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Smoothly Varying Injected Neutral Beam Voltage and Current Provides New Capability on the DIII-D Tokamak*

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A significant engineering upgrade of the DIII-D neutral beam system has recently been completed, providing the ability to smoothly and independently vary the beam voltage and current. This enables greater control of the injected beam power, torque, and plasma instability drive for fusion experiments. Modifications to the high voltage equipment and the Plasma Control System were made and tested over the last year to allow beam energy to vary by as much as 20 kV over a 0.5 sec period anywhere within the 45-85 kV operating range of the beams. The beam current can be made to track the voltage (keeping the perveance constant), or the current and voltage can be varied independently (scanning the perveance). Smooth variation of beam energy avoids the extremely perturbative effects of pulse width modulation, the only tool previously used for regulating the injected neutral beam power. With independent control of voltage and current, the beam ion velocity space can be tailored to facilitate new experiments that explore, for example, the detrimental effects of Alfvén eigenmodes. These modes are driven by energetic particles and can possibly be avoided in steady state scenarios by timely variation of the beam energy while maintaining constant input power. A description of the modifications made to the power supply and beam controls will be presented, as well as some initial physics results employing the new variable beam energy system.

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Eligible for student paper award?

No

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