

# Improving Predictions Under Uncertainty of Material Plasma Device Operations

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Understanding the properties of materials when exposed to various plasma temperatures and fluxes is essential to the building and operating of fusion reactors. The Material Plasma Exposure experiment (MPEX) is an instrument currently being developed by the Department of Energy (DOE) for this purpose. MPEX is expected to come online in stages over the next five years. Proto-MPEX, the predecessor to MPEX, operated from 2014 to 2021, and was designed to understand the generation of plasma temperatures and fluxes at orders of magnitude below what will be obtained by MPEX. This work we summarize research developed using stochastic neural network (SNN), a machine learning technique capable of operating under uncertainty to provide a surrogate model for the Proto-MPEX device (Archibald, et.al., 2022). We demonstrate that SNN outperforms Bayesian neural network (BNN), a standard in the field of machine learning with uncertainty. The development of a robust surrogate of the Proto-MPEX will aid in the commissioning and operation of the MPEX device.

## References

Archibald, R., Cianciosa, M. and Lau, C., 2022, December. Improving Predictions Under Uncertainty of Material Plasma Device Operations. In 2022 IEEE International Conference on Big Data (Big Data) (pp. 3402-3407). IEEE

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