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An update to the JINTRAC integration of KARHU

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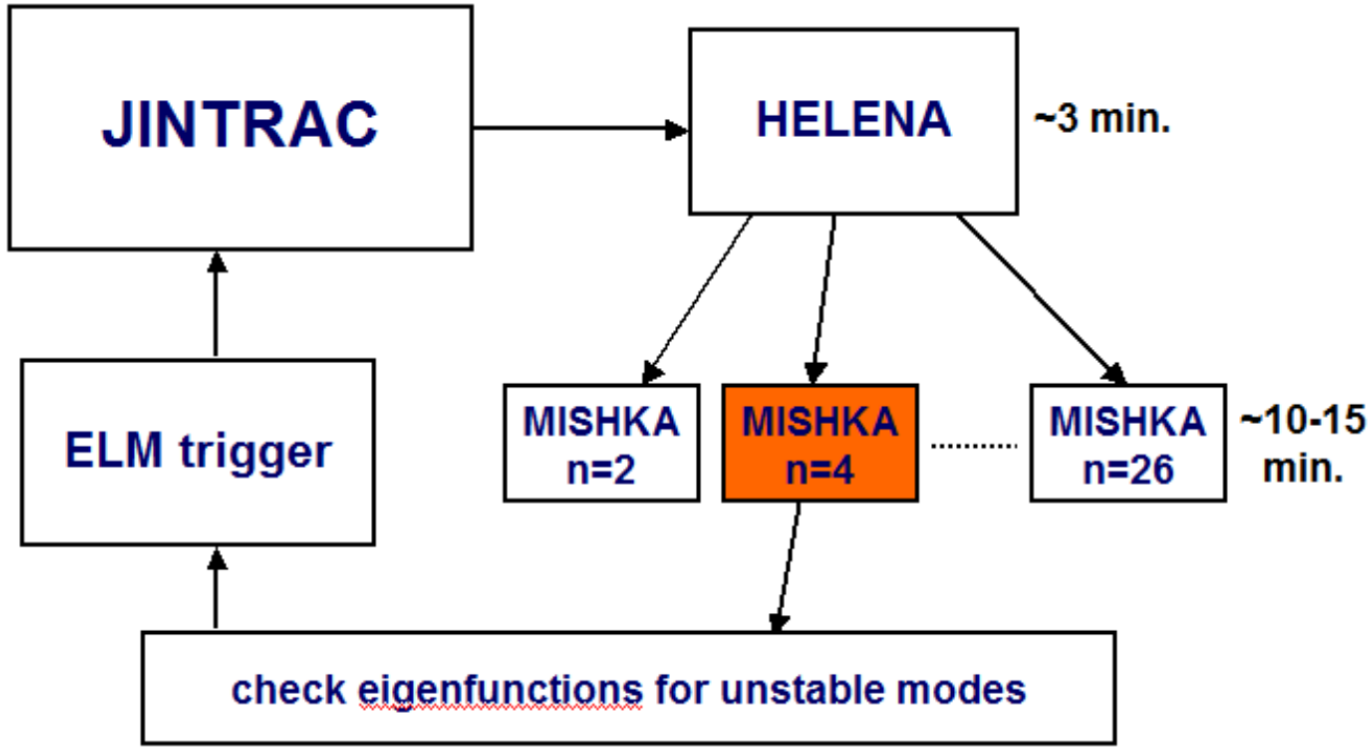
KARHU overview

- Amanda's slides, relevant details below

- KARHU V1 was trained on profiles parameterised using an MTANH profile for density & temperature (pressure), which biases the network

