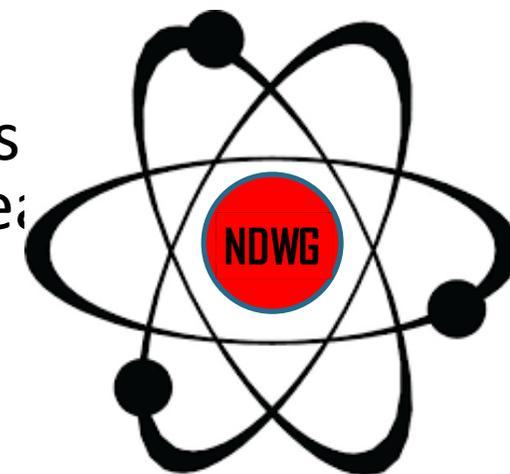
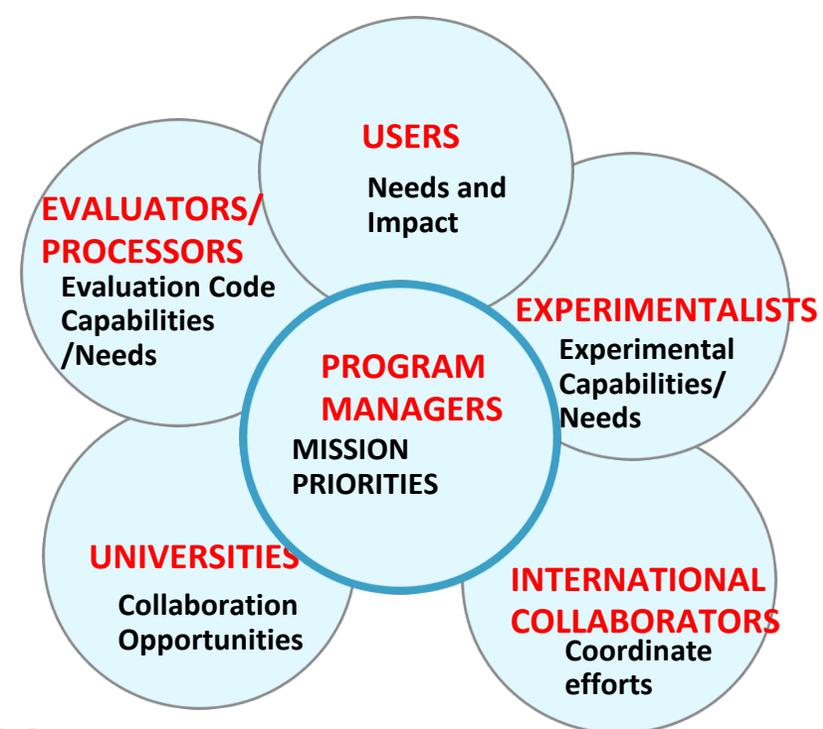


