

NN' ORNL-UT-UKY-LU Zoom meeting • June 02, 2026

Agenda

0. Message from Arina Rostopchina
1. Yuri - 10' - update on the status of PRD paper that is close to completion.
2. Linus - 20' - Magnetic measurements at HIBEAM beam line
3. Yuri & Shaun - 10' - measurements on mu-prototype with a new magnetometer
4. AOB

Rostopchina, Arina<rostopchinaa@ornl.gov>

Kamyshkov, Yuri

Debeer-Schmitt, Lisa M.;Vavra, Shaun;Ramsey, John Clinton

Hello Yuri,

We would like to start the conversations about scheduling your experiment in this upcoming call. The best option, as the HFIR schedule stands right now, is to run you at the beginning of RC517, slated for Sep 8th. This would mean installing the equipment mid to late August. Please advise whether you can work with that timing on your end.

Thank you!

Arina Rostopchina

Scientific Associate

HFIR Beamline Operations

Neutron Sciences Directorate

Oak Ridge National Laboratory

New Limits on $n \rightarrow n'$ Transformation from HFIR Cold Neutron Beam

James M. Rogers,¹ Leah J. Broussard,² Christopher B. Crawford,³ Lisa DeBeer-Schmitt,² Matthew J. Frost,² Francisco M. Gonzalez,² Carolyn O. Haviland,¹ Lawrence Heilbronn,¹ Erik B. Iverson,² Yuri Kamyshkov,¹ Mubasshir Khan,³ Andrew Mullins,³ David Milstead,⁴ Linus B. Persson,⁵ Cary Rock,¹ Valentina Santoro,^{5,6} Alexander Saunders,² Shaun Vavra,¹ and Nathan D. Whittington¹

¹*University of Tennessee, Knoxville, TN 37996, USA*

²*Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA*

³*University of Kentucky, Lexington, KY 40506, USA*

⁴*Department of Physics, Stockholm University, 106 91 Stockholm, Sweden*

⁵*Department of Physics, Lund University, P.O. Box 118, 221 00 Lund, Sweden*

⁶*European Spallation Source ERIC, Partikelgatan 5, 224 84 Lund, Sweden*

(Dated: May 27, 2026)

B-Field (T)	Counts, h^{-1}	Signal ($\times 10^{-12}$)	95% CL
0.0	24.4 ± 49.2	5.1 ± 10.3	1.25×10^{-11}
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}

TABLE I. Limits on the $n \rightarrow n' \rightarrow n$ regeneration probability per neutron at 95% CL [22] with Cd absorber for different values of magnetic field settings. Data of 2024 run.

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}

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

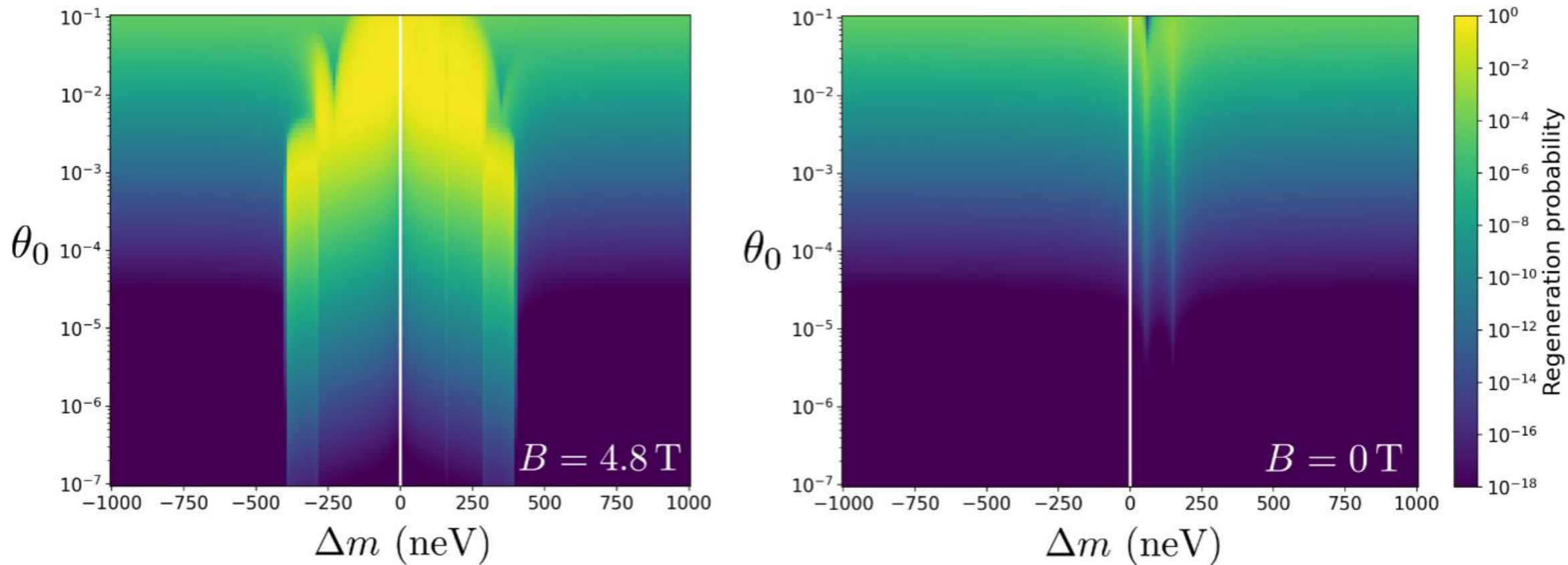


FIG. 8. Calculated regeneration probability ($n \rightarrow n' \rightarrow n$) as a function of the Δm mass difference and the mixing angle θ_0 . Central vertical lines separate two regions from 10 neV to 1000 neV for negative and positive Δm . Left panel shows the map of probability for 4.8 T magnetic field configuration. Right panel is for "zero" magnetic field. See discussion in the text (color online).

