Impact of Unrealistic or Missing Cross Section Covariances

Workshop for Applied Nuclear Data Activities 2020

Elliott School of International Affairs at The George Washington University

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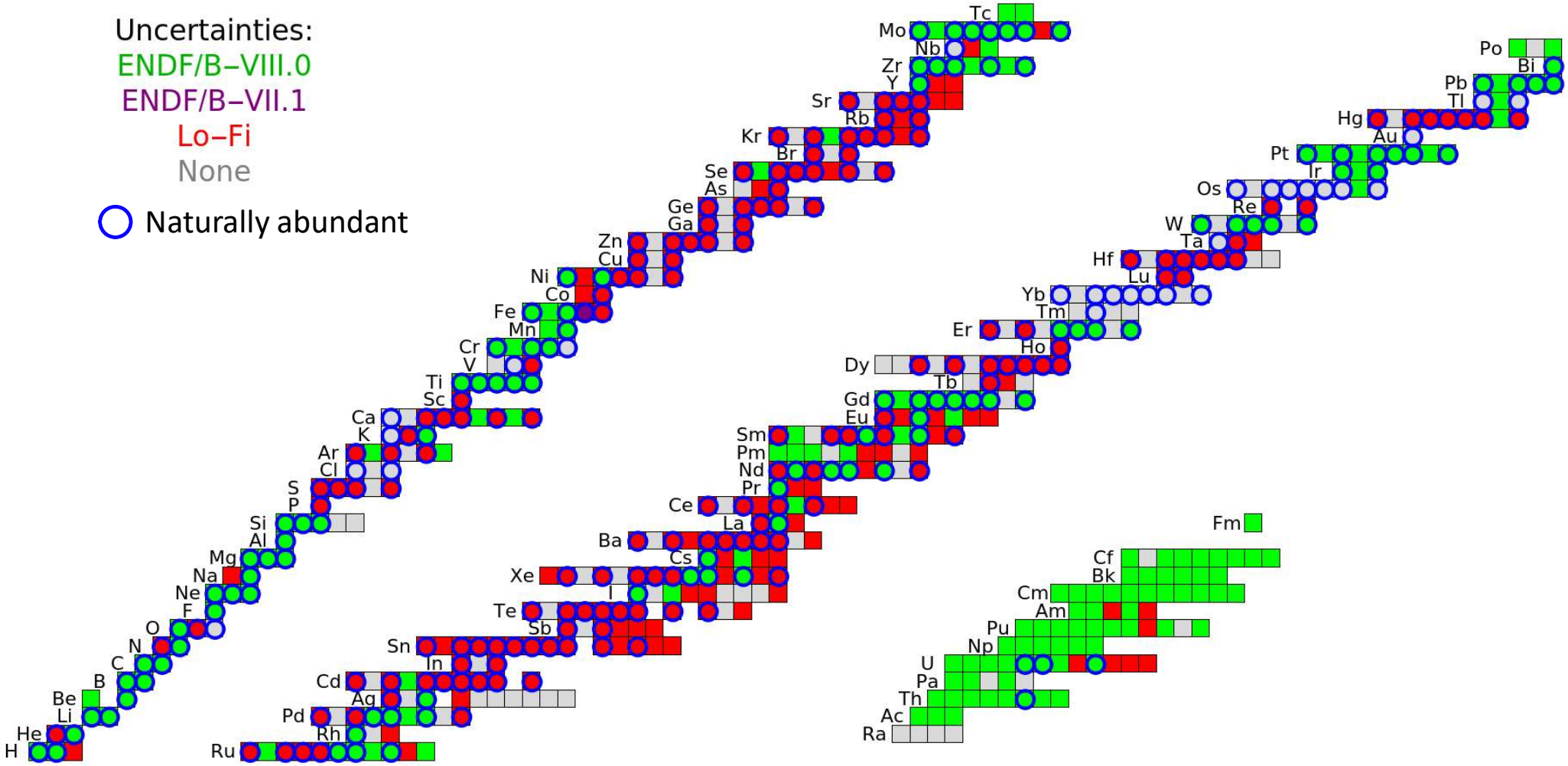
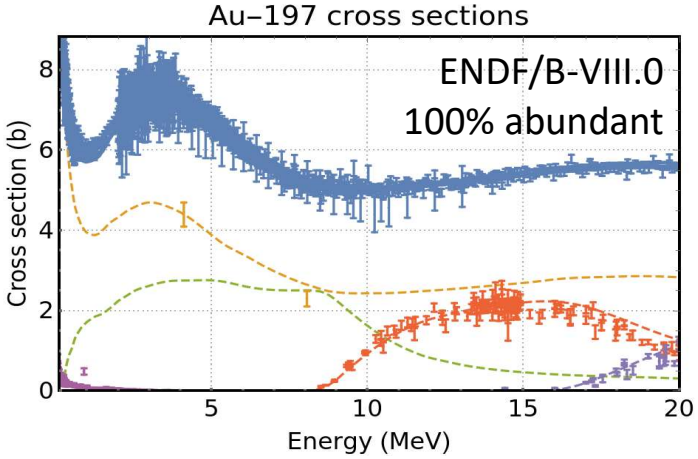
Distribution of data with select covariances

