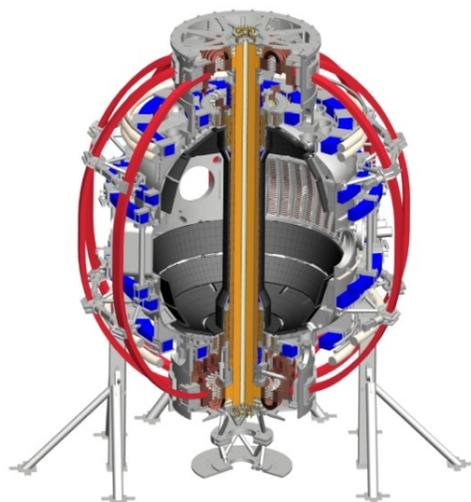


# Research Operations Update

**Stefan Gerhardt**  
*and the NSTX Research Team*

**NSTX Team Meeting**  
**B318**  
**6/26/2012**

*Coll of Wm & Mary*  
*Columbia U*  
*CompX*  
*General Atomics*  
*FIU*  
*INL*  
*Johns Hopkins U*  
*LANL*  
*LLNL*  
*Lodestar*  
*MIT*  
*Lehigh U*  
*Nova Photonics*  
*ORNL*  
*PPPL*  
*Princeton U*  
*Purdue U*  
*SNL*  
*Think Tank, Inc.*  
*UC Davis*  
*UC Irvine*  
*UCLA*  
*UCSD*  
*U Colorado*  
*U Illinois*  
*U Maryland*  
*U Rochester*  
*U Tennessee*  
*U Tulsa*  
*U Washington*  
*U Wisconsin*  
*X Science LLC*



*Culham Sci Ctr*  
*York U*  
*Chubu U*  
*Fukui U*  
*Hiroshima U*  
*Hyogo U*  
*Kyoto U*  
*Kyushu U*  
*Kyushu Tokai U*  
*NIFS*  
*Niigata U*  
*U Tokyo*  
*JAEA*  
*Inst for Nucl Res, Kiev*  
*Ioffe Inst*  
*TRINITI*  
*Chonbuk Natl U*  
*NFRI*  
*KAIST*  
*POSTECH*  
*Seoul Natl U*  
*ASIPP*  
*CIEMAT*  
*FOM Inst DIFFER*  
*ENEA, Frascati*  
*CEA, Cadarache*  
*IPP, Jülich*  
*IPP, Garching*  
*ASCR, Czech Rep*

## In This Update...

- Diagnostics
- Physics Operations
- Boundary Physics
- HHFW

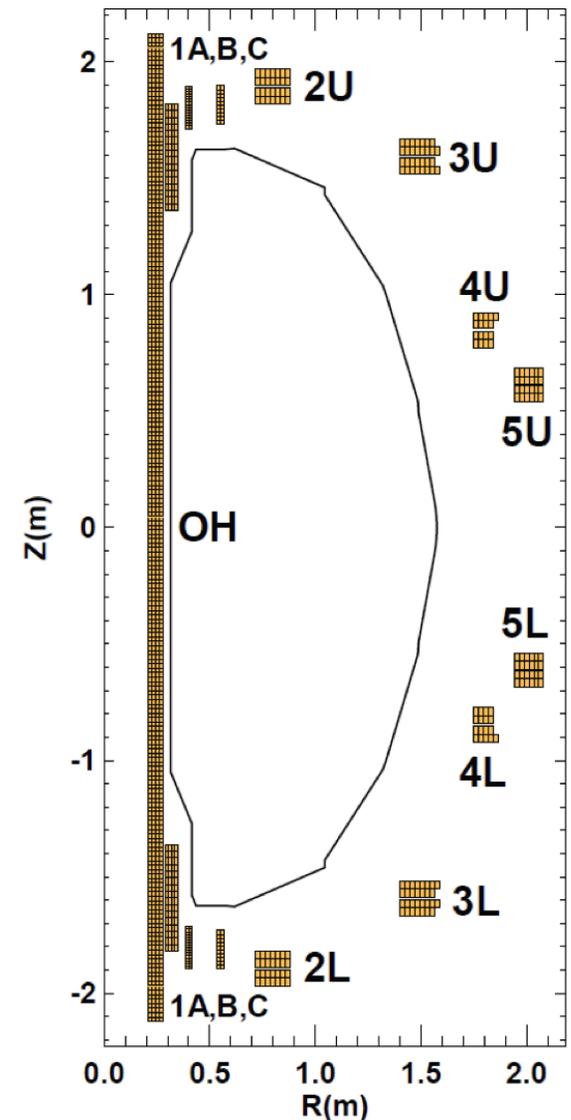
***Apologize in advance if I miss something important  
that you are doing...***

