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Informing Nuclear Data Evaluations by combining ML/AI and CoH Sampling, and Integrating the New Model into CGMF.

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Fission cross-sections are crucial in understanding nuclear reactions, for instance, in designing and analyzing nuclear reactors, applications in nuclear criticality safety, etc.

Current challenges stem from inherent biases and uncertainties within existing fission models, limiting their predictive capabilities, and unknown systematic biases in experimental data. For model predictions we used the Hauser-Feshbach method implemented in the LANL code CoH code. CoH connects fission cross-sections with other reaction channels, and it also correlates fission cross-sections with prompt fission observables through CGMF, a fission-event generator.

In the present work, we discuss recent results utilizing the machine learning algorithm elastic net to explore potential biases in experimental 235U and 239Pu fission cross sections. Experimental uncertainties are then enlarged based on those potential biases found by elastic net that are also deemed realistic by expert judgment. Then we calibrate CoH calculations against this experimental data. Subsequently, model parameters derived from fitting experimental datasets are informed by neural networks, uncovering inadequacies in the parameter space and guiding future model extension. We will integrate this improved model fit of fission cross sections into CGMF and pair it with experimental databases on prompt-fission neutron spectra and multiplicities to further explore inconsistencies within the model and experimental data.

Primary authors: DIABY, Fanta (Los Alamos National Laboratory); Dr NEUDECKER, Denise (Los Alamos National Laboratory); LOVELL, Amy (Los Alamos National Laboratory)

Presenter: DIABY, Fanta (Los Alamos National Laboratory)

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