Current status of access routines to ENDF data in AMPX

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Outline

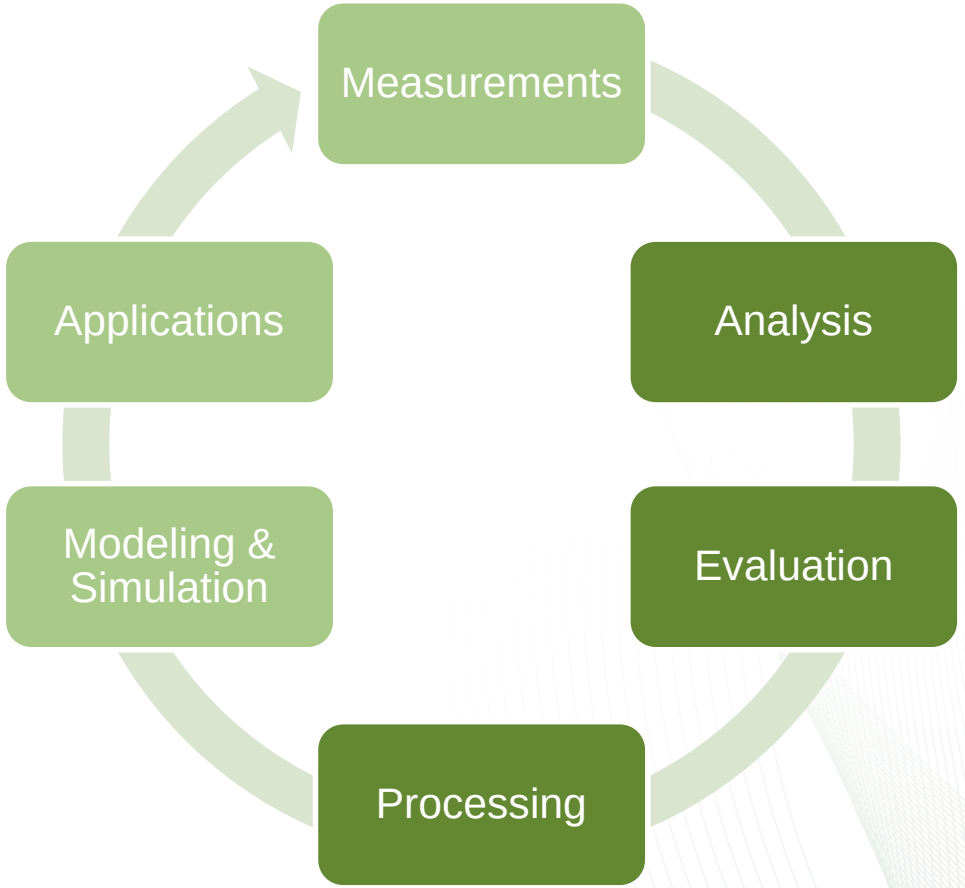
- AMPX and ENDF
- Overview of how General Nuclear Database Structure (GNDS) is/will be implemented in AMPX
- Testing of GNDS processing in AMPX
  - 1D incident neutron data
  - Covariance processing

ORNL nuclear data capabilities tightly coupled with M&S and nuclear applications

Analysis
Nuclear data analysis methods development (SAMMY)

