Testing of ENDF/B-VIIβ0

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October 8th, 2005

RACER Results for 37 Thermal Solution Experiments (HST's) Using PRE7B0 Data

ICSBE Name	# of Cases	Geometry	Relected/Unrefelcted	Solution
HEU-SOL-THERM-001	10	Cylindrical	Unreflected	Nitrate
HEU-SOL-THERM-009	4	Spherical	Reflected	Oxyfluoride
HEU-SOL-THERM-010	4	Spherical	Reflected	Oxyfluoride
HEU-SOL-THERM-011	2	Spherical	Reflected	Oxyfluoride
HEU-SOL-THERM-012	1	Spherical	Reflected	Oxyfluoride
HEU-SOL-THERM-013	4	Spherical	Unreflected	Nitrate
HEU-SOL-THERM-032	1	Spherical	Unreflected	Nitrate
HEU-SOL-THERM-042	8	Spherical	Unreflected	Nitrate
HEU-SOL-THERM-043	3	Spherical	Unreflected	Oxyfluoride

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Ensemble-Average Value Comparisons

- Comparisons of k-eff, core leakage, and absorption fractions[1,2].

Parameter	ENDF65 Avg.	ENDF65+ Avg.	PRE70B Avg.	PRE70B-ENDF65	PRE70B-ENDF65+
k-corrected	0.99971	0.99950	0.99914	-0.00057	-0.00036
Total Leakage	2.9947E-01	2.9953E-01	2.9981E-01	3.3981E-04	2.7722E-04
H Abs.	1.9411E-01	1.9425E-01	1.9434E-01	2.2921E-04	8.2565E-05
O Abs.	3.1928E-03	3.1928E-03	3.0504E-03	-1.4240E-04	-1.4239E-04
U234 Abs.	1.5321E-03	1.5342E-03	1.5342E-03	2.0830E-06	-3.5676E-08
U235 Abs.	4.9011E-01	4.8989E-01	4.8969E-01	-4.2514E-04	-2.0459E-04
U235 Fis.	4.1041E-01	4.0986E-01	4.0971E-01	-6.9973E-04	-1.5676E-04
U235 Cap.	7.9707E-02	8.0029E-02	7.9982E-02	2.7459E-04	-4.7838E-05
U235 Cap. / Fis.	19.42%	19.53%	19.52%	0.10%	0.00%
U236 Abs.	2.0074E-04	2.0096E-04	2.0086E-04	1.1678E-07	-9.8649E-08
U238 Abs.	1.6956E-03	1.6976E-03	1.6835E-03	-1.2165E-05	-1.4128E-05
N Abs.	4.9410E-03	4.9476E-03	4.9493E-03	8.3913E-06	1.7304E-06
F Abs.	1.2770E-04	1.2774E-04	1.2527E-04	-2.4319E-06	-2.4743E-06

[1]Uncertainties are < 0.0004 Δk 95% C.I. on eigenvalues and < approx. 0.1% relative error in absorption fractions.

[2]ENDF65 consists of ENDF/B-VI.5 for all isotopes except 235U which is ENDF/B-VI.3. ENDF65+ includes ENDF/B-VI.5 235U.

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Linear Regression Analysis (RACER)

- Investigate trends in eigenvalue versus various regressors
  - above thermal leakage from core (ATL),
  - above thermal fission (ATF),
  - slowing down density to thermal (Slow-to-Thermal),
  - ^{1}H absorption fraction (H Abs.),
  - ^{16}O absorption fraction (O Abs.),
  - ^{235}U absorption fraction (U235 Abs.),
  - ^{238}U absorption fraction (U238 Abs.),
  - ^{1}H-to-^{235}U ratio in core (H-to-U),
  - ^{14}N absorptions fraction (N Abs.),
  - ^{19}F absorption fraction (F Abs.).
- Look for significant trends or significant changes in trends.
- Perform a multiple regression using all parameters

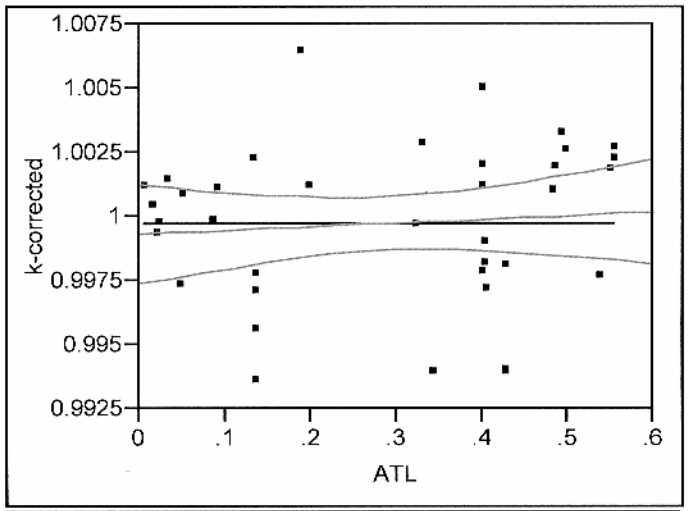
Linear Regression Results (RACER)

