U.S. DEPARTMENT OF ENERGY | Office of Science

Fusion Energy Sciences Perspective

James W. Van Dam

Associate Director, Office of Science

Fusion Energy Sciences

Fusion Energy Sciences Advisory Committee Meeting

August 30, 2021

FES Budget: Enacted and Requested (1)

(dollars in thousands)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
Fusion Energy Sciences				
Advanced Tokamak	123,500	127,038	124,390	-2,648
Spherical Tokamak	101,000	104,331	101,000	-3,331
Theory & Simulation	44,000	42,000	53,037	+11,037
GPP/GPE Infrastructure	7,000	2,640	1,500	-1,140
Public-Private Partnerships	4,000	5,000	6,000	+1,000
Artificial Intelligence and Machine Learning	–	7,000	7,000	–
Strategic Accelerator Technology	–	–	3,073	+3,073
Total, Burning Plasma Science: Foundations	**279,500**	**288,009**	**296,000**	**+7,991**
Long Pulse: Tokamak	14,000	15,000	15,000	–
Long Pulse: Stellarators	8,500	8,500	8,500	–
Materials & Fusion Nuclear Science	47,500	49,000	59,500	+10,500
Future Facilities Studies	–	–	3,000	+3,000
Total, Burning Plasma Science: Long Pulse	**70,000**	**72,500**	**86,000**	**+13,500**
ITER	–	–	2,000	+2,000
Total, Burning Plasma Science: High Power	–	–	**2,000**	**+2,000**

FES Budget: Enacted and Requested (2)

(dollars in thousands)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
Plasma Science and Technology	42,500	32,700	40,000	+7,300
Measurement Innovation	3,000	3,000	3,000	–
Quantum Information Science (QIS)	–	9,520	10,000	+480
Advanced Microelectronics	–	5,000	5,000	–
Other FES Research	4,915	4,271	4,000	-271
Reaching a New Energy Sciences Workforce	–	–	3,000	+3,000
FES SBIR/STTR	14,085	–	–	–
Total, Discovery Plasma Science	**64,500**	**54,491**	**65,000**	**+10,509**
Subtotal, Fusion Energy Sciences	**414,000**	**415,000**	**449,000**	**+34,000**
Construction				
20-SC-61, Matter in Extreme Conditions (MEC) Petawatt Upgrade, SLAC	15,000	15,000	5,000	-10,000
14-SC-60, U.S. Contributions to ITER	242,000	242,000	221,000	-21,000
Subtotal, Construction	**257,000**	**257,000**	**226,000**	**-31,000**
Total, Fusion Energy Sciences	**671,000**	**672,000**	**675,000**	**+3,000**

FY 2021 Appropriations

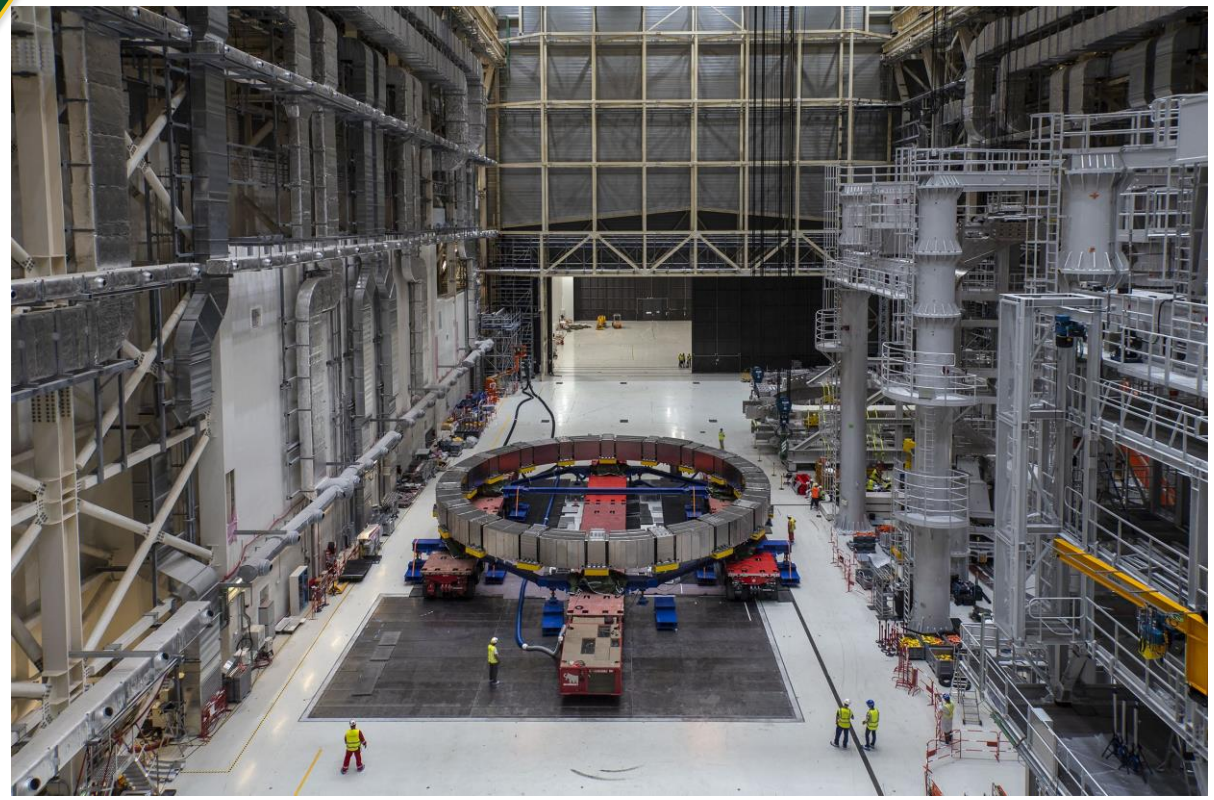
($K)	FY 2019 Enacted		FY 2020 Enacted		FY 2021 Enacted	
	Dollars	Percentage	Dollars	Percentage	Dollars	Percentage
Fusion Energy Sciences						
Research	261,950	46.45%	253,000	37.70%	260,149	38.71%
Facility Operations	143,500	25.44%	128,500	19.15%	129,211	19.23%
Projects	148,346	26.30%	282,500	42.10%	280,000	41.67%
Other	10,204	1.81%	7,000	1.04%	2,640	0.39%
Total, Fusion Energy Sciences	**564,000**	**100.00%**	**671,000**	**100.00%**	**672,000**	**100.00%**

FY 2021 FES Solicitations (FOAs & Lab Calls)

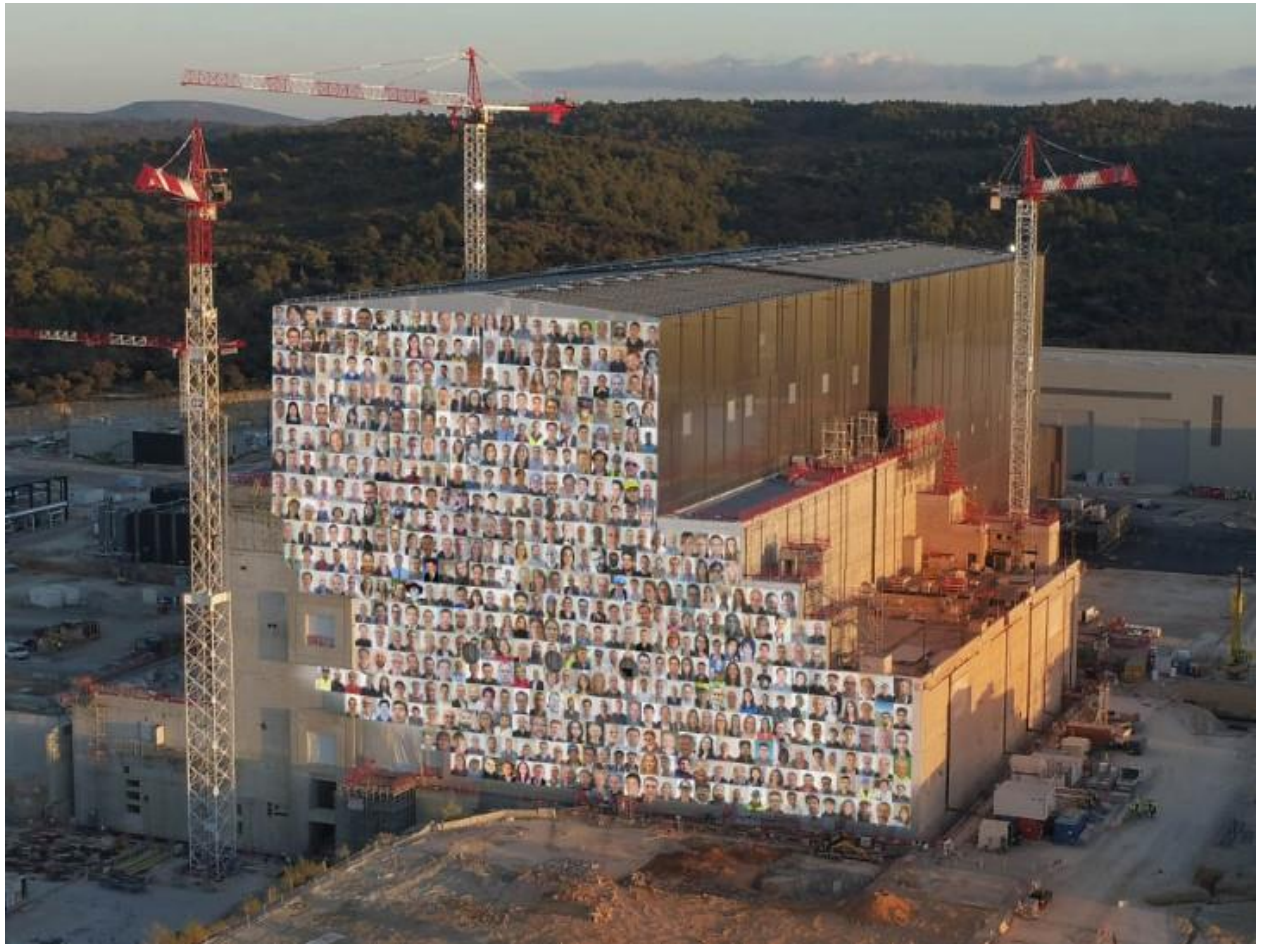
FOA / Lab Call Title	Type	Status
Collaborative Research in Magnetic Fusion Energy Sciences on Long-Pulse International Stellarator Facilities	FOA	Seven awards at $6.4M for three years
High-Energy-Density Laboratory Plasma Science (joint program with NNSA)	FOA	Twenty-one awards at $9.3M for three years ($3.1M from FES and $6.3M from NNSA)
Opportunities in Frontier Plasma Science	Lab Call	Awards to be announced soon
Co-Design Microelectronics R&D Centers (with ASCR, BES, & HEP)	Lab Call	Ten awards to DOE national labs under negotiation at $54M for up to three years (total SC funding)
Quantum Information Science Research for Fusion Energy Sciences (issued FY20)	FOA & Lab Call	Ten awards (one in FY20 and nine in FY21) to universities, private industry, and national labs at $11M for up to three years.
SC Open FOA	FOA	FES uses the SC Open FOA more frequently since FY 2020: • Eight awards for collaborative research on DIII-D at $10.5M per year for three years • Four awards for research on STs at $5.4M for up to four years • Six awards for Theory research at $3.3M for up to three years
SC Early Career Research Program	FOA & Lab Call	Seven FES five-year awards, $14M total, $3.9M in FY 2021

