LLNL Report for USNDP

Nuclear Data Week, November 2019

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LLNL contributions to USNDP

- 0.25 FTE for $134k
- Coordinate LLNL nuclear data efforts with CSEWG
- Make, Verify, Validate R-matrix evaluations
  - With IAEA, R-matrix workshops, and GNDS-interchange codes.
- Leverage LLNL programmatic funding to provide evaluations for inclusion in ENDF

FY19 Metrics Table

NSR Compilations	0
EXFOR Compilations	0
XUNDL Compilations	0
ENSDF Evaluations submitted	0
ENDF Evaluations	12 (see below)
Disseminations (in thousands)	5 (approx)
Articles	2
Reports	0
Invited Talks	2

ENDF evaluations in FY19:
12 candidates submitted

FY19 FTE Table

PhD Permanent	0.20
PhD Temporary	0
Tech. & Admin.	0.05
Grad. Student	0
Total	0.25

$134k FY20 funding

$12k FY18 carry over

$122k FY19 total costs

$24k rollover into FY20

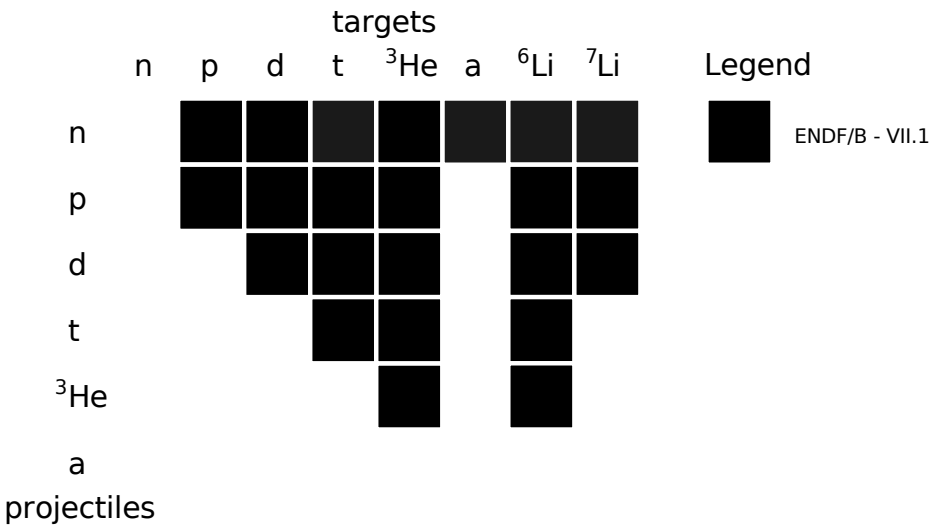
'Proposed scenario':
additional $50k/yr for Sofia Quaglioni

