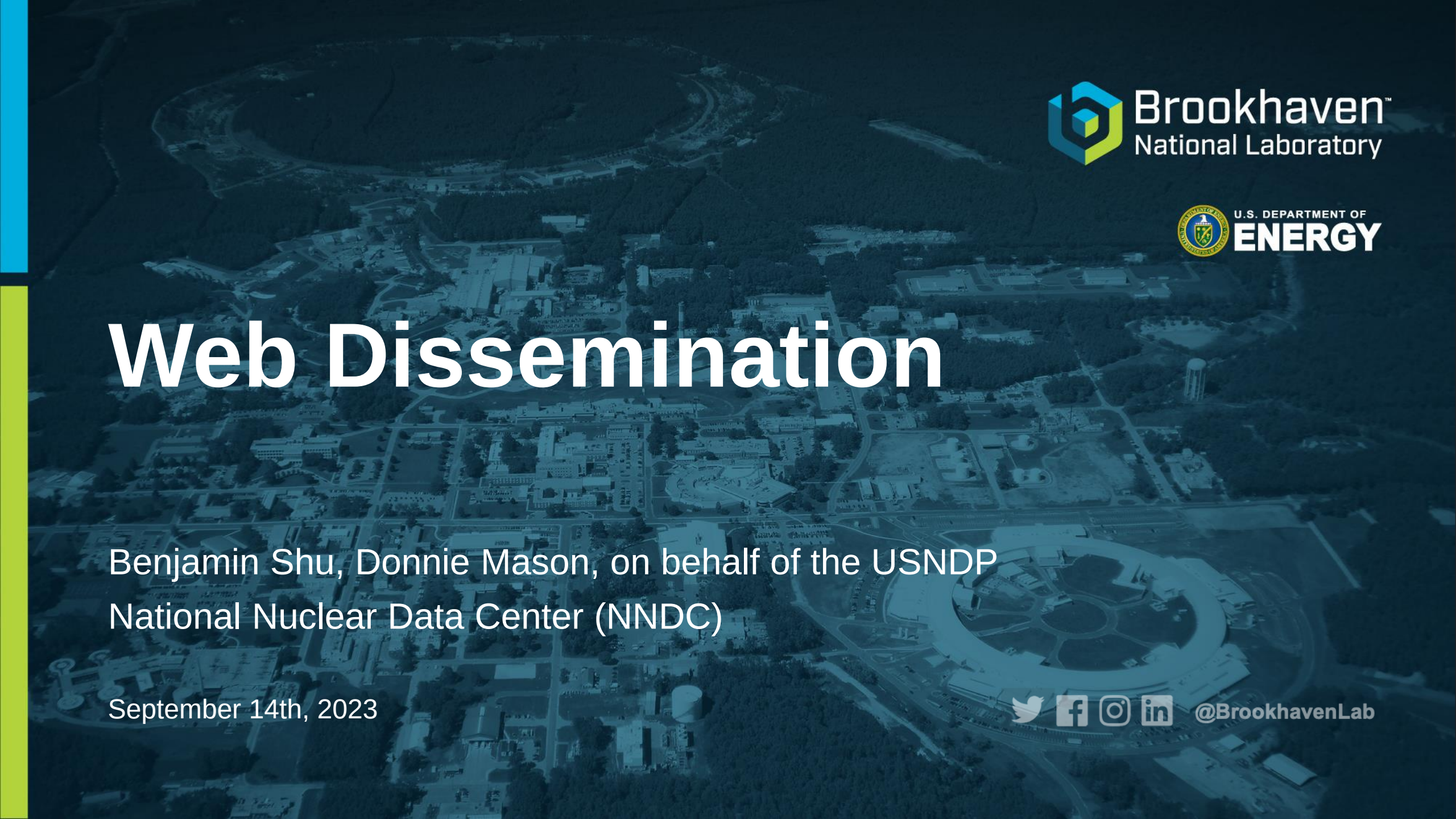

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U.S. DEPARTMENT OF ENERGY

Web Dissemination

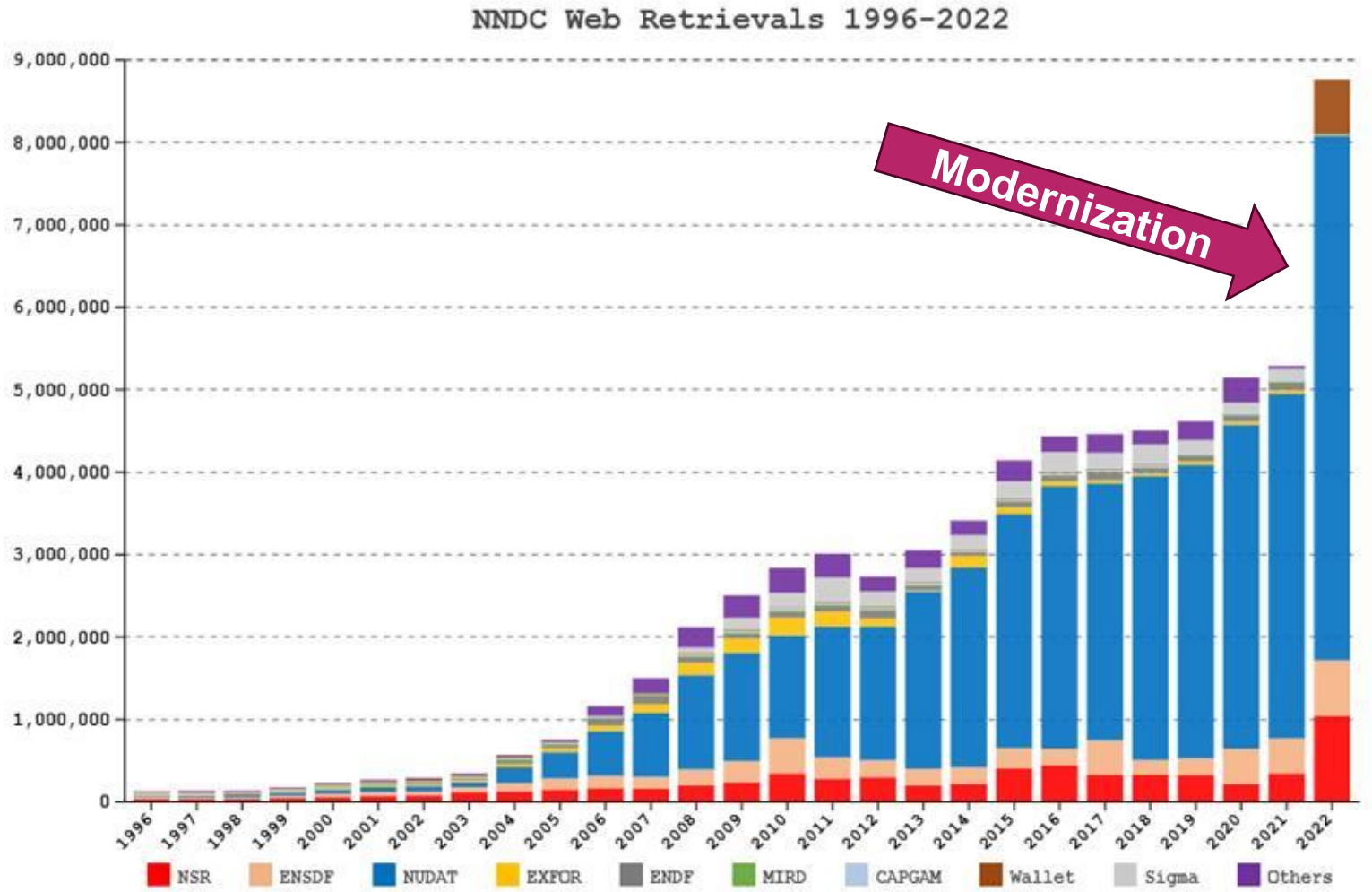
Benjamin Shu, Donnie Mason, on behalf of the USNDP
National Nuclear Data Center (NNDC)

September 14th, 2023

@BrookhavenLab

Web Statistics

- Consistent growth
- >8 million retrievals in FY22
- Every web application saw growth, notably NuDat, ENSDF, Wallet Cards and NSR
- >6 million retrievals from NuDat 3
- Only a lower limit for the reach of our databases



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Database Users

- Reactor design, simulation and licensing codes
- Nuclear waste and repositories
- Radiation spectroscopy, dose, detectors, and shielding
- Defense and CTBTO
- A few examples
  - Scale
  - Geant
  - Gadras
  - RadWare
  - And many more

