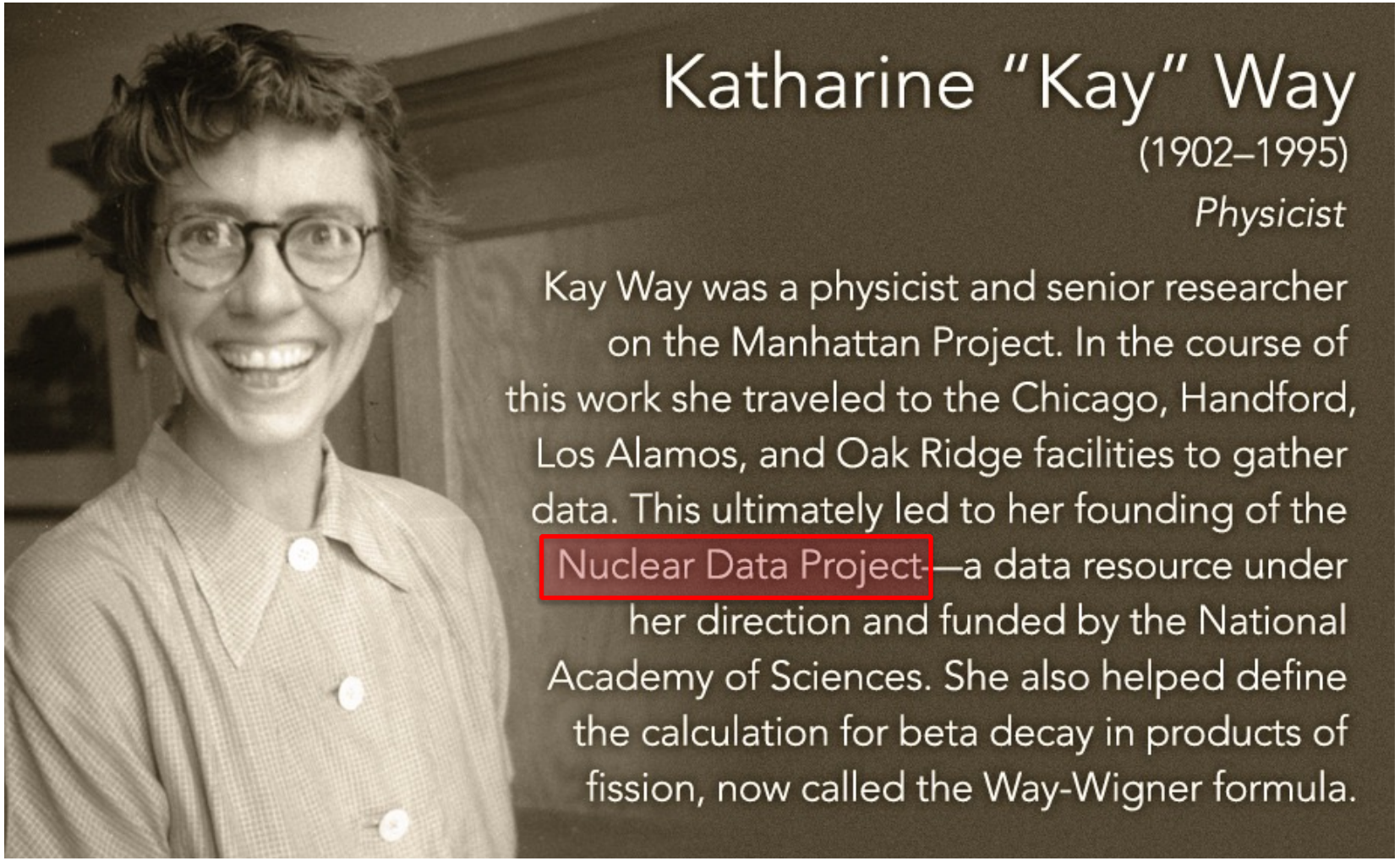
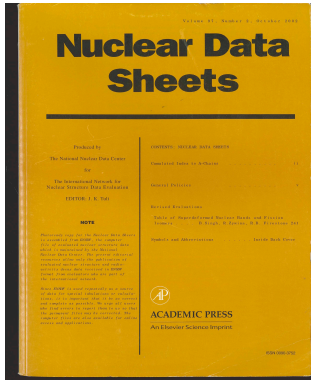
Retrospect on ENSDF

