

ENDF/B-VIII: What has changed so far?

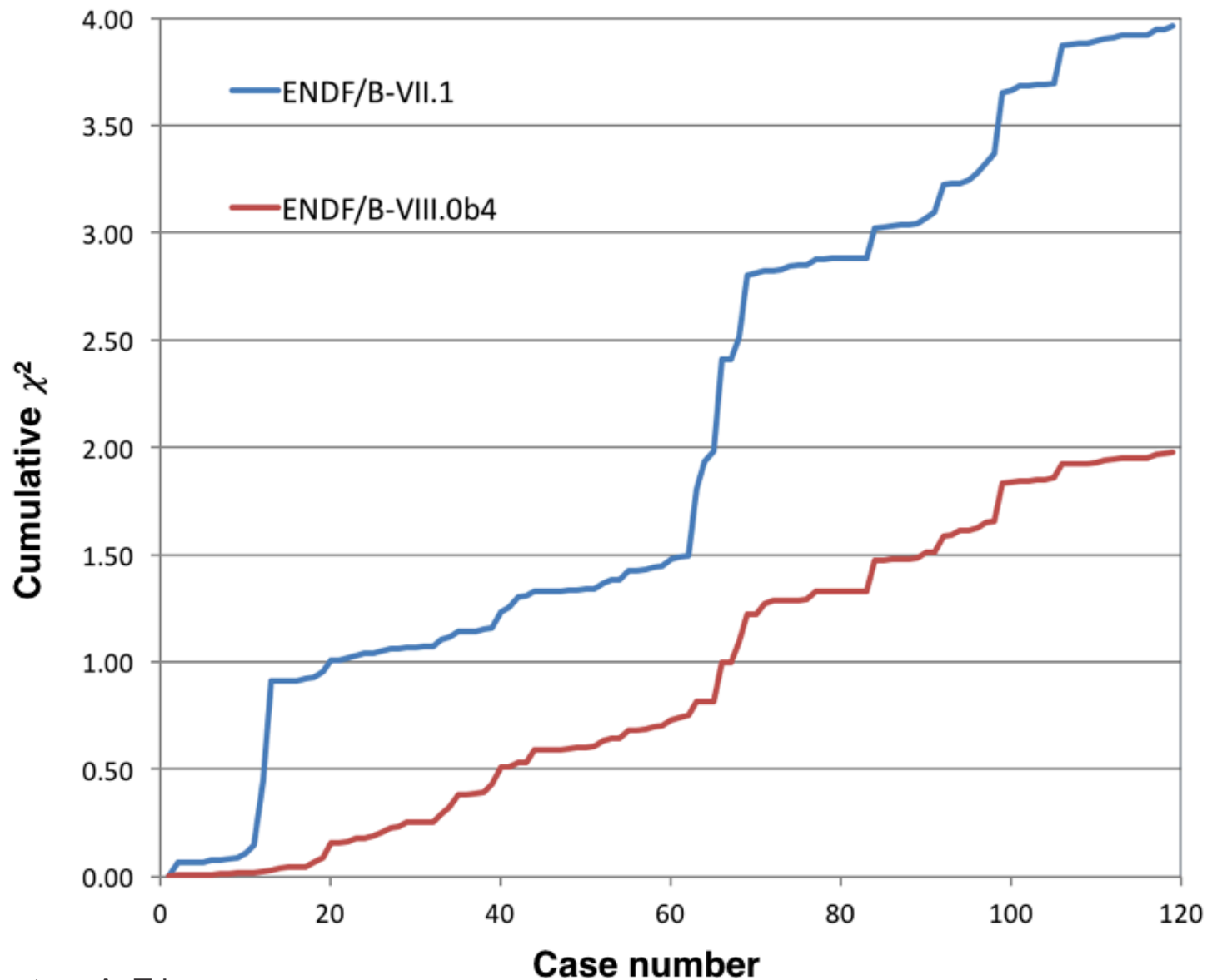
D. Brown, National Nuclear Data Center, BNL



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Critical assembly performance



Plot courtesy A. Trkov

So, what has changed and what hasn't?

- CIELO evaluations
 - TSL evaluations
 - Many other ENDF evaluations
 - V&V, QA
 - New format
- } This is what gets us the amazing performance

So, what has changed and what hasn't?

- CIELO evaluations
 - TSL evaluations
 - Many other ENDF evaluations
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- } But many other applications need these

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This is how we insure good performance

So, what has changed and what hasn't?

