

# Recent Fast Data Testing Results from Los Alamos

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- A set of proposed actinide evaluations for ENDF/B-VII from Los Alamos was recently made available at <http://t2.lanl.gov/data/data/preVII-neutron>. This work reports the performance of these new evaluations for a number of fast critical assemblies.
- Calculations were made with MCNP5 using both the new cross sections and the previous cross sections based on Release 8 (.66c materials with .62c for oxygen). Large numbers of histories were used to keep the statistical errors fairly small.
- Both CSEWG benchmark models and the newer models from the International Handbook of Evaluated Criticality Safety Benchmark Experiments (September 2003) were used.
- The results show a good degree of improvement in predicting criticality for these benchmark experiments.

# Assemblies Calculated

- Godiva – bare sphere of U-235 (CSEWG model)
- HMF001 – Godiva (Handbook model)
- Jezebel – bare sphere of Pu-239
- PMF001 – Jezebel
- Flattop-25 – sphere of U-235 reflected by normal uranium
- HMF028 – Flattop-25
- Flattop-Pu – sphere of Pu-239 reflected by normal uranium
- PMF006 – Flattop-Pu
- Jezebel-23 – bare sphere of U-233
- UMF001 – Jezebel-23
- Flattop-23 – sphere of U-233 reflected by normal uranium
- UMF006 – Flattop-23

## Assemblies Calculated (cont)

- Bigten – interleaved plates of U-235 and normal uranium reflected by normal uranium (CSEWG homogenized two-region spherical model)
- IMF007h – Bigten (homogenized two-zone cylindrical model)
- IMF007s – Bigten (“simplified” 85-cell model)
- PMF011 – sphere of Pu-239 reflected by water
- HMF004 – sphere of U-235 reflected by water

# Features of the New Evaluations

- U-235 – revised fission and nubar in MeV range; new unresolved from ORNL.
- Np-237 – revised fission, preserving ratios to U-235.
- Pu-239 – revised fission and nubar, preserving ratios to U-235; new (n,2n) .
- U-238 – revised fission, preserving ratios to U-235; new elastic, inelastic, and higher reactions with modern treatment of the direct part; new fission chi matrix; new resonance parameters from ORNL.
- U-233 – entirely new evaluation; high-energy part uses modern treatment of direct reactions; new resonance parameters from ORNL.
- U-234, U-236 – entirely new evaluations above the resonance range.

## MCNP5 Results for $k_{\text{eff}}$

Assembly	Experiment	New XS	Release 8
Godiva	1.0000(10)	.99970(19)	.99665(19)
HMF001	1.0000(10)	.99942(19)	.99664(19)
Jezebel	1.0000(20)	1.00051(18)	.99722(18)
PMF001	1.0000(20)	1.00024(18)	.99750(19)
Flattop-25	1.0000(10)	1.00299(21)	1.00193(19)
HMF028	1.0000(30)	1.00328(20)	1.00147(21)
Flattop-Pu	1.0000(14)	1.00194(23)	1.00282(22)
PMF006	1.0000(30)	1.00128(22)	1.00203(22)
Jezebel-23	1.0000(10)	.99883(18)	.99255(18)
UMF001	1.0000(10)	.99857(18)	.99256(18)
Flattop-23	1.0000(14)	1.00059(22)	1.00239(23)
UMF006	1.0000(14)	.99864(21)	1.00055(21)

## MCNP5 Results for $k_{\text{eff}}$ (cont)

Assembly	Experiment	New XS	Release 8
Bigten	.9960(30)	.99708(16) C/E=1.00108	1.00950(17) C/E=1.01355
IMF007h	.9948(13)	.99465(16) C/E=.99985	1.00724(16) C/E=1.01251
IMF007s	1.0045(07)	1.00439(24) C/E=.99989	1.01622(24) C/E=1.01167
PMF011	1.0000(10)	.99908(23)	.99715(23)
HMF004	.9985	.99845(24) C/E=.99995	.99476(25) C/E=.99625

# Summary of Results

- Godiva and Jezebel results show good  $k$  values as a result of the changes in fission and nubar. The U238/U235 fission ratio C/E for Godiva of .96 indicates that the spectrum is probably a bit too soft.
- The reflector bias for U-235 and Pu-239 is reduced quite a bit as shown by the Flattop-25 and Flattop-Pu results, although the  $k$  values for the Flattops are still a little too large, especially for the uranium core (perhaps because of the soft spectrum).
- The improvement in Jezebel-23 and Flattop-23 is dramatic, mostly resulting from the sophisticated new inelastic analysis. Spectral indices now come in within 2% of experiment.
- The improvement in Bigten is also dramatic, mostly resulting from the new inelastic data in the U-238 evaluation. The U238/U235 fission ratio goes from being 3-4% too large to being 4-5% too small, but the small result is more like the small result in Godiva.

# Future Work

- These results will probably look a little worse after adjustments to the cross sections resulting from the standards work (based on preliminary results for the standards).
- The next good improvements could possibly come from updating the treatment of inelastic scattering in U-235 using the methods that were effective for U-233.