Status of T6 and related software

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WPEC-32 SG49 Meeting, May 13 2020, NEA, Boulogne-Billancourt
Rule number 1 for data reproducibility, automation, mass production and efficiency

• All historical nuclear data of importance needs to be available all at once, on the spot, NOW.

• This holds for all existing ENDF libraries, Atlas or resonances, EXFOR etc.

• Two options:
  • (Very) Large complete databases: used for the “big 3 T’s”: TALYS, TENDL, TMC
  • command-line API’s (not available)
Loop over nuclides: TENDL

Randomize parameters N times

Experimental nuclear physics
- EXFOR Database
- Nuclear model software
  - TARES resonances
  - TAFIS nubar
  - TANES fis. neutrons
- Nuclear model input parameter database
- Theoretical nuclear physics
  - TALYS fast energies

SAVE INPUT FILES

Nuclear model software
- TEFAL ENDF fmt
- Older ENDF library

Nuclear data library
- ENDF library

Testing and processing
- BNL checking codes
  - NJOY
    - Processed library
      - PREPRO
        - CALENDF
          - + covariances
            - SAVE INPUT FILES
          - + covariance processing
            - FISPACT
      - DRAGON
        - + covariances
          - + covariance software

Neutronics, depletion Reactor physics
- MCNP
  - Criticality (k-eff)
  - Reactivity coeff. (Doppler, void)
  - Reactivity swing
  - Inventory
  - Radiotoxicity
  - Shielding spectra
  - SAVE INPUT FILES

Input files

+ covariances
TENDL-2019, what is new?

• **TARES-1.4**: resonance formatting and analyzing tool

• Measured/compiled/evaluated resonances:
  - Based on latest JENDL-4.0, ENDF/B-VIII.0 and JEFF-3.3
  - **RESONANCETABLES**: code to produce unifying and prioritized data library for thermal cross sections, resonance integral, MACS, D_0, Gamma_gamma, S_0 etc. based on Atlas, RIPL, EXFOR
  - **Best of all worlds, expect global superiority in RRR and URR**

• Statistical resonances:
  - Based on CALENDF
  - Translating the unresolved range from TALYS into statistically resolved range
  - Consistency between the RRR, URR and fast range

• Covariances in MF32 and MF33
  - Consistency between both format
  - Consistent with the random files (using the ENDSAM from IJS)
<table>
<thead>
<tr>
<th>Lib</th>
<th>F(C/E)</th>
<th>N</th>
<th>N &lt; 5%</th>
<th>N &lt; 20%</th>
<th>N &lt; 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CENDL-3.1</td>
<td>1.036</td>
<td>201</td>
<td>129(0.642)</td>
<td>177(0.881)</td>
<td>187(0.930)</td>
</tr>
<tr>
<td>ENDFB-8.0</td>
<td>1.022</td>
<td>375</td>
<td>284(0.757)</td>
<td>332(0.885)</td>
<td>351(0.936)</td>
</tr>
<tr>
<td>JEFF-3.1</td>
<td>1.024</td>
<td>425</td>
<td>315(0.741)</td>
<td>377(0.887)</td>
<td>398(0.936)</td>
</tr>
<tr>
<td>JENDL-4.0</td>
<td>1.025</td>
<td>359</td>
<td>269(0.749)</td>
<td>320(0.891)</td>
<td>334(0.930)</td>
</tr>
<tr>
<td>TENDL-2019</td>
<td>1.008</td>
<td>446</td>
<td>416(0.933)</td>
<td>431(0.966)</td>
<td>434(0.973)</td>
</tr>
</tbody>
</table>