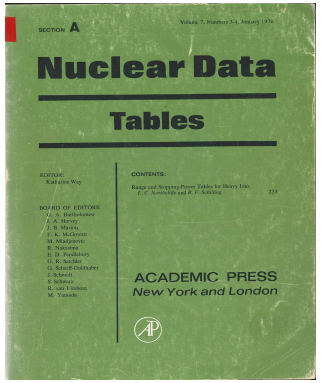
John Kelley

NCSU and TUNL

TUNL







1964:Evaluated Nuclear Structure Data File

1974: INTERNATIONAL NETWORK OF NUCLEAR STRUCTURE AND DECAY DATA EVALUATORS

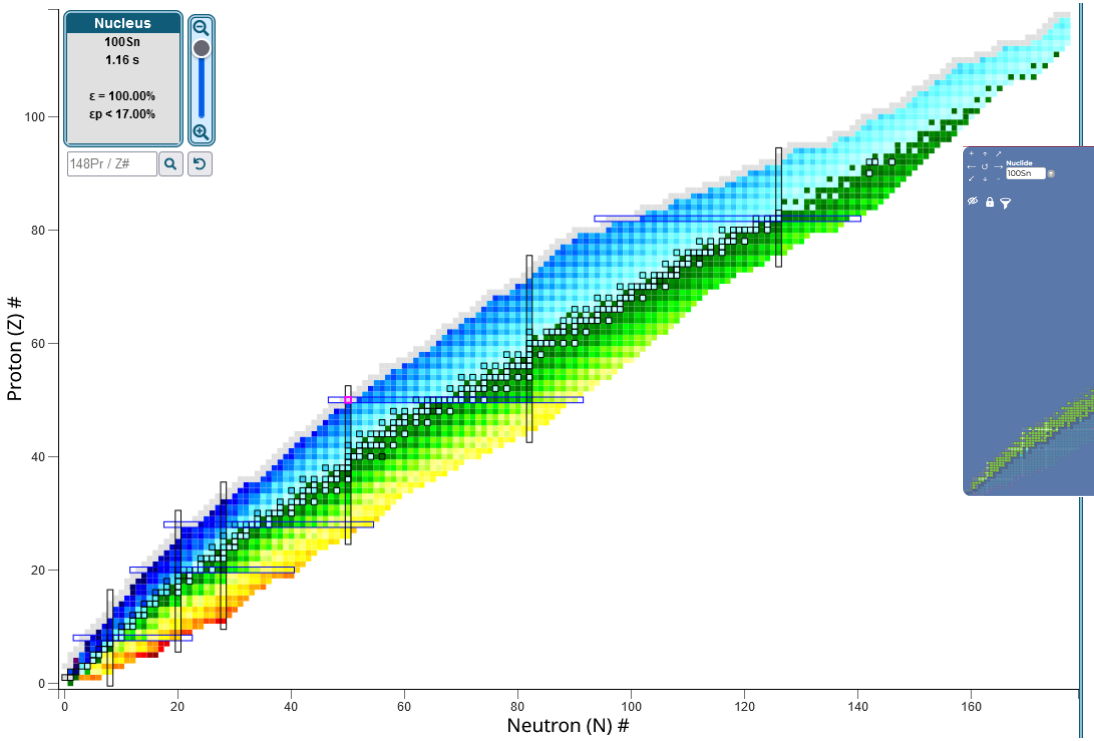
NSDD

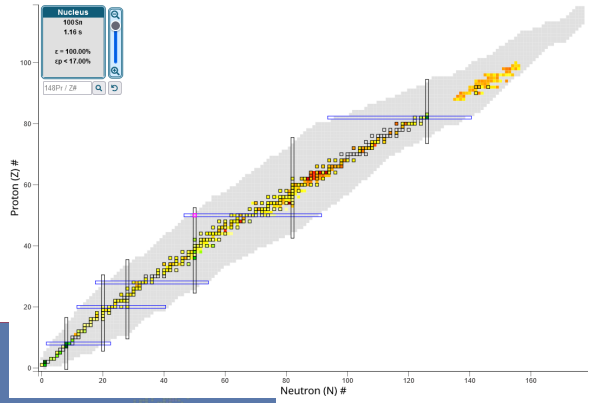
International Atomic Energy Agency
Nuclear Data Services
Provided by the Nuclear Data Section

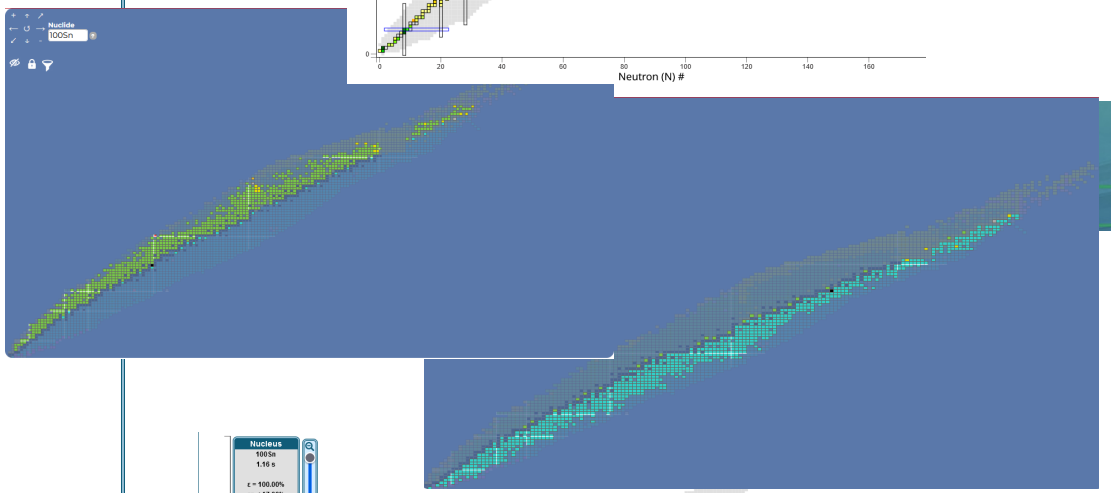
1996/97: Formation of the DoE supported US Nuclear Data Program that united US data centers

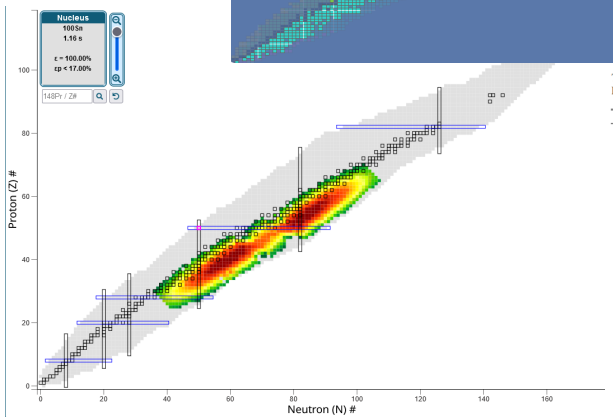
- 1992 NSAC charge on Nuclear Data (R.A. Meyer)
- 1996 LRP

Coverage?

