DIII–D: RECENT PHYSICS RESULTS, IMPLEMENTED AND PLANNED HARDWARE UPGRADES*

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During the last two years the DIII–D tokamak has been operated for a total of 31 weeks, during which significant advances have been achieved in many areas of plasma physics. This progress was only possible because of the improvements in the tools available to the DIII–D program to control and manipulate the plasma core and edge conditions. The important systems in this effort include the electron cyclotron (EC) system, the fast wave system (restarted after being sidelined for four years), 12 new internal coils, an upgraded plasma control system and a comprehensive set of turbulence diagnostics.

The EC system's versatility was demonstrated by the various roles it played in the physics research program: it was used as a probe to demonstrate that "hybrid" plasmas are regulated by m/n = 3/2 tearing modes, to suppress the m/n = 2/1 Neoclassical Tearing Mode which allowed the plasma pressure to be raised to new heights, and in an active feedback mode to control the q-profile using real-time equilibrium reconstructions based upon motional Stark effect data. The fast wave system was used in conjunction with the EC system for current profile experiments. The internal control coils system was used to investigate suppression of the resistive wall modes and reduction and/or elimination of ELMs.

During the next year, the DIII–D facility will implement major changes and upgrades to expand the frontiers in several areas of tokamak plasma physics research. One of the four neutral beams will be rotated to the counter injection mode so that heated plasmas with little or no rotation can be studied. The present lower divertor will be removed and a new extended shelf divertor will be installed which provides capacity of pumping high triangular double-null plasmas. The three new long pulse 1 MW class gyrotron systems will be brought on line, which will double the long pulse capability of the EC system. Two of the three aging cooling towers will be replaced with two new high efficiency towers that can handle the higher heat loads expected in the future from 10-s pulse operation. These and other improvements to the facility will be discussed and presented.

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