

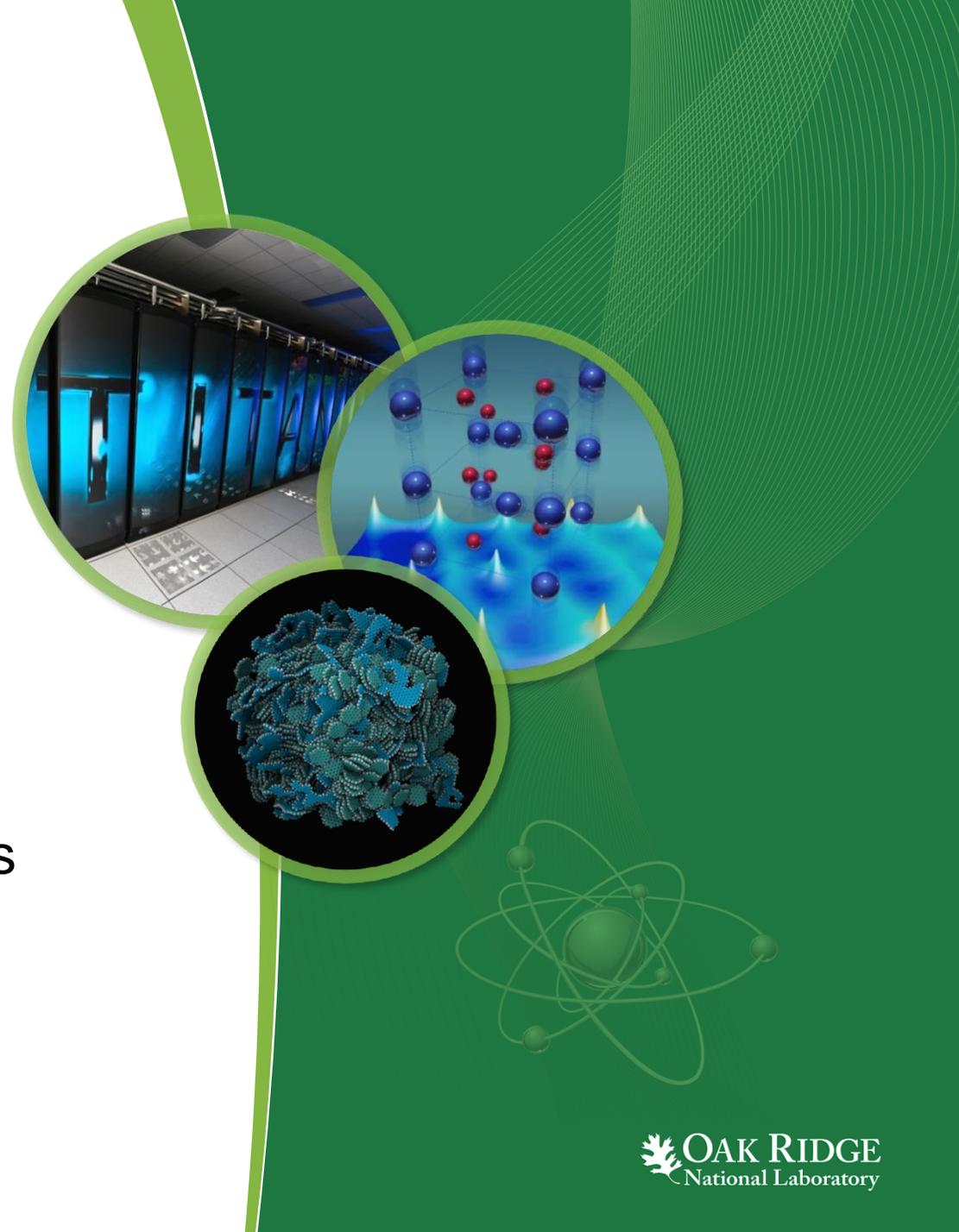
Existing and Proposed MAST-U Collaboration