2021 ITER Highlights

Talk by Dr. Kathryn McCarthy

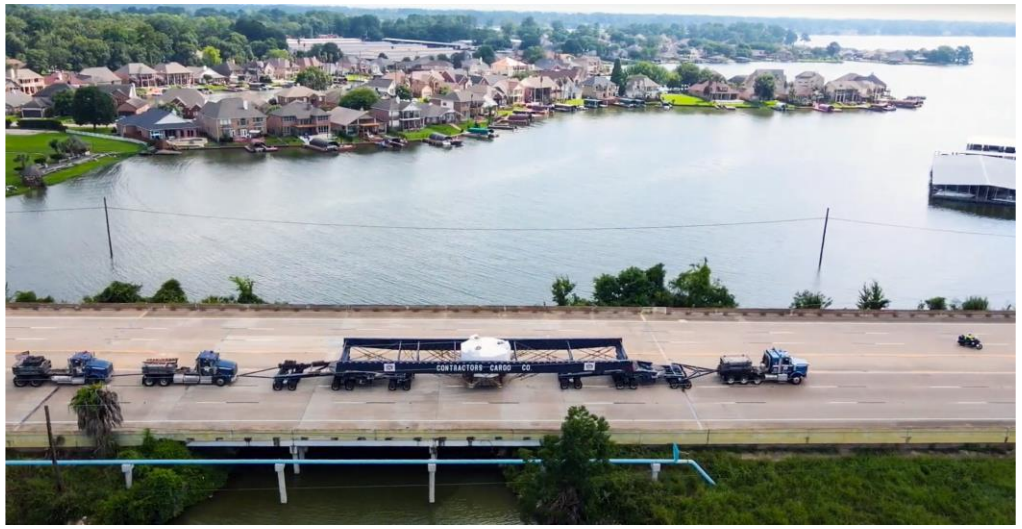


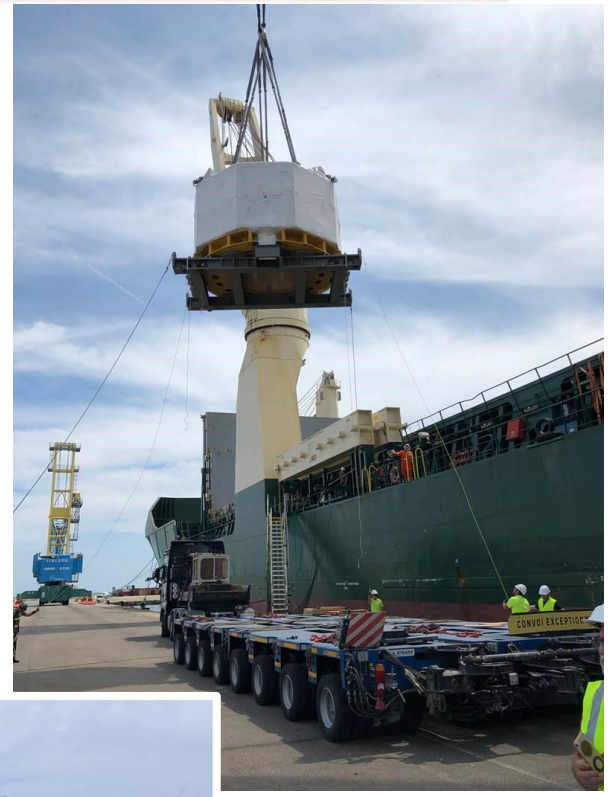
Poloidal field coil #5
(17 meters in diameter, one of six ring-shaped PF coils required for the machine)

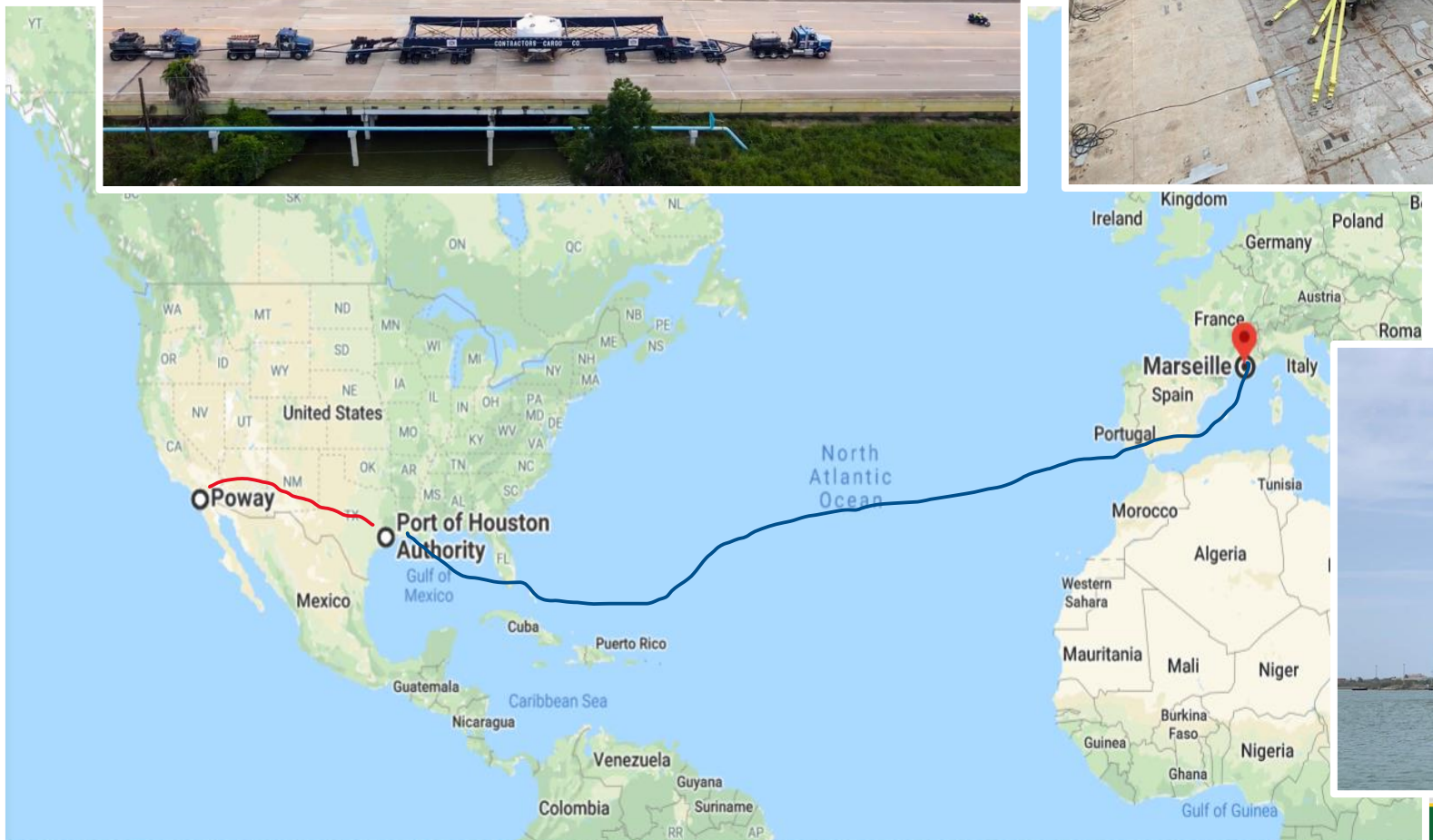


ITER Staff: currently 1,014 (5% from U.S.)

US ITER: Central solenoid module #1 delivery







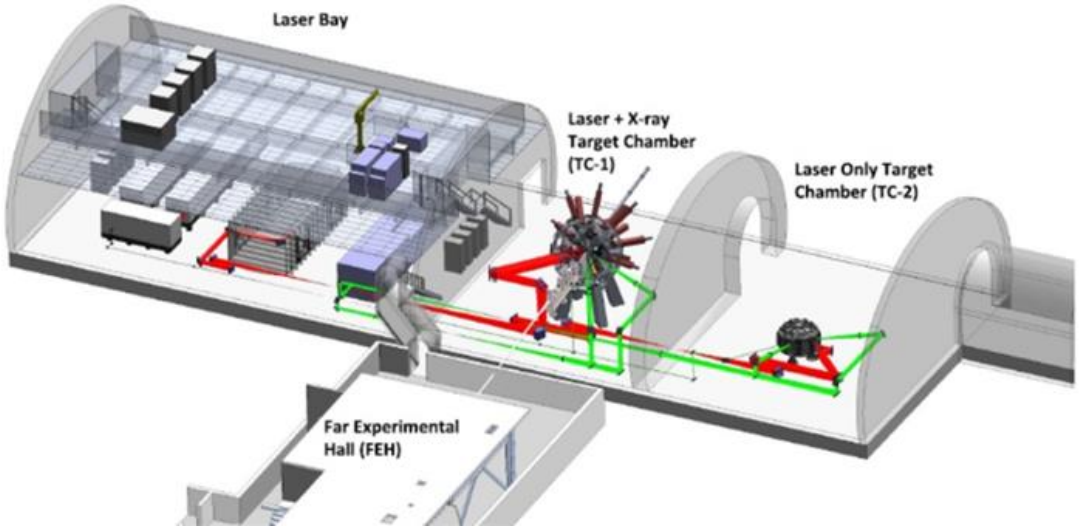
Other FES Projects

Material Plasma Exposure eXperiment (MPEX)

- New world-class plasma exposure facility for accelerated testing of fusion materials.
- CD-1 (Alternative Selection & Cost Range) approval achieved January 2020.
- CD-3A (Long-lead Procurement) approval achieved October 2020.
- Long-lead procurements awarded for magnets, gyrotrons, and high-voltage power supplies.

Matter in Extreme Conditions (MEC) Petawatt Laser Upgrade

- World-leading high-energy-density plasma science instrument.
- Conceptual design was finalized in support of CD-1 (Alternative Selection & Cost Range) approval in September 2021 timeframe.



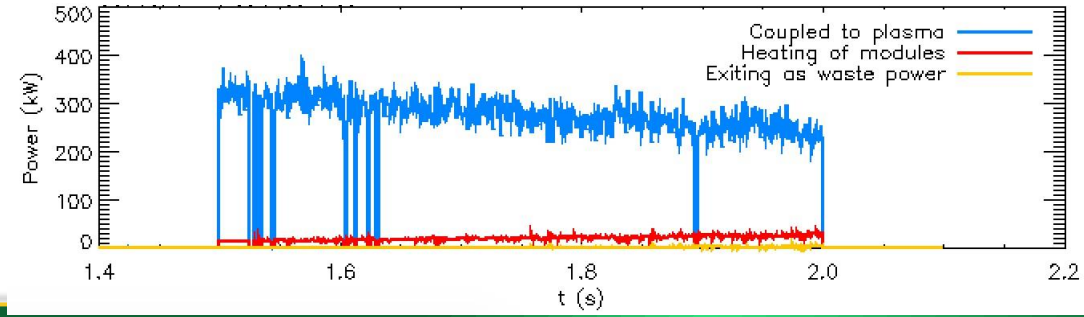
Advanced Tokamak: After successful FY 2021 campaign, DIII-D is pursuing several facility enhancements

- **DIII-D completed 18.7 weeks in FY21 with high system availability (88%)**
  - Helicon system commissioned
  - Hydrogen campaign completed
  - Two new gyrotrons arrived
- **Projects during 6-month maintenance period include**
  - New helium liquefier
  - Internal 3D coil repairs
  - Additional gyrotrons & top launchers
  - Test fittings for HFSLH and neg. tri. armor
  - SAS1-W/V install with diagnostics
  - Collaborator diagnostics: DFSS, helium beam, WiSP, multichord divertor spectroscopy


Helicon antenna installed

Klystron & circulator

Helicon Power Coupled to Plasma (kW)



Spherical Tokamak research

Status of NSTX-U Recovery

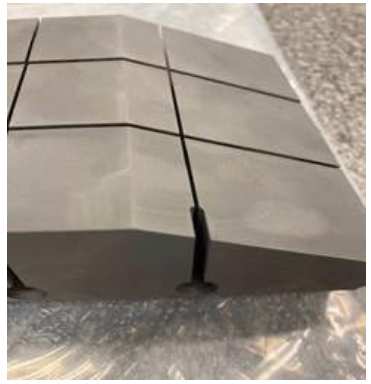
- Overall, approximately 70% complete
- All production plasma-facing-component tiles are delivered to PPPL and ready for installation
- Delivery of the completed center stack casing is expected in the fall of this year
- New Recovery cost and schedule baseline (due to COVID-19 delays) will be reviewed in early FY22

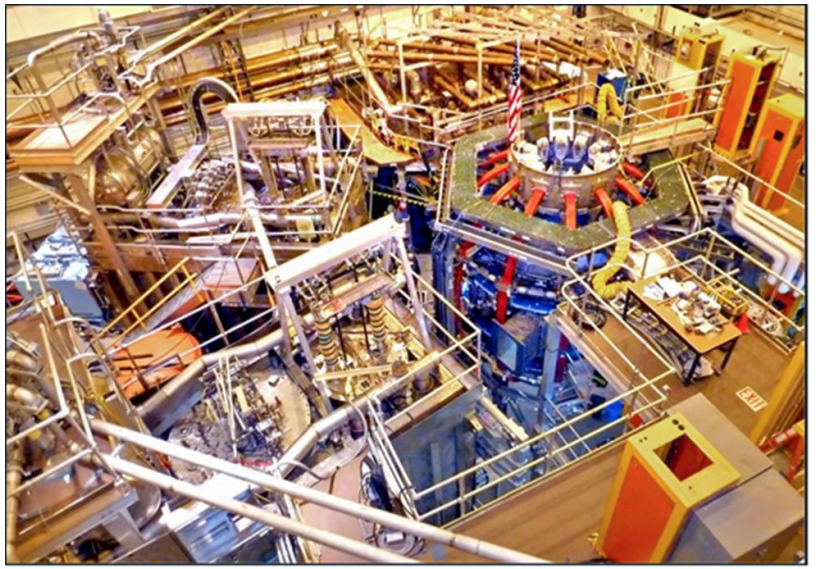
Super-X divertor realized at MAST-U (Culham)

