NSTX

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Discussion of PFC strategy for NSTX-U

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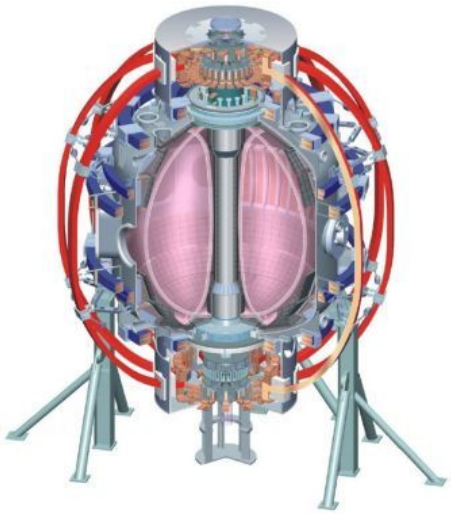
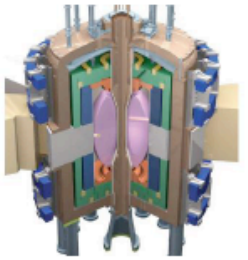
PPPL
December 10, 2012

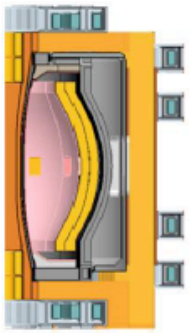


NSTX-U research targets predictive physics understanding needed for fusion energy development facilities

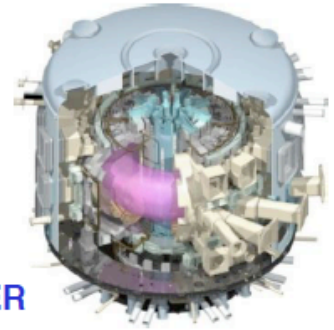
- Enable key ST applications
  - Move toward steady-state ST FNSF, pilot plant
  - Close key gaps to DEMO
- Extend understanding to tokamak / ITER
  - Leverage ST to develop predictive capability



Fusion Nuclear Science Facility (FNSF)



ST Pilot Plant

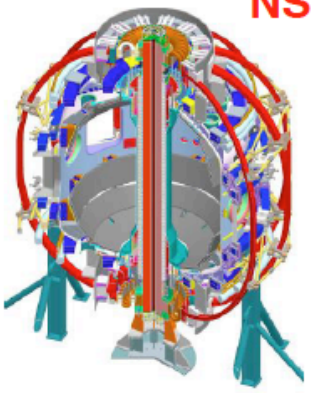


ITER

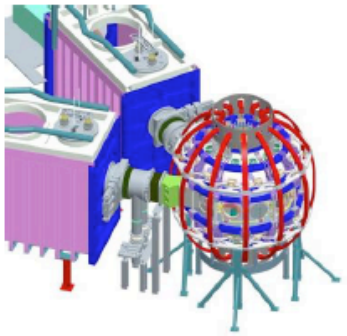
Research Goals:

- Develop key physics understanding to be tested in unexplored, hotter ST plasmas
  - Study high beta plasma transport and stability at reduced collisionality, extended pulse
  - Prototype methods to mitigate very high heat/particle flux
  - Move toward fully non-inductive operation with profile control (current and rotation profiles)

NSTX-U



New center-stack

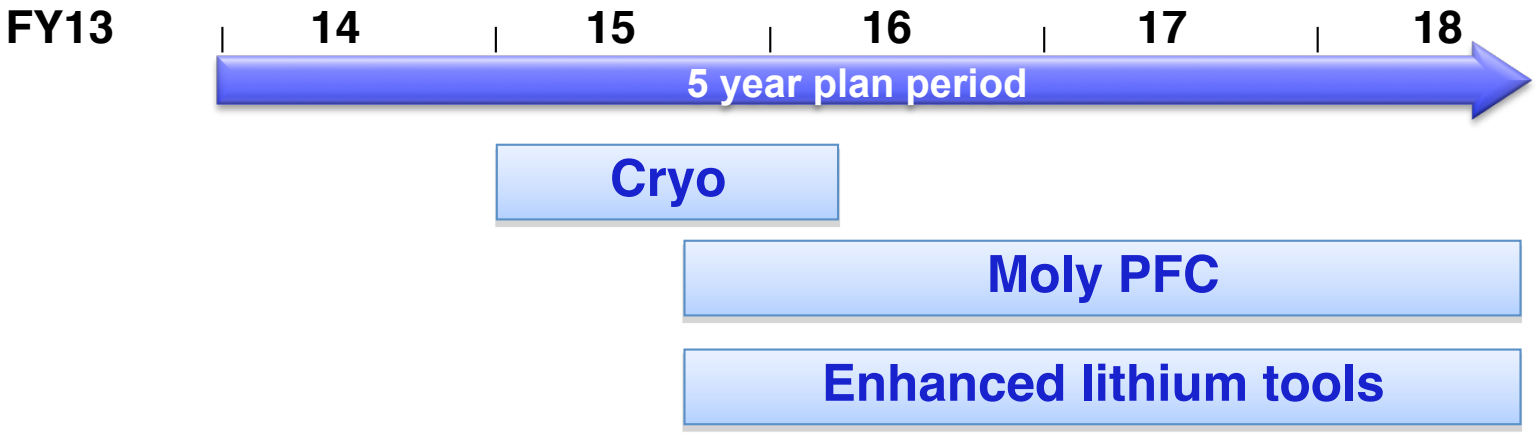


2nd Neutral Beam

Particle control is the most critical component

- PFC / facility elements that require staging:
  - Cryo-pump
    - Enables density / collisionality control
      - directly contributing toward NSTX-U goals
      - Opens up operations window and new scenarios
    - Contributes to research in all TSGs
    - Enables major contributions to Boundary research (divertor, SOL, PFC)
  - Molybdenum PFCs
    - Enable initial (arguably complete) assessment of moly PFC in NSTX-U
    - Enable initial (arguably complete) assessment of lithium coatings on moly PFC
    - Desirable but not necessary for NSTX-U goals
  - "Enhanced" lithium tools (e.g., upper LITER, etc)
    - Enable assessment of pumping and particle control by lithium coatings
    - Contributes to many TSGs
    - Desirable but arguably necessary for NSTX-U goals
    - Results do not scale to future devices

Proposed staging



- Discussion
  - Year 1-2 – no new elements, establish baseline NSTX-U scenarios and results in PFC / Boundary area (pedestal, SOL, divertor), clarify the need for particle control
  - Year 2-3 – implement cryo-pump
  - Year 2-5 – plan and implement moly PFC and enhanced lithium tools as necessary