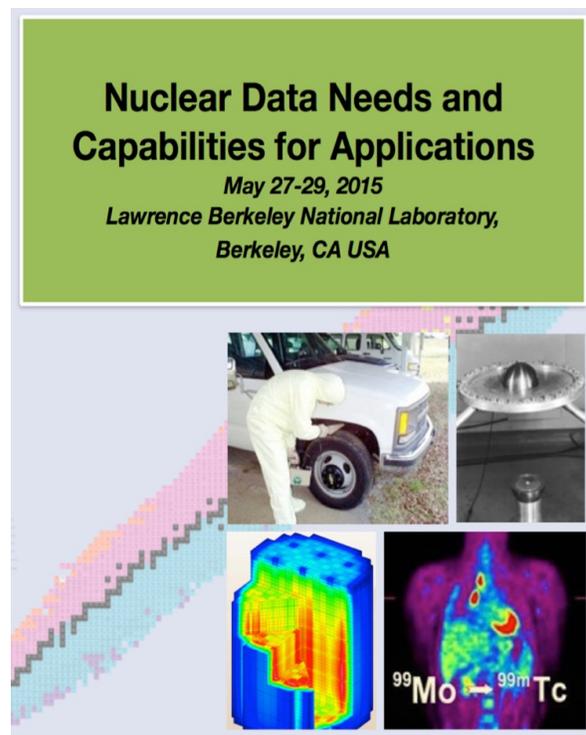
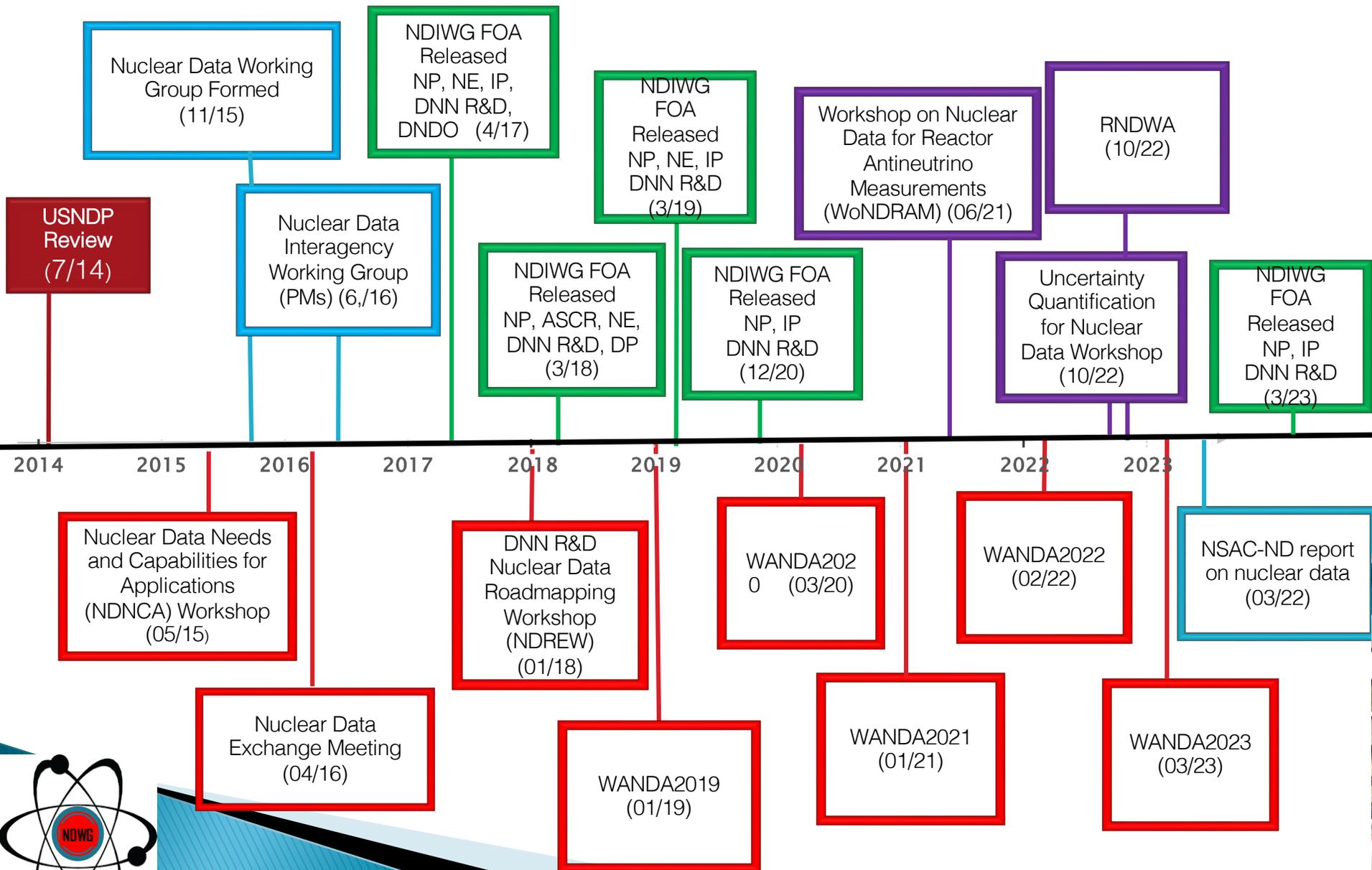
WANDA

- This is to provide updates on WANDA effort since the last NDAC meeting
- The Nuclear Data Working Group (NDWG) determines cross-cutting mission-driven nuclear data needs and selects topics for WANDA roadmapping sessions
- Based on summary reports from C. Romano's talk & Jankowski's at WANDA 2023, past WANDA talks, NSAC reports by the Nuclear Data Charge Subcommittee, and USNDP annual reports

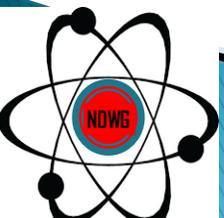


(Courtesy Romano)

