Correction to h-zr.27t: the H in Zirc Hydride S(α,β) Data at 1200K in the ENDF71SaB Library

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Abstract

A problem was reported in the S(α,β) data for H in Zirc Hydride at 1200 K. The particular S(α,β) data in question is denominated as h-zr.27t (or alternatively, h/zr.27t). Plots of the data and an explanation of the problem are given. A new S(α,β) file denominated as h-zr.28t is now the official data at 1200 K.

Identification of the Problem

It was recently pointed out to the nuclear data team that the ENDF71SaB S(α,β) data for H in Zirc Hydride at 1200 K was incorrect[1]. It was noticed that the nxs(5) = 4 setting in the ACE file for h-zr.27t was inconsistent with all of the other H in Zirc Hydride data (20t through 26t) for ENDF71SaB.

In fact, the data error was already evident in Figure 9 of LA-UR-12-0800[2] and in its later revision, LA-UR-14-21878[3] describing the ENDF71SaB data. These graphical results were generated with the S(α,β) data and MCNP and the "broomstick" problem. The broomstick problem is a geometry in which only 1 reaction is allowed to happen in MCNP modelling before

the particle is killed. Extensive tallies are provided so that energy and angular distribution of the scattered neutrons from that one reaction can thus be determined.

Figure 1: Figure 9 from LA-UR-12-0800

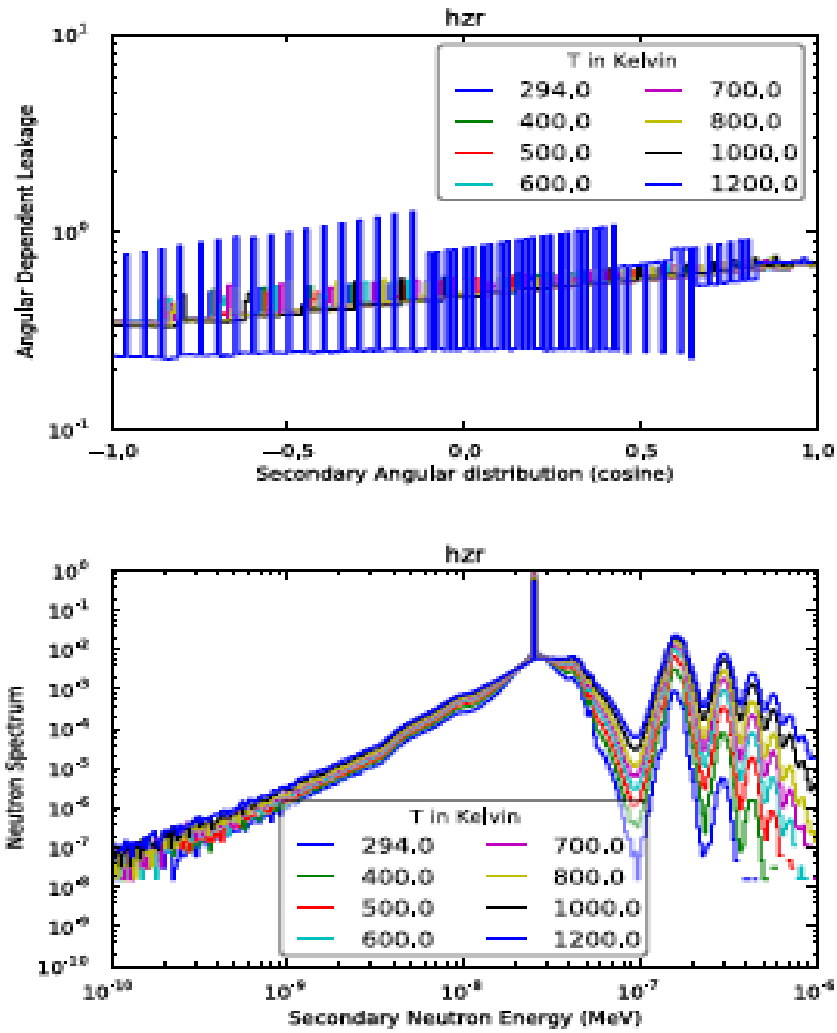


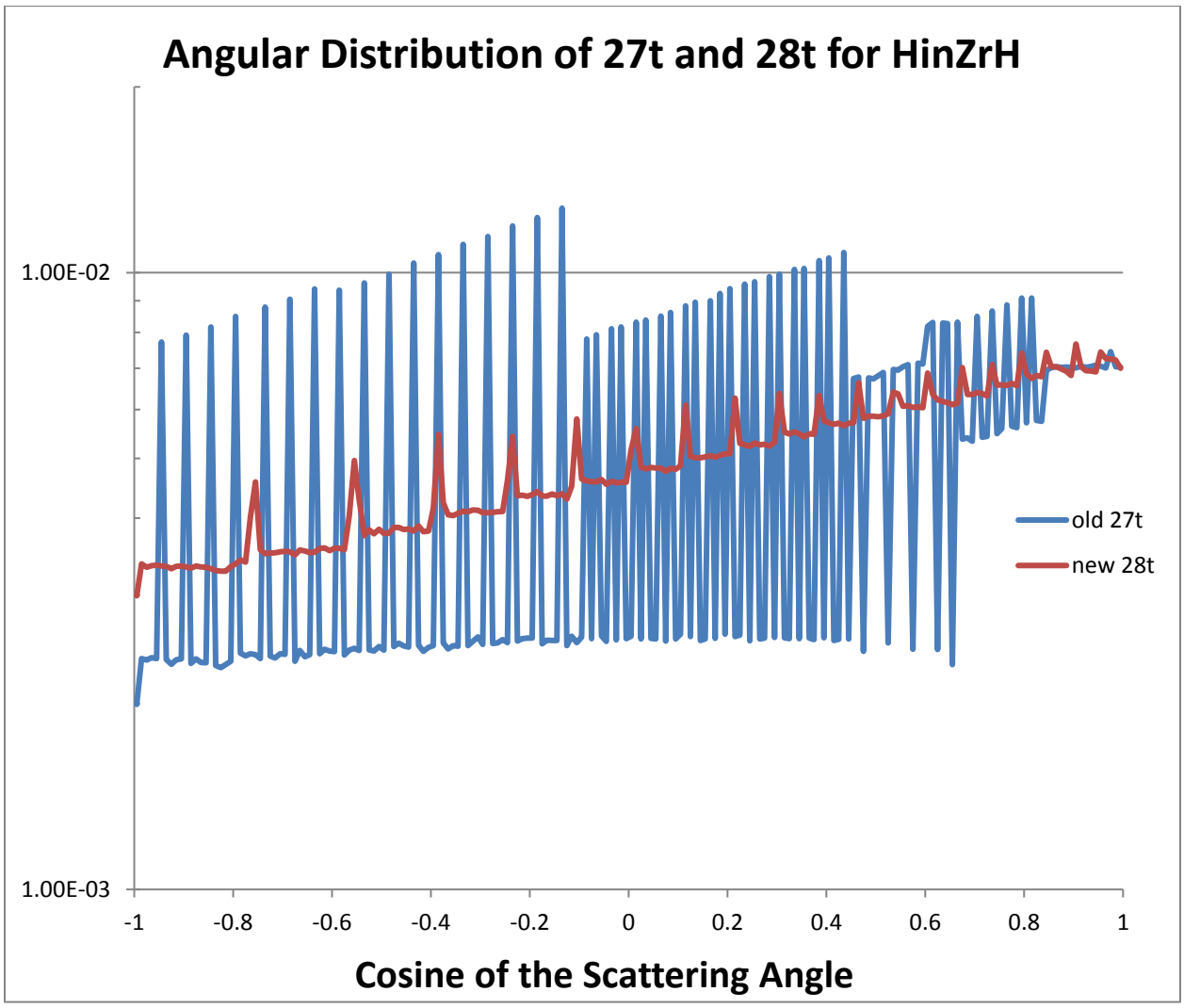
Figure 9: Continuous hzr

