Nuclear Science User Facilities (NSUF) Overview and Status

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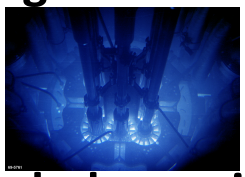
nsuf.inl.gov

NSUF Nuclear Science User Facilities

NSUF Historical

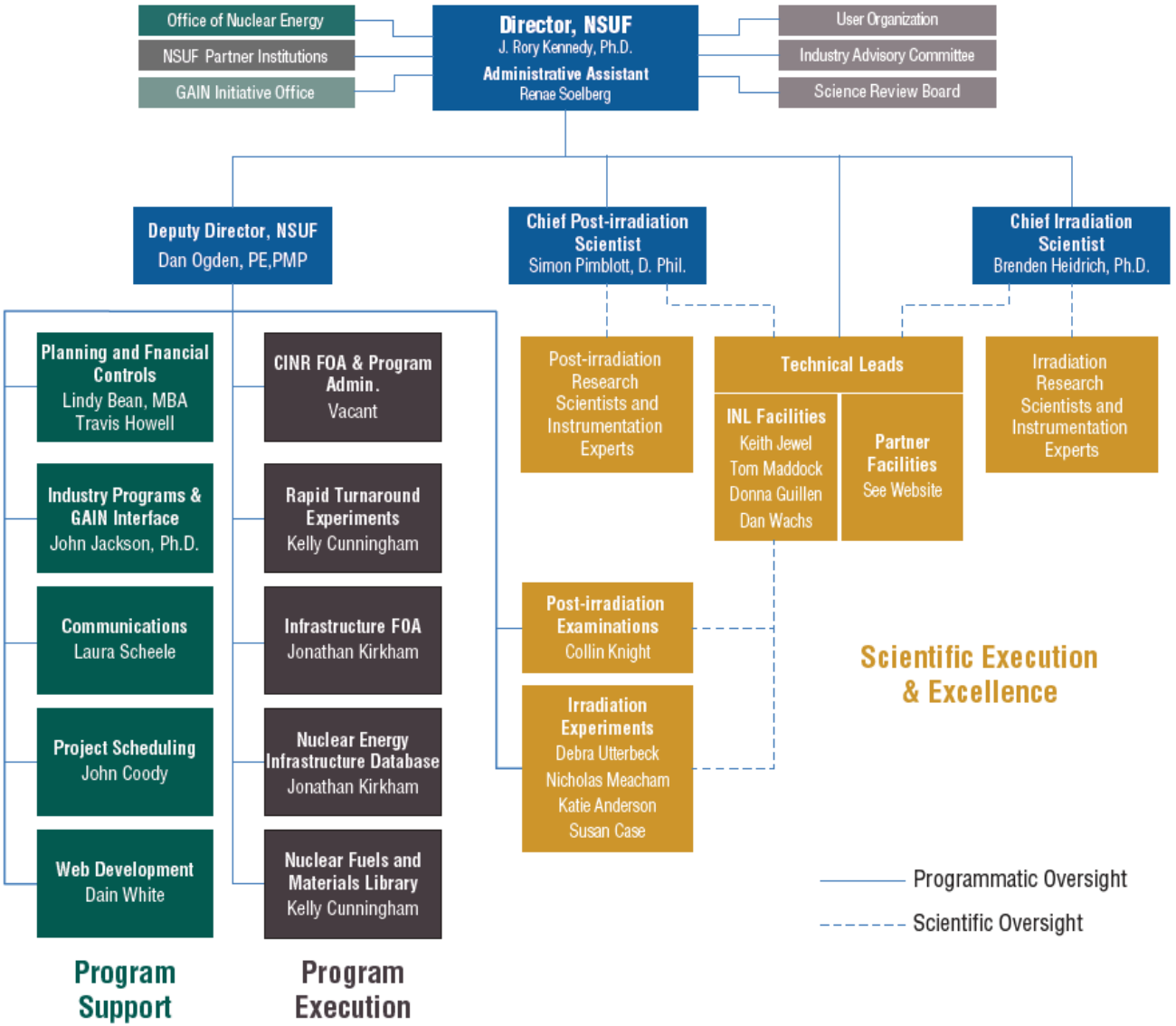
- Established 2007 as US DOE Office of Nuclear Energy (DOE-NE) user facility. Intended to support the mission of DOE-NE by linking national intellectual capital with DOE-NE infrastructure.



