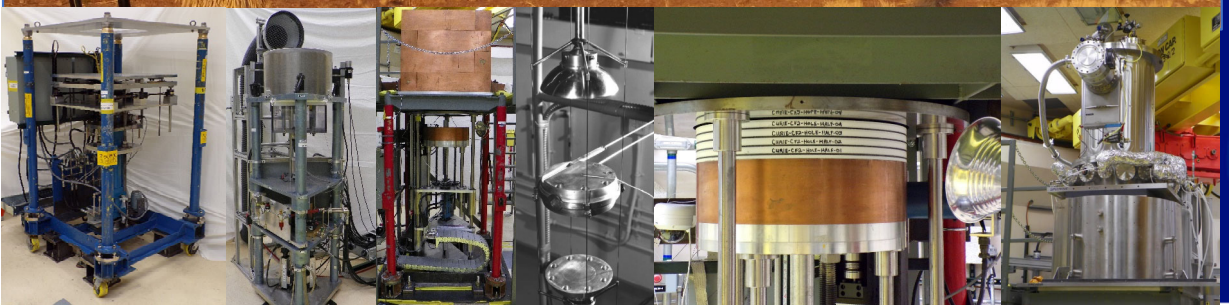

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LANL FY21 NCSP Highlights

Joetta Goda
LANL NCSP Task Manager

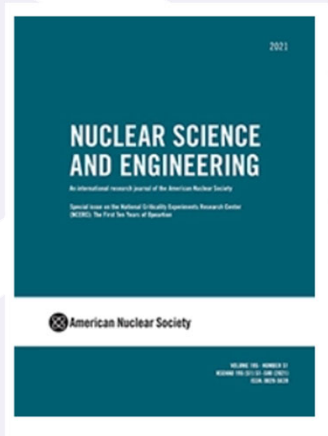
Tuesday, February 15, 2022

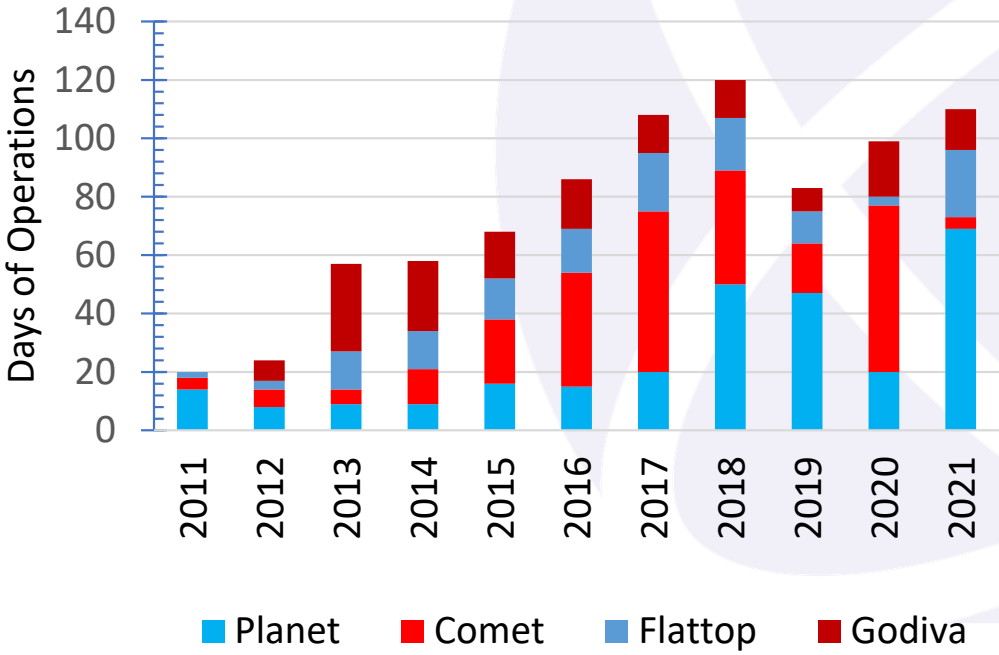
LA-UR-22-21062

Both COVID and Experiments Continued in FY21…

Celebrated 10th Anniversary of NCERC Operations

- Special Issue of Nuclear Science and Engineering(NSE) highlights first decade





Integral Experiments

IE 1: Maintain permanent NCERC Field Staff in DAF and Maintain NCERC staff for HQ
IE 2: Maintain and Train NCERC Team Members
IE 3: LANL Design and Execute Critical Experiments
IE 8: NCERC Small Sample Rabbit Transfer System
IE 14: Control and Data Systems Upgrades and Maintenance
IE 33: IER Collaboration with Other Labs
IE 34: SHEBA Fuel Staging at DAF/NCERC

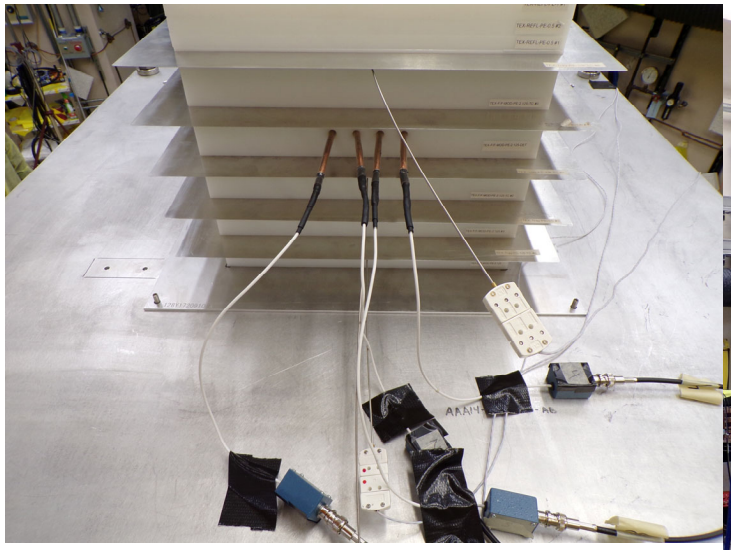
Focused on a Large Experiment Campaign (IER 488)
MUSIC: Measurements of Uranium Subcritical and Critical

- **CED-3b milestone**.
- Measured 10 configurations.
  - 2 critical
  - 8 subcritical
- 4 detector systems
- 2 types of subcritical measurements
  - Passive with source
  - Active with neutron generator
- First evaluation will be critical configurations.
- Additional subcritical evaluations in subsequent years.

