Covariance Evaluation in the Fast Region for U-235, U-238, and Pu-239

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Covariance Evaluation in the Fast Region

Evaluation based on GNASH calculations

- We employed a GNASH-KALMAN technique
- Experimental errors (statistical and systematics) are from EXFOR and literature.

Standards Evaluation

- Covariance data of U-235 and U-238 were taken from the standards covariance data with appropriate energy boundary adjustments.
- Correlations between different nuclides (light elements) were not included

Least-Squares Calculations with SOK and GLUCS

- were applied to evaluate ν_p covariances

Other Resources

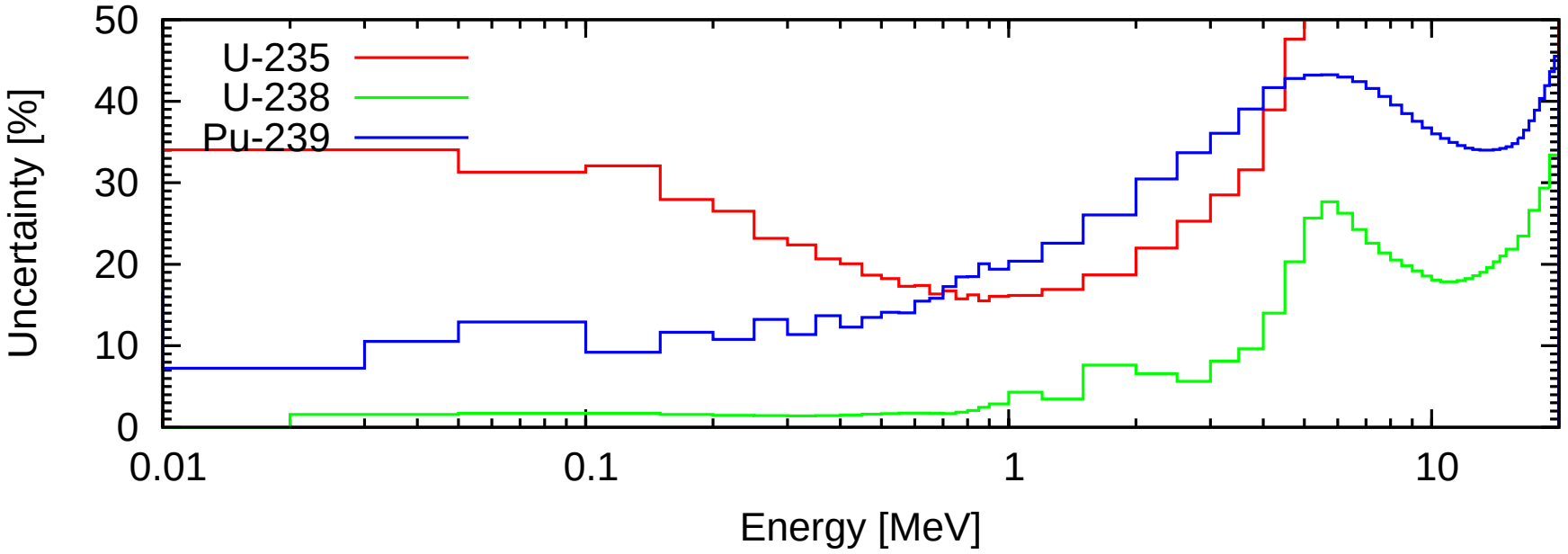
- Th-232 (IAEA), Gd, Ir, Y, Tc (BNL)