- Irradiation Effects in Nuclear Fuels and Materials
- Founded at Idaho National Laboratory initially intended as a single institution user facility. INL remains lead and primary institution.
- NSUF operates as typical US user facility (no cost to user, competitive proposal processes, no funding to users) but also some unique aspects.
- Generally select projects through open competitive proposal processes
  - Consolidated Innovative Nuclear Research (CINR FOA, 1 call/year)
    - Irradiation + PIE ($1.0M - $4.0M, up to 7 years) includes design, analyses, fabrication, transport, irradiation, disassembly, PIE, disposition
    - PIE only (~$500K, up to 3 years)
    - Irradiation only ($500K - $3.5M)
    - Beamlines at other user facilities
    - Possibility to also receive user R&D funding on limited work scopes

  - Rapid Turnaround Experiments (RTE, 3 calls/year, limited $$, executed within 9 months)
- Proposals welcome from university, government laboratory, industry, and small business researchers. Only non-proprietary projects accepted. All awarded projects are fully forward funded.

NSUF Organization Chart



NSUF Capabilities Offer Research Opportunities

Neutron Irradiations	Ion Irradiations	Gamma Irradiations	Hot Cells & Shielded Cells	Low Activity Laboratories	Beamlines	High Performance Computing
INL Idaho National Laboratory	Wisconsin University of Wisconsin-Madison	INL Idaho National Laboratory	INL Idaho National Laboratory	INL Idaho National Laboratory	125 Illinois Tech Since 1890	INL Idaho National Laboratory
Oak Ridge National Laboratory	University of Michigan	Oak Ridge National Laboratory	Oak Ridge National Laboratory	CAES Center for Advanced Energy Studies	Brookhaven National Laboratory	
MIT Massachusetts Institute of Technology	Argonne National Laboratory	Sandia National Laboratories	PNNL	Oak Ridge National Laboratory	NC State University	
NC State University	Sandia National Laboratories		Los Alamos National Laboratory Est. 1943	Cal	Los Alamos National Laboratory Est. 1943	
Ohio State	Texas A&M University		Westinghouse	PNNL		
Sandia National Laboratories	Lawrence Livermore National Laboratory		University of Michigan	Los Alamos National Laboratory Est. 1943		
SCK•CEN Studiecentrum voor Kernenergie Centre d'Etude de l'Energie Nucleaire			SCK•CEN Studiecentrum voor Kernenergie Centre d'Etude de l'Energie Nucleaire	NC State University; University of Michigan; Purdue University; Wisconsin; University of Florida		
				SCK•CEN Studiecentrum voor Kernenergie Centre d'Etude de l'Energie Nucleaire		

