Comparing the Magnetic Divertor Topology and Transport with Resonant Magnetic Perturbation Fields in High and Low Aspect Ratio Tokamaks

I. Waters[1], H. Frerichs[1], O. Schmitz[1], J.-W. Ahn[2], G. Canal[3], T.E. Evans[3], V. Soukhanovskii[4]

[1]*University of Wisconsin-Madison, Madison, WI, USA*
[2]*Princeton Plasma Physics Laboratory, Princeton, NJ, USA*
[3]*General Atomics, San Diego, CA, USA*
[4]*Lawrence Livermore National Laboratory, Livermore, CA, USA*

Lead-author e-mail: iwaters@wisc.edu

Explorations are under way to optimize the magnetic divertor configuration of NSTX-U with the goal of improving neutral and impurity fueling and exhaust. The application of resonant magnetic perturbation (RMP) fields is being considered to spread heat and particle fluxes in the divertor, control impurity transport, and adjust the plasma refueling and neutral exhaust cycle. Given the number of next generation tokamak design studies using both high and low aspect ratio approaches, it is critical to understand the relationship between the perturbed magnetic configuration and edge plasma transport, and how this is affected by the aspect ratio. Similar investigations to those being completed for NSTX-U have already been carried out at the high aspect ratio DIII-D tokamak in San Diego. A comparison is made between the high-aspect ratio DIII-D tokamak (R/a~2.7) and the low aspect ratio NSTX-U tokamak (R/a~1.7), using the EMC3-EIRENE fluid plasma and kinetic neutral transport code. A standard poloidal divertor configuration with an n = 3 RMP field applied is used to compare the effects of RMP fields in these two devices with high and low aspect ratio, respectively. This work is funded in part by the Department of Energy under grant DE-SC0012315, DE-FC02-04ER54698 and by startup funds of the Department of Engineering Physics at the University of Wisconsin-Madison.