See talk by Rob Weldon

Demonstrated Flexibility
Pivoted to TEX-TSL (IER 480)

- Hf for IER 532 was not available.
- Designed/procured fixturing. **CED-3a milestone.**
- Conducted Lucite and poly configurations. **CED-3b milestone.**



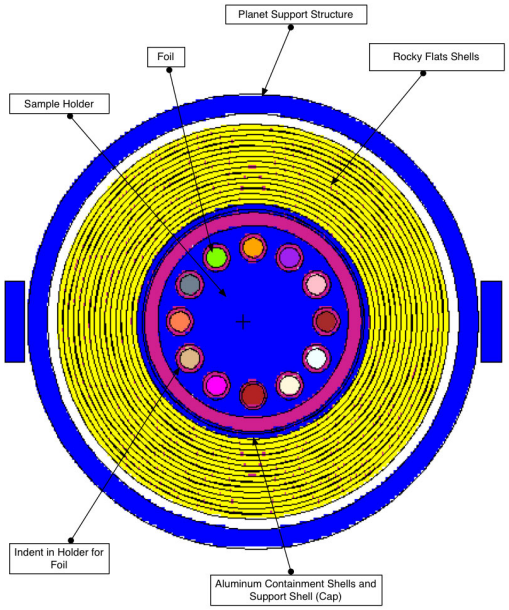
▲ Upper stack of TEX-TSL poly configuration with LANL He-3 detectors and RTD's

Rene Sanchez and Alex McSpaden load ZPPR Pu and poly on Planet.

Prepared for FY22 Experiments…

PFUNS (IER 153)

- **CED-3a milestone.**
- Finalized Experiment Plan
- Completed Drawings
- Procured/Weighed Foils
- Developed Irradiation Plan



Flattop Benchmark (IER 423)

- **CED-2 milestone.**
- Determined measurements to reduce uncertainty

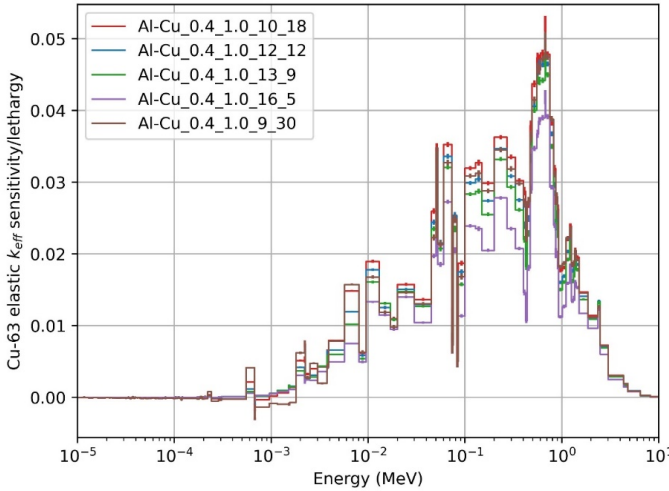
Total Relative Uncertainty in keff (Preliminary)

Effect	σk/keff
Mass and Volume Uncertainty of HEU Parts	±0.00071
Mass and Volume Uncertainty of NU Parts	±0.00137
HEU Isotopics	±0.00018
Structural Material Mass Densities	±0.00001
Gaps Between Reflector Parts	±0.00025
Total	±0.00157

And Beyond…

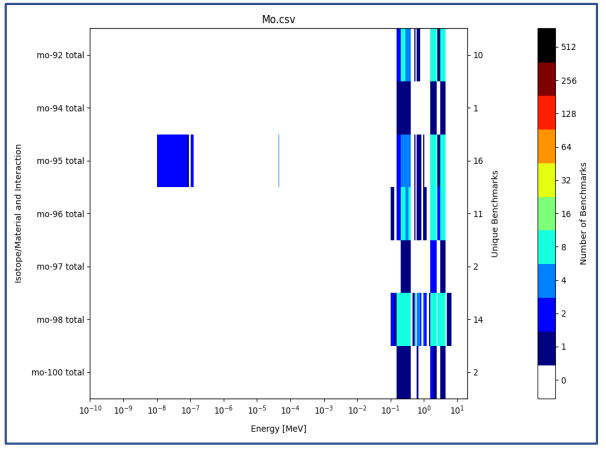
Copper Critical Experiment Preliminary Design (IER 537)

- **CED-1 milestone.**



Elastic scatter

See talk by Kelsey Amundson

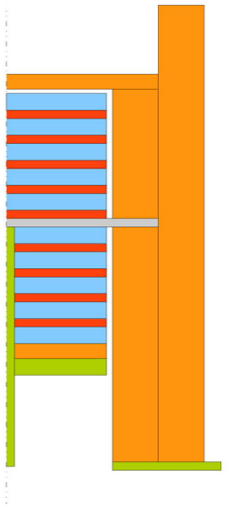


Molybenum Experiment Preliminary Design (IER 517)

Molybdenum Optimized Benchmark System Demonstrating Integral Correlations (MOBY DICK)

See talk by Cole Kostelac

Wrapped Up Completed Experiments…



Submission of CURIE Evaluation (IER 489)

- Submitted to ICSBEP December Meeting. **CED-4a milestone. (FY22)**
  - Evaluators: Jeff Favorite, Theresa Cutler, Travis Grove
  - Internal Reviewer: Kelsey Amundson
  - External Reviewers: Jesse Norris, Catherine Percher, Dave Heinrichs, LLNL

Publication of KRUSTY Evaluation (IER 299)

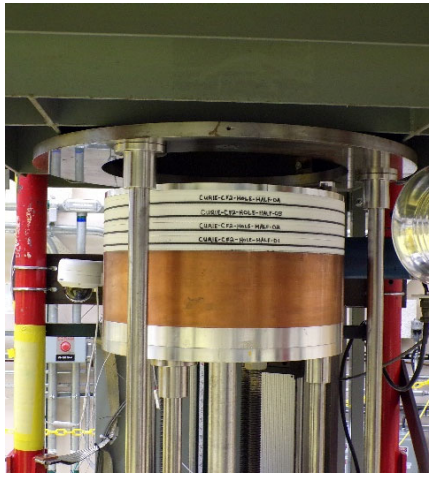
- Final submitted for publication in ICSBEP Handbook.
- **CED-4b milestone.**
- NCERC-FO coordinated the movement of all remaining **KRUSTY waste** from the DAF to warehouse 6-911 to prepare for final disposal**.** In-Situ Object Counting (ISOCs) measurements and walk down evaluations with Waste Generator Services (WGS) were completed.