Visit nsuf.inl.gov for details at individual facilities

11 Universities

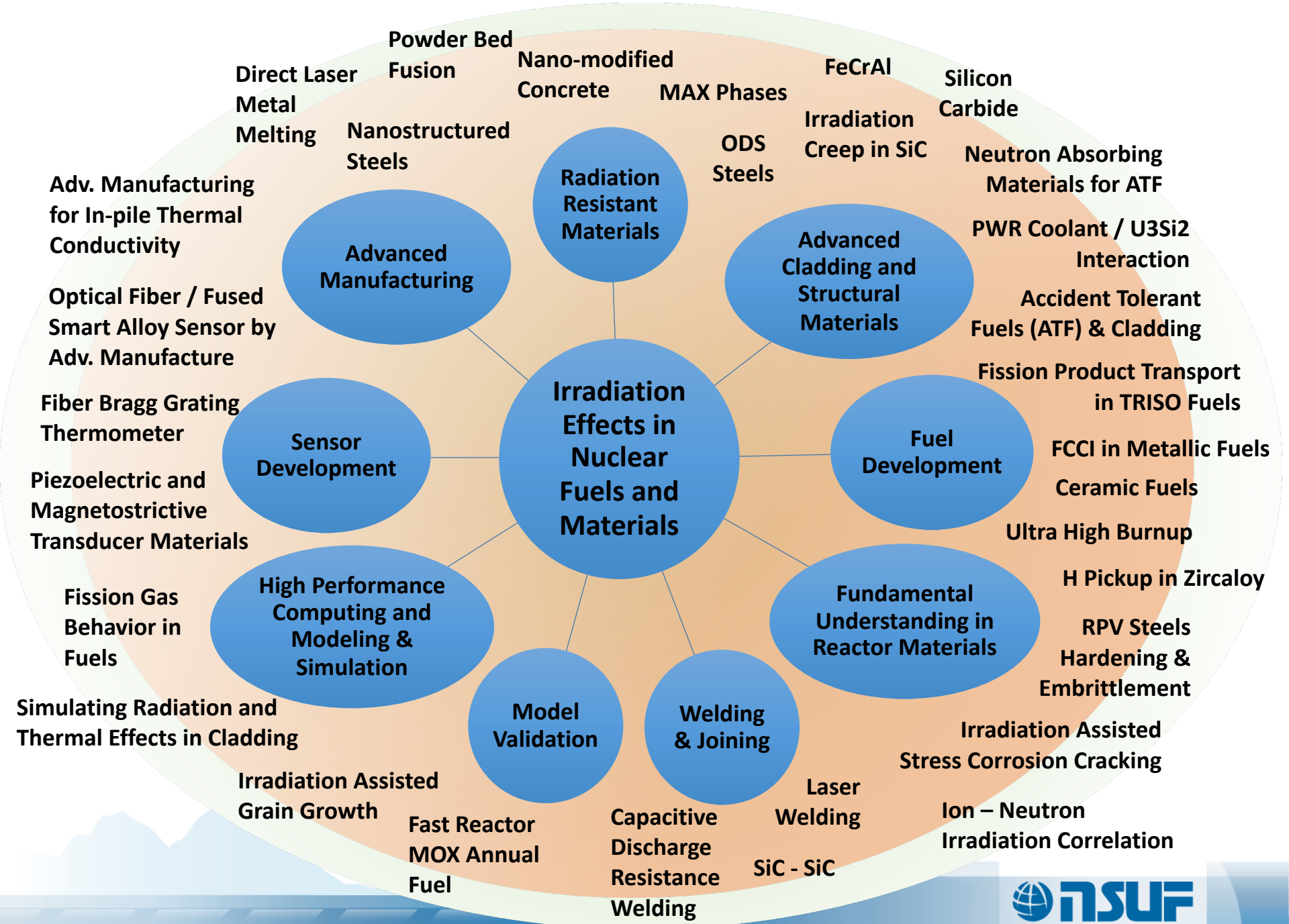
CAES (4 Unis)

7 National Labs

1 Industry

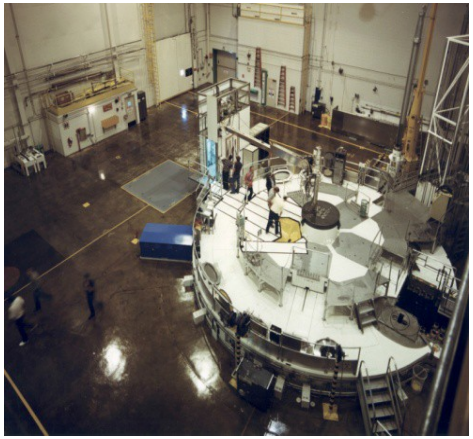
1 int'l affiliate

NSUF


Irradiation Effects in Nuclear Fuels and Materials
Advanced Manufacturing
Radiation Resistant Materials
Advanced Cladding and Structural Materials
Sensor Development
Fuel Development
High Performance Computing and Modeling & Simulation
Model Validation
Welding & Joining
Fundamental Understanding in Reactor Materials
Powder Bed Fusion
Direct Laser Metal Melting
Nano-modified Concrete
MAX Phases
FeCrAl
Silicon Carbide
Nanostructured Steels
ODS Steels
Irradiation Creep in SiC
Neutron Absorbing Materials for ATF
Adv. Manufacturing for In-pile Thermal Conductivity
PWR Coolant / U3Si2 Interaction
Optical Fiber / Fused Smart Alloy Sensor by Adv. Manufacture
Accident Tolerant Fuels (ATF) & Cladding
Fiber Bragg Grating Thermometer
Fission Product Transport in TRISO Fuels
Piezoelectric and Magnetostrictive Transducer Materials
FCCI in Metallic Fuels
Ceramic Fuels
Ultra High Burnup
Fission Gas Behavior in Fuels
H Pickup in Zircaloy
RPV Steels Hardening & Embrittlement
Simulating Radiation and Thermal Effects in Cladding
Irradiation Assisted Stress Corrosion Cracking
Irradiation Assisted Grain Growth
Laser Welding
Ion – Neutron Irradiation Correlation
Fast Reactor MOX Annual Fuel
Capacitive Discharge Resistance Welding
SiC - SiC