NDWG/NDIAWG Timeline



WANDA 2021, Fully Virtual, over 350 participants



Organizations Represented at NDWG Workshops (Courtesy Romano)

NDIAWG membership increased from 8 to 15 since 2020 (Courtesy Jankowski)

Boxes indicate new membership since 2020



SC (NP, HEP, FES)
NNSA
Nuclear Energy



Human Spaceflight
Electronics
Propulsion/power
Spectroscopy



CWMD



DTRA
Missile Defense Agency



Nuclear Physics
(Experiment and Theory)



National Cancer Institute

Universities	National Laboratories	Federal Agencies
Air Force Institute of Technology	Argonne National Laboratory	DOE
Boston University	Brookhaven National Laboratory	Office of Science, Office of Nuclear Physics
Central Michigan University	Idaho National Laboratory	Office of Science, Fusion Energy Sciences
	Jefferson Laboratory	
Colorado School of Mines	Lawrence Berkeley National Laboratory	Office of Science, Office of High Energy Physics
George Washington University	Lawrence Livermore National Laboratory	Office of Science, Adv. Scientific Computing Research
Illinois Institute of Technology	Los Alamos National Laboratory	Office of Science, Isotope Program
Johns Hopkins University	National Institute of Standards and Technology	Office of Nuclear Energy
Michigan State University	National Superconducting Cyclotron Laboratory	ARPA-E
North Carolina State University	Naval Nuclear Laboratory	NNSA
Ohio University	Oak Ridge National Laboratory	Defense Programs, NA-11
Oregon State University	Pacific Northwest National Laboratory	Defense Nuclear Nonproliferation, NA-20
Rensselaer Polytechnic Institute	Sandia National Laboratories	Naval Reactors, NA-30
Texas A&M University	Savannah River National Laboratory	Infrastructure & Environment, NA-50
Triangle Universities Nuclear Laboratory	SLAC National Accelerator Laboratory, Stanford University	Defense Nuclear Security, NA-80
United States Naval Academy	JPL - Jet Propulsion Laboratory	DOD
University of Tennessee	Johns Hopkins Applied Physics Laboratory	Defense Threat Reduction Agency
University of Wisconsin	Thomas Jefferson National Accelerator Facility	MDA - Missile Defense Agency
University of California, Berkeley	Industry	AFTAC - Air Force Technical Applications Center
University of Massachusetts	ARA	Other
University of Michigan	Schlumberger	NRC - Nuclear Regulatory Commission
University of Notre Dame	Studsvik, Scandpower	NASA - National Aeronautics and Space Administration
University of Tennessee, Knoxville	Westinghouse	NIH - National Institute of Health, National Cancer Inst.
University of Washington	X-energy	DHS - Countering Weapons of Mass Destruction
University of California, Davis	The Aerospace Corporation	
Missouri State University	Mayo Clinic	
Carnegie Mellon University	KBR Wyle/ SSAI	
University of Nevada, Las Vegas	International Agencies	
Vanderbilt University	European Commission, Joint Research Centre	
East Carolina University	International Atomic Energy Agency	
Kansas State University	Japan Atomic Energy Agency	
Western Norway Univ. of Applied Sciences	National Institute for Nuclear Physics (INFN)	
North Carolina Central University	UK Ministry of Defence	
Duke University	European Space Agency	
Technical University of Darmstadt	CERN	
Lancaster University	Institute of Astronomy and Space Physics (IAFE)	
Massachusetts Institute of Technology		

Wanda Topics that have Been Funded *(Courtesy Romano)*

“X” represents funded topical areas

NDIAWG FOA-2952, 2023

Topical areas are;

