Proposed changes to ENDF-6 format

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Proposal #1: clarify the sign of the channel spin (SCH) in MF=2 LRF=7

- Some new evaluations use SCH < 0 to indicate the negative parity of the target
  - ENDF manual doesn't mention this convention, but defines SCH as a floating-point number
  - Target spin/parity already specified elsewhere
  - Fudge raises warnings when negative SCH encountered
- Since parity doesn't make a difference to reconstruction, and to avoid redundancy in ENDF files, preference is to define SCH without corresponding parity

Proposal #1: clarify the sign of the channel spin (SCH) in MF=2 LRF=7

- Proposed action:
  1. clarify definition of SCH in section 2.2.1.6:

SCH Channel spin (floating-point value).

becomes:

SCH Channel spin (positive floating-point value).

  2. Remove negative signs on a few evaluations where they appear (Ca40, Cu63, Cu65, W183) and modify SAMMY not to add the sign in future evaluations

Proposal #2: clarify meaning of COM for breakup reactions, and add additional LCT flag

- In ENDF-VIII.beta3 d + t evaluation, MT=51 is a two-body reaction followed by two-body breakup:
  - d + H3 → n + (He4* → p + t)
- Distributions for outgoing **n**, **p** and **t** all given in the center of mass, but for breakup products the center of mass frame is ambiguous
  - frame of d + H3, or frame of He4* prior to breakup?
  - If the latter, converting back to lab frame requires boosting twice. Simple to handle in Monte Carlo transport, but difficult when generating transfer matrices

Recommendation: add a paragraph to section 0.4.3.4: Breakup reactions:

"For break-up products, the center of mass frame indicates the frame of the initial compound nucleus rather than the rest frame of the intermediate product. This convention is chosen to avoid ambiguity in the meaning of center of mass, and to simplify transforming back to the lab frame."

Proposal #2 continued: add additional LCT flag

- New option for specifying frame in MF=6.
  - LCT=1: all products in LAB frame
  - LCT=2: all in center of mass
  - LCT=3: LAB for A>4, COM for A≤4
  - LCT=4: COM for initial products, LAB for breakup products

- LLNL would like to contribute several light charged-particle evaluations using LCT=4
  - d + t ➔ n + (He4* ➔ p + t)
  - a + Li6 ➔ d + (Be8 ➔ a + a)
  - t + Li6 ➔ n + (Be8 ➔ a + a)
  - etc.

Covariance issues

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Receiving frequent requests for additional covariance info:

- N14 (modeling neutron interactions in atmosphere for high-energy detector)
  - No covariances available
- Charged-particle evaluations (NIF)
  - No covariances for *any* charged-particle reactions!
- I'm trying to fill these gaps with rough estimates, but don't have much time to work on it

Questionable covariances

- In n-001_H_002, the covariance matrix for (n,2n) is computed from other matrices: MT1 – MT2 – MT102. Experimental data suggests smaller uncertainty would be appropriate: