

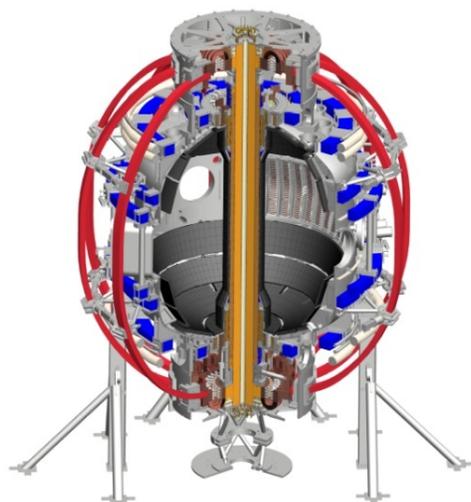
# NSTX-U Collaboration Status and Plans for University of Tennessee, Knoxville

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

**Brian D. Wirth (UTK)**

*R. Maingi (PPPL/UTK), A. Bortolon (UTK)*

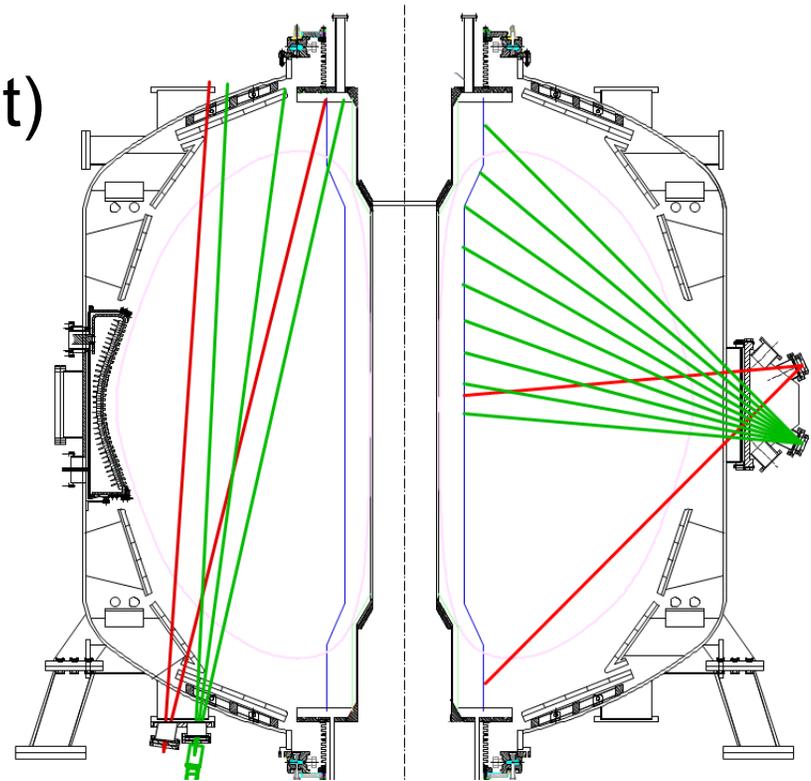
**NSTX-U Collaborator Research Plan Meetings**  
**PPPL – LSB B318**  
**April / May 2014**



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

# Development of spectroscopic and IR views of central stack and upper divertor of NSTX-U

- Extend diagnostic coverage to support Li program
  - Effectiveness of Li evaporation
  - Studies of material evolution and migration
  - Tight collaboration with ORNL collaboration on NSTX
- Upper divertor views (Bay G bot)
  - 16 LOS for UV-NIR spectroscopy
  - “Fast” (1.6kHz) IR camera (ORNL)
- Central stack view (Bay J mid)
  - 16 LOS, for UV-NIR spectroscopy
  - “Slow” (30Hz) IR camera
- Spectrometer and IR cameras PC’s in the DARM



# Research activity in FY2014 focused on diagnostic installation

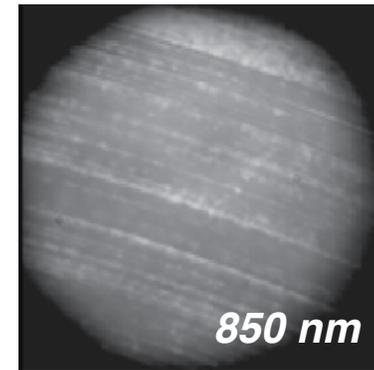
- Present status
  - Design finalized, procurements in progress
  - Diagnostic ports allocated, Bay G port cover installed
  - Vacuum windows (ZnSe, AR coated) acquired (PPPL)
  - Test-cell wall penetration allocated for fiber bundles
- Research plans in preparation for FY2015 operations
  - Install fiber bundles (2x 40m CorrLok) and collection optics
  - Install spectrometer (PI, 320mm, f/4.6) in DARM (location has been selected but requires relocation of stored items)
  - Install (ORNL) new fast IR camera at Bay G bottom
- UD/CS spectroscopy and UD IR ready for physics operations (Mar 2015)

# Research activity in FY2015 focused on diagnostic commissioning and analysis of initial data

- Research Plans for FY2015
  - Commissioning of spectroscopy and IR thermography
  - Monitor evolution of PFC observing ratio of spectrally close C and Li lines {e.g. C(I) / Li (I) : 493/497nm, 601/610nm 805/812nm}
  - Acquire and install “slow” IR for CS view (from Bay J mid-plane)
- FY2016-[...]
  - plan and perform experiments to address specific aspects of effectiveness of Lithium evaporation, enabled by the extended coverage
  - Initiate modeling of observations in terms of transport (SOLPS, EIRENE)
  - and evolution of material morphology/composition (leverage SciDAC – Xolotl-PSI and new UIUC/UTK project)

# Highest-priority incremental measurement capability

- In present design, the spectrometer mounts a camera “borrowed” from ORNL
  - CCD, back illuminated, 512x512, 8.2x8.2mm
- For  $\lambda > 700$  nm, CCDs suffer from “etaloning”:
  - Spurious interference patterns compromise the measurement
- Incremental funds could be used to buy a dedicated camera, with CCD treated to prevent etaloning
- Accurate measurements in the NIR (800-1500nm)
  - Carbon, Lithium, molecular bands (CD)
  - Deuterium Paschen series: electron density from Stark splitting



## Ideas to enhance participation in NSTX-U research/program by U.S. Universities, early-career researchers, and students

- Early Career Awards proven effective for initiating long term collaboration programs
  - e.g. LLNL at NSTX, ORNL at DIII-D
- Although ECA are open to university affiliated scientists, **only** tenure-track are eligible
- Extending ECA to research faculty positions (not tenure-track) could foster new strong collaborations with universities