

USNDP Activities, FY17 and FY18.

Report from LLNL

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FY17 Activites

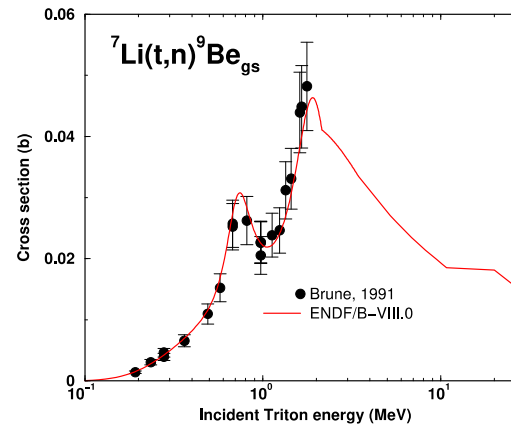
- Provision of 8 charged-particle evaluations to ENDF/B-VIII.0, with conversion from ENDL to ENDF formats via GNDS.
- Improved evaluations for neutron reactions on Be^7 and U^{239}
- Clarified checking of Q-values in terms of masses in ENDF6 files.
- Management and support of international efforts for R-matrix resonance evaluations, focusing on charged-particle reactions. This coordinated work based at IAEA, with LLNL, UND, JAEA, ORNL, IAEA, Tsinghua and LANL to verify and validate all their R-matrix codes and fits of data.
- Writing and testing code FERDINAND for conversion between R-matrix codes and GND, ENDF.
- ENDF Hackathon, August 2017



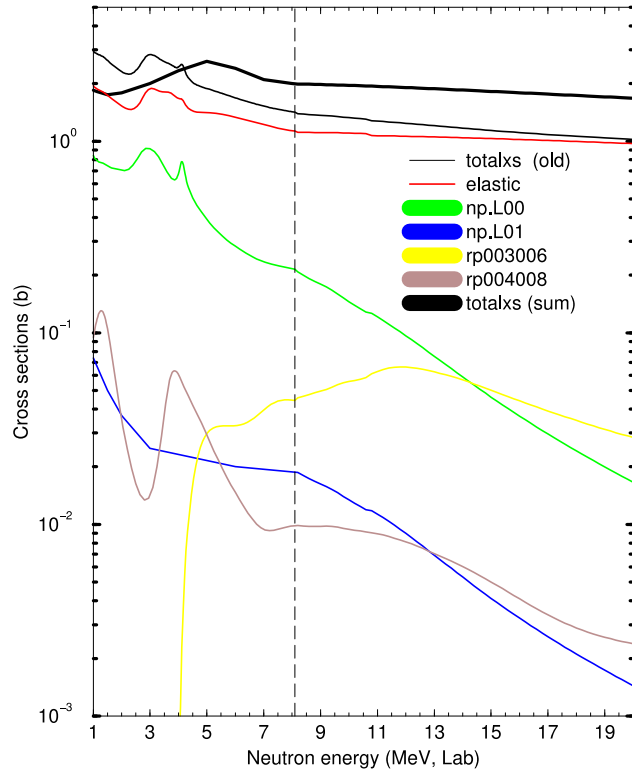
New Charged-particle evaluations for B-VIII.0

Contributions to the
ENDF/B-VIII.0
release.

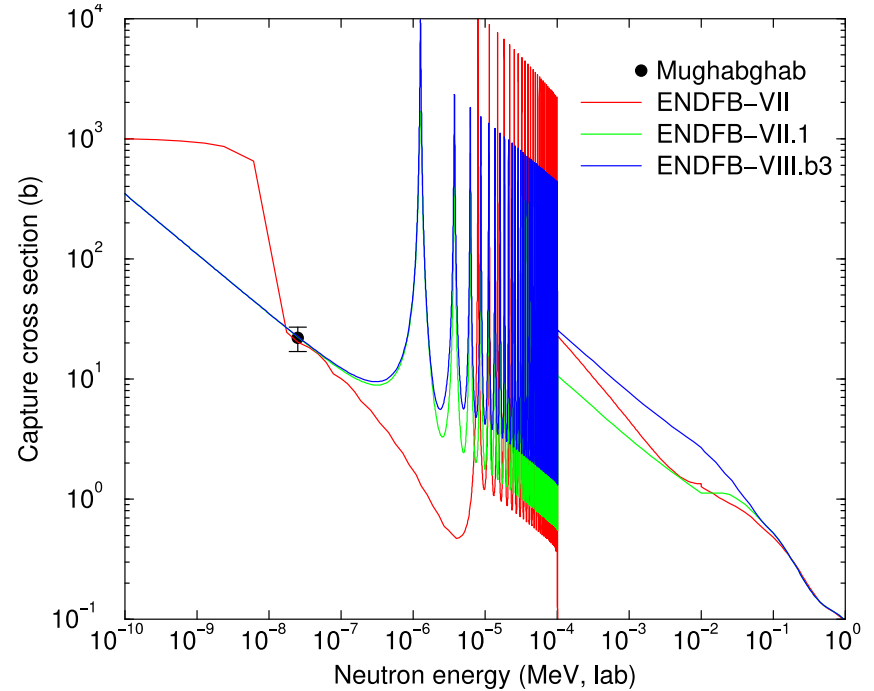
Contributed
 $\alpha+\alpha$, $d+{}^7\text{Li}$, $h+h$, $h+\alpha$,
 $p+\alpha$, $p+{}^7\text{Li}$, $t+\alpha$, $t+{}^7\text{Li}$