- Preliminary results show that heat flux is reduced by more than an order of magnitude using Super-X
- Super-X divertor idea was invented by U.S. scientists at the University of Texas – Austin
- 13 collaborative research awards for U.S. scientists to work at MAST-U

CS Casing

PFC tile

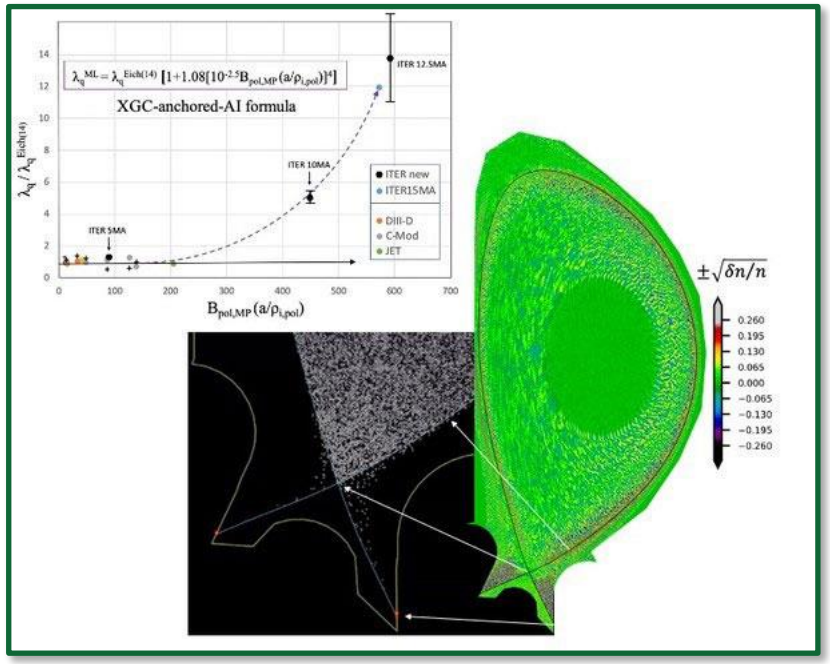




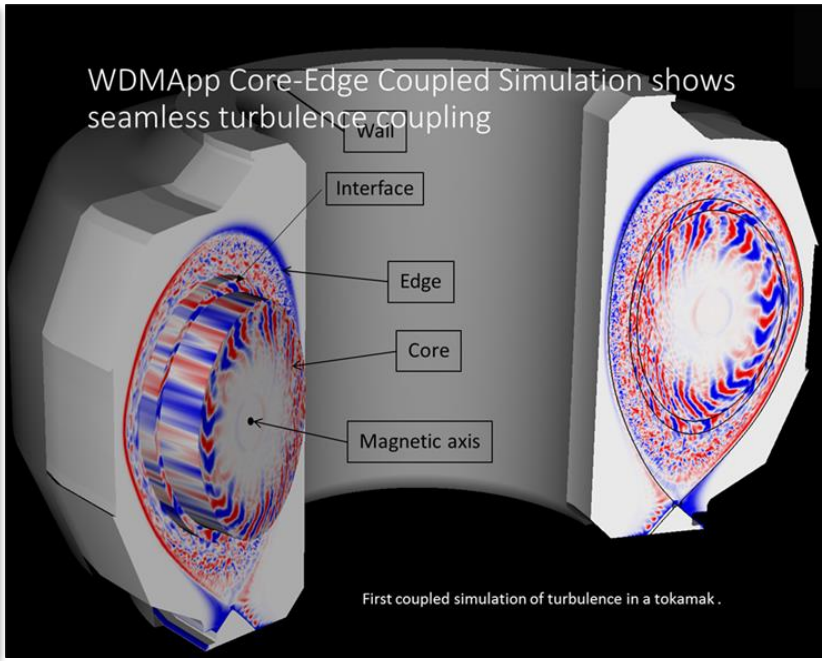
NSTX-U Test Cell

Theory & Simulation

- **Nine FES SciDAC partnerships**
  - Entering their final year
  - Progress status presentations are scheduled for October 2021
  - FES and ASCR started planning for the SciDAC re-competition
- **WDM Exascale App**
  - Continues to make progress toward the coupling of the core and edge regions



AI/ML helps develop formula to predict the heat load width in tokamaks

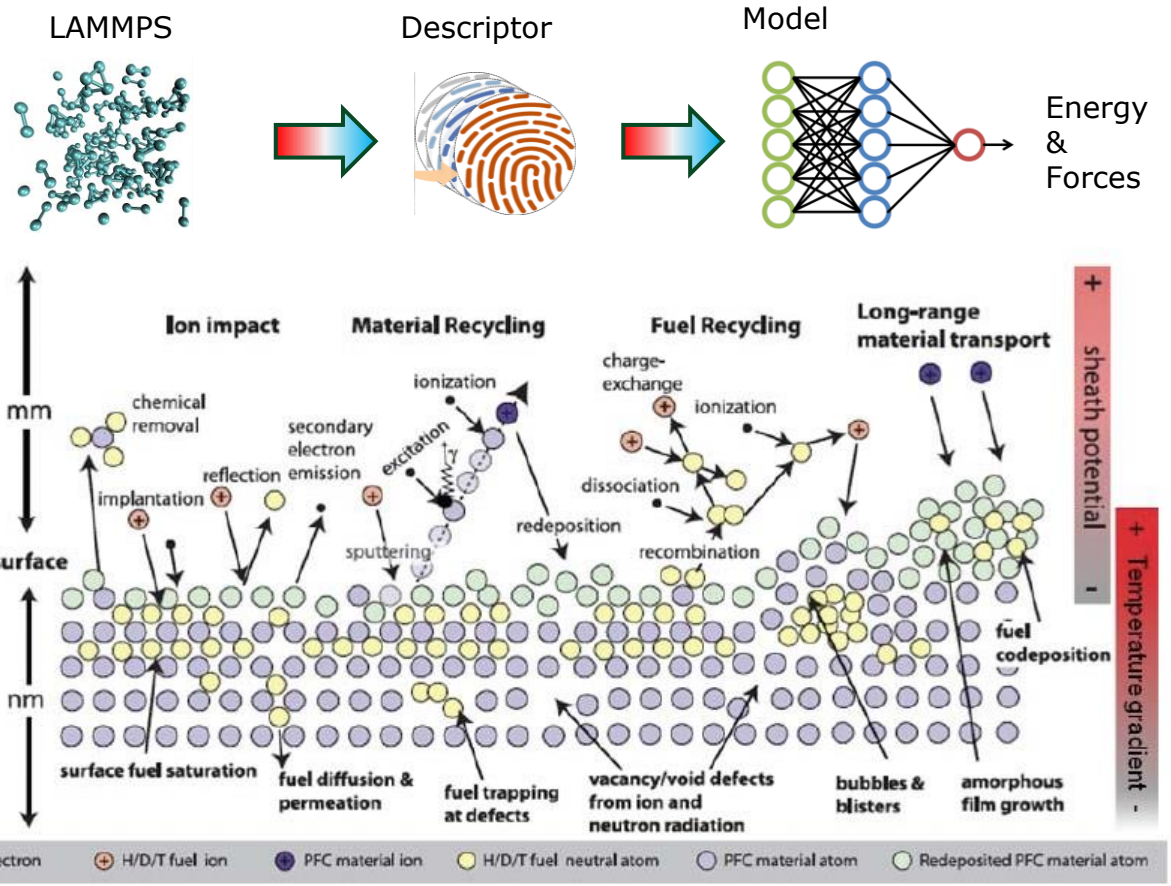


Exascale Computing Project WDMApp

Artificial Intelligence and Machine Learning in Fusion Energy Sciences

- **FY20 FOA:** Five teams were supported to pursue materials modeling, real-time plasma behavior prediction, plasma equilibrium reconstruction, radio frequency modeling, and optimization of experiments with high-repetition-rate lasers.
- **FY21:** Six pilot studies (identified from FY20 solicitation) supported in the areas of randomized methods for real-time plasma control, ML models for plasma pulse design optimization and validation, data-driven stellarator optimization, surrogate models for detached divertor control, optimization of inertial confinement fusion experiments, and physics-informed neural networks for disruption prediction and avoidance.
- **SC vision for AI/ML** is to increasingly use learned models to improve experimental discovery, pursue questions semi-autonomously, merge simulation and AI, and include AI/ML as a common part of scientific activities.

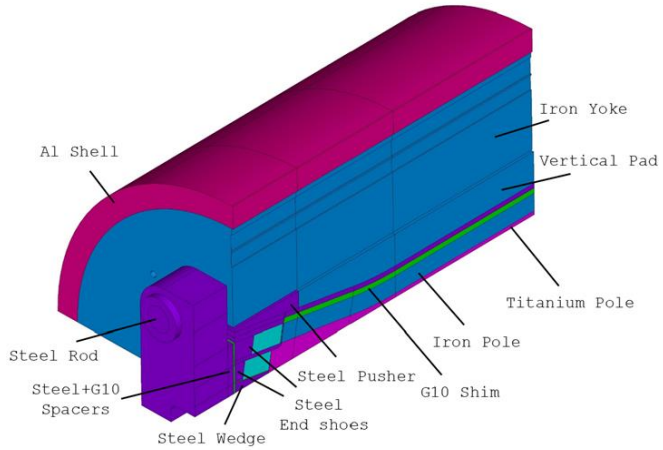
FusMatML (Sandia, UTK, LANL) team is using AI/ML to deploy interatomic potentials for predictive atomistic simulations of materials



Enabling R&D

High-Field Vertical Test Stand

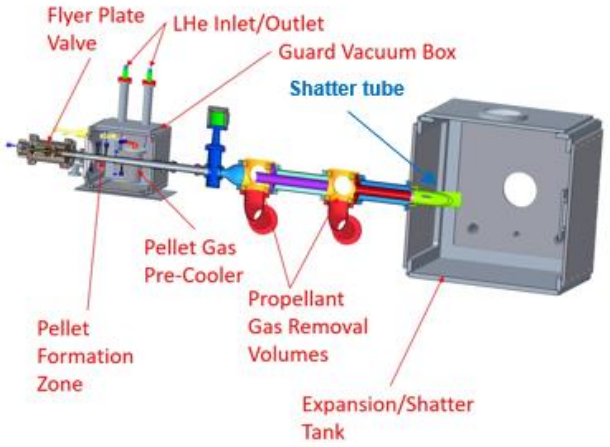
- FES and HEP have joined forces to support the development of a unique world-class High-Field Vertical Test Stand.
- First External Oversight Committee (EOC) meeting held in Jan. 2021 to solicit input on the magnet design and fabrication approach
- Coil fabrication by LBNL to start in early 2022
- Estimated completion by June 2025



High-Field Dipole 3D Design

Shattered Pellet Injector R&D

- ORNL has constructed an ITER-like SPI testbed and conducted experiments to inform the design of the ITER SPI system
- This is the first step in determining the optimal fragment size distribution and shatter tube design needed for the ITER shattered pellet injection system

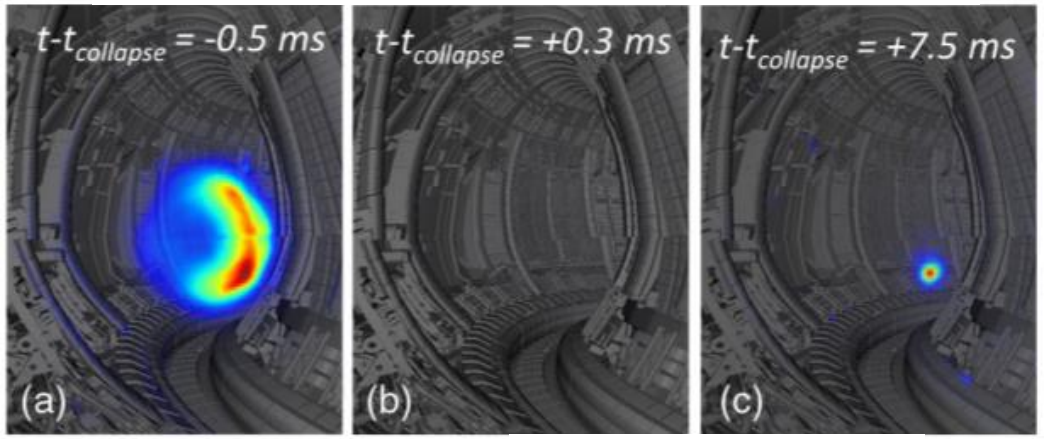


ITER SPI Testbed

Long Pulse Tokamak: 10 multi-institutional teams continue to address gaps in tokamak physics basis using international facilities

