Investigation of ENDF/B-VII.1 Covariance Data for SCALE-6.2

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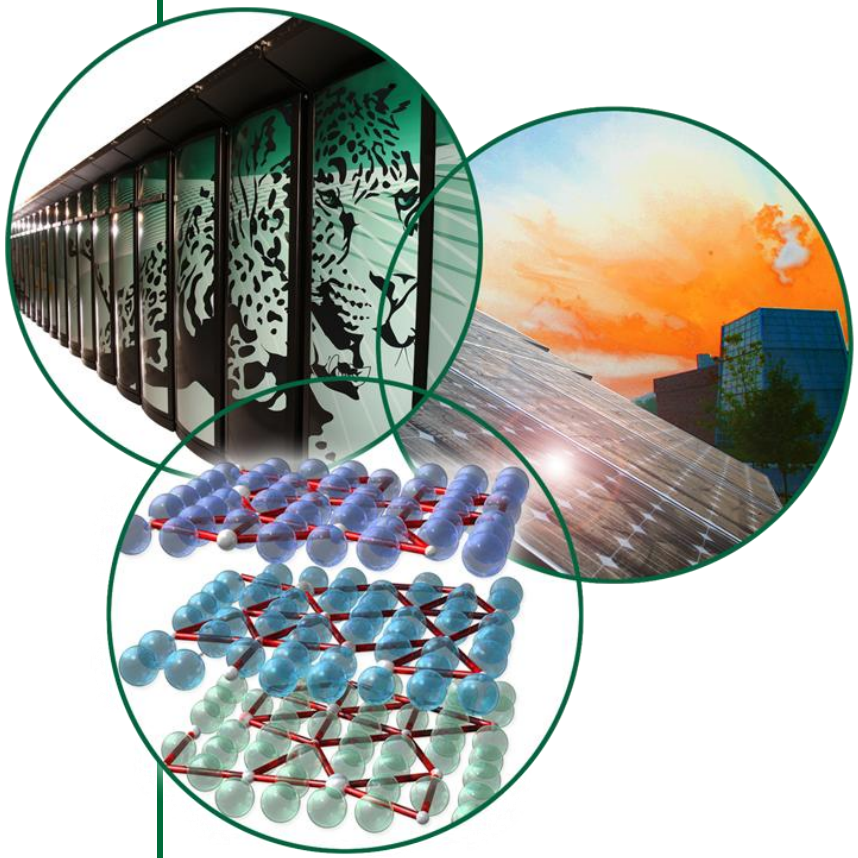


SCALE Is Widely Used For S/U Calculations In Criticality Safety

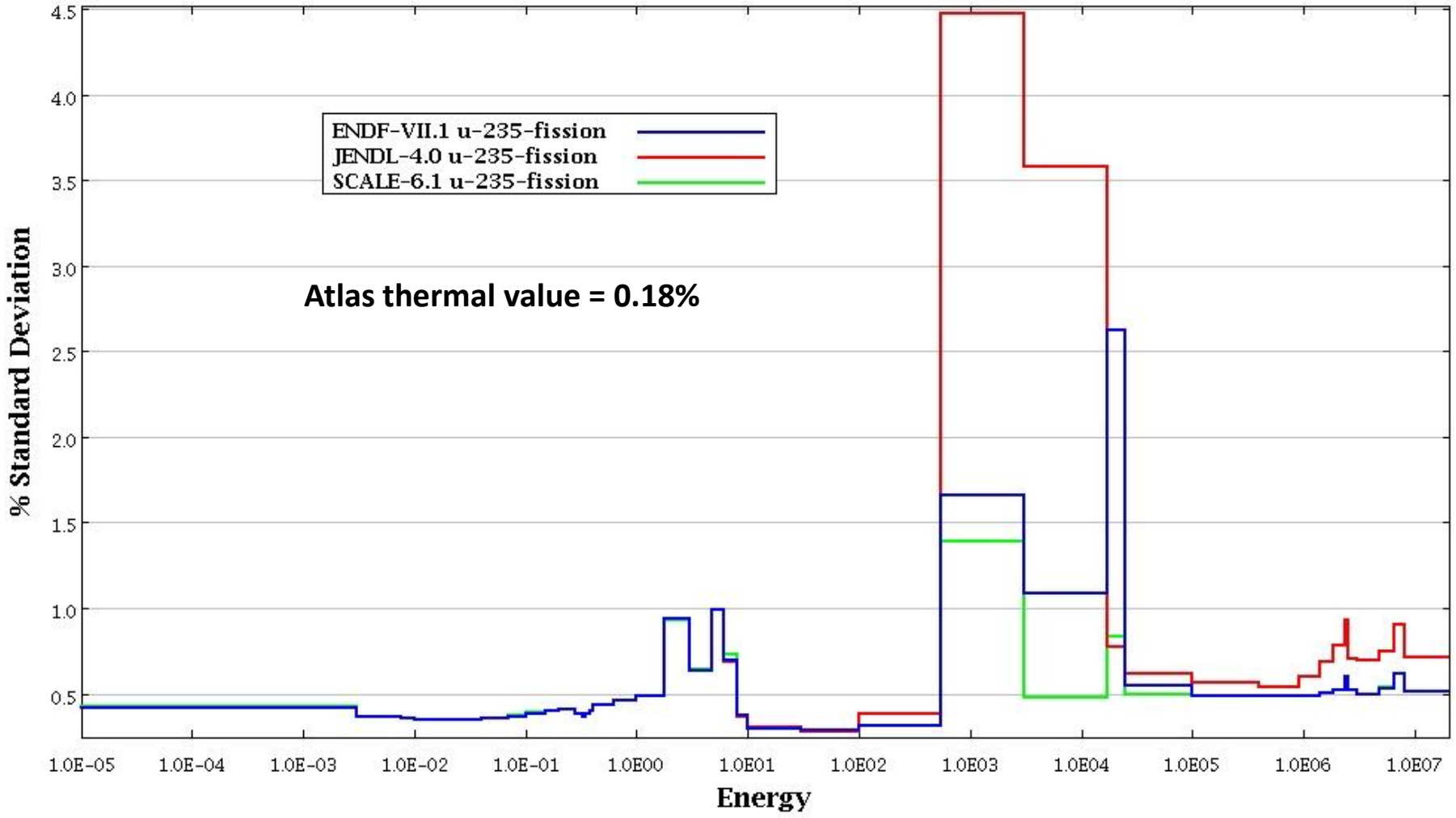
- S/U techniques compute bias and uncertainty in system k_{eff},
- Criticality safety requires robust methods and data to address fast, intermediate, thermal critical configurations
- S/U tools in SCALE include:
  - Monte Carlo transport codes to compute sensitivity coefficients for realistic geometries
  - methods to treat implicit self-shielding sensitivities for thermal systems
  - general purpose covariance library containing high and low fidelity data for ~ 400 materials was distributed with SCALE-6.1 (2011)

