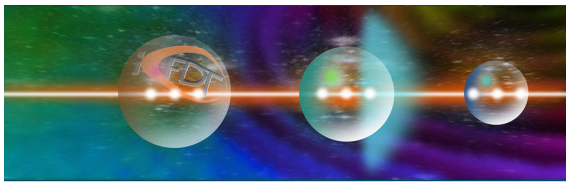

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New diagnostic capabilities of DIII-D

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Comprehensive and accurate physics parameter measurements with appropriate spatial and temporal resolution are vital for controlling plasma shape, equilibrium profiles, and maintaining magnetohydrodynamic (MHD) stability. Additionally, these measurements are key to validating theoretical models and achieving a predictive understanding of plasma behavior for fusion pilot plant (FPP) plasma control.
The DIII-D tokamak is recognized as one of the best-diagnosed magnetic fusion experiments. The diagnostic systems at DIII-D support various aspects of fusion research, including basic tokamak control, transport studies, stability analysis, boundary studies, heating and current drive research. The diagnostic set on DIII-D is the result of collaborations with over 130 institutions, including universities, national laboratories, and industry. In addition, DIII-D provides a flexible environment that supports further development and implementation of new and innovative diagnostics.
This paper briefly describes several new diagnostic capabilities recently added to DIII-D: Doppler-free saturation spectroscopy (DFSS) to directly measure RF fields, a textured tile to estimate the contribution of charge exchange neutrals on the first wall erosion and deposition, an upgrade of the Doppler-back scattering (DBS) system to measure fluctuations associated with Helicon waves, thermal Helium Beam diagnostic for profiles near Helicon antenna, a new 2D divertor Thomson scattering (DTS-2D) system enabling imaging in lower divertor for a variety of shapes, additional hydrogenic Lyman alpha measurements to diagnose neutrals (LLAMA and ALPACA), an additional toroidally displaced chord added to the radial interferometer polarimeter to measure toroidal mode number of high-n fluctuations (TRIP), charge exchange neutral spectroscopy (CENS) diagnostic to measure the atomic neutral energy distribution inside the confined plasma, a fiber-optic bolometer (FOB) utilizing phase shift caused by thermal expansion of micro-silicon pillar, and a pellet sizer which measures the size of fired pellets in-situ.
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