

Expansion of the ORNL VALID Library

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Outline

1. Brief introduction to VALID
2. Cases recently added to VALID
3. Results highlights
4. Conclusions

Brief introduction to VALID

- QA-like process to generate high quality models from reliable reference descriptions
 - Separate origination and review by qualified individuals
 - Documentation of model generation, results, and checks
 - Results are controlled to prevent inadvertent modification
- Primarily includes ICSBEP Handbook evaluations
- Most models include both KENO and TSUNAMI models
- Basis for SCALE/KENO validation reports, papers, and studies since SCALE 6.1 in 2011

Brief introduction to VALID (2)

- Cases included in VALID are documented in validation reports
 - 6.2.2 had 618 KENO models in 14 different ICSBEP categories
 - 428 cases also had SDFs
- Discussed in WPEC SG45 (VaNDaL) final report

Recent VALID Expansion: 138 Benchmarks

Experiment class	ICSBEP experiment numbers	Number of configurations
HEU-MET-FAST	1, 63, 72, 73, 84, 85	40/41 ^a
HEU-MET-INTER	6	4
HEU-SOL-INTER	1	2
HEU-SOL-THERM	4, 20	9
IEU-SOL-THERM	2, 3	59
LEU-COMP-THERM	25	4
PU-MET-FAST	24, 35, 40	3
PU-MET-MIXED	2	5
PU-SOL-THERM	16	11

^aIncludes both the “Godiva” and “shell” models for HMF-001.

- **Results shown for new benchmarks are from SCALE 6.2.4 with ENDF/B-VII.1 data.**
- **Existing results from the SCALE 6.2.4 Validation Report, also with ENDF/B-VII.1 data, are shown in some cases.**

Results highlights 1 of 6: HMF & HMI

- Added Godiva, ZEUS, HMF-084 and -085
- CE average C/E equivalent between new and previous models
 - 1.00159 ± 0.00044 (new) vs. 1.00196 ± 0.00039 (previous)
- MG average slightly lower than previous models
 - 1.00108 ± 0.00044 (new) vs. 1.00314 ± 0.00039 (previous)
- Notes on ZEUS
 - Known biases present for ZEUS cases (ENDF/B-VII.1)
 - No multigroup results for ZEUS models
 - Axial and radial heterogeneity cannot be adequately represented

Results highlights 2 of 6: HSI/HST

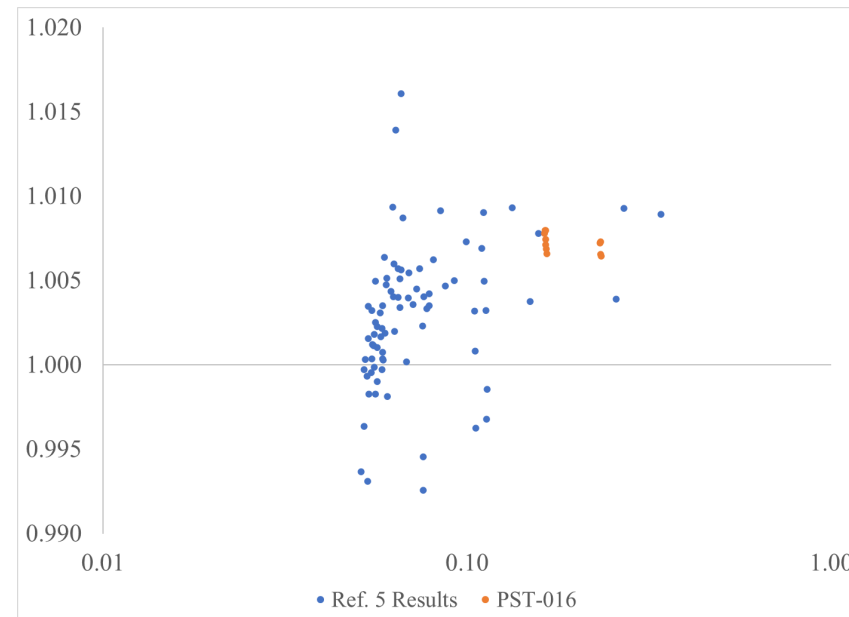
- HIS-001 /HST-004 and HST-020 contain 11 deuterium-moderated solutions
- Larger difference between MG and CE results than typical
 - Not statistically significant including experimental uncertainty
 - Indicative that structure of 252 groups could be improved for deuterium-moderated systems
- Evidence for strong trend with EALF seen: decreasing C/E with increasing EALF from thermal to low intermediate range
 - Similar to trend in ^{233}U -fueled solutions