SCALE-6.2 Will Include Cross Section Libraries and Covariance Data Processed from ENDF/B-VII.1

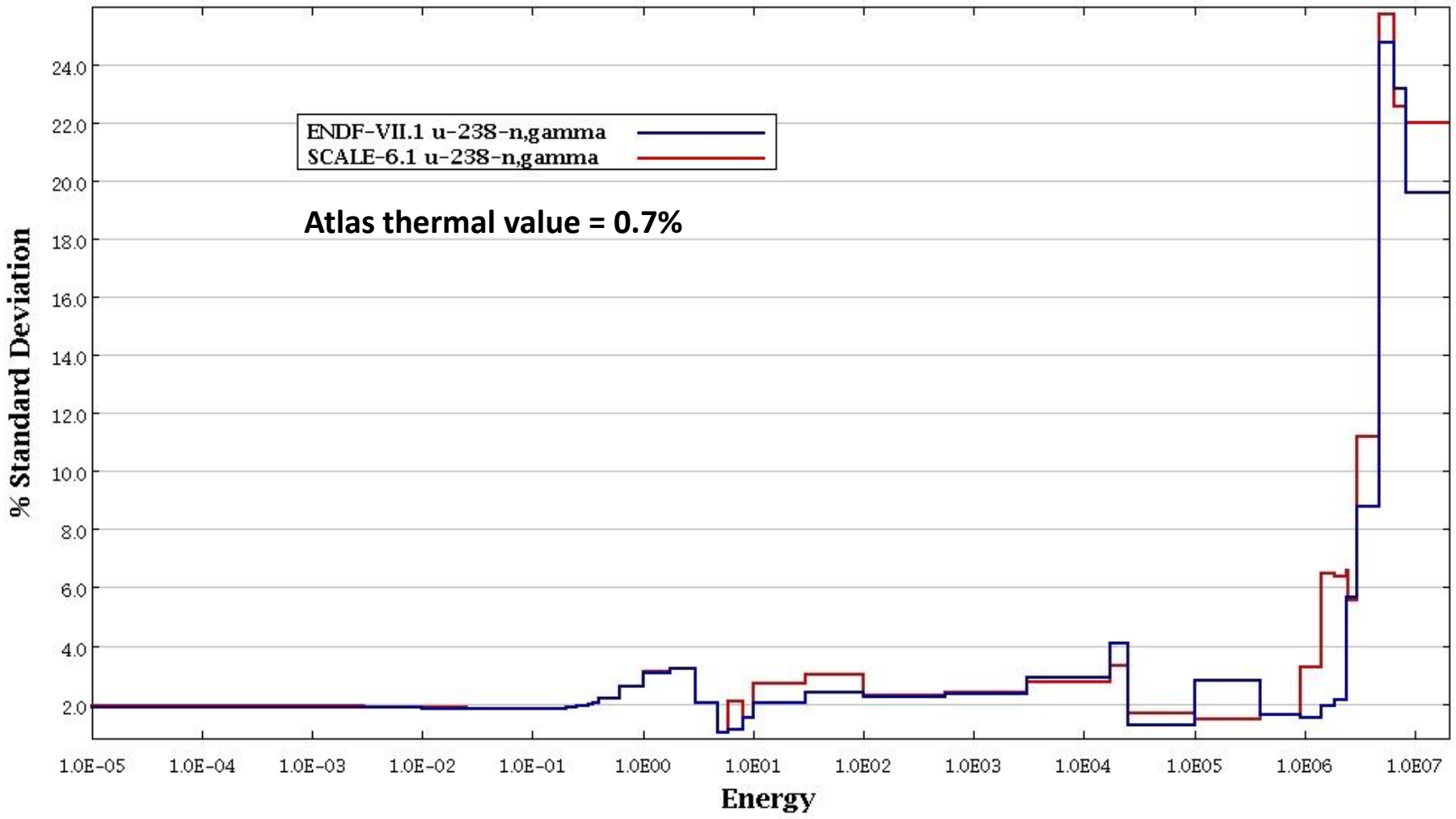
Validation studies performed for 320 benchmark experiments

