Topics in Fusion Energy Sciences under the Continuation of Solicitation for the Office of Science Financial Assistance Program Notice of Funding Opportunity

Notice of Funding Opportunity
DE-FOA-0003432

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Office of Science, Fusion Energy Sciences

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Agenda and Q&A

- **Solicitation Overview and General Guidance**
- **Topic 1:** Tokamak Research (TR) – Section III.4d
  - Presentation by Matt followed by Q&A
- **Topic 2:** Spherical Tokamak and other Emergent Concepts – Section III.4e
  - Presentation by Josh followed by Q&A
  - Areas are covered under the single FES program element Compact Toroidal Concepts (CTC)

Q&A: Please enter your questions in the Q&A window with topic prefix either TR or CTC

e.g., TR: What are the major areas of emphasis for tokamak research?

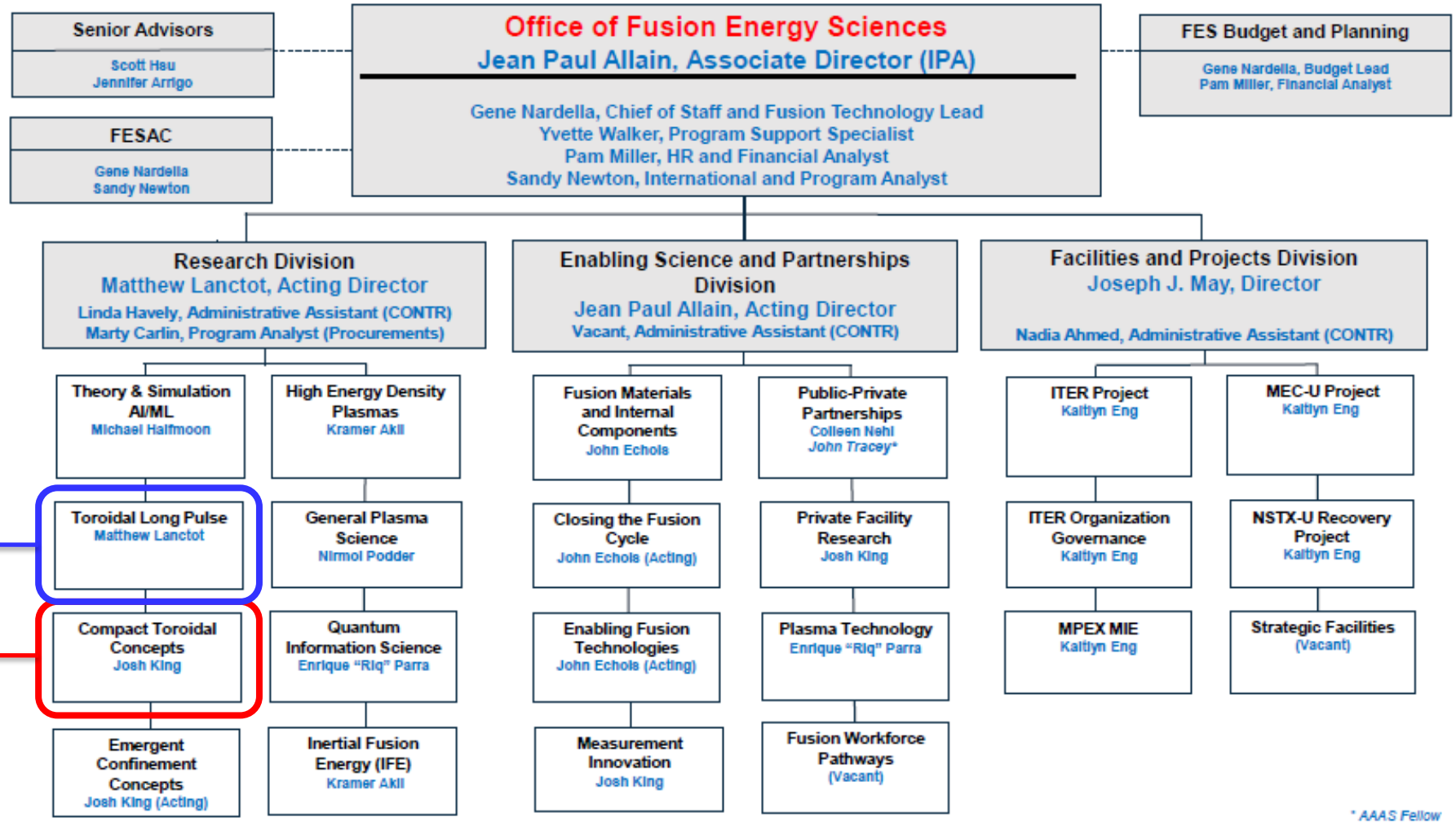
CTC: On which facilities can research be proposed? (wait to submit these until 2nd session)

