Improving the energy balance in (n,γ) reactions

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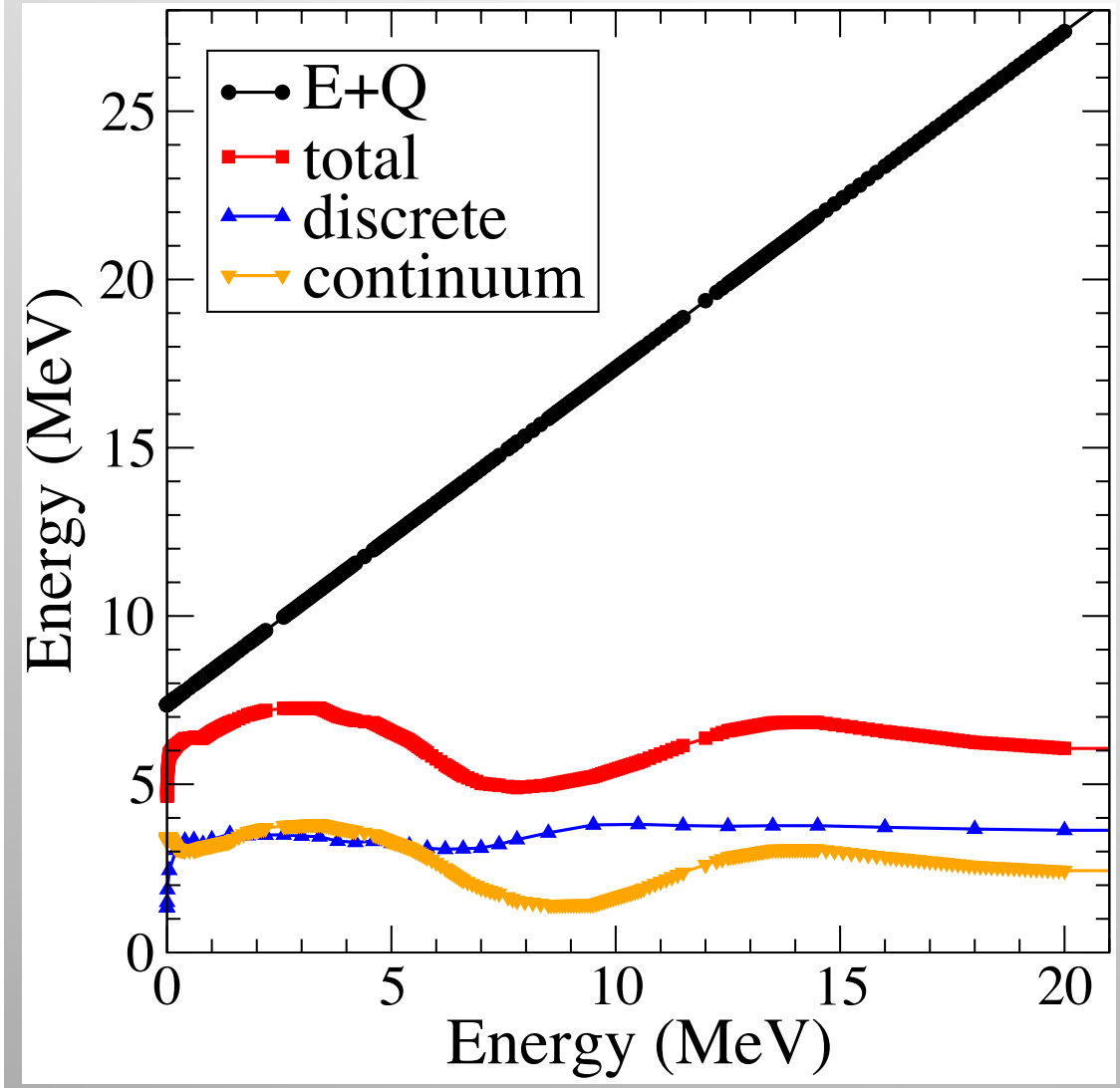
(n,γ) Energy Balance