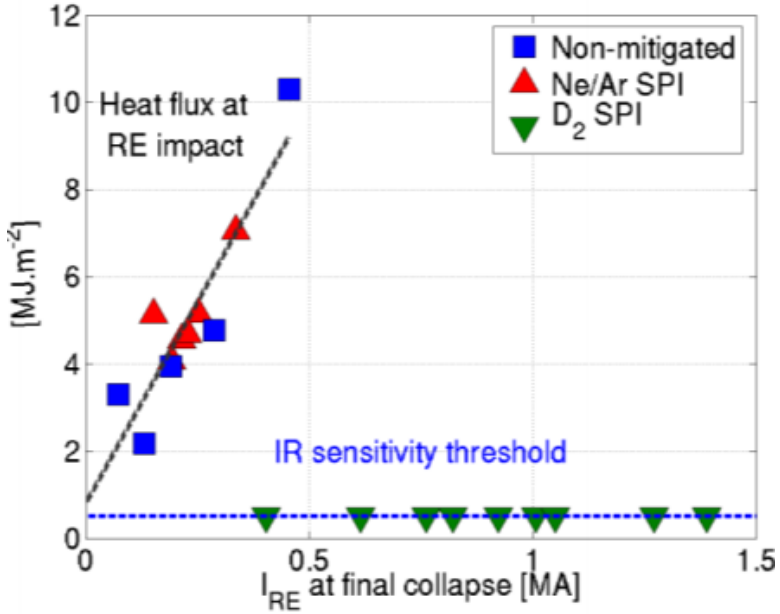
- **JET**
  - Analysis of JET SPI studies continues including D2 SPI leading to benign termination of runaway electron (RE) beams
  - US is supporting ongoing DTE2 campaign: main ion CXS, EP collaborations, and scenario modeling
  - Isotope effect linked to small-but-finite electron mass that strongly affects the ion behavior
- **KSTAR**
  - Dual SPI studies conducted together with DIII-D and JET in support of ITER
  - Real-time disruption prediction tools (DECAF) installed in expanded KSTAR PCS
- **JT-60SA**
  - Two new teams are preparing to install XICS and FIDA diagnostics during planned 26-month vent after first plasma
- **Research continues at AUG, TCV, EAST, WEST, COMPASS-U**

RE suppression by D2 SPI in JET



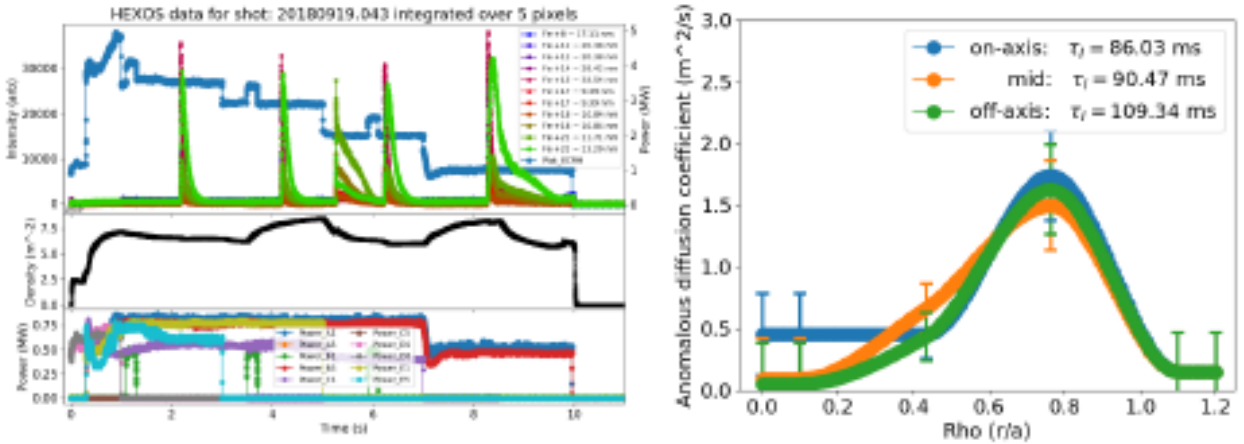
Wall heat flux

Wall heat loads are mitigated after RE suppression

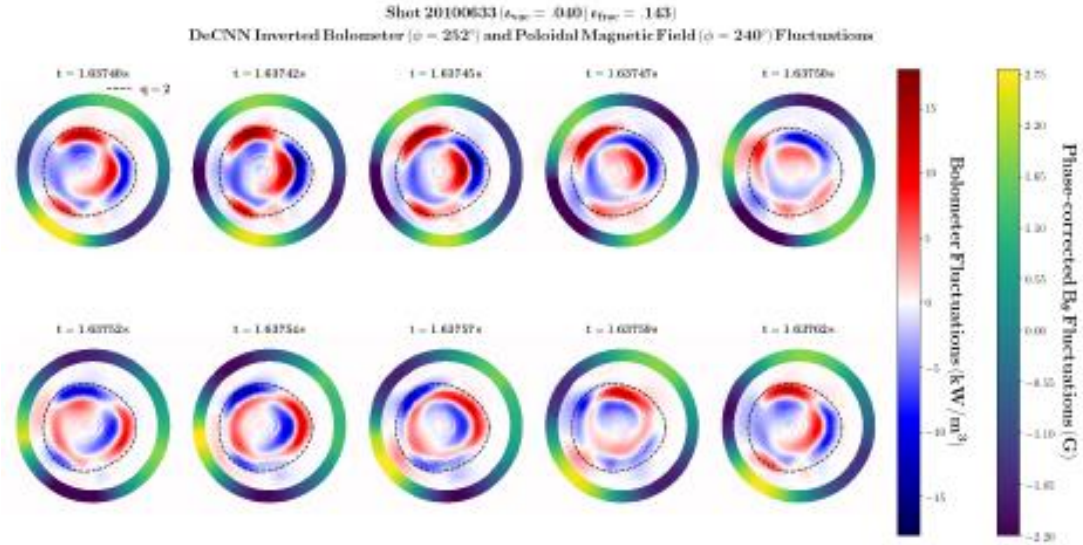


Long-Pulse & Domestic Stellarator

- An international team led by ORNL has been constructing a continuous, high-speed pellet system to fuel W7-X plasmas in quasi-steady-state conditions with significantly enhanced fueling, pumping, and heating capabilities. The system is being assembled at ORNL and will be fully tested in the fall of 2021.
- U.S. stellarator researchers are enhancing their diagnostic systems to prepare for the next major W7-X experimental campaign in late 2022.
- The upgrade of HSX is on schedule to resume operations by December 2021. The upgrade will implement a 70 GHz gyrotron to significantly improve the ECH system and provide a factor of 2 to 3 in electron density, increased heating power, and longer pulses.



Iron impurity transport during on- to off-axis ECH in W7-X

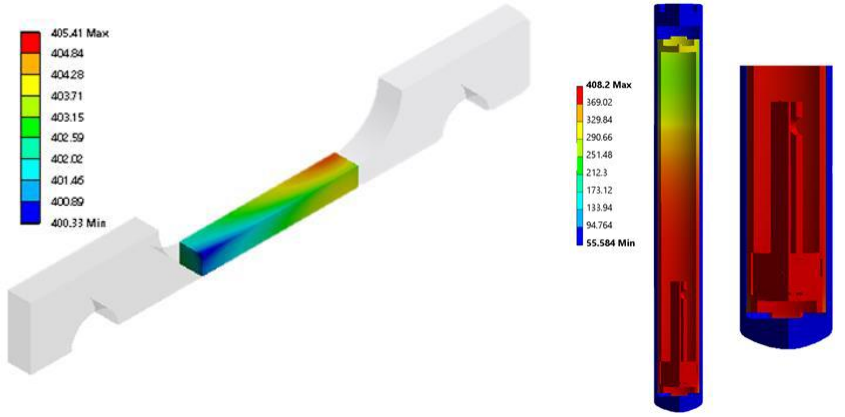


De-Convolutional Neural Network B field fluctuations in CTH

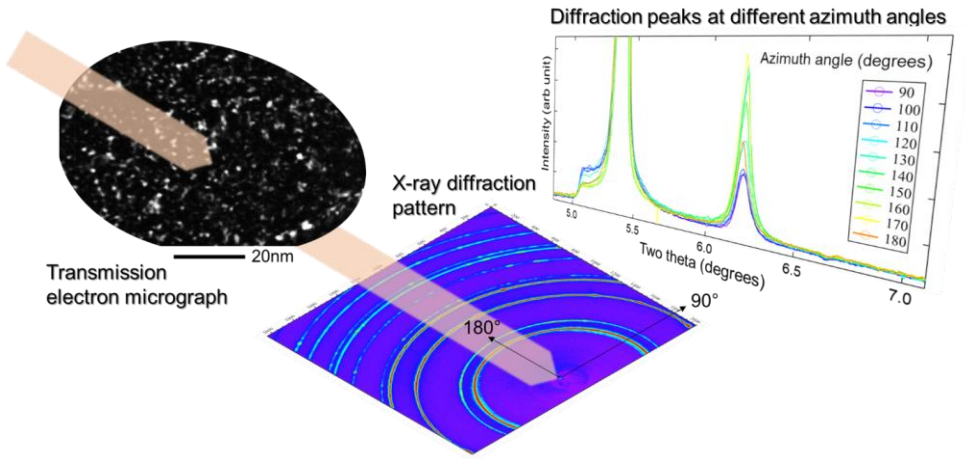
Fusion Materials

- **High Flux Isotope Reactor (HFIR)**
  - Continues to be a workhorse and center of excellence for both the domestic and international fusion materials research programs
  - Nexus for current and proposed international collaborations, including Japan (QST, NIFS), EUROfusion, and the UK
  - Actively developing novel irradiation capabilities to explore fusion relevant regimes, including helium effects studies, hydrogen charging experiments, and in-situ corrosion experiments

- **National Synchrotron Light Source II (NSLS-II)**
  - Synchrotron-based microstructural characterization techniques are increasingly powerful for application to fusion materials research
  - Increased domestic and international interest in these synchrotron methods, which complement traditional characterization approaches
  - New funding for direct collaborative experiments provide enhanced facility access through researchers at Stony Brook University



Temperature distribution calculations for in-situ corrosion experiments on HFIR



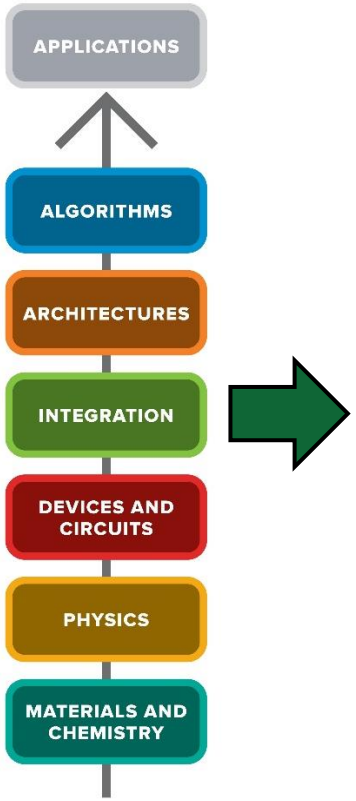
X-ray diffraction analysis at NSLS-II

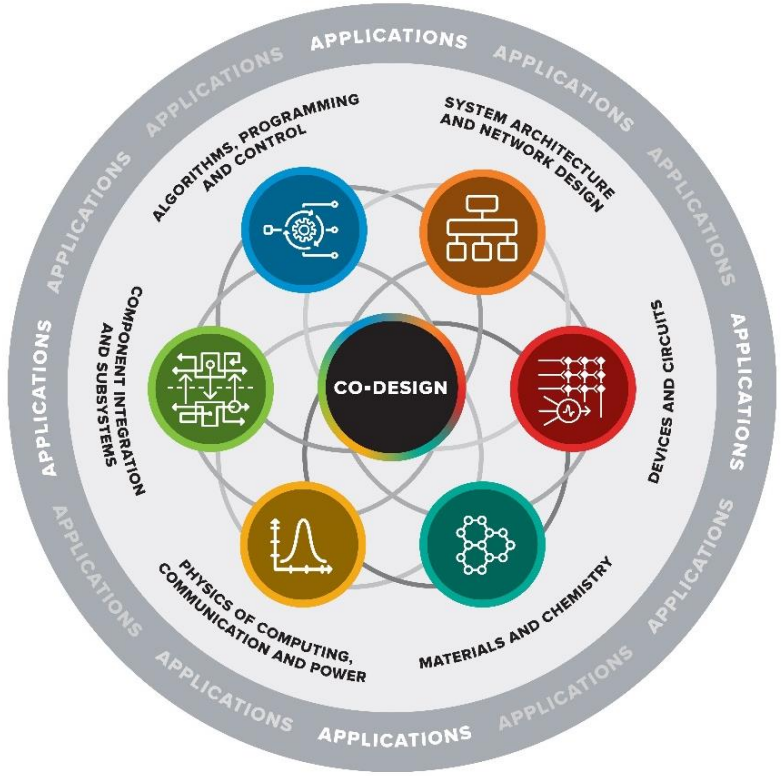
Microelectronics Co-Design Research

U.S. Department of Energy Announces $54 Million to Increase Energy Efficiency in Microelectronics Technologies

