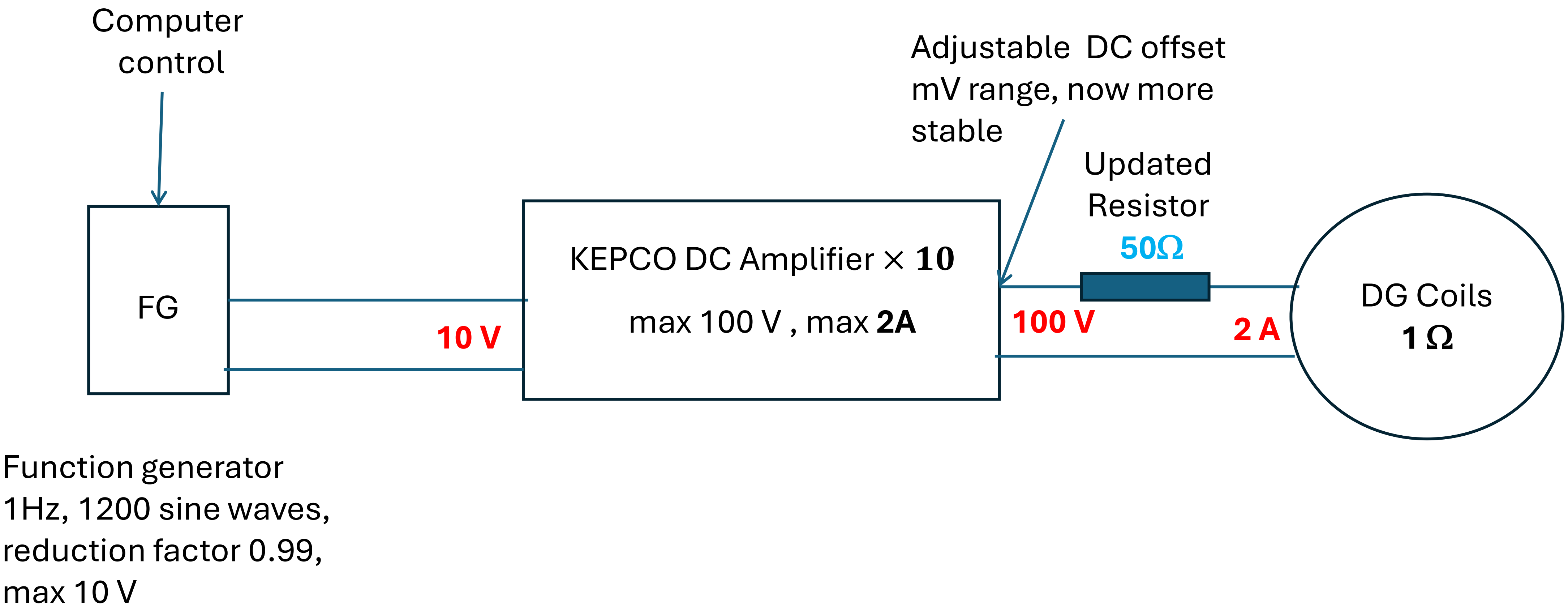
Update -2 on μ-prototype at UT

with improved degaussing procedure

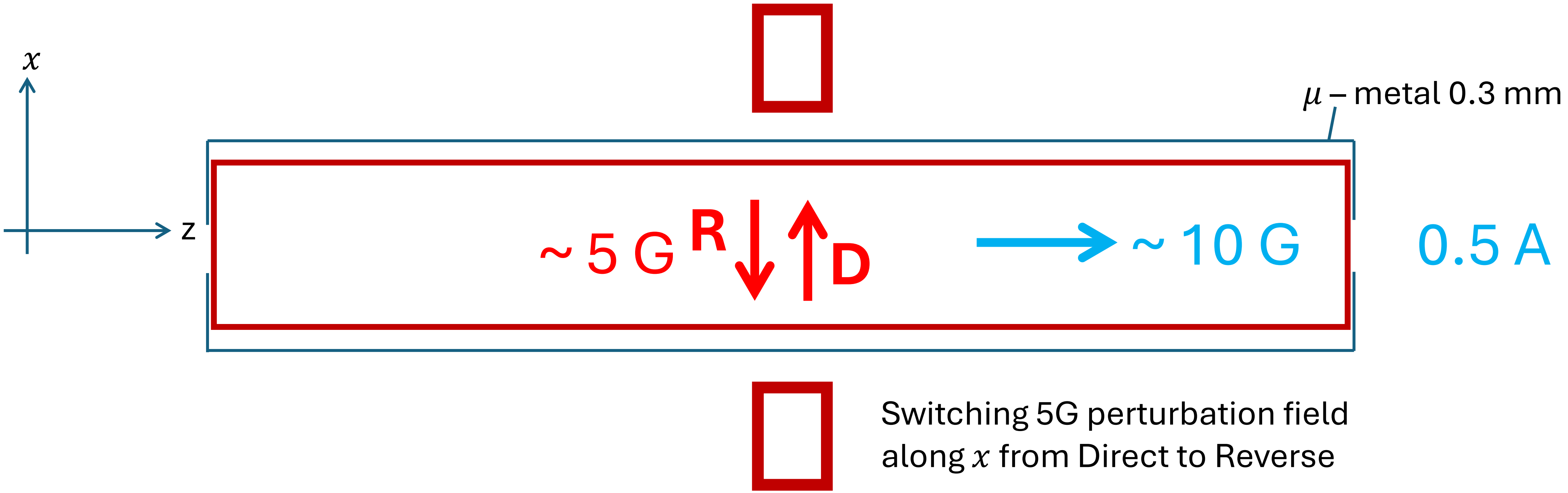
+ Comprehensive degaussing procedure for μ-metal (now called FULL) includes
(only for degaussing circuit on mu-metal; main coil degaussing is a separate procedure)