Solicitation Overview - DE-FOA-0003432

- See Oct. 1 SC office hour slides and video for general FOA information: https://science.osti.gov/-/media/Office-Hours/pdf/2024/FY25_Open_Call.pdf
- Open to universities, industry, other federal agencies, non-profit entities, and non-domestic institutions.
- Applications are received, peer reviewed, and recommended for funding or declined
- Programs request a white paper or pre-application before a full application is submitted.
- FES topics have submission dates to be considered for a review and funded this fiscal year. Applications received after that date may be held for future decision.

- **Today's webinar:** Tailored guidance for two topics in Fusion Energy Sciences

Topics discussed today are in the FES Research Division



Includes DIII-D, int'l facilities, and stellarators

Includes NSTX-U, int'l facilities, and SPARC

General Guidance for all topics

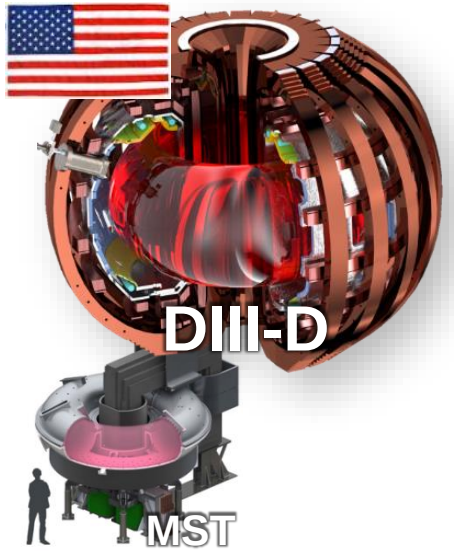
FES guidance for the Annual Open Solicitation: https://science.osti.gov/-/media/grants/pdf/foas-resources/2025/FES-Guidance-on-Annual-Open-Notice-FY-2025.pdf

Recommended Dates for Funding in FY 2025

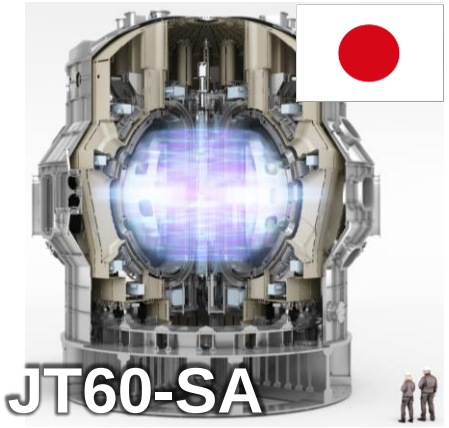
NOFO Dates	Oct. 1, 2025 – Sept. 31, 2025
Pre-application Submission	April 16, 2025
Pre-application Response	April 23, 2025
Application submission	May 21, 2025