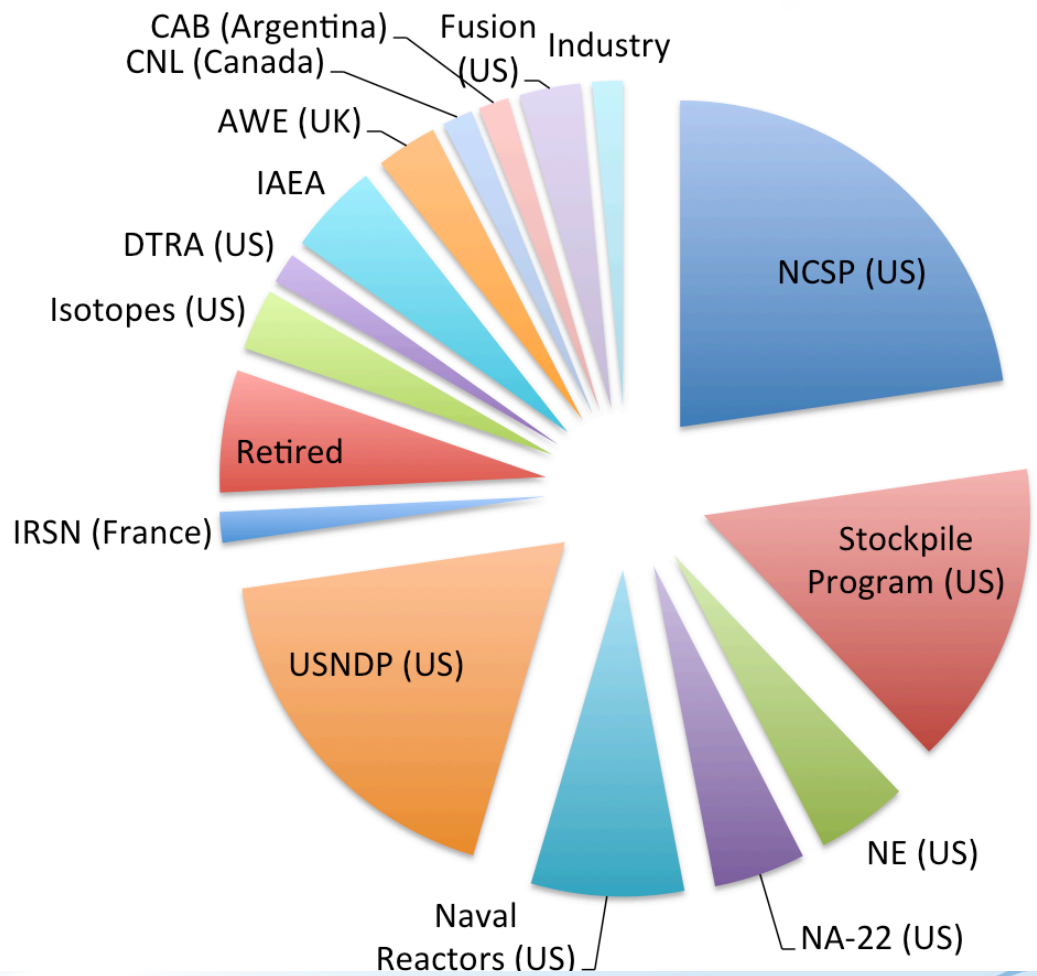
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This is how we
prepare for the
future

CSEWG is a long standing collaboration between data users who, incidentally, are also the biggest content providers

Fraction of evaluations provided for ENDF/B-VIII



ENDF/B-VIII highlights

■ CIELO:

- ^{16}O
- ^{56}Fe
- ^{235}U
- ^{238}U
- ^{239}Pu

■ Neutron standards

- ^1H
- ^6Li
- ^{10}B
- ^{197}Au

■ Structural materials:

- $^{12,13}\text{C}$
- ^{40}Ca
- ^{54}Fe , ^{57}Fe , ^{58}Fe
- $^{58-61}\text{Ni}$
- Yb, Dy, Os (JENDL4)
- $^{63,65}\text{Cu}$
- $^{182,183,184,186}\text{W}$
- $^{174,176,178,179,180}\text{Hf}$
- ^{132}Te

■ Other non-CIELO:

- n
- ^7Be
- ^{18}O (RUSFOND)
- $^{35,37}\text{Cl}$
- ^{59}Co
- $^{73,74}\text{As}$
- ^{78}Kr
- ^{124}Xe
- RQ Wright's nubar
- ^{40}Ar
- $^{236\text{m}1}\text{Np}$
- ^{240}Pu
- EGAF gammas
- Bug fixes

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Bug fixes

▪ Beta4

- 35,37Cl
- 74As
- 241Am

▪ Beta5 (ENDF/A)

- 48Ti
- 10Be
- 180,181Ta
- 185,187Re

Serious changes

■ Beta4

- 63,65Cu Covariances
- 240Pu
- Standards
- CIELO

■ Beta5 ??

- Standards
- CIELO
- 53Cr?