# Diagnostics

- Magnetics
  - Main  $I_p$  Rogowski sensors are being wound.
  - Wide-scope review of NSTX-U operations magnetics needs on May 17<sup>th</sup> identified:
    - >60 new magnetic sensors on the NSTX-U center column.
      - Flux loops, Mirnovs, halo current sensors, partial and full Rogowskis
    - Additional realtime digitizers, likely with updated design, required to bring into PCS.
    - Additional/upgraded integrators, electronics for processing the  $I_p$  Rogowski required
    - Strategy for migration from CAMAC to D-TACQ digitizers was identified.
    - Need for long-pulse, high frequency digitizers for \*AE studies was identified and added to I&C scope.
    - Locked-mode detector remains in jeopardy.
- MPTS
  - Successful completion of the MPTS optics and fiber storage
  - Completed the FDR on the vacuum vessel interface, PDR on ex-vessel components.
  - Final Bay L drawings in fabrication mode, detailed drawings on Bay F near completion
- rtMSE: Purchased prototype data acquisition system for the realtime MSE diagnostic.

# Physics Operations: PF Coils

- Baseline NSTX-U plan: Bipolar PF-1A coils  
unipolar PF-1BL
- Studies of desired equilibrium shapes and potential breakdown scenarios showed a more optimal configuration:
  - Bi-Polar PF-1C for standard vs. snowflake divertor comparisons, CHI.
  - Unipolar PF-1A.
  - Up-down symmetric
- Plan is in final stages of evaluations, appears likely to be adopted.
  - Up-down symmetric snowflake possible in first year
- Developing PCS specifications for controlling new coils.
  - Large task...initial draft is complete except for rtEFIT and ISOFLUX parts.
  - Including new code to avoid requesting over-currents on the PF coils.



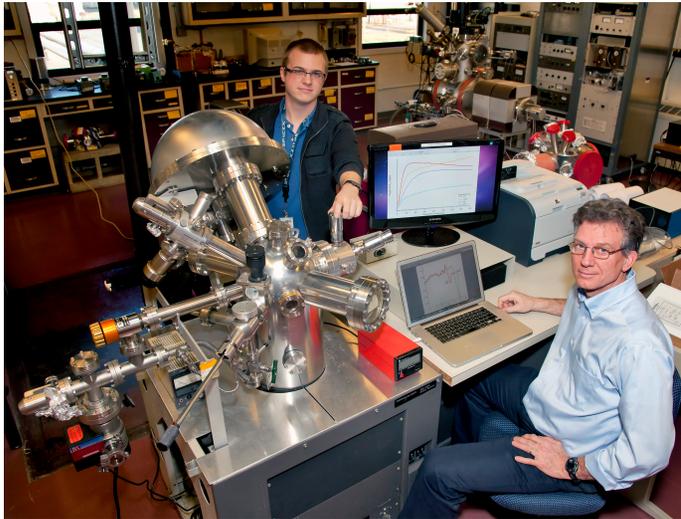
## Physics Operations: Other PCS Work

- New 32-core control computer was delivered.
  - Runs a true realtime operating system with many features for optimizing memory usage, interrupts, and realtime performance in general.
  - Training course was held here at PPPL.
  - Preparing to move the complete set of control codes (ACQ, PCS, PSRTC,...) to new machine for testing, followed by optimization.
- Now developing engineering options to reduce the latency of the input data stream.
- We have prepared draft specifications for PCS control of the NBs in NSTX-U.
  - Better separation between physics algorithms ( $\beta_N$  control) and engineering algorithms (beam modulation control).
- Also fished specification for automated TF rampdown in NSTX-U.
- PCS is sharing software engineer resources with DCPS development, which will generally have priority.