scale
Nuclear Systems Modeling & Simulation

GEANT4
A SIMULATION TOOLKIT

FLUKA

MCNP6

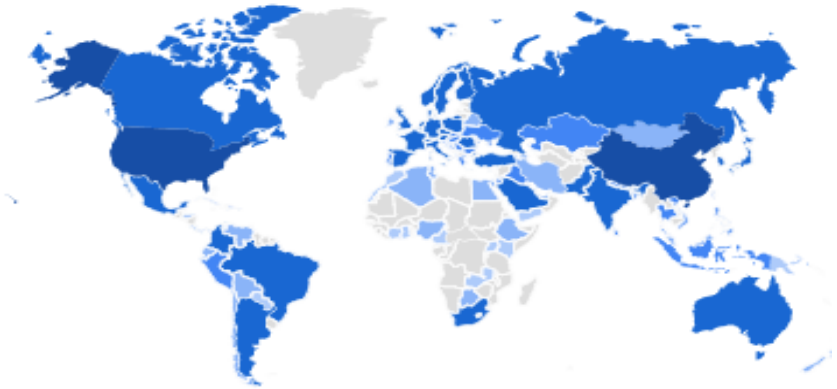
2000
GENIE
Applications Software

PHITS
Particle and Heavy Ion Transport code System

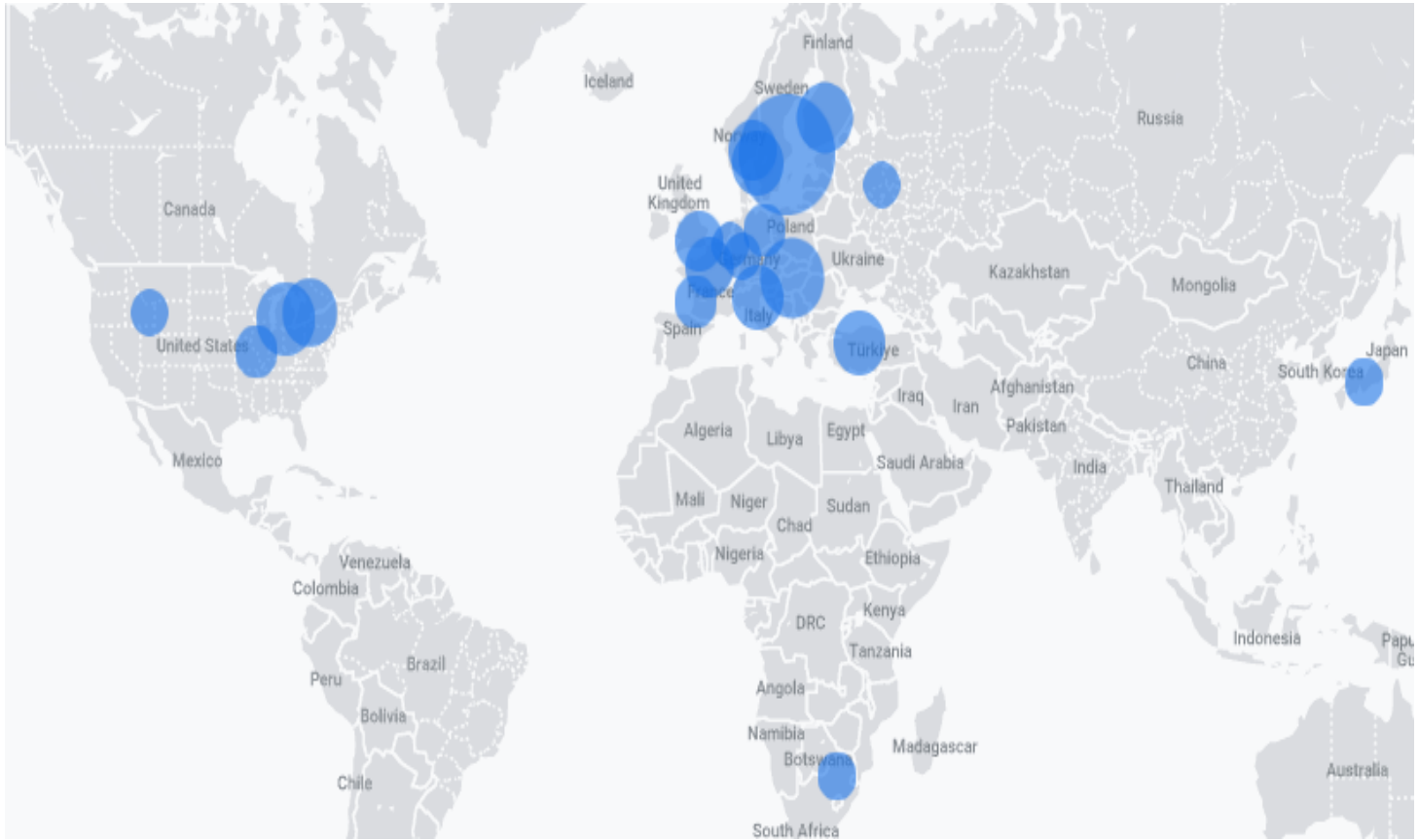
Google Analytics

- Google analytics for broad overview
- Overviews per web application
- Focus modernization efforts
- Provide a better experience for the most users possible

Life-time Geolocation data



Real-time Geolocation data (09/12/23 9am EST)



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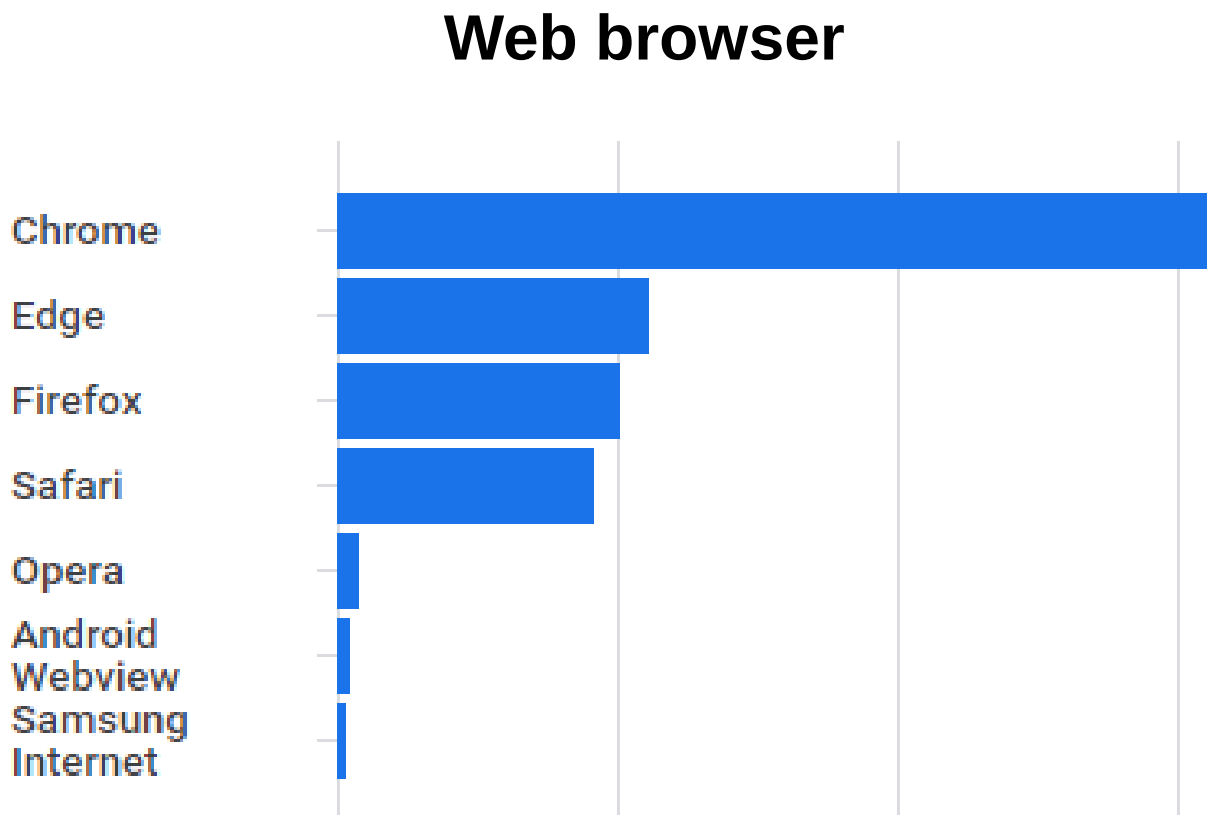

Google Analytics

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- Overviews per web application
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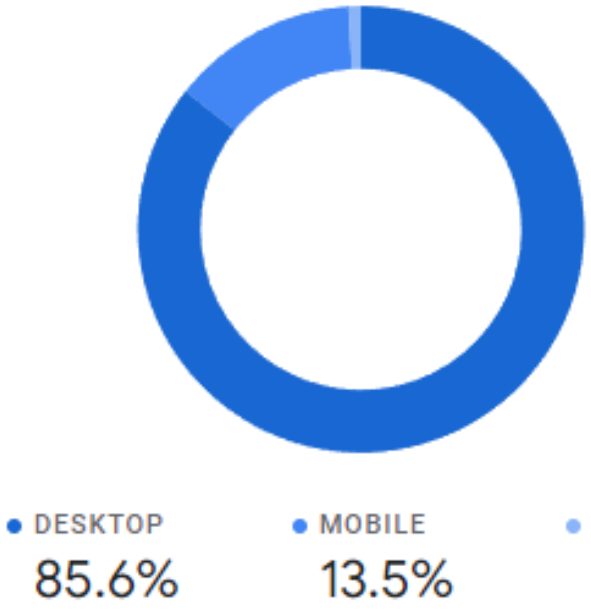
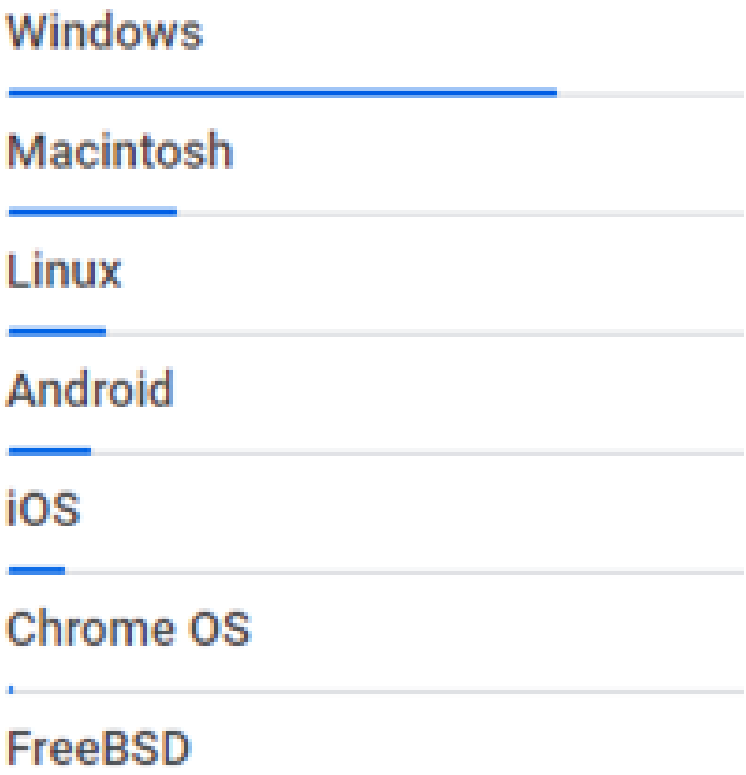
- Provide a better experience for the most users possible