240Pu

■ Resonances

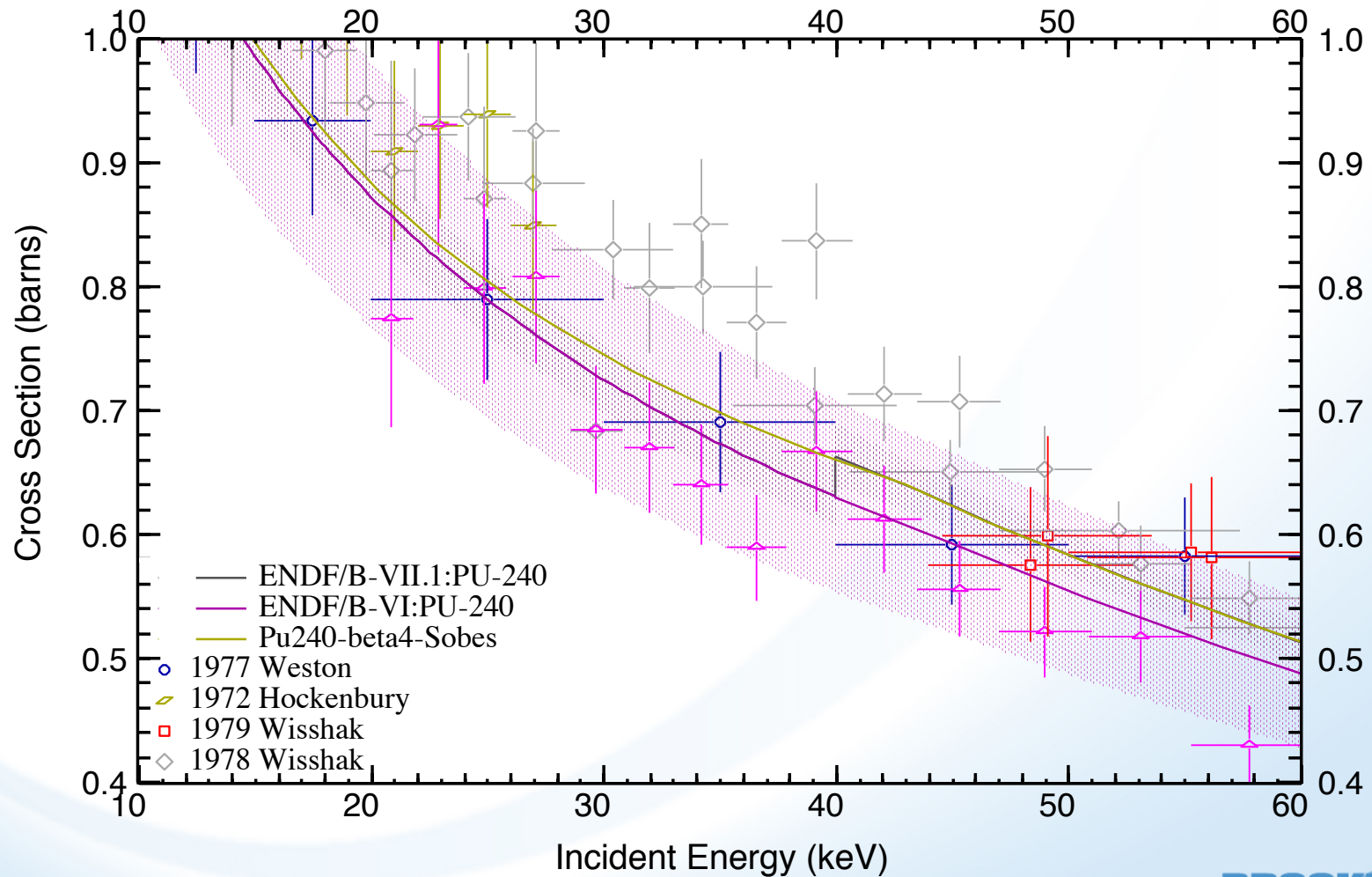
- 2010 ORNL evaluation did not perform well, was rejected, but minor fix to bound level needed, V. Sobes made correction

■ Fast Region

- Fission cross section updated: Replaced by Tovesson 2009 data from 5.7keV to 40 keV (URR), Weston 40keV - 190keV.
- Capture cross section taken from ENDF/B-VII.0 (=ENDF-B/VI.8), with an additional 2% reduction above 42 keV to improve
- Elastic cross section taken from ENDF/B-VII.0 (=ENDF-B/VI.8).IAEA noted problem in URR, ave. capture restored to VI.1

Capture in URR

94-Pu-240(N,G),SIG



Final thermal constants; validation covered later in meeting

Quantity	Atlas	ENDF/B-VIII.0	ENDF/B-VII.1
σ_γ	289.5 ± 1.4 b	289.4 b	287.5 b
σ_s	1.73 ± 0.10 b	1.73 b	0.95 b
σ_f	0.056 ± 0.030 b	0.056 b	0.064 b
σ_B	18.8 b	17.96 b	3.02
Wescott's g -factor	1.0264	1.0259	1.0278

ENDF/B-VIII highlights, continued

■ Charged particles:

- p+d, p+⁷Li, p+a, p+¹³C, p+²⁰⁷Pb
- d+⁷Li
- t+a, t+⁷Li
- ³He+a, ³He+³He
- a+a

■ EPICS2014:

- photoat
- electrons
- atomic_relax

■ Decay data:

- ^{93,95,96}Rb
- ⁹⁵Sr
- ^{82,83}Ge
- ^{95,98,98m,99}Y
- ^{88,89,90,91}Br
- ⁹⁰Kr
- ^{140,141}Cs
- ¹⁴³Ba
- ^{143,144,145}La
- ¹³⁴Sb
- ¹³⁸I

■ Thermal Scattering:

- Be(metal)
- UO₂ (x2)
- Regular & reactor graphite
- BeO (x2)
- Polyethylene
- SiO₂ (x2)
- SiC
- Lucite
- UN
- *Water: H₂O & D₂O (x2)*
- Water Ice Ih (x2)
- YH₂ (x2)

ENDF/B-VIII highlights, continued

■ Charged particles:

- $p+d$, $p+{}^7\text{Li}$, $p+a$, $p+{}^{13}\text{C}$, $p+{}^{207}\text{Pb}$
- $d+{}^7\text{Li}$
- $t+a$, $t+{}^7\text{Li}$
- ${}^3\text{He}+a$, ${}^3\text{He}+{}^3\text{He}$
- $a+a$

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- ${}^{134}\text{Sb}$
- ${}^{138}\text{I}$

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ENDF/B-VIII highlights, continued

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- d+⁷Li

- t+a, t+⁷Li

- ³He+a, ³He+³He

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- Lucite

- UN

- Water: H₂O & D₂O (x2)

- Water Ice Ih (x2)

- YH₂ (x2)

Also, added LEAPR inputs for all TSL evaluations except the General Atomics benzene evaluation from 1969

Bug fixes

- Beta4

- Be(metal)

- Beta5 (ENDF/A)

- p+2H
- D2O (D, O)
- H2O (H)