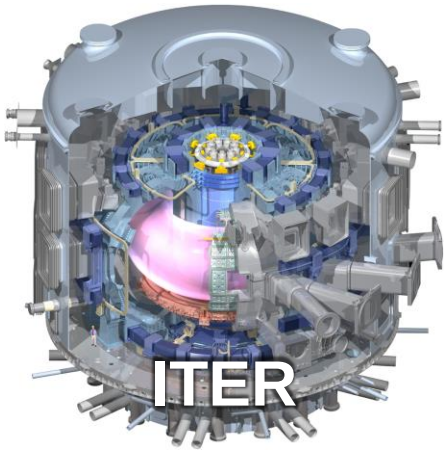
- **Type of Proposal:** DOE will accept new, renewal, and supplemental applications
- **Period of Performance:** DOE anticipates project periods of up to 5 years
- **Maximum/Minimum Award Size:** Depends on the type of award (see next slides)
- **Expected Number of Awards:** The exact number of awards will depend on the number of meritorious applications and the availability of appropriated funds.

Tokamak Research: Domestic short-pulse facilities address gaps and enable international collaborations on long pulse tokamaks abroad



Extend plasma duration & performance





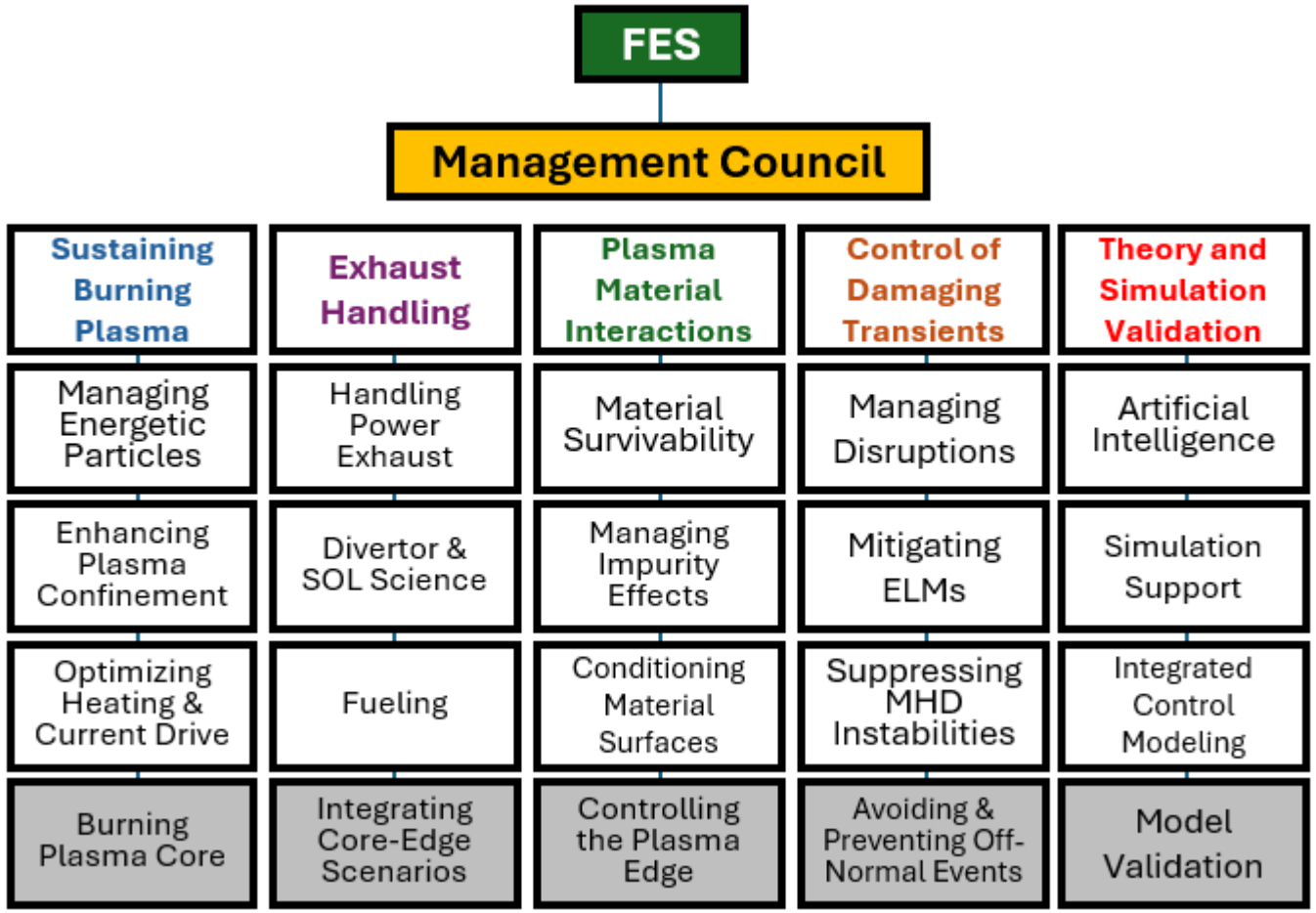
R&D Focus Areas

Sustaining Burning Plasmas	Exhaust Handling	Control of Damaging Transients	Plasma Material Interactions	Theory and Simulation Validation

FY25 SC NOFO aims to support teams engaged on multiple facilities

- Integrated program would aim to sustain burning plasma regimes for long durations as needed in power plant
- R&D is relevant to both tokamak and stellarator path to fusion