Device type / Operating system





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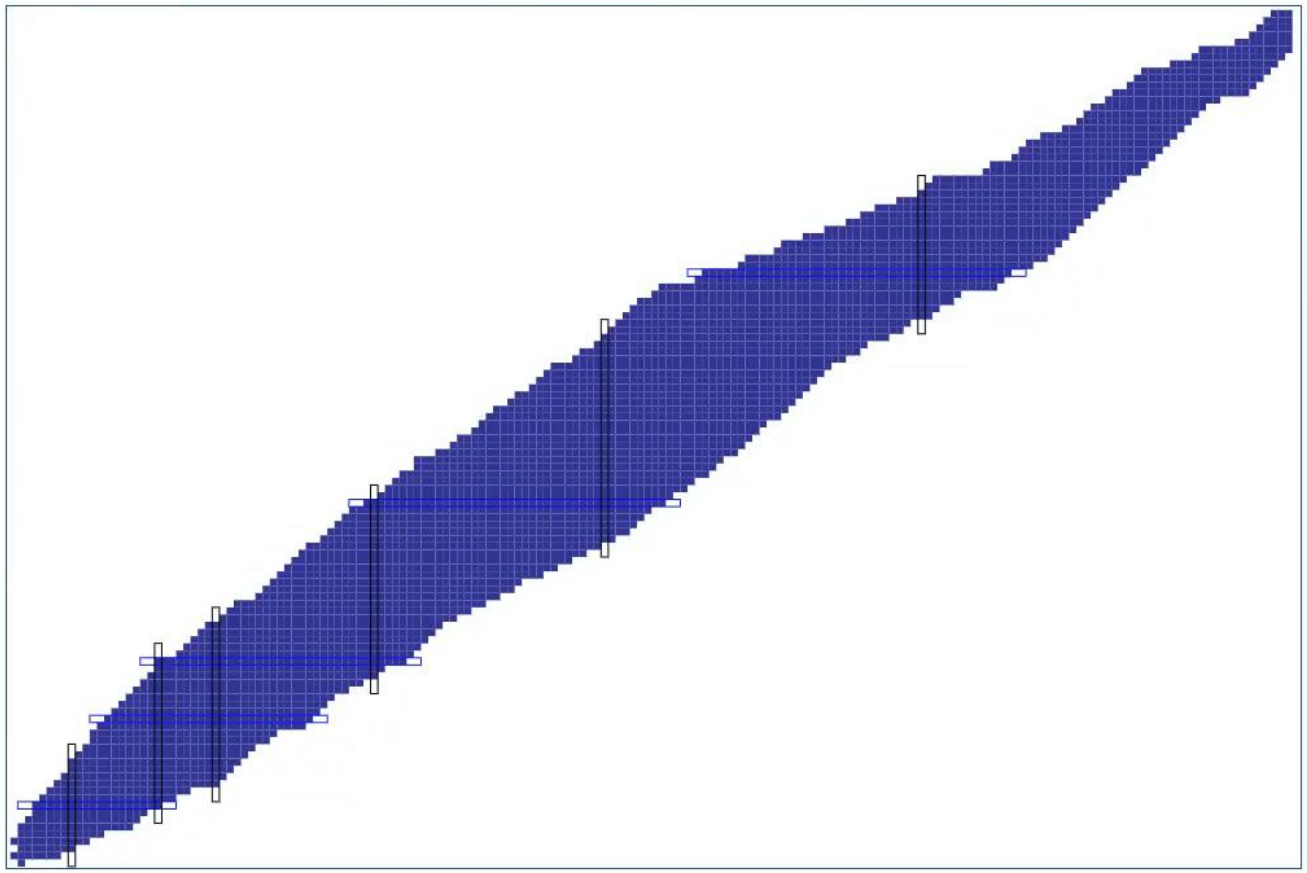
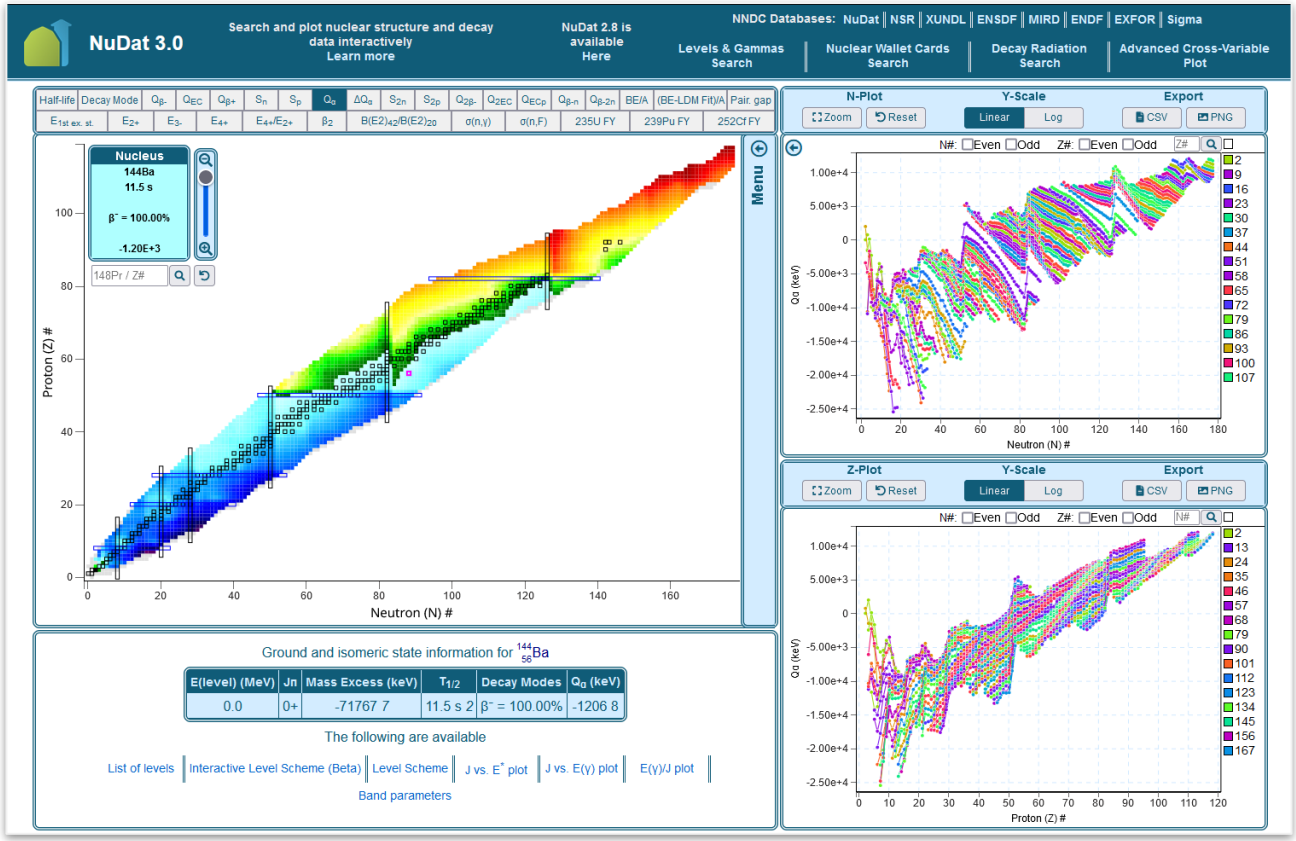
Custom Analytics

- Web application specific analytics
- NuDat 3 nuclide ‘popularity’ by date (right)
- Physics insights
- Prioritization of evaluations
- Only possible due to modernization efforts



NuDat 3.0

- Major overhaul to one of our most frequently visited web applications
- Transitioned from to server-side to client-side image generation
  - Significant performance improvements
  - Dramatically reduced load times
  - Responsive visualizations for better UX
- Overwhelmingly positive user feedback
- Future plans
  - Ongoing optimization
  - Additional features
  - Similar modernization overhauls for other web applications