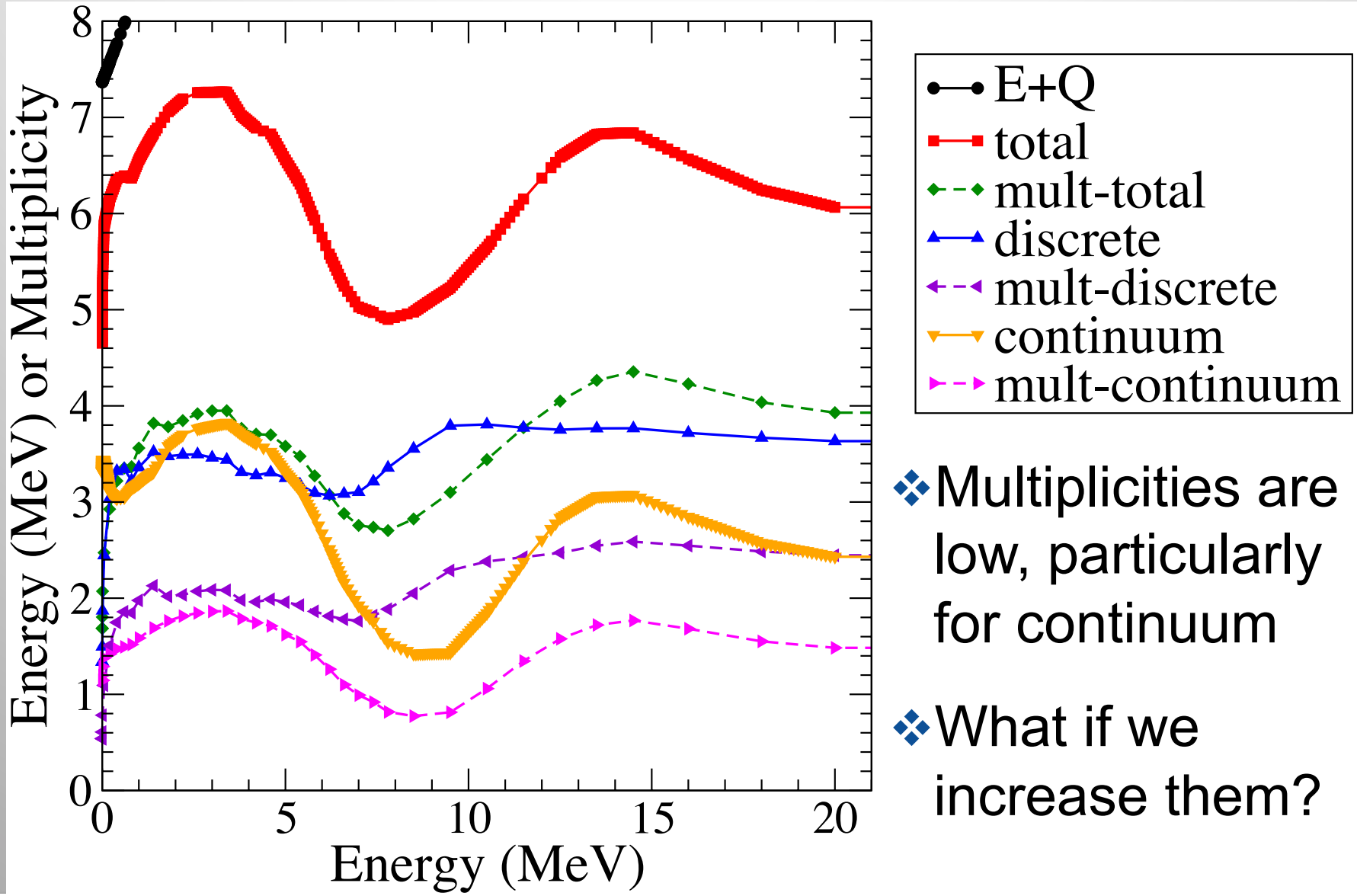
- Vast majority of energy must go to the outgoing gammas
- But the evaluation produces energy deposition much below the total E+Q
- Where is the missing Energy? And What should be done about it?
- This affects (n,gamma) in many isotopes (Pb20x, Ca4x, etc.)

