United States nuclear data program
evaluated nuclear structure data file (ENSDF) at Texas A&M

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Since 2005, when we started our data evaluation program at the Cyclotron Institute, Texas A&M University has become an important participant in the nationwide United States Nuclear Data Program (USNDP), to which we contribute about 10% of the total effort. Our work continued in 2007 with the A=147 mass-chain evaluation [1]: this encompassed all publications since 1992, when this mass chain was last fully evaluated [2].

The A=147 mass chain is a massive one, composed of 16 different elements (Xe, Cs, Ba, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm); it contained 63 datasets[1] in 1992 [2], and the new evaluation, when published, will contain 85 [1]. As well, the number of lines in the database files[2] will be 20,000, about twice what it was before. Figure 1 shows a detailed comparison for each nucleus, where one can see impressive amounts of new data for Nd, Pm, Sm, Eu, Gd and Tb; in particular, ^{147}Gd and

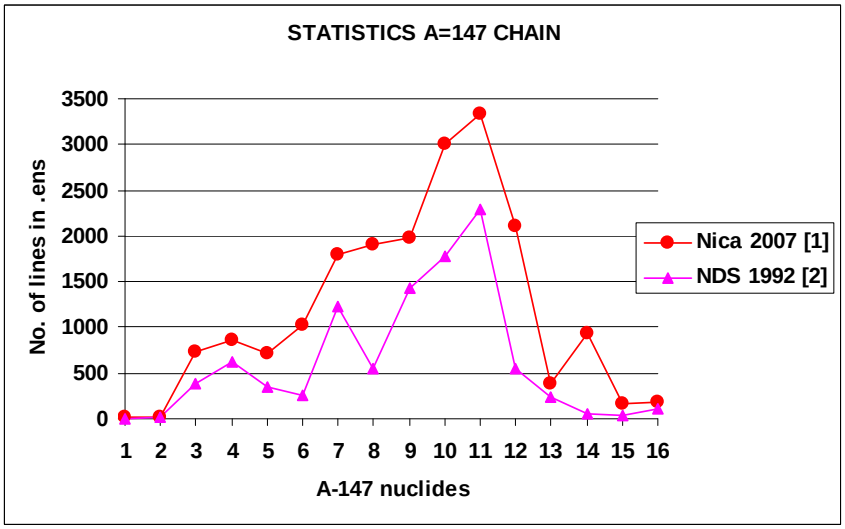

Figure 1. Comparison of the new evaluation [1] with the previous one [2], showing the number of database lines for each of the 16 nuclei in the A=147 mass chain. The nuclides appear from left to right in the same order as they are listed in the text.

[1] A dataset collects the data for one nucleus as measured in a particular decay or reaction, frequently by several independent experiments. The "Adopted Levels, Gammas" dataset, one for each nucleus, is built from the decay and reaction datasets for that nucleus. It gives the best and most extensive data for each nucleus.
[2] The database file (.ens file), one for each dataset, is written in the special ENSDF data format where one line (sometimes extended) contains typical data for a nuclear level, a particular nuclear transition, or other types of data, as well as comment lines.

^{147}Eu contain more than 3,000 lines, largely from high-spin data. There is also a significant increase in the number of publications, about 450 now compared to 350 before[3]. From Fig. 2 one can see that A=147 will be in the group of five largest mass chains.

While the complexity of an evaluation is usually unnoticed by the data consumer, it can have a major impact on the quality of the evaluated data[4]. Each single datum does not exist in isolation but rather is usually interconnected with a wide variety of related data. Often there are significant inconsistencies and conflicts among the existing measurements, and the evaluator must try to reconcile these differences. Obviously, difficult decisions have to be made, often with very little to base them on beyond educated guesswork. Continuity and an experienced evaluator are essential to this process.

In this context, the establishment of an evaluation center at the Cyclotron Institute is becoming desirable. While evaluation now is located predominantly in national laboratories, we have demonstrated that this activity can be done successfully in a university environment at lower costs. Furthermore, at a university some evaluation work can be done with the help of students. Thus, in addition to its intrinsic value for the community, evaluation could also become a tool for teaching nuclear physics.

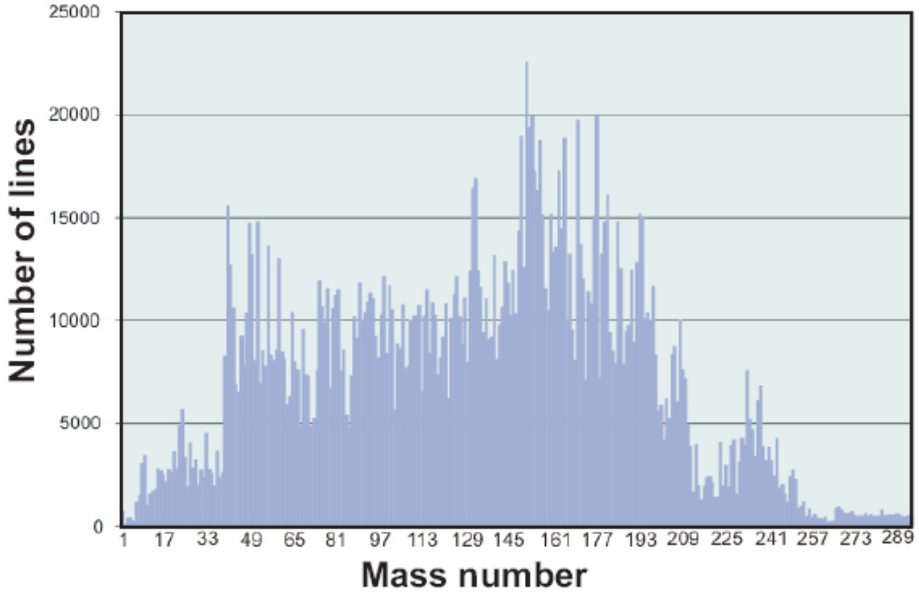

Figure 2. The number of .ens lines for each mass chain in ENSDF on March 2007. One can see that while the average number is about 7,000 lines, there are very few near or above 20,000 lines, where A=147 now lies.

[1] N. Nica, Nucl. Data Sheets (to be published).

[2] E. Der Mateosian and L. K. Peker, Nucl. Data Sheets **66**, 705 (1992).

[3] Only about 2/3 of the added references were published since 1992.

[4] While A=147 is particularly big, the discussion that follows is valid for ENSDF evaluations in general.