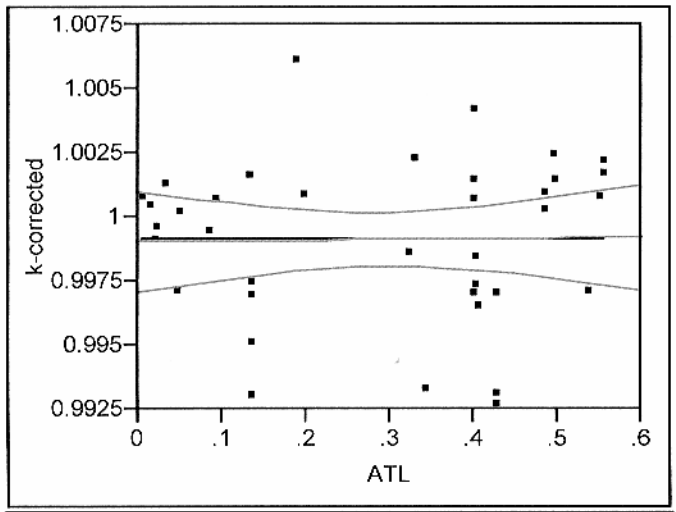
- No statistically significant differences were noted when comparing PRE7B0 to ENDF65.
- k(ATL) is shown as an example. A complete table and plots are available.

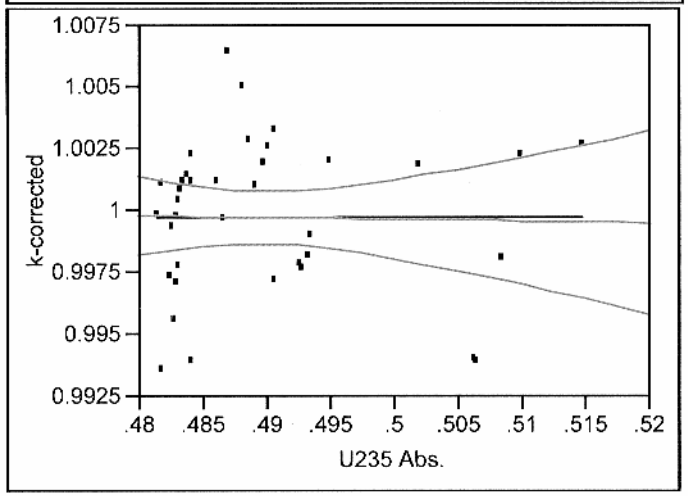
	ENDF65			PRE7B0		
Parameter	Intercept	Slope	R^2	Intercept	Slope	R^2
ATL	0.9993	0.0015	0.0079	0.9990	0.0003	0.0003

