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A compact high power density tokamak power supply

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This abstract uses Supercapacitors and IGBTs to supply power to multiple coils on a tokamak from a SINGLE capacitor bank.. This design is a novel compact high density power supply. Super capacitors combined with IGBTs allow high current switching to provide power with waveform current control at different currents to multiple coils using a single capacitor bank. This allows a more compact and high power density power supply system for tokamaks. Additionally this power supply has applications to industry to assist power supply balancing with active loads. On the ST25 tokamak the Toroidal Field and Poloidal Field coils have their own IGBTs which switch current from the main bank. A TF of 0.1T at a radius of 0.25m can be maintained for >6 second pulses. Using a microcontroller the bank voltage is monitored and PWM control of the IGBTs at approximately 1kHz is used to adjust the duty cycle in real-time to provide the desired current output. A power supply with a footprint of ~2 square metres consists of two Maxwell 125V transport modules in series providing 250V with an internal resistance of 36mΩ and capacity of 31.5F and capable of providing a current up to 2.4kA. This configuration can be paralleled up to provide more current. This paper describes the circuit and shows data where two coils have been simultaneously driven with different current waveforms from the same bank.

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