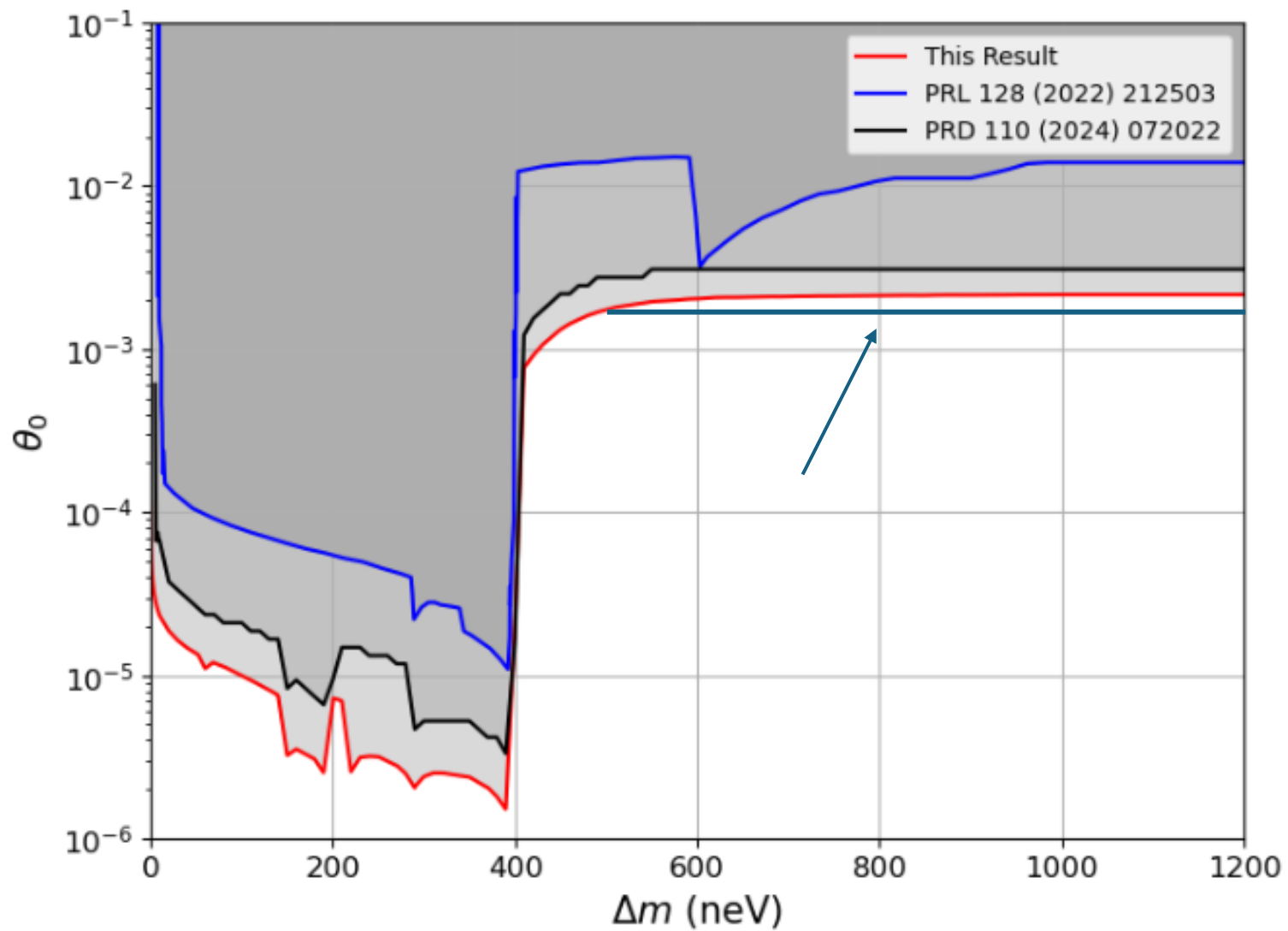


FIG. 9. Comparison of the probability limits of 2 SNS and current HFIR experiments (color online).