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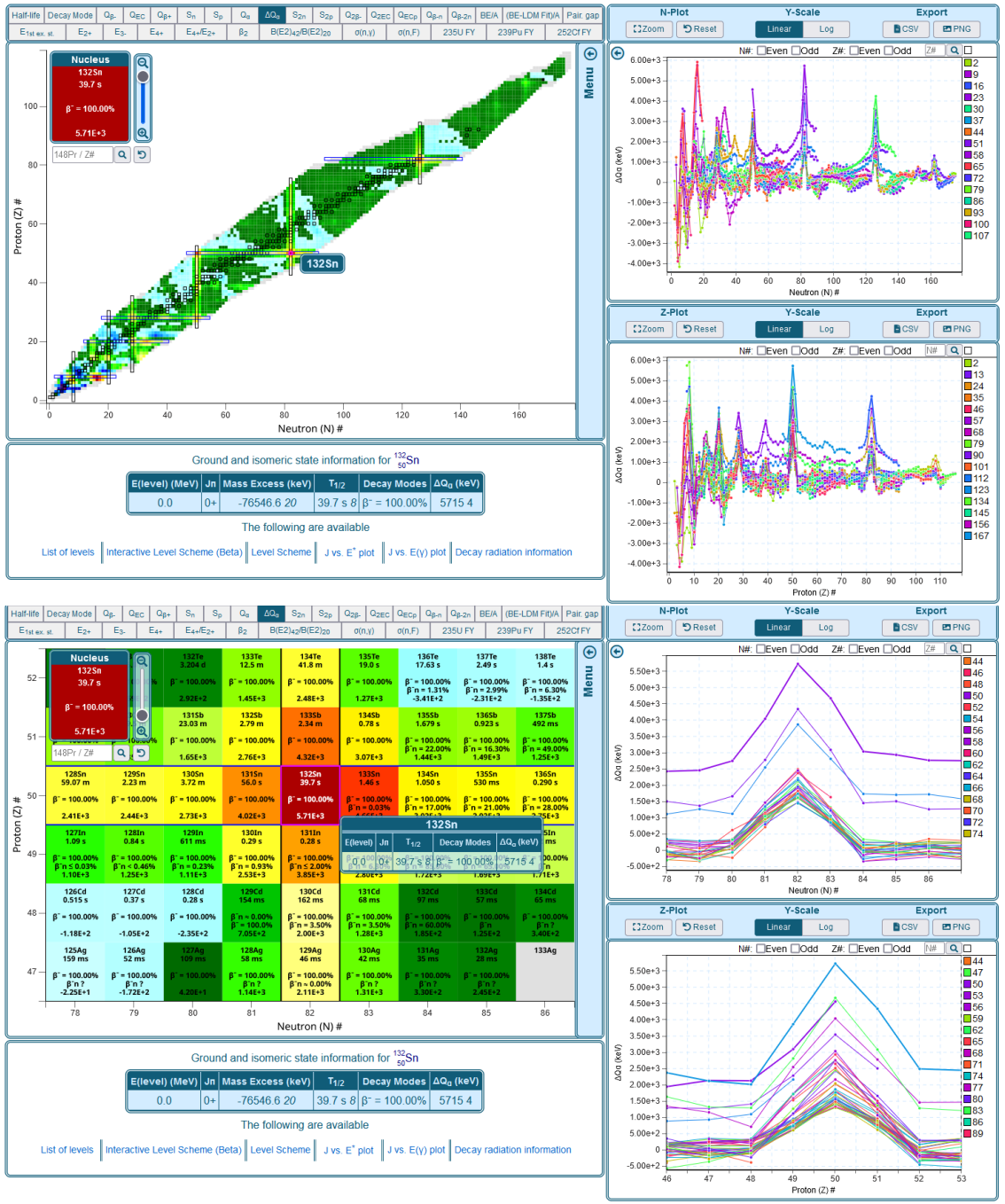
NuDat 3.0 Features

- **Responsive visualizations**
  - **Seamless pan/zoom controls**
  - **Synchronized plots**
- Advanced data filtering
- Export data as CSV/JSON
- Export chart or selection as PNG/SVG
- Upcoming features
  - Improved user interface
  - 3D visualizations
  - Additional datasets



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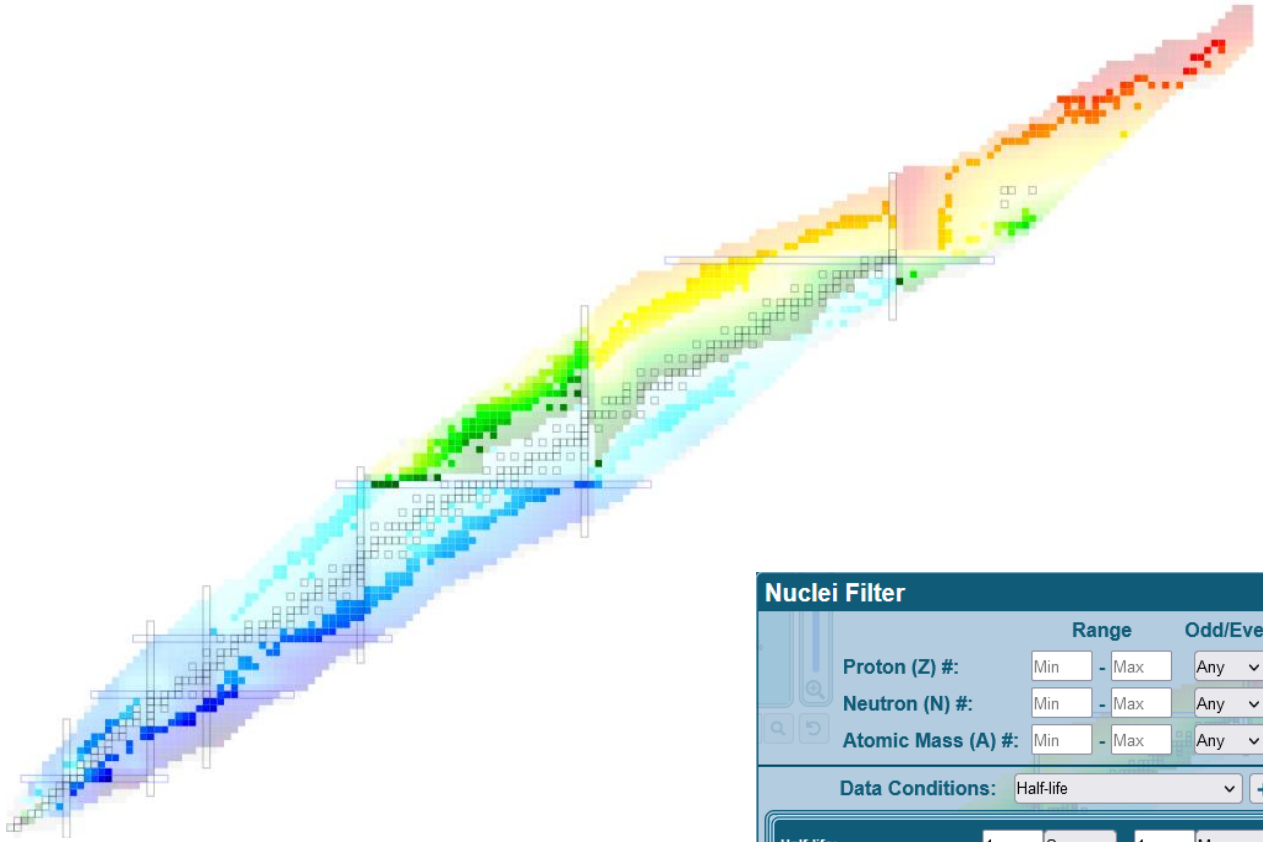

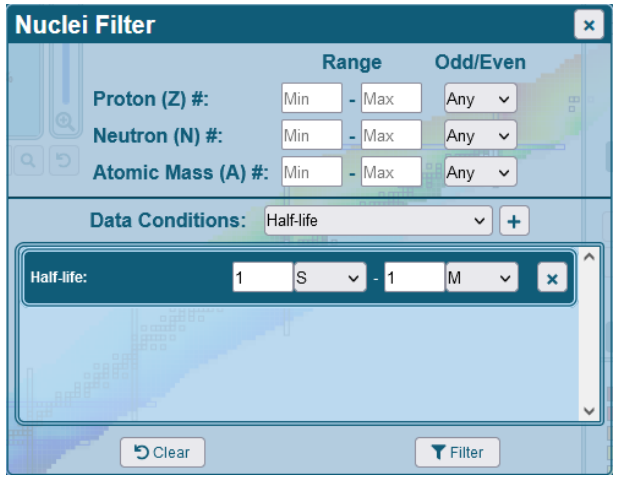

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NuDat 3.0 Features

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- **Export data as CSV/JSON**
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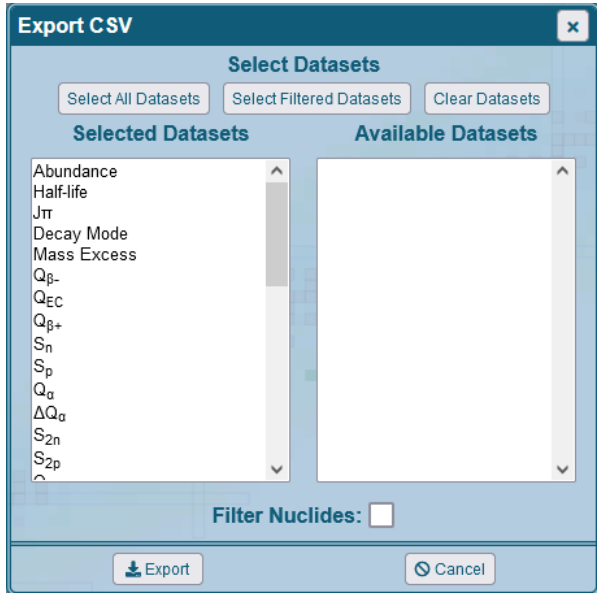

