SYSTEM UPGRADES TO THE DIII-D FACILITY

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During the last 12 months, the DIII-D facility completed a program of major upgrades to the tokamak and subsystems. These new upgrades address a wide range of issues that advance the fundamental goals of the DIII-D program; i.e. advancing the physics of advanced tokamaks, exploring basic fusion physics, and addressing critical issues for ITER.

The major upgrades performed include: (1) conversion from 2 long pulse and 2 short pulse gyrotrons to 4 long pulse, 1 MW gyrotrons with system modifications complete for 6 gyrotron operation, (2) rotation of one neutral beamline (2 of 7 sources) from co- to counter injection including required diagnostic modifications, (3) installation of a new water cooled, lower divertor shelf with full graphite tile coverage to enable density control in highly triangular double null divertor and ITER-like single null discharges, and (4) installation of two new cooling towers for longer pulse and higher heat loads. In addition, smaller upgrades of other subsystems and components included a higher power and bandwidth resistive wall mode stabilization system, installation of four new rows of contoured graphite tiles on the centerpost to reduce carbon erosion and improve toroidal uniformity, refurbishment of the FWCD antenna including a different Faraday shield, redesign of the toroidal field feed point with significantly reduced field error, and more than 20 diagnostic upgrades including a new Motional Stark effect system, an enlarged BES system, and a new fast ion profile diagnostic. Significant enhancements to the plasma control system, now comprising more than 20 high speed CPUs, include faster cycle times for MHD stabilization studies; new algorithms and real time diagnostics (MSE and CER) to enable closed loop control of plasma rotation and current profile. The beamline rotation allows a mix of both co- and counter-injection and will enable the study of the physics of plasma rotation, stabilization of RWM at low rotation, modulated ECCD for NTM stabilization, and ELM-free regimes at low rotation. Both the engineering issues involved in many of these upgrades as well as initial results from the new systems will be presented.

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