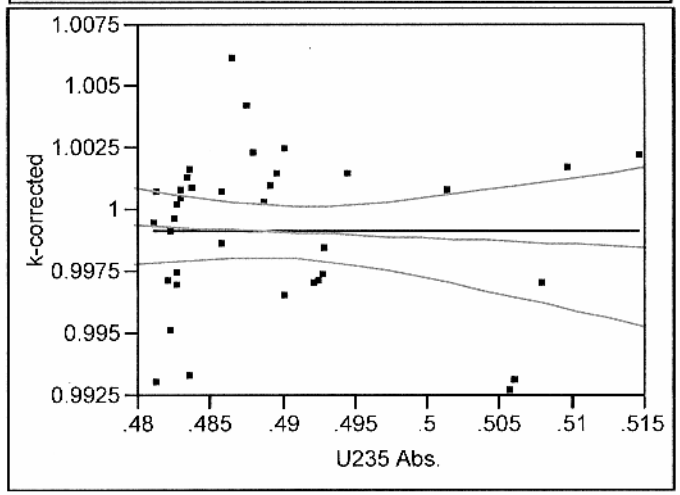
ENDF65

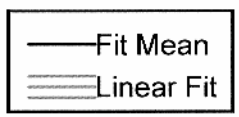
PRE7B0



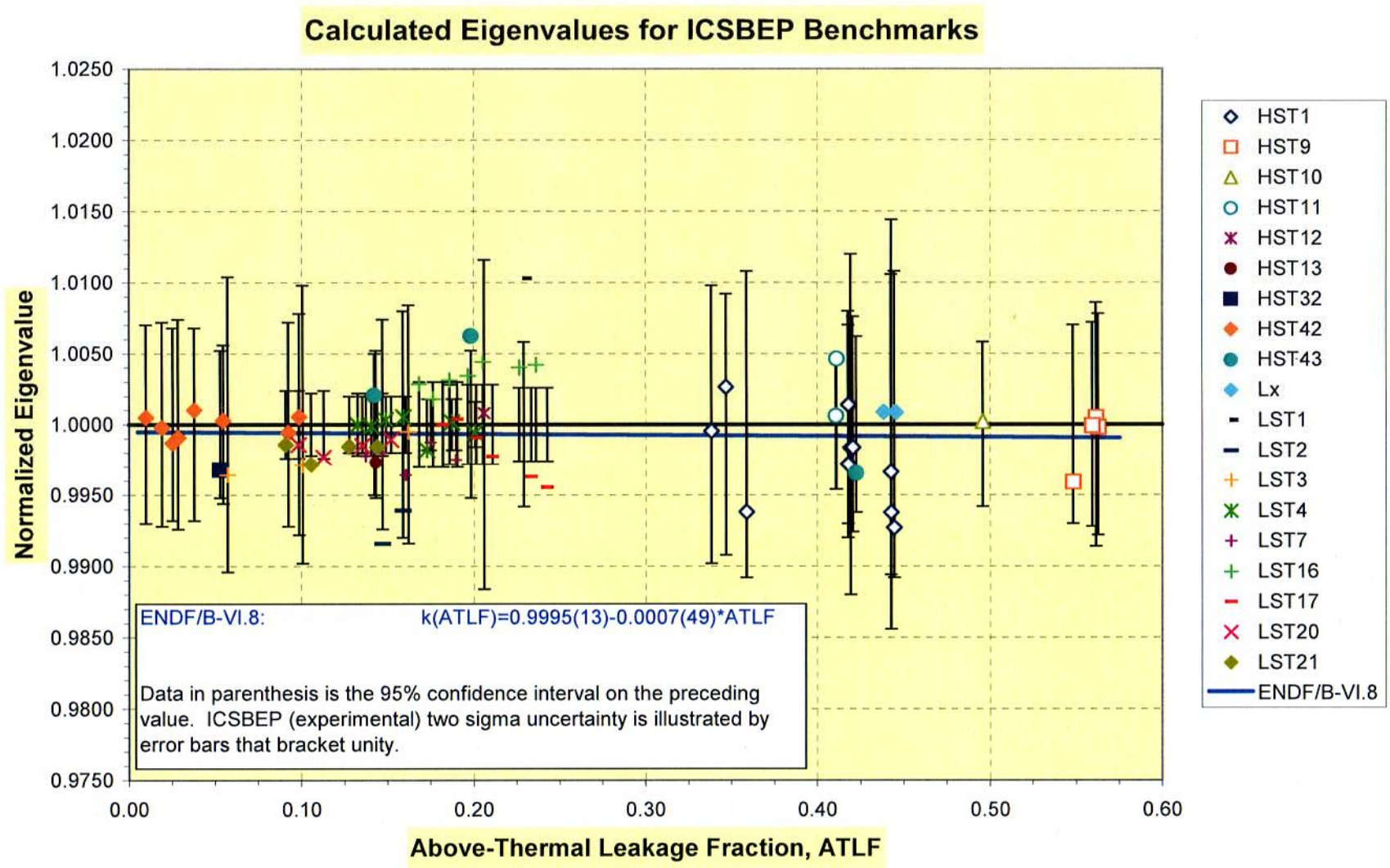




