

WANDA 2023 Project Overview for “Designing Nuclear-data Measurements that Resolve Discrepancies in Existing Data”

AIACHNE (AI/ML Informed cAlifornium CHi Nuclear data Experiment) team:

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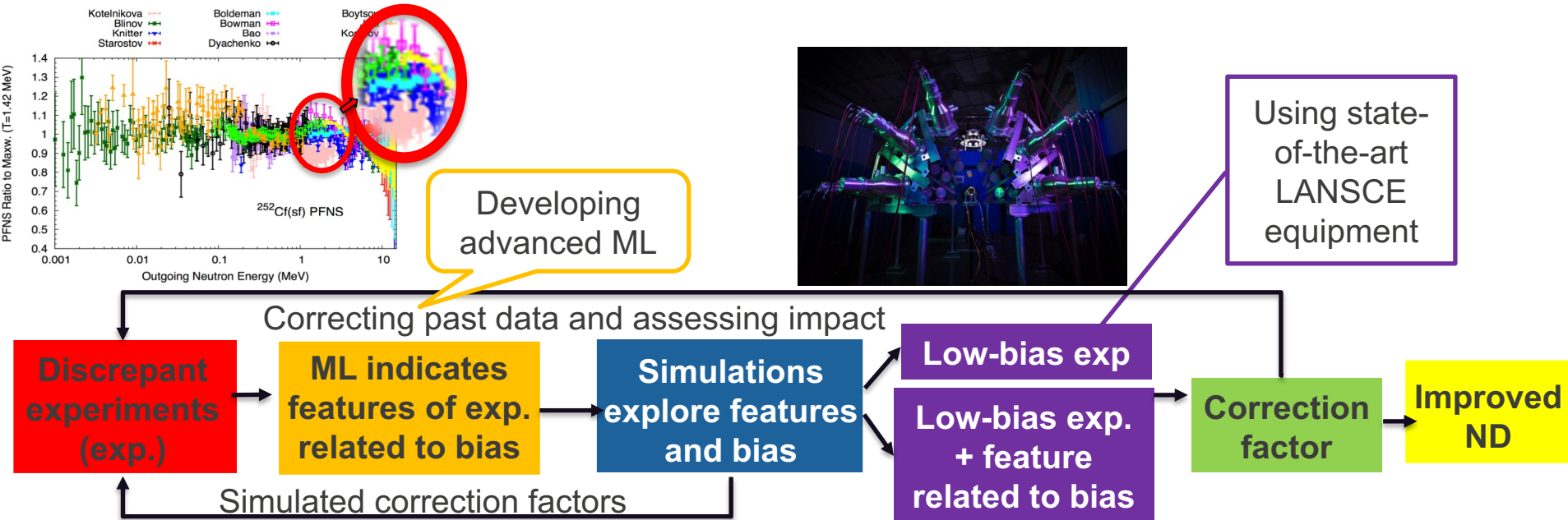
WANDA 2023, 3/2/23

This project is funded by DOE Office of Science through FOA 2440.

The project started August 2022.

AIACHNE creates ML-guided capability to design differential experiments maximally reducing discrepancies in past exp.

Need: Systematic discrepancies in nuclear data (ND) experiments often poorly understood → uncertain/ inaccurate ND → critical barrier to reliable DOE predictive simulations.



Benefit:

- Enhanced mission agility by designing exp. that reduce ND unc.,
- Ability to “salvage” value of past exp. (millions of \$) by partially correcting biases,
- Breakthrough understanding of spread in experiments informing theory and ND,
- $^{252}\text{Cf}(sf)$ PFNS is part of Neutron Data Standards! → reducing unc. vital for various applications as >70% of U/Pu/Th/Np PFNS measured using it.

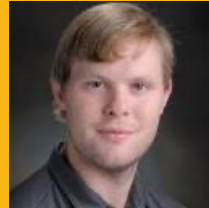
AIACHNE has a team from BNL and LANL; it connects strongly to the Neutron Data Standards project.



D. Brown
ND expert



B. Pritychenko
EXFOR



M. Grosskopf
AI/ ML



K. Kelly
Experiment



D. Neudecker
ND evaluation



S. Vander Wiel
AI/ ML

EXFOR database and literature database
ENDF/B libraries

Chi-Nu array ML tool to identify features related to outliers
EUCLID tools to design experiments via AI/ ML
 $^{252}\text{Cf}(\text{sf})$ PPAC
ARIADNE evaluation tool

Neutron Data Standards database
GMA evaluation code



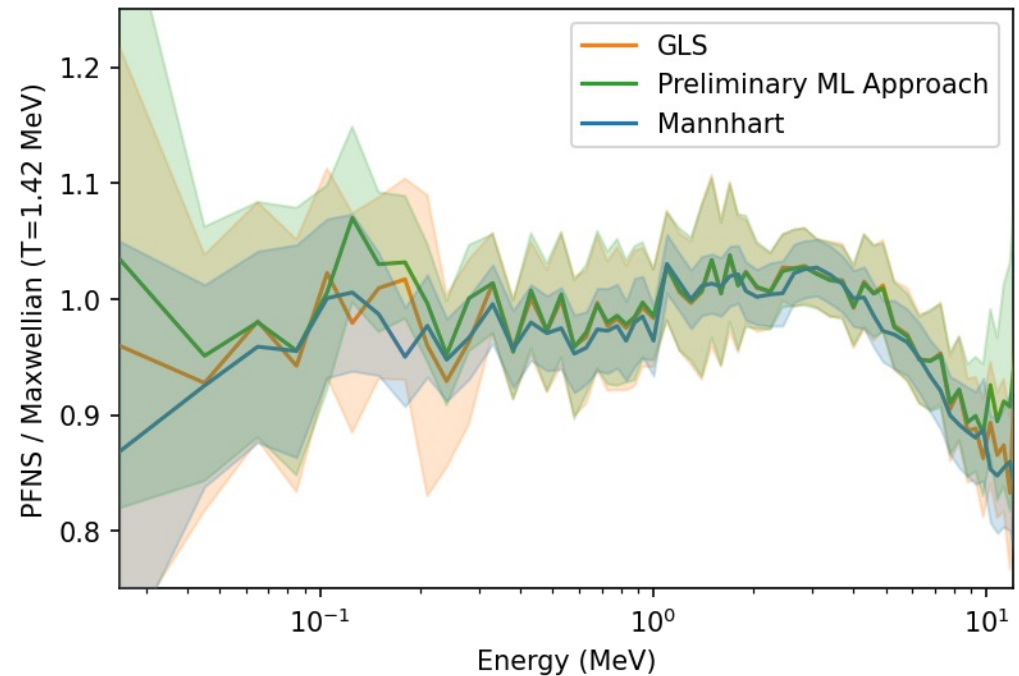
A. Carlson
Standards lead

As a first step, AIACHNE recovered the data and methods for evaluating the ^{252}Cf PFNS standard by Mannhart as baseline.

Input experimental data and mean values underlying Mannhart's ^{252}Cf PFNS standard evaluation were lost to the community.

Work in the last few months:

- Reproducing the previous standard,
- Detailed understanding of all currently available ^{252}Cf PFNS for new standards evaluation, **AND** ML input,
- Selecting ML algorithm for analyzing what experiment features are driving discrepancies in past data sets.



Next step:

A new ^{252}Cf experiment will be designed Informed by a thorough review of literature data and completion of ML/AI studies.