December 2021 ICSBEP Meeting

4 out of 5 Evaluations were NCERC Experiments

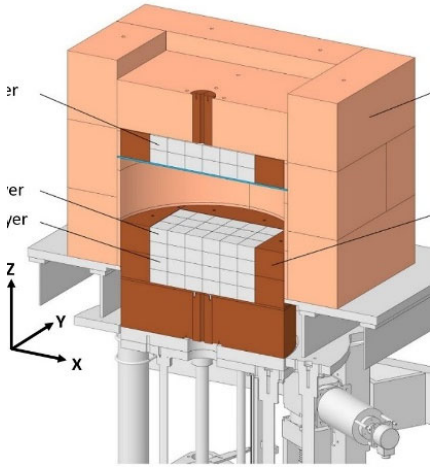
IEU-MET-FAST-025

ZEUS: HEU Jemima plates, natural U, Lead



HEU-MET-INTER-011

CURIE: U-235 Unresolved Resonance Region, HEU Jemima plates, Teflon



PU-MET-FAST-047

JUPITER: Pu PANN ZPPR plates, Lead

HEU-MIX-MET-021

TEX: HEU Jemima plates, HDPE

NCSP and NCERC are central to generation of new experimental data for benchmark evaluations

SAVY Container Procurement

- Joint LANL/MSTS Procurement Effort
- DOE M 441.1 container requirements
- 60 3-qt and 60 5-qt SAVYs

Mechanical Material Handling

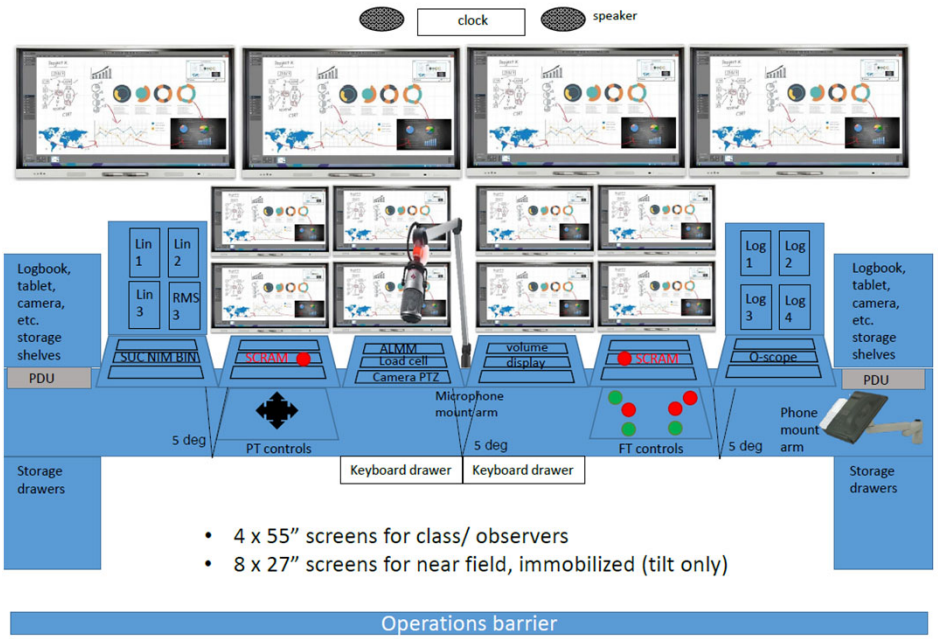
Implemented P101-40, Mechanical Material Handling, a new policy on how to conduct safe movements of loads and reduce worker injury.

Change Notice 9

- Change to NCERC-TSR's
- Introduces Critical Assembly Operational Modes

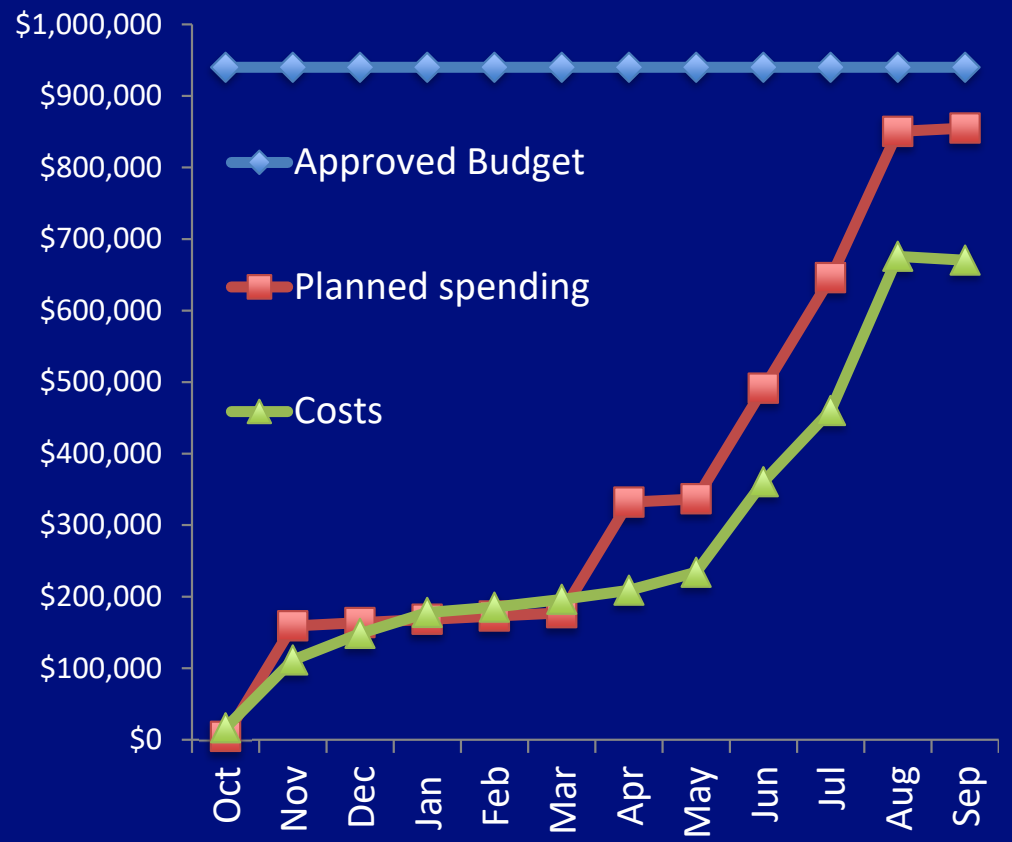
Daniel Perlstein and Stanley Hoffman (NCERC-FO) inspect SAVY containers.

