**Access to sustained high-beta with internal transport barrier and negative central shear in DIII-D**

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**Abstract.** High values of normalized pressure ($\beta_N \sim 4$) and safety factor ($q_{min} \sim 2$) have been sustained simultaneously for ~2 s in DIII-D, suggesting a possible path to high fusion performance, steady-state tokamak scenarios with a large fraction of bootstrap current. The combination of internal transport barrier and negative central magnetic shear results in high confinement ($H_{89P} > 2.5$) and good bootstrap current alignment ($f_{BS} \sim 60\%$). Previously, stability limits in plasmas with core transport barriers have been observed at moderate values of $\beta_N\ (< 3)$ because of the pressure peaking which normally develops from improved core confinement. In recent DIII-D experiments the internal transport barrier is clearly observed in the ion temperature and rotation profiles at $\rho \sim 0.5$ but not in the electron temperature profile, which is very broad. The misalignment of $T_i$ and $T_e$ gradients may help avoid a large local pressure gradient. Furthermore, at low internal inductance ~0.6, the current density gradients are close to

the vessel and the ideal kink modes are strongly wall-coupled. Simultaneous feedback control of both external and internal sets of $n = 1$ magnetic coils was used to maintain optimal error field correction and resistive wall mode stabilization, allowing operation above the free-boundary beta-limit. Large particle orbits at high safety factor in the core help to broaden both the pressure and the beam-driven current profiles, favorable for steady state operation. At plasma current flattop and $\beta \sim 5\%$, a noninductive current fraction of ~100% has been observed. Stability modeling shows the possibility for operation up to the ideal-wall limit at $\beta \sim 6\%$.