- Continuous energy (CE), 252g multigroup, and covariance data were processed using AMPX
- Critical eigenvalues computed with Keno Monte Carlo code using both 252g and CE
- Covariance library generated by replacing covariances in SCALE-6.1 with ENDF-VII.1 data, if available. Variations were made in some ENDF-VII.1 values
- S/U calculations with 252g TSUNAMI-3D (Keno)

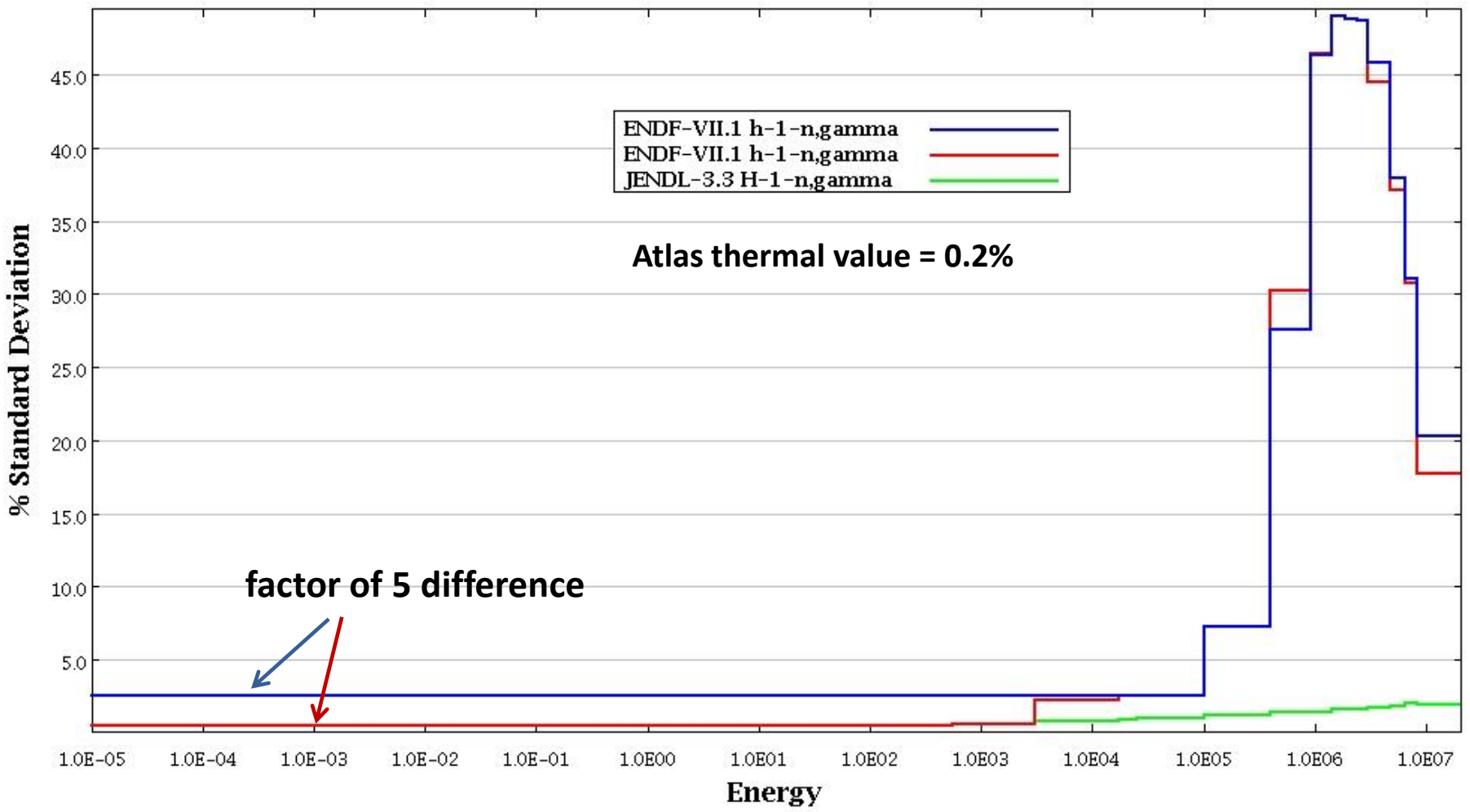
U235 Fission Uncertainty



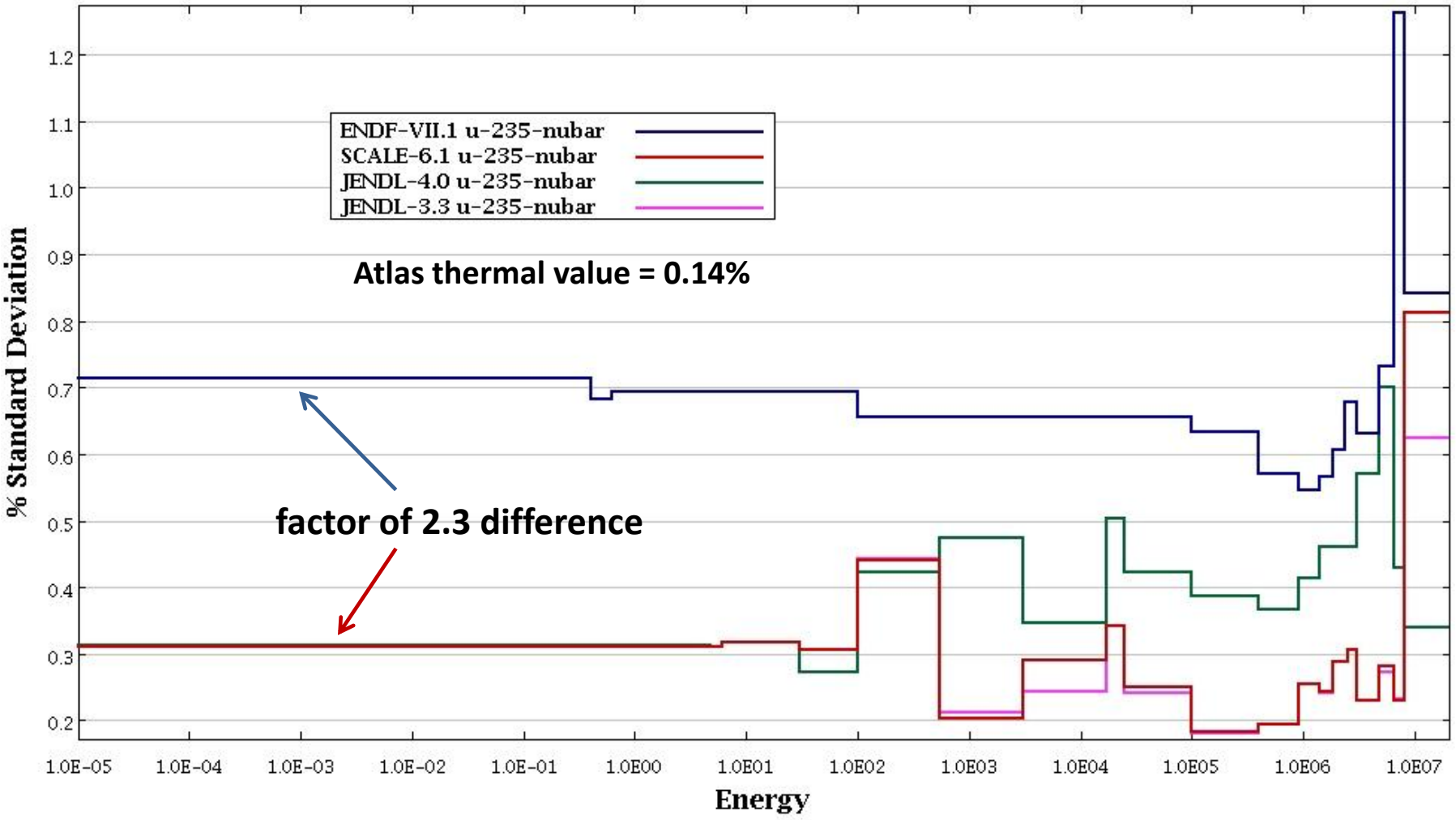
U238 Capture Uncertainty



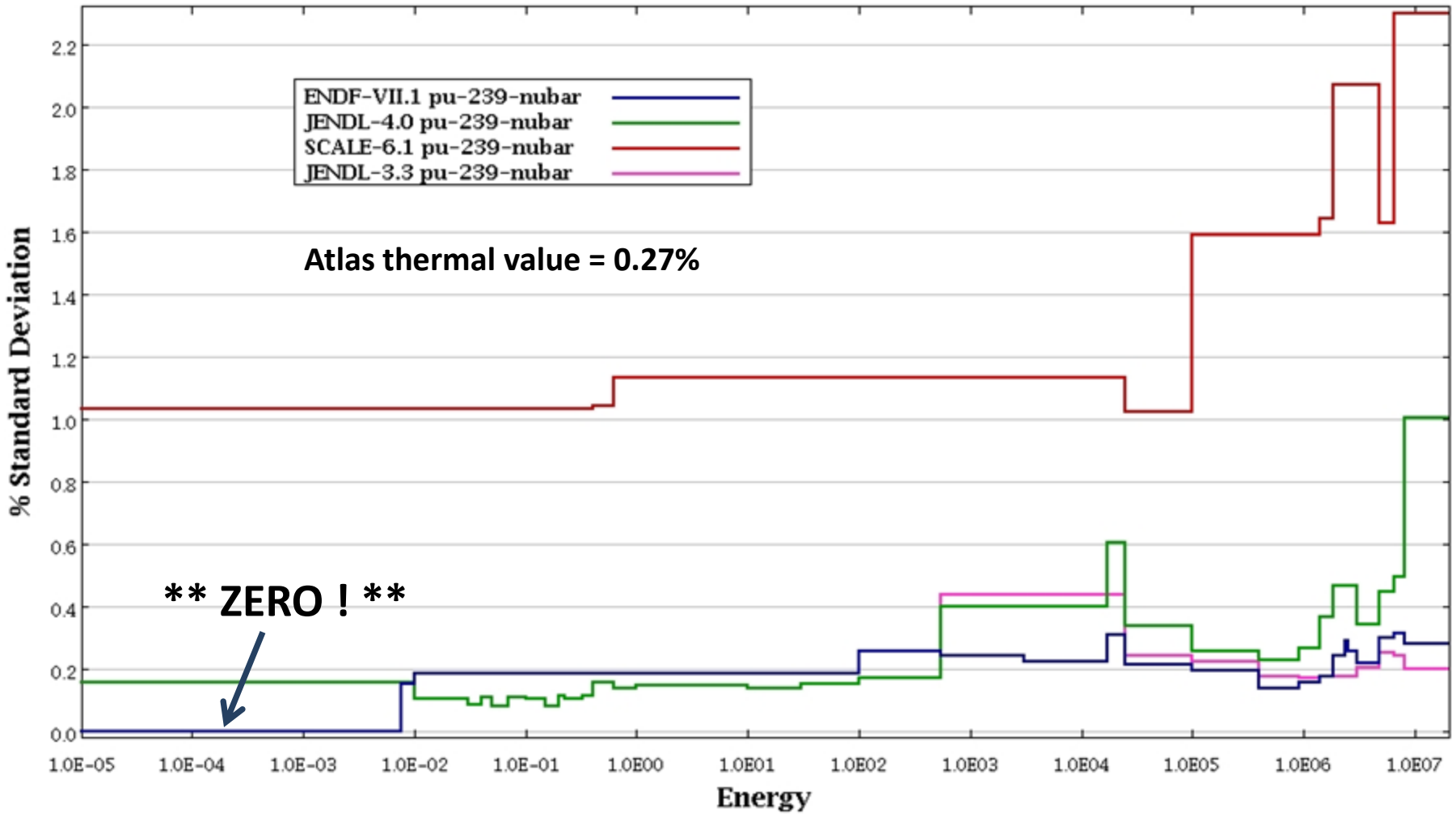