Began Control System Upgrade Project



- Capability Based Investments (CBI) Funding to design and procure upgrades to NCERC Control Systems.
- MSTS has scope for facility upgrades
- Replacing components and migrating control programs
- Targeting Installation in FY23Q1 for first control room

Training & Education

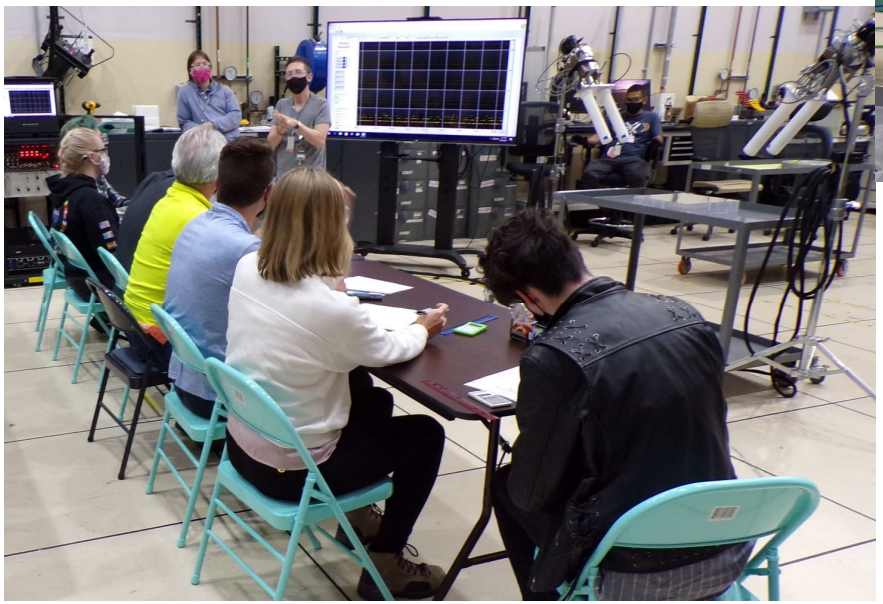


TE3	Conduct Hands-On Criticality Safety Training Course at NCERC
TE4	On-Site Introductory Training for the NCS Practitioner on Modern Approaches to Validation using Sensitivity and Uncertainty Analysis Tools
TE6	Development of University Pipeline for Criticality Safety Professionals

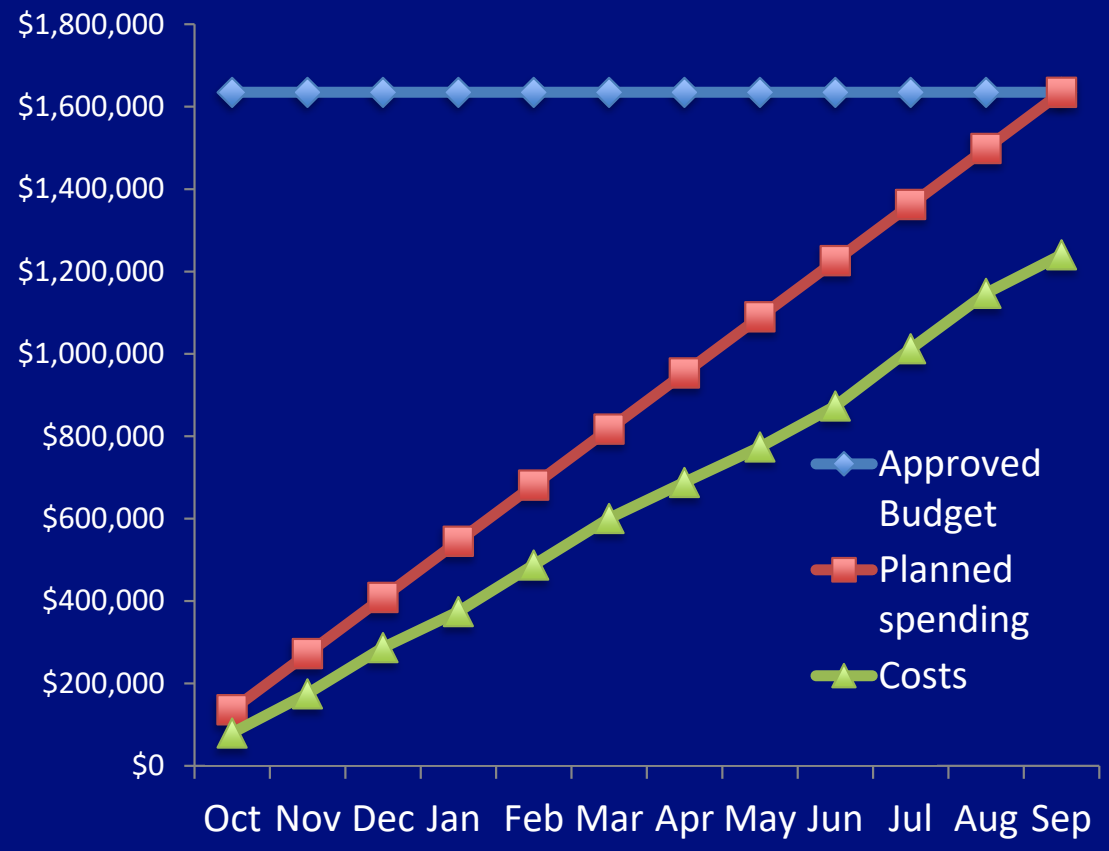
See talk by
Norann Calhoun

Record Number of NCSP Classes in 1 Year

- November – Special class for Y-12
- June – Manager's Course
- July – Makeup CSE Class
- August – Makeup CSE Class
- August – CSE Class