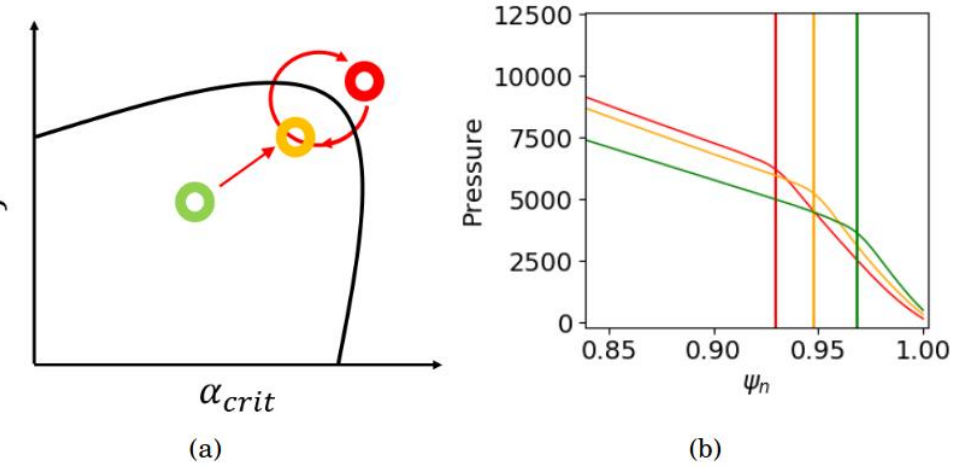
MISHKA in JINTRAC

- ELM trigger
  - `IMISHFILTMETH=5`
    - Documentation says $\gamma^2 \leq 1E-3 = 0.001$
  - Other ELM triggers: (=1,6,7) use N_{tor} information and γ^2, (=0) use the eigenfunctions, (=2,3,4) use $\omega^* N_{\text{tor}}$
    - **For `KARHU` this means we can only use =5**

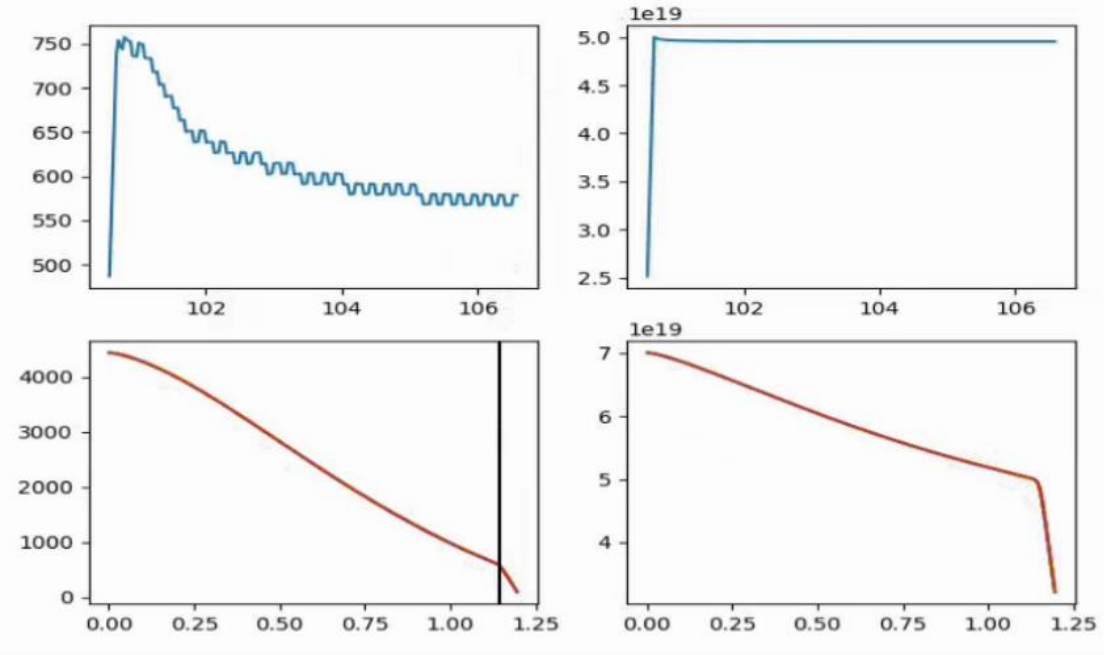


MISHKA in JINTRAC

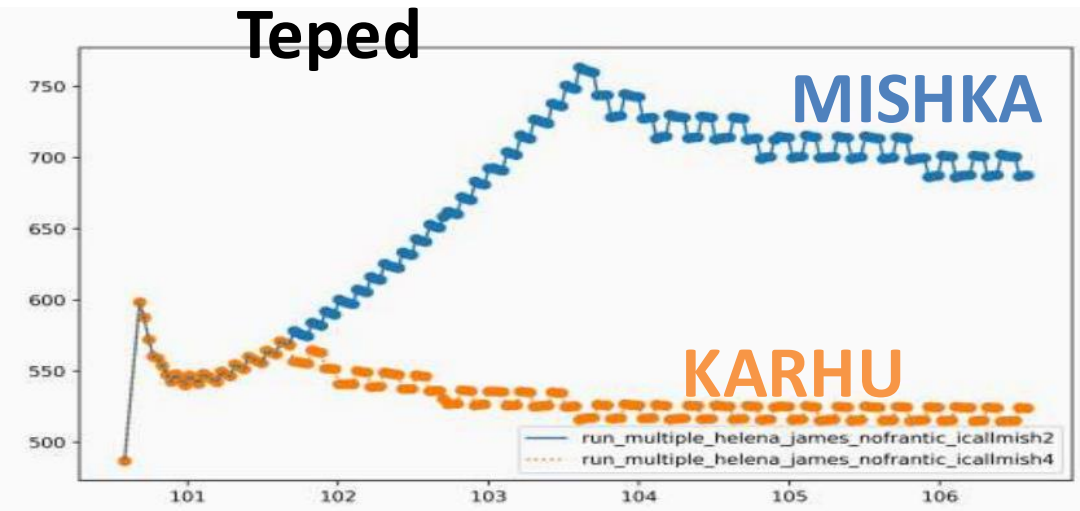
- "Continuous" ELM model (are there ot
  - At HELENA + MISHKA calls ->
    if stable decrease ETB, else increase ETB

