New thermal data processing with NJOY-99.252

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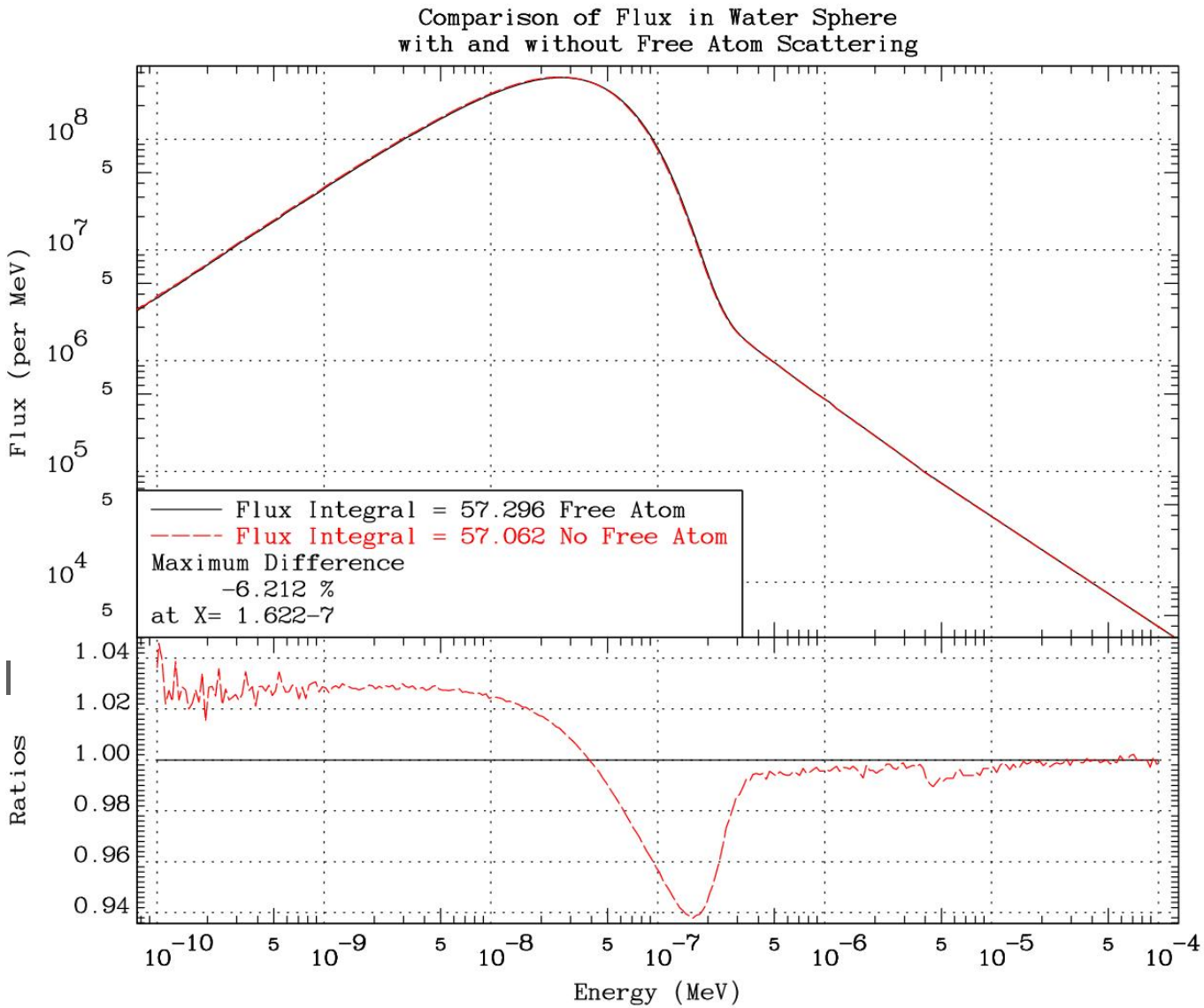
Is Thermal Scattering Important ? Oxygen free data

