NSTX

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"Progress Towards an Advanced ST Operating Point in NSTX" or "Progress Developing the Core Physics Scenarios For Next Step STs in NSTX"

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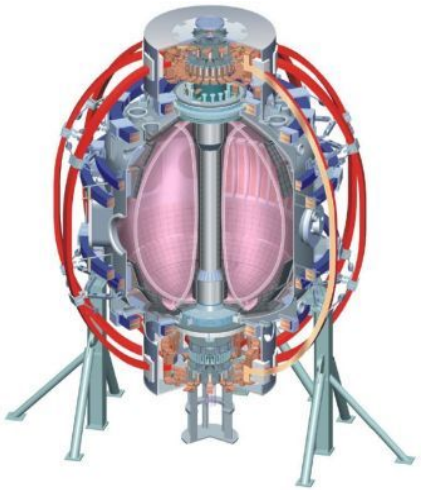

Topic Combines Results from NF Papers Published in 2010 and 2011 (No "scenario" APS or IAEA talks since ~2006)

- Thesis: Recent physics and control research on NSTX has narrowed the gap between present and next step ST core physics scenarios.
- Motivation: Scenario needs of next-step STs,
  - Lots of NBCD, high-κ, some at higher A. (ORNL, PPPL, GA, Culham studies)…and how current drive, transport, and stability are coupled.
- Current drive (TRANSP w/ NUBEAM):
  - Cases with agreement between classical calculations and reconstructed profiles for a range of configurations.
  - Case with documented TAE induced current redistribution.
- Confinement (TRANSP w/ NUBEAM):
  - Different confinement trends with & without Li.
  - Connect the confinement back to observed current drive trends.
- Global Stability (DCON, PEST):
  - Emphasize shaping, low-F_P, n=1 control for improved performance.
    - Connect to the CU work on kinetic RWM physics and advanced controllers.
  - Discuss n=1 kink/tearing that terminates most higher-l_N discharges.
    - Mode eigenfunction with USXR, mode triggering, Breslau modeling, current profile optimization (elevate q_{min}!).
- Comparison to conventional aspect ratio "Hybrid" scenarios.
- Extension to higher-A: Connect the above results (at lower-A), to A=1.75-1.8 space for NSTX-U and (some) next step devices (FY-11 milestone).
- NSTX-Upgrade: Example of free-boundary TRANSP modeling, show examples of a few interesting scenarios with f_{NI}=100% or high-β_T, with elevated q_{min}. (ISOLVER-TRANSP, DCON, PEST).
- Through the talk:
  - Emphasize the importance of shaping, Li, n=1 control, improved PCS in developing these scenarios.
    - Emphasize the "virtuous circle", "synergism" (whatever) that these provide.
  - Bring out example best shots: Highest-W_{MHD}, Lowest-V_{loop}, highest-β_P, "sustained" high-β_T.