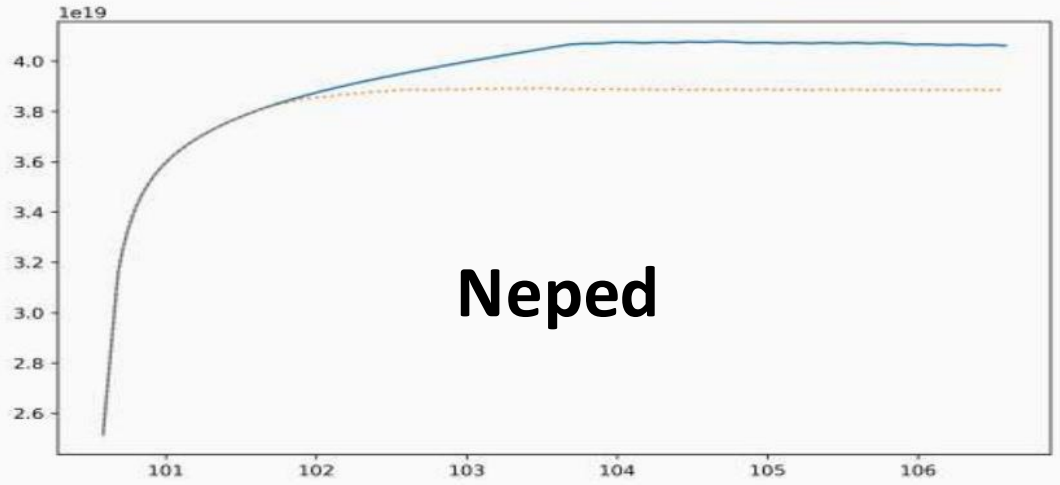


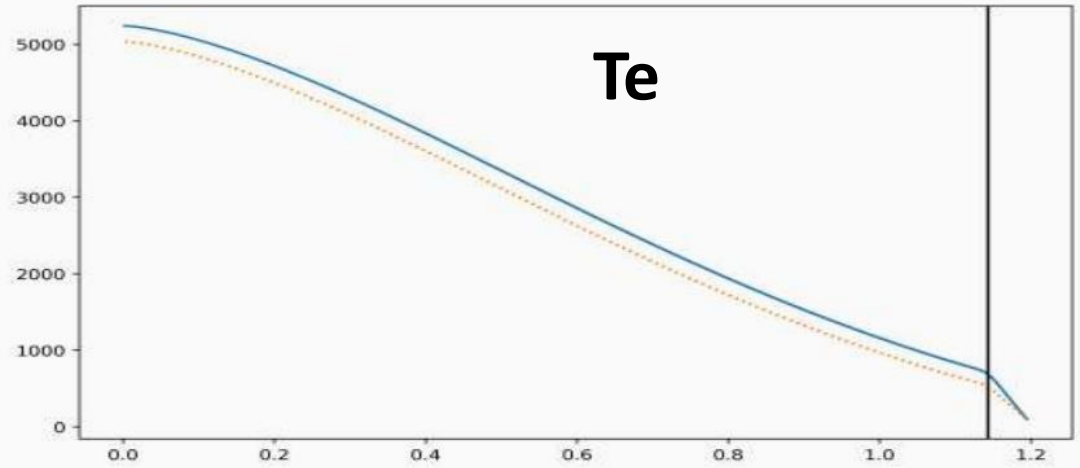
- JINTRAC setup of the HELENA run is arcane
  - Can run in various modes,
    - **perscribed current or <u>perscribed RBPHI</u>**
    - Perscribed pressure profile or perscribed NE/TE