1. 50 Ω in degaussing circuit $\rightarrow 100\ V$ sine amplitude, 2 A max peak from KEPCO amplifier
2. Keep KEPCO pre-wormed with DC offset with full load < 1mV
3. Function generator: V=10V, 1 Hz, 1200 cycles (amplitude does from 100 V → 0.58 mV)
4. After degaussing KEPCO amplifier disconnected from DG circuit
5. At Main Coil current +0.5A (Bz of solenoid $\approx 10G$)
6. Perturbation signal at reproducible distance, with current +3.0 A is $B_{\perp} \cong$ 5 G
7. Magnetometer removed from the magnet during degaussing and turned off

Scheme of degaussing DG

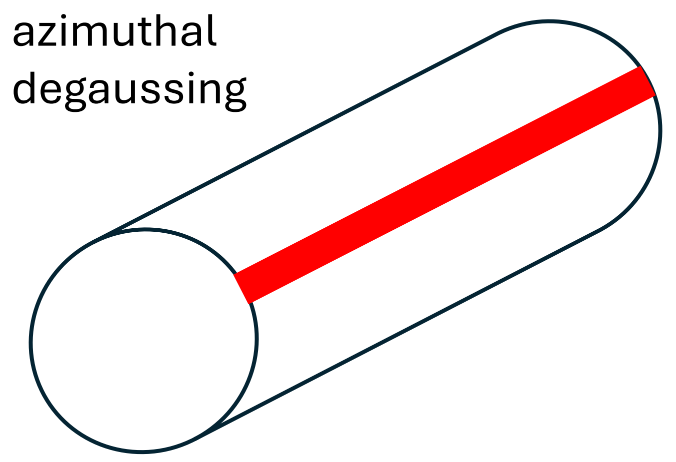


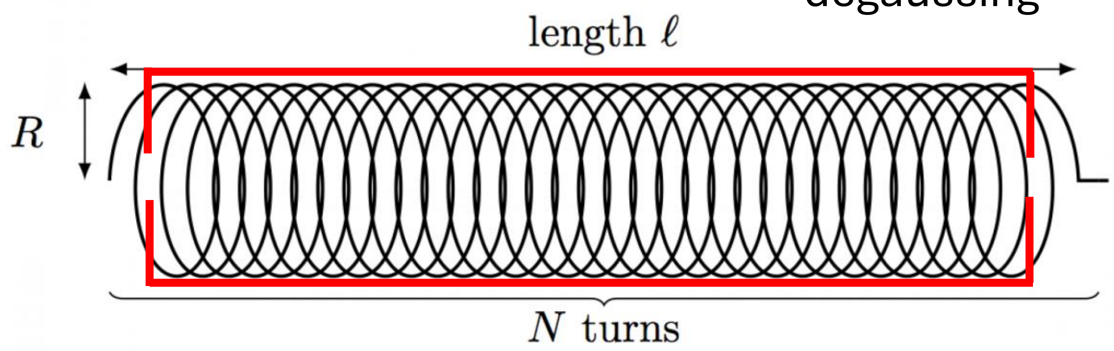
3 degaussing circuits (cylinder and endcaps) serially connected with total resistance ~ 1 Ω

