Comparison of radiating divertor behavior in single-null and double-null plasmas in DIII-D

T.W. Petrie[1], N.H. Brooks[1], M.E. Fenstermacher[2], M. Groth[2], A.W. Hyatt[1], R.C. Isler[3], C.J. Lasnier[2], A.W. Leonard[1], G.D. Porter[2], M.J. Schaffer[1], J.G. Watkins[4], M.R. Wade[1], and W.P. West[1]

[1]General Atomics, San Diego, California, USA

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

[3]Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA

[4]Sandia National Laboratories, Albuquerque, New Mexico, USA

e-mail contact of main author: petrie@fusion.gat.com

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Abstract. "Puff and pump" radiating divertor scenarios, applied to both upper single-null (SN) and double-null (DN) H-mode plasmas, result in a 30-60% increase in radiated power with little or no decrease in τ_E. Argon was injected into the private flux region of the upper divertor, and plasma flow into the upper divertor was enhanced by a combination of deuterium gas puffing upstream of the divertor targets and particle pumping at the targets. For the same constant deuterium injection rate, argon penetrated the main plasma of *SN*s more rapidly and reached a higher steady-state concentration when the $\boldsymbol{B} x \nabla \boldsymbol{B}$-ion drift direction was *toward* the divertor $(V_{\nabla B\uparrow})$ rather than *away from* the divertor $(V_{\nabla B\downarrow})$. We also found that the initial rate at which argon accumulated inside DN plasmas was more than twice that of comparable SN plasmas having the same $\boldsymbol{B}x\nabla\boldsymbol{B}$ -ion drift direction. In *DN*s, the radiated power was not shared equally between divertors during argon injection. Only when the $\boldsymbol{B}x\nabla\boldsymbol{B}$ ion drift direction was away from the divertor were both significant increases in divertor radiated power and an accumulation of argon in the divertor observed, based on spectroscopic measurements of ArII. Our data suggest that an unbalanced double-null shape where the $\boldsymbol{B}x\nabla\boldsymbol{B}$-ion drift is directed *away* from the dominant divertor may provide the best chance of successfully coupling a radiating divertor approach with a higher performance H-mode plasma.

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