NSUF Projects Summary

FY 2007 – FY2019*



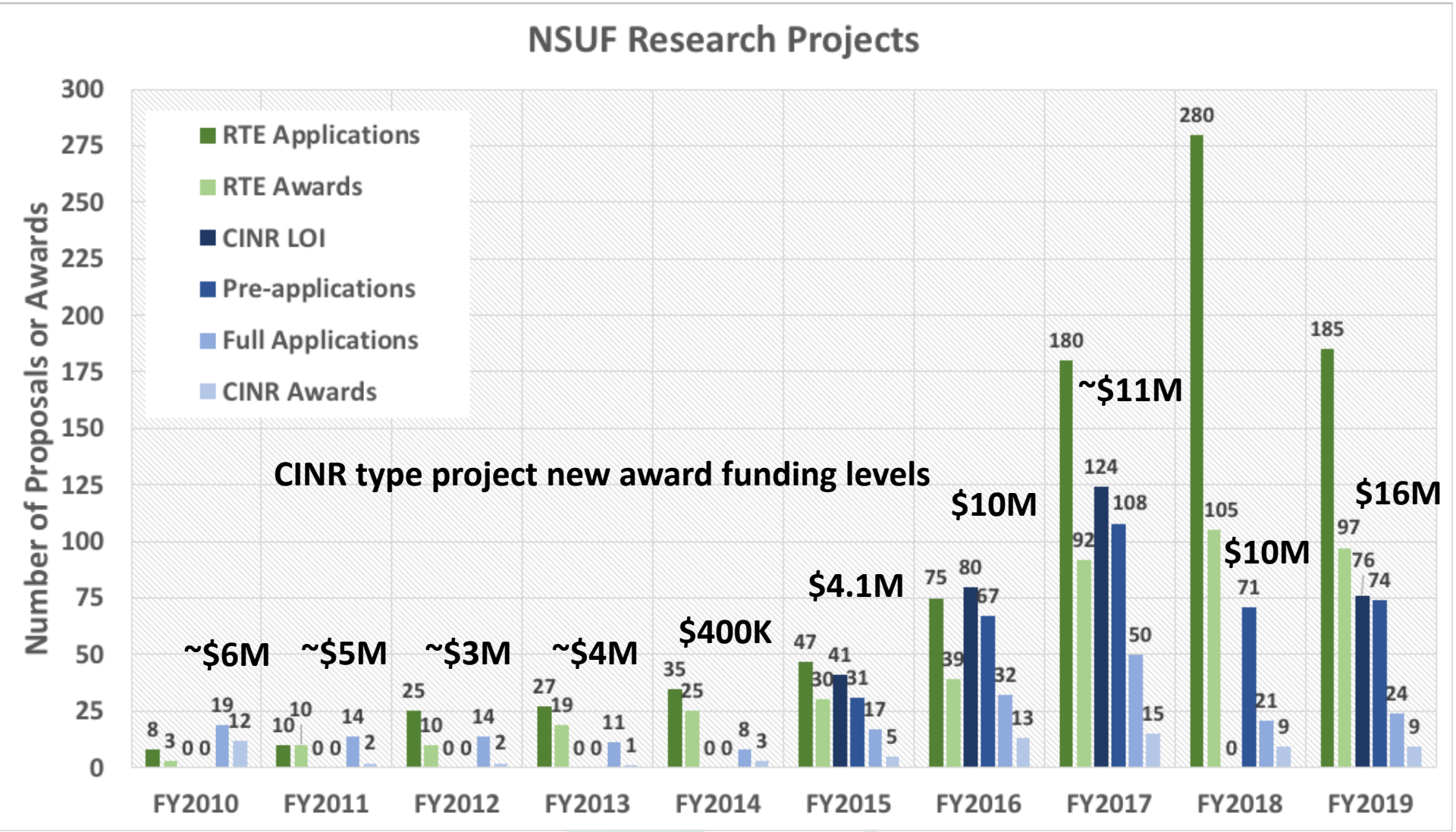
- Total of 39 CINR type projects executed
- Total of 35 CINR type projects currently ongoing
- Total of 289 RTEs executed
- Total of 75 RTEs ongoing
- 438 total projects awarded
  - 269 projects to 45 US universities
  - 133 projects to 6 national laboratories
  - 15 projects to industry
  - 21 projects to 11 international (Oxford U., Manchester U., Liverpool U., Bristol U., NNL, ANSTO, CEA Saclay, Institutio Italiano di Technologia, SCK-CEN, EC-JRC-Karlsruhe, Studsvik Nuclear,)