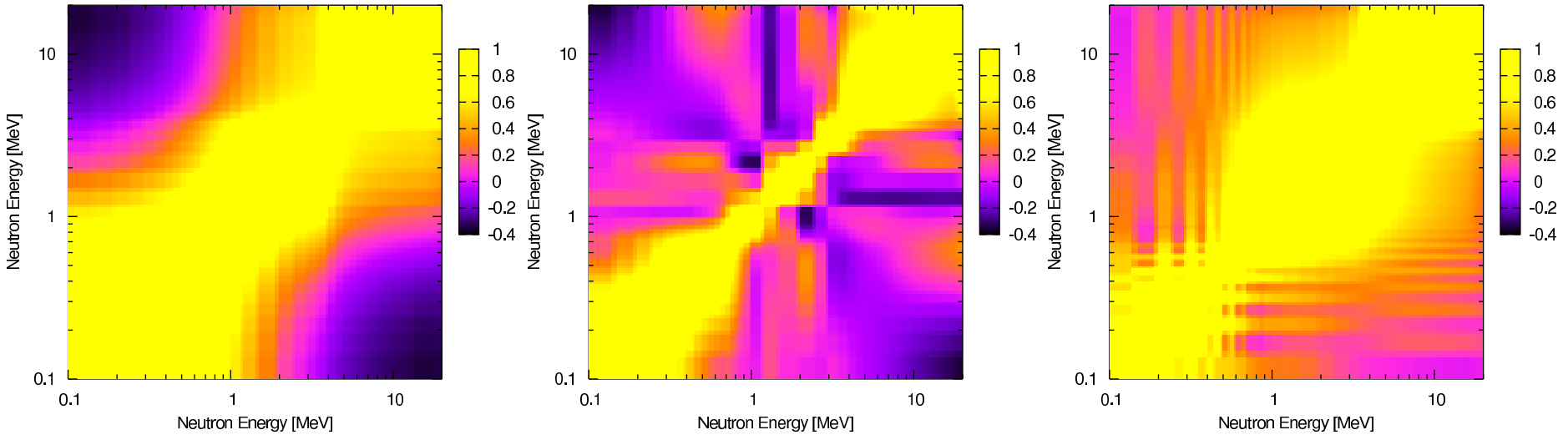
KALMAN Method

GNASH-KALMAN Code System

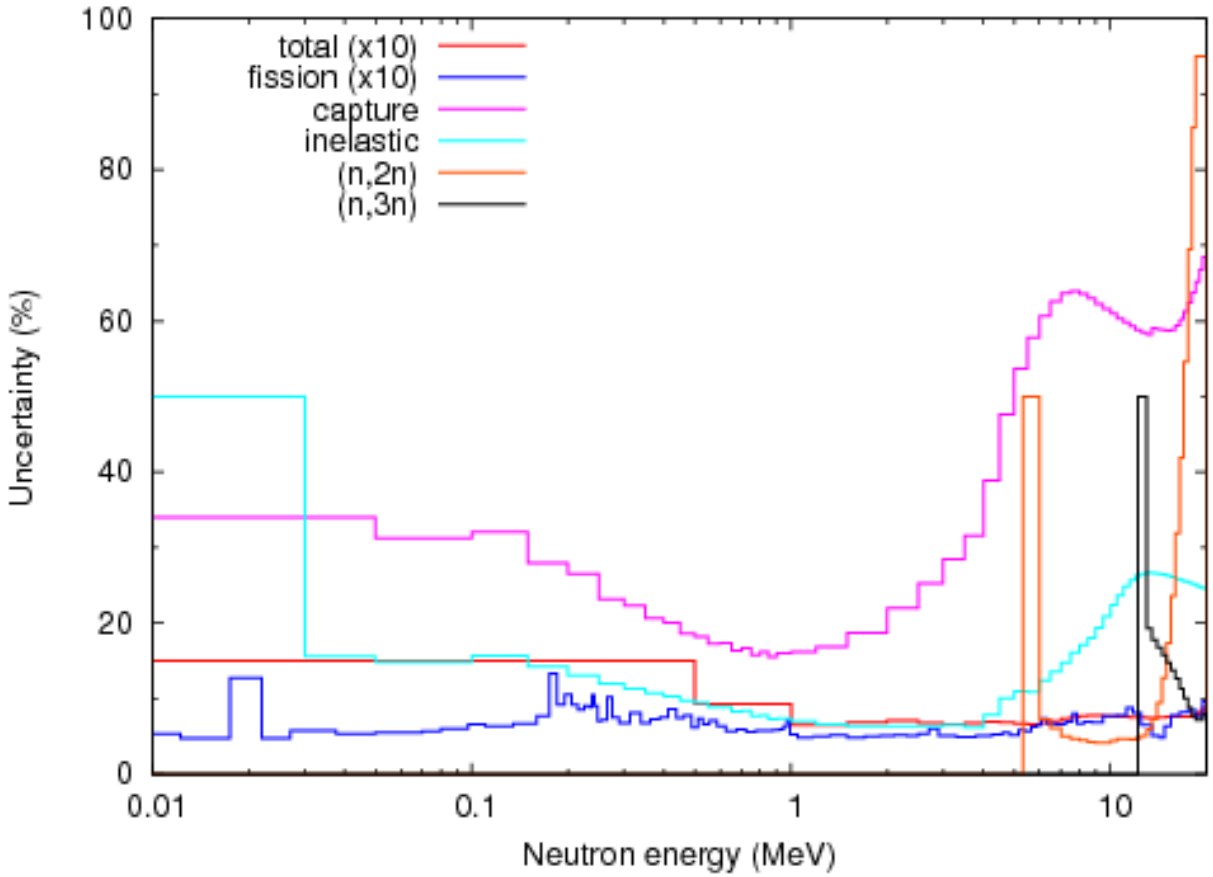
- The KALMAN calculation includes statistical and systematic errors in the experimental data
  - correlation from the systematic errors
- Constraint by a physical model employed
  - correlation from a model which is used for interpolation
- Sensitivities are calculated with the T-16 cluster — almost automated
- The best sets of GNASH (or ECIS) input parameters were already selected by PGY for the ENDF/B-VII evaluations
- The GNASH run for the sensitivity calculation is not exactly the same as for the ENDF/B-VII, fission cross sections, for example
- However, we can assume that the sensitivities of model parameters to the calculated cross sections are not so different