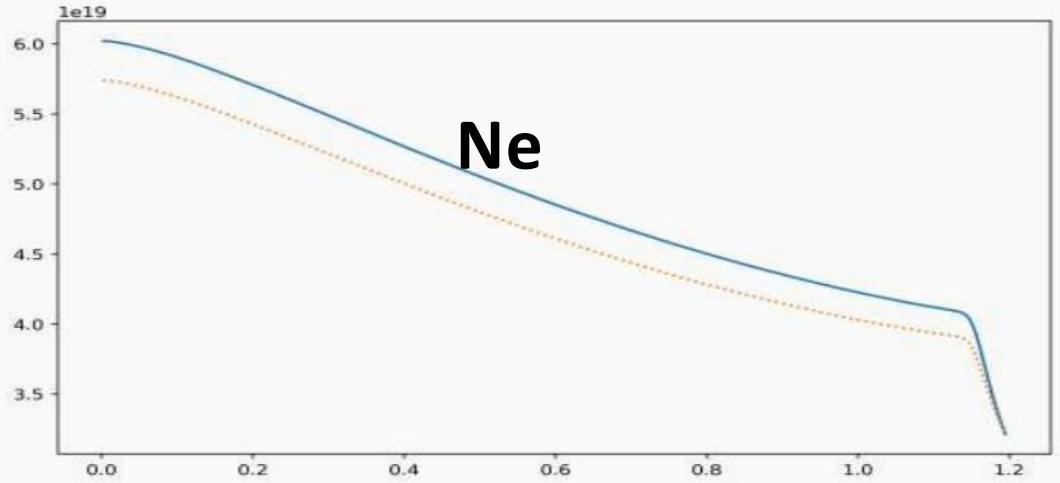


Example run 1: KARHU predicts unstable much earlier

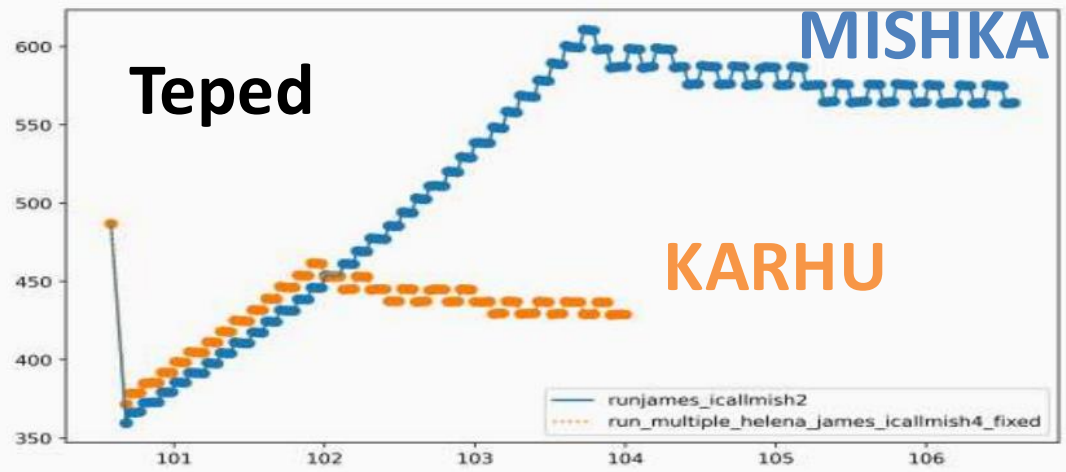


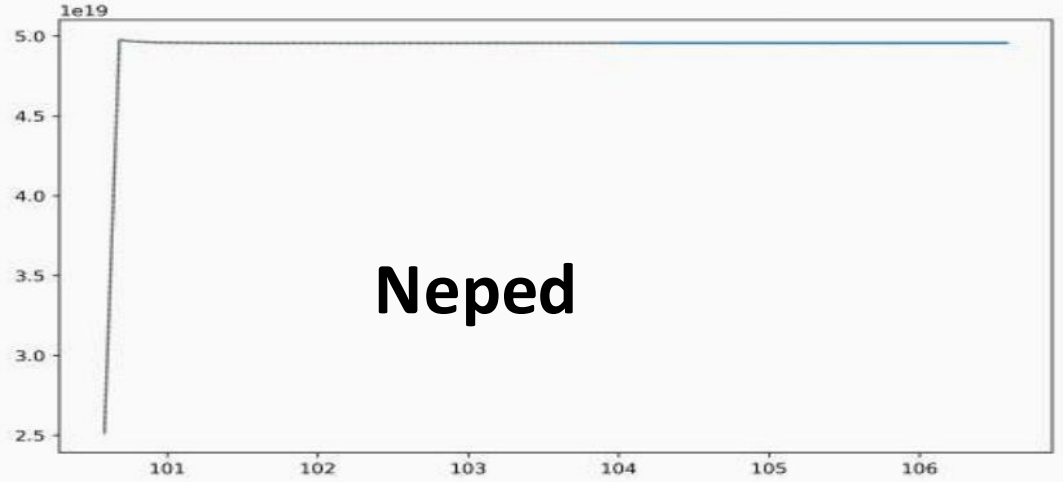


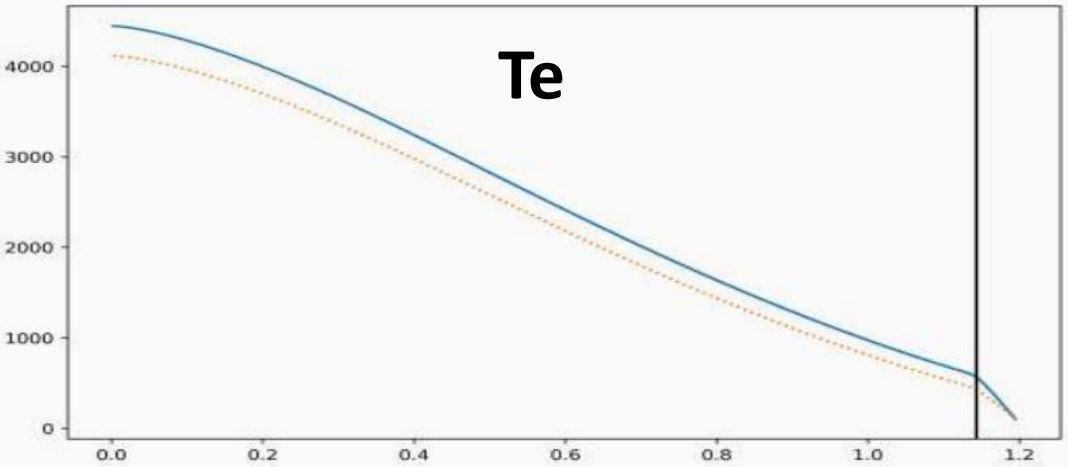


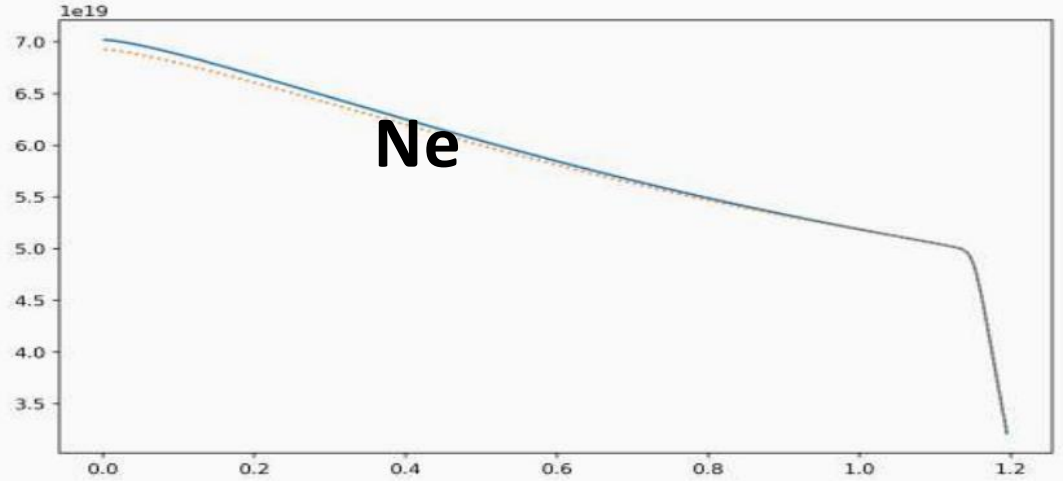


