Appendix I: MagNet Challenge 2 Final Evaluation Rules – 09/01/2025

This document presents the key principles of the final evaluation rules for the 2025 MagNet Challenge 2. These rules should be interpreted as general guidelines with potential updates. Please check https://github.com/minjiechen/magnetchallenge-2 for the most updated explanation of the rules.

The final evaluation of the 2025 MagNet Challenge 2 is a two-step process. In the first step (due 11/15/2025), student teams will self-report the pre-evaluation results of their pre-trained models for the 10 already known materials with abundant data. They will also receive new data for the final evaluation which will determine the results of the competition.

The purpose of the first step is not to evaluate or compare teams or algorithms, but to (1) ensure all teams are familiar with the final evaluation rule; and (2) to provide useful feedback to the team and keep everyone engaged. Teams will only report results and will not release their code or algorithms in this round.

The second step is the final submission (due 01/15/2025), student teams will (1) submit their prediction results based on the new given data, and (2) submit the codes and supporting documents. The top-ranked teams will be invited for a final presentation followed by a code review.

November 15st, 2025 – Pre-Evaluation

1) Download the pre-evaluation data under MagNet_Challenge_2_Pretest folder from the following link for the 10 existing materials:
   https://www.dropbox.com/scl/fo/o07x7fa6d5elev19pzd1w/AISuBEWf8LQVszFeoaTlqY4?rlkey=8ec7mqukfr9no61h193zb4qdb&dl=0
   This pre-evaluation dataset contains >4,500 data segments for each of the 10 materials. Three evenly distributed segment types are segments with 10% known time steps, 50% known steps, and 90% known steps.
2) Evaluate the data with your already trained algorithm and predict the sequence and energy density.
3) Evaluation of the error for the prediction of H(t) field sequence and total energy density for each material.

$$1. \ Sequence \ Relative \ Error: \frac{RMS(H_{pred} - H_{meas})}{RMS(H_{meas})} \times 100\%$$

$$2. \ Energy \ Density \ Normalized \ Relative \ Error: \frac{\int_{t_1}^{t_2}\frac{dB}{dt} \cdot H_{pred}(t)dt - \int_{t_1}^{t_2}\frac{dB}{dt} \cdot H_{meas}(t)dt}{\int_{t_0}^{t_3}\frac{dB}{dt} \cdot H_{meas}(t)dt} \times 100\%$$

Where t_1 and t_2 represent the start and end of the target test segment, t_0 and t_3 marks the beginning and end of the full periodic excitation cycle.
The measured results, H_{meas} come from the dataset, and the predicted results H_{pred} come from your models.

4) Plot the error histograms of the relative sequence and energy density error for each material and create a single-page PDF to summarize the results. Label the average error, 95th percentile error. An example template is shown in Pre_Evaluation_Results. Example codes and models are available in: https://github.com/minjiechen/magnetchallenge-2/tree/main/Pretest.
5) Feel free to submit any explanatory document with your self-evaluation results to pelsmagnet@gmail.com.

November 15th, 2025 – Data released for final evaluation of new materials.

1) New training data and testing data available for final evaluation. The training data will include a small amount of excitations for a few new materials. The testing data will include a large amount of excitation data for the new materials. Student teams will predict the output H for evaluation and testing similar to Pre_Evaluation (Pre_Test).

January 15th, 2026 – Final submission.

1) Prediction results for the testing data due as CSV files.
2) A 5-page IEEE TPEL format document due as a PDF file. Please briefly explain the key concepts.
3) Full executable model due as a ZIP file for a potential code review with winning teams.

January to March 2026 – Model Performance Evaluation, Code Review, Final Winner Selection.