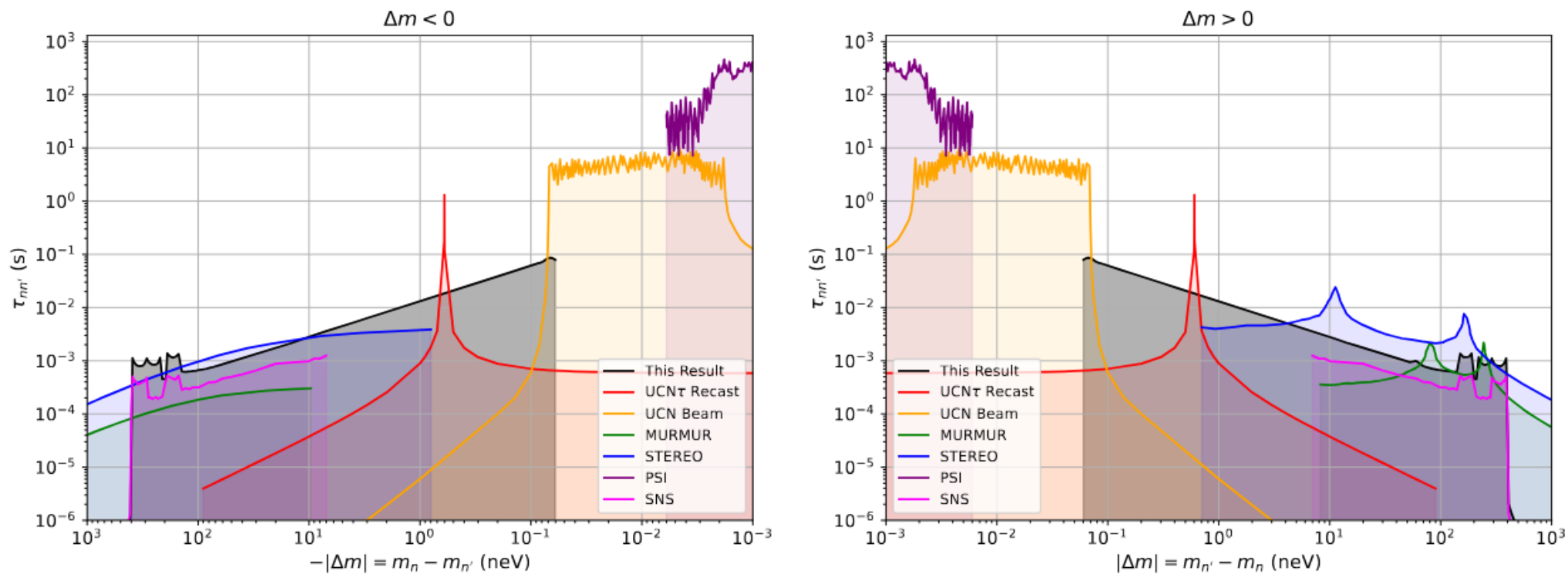


FIG. 10. Summary of most recent $\tau_{nn'}$ limits vs positive and negative Δm range from 6×10^{-5} to 1000 neV. Limits reported in this paper (gray area), overlaid with other searches for sterile neutrons, assuming a unified framework as proposed in [23]. Our previous SNS limits are taken from [4]. Results from UCN storage at PSI [24] have been recast from searches using searches for a nonzero \vec{B}' . The limit from UCN τ comes from the non-observation of anomalous losses, as calculated in [23]. UCN beam results use disappearance in the GADGET detector [25]. The STEREO and MURMUR reactor results below Δm are also presented from [26, 27]. The UCN $n \rightarrow n'$ limits [28] from neutron EDM search apparatus are not shown on this plot.

Magnetic characterisation of the HIBEAM beamline

2026-06-02

linus.persson@fysik.lu.se



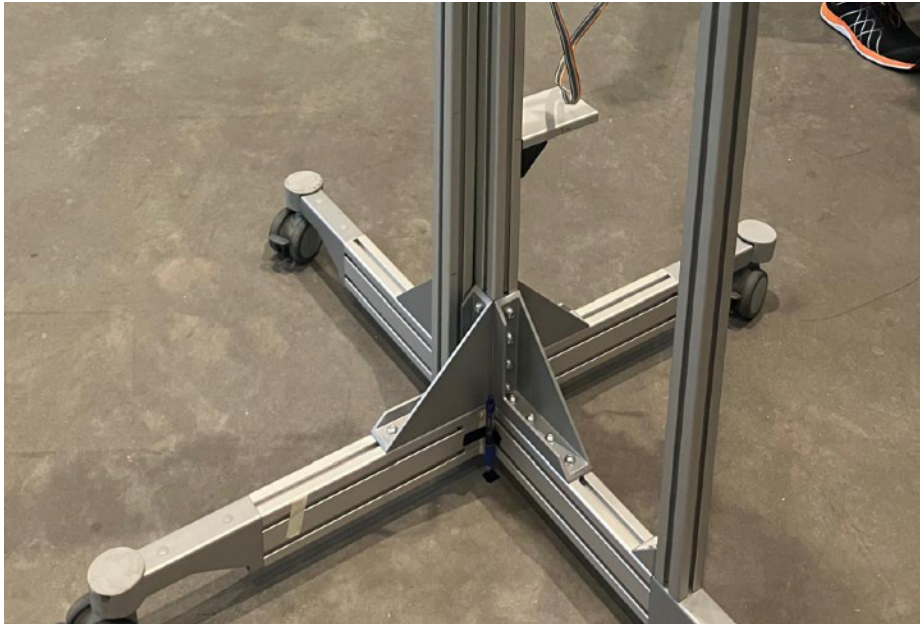
Background

- Measurements performed on May 25th of the E5 beamline at ESS.
- Magnetic field measured with a Wuntronic 3-axis fluxgate magnetometer with precision of 1 nT (10 μ G).
- Survey alignment marked points on either side of the beamline, 1 m apart, every 10 m along beamline.
- We filled in with tape marks every meter along the beam as well as the central beam axis.



Measurement setup

- Magnetometer was taped to a movable stand with set heights (1 m, 2 m and 3 m).
- A pen was taped to the stand and used to line up with tape marks. The stand was always held in same orientation (wheels lined up with transverse beam axis).
- Measurement computer was also moved between measurements.

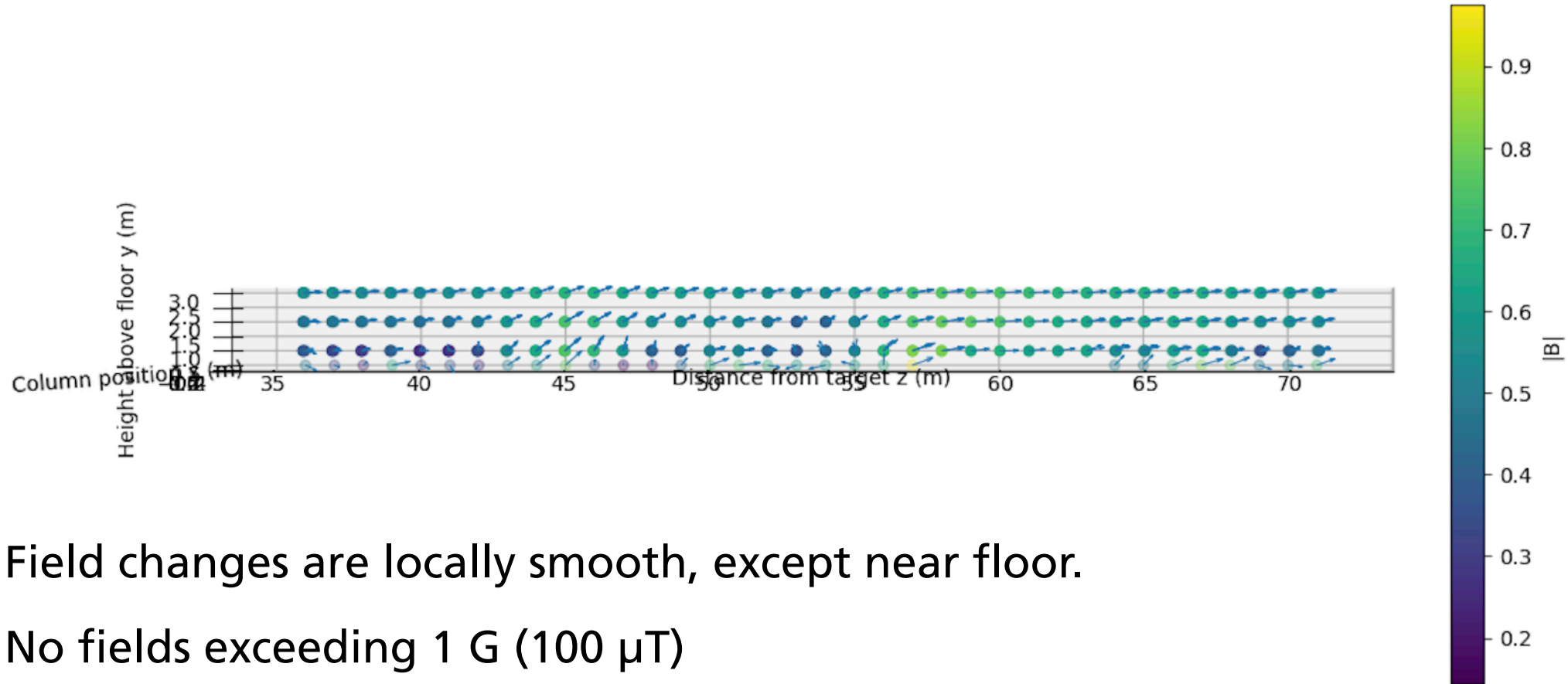


Data collection

- Phones, watches and other magnetic objects were removed from the people measuring. Power supply was held at least 1 m away from magnetometer.
- Average field measured over a few seconds was measured between each point, starting each column in a new log file.
- We could only measure 35 m to 71 m from the target due to SKADI detector installation. We plan to redo these measurements later.

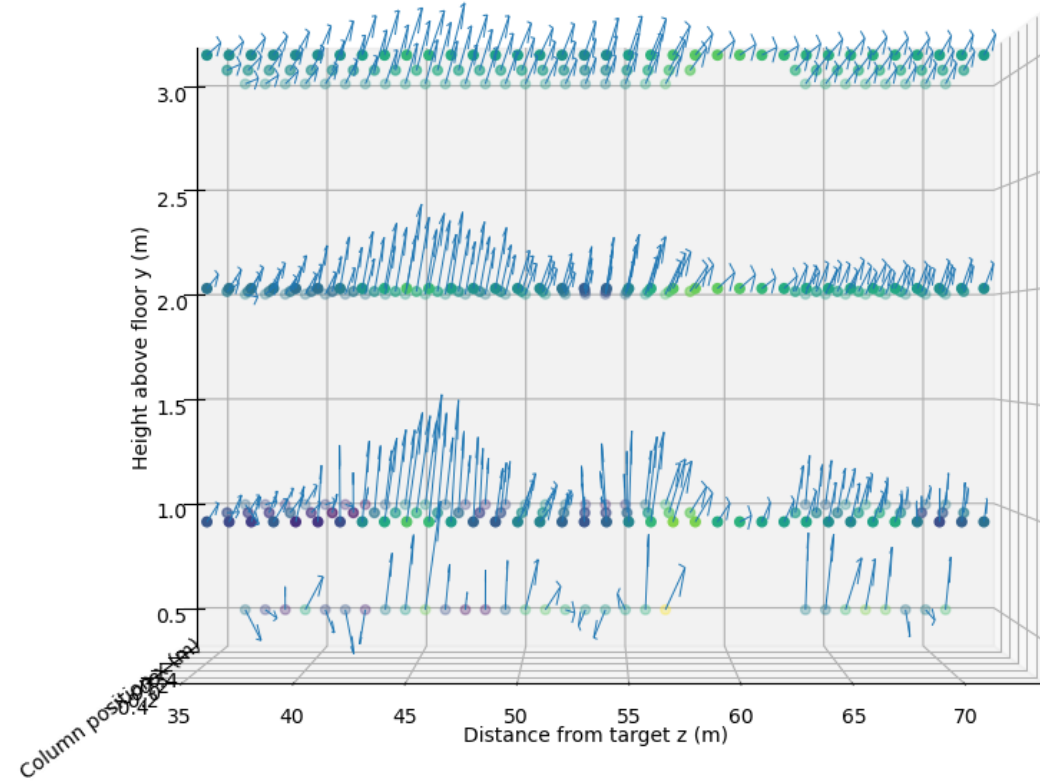
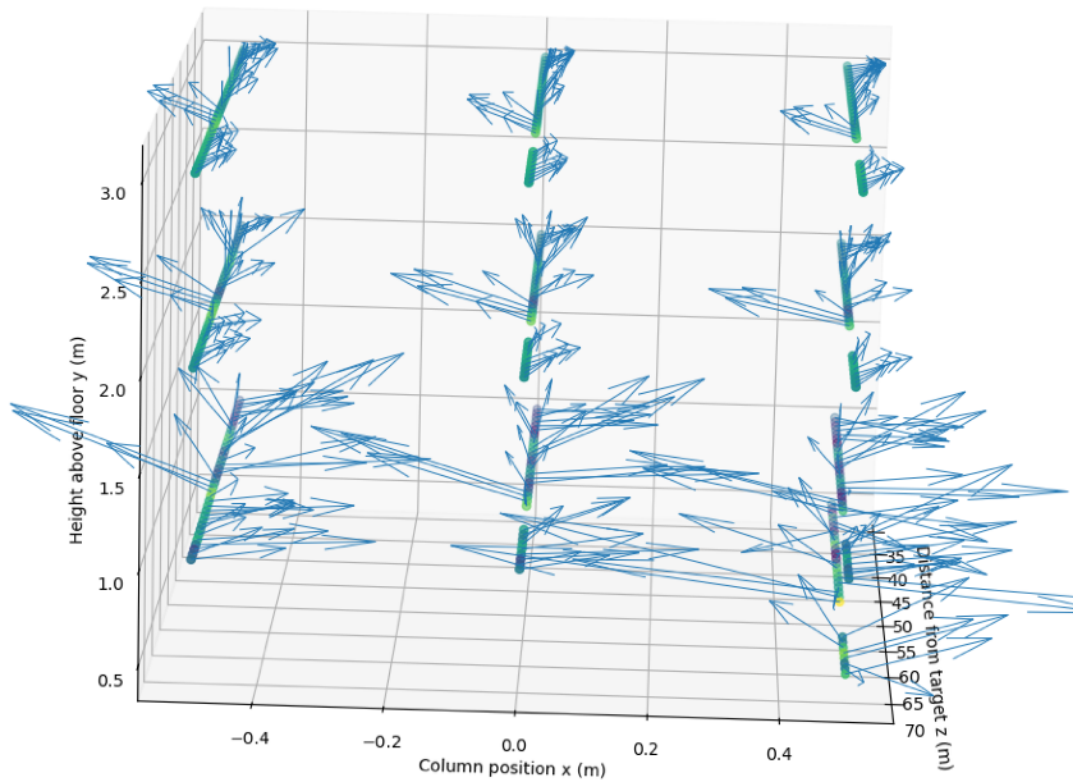


Results (from German)



- Field changes are locally smooth, except near floor.
- No fields exceeding 1 G (100 μT)
- Strongest fields are mainly transverse, which is good for magnetic shielding.

