

# Sigma: Web Retrieval Interface for Nuclear Reaction Data



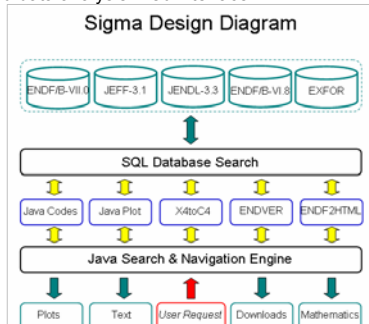
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## Sigma Web Interface

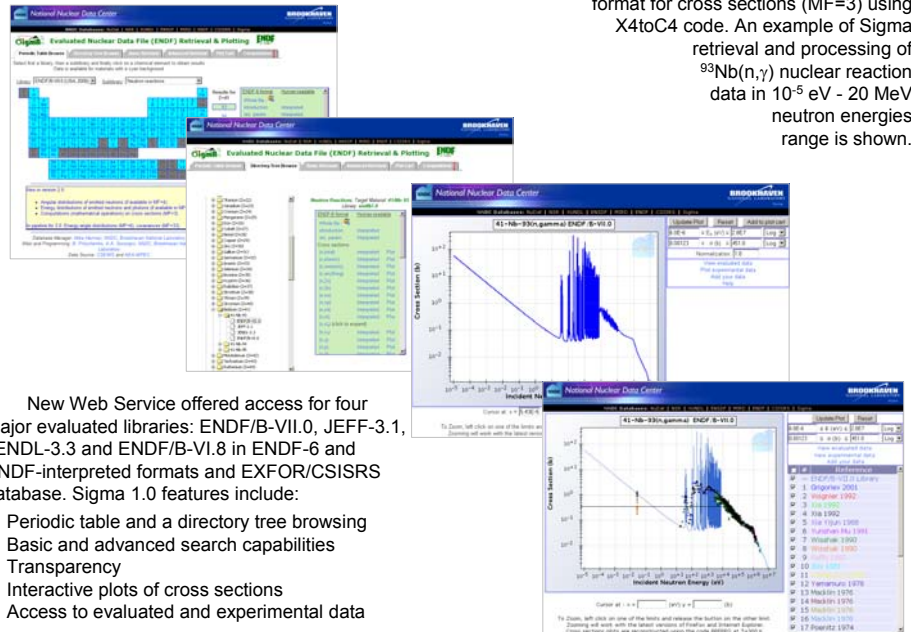
Recent development of the ENDF/B-VII.0 evaluated nuclear reaction data library by CSEWG collaboration was conducted in parallel with the development of an advanced Web interface. Sigma project (<http://www.nndc.bnl.gov/sigma>) was primarily motivated by increasing needs of nuclear reaction community to access the latest evaluated and experimental nuclear data in ENDF-6 and EXFOR formats; secondary was online processing and data analysis Web interface.



Sigma Web application design is completely based on Java 2 Enterprise Edition technologies and relational Sybase ASE 15 databases. Interface is based on NNDC Java codes and Java plotting package, and ENDF FORTTRAN legacy packages: ENDF2HTML (Interpreted), X4toC4 and ENDVER.

## New Web Service

In April of 2007 NNDC launched Sigma Web application 1.0.

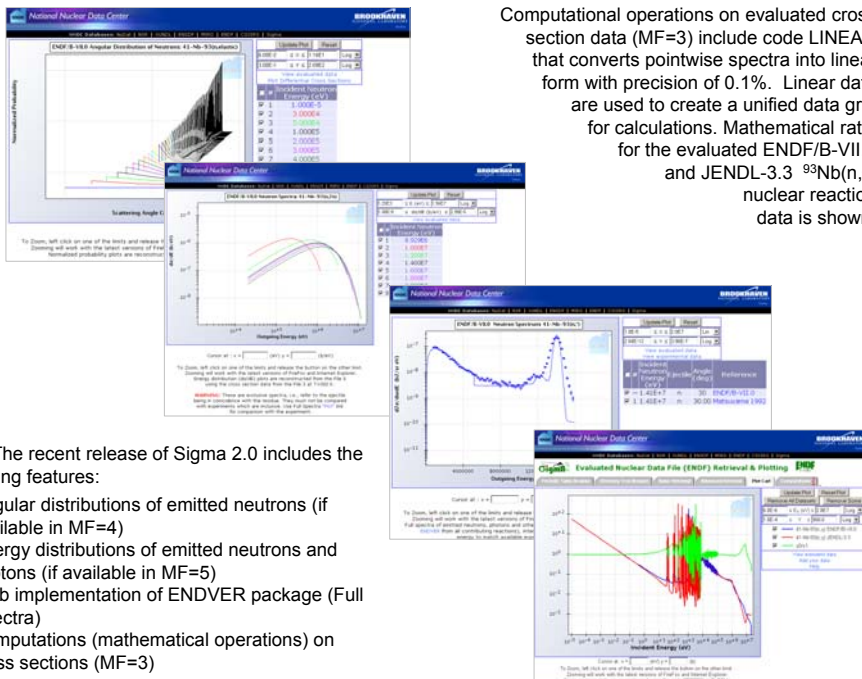


New Web Service offered access for four major evaluated libraries: ENDF/B-VII.0, JEFF-3.1, JENDL-3.3 and ENDF/B-VI.8 in ENDF-6 and ENDF-interpreted formats and EXFOR/CSISRS database. Sigma 1.0 features include:

- ❖ Periodic table and a directory tree browsing
- ❖ Basic and advanced search capabilities
- ❖ Transparency
- ❖ Interactive plots of cross sections
- ❖ Access to evaluated and experimental data

ENDF-6 formatted data can be compared with experimental nuclear reaction data in EXFOR format for cross sections (MF=3) using X4toC4 code. An example of Sigma retrieval and processing of <sup>93</sup>Nb(n,γ) nuclear reaction data in 10<sup>-5</sup> eV - 20 MeV neutron energies range is shown.

## Recent Release



The recent release of Sigma 2.0 includes the following features:

- ❖ Angular distributions of emitted neutrons (if available in MF=4)
- ❖ Energy distributions of emitted neutrons and photons (if available in MF=5)
- ❖ Web implementation of ENDVER package (Full Spectra)
- ❖ Computations (mathematical operations) on cross sections (MF=3)

Computational operations on evaluated cross section data (MF=3) include code LINEAR that converts pointwise spectra into linear form with precision of 0.1%. Linear data are used to create a unified data grid for calculations. Mathematical ratio for the evaluated ENDF/B-VII.0 and JENDL-3.3 <sup>93</sup>Nb(n,γ) nuclear reaction data is shown.

## Future Upgrades

Current development of Sigma 3.0 include energy-angle spectra (MF=6) and visualization of cross section covariance matrices, as well as plotting of cross section uncertainties (MF=33).

These spectra represent distribution of reaction products in energy and angle for:

- ❖ Neutrons
- ❖ Photons
- ❖ Residual nuclei

ENDF/B-VII.0 neutron production cross section ( $d^2\sigma/d\omega dE$ ) plots for <sup>93</sup>Nb(n,anything) and covariance matrix for <sup>191</sup>Ir(n,2n) reactions are shown.