The heavy blue line in the top figure (secondary angular distribution) for 1200 K is quite different than the other lines representing lower temperatures. The discrete nature of the incorrect 27t data would be reasonable only if H in ZrH was a coherent scatterer.

The original NJOY input decks used in processing were checked and indeed the 1200 K case had an incorrect input in the ACER input for card 9, 4th input, "ielas". Instead of "1" for incoherent scattering, the input deck inadvertently had a "0" for coherent scattering. H in ZrH is an incoherent scatterer.

The processing for H in ZrH was redone and the following results were obtained: (Note that the new corrected data is denominated as "28t".)

Figure 2: Comparison of old and new H in ZrH secondary angular distributions from the broomstick problem



The new “28t” data now has similar behavior to the previous (20t through 26t) lower temperature data for H in ZrH. It is the recommended replacement for the “27t” data.

The plan is to add the new “28t” data to the official ENDF71SaB data – while keeping the old 27t data available. Appropriate modifications will be made to the documentation[4] and data files.

References:

1. Forrest W. Brown, “Error in h-zr.27t ACE data”, e-mail to the author, Jeremy Conlin and A.C. (Skip) Kahler, dated 6 January 2015.
2. D. Kent Parsons and Jeremy L. Conlin, “Release of Continuous Representation for S(α,β) ACE Data”, LA-UR-12-00800, Los Alamos National Laboratory, September 2012.
3. Jeremy L. Conlin and D. Kent Parsons, “Release of Continuous Representation for S(α,β) ACE Data”, LA-UR-14-21878, Los Alamos National Laboratory, March 2014.
4. “Listing of Available ACE Data”, in preparation.