Analytical Methods

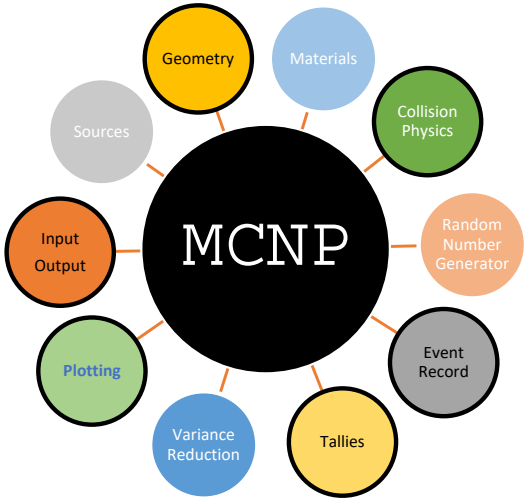


See talk by Mike Rising

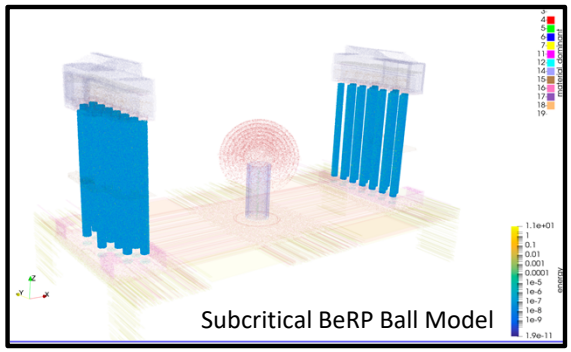
AM1	MCNP Maintenance and Support, Uncertainty Analysis Development, and Modernization
AM2	NJOY Development and Maintenance, Uncertainty Analysis Development, and Modernization
AM3	Development of an Adaptive-in-temperature Method…in MCNP6
AM4	Sensitivity/Uncertainty Comparison Study with a Focus on Upper Subcritical Limits
AM5	Proposed Benchmark Intercomparison Study
AM7	Incorporation of Benchmark Experiment Correlations into Whisper

Analytical Methods Highlight -- MCNP6.3

For the MCNP6.3 release, the finishing touches are being worked on now (see M. Rising talk for more details)



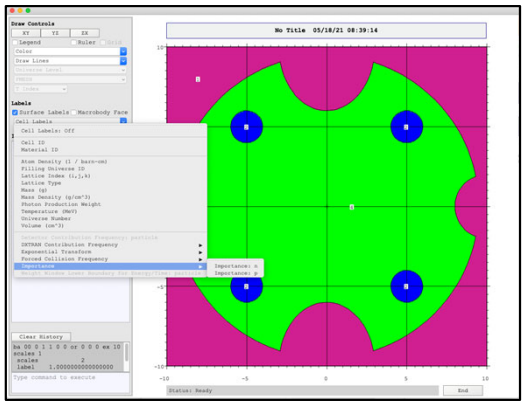
Documentation and V&V Testing Overhaul



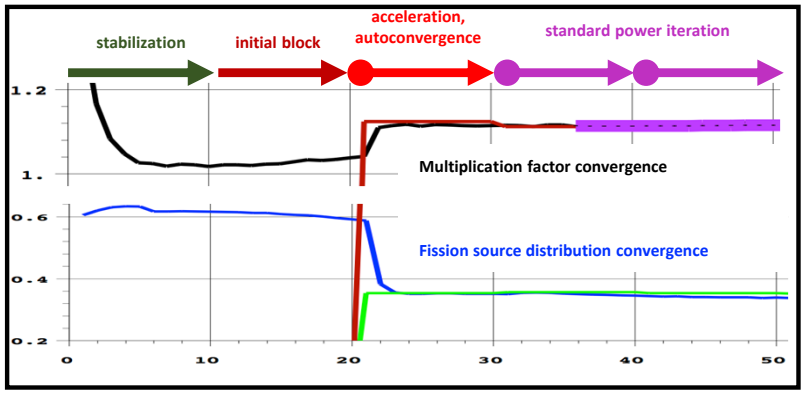
Lots of simultaneous new features, bug fixes, and improvements always ongoing