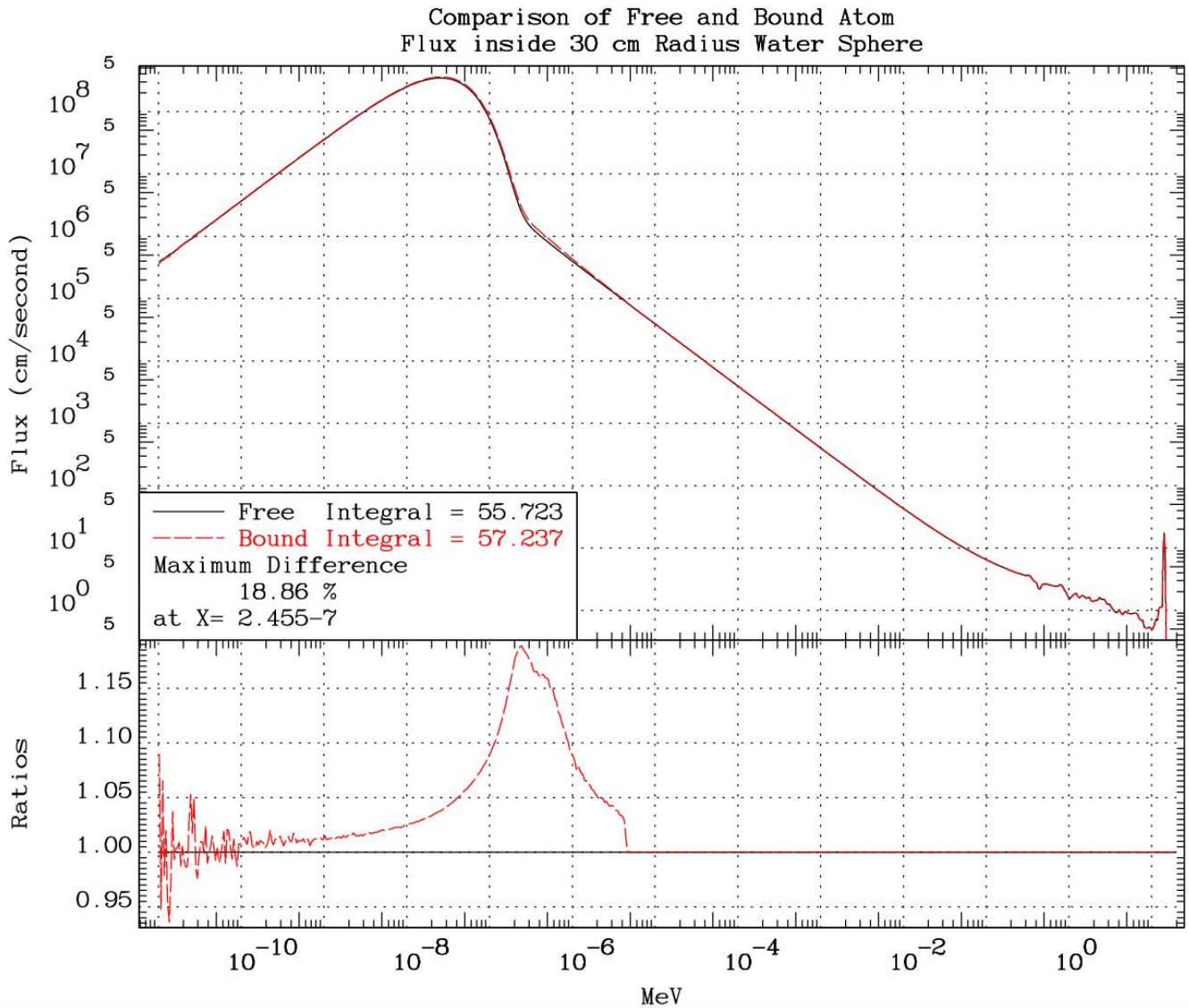
Spectral Shift

But without any thermal scattering, there would not be a thermal peak at all



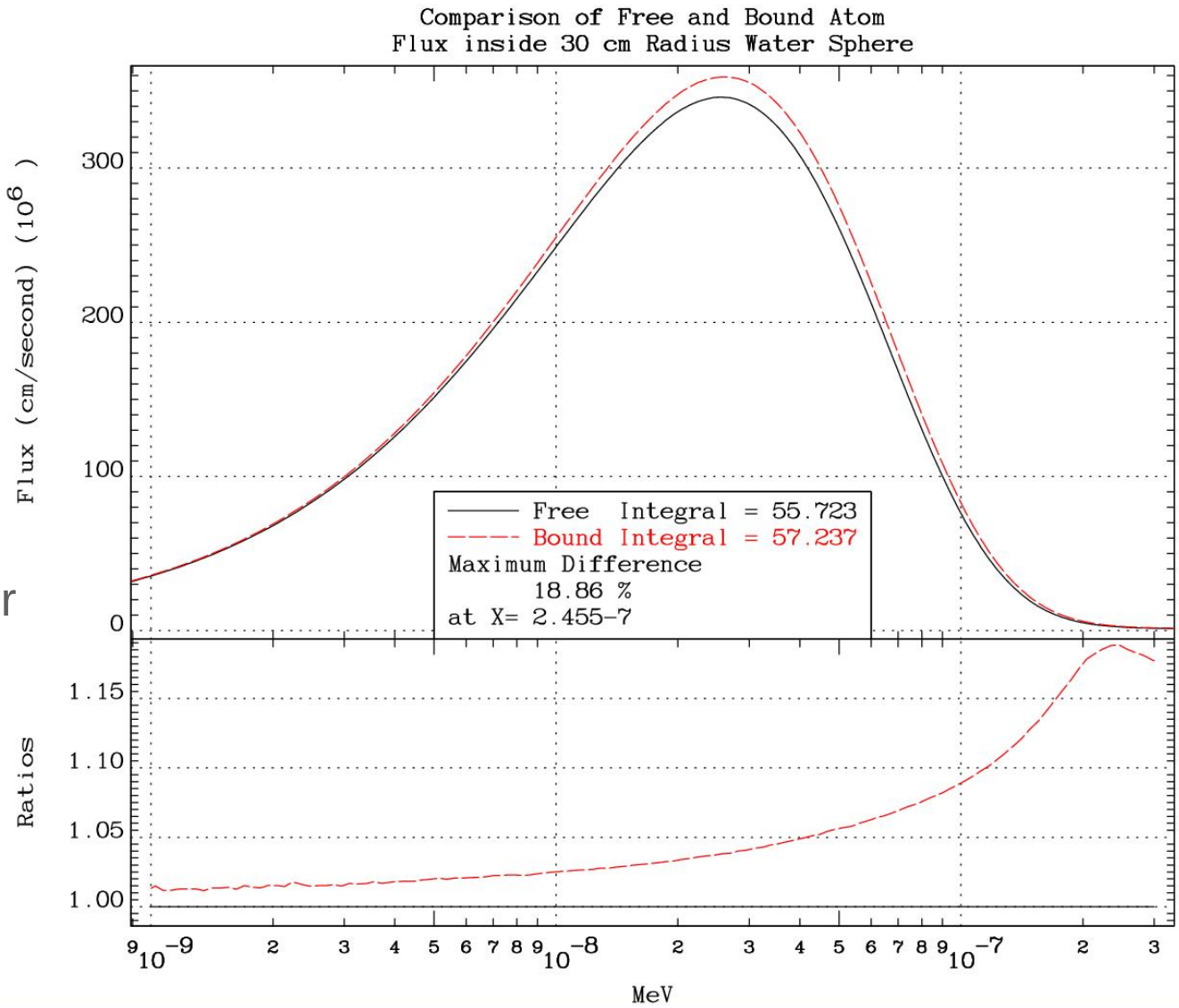
Why study Free and Bound Data Results?