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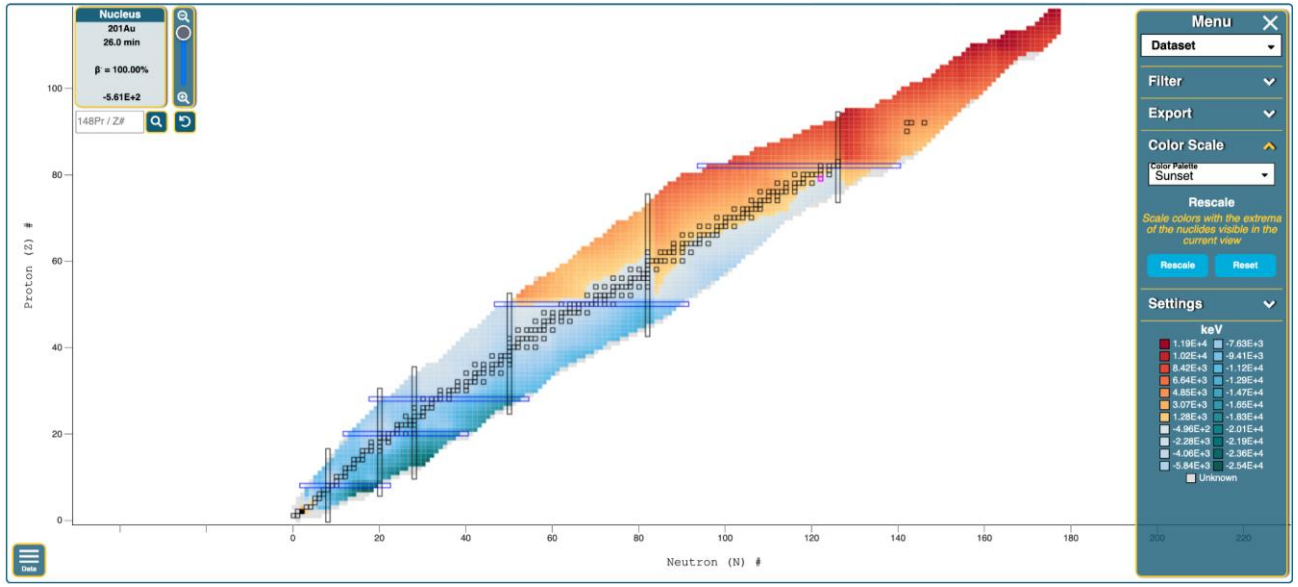
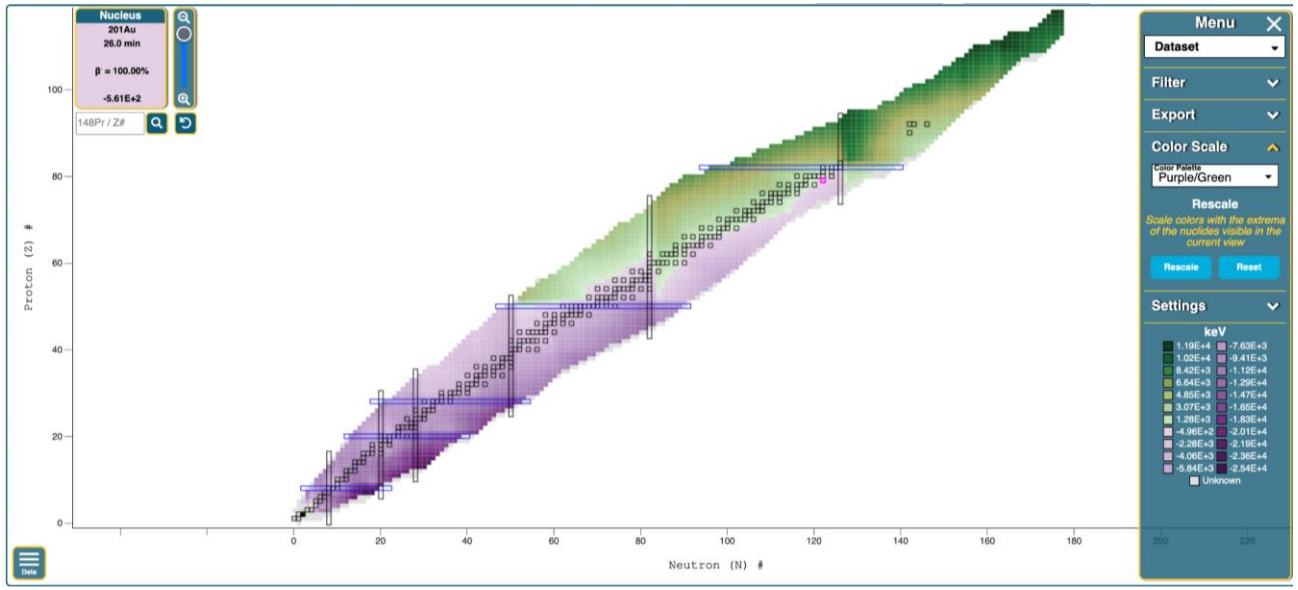
NuDat 3.0 Features

- Responsive visualizations
  - Seamless pan/zoom controls
  - Synchronized plots
- Advanced data filtering
- Export data as CSV/JSON
- Export chart or selection as PNG/SVG
- **Upcoming features**
  - Improved user interface
  - 3D visualizations
  - Additional datasets
  - **Additional color palettes**
    - **Accessibility**





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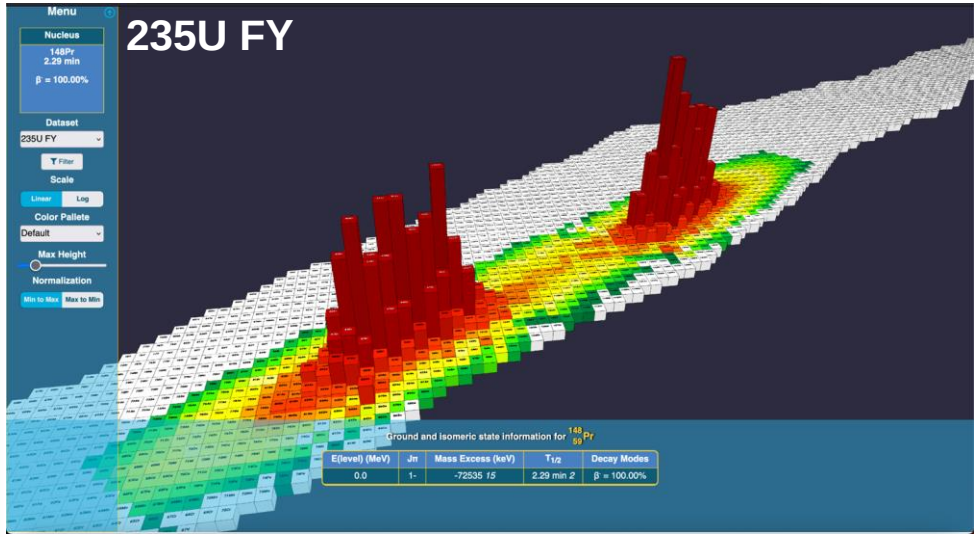
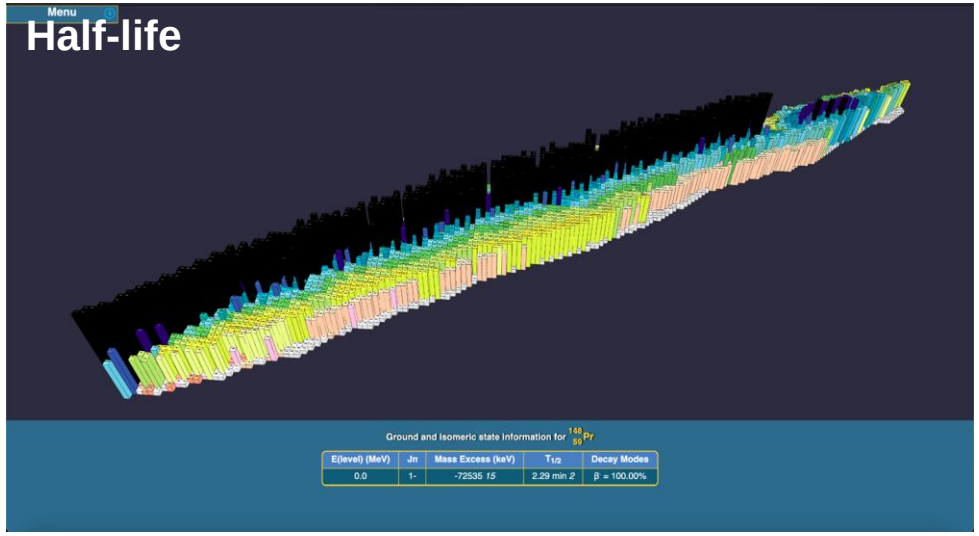
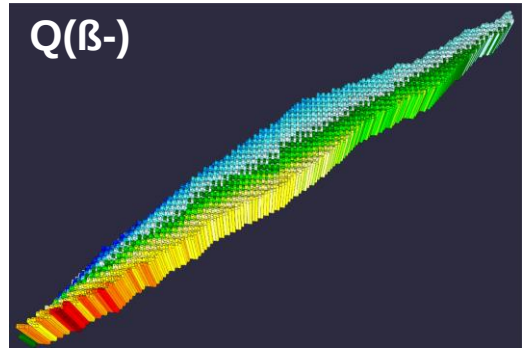
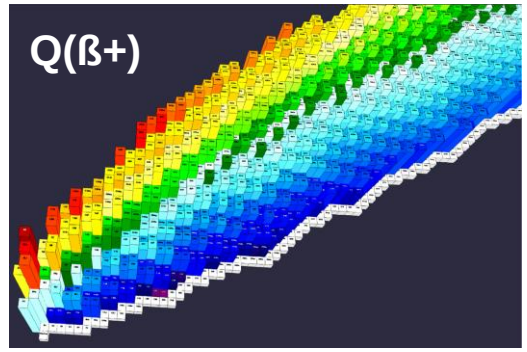
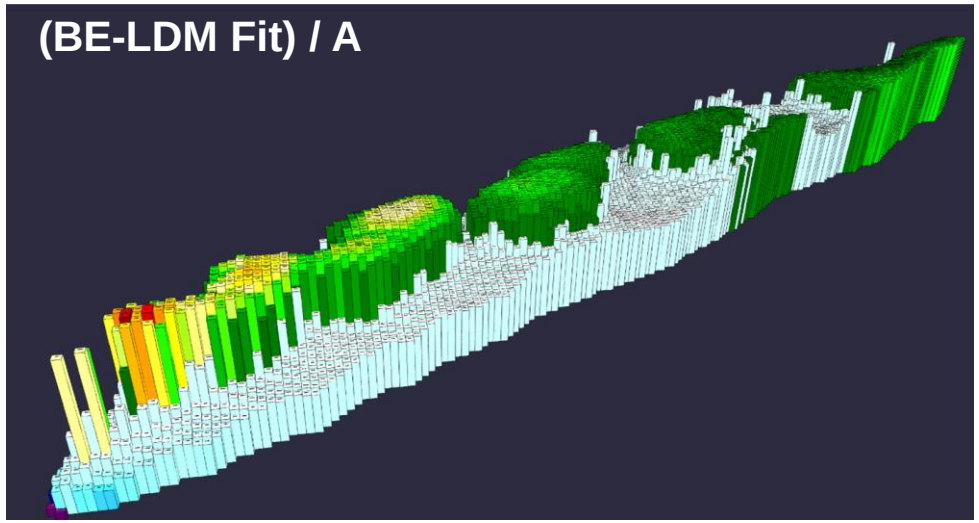
3D Chart of Nuclides (Coming soon)