# Lithium: Surface Analysis Labs Have Been Developed To Improve Understanding of Lithium-Coated PFCs for NSTX-U

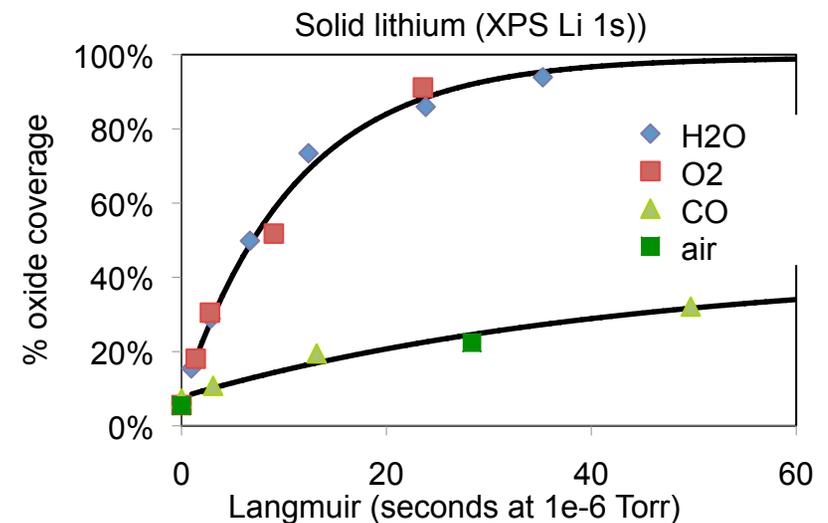
C. Skinner

## New Surface Analysis Labs at PPPL



- Surface analysis experiments show PFC oxide coverage is expected in 10-100 seconds from residual H<sub>2</sub>O at typical NSTX intershot pressures ~1e-7 torr.
- Brainstorming on upward facing LITER designs has begun.
  - Targeting designs with reduced thermal mass to allow shut-off without shutters.

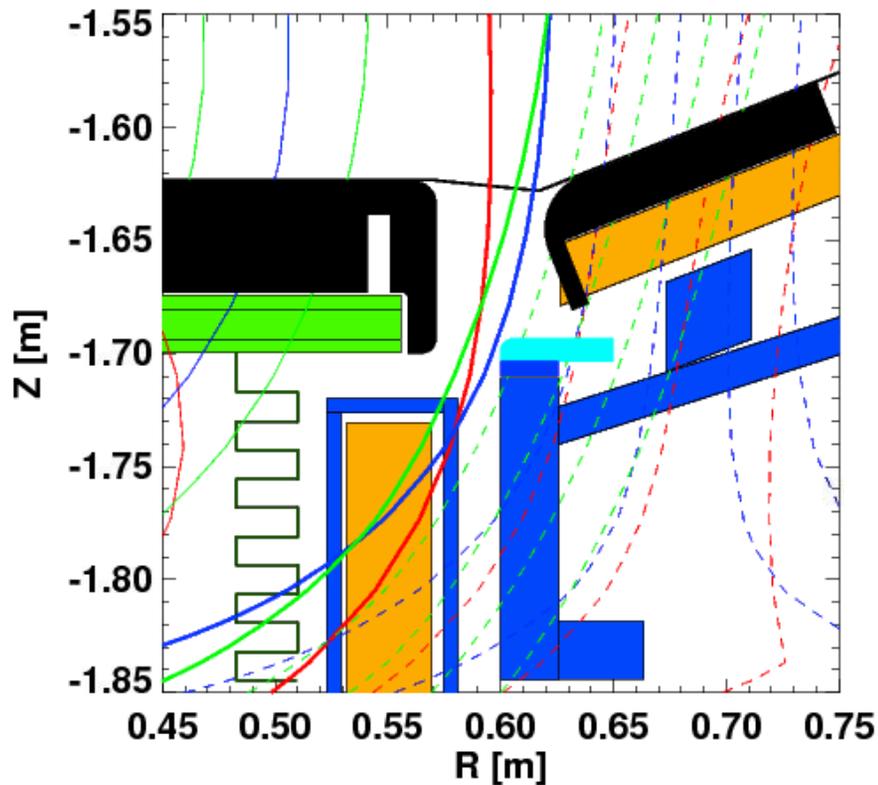
### Li surface oxidation time



PU-PPPL

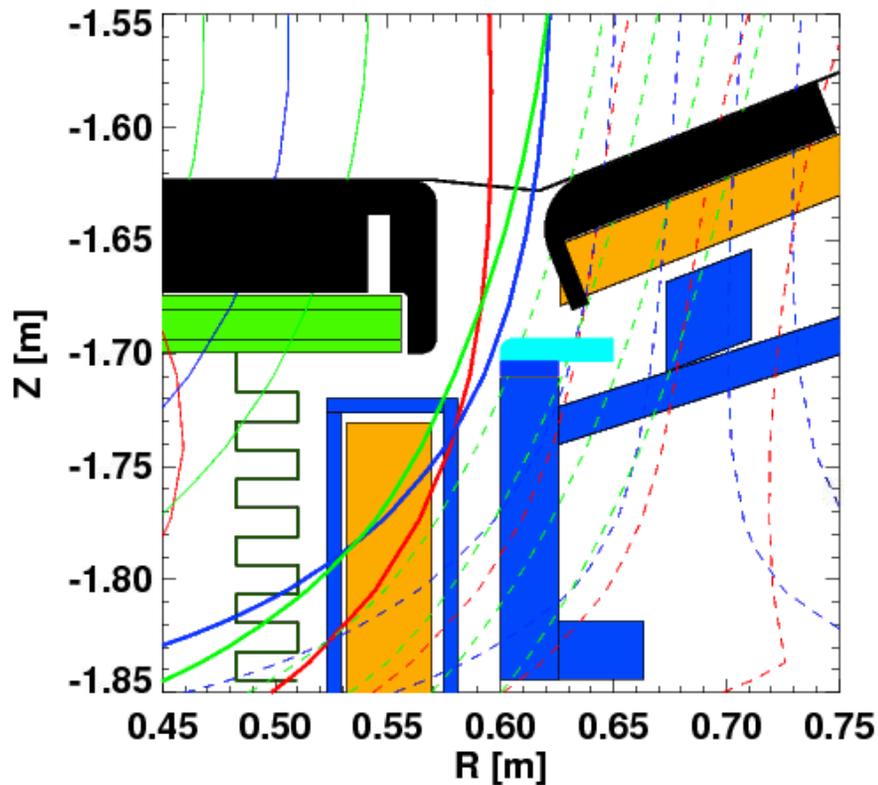
# Equilibrium Studies Showed that Placement of the OSP on The PF-1c Coil is Possible