FY 2019

- Effective FY2019 budget: ~$30M (same as FY18, FY17 & FY16)
- Total effective FY 2019 budget allocated to projects: ~$20.6M direct (CINR + RTE) + ~$3.4M supporting (PIE coordination, experiment managers, experiment analyses, shipping, SCK-CEN pilot projects)
- At any particular time, NSUF is managing ~100 – 130 projects

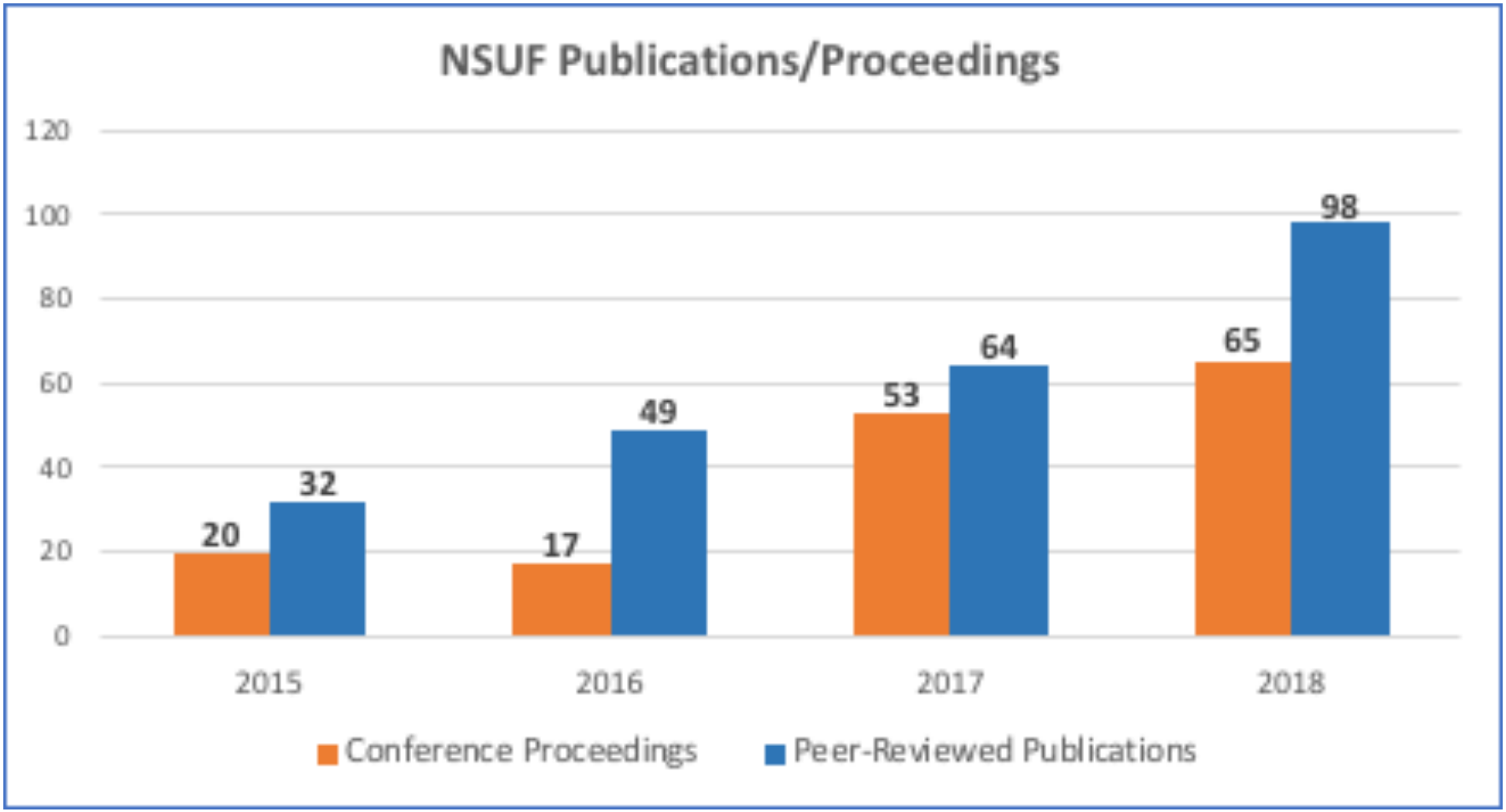