Serious changes

- Beta4

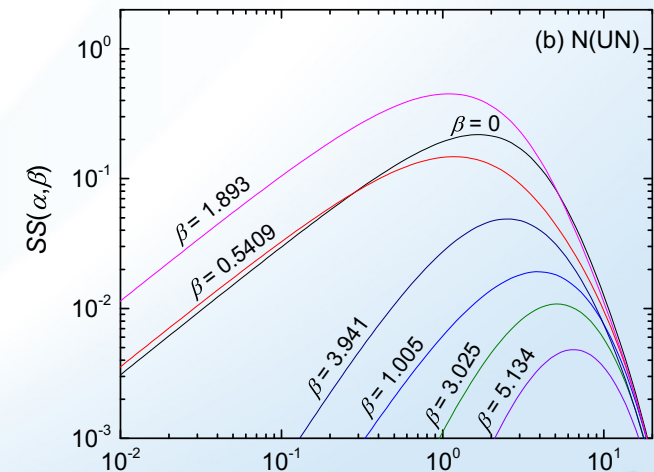
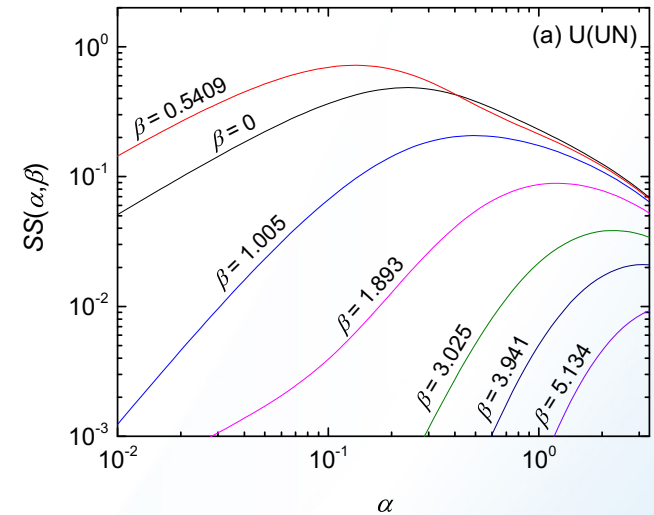
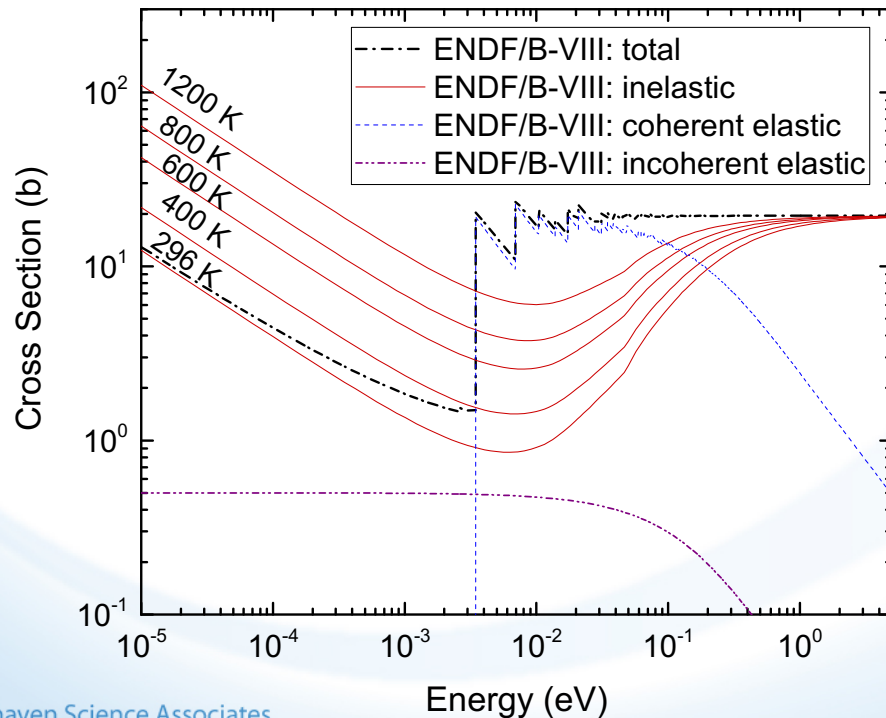
- Light charged particles
- UN

- Beta5 ??