Results (from German)



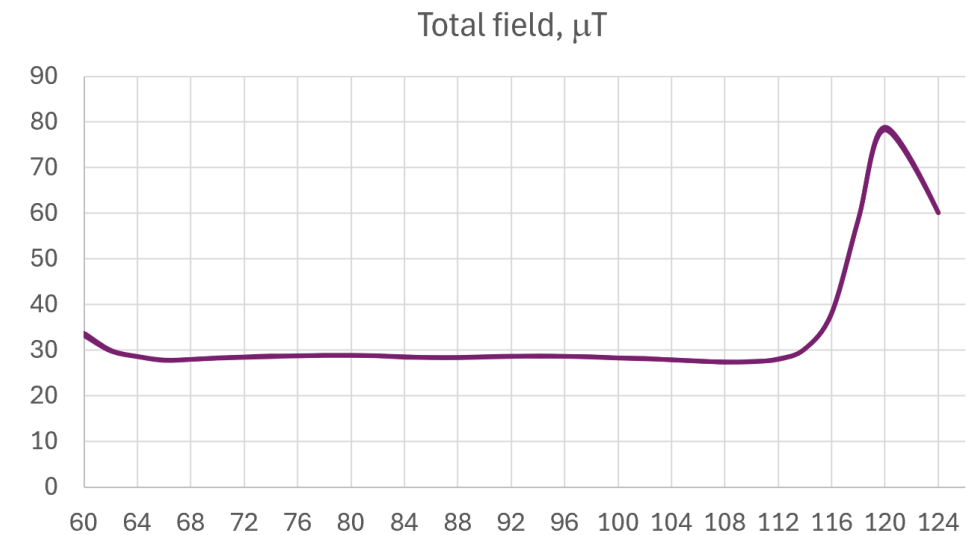
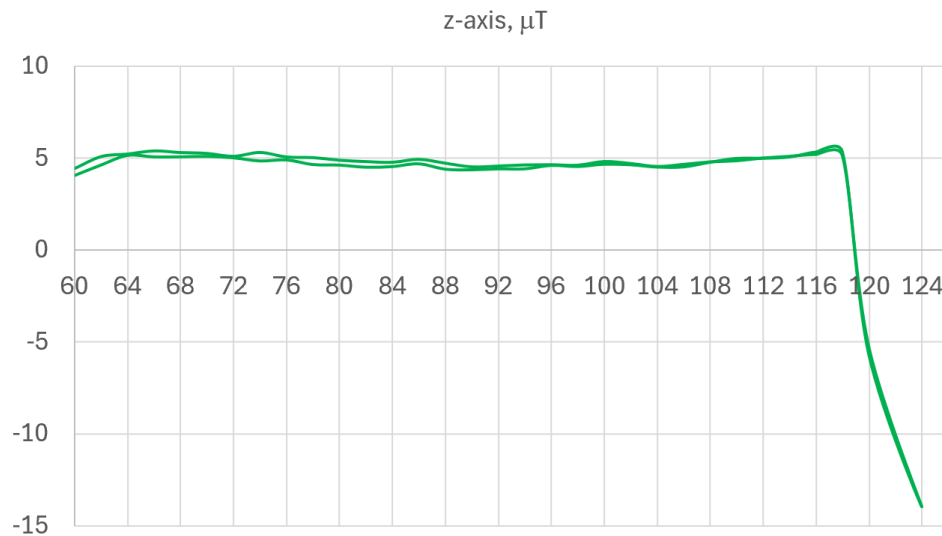
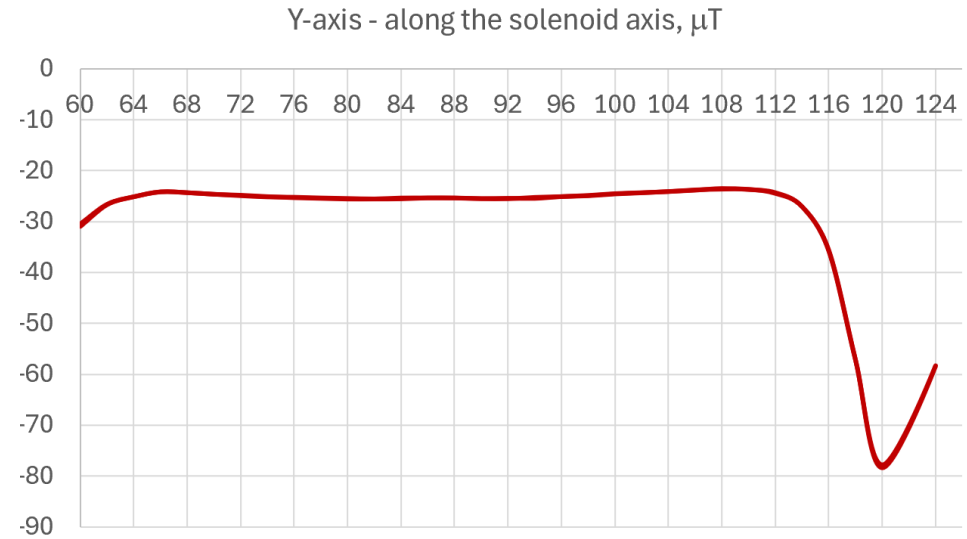
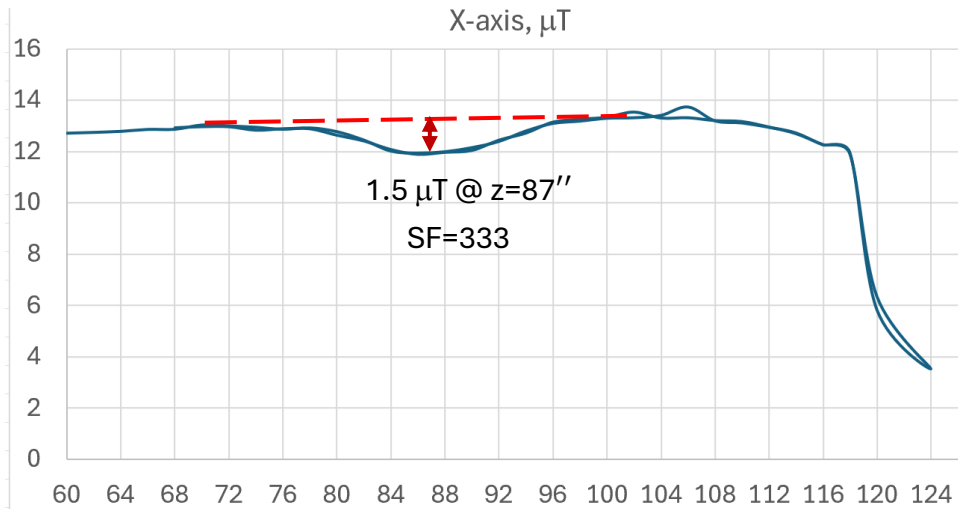
Measurements on mu-prototype with a new magnetometer