Improved Algorithms and Physics Options

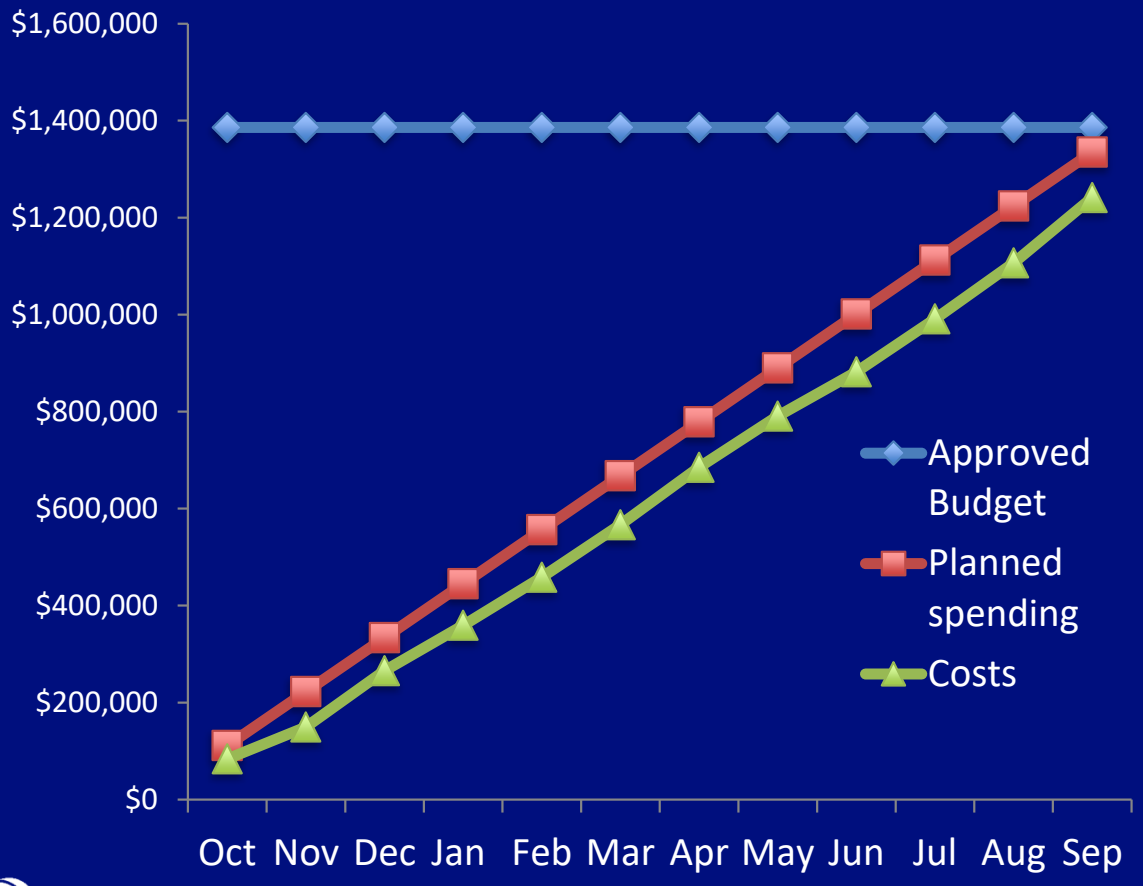
New Particle Track and Output Formats



New Plotter Under Development



Nuclear Data

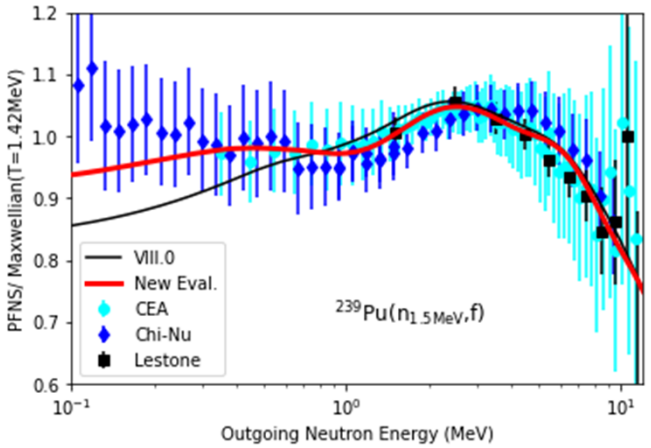


See talk by Amy Lovell, Denise Neudecker

ND1	Nuclear Data Evaluation and Testing
ND2	Prompt Fission Neutron Spectra (PFNS) Measurement of Plutonium-240
ND 3	Unresolved and Fast Measurements of Uraunium-233 (n,gamma)
ND 4	Mo-95 neutron capture and transmission measurements…evaluation

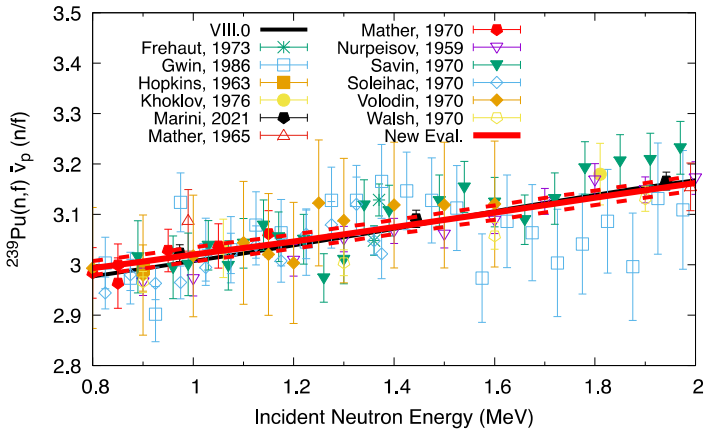
Advanced Fission Modeling at Los Alamos

Chi-Nu PFNS included



^{239}Pu PFNS evaluated with new Chi-Nu and CEA data is in IAEA and LANL VIII.1-beta files.

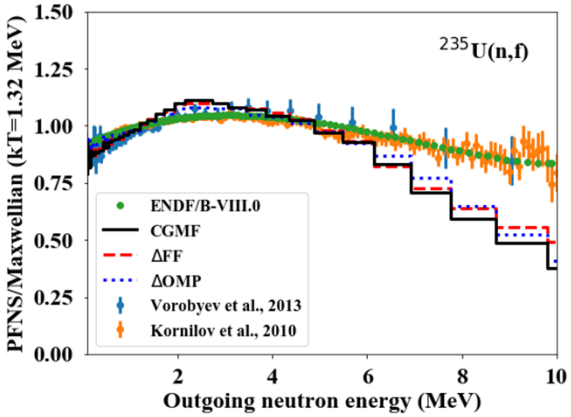
^{239}Pu $\overline{\nu}$ evaluation with CGMF



^{239}Pu $\overline{\nu}$ evaluated with CGMF is in IAEA and LANL VIII.1-beta files. This is the first use of CGMF for ENDF/B $\overline{\nu}$ eval!

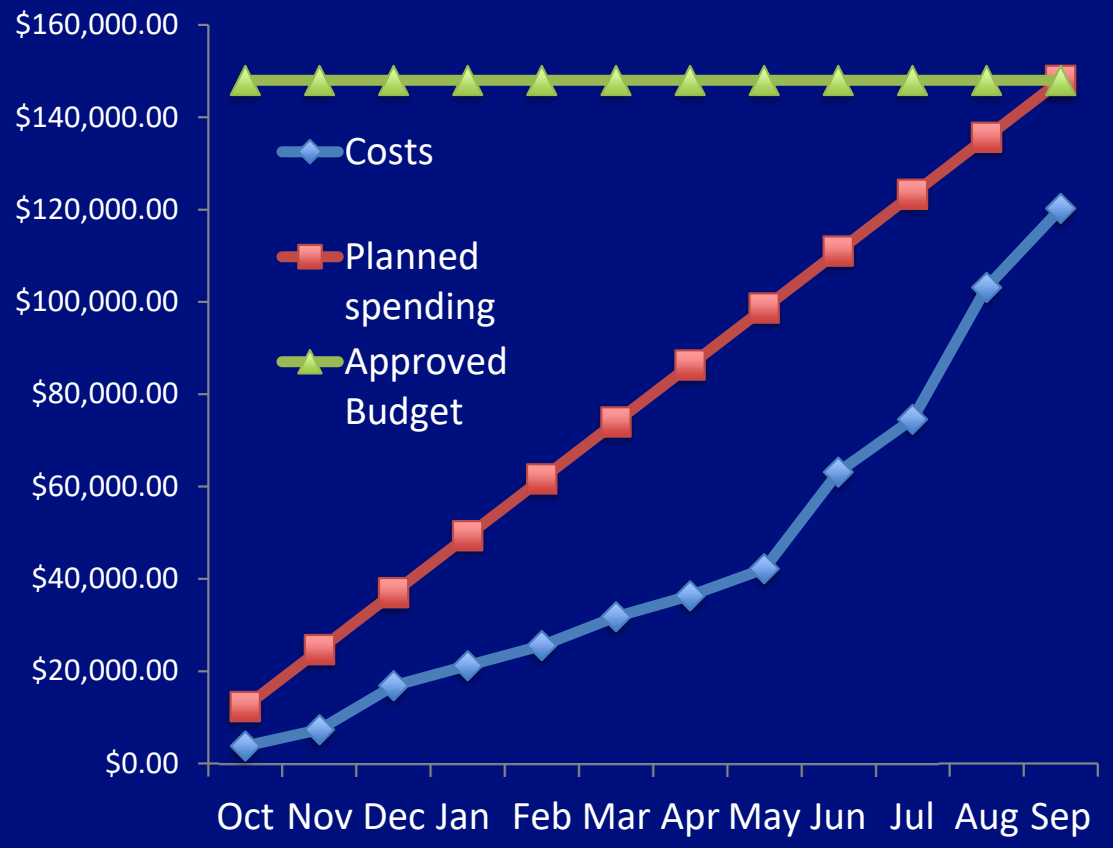
Combination of new $\overline{\nu}$, PFNS & (n,f) cross section gives realistic k_{eff} (1.00047) of Jezebel!

