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Microwave imaging reflectometry (MIR) for visualization of the 2-dimensional structure of density fluctuations on DIII-D[1] C.M. MUSCATELLO, C.W. DOMIER, N.C. LUHMANN JR., X. REN, A. SPEAR, University of California, Davis, B.J. TOBIAS, Princeton Plasma Physics Laboratory —
An imaging diagnostic capable of measuring simultaneously the poloidal and radial structure of density fluctuations is being developed for DIII-D. The success of electron-cyclotron emission imaging developed by UC Davis for DIII-D is a testament to the powerful utility of microwave imaging diagnostics for tokamaks. Since its first deployment on TEXTOR, the MIR concept has undergone several improvements in optical and electronics design. For example, the shape of the wavefront of the probing beam and the curvature of the cutoff layer strongly affect the integrity of the reflected signal. This is addressed with transmitting optical elements that are designed to control the shape of the probing beam. Advances in microwave electronics make it possible to transmit and detect multiple frequencies simultaneously, permitting fluctuation measurements at multiple radial locations. Interesting physics occurs over the entire poloidal cross-section of the plasma, on disparate spatial scales. MIR is flexible in this respect, allowing a remote user to rapidly tune the individual probing frequencies for a variety of correlation studies. Synthetic diagnostic simulations and extensive laboratory tests corroborate our confidence in a successful implementation of MIR on DIII-D.

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