A. DOE NP:

1) Legacy data for completing the nuclear data pipeline

2) nuclear data benchmarks

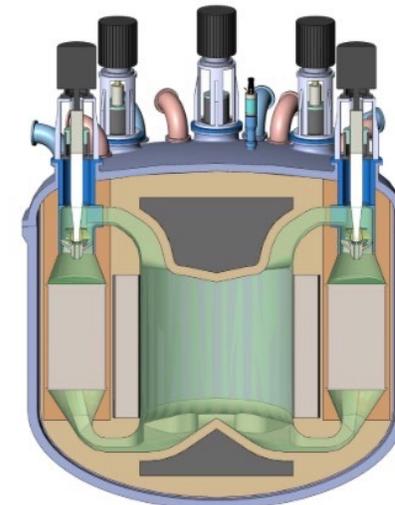
B. DOE NNSA

1) (a,n) reaction data relevant to safeguards and arms control verification

2) Fission data for safeguards and forensics applications

3) Cross sections for reactions involving short-lived fission products

NDNCA (2015) Cross-cutting recommendations		WANDA2019 Topics		WANDA2022 Topics	
Dosimetry Standards		Nuclear Data for Isotope Production	x	Reactions on Unstable Nuclei	
Fission	x	Safeguards	x	High Energy Ion Interactions and Secondary Particles	
Decay Data and g-Branching Ratios	x	Materials Damage		Neutrons as Secondary Particles and Interactions	x
Neutron Transport Covariance Reduction		Nuclear Data for Nuclear Energy	x	Photon Reactions and Transport	
Expanded Integral Validation		(n,x) Reactions	x	Stopping Powers, Energy Deposition and Dose	
Antineutrinos from Reactors	x	Atomic Data, NRF Data		Nuclear Data Adjustments and Impact on Applications	
NDEM (2016) Cross-cutting recommendations		WANDA2020 Topics		WANDA 2023 Topics	
Improving the Pipeline infrastructure	x	Covariance/Uncertainty/Sensitivity/Validation		Gamma Strength Functions & Level Densities	
Improved Covariance Data		Nuclear Data for Isotope Production and Targetry Needs	x	Fission Product Yields, where we are and where we're headed	
Inelastic Scattering on actinides	x	Machine Learning/AI		Department of Energy Isotope Program	
Capture gamma spectra	x	Detector Models, Atomic Data and Stopping Powers		Nuclear Processing & Preservation	
Improved Fission yields	x	Scattering, Transport and Shielding	x		
Target Production to Support Nuclear Data Experiments	x	Neutron induced gammas and gamma decay	x		
NDREW (2018) Topics		WANDA2021 Topics			
Uncertainty, Sensitivity, and Covariance		Advanced Computing for Nuclear Data			
Neutron Capture and Associated Spectra	x	Predictive Codes for Isotope Production			
		Expanded Benchmarks and Validation for Nuclear Data			
Fission I, Independent and Cumulative Yields	x	Nuclear Data for Space Applications			
Gamma-Induced Reactions	x	Nuclear Data for Advanced Reactors and Security			
Inelastic Neutron Scattering and Associated Spectra	x	The Human Pipeline for Nuclear Data			
Fission II, Prompt Gammas and Neutrons	x				
(α ,n) Reactions	x	WoNDRAM Topics			
Targets, Facilities and Detector Systems	x	Reactor Antineutrino Source Term	x		
Fission III, Decay Data	x	Antineutrino Spectrum Calculations	x		
Development of Benchmark Exercises		Detector Response			
Data Processing & Transport Code Needs					
Actinide Cross Sections	x				



$^{35}\text{Cl}(n,p)$ nuclear data needs for Commercial Power MCFR reactors, by T. Cisneros WANDA 2021

MCFR-C 500-1200 MWe

Courtesy Romano

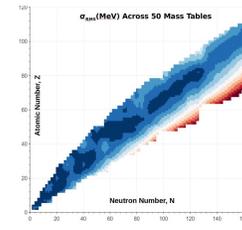
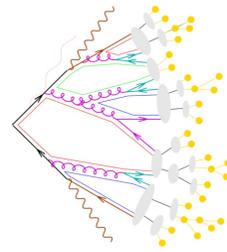
***\$50 Million NDIAWG
FOA Funded
Projects Since 2018***