Example run 2: KARHU predicts unstable much earlier



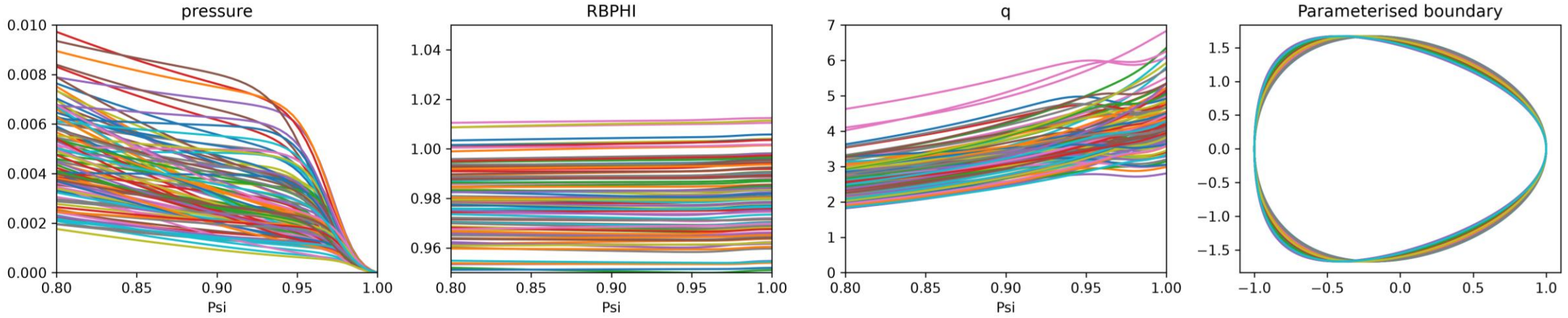




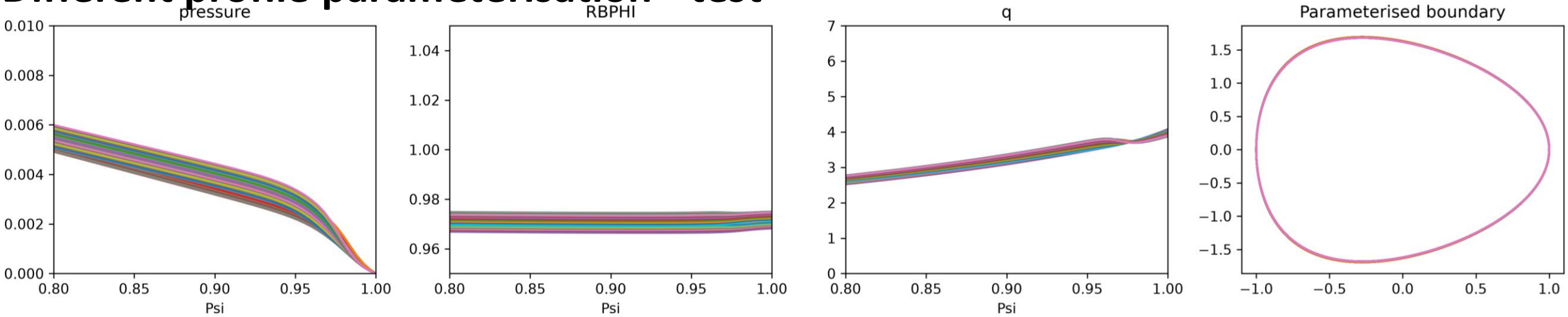


Hypothesis why – the training data uses a TANH parameterisation while JINTRAC (and other sources) do not follow