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NSTX-U Team Discussion

11/22/2017

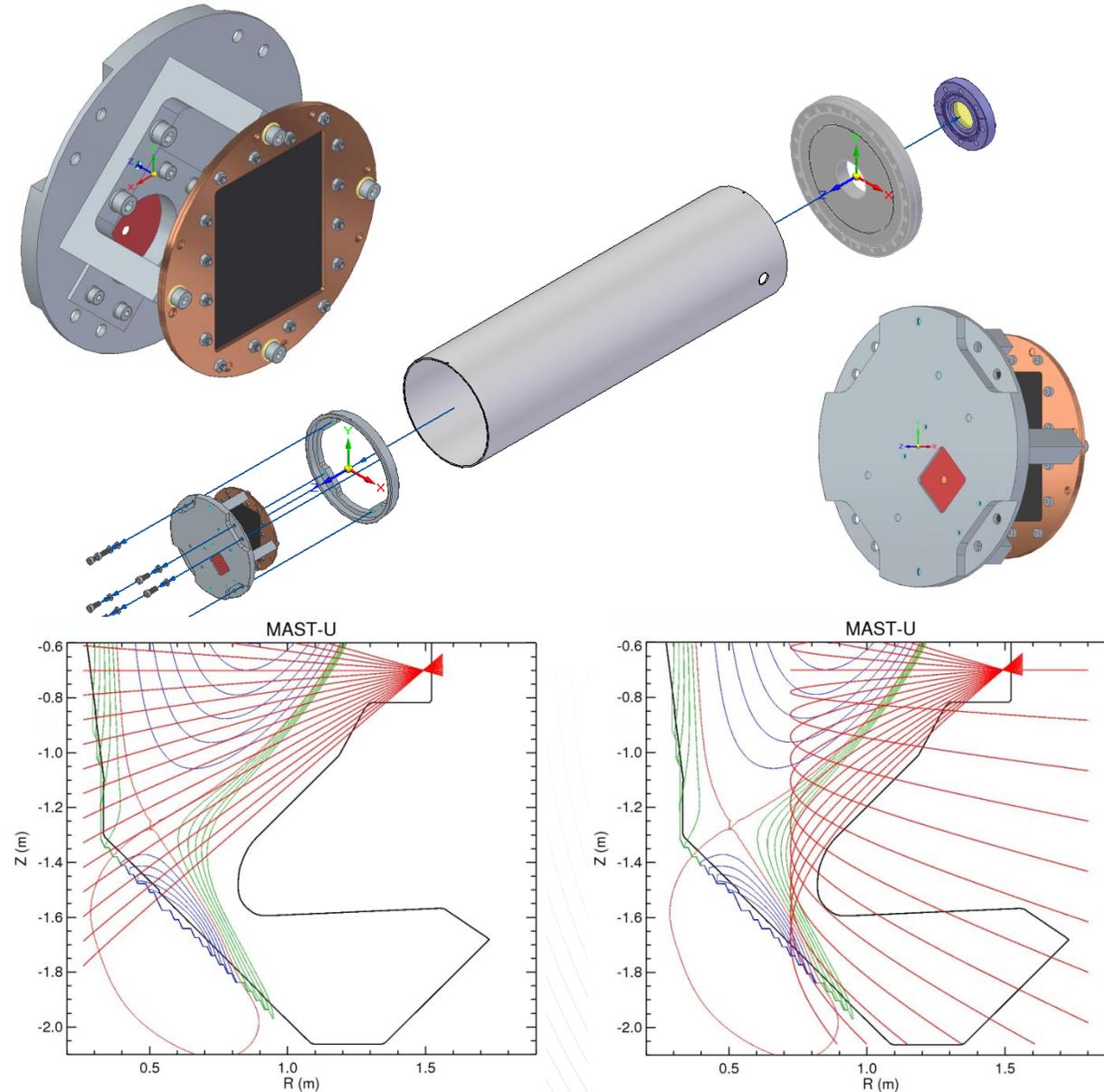


FY16/FY17 ORNL Established Collaboration w/ MAST-U

- intended to mirror ORNL boundary program on NSTX-U with the broader goal of both looking at “ST Power Exhaust”
 - established prior to NSTX-U coil problems and Recovery effort
 - 1) Experimental tests of radiative stability of the super-X divertor
 - 2) Investigation of power balance in the ST configuration
 - 3) Scoping and testing of advanced radiated power diagnostics
- support for 1.2 FTE, extended to 2.2
 - full-time ORNL post-doc based at CCFE (Jack Lovell) to support resistive bolometry diagnostics and perform experiments, 0.2 FTE for PI (Reinke)
 - carryover used to support a 4-year PhD student (Fabio Federici) at University of York to deploy and utilize an InfraRed Video Bolometer (IRVB)
Advisors: Bruce Lipschultz (UoY) and Richard Martin (CCFE)

FY16/FY17 ORNL Established Collaboration w/ MAST-U

- participated in Research Forum
 - MU01_P65, MU01_P67, MU01_P07 (see [forum list](#))
 - expect to participate and lead experiments when planning starts
- IRVB system chosen for support by EU as part of the PEX Enhancements package (e.g. extra NBI, cyroplant, etc)
 - IRVB effort started while at UoY
 - conceptual design delivered to CCFE for detailing and fab 2017
 - installation planned for Feb. 2018



Proposed Expansion Under Review (“ST Physics Call”)

Four Primary Objectives (Split into 11 Science Deliverables):

- *run by multiple ORNL staff at 0.3-0.5 FTE, new CCFE-based post-doc (TBD)*
- **OBJECTIVE 1:** Demonstrate a quantitative understanding of power balance in the ST configuration and extend the scaling of the heat flux width to higher current and power.
- **OBJECTIVE 2:** Investigate the compatibility of using radiative exhaust in high-triangularity, conventional divertor configurations and compare to Super-X.
- **OBJECTIVE 3:** Explore the transient behavior of detachment in H-mode plasmas of various divertor configurations, including Super-X, and test control using novel diagnostics methods.
- **OBJECTIVE 4:** Establish a reliable core pellet fueling capability for density control in pumped, H-mode plasmas and examine its impact on detachment stability and ELM behavior.

Deliverables Enabled by Diag. and Tech. Milestones

- fab + install resistive bolometers for the upper Super-X chamber
- provide an additional IR camera to complete spatial coverage, including multi-spectral optics for surface layer analysis
- test MAST-U HFS pellet guide tubes at ORNL
- fabricate and support a high-frequency pellet injector
- fabricate and support a novel divertor [redacted]
- design, fabricate and install an upgraded main-chamber res. bolom.
- design, fabrication and install a divertor AXUV diode system
 - possibly include Lyman or carbon filters (overlap MIT/PPPL efforts on DIII-D)

guidance FES (King): evaluations complete, no news before end of CR