FY start	Title	Lead	PI
FY18	Novel Approach for Improving Antineutrino Spectra Predictions for Nonproliferation Applications	ANL	Kondev, Filip
FY18	Improving the Nuclear Data on Fission Product Decays at CARIBU	ANL	Savard, Guy
FY19	Independent Fission Product Yields from 0.5 to 20 MeV	LANL	Winkelbauer, Jack
FY19	Energy Dependent Fission Product Yields	LLNL	Tonchev, Anton
FY19	Measurements of Independent Fission Product Yields	LANL	Duke, Dana
FY19	Beta-strength function, reactor decay heat, and anti-neutrino properties from total absorption spectroscopy of fission fragments	ORNL	Rykaczewski, Krzysztof
FY19	Integral Measurements of Independent and Cumulative Fission Product Yields Supporting Nuclear Forensics and Other Applications	LANL	Bredeweg, Todd
FY19	Evaluation of Energy Dependent Fission Product Yields	LANL	Kawano, Toshihiko
FY19	Improving the double-differential $^{238}\text{U}(n,n'\gamma)$ cross section using neutron-gamma coincidences	LBNL	Bernstein, Lee
FY20	Scoping Study of the Impact of (α,n) Reactions and Yields of Nonproliferation Applications	ORNL	Romano, Catherine
FY20	Assessment of Nuclear Data Needs for Neutron Active Interrogation	ORNL	McConchie, Seth
FY20	Fission product yield measurements using ^{252}Cf spontaneous fission and neutron-induced fission on actinide targets at CARIBU	ANL	Savard, Guy
FY20	Modernization and Optimization of the Evaluated Nuclear Structure Data File	BNL	McCutchan, Elizabeth
FY20	$^{238}\text{U}(p,xn)$ and $^{235}\text{U}(d,xn)$ $^{235-237}\text{Np}$ Nuclear Reaction Cross Sections Relevant to the Production of ^{236}gNp	LBNL	Bernstein, Lee
FY21	Neutron Scattering Cross Sections: (n,n') , $(n,n'\gamma)$, and (n,γ) Measurements	USNA	Vanhoy, Jeff
FY19	State-of-the-art Gamma-ray Spectroscopy to Enhance the ENSDF	BNL	McCutchan, Elizabeth
FY22	Gamma Rays Induced by Neutrons	BNL	Brown, Dave
FY22	White-source neutron-gamma coincidence measurements of gamma production cross sections at LANSCE	LANL	Kelly, Keegan
FY22	Evaluation of Gamma-ray Production	LANL	Kawano, Toshihiko
FY22	β -energy spectral shapes in fission products affecting reactor decay heat and anti-neutrino flux	ORNL	Charlie Rasco
FY22	Two and Three-body Photodisintegration of the Triton at Energies Below 30 MeV	Duke Univ	Calvin Howell
FY22	Designing Nuclear-data Measurements that Resolve Discrepancies in Existing Data	LANL	Denise Neudecker
FY22	Modern Structure-based Nuclear Data Evaluations for Basic Science, Nuclear Safety & Security	LANL	Mark Paris

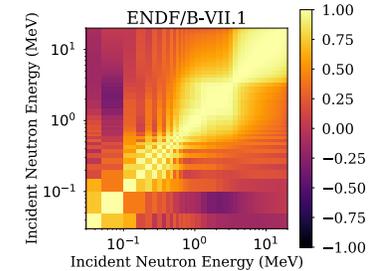
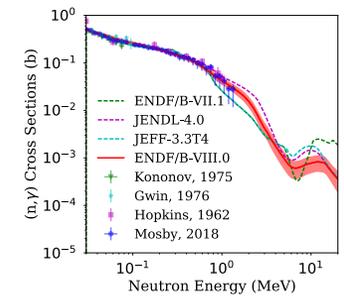
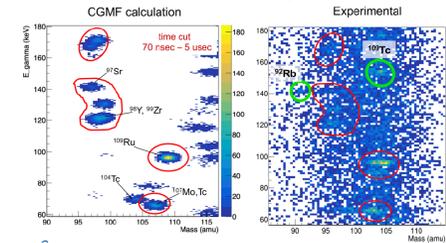
USNDP PIs

Most USNDP members participate as co-PI or co-I rolls for other NDIAWG funded projects