TANH + Core slope TRAINING DATA

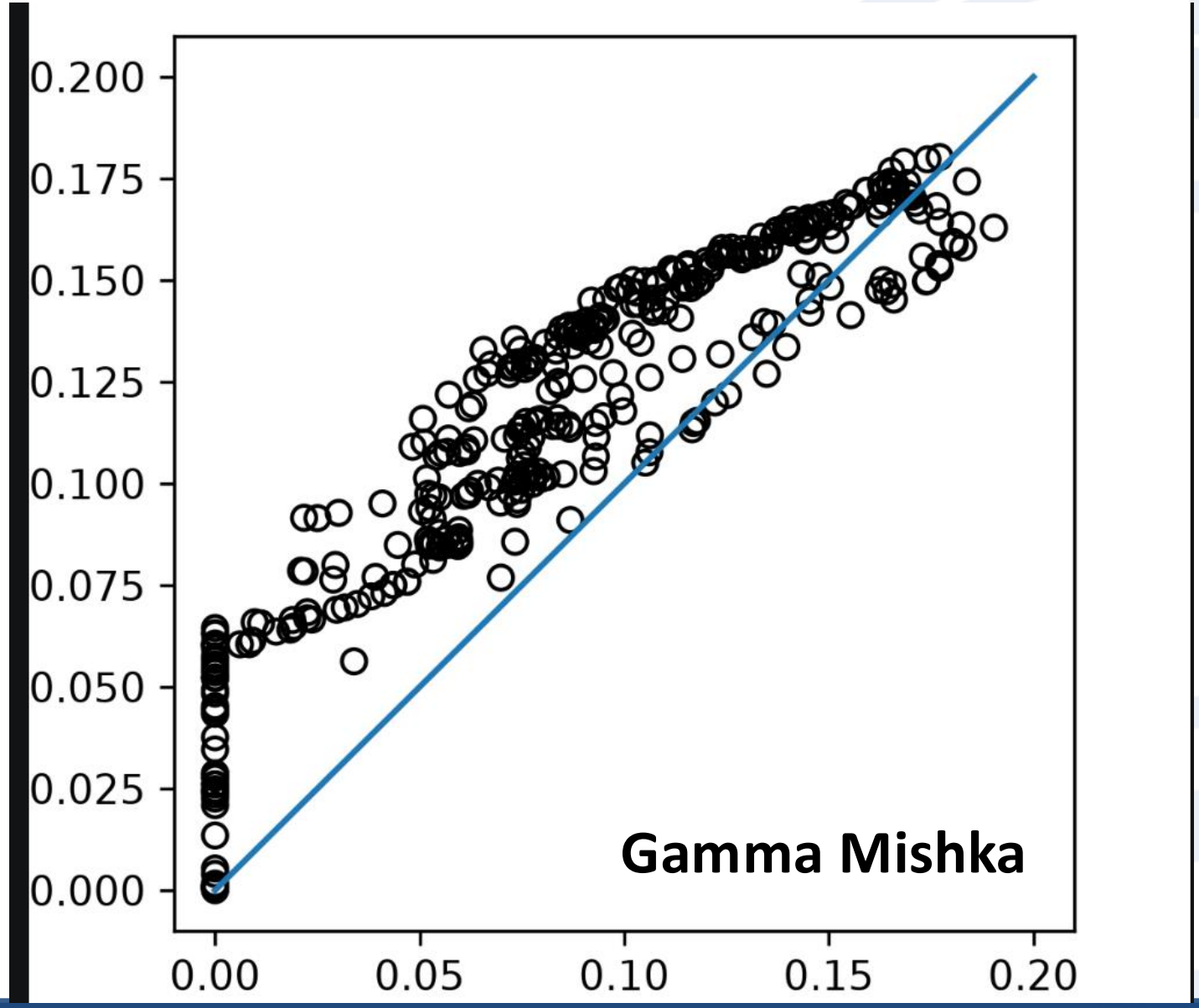


Different profile parameterisation - test



with MTANH instead of TANH + core slope, also fine large over estimation

Gamma KARHU



