

Prospectus

Consistent evaluation of Pt isotopes



M. Herman

4/27/2023

LA-UR-23-24502



Managed by Triad National Security, LLC for the U.S. Department of Energy's NNSA

Pt landscape

Pt isotopes	Abundance %	Exp. data (2022)	Evaluations
190	0.012	(n,g), (n,2n), (n,el)	JENDL-5, TENDL-21, ENDF-8 = TENDL-2015 = JEFF-3.3
192	0.782	(n,g), (n,2n)	JENDL-5, TENDL-21, ENDF-8 = TENDL-2015 = JEFF-3.3
194	32.86	(n,tot), (n,el), (n,n'), (n,g), (n,p), (n,a)	JENDL-5, TENDL-21, ENDF-8 = TENDL-2015 = JEFF-3.3
195	33.78	(n,el), (n,g), (n,p)	JENDL-5, TENDL-21, ENDF-8 = TENDL-2015 = JEFF-3.3
196	25.21	(n,el), (n,n'), (n,g), (n,p), (n,a)	JENDL-5, TENDL-21, ENDF-8 = TENDL-2015 = JEFF-3.3
198	7.36	(n,el), (n,2n), (n,n'), (n,g), (n,a)	JENDL-5, TENDL-21, ENDF-8 = TENDL-2015 = JEFF-3.3
191	0 ($T_{1/2}= 2.83$ d)	none	JENDL-5, TENDL-21, ENDF-8 = TENDL-2015 = JEFF-3.3
197	0 ($T_{1/2}=19.89$ h)	none	JENDL-5, TENDL-21, ENDF-8 = TENDL-2015 = JEFF-3.3
Natural	100	(n,tot), (n,el), (n,2n), (n,f), (n,n'), (n,g)	LANL-LLNL (1973)

Experimental data

Fair amount, mostly for abundant isotopes and natural element. Not enough, however, to pinpoint evaluations.

Many of the available experiments are not useful.

Therefore, all evaluations must, to a large extent, rely on model calculations.

Major evaluations

- **JENDL-5 (15 isotopes)**
 - 2015-06 Evaluated with CCONE code by K.Shibata (JAEA)
 - 2018-07 Activation cross sections and MF=3,6/MT=600-849 added.
 - 2020-10 Energies of discrete primary photons corrected.
- **ENDF/B-VIII.0 (9 isotopes)** adopted from TENDL-15, a large scale evaluation project using TALYS code
- **JEFF-3.3 (8 isotopes)** = TENDL-15 = ENDF/B-VIII.0
- **TENDL-21 (38 isotopes)** seems to be very close to TENDL-15 (at least for Pt194)

Safe to assume that all these evaluations are at least 7 years old.

- **LANL (8 isotopes)** new set of evaluations (next slides)