National Labs Will Lead Groundbreaking R&D in Computing, Communication, and Sensing for Broad Use Technologies

- **August 25, 2021**: DOE today announced nearly $54M for 10 new projects led by DOE National Laboratories to increase energy efficiency in microelectronics design and production.
- Microelectronics are critical to nearly all modern technology, including smartphones, medical equipment, power plant and electricity grids, and automobiles.
- Advanced microelectronics hold the potential to power innovative solutions to challenges in clean energy, climate, and national security.
- FES is supporting 3 awards.





Need to move from the historical sequential R&D process to a ***co-design framework*** where each scientific discipline informs and engages the others, with multi-directional information flow

Interactions with other Agencies

- **NSF-DOE Partnership in Basic Plasma Science and Engineering**
  - $7.9M total FES funds provided in FY 2021
    - $5.5M for 14 new and renewal proposals
    - $2.4M facility operation funds for one-year BaPSF renewal
  - $7.3M average annual FES funding in last five years
  - MOU is being renewed for FY 2022

- **GAMOW Joint FOA/Lab Call with ARPA-E**
  - 14 awards in FY 2020, $15M total funding/3 years (+$15M from ARPA-E)
  - $5M funding by FES in FY 2021

- **SC-NNSA Joint Program in High Energy Density Laboratory Plasma Science**
  - $3.1M total FES funds provided in FY 2021
    - 9 new and renewal proposals
  - $3.8M average annual FES funding in last five years

Office of Science

Department of Energy Announces $9.35 Million for Research on High Energy Density Plasmas

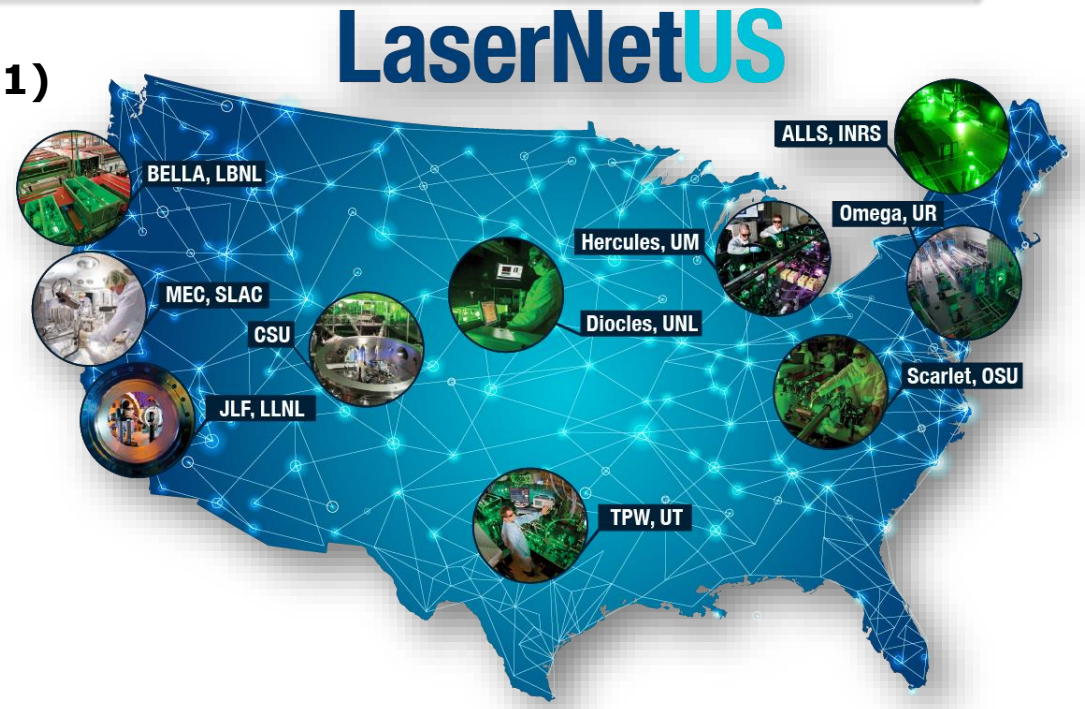
JULY 27, 2021

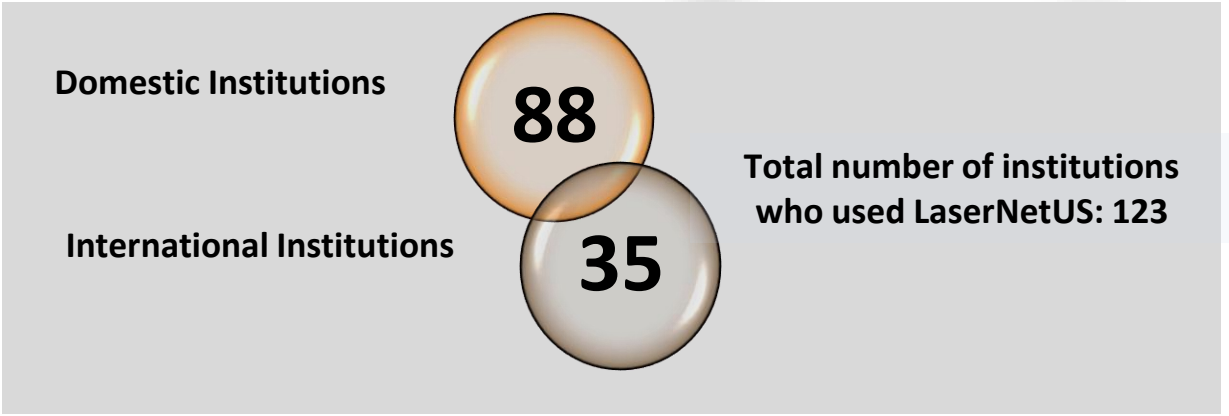
Office of Science » Department of Energy Announces $9.35 Million for Research on High Energy Density Plasmas

WASHINGTON, D.C. – Today, the Department of Energy's Office of Science (SC) and the National Nuclear Security Administration (NNSA) announced $9.35 million for 21 research projects in High-Energy Density Laboratory Plasmas (HEDLP).

LaserNetUS Updates

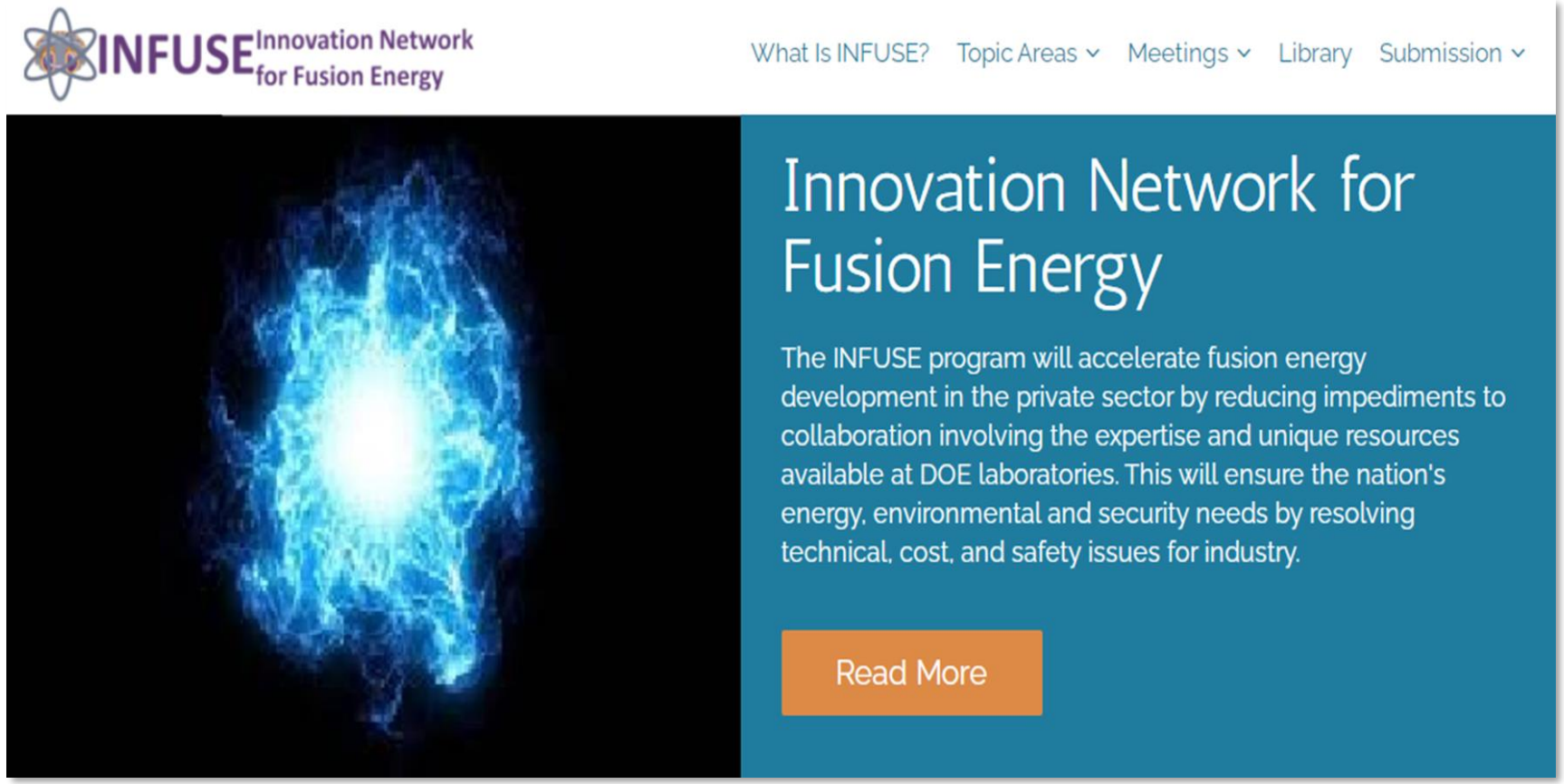
- **LaserNetUS Second Annual Meeting (August 17-19, 2021)**
  - More than 450 participants.
  - Four best poster awards were given to:
    - 1 undergrad & 3 graduate students
    - $500 each, sponsored by AMSL (largest supplier of photolithography systems)
- **LaserNetUS renewed in FY 2020**
  - ALLS laser (Canada) joined the network
  - 9 funding awards, $18M total over 3 years ($6.6M in FY 2021)
- **FY 2021: Three calls for experimental proposals were issued by the network**
  - Applications received : 149
  - Awarded experimental time: 86
  - Success rate: 58%
  - Number of students involved: >130
- **MOU with LaserLab Europe is in process**





Innovation Network for Fusion Energy (INFUSE)

- **INFUSE** is now in its third year
- FY 2021: 2 Request for Assistance Calls, with $4.0M in research awards
- To date, **40** awards totaling **$7.8M** have been made, enabling **8** DOE national labs to collaborate with **22** fusion companies
- Universities to be included in FY 2022



https://infuse.ornl.gov/

Talk by Dr. Dennis Youchison and Dr. Ahmed Diallo

ESnet Networking Requirements Review: FES Program

- **Energy Science Network (ESnet) has been conducting a FES Network Requirements Review during 2021 to comprehensively survey FES stakeholders' plans and processes in networking and data**

EXPECTED REVIEW OUTCOMES:

- Identify technical gaps, bottlenecks, and opportunities that can be addressed by ESnet ***with new or existing services***.
- ***Forecast network capacity needs***, particularly sites anticipating data increases for ***informed investments*** in bandwidth, and services by ESnet and DOE.
- Ensure FES and ESnet ***continue to be forward-looking*** in preparation for ITER
- Build a robust relationship between ESnet and the FES community ***to ensure continued alignment*** in the short- and long-term.