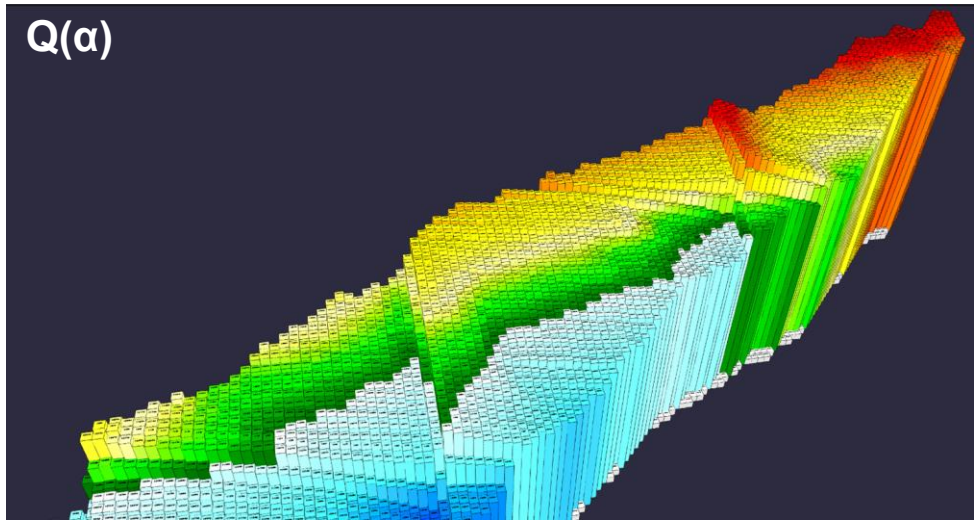


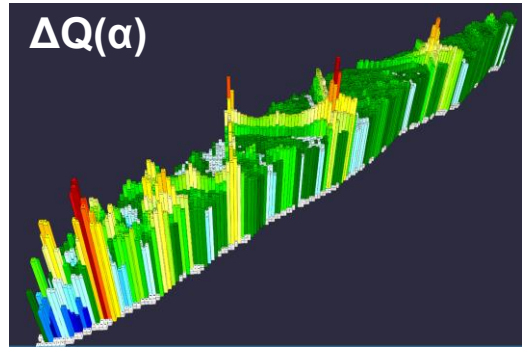








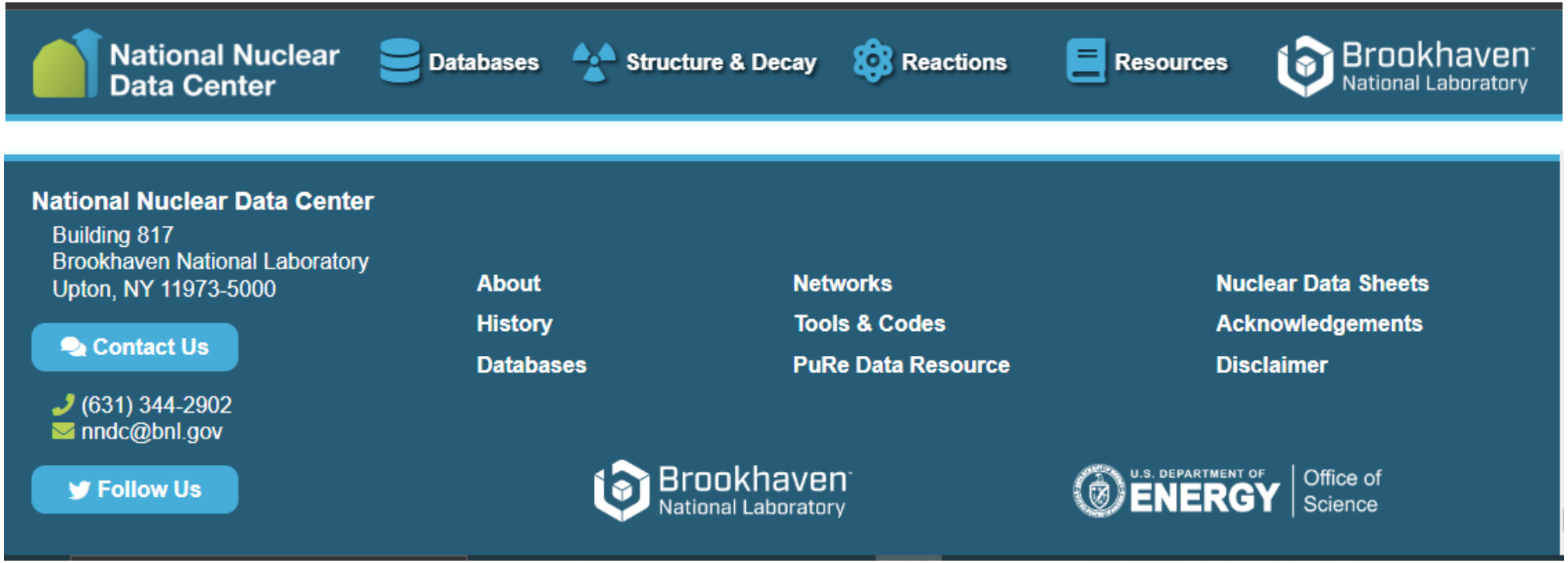




Unified Web Design

New header/footer added to help users navigate

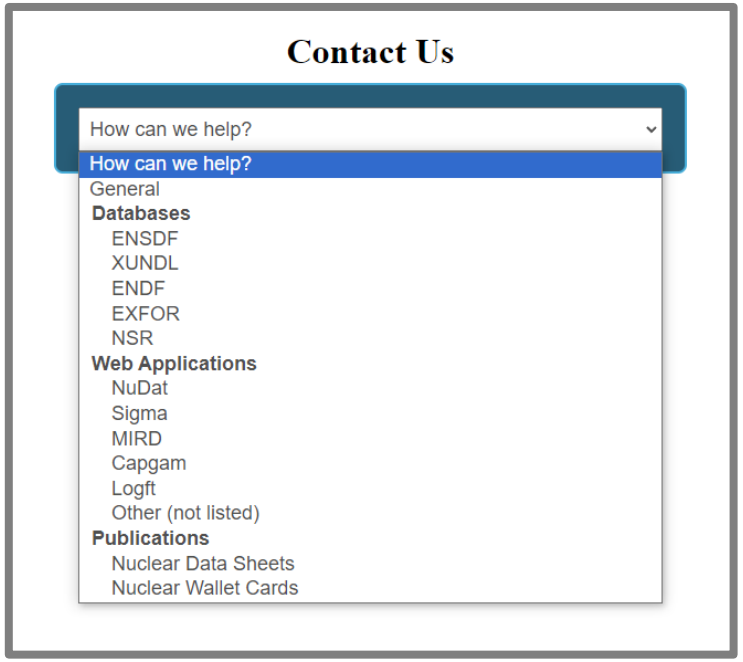
- Links to major data sources as well as new contact page

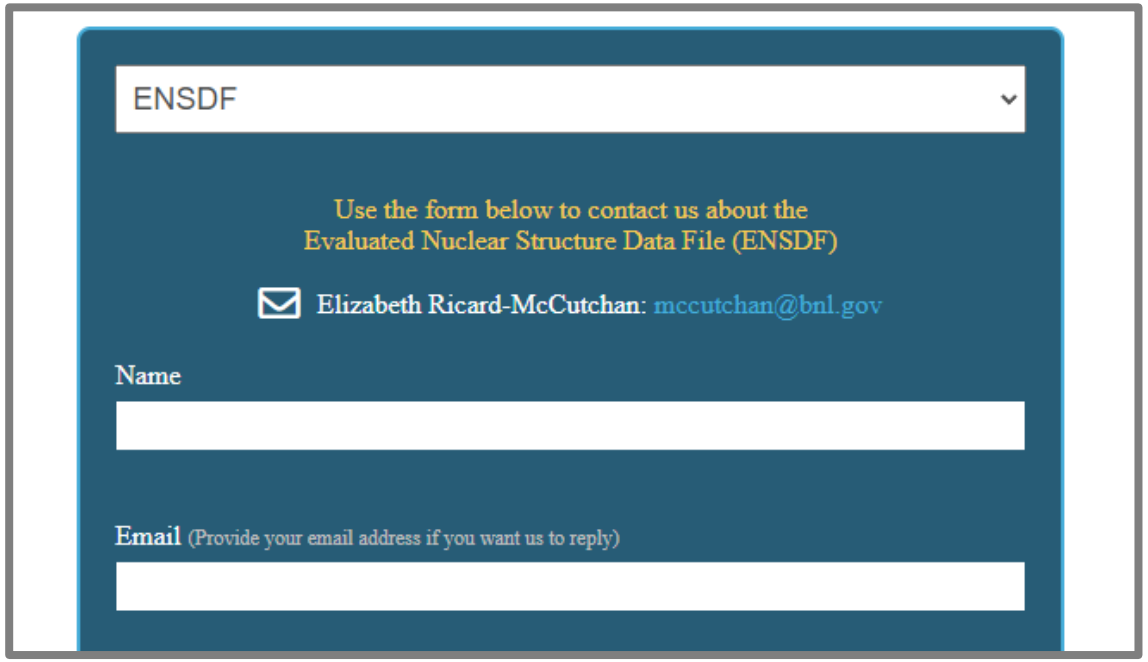


Unified Web Design (contd.)

