Contribution ID: **161** Type: **Poster**

Plasma profiles and impurity screening behavior of the high-field side scrape-off layer in near-double-null configurations: prospect for mitigating plasma-material interactions on RF actuators and first-wall components*

Wednesday, 19 October 2016 08:30 (4 hours)

The improved impurity screening characteristics of the high-field side scrape-off layer to local impurity sources, previously reported for single null geometries, is found to be retained in double null configurations - strengthening the argument for locating current drive and heating actuators on the high-field side.
The high-field-side (HFS) scrape-off layer (SOL) is known to exhibit extremely low levels of cross-field transport [1] and excellent impurity screening characteristics [2] in single-null magnetic configurations. It has been proposed that future tokamaks should exploit these remarkable HFS characteristics to solve critical plasma-material interaction (PMI) and sustainment challenges –relocate all RF actuators and close-fitting wall structures to the HFS and employ near-double-null magnetic topologies, to precisely control plasma conditions at the antenna/plasma interface and mitigate the impact of PMI [3]. Dedicated experiments were performed on Alcator C-Mod during the 2015 experimental campaign to quantify impurity screening characteristics and scrape-off layer profiles in near-double-null configurations. Nitrogen screening by the HFS SOL is found to be a factor of 2.5 better than LFS in balanced double-null discharges, despite an extremely thin scrape-off layer. Impurity screening is found to be insensitive to current and Greenwald fraction. HFS impurity screening is least effective (only a factor of 1.5 improvement) in unbalanced double-null discharges that favor the active divertor in the direction of $B\times\nabla B$. Unbalanced discharges that favor the most active divertor opposite the direction of $B\times\nabla B$ have excellent HFS screening characteristics, a factor of 5 better than LFS. The latter situation is particularly promising for the use of HFS RF actuators in I-mode plasmas –a high confinement, steady state, ELM-free regime that is accessible at high magnetic field to a large range of input power for this magnetic topology [4].
[1] N. Smick, et al., Nucl. Fusion 53 (2013) 02300; [2] G. McCracken, et al., Phys. Plasmas 4 (1997) 1681; [3] B. LaBombard, et al., Nucl. Fusion 55 (2015) 053020; [4] A. Hubbard, et al., IAEA FEC2014, paper EX/P6-22.
*This material is based on work supported by U.S. Department of Energy, Office of Fusion Energy Sciences under Award Number DE-FC02-99ER54512 on Alcator C-Mod, a DoE Office of Science User Facility.

Paper Number

EX/P3-6

Country or International Organization

USA

Primary author: Dr LABOMBARD, Brian (MIT Plasma Science and Fusion Center)

Co-authors: Mr KUANG, Adam (MIT Plasma Science and Fusion Center); Dr MUMGAARD, Bob (MIT Plasma Science and Fusion Center); Dr BRUNNER, Daniel (MIT Plasma Science and Fusion Center); Prof. WHYTE, Dennis (MIT Plasma Science and Fusion Center); Dr MARMAR, Earl (MIT Plasma Science and Fusion Center); Dr WALLACE, Gregory (MIT Plasma Science and Fusion Center); Dr TERRY, James (MIT Plasma Science and Fusion Center); HUGHES, Jerry (MIT Plasma Science and Fusion Center); Dr WALK, John (MIT Plasma Science and Fusion Center); Dr CHILENSKI, Mark (MIT Plasma Science and Fusion Center); Dr REINKE, Matthew (Oak Ridge National Laboratory); WUKITCH, Stephen (MIT Plasma Science and Fusion Center); Dr WOLFE, Steve (MIT Plasma Science and Fusion Center); Dr LIN, Yijun (MIT Plasma Science and Fusion Center)

Presenter: Dr LABOMBARD, Brian (MIT Plasma Science and Fusion Center)

Session Classification: Poster 3

Track Classification: EXS - Magnetic Confinement Experiments: Stability