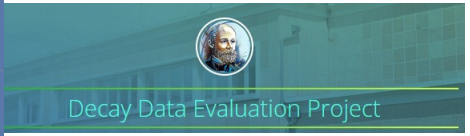








EGAF: Evaluated Gamma-ray Activation File covers only 250 nuclides



Laboratoire National Henri Becquerel covers ~210 nuclides

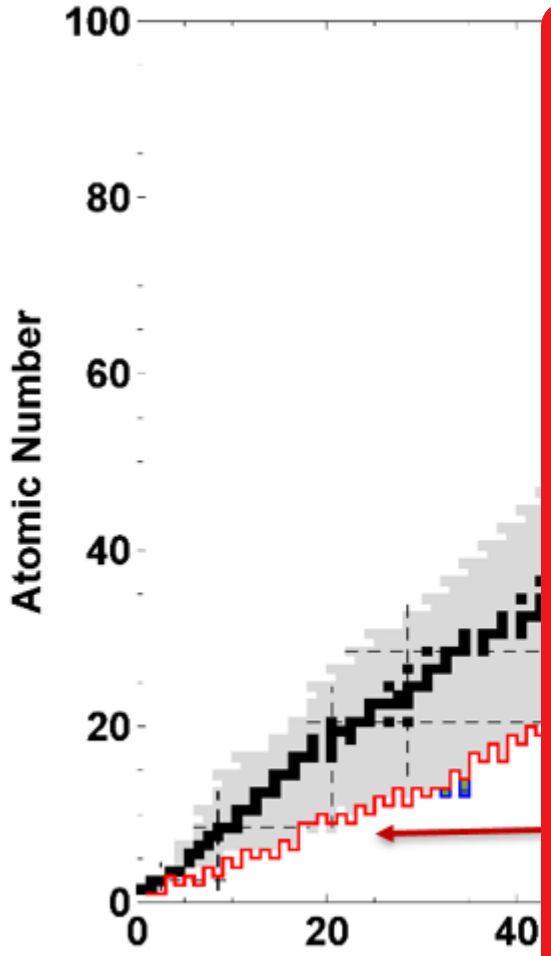
TABLE 6.3.1. FISSION PRODUCTS WHOSE FISSION YIELDS ARE USED AS REFERENCE

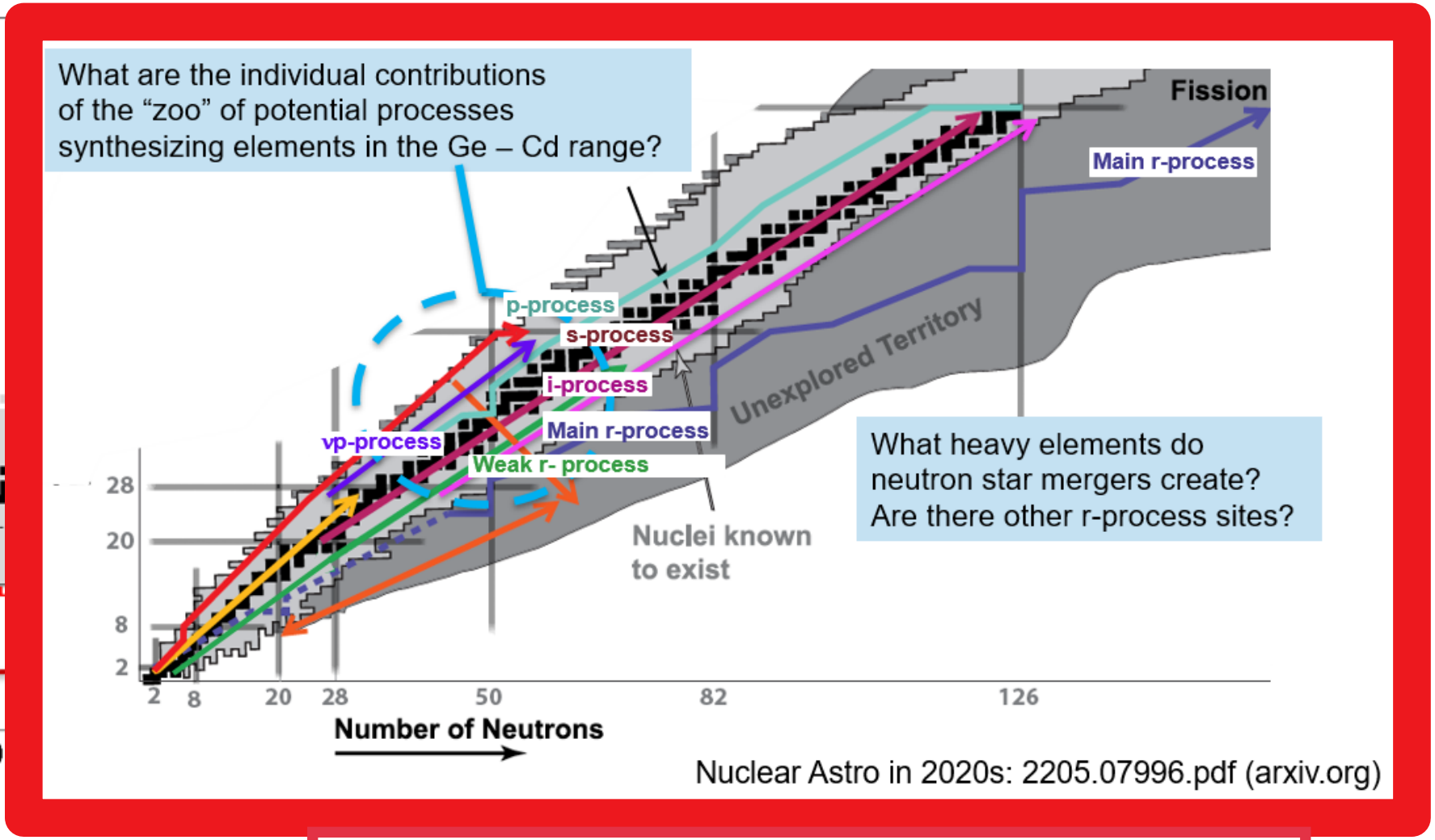
Nuclide	Half-life	Nuclide	Half-life	Nuclide	Half-life
^{83}Kr	stable	^{85m}Kr	4.480 h	^{85}Kr	10.72 y
^{86}Kr	stable	^{87}Kr	76.3 m	^{88}Kr	2.84 h
^{89}Sr	50.55 d	^{90}Sr	28.6 y	^{91}Y	58.51 d
^{95}Zr	64.02d	^{95m}Nb	3.61 d	^{95}Nb	34.97 d
^{95}Mo	stable	^{96}Zr	stable	^{99}Mo	66.0 h
^{100}Mo	stable	^{101}Ru	stable	^{102}Ru	stable
^{103}Ru	39.26 d	^{105}Rh	35.36 h	^{106}Ru	371.63 d
^{106}Rh	29.80 s	^{111}Ag	7.45 d	^{115m}Cd	44.6 d
^{115}Cd	53.46 h	^{125}Sb	2.73 y	^{131}I	8.04 d