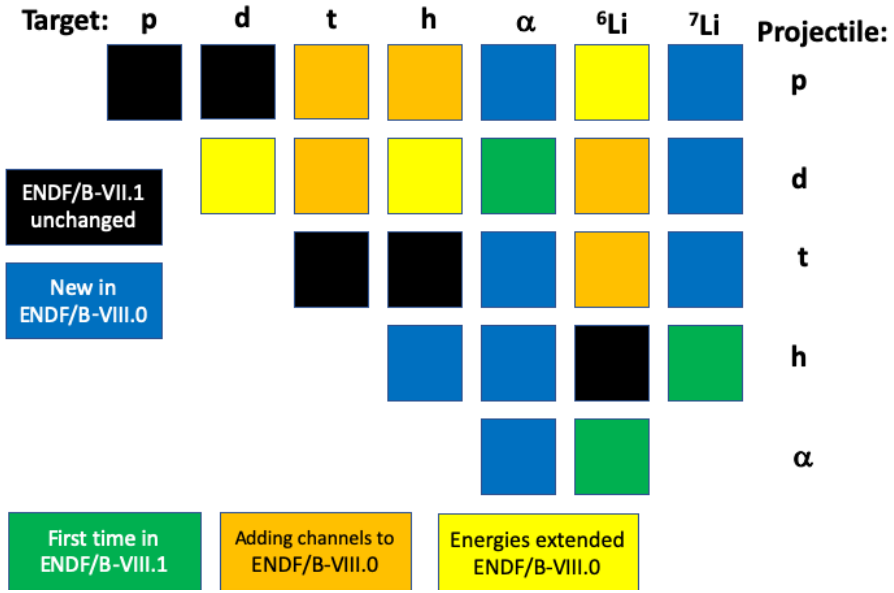
Activity with Current Funding

- National Coordination
  - Coordinate Nuclear Data Efforts with USNDP/CSEWG
    - Attend USNDP/CSEWG meetings
  - Use R-matrix GNDS tools to translate, verify and improve proposed evaluations
  - R-matrix methods: encourage use of Brune basis (soon in SAMMY!)
  - Helping LANL prepare R-matrix parameters for release to CSEWG
- International Coordination
  - Attend IAEA consultants meetings on R-matrix methods
  - Attend INDEN evaluators meeting on light-ion neutron evaluations
    - Projects underway for new evaluations n+^{9}Be, n+^{14}N, n+^{15}N, n+^{23}Na.
- Provide LLNL evaluations for ENDF
  - USNDP funds the translation over to ENDF
  - Delivered LLNL charged-particle evaluations for ENDF/B-VIII release

ENDF Evaluations

- Charged Particle Evaluations by LLNL
  - submitted to CSEWG November 2018.





Used in ENDF/B-VIII.0:
p+a, t+a, h+a, a+a, p+^{7}Li, d+^{7}Li, t+^{7}Li, h+h

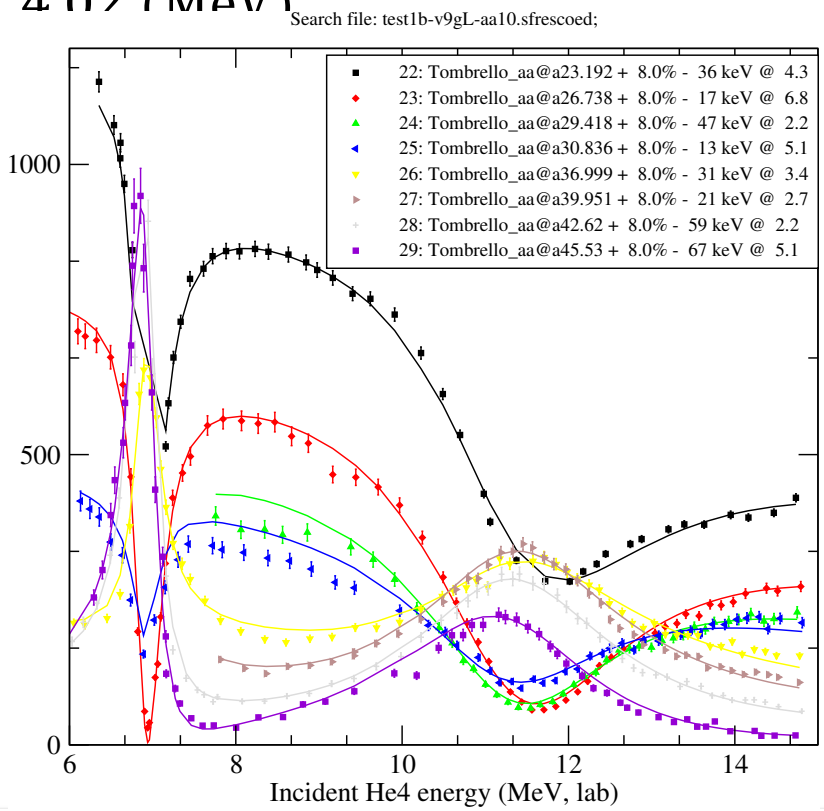
Proposed for ENDF/B-VIII.1:
p+t, p+h, p+^{6}Li, d+d, d+t, d+h, d+a, d+^{6}Li t+^{6}Li, h+^{7}Li, a+^{6}Li.