Topical Areas and Organization

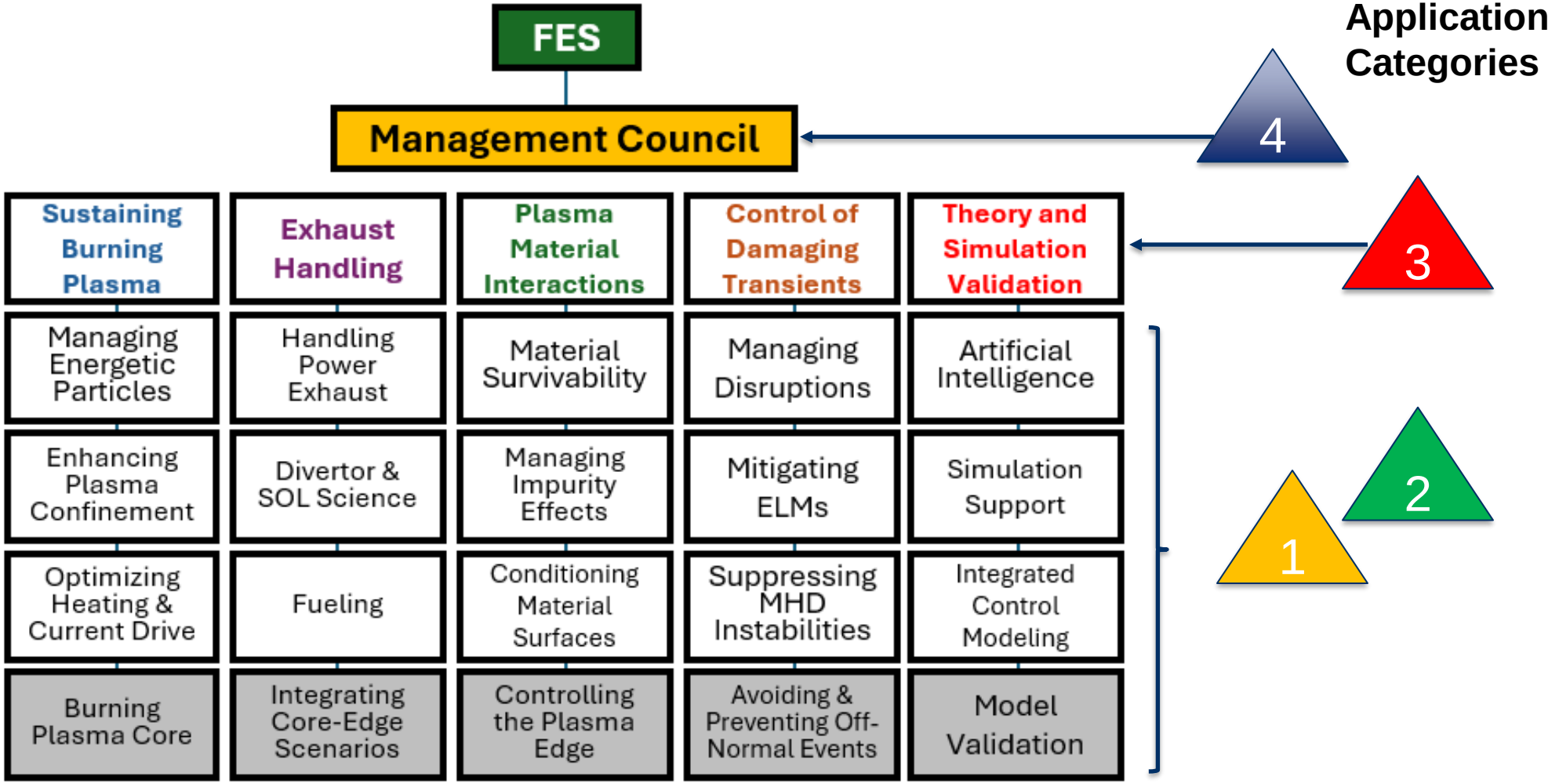


- Key elements: 1 Management Council, 5 Major Topics, and 20 subtopics
- Five major topics are motivated by the FES Long Range Plan
- 16 subtopics cover all major science and technology gap areas; 4 subtopics connect experiment to data and model validation efforts
- One subtopic integrates capabilities within each major topic (shaded box)
- Funded teams can address one or all subtopics in a major topic on multiple facilities (think “national expert team”)

Four application categories of most interest

1. **Fusion Technology and Diagnostic Development**
   - **Int'l Facility:** New diagnostic or fusion technology, and/or major upgrades to existing systems
   - **DIII-D:** New diagnostics and/or technology for the DIII-D facility is out of scope for this NOFO and will be managed under a separate process organized by the DIII-D host institution
2. **Tokamak Exploitation**
   - Hypothesis-driven research that exploits existing capabilities on any facility
   - May propose the exploitation and maintenance (e.g., replacement of consumable components) of existing hardware, but may not propose the implementation of new or upgraded diagnostics or other systems
3. **Research Coordination**
   - Propose a research coordination plan (CP) for one of the major topics
   - CP includes: five-year vision for national effort addressing S&T gaps, management approach, milestone management, subcontract management, cross-program management (i.e., other SC programs, private)
4. **Program Coordination** (to staff key roles of Management Council)
   - Propose a community coordination plan (CP) for the TR program
   - Contact FES for more details and to discuss your interest; today's webinar is focused more on Categories 1-3

Category mapping to Topical Areas and Organization



Guidance for all categories

- All applications are subject to merit review.