* As of 4/2019

Interest and Support Continue to Grow



Graphics created by
Brenden Heidrich

NSUF Publications

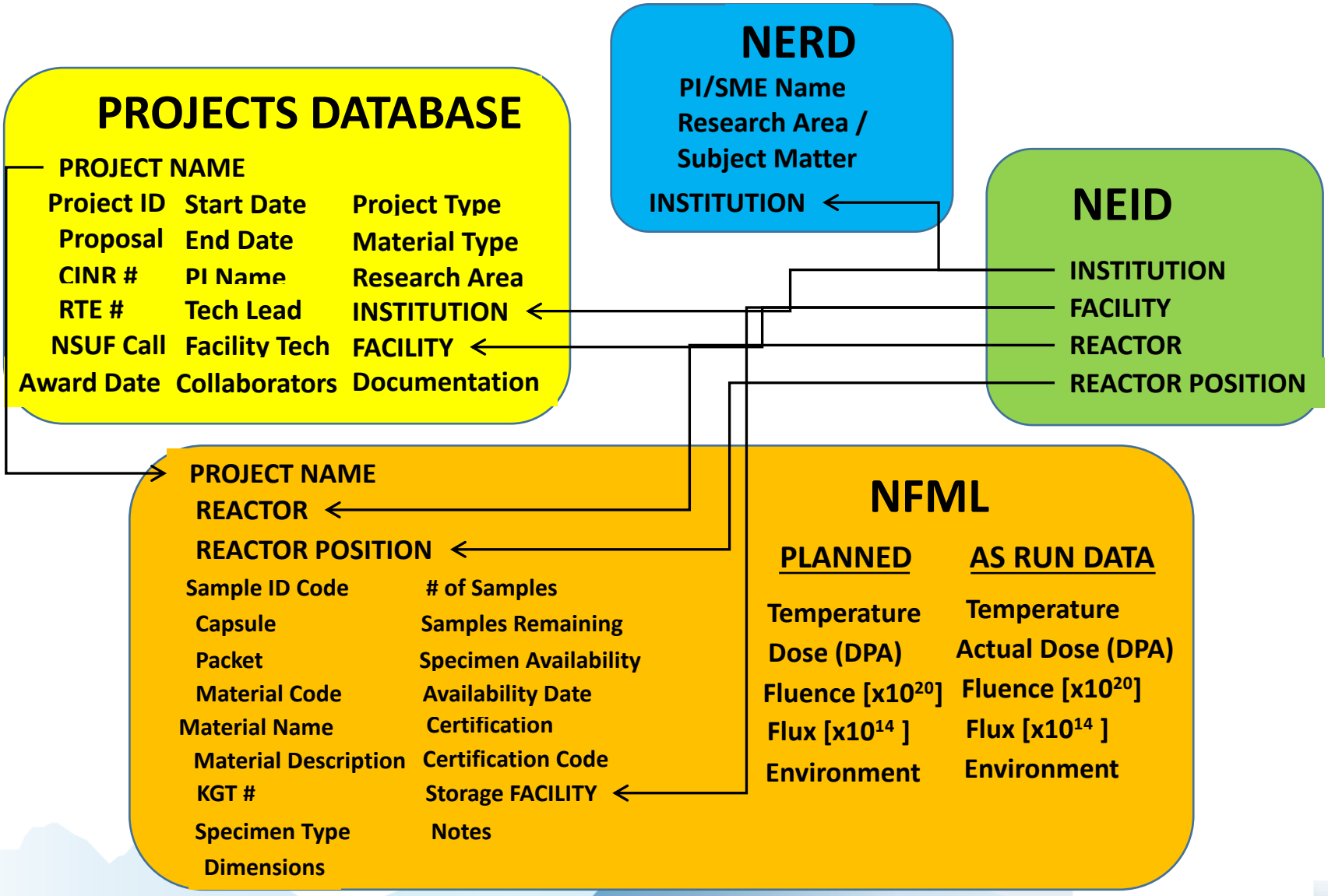


- Continuing to see results from early irradiation tests
- Increase in RTE awards.
- H-index score of 17
- Journal of Nuclear Materials is by far the most published in journal.