Pb 207 (n,γ) Energy Deposition



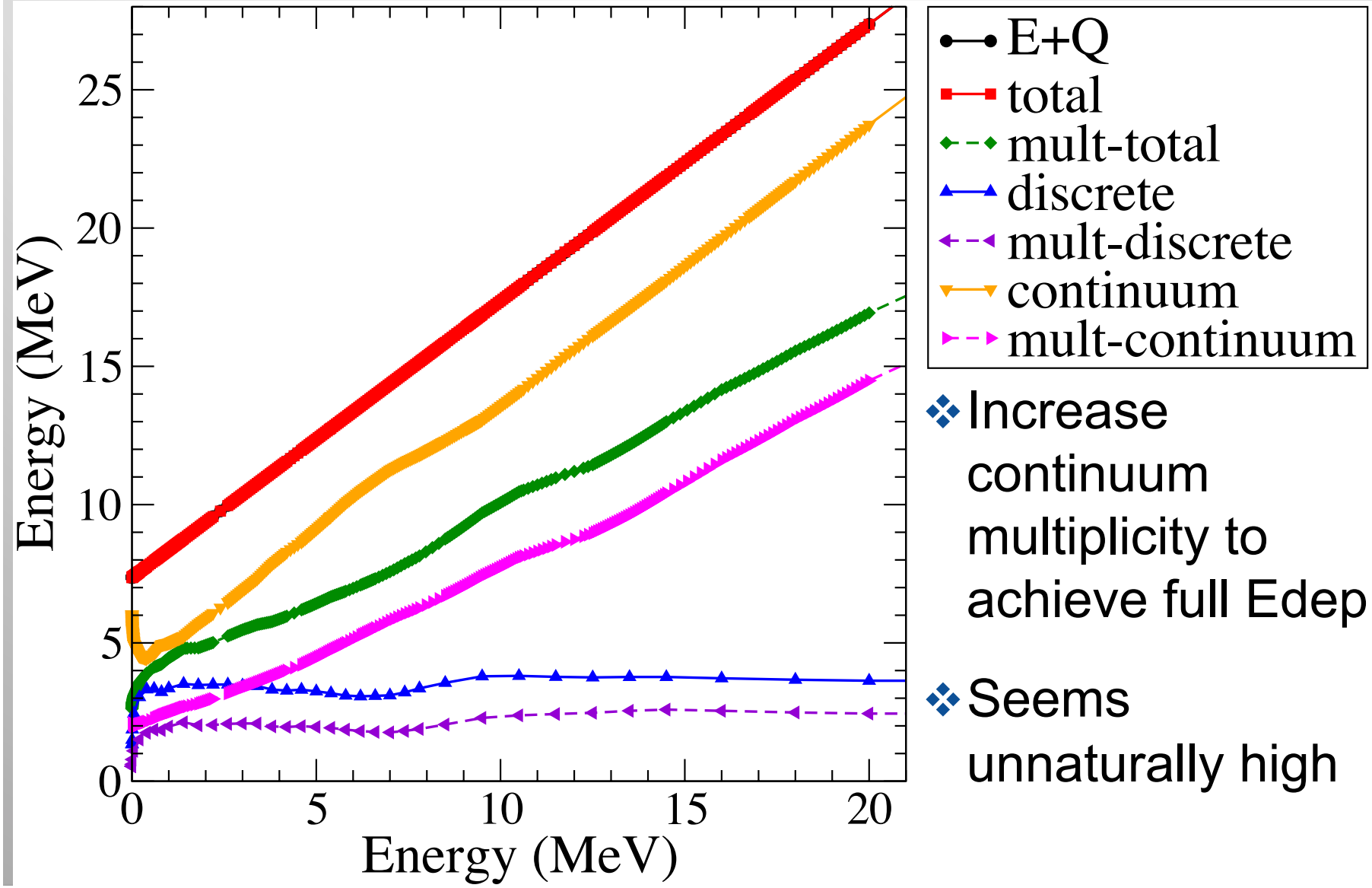
- Total calculated energy deposition by gammas
- Where are the primaries?
- What are the multiplicities?