- nothing planned

UN: New TSL evaluation from NCSU

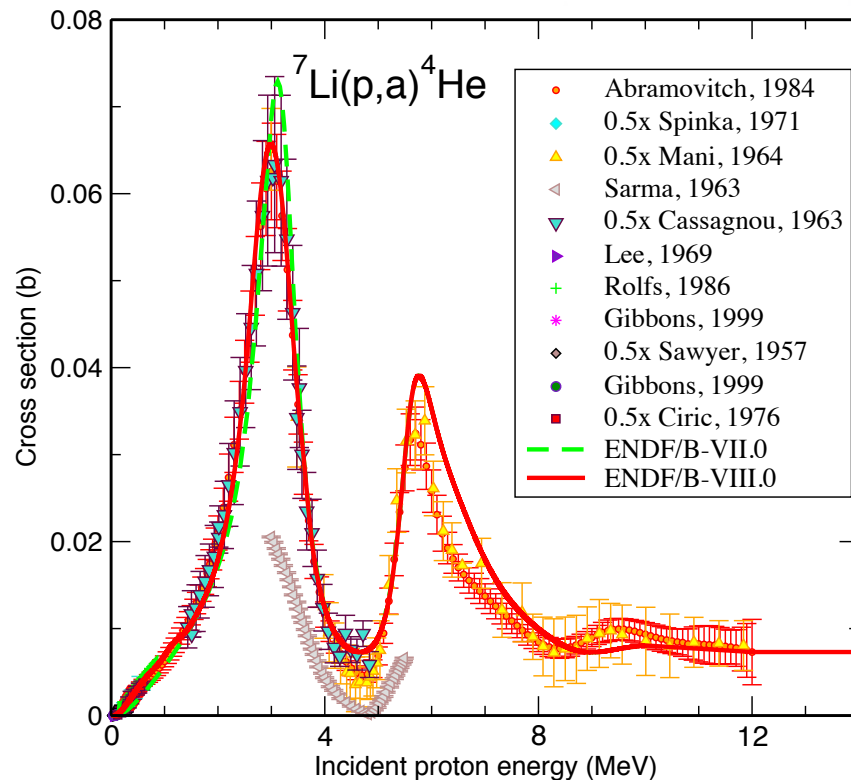
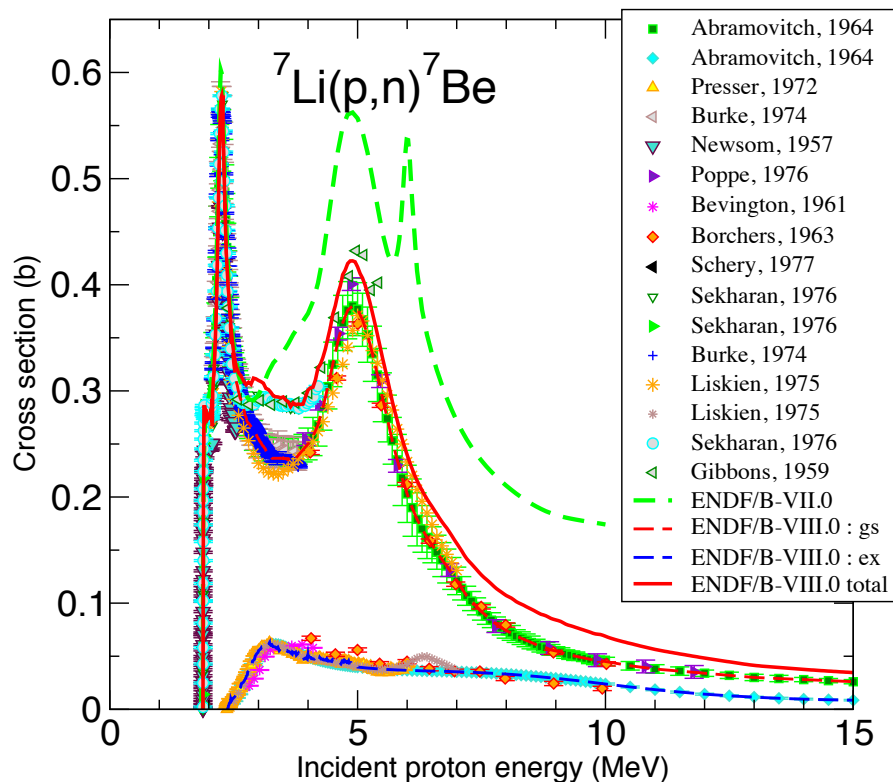
- LEAPR from NJOY99.396
- 7 temps. (296K-120K)
- Inelastic uses Incoherent approx.
- Elastic uses generalized coherent approx. with modified LEAPR