During WANDA



Delayed Gamma Rays



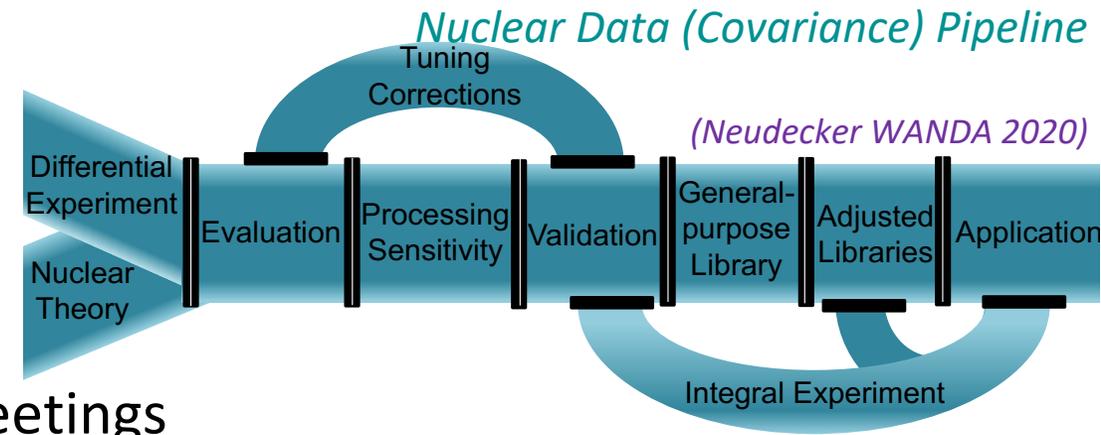
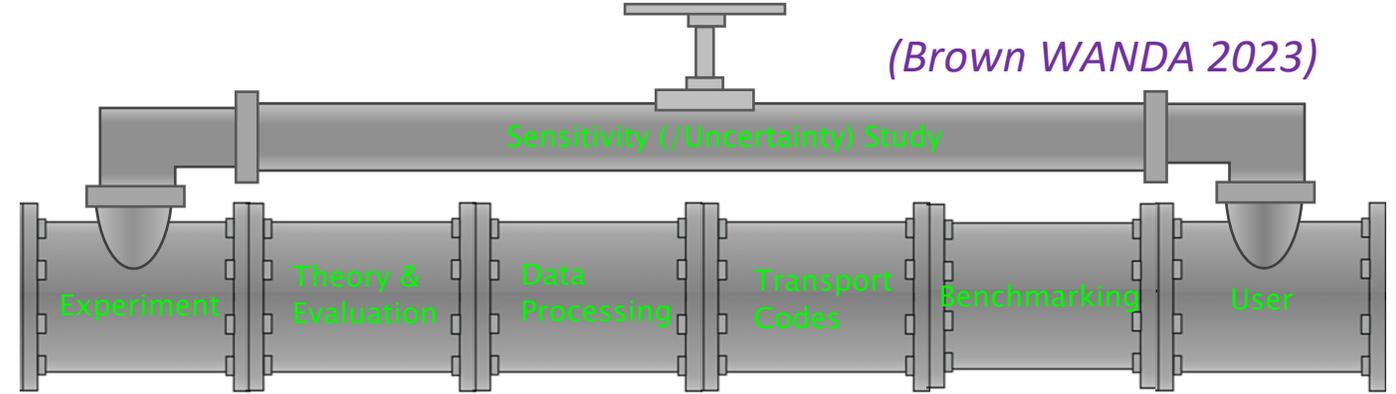
- Communications and coordination across different communities and program offices are the key to success of WANDA
- Collect subject matter expert input, including nuclear data prioritization and recommended solutions
- Increased interest and integration of basic science community
- Educate nuclear data pipeline, nuclear data challenges, and effective collaborations
Continue to expand federal program involvement, eventually dedicated funding for application needs
- Emphasis on “build evaluator workforce”
- Ensure recommended nuclear data improvements are mission driven and will provide impact



WANDA 2019, Washington DC

USNDP and WANDA

- USNDP Provided
 - needed Nuclear Data Pipeline education,
 - initiation of improving lacking areas in Nuclear Data,
 - integration of Nuclear Data Lifecycle,
 - identification of specific Nuclear Data expertise per application needs
- USNDP PIs Participate in NDWG
- Fully engaged at WANDA meetings and NDIAWG calls
- Provided supports and guides to organize WANDA meetings
- Timely incorporated the new experimental outcome of NDIAWG projects, through evaluations of fission code product yields, antineutrino spectra, gamma-ray production, and more to come with new projects
- Extend collaborations beyond USNDP, in partnership with national labs and universities



USNDP outlook for WANDA

- While participating the past WANDA meetings and NDWG meetings, we gained experience on
 - advertising our capabilities to new federal programs
 - maneuvering logistics to deal with different agencies (federal, industry, foreign, etc.)
 - improved efficiency from experiment, evaluation,... to dissemination
 - continue to be a coordinating center to outreach new communities
- Where WANDA is heading
 - Further extension to other application areas and federal/industrial programs
 - Support transition of capabilities, especially recently developed thru WANDA
 - Invest on long-term efforts, i.e. new library development for charged particle up to several hundred MeV (isotope and space applications), stopping powers(material damage-, fusion-, Astro- applications), ...
 - Continue emphasizing the workforce development for Nuclear Data

