

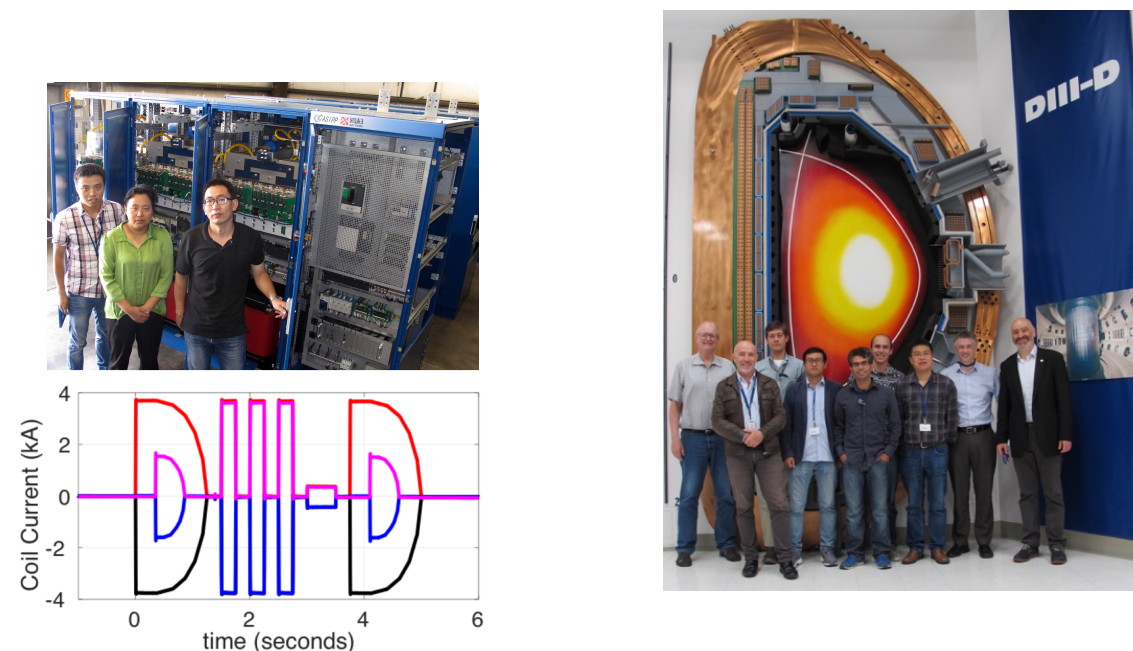
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April 2017

Accelerated Progress Towards Fusion Energy Through US/China Partnership

Advanced Power Supplies contributed in-kind from China advance control of tokamak plasmas in the US



Images courtesy of General Atomics

- 1) ASIPP engineers stand by one of the six four-panel modules that comprise the new “Super Supply”, shortly after its arrival at DIII-D
- 2) Super supply in action – flexible supply enables deployment of arbitrary waveforms on multiple circuits to improve tokamak control
- 3) Joint team of US and Chinese scientists in front of a scale model of the DIII-D tokamak device

The Science

Physicists and Engineers at the DIII-D National Fusion Facility in San Diego, CA have begun exploiting a new advanced power supply (“super-supply”) provided as part of a bi-lateral scientific exchange from China. Integrated teams of US and Chinese scientists worked together to exploit the new capabilities enabled by the super-supply and quickly demonstrated several novel methods of improved control. The supply is used to power multiple magnetic coils around the device, which breaks the usual 2D symmetry of the donut shaped tokamak plasma, making it 3D. Recent results obtained using the power supply include: 1) applying complex structures of non-axisymmetric fields resulted in a dissipation of localized

hot spots on the reactor's walls and helped control heat burst instabilities that can occur at the plasma edge, 2) applying larger magnitude control fields in certain configurations increased the particle motion in the plasma and thus improved its confinement, and 3) applying higher frequency currents enhanced the capability of 3D plasma control.

The Impact

A new power supply provided as part of a bi-lateral scientific exchange from China is giving novel capabilities and enabling experiments on a US fusion facility. This supply was successfully integrated into the control system for the US facility with support from both Chinese and US engineers. Using this new power supply, joint US/China teams have demonstrated reduced heating of the reactor walls, improved control of plasma flows, and excitation of high frequency instabilities. The new supply is now being routinely used to improve experiments at the DIII-D National Fusion Facility.

Summary

Physicists and Engineers at the DIII-D National Fusion Facility in San Diego, CA have begun exploiting a new advanced power supply ("super-supply") delivered as part of a bi-lateral collaboration with China. This power supply (capable of delivering 7 megawatts of power) enables greater flexibility in controlling the magnets that confine the fusion fuel in a tokamak plasma. US and Chinese engineers worked together to install the super-supply and integrate it with other tokamak control systems. Subsequently, integrated teams of US and Chinese scientists worked together to exploit the new capabilities enabled by the super-supply and quickly demonstrated several novel methods of improved control.

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Funding

US/China 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-SC 0010685]. Through collaborations such as these, US and Chinese scientists enhance their ability to conduct world-class research that will impact next step fusion experiments. Work on the DIII-D National Fusion Facility is supported by the U.S. Department of Energy (US DOE) under award DE-FC02-04ER54698.

Publications

In preparation

Related Links

None

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May 2017

Additional information that will not be publically displayed on the webpage:

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