  - Category 3 and 4 applications will be reviewed by federal staff in the Office of Science.
- Within all categories, both single institution and multi-institutional applications are permissible.
  - Multi-institutional teams may submit one pre-application and application from a designated lead institution with all other team members proposed as subrecipients (i.e., the sub-prime model).
  - Collaborative proposals are also allowable.
  - Caveat: Financial assistance for universities should not be provided using subcontracts from national laboratories. If the lead institution is a national laboratory, FES will coordinate the submission of applications from other institutions. (National laboratory staff should #not# submit to DE-FOA-0003432.)
- If multiple applications from a single institution are selected for funding, the activities may be combined into a single award during award negotiation.
- Institutions applying for research coordination may not receive more than 33% of the total budget awarded under a single major topic. Revised budgets that conform to this standard will be requested during award negotiation.

Application Targets

- New capabilities on international facilities will require coordination and/or cooperation with the international partner.
  - International agreements will be needed to authorize the project scope and clarify roles and responsibilities for the domestic and international partners.
- Institutions are asked to refrain from submitting more than **one** Category 4 app.
- Institutions are asked to refrain from submitting more than **one** Category 3 app. in each major topic and are asked to refrain from submitting more than **three** Category 3 applications in total.
- Institutions are asked to refrain from submitting more than **one** Category 1 and **one** Category 2 application to each major topic.
- Applications in excess of these targets will be a lower programmatic priority: Applicants are asked to submit their best concepts.