REVIEW OUTPUT: COMMON THEMES

- Scientific Data Management: Storage, Dissemination, Mobility, and Volume
- ITER Challenges and Opportunities
- Remote Collaboration Requirements and Use Cases
- Multi-Facility Computational Workflows and Use Cases
- International and Transoceanic Networking
- Domestic Networking for Local and Wide-Area Uses Cases
- Software Infrastructure Requirements and Improvements
- Cybersecurity

Plasma and Fusion Undergraduate Research Opportunities (PFURO)

- **PFURO participants:**
  - Conduct 10 weeks of remote summer research guided by faculty/staff at US undergrad institutions
  - Participate in the 2-week Intro to Plasma and Fusion course hosted by PPPL (2021: June 14-June 25).
  - Join all workforce development seminars/workshops available for PPPL summer undergrad interns
  - Receive a $600 weekly stipend for the duration of the 10-week, 40hr/week research experience.
  - Participants are provided travel to Princeton.
  - Housing at the location of your internship (or $150 allowance per week, per student during 2020, 2021, and possibly 2022--dependent on the status of the COVID-19 pandemic).
  - Be sponsored to present their research at a national topical conference. Most students would present at APS-DPP, but it may also be GEC, ICOPS, SOFE, or another relevant topical conference.
  - Women and under-represented minorities are encouraged to apply.

Sponsored by:

DOE Office of Science
Fusion Energy Sciences

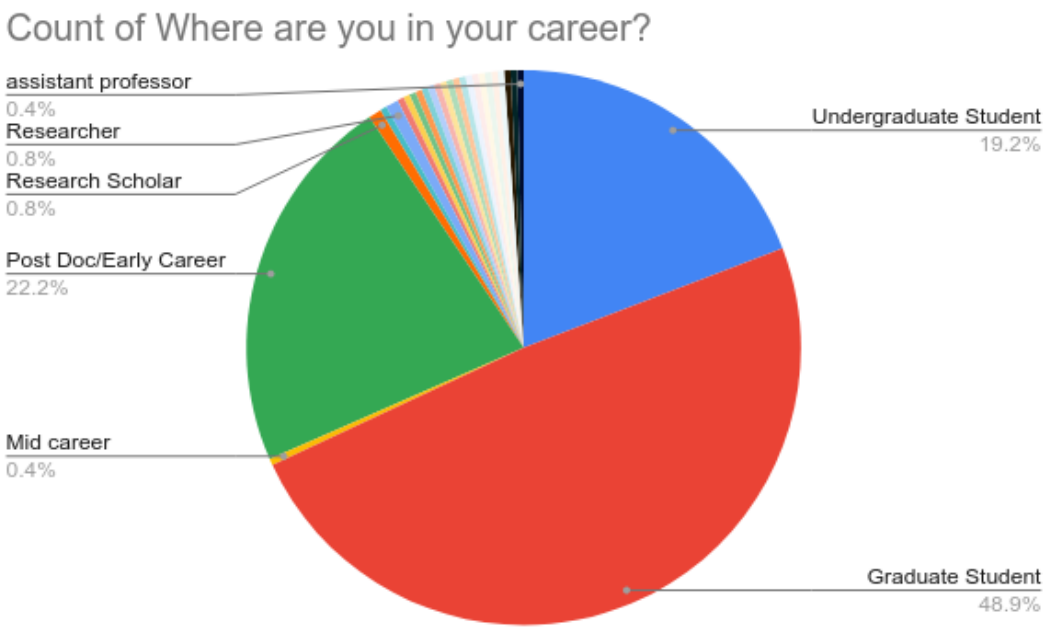
Managed by:

PPPL PRINCETON PLASMA PHYSICS LABORATORY

U.S. Fusion Outreach Team

2nd Computational Physics School for Fusion Research

- August 30–September 3, 2021, virtual, hosted by MIT Plasma Science and Fusion Center
- 260 participants from the U.S. and abroad (e.g., India, Costa Rica, Europe)



- Provide young researchers with critical skill sets to tackle modern fusion energy research challenges through tutorials and classes on:
  - High performance computing; Parallel programming and GPU programming; Computational Statistics; Machine Learning; Optimization methods

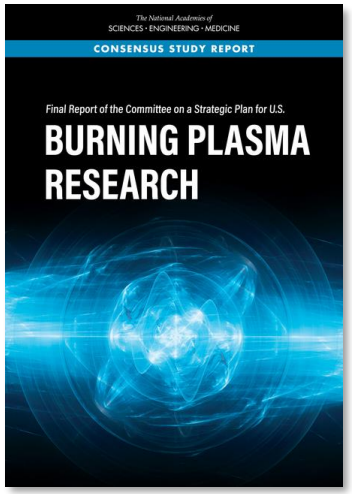
FY 2022 Budget Request

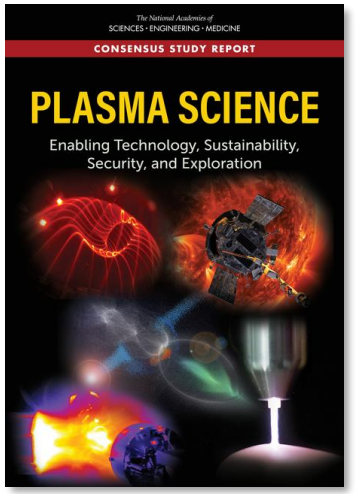
($K)	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Enacted		FY 2022 Request	
	Dollars	Dollars	Dollars	Percentage	Dollars	Percentage
Research	261,950	253,000	260,149	38.7%	297,230	44.0%
Facility Operations	143,500	128,500	129,211	19.2%	125,270	18.6%
Projects	148,346	282,500	280,000	41.7%	251,000	37.2
Other	10,204	7,000	2,640	0.4%	1,500	0.2%
Total, FES	**564,000**	**671,000**	**672,000**	100%	**675,000**	100%

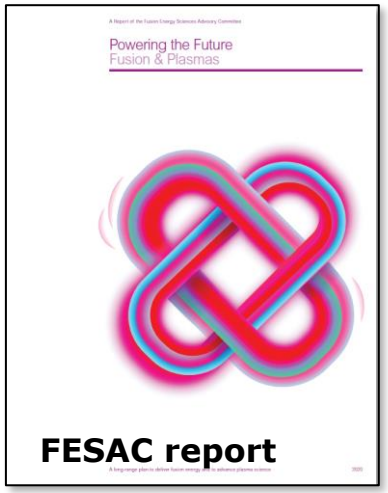
FY22 budget request is marginally into "modest growth scenario" of FESAC Long-Range Plan

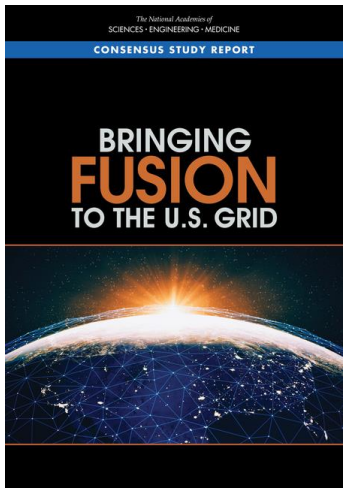
Recent planning reports

Title	Source	Date
Opportunities in Intense Ultrafast Lasers	NASEM	Dec 2017
Burning Plasma Research	NASEM	Jan 2019
Brightest Light Initiative: The Future of Intense Ultrafast Lasers in the U.S.	Community workshop	Workshop held Mar 2019
A Community Plan for Fusion Energy and Discovery Plasma Sciences	FES Community Planning Process	Mar 2020
Plasma Science: Enabling Technology, Sustainability, Security, and Exploration	NASEM Decadal Assessment	May 2020
Powering the Future: Fusion and Plasmas (A Long-Range Plan) *	FESAC	Feb 2021
Key Goals and Innovations Needed for a U.S. Fusion Pilot Plant **	NASEM	Feb 2021







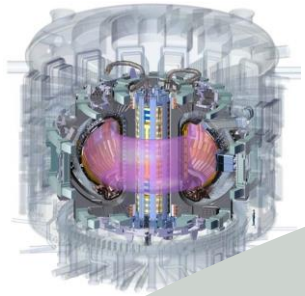


** Talk by Prof. Troy Carter

** Talk by Dr. Richard Hawryluk

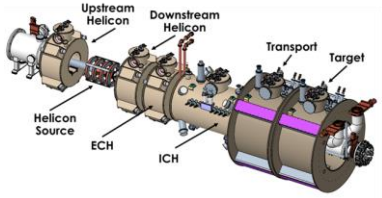
New Long-Range Plan recommends strengthening the domestic program to aim at a Fusion Pilot Plant

- *Fusion nuclear science*
- *Fusion materials R&D*
- *Fusion facilities systems studies*



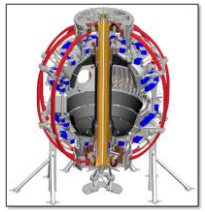
ITER

Material Plasma Exposure Experiment

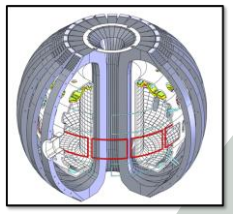


Foundations

NSTX-U

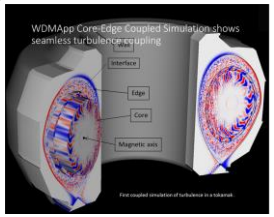


DIII-D



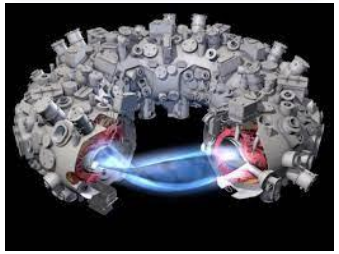
Fusion User Facilities

Long Pulse



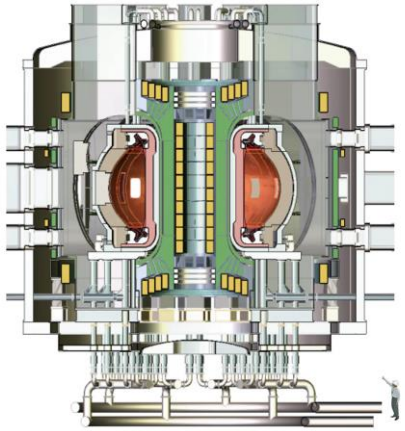
Theory & Simulation

ITER



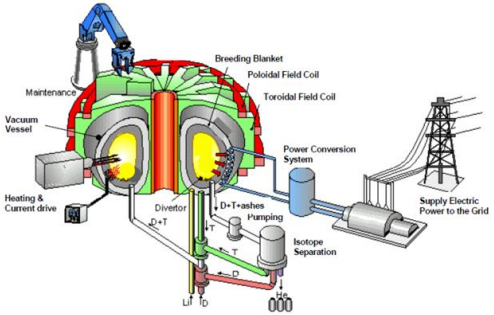
International Collaborations

Fusion Pilot Plant



Fusion Pilot Plant

Electricity on the grid



- *Advanced computing (SciDAC)*
- *Artificial intelligence*
- *Quantum information science*
- *Advanced manufacturing*
- *High-temperature superconductor magnets*

"Powering the Future: Fusion and Plasmas"
(Fusion Energy Sciences Advisory Committee, 2021)

Long Range Plan & FY 2022 budget request (1)

Portfolio Elements	Scenarios		
	Constant Level of Effort Significant loss of US leadership & significant missed opportunities	Modest Growth Loss of US leadership & missed opportunuties	Unconstrained
Research, Operations, and Small Scale Construction			
FM&T Programs	Yes, enhance	Yes, enhance	Yes, enhance
US Tokamak Operations and Research	Yes, but reduce	Yes, but reduce	Yes
Stellarator and Alternates Operations and Research	Yes, but flat	Yes	Yes, enhance
IFE program	Yes, but limited	Yes, but limited	Yes
FPP Design Effort	Yes, but limited	Yes	Yes, enhance
GPS Program	Yes, but reduce modestly	Yes	Yes, enhance
HEDP Program	Yes, but reduce modestly	Yes	Yes, enhance
Plasma-Based Technology Program	Yes, but limited	Yes	Yes, enhance
Theory and Computation	Yes	Yes	Yes, enhance