^{131m}Xe	11.9 h	^{131}Xe	stable	^{132}Te	78.2 h
^{132}Xe	stable	^{130m}Xe	2.188 d	^{133}Xe	5.245 d
^{133}Cs	stable	^{134}Xe	stable	^{134}Cs	2.062 y
^{135}I	6.61 h	^{135m}Xe	15.29 m	^{135}Xe	9.09 h
^{136}Xe	stable	^{136}Cs	13.16 d	^{137}Xe	3.818 m
^{137}Cs	30.17 y	^{138}Xe	14.08 m	^{140}Ba	12.746 d
^{140}La	40.272 h	^{141}Ce	32.501 d	^{141}Pr	stable
^{143}Ce	33.0 h	^{143}Nd	stable	^{144}Ce	284.4 d
^{144}Pr	17.28 m	^{144}Nd	stable	^{145}Nd	stable
^{146}Nd	stable	^{147}Nd	10.98 d	^{147}Pm	2.6234 y
^{148}Nd	stable	^{148m}Pm	41.29 d	^{148}Pm	5.370 d
^{149}Pm	53.08 h	^{149}Sm	stable	^{151}Pm	28.40 h
^{151}Sm	90 y	^{153}Sm	46.7 h	^{153}Eu	stable
^{154}Eu	8.8 y	^{155}Eu	4.96 y	^{156}Eu	15.19 d
^{161}Tb	6.90 d				

FPY studies utilize decay data from a few hundred nuclides.