Budget and Staffing Targets

- **Category 2:**
  - Floor: $2,000,000 for both single institution and multi-institution applications.

- **Category 1,3,4:** This guidance is silent on award floor and ceiling; however
  - Category 3: staffing plan not to exceed two full-time positions (i.e., <= 2 FTEs) involving no more than three institutions
  - Category 4: staffing plan not to exceed 1.5 FTE

Intent: Given present FES staffing levels, FES aims to considerably reduce the number of distinct financial assistance awards being supported under existing programs. Single PI awards are unlikely to be supported except in rare instances.

Tokamak Facilities

Facility	Website	Program Contact
DIII-D	d3dfusion.org	David Pace - pacedc@fusion.gat.com
MST	https://wippl.wisc.edu/madison-symmetric-torus/	Noah Hurst - nhurst@wisc.edu
KSTAR	https://www.kfe.re.kr/menu.es?mid=a20202050000	Yeong-Seok Park - yspark@kfe.re.kr
WEST	https://irfm.cea.fr/en/west	Christel Fenzi – christel.fenzi@cea.fr
JT-60SA	https://www.jt60sa.org/	Contact FES
AUG	https://www.ipp.mpg.de/16195/asdex	Thomas Puetterich – thomas.puetterich@ipp.mpg.de
TCV	https://www.epfl.ch/research/domains/swiss-plasma-center/research/tcv/	Stefano Coda - Stefano.Coda@epfl.ch

- Contact FES for further information about available facilities
- FESAC *Report on International Collaboration Opportunities, Modes, and Workforce Impacts for Advancement of US Fusion Energy* reviews facility relevance to advancing the FES mission
- DIII-D Record of Discussion is required. See the program contact for details.

FAQ

1. **Is there enough time for FES to make awards this fiscal year?** Yes.
2. **My current award ends in FY 2026. Am I encouraged to submit an application this year under the new program organization?** Yes.
3. **My current institutional award ends this year. Is it advisable to request a larger budget for FY 2025?** No. We are in a period of highly constrained budgets. Institutional requests should avoid budget requests exceeding prior award levels adjusted for inflation.
4. **May I propose scope relevant to stellarator research together with a submission to the TR program?** Yes, but only if the proposed research addresses science and/or technology gaps relevant to both stellarators and tokamaks. Stellarator scope may need to be deferred based on appropriations.

Questions on TR?

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Compact Toroidal Concepts Overview

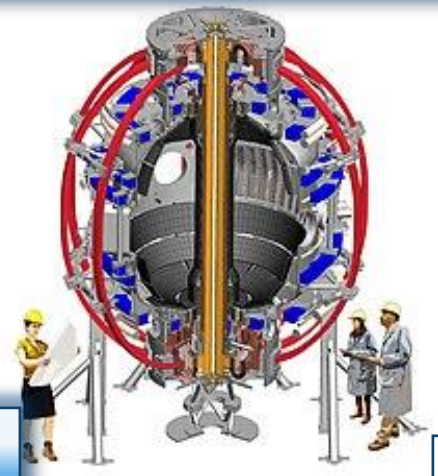
CTC enables FES Building Bridges Vision of cost competitive FPP by reducing fusion core size in complementary ways - high field conventional tokamak (HFCT) & spherical tokamak (ST)