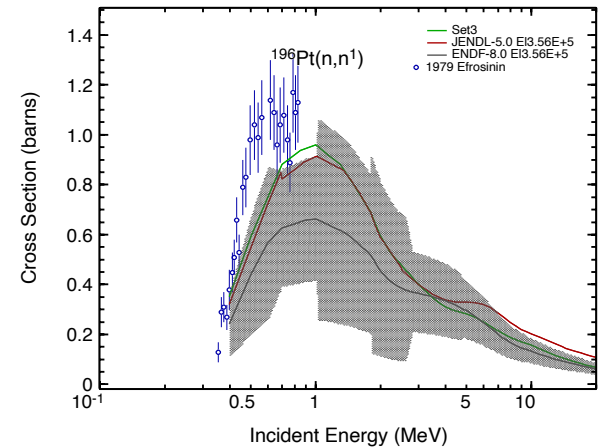
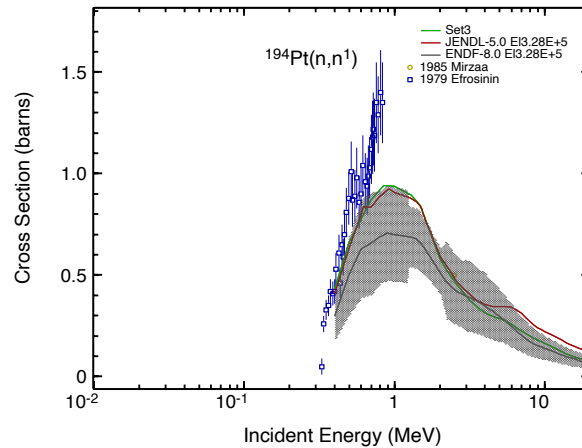
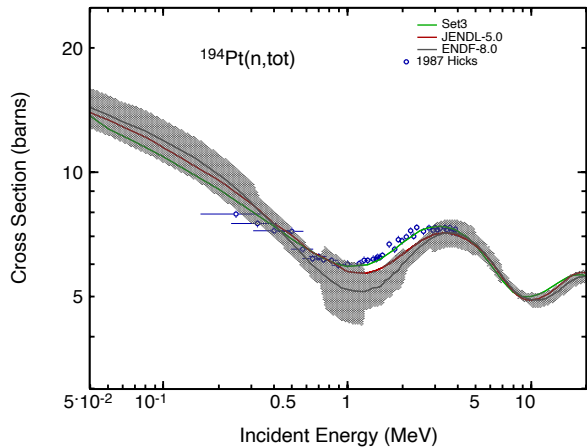
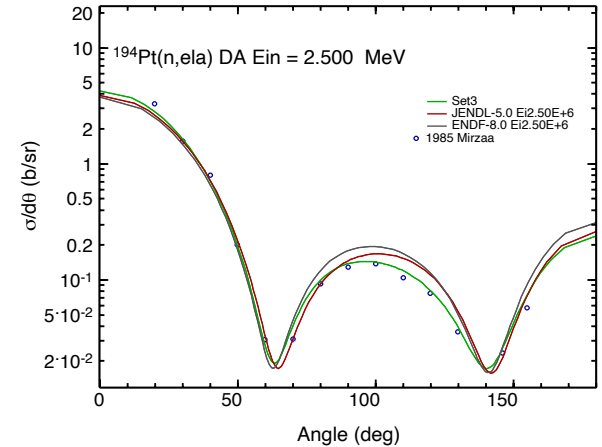
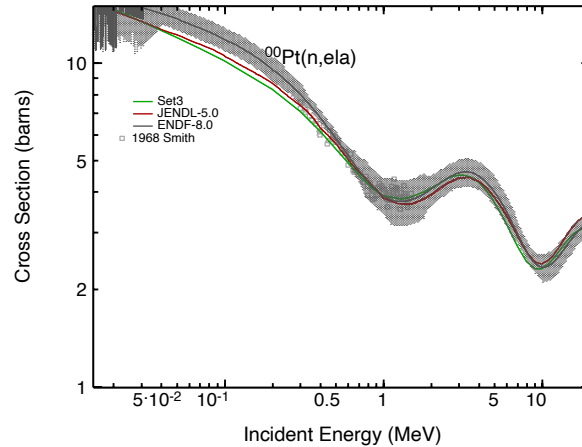
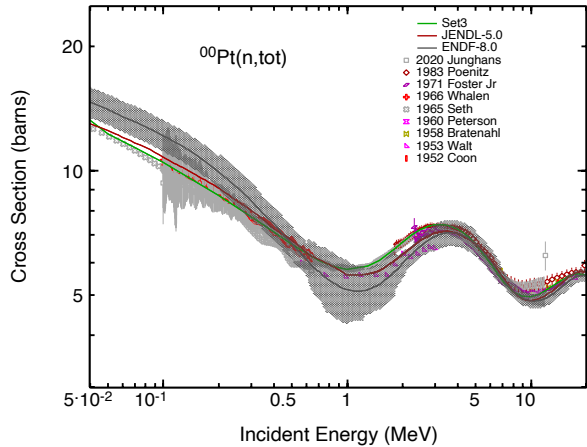
Evaluation methodology comparison