Yuri Kamyshev & Shaun Vavra

New 49-Gauss range magnetometer (similar to one used in nTMM run 2025 at GP-SANS)

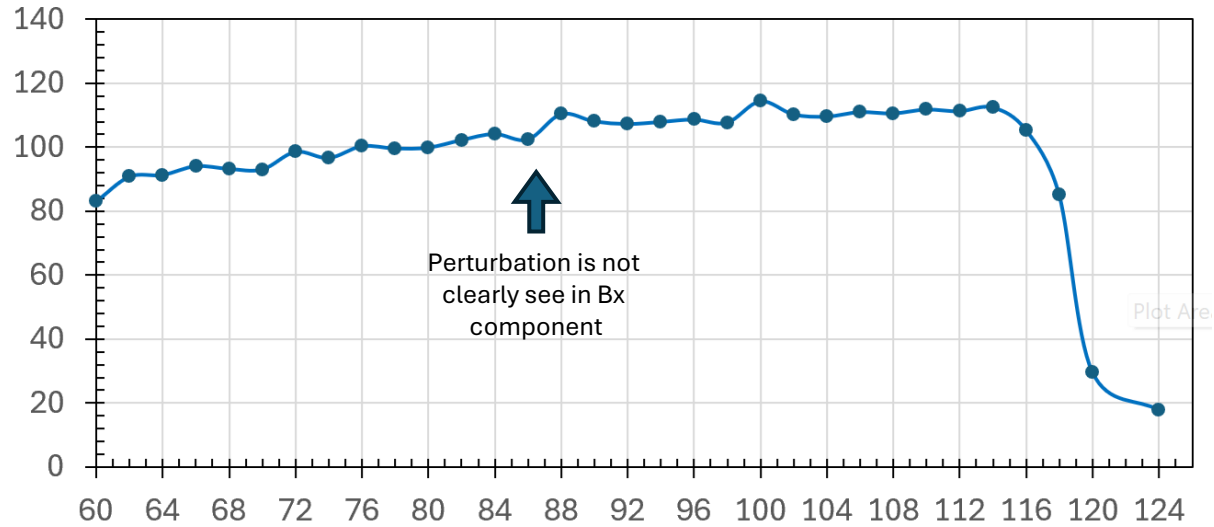
No degaussing. No coil current. Double shield 0.3 mm @ R_1 and 0.3 mm @ R_2 .

Transversal x-perturbation ~ 5 Gauss (with current 3.0 A)

