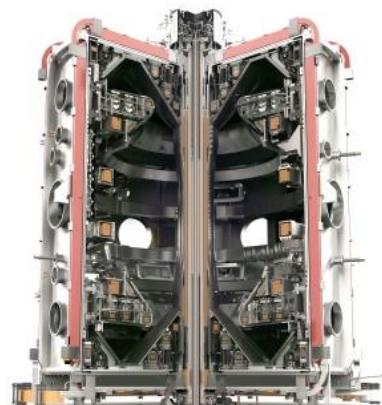
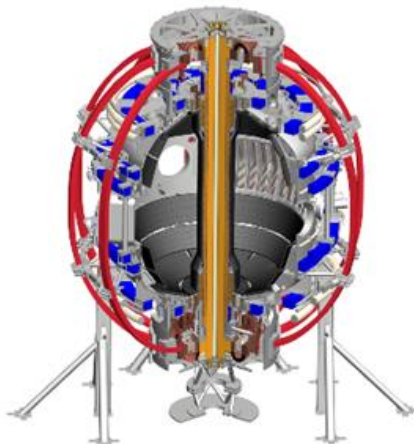
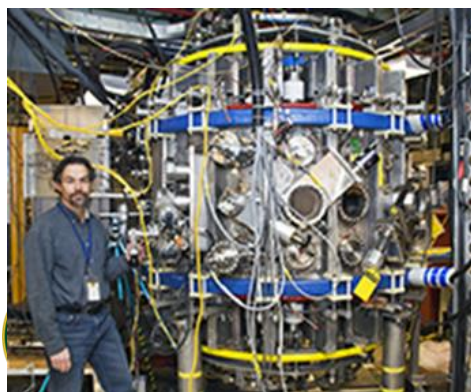


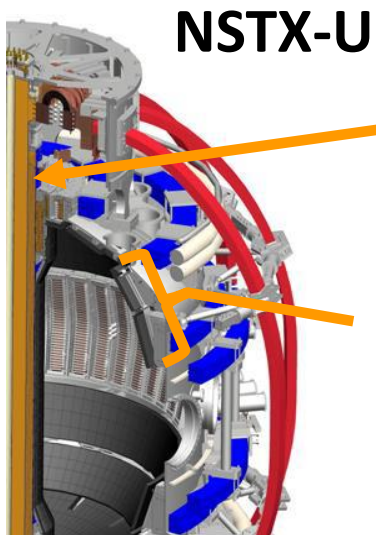
Spherical Tokamak Program Planning FY2020



Josh King, Spherical Tokamak Program Manager, SC - FES

Ray Orbach led a DOE OPA review, which found:

- “Full exploitation of the NSTX-U facility is essential for critical tests of the potential advantages of the spherical tokamak for fusion power production.”
- “In its chosen domain of exploration of high-performance, high- β , and low-collisionality plasmas, NSTX-U *is and will be the world leader.*”



NSTX-U

NSTX-U central magnet provides
 $\sim 2 \times$ higher B_T^2

NSTX-U conducting plates provide
 $\sim 3 \times$ higher total pressure



MAST-U



Dr. Raymond Orbach
former Under Secretary for Science in the DOE

The NSTX-U Recovery project has a baseline completion date of July 2022, allowing for a research planning

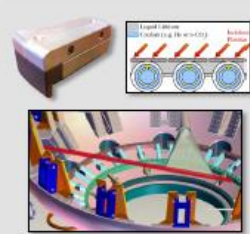
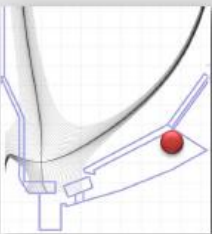
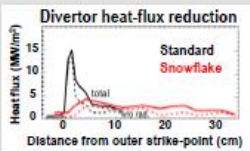
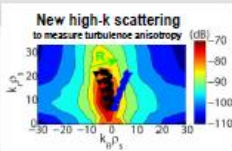
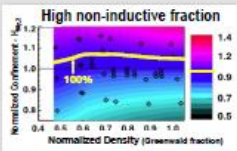
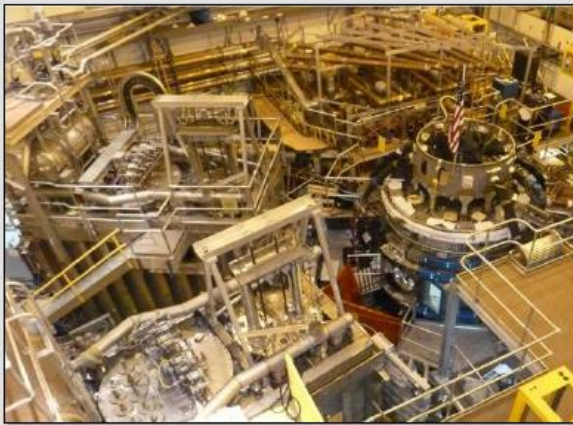
- **An Independent Project Review was held August 27-29 to baseline the NSTX-U Recovery Project**
 - Review panel noted that the project is quite mature, given the overall completion of ~50% (with over 70% design complete), and concluded it is ready to begin major construction
 - The baseline cost of the NSTX-U Recovery project is \$199.4M, with a **completion date (CDE-4) of July 2022** (and early finish in FY 2021)
- **An ESAAB-equivalent meeting was held on September 30**
 - CDE-2/3A received final approval to begin construction
- **Prior-authorized early construction activities have been underway**
 - Preparations to begin winding the PF coils are underway
 - Procurement of all graphite material for PFC replacement is complete