Thermal laws only extend up to 10 eV



Log scaling is often deceptive

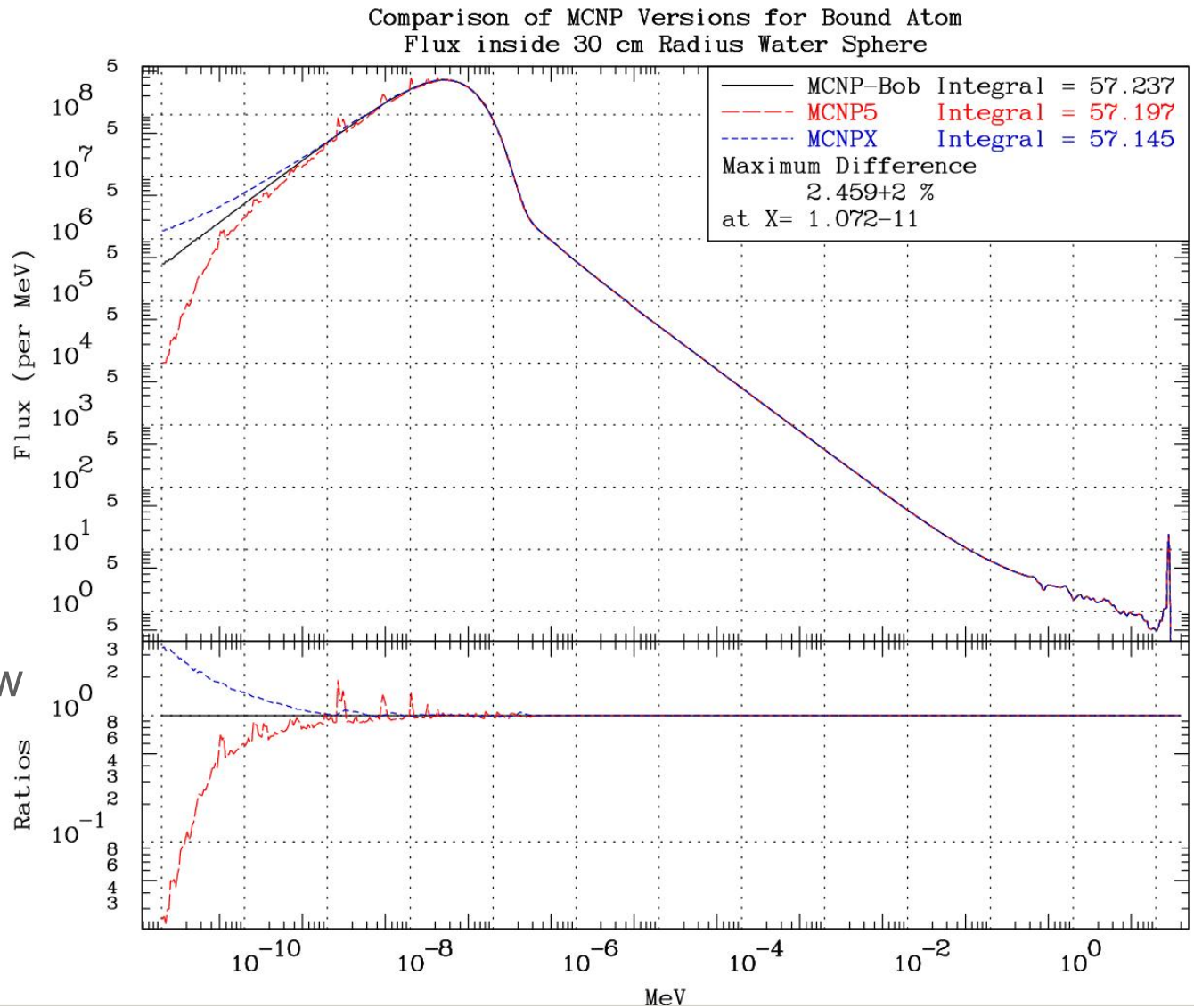
Bound data shifts the thermal spectrum to higher energy



MCNP Family of Codes

MCNP4c3 & MCNP5 use discrete values (energy and cosine)

MCNP5-Bob and NJOY-99.252 new thermal handling give the better answer as with MCNP(X)26d 06/2007



NJOY-99.252 new thermal processing

Modification in Thermr and Acer

- Egrid at 117

- Numbers of cosines bins, up to 32 now

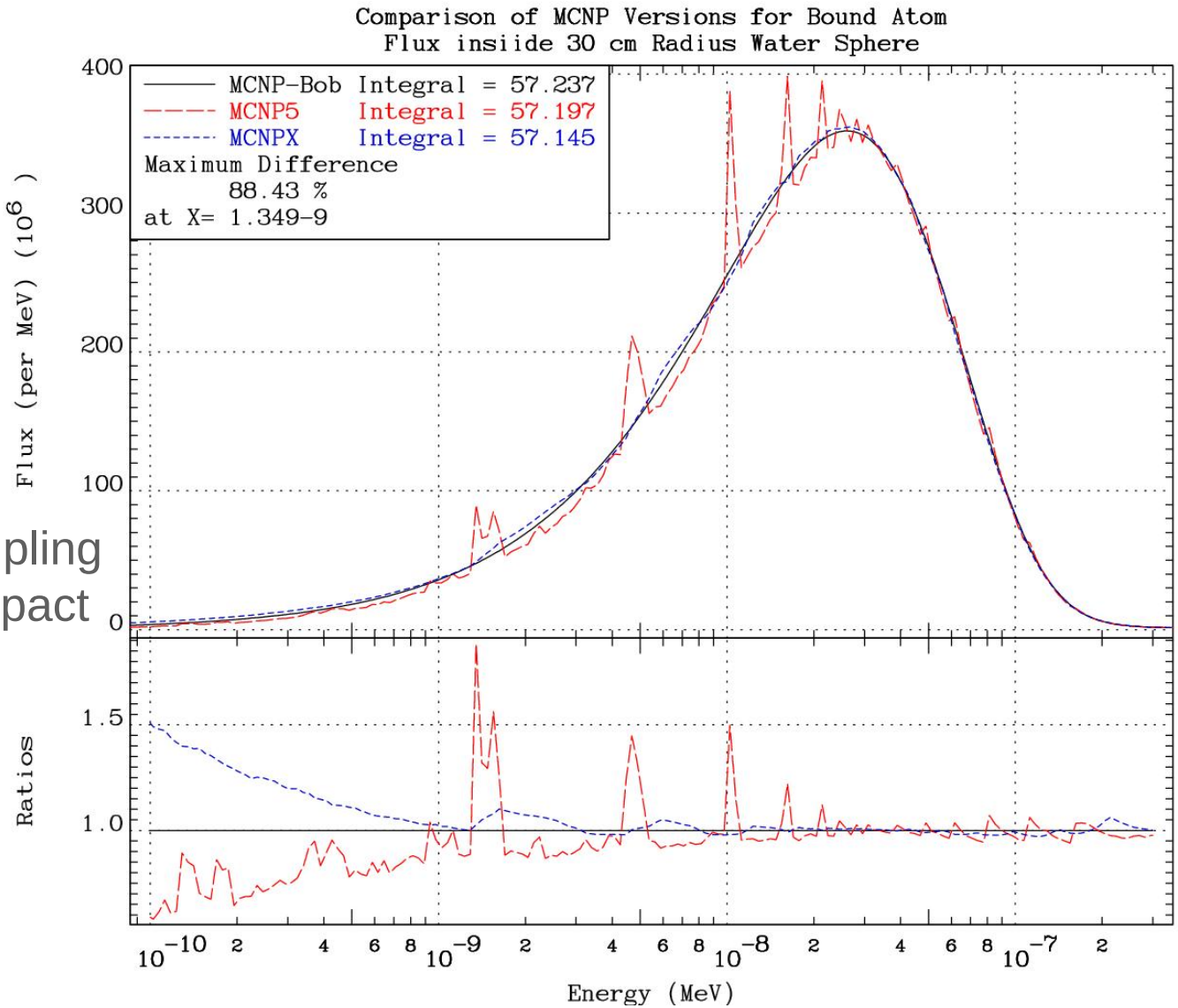
- New iwt =2 option, continuous sampling + extended plots