Results highlights 3 of 6: IST

- First thermal spectrum intermediate enrichment systems added to VALID
- IST-002 slightly overpredicted, IST-003 slightly underpredicted
- Overall average C/E for IST cases is within one standard deviation of 1
 - No statistically significant trend as a function of spectrum

Results highlights 4 of 6: PMF and PST

- Only three PMF cases added, no significant impact
- PST-016 added in support of NCSP intercomparison
 - Average C/E higher than overall PST average
 - Points within range of EALF and C/E values of other results

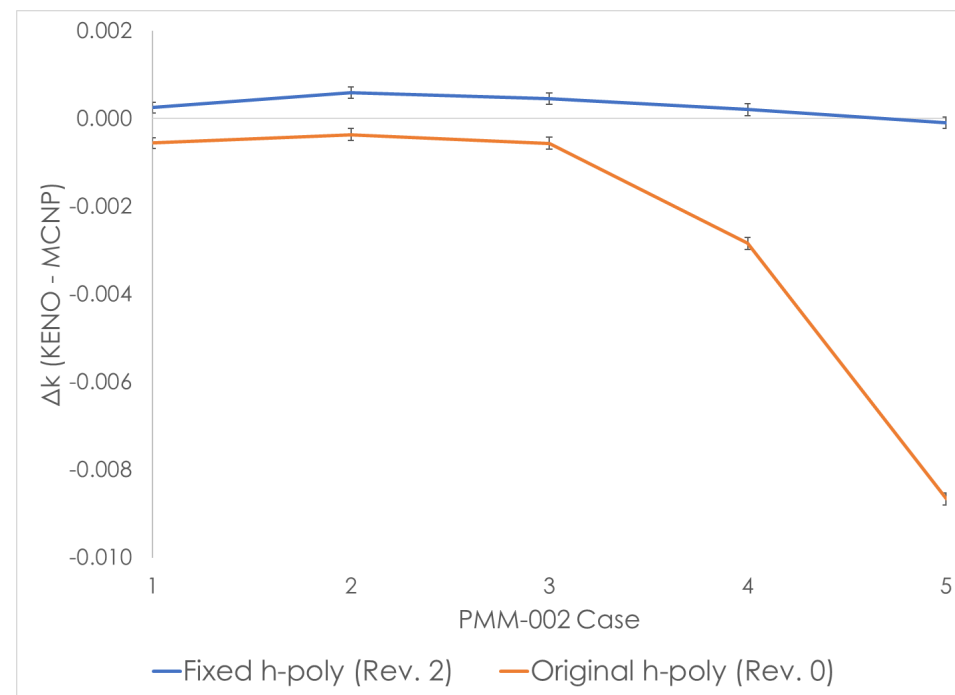


Results highlights 5 of 6: LCT experiments

- LCT-025 (4 cases) added as first hexagonal pitch LCT experiment in VALID
 - 7.5 wt% enrichment of interest for LEU+/HALEU applications
 - Modeled in KENO-VI for simplicity with hexagonal array
- Difference between MG and CE may be slightly larger than for square-pitched cases
 - SQUAREPITCH uses MOC solver, TRIANGPITCH still uses S_N
 - More cases needed to improve statistical confidence

Results highlights 6 of 6: PMM-002

- TEX Pu baseline experiments
 - “Simplified” models because KENO-VI does not have a toroid
- Energy-dependent bias from sample results helped diagnose processing error caused by ENDF manual issue
 - Issued [SSE notification](#) February 26, 2021
 - [Fixed CE data](#) is available
 - See paper from June 2021 meeting for more details



Conclusions

- VALID continues as a library of high-quality models used for testing SCALE and nuclear data
- Recent expansion largest impactful change in a decade
 - Adding ^{233}U experiments circa 2017 added more cases
- Huge number of cases in the pipeline
 - Lack of qualified staff and funding to complete reviews
- Future plans should simplify process and increase availability of models and results for external users
 - Plan for revised procedure discussed in Travis Greene paper presented yesterday afternoon

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Questions?