Light charged particle evaluations

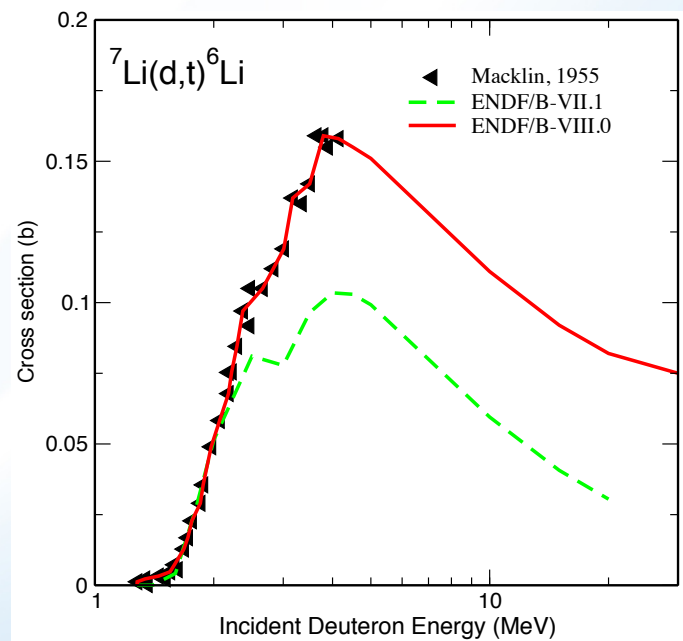
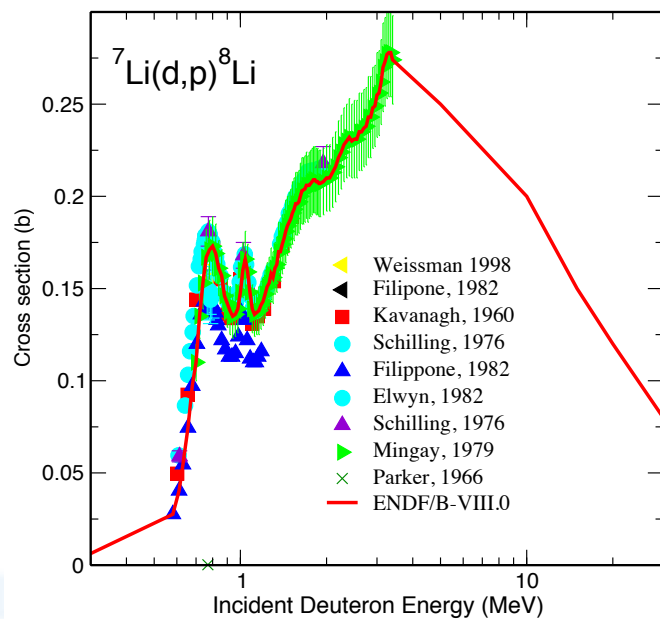
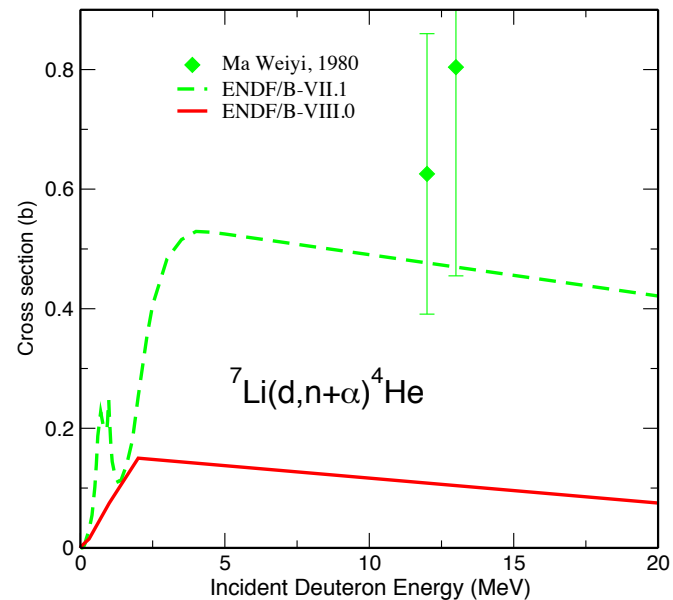
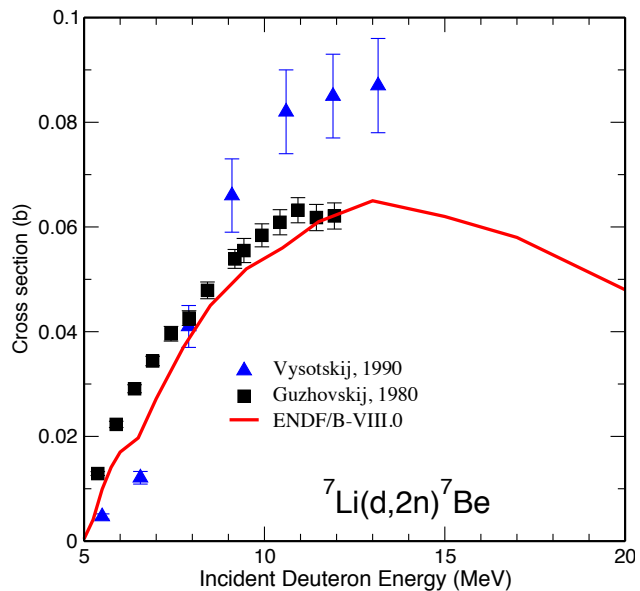
Target:	p	d	t	h	α	${}^6\text{Li}$	${}^7\text{Li}$	Projectile:
	Black	Black	Light Blue	Light Blue	Dark Blue	Light Blue	Dark Blue	p
		Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Dark Blue	d
Keep ENDF/B-VII.0			Black	Black	Dark Blue	Light Blue	Dark Blue	t
Recommend ECPL in future				Dark Blue	Dark Blue	Black	Light Blue	h
Here ECPL to ENDF/B-VIII.0					Dark Blue	Light Blue	White	α