Updated contact page to streamline user feedback

- Sends emails to NNDC staff based on selected library/website
- Has led to a noticeable increase in user emails





Ease-of-Access Features

```
104RH    103RH(N,G) E=TH:PRIMARY       1981KE03                 07NDS    200709
104RH  H TYP=FUL$AUT=JEAN BLACHOT$CIT=NDS 108,2035 (2007)$CUT=30-Mar-2007$
104RH c  110 mg of 99.9% Rh metal was irradiated at McMaster University
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104RH  G 3133.89    7 21     2
104RH  G 3150.95    6 37     3
104RH  G  3693.00   6 35     3
104RH  G 3695.80    6 69     6
104RH  G  3699.06   7  29    2
104RH  G 3706.68    7 26     2
104RH  G 3708.55    6 53     4
104RH  G 3711.51    5 96     8
104RH  G 3716.26    7 25     2
104RH  G 3719.87    6 33     3
104RH  G 3725.18    5 129    10
104RH  G  3728.39   7  25    2
104RH  G   3731.92  7 19     2
104RH  G 3734.90    6 32     3
104RH  G   3737.85  9 7      1
104RH  G 3741.25    7 15     1
104RH  G   3744.12  6 48     4
104RH  G 3747.21    6 68     5
104RH  G 3749.13    8 14     1
104RH  G 3751.18    5 107    9
104RH  G  3754.52   5 84     7
104RH  G 3762.95    6 78     6
104RH  G 3766.02    6 63     5
104RH  G 3769.59    6 47     4
104RH  G 3771.78    6 31     3
104RH  G 3774.88    8 10     1
104RH  G 3777.69    6 49     4
104RH  G 3780.57    6 56     5
104RH  G 3786.38    6 43     3
104RH  G 3788.31    7 24     2
104RH  G 3791.12    5 96     8
104RH  G 3794.58    7 21     2
104RH  G 3797.39    6 69     6
104RH  G 3800.25    6 36     3
104RH  G 3801.78    6 53     4
104RH  G 3805.56    6 31     2
104RH  G 3809.05    6 38     3
104RH  G 3813.09    5  106   8
104RH  G 3816.03    5 91     7
104RH  G 3820.69    6 39     3
104RH  G 3823.12    5 133    11
104RH  G 3828.81    7 27     2
104RH  G 3832.02    8 11     1
104RH  G 3834.04    8 10     1
104RH  G 3837.05    6 52     4
104RH  G 3841.52    6 31     3
104RH  G 3844.88    6 70     6
104RH  G 3846.27    8 12     1
104RH  G 3849.80    5 132    11
104RH  G 3854.95    7 25     2
104RH  G 3856.35    6 50     4
104RH  G  3859.14   5 142    11
104RH  G  3862.13   5 82     7
104RH  G  3870.23   6 42     3
```

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Ease-of-Access Features (contd.)

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104RH  G 3706.68    7 26     2
104RH  G 3708.55    6 53     4
104RH  G 3711.51    5 96     8
104RH  G 3716.26    7 25     2
104RH  G 3719.87    6 33     3
104RH  G 3725.18    5 129    10
104RH  G  3728.39   7  25    2
104RH  G   3731.92  7 19     2
104RH  G 3734.90    6 32     3
104RH  G   3737.85  9 7      1
104RH  G 3741.25    7 15     1
104RH  G   3744.12  6 48     4
104RH  G 3747.21    6 68     5
104RH  G 3749.13    8 14     1
104RH  G 3751.18    5 107    9
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104RH  G 3762.95    6 78     6
104RH  G 3766.02    6 63     5
104RH  G 3769.59    6 47     4
104RH  G 3771.78    6 31     3
104RH  G 3774.88    8 10     1
104RH  G 3777.69    6 49     4
104RH  G 3780.57    6 56     5
104RH  G 3786.38    6 43     3
104RH  G 3788.31    7 24     2
104RH  G 3791.12    5 96     8
104RH  G 3794.58    7 21     2
104RH  G 3797.39    6 69     6
104RH  G 3800.25    6 36     3
104RH  G 3801.78    6 53     4
104RH  G 3805.56    6 31     2
104RH  G 3809.05    6 38     3
104RH  G 3813.09    5  106   8
104RH  G 3816.03    5 91     7
104RH  G 3820.69    6 39     3
104RH  G 3823.12    5 133    11
104RH  G 3828.81    7 27     2
104RH  G 3832.02    8 11     1
104RH  G 3834.04    8 10     1
104RH  G 3837.05    6 52     4
104RH  G 3841.52    6 31     3
104RH  G 3844.88    6 70     6
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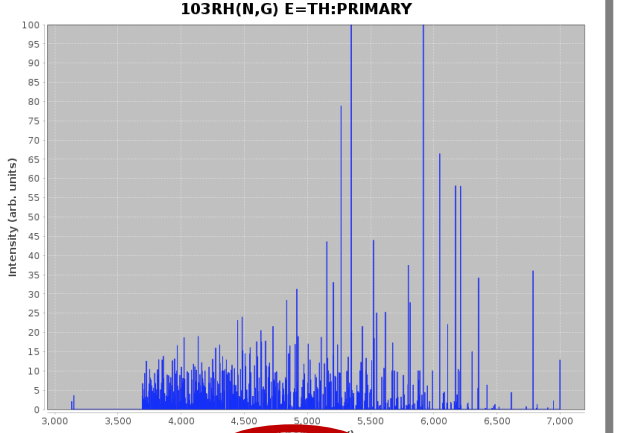
104RH  G 3856.35    6 50     4
104RH  G  3859.14   5 142    11
104RH  G  3862.13   5 82     7
104RH  G  3870.23   6 42     3
```

Strongest Transition:
E(γ) = 5346.65 ± 0.04
I(γ) = 1032 ± 83

Thermal Neutron Capture Cross Section (2006MuZX):
143.5 b ± 1.5 b



Download as .csv

Type	E(γ) (keV)	ΔE(γ) (keV)	$I(\gamma)/I(\gamma)_{max} \times 100$	$\Delta(I(\gamma)/I(\gamma)_{max})$
Secondary	3133.89	*0.07*	2.0349	*0.2536*
Secondary	3150.95	*0.06*	3.5853	*0.4094*
Secondary	3693.00	*0.06*	3.3915	*0.3985*
Secondary	3695.80	*0.06*	6.6860	*0.7920*
Secondary	3699.06	*0.07*	2.8101	*0.2977*
Secondary	3706.68	*0.07*	2.5194	*0.2803*
Secondary	3708.55	*0.06*	5.1357	*0.5664*
Secondary	3711.51	*0.05*	9.3023	*1.0769*
Secondary	3716.26	*0.07*	2.4225	*0.2748*
Secondary	3719.87	*0.06*	3.1977	*0.3881*
Secondary	3725.18	*0.05*	12.5000	*1.3959*
Secondary	3728.39	*0.07*	2.4225	*0.2748*
Secondary	3731.92	*0.07*	1.8411	*0.2439*
Secondary	3734.90	*0.06*	3.1008	*0.3831*
Secondary	3737.85	*0.09*	0.6783	*0.1112*

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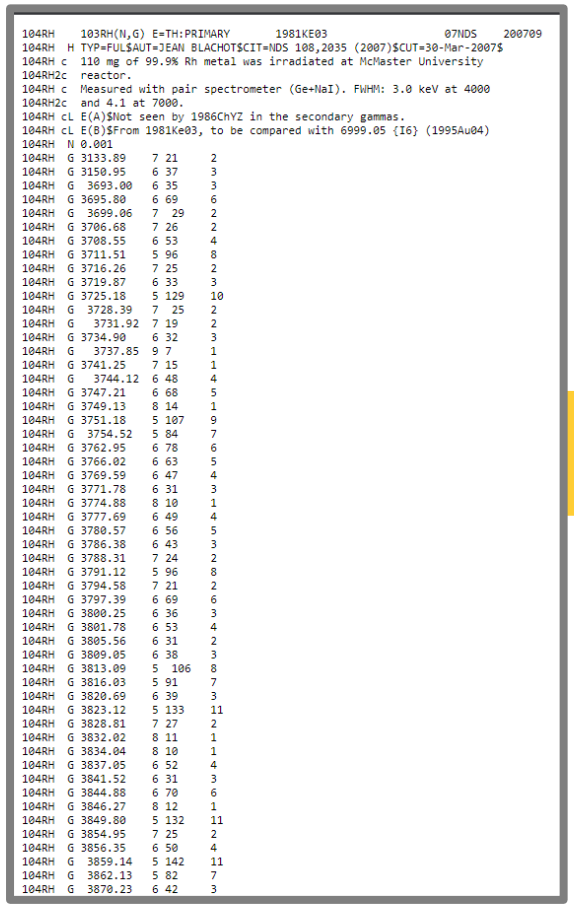
Ease-of-Access Features (contd.)



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104RH  G 3708.55    6 53     4
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104RH  G 3854.95    7 25     2
104RH  G 3856.35    6 50     4
104RH  G  3859.14   5 142    11
104RH  G  3862.13   5 82     7
104RH  G  3870.23   6 42     3
```