Compare FY22 Request to FY21 Enacted

Up $7.6M

Down $3.9M

Constant

Planning IFE BRN Workshop
Initiate Future Facilities Studies $3M

Up $5M

Up $4.3M

Constant (i.e., Microelectronics $5M)

Up $11M (note: SC initiatives)

Long Range Plan & FY 2022 budget request (2)

Portfolio Elements	Scenarios		
	Constant Level of Effort Significant loss of US leadership & significant missed opportunities	Modest Growth Loss of US leadership & missed opportunities	Unconstrained
New Construction of Midscale+ Facilities			
MPEX	Yes	Yes	Yes
FPNS	Yes, but highly delayed	Yes, but delayed	Yes
MEC Upgrade*	No, but develop further*	No, but develop further*	Yes
EXCITE	No	Yes, but highly delayed	Yes
Mid-Scale Stellarator	No	No	Yes
BCTF	No	No	Yes
Solar Wind Facility	No	No	Yes
HHF-Component	No	No	Yes
Multi-PW Laser	No	No	Yes
High Rep. Rate Laser	No	No	Yes, with partnerships
Midscale Z-Pinch	No	No	Yes, with partnerships
VNS	No	No	Concept Study

Compare FY22 Request to FY21 Enacted

Up $4M

Some funding in Materials to study target options

Down $12M

Long Range Plan & FY 2022 budget request (3)

Portfolio Elements	Scenarios		
	Constant Level of Effort Significant loss of US leadership & significant missed opportunities	Modest Growth Loss of US leadership & missed opportunities	Unconstrained
Collaborations and Networks			
ITER research team	Yes	Yes	Yes, full
Private fusion collaborations	Yes, enhance	Yes, enhance	Yes, enhance
International fusion collab.	Yes	Yes	Yes, enhance
LaserNetUS	Yes	Yes, enhance	Yes, upgrade
ZNet, MagNetUS, LTPNet	No	Yes, but limited	Yes

Compare FY22 Request to FY21 Enacted

Initiate ITER research team $2M
INFUSE up $2M; include universities
Constant
Constant

Congressional line item ITER Request down $21M

FY 2022 SC cross-cutting research initiatives

FES commitments **($K)**

Initiative	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request
Accelerator Science and Technology			3,073
Artificial Intelligence and Machine Learning	7,000	7,000	7,000
Fundamental Science to Transform Advanced Manufacturing			3,000
Integrated Computational and Data Infrastructure			4,037
Microelectronics		5,000	5,000
Quantum Information Science	7,520	9,520	10,000
Reaching a New Energy Sciences Workforce (RENEW)			3,000
Total, Research Initiatives	**14,520**	**21,520**	**35,110**

FY 2022 Initiative: Reaching a New Energy Sciences Workforce (RENEW)

- Outreach
- Listening tours and roundtables to:
  - Gain understanding about challenges
  - Develop evidence-based solutions

- Identify unique Office of Science lab opportunities
- Partner with Minority Serving Institutions and professional societies
- Implement action plan

- Competitively support new traineeship awards resulting in:
  - Hands-on experience, mentoring, and enhanced workforce diversity, equity, and inclusion
- Track post-traineeship outcomes
- Assess program effectiveness

Inertial Fusion Energy:
Basic Research Needs Workshop planned in FY 2022

- "Inertial fusion energy (IFE) utilizes advances in lasers, pulsed power technology, and other innovative drivers to achieve fusion at high fuel density. The enormous progress made with indirect drive at the National Ignition Facility, direct drive, magnetic drive inertial confinement fusion (ICF), and heavy ion fusion underpin the promise of IFE. An IFE program that leverages US leadership and current investments should be targeted."

FESAC Long Range Plan (page 34)

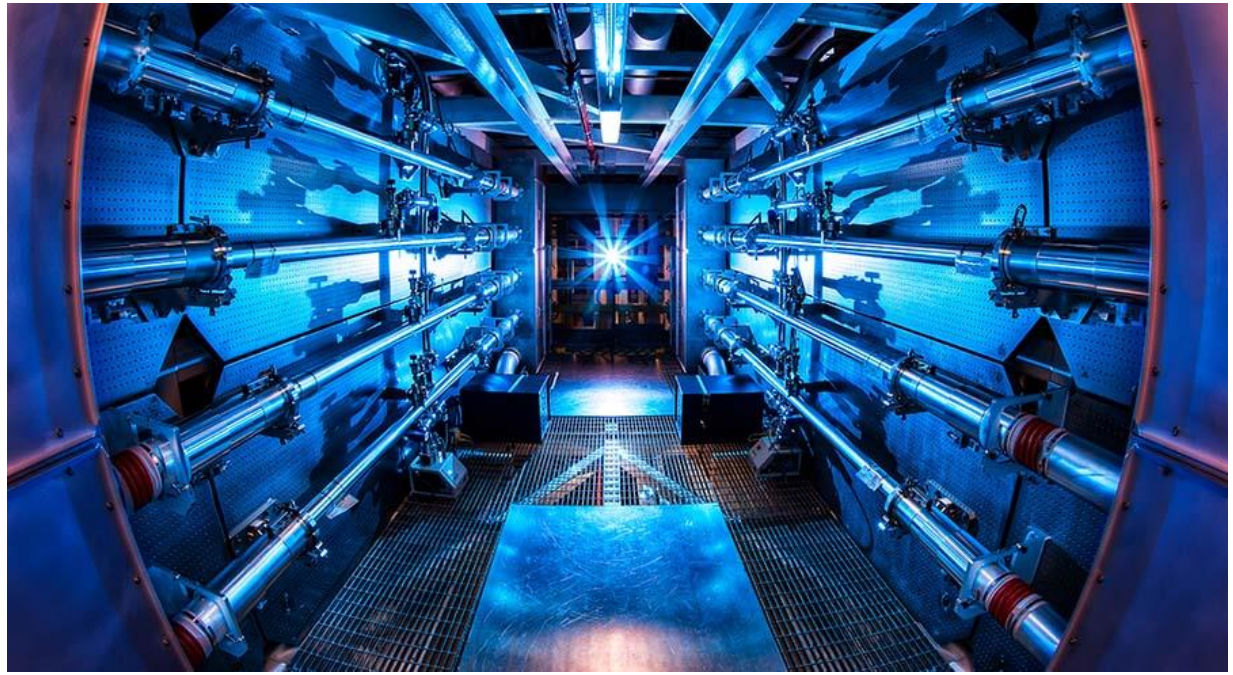
FES is planning a Basic Research Needs (BRN) Workshop for Inertial Fusion Energy in March/April 2022

Dr. Tammy Ma (LLNL) Chair

Prof. Riccardo Betti (UR) Co-Chair

NIF and HEP

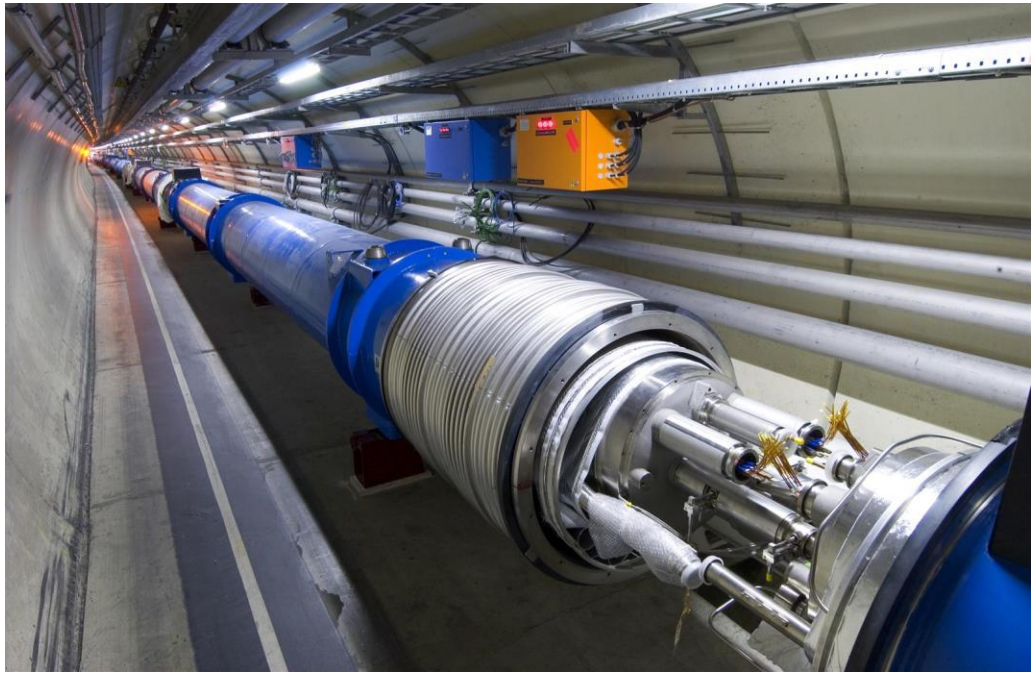
National Ignition Facility



Lawrence Livermore announced a milestone in laser fusion

Talk by Dr. Mark Hermann

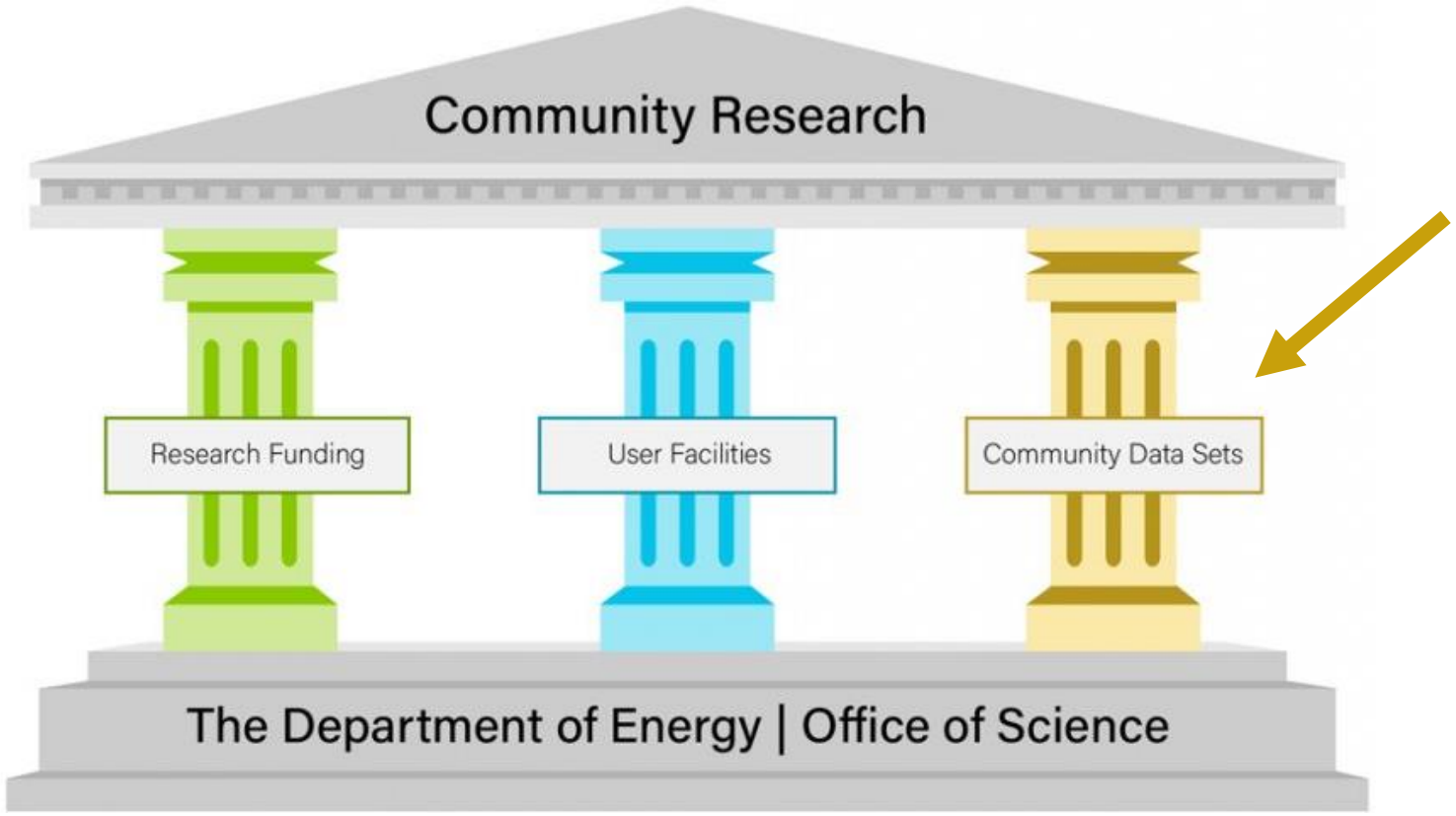
High Energy Physics (HEP)



