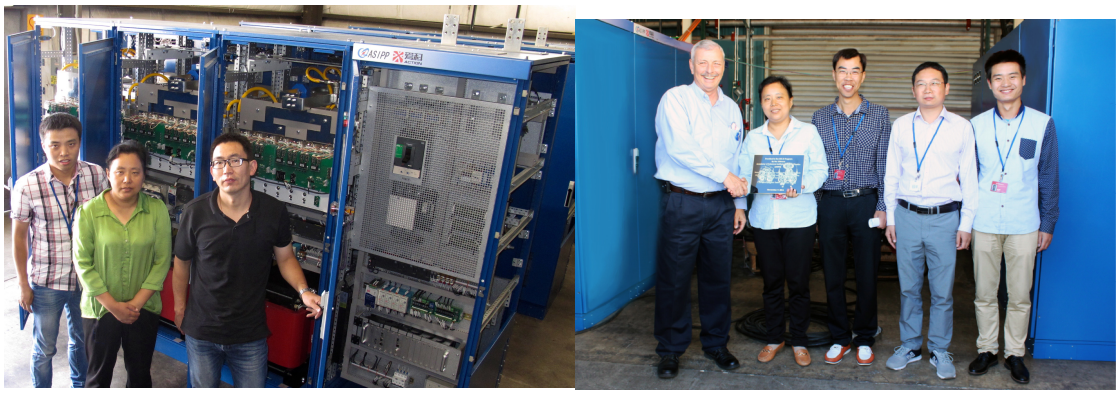
The DIII-D "Super Supply:" Part of a US/China Partnership to Accelerate Fusion Energy Development

Scientists and engineers from the US and China are joining forces to accelerate progress toward the common goal of fusion energy through a collaboration between the DIII-D (at General Atomics in San Diego) and EAST (at ASIPP, the Institute for Plasma Physics in Hefei, China) tokamaks. On November 6, 2016, a powerful switching power amplifier (the "Super Supply") capable of providing up to 16 kA of current at frequencies up to about 1 kHz and a power output of up to 7 MW (enough power to light up over 5000 homes) was inaugurated at DIII-D, less than four months after its arrival in San Diego from China, where it was designed and built. A team from ASIPP has been working at DIII-D with their US colleagues to complete installation and commissioning of the power supply, which will be used in upcoming experiments to enhance the magnetic field shaping and stability control capabilities of the DIII-D tokamak.



Left: ASIPP engineers stand by one of the six four-panel modules that comprise the new "Super Supply", shortly after its arrival at DIII-D. Right: Bill Cary, lead engineer at DIII-D, hands a commemorative plaque to Ge Gao, lead engineer of ASIPP, on the day of the Super Supply inauguration.

DIII-D Experimental Science Director Richard Buttery commented "This new supply dramatically improves DIII-D's ability to develop control of transient events in the plasma, with large magnetic fields, more flexibility in applied structure, and ability to rotate perturbations past diagnostics. This will enable DIII-D to extend and investigate the physics of crucial techniques such as regulation of 'Edge Localized Mode' heat burst instabilities, as well as increase shaping capability to study novel power handling solutions and high performance plasmas at higher current."

Under the auspices of the International Collaboration Center for Tokamak Energy Development (inaugurated April 2015), the DIII-D and EAST Programs have intensified exchanges of scientific staff, hardware, data, and computational software, strengthening a collaboration that started over a decade ago. Regular joint planning workshops are organized to define opportunities for collaborative research tasks and for joint teams to conduct experiments using both devices. Dedicated experiments on DIII-D, using DIII-D's flexibility and extensive diagnostic set, are exploited to validate simulation capability, prototype experiments for EAST, and train ASIPP students and young

scientists. These focused experiments, enabled in part by ASIPP investment in DIII-D upgrades (such as the Super Supply) and DIII-D scientist participation at EAST, will accelerate progress in the extension of high performance scenarios developed in DIII-D to long pulse in the superconducting EAST tokamak. These are key remaining steps toward the definition of the physics basis for a commercially attractive fusion reactor.

Left: David Hill, DIII-D Program Director, and Xianzu Gong, ASIPP co-leader of the International Collaboration Center for Tokamak Energy Development, with the new "Super Supply". Right: Baonian Wan, ASIPP Director, speaks at the Super Supply inauguration, with Ed Synakowski, DOE's Associate Director of Science for Fusion Energy Sciences, and other DOE officials participating via video-conference.

Left: Members of the DIII-D and EAST teams stand in front of two new large transformers (behind the fence) that arrived from ASIPP as part of the Super Supply. Right: Xianzu Gong and Andrea Garofalo, co-leaders of the International Collaboration Center for Tokamak Energy Development, stand in the DIII-D control room after the successful power supply demonstration pulse (input and output waveforms are visible on the TV monitor in the background).

The Center initiatives are complementary to activities under a DOE-funded project focused on "Control and Extension of High Performance Scenarios to Long Pulse" [DOE Cooperative Agreement #DE-SC0010]. Through collaborations such as these, US and Chinese scientists enhance their ability to conduct world-class research that will impact next step fusion experiments.

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