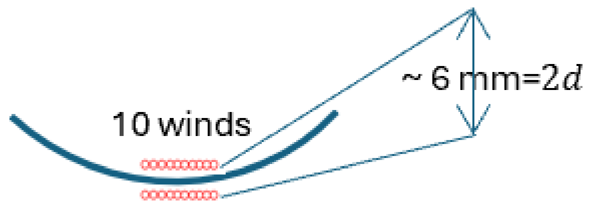


Degaussing after coil current (0.5A → 10 G) and Perturbation (3 A → 5 G) are set. Degauss with D-Perturb and measure Bx , change Perturb from D to R and back to D , measure after degaussing. Also, switch on/off main current; change polarity of main current from (+) → (−) → (+) and degauss. Should see reproducible field reduction after DG.

Degaussing in mu-prototype at UT







$$B = 10 \times \mu_0 \frac{I}{\pi d} = 26.7 \times 10^{-4} T = 26.7\, G \rightarrow 0.76\, T = B_\varphi$$

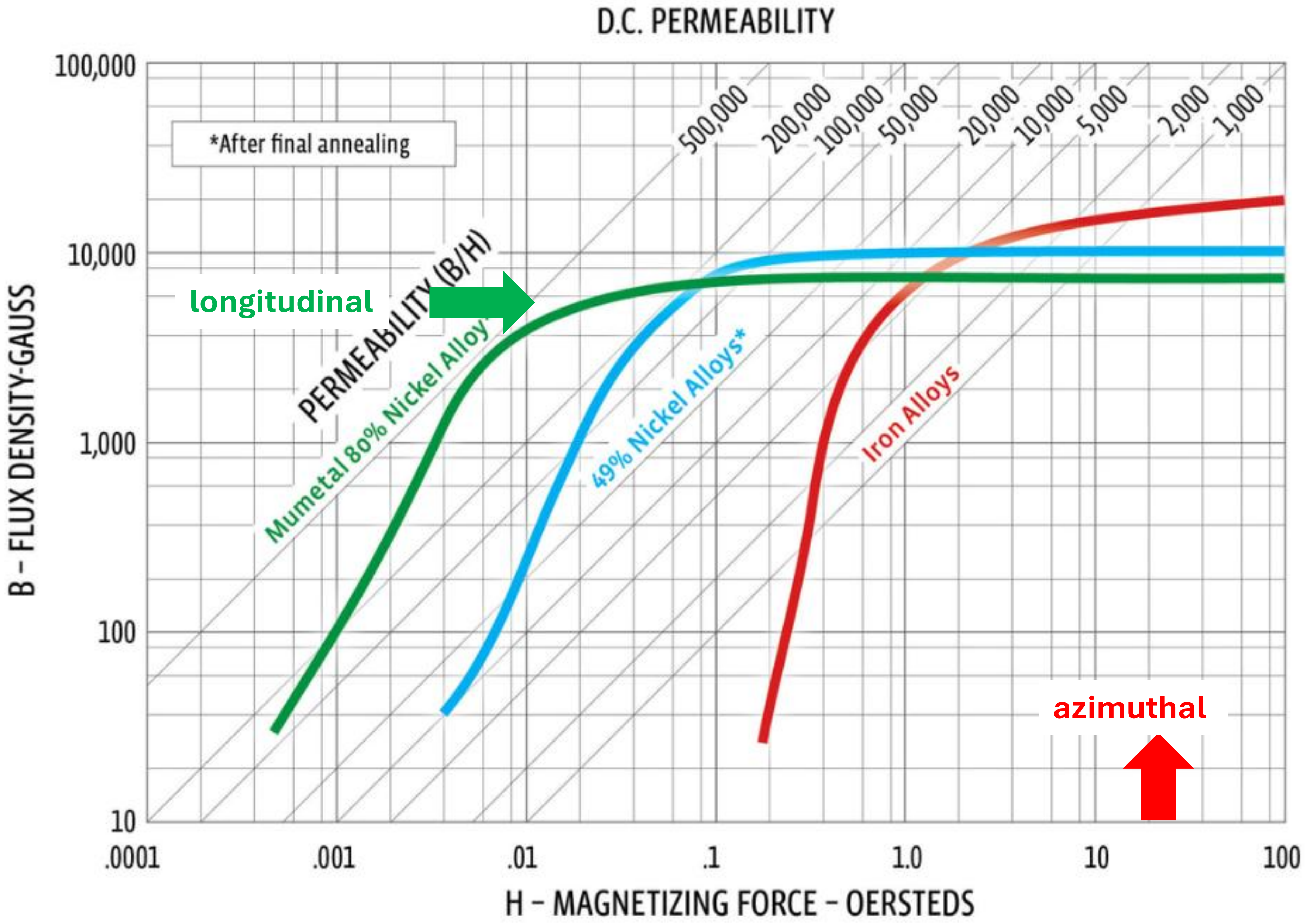
Max degaussing current $= \frac{100V}{50\Omega} = 2A$