IAEA-TECDOC-1168

Where the field is headed

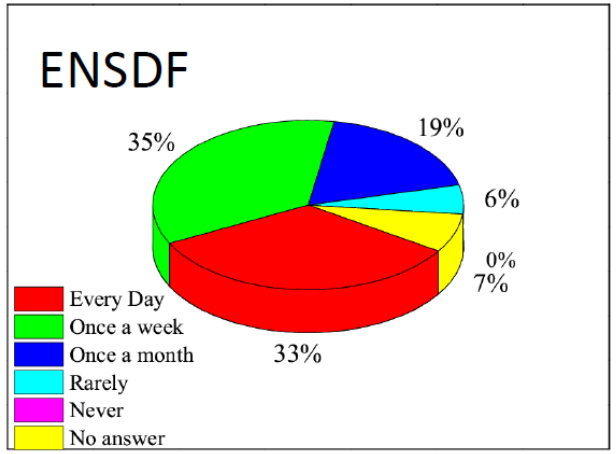


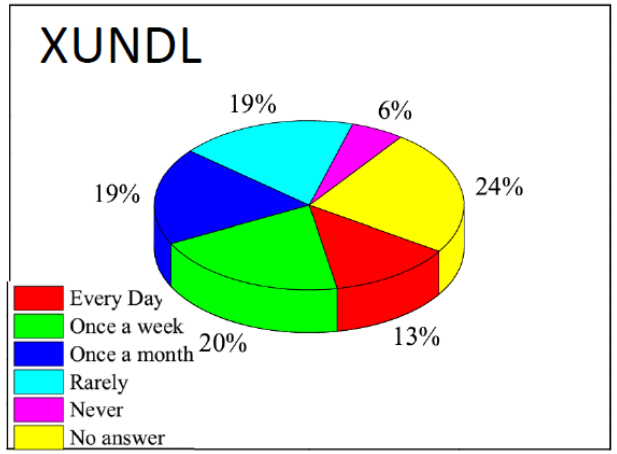


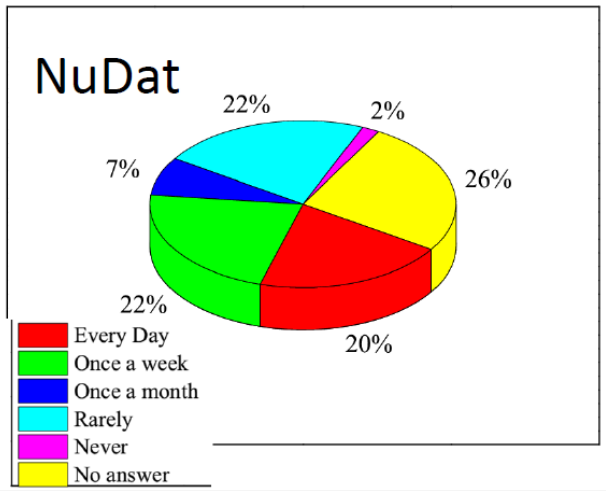
(Images from Sherrill TUNL seminar Nov. 2022)

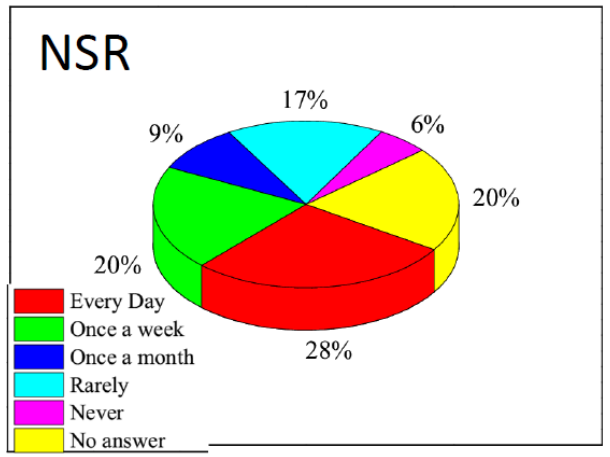
Our field is not driven by data and numbers;
it is driven by science and a need to understand.
Evaluated nuclear data is a building block.

