

# National Spherical Torus eXperiment Upgrade

## NSTX-U Five Year Plan

MFE Physics Meeting – Nov. 14, 2019

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# FES wants NSTX-U to develop Five Year Research Plan

- Refresh of 2014-2018 plan for 2020-2024 with focus on near-term goals
- No major upgrades during this period
  - 1 MW ECH
  - Cryopump\* \* Possibly a component of 2025-2029 plan
  - Divertor TS\*
  - NCC
- Liquid Metal program would be included in following (2025-2029) plan
  - Can include, however, technical development going on in 2020-2024 (in a limited sense) leading to Phase I of LM program

2019      2020      2021      2022      2023      2024      2025      2026      2027      2028      2029



Construction

1st campaign Carbon

Phase I high-Z

Phase II - All metal/Liq. Lithium/VB

Design & Fab. of  
Phase I, II (?)

Li evap (top  
& bottom)

Pre-filled high-Z tiles  
/liquid Li modules

Fully toroidal/VB option

# Focus is on 3 high-level research goals

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1. Demonstrate **high-performance steady-state non-inductively sustained regimes** at large bootstrap fraction ( $f_{BS} > 0.7$ ), large Greenwald density fraction ( $f_{GW} > 0.7$ ) and  $\beta_N$  values surpassing typical conventional-A scenarios with sufficient stability margin for low disruptivity
2. Investigate if a **strong scaling of confinement and stability improvement with reduced collisionality** in regimes dominated by electron thermal transport at high- $\beta$  and low-A persists at lower collisionality
3. Develop and utilize **power handling techniques**, e.g. impurity injection and possible low inventory liquid lithium components, **to mitigate very high projected heat fluxes**

Added third goal as a foundation for moving towards Liquid Metal (Lithium) program

# Research Team and Timeline

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- Five Year Plan can be used as basis to reconstitute Research Team
  - Anticipate FOA to be connected to Five Year Plan review
    - Josh King to discuss FOA plans
- Timeline (subject to change in either direction - later or earlier)
  - Onsite review by external panel: late Spring/early Summer 2020 (?)
  - Final version written: -1 month (then dry runs)
  - PAC review of plan: ~2 months
  - Draft Plan written: ~3 months(then dry runs)
  - Team-wide meetings/discussions: start now
    - Include (potential) Partners on- and off-site
    - Bi-weekly progress updates (informal)