Physics - ST

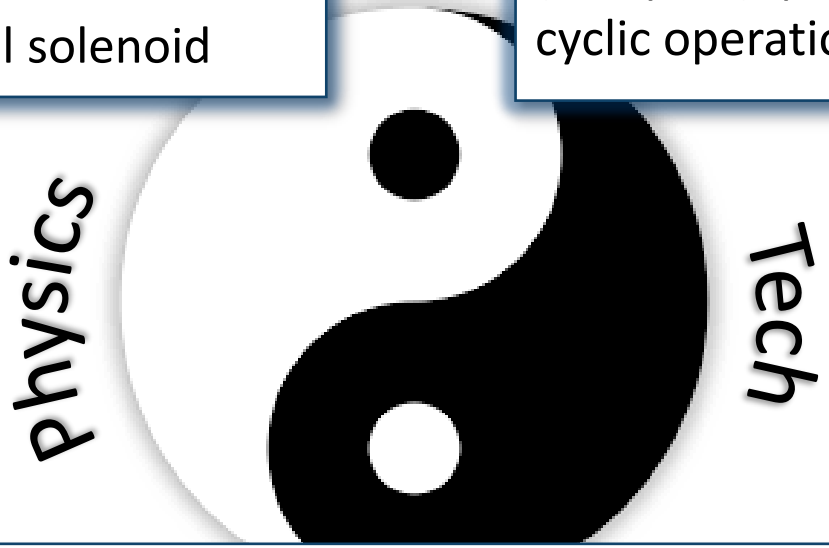
Cost Savings: High confinement and pressure (compact), steady state, eliminate aux. current drive via bootstrap, eliminate central solenoid

Technology - HFCT

Cost Savings: High magnetic field and pressure (compact), pulsed, eliminate aux. current drive via cyclic operation, validated physics basis in-hand



ST



HFCT

Common Challenges: High heat and neutron flux

Guidance

Guidance for ST and HFCT is distinct:

- **ST:** Supports both domestic (e.g., NSTX-U) and intl. (e.g., MAST-U) research. All applications must contain physics deliverables. Applications to this topic may involve the exploitation of existing hardware, but may ***not*** involve the implementation of new diagnostic and/or hardware capabilities. Requires a ***ST Record of Discussion for each ST facility*** contained in an application.

- **HFCT:** Supports research involving high field CTs (e.g., SPARC). Applications with strong physics deliverables are encouraged. Applications ***may*** involve the implementation of additional hardware capabilities and/or diagnostics. Requires a ***HFCT Record of Discussion***

Topical Areas - ST

- ST topical area has a strategic dual science and technology (S&T) mission
- **Science:** Leverage enhanced plasma physics properties at low aspect ratio to develop the physics basis for a compact FPP
  - Improved energy confinement time
  - Higher normalized plasma pressure
  - Enhanced self-driven bootstrap current
- **Technology:** Exploit extreme divertor heat fluxes to develop innovative power and particle handling techniques to optimize plasma exhaust in high performance scenarios
  - Liquid metal plasma facing components
  - Novel divertor geometries (e.g., Super-X, Snowflake)
- The NSTX-U Five Year Plan (5YP) for FY26 to FY30 is currently under development. FY21-25 5YP: https://drive.google.com/file/d/1sxNEiKp4oZS73c5UoA_j0oD7DK0KwfpX/view

Topical Areas - HFCT

- In support of the FES mission to *build the knowledge needed to develop a fusion energy source* FES is strategically engaging in collaborative research on the SPARC facility, which aims to achieve Q > 1 magnetically confined plasmas
- SPARC experimental data have the potential to advance the understanding of many aspects of tokamak physics, including
  - Confinement and stability at high field and high density
  - Burning plasma physics
  - Disruption physics
  - Boundary physics and heat flux management in power plant-relevant conditions.
- Additional details about research topics, desired diagnostic measurements, and additional hardware collaboration opportunities are contained in a Statement of Mutual Interest (SMI)
  - Request a copy of the SMI from jplatano@cfs.energy or josh.king@science.doe.gov

Application Types

Two Application Types:

- **Exploitation Only –** Supports research involving only the analysis of experimental data. A single submission may involve both ST and HFCT research areas (e.g., SPARC, MAST-U, and NSTX-U).

- **Hardware and Exploitation –** Supports both hardware and/or diagnostic implementation and analysis of experimental data. Only available for the HFCT topic (i.e., SPARC). Submissions involving STs are prohibited.

- For either application type, model validation efforts are encouraged.