Many U.S. scientists work at/with the Large Hadron Collider at CERN

Talk by Dr. James Siegrist

Data is the Third Pillar of the DOE SC Enterprise



https://www.energy.gov/science/office-science-pure-data-resources

Talk by Dr. Michael Cooke

Public Reusable Research (PuRe) Data Resources are:

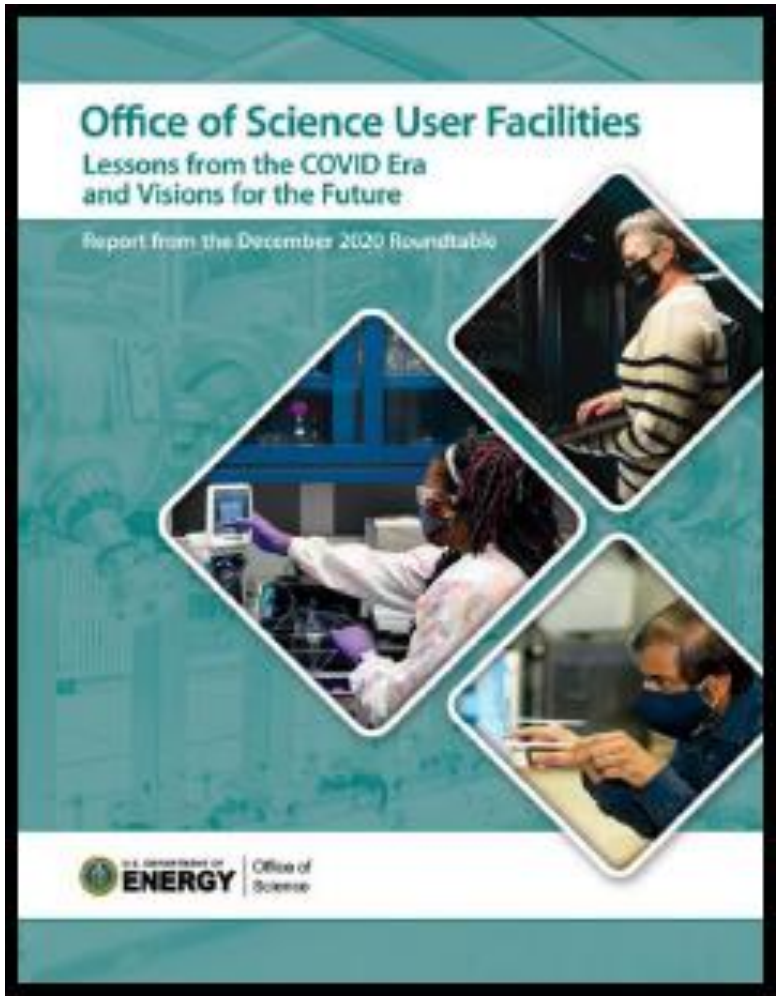
- data repositories,
- knowledge bases,
- analysis platforms,
- and other activities

that aim to make data **publicly available** in order to advance scientific or technical knowledge.

PuRe Data Resource designations **highlight** and **improve stewardship** of SC-supported community data efforts with strategic impact on the SC mission.

Office of Science User Facilities Roundtable: Lessons from the COVID Era and Visions for the Future

- In December 2020, SC convened a virtual roundtable of its scientific user facilities to discuss facility challenges and lessons learned during the COVID-19 pandemic, as well as facility practices, best practices, and innovations that could be adopted going forward.
- Roundtable participants included facility staff, users, and user executive committees.
- Discussions covered topics such as user research and facility operations in virtual and physically distanced contexts; user training and engagement; computation, data, and network resources; and crosscutting issues.



Talk by Dr. Lijuan Ruan

FY 2021 Early Career Research Awards

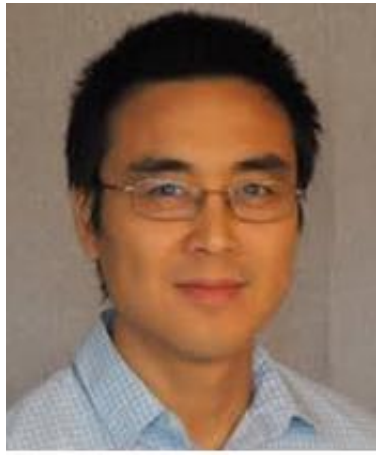
- **FES made two university awards and five laboratory awards in FY 2021**

Prof. Petros Tzeferacos
Univ Rochester
HED Magnetized Plasma Turbulence - Simulations, Experiments and Theory

Prof. Mona Ghassemi
Virginia Tech
Prediction of *Breakdown in Air and Solid Dielectrics: A Complete Plasma Model from Discharge Initiation to Flashover*

Dr. Mark Boyer
PPPL
Machine learning approaches for spherical tokamak scenario optimization and rt control

Dr. Andrea Schmidt
LLNL
Neutron Yield Scaling with Current in Dense Plasma Focus Z-Pinch Discharges



Dr. Daisuke Shiraki
ORNL
Precision Science and Control of Pellet Fueling for Optimizing Tokamak Plasma Scenarios

Dr. Emma McBride
SLAC
First Principles Measurements of Temperature and Transport Properties in Warm Dense Matter

Dr. Matthew Beidler
ORNL
Hybrid Kinetic-Fluid Modeling of Tokamak Disruption Mitigation

Talk by Dr. Félicie Albert

2020 DOE Ernest O. Lawrence Awards

Fusion and Plasma Sciences:

- Dustin Froula (U. Rochester)
- *For innovative research in laser plasma physics including pioneering spatiotemporal pulse shaping techniques, focused laser plasma instability research, and novel high-resolution Thomson scattering methods that has significantly advanced the Department of Energy's mission.*

Talk by Prof. Dustin Froula

Call for Nominations: 2021 E.O. Lawrence Awards

- **Recognizes:** Mid-career U.S. scientists and engineers for exceptional contributions and achievements in research, technical, and engineering supporting the broad missions of DOE and its programs to advance the national, economic, and energy security of the U.S.
- **Awards considered in nine categories:**
  - Atomic, Molecular, and Chemical Sciences
  - Biological and Environmental Sciences
  - Computer, Information, and Knowledge Sciences
  - Condensed Matter and Materials Sciences
  - Energy Science and Innovation
  - Fusion and Plasma Sciences
  - High Energy Physics
  - National Security and Nonproliferation
  - Nuclear Physics
- **Eligibility:**
  - Mid-career, defined as within 20 years of earning highest degree
  - United States citizen
  - Recognized for achievement in research principally funded by DOE
  - Recognized primarily on the scientific impact and technical significance of their work relative to its discipline and/or related mission
- **Deadline for nominations: Tuesday, September 21 (extended), 2021, 5:00 PM (ET)**
  - Nominations made online: https://apps.orau.gov/Award/Lawrence
  - Additional information (eligibility, category descriptions, review process): https://science.osti.gov/lawrence

Questions: SCLawrence.Award@science.doe.gov

DOE Office of Science Graduate Student Research (SCGSR) Program

The SCGSR Program provides supplemental awards to outstanding graduate students to spend 3 to 12 months conducting part of their doctoral thesis/dissertation research at a host DOE national laboratory/facility in collaboration with a DOE laboratory scientist.

FES awardees for 2020 Solicitation 2; 2021 Solicitation-1 awards are in process

Roland Hesse
University of Nebraska-Lincoln
A Numerical Study of Plasma Wavebreaking
(Host lab: LBNL)

Davis Easley
University of Tennessee-Knoxville
Development of a synthetic spectroscopy toolkit for analysis of W-II emission lines at WEST
(Host lab: ORNL)

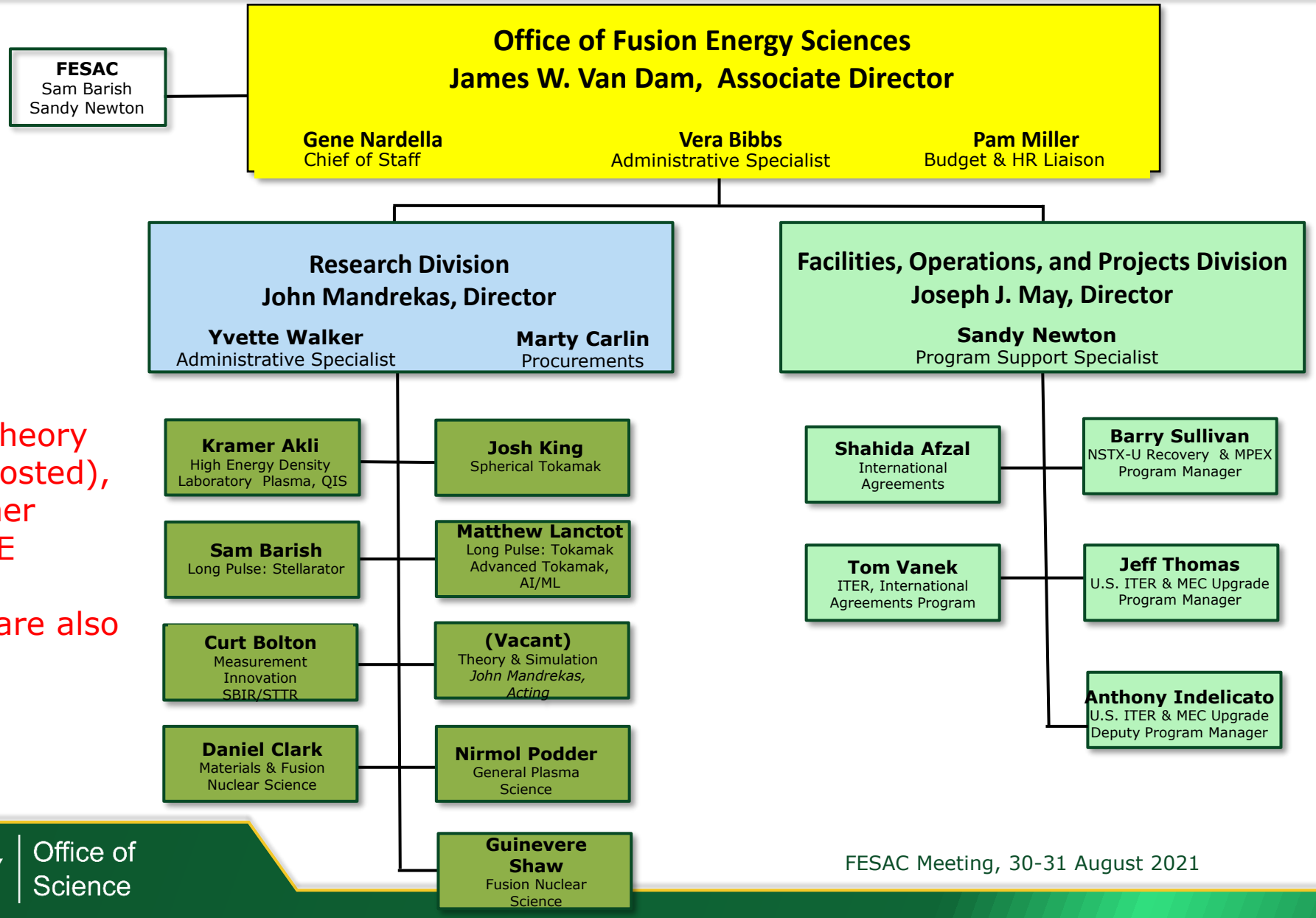
2021 Solicitation-2: Application due November 10, 2021, 5:00 PM ET

Full details, requirements, FAQs, and link to application at:
https://science.osti.gov/wdts/scgsr/

Program Contact : sc.scgsr@science.doe.gov

FES staffing status

- In addition to the Theory position (recently posted), we anticipate another opening--for an MFE program manager.
- IPAs and detailees are also possible.



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