- Thermal energy cutoff at 10 eV, 10.1eV in Acer

Actually, MCNP5-Bob and MCNP(X)26d (not c) can read in both the new and old thermal data tables, results are similar

The new thermal data tables are about 10 times “larger”,
47 to 452 mb for the complete ENDF/B-VII set at one temperature

Smoothing of MCNPX, spike of MCNP5 & MCNP4c3

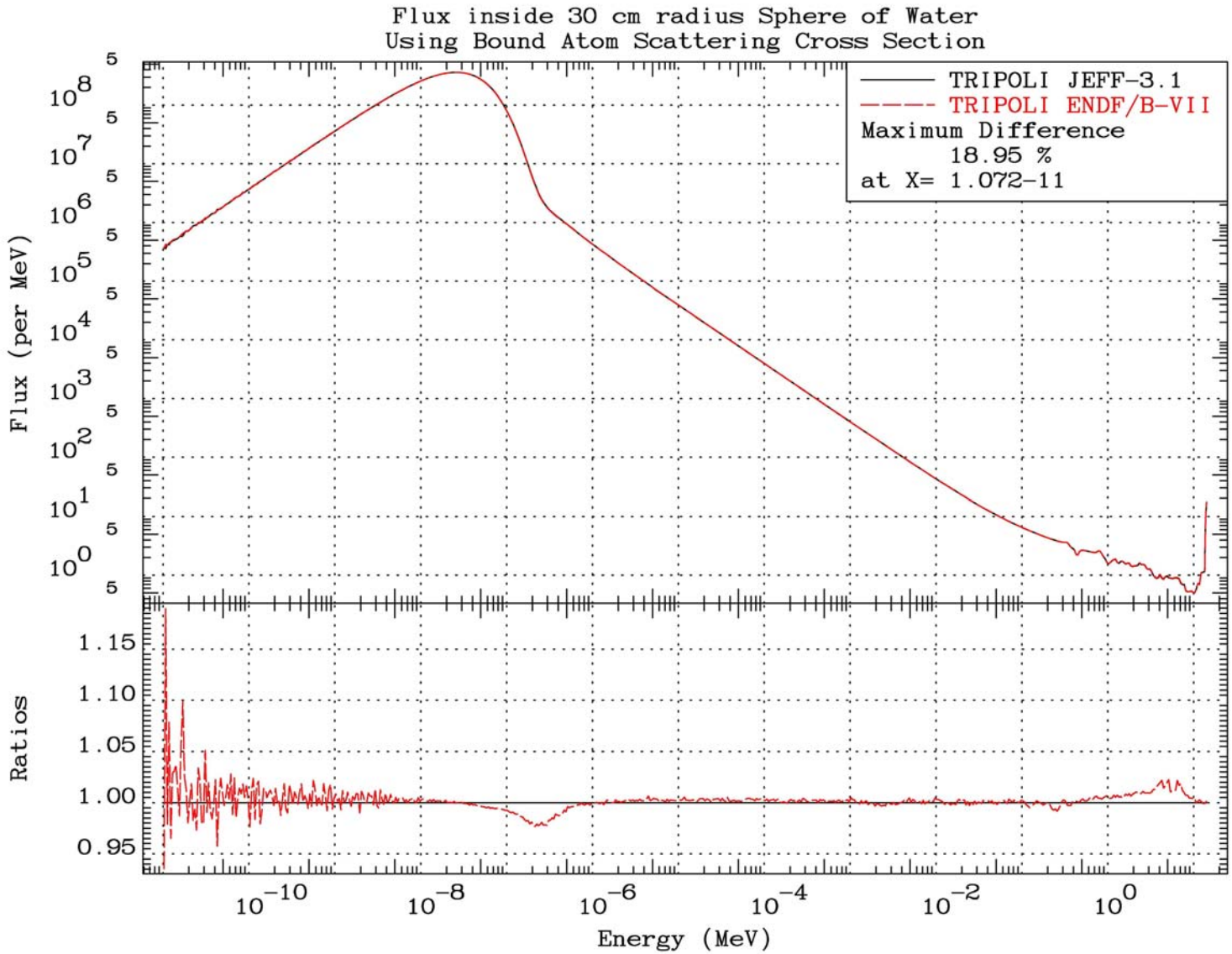


Discrete thermal sampling versus continuous impact on Keff