Application Notes

- Project narratives must include plans for establishing and maintaining an on-site presence at the experimental facilities, as appropriate

- **Single institution and multi-institutional applications are permissible**
  - Multi-institutional teams: Submit one pre-application and application from a designated lead institution with all other team members proposed as subrecipients (i.e., the sub-prime model).

- Research proposals involving ST and HFCT research have also been solicited through the Private Facility Research (PFR) program. Duplicate submissions under multiple solicitations (e.g., both the Open Notice and the PFR NOFO) will not be funded.

Application Targets

- **Teaming within an institution is strongly encouraged & 1 application is preferred**
- Each institution is encouraged to submit no more than two pre-applications or applications, one for each application type.
  - **Example:** One institution may submit an 'Exploitation Only' application and a 'Hardware and Exploitation' application.
- Two-application target applies to multi-institutional applications
  - **Multi-institutional Applications:** An institution may be listed as either a lead or subrecipient on only two applications. ***An institution should NOT be listed on more than two pre-applications or applications in any capacity***.
  - **Example 1:** Institution A submits two single institution applications - 1 'Exploitation Only' and 1 'Hardware and Exploitation' → **Acceptable**
  - **Example 2:** Institution B is a subrecipient on 3 multi-institutional apps→ **Unacceptable**
  - **Example 3:** Institution C submits 2 'Exploitation Only' apps → **Unacceptable**

Budget Target

- **Floor:** Award size in all cases is $2,000,000 for both single institution and multi-institution applications.
- **Renewals:** For applicants with existing ST awards, institutional requests should not exceed prior award levels, and requests for funds in early budget periods should account for any unspent funds anticipated at the end of the current project period
- **NSTX-U Applicants:** Assume NSTX-U plasma operations will resume no earlier than December of 2026 (i.e., CD-4 date) and request less funding in early budget periods
- **All Applicants:** We are in a period of constrained budgets
- **Period of Performance:** Up to 5 years

ST Record of Discussion (RoD)

- **Purpose:** To ensure resources required at the host facility to support the proposed work are identified and the scope and timeline for shared tasks are agreed

- **Points of Contact:**

  NSTX-U:

  - Research Program Director – **Dr. Stanley Kaye – kaye@pppl.gov**
  - Research Program Deputy Director – **Dr. Jack Berkery – jberkery@pppl.gov**

  MAST-U:

  - Director of Tokamak Science and MAST-U – **Dr. Fulvio Militello – Fulvio.Militello@ukaea.uk**
  - MAST-U Science Leader – **Dr. James Harrison – James.Harrison@ukaea.uk**

- Engage the facility leads **early**, but RoD's are not needed prior to a pre-application

HFCT Record of Discussion (RoD)

- **Purpose:** To ensure there is mutual interest in the proposed work between the public researcher and CFS. *CFS is not obligated to sign for all applicants*
- **Point of Contact: Julie Platano – jplatano@cfs.energy**
- **Three Essential RoD Elements:**
  1. **Scope -** Outline of the scope and timeline for shared tasks are agreed
  2. **Data -** Acknowledgement that applicant has been granted access to the facility's data
  3. **Publications** – A notional publication plan that identities the area of intellectual pursuit of the Public Researcher
- HFCT applications **must** include a signed RoD to be considered complete
- Applicants **must** engage CFS prior to submitting a pre-application, but completed RoD's are not needed prior to submitting a pre-application

FAQ

1. **Should I combine my separate NSTX-U and MAST-U grants into one renewal application?** Yes. Given the institutional limits on submissions, you must combine these activities into a single grant application. Additionally, if there are other PIs from your institution with existing grants in this program, it is encouraged to combine your efforts into a single submission.
2. **I've been an NSTX-U collaborator for years, should I consider a broader submission across all CTC facilities and request additional budget in FY25?** Yes and No. Yes, it is advisable to submit a broad proposal covering the CTC facilities, but, given the constrained FES budgets, do not request additional funds.
3. **I have an existing award, should I submit a no-cost extension first and then submit a renewal application?** No. We are aiming to complete all funding actions this fiscal year within the compressed timeframe.

Questions on CTC?

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