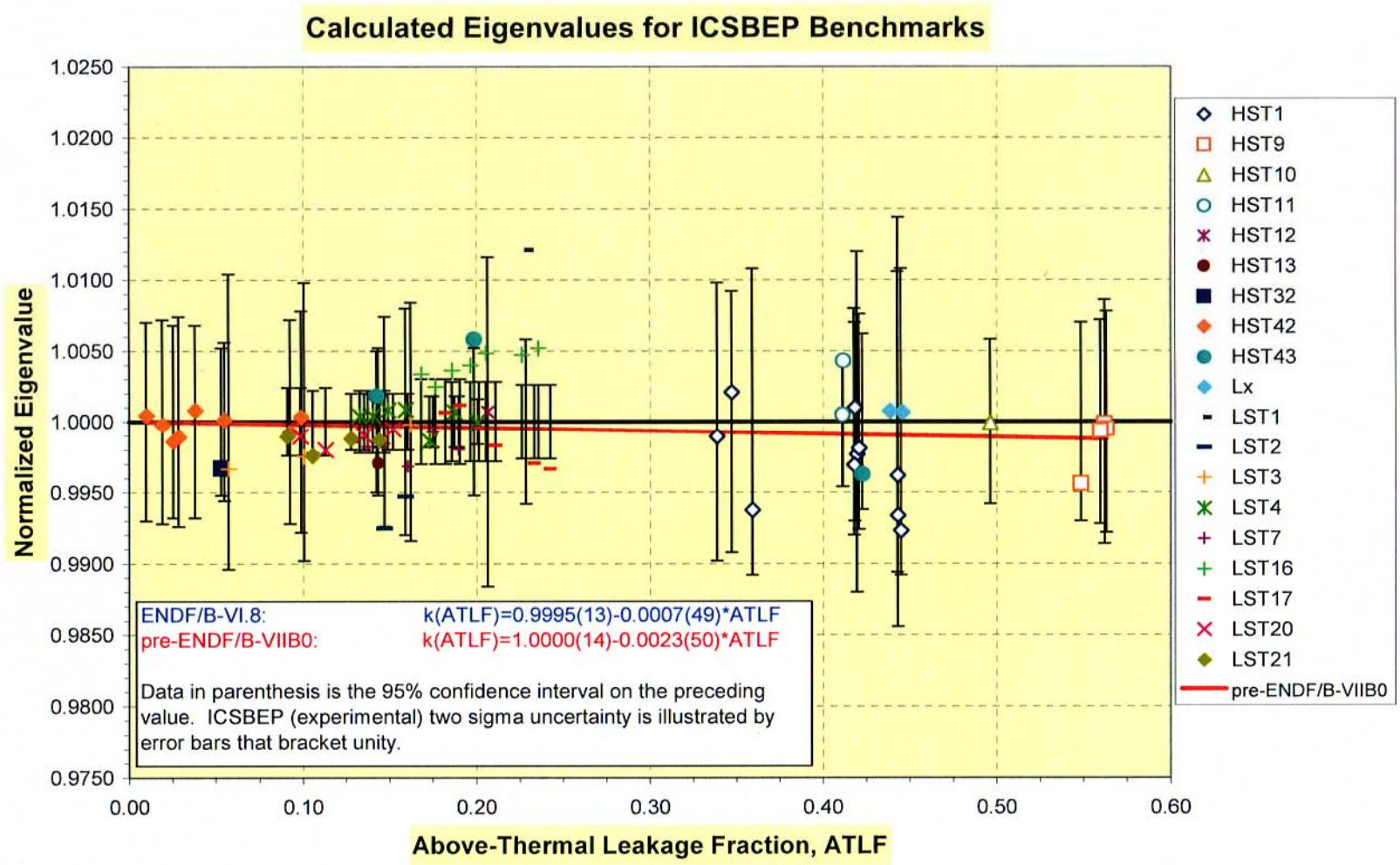




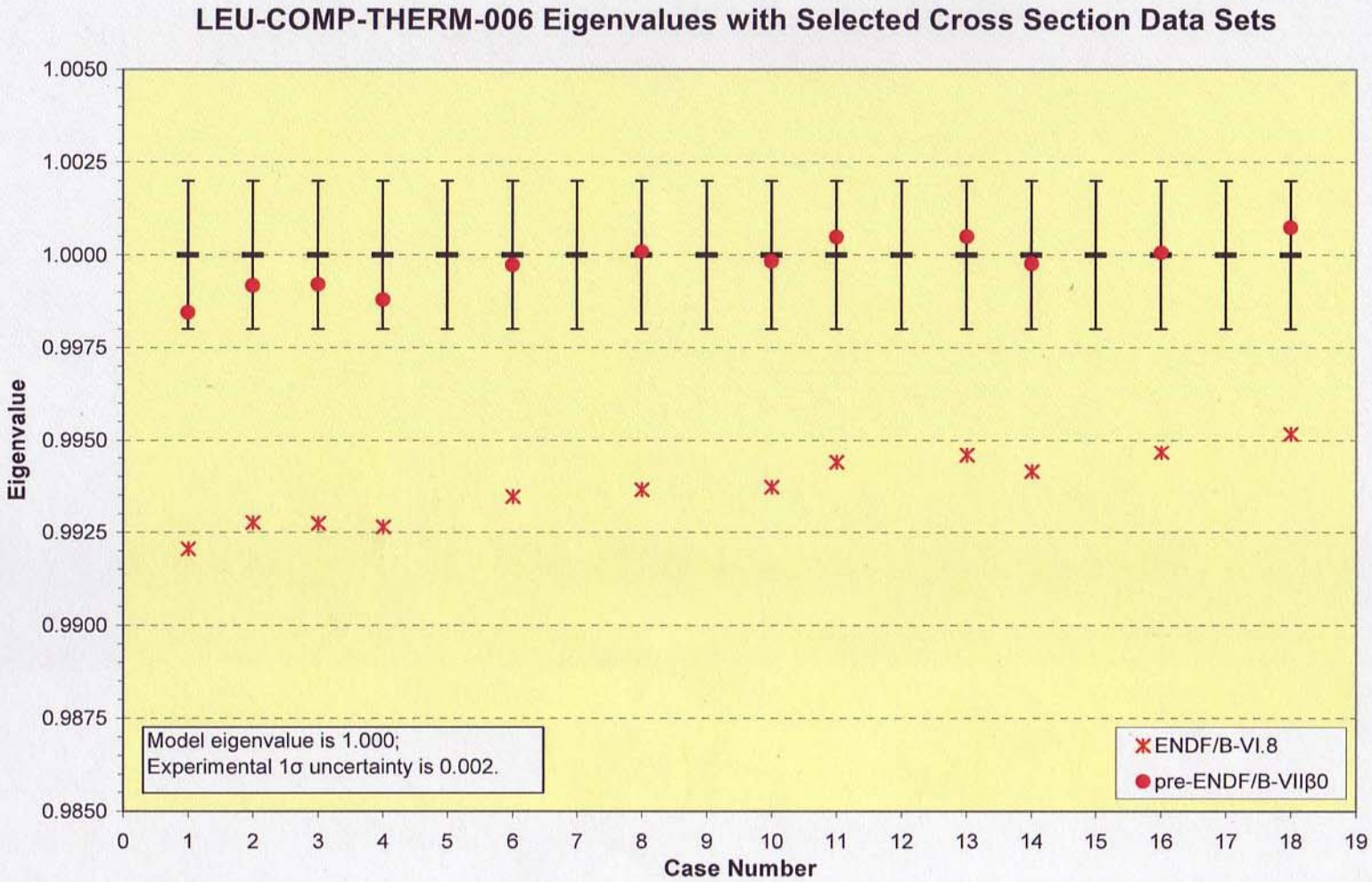
Joint HST / LST (ENDF/B-VI.8 RCP01)