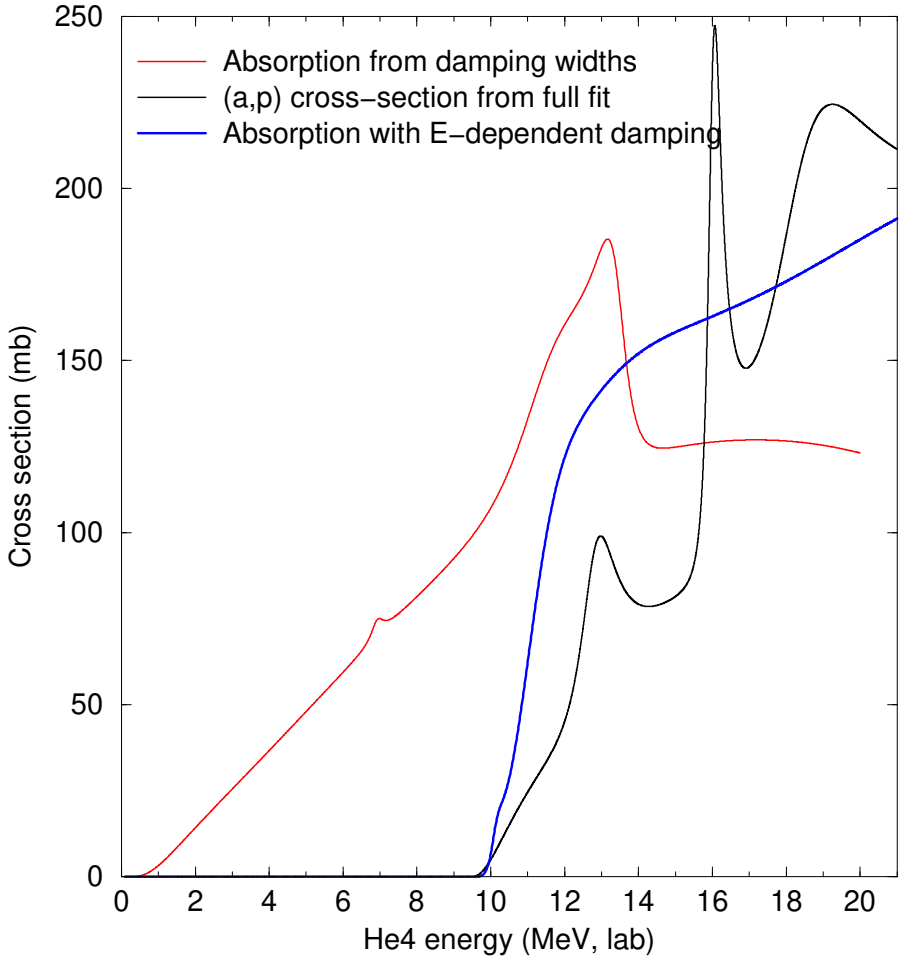
Energy-dependent Damping Widths?

- A simple proposal to include the known energy dependence of flux going to an excluded channel with known threshold E_0.
- Make the damping width energy-dependent: $\bar{\Gamma}_p(E)$
  - Make energy dependence behave as $\Gamma = 2\gamma^2 P_L(E)$ like R-matrix widths
  - So choose
    $$\bar{\Gamma}_p(E) = \tilde{\Gamma}_p \; P_L(E - E_0) / \; P_L(e_p - E_0)$$
  - This cuts off the damping for $E \leq E_0$, and gives $\bar{\Gamma}_p(e_p) = \tilde{\Gamma}_p$ to be fitted.
- Making this work depends on
  - Having good data for angular distributions above the E_0 threshold
  - May need to choose e_p energy in the Brune basis for best physics
  - Knowing physics of missing channels to estimate L and Coulomb barriers
    - For exit in M-body hyper-spherical harmonic K, use $L = K + (3M - 6)/2$

Example fit with Energy-dependent damping

Refit ^{4}He + ^{3}He data.
Choose e_p energy in the Brune basis, with $L = 0, E_0 = 4.02$ (MeV)





First attempt at least gives average transfer cross-sections