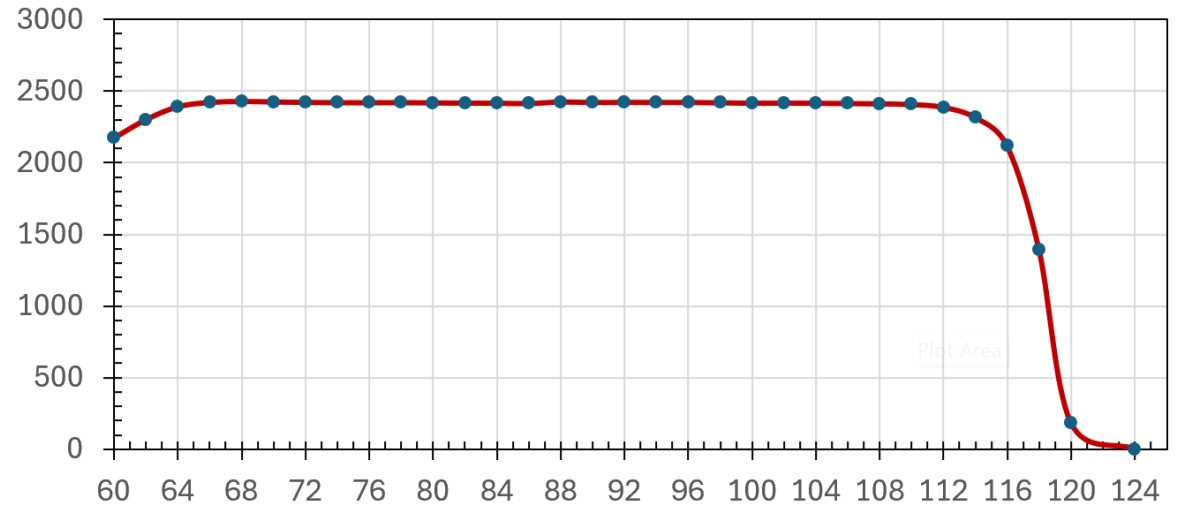


After degaussing. Coil current 1.25 A. Double shield 0.3 mm @ R_1 and 0.3 mm @ R_2 .
Transversal x-perturbation ~ 5 Gauss (with current 3.0 A)

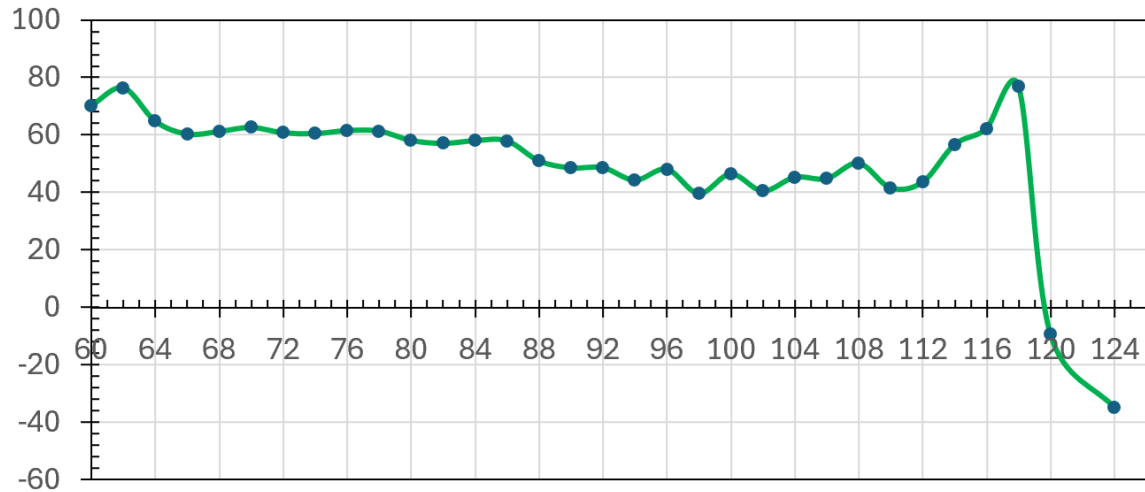
$B_x, \mu\text{T}$



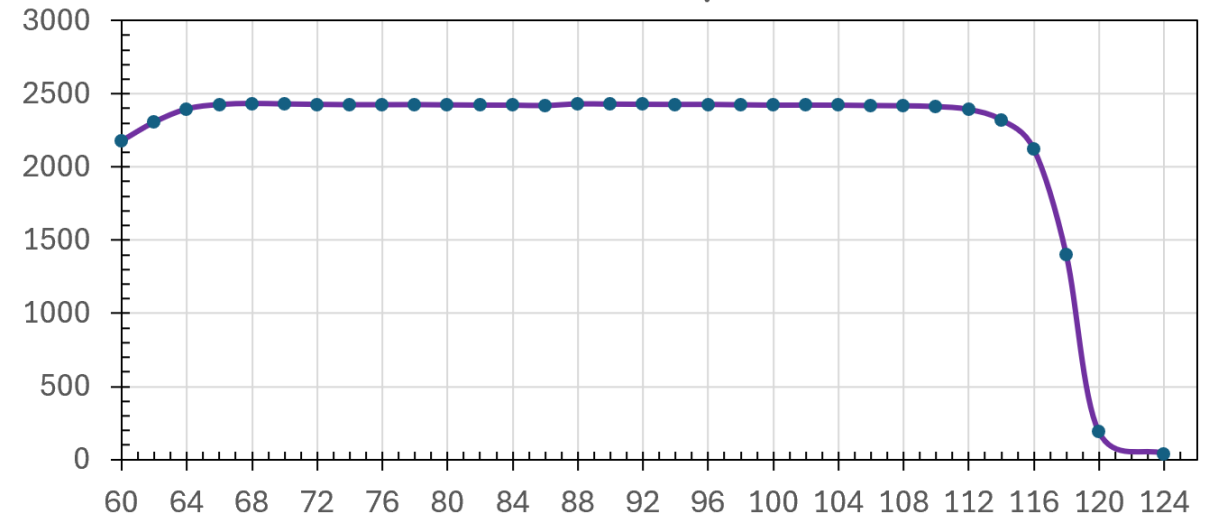
B_y - along the solenoid axis, μT



$B_z, \mu\text{T}$



$B_{\text{total}}, \mu\text{T}$



Btotal, μT