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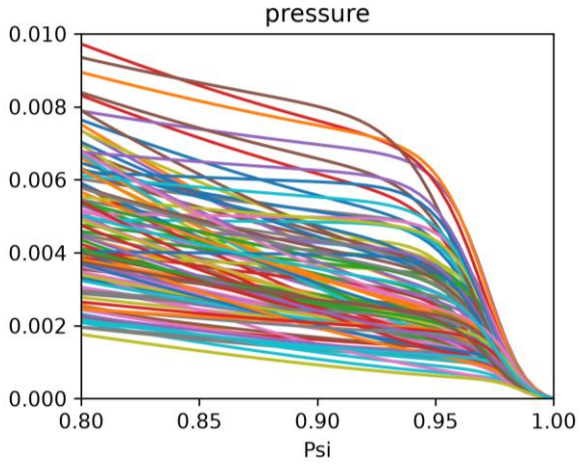
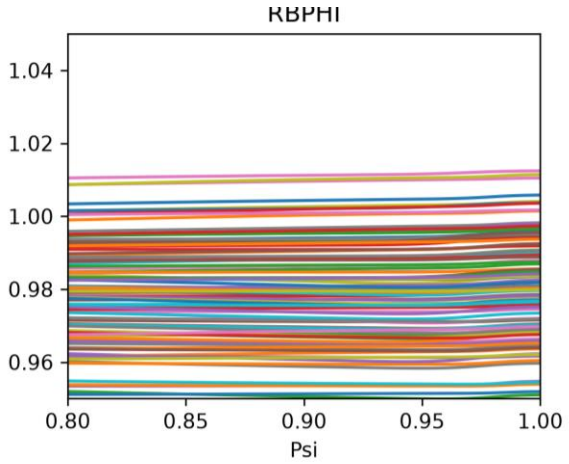
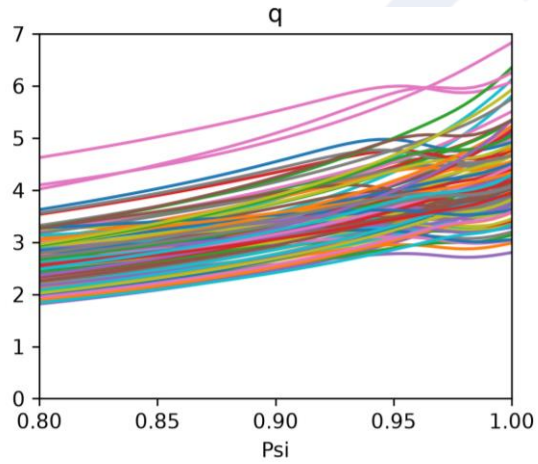
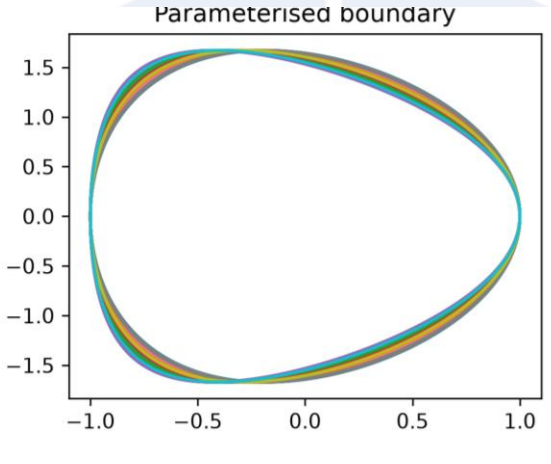
TANH + Core slope TRAINING DATA