H Capture Uncertainty



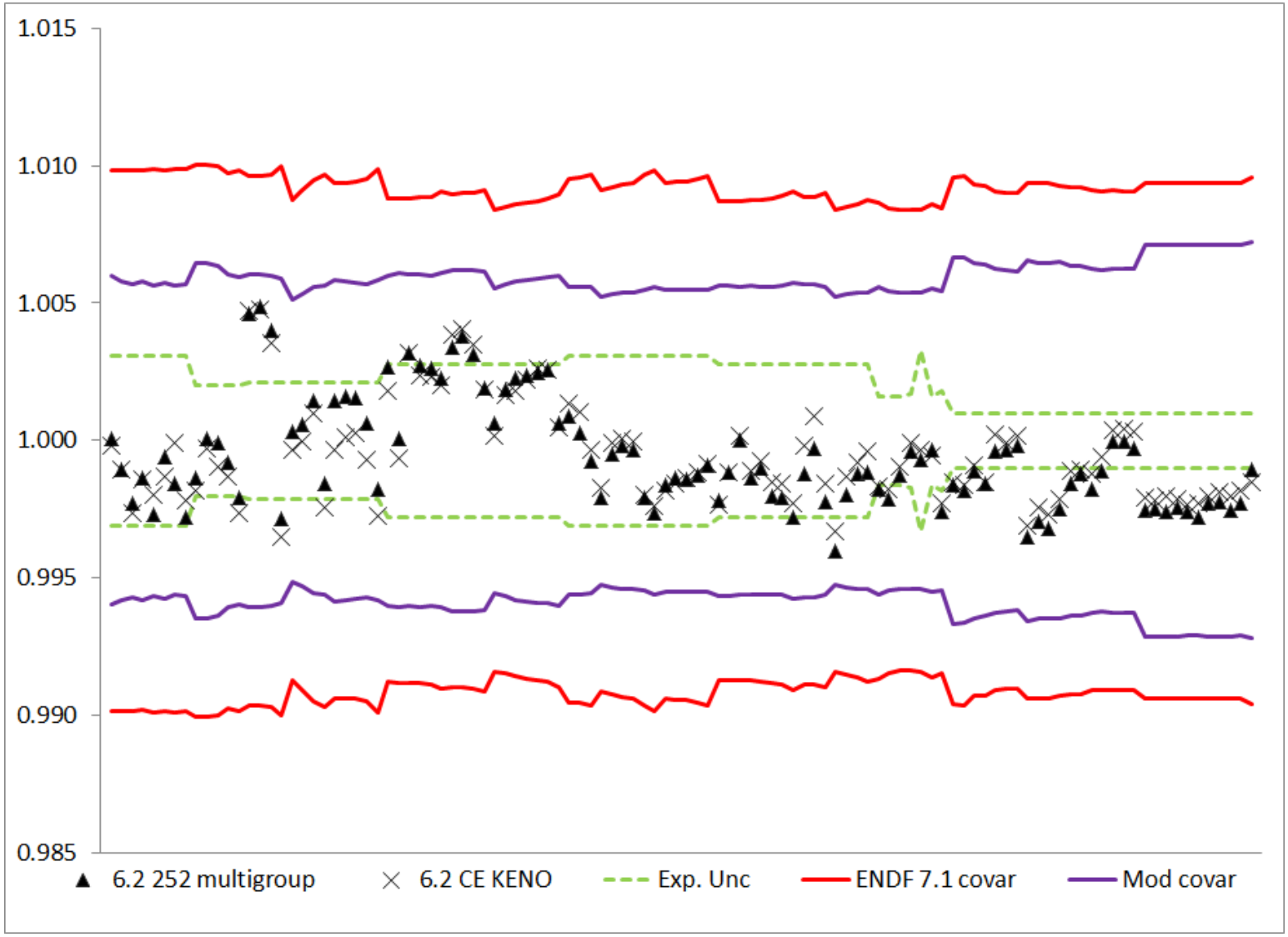
U235 Nu-Bar Uncertainty



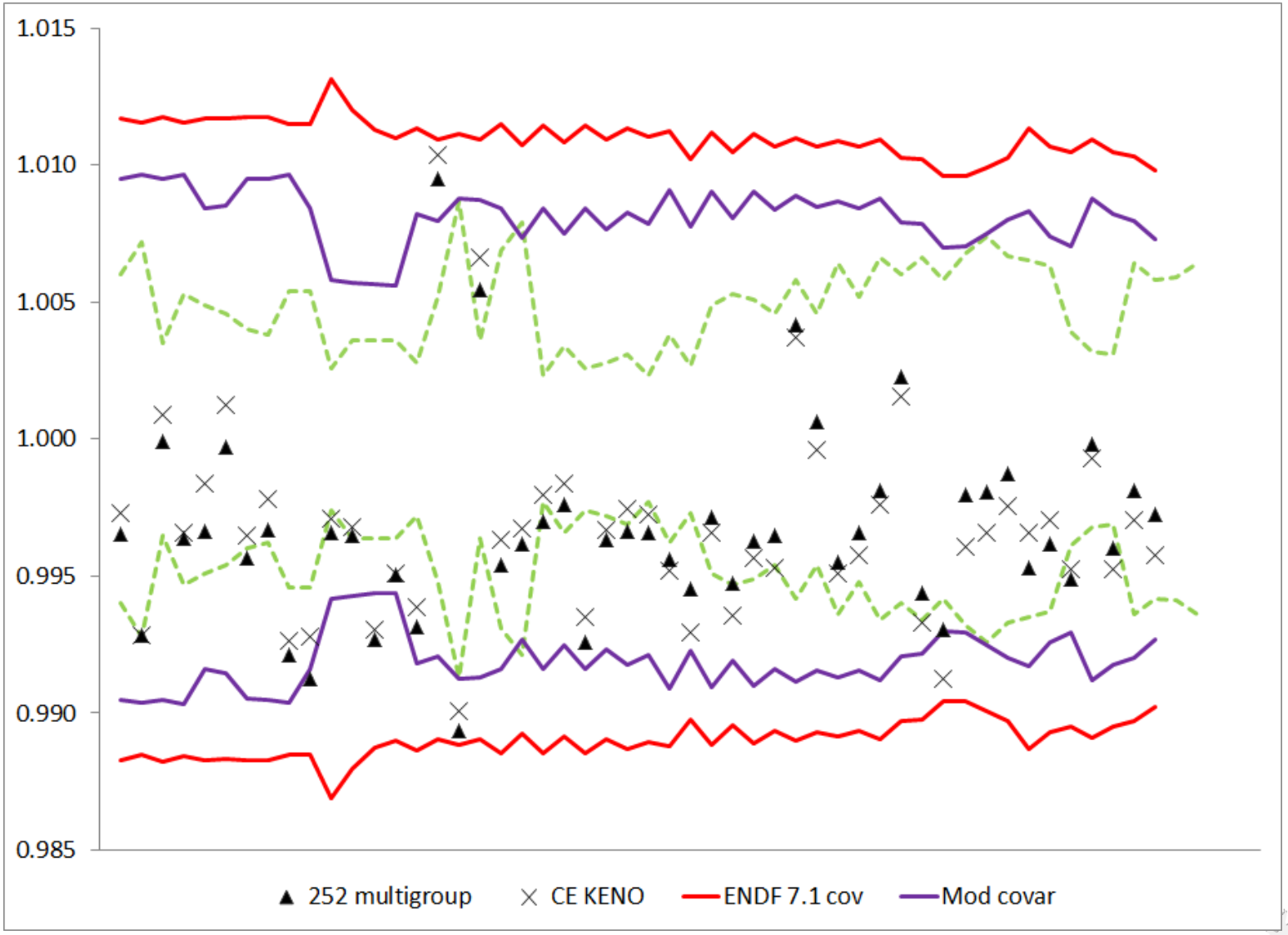
Pu239 Nu-Bar Uncertainty