Improved neutron evaluations for ^9Be , ^{239}U



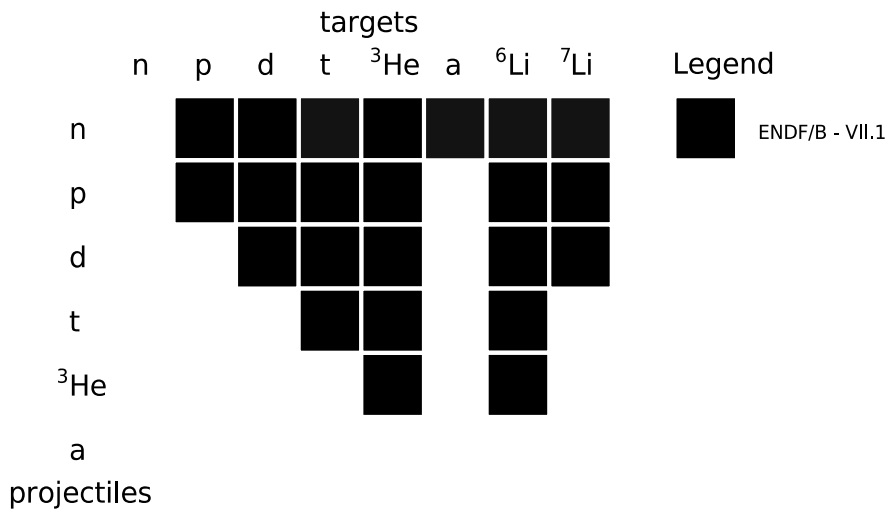
$n + ^7\text{Be}$ evaluation extended beyond 8.1 MeV, to 20 MeV.



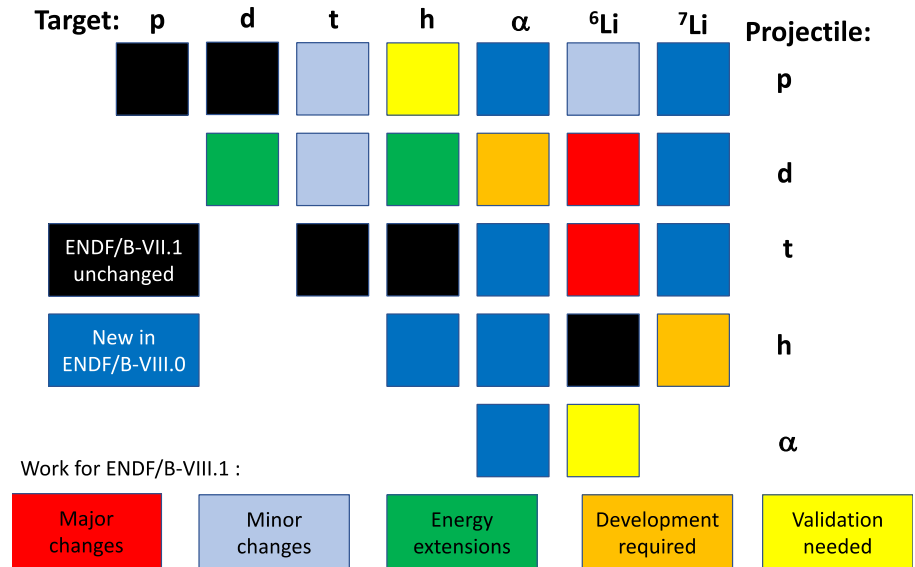
Fixed previous resonance parameters to include both 2^+ and 3^+ resonances as needed for $s_{1/2}$ neutrons on $5/2^+$ target

Past, Present and Future Evaluations

Evaluations in ENDF/B-VII.1



Evaluations in ENDF/B-VIII.0



Submitted from LLNL in October 2016:
 ENDF for a+a, d+⁷Li, h+h, h+a, p+a, p+⁷Li, t+a, t+⁷Li

FY18 plans

- Provision of >7 charged-particle evaluations to ENDF/B-VIII.1, with conversion from ENDL to ENDF formats via GNDS.
- Proposing recent Pu^{236,237} and ²³⁸ evaluations, from LLNL, for ENDF/B-VIII.1 - see talk by Sofia Quaglioni on Nov 8.
- Verifying and validating the R-matrix codes used internationally
 - Contributing to IAEA collaboration
- Providing some R-matrix fits of charged-particle resonances, supplemented by Hauser-Feshbach models, for ENDF/B-VIII.1
 - Using LLNL code Ferdinand for translations to GNDs and ENDF6 formats
- Help evaluate TPC measurements of actinide fission cross-sections
 - Could be funded outside USNDP
- Future ENDF Hackathons.
 - Can we improve Energy Balances?