Pb 207 (n,γ) Energy Deposition



- Multiplicities are low, particularly for continuum
- What if we increase them?

Alter the multiplicity?



- Increase continuum multiplicity to achieve full Edep
- Seems unnaturally high

Let's compare to TENDL

- The Old:

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 <documentations>
   <documentation name="endfDoc"><![CDATA[
 82-Pb-207 NRG        EVAL-DEC04 A.J. Koning
 NRG-2004             DIST-DEC06 REV1-MAY05          20111222
----ENDF/B-VII.1      MATERIAL 8234         REVISION 1
-----INCIDENT NEUTRON DATA
------ENDF-6 FORMAT
```

- The New:

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 <documentations>
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 82-Pb-207  NRG       EVAL-DEC15 A.J. Koning and D. Rochman
 TENDL-2015           DIST-      REV1-
----TENDL-2015        Material 8234         REVISION 1
-----Incident neutron  data
------ENDF-6 Format
```
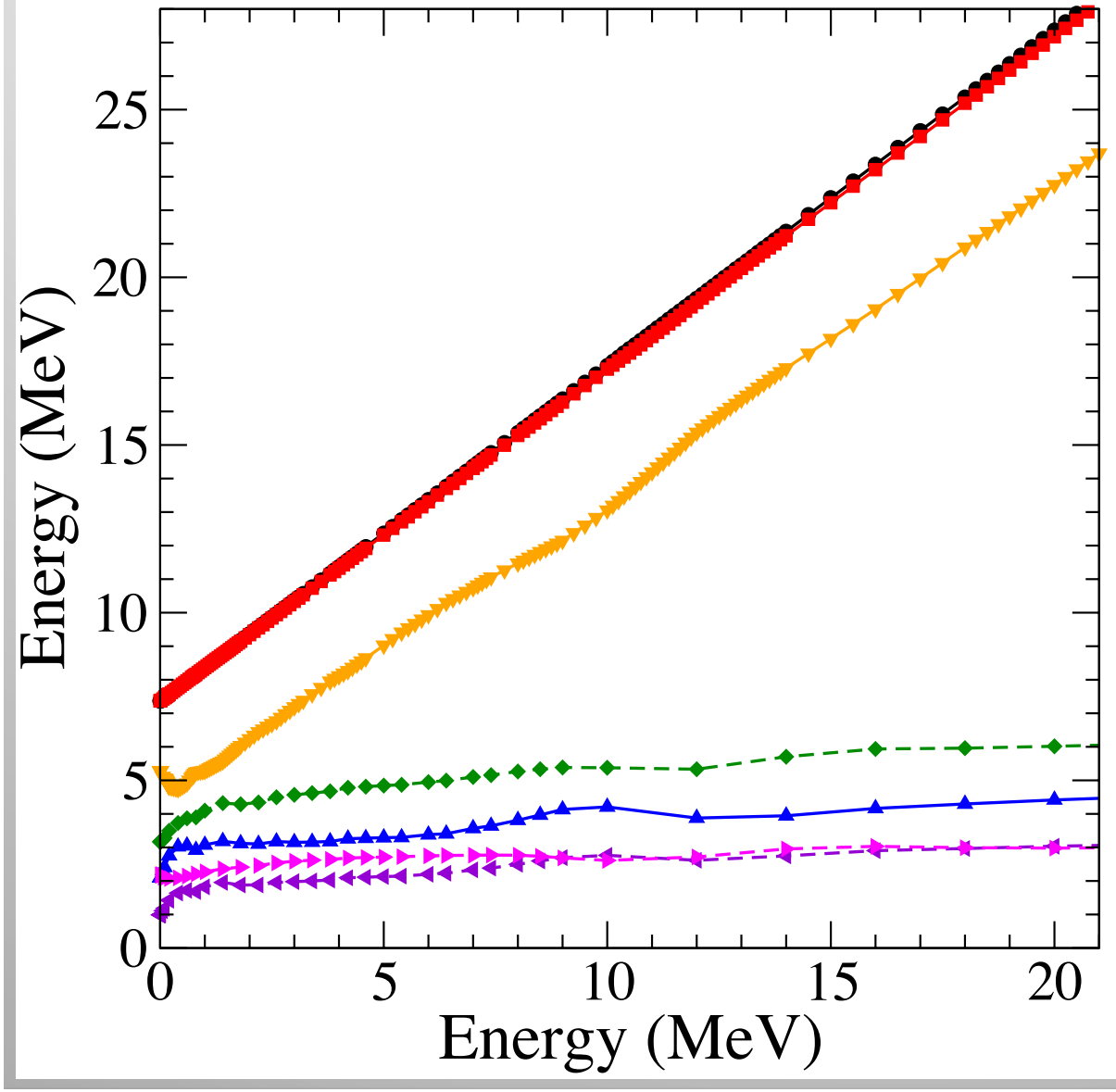
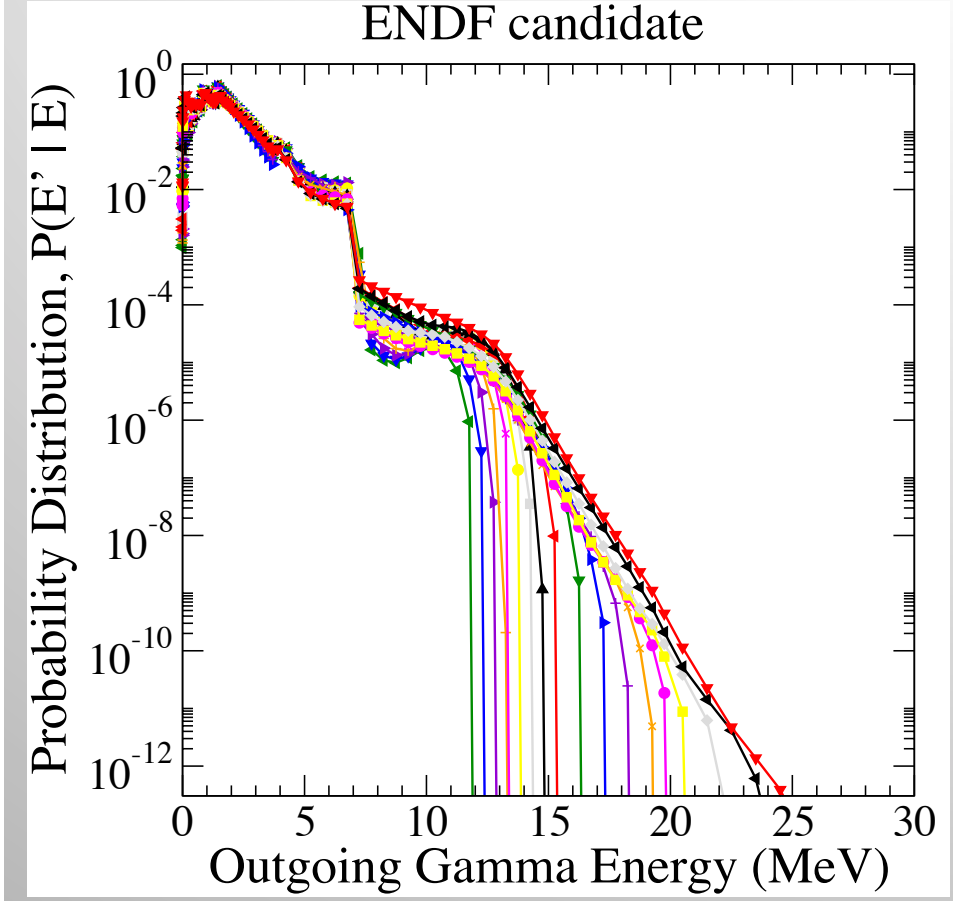

