Correlation of H–mode Barrier Width and Neutral Penetration Length

R.J. Groebner,[1] M.A. Mahdavi,[1] A.W. Leonard,[1] T.H. Osborne,[1] N.S. Wolf,[2] G.D. Porter,[2]

P.C. Stangeby,[3] N.S. Brooks,[1] R.J. Colchin,[4] W.H. Heidbrink,[5] T.C. Luce,[1] G.R. McKee,[6]

L.W. Owen,[4] G. Wang,[7] D.G. Whyte[8*]

[1]General Atomics, P.O. Box 85608, San Diego, California 92186-5608

email: groebner@fusion.gat.com

[2]Lawrence Livermore National Laboratory, Livermore, California

[3]University of Toronto, Toronto, Canada

[4]Oak Ridge National Laboratory, Oak Ridge, Tennessee

[5]University of California, Irvine, California

[6]University of Wisconsin, Madison, Wisconsin

[7]University of California, Los Angeles, California

[8]University of California, San Diego, California

[*]Present address: University of Wisconsin, Madison, Wisconsin

Abstract. Pedestal studies in DIII–D find a good correlation between the width of the region of steep gradient in the H–mode density and the neutral penetration length. These results are obtained by comparing experimental density profiles to the predictions of an analytic model for the profile, obtained from the particle continuity equations for electrons and deuterium atoms. In its range of validity (edge temperature between 40–500 eV), the analytic model quantitatively predicts the observed decrease of the width as the pedestal density increases, the observed strong increase of the gradient of the density as the pedestal density increases and the observation that L–mode and H–mode profiles with the same pedestal density have very similar shapes. The width of the density barrier, measured from the edge of the electron temperature barrier, is the lower limit for the observed width of the temperature barrier. These results support the hypothesis that particle fueling provides a dominant control for the size of the H–mode transport barrier.