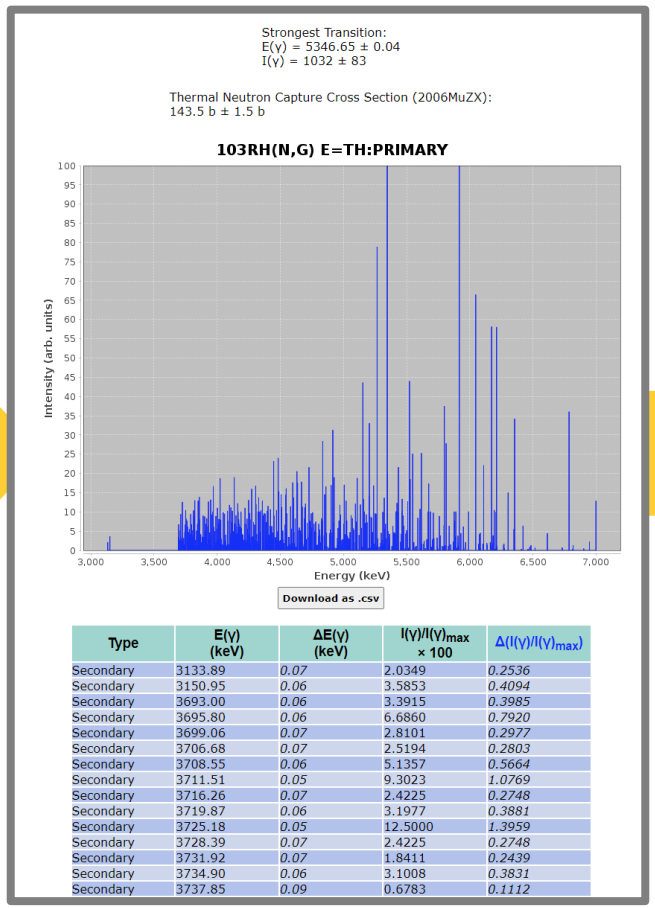

Strongest Transition:
E(γ) = 5346.65 ± 0.04
I(γ) = 1032 ± 83

Thermal Neutron Capture Cross Section (2006MuZX):
143.5 b ± 1.5 b

103RH(N,G) E=TH:PRIMARY

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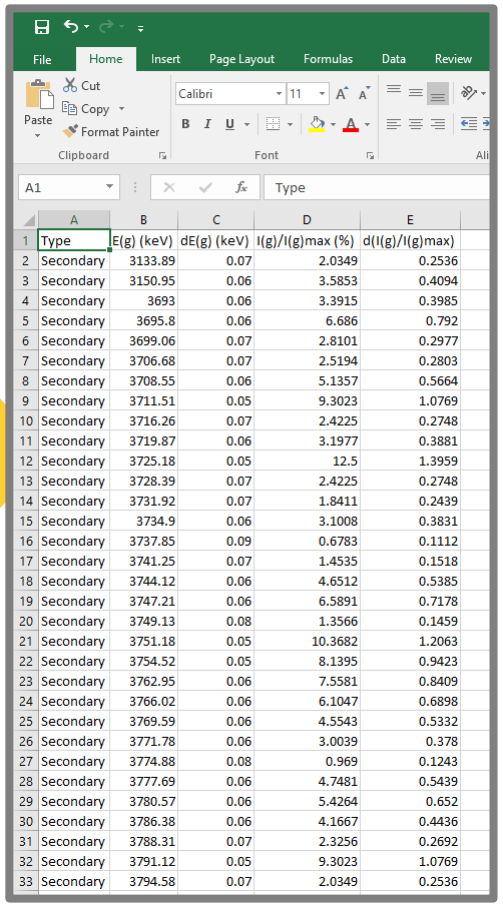
Type	E(γ) (keV)	ΔE(γ) (keV)	$I(\gamma)/I(\gamma)_{max} \times 100$	$\Delta(I(\gamma)/I(\gamma)_{max})$
Secondary	3133.89	*0.07*	2.0349	*0.2536*
Secondary	3150.95	*0.06*	3.5853	*0.4094*
Secondary	3693.00	*0.06*	3.3915	*0.3985*
Secondary	3695.80	*0.06*	6.6860	*0.7920*
Secondary	3699.06	*0.07*	2.8101	*0.2977*
Secondary	3706.68	*0.07*	2.5194	*0.2803*
Secondary	3708.55	*0.06*	5.1357	*0.5664*
Secondary	3711.51	*0.05*	9.3023	*1.0769*
Secondary	3716.26	*0.07*	2.4225	*0.2748*
Secondary	3719.87	*0.06*	3.1977	*0.3881*
Secondary	3725.18	*0.05*	12.5000	*1.3959*
Secondary	3728.39	*0.07*	2.4225	*0.2748*
Secondary	3731.92	*0.07*	1.8411	*0.2439*
Secondary	3734.90	*0.06*	3.1008	*0.3831*
Secondary	3737.85	*0.09*	0.6783	*0.1112*



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Calibri 11 Font

A1 Type

	A	B	C	D	E
1	Type	E(g) (keV)	dE(g) (keV)	I(g)/I(g)max (%)	d(I(g)/I(g)max)
2	Secondary	3133.89	0.07	2.0349	0.2536
3	Secondary	3150.95	0.06	3.5853	0.4094
4	Secondary	3693	0.06	3.3915	0.3985
5	Secondary	3695.8	0.06	6.686	0.792
6	Secondary	3699.06	0.07	2.8101	0.2977
7	Secondary	3706.68	0.07	2.5194	0.2803
8	Secondary	3708.55	0.06	5.1357	0.5664
9	Secondary	3711.51	0.05	9.3023	1.0769
10	Secondary	3716.26	0.07	2.4225	0.2748
11	Secondary	3719.87	0.06	3.1977	0.3881
12	Secondary	3725.18	0.05	12.5	1.3959
13	Secondary	3728.39	0.07	2.4225	0.2748
14	Secondary	3731.92	0.07	1.8411	0.2439
15	Secondary	3734.9	0.06	3.1008	0.3831
16	Secondary	3737.85	0.09	0.6783	0.1112
17	Secondary	3741.25	0.07	1.4535	0.1518
18	Secondary	3744.12	0.06	4.6512	0.5385
19	Secondary	3747.21	0.06	6.5891	0.7178
20	Secondary	3749.13	0.08	1.3566	0.1459
21	Secondary	3751.18	0.05	10.3682	1.2063
22	Secondary	3754.52	0.05	8.1395	0.9423
23	Secondary	3762.95	0.06	7.5581	0.8409
24	Secondary	3766.02	0.06	6.1047	0.6898
25	Secondary	3769.59	0.06	4.5543	0.5332
26	Secondary	3771.78	0.06	3.0039	0.378
27	Secondary	3774.88	0.08	0.969	0.1243
28	Secondary	3777.69	0.06	4.7481	0.5439
29	Secondary	3780.57	0.06	5.4264	0.652
30	Secondary	3786.38	0.06	4.1667	0.4436
31	Secondary	3788.31	0.07	2.3256	0.2692
32	Secondary	3791.12	0.05	9.3023	1.0769
33	Secondary	3794.58	0.07	2.0349	0.2536

Brookhaven National Laboratory

New Web Servers

Replacing current web servers due to 5-year end-of-life

- New servers already present at BNL
- Specifications:
  - 1 CPU: Intel® Xeon® Gold, 28 cores, 2.6 GHz
  - RAM: 384 GB, 12 x 32 GB, DDR4, 2933 MHz, ECC
  - 2 Solid-State Drives (OS): 480 GB, M.2, PCIe NVMe, SSD, Class 40
  - 8 Hard Drives (RAID-6) (Users): 2.4-TB, SAS 12Gbps 10kRPM, 512e 2.5in Hot-Plug
  - 5-year Red Hat OS Subscription and Software Support
  - 7-year ProSupport 7x24 Hardware Technical Support

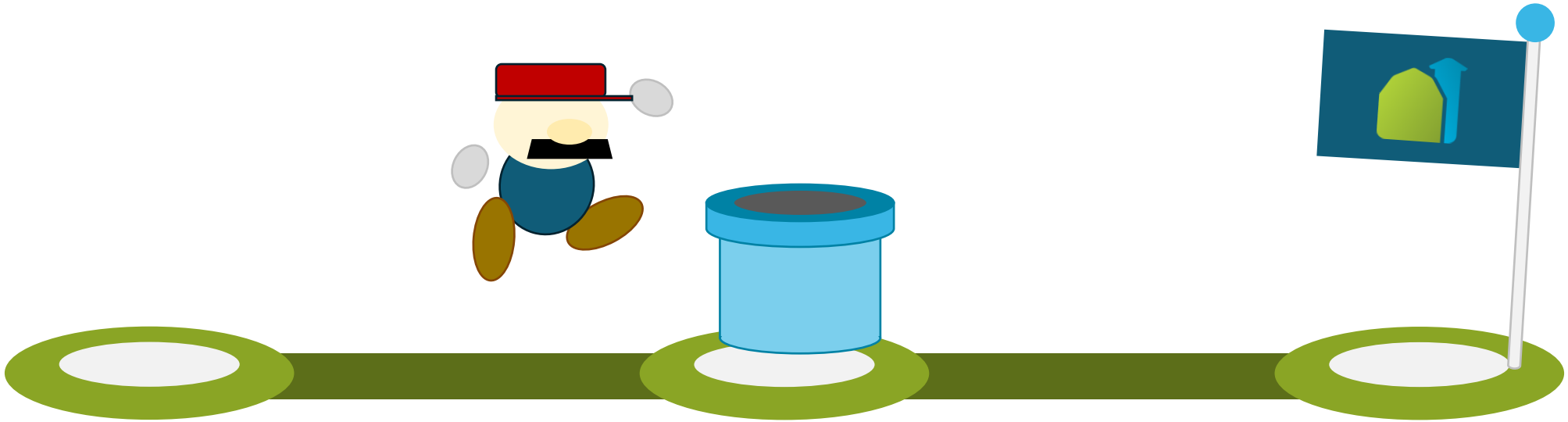
Containerization

All NNDC webapps have been converted into Docker containers

- **Security** – restricted access to servers and databases
- **Portability** – can be re-created on different machines
- **Robustness** – containers can be managed/restarted individually

Currently in use, and will be installed on new web servers

Future Plans



Database APIs

Done	To Do
ENSDF	NSR
EXFOR	CSISRS
ENDF	Atlas

Linking Databases

ENSDF	> ENDF
Atlas	> ENDF
NSR	> Everything

One-Stop Shop

Seamless transitions across databases & web applications