$$R = 6.5''/2 = 82.6 \text{ mm}$$

$$\Phi = B \cdot A = 40G \cdot \pi \cdot (82.6)^2 \cong$$

$$\cong B_\mu \cdot 2\pi \cdot (82.6) \cdot 0.3$$

$$B_\mu(max) = 0.55\, T = B_z$$



D.C. PERMEABILITY
*After final annealing
PERMEABILITY (B/H)
500,000
200,000
100,000
50,000
20,000
10,000
5,000
2,000
1,000
longitudinal
Mumetal 80% Nickel Alloy
49% Nickel Alloys*
Iron Alloys
azimuthal
B – FLUX DENSITY-GAUSS
100,000
10,000
1,000
100
10
.0001
.001
.01
.1
1.0
10
100
H – MAGNETIZING FORCE – OERSTEDS

Some conclusions

1. Comprehensive DG procedure with 50 Ω is useful
2. Reproducibility of Bx measurement after DG is $\pm 2.5\ \mu$T for Bz $\cong$ 10 G
3. suppression factor is reduced with increase of main coil current
4. Reproducibility of the field for Bz $\cong$ 30 G is about $\pm 15\ \mu$T
5. Shielding factor at Bz $\cong$ 30 G with single 0.3 mm μ layer

   SF > 474.7/15 = 31.65 $\Rightarrow$ $\mu \cong 20{,}000$
6. Flipping main coil current as a perturbation affects magnetic memory of $\mu -$ metal

Still need to understand in 2026

7. how SF depends on the magnitude of transverse perturbation
8. what is SF with two layers of $\mu -$ metal with effect of DG in the first layer
9. Reproducibility of the total field field in variation $8G \rightarrow 10G \rightarrow 8G$
10. Reproducibility of the total field field in variation $24G \rightarrow 27G \rightarrow 24G$

    (needed new magnetometer)

4. Magnetic field map (not yet quite ready – Yuri/Evan)

Magnetic Field Map Around Two Magnets of nTMM Experiment measured July 23, 2025

~ 250 3D measured point

Measured with phone S23 Ultra (Samsung)

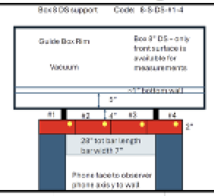
Measured points need to be transformed to the coordinate system of magnets:

z - downstream along beam, y - up, x - to the wall, z_zero is in the middle between magnets, units inches

measured magnetic components Mx,My,Mz will need to be transformed to the coordinate system of magnets Bx,By,Bz

units: coordinates in inches , magnetic field in microteslas (µT)

Supports of the guide boxes - these are the sources of external magnetic field

File name.xlsx	# in file	X, inch	Y, inch	Z, inch	Mx, µT	My, µT	Mz, µT	Bx, µT	By, µT	Bz, µT	Comment	Relevant figure
8-S-DS-#1-4	1	1.08	-20.779	71.75	622	84	-2893	84	-622	-2893	Seems 0 in X is not on the beam axis, ? Y →page 10	
	2	7.72	-20.779	71.75	650	-43	-2705	-43	-650	-2705		
	3	14.36	-20.779	71.75	424	-63	-2440	-63	-424	-2440		
	4	21	-20.779	71.75	444	-90	-2940	-90	-444	-2940		
8-S-US-#1-5	1	21	-23.029	8.049	74	10	-115	10	74	115		
	2	21	-20.779	15.75	5	-26	148	-26	-5	148		
	3	21	-19.928	10.774	34	33	-88	33	-88	34		
	4	-0.86	-20.779	15.75	144	4	-276	4	144	276		
	5	-0.86	-23.029	8.049	-33	-7	209	-7	33	209		
7-S-DS-#1-5	1	21	-23.029	-15.951	-26	26	241					
	2	21	-20.779	-8.25	-93	9	86					
	3	21	-19.928	-13.226	22	7	98					
	4	-0.86	-20.779	-8.25	64	12	-126					
	5	-0.86	-23.029	-15.951	143	65	-233					
7-S-DS-#1-5-repeat	1	21	-23.029	-15.951	7	16	-75					
	2	21	-20.779	-8.25	-104	0.3	340					