LCT6-2,-4,-6,-8,-10
4 to 27 pcm detla
with s.d. of 10 pcm

TRIPOLI-4.5 results: thermal data files influence

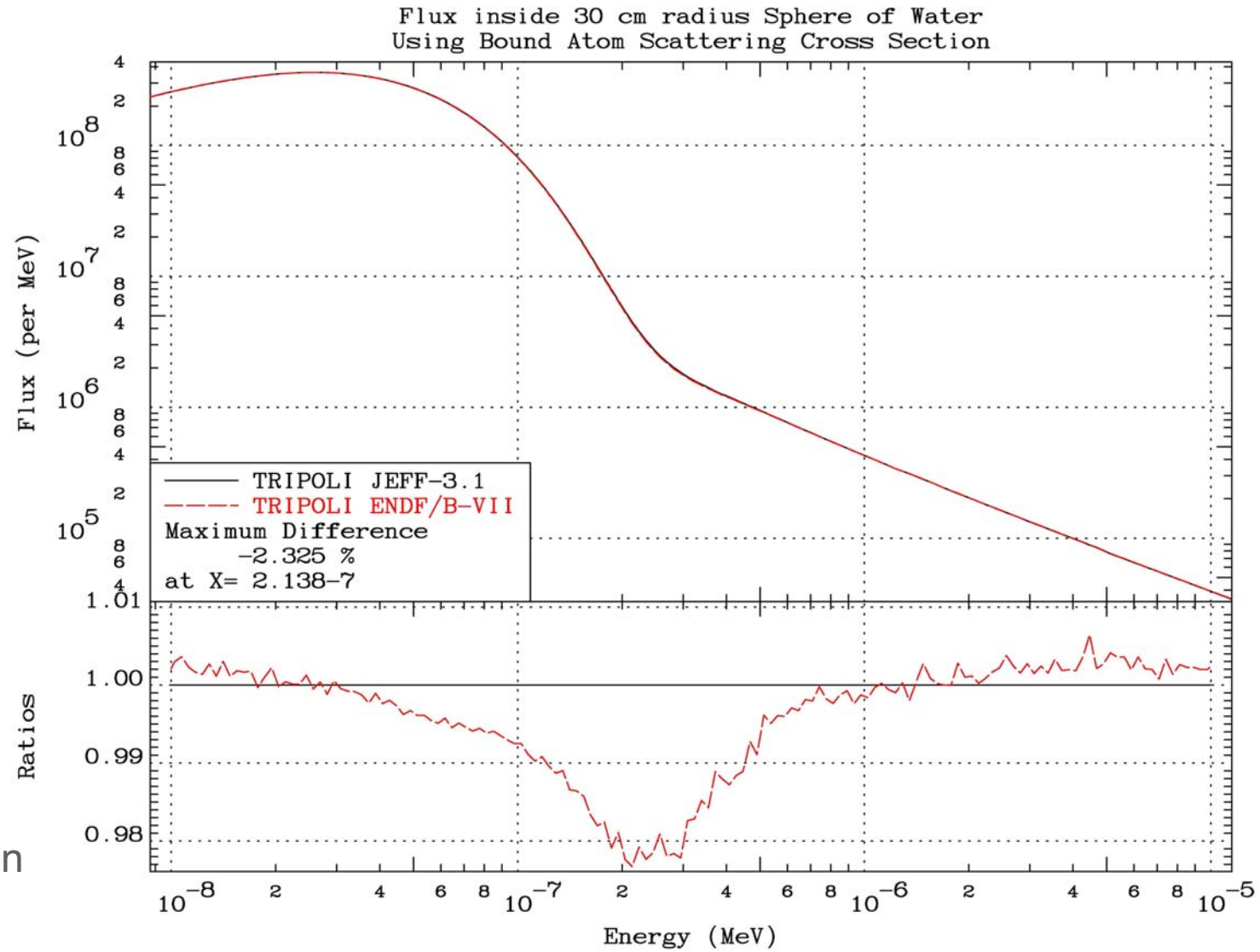
JEFF-3.1 and ENDF/B-VII thermal data converge ..



TRIPOLI-4.5 results: thermal data files influence

ENDF/B-VII slightly different than JEFF-3.1

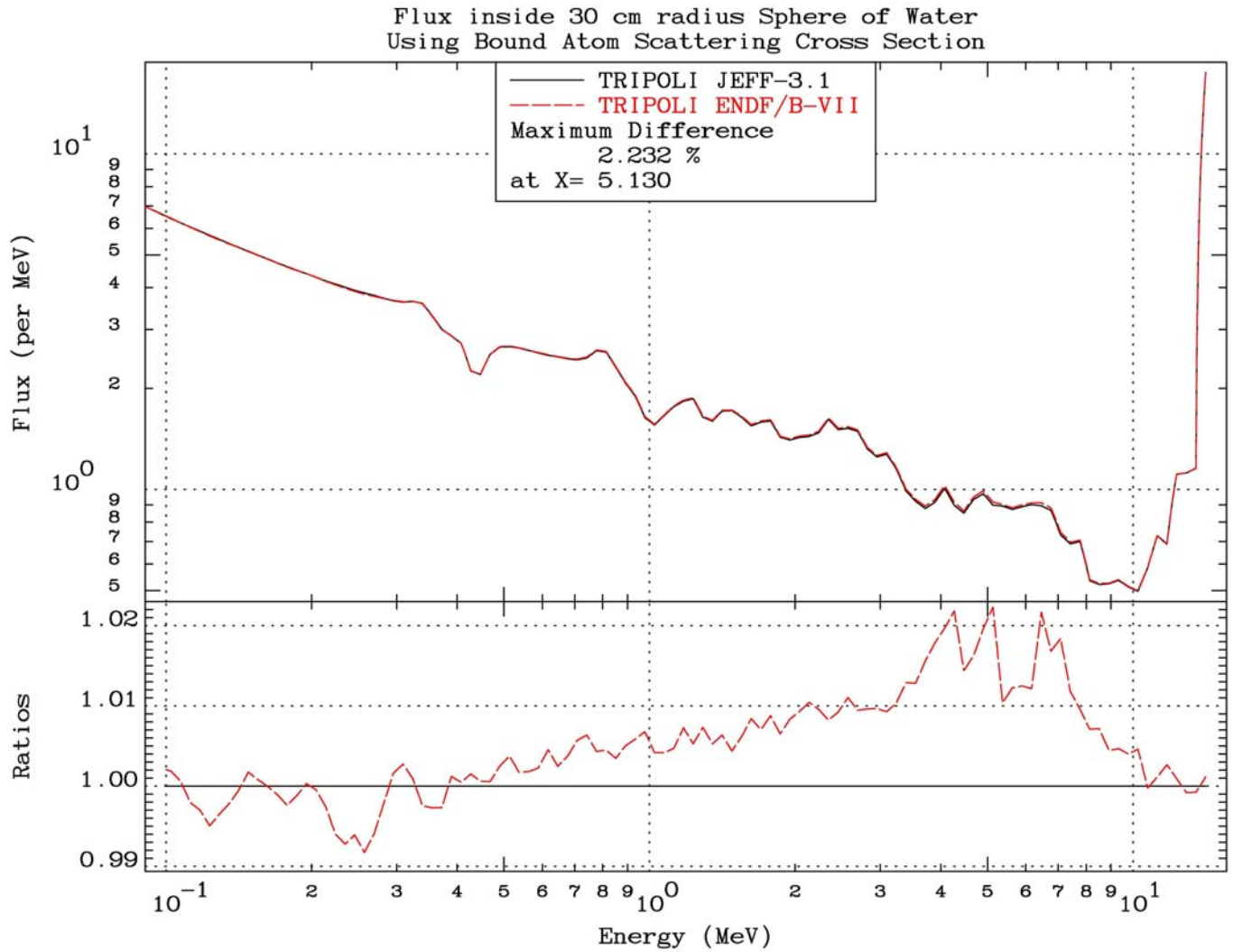
Temperature grid
α, β points
.01 to .1 eV
phonon distribution
(dip at 0.025 eV)