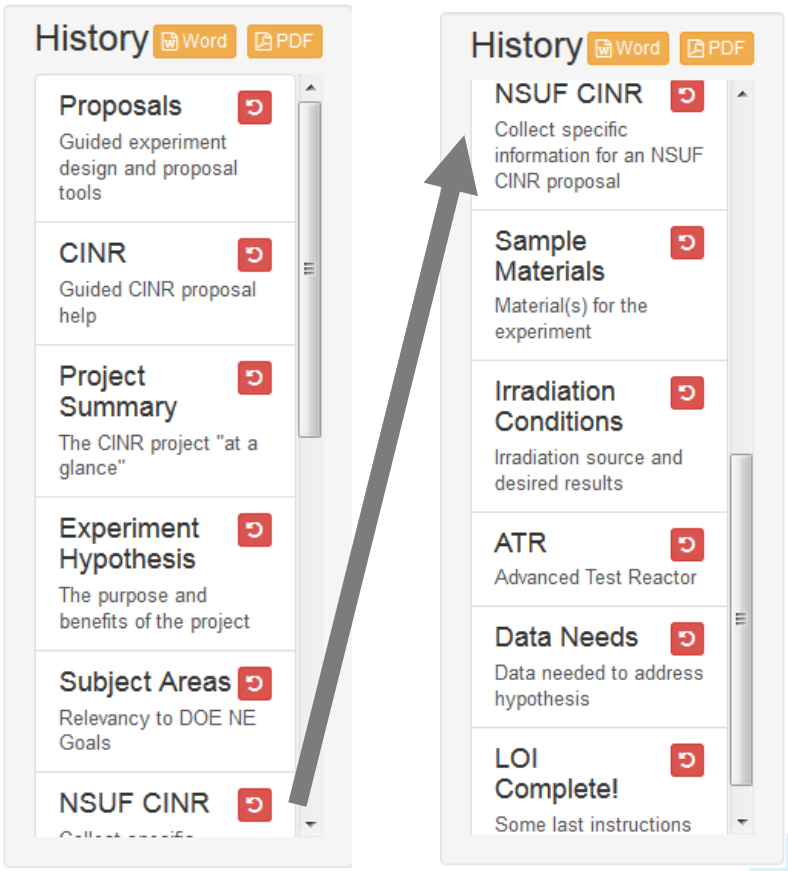
International Collaborations

- **DOE-NE / NSUF and UK / NNUF**
  - DOE-NE and NSUF invited to Nuclear Academics Discussion Meetings
  - UK National Nuclear User facility (NNUF)
  - Initial area of mutual user facility interest and cooperation
    - Nuclear Fuels and Materials Library (Archive)
  - NSUF to collaborate with NNUF
    - US – UK Nuclear Energy R&D Cooperative Action Plan signed September 2018
      - Enabling Technologies Working Group
- **DOE-NE / NSUF / INL and SCK-CEN / BR2 / LHMA**
  - In-kind contributions
  - CRADA with four tasks
    - Monitoring Of Temperature Of Reactor Experiments MOTORE
    - Disc Irradiation for Separate Effects Testing with Control of Temperature (DISECT)
    - Accident Tolerant fuel Test for the Interaction between Coolant and Uranium Silicide (ATTICUS)
    - Cooperative In-Pile Instrumentation Development

Database Integration
Combined Materials Experiment Toolkit (CoMET)

