CRITICAL EDGE PARAMETERS FOR H–MODE TRANSITION IN DIII–D*

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Studies in DIII–D of edge conditions observed just before the transition to the H–mode have suggested that the transition condition is some function of edge temperature [1]. These studies were based on evaluations of edge experimental data which were mapped onto flux coordinates with equilibrium reconstructions of the plasma shape. One problem with this approach was that there were small but significant systematic variations in how the edge of the plasma was defined and these variations affected some of the results. For example, edge temperature was found to be a constant during a B_t scan in contradiction to older results which indicated that edge temperature at the transition increased with B_t [2]. In order that this source of variation be eliminated, an analysis procedure has been developed which has removed the use of equilibrium reconstructions. A modified hyperbolic tangent fit is used in order to parameterize the edge profiles in terms of quantities that are physically meaningful independent of separatrix position. In particular, the edge electron and C VI density profiles typically exhibit transport barriers even in L–mode and this barrier is readily fit with the hyperbolic tangent function. These fits can be used to uniquely determine the midpoint of the transport barrier (density symmetry point) and the location where the pedestal begins (density knee). In turn, the edge electron and ion temperature pressure profiles can be evaluated at these same positions. The database used for the work described in [1] has been reanalyzed with this procedure and edge parameters are analyzed at both the symmetry point and knee of the density profiles. There results show that at the symmetry point, the temperature at the transition (most clearly the ion temperature) increases in the B_t scan. Both T_i and T_e are constant or decreasely slowly in a density scan and are constant in a current scan, as was observed with the previous analysis [1]. Besides removing the magnetic equilibrium from the analysis, the hyperbolic tangent fitting procedure easily allows the analysis of timeseries leading up to the transition. This type of analysis shows that for discharges run near the H–mode power threshold there is typically little change during L–mode in the edge temperatures as evaluated near the density symmetry point. In contrast, analysis of edge temperatures at the density knee shows some evidence of temperature rising to the H–mode transition. These results show that there is some ambiguity in how to define the appropriate location for analyzing edge parameters. They also show that the edge temperature gradient is evolving prior to the transition and might be an ingredient of the critical threshold condition. The role of edge gradients in the transition is being examined and results will be presented.

[1] R.J. Groebner, *et al.*, Plasma Physics and Contr. Fusion, Vol. **38**, 1249 (1996).
[2] T.N. Carlstrom, *et al.*, Proc. 16th Euro. Conf. on Contr. Fusion and Plasma Phys., (European Physical Society, Venice, 1989) Vol. **13**, p. 241.

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