TRIPOLI-4.5 results: thermal data files influence

New O16 of ENDF/B-VII

(n,α0) <32%
2.4 - 8.9 MeV
impact



Same (latest) thermal data but different Monte Carlo

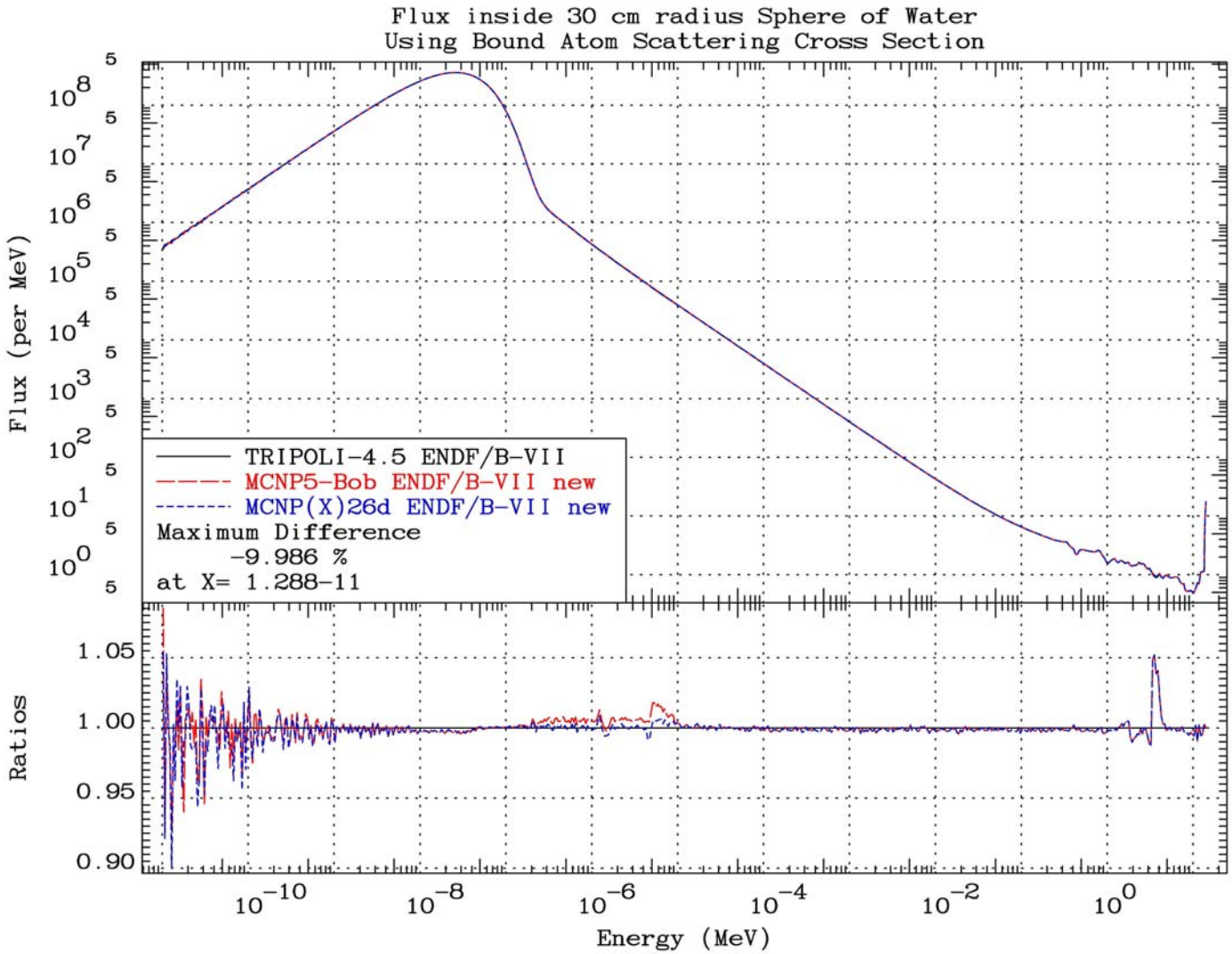
NJOY-99.252

MCNP5-Bob
20 bins, 10 eV
equipro. bins

MCNP(X)26d
16 bins, 4.5 eV

TRIPOLI
32 bins, 4.95 eV
equipro. cosinus

Else excellent agreement
Processing dials?



