Progress towards a predictive model for pedestal height in DIII-D

R.J. Groebner[1], A.W. Leonard[1], P.B. Snyder[1], T.H. Osborne[1], C.F. Maggi[2], M.E. Fenstermacher[3], C.C. Petty[1] and L.W. Owen[4]

[1]General Atomics, PO Box 85608, San Diego, California 92186-5608, USA
[2]IPP-Garching, Garching, Germany
[3]Lawrence Livermore National Laboratory, Livermore, California, USA
[4]Oak Ridge National Laboratory, Oak Ridge, Tennessee USA
e-mail contact of main author: groebner@fusion.gat.com

Abstract. Recent DIII-D pedestal studies provide improved characterization of pedestal scaling for comparison with models. A new pedestal model accurately predicts the maximum achieved pedestal width and height in Type I ELMing discharges over a large range of DIII-D operational space, including ITER demonstration discharges. The model is a combination of the peeling-ballooning theory for the MHD stability limits on the pedestal with a simple empirical pedestal width scaling, which is proportional to the square root of the pedestal poloidal beta. Width scalings based on the ion toroidal or poloidal gyroradius are much poorer descriptions of DIII-D data. A mass scaling experiment in H and D provides support for a poloidal beta scaling and is not consistent with an ion poloidal gyroradius scaling. Studies of pedestal evolution during the inter-ELM cycle provide evidence that both the pedestal width and height increase during pedestal buildup. Model studies with a 1D kinetic neutrals calculation show that the temporal increase in density width cannot be explained in terms of increased neutral penetration depth. These studies show a correlation of pedestal width with both the square root of the pedestal poloidal beta and the square root of the pedestal ion temperature during the pedestal build-up.