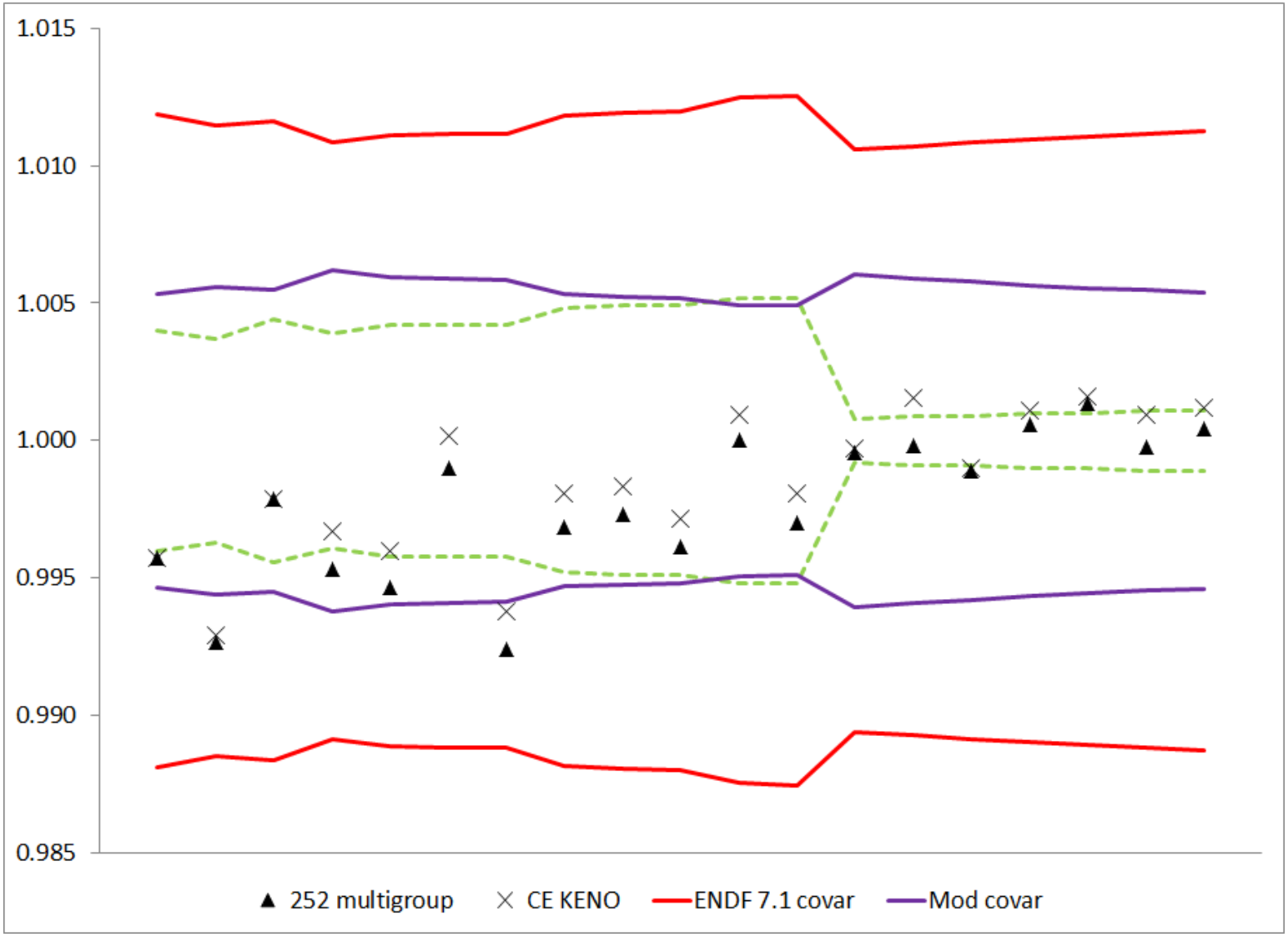
Uncertainties for LEU-COMP-THERM Benchmarks



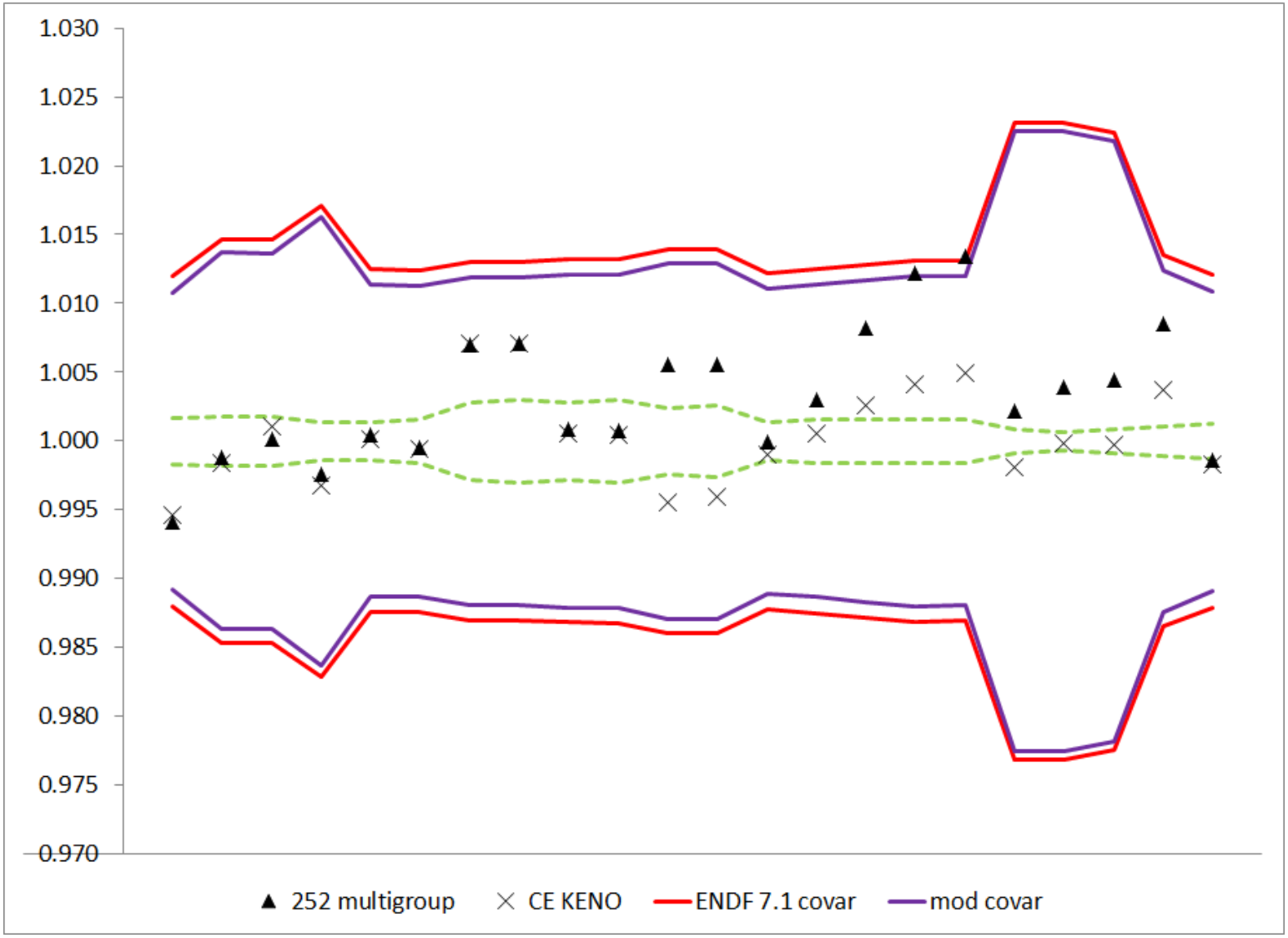
Uncertainties for HEU-SOL-THERM Benchmarks



