# The Effect of Triangularity on H-mode Pedestal Characteristics and Performance at High Density on DIII–D*

T.H. Osborne, L.L. Lao, J.R. Ferron, R.L. Miller, A.D. Turnbull, R. Maingi,[†] M.A.Mahdavi, M.R. Wade,[†] M.E. Fenstermacher,[‡] T.W. Petrie, A.W. Leonard, and J.G. Watkins[◊]

***General Atomics, P.O. Box 85608, San Diego, California, 92186-5608 USA***
[†]***Oak Ridge National Laboratory, Oak Ridge, Tennessee***
[‡]***Lawrence Livermore National Laboratory, Livermore, California***
[◊]***Sandia National Laboratories, Albuquerque, New Mexico***

The characteristics of the H-mode pedestal and there effect on overall plasma performance were studied in discharges with varying triangularity, $0.1 < \delta < 0.9$, over a range of safety factor, $2.2 < q_{95} < 6$, $I_p$ and $B_T$. Divertor pumping was used to achieve low H–mode densities, while densities up to $1.4 \times$ Greenwald with good energy confinement were obtained with gas puffing. The H–mode pedestal pressure in the Type I ELM regime was found to increase strongly $\delta$, primarily as a result of an increase in the edge pressure gradient. $p'_{PED}$ in most discharges exceeded the ideal infinite n ballooning mode stability limit by a margin which increased with $\delta$. The high $p'_{PED}$ observed in Type I ELM discharges is consistent in most cases with access to the second stable regime. In low $q$ discharges, second stable access requires large edge current density, which may be provided by the edge bootstrap current associated with the high $p'_{PED}$. Low $\delta$, low $q$ discharges however appear to have insufficient $j_{PED}$ for second stable access. The RDZ[1] model, which predicts an increase in $p'_{CRIT}$ for samll barrier width, is consistent with the variation in $p'_{PED}$ in the Type I ELM regime for a given shape, but it does not explain the increase of $p'_{PED}$ with $\delta$. The transport barrier width is somewhat larger at high $\delta$, however not to the extent predicted by the scaling, $\Delta \propto p_{PED}^{1/2}/I_P$, obtained for a fixed plasma shape. Previous work in a fixed shape indicated that the energy confinement enhancement factor, **H**, was strongly correlated with the height of the H–mode pressure pedestal, $\mathbf{H} \propto \left(\beta_T^{PED}\right)^{1/2}$. **H** in different ELM classes is then set by $p_{PED}$, and much of the reduction in **H** with gas puffing can be associated with the reduction in $p_{PED}$. This scaling for **H**, which is indicative of some profile stiffness is not consistent with the observation that higher $\delta$, Type I ELM discharges show a much smaller increase in **H** than would be expected from their higher $p_{PED}$. The differences in **H** at different triangularities can be accounted for by the change in $W_{PED}$ only. The high density, high **H**, discharges represent a case in which the temperature profiles are stiff and the density profiles gradually peak. A detailed discussion of the high density discharges will be presented.

---

*Work supported by U.S. Department of Energy under Contracts DE-AC03-99ER54463, DE-AC05-96OR22464, and W-7405-ENG-48.

[1]B.N. Rogers, J.F. Drake, and A. Zeiler, "The L-H Transition and the Stability of the Edge Pedestal", IAEA-CN-69/THP2/01, IAEA Conference, Yokohama, 1998.