Thermal Cross Sections

![Graph showing thermal cross sections for different libraries with values for C/E, N, N < 5%, N < 20%, and N < 50% for each.]
<table>
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<th>N &lt; 5%</th>
<th>N &lt; 20%</th>
<th>N &lt; 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CENDL-3.1</td>
<td>1.056</td>
<td>194</td>
<td>73(0.376)</td>
<td>126(0.649)</td>
<td>158(0.814)</td>
</tr>
<tr>
<td>ENDFB-8.0</td>
<td>1.060</td>
<td>377</td>
<td>138(0.366)</td>
<td>249(0.660)</td>
<td>300(0.796)</td>
</tr>
<tr>
<td>JEFF-3.1</td>
<td>1.059</td>
<td>386</td>
<td>133(0.345)</td>
<td>257(0.666)</td>
<td>312(0.808)</td>
</tr>
<tr>
<td>JENDL-4.0</td>
<td>1.054</td>
<td>334</td>
<td>133(0.398)</td>
<td>233(0.698)</td>
<td>275(0.823)</td>
</tr>
<tr>
<td>TENDL-2019</td>
<td>1.058</td>
<td>412</td>
<td>146(0.354)</td>
<td>263(0.638)</td>
<td>321(0.779)</td>
</tr>
<tr>
<td>Lib</td>
<td>F(C/E)</td>
<td>N</td>
<td>N &lt; 5%</td>
<td>N &lt; 20%</td>
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</tr>
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<td>--------------</td>
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<td>---------</td>
</tr>
<tr>
<td>CENDL-3.1</td>
<td>1.073</td>
<td>176</td>
<td>29(0.165)</td>
<td>78(0.443)</td>
<td>101(0.574)</td>
</tr>
<tr>
<td>ENDFB-8.0</td>
<td>1.082</td>
<td>328</td>
<td>56(0.171)</td>
<td>157(0.479)</td>
<td>208(0.634)</td>
</tr>
<tr>
<td>JEFF-3.1</td>
<td>1.078</td>
<td>346</td>
<td>67(0.194)</td>
<td>175(0.506)</td>
<td>208(0.601)</td>
</tr>
<tr>
<td>JENDL-4.0</td>
<td>1.070</td>
<td>292</td>
<td>59(0.202)</td>
<td>149(0.510)</td>
<td>187(0.640)</td>
</tr>
<tr>
<td>TENDL-2019</td>
<td>1.076</td>
<td>357</td>
<td>75(0.210)</td>
<td>196(0.549)</td>
<td>233(0.653)</td>
</tr>
</tbody>
</table>
YAML-like quality scoring for EXFOR

- Quality scores for 28455 EXFOR subentries
  - Natalia Dzysiuk for activation c.s. + Ni: 2336 subentries
  - Erwin Alhassan for proton induced reactions: 166 subentries
  - Natalie Gaughan for proton induced reactions: 103 subentries
  - Arjan Koning: NEA/DB/DOC(2017)1: 25850 subentries
subentry: 21289020
   evaluator: Natalia Dzysiuk (2018)
   quality : 1
   comment : data were used for evaluation

subentry: 21440014
   evaluator: Natalia Dzysiuk (2018)
   quality : 0
   comment : data were not used for evaluation
              possible extra error from the low energy neutrons

subentry: 30336037
   evaluator: Natalia Dzysiuk (2018)
   quality : 0
   comment : data were not used for evaluation
              an overestimated value of monitor cross section
T6 status

• TALYS: still working on TALYS-2.0 + tutorial, Fortran-95 modularity taken one level back (half year delay, at least)
• TEFAL: as above
• TASMAN: as above
• Will start using gitlab only with 2.0 versions of codes
• T6 too big and complicated for gitlab at the moment: 2 Gb tarred, need to separate libraries from source codes and scripts, especially for TALYS. T6 available for anyone who requests it, distribution via One-drive.
• Working on “Tools for TALYS” Tutorial explains full T6 system, the use of autotalys, how to produce TENDL and all other libraries generated.
Other software

- EXFORTABLES: EXFOR statistical analysis and human+machine-readable database
- RESONANCE TABLES: Unifying basic quantities in the resonance range (thermal xs, Res Int, MACS, etc.)
- ENDF TABLES: Decompose ENDF libraries into directory-structured x-y tables
- All above are needed for data reproducibility as long as versatile command-line API’s (“getexfor”, “getendf”, “geticsbep”) have not been produced by the community.
- All produced libraries/, exfortables/ etc available on request via One-Drive
Thank you!