p+⁷Li

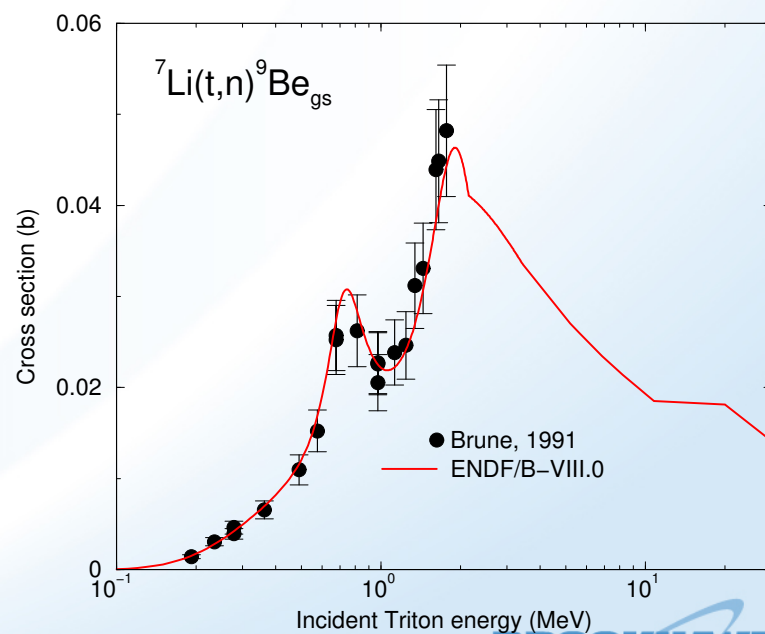
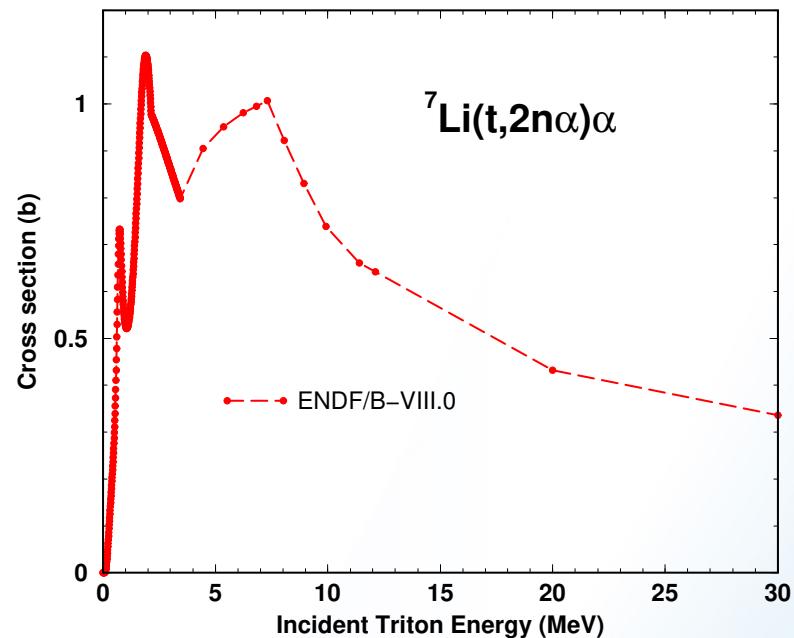
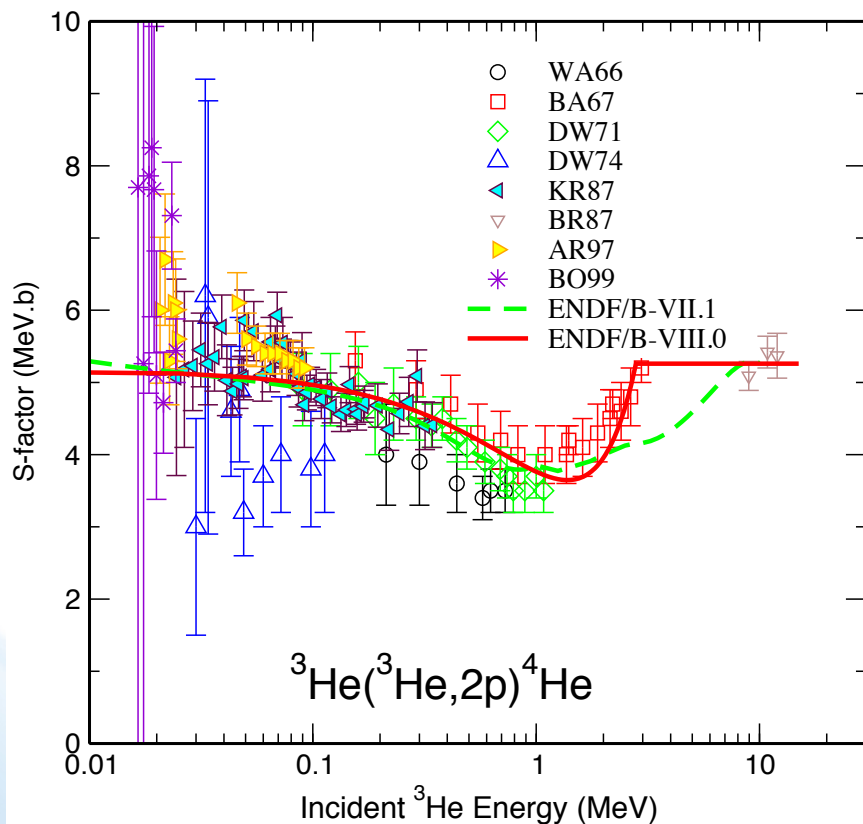


P. Navratil merged ECPL cross sections with fits in literature;
D. Brown added outgoing distributions from ECPL using inverse kinematics when needed