PFNS modeling in CGMF



The PFNS is challenging to model in Hauser-Feshbach codes such as CGMF. Studies are underway to identify a model space that can lead to a harder spectrum.

Technical Support

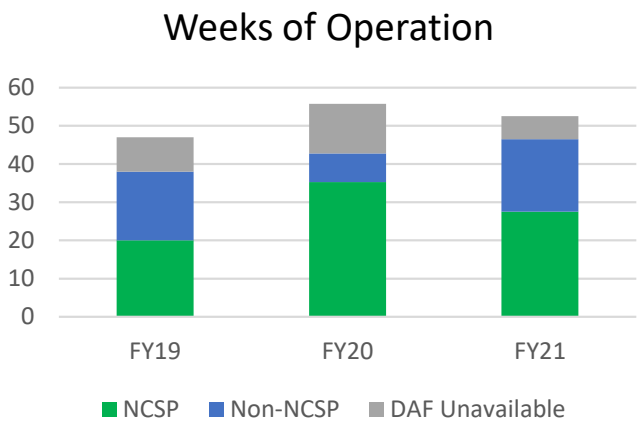


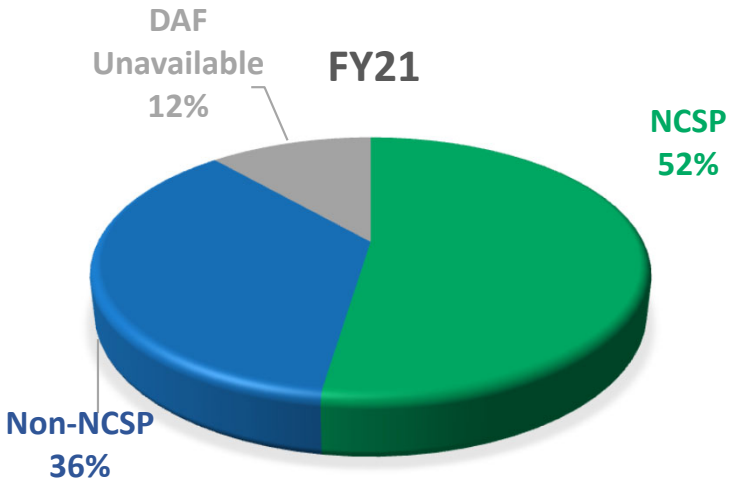
TS4	Succession Planning

COVID Impacts to NCSP Work

- Staffing Challenges:
  - At one point 6 out of 12 NCERC-FO staff were out for various reasons.
  - Limited staff when personnel were quarantining or self-isolating
  - High risk of execution delayed on short notice
- Had to cancel one NCSP Class due to COVID
  - Able to schedule makeup class to makeup for missed weeks
  - Students affected by COVID resulted in smaller classes
- International Collaborators unable to travel, i.e. IRSN for MUSiC
- MCNP and NJOY training classes were forced to be 100% virtual.
- Secondary effect: COVID impacts at LLNL delayed PPAC production which delayed start of PFNS Measurements on Pu-240.

NCERC UTILIZATION





NCSP (28 weeks)
- 4 weeks Godiva PDV (IER 268)
- 1 week CAAS (IER 497)
- 9 weeks MUSIC (IER 488)
- 4 weeks TEX-TSL (IER 480)
- 5 weeks NCSP Classes (IER 462)
- 5 weeks MNT/SRV/ISI/decon/defuel (IER 466)

Non-NCSP (19 weeks)
- 3 weeks PF4 Class (IER 540) NA-10
- 2 weeks ER Class (IER 506) NA-80
- 1 week Godiva SLFY (IER 504) NA-22
- 4 weeks Flattop (IER 504) NA-22
- 2 weeks Hypatia (IER 525) DOE-NE
- 5 weeks RTO measurements (IER 533) NA-80
- 1 week Univ. Measurements (IER 543) NA-22

Unavailable (6 weeks)
- 3 weeks Holiday Closure
- 2 weeks UPS cutover
- 1 week Ventilation/Radcon Issues

Conclusion – FY21 was a productive year!

- CED-1: Copper (IER 537)
- CED-2: Flattop (IER 423)
- CED-3a: PFUNS (IER 153), TEX-TSL (IER 480), CAAS (IER 497)
- CED-3b: MUSIC (IER 488), TEX-TSL (IER 480), PDV (IER 268) and CAAS (IER 497)
- CED-4a: CURIE (IER 489) (FY22 milestone)
- CED-4b: KRUSTY (IER 299)

>100 Publications between IE, AM, and ND
72 Work Control Documents issued or revised
34 Surveillances, In-service Inspections, and Maintenance Activities performed

Fissionable Material Moves (CY)

2021 – 277 moves
2020 – 55 moves
2019 – 216 moves
2018 – 179 moves
2017 – 163 moves
2016 – 97 moves
2015/2014 – 44 moves

Acknowledgements

NCERC is supported by the DOE Nuclear Criticality Safety Program, funded and managed by the National Nuclear Security Administration for the Department of Energy.