Capture Cross Section





Uncertainties in Group Structure



The evaluated covariance data were processed with ERRORJ (same as ERRORR in the fast region)

We observed that the grouped covariance depends on the group structure

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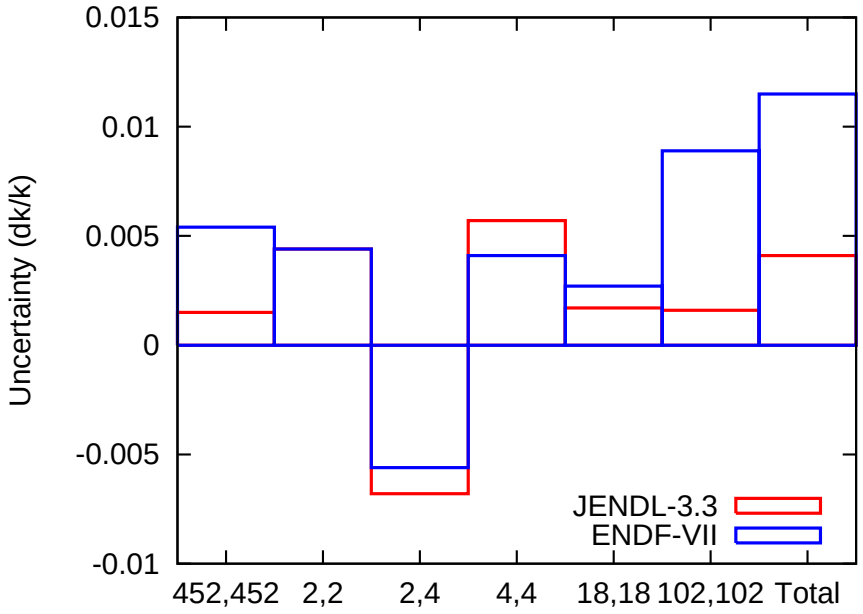
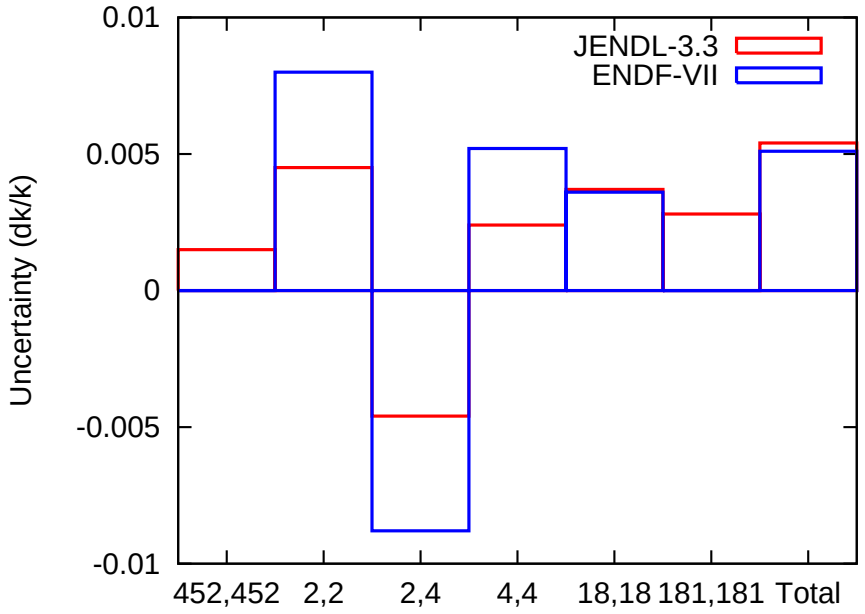
Application of Covariance Data