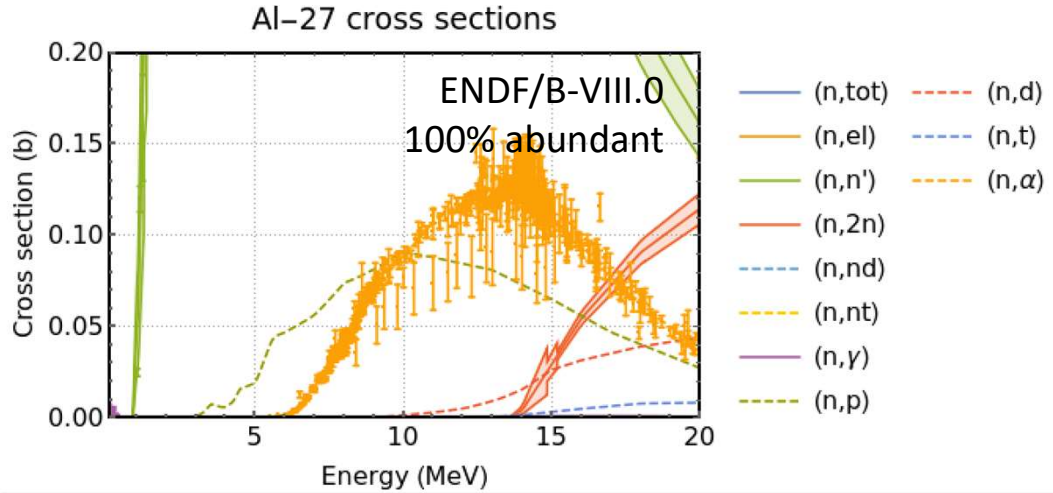
Evaluations that include (n,el), (n,n'), (n,2n), and (n,γ) covariances:



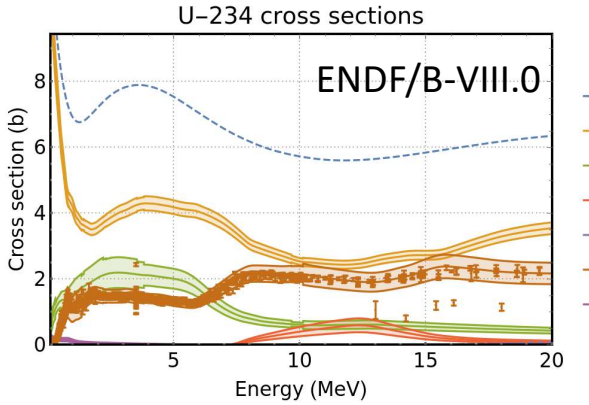
Missing and questionable covariances

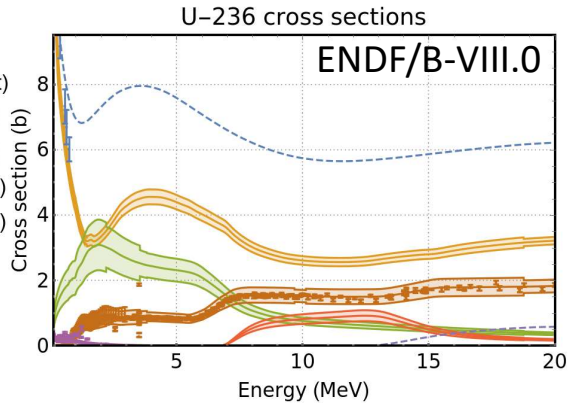
Missing (n,n'), (n,2n), or (n,z) covariances: Gamma production, transport, destruction