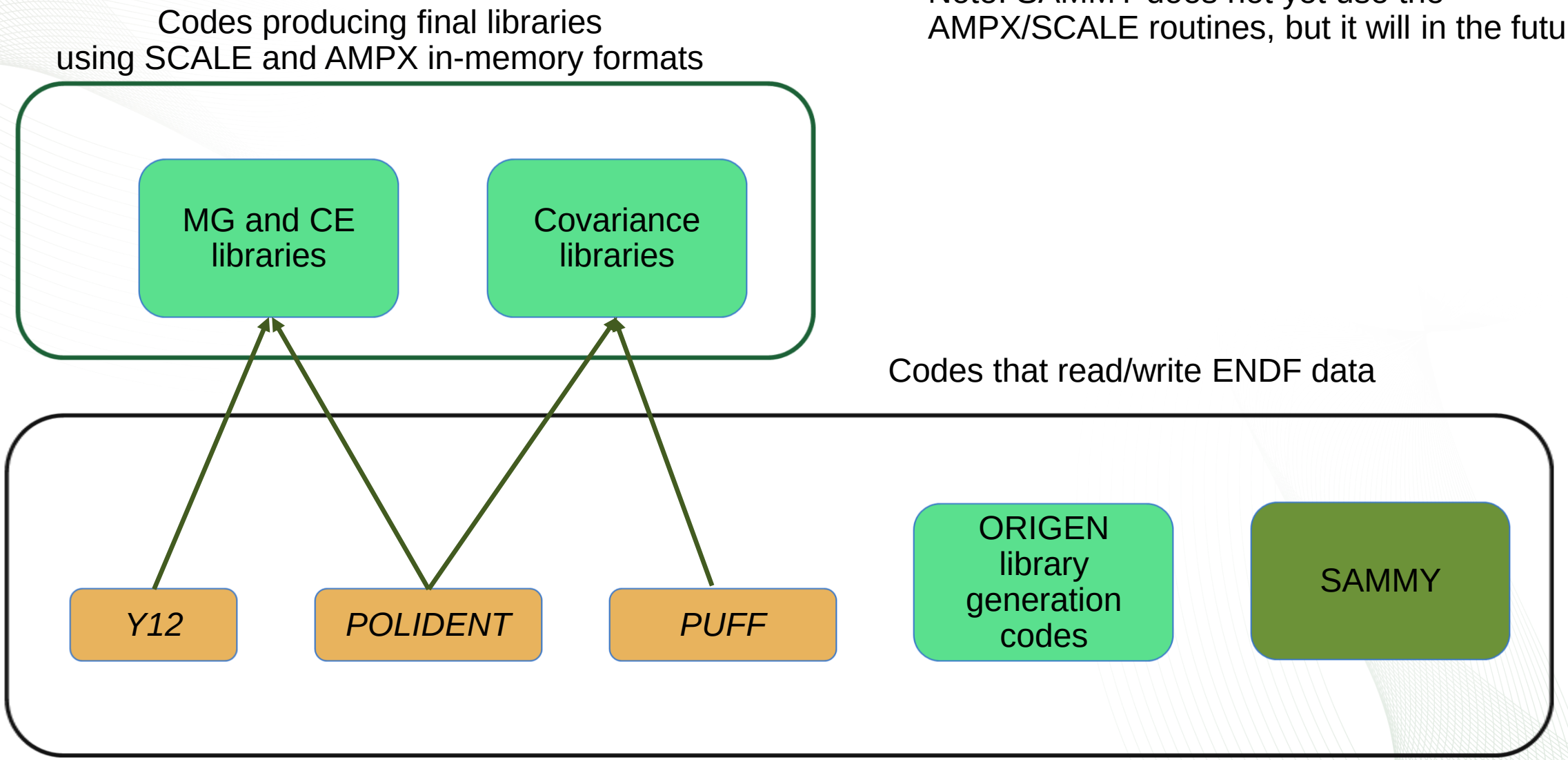
Evaluation
Cross section evaluation and preparation of ENDF/B nuclear data files (SAMMY)

Processing
Cross section processing methods development for generating nuclear data libraries (AMPX)

