Hybrid and "Advanced Inductive" Research on DIII-D*

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Hybrid (q_{95}~4) and "Advanced Inductive" (q_{95}~3) plasmas, which have a higher β than conventional tokamak discharges are an active area of research on DIII-D.[1] A key component of the research is focused on developing the physics basis for projection of hybrid operation to future machines such as ITER. Recent experiments with the new counter neutral beam line have examined hybrid performance as a function of plasma rotation, as it is anticipated that future, larger machines may have lower rotation. Fig. 1 shows a modest ~10% reduction in H_{98Y2} as the core rotation is decreased with more balanced NBI. Comparisons between experiments and the GLF23 transport model show reduced E×B velocity shear is responsible for the increased core heat transport. Even with this reduction, projections indicate ITER hybrid operation at Q~10. Preliminary "radiative divertor" experiments with argon injection, strong D_2 flow, and scrape-off layer pumping have shown that the divertor heat flux can be reduced in hybrids by a factor of two (with the up/down balance varying with magnetic balance), with only a modest (10-15%) decrease in H_{98Y2}. As a benign m/n=3/2 NTM causes a sawtooth-free current profile in the hybrid, we are evaluating mechanisms that affect the NTM, including off-axis current driven by a m=2 sideband[2,3], and ELMs causing a modulation of the NTM amplitude. We will present progress on experiments that examine the role of the H-mode pedestal on hybrid performance, and discharges with electron heating to bring T_e/T_i closer to 1 in low collisionality hybrid plasmas.

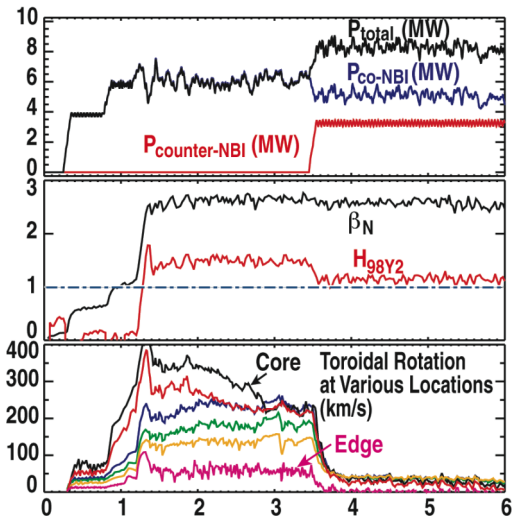

Fig. 1 More balanced neutral beam injection reduces plasma rotation and decreases H_{98Y2}.

[1]P.A. Politzer, *et al.,* Proc. 32nd EPS Conf., Taragona, 2005 ECA Vol. 29C, O-1.001 (2005).
[2]R. Nazikian, *et al.,* these proceedings.
[3]M.S. Chu, *et al.,* IAEA Fusion Energy Conf., Chengdu, China (2006) Paper EX/1-5.

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