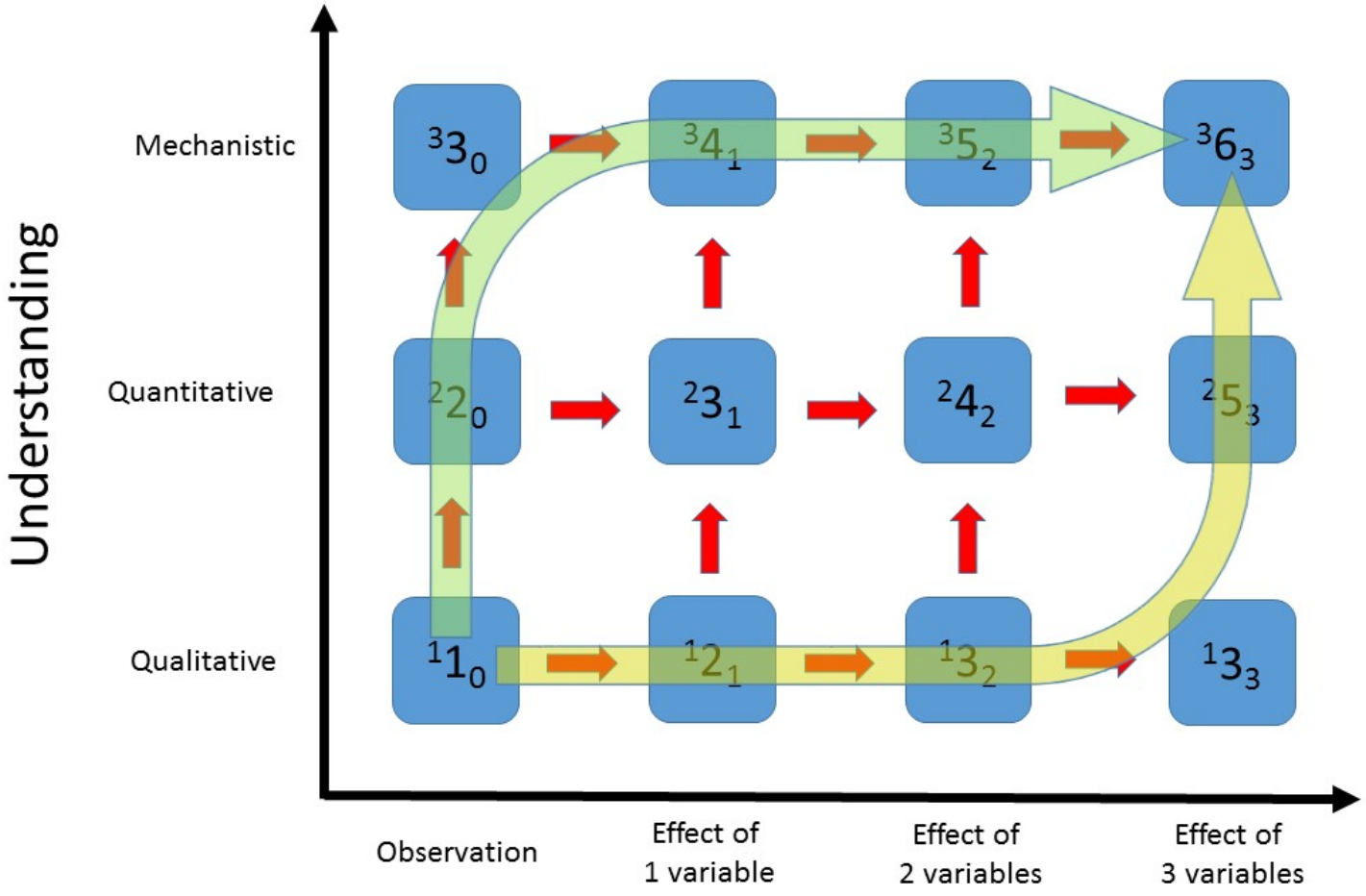


CoMET is Executed through a Process Guidance Application (Wizard)



- **The Wizard guides the user through their undertaking (proposal preparation in this case)**
- **Each box in the history represents a stage in the undertaking where a decision was made and/or information/data was input. At each stage of the undertaking, the user is offered access to additional reference data and information.**
- **Multiple team members, NSUF technical experts, program managers, and others can all work on an undertaking at the same time, keeping all information in one place.**
- **The Wizard clearly communicates all relevant information needed for the decision or input required at each stage.**
- **The Wizard is functional from all communication devices**

Quantifying the Impact of NSUF Fuels and Materials Understanding Scale (FaMUS)

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