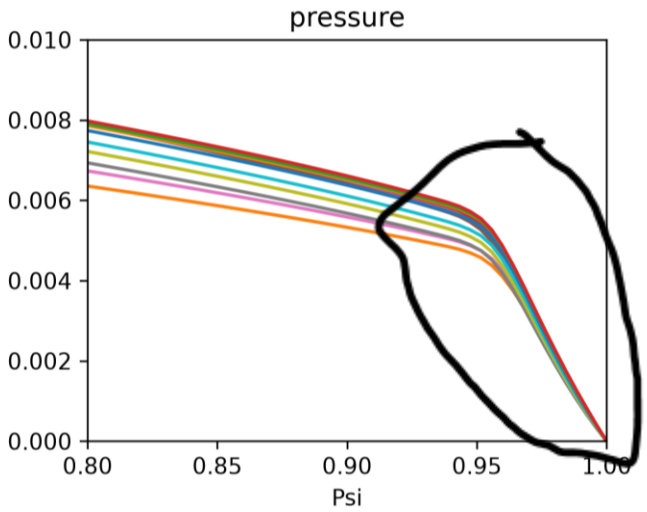


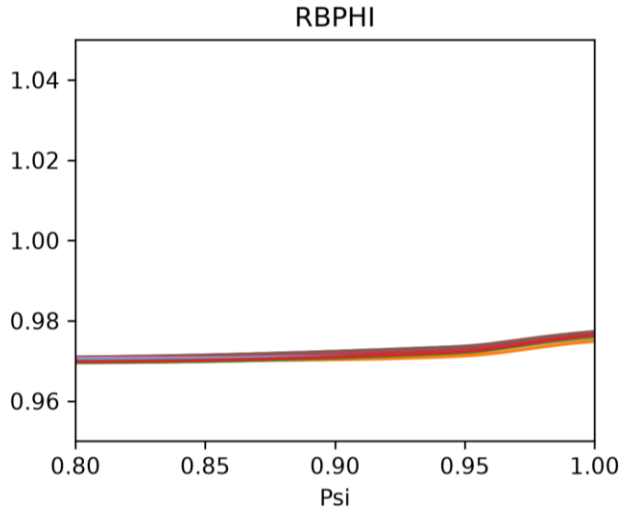


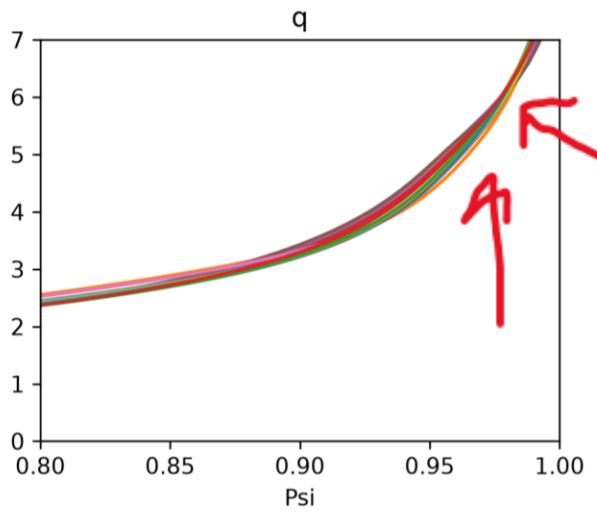


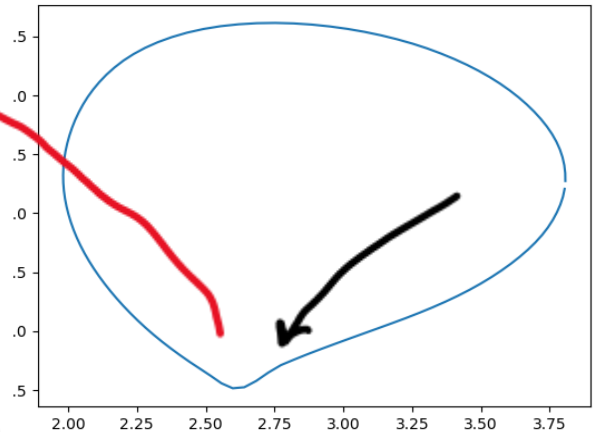


JINTRAC Data









Some things to try in JINTRAC to identify various errors

Are there other approaches than continuous ELM?

Key target scenario we can try for model validation?

1. Use parameterised boundary instead of experiment
2. Force TANH profile

3. Change model structure

   e.g., we are passing just P, RBPHI, Q and boundary, which possible the gradients are "learned" or biased in the NN representation, instead could pass PPRIME, S, FPRIME, etc.,