Uncertainty Calculation for LANL Critical Assembly

- The ENDF/B-VII covariance data were processed with NJOY to generate an 18 energy group library
- Sensitivities of the nuclear data to k_{eff} values for the LANL critical assemblies were calculated with the 1D S_N code, CBG/SNR (Chiba)



Godiva (U-235)



Jezebel (Pu-239)

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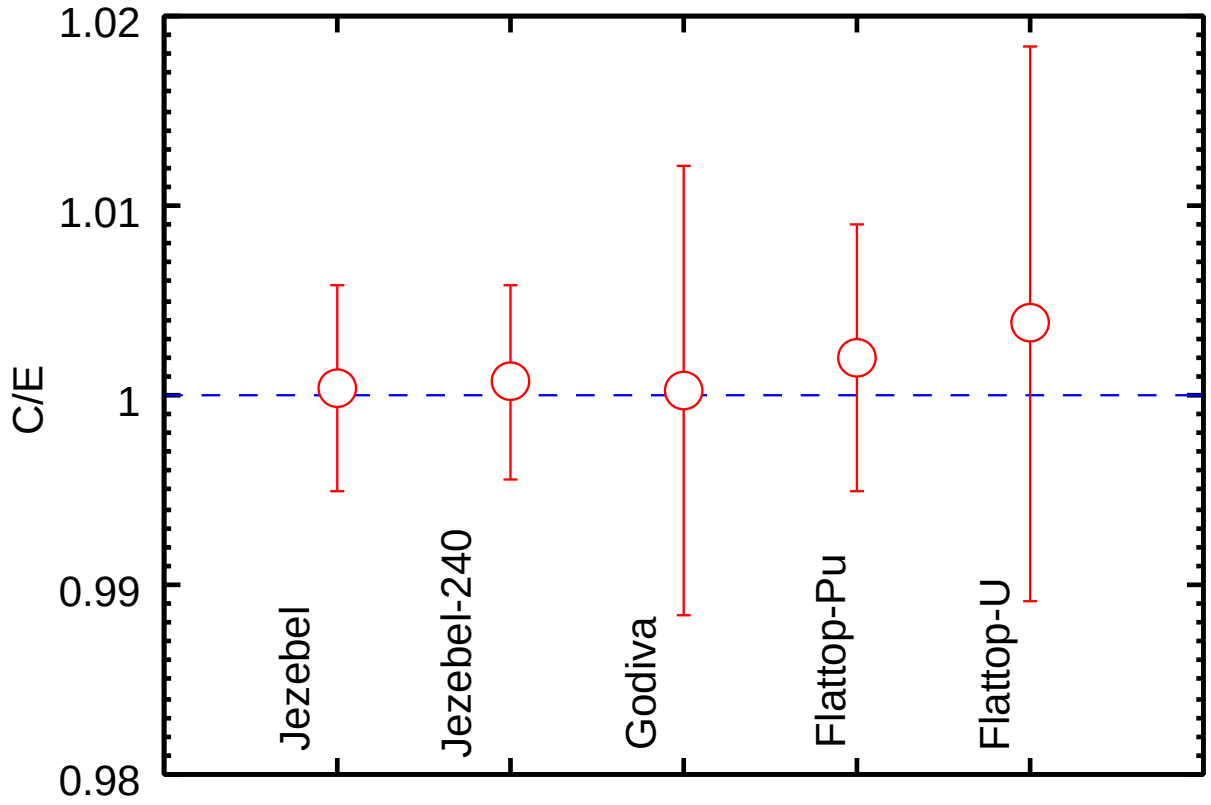
Calculated Uncertainties in k-eff

Uncertainty Calculation for LANL Critical Assembly



Uncertainties taken into account for the calculated k_{eff} are, the nuclear data (covariance), experimental uncertainty in the integral data, and statistical error in the Monte Carlo method.

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Concluding Remarks

Covariance Evaluation at LANL

- We evaluated the covariance data for major actinides : ^{235,238}U and ^{239}Pu in the fast region
- The GNASH-KALMAN method was establised, which runs on the T-16 Linux cluster
- The same technique will be used for other actinides, such as ^{233}U and ^{241}Am
- The evaluated data were processed with NJOY-ERRORJ to generate a grouped covariance, and uncertainties in the integral quantities were calculated

This work was carried out under the auspices of the National Nuclear Security Administration of the U.S. Department of Energy at Los Alamos National Laboratory under Contract No. DE-AC52-06NA25396.