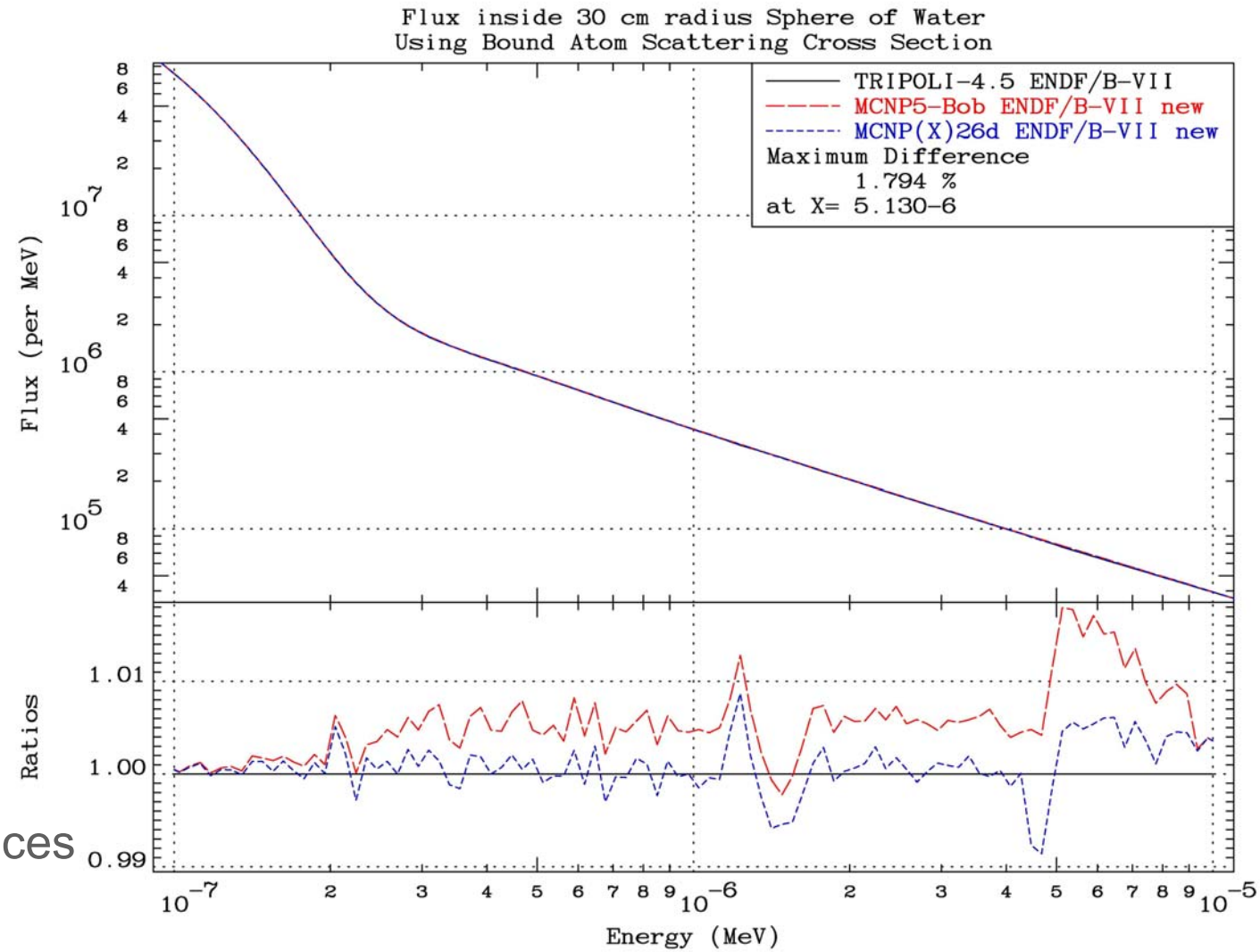
s.d. = 4 to 1% then well below ~0.1%

Same (latest) thermal data but different CODE

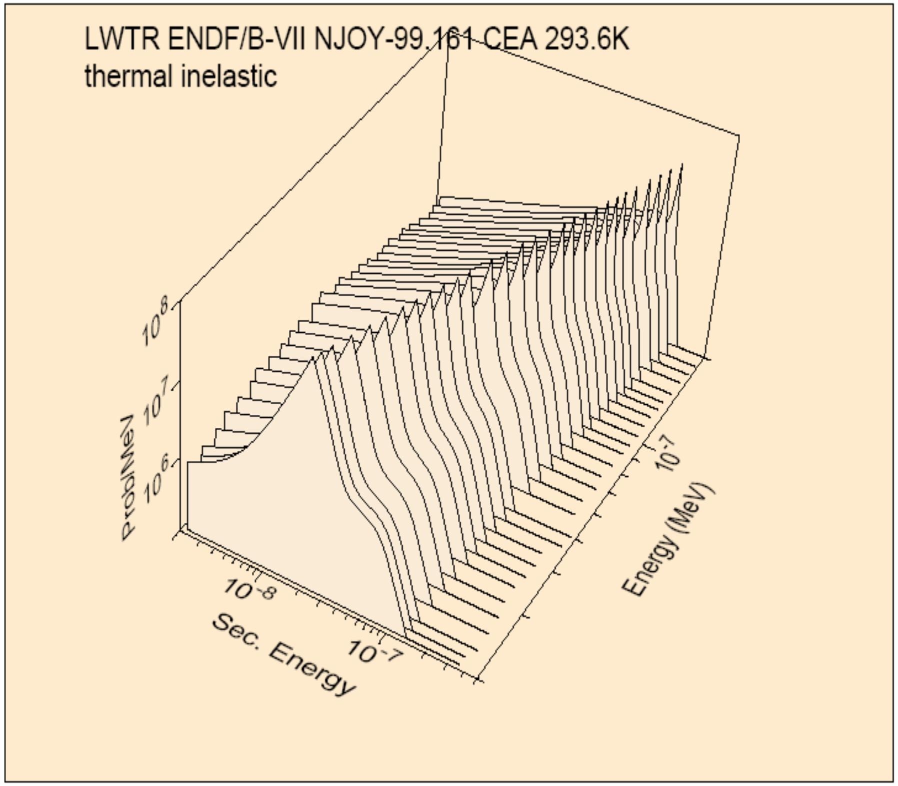
Upper threshold, number of bins influences

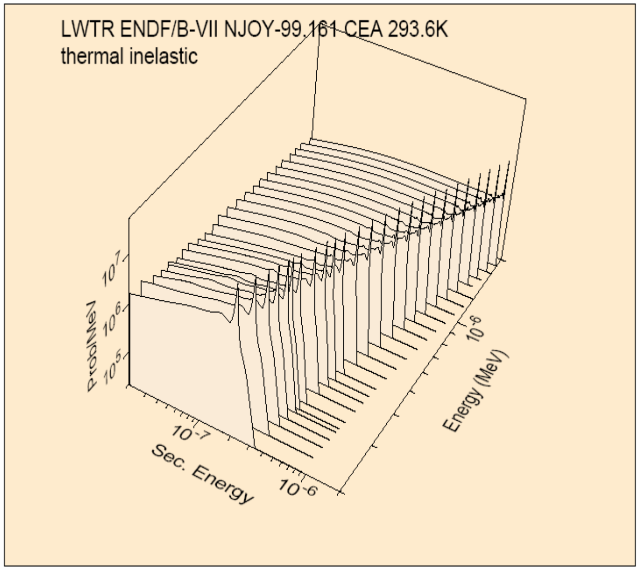
4.95 - 10 eV ?
16 - 20 bins ?

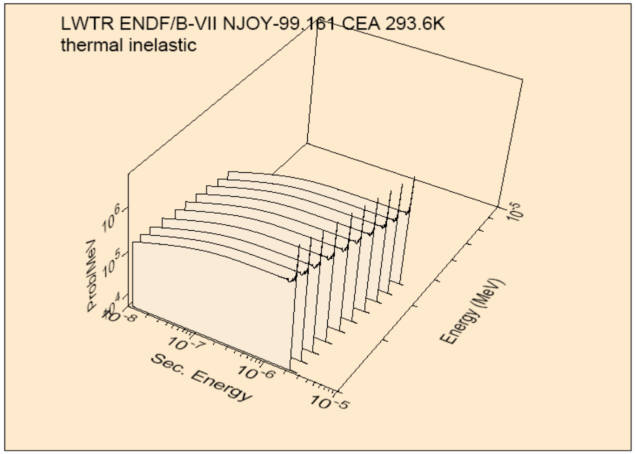
Direct influence in the eV regions where the resonances are at their best..