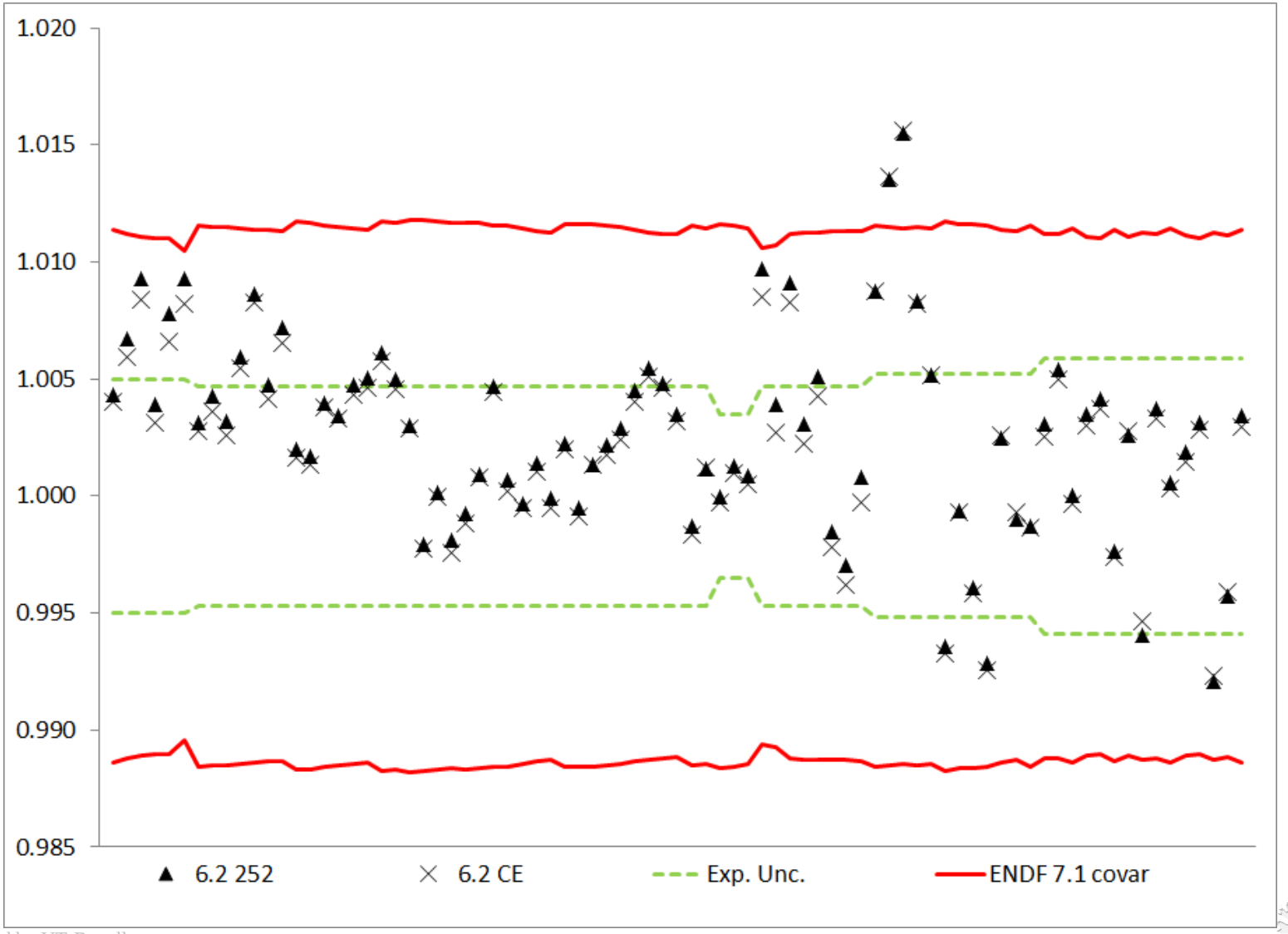
Uncertainties for LEU-SOL-THERM Benchmarks



Uncertainties for HEU-MET-FAST Benchmarks



Uncertainties for PU-SOL-THERM Benchmarks



Observed Standard Deviations are Less Than Predicted from Nuclear Data Covariances

Cases	St. Dev (pcm) from C/E Values	St. Dev (pcm) from S/U
HST	590	800
LST	259	556
LCT	185	583

Conclusions

- ENDF/B-VII.1 provides new covariance data for many nuclides--- expands S/U capability
- Many VII.1 covariances are consistent with data in SCALE-6.1
- Some problems seem to exist with U235 and Pu239 thermal nubar data
- H-1 thermal capture data has 5X larger uncertainty than SCALE-6.1, JENDL, and Atlas
- Structure materials and fission products will require further investigation
- Further investigation of ENDF/B-VII.1 is needed before moving to production use