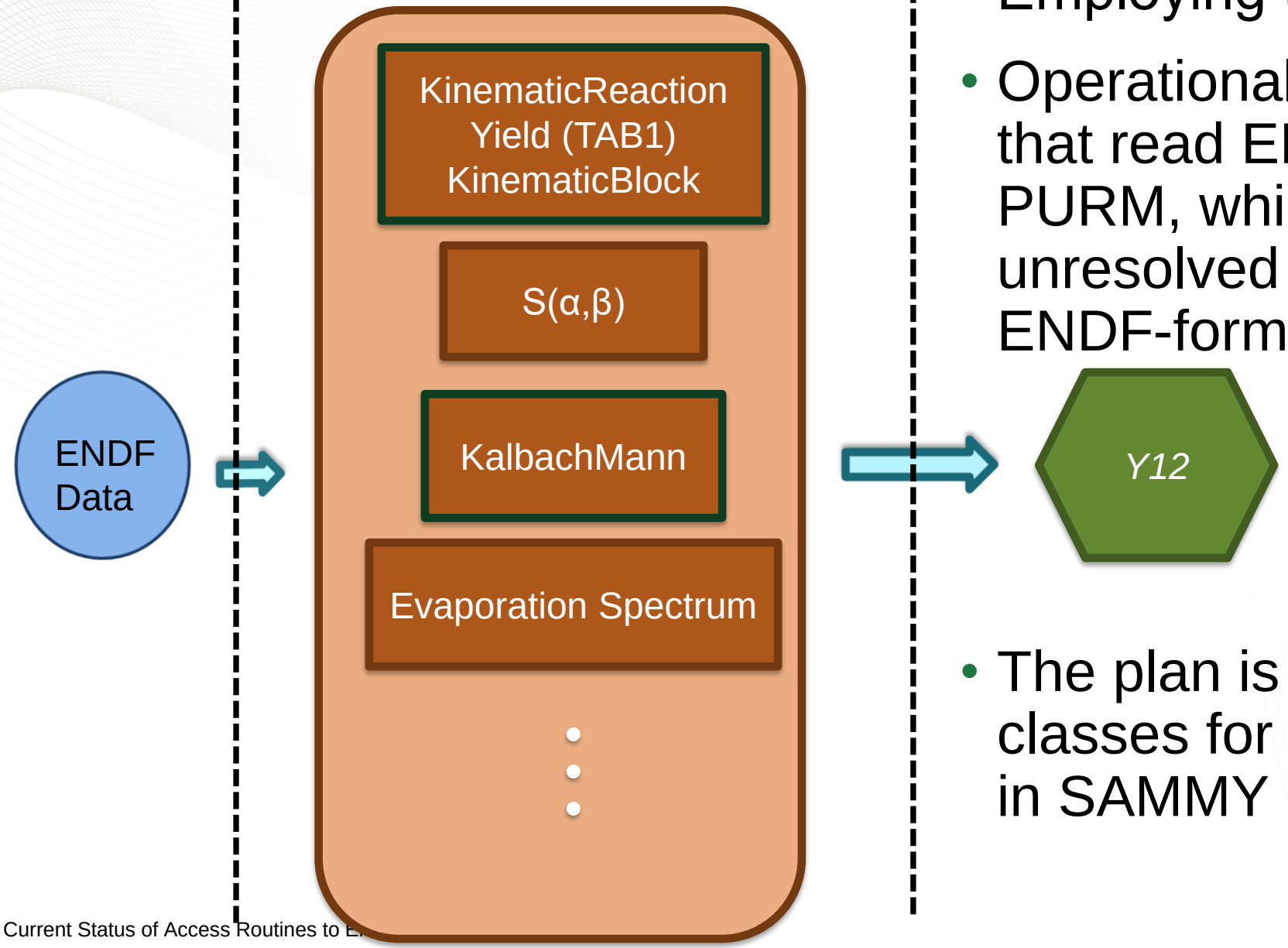


Library generation in AMPX

Note: SAMMY does not yet use the AMPX/SCALE routines, but it will in the future



Processing ENDF data



- Employing the “onion” principle
- Operational for almost all codes that read ENDF data (except PURM, which is used to create unresolved probability tables) for ENDF-formatted files
- The plan is to use the same classes for reading/writing in SAMMY

Add new input parameters

- Codes that read ENDF files get two new input parameters:
  - format: endf or gnds (sometimes already present but not used)
  - Style: the label of the style to use; if not given, defaults to latest evaluated style
- Operational for Polident, Prude and Puff_iv; Y12 (kinematic data) is next on list.
- Previously, the file name of the ENDF file was not passed to the ENDF reader but is now added, as it is needed to resolve external file references
- To do: determine programmatically whether the ENDF file is GNDS or ENDF formatted
- To do: set the GNDS data containers from AMPX in-memory structures, which is needed for SAMMY