Inelastic thermal energy distribution



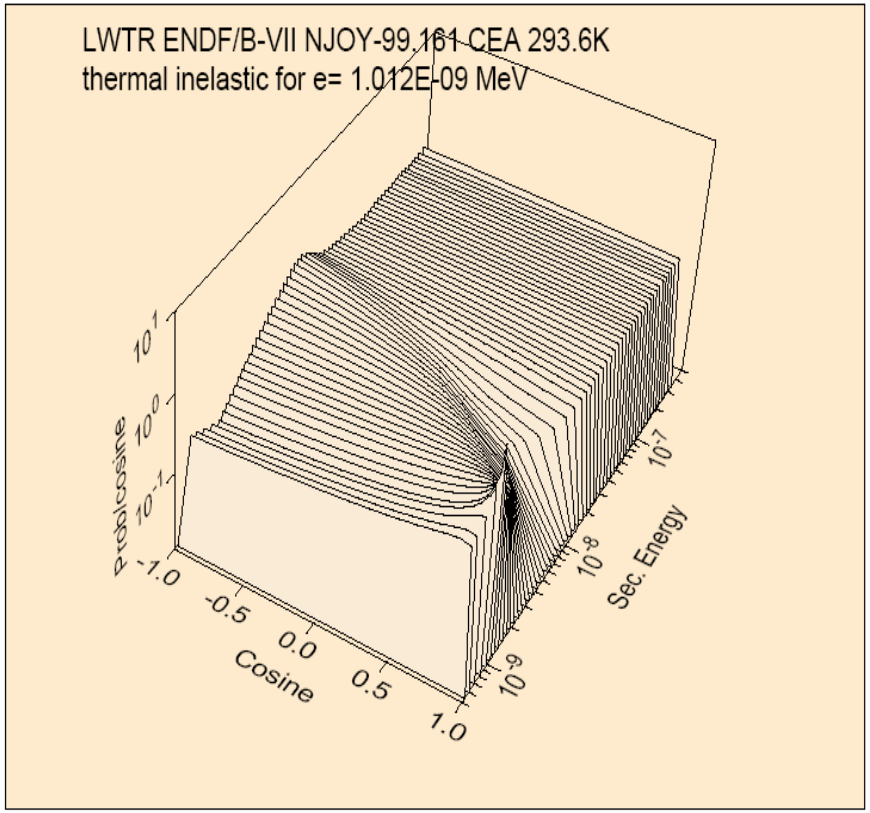


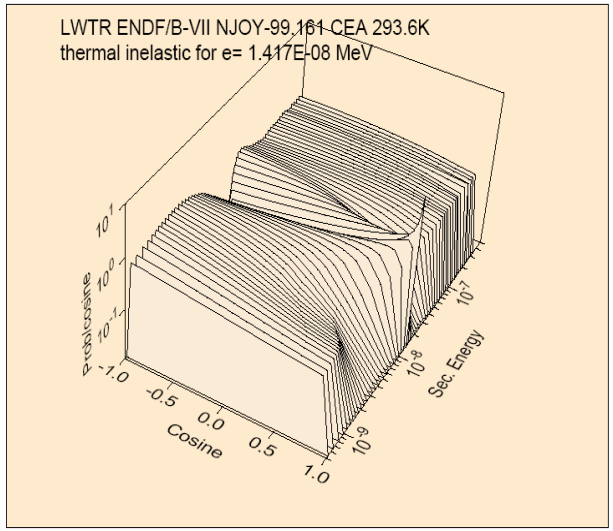


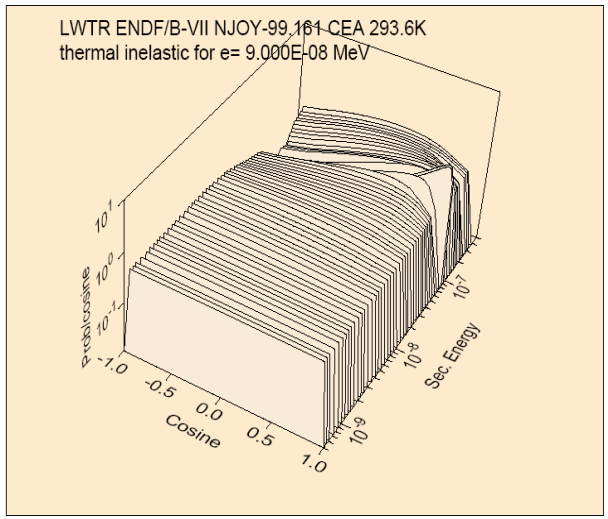
Peaked and evolving…

As for JEFF-3.1

Inelastic thermal angular distribution







Structured …with valley

As for JEFF-3.1

JEFF-3.1 & ENDF/B-VII thermal data (23 in total)

ENDF/B-VII (20)			JEFF-3.1 (9)		
ZAID	Temp.	Nuclide	ZAID	Temp.	Nuclide
sal.70t	293.6	13-Al			
sfe.70t	293.6	26-Fe			
			mg.10t	20.	24-Mg
be.70t	296.	Be metal	bem.10t	293.6	Be metal
beo.70t	296.	Be(BeO)			
			ccah2.10t	296.	Ca(CaH2)
			hcah2.10t	296.	H(CaH2)
hwtr.70t	293.6	D(D2O)	dd2o.10t	293.6	D(D2O)
poly.70t	296.	H(CH2)	hch2.10t	293.6	H(CH2)
lwtr.70t	293.6	H(H2O)	hh2o.10t	293.6	H(H2O)
hzrh.70t	296.	H(ZrH)	hzrh.10t	293.6	H(ZrH)
obeo.70t	293.6	O(BeO)			
ouo2.70t	296.	O(UO2)			
zrzrh.70t	296.	Zr(ZrH)			
benz.70t	296.	Benzine			
grph.70t	296.	graphite	cgra.10t	293.6	graphite
lmeth.70t	100.	l-ch4			
dorth.70t	19.	ortho-d			
horth.70t	20.	ortho-H			
dpara.70t	19.	para-d			
hpara.70t	20.	para-H			
smeth.70t	22.	s-ch4			
uuo2.70t	296.	U(UO2)	(**Temp**.=first temperature)		

Conclusions

NJOY99-252 is up to the job for all processing

The thermal data converge: JEFF-3.1 and ENDF/B-VII for H(H_2O)

The thermal nuclear data, processing codes features and dials have been significantly improved

New, better but not leaner JEFF-3.1 (9) and ENDF/B-VII (20) thermal data libraries for Monte Carlo codes are available

Stay aware of the fact that there is more uncertainty in Monte Carlo answers than the estimates of statistical uncertainty printed out by the codes