## Original NSTX-U Design (w/ Moly Gap Shields)



# Tile Modifications Are Being Considered To Protect Coil & Exposed 304SS in CHI Gap

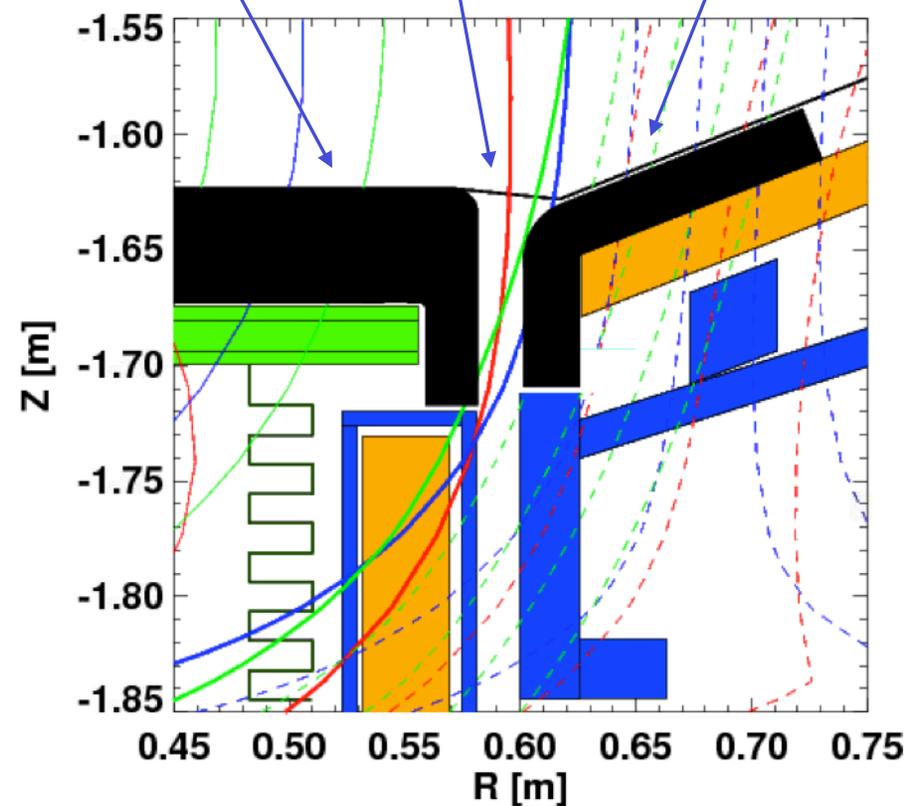
**Original NSTX-U Design**  
(w/ Moly Gap Shields)



**Deeper, Narrower CHI Gap**

**Significant Expansion of the OBD Tile Down to the Vessel Flange**

**Larger Thicker Horizontal Divertor Tile**



# HHFW Operations

- RF test stand is being prepared for testing two NSTX HHFW antenna straps
  - two straps are to be fed with two feedthroughs from source 2 at 30 MHz
  - location of arcs in vacuum to receive major focus
  - hope to locate arcs and change arc areas to achieve higher voltage standoff
- New compliant connectors between the feedthroughs and the current straps will be tested on the test stand next FY
  - forces on copper current strap are up by a factor of  $\sim 4$  on NSTX-U compared to on NSTX
  - compliant connectors will have a bellows-like structure that must be tested to assure voltage standoff
- Source 3 controls are being upgraded to technology of this century to assure reliable operations on NSTX-U
  - new control system has been purchased
  - expect source control mods to begin this summer

**The End**