

Macroscopic Stability TSG Pre-forum Meeting #1

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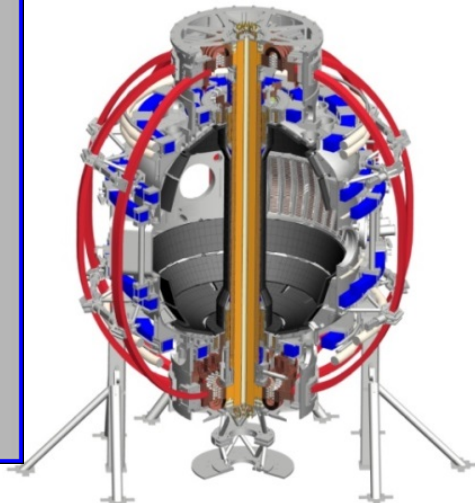
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NSTX-U Pre-forum Meeting #1

December 16th, 2014

PPPL



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MS TSG suggestions

❑ Error field:

- ❑ $n=1$ error field compass scans (multiple phases and amplitudes) (use rotation as a diagnostic?)
- ❑ $n=2, 3$ EF measurement and correction optimization (PF5 shape will be different)
- ❑ EFs during current ramps
- ❑ EFs from other sources (new current feeds for PF-1a and PF-1c)

❑ RWM:

- ❑ XMP for dual sensor active RWM PID control checkout
- ❑ XMP for RWM state-space controller (RWMSC) checkout
- ❑ XMP on MHD spectroscopy checkout (sensor signal/noise vs. f , etc.) ?
- ❑ XP for RWM control gain and phase optimization at higher beta

MS TSG suggestions

□ With ASC:

- Should we have NSTX-U EFIT reconstruction for CD4 plasma – magnetics ready?
- Get rtEFIT working
- Vertical control
- Shutdown methods

□ Other:

- XP for testing 3D physics capabilities including the new six independent SPAs plus $n=3$ magnetic braking (how it works in NSTX-U vs. NSTX)
- XP on characterization of EPs with new NBI (Podesta, et al.)
- XP1062: NTV steady-state rotation at reduced torque (HHFW) (Sabbagh) is an XP that could run early and can establish a pure RF plasma that might be dual-use with someone else?

Supporting slides follow

Other Considerations

□ Recall milestones

- R15-3: Develop physics+operational tools for high-performance discharges (κ , δ , β , EF/RWM)
- JRT15: Quantify impact of broadened $J(r)$ and $p(r)$ on tokamak confinement and stability
- JRT16: Assess disruption mitigation, initial tests of real-time warning / prediction techniques

□ Look for overlaps with any groups, but in particular with Transport and Turbulence and Energetic Particles (in the Core Science Group)

More detail on EF from Stefan Gerhardt

□ Assessment of PF-5 EFs

- Old PF-5 was squeezed back to being a mostly circular coil by some supports to the vessel.
- Those supports were eliminated to provide room for thermal expansion.
- So the PF-5 EFs will be different (and thermal growth will make them time dependent when the coil gets hotter)
- Could have $n=2$ terms now as well
- Can we do some metrology first?

□ Assessment of EFs from other sources

- New current feeds for PF-1a and PF-1c stand out to me, though these may have little impact on core performance.

□ Compass scans, using rotation and disruption as a diagnostic.

- IF we can make longer pulses, we may be able to scan multiple phases and amplitudes at the same time.
- See figures from Nick Logan's defense

□ EFs during the current ramp.

- The vessel is a lot less axisymmetric due to the J-K cap and new bay L.
- The nominally toroidal eddy currents during the ramp will lead to some level of error fields as they jog around the cap.
- Probably not well corrected by DEFC?
- Will this matter in the low density current ramp phase?

Some Columbia U. group experiments proposed for last NSTX campaign are appropriate to run in NSTX-U

Columbia U. Group 2011-12 Macro-stability TSG experiments

- ❑ Macro-stability TSG (proposed for 2011)
 - ❑ XP1144: RWM stabilization/control, NTV V_ϕ alteration of higher A ST targets (Sabbagh)
 - ❑ XP1145: RWM state space active control physics (independent coil control)(Sabbagh)
 - ❑ XP1146: RWM state space active control at low plasma rotation (Y-S Park)
 - ❑ XP1062: NTV steady-state rotation at reduced torque (HHFW) (Sabbagh)
 - ❑ XP1111: RWM PID optimization (Sabbagh)

- ❑ Macro-stability TSG (proposed for FY 2012)
 - ❑ XP1149: RWM stabilization dependence on energetic particle profile (Berkery)
 - ❑ XP1147: RWM control physics with partial control coil coverage (JT-60SA) (Y-S Park)
 - ❑ XP1148: RWM stabilization physics at reduced collisionality (Berkery)
 - ❑ XP1150: Neoclassical toroidal viscosity at reduced ν (independent coil control) (Sabbagh)

- (of course) further experiments specific to NSTX-U will be proposed