	JENDL-5	ENDF/B-VIII.0 (TENDL-15)	New LANL evaluation
Resonance region	Mughabghab 2006	Mughabghab 2006 + randomly generated	Mughabghab 2018
Incident channel	Coupled channels	???	Coupled channels with dispersive OM potential
Preequilibrium emission (PE)	Classical exciton model	Classical exciton model	Quantum Mechanical Multistep (MS) Direct and MS Compound
PE gamma emission	Classical exciton model	Classical exciton model	Quantum Mechanical MS Compound
Compound decay	Hauser-Feshbach	Hauser-Feshbach	Hauser-Feshbach
Level densities	Gilbert-Cameron model	Gilbert_Cameron model?	Enhanced Generalized Superfluid Model
Gamma emission	E1: generalized Lorentzian model (GLO)		E1: modified Lorentzian (MLO1)
Covariances	None	Monte Carlo, including cross-correlations	Kalman, including cross-correlations

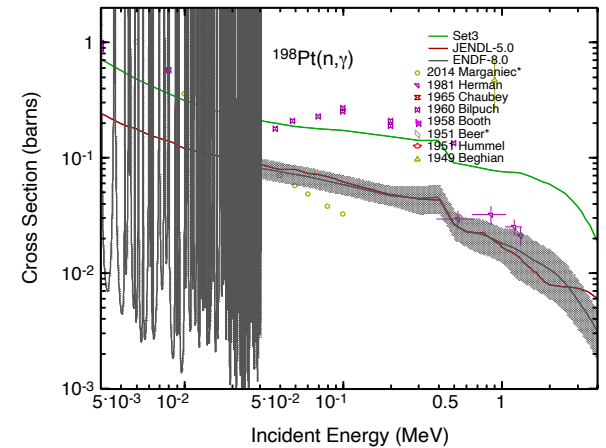
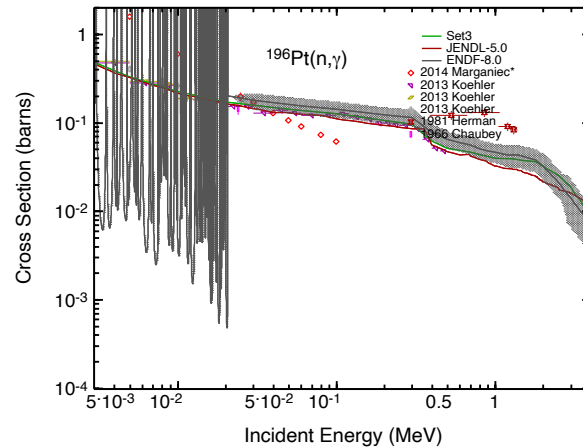
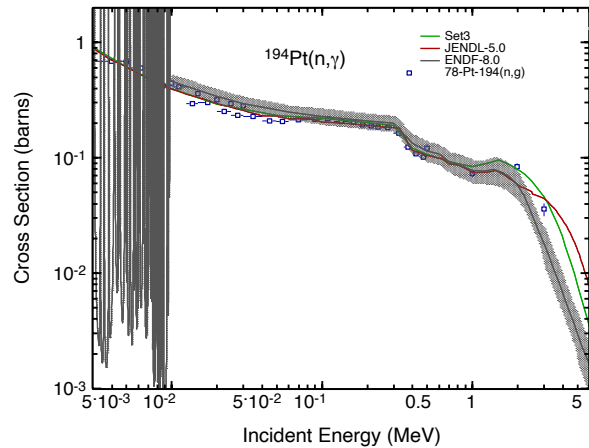
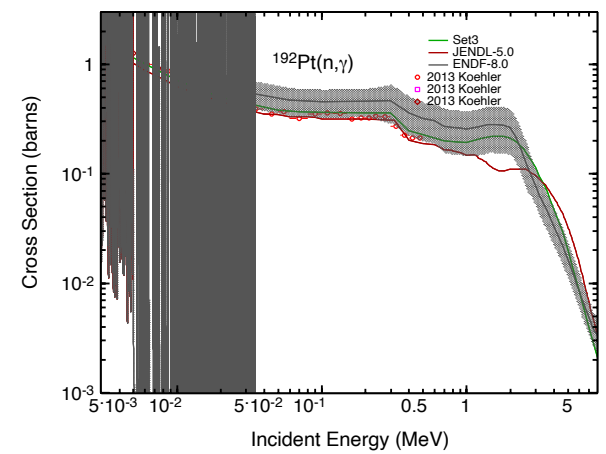
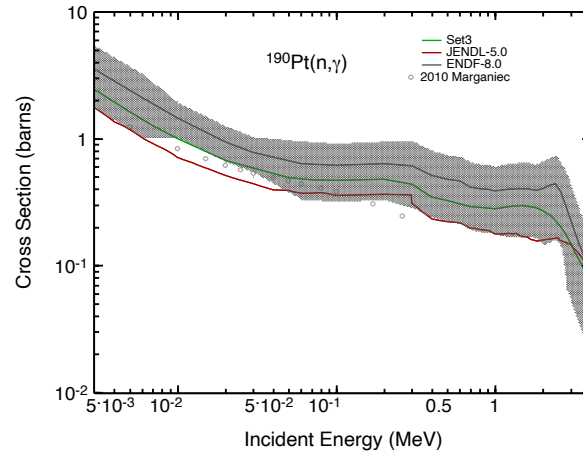
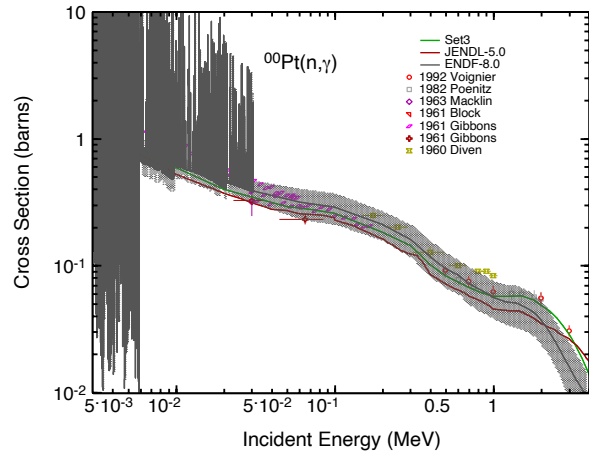
New LANL evaluation

