DIII-D Microwave Imaging Reflectometer (MIR) Design Criteria and Performance Parameters Evaluated by Full-wave Synthetic Diagnostic*

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The diagnostic capabilities of a microwave imaging reflectometer system proposed for the DIII-D tokamak are evaluated by the 2-D full-wave code FWR2D [1]. Using plasma profiles obtained experimentally on DIII-D, the performance of candidate imaging optical designs has been evaluated for a variety of density fluctuation amplitudes and wavenumbers. A survey of cases which include non-idealities representing realistic design constraints and imperfections discovered in the characterization of a prototype system deployed on TEXTOR [2] provides theoretical performance limits and identifies critical aspects in the design such as phase curvature matching of the illumination beam to the cutoff surface. Further, the relevance of notions such as virtual cutoff [3] for imaging systems is explored. The resulting conception of the DIII-D MIR system is detailed, along with initial results from laboratory characterization and ongoing 3D simulation.

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