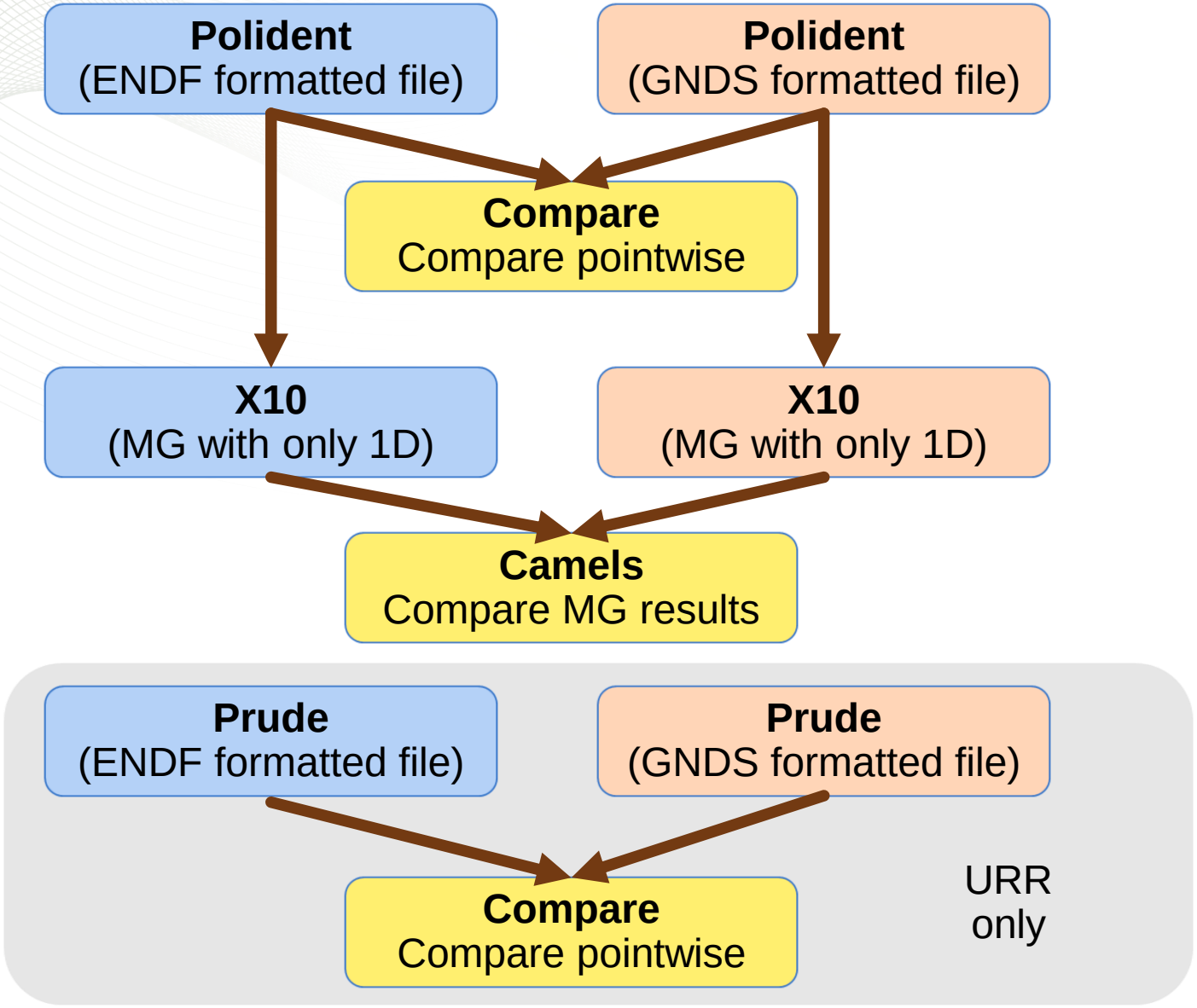
Selection of style label

- If a user supplies a style label, it should be used; this may be evaluated or processed data
- If no style label is supplied, then the latest evaluated style should be used (i.e., an evaluated style from which no other evaluated style inherits)
- For each desired element:
  - Find the label that matches the selected evaluated style exactly
  - If not found, then pick the one with a style label derived from the desired label
  - Example:
    - Angular data were updated with a new style label, “ang,” which derives from “eval”
    - 1D cross sections were not updated
    - If derived is true, then1D cross sections are used, even if style “ang” is requested

Implementation

- Processing 1D incident neutron data – POLIDENT and PRUDE
  - Point-wise data and resonance reconstruction
- Covariance processing
  - Cross section covariance data and resonance parameter covariance data
- In progress: Y12 for kinematic data will include thermal scattering law (TSL) data
- Once these three tasks are completed, incident neutron transport libraries can be created for testing in SCALE
- For a more in-depth view on how this is implemented in AMPX, see talk for SG-43