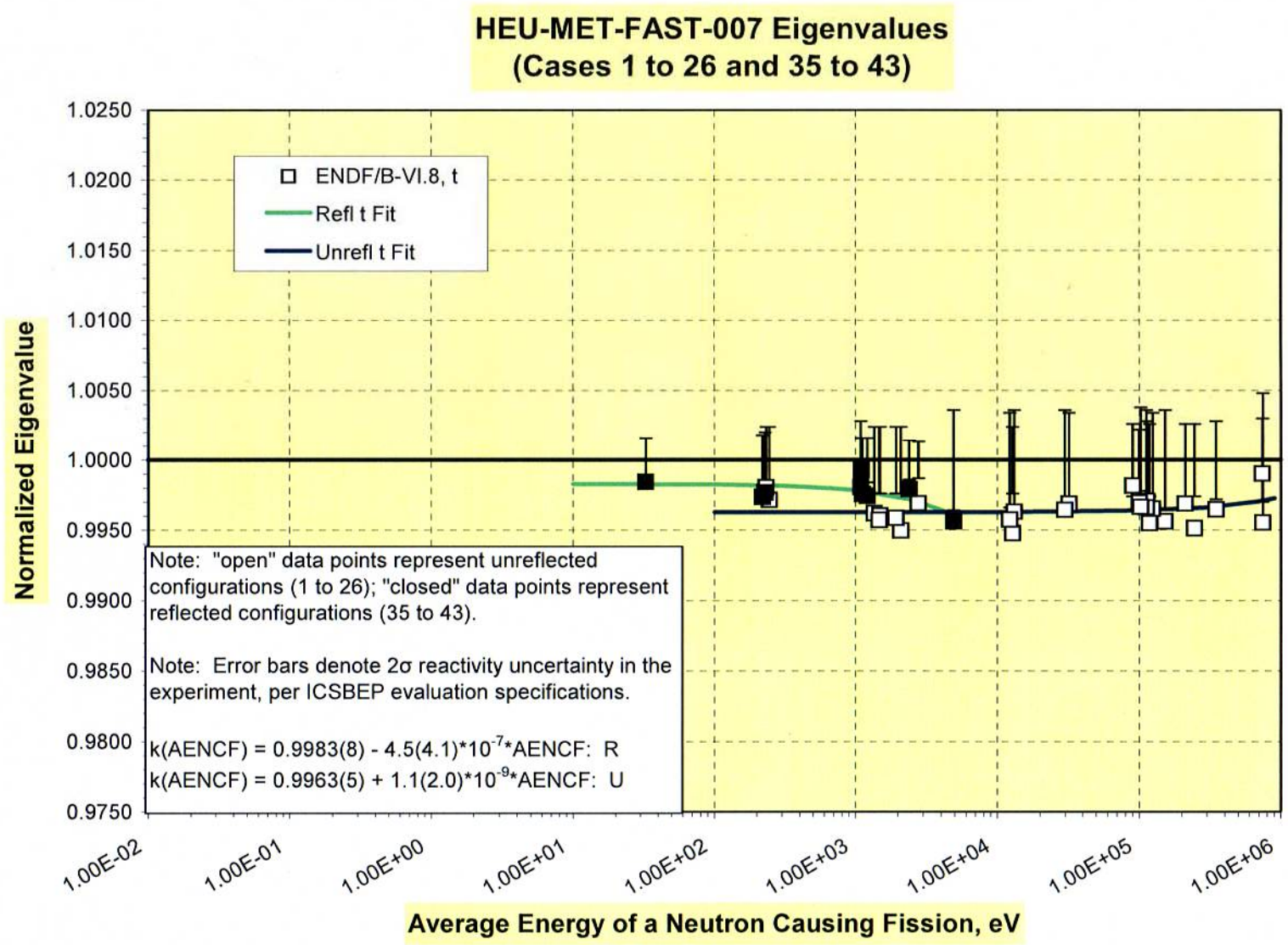
Joint HST / LST (ENDF/B-VIIβ0 RCP01)



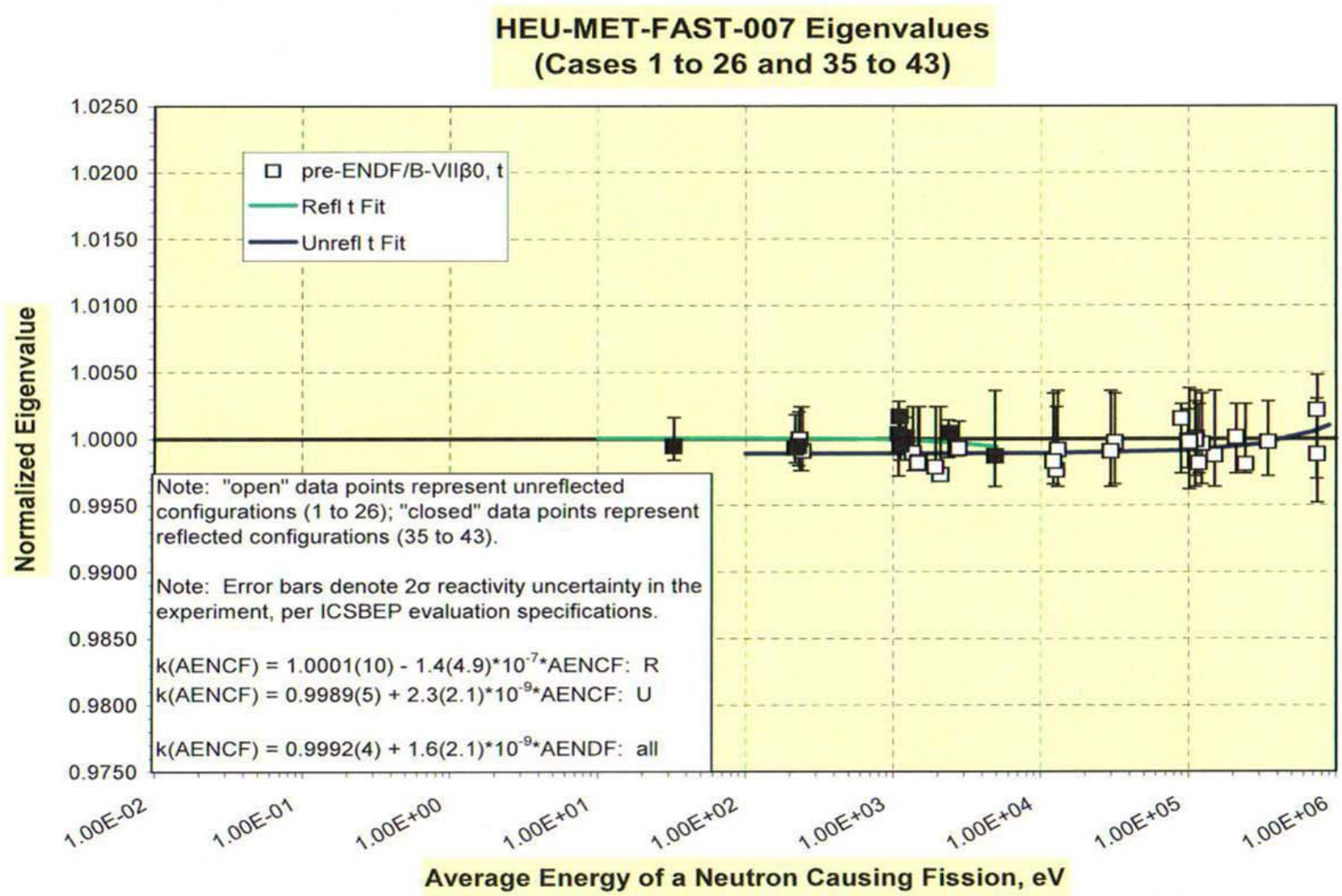
ENDF/B-VI.8 vs VIIβ0 LCT (RCP01)