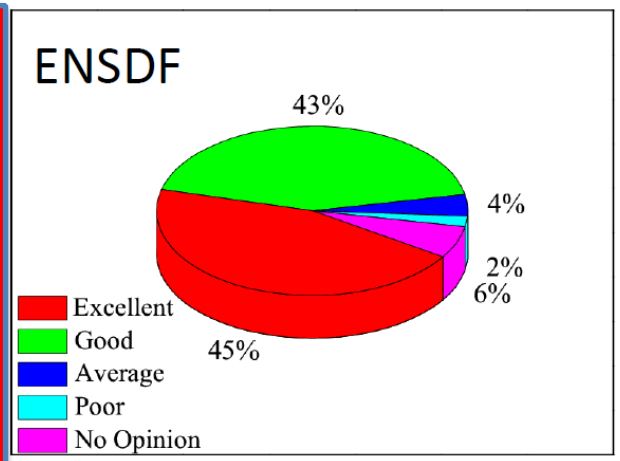
USNDP database usage

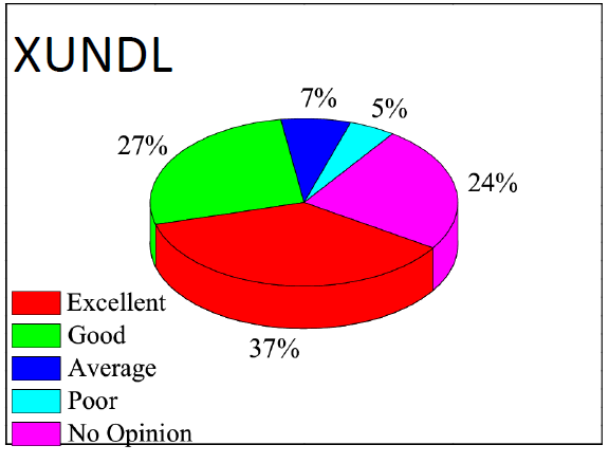


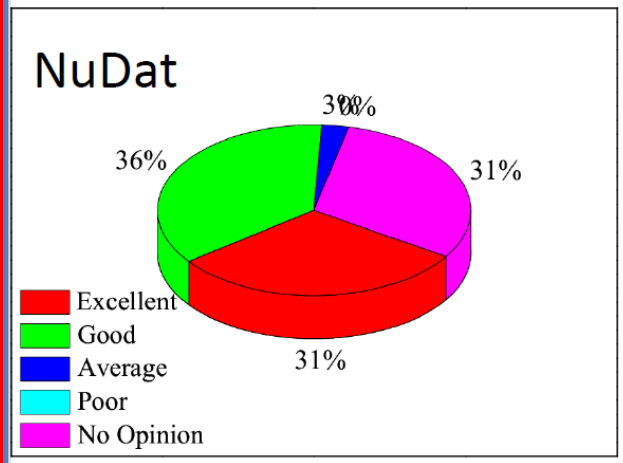


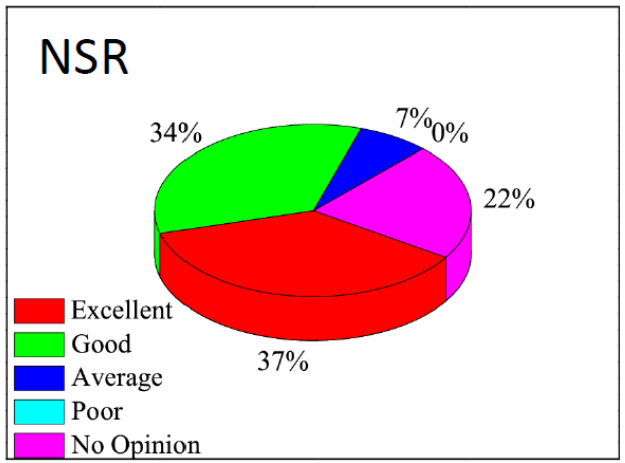




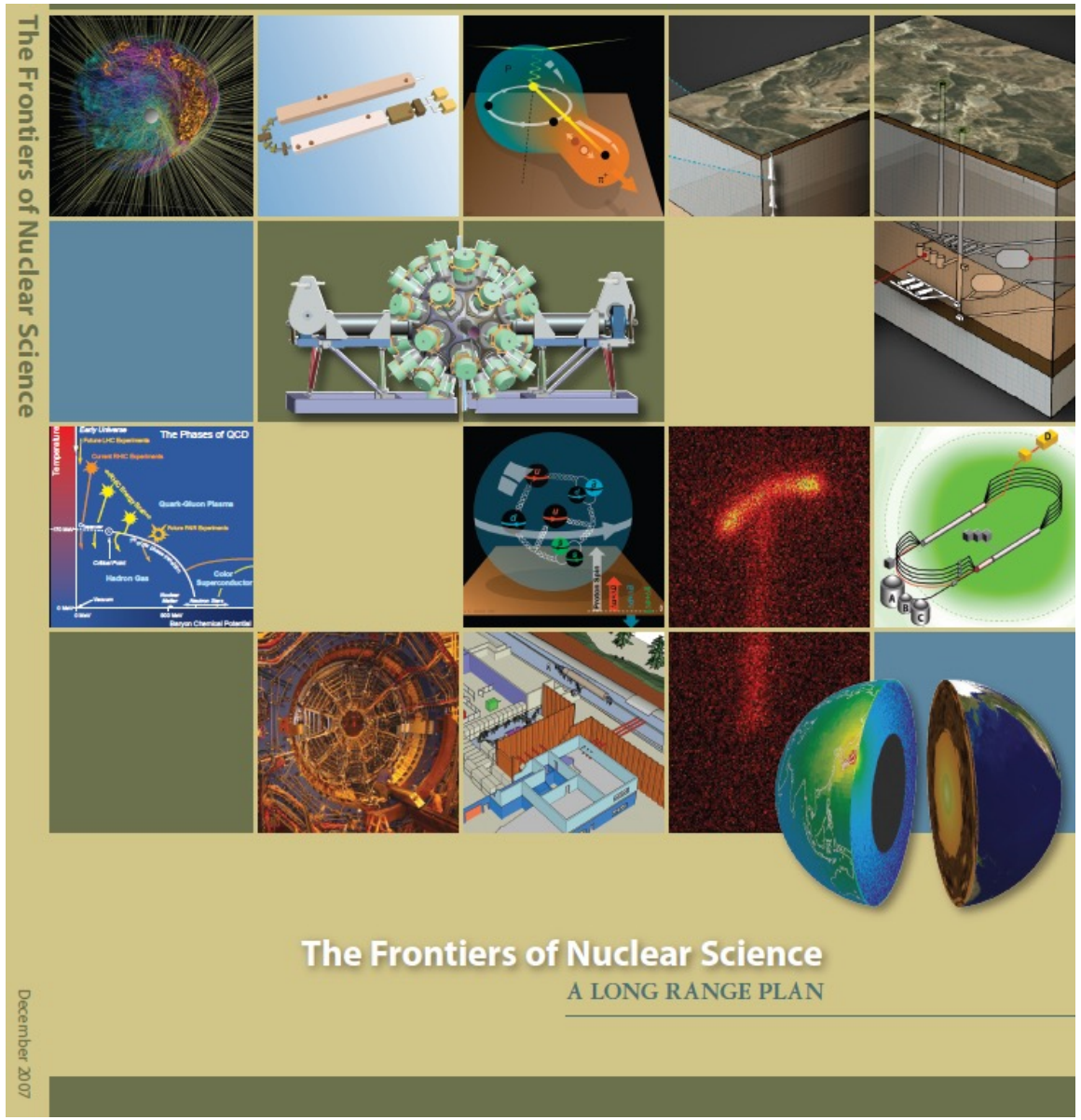








2013 LECM Survey by E.A. McCutchan



Indeed, nuclear science is central to the missions and goals of many organizations within the U.S. government—the Departments of Energy, Defense, and Homeland Security in particular. This section provides some of the many examples of how the knowledge obtained and the technologies developed through basic nuclear science research are being applied to address national needs.