- Evaluations given by model calculations with parameters adjusted to reproduce experimental data.
- Simultaneous and consistent evaluation of 8 isotopes (consistent = parameters for a given nucleus remain the same independently of the changing target).
- Soukhovitskii-Capote CC potential for gold (RIPL #1483) works well for Pt (with the Pt level-scheme coupling) - slightly better than JENDL and much better than TENDL potential (see next slide).
- Preliminary calculations look promising.

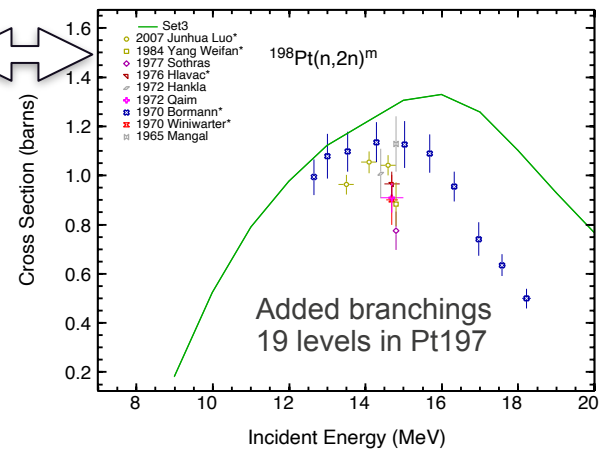
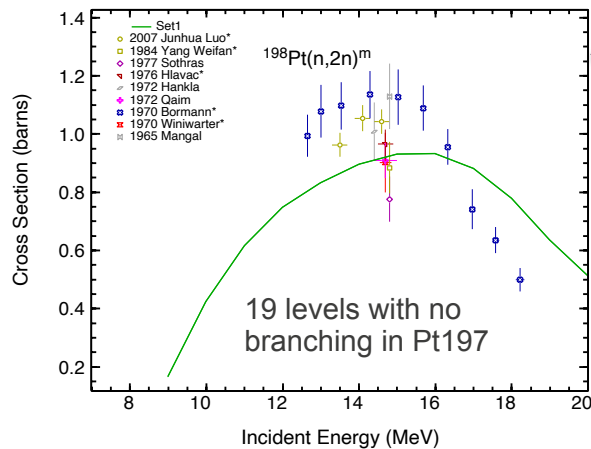
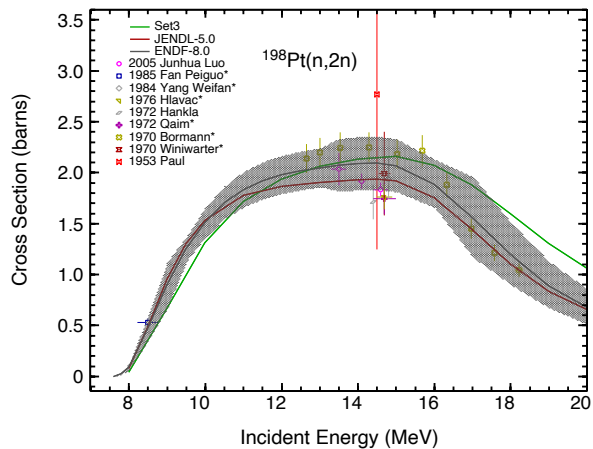
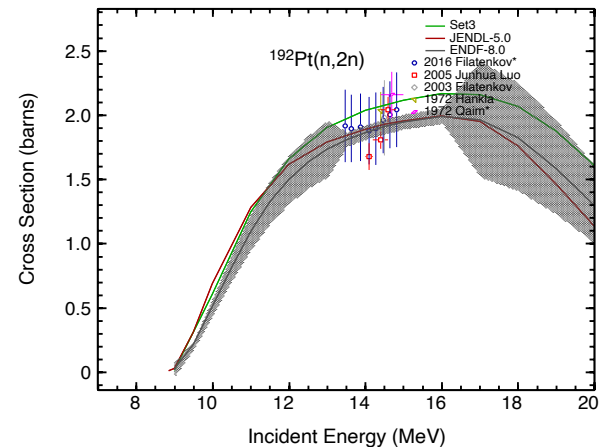
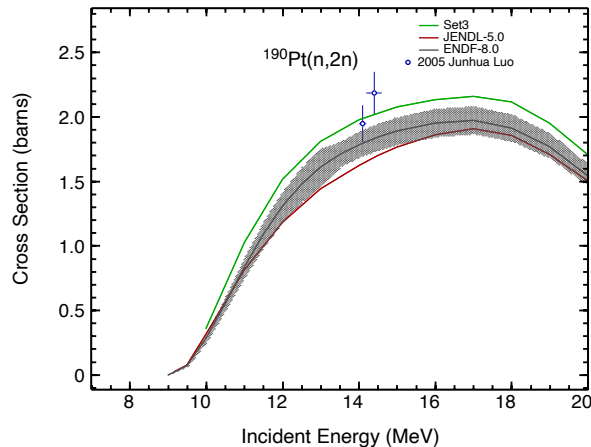
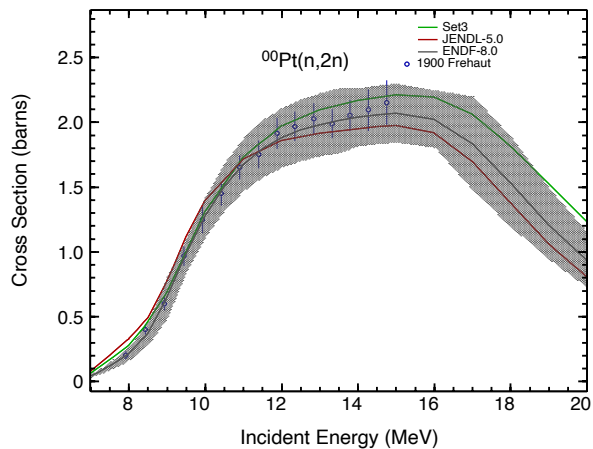
Preliminary results (Optical Model)



Preliminary results (capture 👍)



Preliminary results (n,2n)



Perspective

- Work on charge-exchange reactions
- Fine tune captures (*if needed*)
- Slight tune of (n,2n) (*decay schemes and PE/DWBA strength*)
- Decide on resonance region (*Mughabghab 2018?*)
- Covariances (*cross material correlations???*)