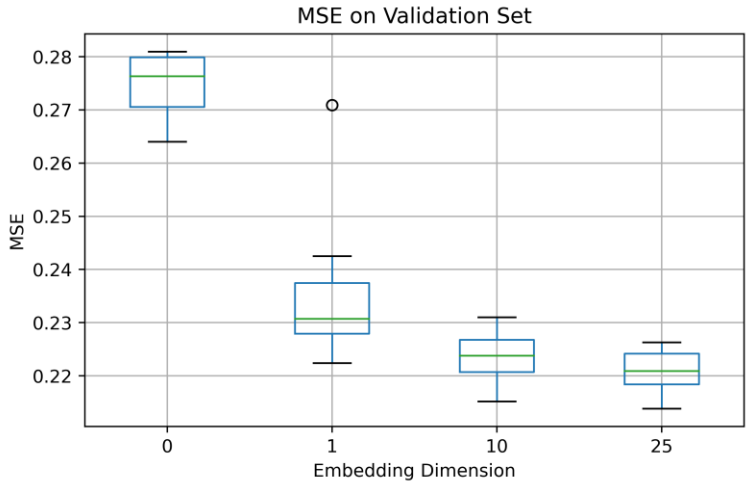
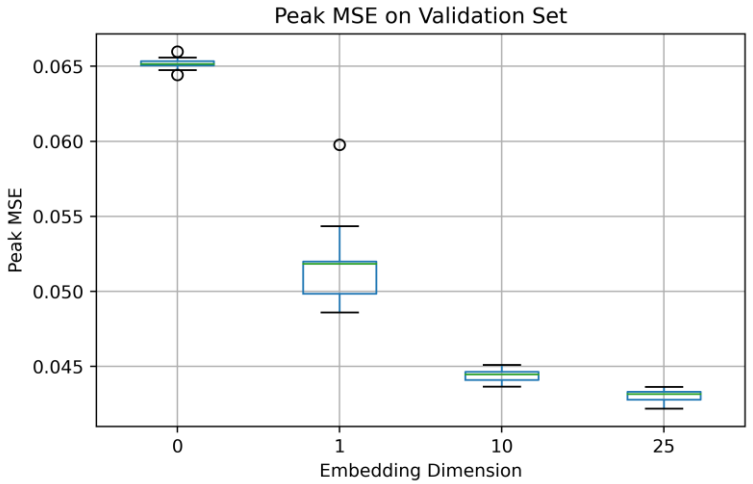
Improving Surrogate Model Performance for Sparse Outputs in the Spatial Domain

Accurate estimates of **where beam loss occurs** is important both for overall optimisation and personnel/machine protection

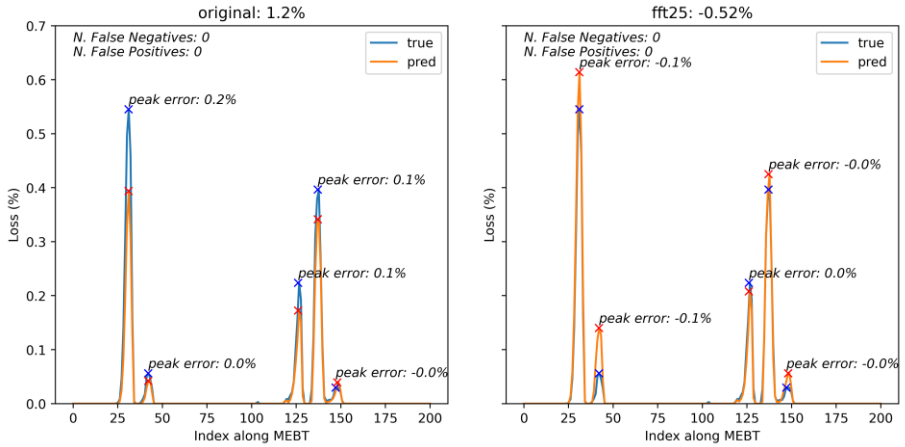
$$\gamma(x) = [cos(2\pi Bx), sin(2\pi Bx)]^T$$

Where $B \in R^{m \times d}$, with m being the embedding dimension





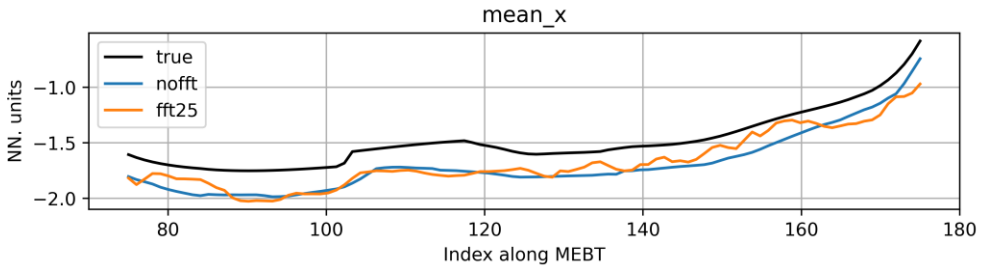
Concatenating **1D-fourier feature mappings** (proven to be effective in 2D applications) of the spatial dimension with the inputs to the model to improve resolution



Increasing the Embedding Dimension (m) **decreases MSE and Peak Error**, as well as reducing errors between predicted peak maxima and the overall cumulative loss.

Also **improves stability** of peak predictions in sparse outputs

BUT **adds a high frequency component** to the output prediction which is non-physical for smoother functions.



Science and Technology Facilities Council
ISIS Neutron and Muon Source

www.isis.stfc.ac.uk

@isisneutronmuon

uk.linkedin.com/showcase/isis-neutron-and-muon-source