NUCLEAR DATA: ACCURATE AND ACCESSIBLE

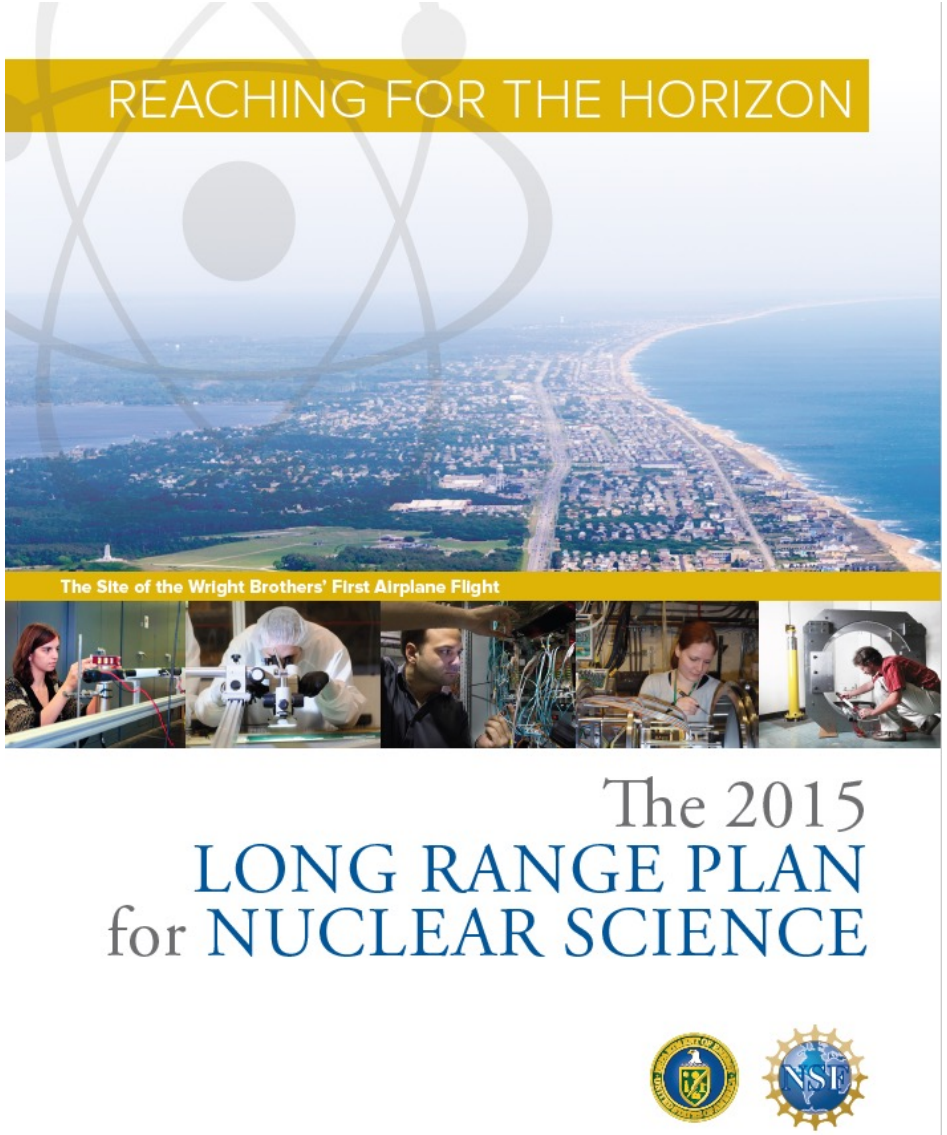
Nuclear data are produced from activities that are motivated either by basic research or by the development of nuclear-based technologies. Globally, programs that generate nuclear data are supported primarily by government agencies. There are three international networks that coordinate nuclear data projects worldwide. Two of these networks, the Nuclear Reaction Data Centres Network (NRDC) and the Nuclear Structure and Decay Data evaluators (NSDD), are coordinated by the International Atomic Energy Agency in Vienna. The third network, the Working Party on International Nuclear Data Evaluation Co-operation (WPEC), is coordinated by the Nuclear Energy Agency of the Organization for Economic Co-operation and Development in Paris.

The dissemination of nuclear data and associated documentation to the consumers of nuclear data is the main goal of these international networks. More information about them can be found at http://www-nds.iaea.org/nrdc.html, http://www-nds.iaea.org/nsdd, and http://www.nea.fr/html/science/wpec.

The hub of the U.S. network, the National Nuclear Data Center (NNDC) at Brookhaven National Laboratory, is the core facility for the DOE-funded U.S. Nuclear Data Program (USNDP). The mission of the USNDP is to collect, evaluate, and disseminate nuclear physics data for basic nuclear physics and applied nuclear technology research. The USNDP includes nuclear data groups and nuclear data experts from national laboratories and academia across the United States. The services provided by this national network of nuclear data groups are essential to organizations with missions that require access to nuclear data. The nuclear data infrastructure provided by the USNDP impacts governmental, educational, commercial, and medical organizations in United States, and is part of the U.S. commitment to the international nuclear data networks.

It is evident that the need for convenient access to nuclear data is rapidly increasing. As shown in figure 5.3, the number of data retrievals from USNDP databases has increased by almost a factor of 10 over the last decade. In 2006 the NNDC web service reached the milestone of one million retrievals from the USNDP databases. The NNDC data retrievals are mainly from users in the United States (42.9%) and Europe (25.7%). The U.S. users are almost equally divided among government, education, and all other types of organizations.

A priority of the USNDP for the next decade is to produce databases in support of advanced simulation codes. This will be very important for applications such as design studies of Advance Fuel Cycle reactors, as well as nuclear-materials-detection systems for homeland security applications. This effort will also maintain a high level of expertise in the area of nuclear data evaluation to assure the continuation of the nuclear databases with sufficient breadth and quality to meet the requirements of advanced computational applications.