Test of 1D incident neutron data

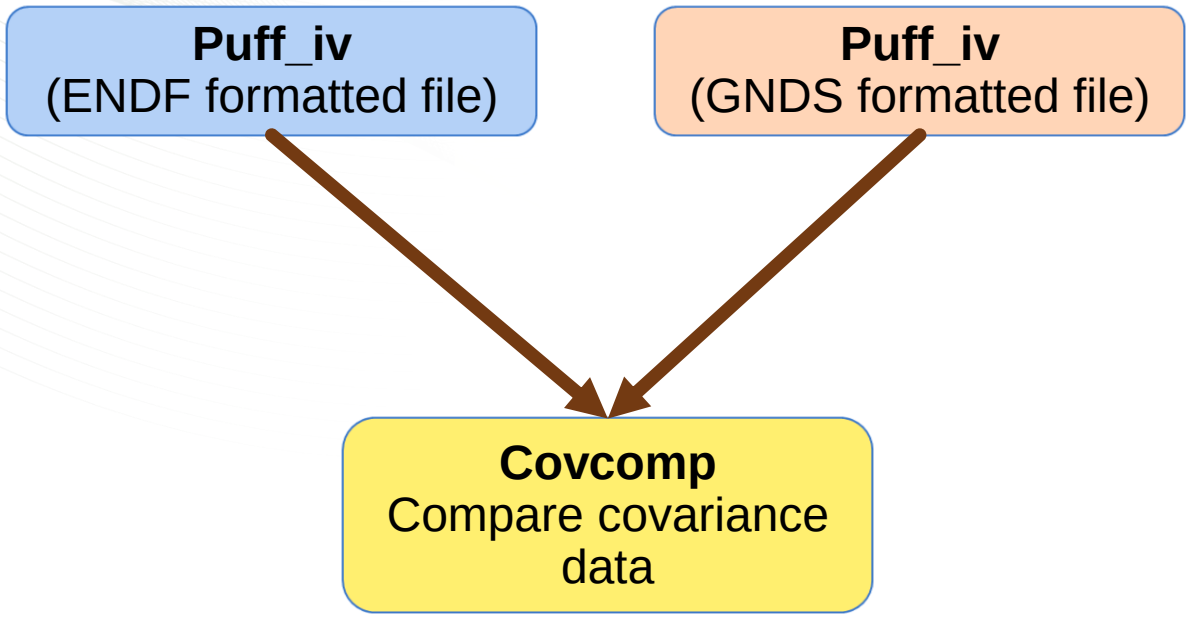


- Generate a custom template for EXSITE that allows for generation of input files for all incident neutron evaluations
- “Compare” makes a comparison of pointwise data on a union grid, but it does not signal missing reactions
- “Camels” compares the missing reactions of grouped data and signals
- “Prude” processes unresolved resonance region (URR) data, whether for shielding only or also for point-wise cross section data

Results for 1D data

- Initial processing showed some differences that were fixed in the current FUDGE release
- For GNDS files downloaded from the National Nuclear Data Center (NNDC), no relative differences larger than 8% were found
- The larger differences are due to differences in the scattering radii used
- Due to better handling of double values in GNDS, some differences due to rounding are also expected
- GNDS does not contain data expected on derived files that may be present on ENDF data; it does contain cross section data for lumped reactions used in covariance processing

Test of covariance neutron data



- Generate a custom template for EXSITE that allows the user to generate input files for all covariance data
- "Puff_iv" can generate
  - Cross section covariance data from pointwise data (File 31/33)
  - Cross section covariance data from resonance parameter (File 32)
  - Covariance data for CHI (File 35)
  - Each can be selected separately
- "Covcomp" shows differences and missing covariance data

Results for cross section covariances

- Differences found due to the following:
  - LB=2 matrix was not being converted correctly (Caleb Mattoon corrected this in the new version of FUDGE)
  - Resonance parameters covariance matrices in compact format are converted in slightly different ways in AMPX and FUDGE
  - Resonance ranges in File 2 and File 32 are different, and this is not translated into GNDS

How to get AMPX

- AMPX is part of SCALE and is available from RSICC with versions SCALE 6.1 and up; GNDS processing is expected to be available in the next beta release
- Efforts are underway to have part or all of AMPX released in an open source format so that access should be easier

Summary

- AMPX accesses in-memory structures of ENDF data
- The structures can be filled from ENDF or GNDS formatted files
- Results are tested by processing ENDF and GNDS formatted files and comparing the results