With the Mission Need for NSTX-U reaffirmed, and an agreed upon timeline for completing the project, it is reasonable to *refresh* the 5 year research plan



Seven

NSTX Upgrade ~~Five Year Plan~~ for FY2014-~~2018~~ 2020



NSTX-U Five Year Plan *Refresh* for FY2021-2025

The 5YP *refresh* will be a subset of activities from the previous 5YP

General Guidance

- PPPL will be coordinating the preparation of the NSTX-U *refreshed* 5YP
- Most of the previous 5YP research scope is still applicable for a *refreshed* 5YP
 - Some of the energetic particle objectives* were accomplished during the initial 10 weeks of plasma operations, however most of the plan remains to be explored.
- *Refreshed* 5YP will be focused on a subset of studies that will assume the NSTX-U **hardware is largely frozen** for FY22-FY25 plasma operations.
 - Brevity: FY21-25 5YP **refresh** 100-ish page, not the 760 page FY14-FY18 5YP
 - Rough Timeline: winter – finalize outline, spring – submit draft, summer – conduct a panel peer review
- Previous facility enhancements will not be considered in *refreshed* 5YP (e.g., NCC, ECH, cryopump, etc.)
- The next major NSTX-U facility enhancement will be the focus of the FY26-30 5YP
 - Initial planning efforts for the FY26-30 5YP are anticipated to begin in late FY23

Scope Revisions

- NSTX-U Recovery scope has required hardware revisions (eliminating CHI gap), and the impact of these revisions will need to be addressed in the *refreshed* 5YP
- The new fish scaled PFCs will represent a new area of research previously not available on NSTX-U pre-Recovery, and a research plan for this new area must be considered.



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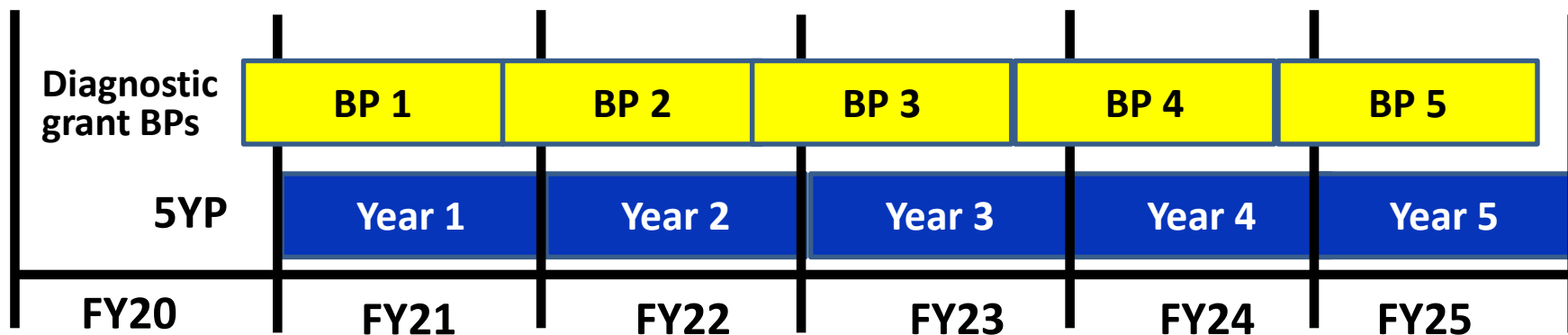
Non-lab Collaborator Solicitations