REACHING FOR THE HORIZON
The Site of the Wright Brothers' First Airplane Flight
The 2015
LONG RANGE PLAN
for NUCLEAR SCIENCE

The ask: ENSDF and the LRP

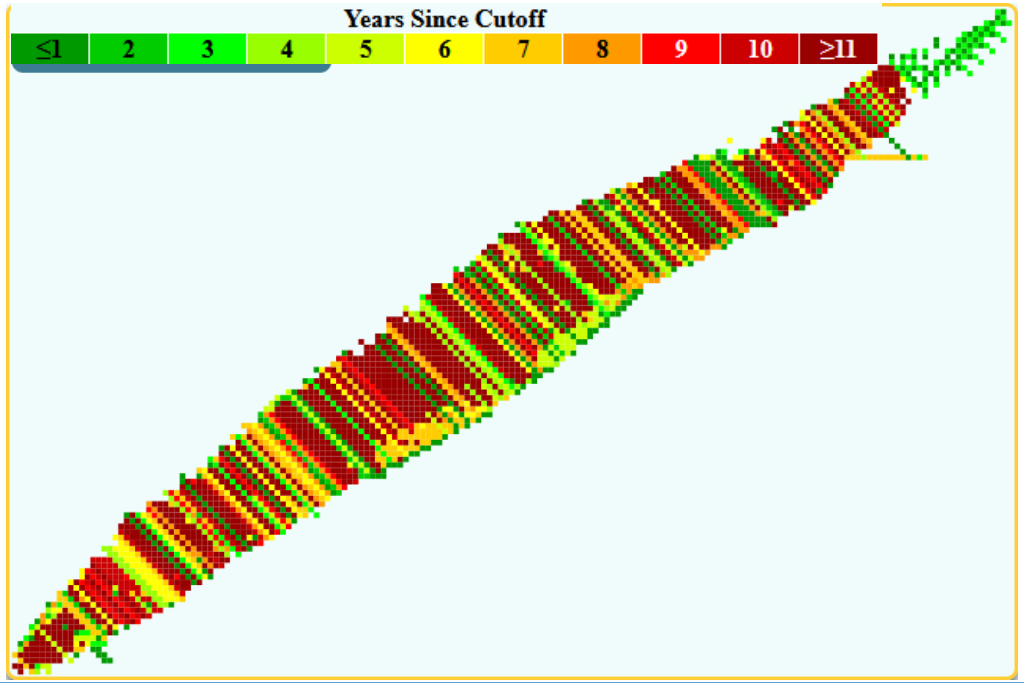
The average age of ENSDF is dramatically increasing:

~7 years (FY04),
~8.5 y (FY16),
~10.1 y (FY20);

implies ~13-, ~16-, and 20 year cycle for all mass chains, respectively.

*The time between publication of a result and its inclusion into ENSDF is impacted by the average age

It is essential for the Basic Science Nuclear Physics community stakeholders to express their needs for Evaluated Nuclear Data, especially ENSDF, etc., and to convey those needs in the Long Range Plan.



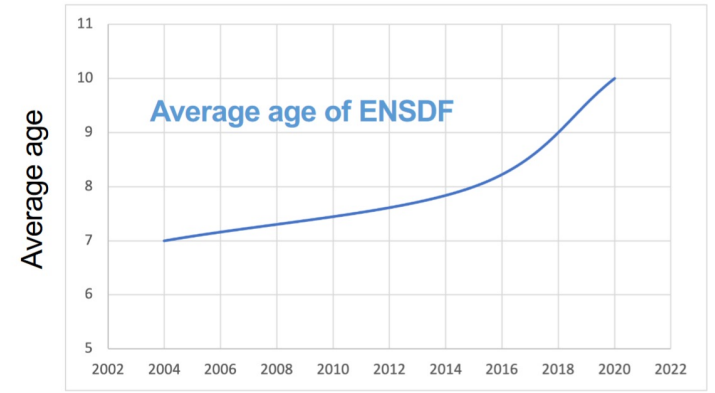


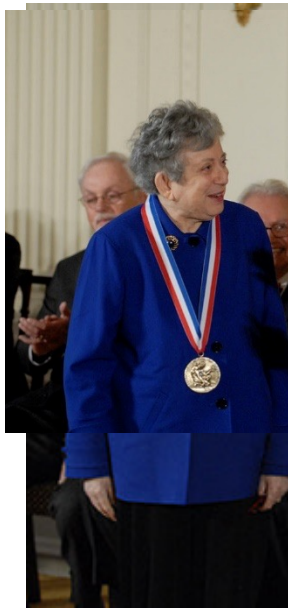
Figure from E.A. McCutchen USNDP 2021

Short Story from 2006

Bill Forman
Harvard Smithsonian
Associate Director of the Center for Astrophysics

Bill Forman's main interests are in X-ray astronomy with a focus on galaxies, clusters, cosmology, and active galaxies. His current interests center on feedback from active galactic nuclei, the interaction of radio plasma with X-ray emitting hot gas, the microphysics of the intracluster medium plasma, and the formation and growth of galaxy clusters. In his research, he uses the Chandra and XMM-Newton Observatories. In addition to science activities, Forman led the CfA's High Energy Astrophysics Division as associate director for over a decade.

Haverford College (BA 1969) Harvard University (PhD 1973)



National Medal of Science recipient in 2007 "for her pioneering contributions in nuclear physics that have advanced research into many applications, including energy generation from fusion, dating of artifacts, and nuclear medicine; her passion for teaching; and her outstanding service to her profession."