Scaling radiative divertor solutions to high power in DIII-D

A.W. Leonard,[1] M.A. Mahdavi,[1] C.J. Lasnier,[2] T.W. Petrie,[1] and P.C. Stangeby[3]

[1]*General Atomics, PO Box 85608, San Diego, California 92186-5608, USA*

[2]*Lawrence Livermore National Laboratory, Livermore, California, USA*

[3]*University of Toronto Institute for Aerospace Studies, 4925 Dufferin St. Toronto M3H 5T6, Canada*

Abstract. Detached radiative divertor plasmas are examined in DIII-D as a function of power. The 2D profile of plasma electron density and temperature is reconstructed from divertor Thomson data while energy transport is deduced from power balance measurements. The combination of plasma and energy diagnostics reveals that parallel energy transport transitions to convective flow at a constant 5 -10 eV as a function of power. Simple considerations would imply divertor density proportional to power density for Mach 1 flow. However, the divertor, upstream separatrix, and core plasma densities increase significantly less than linear with power density. During detached divertor operation H-mode core confinement is maintained though the edge pedestal can experience moderate degradation.

PACS Nos. 52.55.Rk and 52.5.Fa