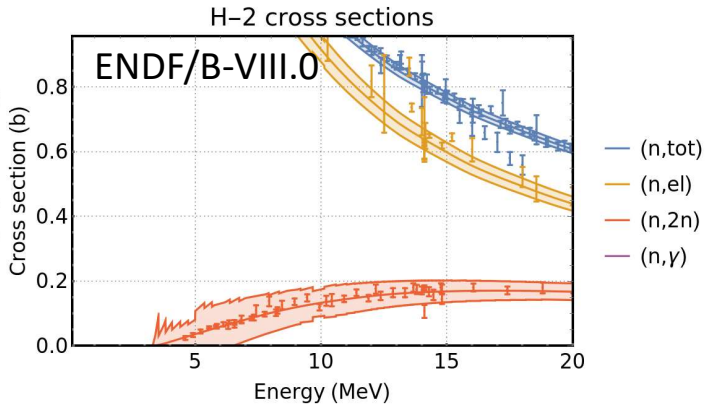




Questionable covariances: Overestimates uncertainty contribution

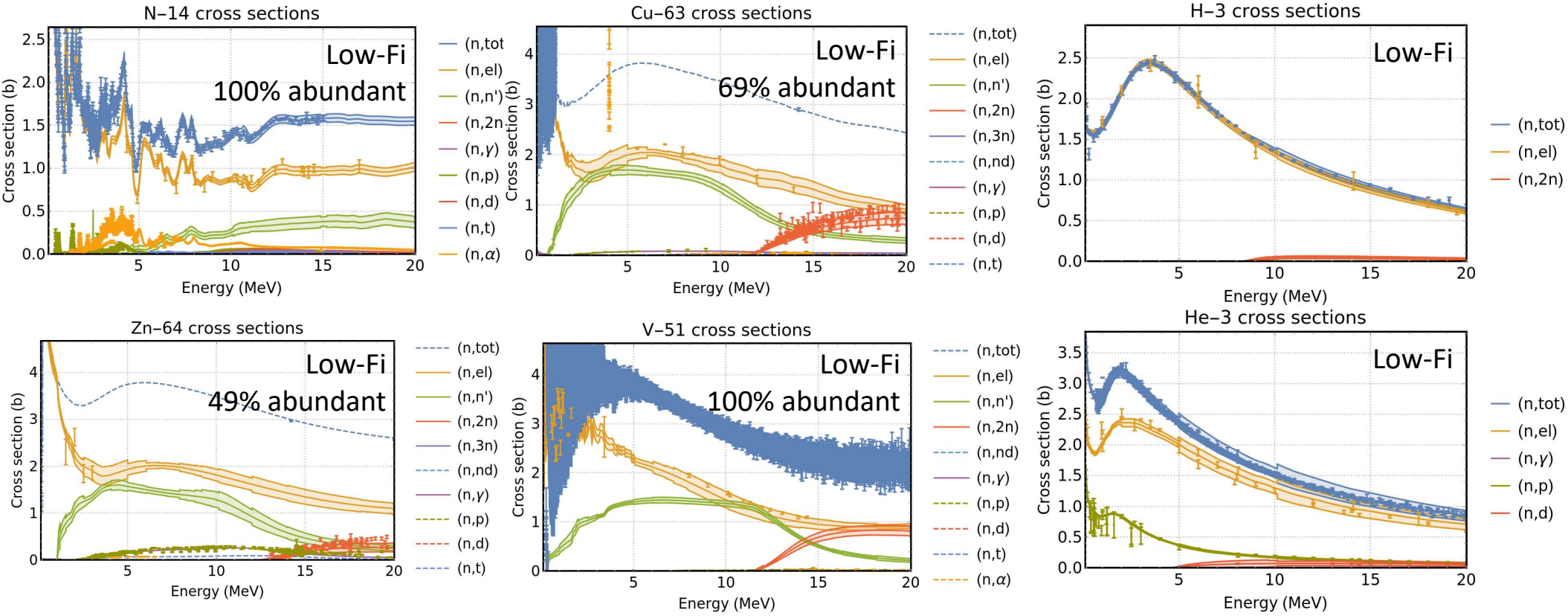






Low-Fi evaluations with available experimental data

Could experimental data be used to test whether these are credible or improve them?



LLNL consensus needs for covariances

- Complete nuclear data covariances needed for applied UQ studies.
  - Needs can't be established without these.
- Methods for determining credibility of evaluation needed:
  - Visual validation provides initial approximation.
- Covariances in (n,n'), (n,2n), and (n,z) needed for many isotopes:
  - (n,n') and (n,2n) covariances often missing from ENDF/B-VIII.0.
  - Some ENDF/B-VIII.0 covariances are difficult to interpret (e.g. sums like (n,2n)+(n,2np)).
  - (n,z) covariances frequently missing from ENDF/B-VIII.0 and Low-Fi.
- Approximate methods for filling in missing and bad covariances needed:
  - Extension of Low-Fi strategy could be a useful starting point for missing reactions.
  - Kyle Wendt will present about a machine learning technique applied to experimental data.
- Need for proper estimation of model and parameter uncertainties and their impact on pure theory covariances.

Some nuclear cross sections of interest with missing, limited, or inconsistent data

Isotope	Reaction	Notes
^{9}Be	n-g	Two lines are fitted to one point
^{12}C/^{14}N/^{16}O	n-n'g	Very limited data
^{58}Fe	n-g	Very limited data
^{183}W	n-p	No data to constrain the threshold
^{190}Pt	n-2n	No data to constrain the threshold
^{190}Pt	n-p	No data available
^{233}U	n-2n	No data available
^{235}U/^{239}Pu	n-n'	Incomplete energy-angle data
^{239}U	n-g	Only one data point available

- Peer review from LANL has begun
- We would like help in assessing, choosing, or performing measurements with a minimum of 10% uncertainty

LLNL Presented this slide last year; we will continue to update this as needed and present it