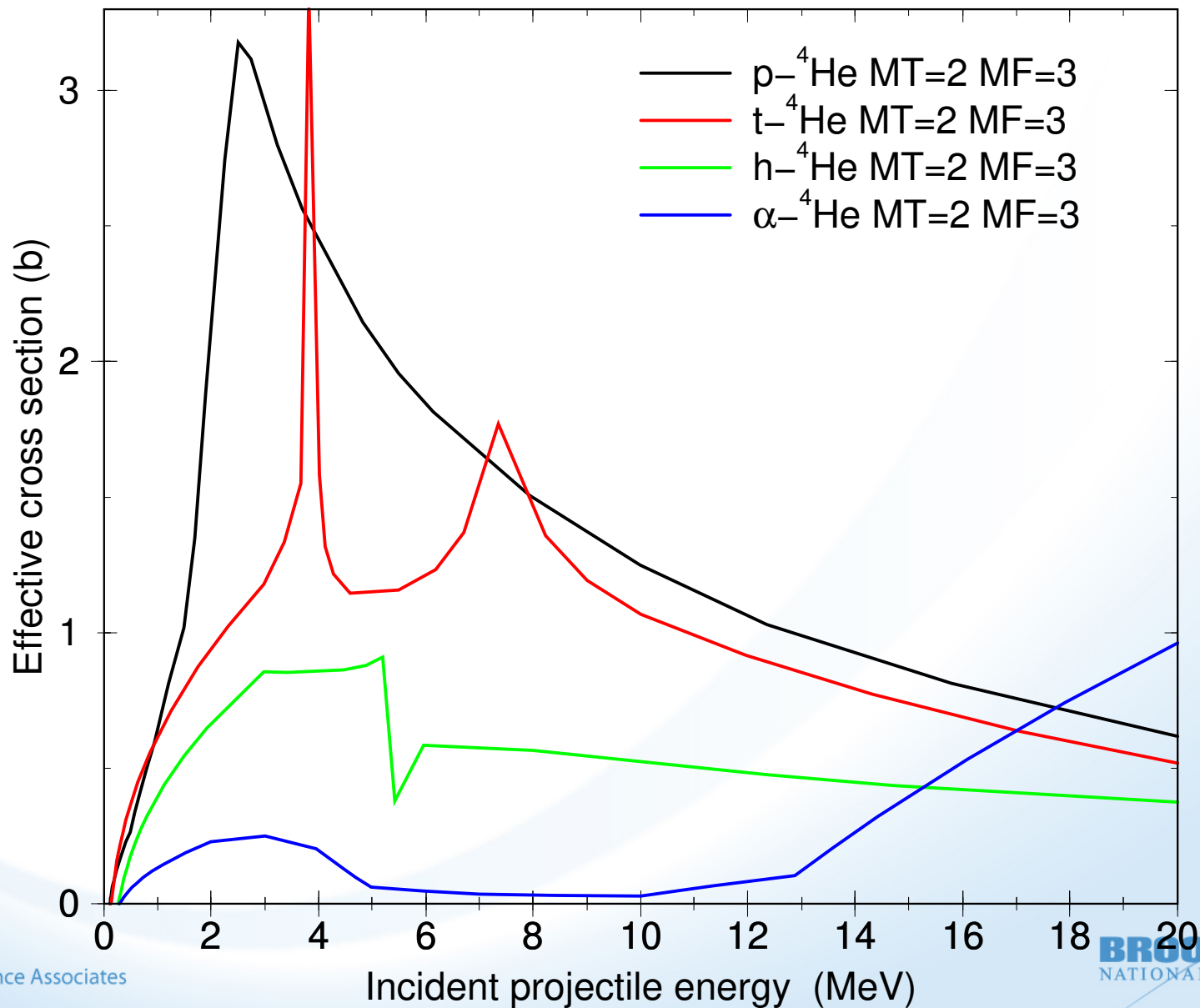
d+⁷Li



$t+{}^7\text{Li}$ & ${}^3\text{He}+{}^3\text{He}$



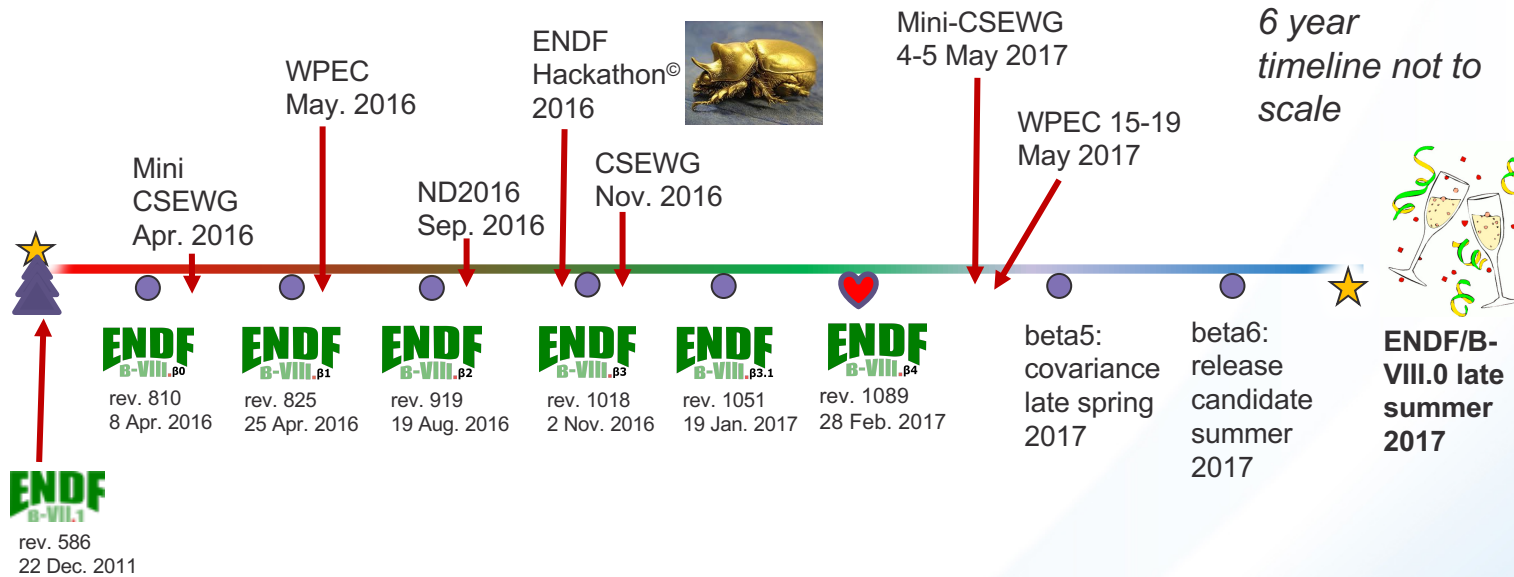
Elastic scattering on ${}^4\text{He}$



More to come

- $^{235,238}\text{U}$
- ^{239}Pu
- $^{54,56,57,58}\text{Fe}$
- Covariances
- C

ENDF/B-VIII planned for late FY17



ENDF/B-VII.0 contains 393 neutron evaluations; 1644 citations since 2006 (Google Scholar)

ENDF/B-VII.1 contains 423 neutron evaluations; 945 citations since 2011 (Google Scholar)