ENDF/B-VI.8 HMF Results (RCP01)



ENDF/B-VIIβ0 HMF Results (RCP01)



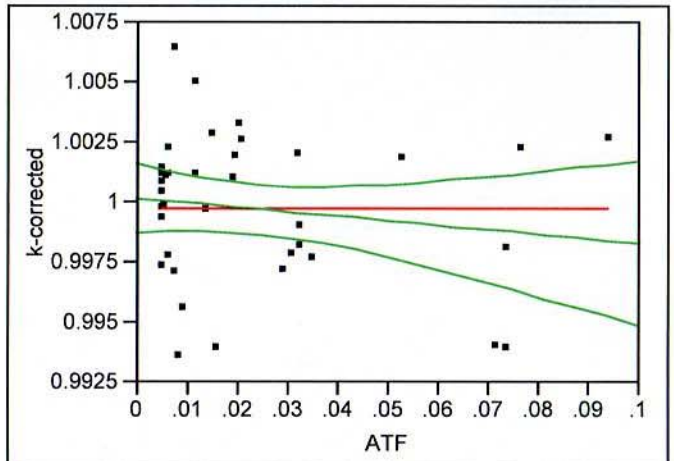
Conclusion

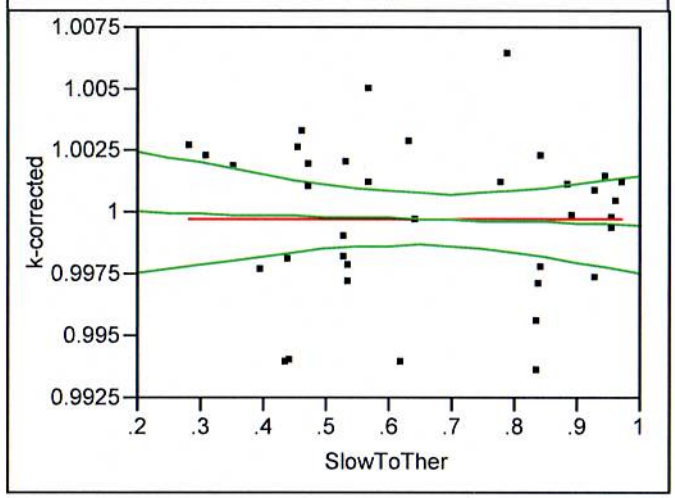
- For the ICSBEP benchmarks we examined, ENDF/B-VIIβ0 performs better than any previous data set we are aware of.
- The dearth of ICSBEP zirconium benchmarks prevents us from drawing any firm conclusions about the Subgroup-23 zirconium cross sections at this time.

Supplemental Information on RACER Results

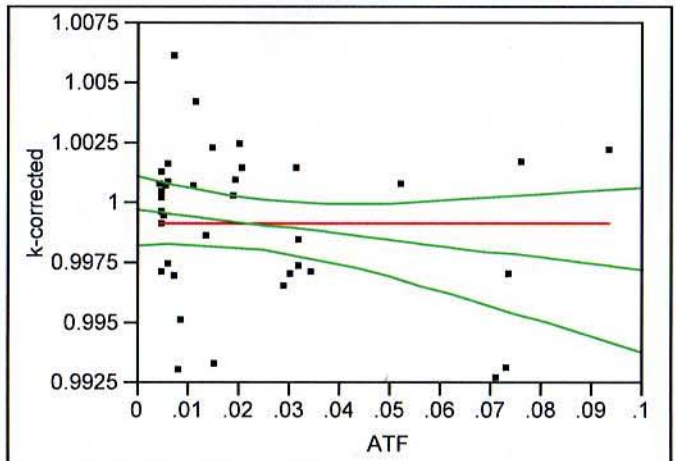
	ENDF65			PRE7B0		
Parameter	Intercept	Slope	R^2	Intercept	Slope	R^2
ATL	0.9993	0.0015	0.0079	0.9990	0.0003	0.0003
ATF	1.0002	-0.0187	0.0221	0.9997	-0.0248	0.0378
Slow-To-Thermal	1.0001	-0.0007	0.0021	0.9989	0.0003	0.0005
H Abs.	0.9995	0.0013	0.0055	0.9986	0.0026	0.0214
O Abs.	1.0029	-1.0064	0.0510	1.0014	-0.7550	0.0258
U235 Abs.	1.0032	-0.0072	0.0004	1.0109	-0.0240	0.0048
U238 Abs.	1.0003	-0.3516	0.0286	0.9999	-0.4600	0.0473
H-TO-U	0.9995	0.0000	0.0052	0.9986	0.0000	0.0207
N Abs.	1.0025	-0.8195	0.0355	1.0012	-0.6667	0.0213
F Abs.	1.0021	-1.8796	0.0082	1.0014	-1.7852	0.0074