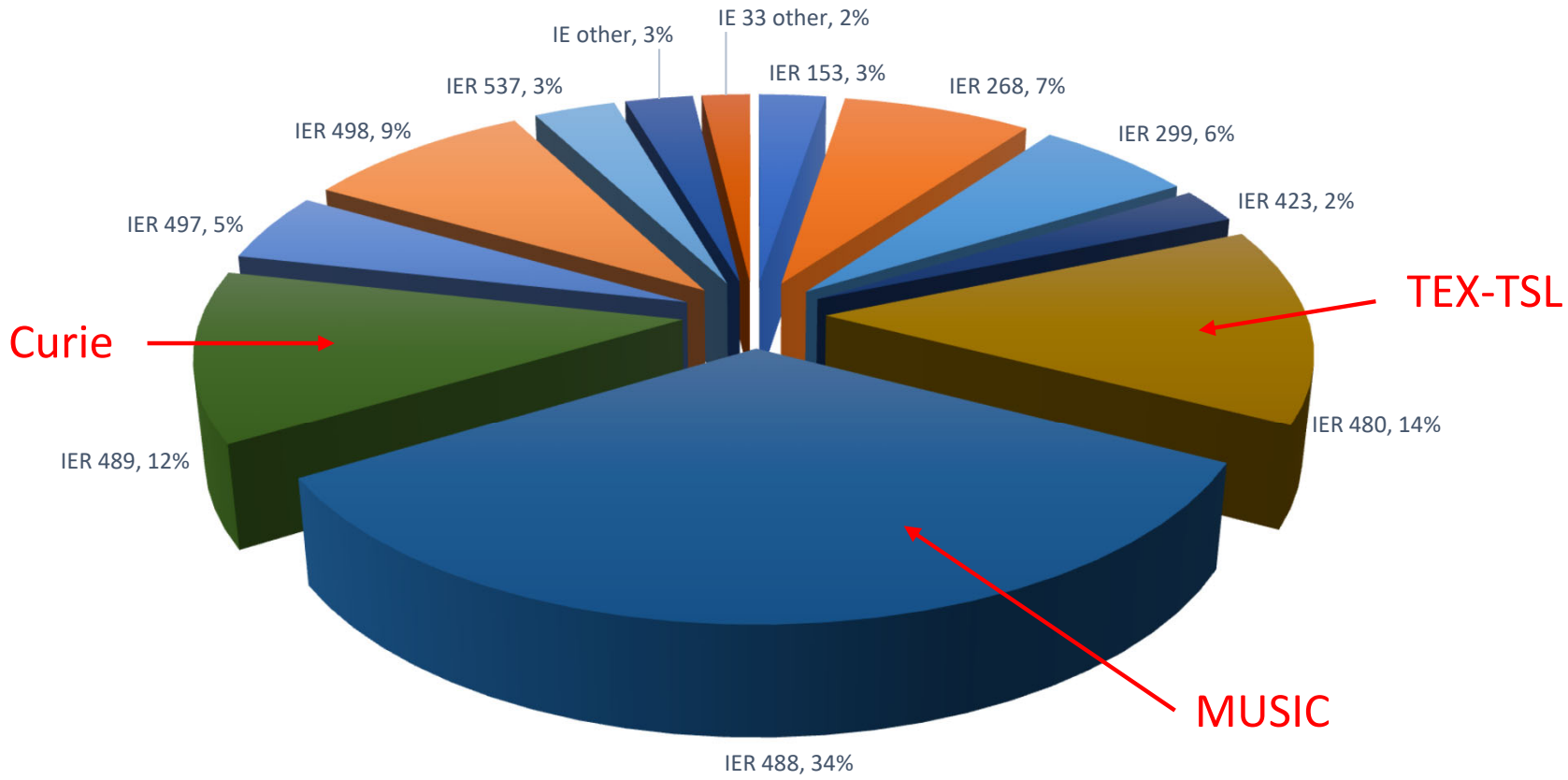
NCSP
NUCLEAR CRITICALITY SAFETY PROGRAM

This work was supported by the US Department of Energy through the Los Alamos National Laboratory. Los Alamos National Laboratory is operated by Triad National Security, LLC, for the National Nuclear Security Administration of the US Department of Energy under Contract No. 89233218CNA000001.

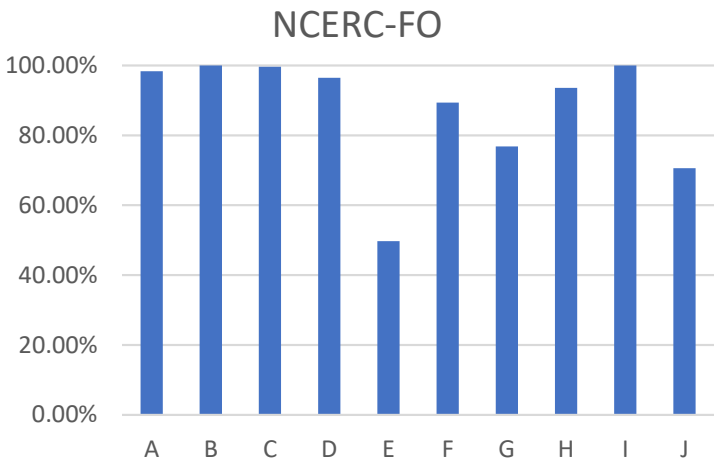
Additional Budget Slides for Angela

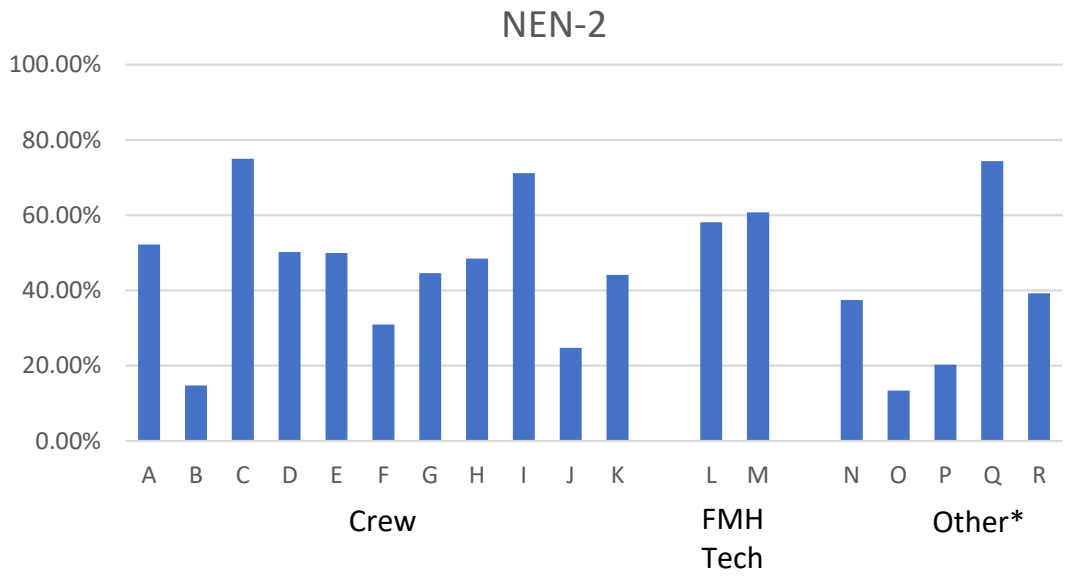
FY20

LANL IE 3 & 33 Budget Breakdown



Staffing, percentage on JREE





* Staff greater than 10% who are not students/retirees