To be issued in late January



Non-lab proposals for NSTX-U Diagnostics

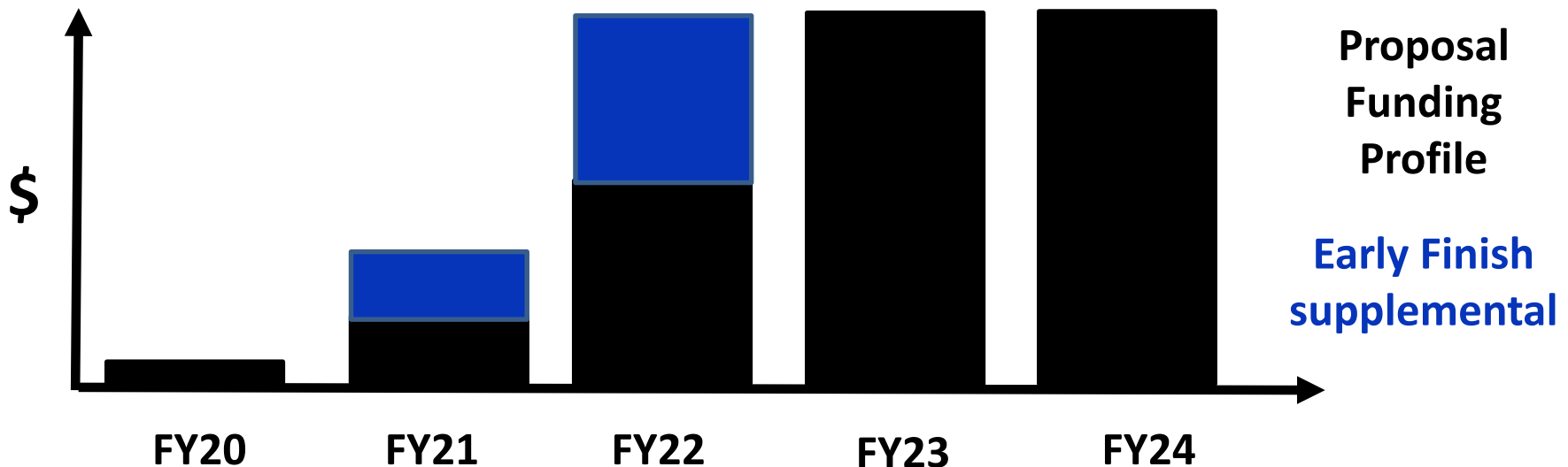
- Project period is 5 years with start dates in late FY20 (synced with *refreshed* 5YP)
- Grants will be peer reviewed alongside of the NSTX-U *refreshed* 5YP via a panel
 - Intended to improve the integration of the NSTX-U collaborators (*one-team approach*)
 - A brief high level synopsis presentation may be provided at the 5YP review, **but this is not required**
 - Details of the proposed original ideas will be restricted to FES and the panel reviewers
- Preproposals will be required
- A Record of Discussion (RoD) with PPPL will be required
- Budget profiles must ensure that the supported level of effort (LOE) is consistent with the **Early Finish Date (May 2021)** for the NSTX-U Recovery
 - Necessary to ensure installation work is satisfactorily coordinated with the NSTX-U Recovery project
 - Necessary to ensure essential NSTX-U data is available on day one of plasma operations



Collaborative Research on International and Domestic STs Solicitation – NSTX-U option

Non-lab proposals for NSTX-U research

- Project period is 5 years, start dates in late FY20, PPPL RoD will be required
- Preproposals will be required, proposals will be peer reviewed via mail-in reviews
- Budget profiles must ensure that the supported level of effort (LOE) is consistent with the **Late Finish Date (July 2022)** for the NSTX-U Recovery
 - In case of Recovery Early Finish (May 2021), supplemental awards could support increased LOE.
- Research topics are constrained by the final machine configuration post-Recovery
 - E.g., proposals dedicated to non-axisymmetric control coil (NCC) studies will not be accepted



Non-lab proposals for STs other than NSTX-U

- Project period is 5 years with start dates in late FY20
- RoD with the experimental leader of these facilities will be required
- Preproposals will be required, proposals will be peer reviewed via mail-in reviews
- Proposals for MAST-U and LTX- β will not be considered in FY20
 - Based upon the existing grant cycle we will solicit renewal and new proposal submissions for these facilities (as well as NSTX-U) in FY21, such that they may all be competed.
 - LTX- β has 2 Notable Outcomes in FY20, so FES does not want to add research scope at this time.

Pegasus-III





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Lab Collaborators





Lab collaborators

- No lab call for proposals associated with the two non-lab solicitations
- Existing lab collaborators should coordinate with PPPL/FES about proposed NSTX-U scope revisions to their existing FWPs
- If new proposed scope is acceptable, then FES will invite the lab to submit a full peer reviewable 5-year proposal
- Lab proposals for NSTX-U work will be evaluated through panel peer review as part of the *refreshed* 5YP review
- Lab proposals for collaboration on other facilities will be evaluated through mail-in peer review

Non-lab collaborators

- Two non-lab solicitations are planned to be announced in late January of FY20
 - 1) **Diagnostics Solicitation** – synced with refreshed 5YP effort
 - 2) **Collaborative Research on International and Domestic STs Solicitation** – has two submission options
 - a) *NSTX-U option* – Budget profiles assume late finish (July 2022)
 - b) *Non-NSTX-U option* – No MAST-U and LTX- β submissions

Lab collaborators

- Lab collaborators should coordinate with PPPL/FES about proposed NSTX-U scope revisions to their existing FWPs
- For acceptable scope revisions, FES will invite lab collaborators to submit a 5-year peer reviewable proposal



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Questions?

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Tokamak Program Manager**

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