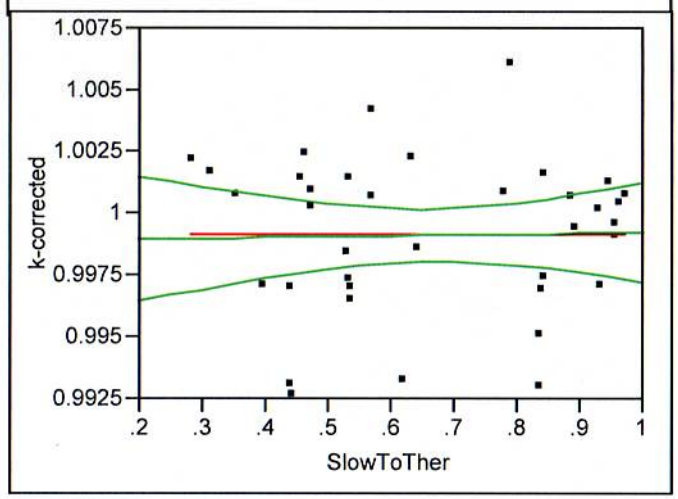
ENDF65

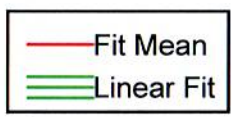




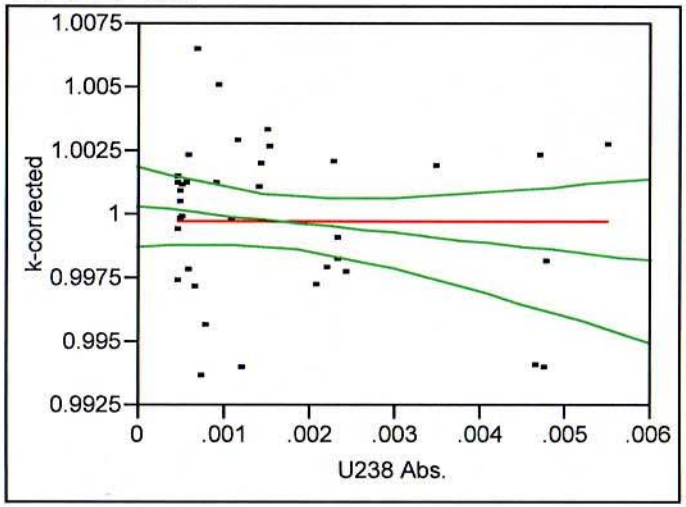
PRE70B

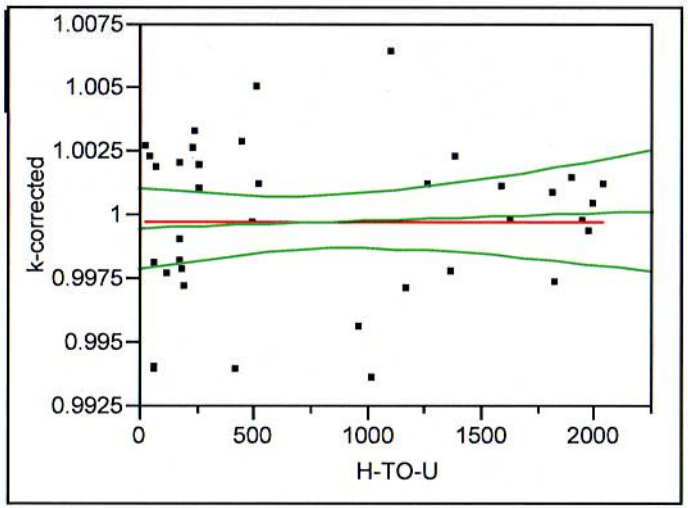




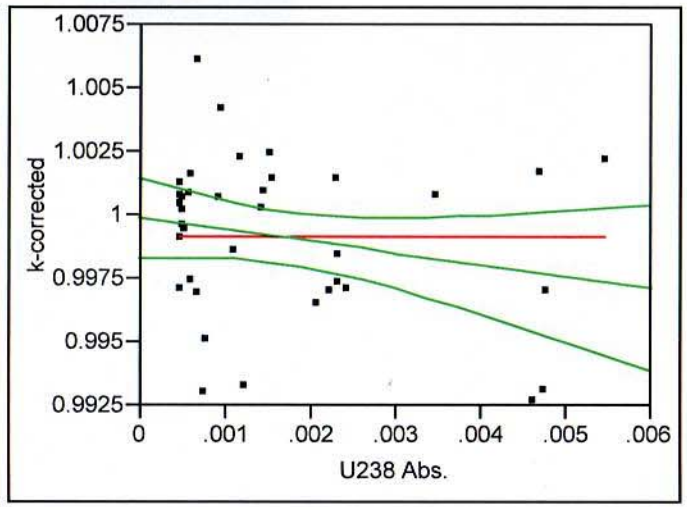


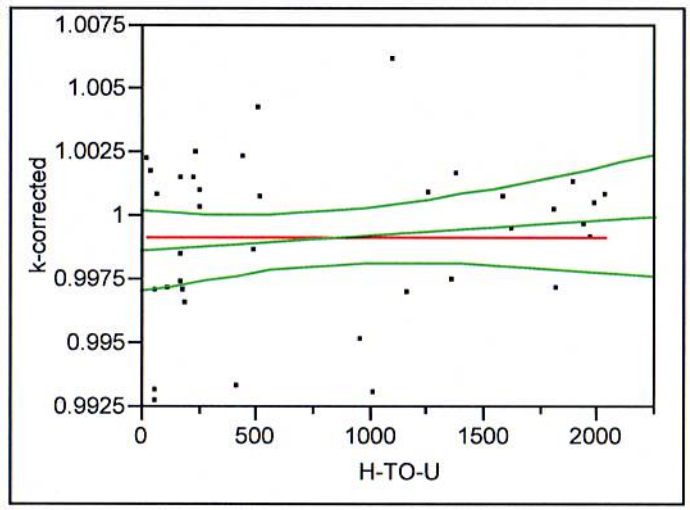
ENDF65

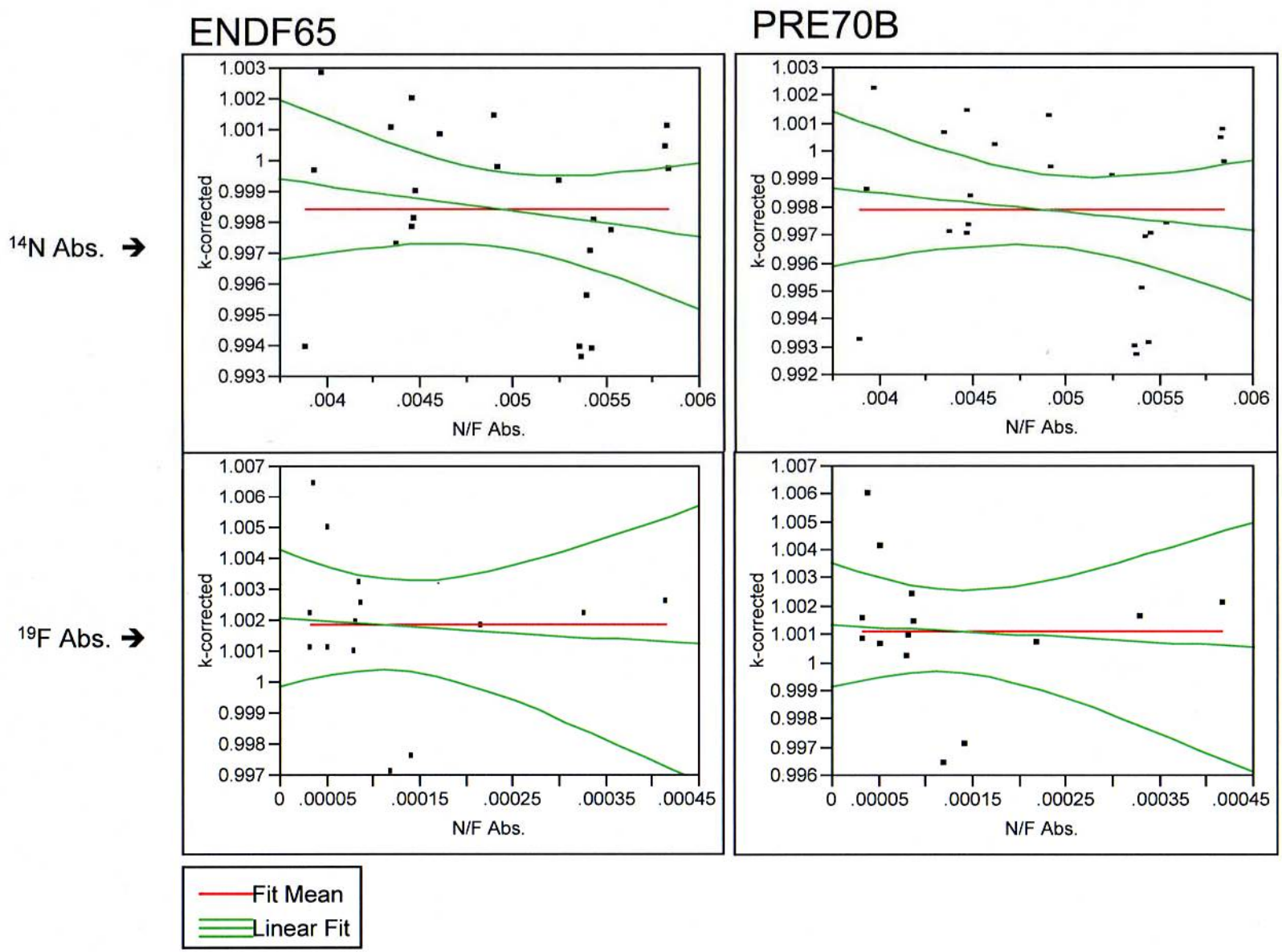




PRE70B






ENDF65
PRE70B
^{14}N Abs. →
^{19}F Abs. →
k-corrected
N/F Abs.
1.003
1.002
1.001
1
0.999
0.998
0.997
0.996
0.995
0.994
0.993
0.992
.004
.0045
.005
.0055
.006
1.007
1.006
1.005
1.004
1.003
1.002
1.001
1
0.999
0.998
0.997
0.996
0
.00005
.00015
.00025
.00035
.00045
Fit Mean
Linear Fit