Q Values in ENDF

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Outline

- Q value interpretation not unique when dealing with isomers
- Example of different interpretations in ENDF/B-VIIβ2, JENDL-3.3's ^{242m}Am
- Consensus from discussions in previous meeting
- What needs to be changed to reflect this consensus

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What Q values for isomers?

QM	Mass-difference Q value (eV): defined as the mass of the target and projectile minus the mass of the residual nucleus in the ground state and masses of all other reaction products; that is, for $a+A \rightarrow b+c+...+B$, $QM=[(m_a+m_A)-(m_b+m_c+...+m_B)](9.315016 \times 10^8)$ if the masses are in amu. (See paragraph 3.3.2).
QI	Reaction Q value for the (lowest energy) state defined by the given MT value in a simple two-body reaction or a breakup reaction. Defined as QM for the ground state of the residual nucleus (or intermediate system before breakup) minus the energy of the excited level in this system. Use QI=QM for reactions with no intermediate states in the residual nucleus and without complex breakup (LR=0). (See paragraph 3.3.2.)

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Interpretation was not unique

			NuDat Values			ENDF File			
Reaction	Target	Library	Q Value (MeV)	Ethreshold (MeV)	Elevel (MeV)	QM (MeV)	QI (MeV)	Ethreshold (MeV)	ELIS (MeV)
(n,n')	242Am	ENDF/B-VII			0	0	-0.041	0.042838	0
MT=51		JENDL-3.3			0	0	-0.041	0.042838	0
(n,2n)	242Am	ENDF/B-VII	-5.53764	5.560523	0	-5.538	-5.538	5.560688	0
MT=16		JENDL-3.3			0	-5.539	-5.539	5.56208	0
(n,n')	242mAm	ENDF/B-VII			0.0486	0.0486	0.0486	1.00E-11	0.0486
MT=51		JENDL-3.3			0.0486	0.0486	0.0486	1.00E-11	0.0486
(n,2n)	242mAm	ENDF/B-VII	-5.48904		0.0486	-5.49	-5.49	5.51E+00	0.0486
MT=16		JENDL-3.3			0.0486	-5.539	-5.539	5.56E+00	0.0486

- JENDL includes E_{level} in Q for ^{242m}Am(n,2n), ENDF/B-VII doesn't
- Both include E_{level} in Q's for (n,n') MT=51
- Need to clarify point in ENDF-102

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Consensus resolution from last meeting

QM	Mass-difference Q value (eV): defined as the target and projectile masses minus the mass of the residual nucleus and masses of all other reaction products; that is, for $a+A \rightarrow b+c+...+B$, $QM=[(m_a+m_A)-(m_b+m_c+...+m_B)] \times (amu/eV)$ if the masses are in amu. (See paragraph 3.3.2).
QI	Reaction Q value for the (lowest energy) state defined by the given MT value in a simple two-body reaction or a breakup reaction. Defined as QM of the residual nucleus (or intermediate system before breakup) minus the energy of the excited level in this system. Use QI=QM for reactions with no intermediate states in the residual nucleus and without complex breakup (LR=0). (See paragraph 3.3.2.)

Summary:
QM uses ground state masses + excitation,
QI uses ground state masses

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What needs to be changed…

- Q value wording fix is insidious since used everywhere…
- Found 3 sections (so far) that need wording fix: MF = 3, 9, 10
- Made fixes to these sections in the ENDF manual at previous meeting
  - Need to be double checked
  - Changes need to be voted on

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