Could be funded outside USNDP



Propose

Charged-particle evaluations to ENDF/B-VIII.1

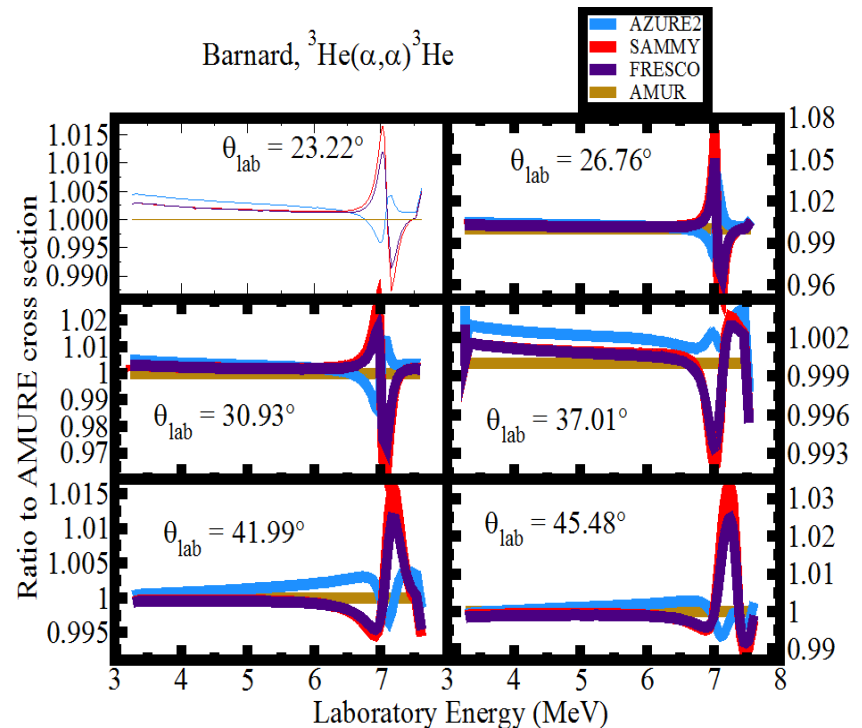
- Major improvements
 - d+Li6 evaluation
 - t+Li6 evaluation
- Better fits within error bars
 - p+t evaluation *
 - p+Li6 evaluation
 - d+t evaluation *
- * also adding gamma capture channels
- Extensions to higher projectile energies
 - d+d evaluation
 - d+h evaluation
- More work needed for some reactions:
 - Gamma decay of ${}^6\text{Li}(3^+)$ resonance, after $h + {}^7\text{Li}$ reaction
 - Gamma decay of ${}^5\text{He}^*$ resonance, during $d + t$ reaction
 - Three-body breakup of deuteron after $d+\alpha$ reaction

For more details,
see CSEWG contribution
next Wed: Nov 8.

Verifying and validating the R-matrix codes

- Focusing on charged-particle reactions.
- Coordinated work at LLNL, UND, JAEA, ORNL, Tsinghua and LANL
- To verify and validate all these R-matrix codes and their fits of data
- Marco Pigni will also describe this collaboration

Recent example of comparisons



This is work in progress!

A New Future of R-matrix evaluations

- USNDP support to contribute to IAEA collaboration
 - Verify and validate R-matrix codes used internationally
 - Prepare the way for new and full R-matrix fits of resonances
- If possible, publish R-matrix evaluations from LANL
 - Include all R-matrix parameters
 - Include all fitted data normalization factors
- Convert between formats (AZURE, EDA, RAC, FRESCO, SAMMY, HYRMA) to GNDS and then ENDF
 - Using my code Ferdinand.py
 - Developed with USNDP funding at LLNL
- Then encourage, monitor and verify new R-matrix fits to data
 - Determine how to fit data above 3-body thresholds
 - Supplement with Hauser-Feshbach models above resonance region
 - Contribute evaluated R-matrix + HF combinations to ENDF/B-VIII.1

Reports

Technical Reports:

- H. Leeb, P. Dimitriou, I. Thompson, “R-Matrix Codes for Charged-particle Induced Reactions in the Resolved Resonance Region (2) Summary Report of an IAEA Consultants’ Meeting 5-7 December 2016”. Report INDC(NDS)-0726, Jan 2017.
- H. Leeb, P. Dimitriou, I. Thompson, “R-Matrix Codes for Charged-particle Induced Reactions in the Resolved Resonance Region (3) Summary Report of an IAEA Consultants’ Meeting 28-30 June 2017”. Report INDC(NDS)-0737, Sept 2017.
 - LLNL contribution supported by USNDP.



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