TENDL 2015

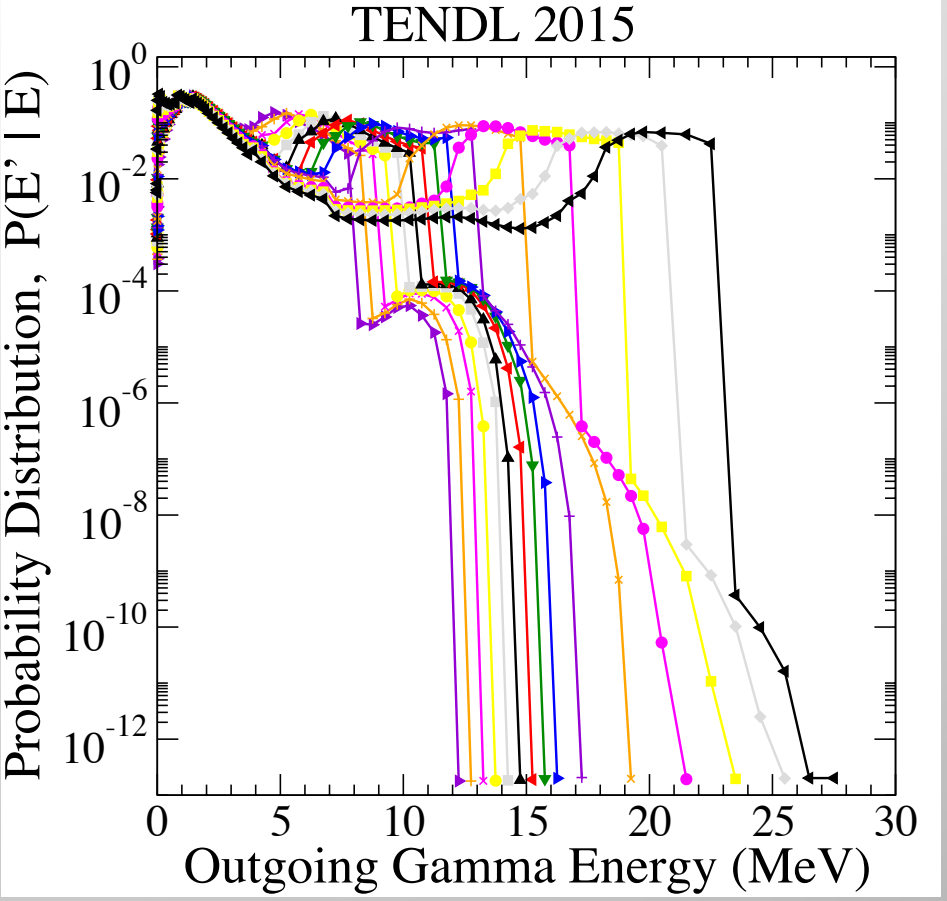


- E+Q
- total
- mult-total
- discrete
- mult-discrete
- continuum
- mult-continuum

- Edep is fixed, but not with multiplicity

Distributions at high neutron energy





- 5 MeV < En ≤ 20 MeV
- Primaries must have been included in continuum

Conclusions

- Gamma types are often absent or confused in an evaluation?
- What could/should be done with this evaluation?
  - Could replace distributions and multiplicities
  - Must check that cross sections haven't changed
- What testing is needed before including a new evaluation like TENDL?

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