Managing and processing nuclear data libraries with FUDGE

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FUDGE (For Updating Data and Generating Evaluations) is an open-source code that supports reading, visualizing, checking, modifying, and processing nuclear reaction and decay data. For ease of use the frontend of FUDGE is written in Python while C and C++ routines are employed for computationally intensive calculations.

FUDGE has been developed primarily at Lawrence Livermore National Laboratory (LLNL) with contributions from Brookhaven National Laboratory (BNL). It is used by the LLNL Nuclear Data and Theory (NDT) group to deliver high-quality nuclear data libraries to users for a variety of applications. FUDGE is also the world leader in converting data to the Generalized Nuclear Database Structure (GNDS) and working with GNDS data, including processing and visualizing. GNDS is a new extensible hierarchy that has been internationally adopted as the new standard for storing and using nuclear data libraries, replacing the previous standard ENDF-6.

A new version of FUDGE (FUDGE-5.0) is under preparation for release at https://github.com/LLNL/fudge. This version has several important changes and adds new capabilities compared to the previous release (FUDGE-4.2.3). Changes include:
- switching from Python 2 to Python 3 (the new version requires Python-3.6 or later),
- support for installing FUDGE with the pip Python package-management system,
- new interactive visualization tools using PyQT5,
- support for reading and writing data files in the GNDS-2.0 format (GNDS-2.0 is in draft form at the time of writing but is expected to be finalized soon),
- enhanced support for processing thermal neutron scattering law data (TNSL), including new evaluations that contain both coherent and incoherent elastic scattering,
- support for writing hybrid XML/HDF5 GNDS files, useful especially for improving data load times in large, processed datasets,
- various fixes to ENDF-6 translation tools, quality checking tools and data processing.
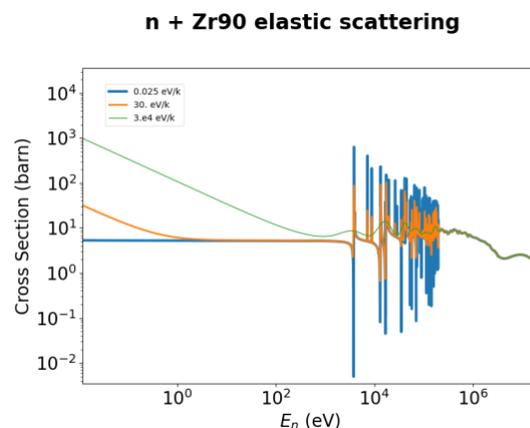
Example of FUDGE Doppler broadening and visualization capabilities

This talk will present an overview of FUDGE, including a quick tour of how to download and install the code and several examples of using it to perform both simple and not-so-simple nuclear data tasks. We also present resources for users interested in gaining more experience with FUDGE and GNDS.